# Power Panel 15/21/35/41

## User's Manual

Everything for your HMI running

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# Chapter 1 • General Information

## Information:

**B&R does its best to keep the printed versions of its user's manuals as current as possible. However, sometimes a newer version of the user's manual can be downloaded in electronic form (Acrobat PDF format) from the B&R homepage www.br-automation.com.**

## 1. Manual history

| Version | Date | Comment |
|---------|------|---------|
| 2.3 | August 2011 | • Change to the chapter arrangement (chapter 1 and 2 were combined)<br>• Correction to the connection example for the digital outputs on the Power Panel 21/41<br>• Information about the IF370 CAN interface module node number added |
| 2.2 | 03.08.2007 | • Inserted Standards in technical data of PP15/PP35<br>• Correction of spelling mistake: GHOST-R -> GOST-R<br>• Text „Power Panel PPxx" changed in „Power Panel xx"<br>• Note inserted: Some screw-in modules can only be operated in certain slots of Power Panel 21/41. |
| 2.0 | July 2005 | • Restructuring of the manual<br>• Update of PP21/PP41<br>• PP15/PP35 added to the manual |
| 1.4 | 22.05.2002 | Changes / new features<br>• Safety guidelines added<br>• Error correction:<br>Digital inputs for PP21/PP41: Electrical isolation for input - output Yes<br>• Error correction:<br>Digital outputs for PP21/PP41: Electrical isolation for input - output Output - Input Yes<br>• Pin assignment for RS232 interface updated<br>• Guidelines for using PCMCIA memory cards regarding Tasks added<br>• Input and output circuit diagrams added<br>• Technical data regarding switching threshold for digital inputs for PP21 and PP41 removed |
| 1.3 | 04.12.2001 | Changes / new features<br>• Operating system updates using the MEMCARD and mode switch described in more detail |
| 1.2 | 09.11.2001 | Changes / new features<br>• PCMCIA interface description added<br>• 7AT324.70 screw-in module included<br>• "Mode switch" image replaced<br>• Battery buffer time improved (10 minutes guaranteed)<br>• Correction of description for the inputs and outputs (they are electrically isolated) |

Table 1: Manual history

# 2. Safety guidelines

## 2.1 Safety regulations

# Information:

**The instructions listed, which refer to the wiring and devices used to ensure safety, must be precisely followed in all cases. Otherwise sources of danger can arise, which could cause the integrated safety equipment in the Power Panel to be bypassed.**

# Danger!

**The corresponding safety guidelines for safety and accident regulations must also be reviewed for the respective situation in addition to and independent of this document.**

## 2.2 Introduction

Programmable logic controllers, operating and monitoring devices (e.g. industrial PCs, Power Panels, Mobile Panels etc.) as well as the uninterruptible power supplies from B&R have all been designed, developed, and produced for conventional use in industry. They were not designed, developed and manufactured for any use involving serious risks or hazards that could lead to death, injury, serious physical damage, or loss of any kind without the implementation of exceptionally stringent safety precautions. In particular, such risks and hazards include the use of these devices to monitor nuclear reactions in nuclear power plants, as well as flight control systems, flight safety, the control of mass transportation systems, medical life support systems, and the control of weapons systems.

The safety precautions applying to industrial control systems (e.g. the provision of safety devices such as emergency stop circuits, etc.) in accordance with applicable national and international regulations must be observed both when using programmable logic controllers and when using operating and monitoring devices as control systems in conjunction with a Soft PLC (e.g. B&R Automation Runtime or comparable products) or a Slot PLC (e.g. B&R LS251 or comparable products). The same applies for all other devices connected to the system, such as drives.

All tasks such as installation, commissioning, and service may only be carried out by qualified personnel. Qualified personnel are persons who are familiar with the transport, mounting, installation, commissioning and operation of the product and have the appropriate qualifications (e.g. IEC 60364). National accident prevention guidelines must be followed.

The safety guidelines, connection descriptions (type plate and documentation), and limit values listed in the technical data are to be read carefully before installation and commissioning and must be observed.

## 2.3  Intended use

Electronic devices are generally not failsafe. In the event of a failure on the programmable control system, operating or monitoring device, or uninterruptible power supply, the user is responsible for ensuring that other devices that may be connected, e.g. motors, are in a secure state.

## 2.4  Transport and storage

During transport and storage, devices must be protected from excessive stress (mechanical load, temperature, humidity, aggressive atmosphere, etc.).

## 2.5  Mounting

- Installation must take place according to the documentation using suitable equipment and tools.
- Devices may only be installed without voltage applied and by qualified personnel.
- General safety regulations and nationally applicable accident prevention guidelines must be observed.
- Electrical installation must be carried out according to the relevant guidelines (e.g. line cross section, fuse, protective ground connection).

## 2.6  Operation

### 2.6.1  Protection against touching electrical parts

To operate programmable logic controllers, operating and monitoring devices, and uninterruptible power supplies, certain components must carry dangerous voltage levels of over 42 VDC. A life-threatening electrical shock could occur if you come into contact with these parts. This could result in death, severe injury, or material damage.

Before turning on the programmable logic controller, the operational and monitoring devices and the uninterruptible power supply, ensure that the housing is properly grounded (PE rail). The ground connection must be established when testing the operating and monitoring devices or the uninterruptible power supply, even when operating them for only a short time.

Before turning the device on, make sure that all voltage-carrying parts are securely covered. During operation, all covers must remain closed.

# 3. Organization of safety notices

The safety notices in this manual are organized as follows:

| Safety notice | Description |
|---|---|
| Danger! | Disregarding the safety regulations and guidelines can be life-threatening. |
| Caution! | Disregarding the safety regulations and guidelines can result in severe injury or serious material damages. |
| Warning! | Disregarding the safety regulations and guidelines can result in injury or material damages. |
| Information: | Important information for preventing errors. |

Table 2: Organization of safety notices

# 4. Standards
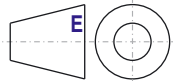
All dimension diagrams (e.g. dimension diagrams, etc.) are drawn according to European dimension standards.

# 5. Material number / serial number

Each B&R device is assigned a unique serial number label with a bar code, which allows the device to be clearly identified.
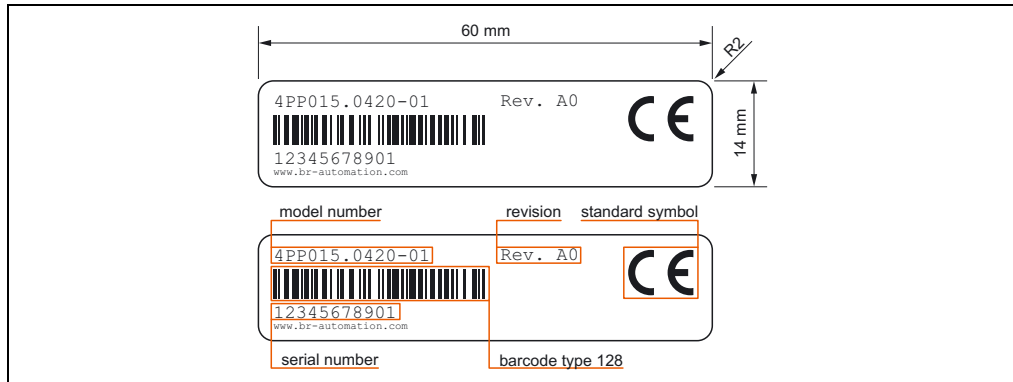


Figure 1: Material number / serial number

If you are a registered user on the B&R homepage (www.br-automation.com) can call up information regarding their products by material number or serial number. You have, for example, access to the revision history for the B&R products you have purchased.

# Chapter 2 • Introduction

B&R offers the B&R Power Panel 15, 21, 35, and 41 for automation of small to midsize machines and systems. These Power Panels are a combination of operator panel and controller in one device.

A 4 x 20 character text display, a 3-inch display with 160 x 80 pixels, or a ¼ VGA graphic display can be selected. Each Power Panel is equipped with a powerful PLC CPU including integrated digital or analog I/O. The series PP21 and PP41 panels have an additional six slots for B&R SYSTEM 2003 screw-in modules. An expansion module is offered for the Power Panel 41 which allows the operation of B&R SYSTEM 2005 interface module inserts.

The visualization application is created using B&R Automation Studio™. B&R Automation Studio™ is used to program the CPU.

## 1. Features

### 1.1 General

- 24 VDC supply voltage
- RS232 interface
- CAN bus interface

- 8-16 digital inputs and outputs
- 0-12 analog outputs
- 0-24 analog inputs

### 1.2 Additional features of the PP21/PP41

- PCMCIA slot
- 1 potential-free relay contact
- 6 slots for B&R SYSTEM 2003 screw-in modules, 3 of which support additional functions (TPU) such as event counting, trigger functions, stepper motor control, frequency measurement or communication modules
- Expansion module for the Power Panel 41 which allows the operation of B&R SYSTEM 2005 interface module inserts

# 2. Overview

| Short description | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model number | 4PP015.0420-01 | 4PP015.0420-36 | 4PP015.C420-01 | 4PP015.E420-01 | 4PP015.E420-101 | 4PP015.C420-36 | 4PP015.E420-36 | 4P0420.00-490 | 4PP035.0300-01 | 4PP035.0300-36 | 4PP035.E300-01 | 4PP035.E300-36 | 4PP035.E300-136 | 4P3040.01-490 |
| Page | 24 | 44 | 24 | 24 | 24 | 44 | 44 | 77 | 102 | 122 | 102 | 122 | 122 | 155 |
| **LCD display** | | | | | | | | | | | | | | |
| 4 x 20 characters | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | - | - | - | - | - | - |
| 160 x 80 pixels | - | - | - | - | - | - | - | - | ✓ | ✓ | ✓ | ✓ | ✓ | - |
| 5.7" QVGA | - | - | - | - | - | - | - | - | - | - | - | - | - | ✓ |
| **Character set** | | | | | | | | | | | | | | |
| English / Katakana | ✓ | ✓ | - | - | - | - | - | ✓ | - | - | - | - | - | - |
| English / Cyrillic | - | - | ✓ | - | - | ✓ | - | - | - | - | - | - | - | - |
| English / European | - | - | - | ✓ | ✓ | - | ✓ | - | - | - | - | - | - | - |
| European / Cyrillic | - | - | - | - | - | - | - | - | ✓ | ✓ | ✓ | ✓ | ✓ | - |
| **Keys** | | | | | | | | | | | | | | |
| Total | 16 | 16 | 26 | 26 | 26 | 26 | 26 | 34 | 16 | 16 | 26 | 26 | 26 | 40 |
| With key LED | 12 | 12 | 10 | 10 | 10 | 10 | 10 | 17 | 12 | 12 | 10 | 10 | 10 | 16 |
| With insert strips | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 17 | 10 | 10 | 10 | 10 | 10 | 16 |
| **Inputs / Outputs** | | | | | | | | | | | | | | |
| Digital inputs | 16 | 8 | 16 | 16 | 16 | 8 | 8 | 10 | 16 | 8 | 16 | 8 | 8 | 10 |
| Digital outputs | 16 | 8 | 16 | 16 | 16 | 8 | 8 | 8 | 16 | 8 | 16 | 8 | 8 | 10 |
| Analog inputs | - | 4 | - | - | - | 4 | 4 | - | - | 4 | - | 4 | 4 | - |
| Analog outputs | - | 4 | - | - | - | 4 | 4 | - | - | 4 | - | 4 | 4 | - |
| **Instruction cycle time** | | | | | | | | | | | | | | |
| 0.8 µs | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | - | ✓ | ✓ | ✓ | ✓ | ✓ | - |
| 0.5 µs | - | - | - | - | - | - | - | ✓ | - | - | - | - | - | ✓ |
| **Memory (SRAM / SystemPROM)** | | | | | | | | | | | | | | |
| 300 kB / 448 kB | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | - | ✓ | ✓ | ✓ | ✓ | ✓ | - |
| 700 kB / 600 kB | - | - | - | - | - | - | - | ✓ | - | - | - | - | - | ✓ |
| **FlashPROM** | | | | | | | | | | | | | | |
| 1,0 MB | ✓ | ✓ | ✓ | ✓ | ✓ | - | ✓ | - | ✓ | ✓ | - | - | - | - |
| 1,4 MB | - | - | - | - | - | - | - | ✓ | - | - | - | - | - | ✓ |
| 1,9 MB | - | - | - | - | - | ✓ | - | - | - | - | ✓ | ✓ | ✓ | - |
| **Slot for ...** | | | | | | | | | | | | | | |
| B&R 2003 screw-in modules | - | - | - | - | - | - | - | 6 | - | - | - | - | - | 6 |
| B&R 2005 communication modules | - | - | - | - | - | - | - | 1 | - | - | - | - | - | 1 |

Table 3: Power Panel overview

# 3. Typical topology - distributed systems

## 3.1 PP15 / PP35

In a distributed system, two or more Power Panel devices (PP15, PP35) are connected to each other over a CAN bus. Control programs run on each Power Panel. The sensors and actuators are connected to the integrated inputs and outputs as well as the remote CAN bus stations.
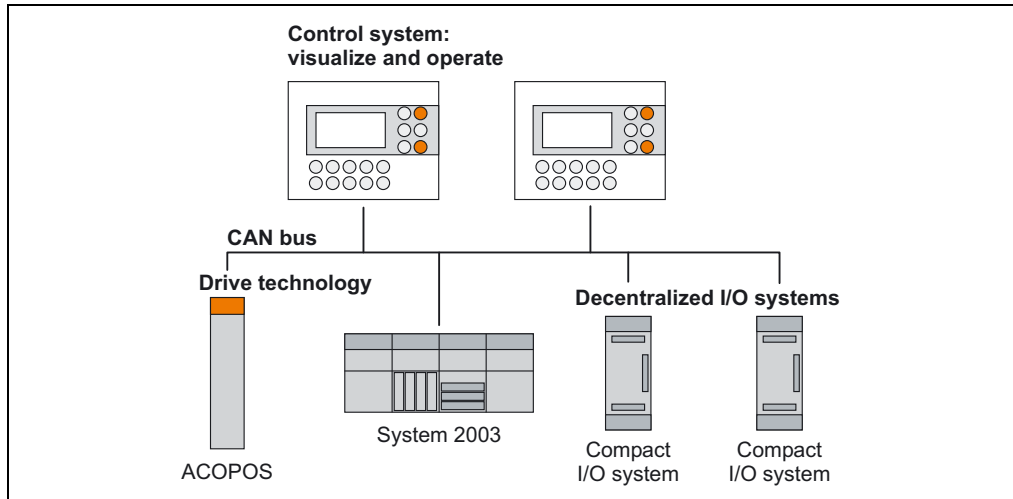


Figure 2: Power Panel topology - distributed systems with PP15/PP35

## 3.2 PP21 / PP41

In a distributed system, two or more Power Panel devices (PP21, PP41) are connected to each other over a CAN bus. Control programs run on each Power Panel. The sensors and actuators are connected to the integrated and insertable inputs and outputs as well as the remote CAN bus stations.
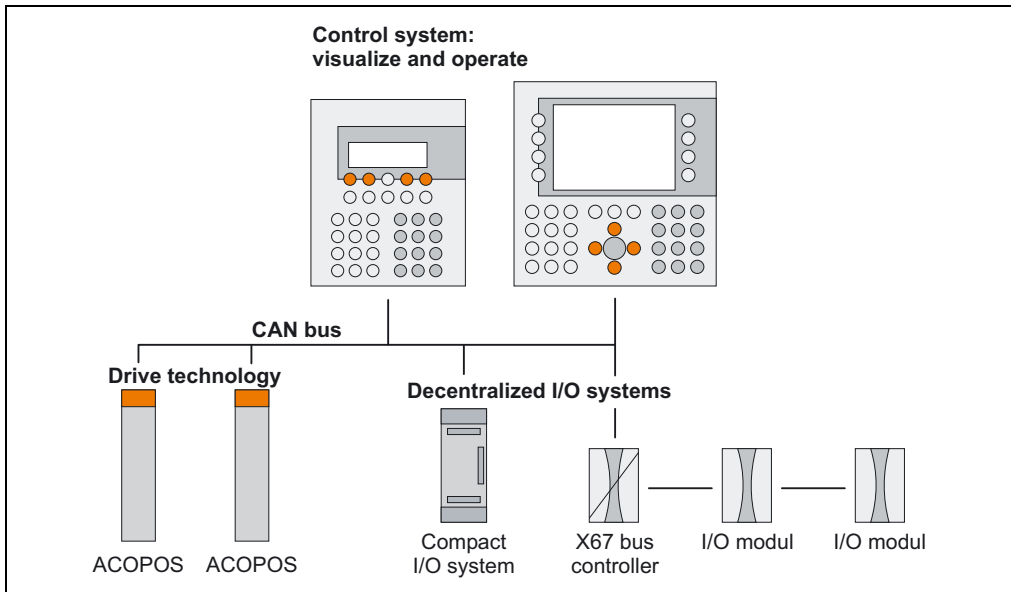


Figure 3: Power Panel topology - distributed systems with PP21/PP41

# Chapter 3 • Power Panel 15

## 1. Types

| Short description | | | | | | | |
|---|---|---|---|---|---|---|---|
| Photo | | | | | | | |
| Model number | 4PP015.0420-01 | 4PP015.0420-36 | 4PP015.C420-01 | 4PP015.E420-01 | 4PP015.E420-101 | 4PP015.C420-36 | 4PP015.E420-36 |
| Page | 24 | 44 | 24 | | | 44 | |
| **LCD display** | | | | | | | |
| 4 x 20 characters | ✓ | | | | | | |
| **Character set** | | | | | | | |
| English / Katakana | ✓ | | - | - | | - | - |
| English / Cyrillic | - | | ✓ | - | | ✓ | - |
| English / European | - | | - | ✓ | | - | ✓ |
| **Keys** | | | | | | | |
| Total | 16 | | 26 | | | | |
| With key LED | 12 | | 10 | | | | |
| With insert strips | 10 | | 10 | | | | |
| **Inputs / outputs** | | | | | | | |
| Digital inputs | 16 | 8 | 16 | | | 8 | |
| Digital outputs | 16 | 8 | 16 | | | 8 | |
| Analog inputs | - | 4 | - | | | 4 | |
| Analog outputs | - | 4 | - | | | 4 | |
| **FlashPROM** | | | | | | | |
| 1,0 MB | ✓ | | | - | | ✓ | |
| 1,9 MB | - | | | ✓ | | - | |

Table 4: PP15 overview

<div style="float:right">Chapter 3<br>Power Panel 15</div>

# 2. Power Panel 15-01

## 2.1 Photos



| 4PP015.0420-01 | 4PP015.C420-01 / 4PP015.E420-01 / 4PP015.E420-101 |
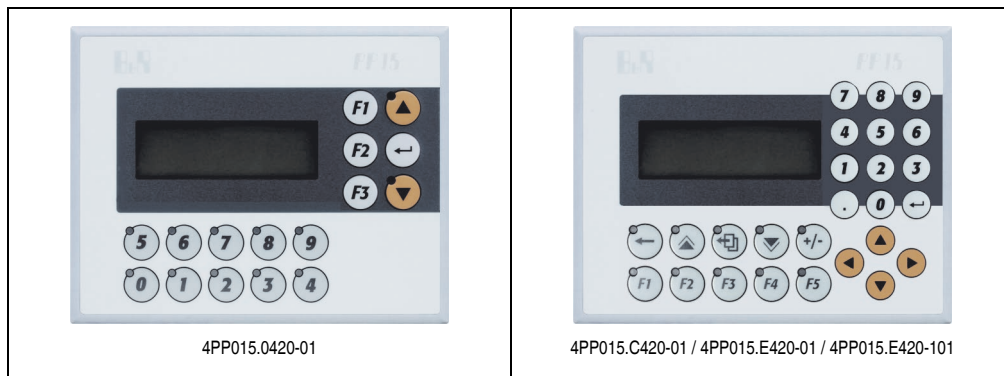
Figure 4: Power Panel 15-01 photos

## 2.2 Order data

| Model number | Short description |
|---|---|
| 4PP015.0420-01 | Power Panel, 24 VDC, 153 x 120 mm, LC display, 4 x 20 characters, background lighting, English / Katakana character set, 16 keys, 300 KB SRAM, 1024 kB FlashPROM, 1 RS232, 1 CAN interface, 16 digital inputs, 24 VDC, sink / source, 2 event counters, 1 incremental encoder or 2 gate-/period measurement, 16 digital outputs, 24 VDC, 0.5 A source, IP65 protection (from front).<br>2 x TB718 and 1 x TB103 terminal blocks sold separately. |
| 4PP015.C420-01 | Power Panel, 24 VDC, 153 x 120 mm, LC display, 4 x 20 characters, background lighting, English / Cyrillic character set, 26 keys, 300 KB SRAM, 1024 kB FlashPROM, 1 RS232, 1 CAN interface, 16 digital inputs, 24 VDC, sink / source, 2 event counters, 1 incremental encoder or 2 gate-/period measurement, 16 digital outputs, 24 VDC, 0.5 A source, IP65 protection (from front).<br>2 x TB718 and 1 x TB103 terminal blocks sold separately. |
| 4PP015.E420-01 | Power Panel, 24 VDC, 153 x 120 mm, LC display, 4 x 20 characters, background lighting, English / European character set, 26 keys, 300 KB SRAM, 1024 kB FlashPROM, 1 RS232, 1 CAN interface, 16 digital inputs, 24 VDC, sink / source, 2 event counters, 1 incremental encoder or 2 gate-/period measurement, 16 digital outputs, 24 VDC, 0.5 A source, IP65 protection (from front).<br>2 x TB718 and 1 x TB103 terminal blocks sold separately. |
| 4PP015.E420-101 | Power Panel, 24 VDC, 153 x 120 mm, LC display, 4 x 20 characters, background lighting, English / European character set, 26 keys, 300 KB SRAM, 1984 kB FlashPROM, 1 RS232, 1 CAN interface, 16 digital inputs, 24 VDC, sink / source, 2 event counters, 1 incremental encoder or 2 gate-/period measurement, 16 digital outputs, 24 VDC, 0.5 A source, IP65 protection (from front).<br>2 x TB718 and 1 x TB103 terminal blocks sold separately. |
| **Note** | |
| All parts required to install the Power Panel, including key legend sheets, are included in its delivery. | |

Table 5: Power Panel 15-01 order data

| Model number | Short description |
|---|---|
| **Required accessories** | |
| 0TB103.9 | Accessory terminal block, 3-pin, Screw clamp, 2.5 mm²; protected against vibration by the screw flange. |
| 0TB103.91 | Accessory terminal block, 3-pin, Cage clamps, 2.5 mm²; protected against vibration by the screw flange. |
| 7TB718.9 | Accessory terminal block, 18-pin, screw clamp, 1.5 mm² |
| 7TB718.91 | Accessory terminal block, 18-pin, cage clamp, 1.5 mm² |
| **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 |
| 4A0044.00-000 | 5 DIN A4 legend strips, 6 fields for a total of 30 devices |
| 7AC911.9 | Bus connector, CAN |

Table 5: Power Panel 15-01 order data (Forts.)

1) Replacement part

## 2.3 Technical data

| Product ID | Power Panel 15-01 |
|---|---|
| **General information** | |
| Certification | CE, C-UL-US, GOST-R |
| Standards<br>Temperature<br>Shock / tests carried out<br>Vibration / tests carried out<br>Emission / tests carried out<br>Immunity / tests carried out | IEC61131-2 / IEC60068-2-x<br>IEC61131-2 / IEC60068-2-27<br>IEC61131-2 / IEC60068-2-6<br>EN61000-6-4 / EN55022<br>IEC 61131-2 / IEC 61000-4-x |
| Status display | I/O function for each channel, status |
| Diagnostics<br>Status<br>I/O function<br>Interfaces | Yes, with status LED<br>Yes, with LEDs<br>Yes, with LEDs |
| **Display** | |
| Type | LCD b/w |
| Resolution | 4 x 20 characters |
| Background lighting | LED |
| Character set<br>4PP015.0420-01<br>4PP015.C420-01<br>4PP015.E420-01<br>4PP015.E420-101 | English / Katakana<br>English / Cyrillic<br>English / European<br>English / European |

Table 6: Power Panel 15-01 technical data

| Product ID | Power Panel 15-01 |
|---|---|
| **Keys** | |
| Total keys<br>   4PP015.0420-01<br>   4PP015.C420-01<br>   4PP015.E420-01<br>   4PP015.E420-101 | 16 (12 with LEDs)<br>26 (10 with LEDs)<br>26 (10 with LEDs)<br>26 (10 with LEDs) |
| System keys | Number block<br>Control keys |
| Labeling | 10 keys with insert strips |
| **Processor** | |
| Typical instruction cycle time | 0.8 µs, average value at 70% bit and 30% analog processing |
| Standard memory<br>   User RAM<br>   System PROM<br>   User PROM<br>      4PP015.0420-01<br>      4PP015.C420-01<br>      4PP015.E420-01<br>      4PP015.E420-101 | <br>300 kB SRAM<br>448 kB FlashPROM<br><br>1024 kByte FlashPROM<br>1024 kByte FlashPROM<br>1024 kByte FlashPROM<br>1984 kByte FlashPROM |
| Data buffering with backup battery | Lithium battery, 3 V / 950 mAh |
| Battey buffer current | Max. 60 µA |
| Hardware Watchdog | Yes |
| Voltage monitoring | An NMI is triggered at a supply voltage of <15 VDC. |
| Real-time clock | 1 s resolution, nonvolatile memory |
| System bus for expansions | No |
| Operating system | PP01x (version V 2.36 and higher) |
| **Status display / diagnostics** | |
| Status LED | Red / green |
| RS232 LED | Indicates if data is being transmitted or received |
| CAN LED | Indicates if data is being transmitted or received |
| I/O LED | Displays whether LEDs 1-16 indicate an input or output state. |
| 01-16 LEDs | State of inputs and outputs |

Table 6: Power Panel 15-01 technical data (Forts.)

| Product ID | Power Panel 15-01 | |
|---|---|---|
| **Interfaces** | | |
| Application interface IF1<br>    Type<br>    Design<br>    Electrical isolation<br>    Max. transfer rate<br>    Distance | RS232<br>9-pin DSUB plug<br>No<br>115.2 kbit/s<br>15 m / 19,200 bit/s | |
| Application interface IF2<br>    Type<br>    Design<br>    Electrical isolation<br>    Distance<br>    Max. transfer rate<br>        Bus length 60 m<br>        Bus length 200 m<br>    Bus length 1,000 m | CAN bus<br>9-pin DSUB plug<br>Yes<br>max. 1,000 m bus length<br><br>500 kbit/s<br>250 kbit/s<br>50 kbit/s | |
| **Digital inputs** | | |
| Channels | 1-3 | 4-16 |
| Additional functions for inputs | 2 x event counter or<br>1 x incremental encoder ABR/AB or<br>2 x gate/period measurement | - |
| Input circuit | Sink or source | Sink or source |
| Input voltage (nom./max.) | 24 VDC / 30 VDC | 24 VDC / 30 VDC |
| Input current at nominal voltage | ca. 10 mA | ca. 5 mA |
| Switching threshold<br>    LOW<br>    HIGH | <5 V<br>>15 V | |
| Input filter | <10 μs | <1 ms |
| Electrical isolation<br>    Channel - bus<br>    Channel - channel<br>    Group isolation | Yes<br>No<br>No | Yes<br>No<br>No |
| **Event counter operation** | | |
| Amount | 2 | |
| Counter 1/2 | Input 1 / 2 | |
| Counter size | 32-bit | |
| Input frequency | Max. 50 kHz | |
| Signal form | Square wave pulse | |
| Evaluation | Positive or negative edge, cyclic counter | |

Table 6: Power Panel 15-01 technical data (Forts.)

Chapter 3
Power Panel 15

| Product ID | Power Panel 15-01 |
|---|---|
| **Incremental encoder operation** | |
| Amount | 1 |
| Type | ABR or AB |
| Counter size | 32 bit |
| Input frequency | Max. 20 kHz |
| Evaluation | 4x |
| Signal form | Square wave pulse |
| **Gate measurement** | |
| Number of gate measurements | 2 |
| Gate measurement on channel 1 and 2<br>Channel 1<br>Channel 2 | Input 1<br>Input 2 |
| Counter size | 32-bit |
| Evaluation | Positive or negative edge |
| Input frequency | Max. 50 kHz |
| Pulse length | ≥10 µs |
| Length of pauses between pulses | ≥10 µs |
| Count frequency<br>Internal<br>External | 4 MHz, 31.25 kHz<br>Max. 50 kHz |
| Signal form | Square wave pulse |
| **Period measurement** | |
| Number of period measurements | 2 |
| Measurement on channel 1 and 2<br>Channel 1<br>Channel 2 | Input 1<br>Input 2 |
| Counter size | 32-bit |
| Evaluation | Positive or negative edge |
| Input frequency | Max. 50 kHz |
| Count frequency<br>Internal<br>External | 4 MHz, 31.25 kHz<br>Max. 50 kHz |
| Signal form | Square wave pulse |

Table 6: Power Panel 15-01 technical data (Forts.)

| Product ID | Power Panel 15-01 |
|---|---|
| **Digital outputs** | |
| Channels | 16 |
| Type | Highside driver (source) |
| Switching voltage<br>  Minimum<br>  Nominal<br>  Maximum | 18 VDC<br>24 VDC<br>30 VDC |
| Nom. output current | 0.5 A |
| Total current | 8 A |
| Output circuit | Source |
| Max. switching frequency | 100 Hz |
| Switching delay | max. 500 µs |
| Short-circuit protection | Yes |
| Overload protection | Yes |
| Internal protective circuit | VDR |
| Electrical isolation<br>  Channel - bus<br>  Channel - channel<br>  Group isolation | No<br>No<br>No |
| **Power supply** | |
| Supply voltage<br>  Minimum<br>  Nominal<br>  Maximum | 18 VDC<br>24 VDC<br>30 VDC |
| Power consumption | Max. 6 W |
| **Environmental conditions** | |
| Temperature<br>  Operation<br>  Storage | 0°C to 50°C<br>-20°C to 60°C |
| Humidity<br>  Operation<br>  Storage | 10 to 90% (non-condensing)<br>5 to 95% (non-condensing) |
| **Mechanics** | |
| Protection | IP65 (from front) |
| Outer dimensions (B x H x T [mm]) | 153 x 120 x 46.1 |
| Weight | 0.5 kg |

Table 6: Power Panel 15-01 technical data (Forts.)

Chapter 3
Power Panel 15

## 2.4 Diagnostic LEDs

Multiple LEDs on the back of the device show the status of the Power Panel, the interfaces, and the digital I/O:



Figure 5: Power Panel 15-01 diagnostic LEDs

### 2.4.1 Status LED

The Power Panel status LED uses a blink code to indicate the operating state of the Power Panel:

| Power Panel operating state | Color / blink code of the status LED | |
|---|---|---|
| Boot mode | Blinking yellow / green 1 Hz | |
| Flash programming | Blinking green / red 5 Hz | |
| Service mode / Diagnostic mode | Yellow | |
| Run | Green | |
| Error | Red | |

Table 7: Power Panel 15-01 status LED

### 2.4.2 I/O LEDs

The I/O LED indicates whether the I/O LEDs (01 ... 16) show the state of the digital inputs or outputs. The display can be set appropriatley using the I/O button.

| I/O LED | LEDs 01 ... 16 |
|---------|----------------|
| Green | The state of the 16 digital inputs is indicated (LEDs are green). |
| Yellow | The state of the 16 digital outputs is indicated (LEDs are yellow). |

Table 8: Power Panel 15-01 I/O LEDs

### 2.4.3 Interface LEDs

| Interface LED | Description |
|---------------|-------------|
| CAN | Indicates if data is being transmitted or received. |
| RS232 | Indicates if data is being transmitted or received. |

Table 9: Power Panel 15-01 interface LEDs

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Power Panel 15

## 2.5 Digital inputs

### 2.5.1 Terminal block connections

Inputs 1 - 3 are equipped with additional functions (event counter, ABR evaluation, etc.). The supply voltage for the digital inputs can be monitored with the application program.
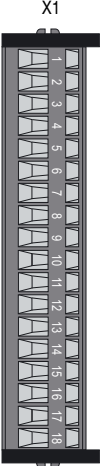
| 18-pin terminal block | Terminal | Assignment |
|---|---|---|
| | 1 | COM si (GND in sink operation, 24 VDC in source operation) |
| | 2 | COM so (24 VDC in sink operation, GND in source operation) |
| X1 | 3 | Input 1 / counter 1 / A |
| | 4 | Input 2 / counter 2 / B |
| | 5 | Input 3 / ext. CLK / R |
| | 6 | Input 4 |
| | 7 | Input 5 |
| | 8 | Input 6 |
| | 9 | Input 7 |
| | 10 | Input 8 |
| | 11 | Input 9 |
| | 12 | Input 10 |
| | 13 | Input 11 |
| | 14 | Input 12 |
| | 15 | Input 13 |
| | 16 | Input 14 |
| 7TB718.91 | 17 | Input 15 |
| | 18 | Input 16 |

Table 10: Power Panel 15-01 terminal assignments - X1 / digital inputs

### 2.5.2 Connection examples
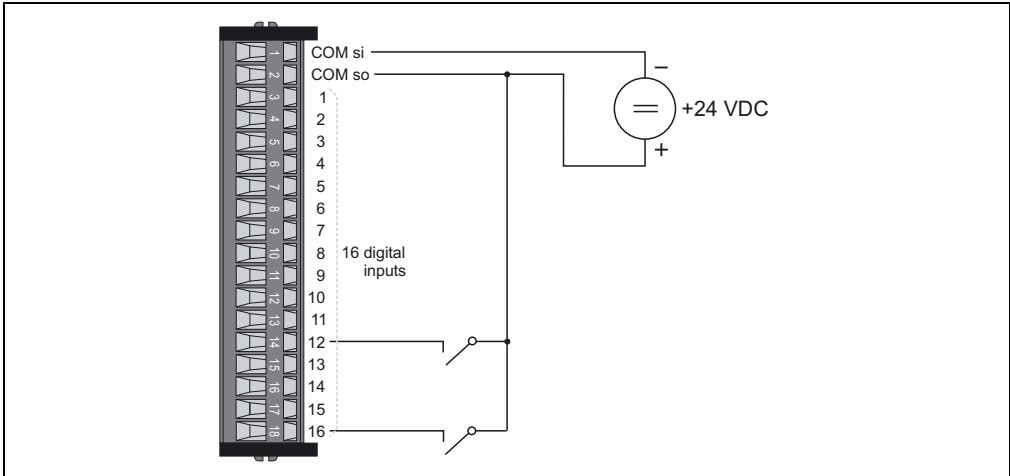
**Sink connection**



Figure 6: Power Panel 15-01 digital input connection examples (sink connection)
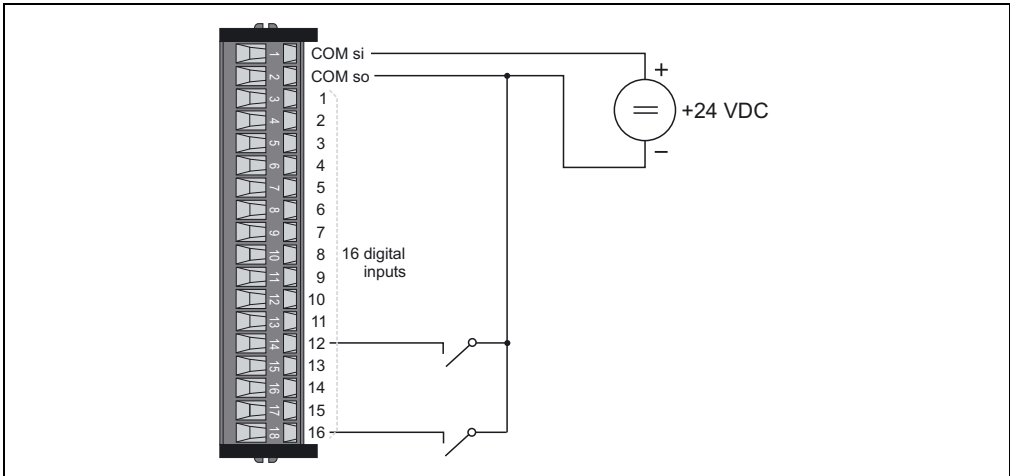
**Source connection**



Figure 7: Power Panel 15-01 digital input connection examples (source connection)

Chapter 3
Power Panel 15
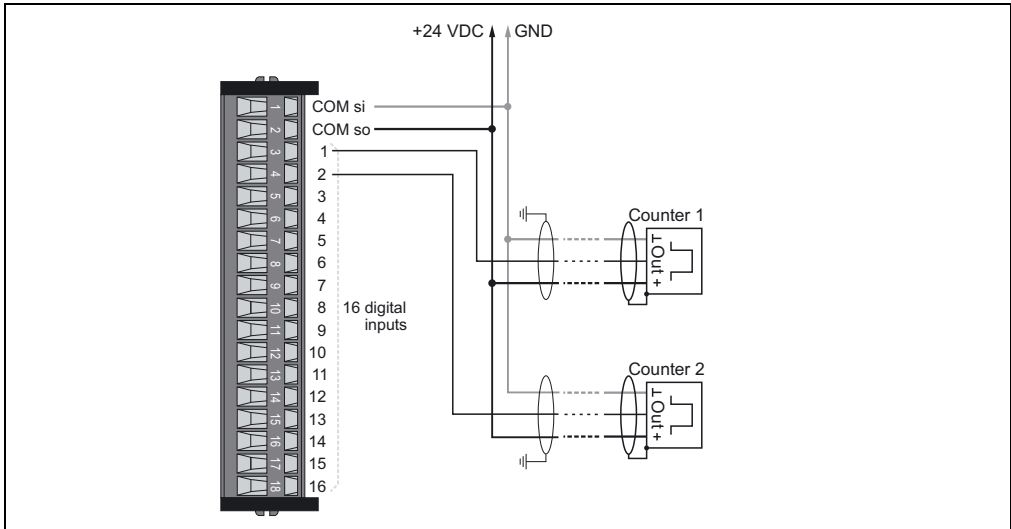
## Counter inputs



Figure 8: Power Panel 15-01 connection example - counter input

## Period or gate measurement
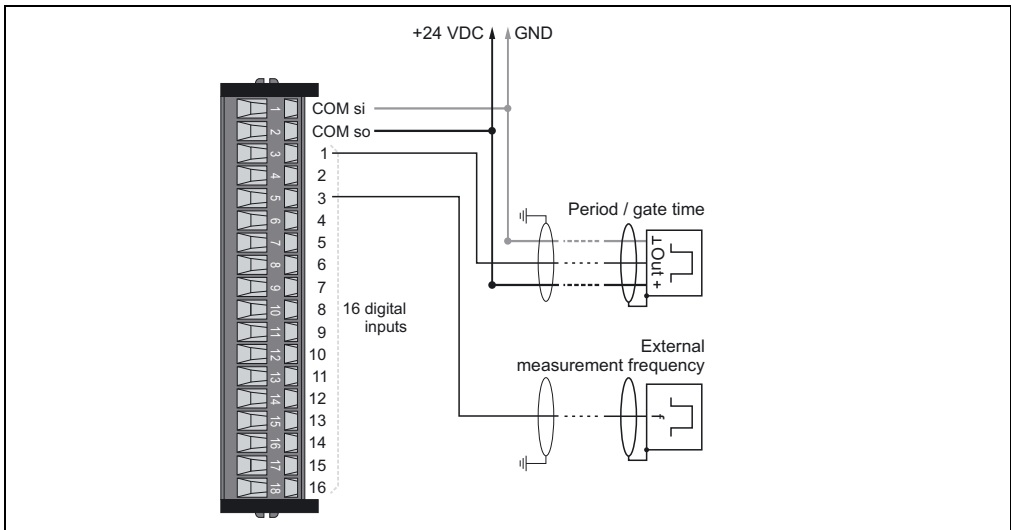


Figure 9: Power Panel 15-01 connection example - period and gate measurement

**Incremental encoders**
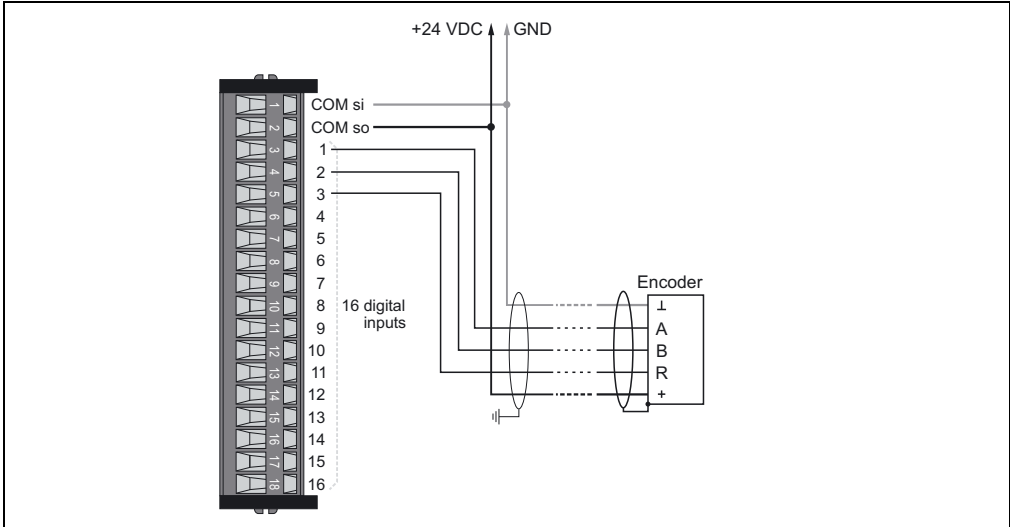


Figure 10: Power Panel 15-01 connection example - incremental encoder

## 2.5.3 Input circuit diagram



Figure 11: Power Panel 15-01 input circuit diagram - digital inputs

## 2.6  Digital outputs

### 2.6.1  Terminal block connections
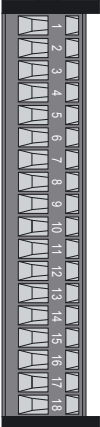
| 18-pin terminal block | Terminal | Assignment |
|---|---|---|
| | 1 | GND |
| | 2 | 24 VDC (DO supply) |
| | 3 | Output 1 |
| | 4 | Output 2 |
| | 5 | Output 3 |
| | 6 | Output 4 |
| | 7 | Output 5 |
| | 8 | Output 6 |
| | 9 | Output 7 |
| | 10 | Output 8 |
| | 11 | Output 9 |
| | 12 | Output 10 |
| | 13 | Output 11 |
| | 14 | Output 12 |
| | 15 | Output 13 |
| | 16 | Output 14 |
| | 17 | Output 15 |
| | 18 | Output 16 |

Table 11: Power Panel 15-01 terminal assignments - X2 / digital outputs

## 2.6.2 Connection example
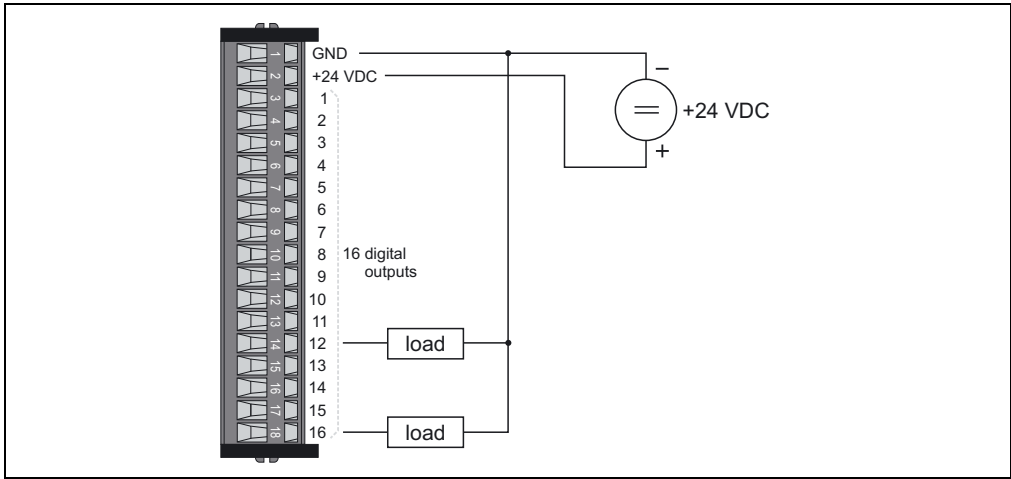


Figure 12: Power Panel 15-01 conneciton example - digital outputs

## 2.6.3 Output circuit diagram
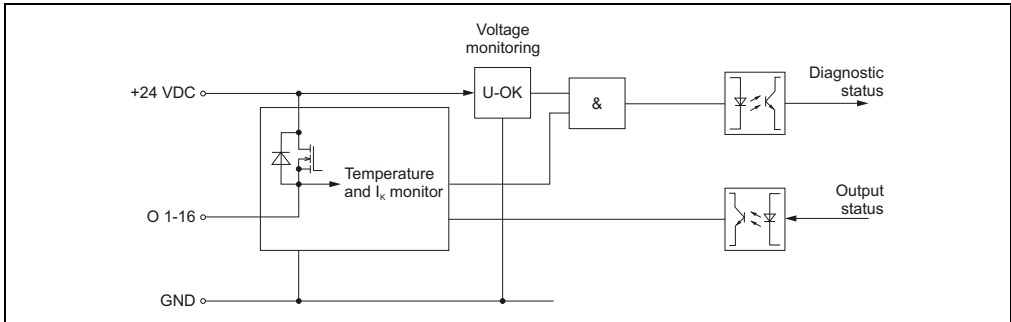


Figure 13: Power Panel 15-01 output circuit diagram - digital outputs

## 2.7 Variable declaration

| Description | Name in Automation Studio | Data type | Description |
|---|---|---|---|
| Digital in 1 - 16 | Digital input 01 - 16 | BIT | Level of digital inputs 1 - 16 |
| Digital out 1 - 16 | Digital output 01 - 16 | BIT | Level of digital outputs 1 - 16 |
| Counter 1 | Analog input 01 | UDINT | Counter state 1 (bit 1 - bit 32) |
| Counter 2 | Analog input 02 | UDINT | Counter state 2 (bit 1 - bit 32) |
| DO back | Analog input 03 | UINT | Actual state of the digital outputs 1 - 16 |
| Status | Analog input 04 | UINT | Status word |
| Config | Analog output 01 | UINT | Configuration word |

Table 12: Power Panel 15-01 variable declaration

## 2.7.1  Configuration register

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
|    |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |

| Bit | Description |
|-----|-------------|
| 0 | Reserved |
| 1 | This setting applies only in AB(R) mode (bit 4+5 set to 01):<br>0 ...  R disabled<br>1 ...  R enabled |
| 2 | Switch between period and gate measurement (only evaluated if bits 4+5 are set to 11):<br>0 ...  Period measurement<br>1 ...  Gate measurement |
| 3 | Beginning of period or gate measurement:<br>0 ...  at rising (positive) edge<br>1 ...  at falling (negative) edge |
| 5-4 | 00 ... No counter operation<br>01 ... AB(R) counter<br>10 ... Event counter<br>11 ... Period or gate measurement |
| 7-6 | 00 ... Counter frequency 4 MHz<br>01 ... External counter frequency<br>10 ... Counter frequency 31.25 kHz<br>11 ... Not allowed |
| 8 | 0 ...  At the reference impulse (positive edge) counter 1 is copied to counter 2<br>1 ...  At the reference impulse (positive edge) counter 1 is reset to counter 0 |
| 9 | Overrun recognition by **counter 1** (only applies in period duration / gate time mode; see bit 4-5 and bit 2 of the configuration register):<br>0 ...  Shut off overrun recognition and reset overrun bit of counter  1 (bit 9 in the status register).<br>1 ...  overrun recognition of the continuous counter. The counter value is limited to \$0000FFFF. |
| 10 | Overrun recognition by **counter 2** (only applies in period duration / gate time mode; see bit 4-5 and bit 2 of the configuration register):<br>0 ...  Shut off overrun recognition and reset overrun bit of counter  2 (bit 10 in the status register).<br>1 ...  overrun recognition of the continuous counter. The counter value is limited to \$0000FFFF. |
| 14-11 | Reserved |
| 15 | 0 ...  Reset time or counter<br>1 ...  Enable time or counter (set this bit to 1 after counter has been configured) |

The reserve bits can only be written with the value 0.

## 2.7.2 Status register

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|

| Bit | Description |
|-----|-------------|
| 8-0 | Reserved |
| 9 | Information regarding counter 1 at period or gate measurement (only applies when bit 9 is set in the configuration register):<br>0 ... The counter's value is within the range 0 - $0000FFFF.<br>1 ... Counter overrun! Acknowledge by resetting bit 9 of the configuration register. |
| 10 | Information regarding counter 2 at period or gate measurement (only applies when bit 10 is set in the configuration register):<br>0 ... The counter's value is within the range 0 - $0000FFFF.<br>1 ... Counter overrun! Acknowledge by resetting bit 10 of the configuration register. |
| 11 | Reserved |
| 12 | Monitoring of the 24 VDC input supply<br>0 ... Input supply OK<br>1 ... Error: input supply to low or missing |
| 14-13 | Reserved |
| 15 | Monitoring of the 24 VDC output supply<br>0 ... Output supply OK<br>1 ... Error: output supply to low or missing |

### 2.7.3  DO back (status of digital outputs)

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
|    |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |

| Bit | Description |
|-----|-------------|
| 0 | 0 ...  Actual state of digital output 1: OUT <br> 1 ...  Actual state of digital output 1: IN |
| 1 | 0 ...  Actual state of digital output 2: OUT <br> 1 ...  Actual state of digital output 2: IN |
| 2 | 0 ...  Actual state of digital output 3: OUT <br> 1 ...  Actual state of digital output 3: IN |
| 3 | 0 ...  Actual state of digital output 4: OUT <br> 1 ...  Actual state of digital output 4: IN |
| 4 | 0 ...  Actual state of digital output 5: OUT <br> 1 ...  Actual state of digital output 5: IN |
| 5 | 0 ...  Actual state of digital output 6: OUT <br> 1 ...  Actual state of digital output 6: IN |
| 6 | 0 ...  Actual state of digital output 7: OUT <br> 1 ...  Actual state of digital output 7: IN |
| 7 | 0 ...  Actual state of digital output 8: OUT <br> 1 ...  Actual state of digital output 8: IN |
| 8 | 0 ...  Actual state of digital output 9: OUT <br> 1 ...  Actual state of digital output 9: IN |
| 9 | 0 ...  Actual state of digital output 10: OUT <br> 1 ...  Actual state of digital output 10: IN |
| 10 | 0 ...  Actual state of digital output 11: OUT <br> 1 ...  Actual state of digital output 11: IN |
| 11 | 0 ...  Actual state of digital output 12: OUT <br> 1 ...  Actual state of digital output 12: IN |
| 12 | 0 ...  Actual state of digital output 13: OUT <br> 1 ...  Actual state of digital output 13: IN |
| 13 | 0 ...  Actual state of digital output 14: OUT <br> 1 ...  Actual state of digital output 14: IN |
| 14 | 0 ...  Actual state of digital output 15: OUT <br> 1 ...  Actual state of digital output 15: IN |
| 15 | 0 ...  Actual state of digital output 16: OUT <br> 1 ...  Actual state of digital output 16: IN |

### 2.7.4  Counter settings

To set the correct counter modes, the configuration register must be written. Counter 1 and counter 2 registers have different meanings for different modes.

**Incremental encoder operation**

If the homing input (input 3) is *enabled* in the configuration register, then the Power Panel is a 32-bit ABR counter whose actual value is found in counter 1 and the saved R value in counter 2.

If the homing input is disabled, a 32-bit AB incremental encoder counter input is read in counter 1.

- A = digital input 1
- B = digital input 2
- R = digital input 3

**Event counter operation**

If the counters in the configuration register are initialized as event counters, two 32-bit counters are available.

- Counter 1 = digital input 1
- Counter 2 = digital input 2

**Period measurement**



Figure 14: Power Panel 15-01 period measurement

The measurement can begin at the decreasing or increasing edge depending on the configuration register. The counter frequency can be set in two steps (4 MHz or 31.25 kHz) or with an external frequency. The external frequency must however be less than 50 kHz. The measured counter state is a 32-bit value and is displayed in counter 1 or counter 2. The value in the temporary register is only updated at the end of the measurement.

The frequency of the signal to be measured can be a maximum of 50 kHz.

- Counter 1 = digital input 1
- Counter 2 = digital input 2
- Ext. Counting frequency = digital input 3

A potential overrun of the continuous counter during the period measurement ( e.g. due to an incorrect counter frequency ), can be detected by reading bit 9 (counter 1) or bit 10 (counter 10) in the status register. However, the maximum value of counter is limited to $0000FFFF as a result. The error bit in the status register is acknowledged by resetting bit 9 (counter 1) or bit 10 (counter 2) of the configuration register.

**Gate measurement**



Figure 15: Power Panel 15-01 gate measurement

The measurement can be begin at the decreasing or increasing edge depending on the configuration register. The R enable bit must be 0. Measurement always occurs up to the next edge. The counter frequency can be set to one of two levels (4 MHz or 31.25 kHz) or with an external frequency. The external frequency must however be less than 50 kHz. The measured counter state is a 32 bit value and is displayed in counter 1 or counter 2. The value in the temporary register is only updated at the end of the active measurement.

The frequency of the signal to be measured can be a maximum of 50 kHz.

- Counter 1 = digital input 1
- Counter 2 = digital input 2
- Ext. Counting frequency = digital input 3

A potential overrun of the continuous counter during the gate measurement ( e.g. due to an incorrect counter frequency ), can be detected by reading bit 9 (counter 1) or bit 10 (counter 2) in the status register. However, the maximum value of counter is limited to $0000FFFF as a result. The error bit in the status register is acknowledged by resetting bit 9 or bit 10 of the configuration register.

# 3. Power Panel 15-36

## 3.1 Photos


4PP015.0420-36

4PP015.C420-36 / 4PP015.E420-36
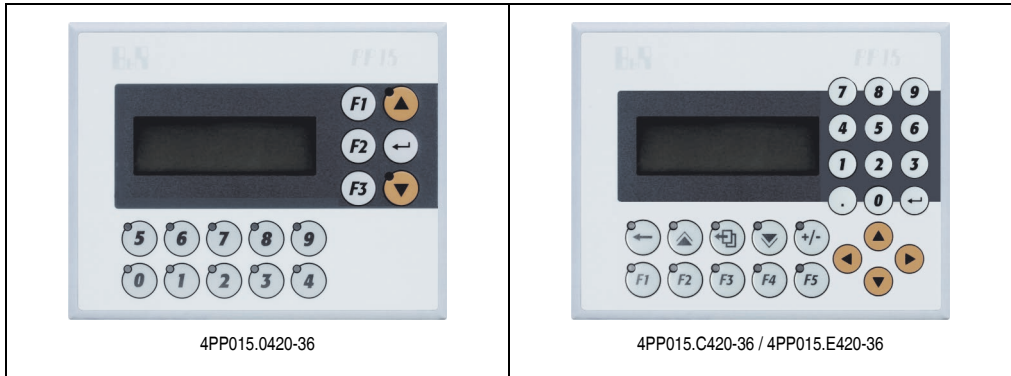
Figure 16: Power Panel 15-36 photos

## 3.2 Order data

| Model number | Short description |
|---|---|
| 4PP015.0420-36 | Power Panel, 24 VDC, 153 x 120 mm, LC display, 4 x 20 characters, background lighting, English / Katakana character set, 16 keys, 300 KB SRAM, 1024 kB FlashPROM, 1 RS232, 1 CAN interface, 8 digital inputs, 24 VDC, sink / source, 2 event counters, 1 incremental encoder or 2 gate -/period measurement, 8 digital outputs, 24 VDC, 0.5 A source, 4 analog inputs, ±10 V, 12-bit, two of the analog inputs can be used as KTY10 or PT1000 inputs. 4 analog outputs, ±10 V, 12 bit, IP65 protection (from front). 2 x TB718 and 1 x TB103 terminal blocks sold separately. |
| 4PP015.C420-36 | Power Panel, 24 VDC, 153 x 120 mm, LC display, 4 x 20 characters, background lighting, English / Cyrillic character set, 26 keys, 300 KB SRAM, 1024 kB FlashPROM, 1 RS232, 1 CAN interface, 8 digital inputs, 24 VDC, sink / source, 2 event counters, 1 incremental encoder or 2 gate-/period measurement, 8 digital outputs, 24 VDC, 0.5 A source, 4 analog inputs, ±10 V, 12-bit, two of the analog inputs can be used as KTY10 or PT1000 inputs. 4 analog outputs, ±10 V, 12 bit, IP65 protection (from front). 2 x TB718 and 1 x TB103 terminal blocks sold separately. |
| 4PP015.E420-36 | Power Panel, 24 VDC, 153 x 120 mm, LC display, 4 x 20 characters, background lighting, English / European character set, 26 keys, 300 KB SRAM, 1024 kB FlashPROM, 1 RS232, 1 CAN interface, 8 digital inputs, 24 VDC, sink / source, 2 event counters, 1 incremental encoder or 2 gate-/period measurement, 8 digital outputs, 24 VDC, 0.5 A source, 4 analog inputs, ±10 V, 12-bit, two of the analog inputs can be used as KTY10 or PT1000 inputs. 4 analog outputs, ±10 V, 12 bit, IP65 protection (from front). 2 x TB718 and 1 x TB103 terminal blocks sold separately. |
| **Note** | |
| All parts required to install the Power Panel, including key legend sheets, are included in its delivery. | |
| **Required accessories** | |
| 0TB103.9 | Accessory terminal block, 3-pin, screw clamp, 2.5 mm², protection against vibration with the screw flange. |
| 0TB103.91 | Accessory terminal block, 3-pin, cage clamp, 2.5 mm², protection against vibration with the screw flange. |
| 7TB718.9 | Accessory terminal block, 18-pin, screw clamp, 1.5 mm² |
| 7TB718.91 | Accessory terminal block, 18-pin, cage clamp, 1.5 mm² |

Table 13: Power Panel 15-36 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 |
| 4A0044.00-000 | 5 DIN A4 legend strips, 6 fields for a total of 30 devices |
| 7AC911.9 | Bus connector, CAN |

Table 13: Power Panel 15-36 order data (Forts.)

1) Replacement part

## 3.3 Technical data

| Product ID | Power Panel 15-36 |
|---|---|
| **General information** | |
| Certification | CE, C-UL-US, GOST-R |
| Standards<br>    Temperature<br>    Shock /  tests carried out<br>    Vibration / tests carried out<br>    Emission / tests carried out<br>    Immunity / tests carried out | IEC61131-2 / IEC60068-2-x<br>IEC61131-2 / IEC60068-2-27<br>IEC61131-2 / IEC60068-2-6<br>EN61000-6-4 / EN55022<br>IEC 61131-2 / IEC 61000-4-x |
| Status display | I/O function for each channel, status |
| Diagnostics<br>    Status<br>    I/O function<br>    Interfaces | Yes, with status LED<br>Yes, with LEDs<br>Yes, with LEDs |
| **Display** | |
| Type | LCD b/w |
| Resolution | 4 x 20 characters |
| Background lighting | LED |
| Character set<br>    4PP015.0420-36<br>    4PP015.C420-36<br>    4PP015.E420-36 | English / Katakana<br>English / Cyrillic<br>English / European |
| **Keys** | |
| Total keys<br>    4PP015.0420-36<br>    4PP015.C420-36<br>    4PP015.E420-36 | 16 (12 with LEDs)<br>26 (10 with LEDs)<br>26 (10 with LEDs) |
| System keys | Number block<br>Control keys |
| Labeling | 10 keys with insert strips |

Table 14: Power Panel 15-36 technical data

| Product ID | Power Panel 15-36 |
|---|---|
| **Processor** | |
| Typical instruction cycle time | 0.8 µs, average value at 70% bit and 30% analog processing |
| Standard memory<br>  User RAM<br>  System PROM<br>  User PROM<br>    4PP015.0420-36<br>    4PP015.C420-36<br>    4PP015.E420-36 | <br>300 kB SRAM<br>448 kB FlashPROM<br><br>1024 kByte FlashPROM<br>1024 kByte FlashPROM<br>1024 kByte FlashPROM |
| Data buffering with backup battery | Lithium battery, 3 V / 950 mAh |
| Battey buffer current | Max. 30 µA |
| Hardware Watchdog | Yes |
| Voltage monitoring | An NMI is triggered at a supply voltage of <15 VDC. |
| Real-time clock | 1 s resolution, nonvolatile memory |
| System bus for expansions | No |
| Operating system | PP01x (version V 2.36 and higher) |
| **Status display / diagnostics** | |
| Status LED | Red / green |
| RS232 LED | Indicates if data is being transmitted or received |
| CAN LED | Indicates if data is being transmitted or received |
| I/O LED | Displays whether LEDs 1-16 indicate an input or output state. |
| 01-16 LEDs | State of inputs and outputs |
| **Interfaces** | |
| Application interface IF1<br>  Type<br>  Design<br>  Electrical isolation<br>  Max. transfer rate<br>  Distance | <br>RS232<br>9-pin DSUB plug<br>No<br>115.2 kbit/s<br>15 m / 19,200 bit/s |
| Application interface IF2<br>  Type<br>  Design<br>  Electrical isolation<br>  Distance<br>  Max. transfer rate<br>    Bus length 60 m<br>    Bus length 200 m<br>  Bus length 1,000 m | <br>CAN bus<br>9-pin DSUB plug<br>Yes<br>max. 1,000 m bus length<br><br>500 kbit/s<br>250 kbit/s<br>50 kbit/s |

Table 14: Power Panel 15-36 technical data (Forts.)

| Product ID | Power Panel 15-36 | |
|---|---|---|
| **Digital inputs** | | |
| Channels | 1-3 | 4-8 |
| Additional functions for inputs | 2 x event counter or<br>1 x incremental encoder ABR/AB or<br>2 x gate/period measurement | - |
| Input circuit | Sink or source | Sink or source |
| Input voltage (nom./max.) | 24 VDC / 30 VDC | 24 VDC / 30 VDC |
| Input current at nominal voltage | ca. 10 mA | ca. 5 mA |
| Switching threshold<br>    LOW<br>    HIGH | <5 V<br>>15 V | |
| Input filter | <10 µs | <1 ms |
| Electrical isolation<br>    Channel - bus<br>    Channel - channel<br>    Group isolation | Yes<br>No<br>No | Yes<br>No<br>No |
| **Event counter operation** | | |
| Amount | 2 | |
| Counter 1/2 | Input 1 / 2 | |
| Counter size | 32-bit | |
| Input frequency | Max. 50 kHz | |
| Signal form | Square wave pulse | |
| Evaluation | Positive or negative edge, cyclic counter | |
| **Incremental encoder operation** | | |
| Amount | 1 | |
| Type | ABR or AB | |
| Counter size | 32-bit | |
| Input frequency | Max. 20 kHz | |
| Evaluation | 4x | |
| Signal form | Square wave pulse | |

Table 14: Power Panel 15-36 technical data (Forts.)

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Power Panel 15

| Product ID | Power Panel 15-36 |
|---|---|
| **Gate measurement** | |
| Number of gate measurements | 2 |
| Gate measurement on channel 1 and 2<br>    Channel 1<br>    Channel 2 | Input 1<br>Input 2 |
| Counter size | 32-bit |
| Evaluation | Positive or negative edge |
| Input frequency | Max. 50 kHz |
| Pulse length | ≥10 µs |
| Length of pauses between pulses | ≥10 µs |
| Count frequency<br>    Internal<br>    External | 4 MHz, 31.25 kHz<br>Max. 50 kHz |
| Signal form | Square wave pulse |
| **Period measurement** | |
| Number of period measurements | 2 |
| Measurement on channel 1 and 2<br>    Channel 1<br>    Channel 2 | Input 1<br>Input 2 |
| Counter size | 32-bit |
| Evaluation | Positive or negative edge |
| Input frequency | Max. 50 kHz |
| Count frequency<br>    Internal<br>    External | 4 MHz, 31.25 kHz<br>Max. 50 kHz |
| Signal form | Square wave pulse |

Table 14: Power Panel 15-36 technical data (Forts.)

| Product ID | Power Panel 15-36 |
|---|---|
| **Digital outputs** | |
| Channels | 8 |
| Type | Highside driver (source) |
| Switching voltage<br>   Minimum<br>   Nominal<br>   Maximum | 18 VDC<br>24 VDC<br>30 VDC |
| Nom. output current | 0.5 A |
| Total current | 4 A |
| Output circuit | Source |
| Max. switching frequency | 100 Hz |
| Switching delay | max. 500 µs |
| Short-circuit protection | Yes |
| Overload protection | Yes |
| Internal protective circuit | VDR |
| Electrical isolation<br>   Channel - bus<br>   Channel - channel<br>   Group isolation | No<br>No<br>No |
| **Analog inputs** | |
| Number of channels | 4 differential inputs; 2 of which can be configured individually as temperature inputs |
| Input | $\pm10$ V |
| Value range / input signal<br>   10 V<br>   0 V<br>   -10 V | $7FFF<br>$0000<br>$8001 |
| Digital converter resolution | 12-bit |
| Conversion time | 150 µs for all channels |
| Input filter<br>   Hardware<br>   Software | Cut-off frequency 10 kHz / attenuation 60 dB<br>- |
| Output format | INT |
| Input impedance in signal range | 20 M$\Omega$ |
| Input circuit | IEC 61131-2 |
| Electrical isolation<br>   Channel - Power Panel<br>   Channel - channel<br>   Group isolation | Yes<br>No<br>No |

Table 14: Power Panel 15-36 technical data (Forts.)

Chapter 3
Power Panel 15

| Product ID | Power Panel 15-36 |
|---|---|
| **Temperature measurement** | |
| Number of channels | Up to 2 (depending on the configuration) |
| Input | Resistance measurement using 2-line procedure with constant current measurement |
| Digital converter resolution | 12-bit |
| Conversion time | 150 µs for all channels |
| Input filter<br>   Hardware<br>   Software | <br>Cut-off frequency 10 kHz / attenuation 60 dB<br>- |
| Output format | INT |
| Data format | 16-bit 2s-complement (INT 16); 1 LSB = 0.1°C |
| Conversion of measurement values to temperature values | Automatic in the module |
| Sensor<br>   KTY10-6<br>   PT1000 | Can be set per channel<br>-50°C to 125°C<br>-200°C to 850°C |
| Resolution in °C<br>   KTY10-6<br>   PT1000 | <br>0.13°C<br>0.56°C |
| Wiring | 2-line |
| Measuring current | 1 mA |
| Resistance measurement range | 0 - 4000 $\Omega$ |
| Input circuit | IEC 61131-2 |
| Electrical isolation | like analog inputs |
| **Analog outputs** | |
| Number of channels | 4 |
| Output | $\pm$10 V |
| Value range / output signal<br>   10 V<br>   0 V<br>   -10 V | <br>$7FFF<br>$0000<br>$8001 |
| Max. load per output | $\pm$10 mA (load 1 k$\Omega$) |
| Digital converter resolution | 12-bit |
| Conversion time | 150 µs for all channels |
| Switch on / switch off procedure | Internal enable relay for boot procedure and error |
| Basic accuracy | $\pm$0.088% at 25°C based on the current output value |
| Output protection | Continuous short circuit protection |
| Electrical isolation<br>   Channel - bus<br>   Channel - channel<br>   Group isolation | <br>Yes<br>No<br>No |

Table 14: Power Panel 15-36 technical data (Forts.)

| Product ID | Power Panel 15-36 |
|---|---|
| **Power supply** | |
| Supply voltage<br>   Minimum<br>   Nominal<br>   Maximum | 18 VDC<br>24 VDC<br>30 VDC |
| Power consumption | Max. 6 W |
| **Environmental conditions** | |
| Temperature<br>   Operation<br>   Storage | 0°C to 50°C<br>-20°C to 60°C |
| Humidity<br>   Operation<br>   Storage | 10 to 90% (non-condensing)<br>5 to 95% (non-condensing) |
| **Mechanics** | |
| Protection | IP65 (from front) |
| Outer dimensions (B x H x T [mm]) | 153 x 120 x 46.1 |
| Weight | 0.5 kg |

Table 14: Power Panel 15-36 technical data (Forts.)

## 3.4 Diagnostic LEDs

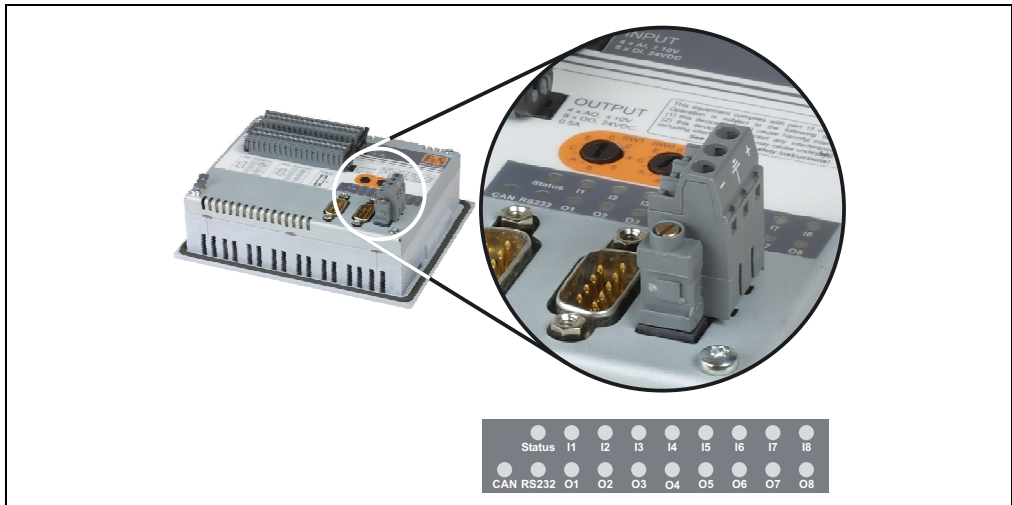Multiple LEDs on the back of the device show the status of the Power Panel, the interfaces, and the digital I/O:



Figure 17: Power Panel 15-36 diagnostic LEDs

Chapter 3
Power Panel 15

### 3.4.1  Status LED

The Power Panel status LED uses a blink code to indicate the operating state of the Power Panel:

| Power Panel operating state | Color / blink code of the status LED | |
|---|---|---|
| Boot mode | Blinking yellow / green 1 Hz | |
| Flash programming | Blinking green / red 5 Hz | |
| Service mode / Diagnostic mode | Yellow | |
| Run | Green | |
| Error | Red | |

Table 15: Power Panel 15-36 status LED

### 3.4.2  I/O LEDs

| I/O LED | Description |
|---|---|
| I1 ... I8 | State of the 8 digital inputs |
| O1 ... O8 | State of the 8 digital outputs |

Table 16: Power Panel 15-36 I/O LEDs

### 3.4.3  Interface LEDs

| Interface LED | Description |
|---|---|
| CAN | Indicates if data is being transmitted or received. |
| RS232 | Indicates if data is being transmitted or received. |

Table 17: Power Panel 15-36 interface LEDs

## 3.5  Analog / digital inputs

### 3.5.1  Terminal block connections

Digital inputs 1 - 3 are equipped with additional functions (event counter, ABR evaluation, etc.).
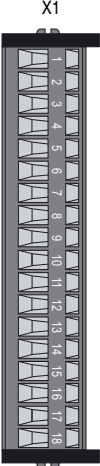The supply voltage for the digital inputs can be monitored with the application program.

| 18-pin terminal block | Terminal | Assignment |
|---|---|---|
| | 1 | COM si (GND in sink operation, 24 VDC in source operation) |
| | 2 | COM so (24 VDC in sink operation, GND in source operation) |
| X1 | 3 | + Analog input 1 |
| | 4 | - Analog input 1 |
| | 5 | + Analog input 2 |
| | 6 | - Analog input 2 |
| | 7 | + Analog input 3 |
| | 8 | - Analog input 3 |
| | 9 | + Analog input 4 |
| | 10 | - Analog input 4 |
| | 11 | Digital input 1 / counter 1 / A |
| | 12 | Digital input 2 / counter 2 / B |
| | 13 | Digital input 3 / ext. CLK / R |
| | 14 | Digital input 4 |
| | 15 | Digital input 5 |
| | 16 | Digital input 6 |
| 7TB718.91 | 17 | Digital input 7 |
| | 18 | Digital input 8 |

Table 18: Power Panel 15-36 terminal assignments - X1 / digital/analog inputs

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Power Panel 15

### 3.5.2 Connection examples

**Analog inputs**



Figure 18: Power Panel 15-36 connection example - analog inputs

**Digital inputs (sink connection)**



Figure 19: Power Panel 15-36 digital input connection example (sink connection)

**Digital inputs (source connection)**
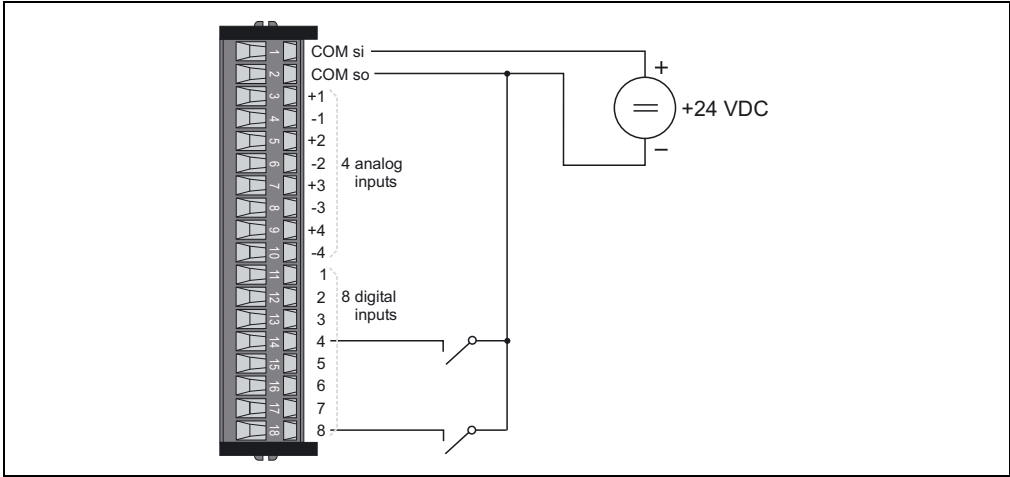


Figure 20: Power Panel 15-36 digital input connection examples (source connection)
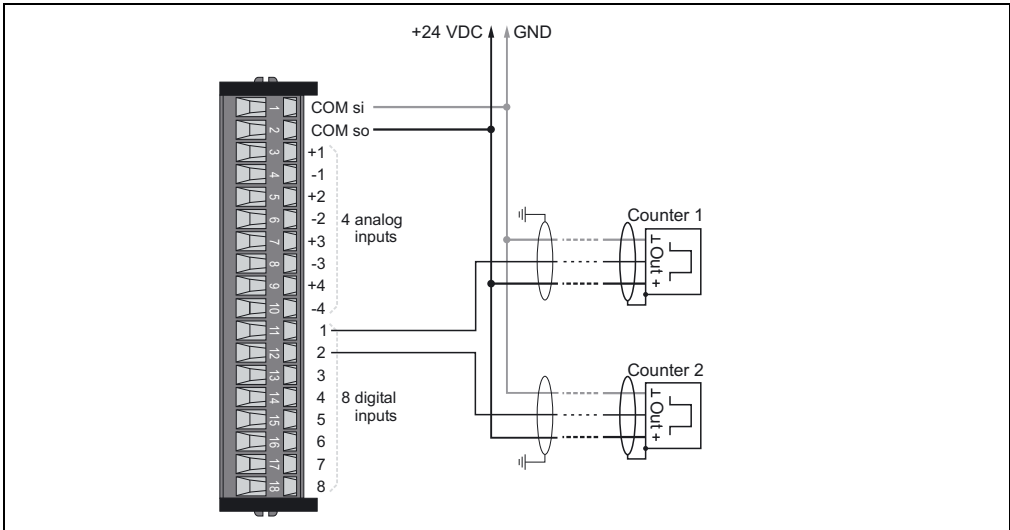
**Counter inputs**



Figure 21: Power Panel 15-36 connection example - counter input

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Power Panel 15

## Period or gate measurement
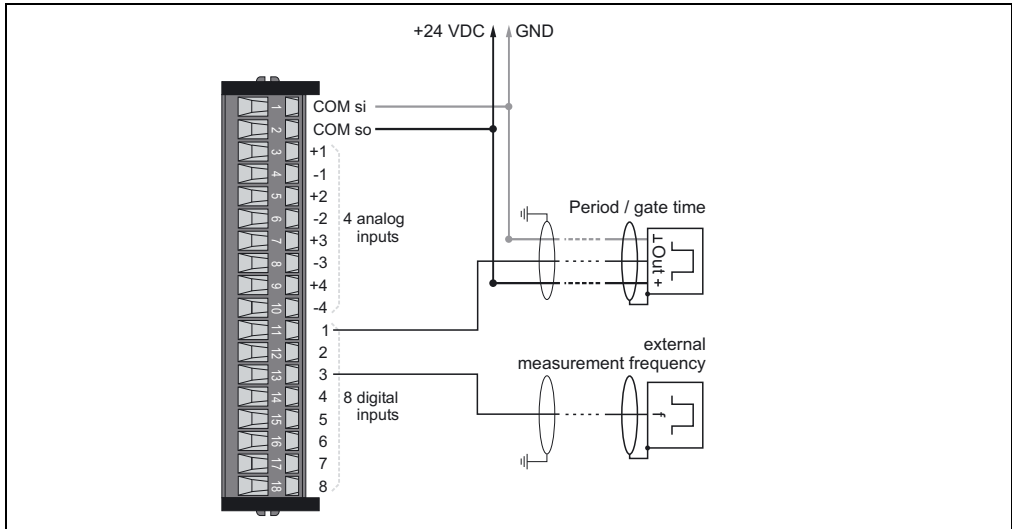


Figure 22: Power Panel 15-36 connection example - period and gate measurement

## Incremental encoders
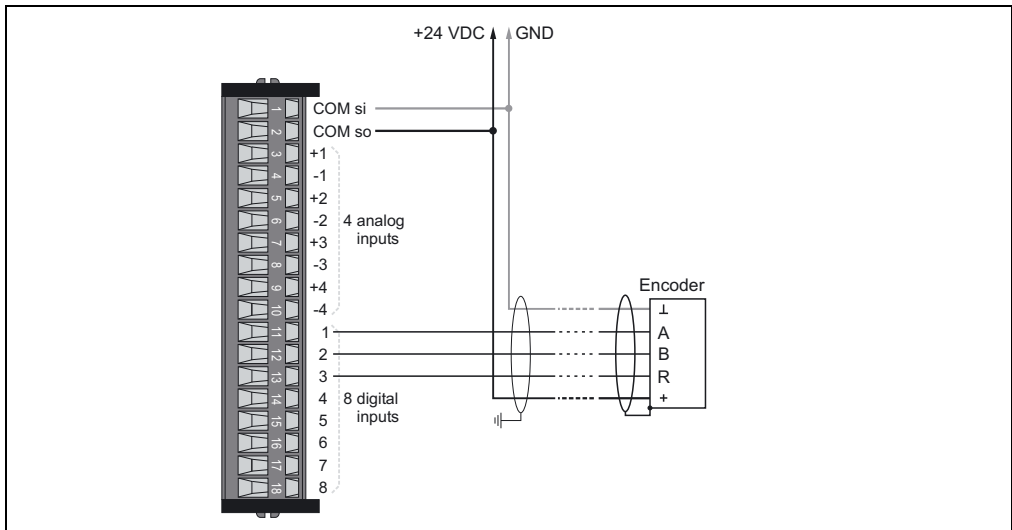


Figure 23: Power Panel 15-36 connection example - incremental encoder

### 3.5.3  Input circuit diagram
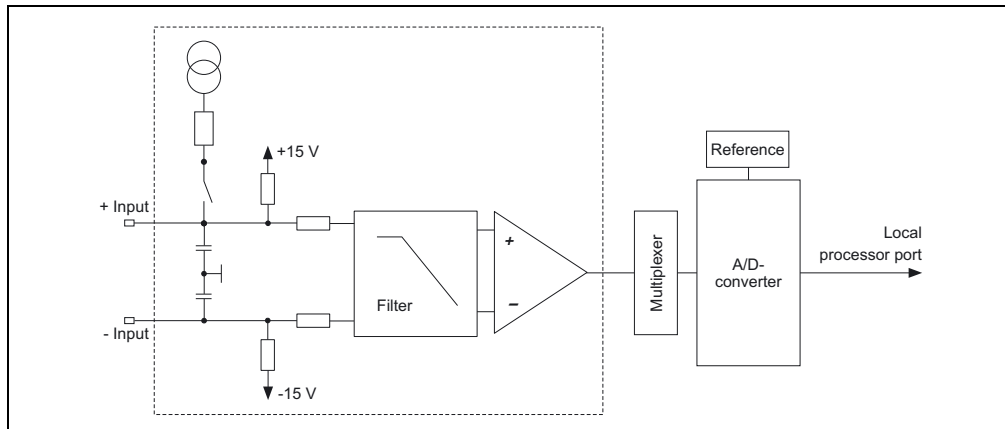
**Analog inputs 1 + 2**



Figure 24: Power Panel 15-36 input circuit diagram - analog inputs 1 + 2

**Analog inputs 3 + 4**



Figure 25: Power Panel 15-36 input circuit diagram - analog inputs 3 + 4

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Power Panel 15
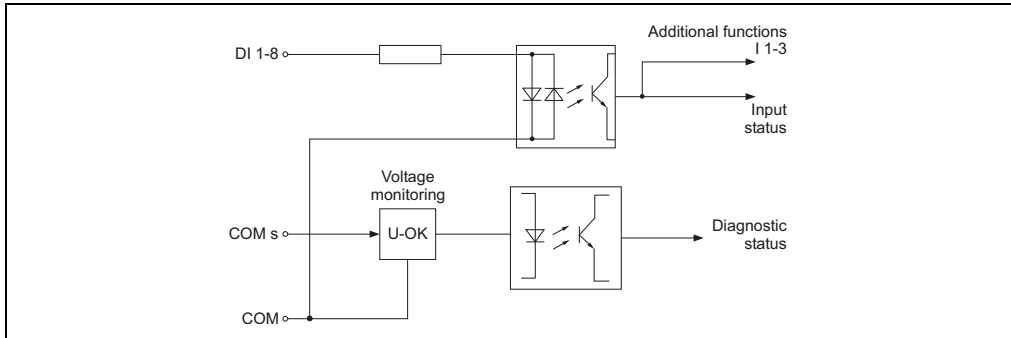
### Digital inputs



Figure 26: Power Panel 15-36 input circuit diagram - digital inputs

## 3.6 Analog / digital outputs

### 3.6.1 Terminal block connections

| 18-pin terminal block | Terminal | Assignment |
|---|---|---|
| X2 | 1 | GND |
| | 2 | 24 VDC (DO supply) |
| | 3 | + Analog output 1 |
| | 4 | ⊥ Analog output 1 |
| | 5 | + Analog output 2 |
| | 6 | ⊥ Analog output 2 |
| | 7 | + Analog output 3 |
| | 8 | ⊥ Analog output 3 |
| | 9 | + Analog output 4 |
| | 10 | ⊥ Analog output 4 |
| | 11 | Digital output 1 |
| | 12 | Digital output 2 |
| | 13 | Digital output 3 |
| | 14 | Digital output 4 |
| | 15 | Digital output 5 |
| 7TB718.91 | 16 | Digital output 6 |
| | 17 | Digital output 7 |
| | 18 | Digital output 8 |

Table 19: Power Panel 15-36 terminal assignments - X2 / digital/analog outputs

### 3.6.2  Connection examples

**Analog outputs**



Figure 27: Power Panel 15-36 connection example - analog output
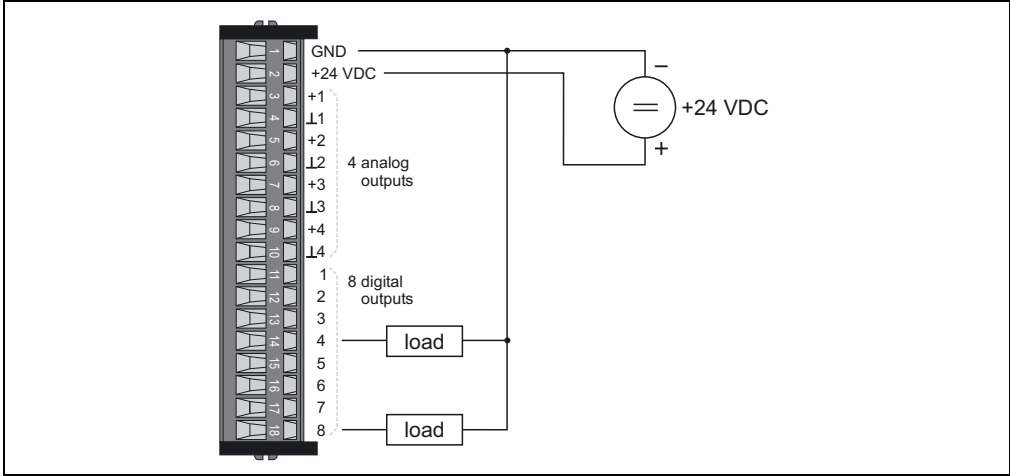
**Digital outputs**



Figure 28: Power Panel 15-36 conneciton example - digital output

### 3.6.3 Output circuit diagram
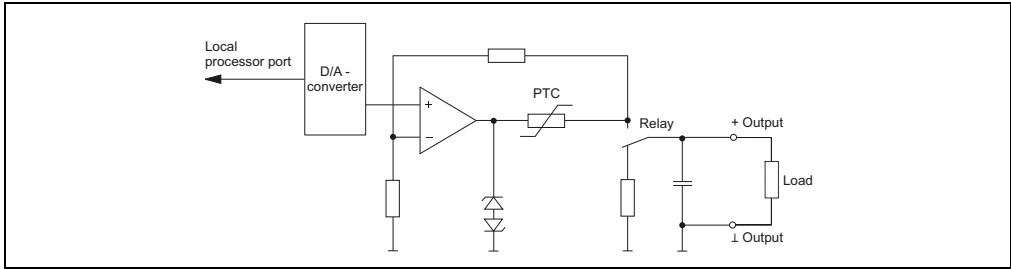
**Analog outputs**
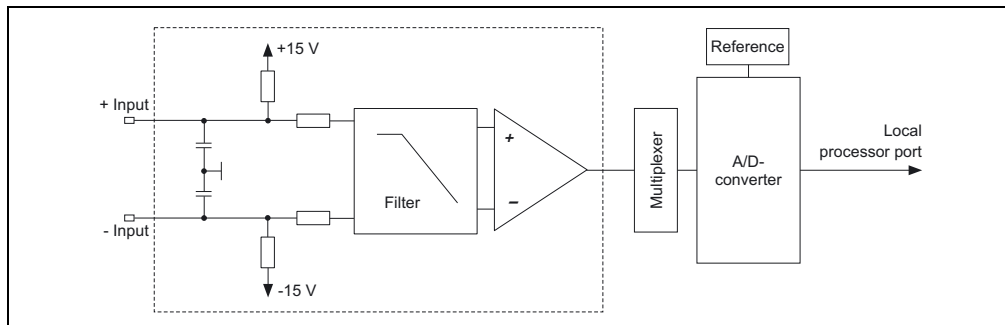


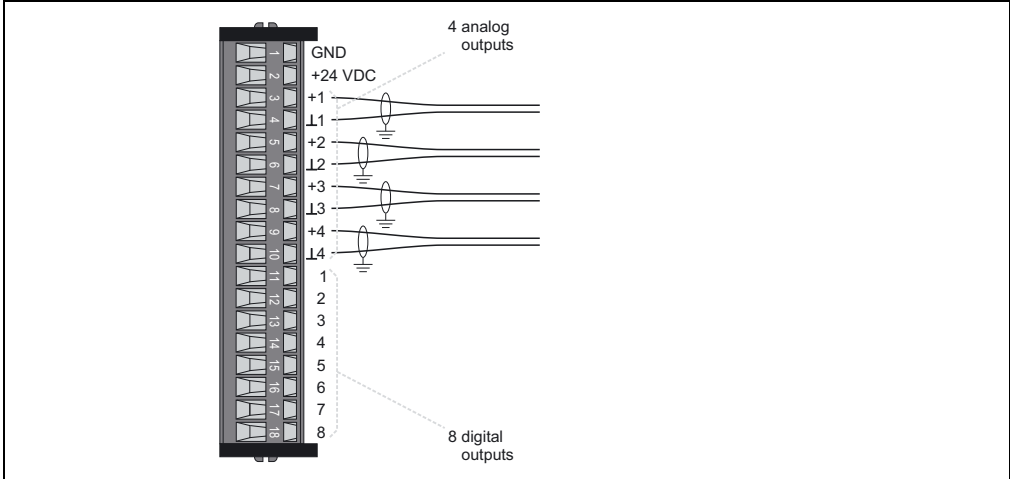Figure 29: Power Panel 15-36 output cirtuit diagram - analog outputs
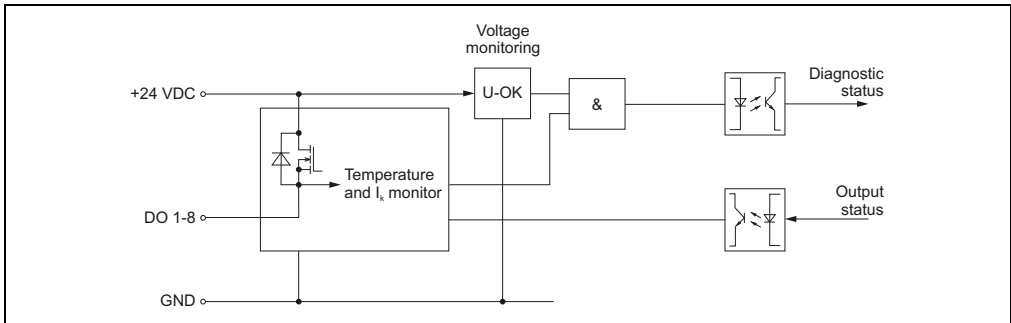
**Digital outputs**



Figure 30: Power Panel 15-36 output circuit diagram - digital outputs

## 3.7 Variable declaration

| Description | Name in Automation Studio | Data type | Description |
|---|---|---|---|
| Digital in 1 - 8 | Digital input 01 - 08 | BIT | Level of digital inputs 1 - 8 |
| Digital out 1 - 8 | Digital output 01 - 08 | BIT | Level of digital outputs 1 - 8 |
| Counter 1 | Analog input 01 | UDINT | Counter state 1 (bit 1 - bit 32) |
| Counter 2 | Analog input 02 | UDINT | Counter state 2 (bit 1 - bit 32) |
| DO back | Analog input 03 | UINT | Actual state of the digital outputs 1 - 8 |
| Status | Analog input 04 | UINT | Status word |
| Config | Analog output 01 | UINT | Configuration word |
| Analog in 1 | Analog input 05 | INT | Analog input 1 ($\pm$10 V, temperature) |
| Analog in 2 | Analog input 06 | INT | Analog input 2 ($\pm$10 V, temperature) |
| Analog in 3 | Analog input 07 | INT | Analog input 3 ($\pm$10 V) |
| Analog in 4 | Analog input 08 | INT | Analog input 4 ($\pm$10 V) |
| Analog out 1 | Analog output 02 | INT | Analog output 1 ($\pm$10 V) |
| Analog out 2 | Analog output 03 | INT | Analog output 2 ($\pm$10 V) |
| Analog out 3 | Analog output 04 | INT | Analog output 3 ($\pm$10 V) |
| Analog out 4 | Analog output 05 | INT | Analog output 4 ($\pm$10 V) |

Table 20: Power Panel 15-36 variable declaration

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Power Panel 15

## 3.7.1  Configuration register

15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

| Bit | Description |
|---|---|
| 0 | Reserved |
| 1 | This setting applies only in AB(R) mode (bit 4+5 set to 01):<br>0 ...  R disabled<br>1 ...  R enabled |
| 2 | Switch between period and gate measurement (only evaluated if bits 4+5 are set to 11):<br>0 ...  Period measurement<br>1 ...  Gate measurement |
| 3 | Beginning of period or gate measurement:<br>0 ...  at rising (positive) edge<br>1 ...  at falling (negative) edge |
| 5-4 | 00 ... No counter operation<br>01 ... AB(R) counter<br>10 ... Event counter<br>11 ... Period or gate measurement |
| 7-6 | 00 ... Counter frequency 4 MHz<br>01 ... External counter frequency<br>10 ... Counter frequency 31.25 kHz<br>11 ... Not allowed |
| 8 | 0 ...  At the reference impulse (positive edge) counter 1 is copied to counter 2<br>1 ...  At the reference impulse (positive edge) counter 1 is reset to counter 0 |
| 9 | Overrun recognition by **counter 1** (only applies in period duration / gate time mode; see bit 4-5 and bit 2 of the configuration register):<br>0 ...  Shut off overrun recognition and reset overrun bit of counter  1 (bit 9 in the status register).<br>1 ...  Overrun recognition of the continuous counter. The counter value is limited to \$0000FFFF. |
| 10 | Overrun recognition by **counter 2** (only applies in period duration / gate time mode; see bit 4-5 and bit 2 of the configuration register):<br>0 ...  Shut off overrun recognition and reset overrun bit of counter  2 (bit 10 in the status register).<br>1 ...  Overrun recognition of the continuous counter. The counter value is limited to \$0000FFFF. |
| 12-11 | Analog input 1:<br>00 ... Voltage measurement (default setting)<br>01 ... Temperature measurement - PT1000<br>10 ... Temperature measurement - KTY10-6<br>11 ... Resistance measurement 1 - 4000 $\Omega$ |
| 14-13 | Analog input 2:<br>00 ... Voltage measurement (default setting)<br>01 ... Temperature measurement - PT1000<br>10 ... Temperature measurement - KTY10-6<br>11 ... Resistance measurement 1 - 4000 $\Omega$ |
| 15 | 0 ...  Reset time or counter<br>1 ...  Enable time or counter (set this bit to 1 after counter has been configured) |

The reserve bits can only be written with the value 0.

### 3.7.2 Status register

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|

| Bit | Description |
|-----|-------------|
| 3-0 | Reserved |
| 4 | 0 ...  Analog input 1 - OK<br>1 ...  Analog input 1 - error |
| 5 | 0 ...  Analog input 2 - OK<br>1 ...  Analog input 2 - error |
| 6 | 0 ...  Analog input 3 - OK<br>1 ...  Analog input 3 - error |
| 7 | 0 ...  Analog input 4 - OK<br>1 ...  Analog input 4 - error |
| 8 | Reserved |
| 9 | Information regarding counter 1 at period or gate measurement (only applies when bit 9 is set in the configuration register):<br>0 ...  The counter's value is within the range 0 - $0000FFFF.<br>1 ...  counter overrun! Acknowledge by resetting bit 9 of the configuration register. |
| 10 | Information regarding counter 2 at period or gate measurement (only applies when bit 10 is set in the configuration register):<br>0 ...  The counter's value is within the range 0 - $0000FFFF.<br>1 ...  counter overrun! Acknowledge by resetting bit 10 of the configuration register. |
| 11 | Reserved |
| 12 | Monitoring of the 24 VDC input supply<br>0 ...  Input supply OK<br>1 ...  Error: input supply to low or missing |
| 14-13 | Reserved |
| 15 | Monitoring of the 24 VDC output supply<br>0 ...  Output supply OK<br>1 ...  Error: output supply to low or missing |

Chapter 3
Power Panel 15

### 3.7.3  DO back (status of digital outputs)

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

| Bit | Description |
|-----|-------------|
| 0 | 0 ...  Actual state of digital output 1: OUT<br>1 ...  Actual state of digital output 1: IN |
| 1 | 0 ...  Actual state of digital output 2: OUT<br>1 ...  Actual state of digital output 2: IN |
| 2 | 0 ...  Actual state of digital output 3: OUT<br>1 ...  Actual state of digital output 3: IN |
| 3 | 0 ...  Actual state of digital output 4: OUT<br>1 ...  Actual state of digital output 4: IN |
| 4 | 0 ...  Actual state of digital output 5: OUT<br>1 ...  Actual state of digital output 5: IN |
| 5 | 0 ...  Actual state of digital output 6: OUT<br>1 ...  Actual state of digital output 6: IN |
| 6 | 0 ...  Actual state of digital output 7: OUT<br>1 ...  Actual state of digital output 7: IN |
| 7 | 0 ...  Actual state of digital output 8: OUT<br>1 ...  Actual state of digital output 8: IN |
| 8-15 | Reserved |

### 3.7.4  Analog input

The analog inputs deliver data in 16-bit 2s complement (INT16 format). Analog inputs 1 and 2 can be used for voltage, temperature, or resistance measurement by writing to the configuration register.

Depending on these settings, the input data can be interpreted as follows:

| Input type | 1 LSB means ... | error appears in status register if ... |
|------------|-----------------|------------------------------------------|
| Voltage measurement | 2.44 mV | Measurement range not reached (input voltage < -10 V)<br>Measurement range exceeded (input voltage >10 V)<br>Wire break |
| Temperature measurement PT1000 | 0.1°C | Measurement range not reached (temperature < -200°C)<br>Measurement range exceeded (temperature >850°C)<br>Wire break |
| Resistance measurement 1 - 4,000 $\Omega$ | 122.074 m$\Omega$ | Measurement range not reached (resistance <1 $\Omega$)<br>Measurement range exceeded (resistance >4,000 $\Omega$)<br>Wire break |

Relationship between numerical value and input voltage:

| Numerical value (INT) | | Voltage measurement |
| --- | --- | --- |
| **Hexadecimal** | **Decimal** | |
| 8001 | -32767 | -10 V |
| C001 | -16383 | -5 V |
| FFF8 | -8 | - 2.44 mV |
| 0000 | 0 | 0 V |
| 0008 | 8 | 2.44 mV |
| 3FFF | 16383 | 5 V |
| 7FFF | 32767 | 10 V |

### 3.7.5  Analog output

The analog outputs are written in INT16 format (16 bit 2s complement) beschrieben. You won't need to change anything here.

Relationship between numerical value and output voltage:

| Numerical value (INT) | | Output voltage |
| --- | --- | --- |
| **Hexadecimal** | **Decimal** | |
| 8001 | -32767 | -10 V |
| C001 | -16383 | -5 V |
| FFF0 | -16 | - 4.88 mV |
| 0000 | 0 | 0 V |
| 0010 | 16 | 4.88 mV |
| 3FFF | 16383 | 5 V |
| 7FFF | 32767 | 10 V |

### 3.7.6  Counter settings

To set the correct counter modes, the configuration register must be written. Counter 1 and counter 2 registers have different meanings for different modes.

**Incremental encoder operation**

If the homing input (input 3) is *enabled* in the configuration register, then the Power Panel is a 32-bit ABR counter whose actual value is found in counter 1 and the saved R value in counter 2.

If the homing input is disabled, a 32-bit AB incremental encoder counter input is read in counter 1.

- • A = digital input 1
- • B = digital input 2
- • R = digital input 3

### Event counter operation

If the counters in the configuration register are initialized as event counters, two 32-bit counters are available.

- Counter 1 = digital input 1
- Counter 2 = digital input 2
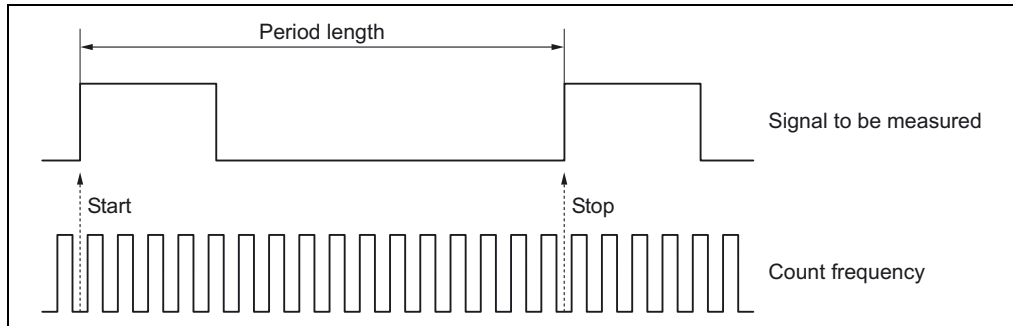
### Period measurement



Figure 31: Power Panel 15-36 period measurement

The measurement can be begin at the decreasing or increasing edge depending on the configuration register. The counter frequency can be set in two steps (4 MHz or 31.25 kHz) or with an external frequency. The external frequency must however be less than 50 kHz. The measured counter state is a 32-bit value and is displayed in counter 1 or counter 2. The value in the temporary register is only updated at the end of the measurement.

The frequency of the signal to be measured can be a maximum of 50 kHz.

- Counter 1 = digital input 1
- Counter 2 = digital input 2
- Ext. Counting frequency = digital input 3

A potential overrun of the continuous counter during the period measurement ( e.g. due to an incorrect counter frequency ), can be detected by reading bit 9 (counter 1) or bit 10 (counter 10) in the status register. However, the maximum value of counter is limited to $0000FFFF as a result. The error bit in the status register is acknowledged by resetting bit 9 (counter 1) or bit 10 (counter 2)  of the configuration register.
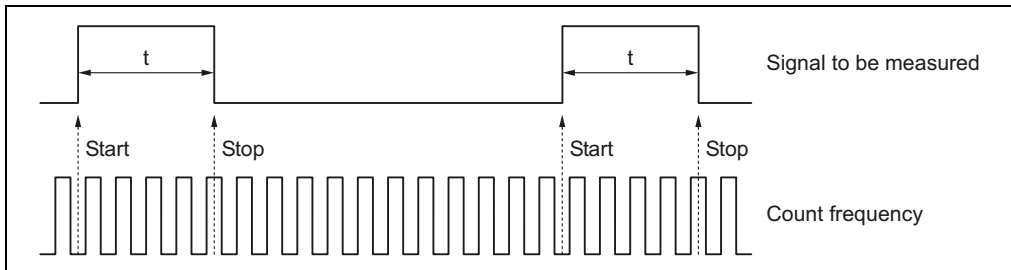
**Gate measurement**



Figure 32: Power Panel 15-36 gate measurement

The measurement can be begin at the decreasing or increasing edge depending on the configuration register. The R enable bit must be 0. Measurement always occurs up to the next edge. The counter frequency can be set to one of two levels (4 MHz or 31.25 kHz) or with an external frequency. The external frequency must however be less than 50 kHz. The measured counter state is a 32-bit value and is displayed in counter 1 or counter 2. The value in the temporary register is only updated at the end of the active measurement.

The frequency of the signal to be measured can be a maximum of 50 kHz.

- Counter 1 = digital input 1
- Counter 2 = digital input 2
- Ext. Counting frequency = digital input 3

A potential overrun of the continuous counter during the gate measurement ( e.g. due to an incorrect counter frequency ), can be detected by reading bit 9 (counter 1) or bit 10 (counter 2) in the status register. However, the maximum value of counter is limited to $0000FFFF as a result. The error bit in the status register is acknowledged by resetting bit 9 or bit 10 of the configuration register.

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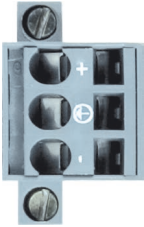
# 4. Supply voltage

| 3-pin terminal block | Terminal | Assignment |
|---|---|---|
|  | 1 | 24 VDC |
| | 2 | Ground |
| | 3 | GND |
| 0TB103.91 | | |

Table 21: Power Panel 15 terminal assignments X3 / voltage supply

# 5. Interfaces

## 5.1 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.).
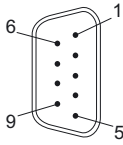
| 9-pin DSUB connector | Pin | Assignment |
|---|---|---|
| <br>9-pin DSUB plug | 1 | n.c. |
| | 2 | RXD |
| | 3 | TXD |
| | 4 | n.c. |
| | 5 | GND |
| | 6 | n.c. |
| | 7 | RTS |
| | 8 | CTS |
| | 9 | n.c. |

Table 22: Power Panel 15 pin assignments IF1 / RS232

## 5.2 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 terminating resistance is integrated in the T-connector for the bus termination, which can be turned on or off. For more information on wiring CAN fieldbus systems, see chapter 2 "Installation", section "CAN Fieldbus", in the B&R SYSTEM 2003 User's Manual.
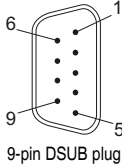
| 9-pin DSUB connector | Pin | Assignment |
|---|---|---|
| | 1 | n.c. |
| | 2 | CAN_L |
| | 3 | CAN_GND |
| | 4 | n.c. |
| 9-pin DSUB plug | 5 | n.c. |
| | 6 | n.c. |
| | 7 | CAN_H |
| | 8 | n.c. |
| | 9 | n.c. |

Table 23: Power Panel 15 pin assignments - IF2 / CAN
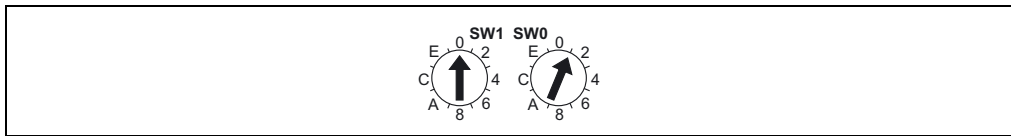
# 6. Operating mode and node number switch



Figure 33: Power Panel 15 operating mode and node number switch

The Power Panel 15 is equipped with 2 hex switches, which are used as operating mode switches. The switch positions 01 - FE are used to set the CAN node number. 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 - FE | Freely available for use in an application (e.g. CAN node number) |
| 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 24: Power Panel 15 switch positions of the operating mode and node number switch
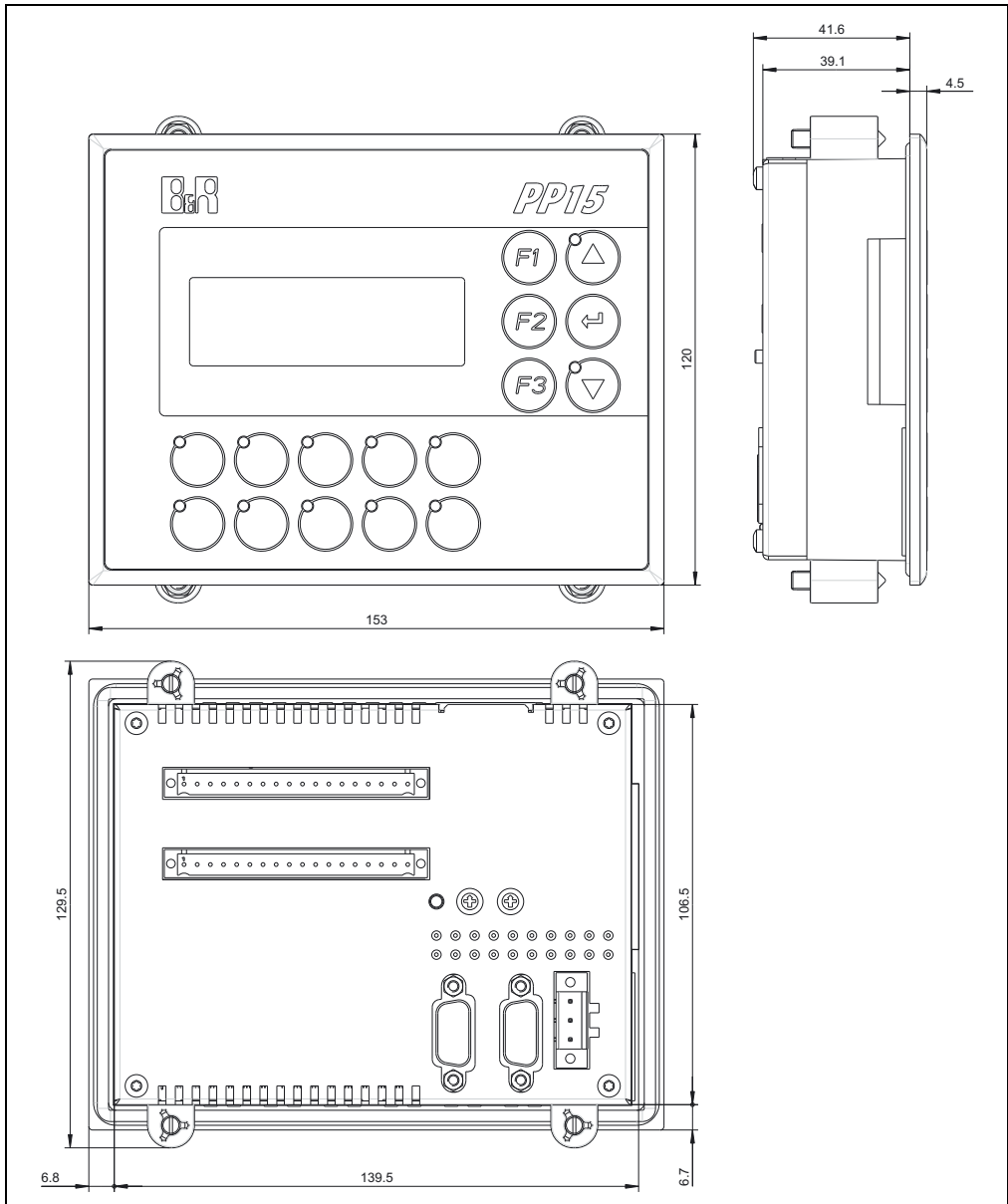
# 7. Dimensions



Figure 34: Power Panel 15 - Dimensions

Installation cutout: 141 mm x 108 mm (max. 4.5 mm plate thickness)

# 8. Set display contrast

The display contrast is set at the factory. However, the user can make a different contrast setting as desired. To do this, press "ENTER". While holding down this key, the "UP" and "DOWN" keys can be used to set the contrast:
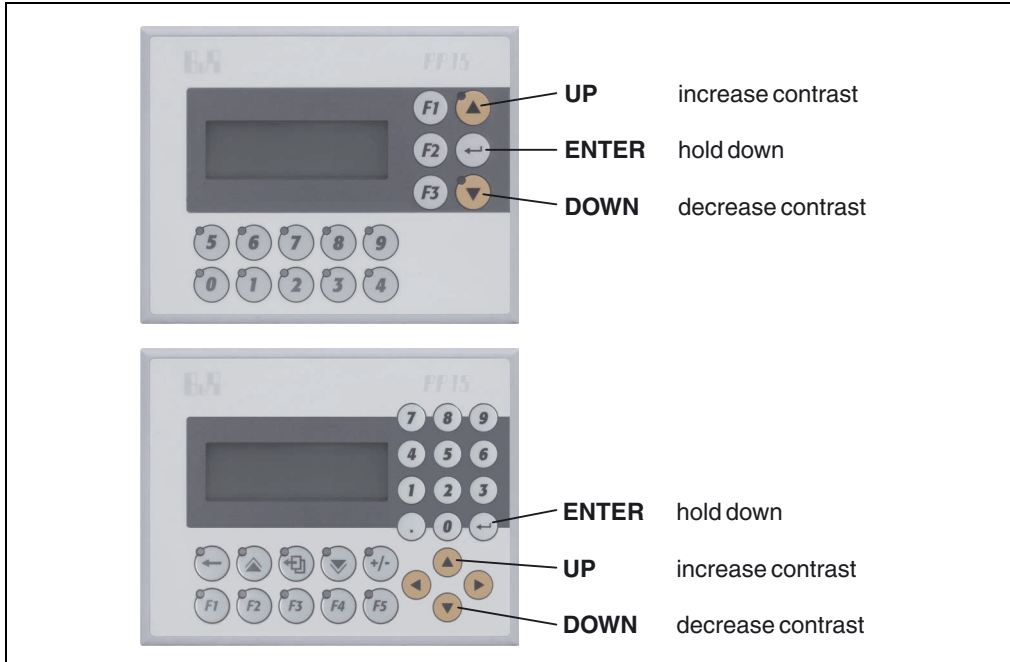
Figure 35: Power Panel 15 set display contrast

The contrast setting made in this way is placed in nonvolatile memory and is used from now on as the default value.

# WARNING

**The key codes for "UP" and "DOWN" are not sent to the controller as long as "ENTER" is being pressed. It is also not possible to use the key combinations ENTER + UP or ENTER + DOWN in the application project.**

# 9. Note regarding operation

## Caution!

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

# 10. Changing the battery

### 10.1  Battery data

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

Table 25: Power Panel 15 battery data

### 10.2  Buffer duration

| **Buffer current** | **Panel CPU** |
|---|---|
| Typical | 10 µA |
| Maximum | 200 µA |

Table 26: Power Panel 15 buffer duration

## Information:

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

### 10.3  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:

**Data stored in RAM will be lost if the battery is changed with the PLC switched off.**

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).
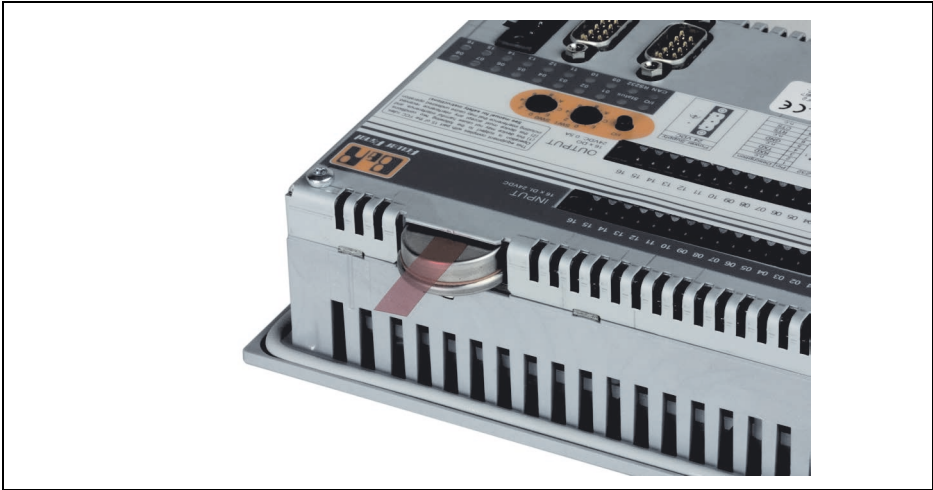


Figure 36: Power Panel 15 changing the battery

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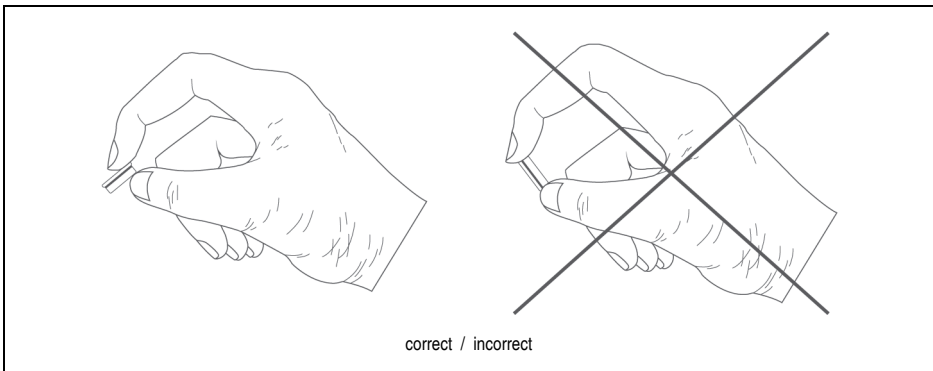


Figure 37: Power Panel 15 handling the battery

- 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.**

## 11. Mounting instructions

The following mounting instructions should be noted:

1) The Power Panel 15 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 20 mm (above and below) between the ventilation slots and all other objects.
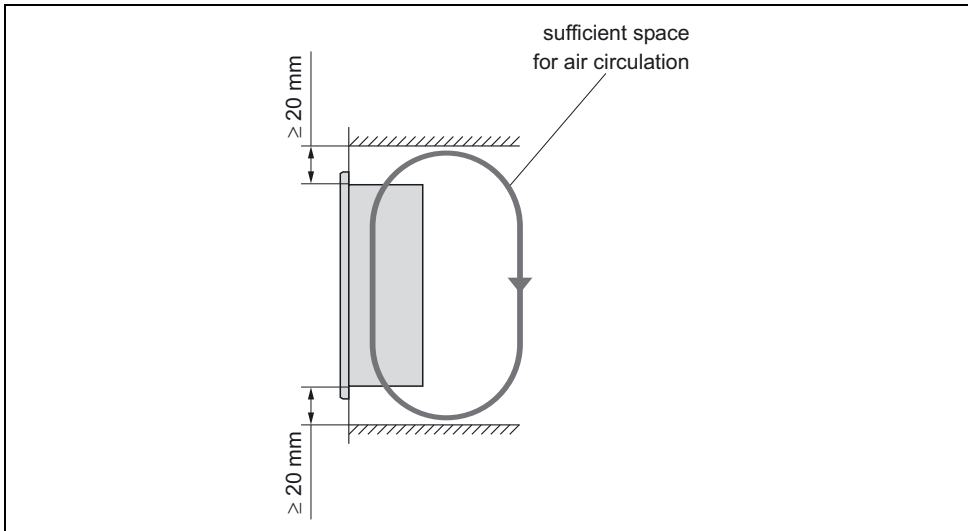
Figure 38: Power Panel 15 distance for air circulation

3)   The Power Panel 15 can be mounted up to a maximum angle of ±45°.
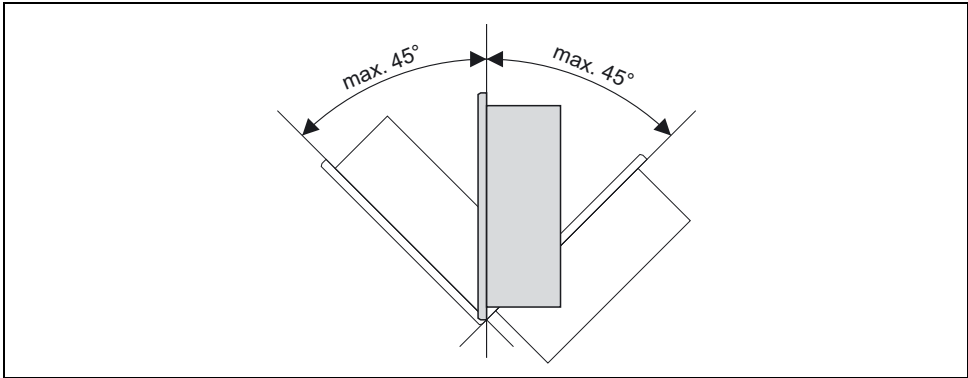


Figure 39: Power Panel 15 mounting angle

# 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.<br>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<br>  Temperature<br>  Shock /  tests carried out<br>  Vibration / tests carried out<br>  Emission / tests carried out<br>  Immunity / tests carried out | IEC61131-2 / IEC60068-2-x<br>IEC61131-2 / IEC60068-2-27<br>IEC61131-2 / IEC60068-2-6<br>EN61000-6-4 / EN55022<br>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<br>    User RAM<br>    SystemPROM<br>    User PROM | 700 kB SRAM<br>600 kB FlashPROM<br>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<br>    Suitable for IF modules (without CAN)<br>    TPU functionality support<br>    Suitable for CAN communication | 6<br>Slots 1 - 3<br>Slots 4 - 6<br>Slot 1 with interface module 4IF370.7 |
| PCMCIA slot (see "PCMCIA slot", on Page 87)<br>    Memory size<br>       SRAM<br>       FlashPROM<br>    Standard<br>    Card height<br>    Card type | 1<br><br>Max. 4 MB<br>Max. 4 MB<br>JEIDA V 4.0 or PCMCIA standard release 2.0<br>Max. 3 mm<br>Memory cards |
| **Standard communication interfaces** | |
| Application interface IF1<br>    Type<br>    Design<br>    Electrical isolation<br>    Max. transfer rate<br>    Max. distance | RS232<br>9-pin DSUB plug<br>No<br>115.2 kbit/s<br>15 m / 19,200 bit/s |
| Application interface IF2<br>    Type<br>    Design<br>    Electrical isolation<br>    Max. transfer rate<br>    Max. distance | CAN bus<br>9-pin DSUB plug<br>Yes<br>500 kbit/s<br>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<br>  Channel - bus<br>  Channel - channel<br>  Group isolation | Yes<br>No<br>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<br>  Log. 0 - log. 1<br>  Log. 1 - log. 0 | Max. 450 µs<br>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<br>  Channel - bus<br>  Channel - channel<br>  Group isolation | Yes<br>No<br>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<br>    Operation<br>    Storage | 0°C to 50°C<br>-20°C to 60°C |
| Humidity<br>    Operation<br>    Storage | 10 to 90% (non-condensing)<br>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.)

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Power Panel 21
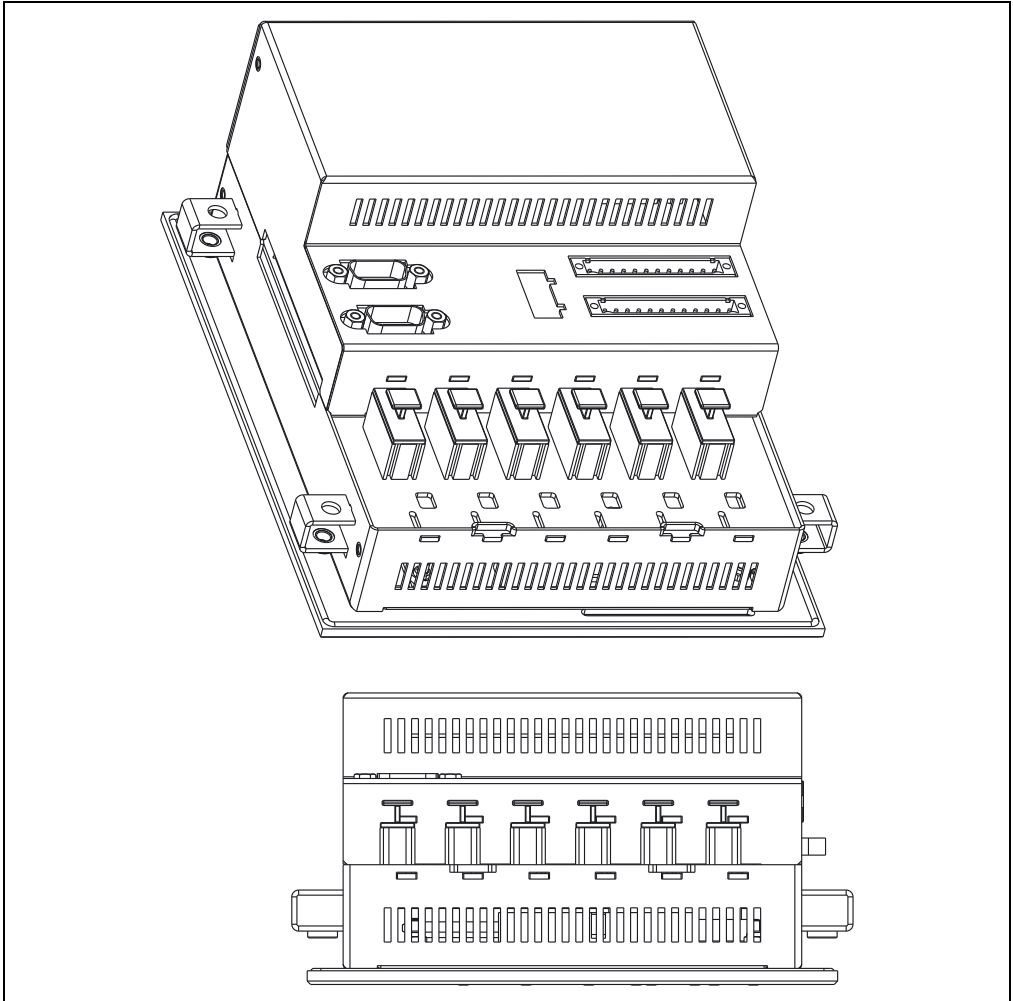
# 4. Images



Figure 41: Power Panel 21 images

# 5. Dimensions
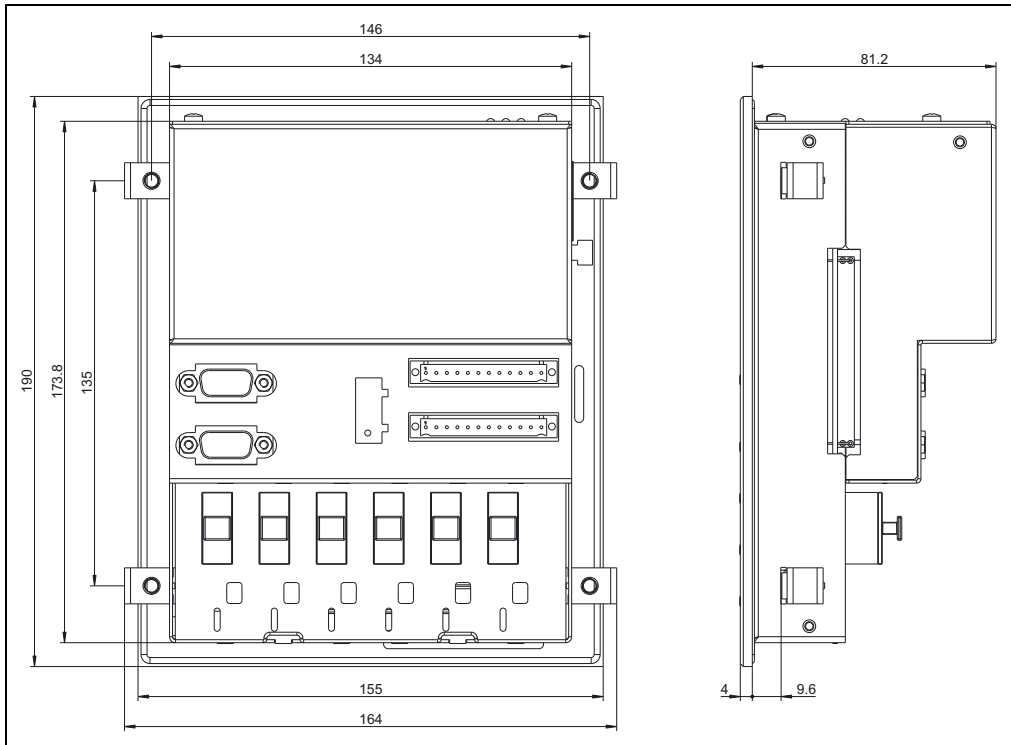


Figure 42: Power Panel 21 dimensions

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

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Power Panel 21

## 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 | - | |
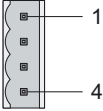
Table 30: Power Panel 21 pin assignment - power supply

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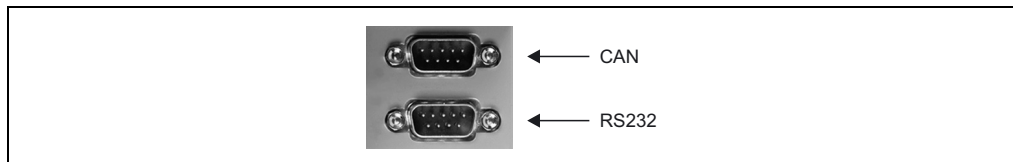
## 6.3 Interfaces

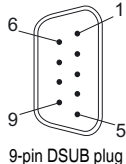The Power Panel has two interfaces:



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 | 6 ┐ ┌ 1 |
| 4 | n. c. | |
| 5 | n. c. | |
| 6 | Reserved | 9 ┘ └ 5 |
| 7 | CAN_H | 9-pin DSUB plug |
| 8 | n. c. | |
| 9 | n. c. | |

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 | 6 ┐ ┌ 1 |
| 4 | 5 VDC / max. 500 mA | |
| 5 | GND | |
| 6 | n. c. | 9 ┘ └ 5 |
| 7 | RTS | 9-pin DSUB plug |
| 8 | CTS | |
| 9 | GND | |

Table 32: Power Panel 21 pin assignment - RS232 interface
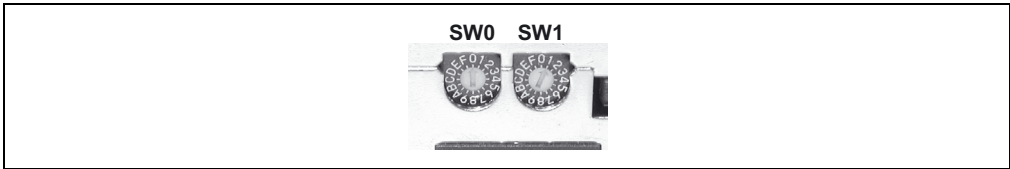
## 6.4 Operating mode switch



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.<br>**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".

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### 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<br>**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<br>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.<br>**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.
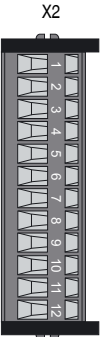
| 12-pin terminal block | Terminal | Assignment |
|---|---|---|
| X2 <br><br> TB712 | 1 | Input 1 |
| | 2 | Input 2 |
| | 3 | Input 3 |
| | 4 | Input 4 |
| | 5 | Input 5 |
| | 6 | Input 6 |
| | 7 | Input 7 |
| | 8 | Input 8 |
| | 9 | Input 9 |
| | 10 | Input 10 |
| | 11 | 24 VDC |
| | 12 | GND |

Table 36: Power Panel 21 terminal assignments - digital inputs

### 6.10.2  Connection example
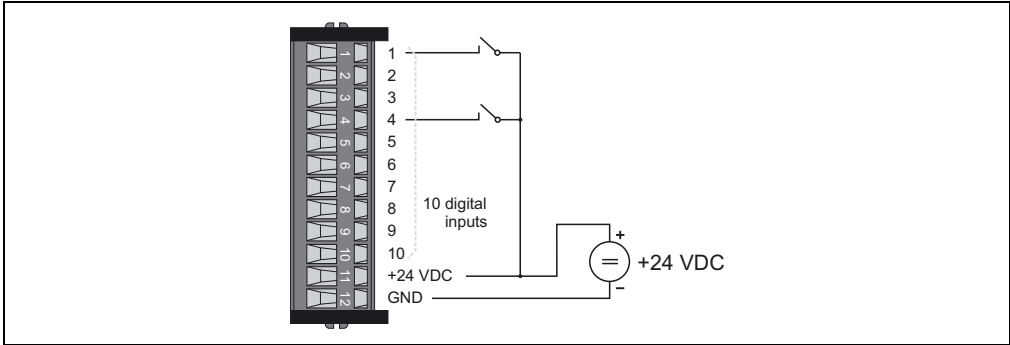


Figure 45: Power Panel 21 connection example - digital inputs

### 6.10.3  Input circuit diagram
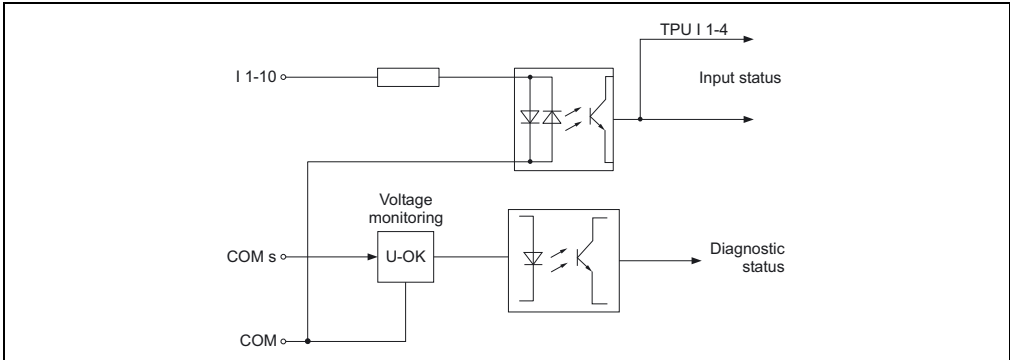


Figure 46: Power Panel 21 input circuit diagram - digital inputs

## 6.11  Digital outputs

### 6.11.1  Terminal block connections
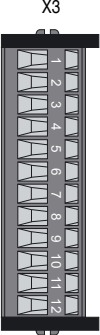
| 12-pin terminal block | Terminal | Assignment |
|---|---|---|
| X3<br><br>TB712 | 1 | Output 1 |
| | 2 | Output 2 |
| | 3 | Output 3 |
| | 4 | Output 4 |
| | 5 | Output 5 |
| | 6 | Output 6 |
| | 7 | Output 7 |
| | 8 | Output 8 |
| | 9 | Potential-free relay contact |
| | 10 | Potential-free relay 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
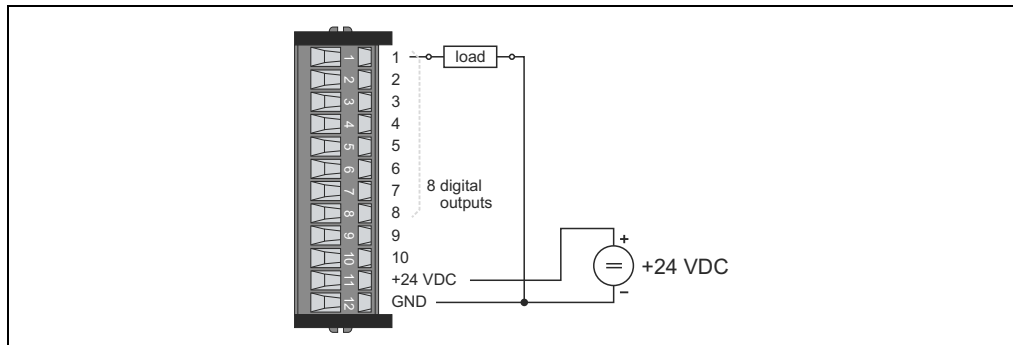
**Outputs 1 - 8**



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

**Potential-free relay contact**
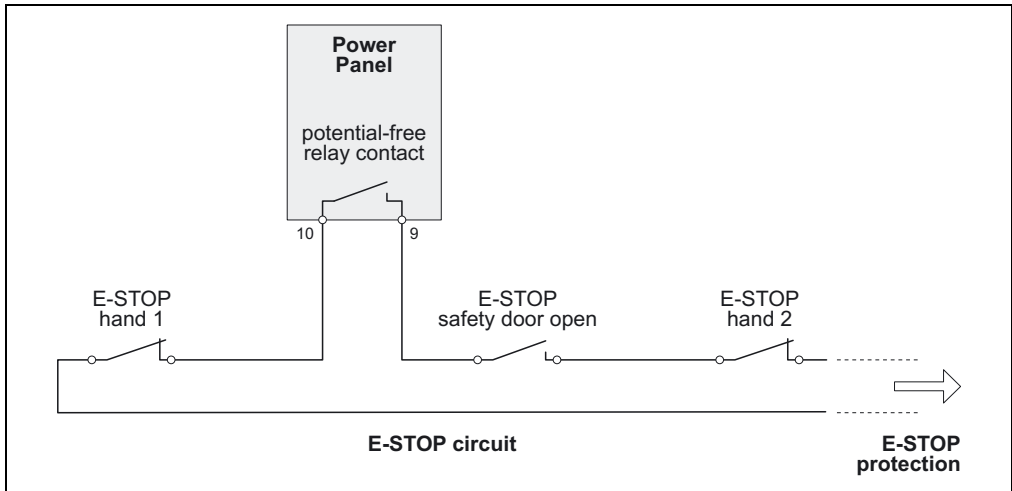
E-STOP circuit



Figure 48: Power Panel 21 E-STOP circuit

Switching a load
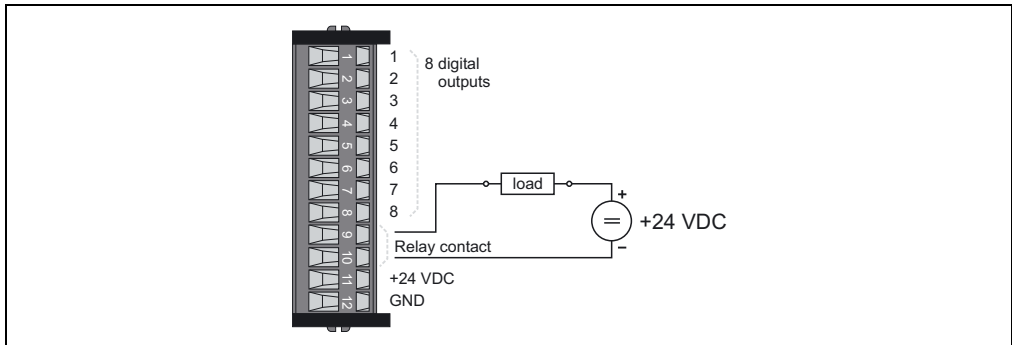


Figure 49: Power Panel 21 switching a load

### 6.11.3 Output circuit diagram
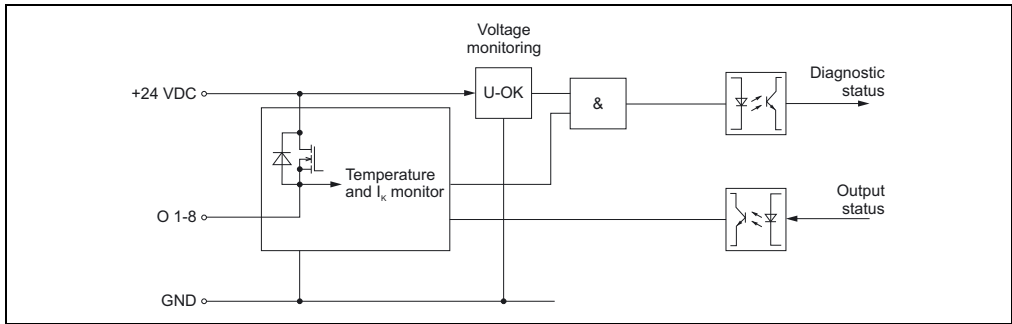
**Digital outputs**



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

**Potential-free relay contact**
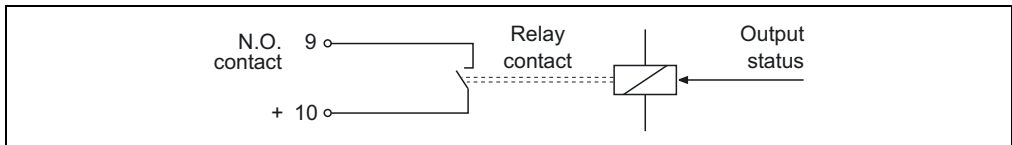


Figure 51: Power Panel 21 connection example - relay contact

# 7. Changing the battery

## 7.1 Battery data

| Lithium battery | 3 V / 950 mAh |
|---|---|
| Model number | 0AC201.9   (lithium batteries, 5 pcs.)<br>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.

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- 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.
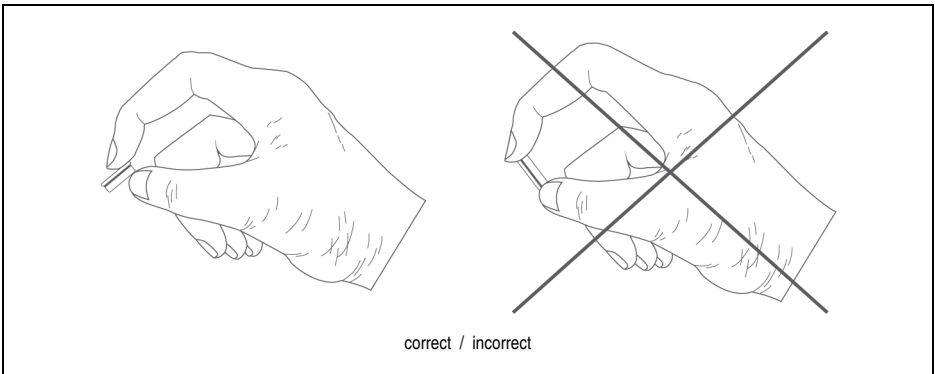


correct / incorrect

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.**

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# 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.
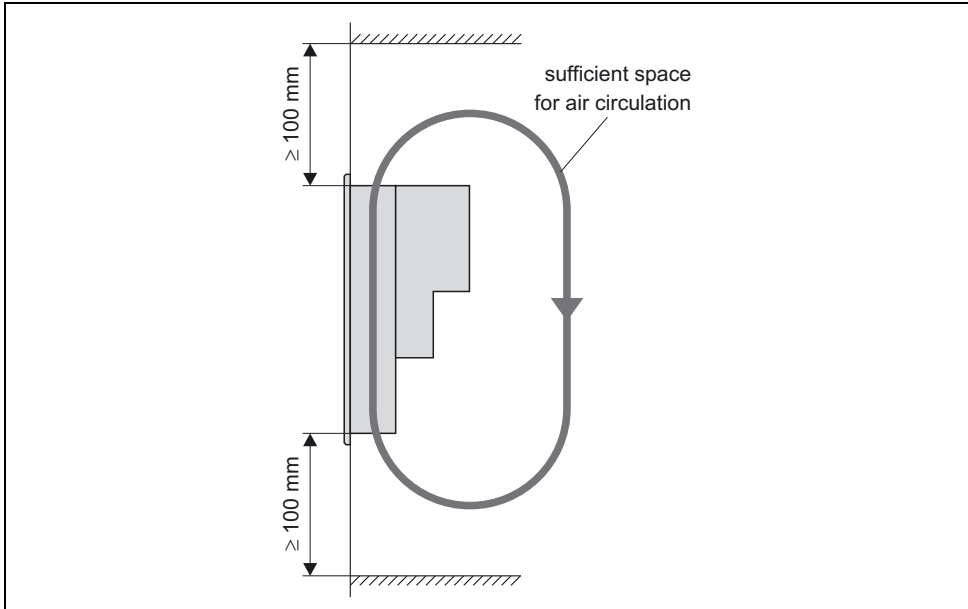


Figure 54: Power Panel 21 distance for air circulation
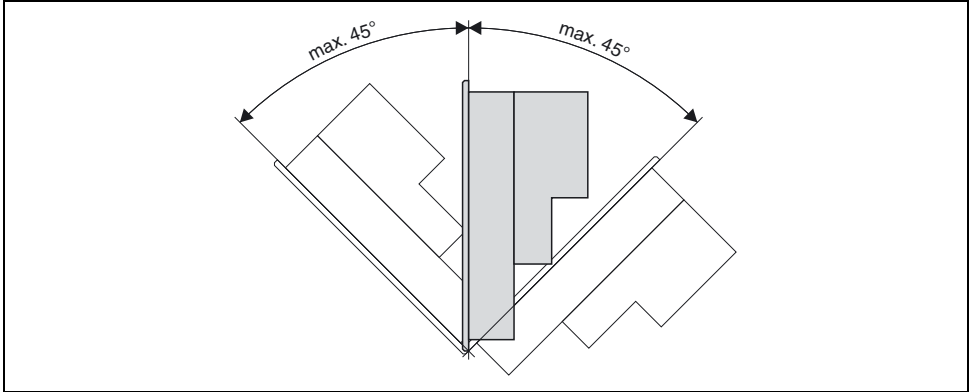
3) The Power Panel 21 can be mounted up to a maximum angle of ±45°.



Figure 55: Power Panel 21 mounting angle

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Power Panel 21

# Chapter 5 • Power Panel 35

## 1. PP35 types

| Short description | | | | | |
|---|---|---|---|---|---|
| Photo | | | | | |
| Model number | 4PP035.0300-01 | 4PP035.0300-36 | 4PP035.E300-01 | 4PP035.E300-36 | 4PP035.E300-136 |
| Page | 102 | 122 | 102 | 122 | |
| **LCD display** | | | | | |
| 160 x 80 pixels | ✓ | | | | |
| **Character set** | | | | | |
| European / Cyrillic | ✓ | | ✓ | | |
| **Keys** | | | | | |
| Total | 16 | | 26 | | |
| With key LED | 12 | | 10 | | |
| With insert strips | 10 | | 10 | | |
| **Inputs / outputs** | | | | | |
| Digital inputs | 16 | 8 | 16 | 8 | |
| Digital outputs | 16 | 8 | 16 | 8 | |
| Analog inputs | - | 4 | - | 4 | |
| Analog outputs | - | 4 | - | 4 | |
| **FlashPROM** | | | | | |
| 1,0 MB | ✓ | | | | - |
| 1,9 MB | - | | | | ✓ |

Table 40: PP35 overview

# 2. Power Panel 35-01

## 2.1 Photos



| | |
|---|---|
| 4PP035.0300-01 | 4PP035.E300-01 |
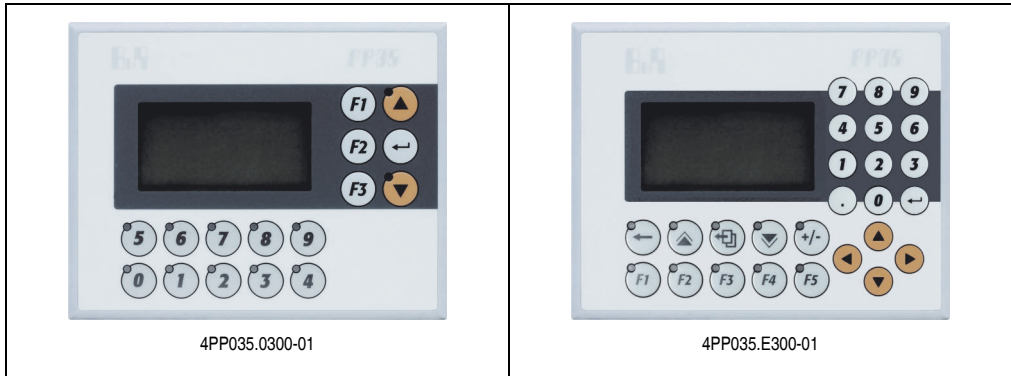
Figure 56: PP35-01 photos

## 2.2 Order data

| Model number | Short description |
|---|---|
| 4PP035.0300-01 | Power Panel, 24 VDC, 153 x 120 mm, LC display, 160x80 Pixel, 3", background lighting, European / Cyrillic character set, 16 keys, 300 KB SRAM, 1024 kB FlashPROM, 1 RS232, 1 CAN interface, 16 digital inputs, 24 VDC, sink / source, 2 event counters, 1 incremental encoder or 2 gate-/period measurement, 16 digital outputs, 24 VDC, 0.5 A source, IP65 protection (from front).<br>2 x TB718 and 1 x TB103 terminal blocks sold separately. |
| 4PP035.E300-01 | Power Panel, 24 VDC, 153 x 120 mm, LC display, 160x80 Pixel, 3", background lighting, European / Cyrillic character set, 26 keys, 300 KB SRAM, 1024 kB FlashPROM, 1 RS232, 1 CAN interface, 16 digital inputs, 24 VDC, sink / source, 2 event counters, 1 incremental encoder or 2 gate-/period measurement, 16 digital outputs, 24 VDC, 0.5 A source, IP65 protection (from front).<br>2 x TB718 and 1 x TB103 terminal blocks sold separately. |
| **Note** | |
| All parts required to install the Power Panel, including key legend sheets, are included in its delivery. | |
| **Required accessories** | |
| 0TB103.9 | Accessory terminal block, 3-pin, Screw clamp, 2.5 mm²; protected against vibration by the screw flange. |
| 0TB103.91 | Accessory terminal block, 3-pin, Cage clamps, 2.5 mm²; protected against vibration by the screw flange. |
| 7TB718.9 | Accessory terminal block, 18-pin, screw clamp, 1.5 mm² |
| 7TB718.91 | Accessory terminal block, 18-pin, cage clamp, 1.5 mm² |

Table 41: PP35-01 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 |
| 4A0044.00-000 | 5 DIN A4 legend strips, 6 fields for a total of 30 devices |
| 7AC911.9 | Bus connector, CAN |

Table 41: PP35-01 order data (Forts.)

1) Replacement part

## 2.3 Technical data

| Product ID | PP35-01 |
|---|---|
| **General information** | |
| Certification | CE, C-UL-US, GOST-R |
| Standards<br>Temperature<br>Shock / tests carried out<br>Vibration / tests carried out<br>Emission / tests carried out<br>Immunity / tests carried out | IEC61131-2 / IEC60068-2-x<br>IEC61131-2 / IEC60068-2-27<br>IEC61131-2 / IEC60068-2-6<br>EN61000-6-4 / EN55022<br>IEC 61131-2 / IEC 61000-4-x |
| Status display | I/O function for each channel, status |
| Diagnostics<br>Status<br>I/O function<br>Interfaces | Yes, with status LED<br>Yes, with LEDs<br>Yes, with LEDs |
| **Display** | |
| Type | LCD b/w |
| Resolution | 160 x 80 pixels |
| Background lighting | LED |
| Character set | European / Cyrillic |
| **Keys** | |
| Total keys<br>4PP035.0300-01<br>4PP035.E300-01 | 16 (12 with LEDs)<br>26 (10 with LEDs) |
| System keys | Number block<br>Control keys |
| Labeling | 10 keys with insert strips |

Table 42: PP35-01 technical data

| Product ID | PP35-01 |
|---|---|
| **Processor** | |
| Typical instruction cycle time | 0.8 µs, average value at 70% bit and 30% analog processing |
| Standard memory<br>   User RAM<br>   System PROM<br>   User PROM<br>      4PP035.0300-01<br>      4PP035.E300-01 | <br>300 kB SRAM<br>448 kB FlashPROM<br><br>1024 kByte FlashPROM<br>1024 kByte FlashPROM |
| Data buffering with backup battery | Lithium battery, 3 V / 950 mAh |
| Battey buffer current | Max. 60 µA |
| Hardware Watchdog | Yes |
| Voltage monitoring | An NMI is triggered at a supply voltage of <15 VDC. |
| Real-time clock | 1 s resolution, nonvolatile memory |
| System bus for expansions | No |
| Operating system | PP01x (version V 2.36 and higher) |
| **Status display / diagnostics** | |
| Status LED | Red / green |
| RS232 LED | Indicates if data is being transmitted or received |
| CAN LED | Indicates if data is being transmitted or received |
| I/O LED | Displays whether LEDs 1-16 indicate an input or output state. |
| 01-16 LEDs | State of inputs and outputs |
| **Interfaces** | |
| Application interface IF1<br>   Type<br>   Design<br>   Electrical isolation<br>   Max. transfer rate<br>   Distance | <br>RS232<br>9-pin DSUB plug<br>No<br>115.2 kbit/s<br>15 m / 19,200 bit/s |
| Application interface IF2<br>   Type<br>   Design<br>   Electrical isolation<br>   Distance<br>   Max. transfer rate<br>      Bus length 60 m<br>      Bus length 200 m<br>   Bus length 1,000 m | <br>CAN bus<br>9-pin DSUB plug<br>Yes<br>max. 1,000 m bus length<br><br>500 kbit/s<br>250 kbit/s<br>50 kbit/s |

Table 42: PP35-01 technical data (Forts.)

| Product ID | PP35-01 | |
|---|---|---|
| **Digital inputs** | | |
| Channels | 1-3 | 4-16 |
| Additional functions for inputs | 2 x event counter or<br>1 x incremental encoder ABR/AB or<br>2 x gate/period measurement | - |
| Input circuit | Sink or source | Sink or source |
| Input voltage (nom./max.) | 24 VDC / 30 VDC | 24 VDC / 30 VDC |
| Input current at nominal voltage | ca. 10 mA | ca. 5 mA |
| Switching threshold<br>LOW<br>HIGH | <5 V<br>>15 V | |
| Input filter | <10 µs | <1 ms |
| Electrical isolation<br>Channel - bus<br>Channel - channel<br>Group isolation | Yes<br>No<br>No | Yes<br>No<br>No |
| **Event counter operation** | | |
| Amount | 2 | |
| Counter 1/2 | Input 1 / 2 | |
| Counter size | 32-bit | |
| Input frequency | Max. 50 kHz | |
| Signal form | Square wave pulse | |
| Evaluation | Positive or negative edge, cyclic counter | |
| **Incremental encoder operation** | | |
| Amount | 1 | |
| Type | ABR or AB | |
| Counter size | 32-bit | |
| Input frequency | Max. 20 kHz | |
| Evaluation | 4x | |
| Signal form | Square wave pulse | |

Table 42: PP35-01 technical data (Forts.)

| Product ID | PP35-01 |
|---|---|
| **Gate measurement** | |
| Number of gate measurements | 2 |
| Gate measurement on channel 1 and 2<br>    Channel 1<br>    Channel 2 | Input 1<br>Input 2 |
| Counter size | 32-bit |
| Evaluation | Positive or negative edge |
| Input frequency | Max. 50 kHz |
| Pulse length | ≥10 µs |
| Length of pauses between pulses | ≥10 µs |
| Count frequency<br>    Internal<br>    External | 4 MHz, 31.25 kHz<br>Max. 50 kHz |
| Signal form | Square wave pulse |
| **Period measurement** | |
| Number of period measurements | 2 |
| Measurement on channel 1 and 2<br>    Channel 1<br>    Channel 2 | Input 1<br>Input 2 |
| Counter size | 32-bit |
| Evaluation | Positive or negative edge |
| Input frequency | Max. 50 kHz |
| Count frequency<br>    Internal<br>    External | 4 MHz, 31.25 kHz<br>Max. 50 kHz |
| Signal form | Square wave pulse |

Table 42: PP35-01 technical data (Forts.)

| Product ID | PP35-01 |
|---|---|
| **Digital outputs** | |
| Channels | 16 |
| Type | Highside driver (source) |
| Switching voltage<br>    Minimum<br>    Nominal<br>    Maximum | 18 VDC<br>24 VDC<br>30 VDC |
| Nom. output current | 0.5 A |
| Total current | 8 A |
| Output circuit | Source |
| Max. switching frequency | 100 Hz |
| Switching delay | max. 500 µs |
| Short-circuit protection | Yes |
| Overload protection | Yes |
| Internal protective circuit | VDR |
| Electrical isolation<br>    Channel - bus<br>    Channel - channel<br>    Group isolation | No<br>No<br>No |
| **Power supply** | |
| Supply voltage<br>    Minimum<br>    Nominal<br>    Maximum | 18 VDC<br>24 VDC<br>30 VDC |
| Power consumption | Max. 6 W |
| **Environmental conditions** | |
| Temperature<br>    Operation<br>    Storage | 0°C to 50°C<br>-20°C to 60°C |
| Humidity<br>    Operation<br>    Storage | 10 to 90% (non-condensing)<br>5 to 95% (non-condensing) |
| **Mechanics** | |
| Protection | IP65 (from front) |
| Outer dimensions (B x H x T [mm]) | 153 x 120 x 46.1 |
| Weight | 0.5 kg |

Table 42: PP35-01 technical data (Forts.)

## 2.4  Diagnostic LEDs

Multiple LEDs on the back of the device show the status of the Power Panel, the interfaces, and the digital I/O:
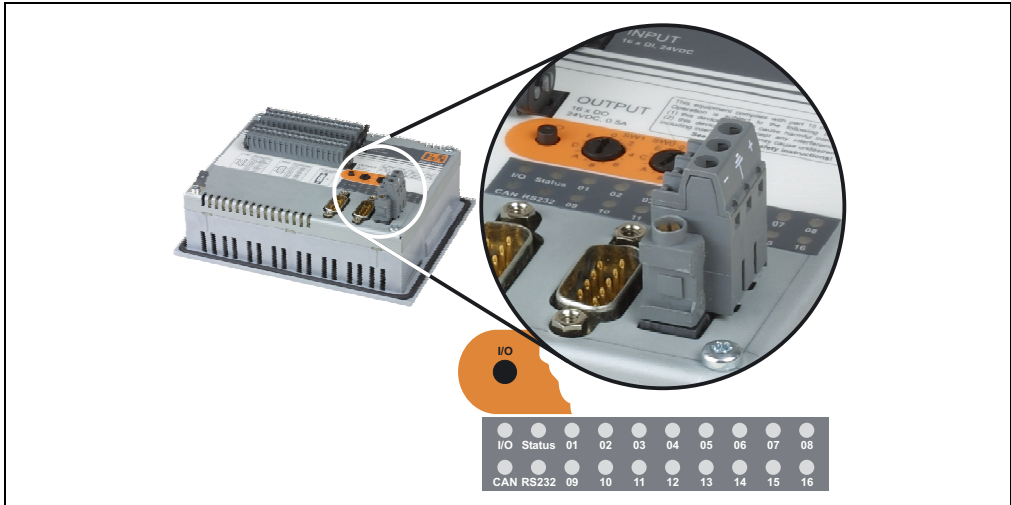


Figure 57: PP35-01 diagnostic LEDs

### 2.4.1  Status LED

The Power Panel status LED uses a blink code to indicate the operating state of the Power Panel:

| Power Panel operating state | Color/blink code of the status LED | |
|---|---|---|
| Boot mode | Blinking yellow / green 1 Hz | |
| Flash programming | Blinking green / red 5 Hz | |
| Service mode / Diagnostic mode | Yellow | |
| Run | Green | |
| Error | Red | |

Table 43: PP35-01 status LED

### 2.4.2  I/O LEDs

The I/O LED indicates whether the I/O LEDs (01 ... 16) show the state of the digital inputs or outputs. The display can be set appropriately using the I/O button.

| I/O LED | LEDs 01 ... 16 |
|---------|----------------|
| Green | The state of the 16 digital inputs is indicated (LEDs are green). |
| Yellow | The state of the 16 digital outputs is indicated (LEDs are yellow). |

Table 44: PP35-01 I/O LEDs

### 2.4.3  Interface LEDs

| Interface LED | Description |
|---------------|-------------|
| CAN | Indicates if data is being transmitted or received. |
| RS232 | Indicates if data is being transmitted or received. |

Table 45: PP35-01 interface LEDs

Chapter 5
Power Panel 35

## 2.5  Digital inputs

### 2.5.1  Terminal block connections

Inputs 1 - 3 are equipped with additional functions (event counter, ABR evaluation, etc.). The supply voltage for the digital inputs can be monitored with the application program.
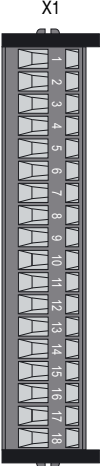
| 18-pin terminal block | Terminal | Assignment |
|---|---|---|
| X1 <br><br> 7TB718.91 | 1 | COM si (GND in sink operation, 24 VDC in source operation) |
| | 2 | COM so (24 VDC in sink operation, GND in source operation) |
| | 3 | Input 1 / counter 1 / A |
| | 4 | Input 2 / counter 2 / B |
| | 5 | Input 3 / ext. CLK / R |
| | 6 | Input 4 |
| | 7 | Input 5 |
| | 8 | Input 6 |
| | 9 | Input 7 |
| | 10 | Input 8 |
| | 11 | Input 9 |
| | 12 | Input 10 |
| | 13 | Input 11 |
| | 14 | Input 12 |
| | 15 | Input 13 |
| | 16 | Input 14 |
| | 17 | Input 15 |
| | 18 | Input 16 |

Table 46: PP35-01 terminal assignments X1 / digital inputs

### 2.5.2 Connection examples
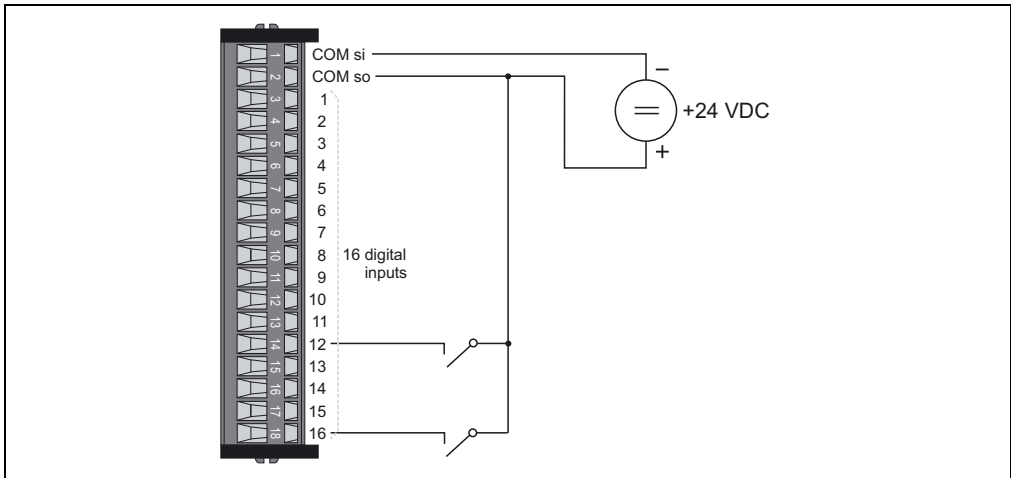
**Sink connection**



Figure 58: PP35-01 digital input connection examples (sink connection)
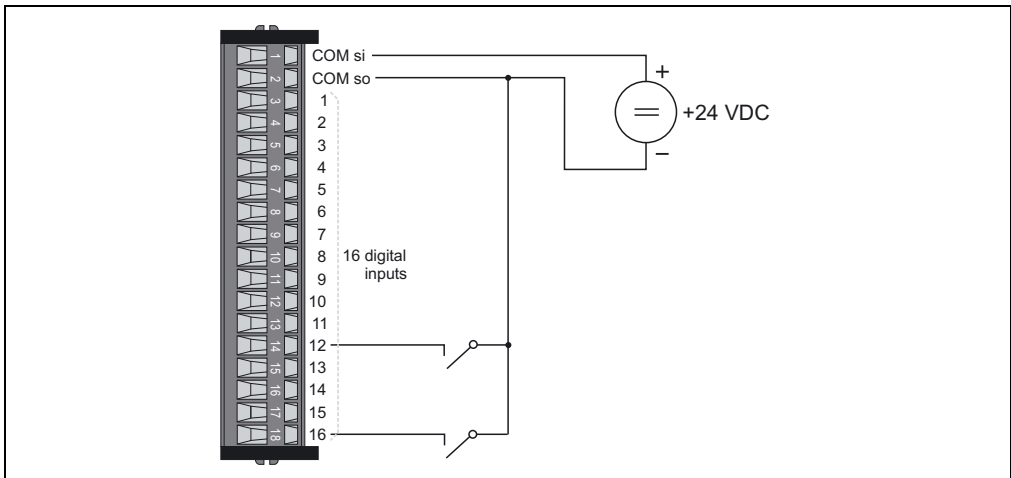
**Source connection**



Figure 59: PP35-01 digital input connection examples (source connection)
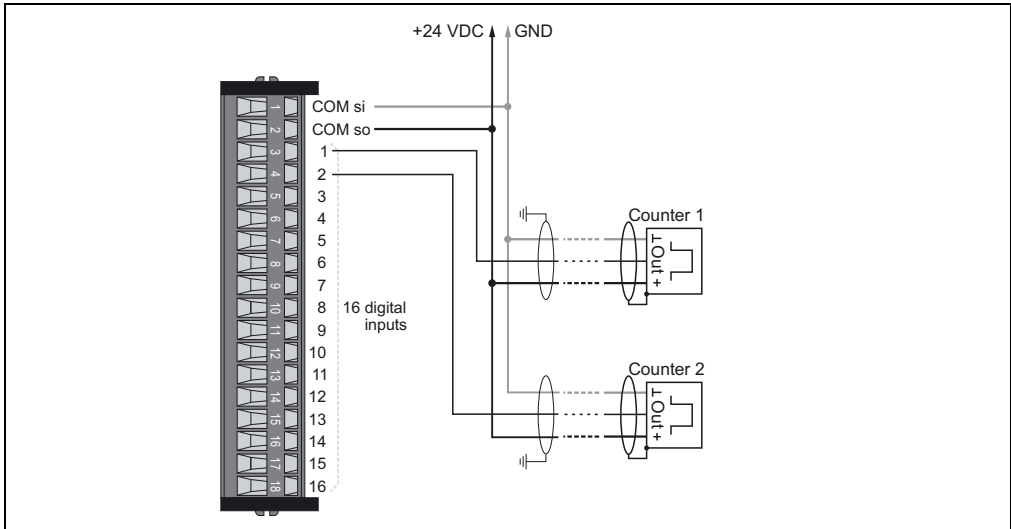
## Counter inputs



Figure 60: PP35-01 connection example - counter input

## Period or gate measurement
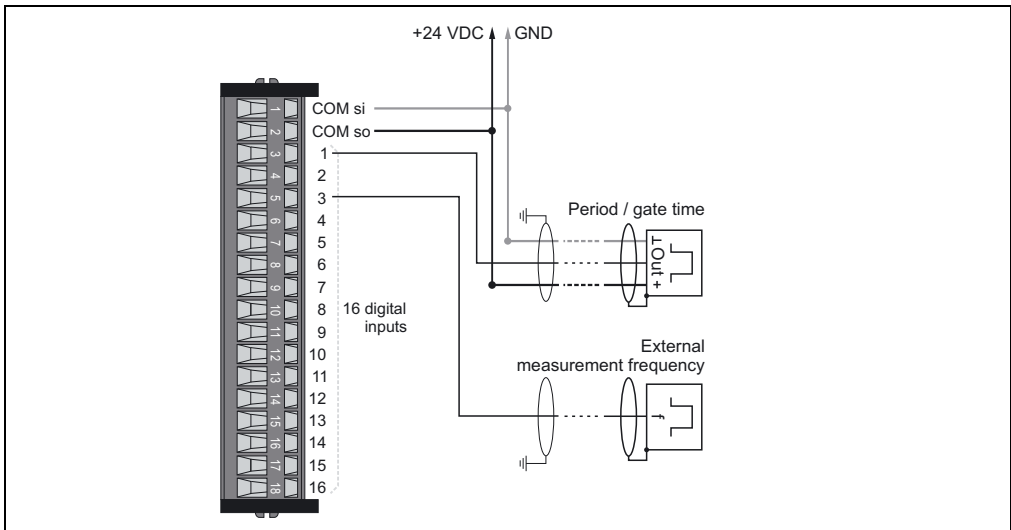


Figure 61: PP35-01 connection example - period and gate measurement

**Incremental encoders**
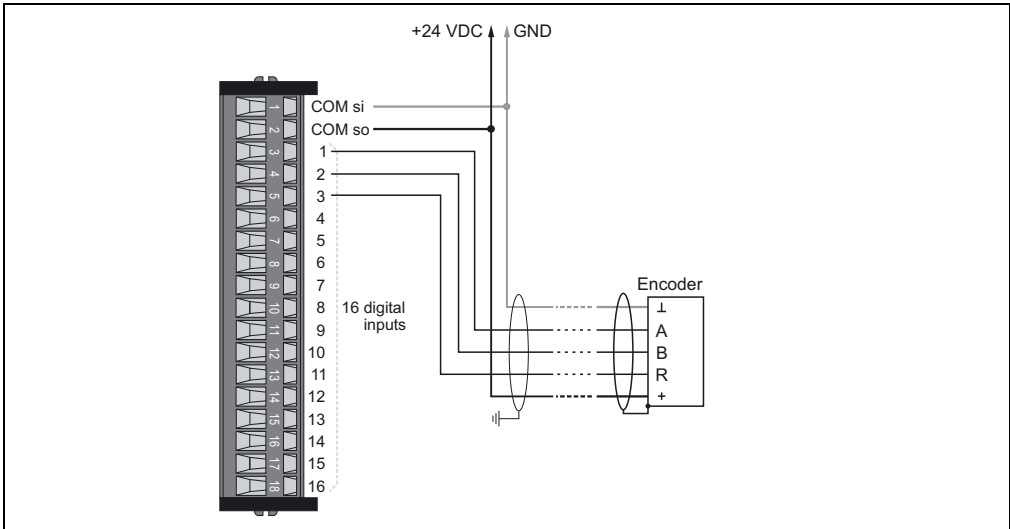


Figure 62: PP35-01 connection example - incremental encoder

## 2.5.3 Input circuit diagram



Figure 63: PP35-01 input circuit diagram - digital inputs

## 2.6  Digital outputs

### 2.6.1  Terminal block connections
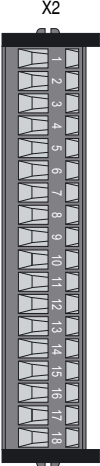
| 18-pin terminal block | Terminal | Assignment |
|---|---|---|
| | 1 | GND |
| | 2 | 24 VDC (DO supply) |
| X2 | 3 | Output 1 |
| | 4 | Output 2 |
| | 5 | Output 3 |
| | 6 | Output 4 |
| | 7 | Output 5 |
| | 8 | Output 6 |
| | 9 | Output 7 |
| | 10 | Output 8 |
| | 11 | Output 9 |
| | 12 | Output 10 |
| | 13 | Output 11 |
| | 14 | Output 12 |
| | 15 | Output 13 |
| | 16 | Output 14 |
| 7TB718.91 | 17 | Output 15 |
| | 18 | Output 16 |

Table 47: PP35-01 terminal assignment - X2 / digital outputs

### 2.6.2  Connection example
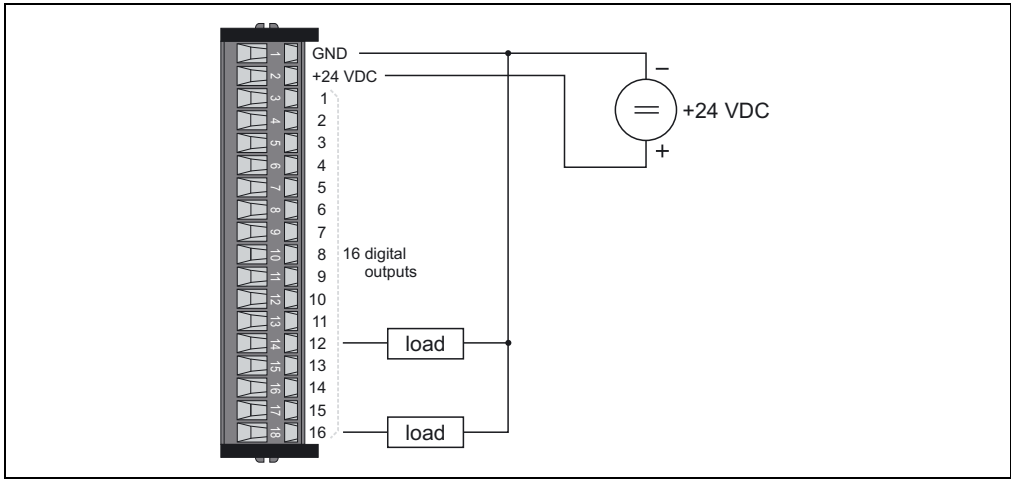


Figure 64: PP35-01 conneciton example - digital outputs

### 2.6.3  Output circuit diagram
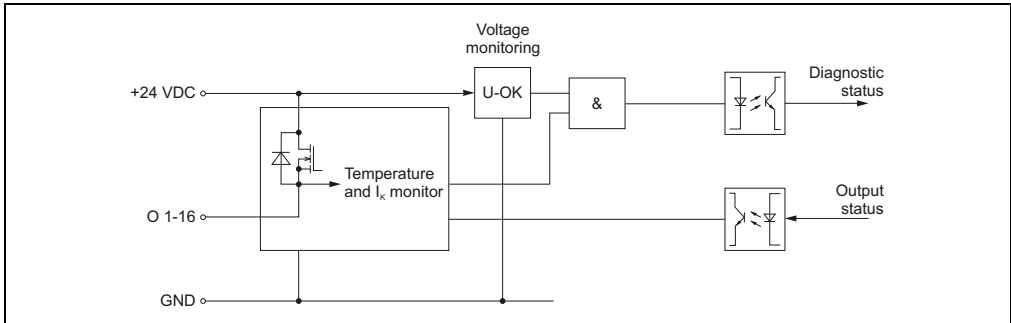


Figure 65: PP35-01 output circuit diagram - digital outputs

## 2.7 Variable declaration

| Description | Name in Automation Studio | Data type | Description |
|---|---|---|---|
| Digital in 1 - 16 | Digital input 01 - 16 | BIT | Level of digital inputs 1 - 16 |
| Digital out 1 - 16 | Digital output 01 - 16 | BIT | Level of digital outputs 1 - 16 |
| Counter 1 | Analog input 01 | UDINT | Counter state 1 (bit 1 - bit 32) |
| Counter 2 | Analog input 02 | UDINT | Counter state 2 (bit 1 - bit 32) |
| DO back | Analog input 03 | UINT | Actual state of the digital outputs 1 - 16 |
| Status | Analog input 04 | UINT | Status word |
| Config | Analog output 01 | UINT | Configuration word |

Table 48: PP35-01 variable declaration

## 2.7.1 Configuration register

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|

| Bit | Description |
|-----|-------------|
| 0 | Reserved |
| 1 | This setting applies only in AB(R) mode (bit 4+5 set to 01):<br>0 ...  R disabled<br>1 ...  R enabled |
| 2 | Switch between period and gate measurement (only evaluated if bits 4+5 are set to 11):<br>0 ...  Period measurement<br>1 ...  Gate measurement |
| 3 | Beginning of period or gate measurement:<br>0 ...  at rising (positive) edge<br>1 ...  at falling (negative) edge |
| 5-4 | 00 ... no counter operation<br>01 ... AB(R) counter<br>10 ... Event counter<br>11 ... Period or gate measurement |
| 7-6 | 00 ... Counter frequency 4 MHz<br>01 ... External counter frequency<br>10 ... Counter frequency 31.25 kHz<br>11 ... Not allowed |
| 8 | 0 ...  At the reference impulse (positive edge) counter 1 is copied to counter 2<br>1 ...  At the reference impulse (positive edge) counter 1 is reset to counter 0 |
| 9 | Overrun recognition by **counter 1** (only applies in period duration / gate time mode; see bit 4-5 and bit 2 of the configuration register):<br>0 ...  Shut off overrun recognition and reset overrun bit of counter  1 (bit 9 in the status register).<br>1 ...  Overrun recognition of the continuous counter. The counter value is limited to $0000FFFF. |
| 10 | Overrun recognition by **counter 2** (only applies in period duration / gate time mode; see bit 4-5 and bit 2 of the configuration register):<br>0 ...  Shut off overrun recognition and reset overrun bit of counter  2 (bit 10 in the status register).<br>1 ...  Overrun recognition of the continuous counter. The counter value is limited to $0000FFFF. |
| 14-11 | Reserved |
| 15 | 0 ...  Reset time or counter<br>1 ...  Enable time or counter (set this bit to 1 after counter has been configured) |

The reserve bits can only be written with the value 0.

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## 2.7.2  Status register

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

| Bit | Description |
|-----|-------------|
| 8-0 | Reserved |
| 9 | Information regarding counter 1 at period or gate measurement (only applies when bit 9 is set in the configuration register):<br>0 ...   The counter's value is within the range 0 - $0000FFFF.<br>1 ...   counter overrun! Acknowledge by resetting bit 9 of the configuration register. |
| 10 | Information regarding counter 2 at period or gate measurement (only applies when bit 10 is set in the configuration register):<br>0 ...   The counter's value is within the range 0 - $0000FFFF.<br>1 ...   counter overrun! Acknowledge by resetting bit 10 of the configuration register. |
| 11 | Reserved |
| 12 | Monitoring of the 24 VDC input supply<br>0 ...   Input supply OK<br>1 ...   Error: input supply to low or missing |
| 14-13 | Reserved |
| 15 | Monitoring of the 24 VDC output supply<br>0 ...   Output supply OK<br>1 ...   Error: output supply to low or missing |

### 2.7.3 DO back (status of digital outputs)

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|

| Bit | Description |
|-----|-------------|
| 0 | 0 ... Actual state of digital output 1: OUT<br>1 ... Actual state of digital output 1: IN |
| 1 | 0 ... Actual state of digital output 2: OUT<br>1 ... Actual state of digital output 2: IN |
| 2 | 0 ... Actual state of digital output 3: OUT<br>1 ... Actual state of digital output 3: IN |
| 3 | 0 ... Actual state of digital output 4: OUT<br>1 ... Actual state of digital output 4: IN |
| 4 | 0 ... Actual state of digital output 5: OUT<br>1 ... Actual state of digital output 5: IN |
| 5 | 0 ... Actual state of digital output 6: OUT<br>1 ... Actual state of digital output 6: IN |
| 6 | 0 ... Actual state of digital output 7: OUT<br>1 ... Actual state of digital output 7: IN |
| 7 | 0 ... Actual state of digital output 8: OUT<br>1 ... Actual state of digital output 8: IN |
| 8 | 0 ... Actual state of digital output 9: OUT<br>1 ... Actual state of digital output 9: IN |
| 9 | 0 ... Actual state of digital output 10: OUT<br>1 ... Actual state of digital output 10: IN |
| 10 | 0 ... Actual state of digital output 11: OUT<br>1 ... Actual state of digital output 11: IN |
| 11 | 0 ... Actual state of digital output 12: OUT<br>1 ... Actual state of digital output 12: IN |
| 12 | 0 ... Actual state of digital output 13: OUT<br>1 ... Actual state of digital output 13: IN |
| 13 | 0 ... Actual state of digital output 14: OUT<br>1 ... Actual state of digital output 14: IN |
| 14 | 0 ... Actual state of digital output 15: OUT<br>1 ... Actual state of digital output 15: IN |
| 15 | 0 ... Actual state of digital output 16: OUT<br>1 ... Actual state of digital output 16: IN |

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### 2.7.4 Counter settings

To set the correct counter modes, the configuration register must be written. Counter 1 and counter 2 registers have different meanings for different modes.

**Incremental encoder operation**

If the homing input (input 3) is *enabled* in the configuration register, then the Power Panel is a 32-bit ABR counter whose actual value is found in counter 1 and the saved R value in counter 2.

If the homing input is disabled, a 32-bit AB incremental encoder counter input is read in counter 1.

- A = digital input 1
- B = digital input 2
- R = digital input 3

**Event counter operation**

If the counters in the configuration register are initialized as event counters, two 32-bit counters are available.

- Counter 1 = digital input 1
- Counter 2 = digital input 2

**Period measurement**



Figure 66: PP35-01 period measurement

The measurement can be begin at the decreasing or increasing edge depending on the configuration register. The counter frequency can be set in two steps (4 MHz or 31.25 kHz) or with an external frequency. The external frequency must however be less than 50 kHz. The measured counter state is a 32-bit value and is displayed in counter 1 or counter 2. The value in the temporary register is only updated at the end of the measurement.

The frequency of the signal to be measured can be a maximum of 50 kHz.

- Counter 1 = digital input 1
- Counter 2 = digital input 2
- Ext. Counting frequency = digital input 3

A potential overrun of the continuous counter during the period measurement ( e.g. due to an incorrect counter frequency ), can be detected by reading bit 9 (counter 1) or bit 10 (counter 10) in the status register. However, the maximum value of counter is limited to $0000FFFF as a result. The error bit in the status register is acknowledged by resetting bit 9 (counter 1) or bit 10 (counter 2) of the configuration register.

**Gate measurement**



Figure 67: PP35-01 gate measurement

The measurement can be begin at the decreasing or increasing edge depending on the configuration register. The R enable bit must be 0. Measurement always occurs up to the next edge. The counter frequency can be set to one of two levels (4 MHz or 31.25 kHz) or with an external frequency. The external frequency must however be less than 50 kHz. The measured counter state is a 32-bit value and is displayed in counter 1 or counter 2. The value in the temporary register is only updated at the end of the active measurement.

The frequency of the signal to be measured can be a maximum of 50 kHz.

- Counter 1 = digital input 1
- Counter 2 = digital input 2
- Ext. Counting frequency = digital input 3

A potential overrun of the continuous counter during the gate measurement ( e.g. due to an incorrect counter frequency ), can be detected by reading bit 9 (counter 1) or bit 10 (counter 2) in the status register. However, the maximum value of counter is limited to $0000FFFF as a result. The error bit in the status register is acknowledged by resetting bit 9 or bit 10 of the configuration register.

# 3. Power Panel 35-36

## 3.1  Photos



4PP035.0300-36

4PP035.E300-36 / 4PP035.E300-136
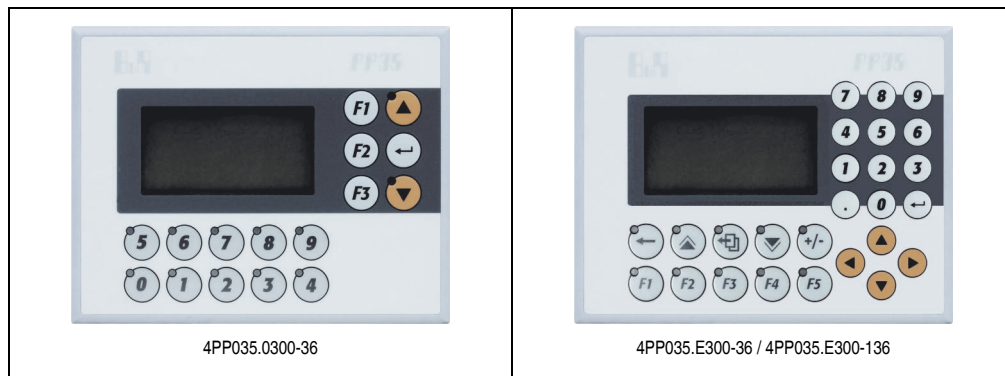
Figure 68: Power Panel 35-36 photos

## 3.2  Order data

| Model number | Short description |
|---|---|
| 4PP035.0300-36 | Power Panel, 24 VDC, 153 x 120 mm, LC display, 160x80 pixels, 3", background lighting, European / Cyrillic character set, 16 keys, 300 kB SRAM, 1024 kB FlashPROM, 1 RS232, 1 CAN interface, 8 digital inputs, 24 VDC, sink / source, 2 event counters, 1 incremental encoder or 2 gate-/period measurement, 8 digital outputs, 24 VDC, 0.5 A source, 4 analog inputs, ±10 V,12-bit, two of the analog inputs can be used as KTY10 or PT1000 inputs. 4 analog outputs, ±10 V, 12-bit, IP65 protection (from front). 2 x TB718 and 1 x TB103 terminal blocks sold separately. |
| 4PP035.E300-36 | Power Panel, 24 VDC, 153 x 120 mm, LC display, 160x80 pixels, 3", background lighting, European / Cyrillic character set, 26 keys, 300 kB SRAM, 1024 kB FlashPROM, 1 RS232, 1 CAN interface, 8 digital inputs, 24 VDC, sink / source, 2 event counters, 1 incremental encoder or 2 gate-/period measurement, 8 digital outputs, 24 VDC, 0.5 A source, 4 analog inputs, ±10 V,12-bit, two of the analog inputs can be used as KTY10 or PT1000 inputs. 4 analog outputs, ±10 V, 12-bit, IP65 protection (from front). 2 x TB718 and 1 x TB103 terminal blocks sold separately. |
| 4PP035.E300-136 | Power Panel, 24 VDC, 153 x 120 mm, LC display, 160x80 pixels, 3", background lighting, European / Cyrillic character set, 26 keys, 300 kB SRAM, 1984 kB FlashPROM, 1 RS232, 1 CAN interface, 8 digital inputs, 24 VDC, sink / source, 2 event counters, 1 incremental encoder or 2 gate-/period measurement, 8 digital outputs, 24 VDC, 0.5 A source, 4 analog inputs, ±10 V,12-bit, two of the analog inputs can be used as KTY10 or PT1000 inputs. 4 analog outputs, ±10 V, 12-bit, IP65 protection (from front). 2 x TB718 and 1 x TB103 terminal blocks sold separately. |
| **Note** | |
| All parts required to install the Power Panel, including key legend sheets, are included in its delivery. | |
| **Required accessories** | |
| 0TB103.9 | Accessory terminal block, 3-pin, Screw clamp, 2.5 mm²; protected against vibration by the screw flange. |
| 0TB103.91 | Accessory terminal block, 3-pin, Cage clamps, 2.5 mm²; protected against vibration by the screw flange. |
| 7TB718.9 | Accessory terminal block, 18-pin, screw clamp, 1.5 mm² |
| 7TB718.91 | Accessory terminal block, 18-pin, cage clamp, 1.5 mm² |

Table 49: Power Panel 35-36 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 |
| 4A0044.00-000 | 5 DIN A4 legend strips, 6 fields for a total of 30 devices |
| 7AC911.9 | Bus connector, CAN |

Table 49: Power Panel 35-36 order data (Forts.)

1) Replacement part

## 3.3  Technical data

| Product ID | Power Panel 35-36 |
|---|---|
| **General information** | |
| Certification | CE, C-UL-US, GOST-R |
| Standards<br>  Temperature<br>  Shock /  tests carried out<br>  Vibration / tests carried out<br>  Emission / tests carried out<br>  Immunity / tests carried out | IEC61131-2 / IEC60068-2-x<br>IEC61131-2 / IEC60068-2-27<br>IEC61131-2 / IEC60068-2-6<br>EN61000-6-4 / EN55022<br>IEC 61131-2 / IEC 61000-4-x |
| Status display | I/O function for each channel, status |
| Diagnostics<br>  Status<br>  I/O function<br>  Interfaces | Yes, with status LED<br>Yes, with LEDs<br>Yes, with LEDs |
| **Display** | |
| Type | LCD b/w |
| Resolution | 160 x 80 pixels |
| Background lighting | LED |
|   Character set | European / Cyrillic |
| **Keys** | |
| Total keys<br>  4PP035.0300-36<br>  4PP035.E300-36<br>  4PP035.E300-136 | 16 (12 with LEDs)<br>26 (10 with LEDs)<br>26 (10 with LEDs) |
| System keys | Number block<br>Control keys |
| Labeling | 10 keys with insert strips |

Table 50: Power Panel 35-36 technical data

| Product ID | Power Panel 35-36 |
|---|---|
| **Processor** | |
| Typical instruction cycle time | 0.8 µs, average value at 70% bit and 30% analog processing |
| Standard memory<br>   User RAM<br>   System PROM<br>   User PROM<br>      4PP035.0300-36<br>      4PP035.E300-36<br>      4PP035.E300-136 | <br>300 kB SRAM<br>448 kB FlashPROM<br><br>1024 kByte FlashPROM<br>1024 kByte FlashPROM<br>1984 kByte FlashPROM |
| Data buffering with backup battery | Lithium battery, 3 V / 950 mAh |
| Battey buffer current | Max. 30 µA |
| Hardware Watchdog | Yes |
| Voltage monitoring | An NMI is triggered at a supply voltage of <15 VDC. |
| Real-time clock | 1 s resolution, nonvolatile memory |
| System bus for expansions | No |
| Operating system | PP01x (version V 2.36 and higher) |
| **Status display / diagnostics** | |
| Status LED | Red / green |
| RS232 LED | Indicates if data is being transmitted or received |
| CAN LED | Indicates if data is being transmitted or received |
| I/O LED | Displays whether LEDs 1-16 indicate an input or output state. |
| 01-16 LEDs | State of inputs and outputs |
| **Interfaces** | |
| Application interface IF1<br>   Type<br>   Design<br>   Electrical isolation<br>   Max. transfer rate<br>   Distance | <br>RS232<br>9-pin DSUB plug<br>No<br>115.2 kbit/s<br>15 m / 19,200 bit/s |
| Application interface IF2<br>   Type<br>   Design<br>   Electrical isolation<br>   Distance<br>   Max. transfer rate<br>      Bus length 60 m<br>      Bus length 200 m<br>      Bus length 1,000 m | <br>CAN bus<br>9-pin DSUB plug<br>Yes<br>max. 1,000 m bus length<br><br>500 kbit/s<br>250 kbit/s<br>50 kbit/s |

Table 50: Power Panel 35-36 technical data (Forts.)

| Product ID | Power Panel 35-36 | |
|---|---|---|
| **Digital inputs** | | |
| Channels | 1-3 | 4-8 |
| Additional functions for inputs | 2 x event counter or 1 x incremental encoder ABR/AB or 2 x gate/period measurement | - |
| Input circuit | Sink or source | Sink or source |
| Input voltage (nom./max.) | 24 VDC / 30 VDC | 24 VDC / 30 VDC |
| Input current at nominal voltage | ca. 10 mA | ca. 5 mA |
| Switching threshold<br>    LOW<br>    HIGH | <5 V<br>>15 V | |
| Input filter | <10 µs | <1 ms |
| Electrical isolation<br>    Channel - bus<br>    Channel - channel<br>    Group isolation | Yes<br>No<br>No | Yes<br>No<br>No |
| **Event counter operation** | | |
| Amount | 2 | |
| Counter 1/2 | Input 1 / 2 | |
| Counter size | 32-bit | |
| Input frequency | Max. 50 kHz | |
| Signal form | Square wave pulse | |
| Evaluation | Positive or negative edge, cyclic counter | |
| **Incremental encoder operation** | | |
| Amount | 1 | |
| Type | ABR or AB | |
| Counter size | 32-bit | |
| Input frequency | Max. 20 kHz | |
| Evaluation | 4x | |
| Signal form | Square wave pulse | |

Table 50: Power Panel 35-36 technical data (Forts.)

| Product ID | Power Panel 35-36 |
|---|---|
| **Gate measurement** | |
| Number of gate measurements | 2 |
| Gate measurement on channel 1 and 2<br>    Channel 1<br>    Channel 2 | Input 1<br>Input 2 |
| Counter size | 32-bit |
| Evaluation | Positive or negative edge |
| Input frequency | Max. 50 kHz |
| Pulse length | ≥10 µs |
| Length of pauses between pulses | ≥10 µs |
| Count frequency<br>    Internal<br>    External | 4 MHz, 31.25 kHz<br>Max. 50 kHz |
| Signal form | Square wave pulse |
| **Period measurement** | |
| Number of period measurements | 2 |
| Measurement on channel 1 and 2<br>    Channel 1<br>    Channel 2 | Input 1<br>Input 2 |
| Counter size | 32-bit |
| Evaluation | Positive or negative edge |
| Input frequency | Max. 50 kHz |
| Count frequency<br>    Internal<br>    External | 4 MHz, 31.25 kHz<br>Max. 50 kHz |
| Signal form | Square wave pulse |

Table 50: Power Panel 35-36 technical data (Forts.)

| Product ID | Power Panel 35-36 |
|---|---|
| **Digital outputs** | |
| Channels | 8 |
| Type | Highside driver (source) |
| Switching voltage<br>   Minimum<br>   Nominal<br>   Maximum | <br>18 VDC<br>24 VDC<br>30 VDC |
| Nom. output current | 0.5 A |
| Total current | 4 A |
| Output circuit | Source |
| Max. switching frequency | 100 Hz |
| Switching delay | max. 500 µs |
| Short-circuit protection | Yes |
| Overload protection | Yes |
| Internal protective circuit | VDR |
| Electrical isolation<br>   Channel - bus<br>   Channel - channel<br>   Group isolation | <br>No<br>No<br>No |
| **Analog inputs** | |
| Number of channels | 4 differential inputs; 2 of which can be configured individually as temperature inputs |
| Input | $\pm 10$ V |
| Value range / input signal<br>   10 V<br>   0 V<br>   -10 V | <br>$7FFF<br>$0000<br>$8001 |
| Digital converter resolution | 12-bit |
| Conversion time | 150 µs for all channels |
| Input filter<br>   Hardware<br>   Software | <br>Cut-off frequency 10 kHz / attenuation 60 dB<br>- |
| Output format | INT |
| Input impedance in signal range | 20 M$\Omega$ |
| Input circuit | IEC 61131-2 |
| Electrical isolation<br>   Channel - Power Panel<br>   Channel - channel<br>   Group isolation | <br>Yes<br>No<br>No |

Table 50: Power Panel 35-36 technical data (Forts.)

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Power Panel 35

| Product ID | Power Panel 35-36 |
|---|---|
| **Temperature measurement** | |
| Number of channels | Up to 2 (depending on the configuration) |
| Input | Resistance measurement using 2-line procedure with constant current measurement |
| Digital converter resolution | 12-bit |
| Conversion time | 150 µs for all channels |
| Input filter<br>    Hardware<br>    Software | Cut-off frequency 10 kHz / attenuation 60 dB<br>- |
| Output format | INT |
| Data format | 16-bit 2s-complement (INT 16); 1 LSB = 0.1°C |
| Conversion of measurement values to temperature values | Automatic in the module |
| Sensor<br>    KTY10-6<br>    PT1000 | Can be set per channel<br>-50°C to 125°C<br>-200°C to 850°C |
| Resolution in °C<br>    KTY10-6<br>    PT1000 | 0.13°C<br>0.56°C |
| Wiring | 2-line |
| Measuring current | 1 mA |
| Resistance measurement range | 0 - 4000 Ω |
| Input circuit | IEC 61131-2 |
| Electrical isolation | like analog inputs |
| **Analog outputs** | |
| Number of channels | 4 |
| Output | ±10 V |
| Value range / output signal<br>    10 V<br>    0 V<br>    -10 V | $7FFF<br>$0000<br>$8001 |
| Max. load per output | ±10 mA (load 1 kΩ) |
| Digital converter resolution | 12-bit |
| Conversion time | 150 µs for all channels |
| Switch on / switch off procedure | Internal enable relay for boot procedure and error |
| Basic accuracy | ±0.088% at 25°C based on the current output value |
| Output protection | Continuous short circuit protection |
| Electrical isolation<br>    Channel - bus<br>    Channel - channel<br>    Group isolation | Yes<br>No<br>No |

Table 50: Power Panel 35-36 technical data (Forts.)

| Product ID | Power Panel 35-36 |
|---|---|
| **Power supply** | |
| Supply voltage<br>    Minimum<br>    Nominal<br>    Maximum | 18 VDC<br>24 VDC<br>30 VDC |
| Power consumption | Max. 6 W |
| **Environmental conditions** | |
| Temperature<br>    Operation<br>    Storage | 0°C to 50°C<br>-20°C to 60°C |
| Humidity<br>    Operation<br>    Storage | 10 to 90% (non-condensing)<br>5 to 95% (non-condensing) |
| **Mechanics** | |
| Protection | IP65 (from front) |
| Outer dimensions (B x H x T [mm]) | 153 x 120 x 46.1 |
| Weight | 0.5 kg |

Table 50: Power Panel 35-36 technical data (Forts.)

## 3.4  Diagnostic LEDs

Multiple LEDs on the back of the device show the status of the Power Panel, the interfaces, and the digital I/O:
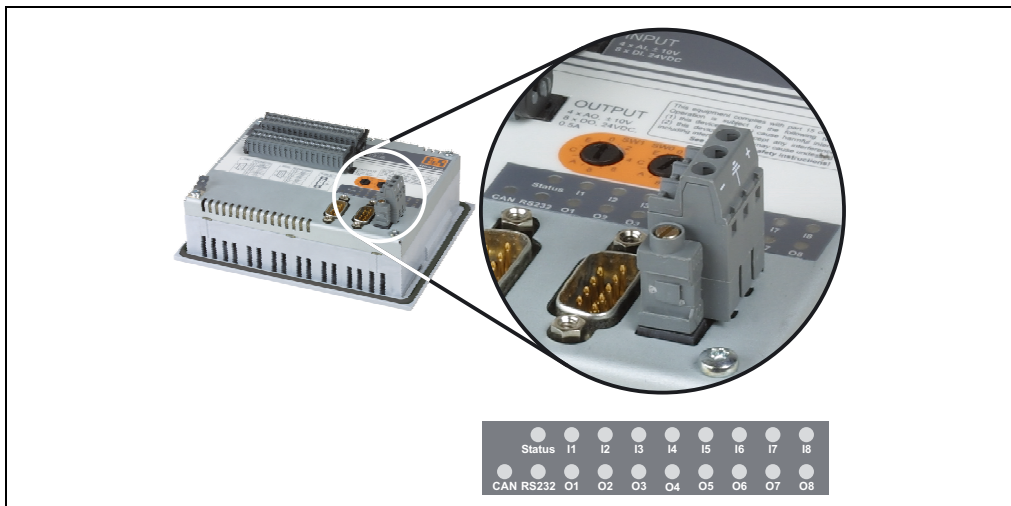


Figure 69: Power Panel 35-36 diagnostic LEDs

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Power Panel 35

### 3.4.1 Status LED

The Power Panel status LED uses a blink code to indicate the operating state of the Power Panel:

| Power Panel operating state | Color/blink code of the status LED | |
|---|---|---|
| Boot mode | Blinking yellow / green 1 Hz | |
| Flash programming | Blinking green / red 5 Hz | |
| Service mode / Diagnostic mode | Yellow | |
| Run | Green | |
| Error | Red | |

Table 51: Power Panel 35-36 status LED

### 3.4.2 I/O LEDs

| I/O LED | Description |
|---|---|
| I1 ... I8 | State of the 8 digital inputs |
| O1 ... O8 | State of the 8 digital outputs |

Table 52: Power Panel 35-36 I/O LEDs

### 3.4.3 Interface LEDs

| Interface LED | Description |
|---|---|
| CAN | Indicates if data is being transmitted or received. |
| RS232 | Indicates if data is being transmitted or received. |

Table 53: Power Panel 35-36 interface LEDs

## 3.5  Analog / digital inputs

### 3.5.1  Terminal block connections

Digital inputs 1 - 3 are equipped with additional functions (event counter, ABR evaluation, etc.). The supply voltage for the digital inputs can be monitored with the application program.
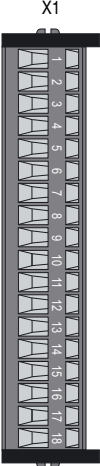
| 18-pin terminal block | Terminal | Assignment |
|---|---|---|
| X1<br><br>7TB718.91 | 1 | COM si (GND in sink operation, 24 VDC in source operation) |
| | 2 | COM so (24 VDC in sink operation, GND in source operation) |
| | 3 | + Analog input 1 |
| | 4 | - Analog input 1 |
| | 5 | + Analog input 2 |
| | 6 | - Analog input 2 |
| | 7 | + Analog input 3 |
| | 8 | - Analog input 3 |
| | 9 | + Analog input 4 |
| | 10 | - Analog input 4 |
| | 11 | Digital input 1 / counter 1 / A |
| | 12 | Digital input 2 / counter 2 / B |
| | 13 | Digital input 3 / ext. CLK / R |
| | 14 | Digital input 4 |
| | 15 | Digital input 5 |
| | 16 | Digital input 6 |
| | 17 | Digital input 7 |
| | 18 | Digital input 8 |

Table 54: Power Panel 35-36 terminal assignments - X1 / digital/analog inputs

### 3.5.2 Connection examples
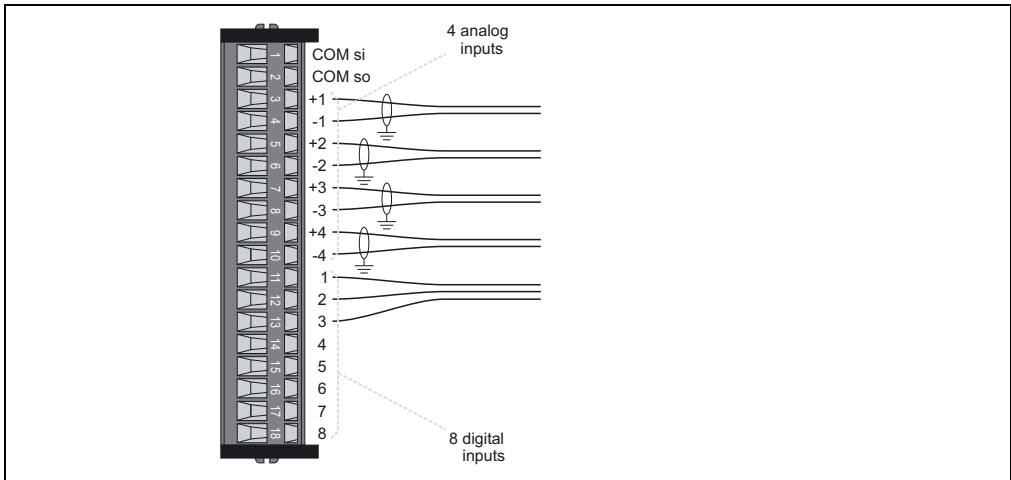
**Analog inputs**



Figure 70: Power Panel 35-36 connection example - analog inputs

**Digital inputs (sink connection)**
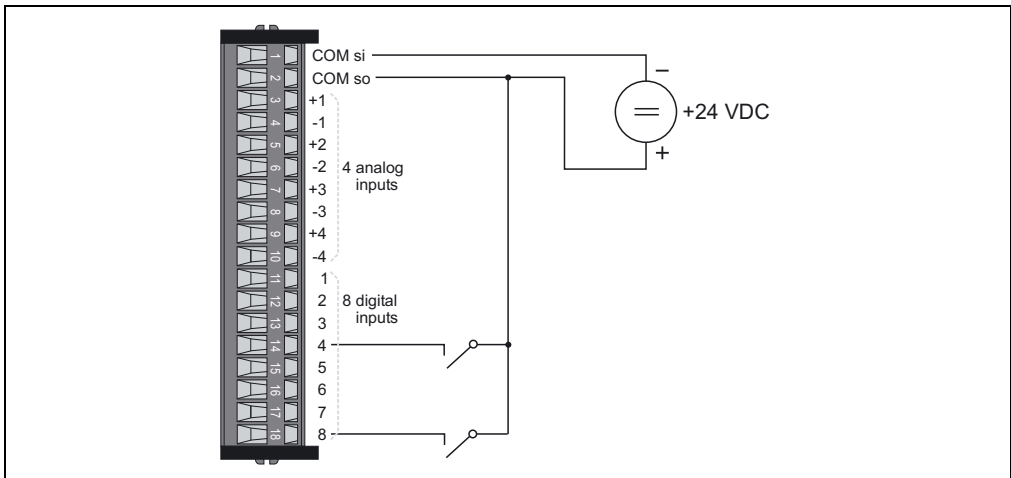


Figure 71: Power Panel 35-36 digital input connection examples (sink connection)

### Digital inputs (source connection)
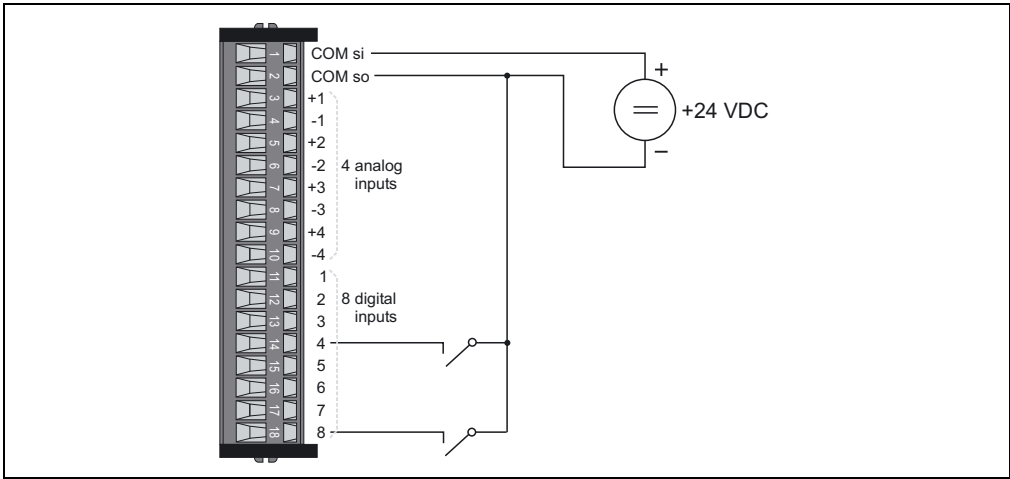


Figure 72: Power Panel 35-36 digital input connection examples (source connection)
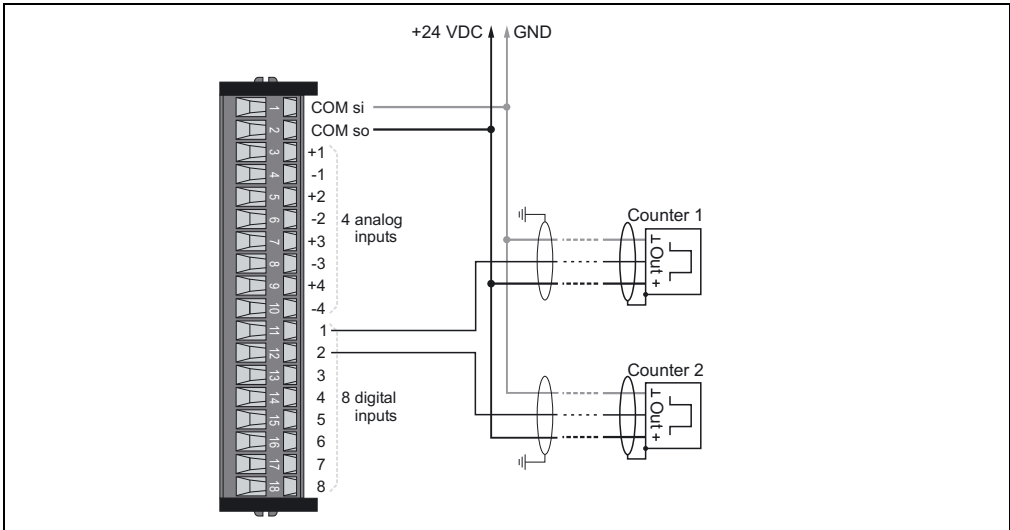
### Counter inputs



Figure 73: Power Panel 35-36 connection example - counter input

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## Period or gate measurement
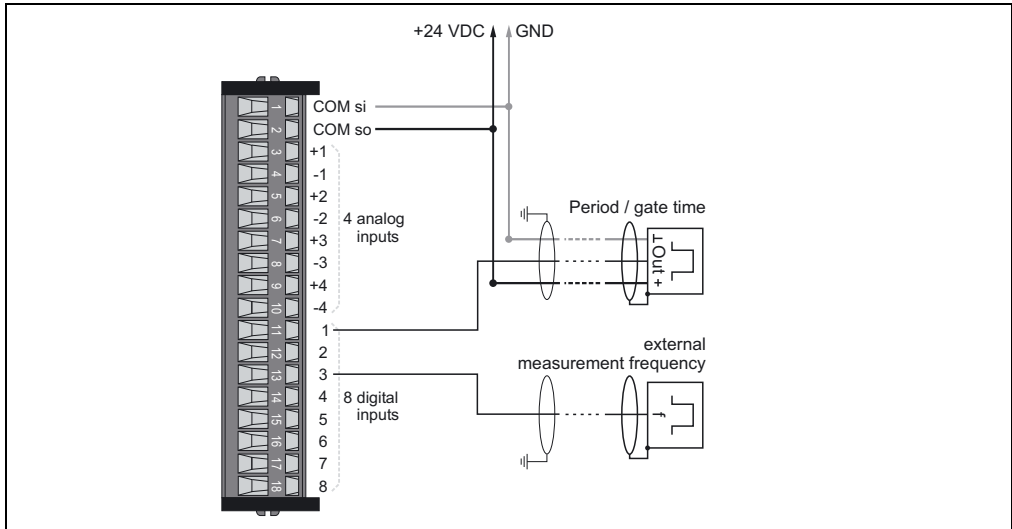


Figure 74: Power Panel 35-36 connection example - period and gate measurement

## Incremental encoders
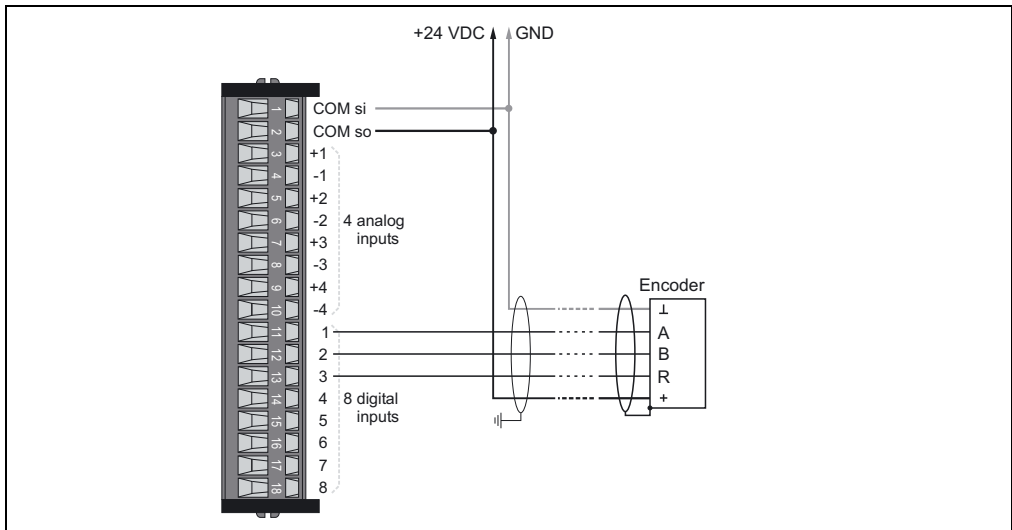


Figure 75: Power Panel 35-36 connection example - incremental encoder

### 3.5.3  Input circuit diagram
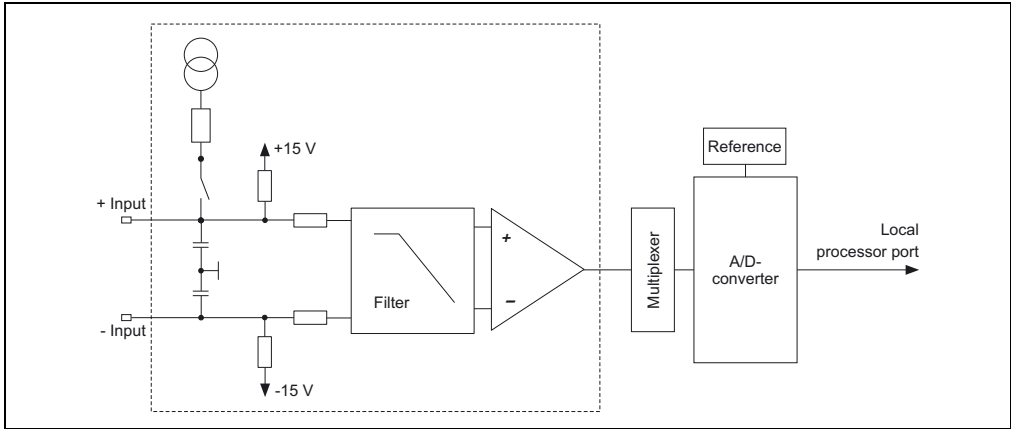
**Analog inputs 1 + 2**



Figure 76: Power Panel 35-36 input circuit diagram - analog inputs 1 + 2
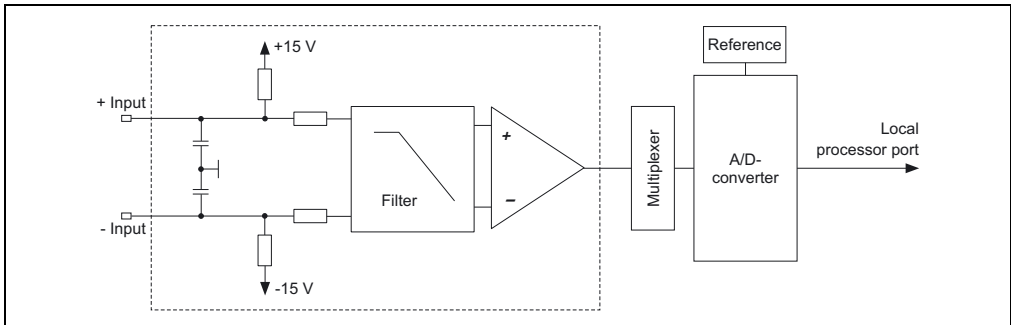
**Analog inputs 3 + 4**



Figure 77: Power Panel 35-36 input circuit diagram - analog inputs 3 + 4

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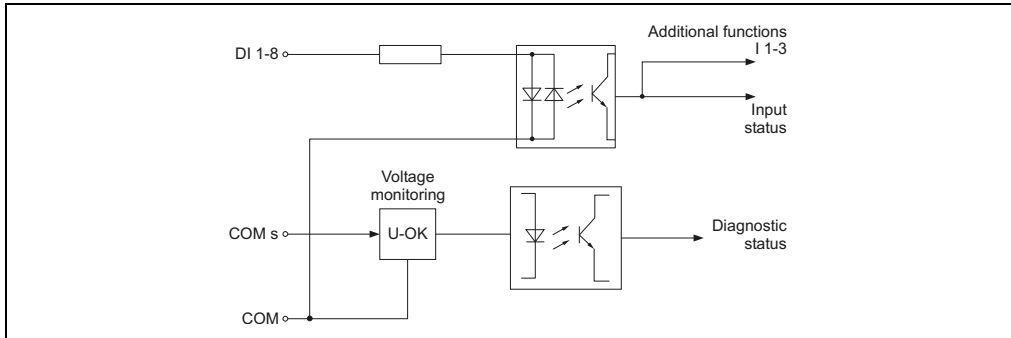
## Digital inputs



Figure 78: Power Panel 35-36 input circuit diagram - digital inputs

## 3.6  Analog / digital outputs

### 3.6.1  Terminal block connections

| 18-pin terminal block | Terminal | Assignment |
|---|---|---|
| X2<br><br>7TB718.91 | 1 | GND |
| | 2 | 24 VDC (DO supply) |
| | 3 | + Analog output 1 |
| | 4 | ⊥ Analog output 1 |
| | 5 | + Analog output 2 |
| | 6 | ⊥ Analog output 2 |
| | 7 | + Analog output 3 |
| | 8 | ⊥ Analog output 3 |
| | 9 | + Analog output 4 |
| | 10 | ⊥ Analog output 4 |
| | 11 | Digital output 1 |
| | 12 | Digital output 2 |
| | 13 | Digital output 3 |
| | 14 | Digital output 4 |
| | 15 | Digital output 5 |
| | 16 | Digital output 6 |
| | 17 | Digital output 7 |
| | 18 | Digital output 8 |

Table 55: Power Panel 35-36 terminal assignment - X2 / digital/analog outputs

### 3.6.2 Connection examples
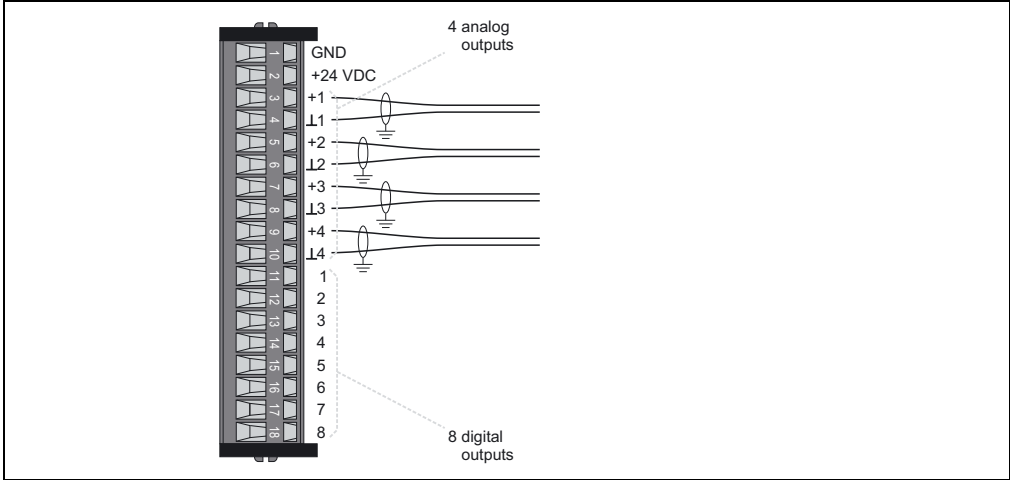
**Analog outputs**



Figure 79: Power Panel 35-36 connection example - analog output
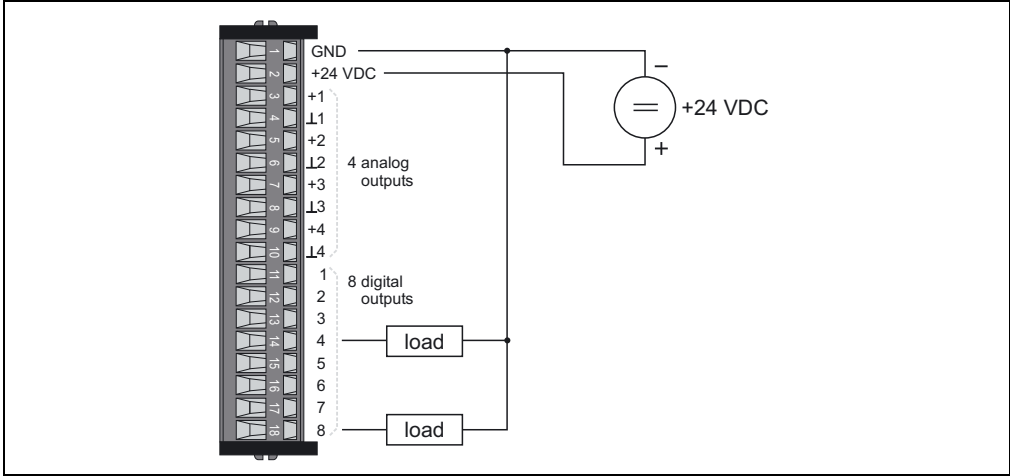
**Digital outputs**



Figure 80: Power Panel 35-36 conneciton example - digital output

### 3.6.3 Output circuit diagram
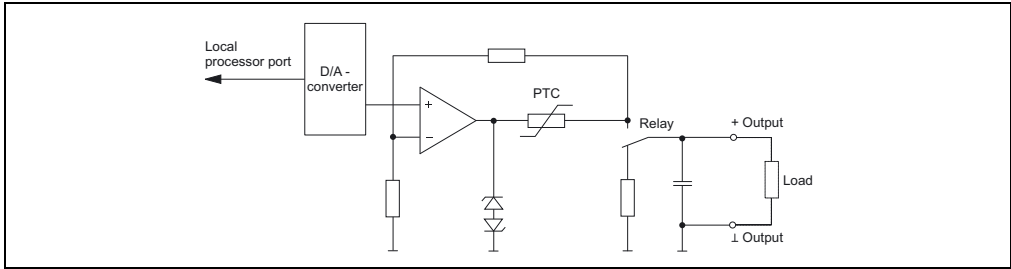
**Analog outputs**



Figure 81: Power Panel 35-36 output cirtuit diagram - analog outputs
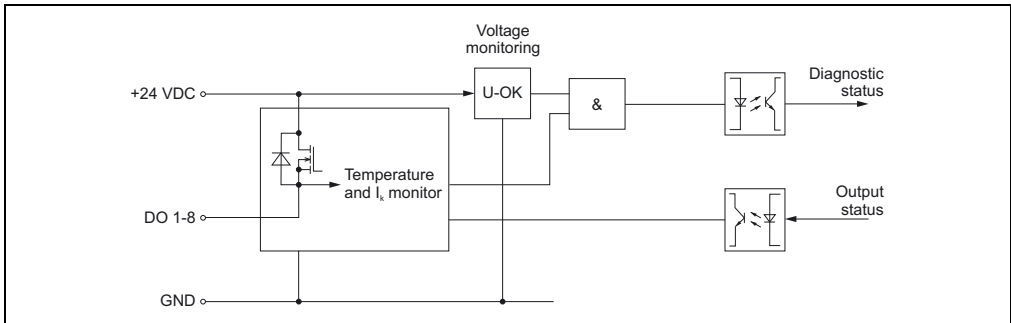
**Digital outputs**



Figure 82: Power Panel 35-36 output circuit diagram - digital outputs

## 3.7  Variable declaration

| Description | Name in Automation Studio | Data type | Description |
|---|---|---|---|
| Digital in 1 - 8 | Digital input 01 - 08 | BIT | Level of digital inputs 1 - 8 |
| Digital out 1 - 8 | Digital output 01 - 08 | BIT | Level of digital outputs 1 - 8 |
| Counter 1 | Analog input 01 | UDINT | Counter state 1 (bit 1 - bit 32) |
| Counter 2 | Analog input 02 | UDINT | Counter state 2 (bit 1 - bit 32) |
| DO back | Analog input 03 | UINT | Actual state of the digital outputs 1 - 8 |
| Status | Analog input 04 | UINT | Status word |
| Config | Analog output 01 | UINT | Configuration word |
| Analog in 1 | Analog input 05 | INT | Analog input 1 ($\pm$10 V, temperature) |
| Analog in 2 | Analog input 06 | INT | Analog input 2 ($\pm$10 V, temperature) |
| Analog in 3 | Analog input 07 | INT | Analog input 3 ($\pm$10 V) |
| Analog in 4 | Analog input 08 | INT | Analog input 4 ($\pm$10 V) |
| Analog out 1 | Analog output 02 | INT | Analog output 1 ($\pm$10 V) |
| Analog out 2 | Analog output 03 | INT | Analog output 2 ($\pm$10 V) |
| Analog out 3 | Analog output 04 | INT | Analog output 3 ($\pm$10 V) |
| Analog out 4 | Analog output 05 | INT | Analog output 4 ($\pm$10 V) |

Table 56: Power Panel 35-36 variable declaration

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Power Panel 35

## 3.7.1  Configuration register

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| Bit | Description |
|---|---|
| 0 | Reserved |
| 1 | This setting applies only in AB(R) mode (bit 4+5 set to 01):<br>0 ...  R disabled<br>1 ...  R enabled |
| 2 | Switch between period and gate measurement (only evaluated if bits 4+5 are set to 11):<br>0 ...  Period measurement<br>1 ...  Gate measurement |
| 3 | Beginning of period or gate measurement:<br>0 ...  at rising (positive) edge<br>1 ...  at falling (negative) edge |
| 5-4 | 00 ... no counter operation<br>01 ... AB(R) counter<br>10 ... Event counter<br>11 ... Period or gate measurement |
| 7-6 | 00 ... Counter frequency 4 MHz<br>01 ... External counter frequency<br>10 ... Counter frequency 31.25 kHz<br>11 ... Not allowed |
| 8 | 0 ...  At the reference impulse (positive edge) counter 1 is copied to counter 2<br>1 ...  At the reference impulse (positive edge) counter 1 is reset to counter 0 |
| 9 | Overrun recognition by **counter 1** (only applies in period duration / gate time mode; see bit 4-5 and bit 2 of the configuration register):<br>0 ...  Shut off overrun recognition and reset overrun bit of counter  1 (bit 9 in the status register).<br>1 ...  Overrun recognition of the continuous counter. The counter value is limited to $0000FFFF. |
| 10 | Overrun recognition by **counter 2** (only applies in period duration / gate time mode; see bit 4-5 and bit 2 of the configuration register):<br>0 ...  Shut off overrun recognition and reset overrun bit of counter  2 (bit 10 in the status register).<br>1 ...  Overrun recognition of the continuous counter. The counter value is limited to $0000FFFF. |
| 12-11 | Analog input 1:<br>00 ... Voltage measurement (default setting)<br>01 ... Temperature measurement - PT1000<br>10 ... Temperature measurement - KTY10-6<br>11 ... Resistance measurement 1 - 4000 $\Omega$ |
| 14-13 | Analog input 2:<br>00 ... Voltage measurement (default setting)<br>01 ... Temperature measurement - PT1000<br>10 ... Temperature measurement - KTY10-6<br>11 ... Resistance measurement 1 - 4000 $\Omega$ |
| 15 | 0 ...  Reset time or counter<br>1 ...  Enable time or counter (set this bit to 1 after counter has been configured) |

The reserve bits can only be written with the value 0.

### 3.7.2 Status register

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

| Bit | Description |
|---|---|
| 3-0 | Reserved |
| 4 | 0 ...   Analog input 1 - OK<br>1 ...   Analog input 1 - error |
| 5 | 0 ...   Analog input 2 - OK<br>1 ...   Analog input 2 - error |
| 6 | 0 ...   Analog input 3 - OK<br>1 ...   Analog input 3 - error |
| 7 | 0 ...   Analog input 4 - OK<br>1 ...   Analog input 4 - error |
| 8 | Reserved |
| 9 | Information regarding counter 1 at period or gate measurement (only applies when bit 9 is set in the configuration register):<br>0 ...   The counter's value is within the range 0 - \$0000FFFF.<br>1 ...   Counter overrun! Acknowledge by resetting bit 9 of the configuration register. |
| 10 | Information regarding counter 2 at period or gate measurement (only applies when bit 10 is set in the configuration register):<br>0 ...   The counter's value is within the range 0 - \$0000FFFF.<br>1 ...   Counter overrun! Acknowledge by resetting bit 10 of the configuration register. |
| 11 | Reserved |
| 12 | Monitoring of the 24 VDC input supply<br>0 ...   Input supply OK<br>1 ...   Error: input supply to low or missing |
| 14-13 | Reserved |
| 15 | Monitoring of the 24 VDC output supply<br>0 ...   Output supply OK<br>1 ...   Error: output supply to low or missing |

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### 3.7.3  DO back (status of digital outputs)

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

| Bit | Description |
|-----|-------------|
| 0 | 0 ...  Actual state of digital output 1: OUT<br>1 ...  Actual state of digital output 1: IN |
| 1 | 0 ...  Actual state of digital output 2: OUT<br>1 ...  Actual state of digital output 2: IN |
| 2 | 0 ...  Actual state of digital output 3: OUT<br>1 ...  Actual state of digital output 3: IN |
| 3 | 0 ...  Actual state of digital output 4: OUT<br>1 ...  Actual state of digital output 4: IN |
| 4 | 0 ...  Actual state of digital output 5: OUT<br>1 ...  Actual state of digital output 5: IN |
| 5 | 0 ...  Actual state of digital output 6: OUT<br>1 ...  Actual state of digital output 6: IN |
| 6 | 0 ...  Actual state of digital output 7: OUT<br>1 ...  Actual state of digital output 7: IN |
| 7 | 0 ...  Actual state of digital output 8: OUT<br>1 ...  Actual state of digital output 8: IN |
| 8-15 | Reserved |

### 3.7.4  Analog input

The analog inputs deliver data in 16-bit 2s complement (INT16 format). Analoginputs 1 and 2 can be used for voltage, temperature, or resistance measurement by writing to the configuration register.

Depending on these settings, the input data can be interpreted as follows:

| Input type | 1 LSB means ... | error appears in status register if ... |
|------------|-----------------|------------------------------------------|
| Voltage measurement | 2.44 mV | Measurement range not reached (input voltage < -10 V)<br>Measurement range exceeded (input voltage >10 V)<br>Wire break |
| Temperature measurement PT1000 | 0.1°C | Measurement range not reached (temperature < -200°C)<br>Measurement range exceeded (temperature >850°C)<br>Wire break |
| Resistance measurement<br>1 - 4,000 $\Omega$ | 122,074 m$\Omega$ | Measurement range not reached (resistance <1 $\Omega$)<br>Measurement range exceeded (resistance >4,000 $\Omega$)<br>Wire break |

Relationship between numerical value and input voltage:

| Numerical value (INT) | | Voltage measurement |
|---|---|---|
| **Hexadecimal** | **Decimal** | |
| 8001 | -32767 | -10 V |
| C001 | -16383 | -5 V |
| FFF8 | -8 | - 2.44 mV |
| 0000 | 0 | 0 V |
| 0008 | 8 | 2.44 mV |
| 3FFF | 16383 | 5 V |
| 7FFF | 32767 | 10 V |

### 3.7.5 Analog output

The analog outputs are written in INT16 format (16-bit 2s complement) beschrieben. You won't need to change anything here.

Relationship between numerical value and output voltage:

| Numerical value (INT) | | Output voltage |
|---|---|---|
| **Hexadecimal** | **Decimal** | |
| 8001 | -32767 | -10 V |
| C001 | -16383 | -5 V |
| FFF0 | -16 | - 4.88 mV |
| 0000 | 0 | 0 V |
| 0010 | 16 | 4.88 mV |
| 3FFF | 16383 | 5 V |
| 7FFF | 32767 | 10 V |

### 3.7.6 Counter settings

To set the correct counter modes, the configuration register must be written. Counter 1 and counter 2 registers have different meanings for different modes.

#### Incremental encoder operation

If the homing input (input 3) is *enabled* in the configuration register, then the Power Panel is a 32-bit ABR counter whose actual value is found in counter 1 and the saved R value in counter 2.

If the homing input is disabled, a 32-bit AB incremental encoder counter input is read in counter 1.

- A = digital input 1
- B = digital input 2
- R = digital input 3

**Event counter operation**

If the counters in the configuration register are initialized as event counters, two 32-bit counters are available.

- Counter 1 = digital input 1
- Counter 2 = digital input 2

**Period measurement**



Figure 83: Power Panel 35-36 period measurement

The measurement can be begin at the decreasing or increasing edge depending on the configuration register. The counter frequency can be set in two steps (4 MHz or 31.25 kHz) or with an external frequency. The external frequency must however be less than 50 kHz. The measured counter state is a 32-bit value and is displayed in counter 1 or counter 2. The value in the temporary register is only updated at the end of the measurement.

The frequency of the signal to be measured can be a maximum of 50 kHz.

- Counter 1 = digital input 1
- Counter 2 = digital input 2
- Ext. Counting frequency = digital input 3

A potential overrun of the continuous counter during the period measurement ( e.g. due to an incorrect counter frequency ), can be detected by reading bit 9 (counter 1) or bit 10 (counter 10) in the status register. However, the maximum value of counter is limited to $0000FFFF as a result. The error bit in the status register is acknowledged by resetting bit 9 (counter 1) or bit 10 (counter 2)  of the configuration register.

**Gate measurement**



Figure 84: Power Panel 35-36 gate measurement

The measurement can be begin at the decreasing or increasing edge depending on the configuration register. The R enable bit must be 0. Measurement always occurs up to the next edge. The counter frequency can be set to one of two levels (4 MHz or 31.25 kHz) or with an external frequency. The external frequency must however be less than 50 kHz. The measured counter state is a 32-bit value and is displayed in counter 1 or counter 2. The value in the temporary register is only updated at the end of the active measurement.

The frequency of the signal to be measured can be a maximum of 50 kHz.

- Counter 1 = digital input 1
- Counter 2 = digital input 2
- Ext. Counting frequency = digital input 3

A potential overrun of the continuous counter during the gate measurement ( e.g. due to an incorrect counter frequency ), can be detected by reading bit 9 (counter 1) or bit 10 (counter 2) in the status register. However, the maximum value of counter is limited to $0000FFFF as a result. The error bit in the status register is acknowledged by resetting bit 9 or bit 10 of the configuration register.

Chapter 5
Power Panel 35

# 4. Supply voltage

| 3-pin terminal block | Terminal | Assignment |
|---|---|---|
| | 1 | 24 VDC |
| | 2 | Ground |
| | 3 | GND |
| 0TB103.91 | | |

Table 57: Power Panel 35 terminal assignments X3 / voltage supply

# 5. Interfaces

## 5.1 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.).

| 9-pin DSUB connector | Terminal | Assignment |
|---|---|---|
| | 1 | n.c. |
| | 2 | RXD |
| | 3 | TXD |
| | 4 | n.c. |
| | 5 | GND |
| 9-pin DSUB plug | 6 | n.c. |
| | 7 | RTS |
| | 8 | CTS |
| | 9 | n.c. |

Table 58: Power Panel 35 pin assignments IF1 / RS232

## 5.2 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 terminating resistance is integrated in the T-connector for the bus termination, which can be turned on or off. For more information on wiring CAN fieldbus systems, see chapter 2 "Installation", section "CAN Fieldbus", in the B&R SYSTEM 2003 User's Manual.

| 9-pin DSUB connector | Terminal | Assignment |
|---|---|---|
| | 1 | n.c. |
| | 2 | CAN_L |
| | 3 | CAN_GND |
| | 4 | n.c. |
| 9-pin DSUB plug | 5 | n.c. |
| | 6 | n.c. |
| | 7 | CAN_H |
| | 8 | n.c. |
| | 9 | n.c. |

Table 59: Power Panel 35 pin assignments - IF2 / CAN

# 6. Operating mode and node number switch
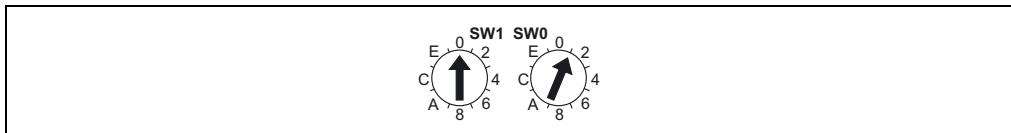


Figure 85: Power Panel 35 operating mode and node number switch

The Power Panel 35 is equipped with 2 hex switches, which are used as an operating mode switch. The switch positions 01 - FE are used to set the CAN node number. The operating system only interprets the switch position when switched on.

All other switch positions are reserved for special functions.

| Switch position | Description |
|---|---|
| ^ | In this switch position, the operating system can be programmed via the online interface. User FlashPROM is only deleted after the update begins. |
| 01 - FE | Freely available for use in an application (e.g. CAN node number) |
| 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 60: Power Panel 35 switch positions of the operating mode and node number switch
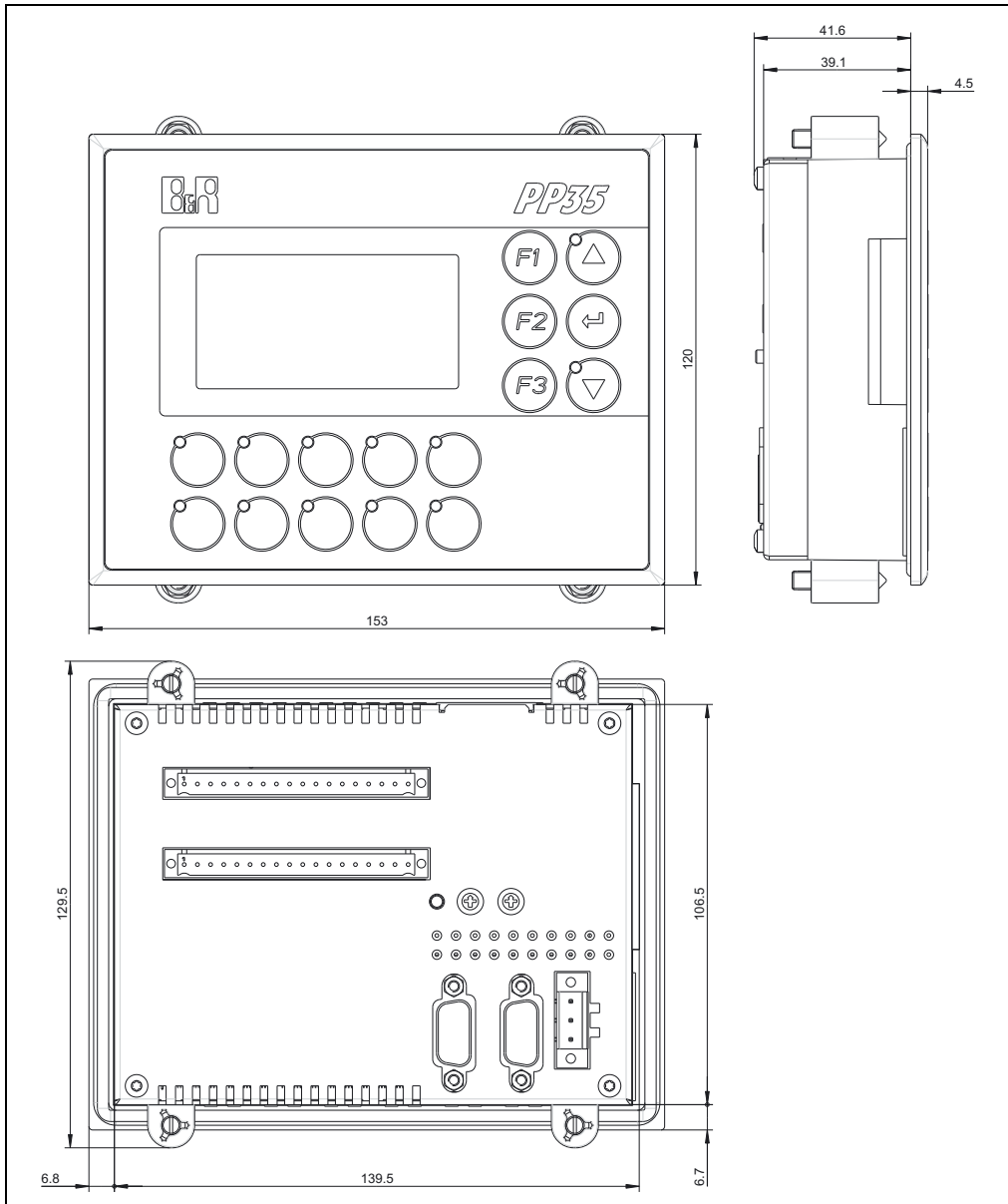
# 7. Dimensions



Figure 86: Power Panel 35 dimensions

Installation cutout: 141 mm x 108 mm (max. 4.5 mm plate thickness)

# 8. Set display contrast

The display contrast is set at the factory. However, the user can make a different contrast setting as desired. To do this, press "ENTER". While holding down this key, the "UP" and "DOWN" keys can be used to set the contrast:
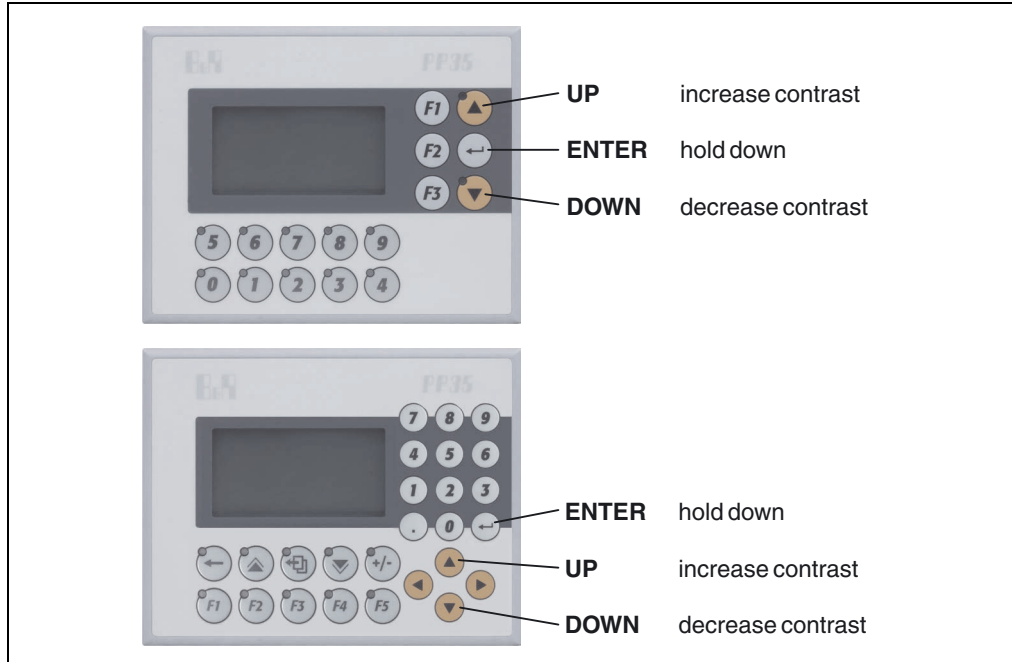


Figure 87: Power Panel 35 set display contrast

The contrast setting made in this way is placed in nonvolatile memory and is used from now on as the default value.

# WARNING

**The key codes for "UP" and "DOWN" are not sent to the controller as long as "ENTER" is being pressed. It is also not possible to use the key combinations ENTER + UP or ENTER + DOWN in the application project.**

Chapter 5
Power Panel 35

# 9. Note regarding operation

# Caution!

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

# 10. Changing the battery

## 10.1  Battery data

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

Table 61: Power Panel 35 battery data

## 10.2  Buffer duration

| **Buffer current** | **Panel CPU** |
|---|---|
| Typical | 10 µA |
| Maximum | 200 µA |

Table 62: Power Panel 35 buffer duration

# Information:

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

## 10.3  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:

**Data stored in RAM will be lost if the battery is changed with the PLC switched off.**

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 88: Power Panel 35 changing the battery

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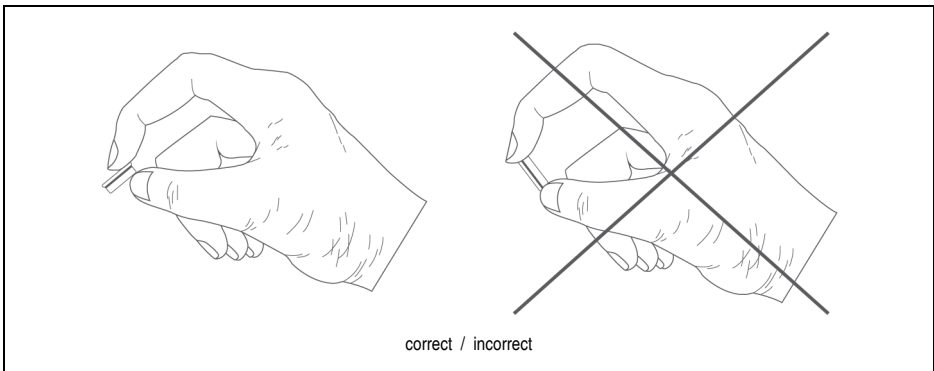


correct / incorrect

Figure 89: Power Panel 35 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.**

## 11. Mounting instructions

The following mounting instructions should be noted:

1) The Power Panel 35 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 20 mm (above and below) between the ventilation slots and all other objects.
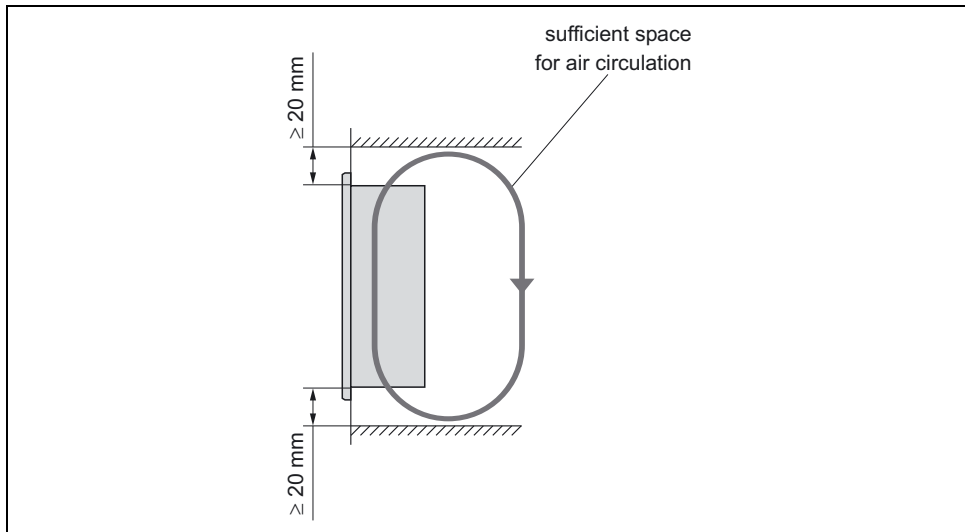


Figure 90: Power Panel 35 distance for air circulation

3) The Power Panel 35 can be mounted up to a maximum angle of ±45°.
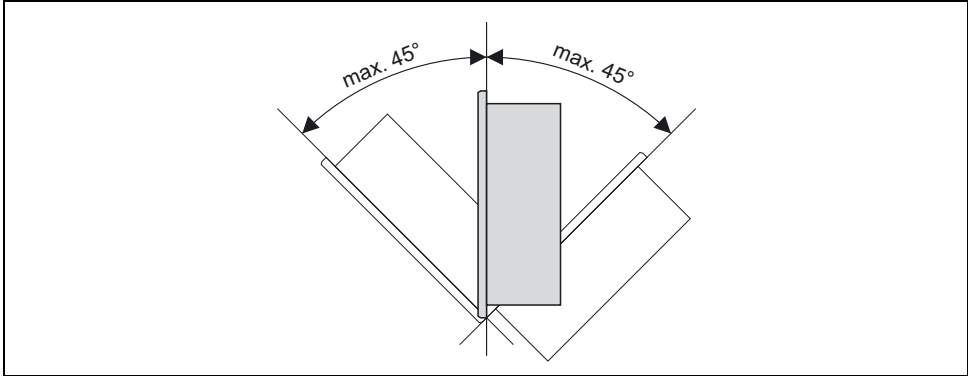


Figure 91: Power Panel 35 mounting angle

# Chapter 6 • Power Panel 41

## 1. Photo
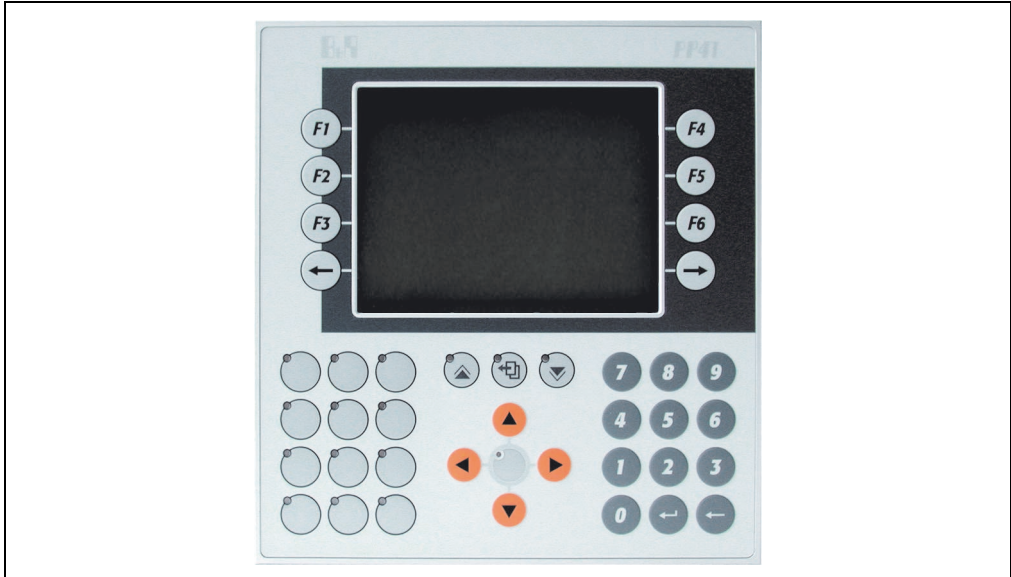


Figure 92: Power Panel 41 photo

## 2. Order data

| Model number | Short description |
|---|---|
| 4P3040.01-490 | Power Panel 41, 5.7" QVGA b/w LCD, 8 soft keys and 32 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 module, 10 digital inputs 24 VDC, 8 digital outputs 24 VDC, 0.4 A, IP65 protection (from front), 205 x 220 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. | |

Table 63: Power Panel 41 order data

| Model number | Short description |
|---|---|
| **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 |
| 7TB712:90-02 | Terminal block, 12-pin, 20 pcs., screw clamps |
| 7TB712:91-02 | Terminal block, 12-pin, 20 pcs., cage clamps |
| **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 |
| 4A0034.00-000 | Set of legend strips for 4P3040.01-490 (for 10 devices) |
| 4EX101.00 | Power Panel expansion for PP41, 1 insert slot for interface module inserts |
| 7AC911.9 | Bus connector, CAN |

Table 63: Power Panel 41 order data (Forts.)

1) Replacement part

# 3. Technical data

| Description | Power Panel 41 |
|---|---|
| **General information** | |
| Certification | CE, C-UL-US, GOST-R |
| Standards<br>    Temperature<br>    Shock /  tests carried out<br>    Vibration / tests carried out<br>    Emission / tests carried out<br>    Immunity / tests carried out | IEC61131-2 / IEC60068-2-x<br>IEC61131-2 / IEC60068-2-27<br>IEC61131-2 / IEC60068-2-6<br>EN61000-6-4 / EN55022<br>IEC 61131-2 / IEC 61000-4-x |
| **Display** | |
| Type | LCD b/w |
| Diagonal | 5.7" (145 mm) |
| Resolution | QVGA, 320 x 240 pixels |
| Brightness | 150 cd/m² |
| Half-brightness time | 50,000 h |
| Reading angle | Approx. 35 ° |

Table 64: Power Panel 41 technical data

| Description | Power Panel 41 |
|---|---|
| **Keys** | |
| Design | Mylar keypad with metallic snap-action disks |
| Front | Multi-layered cover with insertion slots for key legends |
| Total keys | 40 membrane keys |
| Function keys | 16, with LEDs, labeled with legend sheets |
| System keys | 24 (number block, cursor block, control keys) |
| **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<br>　User RAM<br>　SystemPROM<br>　User PROM | 700 kB SRAM<br>600 kB FlashPROM<br>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 | Expansion module EX101<br>1 insert slot for B&R SYSTEM 2005 interface module inserts |
| Slots for B&R 2003 screw-in modules<br>　Suitable for IF modules (without CAN)<br>　TPU functionality support<br>　Suitable for CAN communication | 6<br>Slots 1 - 3<br>Slots 4 - 6<br>Slot 1 with interface module 4IF370.7 |
| PCMCIA slot (see "PCMCIA slot", on Page 165)<br>　Memory size<br>　　SRAM<br>　　FlashPROM<br>　Standard<br>　Card height<br>　Card type | 1<br><br>Max. 4 MB<br>Max. 4 MB<br>JEIDA V 4.0 or PCMCIA standard release 2.0<br>Max. 3 mm<br>Memory cards |

Table 64: Power Panel 41 technical data (Forts.)

| Description | Power Panel 41 |
|---|---|
| **Standard communication interfaces** | |
| Application interface IF1<br>    Type<br>    Design<br>    Electrical isolation<br>    Max. transfer rate<br>    Max. distance | RS232<br>9-pin DSUB plug<br>No<br>115.2 kbit/s<br>15 m / 19,200 bit/s |
| Application interface IF2<br>    Type<br>    Design<br>    Electrical isolation<br>    Max. transfer rate<br>    Max. distance | CAN bus<br>9-pin DSUB plug<br>Yes<br>500 kbit/s<br>1,000 m |
| **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<br>    Channel - bus<br>    Channel - channel<br>    Group isolation | Yes<br>No<br>Input group - output group |

Table 64: Power Panel 41 technical data (Forts.)

| Description | Power Panel 41 |
|---|---|
| **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<br>    Log. 0 - log. 1<br>    Log. 1 - log. 0 | Max. 450 µs<br>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<br>    Channel - bus<br>    Channel - channel<br>    Group isolation | Yes<br>No<br>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 | 11 W |
| **Environmental conditions** | |
| Temperature<br>    Operation<br>    Storage | 0°C to 50°C<br>-20°C to 60°C |
| Humidity<br>    Operation<br>    Storage | 10 to 90% (non-condensing)<br>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]) | 205 x 220 x 110.4 |
| Weight | 1,95 kg |

Table 64: Power Panel 41 technical data (Forts.)

Chapter 6
Power Panel 41

# 4. Images
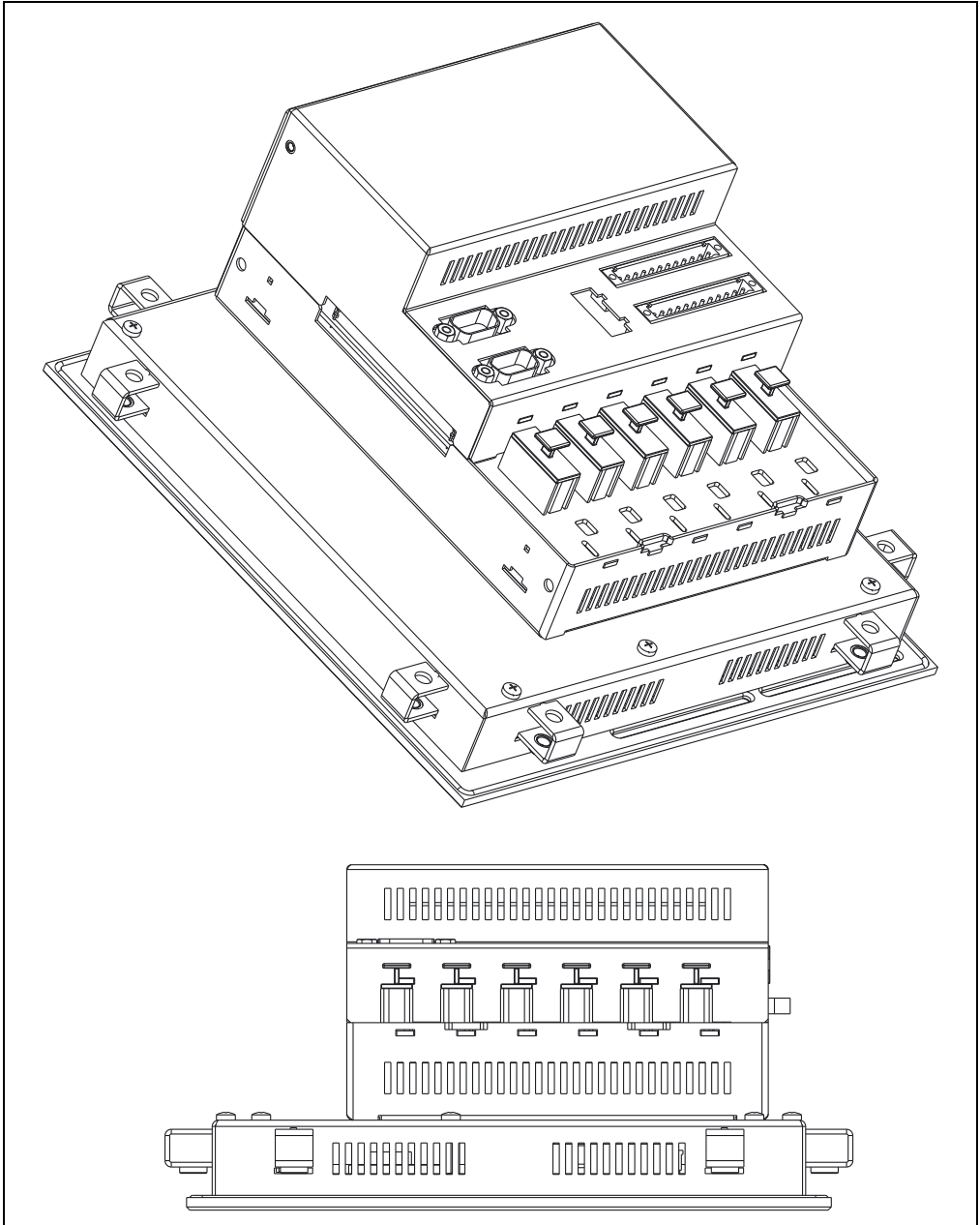


Figure 93: Power Panel 41 - Image

# 5. Dimensions
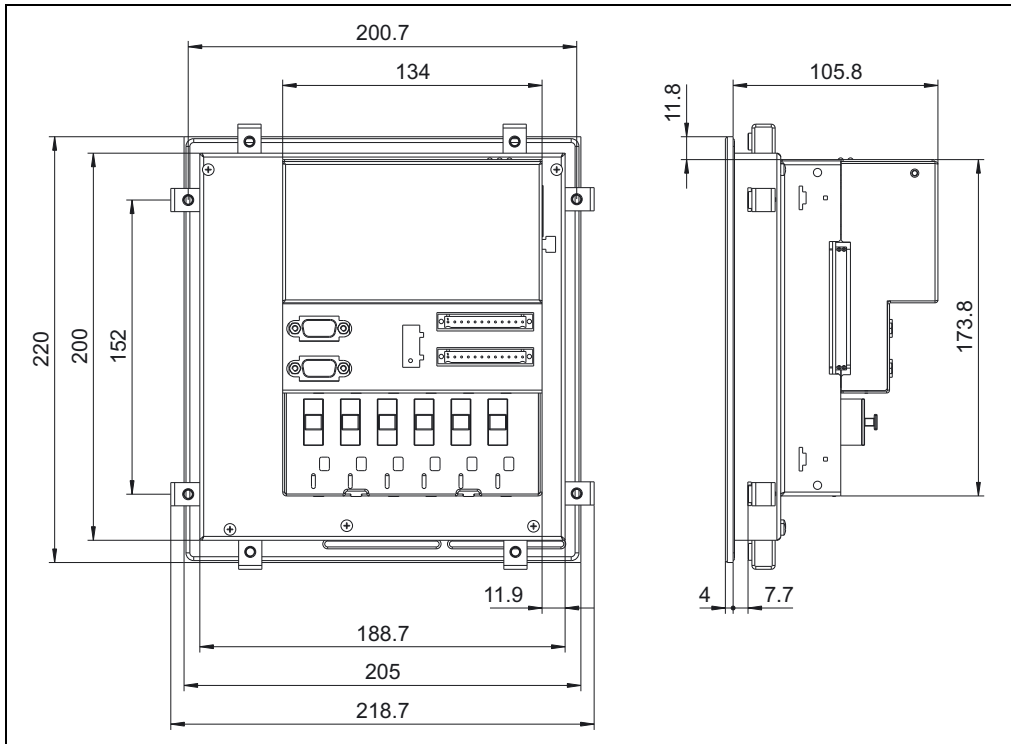


Figure 94: Power Panel 41 - Dimensions

Installation dimensions: 192 mm x 205 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 65: Power Panel 41 - Status LEDs

## 6.2  Power supply

The Power Panel 41 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 | - | |
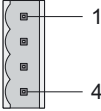
Table 66: Power Panel 41 pin assignment - power supply

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

## 6.3  Interfaces

The Power Panel has two interfaces:
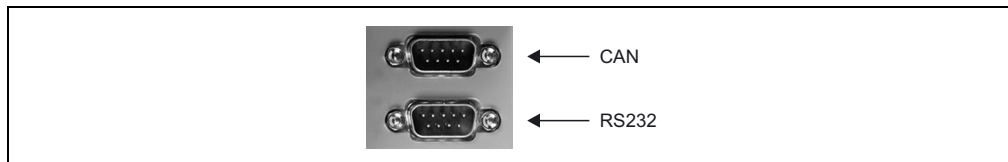


Figure 95: Power Panel 41 interfaces

### 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<br>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 67: Power Panel 41 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<br>Not electrically<br>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 68: Power Panel 41 pin assignment - RS232 interface

## 6.4 Operating mode switch

SW0   SW1
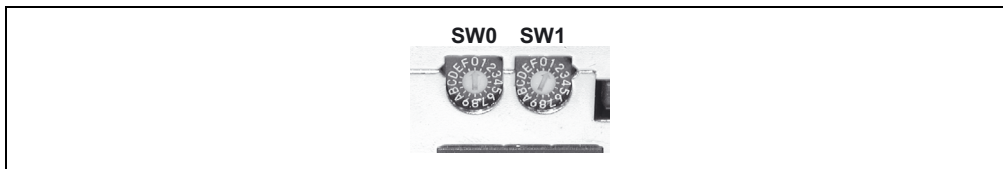
Figure 96: Power Panel 41 operating mode switch

The Power Panel 41 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.<br>**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 69: Power Panel 41 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 carrying out operating system download 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 41 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 70:  Power Panel 41 order data - PCMCIA memory cards

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

Chapter 6
Power Panel 41

### 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 41 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<br>**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<br>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.<br>**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 71: Power Panel 41 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" is available from 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.
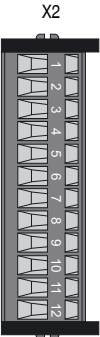
| 12-pin terminal block | Terminal | Assignment |
|---|---|---|
| X2<br><br>TB712 | 1 | Input 1 |
| | 2 | Input 2 |
| | 3 | Input 3 |
| | 4 | Input 4 |
| | 5 | Input 5 |
| | 6 | Input 6 |
| | 7 | Input 7 |
| | 8 | Input 8 |
| | 9 | Input 9 |
| | 10 | Input 10 |
| | 11 | 24 VDC |
| | 12 | GND |

Table 72: Power Panel 41 terminal assignments - digital inputs

### 6.10.2  Connection example
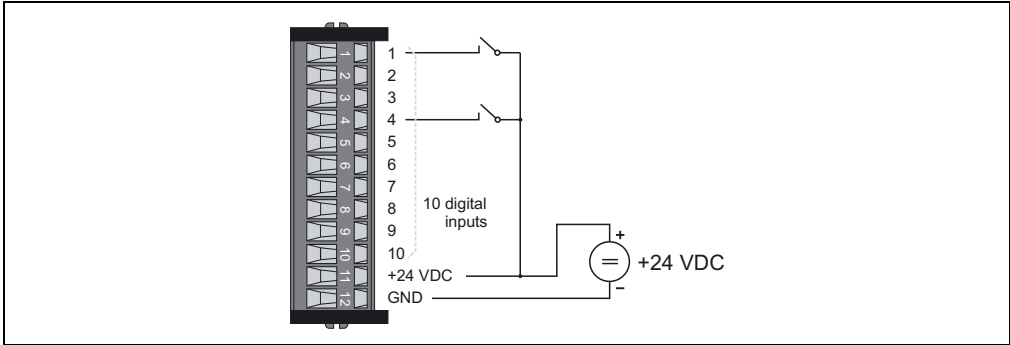


Figure 97: Power Panel 41 connection example - digital inputs

### 6.10.3  Input circuit diagram
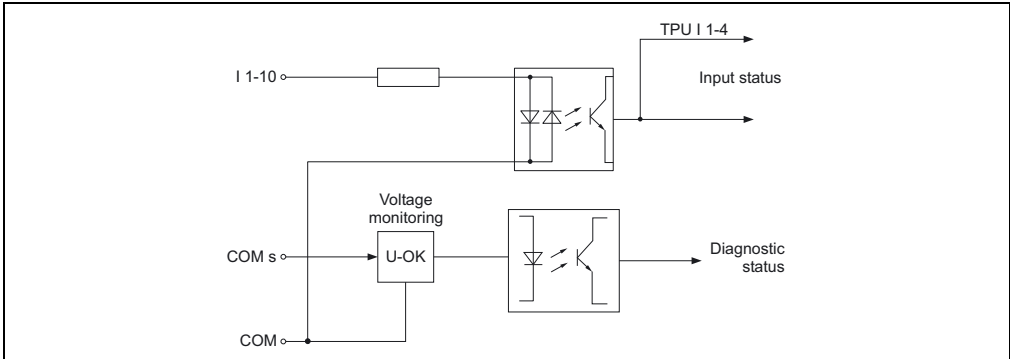


Figure 98: Power Panel 41 input circuit diagram - digital inputs

## 6.11 Digital outputs

### 6.11.1 Terminal block connections
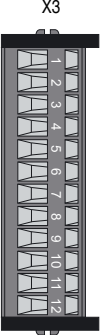
| 12-pin terminal block | Terminal | Assignment |
|---|---|---|
| X3  TB712 | 1 | Output 1 |
| | 2 | Output 2 |
| | 3 | Output 3 |
| | 4 | Output 4 |
| | 5 | Output 5 |
| | 6 | Output 6 |
| | 7 | Output 7 |
| | 8 | Output 8 |
| | 9 | Potential-free relay contact |
| | 10 | Potential-free relay contact |
| | 11 | 24 VDC, outputs 1 - 8 |
| | 12 | GND, outputs 1 - 8 |

Table 73: Power Panel 41 terminal assignments - digital outputs

### 6.11.2 Connection examples
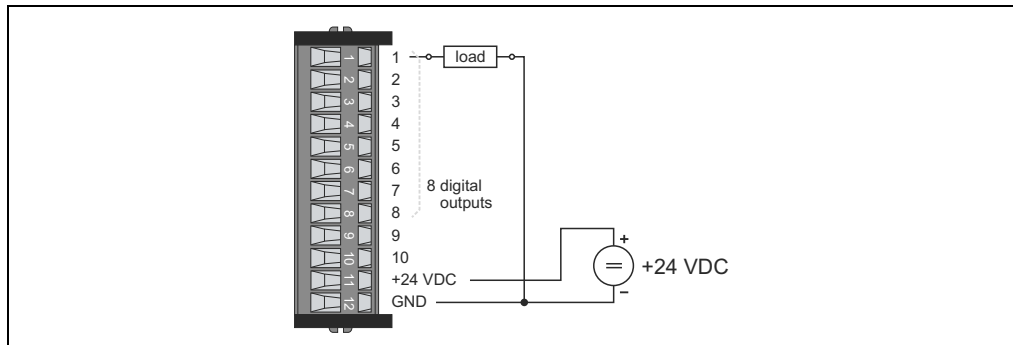
**Outputs 1 - 8**



Figure 99: Power Panel 41 connection example - outputs 1 - 8

**Potential-free relay contact**
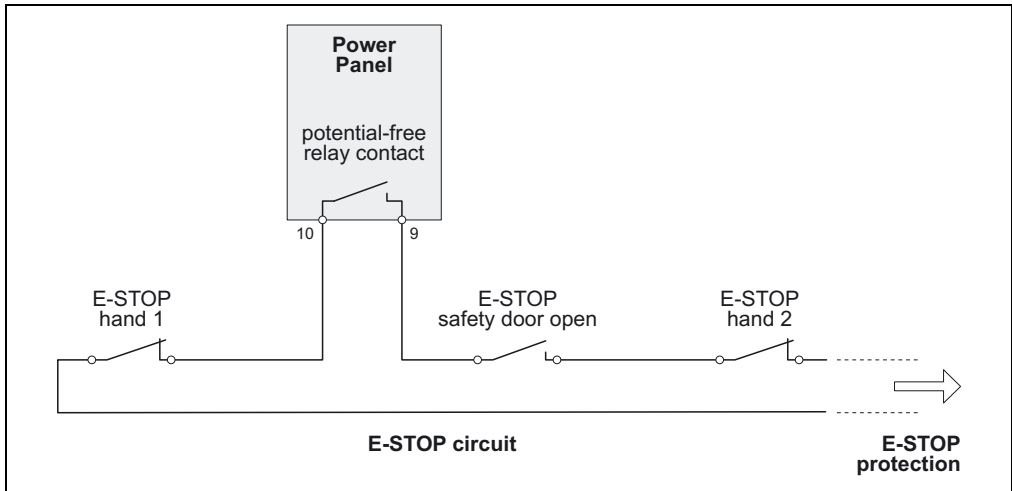
E-STOP circuit



Figure 100: Power Panel 41 E-STOP circuit

Switching a load
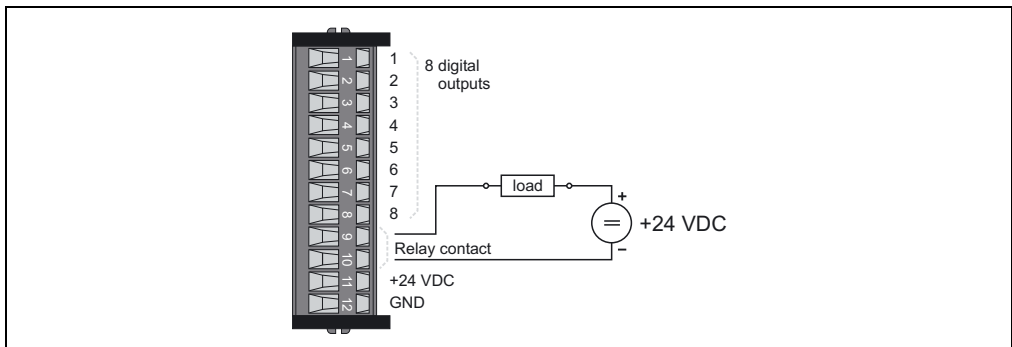


Figure 101: Power Panel 41 switching a load

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Power Panel 41

### 6.11.3  Output circuit diagram
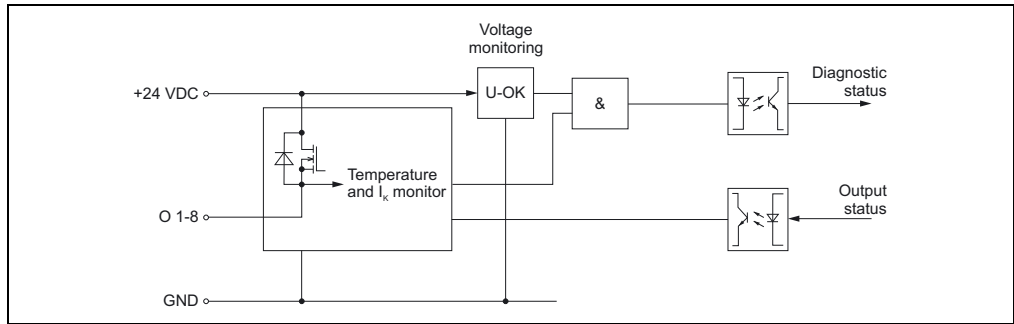
**Digital outputs**



Figure 102: Power Panel 41 output circuit diagram - digital outputs

**Potential-free relay contact**
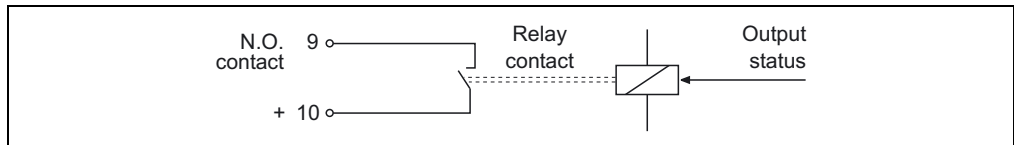


Figure 103: Power Panel 41 connection example - relay contact

# 7. Changing the battery

## 7.1  Battery data

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

Table 74: Power Panel 41 battery data

## 7.2 Buffer duration

| Buffer current | Panel CPU |
|----------------|-----------|
| Typical | 10 µA |
| Maximum | 200 µA |

Table 75: Power Panel 41 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.

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Power Panel 41

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



Figure 104: Power Panel 41 changing the battery

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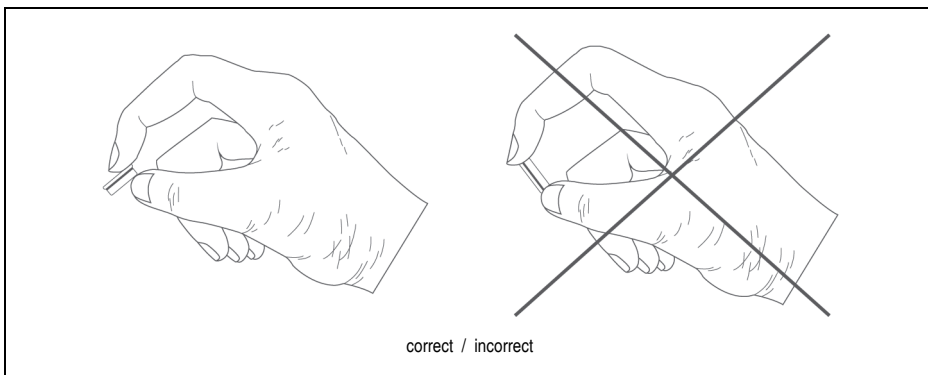


correct / incorrect

Figure 105: Power Panel 41 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.**

Chapter 6
Power Panel 41

# 9. Mounting instructions

The following mounting instructions should be noted:

1) The Power Panel 41 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.
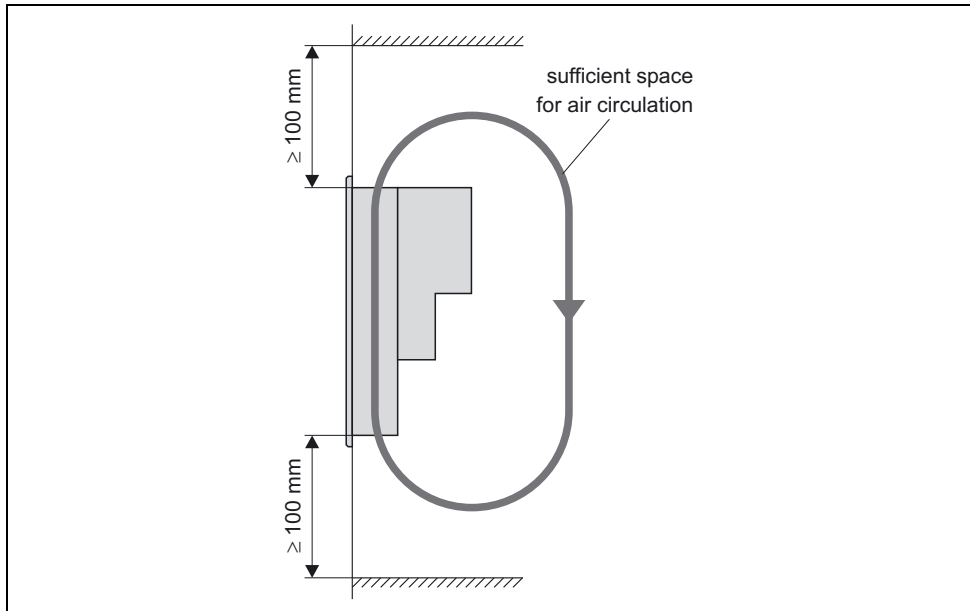


Figure 106: Power Panel 41 distance for air circulation

3) The Power Panel 41 can be mounted up to a maximum angle of ±45°.
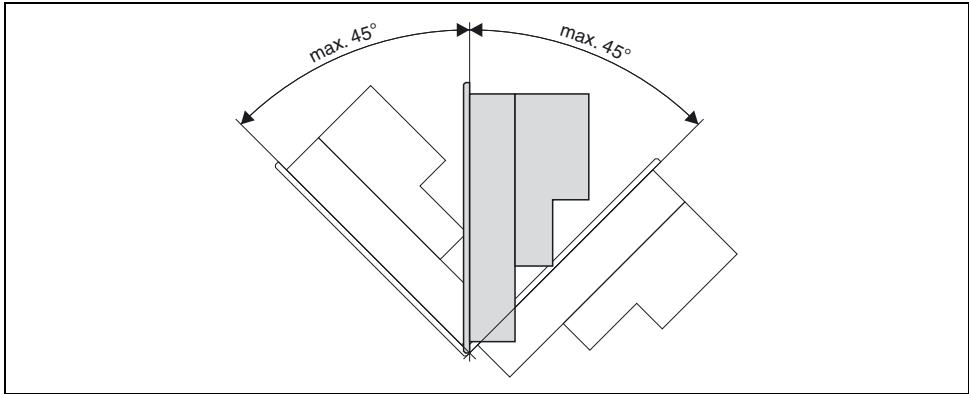


Figure 107: Power Panel 41 mounting angle

# 10. Power Panel expansion EX101

## 10.1 General information

The expansion module EX101 can be installed on the Power Panel 41. B&R SYSTEMS 2005 interface module inserts can be operated in the EX101 insert slot.

A description for interface module inserts can be found in the "B&R SYSTEM 2005 User's Manual" (model no.: MASYS22005-E).

## 10.2 Photo



Figure 108: EX101 photo

## 10.3 Order data

| Model number | Short description |
|---|---|
| 4EX101.00 | Power Panel expansion for PP41, 1 insert slot for interface module inserts |

Table 76: EX101 order data

The following B&R SYSTEM 2005 interface module inserts can be operated with the EX101 module:

| Model number | Short description |
|---|---|
| 3IF613.9 | 2005 interface module, 3 RS232 interfaces, CPU and IF module insert |
| 3IF621.9 | 2005 interface module, 1 RS485/RS422 interface, 1 CAN interface, both electrically isolated and network capable, insert for CPU and IF modules |
| 3IF622.9 | 2005 Interface Module, 1 RS232 interface, 2 RS485/RS422 interfaces electrically isolated, network capable, CPU and IF module insert |
| 3IF661.9 | 2005 interface module, 1 RS485 interface, electrically isolated and network-capable, transfer protocol: PROFIBUS DP, insert for CPU and IF modules |
| 3IF671.9 | 2005 interface module, 1 RS232 interface, 1RS485/RS422 interface, electrically isolated, network capable, 1 CAN interface, electrically isolated, network capable, CPU and IF module insert |
| 3IF672.9 | 2005 interface module, 1 RS232 interface, 2 CAN interfaces, CAN: electrically isolated, network capable, CPU and IF module insert |
| 3IF681.95 | 2005 interface module, 1 RS232 interface, 1 ETHERNET interface, with 10BASE2 CHEAPERNET BNC socket |
| 3IF681.96 | 2005 interface module, 1 RS232 interface, 1 ETHERNET interface, with 10BASE-T twisted pair RJ45 socket |

Table 77: EX101 interface modules that can be inserted in the module

## 10.4  Technical data

| Description | EX101 |
|---|---|
| **General information** | |
| Module type | Power Panel expansion - PP41 |
| **Peripherals** | |
| Insert slots | 1 (for interface module inserts) |
| **Mechanical characteristics** | |
| Dimensions<br>    Width<br>    Height<br>    Depth | <br>31 mm<br>173 mm<br>81.4 mm |

Table 78: EX101 techincal data

## 10.5  Dimensions
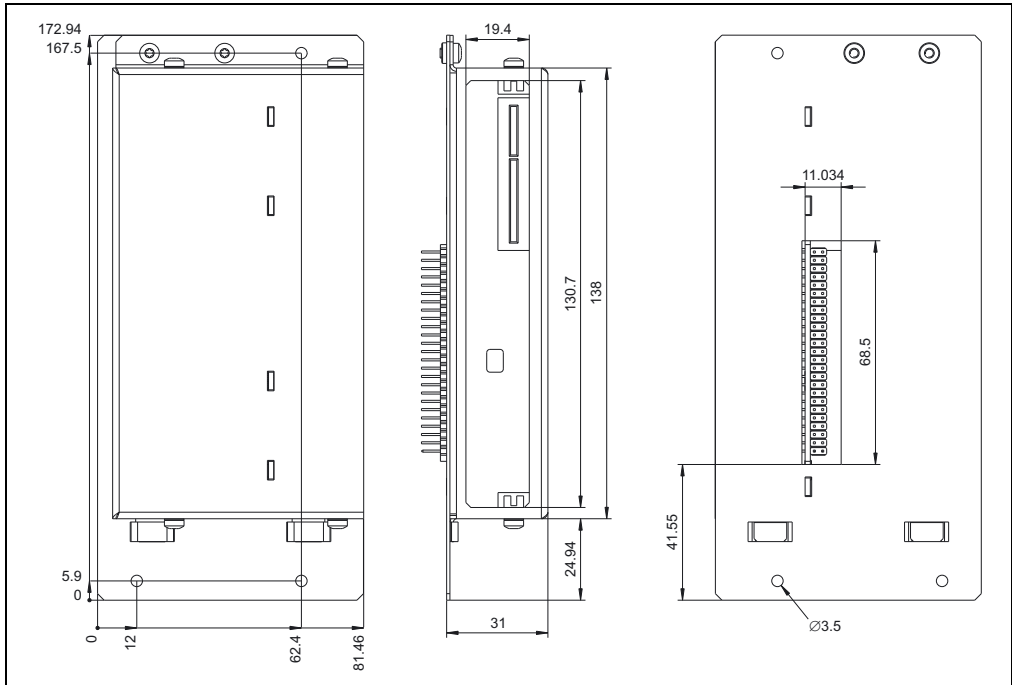


Figure 109: EX101 dimensions

## 10.6  Dimensions PP41 + EX101
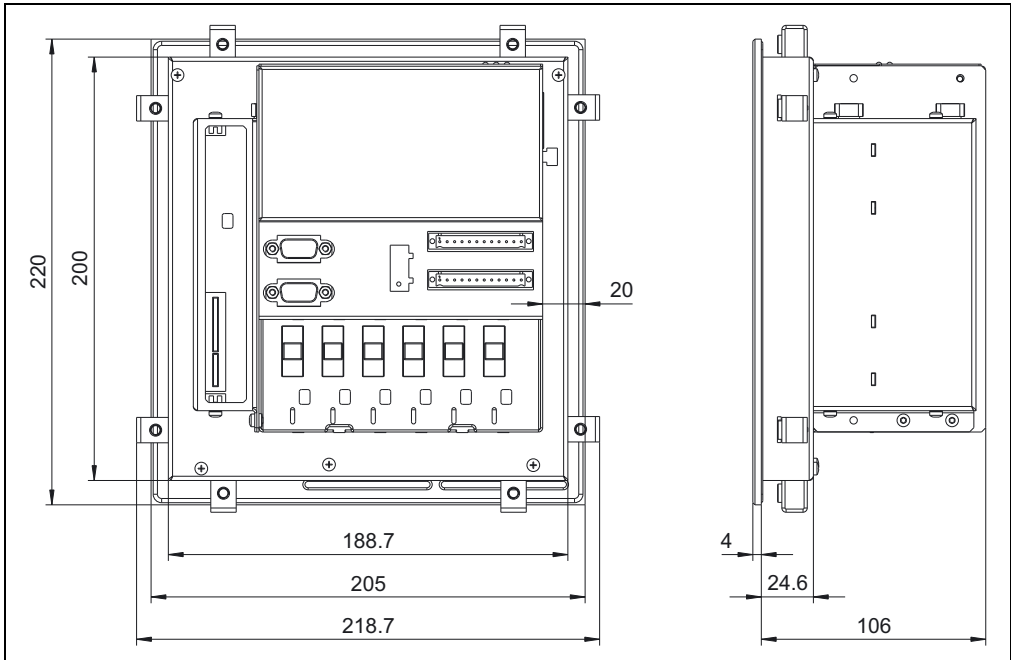


Figure 110: PP41 + EX101 dimensions

## 10.7  Installation
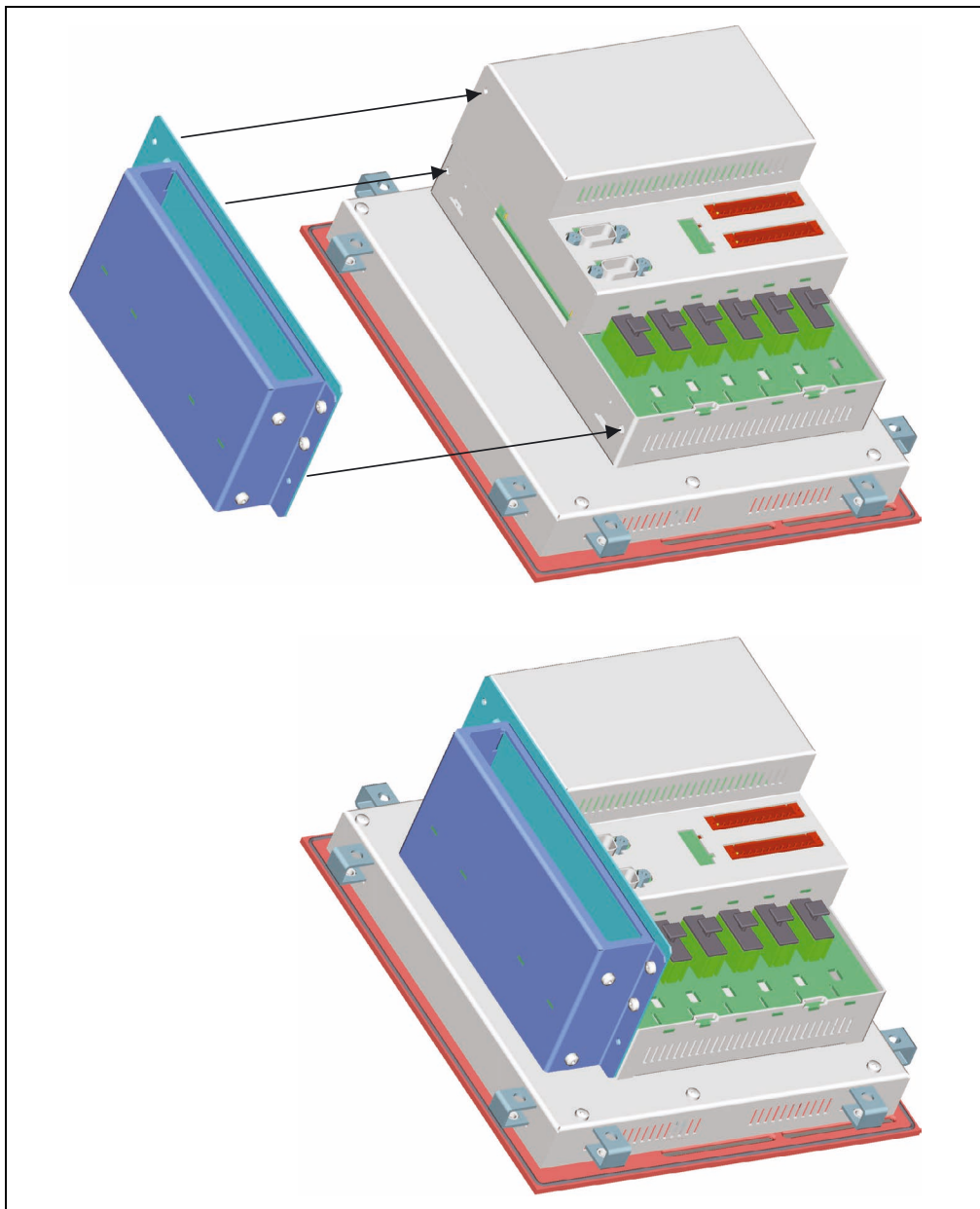


Figure 111: EX101 installation in Power Panel 41

# Chapter 7 • Accessories for PP21 / PP41

## 1. IF370 CAN interface module

### 1.1 General information

The IF370 interface module is used for connecting the B&R Power Panel to a CAN network. It must always be operated in slot 1.

> # WARNING
>
> **The IF370 interface module is only suitable for operating with a B&R Power Panel 21/41. It should never be operated in a B&R SYSTEM 2003 module.**

### 1.2 Photo



Figure 112: IF370 photo

### 1.3 Order data

| Model number | Short description |
|---|---|
| 4IF370.7 | Power Panel interface module, 1 CAN interface, electrically isolated, network capable, screw-in module |

Table 79: IF370

## 1.4 Technical data

| Description | IF370 |
|---|---|
| **General information** | |
| C-UL-US listed | In preparation |
| B&R ID code | $44 |
| Module type | B&R Power Panel screw-in module |
| Slot | Power Panel interface, slot 1 |
| Power consumption | TBD |
| **Standard communication interface** | |
| Interface type | CAN |
| Electrical isolation | Interface - Power Panel |
| Design | 9-pin DSUB plug |
| Status display | 2 status LEDs |
| Maximum distance | 1,000 m |
| Maximum transfer rate<br>   Bus length 10 – 60 m<br>   Bus length 100 – 200 m<br>   Bus length 800 – 1000 m | Max. 500 kbit/s<br>Max. 250 kbit/s<br>Max. 50 kbit/s |
| Network capable | Yes |
| **Mechanical characteristics** | |
| Dimensions | B&R Power Panel screw-in module |

Table 80: IF370 techincal data

## 1.5 Status LEDs
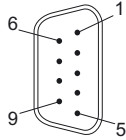
| Lit LEDs | Description |
|---|---|
| Yellow / Green | Data is being sent |
| Green | Data is being received |

Table 81: IF370 status LEDs

## 1.6  Pin assignments

| Pin assignment for CAN interface | | |
|---|---|---|
| **Pin** | **Assignment** | |
| 1 | NC | |
| 2 | CAN_L | |
| 3 | CAN_GND | |
| 4 | NC | |
| 5 | NC | |
| 6 | Reserved | |
| 7 | CAN_H | |
| 8 | NC | |
| 9 | NC | |

9-pin DSUB plug

Table 82: IF370 CAN interface pin assignments

## 1.7  Node number

The node number for the CAN interface on the IF370 interface module is derived from the onboard CAN interface on the Power Panel 21/41 by adding 1 to it.

# Chapter 8 • Programming

## 1. Programming the PLC CPU

B&R Automation Studio™ is used to program the CPU. Several programming languages are available.

| Automation Studio™ |
| --- |
| Automation Basic |
| ANSI C |
| IEC 1131 Ladder Diagram (LAD) |
| IEC 1131 Sequential function chart (SFC) |
| IEC 1131 Structured Text (ST) |
| IEC 1131 Instruction list (IL) |

Table 83: Programming languages

## 2. Visualization

The visualization application is created using B&R Automation Studio™.

# Chapter 9 • Maintenance / Servicing

## 1. Battery change interval

| Display unit | Change interval | Additional information |
|---|---|---|
| PP15 | 5 years | Page 72 |
| PP21 | 5 years | Page 94 |
| PP35 | 5 years | Page 150 |
| PP42 | 5 years | Page 172 |

Table 84: Battery change interval

Chapter 9
Maintenance / Servicing

# Appendix A • Technical Appendix

## 1. Mylar (polyester foil)

The mylar used by B&R conforms to DIN 42 115 (section 2). This means it is resistant to exposure to the following chemicals for a 24 hour period with no visible signs of damage:

| | | |
|---|---|---|
| Ethanol<br>Cyclohexanol<br>Diacetone alcohol<br>Glycol<br>Isopropanol<br>Glycerin<br>Methanol<br>Triacetin<br>Dowandol DRM/PM | Formaldehyde 37% - 42%<br>Acetaldehyde<br>Aliphatic hydrocarbons<br>Toluene<br>Xylene<br>White spirits | Trichloroethane<br>Ethyl acetate<br>Diethyl ether<br>N-Butyl acetate<br>Amyl acetate<br>Butylcellosolve<br>Ether |
| Acetone<br>Methyl ethyl ketone<br>Dioxan<br>Cyclohexanone<br>MIBK<br>Isophorone | Formic acid <50%<br>Acetic acid <50%<br>Phosphoric acid <30%<br>Hydrochloric acid <36%<br>Nitric acid <10%<br>Trichloracetic acid <50%<br>Sulphuric acid <10% | Sodium hypochlorite <20%<br>Hydrogen peroxide <25%<br>Potassium carbonate<br>Washing powders<br>Fabric conditioner<br>Ferric chloride<br>Ferrous chloride (FeCl2)<br>Ferrous chloride (FeCl3)<br>Dibutyl phthalate<br>Dioctyl phthalate<br>Sodium carbonate |
| Ammonia <40%<br>Caustic soda <40%<br>Potassium hydroxide<br>Alkali carbonate<br>Bichromate<br>Potassium<br>Acetonitrile<br>Sodium bisulphate | Cutting oil<br>Diesel oil<br>Linseed oil<br>Paraffin oil<br>Blown castor oil<br>Silicon oil<br>Turpentine oil substitute<br>Universal brake fluid<br>Decon | Aviation fuel<br>Petrol<br>Water<br>Sea water |

Table 85: Resistance to chemicals

The mylar conforms to DIN 42 115 section  2 for exposure to glacial acetic acid <1  hour without any sign of visible damage.

# Appendix B • Character Sets

## 1. Overview

| Power Panel | | Short description | Character set | |
|---|---|---|---|---|
| 24 | 4PP015.0420-01 | | English / Katakana | 194 |
| 44 | 4PP015.0420-36 | | English / Katakana | 194 |
| 24 | 4PP015.C420-01 | | English / Cyrillic | 196 |
| 44 | 4PP015.C420-36 | PP15 | English / Cyrillic | 196 |
| 24 | 4PP015.E420-01 | | English / European | 200 |
| 24 | 4PP015.E420-101 | | English / European | 200 |
| 44 | 4PP015.E420-36 | | English / European | 200 |
| 77 | 4P0420.00-490 | PP21 | English / Katakana | 194 |
| 102 | 4PP035.0300-01 | | European / Cyrillic | 198 |
| 122 | 4PP035.0300-36 | | European / Cyrillic | 198 |
| 102 | 4PP035.E300-01 | PP35 | European / Cyrillic | 198 |
| 122 | 4PP035.E300-36 | | European / Cyrillic | 198 |
| 122 | 4PP035.E300-136 | | European / Cyrillic | 198 |

Table 86: Character sets overview

**Guidelines for using the character set tables:**

- Each pair of the following pages presents a character set.
- All characters with a gray background are not permitted and cannot be used by the user.

# 2. English / Katakana character set

| Dec. | Hex. | Character | Dec. | Hex. | Character | Dec. | Hex. | Character | Dec. | Hex. | Character |
|------|------|-----------|------|------|-----------|------|------|-----------|------|------|-----------|
| 000 | $00 | | 032 | $20 | | 064 | $40 | @ | 096 | $60 | ` |
| 001 | $01 | | 033 | $21 | ! | 065 | $41 | A | 097 | $61 | a |
| 002 | $02 | | 034 | $22 | " | 066 | $42 | B | 098 | $62 | b |
| 003 | $03 | | 035 | $23 | # | 067 | $43 | C | 099 | $63 | c |
| 004 | $04 | | 036 | $24 | $ | 068 | $44 | D | 100 | $64 | d |
| 005 | $05 | | 037 | $25 | % | 069 | $45 | E | 101 | $65 | e |
| 006 | $06 | | 038 | $26 | & | 070 | $46 | F | 102 | $66 | f |
| 007 | $07 | | 039 | $27 | ' | 071 | $47 | G | 103 | $67 | g |
| 008 | $08 | | 040 | $28 | ( | 072 | $48 | H | 104 | $68 | h |
| 009 | $09 | | 041 | $29 | ) | 073 | $49 | I | 105 | $69 | i |
| 010 | $0A | | 042 | $2A | * | 074 | $4A | J | 106 | $6A | j |
| 011 | $0B | | 043 | $2B | + | 075 | $4B | K | 107 | $6B | k |
| 012 | $0C | | 044 | $2C | , | 076 | $4C | L | 108 | $6C | l |
| 013 | $0D | | 045 | $2D | — | 077 | $4D | M | 109 | $6D | m |
| 014 | $0E | | 046 | $2E | . | 078 | $4E | N | 110 | $6E | n |
| 015 | $0F | | 047 | $2F | / | 079 | $4F | O | 111 | $6F | o |
| 016 | $10 | | 048 | $30 | 0 | 080 | $50 | P | 112 | $70 | p |
| 017 | $11 | | 049 | $31 | 1 | 081 | $51 | Q | 113 | $71 | q |
| 018 | $12 | | 050 | $32 | 2 | 082 | $52 | R | 114 | $72 | r |
| 019 | $13 | | 051 | $33 | 3 | 083 | $53 | S | 115 | $73 | s |
| 020 | $14 | | 052 | $34 | 4 | 084 | $54 | T | 116 | $74 | t |
| 021 | $15 | | 053 | $35 | 5 | 085 | $55 | U | 117 | $75 | u |
| 022 | $16 | | 054 | $36 | 6 | 086 | $56 | V | 118 | $76 | v |
| 023 | $17 | | 055 | $37 | 7 | 087 | $57 | W | 119 | $77 | w |
| 024 | $18 | | 056 | $38 | 8 | 088 | $58 | X | 120 | $78 | x |
| 025 | $19 | | 057 | $39 | 9 | 089 | $59 | Y | 121 | $79 | y |
| 026 | $1A | | 058 | $3A | : | 090 | $5A | Z | 122 | $7A | z |
| 027 | $1B | | 059 | $3B | ; | 091 | $5B | [ | 123 | $7B | { |
| 028 | $1C | | 060 | $3C | < | 092 | $5C | ¥ | 124 | $7C | \| |
| 029 | $1D | | 061 | $3D | = | 093 | $5D | ] | 125 | $7D | } |
| 030 | $1E | | 062 | $3E | > | 094 | $5E | ^ | 126 | $7E | → |
| 031 | $1F | | 063 | $3F | ? | 095 | $5F | _ | 127 | $7F | ← |

Table 87: English / Katakana character set

| Dec. | Hex. | Character | Dec. | Hex. | Character | Dec. | Hex. | Character | Dec. | Hex. | Character |
|------|------|-----------|------|------|-----------|------|------|-----------|------|------|-----------|
| 128 | $80 | | 160 | $A0 | | 192 | $C0 | タ | 224 | $E0 | α |
| 129 | $81 | ü | 161 | $A1 | ▫ | 193 | $C1 | チ | 225 | $E1 | β |
| 130 | $82 | | 162 | $A2 | 「 | 194 | $C2 | ツ | 226 | $E2 | ℮ |
| 131 | $83 | | 163 | $A3 | 」 | 195 | $C3 | テ | 227 | $E3 | ε |
| 132 | $84 | ä | 164 | $A4 | 、 | 196 | $C4 | ト | 228 | $E4 | μ |
| 133 | $85 | | 165 | $A5 | ・ | 197 | $C5 | ナ | 229 | $E5 | σ |
| 134 | $86 | | 166 | $A6 | ヲ | 198 | $C6 | ニ | 230 | $E6 | ρ |
| 135 | $87 | | 167 | $A7 | ア | 199 | $C7 | ヌ | 231 | $E7 | g |
| 136 | $88 | | 168 | $A8 | ィ | 200 | $C8 | ネ | 232 | $E8 | √ |
| 137 | $89 | | 169 | $A9 | ゥ | 201 | $C9 | ノ | 233 | $E9 | ⁻¹ |
| 138 | $8A | | 170 | $AA | ェ | 202 | $CA | ハ | 234 | $EA | j |
| 139 | $8B | | 171 | $AB | ォ | 203 | $CB | ヒ | 235 | $EB | × |
| 140 | $8C | | 172 | $AC | ャ | 204 | $CC | フ | 236 | $EC | ¢ |
| 141 | $8D | | 173 | $AD | ュ | 205 | $CD | ヘ | 237 | $ED | £ |
| 142 | $8E | Ä | 174 | $AE | ョ | 206 | $CE | ホ | 238 | $EE | ñ |
| 143 | $8F | | 175 | $AF | ッ | 207 | $CF | マ | 239 | $EF | ö |
| 144 | $90 | | 176 | $B0 | ー | 208 | $D0 | ミ | 240 | $F0 | p |
| 145 | $91 | | 177 | $B1 | ア | 209 | $D1 | ム | 241 | $F1 | q |
| 146 | $92 | | 178 | $B2 | イ | 210 | $D2 | メ | 242 | $F2 | θ |
| 147 | $93 | | 179 | $B3 | ウ | 211 | $D3 | モ | 243 | $F3 | ∞ |
| 148 | $94 | ö | 180 | $B4 | エ | 212 | $D4 | ヤ | 244 | $F4 | Ω |
| 149 | $95 | | 181 | $B5 | オ | 213 | $D5 | ユ | 245 | $F5 | ü |
| 150 | $96 | | 182 | $B6 | カ | 214 | $D6 | ヨ | 246 | $F6 | Σ |
| 151 | $97 | | 183 | $B7 | キ | 215 | $D7 | ラ | 247 | $F7 | π |
| 152 | $98 | | 184 | $B8 | ク | 216 | $D8 | リ | 248 | $F8 | x̄ |
| 153 | $99 | Ö | 185 | $B9 | ケ | 217 | $D9 | ル | 249 | $F9 | y |
| 154 | $9A | Ü | 186 | $BA | コ | 218 | $DA | レ | 250 | $FA | 千 |
| 155 | $9B | | 187 | $BB | サ | 219 | $DB | ロ | 251 | $FB | 万 |
| 156 | $9C | | 188 | $BC | シ | 220 | $DC | ワ | 252 | $FC | 円 |
| 157 | $9D | | 189 | $BD | ス | 221 | $DD | ン | 253 | $FD | ÷ |
| 158 | $9E | | 190 | $BE | セ | 222 | $DE | ゛ | 254 | $FE | |
| 159 | $9F | | 191 | $BF | ソ | 223 | $DF | ▫ | 255 | $FF | █ |

Table 87: English / Katakana character set (Forts.)

# 3. English / Cyrillic character set

| Dec. | Hex. | Character | Dec. | Hex. | Character | Dec. | Hex. | Character | Dec. | Hex. | Character |
|------|------|-----------|------|------|-----------|------|------|-----------|------|------|-----------|
| 000 | $00 |  | 032 | $20 |  | 064 | $40 | @ | 096 | $60 | ` |
| 001 | $01 |  | 033 | $21 | ! | 065 | $41 | A | 097 | $61 | a |
| 002 | $02 |  | 034 | $22 | " | 066 | $42 | B | 098 | $62 | b |
| 003 | $03 |  | 035 | $23 | # | 067 | $43 | C | 099 | $63 | c |
| 004 | $04 |  | 036 | $24 | $ | 068 | $44 | D | 100 | $64 | d |
| 005 | $05 |  | 037 | $25 | % | 069 | $45 | E | 101 | $65 | e |
| 006 | $06 |  | 038 | $26 | & | 070 | $46 | F | 102 | $66 | f |
| 007 | $07 |  | 039 | $27 | ' | 071 | $47 | G | 103 | $67 | g |
| 008 | $08 |  | 040 | $28 | ( | 072 | $48 | H | 104 | $68 | h |
| 009 | $09 |  | 041 | $29 | ) | 073 | $49 | I | 105 | $69 | i |
| 010 | $0A |  | 042 | $2A | * | 074 | $4A | J | 106 | $6A | j |
| 011 | $0B |  | 043 | $2B | + | 075 | $4B | K | 107 | $6B | k |
| 012 | $0C |  | 044 | $2C | , | 076 | $4C | L | 108 | $6C | l |
| 013 | $0D |  | 045 | $2D | — | 077 | $4D | M | 109 | $6D | m |
| 014 | $0E |  | 046 | $2E | . | 078 | $4E | N | 110 | $6E | n |
| 015 | $0F |  | 047 | $2F | / | 079 | $4F | O | 111 | $6F | o |
| 016 | $10 |  | 048 | $30 | 0 | 080 | $50 | P | 112 | $70 | p |
| 017 | $11 |  | 049 | $31 | 1 | 081 | $51 | Q | 113 | $71 | q |
| 018 | $12 |  | 050 | $32 | 2 | 082 | $52 | R | 114 | $72 | r |
| 019 | $13 |  | 051 | $33 | 3 | 083 | $53 | S | 115 | $73 | s |
| 020 | $14 |  | 052 | $34 | 4 | 084 | $54 | T | 116 | $74 | t |
| 021 | $15 |  | 053 | $35 | 5 | 085 | $55 | U | 117 | $75 | u |
| 022 | $16 |  | 054 | $36 | 6 | 086 | $56 | V | 118 | $76 | v |
| 023 | $17 |  | 055 | $37 | 7 | 087 | $57 | W | 119 | $77 | w |
| 024 | $18 |  | 056 | $38 | 8 | 088 | $58 | X | 120 | $78 | x |
| 025 | $19 |  | 057 | $39 | 9 | 089 | $59 | Y | 121 | $79 | y |
| 026 | $1A |  | 058 | $3A | : | 090 | $5A | Z | 122 | $7A | z |
| 027 | $1B |  | 059 | $3B | ; | 091 | $5B | [ | 123 | $7B | Ю |
| 028 | $1C |  | 060 | $3C | < | 092 | $5C | ¢ | 124 | $7C | Б |
| 029 | $1D |  | 061 | $3D | = | 093 | $5D | ] | 125 | $7D | Ы |
| 030 | $1E |  | 062 | $3E | > | 094 | $5E | ^ | 126 | $7E | ↵ |
| 031 | $1F |  | 063 | $3F | ? | 095 | $5F | _ | 127 | $7F | Ё |

Table 88: English / Cyrillic character set

| Dec. | Hex. | Character | Dec. | Hex. | Character | Dec. | Hex. | Character | Dec. | Hex. | Character |
|------|------|-----------|------|------|-----------|------|------|-----------|------|------|-----------|
| 128 | $80 |  | 160 | $A0 | Б | 192 | $C0 | Ч | 224 | $E0 | Д |
| 129 | $81 | ü | 161 | $A1 | Г | 193 | $C1 | Ш | 225 | $E1 | ß |
| 130 | $82 |  | 162 | $A2 | Ё | 194 | $C2 | Ъ | 226 | $E2 | Ш |
| 131 | $83 |  | 163 | $A3 | Ж | 195 | $C3 | Ы | 227 | $E3 | Д |
| 132 | $84 | ä | 164 | $A4 | З | 196 | $C4 | Ь | 228 | $E4 | ф |
| 133 | $85 |  | 165 | $A5 | И | 197 | $C5 | Э | 229 | $E5 | Ц |
| 134 | $86 |  | 166 | $A6 | Й | 198 | $C6 | Ю | 230 | $E6 | Щ |
| 135 | $87 |  | 167 | $A7 | Л | 199 | $C7 | Я | 231 | $E7 |  |
| 136 | $88 |  | 168 | $A8 | П | 200 | $C8 |  | 232 | $E8 |  |
| 137 | $89 |  | 169 | $A9 | У | 201 | $C9 |  | 233 | $E9 |  |
| 138 | $8A |  | 170 | $AA | Ф | 202 | $CA |  | 234 | $EA | é |
| 139 | $8B |  | 171 | $AB | Ч | 203 | $CB |  | 235 | $EB | ç |
| 140 | $8C |  | 172 | $AC | Ш | 204 | $CC |  | 236 | $EC | ü |
| 141 | $8D |  | 173 | $AD | Ъ | 205 | $CD |  | 237 | $ED |  |
| 142 | $8E | Ä | 174 | $AE | Ы | 206 | $CE | ƒ | 238 | $EE |  |
| 143 | $8F |  | 175 | $AF | Э | 207 | $CF | £ | 239 | $EF |  |
| 144 | $90 |  | 176 | $B0 | Ю | 208 | $D0 |  | 240 | $F0 |  |
| 145 | $91 |  | 177 | $B1 | Я | 209 | $D1 |  | 241 | $F1 |  |
| 146 | $92 |  | 178 | $B2 | б | 210 | $D2 |  | 242 | $F2 |  |
| 147 | $93 |  | 179 | $B3 | в | 211 | $D3 |  | 243 | $F3 |  |
| 148 | $94 | ö | 180 | $B4 | г | 212 | $D4 |  | 244 | $F4 |  |
| 149 | $95 | Ц | 181 | $B5 | ё | 213 | $D5 |  | 245 | $F5 |  |
| 150 | $96 |  | 182 | $B6 | ж | 214 | $D6 |  | 246 | $F6 |  |
| 151 | $97 |  | 183 | $B7 | з | 215 | $D7 | I | 247 | $F7 |  |
| 152 | $98 |  | 184 | $B8 | и | 216 | $D8 | II | 248 | $F8 |  |
| 153 | $99 | Ö | 185 | $B9 | й | 217 | $D9 | ↑ | 249 | $F9 |  |
| 154 | $9A | Ü | 186 | $BA | к | 218 | $DA | ↓ | 250 | $FA |  |
| 155 | $9B |  | 187 | $BB | л | 219 | $DB |  | 251 | $FB |  |
| 156 | $9C |  | 188 | $BC | м | 220 | $DC |  | 252 | $FC |  |
| 157 | $9D |  | 189 | $BD | н | 221 | $DD |  | 253 | $FD |  |
| 158 | $9E |  | 190 | $BE | п | 222 | $DE |  | 254 | $FE |  |
| 159 | $9F |  | 191 | $BF | т | 223 | $DF | ▪ | 255 | $FF | ■ |

Table 88: English / Cyrillic character set (Forts.)

# 4. European / Cyrillic character set

| Dec. | Hex. | Character | Dec. | Hex. | Character | Dec. | Hex. | Character | Dec. | Hex. | Character |
|------|------|-----------|------|------|-----------|------|------|-----------|------|------|-----------|
| 000 | $00 | | 032 | $20 | | 064 | $40 | @ | 096 | $60 | ` |
| 001 | $01 | | 033 | $21 | ! | 065 | $41 | A | 097 | $61 | a |
| 002 | $02 | | 034 | $22 | " | 066 | $42 | B | 098 | $62 | b |
| 003 | $03 | | 035 | $23 | # | 067 | $43 | C | 099 | $63 | c |
| 004 | $04 | | 036 | $24 | $ | 068 | $44 | D | 100 | $64 | d |
| 005 | $05 | | 037 | $25 | % | 069 | $45 | E | 101 | $65 | e |
| 006 | $06 | | 038 | $26 | & | 070 | $46 | F | 102 | $66 | f |
| 007 | $07 | | 039 | $27 | ' | 071 | $47 | G | 103 | $67 | g |
| 008 | $08 | | 040 | $28 | ( | 072 | $48 | H | 104 | $68 | h |
| 009 | $09 | | 041 | $29 | ) | 073 | $49 | I | 105 | $69 | i |
| 010 | $0A | | 042 | $2A | * | 074 | $4A | J | 106 | $6A | j |
| 011 | $0B | | 043 | $2B | + | 075 | $4B | K | 107 | $6B | k |
| 012 | $0C | | 044 | $2C | , | 076 | $4C | L | 108 | $6C | l |
| 013 | $0D | | 045 | $2D | – | 077 | $4D | M | 109 | $6D | m |
| 014 | $0E | | 046 | $2E | . | 078 | $4E | N | 110 | $6E | n |
| 015 | $0F | | 047 | $2F | / | 079 | $4F | O | 111 | $6F | o |
| 016 | $10 | ə | 048 | $30 | 0 | 080 | $50 | P | 112 | $70 | p |
| 017 | $11 | ü | 049 | $31 | 1 | 081 | $51 | Q | 113 | $71 | q |
| 018 | $12 | ę | 050 | $32 | 2 | 082 | $52 | R | 114 | $72 | r |
| 019 | $13 | ŏ | 051 | $33 | 3 | 083 | $53 | S | 115 | $73 | s |
| 020 | $14 | ë | 052 | $34 | 4 | 084 | $54 | T | 116 | $74 | t |
| 021 | $15 | ň | 053 | $35 | 5 | 085 | $55 | U | 117 | $75 | u |
| 022 | $16 | ř | 054 | $36 | 6 | 086 | $56 | V | 118 | $76 | v |
| 023 | $17 | š | 055 | $37 | 7 | 087 | $57 | W | 119 | $77 | w |
| 024 | $18 | ü | 056 | $38 | 8 | 088 | $58 | X | 120 | $78 | x |
| 025 | $19 | ý | 057 | $39 | 9 | 089 | $59 | Y | 121 | $79 | y |
| 026 | $1A | ŕ | 058 | $3A | : | 090 | $5A | Z | 122 | $7A | z |
| 027 | $1B | | 059 | $3B | ; | 091 | $5B | [ | 123 | $7B | { |
| 028 | $1C | ţ | 060 | $3C | < | 092 | $5C | ¥ | 124 | $7C | ¦ |
| 029 | $1D | ľ | 061 | $3D | = | 093 | $5D | ] | 125 | $7D | } |
| 030 | $1E | đ | 062 | $3E | > | 094 | $5E | ^ | 126 | $7E | ə |
| 031 | $1F | č | 063 | $3F | ? | 095 | $5F | _ | 127 | $7F | |

Table 89: European / Cyrillic character set

| Dec. | Hex. | Character | Dec. | Hex. | Character | Dec. | Hex. | Character | Dec. | Hex. | Character |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 128 | $80 | Ç | 160 | $A0 | í | 192 | $C0 | В | 224 | $E0 | Ξ |
| 129 | $81 | ü | 161 | $A1 | ó | 193 | $C1 | Г | 225 | $E1 | β |
| 130 | $82 | é | 162 | $A2 | Ḡ | 194 | $C2 | ё | 226 | $E2 | Π |
| 131 | $83 | â | 163 | $A3 | ă | 195 | $C3 | Ж | 227 | $E3 | Х |
| 132 | $84 | ä | 164 | $A4 | î | 196 | $C4 | З | 228 | $E4 | Φ |
| 133 | $85 | à | 165 | $A5 | ţ | 197 | $C5 | И | 229 | $E5 | Ψ |
| 134 | $86 | φ | 166 | $A6 | € | 198 | $C6 | Й | 230 | $E6 | Ω |
| 135 | $87 | Ç | 167 | $A7 | ± | 199 | $C7 | К | 231 | $E7 | α |
| 136 | $88 | ê | 168 | $A8 | ć | 200 | $C8 | Л | 232 | $E8 | Σ |
| 137 | $89 | ş | 169 | $A9 | č | 201 | $C9 | М | 233 | $E9 | γ |
| 138 | $8A | è | 170 | $AA | ł | 202 | $CA | Н | 234 | $EA | δ |
| 139 | $8B | Ñ | 171 | $AB | ļ | 203 | $CB | П | 235 | $EB | ε |
| 140 | $8C | ı | 172 | $AC | ń | 204 | $CC | Т | 236 | $EC | ς |
| 141 | $8D | i | 173 | $AD | ś | 205 | $CD | Ч | 237 | $ED | η |
| 142 | $8E | Ä | 174 | $AE | ż | 206 | $CE | Ш | 238 | $EE | θ |
| 143 | $8F | Å | 175 | $AF | ż | 207 | $CF | Ъ | 239 | $EF | ◌ |
| 144 | $90 | É | 176 | $B0 | Б | 208 | $D0 | Ы | 240 | $F0 | ι |
| 145 | $91 | æ | 177 | $B1 | Ж | 209 | $D1 | Ь | 241 | $F1 | κ |
| 146 | $92 | Æ | 178 | $B2 | З | 210 | $D2 | Э | 242 | $F2 | λ |
| 147 | $93 | ô | 179 | $B3 | И | 211 | $D3 | Ю | 243 | $F3 | μ |
| 148 | $94 | ö | 180 | $B4 | Й | 212 | $D4 | Я | 244 | $F4 | ν |
| 149 | $95 | ø | 181 | $B5 | Л | 213 | $D5 | Д | 245 | $F5 | ξ |
| 150 | $96 | û | 182 | $B6 | П | 214 | $D6 | Ц | 246 | $F6 | π |
| 151 | $97 | ú | 183 | $B7 | У | 215 | $D7 | Щ | 247 | $F7 | ρ |
| 152 | $98 | Ş | 184 | $B8 | Ф | 216 | $D8 | д | 248 | $F8 | σ |
| 153 | $99 | Ö | 185 | $B9 | Ч | 217 | $D9 | ф | 249 | $F9 | τ |
| 154 | $9A | Ü | 186 | $BA | Ш | 218 | $DA | ц | 250 | $FA | υ |
| 155 | $9B |  | 187 | $BB | Ъ | 219 | $DB | щ | 251 | $FB | Ψ |
| 156 | $9C | £ | 188 | $BC | Ы | 220 | $DC | Г | 252 | $FC | ψ |
| 157 | $9D | ă | 189 | $BD | Э | 221 | $DD | Δ | 253 | $FD | ω |
| 158 | $9E | ö | 190 | $BE | Ю | 222 | $DE | θ | 254 | $FE | § |
| 159 | $9F | á | 191 | $BF | Я | 223 | $DF | Λ | 255 | $FF | ■ |

Table 89: European / Cyrillic character set (Forts.)

# 5. English / European character set

| Dec. | Hex. | Character | Dec. | Hex. | Character | Dec. | Hex. | Character | Dec. | Hex. | Character |
|------|------|-----------|------|------|-----------|------|------|-----------|------|------|-----------|
| 000 | $00 |  | 032 | $20 |  | 064 | $40 | @ | 096 | $60 | ` |
| 001 | $01 |  | 033 | $21 | ! | 065 | $41 | A | 097 | $61 | a |
| 002 | $02 |  | 034 | $22 | " | 066 | $42 | B | 098 | $62 | b |
| 003 | $03 |  | 035 | $23 | # | 067 | $43 | C | 099 | $63 | c |
| 004 | $04 |  | 036 | $24 | $ | 068 | $44 | D | 100 | $64 | d |
| 005 | $05 |  | 037 | $25 | % | 069 | $45 | E | 101 | $65 | e |
| 006 | $06 |  | 038 | $26 | & | 070 | $46 | F | 102 | $66 | f |
| 007 | $07 |  | 039 | $27 | ' | 071 | $47 | G | 103 | $67 | g |
| 008 | $08 |  | 040 | $28 | ( | 072 | $48 | H | 104 | $68 | h |
| 009 | $09 |  | 041 | $29 | ) | 073 | $49 | I | 105 | $69 | i |
| 010 | $0A |  | 042 | $2A | * | 074 | $4A | J | 106 | $6A | j |
| 011 | $0B |  | 043 | $2B | + | 075 | $4B | K | 107 | $6B | k |
| 012 | $0C |  | 044 | $2C | , | 076 | $4C | L | 108 | $6C | l |
| 013 | $0D |  | 045 | $2D | — | 077 | $4D | M | 109 | $6D | m |
| 014 | $0E |  | 046 | $2E | . | 078 | $4E | N | 110 | $6E | n |
| 015 | $0F |  | 047 | $2F | / | 079 | $4F | O | 111 | $6F | o |
| 016 | $10 | ± | 048 | $30 | 0 | 080 | $50 | P | 112 | $70 | p |
| 017 | $11 | ≡ | 049 | $31 | 1 | 081 | $51 | Q | 113 | $71 | q |
| 018 | $12 | ▽ | 050 | $32 | 2 | 082 | $52 | R | 114 | $72 | r |
| 019 | $13 | ⁄. | 051 | $33 | 3 | 083 | $53 | S | 115 | $73 | s |
| 020 | $14 | ƒ | 052 | $34 | 4 | 084 | $54 | T | 116 | $74 | t |
| 021 | $15 | ⌐ | 053 | $35 | 5 | 085 | $55 | U | 117 | $75 | u |
| 022 | $16 | ⌐ | 054 | $36 | 6 | 086 | $56 | V | 118 | $76 | v |
| 023 | $17 | ⌐ | 055 | $37 | 7 | 087 | $57 | W | 119 | $77 | w |
| 024 | $18 | ⌐ | 056 | $38 | 8 | 088 | $58 | X | 120 | $78 | x |
| 025 | $19 | ⌐ | 057 | $39 | 9 | 089 | $59 | Y | 121 | $79 | y |
| 026 | $1A | ⁒ | 058 | $3A | : | 090 | $5A | Z | 122 | $7A | z |
| 027 | $1B |  | 059 | $3B | ; | 091 | $5B | [ | 123 | $7B | { |
| 028 | $1C | = | 060 | $3C | < | 092 | $5C | \ | 124 | $7C | | |
| 029 | $1D | ∿ | 061 | $3D | = | 093 | $5D | ] | 125 | $7D | } |
| 030 | $1E | ⊇ | 062 | $3E | > | 094 | $5E | ^ | 126 | $7E | ~ |
| 031 | $1F | ∃ | 063 | $3F | ? | 095 | $5F | _ | 127 | $7F |  |

Table 90: English / European character set

| Dec. | Hex. | Character | Dec. | Hex. | Character | Dec. | Hex. | Character | Dec. | Hex. | Character |
|------|------|-----------|------|------|-----------|------|------|-----------|------|------|-----------|
| 128 | $80 | Ç | 160 | $A0 | á | 192 | $C0 | Γ | 224 | $E0 | γ |
| 129 | $81 | ü | 161 | $A1 | í | 193 | $C1 | J | 225 | $E1 | β |
| 130 | $82 | é | 162 | $A2 | ó | 194 | $C2 | ∞ | 226 | $E2 | δ |
| 131 | $83 | â | 163 | $A3 | ú | 195 | $C3 | Γ | 227 | $E3 | ε |
| 132 | $84 | ä | 164 | $A4 | ¢ | 196 | $C4 | ↵ | 228 | $E4 | ζ |
| 133 | $85 | à | 165 | $A5 | £ | 197 | $C5 | ↑ | 229 | $E5 | η |
| 134 | $86 | å | 166 | $A6 | ¥ | 198 | $C6 | ↓ | 230 | $E6 | θ |
| 135 | $87 | ç | 167 | $A7 | ₧ | 199 | $C7 | → | 231 | $E7 | ι |
| 136 | $88 | ê | 168 | $A8 | ƒ | 200 | $C8 | ← | 232 | $E8 | κ |
| 137 | $89 | ë | 169 | $A9 | ¡ | 201 | $C9 | ⌐ | 233 | $E9 | λ |
| 138 | $8A | è | 170 | $AA | ã | 202 | $CA | ¬ | 234 | $EA | μ |
| 139 | $8B | ï | 171 | $AB | ã | 203 | $CB | ∟ | 235 | $EB | ν |
| 140 | $8C | î | 172 | $AC | õ | 204 | $CC | ⌐ | 236 | $EC | ξ |
| 141 | $8D | ì | 173 | $AD | õ | 205 | $CD | ∙ | 237 | $ED | π |
| 142 | $8E | Ä | 174 | $AE | ø | 206 | $CE | ⌀ | 238 | $EE | ρ |
| 143 | $8F | Å | 175 | $AF | ø | 207 | $CF | ⌀ | 239 | $EF | σ |
| 144 | $90 | É | 176 | $B0 | ˙ | 208 | $D0 | Ŧ | 240 | $F0 | τ |
| 145 | $91 | æ | 177 | $B1 | ¨ | 209 | $D1 | † | 241 | $F1 | υ |
| 146 | $92 | Æ | 178 | $B2 | ✦ | 210 | $D2 | § | 242 | $F2 | γ |
| 147 | $93 | ô | 179 | $B3 | ` | 211 | $D3 | ¶ | 243 | $F3 | ψ |
| 148 | $94 | ö | 180 | $B4 | ´ | 212 | $D4 | Γ | 244 | $F4 | ω |
| 149 | $95 | ò | 181 | $B5 | ½ | 213 | $D5 | ⌐ | 245 | $F5 | ñ |
| 150 | $96 | û | 182 | $B6 | ¼ | 214 | $D6 | θ | 246 | $F6 | ∆ |
| 151 | $97 | ù | 183 | $B7 | × | 215 | $D7 | Λ | 247 | $F7 |  |
| 152 | $98 | ÿ | 184 | $B8 | ÷ | 216 | $D8 | Ξ | 248 | $F8 |  |
| 153 | $99 | Ö | 185 | $B9 | ≤ | 217 | $D9 | Π | 249 | $F9 |  |
| 154 | $9A | Ü | 186 | $BA | ≥ | 218 | $DA | Σ | 250 | $FA |  |
| 155 | $9B |  | 187 | $BB | ≪ | 219 | $DB | Υ | 251 | $FB |  |
| 156 | $9C | Ñ | 188 | $BC | ≫ | 220 | $DC | Φ | 252 | $FC |  |
| 157 | $9D | ∃ | 189 | $BD | ≠ | 221 | $DD | Ψ | 253 | $FD |  |
| 158 | $9E | ọ | 190 | $BE | √ | 222 | $DE | Ω | 254 | $FE |  |
| 159 | $9F | ¿ | 191 | $BF | ‾ | 223 | $DF | α | 255 | $FF | ■ |

Table 90: English / European character set

Table index

# A

# B

# C

# D

# E

# I

# M

# P

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Index

# 0

# 3

# 4

# 7

Model number index