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certified



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Technical description

APCI-2200

Relay board, optically isolated

Edition: 05.13 - 03/2020

Product information

This manual contains the technical installation and important instructions for correct commissioning and usage, as well as production information according to the current state before printing.

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Warning!

The following risks result from the improper implementation of the board and from use contrary to the regulations:



Personal injury



Damage to the board, the PC and peripherals



Pollution of the environment.

- Protect yourself, others and the environment!
- Read the safety precautions (yellow leaflet) carefully!
If this leaflet is not enclosed with the documentation,
please contact us and ask for it.
- Observe the instructions of this manual!
Make sure that you do not forget or skip any step!
We are not liable for damages resulting from the
wrong use of the board.
- Pay attention to the following symbols:



NOTICE!

Designates hints and other useful information.



NOTICE!

Designates a possibly dangerous situation.
If the instructions are ignored, the board, the PC and/or
peripherals may be **destroyed**.



WARNING!

Designates a possibly dangerous situation.
If the instructions are ignored, the board, the PC
and/or peripherals may be **destroyed** and persons
may be **endangered**.

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1 DEFINITION OF APPLICATION

1.1 Intended use

The **APCI-2200** board must be inserted in a personal computer (PC) with PCI slots which is used as electrical equipment for measurement, control and laboratory pursuant to the standard DIN EN IEC 61010-1.

The used personal computer (PC) must fulfil the requirements of DIN EN IEC 62368-1 and DIN EN 55032 or IEC/CISPR 32 and DIN EN 55024 or IEC/CISPR 24.

The use of the board **APCI-2200** in combination with external screw terminal panels requires correct installation according to the standard DIN EN IEC 61439-1 (Low-voltage switchgear and controlgear assemblies).

1.2 Usage restrictions

The **APCI-2200** board must not be used as a safety-related part (SRP).

The board must not be used for safety-related functions, for example for emergency stop functions.

The **APCI-2200** board must not be used in potentially explosive atmospheres.

The **APCI-2200** board must not be used as electrical equipment according to the Low Voltage Directive 2014/35/EU.

1.3 Limits of use

All safety information and the instructions in the manual must be followed to ensure proper intended use.

Uses of the board beyond these specifications are considered as improper use. The manufacturer is not liable for damages resulting from improper use.

The board must remain in its anti-static packaging until it is installed.

Please do not delete the identification numbers of the board or the warranty claim will be invalid.

1.4 General description

The board has up to 8 digital inputs and up to 16 relay outputs for processing digital 24 V signals.

The connection with our standard cables **ST010** and **ST370-16** complies with the specifications:

- metallised plastic hoods
- shielded cable
- cable shield folded back and firmly screwed to the connector housing.

2 USER

2.1 Qualification

Only persons trained in electronics are entitled to perform the following works:

- Installation
- Commissioning
- Use
- Maintenance

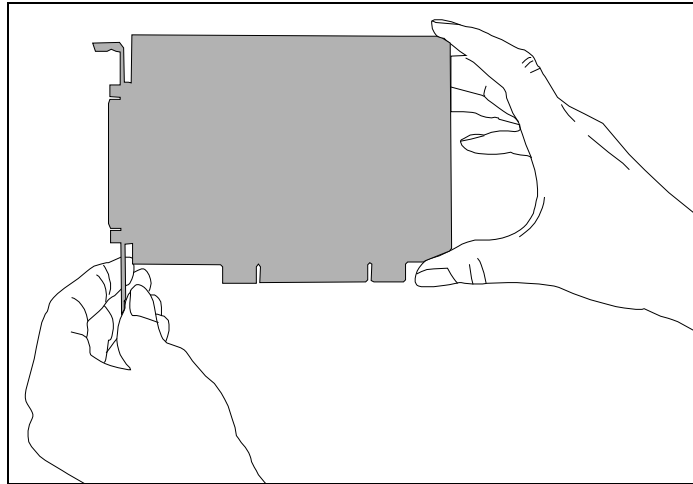
2.2 Country-specific regulations

Do observe the country-specific regulations regarding

- the prevention of accidents
- electrical and mechanical installations
- Electromagnetic compatibility (EMC).

3 HANDLING OF THE BOARD

Fig. 3-1: Correct handling



Hold the board cautiously at the outer end and at the slot bracket.
Do not touch the surface of the board!

4 TECHNICAL DATA

4.1 Electromagnetic compatibility (EMC)

The board **APCI-2200** is suited for installation in personal computers (PCs) which comply with the European EMC directive.

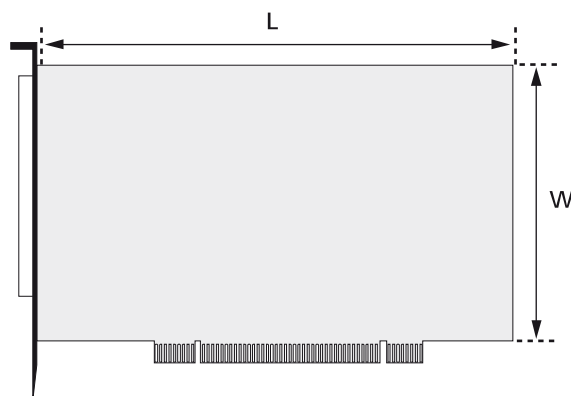
The board **APCI-2200** complies with the European EMC directive.

The tests were carried out by a certified EMC laboratory in accordance with the standard DIN EN IEC 61326-1. The limit values as set out by the European EMC directive for an industrial environment are complied with.

The respective EMC test report is available on request.

4.2 Physical set-up of the board

Dimensions:



Dimensions (L x W): 131 x 97 mm

Weight: approx. 160 g

Installation in: PCI 32-bit slot (3.3 V / 5 V)

Connection to the peripherals: 50-pin D-Sub male connector
 16-pin header for ribbon cable

Accessories¹:

Standard cable: **ST370-16, ST010/ST011**

Ribbon cable: **FB2200-3** for the digital inputs

Screw terminal panel: **PX901-ZG**



NOTICE!

The connection lines must be installed in such a way that they are protected against mechanical loads.

¹ Not included in standard delivery

4.3 Versions

The relay board **APCI-2200** is available in the following versions:

Version	Full version	Partial assembly	Relay outputs	Digital inputs
APCI-2200-16-8	✓		16	8
APCI-2200-16		✓	16	-
APCI-2200-8		✓	8	-
APCI-2200-8-8		✓	8	8

4.4 Limit values

Max. altitude: 2000 m
 Operating temperature: 0 to 60 °C (with forced ventilation)
 Storage temperature: -25 to 70 °C

Relative humidity at indoor installation

50 % at +40 °C

80 % at +31 °C

Minimum PC requirements:

Bus speed: < 33 MHz

Operating system: Windows 10/7/XP, Linux

Energy requirements:

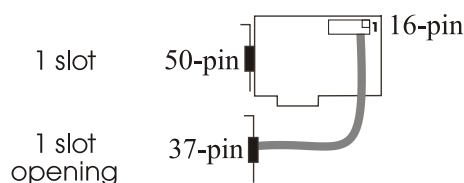
- Operating voltage of the PC: 5 V ± 5 %

- Current consumption (without load): typical, see table ± 10 %

	APCI-2200-16-8	APCI-2200-8-8	APCI-2200-16	APCI-2200-8
+ 5 V from PC	550 mA	330 mA	520 mA	300 mA

Required slots

APCI-2200-16-8: 1+1



APCI-2200-8-8, APCI-2200-16,

APCI-2200-8: 1

Addressing

Data bus access: 8-bits
Required address ranges: 4 bytes (1 Dword)
..... 32 bytes (8 Dword)

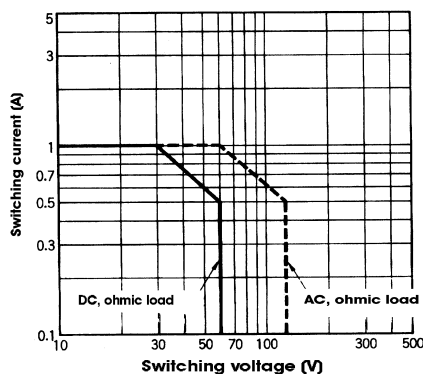
Digital inputs

Input type:	ground-related inputs
Number of inputs:	8
Nominal voltage:	12-24 VDC
Input current at nominal voltage:	approx. 6 mA
Logical input level (standard):	U _H ¹ max.: 30 V / 7 mA typ.
	U _H min.: 9 V / 4 mA typ.
	U _L ² max.: 6 V / 2.3 mA typ.
	U _L min.: 0 V
Signal delay:	70 μs (at nominal voltage)
Maximal input frequency:	5 kHz (at nominal voltage)

Relay data

Types of contacts:	change-over contacts
Max. switching voltage ³ :	60 VDC, 48 VAC
Max. switching current:	1 A
Max. switching capacity:	62.5 VA, 30 W

Max. switching capacity

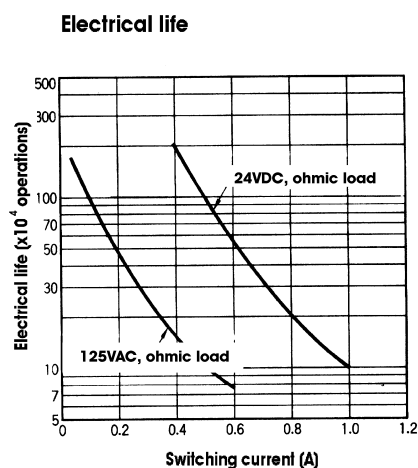


Min. permissible load:	1 mA, 5 VDC
Nominal load:	1 A, 24 VDC
Contact resistance:	< 100 mΩ
Contact material:	Ag and Au-plated
Contact force, working/rest side:	15/15 cN
Responding time:	max 5 ms, typ. 2.5 ms
Release time:	max 5 ms, typ. 0.9 ms
Mechanical life:	5 x 10 ⁶ operations
Electrical life at nominal load:	10 ⁵ operations

¹ U_H: input voltage, logic "1"

² U_I: input voltage, logic "0"

³ This value should not be exceeded. See chapter 1.1: Limits of use



Creeping distance and corresponding voltage values

according to DIN VDE 0110, with stain degree 1 (clean board)

Between the coil and the contacts and

between the contacts: 800 V

between the contacts: 200 V

Test voltage for the relays

1000 VAC, 50/60 Hz 1 minute between the coil and the contacts

400 VAC, 50/60 Hz 1 minute between the open contact

5 INSTALLATION OF THE BOARD



Risk of injury!

Please follow the safety precautions! An improper handling of the board may cause property damage and injury.

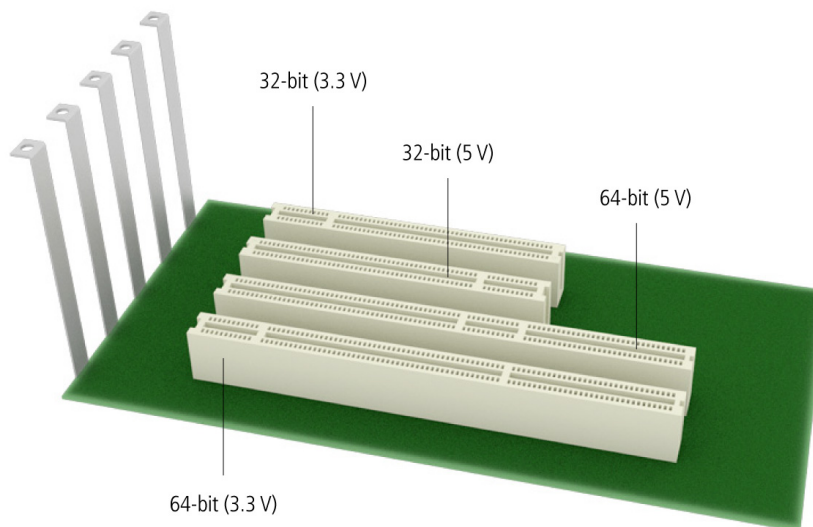
5.1 Opening the PC

- ◆ Switch off your PC and all the units connected to it.
- ◆ Pull the PC mains plug from the socket.
- ◆ Open your PC as described in the manual of the PC manufacturer.

5.2 Selecting a slot

- ◆ Insert the board in a free 32-/64-bit PCI slot (3.3 V or 5 V).

Fig. 5-1: PCI slot types

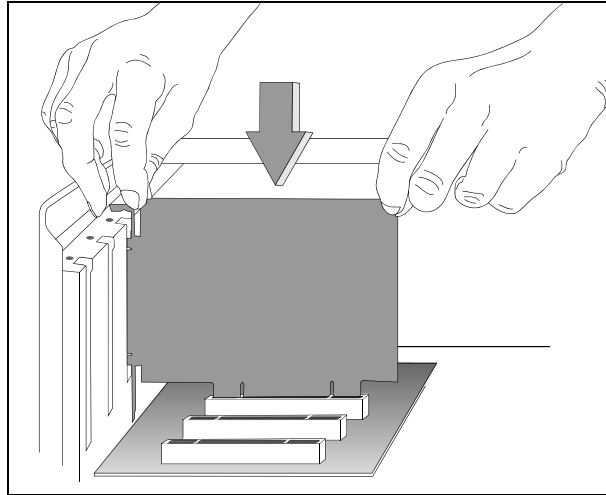


- ◆ Unscrew the back cover from the selected slot. For this, follow the operating instructions provided by the PC manufacturer! Keep the back cover in a safe place. You will need it if you remove the board.
- ◆ Provide for potential equalisation.
- ◆ Take the board out of its protective packaging.

5.3 Inserting the board

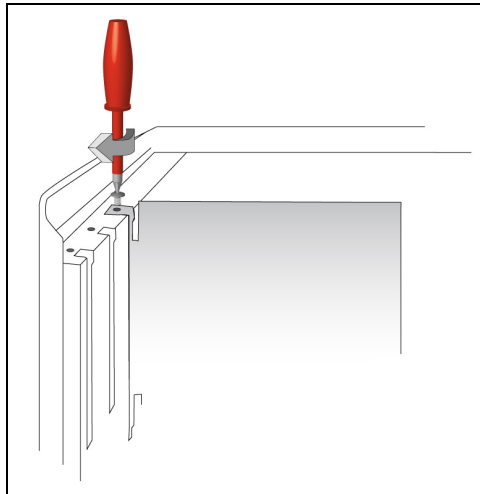
- ◆ Insert the board vertically into the chosen slot.

Fig. 5-2: Inserting the board



- ◆ Fasten the board to the rear of the PC housing with the screw which was fixed on the back cover.

Fig. 5-3: Fastening the board at the back cover



- ◆ Tighten all loose screws.

5.4 Closing the PC

- ◆ Close your PC as described in the manual of the PC manufacturer.

6 DRIVER INSTALLATION

Information on how to select and download the appropriate driver can be found in the document “Quick installation PC boards” (see PDF link).

The installation of drivers of the type “ADDI-DATA Multiarchitecture Device Drivers 32-/64-Bit for x86/AMD64” as well as the installation of the corresponding samples is described in the installation instructions (see PDF link).

6.1 Questions and updates

If you have any questions, do not hesitate to call us or to send us an e-mail:

Phone: +49 7229 1847-0

E-mail: info@addi-data.com

Manual and software download from the Internet

The latest versions of the technical manual and the standard software for the board **APCI-2200** can be downloaded for free at: www.addi-data.com



NOTICE!

Before using the board and in case of malfunction during operation, check if there is an update (manual, driver) available. Current data can be found on our website or contact us directly.

7 CONNECTING THE PERIPHERALS



Risk of death!

The relay board may work with dangerous currents.
Improper operation is dangerous to life!

- ◆ Turn off the mains supply.
- ◆ Pull the mains plug.
- ◆ Disconnect all cables to external devices.



NOTICE!

Make sure that the wire cross section of the connection cable accepts the operating current.

7.1 Connection to the digital inputs

Version 16-8: To connect the peripherals to the digital inputs, the ribbon cable **FB2200-3** is required.

Table 7-1: Connection to the digital inputs

APCI-2200-16-8	Connectors
You can connect the inputs to a 37-pin D-Sub male connector through the optional ribbon cable FB2200-3 in order to connect, for example, an ADDI-DATA screw terminal panel	
APCI-2200-8-8	Connectors
The inputs are internally bridged and led to the 50-pin D-Sub male connector (See Fig. 7-3).	

7.2 Pin assignment

7.2.1 APCI-2200-16-8

Fig. 7-1: Connection of the relay outputs via 50-pin D-Sub male connector

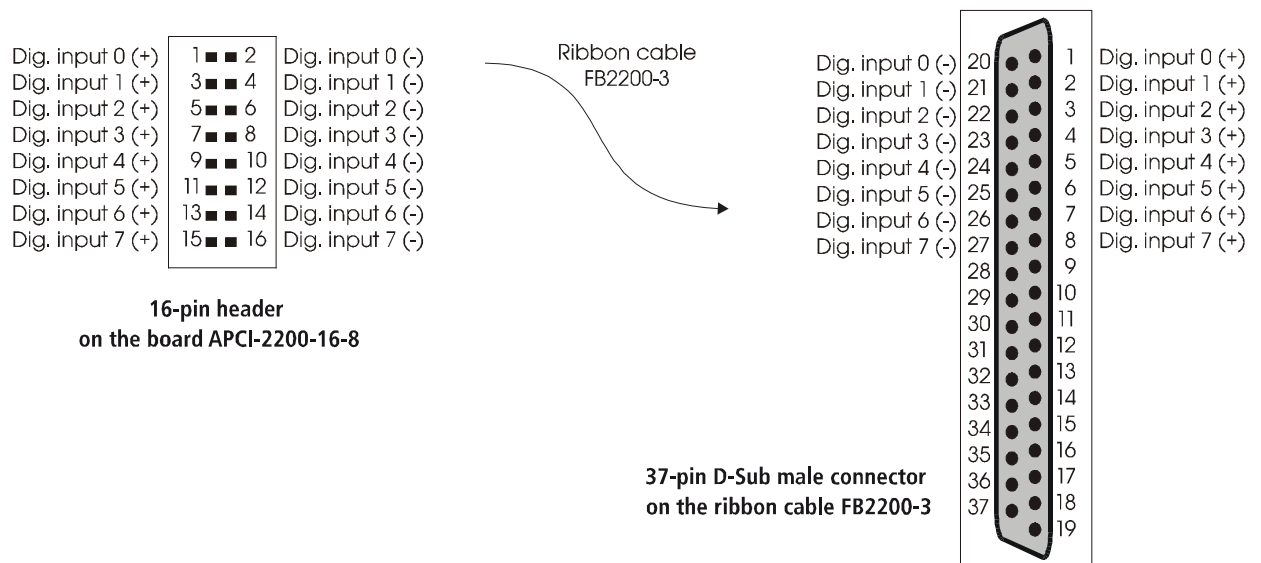
Pin		Pin					Pin
34	OC of relay 0	18	CC of relay 0	34	●	18	1
35	OC of relay 1	19	CC of relay 1	35	●	19	2
36	OC of relay 2	20	CC of relay 2	36	●	20	3
37	OC of relay 3	21	CC of relay 3	37	●	21	4
38	OC of relay 4	22	CC of relay 4	38	●	22	5
39	OC of relay 5	23	CC of relay 5	39	●	23	6
40	OC of relay 6	24	CC of relay 6	40	●	24	7
41	OC of relay 7	25	CC of relay 7	41	●	25	8
42	OC of relay 8	26	CC of relay 8	42	●	26	9
43	OC of relay 9	27	CC of relay 9	43	●	27	10
44	OC of relay 10	28	CC of relay 10	44	●	28	11
45	OC of relay 11	29	CC of relay 11	45	●	29	12
46	OC of relay 12	30	CC of relay 12	46	●	30	13
47	OC of relay 13	31	CC of relay 13	47	●	31	14
48	OC of relay 14	32	CC of relay 14	48	●	32	15
49	OC of relay 15	33	CC of relay 15	49	●	33	16
50	-			50	●	33	-

OC: Opening contact

CC: Closing contact

CO: Change-over contact

Fig. 7-2: Connection of the digital inputs via FB2200-3



7.2.2 APCI-2200-8-8

Fig. 7-3: Connection of the inputs/outputs via 50-pin D-Sub male connector

Pin		Pin		Pin		Pin	
34	OC of relay 0	18	CC of relay 0	34	18	1	CO of relay 0
35	OC of relay 1	19	CC of relay 1	35		2	CO of relay 1
36	OC of relay 2	20	CC of relay 2	36		3	CO of relay 2
37	OC of relay 3	21	CC of relay 3	37		4	CO of relay 3
38	OC of relay 4	22	CC of relay 4	38		5	CO of relay 4
39	OC of relay 5	23	CC of relay 5	39		6	CO of relay 5
40	OC of relay 6	24	CC of relay 6	40		7	CO of relay 6
41	OC of relay 7	25	CC of relay 7	41		8	CO of relay 7
42	Digital input 0 (+)	26	-	42		9	Digital input 0 (-)
43	Digital input 1 (+)	27	-	43		10	Digital input 1 (-)
44	Digital input 2 (+)	28	-	44		11	Digital input 2 (-)
45	Digital input 3 (+)	29	-	45		12	Digital input 3 (-)
46	Digital input 4 (+)	30	-	46		13	Digital input 4 (-)
47	Digital input 5 (+)	31	-	47		14	Digital input 5 (-)
48	Digital input 6 (+)	32	-	48		15	Digital input 6 (-)
49	Digital input 7 (+)	33	-	49		16	Digital input 7 (-)
50	-			50	33	17	-

OC: Opening contact
CC: Closing contact
CO: Change-over contact

7.3 Connecting the relay outputs

Fig. 7-4: Switching principle of the relay outputs

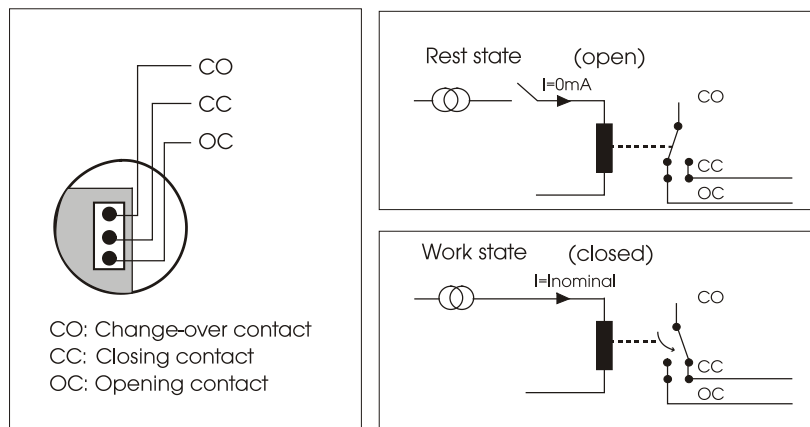
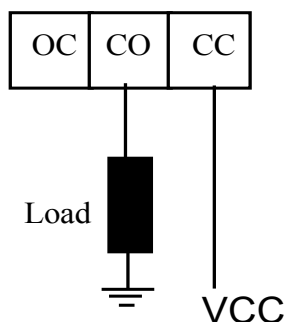


Fig. 7-5: Connecting the relay outputs (example)

**Excited relay:**

The operating voltage (V_{CC}) is connected to the load through the closing contact.

Relay not excited:

The load is isolated from the mains supply.

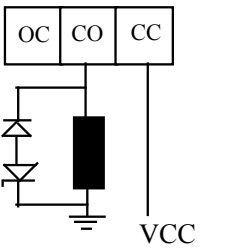
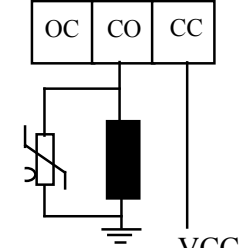
7.4 Protective circuit at the load (examples)

**NOTICE!**

Overloading the relays by connecting ohmic, inductive or capacitive loads without protective circuits can damage a relay or cause a premature wear-out.

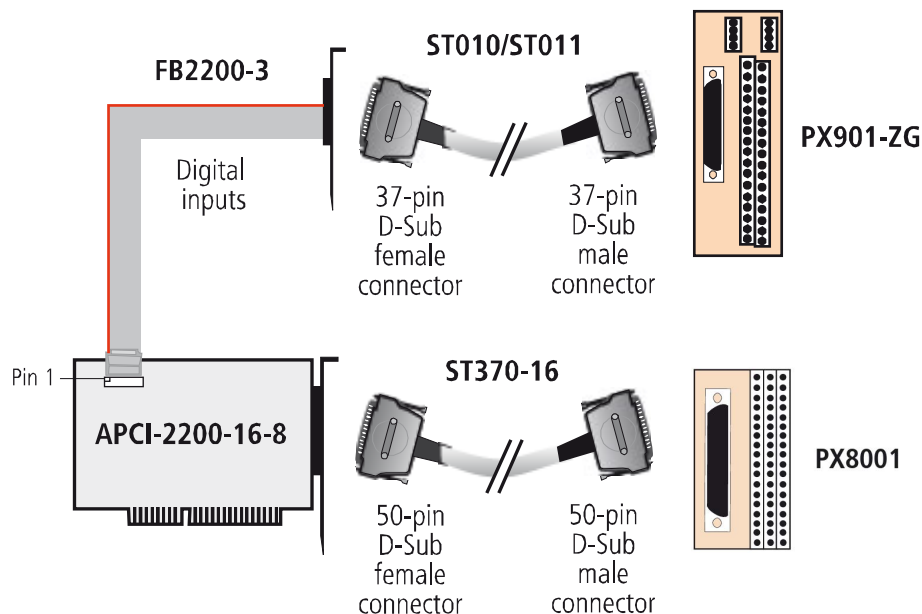
Table 7-2: Protective circuit at the load (examples)

	Use	Remark
	- a resistor R - a capacitor C <u>Typical value</u> $R = 0,5 \text{ to } 1 \, \Omega$ per 1 V contact voltage $C = 1 \text{ to } 0,5 \, \mu\text{F}$ per 1 A contact current	The values depend on the features of the load and may not always correspond to the typical values. • Find out the typical values experimentally Capacitor C: suppresses the charge with opening contacts. Resistor R: limits the current flow on the next closing of the contacts.
	A diode with - an off-stage voltage, supporting more than 10 times the switching voltage - a conducting state current higher than the load current.	By switching off the load, the energy stored in the coil (inductive load) creates a current flow through the diode connected in parallel to the coil. With this type of circuit, the delay in the release time is longer than in an RC circuit.

	Use	Remark
	- a Zener diode The off-state voltage should correspond to the mains voltage	This circuit shortens the release time for applications in which the release time of the protective circuit with diode would be too slow.
	- a varistor	The constant voltage effect of the varistor does not allow high voltages at the contacts. With this protective circuit, the release time is only slightly delayed.

7.5 Connection examples

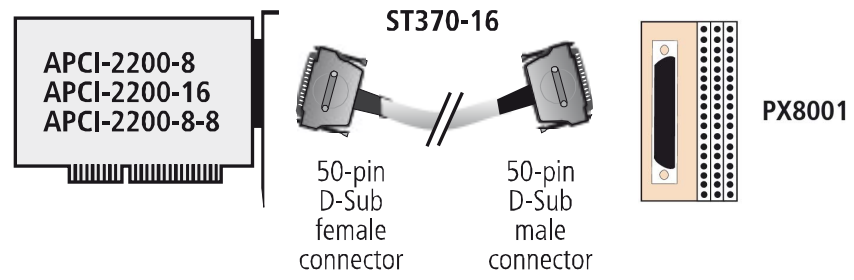
Fig. 7-6: Connection of the screw terminal panel PX901-ZG



NOTICE!

Plug the **FB2200-3** cable into the connector by inserting the red (or blue or black) cable line into pin 1.

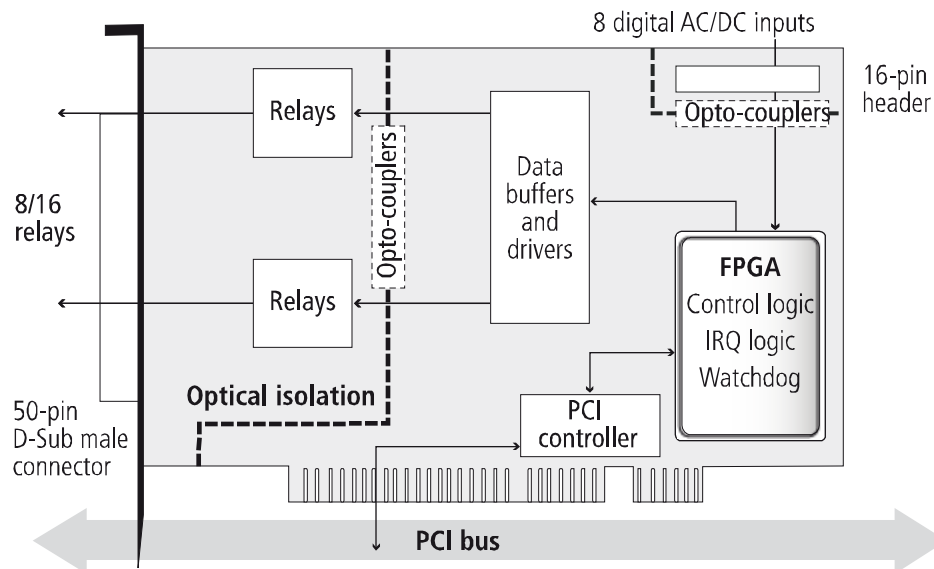
Fig. 7-7: Connection of the cable ST370-16



8 FUNCTIONS OF THE BOARD

8.1 Block diagram

Fig. 8-1: Block diagram



8.2 Relay outputs

The switching states of the relays 0 to 7 or 8 to 15 can be modified simultaneously through software as long as the watchdog is not in alarm state.

8.3 Watchdog

The watchdog is a downward counter, which sets or resets the relay outputs after the complete cycle time has elapsed (time out). This process is defined by a software function:

```
PCI2200_SetWatchdogValue(HANDLE h_DeviceHandle, INT_ int_setvalue)
```

If this function is not used, the relay outputs will be deactivated in case of a time out.

The watchdog can have three different states:

- "OFF":** The watchdog is deactivated and has no influence on the state of the relay outputs.
- "ON":** The watchdog has been activated by a software trigger. It monitors the program flow and has an effect on the state of the relay outputs if there is a time out.
- "Alarm":** In case of a time out, the watchdog signals an alarm by setting/resetting or deactivating all relay outputs.

The operating states of the watchdog can be read back at any time through software. The cycle time can be programmed in the range from 20 ms to 5 s, in steps of 20 ms.

8.4 Digital inputs (option)

This function is available for the versions **APCI-2200-16-8** and **APCI-2200-8-8**.

The inputs acquire the status of external signals. The input information is stored through software as a value in the memory cell of the PC. This value is converted to give the status of the input signals.

24 V opto-isolated inputs (DIN EN IEC 61131-2):

- logic "1" corresponds to an input voltage $> 8\text{ V}$
- logic "0" corresponds to an input voltage $< 6\text{ V}$.

The required current per input is 6 mA at nominal voltage.



NOTICE!

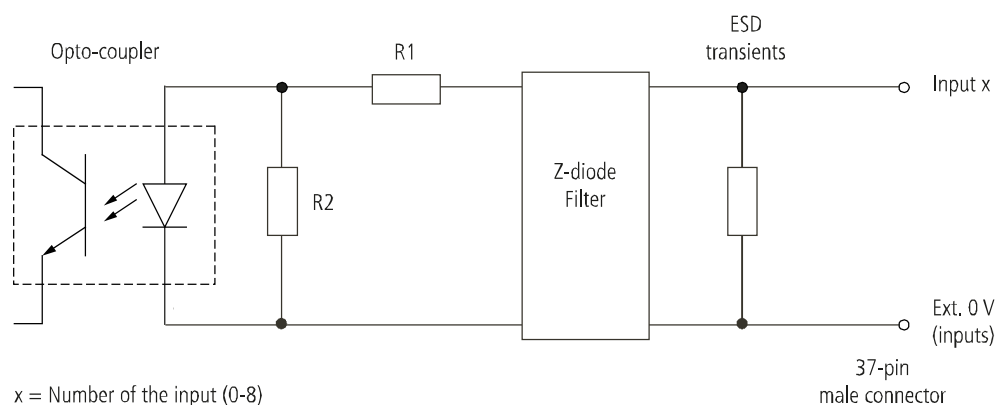
If you operate all inputs with the same voltage supply, the voltage supply must deliver at least $32 \times 6\text{ mA} = 192\text{ mA}$ at $V_{cc\text{ ext.}} = 24\text{ V}$.

The maximum input voltage is 30 V / 7 mA typical.

The input signals are filtered by TVS diodes, Z diodes, LC filters and optical couplers. The effects of inductive and capacitive noise are thus reduced.

The board requires no initialisation to read the 24 V digital input information. After successful power ON, data is immediately available on the board.

Fig. 8-2: Input circuit



9 STANDARD SOFTWARE

The API software functions supported by the board are listed in an HTML document. A description of how to access the respective file can be found in the document “Quick installation PC boards” (see PDF link), in the chapter “Standard software”.

10 RETURN OR DISPOSAL

10.1 Return

If you need to return your board, you should read the following checklist before.

Checklist for returning the board:

- Specify the reason for returning your board (e.g. exchange, modification, repair), the serial number of the board, the contact person in your company including his/her telephone extension and e-mail address, as well as the mailing address for a potential new delivery. You do not have to indicate the RMA number.

Fig. 10-1: Serial number



- Note down the serial number of the board.
- Place the board in an ESD protective cover. Then pack it in a cardboard box so that it is well-protected for shipping. Send the packed board together with your details to:

ADDI-DATA GmbH
Airpark Business Center
Airport Boulevard B210
77836 Rheinmünster
Germany

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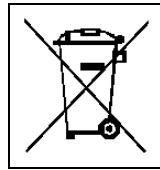
10.2 Disposal of ADDI-DATA waste equipment

ADDI-DATA organises the disposal of ADDI-DATA products that were put on the German market after 13 August 2005.

If you want to return waste equipment, please e-mail your request to: info@addi-data.com.

Boards that were delivered after 13 August 2005 can be recognised by the following label:

Fig. 10-2: Disposal: Label



This symbol indicates the disposal of waste electrical and electronic equipment. It is valid in the European Union and in other European countries that have a separate collection system. Products carrying this symbol must not be treated as household waste.

For more detailed information on the recycling of these products, please contact your local citizens' office, your household waste collection service, the shop where you bought this product or the distributor you purchased this product from.

If you dispose of this product correctly, you will help to prevent damage that could be caused to the environment and to human health by inappropriate disposal. The recycling of materials will help to conserve our natural resources.

Disposal in other countries than Germany

Please dispose of the product according to the country-specific regulations.

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