



DIN EN ISO9001:2015
certified



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

Phone: +49 7229 1847-0
Fax: +49 7229 1847-222
E-mail: info@addi-data.com
www.addi-data.com

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.

The content of this manual and the technical product data may be changed without prior notice.

ADDI-DATA GmbH reserves the right to make changes to the technical data and the materials included herein.

Warranty and liability

The user is not authorised to make changes to the product beyond the intended use, or to interfere with the product in any other way.

ADDI-DATA shall not be liable for obvious printing and phrasing errors.

In addition, ADDI DATA, if legally permissible, shall not be liable for personal injury or damage to materials caused by improper installation and/or commissioning of the product by the user or improper use; for example, if the product is operated despite faulty safety and protection devices, or if notes in the operating instructions regarding transport, storage, installation, commissioning, operation, limit values, etc. are not taken into consideration.

Liability is further excluded if the operator changes the product or the source code files without authorisation and/or if the operator is guilty of not monitoring the permanent operational capability of working parts and this has led to damage.

Copyright

This manual, which is intended for the operator and its staff only, is protected by copyright. Duplication of the information contained in the operating instructions and of any other product information, or disclosure of this information for use by third parties, is not permitted, unless this right has been granted by the product licence issued. Non-compliance with this could lead to civil and criminal proceedings.

ADDI-DATA software product licence

Please read this licence carefully before using the standard software! The customer is only granted the right to use this software if he/she agrees with the conditions of this licence.

The software may only be used to set up the ADDI-DATA products.

Reproduction of the software is forbidden (except for back-up and for exchange of faulty data carriers).

Disassembly, decompilation, decryption and reverse engineering of the software are forbidden. This licence and the software may be transferred to a third party if this party has acquired a product by purchase, has agreed to all the conditions in this licence contract and the original owner does not keep any copies of the software.

Trademarks

- ADDI-DATA, APCI-1500, MSX-Box and MSX-E are registered trademarks of ADDI-DATA GmbH.
- Turbo Pascal, Delphi, Borland C, Borland C++ are registered trademarks of Borland Software Corporation.
- Microsoft .NET, Microsoft C, Visual C++, MS-DOS, Windows XP, Windows 7, Windows 10, Windows Server 2000, Windows Server 2003, Windows Embedded and Internet Explorer are registered trademarks of Microsoft Corporation.
- Linux is a registered trademark of Linus Torvalds.
- LabVIEW, LabWindows/CVI, DASyLab, DIAdem are registered trademarks of National Instruments Corporation.
- CompactPCI is a registered trademark of PCI Industrial Computer Manufacturers Group.
- VxWorks is a registered trademark of Wind River Systems, Inc.
- RTX is a registered trademark of IntervalZero.



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**.

WARNING!	3
1 DEFINITION OF APPLICATION	6
1.1 Intended use	6
1.2 Usage restrictions	6
1.3 Limits of use	6
1.4 General description	7
2 USER	8
2.1 Qualification	8
2.2 Country-specific regulations	8
3 HANDLING OF THE BOARD	9
4 TECHNICAL DATA	10
4.1 Electromagnetic compatibility (EMC)	10
4.2 Physical set-up of the board	10
4.3 Versions	11
4.4 Limit values	11
5 INSTALLATION OF THE BOARD	14
5.1 Opening the PC	14
5.2 Selecting a slot	14
5.3 Inserting the board	15
5.4 Closing the PC	15
6 DRIVER INSTALLATION	16
6.1 Questions and updates	16
7 CONNECTING THE PERIPHERALS	17
7.1 Connection to the digital inputs	17
7.2 Pin assignment	18
7.2.1 APCI-2200-16-8	18
7.2.2 APCI-2200-8-8	19
7.3 Connecting the relay outputs	19
7.4 Protective circuit at the load (examples)	20
7.5 Connection examples	21
8 FUNCTIONS OF THE BOARD	23

8.1 Block diagram..... 23

8.2 Relay outputs..... 23

8.3 Watchdog..... 23

8.4 Digital inputs (option)..... 24

9 STANDARD SOFTWARE 25

10 RETURN OR DISPOSAL 26

10.1 Return 26

10.2 Disposal of ADDI-DATA waste equipment..... 27

11 INDEX..... 28

Figures

Fig. 3-1: Correct handling 9

Fig. 5-1: PCI slot types 14

Fig. 5-2: Inserting the board 15

Fig. 5-3: Fastening the board at the back cover 15

Fig. 7-1: Connection of the relay outputs via 50-pin D-Sub male connector 18

Fig. 7-2: Connection of the digital inputs via FB2200-3 18

Fig. 7-3: Connection of the inputs/outputs via 50-pin D-Sub male connector 19

Fig. 7-4: Switching principle of the relay outputs 19

Fig. 7-5: Connecting the relay outputs (example)..... 20

Fig. 7-6: Connection of the screw terminal panel PX901-ZG 21

Fig. 7-7: Connection of the cable ST370-16 22

Fig. 8-1: Block diagram..... 23

Fig. 8-2: Input circuit..... 24

Fig. 10-1: Serial number 26

Fig. 10-2: Disposal: Label 27

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

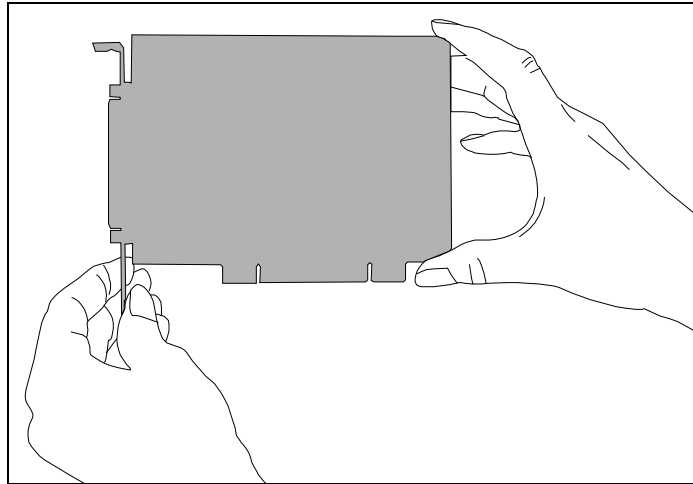
2.2 Country-specific regulations

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.

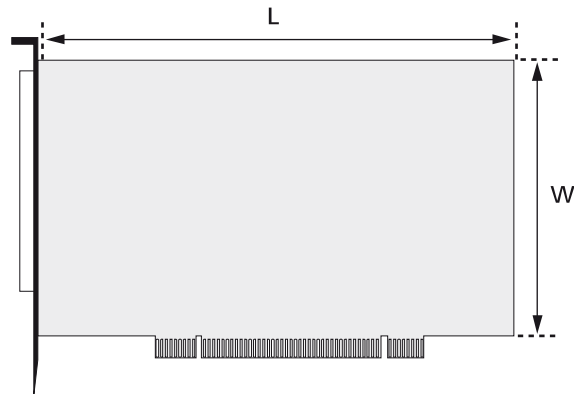
The board **APCI-2200** complies with the European EMC directive.

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

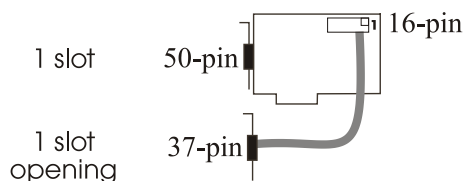
Energy requirements:

- 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)

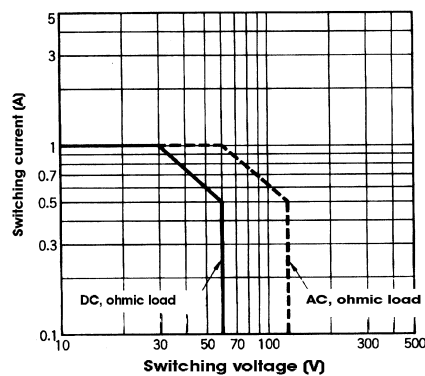
Digital inputs

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 μ s (at nominal voltage)
 Maximal input frequency: 5 kHz (at nominal voltage)

Relay data

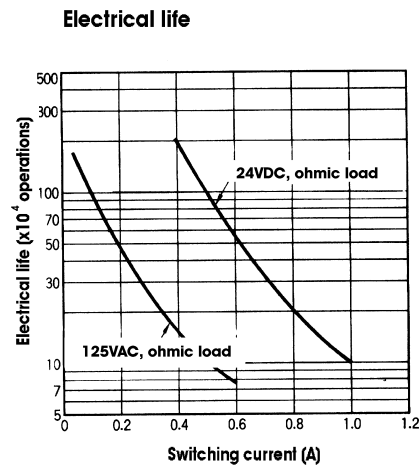
Types of contacts: change-over contacts
 Max. switching voltage³: 60 VDC, 48 VAC
 Max. switching current: 1 A
 Max. switching capacity: 62.5 VA, 30 W

Max. switching capacity



Min. permissible load: 1 mA, 5 VDC
 Nominal load: 1 A, 24 VDC
 Contact resistance: < 100 m Ω
 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 10⁶ operations
 Electrical life at nominal load: 10⁵ operations

¹ U_H : input voltage, logic "1"
² U_L : 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.

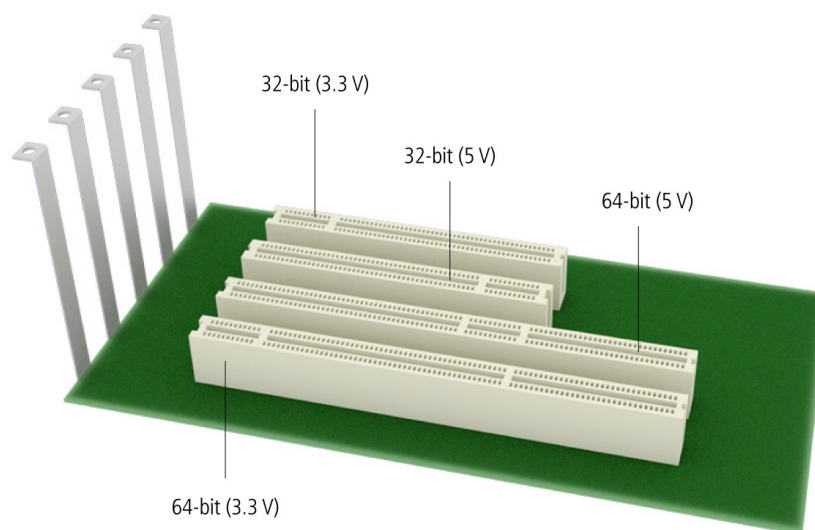
5.1 Opening the PC

- ◆ 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

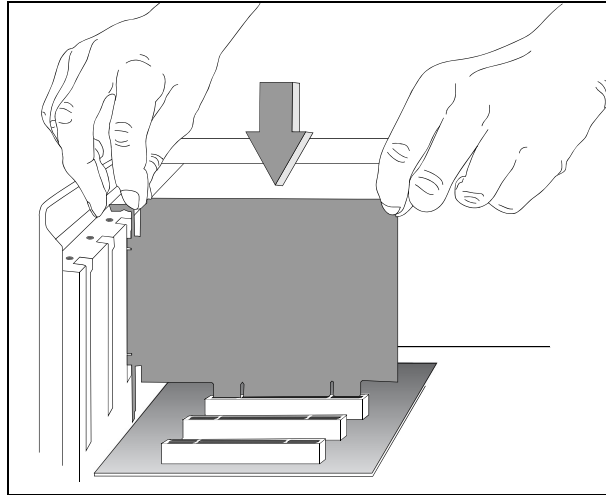


- ◆ Unscrew the back cover from the selected slot. For this, follow the operating instructions provided by the PC manufacturer! Keep the back cover in a safe place. You will need it if you remove the board.
- ◆ Provide for potential equalisation.
- ◆ Take the board out of its protective packaging.

5.3 Inserting the board

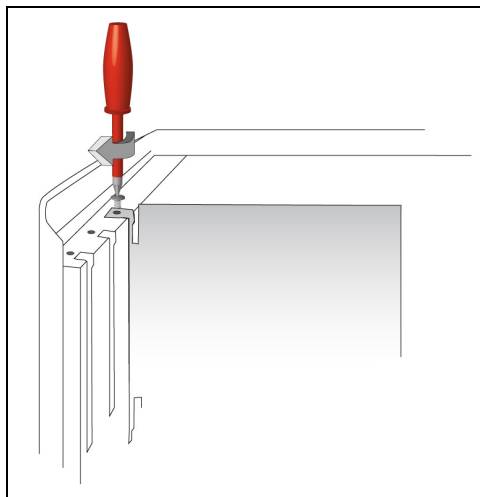
- ◆ Insert the board vertically into the chosen slot.

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.

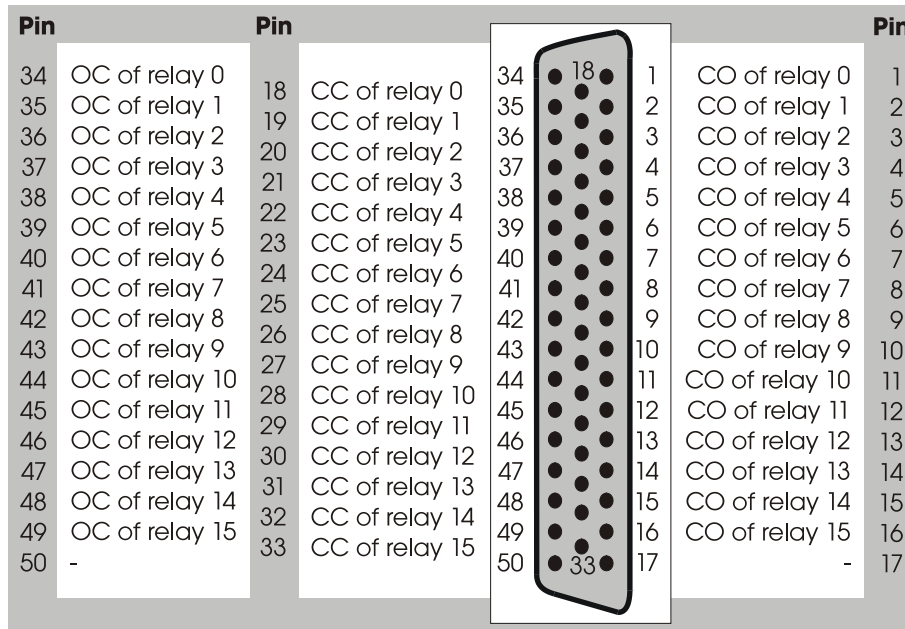
Table 7-1: Connection to the digital inputs

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

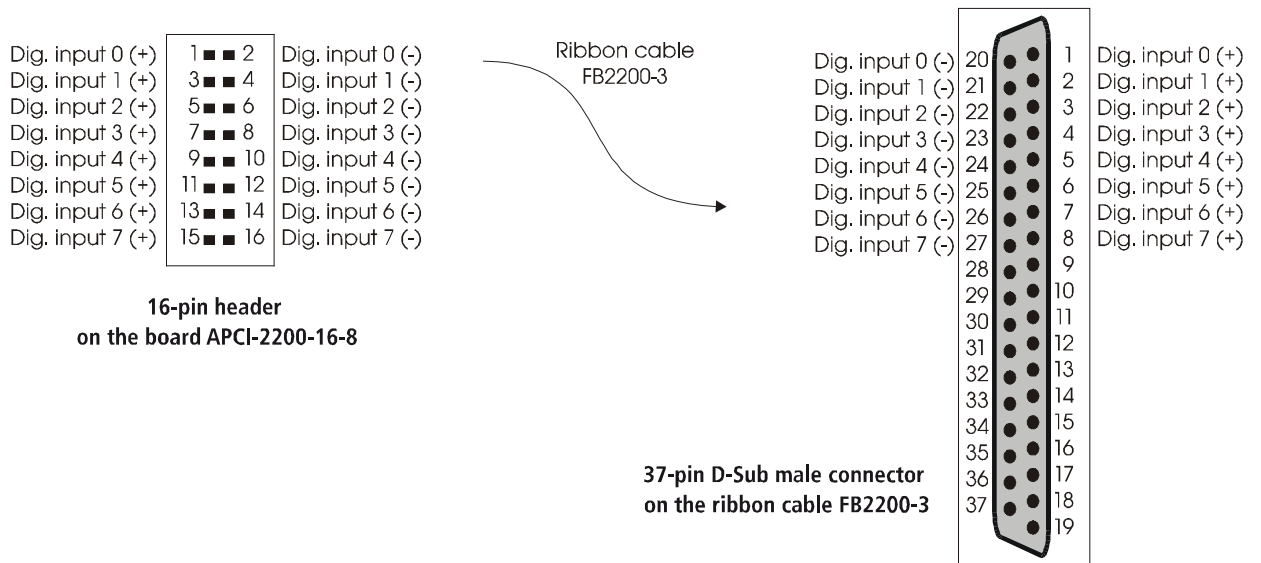
7.2.1 APCI-2200-16-8

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



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

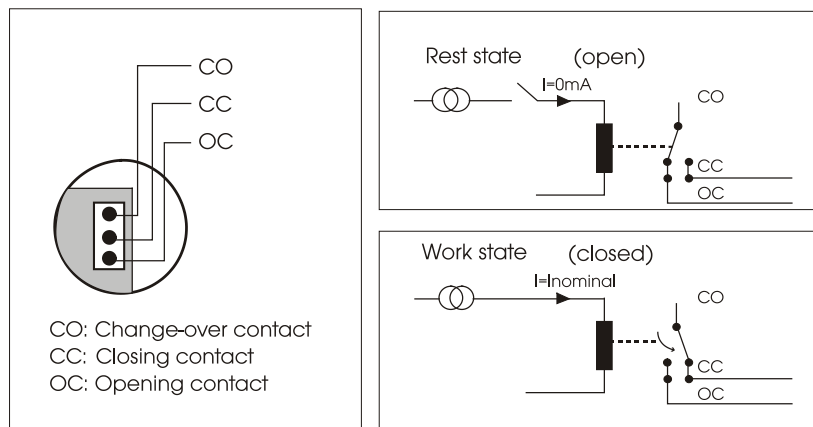
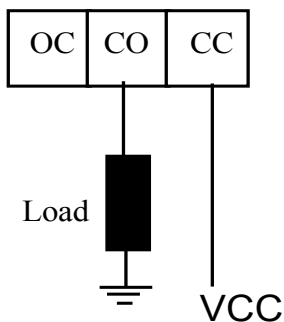


Fig. 7-5: Connecting the relay outputs (example)



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.

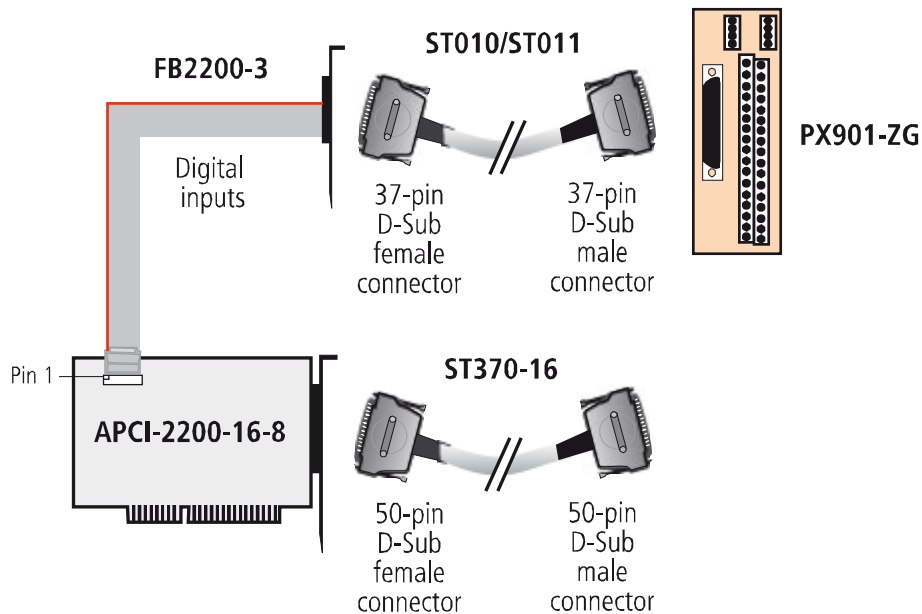
Table 7-2: Protective circuit at the load (examples)

	Use	Remark
	<p>- a resistor R - a capacitor C</p> <p><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</p>	<p>The values depend on the features of the load and may not always correspond to the typical values.</p> <ul style="list-style-type: none"> • Find out the typical values experimentally <p>Capacitor C: suppresses the charge with opening contacts. Resistor R: limits the current flow on the next closing of the contacts.</p>
	<p>A diode with</p> <ul style="list-style-type: none"> - an off-stage voltage, supporting more than 10 times the switching voltage - a conducting state current higher than the load current. 	<p>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.</p> <p>With this type of circuit, the delay in the release time is longer than in an RC circuit.</p>

	Use	Remark
	<p>- a Zener diode The off-state voltage should correspond to the mains voltage</p>	<p>This circuit shortens the release time for applications in which the release time of the protective circuit with diode would be too slow.</p>
	<p>- a varistor</p>	<p>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.</p>

7.5 Connection examples

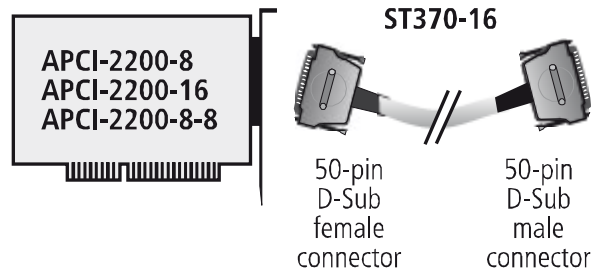
Fig. 7-6: Connection of the screw terminal panel PX901-ZG



NOTICE!

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

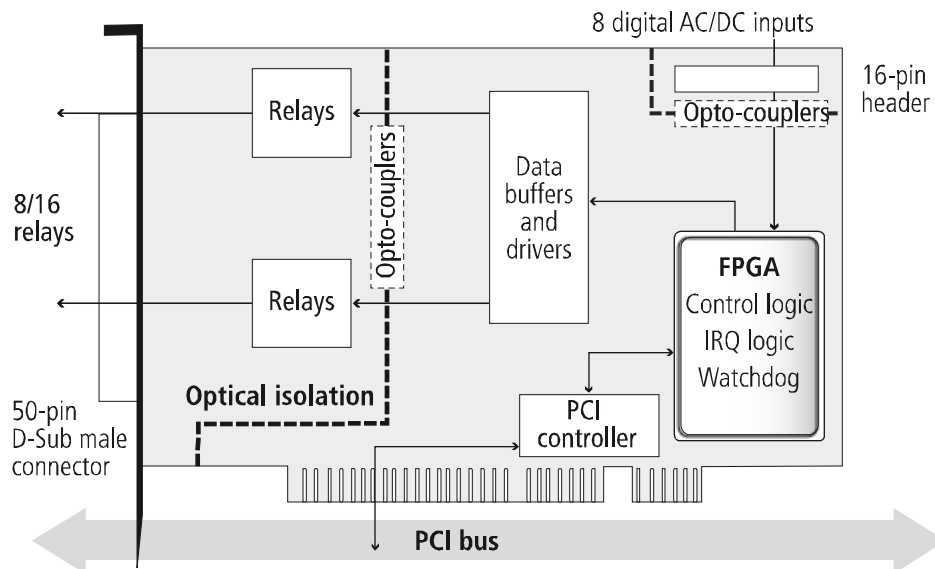
Fig. 7-7: Connection of the cable ST370-16



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 V
- logic "0" corresponds to an input voltage < 6 V.

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



NOTICE!

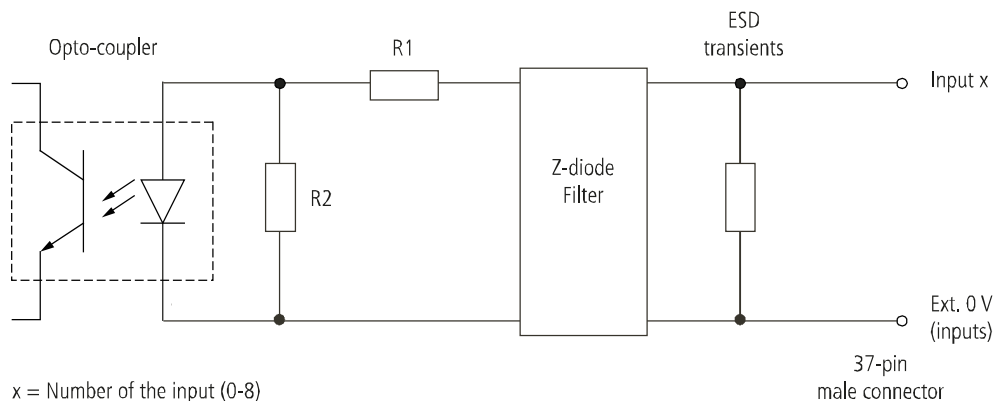
If you operate all inputs with the same voltage supply, the voltage supply must deliver at least $32 \times 6 \text{ mA} = 192 \text{ mA}$ at $V_{cc \text{ ext.}} = 24 \text{ V}$.

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

- If you have any questions, do not hesitate to contact us:
Phone: +49 7229 1847-0
E-mail: info@addi-data.com

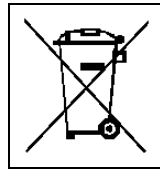
10.2 Disposal of ADDI-DATA waste equipment

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.

11 INDEX

- Accessories 10
 - Connection cables 17
- Application 6
- Block diagram 23
- Connection examples 21
 - creeping distance 13
- Digital inputs (option)
 - Function description 24
- Dimensions 10
- Disposal 27
- driver installation 16
- EMC
 - Electromagnetic compatibility 10
- Energy requirements 11
- Handling 9
- Input circuit 24
- Inputs
 - Limit values 12
- Installation of the board 14
- Intended use 6
- Limit values 11
- Limits of use 8
- Pin assignment 18
- Relay
 - Limit values 12
- Relay outputs
 - Connection 19
- Repair 26
- Return 26
- Slots 14
- Standard software 25
- Technical data 10
- Update
 - Driver 16
 - Manual 16
- Updates 16
- User
 - Qualification 8
- Versions 11
- Watchdog 23
- Weight 10