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Technical description

APCI-1032,
APCI-1564, APCI-2032

Digital I/O boards, optically isolated

Edition: 08.05 – 11/2007

Product information

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WARNING

In case of wrong uses and if the board is not used for the purpose it is intended:



- **people may be injured,**



- **the board, PC and peripheral may be destroyed,**



- **the environment may be polluted**

- **Protect yourself, the others and the environment!**
- **Read carefully the safety precautions (yellow leaflet).**

  If this leaflet is not with the documentation, please contact us and ask for it.

- **Observe the instructions of the manual.**

  Make sure that you do not forget or skip any step. We are not liable for damages resulting from a wrong use of the board.

- **Used symbols:**

IMPORTANT!
designates hints and other useful information.

WARNING!
It designates a possibly dangerous situation.
If the instructions are ignored the board, PC and/or peripheral may be destroyed.

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1 DEFINITION OF APPLICATION

1.1 Intended use

The boards **APCI-1032, APCI-1564** and **APCI-2032** must be inserted in a PC with PCI 5V/32-bit slots which is used as electrical equipment for measurement, control and laboratory pursuant to the norm EN 61010-1 (IEC 61010-1). The used personal computer (PC) must fulfil the requirements of IEC 60950-1 or EN 60950-1 and 55022 or IEC/CISPR 22 and EN 55024 or IEC/CISPR 24.

The use of the boards **APCI-1032, APCI-1564** and **APCI-2032** in combination with external screw terminal panels requires correct installation according to IEC 60439-1 or EN 60439-1 (switch cabinet / switch box).

1.2 Usage restrictions

The boards **APCI-1032, APCI-1564** and **APCI-2032** must not to be used as safety related part (SRP).

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

The boards **APCI-1032, APCI-1564** and **APCI-2032** must not be used in potentially explosive atmospheres.

The boards **APCI-1032, APCI-1564** and **APCI-2032** must not be used as electrical equipment according to the Low Voltage Directive 2006/95/EC.

1.3 General description of the board

Data exchange between the **APCI-1032, APCI-1564** and **APCI-2032** boards and the peripheral is to occur through a shielded cable. This cable must be connected to the 37-pin SUB-D male connector of the boards.

The board are used for processing digital signals (See Limit values):
- the board **APCI-1032** has 32 input channels, in 5 V, 12 V or 24 V version
- the board **APCI-1564** has 32 input channels and 32 output channels in 5 V or 24 V version
- the board **APCI-2032** has 32 output channels, in 5 V or 24 V version.

An external 24 V supply voltage is necessary to run the output channels.
The screw terminal panel **PX901** and the relay board **PX8500** allow connecting the 24 V supply voltage through a shielded cable

The use of the board **APCI-1032, APCI-1564 and APCI-2032** in combination with external screw terminal panel or relay boards is to occur in a closed switch cabinet.

The installation is to be effected competently. **Check the shielding capacity** of the PC housing and of the cable prior to putting the device into operation.

The connection with our standard cable **ST010** and **ST022** complies with the specifications:

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

The functions of the boards are to be used according to their intended purpose.

The use of the board according to its intended purpose includes observing all advises given in this manual and in the safety leaflet.

Uses beyond these specifications are not allowed. The manufacturer is not liable for any damages which would result from the non-observance of this clause.

The use of the board in a PC could change the PC features regarding noise emission and immunity. Increased noise emission or decreased noise immunity could result in the system not being conform anymore.

Make sure that the board remains in its protective blister pack **until it is used**.

Do not remove or alter the identification numbers of the board.
If you do, the guarantee expires.

2 USER

2.1 Qualification

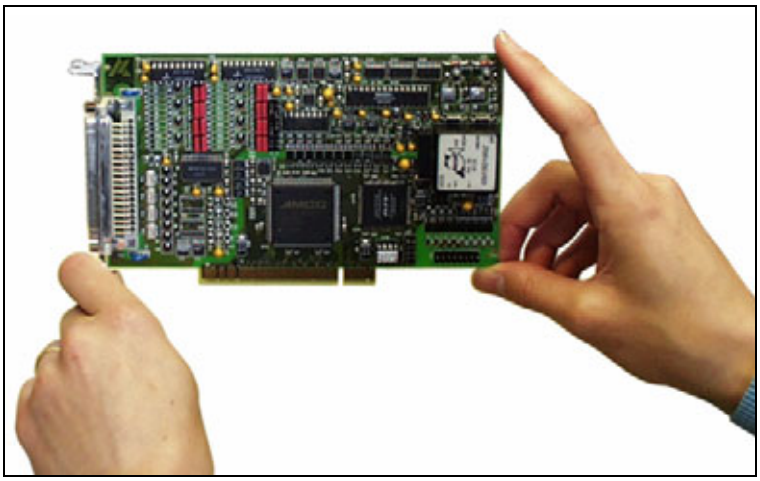
Only persons trained in electronics are entitled to perform the following works:
- installation
- use,
- maintenance.

2.2 Personal protection

Consider the country-specific regulations about:
- the prevention of accidents
- electrical and mechanical installations
- radio interference suppression.

3 HANDLING OF THE BOARD

Fig. 3-1: Correct handling



4 TECHNICAL DATA

4.1 Electromagnetic compatibility (EMC)

The boards **APCI-1032, APCI-1564** and **APCI-2032** comply with the European EMC directive. The tests were carried out by a certified EMC laboratory in accordance with the norm from the EN 61326 series (IEC 61326). 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.



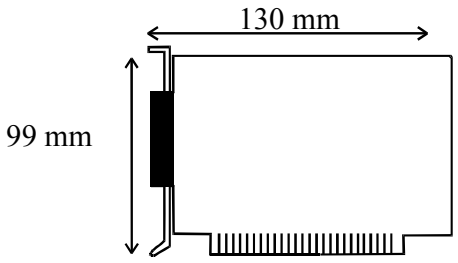
WARNING !
The EMC tests have been carried out in a specific appliance configuration. We guarantee these limit values only in this configuration[1].

4.2 Physical set-up of the board

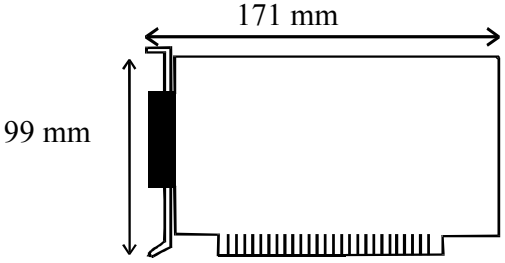
The board is assembled on a 4-layer printed circuit card.

Dimensions:

APCI-1032, APCI-2032 (PCI short board)



APCI-1564



Weight: ..... approx. 160 g
Installation in: ..... 32/64-bit PCI slot 5 V
Connection to the peripheral: ..... 37-pin SUB-D male connector
Accessories[2]:
Standard cables: **ST010, ST011, ST022**
Screw terminal panel: ..... **PX901-D, PX901-DG, PX901-ZG** or **PX9000**
Relay output board: **PX8500**
ACPI-1564: ribbon cable **FB1564** for the digital inputs

[1] We can transmit you the configuration on request.
[2] Not included in the standard delivery.



WARNING!
The supply lines must be installed safely against mechanical loads.

4.3 Versions

The boards are available in the following versions:

APCI-1032: 32 digital inputs

	APCI-1032	APCI-1032-12	APCI-1032-5
Input voltage	24 V	12 V on request	5 V on request

APCI-2032: 32 digital outputs

	APCI-2032	APCI-2032-5
Output voltage	24 V	5 V on request

APCI-1564: 32 digital inputs and 32 digital outputs



WARNING for the APCI-1564!
When all inputs are connected, the temperature of the printed circuit card increases.

Make sure that the maximum supply voltage of 26 V is not exceeded. Please consider the given Limit values. (See below)

	APCI-1564	APCI-1564-5
Input voltage	24 V	5 V on request
Output voltage	24 V	5 V on request

4.4 Limit values

Max. altitude: ..... 2000 m
Operating temperature: ..... 0 to 60°C
Storage temperature: ..... -25 to 70°C
Relative humidity at indoor installation
50% at +40 °C
80% at +31 °C

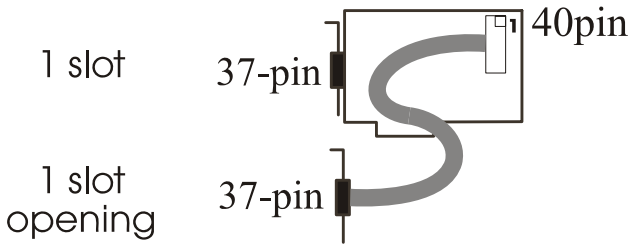
Minimum PC requirements:
PCI BIOS from Version 1.0

Bus speed: ..... < 33 MHz
Operating system: ..... Windows NT, 98, 2000, XP

Energy requirements:
APCI-1032
- Operating voltage of the PC: ..... 5 V ± 5%
- Current consumption (without load): ..... 180 mA ± 10 mA

APCI-2032
External operating voltage:
APCI-2032: ..... 24 V ± 5%
APCI-2032-5: ..... 5 V-12 V ± 5%
Max. current consumption1 (+ 5 V from PC):
APCI-2032: ..... 224 mA ± 10%
APCI-2032-5 ..... 222 mA ± 10%
APCI-1564
External operating voltage:
APCI-1564: ..... 24 V ± 5%
APCI-1564-5: ..... 5 V-12 V ± 5%
Max. current consumption[3]
(+ 5 V from PC):..... 380 mA ± 10 %

Number of slot required:
APCI-1032, APCI-2032: 1
APCI-1564: ..... 1+1



4.4.1 Digital inputs

24 V digital input channels
Input type: ..... mass related inputs
Number of input channels: 32
Nominal voltage: ..... 24 VDC

[3] All inputs and/or outputs are connected.

	APCI-1032	APCI-1564	
	32 (Channels 0 to 31)	**Channels 0 to 3**	**Channels 4 to 31**
Interruptible inputs	16 (Channels 0 to 15)	-	16 (channels 4 to 19)
Input current at nominal voltage	5 mA	10,5 mA	5 mA
Logic input level (Standard) U_H[4] max.: U_H min.: U_L[5] max.: U_L min.:	 30 V / 7.3 mA typ. 19 V / 3.2 mA typ. 14 V / 1.3 mA typ. 0 V	 26 V / 12.3 mA typ. 19 V / 5.5 mA typ. 14 V / 0.7 mA typ. 0 V	 26 V / 5 mA typ. 19 V / 3.2 mA typ. 14 V / 1.3 mA typ. 0 V
Signal delay (at nominal voltage)	70 µs	1 µs	70 µs
Maximum input frequency (at nominal voltage)	5 kHz	500 kHz	5 kHz

12 V digital input channels (APCI-1032)

Input type: ..... mass related inputs
Number of input channels: 32
Interruptible inputs: ..... 16 (input 0 to 15)
Nominal voltage: ..... 12 VDC
Input current at nominal voltage: ..... 6 mA
Logic input level: ..... U_H max.: 16 V / 9 mA typ.
U_H min.: 8 V / 2 mA typ.
U_L max.: 6 V / 0.7 mA typ.
U_L min.: 0 V
Signal delay: ..... 70 µs (at nominal voltage)
Maximum input frequency: ..... 5 kHz (at nominal voltage)

5 V digital input channels

Input type: ..... mass related inputs
Number of input channels: 32
Nominal voltage: ..... 5 VDC

	APCI-1032	APCI-1564	
	32 (channels 0 to 31)	**Channels 0 to 3**	**Channels 4 to 31**
Interruptible inputs	16 (channels 0 to 15)	-	16 (channels 4 to 19)
Input current at nominal voltage	6 mA	8.5 mA	6 mA

[4] U_H: Eingangsspannung, logisch "1"

[5] U_L: Eingangsspannung, logisch "0"

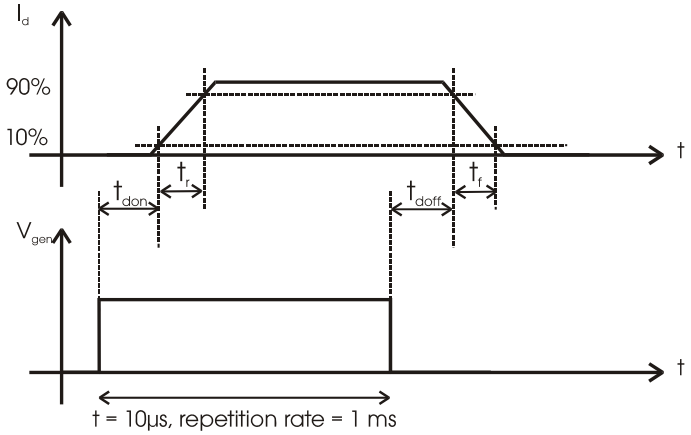
Logic input level (Standard) U_H[6] max.: U_H min.: U_L[7] max.: U_L min.:	 6 V / 8.4 mA typ. 4V / 4 mA typ. 2 V / 0.7 mA typ. 0 V	 6 V / 11.3 mA typ. 4 V / 5.5 mA typ. 2 V / 1 mA typ. 0 V	 6 V / 8.4 mA typ. 4 V / 4 mA typ. 2 V / 0.8 mA typ. 0 V
Signal delay (at nominal voltage)	70 µs	1 µs	70 µs
Maximum input frequency (at nominal voltage)	5 kHz	500 kHz	5 kHz

Safety (all boards)
Optical isolation
(DIN VDE 0411-100): ..... 1000 V (from the PC to the external peripheral).

4.4.2 Digital outputs

Switching times of the outputs - complies with norm IEC 1131
3 switching times are defined for the outputs.

Fig. 4-1: Switching times of the digital outputs



Output delay time: t_{don} or t_{doff}
Output transfer time for transition 0 → 1: Rising time (t_r)
Output transfer time for transition 1 → 0: Falling time (t_f)

24 V digital output channels
Output type: ..... high side (load at ground)
Number of output channels: 32
Nominal voltage: ..... 24 VDC
Range of the supply voltage: ..... 10 V to 36 VDC (over 24 V ext. pins)
Max. output current
for outputs 0-15: ..... 3 A typ. (fused through PTC resistors)

[6] U_H: Eingangsspannung, logisch "1"

[7] U_L: Eingangsspannung, logisch "0"

for outputs 16-31: ..... 3 A typ. (fused through PTC resistors)
Max. output current / output channel: ..... 500 mA
Short-circuit current / output channel at 24 V,
R_{load} < 0.1 Ω: ..... 1.5 A max.: switches off the component (4 channels)
ON-resistor of the output channel
(R_{DS} ON resistor): ..... 0.4 Ω max.
Overtemperature: ..... ϑ_{IC} > 170°C: switches off the component (4 channels)
Temperature hysteresis: ..... 20°C

Switching time of the 24 V outputs
Rising time (t_r): ..... typ. 94 µs, max. 250 µs
Falling time (t_f): ..... typ. 8 µs, max. 20 µs
Output delay times
Switch ON time: ..... typ. 52 µs, max. 150 µs + delay time of the opto-couplers
Switch OFF time: ..... typ. 80 µs, max. 150 µs + delay time of the opto-couplers

Interruptible diagnostics, read back through status bit
ϑ-diagnostic: ..... Pin 19 (24V/10 mA) is switched on in case of overload of the outputs or overtemperature
V_{cc}-diagnostic: ..... is switched on in case of voltage drop < 5 V

Safety (24 V outputs)
Optical isolation
(DIN VDE 0411-100): ..... 1000 V (from the PC to the external peripheral).
Watchdog: ..... 8-bit watchdog. programmable times from 20 ms to 5 s in steps of 20 ms are available.

5 V digital output channels
Output type: ..... open collector
Number of output channels: 32
Nominal voltage: ..... 5 VDC
Range of the supply voltage: ..... 5 V to 12 VDC (over 5 V ext. pins)
Max. output current
per output component (8 channels): ..... 400 mA typ. (fused through PTC resistors)
Max. output current / output channel: ..... 50 mA
Short-circuit current / output channel at 5 V,
R_{load} < 0.1 Ω: ..... → 400 mA: limited through PTC

Switching time of the 5 V outputs

Rising time (t_r):	typ. 280 ns, max. 560 ns
Falling time (t_f):	typ. 100 ns, max. 200 ns
Output delay times	
Switch ON time:	typ. 18 µs, max. 100 µs + delay time of the opto-couplers
Switch OFF time:	typ. 1.5 µs, max. 150 µs + delay time of the opto-couplers
External V_{cc} < 3 V:	V_{cc}-diagnostic is interruptible, can be read back through status bit

Safety (5 V outputs)

Optical isolation (DIN VDE 0411-100):	1000 V (from the PC to the external peripheral).
Watchdog:	8-bit watchdog. programmable times from 20 ms to 5 s in steps of 20 ms are available.

5 V digital outputs type UDN2982

Output type:	High Side
Number of outputs:	32
Nominal voltage:	24 VDC
Range of supply voltage:	5 V to 35 VDC (over 24 V ext. pins)
Max. output current (in mA typ.):	
per output driver (8 channels):	400 mA (fused through PTC).
Max. output current:	50 mA
Short circuit current/output at 24 V,	
R_{last} < 0,1 Ω:	→ 400 mA (limited through PTC)
Switch ON time UDN2982 (t_r):	typ. 1 µs, max. 2 µs
Switch OFF time UDN2982 (t_f):	typ. 5 µs,, max. 10 µs,
Switch delay signal chain optocoupler and driver UDN2982	
at switching on:	typ. 18 µs, max. 100 µs + (optocoupler delay)
at switching off:	typ. 27 µs, max. 150 µs (optocoupler delay)
External V_{cc} < 3 V:	V_{cc}-diagnosis is interruptible Rereadable status bit

Short circuit:
Over the PTC all channels are switched off when thermal overload of the component.

Timer, interruptible (only for APCI-1564)

Number:	1
Timer depth:	12-bit
Time unit:	µs, ms, s

Counter, interruptible (only for APCI-1564)

Number:	3

Counter depth: ..... 32 bit
Reload value: ..... 32 bit, programmable

4.5 Component schemes

Fig. 4-2: Component scheme of the APCI-1032, 24-V version

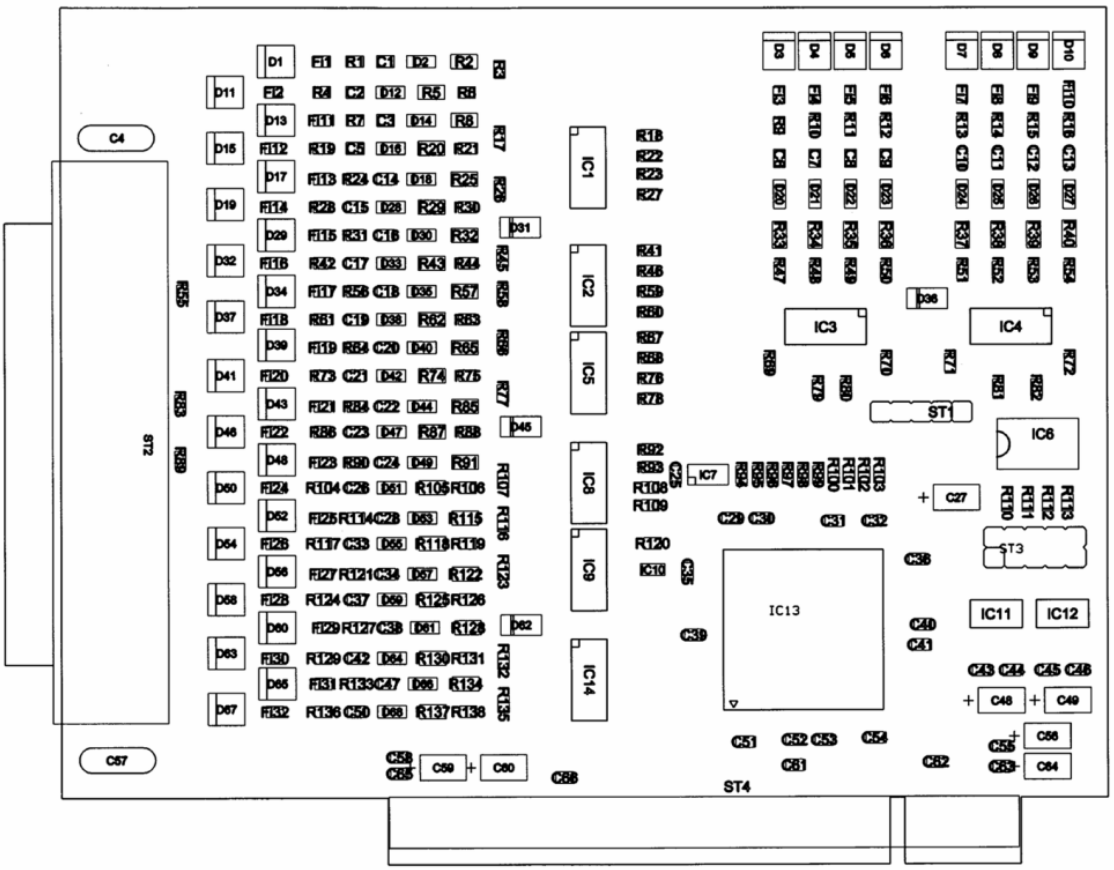


Fig. 4-3: Component scheme of the APCI-1564

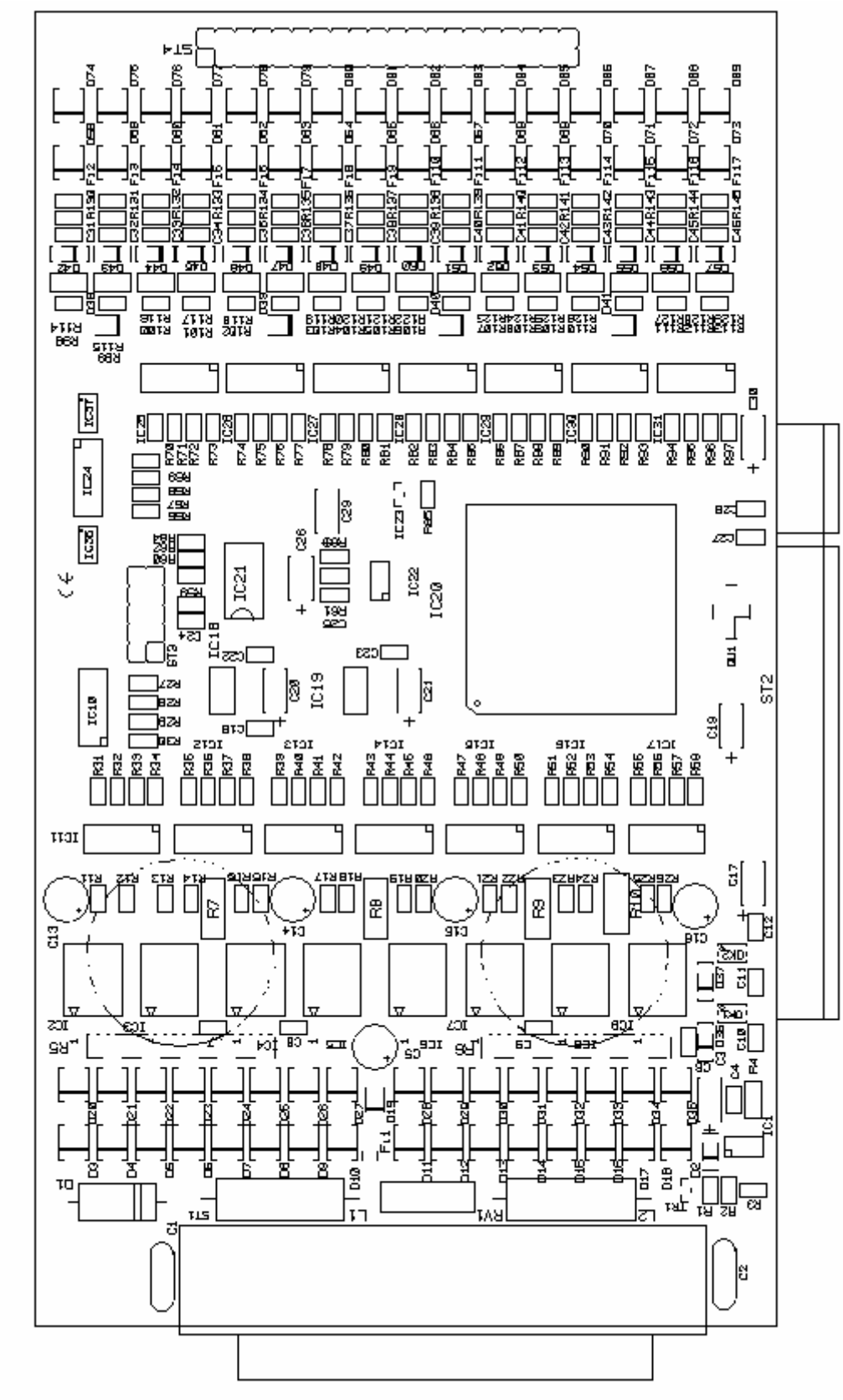
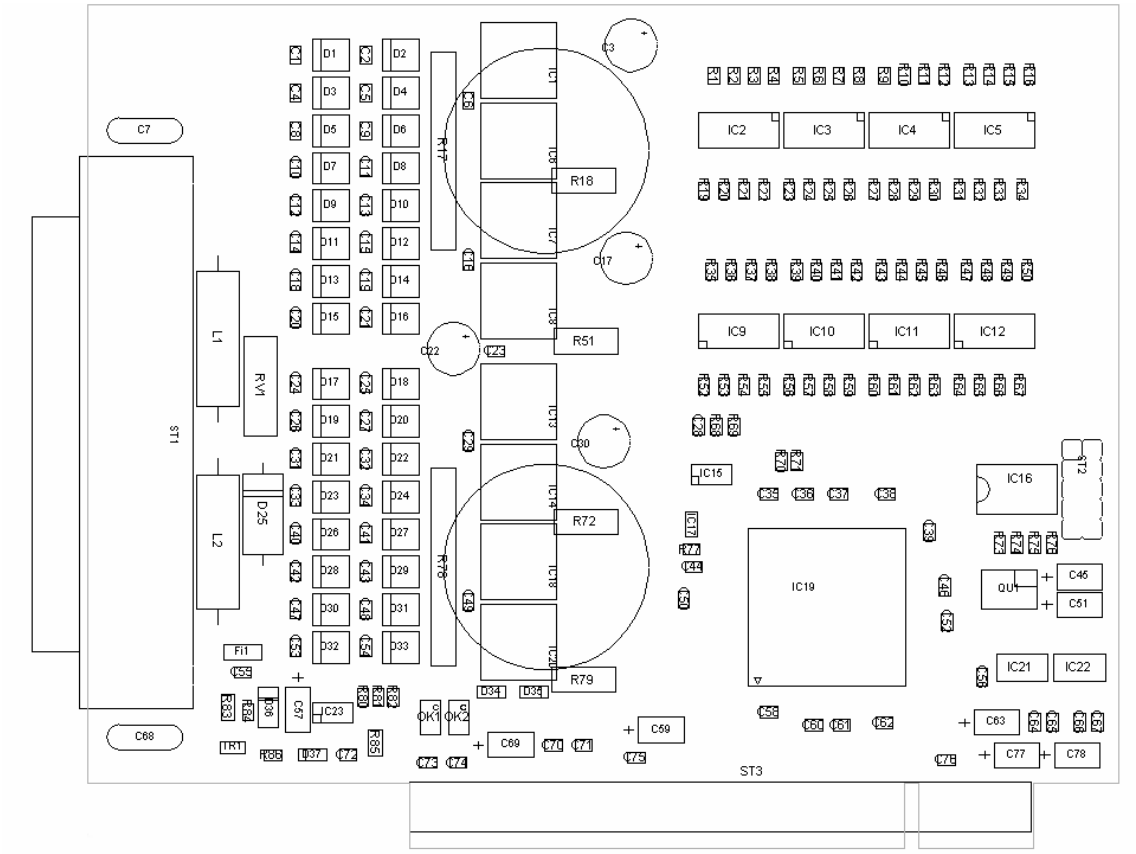


Fig. 4-4: Component scheme of the APCI-2032



5 INSTALLATION OF THE BOARD

IMPORTANT!
Do observe the safety precautions (yellow leaflet)!

5.1 Opening the PC

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

5.2 Selecting a free slot

Insert the board in a free PCI-5V slot (32-bit).

Fig. 5-1: PCI-5V slot (32-bit)



Remove the back cover of the selected slot according to the instructions of the PC manufacturer. Keep the back cover. You will need it if you remove the board

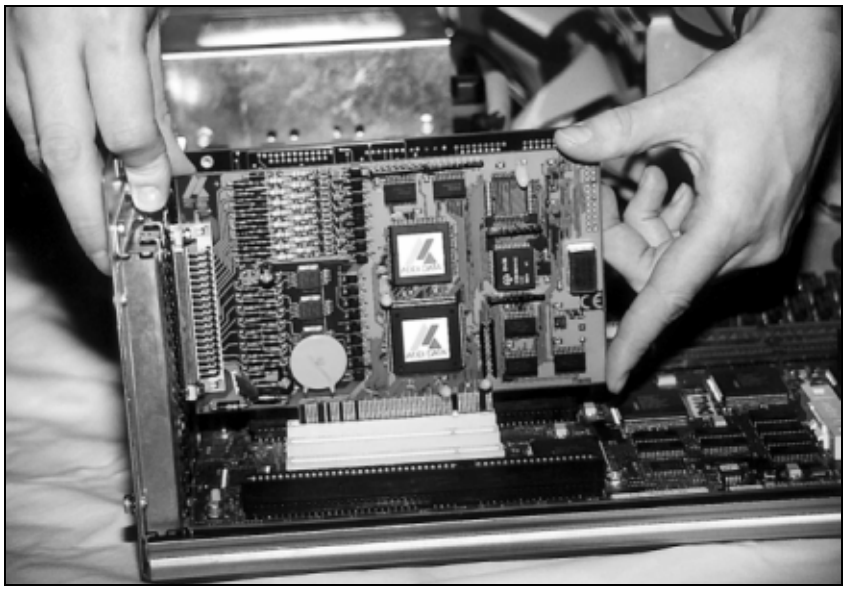
Discharge yourself from electrostatic charges.

Take the board out of its protective pack.

5.3 Plugging the board into the slot

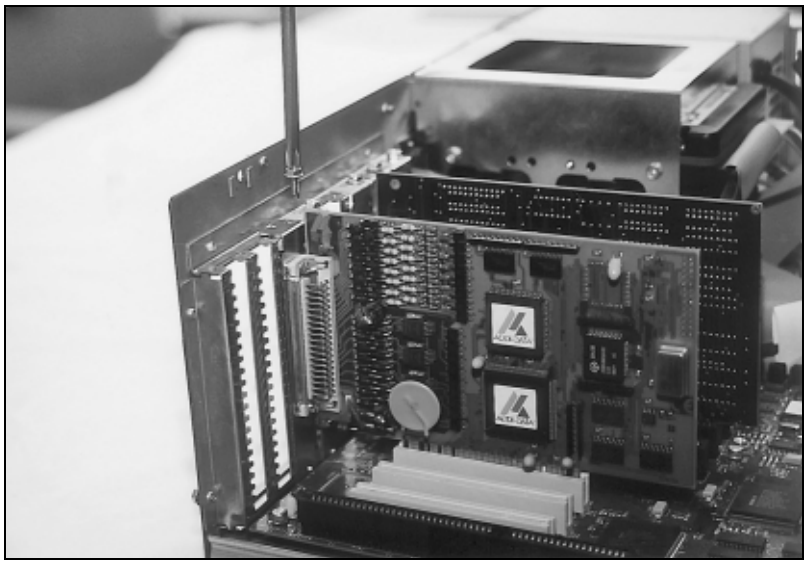
♦ Insert the board **vertically into the chosen slot.**

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 the loosen screws.**

5.4 Closing the PC

♦ **Close your PC as described in the manual of the PC manufacturer.**

6 SOFTWARE

In this chapter you will find a description of the delivered software and its possible applications.

IMPORTANT!
Further information for installing and uninstalling the different drivers is to be found in the delivered description **"Installation instructions for the PCI and ISA bus".**

A link to the corresponding PDF file is available in the navigation pane (Bookmarks) of Acrobat Reader.

IMPORTANT!
The supported software functions for the **APCI-1032**, **APCI-1564** and **APCI-2032** are listed in chapter 9.

The board is supplied with a CD-ROM containing the ADDIPACK software package for Windows NT 4.0 and Windows XP/2000/98.

ADDIPACK is composed of following programs:

- **ADDIREG:** The ADDIREG registration program is a 32-bit program for Windows NT 4.0 and Windows XP/2000/98. The user can register all hardware information necessary to operate the ADDI-DATA PC boards.

- **ADDIDRIVER** contains API functions to operate the ADDI-DATA boards in 32 bits.

- **ADDevice Manager** configures the resources of the ADDI-DATA virtual board (See below).

- **ADDI-DATA virtual board:**
  ADDI-DATA software is based on the principle of a **virtual board:** it transposes the different functions (e.g. digital inputs, analog outputs, timer, ...) of all inserted ADDI-DATA boards as the functions of a single (virtual) board. The virtual board features a pool of functions, the functionality of which can be called up without calling a specific board.

- **ADDEVICE MAPPER** was specifically developed for the ADDIPACK boards to facilitate the management of the virtual board. With this program you can optimally adapt the virtual board to your application requirements.

  IMPORTANT!
  For some functions of the **ADDEVICE MAPPER** program the browser Internet Explorer 6 or higher has to be installed on your PC.

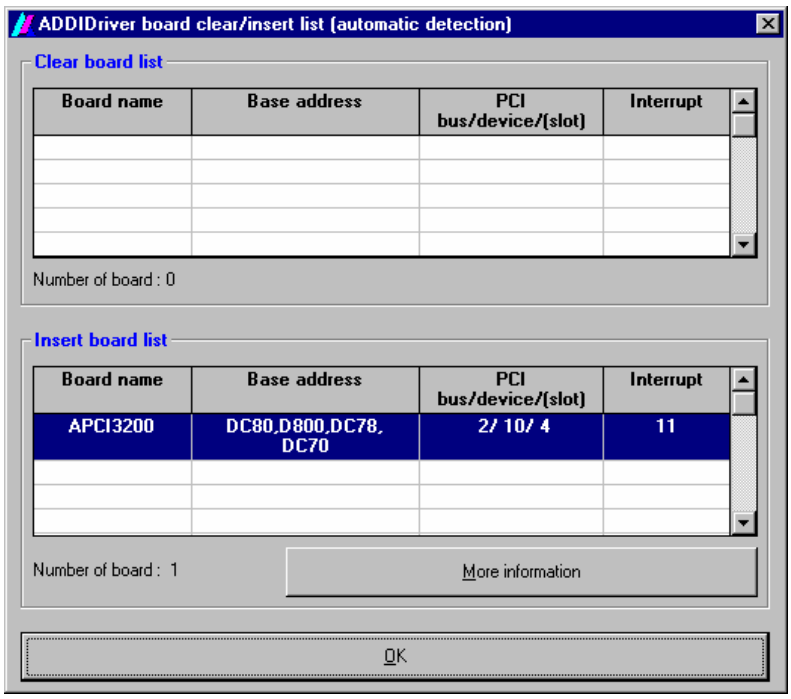
6.1 Board registration

When starting the set-up of ADDIREG, the **APCI-1032**, **APCI-1564** and **APCI-2032** are automatically recognised and registered.

6.1.1 Installation of a new board

If a new board is recognised, the following window is displayed:

Fig. 6-1: New inserted board



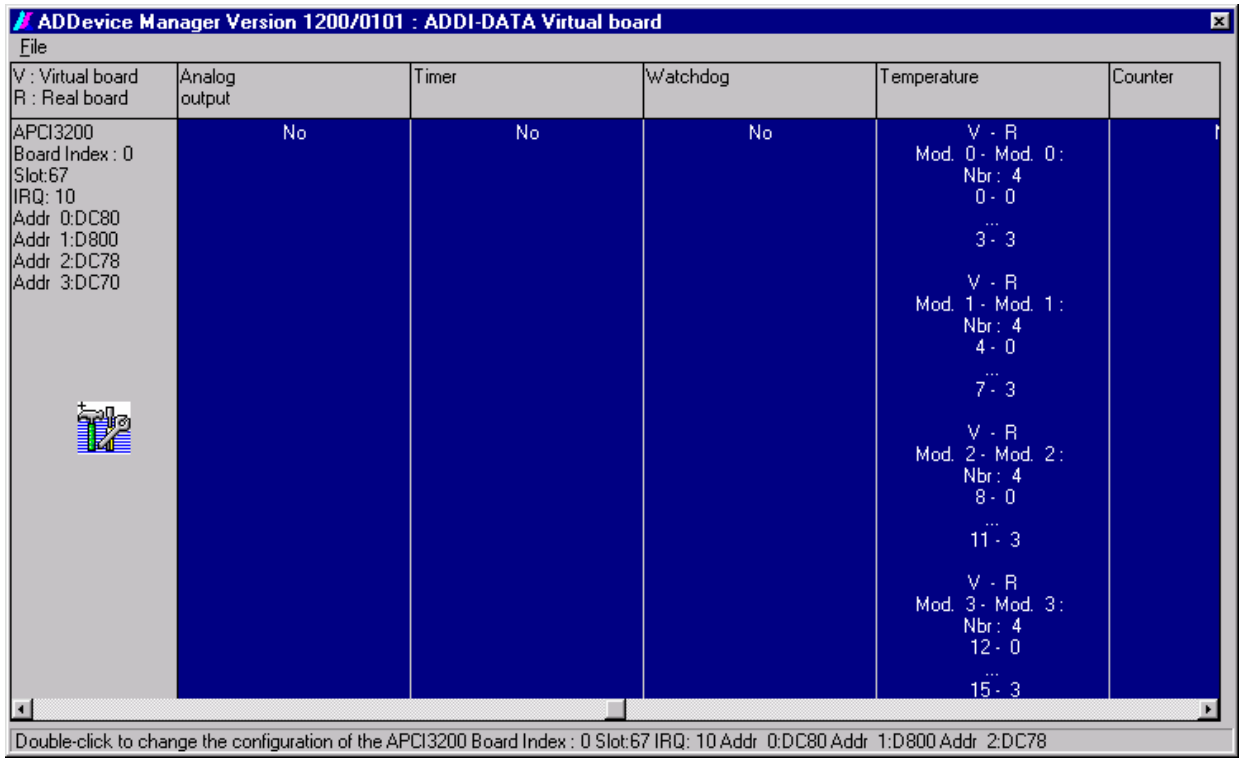
The boards which have been removed from the PC since the last ADDIREG start are listed in the upper table

The new inserted boards are listed in the lower table.

In case further information is required for the operation of the board, click on "More Information". ADDevice Manager is started.

ADDevice Manager

Fig. 6-2: ADDevice Manager



The following parameters are displayed for every inserted board:

First column:
- Board name
- Board index: Number allocated to the board when it is registered in ADDIREG.
- Slot number
- IRQ line
- Different addresses which are automatically allocated to the board by the BIOS.

Other columns:

The program distinguishes between the resources (Analog/digital input/output, watchdog, ...) of the virtual board (**V,** software) and the real board (**R,** board).

The following parameters are listed
- Module number,
- Number of resources
- Index: The first index line represents the number of the first resource (left: virtual resource - right: real board) The second index line represents the number of the last resource (left: virtual resource - right: real board).
- Type (24 V/5 V, voltage/current, HS/OC - High-Side/Open collector).
- IRQ: if the input channels are interruptible, the program displays the number of the first and of the last input channel

By clicking twice within a column, the connection principle and the technical data of the resource are displayed. This function is only possible if a question mark appears with the cursor.

You can export the set configuration as a text file. Click on "file" and save the configuration as a .txt file with "Export information to file...". You can then print the configuration or use it for other boards.

Once you have controlled the registration, you can quit the window of ADDevice Manager. The board is ready to operate.

6.1.2 Changing the registration of a board

You can change the current board configuration with ADDIREG

Description of the ADDIREG program

The program is automatically installed with ADDIPACK.
Start ADDIREG under Start/Programme/ADDIPACK/ADDIREG.

IMPORTANT!
First quit all the applications (programs) which use the board before starting the ADDIREG program.

In the main window of ADDIREG the fields "Insert" and "Clear" are not available for the board.

Fig. 6-3: ADDIREG registration program (example)

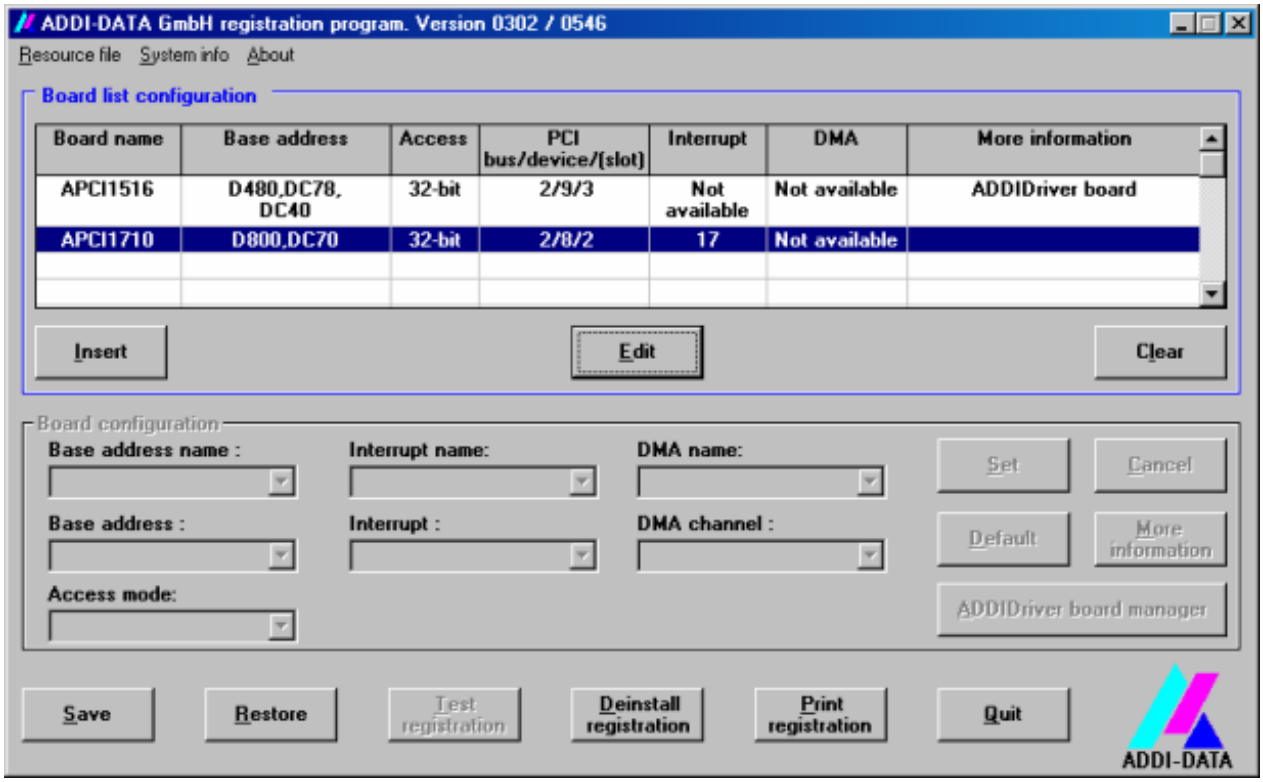


Table:

Board name:
Names of the different registered boards (e.g.: APCI-3200).

Base address:
Selected base address of the board. For PCI boards the base address is allocated through BIOS.

Access:
Selection of the access mode for the ADDI-DATA digital boards.
Access in 8-bit or 16-bit or 32-bit mode.

PCI bus/device/(slot):
Number of the used PCI bus, slot, and device. If the board is no PCI board, the message "NO" is displayed.

Interrupt:
Used interrupt of the board. If the board supports no interrupt, the message "Not available" is displayed.

DMA:
Indicates the selected DMA channel or "Not available" if the board uses no DMA or if the board is no ISA board.

More information:
Additional information like the identifier string or the installed COM interfaces. It also displays whether the board is programmed with ADDIDRIVER.

Text boxes:

Base address name:
Description of the used base addresses for the board. Select a name through the pull-down menu. The corresponding address range is displayed in the field below (Base address).

Interrupt name:
Description of the used IRQ lines for the board. Select a name through the pull-down menu. The corresponding interrupt line is displayed in the field below (Interrupt).

DMA name (for ISA boards only):
When the board supports 2 DMA channels, you can select which DMA channel is to be changed.

DMA channel (for ISA boards only):
Selection of the used DMA channel.

Buttons:

Edit:
Selection of the highlighted board with the different parameters set in the text boxes.

Set:
Sets the parametered board configuration. The configuration should be set before you save it.

Cancel:
Reactivates the former parameters of the saved configuration.

Default:
Sets the standard parameters of the board.

More information (not available for the boards with ADDIPACK)
You can change the board specific parameters like the identifier string, the COM number, the operating mode of a communication board, etc...
If your board does not support these information, you cannot activate this button.

ADDIDriver Board Manager:
Under Edit/ADDIDriver Board Manager you can check or change the current settings of the board set through the ADDEVICE Manager.
ADDevice Manager starts and displays a list of all resources available for the virtual board.

Test registration:
Controls if there is a conflict between the board and other devices installed in the PC. A message indicates the parameter which has generated the conflict. If no conflict has occurred, "Test of device registration OK" is displayed.

Deinstall registration:
Deinstalls the registrations of all boards listed in the table and deletes the entries of the boards in the Windows Registry.

Print registration:
Prints the registration parameter on your standard printer.

Quit:
Quits the ADDIREG program.

Registration test

Under "Test registration" you can test if the registration is "OK".
This test controls if the registration is right and if the board is present. If the test has been successfully completed you can quit the ADDIREG program. The board is initialised with the set parameters and can now be operated.

In case the registration data is to be modified, it is necessary to boot your PC again. A message asks you to do so. When it is not necessary you can quit the ADDIREG program and directly begin with your application.

6.2 Questions and software downloads on the web

Do not hesitate to e-mail us your questions.
per e-mail: info@addi-data.de or
hotline@addi-data.de

Free downloads of standard software

You can download the latest version of the software for the board

http://www.addi-data.com

IMPORTANT!
Before using the board or in case of malfunction during operation, check if there is an update of the product (technical description, driver). The current version can be found on the internet or contact us directly.

7 CONNECTING THE PERIPHERAL

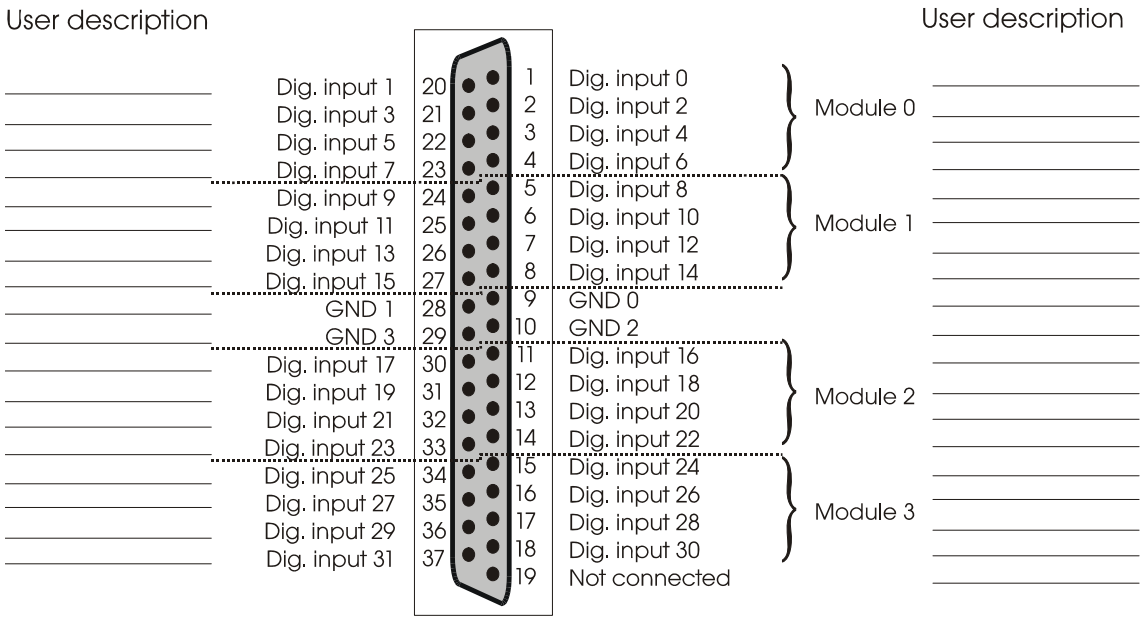
7.1 Digital inputs

WARNING for the APCI-1564!
When all inputs are connected, the temperature of the printed circuit card increases.

Make sure that the maximum supply voltage of 26 V is not exceeded. Please consider the given limit values. (See 0 Digital inputs)

7.1.1 Connector pin assignment

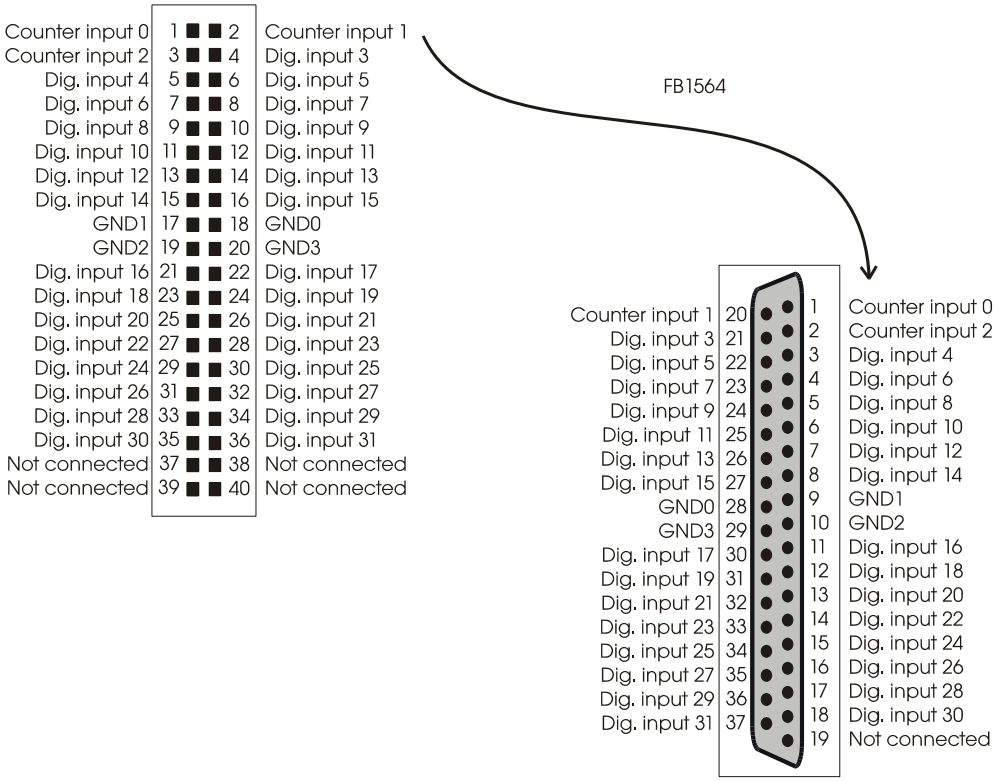
Fig. 7-1: 37-pin SUB-D connector (APCI-1032)



Each module (8 digital inputs) is connected to a common ground line.

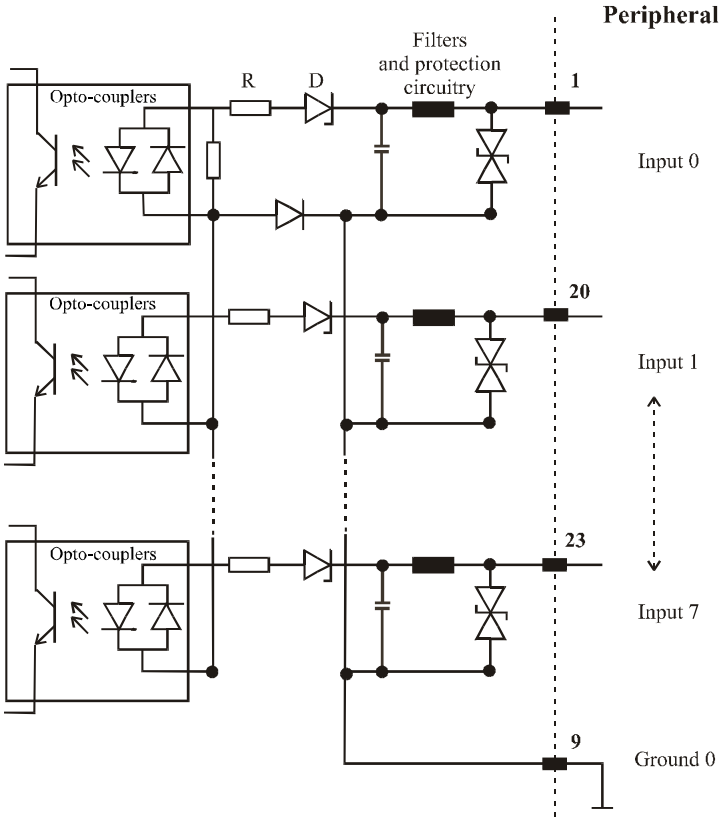
Fig. 7-2: 37-pin SUB-D connector (APCI-1564)

The digital inputs channels are connected to the peripheral through a ribbon cable.



7.1.2 Connection principle

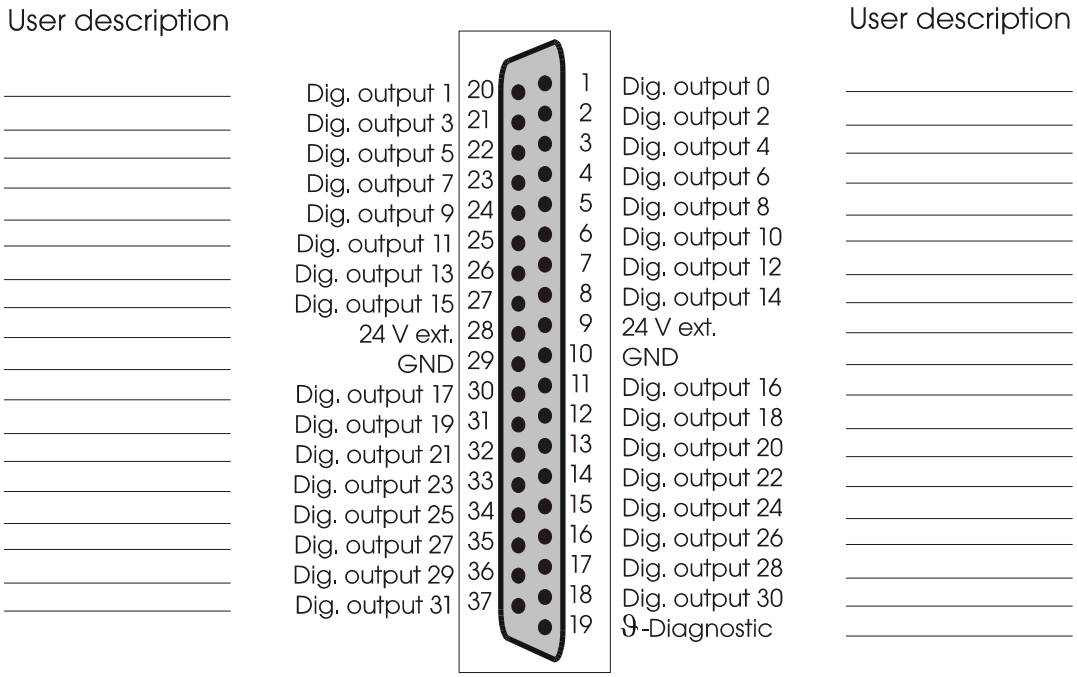
Fig. 7-3: Connection principle: Example for module 0



7.2 Digital outputs - 24 V

7.2.1 Connector pin assignment

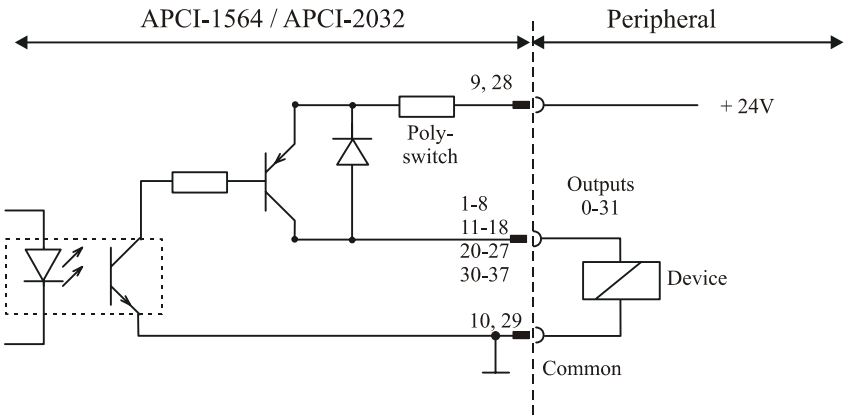
Fig. 7-4: 37-pin SUB-D front connector (24 V)



7.2.2 Connection principle

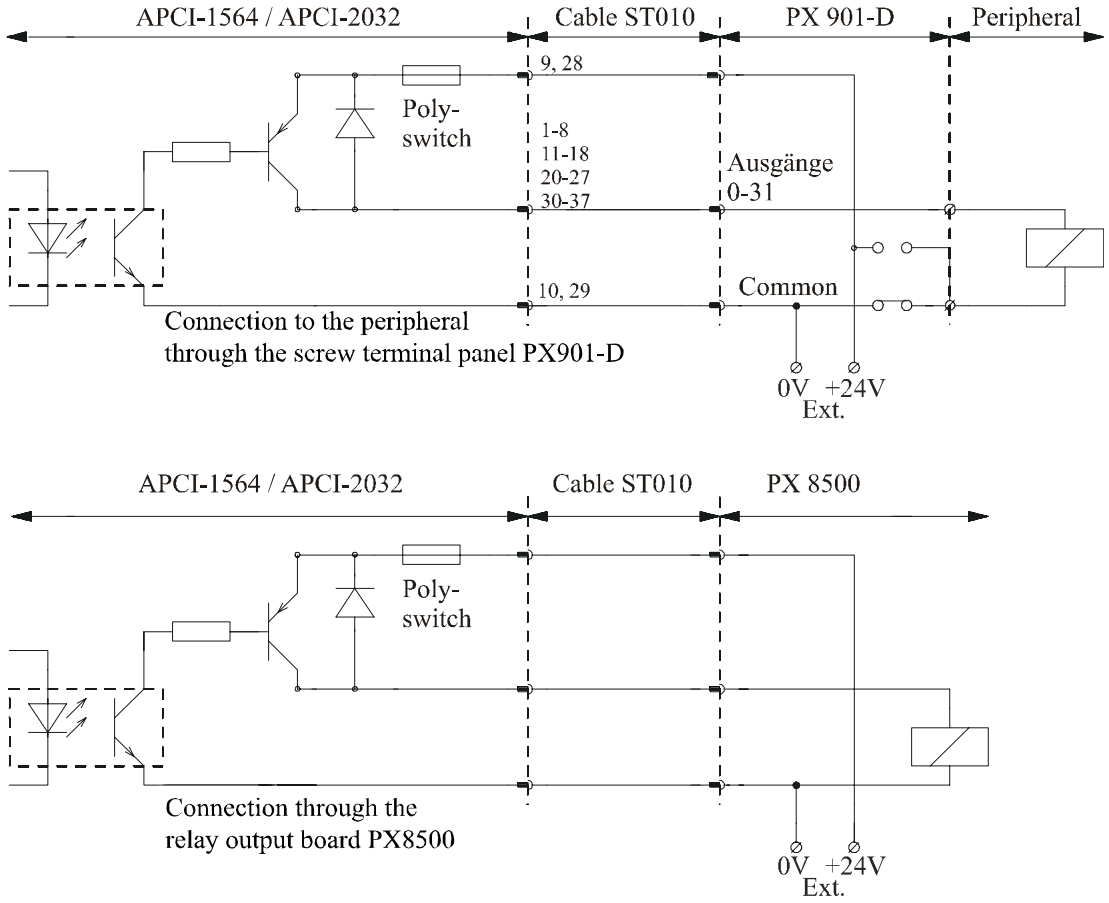
The outputs switch the **+24V ext.** outside to the load. One end of the load is connected to the 0V ext. ground. The outputs have 2 common ground lines: 0V EXT (outputs) at the 37-pin SUB-D male connector.

Fig. 7-5: Connection principle of the 24 V outputs



7.2.3 Connection examples

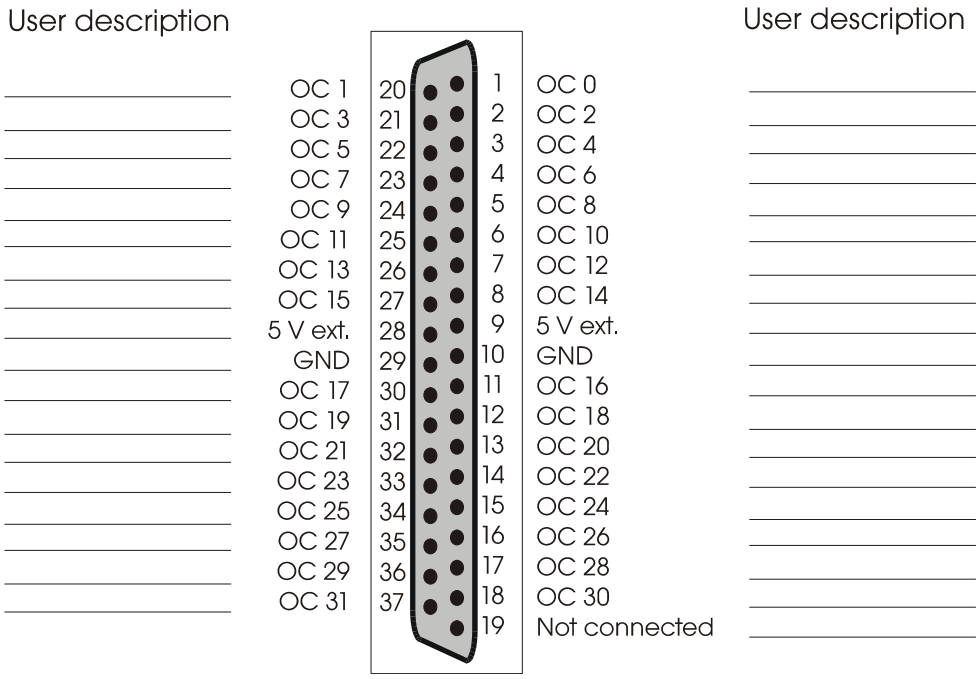
Fig. 7-6: Connection example for the 24 V outputs



7.3 Digital outputs - 5 V

7.3.1 Connector pin assignment

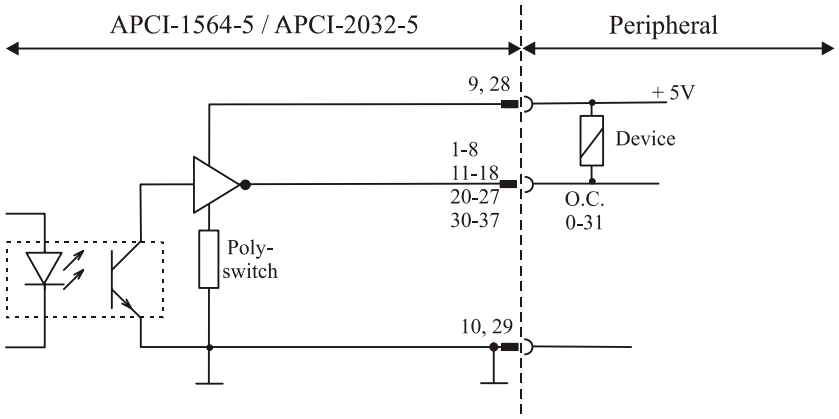
Fig. 7-7: 37-pin SUB-D connector



The outputs are driven as open collectors; the ground is switched.

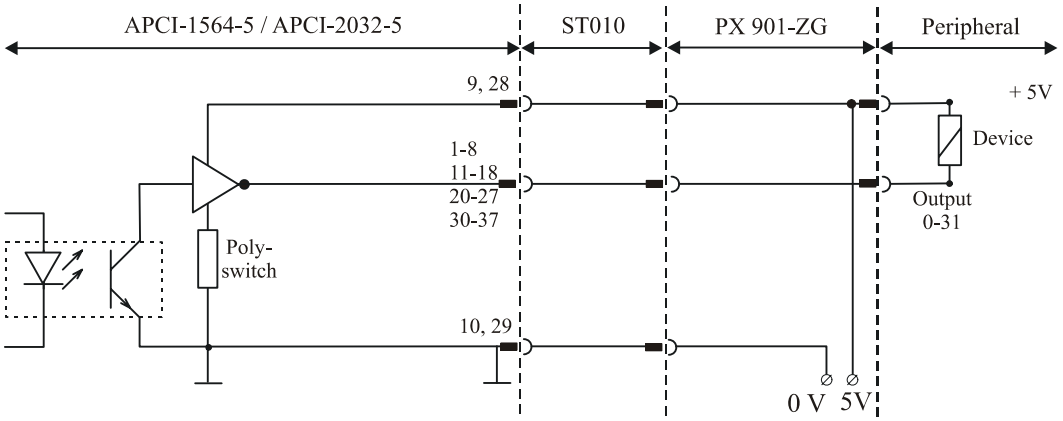
7.3.2 Connector principle

Fig. 7-8: Connection principle of the 5 V outputs



7.3.3 Connection examples

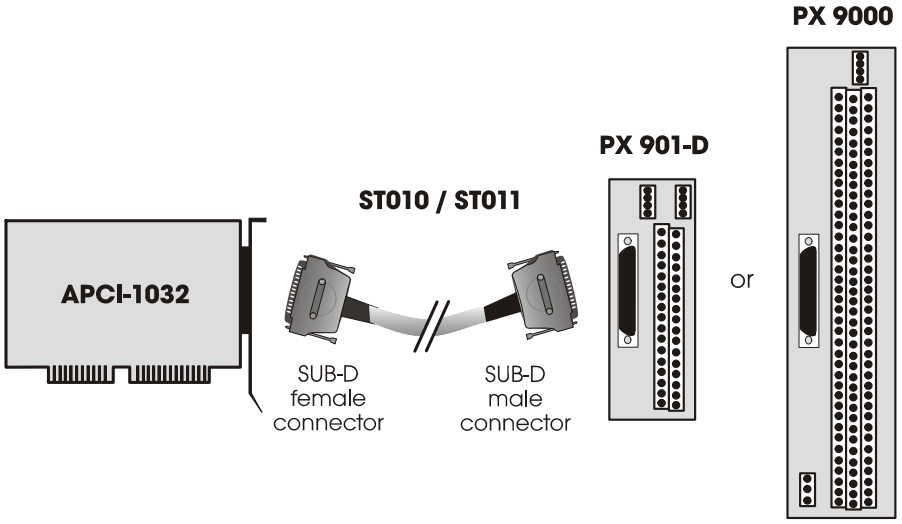
Fig. 7-9: Connection examples for the 5 V outputs



7.4 Connection to screw terminal panel and relay output boards

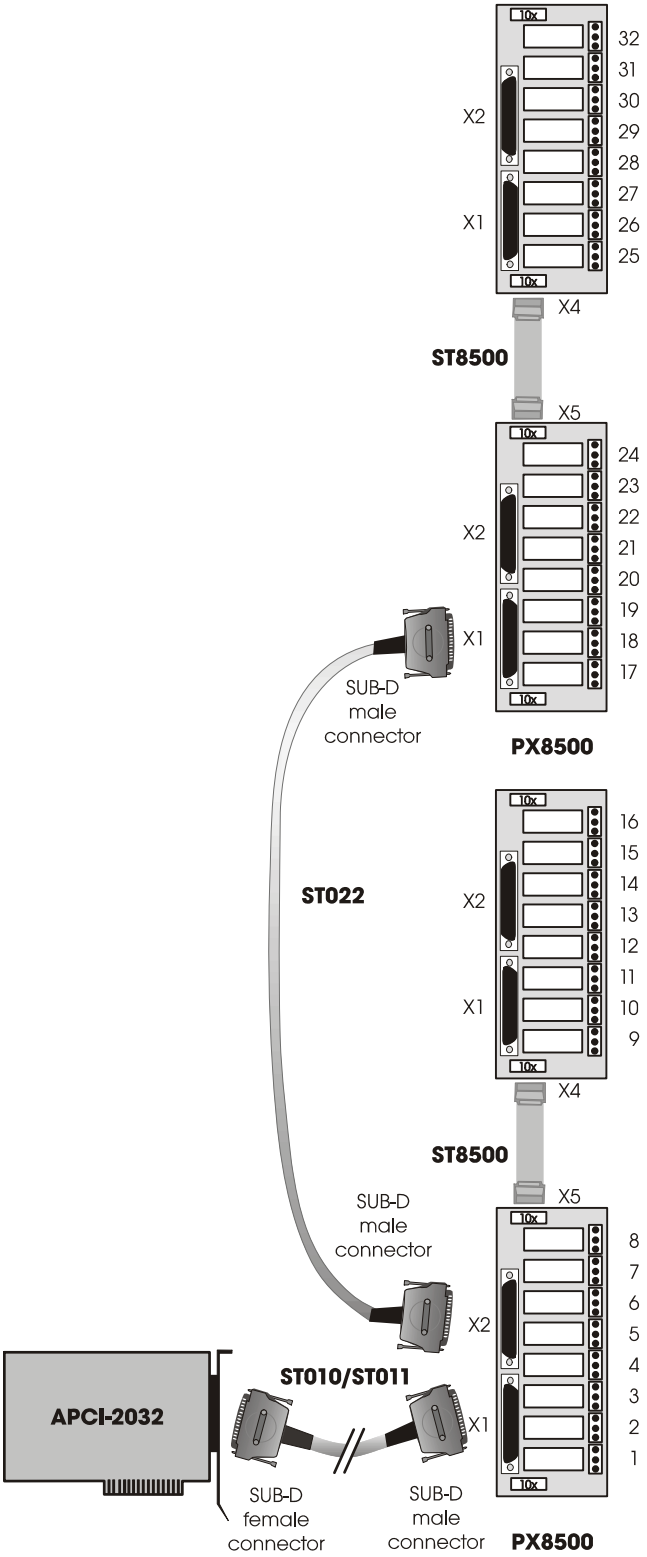
7.4.1 APCI-1032

Fig. 7-10: Connection to the screw terminal panelsPX901 and PX9000



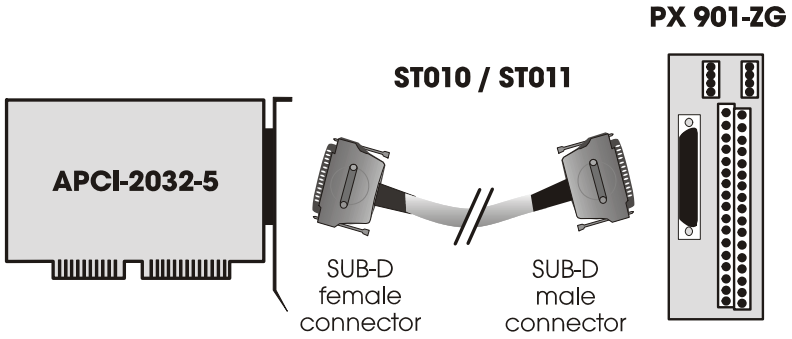
7.4.2 APCI-2032

Fig. 7-11: Connection of the APCI-2032 to the relay output board PX8500



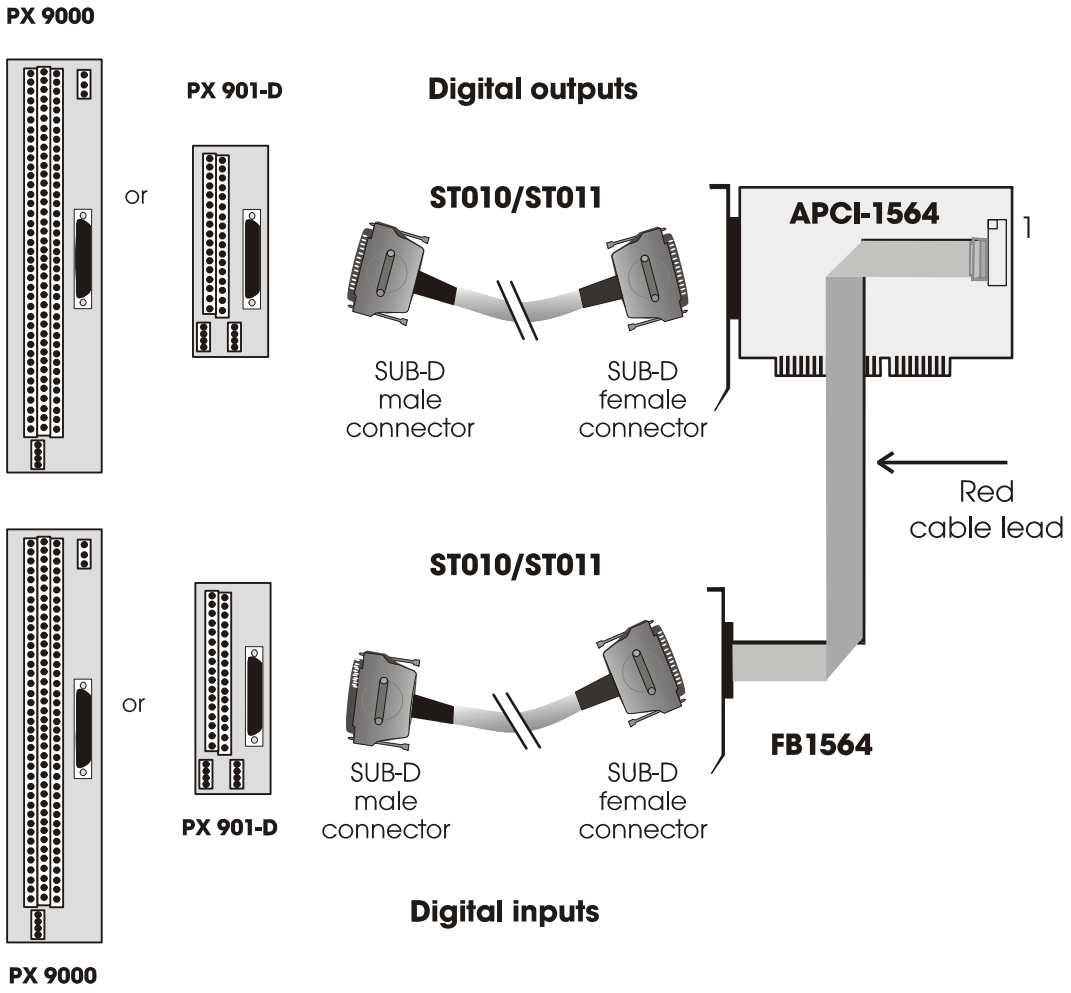
Our technical support department is at your disposal for further information about the ADDI-DATA cables and screw terminal panels.

Fig. 7-12: Connection of the APCI-2032-5 to the screw terminal panel PX901-ZG



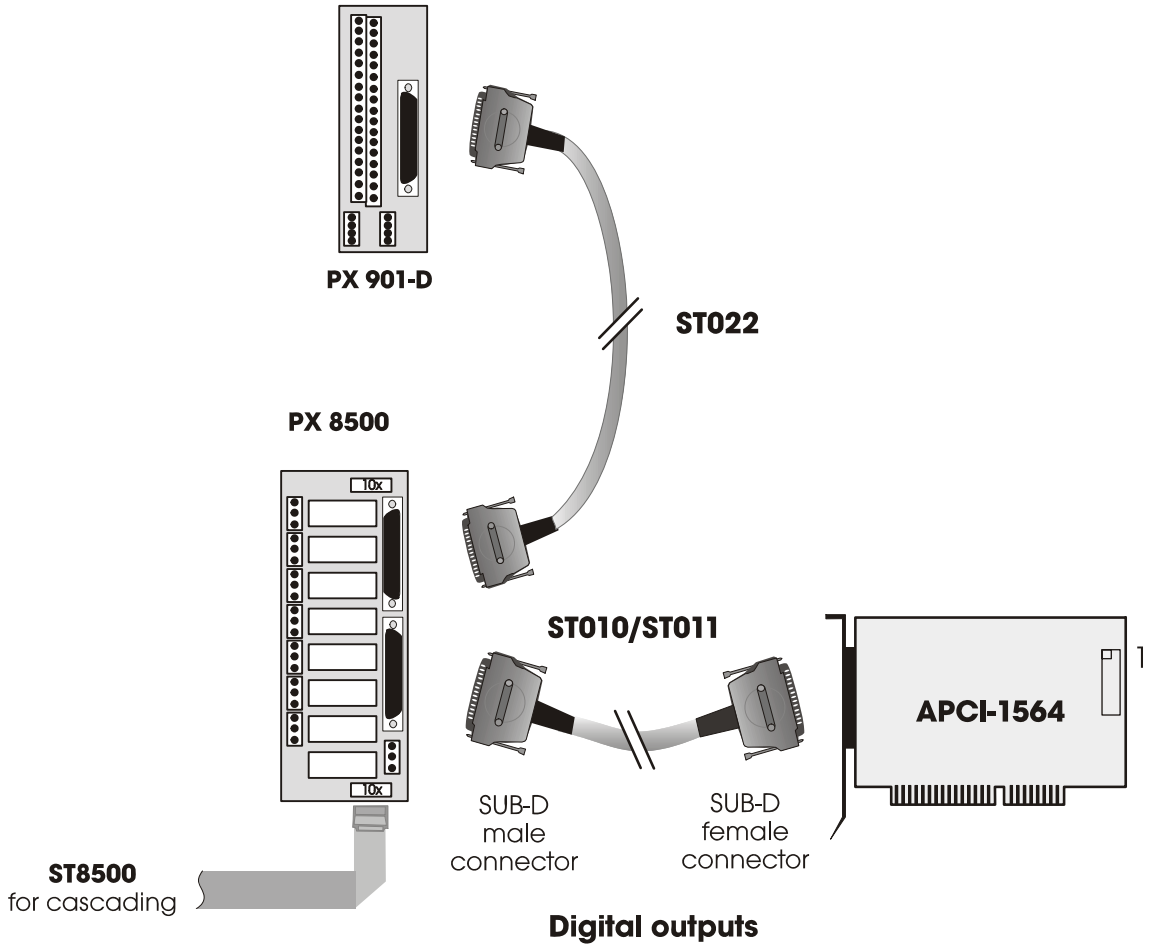
7.4.3 APCI-1564

Fig. 7-13: Connection of the APCI-1564 to PX901 and PX9000



IMPORTANT!
Plug the FB1564 on the connector **with the red cable lead on the side of the pin 1.**

Fig. 7-14: Connection of the APCI-1564 to PX 8500

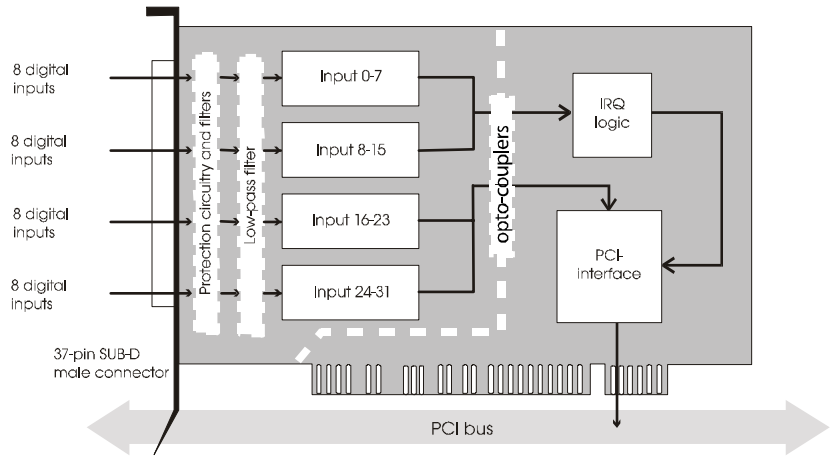


8 FUNCTIONS OF THE BOARD

The boards **APCI-1032, APCI-1564 and APCI-2032** are intended for parallel input and/or parallel output of digital signals in 24 V (industry standard), 12 V (only **APCI-2032**) and 5 V environment.
The peripheral and the system are optically isolated.

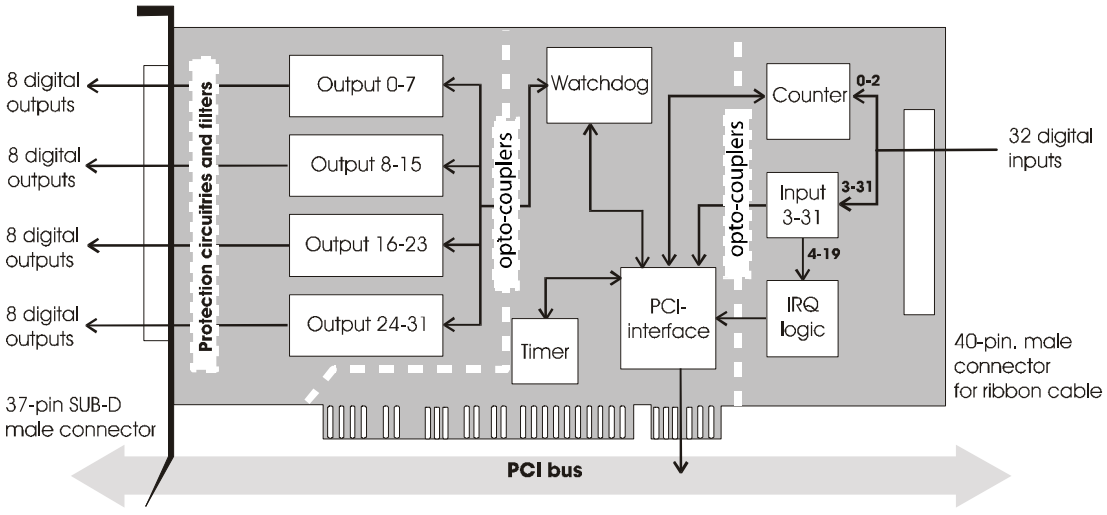
8.1 Block diagrams and short description

Fig. 8-1: Block diagram of the APCI-1032



- **32** digital **inputs,** 16 of which are interruptible (channels 0 to 15)
- 4 groups of ground lines
- interruptible inputs: programmable AND/OR logic.

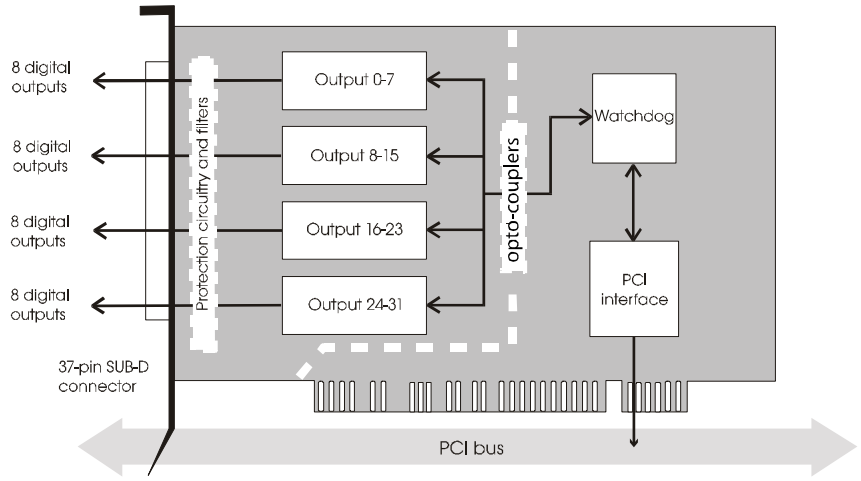
Fig. 8-2: Block diagram of the APCI-1564



- **32** digital **inputs**, 16 of which are interruptible (channels 4 to 19)
- 4 groups of ground lines
- interruptible inputs (channels 4 to 19): programmable AND/OR logic.
- timer
- 3 x 32-bit counter inputs (channels 0 to 2)
- **32** digital **outputs**
- watchdog

- Vcc-diagnostic and ϑ-diagnostic: interruptible for the outputs

Fig. 8-3: Block diagram of the APCI-2032



- **32** digital **outputs**
- watchdog
- Vcc-diagnostic and ϑ-diagnostic: interruptible for the outputs

EMC: design in accordance with CE regulations.

8.2 Digital inputs

8.2.1 General description

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 isolated inputs (IEC1131-2):
- logic "1" corresponds to an input voltage > 19 V
- logic "0" corresponds to an input voltage < 14 V.



WARNING for the APCI-1564!
When all inputs are connected, the temperature of the printed circuit card increases.

Make sure that the maximum supply voltage of 26 V is not exceeded. Please consider the given Limit values. (See 0 Digital inputs)

12 V isolated inputs (IEC1131-2):
- logic "1" corresponds to an input voltage > 8 V
- logic "0" corresponds to an input voltage < 6 V.

5 V isolated inputs (IEC1131-2):
- logic "1" corresponds to an input voltage > 3.3 V
- logic "0" corresponds to an input voltage < 2.7 V.

4 ground lines are available for the inputs:
- GND 0 for the inputs 0-7 (module 0)
- GND 1 for the inputs 8-15 (module 1)
- GND 2 for the inputs 16-23 (module 2)
- GND 3 for the inputs 24-31 (module 3)

The required current input is 6 mA at nominal voltage.

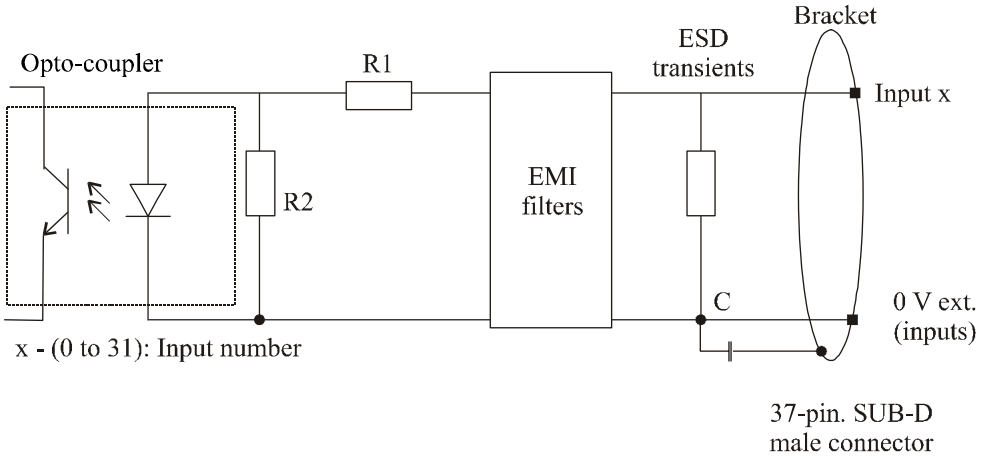
WARNING !
If you operate all inputs with the same voltage supply, the voltage supply must deliver e.g. at least 32 x 6 = 192 mA at V_{cc} ext. = 24 V.

The maximum input voltage is 30 V / 9.6 mA typical.

Transil diodes, Z diodes, LC filters and opto-couplers protect the system bus from noise emitted by the peripheral. The effects of inductive and capacitive noise are thus reduced.

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

Fig. 8-4: Protection circuitry for the inputs



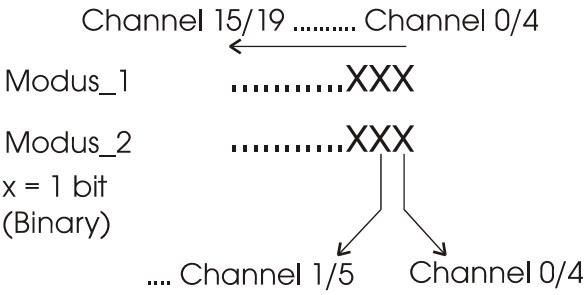
8.2.2 Special functions: interrupt

The inputs 0 to 15 (**APCI-1032**) or 4 to 19 (**APCI-1564**) can generate an interrupt. This function allows to mask OR or AND events at rising/falling edge or at high/low level.

The different functions to control the IRQ logic are the following (set by software):
- Enable/disable of the interrupt function
- Switch between AND/OR logic
- Interrupt source can be read back
- IRQ status register can be read back
- Programming of the interrupt function through 2 registers with which the events are masked (Hex):

Modus_1 reacts to rising edge or high level.
Modus_2 reacts to falling edge or low level.

The registers are set as follows:

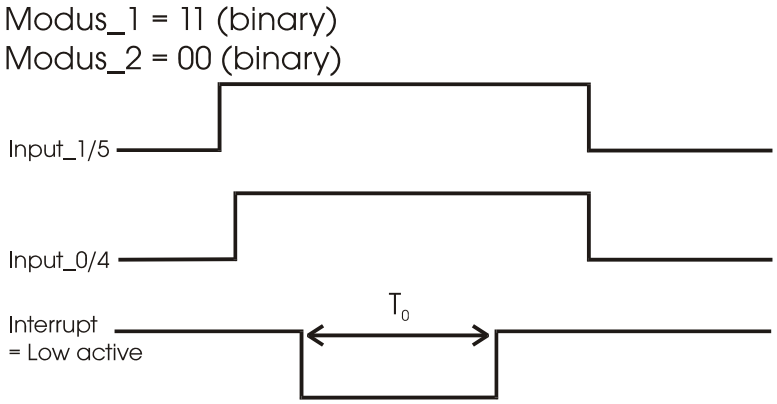


Channels 0 to 15: interruptible inputs on the **APCI-1032**
First channel: 0
Channels 4 to 19: interruptible inputs on the **APCI-1564**
First channel: 4

Interrupt control

The interrupt logic is blocked after an interrupt has occurred. It is released at the end of the interrupt routine. In the interrupt routine the board does not react to modification of the inputs. Another interrupt is generated when an interruptible edge or status modification occurs.

Fig. 8-5: Interrupt control (OR logic)



An interrupt routine is handled after T_0.
(approx. 100 µs; Test PC: Athlon 550 MHz, Windows NT4.0).
The time T_0 depends on the counting capacity, the load of the system and other factors.

OR logic

	Disable	Rising	Falling	Rising/falling
Modus_1	0	1	0	1
Modus_2	0	0	1	1

The OR logic reacts to rising or falling edges.
An interrupt is generated when on an interruptible input an edge modification which fulfills the interrupt conditions set in Modus_1 and Modus_2 occurs.

By OR logic pulses and bounces can generate an interrupt.

The following parameters are set in the figure below:

1st condition: The channels 0/4 and 1/5 react to rising edges (Modus_1 = 11).
2nd condition: The channels 0/4 and 1/5 react to falling edges (Modus_2 = 11).

Fig. 8-6: Example for the OR logic: Egde-change interrupt

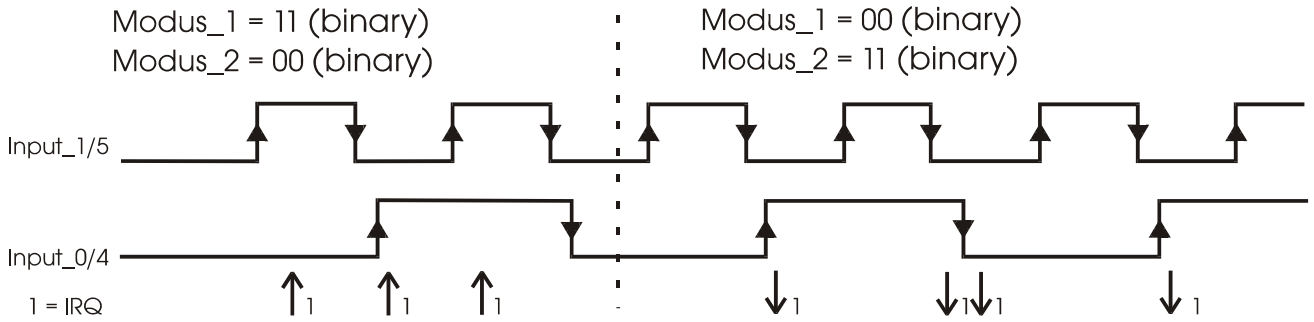


Table 8-1: Principle of the OR logic (for 2 channels)

INPUT 1/5 MODUS2, MODUS1	INPUT 0/4 MODUS2, MODUS1	Input 0/4 / Input 1/5
0,0	0,0	no interrupt
1,0	0,0	10* 10
0,1	0,0	10 10
1,1	0,0	10 10 10 10
0,0	1,0	01** 01
1,0	1,0	01 10 01 10
0,1	1,0	10 01 10 01
1,1	1,0	10 01 10 10 01 10
0,0	0,1	01 01
1,0	0,1	01 10 01 10
0,1	0,1	01 10 10 01
1,1	0,1	01 10 10 10 01 10
0,0	1,1	01 01 01 01
1,0	1,1	01 01 10 01 01 10
0,1	1,1	01 10 01 10 01 01
1,1	1,1	01 10 01 10 10 01 01 10

* 10: **Interrupt source:** the 2nd input (channel 1/5) has generated an interrupt.
** 01: **Interrupt source:** the 1st input (channel 0/4) has generated an interrupt.

AND logic

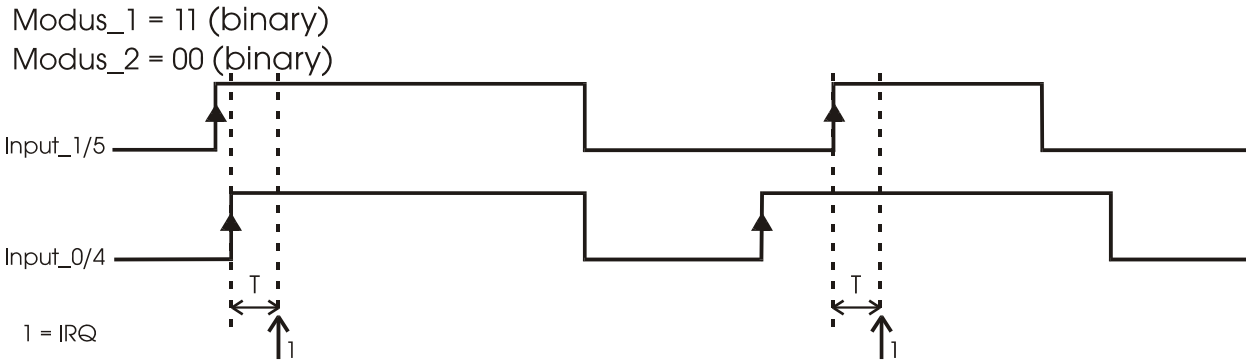
	Disable	High	Low	High/Low
Modus_1	0	1	0	1
Modus_2	0	0	1	1

The AND logic reacts to changes in level of the selected inputs.

An interrupt is generated each time the following condition are fulfilled:
- the interruptible inputs fulfill the conditions set in Modus_1, Modus_2.
- The IRQ condition is to be fulfilled during min. 50 µs. Bounces can thus be avoided.
- After an interrupt, a change in level must occur on the interruptible inputs to release the IRQ logic.

In the figure below both channels 0/4 and 1/5 react to high level.
(Modus_1 = 11).

Fig. 8-7: Example for the AND logic: Level-change interrupt



50 µs (T) after the IRQ condition has been fulfilled, an interrupt is generated.

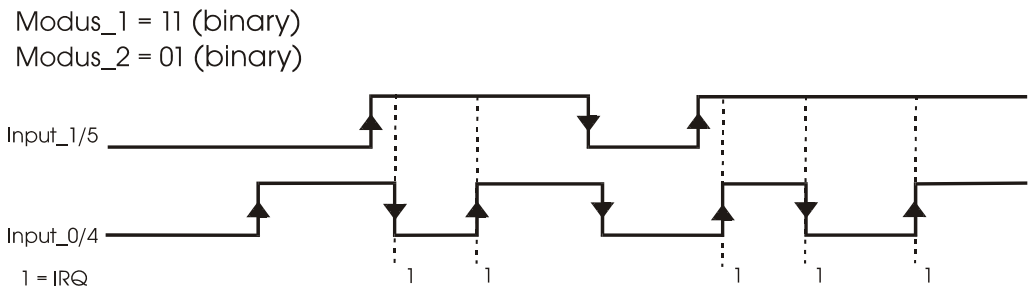
Table 8-2: Principle of the AND logic (for 2 channels)

INPUT 1/5 MODUS2, MODUS1	INPUT 0/4 MODUS2, MODUS1	Input 0/4 Input 1/5
0,0	0,0	No interrupt
1,0	0,0	10* 10
0,1	0,0	10 10
1,1	0,0	10 10 10 10
0,0	1,0	01** 01
1,0	1,0	10 10
0,1	1,0	01 10 01
1,1	1,0	01 10 10 01 10
0,0	0,1	01 01
1,0	0,1	01
0,1	0,1	10 01
1,1	0,1	01 10 01
0,0	1,1	01 01 01 01
1,0	1,1	01 10 10
0,1	1,1	10 01 10 01 01
1,1	1,1	01 10 01 10 10 01 01 10

* 10: **Interrupt source:** the 2nd input (channel 1/5) has generated an interrupt.
** 01: **Interrupt source:** the 1st input (channel 0/4) has generated an interrupt.

In case both IRQ modes (Modus_1 and Modus_2) are set for one channel, this channel reacts according to the OR logic and is linked with the other inputs through an AND logic.

Fig. 8-8: OR and AND logic combination by AND logic



Modus_1 and Modus_2 are set to 1 for the channel 0/4. It reacts either to Low or to High level (OR logic).
To generate an interrupt, the former condition and the condition set on channel 1/5 (High level) are to be fulfilled (AND logic).
The AND and OR logics are the same when both modes are activated on all selected interruptible inputs.

8.3 Digital outputs

The boards **APCI-1564** and **APCI-2032** are supplied with 32 optically isolated outputs.

The positive logic is used
- logic "1": sets the output by software,
- logic "0": resets the output.



WARNING !
The device for the voltage supply of the board must deliver at least the power required for your application.

24 V version (APCI-2032, APCI-1564)

The maximum supply voltage is 36 V. Each output can switch 500 mA current.
But the current is limited for every 16 outputs to approx. 3 A by a self-resetting fuse.

If all channels are switched, a maximum current flow of 187.5 mA per output is allowed.

Features of the 24 V outputs:
- Protection against short-circuit: the outputs are switched off.
- Protection against overtemperature: shut-down logic. Each group of 8 outputs is switched off.
- The outputs are switched off if the ext. supply voltage drops below 5 V.

Transorb diodes, C filters and opto-couplers filter noise from the peripheral to the system bus. Thus the effects of inductive and capacitive noise are reduced. Possible noise emissions are also reduced by C filters.

5 V version

The maximum supply voltage is 12 V. Each output can switch 50 mA current.
But the current is limited for every 8 outputs to approx. 400 mA by a self-resetting fuse.

If all channels are switched, a maximum current flow of 50 mA per output is allowed.

Features of the 5 V outputs:
- Protection against short-circuit: the outputs are switched off.
- The outputs are switched off if the ext. supply voltage drops below 3 V.

The board requires no initialisation to output the digital information.
You can program the outputs immediately after successful power ON reset

State after power ON: all the outputs are reset (switched OFF).

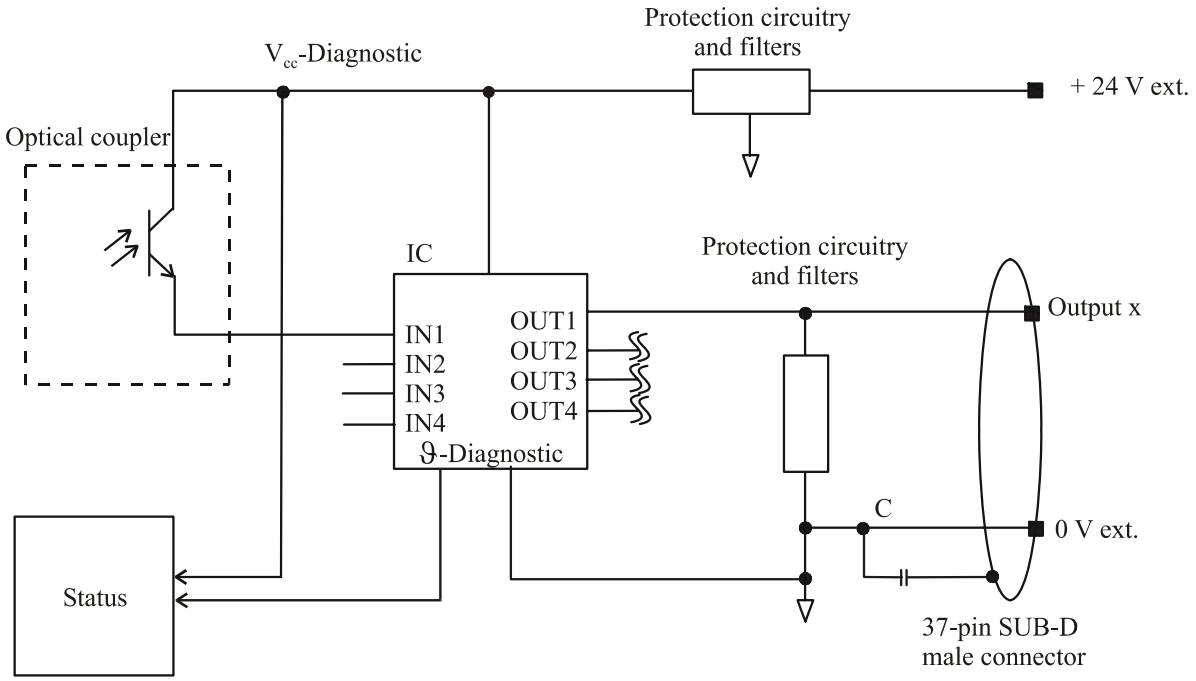
Diagnostic

2 diagnostic bits are available on the **APCI-1564** and **APCI-2032**.

The ϑ-diagnostic (only for the 24V version) is released:
- when short-circuit has occurred on an output or
- in case of overtemperature on an output component (8 channels).

The V_{cc}-diagnostic informs that:
- the external voltage supply has dropped < 5 V (24 V version) or < 3 V (5 V version).

Fig. 8-9: Protection circuitry of the outputs (24 V)



x = 0 to 31 Number of the output

Interrupt

The boards **APCI-1564** and **APCI-2032** have 2 interrupt sources.

Possible interrupt sources:
- ϑ-Diagnose
- V_{cc}-Diagnose

Both diagnostic functions can generate an interrupt. The status of the diagnostic sources is read through software.

8.4 Timer

The 12-bit timer is a downward counter which generates an interrupt after the reload value has run down (timeout). Through timer, a time base can be defined independently from the PC clock and synchronise operations for example.

The status of the counter value, the reload value and of the interrupt register can be read back through software.

8.5 Counter (APCI-1564)

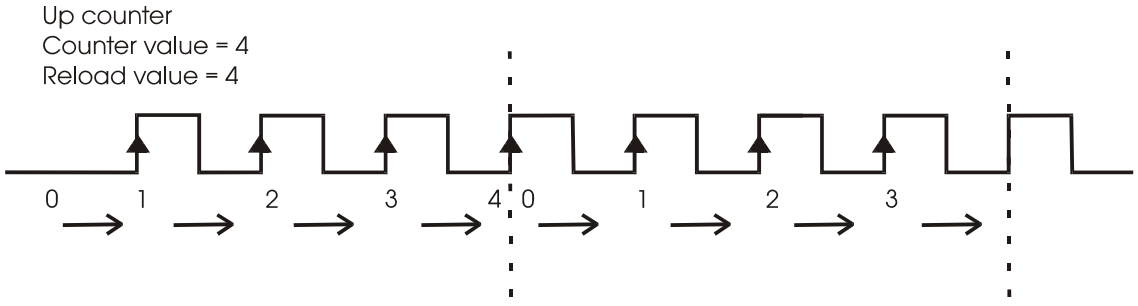
3 x 32-bit counter inputs are available on the board APCI-1564. They have the same functions as a 82C54 counter component. Each counter can be programmed through software.

The counter inputs are connected through the channels 0 to 2. When the counter function is not used, the inputs are connected as regular digital inputs.

A counter has the following technical features:
- 2 counter modes: the counter can be programmed as an up or down counter.
- After reaching the reload value or when the counter has run down, an interrupt can be generated.
- Reload value, 32-bit
- Clock: the counter counts at rising or falling edge or with each input pulse.
- Trigger function: sets the counter back to its start value
  0: start value by up counting = clear function
  Reload value: start value by down counting
- Clear function: the counter status is cleared (reload value and counter value set to 0)
- The 3 counters can be simultaneously initialised, started or stopped by synchronous control.
- The status of the input 0 to 2 can be read back through external clock.

Up counter

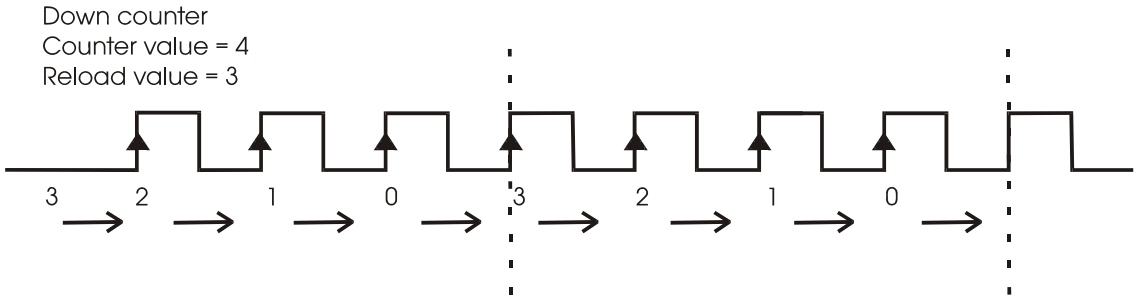
Fig. 8-10: Function of the up counter



After reaching the reload value, the counter value is set to 0 and counts on.
An interrupt can be generated by overflow.

Down counter

Fig. 8-11: Function of the down counter



To count the same number of values (4) as by up counting, the reload value is to be set to 3.
The counter counts down to 0 and is reset to the reload value from the next changing edge.

8.6 Watchdog (APCI-2032, APCI-1564)

The watchdog is a down-counter which resets the digital outputs after the reload value has run down (timeout).

3 different states are available for the watchdog.

"OFF" The watchdog is switched off. It has no influence ont the outputs.

"ON" The watchdog is switched on by software trigger.
It controls the program course and affects the outputs through timeout.

"Alarm" The watchdog sets alarm by resetting all outputs.

The states can be read back through software.

Time intervals can be programmed from 20 ms to 5 s in 20 ms steps.

9 STANDARD SOFTWARE

9.1 APCI-1032

9.1.1 Software functions

ADDIPACK supports the following functions for the **APCI-1032**.

Table 9-1: Supported software functions for the APCI-1032

Functionality	Function name
Common functions	i_ADDIDATA_OpenWin32Driver
	i_ADDIDATA_GetCurrentDriverHandle
	i_ADDIDATA_GetDriverVersion
	i_ADDIDATA_GetLocalisation
	b_ADDIDATA_CloseWin32Driver
Interrupt	b_ADDIDATA_SetFunctionalityIntRoutineWin32
	b_ADDIDATA_TestInterrupt
	b_ADDIDATA_ResetFunctionalityIntRoutine
Error	i_ADDIDATA_GetLastError
	i_ADDIDATA_GetLastErrorAndSource
	b_ADDIDATA_EnableErrorMessage
	b_ADDIDATA_DisableErrorMessage
	b_ADDIDATA_FormatErrorMessage
Digital inputs	b_ADDIDATA_GetNumberOfDigitalInputs
	b_ADDIDATA_GetDigitalInputInformation
	b_ADDIDATA_Read1DigitalInput
	b_ADDIDATA_Read2DigitalInputs
	b_ADDIDATA_Read4DigitalInputs
	b_ADDIDATA_Read8DigitalInputs
	b_ADDIDATA_Read16DigitalInputs
	b_ADDIDATA_Read32DigitalInputs
	b_ADDIDATA_InitDigitalInputInterrupt
	b_ADDIDATA_EnableDisableDigitalInputInterrupt
	b_ADDIDATA_ReleaseDigitalInputInterrupt

9.1.2 Software samples

Table 9-2: Supported software samples for the APCI-1032

Functionality	Sample number	Description
Digital inputs	SAMPLE01	Read 1 digital input
	SAMPLE02	Read 2 digital inputs
	SAMPLE03	Read 4 digital inputs
	SAMPLE04	Read 8 digital inputs
	SAMPLE05	Read 16 digital inputs
	SAMPLE06	Read 32 digital inputs
	SAMPLE07	Test the interrupt of all inputs

9.2 APCI-1564

9.2.1 Software functions

ADDIPACK supports the following functions for the **APCI-1564**.

Table 9-3: Supported software functions for the APCI-1564

Functionality	Function name
Common functions	i_ADDIDATA_OpenWin32Driver
	i_ADDIDATA_GetCurrentDriverHandle
	i_ADDIDATA_GetDriverVersion
	i_ADDIDATA_GetLocalisation
	b_ADDIDATA_CloseWin32Driver
Interrupt	b_ADDIDATA_SetFunctionalityIntRoutineWin32
	b_ADDIDATA_TestInterrupt
	b_ADDIDATA_ResetFunctionalityIntRoutine
Error	i_ADDIDATA_GetLastError
	i_ADDIDATA_GetLastErrorAndSource
	b_ADDIDATA_EnableErrorMessage
	b_ADDIDATA_DisableErrorMessage
	b_ADDIDATA_FormatErrorMessage
Digital inputs	b_ADDIDATA_GetNumberOfDigitalInputs
	b_ADDIDATA_GetDigitalInputInformation
	b_ADDIDATA_Read1DigitalInput
	b_ADDIDATA_Read2DigitalInputs
	b_ADDIDATA_Read4DigitalInputs
	b_ADDIDATA_Read8DigitalInputs
	b_ADDIDATA_Read16DigitalInputs
	b_ADDIDATA_Read32DigitalInputs
	b_ADDIDATA_InitDigitalInputInterrupt
	b_ADDIDATA_EnableDisableDigitalInputInterrupt
	b_ADDIDATA_ReleaseDigitalInputInterrupt
Digital outputs	b_ADDIDATA_GetNumberOfDigitalOutputs
	b_ADDIDATA_GetDigitalOutputInformation
	b_ADDIDATA_SetDigitalOutputMemoryOn
	b_ADDIDATA_SetDigitalOutputMemoryOff

Functionality	Function name
Digital outputs	b_ADDIDATA_Set1DigitalOutputOn
	b_ADDIDATA_Set1DigitalOutputOff
	b_ADDIDATA_Set2DigitalOutputsOn
	b_ADDIDATA_Set2DigitalOutputsOff
	b_ADDIDATA_Set4DigitalOutputsOn
	b_ADDIDATA_Set4DigitalOutputsOff
	b_ADDIDATA_Set8DigitalOutputsOn
	b_ADDIDATA_Set8DigitalOutputsOff
	b_ADDIDATA_Set16DigitalOutputsOn
	b_ADDIDATA_Set16DigitalOutputsOff
	b_ADDIDATA_Set32DigitalOutputsOn
	b_ADDIDATA_Set32DigitalOutputsOff
	b_ADDIDATA_Get1DigitalOutputStatus
	b_ADDIDATA_Get2DigitalOutputStatus
	b_ADDIDATA_Get4DigitalOutputStatus
	b_ADDIDATA_Get8DigitalOutputStatus
	b_ADDIDATA_Get16DigitalOutputStatus
	b_ADDIDATA_Get32DigitalOutputStatus
	b_ADDIDATA_InitDigitalOutputInterrupt
	b_ADDIDATA_EnableDisableDigitalOutputInterrupt
	b_ADDIDATA_ReleaseDigitalOutputInterrupt
Watchdog	b_ADDIDATA_GetNumberOfWatchdogs
	b_ADDIDATA_GetWatchdogInformation
	b_ADDIDATA_GetWatchdogInformationEx
	b_ADDIDATA_InitWatchdog
	b_ADDIDATA_StartWatchdog
	b_ADDIDATA_TriggerWatchdog
	b_ADDIDATA_StopWatchdog
	b_ADDIDATA_ReadWatchdogStatus
	b_ADDIDATA_ReleaseWatchdog

Functionality	Function name
Timer	b_ADDIDATA_GetNumberOfTimers
	b_ADDIDATA_GetTimerInformation
	b_ADDIDATA_GetTimerInformationEx
	b_ADDIDATA_InitTimer
	b_ADDIDATA_EnableDisableTimerInterrupt
	b_ADDIDATA_StartTimer
	b_ADDIDATA_StopTimer
	b_ADDIDATA_ReleaseTimer
	b_ADDIDATA_ReadTimerValue
Counter	b_ADDIDATA_GetNumberOfCounters
	b_ADDIDATA_GetCounterInformation
	b_ADDIDATA_GetCounterInformationEx
	b_ADDIDATA_InitCounter
	b_ADDIDATA_SetCounterDirection
	b_ADDIDATA_EnableDisableCounterInterrupt
	b_ADDIDATA_StartCounter
	b_ADDIDATA_StartAllCounters
	b_ADDIDATA_ClearCounter
	b_ADDIDATA_TriggerCounter
	b_ADDIDATA_TriggerAllCounters
	b_ADDIDATA_StopCounter
	b_ADDIDATA_StopAllCounters
	b_ADDIDATA_ReleaseCounter
	b_ADDIDATA_ReadCounterValue
	b_ADDIDATA_ReadCounterStatus

9.2.2 Software samples

Table 9-4: Supported software samples for the APCI-1564

Functionality	Sample number	Description
Digital inputs	SAMPLE01	Read 1 digital input
	SAMPLE02	Read 2 digital inputs
	SAMPLE03	Read 4 digital inputs
	SAMPLE04	Read 8 digital inputs
	SAMPLE05	Read 16 digital inputs
	SAMPLE06	Read 32 digital inputs
	SAMPLE07	Test the interrupt of all inputs
Digital outputs	SAMPLE01	Test 1 digital output with/without output memory
	SAMPLE02	Test 2 digital outputs with/without output memory
	SAMPLE03	Test 4 digital outputs with/without output memory
	SAMPLE04	Test 8 digital outputs with/without output memory
	SAMPLE05	Test 16 digital outputs with/without output memory
	SAMPLE06	Test 32 digital outputs with/without output memory
	SAMPLE07	Test the interrupt of all digital outputs (short circuit, ϑ-diagnostic or V_{cc}-diagnostic)
Watchdog	SAMPLE01	b_ADDIDATA_GetWatchdogInformation is used. Initialise and release software-trigger at key stroke. Start 1 watchdog. Read status, once the watchdog has run down. Reset the watchdog and quit the program.
	SAMPLE05	b_ADDIDATA_GetWatchdogInformationEx is used. Initialise and release software-trigger at key stroke. Start 1 watchdog. Read status, once the watchdog has run down. Reset the watchdog and quit the program.
Timer	SAMPLE01	Initialise 1 timer in mode 2 without interrupt, start the timer. Read the timer value.
	SAMPLE02	Initialise 1 timer in mode 2 with interrupt, start the timer. Read the timer value. When an interrupt occurs, stop the timer and quit the program.
	SAMPLE03	Initialise 1 timer in mode 2 without interrupt. The timer can be triggered at keystroke.
	SAMPLE04	Initialise 1 timer in mode 2 with interrupt. The timer can be triggered at keystroke.
Counter	SAMPLE01	Initialise 1 counter without interrupt
	SAMPLE02	Initialise 1 counter with interrupt

9.3 APCI-2032

9.3.1 Software functions

ADDIPACK supports the following functions for the **APCI-2032**.

Table 9-5: Supported software functions for the APCI-2032

Functionality	Function name
Common functions	i_ADDIDATA_OpenWin32Driver
	i_ADDIDATA_GetCurrentDriverHandle
	i_ADDIDATA_GetDriverVersion
	i_ADDIDATA_GetLocalisation
	b_ADDIDATA_CloseWin32Driver
Interrupt	b_ADDIDATA_SetFunctionalityIntRoutineWin32
	b_ADDIDATA_TestInterrupt
	b_ADDIDATA_ResetFunctionalityIntRoutine
Error	i_ADDIDATA_GetLastError
	i_ADDIDATA_GetLastErrorAndSource
	b_ADDIDATA_EnableErrorMessage
	b_ADDIDATA_DisableErrorMessage
	b_ADDIDATA_FormatErrorMessage
Digital outputs	b_ADDIDATA_GetNumberOfDigitalOutputs
	b_ADDIDATA_GetDigitalOutputInformation
	b_ADDIDATA_SetDigitalOutputMemoryOn
	b_ADDIDATA_SetDigitalOutputMemoryOff
	b_ADDIDATA_Set1DigitalOutputOn
	b_ADDIDATA_Set1DigitalOutputOff
	b_ADDIDATA_Set2DigitalOutputsOn
	b_ADDIDATA_Set2DigitalOutputsOff
	b_ADDIDATA_Set4DigitalOutputsOn
	b_ADDIDATA_Set4DigitalOutputsOff
	b_ADDIDATA_Set8DigitalOutputsOn
	b_ADDIDATA_Set8DigitalOutputsOff
	b_ADDIDATA_Set16DigitalOutputsOn
	b_ADDIDATA_Set16DigitalOutputsOff
	b_ADDIDATA_Set32DigitalOutputsOn

Functionality	Function name
Digital outputs	b_ADDIDATA_Set32DigitalOutputsOff
	b_ADDIDATA_Get1DigitalOutputStatus
	b_ADDIDATA_Get2DigitalOutputStatus
	b_ADDIDATA_Get4DigitalOutputStatus
	b_ADDIDATA_Get8DigitalOutputStatus
	b_ADDIDATA_Get16DigitalOutputStatus
	b_ADDIDATA_Get32DigitalOutputStatus
	b_ADDIDATA_InitDigitalOutputInterrupt
	b_ADDIDATA_EnableDisableDigitalOutputInterrupt
	b_ADDIDATA_ReleaseDigitalOutputInterrupt
Watchdog	b_ADDIDATA_GetNumberOfWatchdogs
	b_ADDIDATA_GetWatchdogInformation
	b_ADDIDATA_GetWatchdogInformationEx
	b_ADDIDATA_InitWatchdog
	b_ADDIDATA_StartWatchdog
	b_ADDIDATA_TriggerWatchdog
	b_ADDIDATA_StopWatchdog
	b_ADDIDATA_ReadWatchdogStatus
	b_ADDIDATA_ReleaseWatchdog

9.3.2 Software samples

Table 9-6: Supported software samples for the APCI-2032

Functionality	Sample number	Description
Digital outputs	SAMPLE01	Test 1 digital output with/without output memory
	SAMPLE02	Test 2 digital outputs with/without output memory
	SAMPLE03	Test 4 digital outputs with/without output memory
	SAMPLE04	Test 8 digital outputs with/without output memory
	SAMPLE05	Test 16 digital outputs with/without output memory
	SAMPLE06	Test 32 digital outputs with/without output memory
	SAMPLE07	Test the interrupt of all digital outputs (short circuit, ϑ-diagnostic or V_{cc}-diagnostic)
Watchdog	SAMPLE01	b_ADDIDATA_GetWatchdogInformation is used. Initialise and release software-trigger at key stroke. Start 1 watchdog. Read status, once the watchdog has run down. Reset the watchdog and quit the program.
	SAMPLE05	b_ADDIDATA_GetWatchdogInformationEx is used. Initialise and release software-trigger at key stroke. Start 1 watchdog. Read status, once the watchdog has run down. Reset the watchdog and quit the program.

10 GLOSSARY

Table 10-1: Glossary

Term	Description
A/D converter	= *ADC* An electronic device that produces a digital output directly proportional to an analog signal output.
Acquisition	The process by which data is gathered by the computer for analysis or storage.
Analog	Continuous real time phenomena
Bus	The group of conductors that interconnect individual circuitry in a computer. Typically, a bus is the expansion vehicle to which I/O or other devices are connected. Examples of PC buses are PCI, PC Card (PCMCIA), ISA (AT), and EISA bus.
Clock	A circuit that generates time and clock pulses for the synchronisation of the conversion
Creeping distance	In order to avoid the danger of the effects of electrical voltages and currents for electrical-mechanical components, it is required to keep minimum isolation distances. The creeping distance is the shortest distance alongside of an isolation surface between two reference points (contact elements).
D/A converter	= *DAC* A device that converts digital information into a corresponding analog voltage or current.
Data acquisition	Gathering information from sources such as sensors and transducers in an accurate, timely and organized manner. Modern systems convert this information to digital data which can be stored and processed by a computer.
DC voltage	= *Direct current voltage* DC voltage means that the voltage is constant respecting the time. It will always fluctuate slightly. Especially at switching on and switching off the transition behaviour is of high significance.
Digital signal	A signal which has distinct states. Digital computers process data as binary information having either 1 or 0 states.
Disturb signal	Interferences that occur during the transfer caused by reduced bandwidth, attenuation, gain, noise, delay time etc.
Driver	A part of the software that is used to control a specific hardware device such as a data acquisition board or a printer.
FIFO	= *First In First Out* The first data into the buffer is the first data out of the buffer.
Gain	The factor by which an incoming signal is multiplied.
Ground	A common reference point for an electrical system.
Impedance	The reciprocal of admittance. Admittance is the complex ratio of the voltage across divided by the current flowing through a device, circuit element, or network.
Inductive loads	The voltage over the inductor is U=L.(dI/dt), whereas L is the inductivity and I is the current. If the current is switched on fast, the voltage over the load can become very highly for a short time.

Input impedance	The measured resistance and capacitance between the high and low inputs of a circuit.
Input level	The input level is the logarithmic relation of two electric units of the same type (voltage, current or power) at the signal input of any receive device. The receive device is often a logic level that refers to the input of the switch. The input voltage that corresponds with logic "0" is here between 0 and 15 V, and the one that corresponds with logic "1" is between 17 and 30 V.
Instrumentation amplifier	= *IA* Instrumentation amplifiers (IA) are precise measuring amplifiers with high input impedance, low output impedance, significantly high common-mode suppression and adjustable gain with high continuity respecting the time.
Interrupt	A signal to the CPU indicating that the board detected the occurrence of a specified condition or event.
Level	Logic levels are defined in order to process or show information. In binary circuits voltages are used for digital units. Only two voltage ranges represent information. These ranges are defined with H (High) and L (Low). H represents the range that is closer to Plus infinite; the H level is the digital 1. L represents the range that is closer to Minus infinite; the L level is the digital 0. The rising edge is the transition from the 0-state to the 1-state and the falling edge is the transition from the 1-state to the 0-state.
Limit value	Exceeding the limit values, even for just a short time, can lead to the destruction or to a loss of functionality.
MUX	= *Multiplexer* An array of semiconductor or electromechanical switches with a common output used for selecting one of a number of input signals.
Noise immunity	Noise immunity is the ability of a device to work during an electromagnetic interference without reduced functions.
Noise suppression	The suppression of undesirable electrical interferences to a signal. Sources of noise include the ac power line, motors, generators, transformers, fluorescent lights, CRT displays, computers, electrical storms, welders, radio transmitters, and others.
Operating voltage	The operating voltage is the voltage that occurs during the continuous operation of the device. It may not exceed the continuous limit voltage. Furthermore, any negative operation situations, such as net overvoltages over one minute at switching on the device must be taken in consideration.
Optical isolation	The technique of using an optoelectric transmitter and receiver to transfer data without electrical continuity, to eliminate high-potential differences and transients.
Opto-coupler	With an opto-coupler direct current voltage can be transferred. The advantage is the small size.
Output current	The maximum amount of current the sensor can supply across the output signal, expressed as amps DC (A DC).
Output voltage	The nominal voltage output reading when shaft is rotated to full range, expressed in volts DC /Vo DC)

Parameter	The parameters of a control comprise all fort he control process required numeric values, e.g. for limit values and technological number.
PCI bus	PCI bus is a fast local bus with a clock rate up to 33 MHz. This bus is used for processing a great number of data. The PCI bus is not limited like the ISA and EISA systems.
PLD	= *Programmable Logic Device* Prorammable logic circuitry
Protective circuitry	A protective circuitry of the active part is done in order to protect the control electronic. The simplest protective circuitry is the parallel switching of a resistance.
Reference voltage	Reference voltages are stable voltages that are used as reference unit. From them voltages can be derived that are required for example in current supplies and in other electronic circuitries.
Resolution	The smallest significant number to which a measurement can be determined. For example a converter with 12-bit resolution can resolve 1 part in 4096.
Sensor	A device that responds to physical stimuli (heat, light, sound, pressure, motion, etc.) and produces a corresponding electrical output.
Settling time	The time required, after application of a step input signal, for the output voltage to settle and remain within a specified error band around the final value. The settling time of a system includes that of all of the components of the system.
Short circuit	A short circuit of two clamps of an electric switch is when the concerning clamp voltage is zero.
Short circuit current	Short circuit current is the current between tow short-circuited clamps.
Signal delay	The change of a signal affects the following circuitries with finite velocity; the signal will be delayed. Besides the signal delay times that are not wanted, the signal delay can be extended by time switches and delay lines.
Synchronous	In hardware, it is an event that occurs in a fixed time relationship to another event. In software, it refers to a function that begins an operation and returns to the calling program only when the operation is complete.
Throughput rate	The maximum repetitive rate at which data conversion system can operate with a specified accuracy. It is determined by summing the various times required for each part of the system and then by taking the inverse of this time.
Timer	The timer allows the adaptation of program processes between processor and peripheral devices. It usually contains from each other independent counters and can be programmed for several operation types over a control word register.
Diagnostic program	A utility program used to isolate hardware malfunctions on-board, or software malfunctions in the program.

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