DIN EN ISO 9001:2000
certified

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Preliminary version

Technical description

APCI-3122

Multifunction board, optically isolated

Edition: 03.05 – 11/2007

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

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:**

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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.

Figures

Tables

1   DEFINITION OF APPLICATION

1.1   Intended use

The **APCI-3122** 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 board **APCI-3122** 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 **APCI-3122** board must not to be used as safety related part (SRP).

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

The **APCI-3122** board must not be used in potentially explosive atmospheres.

The **APCI-3122** board must not be used as electrical equipment according to the Low Voltage Directive 2006/95/EC.

1.3   General description

Data exchange between the **APCI-3122** board and the peripheral is to occur through 2 shielded cables. These cables must be connected to the 15-pin SUB-D female connector (for analog outputs) and to the 26-pin SUB-D female connector (for digital inputs and outputs) of the **APCI-3122** board.

The board has up to 4 voltage input channels for processing analog signals and 10 input and 12 output channels for processing digital 24 V signals.

An external 24 V supply voltage is necessary to run the output channels.

The **PX 9200** screw terminal panel allows connecting the external voltage supply signals to a cold junction compensation through the **ST3122** cable.

The use of the **APCI-3122** board in combination with external screw terminal panels or relay boards is to occur in a closed switch cabinet; the installation is to be effected competently.

The connection with our standard cables **ST3122-A and ST3122-D** complies with the minimum specifications as follows:
- metallized plastic hoods
- shielded cable
- cable shield folded back and firmly screwed to the connector housing.

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 according to its intended purpose includes observing all advises given in the *Technical description* and in the *Safety* leaflet.

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 packing **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

10
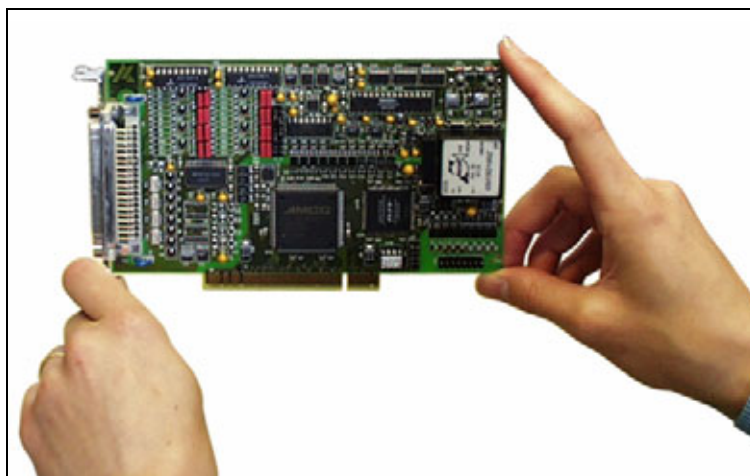
4   TECHNICAL DATA

4.1   Electromagnetic compatibility (EMC)

The board **APCI-3122** complies 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.

4.2   Physical set-up of the board

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

Dimensions:
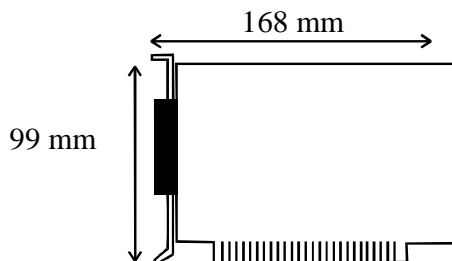
Weight: .... approx. 160 g
Installation in: .... 32/64-bit PCI slot 5 V
Connection to the peripheral:
2 SUB-D HD female connectors .... 1 x 15-pin connector
for the analog outputs
1 x 26-pin connector
for the digital I/O
Accessories[1]:
Standard cables: .... **ST3122-D** for the digital I/O
ST3122-A for the analog outputs
Screw terminal panel.................................. **PX 9200**

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

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1 Not included in the standard delivery.

4.3   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:
External operation voltage:........................ 24 V $\pm$ 5%
Maximum current consumption
(+ 5 V from the PC): .... 560 mA $\pm$ 15 mA[1]

4.3.1   Analog outputs

Number of channels: .... 4 analog outputs
Output type: .... single-ended, voltage channels
Resolution: 12-bit
Output voltage range: .... - 10 V to (+10 V - 1 LSB)
LSB: .... 4.8828 mV
Accuracy: 11-bit
Time to ready (tr): .... typ. 4.5 µs
Settling time
(= tr + settling time of the DAC): .... typ. 15 µs (by 10 V step)
Temperature drift: .... max. 10 ppm/°C
Maximum output current: .... $\pm$ 5 mA
Short-circuit current: .... $\pm$ 20 mA

Safety

Optical isolation to the PC: .... 500 VDC min.
Voltage after reset: .... 0 V / 0 mA

Timer2: .... can be programmed through
                                                           software as a watchdog for the
                                                           analog outputs
Timer/watchdog depth: 12-bit
Time bases: .... µs, ms, s
Control period: .... 1 to 4095 µs, ms, s
Tolerance: .... $\leq$ 1 µs, ms, s

---

[1] All digital outputs are connected and all digital inputs are set to high

4.3.2 Digital inputs

Input type: .... mass-related inputs
Number of input channels: 10
Nominal voltage: .... 24 VDC
Input current at nominal voltage: .... 6 mA
Logical levels (standard):........................... U_H[1] max.: 30 V/9.5 mA typ.

U_H min.: 19 V/3 mA

U_L[2] max.: 14 V/0.5 mA typ.

U_L min.: 0 V

Signal delay (at nominal voltage): .... typ. 40 µs
Maximum input frequency
(at nominal voltage): .... 5 kHz

Safety
Overvoltage protection: .... through transil diodes
Input filter: .... Ferrit and RC filter
Optical isolation: .... 1000 V
(DIN VDE 0411-100):   (from PC to peripheral)

4.3.3 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
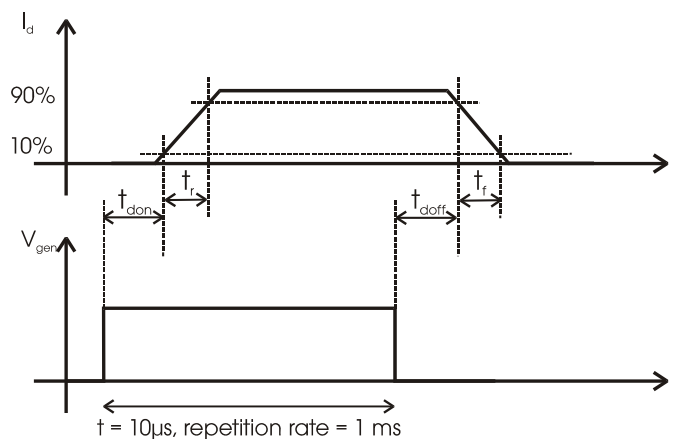
Output delay time: t_{don} or t_{doff}
Output transfer time for transition 0 $\rightarrow$ 1: Rising time (t_r)
Output transfer time for transition 1 $\rightarrow$ 0: Falling time (t_f)

---

[1] U_H: Input voltage, logic "1"
[2] U_L: Input voltage, logic "0"

24 V digital output channels

Output type: .... high side (load at ground)

Number of output channels: 12

Nominal voltage: .... 24 VDC

Range of the supply voltage: .... 10 V to 36 VDC
(over 24 V ext. pins)

Max. output current for all outputs: .... 3 A typ. (fused through
PTC resistors)

Max. output current / output channel: ...... 500 mA

Short-circuit current / output channel at 24 V,

$R_{load} < 0.1\ \Omega$: .... 2 A max.: switches off
the output

ON-resistor of the output channel

(R_{DS} ON resistor): .... 0.4 Ω max.

Overtemperature: .... $\vartheta_{IC} > 170°C$: switches off the
component (4 channels)

Temperature hysteresis: .... 20°C

Switching time of the 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 optical
couplers

Switch OFF time: .... typ. 80 µs, max. 150 µs +
delay time of the optical
couplers

Interruptible diagnostics, read back through status bit

ϑ-diagnostic: .... in case of overload of the
outputs or overtemperature of
the component

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).

Timer1: .... can be programmed through
software as a watchdog for the
digital outputs

Timer/watchdog depth: 12-bit

Time bases: .... µs, ms, s

Control period: .... 1 to 4095 µs, ms, s

Tolerance: .... ≤ 1 µs, ms, s

4.4 Component scheme

Fig. 4-2: Component scheme
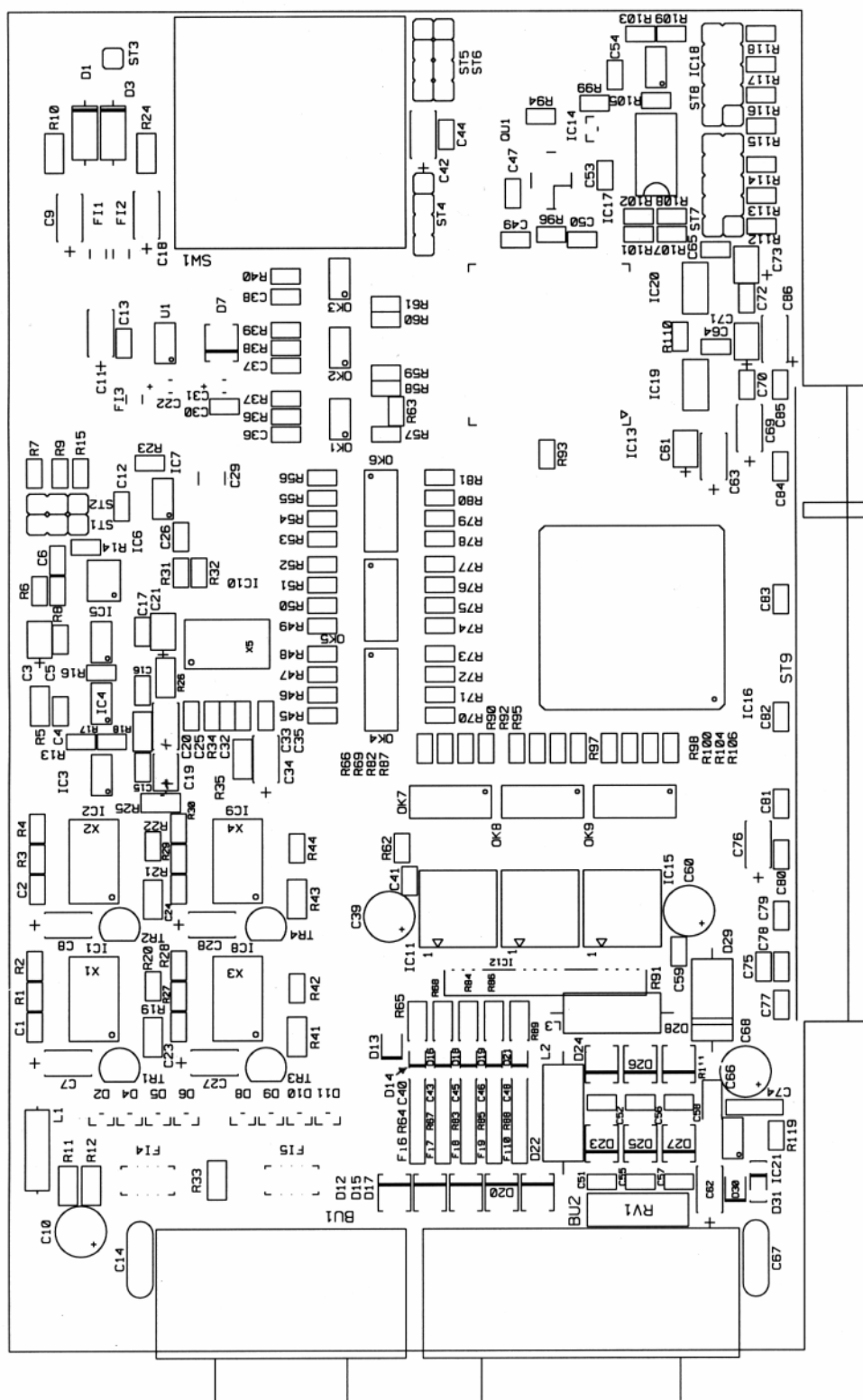
Fig. 4-3: Component scheme (solder side)
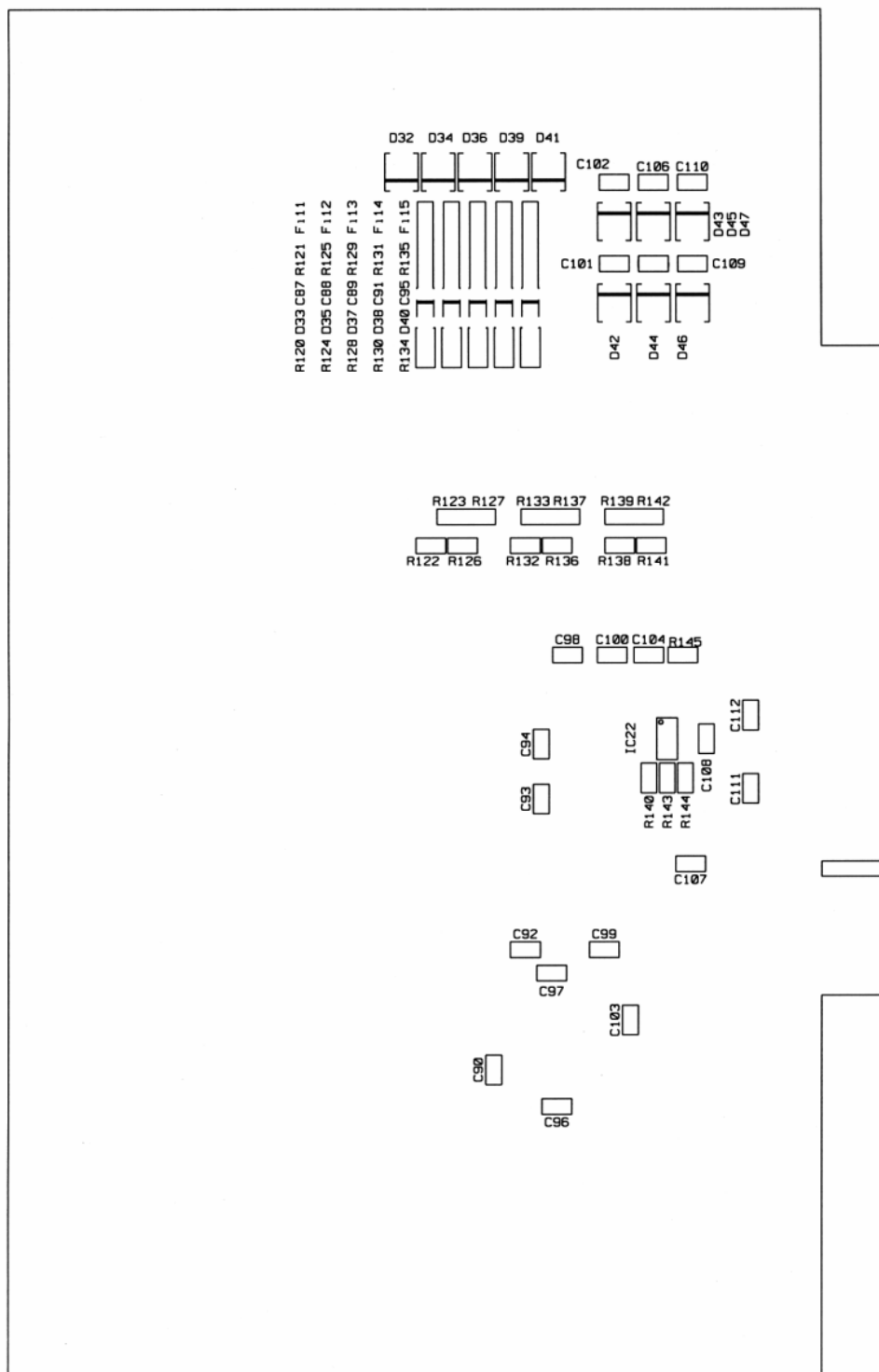
5   INSTALLATION OF THE BOARD

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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)
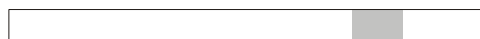
32 bits

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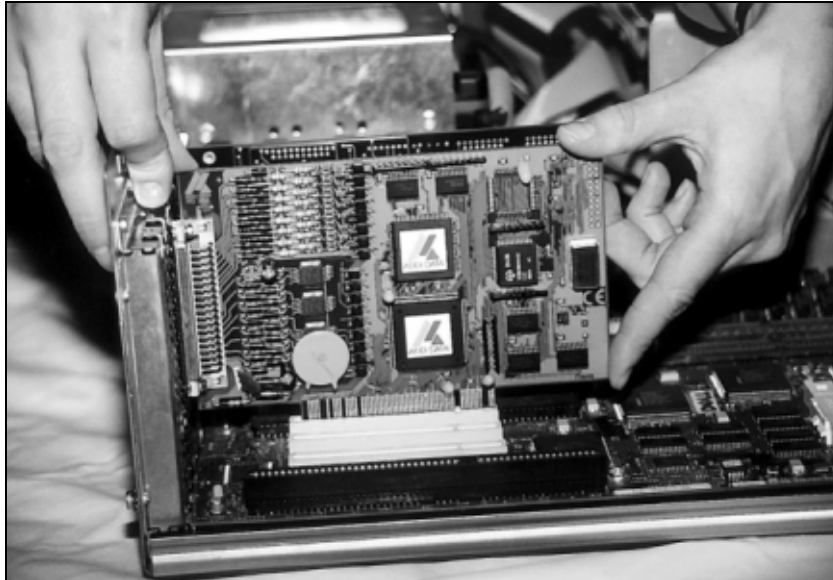
♦ Fasten the board **to the rear of the PC housing with the screw which was fixed on the back cover.**

Fig. 5-3: Fastening the board at the back cover
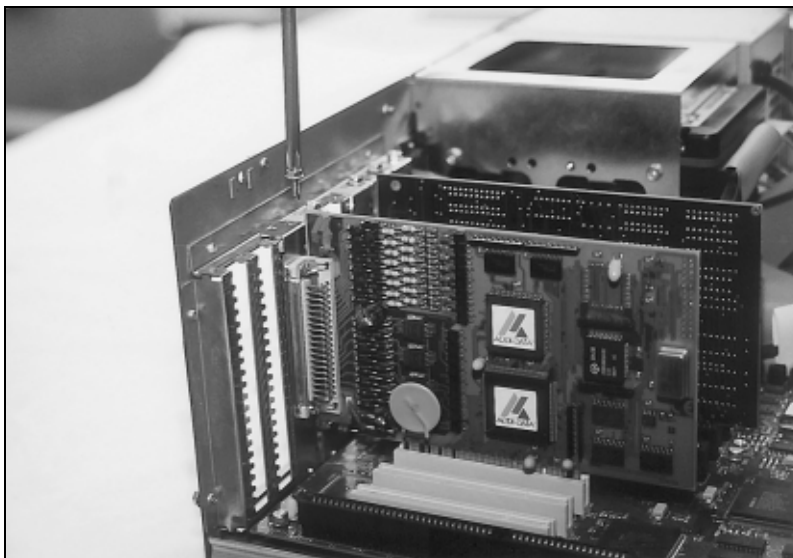
♦ **Tighten all the loosen screws.**

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.

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

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

i   **IMPORTANT!**
The supported software functions for the APCI-3122 are listed in chapter 9.

The board is supplied with a driver CD-ROM (CD 1) 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-bit.

- **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-3122 is 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 (Example)

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 (Example)
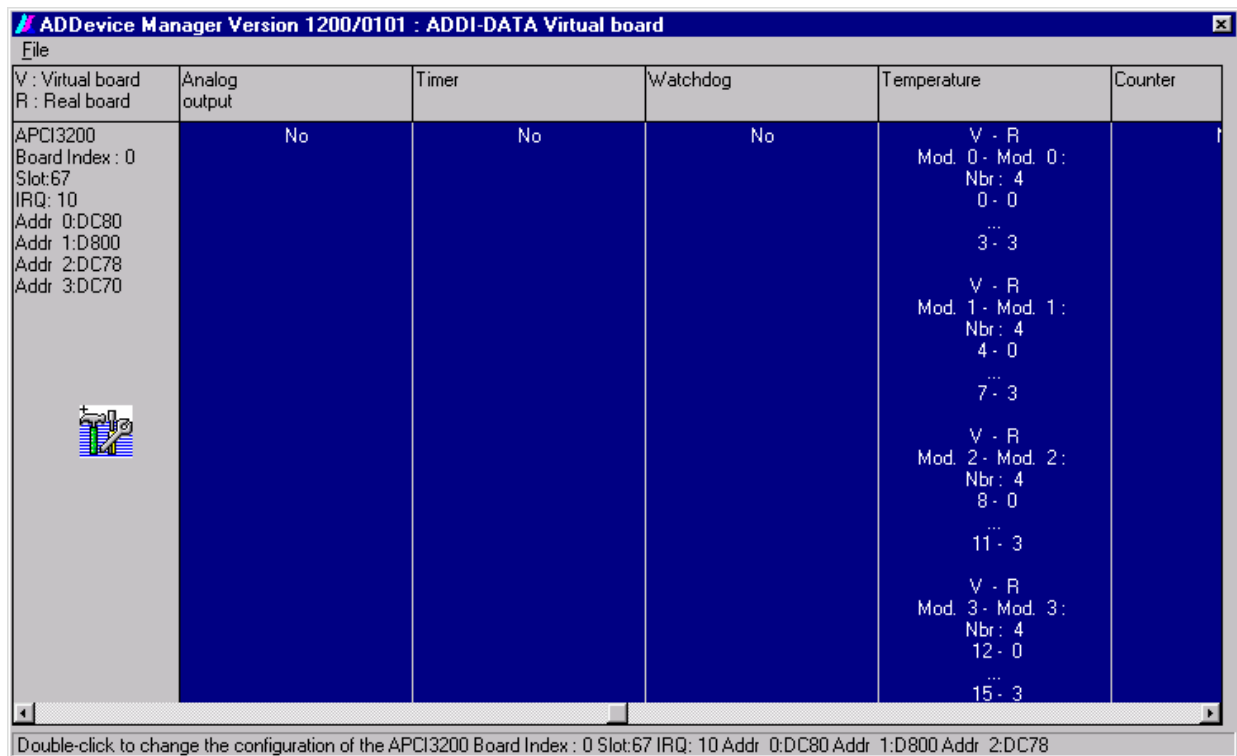
The following parameters are displayed for every inserted board:

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/output channels are interruptible, the program displays the number of the first and of the last input/output channel.

21

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.

APCI-3122 configuration

If a tool icon appears together with the cursor in the first column of the ADDevice Manager, you can modify the board configuration (click twice).

The timer1 and timer2 of the APCI-3122 for example may have different functions.

Fig. 6-3: Configuration of the timers for the APCI-3122
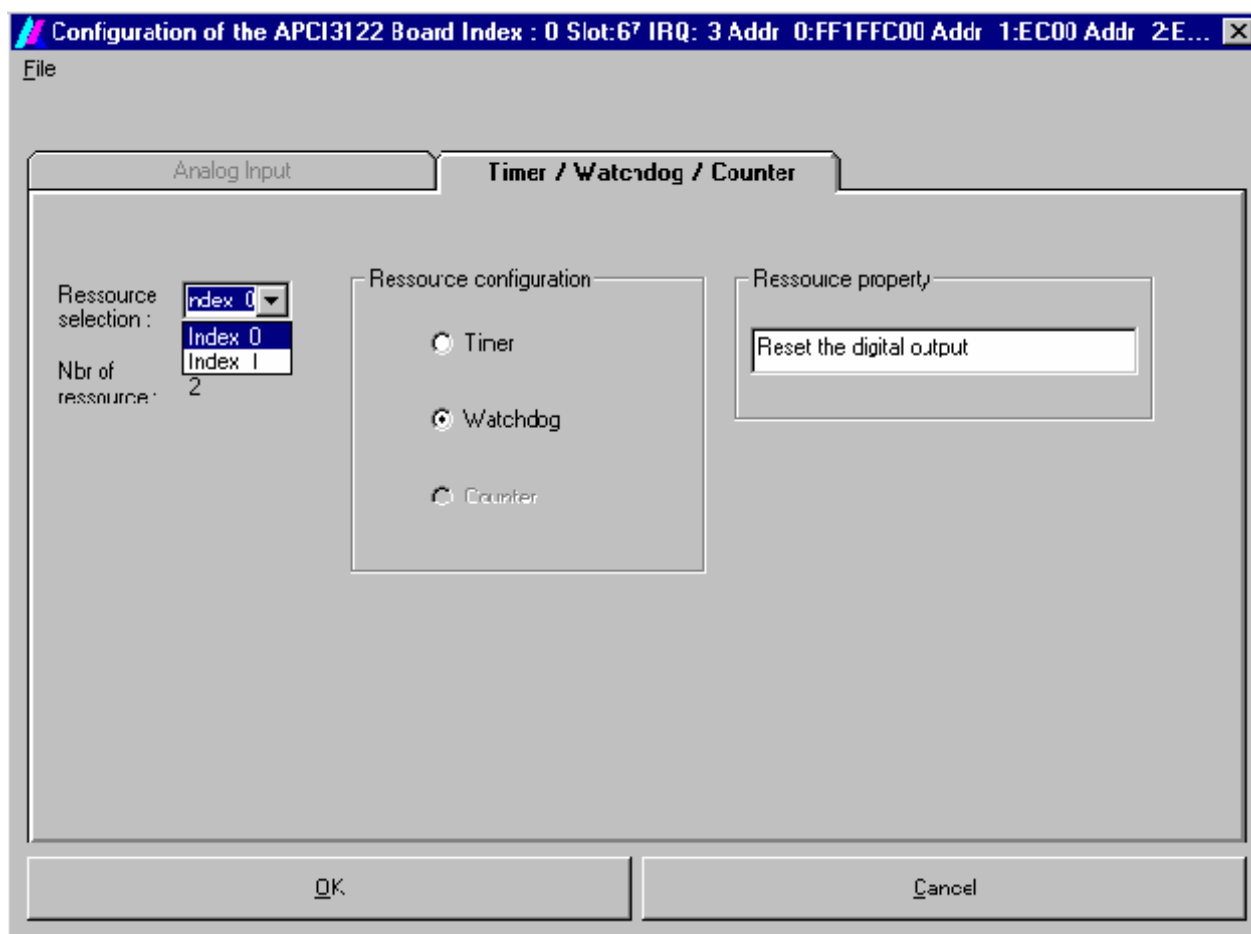
You can configure independently each timer as a timer or a watchdog.

Ressource selection:
Select the timer to be configured.
Index 0 for timer1 and **Index 1** for timer2.

Ressource configuration:
Set the selected timer as a timer or a watchdog.

Ressource property:
Displays the features of the selected configuration.

After configuring the board as required, you come back to the former window
with OK.

You can save the current set configuration for other boards. Click on "file" and
save the configuration as .cdf file with "Save file in". You can then reload the cdf
file for another board APCI-3122 by clicking ""File", "Load from File".

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.
Starten Sie ADDIREG unter Start/Programme/ADDIPACK/ADDIREG.

i   **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. 6-4: 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 **APCI-3122.**

http://www.addi-data.com
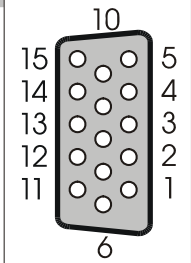
i   **IMPORTANT!**
Before using the board or in case of malfunction during operation, check if there is an update of the product (technical description, driver). The current version can be found on the internet or contact us directly.

7   CONNECTING THE PERIPHERAL

7.1   Analog outputs

7.1.1 Connector pin assignment

Fig. 7-1: 15-pin. SUB-D female connector (BU1)
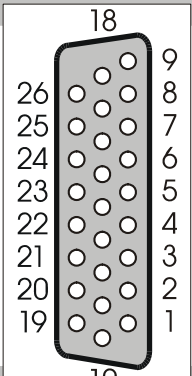
Pin		Pin			Pin			Pin
15	-	10	-	15	5	-	An. output 3	5
14	-	9	An. output 3 GND	14	4	An. output 3		4
13	-	8	An. output 2 GND	13	3	An. output 2		3
12	-	7	An. output 1 GND	12	2	An. output 1		2
11	-	6	An. output 0 GND	11	1	An. output 0		1

-: not connected

7.2   Digital input and outputs

7.2.1 Connector pin assignment

Fig. 7-2: 26-pin SUB-D female connector (BU2)

Pin		Pin			Pin		Pin
26	Dig. input 8	18	Dig. input 7	9	Dig. input 9		9
25	Dig. input 5	17	Dig. input 4	8	Dig. input 6		8
24	Dig. input 2	16	Dig. input 1	7	Dig. input 3		7
23	+24V ext.	15	0V ext. (input)	6	Dig. input 0		6
22	Dig. output 11	14	Dig. output 10	5	+24 V ext.		5
21	Dig. output 8	13	Dig. output 7	4	Dig. output 9		4
20	Dig. output 5	12	Dig. output 4	3	Dig. output 6		3
19	Dig. output 2	11	Dig. output 1	2	Dig. output 3		2
		10	0V ext. (output)	1	Dig. output 0		1

7.2.2 Connection principle of the digital inputs

Fig. 7-3: Connection principle of the digital inputs
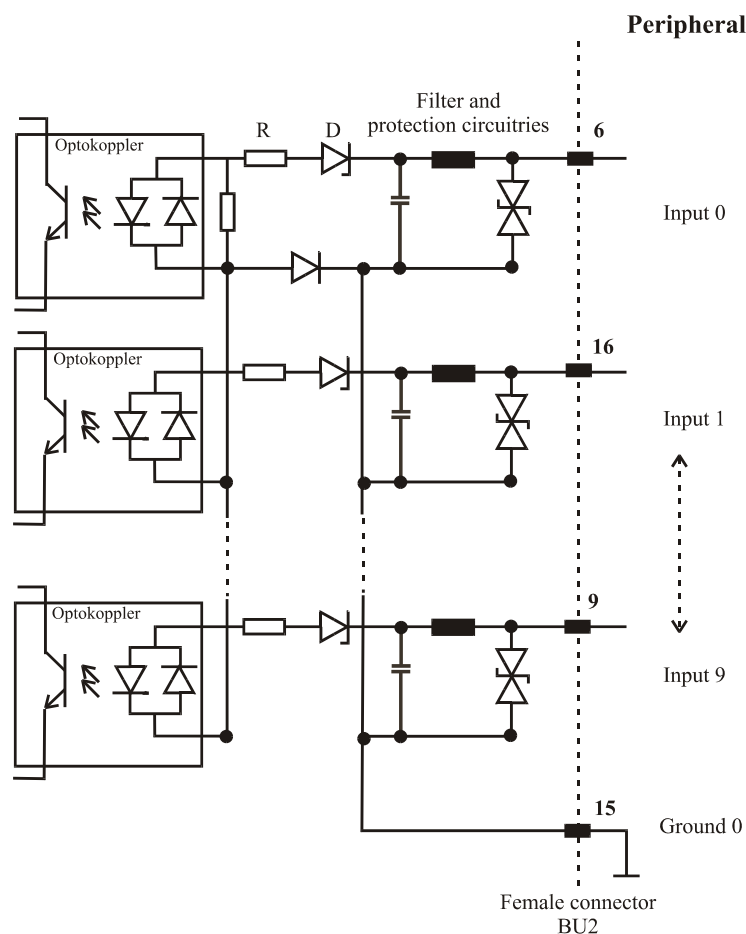
7.2.3 Connection principle of the digital outputs

Fig. 7-4: Connection principle of the digital outputs
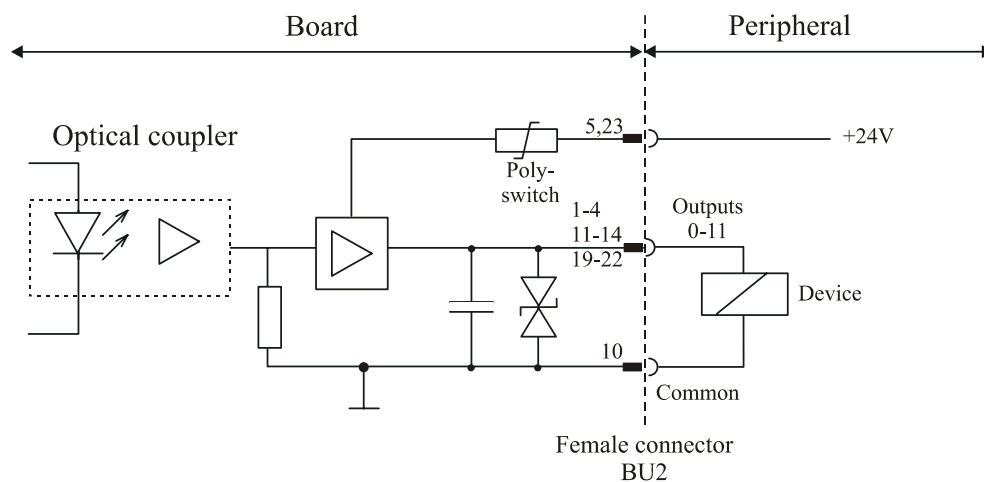
7.3   Connection to the screw terminal panel PX 9200

7.3.1 Connection of the APCI-3122 to the PX 9200

Fig. 7-5: Connection to the screw terminal panel PX 9200
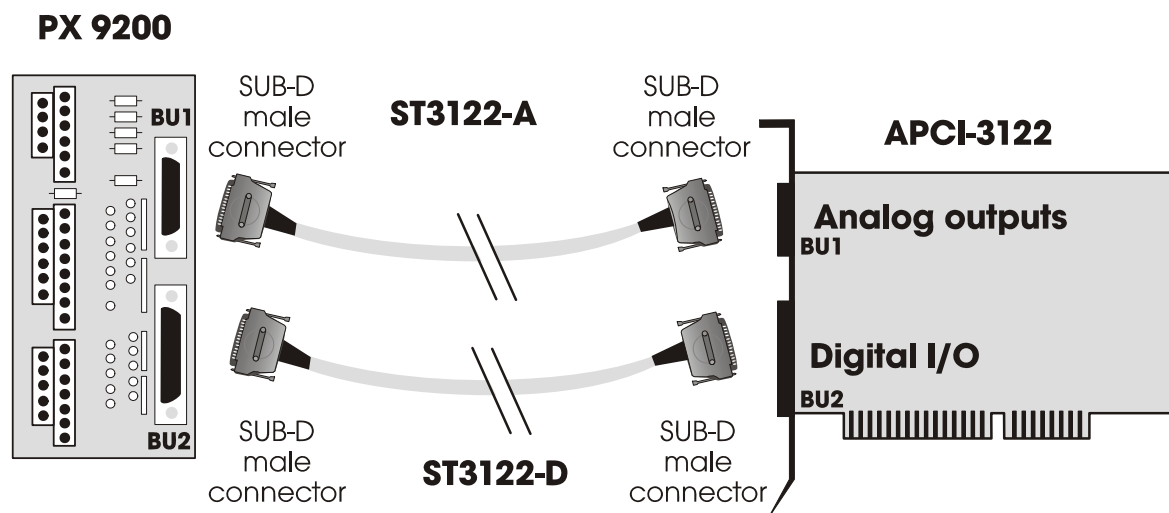
7.3.2 Layout of the screw terminal panel

Fig. 7-6: Layout of the screw terminal panel PX 9200
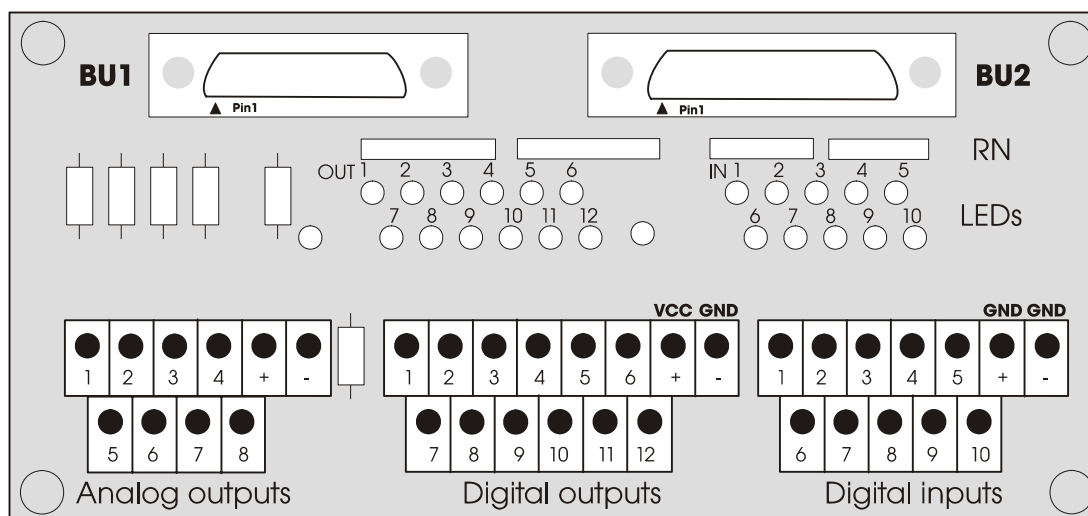
7.3.3 Screw terminal and connector assignment

The assignments of the front connectors BU1 and BU2 of the board are identical to the assignments of the connectors BU1 and BU2 of the screw terminal panel.

BU1 connector assignment (analog outputs)

Board	Description	→	PX 9200	Description
Pin 1	Analog output 0	→	Pin 1	Analog output 0
Pin 6	Analog output 0 GND	→	Pin 6	Analog output 0 GND
...	...	→	...	...
Pin 9	Analog output 3 GND	→	Pin 9	Analog output 3 GND

BU2 connector assignment (digital inputs and outputs)

Board	Description	→	PX 9200	Description
Pin 1	Digital output 0	→	Pin 1	Digital output 0
Pin 6	Digital input 0	→	Pin 6	Digital input 0
...	...	→	...	...
Pin 19	Digital output 2	→	Pin 19	Digital output 2
Pin 26	Digital input 8	→	Pin 26	Digital input 8

Screw terminal assignment

Fig. 7-7: Terminal assignment on the PX 9200

Common ground	● -	
Common ground	● -	●10 Dig. input 9
Dig. input 4	● 5	● 9 Dig. input 8
Dig. input 3	● 4	● 8 Dig. input 7
Dig. input 2	● 3	● 7 Dig. input 6
Dig. input 1	● 2	● 6 Dig. input 5
Dig. input 0	● 1	

0 V ext.	● -	
24 V ext.	● +	●12 Dig. output 11
Dig. output 5	● 6	●11 Dig. output 10
Dig. output 4	● 5	●10 Dig. output 9
Dig. output 3	● 4	● 9 Dig. output 8
Dig. output 2	● 3	● 8 Dig. output 7
Dig. output 1	● 2	● 7 Dig. output 6
Dig. output 0	● 1	

*	● -	
*	● +	● 8 An. output 3 GND
An. output 3	● 4	● 7 An. output 2 GND
An. output 2	● 3	● 6 An. output 1 GND
An. output 1	● 2	● 5 An. output 0 GND
An. output 0	● 1	

*: not used when connecting voltage outputs

8   FUNCTIONS OF THE BOARD

8.1   Block diagram

Fig. 8-1: Block diagram of the APCI-3122
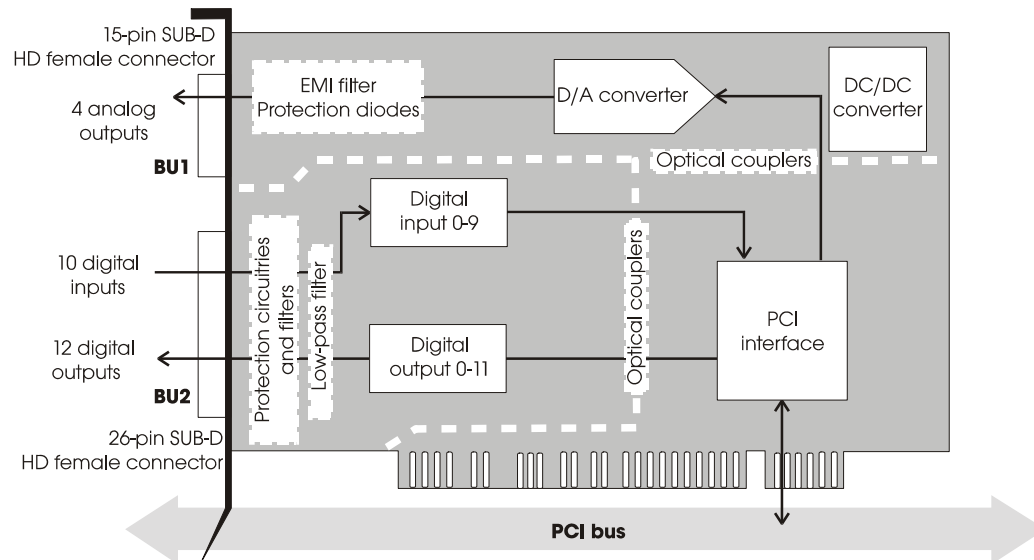
8.2   Analog outputs

There are 4 analog output channels with 12-bit resolution on the board.

The analog outputs are updated through 32-bit write operations on I/O addresses. A stauts bit (DAC ready) indicates if the analog output channels are ready to be updated.

The time ("Time to ready"; see figure below) between the write operations on I/O addresses (DAC registers) and the update of the analog outputs amounts typically 4.5 µs. Further accesses on the DAC registers are not handled within this interval.

The time between the writing of a software command and the reaching of the setpoint value by the analog outputs is typically 15 µs (settling time).

Fig. 8-2: Reaction time of the analog outputs
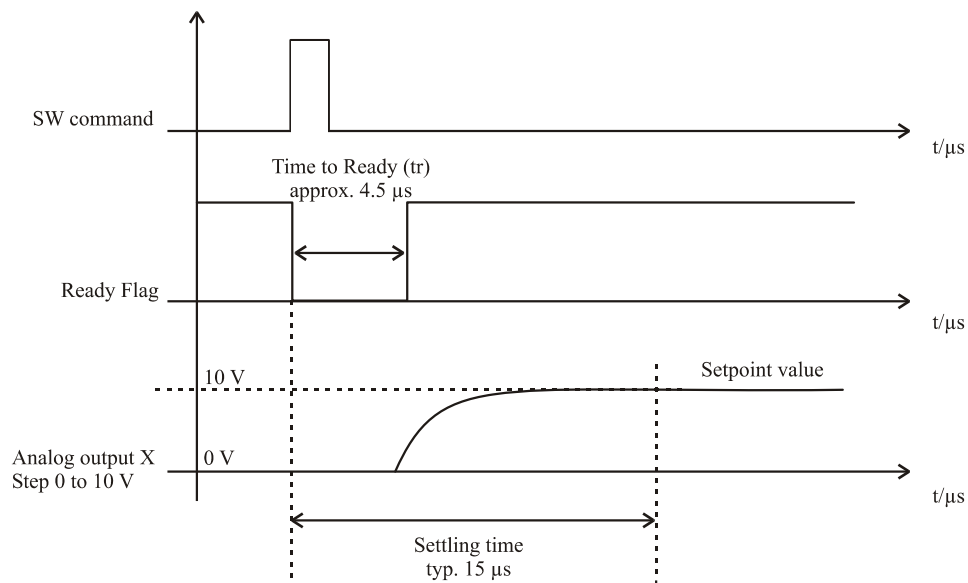
The analog output channels are set to a 0 V voltage value after Power-ON Reset of the PC.

Fig. 8-3: Switching principle of the analog ground lines
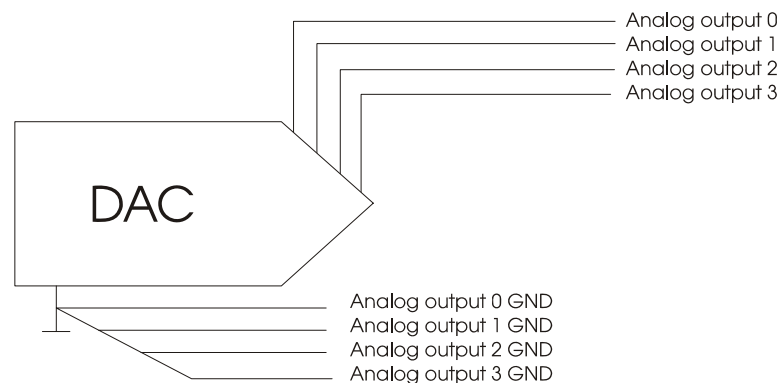
8.3 Digital inputs

8.3.1 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.

The required current input is 6 mA at nominal voltage.

i

IMPORTANT!
If you operate all inputs with the same voltage supply, the
voltage supply must deliver e.g. at least 10 x 6 = 60 mA
at Vcc ext. = 24 V.

The maximum input voltage is 30 V / 9.5 mA typical.

Transil diodes, Z diodes, LC filters and optical 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
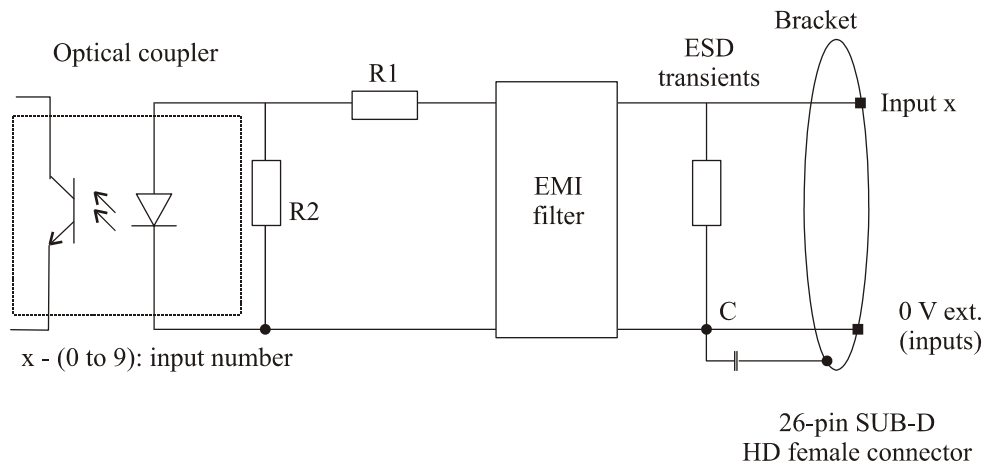
8.4   Digital outputs

The board **APCI-3122** is supplied with 12 optically isolated outputs.

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

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

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.

Features of the 24 V outputs:

34

- Protection against short-circuit: the output is switched off.
- Protection against overtemperature: the output component (4 channels) is switched off.
- The outputs are switched off if the ext. supply voltage drops below 5 V.
- Transorb diodes, C filters and optical 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.

Diagnostic

2 diagnostic bits are available onboard.

The ϑ-diagnostic is released:
- when short-circuit has occurred on an output or
- in case of overtemperature on an output component (4 channels).

The V_{cc}-diagnostic informs that:
- the external voltage supply has dropped < 5 V.

Fig. 8-5: Protection circuitry of the outputs (24 V)

x = 0 bis 11: Output number
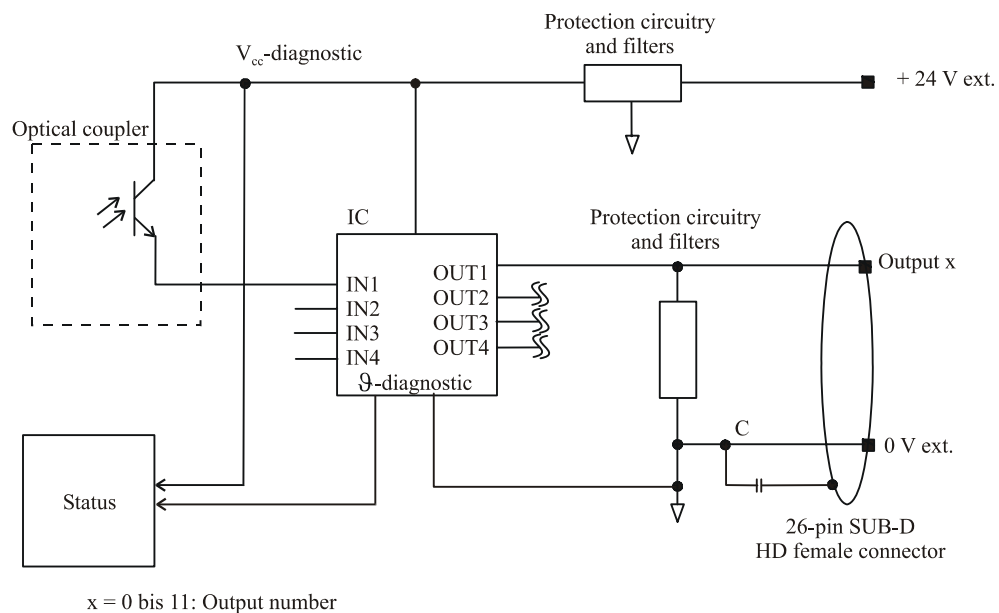
Interrupt

The digital outputs 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 are read through software.

8.5 Timer/Watchdog

8.5.1 Timer1/digital watchdog

The 12-bit timer1 is a down counter, which can generate 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, of the reload value and of the status and interrupt registers can be read back through software.

The timer1 can be programmed as a watchdog, which resets the digital outputs after running down of its reload value (timeout).

When releasing the watchdog, the reload value is loaded anew after each setting of the digital outputs (triggering). Triggering can also occur directly through software command without setting the digital outputs anew.

The operation state can be read back. 3 different clock signals are available as time base for the watchdog (see Limit values).

8.5.2 Timer2/analog watchdog

The 12-bit timer2 is a down counter, which can generate 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, of the reload value and of the status and interrupt registers can be read back through software.

The timer2 can be programmed as a watchdog, which resets the analog outputs after running down of its reload value (timeout).

When releasing the watchdog, the reload value is loaded anew after each setting of the analog outputs (triggering). Triggering can also occur directly through software command without setting the analog outputs anew.

The operation state can be read back. 3 different clock signals are available as time base for the watchdog (see Limit values).

9   STANDARD SOFTWARE

9.1   Software functions

ADDIPACK supports the following functions for the **APCI-3122**.

Table 9-1: Supported software functions

Functionality	Function name
Common functions	i_ADDIDATA_OpenWin32Driver
	i_ADDIDATA_GetCurrentDriverHandle
	i_ADDIDATA_GetDriverVersion
	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
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

Functionality	Function name	
Digital outputs	b_ADDIDATA_Set4DigitalOutputsOn	
	b_ADDIDATA_Set4DigitalOutputsOff	
	b_ADDIDATA_Set8DigitalOutputsOn	
	b_ADDIDATA_Set8DigitalOutputsOff	
	b_ADDIDATA_Set16DigitalOutputsOn	
	b_ADDIDATA_Set16DigitalOutputsOff	
	b_ADDIDATA_Get1DigitalOutputStatus	
	b_ADDIDATA_Get2DigitalOutputStatus	
	b_ADDIDATA_Get4DigitalOutputStatus	
	b_ADDIDATA_Get8DigitalOutputStatus	
	b_ADDIDATA_Get16DigitalOutputStatus	
	b_ADDIDATA_InitDigitalOutputInterrupt	
	b_ADDIDATA_EnableDisableDigitalOutputInterrupt	
	b_ADDIDATA_ReleaseDigitalOutputInterrupt	
Analog outputs	b_ADDIDATA_GetNumberOfAnalogOutputs	
	b_ADDIDATA_GetAnalogOutputInformation	
	b_ADDIDATA_Init1AnalogOutput	
	b_VoltageMode	0: Bipolar ±10V
		1: Unipolar 0-10V
	b_Polarity	2: Bipolar (used with Voltage-Mode 0)
		1: Unipolar (used with voltage mode 1)
	b_ADDIDATA_InitMoreAnalogOutputs *See b_ADDIDATA_Init1AnalogOutput( )*	
	b_ADDIDATA_Write1AnalogOutput	
	dw_ValueToWrite	Min.: 0
		Max.: 16383 (Bipolar)
		or 8191 (Unipolar)
	b_ADDIDATA_WriteMoreAnalogOutputs *See b_ADDIDATA_Write1AnalogOutput( )*	
	b_ADDIDATA_Release1AnalogOutput	
	b_ADDIDATA_ReleaseMoreAnalogOutputs	

Functionality	Function name
Watchdog	b_ADDIDATA_GetNumberOfWatchdogs
	b_ADDIDATA_GetWatchdogInformation
	b_ADDIDATA_GetWatchdogInformationEx

	b_ADDIDATA_InitWatchdog
	
	b_DelayTimeUnit 1: µs
	                  2: ms
	                  3: s
	dw_DelayValue Min.:0
	                  Max.:4095

	b_ADDIDATA_EnableDisableWatchdogInterrupt
	b_ADDIDATA_StartWatchdog
	b_ADDIDATA_StartAllWatchdogs
	b_ADDIDATA_TriggerAllWatchdogs
	b_ADDIDATA_StopWatchdog
	b_ADDIDATA_StopAllWatchdogs
	b_ADDIDATA_ReadWatchdogStatus
	b_ADDIDATA_ReleaseWatchdog
Timer	b_ADDIDATA_GetNumberOfTimers
	b_ADDIDATA_GetTimerInformation
	b_ADDIDATA_InitTimer

	b_TimerMode Mode 2 available
	
	b_TimerTimeUnit 1: µs
	                  2: ms
	                  3: s
	dw_ReloadValue Min.:0
	                  Max.:4095

	b_ADDIDATA_EnableDisableTimerInterrupt
	b_ADDIDATA_StartTimer
	b_ADDIDATA_StartAllTimers
	b_ADDIDATA_TriggerAllTimers
	b_ADDIDATA_StopTimer
	b_ADDIDATA_StopAllTimers
	b_ADDIDATA_ReadTimerValue
	b_ADDIDATA_ReadTimerStatus
	b_ADDIDATA_ReleaseTimer

9.2   Software samples

Table 9-2: Supported software samples for the APCI-3122

Functionality	Sample number	Description
Analog outputs	SAMPLE01	Write 1 analog output value without synchronising.
	SAMPLE02	Write several analog output values without synchronising.
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
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
	SAMPLE07	Test all digital output interrupts (short-circuit and others).
Timer	SAMPLE01	Initialise 1 timer in mode2 without interrupt
	SAMPLE02	Initialise 1 timer in mode2 with interrupt
Watchdog	SAMPLE01	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.
	SAMPLE02	Initialise and release software-trigger at key stroke. Start 1 watchdog with interrupt. Wait till interrupt. Reset the watchdog and quit the program.
	SAMPLE03	Initialise and start all watchdogs. Read status lesen, once all watchdogs have run down. Reset all and quit the program. Hardware gate and trigger are not used. Warning and reset relays are not used.
	SAMPLE04	Initialise and start all watchdogs with interrupt.wait till interrupt. Reset all and quit the program. Hardware gate and trigger are not used. Warning and reset relays are not used.

Functionality	Sample number	Description
Watchdog	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.
	SAMPLE06	b_ADDIDATA_GetWatchdogInformationEx() is used. Initialise and release software trigger at key stroke. Start 1 watchdog with interrupt. Wait for interrupt. 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.
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.
Diagnostic program	A utility program used to isolate hardware malfunctions on-board, or software malfunctions in the program.
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.
Gain	The factor by which an incoming signal is multiplied.
Ground	A common reference point for an electrical system.
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.
Interrupt	A signal to the CPU indicating that the board detected the occurrence of a specified condition or event.
Limit value	Exceeding the limit values, even for just a short time, can lead to the destruction or to a loss of functionality.
Low-pass filter	Transmitting all frequencies below a certain value.
Noise immunity	Noise immunity is the ability of a device to work during an electromagnetic interference without reduced functions.
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	A device containing light-emitting and light-sensitive components used to couple isolated circuits
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.
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.
Protective diode	At the input of the integrated MOS (Metal Oxide Semi-Conductor)-circuits used diodes, which operate at the permitted input voltages in the reverse range, but at overvoltage in the transition range and therefore protects the circuits against damage.
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.
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.
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.
Trigger	Internal trigger: A software generated event that starts an operation. External trigger: An analog or digital hardware event from an external source that starts an operation. Digital trigger: An event that occurs at a user-selected point on a digital input signal. The polarity and sensitivity of the digital trigger can often be programmed.

11 INDEX

45