**DIN EN ISO 9001:2000
certified**

ADDI-DATA®

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Preliminary version

Technical description

APCI-3504

Analog output board, optically isolated

Edition: 05.06 – 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:**

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-3504** board must be inserted in a PC with PCI 5V/32-bit / 64-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-3504** 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-3504** board must <u>not</u> to be used as safety related part (SRP).

The board must <u>not</u> be used for safety related functions, for example for emergency stop functions.

The **APCI-3504** board must <u>not</u> be used in potentially explosive atmospheres.

The **APCI-3504** board must <u>not</u> be used as electrical equipment according to the Low Voltage Directive 2006/95/EC.

1.3   General description

Data exchange between the **APCI-3504** board and the peripheral is to occur through a shielded cable. This cable must be connected to the 15-pin SUB-D female connector of the **APCI-3504** board.

The board has up to 4 input channels in voltage or current version for processing analog 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 through the **ST3122-A** cable.

The use of the **APCI-3504** 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 cable **ST3122-A** 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.

The emergency stop functions are to be secured separately.
This securing must not be influenced by the board or the PC.

The installation of the board APCI-3504 in sites lying under risk of explosion is excluded.

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
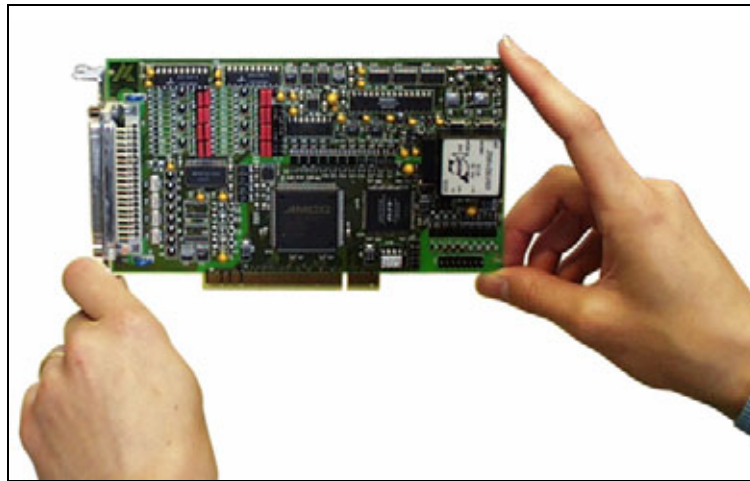
4   TECHNICAL DATA

4.1   Electromagnetic compatibility (EMC)

The board **APCI-3504** 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:
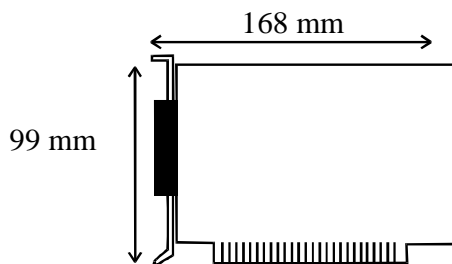

```
Weight: ....................................................... approx. 160 g
Installation in:  ......................................... 32/64-bit PCI slot 5 V
Connection to the peripheral:
2 SUB-D HD female connectors ............... 1 x 15-pin connector
                                             for the analog outputs
```

Accessories[1]:
```
Standard cable: ......................................... ST3122-A
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   Versions

2 versions of the board APCI-3504 are availabe.

	APCI-3504	APCI-3504-C
Analog outputs	4 **voltage** outputs	4 **current** outputs

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

4.4.1 Voltage outputs

Number of channels: .... 4 analog outputs
Output type: .... single-ended
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

---

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

4.4.2 Current outputs (APCI-3504-C)

Number of channels: .... 4 analog outputs
Resolution: 12-bit
Max output current: .... 0 to 20 mA
LSB: .... 4.883 µA
Typical error: .... ≤ 25 µA
Max. error: .... ≤ 100 µA
Time to ready (tr): .... typ. 4.5 µs
Settling time
(= tr + settling time of the DAC): ....typ. 70 µs (by 20 mA step)
Temperature drift: .... max. 10 ppm/°C
Maximum load: .... 500 Ω

4.4.3 Timer

Timer depth: 12-bit
Time bases: .... µs, ms, s
Control period: .... 1 to 4095 µs, ms, s
Tolerance: .... ≤ 1 µs, ms, s

4.4.4 Safety (Voltage and current outputs)

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

Watchdog
Watchdog depth: 12-bit
Time bases: .... µs, ms, s
Control period: .... 1 to 4095 µs, ms, s
Tolerance: .... ≤ 1 µs, ms, s

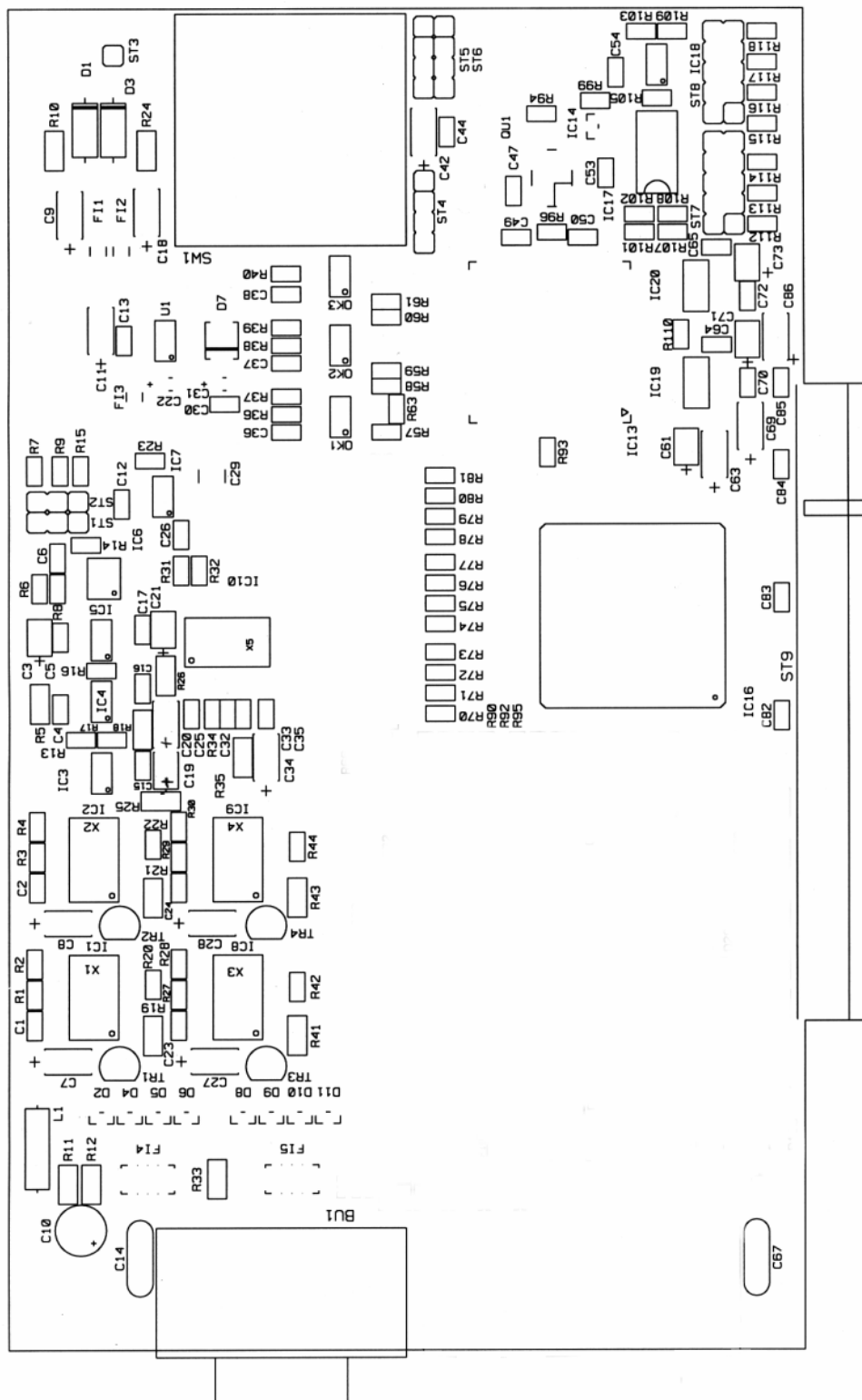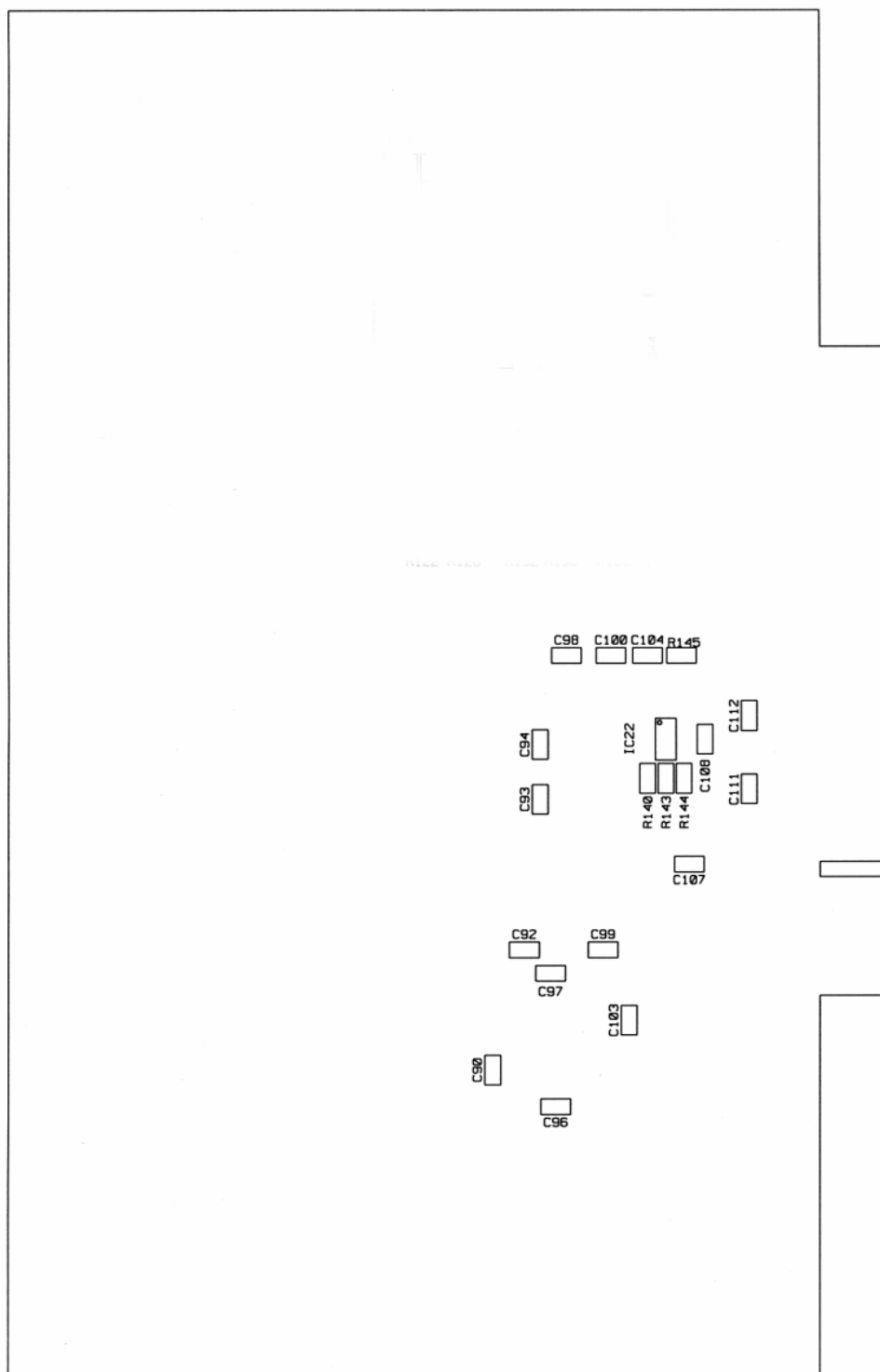## 4.5   Component scheme

Fig. 4-1: Component scheme

Fig. 4-2: Component scheme (solder side)

5   INSTALLATION OF THE BOARD

i   **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
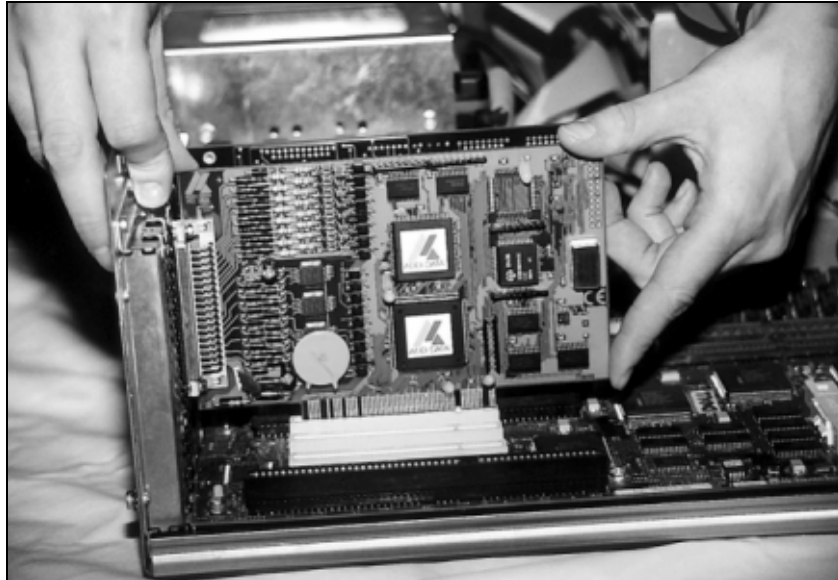
Discharge yourself from electrostatic charges.

Take the board out of its protective pack.
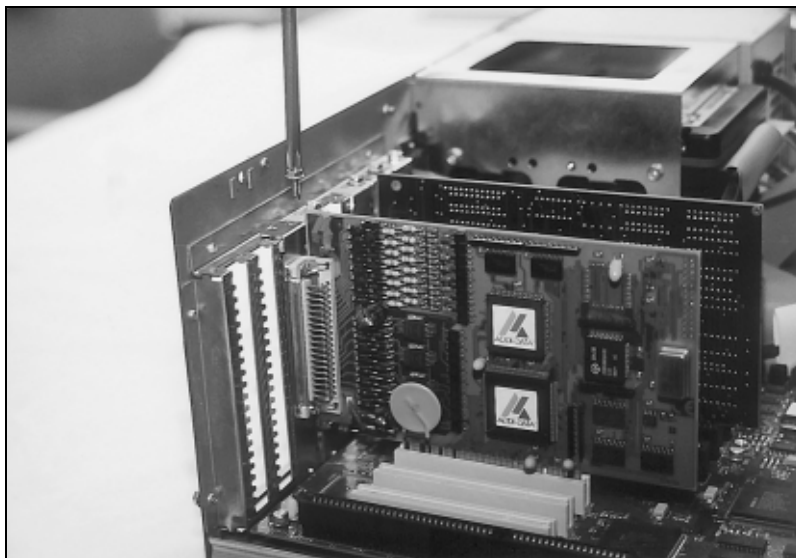
5.3   Plugging the board into the slot

♦ 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 and ISA 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-3504 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-3504** 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.

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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

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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.

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. 6-3: ADDIREG registration program (example)

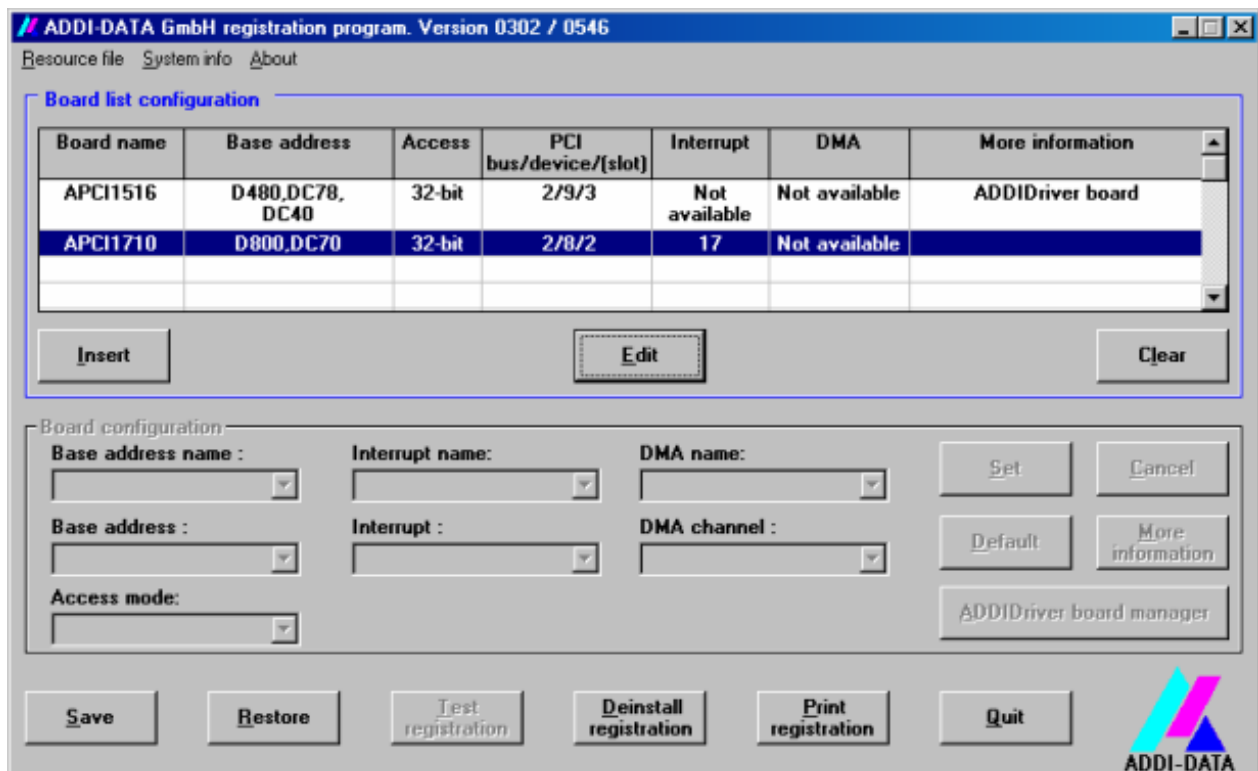| Board name	Base address	Access	PCI bus/device/[slot]	Interrupt	DMA	More information
APCI1516	D480,DC78, DC40	32-bit	2/9/3	Not available	Not available	ADDIDriver board
APCI1710	D800,DC70	32-bit	2/8/2	17	Not available	

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-3504**

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   Connector pin assignment
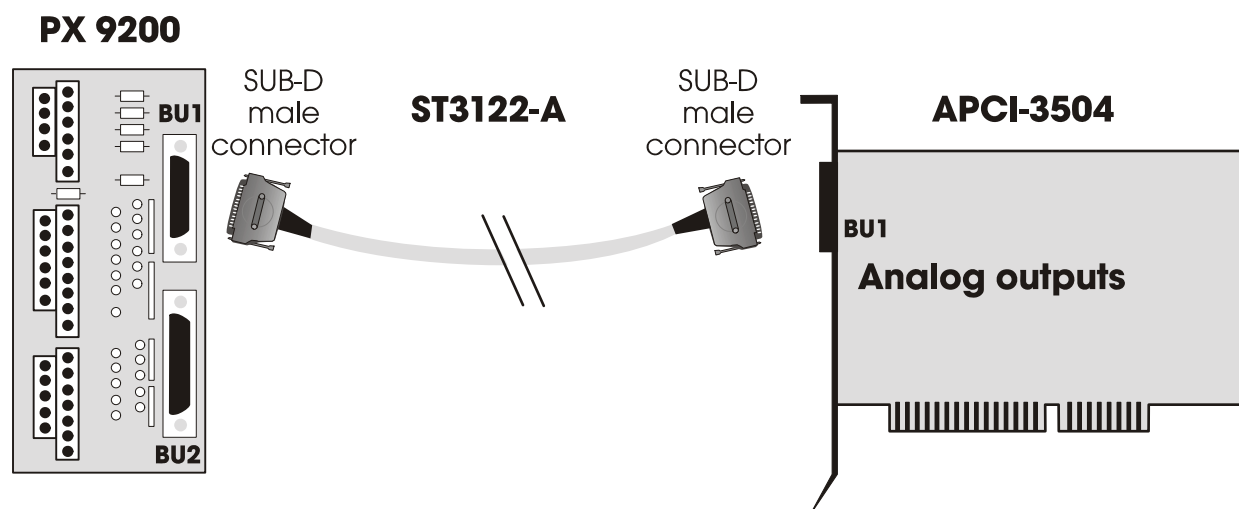
Fig. 7-1: 15-pin. SUB-D female connector (BU1)

Pin		Pin			Pin		Pin
15	+24 V ext (current option)	10	-		15 ... 5	-	5
14	+24 V ext (current option)	9	An. output 3 GND		14 ... 4	An. output 3	4
13	-	8	An. output 2 GND		13 ... 3	An. output 2	3
12	Ext. GND	7	An. output 1 GND		12 ... 2	An. output 1	2
11	Ext. GND	6	An. output 0 GND		11 ... 1	An. output 0	1

-: not connected

7.2   Connection to the screw terminal panel PX 9200

7.2.1   Connection of the APCI-3504 to the PX 9200

Fig. 7-2: Connection to the screw terminal panel PX 9200

PX 9200

SUB-D male connector — ST3122-A — SUB-D male connector — APCI-3504

BU1

Analog outputs

BU1

BU2

7.2.2 Layout of the screw terminal panel

Fig. 7-3: Layout of the screw terminal panel PX 9200
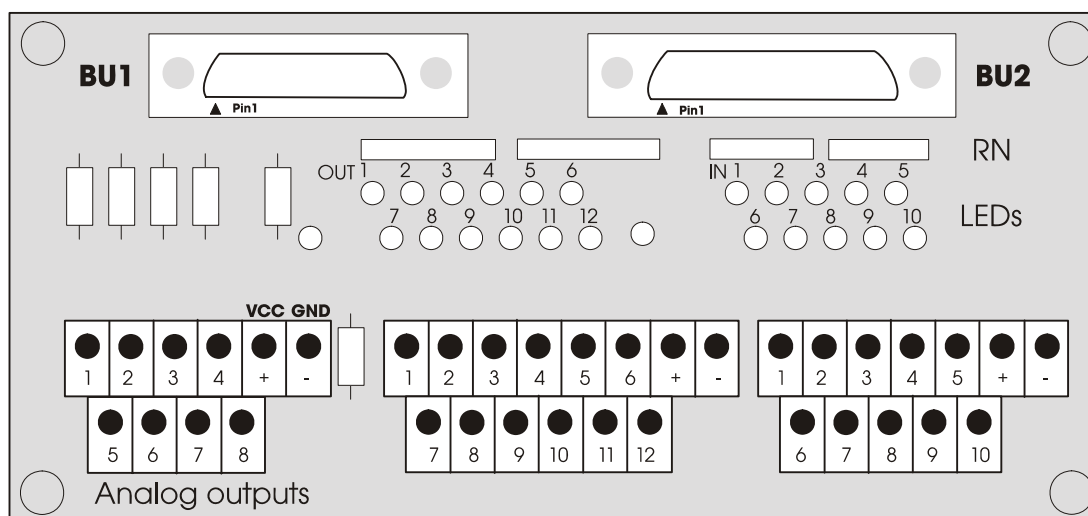
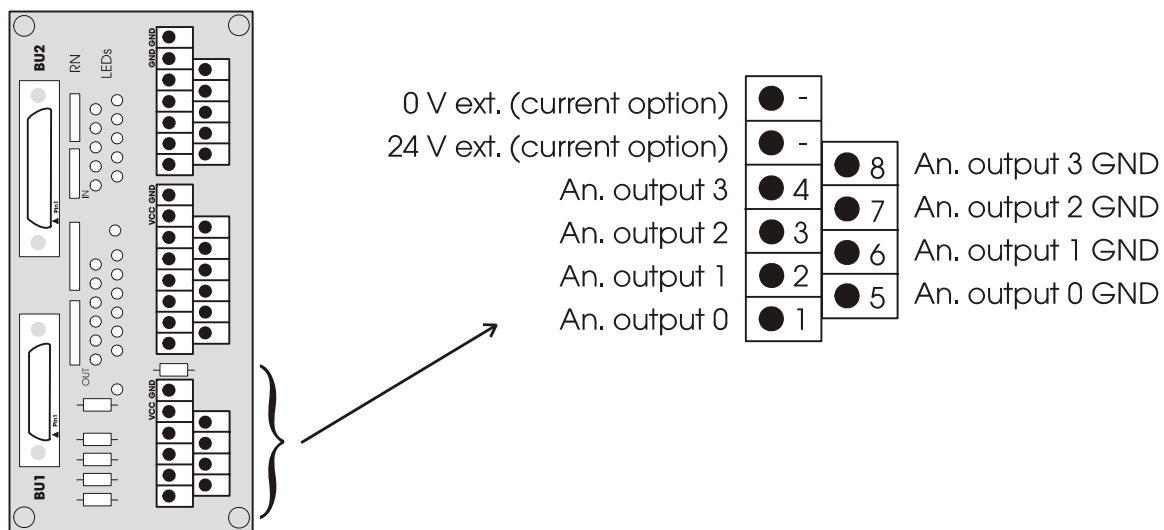## 7.2.3 Screw terminal and connector assignment

The assignment of the front connector BU1 of the board is identical to the assignment of the connector BU1 of the screw terminal panel.

Connector assignment (Board and srew terminal panel)

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 15	+ 24 V (current version)	→	Pin 15	+ 24 V (current version)

Screw terminal assigment

Fig.7-4: Terminal assignment of the PX 9200

0 V ext. (current option) ● -
24 V ext. (current option) ● -
An. output 3 ● 4   ● 8 An. output 3 GND
An. output 2 ● 3   ● 7 An. output 2 GND
An. output 1 ● 2   ● 6 An. output 1 GND
An. output 0 ● 1   ● 5 An. output 0 GND

8 FUNCTIONS OF THE BOARD

8.1 Block diagram

**Fig. 8-1: Block diagram of the APCI-3504**
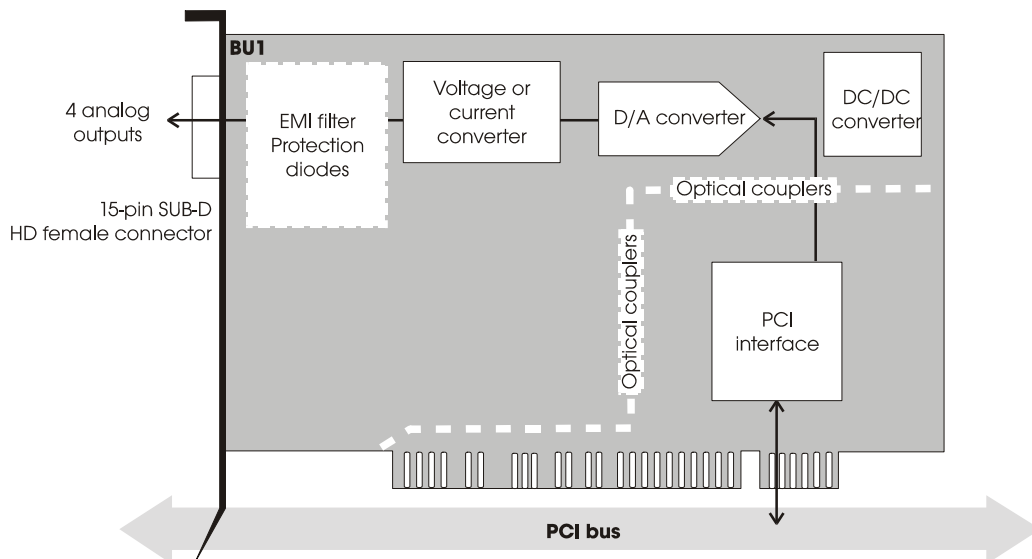
8.2 Analog outputs

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
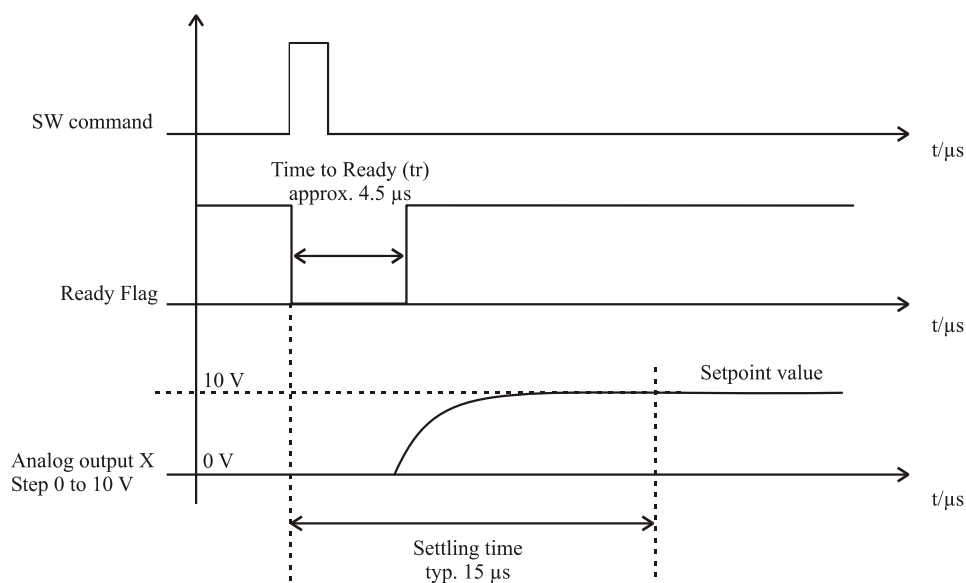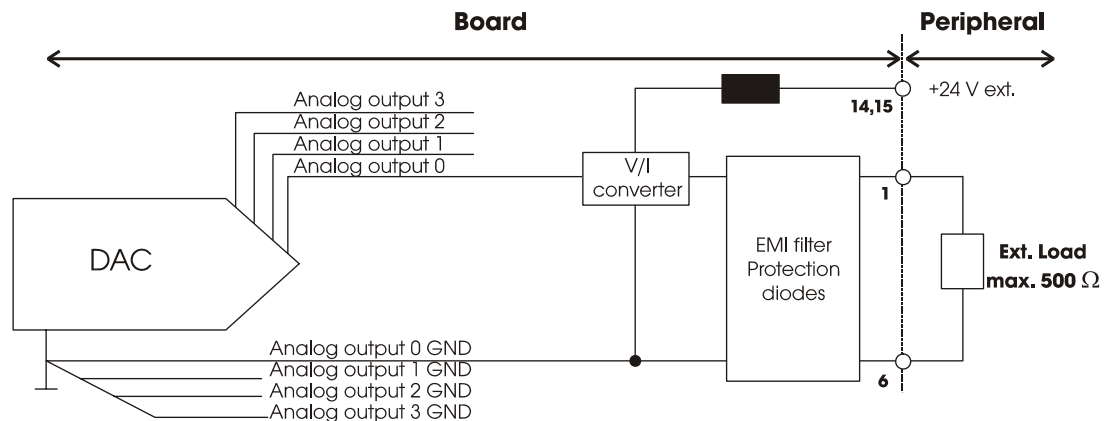

8.2.1 Voltage outputs

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 (voltage version)
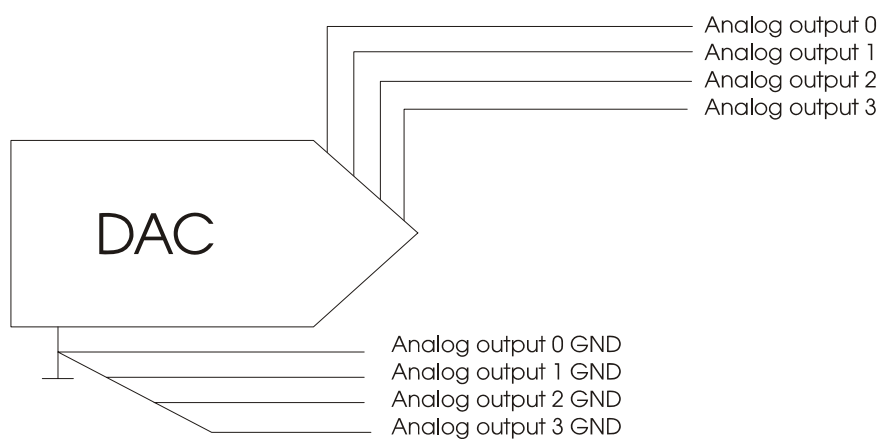
8.2.2 Current outputs

The analog output channels are set to a 0 mA current value after Power-ON Reset of the PC.

Fig. 8-4: Switching principle of the analog ground lines (current version)

8.3 Watchdog

A 12-bit watchdog is available on the **APCI-3504** 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 status can be read back. 3 different clock signals are available as time base for the watchdog (See 4.4 Limit values).

8.4 Timer

The 12-bit timer is a downwards 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 operation status can be read back. 3 different clock signals are available as time base for the watchdog (See 4.4 Limit values).

9   STANDARD SOFTWARE

9.1   Software functions

ADDIPACK supports the following functions for the **APCI-3504**.

Table 9-1: Supported software functions

Functionality	Function name
Global 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
	b_ADDIDATA_EnableErrorMessage
	b_ADDIDATA_DisableErrorMessage
	b_ADDIDATA_FormatErrorMessage (...)
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_TriggerTimer
	b_ADDIDATA_StopTimer
	b_ADDIDATA_ReadTimerValue
	b_ADDIDATA_ReadTimerStatus
	b_ADDIDATA_ReleaseTimer

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_StopWatchdog
	b_ADDIDATA_ReadWatchdogStatus
	b_ADDIDATA_ReleaseWatchdog
Analog outputs	b_ADDIDATA_GetNumberOfAnalogOutputs
	b_ADDIDATA_GetAnalogOutputInformation
	b_ADDIDATA_Init1AnalogOutput b_VoltageMode 　　　　Min 0 (bipolar -+10V) 　　　　Max 1 (unipolar 0-10V) b_Polarity 　　　　2 bipolar (only with b_VoltageMode Mode 0) 　　　　1 unipolar (only with b_VoltageMode Mode 1)
	b_ADDIDATA_InitMoreAnalogOutputs see b_ADDIDATA_Init1AnalogOutput()
	b_ADDIDATA_Write1AnalogOutput dw_ValueToWrite 　　　　Min 0 　　　　Max 4095 (bipolar) or 2047 (unipolar)
	b_ADDIDATA_WriteMoreAnalogOutputs see b_ADDIDATA_Write1AnalogOutput()
	b_ADDIDATA_Release1AnalogOutput
	b_ADDIDATA_ReleaseMoreAnalogOutputs

9.2   Software samples

Table 9-2: Supported software samples for the APCI-3504

Functionality	Sample number	Description
Analog outputs	SAMPLE01	Write 1 analog output value without synchronising.
	SAMPLE02	Write several analog output values without synchronising.
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, 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 until interrupt. Reset all and quit the program. Hardware gate and trigger are not used. Warning and reset relays are not used.
	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.
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.
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.
Optical isolation	The technique of using an optoelectric transmitter and receiver to transfer data without electrical continuity, to eliminate high-potential differences and transients.
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.
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.
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.

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