DIN EN ISO 9001:2000
certified

ADDI-DATA GmbH
Dieselstraße 3
D-77833 OTTERSWEIER
+49 (0)7223 / 9493 – 0

Technical description

APCI-3002

Analog input board, optically isolated

Edition: 01.09 - 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.
ADDI-DATA GmbH reserves the right to make changes to the technical data and the materials included herein.

Warranty and liability

The user is not permitted to make changes to the product beyond the intended use, or to interfere with the product in any other way.
ADDI-DATA shall not be liable for obvious printing and phrasing errors. In addition, ADDI DATA, if legally permissible, shall not be liable for personal injury or damage to materials caused by improper installation and/or commissioning of the board by the user or improper use, for example, if the board is operated despite faulty safety and protection devices, or if notes in the operating instructions regarding transport, storage, installation, commissioning, operation, thresholds, etc. are not taken into consideration. Liability is further excluded if the operator changes the board or the source code files without authorisation and/or if the operator is guilty of not monitoring the permanent operational capability of working parts and this has led to damage.

Copyright

ADDI-DATA software product licence

Please read this licence carefully before using the standard software. The customer is only granted the right to use this software if he/she agrees with the conditions of this licence.
The software must only be used to set up the ADDI-DATA boards.
Reproduction of the software is forbidden (except for back-up and for exchange of faulty data carriers). Disassembly, decompilation, decryption and reverse engineering of the software are forbidden. This licence and the software may be transferred to a third party if this party has acquired a board by purchase, has agreed to all the conditions in this licence contract and the original owner does not keep any copies of the software.

Trademarks

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**.

Figures

Tables

1 DEFINITION OF APPLICATION

1.1 Intended use

The **APCI-3002** board must be inserted in a PC with PCI 5V/32-bit (PCI 3.3V/64-Bit) 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-3002** 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-3002** 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-3002** board must not be used in potentially explosive atmospheres.

The **APCI-3002** board 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-3002** board and the peripheral is to occur through a shielded cable. This cable must be connected to the 37-pin SUB-D connector of the **APCI-3002** board.

The board has 16 input channels for processing analog signals.
The use of the board **APCI-3002** in combination with external screw terminal panels is to occur in a closed switch cabinet. The installation is to be effected competently.

The **PX 901-AG** screw terminal panel allows connecting the analog signals to the peripheral equipment through the **ST010/011** cable.

The connection with our standard cable **ST010/011** complies with the minimum specifications as follows:
- metallized plastic hoods
- shielded cable
- cable shield folded back and firmly screwed to the connector shell.

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 are not being conform anymore.

Check the shielding capacity of the PC housing and of the cable shield prior to putting the device into operation.

The use of the board according to its intended purpose includes observing all advices given in the *Technical description* 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.

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

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

2 USER

2.1 Qualification

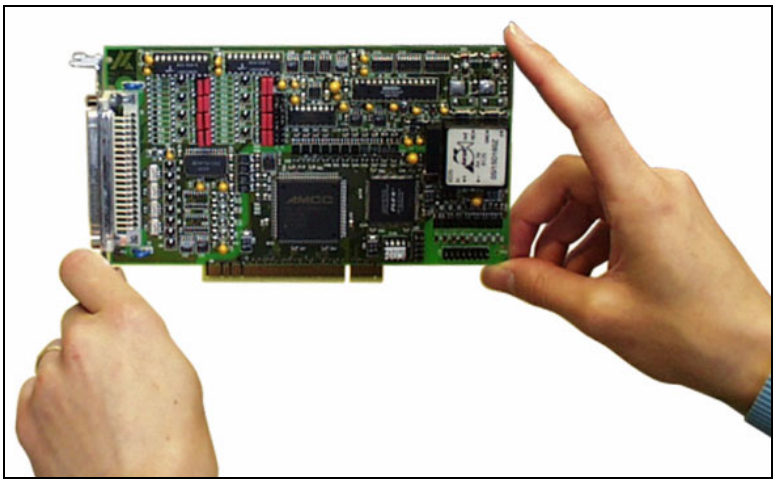
Only persons trained in electronics are entitled to perform the following works:
- installation
- use
- maintenance

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)

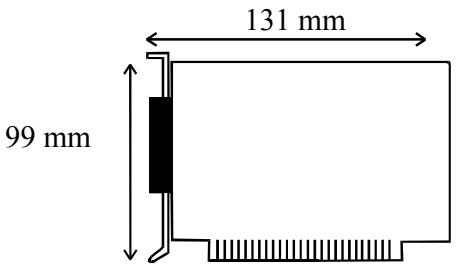
The board **APCI-3002** complies with the European EMC directive. The tests were carried out by a certified EMC laboratory in accordance with the norm from the EN 61326 series (IEC 61326). The limit values as set out by the European EMC directive for an industrial environment are complied with.

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 or 3.3 V
Connection to the peripheral: ..... 37-pin SUB-D male connector
Accessories[1]:
Cable: ..... Standard cable **ST010**
Ribbon cable **FB3000** (for the digital inputs and outputs)
Screw terminal panel: **PX901-AG**
PX901-ZG

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

4.3 Options

DF: Precision filter for the analog inputs

PC: Precision voltage for current inputs 0-20 mA or 4-20 mA for the analog inputs

1 Not included in the standard delivery.

Measuring range	With 16-bit resolution
0 mA	Corresponds 0 digit
4 mA	Corresponds 13107 digits
20 mA	Corresponds 65535 digits

Note: At 4-20 mA a reduced precision is possible.

4.4 Limit values

Max. Altitude: ..... up to 2000 m above sea level
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 2000, XP, Linux (other operating systems on request)
Slot: .....PCI 5 V or PCI 3.3 V, 32-bit

4.4.1 Analog inputs

Number of analog inputs:.....16 differential channels
Analog resolution:.....16-bit, 1 in 65535
Max. sampling rate:.....200 kHz
Acquisition types: .....1) software single scan
2) hardware triggered single scan
3) continuous scan (software)
4) continuous scan with timer delay (software)
5) continuous scan (hardware)
6) continuous scan with timer delay (hardware)

Conversion start: .....1) software trigger
2) external trigger
3) trigger timer

Analog input ranges (adjustable by software):
Voltage:.....Unipolar: 0-10 V
Bipolar: ± 10 V
(selectable through software)

Current: Unipolar: 0-20 mA (but selection 0-10 V range + Gain=2)

Gain: ..... Through PGA Gain 1, 2, 5, 10
(selectable through software)
Overvoltage protection: ..... 44 V when POWER ON
Input impedance (PGA):..... $10^{12}\ \Omega$ // 20 nF against GND
Digital coding ..... linear

Analog Input		Binary Code	HEX Code
Bipolar	Unipolar		
- 10 V	0 V	0000000000000000	0000
0 V	5 V	1000000000000000	8000
+10 V	10 V	1111111111111111	FFFF

Optical isolation from the PC ..... 1000 V

Temperature drift:..... 10 ppm/K
Linearity error of the ADC: ..... ±1.22 mV (typ.)
±2.44 mV (max.)

Calibration of the inputs:
Bipolar offset calibration value: ..... -0.00061 V (tolerance: ±0.0017 V)
Unipolar offset calibration value: ..... 0.01 V (tolerance: ±0.0017 V)
Bipolar gain calibration value: ..... 9.995 V (tolerance: ±0.0017 V)
Unipolar gain calibration value: ..... 9.995 V (tolerance: ±0.0017 V)
Calibration channel:..... 0 (single-ended)
Measurement method: ..... Averaging of more than 200 values

4.4.2 Digital inputs

Number: 4
Filter/protective circuitry:..... Low-pass/transorb diodes
Input current at 24 V: ..... 10.5 mA typ.
Input voltage range: ..... 0-30 V
Optical isolation from the PC: ..... 1000 VAC
Logic "0" level: ..... 0-14 V
Logic "1" level: ..... 19-30 V
Input frequency:..... 1 MHz (max.) at 24 V

4.4.3 Digital outputs

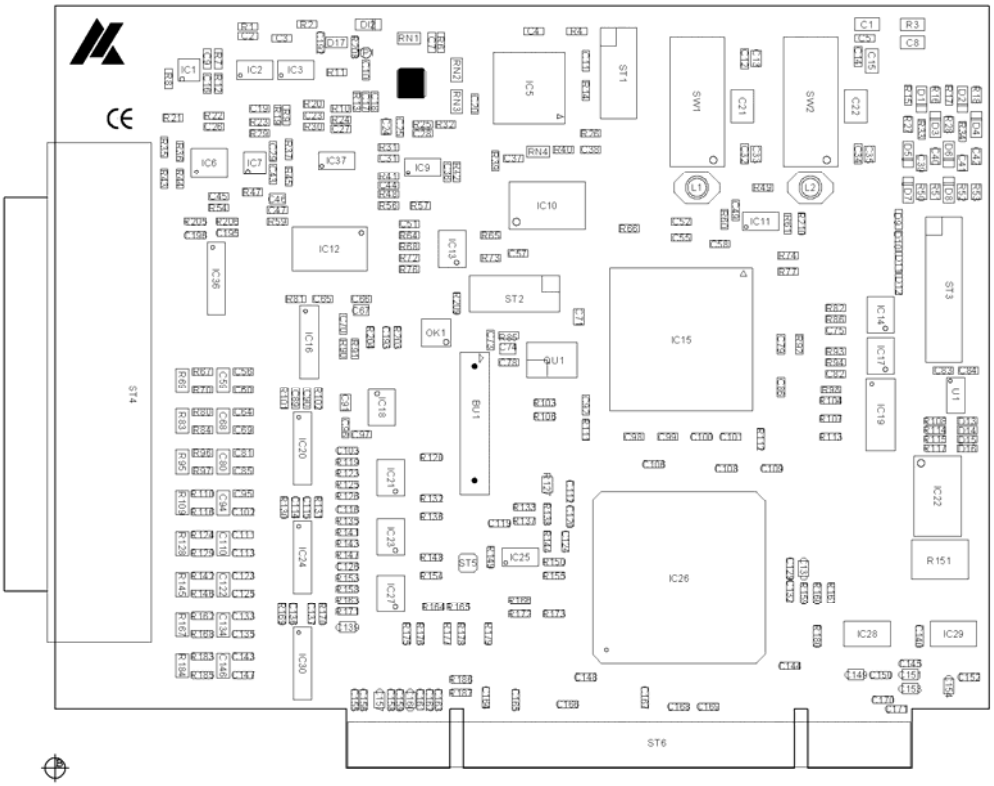
Number: 4
Type: ..... Open Collector (OC)
Max. switch current: ..... 50 mA typ.
Voltage range: ..... 5-30 V
Optical isolation: ..... 1000 VAC
Switching time (load 50 mA) : ..... Switching-on: 2 µs
Switching-off: 36 µs

4.4.4 Timer, 16-bit

Number:..... 1
Time base: ..... us, ms, s

4.5 Component scheme

Fig. 4-1: Component scheme



5 INSTALLATION OF THE BOARD

IMPORTANT!
Do observe the safety precautions!

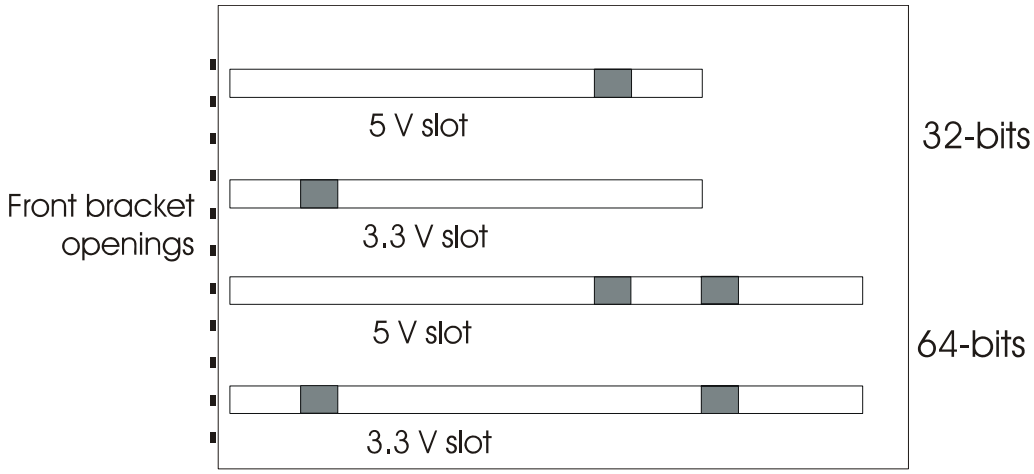
5.1 Opening the PC

- **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

Plug the board into a free PCI-5 V or PCI-3.3 V (32-/64-bit) slot.

Fig. 5-1: Types of slots



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

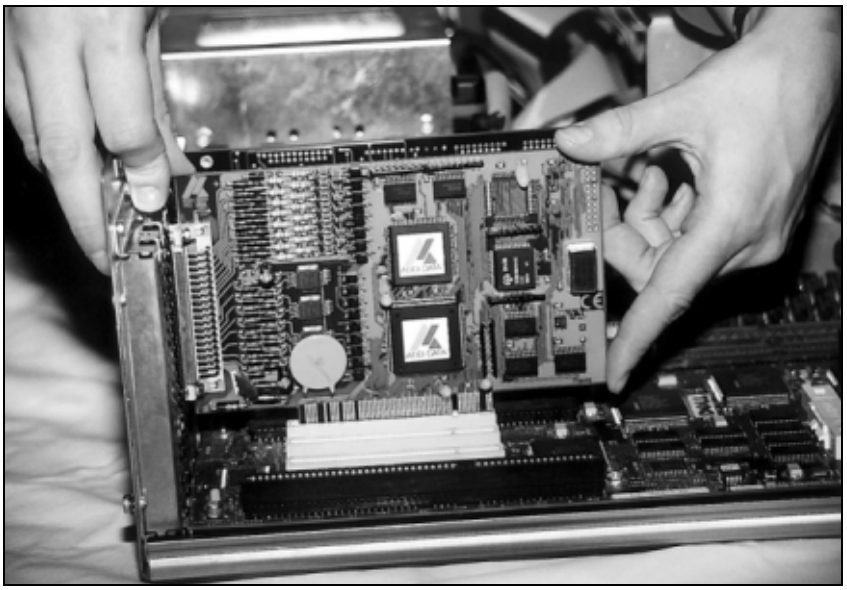
Discharge yourself from electrostatic charges.

Take the board out of its protective pack.

5.3 Plugging the board into the slot

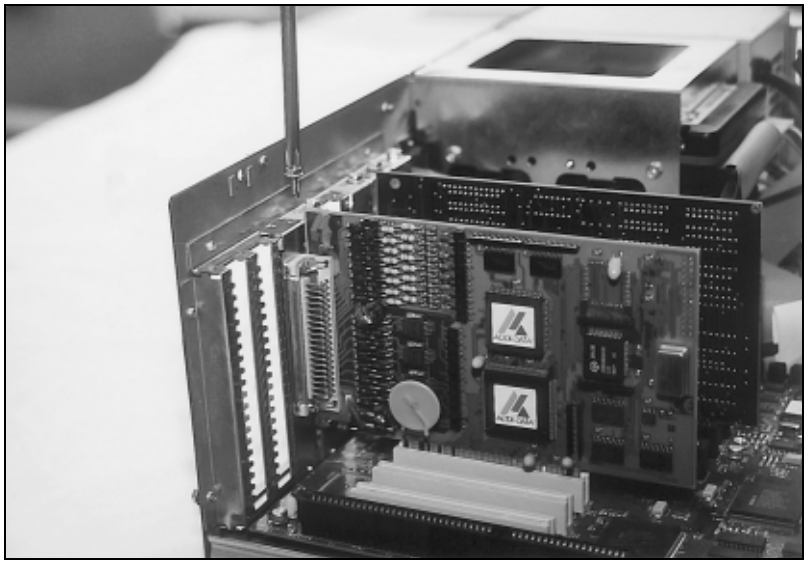
♦ Insert the board **vertically into the chosen slot.**

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 the following 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-3002 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. analog inputs, digital outputs, timer, etc.) 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.

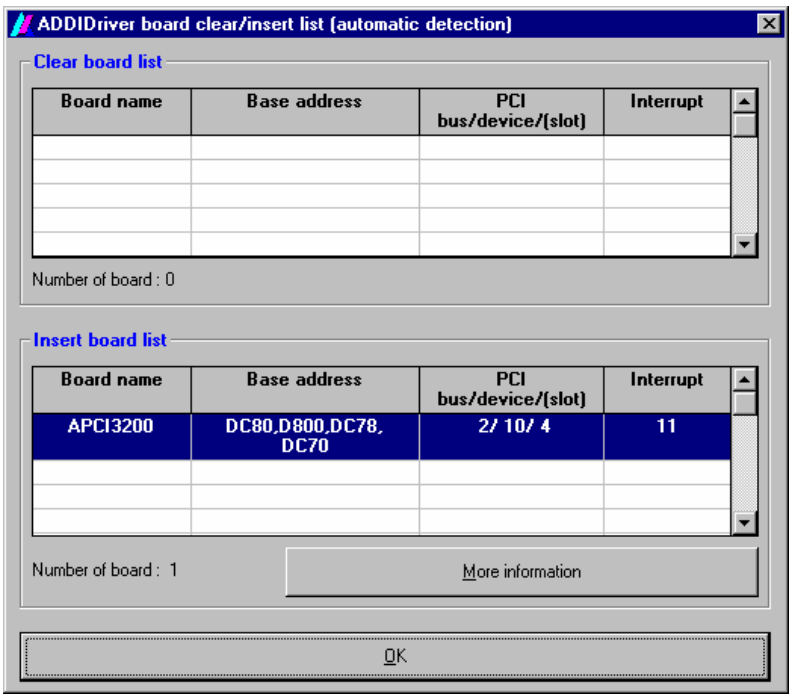
6.1 Board registration

When starting the set-up of ADDIREG, the **APCI-3002** 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)



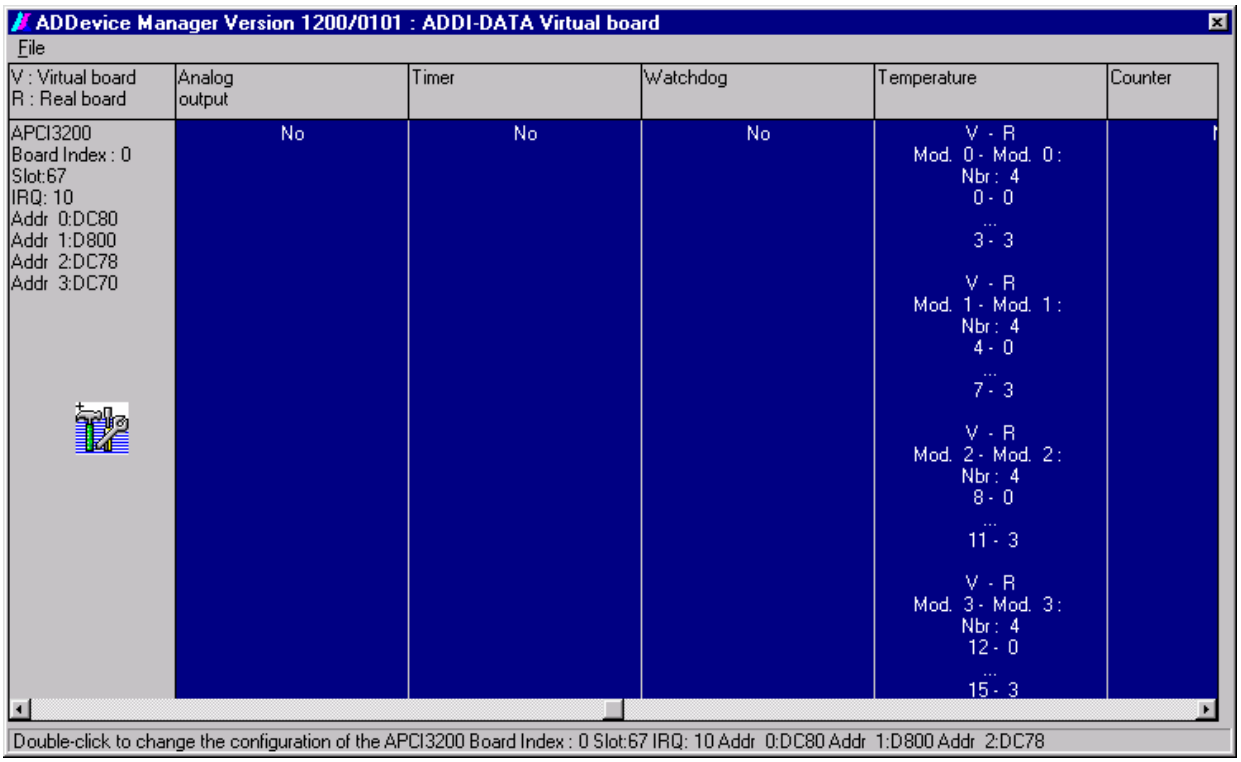
The boards which have been removed from the PC since the last ADDIREG start are listed in the upper table

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



The following parameters are displayed for every inserted board:

First column:

- Board name
- Board index: Number that is 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 etc.). If in this line “various” is showed, the resources are of different types. “Undefined” means that the type of these resources is not defined.
- IRQ: if the input channels are interruptible, the program displays the number of the first and of the last input/output channel

By clicking twice on one of the columns, 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...". Then you can print the configuration or use it as a basis for other boards.

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

6.1.2 Changing the registration of a board

At any time you can change the current board configuration of the **APCI-3002** with ADDIREG.

Description of the ADDIREG program

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

IMPORTANT!
First quit all the applications (programs) that use the board before you start the ADDIREG program.

The board is registered automatically of ADDIREG in the program. For this program the fields "Insert" and "Clear" are of no importance.

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

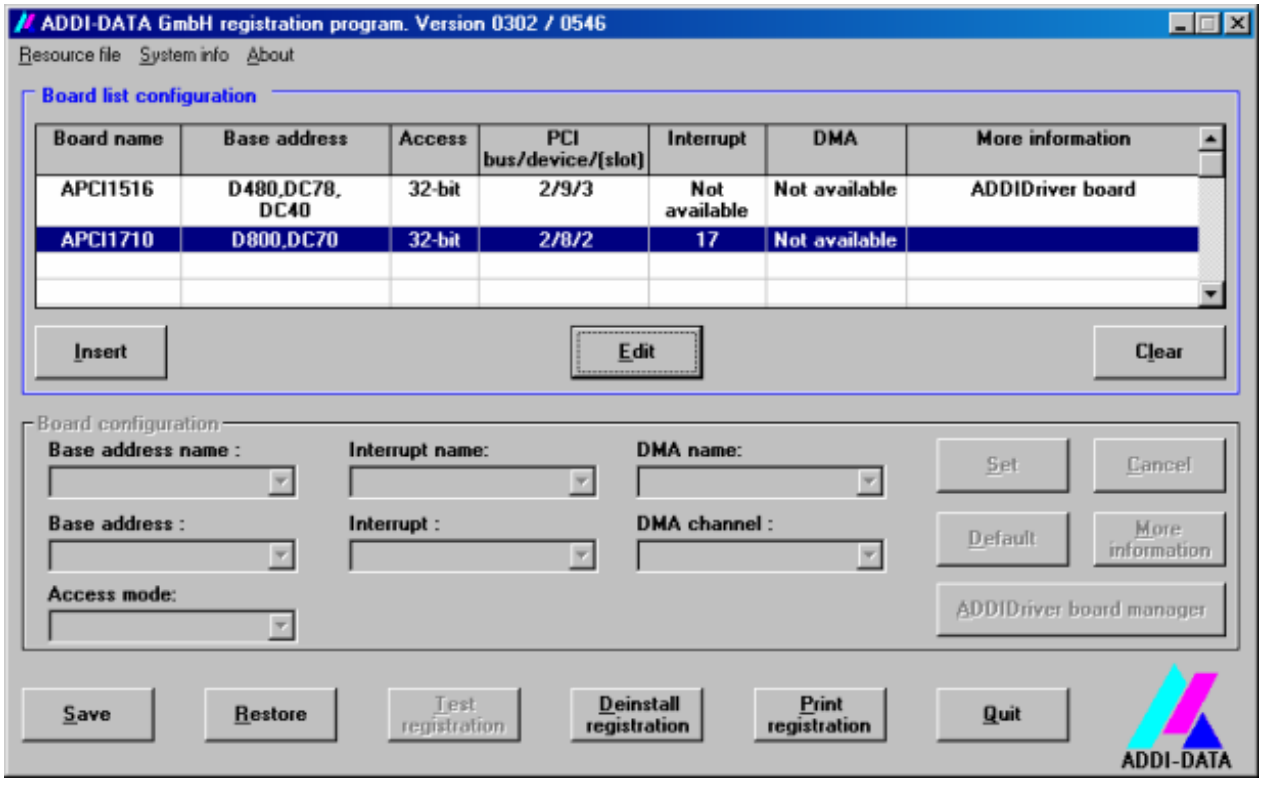


Table:

Board name:
Names of the different registered boards are displayed (e.g. APCI-3002).

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 APCI 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. If the board is programmed with ADDIDRIVER this information also is displayed.

Text boxes:

Base address name:
Description of the used base addresses for the board. You can 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. You can 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 parameterized board configuration. The configuration should be confirmed with Set before you can save it.

Cancel:
Replaces the former parameters onto the current saved configuration.

Default:
Sets the standard parameter of the board.

More information (not available for the boards with ADDIPACK)
You can modify the board specific parameters like the identifier string, the COM number, the operating mode of a communication board, etc.

ADDIDriver Board Manager:
Under Edit/ADDIDriver Board Manager you can check or change the current settings of each board that is set through the ADDEVICE Manager.
ADDevice Manager 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.

Test the board registration

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.com or
hotline@addi-data.com

Free downloads of standard software

You can download the latest version of the software for the board **APCI-3002:**

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 Connector pin assignment

Fig. 7-1: 37-pin SUB-D male connector (analog inputs, differential)

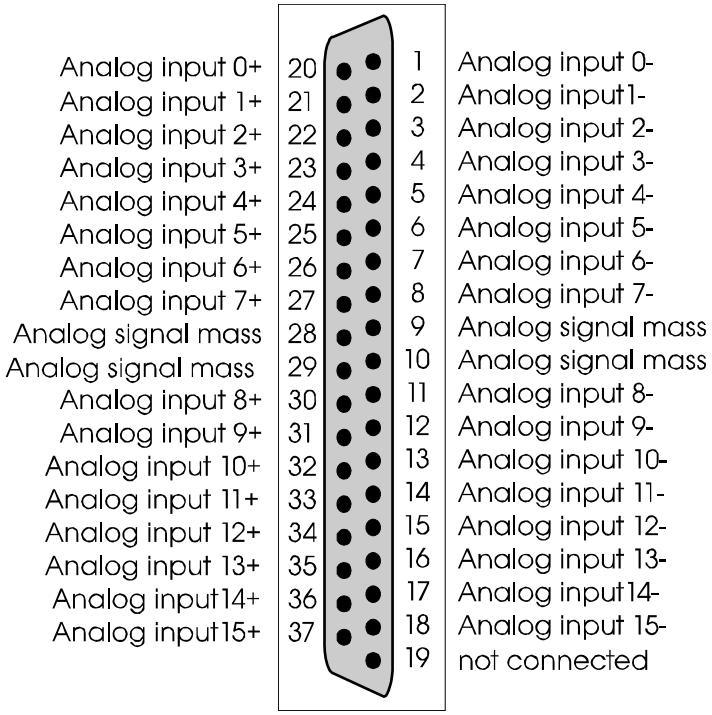
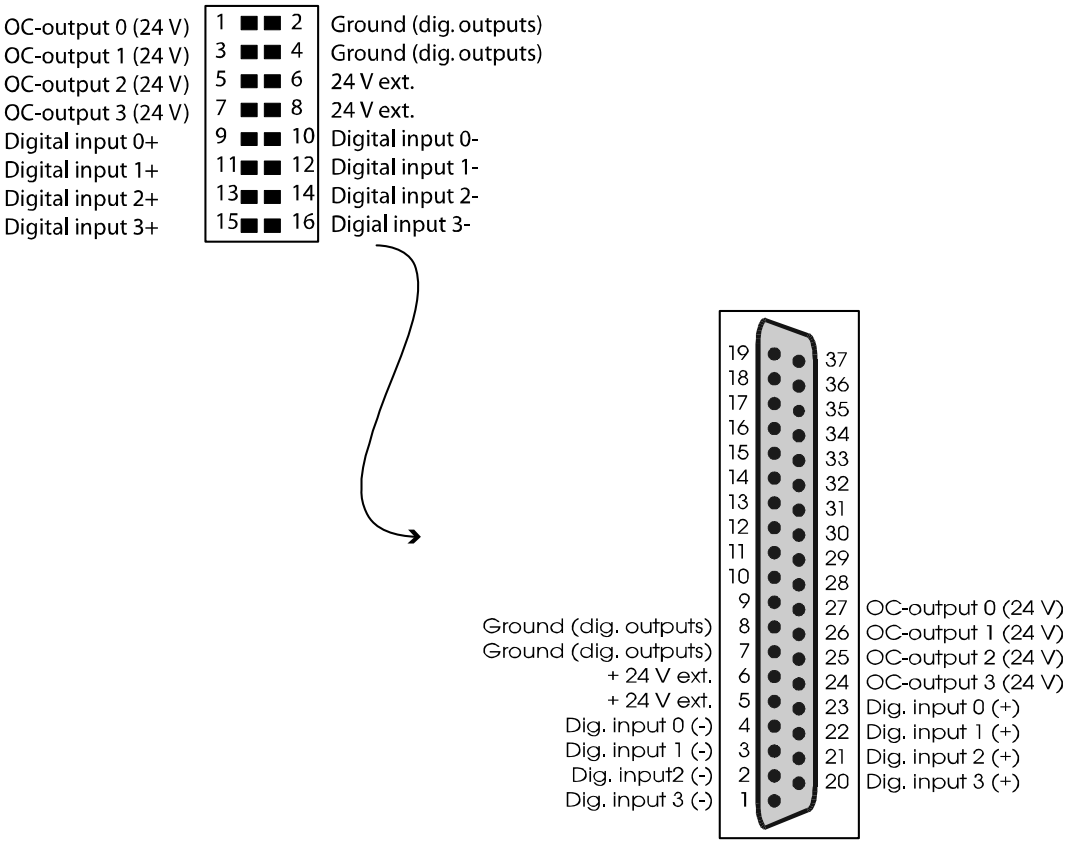


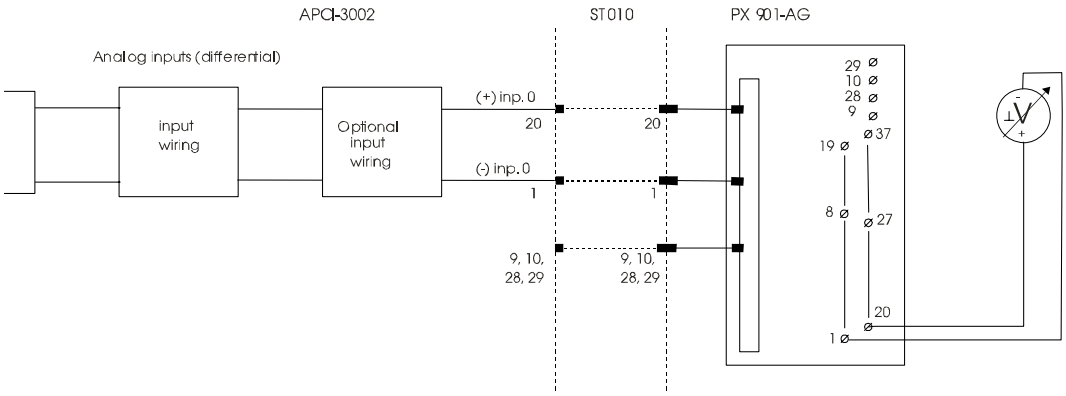
Fig. 7-2: 16-pin connector for digital inputs/outputs



7.2 Connection principles

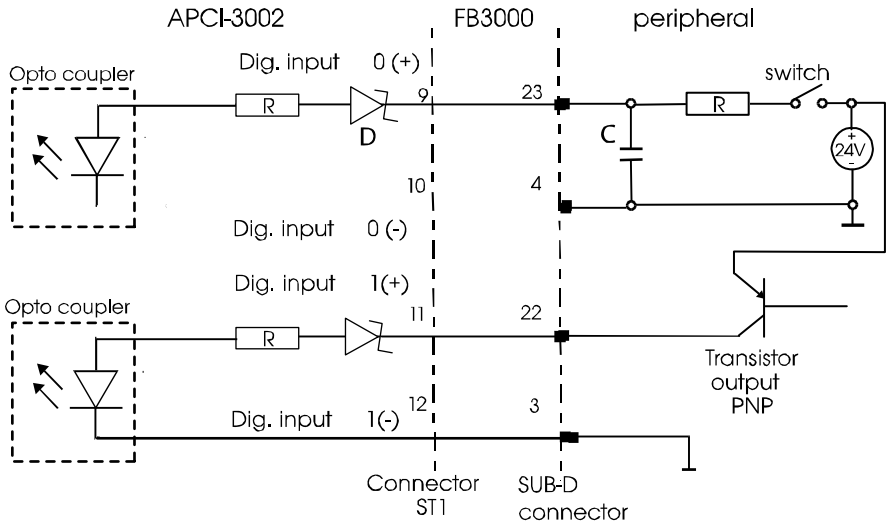
7.2.1 Analog inputs

Fig. 7-3: Connection of the analog inputs (differential)



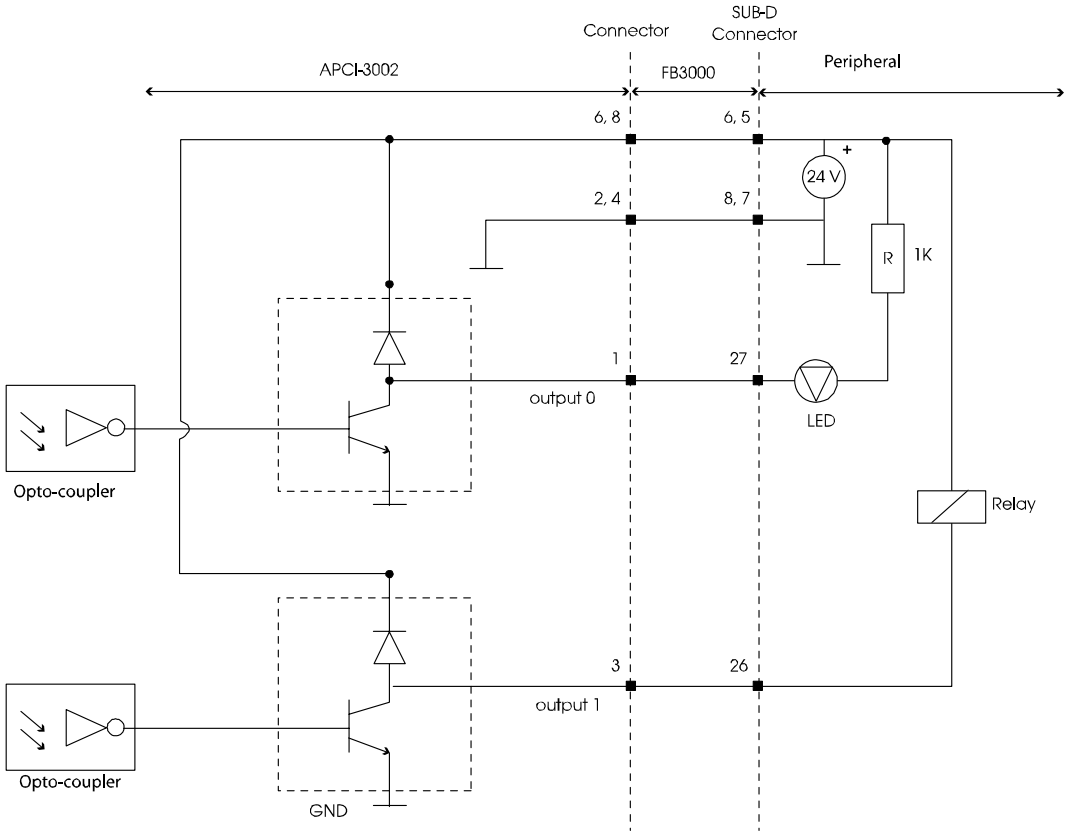
7.2.2 Digital inputs

Fig. 7-4: Connection of the digital inputs



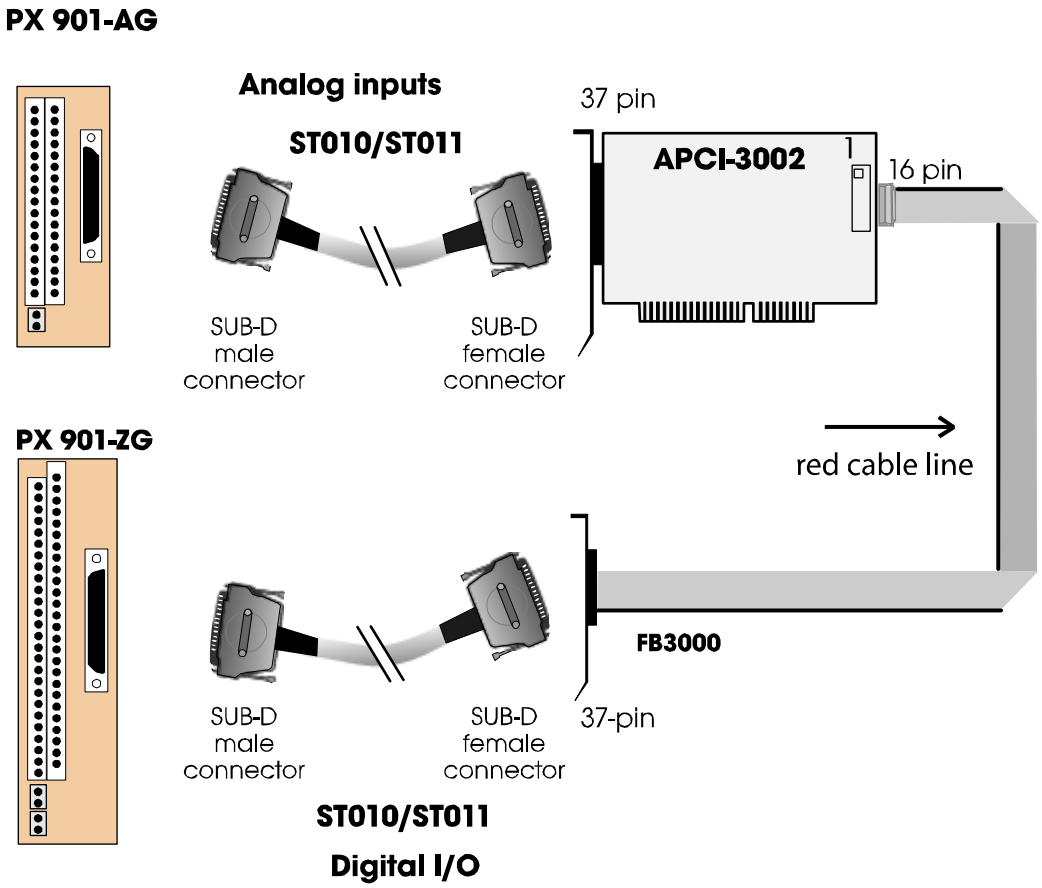
7.2.3 Digital outputs

Fig. 7-5 Connection of the digital outputs



7.3 Connection to the screw terminal panels

Fig. 7-6: Connection to the screw terminal panels

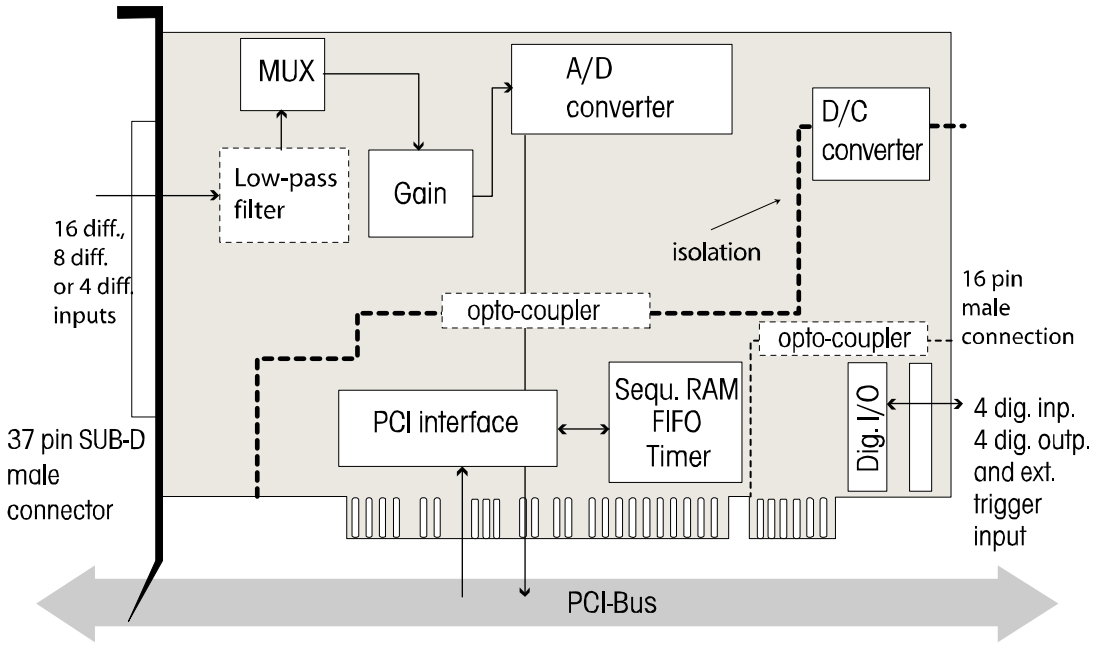


IMPORTANT!
Insert the FB3000 on the connector with the red cable lead on the side of the pin 1.

8 FUNCTIONS OF THE BOARD

8.1 Block diagram

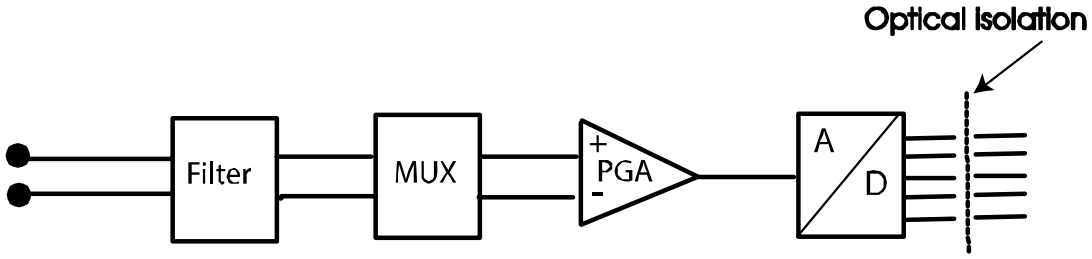
Fig. 8-1: Block diagram of the APCI-3002



8.2 Analog inputs

8.2.1 Overview

Up to 16 analog differential signals can be connected to the board **APCI-3002**.



After the signals are transferred over a filter (RC-component) to a multiplexer (time multiplexed system), they are lead over a programmable instrumental gain to a 16-bit A/D converter.

8.2.2 Voltage ranges

The analog input ranges (0..10 V, ± 10 V, 0..5 V, ± 5 V, 0..2 V, ± 2 V, 0..1 V, ± 1 V and optional 0-20 mA) and the gain can be configured through software.

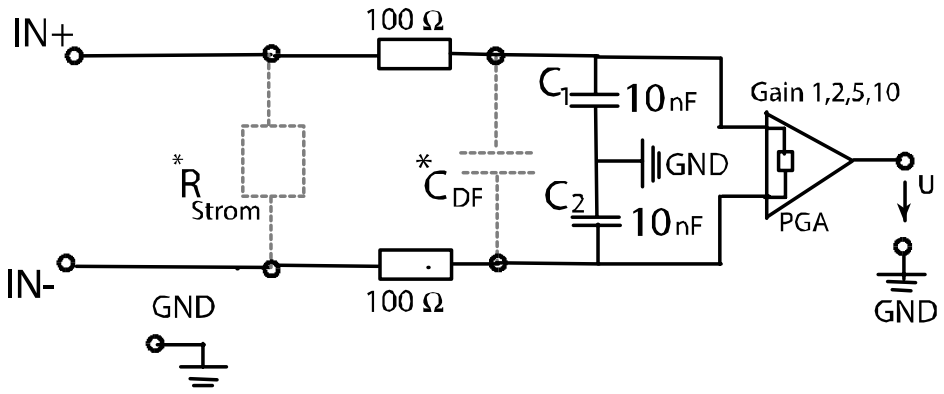
This enables different voltages (or rather currents) from channel to channel and the A/D converter's best resolution.

Please note: During the switching of the voltage range from unipolar to bipolar or from bipolar to unipolar there is a longer settling time of the measuring chain.

8.2.3 Analog input switch

The input impedance is the PGA's input resistance (10^{12} Ω) and the hereto connected capacities (C_1 and C_2).

Input impedance= 10^{12} Ω || 5 nF



*$R_{current}$ = optional assembly for the version current.
*C_{DF} = optional assembly for DF-filter

Limit frequency f_g = $\frac{1}{2\,\pi * (100\,\Omega + 100\,\Omega) * [C_{DF} + (C_1 \| C_2]}$ = **159.15 KHz**

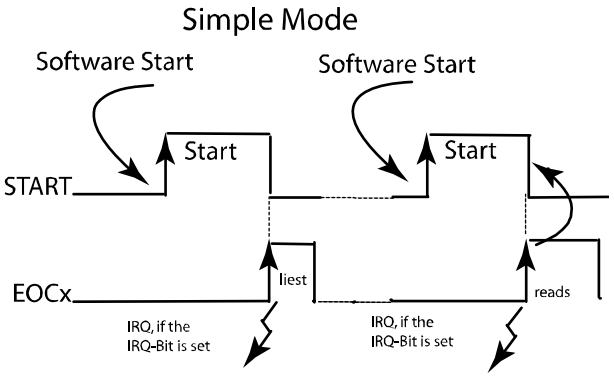
8.2.4 Input modes of the analog inputs

On the board are 16 differential channels available for the analog inputs. The acquisition can be realized in the following modes

- 1) Simple mode
- 2) Scan mode
- 3) Sequence mode
- 4) Auto refresh mode

1) Simple Mode

The software initializes and starts the A/D conversion and after this step it reads the digital value of one or more channels. For more detailed information please refer to the software function "Analog Inputs" in the ADDIPACK manual.



2) Scan Modes

There are 6 different scan modes:

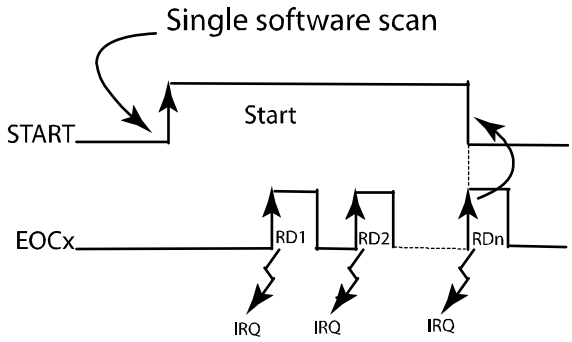
a) Single software scan
b) Single hardware triggered scan
c) Continuous software scan
d) Continuous software scan with timer delay
e) Continuous hardware scan
f) Continuous hardware scan with timer delay

The following section will describe the above mentioned scan modes more detailed:

a) Single software scan

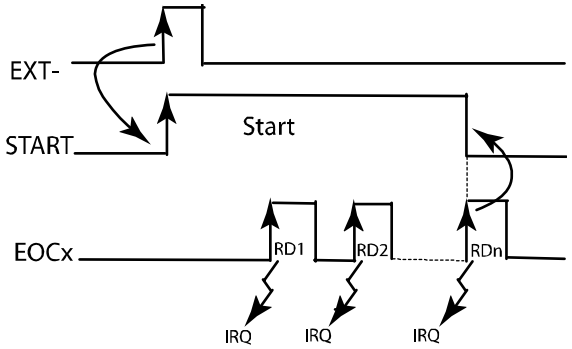
The user interrupt routine is called after the last IRQ (=ADDI-DATA driver).

Note: In the scan mode no DMA functionality is used!

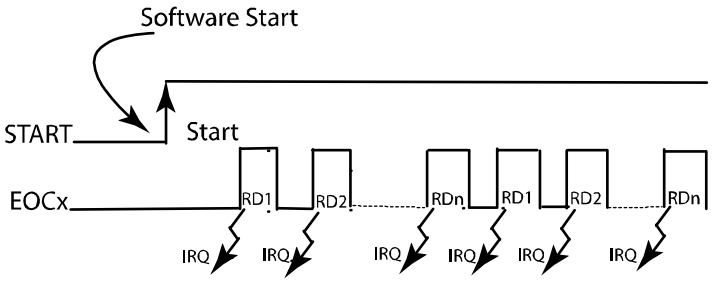


b) Single hardware triggered scan (24 V signal at digital input 0)

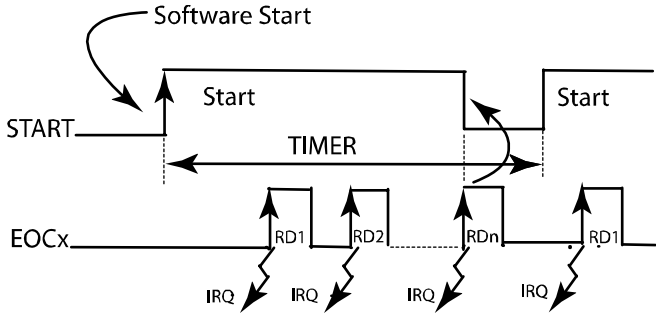
This scan can be triggered with ascending or descending flank (software initializes it).



c) Continuous software scan

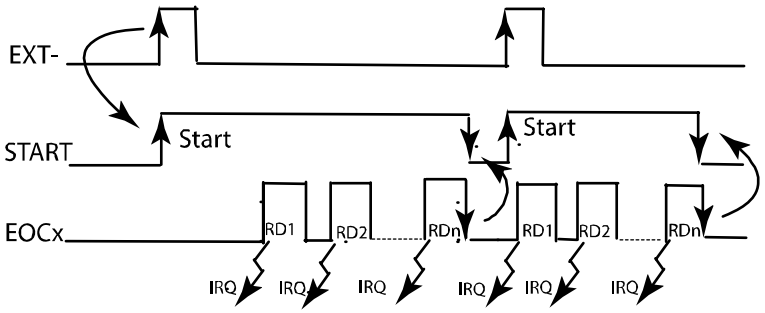


d) Continuous software scan with timer delay

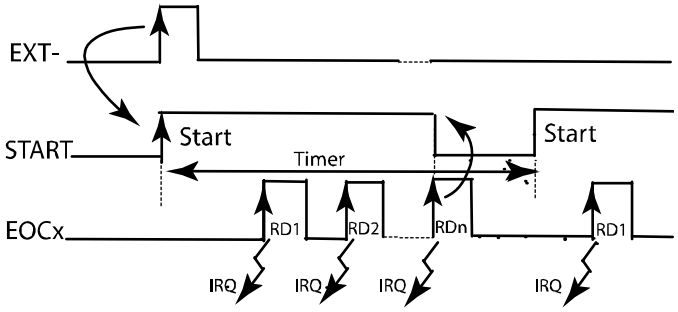


e) Continuous hardware triggered scan (24 V signal at digital input 0)

Note: In this scan mode the external signal triggers only one scan at once!



f) Continuous hardware triggered scan with timer delay (24 V signal at digital input 0)



3) Sequence modes

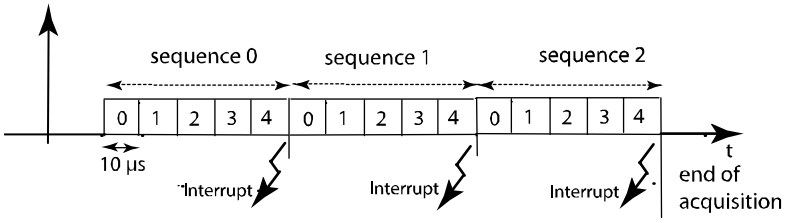
There are 2 sequence modes that are shown in the following 2 examples:

a) Simple sequence mode (example 1 and 2)
b) Sequence mode with delay (example 1 and 2)

Note: The sequence mode always uses DMA!

a) Simple sequence mode

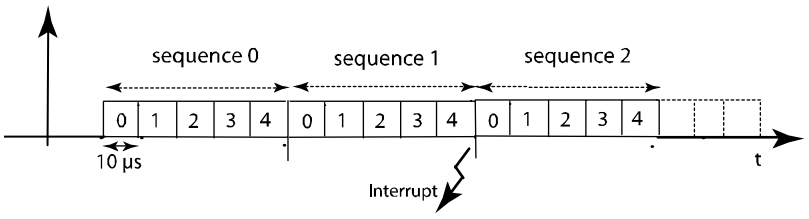
Simple sequence mode – Example 1
In this example the interrupt occurs at the end of each sequence (after 5 acquisitions) and the acquisition is stopped after 3 sequences.



dw_NbrOfChannel = 5
dw_SequenceChannelArray = 0, 1, 2, 3, 4
b_DelayTimeMode = ADDIDATAG_DELAY_NOT_USED
dw_SequenceCounter = 3
dw_InterruptSequenceCounter= 1

Simple sequence mode - example 2

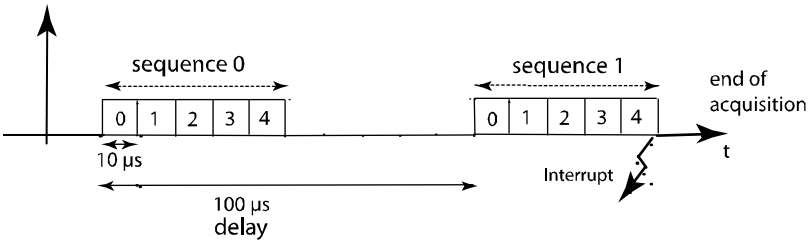
Here the interrupt occurs after 2 sequences (10 acquisitions) and the acquisition is stopped via the following function:
b_ADDIDATA_StopAnalogInputSequenceAcqusisition



dw_NbrOfChannel = 5
dw_SequenceChannelArray = 0, 1, 2, 3, 4
b_DelayTimeMode = ADDIDATAG_DELAY_NOT_USED
dw_SequenceCounter = 0
dw_InterruptSequenceCounter= 2

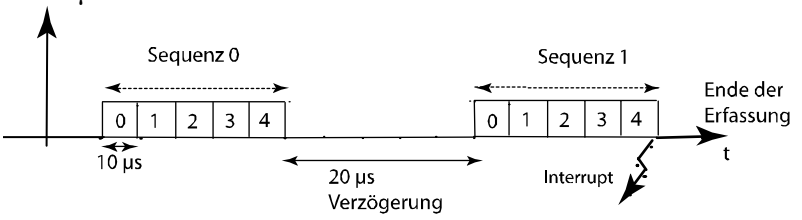
b) Sequence mode with delay

Sequence mode with delay - example 1
The interrupt occurs after the second sequence (10 acquisitions) and the acquisition is stopped. The total delay time from the start of one sequence to the next one is 100 µs.



dw_NbrOfChannel = 5
dw_SequenceChannelArray = 0, 1, 2, 3, 4
b_DelayTimeMode = ADDIDATAG_DELAY_MODE1_USED
b_DelayTimeUnit; = 1(µs)
dw_DelayTime = 100
dw_SequenceCounter = 2
dw_InterruptSequenceCounter= 2

Sequence mode with delay – example 2
The delay time after the end of one sequence to the start of the next sequence is in this example 20 µs.

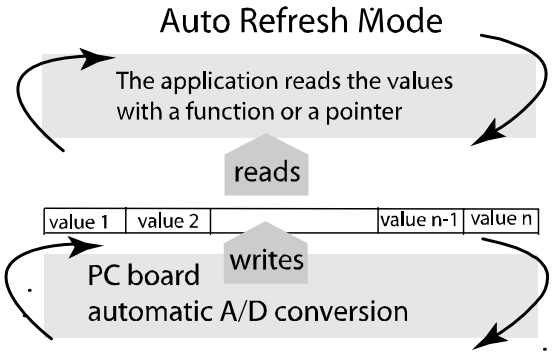


dw_NbrOfChannel = 5
dw_SequenceChannelArray = 0, 1, 2, 3, 4

b_DelayTimeMode = ADDIDATAG_DELAY_MODE2_USED
b_DelayTimeUnit; = 1(µs)
dw_DelayTime = 20
dw_SequenceCounter = 2
dw_InterruptSequenceCounter= 2

4) Auto Refresh Mode

The analog acquisition is initialized and writes the values of the channels into a storage location on the **APCI-3002**. The PC reads the data asynchronous to the acquisition.



9 STANDARDSOFTWARE

9.1 Software functions

ADDIPACK supports the following functions for the **APCI-3002**.

Table 9-1: Supported software functions

Functionality	Function name
Global Functions	i_ADDIDATA_OpenWin32Driver
	i_ADDIDATA_GetCurrentDriverHandle
	v_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
Analog inputs	b_ADDIDATA_GetNumberOfAnalogInputs
	b_ADDIDATA_GetNumberOfAnalogInputModules
	b_ADDIDATA_GetNumberOfAnalogInputsForTheModule
	b_ADDIDATA_GetAnalogInputModuleNumber
	b_ADDIDATA_GetAnalogInputModuleGeneralInformation Return: -Resolution: 16-bit - Unipolar/bipolar configurable - Available convert timing: µs, ms - Convert resolution: 16-bit - Min. convert time 5 µs
	b_ADDIDATA_GetAnalogInputModuleSingleAcquisition Information Return: - Interrupt available - Gains available: 1, 2, 5, 10 - No hardware/software trigger - No hardware gate
	b_ADDIDATA_GetAnalogInputModuleAutoRefreshInformation Return:

Functionality	Function name
	- Interrupt not available - Gains available: 1, 2, 5, 10 - Hardware /software trigger available - No hardware gate - Access mode: 32-bit
	b_ADDIDATA_GetAnalogInputModuleSCANInformation Return: - Gains available: 1, 2, 5, 10 - Hardware /software trigger available - No hardware gate - Single-SCAN cycle mode available - X SCAN cycles mode available - Continuous SCAN cycles mode - Delay available - Delay timing available: µs, ms - Resolution delay time: 16-bit
	b_ADDIDATA_GetAnalogInputModuleSequenceInformation Return: - Gains available: 1, 2, 5, 10 - Hardware/software trigger available - No hardware gate - Single sequence mode available - X sequence mode available - Continuous sequence mode available - Delay available - Delay timing available: µs, ms - Delay time resolution: 16-bit
	b_ADDIDATA_InitAnalogInput Available parameters: - Gain: 1, 2, 5, 10 - Polarity: Unipolar/Bipolar - Offset-range: Not used - Coupling DC
	b_ADDIDATA_ReleaseAnalogInput
	b_ADDIDATA_Read1AnalogInput Available parameters: - Interrupt: Enable/Disable - Conver time unit: µs/ms - Convert time: 5 to 65535 at µs 1 to 65535 at ms
	b_ADDIDATA_ReadMoreAnalogInputs Available parameters: - Interrupt: Enable/Disable - Convert time unit: µs/ms - Convert time: 5 to 65535 at µs 1 to 65535 at ms

Functionality	Function name
	b_ADDIDATA_ConvertDigitalToRealAnalogValue
	b_ADDIDATA_ConvertMoreDigitalToRealAnalogValues
	b_ADDIDATA_GetAutoRefreshAcquisitionChannelPointer
	b_ADDIDATA_GetAutoRefreshAcquisitionModulePointer
	b_ADDIDATA_GetAnalogInputAutoRefreshModuleCounterPointer
	b_ADDIDATA_StartAutoRefreshAcquisition Available parameters: - Convert time unit: µs/ms - Convert time: 5 to 65535 at µs 1 to 65535 for ms
	b_ADDIDATA_StopAutoRefreshAcquisition
	b_ADDIDATA_InitAnalogInputSCANAcquisition Available parameters: - Convert time unit: µs/ms - Convert time: 5 to 65535 at µs 1 to 65535 at ms - Scan mode: Single/X-cycles/continuous - Delay mode: Not used/Mode1/Mode2 - Delay timing: µs/ms
	b_ADDIDATA_StartAnalogInputSCAN
	b_ADDIDATA_GetAnalogInputSCANStatus
	b_ADDIDATA_ConvertDigitalToRealAnalogValueSCAN
	b_ADDIDATA_StopAnalogInputSCAN
	b_ADDIDATA_CloseAnalogInputSCAN
	b_ADDIDATA_InitAnalogInputSequenceAcquisition Available parameters: - Convert time unit: µs/ms - Convert time: 5 to 65535 at µs 1 to 65535 at ms - Scan mode: X cycles / continuous - Delay mode: Not used/Mode1/Mode2 - Delay timing: µs/ms
	b_ADDIDATA_StartAnalogInputSequenceAcquisition
	b_ADDIDATA_ConvertDigitalToRealAnalogValueSequence Acquisition
	b_ADDIDATA_GetSequenceAcquisitionCounter
	b_ADDIDATA_StopAnalogInputSequenceAcquisition
	b_ADDIDATA_ReleaseAnalogInputSequenceAcquisition
	b_ADDIDATA_GetAnalogInputHardwareTriggerInformation Return:

Functionality	Function name
	- High/Low level selectable - Can be used for auto refresh, SCAN and sequence. - Max. trigger counter is 65535 (16-bit) - One shot trigger mode is available - Single cycle trigger mode is available - X-cycles trigger mode is available
	b_ADDIDATA_EnableDisableAnalogInputHardwareTrigger Available parameters: - Level: High/Low - Action: Auto refresh/SCAN/sequence One-shot Single cycle x-cycles
	b_ADDIDATA_GetAnalogInputHardwareTriggerStatus
	b_ADDIDATA_GetAnalogInputSoftwareTriggerInformation Return: - Can be used for auto refresh, SCAN and sequence - One shot trigger mode available - Single cycle trigger mode available - X-cycles trigger mode available
	b_ADDIDATA_EnableDisableAnalogInputSoftwareTrigger Available parameters: - Action: Auto refresh/SCAN/sequence One shot Single cycle x-cycles
	b_ADDIDATA_GetAnalogInputSoftwareTriggerStatus
Digital outputs (24 V)	b_ADDIDATA_GetNumberOfDigitalOutputs
	b_ADDIDATA_GetDigitalOutputInformation Return: Output type: 24 V No interrupt available
	b_ADDIDATA_SetDigitalOutputMemoryOn
	b_ADDIDATA_SetDigitalOutputMemoryOff
	b_ADDIDATA_Set1DigitalOutputOn
	b_ADDIDATA_Set1DigitalOutputOff
	b_ADDIDATA_Set2DigitalOutputOn
	b_ADDIDATA_Set2DigitalOutputOff b_ADDIDATA_Set4DigitalOutputOn
	b_ADDIDATA_Set4DigitalOutputOff
	b_ADDIDATA_Set8DigitalOutputOn
	b_ADDIDATA_Set8DigitalOutputOff

Functionality	Function name
	b_ADDIDATA_Set16DigitalOutputOn
	b_ADDIDATA_Set16DigitalOutputOff
	b_ADDIDATA_Set32DigitalOutputOn
	b_ADDIDATA_Set32DigitalOutputOff
	b_ADDIDATA_Get1DigitalOutputStatus
	b_ADDIDATA_Get2DigitalOutputStatus
	b_ADDIDATA_Get4DigitalOutputStatus
Digital inputs (24 V)	b_ADDIDATA_GetNumberOfDigitalInputs
	b_ADDIDATA_GetDigitalInputInformationEx Return: Input type: 24 V No interrupt available
	b_ADDIDATA_Read1DigitalInput
	b_ADDIDATA_Read2DigitalInputs
	b_ADDIDATA_Read4DigitalInputs
	b_ADDIDATA_Read8DigitalInputs
	b_ADDIDATA_Read16DigitalInputs
	b_ADDIDATA_Read32DigitalInputs
Timer	b_ADDIDATA_GetNumberOfTimers
	b_ADDIDATA_GetTimerInformationEx Return: Interrupt available: 16-bit Available time unit: µs, ms, s Available output: High/Low Available modes: 2 and 3
	b_ADDIDATA_InitTimer Available parameters: Interrupt: Enable or disable Resolution: 16-bit Time unit: µs, ms or s Available modes: 2 or 3
	b_ADDIDATA_EnableDisableTimerInterrupt
	b_ADDIDATA_StartTimer
	b_ADDIDATA_StartAllTimers
	b_ADDIDATA_TriggerTimer
	b_ADDIDATA_TriggerAllTimers
	b_ADDIDATA_StopTimer
	b_ADDIDATA_StopAllTimers

Functionality	Function name
	b_ADDIDATA_ReadTimerValue
	b_ADDIDATA_ReadTimerStatus
	b_ADDIDATA_EnableDisableTimerOutput Available parameters: Action: Low or High b_ADDIDATA_GetTimerHardwareOutputStatus
	b_ADDIDATA_ReleaseTimer
	b_ADDIDATA_TestTimerAsynchronousFIFOFull

9.2 Software samples

ADDIPACK supports the following samples for the **APCI-3002**.

Table 9-2: Software samples for the APCI-3002

Functionality	Sample number	Description
Analog inputs	SAMPLE00	Shows 1 analog input information
	SAMPLE01	Reads 1 analog input channel without interrupt. The user defines the channel that he wants to use.
	SAMPLE02	Reads 1 analog input channel with interrupt. The user defines the channel that he wants to use. The user defines the interrupt mode (asynchronous / synchronous)
	SAMPLE03	Reads several analog input channels without interrupt
	SAMPLE04	Reads several analog input channels with interrupt
	SAMPLE05	Tests the sequence acquisition with interrupt. The user defines the channel that he wants to use. The user defines the interrupt mode (asynchronous / synchronous). The user defines the external trigger and gate mode, if available. The user defines if he wants the delay and defines its value.
	SAMPLE06	Tests the auto refresh sequence acquisition. The user defines the channel that he wants to use. The user defines the external trigger and gate mode, if available.
	SAMPLE 07	Initialises the SCAN with interrupt. The user defines the external trigger and gate mode, if available. The user defines if he wants the delay and defines its value. The user defines the interrupt mode (asynchronous / synchronous)
Digital inputs	SAMPLE00	Gets the information of the selected input channel
	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
Digital	SAMPLE01	Tests1 digital output with / without output memory.

outputs		Shows the status of the digital output, if possible.
	SAMPLE02	Tests 2 digital outputs with / without output memory. Shows the status of the digital outputs, if possible.
	SAMPLE03	Tests 4 digital outputs with / without output memory. Shows the status of the digital outputs, if possible.
	SAMPLE04	Tests 8 digital outputs with / without output memory. Shows the status of the digital outputs, if possible.
	SAMPLE05	Tests 16 digital outputs with / without output memory. Shows the status of the digital outputs, if possible.
	SAMPLE06	Tests 2 digital outputs with / without output memory. Shows the status of the digital outputs, if possible.
Timer	SAMPLE00	Shows all timer information.
	SAMPLE01	Initialisation of 1 timer without interrupt. The user can trigger the timer by key press. The user can trigger the timer by key press. The user selects the timer that he wants to test. The user defines if HW gate, HW trigger and HW output are used
	SAMPLE02	Initialisation of 1 timer with interrupt. The user can trigger the timer by key press. The user can trigger the timer by key press. The user selects the timer that he wants to test. The user defines if HW gate, HW trigger and HW output are used. The user defines the interrupt mode (asynchronous / synchronous)
	SAMPLE03	Initialisation of all timers without interrupt. The user can trigger the timer by key press. The user can trigger the timer by key press. The user selects the timer that he wants to test. The user defines if HW gate, HW trigger and HW output are used
	SAMPLE04	Initialisation of all timers with interrupt. The user can trigger the timer by key press. The user can trigger the timer by key press. The user selects the timer that he wants to test. The user defines if HW gate, HW trigger and HW output are used. The user defines the interrupt mode (asynchronous / synchronous)

10 APPENDIX

10.1 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
Auto refresh mode	The analog acquisition is initialized and writes the values of the channels into a storage location on the board. The PC reads the data asynchronous to the acquisition.
Clock	A circuit that generates time and clock pulses for the synchronisation of the conversion
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.
Differential inputs (DIFF)	An analog input with two input terminals, neither of which is grounded, whose value is the difference between the two terminals.
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.
Edge	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.
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.
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.
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 operates at the permitted input voltages in the reverse range, but at overvoltage in the transition range and therefore protects the circuits against damage.
Reference voltage	A point to which all further potentials of a series are referred (often ground potential). In the field of control and regulation, all voltages are measured against a reference voltage.
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.
Scan mode	Scan modes are: Single software scan, single hardware triggered scan, continuous software scan, continuous software scan with timer delay, continuous hardware triggered scan and continuous hardware triggered scan with timer delay.
Sensor	A device that responds to physical stimuli (heat, light, sound, pressure, motion, etc.) and produces a corresponding electrical output.
Sequence mode	A sequence consists of a certain number of acquisitions, and the sequence mode defines the mode of acquisition (simple sequence mode and sequence mode with delay)
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.
Simple mode	The software initializes and starts the A/D conversion and after this step it reads the digital value of one or more channels.
Single Ended inputs (SE)	An analog input with one input terminal whose value is measured with respect to a common ground
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.

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.
TTL	*= transistor-transistor-logic* A popular logic circuit family that uses multiple-emitter transistors.

10.2 Index

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