Important information

1. Software update **SET3701**
2. Diagnostic function
3. Change position of Pin 1
4. New cable **FB3702**

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Because of the migration to RoHS-compliant products the board **APCI-3701** has been revised.

The photo shows a new **APCI-3701**.

Thus, do observe the following changes:

1. Software update SET3701

WICHTIG!
Because of the migration to RoHS-compliant ADDI-DATA products, the board **APCI-3701** has been revised. Thus, it is necessary to **update** the software!

Please observe that you must use the calibration and update tool **SET3701** from **version 3030-1006** for the new board. Please find the current version of **SET3701** on the delivered CD.

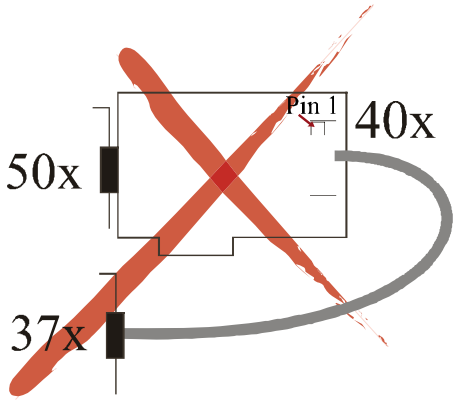
If you replace an old board by a new **APCI-3701:**
Uninstall the old version of **SET3701** and install the new version of **SET3701**.

2. Diagnostic function

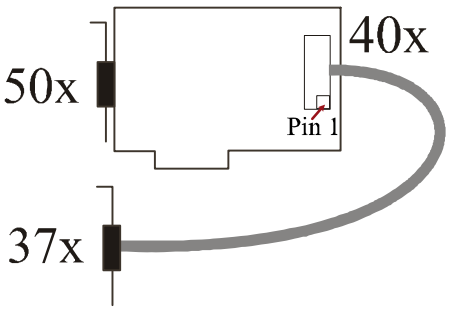
After the calibration of the board, it is possible to detect with the Primary Open Circuit Test if no transducer is connected.

3. Position Pin 1 of the connector ST3

Old:
APCI-3701 before the change to RoHS-compliant



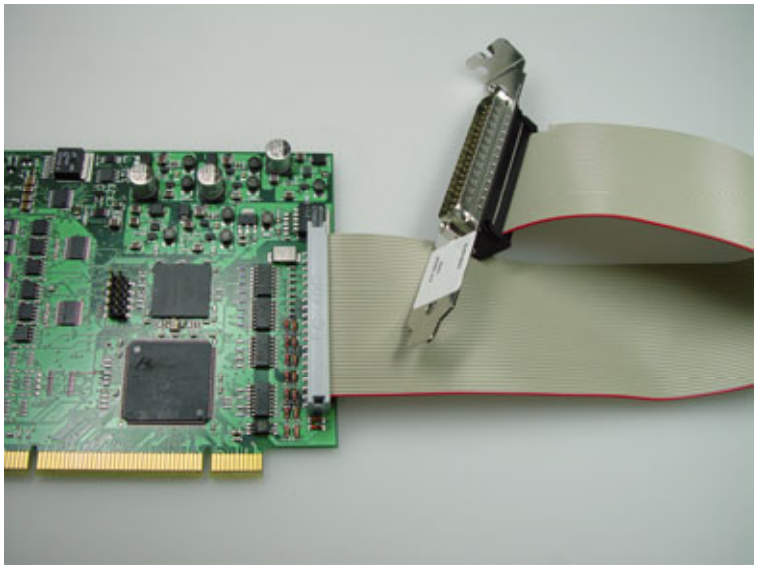
New:
APCI-3701 after the change to RoHS-compliant



4. New cable FB3702

The ribbon cable **FB3702** replaces the cable **FB3701**.

Connection new cable FB3702



Connection FB3701:

Should you still have a **FB3701** cable and want to use it, please do observe also the new position of Pin 1 and that the red cable line must be connected to Pin 1 (right side below). Therefore you must turn the cable. Thus, we recommend you to use the new cable **FB3702** – for an easy connection.

DIN EN ISO 9001:2000
certified

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Technical description

APCI-3701

Length measurement board, optically isolated, 16-bit

Edition: 03.05 - 11/2006

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.

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- VxWorks is a registered trademark of Wind River Systems Inc.

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 board **APCI-3701** is the interface between an industrial process and a personal computer (PC).

The board **APCI-3701** must be inserted in a PC with PCI 3.3 V/5V / 32-bit/64-bit slots, which is used as electrical equipment for measurement, control and laboratory use as defined in the norm IEC 61010-1.

The PC is to comply with the norm IEC 61326 for measurement, control and laboratory use and with the specifications for EMC protection.

Products complying with these specifications bear the CE mark.

Data exchange between the **APCI-3701** board and the peripheral is to occur through a shielded cable. This cable must be connected to the 50-pin SUB-D male connector of the **APCI-3701** board. The board is fitted with a sinus generator and has up to 16 analog inputs for connecting up to 16 inductive displacement transducers exclusively.

The **PX371** screw terminal panel allows the connection of the analog signals with the ST370 shielded cable.

The use of the board **APCI-3701** in combination with external screw terminal panels is to occur in a closed switch cabinet.

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

The connection with our standard cable **ST3701** complies with the following specifications:
- metallized plastic hoods
- shielded cable
- cable shield folded back and firmly screwed to the connector housing.

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

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

1.2 Limits of use

The APCI-3701 board is not to be used as safety related part for securing emergency stop functions.

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

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 installation of the board APCI-3701 in sites lying under risk of explosion is excluded.

1.3 Usage restrictions

The **APCI-3701** board must not to be used as safety related part for securing emergency stop functions.

The **APCI-3701** board must not be used in potentially explosive atmospheres.

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

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

2 USER

2.1 Qualification

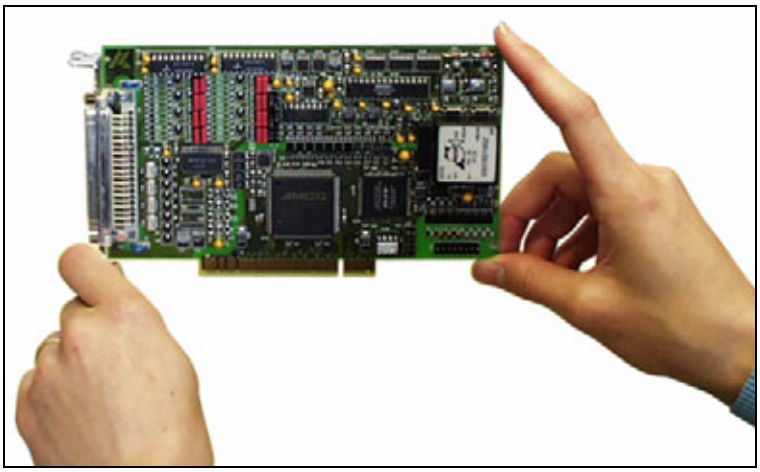
Only persons trained in electronics are entitled to perform the following works:
- installation
- use,
- maintenance.

2.2 Personal protection

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

3 HANDLING OF THE BOARD

Fig. 3-1: Correct handling



4 TECHNICAL DATA

4.1 Electromagnetic compatibility (EMC)

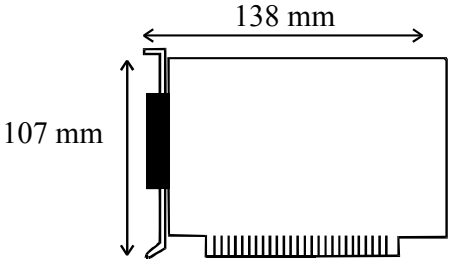
The board has been subjected to EMC tests in an accredited laboratory. The board complies with the limit values set by the norms IEC 61326 as follows:

	True value	Set value
ESD (Discharge by contact/air)	4/8 kV	4/8 kV
Fields	10 V/m	10 V/m
Burst	4 kV	2 kV
Conducted radio interferences	10 V	10 V

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: ..... 50-pin SUB-D male connector

Accessories[1]:
for the standard version APCI-3701
Cables:
Standard cable: ..... ST3701, 2 m; max. length: 10 m
Ribbon cable: ..... FB3702 (connection of the dig. I/O)
Connection boxes/Screw terminal panel:
for LVDT transducers: ..... PX3701LVDT-8 or PX3701LVDT-16
for half-bridge transducers: ..... PX3701HB-8 or PX3701HB-16
Screw terminal panel: ..... PX 901-ZG for the digital I/O

1 Not included in the standard delivery.

4.3 Versions

The board **APCI-3701** is available in the following versions:

Standard	Version	Number of connected transducers	Number of connected digital I/O
✓	APCI-3701-16	16	8 inputs and 8 outputs
✓	APCI-3701-8	8	8 inputs and 8 outputs

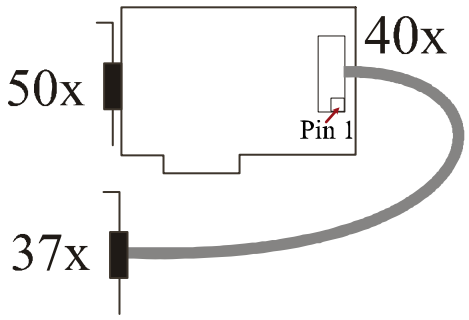
Please observe:
If you use **LVDT transducers ≥±1 mm,** please use the version **APCI-3701-LVDT+**.

4.4 Limit values of the standard version

Max. altitude: ..... 2000 m
Operating temperature: ..... 0 to 60°C
Storage temperature: ..... -25 to 70°C
Relative humidity: ..... 30% to 99% non condensing

Minimum PC requirements:
PCI BIOS from Version 1.0
Bus speed: ..... < 33 MHz
Operating system: ..... Windows NT, 98, 2000, XP
Slot: ..... PCI 5 V or PCI 3.3 V, 32-bit
+ 1 slot opening for connecting the digital I/O

Fig. 4-1: Required slots[1]



PCI bus interface
Bus speed: ..... < 33 MHz
Data access: 32-bit
Decoding: ..... in 32-byte I/O address range of the PC
in 256-byte memory range of the PC

[1] Since the switching to RoHS-compliant products, the position of Pin 1 changed (see figure)

Energy requirements:
- Operating voltage of the PC: ..... 5 V ± 5%
- Current consumption (without load): ..... typ. see table ± 10%

	APCI-3701-8	APCI-3701-16
+ 5 V from PC	0.48 A	0.58 A

WARNING !
The cooling components and the DC/DC connector can warm up during the board operation.

- **Install the board in the PC so that cooling air can flow easily between the different inserted boards.**
- **Before removing the board from the PC, wait until it sufficiently cooled down.**

4.4.1 Sinus generator

Output signal: ..... sinus
Possible frequency values

Table 4-1: Available frequency values for the sinus generator

1.993 kHz	9.765 kHz
3.005 kHz	10.851 kHz
3.986 kHz	12.207 kHz
4.883 kHz	13.021 kHz
6.104 kHz	13.951 kHz
6.975 kHz	16.276 kHz
8.138 kHz	19.531 kHz

Edge frequency of the high-pass filter (-3 dB): 230 Hz
Output voltage: ..... can be set between 0.707 V_{rms} and 3.5 V_{rms}
Output current: ..... ± 260 mA max.
Offset voltage: ..... ± 1 mV typ.
Harmonic distortion: ..... 0.75 % typ. (Duty Cycle adjusted to 50%)
Duty cycle: ..... 50 % typ.

4.4.2 Analog inputs

Number: ..... 8 to 16
Input type: ..... single-ended
Coupling: ..... AC
Edge frequency of the
high-pass filter (-3 dB): ..... 500 Hz
Edge frequency of the
low pass filter (-3 dB): ..... 32 kHz
Maximum input voltage: ..... 0.916 Vrms typ.
Input capacity: ..... 54 pF typ.
Input resistance: ..... can be set up to 200 kΩ max.

A-D converter
Resolution: 16-bit
Precision: 13-bit
Digital coding: ..... 2nd complement
Dynamic range: ..... 98 dB
Digital filter
Pass band ripple: ..... from -0.09 dB to 0 dB
Stop band: ..... 64.1 kHz min.
Stop band attenuation: ..... -48.4 dB min.
High-pass filter
Edge frequency (-3dB): ..... 3.7 Hz typ.
Edge frequency (-0,1 dB): ..... 24.2 Hz typ.
Pass band ripple: ..... 0.09 dB max.

4.4.3 Digital outputs

Number: 8
Output type: ..... Open Collector
Nominal voltage: ..... 24 V
Output range: ..... 5-30 V
Switching current: ..... 50 mA
Optical isolation: ..... 1000 V

4.4.4 Digital inputs

Number: 8
Input type: ..... 24 V
Nominal voltage: ..... 24 V
Input range: ..... 0-30 V
Switching current: ..... 6 mA at nominal voltage
Logical input levels (standard): ..... U_H max.: 30 V
U_H min.: 19 V
U_L max.: 14 V
U_L min.: 0 V
Optical isolation: ..... 1000 V
Input frequency of trigger input 0: ..... 1 MHz
Input frequency of the inputs 1 to 7: ..... 5 kHz

4.5 Technical data of the accessories

4.5.1 Connection boxes and cables of the standard versions

Version	Number of connected transducers	Connection cable
PX3701HB-16	16 half-bridge transducers	ST3701-16
PX3701HB-8	8 half-bridge transducers	ST3701-8
PX3701LVDT-16	16 LVDT transducers	ST3701-16
PX3701LVDT-8	8 LVDT transducers	ST3701-8

Connection box

Housing: ..... Aluminium die-cast
The signal connections can be labelled
Protection: ..... protecting cap for flange socket, dustproof, IP54
Transducer connection: ..... 8 or 16 x 5-pin flange socket DIN 45322
See Connection of inductive transducers
Connector: ..... 50-pin SUB-D female connector for connecting the cable ST3701

Dimensions (L x W x H):
PX 3701-8: ..... 80 x 57 x 120 mm
PX 3701-16: ..... 80 x 57 x 250 mm
Fastening : ..... through 2 mounting points within the enclosure bottom
Temperature range: ..... 0 to 60 °C

Cable specifications

Cable length: ..... 2 m, 5 m or 10 m
Connectors: ..... 50-pin SUB-D female connector (board) to 50-pin SUB-D male connector (connection box)
Shield: ..... twisted-pair leads with common shield

4.6 Supported transducers

The transducer type and manufacturers listed in the table below are parameterised and stored by ADDI-DATA in a function library.

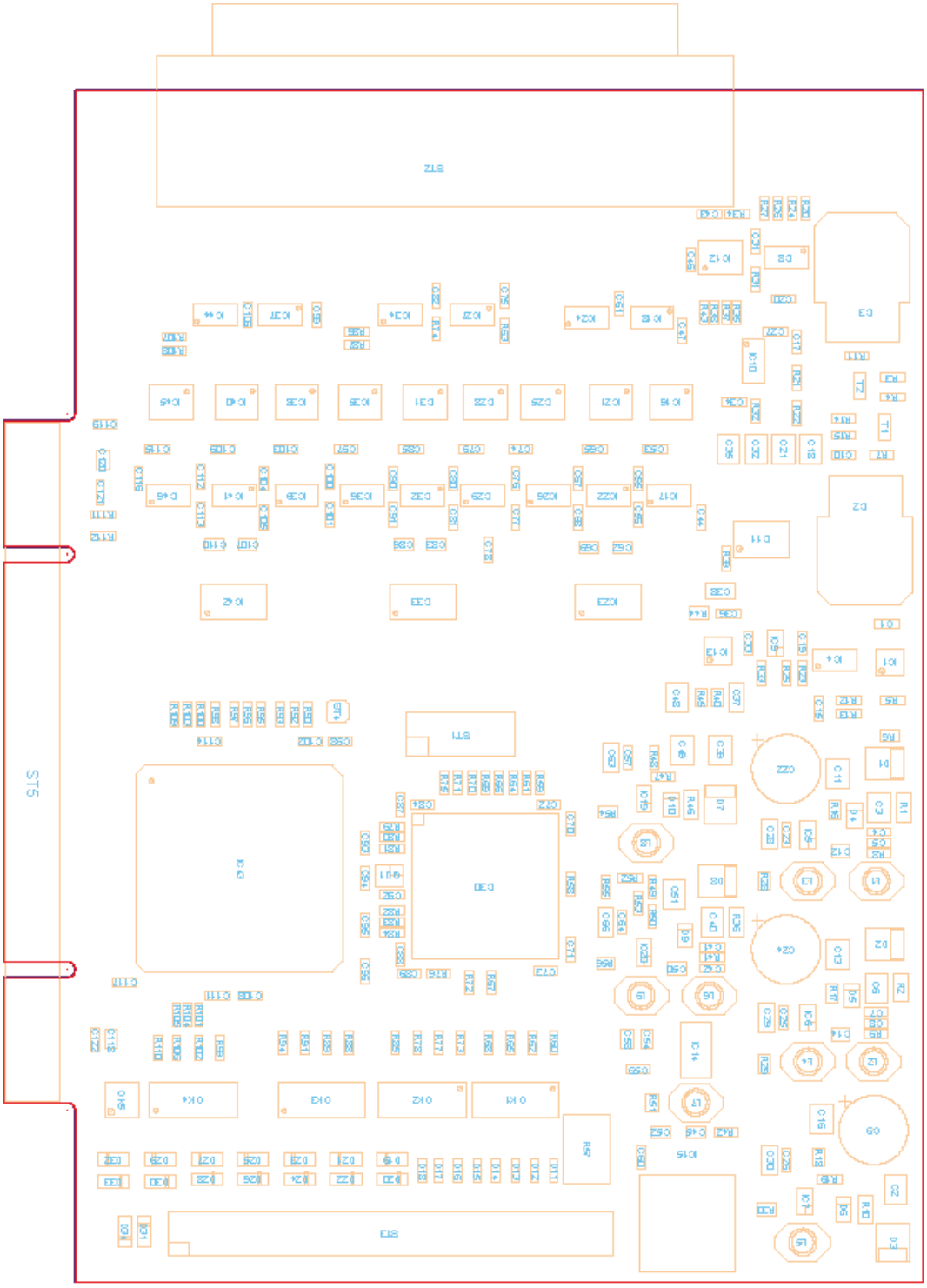
If you want to install another transducer that is not included in this library, contact us. We will adapt the board so that you can run your transducer with the required parameters and data through the ADDI-DATA **APCI-3701**.

ADDI-DATA sales department: + 49 7223 94 93 -120

Board version	Manufacturer	Transducer type	Measuring path (mm)	Sensitivity (mV/V/mm)	Frequency (kHz)	Load (kΩ)	Manufacturer designation	Current ADDI-DATA data base
APCI-3701	Solartron	HB	+/-1	73,5	10	2	AX/1.0/SH	AX/1.0/SH
			+/-1,5	49	10	2	AX/1.5/SH	
			+/-2,5	29,5	10	2	AX/2,5/SH	
			+/-5	14,7	10	2	AX/5.0/SH	
			+/-10	7,35	10	2	AX/10.0/SH	
		LVDT	+/-1	200	5	10	AX/1.0/S	AX/1.0/S
			+/-1,5	133,33	5	10	AX/1.5/S	
			+/-2,5	80	5	10	AX/2,5/S	
			+/-5	40	5	10	AX/5.0/S	
			+/-10	20	5	10	AX/10.0/S	
			+/-0,25	100	10	10	System 256 AX/0.25/S	System 256 AX/0.25/S
			+/-0,5	100	10	10	System 256 AX/0.5/S	System 256 AX/0.5/S
			+/-1	100	10	10	System 256 AX/1.0/S	System 256 AX/1.0/S
			+/-2,5	100	10	10	System 256 AX/2.5/S	System 256 AX/2.5/S
			+/-5	100	10	10	System 256 AX/5.0/S	System 256 AX/5.0/S
			+/-10	100	10	10	System 256 AX/10/S	System 256 AX/10/S
	TESA	HB	+/-2	73,75	13	2	GT21	GT21
			+/-5	29,5	13	2	GT61	
			+/-0,2	73,75	13	2	GT21HP	GT21HP
	Marposs	LVDT	+/-0,5	230	7,5	1000	F05	*On request*
			+/-1	230	7,5	1000	F10	*On request*
			+/-2,5	115	7,5	1000	F25	F25
			+/-5	115	7,5	1000	F50	*On request*
		HB	+/-0,5	73,75	7,5	2	H05	*On request*
			+/-1	73,75	7,5	2	H10	*On request*
			+/-2,5	36,9	7,5	2	H25	*On request*
			+/-5	29,5	7,5	2	H50	*On request*
	Peter & Hirt	LVDT	+/-2	150	5	100	T151/T152 T159/T160 T181/T182	*On request*
			+/-2	184	20	x	T161/T162 T191/T192	*On request*
		HB	+/-1	73	13	2	T201/T202 T210 T232	*On request*
			+/-2	73	13	2	T101/T102 T109/T110 T131/T132 T301/T302	T109/T110
			+/-5	7,3	13	2	T501/502 T531/T532	*On request*
	Mahr	HB	+/-2	192	19,4	High Z	P2004M	P2004
			+/-2	73,75	13	2	P2004T	GT21
		LVDT	+/-2,5	115	7,5	1000	P2004U	F25
	RDP	LVDT	+/-5,0	72	5	100	D5/200AG	D5/200AG
	Schaevitz	LVDT	+/-6,35	63	10	500	GCA121-250	GCA121-250
	SMPR-ATI	HB	+/-1,0	76,3	10	10	AXH/1.0	AXH/1.0

4.7 Component scheme

Fig. 4-2: Component scheme



5 INSTALLATION OF THE BOARD

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

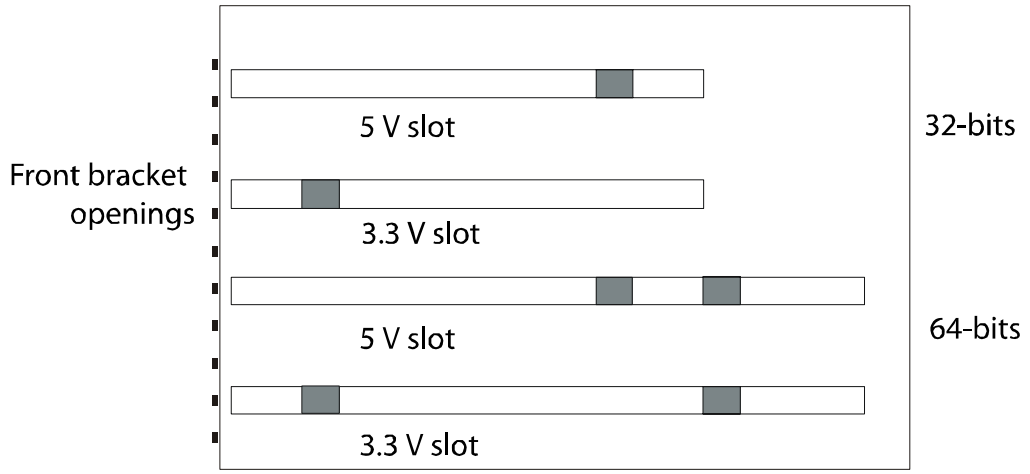
5.1 Opening the PC

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

5.2 Selecting a free slot

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

Fig. 5-1: PCI slot types



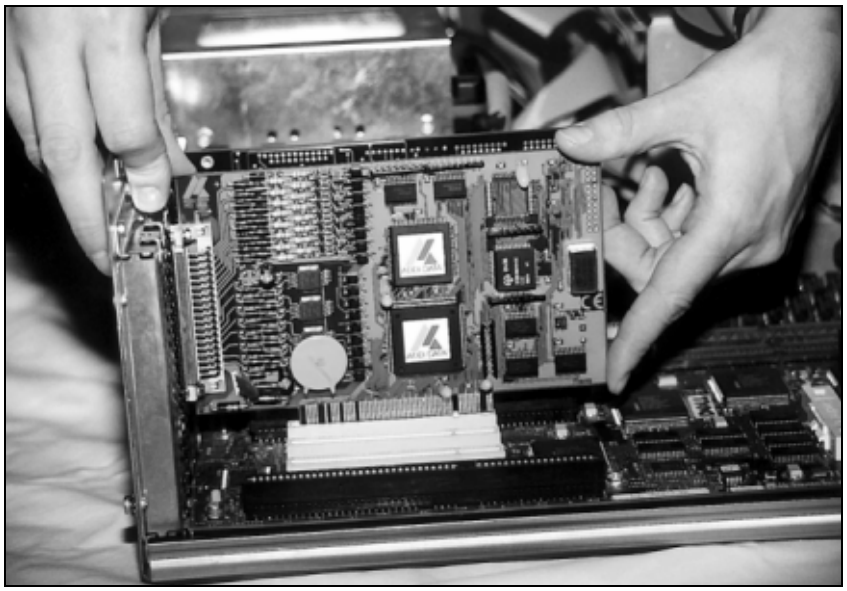
Remove the back cover of the selected slot according to the instructions of the PC manufacturer. Keep the back cover. You will need it if you remove the board

Discharge yourself from electrostatic charges.

Take the board out of its protective pack.

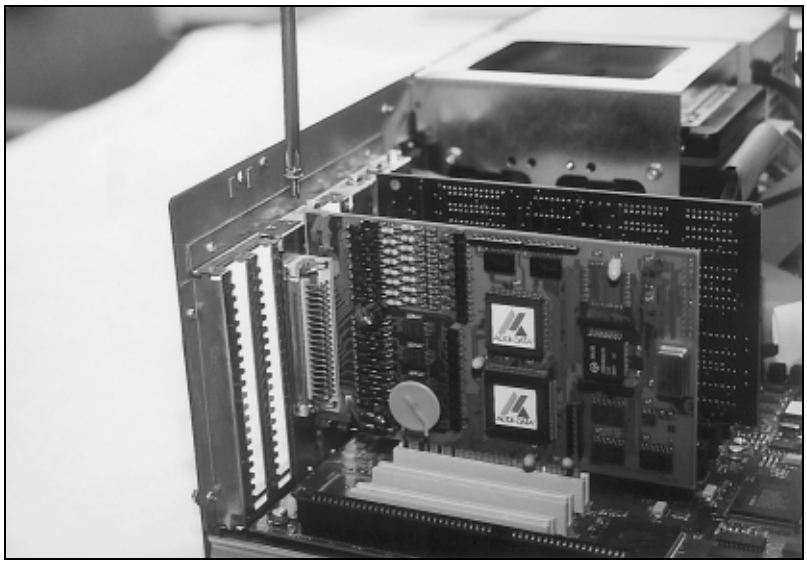
♦ **Plugging the board into the slot into the chosen slot.**

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.**

5.3 Closing the PC

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

6 ACCESSORIES

This chapter will inform you about the following accessories connection possibilities:

- Cables (chapter 6.1)
- Connection boxes (chapter 6.2)
- Connection examples (chapter 6.3)

6.1 Cables

Please note that the different cable types can be used for the respecting versions of the **APCI-3701**.

On the next page you will find a overview of the cables (including the combination possibilities with the connection boxes and the different versions of the board **APCI-3701**).

In addition, in the following sections you will find more detailed information about the single cable types as well as recommendations for the combination of cable with board, transducer type and connection box:

- Standard cable (see chapter 6.1.1)
- 1-channel-cable (see chapter 6.1.2)

		Boards					Connection boxes				
							Standard connection boxes				
Cable type	**Order name**	**APCI-3701-1**	**APCI-3701-8**	**APCI-3701-16**	**APCI-3701-8-K**	**APCI-3701-16-**	**PX3701-HB-8**	**PX3701-HB-8**	**PX3701-LVDT-8**	**PX3701-LVDT-16**	
											Length
Standard cable (**chapter** Fehler! Verweisquelle konnte nicht gefunden werden.) -Round cable - Twisted pairs - 50-pin female connector on 50-pin male connector				***S t a n d a r d c a b l e***							
	ST3701		▲ ■	▲ ■			▲	▲	▲	▲	2 m
	ST3701_5		▲ ■	▲ ■			▲	▲	▲	▲	5 m
	ST3701_10		▲ ■	▲ ■			▲	▲	▲	▲	10 m
1-channel-cable (**chapter** Fehler! Verweisquelle konnte nicht gefunden werden.) (50-pin SUB-D female connector with hood, shielded on 5-pin binder)				***1 - c h a n n e l - c a b l e***							
	ST3701-1-HB	▲									2 m
	ST3701-1-LVDT	▲									2 m
	ST-3701-16-KS			■		▲		■		■	2 m
	ST-3701-16-KS_5			■		▲		■		■	5 m
	ST-3701-16-KS_10			■		▲		■		■	10 m

Additional combination possibilities – for better results with certain transducers: ■ = Standard combination ▲ = Recommended combination

6.1.1 Standard cables: ST3701, ST3701-5 und ST3701-10

The standard cables have the following characteristics in common:
- Connectable to all versions of the **APCI-3701**
- Round cable, twisted pairs
- 50-pin female connector on 50-pin male connector

They differ from each other only in the cable length.

Recommendation:
The standard cables are considered for the use of standard transducers, e.g. Tesa, Schaevitz, etc. in common industrial environment.

6.1.2 1-channel-cables: ST3701-1-HB und ST3701-1-LVDT

The standard delivery of the **APCI-3701-1** always contains one of the both 1-channel-connection cables (whereas, additionally, both cable types can be ordered separately).

The both cables have the following characteristics in common:
- Connectable directly to a **APCI-3701-1**
- D-SUB 50-pin female connector with hoods, shielded on binder
- Length 2 m
- 5-pin female connector with screw cap

They differ from each other only in the transducer types that can be connected:

ST3701-1-HB	ST3701-1-LVDT
Connectable directly to a **APCI-3701** with a **HB-transducer**	Connectable directly to a **APCI-3701** with a **LVDT-transducer**

Recommendation:

The cables are considered especially for the following applications:
- Block gauge test
- Roundness test
- Major diameter test at rotating parts

6.2 Connection boxes

The standard connection boxes have the following characteristics in common:
- Connection of inductive transducers to the **APCI-3701**
- Solid aluminium housing
- Sealing caps for the transducer inputs

The standard connection boxes differ from each other only in type and number of the connectable transducers:

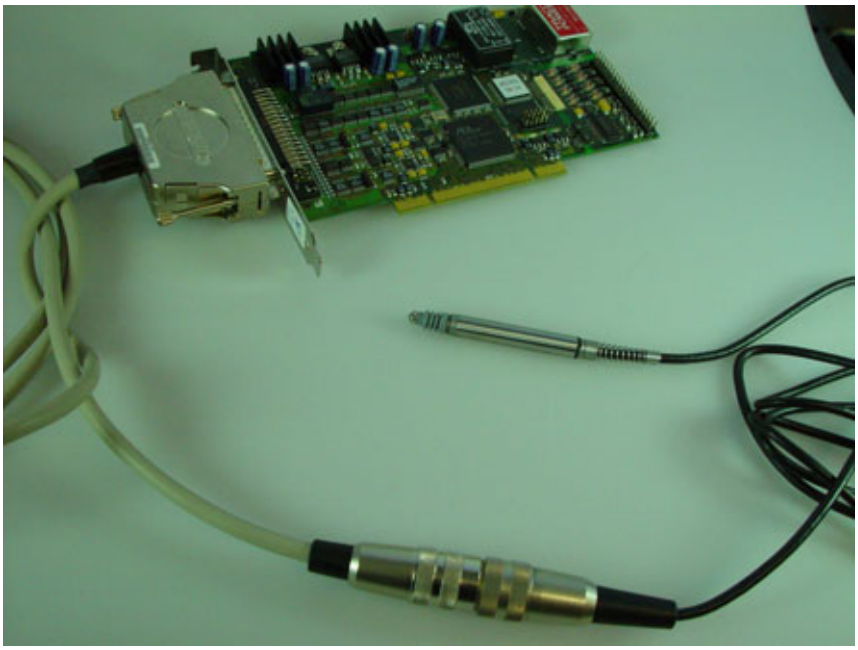
PX3701-HB-8	PX3701-HB-16	PX3701-LVDT-8	PX3701-LVDT-16
Connection of up to 8 HB transducers	Connection of up to 16 HB transducers	Connection of up to 8 LVDT transducers	Connection of up to 16 LVDT transducers

6.3 Connection examples

Connection: 1-channel version with a transducer

For the connection of the **APCI-3701-1**, please use either the cable **ST3701-1-HB** or the cable **ST3701-1-LVDT** with round connector. Connect this cable with the **APCI-3701** and with the transducer. You do not require any additional terminal panels.

Fig. 6-1: Connection of a ST3701-1-x with board and transducer



♦ **Connect the round connector of the ST3701-1-x with the transducer.**

Note:
The standard delivery of the 1-channel board **APCI-3701-1** includes one of the cable types **ST3701-1-HB** or **ST3701-1-LVDT**, without extra charge. Both cable types also can be ordered separately.

7 SOFTWARE

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

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

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

IMPORTANT!
The supported software functions for the APCI-3701 are listed in chapter 10.

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

ADDIPACK is composed of following programs:

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

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

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

- **ADDI-DATA virtual board:**
  ADDI-DATA software is based on the principle of a **virtual board:** it transposes the different functions (e.g. digital inputs, analogy 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.

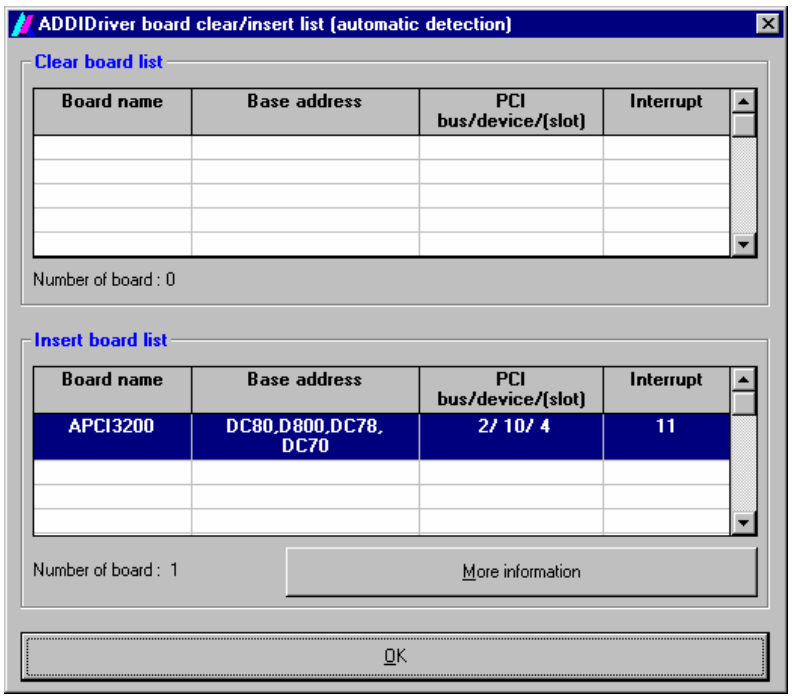
7.1 Board registration

When starting the set-up of ADDIREG, the APCI-3701 is automatically recognised and registered.

7.1.1 Installation of a new board

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

Fig. 7-1: New inserted board (example)



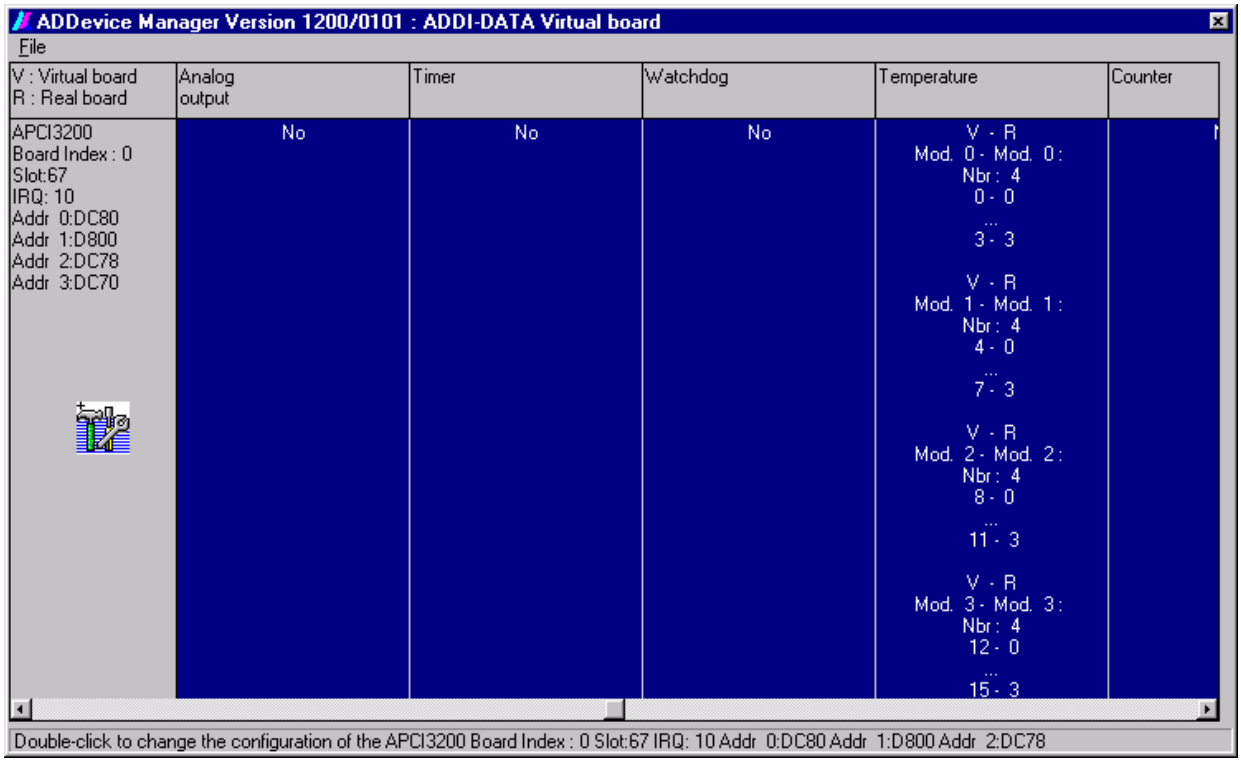
The boards which have been removed from the PC since the last ADDIREG start are listed in the upper table

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. 7-2: 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 channels are interruptible, the program displays the number of the first and of the last input channel

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

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

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

7.1.2 Changing the registration of a board

You can change the current board configuration with ADDIREG

Description of the ADDIREG program

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

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

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

Fig. 7-3: ADDIREG registration program (example)

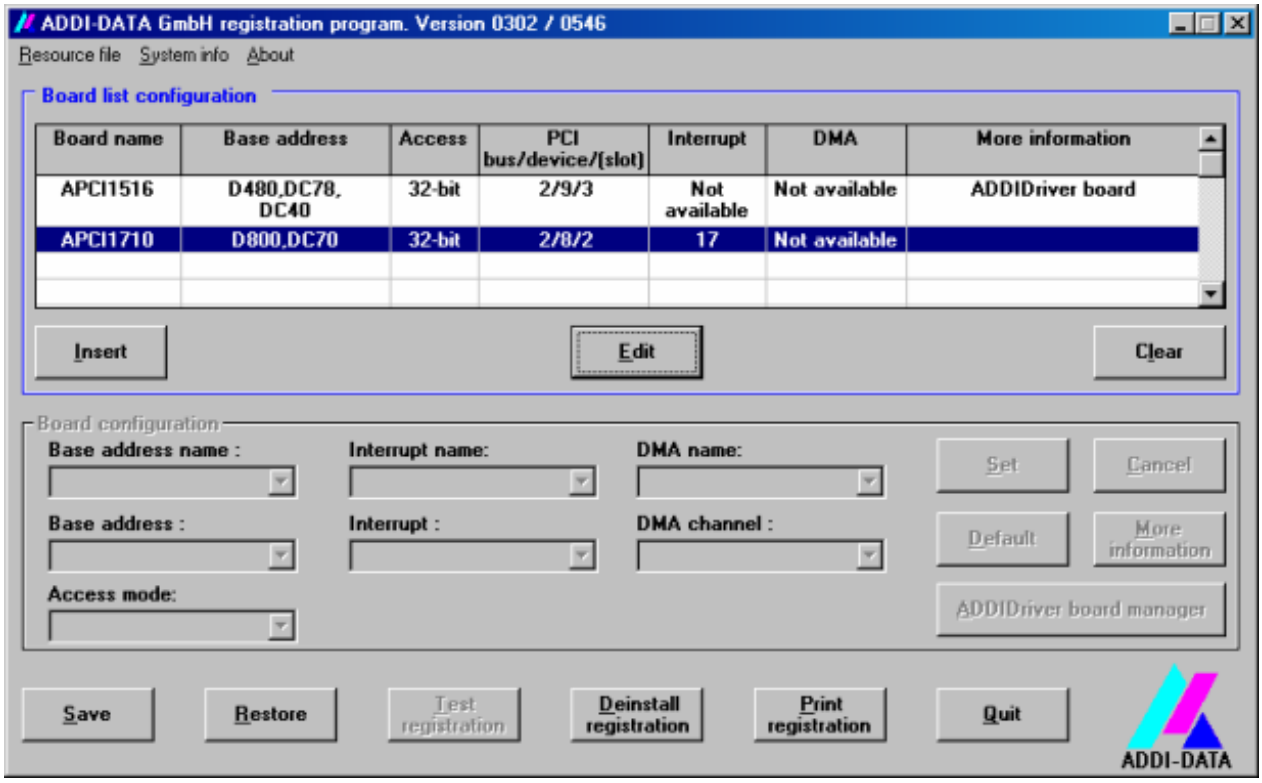


Table:

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

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

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

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

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

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

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

Text boxes:

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

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

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

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

Buttons:

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

Set:
Sets the parameterised 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.

7.2 Questions and software downloads on the web

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

Free downloads of standard software

You can download the latest version of the software for the board **APCI-3701.**

http://www.addi-data.com

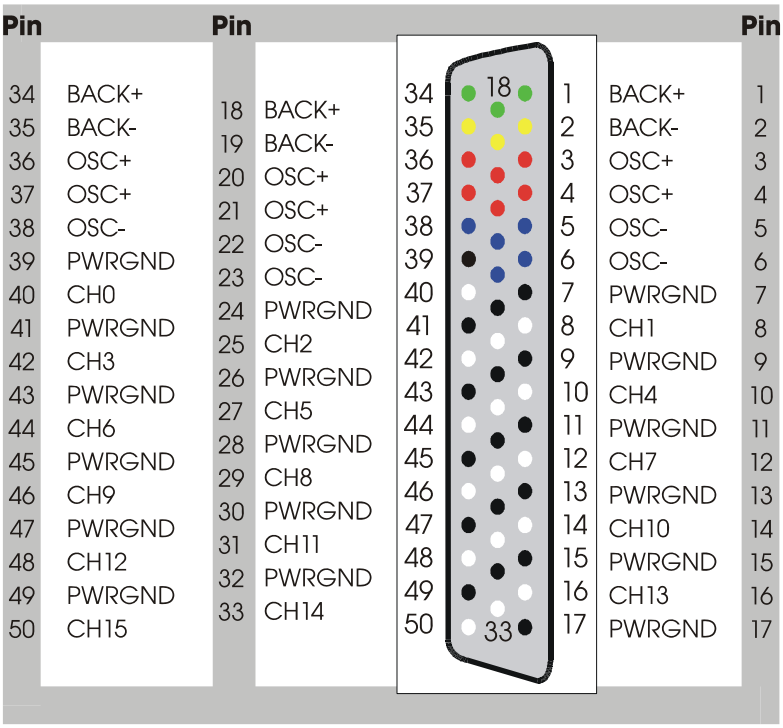
IMPORTANT!
Before using the board or in case of malfunction during operation, check if there is an update of the product (technical description, driver). The current version can be found on the internet or contact us directly.

8 CONNECTING THE PERIPHERAL

8.1 Connector pin assignment

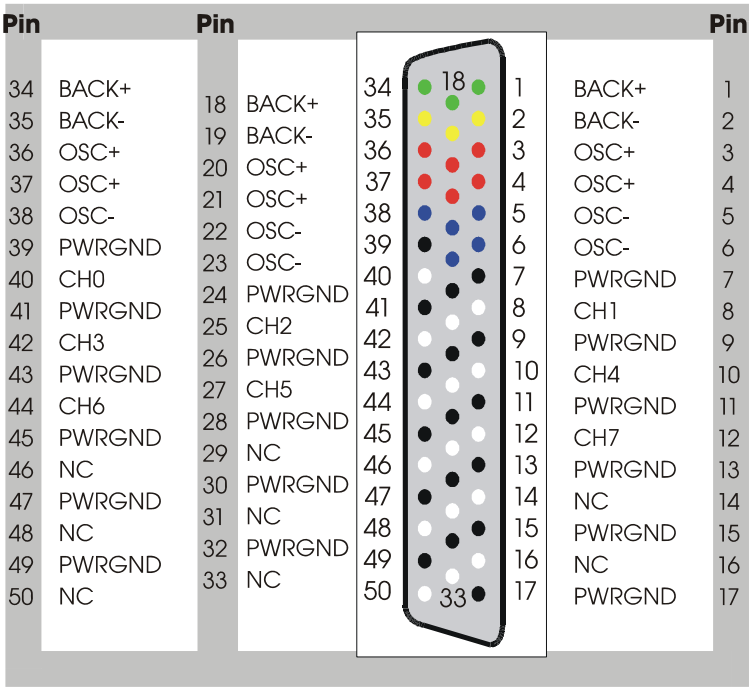
8.1.1 50-pin SUB-D male front connector ST1

Fig. 8-1: Pin assignment: APCI-3701-16



Signal	Meaning
OSC+ (Red pins) or OSC- (Blue pins)	phase-shifted supply signal of the inductive transducers
BACK+ (green pins) or BACK- (yellow pins)	Return lines of the supply voltage for measuring the amplitude. It serves as true value signal of the oscillator for the supply voltage.
CHx (white pins)	Transducer input and input number
PWRGND (black pins)	Ground

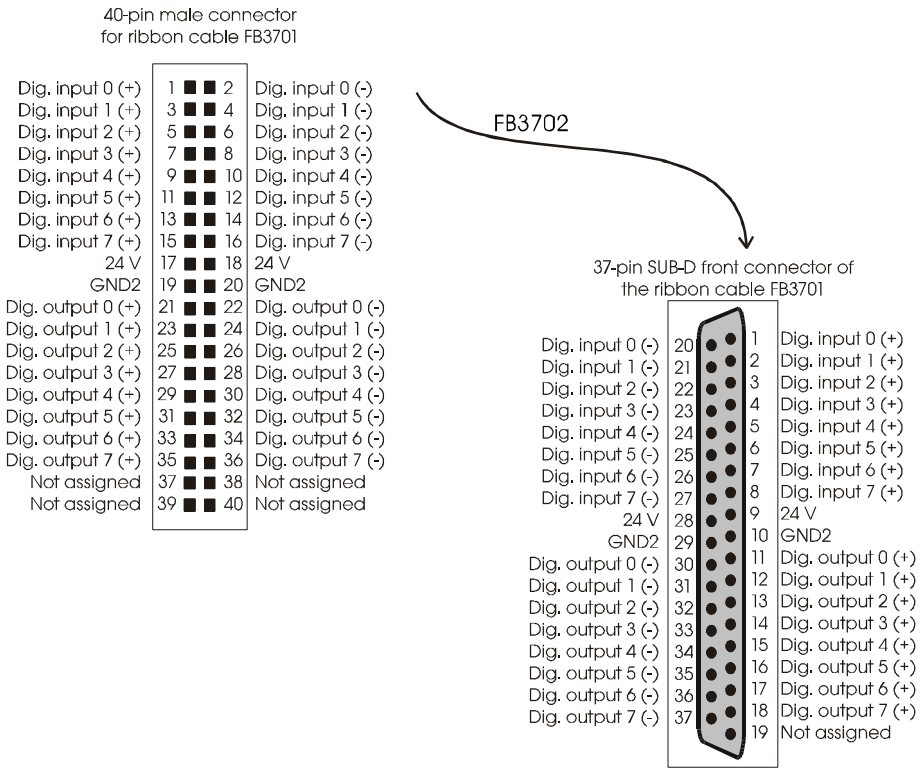
Fig. 8-2: Pin assignment: APCI-3701-8



NC: not connected

8.1.2 40-pin male connector ST3

Fig. 8-3: Pin assignment: 40-pin connector to 37-pin SUB-D bracket



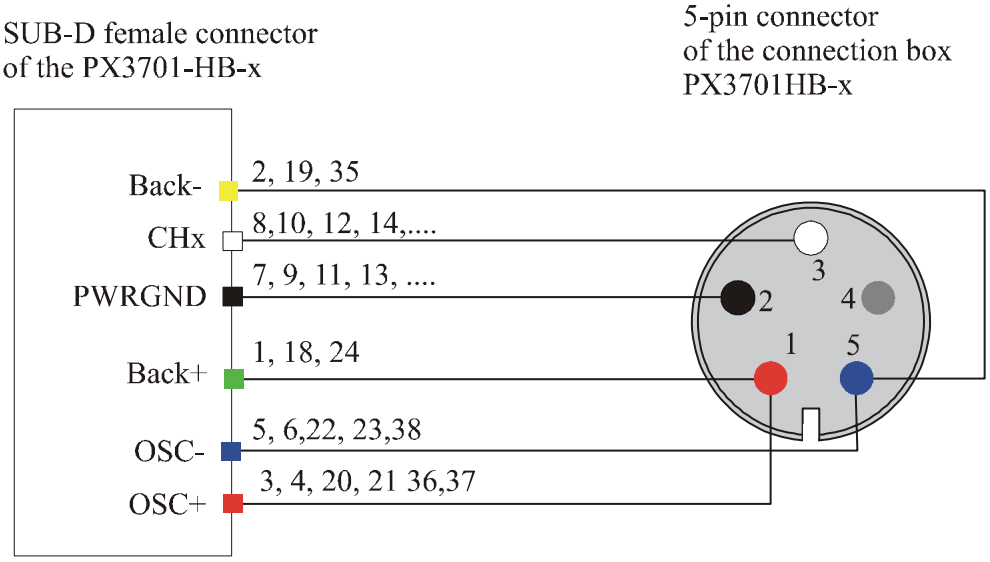
IMPORTANT!
Plug the FB3702 on the connector **with the red cable lead on the side of the pin 1.**

8.2 Connection of inductive transducers

Two connection boxes with 8 (PX371-8) or 16 (PX371-16) transducer female connectors and the belonging connecting cable are available for connecting the inductive displacement transducers to the board. The connection with the board is made via a 50-pin SUB-D male connector.

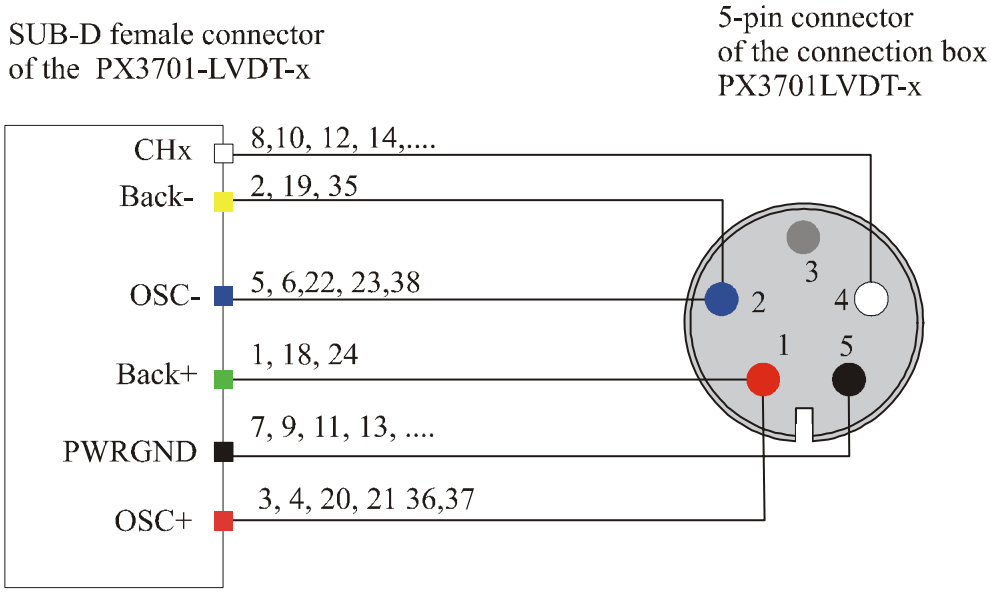
8.2.1 Connection of half-bridge transducers

Fig. 8-4: Connection of half-bridge transducers



8.2.2 Connection of LVDT transducers (Series-opposed)

Fig. 8-5: Connection of LVDT transducers (Series-opposed)



8.2.3 Connection of Mahr transducers

The pin assignment for Mahr transducers of the product range P2xxx-M (e.g.: P2004-M) differs from the pin assignment for standard half-bridge transducers (e.g. GT21 of Tesa).

Should you want to connect a Mahr transducer to the Box PX3701-HB-x with the Mahr assignment (Designation M), an adapter between the transducer and the flange socket of the connection box is necessary.

The Mahr transducers are also available with a Tesa compliant assignment (Designation T; e.g. P2004-T). This version can be directly connected to the connection box.

IMPORTANT!
Before ordering a Mahr transducer, you have to consider the different types of the 5-pin assignment.

Table 8-1: Compliance of the Mahr transducers

Transducer pin number	TESA-compliant assignment	MAHR assignment
1	OSC+	OSC+
2	GND	Not assigned
3	Output signal	Output signal
4	Not assigned	GND
5	OSC-	OSC-

Remark: Pin 2 and 4 are inverted.

8.3 Connection of the digital inputs and outputs

Fig. 8-6: Digital inputs

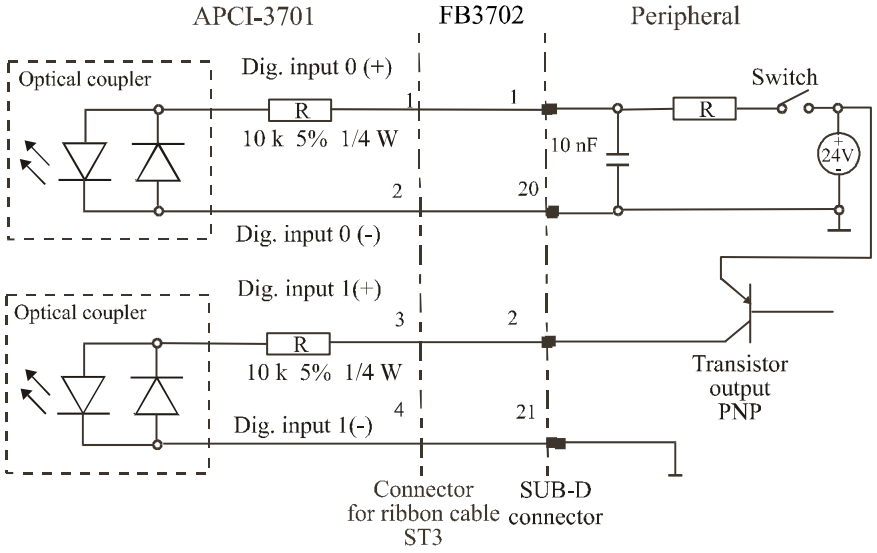
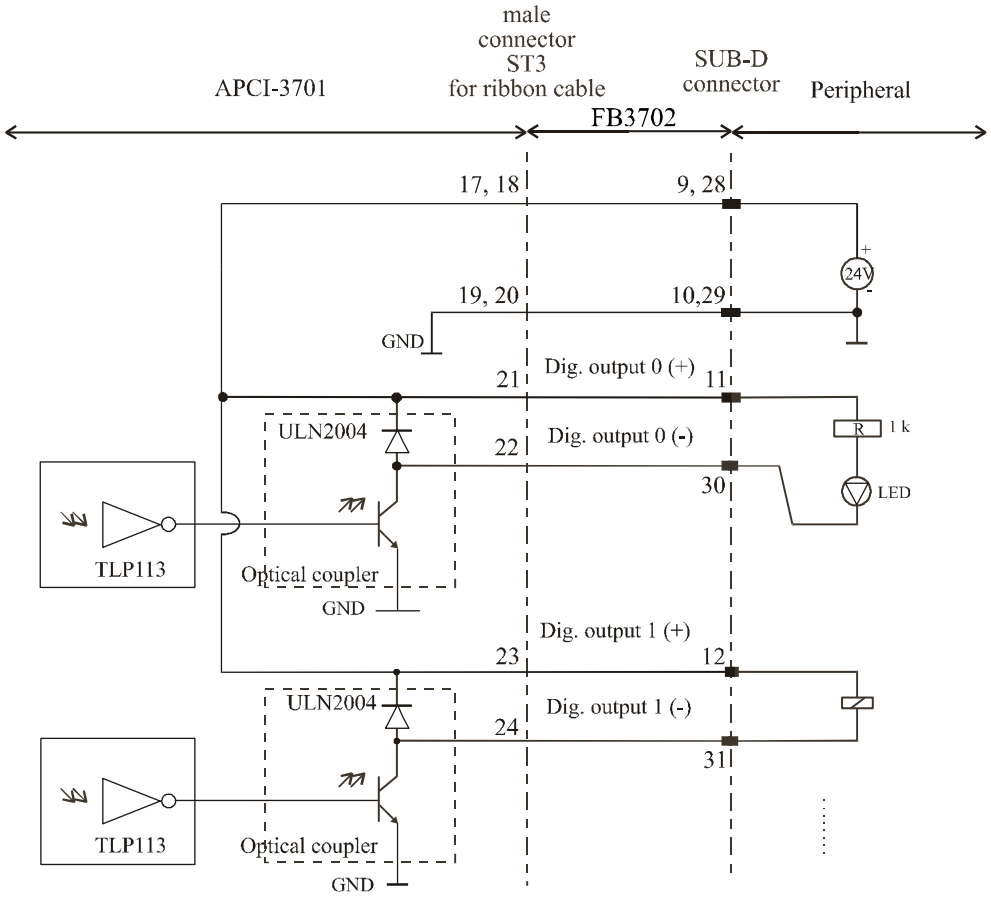
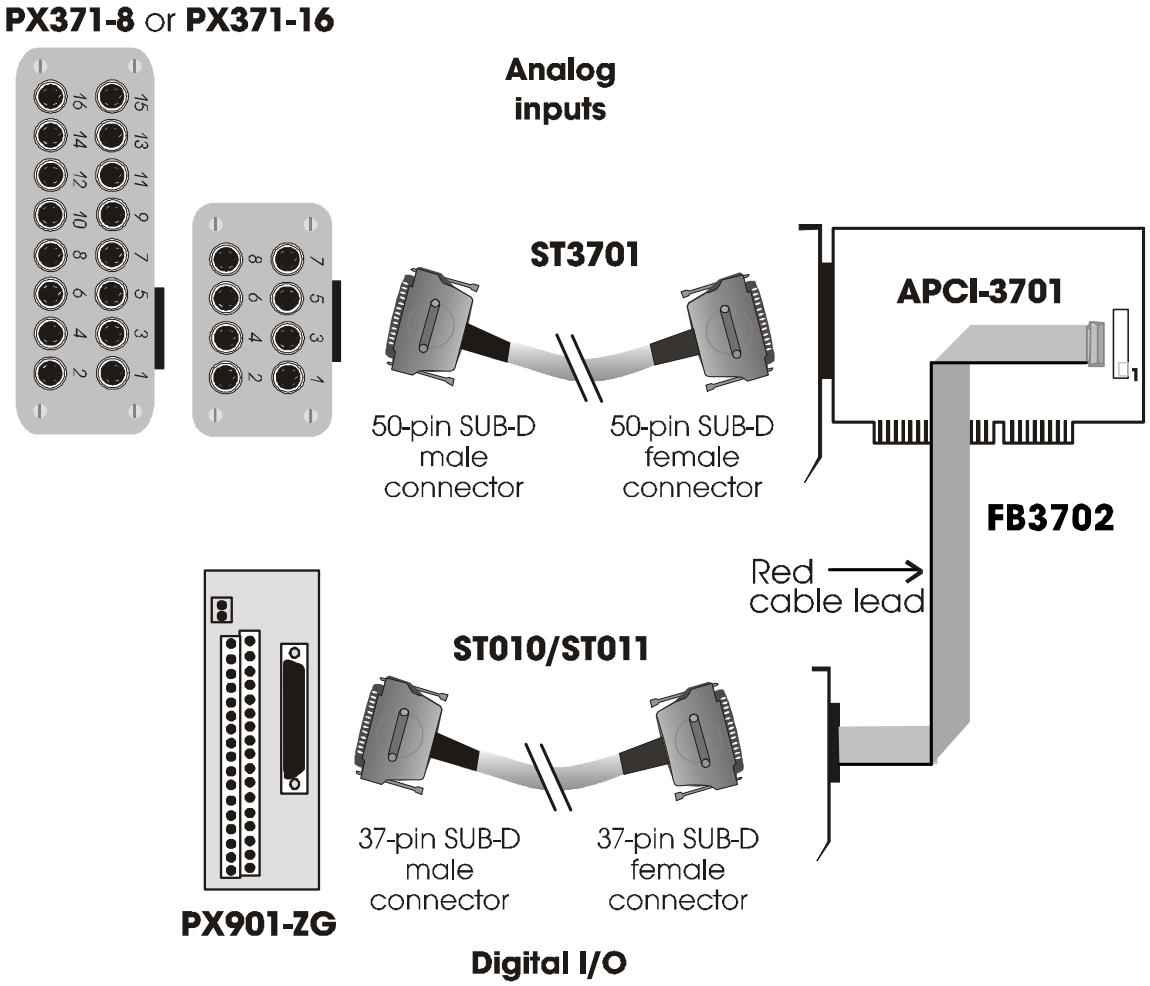


Fig. 8-7: Digital outputs



8.4 Connection to screw terminal panels/boxes

Fig. 8-8: Connection to screw terminal panels/boxes



IMPORTANT!
Plug the FB3702 on the connector **with the red cable lead on the side of the pin 1.**

The cable ST3701 is 2 m long in the standard delivery; The max. permissible length is 10 m.

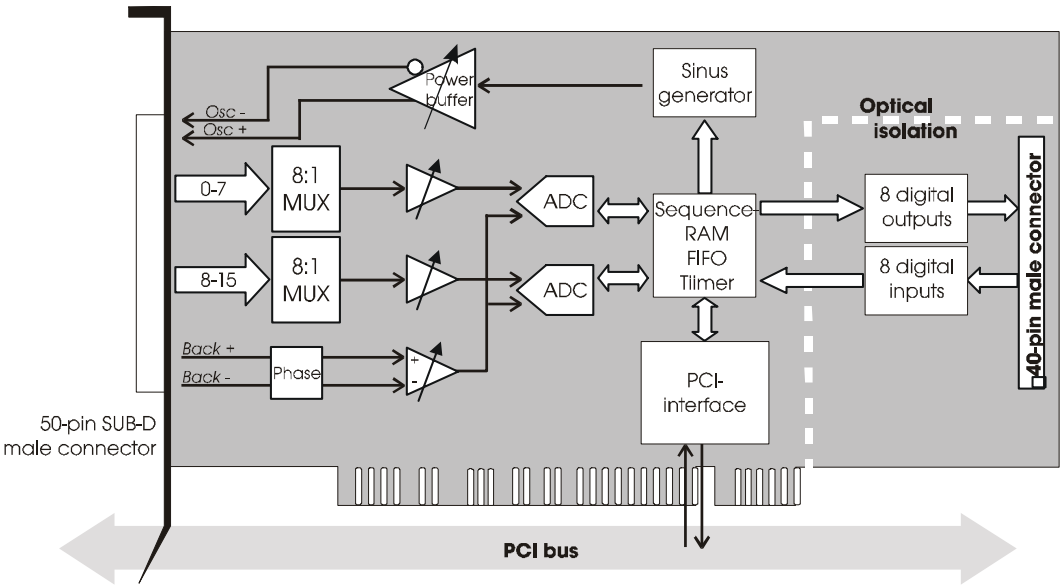
9 FUNCTIONS OF THE BOARD

WARNING !
The cooling components and the DC/DC connector can warm up during the board operation.

- **Install the board in the PC so that cooling air can flow easily between the different inserted boards.**
- **Before removing the board from the PC, wait until it sufficiently cooled down.**

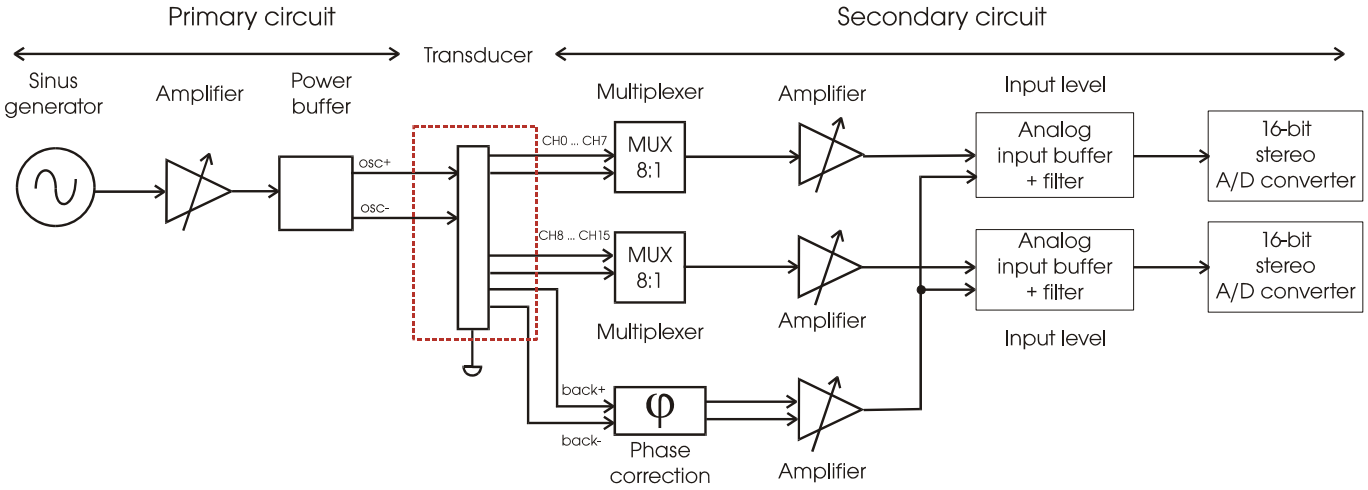
9.1 Block diagram

Fig. 9-1: Block diagram of the APCI-3701



9.2 Acquisition principle

Fig. 9-2: Acquisition principle of the APCI-3701



The board **APCI-3701** has up to 16 analog inputs. It is typically designed for acquiring measurement signals of inductive displacement transducers. Therefore the board provides all signals required for supplying the inductive transducers.

The primary circuit of the sensor is excited by means of a sinus generator.

The supply of the transducer is made through a differential power buffer.

The input level is generated parallely twice to optimise the clock frequency.

The circuit and secondary signals are simultaneously sampled through a 16-bit, 100 kHz stereo A/D converter (with AC specifications). The sampling occurs synchronously with the exciting signal and at the extreme points to reach the best precision.

9.2.1 Board calibration

The board is programmed with the following predefined parameters:
- gain adjustment on primary and secondary circuit
- Duty cycle is adjusted to 50 % at the delivery.

9.2.2 Board settings

The board **APCI-3701** is supplied with a predefined library of the sensor properties and is programmed according to the connected sensor.

For each connected sensor, the following values are set:
- frequency of the exciting signal in a range from 2 to 20 kHz
- gain on the primary circuit between 0.7 V_{rms} and 3.5 V_{rms}
- gain on the secondary circuit between 1 and 20
- load
- phase of the return line signal for the supply voltage

9.3 Primary circuit

9.3.1 Sinus generator

The sinus generator generates a sinus signal for the excitation of the primary circuit.

The frequency and the amplitude are set through software according to the connected sensor type.

The frequency can be set with 14 predefined values in a range from 2 to 20 kHz (See Table 4-1).

The amplitude can be set in a range from 0,7 V_{rms} and 3,5 V_{rms}.

The duty cycle is set to 50 % to avoid any distortion of the output signal.

Synchronising

The sinus generator is synchronised with the master clock of the A/D converter to allow the signal acquisition always at the extreme values (minimum and maximum) of the sinus signal.

9.3.2 Power buffer

The board is fitted with a power buffer which feeds in the connected sensors.

Its high performance allows supplying each of the 2 exciting lines (OSC+ and OSC-) with a maximum value of 260 mA.

The power buffer is also fitted with analogue filters to avoid the internal perturbances (PC noise). Therefore the quality of the outputted signal is increased and its distortion is set to the lowest level.

In case of short circuit the internal fuses of the power buffer switch the outputs off.

9.4 Secondary circuit

The incoming measuring signals are driven through 2 separate 8:1 multiplexers. Each input level is then amplified by a programmable amplifier. The measuring signal is driven through analogue filters (pass band filters) with edge frequencies of 500 Hz and 32 kHz and acquired simultaneously with the feedback signal (return line signal) in the A/D converter.

9.4.1 Measurement of the supply signal

The signal generated by the power buffer (OSC+ and OSC-) is returned from the transducer to the board through the return lines Back+ and Back-. The exciting signal is directly measured at the sensor. A precise control of the amplitude on the primary circuit is hence not required.

A phase correction is predefined on the board to balance the phase difference between the exciting signal of the primary circuit and the measuring signal of the secondary signal.

9.4.2 A/D converter

The onboard converter is a 16-bit delta-sigma stereo A/D converter. This enables to measure the measuring signal and the return line signal simultaneously.

The synchronising of the sinus signal with the master clock of the A/D converter allow the simultaneous sampling of the measuring signal and of the return line signal always at the same measuring points.

The A/D converter is operated in the bipolar mode. Conversion of the analog values into digital code is carried out according to the second complement. This means that the MSB is set to logic "1" for a negative voltage. The core of the measuring bolt is moved inwards into the transducer. For voltages equal or superior to 0V the MSB is set to logic "0". The core of the measuring bolt is moved outwards out of the transducer.

9.5 Transducer principle

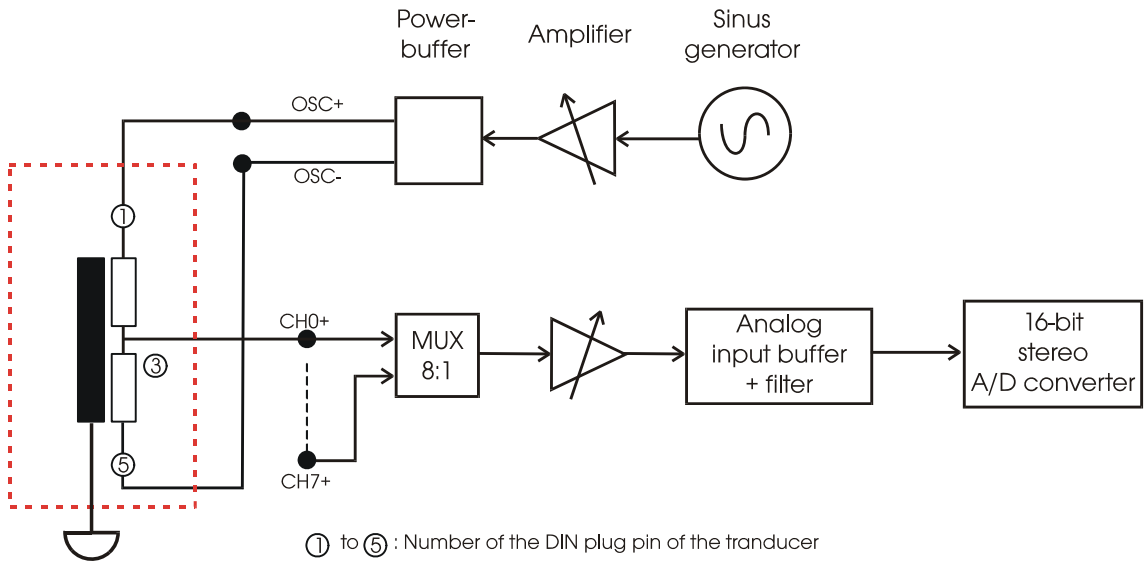
The inductive transducer is basically used for precise measuring travels. It is a travel/voltage sensor, the output voltage of which changes linearly along with the moving ferromagnetic core. The ferromagnetic core moves according to a straight line in a transformator, which consists of a central primary coil and 2 external secondary coils (cylindrical windings). The power buffer provides an AC voltage source to the primary coil. This enables the secondary voltage to be supplied and to change according to the position of the magnetic core.

9.5.1 Half-bridge transducer

The half bridge transducer features 2 inductive coils (windings). These are directly fed with 2 sinusoidal voltage signals (a positive oscillator voltage and a negative oscillator voltage). The measuring bolt moves along the 2 coils with a ferromagnetic core which changes the voltages in the two coils depending on its position.

The measuring bolt functions like a variable voltage distributor and the change in voltage at the coils results in the sinusoidal measuring signal to be evaluated.

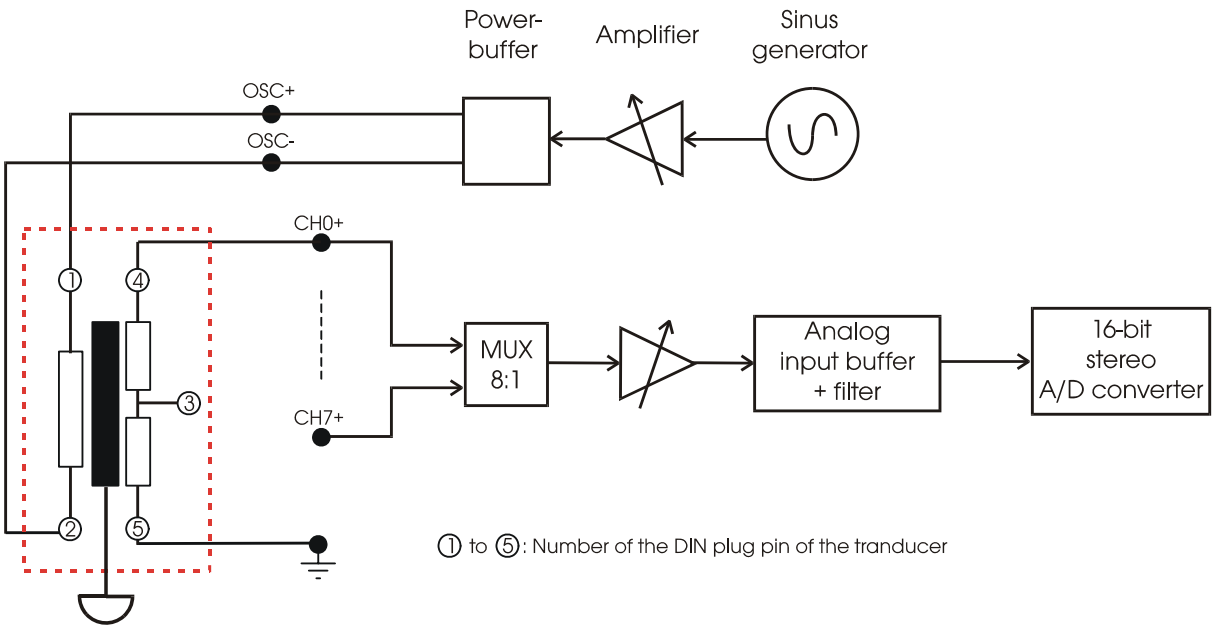
Fig. 9-3: Half-bridge transducer



9.5.2 LVDT transducer (Series-opposed)

The series-opposed transducer features 3 inductive coils, one primary coil and 2 secondary coils. These coils are positioned concentrically around the mobile core and form two symmetrical transformers with respect to the electrical zero point of the transducer. The primary coil is fed by 2 sinusoidal voltage signals (a positive and a negative one) whereas both secondary coils (switched in phase opposition) produce an electrical signal proportional to the measured displacement.

Fig. 9-4: LVDT transducer (Series-opposed)



9.5.3 Settings of the transducer

A transducer features different properties which are important for configuring the board:

- the nominal frequency F in Hz
- the nominal voltage V in V_{rms}
- the sensitivity S in mV/V/mm
- the measuring range d_{max} in mm ($\pm d_{max}$)
- the load R_{load}

According to these values, the settings parameters are programmed for adapting the board to the connected transducer (See 9.2.2: board settings).

9.6 Possible acquisitions

The board **APCI-3701** generates the sinusoidal supply voltage and evaluates the measuring signal.

- Each channel can be independently acquired (single mode; See Fig. 9-5)
- The board can acquire the channels in sequences:
  n sequences can be carried out; $1 \leq n \leq 65.535$ (See Fig. 9-7)
- n sequences can be divided in k sequences. After acquiring m sequences, the conversion is stopped. This occurs k times. A new trigger starts the conversion for m sequences again and so on till the n sequences have been acquired. (n = k.m See Fig. 9-8)
- The board can acquire sequences in continuous mode.

Each of this acquisition possibility (programmable by software) is started:
- through start enable
- by software trigger (Single software sequence) or
- by hardware trigger (through the digital input 0).

Delay

A delay time can be set in sequence or continuous mode. It can be set between 2 successive conversion starts or between the end of a conversion and the start of the next conversion.

The delay time is determined by software through a 16-bit timer (from 0 to 65.535 ms).

Fig. 9-5: Possible acquisitions: Single start enable

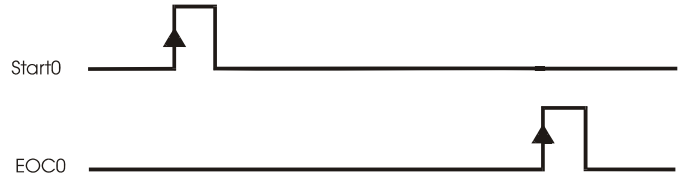


Fig. 9-6: Possible acquisitions: single software/hardware trigger

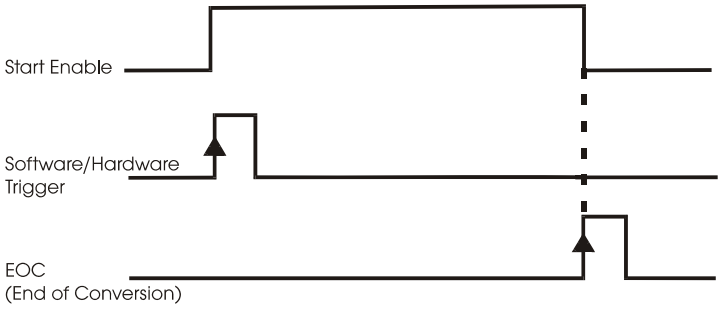


Fig. 9-7: Possible acquisitions: sequence start enable

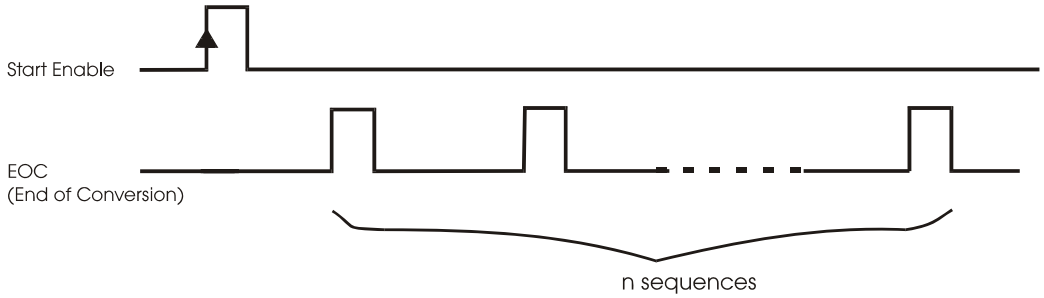
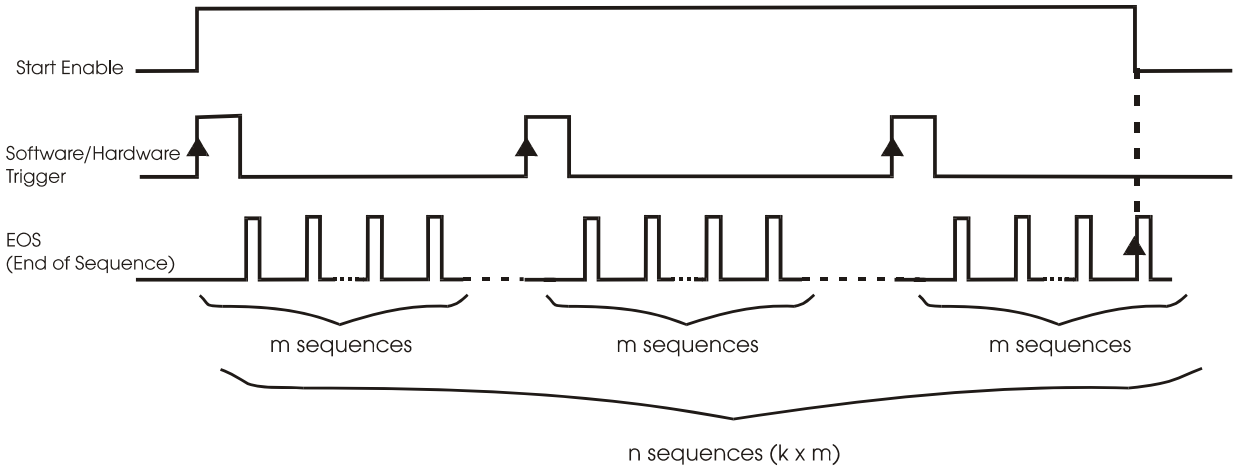


Fig. 9-8: Possible acquisitions: m/n sequences with hardware/software trigger



9.7 Diagnostic

The board disposes of a diagnostic function which under certain circumstances can detect a short circuit or an open line on the primary circuit as well as on the secondary circuit.

The short-circuit detection on the primary circuit is activated continuously. The other diagnostic functions are activated by software functions.

9.7.1 Short circuit

On the primary circuit the supply voltage of the power buffer is controlled. If a short circuit occurs, a voltage drop is detected. This information is returned by software. (See the software diagnostic function).
In case of short circuit the power buffer disposes of internal fuses which switch the outputs off.

On the secondary circuit the number of the channel which caused a short circuit is returned by software.

9.7.2 Line break

In case of a line break on the primary circuit a software function controls if **at least one** of the **n** connected transducers is not correctly connected. The user is to make sure that all transducers are correctly connected.

On the secondary circuit the number of the channel which has a line break is returned by software.

9.8 Interrupt

Below are the possible interrupt sources:
- short circuit on the primary circuit
- timer has run down
- end of conversion (EOC)
- end of sequence (EOS)
- the sequence counter has run down
- DMA end of transfer
- FIFO memory is full

9.9 Timer

A 12-bit timer is available onboard to generate an interrupt. It can be pre-programmed with 3 different clock units.

Table 9-1: Timer time intervals

Time unit	Range of the delay time in the time unit
µs	from 0 to 4095 µs = 4.095 ms
ms	from 0 to 4095 ms = 4.095 s
s	from 0 to 4095 s = 1 h 08 mn 15 s

10 STANDARD SOFTWARE

10.1 Software functions

ADDIPACK supports the following functions for the **APCI-3701**.

Table 10-1: 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
Transducer	b_ADDIDATA_GetNumberOfTransducerChannels
	b_ADDIDATA_GetNumberOfTransducerModules
	b_ADDIDATA_GetNumberOfTransducerChannelsForTheModule
	b_ADDIDATA_GetTransducerChannelModuleNumber
	b_ADDIDATA_GetTransducerModuleGeneralInformation
	b_ADDIDATA_GetTransducerModuleSingleAcquisitionInformation
	b_ADDIDATA_GetTransducerModuleAutoRefreshInformation
	b_ADDIDATA_GetTransducerSequenceInformation
	b_ADDIDATA_InitTransducerChannel
	b_ADDIDATA_ReleaseTransducerChannel
	b_ADDIDATA_Read1TransducerChannel
	b_ADDIDATA_ConvertDigitalToRealMetricValue
	b_ADDIDATA_ReadMoreTransducerChannels
	b_ADDIDATA_ConvertMoreDigitalToRealMetricValues
	b_ADDIDATA_InitTransducerSequenceAcquisition

Functionality	Function name
Transducer	b_ADDIDATA_StartTransducerSequenceAcquisition
	b_ADDIDATA_PauseTransducerSequenceAcquisition
	b_ADDIDATA_ConvertTransducerSequenceDigitalToRealMetricValue
	b_ADDIDATA_StopTransducerSequenceAcquisition
	b_ADDIDATA_GetTransducerSequenceAcquisitionHandleStatus
	b_ADDIDATA_ReleaseTransducerSequenceAcquisition
	b_ADDIDATA_GetTransducerHardwareTriggerInformation
	b_ADDIDATA_EnableDisableTransducerHardwareTrigger
	b_ADDIDATA_GetTransducerHardwareTriggerStatus
	b_ADDIDATA_EnableDisableTransducerSoftwareTrigger
	b_ADDIDATA_TransducerSoftwareTrigger
	b_ADDIDATA_GetTransducerSoftwareTriggerStatus
	b_ADDIDATA_TestTransducerChannelSecondaryConnection
	b_ADDIDATA_EnableDisableTransducerModulePrimaryConnectionTest
	b_ADDIDATA_TestTransducerModulePrimaryConnection
	b_ADDIDATA_EnableDisableTransducerModulePrimaryShortCircuitInterrupt
	b_ADDIDATA_RearmTransducerModulePrimaryShortCircuitConnectionTest
Timer	b_ADDIDATA_GetNumberOfTimers
	b_ADDIDATA_GetTimerInformation
	b_ADDIDATA_InitTimer
	b_ADDIDATA_EnableDisableTimerInterrupt
	b_ADDIDATA_StartTimer
	b_ADDIDATA_StartAllTimers
	b_ADDIDATA_TriggerTimer
	b_ADDIDATA_TriggerAllTimers
	b_ADDIDATA_StopTimer
	b_ADDIDATA_StopAllTimers
	b_ADDIDATA_ReleaseTimer
	b_ADDIDATA_ReadTimerValue
	b_ADDIDATA_ReadTimerStatus

Functionality	Function name
Digital inputs	b_ADDIDATA_GetNumberOfDigitalInputs
	b_ADDIDATA_GetDigitalInputInformation
	b_ADDIDATA_GetDigitalInputInformationEx
	b_ADDIDATA_Read1DigitalInput
	b_ADDIDATA_Read2DigitalInputs
	b_ADDIDATA_Read4DigitalInputs
	b_ADDIDATA_Read8DigitalInputs
Digital outputs	b_ADDIDATA_GetNumberOfDigitalOutputs
	b_ADDIDATA_GetDigitalOutputInformation
	b_ADDIDATA_SetDigitalOutputMemoryOn
	b_ADDIDATA_SetDigitalOutputMemoryOff
	b_ADDIDATA_Set1DigitalOutputOn
	b_ADDIDATA_Set1DigitalOutputOff
	b_ADDIDATA_Set2DigitalOutputsOn
	b_ADDIDATA_Set2DigitalOutputsOff
	b_ADDIDATA_Set4DigitalOutputOn
	b_ADDIDATA_Set4DigitalOutputOff
	b_ADDIDATA_Set8DigitalOutputsOn
	b_ADDIDATA_Set8DigitalOutputsOff
	b_ADDIDATA_Get1DigitalOutputStatus
	b_ADDIDATA_Get2DigitalOutputsStatus
	b_ADDIDATA_Get4DigitalOutputStatus
	b_ADDIDATA_Get8DigitalOutputsStatus

10.2 Software samples

Table 10-2: Supported software samples

Functionality	Sample number	Description
Transducer	SAMPLE00	Show information of a transducer channel
	SAMPLE01	Read 1 transducer channel without interrupt.
	SAMPLE02	Read 1 transducer channel with interrupt.
	SAMPLE03	Several transducer channels without interrupt.
	SAMPLE04	Several transducer channels with interrupt.
	SAMPLE05	Test sequence acquisition with interrupt
Digital inputs	SAMPLE01	Read 1 digital input
	SAMPLE02	Read 2 digital inputs
	SAMPLE03	Read 4 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
Timer	SAMPLE01	Initialise 1 timer in mode 2 without interrupt, start the timer. Read the timer value.
	SAMPLE02	Initialise 1 timer in mode 2 with interrupt, start the timer. Read the timer value. When an interrupt occurs, stop the timer and quit the program.

11 SET3701: CALIBRATION AND UPDATE TOOL

11.1 Introduction

This program allows you to calibrate the APCI-3701 with any transducer type. ADDI-DATA GmbH selected the most common used transducer types, but you may define any other type. This software consists of two parts:

1. Transducer database management
2. Calibration part

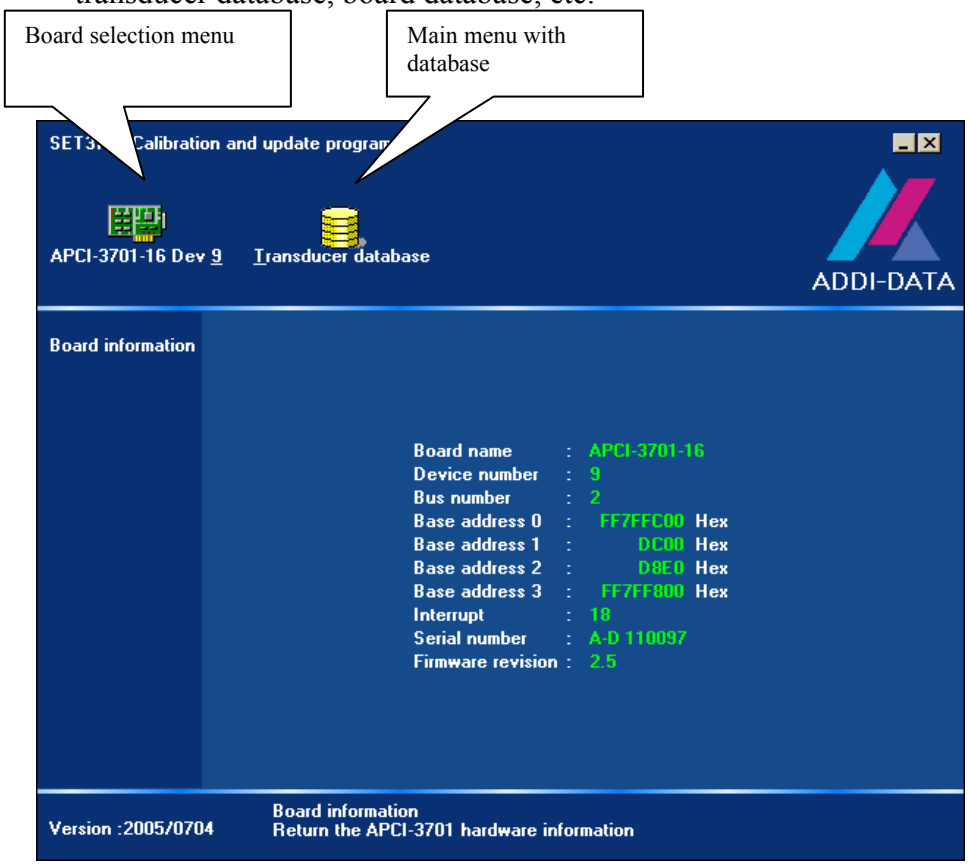
11.2 Program start

After the installation (CD\APCI-3701\SET3701 DISK1)) start Set3701 via "Start\Program\ Set3710\Set3701".
After the introduction screen opened, the main window will open. On the upper left of the window you can see two icons.

♦ **Double-click on one of the two icons, so that the corresponding menu opens**

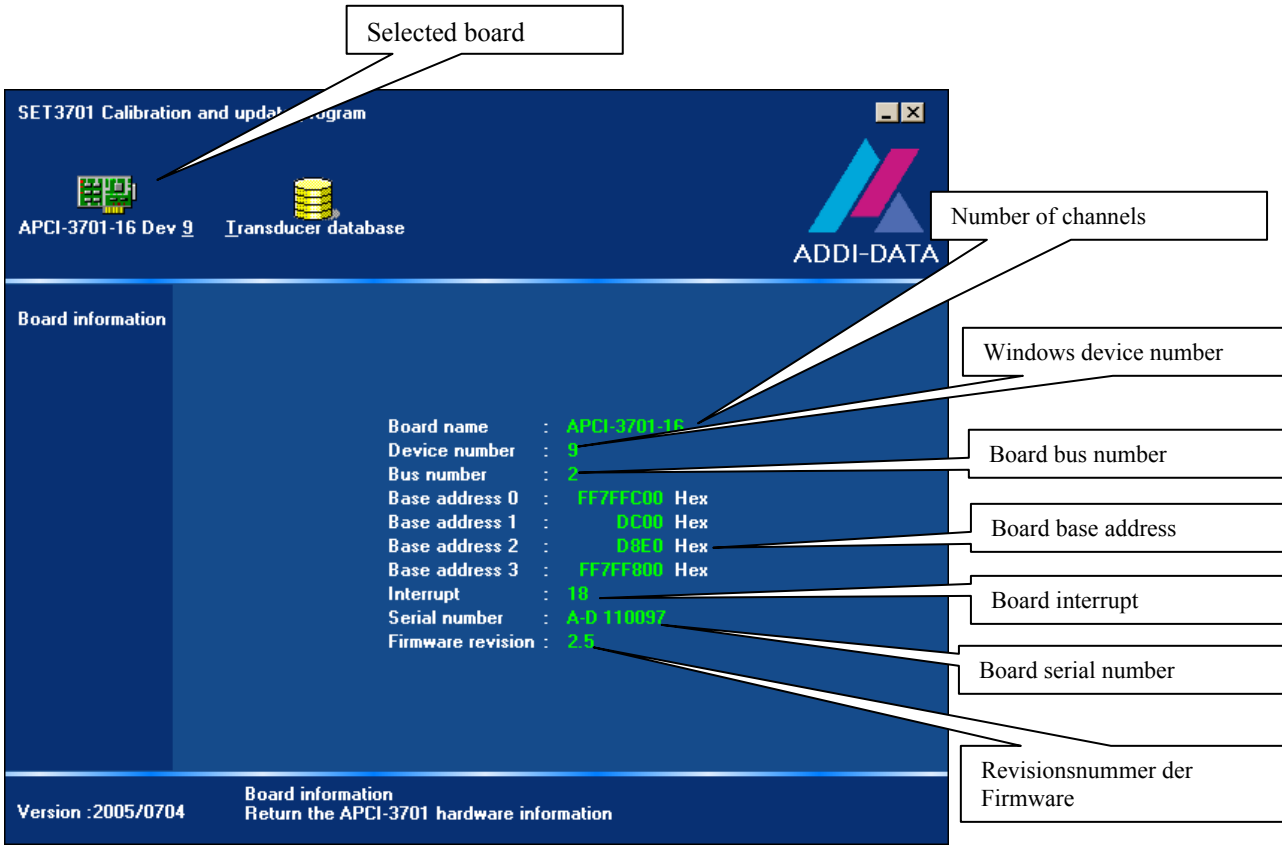
The icons have the following meaning:

- The first icon represents the board and is used for selecting the board.
- The second icon represents a database after the start. By double-clicking on this icon, the main menu opens. It contains call program functionalities, e.g. transducer database, board database, etc.



11.3 Board information

After starting the Set3701 application, the first board information can be visualised automatically.



If you have several **APCI-3701** boards in you PC:

♦ **Double-click on the board icon**

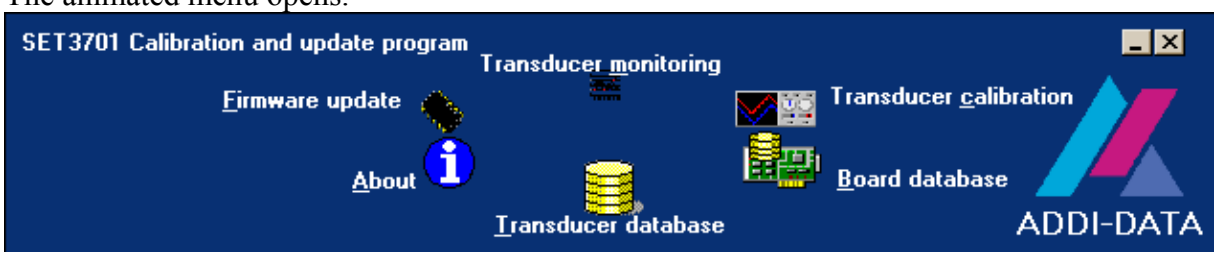
An animated menu opens.

♦ **Double-click on the required board to select it**

11.4 Transducer database

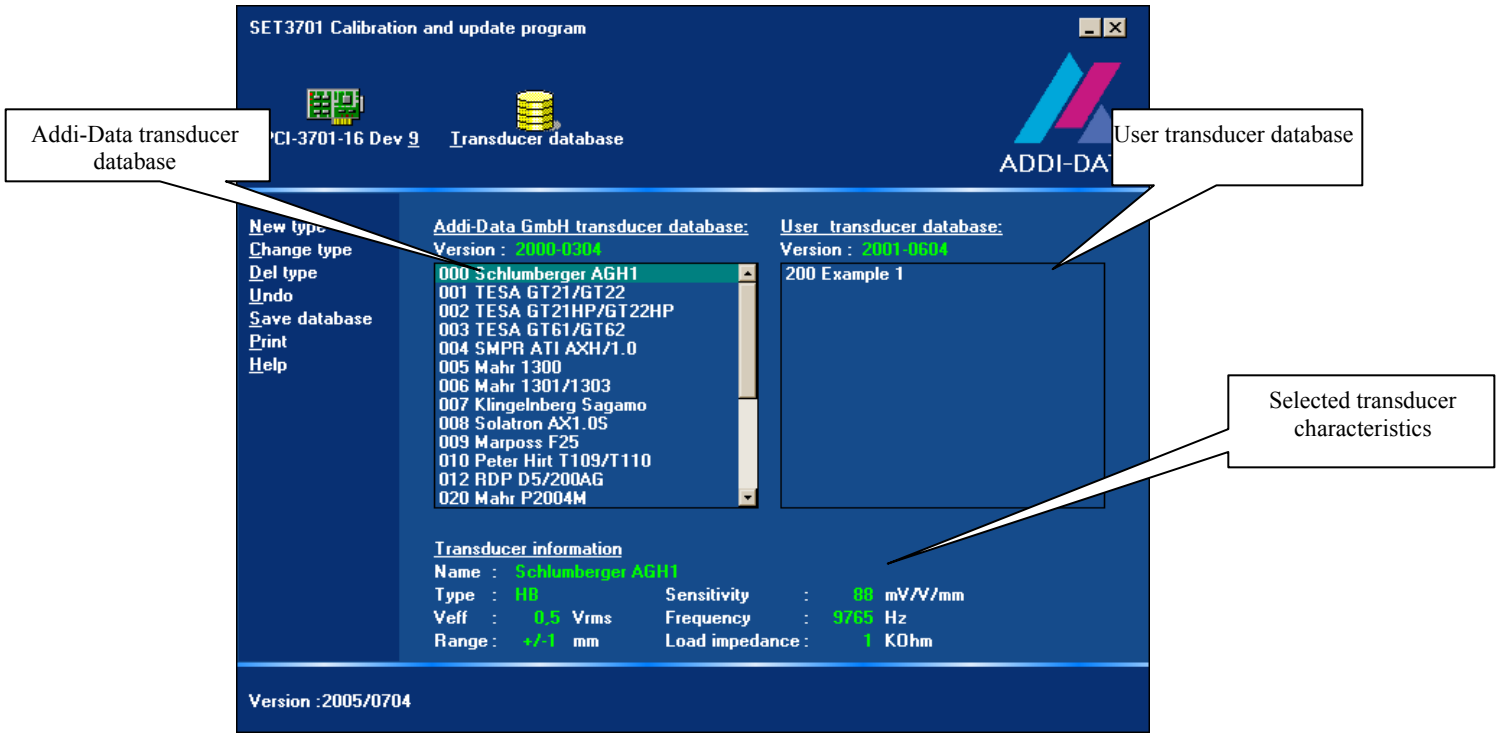
♦ **Double-click on the main menu icon for activating the menu "Transducer database"**

The animated menu opens.



♦ **Double-click on the icon "Transducer database"**
The animated menu disappears and the „Transducer database" window is activated.

Fig. 11-1: Window „Transducer database"



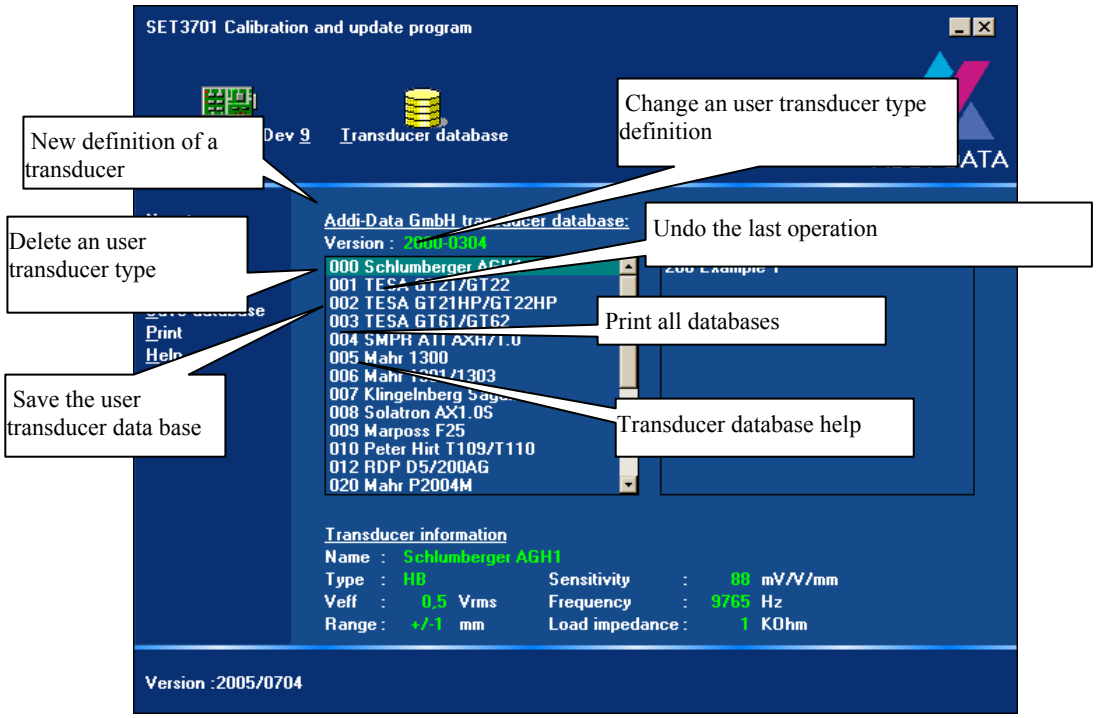
The **APCI-3701** can be connected to different transducers. All transducer information will be saved in two databases:
- Addi-Data GmbH transducer database
- User transducer database

Each database contains the following transducer information:
- Transducer name
- Transducer type (LVDT oder HB)
- Sensitivity (mV/v/mm)
- Veff (Vrms)
- Frequency (Hz)
- Range (+/- mm)
- Load impedance

Each of these characteristics is given by the transducer manufacturer. Select a transducer. Then the characteristics will be shown in the lower field. The databases do not indicate the transducers that are loaded on the board.

11.4.1 Menu transducer database

Fig. 11-2: Menu transducer database



11.4.2 ADDI-DATA GmbH transducer database

Addi-Data selected already several transducers. This transducer list cannot be deleted or modified by the user. The transducers are defined by the manufacturer information The number before the transducer name is the transducer index number. This number is the same number which the user must enter in the function „b_ADDIDATA_InitTransducerChannel" of the ADDIPACK driver (sse parameter: w_TransducerIndex). The version number above the list "Addi-Data GmbH transducer database" indicates the last modification date (the first 4 figures: Month and year) and the revision number (last 4 figures).

11.4.3 User transducer database

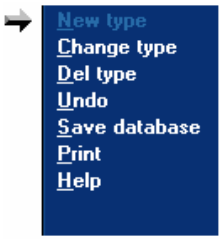
By the first installation the database is empty. If you have not found a compatible transducer in the list "Addi-Data GmbH transducers database", you shall define a new transducer type. The new types will be saved in database file. The file name for the standard board **APCI-3701** is „User_SV.DB" and for the Knäbel version of the **APCI-3701** „User_KV.DB".

These files can be found in the SET3701 installation path "\DataBase". If you delete or reinstalle the Set3701 application, these files will not be deleted.

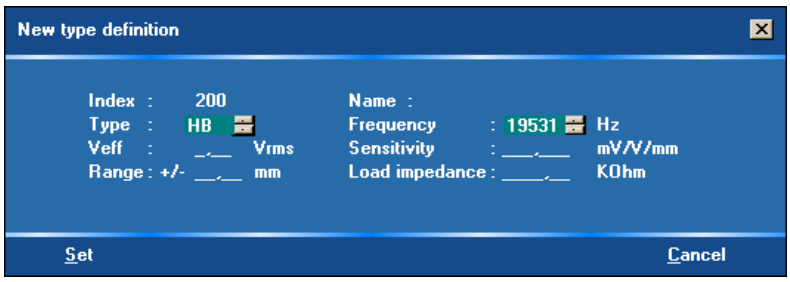
11.4.4 New transducer type definition

The user has the possibility to create 56 transducer types. For creating a new type:

♦ **Click on "New type" to create a new transducer type**



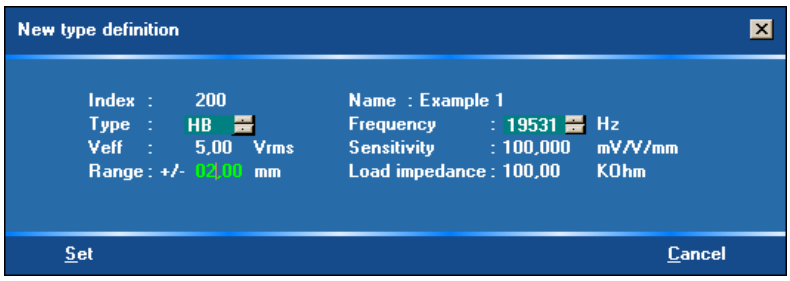
A new window appears.



You must complete the following fields:
- Name
- Type (LVDT orr HB)
- Sensitivity (mV/v/mm)
- Veff (Vrms)
- Frequency (Hz)
- Range (mm)
- Load impedance (KOhm)

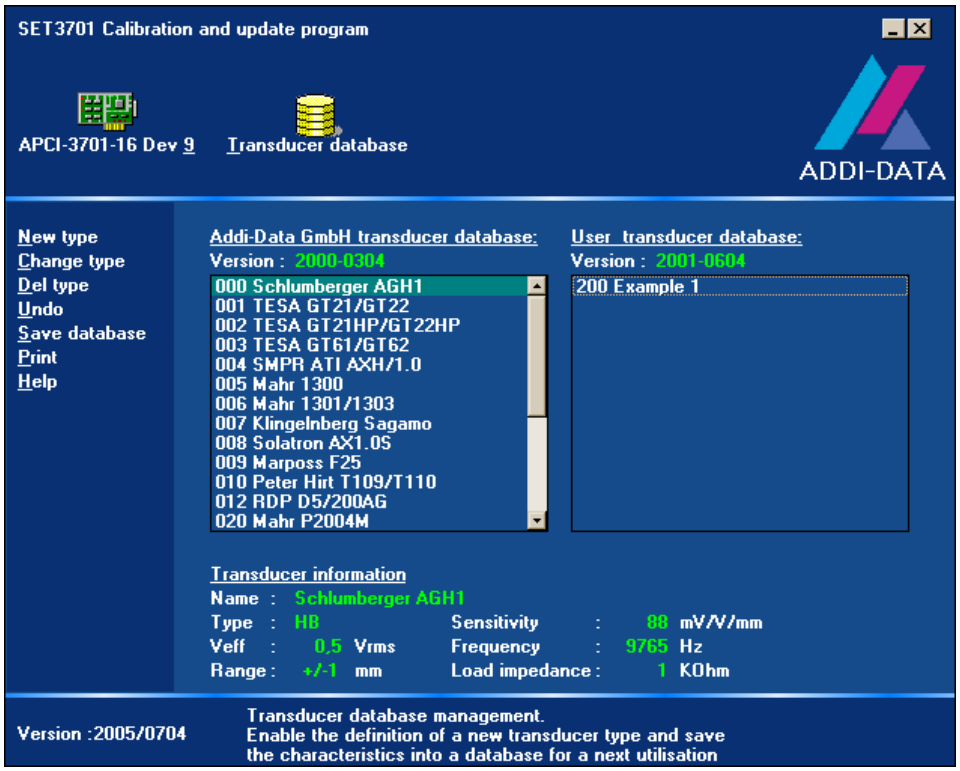
The characteristics of the transducer shall be given by the transducer manufacturer. Except the field „Name“, all blanks („ „) must be replaced by „0“. „Index“ is the index number of the transducer. The number is the same number as the one passed in the function „b_ADDIDATA_InitTransducerChannel“ of the ADDIPACK driver (see parameter “w_TransducerIndex”). The value of the “Index” can range between 200 and 255.

Fig. 11-3: Example: Definition of a new type



After having defined a new transducer type, it is displayed in the “User transducer database”

Fig. 11-4: Display: New transducer type

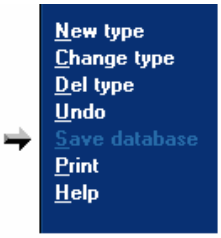


For modifying the transducer information:

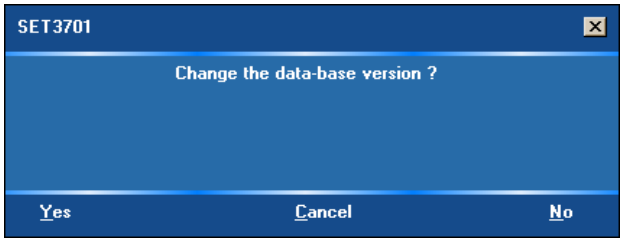
♦ **Double-click on the required type or use the menu "Change type".**

♦ **If all information is correct, click on "Save database" to save the new type.**

Fig. 11-5: Save a new type



A new window appears:



The version above the „User transducers database" list indicates the last modification date (the first 4 figures: Month and year) and the revision number (last 4 figures). You can change the database version. This enables you for example to compare this version with the version of your final client.
Select "Yes" to change the

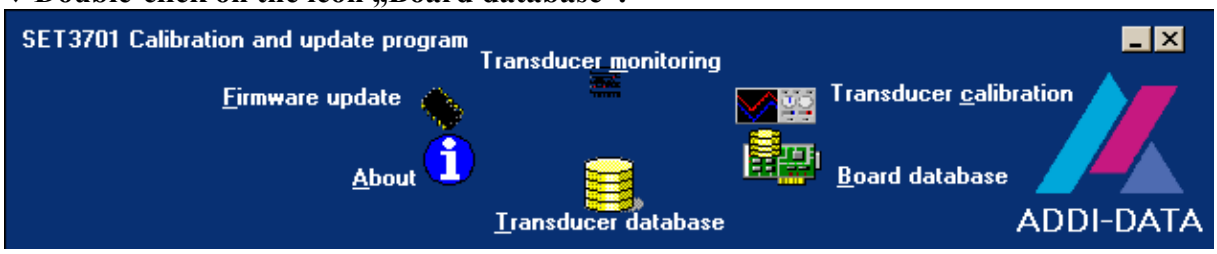
version.

IMPORTANT!
Please observe that the new transducer type is not loaded directly on the board. (see 11.5)

11.5 Board database

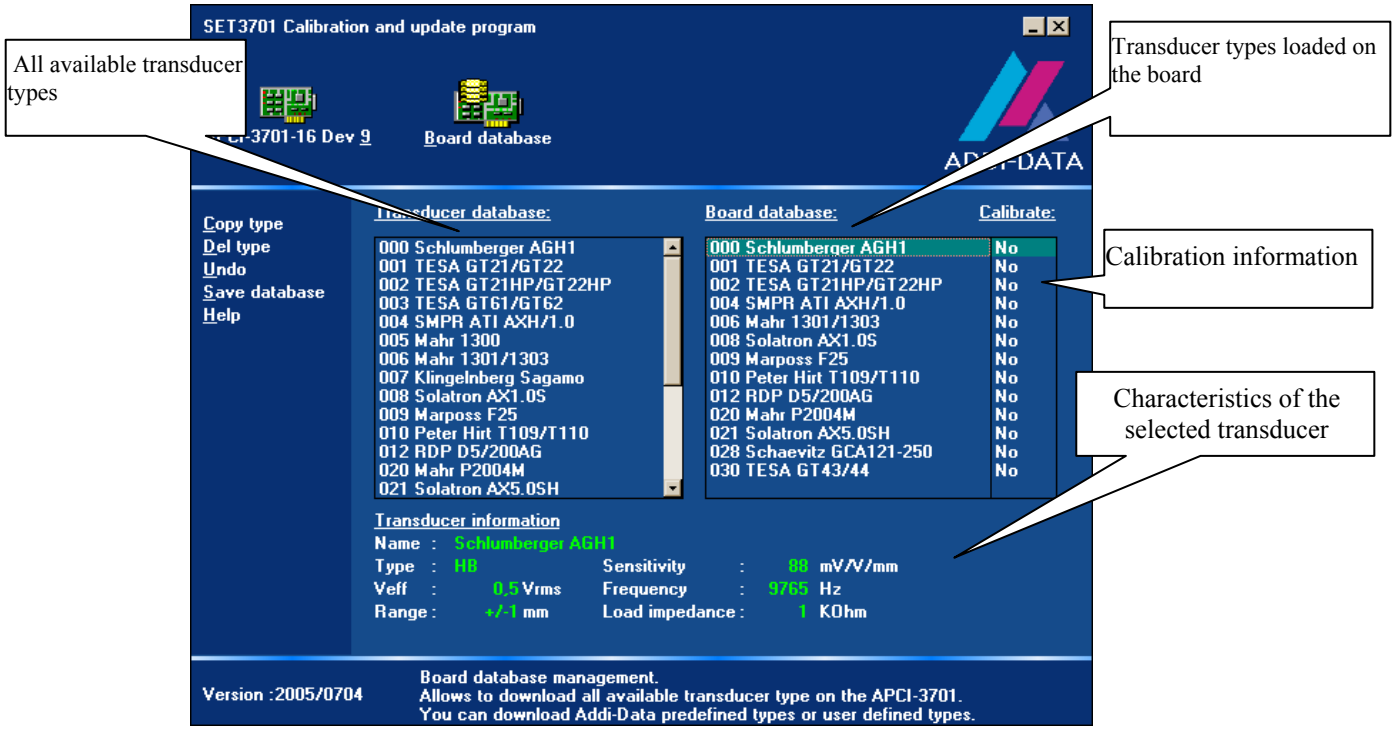
♦ **Double-click on the main menu icon to activate the animated menu**
Das animierte Menü erscheint.

♦ **Double-click on the icon „Board database“.**



The animated menu disappears and the window “Board database” is activated.

Fig. 11-6: Window„Board database“

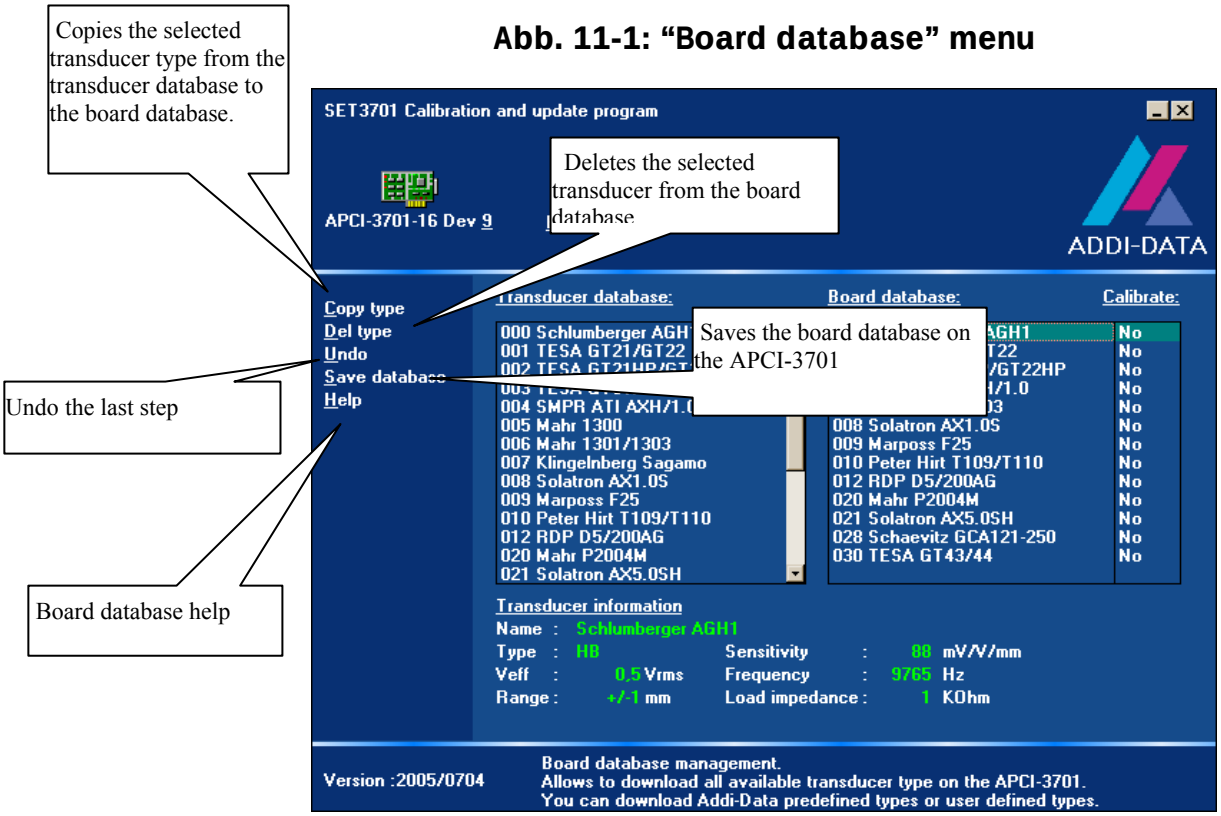


You can load max.14 transducer types on an **APCI-3701.**
“Transducers database” listes all available transducers. This list contains the “Addi-Data Gmbh transducer database” (ADDI-DATA GmbH and the “User

transducer database". (See chapter 11.4). "Board database" lists all transducer types that are loaded on the **APCI-3701**.

11.5.1 "Board database" menu

Abb. 11-1: "Board database" menu



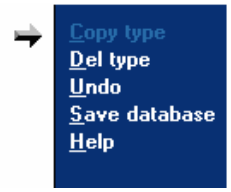
11.5.2 Copy a new transducer type into the board database

You can copy a transducer type either trough the command "Copy type" (see chapter 11.5.3) or through drag & drop (see chapter 11.5.4) to the board.

11.5.3 Copy a transducer type via the command

♦ **Select the transducer type that you want to copy from the "Transducer database" and click on the command "Copy type".**

Then the selected transducer type will be copied to the "Board database".



IMPORTANT!
You can copy only 14 transducer types to the „Board database“. Transducer types that are not used, you can delete with the command „Del type“ to leave space for the other ones.

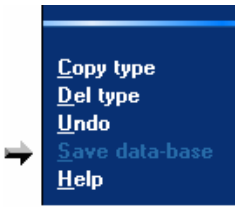
11.5.4 Copy a transducer type through drag & drop

- **Select the transducer type that you want to copy**
- **Press the right mouse key and drop the transducer type to the “Board database”**
- **Release the mouse button**

IMPORTANT!
You can copy may. 14 transducer types into the „Board database“. Not used transducer types you can delete with the command „Del typ2“ to leave space for other transducers.

11.5.5 Save the board database

After having loaded all required transducer types, select “Save database” to load this list on the selected **APCI-3701**.



11.6 Transducer calibration

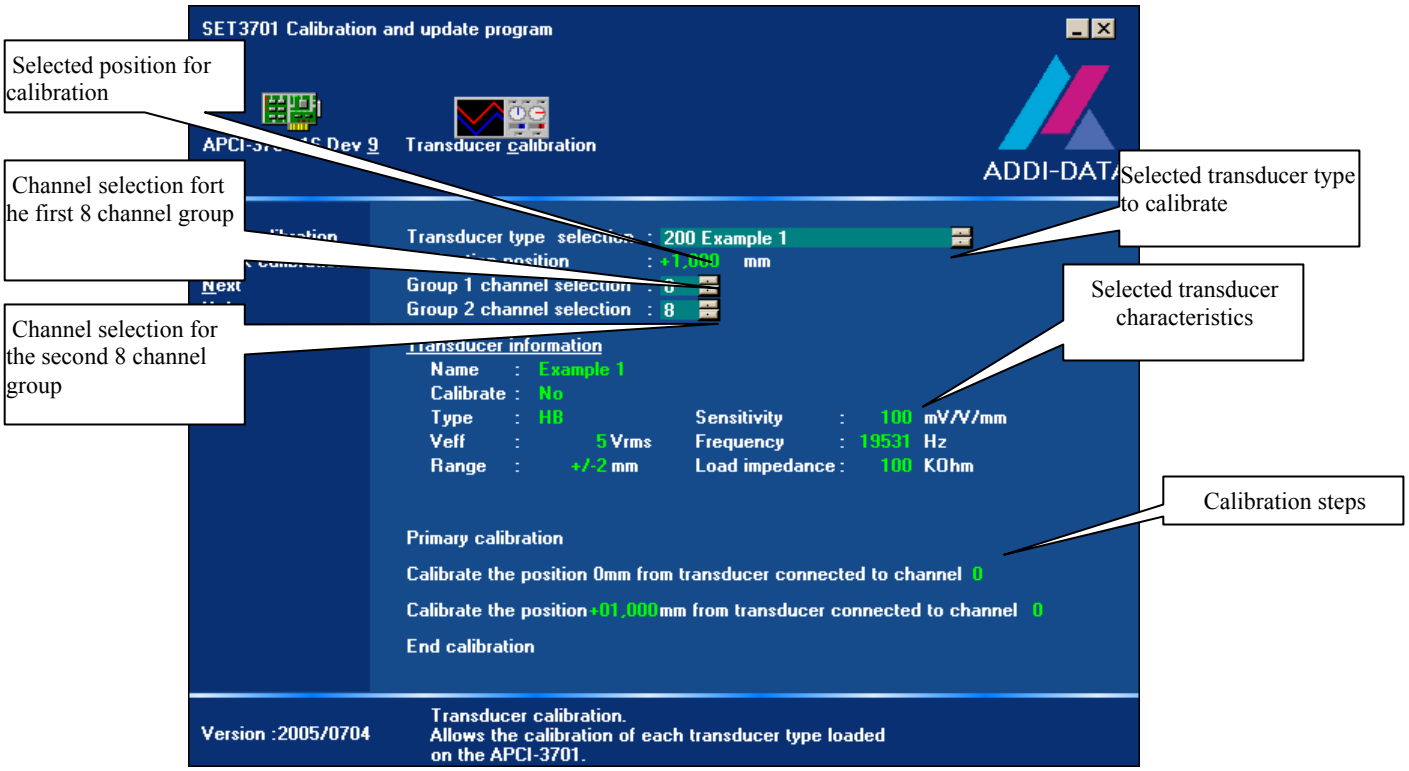
- **Double-click on the main menu icon to activate the window “Transducer calibration”**

The animated window appears.

- **Double-click on the icon “Transducer calibration”.**

Now the window „Transducer calibration” is activated.

Fig. 11-7: „Transducer calibration“ window

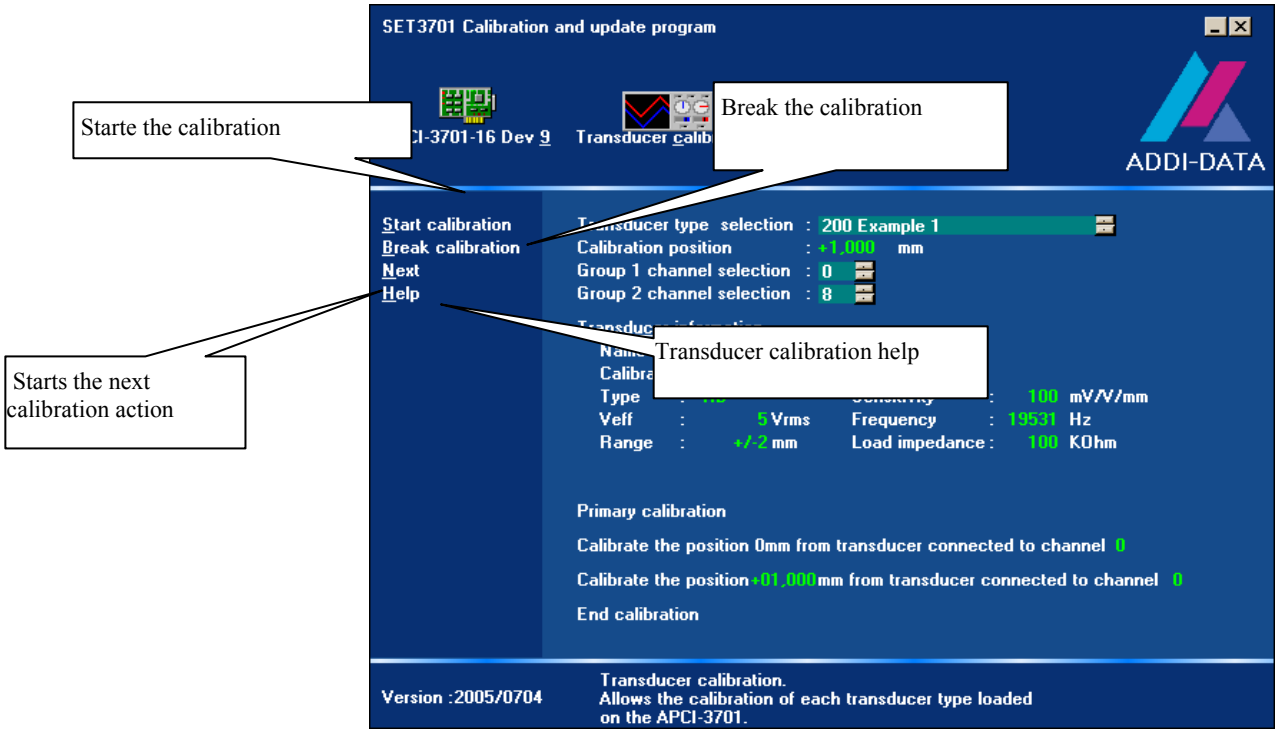


For each used transducer type you have to calibrate the board. The “Transducer type selection” lists all transducer types that are loaded on the **APCI-3701**. “Calibration position” indicates the position that is used for calibration. This position ranges from 0 to the maximum positive transducer position. Per default the software selects the middle of this range.

Above ”Group 1 channel selection” and “Group 2 channel selection” you can select the channels to which the transducers are connected. If you have only 8 channels on the board, “Group 2 channel selection” does not appear.

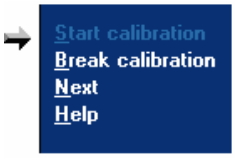
11.6.1Transducer calibration menu

Fig. 11-8: Transducer calibration menu

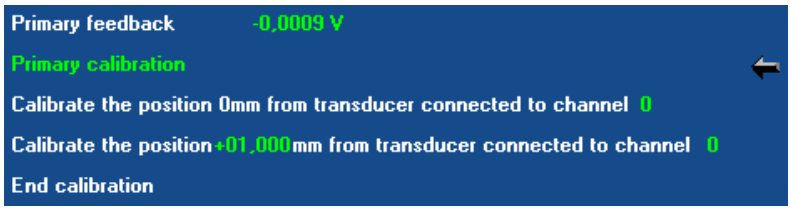


11.6.2 Calibration

For the calibrationn you need a **PX 3701-Box** and the cable **ST3701**. Connect the box to the **APCI-3701** via the cable. After having selected the transducer type that you want to calibrate, the calibration position and the channels of group 1 and group 2 to which the transducers are connected, click on "Start calibration". Each step in progress is indicated by a pointer and the text colour that changes to green. Each step in waiting status is indicated blinking text colour that changes to red/white.

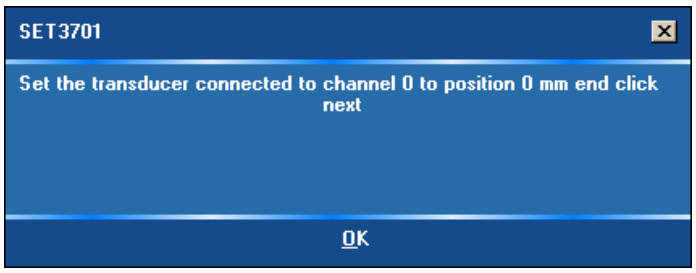


The first calibration step is the board calibration. Therefore, no manipulation of the user is needed.



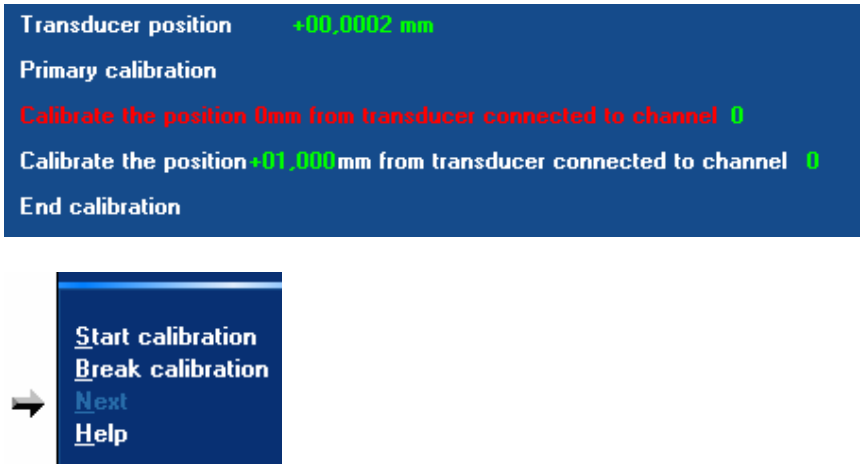
If this step takes longer or if an error message appears, this means that you have not connected the **PX 3701** to the **APCI-3701**. In this case, stop the calibration with "Break calibration", connect the
PX 3701 and start again with the calibration.

After this, the mechanical 0 position is calibrated.

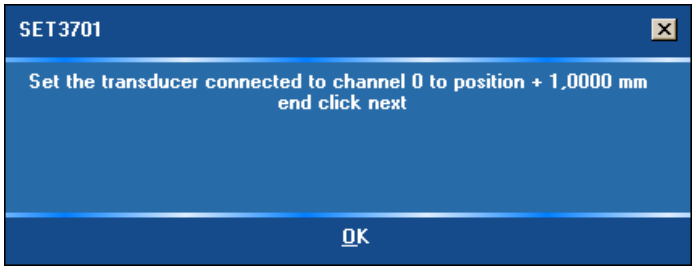


♦ **Click on "OK"**

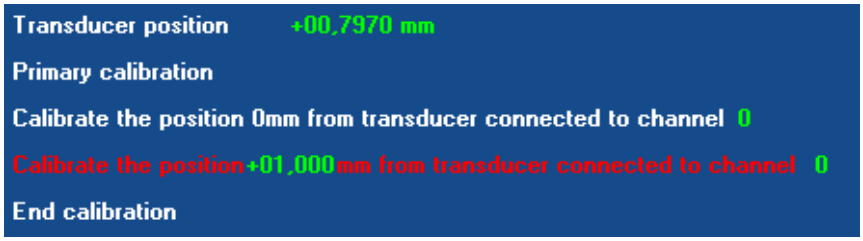
♦ **Set the transducer to the mechanical position and click on "Next"**

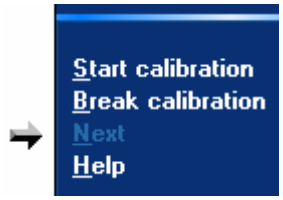


The user selected calibration position is then calibrated.

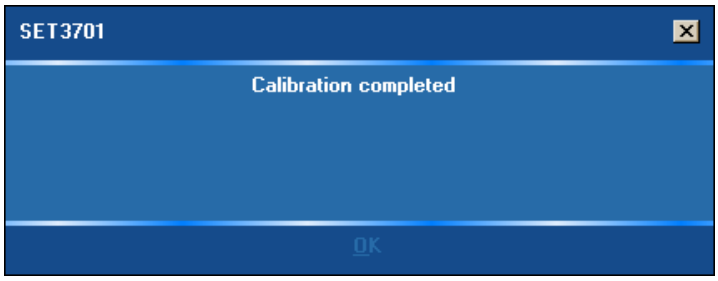


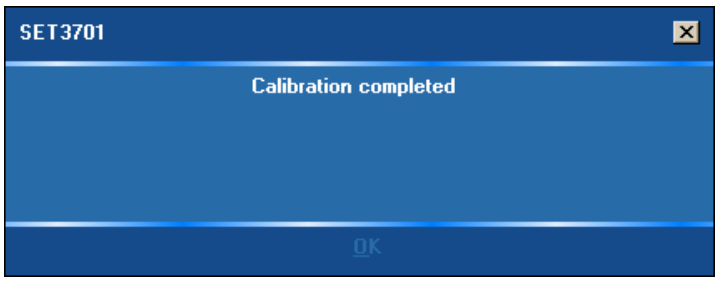
- **Click on "OK"**
- **Set the transducer to the mechanical selected calibration position and click on "Next"**

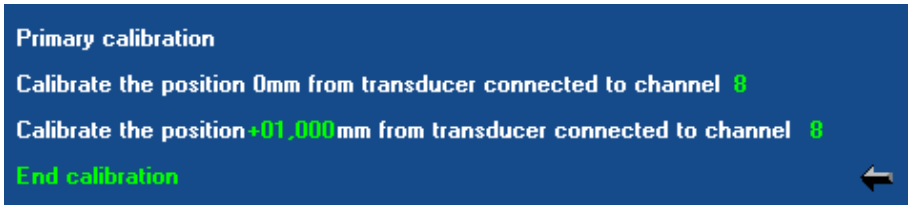




The calibration is completed if you have only 8 channels. If you have 16 channels, the same steps are started for the second channel group.





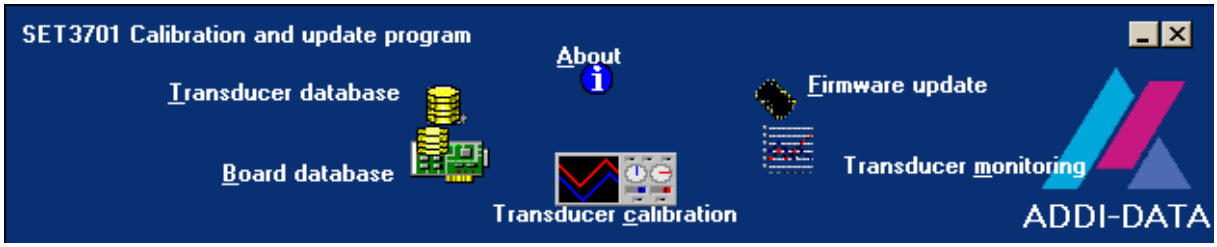


11.7 Transducer monitoring

♦ **Double-click on the main menu icon to activate the window "Transducer monitoring"**

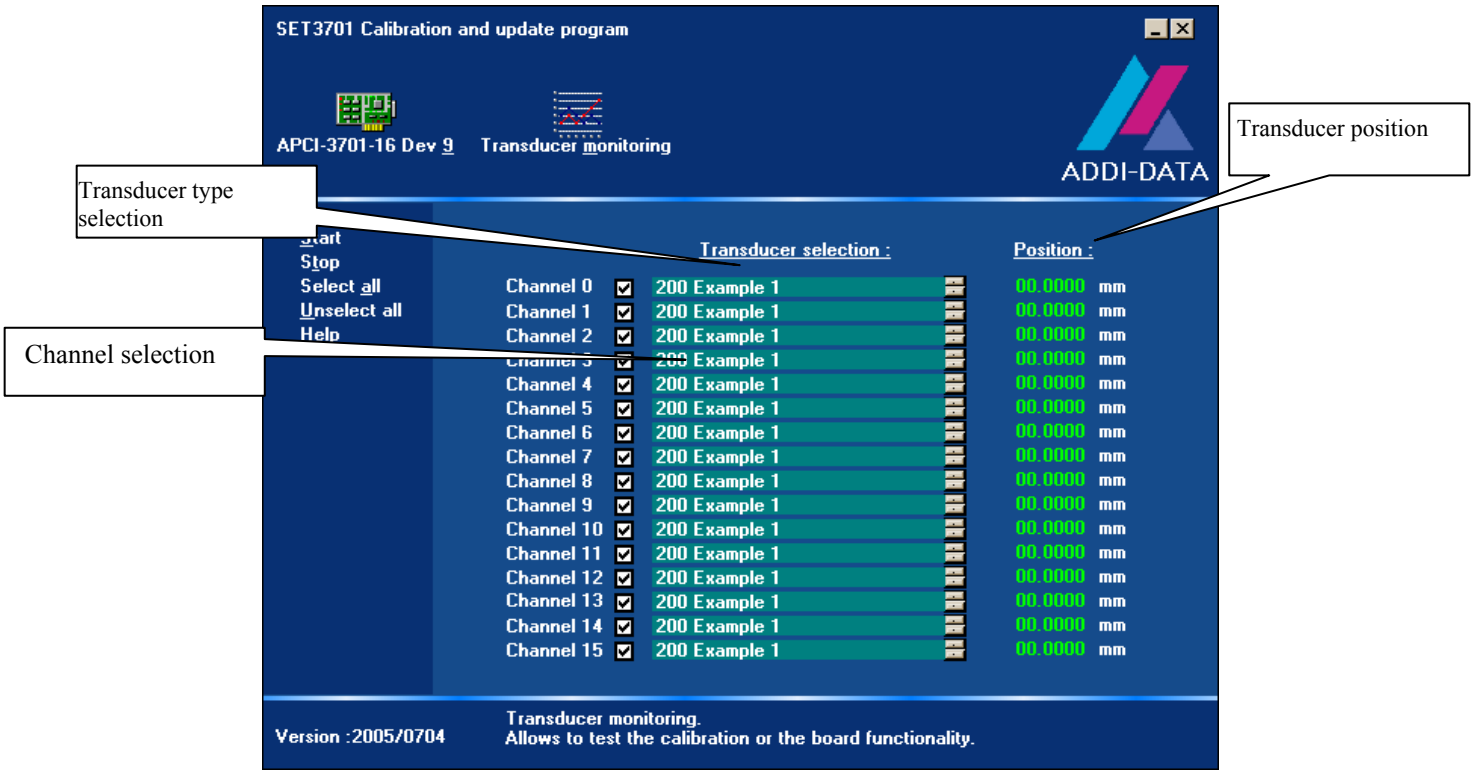
An animated menu appears

♦ **Double-click on the icon "Transducer monitoring"**



The animated menu disappears ant the window "Transducer calibration" is activated.

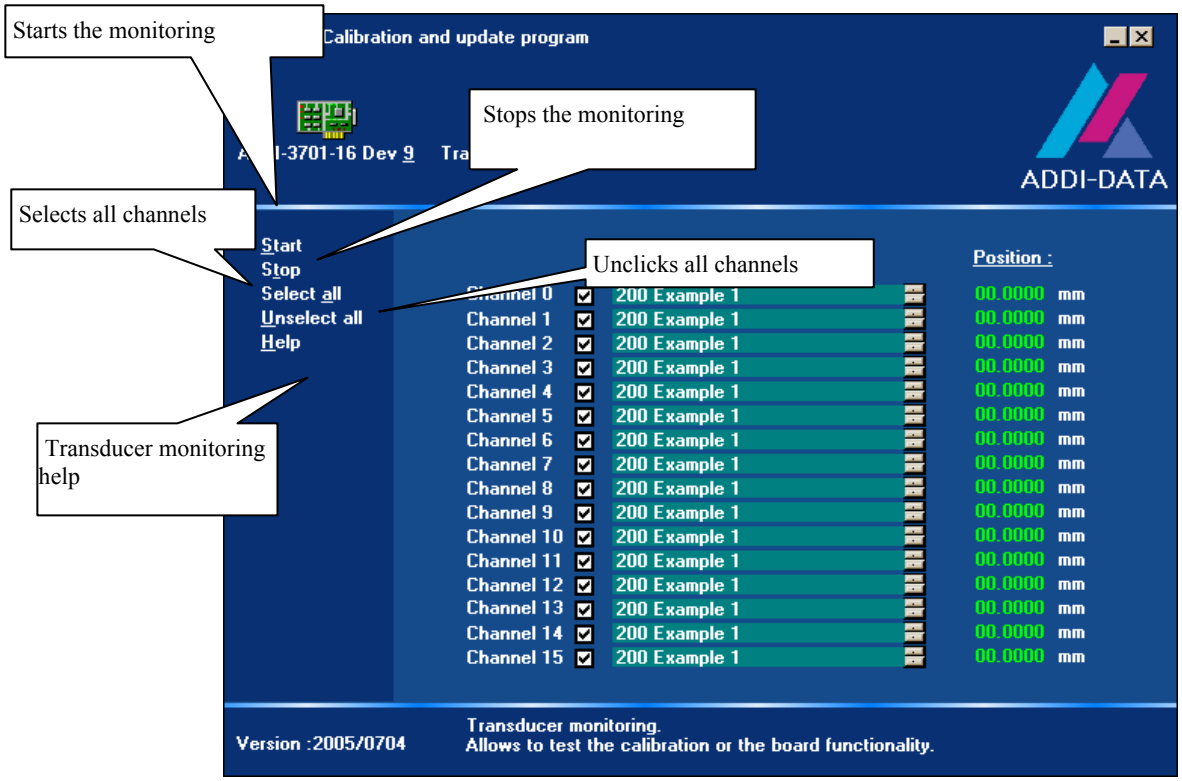
Fig. 11-9: Window „Transducer calibration"



After having calibrated the board, you can use the transducer monitoring to test the board function. When the window first appears, the last calibrated transducer type is selected automatically as default and all available channels are selected. You can change the transducer type. All transducer types that are loaded on the **APCI-3701** can be selected.

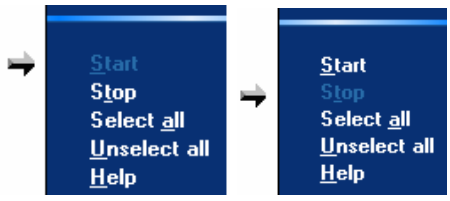
11.7.1 Transducer monitoring menu

Fig. 11-10: Monitoring menu

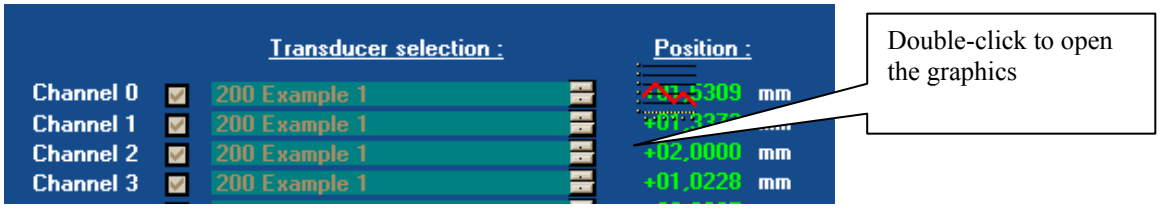


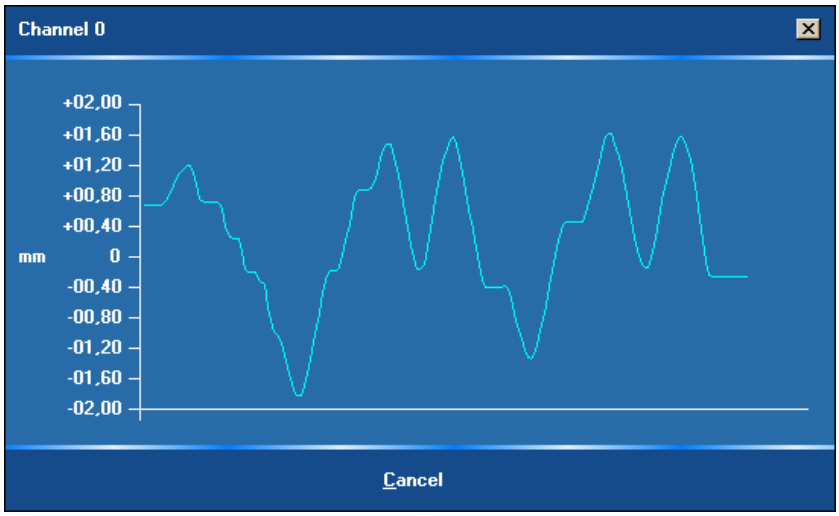
11.7.2 Acquisition

You can select one or more channels for the monitoring. For each channel you can select any available transducer type. The commands “Select all” and “Unselect all” enable the selection of all channels by one click. The acquisition rate depends on the number of channels to be acquired. For starting the monitoring click on “Start”. You can stop the monitoring at any time with “Stop”.



After having started the monitoring, you can open a trend graphics window for one channel. To do this, double-click on the selected channel result.



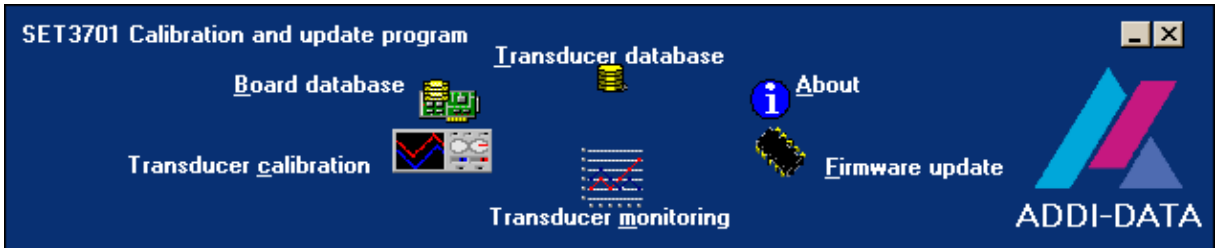


11.8 Firmware update

♦ **Double-click on the main menu icon to call the window "Firmware update"**

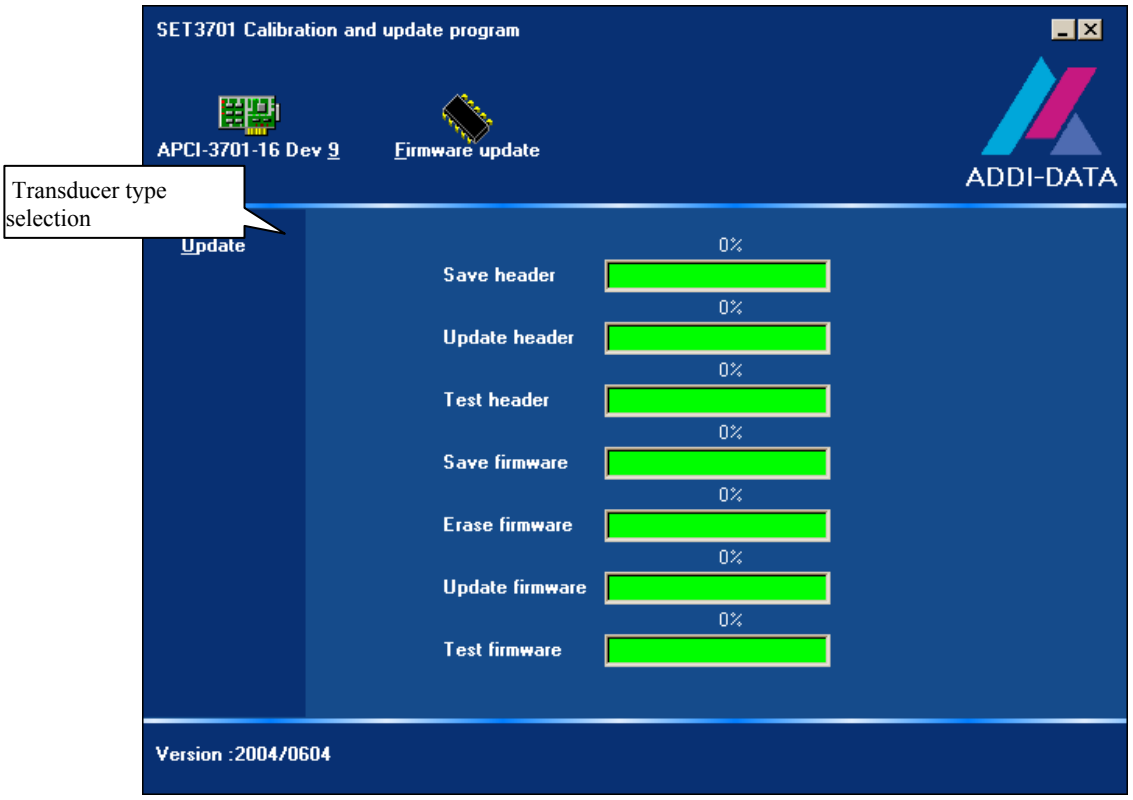
The animated window appears.

♦ **Double-click on "Firmware update".**



The animated menu disappears and the window "Firmware update" is activated.

Fig. 11-11: Window „Firmware update“



A firmware update is required if you have a standard **APCI-3701** with a firmware revision lower than 2.6.
If you start the calibration and the board firmware is from a lower version than the required version, the program automatically runs an update. To start the update manually, click on the command “Update”.

12 GLOSSARY

Table 12-1: 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
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* First-in/first-out memory buffer. 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.
Half-bridge	With the core in the central position the two signals VA and VB are equal and half the energising signal VA. As the core is displaced, VA and VB vary in a complimentary fashion.

	Typically the half-bridge transducer forms half of a Wheatstone Bridge circuit which enables change from null to be readily determined.
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.
Low-pass filter	Transmitting all frequencies below a certain value
LVDT	*= Linear Variable Differential Transformer* With the core in a central position the coupling from the primary to each secondary is equal, so VA = VB and the output V0 = 0. As the core is displaced, VA differs from VB in proportion to the displacement hence V0 changes in magnitude and phase in proportion to movement in either direction from null.
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.

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.
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.
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.

13 INDEX

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V