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SPIRIT OF EXCELLENCE

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Technical description

APCI-3300

Pressure measurement board, optically isolated

Edition: 07.11 - 10/2014

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.
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Warning

The following risks result from improper implementation and from use of the board contrary to the regulations:

Personal injury

Damage to the board, the PC and peripherals

Pollution of the environment

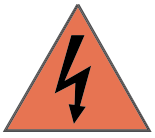
- Protect yourself, others and the environment!
- Read the safety precautions (yellow leaflet) carefully!

  If this leaflet is not enclosed with the documentation, please contact us and ask for it.
- Observe the instructions of this 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.
- Pay attention to the following symbols:

IMPORTANT!
Designates hints and other useful information.

WARNING!
Designates a possibly dangerous situation.
If the instructions are ignored, the board, the PC and/or peripherals may be **destroyed**.



WARNING!
Designates a possibly dangerous situation.
If the instructions are ignored, the board, the PC and/or peripherals may be **destroyed** and persons may be **endangered**.

Figures

Tables

1 DEFINITION OF APPLICATION

1.1 Intended use

The **APCI-3300** must be inserted in a PC with PCI slots which is used as electrical equipment for measurement, control and laboratory pursuant to the norm EN 61010-1 (IEC 61010-1).

The used personal computer (PC) must fulfil the requirements of IEC 60950-1 or EN 60950-1 and EN 55022 or IEC/CISPR 22 and EN 55024 or IEC/CISPR 24.

The use of the board **APCI-3300** 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-3300** board must not 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-3300** board must not be used in potentially explosive atmospheres.

The **APCI-3300** board must not be used as electrical equipment according to the Low Voltage Directive 2006/95/EC.

1.3 Limits of use

All safety information and the instructions in the manual must be followed to ensure proper intended use.

Uses of the board beyond these specifications are considered as improper use. The manufacturer is not liable for damages resulting from improper use.

The board must remain in its anti-static packaging until it is installed.

Please do not delete the identification numbers of the board or the warranty claim will be invalid.

1.4 General description of the board

Data exchange between the **APCI-3300** 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-3300** board.

The board has 8 or 4 input channels for processing analog pressure signals and 4 input and 3 output channels for processing digital 24 V signals.
The use of the board **APCI-3300** in combination with external screw terminal panels is to occur in a closed switch cabinet.

The **PX3200** screw terminal board allows connecting the analog pressure signals to a cold junction compensation through the **ST3200** cable.

The use of the **APCI-3300** board in combination with external screw terminal panels or relay boards is to occur in a closed switch cabinet; the installation is to be effected competently.

The connection with our standard cable **ST3200** complies with the minimum specifications as follows:
- metallised plastic hoods
- shielded cable
- cable shield folded back and firmly screwed to the connector housing.

2 USER

2.1 Qualification

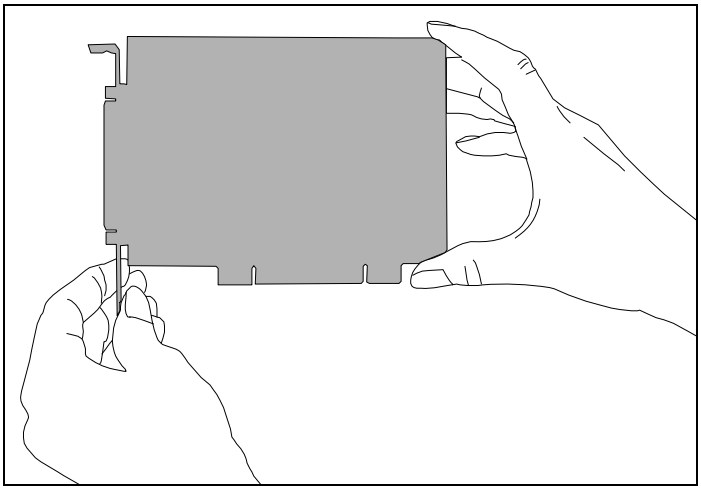
Only persons trained in electronics are entitled to perform the following works:
- installation
- commissioning
- use
- maintenance.

2.2 Country-specific regulations

Do observe the country-specific regulations regarding
- the prevention of accidents
- electrical and mechanical installations
- Electromagnetic compatibility (EMC).

3 HANDLING OF THE BOARD

Fig. 3-1: Correct handling



Hold the board cautiously at the outer end and at the slot bracket.
Do not touch the surface of the board!

4 TECHNICAL DATA

4.1 Electromagnetic compatibility (EMC)

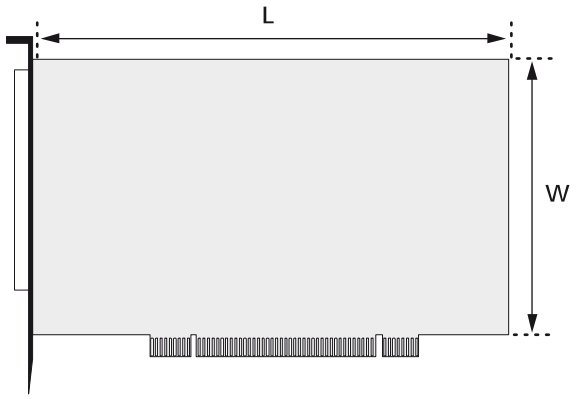
The board **APCI-3300** is suited for installation in personal computers (PCs) which comply with the European EMC directive.

The board **APCI-3300** 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

Dimensions:



Dimensions (L x W):…….. 131 x 99 mm
Weight: ..... approx. 160 g
Installation in: ..... 32/64-bit PCI slot 3.3 V / 5 V
Connection to the peripheral:..... 50-pin SUB-D male connector
Accessories[1]:
Cable: **ST3200**
Screw terminal panel..... **PX3200**

IMPORTANT!
The connection lines must be installed in such a way that they are protected against mechanical loads.

1 Not included in the standard delivery.

4.3 Versions

The board **APCI-3300** is available in 2 versions.

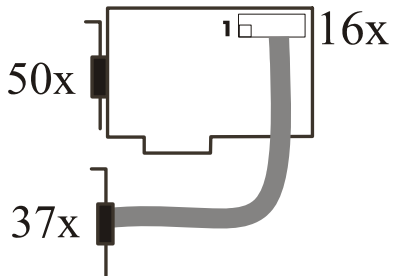
Version	Number of connected pressure signals	Number of digital signals
APCI-3300-4	4	4 inputs and 3 outputs
APCI-3300-8	8	4 inputs and 3 outputs

4.4 Limit values

Max. Altitude: ..... 2000 m over NN
Operating temperature: ..... 0 to 60°C (with forced ventilation)
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 7, Vista (32-bit), XP, 2000, Linux
Number of slots required: ..... PCI 3.3 V / 5 V, 32 bits/64 bits
1 slot opening for the connection of digital I/O

Fig. 4-1: Number of slots required



PCI bus interface:
Bus speed: ..... 33 MHz
Data access: 32-bit

Optical isolation:
Creeping distance: ..... 3.2 mm
Testing voltage: ..... 1000 VAC

Voltage sources:
Number of voltage sources: ..... 4 or 8
Output voltage V_{exc} (25 °C): ..... typ. 5 V, 40 mA
Input noise signal
(25°C; Band width: 10 Hz to 10 kHz): ..... typ. 40 µV

Energy requirements:
Operating voltage of the PC: ..... 3.3 V ± 5%
Current consumption in mA (without load): typ. See table ± 10%

	APCI-3300-4	**APCI-3300-8**
+ 3.3 V from the PC	570 mA	600 mA

Analog input pressure channels
Resolution: ..... 18-bit, unipolar
Input type: ..... differential channels
Number of voltage inputs: ..... 4 or 8
Overvoltage protection: ..... ± 30 V
Input voltage range: ..... 0 to 1.25V/PGA
Input impedance: ..... 25 MΩ
Input capacity: ..... 530 pF
Input current: ..... 10 nA
Input amplifier (PGA): 1, 2, 4, 8, 16, 32, 64, 128
Data transfer: ..... The board is located in the I/O address space of the PC. The values are written on the board through 32-bit accesses.
Digital coding: ..... Unipolar: Straight binary coding

Voltage range: 0 mV < V < + 100 mV
(See Table 8-4: Voltage accuracy)
Precision: 16-bit
Integral non-linearity (INL): .....± 0.0015 % of FSR[1] over the temperature range
Offset error: ..... ± 0.0015 % of FSR (Bipolar Offset Error)

[1] FSR: Full Scale Range

Voltage range: 100 mV < V < + 1.25 V
(See Table 8-4: Voltage accuracy)
Precision: 14-bit
Integral non-linearity (INL): ..... ± 0.0060 % of FSR over the temperature range
Offset error: ..... ± 0.0060 % of FSR (Bipolar Offset Error)

Gain error:
for gain 1, 2, 4, 8, 16, 32, 64: ..... ± 2 % of FSR
for gain 128 ..... ± 3 % of FSR

Table 4-1: Possible acquisition times

Acquisition times (Hz) 1 channel, offset, reference	Sample period (ms)
20	50
40	25
80	12.5
160	6.25

Digital input channels:
Number: 4
Input current at 24 V: ..... 2 mA typ.
Input voltage range: ..... 0-30 V
Optical isolation: ..... 1000 VAC
Logic "0" level: ..... 0-5 V
Logic "1" level: ..... 12-30 V

Digital output channels:
Number: 3
Max. switch current: ..... 125 mA typ.
Voltage range: ..... 8-30 V
Optical isolation: ..... 1000 VAC
Type: ..... Open Collector

5 INSTALLATION OF THE BOARD

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

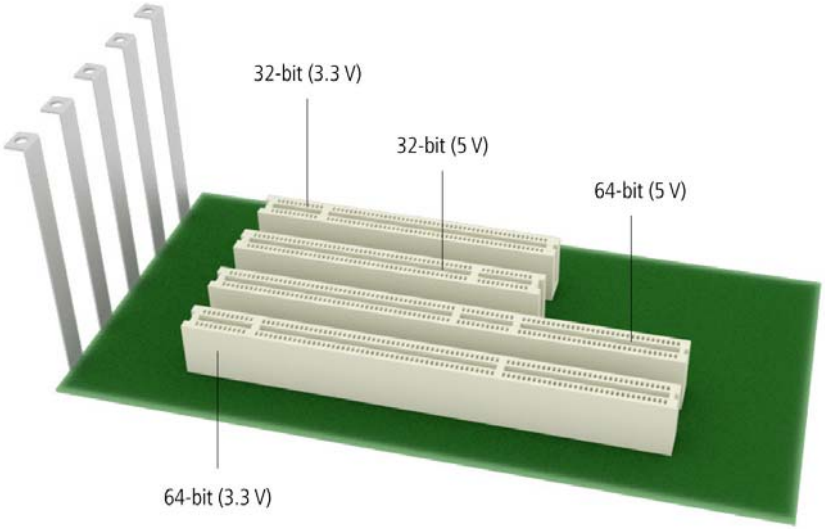
5.1 Opening the PC

- **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

The following PCI slot types are available for 5V systems:
PCI-5V (32-bit) and PCI-5V (64-bit)

Fig. 5-1: PCI slot types

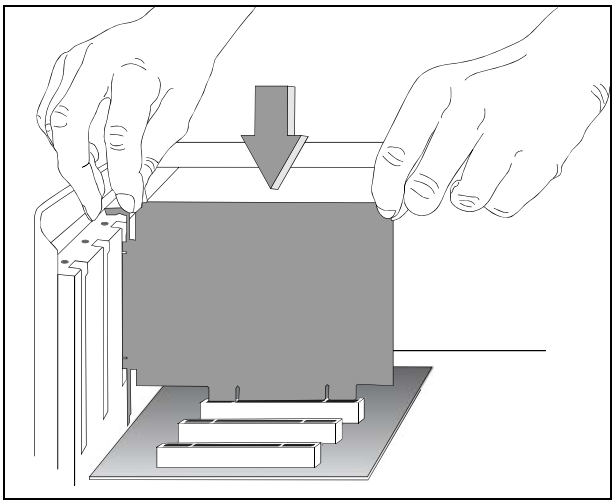


- **Remove the back cover of the selected slot according to the instructions of the PC manufacturer. Keep the back cover. You will need it if you remove the board**
- **Discharge yourself from electrostatic charges.**
- **Take the board out of its protective pack.**

5.3 Plugging the board into the slot

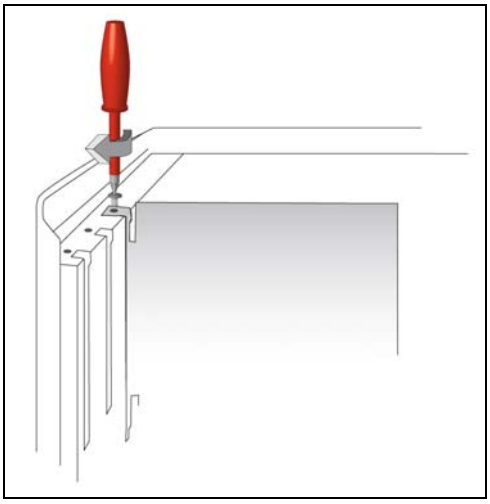
♦ Insert the board **vertically into the chosen slot.**

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 loose screws.**

5.4 Closing the PC

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

6 SOFTWARE

6.1 Driver installation

In the document “Quick installation PC boards” (see PDF link), you can get information on the selection of the appropriate driver and on the driver download.

The most important information on the installation of drivers of the type “ADDI-DATA Multiarchitecture Device Drivers 32-/64-Bit for x86/ AMD64” as well as on the installation of the corresponding samples is to be found in the installation instructions (see PDF link).

6.2 Questions and software downloads on the web

Do not hesitate to e-mail us your questions.
info@addi-data.com

Free downloads of standard software

You can download the latest version of the software for the **APCI-3300** from our website: **www.addi-data.com**

IMPORTANT!
Before using the board or in case of malfunction during operation, check if there is an update available on our website (technical description, drivers) or contact us directly.

7 CONNECTING THE PERIPHERALS

7.1 Connector pin assignment

Fig. 7-1: 50-pin SUB-D male connector

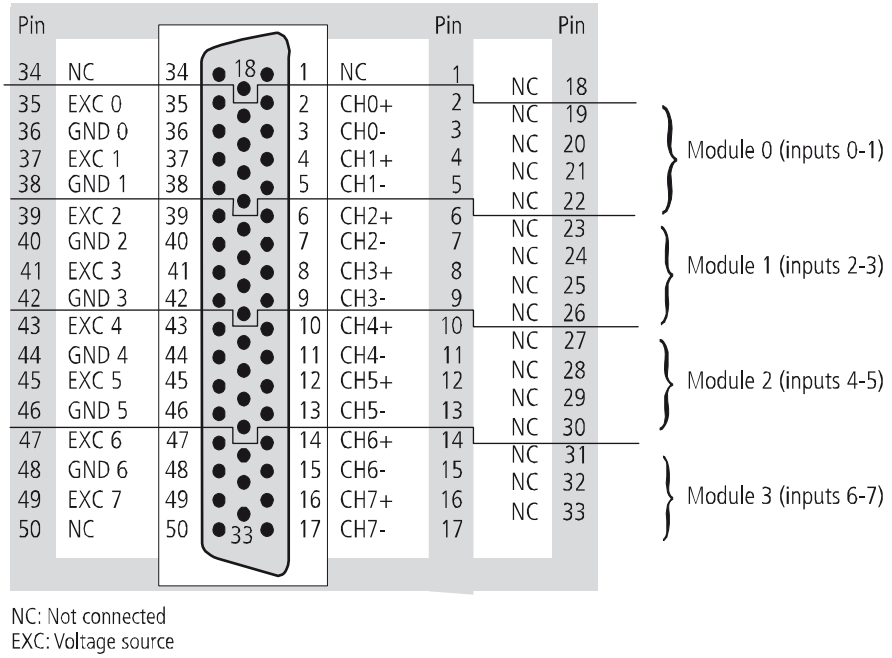
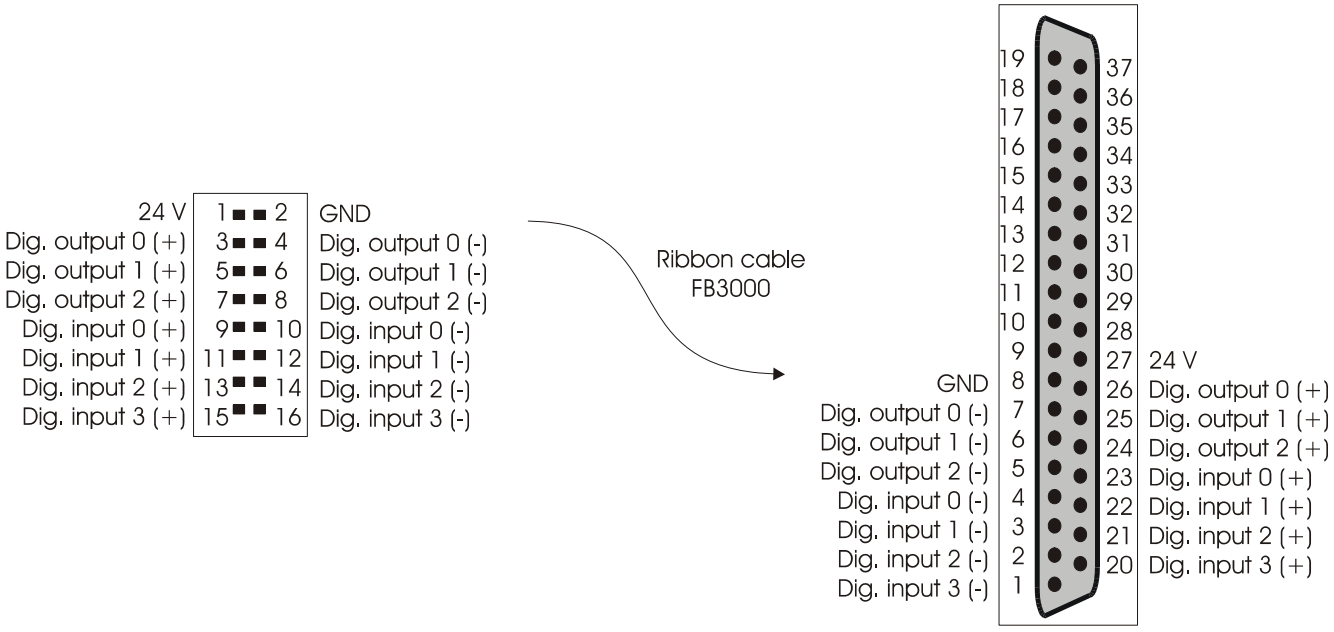


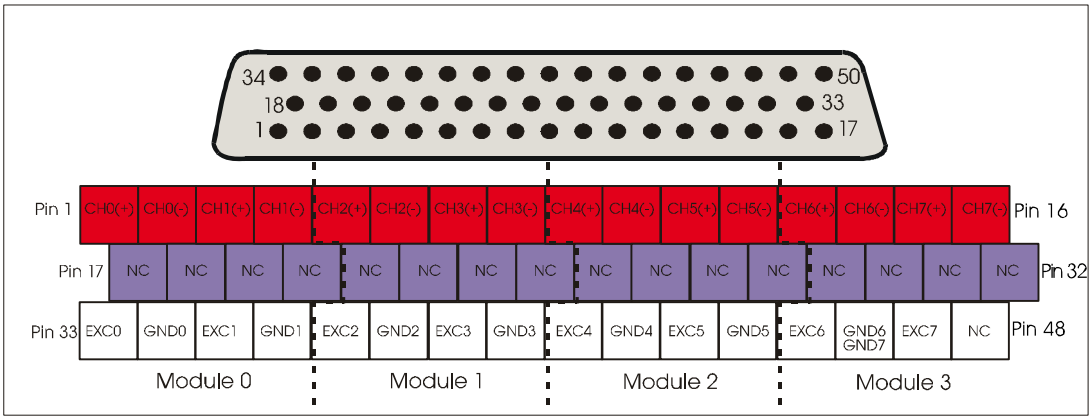
Fig. 7-2: 16-pin connector to 37-pin SUB-D connector



IMPORTANT!
Plug the **FB3000** cable into the connector of the board by inserting the red (or blue or black) cable line into pin 1.

7.2 Assignment of the screw terminal panel PX3200

Fig. 7-3: 48-screw terminal panel PX3200

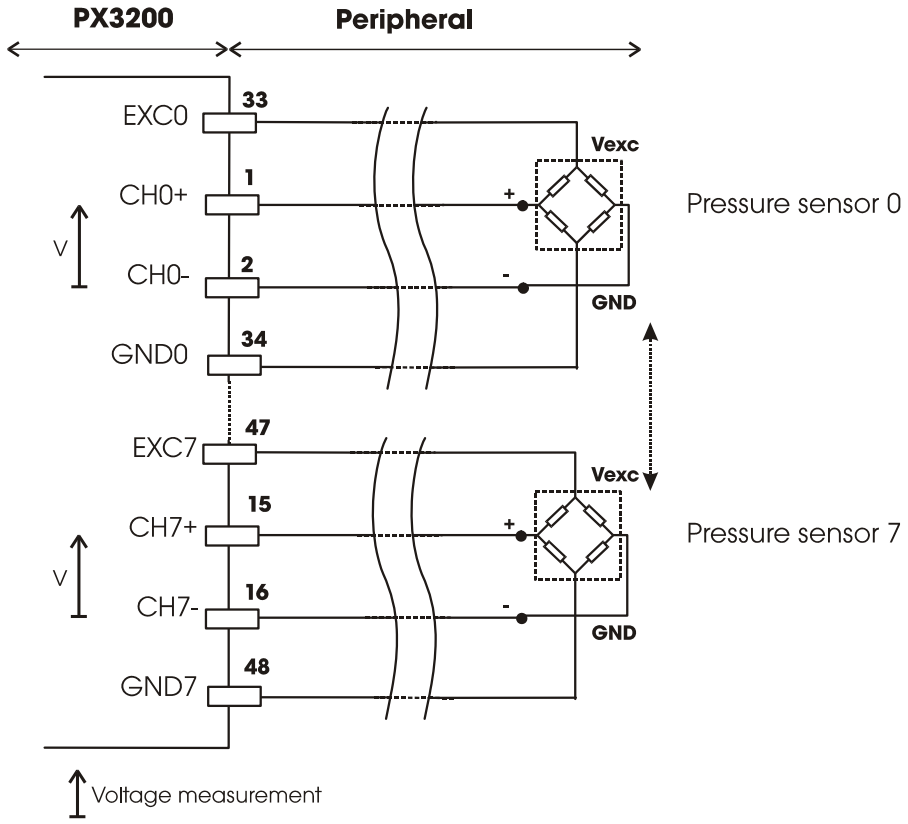


EXC: Excitation; voltage sources
Pin x: Screw terminal number
NC: Not connected
GND6 and GND7 are connected to the same pin of the screw terminal panel

7.3 Connection principle

7.3.1 Connection of pressure sensors through the PX3200

Fig. 7-4: Connector of pressure sensors through the PX3200



7.3.2 Connection of the digital I/O channels

Fig. 7-5: Connection of the digital input channels

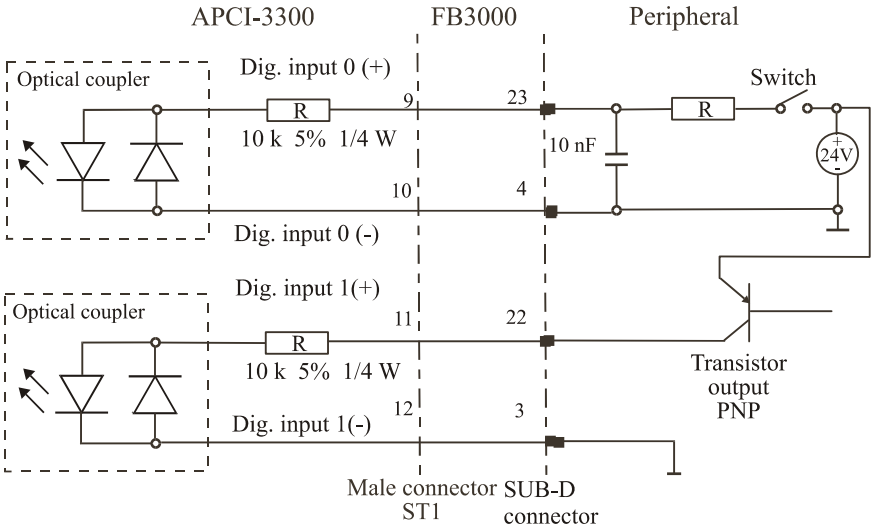
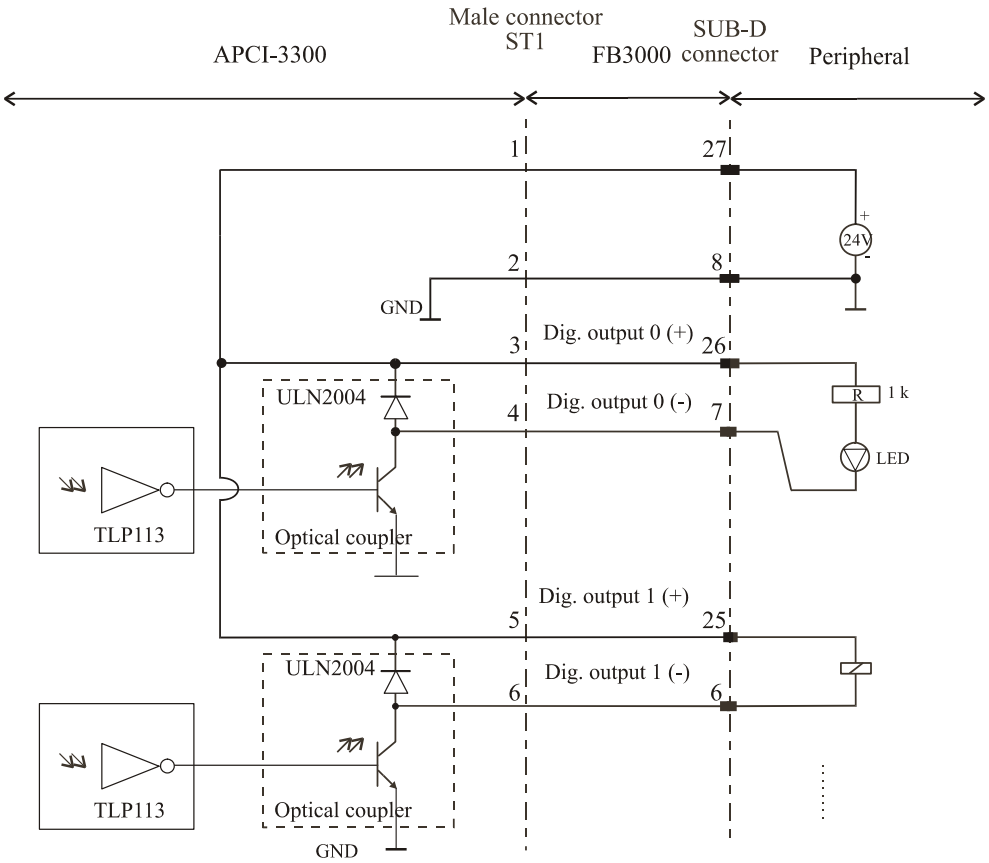
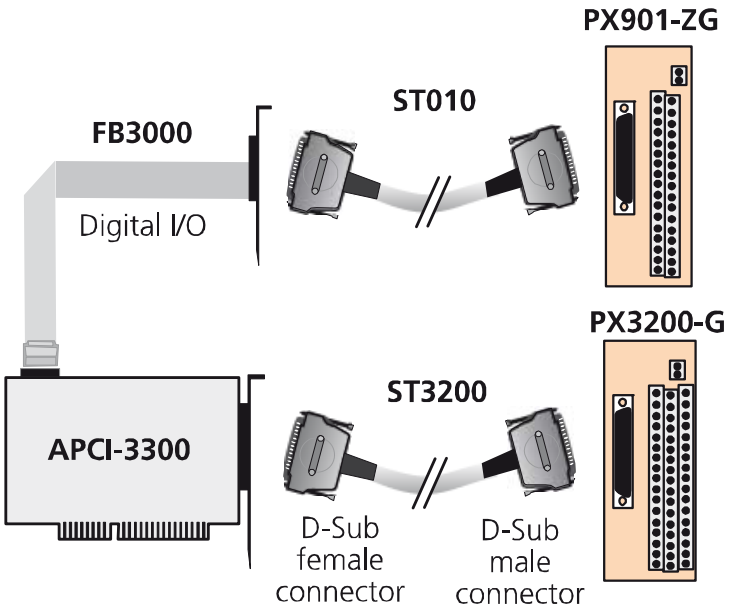


Fig. 7-6: Connection of the digital output channels



7.3.3 Connection to the screw terminal panels

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

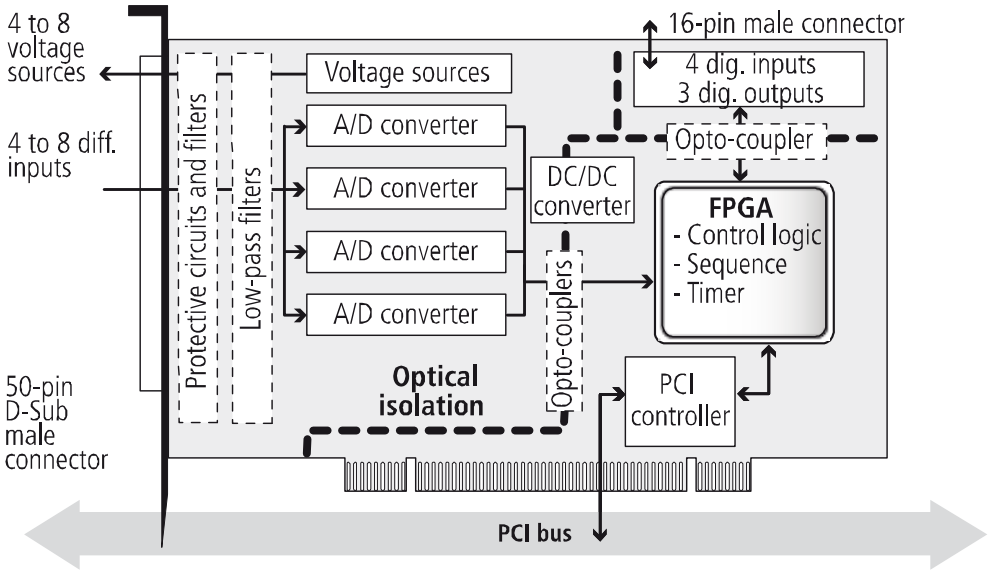


IMPORTANT!
Plug the **FB3000** cable into the connector of the board by inserting the red (or blue or black) cable line into pin 1.

8 FUNCTIONS OF THE BOARD

8.1 Block diagram

Fig. 8-1: Block diagram of the APCI-3300



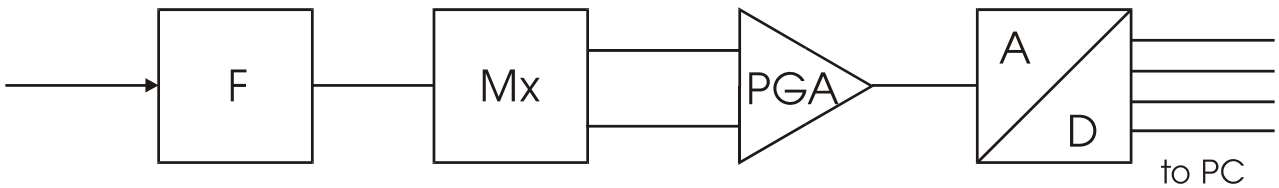
8.2 Pressure measurement

The board has max. 8 analog pressure inputs. These are organised in 4 different modules. An 18-bit A/D converter is allocated to each module.
A converter can acquire 2 inputs independently from each other or sequentially, once or in cycles through timer. (Scan, Single or Continuous Mode).

The APCI-3200 allows an acquisition with 18-bit resolution in a range of 0 to + 1.25 V.

For the acquisition of the input signals, the following parameters are to be configured by software:
- gain
- polarity

Fig. 8-2: Acquisition principle of the analog pressure signals



Acquisition principle for 1 module

Module 0 corresponds to the inputs 0 to 1.
Module 1 corresponds to the inputs 2 to 3.
Module 2 corresponds to the inputs 4 to 5.
Module 3 corresponds to the inputs 6 to 7.

The conversion of module x is started by single start, single scan, continuous scan with or without timer, through software trigger or external hardware trigger via a digital input channel:

- Digital input 0 for module 0.
- Digital input 1 for module 1.
- Digital input 2 for module 2.
- Digital input 3 for module 3.

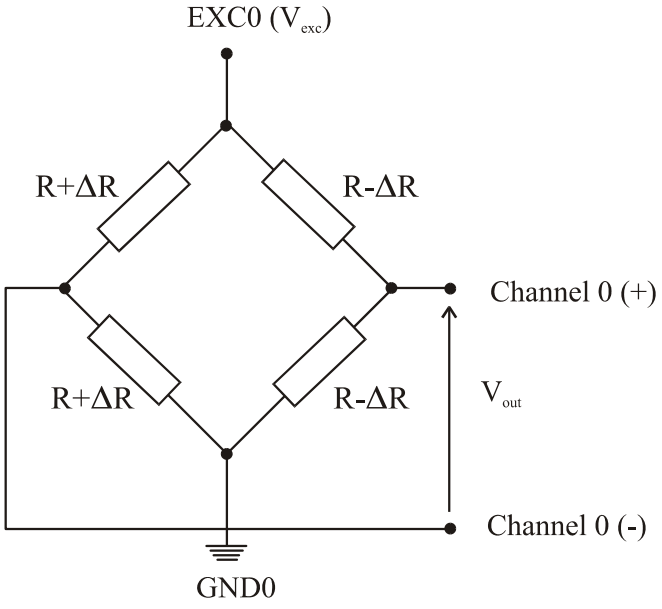
Once the conversion is completed, an interrupt is generated (EOC: end of conversion). The measured value can be read back at any time with the corresponding driver function.

8.2.1 Principle of the pressure measurement

The board APCI-3300 allows the connection of linear sensors and functions according to the principle of a "Wheatstone" bridge (See figure below). When pressure affects the connected sensor, the whole resistance value (R) of the bridge is modified by ΔR. The higher the resistance, the higher the voltage and in consequence the pressure.

The V_{exc} (EXC0 to EXC7) on the screw terminal panel are used as reference voltage i.e. as excitation voltage for the resistance bridge. The voltage measured at the 2 pins corresponds to the resistance difference ΔR between the 2 sides of the bridge.

Fig. 8-3: Principle of the pressure sensor



V_{out}: Voltage measurement

The output voltage (V_{out}) is defined as follows:

$$V_{out} = V_{exc} \times \frac{\Delta R}{R}$$

The connected sensors have technical properties which must be carefully considered for the pressure measurement:

- the offset voltage: measured voltage when the sensor resistance amounts 0 Ω.
- the sensor sensitivity

You will find the required values in the product specifications of the sensor manufacturer. Enter this date in the following software function (See chapter 9): b_ADDIDATA_InitPressureChannel.

Pressure is proportional to the resistance whatever the sensor type is. It results the following calculation:

$$P = \frac{V_{out} + V_{off}}{V_{exc} \times S}$$

- V_{out}: output voltage in mV
- V_{off} : offset voltage (See product information of the sensor manufacturer)
- V_{exc}: reference voltage in V
- S: sensitivity of the sensor in $\frac{mV}{V \times bar}$ (See product information of the sensor manufacturer)
- P: measured pressure in Bar. The pressure value is returned with a slight inaccuracy ±ΔP.

ΔP is calculated as follows:

$$\Delta P = \mathrm{P}\left(\frac{\Delta V_{out} + \Delta V_{off}}{V_{out} + V_{off}} + \frac{\Delta S}{S} + \frac{\Delta V_{exc}}{V_{exc}} \right)$$

- ΔS: Sensitivity error (See product information of the sensor manufacturer)
- ΔV_{exc}: Reference voltage error
- ΔV_{off}: Offset error (See product information of the sensor manufacturer)
- ΔV_{out}: Measurement precision of the board (See Table 8-4)

Table 8-1: Conversion table of SI pressure units

	SI-Units			Technical Units		
	bar	mbar	Pa	mmHg	kp/cm²	atm
1 bar	1	10^3	10^5	750,064	1,01972	0,986923
1 mbar	10^{-3}	1	100	750,064E-03	1,01972E-03	0,986923E-03
1 Pa	10^{-5}	0,01	1	7,50064E-03	10,1972E-06	9,86923E-06
1 mmHg	1,33322E-03	1,33322	133,322	1	1,35951E-03	1,31579E-03
1 kp/cm²	0,980665	0,980665E03	98,0665E-03	735,561	1	0,967841
1 atm	1,01325	1,01325E03	101,325E-03	760	1,03323	1

Other pressure unit: psi (pound per square inch)
1 psi = 6.89 x 10^3 Pa (N/m2)
1 psi = 6.89 x 10^{-2} bar

8.2.2 Temperature compensation

For a given constant pressure the output voltage changes with the temperature variations as follows:

$$\frac{dV_{out}}{dT} = \frac{dS}{dT} \times P \times V_{ref}$$

The temperature dependence of the sensor sensitivity can be calculated as follows:

$$S = S_0\left[(1 - \beta T_D) + \rho T_D^2\right]$$

- T_D: temperature difference between 25°C and the sensor temperature
- S_0: sensitivity at 25°C
- β and ρ are correlation constants (See product information of the sensor manufacturer)

Between 0°C and 70°C the change in sensitivity with temperature is quite linear and the 2nd order temperature dependent term can be ignored. Outside this temperature range, the terms from the 2nd order must be considered if accuracy of better than ± 1% is required (See sensor technical features).

Most pressure applications fall within the 0°C to 70°C operating temperature and the non-linear effects can then be ignored. Thus:

$$S = S_0(1 - \beta T_D)$$

The pressure dependence with temperature can be calculated as follows:

$$P = \frac{V_{out} + V_{off}}{V_{ref} \times S_0 (1 - \beta T_D)}$$

Example of temperature compensation

Values

- V_{off} = - 20 mV
- V_{ref} = 5 V or 10 V
- S_0 = 21.77 $\frac{mV}{V \times bar}$
- V_{out} = 40 mV
- β = - 2150 ppm/°C
- T° = 60°C

Calculation:

- **without temperature compensation:**

$$P = \frac{V_{out} + V_{off}}{V_{ref} \times S} = 0.184 bar$$

- **with temperature compensation:**

$$P = \frac{V_{out} + V_{off}}{V_{ref} \times S_0 (1 - \beta T_D)} = 0.171 bar$$

IMPORTANT!
To avoid pressure modification in relation to temperature variation, the use of **temperature compensated sensors is recommended**.

If no temperature compensated sensor is used and in case the operating temperature is not 25°C or is unknown, temperature compensation is absolutely necessary.

Contact our sales department which will be pleased to help you find the required solution by inserting the board **APCI-3200 for temperature measurement**.

8.2.3 Acquisition functions

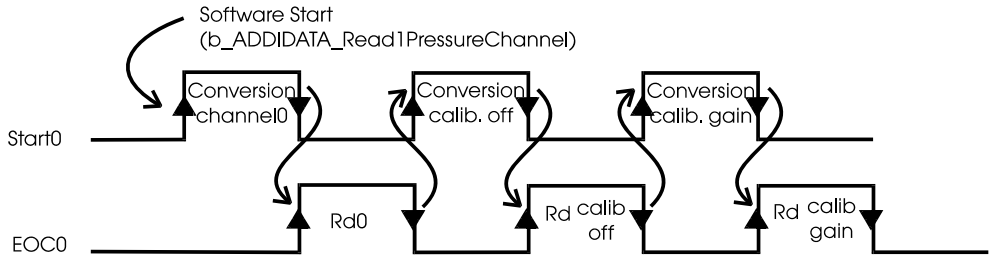
Each channel can be independently acquired (software start; See Fig. 8-4).

Each module (4 channels) can be independently acquired (one channel after the other):
- once through software trigger (single software scan; See Fig 8-5)
- once through external trigger (single hardware scan)
- cyclically through software trigger (continuous software scan)
- cyclically through software trigger with timer (continuous software scan with Timer)
- cyclically through external trigger (continuous hardware scan)
- cyclically through external trigger with timer (continuous hardware scan with Timer; See Fig. 8-6)

All functions can be configured through software.

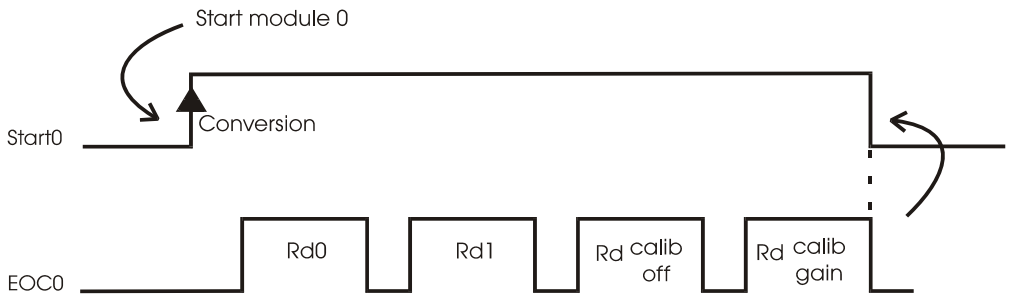
Fig. 8-4: Acquisition example - Software start

Rdx: Read Channel x
CJC: Cold junction compensation
calib. gain: Gain calibration
EOC0: End of Conversion for the module 0
Start0: Start of module 0



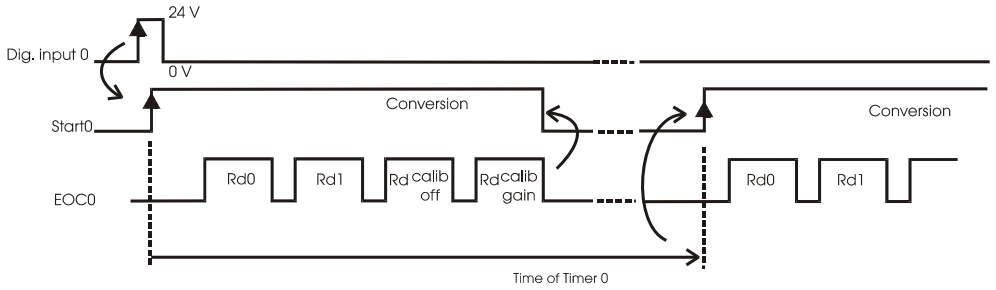
After software-start, the channel x, the offset value and the gain value are read and a 16-bit value is returned.

Fig. 8-5: Acquisition example - Single software scan



Single software scan in differential mode:
After a single software scan the channels 0, 1, the offset value and the gain value are read. The conversion is made once (single scan) and stopped.

Fig. 8-6: Acquisition example - Continuous hardware scan with Timer (rising edge)



The conversion is identical to the conversion in single software scan. The only difference is that the conversion is started by one of the 4 digital inputs (external trigger). A delay time between 2 scan starts can be set through one 10-bit timer. The conversion is stopped by software.

Acquisition times

Table 8-2: Acquisition times

Acquisition times (Hz) 1 channel, offset, reference	Sample period (ms)
20	50
40	25
80	12.5
160	6.25

8.2.4 Interrupt

For each module, an "End of Conversion" (EOC) is automatically generated after each measurement. This function can generate an interrupt.

8.2.5 Timer

Through the 4 x 10-bit timers, delays can be determined between 2 starts of SCAN. Each timer can be independently configured in 3 different time bases.

Table 8-3: Timer time delays

Time unit	Range of the delay for this time unit	Corresponds to
1ms	0< t < 1023 ms	0 < t < 1.023 s
1s	0< t < 1023 s	0 < t < 17.067 min

After the delay has run down, a new SCAN cycle is started.

8.2.6 Software calibration

Each channel can be independently configured through software. For each measuring process, a software calibration of the A/D converter is completed through internal comparison with the reference voltage. The offset and gain error can then be corrected in order to measure the voltage with a precision of 16 bits.

8.3 Voltage acquisition

Table 8-4: Voltage accuracy

Range	Accuracy (Gain = 1)
0 < V < 100 mV	± 19 µV
100 mV < V < + 1.25 V	± 76 µV

See also the limit values on page 5.

9 STANDARD SOFTWARE

The API software functions supported by the board are listed in an HTML document. A description on how to access the respective file can be found in the document “Quick installation PC boards” (see PDF link), in the chapter “Standard software”.

10 RETURNING OR DISPOSING

10.1 Returning

In the event that you must return your board, you should read the following checklist beforehand.

Checklist for returning the board

- Specify the reason for returning your board (e.g. exchange, modification, repair), the serial number of the board, the contact person in your company including his/her telephone extension and e-mail address, as well as the mailing address for a potential new delivery.

- Please make a note of the serial number which is indicated on the board.

Fig. 10-1: Serial number

- You do not have to indicate the RMA number.

- Please use an ESD protective cover for packing the board. Then put it in a cardboard box so that it is protected as best as possible for shipping. Send the board in its package together with your details to:

  ADDI-DATA GmbH
  Airpark Business Center
  Airport Boulevard B210
  77836 Rheinmünster
  Germany

- For any further questions, you can contact us directly at:

  Phone: +49 7229 1847-0

  E-mail: info@addi-data.com

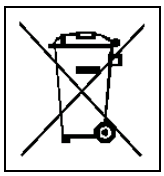
10.2 Disposal of ADDI-DATA devices

ADDI-DATA organises the disposal of ADDI-DATA products that were launched on the German market after 13 August 2005.

If you want to return old devices, please mail your request to: rohs@addi-data.com.

The following sign shows if the boards were delivered after 13 August 2005:

Fig. 10-2: Disposal: Labelling



This symbol indicates the disposal of electrical and electronic waste (valid in the European Union and other European countries with separate collection system). Products with this symbol must not be treated as household waste when you wish to dispose them.
If you dispose these products correctly, you will help to prevent potential negative consequences to the environment and human health, which could otherwise be caused by inappropriate disposal of these products. The recycling of materials will help to conserve natural resources.

For more detailed information about the recycling of these products, please contact your local city office, waste disposal service, the shop where you bought this product or the distributor you purchased this product from.

Disposal in other countries than Germany
Please dispose the product according to the country-specific regulations.

11 GLOSSARY

Table 11-1: 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.
Digital signal	A signal which has distinct states. Digital computers process data as binary information having either true or false states.
Disturb signal	Interferences that occur during the transfer caused by reduced bandwidth, attenuation, gain, noise, delay time etc.
Driver	A part of the software that is used to control a specific hardware device such as a data acquisition board or a printer.
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.
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.

Term	Description
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
MUX	= *Multiplexer* An array of semiconductor or electromechanical switches with a common output used for selecting one of a number of input signals.
Noise immunity	Noise immunity is the ability of a device to work during an electromagnetic interference without reduced functions.
Noise suppression	The suppression of undesirable electrical interferences to a signal. Sources of noise include the ac power line, motors, generators, transformers, fluorescent lights, CRT displays, computers, electrical storms, welders, radio transmitters, and others.
Operating voltage	The operating voltage is the voltage that occurs during the continuous operation of the device. It may not exceed the continuous limit voltage. Furthermore, any negative operation situations, such as net overvoltages over one minute at switching on the device must be taken in consideration.
Optical isolation	The technique of using an optoelectric transmitter and receiver to transfer data without electrical continuity, to eliminate high-potential differences and transients.
Opto-coupler	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)
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.

Term	Description
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.
Resolution	The smallest significant number to which a measurement can be determined. For example a converter with 12-bit resolution can resolve 1 part in 4096.
Sensor	A device that responds to physical stimuli (heat, light, sound, pressure, motion, etc.) and produces a corresponding electrical output.
Settling time	The time required, after application of a step input signal, for the output voltage to settle and remain within a specified error band around the final value. The settling time of a system includes that of all of the components of the system.
Short circuit	A short circuit of two clamps of an electric switch is when the concerning clamp voltage is zero.
Short circuit current	Short circuit current is the current between tow short-circuited clamps.
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.
Wheatstone bridge	A simple circuit for measuring an unknown resistance by connecting it so as to form a quadrilateral with three known resistances and applying a voltage between a pair of opposite corners

12 INDEX