



**DIN EN ISO 9001: 2015  
certified**



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

**Phone: +49 7229 1847-0  
Fax: +49 7229 1847-222  
E-mail: [info@addi-data.com](mailto:info@addi-data.com)  
[www.addi-data.com](http://www.addi-data.com)**

**Technical description**

**APCI-1648, APCI-1696**

**TTL I/O board**

Edition: 02.05 - 09/2020

### Product information

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## Warning!

The following risks result from the improper implementation of the board and from use 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 the  
wrong use of the board.
- Pay attention to the following symbols:



### NOTICE!

Designates hints and other useful information.



### NOTICE!

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**.

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# 1 DEFINITION OF APPLICATION

## 1.1 Intended use

The boards **APCI-1648** and **APCI-1696** must be inserted in a personal computer (PC) with PCI slots which is used as electrical equipment for measurement, control and laboratory pursuant to the standard DIN EN IEC 61010-1.

The used personal computer (PC) must fulfil the requirements of DIN EN IEC 62368-1 and DIN EN 55032 or IEC/CISPR 32 and DIN EN 55024 or IEC/CISPR 24.

The use of the boards **APCI-1648** and **APCI-1696** in combination with external screw terminal panels requires correct installation according to the standard DIN EN IEC 61439-1 (Low-voltage switchgear and controlgear assemblies).

## 1.2 Usage restrictions

The boards **APCI-1648** and **APCI-1696** must not be used as safety-related parts (SRP).

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

The boards **APCI-1648** and **APCI-1696** must not be used in potentially explosive atmospheres.

The boards **APCI-1648** and **APCI-1696** must not be used as electrical equipment according to the Low Voltage Directive 2014/35/EU.

## 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-1648/APCI-1696** board and the peripherals is to occur through a shielded cable. This cable must be connected to the 50-pin D-Sub male connector of the board

The board has 48 or 96 bidirectional input/output channels for processing TTL signals.

The **PX8001** screw terminal board allows the connection of the digital signals with a shielded cable. The connection with our standard cable **ST370-16** complies with the following specifications:

- 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**

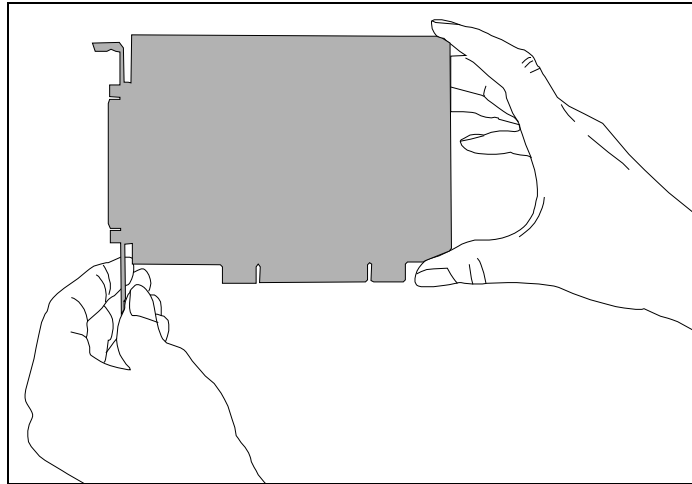
Consider the country-specific regulations about:

- 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)

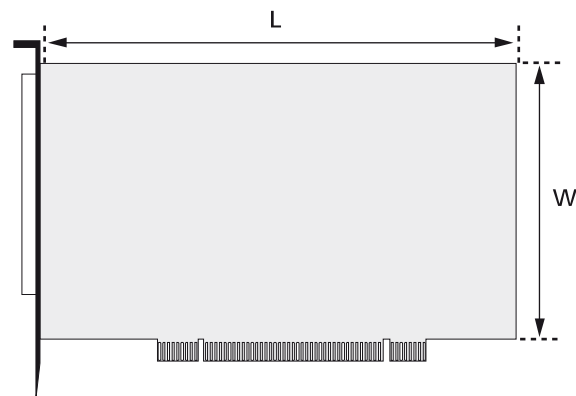
The board **APCI-1648/APCI-1696**<sup>1</sup> is suited for installation in personal computers (PCs) which comply with the European EMC directive.

The board **APCI-1648/APCI-1696** complies with the European EMC directive. The tests were carried out by a certified EMC laboratory in accordance with the standard 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):	127 x 80 mm
Weight:	approx. 160 g
Installation in:	PCI 32-bit slot (3.3 V / 5 V)
Connection to the peripherals:	
<b>APCI-1648:</b>	50-pin D-Sub male connector
<b>APCI-1696:</b>	
50-pin D-Sub male connector:	TTL I/O 0 to 47
50-pin header:	TTL I/O 48 to 95

**Accessories**<sup>2</sup>:

Standard cable:	<b>ST370-16</b>
Screw terminal board:	<b>PX8001</b>

**APCI-1696:** The ribbon cable **FB1696** for connecting the TTL I/O 48 to 95 is included in standard delivery.

<sup>1</sup> The test has been carried out with an **APCI-1696** board.  
<sup>2</sup> Not included in standard delivery.

**NOTICE!**

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

### 4.3 Limit values

Max. altitude: ..... 2000 m  
 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:**

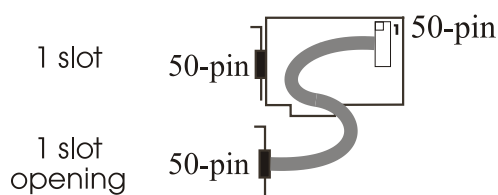
Bus speed: ..... < 33 MHz

Operating system: ..... Windows 10/7/XP, Linux

**Required slots**

APCI-1648: ..... 1

APCI-1696: ..... 1+1

**Energy requirements:**

- Operating voltage: ..... +5 V from the PC

- Current consumption

**APCI-1648**

all channels connected as inputs: ..... 100 mA ± 10 %

TTL channels connected as outputs: ..... 100 mA ± 10 %

**APCI-1696**

all channels connected as inputs: ..... 100 mA ± 10 %

TTL channels connected as outputs: ..... 100 mA ± 10 %

TTL inputs and outputs



**NOTICE!**

The TTL inputs and outputs are not optically isolated. Please make sure that no signal from the peripherals is connected to the inputs and outputs when the PC system is switched off or being booted up or shut down. This can be realised by means of a relay or tri-state circuit between the peripherals and the TTL inputs and outputs.

<b>APCI-1648:</b>	.....	48 TTL inputs and outputs, 6 independent modules with each 8 TTL input/output channels
<b>APCI-1696:</b>	.....	96 TTL inputs and outputs, 12 independent modules with each 8 TTL input/output channels
I/O address range:	.....	128 bytes
Access:	.....	8-bit, 32-bit
Programming:	.....	through I/O read or write commands
Driver type:	.....	74ALVC164245
Min. output voltage:	.....	3.84 V (High level)
Max. output voltage:	.....	0.1 V (Low level)
TTL input compatible:	.....	0.8 V (max. Low level) 2 V (min. High level)
Max. output load:	.....	20 LSTTL loads
Max. output current:	.....	DC ± 50 mA
Signal delay:	.....	15 ns
Max. DC input signal:	.....	4.75 V (PC supply voltage: 5 V ± 5%)
Min. DC output signal:	.....	3.8 V (PC supply voltage: ≥ 4.75 V)

## 5 INSTALLATION OF THE BOARD



### **Risk of injury!**

Be sure to follow the safety precautions!  
Improper use of the board may lead to property damage and personal injury.

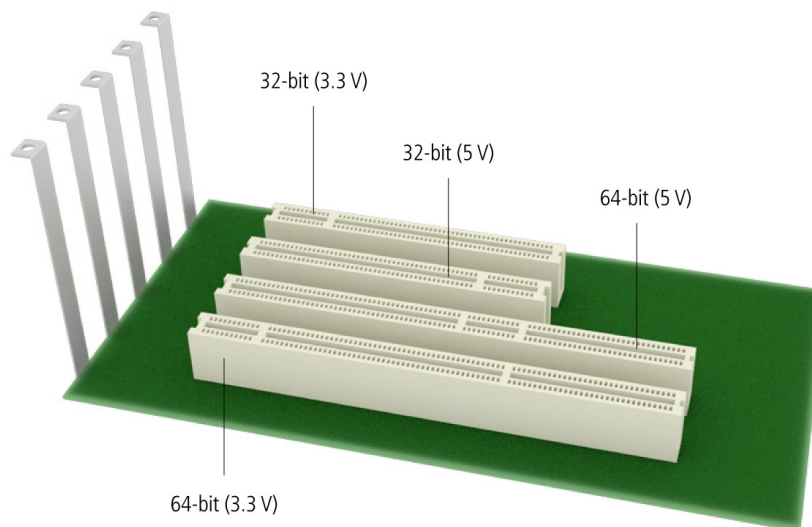
### 5.1 Opening the PC

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

### 5.2 Selecting a slot

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

**Fig. 5-1: PCI slot types**

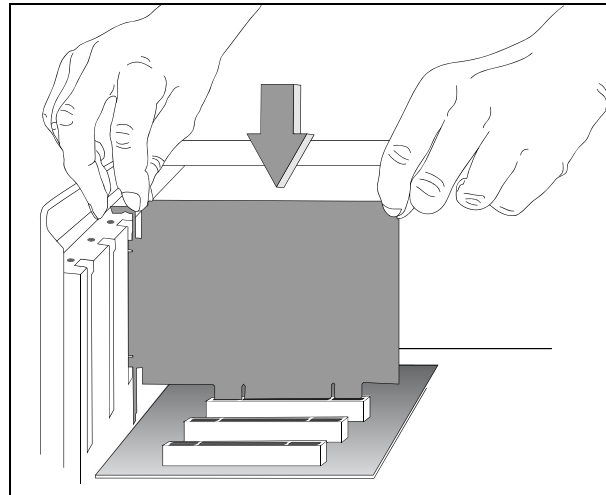


- ◆ Unscrew the back cover from the selected slot. For this, follow the operating instructions provided by the PC manufacturer!  
Keep the back cover in a safe place. You will need it if you remove the board.
- ◆ Provide for potential equalisation.
- ◆ Take the board out of its protective pack.

## 5.3 Plugging the board into the slot

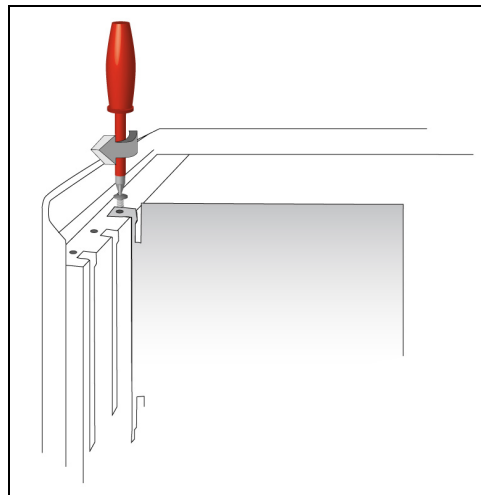
- ◆ Insert the board vertically into the chosen slot.

**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

Information on how to select and download the appropriate driver can be found in the document “Quick installation PC boards” (see PDF link).

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

### 6.2 Questions and Updates

If you have any questions, do not hesitate to call us or to send us an e-mail:

Phone: +49 7229 1847-0

E-mail: [info@addi-data.com](mailto:info@addi-data.com)

#### Manual and software download from the Internet

The latest versions of the technical manual and the standard software for the board **APCI-1648/APCI-1696** can be downloaded for free at: [www.addi-data.com](http://www.addi-data.com)



#### NOTICE!

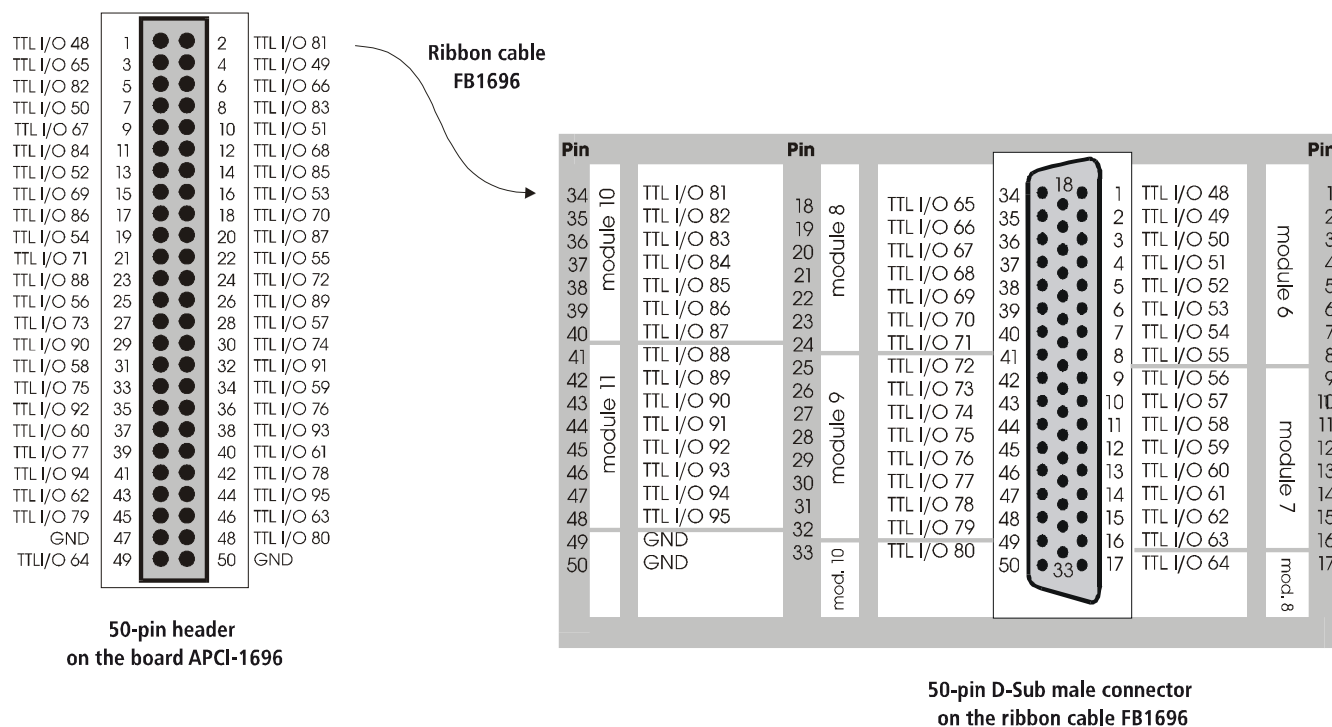
Before using the board and in case of malfunction during operation, check if there is an update (manual, driver) available. Current data can be found on our website or contact us directly.

## 7.1 Pin assignment

**Fig. 7-1: 50-pin D-Sub male connector (TTL I/O 0-47)**

Pin		Pin					Pin			
34	module 4	TTL I/O 33	18	module 2	TTL I/O 17	34	18	1	TTL I/O 0	module 0
35		TTL I/O 34			35	•	2	TTL I/O 1		
36		TTL I/O 35			36	•	3	TTL I/O 2		
37		TTL I/O 36			37	•	4	TTL I/O 3		
38		TTL I/O 37			38	•	5	TTL I/O 4		
39	module 5	TTL I/O 38	21	module 3	TTL I/O 21	39	•	6	TTL I/O 5	module 1
40		TTL I/O 39			40	•	7	TTL I/O 6		
41		TTL I/O 40			41	•	8	TTL I/O 7		
42		TTL I/O 41			42	•	9	TTL I/O 8		
43		TTL I/O 42			43	•	10	TTL I/O 9		
44	module 6	TTL I/O 43	22	module 4	TTL I/O 22	44	•	11	TTL I/O 10	module 2
45		TTL I/O 44			45	•	12	TTL I/O 11		
46		TTL I/O 45			46	•	13	TTL I/O 12		
47		TTL I/O 46			47	•	14	TTL I/O 13		
48		TTL I/O 47			48	•	15	TTL I/O 14		
49	GND	GND	32	mod. 4	TTL I/O 31	49	•	16	TTL I/O 15	module 3
50					TTL I/O 32	50	33	17	TTL I/O 16	

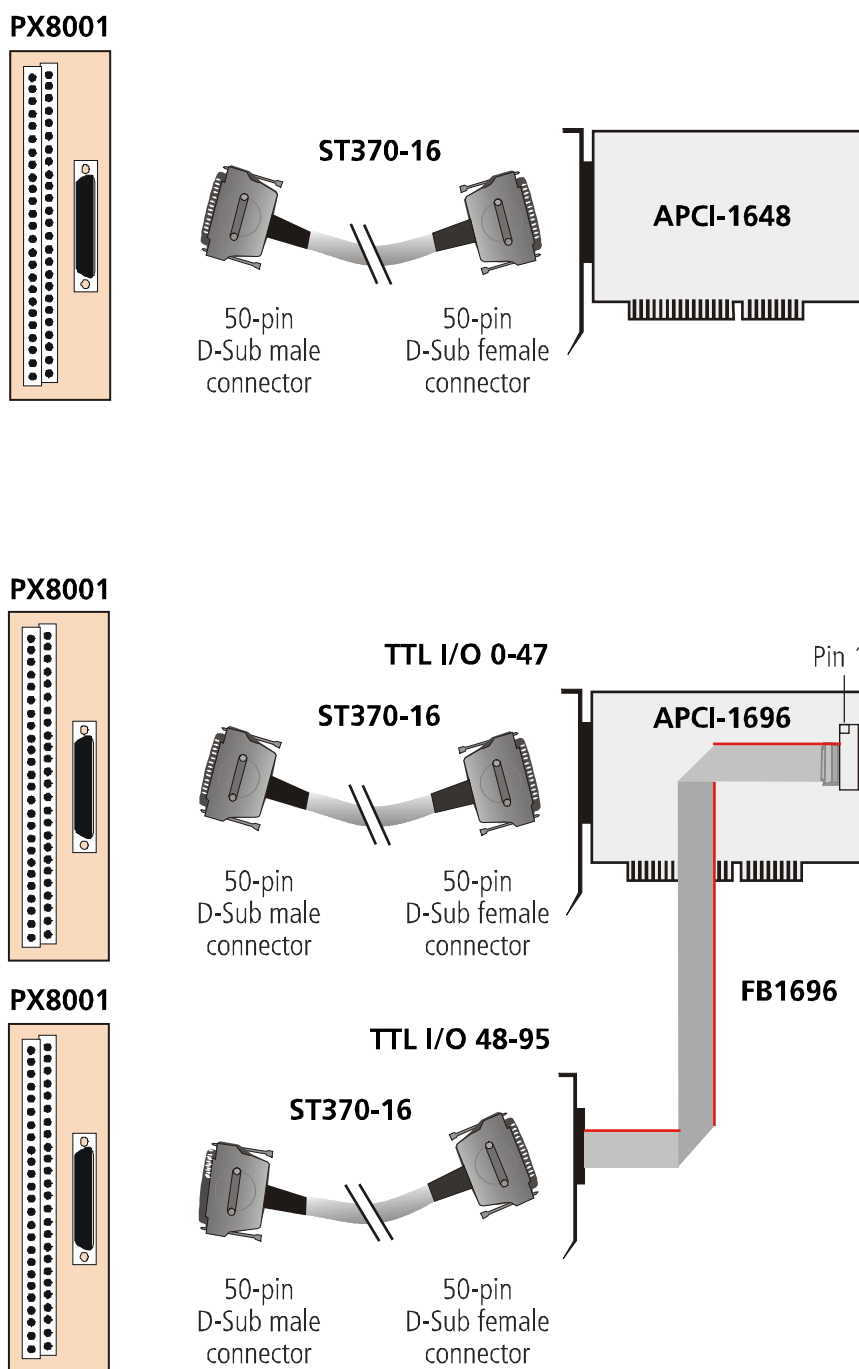
**Fig. 7-2: 50-pin D-Sub male connector (TTL I/O 48-95)**





## 7.2 Connecting the accessories

Fig. 7-3: Connection of the screw terminal panel PX8001

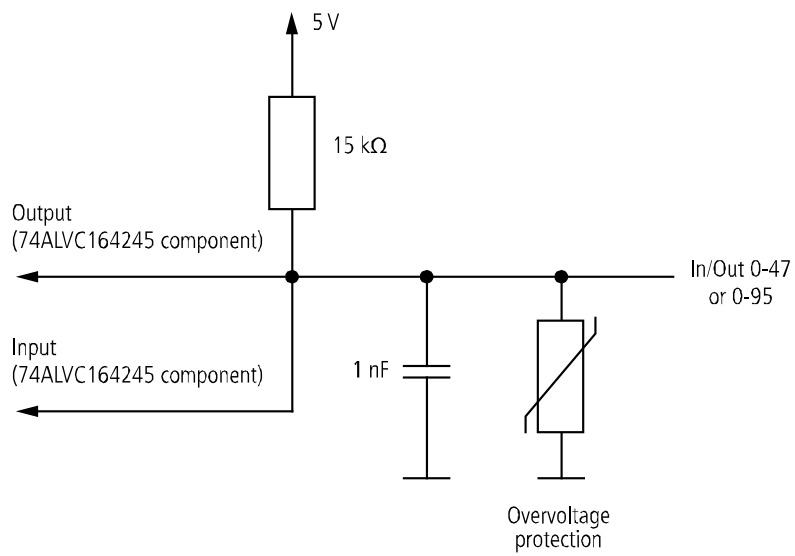


### NOTICE!

Plug the **FB1696** cable into the connector of the board by inserting the red (or blue or black) cable line into pin 1.

## 7.3 Input/output circuit

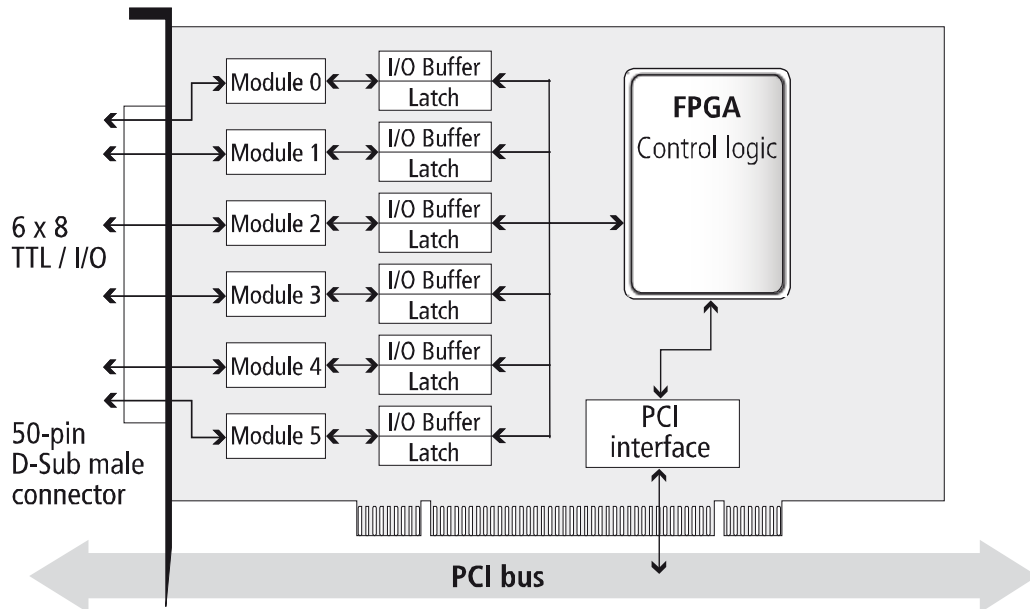
**Fig. 7-4: Input/output circuit (APCI-1648 or APCI-1696)**



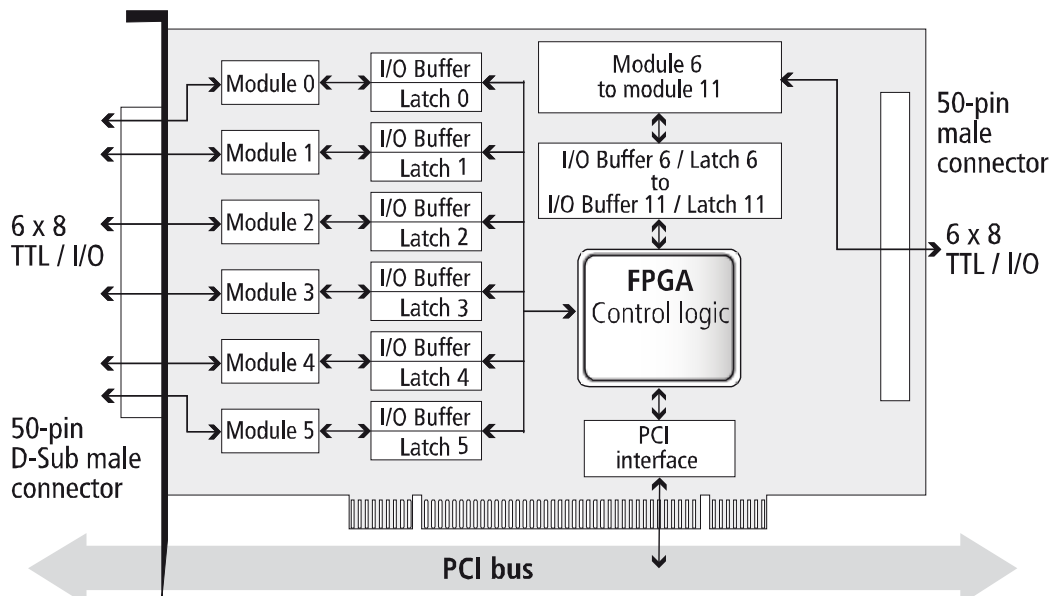
## 8 FUNCTIONS OF THE BOARD

### 8.1 Block diagrams

**Fig. 8-1: Block diagram of the APCI-1648**



**Fig. 8-2: Block diagram of the APCI-1696**



## 8.2 TTL inputs and outputs

The configuration of the inputs and outputs is modular. One module includes 8 channels and can be configured either as input or output.

Up to 20 LSTTL loads can be controlled through the **TTL outputs**.

The combination of several inputs and outputs allows data to be exchanged in parallel and bidirectionally with various peripheral devices.



### **NOTICE!**

The outputs are not protected against short circuits.

## **9 STANDARD SOFTWARE**

The API software functions supported by the board are listed in an HTML document. A description of 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 RETURN OR DISPOSAL

### 10.1 Return

If you need to return your board, you should read the following checklist before.

**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. You do not have to indicate the RMA number.

**Fig. 10-1: Serial number**



- Note down the serial number of the board.
- Place the board in an ESD protective cover. Then pack it in a cardboard box so that it is well-protected for shipping. Send the packed board together with your details to:

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

- If you have any questions, do not hesitate to contact us:

Phone: +49 7229 1847-0

E-mail: [info@addi-data.com](mailto:info@addi-data.com)

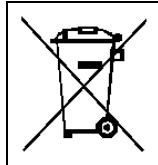
## 10.2 Disposal of ADDI-DATA waste equipment

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

If you want to return waste equipment, please e-mail your request to:  
[info@addi-data.com](mailto:info@addi-data.com).

Boards that were delivered after 13 August 2005 can be recognised by the following label:

**Fig. 10-2: Disposal: Label**



This symbol indicates the disposal of waste electrical and electronic equipment. It is valid in the European Union and in other European countries that have a separate collection system. Products carrying this symbol must not be treated as household waste.

For more detailed information on the recycling of these products, please contact your local citizens' office, your household waste collection service, the shop where you bought this product or the distributor you purchased this product from.

If you dispose of this product correctly, you will help to prevent damage that could be caused to the environment and to human health by inappropriate disposal. The recycling of materials will help to conserve our natural resources.

### **Disposal in other countries than Germany**

Please dispose of the product according to the country-specific regulations.

# 11 GLOSSARY

**Table 11-1: Glossary**

Term	Description
A/D converter	= <i>ADC</i> 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.
Bus	The group of conductors that interconnect individual circuitry in a computer. Typically, a bus is the expansion vehicle to which I/O or other devices are connected. Examples of PC buses are PCI, PC Card (PCMCIA), ISA (AT), and EISA bus.
Counter	A circuit that counts pulses or measures pulse duration
D/A converter	= <i>DAC</i> 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	= <i>Direct current voltage</i> 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.
Digital signal	A signal which has distinct states. Digital computers process data as binary information having either 1 or 0 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.
Gain	The factor by which an incoming signal is multiplied.
Ground	A common reference point for an electrical system.
Inductive loads	The voltage over the inductor is $U=L \cdot (dI/dt)$ , whereas $L$ is the inductivity and $I$ is the current. If the current is switched on fast, the voltage over the load can become very highly for a short time.
Interrupt	A signal to the CPU indicating that the board detected the occurrence of a specified condition or event.
Limit value	Exceeding the limit values, even for just a short time, can lead to the destruction or to a loss of functionality.
Noise immunity	Noise immunity is the ability of a device to work during an electromagnetic interference without reduced functions.
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.



Term	Description
Optical isolation	The technique of using an optoelectric transmitter and receiver to transfer data without electrical continuity, to eliminate high-potential differences and transients.
Output current	The maximum amount of current the sensor can supply across the output signal, expressed as amps DC (A DC).
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 for the 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.
Reference voltage	Reference voltages are stable voltages that are used as reference unit. From them voltages can be derived that are required for example in current supplies and in other electronic circuitries.
Resolution	The smallest significant number to which a measurement can be determined. For example, a converter with 12-bit resolution can resolve 1 part in 4096.
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.
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.
TTL	= <i>transistor-transistor logic</i> A popular logic circuit family that uses multiple-emitter transistors. The Low signal is defined as a signal of 0.8 V or lower. A High signal is defined as a signal of 2 V or higher.

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