Digital I/O board, optically isolated, 32 digital inputs/outputs, 24 V

APCI-1500

16 digital inputs, 24 V,

including 14 interruptible inputs

16 digital outputs, 24 V, 500 mA/channel

Optical isolation 1000 V

Input and output filters

Watchdog, timer

After power-on the outputs are reset to "0"

RoHS compliant

Compatible version for *CompactPCI™*
page 106

LabVIEW™

DASYLab™

LabWindows/CVI™

Embedded System MSX-Box

Features

- PCI Interface to the 32-bit data bus
- 3 timers programmable by software
- Connector compatible to digital I/O board PA 1500 for the ISA bus as well as connector and software compatible to CPCI-1500 for the CompactPCI bus
- Monitoring program for testing and setting the board functions

Inputs

- 16 isolated digital inputs, 24 V, incl. 14 interruptible
- Protection against pole reversal
- All inputs are filtered

Outputs

- 16 isolated digital outputs, 10 to 36 V
- Output current per channel 500 mA
- Timer-programmable watchdog for resetting the outputs to "0"
- Diagnostic report through status register in case of short circuit, overtemperature, voltage drop or watchdog
- Interrupt triggered through watchdog, timer, error
- At power-on, the outputs are reset to"0"
- Short-circuit current for 16 outputs ˜ 3 A typ.
- Short-circuit current per output ˜1.5 A typ.
- Self-resetting fuse (electronic fuse)
- Overtemperature and overvoltage protection
- 24 V power outputs with protection diodes and filters
- Output capacitors against electromagnetic emissions
- External 24 V voltage supply screened through protection circuitry
- Shut-down logic when the external supply voltage drops below 5 V

Safety features

- Optical isolation 1000 V
- Creeping distance IEC 61010-1 (VDE411-1)
- Protection against fast transients (burst), overvoltage, electrostatic discharge and high-frequency EMI
- Separate grounds for inputs/outputs channels

EMC tested acc. to 89/336/EEC

- IEC 61326: electrical equipment for measurement, control and laboratory use

Applications

- Industrial I/O control
- PLC connection
- Signal switching
- Interface to eletromechanical relays
- Automatic test equipment
- ON/OFF monitoring of motors, lights ...
- Watchdog timer
- Machine interfacing
- ...

Software drivers

Standard drivers for:
Linux kernel version 2.4.2, Windows XP/2000/NT/98.
Real-time drivers for Windows XP/2000/NT/98.
Monitoring program ADDIMON

Drivers for the following application software:
LabVIEW 5.01 • LabWindows/CVI • Diadem 6/7

Samples for the following compilers:
Microsoft VC++ 5.0; Microsoft C 6.0
Borland C++ 5.01; Borland C 3.1
Visual Basic 1.0/4.0/5.0
Delphi 4.0
Turbo Pascal 7.0

On request:
Dasylab 6/7 • Embedded NT • RTX-driver
ADDIPACK functions on request::
Digital Input with or without IRQ • Digital Output

Customer-tailored modifications,
designed to suit your needs
hardware and software, firmware, PLDs, ...
Contact us!

Digital I/O board, optically isolated
32 digital inputs/outputs, 24 V

Demanding and safe

The ADDI-DATA APCI-1500 is a digital input/output board with 32 channels for the industrial use on PCI basis. It is protected efficiently against disturbances thanks to the optical isolation up to 1000 V. Furthermore, it is equipped with protective circuitries at the inputs/outputs, as well as with interruptible inputs and watchdog function.

Robust terminal panels and shielded connection cables round off the noise immunity of the APCI-1500. In this way it is suited ideally for highly demanding tasks in control and acquisition of measurement values, where the interference-free digital communication is necessary for a smooth operation.

In order to simplify the handling of the PCI board, strong software for configuration and monitoring as well as numerous drivers and programming samples are delivered freely.

On request the APCI-1500 is also available for 5 V and 12 V signal.

Possible applications

The board APCI-1500 can be used in numerous fields of industrial automation and control.

Example 1:

SPS

© Siemens AG

The 24 V inputs/outputs are suited perfectly for the communication with other control components, e. g. stored program control (SPS).

Example 2: The fast data transmission of bit patterns via parallel lines is used everywhere where time-critical regulation processes are involved or a lot of data is to be acquired with high sampling frequency, e.g. in test benches.

Example 3: For the acquisition of signals and measurement values of binary single units, the whole range of binary 24-V-sensor technology is available: Light barriers, inductive proximity switches, ultrasonic sensors, mechanical switches, etc. Together with incremental incremental encoders and time-based counter inputs, speed of rotation and angles can be determined.

Example 4: With the outputs actuators, indicator elements, alert functions or valves are switched digitally. The outputs can supply up to 500 mA per channel at a total current of 3 A for all outputs, so that also high switching-on or starting currents cause no problems.

Example 5: Via electromechanical relays strong consumers or contactor for motors, driving systems and pumps can be controlled.

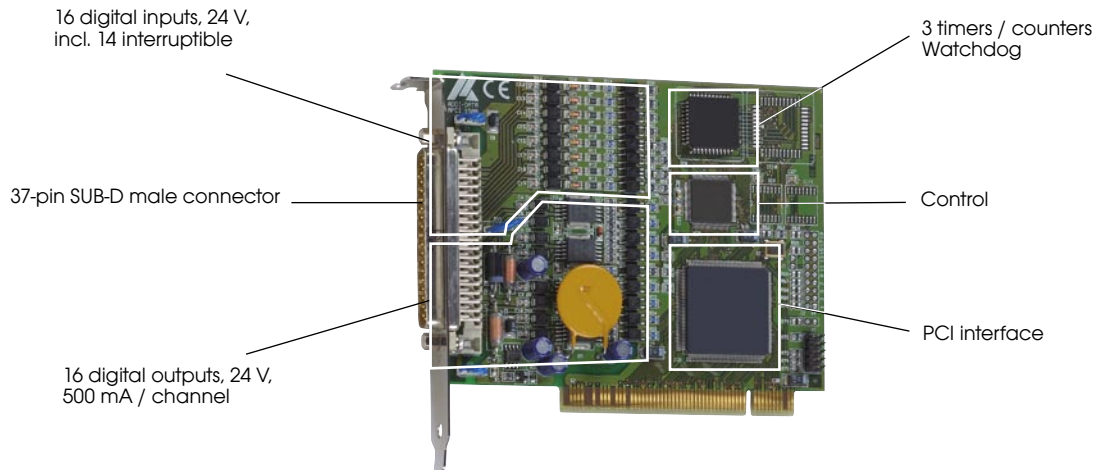## Interference free products
- Smooth processes

Noise immunity and reliability in continuous duty belong to the most important demands of the industry. For hardware components these demands impact the electromagnetic compatibiliy (EMC) and a low-heat development.

In harsh industrial use the electronic componentries are exposed to electromagnetic interactions that can endanger the operating safety. Machine down-times and trouble shooting, especially of reproducible field functions, are feared by operators because they can be responsible for incalculable growing project costs and time. Therefore the APCI-1500 offers numerous protective measures in order to ensure reliable use in the industrial environment: Optical isolation, protective circuitries at inputs/outputs, shielded voltage delivery and a creeping distance of 3.2 mm according to IEC 61010-1. In order to keep the heat development as low as possible and to dissipate power loss as thoroughly as possible, the components were selected carefully and the layout of the printed circuit card was adjusted especially to these aspects.

Digital I/O board, optically isolated
32 digital inputs/outputs, 24 V

ADDI-DATA®

APCI-1500

16 digital inputs, 24 V, incl. 14 interruptible

37-pin SUB-D male connector

16 digital outputs, 24 V, 500 mA / channel

3 timers / counters Watchdog

Control

PCI interface

Optical isolation

Fast transients, overvoltages and ground loops often lead to inexact measurements or to the failure of measurement equipment. Thus, all digital inputs/outputs of the APCI-1500 are isolated optically via opto-couplers. The optical isolation is a reliable method for protecting the hardware against damaging overvoltages. There is no direct connection via copper wire or semiconductor between the input and output side of the opto-coupler. For the signal transmission there is only an optical signal path with transmitter LED and light-sensitive receiver component. The opto-couplers that are used on the APCI-1500 protect the system against voltages up to 1000 V.

The opto-couplers and the design of the printed circuit boards are adjusted carefully to each other. The creeping distance complies with IEC 61010-1, i.e. the shortest physical distance between the potentials is at least 3.2 mm.

Numerous protective circuitries

Additionally, the APCI-1500 is equipped with numerous protective circuitries at the inputs/outputs. Besides the optical isolation there are EMC-filters for the protection against fast transients (burst), electrostatic discharge and high-frequency emission. Furthermore, the inputs are protected against voltage reversal.

The outputs are protected against short-circuits and overtemperature that protect the output drivers of the APCI-1500 against destruction and overload. The total current is limited to 3 A. If the fuse switches on, all outputs are switched off. Each single output is protected against short-circuits. At overload the output is pulsed automatically.

The self-resetting fuse takes the outputs automatically into operation after the cause of trouble is removed. Special attention is also required e.g. for switching inductive loads. If such a consumer is switched off, the energy that is stored in the magnetic field usually discharges via an electric arc. In order to prevent this, the outputs of the APCI-1500 have free-wheeling diodes in order to derive the discharge current specifically.

Higher computer performance through CPU relief

Continuous cyclic request processes (polling) for standard monitoring and evaluation tasks become redundant thanks to the interruptible inputs of the APCI-1500; in this way processor and signal lines are relieved. At a change of state at the digital inputs the APCI-1500 generates always an interrupt so that the system reacts on the event via the interrupt routine and herewith fulfils the given real time criteria.

24 V instead of TTL

The inputs/outputs of the APCI-1500 work with the industrial 24 V standard. Compared to the TTL level of the transistor-transistor-logic of only 5 V, the higher voltage level offers a more stable operation, even under bad conditions. Interferences that are induced into the signal lines are smaller than the wanted signal and can cause less damage, i.e. the signal-to-noise voltage ratio is bigger. In practice, this means that for example longer signal lines can be used and that the transmission near interference sources, like transformators, roboters etc., is safe. The APCI-1500 interprets voltages form 0...14 V as "Low" and voltages from 19...30 V as "High", i.e. there is no important field that is not defined.

Setting the outputs to „0"

In the turn-on phase, the logic components on electronic componentries have different undefined intermediate states until the current supplies provide their nominal voltage. Without special measures, it cannot be determined surely, which state the output channels will take. Thus, the APCI-1500 sets all outputs after Power-On or Reset to „0". This allows clear solutions when starting systems or measurements.

Why watchdog function?

Each computer system can crash because of malfunction of hardware, operating system or software.

For these cases professional applications have a special "emergency solution". For this the watchdog-timer of the APCI-1500 or several certain system events can be monitored, that repeat cyclically within a defined time period during standard operation. If the defined time period is exceeded or this "sign" does not occur at all, all outputs are set immediately to "0" and an interrupt is generated with the emergency routine in order to generate alerts. Herewith systems can be brought into a safe condition or can be switched off.

The integrated shut-down-logic has similar aim; it runs if the external voltage supply drops under 5 V.

Digital I/O board, optically isolated
32 digital inputs/outputs, 24 V

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Simplified block diagram
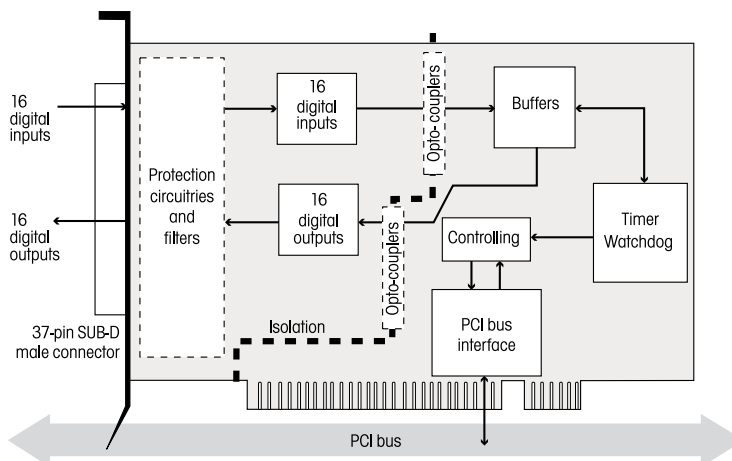
Specifications

Digital inputs

Number of inputs:	16 (common ground acc. to IEC 1131-2)
Interruptible inputs:	14, IRQ line selected through BIOS
Optical isolation:	through opto-couplers, 1000 V from the PC to the peripheral
Compare logic:	AND and OR mode; OR priority
Nominal voltage:	24 V
Input current at 24 V:	6 mA typ.
Logical input level:	U nominal: 24 V
UH max:	30 V/Current 9 mA typ.
UH min.:	19 V/Current 2 mA typ.
UL max.:	14 V/Current 0.7 mA typ.
UL min.:	0 V/Current 0 mA typ.
Signal delay:	70 µs (at 24 V inputs)
Maximum input frequency:	5 kHz (at 24 V)

Digital outputs

Number of outputs:	16, optically isolated up to 1000 V through opto-couplers
Output type:	High-Side (Load at ground) acc. to IEC 1131-2
Nominal voltage:	24 V
Supply voltage:	10 to 36 V, min. 5 V (through front connector)
Max. current for 16 outputs:	3 A typ.
Output current/output:	500 mA typ.
Short-circuit current/output	
Shut-down at 24 V, R_{load} < 0.1Ω:	1.5 A
RDS ON resistance:	0.4 Ω max.
Switch-on time:	I out=0.5 A, Load = resistance: 100 µs
Switch-off time:	I out=0.5 A, Load = resistance: 60 µs
Overtemperature (Shut-down):	170 °C (output driver)
Temperature hysteresis:	20 °C (output driver)

Safety

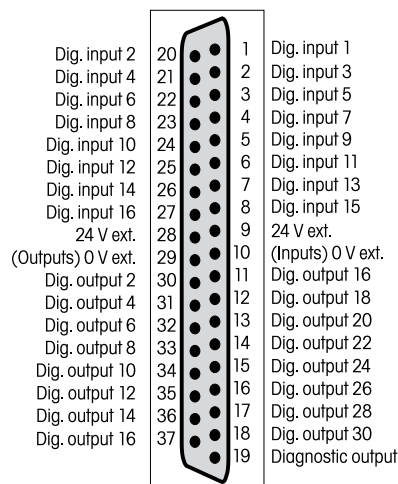|	
Shut-down logic:	When the ext. 24 V voltage drops below 5 V, the outputs are switched off.
Diagnostic:	Status bit or interrupt to the PC
Timer:	3
Watchdog:	Timer-programmable, 10 µs to 37 s

Noise immunity

Test level:	- ESD: 4 kV
	- Fields: 10 V/m
	- Burst: 4 kV
	- Conducted radio interferences: 10 V

Physical and environmental conditions

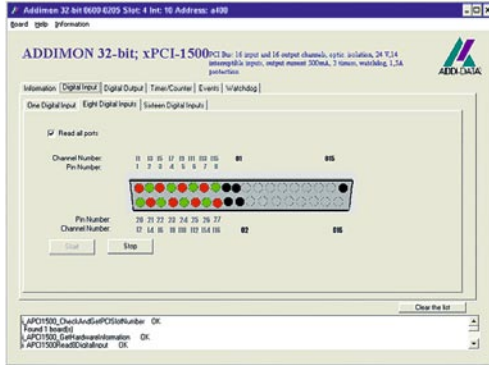|	
Dimensions:	131 x 99 mm
System bus:	PCI 32-bit 5 V acc. to specification 2.1 (PCISIG)
Space required:	short board, 1 PCI slot
Operating voltage:	+5 V, ± 5 % from PC
Current consumption:	400 mA typ. ± 10 %
Front connector:	37-pin SUB-D male connector
Temperature range:	0 to 60 °C (with forced cooling)

Pin assignment – 37-pin SUB-D male connector

|				
Dig. input 2	20		1	Dig. input 1
Dig. input 4	21		2	Dig. input 3
Dig. input 6	22		3	Dig. input 5
Dig. input 8	23		4	Dig. input 7
Dig. input 10	24		5	Dig. input 9
Dig. input 12	25		6	Dig. input 11
Dig. input 14	26		7	Dig. input 13
Dig. input 16	27		8	Dig. input 15
24 V ext.	28		9	24 V ext.
(Outputs) 0 V ext.	29		10	(Inputs) 0 V ext.
Dig. output 2	30		11	Dig. output 16
Dig. output 4	31		12	Dig. output 18
Dig. output 6	32		13	Dig. output 20
Dig. output 8	33		14	Dig. output 22
Dig. output 10	34		15	Dig. output 24
Dig. output 12	35		16	Dig. output 26
Dig. output 14	36		17	Dig. output 28
Dig. output 16	37		18	Dig. output 30
			19	Diagnostic output

APCI-1500

Monitoring program ADDIMON

The APCI-1500 is configured with the monitoring program ADDIMON that is contained in the standard delivery. After the installation of the PC board the parameters can be indicated, configured and the basic functions can be tested. First field tests of the application are possible even before a specific user program is written. As there is a specific ADDIMON-tool for each PC board, the board functionalities are supported extensively.

Universal driver software
ADDIPACK
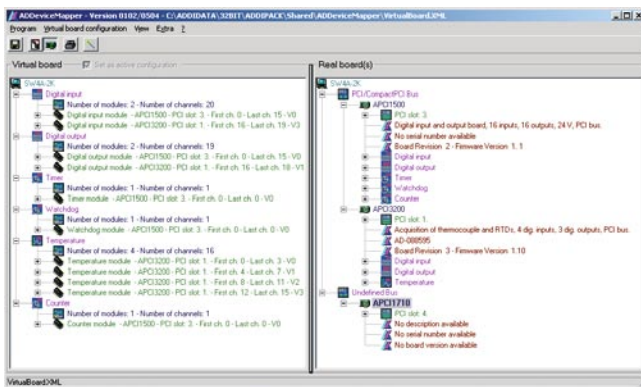
The ADDIPACK software simplifies the configuration and management of PCI boards. Until now measurement boards that were implemented in a PC, had to be managed separately. This means that when a board changed, the new boards had to be installed and configured completely new.

With the ADDIPACK software you save this effort. This software bundles all ADDI-DATA boards that are installed in a computer to a single "virtual board". As soon as the actually installed hardware is registered with the ADDIREG-tool, similar functions, which are distributed over several board types, can be called up uniformly via a 32-bit ADDIDRIVER-API.

The ADDEVICE-Mapper manages the virtual board dynamically: number of functions, function types, change of the virtual module and channel index.

New measurement board can be added or exchanged easily. The changes of functionalities that were caused by this can be seen instantly.

The ADDIPACK drivers are also designed for products running with new bus types such as PCI express. More information: see page 8.

Embedded System MSX-Box

Your PC alternative system for networked control, regulation and acquisition of measurement data

The APCI-1500 normally works in each standard industrial PC whose extension slots comply with the PCI specification 2.1

As a smart alternative, ADDI-DATA offers the MSX-Box, a real time embedded system for networked control, regulation and acquisition of measurement data.

The MSX-Box is equipped with standard components like PCI backplane, PCI I/O boards, CPU, ... but has no wearing parts like hard disk, drive, keyboard, mouse, etc.

It saves space and therefore it can be integrated easily in small 19" racks or attached on DIN rail.

The MSX-Box is based on open source standards: RTAI Linux, RISC processor, webserver, PCI slots for boards of any manufacturer. It exchanges measurement data with other systems via Ethernet (TCP/IP) or RS232 and has its own IP address. The self-developed CPU (MIPS 64-bit processor) was selected specifically, as well as the ADDI-DATA PCI I/O boards, in order to guarantee the long term availability and so to ensure the durability of your application. More information: see page 14

Digital I/O board, optically isolated
32 digital inputs/outputs, 24 V

ADDI-DATA®

Suitable accessories

The mechanical interface between process level and data processing is normally located in distributed switching cabinets close to the machine.

ADDI-DATA offers for all PC boards suitable accessories like connection cables, pin compatible terminal panels and relay modules for mounting on DIN rails.

Also for the accessories we set the same high standards respecting operating safety and EM-compatibility as for the PC boards. Only in this way reliable data transmission and reliability of the whole system can be guaranteed. The cables have a braid shielding, earthing on both sides and metallised hoods. The connection wires in twisted pairs match exactly the pin assignment of the APCI-1500. At the terminal panels an earthing band surrounds all sensitive components. Helpful for commissioning, trouble shooting and system diagnostics are LEDs that show the status of each digital channel. There is also the 24 V supply on the terminal panels. For the switching of big outputs up to 2500 VA there is a switching module with eight relays. Up to four relay modules are cascadable, so that 32 strong change-over contacts are available.

SUB-D connector instead of High-density (SCSI)

For the connection ADDI-DATA uses industry standard SUB-D connectors. All outwardly connections of the APCI-1500 are realised with a 37-pin SUB-D connector. ADDI-DATA does not support High-Density connectors from the SCSI range for industrial applications. They do not completely meet the high requirements in industrial measurement and control.
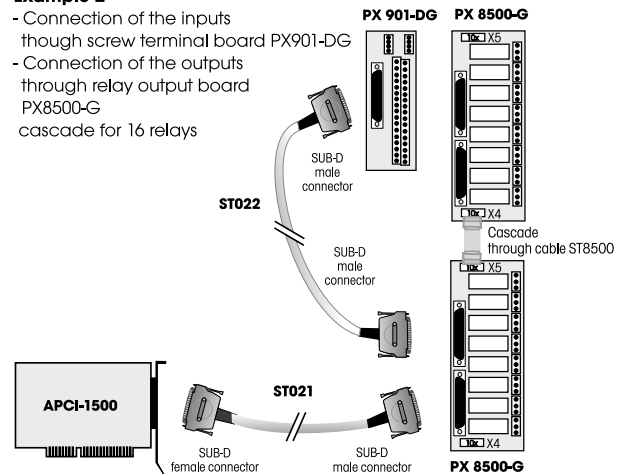
Recommended accessories for the APCI-1500

Example 1
Connection of the inputs and outputs through screw terminals boards
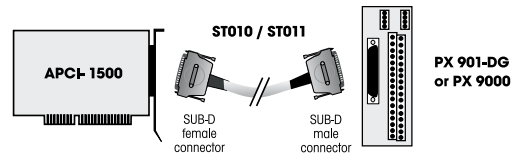
Example 2
- Connection of the inputs though screw terminal board PX901-DG
- Connection of the outputs through relay output board PX8500-G cascade for 16 relays

ORDERING INFORMATION

APCI-1500
Digital I/O board, optically isolated, 32 digital inputs/outputs, 24 V.
Incl. technical description, software driver and monitoring program.

Connection

PX 901-D: Screw terminal panel, LED status display
PX 901-DG: Screw terminal panel, LED status display, for DIN rail
PX 9000: 3-row screw terminal panel for DIN rail, with LED status display
PX 8500-G: Relay output board for DIN rail, cascadable
ST010: Standard round cable, shielded, twisted pairs, 2 m
ST011: Standard round cable, shielded, twisted pairs, 5 m
ST010-S: Same as ST010, for high currents (separate 24 V supply)
ST021: Round cable between APCI-1500 and PX 8500-G, shielded, twisted pairs, 2 m
ST022: Round cable between PX 8500-G and PX 901-DG, shielded, 2 m
ST8500: Ribbon cable for cascading two PX 8500

PX 901-DG screw terminal panel with **ST010** standard cable

ST010-S cable, for high currents

If you need to connect higher loads, then connect the **PX 8500-G** relay output board directly to the digital I/O