

Length measurement board, 16-bit, 16 or 8 inductive transducers, LVDT, half-bridge



PCI 32-bit



Signed 64-bit drivers for
Windows 7/Vista/XP



LabVIEW™

With the length measurement board APCI-3701, you can connect directly and acquire up to 16 half-bridge or LVDT transducers. The software ConfigTools guides you through each step of the installation, beginning with the selection of a transducer from a database including more than 50 pre-calibrated transducers up to testing each single channel.

Features

- PCI interface to the 32-bit data bus, 3.3 V or 5 V
- Acquisition of 8 or 16 inductive transducers (half-bridge, LVDT, Knäbel)
- 16-bit resolution
- Sampling rate depending on the transducer:
APCI-3701-8/-16: from 2 to 20 kHz
- Measuring frequency programmable through software:
Standard version APCI-3701-8/-16: from 2 to 20 kHz
(50 kHz on request)
- Conversion triggered through software, digital input or timer
- End of conversion through software and/or interrupt
- PCI-DMA access
- Onboard FIFO
- Sequence RAM
- 16 digital inputs and outputs, optically isolated, 24 V
- Connection of the transducer through an external box PX3701-8 or -16. The box type depends on the transducer, please order separately.
- Software operation
- Automatic setting of the input levels (gain and offset) acc. to the transducer sensitivity
- Tool for the individual calibration of the transducers with transducer database
- Database for connecting/calibrating a large range of industry-standard transducers (APCI-3701-8, or -16):
 - Solartron • Tesa • Marposs • Schlumberger
 - Peter & Hirt • Mahr • RDP • Schaevitz
 - SMPR Controle • Knäbel

Safety features

- Input filters
- Diagnostic function in case of short-circuits or line break

APCI-3701

Acquisition of 16 or 8 inductive transducers

Half-bridge, LVDT, Knäbel

16-bit resolution

16 digital inputs and outputs, optically isolated

Measurement of different transducer types with the same board!

Applications

- Gear wheel control
- Gauge block
- Acquisition of sensor data
- Quality control
- Industrial process control
- Automatic parts control
- R&D Instrumentation

Software

ConfigTools (supplied with the board)

- Easy transducer calibration
- Step by step from the transducer selection up to testing each single channel.
- Database with more than 50 pre-calibrated transducers
- Update of the APCI-3701 firmware

Standard drivers for:

- Linux (real-time)
- 32-bit drivers for Windows 7/Vista/XP/2000 (real-time)
- Signed 64-bit drivers for Windows 7 and XP

Drivers for the following compilers and software packages:

- Microsoft VC++ • Borland C++ • Visual Basic • Delphi
- LabVIEW • LabWindows/CVI

ADDIPACK functions:

Transducer • Timer • Digital input • Digital output

On request:

Further operating systems, compilers and samples

Driver download: www.addi-data.com, download menu



Connection box for transducers

Specifications

Inputs for inductive transducers

Channel features	
Number	-4/-8/-16/ multiplexed
Input type	Single ended
Coupling	DC
Resolution	24-bit
Sampling rate f_s	On 1 channel At primary frequency f_p of 4.883 kHz $f_s = f_p$ 9.768 kHz 13.951 kHz 19.531 kHz
	Ab $n \geq 2$ channels $f_p =$ primary frequency SP . Settling period $5 \leq SP \leq 255$ $f_s = \frac{f_p}{SP \times n}$ f_s here concerns all n channels
Example with TESA GT21	On one channel $f_s = f_p = 13.951$ kHz Ab $n \geq 2$ channels $f_s = \frac{13.951 \text{ kHz}}{5 \times 4} = 697.5$ Hz for 4 channels $f_s = \frac{13.951 \text{ kHz}}{5 \times 8} = 348.7$ Hz for 8 channels $f_s = \frac{13.951 \text{ kHz}}{5 \times 16} = 174.4$ Hz for 16 channels

Input level

Input impedance	2 k Ω software-programmable 10 k Ω , 100 k Ω , 10 M Ω
Input ranges	± 3 V single ended
Sensor supply (sinus generator)	
Type	Sinus differential (180° phase-shift)
Coupling	AC
Programmed signals:	
Output frequency f_p (primary frequency)	2-20 kHz depending on the transducer (50 kHz Knäbel)
Output impedance	< 0.1 Ω typ., > 30 k Ω typ. in shutdown mode
Short-circuit current	0.7 A typ. at 25°C with thermal protection

Digital I/O

Number of I/O channels:	8 dig. inputs, 8 dig. outputs, 24 V
Optical isolation:	1000 V through opto-couplers
Input current at 24 V:	3 mA typ.
Max. input frequency:	5 kHz
Max. switching current:	50 mA typ.
Input range:	0-30 V
Output range:	5-30 V

EMC – Electromagnetic compatibility

The product 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.

Physical and environmental conditions

Dimensions:	140 x 99 mm
System bus:	PCI 32-bit 3.3/5 V acc. to spec. 2.2 (PCISIG)
Space required:	1 PCI slot for analog inputs, 1 slot opening for digital I/O with FB3701
Operating voltage:	+5 V, $\pm 5\%$ from the PC; 24 V external
Current consumption (+ 5 V from the PC):	APCI-3701-8: typ. 630 mA APCI-3701-16: typ. 800 mA
Front connector:	50-pin D-Sub male connector
Additional connector:	16-pin male connector for connecting the dig. I/O
Temperature range:	0 to 60 °C (with forced cooling)

APCI-3701

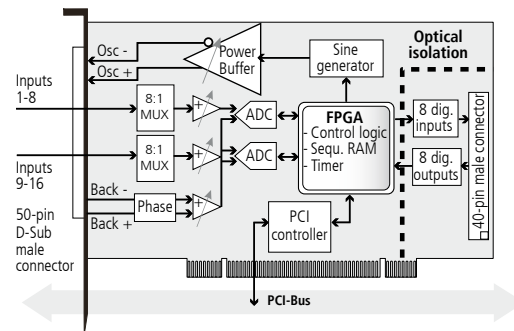
Length measurement board, 16-bit, 16 or 8 inductive transducers, LVDT, half-bridge, Knäbel.
Incl. technical description and software drivers.

APCI-3701-8:	For 8 inductive transducers
APCI-3701-16:	For 16 inductive transducers
APCI-3701-8-K:	For 8 Knäbel inductive transducers
APCI-3701-16-K:	For 16 Knäbel inductive transducers

Accessories:

FB3702:	Ribbon cable for digital I/O
PX901-ZG:	Screw terminal panel for digital I/O, for DIN rail
ST010:	Standard round cable, shielded, twisted pairs, 2 m

Simplified block diagram



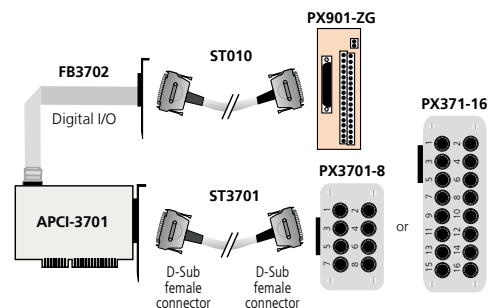
Pin assignment

50-pin D-Sub male connector (APCI-3701-16)

Pin	Pin	Pin	Pin
34 BACK+	18 BACK+	34 18	1 BACK+
35 BACK-	19 BACK-	35 19	2 BACK-
36 OSC+	20 OSC+	36 20	3 OSC+
37 OSC+	21 OSC+	37 21	4 OSC+
38 OSC-	22 OSC-	38 22	5 OSC-
39 PWRGND	23 OSC-	39 23	6 OSC-
40 CH0	24 PWRGND	40 24	7 PWRGND
41 PWRGND	25 CH2	41 25	8 CH1
42 CH3	26 PWRGND	42 26	9 PWRGND
43 PWRGND	27 CH5	43 27	10 CH4
44 CH6	28 PWRGND	44 28	11 PWRGND
45 PWRGND	29 CH8	45 29	12 CH7
46 CH9	30 PWRGND	46 30	13 PWRGND
47 PWRGND	31 CH11	47 31	14 CH10
48 CH12	32 PWRGND	48 32	15 PWRGND
49 PWRGND	33 CH14	49 33	16 CH13
50 CH15		50 33	17 PWRGND

Osc +/-:	Phase-shifted supply signal of the inductive transducers
Back +/-:	Return lines of the supply voltage for measuring the amplitude. Actual value signal of the oscillator for the supply voltage.
CHx:	Transducer input and input number
PWRGND:	Ground

ADDI-DATA connection

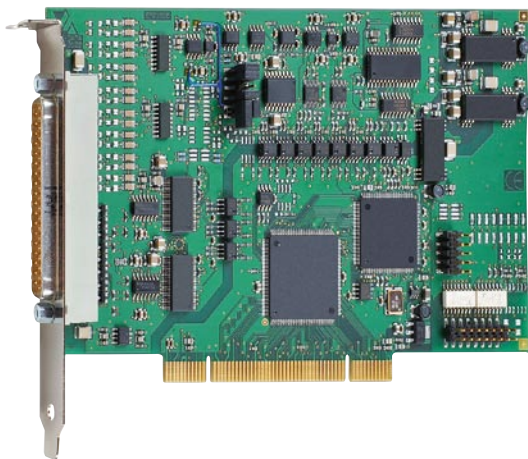


Ordering information

Accessories for half-bridge and LVDT transducer:

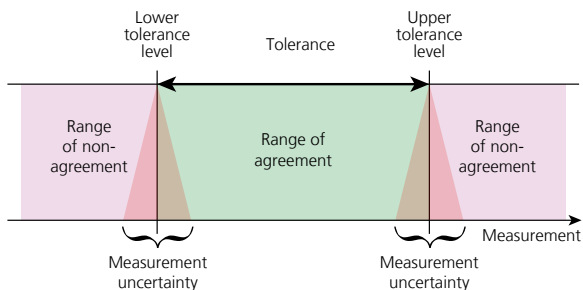
PX3701HB-8:	Connection box of the APCI-3701-8, 8 x half-bridge
PX3701HB-16:	Connection box of the APCI-3701-16, 16 x half-bridge
PX3701LVDT-8:	Connection box of the APCI-3701-8, 8 x LVDT
PX3701LVDT-16:	Connection box of the APCI-3701-16, 16 x LVDT
ST3701:	Connection cable between APCI-3701 and Connection box PX3701

PCI BOARDS: ANALOG I/O



High-precision measurement in the field

There are numerous measurement systems that provide precise data under laboratory conditions. This is different in the production or in outdoor areas, where the conditions are considerably more demanding. There the measurement results play a central role. Rework and defective goods can only be effectively reduced if the tolerance testing during the production process is precise enough to sort products reliably as being within or without the tolerance range. The importance of accuracy appears even clearer in cases where the measurement is used for regulation.



Precise even in case of temperature drift

Temperature drift can be caused by the surrounding temperature as well as by the board itself. To ensure the accuracy of the measurement, on the one hand we are careful to use only high-quality components with little drift. On the other hand we pay a lot of attention to the board layout. For example, components that generate heat are placed where they will not heat up the other components unnecessarily.

Precision through interference resistance

Not only the quality of the A/D converter is important but the interference resistance of the whole chain of acquisition has to be analysed, from the sensors to the acquisition board. Therefore in addition to our PC boards we offer robust cables and screw terminal boards that are intended for the use in a harsh industrial environment.

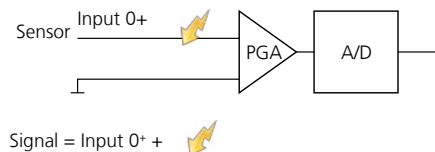
High-precision measurement

Measurement technology is the basis of every automation process. Therefore the accuracy of the sensor acquisition is highly important. The environment of a production line with a lot of interference requires peak performance from the measurement technology. For more than 25 years, ADDI-DATA has been developing analog boards for data acquisition intended for an industrial environment: they are robust, precise and fast.

Single-ended or differential inputs

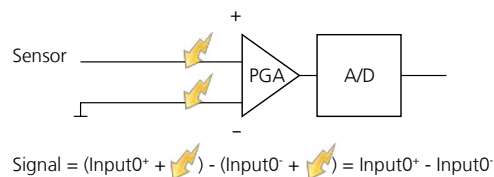
When measuring input voltage you can choose between 2 modes with important differences:

Single-ended mode – One-wire inputs connected to the system ground.



When acquiring analog signals in the single-ended mode, interfering signals are acquired with the signal. Therefore this mode is only advisable in case of high voltage levels and short lines.

Differential mode – Two-wire inputs



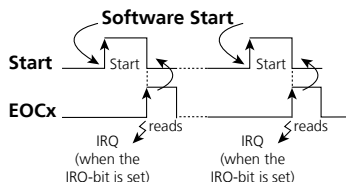
Interference signals affecting both lines are not included in the measurement because of the difference on the input. This is the optimal mode for measurement lines with a lot of interferences and long lines.

Acquisition modes of the analog inputs

There are four modes available for analog inputs. The following is a short overview of the settings available for data acquisition:

A. Simple mode

The software initiates and starts the A/D conversion and reads out the digital values of one or more channels after the end of conversion.



B. Sequence modes

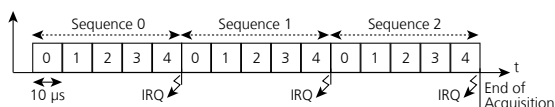
With the DMA function (Direct Memory Access) for a direct data exchange with the PC memory

There are 2 available sequence modes:

1. Simple sequence mode

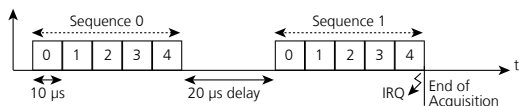
In this example the interrupt is generated at the end of each sequence after 5 acquisitions.

The complete acquisition process ends after 3 sequences.



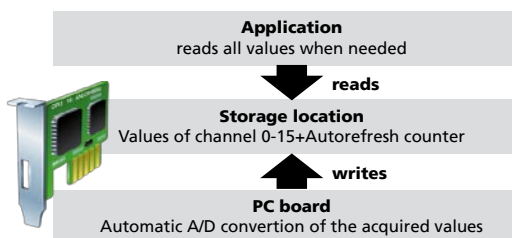
2. Sequence mode with delay

In this example the delay time between the end of one sequence and the start of the next sequence is 20 μs.



C. Auto refresh mode

The analog acquisition is initialised and the values of the channels are written in a buffer on an analog board. The PC reads the data asynchronously to the acquisition.

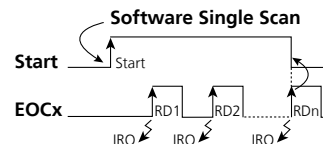


D. Scan mode

There are 6 different scan modes:

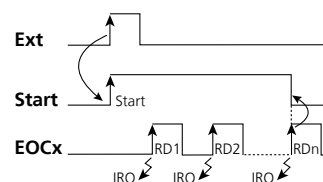
1. Software single scan

The interrupt routine of the user is called up after the last IRQ.

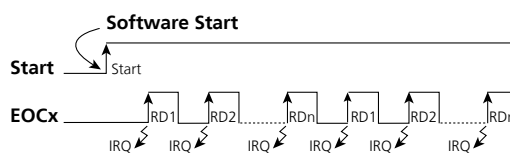


2. Hardware triggered single scan

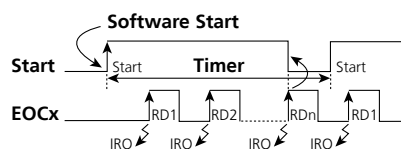
This scan can be triggered with increasing or decreasing edge. The hardware trigger allows to start the acquisition independently from the software or to start the acquisition of more than one board at the same time.



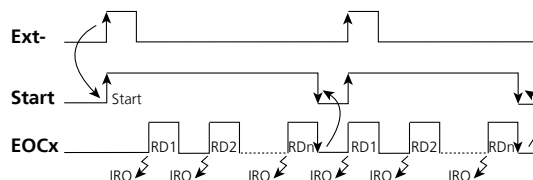
3. Continuous scan (software)



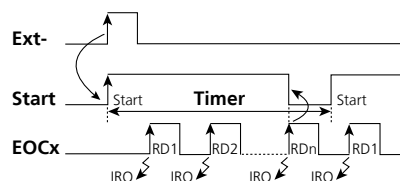
4. Continuous scan with timer delay (software)



5. Continuous scan (hardware)

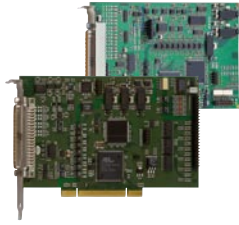


6. Continuous scan with timer delay (hardware)



PCI BOARDS: ANALOG I/O

Multifunction, analog input and analog output boards for 3.3 V or 5 V PCI








	Multifunction boards			Analog input boards					Analog output boards		
	APCI-3120	APCI-3110	APCI-3116	APCI-3010	APCI-3016	APCI-3002	APCI-3003	APCI-3001	APCI-3504	APCI-3504C	APCI-3501
32-bit PCI bus	3.3/5 V	3.3/5 V	3.3/5 V	3.3/5 V	3.3/5 V	3.3/5 V	3.3/5 V	3.3/5 V	5 V	5 V	3.3/5 V
FPGA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Simultaneous acquisition							✓				
Analog inputs											
Single Ended	16/8	16/8	16/8	16/8/4	16/8/4			16/8/4			
Differential	8/4	8/4	8/4	8/4/2	8/4/2	16		8/4			
Diff. separated from each other							4				
Resolution (-bit)	16	12	16	12	16	16	16	12			
Optical isolation	500 V	✓	✓	✓	✓	✓	✓	✓			
Throughput (kHz)	100	200	200	200	200	200	400/ channel	100			
Voltage range											
0-10 V; ± 10 V / 0-5 V; ± 5 V 0-2 V; ± 2 V / 0-1 V; ± 1 V	✓	✓	✓	✓	✓	✓	✓	✓			
Other ranges (optional)	0-20 mA	0-20 mA	0-20 mA	0-20 mA	0-20 mA	0-20 mA	0-20 mA	0-20 mA			
Gain 1, 2, 5, 10	✓	✓	✓	✓	✓	✓	✓	✓			
FIFO (value)	256	512	512	512	512	512	1024	256			
Functions of the analog inputs											
DMA (scatter gather, single, continuous, Sequence)		✓	✓	✓	✓	✓	✓	✓			
DMA (single, continuous, Sequence)	✓							✓			
Auto Refresh		✓	✓	✓	✓	✓	✓	✓			
Interrupt	✓	✓	✓	✓	✓	✓	✓	✓			
Programmed I/O	✓	✓	✓	✓	✓	✓	✓	✓			
Trigger:											
Software	✓	✓	✓	✓	✓	✓	✓	✓			
TTL input	-	-	-	-	-	-	-	-			
24 V input	✓	✓	✓	✓	✓	✓	✓	✓			
Sequence RAM	✓	✓	✓	✓	✓	✓	✓	✓			
Analog outputs	4 or 8	4	4						4	4	4 or 8
Resolution (-bit)	14	12	12						12	12	14
Optical isolation	✓	✓	✓						✓	✓	✓
0-10 V ± 10 V	✓	✓	✓						✓	✓	✓
Current outputs										0-20 mA	
Setup time	30 µs	15 µs	15 µs						15 µs	70 µs	30 µs
Digital I/O											
24 V inputs, optically isolated	4	4	4	4	4	4	4	4			
24 V outputs, optically isolated	4(OpenC)	4(50mA)	4(50mA)	4(50mA)	4(50mA)	4(50mA)	4(50mA)	4(OpenC)			2 2(OpenC)
TTL I/O		24	24	24	24						
Timer/Counter/Watchdog (depth) and/or	1 / - / 1 24-bit	3 / 3 / 2 16-bit	3 / 3 / 2 16-bit	3 / 3 / 1 16-bit	3 / 3 / 1 16-bit	1 / - / - 16-bit	1 / - / - 16-bit	1 / - / - 16-bit	1 / - / - 12-bit	1 / - / - 12-bit	1 / - / - 12-bit
Page	138	140	140	142	142	144	146	148	150	150	152
Software	Current driver list on the web: www.addi-data.com										



Temperature, pressure, noise, vibration and length measurement

New!

	Temperature measurement	Pressure measurement	Noise and vibration measurement	Length measurement	
					
	APCI-3200	APCI-3300	APCI-3600	APCI-3702	APCI-3701
64-bit or 32-bit PCI-Bus	3.3 V / 5 V	3.3 V / 5 V	3,3 V / 5 V	3.3 V / 5 V	3.3 V / 5 V
FPGA			✓		
Noise and vibration			✓		
Thermocouples J,K,T,E,R,S,B,N Pt100, Pt1000	✓				
Strain gauges		✓			
Inductive transducers				Half Bridge, LVDT	Half Bridge, LVDT
Signal conditioning			8 current sources for connecting ICP™ sensors		
Analog inputs	4 groups 4 channels	4 groups 4 channels			
Single Ended (SE)/ differential (diff.)	16 thermo/8 RTDs 8 thermo/4 RTDs 4 thermo/2 RTDs	8/4 inputs for strain gauges	8/8	5 channels <i>simultaneous</i> acquisition for induct. displacement transducers	16/8/1 channels for inductive displacement transducers
Resolution (-bit)	18	18	24	16	16
Optical isolation	✓	✓			
Throughput	20-160 Hz	20-160 Hz	2-200 kHz (through software)	depends on transducer type	depends on transducer type 2-20 kHz (50 kHz opt.)
Voltage ranges	+ 1.25 V	+ 1.25 V	± 10 V		
Gain	1, 2, 4, 8, 16, 32, 64, 128	1, 2, 4, 8, 16, 32, 64, 128		depends on transducer type	depends on transducer type
FIFO (Values)			128 DWORD		
Functions of the analog inputs					
DMA (scatter gather; single; continuous; Sequence)			scatter gather free run, ring buffer	✓	✓
Auto Refresh				✓	✓
Interrupt	✓	✓	✓	✓	✓
Programmed I/O	✓	✓	✓	✓	✓
Trigger: Software 24 V input	✓ ✓	✓ ✓	✓ ✓	✓ ✓	✓ ✓
Sequence RAM				✓	✓
Analog outputs					
Resolution (-bit)			2		
Optical isolation			16		
0-10 V ± 10 V			± 10 V		
Chronometer inputs Gate inputs			4 2		
Timer/Watchdog (depth) in combination, and/or	- / -	- / -	- / -	1 / - 16-bit	1 / - 16-bit
Digital I/O Inputs 24 V, optically isolated Outputs 24 V, optically isolated	4 3 (Open Collector)	4 3 (Open Collector)	8 8 (50 mA)	8 8 (125 mA)	8 8 (125 mA)
Page	154	158	160	164	166
Software	Current driver list on the web: www.addi-data.com				