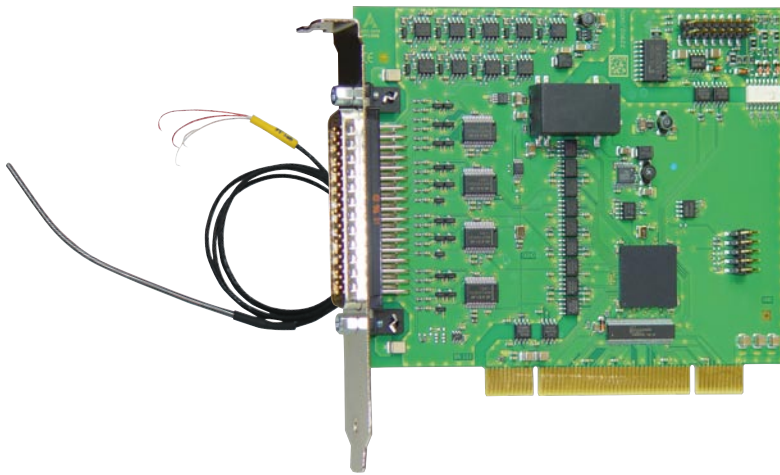# Temperature measurement board, optically isolated, 16/8/4 channels for thermocouples, Pt100, RTD, 18-bit

APCI-3200

Up to 16 channels for thermocouples
or 8 inputs for resistance temperature detectors (RTD)

Mixed configuration of the channels

18-bit resolution

Optical isolation 1000 V

Cold junction compensation on PX3200-G

Software linearisation

RoHS 2002/95/EC

PCI 32-bit

Signed 64-bit drivers for Windows 7/XP

LabVIEW™

LabWindows/CVI™

DIAdem

DASYLab10
Data Acquisition System Laboratory

Features

- PCI 3.3 V or 5 V
- 18-bit resolution, 16-bit accuracy
- Each channel can be configured either to thermo-couples, RTD or as an analog voltage input channel
  - 16 analog inputs for thermocouple types J, K, T, E, R, S, B, N
  - or 8 diff. analog inputs for the acquisition of the resistance temperature detectors (Pt100)
  - or 16 SE/8 differential analog voltage inputs, ± 1.25 V
- 8 independent current sources for resistance tempera-ture detectors (RTD) and one current source for the cold junction compensation
- Cold junction compensation (on separate screw terminal board PX3200-G)
- Gain and offset calibration
- Linearisation through table and calculation for thermocouple types J, K, T, E, R, S, B, N and RTDs
- Programmable gain
- 16-bit accuracy with converter sample rate of 20, 40, 80 or 160 Hz (higher sample rate on request)
- 4 digital inputs, 24 V and 3 digital outputs, open collec-tor, optically isolated
- Base address and IRQ channels set through BIOS
- The board is supplied with a monitoring program for testing and setting the board functions

Safety features

- Optical isolation 1000 V
- Creeping distance IEC 61010-1
- Diagnostic: Short-circuits- and line break detection, depending on the type of sensor used
- Protection against overvoltage (±30 V) and high-frequency EMI

Software drivers

A CD-ROM with the following software and programming examples is supplied with the board.

Standard drivers for:
- Linux
- 32-bit drivers for Windows 8 / 7 / Vista / XP / 2000
- Signed 64-bit drivers for Windows 8 / 7 / XP
- Real-time use with Linux and Windows on request

Drivers and samples for the following compilers and software packages:
- .NET
- Microsoft VC++ • Borland C++
- Visual Basic • Delphi
- LabVIEW • LabWindows/CVI • DIAdem

ADDIPACK functions
• Analog input • Temperature • Resistance • Digital input
• Digital output

On request:
Further operating systems, compilers and samples.

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

Simplified block diagram

16 SE/8 diff.
or
8 SE/4 diff.
or
4 SE/2 diff.

Protective circuits and filters

Low-pass filters

Current source

A/D converter

A/D converter

A/D converter

A/D converter

Optical isolation

DC/DC converter

Opto-couplers

16-pin male connector

4 dig. inputs
3 dig. outputs

Opto-couplers

FPGA
- Control logic
- Sequence
- Timer

PCI controller

50-pin
D-Sub
connector

PCI bus
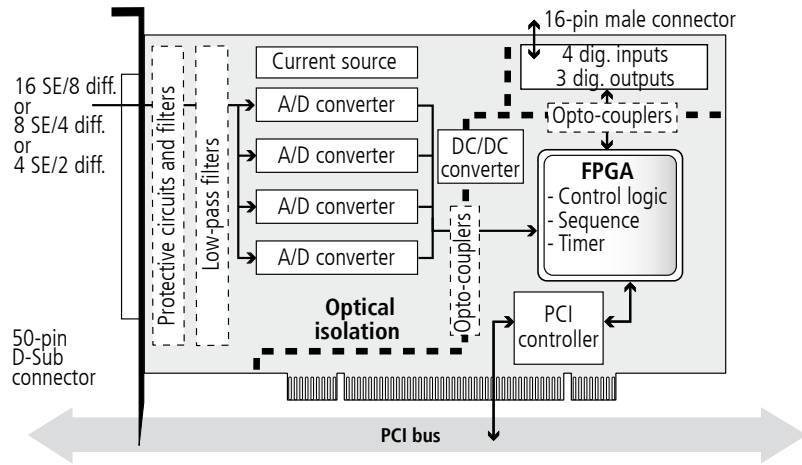
Specifications

Analog inputs

Analog inputs:	- 16 x thermocouples or
	- 8 x RTD with 2 or 4 wire connection or
	- 4 x RTD with 3 wire connection
	or 16 SE/8 diff. inputs, ± 2.5 V
Resolution:	18-bit
Accuracy:	16-bit
Input amplifier:	1, 2, 4, 8, 16, 32, 64, 128
Conversion start:	Through software or external trigger

Digital I/O

Number of I/O channels:	4 digital inputs, 24 V,
	3 digital outputs, 24 V,
	125 mA typ., open collector
Logical "0" level:	0-5 V
Logical "1" level:	12-30 V
Optical isolation:	1000 V through opto-couplers for analog
	and digital channels

Sampling frequencies

Selectable

Sampling frequencies f_{ADC} f_{ADC} = 160 Hz, 80 Hz, 40 Hz or 20 Hz

Various sampling rates F_S in „Read 1" and in „Scan" mode depending on the type of transducer RTD or thermocouple (TC)

Sensor	Selectable sampling frequencies f_{ADC}	Sampling frequencies im „Read 1" Mode	Sampling frequencies in „Scan" Mode	
RTD (Pt100…)	160 Hz	53 Hz / channel	32 Hz	for 2, 4, 6 and/or 8 channels
	80 Hz	26 Hz / channel	16 Hz	
	40 Hz	13 Hz / channel	8 Hz	
	20 Hz	6 Hz / channel	4 Hz	
Thermo-couples	160 Hz	26 Hz / channel	23 Hz	for 4, 8, 12 and/or 16 channels
	80 Hz	16 Hz / channel	11 Hz	
	40 Hz	6 Hz / channel	6 Hz	
	20 Hz	3 Hz / channel	3 Hz	

Four cases are possible:

1. „Read 1" mode with RTD

$$F_s = \frac{f_{ADC}}{3}$$

With RTD (Pt100…) 3 values are acquired at each measurement:
- the measured value,
- the offset,
- the reference voltage.

F_s = 53 Hz, 26 Hz, 13 Hz, 6 Hz

2. „Read 1" mode with thermocouples (TC)

$$F_s = \frac{f_{ADC}}{6}$$

With TC 2 x 3 values are acquired at each measurement:
- the measured value,
- the offset,
- the reference voltage.

One time for the acquisition value and one time for the cold junction compensation.

F_s = 26 Hz, 13 Hz, 6 Hz, 3 Hz

3. „Scan" Mode with RTD

$$F_s = \frac{f_{ADC}}{5}$$

With RTD (Pt100…) 5 values (unipolar, diff.) are acquired per scan measurement to sample 2 channels: for 2 values for 1, 2, 3 and/or 4 modules

F_s = 32Hz, 16Hz, 8Hz, 4Hz

4. „Scan" Mode with thermocouples (TC)

$$F_s = \frac{f_{ADC}}{7}$$

With TC 7 values (bipolar, SE) are acquired, per scan measurement to sample 4 channels: for 4 values for 1, 2, 3 and/or 4 modules

F_s = 23 Hz, 11 Hz, 6 Hz, 3 Hz

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:	131 x 99 mm
System bus:	PCI 32-bit 3.3/5 V acc. to spec. 2.2 (PCISiG)
Space required:	1 PCI slot and
	1 slot opening for the digital I/O
Operating voltage:	+5 V, ±5 % from the PC
Current consumption (typ.):	550 to 600 mA depending on the version
Front connector (analog channels):	50-pin D-Sub male connector
Additional connector :	16-pin male connector for connecting the digital I/O
	via ribbon cable with 37-pin D-Sub connector
Operating temperature:	0 to 60 °C (with forced cooling)

Thermocouples accuracy

Type DIN EN 60584	Range		Accuracy (+/-)
Type J	-200.0 °C	-0.1 °C	±0.6 °C
	0.0 °C	+599.9 °C	±0.2 °C
	+600.0 °C	+1200.0 °C	±0.6 °C
Type T	-200.0 °C	-80.0 °C	±0.7 °C
	-79.9 °C	+400.0 °C	±0.3 °C
Type K	-200.0 °C	-0.1 °C	±0.8 °C
	0.0 °C	+999.9 °C	±0.4 °C
	+1000.0 °C	+1300.0 °C	±0.6 °C
Type E	-200.0 °C	+1000.0 °C	±0.5 °C
Type N	-200.0 °C	-0.1 °C	±1.0 °C
	0.0 °C	+799.9 °C	±0.2 °C
	+800.0 °C	+1300.0 °C	±0.5 °C
Type S	0.0 °C	+399.9 °C	±1.6 °C
	+400.0 °C	+1768.0 °C	±0.7 °C
Type R	0.0 °C	+399.9 °C	±1.6 °C
	+400.0 °C	+1768.0 °C	±0.6 °C
Type B	+400.0 °C	+799.9 °C	±2.0 °C
	+800.0 °C	+1820.0 °C	±1.0 °C

Accuracy of the reference cold junction temperature

Type	Range	Accuracy (+/-)
Pt1000	0° C+60° C	± (0.30 °C + 0.0050 x |T|) (T: Temperature in °C)

Accuracy of the resistance thermometer (RTD)

Type DIN EN 60751	Range		Accuracy (+/-) Worst Case (Gain=1 unipolar)
Pt100	-200.0 °C	+850.0 °C	±0.4 °C
Pt200	-200.0 °C	+850.0 °C	±0.4 °C
Pt500	-200.0 °C	+850.0 °C	±0.3 °C
Pt1000	-200.0 °C	+499.9 °C	±0.2 °C
	+500.0 °C	+850.0 °C	±1.0 °C
Ni100	-60.0 °C	+250.0 °C	±0.3 °C

Accuracy in the temperature range of -20 °C to +40 °C with Pt100

Gain	Accuracy
1	± 0.40 °C
2	± 0.20 °C
4	± 0.15 °C
8	± 0.10 °C
16	± 0.08 °C
32	± 0.08 °C
64	± 0.08 °C

Sensor short-circuit / line break detection

Type	short-circuits	line break
Thermocouple (SE)	no detection	no detection
Resistance thermometer (diff.)	detection	detection
Potentiometer (diff.)	detection	detection

Screw terminal panel with cold junction compensation PX3200-G
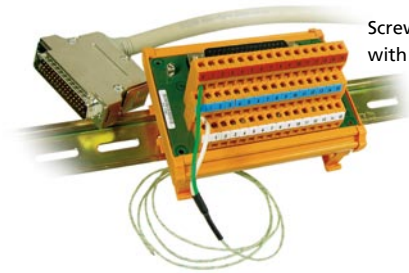
Screw terminal panel PX3200-G with cable ST3200

The PX3200-G screw terminal panel is used for connecting thermocouples/RTDs. It is connected to the APCI-3200 through the ST3200 cable.

The housing of the female connector is connected to two ground terminals so that the board is additionally earthed for more security. All components of the board are enclosed in an earthing strip also connected to the ground terminals.

Each terminal is directly connected to one pin of the 50-pin D-Sub female connector. The designations on the terminals indicate the respective connections for the 50-pin D-Sub female connector.

The PX3200-G features an integrated cold junction compensation.

The voltage (V_{CJC}[1]) is measured through an RTD (Pt1000) at the cold junction and used as reference voltage for the temperature measurement of the thermocouples connected to the panel.

After each acquisition, a new measurement of the cold junction compensation is made for each channel and processed through software.

1   CJC: Cold Junction Compensation

Pin assignment – 50-pin D-Sub male connector

Pin					Pin		Pin		
34	EXC CJC	34		1	CJC IN	1	GND CJC	18	
35	EXC 0	35		2	CH0+	2	CH0-	19	Eingang 0-3 / Modul 0
36	GND 0	36		3	CH1+	3	CH1-	20	
37	EXC 1	37		4	CH2+	4	CH2-	21	
38	GND 1	38		5	CH3+	5	CH3-	22	
39	EXC 2	39		6	CH4+	6	CH4-	23	Eingang 4-7 / Modul 1
40	GND 2	40		7	CH5+	7	CH5-	24	
41	EXC 3	41		8	CH6+	8	CH6-	25	
42	GND 3	42		9	CH7+	9	CH7-	26	
43	EXC 4	43		10	CH8+	10	CH8-	27	Eingang 8-11 / Modul 2
44	GND 4	44		11	CH9+	11	CH9-	28	
45	EXC 5	45		12	CH10+	12	CH10-	29	
46	GND 5	46		13	CH11+	13	CH11-	30	
47	EXC 6	47		14	CH12+	14	CH12-	31	Eingang 12-15 / Modul 3
48	GND 6	48		15	CH13+	15	CH13-	32	
49	EXC 7	49		16	CH14+	16	CH14-	33	
50	CH15-	50		17	CH15+	17			

Pin assignment – 16-pin male connector

24 V	1	2	GND
Dig. output 0 (+)	3	4	Dig. output 0 (-)
Dig. output 1 (+)	5	6	Dig. output 1 (-)
Dig. output 2 (+)	7	8	Dig. output 2 (-)
Dig. input 0 (+)	9	10	Dig. input 0 (-)
Dig. input 1 (+)	11	12	Dig. input 1 (-)
Dig. input 2 (+)	13	14	Dig. input 2 (-)
Dig. input 3 (+)	15	16	Dig. input 3 (-)

ADDI-DATA connection

PX901-ZG

FB3000

Digital I/O

ST010

APCI-3200

PX3200-G

ST3200

D-Sub female connector

D-Sub male connector

Specifications

Possible connections

Versions	Number of thermocouples (SE inputs)	Number of RTDs (diff. inputs)		
		2-wire connection	3-wire connection	4-wire connection
APCI-3200-4	4	2	1	2
APCI-3200-8	8	4	2	4
APCI-3200-16	16	8	4	8

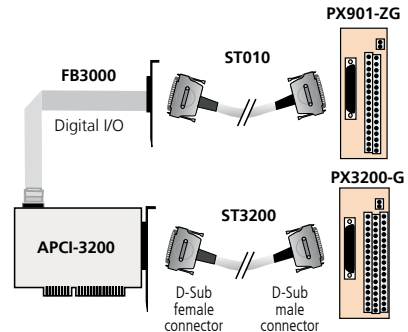|	
Safety features:	Ground terminals
Connector:	50-pin D-Sub female connector
Dimensions of the board:	(L x W x H) 110 x 70 x 45 mm
Dimensions with housing:	(L x W x H) 113 x 87 x 80 mm
Temperature range:	0-70 °C

Ordering information

APCI-3200
Temperature measurement board, optically isolated, 16/8/4 channels for thermocouples, Pt100, RTD, 18-bit.
Incl. technical description, software drivers and monitoring program.

Versions

APCI-3200-16: 16 analog inputs:
16 thermocouples
or 8 RTDs or 16 single-ended
or 8 diff. voltage inputs

APCI-3200-8: 8 analog inputs: 8 thermocouples
or 4 RTDs or 8 single-ended
or 4 diff. voltage inputs

APCI-3200-4: 4 analog inputs: 4 thermocouples
or 2 RTDs or 4 single-ended
or 2 diff. voltage inputs

Accessories

PX3200-G: Screw terminal panel with cold junction compensation and housing for DIN rail.

PX3200: Screw terminal panel with cold junction compensation and 4 mounting holes for wall mounting.

ST3200: Standard round cable, shielded, twisted pairs, 2 m

FB3000: Ribbon cable for digital I/O on separate bracket

PX901-ZG: Screw terminal panel for connecting the digital I/O, for DIN rail

ST010: Standard round cable, shielded, twisted pairs, 2 m
ST011: Standard round cable, shielded, twisted pairs, 5 m