Ethernet system for length measurement, 24-bit 16/8/4 inductive transducers, LVDT, Half-Bridge, Mahr

New!
32 digital I/O (Option)

MSX-E3701 / MSX-E3701-x / MSX-E3700

Acquisition of 4, 8 or 16 inductive transducers

For Half-Bridge, LVDT, Mahr or Knaebel transducers

Digital output 24 V with compare logic

24 V digital trigger input

Integrated Ethernet switch

+ 85 °C* / - 40 °C

*Operating temperature

IP 65 IP 40

ARM®9 Technology

Cascadable, can be synchronised in the µs range

Timer function for synchro trigger signal

RoHS 2002/95/EC

on request

DatabaseConnect
see page 112

Q-DAS®

procella®

More information on www.addi-data.com

Features

- ARM®9 32-bit processor
- Robust standardized metal housing
- Power Save Mode: Reduced power consumption when no acquisition runs

Inputs for transducers

- 4, 8 or 16 inputs for transducers, 24-bit, 5-pin M18 female connector
- Half-bridge (HB), LVDT, Mahr compatible, Knaebel
- Diagnostics (short-circuits, line break)
- 16-bit accuracy, example of a measurement:
  Typ TESA GT21, range ± 2 mm (Δ 4 mm),
  $\frac{4\ mm}{2^{16}}$ = ± 61 nm = 0,061 µm

Safety features

- Status LEDs for fast error diagnostics
- Optical isolation
- Input filters
- Overvoltage protection ± 40 V
- Internal temperature monitoring

Interfaces

- Fast 24 V trigger input
- Ethernet switch with 2 ports
- Synchronisation/trigger In/Out
- Line in for 24 V supply and cascading

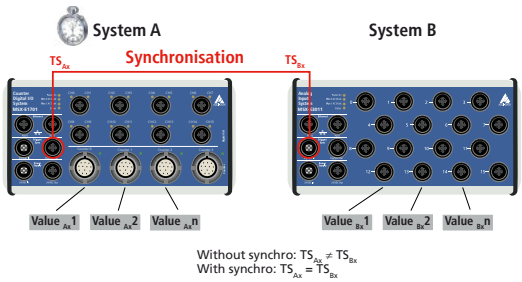
Communication interfaces

- Web server (configuration and monitoring)
- Command server SOAP for transferring commands
- Data server (TCP/IP or UDP socket) for sending acquisition data
- Event server (TCP/IP socket) for sending system events (Diagnostics such as temperature, short-circuits ...)
- Command server Modbus TCP and Modbus (UDP) for sending commands

Synchronisation/time stamp

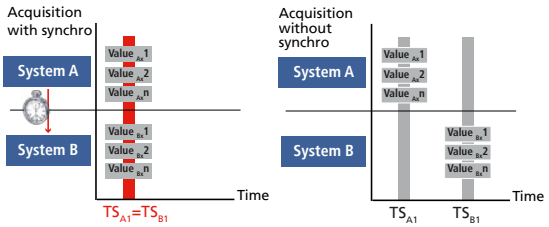
Time stamp

Several MSX-E systems can be synchronised with one another in the µs range through a synchro connection. This allows to start a synchronous data acquisition, to generate trigger events and to synchronise the time on several MSX-E systems. Furthermore, the systems have a time stamp that logs the point in time at which the data was acquired by the system.



Without synchro: $TS_{Ax} \neq TS_{Bx}$
With synchro: $TS_{Ax} = TS_{Bx}$

The combination of synchronisation and time stamp (TS) allows the clear allocation of signals that were captured by several systems.



Drivers and samples
Find software for the MSX-E systems at:
www.addi-data.com/downloads

Phone: +49 7229 1847-0 info@addi-data.com
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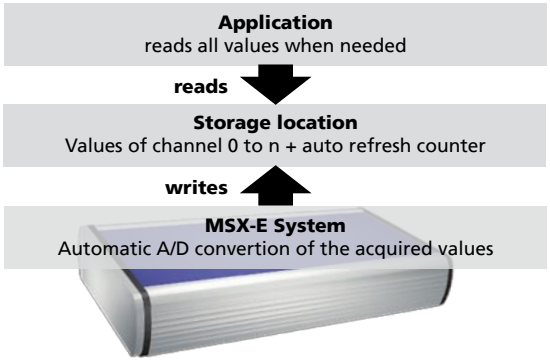
Acquisition modes

Auto-refresh mode

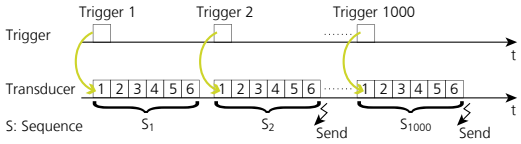
In the auto-refresh mode, the measurement values are updated automatically after each acquisition. The acquisition is initialised once and the values of the channels are stored in the memory of the MSX-E Ethernet system. The client (e.g. PC, server, PLC, ...) reads the acquired values asynchronously to the acquisition through socket connection, SOAP or Modbus function. Thereby, the new value is read and the old values are overwritten.
In addition to the measurement values, the auto-refresh counter can also be read, which allows to sort the measurement values chronologically. The auto-refresh mode can be combined with a hardware or a synchro trigger and also allows the automatic averaging of values.



Sequence Mode

In the sequence mode, a list of channels is acquired. Thereby, the single measurement rows are stored one after another. The client receives the acquired values asynchronously to the acquisition through a socket connection. In the sequence mode, the measurement values are read in chronological order, this means the oldest values are read first.
The acquisition can be effected continuously, with or without delay or in combination with a hardware or synchro trigger.

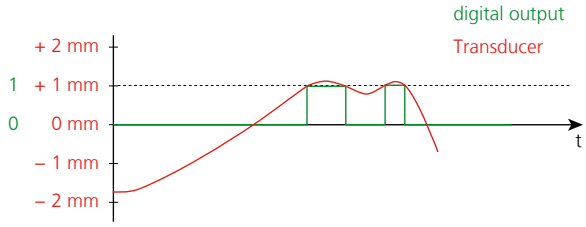
Example: Sequence acquisition of 6 channels, 1 Trigger for each sequence sending data after 2 sequences – a total of 1000 sequences



Digtal output with Compare logic

The MSX-3701-x-4 system can optionally be equipped with a digital 24 V output with Compare logic (OPT. MSX-E Dig. Out). This output can be set either manually or through a transducer.
This allows easy threshold value monitoring, e.g. probing a workpiece and then automatically sending an message to a PLC.

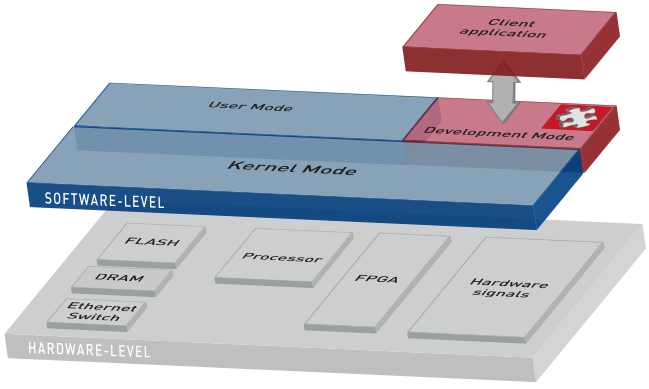
Example: Transducer channel 0, TESA GT21, range ± 2 mm, threshold value: + 1 mm



Onboard programming / stand-alone operation

Development mode

With the Development mode of the MSX-E systems you can customise your measurement, control and regulation applications to fit your requirements. The programs run directly on the MSX-E systems, which has two advantages: external PCs are relieved and you can process data freely according to your requirements. This helps you to improve the efficiency of your processes and to secure your investments.



* Preliminary product information

ConfigTools

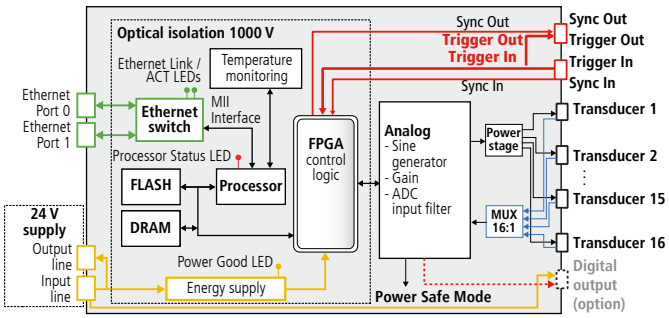
The **ConfigTools** program allows an easy administration of the MSX-E systems. These are automatically detected in the network. **ConfigTools** consists of common and specific functions.
In addition, with **ConfigTools**, the complete configuration of a MSX-E system can be saved and transferred to another system of the same type (clone function).

ConfigTools is included in the delivery.

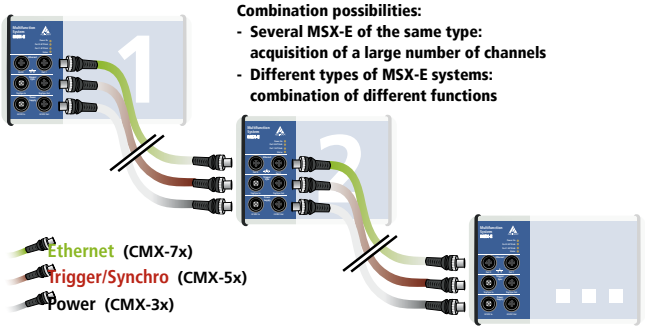
ConfigTools functions for MSX-E3701 / MSX-E3701-x / MSX-E3700:

- Change of IP address
- Display of web interface
- Firmware update
- Save/load system configuration
- Save/load channel configuration
- Transducer calibration
- Transducer database
- Transducer monitoring
- Transducer diagnostics

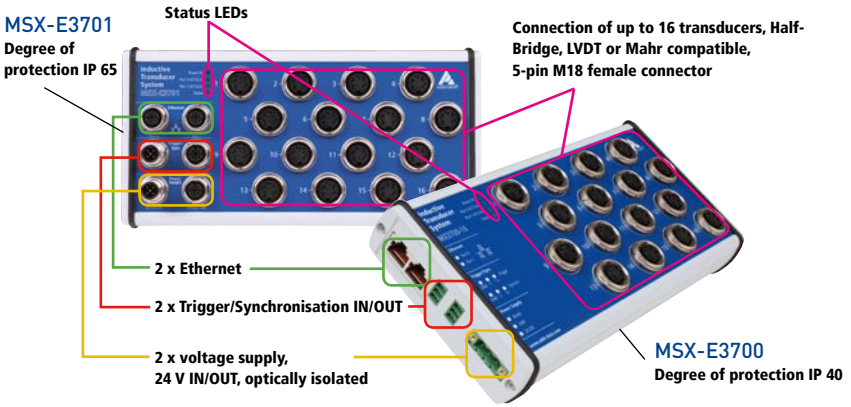
Simplified block diagram



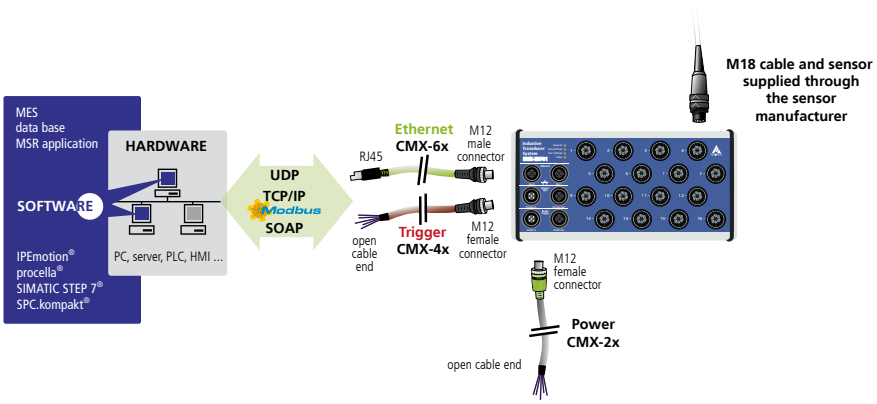
Cascading

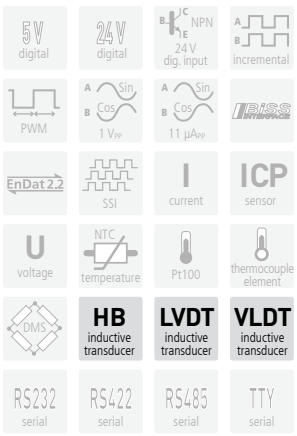


Features



ADDI-DATA connection technology





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Specifications

Inputs for inductive transducers

Channel features

Number:	-4/-8/-16/ multiplexed	
Input type:	single-ended	
Coupling:	DC	
Resolution:	24-bit	
Sampling frequency f_s:	On 1 channel	At primary frequency f_P of 5 kHz, 7.69 kHz, 10 kHz, 12.5 kHz, 20 kHz, 50 kHz
	$f_s = f_P$	
	Ab n ≥ 2 channels	f_P = primary frequency SP . Settling period 5 ≤ SP ≤ 255
	$f_s = \frac{f_P}{SP \times n}$	f_s concerns here all n channels
Example with TESA GT21:	On 1 channel	$f_s = f_P$ = 12.5 kHz
	From n ≥ 2 channels	$f_s = \frac{12.5\ kHz}{5 \times 4}$ = 625 Hz for 4 channels
		$f_s = \frac{12.5\ kHz}{5 \times 8}$ = 312.5 Hz for 8 channels
		$f_s = \frac{12.5\ kHz}{5 \times 16}$ = 156.25 Hz for 16 channels

Input level

Input impedance:	2 kΩ software-programmable 10 kΩ 100 kΩ 10 MΩ

Sensor supply (sine generator)

Type:	Sine differential (180° phase-shift)
Coupling:	AC
Programmed signals: output frequency f_P (primary frequency)	2-20 kHz depending on the transducer (50 kHz Knaebel)
Output impedance:	< 0.1 Ω typ. > 30 kΩ typ. in shutdown mode
Short-circuit current:	0.7 A typ. at 25 °C with thermal protection

Voltage supply

Nominal voltage:	24 V	⎓
Voltage supply:	18-30 V	
Optical isolation:	1000 V	
Current consumption at 24 V:	90 mA	typ. in power safe mode / idle
	120 mA	Power on
	150 mA	DAC init, sine on, Buffer off
	200 mA	typ. without load (transducers) at ± 9 V power (Buffer on)
	320 mA	typ. with 16 Solartron AX1S transducers at ± 7 V power, 5 kHz and 3 V_{rms}
	330 mA	typ. with 8 Knaebel IET0200 transducers at 5 V power, 50 kHz and 1 V_{rms}
Reverse voltage protection		

Digital output (option for MSX-E3701-x-4)

Number of outputs:	1, M12 female connector
Optical isolation:	1000 V through opto-couplers
Output type:	High Side, load to ground acc. to IEC 1131-2
Nominal voltage:	24 V
Voltage supply:	18 V-30 V
Output current:	0.8 A
Short-circuit current / output:	0.8 A max.
RDS ON resistance:	1 mΩ max.
Switch-on time:	21 µs typ. RL = 270 Ω
Switch-off time:	11 µs typ. RL = 270 Ω
Overtemperature (shutdown):	150°C max. (output driver)
Temperature hysteresis:	10°C typ. (output driver)

Ethernet

Number of ports:	2	
Cable length:	150 m	max. at CAT5E UTP
Bandwidth:	10 Mbps	auto-negotiation
	100 Mbps	auto-negotiation
Protocol:	10Base-T	IEEE802.3 compliant
	100Base-TX	IEEE802.3 compliant
Optical isolation:	1000 V	
MAC address:	00:0F:6C:##:##:##, unique for each device	

Trigger

Number of inputs:	1 trigger input
Number of outputs:	1 trigger output
Filters/protective circuit:	Low-pass/transorb diode
Optical isolation:	1000 V
Nominal voltage:	24 V external
Input voltage:	0 to 30 V
Input current:	11 mA at 24 VDC, typical
Input frequency (max.):	2 MHz at 24 V
Connector, common with Synchro	
Trigger input:	1 x 5-pin male connector M12
Trigger output:	1 x 5-pin female connector M12

Synchro

Number of inputs:	1
Number of outputs:	1
Max. cable length:	20 m
Optical isolation:	1000 V
Signal type:	RS485
Connector, common with Trigger	
Trigger input:	1 x 5-pin male connector M12
Trigger output:	1 x 5-pin female connector M12

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.

System features

Interface:	Ethernet acc. to specification IEEE802.3	
Dimensions:	MSX-E3700-16	215 x 110 x 39 mm
	MSX-E3700-4/8	154 x 110 x 39 mm
	MSX-E3701-16	215 x 110 x 50 mm
	MSX-E3701-4/8	154 x 110 x 50 mm
Weight:	MSX-E370x-16:	760 g
	MSX-E370x-8:	560 g
	MSX-E370x-4:	530 g
Degree of protection:	MSX-E3701-4/-8/-16:	IP 65
	MSX-E3700-4/-8/-16:	IP 40
Operating temperature:	MSX-E370x:	-40 °C to + 85°C

MSX-E3701 interface connectors

Ethernet:	2 x 4-pin M12 female connector, D-coded for port 0 and port 1
Trigger/Synchro IN:	1 x 5-pin male connector M12
Trigger/Synchro OUT:	1 x 5-pin female connector M12
Voltage supply	
24 VDC IN:	1 x 5-pin male connector M12
24 VDC OUT:	1 x 5-pin female connector M12

MSX-E3700 interface connectors

Ethernet:	RJ45 for Port 0 and 1
External trigger:	1 x 3-pin binder, 3.81 mm grid
Synchro signal:	1x 3-pin binder, 3.81 mm grid
Voltage supply	
24 VDC:	3-pin binder, 5.08 mm grid

Connectors for connecting inductive transducers

MSX-E370x-4:	4 x 5-pin M18 female connector
MSX-E370x-8:	8 x 5-pin M18 female connector
MSX-E370x-16:	16 x 5-pin M18 female connector

Versions	Temperature range - 40 °C to + 85 °C	Number of transducers	Type of transducer	Digital output 24 V (option)	Degrees of protection
MSX-E3701-HB-16	✓	16	Half-Bridge		**MSX-E3701: Degree of protection IP 65** Protection against a water jet directed at the housing from any direction. Protection against the penetration of dust. Total protection against contact (dust-proof). 
MSX-E3701-HB-8		8			
MSX-E3701-HB-4		4		✓	
MSX-E3701-LVDT-16	✓	16	LVDT		
MSX-E3701-LVDT-8		8			
MSX-E3701-LVDT-4		4		✓	
MSX-E3701-K-8	✓		Knaebel		
MSX-E3701-M-8	✓	8	Mahr compatible		
MSX-E3701-M-4		4		✓	
MSX-E3700-HB-16	✓	16	Half-Bridge		**MSX-E3700: Degree of protection IP 40** Protection against the penetration of foreign bodies with a diameter greater than 1 mm. 
MSX-E3700-HB-8		8			
MSX-E3700-HB-4		4			
MSX-E3700-LVDT-16	✓	16	LVDT		
MSX-E3700-LVDT-8		8			
MSX-E3700-LVDT-4		4			

Ordering information

MSX-E3701 / MSX-E3701-EXT / MSX-E3700

Ethernet system for length measurement, 24-bit, 16/8/4 inductive displacement transducers, LVDT, half-bridge, Mahr-compatible, Knaebel.
Incl. technical description, software drivers and ConfigTools.

MSX-E3701: IP 65, standard system

MSX-E3701-HB-16: For 16 HB inductive displacement transducers
MSX-E3701-LVDT-16: For 16 LVDT inductive displacement transducers
MSX-E3701-HB-8: For 8 HB inductive displacement transducers
MSX-E3701-K-8: For 8 Knaebel induct. displacement transducers
MSX-E3701-LVDT-8: For 8 LVDT inductive displacement transducers
MSX-E3701-HB-4: For 4 HB inductive displacement transducers
MSX-E3701-M-8: for 8 Mahr-compatible displacement transducers
MSX-E3701-LVDT-4: For 4 LVDT inductive displacement transducers
MSX-E3701-M-4: for 4 Mahr-compatible displacement transducers

Options

MSX-E 5V-Trigger: Level change of the trigger inputs and outputs to 5 V
Opt. MSX-E Dig. Out: additional dig. ouptut with compare logic for transducer 0 (only available for MSX-E3701-x-4)

MSX-E3700 (degree of protection IP 40)

Incl. standard binders SMX-10 and SMX-20
MSX-E3700-HB-16: For 16 HB inductive transducers
MSX-E3700-LVDT-16: For 16 LVDT inductive transducers
MSX-E3700-HB-8: For 8 HB inductive transducers
MSX-E3700-LVDT-8: For 8 LVDT inductive transducers
MSX-E3700-HB-4: For 4 HB inductive transducers
MSX-E3700-LVDT-4: For 4 LVDT inductive transducers

Binders for MSX-E3700:

Power Supply
SMX-10: Standard 3-pin binder, 5.08 mm grid, screw connector (included in delivery)
SMX-11: 3-pin binder, 5.08 mm grid, 2-row screw connector
SMX-12: 3-pin binder,5.08 mm grid, 2-row spring-cage connector
Trigger
SMX-20: Standard 3-pin binder, 5.08 mm grid

Options for MSX-E3701 and MSX-E3700

S7 Modbus TCP Client Library for S7: Easy use of the Ethernet systems MSX-E with PLCs

Connection cables

Voltage supply
CMX-2x: Shielded cable, M12 5-pin female connector/open end, IP 65
CMX-3x: For cascading, shielded cable, M12 5-pin female connector/male connector IP 65
Trigger/Synchro
CMX-4x: Shielded cable, M12 5-pin female connector/open end, IP 65
CMX-5x: For cascading, shielded cable, M12 5-pin female connector/male connector IP 65
Ethernet
CMX-6x: CAT5E cable, M12 D-coded male connector/RJ45 connector
CMX-7x: For cascading: CAT5E cable, 2 x M12 D-coded male connector
MSX-E 5V-Trigger: Level change of the trigger inputs and outputs to 5 V
MX-Clip, **MX-Rail** (Please specify when ordering!),**MX-Screw, PCMX-1x**

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Applications

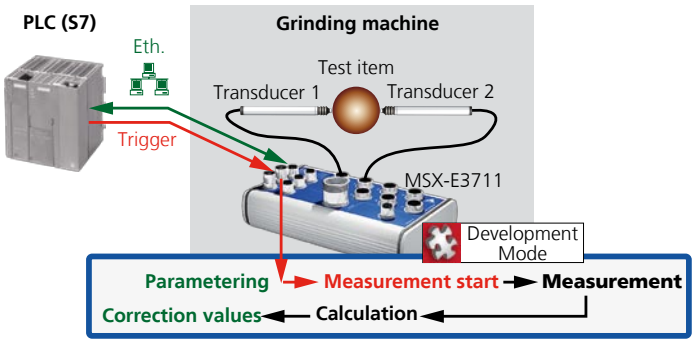
Practical Examples

Machinery

Inline quality control of balls for ball-bearings

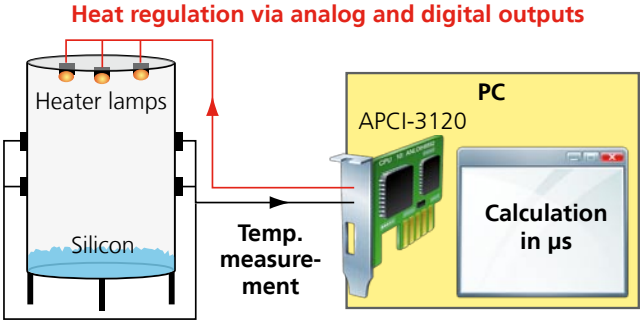
Challenge:
On a grinding machine balls for ball-bearings are ground. After the grinding process the balls are to be measured directly on site and evaluated. Possible correction values for the production process are to be transferred directly to the PLC which controls the grinding machine. For this purpose a very robust measurement technology is required as the measurement is effected on the production site. The application controls whether the dimensions of the balls lie within predefined parameters or not.
If not, the PLC is to initiate the necessary corrections.

Solution:
For this task the robust MSX-E3701 system is used with a development mode application, in which two sensors acquire and measure the balls. The measured values are calculated and compared to the predefined parameters of the PLC.
With this predefined values it is possible to check if the balls have the correct size or if it is necessary to regrind them.
The result of the calculation and the measured values are transferred to the PLC which controls the grinding machine. The PLC can then readjust the grinding process. The capacity to calculate values onboard relieves the PLC, accelerates production cycles and achieves significant improvements in quality.



Temperature regulation for the production of wafers

Challenge:
During the production process, a wafer has to go through several temperature stages, which must be regulated in order to avoid wasting the expensive material.
This involves much data and complex calculations, and therefore a PC-based solution is chosen.
With an analog PC board the values of 32 pyrometers (0 to 10 V) are to be acquired with an acquisition cycle of 1 ms. For regulating the heating lamps, an algorithm is executed on the FPGA of the PC board. Analog and digital outputs are used for controlling and regulating the heating lamps.



Solution:
For the measurement and regulation of the temperature the analog I/O board APCI-3120 for the PCI-bus was chosen. It satisfies all requirements: speed, precision, FPGA technology and long-term availability. Due to its various protective circuits it is suitable for the use in an environment with interferences.