PAC system MSX-Box
for the CompactPCI bus

- Open and transparent Programmable Automation Controller system
- With free development tools
- Live DVD based on open source programs
- Real-time measurement system

PAC systems

Programmable Automation Controller

PAC systems are mainly used for industrial measurement and control or regulation tasks as well as for motion control.

They execute several tasks simultaneously and in a deterministic way.

Core features of a PAC system:

- **Compact and robust design**
- **Programmable**
- **Standard Ethernet (TCP/IP)**
- **CPU board as system controller**
- **Different I/O modules**

Set course for freedom

Experience with the MSX-Box-CPCI what freedom of decision-making really means:

- **You** select the components of your PAC system: The MSX-Box-CPCI is based only on reliable standard technologies like for example CompactPCI backplane. Freedom also means that you can use any of the numerous standard CompactPCI I/O boards.

- **You** decide, whether and when to update your operating system: Using the real-time operating system Linux with RTAI extension, no need to take care of updates. Save time and money!

- **You** have free access to the software down to the kernel source code: You can make extensive system adaptations and realize your own optimized measurement system.

Boost your applications

Working with the MSX-Box-CPCI that fits to your needs will boost your measurement and control applications. The MSX-Box-CPCI is supplied with development tools: You can realize even very complex tasks quite easily.
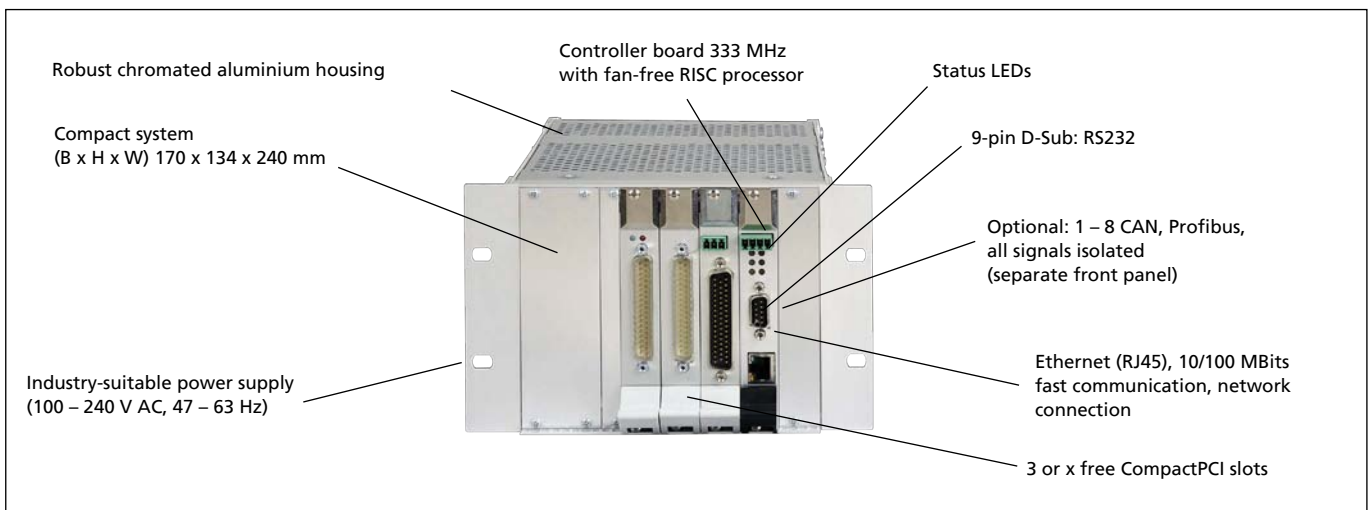
The most important advantage of a PAC system with such a transparent structure is that in case of emergency, you can react fast and efficiently.

Thanks to the long-term ADDI-DATA supply philosophy, you secure your investments for a long time.
Furthermore, the fact that the MSX-Box-CPCI is supplied with free development tools limits the purchase price for serial equipment.

Experience today how to realize your applications of tomorrow:
www.msx-box.com

Robust chromated aluminium housing

Compact system
(B x H x W) 170 x 134 x 240 mm

Controller board 333 MHz
with fan-free RISC processor

Status LEDs

9-pin D-Sub: RS232

Optional: 1 – 8 CAN, Profibus,
all signals isolated
(separate front panel)

Industry-suitable power supply
(100 – 240 V AC, 47 – 63 Hz)

Ethernet (RJ45), 10/100 MBits
fast communication, network
connection

3 or x free CompactPCI slots

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MSX-Box-CPCI-400

CompactPCI controller board

RISC processor:	64-bit MIPS, no fan
Clock:	333 MHz
Memory:	16 MB Flash, 128 MB SDRAM, option up to 256 MB
Installed OS:	Embedded RTAI Linux
Standard interface:	D-Sub 9-pin: 1 x RS232
Safety features:	24 V reset input, H-active; Relay output, freely programmable, closing contact
Optional:	Additional front panel: D-Sub 25-pin: 1 – 8 CAN, Master/Slave, isolated D-Sub 9-pin: 1 x Profibus/Slave, isolated
Transfer rate:	10/100 MBits

Mains supply unit

Input voltage:	100 V – 240 V, AC, 47 – 63 Hz (other voltage on request)
Output voltage:	5 V (depending on the system)
Noise immunity:	Short circuit, overload, overvoltage
Connection:	Power cable, 2 m

CompactPCI backplane with 4 CompactPCI slots

CompactPCI slots:	Total amount: 4 Reserved: 1 x CompactPCI controller board Free: for 3 additional CompactPCI boards
Specification:	PCI specification PICMG rev. 2.1. PICMG2.0 R3.0 CPCI Core Specification V I/O +5V

MSX-Box-CPCI-xxxx

Same as MSX-Box-CPCI-400, but with a CompactPCI-Backplane with x slots, incl. x-1 free slots for CompactPCI boards

Mains supply unit

Input voltage:	100 V – 240 V, AC, 47 – 63 Hz (other voltage on request)
Output voltage:	5 V, 3,3 V, ±12 V (depending on the system)
Noise immunity:	Short circuit, overload, overvoltage
Connection:	Power cable, 2 m

CompactPCI backplane with x CompactPCI slots

Number of the CompactPCI slots according to requirements	Reserved: 1 x CompactPCI controller board, further slots free for CompactPCI boards
Specification:	PCI specification PICMG rev. 2.1. PICMG2.0 R3.0 CPCI Core Specification PICMG 2.6 Bridging Specification (according to requirements) V I/O +5 V

For MSX-Box-CPCI-400 and -xxxx

Extensive software support

Free development tools (GNU compiler, Cygwin, samples in source code …), Knoppix Live-DVD development environment.

Housing

Material:	Chromated aluminium
Heat dissipation:	Through programmable fan
Temperature range:	0 – 60 °C
Temperature monitoring:	Configuration at delivery: 5 °C to 45 °C, min. and max. value programmable through software. The temperature value can be monitored. Resolution: 1 °C
Front openings:	for 3 CompactPCI boards and 1 bracket (MSX-Box-CPCI-400) for x CompactPCI boards and 1 bracket (MSX-Box-CPCI-xxxx)
Housing dimensions: (L x H x W)	170 x 134 x 240 mm (without fan) (MSX-Box-CPCI-400)
Weigth:	approx. 2.5 kg (standard MSX-Box-CPCI-400 system)
Status display:	6 LEDs, incl. 4 freely programmable

Optional accessories

Cable:	Ethernet patch cable 2 m, shielded, RJ45 connector (PC ↔ MSX-Box-CPCI)

i You will find a large range of adapted CompactPCI boards on page 240

Ordering information

MSX-Box-CPCI: PAC system, incl. development tools (GNU compiler, Cygwin, source code samples, …) and technical description

Versions
MSX-Box-CPCI-400:   4 CompactPCI slots (incl. 1 slot reserved for the controller board; 3 free slots)
MSX-Box-CPCI-xxxx: x CompactPCI slots (incl. 1 slot reserved for the controller board; x-1 free slot)

Options
MSX-256MB: Memory extension up to 256 MB

MSX-Basis: Basic equipment for the options MSX-CAN, MSX-Profibus, MSX RTSync
MSX-CAN-x: 1/2/4/8 x CAN bus, master/slave, optically isolated, incl. FB-CPCI-CAN
MSX-Profibus: 1 x Profibus, slave
  FB-Profibus: FB-CPCI-Profi (please order separately)
MSX-RTSYNC: for the synchronisation of several MSX-Boxes (with time stamp), incl. FB-CPCI-RTSync

On request: further housing dimensions

Measurement and control directly in the field

The intelligent Ethernet systems of the MSX-E series are especially suited for industrial measurement, control and regulation tasks directly at the measuring point.
They are mounted in robust metal housings and comply with the degrees of protection IP67/IP 65/IP 40. Furthermore, they can be used in a temperature range from –40 C to +85 °C as they are equipped with many protective circuits. The Ethernet systems can be freely cascaded and synchronised in the µs range. Sensors can be connected directly to the measurement systems through screw connectors.

HIGHLIGHTS

- Designed for use in the field
- ARM®9 processor
  for intelligent systems
- Stand-alone operating
- Easy configuration

Driverless installation
The installation of the MSX-E systems is fast and easy: After connecting the systems just click on „import web services" in your compiler and enter the IP address of your MSX-E system. Then open the WSDL file, where all functionalities are described. After that you can access all system functionalities without driver installation. To get remote access to the system from a distant PC, each system has a SOAP server. The data transfer is realised with the network protocol HTTP.

Direct administration via PLC
The MSX-E systems can relieve PLCs by taking over fast measurement tasks. To administrate the systems from a PLC, the Modbus TCP Client library is available which enables a direct parameterisation of the systems, the installation of the measurement processes like for example the choice of the acquisition mode, start and stop commands or trigger functionalities and the administration and reading-out of system information.

Easy administration with ConfigTools
ConfigTools is a user-friendly tool with which all MSX-E systems in a network can be scanned and administrated and their status visualised. It is available for 32-bit and 64-bit Windows and Linux operating systems in German, English, French and Chinese.
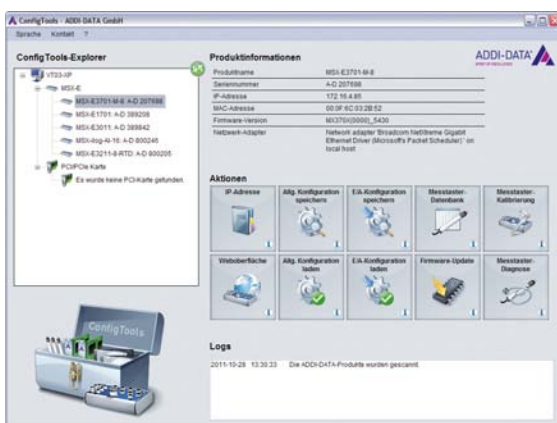
ConfigTools features

- Automatic scan of all MSX-E systems in a network
- Administration of the MSX-E systems: IP address, firmware version
- System-specific plug-ins: for example sensor calibration and visualisation
- Plug-Ins clickable / selectable via buttons: for example upload / save configuration, firmware update
- Possibility of customised plug-ins
- Changes that are made are logged
- A direct access to the website of the MSX-E systems is possible

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Fax: +49 7229 1847-222   www.addi-data.com

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Measurement and control directly in the field

The MSX-E systems are organised in two parts:

- The **control par**t is common to all system types and allows a fast and reliable communication as well as signal processing.

- The **signal part** features the specific function of each system type: counter, digital I/O, analog I/O, length measurement etc.
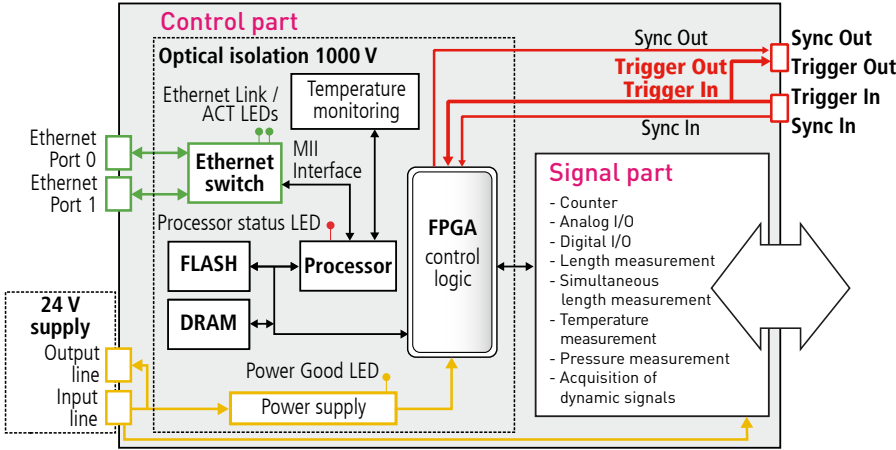

Time stamp

Several MSX-E systems can be synchronised with one another 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.

The combination of the **synchronisation** and **time stamp** allows a clear allocation of signals that were captured by several systems.
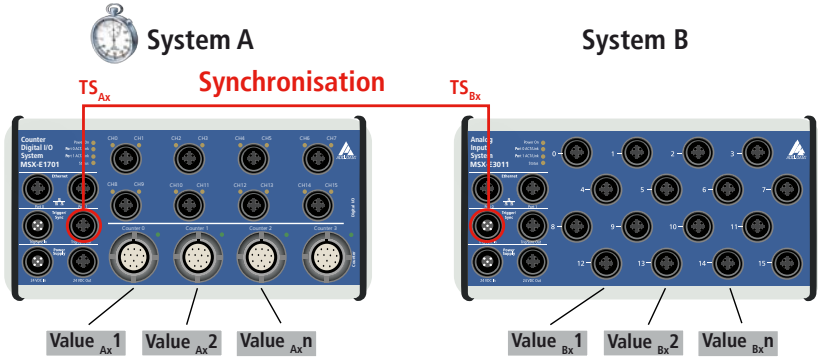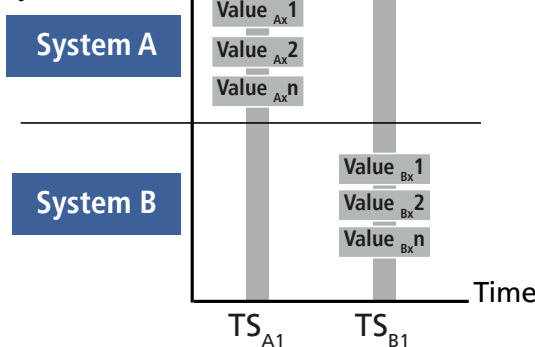

Without synchro: $TS_{Ax} \neq TS_{Bx}$
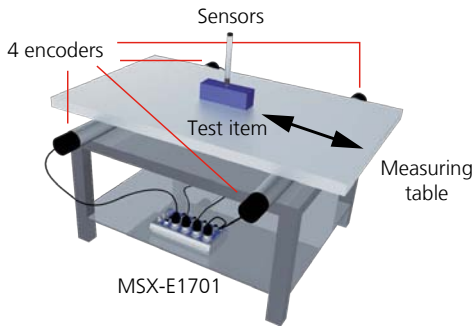With synchro: $TS_{Ax} = TS_{Bx}$
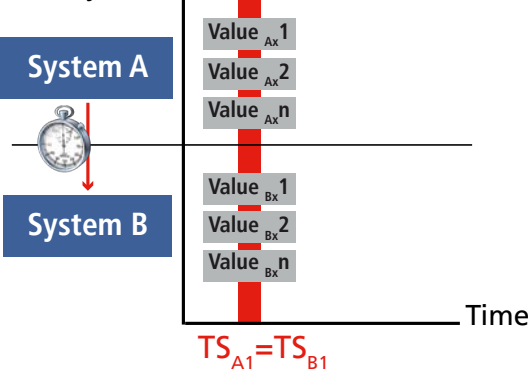
Intelligent Ethernet systems: Special functions

Synchro timer

With the „synchro timer function" you can choose whether a synchro trigger signal shall be generated and if yes define the frequency at which it shall be generated.

4 encoders

Sensors

Test item

Measuring table

MSX-E1701

During the measurement of a test item the measuring table must move. To guarantee the parallelism of the axis there are two incremental encoders placed at each side of the table and connected to the counter system MSX-E1701. The cycle for the trigger which starts the acquisition is defined in the FPGA of the system. All counters are acquired simultaneously.

Synchro trigger

With the synchro trigger line a MSX-E system that serves as a Master can start a simultaneous acquisition on several other MSX-E systems, generate trigger events and synchronise the time.

Event logic for digital I/O

With the event logic of the digital I/O Ethernet system MSX-E1516 status changes of the inputs and outputs can be detected and logged.

Advantages:
- The generated data set contains the time stamp as well as the event mask, i.e. which input or output has generated the event, and the status of all inputs and outputs.
- The data set can be read out for example in databases for statistical purposes or in operating and machine data logging for process control.
- The "polling" on the inputs is not necessary anymore.
- Status changes are also registered when there is no Ethernet connection. The according data sets (events) can be read out as soon as the Ethernet connection is available again.

See more examples on www.addi-data.com

Function generator with analog outputs

The analog output system MSX-E3511 can generate up to 8 different analog signal curves like for example trapezoid signals, sine curves or sawtooth curves. Thus for example real processes or measuring processes can be simulated and automatic test processes can be realised at test benches.

Customisation

Hardware combination

Each Ethernet system has its specific functionality and can be freely combined with the other system types. Through synchronisation and cascading the systems work together fast and reliably. Create your own system combination according to your requirements!

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.

Software tools

The MSX-E Ethernet systems come with a CD with samples for .NET, C, LabVIEW, etc. and technical descriptions. For applications that run in the development mode we provide you with a Live-DVD including numerous free development tools and a cross compiler for ARM. The Live-DVD is based on the Eclipse development environment and the Ubuntu distribution.

Firmware adaptations

The functionalities of the MSX-E systems can be extended through a change in the firmware. Calculations like for example calculation of the average value, data conversion or digital filter etc. can be implemented.

Our service: We develop your applications

Save time and resources without forgoing the advantages of a customised solution.
Describe us your requirements and we will take care of the programming..

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Measurement, Control, Regulation.

Discover the wide range of applications of the intelligent Ethernet systems!

Process optimisation and monitoring

The intelligent Ethernet systems MSX-E allow the direct connection to MES and ERP systems. The MSX-E systems acquire data directly at the measuring point, convert raw data into physical values and transfer them via the company network into the MES systems on the IT level.
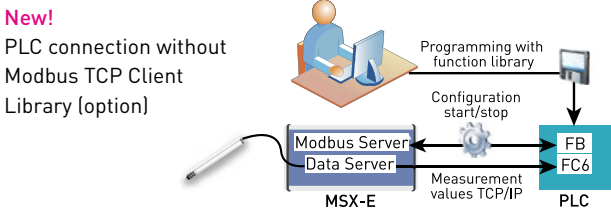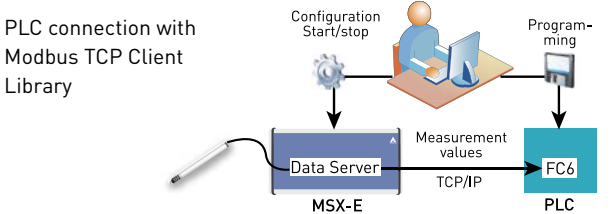
Thanks to their integrated intelligence, the MSX-E systems can, in stand-alone operating mode, transfer measurement values, i.e. „meaningful" data and not raw data, directly to the MES.
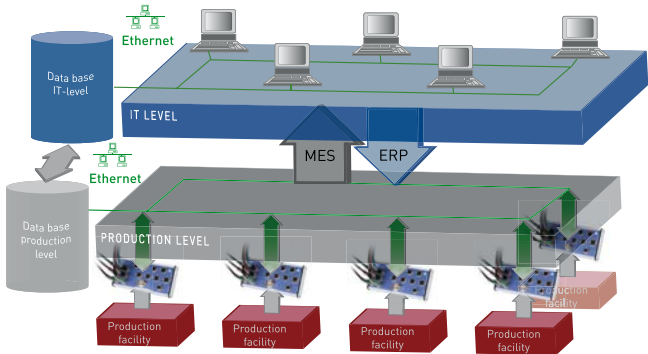
Extend the functionality range of PLCs with MSX-E systems

The MSX-E systems can be connected via Ethernet directly to a PLC and thus significantly extend its functionality. The actual measurement task is parameterised and stored on the systems via the website. With the autostart function, the systems load the measurement settings after booting and execute them independently, which makes additional programming unnecessary. The PLC accesses the data and stores it in a data block.

New! The Ethernet systems of the MSX-E series can now be managed directly from a PLC by means of a library. Frames enable the PLC to directly parameterise the MSX-E systems, to read system information and to start or stop measurements.

PLC connection with Modbus TCP Client Library

New!
PLC connection without Modbus TCP Client Library (option)

### Data measurement and visualisation

For the visualisation of data acquired via the intelligent Ethernet systems MSX-E, ADDI-DATA offers two solutions: the software procella® by Q-DAS and SPC.kompakt by ProNES. There is no need for programming a connection to the hardware. The values acquired are directly recorded and displayed by procella® or SPC.kompakt. The graphical display allows the operator to distinguish fast and reliably between "good" and "incorrect" parts.
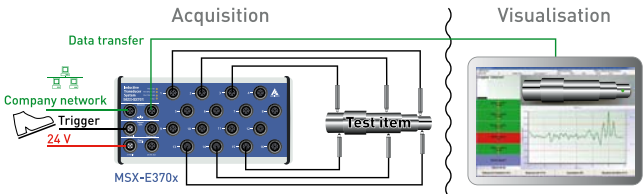
Stand-alone applications

The MSX-E systems feature a Development Mode which allows to realise and execute applications directly on the MSX-E systems. The MSX-E systems can access other MSX-E systems or any other Ethernet hardware through the Ethernet switch.
The connection via standard Ethernet allows to realise complex distributed measurement and control tasks on site, close to the test item. Such stand-alone applications would be suitable for fill level monitoring and regulation tasks.
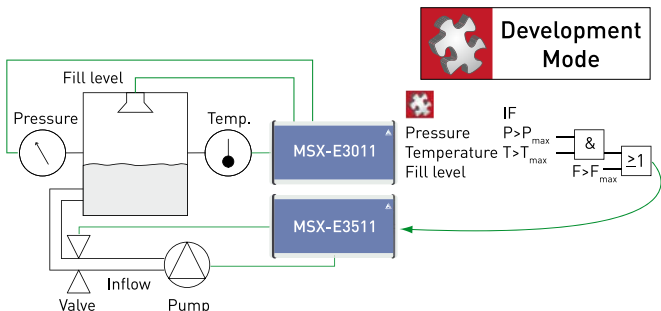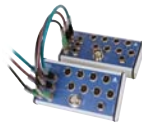
Overview of the Ethernet systems

	Digital I/O, 24 V		Multifunction counter					Analog I/O		Analog input			Analog output		Temperature measurement
	MSX-E1516	MSX-E1516-NPN	MSX-E1701	MSX-E1711	MSX-E1721	New! MSX-E1731	New! MSX-E1741-1VPP	MSX-E3121	New! MSX-E3122	MSX-E3011	MSX-E3021	MSX-E3027	MSX-E3511	New! MSX-E3511-C	MSX-E3211
Intelligent through ARM©9 technology	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ethernet	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Optical isolation 1000 V	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1 x trigger input / 1 x synchro input / time synchronisation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Compare logic generates synchro trigger signal			✓	✓		on request	on request	on request	on request	on request	on request	on request			on request
Timer function generates synchro trigger signal	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Cascading	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Degree of protection	IP 65	IP 65	IP 65	IP 65	IP 65	IP 65	IP 65	IP 65	IP 65	IP 65	IP 65	IP 67	IP 65	IP 65	IP 65
Temperature range from –40 °C to +85 °C (Internal temperature of the system)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Dimensions (mm)	215 x 110 x 50	215 x 110 x 50	215 x 110 x 54	215 x 110 x 54	215 x 110 x 54	215 x 110 x 50	215 x 110 x 54	260 x 140 x 50	260 x 140 x 50	215 x 110 x 50	215 x 110 x 50	215 x 110 x 50	154 x 110 x 54	154 x 110 x 54	215 x 138 x 50
Digital I/O, 24 V / 5 V, status LEDs	16 / 5	16 / 5	16	16	16	16		32	32						
Event logic	✓	✓													
Input filter configuration through software	✓	✓													
M12 female connector, 5-pin (for 2 inputs or outputs)	8	8	8	8	8	8		1 x 37-pin, D-Sub	1 x 37-pin, D-Sub						
Multifunction counter			✓	✓	✓	✓									
Incremental counter inputs (A, B, C, D Signals) M23 female connector			4 x 12-pin												
Sin/Cos counter inputs (A, B, C signals), M23 female connector				4 x 12-pin 1 V_{pp}	4 x 9-pin 11 μA_{pp}		✓								
EnDat 2.2-inputs, M12 female connector						4 x 8-pin									
5 V inputs, RS422, 24 V inputs (opt.)			✓			✓									
Max. input frequency			5 MHz	250 kHz	250 kHz	4.5 MHz clock speed	250 kHz								
Analog input (channels)								3 diff.	6 diff.	4 x 4, diff.	4 x 4, diff.	4 x 4, diff.			16/8 diff.
Resolution								24-bit	24-bit	16-bit	16-bit	16-bit			24-bit
Type								V / A	V / A	V / A	V / A	V / A			Thermo couples / RTD
Connector								63 x M12 female 5-pin	6 x M12 female 5-pin	16 x M12 female 5-pin	16 x M12 female 5-pin	16 x M12 female 5-pin			8 x M12 female 8-pin
Simultaneous acquisition										up to 4 channels	up to 4 channels	up to 4 channels			8 channels
Throughput								up to 100 kHz		up to 100 kHz	up to 100 kHz	up to 100 kHz			up to 788 Hz
Input ranges								± 10 V, ± 1 V, ± 100 mV, ± 10 mV, 0-10 V, 0-1 V, 0-100 mV, 0-10 mV	± 10 V, ± 1 V, ± 100 mV, ± 10 mV, 0-10 V, 0-1 V, 0-100 mV, 0-10 mV	± 5 V, ± 10 V, 0-5 V, 0-10 V	± 5 V, ± 10 V, 0-5 V, 0-10 V	± 5 V, ± 10 V, 0-5 V, 0-10 V			
Current inputs (PC-Diff option): 0(4)-20 mA									✓		✓				
Analog output, 16-Bit								4					8	8	
M12 female connector								2 x 4-pin					8 x 5-pin	8 x 5-pin	
Output voltage: 0-10 V, ± 10 V								✓					✓	✓	
Current outputs: 0-20 mA								✓					✓	✓	
Length measurement															
Number of transducers (Half-Bridge, LVDT, Mahr)															
5-pin M18 female connector															
Simultaneous acquisition															
Temperature input for Pt100															
Page	36	36	40	40	40	44	48	72	76	52	64	68	80	80	84
Software	Current driver list on the web: **www.addi-data.com**														

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Pressure measurement	Force distance measurement		Acquisition of dynamic signals	Length measurement				Protocol interpreter
MSX-E3311	New! MSX-E3017	New! MSX-E3317	MSX-E3601	MSX-E3711	MSX-E3701	MSX-E3700	MSX-E3701-DIO	MSX-E7511
✓	✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓	✓
✓	✓		✓	✓	✓	✓	✓	✓
on request	on request	on request		✓			on request	on request
✓	✓	✓		✓	✓	✓	✓	
✓	✓	✓	✓	✓	✓	✓	✓	✓
IP 65	IP 65	IP 65	IP 65	IP 65	IP 65	IP 40	IP 65	IP 65
✓	✓	✓	✓	✓	✓	✓	✓	✓
215 x 138 x 50	on request	on request	215 x 110 x 50	215 x 110 x 54	215 x 110 x 50	215 x 110 x 39	260 x 110 x 50	215 x 138 x 50
							32	
							✓	
							1 x 37-pin, D-Sub	
	✓	✓						
	✓	✓	1 x 12-pin					Serial: RS232, RS422, RS485, 20 mA CL
	✓	✓						
				✓				
	on request	on request		5 MHz				
16/8 diff.			8 SE, diff., ICP					
24-bit	16-bit	24-bit	24-bit					
Strain gauges	V / A	Strain gauges	V / A / ICP					
8 x M12 female 8-pin	3 x M12 female 5-pin	3 x M12 female 8-pin	8 x BNC					
8 channels	3 channels	8 channels	up to 8 channels					
up to 1 kHz	up to 100 kHz	up to 788 kHz	up to 128 kHz					
	± 5 V, ± 10 V, 0-5 V, 0-10 V		± 5 V, ± 10 V					
	✓		✓					
				24-bit	24-bit	24-bit	24-bit	
				8	4 / 8 / 16	4 / 8 / 16	16 only HB and LVDT	
				8	4 / 8 / 16	4 / 8 / 16	16	
				✓				
				✓				
88	56	60	92	96	100	100	106	110

Common specifications for all MSX-E systems

Voltage supply

Nominal voltage:	24 V ⎓
Supply voltage:	18-30 V
Optical isolation:	1000 V
Reverse voltage protection: 1 A max. (except MSX-E3711)	
Connectors	
24 VDC input	1 x 5-pin M12 male connector (except MSX-E3700)
24 VDC output	1 x 5-pin M12 female connector (except MSX-E3700)

Ethernet

Interface:	Ethernet acc. to IEEE802.3 specification	
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	
Connectors		
Ethernet:	2 x 4-pin female connector, D-coded M12 for Port 0 and Port 1 (except MSX-E3700)	

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
Connectors, common with synchro	
Trigger input:	1 x 5-pin M12 male connector (except MSX-E3700)
Trigger output:	1 x 5-pin M12 female connector (except MSX-E3700)

Synchro

Number of inputs:	1
Number of outputs:	1
Max. cable length:	20 m
Optical isolation:	1000 V
Signal type:	RS422
Connectors, common with trigger	
Synchro input:	1 x 5-pin M12 male connector (except MSX-E3700)
Synchro output:	1 x 5-pin M12 female connector (except MSX-E3700)

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.

DatabaseConnect

Database connection

DatabaseConnect is an easy-to-use database interface software which does not require any programming skills. DatabaseConnect stores measurement data which has been acquired through MSX-E Ethernet systems directly into databases via standard Ethernet. System requirements and other important product information see the datasheet on page 114.

Accessories for the Ethernet systems
Cables and connectors

	Digital I/O, 24 V	Multifunction counter		
	MSX-E1516 / MSX-E1516-NPN	MSX-E1701 / MSX-E1711 / MSX-E1721	New! MSX-E1731	New! MSX-E1741
Cables: Temperature range from –25 °C to +80 °C, bent cables and special length on request				
Voltage supply: Shielded cable, M12 5-pin female connector/open end, IP 65 **CMX-20** (1.5 m), **CMX-21** (3 m), **CMX-22** (5 m), **CMX-23** (10 m), **CMX-29** (length on request)	✓	✓	✓	✓
Voltage supply – Cascading: Shielded cable, M12 5-pin female connector/male connector, IP 65 **CMX-38** (0.6 m), **CMX-30** (1 m), **CMX-31** (3 m), **CMX-32** (5 m), **CMX-39_0,3** (0.3 m), **CMX-39** (length on request)	✓	✓	✓	✓
Trigger/Synchro: Shielded cable, M12 5-pin female connector/open end, IP 65 **CMX-40** (1.5 m), **CMX-41** (3 m), **CMX-42** (5 m), **CMX-43** (10 m), **CMX-49** (length on request)	✓	✓	✓	✓
Trigger/Synchro – Cascading: Shielded cable, M12 5-pin female connector/male connector, IP 65 **CMX-58** (0.6 m), **CMX-50** (1 m), **CMX-51** (3 m), **CMX-52** (5 m), **CMX-59_0,3** (0.3 m), **CMX-59** (length on request)	✓	✓	✓	✓
Ethernet: CAT5E cable, M12 D-coded male connector/RJ45 connector **CMX-60** (2 m), **CMX-61** (5 m), **CMX-62** (10 m), **CMX-69** (length on request)	✓	✓	✓	✓
Ethernet – Cascading: CAT5E cable, 2 x M12 D-coded male connector **CMX-78** (1 m), **CMX-70** (2 m), **CMX-71** (5 m), **CMX-72** (10 m), **CMX-79_0,3** (0,3 m), **CMX-79** (length on request)	✓	✓	✓	✓
Connecting peripheral equipment: Shielded cable, M12 5-pin male connector/open end, IP 65 **CMX-80** (1.5 m), **CMX-81** (3 m), **CMX-83** (10 m), **CMX-89** (length on request)	✓	✓	✓	✓
Connecting peripheral equipment: Shielded cable, M12 8-pin male connector/open end, IP 65 **CMX-9x** (length on request)			✓	✓
Connectors				
SC-M12: M12 5-pin connector for connecting open end cables	✓	✓	✓	✓
SC-M12-8: M12 8-pin connector for connecting open end cables				
SC-M12-8-TC: M12 8-pin connector for connecting thermocouples with integrated cold junction compensation (CJC)				
SC-M12-ABGW: M12 5-pin 90° bent connector for connecting open end cables	✓	✓	✓	✓
SC-M12-BU-ABGW: M12 5-pin 90° bent female connector for connecting open end cables	✓	✓	✓	✓
SC-M12-8-ABGW: M12 8-pin 90° bent connector for connecting open end cables				
SC-M12-Y-M12: 5-pin Y-splitter cable with M12 connector to 2 x M12 female connectors	✓	✓	✓	✓
SC-M23: M23 12-pin connector for the direct connection of shaft encoders, gauges, and digital transducers		✓ not for MSX-E1721		✓

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Analog I/O		Analog input		Analog output		Force distance measurement		Temperature measurement	Pressure measure-ment	Acquisition of dynamic signals	Length measurement				Protocol interpreter
MSX-E3121	New! MSX-E3122	MSX-E3011 MSX-E3021	MSX-E3027	MSX-E3511	New! MSX-E3511-C	New! MSX-E3017	New! MSX-E3317	MSX-E3211	MSX-E3311	MSX-E3601	MSX-E3711	MSX-E3701	MSX-E3700	MSX-E3701-DIO	MSX-E7511
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
✓	✓	✓	✓	✓	✓	✓								✓	
✓	✓						✓	✓	✓						
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
							✓	✓ (RTD)	✓						
								✓ (TC)			✓ MSX-E-3711-TC				
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
						✓	✓	✓ not suitable for TC	✓						
✓	✓														
						✓	✓				✓				

Accessories for the Ethernet systems
Clips and mounting components

		Digital I/O, 24 V	Multifunction counter		
		MSX-E1516 MSX-E1516-NPN	MSX-E1701 MSX-E1711 MSX-E1721	New! MSX-E1731	New! MSX-E1741
Screw connector binders for voltage supply: 3-pin binder, 5.08 mm grid					
	SMX-10 1-row screw connector, included in the delivery content				
	SMX-11 2-row screw connector				
	SMX-12 2-row spring-cage connector with double link				
Screw connector binders for trigger/synchro					
	SMX-20 3-pin binders, 5.08 mm grid, included in the delivery content				
Options / Mounting					
	MX-Clip 2 clips for DIN-rail mounting or for direct mounting on units	✓	✓	✓	✓
	MX-Rail Assembly equipment for DIN-rail mounting. Please specify when ordering!	✓	✓	✓	✓
	MX-Screw Assembly equipment for direct mounting on machines	✓	✓	✓	✓
Options / Protection caps					
	PCMX-10: 5 x protection caps for M12 connector (4 x female, 1 x male)	✓	✓	✓	✓
	PCMX-11: 10 x protection caps for M18 connector				
	PCMX-12: 1 protection cap for M23 connector		✓		✓
	PCMX-13: 10 x protection caps for M12 connector	✓	✓	✓	✓

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	Analog I/O		Analog input			Analog output		Force distance measurement		Temperature measurement	Pressure measurement	Acquisition of dynamic signals	Length measurement				Protocol interpreter
	MSX-E3121	New! MSX-E3122	MSX-E3011 MSX-E3021	MSX-E3027	MSX-E3511	New! MSX-E3511-C	New! MSX-E3017	New! MSX-E3317	MSX-E3211	MSX-E3311	MSX-E3601	MSX-E3711	MSX-E3701	MSX-E3700	MSX-E3701-DIO	MSX-E7511
														✓		
														✓		
														✓		
														✓		
			✓	✓	✓	✓					✓	✓	✓	✓	✓	
	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
												✓	✓	✓	✓	
							✓	✓				✓				
	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						

Ethernet digital I/O system
16 digital I/O, 24 V, with event logic

New!*
MSX-E 1516-NPN

MSX-E1516 / MSX-E1516-NPN

16 digital I/O, 24 V, status LEDs

Configurable inputs and outputs

Event logic for the inputs and outputs

24 V digital trigger input

M12 connectors

Integrated Ethernet switch

+ 85 °C*
- 40 °C

IP 65

ARM®9 Technology

Cascadable, can be synchronised in the µs range

Timer function for synchro trigger signal

*Operating temperature

RoHS 2002/95/EC

on request

DatabaseConnect
see page 114

More information on www.addi-data.com

Features

- 24 V digital trigger input
- ARM®9 32-bit processor
- 64 MB onboard SDRAM for storing data
- Robust standardized metal housing
- Power Save Mode: Reduced power consumption when no acquisition runs

Safety features

- Status LEDs for fast error diagnostics
- Optical isolation 1000 V
- Overtemperature and reverse voltage protection
- Internal temperature monitoring
- Filters on all inputs (software-programmable)
- Short-circuit protection
- Overvoltage protection 30 V
- Electronic fuse

Digital I/O

- 8 x 2 digital lines, 24 V, which can be parameterised as pairs of inputs or outputs
- Shutdown logic
- Watchdog for resetting the outputs to "0"
- At Power-On the outputs are set to "0"
- Electronic fuse
- Dual LED for each 24 V digital I/O with direction indication

Interfaces

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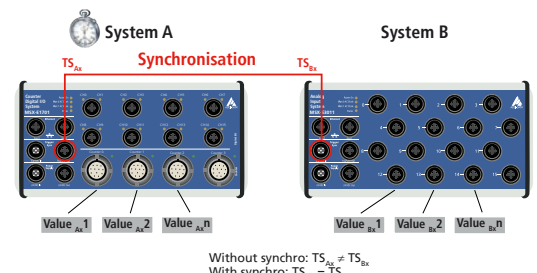- Line in for 24 V supply and cascading

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 ...)
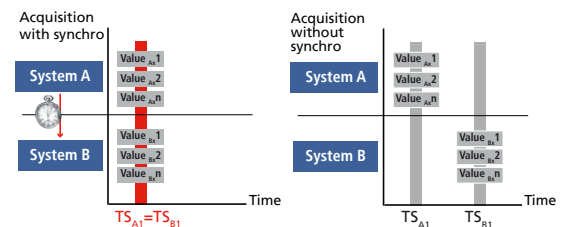- Command server Modbus TCP and Modbus (UDP) for sending commands

*Preliminary
 Product information

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.

System A   Synchronisation   System B

TS_{Ax} TS_{Bx}

Value$_{A}$1 Value$_{A}$2 Value$_{A}$n   Value$_{B}$1 Value$_{B}$2 Value$_{B}$n

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.

Acquisition with synchro

System A
Value$_{A}$1
Value$_{A}$2
Value$_{A}$n

System B
Value$_{B}$1
Value$_{B}$2
Value$_{B}$n

$TS_{A1} = TS_{B1}$ Time

Acquisition without synchro

System A
Value$_{A}$1
Value$_{A}$2
Value$_{A}$n

System B
Value$_{B}$1
Value$_{B}$2
Value$_{B}$n

TS_{A1} TS_{B1} Time

NOTE

NPN

While most sensors when activated will output a 24V signal (PNP sensors), a NPN sensor when activated switches to ground.
The swichting to ground of NPN sensors can be read by the MSX-E1516-NPN system.

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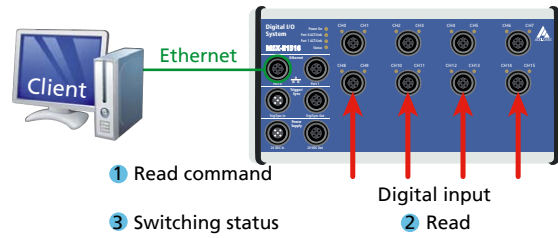
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Acquisition modes

Acquisition modes – There are 2 different possibilities for reading the digital inputs.
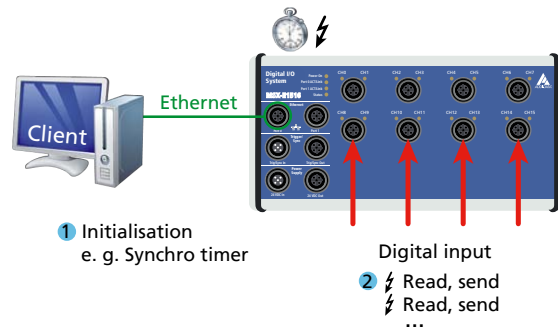
1. Asynchronous acquisition

With the asynchronous acquisition, the digital inputs can be read out via SOAP or Modbus function. For each function call, the values of one channel are transmitted.

Ethernet
Client

① Read command
③ Switching status

Digital input
② Read

2. Synchronous acquisition

With the synchronous acquisition, the inputs are first initialised and then the acquisition is parameterised. The acquisition runs automatically depending from a trigger source.
Either the 24V trigger input or a synchro trigger can be used as trigger source.

Ethernet
Client

① Initialisation
e. g. Synchro timer

Digital input
② ⚡ Read, send
⚡ Read, send
…

Synchro latch

A periodic acquisition of the digital inputs is possible using the synchro timer (synchro latch). Several MSX-E systems (of same or different types) can be combined through synchro trigger. With the synchronous acquisition, as soon as there are measurement values available, they are sent to the clients via socket connection.

Event logic

The event logic of the MSX-E1516 can be used to detect a change of edge on the digital inputs (e. g. to show that 1 unit has been produced, or that the machine runs or stands still).
This information (time stamp + event mask) is stored on the data server of the MSX-E1516 and can be read through a socket connection.
The information can be read either through an application written for this purpose or by using the DatabaseConnect software. DatabaseConnect writes the information in a database and can then evaluate it.
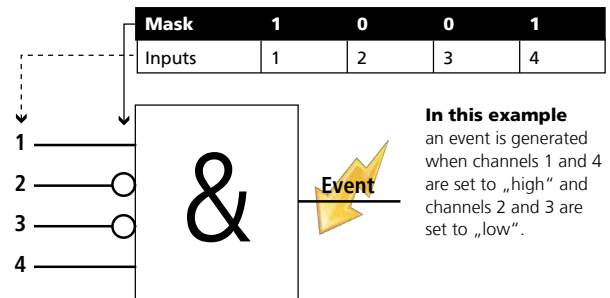
Mask	1	0	0	1
Inputs	1	2	3	4

In this example
an event is generated when channels 1 and 4 are set to „high" and channels 2 and 3 are set to „low".

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.
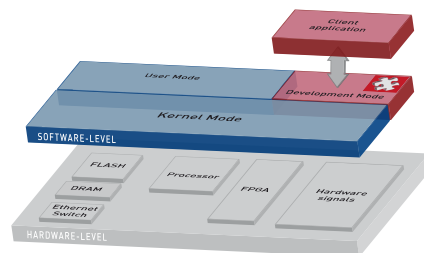
Safety

Watchdog

The MSX-E1516 Ethernet system has a 16-bit watchdog which can be programmed in 3 time units (μs, ms, s). The watchdog is used for automatically resetting the digital outputs to 0 V after a defined time in order e. g. to switch off actuators if an error has occurred.

*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).

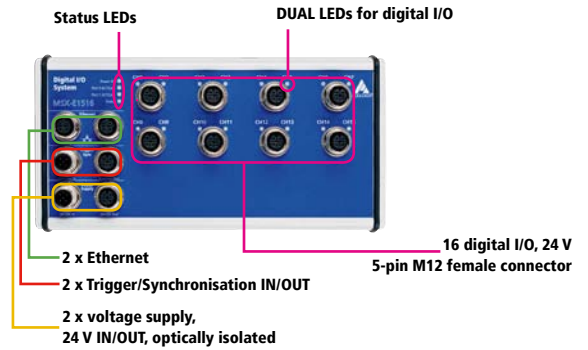**ConfigTools** is included in the delivery.

ConfigTools functions for
MSX-E1516 / MSX-E1516-NPN:
• Change of IP address
• Display of web interface
• Firmware update
• Save/load system configuration
• Save/load channel configuration

Very easy use through the „ConfigTools" program;
The MSX-E system is automatically detected in the network.

Features

Status LEDs

DUAL LEDs for digital I/O

2 x Ethernet

2 x Trigger/Synchronisation IN/OUT

2 x voltage supply, 24 V IN/OUT, optically isolated

16 digital I/O, 24 V
5-pin M12 female connector

Simplified block diagram

Cascading

Combination possibilities:
- **Several MSX-E of the same type:**
  acquisition of a large number of channels
- **Different types of MSX-E systems:**
  combination of different functions

Ethernet (CMX-7x)
Trigger/Synchro (CMX-5x)
Power (CMX-3x)

ADDI-DATA connection technology

* Preliminary product information

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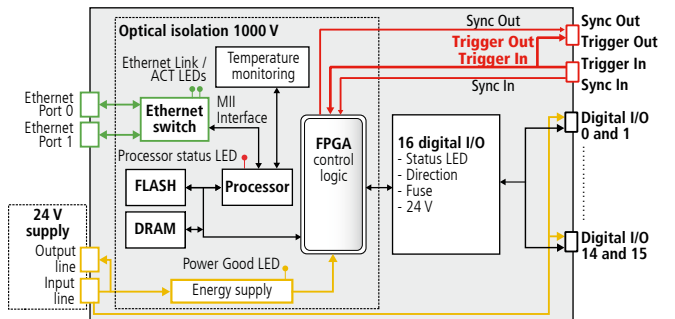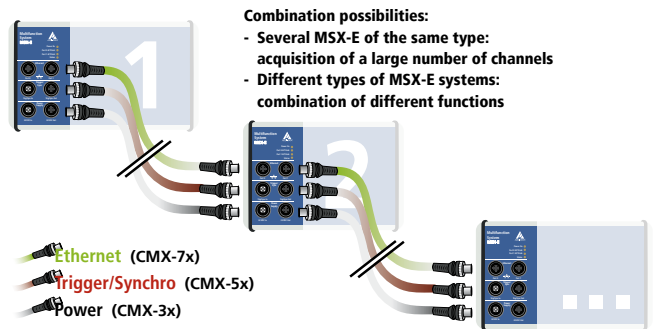
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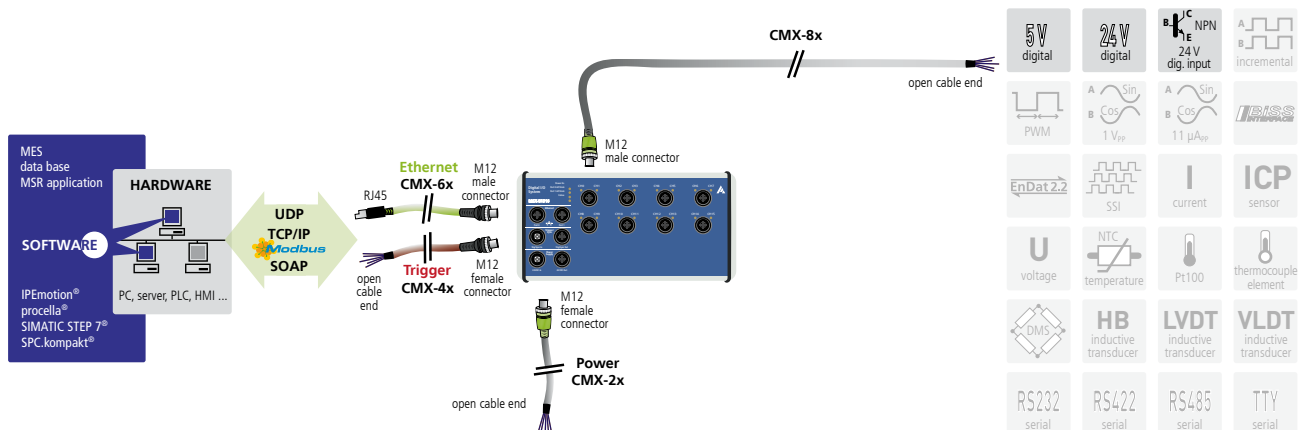
Specifications*

Digital inputs

Number of inputs:	16, 2 per M12 female connector
	Common ground acc. to IEC 1131-2
Overvoltage protection:	30 V
Optical isolation:	1000 V through opto-couplers
Nominal voltage:	24 VDC
Input voltage:	0 to 30 V
Input impedance:	> 1 MΩ
Logic input levels:	UH (max) 30 V typ.
	UH (min) 18 V typ.
	UL (max) 16 V typ.
	UL (min) 0 V typ.

Digital outputs

Number of outputs:	16, 2 per 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
Current (max.):	1.85 A typ. for 8 channels through PTC at 20°C
Output current per channel:	500 mA max.
	Short-circuit current per output 1.7 A max
	Shut-down logic at 24 V, R_{load} = 10 mΩ
RDS ON Resistance:	280 mΩ max.
Switch-on time:	100 µs max RL = 48 Ω of 80 % V_{out}
Switch-off time:	150 µs max RL = 48 Ω of 10 % V_{out}
Overtemperature (shutdown):	135°C max. (output driver)
Temperature hysteresis:	15°C typ. (output driver)
Diagnostics:	Common diagnostics bit for all 16 channels at overtemperature of one channel

Voltage supply, Ethernet, Trigger, Synchro

The specifications for the voltage supply, Ethernet, Trigger, Synchronisation and Electromagnetic Compatibility apply to all MSX-E systems. See page 31.

System features

Interface:	Ethernet acc. to specification IEEE802.3
Dimensions:	215 mm x 110 mm x 50 mm
Weight:	900 g
Degree of protection:	IP 65
Current consumption at 24 V:	160 mA
Operating temperature:	-40 °C to +85 °C
Connectors for sensors	
For digital I/O:	8 x 5-pin M12 female connector

Ordering information

MSX-E1516 / MSX-E1516-NPN

Ethernet digital I/O system, 16 digital I/O, 24 V, with event logic. Incl. technical description, software drivers and ConfigTools.

Versions
MSX-E1516: 16 digital I/O, 24 V
MSX-E1516-NPN: 16 digital inputs, 24 V (NPN)

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
Connection to peripherals
CMX-8x: Shielded cable, M12 5-pin male connector/open end, IP 65

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

***Preliminary product information**

Ethernet multifunction counter system
4 counter inputs (incremental, sin/cos), 16 digital I/O, 24 V

MSX-E1701 / MSX-E1711 / MSX-E1721

4 incremental counter inputs
or 8 PWM outputs (MSX-E1701)

4 sin/cos counter inputs 1 V_{pp} (MSX-E1711),
11 μA_{pp} (MSX-E1721) with A, B, C (index) signals

16 digital I/O, 24 V, status LEDs

Configurable inputs and outputs

24 V digital trigger input
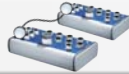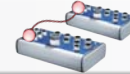
M12 and M23 connectors

Integrated Ethernet switch	+ 85 °C* / - 40 °C	IP 65	ARM°9 Technology	Cascadable, can be synchronised in the µs range	Timer function or compare logic for synchro trigger signal

*Operating temperature

RoHS 2002/95/EC

on request

DatabaseConnect
see page 114

More information on
www.addi-data.com

Features

- 24 V digital trigger input
- ARM®9 32-bit processor
- 64 MB onboard SDRAM for storing data
- Robust standardized metal housing
- Power Save Mode: Reduced power consumption when no acquisition runs

Safety features

- Status LEDs for fast error diagnostics
- Optical isolation • Input filters

Counter

- 4 x 32-bit incremental counter inputs (MSX-E1701), max. 5 MHz, or 8 x PWM outputs, can be configured through firmware
- 4 x 32-bit sin/cos counter inputs with $1V_{pp}$ (MSX-E1711) or 11 μA_{pp} (MSX-E1721), 250 kHz
- Voltage supply of the sensors through M23 female connector (24 V or 5 V)
- Single, double, quadruple edge analysis (MSX-E1701)
- Compare logic
- Status LEDs for incremental counter inputs

Digital I/O

- 8 x 2 digital lines, 24 V, which can be parameterised as pairs of inputs or outputs
- Shutdown logic
- Watchdog for resetting the outputs to "0"
- At Power-On the outputs are set to "0"
- Electronic fuse
- Dual LED for each 24 V digital I/O with direction indication

Interfaces

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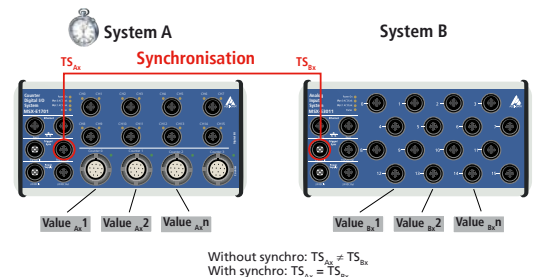
Communication interfaces

- 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 ...)
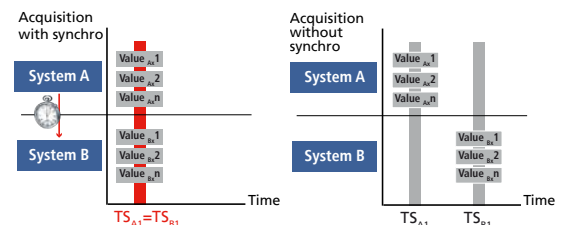- Command server Modbus TCP and Modbus (UDP) for sending commands

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.

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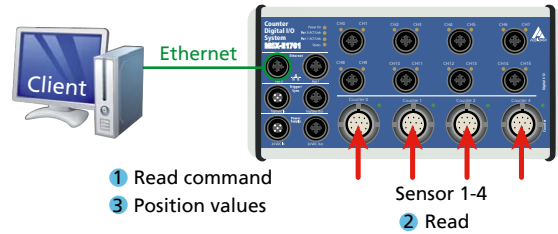ADDI-DATA®
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Acquisition modes

Acquisition modes – There are 2 different possibilities for reading the counter inputs.
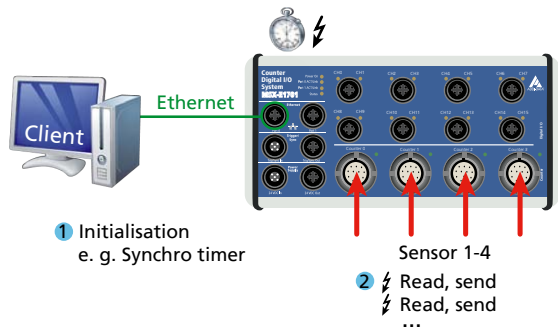
1. Asynchronous acquisition

With the asynchronous acquisition, the counter inputs can be read out via SOAP or Modbus function. For each function call, the values of one channel are transmitted.

1 Read command
3 Position values

Sensor 1-4
2 Read

2. Synchronous acquisition

With the synchronous acquisition, the inputs are first initialised and then the acquisition is parameterised. The acquisition runs automatically depending from a trigger source.
Either the 24V trigger input or a synchro trigger can be used as trigger source.

1 Initialisation
e. g. Synchro timer

Sensor 1-4
2 ⚡ Read, send
⚡ Read, send
...

Synchro latch

A periodic acquisition of the counter inputs is possible using the synchro timer (synchro latch). Several MSX-E systems (of same or different types) can be combined through synchro trigger. With the synchronous acquisition, as soon as there are measurement values available, they are sent to the clients via socket connection.

Compare logic

With the compare logic, a synchro-trigger signal can be generated in order to latch the counter value as soon as the counter value is equal to the compare value.
With the additional „Modulo-Mode" (Modulo Compare), a trigger can also be generated at the n value of the compare value.
Thus it is possible, e. g. when using an encoder with 3,600 steps / revolution to obtain each degree of a measurement value (Modulo Compare = 10).
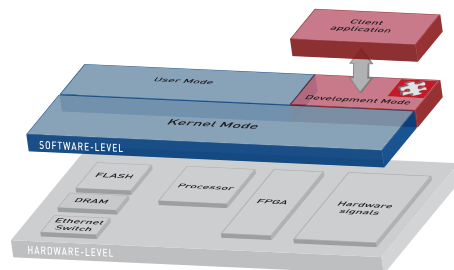The thus generated synchro-trigger can also be used for data acquisition on further MSX-E systems.

② **counter**

	0
1 2 3 4 5 6 7 8 9 10	
11 12 ...	20
21 22 ...	30
...	

① **Modulo Compare = 10**

③ **send data**
③ **send data**

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.

Client application

User Mode

Development Mode

Kernel Mode

SOFTWARE-LEVEL

FLASH   Processor   FPGA   Hardware signals

DRAM

Ethernet Switch

HARDWARE-LEVEL

Safety

Watchdog

The MSX-E17x1 Ethernet system has a 16-bit watchdog which can be programmed in 3 time units (μs, ms, s). The watchdog is used for automatically resetting the digital outputs to 0 V after a defined time in order e. g. to switch off actuators if an error has occurred.

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).

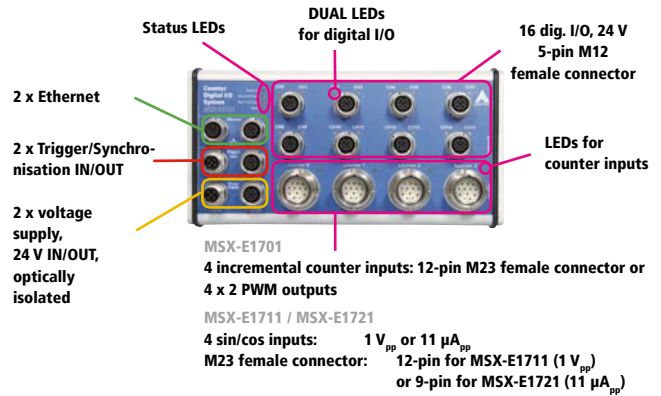**ConfigTools** is included in the delivery.

ConfigTools functions for MSX-E1701 / MSX-E1711 / MSX-E1721:
- Change of IP address
- Display of web interface
- Firmware update
- Save/load system configuration
- Save/load channel configuration

Very easy use through the „ConfigTools" program; The MSX-E system is automatically detected in the network.
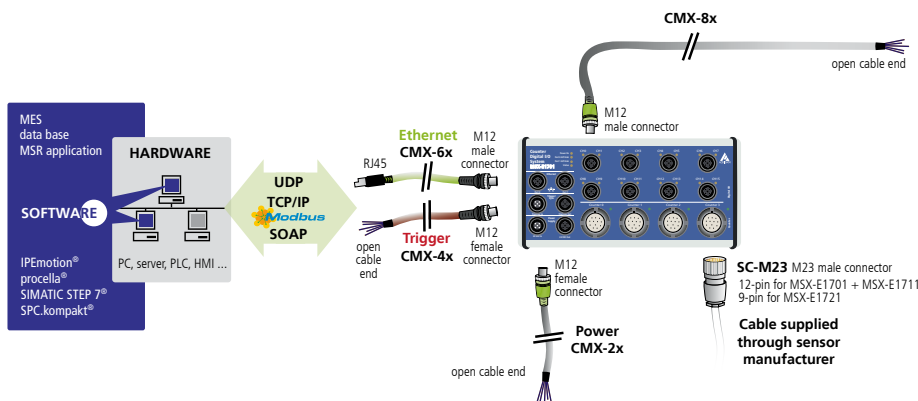

Features

- Status LEDs
- DUAL LEDs for digital I/O
- 16 dig. I/O, 24 V 5-pin M12 female connector
- 2 x Ethernet
- 2 x Trigger/Synchro-nisation IN/OUT
- LEDs for counter inputs
- 2 x voltage supply, 24 V IN/OUT, optically isolated

MSX-E1701
4 incremental counter inputs: 12-pin M23 female connector or
4 x 2 PWM outputs

MSX-E1711 / MSX-E1721
4 sin/cos inputs: 1 V_{pp} or 11 μA_{pp}
M23 female connector: 12-pin for MSX-E1711 (1 V_{pp})
                       or 9-pin for MSX-E1721 (11 μA_{pp})

Simplified block diagram

Cascading

Combination possibilities:
- **Several MSX-E of the same type:** acquisition of a large number of channels
- **Different types of MSX-E systems:** combination of different functions

Ethernet (CMX-7x)
Trigger/Synchro (CMX-5x)
Power (CMX-3x)

ADDI-DATA connection technology

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Specifications

Incremental counter inputs (MSX-E1701)

Number of inputs:	4 x incremental counters each with A, B, C and D signals

5 V inputs (MSX-E1701 version)

Differential inputs:	Complies with the EIA standards RS422A
Input type:	Differential or TTL (with reference voltage)
Common mode range:	+12 / -7 V
Input sensitivity:	± 200 mV
Input hysteresis:	50 mV typ.
Input impedance:	12 kΩ min.
Max. input frequency:	5 MHz
„Open Circuit Fail Safe Receiver Design"	
ESD protection:	Up to ±15 kV

24 V inputs (MSX-E1701-24 version)

	For 24 V encoders. Only 24 V signals can be connected.
Nominal voltage:	24 VDC
Max. input frequency:	1 MHz at nominal voltage
Input impedance:	> 1 MΩ
Logic input levels:	UH (max): 30 V typ.
	UH (min): 18 V typ.
	UL (max): 16 V typ.
	UL (min): 0 V typ.
Voltage supply:	Incremental encoder selectable, 5 V or 24 V, max. 500 mA

PWM outputs (MSX-E1701)

Number of outputs:	8
Differential I/O:	Complies with the EIA standards RS422A
Output type:	Differential
Common mode range:	+12 / -7 V
Input sensitivity:	± 200 mV
Input hysteresis:	50 mV typ.
Input impedance:	12 kΩ min.
Time base:	250 ns, 1 µs, 1 ms, 1 s
Min. pulse duration:	250 ns
Max. output rate:	n: number of pulses (Duty Cycle), n ≥ 2

$$f = \frac{1}{n \cdot \text{time base}}$$

Examples (time base = 250 ns)**:**

Duty Cycle 50%
1 high pulse, 1 low pulse, n=2

$$f = \frac{1}{2 \cdot 250 \text{ ns}} = 2 \text{ MHz}$$

Duty Cycle 66%
2 high pulses, 1 low pulse, n=3

$$f = \frac{1}{3 \cdot 250 \text{ ns}} = 1.33 \text{ MHz}$$

Voltage supply:	5 V or 24 V, max. 500 mA

Sin/cos counter inputs (MSX-E1711, MSX-E1721)

Number of inputs:	4 x sin/cos counter inputs each with A, B, C and D signals
Resolution:	32-bit
Differential inputs:	- 1 V_{pp} (MSX-E1711)
	- 11µA_{pp} (MSX-E1721)

Interpolation factor:	Up to 8192
Max. input frequency:	max. 250 kHz (at min. interpolation), on request
ESD protection:	2 kV

Digital inputs

Number of inputs:	max. 16, 2 per M12 female connector, common ground acc. to IEC 1131-2
Overvoltage protection:	30 V
Optical isolation:	1000 V through opto-couplers
Nominal voltage:	24 VDC
Input voltage:	0 to 30 V
Input impedance:	> 1 MΩ
Logic input levels:	UH (max): 30 V typ. UH (min):18 V typ.
	UL (max):16 V typ. UL (min):0 V typ.

Digital outputs

Number of outputs:	max. 16, 2 per 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
Current (max.):	1.85 A typ. for 8 channels through PTC
Output current / output:	500 mA max.
Short-circuit current / output:	1.7 A max., shut-down logic at 24 V, R_{load}= 10 mΩ
RDS ON resistance:	280 mΩ max.
Switch-on time:	100 µs, max. RL = 48 Ω from 80 % V_{out}
Switch-off time:	150 µs, max. RL=48 Ω from 10 % V_{out}
Overtemperature (shutdown):	135°C max. (output driver)
Temperature hysteresis:	15°C typ. (output driver)
Diagnostics:	Common diagnostics bit for all 16 channels at overtemperature of one channel

Voltage supply, Ethernet, Trigger, Synchro

The specifications for the voltage supply, Ethernet, Trigger, Synchronisation and Electromagnetic Compatibility apply to all MSX-E systems. See page 31.

System features

Interface:	Ethernet acc. to specification IEEE802.3
Dimensions (mm):	215 x 110 x 54
Weight:	900 g
Degree of protection:	IP 65
Current consumption at 24 V:	150 mA without load
Operating temperature:	-40 °C to +85 °C
Connectors for sensors	
Digital I/O:	8 x 5-pin M12 female connector
Incremental counter inputs:	4 x 12-pin M23 female connector
Sin/cos counter input 1 V_{ss}:	4 x 12-pin M23 female connector
Sin/cos counter input 11 µA_{ss}:	4 x 9-pin M23 female connector

---

MSX-E1701 / MSX-E1711 / MSX-E1721

Ethernet multifunction counter system, 4 counter inputs (incremental, sin/cos), 16 digital I/O, 24 V.
Incl. technical description, software drivers and ConfigTools.

Versions

MSX-E1701:	5 V RS422 incremental counter inputs
MSX-E1701-24V:	24 V incremental counter inputs
MSX-E1711:	Sin/cos inputs, 1 V_{pp}
MSX-E1721:	Sin/cos inputs, 11 µA_{pp}

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

Connection to peripherals

CMX-8x: Shielded cable, M12 5-pin male connector/open end, IP 65

Options

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

Ethernet multifunction counter system
4 EnDat counter inputs, 16 digital I/O, 24 V

EnDat 2.2

MSX-E1731

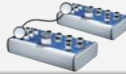| 4 EnDat 2.2 inputs |
| --- |
| 16 digital I/O, 24 V, with status LEDs |
| 24 V digital trigger input |
| M12 connectors |

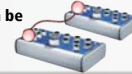Integrated Ethernet switch

+ 85 °C* **- 40 °C**
Operating temperature

IP 65

ARM®9 Technology

Cascadable, can be synchronised in the µs range

On request: Compare logic for synchro trigger signal

RoHS 2002/95/EC

on request

DatabaseConnect on request

More information at www.addi-data.com

Features

- 24 V digital trigger input
- ARM®9 32-bit processor
- 64 MB onboard SDRAM for storing data
- Robust standardized metal housing
- Power Save Mode: Reduced power consumption when no acquisition runs

Safety features

- Status LEDs for fast error diagnostics
- Optical isolation 1000 V
- Input filters

Sensor inputs

- 8-pin M12 female connectors
- 4 x EnDat counter inputs for the acquisition of EnDat encoders
- Max. clock frequency 4.5 MHz
- Voltage supply of the EnDat encoders via M12 female connectors: 5 V ±10%
- Output of the values as raw value or position value (mm or °)
- Communication LED for each EnDat input

Interfaces

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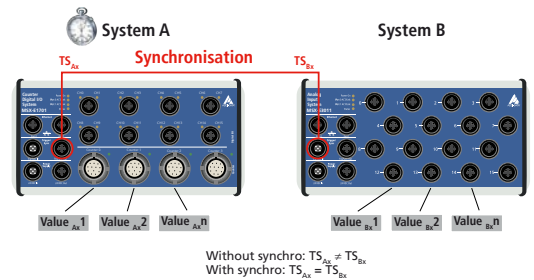- Line in for 24 V supply and cascading

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 ...)
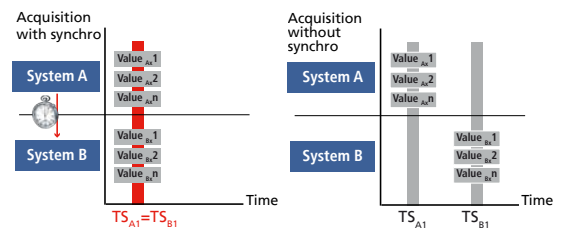- Command server Modbus TCP and Modbus (UDP) for sending commands

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.


System A Synchronisation System B

TS_{Ax} TS_{Bx}

Value $_{Ax}$1 Value $_{Ax}$2 Value $_{Ax}$n   Value $_{Bx}$1 Value $_{Bx}$2 Value $_{Bx}$n

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.

Acquisition with synchro

System A
Value $_{Ax}$1
Value $_{Ax}$2
Value $_{Ax}$n

System B
Value $_{Bx}$1
Value $_{Bx}$2
Value $_{Bx}$n

$TS_{A1} = TS_{B1}$ Time

Acquisition without synchro

System A
Value $_{Ax}$1
Value $_{Ax}$2
Value $_{Ax}$n

System B
Value $_{Bx}$1
Value $_{Bx}$2
Value $_{Bx}$n

TS_{A1} TS_{B1} Time

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EnDat

EnDat is a bidirectional synchronous-serial interface for position measurement devices. This interface allows to read out absolute position values and parameters, to write status and initialisation registers and to transfer additional information about the position value. In addition, ADDI-DATA EnDat 2.2 solutions support the evaluation of diagnostic values and access to the OEM memory. Data is transferred serially.

- Fast data transfer
- Signal delay time compensation
- High contour accuracy
- High transmission safety
- No need for additional sensors: Evaluation (temperature, limit switch, etc.)
- Serial transmission: only 4 lines necessary (EnDat 2.2)
- Single-line wiring (M12, 8-pin)
- Automatic parameterisation through electronic type plate
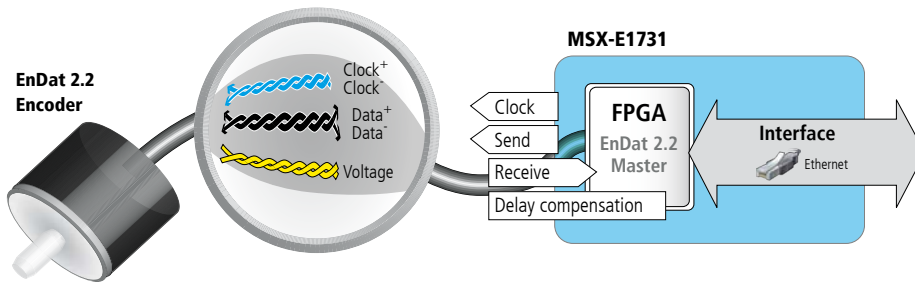
Acquisition modes

There are two different acquisition modes for EnDat sensors:

Asynchronous acquisition

With the asynchronous acquisition, the EnDat sensors can be read out after initialisation via SOAP or Modbus function.
For each function call, one position value is transmitted.
EnDat 2.2 also allows to read out additional sensor-specific values (e. g. temperature,...)

① Read command
③ Position values
② Read
Sensor 1-4
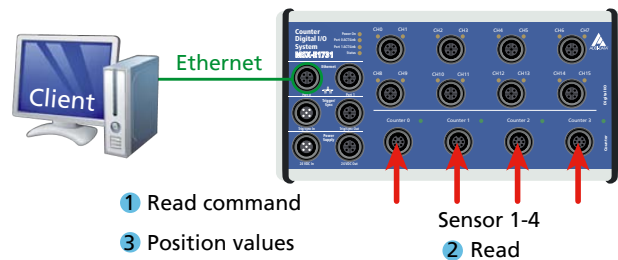
Synchronous acquisition

With the synchronous acquisition, at first the sensors are initialised and then the acquisition is parameterised. The acquisition runs automatically in relation to a trigger source.
Either the 24 V trigger input or a Synchro timer can be used as a trigger source.
When using the Synchro timer, a periodical acquisition of the EnDat inputs is also possible.
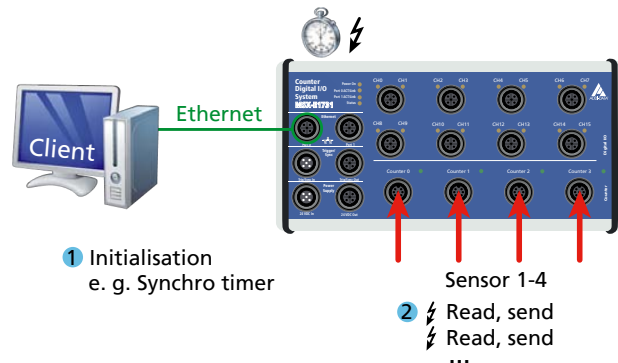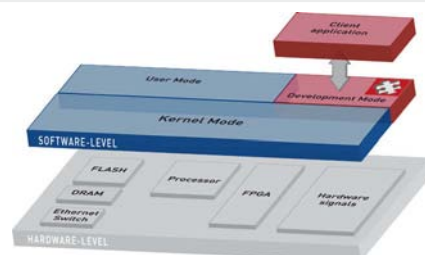
With the synchronous acquisition, it is possible to acquire all 4 sensor inputs of the MSX-E1731 simultaneously.
It is also possible to combine several MSX-E systems (even of different types) through the Synchro trigger. In synchronous acquisition mode, measurement data is sent to the clients as soon as it is available via a socket connection.

① Initialisation
e. g. Synchro timer
② ⚡ Read, send
⚡ Read, send
...
Sensor 1-4

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.

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).

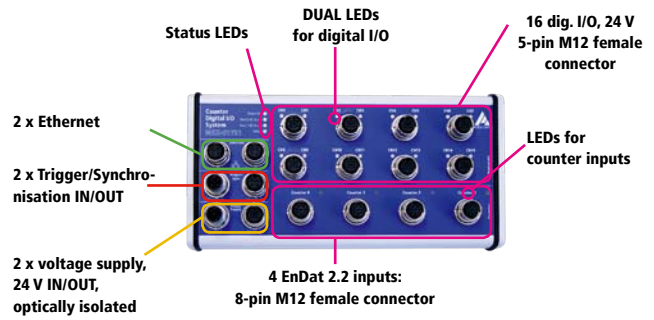**ConfigTools** is included in the delivery.

ConfigTools functions for MSX-E1731:
• Change of IP address
• Display of web interface
• Firmware update
• Save/load system configuration
• Save/load channel configuration

Very easy use through the „ConfigTools" program; The MSX-E system is automatically detected in the network.
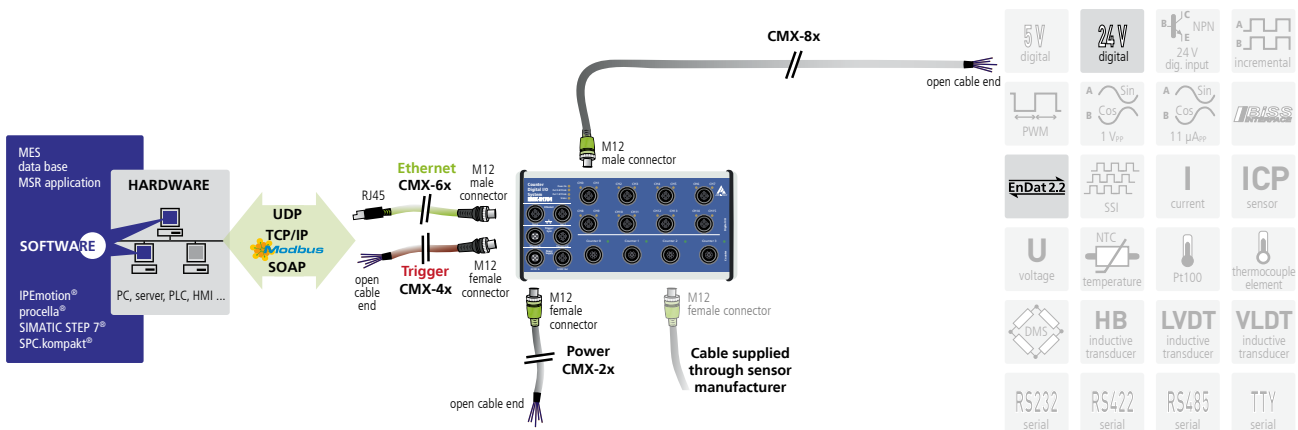

Features

- Status LEDs
- DUAL LEDs for digital I/O
- 16 dig. I/O, 24 V 5-pin M12 female connector
- 2 x Ethernet
- LEDs for counter inputs
- 2 x Trigger/Synchro-nisation IN/OUT
- 2 x voltage supply, 24 V IN/OUT, optically isolated
- 4 EnDat 2.2 inputs: 8-pin M12 female connector

Simplified block diagram

Cascading

Combination possibilities:
- **Several MSX-E of the same type:** acquisition of a large number of channels
- **Different types of MSX-E systems:** combination of different functions

Ethernet **(CMX-7x)**
Trigger/Synchro **(CMX-5x)**
Power **(CMX-3x)**

ADDI-DATA connection technology

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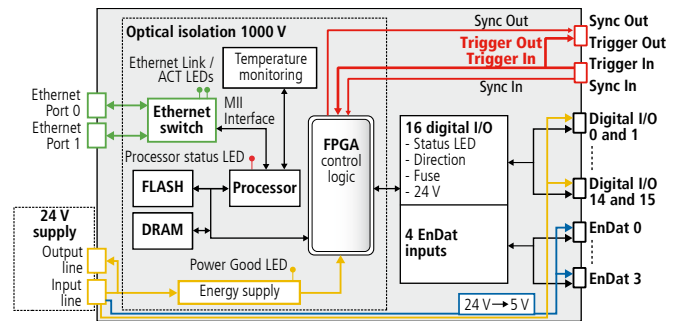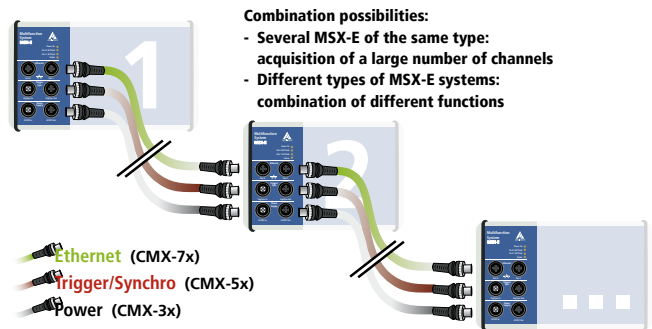
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Specifications

Counter inputs

Input type:	EnDat 2.2
Differential inputs:	Complies with the EIA standards RS422A
Input type:	Differential
Common mode range:	+12 / -7 V
Input sensitivity:	± 200 mV
Input hysteresis:	50 mV typ.
Input impedance:	12 kΩ min.
Max. input frequency:	5 MHz
ESD protection:	Up to ±15 kV
Clock frequencies:	4500 kHz
	2500 kHz
	1500 kHz
	900 kHz
	500 kHz

Digital inputs

Number of inputs:	max. 16, 2 per M12 female connector, common ground acc. to IEC 1131-2
Overvoltage protection:	30 V
Optical isolation:	1000 V through opto-couplers
Nominal voltage:	24 VDC
Input voltage:	from 0 to 30 V
Input impedance:	> 1 MΩ
Logic input levels:	UH (max):30 V typ.
	UH (min): 18 V typ.
	UL (max): 16 V typ.
	UL (min): 0 V typ.

Digital outputs

Number of outputs:	max. 16, 2 per 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
Current (max.):	1.85 A typical for 8 channels through PTC
Output current / output:	500 mA max.

Short-circuit current / output:	1.7 A max. Shut-down logic at 24 V, Rload=10 mΩ
RDS ON resistance:	280 mΩ max.
Switch-on time:	100 µs max RL=48 Ω from 80 % Vout
Switch-off time:	150 µs max RL=48 Ω from 10 % Vout
Overtemperature (shutdown):	135°C max. (output driver)
Temperature hysteresis:	15°C typ. (output driver)
Diagnostics:	Common diagnostics bits for all 16 channels at overtemperature

Watchdog

Number:	1
Resolution:	16-bit
Time base:	µs, ms, s (programmable)
Time value range:	1 to 65535

Voltage supply, Ethernet, Trigger, Synchro

The specifications for the voltage supply, Ethernet, Trigger, Synchronisation and Electromagnetic Compatibility apply to all MSX-E systems. See page 31.

System features

Interface:	Ethernet acc. to specification IEEE802.3
Dimensions (mm):	215 x 110 x 54 mm
Weight:	approx. 900 g
Degree of protection:	IP 65
Current consumption at 24 V:	150 mA without load
Operating temperature:	-40 °C to +85 °C
Connectors for sensors	
Digital I/O:	8 x 5-pin M12 female connector
Counter inputs:	4 x 8-pin M12 female connector

Ordering information

MSX-E1731
Ethernet multifunction counter system, 4 EnDat counter inputs, 16 digital I/O. Incl. technical description, software drivers and ConfigTools.

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

Connection to peripherals
CMX-8x: For the digital I/O, shielded cable, M12 5-pin male connector/open end, IP 65

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

Ethernet counter system
3 sin/cos counter inputs 1 V_{pp} , 1 analog input, 24-bit

New!*

MSX-E1741-1VPP

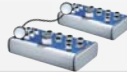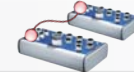| 3 sin/cos counter inputs 1 V_{pp} |
| 1 analog input |
| 24 V digital trigger input |
| M12 and M23 connectors |

Integrated Ethernet switch

+ 85 °C* / - 40 °C

IP 65

ARM®9 Technology

Cascadable, can be synchronised in the μs range

Timer function or compare logic for synchro trigger signal

*Operating temperature

RoHS 2002/95/EC

on request

DatabaseConnect see page 114

Features

- 24 V digital trigger input
- ARM®9 32-bit processor
- 64 MB onboard SDRAM for storing data
- Robust standardized metal housing
- Power Save Mode: Reduced power consumption when no acquisition runs

Safety features

- Status LEDs for fast error diagnostics
- Optical isolation 1000 V
- Input filters

Counter

- 3 x 32 bit sin/cos counter inputs 1 V_{pp}, 250 kHz
- Voltage supply of the sensors via M23 female connectors (5 V)
- Compare logic
- Status LED for counter inputs

Analog input

- 1 diff./SE inputs, 24-bit, 4-pin M12 female connector
- Sampling frequency 100 kHz/channel max.

Interfaces

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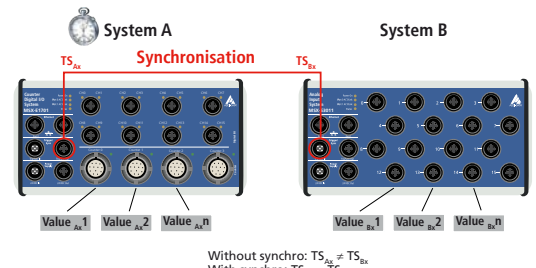- Line in for 24 V supply and cascading

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 ...)
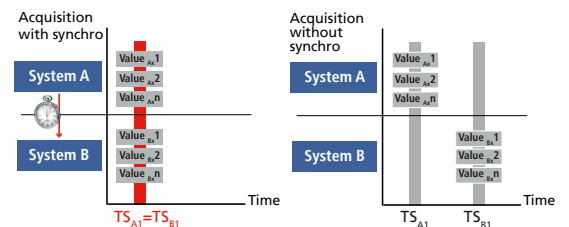- Command server Modbus TCP and Modbus (UDP) for sending commands

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.

System A — Synchronisation — System B

TS_{Ax} — TS_{Bx}

Value$_{A}$1 Value$_{A}$2 Value$_{A}$n   Value$_{B}$1 Value$_{B}$2 Value$_{B}$n

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.

Acquisition with synchro

System A
Value$_{A}$1
Value$_{A}$2
Value$_{A}$n

System B
Value$_{B}$1
Value$_{B}$2
Value$_{B}$n

$TS_{A1}=TS_{B1}$ Time

Acquisition without synchro

System A
Value$_{A}$1
Value$_{A}$2
Value$_{A}$n

System B
Value$_{B}$1
Value$_{B}$2
Value$_{B}$n

TS_{A1} TS_{B1} Time

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Fax: +49 7229 1847-222   www.addi-data.com
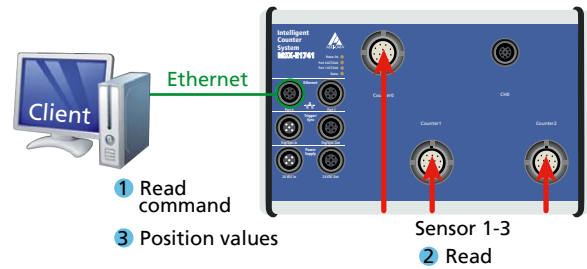
ADDI-DATA®
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Acquisition modes

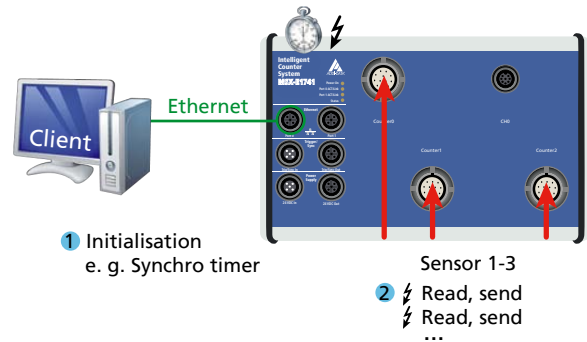**Acquisition modes** – There are 2 different possibilities for reading the counter inputs.

1. Asynchronous acquisition

With the asynchronous acquisition, the counter inputs can be read out via SOAP or Modbus function. For each function call, the values of one channel are transmitted.

❶ Read command

❸ Position values

Sensor 1-3

❷ Read

2. Synchronous acquisition

With the synchronous acquisition, the inputs are first initialised and then the acquisition is parameterised. The acquisition runs automatically depending from a trigger source.
Either the 24V trigger input or a synchro trigger can be used as trigger source.

❶ Initialisation e. g. Synchro timer

Sensor 1-3

❷ ⚡ Read, send
⚡ Read, send
…

Synchro latch

A periodic acquisition of the counter inputs is possible using the synchro timer (synchro latch). Several MSX-E systems (of same or different types) can be combined through synchro trigger. With the synchronous acquisition, as soon as there are measurement values available, they are sent to the clients via socket connection.

Compare logic

With the compare logic, a synchro-trigger signal can be generated in order to latch the counter value as soon as the counter value is equal to the compare value.
With the additional „Modulo-Mode" (Modulo Compare), a trigger can also be generated at the n value of the compare value.
Thus it is possible, e. g. when using an encoder with 3,600 steps / revolution to obtain each degree of a measurement value (Modulo Compare = 10).
The thus generated synchro-trigger can also be used for data acquisition on further MSX-E systems.

② Counter

			0
1 2 3 4 5 6 7 8 9 10			
11 12 …			20
21 22 …			30
…			

① Modulo Compare = 10
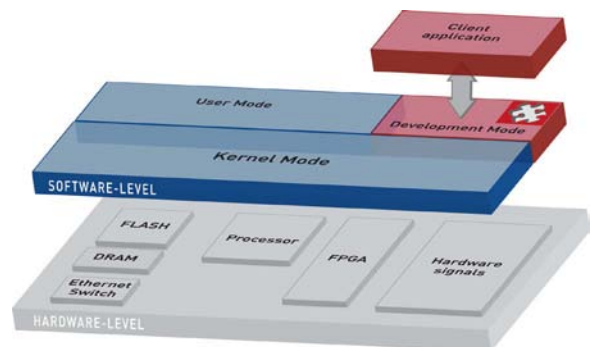
③ Send data

③ Send data

Index logic

The Index track of the encoder can also be used as trigger source. Either the selected edge of the index signal can directly start the acquisition or a synchro-trigger can be generated and then used on further MSX-E systems. Furthermore, the index signal can be used to delete the counter channel.

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.

*Preliminay 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).

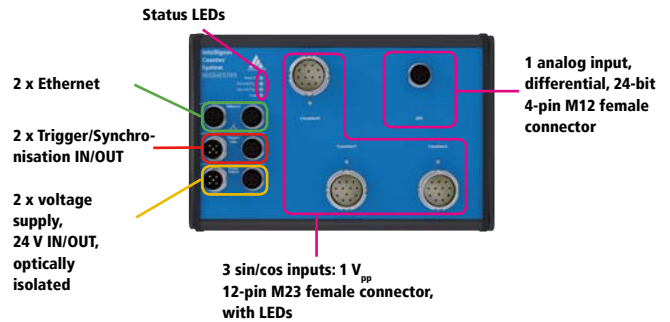**ConfigTools** is included in the delivery.

ConfigTools functions for MSX-E1741-1VPP:
• Change of IP address
• Display of web interface
• Firmware update
• Save/load system configuration

Very easy use through the „ConfigTools" program; The MSX-E system is automatically detected in the network.

Features

Status LEDs

2 x Ethernet

2 x Trigger/Synchronisation IN/OUT

2 x voltage supply, 24 V IN/OUT, optically isolated

1 analog input, differential, 24-bit 4-pin M12 female connector

3 sin/cos inputs: 1 V$_{PP}$ 12-pin M23 female connector, with LEDs

Simplified block diagram

Cascading

Combination possibilities:
- **Several MSX-E of the same type: acquisition of a large number of channels**
- **Different types of MSX-E systems: combination of different functions**

Ethernet (CMX-7x)
Trigger/Synchro (CMX-5x)
Power (CMX-3x)

ADDI-DATA connection technology

*Preliminay product information

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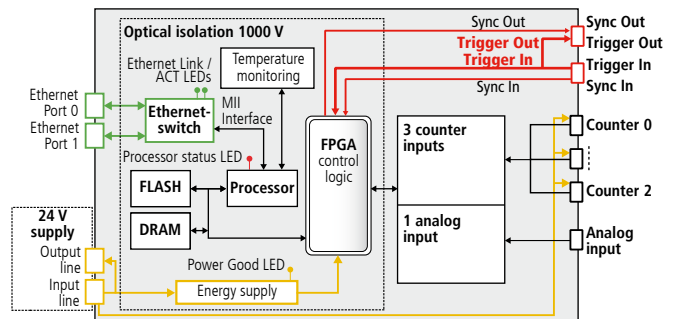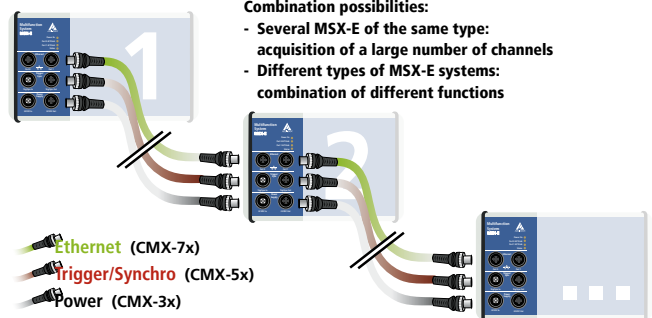
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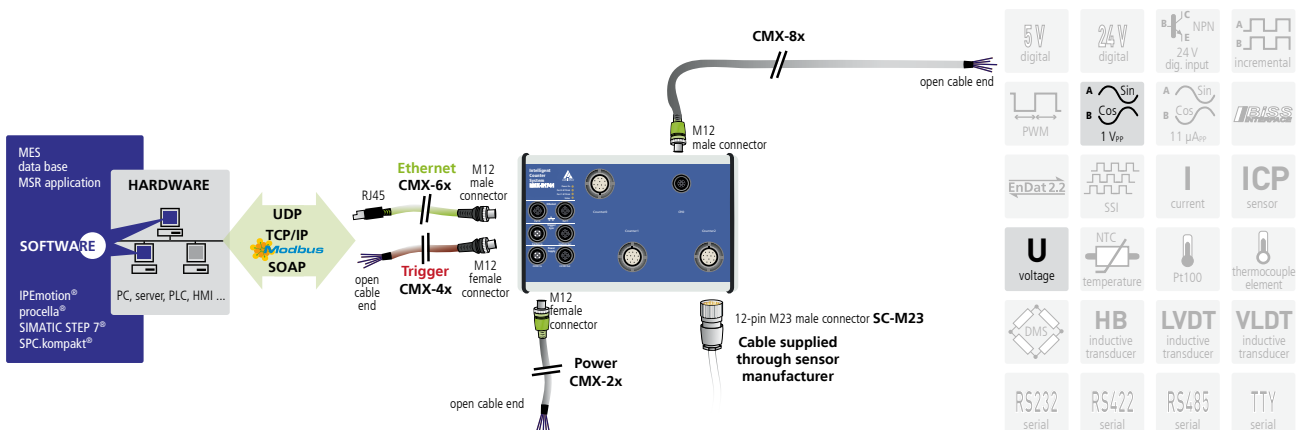
Specifications*

Sin/cos counter inputs

Number of inputs:	3 x sin/cos counter inputs, each with A, B, C signals
Resolution:	32-bit
Differential inputs:	1 V_{pp}
Interpolation factor:	up to 8192
Max. input frequency:	max. 250 kHz (at min. interpolation)
ESD protection:	2 kV

Analog input

Number/type:	1 differential / single-ended input (software-selectable)
Resolution:	24-bit
Optical isolation:	1000 V
Input ranges:	± 10 V, ± 1 V, ± 100 mV, ± 10 mV (24-bit), 0-10 V, 0-1 V, 0-100 mV, 0-10 mV (23-bit), software-programmable, current input 0(4) – 20 mA optional
Sampling frequency:	100 kHz
Gain:	x1, x10, x100, software-programmable
Trigger:	digital input, synchro, software-programmable

Voltage supply, Ethernet, Trigger, Synchro

The specifications for the voltage supply, Ethernet, Trigger, Synchronisation and Electromagnetic Compatibility apply to all MSX-E systems. See page 31.

System features

Interface:	Ethernet acc. to specification IEEE802.3
Dimensions (mm):	215 x 110 x 54
Weight:	in preparation
Degree of protection:	IP 65
Current consumption at 24 V:	in preparation
Operation temperature:	-40 °C to +85 °C
Connectors for sensors	
Sin/cos counter input 1 V_{pp}:	3 x 12-pin M23 female connector
Analog input:	1 x 4-pin M12 female connector

Ordering information

MSX-E1741-1VPP

Ethernet counter system, 3 sin/cos counter inputs 1 V_{pp}, 1 analog input, 24-bit. Incl. technical description, software drivers and ConfigTools.

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

Connection to peripherals
CMX-8x: For the analog input, shielded cable, M12 5-pin male connector/open end, IP 65

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

*** Preliminay product information**

Ethernet analog input system
16 analog inputs, diff., 16-bit

MSX-E3011

16 analog inputs, differential, 16-bit

Voltage or current inputs

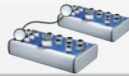**Simultaneous acquisition of 4 channels with 100 kHz each**

M12 connector

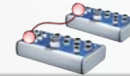**24 V trigger input**

Integrated Ethernet switch

+ 85 °C* - 40 °C

IP 65

ARM®9 Technology

Cascadable, can be synchronised in the µs range

On request: Compare logic for synchro trigger signal

*Operating temperature

RoHS 2002/95/EC

on request

DatabaseConnect
see page 114

More information on
www.addi-data.com

Features

- 24 V digital trigger input
- ARM®9 32-bit processor
- 64 MB onboard SDRAM for storing data
- Robust standardized metal housing
- Power Save Mode: Reduced power consumption when no acquisition runs

Analog inputs

- 16 diff. inputs, 16-bit, 5-pin M12 female connector
- Sampling frequency max. 100 kHz, up to 4 simultaneous channels
- Input ranges: ± 5 V, ± 10 V (16-bit)
  0-5 V, 0-10 V (15-bit)
- Current inputs optional

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
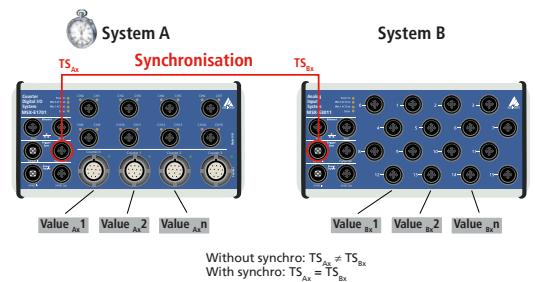- Synchronisation/trigger In/Out
- Line in for 24 V supply and cascading

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 ...)
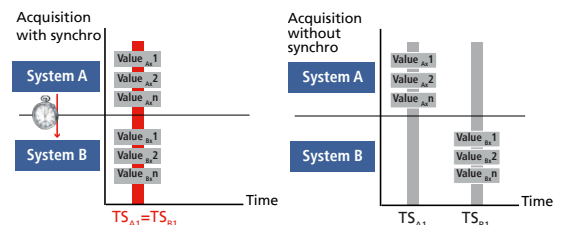- Command server Modbus TCP and Modbus (UDP) for sending commands

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.

System A Synchronisation System B

TS_{Ax} TS_{Bx}

Value$_{Ax}$1 Value$_{Ax}$2 Value$_{Ax}$n Value$_{Bx}$1 Value$_{Bx}$2 Value$_{Bx}$n

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.

Acquisition with synchro

System A
Value$_{Ax}$1
Value$_{Ax}$2
Value$_{Ax}$n

System B
Value$_{Bx}$1
Value$_{Bx}$2
Value$_{Bx}$n

Time

$TS_{A1}=TS_{B1}$

Acquisition without synchro

System A
Value$_{Ax}$1
Value$_{Ax}$2
Value$_{Ax}$n

System B
Value$_{Bx}$1
Value$_{Bx}$2
Value$_{Bx}$n

Time

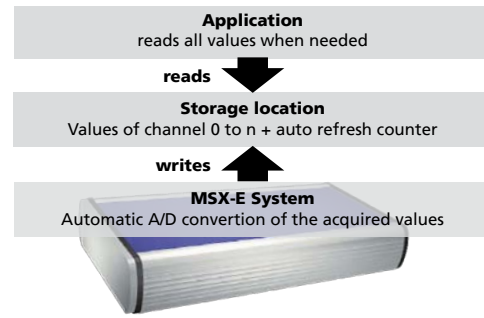TS_{A1} TS_{B1}

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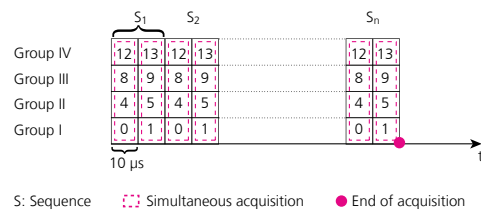## Acquisition modes

Auto-refresh mode

In 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.

Application
reads all values when needed

reads

Storage location
Values of channel 0 to n + auto refresh counter

writes

MSX-E System
Automatic A/D convertion of the acquired values

Sequence mode

In 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.
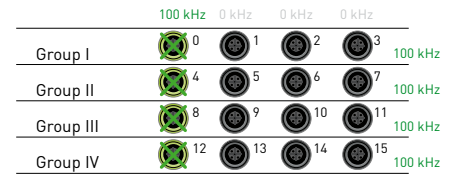
Example: 8 channels, each with 10 µs

S: Sequence   Simultaneous acquisition   ● End of acquisition

Acquisition speed
Different wiring
for 25 kHz/channel and 100 kHz/groups

Horizontal wiring (with 4 gauges/sensors)

Vertical wiring (with 4 gauges/sensors)

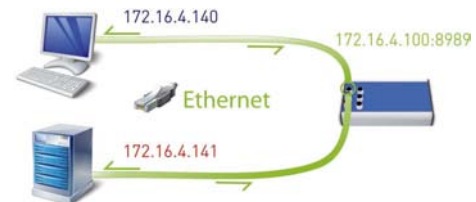### Acquisition triggered through trigger or synchro input
Example: A measurement process is to be started through an external trigger impulse. For each trigger, 10 sequences are to be acquired. After the acquisition of the 10 sequences they are to be sent to the client.

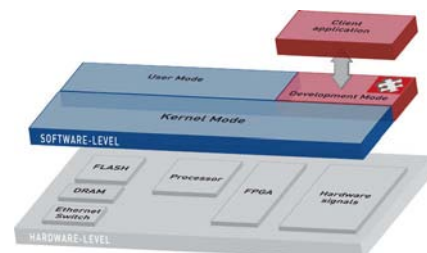### Reading data from a MSX-E system

MSX-E systems are multi-client capable, this means several clients (e. g. PC, server, PLC, …) can read the measurement values of one MSX-E system at the same time. For this, each client establishes a socket connection to the data server of the MSX-E system (port 8989). As soon as the measurement values are available on the data server, the MSX-E system transfers them to the clients.

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.

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.
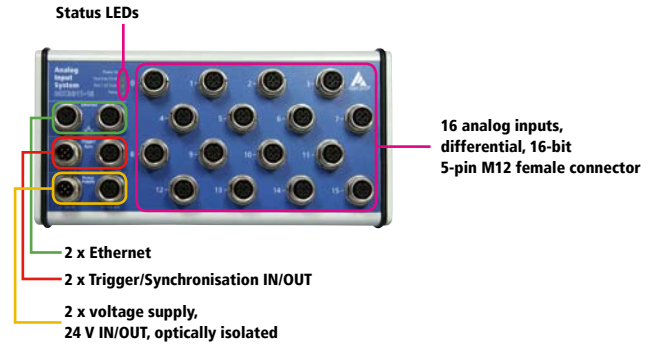
ConfigTools functions for MSX-E3011:
- Change of IP address
- Display of web interface
- Firmware update
- Save/load system configuration
- Save/load channel configuration
- Monitor for analog inputs

Very easy use through the „ConfigTools" program; The MSX-E system is automatically detected in the network.
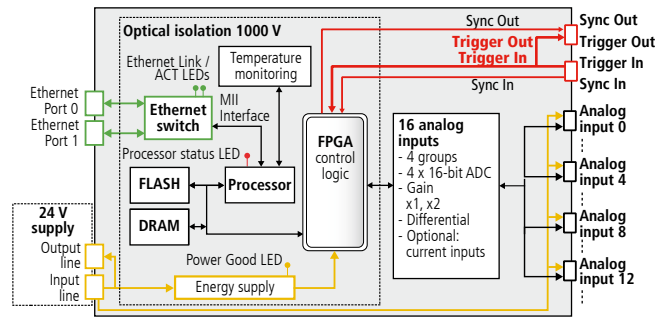

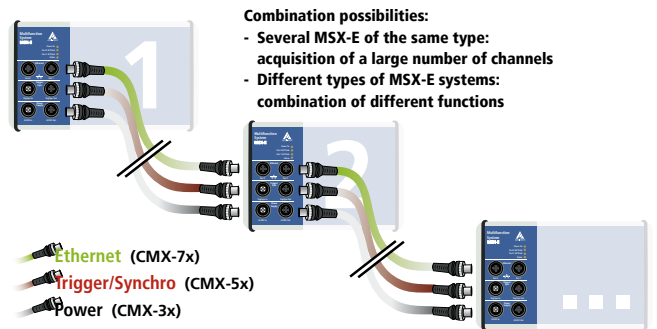**Example of monitor function: Testing the analog inputs.**

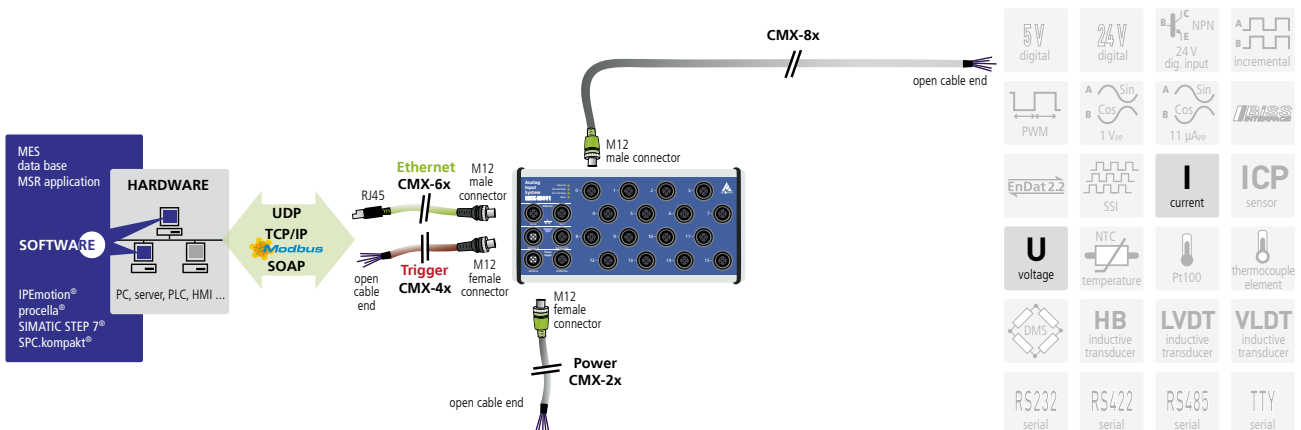## Features

Status LEDs

16 analog inputs, differential, 16-bit 5-pin M12 female connector

2 x Ethernet

2 x Trigger/Synchronisation IN/OUT

2 x voltage supply, 24 V IN/OUT, optically isolated

Simplified block diagram

Cascading

Combination possibilities:
- **Several MSX-E of the same type: acquisition of a large number of channels**
- **Different types of MSX-E systems: combination of different functions**

Ethernet **(CMX-7x)**
Trigger/Synchro **(CMX-5x)**
Power **(CMX-3x)**

ADDI-DATA connection technology

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Specifications

Analog inputs

Number/type:	16 differential inputs
Architecture:	4 groups of 4 channels each 4-port simultaneous converter with one 4-channel multiplexer per converter
Resolution:	16-bit, SAR ADC
Accuracy:	± 1.221 mV typ. (± 4 LSB) ± 2.442 mV max.
Relative Accuracy (INL):	± 3 LSB max (ADC)
Optical isolation:	1000 V
Input ranges:	± 5 V, ± 10 V (16-bit), 0-5 V, 0-10 V (15-bit) software-programmable, current inputs optional
Sampling frequency:	25 kHz per channel / 100 kHz max.
Gain:	x1, x2, software-programmable
Common mode rejection:	80 dB min. DC up to 60 Hz (diff. amplifier)
Input impedance (PGA):	$10^9 \ \Omega$ // 10nF against GND
Bandwidth (-3dB):	160 kHz limited through TP filters 16 Hz version with differential filter
Trigger:	digital input, synchro, software-programmable
Offset error:	± 1 LSB (± 305 µV)
Gain error:	± 2.5 LSB
Temperature drift: V_{in}: input voltage in Volts $(-10 \ V \leq V_{in} \leq +10 \ V)$ In the temperature range: from -40°C to +85°C	$2.3 \times V_{in} + 22.5$ (µ V/ °C) typ. 4.5 ppm/°C FSR

Voltage supply, Ethernet, Trigger, Synchro

The specifications for the voltage supply, Ethernet, Trigger, Synchronisation and Electromagnetic Compatibility apply to all MSX-E systems. See page 31.

System features

Interface:	Ethernet acc. to specification IEEE802.3
Dimensions:	215 x 110 mm x 50 mm
Weight:	850 g
Degree of protection:	IP 65
Current consumption at 24 V:	180 mA
Operating temperature:	-40 °C to +85 °C
Connectors for sensors	
For analog inputs	16 x 5-pin M12 female connector

Ordering information

MSX-E3011
Ethernet analog input system, 16 analog inputs, diff., 16-bit. Incl. technical description, software drivers and ConfigTools.

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

Connection to peripherals
CMX-8x: Shielded cable, M12 5-pin male connector/open end, IP 65

Options

PC-Diff: Current input 0(4)-20 mA for 1 input, diff.
(please indicate the number of channels)
S7 Modbus TCP Client Library for S7: Easy use of the Ethernet systems MSX-E with PLCs
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

Ethernet force-distance measurement system, 1 counter input, 4 analog inputs, 24-bit, 2 dig. I/O, 24 V

New!*

MSX-E3017

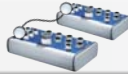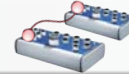| 1 counter input |
| 4 analog inputs, diff, 24-bit |
| 2 digital I/O, 24 V |
| Easy configuration: Easy mode |

Integrated Ethernet switch

On request + 85 °C* - 40 °C

IP 65

ARM®9 Technology

Cascadable, can be synchronised in the µs range

On request: Compare logic for synchro trigger signal

*Operating temperature

RoHS 2002/95/EC

on request

DatabaseConnect
on request, see page 114

More information on www.addi-data.com

Features

- 24 V digital trigger input
- ARM®9 32-bit processor
- 64 MB onboard SDRAM for storing data
- Robust standardized metal housing
- Power Save Mode: Reduced power consumption when no acquisition runs

Safety features

- Status LEDs for fast error diagnostics
- Optical isolation • Input filters

Counter input

- 1 incremental counter input, 32-bit, (on request: Sin/Cos 1 V_{pp} or Sin/Cos 11 μA_{pp}) 12-pin M23 female connector
- Max. input frequency 5 MHz

Analog inputs

- 4 diff. inputs, 24-bit, 4-pin M12 female connector
- Sampling frequency max. 100 kHz/channel simultaneous on 4 channels

Digital I/O

- 1 x 2 digital lines, 24 V, which can be parameterised as pairs of inputs or outputs
- Shutdown logic
- Watchdog for resetting the outputs to "0"
- At Power-On the outputs are set to "0"
- Electronic fuse
- Dual LED for each 24 V digital I/O with direction indication

Interfaces

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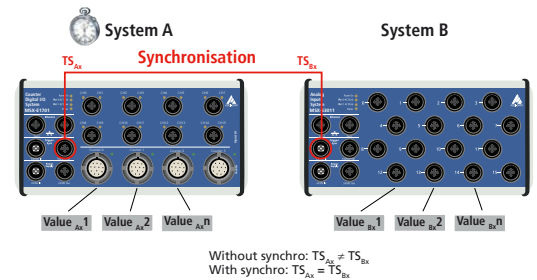- Line in for 24 V supply and cascading

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 ...)
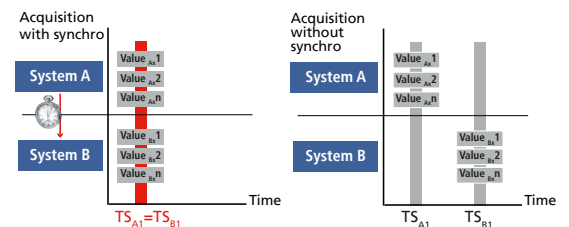- Command server Modbus TCP and Modbus (UDP) for sending commands

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.

*Preliminary Product information

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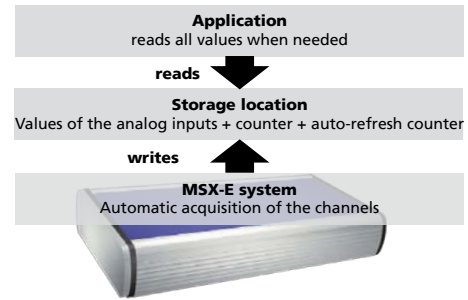
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Acquisition modes

With the MSX-E3017 system, you can effect force-distance measurements in 2 different ways: in auto-refresh mode or sequence mode.
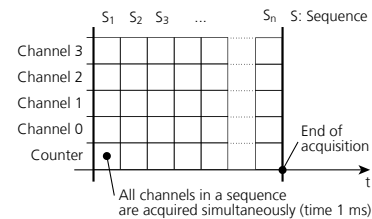The acquisition can be done depending on a position or on time.w

Auto-refresh mode

In 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.
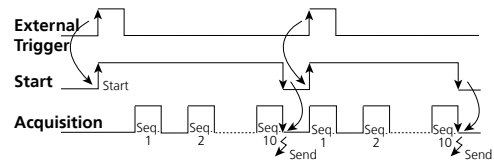

Sequence mode

In 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.
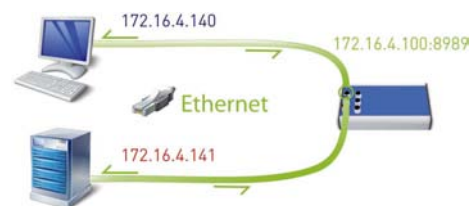

Acquisition triggered through trigger or synchro input

Example: A measurement process is to be started through an external trigger impulse. For each trigger, 10 sequences are to be acquired. After the acquisition of the 10 sequences they are to be sent to the client.
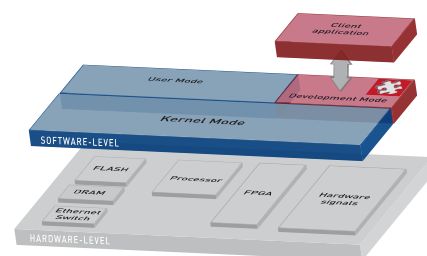

Reading data from a MSX-E system

MSX-E systems are multi-client capable, this means several clients (e. g. PC, server, PLC, …) can read the measurement values of one MSX-E system at the same time. For this, each client establishes a socket connection to the data server of the MSX-E system (port 8989). As soon as the measurement values are available on the data server, the MSX-E system transfers them to the clients.

Onboard programming

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

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Fax: +49 7229 1847-222   www.addi-data.com

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).

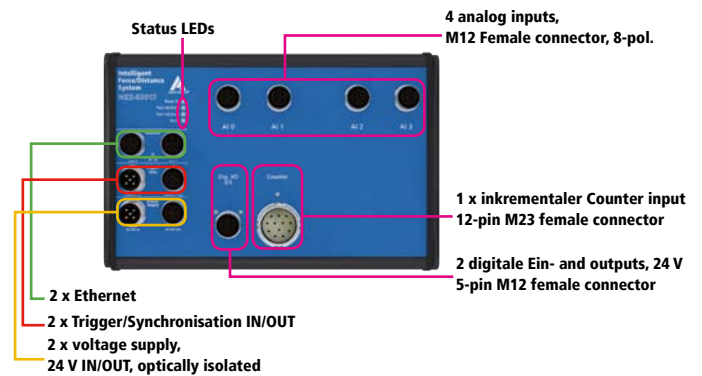**ConfigTools** is included in the delivery.

ConfigTools functions for MSX-E3017:
- Change of IP address
- Display of web interface
- Firmware update
- Save/load system configuration
- Save/load channel configuration
- Monitor for analog inputs
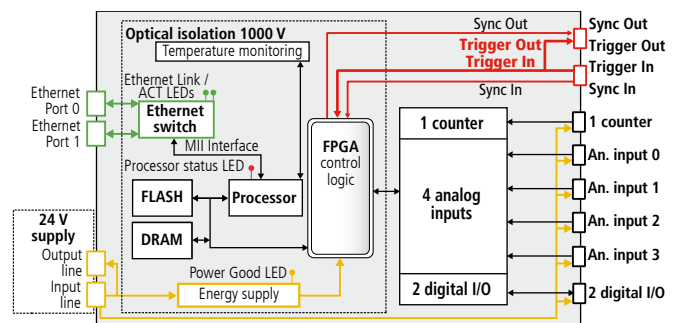- Visualisation of the force-distance measurement (Easy mode)

Very easy use through the „ConfigTools" program; The MSX-E system is automatically detected in the network.
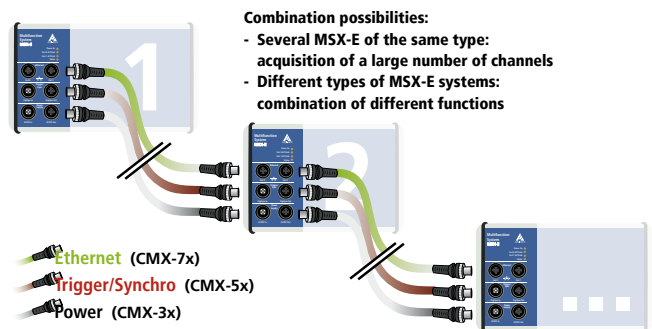
Features
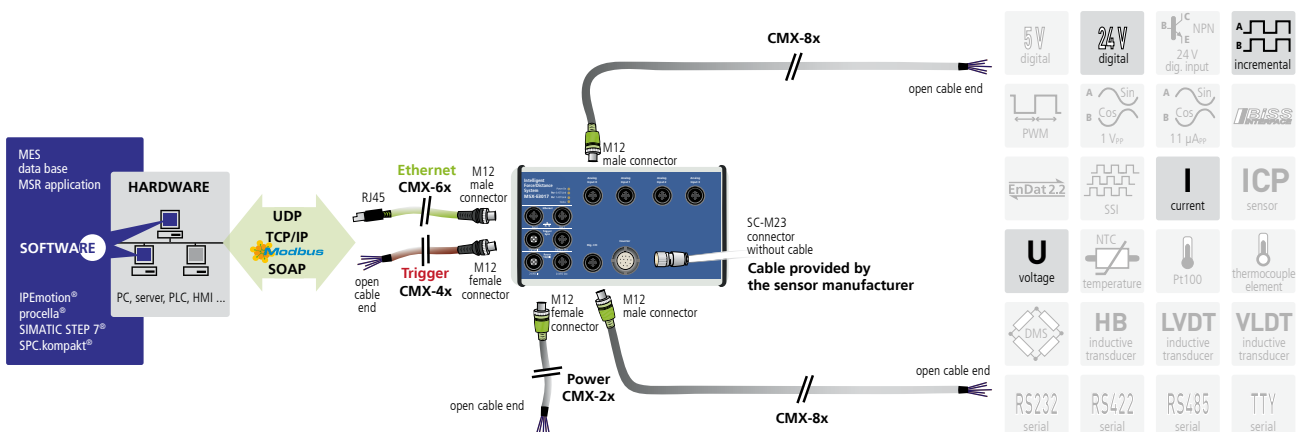
Status LEDs

4 analog inputs, M12 Female connector, 8-pol.

1 x inkrementaler Counter input 12-pin M23 female connector

2 digitale Ein- and outputs, 24 V 5-pin M12 female connector

2 x Ethernet
2 x Trigger/Synchronisation IN/OUT
2 x voltage supply, 24 V IN/OUT, optically isolated

Simplified block diagram

Cascading

Combination possibilities:
- **Several MSX-E of the same type:** acquisition of a large number of channels
- **Different types of MSX-E systems:** combination of different functions

Ethernet (CMX-7x)
Trigger/Synchro (CMX-5x)
Power (CMX-3x)

ADDI-DATA connection technology

CMX-8x
open cable end

MES data base MSR application

HARDWARE

SOFTWARE

IPEmotion®
procella®
SIMATIC STEP 7®
SPC.kompakt®

PC, server, PLC, HMI ...

UDP
TCP/IP
Modbus
SOAP

RJ45

Ethernet CMX-6x

M12 male connector

M12 male connector

open cable end

Trigger CMX-4x

M12 female connector

M12 female connector

M12 male connector

Power CMX-2x

open cable end

M12 male connector

SC-M23 connector without cable
Cable provided by the sensor manufacturer

open cable end

CMX-8x

* **Preliminary product information**

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Specifications*

Incremental counter

Number of counter inputs:	1
Input type:	Differential or TTL inputs
Differential inputs:	Complies with the EIA standards RS422A
Common mode range:	+12 / -7 V
Input sensitivity:	± 200 mV
Input hysteresis:	50 mV typ.
Input impedance:	12 kΩ min.
Max. input frequency:	5 MHz at nominal voltage
"Open Circuit Fail Safe Receiver Design"	"1" = inputs open
ESD protection:	Up to ±15 kV
Voltage supply Incremental encoder:	5 V or 24 V, max. 500 mA

Analog inputs

Number/type:	4 differential inputs, 1 A/D converter per channel
Resolution:	24-bit, SAR ADC
Optical isolation:	1000 V
Input ranges:	± 10 V, ± 5 V (24-bit), 0-10 V, 0-5 V (23-Bit), software-programmable, current inputs optional
Sampling frequency:	100 kHz per channel
Gain:	x1, x10, x100, x1000, software-programmable
Trigger:	digital input, synchro, software-programmable

Digital inputs

Number of inputs:	2, on 1 M12 female connector Common ground acc. to IEC 1131-2
Overvoltage protection:	30 V
Optical isolation:	1000 V through opto-couplers
Nominal voltage:	24 VDC
Input voltage:	0 to 30 V
Input impedance:	> 1 MΩ
Logic input levels:	UH (max) 30 V typ. UH (min) 18 V typ. UL (max) 16 V typ. UL (min) 0 V typ.

Digital outputs

Number of outputs:	2, on 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
Current (max.):	1.85 A typical for 2 channels through PTC
Output current / output:	500 mA max.
Short-circuit current / output:	1.7 A max. Shut-down logic at 24 V, R_{load}=10mΩ
RDS ON Resistance:	280 mΩ max.
Switch-on time:	100 µs max RL=48 Ω at 80 % V_{out}
Switch-off time:	150 µs max RL=48 Ω at 10 % V_{out}
Overtemperature (shutdown):	135°C max. (output driver)
Temperature hysteresis:	15°C typ. (output driver)
Diagnostics:	Common diagnostic bit at overtemperature

Watchdog:

Number:	1
Resolution:	16-bit
Time base:	µs, ms, s (programmable)
Time value range:	1 to 65535

Voltage supply, Ethernet, Trigger, Synchro

The specifications for the voltage supply, Ethernet, Trigger, Synchronisation and Electromagnetic Compatibility apply to all MSX-E systems. See page 31.

System features

Interface:	Ethernet acc. to specification IEEE802.3
Dimensions:	220 x 140 x 50 mm
Weight:	ca. 900 g
Degree of protection:	IP 65
Current consumption at 24 V:	150 mA without load
Operating temperature:	-40 °C to +85 °C
Connectors for sensors	
For analog inputs:	4 x 4-pin M12 female connector
For digital I/O:	1 x 5-pin M12 female connector
For the counter input:	1 x 12-pin M23 female connector

Ordering information

MSX-E3017

Ethernet force-distance measurement system, 1 counter input, 4 analog inputs, 24-bit, 2 digital I/O, 24 V.
Incl. technical description, software drivers and ConfigTools.

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

Connection to peripherals
CMX-8x: Shielded cable, M12 5-pin male connector/open end, IP 65

Options
PC-Diff: Current input 0(4)-20 mA for 1 input, diff. (please indicate the number of channels)

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

* Preliminary product information

Ethernet force-distance measurement system, 1 counter input, 4 inputs for strain gauges, 24-bit, 2 digital I/O, 24 V

New!*

MSX-E3317

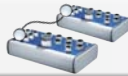| 1 counter input |
| --- |
| 4 inputs for strain gauges, diff, 24-bit |
| 2 digital I/O, 24 V |
| Easy configuration: Easy mode |

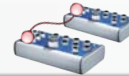Integrated Ethernet switch

On request + 85 °C* - 40 °C
*Operating temperature

IP 65

ARM®9 Technology

Cascadable, can be synchronised in the µs range

On request: Compare logic for synchro trigger signal

RoHS 2002/95/EC

on request

DatabaseConnect
on request, see page 114

More information on
www.addi-data.com

Features

- 24 V digital trigger input
- ARM®9 32-bit processor
- 64 MB onboard SDRAM for storing data
- Robust standardized metal housing
- Power Save Mode: Reduced power consumption when no acquisition runs

Safety features
- Status LEDs for fast error diagnostics
- Optical isolation • Input filters

Counter input
- 1 incremental counter input, 32-bit,
  (on request: Sin/Cos 1 V_{pp} or Sin/Cos 11 μA_{pp})
  12-pin M23 female connector
- Max. input frequency 5 MHz

Inputs for strain gauges
- 4 inputs for strain gauges, 24-bit,
  M12 female connector, 8-pin
- Sampling frequency max. 788 Hz/channel
  (max. 2 channels simultaneously)

Digital I/O
- 1 x 2 digital lines, 24 V, which can be parameterised as pairs of inputs or outputs
- Shutdown logic
- At Power-On the outputs are set to „0"
- Electronic fuse
- Dual LED for each 24 V dig. I/O with direction indication

Interfaces

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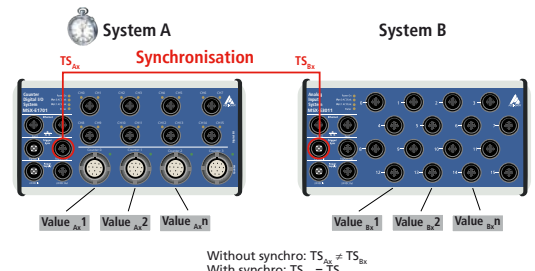- Line in for 24 V supply and cascading

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 ...)
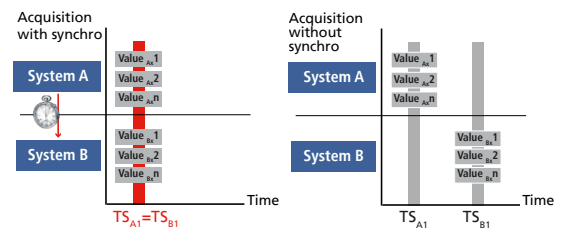- Command server Modbus TCP and Modbus (UDP) for sending commands

* Preliminary Product information

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.

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Fax: +49 7229 1847-222 www.addi-data.com
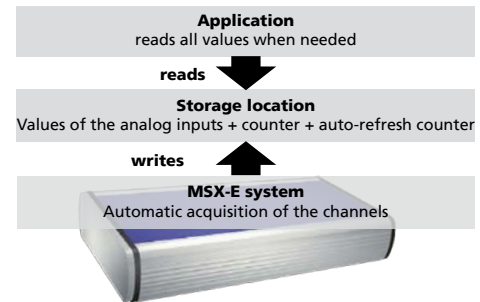
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Acquisition modes

With the MSX-E3317 system, you can effect force-distance measurements in 2 different ways: in auto-refresh mode or sequence mode. The acquisition can be done depending on a position or on time.
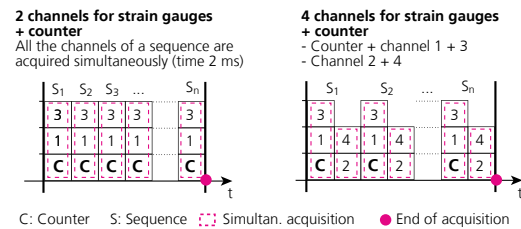
Auto-refresh mode

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.
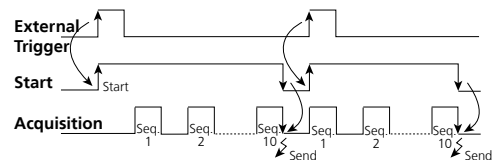

Sequence mode

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.
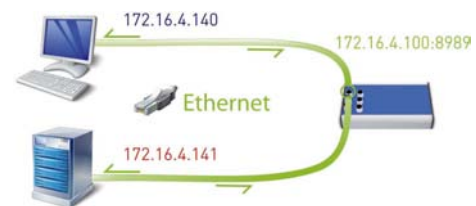

Acquisition triggered through trigger or synchro input

Example: A measurement process is to be started through an external trigger impulse. For each trigger, 10 sequences are to be acquired. After the acquisition of the 10 sequences they are to be sent to the client.
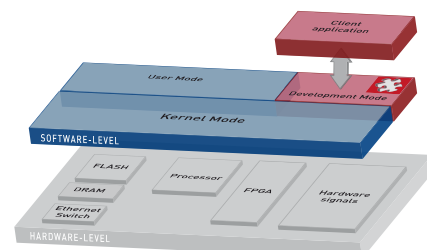

Reading data from a MSX-E system

MSX-E systems are multi-client capable, this means several clients (e. g. PC, server, PLC, …) can read the measurement values of one MSX-E system at the same time. For this, each client establishes a socket connection to the data server of the MSX-E system (port 8989). As soon as the measurement values are available on the data server, the MSX-E system transfers them to the clients.

Onboard programming

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).

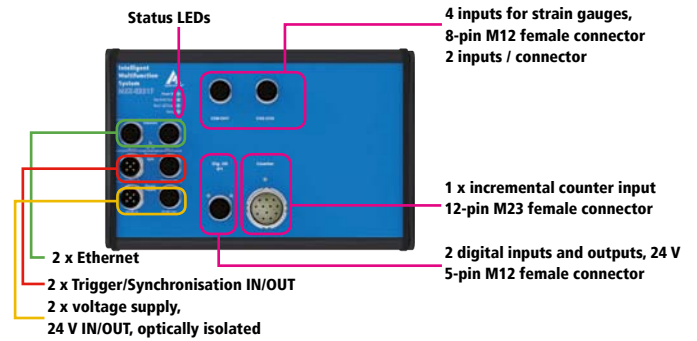**ConfigTools** is included in the delivery.

ConfigTools functions for MSX-E3317:
- Change of IP address
- Display of web interface
- Firmware update
- Save/load system configuration
- Save/load channel configuration
- Monitor for Inputs for strain gauges
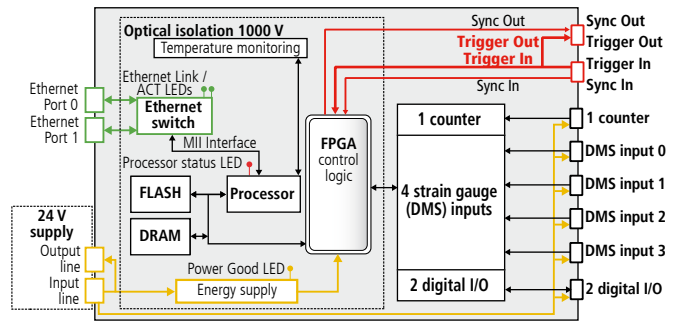- Visualisation of the force-distance measurement (Easy mode)

Very easy use through the „ConfigTools" program; The MSX-E system is automatically detected in the network.

Features

Status LEDs

4 **inputs for strain gauges,**
8-pin M12 female connector
2 inputs / connector

1 x incremental counter input
12-pin M23 female connector

2 digital inputs and outputs, 24 V
5-pin M12 female connector

2 x Ethernet
2 x Trigger/Synchronisation IN/OUT
2 x voltage supply,
24 V IN/OUT, optically isolated

Simplified block diagram

Cascading

Combination possibilities:
- **Several MSX-E of the same type:**
  acquisition of a large number of channels
- **Different types of MSX-E systems:**
  combination of different functions

Ethernet **(CMX-7x)**
Trigger/Synchro **(CMX-5x)**
Power **(CMX-3x)**

ADDI-DATA connection technology

* Preliminary product information

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Specifications*

Incremental counter

Number of counter inputs:	1
Input type:	Differential or TTL inputs
Differential inputs:	Complies with the EIA standards RS422A
Common mode range:	+12 / -7 V
Input sensitivity:	± 200 mV
Input hysteresis:	50 mV typ.
Input impedance:	12 kΩ min.
Max. input frequency:	5 MHz at nominal voltage
"Open Circuit Fail Safe Receiver Design"	"1" = inputs open
ESD protection:	Up to ±15 kV
Voltage supply Incremental encoder:	5 V or 24 V, max. 500 mA

Inputs for strain gauges

Number of inputs:	4 differential inputs for strain gauges 2 inputs per M12 connector
Resolution:	24-bit
Optical isolation:	1000 V
Throughput per M12 connector:	max. 788 Hz for 1 channel, max. 528 Hz for 2 channels
Voltage supply for the sensors:	10 V, 50 mA
Trigger:	Digital input, synchro, software-programmable

Digital inputs

Number of inputs:	2, on 1 M12 female connector, Common ground acc. to IEC 1131-2
Overvoltage protection:	30 V
Optical isolation:	1000 V through opto-couplers
Nominal voltage:	24 VDC
Input voltage:	0 to 30 V
Input impedance:	> 1 MΩ
Logic input levels:	UH (max) 30 V typ. UH (min) 18 V typ. UL (max) 16 V typ. UL (min) 0 V typ.

Digital outputs

Number of outputs:	2, on 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
Current (max.):	1.85 A typical for 2 channels through PTC
Output current / output:	500 mA max.
Short-circuit current / output:	1.7 A max. Shut-down logic at 24 V, R_{load}=10mΩ
RDS ON Resistance:	280 mΩ max.
Switch-on time:	100 µs max RL=48 Ω at 80 % V_{out}
Switch-off time:	150 µs max RL=48 Ω at 10 % V_{out}
Overtemperature (shutdown):	135°C max. (output driver)
Temperature hysteresis:	15°C typ. (output driver)
Diagnostics:	Common diagnostic bit at overtemperature

Voltage supply, Ethernet, Trigger, Synchro

The specifications for the voltage supply, Ethernet, Trigger, Synchronisation and Electromagnetic Compatibility apply to all MSX-E systems. See page 31.

System features

Interface:	Ethernet acc. to specification IEEE802.3
Dimensions:	220 x 140 x 50 mm
Weight:	ca. 900 g
Degree of protection:	IP 65
Current consumption at 24 V:	150 mA without load
Operating temperature:	-40 °C to +85 °C
Connectors for sensors	
For inputs for strain gauges:	2 x 8-pin female connector M12
For digital I/O:	1 x 5-pin M12 female connector
For the counter input:	1 x 12-pin M23 female connector

Ordering information

MSX-E3317

Ethernet force-distance measurement system, 1 counter input, 4 inputs for strain gauges, 24-bit, 2 digital I/O, 24 V.
Incl. technical description, software drivers and ConfigTools.

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

Connection to peripherals
CMX-8x: Shielded cable, M12 5-pin male connector/open end, IP 65
CMX-9x: Shielded cable, M12 8-pin male connector/open end, IP 65

Options

S7 Modbus TCP Client Library for S7: Easy use of the Ethernet systems MSX-E with PLCs
MSX-E 5V-Trigger: Level change of the trigger inputs and outputs to 5 V
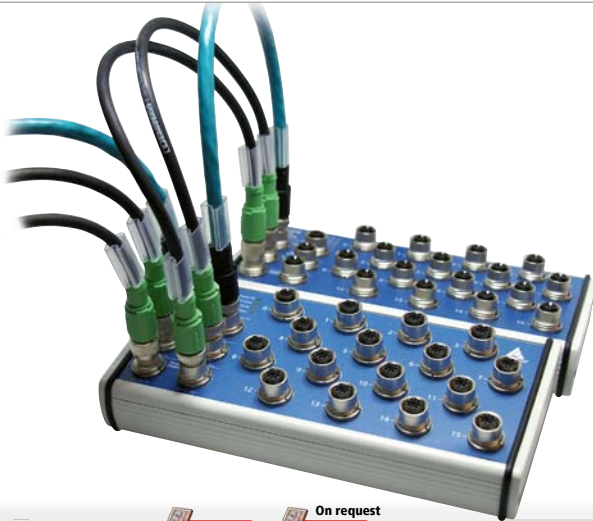**MX-Clip**, **MX-Rail** (please specify when ordering!),
MX-Screw, PCMX-1x

* Preliminary product information

Ethernet analog input system
16 analog inputs, diff., 16-bit

MSX-E3021

16 analog inputs, differential, 16-bit

Voltage or current inputs

Simultaneous acquisition of 4 channels
with 100 kHz per channel

4 GB extended memory

Buffered real-time clock

24 V digital trigger input

Integrated Ethernet switch | + 85 °C* − 25 °C | On request: + 85 °C* − 40 °C | IP 65 | ARM®9 Technology | Cascadable, can be synchronised in the µs range | On request: Compare logic for synchro trigger signal | 4 GB flash memory, real-time clock

*Operating temperature

RoHS 2002/95/EC

on request

DatabaseConnect
see page 114

More information on
www.addi-data.com

Features

- 24 V digital trigger input
- ARM®9 32-bit processor
- 64 MB onboard SDRAM for storing data
- Robust standardized metal housing
- Power Save Mode: Reduced power consumption when no acquisition runs

Analog inputs

- 16 diff. inputs, 16-bit, 5-pin M12 female connector
- Sampling frequency max. 100 kHz, up to 4 simultaneous channels
- Input ranges: ±5 V, ±10 V (16-bit), 0-5 V, 0-10 V (15-bit)
- Gain PGA x1, x2, x10, x20, x100, x200, x1000, x2000 software-programmable, signals up to +/-5mV (16-bit) are possible
- Current inputs optional

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
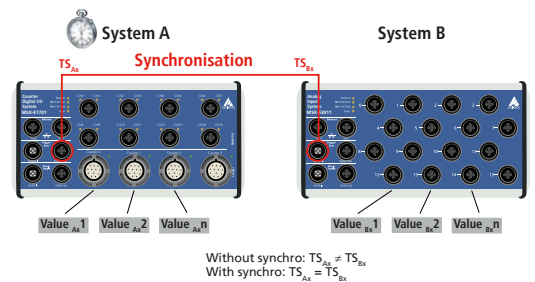- Line in for 24 V supply and cascading

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 ...)
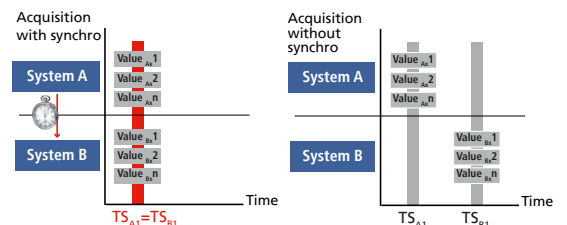- Command server Modbus TCP and Modbus (UDP) for sending commands

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.
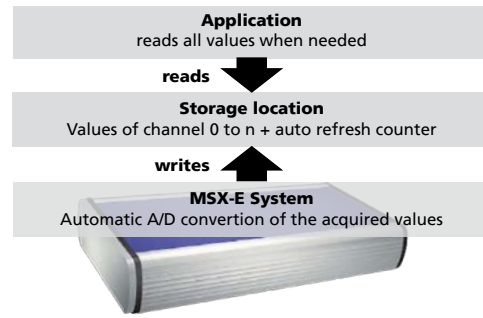
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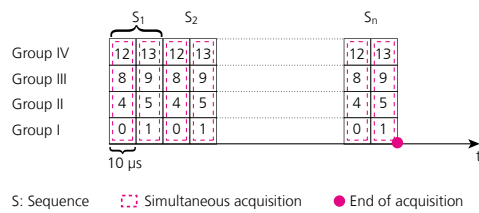
Acquisition modes

Auto-refresh mode

In 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.

Application
reads all values when needed

reads

Storage location
Values of channel 0 to n + auto refresh counter

writes

MSX-E System
Automatic A/D convertion of the acquired values

Sequence mode

In sequence mode, a list of channels is acquired. Thereby, the single meas-urement 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.
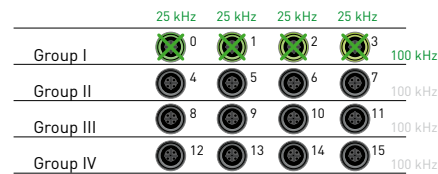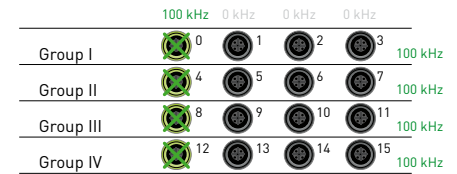
Example: 8 channels, each with 10 µs

	S_1	S_2		S_n
Group IV	12 13	12 13		12 13
Group III	8 9	8 9		8 9
Group II	4 5	4 5		4 5
Group I	0 1	0 1		0 1

10 µs → t

S: Sequence   ⸽ ⸽ Simultaneous acquisition   ● End of acquisition

Acquisition speed

Different wiring

for 25 kHz/channel and 100 kHz/groups

Horizontal wiring (with 4 gauges/sensors)

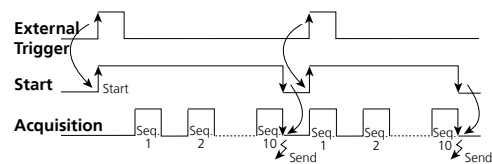|	25 kHz	25 kHz	25 kHz	25 kHz
Group I	0	1	2	3	100 kHz
Group II	4	5	6	7	100 kHz
Group III	8	9	10	11	100 kHz
Group IV	12	13	14	15	100 kHz

Vertical wiring (with 4 gauges/sensors)

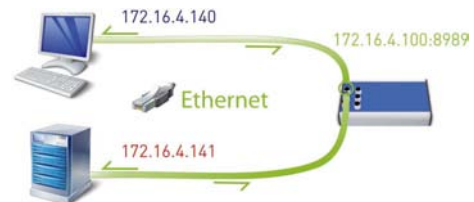|	100 kHz	0 kHz	0 kHz	0 kHz
Group I	0	1	2	3	100 kHz
Group II	4	5	6	7	100 kHz
Group III	8	9	10	11	100 kHz
Group IV	12	13	14	15	100 kHz

Acquisition triggered through trigger or synchro input

Example: A measurement process is to be started through an external trigger impulse. For each trigger, 10 sequences are to be acquired. After the acquisition of the 10 sequences they are to be sent to the client.

External Trigger

Start   Start

Acquisition   Seq. 1   Seq. 2   Seq. 10   Send   Seq. 1   Seq. 2   Seq. 10   Send
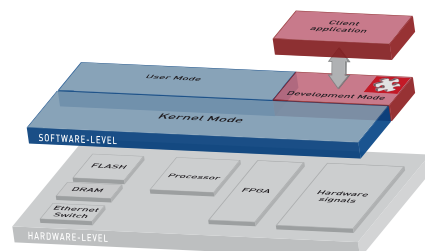
Reading data from a MSX-E system

MSX-E systems are multi-client capable, this means several clients (e. g. PC, server, PLC, …) can read the measurement values of one MSX-E system at the same time. For this, each client establishes a socket connection to the data server of the MSX-E system (port 8989). As soon as the measurement values are available on the data server, the MSX-E system transfers them to the clients.

172.16.4.140   172.16.4.100:8989

Ethernet

172.16.4.141

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.

Client application

User Mode   Development Mode

Kernel Mode

SOFTWARE-LEVEL

FLASH   DRAM   Processor   FPGA   Hardware signals   Ethernet Switch

HARDWARE-LEVEL

*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.
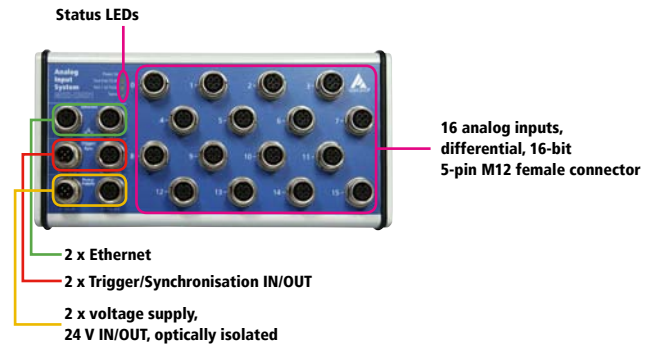
ConfigTools functions for MSX-E3021:

- Change of IP address
- Display of web interface
- Firmware update
- Save/load system configuration
- Save/load channel configuration
- Monitor for analog inputs

Features

Status LEDs

16 analog inputs, differential, 16-bit 5-pin M12 female connector

2 x Ethernet

2 x Trigger/Synchronisation IN/OUT

2 x voltage supply, 24 V IN/OUT, optically isolated

Simplified block diagram

Very easy use through the „ConfigTools" program; The MSX-E system is automatically detected in the network.

Example of monitor function: Testing the analog inputs.

Cascading

Combination possibilities:
- **Several MSX-E of the same type: acquisition of a large number of channels**
- **Different types of MSX-E systems: combination of different functions**

Ethernet (CMX-7x)
Trigger/Synchro (CMX-5x)
Power (CMX-3x)

ADDI-DATA connection technology

*Preliminary product information

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Specifications*

Analog inputs

Number/type:	16 differential inputs
Architecture:	4 groups of 4 channels each 4-port simultaneous converter with one 4-channel multiplexer per converter
Resolution:	16-bit, SAR ADC
Accuracy:	± 1.221 mV typ. (± 4 LSB) ± 2.442 mV max.
Relative Accuracy (INL):	± 3 LSB max (ADC)
Optical isolation:	1000 V
Input ranges:	± 5 V, ± 10 V (16-bit), 0-5 V, 0-10 V (15-bit) current inputs optional
Sampling frequency:	25 kHz per channel / 100 kHz max.
Gain:	x1, x2, x10, x20, x100, x200, x1000, x2000 software-programmable
Common mode rejection:	80 dB min. DC up to 60 Hz (diff. amplifier)
Input impedance (PGA):	$10^9 \, \Omega$ // 10nF against GND
Bandwidth (-3dB):	160 kHz limited through TP filters 16 Hz version with differential filter
Trigger:	digital input, synchro, software-programmable
Offset error:	± 1 LSB (± 305 µV)
Gain error:	± 2.5 LSB
Temperature drift :	2.3 x V_{in} + 22.5 (µ V/ °C) typ. V_{in}: input voltage in Volts (-10 V $\leq V_{in} \leq$ +10 V) In the temperature range from -40°C to +85°C: 4.5 ppm/°C FSR

Data storage

RAM:	64 MB
FLASH:	4 MB for system data
Extended FLASH memory:	4 GB (3.7 GB for measured data)
Buffered real-time clock:	approx. 4 weeks at 20 °C

Voltage supply, Ethernet, Trigger, Synchro

The specifications for the voltage supply, Ethernet, Trigger, Synchronisation and Electromagnetic Compatibility apply to all MSX-E systems. See page 31.

System features

Interface:	Ethernet acc. to specification IEEE802.3
Dimensions:	215 x 110 x 50 mm
Weight:	850 g
Degree of protection:	IP 65
Current consumption at 24 V:	180 mA
Operating temperature:	-25 °C to +85 °C -40 °C to +85 °C on request

Connectors for sensors

For analog inputs:	8 x 5-pin M12 female connector

Ordering information

MSX-E3021
Ethernet analog input system, 16 analog inputs, diff., 16-bit. Incl. technical description, software drivers and ConfigTools.

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

Connection to peripherals
CMX-8x: Shielded cable, M12 5-pin male connector/open end, IP 65

Options
PC-Diff: Current input 0(4)-20 mA for 1 input, diff. (please indicate the number of channels)
S7 Modbus TCP Client Library for S7: Easy use of the Ethernet systems MSX-E with PLCs
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

*Preliminary product information

Ethernet analog input system
16 analog inputs, differential, 16-bit

MSX-E3027

16 analog inputs, differential, 16-bit

Voltage or current inputs

4 GB extended memory

Buffered real-time clock

Stainless steel housing – IP 67

Fast distributed data acquisition

Integrated Ethernet switch | + 85 °C* / − 25 °C | On request: + 85 °C* / − 40 °C | IP 67 | ARM®9 Technology | Cascadable, can be synchronised in the µs range | On request: Compare logic for synchro trigger signal | 4 GB flash memory, real-time clock

*Operating temperature

RoHS 2002/95/EC

on request

DatabaseConnect
see page 114

More information on
www.addi-data.com

Features
- 24 V digital trigger input
- ARM®9 32-bit processor
- 64 MB onboard SDRAM for storing data
- Robust standardized metal housing
- Power Save Mode: Reduced power consumption when no acquisition runs

Analog inputs
- 16 diff. inputs, 16-bit, 5-pin M12 female connector
- Sampling frequency max. 100 kHz, up to 4 simultaneous channels
- Input ranges: ±5 V, ±10 V (16-bit), 0-5 V, 0-10 V (15-bit)
- Gain PGA x1, x2, x10, x20, x100, x200, x1000, x2000 software-programmable, signals up to +/-5mV (16-bit) are possible
- Current inputs 0(4) to 20 mA optional

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
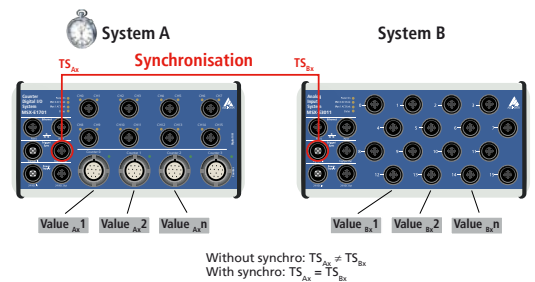- Line in for 24 V supply and cascading

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 ...)
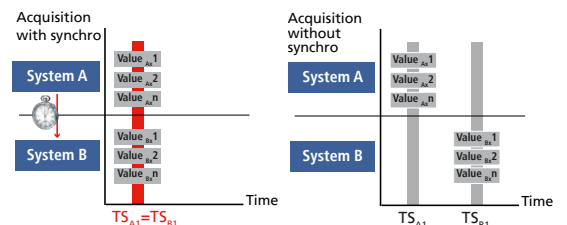- Command server Modbus TCP and Modbus (UDP) for sending commands

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.

System A   System B

TS_{Ax} Synchronisation TS_{Bx}

Value$_{Ax}$1   Value$_{Ax}$2   Value$_{Ax}$n   Value$_{Bx}$1   Value$_{Bx}$2   Value$_{Bx}$n

Without synchro: $TS_{Ay} \neq TS_{Bx}$
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.

Acquisition with synchro

System A — Value$_{Ax}$1 / Value$_{Ax}$2 / Value$_{Ax}$n

System B — Value$_{Bx}$1 / Value$_{Bx}$2 / Value$_{Bx}$n — Time

$TS_{A1} = TS_{B1}$

Acquisition without synchro

System A — Value$_{Ax}$1 / Value$_{Ax}$2 / Value$_{Ax}$n

System B — Value$_{Bx}$1 / Value$_{Bx}$2 / Value$_{Bx}$n — Time

TS_{A1} TS_{B1}

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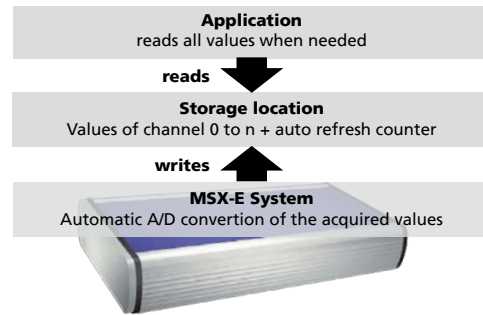
ADDI-DATA®
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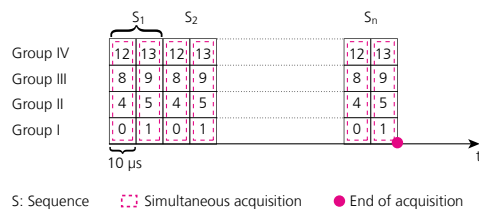
Acquisition modes

Auto-refresh mode

In 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.

Application
reads all values when needed

reads

Storage location
Values of channel 0 to n + auto refresh counter

writes

MSX-E System
Automatic A/D convertion of the acquired values

Sequence mode

In 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: 8 channels, each with 10 μs

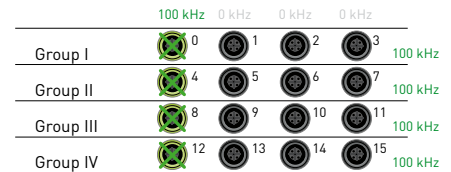S: Sequence   Simultaneous acquisition   End of acquisition

Acquisition speed

Different wiring

for 25 kHz/channel and 100 kHz/groups

Horizontal wiring (with 4 gauges/sensors)

Vertical wiring (with 4 gauges/sensors)

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.
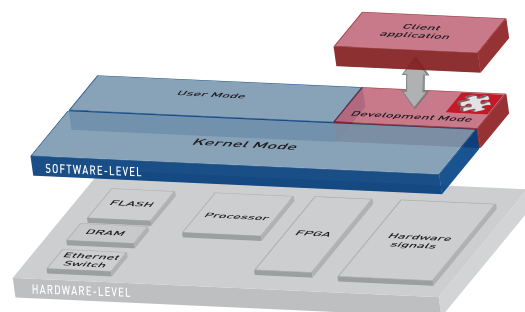
Buffered real-time clock

The MSX-E3027 system features a buffered real-time clock (SuperCap). This clock keeps on running 4 weeks after the MSX-E system has been switched off. After a new start, the system time is still the current time.

*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.
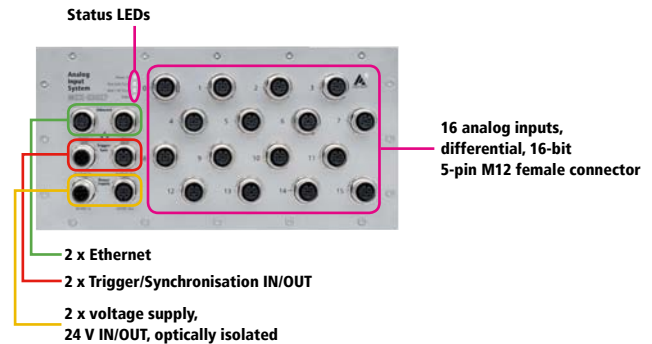
ConfigTools functions for MSX-E3027:
• Change of IP address
• Display of web interface
• Firmware update
• Save/load system configuration
• Save/load channel configuration
• Monitor for analog inputs

Very easy use through the „ConfigTools" program; The MSX-E system is automatically detected in the network.
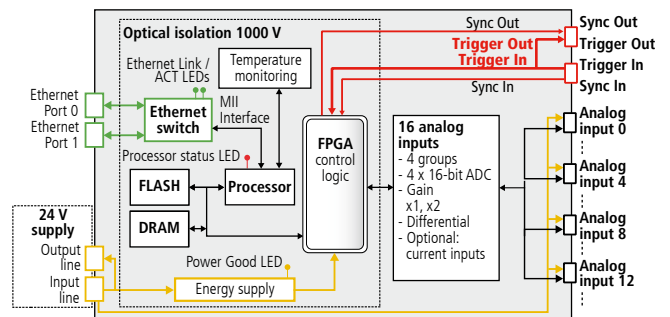

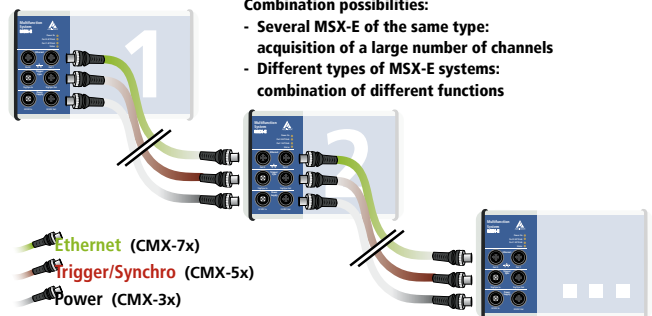Example of monitor function: Testing the analog inputs.

Features

Status LEDs

16 analog inputs, differential, 16-bit 5-pin M12 female connector

2 x Ethernet

2 x Trigger/Synchronisation IN/OUT

2 x voltage supply, 24 V IN/OUT, optically isolated

Simplified block diagram

Cascading

Combination possibilities:
- **Several MSX-E of the same type: acquisition of a large number of channels**
- **Different types of MSX-E systems: combination of different functions**

Ethernet (CMX-7x)
Trigger/Synchro (CMX-5x)
Power (CMX-3x)

ADDI-DATA connection technology

*Preliminary product information

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Specifications*

Analog inputs

Number/type:	16 differential inputs
Architecture:	4 groups of 4 channels each 4-port simultaneous converter with one 4-channel multiplexer per converter
Resolution:	16-bit, SAR ADC
Accuracy:	± 1.221 mV typ. (± 4 LSB) ± 2.442 mV max.
Relative Accuracy (INL):	± 3 LSB max (ADC)
Optical isolation:	1000 V
Input ranges	± 5 V, ± 10 V (16-bit), 0-5 V, 0-10 V (15-bit) current inputs optional
Sampling frequency:	25 kHz per channel / 100 kHz max.
Gain:	x1, x2, x10, x20, x100, x200, x1000, x2000 software-programmable
Common mode rejection:	80 dB min. DC up to 60 Hz (diff. amplifier)
Input impedance (PGA):	$10^9 \, \Omega$ // 10nF against GND
Bandwidth (-3dB):	160 kHz limited through TP filters 16 Hz version with differential filter
Trigger:	digital input, synchro, software-programmable
Offset error:	± 1 LSB (± 305 µV)
Gain error:	± 2.5 LSB
Temperature drift : V_{in}: input voltage in Volts ($-10 \, V \leq V_{in} \leq +10 \, V$) In the temperature range from -40°C to +85°C:	$2.3 \times V_{in} + 22.5$ (µ V/ °C) typ. 4.5 ppm/°C FSR

Data storage

RAM:	64 MB
FLASH:	4 MB for system data
Extended FLASH memory:	4 GB (3.7 GB for measured data)
Buffered real-time clock:	approx. 4 weeks at 20 °C

Voltage supply, Ethernet, Trigger, Synchro

The specifications for the voltage supply, Ethernet, Trigger, Synchronisation and Electromagnetic Compatibility apply to all MSX-E systems. See page 31.

System features

Interface:	Ethernet acc. to specification IEEE802.3
Degree of protection:	IP 67
Current consumption at 24 V:	160 mA
Operating temperature:	-25 °C to +85 °C -40 °C to +85 °C on request
Connectors for sensors	
For analog inputs:	8 x 5-pin M12 female connector

Ordering information

MSX-E3027
Ethernet analog input system, 16 analog inputs, differential, 16-bit. Incl. technical description, software drivers and ConfigTools.

Connection cables
Voltage supply
CMX-2x: Shielded cable, M12 5-pin female connector/open end, IP 67
CMX-3x: For cascading, shielded cable, M12 5-pin female connector/male connector IP 67
Trigger/Synchro
CMX-4x: Shielded cable, M12 5-pin female connector/open end, IP 67
CMX-5x: For cascading, shielded cable, M12 5-pin female connector/male connector IP 67
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

Connection to peripherals
CMX-8x: Shielded cable, M12 5-pin male connector/open end, IP 67

Options

PC-Diff: Current input 0(4)-20 mA for 1 input, diff. (please indicate the number of channels)
S7 Modbus TCP Client Library for S7: Easy use of the Ethernet systems MSX-E with PLCs
MSX-E 5V-Trigger: Level change of the trigger inputs and outputs to 5 V
MX-Rail (please specify when ordering!), **PCMX-1x**

*Preliminary product information

Ethernet multifunction system
6 diff./SE inputs, 4 analog outputs, 32 digital I/O

New!*

MSX-E3121

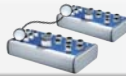| 6 analog inputs, differential/single-ended, 24-bit |
| --- |
| Voltage or current inputs |
| 4 analog outputs, 16-bit |
| 32 digital I/O |
| 24 V digital trigger input |

Integrated Ethernet switch

+ 85 °C*
- 40 °C

*Operating temperature

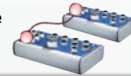IP 65

ARM®9 Technology

Cascadable, can be synchronised in the μs range

On request: Compare logic for synchro trigger signal

RoHS 2002/95/EC

on request

DatabaseConnect
see page 114

More information at
www.addi-data.com

Features

- 24 V digital trigger input
- ARM®9 32-bit processor
- 64 MB onboard SDRAM for storing data
- Robust standardized metal housing
- Power Save Mode: Reduced power consumption when no acquisition runs

Safety features

- Status LEDs for fast error diagnostics
- Optical isolation 1000 V
- Input filters

Analog inputs

- 6 diff./SE inputs, 24-bit, 4-pin M12 female connector
- Sampling frequency max. 100 kHz/channel

Analog outputs

- 4 voltage outputs or
  2 voltage outputs and 2 current outputs

Digital input and output

- 16 digital inputs, 24 V, optically isolated
- 16 digital outputs, 24 V, optically isolated

Interfaces

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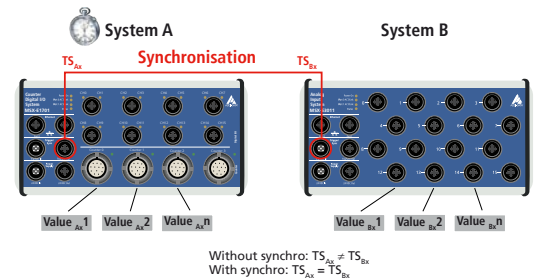- Synchronisation/trigger In/Out
- Line in for 24 V supply and cascading

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 ...)
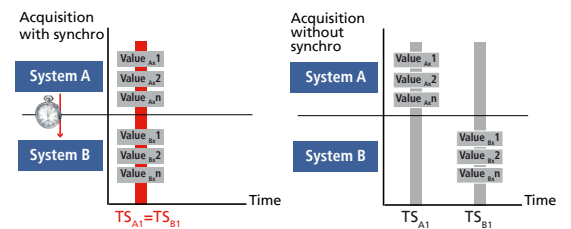- Command server Modbus TCP and Modbus (UDP) for sending commands

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.

System A   Synchronisation   System B

TS_{Ax} TS_{Bx}

Value$_{Ax}$1   Value$_{Ax}$2   Value$_{Ax}$n   Value$_{Bx}$1   Value$_{Bx}$2   Value$_{Bx}$n

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.
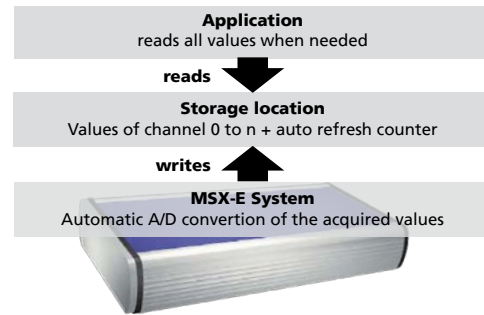
Acquisition with synchro

System A   Value$_{Ax}$1 / Value$_{Ax}$2 / Value$_{Ax}$n
System B   Value$_{Bx}$1 / Value$_{Bx}$2 / Value$_{Bx}$n

$TS_{A1} = TS_{B1}$ Time

Acquisition without synchro

System A   Value$_{Ax}$1 / Value$_{Ax}$2 / Value$_{Ax}$n
System B   Value$_{Bx}$1 / Value$_{Bx}$2 / Value$_{Bx}$n

TS_{A1} TS_{B1} Time

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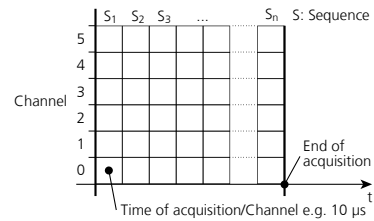
Acquisition modes

Auto-refresh mode

In 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.
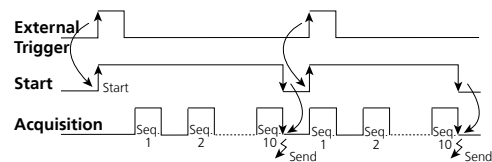

Sequence mode

In 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.
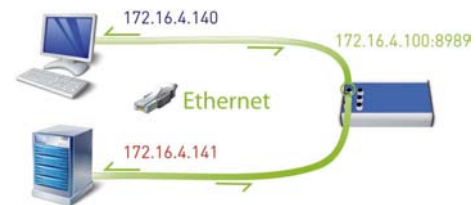

Acquisition triggered through trigger or synchro input

Example: A measurement process is to be started through an external trigger impulse. For each trigger, 10 sequences are to be acquired. After the acquisition of the 10 sequences they are to be sent to the client.

Reading data from a MSX-E system

MSX-E systems are multi-client capable, this means several clients (e. g. PC, server, PLC, …) can read the measurement values of one MSX-E system at the same time. For this, each client establishes a socket connection to the data server of the MSX-E system (port 8989). As soon as the measurement values are available on the data server, the MSX-E system transfers them to the clients.

Onboard programming / stand-alone operation
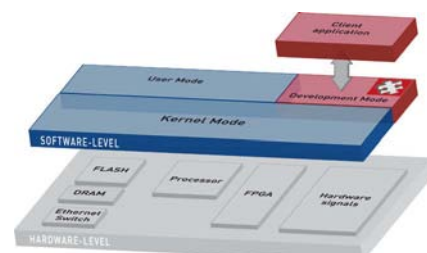
New: Cycle mode

MSX-E systems which are used in stand-alone operation can be controlled through the cycle mode. The cycle mode is a cyclic processing of a program written by the user – the inputs are acquired and the values calculated, if required. At the same time a digital or analog output is possible. Measurement values are read in the auto-refresh mode, thus the current value is always available. A selectable clock pulse (1 ms up to 65535 ms) is available. The programming is executed onboard according to IEC 61131-3.

```
GLOBAL
END

(*Task1 with 10ms pulse*)
TASK Task1 10
        HEADER
                VAR REAL Sensor1Volt 0
                VAR DWORD Sensor1 16#0
        END

        BODY
                (* Reading of Sensor1 as digital value *)
                LD %ID0.0.0
                ST Sensor1
                (* Reading of Sensor1 as float value*)
                LD %IF0.0.0
                ST Sensor1Volt
        END
END
```

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

Phone: +49 7229 1847-0   info@addi-data.com
Fax: +49 7229 1847-222   www.addi-data.com

ConfigTools

The **ConfigTools** program allows an easy administration of the MSX-E systems. These are recognised automatically 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.
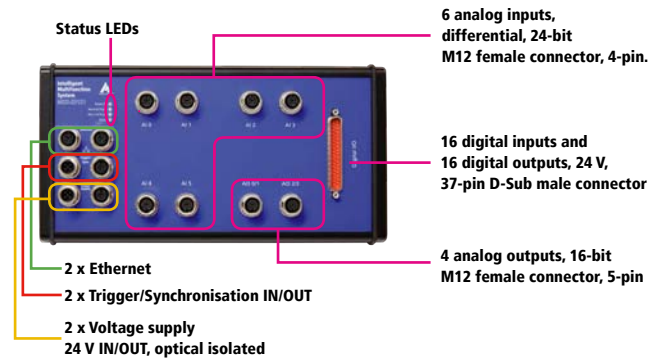
ConfigTools functions for MSX-E3121:
• Change of IP address
• Display of web interface
• Firmware update
• Save/load system configuration
• Save/load channel configuration
• Monitoring the analog inputs/outputs

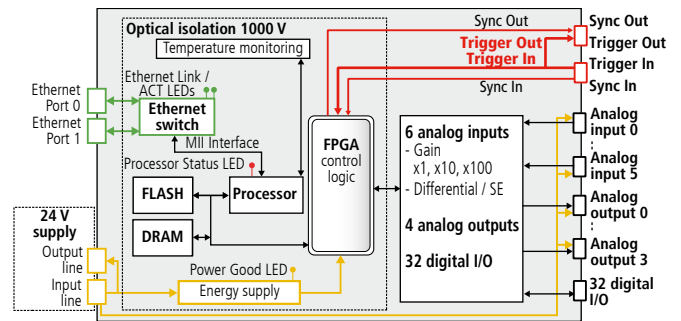Very easy use through the „ConfigTools" program; The MSX-E system is automatically detected in the network.

Monitor function example: Check of the analog outputs – value display without programming.
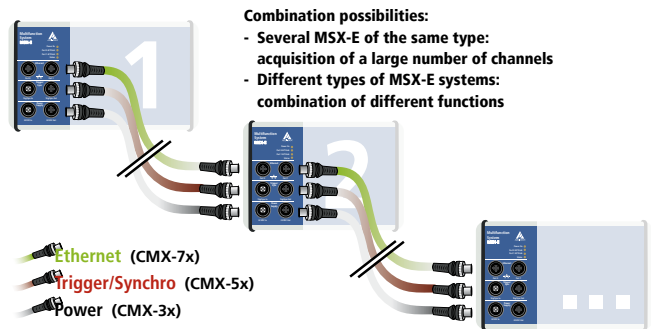
Features

Status LEDs

6 analog inputs, differential, 24-bit M12 female connector, 4-pin.

16 digital inputs and 16 digital outputs, 24 V, 37-pin D-Sub male connector

4 analog outputs, 16-bit M12 female connector, 5-pin

2 x Ethernet
2 x Trigger/Synchronisation IN/OUT
2 x Voltage supply 24 V IN/OUT, optical isolated

Simplified block diagram

Cascading

Combination possibilities:
- **Several MSX-E of the same type:** acquisition of a large number of channels
- **Different types of MSX-E systems:** combination of different functions

Ethernet (CMX-7x)
Trigger/Synchro (CMX-5x)
Power (CMX-3x)

ADDI-DATA connection technology

*Preliminary product information

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Specifications*

Analog inputs

Number/type:	6 differential inputs, 1 A/D converter per channel
Resolution:	24-bit
Optical isolation:	1000 V
Input ranges:	± 10 V, ± 1 V, ± 100 mV, ± 10 mV (24-bit), 0-10 V, 0-1 V, 0-100 mV, 0-10 mV (23-bit), software-programmable, current input optional
Input frequency:	100 kHz per channel
Gain:	x1, x10, x100 software-programmable
Trigger:	digital input, synchro, software-programmable

Analog outputs

Number of outputs:	4
Resolution:	16-bit (bipolar) / 15-bit (unipolar)
Optical isolation:	1000 V
Output range:	Voltage output: 0-10 V (±10 V) Current output: 0-20 mA
Output value after reset:	0 V voltage output, not calibrated

Digital inputs

Number of inputs:	16, common ground acc. to IEC 1131-2	
Optical isolation:	1000 V through opto-couplers	
Nominal voltage:	24 VDC	
Input voltage:	0 – 30 V	
Logic input levels:	UH (max) 30 V typ.	UH (min) 19 V typ.
	UL (max) 14 V typ.	UL (min) 0 V typ.

Digital outputs

Number of outputs:	16
Optical isolation:	1000 V through opto-couplers
Output type:	High-side, load to ground acc. IEC 1131-2
Nominal voltage:	24 V
Voltage supply:	11 – 36 V
Output current per output:	150 mA max.
Diagnostics:	Common diagnostic bit for 16 channels at overtemperature of one channel

Voltage supply, Ethernet, Trigger, Synchro

The specifications for the voltage supply, Ethernet, Trigger, Synchronisation and Electromagnetic Compatibility apply to all MSX-E systems. See page 31.

System features

Interface:	Ethernet acc. to specification IEEE802.3
Dimensions (mm):	270 x 140 x 35
Weight:	approx. 1200 g
Degree of protection:	IP 65
Current consumption at 24 V:	390 mA typ. ± 10 %
Operating temperature:	-40 °C to +85 °C
Connectors for sensors	
For analog inputs:	6 x 4-pin female connector M12
For analog outputs:	2 x 5-pin female connector M12
For digital I/O:	1 x 37-pin D-Sub male connector

Ordering information

MSX-E3121

Ethernet multifunction system, 6 diff./SE inputs, 4 analog outputs, 32 digital I/O. Incl. technical description, software drivers and ConfigTools.

Versions
MSX-E3121-6-4:   4 voltage outputs
MSX-E3121-6-4C: 2 voltage outputs, 2 current outputs

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

Connection to peripherals
CMX-8x: Shielded cable, M12 5-pin male connector/open end, IP 65
ST010:   Standard round cable, shielded, twisted pairs, 2m
PX901-DG: Screw terminal panel LED status display for DIN rail

Options
PC-Diff: Current input 0(4)-20 mA for 1 input, diff. (please indicate the number of channels)
S7 Modbus TCP Client Library for S7:
        Easy use of the Ethernet systems MSX-E with PLCs
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**

*Preliminary product information

Ethernet multifunction system
6 diff./SE inputs, 4 analog outputs, 64 dig. I/O

New!*

MSX-E3122

6 analog inputs, differential/Single-Ended, 24-bit

Voltage or current inputs

4 analog outputs, 16-bit, voltage outputs, current outputs

64 digital I/O, 24 V

24 V digital trigger input

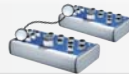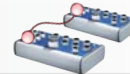
Integrated Ethernet switch

+ 85 °C* - 40 °C
*Operating temperature

IP 65

ARM®9 Technology

Cascadable, can be synchronised in the μs range

On request: Compare logic for synchro trigger signal

RoHS 2002/95/EC

on request

**DatabaseConnect
see page 114**

**More information on
www.addi-data.com**

Features

- 24 V digital trigger input
- ARM®9 32-bit processor
- 64 MB onboard SDRAM for storing data
- Robust standardized metal housing
- Power Save Mode: Reduced power consumption when no acquisition runs

Safety features
- Status LEDs for fast error diagnostics
- Optical isolation • Input filters

Analog inputs
- 6 diff./SE inputs, 24-bit, 4-pin M12 female connector
- Sampling frequency max. 100 kHz/channel

Analog outputs
- 4 voltage outputs or
  2 voltage and 2 current outputs

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

Interfaces

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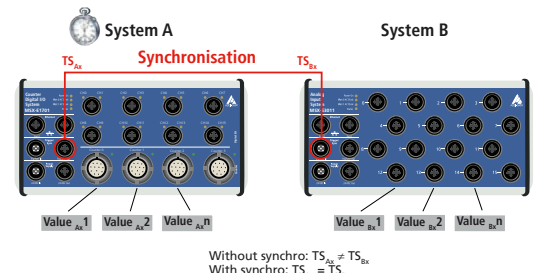- Line in for 24 V supply and cascading

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 …)
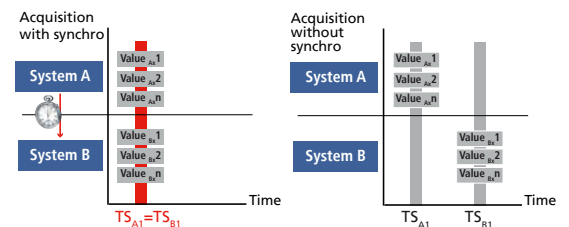- Command server Modbus TCP and Modbus (UDP) for sending commands

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.

System A — Synchronisation — System B

TS_{Ax} — TS_{Bx}

Value$_{Ax}$1 Value$_{Ax}$2 Value$_{Ax}$n   Value$_{Bx}$1 Value$_{Bx}$2 Value$_{Bx}$n

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.

Acquisition with synchro

System A
Value$_{Ax}$1
Value$_{Ax}$2
Value$_{Ax}$n

System B
Value$_{Bx}$1
Value$_{Bx}$2
Value$_{Bx}$n

Time

$TS_{A1} = TS_{B1}$

Acquisition without synchro

System A
Value$_{Ax}$1
Value$_{Ax}$2
Value$_{Ax}$n

System B
Value$_{Bx}$1
Value$_{Bx}$2
Value$_{Bx}$n

Time

TS_{A1} TS_{B1}

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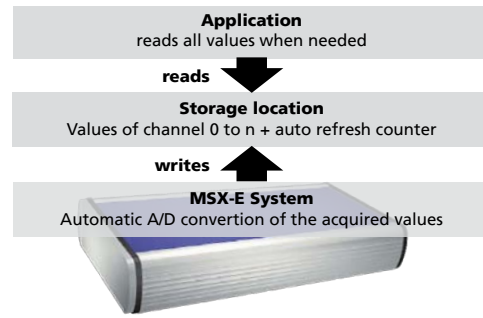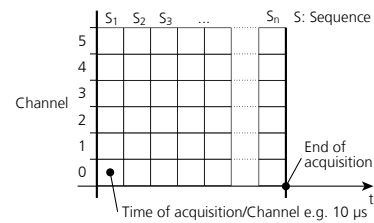
Acquisition modes

Auto-refresh mode

In 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.

Application
reads all values when needed

reads

Storage location
Values of channel 0 to n + auto refresh counter

writes

MSX-E System
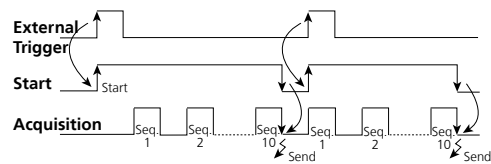Automatic A/D convertion of the acquired values

Sequence mode

In 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.
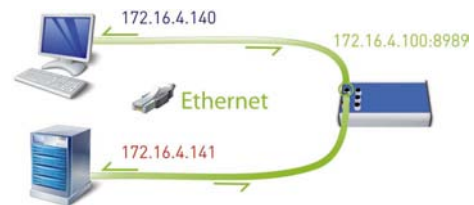

Acquisition triggered through trigger or synchro input

Example: A measurement process is to be started through an external trigger impulse. For each trigger, 10 sequences are to be acquired. After the acquisition of the 10 sequences they are to be sent to the client.

Reading data from a MSX-E system

MSX-E systems are multi-client capable, this means several clients (e. g. PC, server, PLC, …) can read the measurement values of one MSX-E system at the same time. For this, each client establishes a socket connection to the data server of the MSX-E system (port 8989). As soon as the measurement values are available on the data server, the MSX-E system transfers them to the clients.

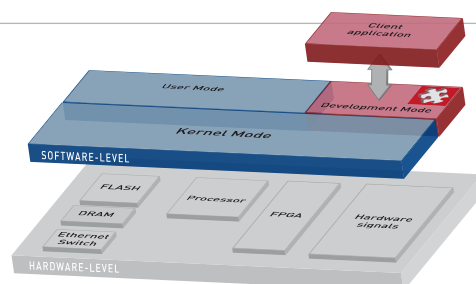## Onboard programming / stand-alone operation

New: Cycle mode

MSX-E systems which are used in stand-alone operation can be controlled through the cycle mode. The cycle mode is a cyclic processing of a program written by the user – the inputs are acquired and the values calculated, if required. At the same time a digital or analog output is possible. Measurement values are read in the auto-refresh mode, thus the current value is always available. A selectable clock pulse (1 ms up to 65535 ms) is available. The programming is executed onboard according to IEC 61131-3.

```
GLOBAL
END

(*Task1 with 10ms pulse*)
TASK Task1 10
         HEADER
                  VAR REAL Sensor1Volt 0
                  VAR DWORD Sensor1 16#0
         END

         BODY
                  (* Reading of Sensor1 as digital value *)
                  LD %ID0.0.0
                  ST Sensor1
                  (* Reading of Sensor1 as float value*)
                  LD %IF0.0.0
                  ST Sensor1Volt
         END
END
```

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.
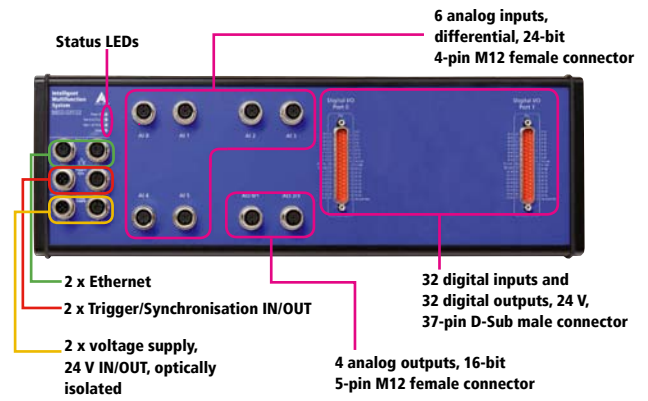
ConfigTools functions for MSX-E3122:

- Change of IP address
- Display of web interface
- Firmware update
- Save/load system configuration
- Save/load channel configuration
- Monitor for analog inputs and outputs

Very easy use through the „ConfigTools" program;
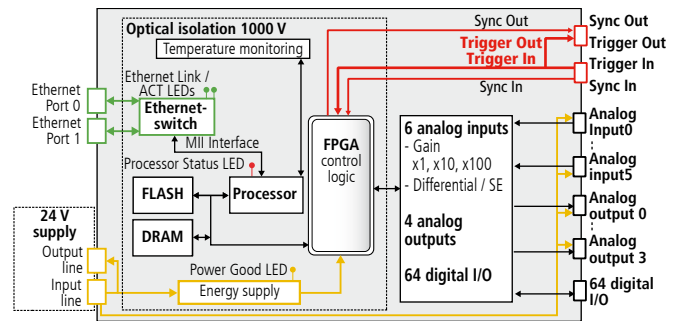**The MSX-E system is automatically detected in the network.**

Example of monitor function:
Testing the analog outputs
– Value output without programming.

Features

Status LEDs

6 analog inputs, differential, 24-bit 4-pin M12 female connector

2 x Ethernet

2 x Trigger/Synchronisation IN/OUT

2 x voltage supply, 24 V IN/OUT, optically isolated

32 digital inputs and 32 digital outputs, 24 V, 37-pin D-Sub male connector

4 analog outputs, 16-bit 5-pin M12 female connector

Simplified block diagram

Cascading

Combination possibilities:
- **Several MSX-E of the same type: acquisition of a large number of channels**
- **Different types of MSX-E systems: combination of different functions**

Ethernet (CMX-7x)
Trigger/Synchro (CMX-5x)
Power (CMX-3x)

ADDI-DATA connection technology

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Specifications*

Analog inputs

Number/type:	6 differential/Single-Ended inputs (software-configurable), 1 A/D converter per channel
Resolution:	24-bit
Optical isolation:	1000 V
Input ranges:	± 10 V, ± 1 V, ± 100 mV, ± 10 mV (24-bit), 0-10 V, 0-1 V, 0-100 mV, 0-10 mV (23-Bit), software-programmable, current inputs 0(4) – 20 mA optional
Sampling frequency:	100 kHz per channel
Gain:	x1, x10, x100, software-programmable
Trigger:	Digital input, synchro, software-programmable

Analog outputs

Number of outputs:	4
Resolution:	16-bit (bipolar) / 15-bit (unipolar)
Optical isolation:	1000 V
Output range:	Voltage output: 0-10 V (±10 V) Current output: 0-20 mA
Output value after reset:	0 V voltage output, not calibrated

Digital inputs

Number of inputs:	32, common ground acc. to IEC 1131-2
Optical isolation:	1000 V through opto-couplers
Nominal voltage:	24 VDC
Input voltage:	0 – 30 V
Logic input levels:	UH (max) 30 V typ. UH (min) 19 V typ. UL (max) 14 V typ. UL (min) 0 V typ.

Digital outputs

Number of outputs:	32
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:	11 – 30 V
Output current per channel:	500 mA max.
Max. total current of 16 outputs:	2 A
Diagnostics:	Common diagnostics bit for all 16 channels at Overtemperature of one channel

Voltage supply, Ethernet, Trigger, Synchro

The specifications for the voltage supply, Ethernet, Trigger, Synchronisation and Electromagnetic Compatibility apply to all MSX-E systems. See page 31.

System features

Interface:	Ethernet acc. to specification IEEE802.3
Dimensions:	380 x 130 x 50 mm
Weight:	in preparation
Degree of protection:	IP 65
Current consumption at 24 V:	390 mA typ. ± 10 %
Operating temperature:	-40 °C to +85 °C
Connectors for sensors	
For analog inputs:	6 x 4-pin M12 female connector
For analog outputs:	2 x 5-pin M12 female connector
For digital I/O:	2 x 37-pin D-Sub male connector

Ordering information

MSX-E3122

Ethernet multifunction system, 6 diff./SE inputs, 4 analog outputs, 64 digital I/O. Incl. technical description, software drivers and ConfigTools.

Versions
MSX-E3122:   4 voltage outputs
MSX-E3122-C: 2 voltage outputs, 2 current outputs

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

Connection to peripherals
CMX-8x: Shielded cable, M12 5-pin male connector/open end, IP 65
ST010:   Standard round cable, shielded, twisted pairs, 2 m
PX901-DG: Screw terminal board, LED Status display, for DIN rail

Options
PC-Diff: Current input 0(4)-20 mA for 1 input, diff. (please indicate the number of channels)

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

*Preliminary product information

Ethernet analog output system
8 analog outputs (voltage and/or current), 16-bit

MSX-E3511 / MSX-E3511-C

8 analog outputs, 16-bit

Voltage or current outputs

Function generator for the output of any signal type, e. g. sine curves, sawtooth curves etc. – can be configured separately for each channel
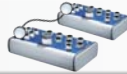
M12 connector

24 V trigger input

Integrated Ethernet switch	+ 85 °C* - 40 °C	IP 65	ARM®9 Technology	Cascadable, can be synchronised in the µs range

*Operating temperature

RoHS 2002/95/EC

on request

More information on www.addi-data.com

Features

- 24 V digital trigger input
- ARM®9 32-bit processor
- 64 MB onboard SDRAM for storing data
- Robust standardized metal housing
- Power Save Mode: Reduced power consumption when no acquisition runs

Safety features

- Status LEDs for fast error diagnostics
- Optical isolation
- Diagnostics in case of short-circuits (voltage mode) or line break (current mode)
- Internal temperature monitoring

Analog outputs

- 8 analog outputs, 16-bit:
  MSX-E3511: voltage outputs 0-10 V, ± 10 V
  MSX-E3511-C: each output can be configured as voltage or current output 0-20 mA
- Output voltage after reset 0 V
- 5-pin M12 female connector
- Output mode/operation mode: Data output per software function, trigger input or synchro output

Function generator

- Output of any signal type, e. g. sine curves, sawtooth curves etc.
- Maximal 8 channels (each channel independently)
- Can be used without programming skills, e. g. via .csv-file or mathematic functions such as $f(x) = \sin(x)$

Interfaces

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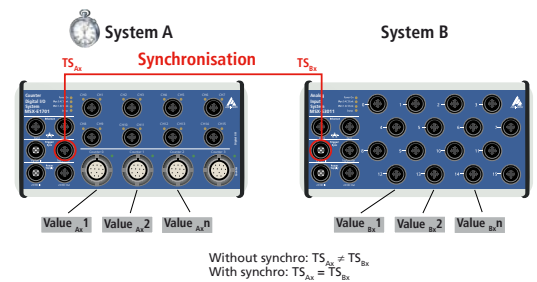- Line in for 24 V supply and cascading

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.

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Output modes

Output modes – Analog output values can be generated either via direct access or through function generator:

1. Direct access

In direct access, the values of the outputs are transmitted via SOAP or Modbus function.
For each function call, 1 value (for one or several outputs) is sent.
The value output is triggered per software, 24V hardware or synchro trigger.

Ethernet
② Output
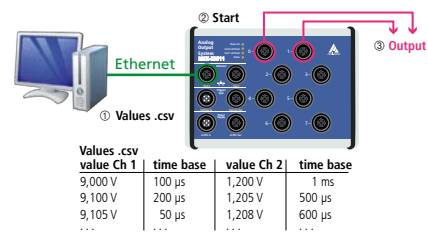① Value channel 1
Value channel 2
...
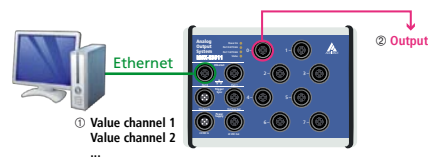
2. Function generator

The MSX-E3511 system features a function generator for each analog output. The values are sent either automatically at a defined rate or using a trigger. The 24V trigger input or the synchro trigger can be used, included those issued by another MSX-E system.

Generator with CSV file

The value are transmitted to the function generator via a CSV file which contains both the values and the number of cycles for each value.

② Start
③ Output
① Values .csv
Ethernet

Values .csv

value Ch 1	time base	value Ch 2	time base
9,000 V	100 µs	1,200 V	1 ms
9,100 V	200 µs	1,205 V	500 µs
9,105 V	50 µs	1,208 V	600 µs
...	...	...	...

Generator with mathematical formula

The values are generated through a formula, e.g. $f(x) = \sin(x)$.

$f(x) = \sin(x)$

Ethernet

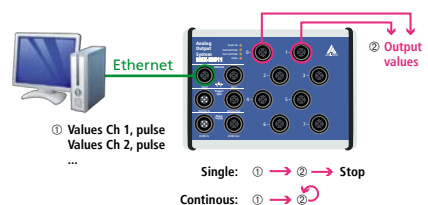$f(x) = (100 - \mathrm{abs}(x)) \cdot (MAXOUT/100)$
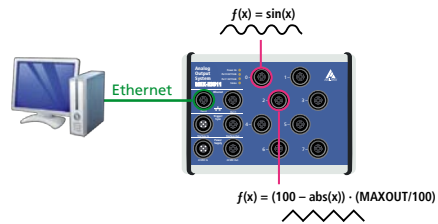
„Single Mode" Generator

In „Single Mode", an array with values is sent to the respective generator via SOAP function. After all values have been transmitted, the generator stops automatically (outputs = 0V).

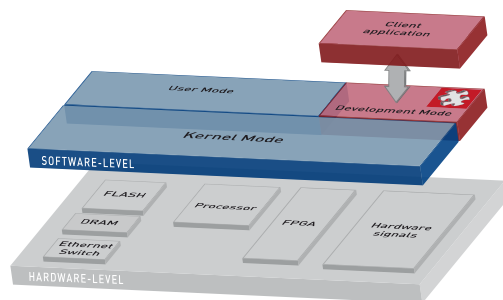#### „Continuous Mode" Generator

In „Continuous Mode", an array with values is sent to the respective generator via SOAP function. After all values have been transmitted, the generator automatically starts again at the first value.

Ethernet
② Output values
① Values Ch 1, pulse
Values Ch 2, pulse
...

Single: ① → ② → Stop
Continous: ① → ②

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.

Client application
User Mode
Development Mode
Kernel Mode
SOFTWARE-LEVEL
FLASH
DRAM
Ethernet Switch
Processor
FPGA
Hardware signals
HARDWARE-LEVEL

Safety

Watchdog

The MSX-E3511 Ethernet system has a 16-bit watchdog which can be programmed in 3 time units (µs, ms, s). The watchdog is used for automatically resetting the digital outputs to 0 V after a defined time in order e. g. to switch off actuators if an error has occurred.
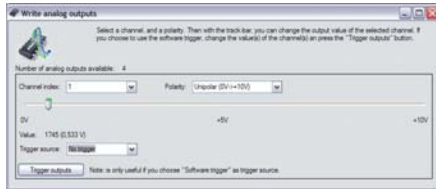
ConfigTools

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.
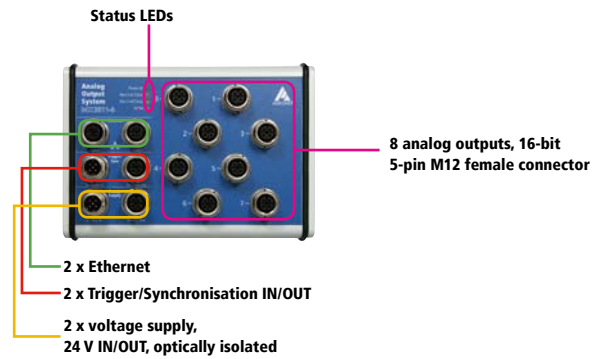
ConfigTools functions for MSX-E3511 / MSX-E3511-C:
- Change of IP address
- Display of web interface
- Firmware update
- Save/load system configuration

**Very easy use through the „ConfigTools" program;
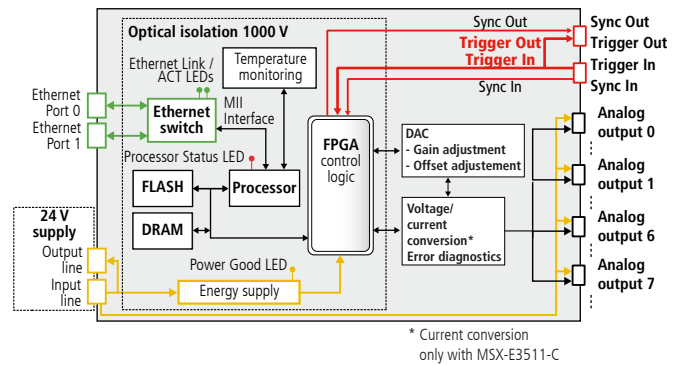The MSX-E system is automatically detected in the network.**

Example of monitor function:
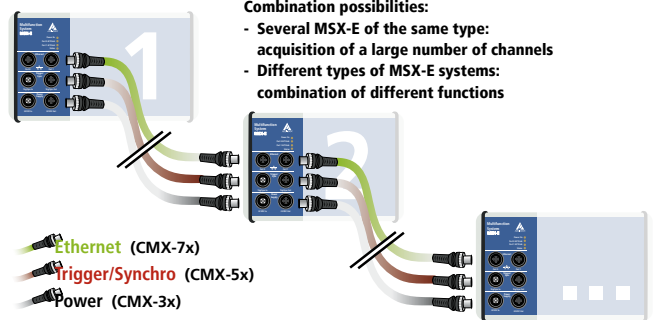Testing the analog outputs – Value output without programming.

Features

Status LEDs

8 analog outputs, 16-bit
5-pin M12 female connector

2 x Ethernet

2 x Trigger/Synchronisation IN/OUT

2 x voltage supply,
24 V IN/OUT, optically isolated

Simplified block diagram

Optical isolation 1000 V

Ethernet Link / ACT LEDs
Temperature monitoring

Ethernet Port 0
Ethernet Port 1
Ethernet switch
MII Interface

Processor Status LED
FPGA control logic

FLASH
Processor

DRAM

DAC
- Gain adjustment
- Offset adjustement

Voltage/current conversion*
Error diagnostics

24 V supply
Output line
Input line

Power Good LED
Energy supply

Sync Out — Sync Out
Trigger Out — Trigger Out
Trigger In — Trigger In
Sync In — Sync In

Analog output 0
Analog output 1
Analog output 6
Analog output 7

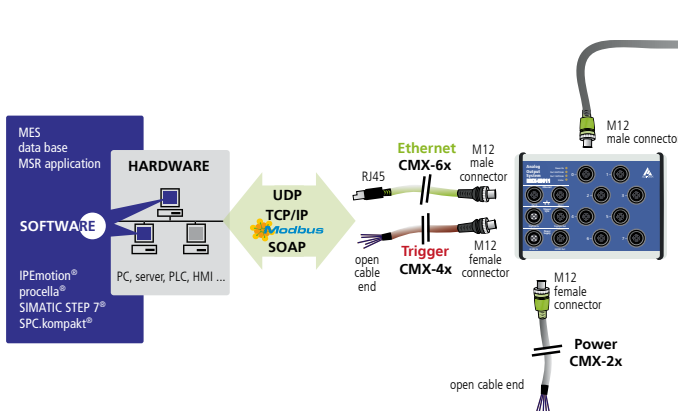* Current conversion only with MSX-E3511-C

Cascading

Combination possibilities:
- **Several MSX-E of the same type:**
  acquisition of a large number of channels
- **Different types of MSX-E systems:**
  combination of different functions

Ethernet (CMX-7x)
Trigger/Synchro (CMX-5x)
Power (CMX-3x)

ADDI-DATA connection technology

CMX-8x
open cable end

M12 male connector

MES
data base
MSR application

HARDWARE

SOFTWARE

IPEmotion®
procella®
SIMATIC STEP 7®
SPC.kompakt®

PC, server, PLC, HMI ...

UDP
TCP/IP
Modbus
SOAP

RJ45

Ethernet
CMX-6x
M12 male connector

open cable end

Trigger
CMX-4x
M12 female connector

M12 female connector

Power
CMX-2x

open cable end

5V digital
24V digital
NPN 24 V dig. input
incremental

PWM
Sin/Cos 1 V$_{PP}$
Sin/Cos 11 µA$_{PP}$
BiSS

EnDat 2.2
SSI
I current
ICP sensor

U voltage
NTC temperature
Pt100
thermocouple element

DMS
HB inductive transducer
LVDT inductive transducer
VLDT inductive transducer

RS232 serial
RS422 serial
RS485 serial
TTY serial

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Fax: +49 7229 1847-222

info@addi-data.com
www.addi-data.com

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Specifications

Analog outputs

Number of outputs:	8
Resolution:	16-bit (bipolar) 15-bit (unipolar)
Optical isolation:	1000 V
Output range:	voltage output: 0-10 V (±10 V) current output: 0-20 mA
Output velocity:	Voltage version: max. 40 kHz
	Voltage version: max. 25 kHz FSR (Full Scale Range) Current version: depending on load
Overvoltage protection:	±14 V
Output current/Last:	voltage output: 15 mA, min. 680 Ω current output: 20 mA, max. 550 Ω
Short-circuit current:	Voltage output: ± 20 mA Current output: ± 32 mA
Output value after reset	0 V voltage output, not calibrated
1 watchdog (programmable):	16-bit, 1 µs to 65535 s

Voltage supply, Ethernet, Trigger, Synchro

The specifications for the voltage supply, Ethernet, Trigger, Synchronisation and Electromagnetic Compatibility apply to all MSX-E systems. See page 31.

System features

Interface:	Ethernet acc. to specification IEEE802.3	
Dimensions:	154 mm x 110 mm x 50 mm	
Weight:	620 g	
Degree of protection:	IP 65	
Current consumption at 24 V:	150 mA	without load
	310 mA	current outputs switched on
	410 mA	voltage outputs switched on
Operating temperature:	- 40°C to + 85°C	
Connectors for sensors		
Analog outputs	8 x 5-pin M12 female connector	

Ordering information

MSX-E3511 / MSX-E3511-C
Ethernet analog output system, 8 analog outputs (voltage and/or current), 16-bit. Incl. technical description, software drivers and ConfigTools.

Versions
MSX-E3511-C: Ethernet analog output system, 8 analog outputs (voltage and/or current), 16-bit
MSX-E3511: Ethernet analog output system, 8 analog outputs, only voltage for fast signal output, 16-bit

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
Connection to peripherals
CMX-8x: Shielded cable, M12 5-pin male connector/open end, IP 65

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

Ethernet system for temperature measurement
16/8/4 channels for thermocouples or RTD, 24-bit

MSX-E3211

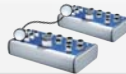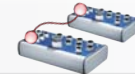| |
|---|
| 16/8/4 differential inputs, 24-bit |
| For thermocouples or RTD (Pt100, Pt1000) |
| Simultaneous data acquisition up to 8 channels |
| 24 V digital trigger input |

Integrated Ethernet switch

+ 85 °C* **- 40 °C**

IP 65

ARM®9 Technology

Cascadable, can be synchronised in the μs range

On request: Compare logic for synchro trigger signal

*Operating temperature

RoHS 2002/95/EC

on request

DatabaseConnect see page 114

More information at www.addi-data.com

Features

- 24 V digital trigger input
- ARM®9 32-bit processor
- 64 MB onboard SDRAM for storing data
- Robust standardized metal housing
- Power Save Mode: Reduced power consumption when no acquisition runs

Safety features

- Status LEDs for fast error diagnostics
- Optical isolation
- Input filters

Temperature inputs

- 16/8/4 differential inputs for thermocouples or RTD, 24-bit
- Sampling frequency max. 788 Hz/channel (max. 8/4/2 channels simultaneously)
- Auto gain: Optimal adjustment of the gain to the measuring range
- Integrated cold junction compensation (CJC) for thermocouples
- NTC sensors optional

Interfaces

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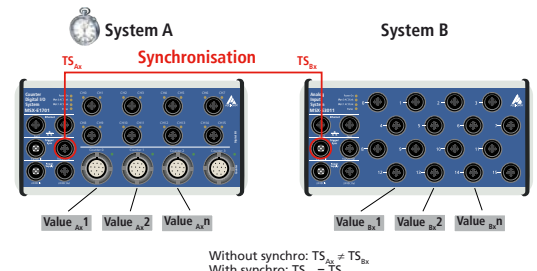- Synchronisation/trigger In/Out
- 24 V supply and cascading

Communication interface

- 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.

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Acquisition modes
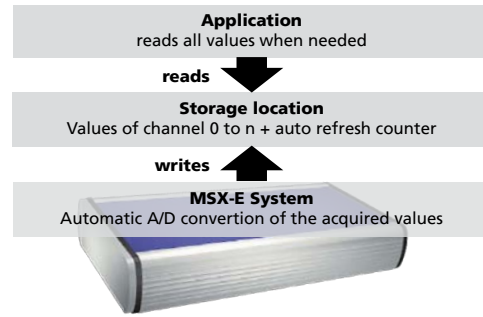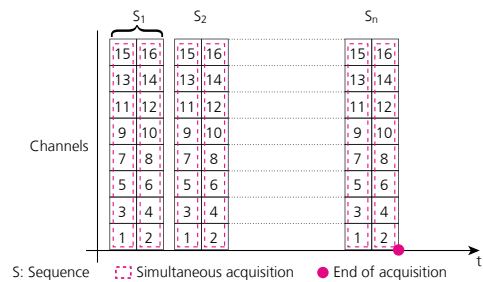
Auto-refresh mode

In 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.

Application
reads all values when needed

reads

Storage location
Values of channel 0 to n + auto refresh counter

writes

MSX-E System
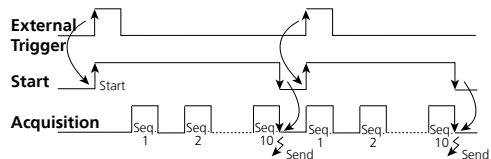Automatic A/D convertion of the acquired values

Sequence mode

In 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.

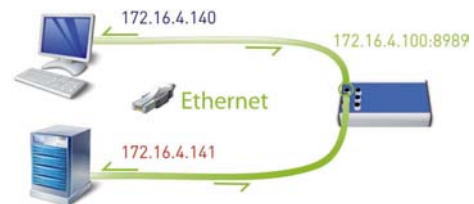S: Sequence   Simultaneous acquisition   ● End of acquisition

Acquisition triggered through trigger or synchro input

Example: A measurement process is to be started through an external trigger impulse. For each trigger, 10 sequences are to be acquired. After the acquisition of the 10 sequences they are to be sent to the client.
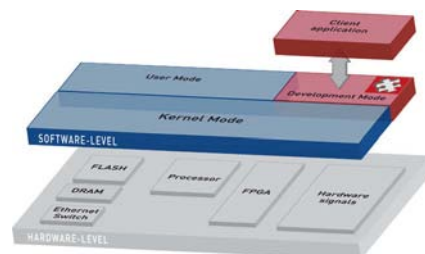

Reading data from a MSX-E system

MSX-E systems are multi-client capable, this means several clients (e. g. PC, server, PLC, …) can read the measurement values of one MSX-E system at the same time. For this, each client establishes a socket connection to the data server of the MSX-E system (port 8989). As soon as the measurement values are available on the data server, the MSX-E system transfers them to the clients.

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.

NOTE
With thermocouples, it is only possible to capture the relative temperature between the terminal to which the thermocouple is connected and the welding spot. For this reason, in order to calculate the actual temperature at the measuring point, it is necessary to capture an absolute temperature on a second sensor (PTC) . This is called cold junction compensation (CJC) and is included on the MSX-E3211-TC system.

ConfigTools

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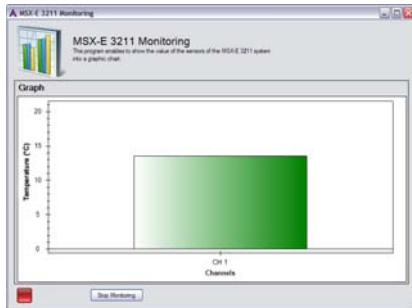
In addition, with **ConfigTools**, the complete configuration of a MSX-E system can be saved and transferred to another system of the same type (clone function).

ConfigTools is included in the delivery.

ConfigTools functions for MSX-E3211:
• Change of IP address
• Display of web interface
• Firmware update
• Save/load system configuration
• Save/load channel configuration
• Monitoring the temperature inputs

Very easy use through the „ConfigTools" program; The MSX-E system is automatically detected in the network.

Monitor function example for temperature inputs

Features

Status LEDs

16/8/4 differential inputs for temperature measurement, 8-pin M12 female connector, 2 inputs / connector

2 x Ethernet

2 x Trigger/Synchronisation IN/OUT

2 x Voltage supply, 24 V IN/OUT, optical isolated

Simplified block diagram

Cascading

Combination possibilities:
- **Several MSX-E of the same type: acquisition of a large number of channels**
- **Different types of MSX-E systems: combination of different functions**

Ethernet **(CMX-7x)**
Trigger/Synchro **(CMX-5x)**
Power **(CMX-3x)**

ADDI-DATA connection technology

Phone: +49 7229 1847-0   info@addi-data.com
Fax: +49 7229 1847-222   www.addi-data.com

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Specifications

Analog inputs

Number of inputs:	16, 8 or 4 differential inputs for thermocouples or RTD 2 outputs for each M12 connector
Resolution:	24-bit
Optical isolation:	1000 V
Throughput:	max. 788 Hz for 1 channel, max. 528 Hz for 2 channels
Current source:	~200 µA (intern kalibriert)

Real acquisition frequency:	at 1 channel	at 2 channels	Sampling frequency (software programmable)
	2.37 Hz	1.585 Hz	5 Hz
	4.73 Hz	3.154 Hz	10 Hz
	9.37 Hz	6.243 Hz	20 Hz
	18.9 Hz	12.6 Hz	40 Hz
	37.35 Hz	24.89 Hz	80 Hz
	73 Hz	48.65 Hz	160 Hz
	145 Hz	96.8 Hz	320 Hz
	276.4 Hz	184.26 Hz	640 Hz
	407.83 Hz	271.96 Hz	1 kHz
	788 Hz	525.48 Hz	2 kHz

Voltage supply, Ethernet, Trigger, Synchro

The specifications for the voltage supply, Ethernet, Trigger, Synchronisation and Electromagnetic Compatibility apply to all MSX-E systems. See page 31.

System features

Interface:	Ethernet acc. to specification IEEE802.3
Dimensions (mm):	220 x 140 x 50
Weight:	620 g
Degree of protection:	IP 65
Current consumption:	150 mA ± 10 % typ. in idle/power save
Operating temperature:	-40 °C to +85 °C
Connectors for sensors	
Analog inputs:	8, 4 or 2 x 8-pin M12 female connector

Ordering information

MSX-E3211

Ethernet system for temperature measurement, 16/8/4 channels for thermocouples or RTD, 24-bit. Incl. technical description and software drivers.

Versions
MSX-E3211-TC-16: for 16 thermocouples
MSX-E3211-TC-8: for 8 thermocouples
MSX-E3211-TC-16: for 4 thermocouples
MSX-E3211-RTD-16: for 16 RTD
MSX-E3211-RTD-8: for 8 RTD
MSX-E3211-RTD-4: for 4 RTD

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

Cold junction compensation
SC-M12-8-TC: M12 8-pin connector for connecting thermocouples with integrated CJC. (Included in delivery!)

Options
S7 Modbus TCP Client Library for S7: Easy use of the Ethernet systems MSX-E with PLCs
MSX-E 5V-Trigger: Level change of the trigger inputs and outputs to 5 V
MSX-E-Filter-20Hz: 20 Hz input filter
MSX-E-NTC-100µA: for NTC sensors with 0-20 kΩ
MSX-E-NTC-50µA: for NTC sensors with 0-40 kΩ
MX-Rail (Please specify when ordering!),
MX-Screw, PCMX-1x

Ethernet system for pressure/force measurement
16/8 channels for strain gauges, 24-bit

MSX-E3311

16/8 differential inputs, 24-bit
For strain gauges
Simultaneous acquisition of up to 8 channels
24 V digital trigger input

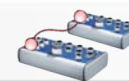**Integrated Ethernet switch**

+ 85 °C* − 40 °C

IP 65

ARM®9 Technology

Cascadable, can be synchronised in the µs range

On request: Compare logic for synchro trigger signal

*Operating temperature

RoHS 2002/95/EC

on request

DatabaseConnect see page 114

More information on www.addi-data.com

Features

- 24 V digital trigger input
- ARM®9 32-bit processor
- 64 MB onboard SDRAM for storing data
- Robust standardized metal housing
- Power Save Mode: Reduced power consumption when no acquisition runs

Safety features

- Status LEDs for fast error diagnostics
- Optical isolation
- Input filters

Inputs for strain gauges

- 16/8 differential inputs for strain gauges, 24-bit
- Sampling frequency max. 788 Hz/channel (max. 8/4 channels simultaneously)
- Autogain: Optimal adjustment of the gain to the measuring range
- Integrated sensor supply: 10 V, 50 mA (5 V optional)

Interfaces

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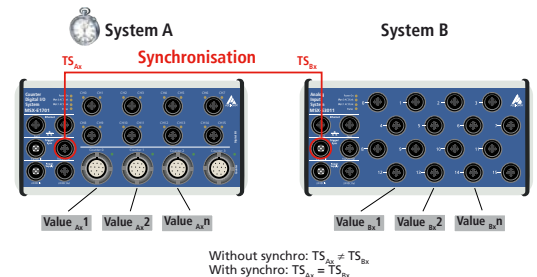- Line in for 24 V supply and cascading

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.

System A — Synchronisation — System B

TS_{Ax} TS_{Bx}

Value$_{Ax}$1 Value$_{Ax}$2 Value$_{Ax}$n   Value$_{Bx}$1 Value$_{Bx}$2 Value$_{Bx}$n

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.

Acquisition with synchro

System A: Value$_{Ax}$1, Value$_{Ax}$2, Value$_{Ax}$n
System B: Value$_{Bx}$1, Value$_{Bx}$2, Value$_{Bx}$n

$TS_{A1} = TS_{B1}$

Acquisition without synchro

System A: Value$_{Ax}$1, Value$_{Ax}$2, Value$_{Ax}$n
System B: Value$_{Bx}$1, Value$_{Bx}$2, Value$_{Bx}$n

TS_{A1} TS_{B1}

Time

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Acquisition modes

Auto-refresh mode

In 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.
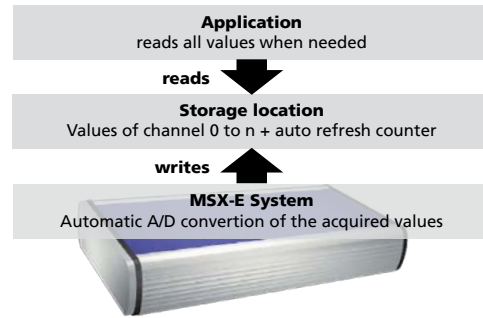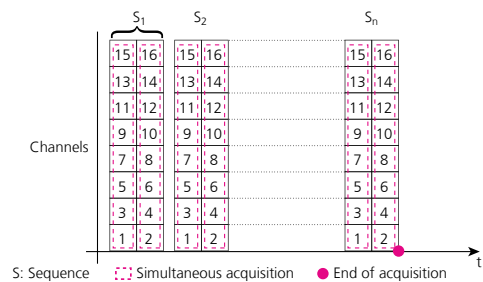The client (e.g. PC, server, PLC, …) reads the acquired values asynchronously to the acquisition through socket connection, SOAP or Modbus function. Thereby, the new value is read and the old values are overwritten.
In addition to the measurement values, the auto-refresh counter can also be read, which 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.

Application
reads all values when needed

reads

Storage location
Values of channel 0 to n + auto refresh counter

writes

MSX-E System
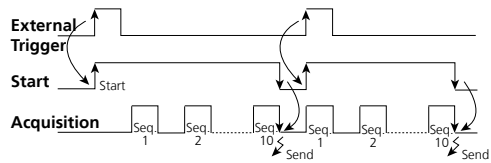Automatic A/D convertion of the acquired values

Sequence mode

In 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.

S: Sequence   [ ] Simultaneous acquisition   ● End of acquisition

Acquisition triggered through trigger or synchro input

Example: A measurement process is to be started through an external trigger impulse. For each trigger, 10 sequences are to be acquired. After the acquisition of the 10 sequences they are to be sent to the client.

Reading data from a MSX-E system

MSX-E systems are multi-client capable, this means several clients (e. g. PC, server, PLC, …) can read the measurement values of one MSX-E system at the same time. For this, each client establishes a socket connection to the data server of the MSX-E system (port 8989). As soon as the measurement values are available on the data server, the MSX-E system transfers them to the clients.

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.

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-E3311:

• Change of IP address
• Display of web interface
• Firmware update
• Save/load system configuration
• Save/load channel configuration
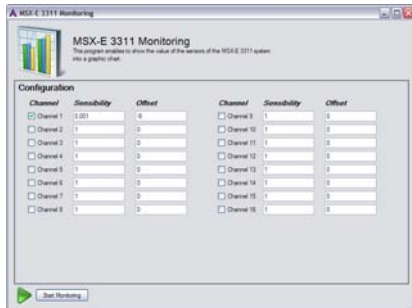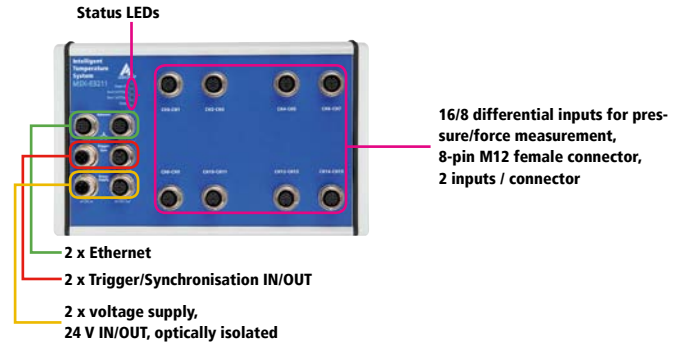• Monitor for Inputs for strain gauges

**Very easy use through the „ConfigTools" program;
The MSX-E system is automatically detected in the network.**

Example of monitor function for Inputs for strain gauges

Features

Status LEDs

16/8 differential inputs for pressure/force measurement,
8-pin M12 female connector,
2 inputs / connector

2 x Ethernet

2 x Trigger/Synchronisation IN/OUT

2 x voltage supply,
24 V IN/OUT, optically isolated

Simplified block diagram

Optical isolation 1000 V

Sync Out
Trigger Out
Trigger In
Sync In

Ethernet Link / ACT LEDs
Temperature monitoring

Ethernet Port 0
Ethernet Port 1

Ethernet switch

MII Interface

Processor Status LED

16/8 DMS inputs

ADC0   2:1

FLASH   Processor

FPGA control logic

DMS input 0 /1

24 V supply
Output line
Input line

DRAM

Power Good LED

Energy supply

ADC7   2:1

DMS input 14/15

Cascading

Combination possibilities:

- **Several MSX-E of the same type:
  acquisition of a large number of channels**
- **Different types of MSX-E systems:
  combination of different functions**

Ethernet **(CMX-7x)**
Trigger/Synchro **(CMX-5x)**
Power **(CMX-3x)**

ADDI-DATA connection technology

CMX-9x

open cable end

M12 male connector

MES data base
MSR application

HARDWARE

Ethernet
CMX-6x

M12 male connector

RJ45

SOFTWARE

UDP
TCP/IP
Modbus
SOAP

Trigger
CMX-4x

M12 female connector

IPEmotion®
procella®
SIMATIC STEP 7®
SPC.kompakt®

PC, server, PLC, HMI ...

open cable end

M12 female connector

Power
CMX-2x

open cable end

5 V digital
24 V digital
NPN 24 V dig. input
incremental

PWM
Sin Cos 1 Vpp
Sin Cos 11 µApp
BiSS

EnDat 2.2
SSI
current
ICP sensor

U voltage
NTC temperature
Pt100
thermocouple element

DMS
HB inductive transducer
LVDT inductive transducer
VLDT inductive transducer

RS232 serial
RS422 serial
RS485 serial
TTY serial

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Specifications

Inputs for strain gauges

Number of inputs:	16 or 8 differential inputs for strain gauges 2 inputs per M12 connector
Resolution:	24-bit
Optical isolation:	1000 V
Throughput per M12 connector:	max. 788 Hz for 1 channel, max. 528 Hz for 2 channels
Voltage supply for the sensors:	10 V, 50 mA
Voltage supply:	~10 V / optional 5 V (onboard calibration) 100 mA max.

Real Sampling frequency:	on 1 channel	on 2 channels	Sampling frequency (software-configurable)
	2.37 Hz	1.585 Hz	5 Hz
	4.73 Hz	3.154 Hz	10 Hz
	9.37 Hz	6.243 Hz	20 Hz
	18.9 Hz	12.6 Hz	40 Hz
	37.35 Hz	24.89 Hz	80 Hz
	73 Hz	48.65 Hz	160 Hz
	145 Hz	96.8 Hz	320 Hz
	276.4 Hz	184.26 Hz	640 Hz
	407.83 Hz	271.96 Hz	1 kHz
	788 Hz	525.48 Hz	2 kHz

Voltage supply, Ethernet, Trigger, Synchro

The specifications for the voltage supply, Ethernet, Trigger, Synchronisation and Electromagnetic Compatibility apply to all MSX-E systems. See page 31.

System features

Interface:	Ethernet acc. to specification IEEE802.3
Dimensions:	220 mm x 140 mm x 50 mm
Weight:	620 g
Degree of protection:	IP 65
Current consumption:	150 mA ± 10 % typ. in idle/power save mode
Operating temperature:	-40 °C to +85 °C
Connectors for sensors	
Analog inputs:	8 or 4 x 8-pin female connector, M12

Ordering information

MSX-E3311

Ethernet system for pressure/force measurement, 16/8 channels for strain gauges, 24-bit. Incl. technical description, software drivers and ConfigTools.

Versions
MSX-E3311-16: for 16 strain gauges
MSX-E3311-8: for 8 strain gauges
Opt.MSX-E-5Vss: Bridge supply voltage adjustment to 5 V **(optional)**

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
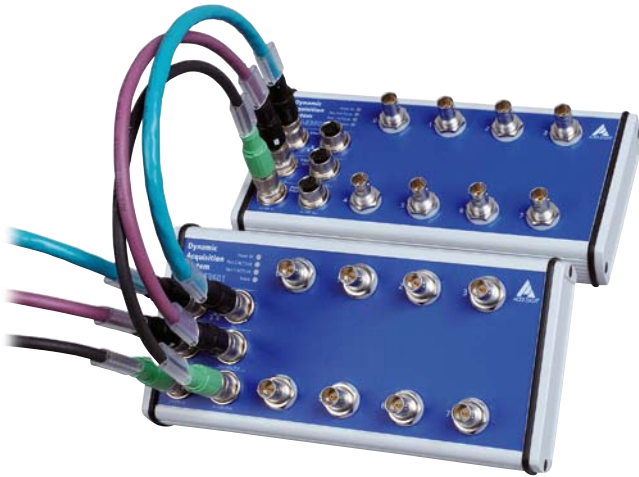
Options
S7 Modbus TCP Client Library for S7: Easy use of the Ethernet systems MSX-E with PLCs
MSX-E 5V-Trigger: Level change of the trigger inputs and outputs to 5 V
MX-Rail (please specify when ordering!), **MX-Screw, PCMX-1x**

Ethernet system for the acquisition of dynamic signals
8 or 2 SE/diff. inputs, 24-bit, simultaneous acquisition

MSX-E3601 / MSX-E3601-2

8 or 2 SE/diff. inputs, 24-bit

Simultaneous acquisition

8 or 2 current sources for ICP® or IEPE sensors
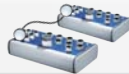
Onboard calibration

24 V digital trigger input

Integrated Ethernet switch

+ 85 °C*
- 40 °C

IP 65

ARM®9 Technology

Cascadable, can be synchronised in the µs range

*Operating temperature

RoHS 2002/95/EC

on request

DatabaseConnect see page 114

More information on www.addi-data.com

Features

- 24 V digital trigger input
- ARM®9 32-bit processor
- 64 MB onboard SDRAM for storing data
- Robust standardized metal housing
- Power Save Mode: Reduced power consumption when no acquisition runs

Analog inputs
- 8 or 2 SE or diff. inputs, 24-bit, AC/DC coupling
- One A/D converter per channel: simultaneous acquisition on all analog inputs
- Sampling rate up to 128 kHz
- Antialiasing filter
- BNC female connector:
  - inner conductor for positive input
  - outer conductor for negative input (diff) or GND (SE)
- Gain x1, x10, x100

Current sources
- 8 or 2 current sources for the direct connection of ICP® sensors (integrated circuit piezoelectric) or IEPE sensors (integrated electronics piezoelectric)
- 4 mA typ., 24 V max.

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
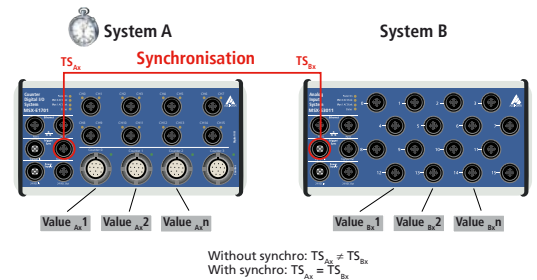- Line in for 24 V supply and cascading

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 ...)

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.

System A			System B		
TS_{Ax}	Synchronisation		TS_{Bx}		
Value$_{Ax}$1	Value$_{Ax}$2	Value$_{Ax}$n	Value$_{Bx}$1	Value$_{Bx}$2	Value$_{Bx}$n

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.

Acquisition with synchro

Acquisition without synchro

$TS_{A1} = TS_{B1}$

TS_{A1} TS_{B1}

MSX-E3601-2

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Acquisition modes

Sequence mode

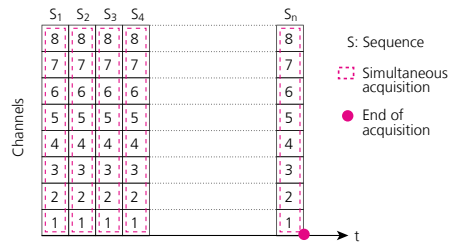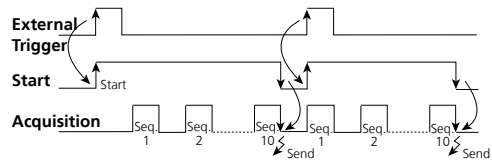In sequence mode, a list of channels is acquired. Thereby, the single measurement rows are stored one after another. The client receives the acquired values asynchronously to the acquisition through a socket connection. In the sequence mode, the measurement values are read in chronological order, this 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.
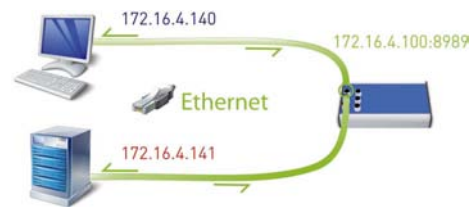
Acquisition triggered through trigger or synchro input

Example: A measurement process is to be started through an external trigger impulse. For each trigger, 10 sequences are to be acquired. After the acquisition of the 10 sequences they are to be sent to the client.
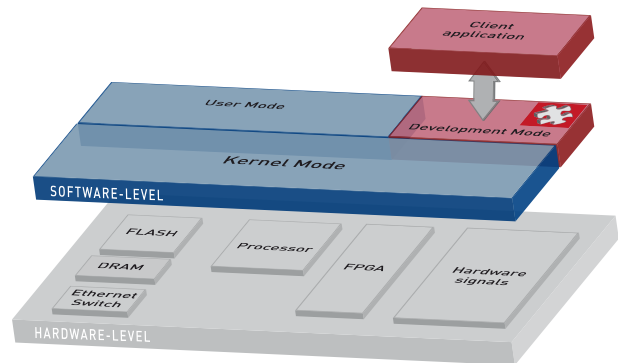
Reading data from a MSX-E system

MSX-E systems are multi-client capable, this means several clients (e. g. PC, server, PLC, …) can read the measurement values of one MSX-E system at the same time. For this, each client establishes a socket connection to the data server of the MSX-E system (port 8989). As soon as the measurement values are available on the data server, the MSX-E system transfers them to the clients.

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.

Anti-aliasing filter

Low-pass filters are used before or during digitising in order to remove all frequency components which are higher than the Nyquist frequency.
This is to make sure that the digitised value or result does not contain any unwanted frequencies (aliasing frequencies). According to the Nyquist criterion, in order to obtain the full signal information, the sampling rate must be at least 2 x the signal band width.

Firmware and software adaptation

Because MSX-E systems are very flexible, the MSX-E3601 firmware can be easily extended. Thus, calculations such as RMS or limit values etc. can be integrated.
Using the Development Mode, it is possible to create self-sufficient intelligent nodes.
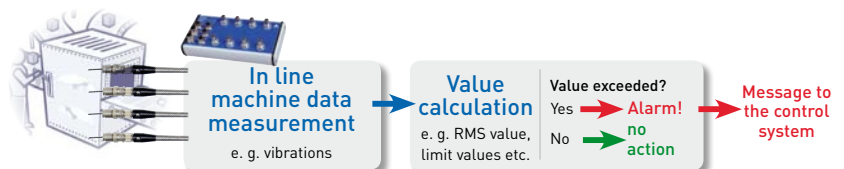
ConfigTools

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-E3601 / MSX-E3601-2:
- Change of IP address
- Display of web interface
- Firmware update
- Save/load system configuration
- Save/load channel configuration

Very easy use through the „ConfigTools" program;
The MSX-E system is automatically detected in the network.

Features

Status LEDs

8 analog inputs,
BNC female connector:
- inner conductor for pos. input
- outer conductor for neg. input
  (diff) or GND (SE)

2 x Ethernet

2 x Trigger/Synchronisation IN/OUT

2 x voltage supply,
24 V IN/OUT, optically isolated

Simplified block diagram

Cascading

Combination possibilities:
- **Several MSX-E of the same type:**
  acquisition of a large number of channels
- **Different types of MSX-E systems:**
  combination of different functions

Ethernet (CMX-7x)
Trigger/Synchro (CMX-5x)
Power (CMX-3x)

ADDI-DATA connection technology

Phone: +49 7229 1847-0   info@addi-data.com
Fax: +49 7229 1847-222   www.addi-data.com

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Specifications

Analog inputs

Number of inputs:	**MSX-E3601:**	8, 1 AD converter per channel
	MSX-E3601-2:	2, simultaneous acquisition, 1 AD converter per channel
Coupling:	DC, AC (software-configurable)	
Input type:	single-ended or differential (software-configurable)	

Input ranges	**SE**	**Diff.**
Gain x1:	± 10 V single-ended	± 5 V differential
Gain x10:	± 1 V single-ended	± 0.5 V differential
Gain x100:	± 0.1 V single-ended	± 0.05 V differential

ADC-Typ:	Oversampled SAR with linear phase FIR antialiasing digital filter
Resolution:	24-bit
Sampling rate f_s:	up to 128 kHz

Selectable frequencies f_s:	128000.00	100000.00	80000.00	66666.67
	64000.00	50000.00	40000.00	33333.33
	32000.00	25000.00	20000.00	16666.67
	16000.00	13333.33	12800.00	12500.00
	10000.00	8000.00	6666.67	6400.00
	6250.00	5000.00	4000.00	3333.33
	3200.00	3125.00	2500.00	2000.00
	1666.67	1600.00	1562.50	1280.00
	1000.00			

Oversampling:	8 x f_s
Frequency accuracy:	± 50 ppm

Input stage characteristics

Input impedance:	1 MΩ // 300 pF typ., DC coupled	
AC cutoff frequency (-3 dB):	0.48 Hz typ.	
Overvoltage protection:	Positive input	+27 V/-14 V, ± 100 mA Max. continuous current
	Negative input	± 14 V, ± 100 mA Max. continuous current

Filter response

Passband:	DC up to 0.453 x f_s typ.
Passband ripple:	+/-0.01 dB max. DC up to 0.453 x f_s
Bandwidth (-3 dB):	0.49 x f_s typ.
Stop band:	0.547 x f_s typ.
Stop band attenuation:	100 dB min.
Group delay:	37/f_s (µs) typ.
Settling time (latency):	74/f_s (µs) complete settling

Dynamic characteristics

Signal-to-noise ration (SNR):	FSR, f_{in}=1 kHz	
	≥ 95 dB	Gain x1
	≥ 94 dB	Gain x10
	≥ 75 dB	Gain x100
Total Harmonic Distortion (THD):	FSR, f_{in}=1 kHz	
	≥ 100 dB	Gain x1
	≥ 100 dB	Gain x10
	≥ 90 dB	Gain x100
Dynamic range:	Shorted inputs	
	≥ 105 dB	Gain x1
	≥ 100 dB	Gain x10
	≥ 85 dB	Gain x100

Crosstalk:	Between channels 0-1, 2-3, 4-5, 6-7, with gain x1	
	≥ 104 dB	short input, f_{in} = 100 Hz
	≥ 100 dB	short input, f_{in} = 1 kHz
	≥ 104 dB	50 Ω input, f_{in} = 100 Hz
	≥ 100 dB	50 Ω input, f_{in} = 1 kHz
Phase mismatch:	Between channels 1-2, 3-4, 5-6, 7-8, with gain x1	
	± 0.001°	f_{in} < 100 Hz
	± 0.01°	f_{in} < 1 kHz
	± 0.1°	f_{in} < 10 kHz
Amplitude accuracy:	± 0.009 dB max. at f_{in} = 1 kHz sine signal, Gain x1, x10, x100	
CMRR:	> 110 dB typ. at DC > 90 dB typ. at f_{in} < 1000 Hz	
Offset error:	± 90 µV after calibration at 25 °C	
Onboard DC calibration:	Software-configurable	
Calibration voltage:	5 V typ. Gain x1 900 mV typ. Gain x10 90 mV typ. Gain x100	
Temperature drift:	± 8 ppm/°C typ.	

Sensor supply voltage

Number of channels:	8 (MSXE-3601) or 2 (MSX-E3601-2) positive input
Current source:	4 mA typ. to 24 V max.
Coupling:	AC (positive input) GND (negative input)
Recording duration:	TBD max. at 128 kHz sampling rate on 8 channels

Current sources

Number:	8 or 2 constant current sources for the supply of the ICP® or IEPE sensors, 4 mA typ., 24 V max.

Voltage supply, Ethernet, Trigger, Synchro

The specifications for the voltage supply, Ethernet, Trigger, Synchronisation and Electromagnetic Compatibility apply to all MSX-E systems. See page 31.

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:	215 x 110 x 52 mm
Weight:	860 g
Degree of protection:	IP 65
Current consumption at 24 V:	350 mA typ.
Operating temperature:	-40 °C to +85 °C
Connectors for sensors	
for analog inputs:	8 x BNC female connector (MSX-E3601) 2 x BNC female connector (MSX-E3601-2)

Ordering information

MSX-E3601 / MSX-E3601-2

Ethernet system for the acquisition of dynamic signals, 8 or 2 SE/diff. inputs, 24-bit, simultaneous acquisition. Incl. technical description, software drivers and ConfigTools.

Versions

MSX-E3601:	8 SE/diff. inputs
MSX-E3601-2:	2 SE/diff. inputs

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

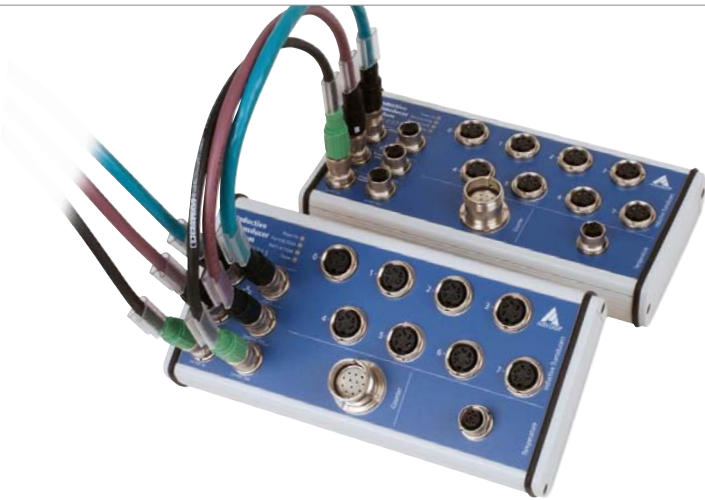**CMX-6x:** CAT5E cable, M12 D-coded male connector/RJ45 connector
CMX-7x: For cascading, CAT5E cable, 2 x M12 D-coded male connector

Options

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

Ethernet system for length measurement, 24-bit, simultaneous, 8 transducers, counter and temperature inputs

MSX-E3711

Simultaneous acquisition of
up to 8 inductive displacement transducers

For half-bridge, LVDT, Mahr or Knaebel transducers

1 incremental counter input (32-bit)

1 input for temperature measurement (Pt100)
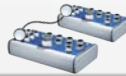or for thermocouples (TC)

24 V digital trigger input
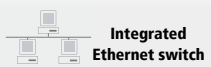
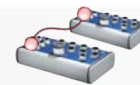|					
Integrated Ethernet switch	+ 85 °C* / - 40 °C	IP 65	ARM°9 Technology	Cascadable, can be synchronised in the μs range	On request: Compare logic for synchro trigger signal

*Operating temperature

RoHS 2002/95/EC

on request

DatabaseConnect
see page 114

More information at
www.addi-data.com

Features

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

Transducer inputs

- 8 transducer inputs, 24-bit, 5-pin M18 female connector
- Half-bridge (HB), LVDT, Mahr-compatible, Knaebel
- Simultaneous acquisition
- Diagnostic option (short-circuit, line break)

Counter input

- 1 x 32-bit incremental counter input, max. 5 MHz
- Voltage supply of sensors with M23 female connector (24 V or 5 V)
- Single, double, quadruple edge analysis
- Compare logic

Temperature input

- 1 x RTD input, 16-bit, 5-pin M12 female connector
- +/- 0,01 °C resolution
- Thermocouple input, optional (MSX-E3711-TC)

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 an-other 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.

System A — Synchronisation — System B

TS_{Ax} TS_{Bx}

Value$_{Ax}$1 Value$_{Ax}$2 Value$_{Ax}$n   Value$_{Bx}$1 Value$_{Bx}$2 Value$_{Bx}$n

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.

Acquisition with synchro

System A: Value$_{Ax}$1, Value$_{Ax}$2, Value$_{Ax}$n
System B: Value$_{Bx}$1, Value$_{Bx}$2, Value$_{Bx}$n
$TS_{A1}=TS_{B1}$ — Time

Acquisition without synchro

System A: Value$_{Ax}$1, Value$_{Ax}$2, Value$_{Ax}$n
System B: Value$_{Bx}$1, Value$_{Bx}$2, Value$_{Bx}$n
TS_{A1} TS_{B1} — Time

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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.
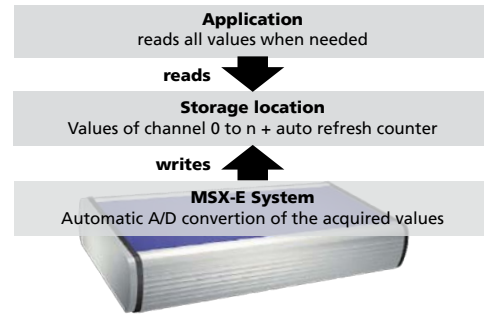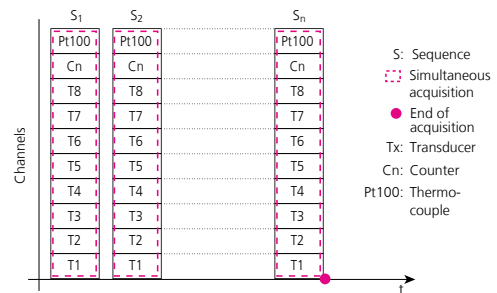

Sequence mode

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.

Compare logic

With the compare logic of the incremental counter, a synchro-trigger signal can be generated in order to latch the counter value, the transducers and the temperature input as soon as the counter value is equal to the compare value.

Thus all the inputs of the MSX-E3711 system can be acquired simultaneously.

With the additional „Modulo-Mode" (Modulo Compare), a trigger can also be generated at the n value of the compare value.

Thus it is possible, e. g. when using an encoder with 3,600 steps / revolution to obtain each degree of a measurement value (Modulo Compare = 10).

The thus generated synchro-trigger can also be used for data acquisition on further MSX-E systems.

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.

ConfigTools

The **ConfigTools** program allows an easy administration of the MSX-E systems. These are recognised automatically 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-E3711:
• Change of IP address
• Display of web interface
• Firmware update
• Save/load system configuration
• Save/load channel configuration
• Calibration of transducers
• Data base of transducers
• Monitoring of transducers
• Diagnostics of transducers

Very easy use through the „ConfigTools" program;
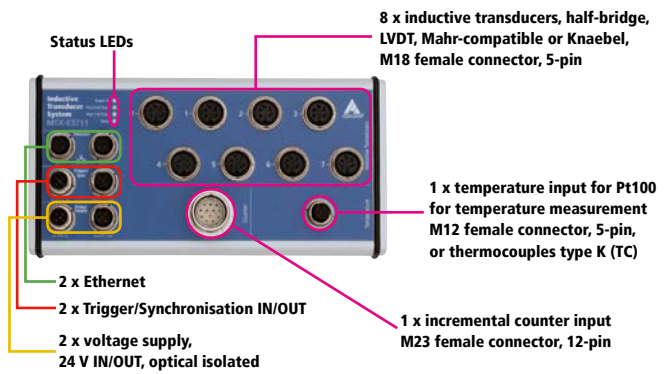The MSX-E system is automatically detected in the network.

Monitor function example:
Check of the analog inputs.

Features

Status LEDs

8 x inductive transducers, half-bridge, LVDT, Mahr-compatible or Knaebel, M18 female connector, 5-pin

2 x Ethernet

2 x Trigger/Synchronisation IN/OUT

2 x voltage supply, 24 V IN/OUT, optical isolated

1 x temperature input for Pt100 for temperature measurement M12 female connector, 5-pin, or thermocouples type K (TC)

1 x incremental counter input M23 female connector, 12-pin

Simplified block diagram

Optical isolation 1000 V

Ethernet Link / ACT LEDs
Temperature monitoring
Ethernet Port 0
Ethernet Port 1
Ethernet switch
MII Interface
Processor Status LED
FLASH
Processor
DRAM
24 V supply
Output line
Input line
Power Good LED
Energy supply

Sync Out
Trigger Out
Trigger In
Sync In
Sine generator
FPGA control logic
Analog
Temperature
Incremental counter
Power Safe Mode

Sync Out
Trigger Out
Trigger In
Sync In
Transducer 1
Transducer 8
Temperature input
Incremental counter

Cascading

Combination possibilities:
- Several MSX-E of the same type: acquisition of a large number of channels
- Different types of MSX-E systems: combination of different functions

Ethernet (CMX-7x)
Trigger/Synchro (CMX-5x)
Power (CMX-3x)

ADDI-DATA connection technology

MES data base MSR application
HARDWARE
SOFTWARE
IPEmotion®
procella®
SIMATIC STEP 7®
SPC.kompakt®
PC, server, PLC, HMI ...

UDP TCP/IP Modbus SOAP

RJ45
Ethernet CMX-6x
M12 male connector
Trigger CMX-4x
M12 female connector
open cable end

M18 cable and sensor supplied through sensor manufacturer

Power CMX-2x
M12 female connector
open cable end

SC-M23 or cable from sensor manufacturer

CMX-8x
open cable end

5V digital
24V digital
NPN 24 V dig. input
incremental
PWM
Sin Cos 1 Vpp
Sin Cos 11 µApp
BiSS INTERFACE
EnDat 2.2
SSI
I current
ICP sensor
U voltage
NTC temperature
Pt100
optional thermocouple element
DMS
HB inductive transducer
LVDT inductive transducer
VLDT inductive transducer
RS232 serial
RS422 serial
RS485 serial
TTY serial

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Specifications

Connection of inductive transducers

Inputs for inductive transducers

Channel features:

Number:	8 x ADC (not multiplexed)
Input type:	Single-ended
Coupling:	DC
Resolution:	24-bit

Sampling rate f_s:	On 8 channels	At primary frequency f_P of
		5 kHz
		7.69 kHz
	$f_s = f_P$	10 kHz
		12.5 kHz
		20 kHz
		50 kHz
Example with TESA GT21:	$f_s = f_P = 12.5$ kHZ	on all 8 channels

Input level

Input impedance:	2 kΩ	software-programmable
	10 kΩ	
	100 kΩ	
	10 MΩ	
Transducer accuracy:	± 61 nm (Tesa GT21)	

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

Counter

Number of counter inputs:	1
Input type:	Differential inputs or TTL
Differential inputs:	Comply with the EIA standards RS422A
Common mode range:	+12 V / - 7 V
Input sensitivity:	± 200 mV
Input hysteresis:	50 mV typ.
Input impedance:	12 kΩ min.
Max. input frequency:	5 MHz at nominal voltage
"Open Circuit Fail Safe Receiver Design"	"1" = inputs open
ESD protection:	Up to ± 15 kV
Voltage supply of the encoder:	5 or 24 V/500 mA max.

24 V version

This version is designed for the connection of 24 V encoders.

Only 24 V signals can be connected to the inputs.

Nominal voltage:	24 V_{DC}
Max. input frequency:	1 MHz at nominal voltage
Input impedance:	1 MΩ typ.
Logic input levels:	
UH (max.)	30 V typ.
UH (min)	18 V typical (on request)
UL (max.)	16 V typical (on request)
UL (min)	0 V typical

Temperature measurement

Number of inputs:	1
Type:	RTD Pt100 or TC type K (optional)
Connection:	4-wire
Temperature range:	-200 to 850 °C
Resolution:	± 0.01 °C

System features

Interface:	Ethernet acc. to specification IEEE802.3
Dimensions (mm):	215 x 110 x 54
Weight:	760 g
Degree of protection:	IP 65
Operating temperature:	- 40 to + 85°C
Current consumption at 24 V:	400 mA
Voltage Supply	
24 VDC IN	1 x 5-pin M12 male connector
24 VDC OUT	1 x 5-pin M12 female connector
Connectors for sensors	
For inductive transducers:	8 x 5-pin M18 female connector
For temperature sensors:	1 x 5-pin M12 female connector
	1-, 2-, 4-wire Pt100
For the counter function:	1 x 12-pin M23 female connector

Ordering information

MSX-E3711

Ethernet system for length measurement, 24-bit, simultaneous, 8 transducers, counter and temperature input.
Incl. technical description, software drivers and ConfigTools.

Versions

MSX-E3711-HB:	for 8 HB inductive transducers, 5 V counter input
MSX-E3711-LVDT:	for 8 LVDT inductive transducers, 5 V counter input
MSX-E3711-M:	for 8 Mahr-comp. transducers, 5 V counter input
MSX-E3711-K:	for 8 Knaebel transducers, 5 V counter input
MSX-E3711-HB-24V:	for 8 HB inductive transducers, 24 V counter input
MSX-E3711-LVDT-24V:	for 8 LVDT inductive transducers, 24 V counter input
MSX-E3711-TC:	Type K thermocouple in place of the Pt100 input, other types on request

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

Options

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

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**

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

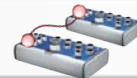Digital output 24 V with compare logic

24 V digital trigger input

Integrated Ethernet switch

+ 85 °C*
- 40 °C

IP 65 | IP 40

ARM®9 Technology

Cascadable, can be synchronised in the μs range

Timer function for synchro trigger signal

*Operating temperature

RoHS 2002/95/EC

on request

DatabaseConnect
see page 114

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),

    $$\frac{4\ mm}{2^{16}} = \pm\ 61\ nm = 0.061\ \mu m$$

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
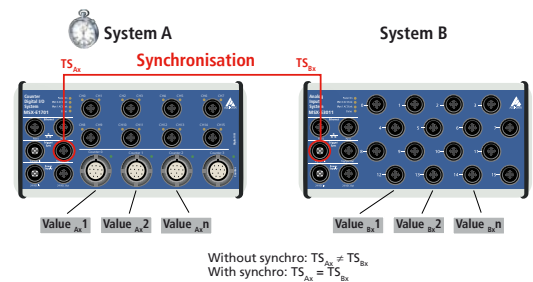- Line in for 24 V supply and cascading

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.

System A   Synchronisation   System B

TS_{Ax} TS_{Bx}

Value$_{A1}$1 Value$_{Ax}$2 Value$_{Ax}$n   Value$_{Bx}$1 Value$_{Bx}$2 Value$_{Bx}$n

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.

Acquisition with synchro

System A
System B

$TS_{A1}=TS_{B1}$

Time

Acquisition without synchro

System A
System B

TS_{A1} TS_{B1}

Time

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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 a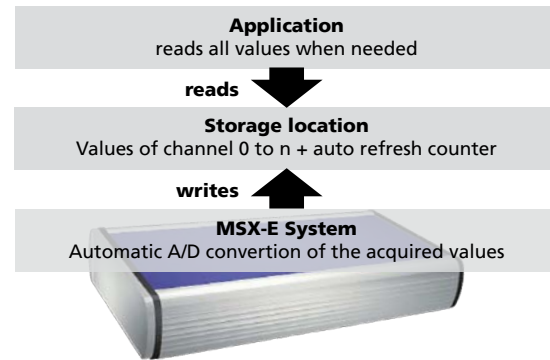re stored in the memory of the MSX-E Ethernet system. The client (e.g. PC, server, PLC, …) reads the acquired values asynchronously to the acquisition through socket connection, SOAP or Modbus function. Thereby, the new value is read and the old values are overwritten.
In addition to the measurement 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.

Application
reads all values when needed

reads

Storage location
Values of channel 0 to n + auto refresh counter

writes

MSX-E System
Automatic A/D convertion of the acquired 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.
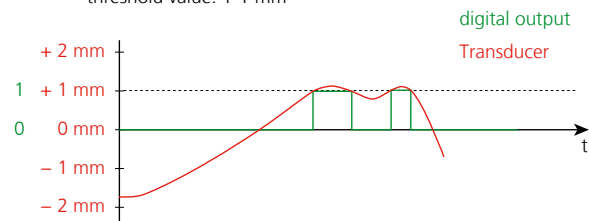

Example: Sequence acquisition of 6 channels, 1 Trigger for each sequence sending data after 2 sequences – a total of 1000 sequences
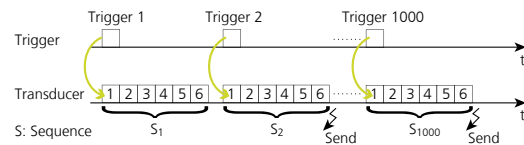
Digtal output with Compare logic

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
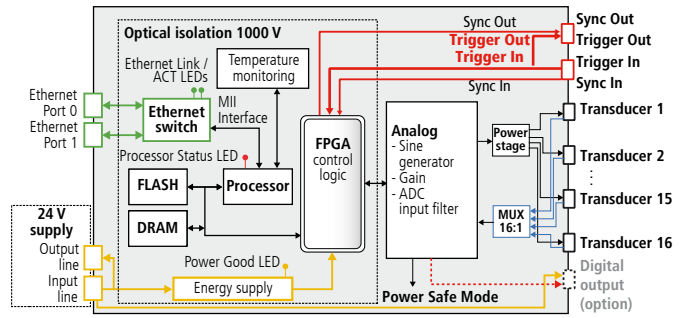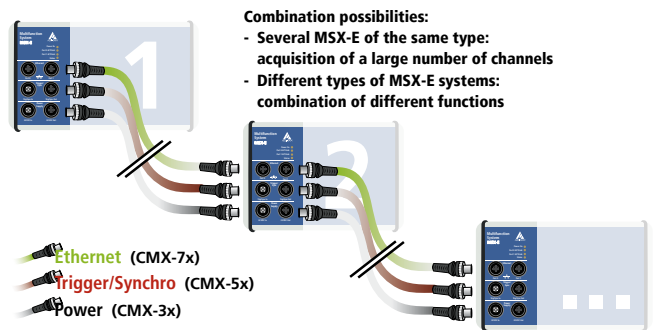- Save/load channel configuration
- Transducer calibration
- Transducer database
- Transducer monitoring
- Transducer diagnostics

Simplified block diagram

Cascading

Combination possibilities:
- Several MSX-E of the same type: acquisition of a large number of channels
- Different types of MSX-E systems: combination of different functions

Ethernet (CMX-7x)
Trigger/Synchro (CMX-5x)
Power (CMX-3x)

Features

MSX-E3701
Degree of protection IP 65

Status LEDs

Connection of up to 16 transducers, Half-Bridge, LVDT or Mahr compatible, 5-pin M18 female connector

2 x Ethernet
2 x Trigger/Synchronisation IN/OUT
2 x voltage supply, 24 V IN/OUT, optically isolated

MSX-E3700
Degree of protection IP 40

MSX-E3701-x
Opt. MSX-E Dig. Out:
additional dig. output with compare logic for transducer 0 (only for MSX-E3701-x-4)

New!*

ADDI-DATA connection technology

M18 cable and sensor supplied through the sensor manufacturer

MES data base MSR application

HARDWARE

SOFTWARE

IPEmotion®
procella®
SIMATIC STEP 7®
SPC.kompakt®

PC, server, PLC, HMI ...

UDP TCP/IP Modbus SOAP

Ethernet CMX-6x
RJ45
M12 male connector

Trigger CMX-4x
open cable end
M12 female connector

Power CMX-2x
M12 female connector
open cable end

Phone: +49 7229 1847-0   info@addi-data.com
Fax: +49 7229 1847-222   www.addi-data.com

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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
	$f_s = f_P$	10 kHz
		12.5 kHz
		20 kHz
		50 kHz

$$\text{Ab } n \geq 2 \text{ channels} \quad f_P = \text{primary frequency}$$
$$f_s = \frac{f_P}{SP \times n} \quad \begin{array}{l} SP \cdot \text{ Settling period } 5 \leq SP \leq 255 \\ f_s \text{ concerns here all n channels} \end{array}$$

Example with TESA GT21:	On 1 channel	$f_s = f_P$ = 12.5 kHz

$$\text{From } n \geq 2 \text{ channels} \quad f_s = \frac{12.5 \text{ kHz}}{5 \times 4} = 625 \text{ Hz for 4 channels}$$
$$f_s = \frac{12.5 \text{ kHz}}{5 \times 8} = 312.5 \text{ Hz for 8 channels}$$
$$f_s = \frac{12.5 \text{ kHz}}{5 \times 16} = 156.25 \text{ Hz for 16 channels}$$

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	2-20 kHz depending on the transducer
(primary frequency)	(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 1V$_{rms}$

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-x / 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

Precise and error-free diameter detection of gear wheels

Challenge
A manual test station shall be replaced by a modern and easy-to-use measuring system. The goal is to improve the accuracy of the measurement and to avoid errors which occur when measurement values are entered manually.

Solution
The diameter between the gear teeth shall be measured. Therefore the gear wheel is put on a measurement table with a ball for stopping. On the opposite side, a spring-loaded ball and an inductive measurement sensor are installed. The diameter between the fixed ball and the sensor is detected by the Ethernet length measurement system MSX-E3701. Then the measured values are calculated through an integrated logic and classified in 4 predefined categories (tolerance range). The measurement result is displayed with an LED on the digital Ethernet system MSX-E1516.

Ethernet

MSX-E1516
Switching of the LEDs

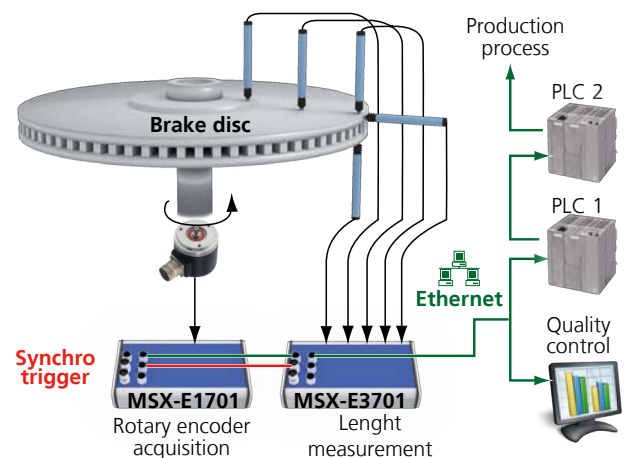**MSX-E3701-4**
Acquisition and calculation
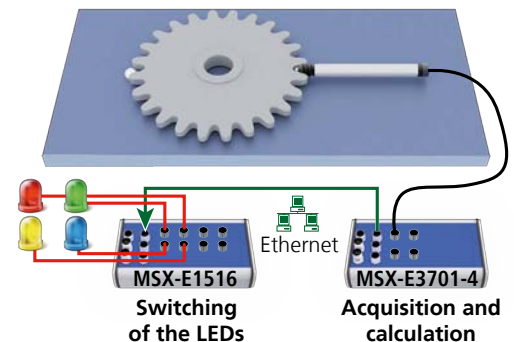
Consistent data for parameter corrections and precise rework of brake discs

Challenge
A manufacturer of car parts wants to test the surface of his produced brake discs as exactly as possible for roundness, radius and surface quality. In order to allow precise rework and corrections of the process parameters, the measurement device must be able to transfer a consistent data set of the position value and the measured value to the control unit.

Solution
For this application, two intelligent Ethernet systems are used: The MSX-E1701 counter system for the position acquisition and the MSX-E3701 length measurement system for the detection of the measurement values through the connected displacement transducers. For each measurement point, the MSX-E1701 system triggers the MSX-E3701 system angle-dependently. For a precise matching of position and measurement values at each measurement point, both systems are synchronised and have a time stamp. The acquired data is then transferred through Ethernet to a PC or a PLC for evaluation and regulation purposes. Exceeded tolerance values are forwarded to the super-ordinate machine in order to adjust process parameters or to effect corrections on the measured brake disc.

Production process

Brake disc

PLC 2

PLC 1

Ethernet

Quality control

Synchro trigger

MSX-E1701
Rotary encoder acquisition

MSX-E3701
Lenght measurement

Ethernet system for length measurement, 24-bit
16 inductive transducers, LVDT, half-bridge

MSX-E3701-DIO

Acquisition of 16 inductive transducers

For half-bridge and LVDT transducers

24 V digital trigger input
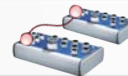
32 digital I/O, 24 V

Integrated Ethernet switch

+ 85 °C*
- 40 °C

IP 65

ARM®9 Technology

Cascadable, can be synchronised in the µs range

Timer function for synchro trigger signal

*Operating temperature

RoHS 2002/95/EC

on request

DatabaseConnect
see page 114

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

- 16 inputs for transducers, 24-bit, 5-pin M18 female connector
- Half-bridge (HB), LVDT
- Diagnostics at short-circuits or line break
- 16-bit accuracy

Transducer precision: example of a measurement

Typ TESA GT21, range ± 2 mm (∆ 4 mm),
16-bit accuracy

$$\frac{4\ mm}{2^{16}} = \pm\ 61\ nm = 0,061\ \mu m$$

Digital I/O

- 16 inputs for transducers, 24-bit, 5-pin M18 female connector
- 32 digital I/O, 24 V:
  16 opt. isolated inputs, 24 V, optional filter
  16 opt. isolated outputs, 11 V to 36 V,
  output current per channel 150 mA

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
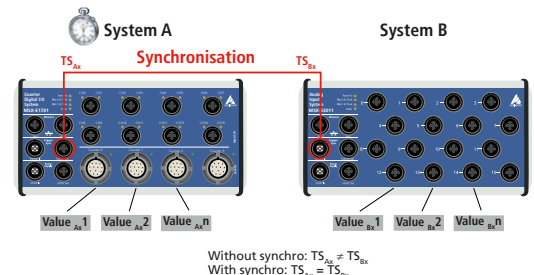
Communication interfaces

- 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
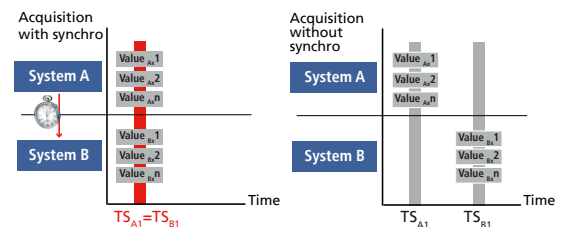
*Preliminary
 Product information

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.

System A   Synchronisation   System B

TS_{Ax} TS_{Bx}

Value $_{A1}$1   Value $_{A1}$2   Value $_{A1}$n   Value $_{B1}$1   Value $_{B1}$2   Value $_{B1}$n

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.

Acquisition with synchro

System A

Value $_{A1}$1
Value $_{A1}$2
Value $_{A1}$n

System B

Value $_{B1}$1
Value $_{B1}$2
Value $_{B1}$n

Time

$TS_{A1}=TS_{B1}$

Acquisition without synchro

System A

Value $_{A1}$1
Value $_{A1}$2
Value $_{A1}$n

System B

Value $_{B1}$1
Value $_{B1}$2
Value $_{B1}$n

Time

TS_{A1} TS_{B1}
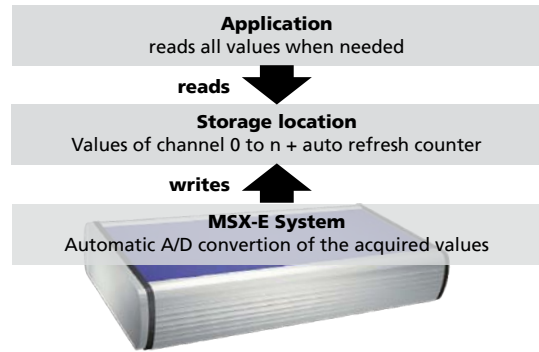
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Acquisition modes

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.

Application
reads all values when needed

reads

Storage location
Values of channel 0 to n + auto refresh counter

writes

MSX-E System
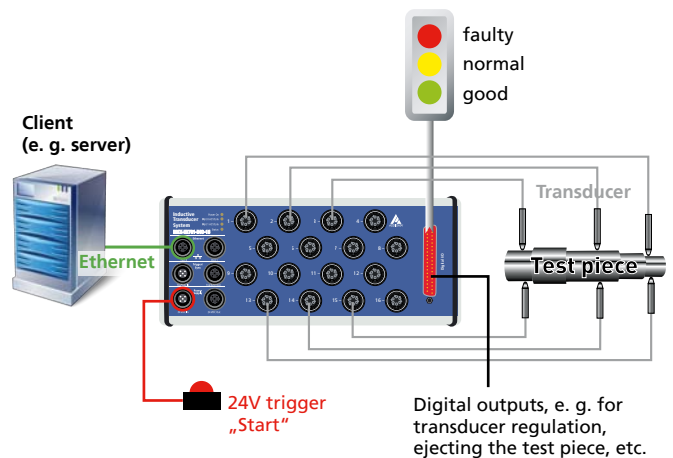Automatic A/D convertion of the acquired values

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 per sequence
Send data after 2 sequences – 1000 sequences in total
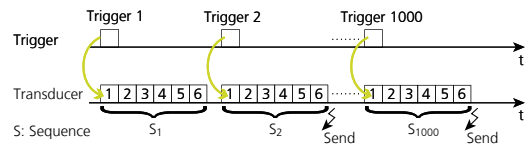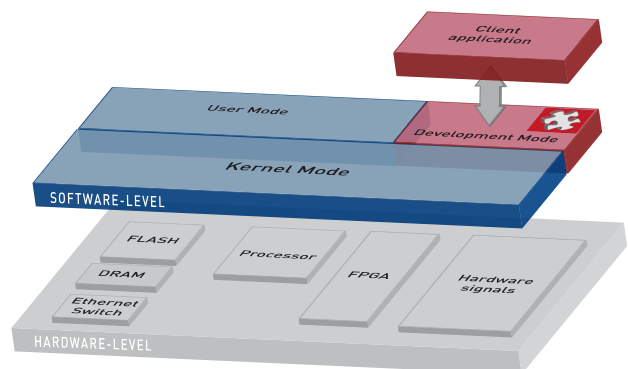
Digital I/O

In addition to the transducer channels, the MSX-3701-DIO system has 32 digital 24 V I/O channels (16 inputs, 16 outputs). The system is therefore very flexible and can manage complete measurement and test applications. Example: Test bench for cylindrical parts, probing the workpieces, automatic regulation of the transducers and visualisation of the results via LED trafic light. The measurement data is at the same time stored in a database.

faulty
normal
good

Client
(e. g. server)

Ethernet

Transducer

Test piece

24V trigger
„Start"

Digital outputs, e. g. for transducer regulation, ejecting the test piece, etc.

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.

Client application

User Mode

Development Mode

Kernel Mode

SOFTWARE-LEVEL

FLASH
Processor
FPGA
Hardware signals
DRAM
Ethernet Switch

HARDWARE-LEVEL

* 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.
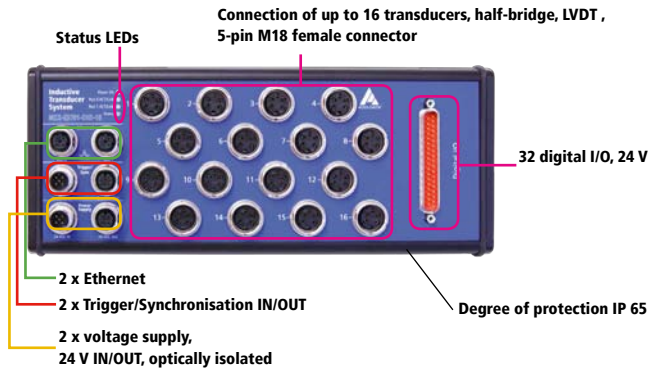
ConfigTools functions for MSX-E3701-DIO:
• Change of IP address
• Display of web interface
• Firmware update
• Save/load system configuration
• Save/load channel configuration
• Transducer calibration
• Transducer database
• Transducer monitoring
• Transducer diagnostics

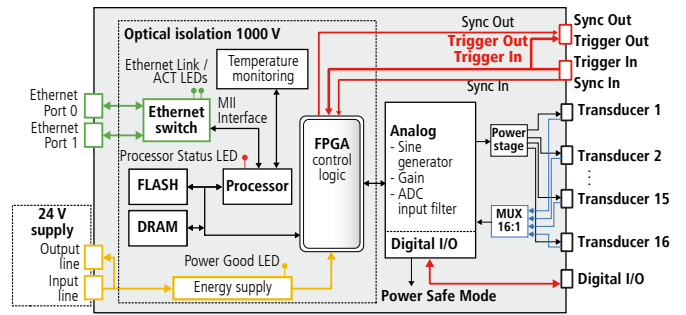**Very easy use through the „ConfigTools" program; The MSX-E system is automatically detected in the network.**
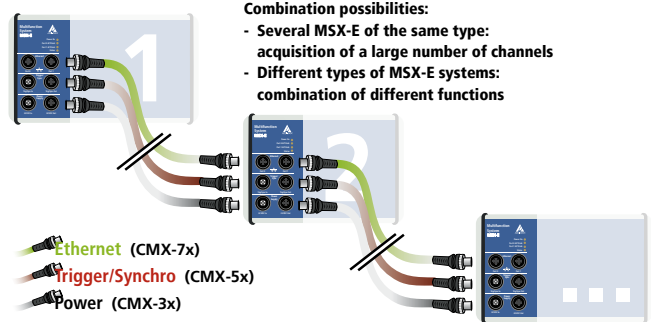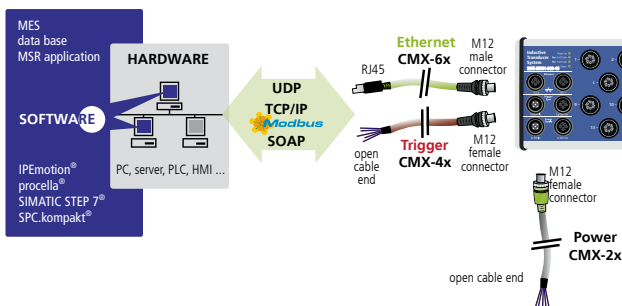

... and can then be calibrated.

Features

Status LEDs

Connection of up to 16 transducers, half-bridge, LVDT , 5-pin M18 female connector

32 digital I/O, 24 V

Degree of protection IP 65

2 x Ethernet
2 x Trigger/Synchronisation IN/OUT
2 x voltage supply,
24 V IN/OUT, optically isolated

Simplified block diagram

Cascading

Combination possibilities:
- **Several MSX-E of the same type: acquisition of a large number of channels**
- **Different types of MSX-E systems: combination of different functions**

Ethernet **(CMX-7x)**
Trigger/Synchro **(CMX-5x)**
Power **(CMX-3x)**

ADDI-DATA connection technology

* **Preliminary product information**

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Fax: +49 7229 1847-222   www.addi-data.com

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Specifications*

Inputs for inductive transducers

Channel features

Number:	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
$f_s = f_P$		10	kHz
		12.5	kHz
		20	kHz
		50	kHz

From n ≥ 2 channels f_P = primary frequency
SP = settling period (5 ≤ SP ≤ 255)
fs concerns here all n channels

$$f_s = \frac{f_P}{SP \times n}$$

Example with TESA GT21: On one channel $f_s = f_P$ = 12.5 kHz

From n ≥ 2 channels $f_s = \dfrac{12.5\ kHz}{5 \times 4}$ = 625 Hz for 4 channels

$f_s = \dfrac{12.5\ kHz}{5 \times 8}$ = 312.5 Hz for 8 channels

$f_s = \dfrac{12.5\ kHz}{5 \times 16}$ = 156.25 Hz for 16 channels

Input level

Input impedance:	2 kΩ software-configurable
	10 kΩ, 100 kΩ, 10 MΩ

Sensor supply (sine generator)

Type:	Differential sine (180° phase shift)
Coupling:	AC
Programmed signals:	5 kHz; 7.69 kHz; 10 kHz; 12.5 kHz; 20 kHz, 50 kHz,
Output frequency f_P	depending on the transducer
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

Power 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, sinus on, buffer off
	200 mA	typ. without load (transducer) at ± 9 V power (buffer on)
	320 mA	typ. with 16 Solartron AX1S transducers at ± 7 V power, 5 kHz and 3 V$_{rms}$
Reverse voltage protection		

Digital inputs

Number of inputs:	16, common ground acc. to IEC 1131-2	
Optical isolation:	1000 V through opto-couplers	
Nominal voltage:	24 VDC	
Input voltage:	0 to 30 V	
Logic input levels:	UH (max) 30 V typ.	UH (min) 19 V typ.
	UL (max) 14 V typ.	UL (min) 0 V typ.

Digital outputs

Number of outputs:	16
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:	11 V-36 V	
Output current per channel:	150 mA max.	
Diagnostics:	Common diagnostics bit for all 16 channels at overtemperature of one channel	

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:	260 x 110 x 50 mm
Weight:	965 g
Degree of protection:	IP 65
Operating temperature:	-40 °C to + 85°C

Interface connectors

Ethernet:	2 x 4-pin female connector, D-coded M12 for port 0 and port1
Trigger/Synchro input:	1 x 5-pin M12 male connector
Trigger/Synchro output:	1 x 5-pin M12 female connector
Voltage supply	
24 VDC input:	1 x 5-pin M12 male connector
24 VDC output:	1 x 5-pin M12 female connector

Ordering information

MSX-E3701-DIO
Ethernet system for length measurement, 24-bit, 16 inductive transducers, LVDT, half-bridge. Incl. technical description, software drivers and ConfigTools.

Versions
MSX-E3701-DIO-HB-16: for 16 HB inductive transducers
MSX-E3701-DIO-LVDT-16: for 16 LVDT inductive transducers

Connection cables for 32 dig. I/O, 24 V auf 37-pol. D-Sub-Connector
ST010: Standard round cable, shielded twisted pairs, 2m
PX901-DG: Screw terminal board with Schraubklemmen, LED Status display, for DIN rail
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

Options
MX-Clip, **MX-Rail** (please specify when ordering!),
MX-Screw, PCMX-1x

*Preliminary product information

Ethernet system for serial interfaces
4 ports for RS232, RS422, RS485 or 20 mA CL

MSX-E7511

4 serial interfaces

RS232, RS422, RS485, 20 mA Current Loop

128-byte FIFO buffer for each port

16C950 compatible UART

Optical isolation

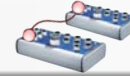Onboard evaluation of user data

---

Integrated Ethernet switch

+ 85 °C* / **- 40 °C**

IP 65

ARM®9 Technology

Cascadable, can be synchronised in the µs range

On request: Compare logic for synchro trigger signal

*Operating temperature

RoHS 2002/95/EC

on request

More information on www.addi-data.com

Features

- 24 V digital trigger input
- ARM®9 32-bit processor
- 64 MB onboard SDRAM for storing data
- Robust standardized metal housing
- Power Save Mode: Reduced power consumption when no acquisition runs

Safety features

- Status LEDs for fast error diagnostics
- Optical isolation • Input filters

Serial interfaces

- 4 serial interfaces
- RS232, RS422, RS485 and TTY (20 mA Current Loop)
- The port modes can be mixed
- The channels are optically isolated from each other

Interfaces

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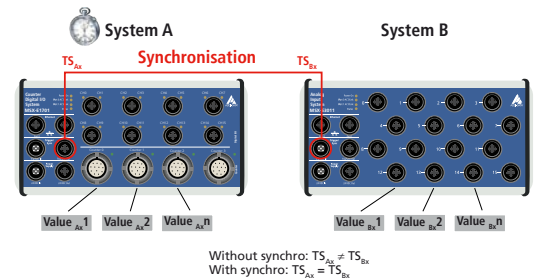- Line in for 24 V supply and cascading

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 …)
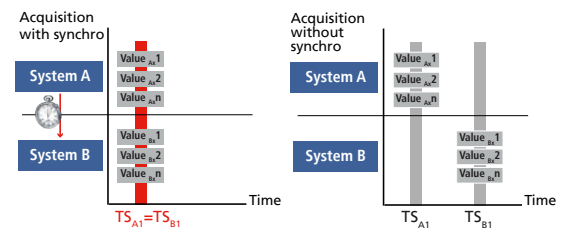- Command server Modbus TCP and Modbus (UDP) for sending commands

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.

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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.

Flexibility through firmware and software adaptation

Thanks to the flexibility of the MSX-E product range, the MSX-E7511 system can be easily extended via firmware, e. g. to install additional protocols on the serial interfaces.
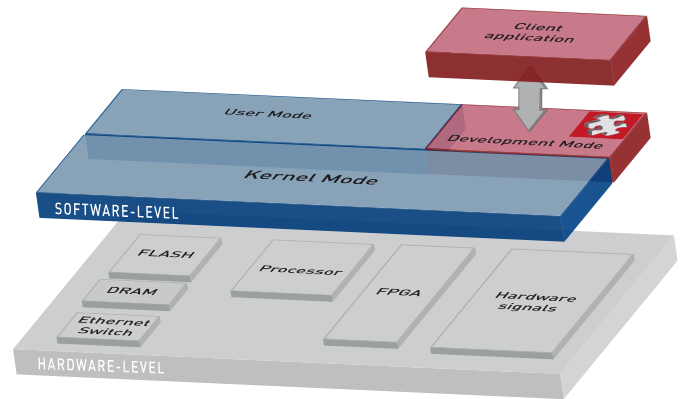
Fields of application

The MSX-E7511 Ethernet system features 4 serial interfaces.
Depending on the version, the interface standards are RS232, RS422, RS485 and TTY (20 mA Current Loop).
Any application can be programmed either through a firmware adaptation or using the Development mode.

Data collector

Via the RS485 interface, the Modbus RTU protocol can be used. For example, temperature sensors featuring an integrated Modbus RTU interface can be read and the complete protocol interpretation can be made on the MSX-E7511 system.
It is thus possible to filter the actual user data - in this case temperature data - and to transmit only this data or to store it in a database.

Onboard calculation

As the system can be programmed, it is possible to effect calculations with the different ports.
Example:
Using a radar sensor, the position of an object is to be displayed.
The sensors indicate the distance via RS422.
Three sensors are used:
• Sensor 1 as a reference to control whether there is an object or not.
• Sensor 2 and 3 for establishing the position of the object.

On the MSX-E7511 system, the interface data is read and interpreted.
The position of the object is obtained through calculation of the values of sensor 2 and 3 (e.g. as x/y value). Sensor 1 is used to validate the result.
The MSX-E7511 system transmits then only the position data to the Client.
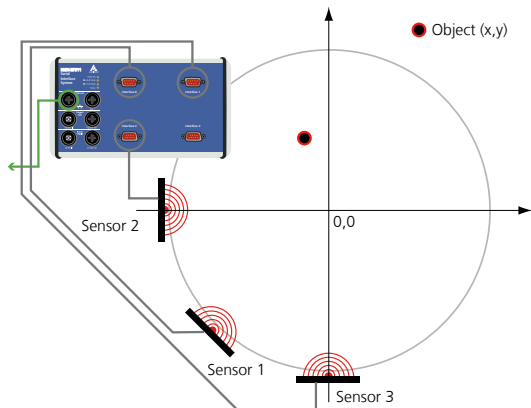
Selft-sufficient unit

Using further systems from the MSX-E product range, the MSX-E7511 system can also be used as a self-sufficient unit.
Example:
Components are acquired via a scanner (RS232). The MSX-E7511 system reads the barcode and sends the corresponding commands for the processing of the components to a MSX-E1516 Ethernet digital I/O system (handling) and a printer (marking).
There is thus no need for an additional PLC or PC.
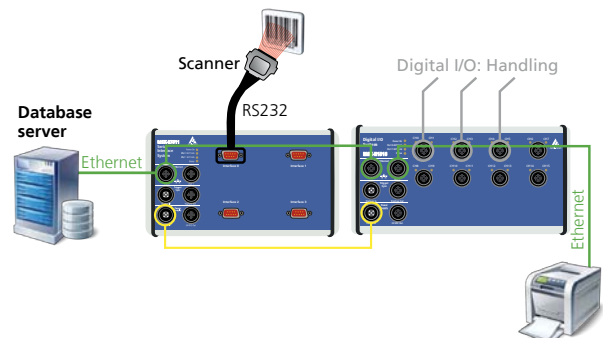
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