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



MSX-E3701 / MSX-E3700

Acquisition of 8 or 16 inductive transducers

For Half-Bridge, LVDT, Mahr or Knaebel transducers

24 V digital trigger input

Integrated Ethernet switch

+ 85 °C* / - 40 °C

*Operating temperature

IP 65 / IP 40

ARM®9 Technology

Cascadable, can be synchronised in the µs range

Timer function for synchro trigger signal

RoHS 2011/65/EU

DatabaseConnect
see page 114

Features

- ARM®9 32-bit processor
- Robust standardised metal housing

Inputs for transducers

- 8 or 16 inputs for transducers, 24-bit, 5-pin M18 female connector
- Half-bridge (HB), LVDT, Mahr-compatible, Knaebel
- Diagnosis (short-circuits, line break)
- 16-bit accuracy, example of a measurement:
  Typ TESA GT21, range ± 2 mm (Δ 4 mm),
  $\frac{4\ mm}{2^{16}}$ = ± 61 nm = 0.061 µm

Safety features

- Status LEDs for fast error diagnosis
- 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
- 24 V connection and cascading

Communication interfaces

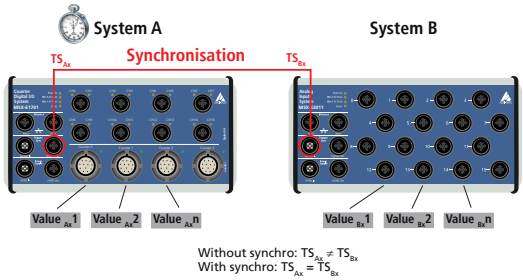
- Web server for configuration and monitoring
- SOAP command server for configuration and control
- Data server (TCP/IP or UDP) for high-speed acquisition data
- Event server (TCP/IP) for system events and diagnostics
- Modbus TCP / UDP command server
- **Ready-to-use software clients for Python and .NET (only for the MSX-E3701)**

Python – Open-source MSX-E client and ready-to-run examples available on GitHub (only for the MSX-E3701)
.NET – Official MSX-E SOAP client available as a NuGet package (only for the MSX-E3701)

Synchronisation/time stamp

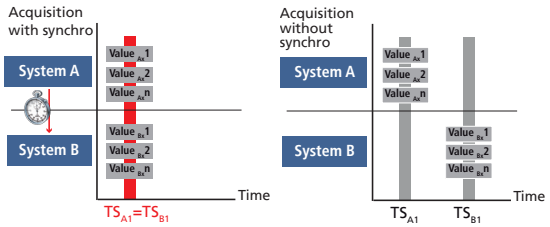
Time stamp

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.



More information on www.addi-data.com

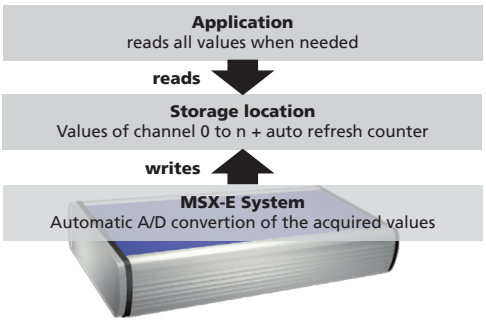
Drivers and samples
Find software for the MSX-E systems at:
www.addi-data.com

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

Auto-refresh mode

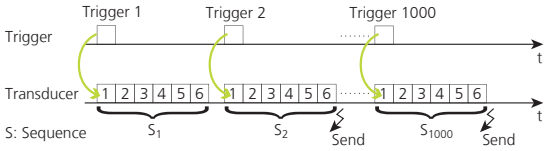
In the auto-refresh mode, the measurement values are updated automatically after each acquisition. The acquisition is initialised once and the values of the channels are stored in the memory of the MSX-E Ethernet system. The client (e.g. PC, server, PLC, ...) reads the acquired values asynchronously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



Sequence Mode

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

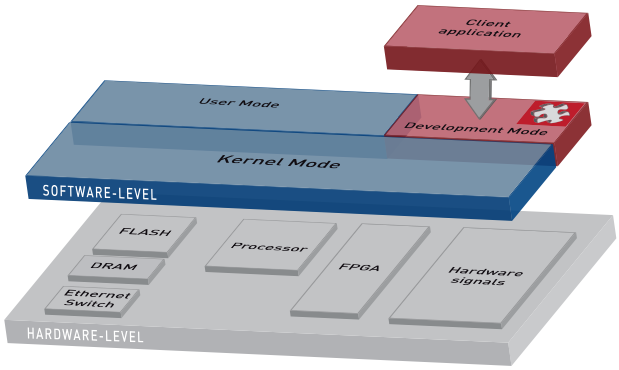
Example: Sequence acquisition of 6 channels, 1 Trigger for each sequence sending data after 2 sequences – a total of 1000 sequences



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

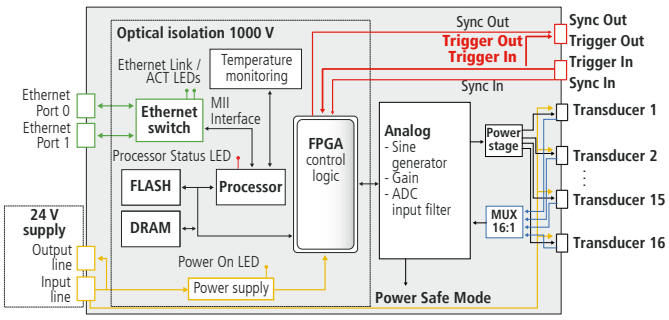
The **ConfigTools** program allows an easy administration of the MSX-E systems. These are automatically detected in the network. **ConfigTools** consists of common and specific functions.
In addition, with **ConfigTools**, the complete configuration of an MSX-E system can be saved and transferred to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

ConfigTools is included in delivery.

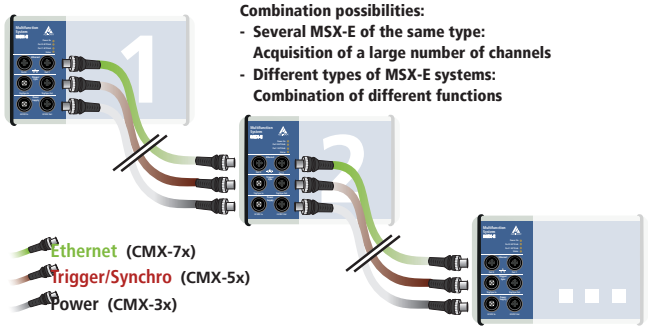
ConfigTools functions for MSX-E3701 / MSX-E3700:

- 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 diagnosis

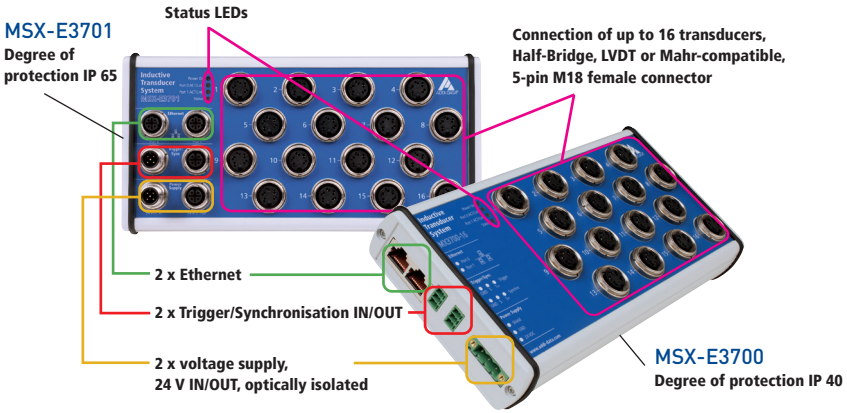
Simplified block diagram



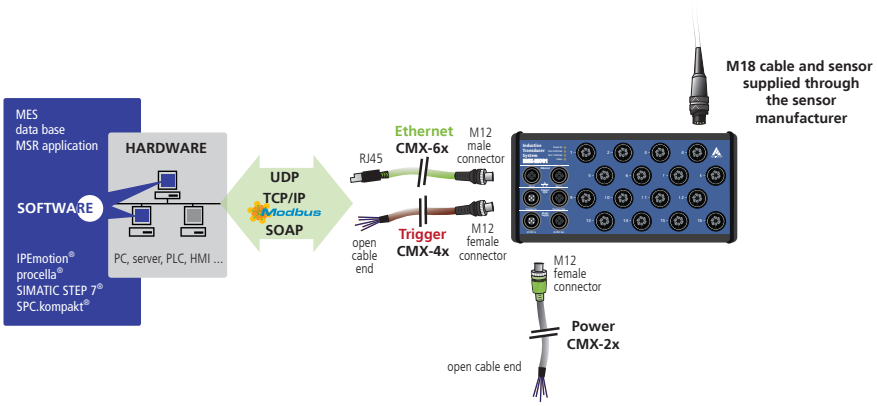
Cascading

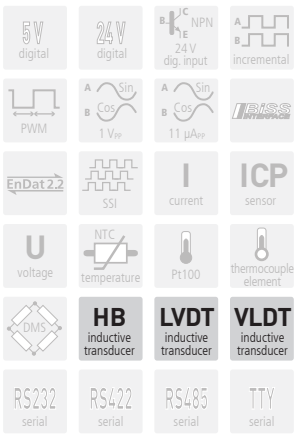


Features



ADDI-DATA connection technology





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Specifications

Inputs for inductive transducers

Channel features

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

Input level

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

Sine wave generator (transducer supply)

Type:	Sine differential (180° phase-shift)
Coupling:	AC

Programmed signals

Output frequency f_P (primary frequency):	Depending on the transducer: 5 kHz 7.69 kHz 10 kHz 12.5 kHz 20 kHz 50 kHz (Knäbel)

Output level

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

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/TVS diode
Optical isolation:	1000 V
Nominal voltage:	24 V external
Input voltage:	0-30 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 standard DIN EN IEC 61326-1. 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-E3700-8	154 x 110 x 39 mm
	MSX-E3701-16	215 x 110 x 50 mm
	MSX-E3701-8	154 x 110 x 50 mm
Weight:	MSX-E370x-16:	760 g
	MSX-E370x-8:	560 g
Degree of protection:	MSX-E3701-8/-16:	IP 65
	MSX-E3700-8/-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-8:	8 x 5-pin M18 female connector
MSX-E370x-16:	16 x 5-pin M18 female connector

Version	Temperature range -40 °C to +85 °C	Number of transducers	Type of transducer	Degree 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-LVDT-16	✓	16	LVDT	
MSX-E3701-LVDT-8		8		
MSX-E3701-K-8	✓	8	Knaebel	
MSX-E3701-M-8	✓	8	Mahr-compatible	
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-LVDT-16	✓	16	LVDT	
MSX-E3700-LVDT-8		8		

Ordering information

MSX-E3701 / MSX-E3700

Ethernet system for length measurement, 24-bit, 16/8 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-M-8: for 8 Mahr-compatible displacement transducers

Options

MSX-E 5V-Trigger: Level change of the trigger inputs and outputs to 5 V

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

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

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