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

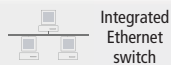**New!*** -40 °C to +85 °C digital output 24 V with compare logic

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

Acquisition of 4, 8 or 16 inductive displacement transducers

For half-bridge, LVDT, Mahr or Knaebel transducers

24 V digital output with compare logic

Dynamic measurement via 24 V digital trigger input

Integrated Ethernet switch	MSX-E3701-EXT +85 °C* / -40 °C	+60 °C* / 0 °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 66

SPC.kompakt

Q-DAS

procella®

More information at
www.addi-data.com

With the intelligent Ethernet systems MSX-E3701 and MSX-E3700 you can acquire 4, 8 or 16 half-bridge, LVDT, Mahr-compatible or Knaebel displacement transducers with 24-bit resolution. The 4-transducer version is now also available with one 24 digital output and compare logic. The transducers can be connected directly through the 5-pin M18 connectors.

The systems can be freely cascaded and synchronised in the µs range. You can thus acquire data from several systems at the same time. The ARM®9 processor allows the system to perform calculations. The timer function can generate a synchro trigger signal in order to start acquisitions.

Features

- **New:** Extended temperature range -40 °C to +85 °C available (MSX-E3701-EXT)
- **New:** 1 digital output, 24 V with compare logic for input 0 (optional, only available for MSX-E3701-x-4)
- Connection of all commercially available transducers (half-bridge, LVDT, Mahr-compatible or Knaebel)
- 4, 8 or 16 channels depending on the version, cascadable
- 24-bit resolution
- Fast distributed data acquisition
- 16 MB onboard SDRAM for storing data
- ARM®9 32-bit processor for data processing
- Diagnostics possibility at short-circuits or line break of the transducers
- Robust normed metal housing
- Power Save Mode: reduction of the power consumption when no acquisition runs

Acquisition modes:

- Auto-refresh mode: Automatic update of the acquired data in the background
- Sequence mode: Data acquisition in "packages"
- With trigger or synchro input

Safety features

- LED status display for fast error diagnostics
- Input filters
- Diagnostic possible at short-circuits or line break
- Internal temperature monitoring

Transducer precision: Example of a measurement

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

$$\frac{4\ mm}{2^{16}} = ± 61\ nm = 0.061\ µm$$

Applications

- Gear wheel control • Gauge block control
- Acquisition of sensor data
- Quality assurance, automatic parts control
- Industrial process control
- Profile and surface measurement

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

Software:

- Software drivers for Windows 7 (32-bit)/Vista™ (32-bit)/XP/2000. On request: Windows 7 (64-Bit), Linux
- Direct access via SOAP (TCP/IP), WSDL files
- Direct access via Modbus TCP and Modbus (UDP)
- Programming examples .net2005, VC++ 6.0
- Programming examples LabVIEW from 8.5 on request
- Programming examples for Linux on request
- Instruction manual for connecting a PLC (SIMATIC® S7®)

Driver list on the web: www.addi-data.com

***Preliminary
product information**

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Features

Degree of protection
IP 65
MSX-E3701

Status LEDs

Connection of up to 16 inductive
displacement transducers, half-
bridge, LVDT or Mahr-compatible,
M18 female connector, 5-pin

Degree of protection IP 40
MSX-E3700

**Calibration tool
SET3701**

2 x Ethernet

Trigger/Synchronisation IN/
OUT

Voltage supply, 24 V, optically isolated

New!*

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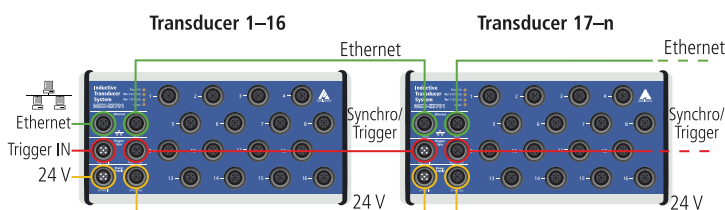logic for transducer 0 available (only for MSX-E3701-x-4)
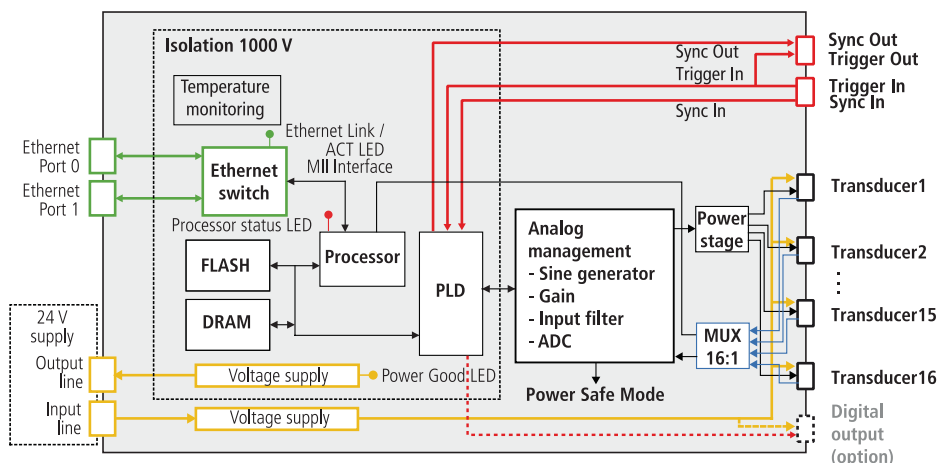
Synchronisation

Ethernet, synchronisation and supply signals can
be looped from one system to the next. In this
way, you can acquire and process distributed I/O
signals directly at production machines.
With these features, the MSX-E systems are suited
both for simple distributed applications and for
complex applications, in which multiple devices
with physically widely separated signals have to
operate together.

Transducer 1–16

Transducer 17–n

Ethernet

Ethernet

Ethernet

Ethernet

Synchro/
Trigger

Synchro/
Trigger

Trigger IN

24 V

24 V

24 V

Simplified block diagram

Isolation 1000 V

Sync Out
Trigger Out

Trigger In
Sync In

Temperature
monitoring

Sync Out
Trigger In

Sync In

Ethernet
Port 0

Ethernet Link /
ACT LED
MII Interface

Ethernet
switch

Ethernet
Port 1

Processor status LED

Transducer1

Processor

Analog
management
- Sine generator
- Gain
- Input filter
- ADC

Power
stage

Transducer2

FLASH

PLD

DRAM

24 V
supply

Output
line

Voltage supply

Power Good LED

MUX
16:1

Transducer15

Transducer16

Input
line

Voltage supply

Power Safe Mode

Digital
output
(option)

*Preliminary product information

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
	Ab n ≥ 2 channels	f_P = primary frequency
	$f_s = \dfrac{f_P}{SP \times n}$	SP . Settling period 5 ≤ SP ≤ 255
		f_s concerns here all n channels

Example with TESA GT21:	On 1 channel $\quad f_s = f_P$	= 12.5 kHz
	From n ≥ 2 channels $f_s = \dfrac{12.5\ \text{kHz}}{5 \times 4}$	= 625 Hz for 4 channels
	$f_s = \dfrac{12.5\ \text{kHz}}{5 \times 8}$	= 312.5 Hz for 8 channels
	$f_s = \dfrac{12.5\ \text{kHz}}{5 \times 16}$	= 156.25 Hz for 16 channels

Input level

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

Sensor supply (sine generator)

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

Voltage supply

Nominal voltage:	24 V	===
Supply voltage:	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-E370x-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
Supply voltage:	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

Synchro

Number of inputs:	1
Number of outputs:	1
Max. cable length:	20 m
Optical isolation:	1000 V
Signal type:	RS485

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:	0 to + 60 °C
	MSX-E370x-EXT:	-40 °C to + 85°C

MSX-E3701 interface connectors

Ethernet	2 x 4-pin M12 female connector, D-coded for Port 0 and 1Port1
Trigger/Synchro IN	1 x 5-pin male connector M12
Trigger/Synchro OUT	1 x 5-pin female connector M12
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
24 VDC	3-pin binder, 5.08 mm grid
External trigger	1 x 3-pin binder, 3.81 mm grid
Synchro signal	1x 3-pin binder, 3.81 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

*Preliminary
  product information

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Versions	Temperature range		Number of transducers	Type of transducer	Digital output 24 V (option)	Degrees of protection
	0 to 60 °C	−40 °C to 85 °C				
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-16-EXT		✓				
MSX-E3701-HB-8	✓		8			
MSX-E3701-HB-8-EXT		✓				
MSX-E3701-HB-4	✓		4		✓	
MSX-E3701-HB-4-EXT		✓				
MSX-E3701-LVDT-16	✓		16	LVDT		
MSX-E3701-LVDT-16-EXT		✓				
MSX-E3701-LVDT-8	✓		8			
MSX-E3701-LVDT-8-EXT		✓				
MSX-E3701-LVDT-4	✓		4		✓	
MSX-E3701-LVDT-4-EXT		✓				
MSX-E3701-K-8	✓			Knaebel		
MSX-E3701-K-8-EXT		✓				
MSX-E3701-M-8	✓		8	Mahr-compatible		
MSX-E3701-M-8-EXT		✓				
MSX-E3701-M-4	✓		4		✓	
MSX-E3701-M-4-EXT		✓				
MSX-E3700-HB-16	✓		16	Half-Bridge		**MSX-E3700: Degree of protection IP 40** Protection against the penetration of foreign bodies with a diameter greater than 1 mm.
MSX-E3700-HB-8			8			
MSX-E3700-HB-4			4			
MSX-E3700-LVDT-16			16	LVDT		
MSX-E3700-LVDT-8			8			
MSX-E3700-LVDT-4			4			

Ordering information

MSX-E3701 / MSX-E3701-EXT / MSX-E3700
Ethernet system for length measurement, 24-bit, 16/8/4 inductive displacement transducers, LVDT, half-bridge, Mahr-compatible, Knaebel.
Incl. technical description and software drivers

MSX-E3701 (degree of protection IP 65)
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

MSX-E3701-LVDT-8-EXT: For 8 LVDT inductive displacement transducers
MSX-E3701-HB-4-EXT: For 4 HB inductive displacement transducers
MSX-E3701-LVDT-4-EXT: For 4 LVDT inductive displacement transducers
MSX-E3701-M-8-EXT: for 8 Mahr-compatible displacement transducers
MSX-E3701-M-4-EXT: 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-E3701-EXT
(degree of protection IP 65, extended temperature range)
MSX-E3701-HB-16-EXT: For 16 HB inductive displacement transducers
MSX-E3701-LVDT-16-EXT: For 16 LVDT inductive displacement transducers
MSX-E3701-HB-8-EXT: For 8 HB inductive displacement transducers
MSX-E3701-K-8-EXT: For 8 Knaebel induct. displacement transducers

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

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

*Preliminary product information