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

ARM®9 Technology

MSX-E3701 / MSX-E3700

Acquisition of 4, 8 or 16 inductive displacement transducers

For half-bridge or LVDT transducers

Trigger / synchro

Degree of protection IP 65 or IP 40

Cascadable

RoHS 2002/95/EC

More information on www.addi-data.com

With the intelligent Ethernet I/O modules MSX-E3701 and MSX-E3700, ADDI-DATA offers a new distributed platform for the acquisition of displacement transducers, based on the ARM®9 technology.
The I/O modules are available in 4-, 8- or 16-channel versions and comply with the degrees of protection IP 65 or IP 40.
You can connect up to 16 displacement transducers (half-bridge or LVDT) directly through a 5-pin M18 connector and acquire data on-site in 24-bit resolution.
Several modules can be cascaded via a 2-port Ethernet switch: no need to connect each module to the PC.
The external trigger signal (hardware trigger) can also be cascaded. In addition, the I/O modules can be synchronised. Thanks to the combination of synchronisation and cascading of the trigger signal, it is possible to acquire data from several modules simultaneously and to trigger the tranducer acquisition with encoders.
The MSX-E3701 and MSX-E3700 are mounted in robust, EMC-protected metal housings which comply with the degrees of protection IP 65 (with additional protection against waterjets) or IP 40.

Features

- Connection of all commercially available transducers (half-bridge or LVDTs)
- 4, 8, or 16 channels depending on the version, cascadable
- 24-bit resolution
- Fast distributed data acquisition
- Dynamic measurement via 24 V digital trigger input
- Synchronisation of several modules
- 16 MB onboard SDRAM for storing data
- ARM®9 32-bit processor for data processing
- Integrated Ethernet switch
- Cascading of all MSX-E module types
- Cascading of the 24 V supply
- Diagnostics possibility at short-circuits or line break of the transducers
- The modules comply with the degree of protection IP 65 or IP 40
- Robust metal housing
- Power Save Mode: reduction of the power consumption when no acquisition runs
- LED status display for fast error diagnostics

Acquisition modes:

- Auto Refresh mode: Automatic update of the acquired data in the background
- Sequence mode: Data acquisition in „packages"

Safety features

- Input filters
- Diagnostics possibility at short-circuits or line break
- Internal temperature monitoring

Transducer precision: Example of a measurement

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

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

Applications

- Gear wheel control
- Gauge block
- Acquisition of sensor data
- Quality assurance
- Industrial process control, automatic parts control
- R&D Instrumentation

Interfaces

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

Communication interface

- Web server (configuration and monitoring)
- Access via TCP/IP socket
- Command server (SOAP) for sending commands
- Data server (TCP/IP or UDP socket) for sending acquisition data
- Event server (TCP/IP socket) for sending module events (diagnostics such as temperature, short-circuits...)
- Access via UDP
- Command server (MODBUS) for sending commands

Software:

- Software drivers for Windows Vista™ (32-bit)/XP/2000
- ADDIPACK (not all functions are supported)
- Direct access via SOAP (TCP/IP)
- Direct access via MODBUS (UDP)
- Programming examples .net2003, VC++ 6.0
- LABVIEW from 8.20 on request

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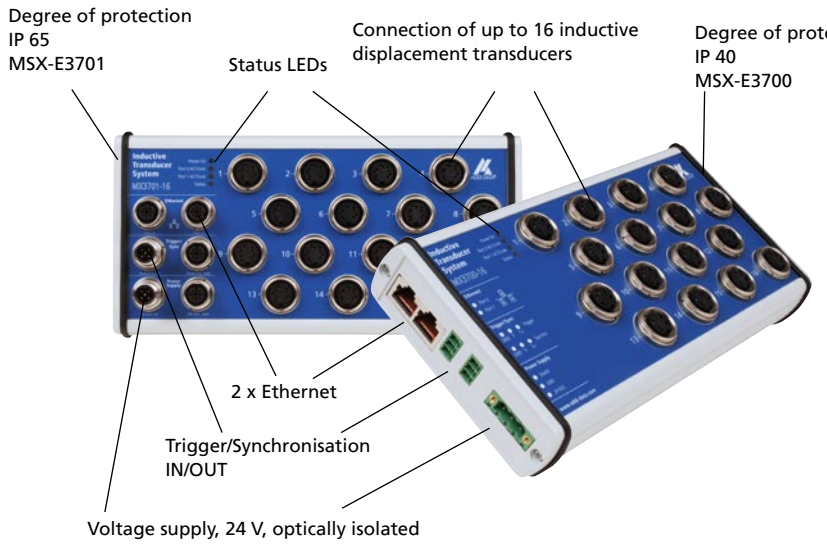
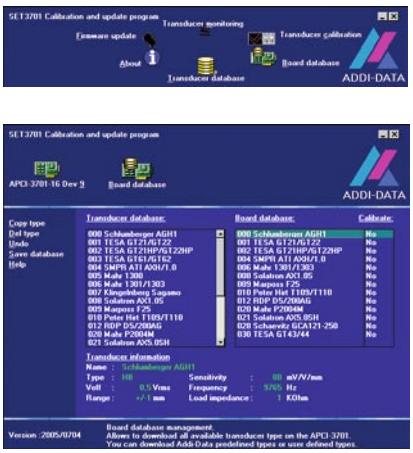
Features

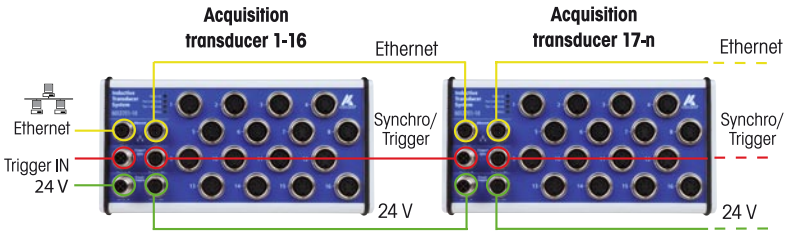


Calibration tool SET3701

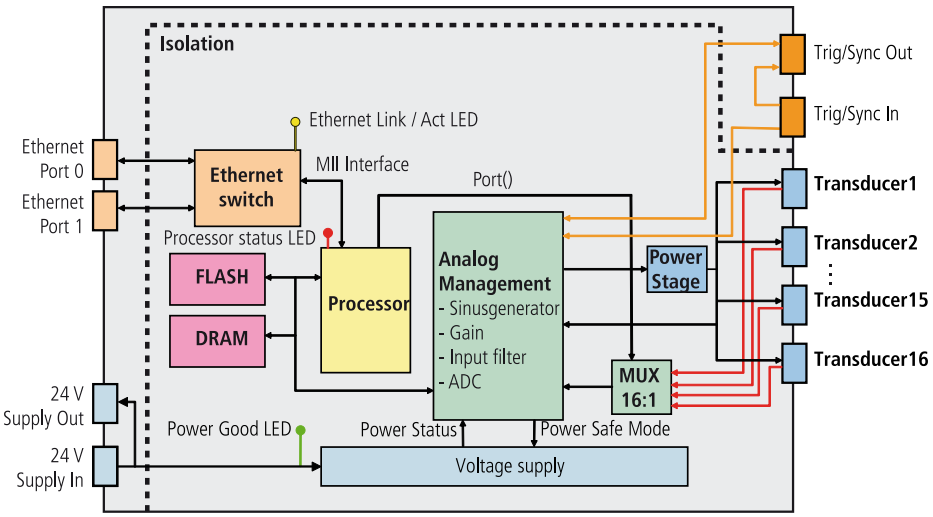


Synchronisation

Ethernet, synchronisation and supply signals can be put through from one module to the next. In this way, you can acquire and process distributed I/O signals directly at production machines. These features allow the I/O modules to be used for simple, distributed applications and for complex applications, in which numerous devices have to interact with signals that are far away from each other.



Simplified block diagram



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inputs for inductive transducers

Channel features		
Number	-4/-8/-16/	multiplexed
Input type	single ended	
Coupling	DC	
Resolution	24-bit	
Sampling rate 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
	$f_s = \frac{f_P}{SP \times n}$	SP . Settling period 5 ≤ SP ≤ 255
		f_s concerns here all n channels
Example with TESA GT21	On one channel	$f_s = f_P$ = 12.5 kHZ
	Ab n ≥ 2 channels	$f_s = \frac{12{,}5\ kHz}{5 \times 4}$ = 625 HZ for 4 channels
		$f_s = \frac{12{,}5\ kHz}{5 \times 8}$ = 312.5 HZ for 8 channels
		$f_s = \frac{12{,}5\ kHz}{5 \times 16}$ = 156.25 HZ for 16 channels

Input level	
Input impedance	2 kΩ software-programmable 10 kΩ 100 kΩ 10 MΩ
Input ranges	± 3 V single ended
Sensor supply (Sinus Generator)	
Type	Sinus 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

Power 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, Sinus 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 Vrms
	330 mA	typ. with 8 Knaebel IET0200 transducers at 5 V power, 50 kHz and 1Vrms
Voltage reversal 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 input

Number of inputs	1 trigger input
Filters/protective circuitry	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 outputs	1
Max. cable length	20 m
Optical isolation	1000 V
Signal type	RS485

System requirements

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	0 up to + 60°C	
MSX-E3701 function connectors		
Ethernet	2x 4-pin flange type socket, D-coded M12 for Port 0 and 1Port1	
Trigger/synchro input	1 x 5-pin flange connector M12	
Trigger/synchro output	1 x 5-pin flange type socket M12	
24 VDC input	1 x 5-pin flange connector M12	
24 VDC output	1 x 5-pin flange type socket M12	
MSX-E3700 function connectors		
Ethernet	RJ45 for Port 0 and 1	
24 VDC	3-pin binder, 5.08 mm grid	
External trigger	1x 3-pin binder, 3.81 mm grid	
Synchro signal	1x 3-pin binder, 3.81 mm grid	
Connector for the inductive displacement transducers		
MSX-E370x-4	4 x 5-pin flange type socket M18	
MSX-E370x-8	8 x 5-pin flange type socket M18	
MSX-E370x-16	16 x 5-pin flange type socket M18	

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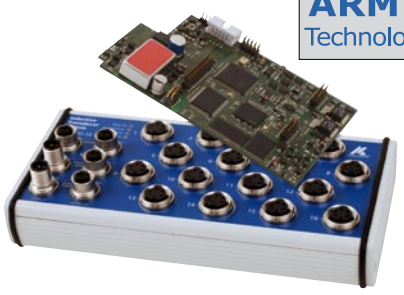

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Connection cables and binders

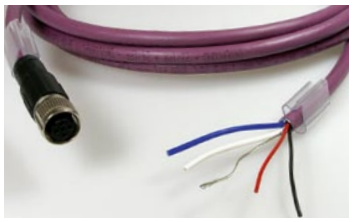
for MSX-E3701

Power Supply

Shielded cable,
M12 5-pin cable box/open end,
IP 65
CMX-20: 1.5 m
CMX-21: 3 m
CMX-22: 5 m
CMX-23: 10 m
CMX-29: On request

For cascading
Shielded cable,
M12 5-pin cable box/connector
IP 65
CMX-38: 0.6 m
CMX-30: 1.5 m
CMX-31: 3 m
CMX-32: 5 m
CMX-39: On request

Trigger/Synchro



Shielded cable,
M12 5-pin cable box/open end,
IP 65
CMX-40: 1.5 m
CMX-41: 3 m
CMX-42: 5 m
CMX-43: 10 m
CMX-49: On request

For cascading, shielded cable,
M12 5-pin cable box/connector
IP 65
CMX-58: 0.6 m
CMX-50: 1.5 m
CMX-51: 3 m
CMX-52: 5 m
CMX-59: On request

Ethernet

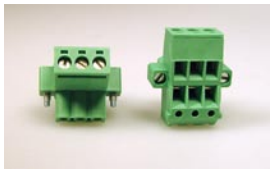
CAT5E cable,
M12 D-coded cable connector/
RJ45 connector
CMX-60: 2 m
CMX-61: 5 m
CMX-62: 10 m
CMX-69: On request

For cascading
CAT5E cable,
2 x M12 D-coded cable
connector
CMX-78: 1 m
CMX-70: 2 m
CMX-71: 5 m
CMX-72: 10 m
CMX-79: On request

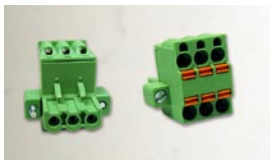
for MSX-E3700

Power supply

SMX-10:
Standard 3-pin binder
5.08 mm grid,
1-row, screw connector
Included in the delivery content



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 / Synchro

SMX-20:
Standard 3-pin binder
5.08 mm grid
Included in the delivery content

Options for MSX-E3701 and MSX-E3700

MX-Rail:
for DIN-rail mounting

MX-Screw:
for wall mounting

PCMX-10:
Protection cap for M12 connector

PCMX-11:
Protection cap for M18 connector

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Versions and degrees of protection

Versions	Number of transducers	Type of transducer	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-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-E3700

Ethernet modules for length measurement, 24-bit, 16/8/4 inductive displacement transducers, LVDT, half-bridge.
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-LVDT-8: For 8 LVDT inductive displacement transducers
MSX-E3701-HB-4: For 4 HB inductive displacement transducers
MSX-E3701-LVDT-4: For 4 LVDT inductive displacement transducers

Connection cables for MSX-E3701

Power Supply
Shielded cable, M12 5-pin cable box/open end, IP 65
CMX-20: 1.5 m
CMX-21: 3 m
CMX-22: 5 m
CMX-23: 10 m
CMX-29: Cable length on request

For cascading:
Shielded cable, M12 5-pin cable box/connector IP 65
CMX-38: 0.6 m
CMX-30: 1.5 m
CMX-31: 3 m
CMX-32: 5 m
CMX-39: Cable length on request

Trigger/Synchro
Shielded cable, M12 5-pin cable box/open end, IP 65
CMX-40: 1.5 m
CMX-41: 3 m
CMX-42: 5 m
CMX-43: 10 m
CMX-49: Cable length on request

For cascading:
Shielded cable, M12 5-pin cable box/connector IP 65
CMX-58: 0.6 m
CMX-50: 1.5 m
CMX-51: 3 m
CMX-52: 5 m
CMX-59: Cable length on request

Ethernet
CAT5E cable, M12 D-coded cable connector/RJ45 connector
CMX-60: 2 m
CMX-61: 5 m
CMX-62: 10 m
CMX-69: Cable length on request

For cascading: CAT5E cable, 2 x M12 D-coded cable connector
CMX-78: 0.6 m
CMX-70: 2 m
CMX-71: 5 m
CMX-72: 10 m
CMX-79: Cable length on request

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 the delivery content)
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

MX-Rail: Mounting set for MSX-E3701 and MSX-E3700 for DIN-rail mounting
MX-Screw: Mounting set for MSX-E3701 and MSX-E3700 for direct mounting on devices and machines

PCMX-10: 5 protection caps for M12 connector (4 x female, 1 x male)
PCMX-11: Protection caps for MSX-E3701 and MSX-E3700 (10 protection caps for M18 connector)

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