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TECHNICAL

DESCRIPTION

MSX-E3317-4-1V_{PP}

Ethernet system for force/distance measurement

DIN EN ISO 9001:2008 certified

Edition: 02.02-11/2013

Product information

This manual contains the technical installation and important instructions for correct commissioning and usage, as well as production information according to the current status before printing.
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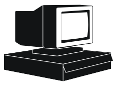
Personal injury



Damage to the Ethernet system, the PC and peripherals

Pollution of the environment

- Protect yourself, others and the environment!
- Read the safety precautions (yellow leaflet) carefully!

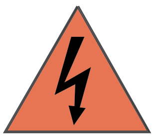
  If this leaflet is not enclosed with the documentation, please contact us and ask for it.
- Observe the instructions of this manual!

  Make sure that you do not forget or skip any step. We are not liable for damages resulting from a wrong use of the Ethernet system.
- Pay attention to the following symbols:

i

IMPORTANT!
Designates hints and other useful information.

WARNING!
Designates a possibly dangerous situation.
If the instructions are ignored, the Ethernet system, the PC and/or peripherals may be **destroyed**.



WARNING!
Designates a possibly dangerous situation.
If the instructions are ignored, the Ethernet system, the PC and/or peripherals may be **destroyed** and persons may be **endangered**.

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Chapter overview

In this manual, you will find the following information:

Chapter	Content
1	Important information on the application, the user and on handling the MSX-E system as well as safety precautions
2	Brief description of the MSX-E system (functions, features, block diagram)
3	Information on strain gauge sensors and the Wheatstone bridge
4	Function description (strain gauge inputs) including pin assignment and connection example
5	Function description (Sin/Cos counter) including pin assignment and connection example
6	Function description (digital inputs/outputs) including pin assignment and connection examples
7	Description of the function-specific pages of the MSX-E web interface
8	Description of the acquisition modes (Auto-refresh and Sequence modes)
9	List of technical data and limit values of the MSX-E system
10	Appendix with glossary and index
11	Contact and support address

1 Definition of application, user, handling

1.1 Definition of application

1.1.1 Intended use

The Ethernet system **MSX-E3317** for the acquisition, processing and transferring of signals from strain gauge sensors and Sin/Cos signal generators as well as for digital input and output is intended for the connection to a network, which is used as electrical equipment for measurement, control and laboratory pursuant to the norm EN 61010-1 (IEC 61010-1).

1.1.2 Usage restrictions

The Ethernet system **MSX-E3317** must not be used as safety-related parts (SRP).

The Ethernet system **MSX-E3317** must not be used for safety-related functions.

The Ethernet system **MSX-E3317** must not be used in potentially explosive atmospheres.

The Ethernet system **MSX-E3317** must not be used as electrical equipment according to the Low Voltage Directive 2006/95/EC.

1.1.3 Limits of use

All safety information and the instructions in the manuals must be followed to ensure proper intended use.

Uses of the Ethernet system beyond these specifications are considered as improper use.
The manufacturer is not liable for damages resulting from improper use.

The Ethernet system must remain in its anti-static packaging until it is installed.

Please do not delete the identification numbers of the Ethernet system or the warranty claim will be invalid.

1.2 Safety precautions

1.2.1 Current sources

All connected devices must be supplied from current sources that comply with SELV according to IEC 60950 or EN 60950; or PELV according to IEC 60204-1 or EN 60204-1.

1.2.2 Degrees of protection

IMPORTANT!
The protection according to the defined degree of protection (see Chapter 9.4) is only given if the openings are protected with adequate protection caps or connectors.

If you are not sure, please contact us:

Phone: +49 7229 1847-0

E-mail: info@addi-data.com

1.2.3 Cables

The cables must be installed safely against mechanical load.

1.2.4 Housing

The housing must not be opened. It may only be opened by persons who have been authorised by ADDI-DATA.

1.3 User

1.3.1 Qualification

Only persons trained in electronics are entitled to perform the following works:

- Installation
- Commissioning
- Use
- Maintenance.

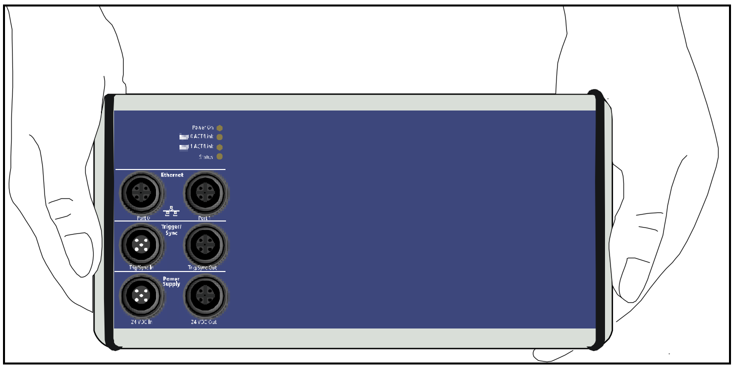
1.3.2 Country-specific regulations

Do observe the country-specific regulations regarding

- the prevention of accidents
- electrical and mechanical installations
- Electromagnetic compatibility (EMC).

1.4 Handling of the Ethernet system

Fig. 1-1: Correct handling



- Hold the Ethernet system by the bottom and the grey sides.
- Do not hold the Ethernet system by the connectors!

1.5 Questions and updates

You can send us any questions by e-mail or call us:

E-mail: info@addi-data.com
Phone: +49 7229 1847-0.

Manual and software download from the Internet

The latest versions of the technical manual and the standard software for the Ethernet system **MSX-E3317** can be downloaded for free at:

www.addi-data.com

IMPORTANT!
Before using the Ethernet system or in case of malfunction during operation, check if there is an update (manual, driver, firmware) available on our website or contact us directly.

2 Brief description

In this chapter, the functions and features of the Ethernet system **MSX-E3317** are described in brief. Furthermore, you will find a general block diagram of the MSX-E system.

2.1 Functions and features

With the intelligent Ethernet system **MSX-E3317**, up to four strain gauge sensors can be acquired. The voltage sources are integrated in the system in order for measurement bridges to be used. In addition, the system is equipped with one Sin/Cos counter input for the acquisition of 1 V_{PP} signals and with two digital I/O.

By means of an external trigger, on multiple systems, measurement sequences can be started simultaneously or the inputs and outputs can be updated simultaneously (synchronisation). The system can be configured and the acquisition can be started over either the integrated web interface or SOAP or Modbus commands. These interfaces also enable sensor data to be accessed.

Over an integrated Ethernet switch, the systems can be cascaded with other MSX-E systems. This also applies to the voltage supply and the trigger/synchro line, which facilitates wiring between the single systems.

The Ethernet system is mounted in a robust EMC-protected metal housing, which complies with the degree of protection IP 65. In this way, the Ethernet system is able to cope with daily stresses and strains such as current peaks, vibrations, dirt or extreme temperatures. Moreover, it can be used in the operating temperature range from 0 °C bis +60 °C and is equipped with numerous protective circuits. Error diagnoses are quickly identified by means of the "Status" LED display.

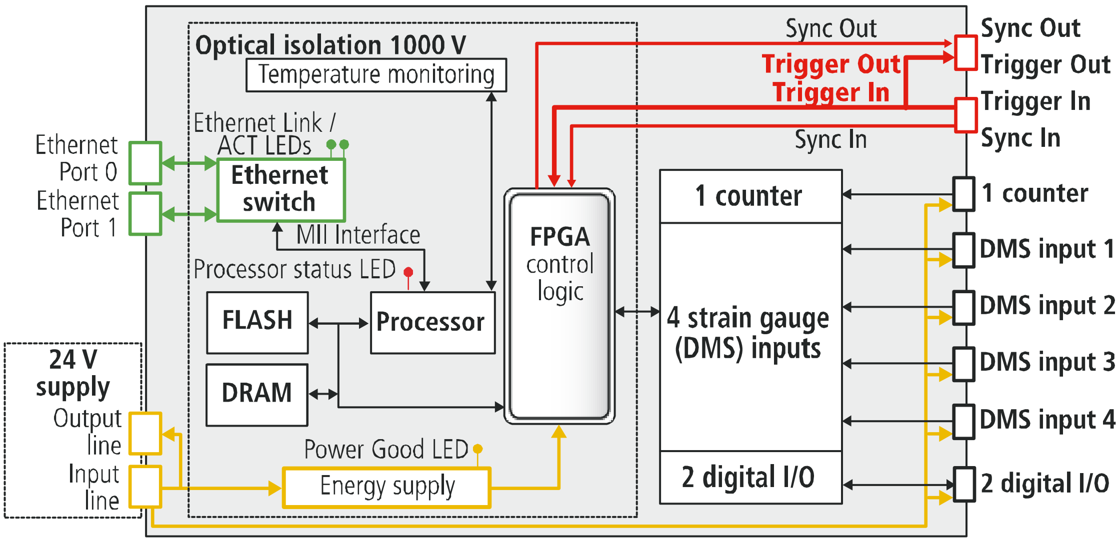
The electronics are no longer in the computer itself but in an external housing connected to the computer via Ethernet. As the Ethernet system is attached directly to the signal generator (measuring point) or in direct vicinity of the sensor or actuator, the measurements and accordingly, the function of the sensor or actuator is no longer affected by long cables. The length of the (Ethernet) connection cable from the Ethernet system to the computer may be up to 150 m. The systems must be supplied with external voltage (24 V).

Features:

- 4 differential inputs for strain gauge sensors; internal voltage sources for sensor supply; sampling frequency: can be configured in pairs in the range from 5 Hz to 2 kHz
- 1 Sin/Cos counter input (32-bit) for 1 V_{PP} signals
- 2 digital inputs/outputs, 24 V, LEDs to display level and direction
- Simultaneous acquisition of all inputs
- Acquisition or input/output: can be controlled by means of an external trigger (digital 24 V trigger input)
- Web interface to configure, control and monitor the acquisition or the inputs and outputs
- Data access via SOAP or Modbus (always TCP or UDP)
- Optical isolation
- Degree of protection: IP 65
- Cascadable; synchronisation in the µs range
- Extended operating temperature range from -40 °C to +85 °C

2.2 Block diagram

Fig. 2-1: MSX-E3317: Block diagram



3 Strain gauge sensors

In this chapter, the properties of the different strain gauge sensors are described in more detail.[1] This should help you to find the right strain gauge sensor for your measuring system and to identify and prevent possible measuring errors in advance.

A strain gauge sensor is a strain gauge that has been glued on the test item with a special adhesive. Pressure or force applied on the test item affects its form (compression or extension) and accordingly, the form of the strain gauge.
This deformation of the strain gauge again leads to a change in its electrical resistance. If the strain gauge gets longer or its cross-section smaller, its resistance increases and vice versa, it decreases.

Strain gauges are used, for example, for strain measurement at machines, wooden constructions and buildings as well as for load measurement at load cells, force or torque sensors and pressure converters.

Usually, foil strain gauges are used. They consist of a measuring grid made of resistance wire, which is embedded between two thin plastic foils and which has electrical leads. The form of the measuring grid, which can be up to 150 mm long, varies according to the application. The measuring grid of metal foil strain gauges is mostly made up of constantan or a nickel-chrome compound, whereas silicon serves as a semiconductor gauge material.

The ratio of change in resistance to strain, that is the sensitivity of the strain gauge, is indicated by the gauge factor. This factor depends on the measuring grid material of the strain gauge. Therefore, some semiconductor gauges have considerably higher gauge factors than metal foil gauges, because their resistivity changes with volume (piezoresistive effect). Length and cross-section are of rather little importance with semiconductor gauges.

Table 3-1: Strain gauge sensors: Gauge factor

	Measuring grid material	Composition	Gauge factor
Metal foil strain gauge	Constantan	54 % Cu, 45 % Ni, 1 % Mn	2.05
	Platinum	100 % Pt	6.0
Semiconductor strain gauge	Silicon	100 % p-type Si: B (Bor in ppm range)	+80 … +190

The resistance of the unloaded strain gauge can be calculated as follows:

$$R = \rho \frac{l}{S} = \rho \frac{4 \cdot l}{d^2 \cdot \pi}$$

ρ = Resistivity

l = Wire length

S = Cross-sectional area

d = Wire diameter

[1] Source: http://de.wikipedia.org/wiki/Dehnungsmessstreifen (23/05/2011)

General change in resistance under load:

$$\Delta R = \frac{\partial R}{\partial \rho} \cdot \Delta\rho + \frac{\partial R}{\partial l} \cdot \Delta l + \frac{\partial R}{\partial d} \cdot \Delta d$$

Relative change in resistance:

$$\frac{\Delta R}{R} = \frac{\Delta\rho}{\rho} + \frac{\Delta l}{l} - \frac{2 \cdot \Delta d}{d}$$

Longitudinal and transverse strain from which the relative change in resistance depends:

$$\varepsilon = \frac{\Delta l}{l} \quad \text{and} \quad \varepsilon_q = \frac{\Delta d}{d} = -\mu \cdot \varepsilon$$

ε = Relative change in length

ε_q = Relative change in cross-section

μ = Poisson's ratio

This results in the following equation:

$$\frac{\Delta R}{R} = k \cdot \frac{\Delta l}{l} = k \cdot \varepsilon$$

k = Gauge factor

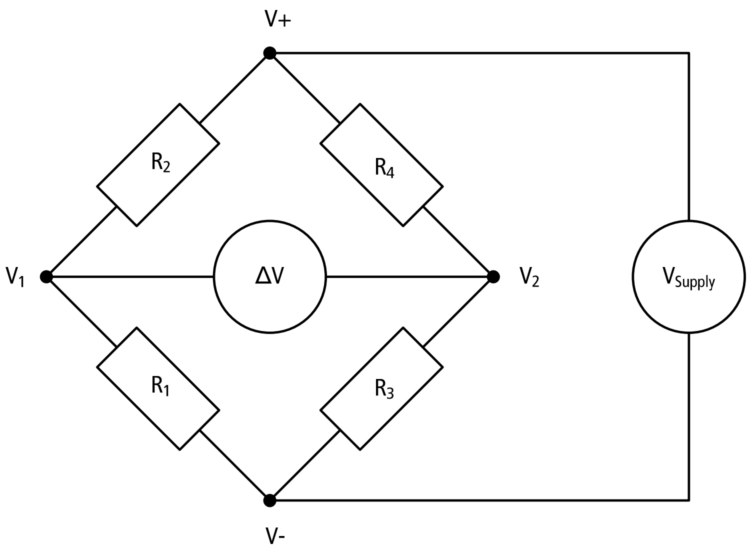
To the gauge factor, the following equation applies:

$$k = \frac{\Delta\rho}{\rho \cdot \varepsilon} + 1 + 2 \cdot \mu$$

The maximum elasticity of the strain gauge depends on the elasticity of the measuring grid material, carrier foil and adhesive used.
A maximum frequency is not known yet, but measurements in the range from 5 MHz to 8 MHz have still provided correct results.
The resistance of the connected, but unloaded strain gauge is considered as the nominal resistance. Typical values are 120 Ω, 350 Ω, 700 Ω and 1000 Ω.
The maximum voltage that may be applied to a strain gauge depends on the size of the strain gauge and the material on which it is affixed. As voltage losses have to be diverted via the surface of the strain gauge, it is quite possible that a voltage not higher than 0.5 V may be connected to small strain gauges and poor heat conductors, whereas up to 10 V may be connected to strain gauges of a normal size and good heat conductors.

Interfering factors such as temperature can lead to incorrect measurement results, since materials stretch with rising temperature even without load. In order to compensate for this temperature error to the greatest possible extent, bridge circuits such as the Wheatstone bridge are often used. The latter is composed of four resistors to which a voltage source and a voltage meter are connected (see also Fig. 4-1)

Fig. 3-1: Wheatstone bridge



Full bridges are always used in the manufacture of transducers; whereas in the experimental stress analysis rather quarter or half bridges are used. In the latter case, three or two fixed resistors are added to the strain gauges. These four resistors and also the entire bridge have the same nominal resistance R1 = R2 = R3 = R4. All of these strain gauges have the same gauge factor.

Table 3-2: Wheatstone bridge: Bridge factor

Bridge type	Bridge factor	Number of strain gauges
Full bridge	4	4
Full bridge with transverse contraction	2 (1+v)	4
Half bridge	2	2
Half bridge with transverse contraction	1+v	2
Quarter bridge	1	1

v is the Poisson’s ratio of the material on which the strain gauge is affixed.

For the Wheatstone bridge, the following equations apply:

$$\frac{\Delta V}{V_s} = \frac{1}{4} \cdot \left(\frac{\Delta R_1}{R_1} - \frac{\Delta R2}{R2} - \frac{\Delta R3}{R3} + \frac{\Delta R4}{R4} \right)$$

V_S = Supply voltage

$$\frac{\Delta R}{R} = k \cdot \varepsilon$$

Full bridge with R1 = R2 = R3 = R4:

$$\frac{\Delta V}{V_s} = \frac{1}{4} \cdot k \cdot (\varepsilon_1 - \varepsilon_2 - \varepsilon_3 + \varepsilon_4)$$

Quarter bridge: $\varepsilon_2 = \varepsilon_3 = \varepsilon_4 = 0$
Half bridge: $\varepsilon_3 = \varepsilon_4 = 0$
Full bridge: ε_2 and ε_3 = negative

$$\frac{\Delta V}{V_s} = \frac{1}{4} \cdot k \cdot \varepsilon \cdot B$$

B = Bridge factor

Further factors that may interfere with strain gauge measurements are moisture, creep, hysteresis, cross-sensitivity, electromagnetic fields, hydrostatic pressure and nuclear radiation.

4 Function description: Strain gauge inputs

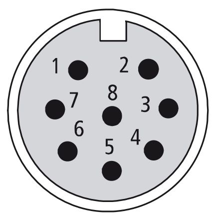
The Ethernet system **MSX-E3317** has four differential inputs for strain gauges.

4.1 Pin assignment

To each M12 female connector, up to two strain gauge sensors can be connected.
The differential sensor input 1 or 2 consists of DMSx+ and DMSx-. One input channel consists of sensor input DMSx+ and DMSx- signals and of the voltage sources V+ and V-. The voltage sources V+ and V- are used in parallel for channels 1 and 2.

Table 4-1: Pin assignment: Strain gauge inputs

Pin No.	Female connector, 8-pin, M12	Cable (black)
		Lead colour
1	DMS1+	white
2	DMS1-	brown
3	V-	green
4	GND	yellow
5	DMS2+	grey
6	DMS2-	pink
7	V+	blue
8	GND	red

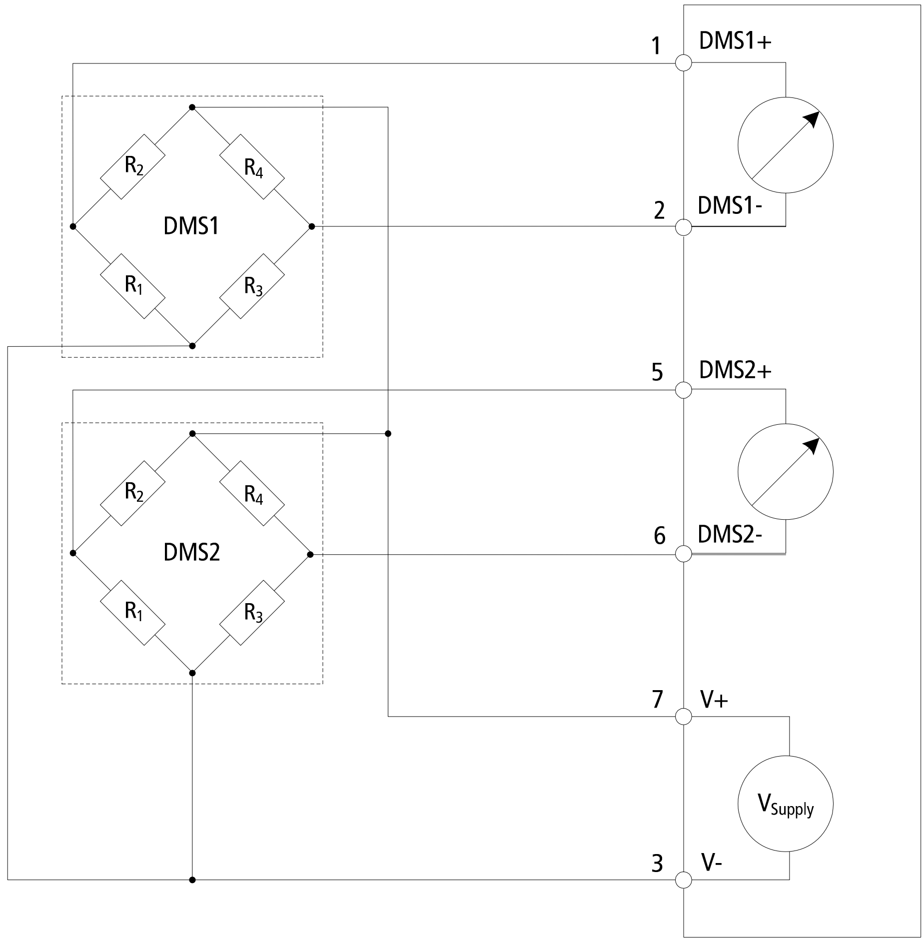


DMS = Strain gauge

V = Supply voltage

4.2 Connection example

Fig. 4-1: Connection example: Strain gauge sensors



5 Function description: Sin/Cos counter input

The Ethernet system **MSX-E3317** has one input for the acquisition of Sin/Cos signals with 1 V_{PP}.

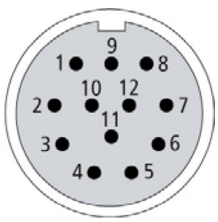
A signal period of the Sin/Cos signal is divided into a defined number of steps according to the selected resolution. The maximum input frequency of the counter input also depends on the selected resolution.

5.1 Pin assignment

To the M23 female connector, one Sin/Cos encoder can be connected.

Table 5-1: Pin assignment: Sin/Cos counter input

Pin No.	Female connector, 12-pin, M23	Polarity	Function
2, 12	Voltage supply (5 V)	Output (5 V)	Supply for Sin/Cos encoder
10, 11	GND	GND	
5	A+	Input	Trace A (Sine)
6	A-		
8	B+	Input	Trace B (Cosine)
1	B-		
3	C+	Input	Trace C (Index)
4	C-		
7, 9	not connected		



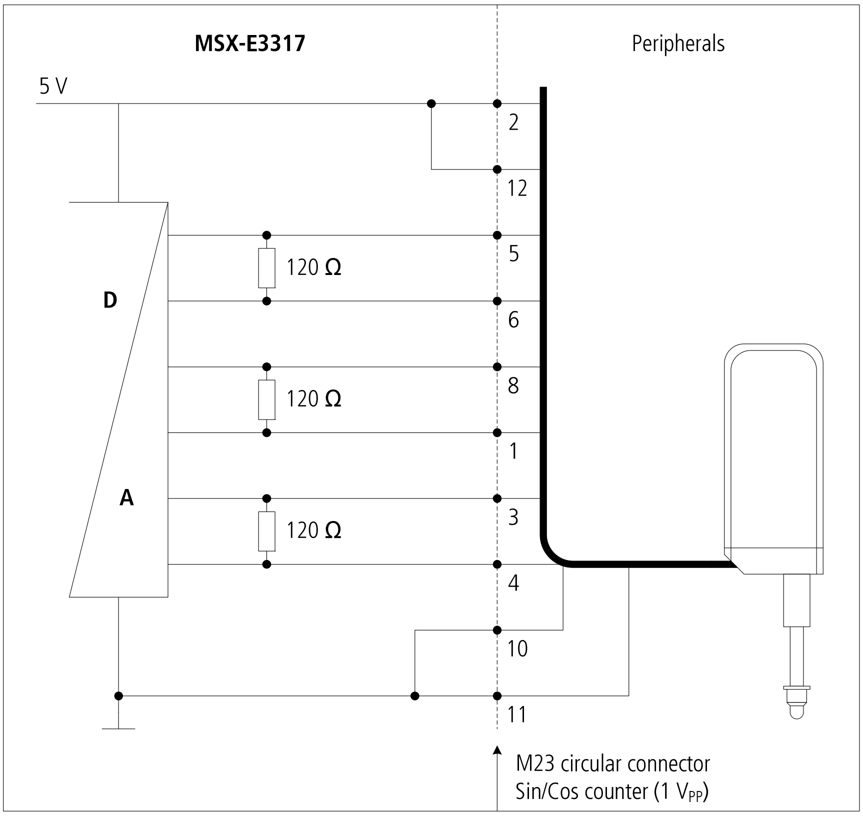
5.2 LED display

Table 5-2: LED display: Sin/Cos counter input

Display	Meaning
No display	The Sin/Cos input signal is constant (signal generator not moved).
Lights green	The Sin/Cos input signal is constant (signal generator not moved).
Flashes green	The counter is active.

5.3 Circuit diagram

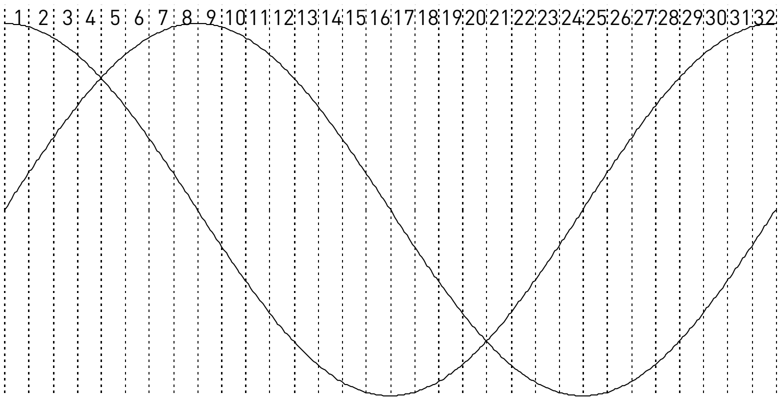
Fig. 5-1: Basic input circuit



5.4 Acquisition principle

A Sin/Cos signal generator transfers two sinusoidal signals that have a common signal period, with each signal being transferred on a differential trace. The two traces are shifted by 90° so that one trace is referred to as sine and the other one as cosine.
This signal period is indicated in the data sheet of the signal generator and is needed for the initialisation of the counter.

Fig. 5-2: Division of a signal period (resolution: 32)



If, for example, a connected Sin/Cos displacement transducer has a signal period of 2 µm, this means that with a distance of 0.4 mm an exact total of 200 sine periods and cosine periods is passed through. With the aid of the resolution, this hardware-specific distance is divided one more time into 16 to 8192 steps.
Accordingly, with a transducer that has a signal period of 10 µm and a selected resolution of 100, the increment is 0.1 µm.

5.5 Function parameters

To provide for a correct acquisition of data from the Sin/Cos signal generator, the following parameters have to be indicated with the initialisation:

- Channel number (0)
- Signal period
- Resolution.

The return value is the maximum input frequency which the counter input may be operated with. The higher the resolution is selected, the lower is the maximum frequency of the sine signals at the input, which can be processed.

The individual parameters are explained in the following chapters.

5.5.1 Channel number

The Ethernet system **MSX-E3317** has one input for the acquisition of Sin/Cos signals.
With all functions for the initialisation or parameterisation concerning exclusively the Sin/Cos channel, you have to select "0" as the channel number. For the acquisition, channel number „4" applies to the Sin/Cos channel.

5.5.2 Signal period

This parameter is required in particular to calculate standardised values correctly and to output them. The signal period is specified in the data sheet of the connected signal generator.

Example

The signal period of your displacement transducer is 10 µm, according to the data sheet, and the traverse distance is 123 µm.

Table 5-3: Signal period

Signal period		
Unit	**Input value**	**Output value**
nm	10000	123000
µm	10	123
mm	0.01	0.123

5.5.3 Resolution

The resolution determines the actual increment, i.e. the smallest change in distance that can be measured. The increment is the quotient of the signal period and the selected resolution.

$$\text{Increment} = \frac{\text{Signal period}}{\text{Resolution}}$$

IMPORTANT!
If the resolution is increased, the maximum input frequency, which can be processed, decreases.

In the following table, all available resolutions are listed.

Table 5-4: Available resolutions

Resolution	Maximum input frequency (Hz)
16	250,000
32	162,500
40	16,300
64	81,300
80	16,300
100	26,000
128	40,600
160	16,300
200	26,000
256	20,300
320	16,300
400	13,000
500	10,400
512	10,200
800	6,500
1000	5,200
1024	5,100
1600	3,300
2000	2,600
2048	2,540
4096	1,270
8192	635

5.5.4 Input frequency

To receive correct values when the Sin/Cos encoder data is acquired, it is necessary that the maximum input frequency, which depends on the resolution, is complied with. This frequency directly relates to the sine signal.
With the aid of the signal period, the maximum movement speed for transducers (v_{max}) can be calculated from the product of the signal period and the maximum input frequency (f_{max}).
If you divide the input frequency (f_{max}) by the number of periods per revolution, you obtain the maximum speed for shaft encoders (n_{max}).

$$v_{max} = \text{Signal period} \cdot f_{max}$$

$$n_{max} = \frac{f_{max}}{\text{Periods per revolution}}$$

Table 5-5: Conversion from maximum frequency

Frequency (Hz)	Max. velocity (with signal period of 2 µm)	Max. speed (with 2048 periods per revolution)
635	0.08 m/min	18.6 rev/min
1,270	0.15 m/min	37.21 rev/min
2,540	0.3 m/min	74.41 rev/min
2,600	0.31 m/min	76,17 rev/min
3,300	0.4 m/min	96.68 rev/min
5,100	0.61 m/min	149.41 rev/min
5,200	0.62 m/min	152.34 rev/min
6,500	0.78 m/min	190.43 rev/min
10,200	1.22 m/min	298.83 rev/min
10,400	1.25 m/min	304.69 rev/min
13,000	1.56 m/min	380.86 rev/min
16,300	1.96 m/min	477.54 rev/min
20,300	2.44 m/min	594.73 rev/min
26,000	3.12 m/min	761.72 rev/min
40,600	4.87 m/min	1189.45 rev/min
81,300	9.76 m/min	2381.84 rev/min
162,500	19.5 m/min	4760.74 rev/min
250,000	30 m/min	7324.22 U/min

5.5.5 Error logging

If the cut-off frequency is exceeded during the acquisition of the Sin/Cos encoder data, an error occurs, which shifts the reference point permanently. For this reason, the error status needs always to be checked and handled accordingly.

IMPORTANT!
If an error has occurred, the reference point is permanently shifted, which results in errors during the following measurement process.

In case the Sin/Cos encoder data are not read via single accesses but via Auto-refresh or Sequence acquisition, it is absolutely necessary for the status register of the **MSX-E3317** to be activated. Besides more information on the trigger source and the channel that has triggered the acquisition, this register contains the error information on the Sin/Cos channel.
If bit 8 of the status register indicates an error, the frequency has been exceeded since the initialisation of the Sin/Cos encoder. The reference point shift caused thereby could lead to incorrect data of the Sin/Cos channel.

5.6 Compare logic

By means of the compare logic, an acquisition in Auto-refresh or Sequence mode can be triggered.
In addition, there is the possibility to generate a synchro trigger signal for triggering further systems.

The reference value can be indicated either as a digital or analog value (the latter in the physical unit of the signal period). If the desired analog value is not a valid multiple of the increment, the next valid value is automatically used.

There are two compare logic modes:

a) Simple mode

In Simple mode, a reference value can be indicated. As soon as the counter value corresponds to the reference value, a trigger or synchro trigger is released.

b) Modulo mode

In Modulo mode, a reference value is indicated as well. When the counter value corresponds to the reference value or a multiple of it, a trigger or synchro trigger is released.

When the compare logic in Modulo mode is initialised, a second counter which the reference value relates to is activated internally. This internal counter always starts with the value "0", independent of the counter value of the Sin/Cos counter at this time.
If the counter value of the Sin/Cos counter is cleared, i.e. set to "0", the value of the internal counter is cleared as well. Thus, the two counters have the same values afterwards.

Table 5-6: Sample values for the compare logic in Modulo mode

Event	Internal reference counter	Sin/Cos counter
Initialisation of the Sin/Cos channel	-	0 mm
Sin/Cos encoder is moved	-	… 1.23 mm

Event	Internal reference counter	Sin/Cos counter
Compare logic (Modulo mode, reference value = 1 mm) is initialised	0 mm	1.23 mm
Sin/Cos encoder is moved	… 0.5 mm …	… 1.73 mm …
Compare logic triggers the acquisition	… 1 mm	… 2.23 mm
Counter value of the Sin/Cos counter is cleared (e.g. via index clear function)	0 mm	0 mm
Sin/Cos encoder is moved	… 0.5 mm …	… 0.5 mm …
Compare logic triggers the acquisition	… 1 mm	… 1 mm

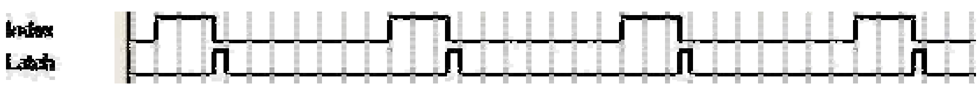
It is recommended to clear the counter value of the Sin/Cos counter, using the clear function, directly after the initialisation of the compare logic in Modulo mode in order to prevent possible problems caused by the different values of the two counters.

5.7 Index logic

The index signal of a Sin/Cos encoder can be used to delete the counter value. Moreover, an acquisition in Auto-refresh or Sequence mode can be triggered and a synchro trigger signal for triggering further systems can be generated using the index signal.
You can select if the rising edge, the falling edge or both edges of the index signal should be counted.

Example

Index logic with falling edge in continuous mode



6 Function description: Digital inputs/outputs

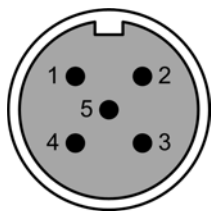
The Ethernet system **MSX-E3317** has two digital inputs or outputs for sensors or actuators.

6.1 Pin assignment

To the M12 female connector, up to two sensors or actuators can be connected. In addition, a 24 V supply is available.

Table 6-1: Pin assignment: Digital I/O

Pin No.	Female connector, 5-pin, M12	Cable (black)
		Lead colour
1	24 V output	brown
2	Digital I/O 1	white
3	GND	blue
4	Digital I/O 0	black
5	not connected	grey



6.2 LED display

Table 6-2: LED display: Digital I/O

Direction	Status	LED	Meaning
Output	inactive	No display	- The output is inactive. - No voltage is applied.
Output	active	Lights red	- The output is active. - No voltage is applied. **Caution, risk of short-circuit!**
Input	inactive	Lights green	- The input is ready for operation. - Signals can be received.
Input	active	Lights yellow	- The input is active. - A signal is being received.

6.3 Connection examples

Fig. 6-1: Connection example: Digital inputs (24 V)

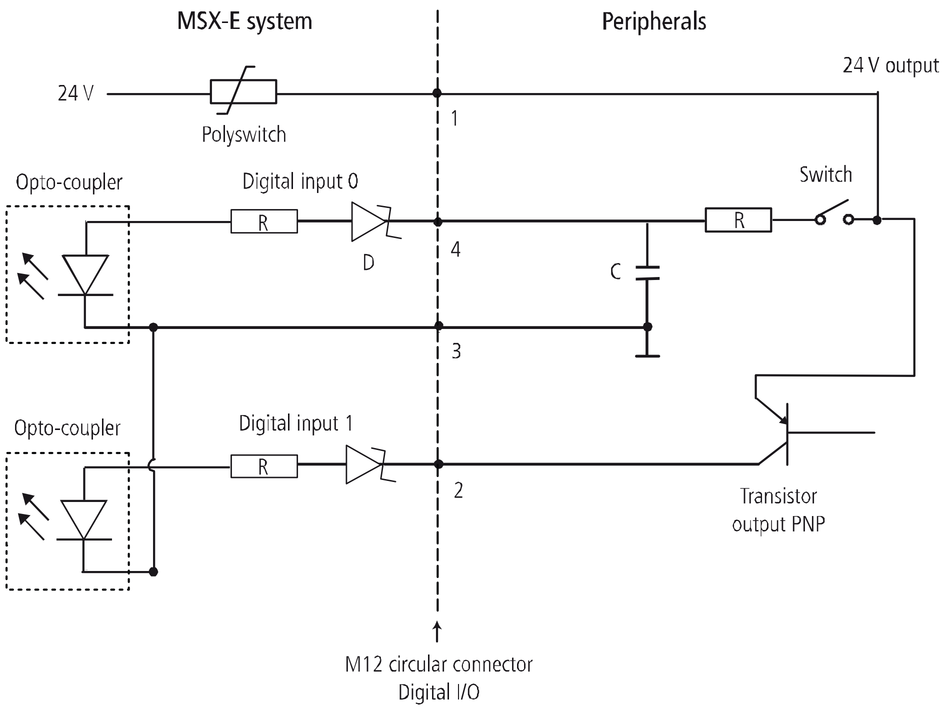
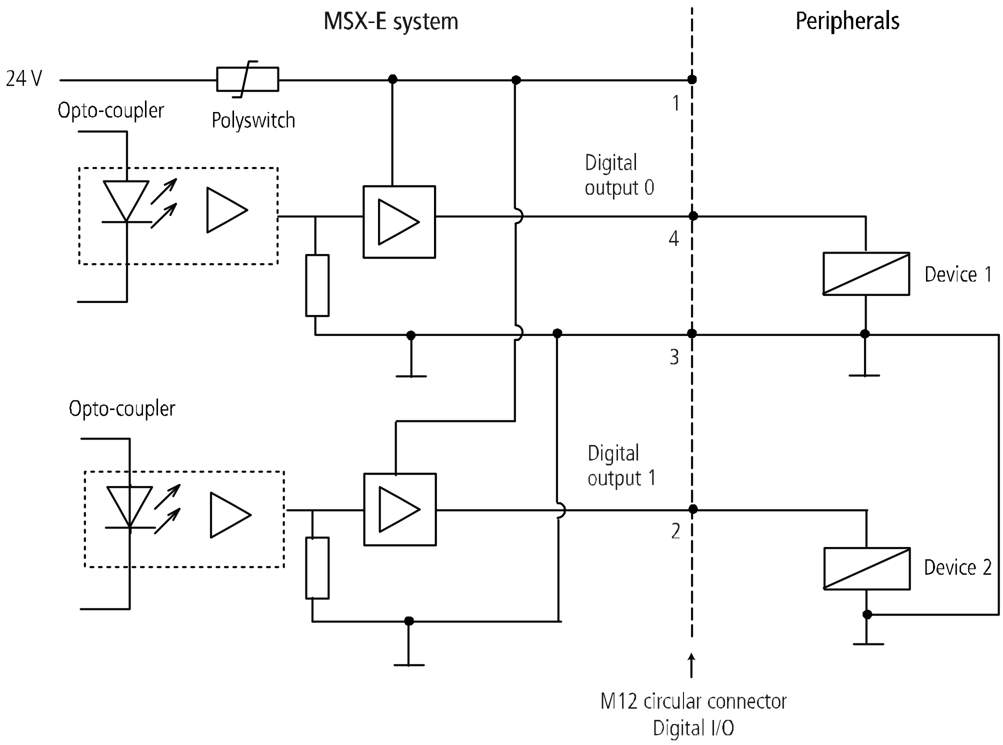


Fig. 6-2: Connection example: Digital outputs (24 V)



6.4 Digital outputs

By default, the digital channels of the **MSX-E3317** are configured as inputs. A channel can be configured as an output via the web interface of the MSX-E system (see Chapter 7.1.2) or the SOAP or Modbus function "DigitalIOInitPortConfiguration".

A channel configured as an output is high-impedance. The status of the outputs can be read back by way of control.

If a short-circuit occurs at a connected output, all output will be deactivated. As in case of a short-circuit, the supply voltage of the 24 V outputs may drop for a short time, a short-circuit may be indicated for both outputs even if only one output is short-circuited.
As soon as the short-circuit has been eliminated, a rearm has to be carried out to reactivate the respective outputs (see Chapter 7.1.2). A new value can only be defined after the rearm event.

7 Web interface: Quick access to the MSX-E system

In this chapter, the system-specific parts of the **MSX-E3317** web interface are described.
For further information on the MSX-E web interface, please refer to the general manual of the MSX-E systems (see PDF link).

7.1 Menu item "I/O Configuration"

Under this menu item, you can configure the inputs and outputs of the MSX-E system.

IMPORTANT!
The configuration only takes effect if you click on the "Set and save" button.

By clicking on the "Reload" button, the configuration that has been saved last is displayed.

7.1.1 „Pressure" tab

Fig. 7-1: I/O configuration: Pressure

Channel	Sensitivity (mV/V/Unit)	Offset (Unit)	Sampling rate (Hz)
0	100.000000	0.000000	160
1	1.000000	0.000000	
2	1.000000	0.000000	160
3	1.000000	0.000000	

You can configure the strain gauge inputs by defining the sensitivity and the offset for each channel (see datasheet of the sensor) as well as by selecting the sampling frequency per two channels.

7.1.2 "Digital I/O" tab

Fig. 7-2: I/O configuration: Digital inputs

Filter time	100

Channel	Direction	Filter	State	Diagnosis
0	Output	☐	Low	OK
1	Input	☐	Low	OK

In the table column "Direction", you can configure each of the two digital channels as an input or output.
For the digital inputs, a filter is available. The filter time is computed by multiplying the entered value (1 to 16777215) by 250 ns.

For each digital output, the state ("High" or "Low") can be defined by clicking on the corresponding button.
If a short-circuit occurs at the outputs, this will be specified in the table column "Diagnosis".
The required rearm (see Chapter 6.4) can be carried out via the button "Rearm digital ouputs".

7.1.3 "Sine/Cosine" tab

Fig. 7-3: Sine/Cosine: Base configuration

Resolution (steps/period)	32
Signal period (Unit/period)	0.010000
Maximum signal period frequency	162500
Current state	Initialised
Current standardised value	1.042812
Current raw value	3337
Current measuring error	0

In this section, the resolution (see Chapter 5.3) and the signal period (see Chapter 5.5.2) have to be defined. The maximum input frequency of the signal is automatically indicated.

After the initialisation of the counter, its current state including standardised value, raw value and potential measuring error is displayed.
If you click on the button „Clear measuring error", the measuring error display is cleared.
The reference point does not change in this way.

i **IMPORTANT!**
If an error has occurred, the reference point is permanently shifted, which results in errors during the following measurement process.

Via the button "Clear value", the Sin/Cos counter can be reset to zero.

Fig. 7-4: Sine/Cosine: Index logic

Activation	
Edge	Rising Edge
Action	Clear the value of the sensor Generate a synchro trigger

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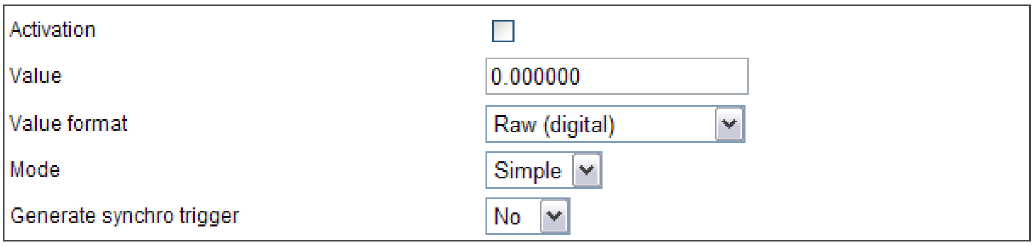
If you want to use the index logic (see Chapter 5.7), you can select the desired action and edge in this section.
In order to trigger an acquisition in Auto-refresh or Sequence mode using the index signal, you have to click on the menu item "Acquisition", and on the corresponding tab, in the section "Trigger configuration", you have to select the trigger source "Index logic" (see also Chapter 8.3.2).

Fig. 7-5: Sine/Cosine: Compare logic

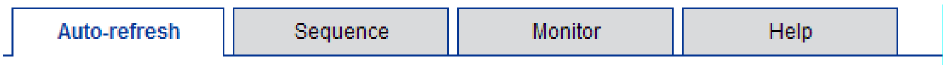


To use the compare logic (see Chapter 5.6), the reference value and its format as well as the mode need to be defined.
In order to trigger an acquisition in Auto-refresh or Sequence mode using the compare logic, you have to click on the menu item "Acquisition", and on the corresponding tab, in the section "Trigger configuration", you have to select the trigger source "Index logic" (see also Chapter 8.3.2).

7.2 Menu item "Acquisition"

7.2.1 "Auto-refresh" and "Sequence" tabs

Fig. 7-6: Acquisition modes: Auto-refresh and Sequence



For the acquisition, the Auto-refresh mode and the Sequence mode are available. A detailed description of these modes can be found in Chapter 8 of this manual.

The acquisition is started and stopped in the tool bar above ("Start" and "Stop" buttons). In addition, the configuration can be saved in a file ("Save as") and later be reloaded ("Load configuration"). Moreover, you can display the source code as a C sample ("Source code").

On these tabs, also the data format (see Chapter 8.3.3) is shown for all data to be acquired.

7.2.2 "Monitor" tab

When the acquisition has been started, the number of data packets to be transferred can be entered. The respective transfer time is automatically displayed in the line below. Via the button "Display as table", all values that have been sent are listed.

7.2.3 “Help” tab

Here, you can find detailed information on the channel selection in Sequence mode and the data transfer in both acquisition modes.

8 Acquisition modes

This chapter exemplifies how to configure and start an acquisition via the web interface of the Ethernet system **MSX-E3317**. Moreover, you can use Modbus or SOAP functions (see MSX-E CD or driver download on the ADDI-DATA website) to perform these steps.

8.1 Auto-refresh mode

In Auto-refresh mode, one or more channels can be acquired. It is possible to start the acquisition by means of a trigger. Directly on the MSX-E system, an average value can be calculated.

- On the web interface, from the menu on the left, select the item "Acquisition", and on the right, select the "Auto-refresh" tab.

8.1.1 "Channel configuration" (channel selection)

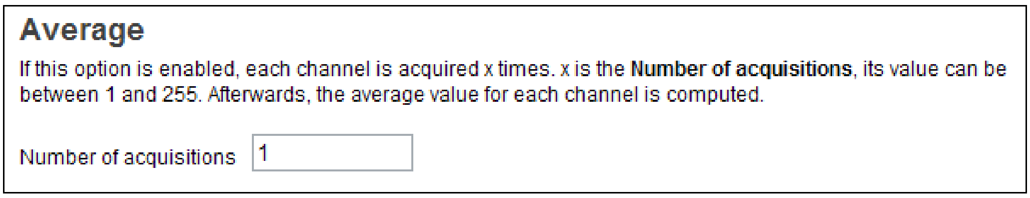
Fig. 8-1: Auto-refresh mode: "Channel configuration"

Designation	Type/Description	Selection
Channel 0	Pressure Input 0	☐
Channel 1	Pressure Input 1	☐
Channel 2	Pressure Input 2	☐
Channel 3	Pressure Input 3	☐
Channel 4	Sine/Cosine Input	☐
Channel 5	Digital I/O	☐

- Select the channels you want to acquire.

8.1.2 "Average" (average value calculation)

Fig. 8-2: Auto-refresh mode: "Average"

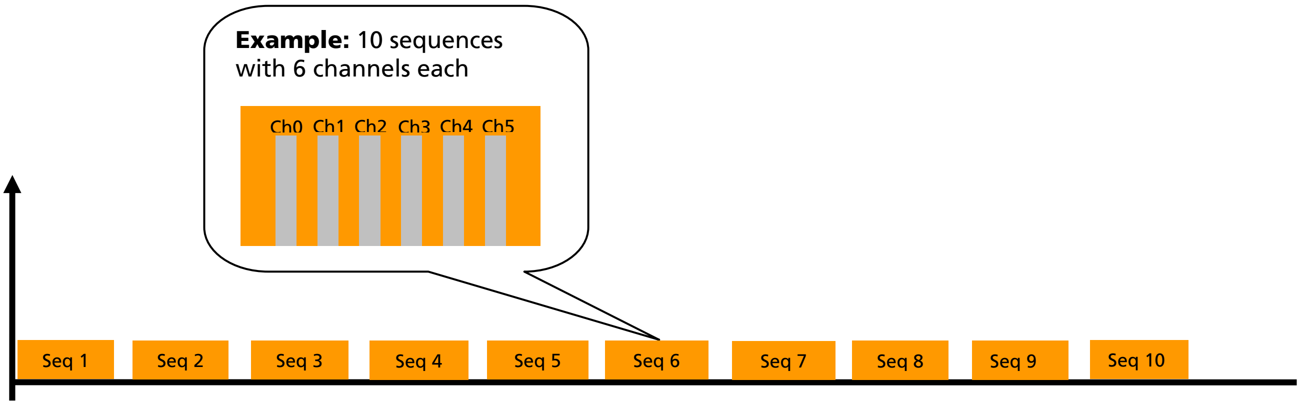


The MSX-E system is capable of computing an average value for each channel.
In the field "Number of acquisitions", you have to enter the number of acquisitions (2 to 255) after which this value should be computed.

Example

The MSX-E system acquires channels 0 to 5. “Number of acquisitions” contains the value 10. This means that ten sequences run down, with each sequence consisting of six channels to be acquired simultaneously.

Fig. 8-3: Auto-refresh mode: Acquisition per sequence



After these ten sequences have run down, the MSX-E system performs the following calculation:

Average value of channel 0
= (sequence 1, value of channel 0 + sequence 2, value of channel 0 + … + sequence 10, value of channel 0) / 10

Average value of channel 1
= (sequence 1, value of channel 1 + sequence 2, value of channel 1 + … + sequence 10, value of channel 1) / 10

…

Average value of channel 5
= (sequence 1, value of channel 5 + sequence 2, value of channel 5 + … + sequence 10, value of channel 5) / 10

The network client will not receive ten data packets, with six values in each packet, but only one data packet containing the average values from channels 0 to 5.

8.2 Sequence mode

The Sequence mode enables you to acquire one or more channels. The acquisition can be started by a trigger. There is a definable delay between the individual sequences.

- On the web interface, from the menu on the left, select the item “Acquisition”, and on the right, select the “Sequence” tab.

8.2.1 "Channel configuration" (channel selection)

Fig. 8-4: Sequence mode: "Channel configuration"

Designation	Type/Description	Selection	Acquisition order
Channel 0	Pressure Input 0	☐	
Channel 1	Pressure Input 1	☐	
Channel 2	Pressure Input 2	☐	
Channel 3	Pressure Input 3	☐	
Channel 4	Sine/Cosine Input	☐	
Channel 5	Digital I/O	☐	

You can define the acquisition order of the channels. This is displayed in the correspondent column as soon as you have selected a channel. Each channel can be acquired only once per sequence.

- Select the channels you want to acquire.

8.2.2 "Sequence measurement" (number of sequences)

Fig. 8-5: Sequence mode: "Sequence measurement"

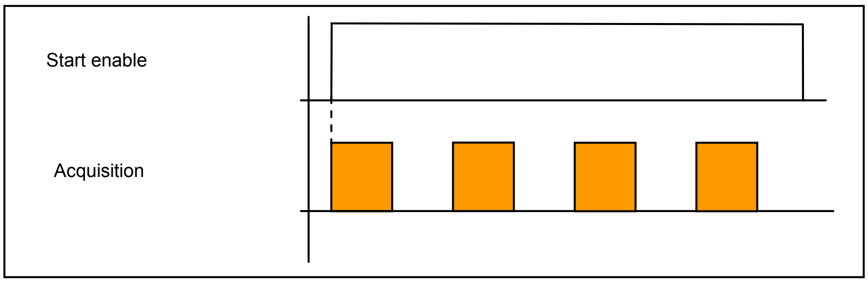
Number of sequences	0
Number of data frames	1

In the field "Number of sequences", you have to enter the number of sequences to be acquired (1 to 4294967295). If this value is 0, the acquisition is continuous.

Example

To acquire four sequences after the start, the field "Number of sequences" must contain the value 4.

Fig. 8-6: "Number of sequences" (example)



In the field "Number of data frames", you need to define the number of sequences (1 to 4096) that have to be acquired before the measurement values are sent to the target system.

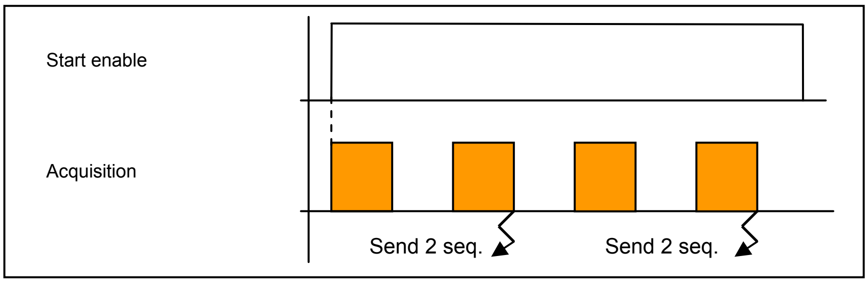
IMPORTANT!
The value entered must not be higher than the value in the field "Number of sequences". The latter must be divisible by this value.

If the MSX-E system does not have sufficient memory to store the required number of sequences, the measurement values are sent earlier, that is, before the maximum number of sequences to be acquired is reached. This helps to reduce the network traffic load and the CPU resources of the MSX-E systems.

Example

After the start, two sequences are acquired. Then the measurement values are sent to the client.

Fig. 8-7: "Number of data frames" (example)



8.3 Common functions

The following functions are available both in Auto-refresh mode and in Sequence mode.

8.3.1 "Refresh time"

Fig. 8-8: Acquisition: Refresh time

Refresh time unit	Refresh time range
Microsecond	10 to 65535
Millisecond	1 to 65535
Second	1 to 65535

Selection 10 Microseconds

In Auto-refresh mode, the refresh time is the time between the refreshing of the single sequences (acquisition refresh time). In Sequence mode, it is the time between the acquisitions of single sequences (delay).
As the unit of this acquisition refresh time or delay, microseconds, milliseconds or seconds can be defined. The range in which this time can lie is based on the selected unit.

8.3.2 Trigger configuration

The acquisition can be started by an external signal.
The synchro trigger configuration has to be set both on the master's and slave's web interface.

Fig. 8-9: Acquisition: Trigger configuration

	Trigger source	Trigger mode	Number of sequences per trigger
Description	Trigger mask (API)		Number of sequences to be acquired at each trigger event
Value	Disabled	One-shot	1 (1 - 65535)

	Hardware trigger active edge	Hardware trigger count
Description		Number of trigger events before the acquisition starts
Value	Rising	1 (1 - 65535)

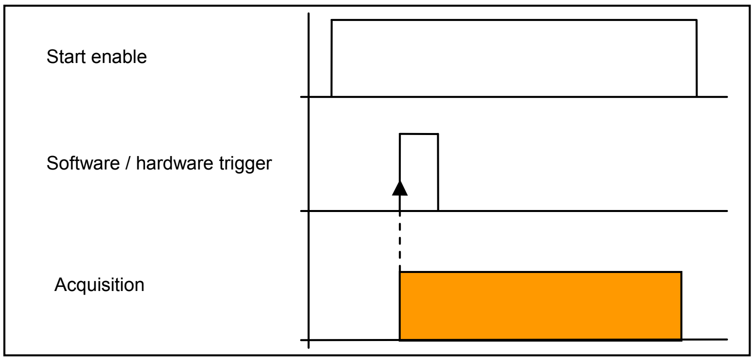
- **Trigger source:** Available trigger sources are hardware trigger, synchro trigger, compare logic and index logic.
- **Trigger mode:** If the trigger mode "One-shot" is selected, only one acquisition starts after a trigger. If the option "Sequence" (= "Multi-shot") is activated, a defined number of acquisitions starts (see field "Number of sequences per trigger").
- **Number of sequences per trigger:** In the trigger mode "Sequence" (see field "Trigger mode"), the number of sequences that are acquired after a trigger is defined. This value must be between 1 and 65535.
- **Hardware trigger active edge:** Here, the type of edge is defined in case of which the MSX-E system identifies a trigger.
- **Hardware trigger count:** This field defines the number of edges after which an acquisition is started.

The following pages contain examples of the hardware trigger.
For further information on the hardware or synchro trigger, please refer to the general manual of the MSX-E systems (see PDF link).

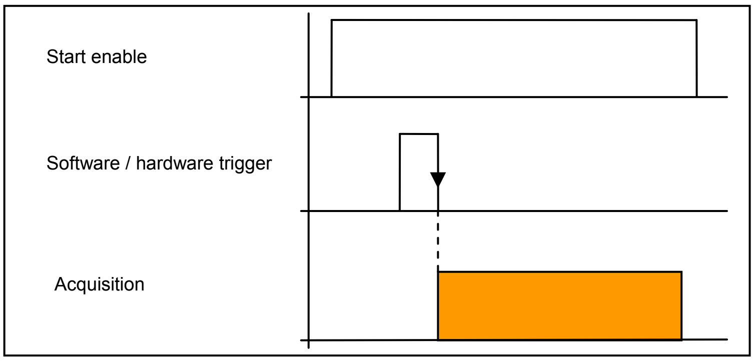
Hardware trigger

1) Examples of edges

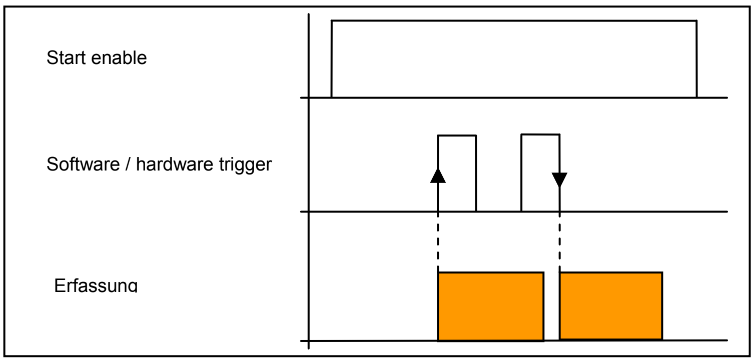
a) Rising: Rising edge



b) Falling: Falling edge



c) Both: Rising and falling edges



2) Examples of hardware triggers with "One-shot"

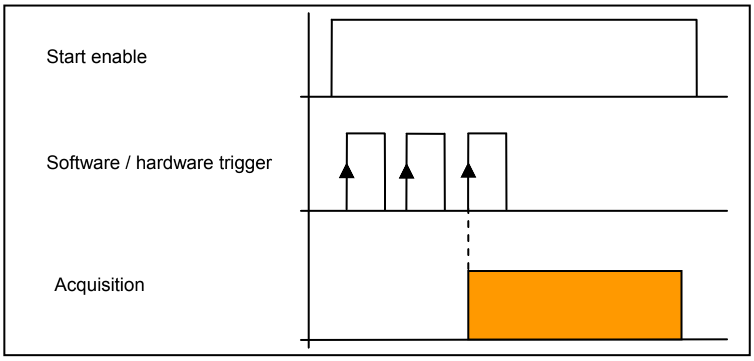
a) To start the acquisition once only after three rising edges, you can use the following configuration:

Fig. 8-10: Hardware trigger with "One-Shot" (a)

	Trigger source	Trigger mode	Number of sequences per trigger
Description	Trigger mask (API)		Number of sequences to be acquired at each trigger event
Value	Hardware	One-shot	1 (1 - 65535)

	Hardware trigger active edge	Hardware trigger count
Description		Number of trigger events before the acquisition starts
Value	Rising	3 (1 - 65535)

After the start, the MSX-E system waits for three rising hardware edges. Once the three edges have been identified, the acquisition starts.



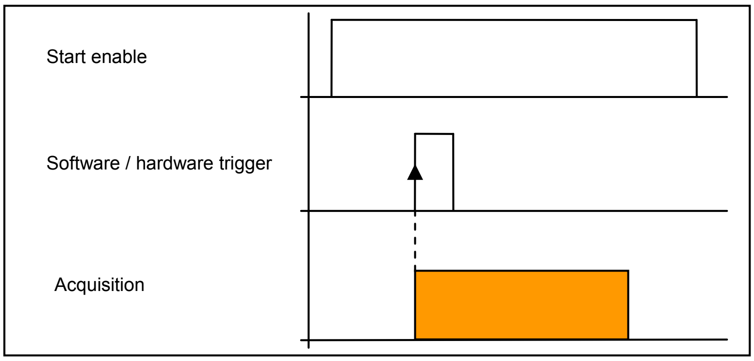
b) With "Hardware trigger active edge", "Rising" is selected again, and with "Hardware trigger count", the value 1 is entered.

Fig. 8-11: Hardware trigger with "One-Shot" (b)

	Trigger source	Trigger mode	Number of sequences per trigger
Description	Trigger mask (API)		Number of sequences to be acquired at each trigger event
Value	Hardware	One-shot	1 (1 - 65535)

	Hardware trigger active edge	Hardware trigger count
Description		Number of trigger events before the acquisition starts
Value	Rising	1 (1 - 65535)

The trigger starts only one acquisition, which begins with the first hardware edge after the start.



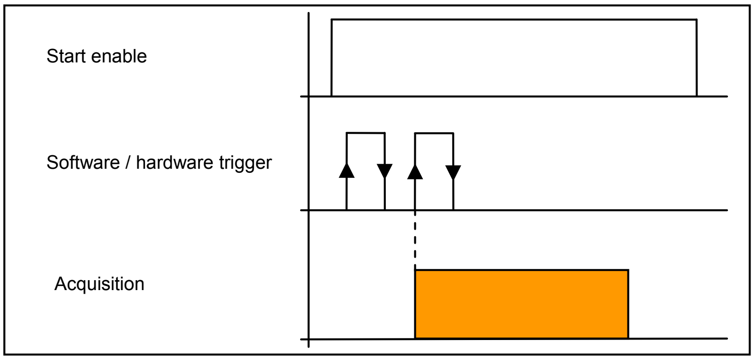
c) With "Hardware trigger active edge", the option "Both" is selected, and with "Hardware trigger count", the value 3 is entered.

Fig. 8-12: Hardware trigger with "One-Shot" (c)

	Trigger source	Trigger mode	Number of sequences per trigger
Description	Trigger mask (API)		Number of sequences to be acquired at each trigger event
Value	Hardware	One-shot	1 (1 - 65535)

	Hardware trigger active edge	Hardware trigger count
Description		Number of trigger events before the acquisition starts
Value	Both	3 (1 - 65535)

After the start, the MSX-E system waits for three rising and falling hardware edges. Once the three edges have been identified, the acquisition starts.



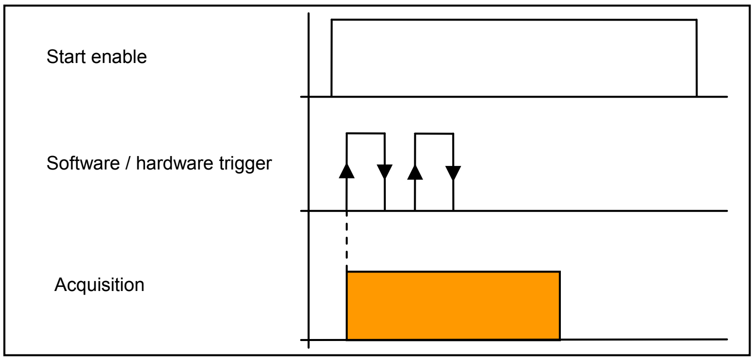
d) With “Hardware trigger active edge”, the option “Both” is selected again, and with “Hardware trigger count”, the value 1 is entered.

Fig. 8-13: Hardware trigger with “One-Shot” (d)

	Trigger source	Trigger mode	Number of sequences per trigger
Description	Trigger mask (API)		Number of sequences to be acquired at each trigger event
Value	Hardware	One-shot	1 (1 - 65535)

	Hardware trigger active edge	Hardware trigger count
Description		Number of trigger events before the acquisition starts
Value	Both	1 (1 - 65535)

If several edges occur after the start, the acquisition is started (triggered) with the first edge. The subsequent edges are ignored.



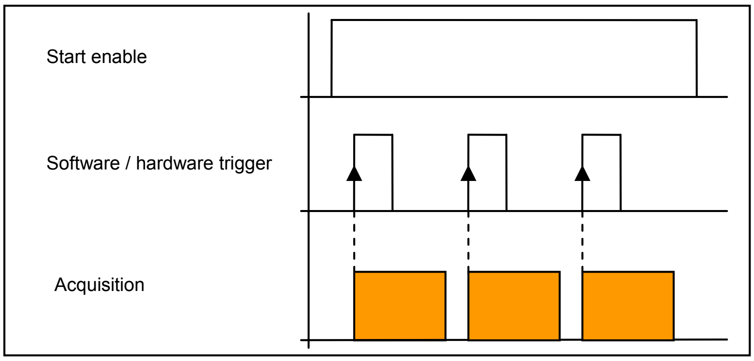
3) Examples of hardware triggers with “Sequence”

a) To start the acquisition after each rising edge, you can use the following configuration:

Fig. 8-14: Hardware trigger with “Sequence” (a)

	Trigger source	Trigger mode	Number of sequences per trigger
Description	Trigger mask (API)		Number of sequences to be acquired at each trigger event
Value	Hardware	Sequence	1 (1 - 65535)

	Hardware trigger active edge	Hardware trigger count
Description		Number of trigger events before the acquisition starts
Value	Rising	1 (1 - 65535)



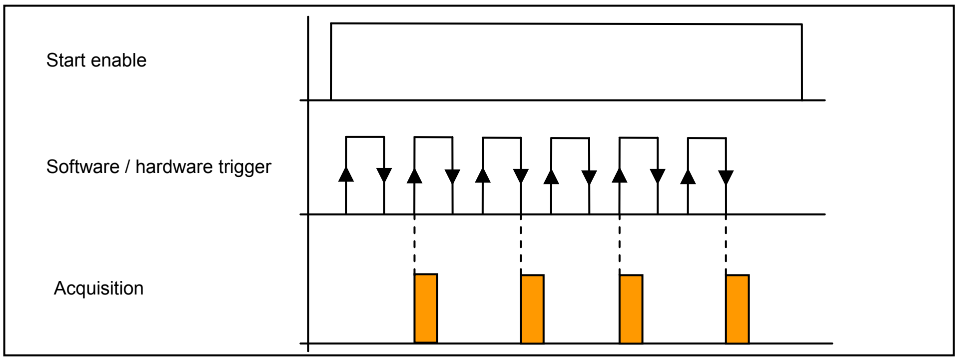
b) With "Hardware trigger active edge", "Both" is selected, and with "Hardware trigger count", the value 3 is entered.

Fig. 8-15: Hardware trigger with "Sequence" (b)

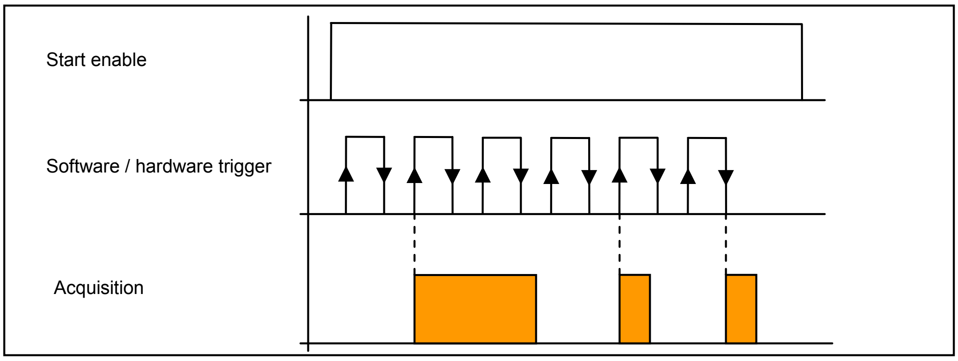
	Trigger source	Trigger mode	Number of sequences per trigger
Description	Trigger mask (API)		Number of sequences to be acquired at each trigger event
Value	Hardware	Sequence	1 (1 - 65535)

	Hardware trigger active edge	Hardware trigger count
Description		Number of trigger events before the acquisition starts
Value	Both	3 (1 - 65535)

After the start, the acquisition is started after three rising and falling edges. After the end of this sequence, the next sequence is started after three rising and falling edges, and so on.



IMPORTANT!
Edges that occur during an acquisition are ignored.
Only those edges are considered that occur after the end of an acquisition (see the previous and following example).



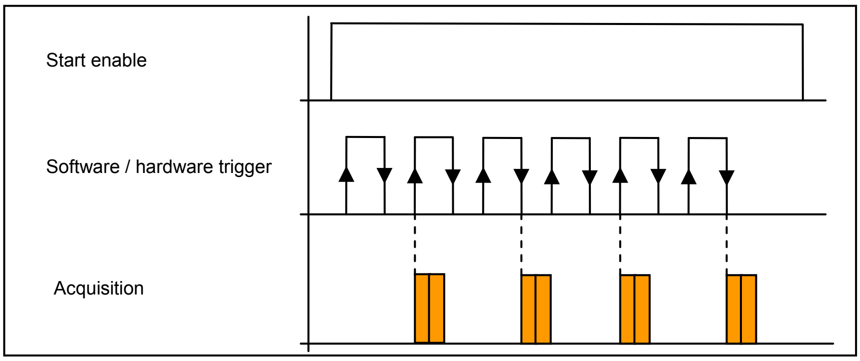
c) The settings correspond to example 2 b) with the exception of "Number of sequences per trigger", where the value 2 is entered.

Fig. 8-16: Hardware trigger with "Sequence" (c)

	Trigger source	Trigger mode	Number of sequences per trigger
Description	Trigger mask (API)		Number of sequences to be acquired at each trigger event
Value	Hardware	Sequence	2 (1 - 65535)

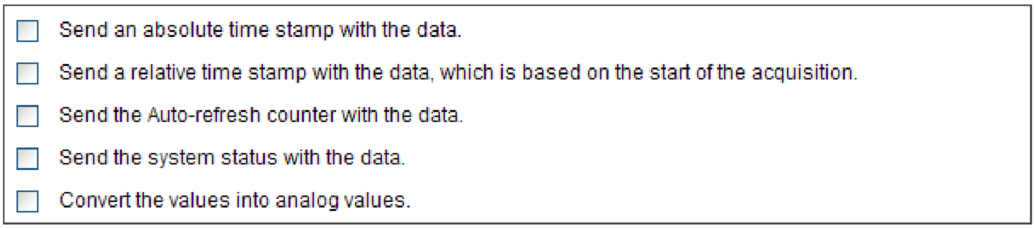
	Hardware trigger active edge	Hardware trigger count
Description		Number of trigger events before the acquisition starts
Value	Both	3 (1 - 65535)

After each trigger, two sequences are acquired.



8.3.3 "Data server frame configuration" (supplementary data)

Fig. 8-17: Data server frame configuration (Auto-refresh mode)



By default, only the acquisition values are sent to the client. However, it can also receive additional information if you activate the following options.

- **Send an absolute time stamp with the data:** A time stamp is sent, which contains the date of the acquisition.
- **Send a relative time stamp with the data:** A time stamp is sent, which contains the date of the acquisition. This date relates to the starting point 0 of the acquisition.
- **Send the Auto-refresh (or "Sequence") counter with the data:** The value of the Auto-refresh or Sequence counter is sent. In Auto-refresh mode, not all sequences are acquired so that the succession of the counter values is incomplete (e. g. 1, 3, 7). In Sequence mode, however, all sequences are acquired. Thus, the succession of these counter values is complete (1, 2, 3, etc.).
- **Send the system status with the data:** The current acquisition status of the system is sent. More information on this can be found in Chapter 8.3.4.

IMPORTANT!
In case the Sin/Cos channel of the Ethernet system **MSX-E3317** is selected for an acquisition, it is absolutely necessary for the status register to be activated. The data from the Sin/Cos encoder are only valid if bit 8 of the status register does not indicate an error.

- **Convert the raw values into analog values:** With this option, the MSX-E system can convert the raw values immediately to the correct unit. This unit depends on the system type. With an **MSX-E3317**, the unit depends on the selected channel. As the conversion affects the MSX-E CPU to a certain extent, this can result in slower sending speed.

8.3.4 “Data server frame format” (data format)

Fig. 8-18: Acquisition: Data server frame format

Size	Name	Description
4 bytes	Time stamp (second)	The second part of the system time stamp (encoded as integer)
4 bytes	Time stamp (microsecond)	The microsecond part of the system time stamp (encoded as integer)
4 bytes	Sequence counter	The number of acquired sequence (encoded as integer)
4 bytes	System status	Bit 0: Status of the hardware trigger (0 or 1). Bit 1: Falling edge occurred. Bit 2: Rising edge occurred. Bit 3: Source is the hardware trigger. Bit 4: Source is the synchro trigger. Bit 5: Source is the compare logic. Bit 6: Source is the index logic. Bit 8: Error status of the Sine/Cosine. Bit 20: Source is the Sine/Cosine.

The MSX-E system sends the data over the network to one or more clients. In order that the client can interpret the values correctly, these are formatted. All measurement values and the additional data such as the time stamp form a group of values that is called a packet.

IMPORTANT!
The MSX-E system sends the packets in the Intel format (Little Endian).

The type and amount of the data sent depends on the respective configuration. The complete data format is as follows:

Table 8-1: Data format

Information	Size	Description	Format
Time stamp (s)	4 bytes	Seconds part of the acquisition time	Integer
Time stamp (µs)	4 bytes	Microseconds part of the acquisition time	Integer
Sequence counter	4 bytes	Number of the data packet	Integer
System status	4 bytes	System status at the acquisition time	Bit-coded according to Table 8-2
Strain gauge inputs	n * 4 bytes (n = number of channels)	Acquired data of the selected strain gauge inputs	Floating point value

Table 8-2: Bit-coding of the system status

Bit	Description
0	Hardware trigger status (0 = low, 1 = high)
1	Falling edge of the hardware trigger (occurred since the last acquisition time)
2	Rising edge of the hardware trigger (occurred since the last acquisition time)
3	Acquisition has been triggered by the hardware trigger
4	Acquisition has been triggered by the synchro trigger
5	Acquisition has been triggered by the compare logic
6	Acquisition has been triggered by the index logic
8	Error status of the Sin/Cos channel (see Chapter 5.5.5)
20	Acquisition has been triggered by an event of the Sin/Cos channel (compare or index logic)

9 Technical data and limit values

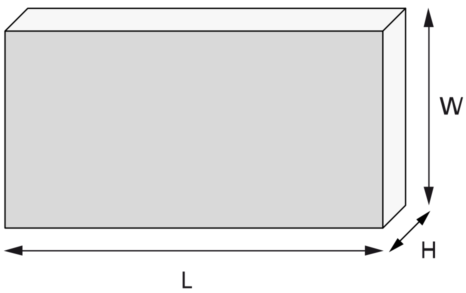
9.1 Electromagnetic compatibility (EMC)

The Ethernet system **MSX-E3317** 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.

9.2 Mechanical structure

Fig. 9-1: MSX-E3317: Dimensions



Dimensions (L x W x H):	220.4 x 140 x 54 mm
Weight:	940 g 1000 g (with MX-Rail)

Fig. 9-2: MSX-E3317: View from above

9.3 Versions

The specific version name can be found on the type label of your Ethernet system (see also Chapter 1.1 of the general MSX-E manual).

9.4 Limit values

Height:	2000 m over NN
Operating temperature:	0 °C to +60 °C
Storage temperature:	-25 °C to +70 °C
Relative air humidity at indoor installation:	50 % at +40 °C 80 % at +31 °C (Ice formation from condensation must be prevented.)
Current supply:	
Nominal voltage:	24 VDC
Supply voltage:	18-30 V
Current consumption (at 24 V):	400 mA (±10 %)
Safety:	
Degree of protection:	IP 65[2]
Optical isolation:	1000 V

IMPORTANT!
After boot-up, the MSX-E system should warm up for a minimum 15 minutes so that a constant internal temperature will be reached.

9.4.1 Ethernet

Number of ports:	2
Optical isolation:	1000 V
Cable length:	150 m (max. for CAT5E UTP)
Bandwidth:	10 Mbps (auto-negotiation) 100 Mbps (auto-negotiation)
Protocol:	10 Base-T according to IEEE 802.3 100 Base-TX according to IEEE 802.3
MAC address:	00:0F:6C:##:##:## (unique for each device)

[2] The degree of protection is only provided when the relevant protection caps are used.

9.4.2 Trigger input

24 V trigger input

Number of inputs:	1
Filter/Protective circuit:	low-pass/transorb diode
Optical isolation:	1000 V (via opto-couplers)
Nominal voltage:	24 VDC
Input voltage:	0-30 V
Input current:	11 mA typ. (at nominal voltage)
Max. input frequency:	2 MHz (at nominal voltage)
Logic input levels:	UH_{max}: 30 V UH_{min}: 19 V UL_{max}: 14 V UL_{min}: 0 V

5 V trigger input (optional)

Number of inputs:	1
Filter/Protective circuit:	low-pass/transorb diode
Optical isolation:	1000 V (via opto-couplers)
Nominal voltage:	5 VDC
Input voltage:	0-5 V
Input current:	12 mA typ. (at nominal voltage)
Max. input frequency:	1 MHz (at nominal voltage)
Signal threshold:	2.2 V typ.

9.4.3 Synchro input and output

Number of inputs:	1
Number of outputs:	1
Optical isolation:	1000 V
Output type:	RS422
Driver level (master) V_{A-B}:	≤ -1.5 V (low) ≥ 1.5 V (high)
Receiver level (slave) V_{A-B}:	≤ -200 mV (low) ≥ 200 mV (high)

9.4.4 Strain gauge inputs

Number of inputs:	4 (2 per female connector / common supply voltage)
Resolution:	24-bit
Real acquisition frequency:	see Table 9-1
Supply voltage (between V+ and V-):	~ 10 V / optional ~ 5 V (calibrated internally) 100 mA_{max}

Table 9-1: Real acquisition frequency

Real acquisition frequency		
on 1 channel	on 2 channels	Sampling frequency (software-selectable)
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

9.4.5 Sin/Cos counter input

Number of inputs:	1 (with A, B and C signals)
Input type:	Sin/Cos 1 V_{PP}
Input frequency:	250 kHz max. (may be lower depending on mode and resolution)
Output voltage (sensor supply):	5 V
Current:	500 mA max. (for each female connector) via PTC
Signal size:	0.6–1.2 V_{PP} (1 V_{PP} typ.)
ESD:	2 kV

9.4.6 Digital inputs

Number of inputs:	2 (common GND according to IEC 1131-2)
Overvoltage protection:	30 V
Optical isolation:	1000 V (via opto-couplers)
Nominal voltage:	24 VDC
Input voltage:	0-30 V
Max. input frequency:	1 MHz (at nominal voltage)
Input impedance:	> 1 MΩ
Logic input levels:	UH_{max}: 30 V UH_{min}: 19 V UL_{max}: 14 V UL_{min}: 0 V

9.4.7 Digital outputs

Number of outputs:	2
Optical isolation:	1000 V (via opto-couplers)
Output type:	high-side (load to ground according to IEC 1131-2)
Nominal voltage:	24 VDC
Supply voltage:	18-30 V
Output current per output:	500 mA max.
Short-circuit current per output:	1.7 A max. shut-down logic at 24 V, R_{Load} = 10 mΩ
R_{DS} ON resistor:	280 mΩ max.
Switch-on time:	100 µs (max. R_L = 48 Ω of 80 % V_{out})
Switch-off time:	150 µs (max. R_L = 48 Ω of 10 % V_{out})
Overtemperature (shut-down):	135 °C max. (output driver)
Temperature hysteresis:	15 °C typ. (output driver)
Diagnosis:	common diagnostic bit for all channels at overtemperature of one channel

9.4.8 Sensor-specific properties

The sensor-specific properties were measured under the following conditions:

Height:	180 m over NN
Ambient temperature:	+25 °C
Air humidity:	70 %

10 Appendix

10.1 Glossary

Cascading
Cascading means connecting multiple similar elements together to enhance their individual effect. The individual elements must be such that the outputs of a given element are compatible with the inputs of the subsequent element in terms of values and functionality.

Counter
A counter is a circuit that counts pulses or measures pulse duration.

Digital signal
A digital signal is a digital representation of a constantly changing value or other piece of information. Digital signals consist of a finite number of values. The smallest possible difference between two digital values is referred to as the resolution. Digital signals are discontinuous in terms of value and time ranges.

Driver
A driver is a series of software instructions written specifically to manage particular devices.

Edge
Edges can either be rising or falling.
Logic levels are defined for processing and displaying information. In binary circuits, voltages are used for digital values. Here, the two voltage ranges "H" (high) und "L" (low) represent the information. The "H" range is closer to plus infinity; the "H" level corresponds to digital 1. "L" denotes the range closer to minus infinity; the "L" level corresponds to digital 0. The rising edge is the transition from the status "0" to "1"; the falling edge is the opposite transition.

EMC
= Electromagnetic Compatibility

The definition of the VDE regulation 0870 states: Electromagnetic compatibility is the ability of an electrical installation to function satisfactorily within its electromagnetic environment without unduly affecting its environment and the equipment it contains.

ESD
= Electrostatic Discharge

On non-conductive surfaces, an electric charge is conducted away very slowly. If the dielectric strength is overcome, there is a fast potential equalisation between the surfaces involved. The often very sudden equalisation process is referred to as electrostatic discharge (ESD). Currents of up to 20 A may occur in this process.

Ethernet
The Ethernet is a baseband bus system originally developed in order to connect mini-computers. It is based on the CSMA/CD access method. Coaxial cables or twisted-pair cables are used as the transmission medium.
The transmission speeds are 10 Mbit/s (Ethernet), 100 Mbit/s (Fast Ethernet) and 1 Gbit/s or 10 Gbit/s (Gigabit-Ethernet). This widely used technology for computer networking in a LAN has been standardised since 1985 (IEEE 802.3 and ISO 8802-3).
Ethernet technology is now common practice in the office environment. After making even very tough real-time requirements possible and adapting the device technology (bus cables, patch fields, junction boxes) to the harsh application conditions of the industrial environment, Ethernet is now also increasingly used in the field areas of automation technology.

Event
An event is an occurrence detected by the MSX-E system. Where e. g. a short-circuit is detected and an event is activated, a short-circuit warning can be sent via the event server.

Ground line
Ground lines should not be seen as potential-free return lines. Different ground points may have small potential differences. This is always true with large currents and may cause inaccuracy in high-resolution circuits.

Hysteresis
Hysteresis is the difference between the start-up and shut-down voltage. In TTL circuits, it is typically 0.8 V; in CMOS circuits, it depends on the supply voltage.

IEC
= International Electrotechnical Commission

The IEC is a UN body affiliated to the ISO (International Standards Organisation) which sets standards for electrotechnical parts and components.

Input impedance
The input impedance is the ratio of voltage to current at the input terminals when the output terminals are open.

Input level
The input level is the logarithmic ratio between two electrical values of the same type (voltage, current or power) at the signal input of any receiving unit. This unit is often configured as a logical level related to the input of the circuit. The input voltage corresponding to logic "0" is between 0 V and 15 V and the voltage corresponding to logic "1" is between 17 V and 30 V.

IP degree of protection
The IP standard defines the degree of protection of a system against dirt and water. The first figure after the "IP" (e.g. 6 in IP 65) indicates the degree of protection against solid objects penetrating the housing.
The second figure indicates the degree of protection against liquids penetrating the housing.
In IP 65, the figures 6 and 5 have the following meaning: 6 = full protection against moving parts and against dirt penetration;
5 = protection against jets of water from any direction.
In IP 40, the figure 4 equates to protection against contact with small objects and protection against small foreign bodies (larger than 1 mm). The figure 0 means that there is no protection.

Level
Logic levels are defined for processing and displaying information.
In binary switches, voltages are used for digital values. Here, the two voltage ranges "H" (high) und "L" (low) represent the information.
The "H" range is closer to plus infinity; the "H" level corresponds to digital 1. "L" denotes the range closer to minus infinity; the "L" level corresponds to digital 0.

Limit value
Exceeding the limit values, even for a short time, can easily result in the destruction of the component or the (temporary) loss of functionality.

MAC address
MAC = Media Access Control

This is the hardware address of network components used to identify them uniquely within the network.

Optical isolation
Optical isolation means that there is no flow of electrical current between the circuit to be measured and the measuring system.

Protective circuit
A protective circuit is set up on the actuator side to protect the control electronics and provide adequate EMC safety. The simplest protective circuit involves connecting a resistor in parallel.

PTC
= Positive Temperature Coefficient

The best-value resistance sensors are either specified as PTC or NTC thermistors. A PTC thermistor has a positive temperature coefficient, hence, “PTC”.

Resolution
The resolution indicates how precisely a signal or value is held within the computer.

Short-circuit
A short-circuit exists between two terminals of an electric circuit if the relevant terminal voltage is zero.

Short-circuit current
A short-circuit current is the current between two short-circuited terminals.

SOAP
= Simple Object Process Protocol

SOAP is a simple extensible protocol for exchanging information in distributed environments. It defines XML messages that can be exchanged between heterogeneous applications via HTTP.

SOAP is independent of operating systems and can be integrated into existing Internet structures, including Ethernet TCP/IP-based automation concepts. SOAP is based on Remote Procedure Calls and XML. This means that functions from other platforms can be called and used from any point within the network. Any results data can also be returned using XML schemas. This enables distributed computing capacity and non-redundant data storage in distributed systems.

Switch-off time
The switch-off time is the time between the control current being switched off and the output voltage falling to 10% of its original value.

synchronous
Two time-dependent events, time slots, or signals are synchronous if their respective significant dates correspond with each other and are divided by requested time intervals that are nominally the same.

TCP/IP
= Transmission Control Protocol/Internet Protocol

TCP/IP is a family of network protocols and therefore often just referred to as Internet protocol. The computers that are part of the network are identified via their IP addresses.

UDP is another transport protocol that belongs to the core group of this protocol family.

Trigger
A trigger is a pulse or signal for starting or stopping a special task. Triggers are often used for controlling data acquisition.

UDP
= User Datagram Protocol

This is a minimal connection-free network protocol which is part of the transport layer within the Internet protocol family. The purpose of UDPs is to ensure that data transmitted over the Internet reach the correct application.

10.2 Index

11 Contact and support

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