DIN EN ISO 9001:2000
certified

ADDI-DATA GmbH
Dieselstraße 3
D-77833 OTTERSWEIER

Technical support:
+49 (0)7223 / 9493 – 0

Preliminary version

Technical description

MSX-E1701

Intelligent Ethernet counter/digital I/O module

- Incremental counter -

Edition: 01.02 – 04/2007

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.
The content of this manual and the technical product data may be changed without prior notice.
ADDI-DATA GmbH reserves the right to make changes to the technical data and the materials included herein.

Warranty and liability

The user is not permitted to make changes to the product beyond the intended use, or to interfere with the product in any other way.
ADDI-DATA shall not be liable for obvious printing and phrasing errors. In addition, ADDI DATA, if legally permissible, shall not be liable for personal injury or damage to materials caused by improper installation and/or commissioning of the board by the user or improper use, for example, if the board is operated despite faulty safety and protection devices, or if notes in the operating instructions regarding transport, storage, installation, commissioning, operation, thresholds, etc. are not taken into consideration. Liability is further excluded if the operator changes the board or the source code files without authorisation and/or if the operator is guilty of not monitoring the permanent operational capability of working parts and this has led to damage.

Copyright

ADDI-DATA software product licence

Please read this licence carefully before using the standard software. The customer is only granted the right to use this software if he/she agrees with the conditions of this licence.
The software must only be used to set up the ADDI-DATA boards.
Reproduction of the software is forbidden (except for back-up and for exchange of faulty data carriers). Disassembly, decompilation, decryption and reverse engineering of the software are forbidden. This licence and the software may be transferred to a third party if this party has acquired a board by purchase, has agreed to all the conditions in this licence contract and the original owner does not keep any copies of the software.

Trademarks

WARNING

The following risks result from improper implementation and from use of the product contrary to the regulations:

- **Personal injury**

- **Damage to the I/0 module, PC and peripherals**

- **Pollution of the environment**

- **Protect yourself, the others and the environment!**

- **Read carefully the safety precautions (yellow leaflet).**

  If this leaflet is not with the documentation, please contact us and ask for it.

- **Observe the instructions of the 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 product.

- **Used symbols:**

IMPORTANT!
designates hints and other useful information.

WARNING!
It designates a possibly dangerous situation.
If the instructions are ignored the module, PC and/or peripheral may be destroyed.

Figures

Tables

1 DEFINITION OF APPLICATION

1.1 Intended use

The Ethernet I/O module **MSX-E1701** with digital and counter functions is intended for the connection to a network, which is used as electrical equipment for measurement, control and laboratory pursuant to the norm IEC 61010-1.

1.2 Usage restrictions

The Ethernet I/O module **MSX-E1701** must not to be used as safety related part for securing emergency stop functions.

The Ethernet I/O module **MSX-E1701** must not be used in potentially explosive atmospheres.

1.3 General description of the board

Characteristics

The Ethernet I/O module **MSX-E1701** can be used for the acquisition of incremental counter inputs and the processing of digital signals via 16 digital inputs/outputs.

1.4 Safety precautions

1.4.1 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.

1.4.2 Degrees of protection

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

If you are not sure, please contact us:

Phone: +49 (0)7223/94 93-0
E-mail: info@addi-data.de

1.4.3 Cables

The cables must be installed safely against mechanical load.

1.4.4 Housing

The housing may not be opened. It may be opened only by persons who are authorized by ADDI-DATA.

1.4.5 Connection

Please find information about cables and further accessories in a separate PDF file "Accessories table"

1.4.6 Remarks

The use of the Ethernet I/O module according to its intended purpose includes observing all advices given in this manual and in the safety leaflet.

Uses beyond these specifications are not allowed. The manufacturer is not liable for any damages which would result from the non-observance of this clause.

Make sure that the Ethernet I/O module remains in its protective pack **until it is used**.

Do not remove or alter the identification numbers of the Ethernet I/O module. If you do, the guarantee expires.

2 USER

2.1 Qualification

Only persons trained in electronics are entitled to perform the following works:
- installation
- use
- maintenance

2.2 Personal protection

Consider the country-specific regulations about:
- the prevention of accidents
- electrical and mechanical installations
- radio interference suppression

3 HANDLING OF THE ETHERNET I/O MODULE

Fig. 3-1: Correct handling

- Do not touch the connectors
- Hold the module only at the sides and at the bottom

4 TECHNICAL DATA

4.1 Electromagnetic compatibility (EMC)

The PC is to comply with the norm IEC61326 for measurement, control and laboratory use and with the specifications for EMC protection.

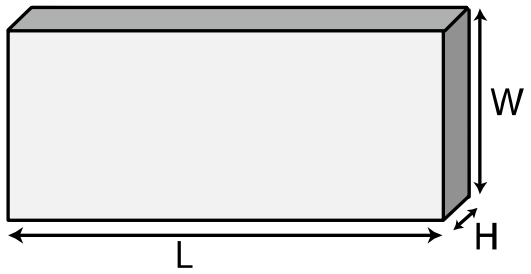
4.2 Physical set-up

Dimensions

Table 4-1: Dimensions

	Length x Width x Height (L x W x H)
MSX-E1701	215 mm x 110 mm x 54 mm

Fig. 4-1: Dimensions



Weight
MSX-E1701: 900g
960 g (with DIN rail mounting)

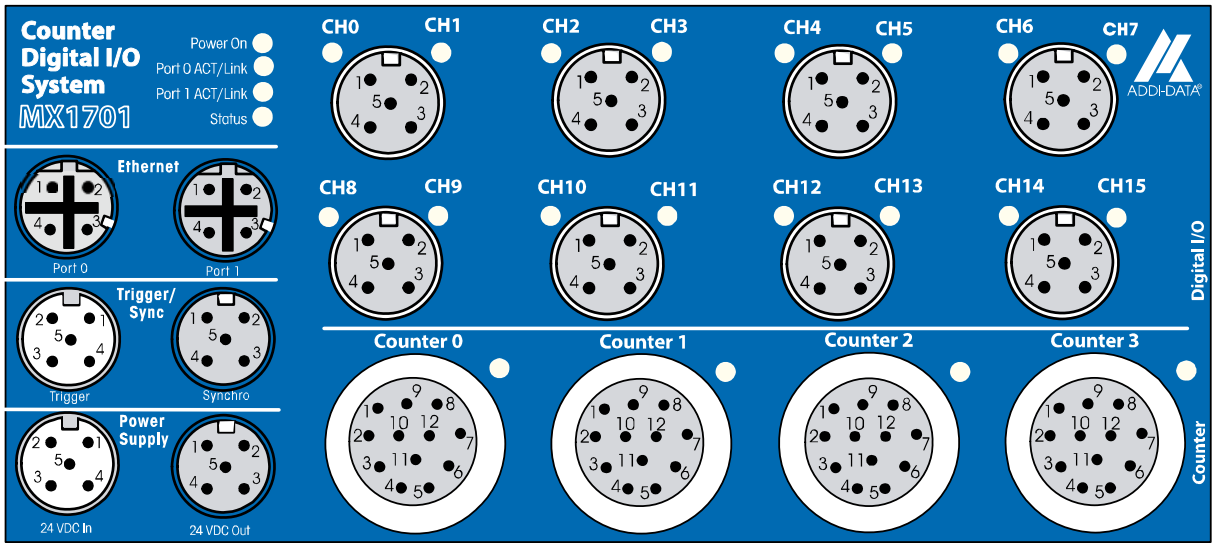
Degreee of protection
Degree of protection: ..... IP 65[1]

Versions

	Counter	Digital I/O[2]
MSX-E1701	RS422	24 V
MSX-E1701-24	24 V	24 V

[1] Please observe that the protection is only reached if adequate protection caps are used (see chapter 1.4.2)
[2] The function digital I/O can be found in the manual MSX-E1701: Digital I/O.

Fig. 4-2: MSX-E1701: View from above



Accessories[3]:
See link in the bookmarks „Accessories table"

4.3 Limit values

Max altitude: ..... 2000 m
Operating temperature:..... 0 to 60°C (with forced ventilation)
Relative humidity:..... 30 to 99% non condensing
Storage temperature: ..... -25 to + 70°C

Safety features:
Optical isolation: .....1000 V
Voltage reversal protection: .....max. 1 A

Current supply:
Nominal voltage:.....24 V direct current ⎓
(symbol acc. to IEC 60417 # 5031)
Supply voltage.....18-30 V
Current consumption at 24 V: ..... 150 mA (±10 %)

4.3.1 Ethernet

Number of ports: 2
Optical isolation: .....1000 V
Cable length: .....150 m (max. at CAT5E UTP)
Bandwidth: .....10 Mbps (auto-negotiation)
100 Mbps (auto-negotiation)
Protocol: .....10 Base-T according to IEEE802.3
100 Base-TX according to IEEE802.3
MAC-address: .....00:0F:6C:##:##:##
(unique for each device)

3 Not contained in the standard delivery.

4.3.2 Trigger input

Number of inputs: 1
Filter/protective circuitry: ..... Low-pass/transorb diode
Optical isolation: ..... 1000 V (through opto-coupler)
Nominal voltage (external): ..... 24 V
Input voltage: ..... 0 V to 30 V
Input current: ..... 11 mA (at 24 VDC, typical)
Input frequency (max.): ..... 2 MHz (at 24 V)

4.3.3 Synchro inputs and outputs

Number of inputs: 1
Number of outputs: 1
Optical isolation: ..... 1000 V
Output type: RS485
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)

4.3.4 Counter

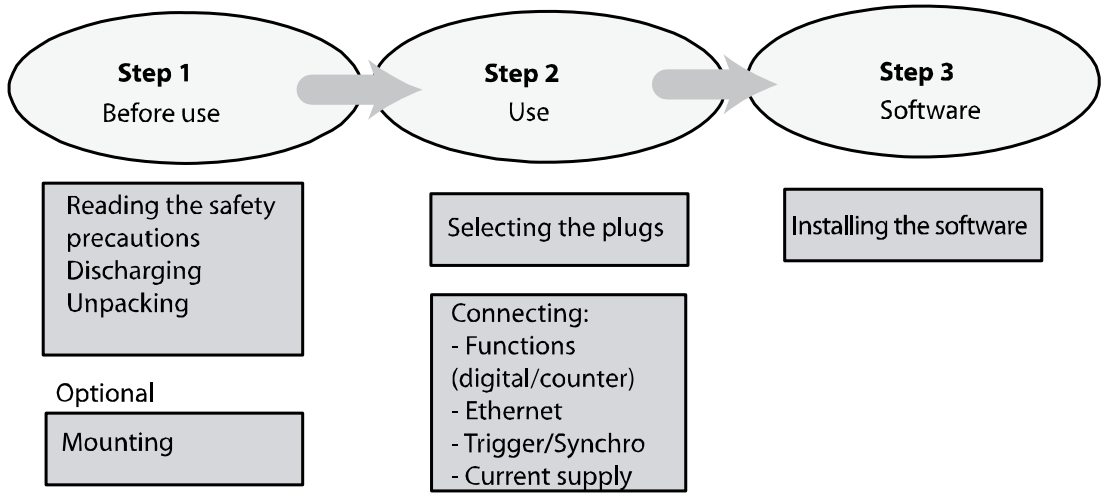
Number of counter inputs: ..... 16 (4 per female connector)
Input types: ..... Differential inputs or TTL

Differential inputs (complies with the EIA standards RS422A):
Common mode range: ..... +12V/-7 V
Input sensitivity: ..... ±200 mV
Input hysteresis: ..... 50 mV (typical)
Input impedance: ..... 12 kΩ (min.)
Max. input frequency: ..... 5 MHz (at nominal voltage)
Open Circuit Fail Safe Receiver Design: .. "1" = Input open
ESD protection: ..... Up to ±15 kV

24 V inputs (MSX-E1710-24):
The version **MSX-E1710-24** is especially considered for the connection of 24 V encoders. Only 24 V signals can be connected to the inputs.
Nominal voltage: ..... 24 V_{DC}
Max. input frequency: ..... 1 MHz (at nominal voltage)
Input impedance: ..... 1 MΩ (typical)

5 USE

Fig. 5-1: Use



5.1 Before use

- **Discharge yourself by touching a conducting surface**
- **Remove the Ethernet I/O module from its protective package**

5.1.1 Mounting the Ethernet I/O module: DIN rail

With the mounting set **MX-Rail** (see PDF table „Accessories“) you can attach the Ethernet I/O module to a DIN rail.

WARNING!
Should you have already mounted the **MSX-E1701** and want to transport it in a switch cabinet or in other systems, do ensure that there is sufficient transportation lock. The **MSX-E1701** could fall e.g. from the DIN rail, which could lead to the damage of the **I/O module** and/or other objects/persons.

- **Attach the clamps to the Ethernet I/O module**
- **Fasten the clamps in the holes with the 2 delivered screws**

IMPORTANT!
The spring within the clamps points to the housing ground (see figure below).

Fig. 5-2: Clamps

- **Attach the Ethernet I/O module to the DIN rail by placing the clamp with the springs under the rail**
- **Lift the Ethernet I/O module until the upper part of the clamp locks on the rail**

5.1.2 Mounting the Ethernet I/O module: Angle mounting

With the mounting set **MX-Screw** (see PDF table “Accessories”) you can prepare the Ethernet I/O module for the direct attachment to machines and devices.

According to your requirements you can attach the four angles either pointing inside or outside.

Fig. 5-3: Angles pointing to the outside

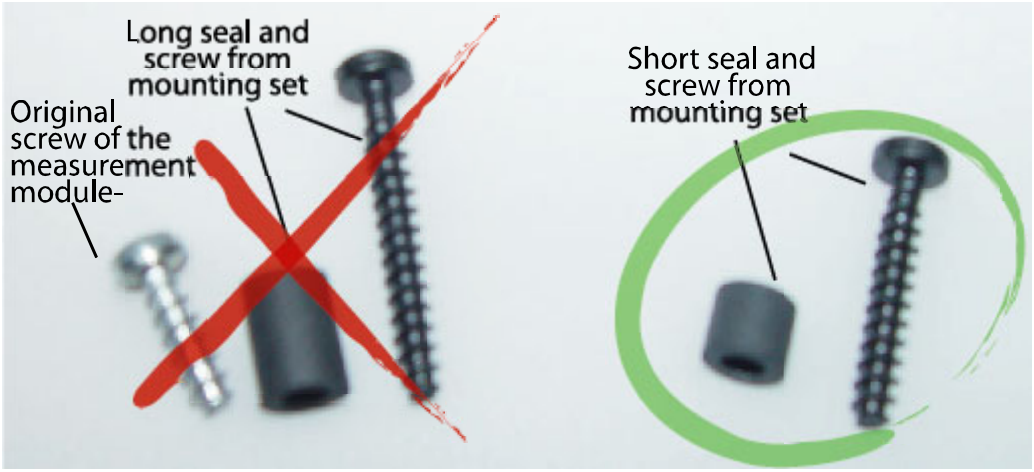
Fig. 5-4: Angles pointing to the inside

For mounting please observe the following steps:

- **Unscrew the screws from the side of the Ethernet I/O module**

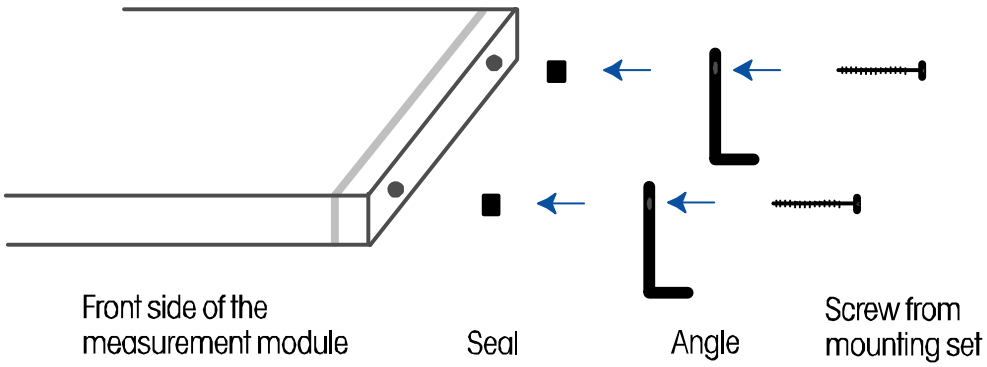
For further mounting please use only the **short** seals and screws from the mounting set.

Fig. 5-5: Screws and seals



- **Put the seal into the opening**
- **Put the angle on the seal**
- **Fasten the angle with a short screw from the mounting set**

Fig. 5-6: Angle mounting



After having attached the angles to the Ethernet I/O module, you can attach the module directly to devices and machines with further screws.

5.2 Connecting the components

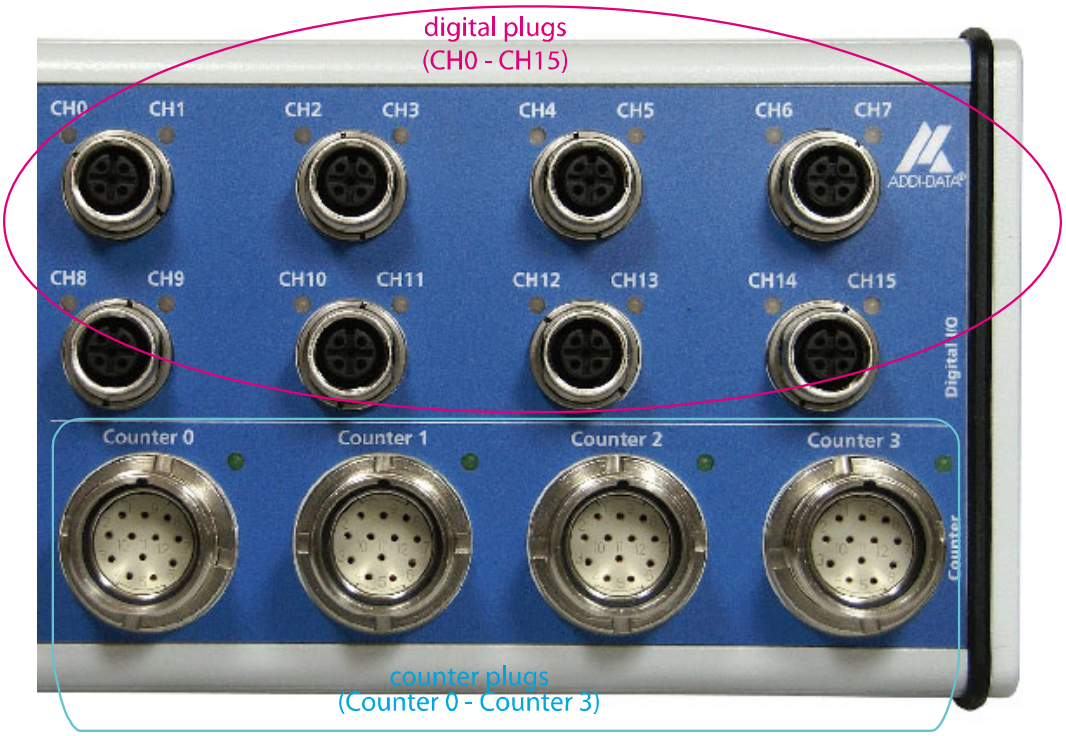
♦ **Discharge yourself**

♦ **Take the Ethernet I/O module out of its protective pack**

5.2.1 Connecting the counter function

♦ **Select one or more plugs for counter functions**
Counter plugs: Counter 0 – Counter 3

Fig. 5-7: Selecting a counter plug



♦ **Plug the cable/clamp into the required plug/s**

5.2.2 Connecting Ethernet ports

♦ **Plug the Ethernet cable in Ethernet port 0**[4]

Fig. 5-8: Connecting Ethernet ports

5.2.3 Connecting trigger and synchro signals

♦ **Plug the cable into the plug Trig/Sync In**[1]

Fig. 5-9: Connecting trigger and synchro signals

[4] If you want to connect several Ethernet I/O modules, please do observe chapter 5.3.

5.2.4 Connecting to the current supply

♦ **Plug the cable into the input (24 VDC In)**[5]

Fig. 5-10: Connecting the current supply

5.3 Connecting several Ethernet I/O modules

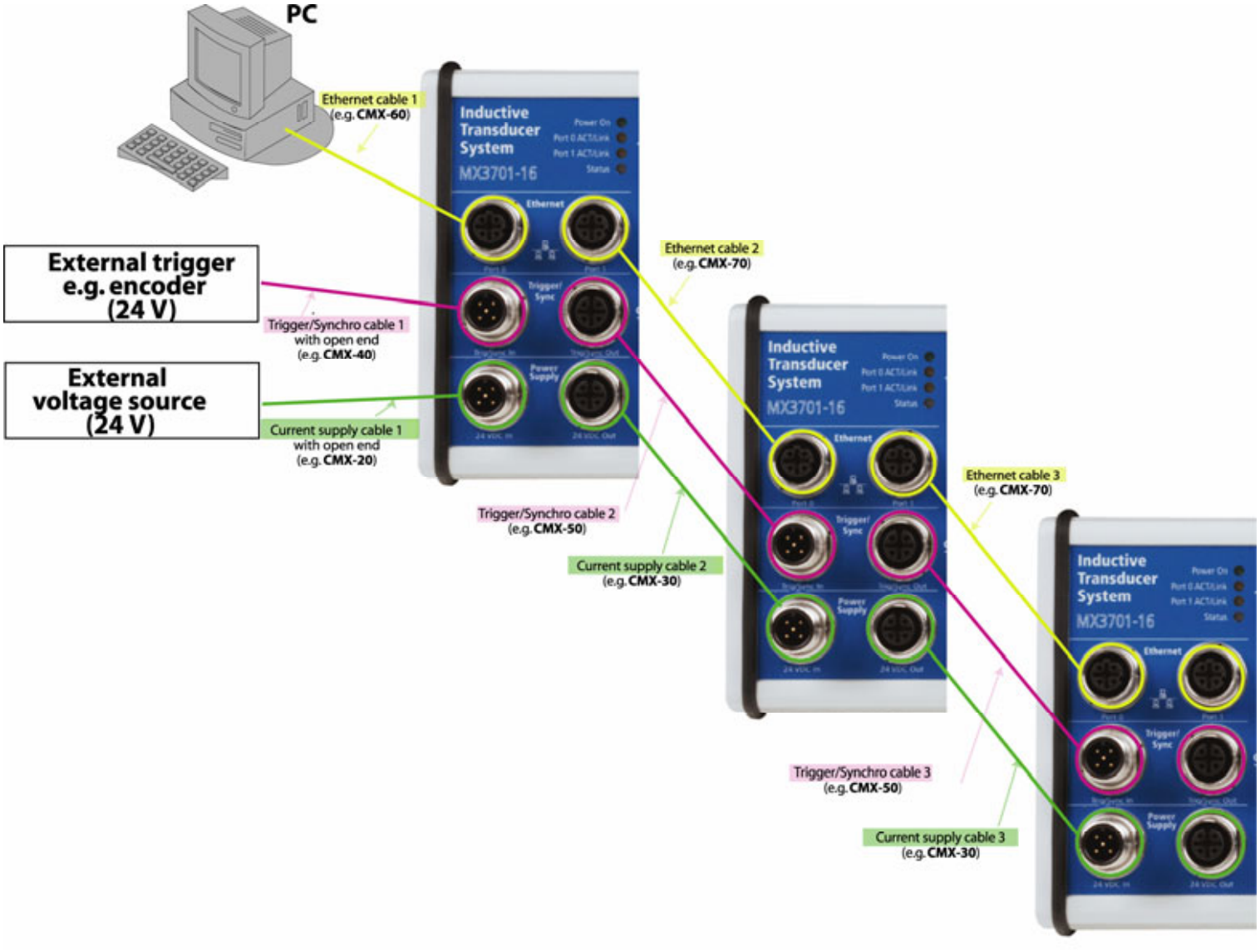
You can connect several Ethernet I/O modules. Hereto please observe the following steps:

♦ **Connect the first Ethernet I/O module as described above**

♦ **Connect the components as shown in the figure (see next page)**

[5] If you want to connect several Ethernet I/O modules please do observe chapter 5.3.

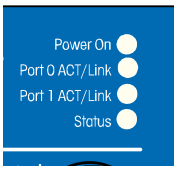
Fig. 5-11: Connecting several Ethernet I/O modules



5.4 LED display

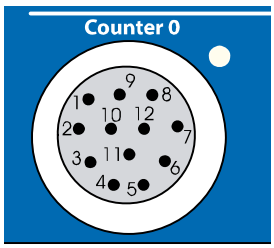
5.4.1 Overview

Fig. 5-12: LEDs: Current supply, Ethernet and Status



	LED	Description
Power On	Lights green	Current supply OK
Port 0 ACT/Link	Blinks yellow	Ethernet cable connected to Port 0
Port 1 ACT/Link	Blinks yellow	Ethernet cable connected to Port 1
Status	Lights green	**As soon as the Status LED lights green, the module is ready for work.**
	Lights yellow	**If the Status-LED lights yellow, the network cables are possibly not connected**
	Detailed description of the status LED: See table next page	

Fig. 5-13: LEDs: Counter

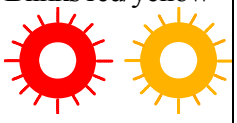
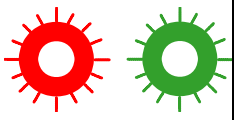


	LED	Description
Counter	green	Both tracks (A and B) are connected via OR gate

5.4.2 LED “Status”

The table below contains further information about the LED “Status”.

Table 5-1: LED “Status”

Display	Meaning	Possible cause	Tip
Lights red 	Error during booting	Hardware error (e.g. RAM)	- Contact us for reparation or exchange
Blinks red 	Damaging ambiance conditions	Internal temperature is outside the working range (< -40 C° or > 85 C°)	- The module should be handled quickly appropriately - Under such conditions the measurement values are inexact and the whole functions are limited - Such conditions can damage the internal components and thus make the whole system useless
Blinks red/yellow 	The system cannot be accessed via a network connection and dangers are possible to arrive	Internal temperature is low (LOW) or high (HIGH) **and** network cables are not connected.	- The module should be handled appropriately - Check the Ethernetlinks (see LEDs **Port 0 ACT/LINK** and **Port 1 ACT 1/LINK**) - Please observe that in the meantime also further errors can occur that prevent data acquisition (e.g. a short-circuit)
Blinks red/yellow 	System still works and communicates correctly, but dangers are possible to arrive	Internal temperature is low (LOW) or high (HIGH)	The module should be handled appropriately
Lights yellow 	System is serviceable, but cannot be accessed via a network connection	- System is booting - Network cables are not connected	- Wait until the system initialization is finished (approx. 40 s) - Check Ethernet connection (see LEDs **Port 0 ACT/Link** or **Port 1 ACT/Link**)
Blinks yellow 	Data acquisition is not possible, but the system can be accessed via a network connection	- After an update with a defect firmware - Essential part works not correctly - Short-circuit at the primary side of one or several sensors	- Check the diagnostics on the website of the system - Check the cables and sensors that are connected to the module - Use an updated firmware for your system - Contact us for reparation or exchange

Display	Meaning	Possible cause	Tip
Blinks yellow/green 	Data acquisition is possible but some parts are not working correctly.	- The Flash memory is not working correctly - A wrong IP address has been configured	- Check your IP address - Contact us for reparation or exchange
Blinks green 	System is working	- Firmware update - Data acquisition is running	
Lights green 	System is ready for work		

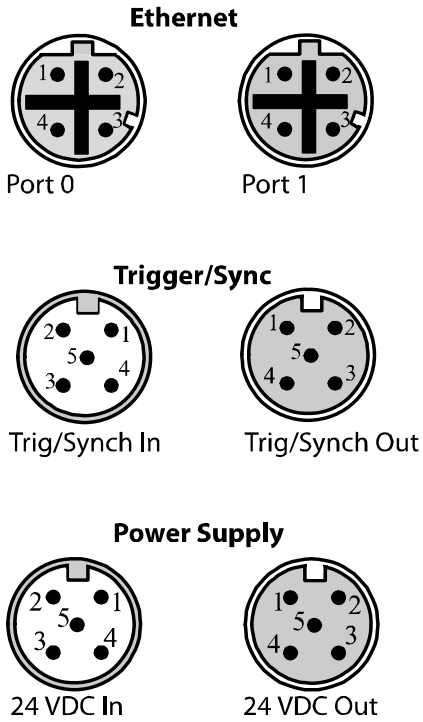
 Note: During booting, the LED “Status” is yellow

6 CONNECTING THE PERIPHERAL

This chapter contains the connector pin assignment of the control signals (see chapter 6.1) and of the function signals (see chapter 6.2).

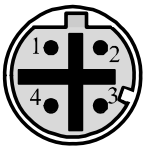
6.1 Pin assignment control signals

Fig. 6-1: Control signals MSX-E1701



6.1.1 Ethernet Ports

Table 6-1: Pin assignment: Ethernet Port 0 and Port 1

	Ethernet Port 0	Ethernet Port 1
Pin No.	Ethernet female connector D-coded, M12	Ethernet female connector D-coded, M12
1	TD0+	TD1+
2	RD0+	RD1+
3	TD0-	TD1-
4	RD0-	RD1-
	Ethernet Port 0 	**Ethernet Port 1** 

6.1.2 Trigger/sync

Table 6-2: Pin assignment: Trigger/Synchro

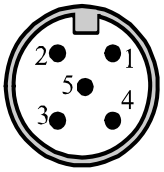
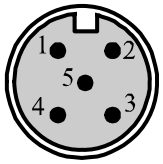
	Trigger/Sync In	Trigger/Sync Out	Cable color
Pin No.	Male connector, 5-pin., M12	Female connector, 5-pin, M12	
1	Dig. trigger input -	Dig. trigger input -	Brown
2	Dig. trigger input +	Dig. trigger input +	White
3	Synchro trigger input +	Synchro trigger output +	Blue
4	Synchro trigger input -	Synchro trigger output -	Black
5	Ground	Ground	Gray
	Trigger/Sync In 	**Trigger/Sync Out** 	

Photo: Connecting the trigger/synchro signals (see Fig. 5-9)

6.1.3 Current supply

Table 6-3: Pin assignment: Current supply

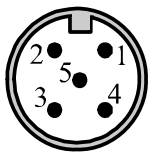
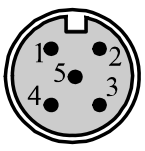
	Power Input	Power Output	Cable color
Pin No.	Male connector, 5-pin, M12	Female connector, 5-pin, M12	
1	24 V	24 V	Brown
2	24 V	24 V	Whiter
3	Ground	Ground	Blue
4	Ground	Ground	Black
5	Shield	Shield	Gray
	Power Input 	**Power Output** 	

Photo: Connecting the current supply (see Fig. 5-10)

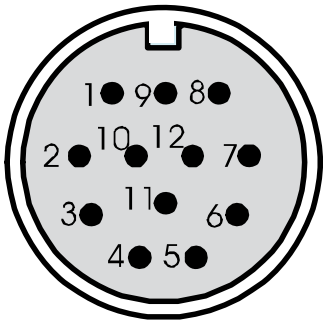
6.2 Signals of the counter functions

Table 6-4: Overview: Pin assignment counter

		MSX-E1701		MSX-E1701-24	
Pin number	**Female: Counter 0…3**	**Polarity**	**Function**	**Polarity**	**Function**
2, 12	Power Supply 24 V or 5 V[6]	Output 5 V/24 V can be set by jumper State at delivery: 5 V	Supply for incremental encoder	Output 5V / 24V can be set by jumper State at delivery: 24 V	Supply incremental encoder
10, 11	GND	GND			
5	A+	Input RS485 / TTL[7]	Track A Incremental signal	Input 24 V	Trace A Incremental signal
6	A-			not connected	
8	B+	Input RS485 / TTL[2]	Track B Incremental signal	Input 24 V	Trace B Incremental signal
1	B-			not connected	
3	C+	Input RS485 / TTL[2]	Index	Input 24 V	Index
4	C-			not connected	
9	D+	Input RS485 / TTL[2]	Reference signal for reference point logic	Input 24 V	Reference signal for reference point logic
7	D-			not connected	

[6] See chapter 6.2.1„Jumper: Selection of supply voltage“
[7] See chapter 6.2.2: “TTL-signals at RS485 input”

Fig. 6-2: Pin assignment: Counter



6.2.1 Jumper: Selection of the supply voltage

With the counter function you can select between 24 V and 5 V supply voltage at Pin 2 and Pin 12 of the female connector via the jumper ST3.

The jumper is on the right side of the housing. In order to use the jumper you have to unscrew the right side of the housing.

Please observe: The housing may not be opened. It may be opened only by persons who are authorized by ADDI-DATA.

Fig. 6-3: Counter: 24 V supply: Jumper on 1 and 2

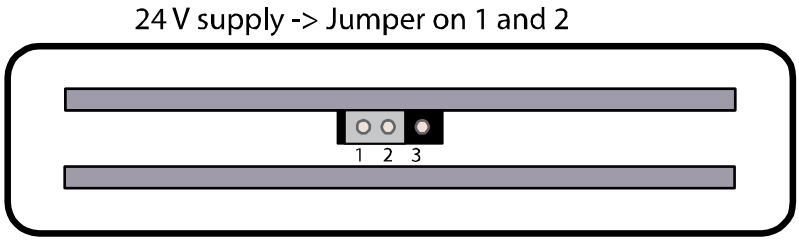
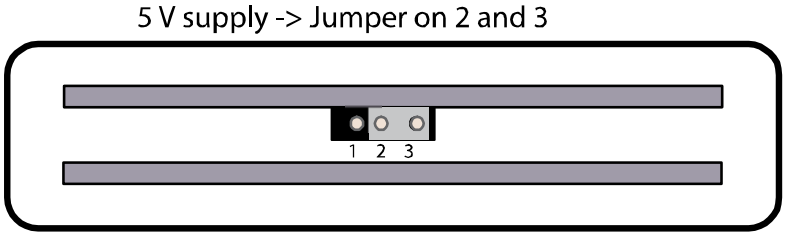


Fig. 6-4: Counter: 5 V supply: Jumper on 2 and 3



IMPORTANT!
Please observe that this selection only concerns the 24 V or 5 V-supply of the encoder and that this has **no** connection with the version of the module (**MSX-E-1701** or **MSX-E1701-24**).

6.2.2 TTL-signal at RS485-input

Note:
This function is only available on the **MSX-E1701** and **not** on the **MSX-E1701-24**.

Always at Pin D of the M23 female connector it is possible to output a reference voltage of 1.4 V. The voltage can be added via software. With the help of this reference voltage TTL-signals can be put on the RS485 inputs. As soon as the reference voltage is output at Pin D-, no differential signal can be connected anymore to input D, only TTL signals.

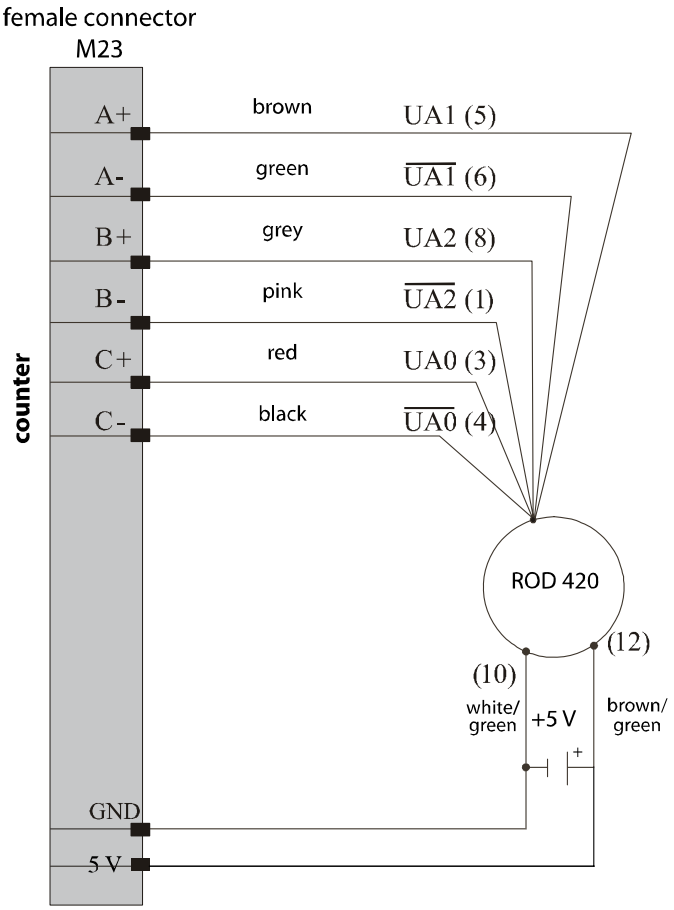
Example: TTL signal at input D
The reference voltage must be output at Pin D-. GND of the TLL signal must be connected to GND of the female connector. The TTL signals must be connected to D+.

Example: TTL signal at input A, B, C
The reference voltage must be output at Pin D-. The reference voltage must be connected externally from Pin D- to the required negative input (A-, B- or C-). The GND of the TTL signal must be connected to the GND of the female connector. The TTL signal must be connected to the required positive input (A+, B+ or C+).

6.3 Connection example: Incremental encoder

The encoder ROD 420 of HEIDENHAIN is connected to a counter of the Ethernet I/O module **MSX-E1701.**

Fig. 6-5: Connection example: Incremental encoder


female connector
M23
counter
A+
A-
B+
B-
C+
C-
GND
5 V
brown
green
grey
pink
red
black
UA1 (5)
$\overline{UA1}$ (6)
UA2 (8)
$\overline{UA2}$ (1)
UA0 (3)
$\overline{UA0}$ (4)
ROD 420
(12)
(10)
white/
green
+5 V
brown/
green
+

7 SOFTWARE

In this chapter you will find a description of the delivered software and its possible applications.

The detailed software descriptions of the several functions can be found in separate PDF files.

7.1 Direct access

7.1.1 Interface to the module

The module is accessed via a TCP/IP socket:

The Ethernet I/O module has the following two servers:

Command server (SOAP)	>	to send commands (acquisition initialisation, etc.)
Data server (TCP socket)	>	to obtain the values of the acquisition

MSX-E1701 server access information:

SOAP server: Port number 5555
Data server: Port number 8989

7.1.2 SOAP: General definition

What is SOAP?
SOAP (originally *Simple Object Access Protocol*) is a protocol with which data can be exchanged between systems, and Remote Procedure Calls can be executed. SOAP is based on services of other standards, XML for representing the data and internet protocols of the transport and user layer (see TCP/IP reference model) for transmitting the messages. The most usual combination is SOAP via HTTP and TCP. The abbreviation SOAP is not used anymore since version 1.2 because it is (subjective) not „simple“ and it serves not only for accessing to objects (Object Access).

Fig. 7-1: SOAP in the TCP/IP protocol staple

<table>
<tr><td rowspan="2">Application</td><td colspan="4">SOAP</td></tr>
<tr><td>HTTP</td><td>HTTPS</td><td colspan="2">…</td></tr>
<tr><td>Transport</td><td colspan="4">TCP</td></tr>
<tr><td>Network</td><td colspan="4">IP</td></tr>
<tr><td>Net access</td><td>Ethernet</td><td>Token Ring</td><td>FDDI</td><td>…</td></tr>
</table>

What is a socket?

A **socket** is a bidirectional software interface to interprocess *(IPC)* or network *communication*.

Sockets are a standardized interface (API) between the network-protocol-implementation of the operating system and the actual application software.

7.1.3 SOAP functions

For further information: See “SOAP function description” (link on pdf file in the bookmarks).

7.1.4 Data server and data protocol

What is a data server?
A data server is a network component that reads data from the module and sends it to all connected clients.

Characteristics:
- Multiclients
- Optimized for high throughput and fast servicing of available data.

Data protocol

A data package consists of five fields (field format: 32-bit little-indian)

time stamp low	time stamp high	source counter	source type	data

Time stamp

timestamp low	micro second
timestamp high	second

Source counter
Source counter: 0 to 3

Source type

0	compare logic
1	Frequence
2	latch register digital trigger
3	latch register synchro trigger
4	Index

Data

The width of all data is 32-bit (0 to 0xFFFFFFFF)

Source type	Definition
Compare logic	Counter value when the compare-condition becomes true.
Frequence	Number of pulses during a given interval.
Latch register digital trigger	Counter value when the digital trigger occurs.
Latch register synchro trigger	Counter value when the synchro trigger occurs.
Index	Counter value when the index comes.

7.1.5 Questions and software downloads on the web

Do not hesitate to e-mail us your questions. We will be pleased to support you.
e-mail: info@addi-data.de or hotline@addi-data.de

Free downloads of standard software

You can download the latest version of the software for the Ethernet I/O module **MSX-E1701**:

http://www.addi-data.com

IMPORTANT!
Before using the product or in case of malfunction during operation, check if there is an update of the technical description or driver. The current version can be found on our web site (download). You also can phone us directly (Phone: +49 7223 9493-0) or send us an e-mail.

7.2 Webserver

For a more comfortable management we offer you an additional webserver.

You access the webserver as follows:

First enter the IP address of the module in a webbrowser (e.g. Internet Explorer or Mozilla Firefox).A login window is displayed.

♦ **Enter „mxadmin“ as username and as password**

After this the window „Module information“ appears.

Fig. 7-2: Webserver: Module information

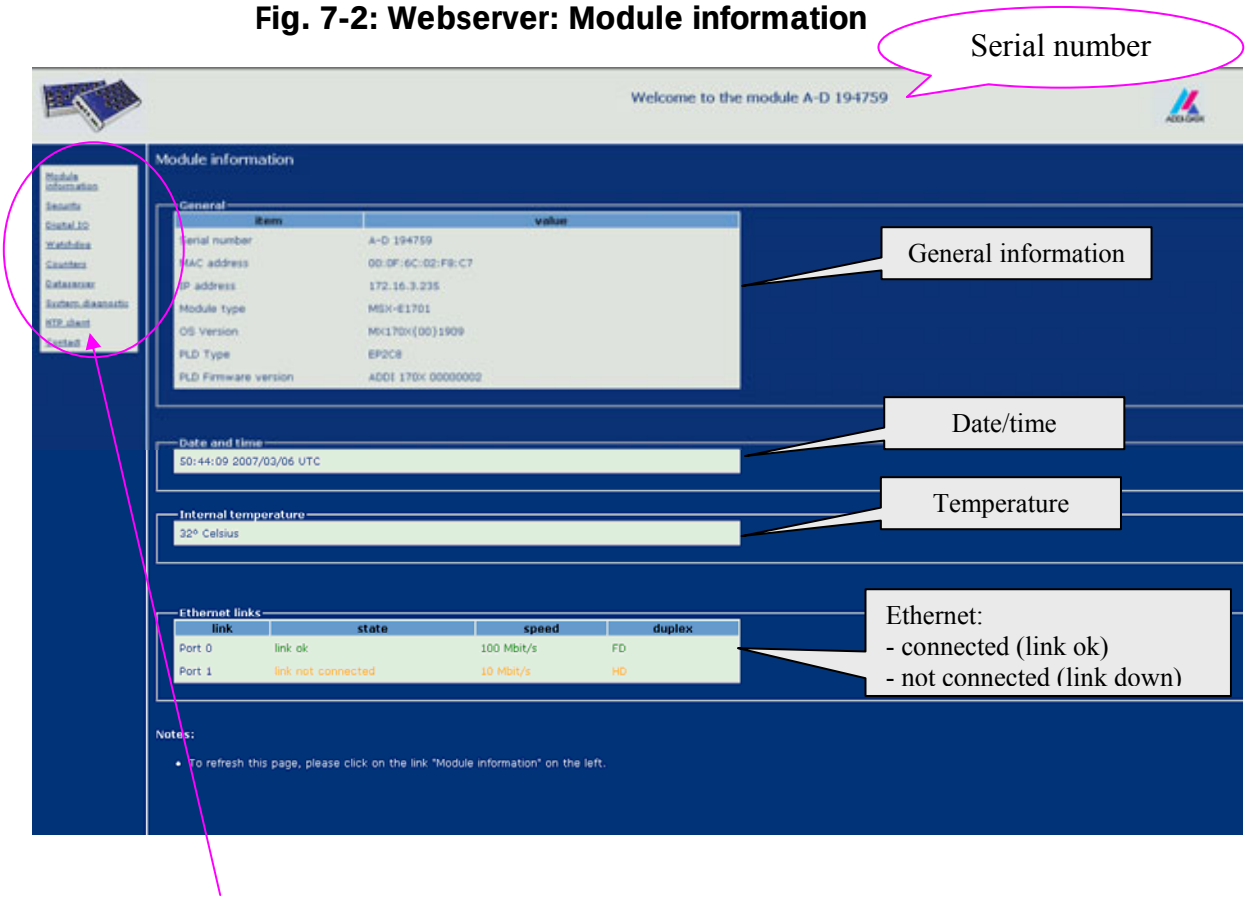


Table 7-1: Webserver: Further points

Point	Description
Module information	General information about the Ethernet I/O module is displayed (see figure above).
Security	Change the default password („mxadmin“). Enter your new password twice. Encryption of the webserver data is possible (TLS).
Digital I/O	Configuration of the digital inputs/outputs.

Watchdog	Control of the function „Watchdog“. Refresh / (Re)initialise and start / stop watchdog
Counters	Status and configuration of the additional counters (compare logic, latch register, frequency measurement and index) can be displayed.
Dataserver	Network service is a service to supply the clients acquired data via TCP/IP-socket. Here you can parameterize this service.
System diagnostics	Additional information about the Ethernet module
NTP client	Remote synchronization of the Ethernet module by saving the IP address of the server on the module. You have to set this only once.
Contact	ADDI-DATA contact information

7.3 Software tool SETMSXExxxx

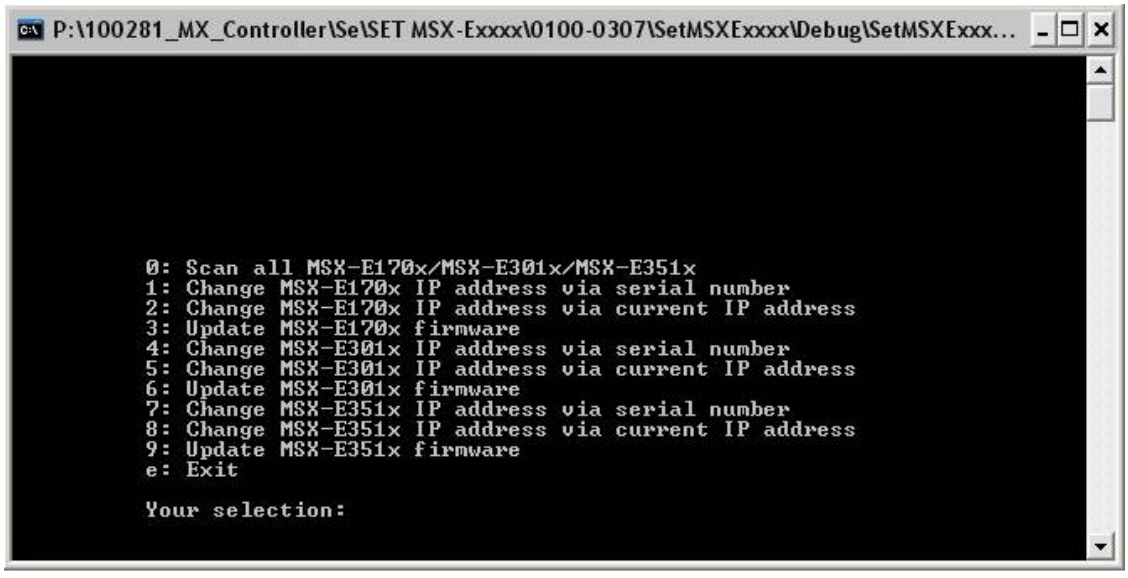
The software tool SETMSXExxxx supports you in:
- Changing the IP address of the Ethernet I/O module (either via the current IP address or via the serial number)
- Updating the firmware
- Scanning the Ethernet I/O modules

First steps:

♦ **Start the software tool SETMSXExxxx via the delivered CD.**

The introduction screen of the tool appears:

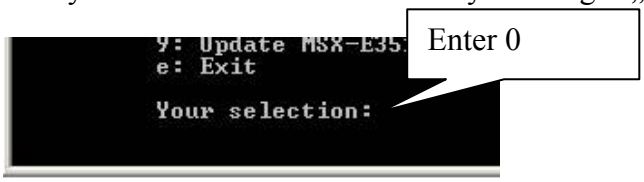
Fig. 7-3: SET MSX-Exxx: Main menu



Your selection[8]	Meaning
0	Scanning all Ethernet I/O modules
1	Changing the IP address of the module MSX-E170x via the serial number
2	Changing the IP address of the module MSX-E170x via the current IP address
3	Updating the MSX-E170x firmware
4	Changing the IP address of the module MSX-E301x via the serial number
5	Changing the IP address of the module MSX-E301x via the current IP address
6	Updating the MSX-E301x firmware
7	Changing the IP address of the module MSX-E351x via the serial number
8	Changing the IP address of the module MSX-E351x via the current IP address
9	Updating the MSX-E351x firmware
e	Exit

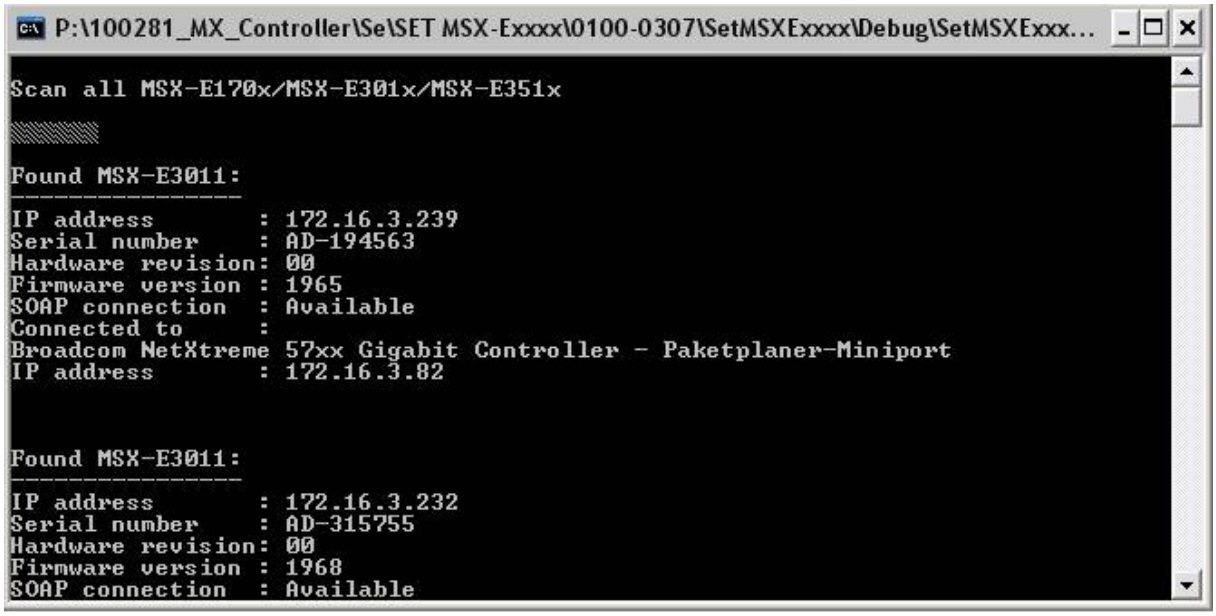
Application sample:
Changing the IP address via the serial number of the analog input module MSX-E3011:

Firstly scan all connected modules by entering as„Your Selection“ the number „0“



[8] The table is valid for all Ethernet I/O modules (MSX-E1701, MSX-E301x and MSX-E351x)

The following screen appears:



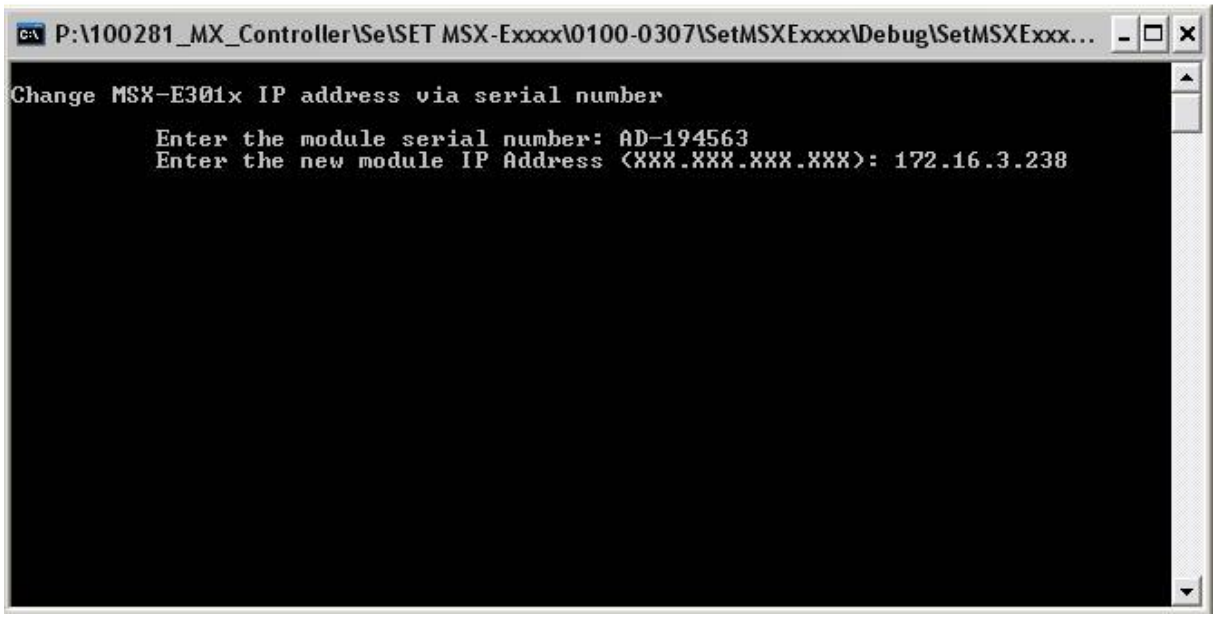
The screen shows information about all connected modules.

♦ **Note the serial number of the selected module (the serial number can be found on the label on the back of your module)**

You will automatically get into the main menu.

♦ **Enter as „Your selection“ the number[9] 1, 4 or 7**

The following window appears:

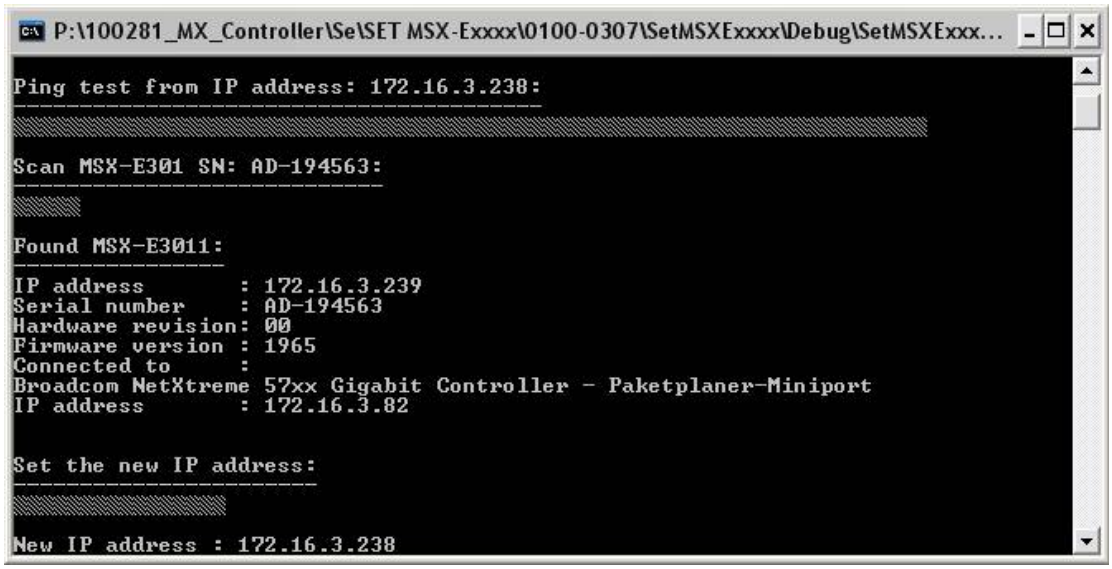


[9] 1=MSX-E170x, 4=MSX-E301x, 7=MSX-E350x

♦ **Enter the serial number and the new IP address.**

Firstly a Ping test is realized on the selected IP address to test whether it is occupied or not.
Then the new IP address is set.

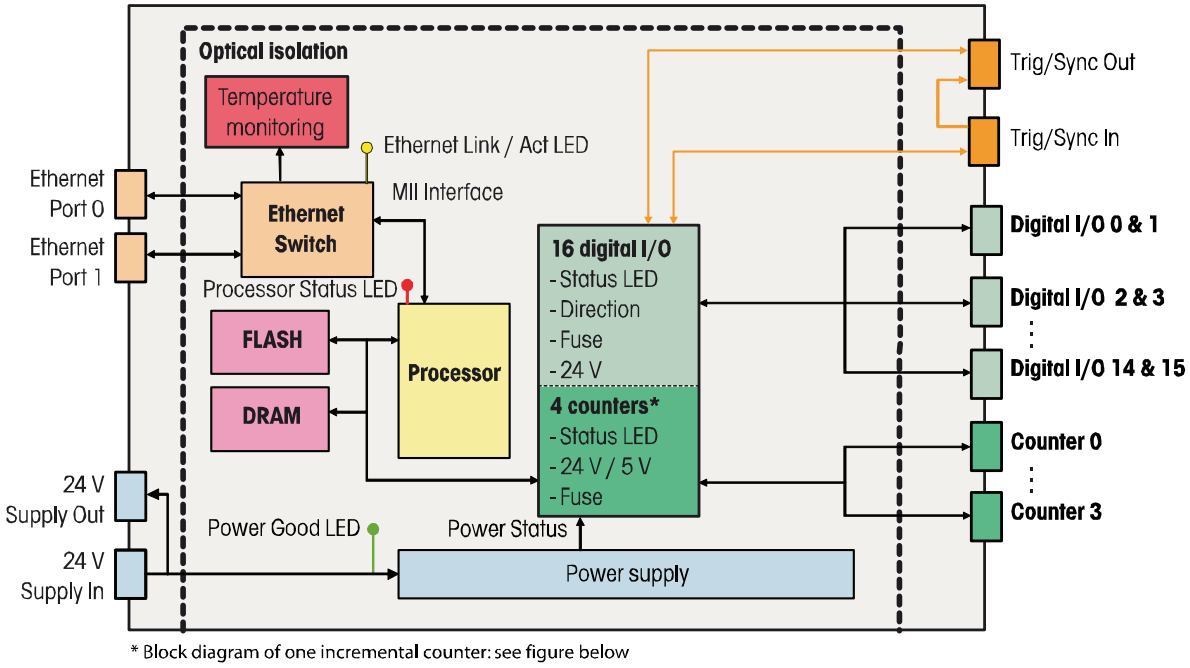
Fig. 7-4: New IP address changed



8 FUNCTIONS OF THE MODULE

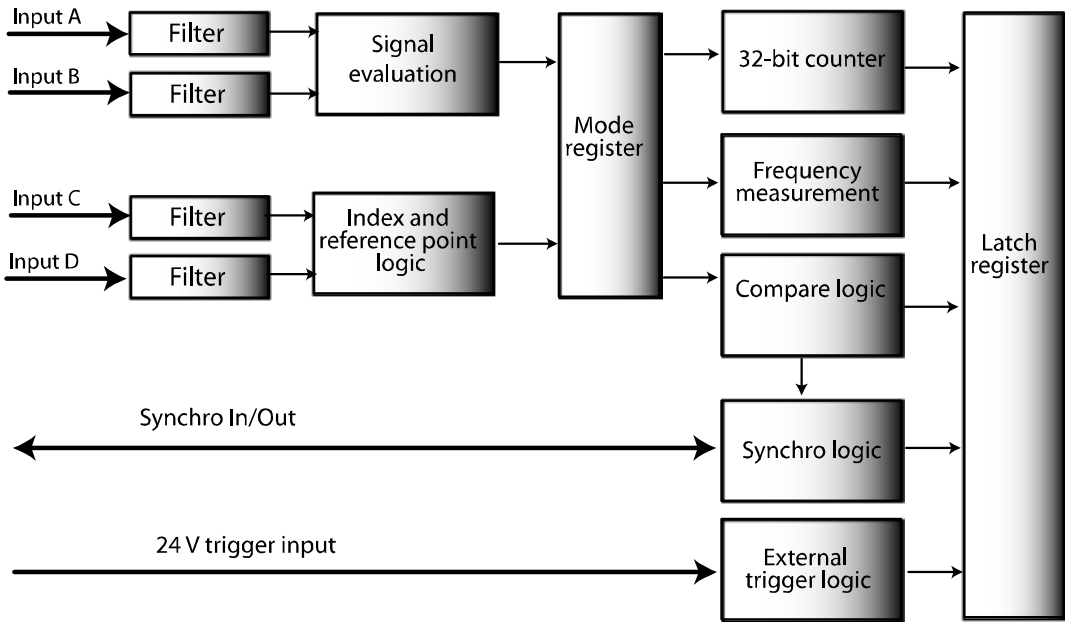
8.1 Block diagram: MSX-E1701

Fig. 8-1: Block diagram: MXS-E1701



8.2 Block diagram: Incremental counter

Fig. 8-2: Block diagram: Incremental counter



8.3 Function description: Incremental counter

The function **incremental counter** is a fast counter for 90° phase-shifted signals (displacement measurement systems).

It is used especially for applications, in which high precision and reliability for industrial environment is required.

Characteristics:
- Different modes (single/double/quadruple and direct mode) for the acquisition of incremental signals (see chapter 8.3.1)
- Hysteresis function for the absorption of the first pulse after a change in rotation (see chapter 8.3.2)
- Index and reference point logic (see chapter 8.3.5)
- Compare mode (see chapter 8.3.4)
- Pulse counting function with gate input (direct mode)
- Frequency measurement (see chapter 8.3.3)
- Programmabe filter for counter inputs (see chapter 8.3.8)
- 24 V trigger input (see chapter 8.3.6)
- Synchronisation to further Ethernet modules (see chapter 8.3.7)

8.3.1 Single/double/quadruple/direct mode

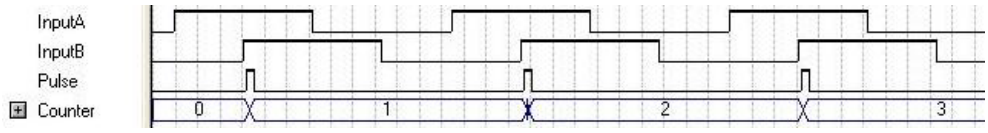
You have the possibility to use different modes for the acquisition of incremental signals:

Table 8-1: Acquisition modes

Single mode	Acquisition with ¼ of the highest possible resolution
Double mode	Acquisition with ½ of the highest possible resolution
Quadruple mode	Acquisition with the highest possible resolution

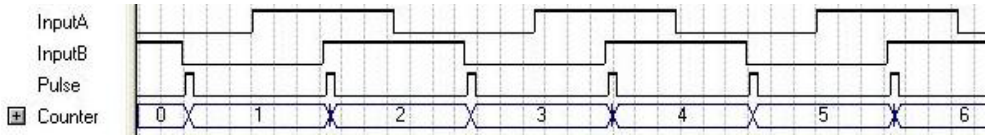
Single mode

In the single mode with each rising edge of track B of the incremental signal is counted until track A is on high.



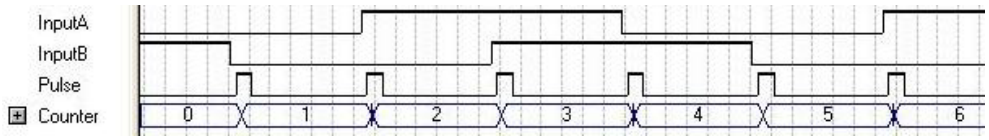
Double mode

In the double mode with each falling and rising edge of track B of the incremental signal is counted.



Quadruple mode

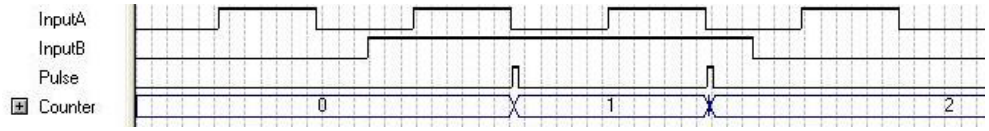
In the quadruple mode with each falling and rising edge of track A and track B of the incremental signal is counted.



Direct mode

In the direct mode with each falling edge of input A is counted, whereas input B serves as gate input. It is counted only as long as input B is on the high level. Furthermore, in the direct mode the counting direction can be programmed via software.

Example: Direct mode, increment counter



8.3.2 Hysteresis function

The hysteresis function can be used in the single, double and quadruple mode. At hysteresis „ON“ the first counting pulse after a change in rotation is not evaluated.

Fig. 8-3: Example: Quadruple mode, hysteresis ON

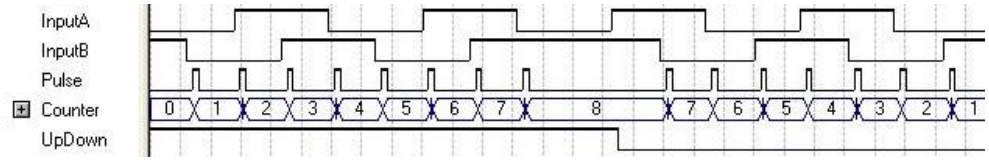
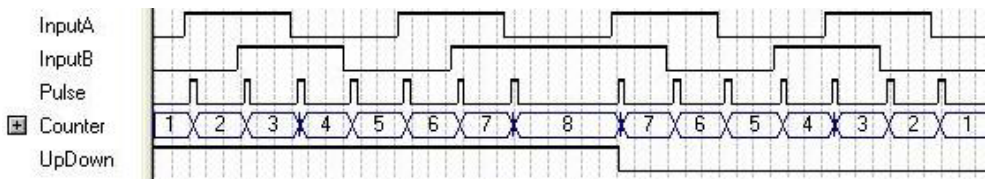


Fig. 8-4: Example: Quadruple mode, hysteresis OFF



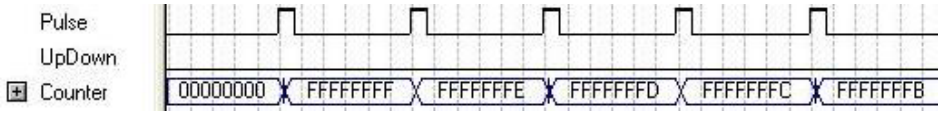
8.3.3 Frequency measurement

For the frequency measurement all pulses are counted within a selectable time period of 100 ns to 6.55 ms. The pulses are generated, depending on the mode (single, double, quadruple or direct mode), at the rising or falling edges of the signals (see chapter 8.3.1). After the measurement is finished, the frequency of the inputs signals can be calculated with the help of the time period and the counted pulses.

The frequency measurement is started via software, independently from the input signals. The end of the measurement is reported via status and, if wanted, via interrupt.

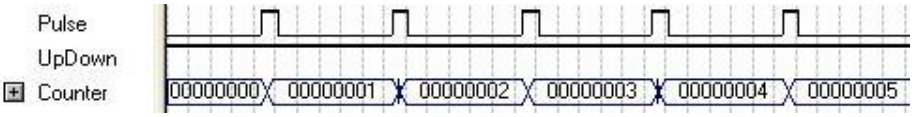
With the start of the measurement there is a reset of the 32-bit counter that begins to count again from 0. Besides the counting pulses also the direction rotation is evaluated in the single, double and quadruple mode. In this way it is possible that the counter counts downwards and an overflow occurs already with the first pulse. This case shall be taken into consideration for the later analysis.

Example: Counting direction downwards, five counting pulses within the time period.



The 32-bit counter counts from 0x00000000 to 0xFFFFFFFB. The result of the frequency measurement would be 0xFFFFFFFB.

Example: Counting direction upwards, five counting pulses within the time period.



The 32-bit counter counts from 0x00000000 to 0x00000005. The result of the frequency measurement would be 0x00000005.

8.3.4 Compare logic

Absolute Mode

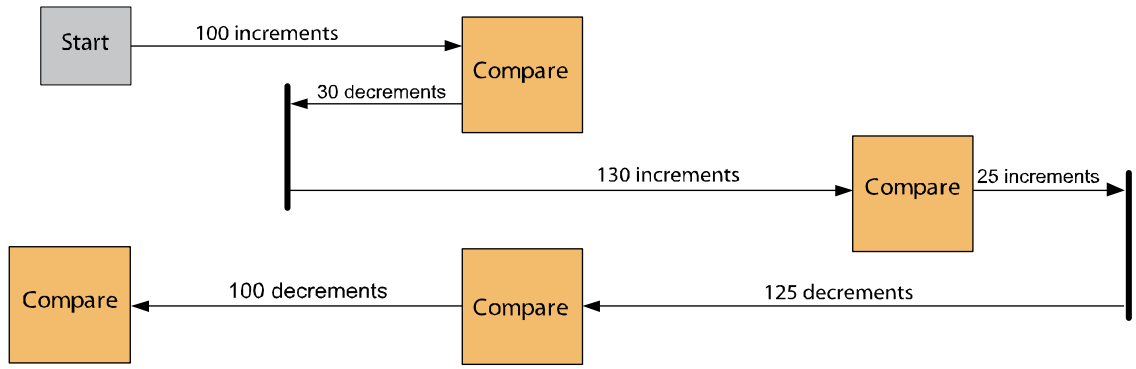
In the absolute mode a compare value can be given. As soon as the counter value is identical to the compare value, the counter value is latched, either an event is realized or a synchro signal (see chapter 8.3.7) is given.

Modulo Mode

In the modulo mode also a compare value is given. With the activation of the compare logic the current counter value „X_N“ is stored internally. At the counter value „X_N + compare value“ or „X_N – compare value“ the counter value is latched, either an event realized or a synchro signal (see chapter 8.3.7) given. The counter value „X_{N+1}“ is stored internally. At the new counter value„X_{N+1} + compare value“ or „X_{N+1} – compare value“ the counter value is latched, either an event is realized or a synchro signal (see chapter 8.3.7) is given until the compare logic is disabled.

Example: compare value = 100

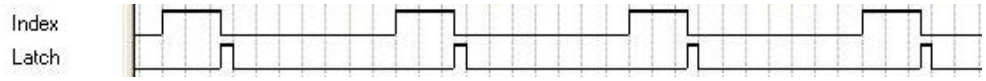
Fig. 8-5: Compare logic



8.3.5 Index and reference point logic

The index signal of an incremental encoder can be used either for latching or for latching and deleting of the counter. Here it can be set whether the rising or falling edge of the index signal is evaluated. It can be latched only once with the first index signal or continuously with each index signal.

Example: Index logic with falling edge in the continuous mode



In addition to the index logic the reference point logic can be activated. When using the reference point logic additionally to the index, the falling edge of the external reference signal is evaluated (Pin 7, 9 at M23 female connector). In this case the index signal is only evaluated if the falling edge arrived before at the reference signal. After each latch the condition for the reference signal must be fulfilled newly before the next index is evaluated and realises a latch.

Example: Index logic with rising edge in the continuous mode
Reference point logic with falling edge active

8.3.6 Digital trigger

The digital 24 V trigger input of the module can be used for latching the counter value. You can select if the rising edge, the falling edge or both edges of the signal shall be evaluated. Via a counter it can be defined which edge realises the latch of the counter.

Example: rising edge is evaluated, counter on 1

Each rising edge of the trigger signal realises a latch.

Example: rising edge is evaluated, counter on 3

One in three rising edges of the trigger signal realises a latch.

Example: both edges are evaluated, counter on 3

One in three edges (no matter if rising or falling) of the trigger signal realises a latch.

To avoid disturbances of the external trigger signal, a software-programmable digital filter, can be used. Filter times from 200 ns to 13.1 ms can be set.
If the filter is activated, each pulse, no matter whether positive or negative, that is smaller than the set filter time, is suppressed.

8.3.7 Synchro function

With the compare function (see chapter 8.3.4) a synchro signal can be given. This synchro signal can be lead to further Ethernet modules and realise there different events.

In the incremental counter function the signal at the synchro input can be used for latching the counter value.

8.3.8 Programmable filters for counter inputs

To avoid disturbances caused by external signals, a digital filter can be used. This filter can be set by software. For each of the inputs (A, B, C or D) the filter can be parameterized separately. Filter times from 100 ns to 26.2 ms can be set. If the filter is activated, each positive or negative pulse, which is smaller than the set filter time, is suppressed.

9 APPENDIX

9.1 Glossary

Term	Description
A/D converter	*=ADC* An electronic device that produces a digital output directly proportional to an analog signal output.
Baud rate	Serial communications data transmission rate expressed in bits per second (b/s).
D/A converter	*= DAC* A device that converts digital information into a corresponding analog voltage or current.
Data acquisition	Gathering information from sources such as sensors and transducers in an accurate, timely and organized manner. Modern systems convert this information to digital data which can be stored and processed by a computer.
DC voltage	*= Direct current voltage* DC voltage means that the voltage is constant respecting the time. It will always fluctuate slightly. Especially at switching on and switching off the transition behaviour is of high significance.
Digital signal	A signal which has distinct states. Digital computers process data as binary information having either 1 or 0 states.
Driver	A part of the software that is used to control a specific hardware device such as a data acquisition board or a printer.
FIFO	*= First In First Out* The first data into the buffer is the first data out of the buffer.
Gain	The factor by which an incoming signal is multiplied.
Input impedance	The measured resistance and capacitance between the high and low inputs of a circuit.
Input level	The input level is the logarithmic relation of two electric units of the same type (voltage, current or power) at the signal input of any receive device. The receive device is often a logic level that refers to the input of the switch. The input voltage that corresponds with logic “0” is here between 0 and 15 V, and the one that corresponds with logic “1” is between 17 and 30 V.
Limit value	Exceeding the limit values, even for just a short time, can lead to the destruction or to a loss of functionality.
MUX	*= Multiplexer* An array of semiconductor or electromechanical switches with a common output used for selecting one of a number of input signals.
Operating voltage	The operating voltage is the voltage that occurs during the continuous operation of the device. It may not exceed the continuous limit voltage. Furthermore, any negative operation situations, such as net overvoltages over one minute at switching on the device must be taken in consideration.

Optical isolation	The technique of using an optoelectric transmitter and receiver to transfer data without electrical continuity, to eliminate high-potential differences and transients.
Output voltage	The nominal voltage output reading when shaft is rotated to full range, expressed in volts DC /Vo DC).
Parameter	The parameters of a control comprise all for the control process required numeric values, e.g. for limit values and technological number.
Reference voltage	Reference voltages are stable voltages that are used as reference unit. From them voltages can be derived that are required for example in current supplies and in other electronic circuitries.
Resolution	The smallest significant number to which a measurement can be determined. For example a converter with 12-bit resolution can resolve 1 part in 4096.
Sensor	A device that responds to physical stimuli (heat, light, sound, pressure, motion, etc.) and produces a corresponding electrical output.
Throughput rate	The maximum repetitive rate at which data conversion system can operate with a specified accuracy. It is determined by summing the various times required for each part of the system and then by taking the inverse of this time.
Trigger	Internal trigger: A software generated event that starts an operation. External trigger: An analog or digital hardware event from an external source that starts an operation. Digital trigger: An event that occurs at a user-selected point on a digital input signal. The polarity and sensitivity of the digital trigger can often be programmed.

9.2 Index