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SPIRIT OF EXCELLENCE

TECHNICAL

DESCRIPTION

MSX-E3511

Ethernet analog output system

DIN EN ISO 9001:2008 certified

Edition: 02.01-02/2012

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.
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Warning

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

Personal injury

Damage to the Ethernet system, the PC and peripherals

Pollution of the environment

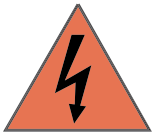
- Protect yourself, others and the environment!
- Read the safety precautions (yellow leaflet) carefully!

  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:

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**.

Contents

Figures

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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	Function description (analog outputs) including pin assignment
4	Description of the function-specific pages of the MSX-E web interface
5	List of technical data and limit values of the MSX-E system
6	Appendix with glossary and index
7	Contact and support address

1 Definition of application, user, handling

1.1 Definition of application

1.1.1 Intended use

The Ethernet system **MSX-E3511** for analog 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-E3511** must not be used as safety-related part (SRP).

The Ethernet system **MSX-E3511** must not be used for safety-related functions.

The Ethernet system **MSX-E3511** must not be used in potentially explosive atmospheres.

The Ethernet system **MSX-E3511** 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 5.4) 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.

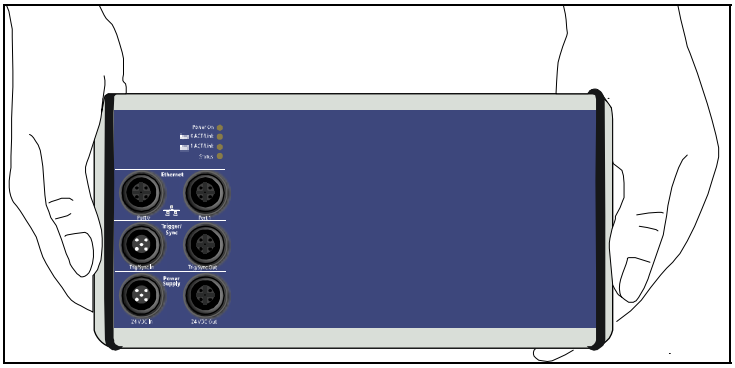
1.3.2 Country-specific regulations

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-E3511** 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-E3511** are described in brief. Furthermore, you will find a general block diagram of the MSX-E system.

2.1 Functions and features

The intelligent Ethernet system **MSX-E3511** has eight analog outputs with 16-bit resolution.

By means of an external trigger, analog outputs on multiple systems can be updated simultaneously. The system can be configured over either the integrated web interface or SOAP commands.

Via an integrated Ethernet switch, the system 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 extended operating temperature range from -40 °C to +85 °C and is equipped with numerous protective circuits. Error diagnoses are quickly identified by means of the “Status” LED display.

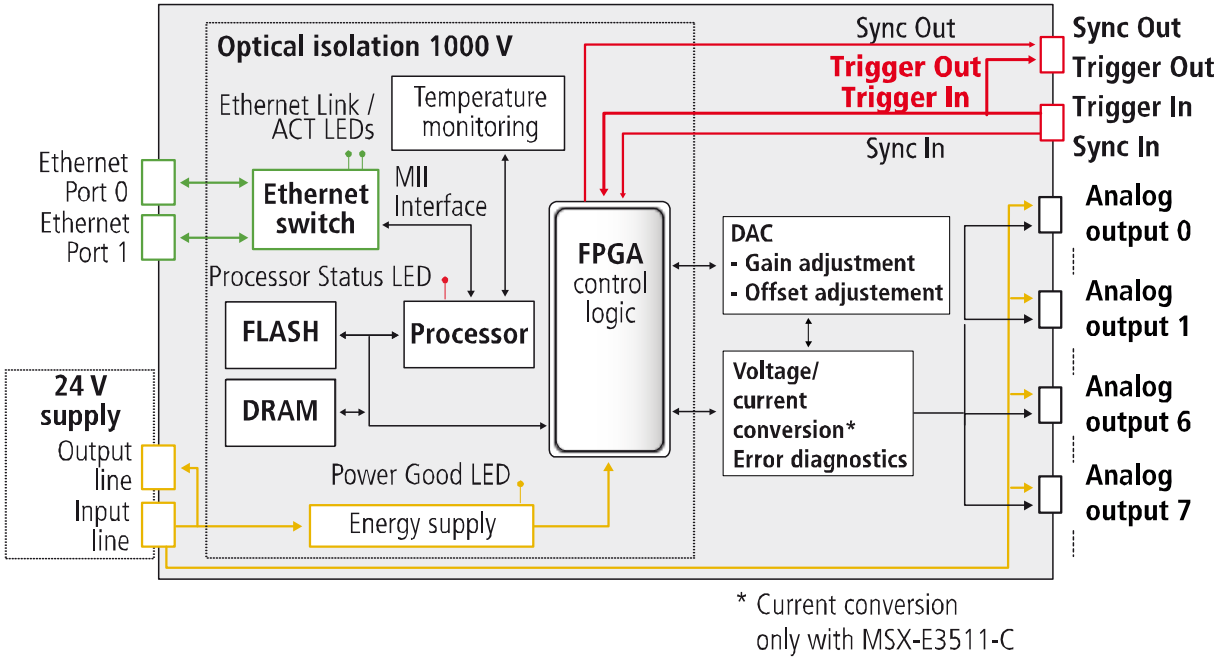
The electronics are no longer in the computer itself but in an external housing connected to the computer via Ethernet. As the Ethernet system is attached in direct vicinity of the actuator, the function of the latter is no longer affected by long cables. The length of the (Ethernet) connection cable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

Features:

- 8 analog outputs, 16-bit, can be configured individually as voltage or current outputs
- Function generator for the output of various signal curves such as sine curves, sawtooth curves, etc.
- Analog output: can be controlled by means of an external trigger (digital 24 V trigger input)
- Web interface to configure, control and monitor the analog output
- 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-E3511: Block diagram



3 Function description: Analog outputs

The Ethernet system **MSX-E3511** has eight analog outputs for actuators.

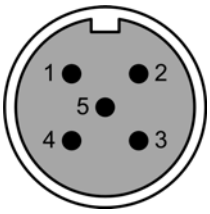
Each output can be configured either as voltage output or current output.
For voltage outputs, you can also define if the voltage should be output in unipolar or bipolar mode.
In unipolar mode, the resolution is reduced from 16-bit to 15-bit.

IMPORTANT!
The current outputs can only be used in unipolar mode!

3.1 Pin assignment

To each M12 female connector, one actuator can be connected.
One analog output consists of output + and output -. Optionally, a 24 V supply is available. If required, an actuator can be connected to it.

Table 3-1: Pin assignment: Analog outputs

Pin No.	Female connector, 5-pin, M12	Cable (black) Lead colour
1	+24 V (supply)	brown
2	Analog output -	white
3	GND (supply)	blue
4	Analog output +	black
5	not connected	grey
		

3.2 Diagnosis function (MSX-E3511-C)

Each output has a diagnosis function in order to detect the following errors:

- short-circuit (voltage output)
- line break (current output)
- overtemperature (voltage and current output).

If one of these errors occurs, the respective output is switched off.
As soon as the short-circuit or line break has been eliminated, a rearm has to be carried out to reactivate the output (see also Chapter 4.1.2). This means that the output is set to the voltage or current value that was programmed before the error occurred. A new value can only be defined after the rearm event.

3.3 Digital trigger

The digital trigger allows you to update one or more analog outputs at the same time with an external signal. Likewise, it is possible to use the synchro trigger for this purpose.

3.4 Watchdog

The Ethernet system **MSX-E3511** has a 16-bit watchdog, which is programmable in three time units (µs, ms, s). The watchdog is used to reset the analog outputs to 0 V after a specific time.

Operation of the watchdog

1. After the system reboot, the watchdog is in “Uninitialised” state.
   It can be initialised and activated (“Running” state) over the web interface or by a software function.
2. With the first write access to the outputs, the watchdog is started: The watchdog time is loaded and the watchdog starts counting down.
   As long as the watchdog time has not elapsed, the watchdog is triggered with every further write access to the outputs, i. e. the watchdog time is reloaded.
3. When the watchdog time has elapsed, the watchdog is put in “Overrun” state and all analog outputs are set to 0 V or 0 mA. In “Overrun” state, any write access to the outputs is ignored.
4. To re-enable write access, the watchdog first has to be put in “Stopped” state (web interface) or deactivated by a software function.
   To reactivate the watchdog, it has to be put in “Running” state again or reinitialised and reactivated by a software function.

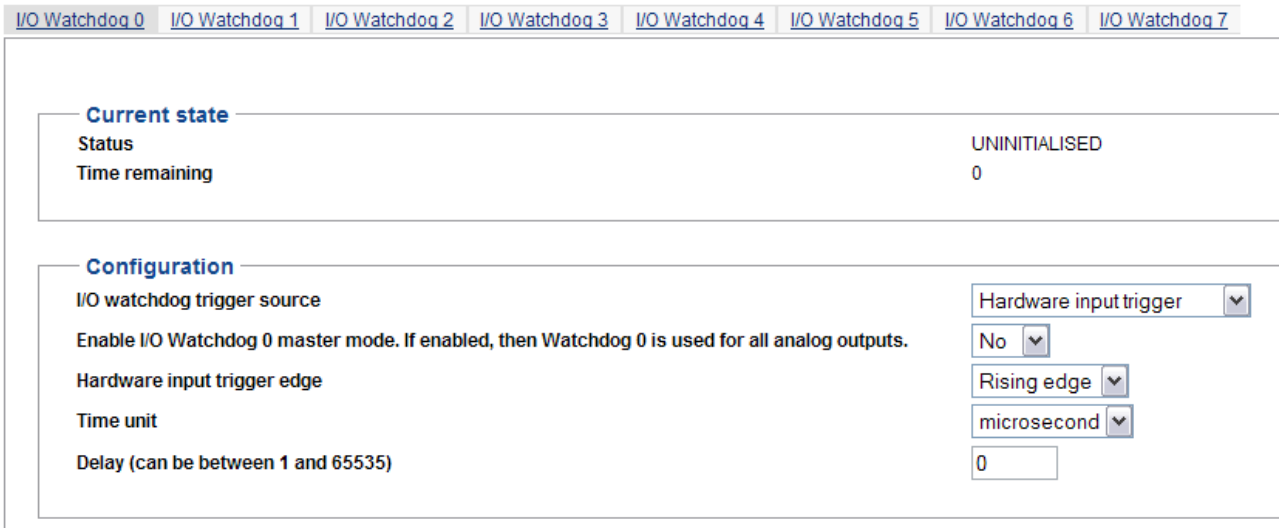
4 Web interface: Quick access to the MSX-E system

4.1 "I/O Configuration"

In this manual, the function-specific pages of the **MSX-E3511** web interface, which are located under the menu item "I/O Configuration", 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).

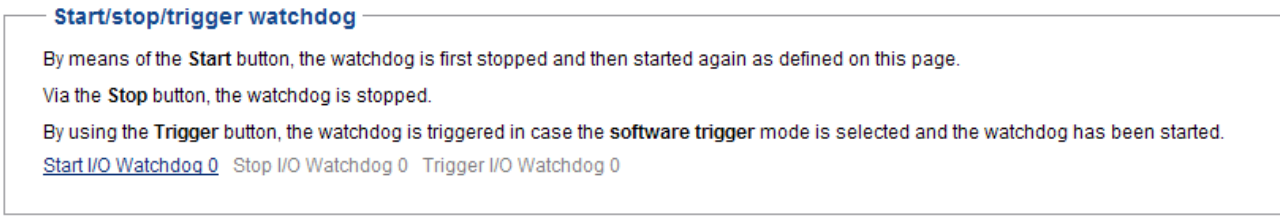
4.1.1 Menu item "I/O Watchdogs"

Fig. 4-1: MSX-E web interface: "I/O Watchdogs"



On this page, you can configure the I/O watchdogs of the analog outputs by defining the type of trigger, time unit and watchdog time. There is the option of using the configuration of Watchdog 0 for all watchdogs.
Also, you can check the status of each watchdog. Chapter 3.4 of this manual describes how the watchdog operates.

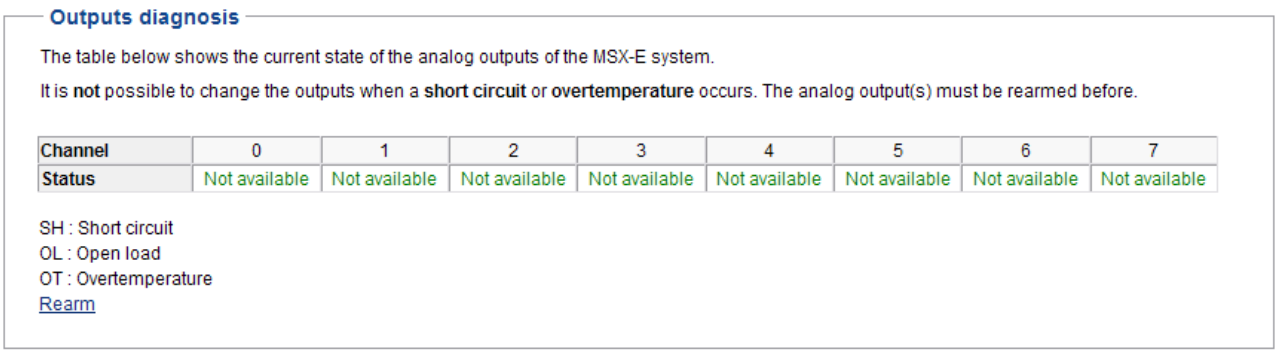
Fig. 4-2: I/O Watchdogs: Start/stop/trigger watchdog



In this section, the watchdog can be started and stopped.
If the software trigger is selected, this can be activated after the start of the watchdogs via the button "Trigger I/O Watchdog".

4.1.2 Menu item “Analog outputs”

Fig. 4-3: Analog outputs: Outputs diagnosis



Outputs diagnosis

The table below shows the current state of the analog outputs of the MSX-E system.

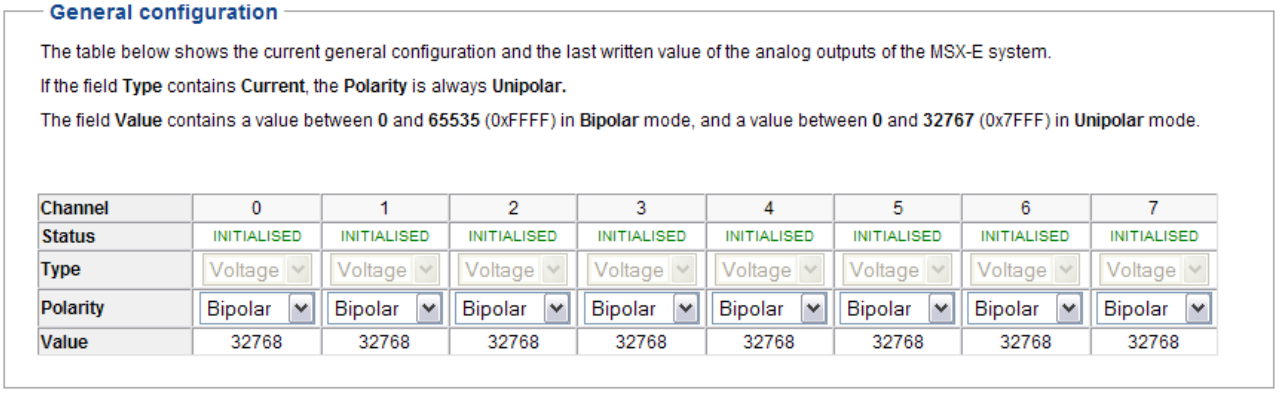
It is **not** possible to change the outputs when a **short circuit** or **overtemperature** occurs. The analog output(s) must be rearmed before.

Channel	0	1	2	3	4	5	6	7
Status	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available

SH : Short circuit
OL : Open load
OT : Overtemperature
Rearm

If a short-circuit, line break or overtemperature occurs at the analog outputs, this will be specified in the table above. Please find further information on the diagnosis function in Chapter 3.2 of this manual.

Fig. 4-4: Analog outputs: General configuration



General configuration

The table below shows the current general configuration and the last written value of the analog outputs of the MSX-E system.

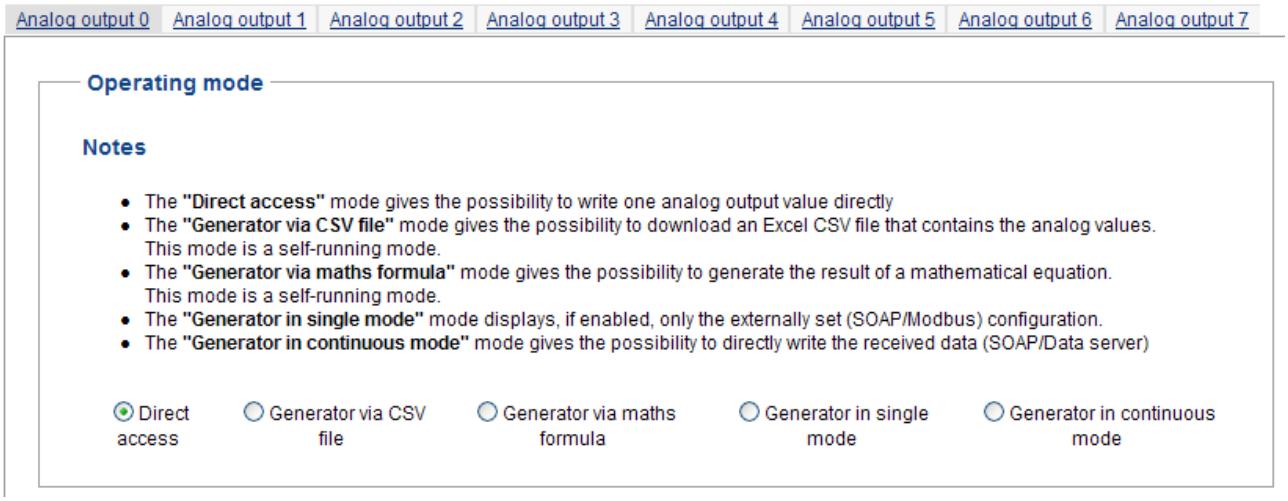
If the field **Type** contains **Current**, the **Polarity** is always **Unipolar.**

The field **Value** contains a value between **0** and **65535** (0xFFFF) in **Bipolar** mode, and a value between **0** and **32767** (0x7FFF) in **Unipolar** mode.

Channel	0	1	2	3	4	5	6	7
Status	INITIALISED	INITIALISED	INITIALISED	INITIALISED	INITIALISED	INITIALISED	INITIALISED	INITIALISED
Type	Voltage	Voltage	Voltage	Voltage	Voltage	Voltage	Voltage	Voltage
Polarity	Bipolar	Bipolar	Bipolar	Bipolar	Bipolar	Bipolar	Bipolar	Bipolar
Value	32768	32768	32768	32768	32768	32768	32768	32768

In the general configuration table, you can select for each output to be a voltage or current output. For the current outputs, “unipolar” is predefined as the polarity (see also Chapter 3).

Fig. 4-5: Analog outputs: Operating mode

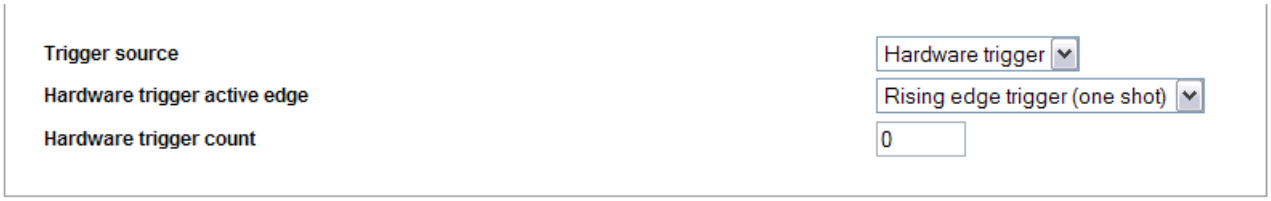


The analog output values can be provided to the MSX-E system in different ways:

- **Direct access:** The analog output value is entered directly on the web interface in the section "Set value". This mode cannot be used if for another output, a "Generator" mode is selected and, as a sampling rate, the hardware trigger input or the synchro trigger.
- **Generator via CSV file:** The analog output values are stored in a CSV table, which can be uploaded and edited via the web interface.
- **Generator via maths formula:** The analog output values are computed with a mathematical formula, which is entered on the web interface. Selecting a sampling rate of 20 kHz or 40 kHz enables you to use a preset formula.
- **Generator in single mode:** The analog values of the output cycle are provided by SOAP or Modbus commands. The externally set configuration is displayed on the web interface.
- **Generator in continuous mode:** The analog output values are continuously provided by SOAP commands or a data server. The value output of all analog outputs configured in this mode can be started simultaneously.

a) "Direct access" mode

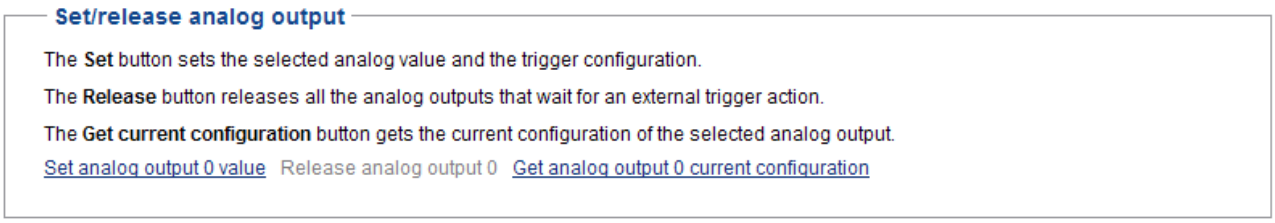
Fig. 4-6: Analog outputs: Trigger configuration



In each mode, you have the possibility to use a hardware or synchro trigger for the analog value output.

If the hardware trigger is selected, the type of edge in case of which the MSX-E system identifies a trigger has to be defined.
In addition, the number of edges after which an acquisition is started has to be specified. If an output is configured in a "Generator" mode, this value is always 1. Otherwise, this value can be between 1 and 65535.

Fig. 4-7: Analog outputs: Set/release analog output

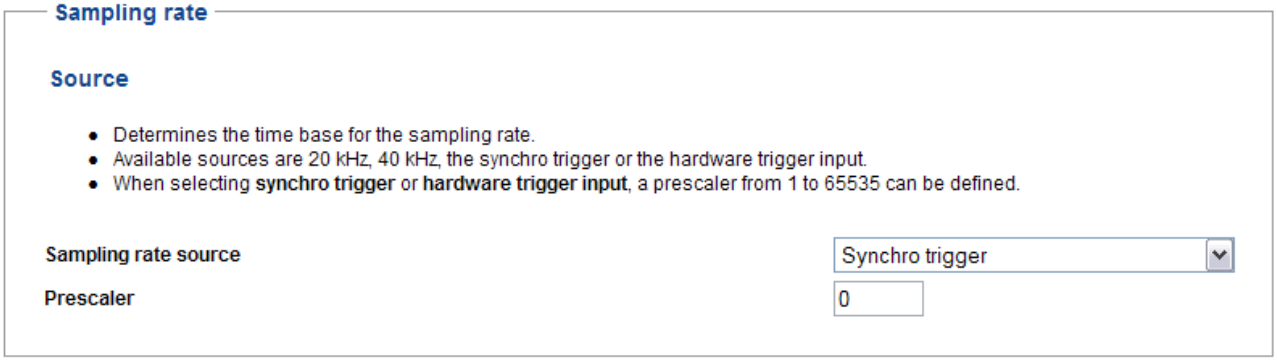


By clicking on the buttons, the following actions are performed:

- **Set analog output value:** The output is set directly or after a trigger event.
- **Release analog output value:** The trigger logic is released.
- **Get analog output current configuration:** The last set configuration is displayed.

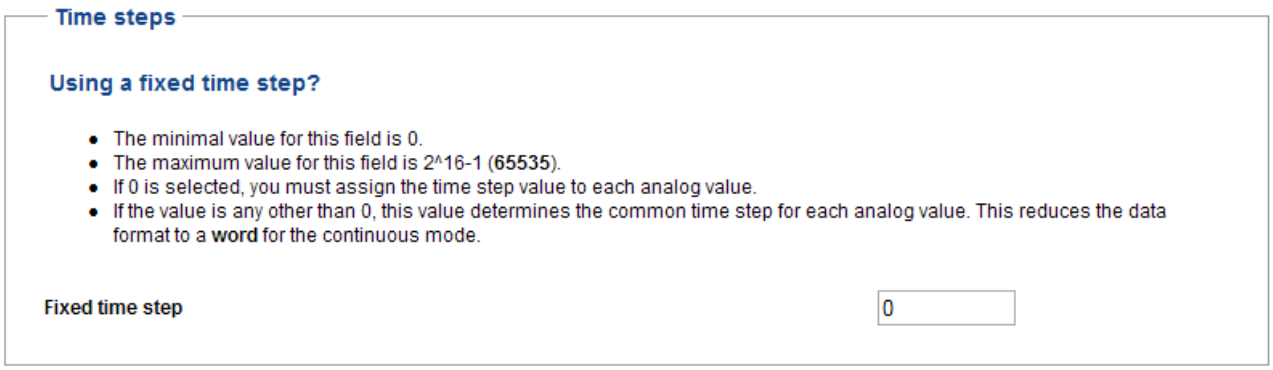
b) „Generator"-Modus

Fig. 4-8: Analog outputs: Sampling rate



In each "Generator" mode, the sampling rate needs to be selected.
In the event that the hardware or synchro trigger is selected, also the frequency divisor of the trigger input has to be indicated.

Fig. 4-9: Analog outputs: Time steps

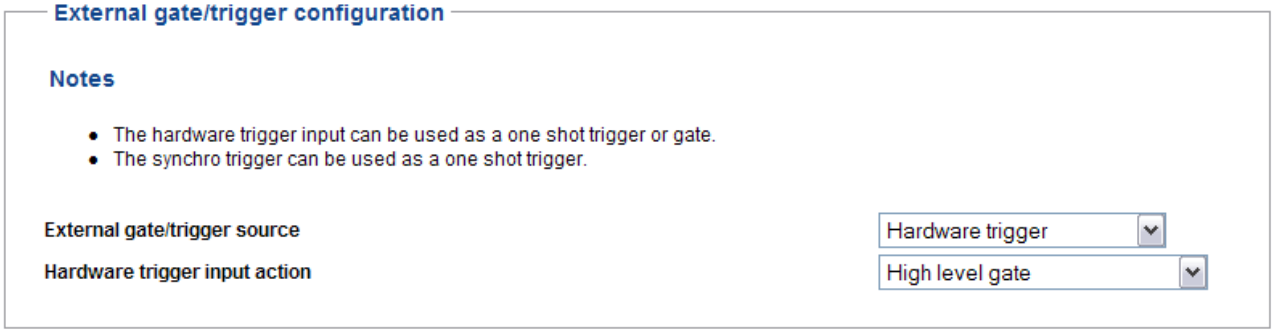


The time interval, that is the time between the output of two analog values, has to be specified. This value may be 65535 as a maximum. If you enter 0, each analog value has to be assigned a time interval.

Fig. 4-10: Analog outputs: Number of cycles

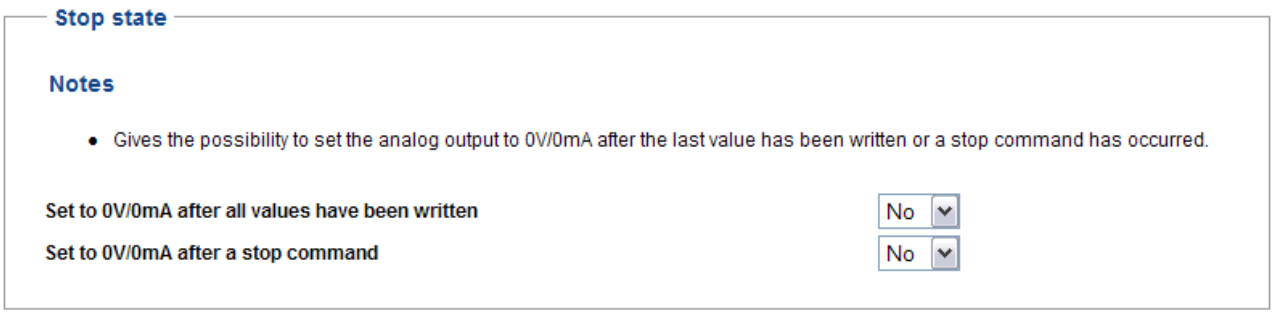
While in the mode “Generator in continuous mode” new values are continuously output, an output cycle with defined values is rerun in the other modes.
If you enter the value 0 in the field in the section above, the number of these cycles is infinite.

Fig. 4-11: Analog outputs: External gate/trigger configuration



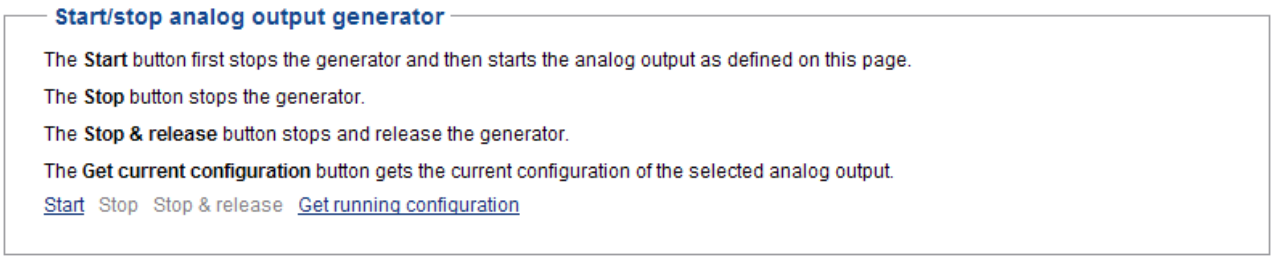
The hardware trigger can be released after an edge or a gate of the external signal.

Fig. 4-12: Analog outputs: Stop state



The analog output can be set to 0 V or 0 mA once all values have been output or a stop command has been executed.

Fig. 4-13: Analog outputs: Start/stop analog output generator



In this section, the output of the analog values can be started and stopped.
By clicking on the button “Stop & release”, the output channel is stopped and released.
The last set configuration can be displayed via the button “Get running configuration”.

5 Technical data and limit values

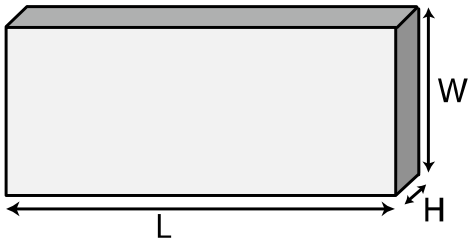
5.1 Electromagnetic compatibility (EMC)

The Ethernet system **MSX-E3511** 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.

5.2 Mechanical structure

Fig. 5-1: MSX-E3511: Dimensions



154 mm (L) x 110 mm (W) x 50 mm (H)

Weight:	620 g 680 g (with MX-Rail)

Fig. 5-2: MSX-E3511: View from above

5.3 Versions

The Ethernet system **MSX-E3511** is available in the following versions:

Table 5-1: MSX-E3511: Versions

Version	Sensor type
MSX-E3511	8 analog outputs (voltage)
MSX-E3511-C	8 analog outputs (voltage and/or current)

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).

5.4 Limit values

Height:	2000 m over NN
Operating temperature:	-40 °C to +85 °C
Storage temperature:	-40 °C to +85 °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):	The following values apply (±10 %): 150 mA (without load) 310 mA (current outputs configured) 410 mA (voltage outputs configured)
Safety:	
Degree of protection:	IP 65[1]
Optical isolation:	1000 V
Reverse polarity protection:	1 A max.

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.

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

5.4.1 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)

5.4.2 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.

5.4.3 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)

5.4.4 Analog outputs

Number of outputs:	8
Resolution:	16-bit (bipolar) 15-bit (unipolar)
Linearity error (±10 V):	±4 LSB typ.
Settling time:	
FSR (20 V):	40 µs (2 V/µs)
0.1 % FSR (20 V):	1 ms typ.
0.01 % FSR (20 V):	4 ms typ.
Temperature drift:	±100 µV/°C typ.
Optical isolation:	1000 V
Output range:	0-10 V (±10 V) (voltage output) 0-20 mA (current output)
Overvoltage protection:	±14 V
Output current/load:	15 mA, 680 Ω min. (voltage output) 20 mA, 550 Ω max. (current output)
Short-circuit current:	±20 mA (voltage output) ±32 mA (current output)
Output voltage after reset:	0 V voltage output, not calibrated
Current supply of actuators:	800 mA max. (for all channels)

5.4.5 Watchdog

Number:	1
Watchdog depth:	16-bit
Programmability:	1 µs to 65535 s
Time base:	µs, ms, s (programmable)

6 Appendix

6.1 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.

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.

FSR
= Full Scale Range

FSR is the usable measurement range.

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.

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 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.

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.

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

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.

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.

6.2 Index

7 Contact and support

Do you have any questions? Write or phone us:

Address: ADDI-DATA GmbH
Airpark Business Center
Airport Boulevard B210
77836 Rheinmünster
Germany

Phone: +49 7229 1847-0
Fax: +49 7229 1847-222

E-mail: info@addi-data.com

Manual and software download from the Internet:

www.addi-data.com