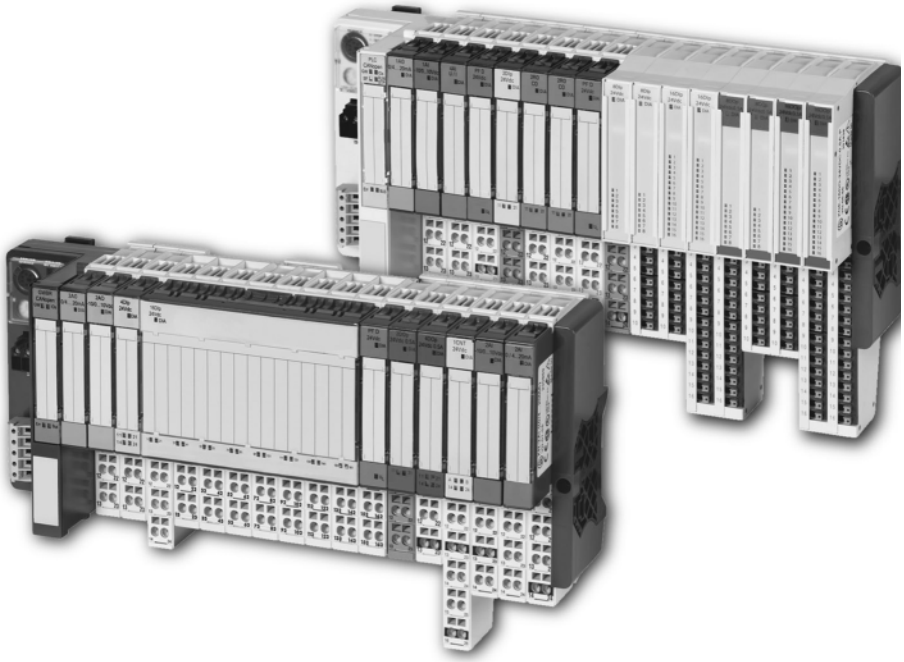
XNE-GWBR-2ETH-IP
Gateway



Powering Business Worldwide

Imprint

Manufacturer
Eaton Automation AG
Spinnereistrasse 8-14
CH-9008 St. Gallen
Switzerland
www.eaton-automation.com
www.eaton.com

Support
Region North America
Eaton Corporation
Electrical Sector
1111 Superior Ave.
Cleveland, OH 44114
United States
877-ETN-CARE (877-386-2273)
www.eaton.com

Other regions
Please contact your supplier or send an
E-mail to:
automation@eaton.com

Original manual
The German version of this document is the original manual.

Translations of the original manual
All non-German editions of this document are translations of the original manual.

Editorial department
Monika Jahn

Safety regulations

Before commencing the installation:

- Disconnect the power supply of the device.
- Ensure that devices cannot be accidentally restarted.
- Verify isolation from the supply.
- Earth and short circuit.
- Cover or enclose neighboring units that are live.
- Follow the engineering instructions of the device concerned.
- Only suitably qualified personnel in accordance with EN 50110-1/-2 (DIN VDE 0105 Part 100) may work on this device/system.
- Before installation and before touching the device ensure that you are free of electrostatic charge.
- The functional earth (FE) must be connected to the protective earth (PE) or to the potential equalization. The system installer is responsible for implementing this connection.
- Connecting cables and signal lines should be installed so that inductive or capacitive interference do not impair the automation functions.
- Install automation devices and related operating elements in such a way that they are well protected against unintentional operation.
- Suitable safety hardware and software measures should be implemented for the I/O interface so that a line or wire breakage on the signal side does not result in undefined states in the automation devices.
- Ensure a reliable electrical isolation of the low voltage for the 24 volt supply. Only use power supply units complying with IEC/HD 60364-4-41 (DIN VDE 0100 Part 410).
- Deviations of the mains voltage from the rated value must not exceed the tolerance limits given in the specifications, otherwise this may cause malfunction and dangerous operation.
- Emergency stop devices complying with IEC/EN 60204-1 must be effective in all operating modes of the automation devices. Unlatching the emergency-stop devices must not cause restart.
- Devices that are designed for mounting in housings or control cabinets must only be operated and controlled after they have been installed with the housing closed. Desktop or portable units must only be operated and controlled in enclosed housings.
- Measures should be taken to ensure the proper restart of programs interrupted after a voltage dip or failure. This should not cause dangerous operating states even for a short time. If necessary, emergency-stop devices should be implemented.
- Wherever faults in the automation system may cause damage to persons or property, external measures must be implemented to ensure a safe operating state in the event of a fault or malfunction (for example, by means of separate limit switches, mechanical interlocks etc.).
- The electrical installation must be carried out in accordance with the relevant regulations (e. g. with regard to cable cross sections, fuses, PE).

- All work relating to transport, installation, commissioning and maintenance must only be carried out by qualified personnel. (IEC/HD 60364 (DIN VDE 0100) and national work safety regulations).
- All shrouds and doors must be kept closed during operation.

Table of contents

1 About this manual

1.1 Documentation concept

This manual contains all information about the XI/ON gateway for EtherNet/IP of the product series XI/ON ECO (XNE-GWBR-2ETH-IP).

The following chapters contain a short XI/ON system description, a description of the field bus system EtherNet/IP, exact information about function and structure of the gateway as well as all bus-specific information concerning the connection to automation devices, the maximum system extension etc.

The bus-independent I/O-modules for XI/ON as well as all further fieldbus-independent chapters such as mounting, labelling etc. are described in separate manuals:

- MN05002010Z
  User Manual XI/ON
  Digital I/O-Modules, Supply Modules
- MN05002011Z
  User Manual XI/ON
  Analog I/O-Modules
- MN05002012Z
  User Manual XI/ON
  XN-1CNT-24VDC
- MN05002035Z
  User Manual XI/ON
  XNE-2CNT-2PWM
- MN05002013Z
  User Manual XI/ON
  XN-1RS232
- MN05002014Z
  User Manual XI/ON
  XN-1RS485/422
- MN05002015Z
  User Manual XI/ON
  XN-1SSI
- MN05002016Z
  User Manual XI/ON
  XNE-1SWIRE

Furthermore, the manual mentioned above contains a short description of the project planning and diagnostics software for Eaton I/O-systems, the software I/O-ASSISTANT.

1.2 Description of symbols used

Warning

This sign can be found next to all notes that indicate a source of hazards. This can refer to danger to personnel or damage to the system (hardware and software) and to the facility.

This sign means for the operator: work with extreme caution.

Attention

This sign can be found next to all notes that indicate a potential hazard.

This can refer to possible danger to personnel and damages to the system (hardware and software) and to the facility.

Note

This sign can be found next to all general notes that supply important information about one or more operating steps.

These specific notes are intended to make operation easier and avoid unnecessary work due to incorrect operation.

1.3 Overview

Attention

Please read this section carefully. Safety aspects cannot be left to chance when dealing with electrical equipment.

This manual includes all information necessary for the prescribed use of the gateway XNE-GWBR-2ETH-IP. It has been specially conceived for personnel with the necessary qualifications.

1.3.1 Prescribed use

Appropriate transport, storage, deployment and mounting as well as careful operating and thorough maintenance guarantee the trouble-free and safe operation of these devices.

Warning

The devices described in this manual must be used only in applications prescribed in this manual or in the respective technical descriptions, and only with certified components and devices from third party manufacturers.

1.3.2 Notes concerning planning /installation of this product

Warning

All respective safety measures and accident protection guidelines must be considered carefully and without exception.

2 XI/ON philosophy

2.1 The basic concept

XI/ON is a modular I/O system for use in industrial automation. It connects the sensors and actuators in the field with the higher-level master.

XI/ON offers modules for practically all applications:

- Digital input and output modules
- Analog input and output modules
- Technology modules (counters, RS232 interface...)

A complete XI/ON station counts as **one** station on the bus and therefore occupies **one** fieldbus address in any given fieldbus structure. A XI/ON station consists of a gateway, power supply modules and I/O modules.

The connection to the relevant fieldbus is made via the bus-specific gateway, which is responsible for the communication between the XI/ON station and the other fieldbus stations.

The communication within the XI/ON station between the gateway and the individual XI/ON modules is regulated via an internal module bus.

Note

The gateway is the only fieldbus-dependent module on a XI/ON station. All other XI/ON modules are not dependent on the fieldbus used.

2.1.1 Flexibility

All XI/ON stations can be planned to accommodate the exact number of channels to suit your needs, because the modules are available with different numbers of channels in block and slice design.

A XI/ON station can contain modules in any combination, which means it is possible to adapt the system to practically all applications in automated industry.

2.1.2 Compactness

The slim design of the XI/ON modules (XN standard gateway 50.4 mm / 1.98 inch, XNE ECO gateway 34 mm/ 1.34 inch, XN standard slice 12.6 mm / 0.49 inch, XNE ECO slice 13 mm / 0.51 inch and block 100.8 mm / 3.97 inch) and their low overall height favor the installation of this system in confined spaces.

2.1.3 Easy to handle

Note

All XNE ECO modules can be used with XN standard products with tension clamp connection technology. Possible combinations, see Chapter 7.1.1 Combination possibilities in a XI/ON station, Page 173.

XI/ON modules of the standard line (XN standard modules

- All XI/ON modules of the standard line, with the exception of the gateway, consist of a base module and an electronics module.
- The gateway and the base modules are snapped onto a mounting rail. The electronics modules are plugged onto the appropriate base modules.
- The base modules of the standard line are designed as terminal blocks. The wiring is secured by tension clamp or screw connection.
- The electronics modules can be plugged or pulled when the station is being commissioned or for maintenance purposes, without having to disconnect the field wiring from the base modules.

XI/ON modules of the ECO line (XNE ECO modules)

- The XNE ECO electronics modules combine base module and electronics module in one housing.
- The gateway and the electronics modules are snapped onto a mounting rail.
- The electronics modules of the ECO line are designed as terminal blocks. The wiring is secured by "push-in" spring-type terminal.

2.2 XI/ON components

2.2.1 Gateways

The gateway connects the fieldbus to the I/O modules. It is responsible for handling the entire process data and generates diagnostic information for the higher-level master and the software tool I/O-ASSISTANT.

XNE ECO gateways

The XNE ECO gateways enlarge the product portfolio of XI/ON. They offer an excellent cost/performance ratio.

Further advantages of the XNE ECO gateways:

- At the moment available for PROFIBUS-DP, CANopen, Modbus TCP and EtherNet/IP
- Low required space: width 34 mm/ 1.34 inch
- Integrated power supply
- Can be combined with all existing XN standard modules (with tension clamp connection technology) and XNE ECO modules
- Simple wiring of the fieldbus connection via "Push-in" tension clamp terminals or via RJ45-connectors of Ethernet gateways
- Automatic bit rate detection for PROFIBUS-DP and CANopen
- Setting of fieldbus address and bus terminating resistor (PROFIBUS-DP, CANopen) via DIP-switches
- Service interface for commissioning with I/O-ASSISTANT

Figure 1: Gateway XNE-GWBR-2ETH-IP

XN standard gateways

The standard line of XI/ON contains gateways with and gateways without an integrated power supply unit:

- Gateways with an integrated power supply unit: XN-GWBR-…
- Gateways without an integrated power supply unit: XN-GW-…

The integrated power supply unit U_{SYS} feeds the gateway and in a limited range (note the permitted current I_{MB}) the communication part of the connected I/O modules. Additionally, the field voltage distributed via the system interne current rail system is fed by the further voltage U_L. Because of this, a XN-GWBR gateway does not require the XN-BR-24VDC-D module which is necessary with XN-GW gateways.

Note

The gateway types XN-GW-… need an additional power supply module (bus refreshing module) which feeds the gateway an the connected I/O modules.

Figure 2: Gateway example: XN-GWBR-PBDP

2.2.2 Power supply modules

The power supply for gateways and I/O modules is provided by the power supply modules; therefore, it is not necessary to supply each individual module with a separate voltage.

Figure 3: Power supply module with base module

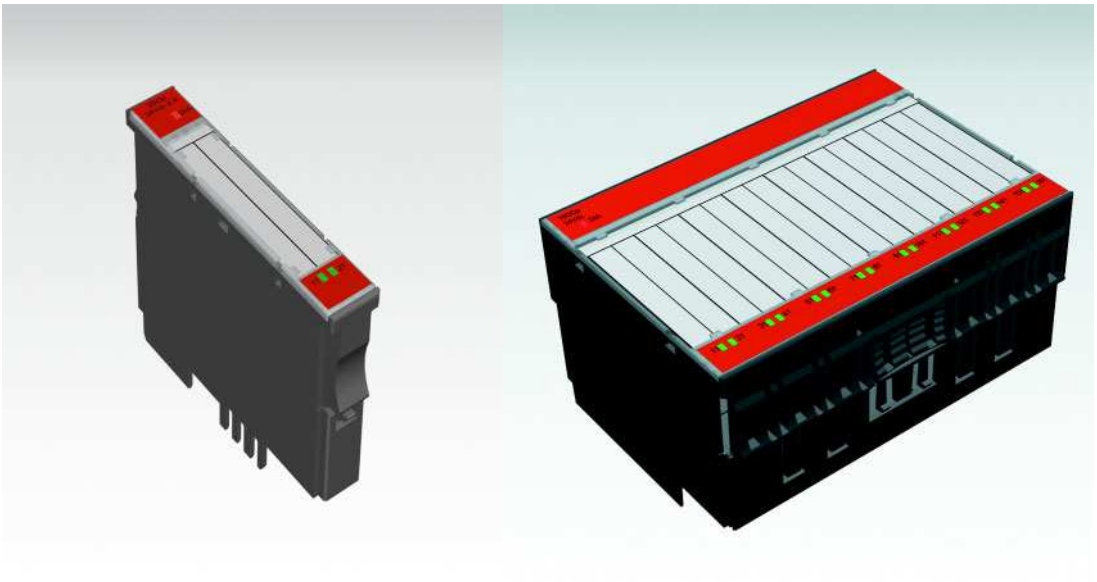
2.2.3 Electronics modules

The electronics modules contain the I/O-functions of the XI/ON modules (power supply modules, digital and analog input/output modules, and technology modules).

XN standard electronics modules

The XN standard electronics are plugged onto the base modules and are not directly connected to the wiring and can be plugged or pulled when the station is being commissioned or for maintenance purposes, without having to disconnect the field wiring from the base modules.

Figure 4: XN standard electronics module in slice design (left) and in block design (reght)



XNE ECO electronics modules

XNE ECO electronics modules with a high signal density and low channel price expand the XI/ON I/O bus terminal system.

Depending on type, up to 16 digital inputs and outputs can be connected on only 13 mm. This high connection density considerably reduces the mounting width required for typical applications.

All advantages at a glance:

- Space saving thanks to up to 16 channels on 13 mm / 0.51 inch width
- Cost saving thanks to electronics with integrated connection level
- High signal density
- Tool-less connection via "push-in" spring-type terminal technology for simple and fast mounting
- Flexible combinable with:
  - XN standard electronics modules with base modules with tension clamp connection technology,
  - XN standard gateways with an integrated power supply unit (XN-GWBR-…) and
  - XNE ECO gateways
- Simple assembly reduces error sources

Figure 5:
XNE ECO electronics module

2.2.4 Base modules

For the XN standard electonics modules, the field wiring is connected to the base modules. The base modules are constructed as terminals in block and slice designs. Base modules are available in versions with 3, 4 or 6 connection levels in tension clamp or in screw connection technology.

Figure 6: Base module with tension clamp connection

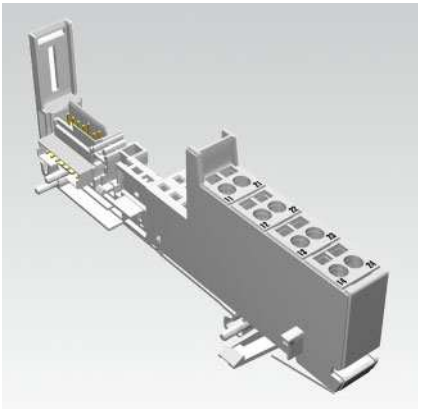


Figure 7: Base module with screw connection

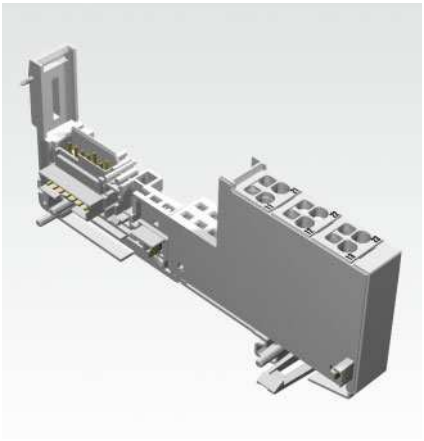
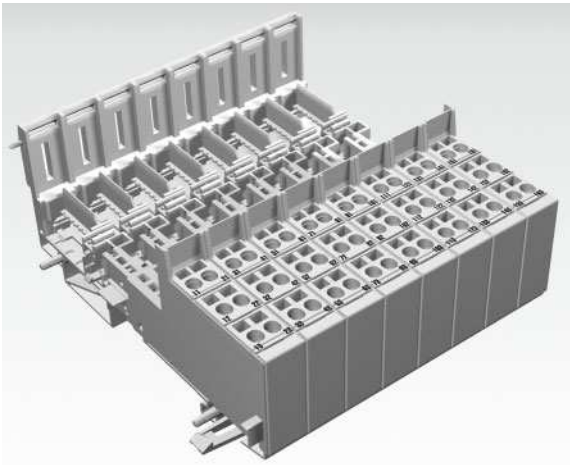


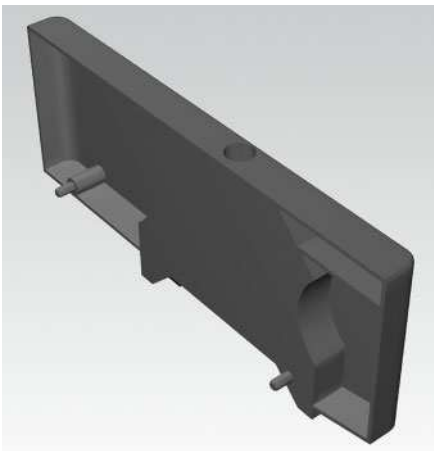
Figure 8: Base module in block design



2.2.5 End plate

An end plate on the right-hand side physically completes the XI/ON station. An end bracket mounted into the end plate ensures that the XI/ON station remains secure on the mounting rail even when subjected to vibration.

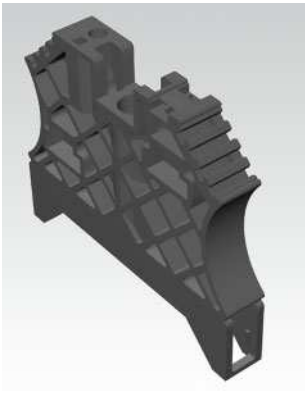
Figure 9:
End plate



2.2.6 End bracket

A second end bracket to the left of the gateway is necessary, as well as the one mounted into the end plate to secure the XI/ON station.

Figure 10:
End bracket



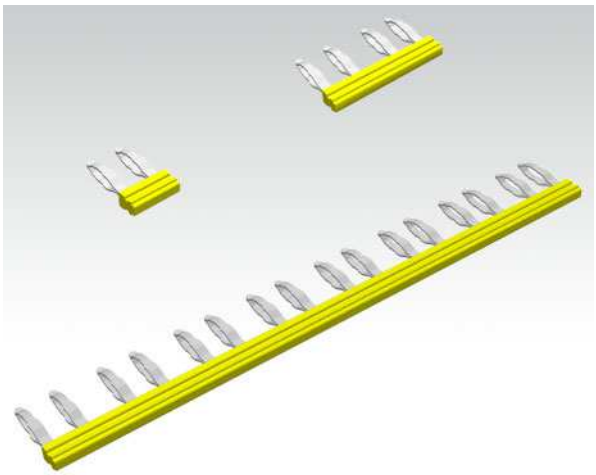
Note

The scope of delivery of each gateway contains an end plate and two end brackets.

2.2.7 Jumpers

Jumpers (QVRs) are used to bridge a connection level of a base module with 4 connection levels. They can be used to connect potentials in relay modules (bridging the relay roots); thus considerably reducing the amount of wiring.

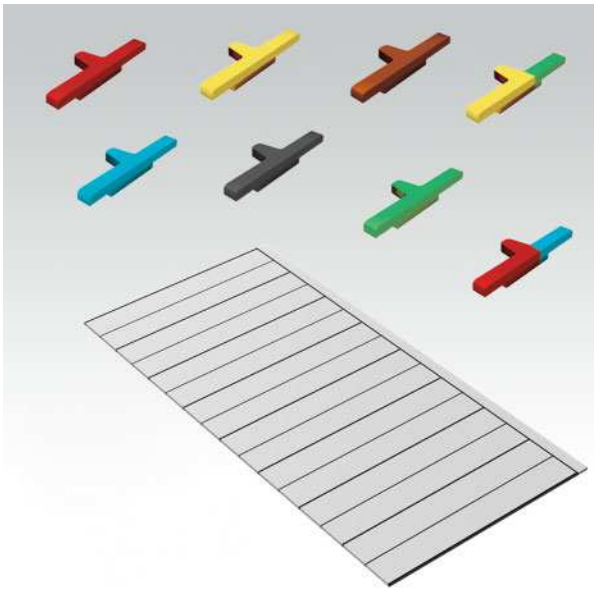
Figure 11: Jumpers



2.2.8 Marking material

- Labels: for labeling electronics modules.
- Markers: for colored identification of connection levels of base modules and XN electronics modules

Figure 12: Marking material



2.2.9 Shield connectionfor gateways

Note

The gateway attatchment is only suitable for XN-GW-PBDP-1.5MB and XN-GW-CANOPEN.

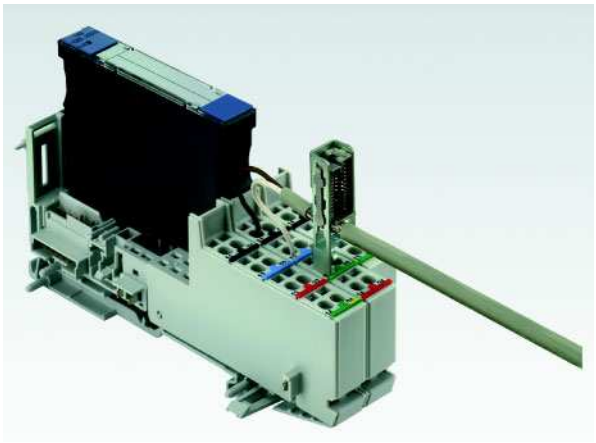
If the gateway is wired directly to the fieldbus, it is possible to shield the connection using an attachment (SCH-1-WINBLOC) on the gateway.

Figure 13: Shield connection (gateway)

2.2.10 Shield connection, 2-pole for analog modules

The 2-pole shield connection can be used to connect signal-cable shielding to the base modules of analog input and output modules.

Figure 14: Shield connection



3 EtherNet/IP

3.1 System description

Ethernet Industrial Protocol (EtherNet/IP) is a communication system for industrial applications.

It is used to exchange time-critical application information between industrial devices such as simple I/O devices (sensors/actuators) or even complex control devices (robots, programmable logic controllers, etc.).

EtherNet/IP is an open network because it uses:

- IEEE 802.3 Physical and Data Link standard
- Ethernet TCP/IP protocol suite (Transmission Control Protocol/Internet Protocol), the Ethernet industry standard.
- Common Industrial Protocol (CIP), the protocol that provides real-time I/O messaging and information/peer-to-peer messaging. ControlNet and DeviceNet networks also use CIP.

Note

For further infomation about CIP and EtherNet/IP, please contact also the user organization ODVA (www.odva.org).

3.1.1 IP (Internet Protocol)

The Internet Protocol is a connection-free transport protocol. Since the protocol does not use acknowledgement messages, telegrams can get lost. Therefore it is not suitable for safe data transfer. The main functions of the internet protocol are the addressing of hosts and the fragmentation of data packages.

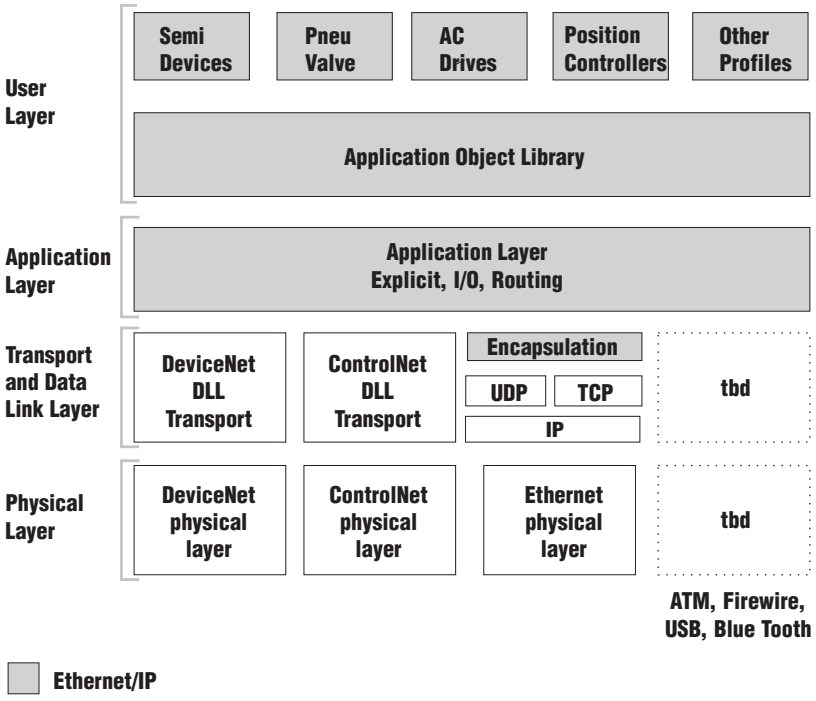
3.1.2 TCP (Transmission Control Protocol)

The Transmission Control Protocol (TCP) is a connection-oriented transport protocol and is based on the Internet Protocol. A safe and error-free data transport can be guaranteed by means of certain error diagnostic mechanisms. For example, the acknowledgement and time monitoring of telegrams.

UDP/IP (User Datagram Protocol)

UDP/IP provides the fast, efficient data transport necessary for real-time data exchange. To make EtherNet/IP successful, CIP has been added on top of TCP/UDP/IP to provide a common application layer.

Figure 15: EtherNet/IP in OSI 7 layer model



3.1.3 Network-topology

EtherNet/IP network uses an active star topology in which groups of devices are connected point-to-point to a switch.

Products with both transmission speeds (10 and 100 Mbit/s) can be used in the same network and most Ethernet switches will negotiate the speed automatically.

Transmission media

For communication via Ethernet, different transmission media can be used:

- coaxial cable (10Base5)
- optical fibre (10BaseF)
- twisted two-wire cable (10BaseT) with shielding (STP) or without shielding (UTP)

3.1.4 Addressing on EtherNet/IP

Ethernet MAC-ID

The Ethernet MAC-ID is a 6-byte-value which serves to uniquely identify an Ethernet device. The MAC-ID is determined for each device by the IEEE (Institute of Electrical and Electronics Engineers, New York).

The first 3 bytes of the MAC-ID contain a manufacturer identifier. The last 3 bytes can be chosen freely by the manufacturer for each device and contain a unique serial number.

In addition to this, the MAC-ID can be read from the module using the software tool "I/O-ASSISTANT".

IP address

Each Ethernet-host receives its own IP address. In addition, the node knows its netmask and the IP address of the default gateway.

The IP address is a 4-byte-value which contains the address of the network to which the node is connected as well as the host address in the network.

The IP address of the gateway XNE-GWBR-2ETH-IP is predefined as follows:

IP address:	192.168.1.×××
netmask:	255.255.255.0
gateway:	192.168.1.001

The netmask shows which part of the IP address defines the network as well as the network class, and which part of the IP address defines the single node in the network.

In the example mentioned above, the first 3 bytes of the IP address define the network. They contain the subnet-ID 192.168.1.
The last byte of the IP address defines the node's address within the network.

Note

In order to build communication between a PC and an Ethernet-module, both have to be nodes on the same network.

If necessary, the nodes' network addresses have to be adapted one to another. Please read Chapter 6.3 Changing the IP address of a PC/ network interface card, Page 153.

3.1.5 Network classes

The available networks are divided into the different network classes A, B, and C.

Table 1: Network classes

Class	Network addresses	Bytes for net address	Bytes for host address	No. of possible networks/ hosts
A	1.×××.×××.××× - 126.×××.×××.×××	1	3	126/ 2^{24}
B	128.0.×××.××× - 191.255.×××.×××	2	2	2^{14}/ 2^{16}
C	192.0.0.××× - 223.255.255.×××	3	1	2^{21}/ 256

According to their predefined address 192.168.1.××× XI/ON gateways are nodes on a Class C network.

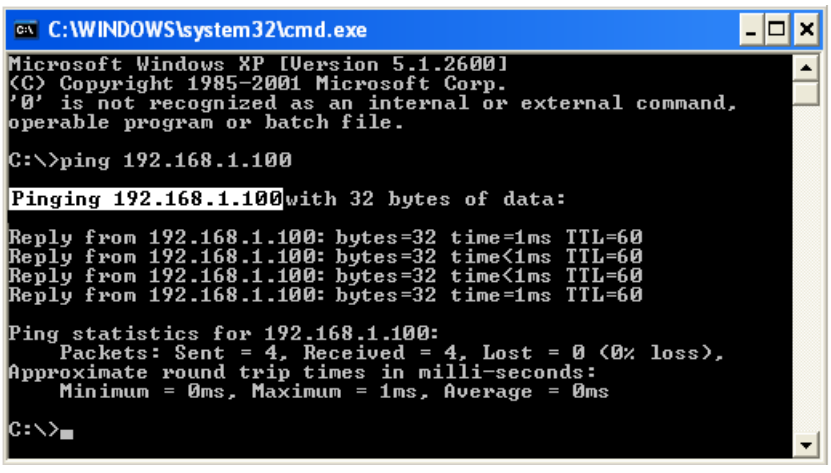
3.1.6 Checking the communication via "ping-signals"

You can check the communication between nodes in a network using ping-signals in the DOS-prompt of your PC.

For that purpose, enter the command "ping" and the IP address of the network node to be checked.

If the node answers the ping-signal, it is ready for communication and takes part in the data transfer.

Figure 16: ping-signal



3.1.7 ARP (Address Resolution Protocol)

In each TCP/IP-capable computer, ARP serves to clearly assign the worldwide unique hardware addresses (MAC-IDs) to the single IP addresses of the network nodes via internal tables.

Using ARP in the DOS-prompt, every node in a network can be clearly identified via its MAC-ID.

- Write a ping command for the respective station/ IP address: (example: "x:\\ping 192.168.1.100").
- Via the command "x:\\arp -a", the MAC-ID for this IP address is determined. This MAC-ID clearly identifies the network node.

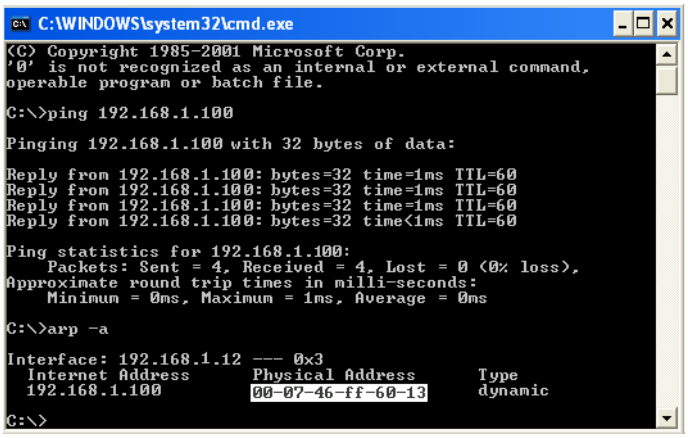


Figure 17: Determination of the MAC-ID of a XI/ON module via ARP

3 EtherNet/IP

3.1 System description

4 Technical features

4.1 General

This chapter contains the general technical description of the gateway XNE-GWBR-2ETH-IP for Ethernet. The following technical features are independent of the implemented protocol. The chapter describes: the technical data, the connection possibilities, the addressing of the gateway etc.

4.2 Function

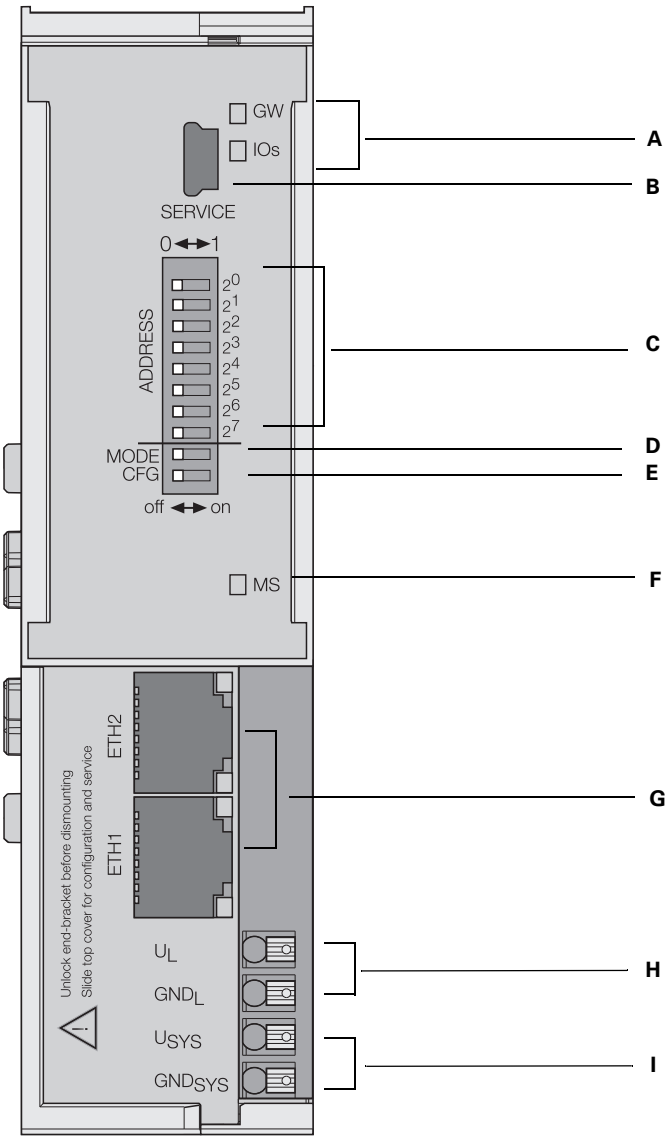
The gateway is the connection between the XI/ON I/O-modules and the Ethernet network.

It handles the entire process data traffic between the I/O-level and the fieldbus and generates diagnostic information for higher-level nodes and the software tool I/O-ASSISTANT.

4.3 Technical data

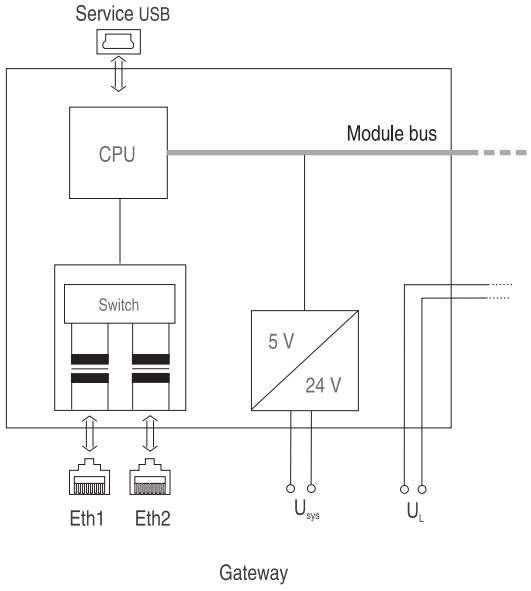
Figure 18:
Top view

A LEDs for XI/ON-module bus
B service-interface
C DIP-switch for field bus addressing
D DIP-switch for operation mode
E DIP-switch for configuration storage
F LED for the EtherNet connection
G EtherNet-switch with EtherNet-LEDs
H Push-in tension clamps for field supply
I Push-in tension clamps for system supply



4.3.1 Block diagram

Figure 19: Block diagram XNE-GWBR-2ETH-IP



4.3.2 General technical data of a station

Attention

The auxiliary power supply must comply with the stipulations of SELV (Safety Extra Low Voltage) according to IEC 60364-4-41.

Table 2: General technical data of a station

Maximum system extension	32 modules (XN, XNE) in slice design or max. length of station: 1 m
Supply voltage/ auxiliary voltage	
Field supply	
U_L nominal value (range)	24 V DC (18 to 30 V DC)
I_L max. field current	8 A
Insulation voltage (U_L to U_{SYS} / U_L to field bus / U_L to FE)	500 V_{rms}
System supply	
U_{SYS} nominal value (range)	24 V DC (18 to 30 V DC)
I_{SYS} (at maximum station extension → see Chapter 7.2, Page 175)	max. 600 mA
I_{MB} (supply to the moudle bus participants)	400 mA
Insulation voltage (U_{SYS} to U_L / U_{SYS} to field bus / U_{SYS} to FE)	500 V_{rms}

Residual ripple	according to IEC/EN 61131-2
Voltage anomalies	according to IEC/EN 61131-2
Connection technology	Push-in tension clamp terminals, LSF from Weidmueller
Physical interfaces	
Fieldbus	
Protocol	Ethernet
Transmission rate	10/100 MBit
Passive fibre-optic-adapters can be connected	current consumption max. 100 mA
Fieldbus connection	RJ45-female connector, RJ45-male connector
Fieldbus shielding connection	via Ethernet cable
Address setting	via DIP-switches (2^0 to 2^7)
Service interface	mini USB
Isolation voltages	
U_{SYS} to service interface USB	-
U_L, U_{SYS} to Ethernet	500 V_{rms}
ETH1 to ETH2	500 V_{rms}
Ambient conditions	
Ambient temperature	
Operating temperature	0 to +55 °C / 32 to 131 °F
Storage temperature	-25 to +85 °C / 13 to 185 °F
Relative humidity according to IEC/EN 60068-2-30	5 to 95 % (indoor), Level RH-2, no condensation (storage at 45 °C, no function test)
Climatic tests	according to IEC/EN 61131-2
Resistance to vibration according to IEC/EN 60068-2-6	
10 to 57 Hz, constant amplitude 0.075 mm / 0.003 inch, 1g	Yes
57 to 150 Hz, constant acceleration 1 g	Yes
Mode of vibration	Frequency sweeps with a change in speed of 1 Octave/min
Period of oscillation	20 frequency sweeps per axis of coordinate

Shock resistant according to IEC/EN 60068-2-27	18 shocks, sinusoidal half-wave 15 g peak value/11 ms, in each case in ± direction per space coordinate
Resistance to repetitive shock according to IEC/EN 60068-2-29	1 000 shocks, half-sinus 25 g peak value/6 ms, in each case in ± direction per space coordinate
Topple and fall according to IEC/EN 60068-2-31 and free fall according to IEC/EN 60068-2-32	
Height of fall (weight < 10 kg)	1.0 m
Height of fall (weight 10 to 40 kg)	0.5 m
Test runs	7
Device with packaging, electrically tested printed-circuit board.	
Electromagnetic compatibility (EMC) according to IEC/EN 61000-6-2 (Industry)	
Static electricity according to IEC/EN 61000-4-2	
Discharge through air (direct)	8 kV
Relay discharge (indirect)	4 kV
Electromagnetic HF fields according to IEC/EN 61000-4-3	10 V/m
Conducted interferences induced by HF fields according to IEC/EN 61000-4-6	10 V
Fast transients (Burst) according to IEC/EN 61000-4-4	1 kV / 2 kV
Emitted interference according to IEC/EN 61000-6-4 (Industry)	
Emitted interference according to IEC/CISPR 11 / EN 55011	Class A **A**

A The use in residential areas may lead to functional errors. Additional suppression measures are necessary!

Warning

This device can cause radio disturbances in residential areas and in small industrial areas (residential, business and trading). In this case, the operator can be required to take appropriate measures to suppress the disturbance at his own cost.

Note

For testing high energie surge (according to IEC/EN 61000-4-5 and product standard IEC/EN 61131-2) a cable lenght of digital and analogue I/O ports is specified with < 30 m.

4.3.3 Approvals and tests

Table 3: Approvals and tests of a XI/ON station

Description	
Approvals	
cUL	in preparation
Tests (IEC/EN 61131-2)	
Cold	IEC/EN 60068-2-1
Dry heat	IEC/EN 60068-2-2
Damp heat, cyclic	IEC/EN 60068-2-30
Operational life MTBF	120 000 h
Pollution severity according to IEC/EN 60664 (IEC/EN 61131-2)	2
Protection class according to IEC/EN 60529	IP20

4.3.4 Technical data for the push-in tension clamp terminals

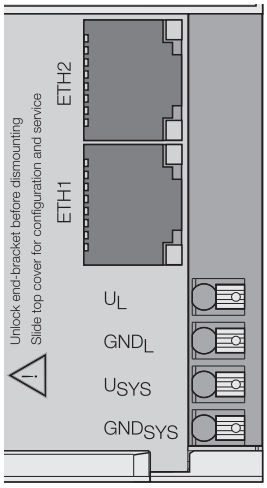
Table 4: Technical data for the Push-in tension clamp terminals

Designation	
Measurement data	according to VDE 0611 Part 1/8.92 / IEC/EN 60947-7-1
Protection class	IP20
Insulation stripping length	8.0 to 9.0 mm / 0.32 to 0.36 inch
Max. wire range	0.14 to 1.5 mm^2 / 0.0002 to 0.0023 $inch^2$ / 24 to 16 AWG
Crimpable wire	
"e" solid core H 07V-U	0.25 to 1.5 mm^2 / 0.0004 to 0.0023 $inch^2$
"f" flexible core H 07V-K	0.25 to 1.5 mm^2 / 0.0004 to 0.0023 $inch^2$
"f" with ferrules **without** plastic collar according to DIN 46228-1 (ferrules crimped gas-tight)	0.25 to 1.5 mm^2 / 0.0004 to 0.0023 $inch^2$
"f" with ferrules **with** plastic collar according to DIN 46228-1 (ferrules crimped gas-tight)	0.25 to 0.75 mm^2 / 0.0004 to 0.0012 $inch^2$
Test finger according toaccording to IEC/EN 60947-1	A1

4.4 Connection options at the gateway

The fieldbus connection is realized via an integrated RJ45-Ethernet-switch, the connection of the power supply via push-in tension clamps.

Figure 20: Connection level at the gateway



4.4.1 Voltage supply

The XNE-GWBR-2ETH-IP provides an integrated power supply unit and push-in tension clamps for:

- field supply (U_L, GND_L)

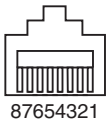
and

- system supply (U_{SYS}, GND_{SYS})

4.4.2 Field bus connection via Ethernet-switch

The XI/ON-ECO-gateways for Ethernet provide an integrated RJ45-Ethernet-switch.

Figure 21: RJ45-female connector



1 = TX +
2 = TX –
3 = RX +
4 = n.c.
5 = n.c.
6 = RX –
7 = n.c.
8 = n.c.

4.4.3 Service interface connection (mini USB female connector)

The service interface is used to connect the gateway to the project planning and diagnostic software I/O-ASSISTANT.

The service interface is designed as a 5-pole mini-USB-connection.

In order to connect the gateway's service-interface to the PC, a commercial cable with mini USB connector is necessary.

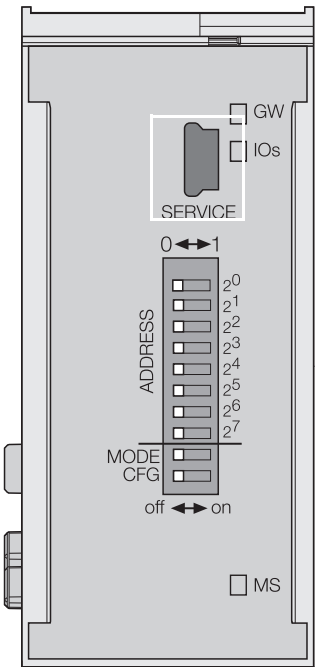


Figure 22: Mini-USB-female connector at the gateway

4.5 Address setting

4.5.1 Default-settings for the gateway

IP-address: 192.168.1.254
subnet mask: 255.255.255.000
default-gateway: 192.168.1.001

Note

The gateway can be reset to these default settings by the user at any time.

To reset the gateway, please set the DIP-switches 2^0 to 2^7 to "0" followed by a power-on reset.

Attention

After every change of the address-mode, a voltage reset must be carried out.

4.5.2 Function of the DIP-switches

The DIP-switches for address setting, operation mode setting and for the storage of the station configuration are located under the gateway's upper label.

Figure 23: DIP-switches at the gateway

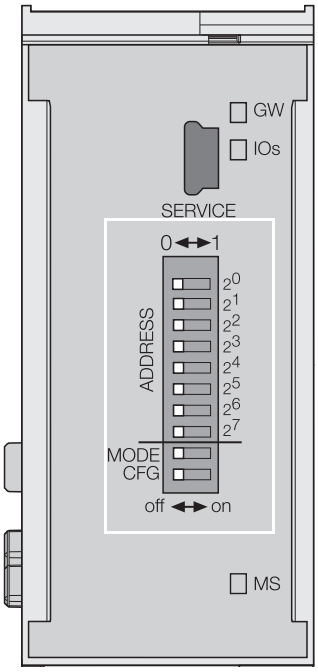


Table 5: Meaning of the DIP-switches

Designation	Function
2^0 - 2^7	Address-switch for setting the last byte of the gateway's IP-address, only if the "MODE" switch is set to "OFF" (see Table 6: Combinations for the address-switch settings, Page 38).
MODE	Depending on its setting, this switch changes the function of address-switches 2^0 - 2^7 (see Table 6: Combinations for the address-switch settings, Page 38).
CFG	Switching from "OFF" to "ON" activates the storage of the station configuration (see Chapter 4.6 Storing the station configuration, Page 47).

Note

The position of the DIP-switches 2^7, CFG and MODE is also important for the download of new firmware to the gateway. Please read Chapter 7.7 Firmware download, Page 183.

Table 6: Combinations for the address-switch settings

Address switch 2^0 - 2^7	Address switch "MODE"	Function
0	OFF	Setting the „Default-settings for the gateway".
1-254	OFF	„Manual address allocation via DIP-switches 20 to 27" (Setting the last byte of the gateway's IP-address)
1	ON	Gateway-„Address setting via DHCP-mode"
2	ON	Gateway-„Address setting via BootP-mode"
4	ON	Gateway-„Address setting via PGM-mode"
8	ON	Gateway-„Address setting via PGM-DHCP-mode"

4.5.3 Manual address allocation via DIP-switches 2^0 to 2^7

Addresses from 1 to 254 can be set using the DIP-switches 2^0 to 2^7. The addresses 0 and 255 are used for Broadcast-messages in the subnet.

The DIP-switch "MODE" has to be set to "OFF"

Note

All other network settings are stored in the module's non-volatile EEPROM and can not be changed.

The gateway's field bus address results from the addition of the valences (2^0 to 2^7) of the active DIP-switches (position = 1).

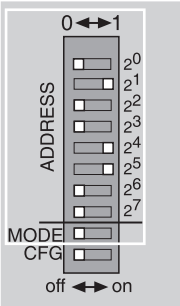
Note

Pull the label upwards out of the housing in order to reach the DIP-switches.

Example:

Bus address 50 = 0×32 = 00110010

Figure 24:
Address setting



Note

The internal module bus does not require any addressing.

Attention

The settings carried out by manual allocation 2^0 and 2^7 are not stored in the module's EEPROM. Thus, they will get lost in case of a subsequent address-assignment via a BootP, DHCP or PGM.

Attention

After changing the position of the DIP-switches, a voltage reset must be carried out to store the new address.

LED-behavior

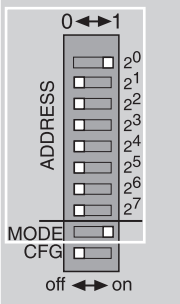
During the module's start-up, the "MS" LED shortly becomes constant red. After the successful start-up, the LED begins to flash green and the station is then ready for communication.

4.5.4 Address setting via DHCP-mode

The address setting is carried out by a DHCP-server in the network after the start-up of the gateway.

In order to activate the DHCP-mode, the DIP-switch "MODE" is set to "ON", the address-switches 2^0 to 2^7 to address "1" (see Table 6: Combinations for the address-switch settings, Page 38).

Figure 25:
DHCP-mode



Note

The subnet mask as well as the default IP address assigned to the gateway by the DHCP-server are stored in the gateway's non-volatile EEPROM.

If the gateway is subsequently switched to another adress-mode, the settings carried out via DHCP (IP address, subnet mask, etc) will be taken from the module's EEPROM.

Attention

After every change of the address-mode, a voltage reset must be carried out.

DHCP supports three mechanisms for IP address allocation:

- In "automatic allocation", the DHCP-server assigns a permanent IP address to a client.
- In "dynamic allocation", DHCP assigns an IP address to a client for a limited period of time. After this time or until the client explicitly relinquishes the address, the address can be re-assigned.
- In "manual allocation", a client's IP address is assigned by the network administrator, and DHCP is used simply to convey the assigned address to the client.

LED-behavior

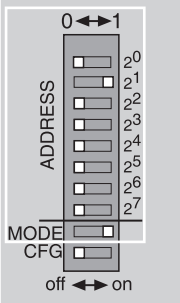
During it's start-up, the module waits for the address setting via the DHCP-/BootP-server. This is indicated by the red flashing "MS" LED. The LED begins to flash green, as soon as the address setting via the server is completed. The station is ready for communication.

4.5.5 Address setting via BootP-mode

The address setting is carried out by a BootP-server in the network after the start-up of the gateway.

In order to activate the BootP-mode, the DIP-switch "MODE" is set to "ON", the address switches 2^0 to 2^7 to address "2" (see Table 6: Combinations for the address-switch settings, Page 38).

Figure 26: BootP



Note

The subnet mask as well as the default IP address mask assigned to the gateway by the BootP-server are stored in the gateway's non-volatile EEPROM.

If the gateway is subsequently switched to another adress-mode, the settings carried out via BootP (IP address, subnet mask, etc.) will be taken from the module's EEPROM.

Attention

After every change of the address-mode, a voltage reset must be carried out.

LED-behavior

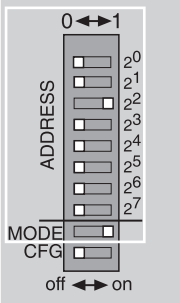
During it's start-up, the module waits for the address setting via the DHCP-/BootP-server. This is indicated by the red flashing "MS" LED. The LED begins to flash green, as soon as the address setting via the server is completed. The station is ready for communication.

4.5.6 Address setting via PGM-mode

The PGM-mode enables the access of I/O-ASSISTANT to the gateway's network settings (see also Chapter 4.5.8 Address setting via the software "I/O-ASSISTANT", Page 45).

In order to activate the PGM-mode, the DIP-switch "MODE" is set to "ON", the address switches 2^0 to 2^7 to address "4" (see Table 6: Combinations for the address-switch settings, Page 38).

Figure 27: PGM



Note

In the PGM-mode, all network settings (IP address, subnet mask, etc.) are read from the module's internal EEPROM.

Attention

After every change of the address-mode, a voltage reset must be carried out.

The DIP-switch-settings are stored in the module's non-volatile EEPROM.

LED-behavior

During it's start-up, the module waits for the address setting via DHCP-/BootP-server. This is indicated by the red flashing "MS" LED. The LED begins to flash green, as soon as the address setting via the server is completed. The station is ready for communication.

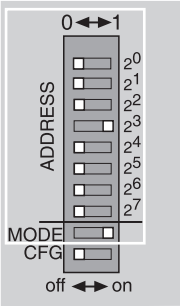
4.5.7 Address setting via PGM-DHCP-mode

This mode operates exactly like the PGM-mode except that when the gateway is initially powered in this mode it will broadcast its MAC ID (similar to DHCP mode).

But, in contrast to the regular DHCP mode, the DHCP transmission on startup can be enabled/disabled via TCP Object attributes in EtherNet/IP.

In order to activate the PGM-DHCP-mode, the DIP-switch "MODE" is set to "ON", the address switches 2^0 to 2^7 to address "8" (see Table 6: Combinations for the address-switch settings, Page 38).

Figure 28: PGM-DHCP



The I/O-ASSISTANT can also be used to set the IP Address in this mode.

This mode is the Out-of-the-Box mode for the gateway and provides powerful and convenient Start-up features.

1 DHCP start up –if network contains DHCP server and/or automated configuration setup

Easy Rockwell BOOTP/DHCP-Server manipulation allowing TCP object access.

Note

In the PGM-DHCP-mode, all network settings (IP address, subnet mask, etc.) are read from the module's internal EEPROM.

Attention

After every change of the address-mode, a voltage reset must be carried out.

The DIP-switch-settings are stored in the module's non-volatile EEPROM.

LED-behavior

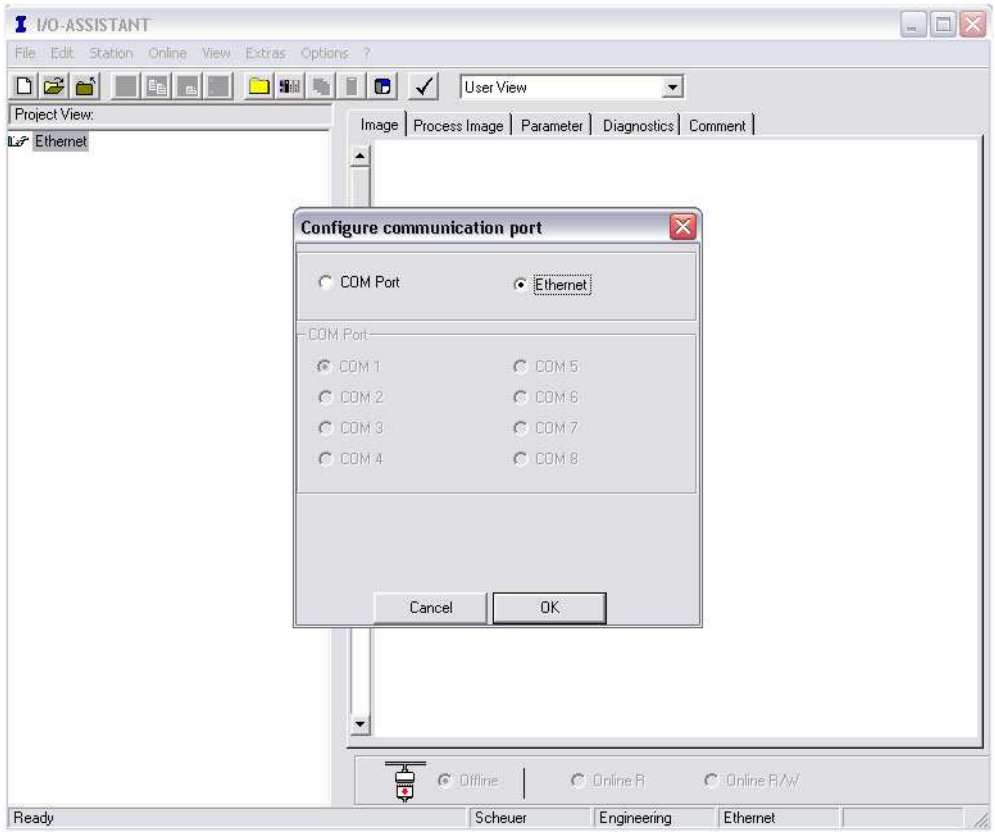
During it's start-up, the module waits for the address setting via DHCP-/BootP-server. This is indicated by the red flashing "MS" LED. The LED begins to flash green, as soon as the address setting via the server is completed. The station is ready for communication.

4.5.8 Address setting via the software "I/O-ASSISTANT"

The software I/O-ASSISTANT enables direct access to the Ethernet-gateway via the Ethernet-network.

Naturally, the access to the single station via the service interface at the gateway is possible as well.

Figure 29: Interface Ethernet



The IP address as well as the subnet mask of theEthernet gateways can be changed according to the application by using the integrated Address Tool.

Note

The access of the IO-ASSISTANT to the gateway is only possible if the gateway is operated in PGM- and PGM-DHCP-mode (see also Chapter 4.5.6 Address setting via PGM-mode, Page 43 or Chapter 4.5.7 Address setting via PGM-DHCP-mode, Page 44).

Figure 30: Opening the Address-Tool

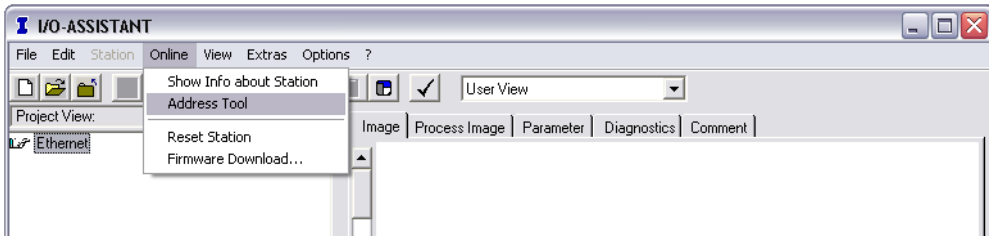
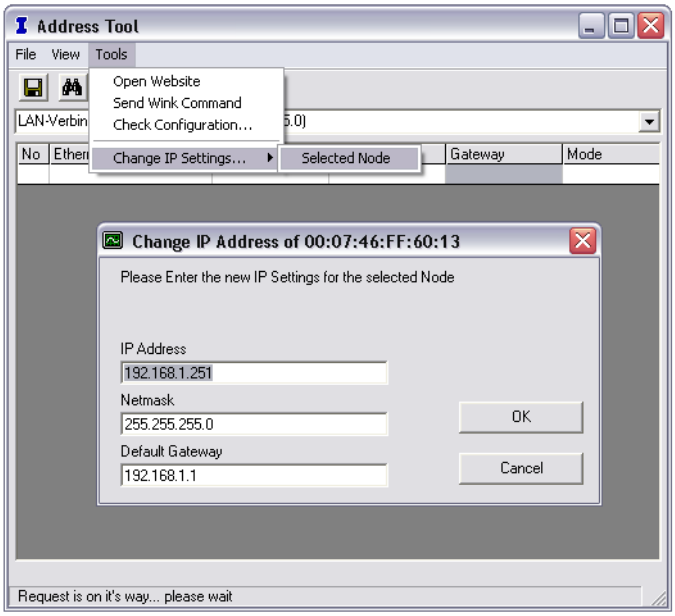


Figure 31: Changing the IP address



Attention

Please observe that, if the system integrated Windows-firewall is activated, difficulties may occur during the communication between the gateway and the Address-tool. The firewall may possibly inhibit the access of the tool on Ethernet.

4.6 Storing the station configuration

4.6.1 DIP-switch CFG

The DIP-switch "CFG" at the gateway serves to take-over the Current Configuration of the XI/ON-station as Required Configuration to the gateway's non-volatile memory.

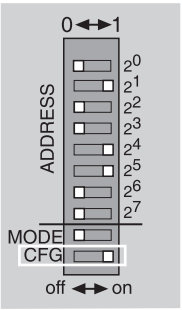


Figure 32: DIP-switch for storing the current station configuration

Switching from OFF to ON starts the storage of the Current Configuration as the Required Configuration (Reference configuration).

Procedure:

Switching the DIP-switch "CFG" from OFF to ON

→ Starting of the storage process

→ LED IOs flashes green (1 HZ)

→ LED IOs shortly lits up orange

→ storage process active

→ set back the DIP-switch from ON to OFF

→ storage process terminated successfully, if the LEDs IOs and GW are constant green.

Note

If the DIP-switch is not set back, the gateway will continiously restart the storage process. Only setting the switch back from ON to OFF will terminate this process.

4.7 Status indicators/diagnostic messages gateway

The gateway sends the following diagnostic messages:

- Undervoltage monitoring for system- and field supply,
- Monitoring of the station status,
- Monitoring of the communication via the internal module bus,
- Monitoring of the communication to Ethernet
- Monitoring of the gateway status

Diagnostic messages are displayed in two different ways:

- Via the LEDs
- Via the respective configuration software (I/O-ASSISTANT) or Modbus-Client

4.7.1 Diagnostic messages via LEDs

Every XI/ON gateway displays the following statuses via LEDs:

- 2 LEDs for module bus communication (module bus LEDs): **GW** and **IOs**
- 1 LED for the Ethernet communication (fieldbus-LEDs): **MS**
- 2 LEDs for the state of the Ethernet connection (at the Ethernet connectors): **ETH1** and **ETH2**

Table 7: LED-displays

LED	Status	Meaning	Remedy
GW	Off	CPU not supplied.	Check the voltage supply U_{SYS} at the gateway.
	Green	Firmware active, gateway ready to operate and transmit	-
	Green flashing, 1 Hz	Firmware not active.	If in addition the "**IOs**" LED is red, a Firmware download is necessary.
	Red	CPU is not ready, V_{CC} level is not within the required range. → possible reasons: – too many modules connected to the gateway – short circuit in connected module – hardware error in gateway	– Check wiring at the gateway and the voltage supply. – Dismount modules – Replace the gateway.
	Red/green flashing, 4 Hz	WINK-Command active	The software I/O-ASSISTANT is executing a WINK command on the device. This command is executed in order to find out which network node is accessed.

Table 7: LED-displays

LED	Status	Meaning	Remedy
IOs	Off	CPU not supplied.	– Check the voltage supply U_{SYS} at the gateway.
	Green	The configured module bus station corresponds to the physically connected station, communication is active.	-
	Green flashing 1 Hz	Station is in the I/O-ASSISTANT Force Mode.	– Deactivate the I/O-ASSISTANT Force Mode.
	Red	CPU is not ready, V_{CC} level is not within the required range → possible reasons: – too many modules connected to the gateway – short circuit in connected module – hardware error in gateway	– Check wiring at the gateway and the voltage supply. – Dismount modules – Replace the gateway.
	Red flashing, 1 Hz	Non-adaptable modification of the physically connected station.	– Compare the planned XI/ON station with the physical station. – Check the physical XI/ON station for defective or incorrectly fitted electronics modules.
	Red flashing, 4 Hz	No module bus communication	– At least one electronics module has to be mounted correctly and has to be able to communicate with the gateway.
	Red/green flashing, 1 Hz	Adaptable modification of the actual layout of the module bus participants; data transfer possible	– Check the XI/ON station for missing or new, unplanned modules.
MS	Off	XI/ON station not supplied.	– Check the voltage supply at the gateway.
	Green	Displays an active CIP Class 1 I/O connection	–
	Green flashing	Gateway is ready for operation	–
	Red	Gateway indicates error	–
	Red flashing	DHCP/BootP search of settings, wait for address setting	–

Table 7: LED-displays

LED	Status	Meaning	Remedy
ETH1, ETH2	Off	No Ethernet link	– Check the Ethernet-connection.
	Green	Link	–
	Green flashing	Ethernet Traffic	–
	Yellow	100 Mbps (if no LED lits yellow: 10 Mbps)	–

4.7.2 Diagnostic Messages via the Process Data

Besides the evaluation of diagnostic data via Explicit Messages, XI/ON for EtherNet/IP offers the possibility of mapping diagnostic data into the gateways' process data.

2 different forms of diagnostic data handling are provided:

- Summarized Diagnostics
- Scheduled Diagnostics

Summarized Diagnostics

The summarized diagnostic data mode will send back 1 bit for each slice within the station. This bit will be "0" if there are no diagnostic flags set on the slice. If there are any diagnostic events on the slice the bit will be set to "1".

Values:

0 = ok

1 = module sends diagnostics, wrong module or module pulled (acc. to VSC 100, Gateway Class, Attr. 116, Section „Gateway Class (VSC 100)", Page 77).

The diagnostic bits are placed at the end of the input data. The diagnostic data start WORD aligned (see Section „Mapping of process data", Page 64).

Scheduled Diagnostics

Note

The Scheduled Diagnostics possibility is only implemented in gateways with Maj. Rev. ≧ 1.6.0.

The scheduled diagnostic data map is a time sliced module related data block, which holds diagnostic data of all modules with active diagnostics using a round robin mechanism.

This diagnostic "window" visualizes a specific module diagnostic data for approx. 125 ms and changes over to the next active diagnostics afterwards. This is done automatically by the gateway.

The data length for the scheduled diagnostics is set according to properties of the modules attached to the gateway.

Word	Byte	Data
0	0	Slot number of the module which sends the diagnostic data.
	1	State of the diagnostic message: bit 5 = 1: diagnostic active bit 6 = 1: wrong module bit 7 = 1: module pulled (acc. to VSC 100, Gateway Class, Attr. 116, Section „Gateway Class (VSC 100)", Page 77)
n		Module diagnostics from the module actually referenced by the round robin mechanism.

The scheduled diagnostic data is placed at the end of the input data and after the summarized diagnostic data (see Section „Mapping of process data", Page 64).

4.8 Status Word of the Gateway

The gateways status word in the process data contains common diagnostic messages like:

- gateway errors
- module bus errors
- voltage errors
- configuration/ diagnostic warnings

It can also be accessed via the Gateway Class VSC 100, Object Instance 2, Gateway Instance, attribute 109 (0×6D) "STATUS REGISTER 2" (for detailed information, see Section „Object instance 2, Gateway Instance", Page 78).

4.9 Module specific diagnostic messages

Detailed module specific diagnostic messages can be read out from Gateway Class VSC 100, Object Instance 2, Gateway Instance, attribute 116 (0×74) "MODULE DIAG SUMMARY" (for detailed information, see also Section „Object instance 2, Gateway Instance", Page 78).

5 Implementation of EtherNet/IP

5.1 The EtherNet/IP communications profile

EtherNet/IP is based on a connection-oriented communication model. This means that it is only possible to exchange data via specified connections assigned to the devices.

Communication between the nodes in the EtherNet/IP network can be carried out either via I/O Messages or Explicit Messages.

5.1.1 I/O Messages

I/O Messages serve to exchange high priority process and application data over the network. Communication between the slaves in the EtherNet/IP network is carried out according to the Server/Client Model, which means a producing application transmits data to another or a number of consuming applications. It is quite possible that information is passed to a number of Application Objects in a single device.

5.1.2 Explicit Messages

Explicit Messages are used to transmit low-priority configuration data, general management data or diagnostic data between two specific devices. This is a point-to-point connection in a Server/Client System that requires a request from a client always to be confirmed by a response from the server.

Explicit messages, whether connected or unconnected, use the Message Router (for detailed information, read Section „Message Router Request/Response Formats", Page 59).

- Message Router Request
  Consists of a service code, path size value, a message router path and service data. An EPATH is used in the message router path to indicate the target object.
- Message Router Response
  Consists of a service field with the most significant bit set. This is an echo of the service code in the request message with the most significant bit set. A reserved byte follows the service code, which is followed by the General Status code.

5.1.3 Communications profile of the XI/ON EtherNet/IP gateway

The EtherNet/IP gateway behaves as an EtherNet/IP Server in the network; the scanner of the higher-level controller operates as a EtherNet/IP Client.

The following EtherNet/IP communications types are supported:

- Point to Point or Multicast
- Cyclic Connection
- Unconnected (UCMM) Explicit Messaging
- Connected Explicit Messaging

Point to point

A connection that exists between two nodes only.

Multicast

A packet with a special destination address, which multiple nodes on the network may be willing to receive.

COS I/O Connection

COS (Change Of State) I/O Connections establish event-controlled connections. This means that the EtherNet/IP devices generate messages as soon as a change of status occurs.

Cyclic I/O Connection

Messages are triggered time-controlled in Cyclic I/O connections by means of a time generator.

UCMM

The EtherNet/IP gateway offers the option of establishing explicit messaging via the UCMM port (Unconnected Message Manager Port).

UCMM-based explicit messaging is normally used for random, non-periodic requests. It is not recommended for frequent messaging because the UCMM input queue in a product is typically limited to just a few messages. Once this limit is reached, subsequent requests are ignored and must be retried.

Connected Explicit messaging

CIP is a connection-based system. For most communications between nodes, a connection is used.

A connection is a path or a virtual circuit between two or more end points in a system. The purpose is to transfer data in the most efficient manner possible.

The Connection ID is a number that is associated with a communication relationship. Receiving nodes decode this key to know whether they must accept the data or not.

5.2 Classes and instances of the EtherNet/IP-gateway

5.2.1 EtherNet/IP standard classes

The XI/ON gateway supports the following EtherNet/IP Standard Classes in accordance with the CIP specification.

Table 8: EtherNet/IP standard classes

Class code	Object-name	Description
01 (0×01)	„Identity Object (0×01)"	The Identity Object is required on all devices and provides general information about the device. It enables clear and unambiguous identification of modules. Contains information such as manufacturer name, product type, ident number, revision number etc.
02 (0×02)	„Message Router Object (0×02)"	The Message Router Object provides a messaging connection point through which a Client may address a service to any object class or instance residing in the physical device.
04 (0×04)	„Assembly Object (0×04)"	The Assembly Object binds attributes of multiple objects, which allows data to or from each object to be sent or received over a single connection. Assembly objects can be used to bind input data or output data. The terms "input" and "output" are defined from the network's point of view. An input will produce data on the network and an output will consume data from the network.
06 (0×06)	„Connection Manager Object (0×06)"	The Connection Manager Class allocates and manages the internal resources associated with both I/O and Explicit Messaging Connections. The specific instance generated by the Connection Manager Class is referred to as a Connection Instance or a Connection Object.
15 (0×0F)	Parameter Object	currently not supported
244 (0×F4)	„Port Object (0×F4)"	Provides a standard way of describing a device's ports.
245 (0×F5)	„TCP/IP Interface Object (0×F5)"	Contains the device TCP/IP-related configuration information.
246 (0×F6)	„Ethernet Link Object (0×F6)"	Contains link-specific counters and status information for an Ethernet 802.3 communications interface.

5.2.2 Identity Object (0×01)

The following description of the Identity Object is taken from the CIP specification, Vol. 1, Rev. 2.1, by ODVA & ControlNet International Ltd. and adapted to XI/ON.

Class attributes

Table 9: Class attributes

Attr. no.	Attribute name	Get/ Set	Type	Value
1 (0×01)	REVISION	G	UINT	1
2 (0×02)	MAX OBJECT INSTANCE	G	UINT	1
6 (0×06)	MAX CLASS ATTRIBUTE	G	UINT	7
7 (0×07)	MAX INSTANCE ATTRIBUTE	G	UINT	7

Instance attributes

Table 10: Instance attributes

Attr. no.	Attribute name	Get/ Set	Type	Description
1 (0×01)	VENDOR	G	UINT	Contains the vendor ID, managed by the Open DeviceNet™ Vendor Association, Inc. (ODVA) and ControlNet International (CI): Eaton = 972
2 (0×02)	PRODUCT TYPE	G	UINT	Indicates the general type of product. Communications Adapter 12_{dez} = 0×0C
3 (0×03)	PRODUCT CODE	G	UINT	Identifies a particular product within a device type. Default: 40047
4 (0×04)	REVISION Major Minor	G	STRUCT OF: USINT USINT	Revision of the item the Identity Object is representing. 0x01 0x09
5 (0×05)	DEVICE STATUS	G	WORD	See Table 11: Device Status, Page 57
6 (0×06)	SERIAL NUMBER	G	UDINT	Contains the ident-no. of the product (3 last bytes of the MAC-ID).
7 (0×07)	PRODUCT NAME LENGTH NAME	G	STRUCT OF: USINT STRING [13]	XNE-GWBR-2ETH-IP

Device Status

Table 11: Device Status

Bit	Name	Definition
0 to 1	reserved	Default = 0
2	Configured	TRUE → The application of the device has been configured (≠ default-settings).
3	reserved	Default = 0
4 to 7	Extended Device Status	0011 = No I/O connections established 0110 = At least one I/O connection in run mode 0111 = At least one I/O connection established, all in idle mode All other settings = reserved
8 to 15	reserved	Default = 0

Common services

Table 12: Common services

Service code	Class	Instance	Service name
01 (0x01)	yes	yes	Get_Attribute_All Returns a predefined listing of this objects attributes.
05 (0x05)	no	yes	Reset Starts the Reset service for the device.
14 (0x0E)	yes	yes	Get_Attribute_Single Returns the contents of a specified attribute.
16 (0x10)	no	no	Set_Attribute_Single Modifies a single attribute.

5.2.3 Message Router Object (0×02)

This object provides a messaging connection point through which a Client may address a service to any object class or instance residing in the physical device.

The following description of the Message Router Object is taken from the CIP specification, Vol. 1, Rev. 2.1 by ODVA & ControlNet International Ltd. and adapted to XI/ON.

Class attributes

Table 13: Class attributes

Attr. no.	Attribute name	Get/ Set	Type	Value
1 (0×01)	REVISION	G	UINT	1
4 (0×04)	OPTIONAL ATTRIBUTE NUMBER	G	UINT	0
5 (0×05)	OPTIONAL SERVICE NUMBER	G	UINT	0
6 (0×06)	MAX CLASS IDENTIFIER	G	UINT	7
7 (0×07)	MAX INSTANCE ATTRIBUTE	G	UINT	2

Instance attributes

Table 14: Instance attributes

Attr. no.	Attribute name	Get/ Set	Type	Description
1 (0×01)	OBJECT LIST	G	STRUCT OF	Structure with an array of object class-codes supported by the device.
	NUMBER	G	UINT	Depending
	CLASSES	G	ARRAY of UINT	Number of the classes supported by the gateway.
2 (0×02)	MAX NUMBER OF CONNECTIONS	G	UINT	Count of the maximum number of connections supported.

Common services

Table 15: Common services

Service code	Class	Instance	Service name
01 (0x01)	yes	yes	Get_Attribute_All
14 (0x0E)	yes	yes	Get_Attribute_Single

Message Router Request/Response Formats

- Message Router Request Format:

Table 16: Message Router Request

Parameter	Data type	Description
Service	USINT	Service code of the request.
Request Path Size	USINT	Number of 16 bit words in the "Request Path".
Request Path	Padded EPATH	Array of bytes containing the information for the path of request (class ID, Instance ID, etc.) for this transaction.
Request Data	Array of octed	Additional service specific data to be delivered in the Explicit Messaging Request.

- Message Router Response Format:

Table 17: Message Router Request

Parameter	Data type	Description
Reply Service	SINT	Reply service code.
General Status	USINT	General Status code according to CIP specification. See Table 18: General status codes according to CIP spec., Page 59
Size of Additional Status	USINT	Number of 16 bit words in Additional status.
Additional Status	Array of USINT	Additional status.
Response Data	Array of octet	Response data from request or additional error data if an error was indicated in "General Status".

Table 18: General status codes according to CIP spec.

Status code (hex)	Status name	Description
00	Success	Service successfully performed by the object specified.
01	Connection failure	A connection related service failed along the connection path.
02	Resource unavailable	Resources needed for the object to perform the requested service were unavailable.
03	Invalid parameter value	See Status code 0x20, which is the preferred value to use for this condition.
04	Path segment error	The path segment identifier or the segment syntax was not understood by the processing node. Path processing shall stop when a path segment error is encountered.

Table 18: General status codes according to CIP spec.

Status code (hex)	Status name	Description
05	Path destination unknown	The path is referencing an object class, instance or structure element that is not known or is not contained in the processing node. Path processing shall stop when a path destination unknown error is encountered.
06	Partial transfer	Only part of the expected data was transferred.
07	Connection lost	The messaging connection was lost.
08	Service not supported	The requested service was not implemented or was not defined for this Object Class/Instance.
09	Invalid attribute value	Invalid attribute data detected.
0A	Attribute list error	An attribute in the Get_Attribute_List or Set_Attribute_List response has a non-zero status.
0B	Already in requested mode/state	The object is already in the mode/state being requested by the service.
0C	Object state conflict	The object cannot perform the requested service in its current mode/state.
0D	Object already exists	The requested instance of object to be created already exists.
0E	Attribute not settable	A request to modify a non-modifiable attribute was received.
0F	Privilege violation	A permission/privilege check failed.
10	Device state conflict	The device's current mode/state prohibits the execution of the requested service.
11	Reply data too large	The data to be transmitted in the response buffer is larger than the allocated response buffer.
12	Fragmentation of a primitive value	The service specified an operation that will fragment a primitive data value, i.e. half a REAL data type.
13	Not enough data	The service did not supply enough data to perform the specified operation.
14	Attribute not supported	The attribute specified in the request is not supported.
15	Too much data	The service supplied more data than expected.
16	Object does not exist	The object specified does not exist in the device.
17	Service fragmentation sequence not in progress	The fragmentation sequence for this service is not currently active for this data.

Table 18: General status codes according to CIP spec.

Status code (hex)	Status name	Description
18	No stored attribute data	The attribute data of this object was not saved prior to the requested service.
19	Store operation failure	The attribute data of this object was not saved due to a failure during the attempt.
1A	Routing failure, request packet too large	The service request packet was too large for transmission on a network in the path to the destination. The routing device was forced to abort the service.
1B	Routing failure, response packet too large	The service response packet was too large for transmission on a network in the path from the destination. The routing device was forced to abort the service.
1C	Missing attribute list entry data	The service did not supply an attribute in a list of attributes that was needed by the service to perform the requested behavior.
1D	Invalid attribute value list	The service is returning the list of attributes supplied with status information for those attributes that were invalid.
1E	Embedded service error	An embedded service resulted in an error.
1F	Vendor specific error	A vendor specific error has been encountered. The Additional Code Field of the Error Response defines the particular error encountered. Use of this General Error Code should only be performed when none of the Error Codes presented in this table or within an Object Class definition accurately reflect the error.
20	Invalid parameter	A parameter associated with the request was invalid. This code is used when a parameter does not meet the requirements of this specification and/or the requirements defined in an Application Object Specification.
21	Write-once value or medium already written	An attempt was made to write to a write-once medium (e.g. WORM drive, PROM) that, has already been written, or to modify a value that cannot be changed once established.
22	Invalid Reply Received	An invalid reply is received (e.g. reply service code does not match the request service code, or reply message is shorter than the minimum expected reply size). This status code can serve for other causes of invalid replies.
23 to 24	Reserved by CIP for future extensions	
25	Key Failure in path	The Key Segment that was included as the first segment in the path does not match the destination module. The object specific status shall indicate which part of the key check failed.

Table 18: General status codes according to CIP spec.

Status code (hex)	Status name	Description
26	Path Size Invalid	The size of the path which was sent with the Service Request is either not large enough to allow the Request to be routed to an object or too much routing data was included.
27	Unexpected attribute in list	An attempt was made to set an attribute that is not able to be set at this time.
28	Invalid Member ID	The Member ID specified in the request does not exist in the specified Class/Instance/Attribute
29	Member not settable	A request to modify a non-modifiable member was received
2A	Group 2 only server general failure	This error code may only be reported by Group 2 Only servers with 4K or less code space and only in place of Service not supported, Attribute not supported and Attribute not settable.
2B to CF	Reserved by CIP for future extensions	
D0 to FF	Reserved for Object Class and service errors	This range of error codes is to be used to indicate Object Class specific errors. Use of this range should only be performed when none of the Error Codes presented in this table accurately reflect the error that was encountered.

5.2.4 Assembly Object (0×04)

Assembly Objects bind attributes of multiple objects to allow data to or from each object to be sent or received over a single connection.

The following description of the Assembly Object is taken from the CIP specification, Vol. 1, Rev. 2.1 by ODVA & ControlNet International Ltd. and adapted to XI/ON.

Class attributes

Table 19: Class attributes

Attr. no.	Attribute name	Get/ Set	Type	Value
1 (0×01)	REVISION	G	UINT	2
2 (0×02)	MAX OBJECT INSTANCE	G	UINT	104

Instance attributes

Table 20: Instance attributes

Attr. no.	Attribute name	Get/ Set	Type	Description
1 (0×01)	NUMBER OF MEMBERS IN LIST	G	UINT	0 (no dynamic)
2 (0×02)	MEMBER LIST	G	ARRAY of STRUCT UINT Packed EPATH	Depends on Instance.
3 (0×03)	DATA	S	ARRAY OF BYTE	
4 (0×04)	SIZE	G	UINT Number of bytes in Attr. 3	256 or viariable

Instance 101

Input assembly instance with variable assembly sizes. The assembly size is precalculated to support the stations I/O-configuration, enabled diagnostics, etc.

The size of the assembly instance can be retrieved through the assembly object, instance 0x65, attribute: 0x04 and can vary between 2 and 256 bytes.

Instance 102

Output assembly instance with variable assembly sizes. The assembly size is precalculated to support the stations I/O-configuration.

The size of the assembly instance can be retrieved through the assembly object, instance 0x66, attribute: 0x04 and can vary between 2 and 256 bytes.

Common services

Table 21: Common services

Service code	Class	Instance	Service name
01 (0x01)	yes	yes	Get_Attribute_All
14 (0x0E)	no	yes	Get_Attribute_Single

Mapping of process data

The process image of the XI/ON gateway is depicted in WORD format (16 bit). The process data of successive modules of the same type, with process data of less than 1 word, are grouped together until 16 bits of process data is reached. The process data is written in a new word when:

- 16-bit input data is reached and further input modules follow
- 16-bit output data is reached and further output modules follow
- An input module, whose process data length cannot be completely incorporated in the preceding word, follows on from another input module
- An output module, whose process data length cannot be completely incorporated in the preceding word, follows on from another output module

Data mapping for the XNE-GWBR-2ETH-IP

Table 22: Data mapping for gateways with Maj. Rev. ≧ 1.6.0

Produced Data (word no.)	**Input data**
0	Status Word of the gateway (Mapping can be disabled using attr. 138 in VSC100, Object Instance 2, Section „Gateway Class (VSC 100)", Page 77)
1 to n	Input data of modules
n + x	Summarized diagnostic data (page 51) of individual length. Can be enabled/disabled using VSC102, Object instance 3, attr. 104, Section „Process Data Class (VSC102)", Page 82. (x = the no. of following bytes depending on the no. of slices within the station)
n + y	Scheduled diagnostic data (page 51). Can be enabled/disabled using VSC102, Object instance 3, attr. 105, Section „Process Data Class (VSC102)", Page 82. (y = data length for the scheduled diagnostics set according to the properties of the modules attached to the gateway)
Consumed Data (word no.)	**Output data**
0	Control register of the gateway (Mapping can be disabled using attribute 139 "GW CONTROL REGISTER" in "Gateway Class (VSC 100)", Object Instance 2, page 77)
1- n	Output data of the modules.

Note

The data mapping can be structured individually. All parts except for the in- and output data of the station can be enabled/ disabled independently from each other.

5.2.5 Connection Manager Object (0×06)

This object is used for connection and connectionless communications, including establishing connections across multiple subnets.

The following description of the Connection Manager Object is taken from the CIP specification, Vol. 1, Rev. 2.1 by ODVA & ControlNet International Ltd. and adapted to XI/ON.

Common services

Table 23: Common services

Service code	Class	Instance	Service name
84 (0x54)	no	yes	FWD_OPEN_CMD (Opens a connection)
78 (0x4E)	no	yes	FWD_CLOSE_CMD (Closes a connection)
82 (0x52)	no	yes	UNCONNECTED_SEND_CMD (Unconnected Send Service. Only originating devices and devices that route between links need to implement).

5.2.6 Port Object (0×F4)

The following description of the Port Object is taken from the CIP specification, Vol. 1, Rev. 2.1 by ODVA & ControlNet International Ltd. and adapted to XI/ON.

Class attributes

Table 24: Class attributes

Attr. no.	Attribute name	Get/ Set	Type	Value
1 (0×01)	REVISION	G	UINT	1
2 (0×02)	MAX OBJECT INSTANCE	G	UINT	1
3 (0×03)	NUMBER OF INSTANCES	G	UINT	1
8 (0×08)	ENTRY PORT	G	UINT	1
9 (0×09)	ALL PORTS	G	ARRAY of STRUCT UINT UINT	0.0 for class 4.2 for TCP_IP_PORT

Instance attributes

Table 25: Instance attributes

Attr. no.	Attribute name	Get/ Set	Type	Description
1 (0×01)	ATTRIBUTE PORT TYPE	G	UINT	4 for TCP_IP_PORT
2 (0×02)	ATTRIBUTE PORT NUMBER	G	UINT	2
3 (0×03)	ATTRIBUTE PORT OBJECT	G	UINT EPATH Logical path	2 0x12, 0x02 0x00, 0x00

Common services

Table 26: Common services

Service code	Class	Instance	Service name
01 (0x01)	yes	yes	Get_Attribute_All
14 (0x0E)	yes	yes	Get_Attribute_Single

5.2.7 TCP/IP Interface Object (0×F5)

The following description of the TCP/IP Interface Object is taken from the CIP specification, Vol. 2, Rev. 1.1 and adapted to XI/ON.

Class attributes

Table 27: Class attributes

Attr. no.	**Attribute name**	**G**et/ **S**et	**Type**	**Value**
1 (0×01)	REVISION	G	UINT	1
2 (0×02)	MAX OBJECT INSTANCE	G	UINT	1
3 (0×03)	NUMBER OF INSTANCES	G	UINT	1
6 (0×06)	MAX CLASS IDENTIFIER	G	UINT	7
7 (0×07)	MAX INSTANCE ATTRIBUTE	G	UINT	6

Instance attributes

Table 28: Instance attributes

Attr. no.	Attribute name	Get/ Set	Type	Description
1 (0×01)	STATUS	G	DWORD	Interface status (see page 70)
2 (0×02)	CONFIGURATION CAPABILITY	G	DWORD	Interface Capability Flag (see page 70)
3 (0×03)	CONFIGURATION CONTROL	G/S	DWORD	Interface Control Flag (see page 70)
4 (0×04)	PHYSICAL LINK OBJECT	G	STRUCT	
	Path size		UINT	Number of 16bit words: 0×02
	Path		Padded EPATH	0×20, 0×F6, 0×24, 0×01
5 (0×05)	INTERFACE CONFIGURATION	G	Structure of:	TCP/IP Network Interface Configuration (see page 70)
	IP ADDRESS	G	UDINT	Current IP address
	NETWORK MASK	G	UDINT	Current network mask
	GATEWAY ADDRESS	G	UDINT	Current default gateway
	NAME SERVER	G	UDINT	0 = no name server address configured
	NAME SERVER 2		UDINT	0 = no secondary name server address configured
5 (0×05)	DOMAIN NAME	G	UDINT	0 = no Domain Name configured
6 (0×06)	HOST NAME	G	STRING	0 = no Host Name configured (see page 71)

Common services

Table 29: Common services

Service code	Class	Instance	Service name
01 (0x01)	yes	yes	Get_Attribute_All
02 (0x02)	no	no	Set_Attribute_All
14 (0x0E)	yes	yes	Get_Attribute_Single
16 (0×10)	no	yes	Set_Attribute_Single

- **Interface Status**

  The Status attribute indicates the status of the TCP/IP network interface.
  Refer to the state diagram, Figure 33: TCP/IP object state diagram (acc. to CIP Spec., Vol.2, Rev. 1.1), Page 72 for a description of object states as they relate to the Status attribute.

Table 30: Interface Status

Bit(s)	Name	Definition
0-3	Interface Configuration Status	Indicates the status of the Interface Configuration attribute: 0 = The Interface Configuration attribute has not been configured 1 = The Interface Configuration attribute contains valid configuration. 2 to 15 = Reserved
4 to 31	reserved	

- **Configuration Capability**

  The Configuration Capability indicates the device's support for optional network configuration capability.

Table 31: Configuration Capability

Bit(s)	Name	Definition	Value
0	BOOTP Client	The device is capable of obtaining its network configuration via BOOTP.	1
1	DNS Client	The device is capable of resolving host names by querying a DNS server.	0
2	DHCP Client	The device is capable of obtaining its network configuration via DHCP.	1

- **Configuration Control**

  The Configuration Control attribute is used to control network configuration options.

Table 32: Configuration Control

Bit(s)	Name	Definition
0-3	Startup Configuration	Determines how the device shall obtain its initial configuration at start-up. 0 = The device shall use the interface configuration values previously stored (for example, in non-volatile memory or via hardware switches, etc). 1 to 3 = reserved
4	DNS Enable	Always 0.
5-31	Reserved	Set to 0.

- **Interface Configuration**

  This attribute contains the configuration parameters required to operate as a TCP/IP node.

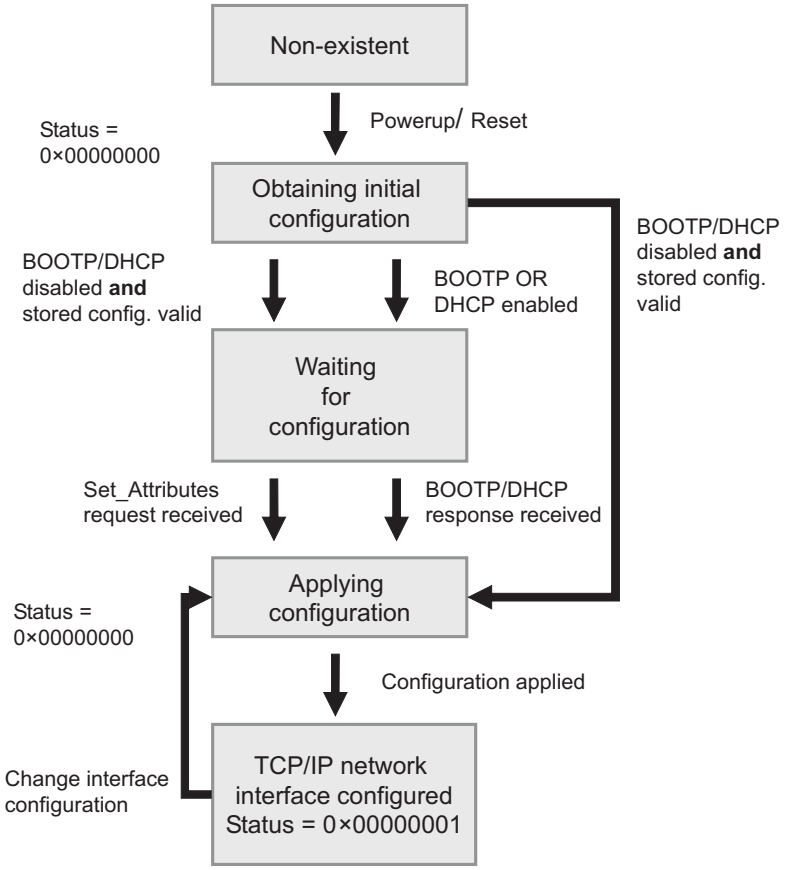
  To modify the Interface Configuration attribute, get the Interface Configuration attribute first, change the desired parameters, then set the attribute.
  The TCP/IP Interface Object applies the new configuration upon completion of the Set service. If the value of the Startup Configuration bits (Configuration Control attribute) is 0, the new configuration is stored in non-volatile memory.
  The device does not reply to the set service until the values are safely stored to non-volatile memory.
  An attempt to set any of the components of the Interface Configuration attribute to invalid values results in an error (status code 0x09) returned from the Set service.
  If initial configuration is obtained via BOOTP or DHCP, the Interface Configuration attribute components are all zeros until the BOOTP or DHCP reply is received.
  Upon receipt of the BOOTP or DHCP reply, the Interface Configuration attribute shows the configuration obtained via BOOTP/DHCP.

- **Host Name**

  The Host Name attribute contains the device's host name.

  The host name attribute is used when the device supports the DHCP-DNS Update capability and has been configured to use DHCP upon start up.
  The mechanism allows the DHCP client to transmit its host name to the DHCP server. The DHCP server then updates the DNS records on behalf of the client. The host name attribute does not need to be set for the device to operate normally. The value of the Host Name attribute, if it is configured, is used for the value of the FQDN option in the DHCP request. If the Host Name attribute has not been configured, then the device shall not include the FQDN option in the DHCP request.

Figure 33: TCP/IP object state diagram (acc. to CIP Spec., Vol.2, Rev. 1.1)



5.2.8 Ethernet Link Object (0×F6)

The following description of the Ethernet Link Object is taken from the CIP specification, Vol. 2, Rev. 1.1 by ODVA & ControlNet International Ltd. and adapted to XI/ON.

Class attributes

Table 33: Class attributes

Attr. no.	Attribute name	Get/ Set	Type	Value
1 (0×01)	REVISION	G	UINT	1
2 (0×02)	MAX OBJECT INSTANCE	G	UINT	1
3 (0×03)	NUMBER OF INSTANCES	G	UINT	1
6 (0×06)	MAX CLASS IDENTIFIER	G	UINT	7
7 (0×07)	MAX INSTANCE ATTRIBUTE	G	UINT	6

Instance attributes

Table 34: Instance attributes

Attr. no.	Attribute name	Get/ Set	Type	Description
1 (0×01)	INTERFACE SPEED	G	UDINT	Speed in megabits per second (e.g., 10, 100, 1000, etc.)
2 (0×02)	INTERFACE FLAGS	G	DWORD	see Table 35: Interface flags, Page 73
3 (0×03)	PHYSICAL ADDRESS	G	ARRAY OF USINT	Contains the interface's MAC address

Table 35: Interface flags

Bits	Name	Definition	Default-value
0	Link Status	Indicates whether or not the Ethernet 802.3 communications interface is connected to an active network. 0 = inactive link 1 = active link.	Depends on application
1	Half / Full Duplex	0 = half duplex; 1 = full duplex If the Link Status flag is 0, the value of the Half/Full Duplex flag is indeterminate.	Depends on application

Table 35: Interface flags

Bits	Name	Definition	Default-value
2 to 4	Negotiation Status	Indicates the status of link auto-negotiations. 0 = Auto-negotiation in progress 1 = Auto-negotiation and speed detection failed. Using default values for speed and duplex (10 Mbps/half duplex). 2 = Auto negotiation failed but detected speed (default: half duplex). 3 = Successfully negotiated speed and duplex. 4 = Auto-negotiation not attempted. Forced speed and duplex.	Depends on application
5	Manual Setting Requires Reset	0 = interface can activate changes to link parameters (auto-negotiate, duplex mode, interface speed) automatically 1 = device requires a Reset service to be issued to its Identity Object in order to adapt the changes	0
6	Local Hardware Fault	0 = interface detects no local hardware fault 1 = a local hardware fault is detected	0

Common services

Table 36: Common services

Service code	Class	Instance	Service name
01 (0x01)	yes	yes	Get_Attribute_All
14 (0x0E)	yes	yes	Get_Attribute_Single
76 (0×4C)	no	yes	Enetlink_Get_and_Clear

5.3 VSC-Vendor Specific Classes

In addition to supporting the above named CIP Standard Classes, the XI/ON gateway for EtherNet/IP supports the below vendor specific classes.

It is possible to gain read (**G**= Get) and/or write (**S**= Set) access to the attributes of classes described in the following VSC-Vendor Specific Classes

Table 37: VSC-Vendor Specific Classes

Class Code dec. (hex.)	**Name**	**Description**
100 (64h)	Gateway class	Contains data and settings concerning the gateway and the XI/ON system as a whole.
101 (65h)	Terminal slot class	Contains data concerning the base modules
102 (66h)	Process data class	Contains process data
103 (67h)	Power supply module class	Describes the power supply modules
104 (68h)	Digital input module class	Describes the modules of the type XN-#DI-… and XNE-#DI-…
105 (69h)	Digital output module class	Describes the modules of the type XN-#DO-… and XNE-#DO-…
106 (6Ah)	Analog input voltage module class	Describes the modules of the type XN-#AI-U(-10/0…+10VDC)
107 (6Bh)	Analog output voltage module class	Describes the modules of the type XN-#AO-U(-10/0…+10VDC)
108 (6Ch)	Analog input current module class	Describes the modules of the type XN-#AI-I(0/4…20MA)
109 (6Dh)	Analog output current module class	Describes the modules of the type XN-#AO-I(0/4…20MA)
110 (6Eh)	Analog input RTD module class	Describes the modules of the type XN-#AI-PT/NI-2/3
111 (6Fh)	Analog input THERMO module class	Describes the modules of the type XN-#AI-THERMO-PI
112 (70h)	Counter module class	Describes the modules of the type XN-1CNT-24VDC
113 (71h)	reserved	–
114 (72h)	RS232 module class	Describes the modules of the type XN-1RS232
115 (73h)	RS485/422 module class	Describes the modules of the type XN-1RS485/422

Table 37: VSC-Vendor Specific Classes

Class Code dec. (hex.)	**Name**	**Description**
116 (74h)	SSI module class	Describes the modules of the type XN-1SSI
117 (75h)	Digital versatile module class	No XI/ON modules available in this class.
118 (76h)	Analog versatile module class	Describes modules of the types XN-4AI-U/I XNE-8AI-U/I-4PT/NI XNE-4AO-U/I
121 (79h)	SWIRE module class	Describes modules of the type XNE-1SWIRE.

5.3.1 Class instance of the VSC

Note

The Class instance attributes are the same for each Vendor Specific Class.

The class-specific Object instances and the corresponding attributes are explained in the paragraphs for the different VSC.

The general VSC - Class instance attributes are defined as follows:.

Table 38: Class instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
100 (64h)	Class revision	G	UINT	States the revision number of the class (Maj. Rel. *1000 + Min. Rel.).
101 (65h)	Max. instance	G	USINT	Contains the number of the highest instance of an object created on this level in the class hierarchy.
102 (66h)	# of instances	G	USINT	Contains the number of Object instances created in this class.
103 (67h)	Max. class attribute	G	USINT	Contains the number of the last Class Attribute to be implemented.

5.3.2 Gateway Class (VSC 100)

The Gateway Class contains all the parameters that concern the XI/ON system and the gateway.

Class instance

Note

Please refer to Chapter 5.3.1 Class instance of the VSC, Page 76, for the description of the class instance for the VSC.

Object instance 1

Table 39: Object instance 1, Boot instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented
101 (65h)	Hardware revision	G	STRUCT	Contains the hardware revision number of the gateway (USINT Maj./USINT Min.)
102 (66h)	Firmware revision	G	STRUCT	Contains the revision number of the Boot Firmware for DeviceNet™ (Maj./Min.).
103 (67h)	Service tool ident number	G	UDINT	Contains the BOOT ID number that serves as an identification number for the software I/O-ASSISTANT
104 (68h)	Hardware info	G	STRUCT	Contains gateway hardware information (UINT): – count (number of the following entries) – CLOCK FREQUENCY (kHz) – MAIN FLASH (in kB) – MAIN FLASH SPEED (ns) – SECOND FLASH (kB) – RAM (kB), – RAM SPEED (ns), – RAM data WIDTH (bit), – SERIAL EEPRPOM (kbit) – RTC SUPPORT (in #) – AUTO SERVICE BSL SUPPORT (BOOL) – HDW SYSTEM

Object instance 2

Table 40: Object instance 2, Gateway Instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
109 (6Dh)	Status register 2	G	STRUCT	Gateway-Status contains general gateway status information: **Gateway** – Bit 15: "I/O Controller Error" The communication controller for the I/O-system is faulty. – Bit 14: "Force Mode Active Error" The Force Mode is activated. – Bit 13: reserved – Bit 12: reserved **Module bus** – Bit 11: "I/O Cfg Modified Error" The I/O-configuration has been changed and is now incompatible. – Bit 10: "I/O Communication Lost Error" No communication on the I/O module bus. **Voltage errors** – Bit 09: "U_{SYS} too low" System supply voltage too low (< 18 VDC). – Bit 08: "U_{SYS} too high" System supply voltage too high (> 30 VDC). – Bit 07: "U_L too low" Load voltage too low (< 18 VDC). – Bit 06: "U_L too high" Load voltage too high (> 30 VDC) – Bit 05: "I_{SYS} too high" Overload of the system voltage supply. – Bit 04: reserved **Warnings** – Bit 03: "I/O Cfg Modified Warning" – Bit 02: reserved – Bit 01: reserved – Bit 00: "I/O Diags Active Warning" At least one I/O-module sends active diagnostics.

Table 40: Object instance 2, Gateway Instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
116 (74h)	Module diag summary	G	ARRAY OF STRUCT	Contains the diagnostic information of all modules ARRAY OF STRUCT: USINT SLOT #: Indicates the slot number (module position) with diagnostic messages. BYTE SLOT FLAGS: Offers slot-related information. Bit 7 = 1 module missing Bit 6 = 1 wrong module plugged DWORD Diag: Contains the module diagnostic information. Module diagnostic bits that are not used are indicated by a "0".

5.3.3 Terminal Slot Class (VSC 101)

This class contains parameters and data for the base modules.

Class instance

Note

Please refer to Chapter 5.3.1 Class instance of the VSC, Page 76, for the description of the class instances for VSC.

Object instance

Table 41: Object Instances

Attr. no. dec. (hex.)	Attribute name	Get/ Set	Type	Description
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Module present	G	BOOL	0 = module missing, base module without electronic module. 1 = module is plugged
102 (66h)	Slot state	G	ENUM USINT	NOT USED (0): A non-occupied slot is not taking part in process data traffic. It is not responding to data transmitted or received via I/O Connection Messages. PROCESSING (1): A XI/ON module, recognized by the fieldbus is occupying a slot. Data transfer is taking place with the other fieldbus devices via I/O Connection Messages. ALLOCATED (2): The slot is not occupied, but has been reserved for a certain electronic module. The process data are set to 0. WRONG MODULE (3): The wrong module has been plugged in the slot, meaning, it supports process data lengths that were not previously defined or it is a different type of module. This false module will not be made known to the fieldbus and will not take part in process data traffic. The process data for this slot are set to 0.
103 (67h)	Module ID	G	DWORD	Contains the ID of the XI/ON module.
104 (68h)	Module diag bit count	G	UINT	States the number of diagnostic bits of the module.

Table 41: Object Instances

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
105 (69h)	Module param bit count	G	UINT	States the number of parameter bits of the module.
106 (6Ah)	Module diag bit count	G	UINT	States the number of input bits (produced bits) of the module.
107 (6Bh)	Module output bit count	G	UINT	States the number of output bits (consumed bits) of the module.
108 (6Ch)	Module SUBMODE	G	USINT	Contains the Submode ID of the XI/ON module.
109 (6Dh	Module group count	G	USINT	States the number of internal groups of the module.
110 (6Eh)	Diag	G	ARRAY OF BYTE	Contains the diagnostic information of the module.
111 (6Fh)	Param	G/S	ARRAY OF BYTE	Contains the parameters of the module.
112 (70h)	Input	G	ARRAY OF BYTE	Contains the input data (produced data) of the module.
113 (71h)	Output	G/S	ARRAY OF BYTE	Contains the output data (consumed data) of the module.
114 (72h)	Referenced VSC	G	USINT	The VSC that represents this XI/ON module. If this module is contained in the internal gateway library, then it is listed in a specific VSC that describes the typical attributes of the module.
115 (73h)	Referenced VSC instance	G	USINT	The VSC Instance that represents this XI/ON module. If this module is contained in the internal gateway library, then it is listed in a specific VSC that describes the typical attributes of the module.
116 (74h)	Module regis-tered index	G/S	ENUM USINT	Contains the index numbers specified in all the module lists.

5.3.4 Process Data Class (VSC102)

This class contains the process-relevant information.

Class instance

Note
Please refer to Chapter 5.3.1 Class instance of the VSC, Page 76, for the description of the class instances for VSC.

Object instance 1, standard input process data (compressed)

Table 42: Object instance 1, standard input process data (compressed)

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Attribute list	G	ARRAY OF USINT	List of all attributes that are supported by this Instance.
102 (66h)	Standard packed process input data	G	ARRAY OF WORD	Input process data, 16-bit aligned, compressed.
103 (67h)	Process data byte count	G	USINT	The number of bytes that are exchanged with this Instance.

Note
The following object instances of VSC 102 (Object instance 2 to Object instance 8) are only valid for gateways with Maj. Rev. ≧ 1.6.0.

Object instance 2, standard output process data (compressed)

Table 43: Object instance 2, standard output process data (compressed)

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Attribute list	G	ARRAY OF USINT	List of all attributes that are supported by this Instance.
102 (66h)	Standard packed process output data	G/S	ARRAY OF WORD	Output process data, 16-bit aligned, compressed.
103 (67h)	Process data byte count	G	USINT	The number of bytes that are exchanged with this Instance.

Object instance 3, diagnostic instance

Table 44: Object instance 3, diagnostic instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
104 (68h)	GW summarized diagnostics	G/S	BOOL	0 = disabled 1 = enabled: 1 bit of diagnosis per slot mapped at the end of the input data image (page 51). The actual data is loaded to the non-volatile memory of the gateway. Changes become valid after a start-up!
105 (69h)	GW scheduled diagnostics	G/S	BOOL	0 = disabled 1 = enabled: time sliced module related data block using a round robin mechanism (page 51). The actual data is loaded to the non-volatile memory of the gateway. Changes become valid after a start-up!
106 (6Ah)	reserved			
107 (6Bh)	I-MAP summarized diags	G	USINT	Contains the number of summarized diagnostic bytes. Changes become valid after a start-up!
108 (6Ch)	I-MAP scheduled diags	G	USINT	Contains the number of scheduled diagnostics bytes. Changes become valid after a start-up!

Object instance 4, COS/CYCLIC instance

Table 45: Object instance 4, COS/CYCLIC instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
104 (68h)	COS data mapping	G/S	ENUM USINT	Currently not supported

5.3.5 Power supply module class (VSC103)

This class contains all the relevant information and parameters for the power supply modules.

Class instance

Note

Please refer to Chapter 5.3.1 Class instance of the VSC, Page 76, for the description of the class instances for VSC.

Object instance

Table 46: Object instance

Attr. no. dec. (hex.)	Attribute name	Get/ Set	Type	Description
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Module present	G	BOOL	0 = module missing, base module without electronic module. 1 = module is plugged
102 (66h)	Terminal slot number	G	USINT	The slot number of the base module belonging to the module (base module to the right of the gateway = No. 1). Corresponds to the respective Instance Number within the TERMINAL SLOT CLASS.
103 (67h)	Module ID	G	DWORD	Contains the module ID.
104 (68h)	Module order number	G	UDINT	Contains the ident number of the module.
105 (69h)	Module order name	G	SHORT STRING	Contains the name of the module, for example "XN-PF-24VDC-D"
106 (6Ah)	Module revision	G	USINT	Contains the revision number of the module firmware.

Table 46: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
107 (6Bh)	Module type ID	G	ENUM USINT	Describes the module type: – 0x00: type of module unknown (default) – 0x01: digital module – 0x11: analog voltage mod. – 0x12: analog current mod. – 0x13: analog RTD mod. – 0x14: analog THERMO mod. – 0x1F: analog volt./curr. mod. – 0x22: counter/incr. encoder 32bit – 0x28: SSI interface – 0x31: starter, mechanical – 0x32: starter, electronical – 0x41: RS232 mod. – 0x42: RS485/RS422 mod. – etc.
108 (6Ch)	Module command interface	G/S	ARRAY	The control interface of the XI/ON module. ARRAY OF: BYTE: Control byte sequence
109 (6Dh	Module response interface	G	ARRAY	Response interface of the XI/ON module. ARRAY OF: BYTE: Response byte sequence
110 (6Eh)	Diag size	G	UINT	Indicates the number of diagnostic bits of the module.
111 (6Fh)	Diag	G	WORD	Contains the diagnostic information of the module. WORD: Bit for bit assignment according to module specification.
112 (70h)	Module registered index	G	ENUM USINT	Contains the index numbers specified in all the module lists.

5.3.6 Digital input module class (VSC104)

This Class contains all information and parameters for digital input modules.

Class instance

> **Note**
> Please refer to Chapter 5.3.1 Class instance of the VSC, Page 76, for the description of the class instances for VSC.

Object instance

Table 47: Object instance

Attr. no. dec. (hex.)	Attribute name	Get/ Set	Type	Description
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented
101 (65h)	Module present	G	BOOL	0 = module missing, base module without electronic module. 1 = module is plugged
102 (66h)	Terminal slot number	G	USINT	The slot number of the base module belonging to the module (base module to the right of the gateway = No. 1). Corresponds to the respective Instance Number within the TERMINAL SLOT CLASS.
103 (67h)	Module ID	G	DWORD	Contains the module ID.
104 (68h)	Module order number	G	UDINT	Contains the ident number of the module.
105 (69h)	Module order name	G	SHORT STRING	Contains the name of the module, for example, "XN-4DI-24VDC-P".
106 (6Ah)	Module revision	G	USINT	Contains the revision number of the module firmware.
107 (6Bh)	Module type ID	G	ENUM USINT	Describes the module type: see attribute 107 (6Bh) on page 86
108 (6Ch)	Module command interface	G/S	ARRAY	The control interface of the XI/ON module. ARRAY OF: BYTE: Control byte sequence
109 (6Dh	Module response interface	G	ARRAY	Response interface of the XI/ON module. ARRAY OF: BYTE: Response byte sequence
110 (6Eh)	Produced data size	G	UINT	Contains information concerning the range of data produced by the module.

Table 47: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
111 (6Fh)	Produced data	G	DWORD	Contains the input data of the module. DWORD: Bit for bit assignment according to module specification.
112 (70h)	Diag size	G	UINT	Contains information concerning the range of the diagnostic data of the module.
113 (71h)	Diag	G/S	DWORD	Contains the diagnostic information of the module. DWORD: Bit for bit assignment according to module specification.
114 (72h)	Param size	G	UINT	Contains information concerning the range of parameters of the module.
115 (73h)	Params	G/S	DWORD	Contains the parameters of the module. DWORD: Bit for bit assignment according to module specification.
116 (74h)	Module registered index	G	ENUM USINT	Contains the index numbers specified in all the module lists.

5.3.7 Digital output module class (VSC105)

This Class contains all information and parameters for digital output modules.

Class instance

Note

Please refer to Chapter 5.3.1 Class instance of the VSC, Page 76, for the description of the class instances for VSC.

Object instance

Table 48: Object instance

Attr. no. dec. (hex.)	Attribute name	Get/ Set	Type	Description
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Module present	G	BOOL	0 = module missing, base module without electronic module. 1 = module is plugged
102 (66h)	Terminal slot number	G	USINT	The slot number of the base module belonging to the module (base module to the right of the gateway = No. 1). Corresponds to the respective Instance Number within the TERMINAL SLOT CLASS.
103 (67h)	Module ID	G	DWORD	Contains the module ID.
104 (68h)	Module order number	G	UDINT	Contains the ident number of the module.
105 (69h)	Module order name	G	SHORT STRING	Contains the name of the module, for example, "XN-4DO-24VDC-0.5A-P".
106 (6Ah)	Module revision	G	USINT	Contains the revision number of the module firmware.
107 (6Bh)	Module type ID	G	ENUM USINT	Describes the module type: see attribute 107 (6Bh) on page 86
108 (6Ch)	Module command interface	G/S	ARRAY	The control interface of the XI/ON module. ARRAY OF: BYTE: Control byte sequence
109 (6Dh	Module response interface	G	ARRAY	Response interface of the XI/ON module. ARRAY OF: BYTE: Response byte sequence
110 (6Eh)	Consumed data size	G	UINT	Contains information concerning the range of data consumed by the module.

Table 48: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
111 (6Fh)	Consumed data	G	DWORD	Contains the output data of the module. DWORD: Bit for bit assignment according to module specification.
112 (70h)	Diag size	G	UINT	Contains information concerning the range of the diagnostic data of the module.
113 (71h)	Diag	G/S	DWORD	Contains the diagnostic information of the module. DWORD: Bit for bit assignment according to module specification.
114 (72h)	Param size	G	UINT	Contains information concerning the range of parameters of the module.
115 (73h)	Params	G/S	DWORD	Contains the parameters of the module. DWORD: Bit for bit assignment according to module specification.
116 (74h)	Module registered index	G	ENUM USINT	Contains the index numbers specified in all the module lists.

5.3.8 Analog input voltage module class (VSC106)

This Class contains all information and parameters for analog input modules (voltage).

Class instance

Note

Please refer to Chapter 5.3.1 Class instance of the VSC, Page 76, for the description of the class instances for VSC.

Object instance

Table 49: Object instance

Attr. no. dec. (hex.)	Attribute name	Get/ Set	Type	Description
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Module present	G	BOOL	0 = module missing, base module without electronic module. 1 = module is plugged
102 (66h)	Terminal slot number	G	USINT	The slot number of the base module belonging to the module (base module to the right of the gateway = No. 1). Corresponds to the respective Instance Number within the TERMINAL SLOT CLASS.
103 (67h)	Module ID	G	DWORD	Contains the module ID.
104 (68h)	Module order number	G	UDINT	Contains the ident number of the module.
105 (69h)	Module order name	G	SHORT STRING	Contains the name of the module, for example, "XN-2AI-U(-10/0…+10VDC)".
106 (6Ah)	Module revision	G	USINT	Contains the revision number of the module firmware.
107 (6Bh)	Module type ID	G	ENUM USINT	Describes the module type: see attribute 107 (6Bh) on page 86
108 (6Ch)	Module command interface	G/S	ARRAY	The control interface of the XI/ON module. ARRAY OF: BYTE: Control byte sequence
109 (6Dh	Module response interface	G	ARRAY	Response interface of the XI/ON module. ARRAY OF: BYTE: Response byte sequence
110 (6Eh)	Module registered index	G	ENUM USINT	Contains the index numbers specified in all the module lists.

Table 49: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
111 (6Fh)	Number of supported channels	G	USINT	States the number of analog input channels supported by this module Instance.
112 - 119 (70h - 77h)	Produced data	G	INT	Contains the data transmitted by the analog input module of channels No. 1 to No. 8. Only those channels are supported that are contained in attribute 111, "Number of supported channels". Attribute 112 contains the data for channel 1, attribute 119 for channel 8.
120 - 127 (78h - 7Fh)	Diag data	G	BYTE	Contains the diagnostic data of the channels 1 to 8 of the analog input module. Only those channels are supported that are defined in attribute 111, "Number of supported channels". Attribute 120 contains the data for channel 1, attribute 127 for channel 8. BYTE diag: Bit0: 0 =ok 1 =measurement value range error Bit1 to 7: reserved
128 - 135 (80h - 87h)	Mode parameter data	G/S	BYTE	Contains the diagnostic data of the channels 1 to 8 of the analog input module. Only those channels are supported that are defined in attribute 111, "Number of supported channels". Attribute 128 contains the data for channel 1, attribute 135 for channel 8. BYTE mode: Bit0: Voltage mode: 0 =0…10V 1 =-10V…+10V Bit 1: Value representation 0 =Integer (15Bit + sign) 1 =12Bit (left-justified) Bit 2: Diagnostic: 0 = enable 1 = disable Bit 3 to 7: reserved

5.3.9 Analog output voltage module class (VSC107)

This Class contains all information and parameters for analog output modules (voltage).

Class instance

Note

Please refer to Chapter 5.3.1 Class instance of the VSC, Page 76, for the description of the class instances for VSC.

Object instance

Table 50: Object instance

Attr. no. dec. (hex.)	Attribute name	Get/ Set	Type	Description
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Module present	G	BOOL	0 = module missing, base module without electronic module. 1 = module is plugged
102 (66h)	Terminal slot number	G	USINT	The slot number of the base module belonging to the module (base module to the right of the gateway = No. 1). Corresponds to the respective Instance Number within the TERMINAL SLOT CLASS.
103 (67h)	Module ID	G	DWORD	Contains the module ID.
104 (68h)	Module order number	G	UDINT	Contains the ident number of the module.
105 (69h)	Module order name	G	SHORT STRING	Contains the name of the module, for example, "XN-2AO-U(-10/0…+10VDC)".
106 (6Ah)	Module revision	G	USINT	Contains the revision number of the module firmware.
107 (6Bh)	Module type ID	G	ENUM USINT	Describes the module type: see attribute 107 (6Bh) on page 86
108 (6Ch)	Module command interface	G/S	ARRAY	The control interface of the XI/ON module. ARRAY OF: BYTE: Control byte sequence
109 (6Dh	Module response interface	G	ARRAY	Response interface of the XI/ON module. ARRAY OF: BYTE: Response byte sequence
110 (6Eh)	Module registered index	G	ENUM USINT	Contains the index numbers specified in all the module lists.

Table 50: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
111 (6Fh)	Number of supported channels	G	USINT	States the number of analog input channels supported by this module Instance.
112 - 119 (70h - 77h)	Consumed data	G	INT	Contains the data received by the analog output module of channels No. 1 to No. 8. Only those channels are supported that are contained in attribute 111, "Number of supported channels". Attribute 112 contains the data for channel 1, attribute 119 for channel 8.
120 - 127 (78h - 7Fh)	Diag data	G	BYTE	Contains the diagnostic data of the channels 1 to 8 of the analog output module. Only those channels are supported that are defined in attribute 111, "Number of supported channels". Attribute 120 contains the data for channel 1, attribute 127 for channel 8. BYTE diag: Bit 0 to 7: reserved
128 - 135 (80h - 87h)	Mode parameter data	G/S	BYTE	Contains the diagnostic data of the channels 1 to 8 of the analog output module. Only those channels are supported that are defined in attribute 111, "Number of supported channels". Attribute 128 contains the data for channel 1, attribute 135 for channel 8. BYTE mode: Bit0: Voltage mode: 0 = 0…10V 1 = -10V…+10V Bit1: Value representation 0 = Integer (15Bit + sign) 1 = 12Bit (left-justified) Bit2 to 7: reserved
136 - 143 (88h - 8Fh)	Fault value parameter data	G/S	INT	Contains the Fault Value-Definition of the channels 1 to 8 of the analog output modules. Only those channels are supported that are defined in attribute 111, "Number of supported channels". Attribute 136 contains the data for channel 1, attribute 143 for channel 8.

5.3.10 Analog input current module class (VSC108)

This Class contains all information and parameters for analog input modules (current).

Class instance

Note

Please refer to Chapter 5.3.1 Class instance of the VSC, Page 76, for the description of the class instances for VSC.

Object instance

The Object instances/ attributes of the analog input modules (current) correspond to those of the analog input modules (voltage). Differences are only to be found in the attributes no. 112 to 135 that concern the measurement ranges of the modules (current or voltage measurements).

Table 51: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
112 - 119 (70h - 77h)	Produced data	G	INT	Contains the data transmitted by the analog input module of channels No. 1 to No. 8. Only those channels are supported that are contained in attribute 111, "Number of supported channels". Attribute 112 contains the data for channel 1, attribute 119 for channel 8.
120 - 127 (78h - 7Fh)	Diag data	G	BYTE	Contains the diagnostic data of the channels 1 to 8 of the analog input module. Only those channels are supported that are defined in attribute 111, "Number of supported channels". Attribute 120 contains the data for channel 1, attribute 127 for channel 8. BYTE diag: Bit 0: 0 = ok 1 = measurement value range error Bit 1: 0 = ok 1 = open circuit (only measurement range 4 to 20 mA) Bit 2 to 7: reserved

Table 51: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
128 - 135 (80h - 87h)	Mode parameter data	G/S	BYTE	Contains the diagnostic data of the channels 1 to 8 of the analog input module. Only those channels are supported that are defined in attribute 111, "Number of supported channels". Attribute 128 contains the data for channel 1, attribute 135 for channel 8. BYTE mode: Bit 0: Current mode: 0 = 0 to 20 mA 1 = 4 to 20 mA Bit 1: Value representation: 0 = Integer (15 Bit + sign) 1 = 12 Bit (left-justified) Bit 2: Diagnostic: 0 = enable 1 = disable Bit 3 to 7: reserved

5.3.11 Analog output current module class (VSC109)

This Class contains all information and parameters for analog output modules (current).

Class instance

Note

Please refer to Chapter 5.3.1 Class instance of the VSC, Page 76, for the description of the class instances for VSC.

Object instance

The Object instances/attributes of the analog output modules (current) correspond to those of the analog output modules (voltage). Differences are only to be found in the attributes no. 112 to 143 that concern the measurement ranges of the modules (current or voltage measurements).

Table 52: Object instance

Attr. no. dec. (hex.)	Attribute name	Get/ Set	Type	Description
112 - 119 (70h - 77h)	Consumed data	G	INT	Contains the data received by the analog output module of channels No. 1 to No. 8. Only those channels are supported that are contained in attribute 111, "Number of supported channels". Attribute 112 contains the data for channel 1, attribute 119 for channel 8.
120 - 127 (78h - 7Fh)	Diag data	G	BYTE	Contains the diagnostic data of the channels 1 to 8 of the analog output module. Only those channels are supported that are defined in attribute 111, "Number of supported channels". Attribute 120 contains the data for channel 1, attribute 127 for channel 8. BYTE diag: Bit 0 to 7: reserved

Table 52: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
128 - 135 (80h - 87h)	Mode parameter data	G/S	BYTE	Contains the diagnostic data of the channels 1 to 8 of the analog output module. Only those channels are supported that are defined in attribute 111, "Number of supported channels". Attribute 128 contains the data for channel 1, attribute 135 for channel 8. BYTE mode: Bit 0: Current mode: 0 = 0 to 20 mA 1 = 4 to 20 mA Bit 1: Value representation: 0 = Integer (15 Bit + sign) 1 = 12 Bit (left-justified) Bit 2 to 7: reserved
136 - 143 (88h - 8Fh)	Fault value parameter data	G/S	INT	Contains the Fault Value-Definition of the channels 1 to 8 of the analog output modules. Only those channels are supported that are defined in attribute 111, "Number of supported channels". Attribute 136 contains the data for channel 1, attribute 143 for channel 8.

5.3.12 Analog input PT/NI module class (VSC110)

This Class contains all information and parameters for analog input modules for PT/NI- sensors (current).

Class instance

Note

Please refer to Chapter 5.3.1 Class instance of the VSC, Page 76, for the description of the class instances for VSC.

Object instance

Table 53: Object instance

Attr. no. dec. (hex.)	Attribute name	Get/ Set	Type	Description
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Module present	G	BOOL	0 = module missing, base module without electronic module. 1 = module is plugged
102 (66h)	Terminal slot number	G	USINT	The slot number of the base module belonging to the module (base module to the right of the gateway = No. 1). Corresponds to the respective Instance Number within the TERMINAL SLOT CLASS.
103 (67h)	Module ID	G	DWORD	Contains the module ID.
104 (68h)	Module order number	G	UDINT	Contains the ident number of the module.
105 (69h)	Module order name	G	SHORT STRING	Contains the name of the module, for example, "XN-2AI-PT/NI-2/3".
106 (6Ah)	Module revision	G	USINT	Contains the revision number of the module firmware.

Table 53: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
107 (6Bh)	Module type ID	G	ENUM USINT	Describes the module type: see attribute 107 (6Bh) on page 86
108 (6Ch)	Module command interface	G/S	ARRAY	The control interface of the XI/ON module. ARRAY OF: BYTE: Control byte sequence
109 (6Dh	Module response interface	G	ARRAY	Response interface of the XI/ON module. ARRAY OF: BYTE: Response byte sequence
110 (6Eh)	Module registered index	G	ENUM USINT	Contains the index numbers specified in all the module lists.
111 (6Fh)	Number of supported channels	G	USINT	States the number of analog input channels supported by this module Instance.
112 - 119 (70h - 77h)	Produced data	G	INT	Contains the data received by the analog input module of channels No. 1 to No. 8. Only those channels are supported that are contained in attribute 111, "Number of supported channels". Attribute 112 contains the data for channel 1, attribute 119 for channel 8.
120 - 127 (78h - 7Fh)	Diag data	G	BYTE	Contains the diagnostic data of the channels 1 to 8 of the analog input module. Only those channels are supported that are defined in attribute 111, "Number of supported channels". Attribute 120 contains the data for channel 1, attribute 127 for channel 8. BYTE diag: Bit 0: 0 = ok 1 = measurement value range error Bit 1: 0 = ok 1 = open circuit Bit 2: 0 = ok 1 = short-circuit

Table 53: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
128 - 135 (80h - 87h)	Mode parameter data	G/S	BYTE	Contains the diagnostic data of the channels 1 to 8 of the analog input module. Only those channels are supported that are defined in attribute 111, "Number of supported channels". Attribute 128 contains the data for channel 1, attribute 135 for channel 8. BYTE mode: Bit 0: Mains suppression 0 = 50 Hz mains suppression 1 = 60 Hz mains suppression Bit 1: value representation: 0 = Integer (15 Bit + sign) 1 = 12 Bit (left-justified) Bit 2: Diagnose: 0 = release 1 = block Bit 3:Channel: 0 = activate channel 1 = deactivate channel Bit 4: Measurement mode: 0 = 2-wire 1 = 3-wire Bit 5 to 7: reserved

Table 53: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
136 - 143 (88h - 8Fh)	Sensor parameter data	G/S	ENUM USINT	Contains the sensor-specific parameter data of the channels 1 to 8 of the analog input module. Only those channels are supported that are defined in attribute 111, "Number of supported channels". Attribute 136 contains the data for channel 1, attribute 143 for channel 8. ENUM USINT: Element: 0:Pt100, -200...850 °C 1:Pt100, -200...150 °C 2:Ni100, -60...250 °C 3:Ni100, -60...150 °C 4:Pt200, -200...850 °C 5:Pt200, -200...150 °C 6:Pt500, -200...850 °C 7:Pt500, -200...150 °C 8:Pt1000, -200...850 °C 9:Pt1000, -200...150 °C 10:Ni1000, -60...250 °C 11:Ni1000, -60...150 °C 12:resistance: 0...100 Ω 13:resistance: 0...200 Ω 14:resistance: 0...400 Ω 15:resistance: 0...1000 Ω 16 to 255: reserved

5.3.13 Analog input THERMO module class (VSC111)

This Class contains all information and parameters for analog input modules for thermo-couples.

Class instance

Note

Please refer to Chapter 5.3.1 Class instance of the VSC, Page 76, for the description of the class instances for VSC.

Object instance

Table 54: Object instance

Attr. no. dec. (hex.)	Attribute name	Get/ Set	Type	Description
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Module present	G	BOOL	0 = module missing, base module without electronic module. 1 = module is plugged
102 (66h)	Terminal slot number	G	USINT	The slot number of the base module belonging to the module (base module to the right of the gateway = No. 1). Corresponds to the respective Instance Number within the TERMINAL SLOT CLASS.
103 (67h)	Module ID	G	DWORD	Contains the module ID.
104 (68h)	Module order number	G	UDINT	Contains the ident number of the module.
105 (69h)	Module order name	G	SHORT STRING	Contains the name of the module, for example, "XN-2AI-THERMO-PI".
106 (6Ah)	Module revision	G	USINT	Contains the revision number of the module firmware.
107 (6Bh)	Module type ID	G	ENUM USINT	Describes the module type: see attribute 107 (6Bh) on page 86
108 (6Ch)	Module command interface	G/S	ARRAY	The control interface of the XI/ON module. ARRAY OF: BYTE: Control byte sequence
109 (6Dh	Module response interface	G	ARRAY	Response interface of the XI/ON module. ARRAY OF: BYTE: Response byte sequence

Table 54: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
110 (6Eh)	Module registered index	G	ENUM USINT	Contains the index numbers specified in all the module lists.
111 (6Fh)	Number of supported channels	G	USINT	States the number of analog input channels supported by this module Instance.
112 - 119 (70h - 77h)	Produced data	G	INT	Contains the data received by the analog input module of channels No. 1 to No. 8. Only those channels are supported that are contained in attribute 111, "Number of supported channels". Attribute 112 contains the data for channel 1, attribute 119 for channel 8.
120 - 127 (78h - 7Fh)	Diag data	G	BYTE	Contains the diagnostic data of the channels 1 to 8 of the analog input module. Only those channels are supported that are defined in attribute 111, "Number of supported channels". Attribute 120 contains the data for channel 1, attribute 127 for channel 8. BYTE diag: Bit 0: 0 = ok 1 = measurement value range error Bit 1: 0 = ok 1 = open circuit Bit 2 to 7: reserved

Table 54: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
128 - 135 (80h - 87h)	Mode parameter data	G/S	BYTE	Contains the diagnostic data of the channels 1 to 8 of the analog input module. Only those channels are supported that are defined in attribute 111, "Number of supported channels". Attribute 128 contains the data for channel 1, attribute 135 for channel 8. BYTE mode: Bit 0: Mains suppression 0 = 50 Hz mains suppression 1 = 60 Hz mains suppression Bit 1: value representation: 0 = Integer (15 Bit + sign) 1 = 12 Bit (left-justified) Bit 2: Diagnose: 0 = release 1 = block Bit 3: Channel: 0 = activate channel 1 = deactivate channel Bit 4 to 7: reserved
136 - 143 (88h - 8Fh)	Sensor parameter data	G/S	ENUM USINT	Contains the sensor-specific parameter data of the channels 1 to 8 of the analog input module. Only those channels are supported that are defined in attribute 111, "Number of supported channels". Attribute 136 contains the data for channel 1, attribute 143 for channel 8. ENUM USINT: Element: 0: Type K -270…1370 °C 1: Type B 100…1820 °C 2: Type E -270…1000 °C 3: Type J -210…1200 °C 4: Type N -270…1300 °C 5: Type R -50…1760 °C 6: Type S -50…1540 °C 7: Type T -270…400 °C 8: ± 50 mV 9: ± 100 mV 10± 500 mV 11± 1000 mV 12 to 255: reserved

5.3.14 Counter module class (VSC112)

This Class contains all information and parameters concerning the counter module.

Note

Please refer to Chapter 5.3.1 Class instance of the VSC, Page 76, for the description of the class instances for VSC.

Object instance

Two different operating modes can be selected for the counter module: counter mode and measurement mode. Different attributes are supported depending on the operating mode selected, meaning, with certain attributes the operating mode has to be defined. The operating mode is determined in attribute 113.

Table 55: Object instance

Attr. no. dec. (hex.)	Attribute name	Get/ Set	Type	Description
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Module present	G	BOOL	0 = module missing, base module without electronic module. 1 = module is plugged
102 (66h)	Terminal slot number	G	USINT	The slot number of the base module belonging to the module (base module to the right of the gateway = No. 1). Corresponds to the respective Instance Number within the TERMINAL SLOT CLASS.
103 (67h)	Module ID	G	DWORD	Contains the module ID.
104 (68h)	Module order number	G	UDINT	Contains the ident number of the module.
105 (69h)	Module order name	G	SHORT STRING	Contains the name of the module, for example, "XN-1CNT-24VDC".
106 (6Ah)	Module revision number	G	USINT	Contains the revision number of the module firmware.
107 (6Bh)	Module type ID	G	ENUM USINT	Describes the module type: see attribute 107 (6Bh) on page 86
108 (6Ch)	Module command interface	G/S	ARRAY	The control interface of the XI/ON module. ARRAY OF: BYTE: Control byte sequence
109 (6Dh	Module response interface	G	ARRAY	Response interface of the XI/ON module. ARRAY OF: BYTE: Response-byte sequence

Table 55: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
110 (6Eh)	Module registered index	G	ENUM USINT	Contains the index numbers specified in all the module lists.
111 (6Fh)	Number of supported channels	G	USINT	States the number of analog input channels supported by this module Instance.
112 (70h)	Counter diag	G	WORD	Contains the diagnostic data of the counter module. Bits 0 to 7 apply to the counter mode (CNT); bits 8 to 15 the counter mode (MSRM). **CNT:** Bit 0: 0 = ok 1 = short-circuit/open circuit Bit 1: 0 = ok 1 = short-circuit in sensor power supply 24 VDC Bit 2: 0 = ok 1 = upper limit wrong Bit 3: 0 = ok 1 = lower limit wrong Bit 4: 0 = ok 1 = it is not permitted to invert the level of the digital input when using the latch retrigger function Bit 5: 0 = ok 1 = main count direction wrong Bit 6: 0 = ok 1 = counter operating mode wrong Bit 7: 0 = CNT Mode NOT active 1 = CNT Mode active

Table 55: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
112 (70h)	Counter diag	G	WORD	**MSRM:** Bit 8: 0 = ok 1 = short- circuit/open circuit Bit 9: 0 = ok 1 = short-circuit in sensor power supply 24 VDC Bit 10: 0 = ok 1 = sensor pulse wrong Bit 11: 0 = ok 1 = integration time wrong Bit 12: 0 = ok 1 = upper limit wrong Bit 13: 0 = ok 1 = power limit wrong Bit 14: 0 = ok 1 = measurement operating mode wrong Bit 15: 0 = measurement Mode NOT active 1 = measurement Mode active
113 (71h)	Basic mode	G/S	ENUM USINT	Defines the operating mode of the counter module; hence, it must be written first. The definition of the operating mode in this attribute is the prerequisite for all further Instances and attributes in this class. Operating mode (basic mode): – 0: CNT: continuous count – 1: CNT: single-action count – 2: CNT: periodical count – 3: MSRM: frequency measurement – 4: MSRM: revolutions measurement – 5: MSRM: period duration measurement – 6 to 255: reserved

Table 55: Object instance

Attr. no. dec. (hex.)	Attribute name	Get/ Set	Type	Description
114 (72h)	CNT gate function **A**	G/S	ENUM USINT	The gate function defines the counter's reaction to the resetting of the internal release. Gate function: – 0: CNT: abort count procedure – 1: CNT: interrupt count procedure – 2 to 255: reserved
115 (73h)	Digital input DI	G/S	ENUM USINT	Defines if the digital input of the module will be inverted or not. USINT digital input DI: – 0: normal – 1: inverted – 2 to 255: reserved
116 (74h)	Function DI **A**	G/S	ENUM USINT	Defines the function of the digital input. Function DI: – 0: input – 1: HW gate – 2: CNT: latch retrigger when edge positive – 3: CNT: synchronization when edge positive – 4 to 255: reserved
117 (75h)	CNT synchronization **A**	G/S	ENUM USINT	Defines the kind of synchronization. Synchronization: – 0: CNT: single-action – 1: CNT: periodical – 2 to 255: reserved
118 (76h)	CNT main count direction **A**	G/S	ENUM USINT	Defines the main count direction: – 0: CNT: none – 1: CNT: up – 2: CNT: down – 3 to 255: reserved
119 (77h)	Lower limit	G/S	DINT	Defines the lower limit of the module. The module reacts according to its parameterization on reaching or undershooting the lower limit.
120 (78h)	Upper limit	G/S	DINT	Defines the upper limit of the module. The module reacts according to its parameterization on reaching or overshooting the upper limit.
121 (79h)	MSRM integration **A**	G/S	USINT	Defines the integration time. Integration [n * 10 ms]

A Depend on the selected operating mode (CNT/ MSRM) and are not supported in the other operating mode. Please refer to Attribute No. 113 BASIC MODE.

Table 55: Object instance

Attr. no. dec. (hex.)	Attribute name	Get/ Set	Type	Description
122 (7Ah)	CNT hysteresis **A**	G/S	USINT	Defines the hysteresis, meaning the differential threshold value. Hysteresis
123 (7Bh)	CNT pulse duration **A**	G/S	USINT	Defines the pulse duration. Pulse duration [n * 2 ms]
124 (7Ch)	MSRM pulses per revolution **A**	G/S	UINT	Defines the number of pulses per revolution. Pulses per revolution
125 (7Dh)	Fault value DO1	G/S	BOOL	Defines the substitute value of the digital output DO1. Fault value DO1: FALSE: 0 = off, 0V TRUE: 1 = on, 24V
126 (7Eh)	Diagnostic DO1	G/S	BOOL	Defines if the diagnostic data of the DO1 are transmitted to the gateway. Diagnostic DO1: – FALSE: on Diagnostic data of the DO1 are being transmitted – TRUE: off Diagnostic data of the DO1 are not being transmitted
127 (7Fh)	Function DO1 **A**	G/S	ENUM USINT	Defines the function of the output DO1. Function DO1: 0: output 1: CNT: on when count value ≧ reference value 2: CNT: on when count value ≦ reference value 3: CNT: pulse when count value = reference value 4: MSRM: outside of limit 5: MSRM: below lower limit 6: MSRM: above upper limit 7 to 255: reserved

A Depend on the selected operating mode (CNT/ MSRM) and are not supported in the other operating mode. Please refer to Attribute No. 113 BASIC MODE.

Table 55: Object instance

Attr. no. dec. (hex.)	Attribute name	Get/ Set	Type	Description
128 (80h)	CNT function DO2 **A**	G/S	ENUM USINT	Defines the function of the output DO2. This is not a physical output, meaning, the value from this output is read in the process input image only. Function DO2: – 0: output – 1: CNT: on when count value ≧ reference value – 2: CNT: on when count value ≦ reference value – 3: CNT: pulse when count value = reference value – 4 to 255: reserved
129 (81h)	Signal evaluation **A**	G/S	ENUM USINT	Defines the kind of signal evaluation. Signal evaluation: – 0: pulse and direction – 1: rotary sensor: single – 2: CNT: rotary sensor: double – 3: CNT: rotary sensor: fourfold – 4 to 255: reserved
130 (82h)	Sensor/input filter (A)	G/S	ENUM USINT	Defines the value of the input filter A. Sensor/input filter (A): – 0: 2.5 µs / 200 kHz – 1: 25 µs / 20k Hz – 2 to 255: reserved
131 (83h)	Sensor/input filter (B)	G/S	ENUM USINT	Defines the value of the input filter B. Sensor/input filter (B): – 0: 2.5 µs / 200 kHz – 1: 25 µs / 20 kHz – 2 to 255: reserved
132 (84h)	Sensor/input filter (DI)	G/S	ENUM USINT	Defines the value of the input filter DI. Sensor/input filter (DI): 0: 2.5 µs / 200 kHz 1: 25 µs / 20 kHz 2 to 255: reserved
133 (85h)	Sensor (A)	G/S	ENUM USINT	Defines the sensor mode. ENUM USINT sensor (A): – 0: normal – 1: inverted – 2 to 255: reserved

A Depend on the selected operating mode (CNT/ MSRM) and are not supported in the other operating mode. Please refer to Attribute No. 113 BASIC MODE.

Table 55: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
134 (86h)	Direction input B	G/S	BOOL	States if the direction input B will be inverted. Direction input B: – FALSE: normal – TRUE: inverted
135 (87h)	Group diagnostics	G/S	BOOL	Defines if the group diagnostic will be transmitted to the gateway or not. Group diagnostic: – FALSE: release – TRUE: block
136 (88h)	On I/O connection fault	G/S	ENUM USINT	Defines the behavior of the module in the cased of an I/O Connection Fault of the gateway. Behavior by I/O Connection Fault (parameter name of the counter: CPU/master STOP): – 0: turn off DO1 – 1: proceed with operating mode – 2: DO1 switch to Fault Value – 3: DO1 hold last value – 4 to 255:reserved

5.3.15 RS232 module class (VSC114)

This Class contains all information and parameters for RS232 modules.

Class instance

Note

Please refer to Chapter 5.3.1 Class instance of the VSC, Page 76, for the description of the class instances for VSC.

Object instance

Table 56: Object instance

Attr. no. dec. (hex.)	Attribute name	Get/ Set	Type	Description
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Module present	G	BOOL	0 = module missing, base module without electronic module. 1 = module is plugged
102 (66h)	Terminal slot number	G	USINT	The slot number of the base module belonging to the module (base module to the right of the gateway = No. 1). Corresponds to the respective Instance Number within the TERMINAL SLOT CLASS.
103 (67h)	Module ID	G	DWORD	Contains the module ID.
104 (68h)	Module order number	G	UDINT	Contains the ident number of the module.
105 (69h)	Module order name	G	SHORT STRING	Contains the name of the module, for example, "XN-1RS232".
106 (6Ah)	Module revision number	G	USINT	Contains the revision number of the module firmware.
107 (6Bh)	Module type ID	G	ENUM USINT	Describes the module type: see attribute 107 (6Bh) on page 86
108 (6Ch)	Module command interface	G/S	ARRAY	The control interface of the XI/ON module. ARRAY OF: BYTE: Control byte sequence
109 (6Dh	Module response interface	G	ARRAY	Response interface of the XI/ON module. ARRAY OF: BYTE: Response-byte sequence

Table 56: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
110 (6Eh)	Module registered index	G	ENUM USINT	Contains the index numbers specified in all the module lists.
111 (6Fh)	Number of supported channels	G	USINT	States the number of analog input channels supported by this module Instance.
112 (70h)	RX byte count	G	USINT	Number of the valid bytes (0 to 7) in this data segment.
113 (71h)	RX count	G	USINT	This value is transferred together with every data segment of the process input data. The RX count values are sequential: 00->01->10->11->00… (decimal: 0->1->2->3->0…) Errors in this sequence show the loss of data segments.
114 (72h)	TX count acknowledge	G	USINT	This value is a copy of the value TX count. TX count has been transmitted together with the last data segment of the process output data. TX count acknowledge is an acknowledge for the successful transmission of the data segment with TRANSMIT count.
115 (73h)	Status	G	BOOL	0 = The communication with the data terminal equipment (DTE) is disturbed. A diagnostic message is generated if the parameter "Diagnostics" is set to "0/ release". The diagnostic data show the cause of the communication disturbance. The user has to set back this bit in the process output data by using STATRES. 1 = The communication with the data terminal equipment (DTE) is error free

Table 56: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
116 (74h)	Process diagnostics data	G	BYTE	Contains the diagnostic information: The diagnostic data are part of the process input data, if ACTIVE MODE = 1 or "2bytes ctrl/status header" is set. Diagnostics messages: – Bit 0 to Bit 2: reserved – Bit 3: 0 = ok 1 = "parameter error": The set parameter values are not supported. – Bit 4: 0 = ok 1 = "hardware failure": The module has to be replaced, e.g. EEPROM or UART may be defect.
116 (74h)	Process diagnostics data	G	BYTE	– Bit 5: 0 = ok 1 = "handshake error": The DTE connected to the module does not answer a XOFF or RTS handshake. This may cause a overflow in the internal receive-buffer. – Bit 6: 0 = ok 1 = "frame error": The module has to be parameterized to be adapted to the data structure of the connected DTE. A "frame error" occurs if the parameterization (number of data bits, stop bits, parity) is not correct. – Bit 7: 0 = ok 1 = "buffer overflow": Overflow in the RX-buffer. – Bit 8 to Bit 15: reserved
117 (75h)	RX data	G	ARRAY OF BYTE	Defines the receive-data (0...7).
118 (76h)	RX data and release	G	ARRAY OF BYTE	Defines the data received via RS232 (0...7) + acknowledge for reception
119 (77h)	TX BYTE count	G/S	USINT	Number of the valid user data bytes in this data segment. I

Table 56: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
120 (78h)	TX count	G/S	USINT	This value is transferred together with every data segment. The TX count values are sequential: 00->01->10->11->00… (decimal: 0->1->2->3->0…) Errors in this sequence show the loss of data segments.
121 (79h)	RX count acknowledge	G/S	USINT	This value is a copy of RX count. RX count has been transmitted together with the last data segment of the process input data. RX count acknowledge is an acknowledge for the successful transmission of the data segment with RX count.
122 (7Ah)	Status reset control	G/S	BOOL	STATRES: This bit is set to reset the STAT bit in the process input data. With the change from 1 to 0 the status bit is reset (from 0 to 1). If this bit is 0, all changes in TRANSMIT BYTE count, TRANSMIT count and RECEIVE count acknowledge are ignored. Flushing the transmit-/ receive-buffer with Process control data (Attr. 123) is possible. If this bit is 1 or with the change from 0 to 1, the flushing of the transmit-/ receive-buffer with Process control data (Attr. 123) is not possible.
123 (7Bh)	Process control data	G/S	BYTE	Bit 0 = transmit-buffer flush, Bit 1 = receive-buffer flush
124 (7Ch)	TX data	G/S	ARRAY OF BYTE	Defines the transmit-data (0...7)
125 (7Dh)	TX data and release	S	ARRAY OF BYTE	Defines the data to be transmitted via RS232 (0...7) + transmission is released/ charged immediately
126 (7Eh)	reserved			

Table 56: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
127 (7Fh)	Diagnostics	G	WORD	Contains the diagnostic messages (low byte): Diagnostics messages: – Bit 0 to Bit 2: reserved – Bit 3: 0 = ok 1 = "parameter error": The set parameter values are not supported. – Bit 4: 0 = ok 1 = "hardware failure": The module has to be replaced, e.g. EEPROM or UART may be defect. – Bit 5: 0 = ok 1 = "handshake error": The DTE connected to the module does not answer a XOFF or RTS handshake. This may cause a overflow in the internal receive-buffer.
127 (7Fh)	Diagnostics	G	WORD	– CBit 6: 0 = ok 1 = "frame error": The module has to be parameterized to be adapted to the data structure of the connected DTE. A "frame error" occurs if the parameterization (number of data bits, stop bits, parity) is not correct. – Bit 7: 0 = ok 1 = "buffer overflow": Overflow in the RX-buffer. – High byte: reserved
128 (80h)	Active mode	G/S	BOOL	0 = "1byte ctrl/status header": The diagnostic data are not part of the process input data, 7 bytes of user data are available. 1 = "2byte ctrl/status header": The diagnostic data are part of the process input data, 6 bytes of user data are available.

Table 56: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
129 (81h)	Bit rate	G/S	ENUM USINT	Used to set the baudrate for the gateway: 0= reserved, 1 = 300 bps 2 = 600 bps 3 = 1200 bps 4 = 2400 bps 5 = 4800 bps 6 = 9600 bps 7 = 14400 bps 8 = 19200 bps 9 = 28800 bps 10 = 38400 bps 11 = 57600 bps 12 = 115200 bps ... 15 = reserved
130 (82h)	Disable diagnos-tics	G/S	BOOL	0 = "released": The diagnostic function is activated. 1 = "blocked": The diagnostic function is deactivated.
131 (83h)	Flow control	G/S	ENUM USINT	0 = "off": data flow control is deactivated 1 = XON/XOFF Software-handshake is activated 2 = RTS/CTS Hardware-handshake is activated 3: reserved
132 (84h)	Data width	G/S	ENUM USINT	0 = "7 bits" 1 = "8 bits"
133 (85h)	Parity	G/S	ENUM USINT	0 = "none" 1 = "odd" The number of the bits set to 1 is odd (incl. data and parity bit). 2 = "even" The number of the bits set to 1 is even (incl. data and parity bit).
134 (86h)	Stop	G/S	ENUM USINT	Number of the stop bits. 0 = "1 bit" 1 = "2 bits"

Table 56: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
135 (87h)	XON character	G/S	USINT	XON character This sign is used to start the data transfer to the data terminal equipment (DTE) with the activation of the software handshake. 0 - 255 default: 17/ 11h
136 (88h)	XOFF character	G/S	USINT	XOFF character This sign is used to stop the data transfer to the data terminal equipment (DTE) with the activation of the software handshake. (0 - 255) default: 19/ 13h

5.3.16 RS485/422 module class (VSC115)

This Class contains all information and parameters for RS485/422 modules.

Class instance

Note

Please refer to Chapter 5.3.1 Class instance of the VSC, Page 76, for the description of the class instances for VSC.

Object instance

Table 57: Object instance

Attr. no. dec. (hex.)	Attribute name	Get/ Set	Type	Description
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Module present	G	BOOL	0 = module missing, base module without electronic module. 1 = module is plugged
102 (66h)	Terminal slot number	G	USINT	The slot number of the base module belonging to the module (base module to the right of the gateway = No. 1). Corresponds to the respective Instance Number within the TERMINAL SLOT CLASS.
103 (67h)	Module ID	G	DWORD	Contains the module ID.
104 (68h)	Module order number	G	UDINT	Contains the ident number of the module.
105 (69h)	Module order name	G	SHORT STRING	Contains the name of the module, for example, "XN-1RS485/422".
106 (6Ah)	Module revision number	G	USINT	Contains the revision number of the module firmware.
107 (6Bh)	Module type ID	G	ENUM USINT	Describes the module type: see attribute 107 (6Bh) on page 86
108 (6Ch)	Module command interface	G/S	ARRAY	The control interface of the XI/ON module. ARRAY OF: BYTE: Control byte sequence
109 (6Dh	Module response interface	G	ARRAY	Response interface of the XI/ON module. ARRAY OF: BYTE: Response-byte sequence

Table 57: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
110 (6Eh)	Module registered index	G	ENUM USINT	Contains the index numbers specified in all the module lists.
111 (6Fh)	Number of supported channels	G	USINT	States the number of analog input channels supported by this module Instance.
112 (70h)	RX byte count	G	USINT	Number of the valid bytes (0 to 7) in this data segment.
113 (71h)	RX count	G	USINT	This value is transferred together with every data segment of the process input data. The RX count values are sequential: 00->01->10->11->00… (decimal: 0->1->2->3->0…) Errors in this sequence show the loss of data segments.
114 (72h)	TX count acknowledge	G	USINT	This value is a copy of the value TX count. TX count has been transmitted together with the last data segment of the process output data. TX count acknowledge is an acknowledge for the successful transmission of the data segment with TRANSMIT count.
115 (73h)	Status	G	BOOL	0 = The communication with the data terminal equipment (DTE) is disturbed. A diagnostic message is generated if the parameter "Diagnostics" is set to "0/ release". The diagnostic data show the cause of the communication disturbance. The user has to set back this bit in the process output data by using STATRES. 1 = The communication with the data terminal equipment (DTE) is error free,

Table 57: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
116 (74h)	Process diagnostics data	G	BYTE	Contains the diagnostic information: The diagnostic data are part of the process input data, if ACTIVE MODE = 1 or "2bytes ctrl/status header" is set. Diagnostics messages: – Bit 0 to Bit 2: reserved – Bit 3: 0 = ok 1 = "parameter error": The set parameter values are not supported. – Bit 4: 0 = ok 1 = "hardware failure": The module has to be replaced, e.g. EEPROM or UART may be defect.
116 (74h)	Process diagnostics data	G	BYTE	– Bit 5: 0 = ok 1 = "handshake error": The DTE connected to the module does not answer a XOFF or RTS handshake. This may cause a overflow in the internal receive-buffer. – Bit 6: 0 = ok 1 = "frame error": The module has to be parameterized to be adapted to the data structure of the connected DTE. A "frame error" occurs if the parameterization (number of data bits, stop bits, parity) is not correct. – Bit 7: 0 = ok 1 = "buffer overflow": Overflow in the RX-buffer. – Bit 8 to Bit 15: reserved
117 (75h)	RX data	G	ARRAY OF BYTE	Defines the receive-data (0...7).
118 (76h)	RX data and release	G	ARRAY OF BYTE	Defines the data received via RS485/422 (0...7) + acknowledge for reception
119 (77h)	TX byte count	G/S	USINT	Number of the valid user data bytes in this data segment. I

Table 57: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
120 (78h)	TX count	G/S	USINT	This value is transferred together with every data segment. The TX count values are sequential: 00->01->10->11->00… (decimal: 0->1->2->3->0…) Errors in this sequence show the loss of data segments.
121 (79h)	RX count acknowledge	G/S	USINT	This value is a copy of RX count. RX count has been transmitted together with the last data segment of the process input data. RX count acknowledge is an acknowledge for the successful transmission of the data segment with RX count.
122 (7Ah)	Status reset control	G/S	BOOL	STATRES: This bit is set to reset the STAT bit in the process input data. With the change from 1 to 0 the status bit is reset (from 0 to 1). If this bit is 0, all changes in TRANSMIT BYTE count, TRANSMIT count and RECEIVE count acknowledge are ignored. Flushing the transmit-/ receive-buffer with Process control data (Attr. 123) is possible. If this bit is 1 or with the change from 0 to 1, the flushing of the transmit-/ receive-buffer with Process control data (Attr. 123) is not possible.
123 (7Bh)	Process control data	G/S	BYTE	Bit 0 = transmit-buffer flush, Bit 1 = receive-buffer flush
124 (7Ch)	TX data	G/S	ARRAY OF BYTE	Defines the transmit-data (0...7)
125 (7Dh)	TX data and release	S	ARRAY OF BYTE	Defines the data to be transmitted via RS485/422 (0...7) + transmission is released/ charged immediately
126 (7Eh)	reserved			

Table 57: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
127 (7Fh)	Diagnostics	G	WORD	Contains the diagnostic messages (low byte): Diagnostics messages: – Bit 0 to Bit 2: reserved – Bit 3: 0 = ok 1 = "parameter error": The set parameter values are not supported. – Bit 4: 0 = ok 1 = "hardware failure": The module has to be replaced, e.g. EEPROM or UART may be defect. – Bit 5: 0 = ok 1 = "handshake error": The DTE connected to the module does not answer a XOFF or RTS handshake. This may cause a overflow in the internal receive-buffer.
127 (7Fh)	Diagnostics	G	WORD	– Bit 6: 0 = ok 1 = "frame error": The module has to be parameterized to be adapted to the data structure of the connected DTE. A "frame error" occurs if the parameterization (number of data bits, stop bits, parity) is not correct. – Bit 7: 0 = ok 1 = "buffer overflow": Overflow in the RX-buffer. – High byte: reserved
128 (80h)	Active mode	G/S	BOOL	0 = "1byte ctrl/status header": The diagnostic data are not part of the process input data, 7 bytes of user data are available. 1 = "2byte ctrl/status header": The diagnostic data are part of the process input data, 6 bytes of user data are available.

Table 57: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
129 (81h)	Bit rate	G/S	ENUM USINT	Used to set the baudrate for the gateway: 0 = reserved, 1 = 300 bps 2 = 600 bps 3 = 1200 bps 4 = 2400 bps 5 = 4800 bps 6 = 9600 bps 7 = 14400 bps 8 = 19200 bps 9 = 28800 bps 10 = 38400 bps 11 = 57600 bps 12 = 115200 bps ... 15 = reserved
130 (82h)	Disable diagnos-tics	G/S	BOOL	0 = "released": The diagnostic function is activated. 1 = "blocked": The diagnostic function is deactivated.
131 (83h)	Flow control	G/S	ENUM USINT	0 = "off": data flow control is deactivated 1 = XON/XOFF Software-handshake is activated 2 = RTS/CTS Hardware-handshake is activated 3 = reserved
132 (84h)	Data width	G/S	ENUM USINT	0 = "7 bits" 1 = "8 bits"
133 (85h)	Parity	G/S	ENUM USINT	0 = "none" 1 = "odd" The number of the bits set to 1 is odd (incl. data and parity bit). 2 = "even" The number of the bits set to 1 is even (incl. data and parity bit).
134 (86h)	Stop	G/S	ENUM USINT	Number of the stop bits. 0 = "1 bit" 1 = "2 bits"

Table 57: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
135 (87h)	XON character	G/S	USINT	XON character This sign is used to start the data transfer to the data terminal equipment (DTE) with the activation of the software handshake. 0 - 255 default: 17/ 11h
136 (88h)	XOFF character	G/S	USINT	XOFF character This sign is used to stop the data transfer to the data terminal equipment (DTE) with the activation of the software handshake. (0 - 255) default: 19/ 13h
137 (89h)	RS××× mode	G/S	ENUM USINT	0 = "RS422": Parameterization as 422 1 = "RS485": Parameterization as 485

5.3.17 SSI module class (VSC116)

This Class contains all information and parameters for SSI-modules.

Class instance

Note

Please refer to Chapter 5.3.1 Class instance of the VSC, Page 76, for the description of the class instances for VSC.

Object instance

Table 58: Object instance

Attr. no. dec. (hex.)	Attribute name	Get/ Set	Type	Description
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Module present	G	BOOL	0 = module missing, base module without electronic module. 1 = module is plugged
102 (66h)	Terminal slot number	G	USINT	The slot number of the base module belonging to the module (base module to the right of the gateway = No. 1). Corresponds to the respective Instance Number within the TERMINAL SLOT CLASS.
103 (67h)	Module ID	G	DWORD	Contains the module ID.
104 (68h)	Module order number	G	UDINT	Contains the ident number of the module.
105 (69h)	Module order name	G	SHORT STRING	Contains the name of the module, for example, "XN-1SSI".
106 (6Ah)	Module revision number	G	USINT	Contains the revision number of the module firmware.
107 (6Bh)	Module type ID	G	ENUM USINT	Describes the module type: see attribute 107 (6Bh) on page 86
108 (6Ch)	Module command interface	G/S	ARRAY	The control interface of the XI/ON module. ARRAY OF: BYTE: Control byte sequence
109 (6Dh	Module response interface	G	ARRAY	Response interface of the XI/ON module. ARRAY OF: BYTE: Response-byte sequence

Table 58: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
110 (6Eh)	Module registered index	G	ENUM USINT	Contains the index numbers specified in all the module lists.
111 (6Fh)	Number of supported channels	G	USINT	States the number of analog input channels supported by this module Instance.
112 (70h)	Diagnostics and status	G	WORD	Bit 0: – 0 = No enabled status signal is active (SSI_STSx = 0). – 1 = "group diagnostics" At least one enabled status signal is active (SSI_STSx = 1). Bit 1: – 0 = SSI encoder signal present. – 1 = "SSI error/open circuit" SSI encoder signal faulty. (e.g. due to a cable break). Bit 2: – 0 = A comparison of the register contents has produced the following result: (REG_SSI_POS) ≦ (REG_UPPER_LIMIT) – 1 = "error POS > UPPER LIMIT" A comparison of the register contents has produced the following result: (REG_SSI_POS) > (REG_UPPER_LIMIT) Bit 3: – 0 = A comparison of the register contents has produced the following result: (REG_SSI_POS) ≧ (REG_LOWER_LIMIT) – 1 = "error POS < LOWER LIMIT" A comparison of the register contents has produced the following result: (REG_SSI_POS) < (REG_LOWER_LIMIT) Bit 4: – 0 = The parameter set of the module has been accepted. – 1 = "parameterization error" Operation of the module is not possible with the present parameter set. Bit 5 to 6: reserved

Table 58: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
112	Diagnostics and status	G	WORD	Bit 7: – 0 = The SSI encoder is read cyclically. – 1 = "SSI communication suspended" Communication with the SSI encoder is stopped as STOP = 1 (process output) or ERR_PARA = 1. Bit 8: – 0 = A comparison of the register contents has produced the following result: (REG_SSI_POS) ≠ (REG_CMP1) – 1 = "CMP1 register value matches POS" A comparison of the register contents has produced the following result: (REG_ SSI_POS) = (REG_CMP1) Bit 9: – 0 = Default status, i.e. the register contents have not yet matched (REG_SSI_POS) = (REG_CMP1) since the last reset. – 1= "CMP1 flag set" The contents of the registers match: (REG_SSI_POS) = (REG_CMP1). This marker must be reset with bit 9 of the "Control" attribute. Bit 10: – 0 = A comparison of the register contents has produced the following result: (REG_SSI_POS) < (REG_CMP1) – 1 = "POS ≧ CMP1 register value" A comparison of the register contents has produced the following result: (REG_ SSI_POS) ≧ (REG_CMP1) Bit 11: – 0 = A comparison of the register contents has produced the following result: (REG_SSI_POS) ≠ (REG_CMP2) – 1 = "CMP2 register value matches POS" A comparison of the register contents has produced the following result: (REG_ SSI_POS) = (REG_CMP29)

Table 58: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
112	Diagnostics and status	G	WORD	Bit 12: – 0 = Default status, i.e. the register contents have not yet matched (REG_SSI_POS) = (REG_CMP2) since the last reset. – 1 = "CMP2 flag set" The contents of the registers match: (REG_SSI_POS) = (REG_CMP2). This marker must be reset with bit 12 of the "Control" attribute. Bit 13: – 0 = A comparison of the register contents has produced the following result: (REG_SSI_POS) < (REG_CMP2) – 1 = "POS ≧ CMP2 register value". A comparison of the register contents has produced the following result: (REG_SSI_POS) ≧ (REG_CMP2) Bit 14: – 0 = The SSI encoder values are incremented or the values are constant. – 1 = "counting downwards" The SSI encoder values are decremented. Bit 15: – 0 = The SSI encoder values are decremented or the values are constant. – 1 = "counting upwards" The SSI encoder values are incremented.

Table 58: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
113 (71h)	Result write operation	G		Bit 0 to 5: reserved Bit 6: – 0 = No modification of the data in the register bank by process output, i.e. WRITE OPERATION = 0. A write job would be accepted with the next telegram of process output data. (handshake for data transmission to the register.) – 1 = "control register write acknowledged" A modification of the register contents by a process output was initiated, i.e. WRITE OPERATION = 1. A write job would not be accepted with the next telegram of process output data. Bit 7: – 0 = The writing of user data for process output to the register addressed with "Address write register" in the process output data could not be executed. – 1 = "control register write accepted" The writing of user data for process output to the register addressed with "Address write register" in the process output data could be executed successfully.
114 (72h)	Result read operation	G	BYTE	Bit 0 to 6: reserved Bit 7: 0 = The reading of the register stated in "Address read register" was accepted and executed. The content of the register is located in "Value read register". 1 = "register read operation aborted" The reading of the register stated in "Address read register" was not accepted. "Value read register" is zero.
115 (73h)	Address read register	G	UINT	Address of the input register with contents stated in "Value read register" when "Result read operation" = 0.
116 (74h)	Value read register	G	DWORD	Content of the register to be read if "Result read operation" = 0. If "Result read operation" = 1, "Value read register" = 0.

Table 58: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
117 (75h)	Control	G/S	WORD	Bit 0 to 6: reserved Bit 7: – 0 = Request to read the SSI encoder cyclically – 1 = "suspend communication requested" Request to interrupt communication with the encoder Bit 8: – 0 = Default status, i.e. the data bits 8 to 10 of the "Diagnostics and status" attribute always have the value 0, irrespective of the actual SSI encoder value. – 1 = "compare/flag CMP1 active" Comparison active, i.e. the data bits 8 to 10 of the "Diagnostics and status" attribute always have a value based on the result of the comparison with the actual SSI encoder value. Bit 9: – 0 = Default status, i.e. reset of Bit 9 of the "Diagnostics and status" attribute not active. – 1 = "clear CMP1 flag" Reset of bit 9 of the "Diagnostics and status" attribute active. Bit 10: reserved Bit 11: 0 = Default status, i.e. the data bits 11 to 13 of the "Diagnostics and status" attribute always have the value 0, irrespective of the actual SSI encoder value. 1 = "compare/flag CMP2 active" Comparison active, i.e. the data bits 11 to 13 of the "Diagnostics and status" attribute always have a value based on the result of the comparison with the actual SSI encoder value. Bit 12: 0 = Default status, i.e. no reset of Bit 12 of the "Diagnostics and status" attribute active. 1 = "clear CMP2 flag" Reset of bit 12 of the "Diagnostics and status" attribute active.

Table 58: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
117 (75h)	Control	G/S	WORD	Bit 13 to 15: reserved
118 (76h)	Address read register	G/S	UINT	Address of the register with contents stated in "Value read register" when "Result read operation" 7 = 0.
119 (77h)	Address write register	G/S	UINT	Address of the register to be written with "Value write register".
120 (78h)	Value write register	G/S	DWORD	Value to be written to the register with the address stated at "Address write register".
121 (79h)	Write operation	G/S	BOOL	0 = Default status, i.e. there is no request to overwrite the content of the register address stated at "Address write register" with "Value write register". Bit 6 of the "Result write operation" attribute is reset (=0) if necessary. 1 = Request to overwrite the content of the register at the address "Address write register" with "Value write register".
122 (7Ah)	Write register and execute	S	STRUCTO F UINT DWORD	The structure contains both parts: – Address of the register to be written. – Value to be written. The write operation is executed without checking whether a write job is already present.
123 (7Bh)	Diagnostics	G	WORD	Bit 0: – 0 = No enabled status signal is active (SSI_STSx = 0). – 1 = "group diagnostics" At least one enabled status signal is active (SSI_STSx = 1). Bit 1: 0 = SSI encoder signal present. – 1 = "SSI error/open circuit" SSI encoder signal faulty. (e.g. due to a cable break). Bit 2: – 0 = A comparison of the register contents has produced the following result: (REG_SSI_POS) ≦ (REG_UPPER_LIMIT) – 1 = "error POS > UPPER LIMIT" A comparison of the register contents has produced the following result: (REG_SSI_POS) > (REG_UPPER_LIMIT)

Table 58: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
123 (7Bh)	Diagnostics	G	WORD	Bit 3: – 0 = A comparison of the register contents has produced the following result: (REG_SSI_POS) ≧ (REG_LOWER_LIMIT) – 1 = "error POS < LOWER LIMIT" A comparison of the register contents has produced the following result: (REG_SSI_POS) < (REG_LOWER_LIMIT) Bit 4: – 0 = The parameter set of the module has been accepted. – 1 = "parameterization error" Operation of the module is not possible with the present parameter set. Bit 5 to 15: reserved
124 (7Ch)	Check mode	G/S	WORD	Bit 0 to 4: reserved Bit 5: 0 = ZERO test of data cable. 1 = "disable SSI error detection" After the last valid bit, a ZERO test of the data cable is not carried out. Bit 6 to 15: reserved
125 (7Dh)	Invalid bits LSB **A**	G/S	USINT	Number of invalid bits on the LSB side of the position value supplied by the SSI encoder. The meaningful word width of the position value transferred to the module bus master is as follows: FRAME LENGTH - INVALID BITS MSB - INVALID BITS LSB. The invalid bits on the LSB side are removed by shifting the position value to the right, starting with the LSB. (Default 0 Bit = 0hex). INVALID BITS MSB + INVALID BITS LSB must always be less than FRAME LENGTH.

A INVALID_BITS: INVALID BITS MSB + INVALID BITS LSB

Table 58: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
126 (7Eh)	Bit rate		ENUM USINT	0 = "1 Mbps" 1 = "500 kbps" 2 = "250 kbps" 3 = "100 kbps" 4 = "125 kbps" 5 = "83 kbps" 6 = "71 kbps" 7 = "62.5 kbps" 8 to 15: reserved
128 (80h)	Frame length	G/S	USINT	Number of bits of the SSI data frame. FRAME LENGTH must always be greater than INVALID_BITS. **A** Default: 25 = 19hex
129 (81h)	Kind of coding SSI	G/S	BOOL	0 = "Binary code" 1 = "GRAY code"
130 (82h)	Invalid bits MSB	G/S	USINT	Number of invalid bits on the MSB side of the position value supplied by the SSI encoder. The meaningful word width of the position value transferred to the module bus master is as follows: FRAME LENGTH - INVALID BITS MSB - INVALID BITS LSB. The invalid bits on the MSB side are zeroed by masking the position value. I NVALID BITS MSB + INVALID BITS LSB must always be less than FRAME LENGTH. Default: 0 = 0hex

5.3.18 Digital versatile module class (VSC117)

This class contains all information and parameters for digital versatile modules.

Attention

In this class, chosen parameter options can only be deactivated by activating another option of this parameter.

Class instance

Note

Please refer to Chapter 5.3.1 Class instance of the VSC, Page 76, for the description of the class instances for VSC.

Object instance

Table 59: Object instance

Attr. no. dec. (hex.)	Attribute name	Get/ Set	Type	Description
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Module present	G	BOOL	0 = module missing, base module without electronic module. 1 = module is plugged
102 (66h)	Terminal slot number	G	USINT	The slot number of the base module belonging to the module (base module to the right of the gateway = No. 1). Corresponds to the respective Instance Number within the TERMINAL SLOT CLASS.
103 (67h)	Module ID	G	DWORD	Contains the module ID.
104 (68h)	Module order number	G	UDINT	Contains the ident number of the module.

Table 59: Object instance

Attr. no. dec. (hex.)	Attribute name	Get/ Set	Type	Description
105 (69h)	Module order name	G	SHORT STRING	Contains the name of the module, for example, "XN-4DO-24VDC-0.5A-P".
106 (6Ah)	Module revision	G	USINT	Contains the revision number of the module firmware.
107 (6Bh)	Module type ID	G	ENUM USINT	Describes the module type: see attribute 107 (6Bh) on page 86
108 (6Ch)	Module command interface	G/S	ARRAY	The control interface of the XI/ON module. ARRAY OF: BYTE: Control byte sequence
109 (6Dh)	Module response interface	G	ARRAY	Response interface of the XI/ON module. ARRAY OF: BYTE: Response byte sequence
110 (6Eh)	Module registered index	G	ENUM USINT	Contains the index numbers specified in all the module lists.
111 (6Fh)	Module output channel count	G	USINT	Contains the number of input channels supported by the module.
112 (70h)	Module input channel count	G	USINT	Contains the number of output channels supported by the module.
Input data				
113 (71h)	Module input_1	G	DWORD	Input data of the module (according to channels).
114 (72h)	Module input_2	G	DWORD	Input data of the module (according to channels).
Output data				
115 (73h)	Module output_1	G	DWORD	Output data of the module (according to channels).
116 (74h)	Module output _2	G	DWORD	Output data of the module (according to channels).
Diagnosis data				
117 (75h)	Open circuit error_1	G	DWORD	This attribute contains diagnosis information about open circuit errors (according to channels).
118 (76h)	Open circuit error_2	G	DWORD	This attribute contains diagnosis information about open circuit errors (according to channels).

Table 59: Object instance

Attr. no. dec. (hex.)	Attribute name	Get/ Set	Type	Description
119 (77h)	Short circuit output error_1	G	DWORD	This attribute contains diagnosis information about output short-circuits (according to channels).
120 (78h)	Short circuit output error_2	G	DWORD	This attribute contains diagnosis information about output short-circuits (according to channels).
121 (79h)	Short circuit sensor error_1	G	DWORD	This attribute contains diagnosis information about sensor short-circuits (according to channels).
122 (7Ah)	Short circuit sensor error_2	G	DWORD	This attribute contains diagnosis information about sensor short-circuits (according to channels).
123 (7Bh)	Cable error_1	G	DWORD	This attribute contains diagnosis information about a wire break (channel 1 to 32).
124 (7Ch)	Cable error_2	G	DWORD	This attribute contains diagnosis information about a wire break (channel 33 to 64).
Parameter data				
125 (7Dh)	Open circuit monitoring mode_2	G/S	DWORD	Enables the wire break detection mode (channel 1 to 32).
126 (7Eh)	Open circuit monitoring mode_1	G/S	DWORD	Enables the wire break detection (channel 33 to 64).
127 (7Fh)	Invert input data_1	G/S	DWORD	The input signal is inverted (channel 1 to 32).
128 (80h)	Invert input data_2	G/S	DWORD	The input signal is inverted (channel 33 to 64).
129 (81h)	Invert output data_1	G/S	DWORD	The output signal is inverted (channel 1 to 32).
130 (81h)	Invert output data_2	G/S	DWORD	The output signal is inverted (channel 33 to 64).
131 (82h)	reserved	-	-	-
132 (83h)	reserved	-	-	-
133 (84h)	Auto recovery output_1	G/S	DWORD	The outputs switch on automatically after an overload.

Table 59: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
134 (85h)	Auto recovery output_1	G/S	DWORD	The outputs switch on automatically after an overload.
135 (86h)	reserved	-	-	-
136 (87h)	reserved	-	-	-
137 (88h)	Retriggered recovery output_1	G/S	DWORD	The outputs (channel 1 to 32) have to be retriggered in case of an overload.
138 (89h)	Retriggered recovery output_2	G/S	DWORD	The outputs (channel 33 to 64) have to be retriggered in case of an overload.
139 (8Ah)	Enable high side output driver_1	G/S	DWORD	Enables the high side output driver of channels (channel 1 to 32).
140 (8Bh)	Enable high side output driver_2	G/S	DWORD	Enables the high side output driver of channels (channel 33 to 64).
141 (8Ch)	Enable low side output driver_1	G/S	DWORD	Enables the low side output driver of channels (channel 1 to 32).
142 (8Dh)	Enable low side output driver_2	G/S	DWORD	Enables the low side output driver of channels (channel 33 to 64).
143 (8Eh)	Filter 2500µs channel 1	G/S	DWORD	Enables the input filter of the channel (channel 1 to 32).
144 (8Fh)	Filter 2500µs channel 2	G/S	DWORD	Enables the input filter of the channel (channel 33 to 64).
145 (90h)	Fault value	G/S	DWORD	Activates the fault value for the channel (channel 1 to 32).
146 (91h)	Fault value	G/S	DWORD	Activates the fault value for the channel (channel 33 to 64).
147 (92h)	Block Diagnostics	G/S	DWORD	Channel specific diagnostic information is blocked (channel 1 to 32).
148 (93h)	Block Diagnostics	G/S	DWORD	Channel specific diagnostic information is blocked (channel 33 to 64).

5.3.19 Analog versatile module class (VSC118)

This class contains all information and parameters for analog versatile modules.

Attention

In this class, chosen parameter options can only be deactivated by activating another option of this parameter.

Class instance

Note

Please refer to Chapter 5.3.1 Class instance of the VSC, Page 76, for the description of the class instances for VSC.

Object instance

Table 60: Object instance

Attr. no. dec. (hex.)	Attribute name	Get/ Set	Type	Description
100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
101 (65h)	Module present	G	BOOL	0 = module missing, base module without electronic module. 1 = module is plugged
102 (66h)	Terminal slot number	G	USINT	The slot number of the base module belonging to the module (base module to the right of the gateway = No. 1). Corresponds to the respective Instance Number within the TERMINAL SLOT CLASS.
103 (67h)	Module ID	G	DWORD	Contains the module ID.
104 (68h)	Module order number	G	UDINT	Contains the ident number of the module.

Table 60: Object instance

Attr. no. dec. (hex.)	Attribute name	Get/ Set	Type	Description
105 (69h)	Module order name	G	SHORT STRING	Contains the name of the module, for example, "XN-4AI-U/I".
106 (6Ah)	Module revision	G	USINT	Contains the revision number of the module firmware.
107 (6Bh)	Module type ID	G	ENUM USINT	Describes the module type: see attribute 107 (6Bh) on page 86
108 (6Ch)	Module command interface	G/S	ARRAY	The control interface of the XI/ON module. ARRAY OF: BYTE: Control byte sequence
109 (6Dh)	Module response interface	G	ARRAY	Response interface of the XI/ON module. ARRAY OF: BYTE: Response byte sequence
110 (6Eh)	Module registered index	G	ENUM USINT	Contains the index numbers specified in all the module lists.
111 (6Fh)	Module input channel count	G	USINT	Contains the number of input channels supported by the module.
112 (70h)	Module output channel count	G	USINT	Contains the number of output channels supported by the module.
Input data				
113 (71h) to 128 (80h)	Module input 1 to Module input 16	G	UINT	Input data of the module (according to channels).
Output data				
129 (81h) to 144 (8Fh)	Module output_1 to Module output_16	G	DWORD	Output data of the module (according to channels).
Diagnosis data				
145 (90h)	Range error	G	WORD	Indicates an over- or undercurrent of 1 % of the set current/voltage range; whereby, undercurrents can only be recognized with those modules that have a set current range of 4 to 20 mA.
146 (91h)	Open circuit error	G	WORD	Indicates an open circuit in the signal line for the operating mode

Table 60: Object instance

Attr. no. dec. (hex.)	Attribute name	Get/ Set	Type	Description
147 (92h)	Short circuit error	G	WORD	
148 (93h)	reserved	-	-	-
Parameter data				
149 (94h) to 164 (A4h)	Channel 1 to Channel 16	G/S	UINT	Activates or deactivates the corresponding channel.
165 (A5h) to 180 (B4h)	Operating mode channel 1 to Operating mode channel 16	G/S	ENUM	Sets the operating mode for the channel 0 = deactivate channel 1 = -10 V…+10 V 2 = 0 V…+10 V 3 = 0 mA…20 mA 4 = 4 mA…2 0mA
181 (B5h) to 196 (C4h)	Value representation channel 1 to Value representation channel 16	G/S	ENUM	Sets the value representation for the channels: 0 = default 1 = 16 bit integer 2 = 12 bit left justified + diagnostics.

5.3.20 SWIRE module class (VSC121)

This class contains all the parameters and information for the XNE-1SWIRE module.

Note

The SWIRE module class (VSC121) is only implemented in gateways with Maj. Rev. ≧ 1.6.0.

Attention

In this class, chosen parameter options can only be deactivated by activating another option of this parameter.

Class instance

Note

Please refer to Chapter 5.3.1 Class instance of the VSC, Page 76, for the description of the class instances for VSC.

Object instance

Table 61: Object instance

Attr. no. dec. (hex.)	Attribute name	Get/ Set	Type	Description
100 (64h)	Max object attribute	G	USINT	Contains the number of the last implemented object attribute.
101 (65h)	Module present	G	BOOL	0: XI/ON module is not fitted, empty base module. 1: XI/ON module is fitted.
102 (66h)	Terminal slot number	G	USINT	The slot number of the base module belonging to the module (base module to the right of the gateway = No. 1). Corresponds to the respective instance Number within the TERMINAL SLOT CLASS.
103 (67h)	Module ID	G	DWORD	Contains the module ID.
104 (68h)	Module order number	G	UDINT	Contains the order number of the module.
105 (69h)	Module order name	G	SHORT_ STRING	Contains the name of the module, for example, "XNE-1SWIRE".
106 (6Ah)	Module revision number	G	USINT	Contains the revision number of the module firmware.

Table 61: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
107 (6Bh)	Module type ID	G	ENUM USINT	Describes the module type: see attribute 107 (6Bh) on page 86
108 (6Ch)	Module command interface	G/S	ARRAY	The control interface of the module. ARRAY OF: BYTE: Control byte sequence
109 (6Dh)	Module response interface	G	ARRAY	Response interface of the module. ARRAY OF: BYTE: Response byte sequence
110 (6Eh)	Module registered Index	G	ENUM USINT	Contains the index numbers specified in all the module lists.
111 (6Fh)	Number of supported input channels	G	USINT	Shows the number of input channels supported by this module instance.
112 (70h)	Number of supported output channels	G	USINT	Shows the number of output channels supported by this module instance.
SWIRE data				
113 (71h)	Input1_DWORD	G	DWORD	Contains the first 4 bytes of the process input data.
114 (72h)	Input2_DWORD	G	DWORD	Contains the last 4 bytes of the process input data
115 (73h)	Output1_DWORD	G	DWORD	Contains the first 4 bytes of the process output data.
116 (74h)	Output2_DWORD	G	DWORD	Contains the last 4 bytes of the process output data
117 (75h)	Diag_common_error	G	WORD	One bit per SWIRE slave shows if diagnostics messages are present or not. Slave 1 belongs to bit 0, slave 2 to bit 1 etc. 0: No diagnostics message present. 1: One/several diagnostics messages present.

Table 61: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
118 (76h)	Diag_config_error	G	WORD	One bit per SWIRE slave shows the configuration state of the slave: Slave 1 belongs to bit 0, slave 2 to bit 1 etc. 0: The physical structure of the SWIRE bus was accepted and the SWIRE bus is in operation. 1: The physical structure of the SWIRE bus does not match the configuration stored in the XNE-1SWIRE. The physical structure was not accepted The SWIRE bus does not start operation (SW LED flashing).
119 (77h)	Diag_communication_error	G	WORD	One bit per SWIRE slave shows possible communication errors. Slave 1 belongs to bit 0, slave 2 to bit 1 etc. 0: No error present. 1: A communication error is present, such as a slave is no longer reached, its internal timeout has elapsed or communication is faulty. The master cannot carry out data exchange with at least one slave.
120 (78h)	Diag_PKZ_error	G	WORD	One bit per SWIRE slave shows if the PKZ has tripped or not: Slave 1 belongs to bit 0, slave 2 to bit 1 etc. 0: No PKZ (overcurrent protective circuit-breaker) has tripped or diagnostics function has been deactivated via the parameter setting. 1: At least one PKZ (overcurrent protective circuit-breaker) has tripped.

Table 61: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
121 (79h)	Param_common_ operation_modes	G/S	BYTE	Bit 0: reserved
				Bit 1 - Automatic SWIRE configuration 0: Manual SWIRE configuration: To store the physical structure of the SWIRE bus in the XNE-1SWIRE, the CFG button of the XNE-1SWIRE must be pressed manually (only functions if the SW LED is flashing). 1: Automatic SWIRE configuration: If the physical structure of the SWIRE bus does **not** match the configuration stored in the XNE-1SWIRE on power up, the physical structure is stored automatically in the XNE-1SWIRE.
				Bit 2 - PLC configuration check 0: PLC configuration check is active: The configuration stored in XNE-1SWIRE is compared with the SET configuration stored in the PLC. Only SWIRE slaves in the SWIRE bus are accepted that have a device ID completely matching the SET configuration. 1: PLC configuration check is not active: All slaves are mapped in 4Bit INPUT / 4Bit OUTPUT without checking the device ID.

Table 61: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
121 (79h)	Param_common_ operation_modes	G/S	BYTE	Bit 3 - Configuration check Bus or slave-oriented configuration check (without function if MC = 1) 0: Bus-oriented: If the PLC configuration check is activated, data exchange is only started if the configuration stored in the XNE-1SWIRE fully matches the SET configuration stored in the PLC. Modifying the bus during operation causes the system to be aborted. 1: Slave oriented: If the PLC configuration check is activated, data exchange is started with all SWIRE slaves that match the SET configuration stored in the PLC. The SWIRE slaves that do not match the SET configuration stored in the PLC do not perform any data exchange.
				Bit 4 - Moeller conformance **(from version VN 01-04)** Behacior of the XNE-1SWIRE in accordance with SWIRE Comformance criteria. 0: Default behavior 1: The XNE-1SWIRE master responds according to the Moeller SWIRE Conformance criteria.
				Bit 5 to bit 6: reserved

Table 61: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
122 (7Ah)	Param_error_ report_control	G/S	BYTE	Bit 0 - Field -Slave error- 0: Single diagnostics is activated 1: Single diagnostics is not activated
				Bit 1 - Group error -Slave error- 0: Group diagnostics is activated 1: Group diagnostics is not activated
				Bit 2 - Field -PKZ error- 0: Single diagnostics is activated 1: Single diagnostics is not activated
				Bit 3 - Group error -PKZ error- 0: Group diagnostics is activated 1: Group diagnostics is not activated
				Bit 4 - Field -Configuration error- 0: Single diagnostics is activated 1: Single diagnostics is not activated
				Bit 5 - Group error -Configuration error- 0: Group diagnostics is activated 1: Group diagnostics is not activated
122 (7Ah)	Param_error_ report_control	G/S	BYTE	Bit 6 - Error message -U_{AUX}- 0: Error message U_{AUXERR} activated 1: Error message U_{AUXERR} not activated
				Bit 7: reserved
124 (7Ch)	reserved / Lifeguarding time **(Lifeguarding time only up to version VN 01-03)**	G/S	USINT	02_{hex}-FF_{hex} Default: 64_{hex} Disconnect: FF_{hex} Setting of lifeguarding time, timeout time up to automatic reset of the slaves in the event of communication failure. (n × 10 ms) (Default 1 s)
125 (7Dh)	Process_data_ slave_diag	G/S	WORD	Input bit communication error, slave x 0: Slave diagnostics message from Byte 1 / Bit 7 is accepted in the feedback interface as Bit 4 1: Slave diagnostics message from Byte 1 / Bit 7 is not accepted in the feedback interface as Bit 4
126 (7Eh), 127 (7Fh)	reserved			

Table 61: Object instance

Attr. no. dec. (hex.)	**Attribute name**	**G**et/ **S**et	**Type**	**Description**
128 (7Eh) - 143 (8Fh)	Param_SWIRE_ type_ident_slave _1 - Param_SWIRE_ type_ident_slave _16	G/S	BYTE	Bit 0 to bit 3 - Variant ID TYPE setting for the LIN slave at position x on the SWIRE bus: FF_{hex} No slave 20_{hex} SWIRE-DIL (Moeller) 21_{hex} SWIRE-4DI-2DO-R (Moeller) 01_{hex} PH9285.91 (Dold) 02_{hex} PH9285.91/001 (Dold) 03_{hex} PH9285.91/002 (Dold)

6 Application example: XNE gateway with an Allen Bradley PLC

6.1 General

The following example shows detailed information about the connection of a XI/ON station for EtherNet/IP to an Allen Bradley PLC.

6.1.1 Prerequisites for this example

In order to configure XI/ON devices and to build up communications with the Allen Bradley ControlLogix PLC over EtherNet/IP, the following software tools and hardware devices are necessary.

Software:

- RSLinX - used to establish communication over EtherNet/IP
- RSLogix 5000 - used to configure the controller and the other network hosts

Hardware used in this example:

- Allen Bradley PLC 1756-L55/ A 1756-M12/A LOGIX5555,
- Ethernet Bridge 1756-ENBT/A
- XI/ON station with a gateway XNE-GWBR-2ETH-IP with EtherNet/IP protocol

Example station

The following station is used in this application example:

Table 62: Example station

Module		Data width		
		Process in	Process out	Alignment
GW	XNE-GWBR-2ETH-IP			
0	XN-2AI-I(0/4...20MA)	2 words	-	word by word
1	XN-2DI-24VDC-P	2 bits	-	bit by bit
2	XN-2DO-24VDC-0.5A-P	-	2 bits	bit by bit
3	XN-2AI-THERMO-PI	2 words	-	word by word
4	XN-4DI-24VDC-P	4 bits		bit by bit
5	empty slot			
6	XN-1AI-U(-10/0...+10VDC)	1 word	-	word by word
7	XN-2AO-I(0/4...20MA)		2 words	word by word
8	XN-4DI-24VDC-P	4 bits		bit by bit
9	XN-1SSI	4 words	4 words	word by word

6.2 Network configuration

The XI/ON gateways are delivered with the IP address **192.168.1.1**.

Note

In order to build up the communication between the XI/ON gateway and a PLC/ PC or a network interface card, both devices have to be hosts in the same network.

To achieve this, you have either

- to adjust the gateway's IP address via BootP, DHCP etc. for integrating it into your own network (for detailed information about the different possibilities for address setting, please read, Chapter 4.5 Address setting, Page 37).

  or

- to change the IP address of the used PC or network interface card (for detailed information, please read the following Chapter 6.3 Changing the IP address of a PC/ network interface card, Page 153).

6.3 Changing the IP address of a PC/ network interface card

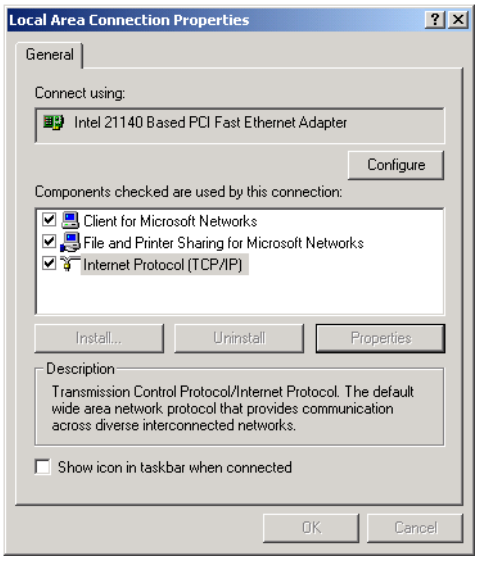
6.3.1 Changing the IP address in Windows 2000/ Windows XP

The IP address is changed in the "Control Panel" in "Network and Dial-up Connections":

1 Open the folder "Local Area Connection" and open the dialog "Local Area Connection Properties" via the button "Properties" in the dialog "Local Area Connection Status".

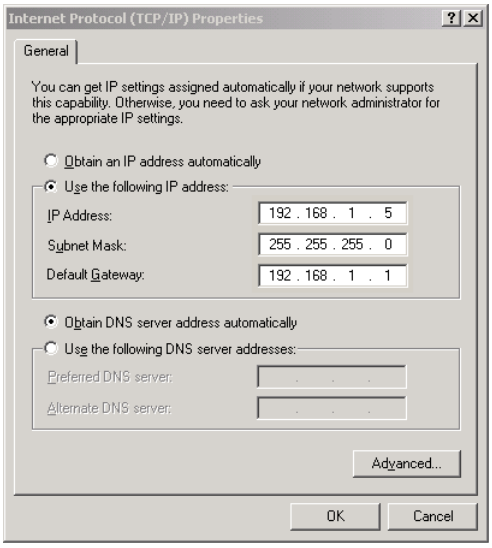
2 Mark "Internet Protocol (TCP/IP)" and press the "Properties"-button to open the dialog "Internet Protocol (TCP/IP) Properties".

Figure 34: Local Area Connection Properties



3 Activate "Use the following IP address" and assign an IP address of the network mentioned above to the PC/ Network interface card (see the following figure).

Figure 35: Changing the PC's IP address

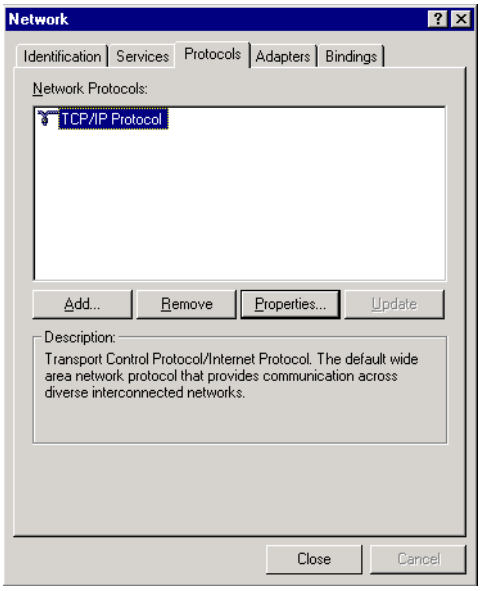


6.3.2 Changing the IP address in Windows NT

1 Open the folder "Network" in the Control Panel.

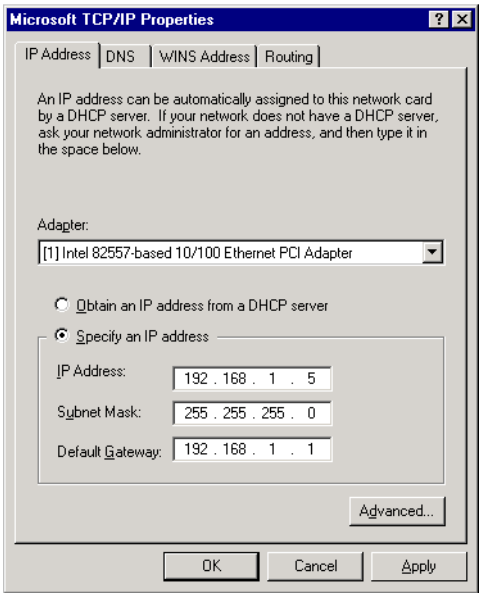
2 Activate TCP/IP connection in the tab "Protocols" and click the "Properties" button.

Figure 36: Network configuration WIN NT



3 Activate "Specify IP address " and set the address as follows.

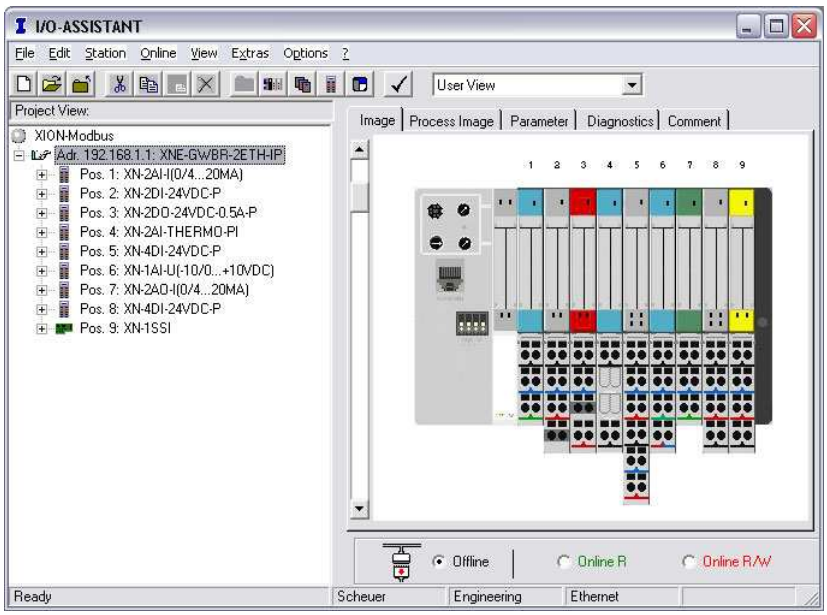
Figure 37: Specify IP address



6.3.3 Changing the IP address via I/O-ASSISTANT

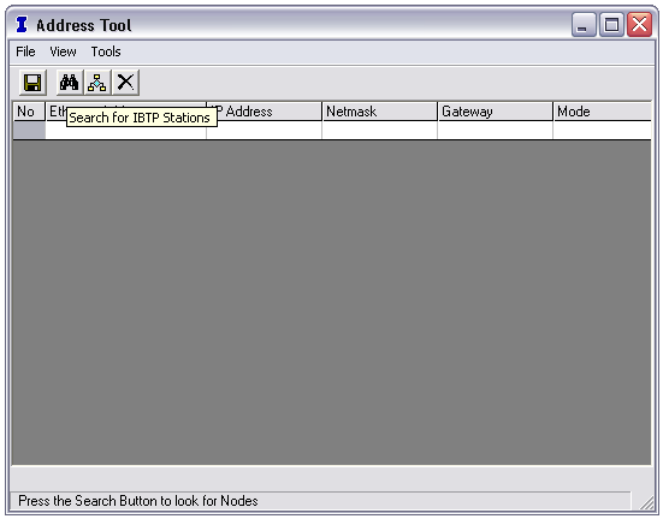
The Address Tool integrated in the software I/O-ASSISTANT offers the possibility to browse the whole Ethernet network for connected nodes and to change their IP address as well as the subnet mask according to the application.

Figure 38: Address Toolt in the I/O-ASSISTANT



The network is browsed by using the search function in the Address Tool.

Figure 39: Search function in the Address Tool



Attention

If Windows XP is used as operating system, problems with the system internal firewall may occur.

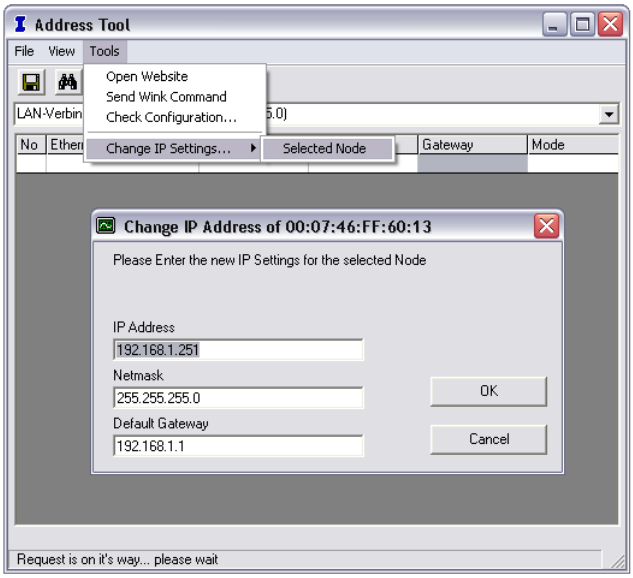
It may eventually inhibit the access of the I/O-ASSISTANT to the Ethernet. Please adapt your firewall settings accordingly or deactivate it completely (see also Chapter 6.3.4 Deactivating/ adapting the firewall in Windows XP, Page 157).

The network is browsed for connected hosts which are then listed in the Address Tool.

The address changing is done via "Tools → Changing IP settings...".

It is now possible to change the address settings for all nodes in the list or only for the selected one

Figure 40: Address changing for selected nodes



6.3.4 Deactivating/ adapting the firewall in Windows XP

If you use Windows XP as operating system, problems may occur when changing the IP addresses via the I/O-ASSISTANT.

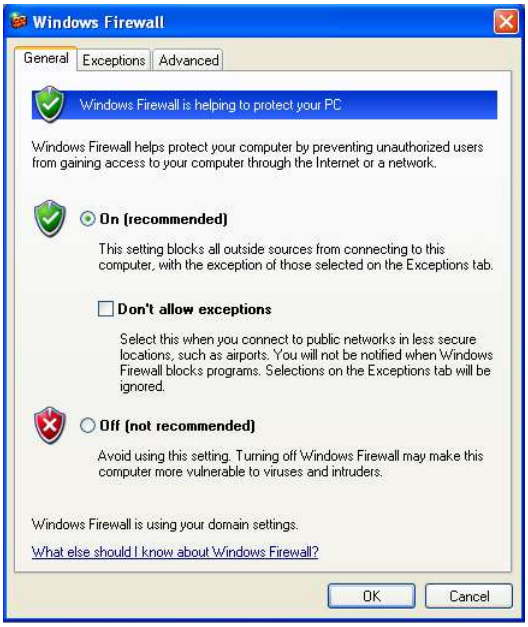
In this case, you can deactivate the system integrated Windows XP firewall completely or adapt it to your application.

- **Deactivating the firewall**
  Open the "Windows Firewall" dialog in the control panel of your PC and deactivate it as follows:

Figure 41: Deactivating the Windows firewall

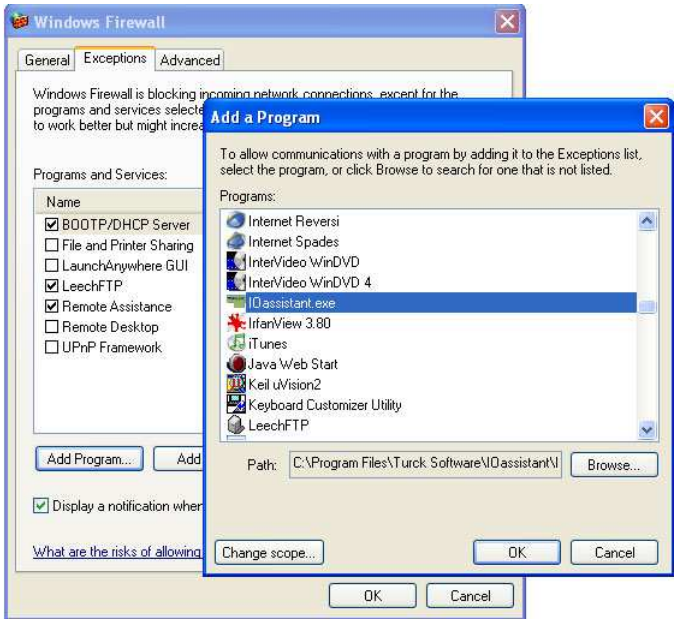
- **Adapting the firewall**
  The firewall remains active, the option "Don't allow exceptions" is deactivated:

Figure 42: Activating the Windows firewall



- In the "Exceptions"-tab, add the I/O-ASSISTANT to "Programs and Services".
- Pressing the button "Add Program..." opens the dialog "Add a Program". Select the I/O-ASSISTANT from the list of installed programs.
- If necessary, use the button "Browse..." to choose the file "IOassistant.exe" from the installation directory of the software.

Figure 43: "Exceptions"-tab

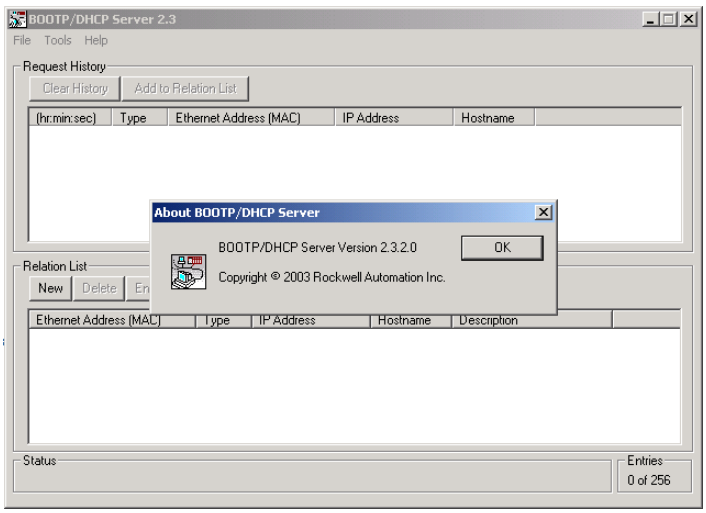


- Despite an active firewall, the I/O-ASSISTANT is now able to browse the network for hosts and the address changing via the software is possible for the connected nodes.

6.3.5 Address setting via DHCP-mode

In this application example, the IP address is set via DHCP using the software tool "BootP/DHCP-Server" version 2.3.2.0 from Rockwell Automation.

Figure 44: BootP-Server from Rockwell Automation



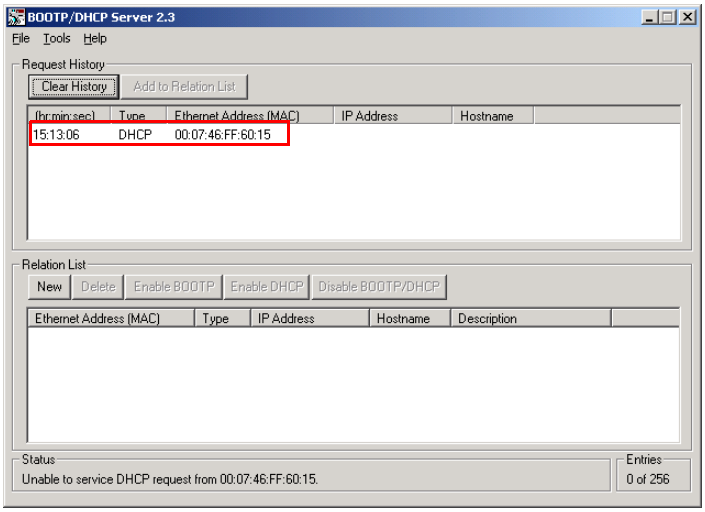
Addresses in the range from 1 to 254 can be allocated. The addresses 0 and 255 are reserved for broadcast messages in the subnet.

Note

In order to activate the DHCP-mode, the DIP-switch "MODE" is set to "ON", the address-switches 2^0 to 2^7 to address "1".

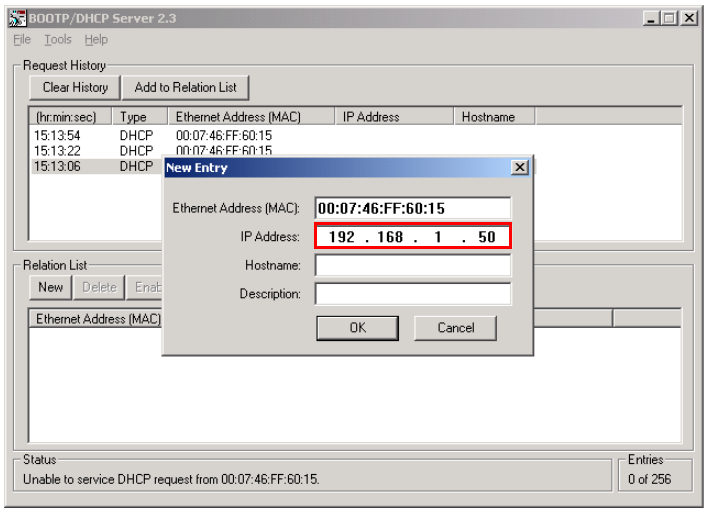
After having been connected to the network, the XI/ON sends DHCP requests to the server using its MAC-ID.

Figure 45: DHCP-request of XI/ON gateway



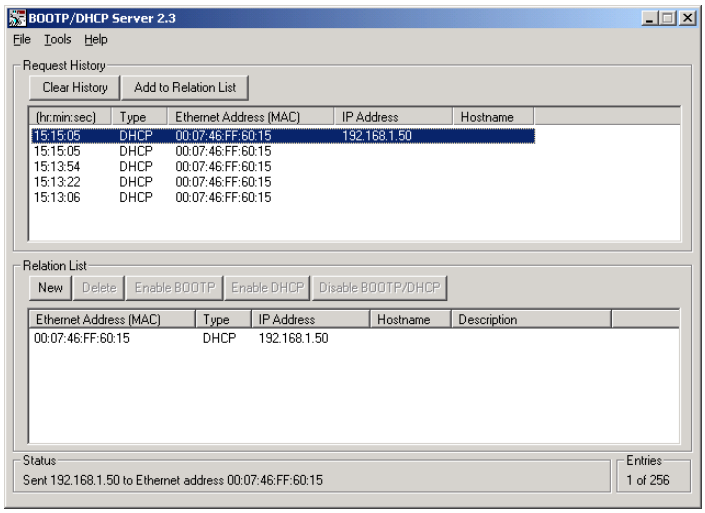
A double click on the request-entry opens the "New Entry" dialog box in which an IP address can be assigned to the module's MAC-ID.

Figure 46: Setting the IP address via DHCP



The BootP/DHCP-Server sends the IP Address via BootP/DHCP to the XI/ON gateway and, after a few seconds, the gateway answers with its new IP address when having stored it.

Figure 47: Setting the IP address via DHCP



The "Relation list" can be stored for further applications. It can serve for permanent assignment of defined IP addresses to MAC-IDs/ modules.

Attention

If the BootP/DHCP-server is shut down, the XI/ON gateway loses the IP address after a power reset!

6.4 Setting-up communications with the software tool "RSLinx"

Before the EtherNet/IP network can be configured, access to EtherNet/IP must be established using the software "RSLinx" (version 2.43.01) from Rockwell Automation.

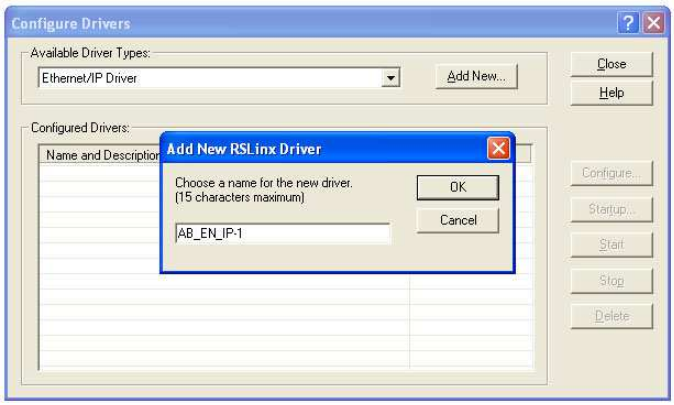
The following example explains the creation of a connection via the Allen Bradley EtherNet/IP interface.

The selection of the EtherNet/IP Driver module is done using the "Communications → Configure Drivers" command.

Select the driver type category "EtherNet/IP Driver".

Once the driver type has been selected, click the "Add new" button and choose a name for the new EtherNet/IP Driver.

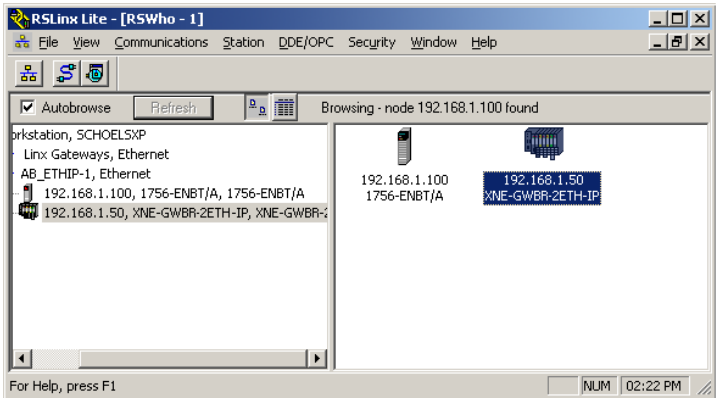
Figure 48: Selecting the EtherNet/IP Driver module



The connection to EtherNet/IP is established following successful configuration driver.

In RSLinx, the "Autobrowse" function can be used to scan the network. All hosts in the network, which is defined by the settings of your network card, will be found.

Figure 49: Scanning the EtherNet/IP network via RSWho

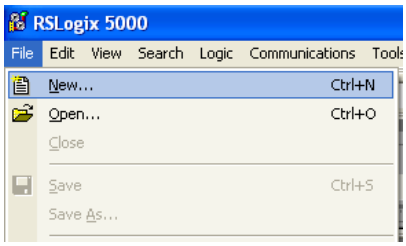


6.5 Configuration of the network in "RSLogiX 5000"

The EtherNet/IP hosts (PLC, EtherNet/IP interface, I/O modules) have to be configured using the software "RSLogix 5000" (in this example version 15) from Rockwell Automation.

Start RSLogix and open a new project using the "File" menu.

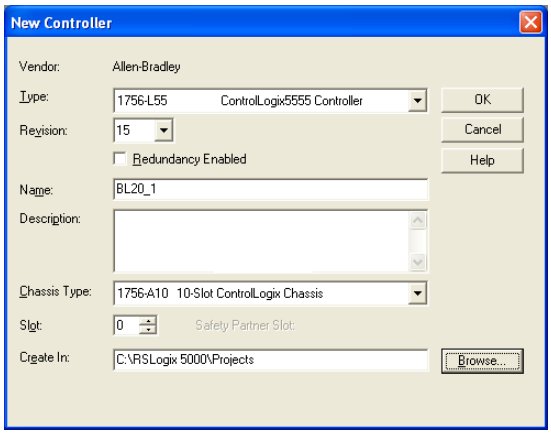
Figure 50: Creating a new project in RSLogix



6.5.1 Configuration of the controller

Enter the information related to the controller depending on your configuration, as well as a name for the project.

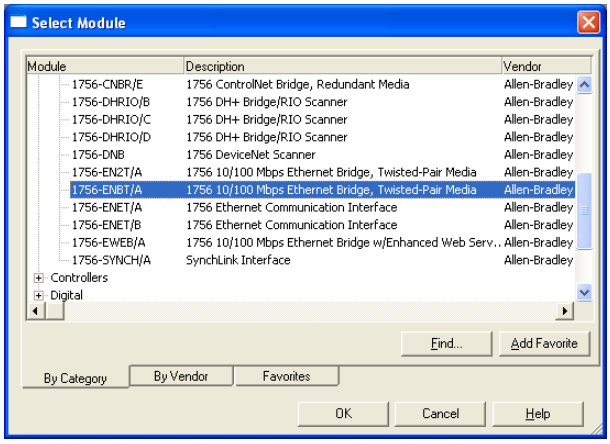
Figure 51: Configuration of the controller



Your project will be opened offline. In order to configure the network, please right-click "I/O Configuration" and select "new Module" to add the first host, the EtherNet/IP bridge, to the network.

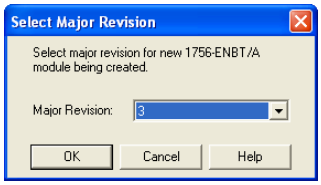
Open "Communications" and select the bridge. In this example this would be 1756-ENBT/A.

Figure 52: Selection of the EtherNet/IP bridge



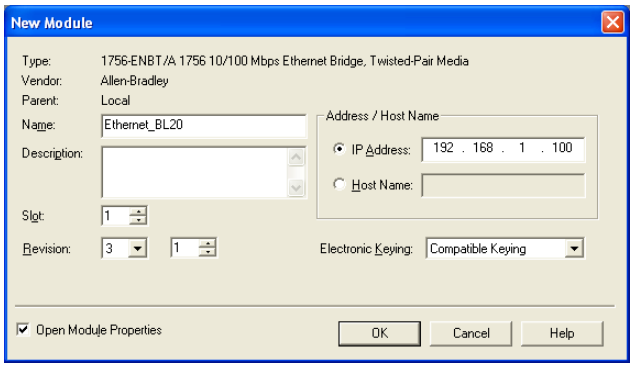
Enter the "Major Revision" of your EtherNet/IP bridge and click "OK".

Figure 53: Major Revision of the Ether-Net/IP Bridge



In the following dialog box "New Module" enter a name for the bridge and define its IP Address (in this example 192.168.1.100).

Figure 54: Configuring the EtherNet/IP Bridge

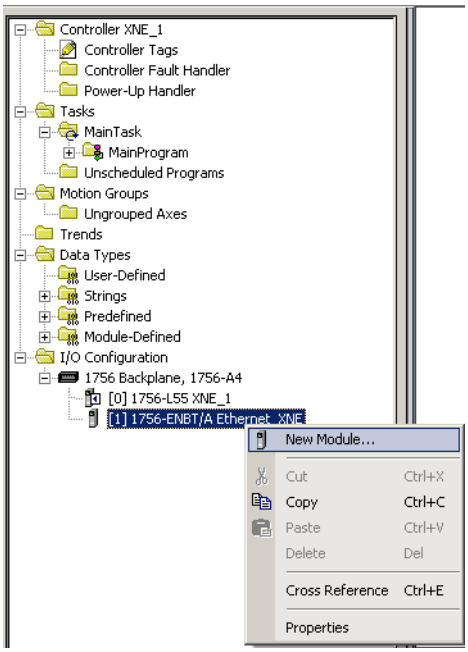


In the following dialog box "Module Properties: Local..." press "OK". You may also browse offline through the module properties when you click "Next". At this point there is no need for further entry action. If "Next" is selected, the "Module Properties" window displays information that will be available when the module is online. The configuration of the interface is completed. Press "Finish" to close the dialog box.

6.5.2 Configuration of a XI/ON station

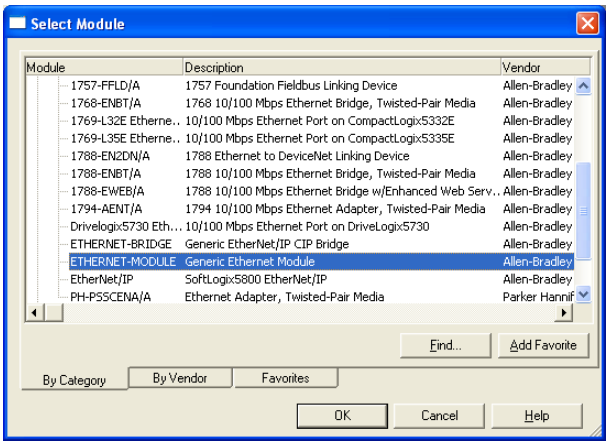
Add the XI/ON to the I/O configuration by using a right-click on the EtherNet/IP bridge module 1756-ENBT/A and select "New Module".

Figure 55: Adding the XI/ON station to the I/O configuration



Open "Communications" and select the entry "Generic Ethernet Module" to configure a XI/ON gateway.

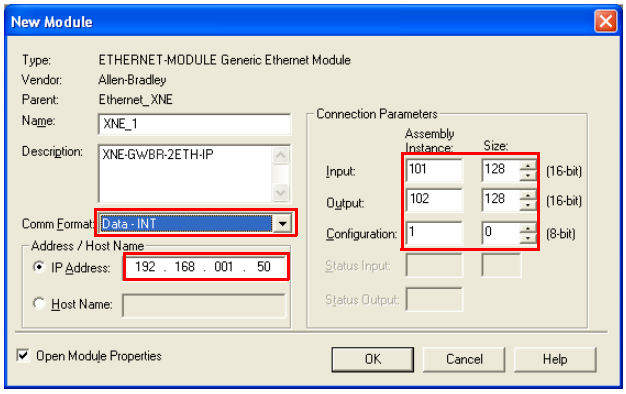
Figure 56: Add generic Ethernet module



Enter the necessary device information, like "Module name" and "Communication format" and define the gateway's IP Address and the connection parameters.

For the Assembly Instances 101 and 102, the Connection Parameters (input and output size = 256 Byte each) are static and have to be set as follows:

Figure 57: Configuration of XI/ON gateway

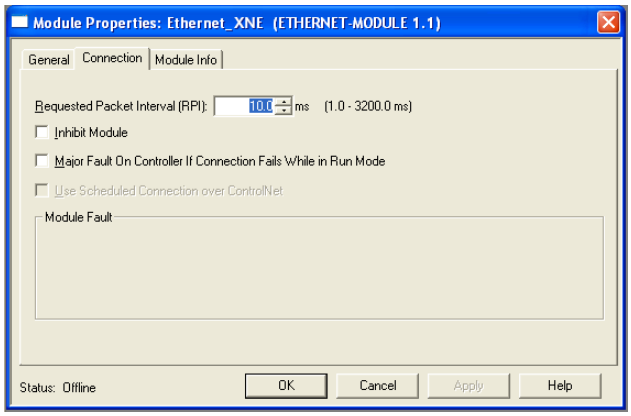


Note

If the variable Assembly Instances 103 and 104 (see page 63) are used, the Connection Parameters have to be set according to the actual station configuration which means, the in- and output sizes have to match the sizes definitely required by the station. This required in- and output size (2 to max. 496 Byte) can be read out using Assembly Class (0×04), Instance 0×67, Attr. 0×04 and Assembly Class (0×04), Instance 0×68, Attr. 0×04.

In the "Connection" tab set the "Requested Packet Interval" (RPI) to 10 ms, which normally should be the default setting. For XI/ON, the successfully tested RPI range is 5 and higher.

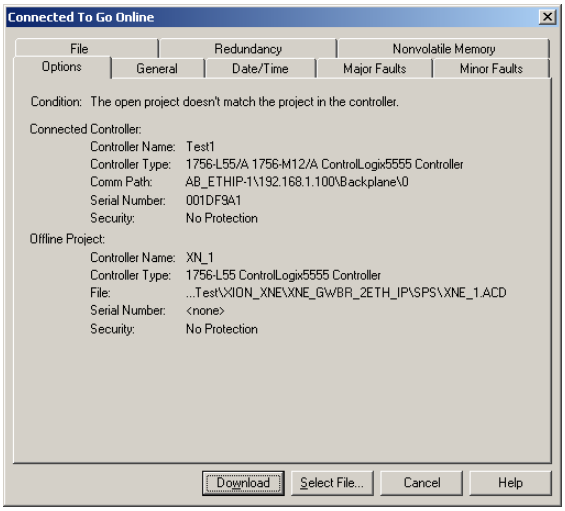
Figure 58: Set connection options for XI/ON



6.5.3 Downloading the I/O configuration

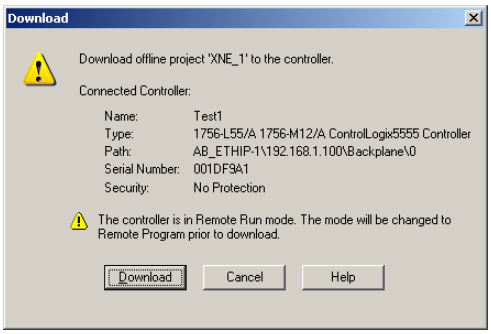
If the configuration of the network is completed, it can be downloaded to the controller by using for example the "Communication → Download" command.

Figure 59: Downloading the configuration



In the "Download" dialog box, start the download by pressing the "Download" button.

Figure 60: Downloading the configuration



If an error message is generated, warning, that the communication path can not be found, please open the "Path" menu (see Figure 62: Communication Path, Page 166), select your controller and press "Set Project Path" (see Figure 63: Communication Path, Page 167).

Figure 61: Error message

Figure 62: Communication Path

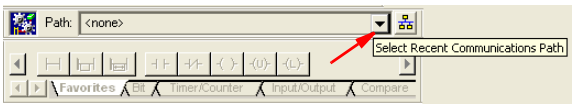
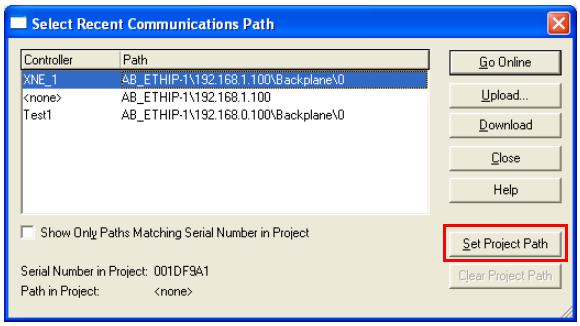


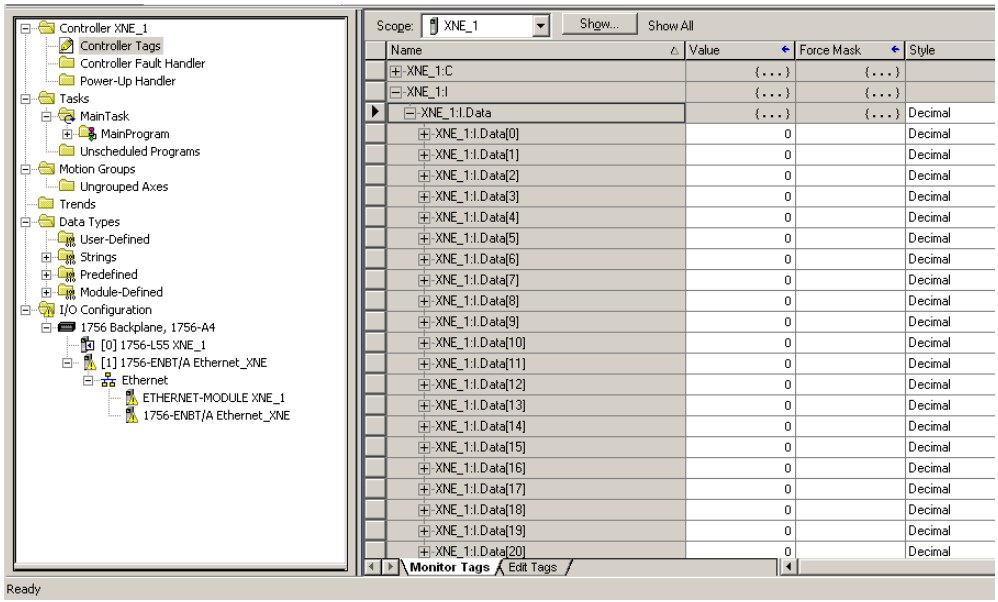
Figure 63: Communication Path



If the correct communication path is set, it is possible to download the configuration.

Once the I/O configuration is downloaded and the controller is in "Run" or "Remote Run" mode, the I/O-data mapping of the XI/ON station is shown in the "Controller Tags":

Figure 64: Controller Tags



The controller tags for XI/ON are divided into:

- XNE_1: C - the station's mapped configuration data
- XNE_1: I - the station's mapped input data
- XNE_1: O - the station's mapped output data

6.6 Examples for I/O data mapping

Each module is now accessible via the controller tags for viewing input data and/or forcing outputs.

The data mapping depends on the data width of each module connected to the gateway.

Table 63: Example station

Module		Data width	
		Process input	**Process output**
GW	XNE-GWBR-2ETH-IP	1 status word	1 control word
0	XN-2AI-I(0/4...20MA)	2 words	-
1	XN-2DI-24VDC-P	2 bits	-
2	XN-2DO-24VDC-0.5A-P	-	2 bits
3	XN-2AI-THERMO-PI	2 words	-
4	XN-4DI-24VDC-P	4 bits	-
5	empty slot	-	-
6	XN-1AI-U(-10/0...+10VDC)	1 word	-
7	XN-2AO-I(0/4...20MA)	-	2 words
8	XN-4DI-24VDC-P	4 bits	-
9	XN-1SSI	4 words	4 words

According to the I/O data widths of the modules in the example station (see Table 63: Example station, Page 168), the I/O data mapping for the example station is the following:

Table 64: Data mapping for the example station

A I.Data [0] = Byte 0 of mapped input data

Module		**I/O data word in RSLogix**
GW	XNE-GWBR-2ETH-IP	– Input data: **A** XNE_1:**I.Data [0]**; Status Word
		– Output data: XNE_1:**O.Data [0]**; Command Word
0	XN-2AI-I(0/4...20MA)	– Input data: XNE_1:**I.Data [1]**; ch. 0 XNE_1:**I.Data [2]**; ch. 1
1	XN-2DI-24VDC-P	– Input data: XNE_1:**I.Data [3]**; Bits 0 and 1 for ch. 0 and 1.
2	XN-2DO-24VDC-0.5A-P	– Output data: XNE_1:**O.Data [1]**; Bits 0 and 1 for ch. 0 and 1.
3	XN-2AI-THERMO-PI	– Input data: XNE_1:**I.Data [4]**; ch. 0: XNE_1:**I.Data [5]**; ch. 1:
4	XN-4DI-24VDC-P	– Input data XNE_1:**I.Data [6]**; Bits 2 to 5 for ch. 0 to 3.
5	empty slot	-
6	XN-1AI-U(-10/0...+10VDC)	– Output data: XNE_1:**I.Data [7]**; ch. 0
7	XN-2AO-I(0/4...20MA)	– Output data: XNE_1:**O.Data [2]**; ch. 0 XNE_1:**O.Data [3]**; ch. 1
8	XN-4DI-24VDC-P	– Input data XNE_1:**I.Data [8]**; Bits 0 to 3 for ch. 0 to 3.
9	XN-1SSI	– Input data XNE_1:**I.Data [9 - 12]** – Output data XNE_1:**O.Data [4 - 7]**

6.6.1 Mapping report via I/O-ASSISTANT

An EtherNet/IP I/O mapping report can be generated for each individual station by means of the software tool I/O-ASSISTANT.

Figure 65: I/O mapping report in software tool I/O-ASSISTANT

1. Station (Adr.: 192.168.1.1) description and I/O sizes in/out

Module Pos.	Module Part Number	Desc.	Data Size In	Data Size Out
Position 0*	XNE-GWBR-2ETH-IP	Term 0A	16 bits (status)	16 bits (control)
Position 1	XN-2AI-I(0/4...20MA)	Term 0B	32 bits	0 bits
Position 2	XN-2DI-24VDC-P	Term 0C	2 bits	0 bits
Position 3	XN-2DO-24VDC-0.5A-P	Term 0D	0 bits	2 bits
Position 4	XN-2AI-THERMO-PI	Term 0E	32 bits	0 bits
Position 5	XN-4DI-24VDC-P	Term 0F	4 bits	0 bits
Position 6	Empty Place	Term 0G	0 bits	0 bits
Position 7	XN-1AI-U(-10/0...+10VDC)	Term 0H	16 bits	0 bits
Position 8	XN-2AO-I(0/4...20MA)	Term 0I	0 bits	32 bits
Position 9	XN-4DI-24VDC-P	Term 0J	4 bits	0 bits
Position 10	XN-1SSI	Term 0K	64 bits	64 bits
Total Data In/Out size in Bytes (rounded on full words):			**26 Byte**	**16 Byte**

*For detailed information on Status/Control word see online Help - choose your gateway, click right for technical data

2. I/O map allocates 26 bytes for input data

-	Byte n+1								Byte n							
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Word 0*	0A.15	0A.14	0A.13	0A.12	0A.11	0A.10	0A.9	0A.8	0A.7	0A.6	0A.5	0A.4	0A.3	0A.2	0A.1	0A.0
Word 1	0B.15	0B.14	0B.13	0B.12	0B.11	0B.10	0B.9	0B.8	0B.7	0B.6	0B.5	0B.4	0B.3	0B.2	0B.1	0B.0
Word 2	0B.31	0B.30	0B.29	0B.28	0B.27	0B.26	0B.25	0B.24	0B.23	0B.22	0B.21	0B.20	0B.19	0B.18	0B.17	0B.16
Word 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0C.1	0C.0
Word 4	0E.15	0E.14	0E.13	0E.12	0E.11	0E.10	0E.9	0E.8	0E.7	0E.6	0E.5	0E.4	0E.3	0E.2	0E.1	0E.0
Word 5	0E.31	0E.30	0E.29	0E.28	0E.27	0E.26	0E.25	0E.24	0E.23	0E.22	0E.21	0E.20	0E.19	0E.18	0E.17	0E.16
Word 6	-	-	-	-	-	-	-	-	-	-	-	-	0F.3	0F.2	0F.1	0F.0
Word 7	0H.15	0H.14	0H.13	0H.12	0H.11	0H.10	0H.9	0H.8	0H.7	0H.6	0H.5	0H.4	0H.3	0H.2	0H.1	0H.0
Word 8	-	-	-	-	-	-	-	-	-	-	-	-	0J.3	0J.2	0J.1	0J.0
Word 9	0K.15	0K.14	0K.13	0K.12	0K.11	0K.10	0K.9	0K.8	0K.7	0K.6	0K.5	0K.4	0K.3	0K.2	0K.1	0K.0
Word 10	0K.31	0K.30	0K.29	0K.28	0K.27	0K.26	0K.25	0K.24	0K.23	0K.22	0K.21	0K.20	0K.19	0K.18	0K.17	0K.16
Word 11	0K.47	0K.46	0K.45	0K.44	0K.43	0K.42	0K.41	0K.40	0K.39	0K.38	0K.37	0K.36	0K.35	0K.34	0K.33	0K.32
Word 12	0K.63	0K.62	0K.61	0K.60	0K.59	0K.58	0K.57	0K.56	0K.55	0K.54	0K.53	0K.52	0K.51	0K.50	0K.49	0K.48

*For detailed information on Status word see online Help - choose your gateway, click right for technical data

3. I/O map allocates 16 bytes for output data

-	Byte n+1								Byte n							
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Word 0*	0A.15	0A.14	0A.13	0A.12	0A.11	0A.10	0A.9	0A.8	0A.7	0A.6	0A.5	0A.4	0A.3	0A.2	0A.1	0A.0
Word 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0D.1	0D.0
Word 2	0I.15	0I.14	0I.13	0I.12	0I.11	0I.10	0I.9	0I.8	0I.7	0I.6	0I.5	0I.4	0I.3	0I.2	0I.1	0I.0
Word 3	0I.31	0I.30	0I.29	0I.28	0I.27	0I.26	0I.25	0I.24	0I.23	0I.22	0I.21	0I.20	0I.19	0I.18	0I.17	0I.16
Word 4	0K.15	0K.14	0K.13	0K.12	0K.11	0K.10	0K.9	0K.8	0K.7	0K.6	0K.5	0K.4	0K.3	0K.2	0K.1	0K.0
Word 5	0K.31	0K.30	0K.29	0K.28	0K.27	0K.26	0K.25	0K.24	0K.23	0K.22	0K.21	0K.20	0K.19	0K.18	0K.17	0K.16
Word 6	0K.47	0K.46	0K.45	0K.44	0K.43	0K.42	0K.41	0K.40	0K.39	0K.38	0K.37	0K.36	0K.35	0K.34	0K.33	0K.32
Word 7	0K.63	0K.62	0K.61	0K.60	0K.59	0K.58	0K.57	0K.56	0K.55	0K.54	0K.53	0K.52	0K.51	0K.50	0K.49	0K.48

*For detailed information on Control word see online Help - choose your gateway, click right for technical data

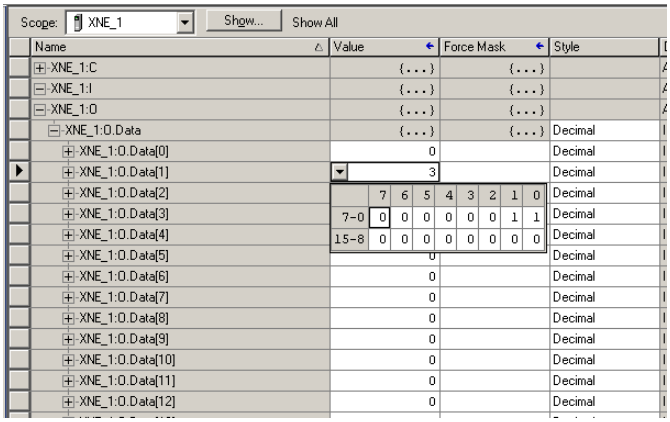
6.7 Example for process data access

6.7.1 Setting outputs at XN-2DO-24VDC-0.5A-P

Example:

To set the outputs "0" and "1" at module no. 2 in the example station (XN-2DO-24VDC-0.5A-P), bit 0 bit 1 in output data word 1 (XNE_1: O.Data [1]) have to be set (see above Table 64: Data mapping for the example station, Page 169).

Figure 66: Setting outputs at module no. 7



7 Guidelines for station planning

7.1 Module arrangement

7.1.1 Combination possibilities in a XI/ON station

Note

A mixed usage of XNE ECO or XN standard gateways and XNE ECO and XN standard I/O-modules (base modules with tension clamp terminals) is possible without any problems.

Note

The mixed usage of base modules with screw connections and base modules with tension clamp connections requires a further power supply module to be mounted. Thereby, it must be ensured that the base modules are fitted with the same connection technology (screw or tension clamp) as the power supply module.

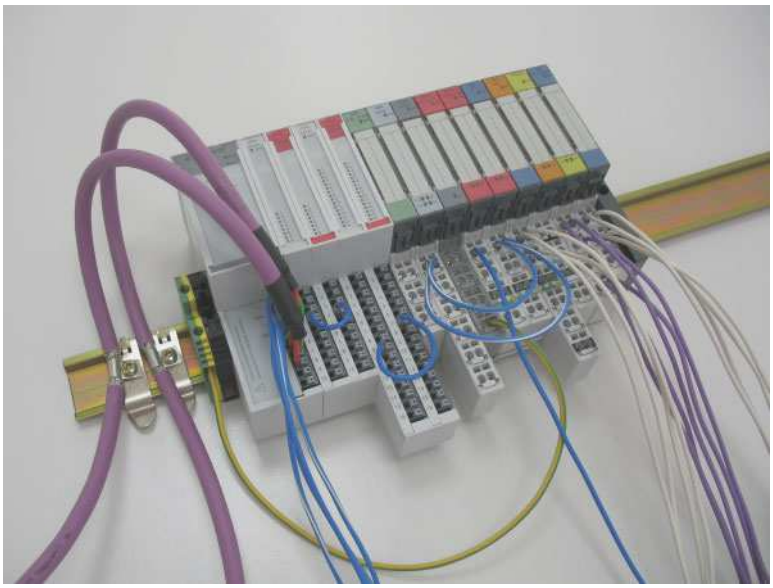


Figure 67: Example of a station structure with XNE ECO gateway (here for CANopen), XNE ECO and XN standard I/O modules

7.1.2 Random module arrangement

The arrangement of the I/O modules within a XI/ON station can basically be chosen at will. Nevertheless, it can be useful with some applications to group certain modules together.

7.1.3 Complete planning

The planning of a XI/ON station should be thorough to avoid faults and increase operating reliability.

Attention

If there are more than two empty slots next to one another, the communication is interrupted to all following XI/ON modules.

The power to XI/ON systems is supplied from a common external source. This avoids the occurrence of potential compensating currents within the XI/ON station.

7.2 Maximum station extension

The maximum number of modules within XI/ON station with the gateway XNE-GWBR-2ETH-IP depends on the following factors:

- The station extension may not exceed the maximum number of **32 modules**.
- The maximum permissible number of **192** communication bytes which are transmitted via the module bus from the modules to the gateway must not be exceeded (see below Table 65: Communication bytes and nominal current consumptions of the XI/ON modules from the module bus IMB, Page 175).
- If the maximum sum of the modules' nominal current consumptions (see below Table 65: Communication bytes and nominal current consumptions of the XI/ON modules from the module bus IMB, Page 175) right to the gateway (max. sum Σ I_{MB} = **400 mA**) is reached, a bus refreshing module has to be used in order to provide the module bus voltage.
  To the right of the bus refreshing module, the sum of the modules' current consumptions can amount to **1.5 A**.

Attention

Ensure that a sufficient number of bus refreshing and power feeding modules are used if the system is extended to its maximum.

Note

If the system limits are exceeded, the software I/O-ASSISTANT generates an error message when the user activates the menu item [Station] > [Verify].

For the calculation of the maximum system extension, the following table contains an overview about communication bytes as well as about the modules' nominal current consumptions:

Table 65: Communication bytes and nominal current consumptions of the XI/ON modules from the module bus I_{MB}

Module	Number of communication bytes	Nominal current consumption from the module bus I_{MB}
XN-BR-24VDC-D	2	–
XN-PF-24VDC-D	2	≦ 28 mA
XN-PF-120/230VAC-D	2	≦ 25 mA
XN-2DI-24VDC-P	1	≦ 28 mA
XN-2DI-24VDC-N	1	≦ 28 mA
XN-2DI-120/230VAC	1	≦ 28 mA
XN-4DI-24VDC-P	1	≦ 29 mA
XN-4DI-24VDC-N	1	≦ 28 mA

Table 65: Communication bytes and nominal current consumptions of the XI/ON modules from the module bus I_{MB}

Module	Number of communication bytes	Nominal current consumption from the module bus I_{MB}
XN-16DI-24VDC-P	2	≦ 45 mA
XN-32DI-24VDC-P	4	≦ 30 mA
XNE-8DI-24VDC-P	1	≦ 15 mA
XNE-16DI-24VDC-P	2	≦ 15 mA
XN-1AI-I(0/4...20MA)	3	≦ 41 mA
XN-2AI-I(0/4...20MA)	5	≦ 35 mA
XN-1AI-U(-10/0...+10VDC)	3	≦ 41 mA
XN-2AI-U(-10/0...+10VDC)	5	≦ 35 mA
XN-2AI-PT/NI-2/3	5	≦ 45 mA
XN-2AI-THERMO-PI	5	≦ 45 mA
XN-4AI-U/I	9	≦ 20 mA
XNE-8AI-U/I-4AI-PT/NI	9	≦ 30 mA
XN-2DO-24VDC-0.5A-P	2	≦ 32 mA
XN-2DO-24VDC-0.5A-N	2	≦ 32 mA
XN-2DO-24VDC-2A-P	2	≦ 33 mA
XN-2DO-120/230VAC-0.5A	2	≦ 35 mA
XN-4DO-24VDC-0.5A-P	2	≦ 30 mA
XN-16DO-24VDC-0.5A-P	3	≦ 120 mA
XN-32DO-24VDC-0.5A-P	5	≦ 30 mA
XNE-8DO-24VDC-0.5A-P	2	≦ 15 mA
XNE-16DO-24VDC-0.5A-P	2	≦ 25 mA
XN-1AO-I(0/4...20MA)	4	≦ 39 mA
XN-2AO-I(0/4...20MA)	7	≦ 40 mA
XN-2AO-U(-10/0...+10VDC)	7	≦ 43 mA
XNE-4AO-U/I	9	≦ 40 mA
XN-2DO-R-NC	1	≦ 28 mA
XN-2DO-R-NO	1	≦ 28 mA

Table 65: Communication bytes and nominal current consumptions of the XI/ON modules from the module bus I_{MB}

Module	**Number of communication bytes**	**Nominal current consumption from the module bus I_{MB}**
XN-2DO-R-CO	1	≦ 28 mA
XN-1CNT-24VDC	9	≦ 40 mA
XNE-2CNT-2PWM		≦ 30 mA
XN-1RS232	9	≦ 140 mA
XN-1RS485/422	9	≦ 60 mA
XN-1SSI	9	≦ 50 mA
XNE-1SWIRE	9	≦ 60 mA

7.3 Power supply

7.3.1 Power supply to the gateway

The gateways XNE-GWBR-2ETH-IP offer an integrated power supply (see also Chapter 4.4.1 Voltage supply, Page 35)

7.3.2 Module bus refreshing

The number of XI/ON modules, which can be supplied via the internal module bus by the gateway or a bus refreshing module depends on the modules' nominal current consumptions at the module bus (see Table 65: Communication bytes and nominal current consumptions of the XI/ON modules from the module bus IMB, Page 175).

Attention

The sum of the nominal current consumptions (see Table 65: Communication bytes and nominal current consumptions of the XI/ON modules from the module bus IMB, Page 175) of the used XI/ON modules may not exceed **400 mA**.
If a bus refreshing module is mounted, the sum of the current consumptions which follow the bus refreshing module must not exceed **1.5 A**.

Note

The bus refreshing modules which are used in a XI/ON station with XNE-GWBR-2ETH-IP have to be combined with the base modules XN-P3T-SBB-B or XN-P4T-SBBC-B (tension clamp) or with the base modules XN-P3S-SBB-B or XN-P4S-SBBC-B (screw terminals).

With the system supply, it must be ensured that the same ground potential and ground connections are used. Compensating currents flow via the module bus if different ground potentials or ground connections are used, which can lead to the destruction of the bus refreshing module.

All bus refreshing modules are connected to one another via the same ground potential.

The power to the module bus is supplied via the connections 11 and 21 on the base module.

If the power supply from the module bus is not guaranteed or if the maximum station size is exceeded, the software I/O-ASSISTANT generates an error message when the user activates the menu item [Station] > [Verify].

7.3.3 Creating potential groups

Power feeding modules can be used to create potential groups. The potential isolation of potential groups to the left of the respective power supply modules is provided by the base modules.

Note

The system can be supplied with power independent of the potential group formation.

When using I/O modules for 120/230 V AC (XN-2DI-120/230VAC and XN-2DO-120/230VAC-0.5A), it has to be ensured that a potential group is created in conjunction with the power feeding module XN-PF-120/230VAC-D.

Attention

It is not permitted to use modules with 24 V DC and 120/230 V AC field supply in a joint potential group.

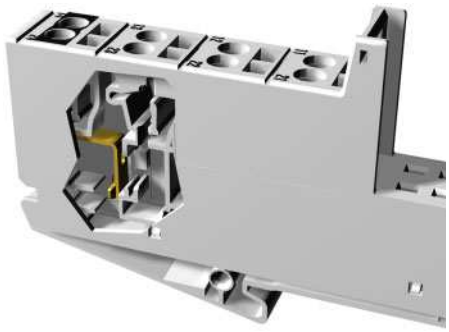
7.3.4 C-rail (cross connection)

The C-rail runs through all base modules. The C-rail of the base modules for power supply modules is mechanically separated; thus potentially isolating the adjoining supply groups.

Access to the C-rail is possible with the help of base modules with a C in their designation (for example, XN-S4T-SBCS). The corresponding connection level is indicated on these modules by a thick black line. The black line is continuous on all I/O modules. On power supply modules, the black line is only above the connection 24. This makes clear that the C-rail is separated from the adjoining potential group to its left.

Figure 68:
C-rail front view

Figure 69:
C-rail side view



Warning

It is permitted to load the C-rail with a maximum of 24 V. **Not** 230 V!

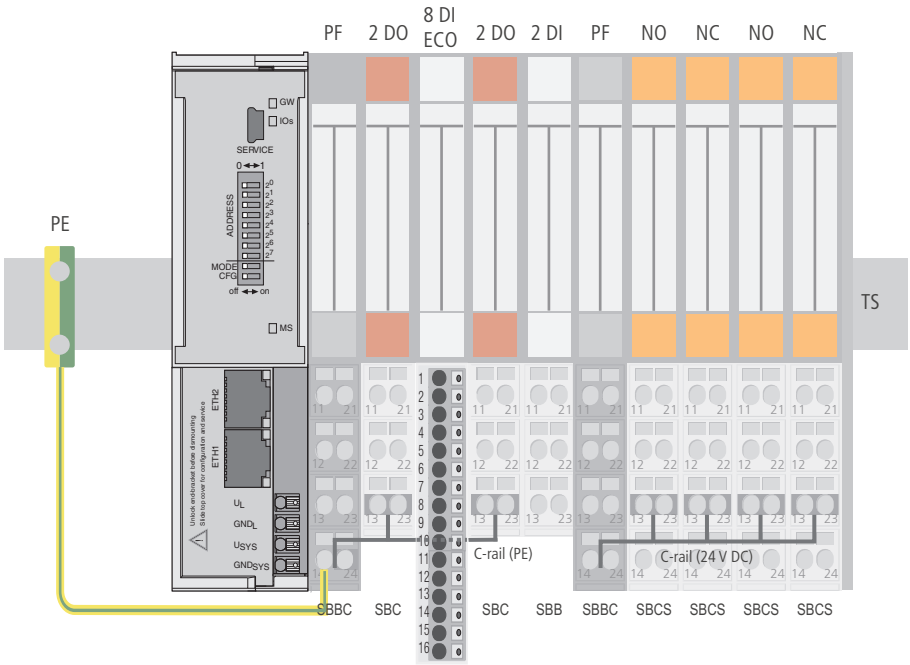
The C-rail can be used as required by the application, for example, as a protective earth (PE). In this case, the PE connection of each power supply module must be connected to the mounting rail via an additional PE terminal, which is available as an accessory.

The C-rail is not interrupted by the modules of the XNE ECO-products. It is connected through the modules' connection level. But, an access to the C-rail is not possible.

Note

For information about introducing a XI/ON station into a ground reference system, please read Chapter 8, Page 185.

Figure 70:
Using the C-rail as a protective earth



C-rails can be used for a common voltage supply (24 V DC) when relay modules are planned. To accomplish this, the load voltage is connected to a power feeding module with the XN-P4x-SBBC base module. All the following relay modules are then supplied with power via the C-rail.

Attention

When relay modules are planned and the C-rail is used for a common voltage supply, a further power supply module must be used for the potential isolation to the following modules. The C-rail can only again be used as a PE following potential isolation.

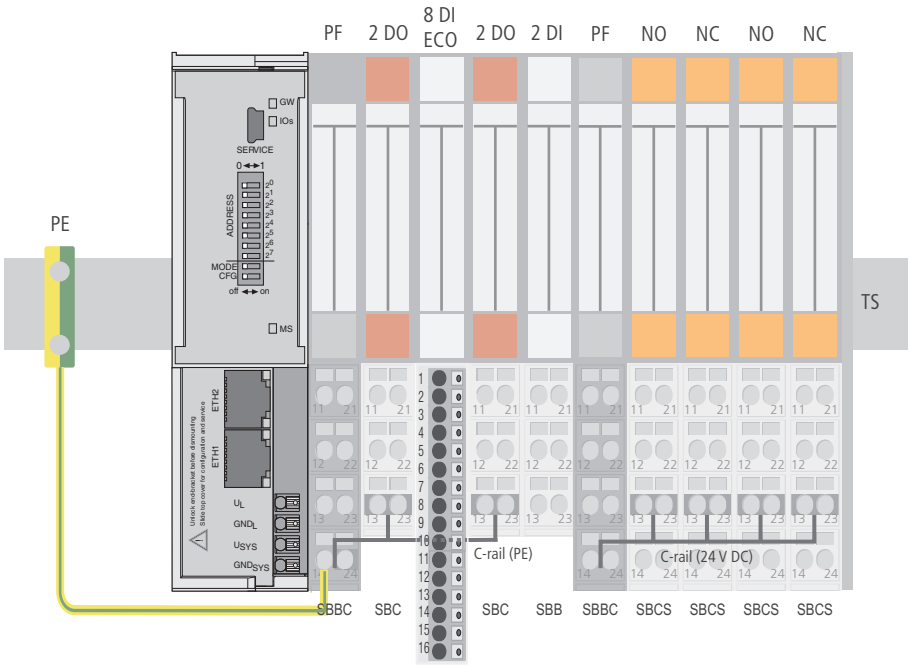


Figure 71: Using the C-rail as protective earth and for the power supply with relay modules

Cross-connecting relay module roots is achieved by the use of jumpers. The corresponding wiring diagram including the jumpers can be found in the following manual:

- MN05002010Z
  User Manual XI/ON
  Digital I/O-Modules, Supply Modules

7.3.5 Direct wiring of relay modules

As well as the options mentioned above, relay modules can be wired directly. In this case, base modules without C-rail connections should be chosen to guarantee the potential isolation to the adjoining modules.

7.4 Protecting the service interface on the gateway

During operation, the label protecting the service interface and the DIP-switches must remain in place due to EMC and ESD requirements.

7.5 Plugging and pulling electronics modules

XI/ON enables the pulling and plugging of XN standard electronics modules without having to disconnect the field wiring. The XI/ON station remains in operation if an electronics module is pulled. The voltage and current supplies as well as the protective earth connections are not interrupted.

Attention

If the field and system supplies remain connected when electronics modules are plugged or pulled, short interruptions to the module bus communications can occur in the XI/ON station. This can lead to undefined statuses of individual inputs and outputs of different modules.

7.6 Extending an existing station

Attention

Please note that extensions to the station (mounting further modules) should be carried out only when the station is in a voltage-free state.

7.7 Firmware download

Firmware can only be downloaded via the service interface on the gateway using the software tool I/O-ASSISTANT. It can not be downloaded via Ethernet.
More information is available in the program's online help.

Attention

The station should be disconnected from the fieldbus when downloading.

Firmware must be downloaded by authorized personnel only.

The field level must be isolated.

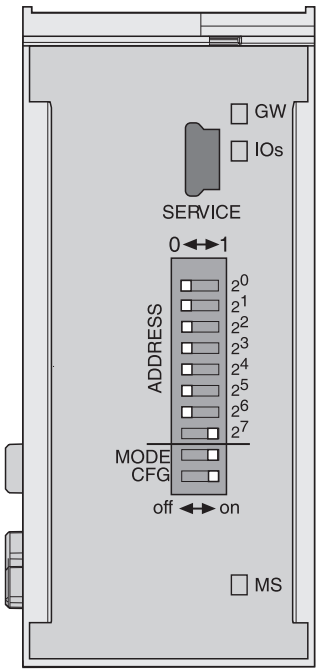
7.7.1 DIP-switch position

A firmware download to the gateway using the I/O-ASSISTANT, does not require a special position of the DIP-switches. The described DIP-switch position can be used to "force" the gateway into the download mode. This can be necessary, if the current supply was interrupted during the download.

Table 66: Position of the DIP-switches for firmware download

Address switch	Position
2^0 -2^6	0
2^7	1
MODE	1
CFG	1

Figure 72: Position of the DIP-switches for firmware download



8 Guidelines for electrical installation

8.1 General notes

8.1.1 General

Cables should be grouped together, for example: signal cables, data cables, heavy current cables, power supply cables.

Heavy current cables and signal or data cables should always be routed in separate cable ducts or bundles. Signal and data cables must always be routed as close as possible to ground potential surfaces (for example support bars, cabinet sides etc.).

8.1.2 Cable routing

Correct cable routing prevents or suppresses the reciprocal influencing of parallel routed cables

Cable routing inside and outside of cabinets

To ensure EMC-compatible cable routing, the cables should be grouped as follows:

Various types of cables within the groups can be routed together in bundles or in cable ducts.

Group 1:

- shielded bus and data cables
- shielded analog cables
- unshielded cables for DC voltage ≦ 60 V
- unshielded cables for AC voltage ≦ 25 V

Group 2:

- unshielded cables for DC voltage > 60 V and ≦ 400 V
- unshielded cables for AC voltage > 25 V and ≦ 400 V

Group 3:

- unshielded cables for DC and AC voltages > 400 V

The following group combination can be routed only in separate bundles or separate cable ducts (no minimum distance apart):

- **Group 1/Group 2**

The group combinations:

- **Group 1/Group 3 and Group 2/Group 3**

must be routed in separate cable ducts with a minimum distance of 10 cm apart. This is equally valid for inside buildings as well as for inside and outside of switchgear cabinets.

Cable routing outside buildings

Outside of buildings, cables should be routed in closed (where possible), cage-type cable ducts made of metal. The cable duct joints must be electrically connected and the cable ducts must be earthed.

Warning

Observe all valid guidelines concerning internal and external lightning protection and grounding specifications when routing cables outside of buildings.

8.1.3 Lightning protection

The cables must be routed in double-grounded metal piping or in reinforced concrete cable ducts.

Signal cables must be protected against overvoltage by varistors or inert-gas filled overvoltage arrestors. Varistors and overvoltage arrestors must be installed at the point where the cables enter the building.

8.1.4 Transmission media

For a communication via Ethernet, different transmission media can be used:

- coaxial cable
  10Base2 (thin koax),
  10Base5 (thick koax, yellow cable)
- optical fibre (10BaseF)
- twisted two-wire cable (10BaseT) with shielding (STP) or without shielding (UTP).

8.2 Potential relationships

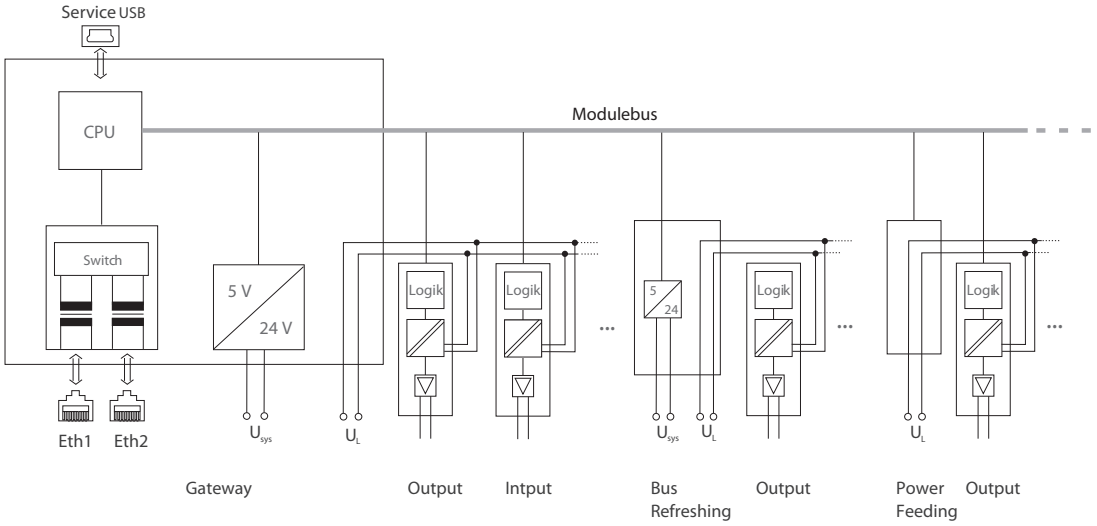
8.2.1 General

The potential relationship of a Ethernet system realized with XI/ON modules is characterized by the following:

- The system supply of gateway and I/O-modules as well as the field supply are realized via one power feed at the gateway.
- All XI/ON modules (gateway, power feeding and I/O-modules), are connected capacitively via base modules to the mounting rails.

The block diagram shows the arrangement of a typical XI/ON station with the gateway XNE-GWBR-2ETH-IP.

Figure 73: Block diagram of a XI/ON station with XNE-GWBR-2ETH-IP



8.3 Electromagnetic Compatibility (EMC)

XI/ON products comply in full with the requirements pertaining to EMC regulations.

Nevertheless, an EMC plan should be made before installation. Hereby, all potential electro-mechanical sources of interference should be considered such as galvanic, inductive and capacitive couplings as well as radiation couplings.

8.3.1 Ensuring Electromagnetic Compatibility

The EMC of XI/ON modules is guaranteed when the following basic rules are adhered to:

- Correct and large surface grounding of inactive metal components.
- Correct shielding of cables and devices.
- Proper cable routing – correct wiring.
- Creation of a standard reference potential and grounding of all electrically operated devices.
- Special EMC measures for special applications.

8.3.2 Grounding of inactive metal components

All inactive metal components (for example: switchgear cabinets, switchgear cabinet doors, supporting bars, mounting plates, tophat rails, etc.) must be connected to one another over a large surface area and with a low impedance (grounding). This guarantees a standardized reference potential area for all control elements and reduces the influence of coupled disturbances.

- In the areas of screw connections, the painted, anodized or isolated metal components must be freed of the isolating layer. Protect the points of contact against rust.
- Connect all free moving groundable components (cabinet doors, separate mounting plates, etc.) by using short bonding straps to large surface areas.
- Avoid the use of aluminum components, as its quick oxidizing properties make it unsuitable for grounding.

Warning

The grounding must never – including cases of error – take on a dangerous touch potential. For this reason, always protect the ground potential with a protective cable.

8.3.3 PE connection

A central connection must be established between ground and PE connection (protective earth).

8.3.4 Earth-free operation

Observe all relevant safety regulations when operating an earthfree system.

8.3.5 Mounting rails

All mounting rails must be mounted onto the mounting plate with a low impedance, over a large surface area, and must be correctly earthed.

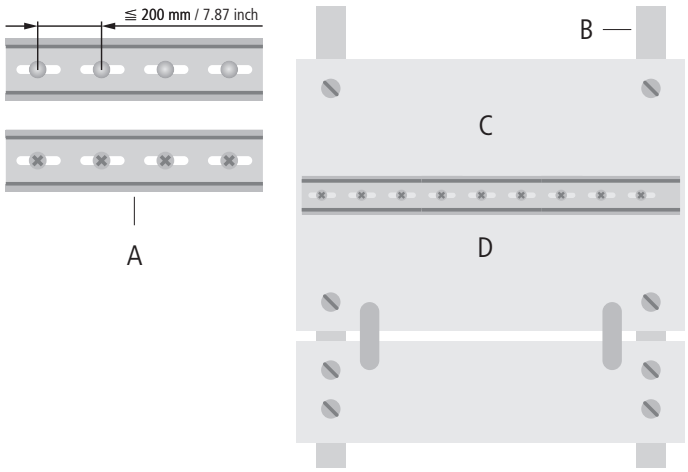


Figure 74: Mounting options

A TS 35
B Mounting rail
C Mounting plate

Mount the mounting rails over a large surface area and with a low impedance to the support system using screws or rivets.

Remove the isolating layer from all painted, anodized or isolated metal components at the connection point. Protect the connection point against corrosion (for example with grease; caution: use only suitable grease).

8.4 Shielding of cables

Shielding is used to prevent interference from voltages and the radiation of interference fields by cables. Therefore, use only shielded cables with shielding braids made from good conducting materials (copper or aluminum) with a minimum degree of coverage of 80 %.

The cable shield should always be connected to both sides of the respective reference potential (if no exception is made, for example, such as high-resistant, symmetrical, analog signal cables). Only then can the cable shield attain the best results possible against electrical and magnetic fields.

A one-sided shield connection merely achieves an isolation against electrical fields.

Warning

When installing, please pay attention to the following...

- the shield should be connected immediately when entering the system,
- the shield connection to the shield rail should be of low impedance,
- the stripped cable-ends are to be kept as short as possible,
- the cable shield is not to be used as a bonding conductor.

The insulation of the shielded data-cable should be stripped and connected to the shield rail when the system is not in operation. The connection and securing of the shield should be made using metal shield clamps. The shield clamps must enclose the shielding braid and in so doing create a large surface contact area. The shield rail must have a low impedance (for example, fixing points of 10 to 20 cm apart) and be connected to a reference potential area.

The cable shield should not be severed, but routed further within the system (for example, to the switchgear cabinet), right up to the interface connection.

Note

Should it not be possible to ground the shield on both sides due to switching arrangements or device specific reasons, then it is possible to route the second cable shield side to the local reference potential via a capacitor (short connection distances). If necessary, a varistor or resistor can be connected parallel to the capacitor, to prevent disruptive discharges when interference pulses occur.

A further possibility is a double-shielded cable (galvanically separated), whereby the innermost shield is connected on one side and the outermost shield is connected on both sides.

8.5 Potential compensation

Potential differences can occur between installation components that are in separate areas and these

- are fed by different supplies,
- have double-sided conductor shields which are grounded on different installation components.

A potential-compensation cable must be routed to the potential compensation.

Warning

Never use the shield as a potential compensation.

A potential compensation cable must have the following characteristics:

- Low impedance. In the case of compensation cables that are routed on both sides, the compensation line impedance must be considerably smaller than that of the shield connection (max. 10 % of shield connection impedance).
- Should the length of the compensation cable be less than 200 m, then its cross-section must be at least 16 mm^2 / 0.025 $inch^2$. If the cable length is greater than 200 m, then a cross-section of at least 25 mm^2 / 0.039 $inch^2$ is required.
- The compensation cable must be made of copper or zinc coated steel.
- The compensation cable must be connected to the protective conductor over a large surface area and must be protected against corrosion.
- Compensation cables and data cables should be routed as close together as possible, meaning the enclosed area should be kept as small as possible.

8.5.1 Switching inductive loads

In the case of inductive loads, a protective circuit on the load is recommended.

8.5.2 Protection against Electrostatic Discharge (ESD)

Attention

Electronic modules and base modules are at risk from electrostatic discharge when disassembled. Avoid touching the bus connections with bare fingers as this can lead to ESD damage.

9 Appendix

9.1 Nominal current consumption

Table 67: Nominal current consumption of the XI/ON modules from the supply terminal I_L

Modules	Power supply I_L	Nominal current consumption I_L
Gateway XNE-GWBR-2ETH-IP	≦ 8 A	–
XN-BR-24VDC-D	≦ 10 A	–
XN-PF-24VDC-D	≦ 10 A	–
XN-PF-120/230VAC-D	≦ 10 A	–
XN-2DI-24VDC-P		≦ 20 mA
XN-2DI-24VDC-N		≦ 20 mA
XN-2DI-120/230VAC		≦ 20 mA
XN-4DI-24VDC-P		≦ 40 mA
XN-4DI-24VDC-N		≦ 40 mA
XN-16DI-24VDC-P		≦ 40 mA
XN-32DI-24VDC-P		≦ 30 mA
XNE-8DI-24VDC-P		≦ 1.5 mA
XNE-16DI-24VDC-P		≦ 3 mA
XN-1AI-I(0/4…20MA)		≦ 50 mA
XN-2AI-I(0/4…20MA)		≦ 12 mA
XN-1AI-U(-10/0…+10VDC)		≦ 50 mA
XN-2AI-U(-10/0…+10VDC)		≦ 12 mA
XN-2AI-PT/NI-2/3		≦ 30 mA
XN-2AI-THERMO-PI		≦ 30 mA
XN-4AI-U/I		≦ 50 mA
XNE-8AI-U/I-4PT/NI		normally 35 mA
XN-2DO-24VDC-0.5A-P		≦ 20 mA (when load current = 0 mA)
XN-2DO-24VDC-0.5A-N		≦ 20 mA (when load current = 0 mA)
XN-2DO-24VDC-2A-P		≦ 50 mA (when load current = 0 mA)
XN-2DO-120/230VAC-0.5A		≦ 20 mA (when load current = 0 mA)
XN-4DO-24VDC-0.5A-P		≦ 25 mA (when load current = 0 mA)
XN-16DO-24VDC-0.5A-P		≦ 30 mA (when load current = 0 mA)

Modules	Power supply I_L	Nominal current consumption I_L
XN-32DO-24VDC-0.5A-P		≦ 50 mA (when load current = 0 mA)
XNE-8DO-24VDC-0.5A-P		≦ 3 mA (when load current = 0 mA, all outputs OFF)
XNE-16DO-24VDC-0.5A-P		≦ 3 mA (when load current = 0 mA, all outputs OFF)
XN-1AO-I(0/4…20MA)		≦ 50 mA
XN-2AO-I(0/4…20MA)		≦ 50 mA
XN-2AO-U(-10/0…+10VDC)		≦ 50 mA
XNE-4AO-U/I		≦ 150 mA
XN-2DO-R-NC		≦ 20 mA
XN-2DO-R-NO		≦ 20 mA
XN-2DO-R-CO		≦ 20 mA
XN-1CNT-24VDC		≦ 50 mA (when load current = 0 mA)
XNE-2CNT-2PWM		normally 35 mA (all inputs and outputs are ‚zero')
XN-1RS232		0 mA
XN-1RS485/422		≦ 25 mA
XN-1SSI		≦ 25 mA
XNE-1SWIRE		0 mA

Table 68: Nominal current consumption of the XI/ON modules from the module bus I_{MB}

Modules	Power supply I_{MB}	Nominal current consumption I_{MB}
Gateway XNE-GWBR-2ETH-IP	400 mA	–
XN-BR-24VDC-D	1500 mA	–
XN-PF-24VDC-D		≦ 28 mA
XN-PF-120/230VAC-D		≦ 25 mA
XN-2DI-24VDC-P		≦ 28 mA
XN-2DI-24VDC-N		≦ 28 mA
XN-2DI-120/230VAC		≦ 28 mA
XN-4DI-24VDC-P		≦ 29 mA
XN-4DI-24VDC-N		≦ 28 mA
XN-16DI-24VDC-P		≦ 45 mA
XN-32DI-24VDC-P		≦ 30 mA
XNE-8DI-24VDC-0.5A-P		≦ 15 mA
XNE-16DI-24VDC-0.5A-P		≦ 15 mA
XN-1AI-I(0/4…20MA)		≦ 41 mA
XN-2AI-I(0/4…20MA)		≦ 35 mA
XN-1AI-U(-10/0…+10VDC)		≦ 41 mA
XN-2AI-U(-10/0…+10VDC)		≦ 35 mA
XN-2AI-PT/NI-2/3		≦ 45 mA
XN-2AI-THERMO-PI		≦ 45 mA
XN-4AI-U/I		≦ 20 mA
XNE-8AI-U/I-4PT/NI		≦ 30 mA
XN-2DO-24VDC-0.5A-P		≦ 32 mA
XN-2DO-24VDC-0.5A-N		≦ 32 mA
XN-2DO-24VDC-2A-P		≦ 33 mA
XN-2DO-120/230VAC-0.5A-P		≦ 35 mA
XN-4DO-24VDC-0.5A-P		≦ 30 mA
XN-16DO-24VDC-0.5A-P		≦ 120 mA
XN-32DO-24VDC-0.5A-P		≦ 30 mA
XNE-8DO-24VDC-0.5A-P		≦ 15 mA
XNE-16DO-24VDC-0.5A-P		≦ 25 mA
XN-1AO-I(0/4…20MA)		≦ 39 mA

Modules	Power supply I_{MB}	Nominal current consumption I_{MB}
XN-2AO-I(0/4…20MA)		≦ 40 mA
XN-2AO-U(-10/0…+10VDC)		≦ 43 mA
XNE-4AO-U/I		≦ 40 mA
XN-2DO-R-NC		≦ 28 mA
XN-2DO-R-NO		≦ 28 mA
XN-2DO-R-CO		≦ 28 mA
XN-1CNT-24VDC		≦ 40 mA
XNE-2CNT-2PWM		≦ 30 mA
XN-1RS232		≦ 140 mA
XN-1RS485/422		≦ 60 mA
XN-1SSI		≦ 50 mA
XNE-1SWIRE		≦ 60 mA

9.2 Power loss of the modules

Table 69: Power loss of the XI/ON modules

Modules	Power loss (typical)
Gateway XNE-GWBR-2ETH-IP	–
XN-BR-24VDC-D	–
XN-PF-24VDC-D	–
XN-PF-120/230VAC-D	–
XN-2DI-24VDC-P	0.7 W
XN-2DI-24VDC-N	0.7 W
XN-2DI-120/230VAC	1 W
XN-4DI-24VDC-P	1 W
XN-4DI-24VDC-N	1 W
XN-16DI-24VDC-P	2.5 W
XN-32DI-24VDC-P	4.2 W
XNE-8DI-24VDC-P	< 1.5 W
XNE-16DI-24VDC-P	< 2.5 W
XN-1AI-I(0/4…20MA)	< 1 W
XN-2AI-I(0/4…20MA)	< 1 W
XN-1AI-U(-10/0…+10VDC)	< 1 W
XN-2AI-U(-10/0…+10VDC)	< 1 W
XN-2AI-PT/NI-2/3	< 1 W
XN-2AI-THERMO-PI	< 1 W
XN-4AI-U/I	< 1 W
XN-8AI-U/I-4PT/NI	< 1.5 W
XN-2DO-24VDC-0.5A-P	normally 1 W
XN-2DO-24VDC-0.5A-N	normally 1 W
XN-2DO-24VDC-2A-P	normally 1 W
XN-2DO-120/230VAC-0.5A	normally 1 W
XN-4DO-24VDC-0.5A-P	normally 1 W
XN-16DO-24VDC-0.5A-P	normally 4 W
XN-32DO-24VDC-0.5A-P	normally 5 W
XNE-8DO-24VDC-0.5A-P	normally 1.5 W

Modules	Power loss (typical)
XNE-16DO-24VDC-0.5A-P	normally 2.5 W
XN-1AO-I(0/4…20MA)	normally 1 W
XN-2AO-I(0/4…20MA)	normally 1 W
XN-2AO-U(-10/0…+10VDC)	normally 1 W
XNE-4AO-U/I	< 3 W
XN-2DO-R-NC	normally 1 W
XN-2DO-R-NO	normally 1 W
XN-2DO-R-CO	normally 1 W
XN-1CNT-24VDC	< 1.3 W
XNE-2CNT-2PWM	< 2 W
XN-1RS232	normally 1 W
XN-1RS485/422	normally 1 W
XN-1SSI	normally 1 W
XNE-1SWIRE	normally 2 W

9.3 Glossary

Acknowledge
Acknowledgment of a signal received.

Active metal component
Conductor or conducting component that is electrically live during operation.

Address
Identification number of, e.g. a memory position, a system or a module within a network.

Addressing
Allocation or setting of an address, e. g. for a module in a network.

ARP
Used to definitely allocate the hardware addresses (MAC-IDs) assigned worldwide to the IP addresses of the network clients via internal tables.

Analog
Infinitely variable value, e. g. voltage. The value of an analog signal can take on any value, within certain limits.

Automation device
A device connected to a technical process with inputs and outputs for control. Programmable logic controllers (PLC) are a special group of automation devices.

Baud
Baud is a measuring unit for the transmission speed of data. 1 Baud corresponds to the transmission of one step per second. If one bit is transitted per step, the baud rate is identical to the transmission rate in bit per second (bit/s).

Baud rate
See „Baud".

Bidirectional
Working in both directions.

Bonding strap
Flexible conductor, normally braided, that joins inactive components, e. g. the door of a switchgear cabinet to the cabinet main body.

Bus
Bus system for data exchange, e. g. between CPU, memory and I/O levels. A bus can consist of several parallel cables for data transmission, addressing, control and power supply.

Bus cycle time
Time required for a master to serve all slaves or stations in a bus system, i. e. reading inputs and writing outputs.

Bus line
Smallest unit connected to a bus, consisting of a PLC, a coupling element for modules on the bus and a module.

Bus system
All units which communicate with one another via a bus.

Capacitive coupling
Electrical capacitive couplings occur between cables with different potentials. Typical sources of interference are, for example, parallel-routed signal cables, contactors and electrostatic discharges.

Check-back interface
The check-back interface is the interface from the counter module to the internal module bus. The bits and bytes are converted by the gateway from the respective type of communication applicable to the fieldbus in to the module-specific bits and bytes.

Coding elements
Two-piece element for the unambiguous assignment of electronic and base modules.

Configuration
Systematic arrangement of the I/O-modules of a station.

Control interface
The control interface is the interface from the internal module bus to the counter module. The commands and signals directed to the counter module are converted by the gateway from the respective type of communication applicable to the fieldbus in to the module-specific bits and bytes.

CPU
Central Processing Unit. Central unit for electronic data processing, the processing core of the PC.

DHCP
Client-Server-protocol which reduces the effort of assigning IP addresses or other parameters. Serves for dynamic and automatic configuration of devices.

Digital
A value (e. g. a voltage) which can adopt only certain statuses within a finite set, mostly defined as 0 and 1.

DIN
German acronym for German Industrial Standard.

EIA
Electronic Industries Association – association of electrical companies in the United States.

Electrical components
All objects that produce, convert, transmit, distribute or utilize electrical power (e. g. conductors, cable, machines, control devices).

EMC
Electromagnetic compatibility – the ability of an electrical part to operate in a specific environment without fault and without exerting a negative influence on its environment.

EN
German acronym for European Standard.

ESD
Electrostatic Discharge.

Field power supply
Voltage supply for devices in the field as well as the signal voltage.

Fieldbus
Data network on sensor/actuator level. A fieldbus connects the equipment on the field level. Characteristics of a fieldbus are a high transmission security and real-time behavior.

Force Mode
Software mode which enables the user to set his plant to a required state by forcing certain variables on the input and output modules.

GND
Abbreviation of ground (potential "0").

Ground
Expression used in electrical engineering to describe an area whose electrical potential is equal to zero at any given point. In neutral grounding devices, the potential is not necessarily zero, and one speaks of the ground reference.

Ground connection
One or more components that have a good and direct contact to earth.

Ground reference
Potential of ground in a neutral grounding device. Unlike earth whose potential is always zero, it may have a potential other than zero.

Hexadecimal
System of representing numbers in base 16 with the digits 0... 9, and further with the letters A, B, C, D, E and F.

Hysteresis
A sensor can get caught up at a certain point, and then "waver" at this position. This condition results in the counter content fluctuating around a given value. Should a reference value be within this fluctuating range, then the relevant output would be turned on and off in rhythm with the fluctuating signal.

I/O
Input/output.

Impedance
Total effective resistance that a component or circuit has for an alternating current at a specific frequency.

Inactive metal components
Conductive components that cannot be touched and are electrically isolated from active metal components by insulation, but can adopt voltage in the event of a fault.

Inductive coupling
Magnetic inductive couplings occur between two cables through which an electrical current is flowing. The magnetic effect caused by the electrical currents induces an interference voltage. Typical sources of interference are for example, transformers, motors, parallel-routed network and HF signal cables.

Intelligent modules
Intelligent modules are modules with an internal memory, able to transmit certain commands (e. g. substitute values and others).

IP
Abbreviation for Internet-Protocol, protocol for the packet-oriented and connectionless transport of data packets from a transmitter to a receiver crossing different networks.

Lightning protection
All measures taken to protect a system from damage due to overvoltages caused by lightning strike.

Low impedance connection
Connection with a low AC impedance.

LSB
Least Significant bit

Mass
All interconnected inactive components that do not take on a dangerous touch potential in the case of a fault.

Master
Station in a bus system that controls the communication between the other stations.

Modbus TCP
The Modbus protocol is part of the TCP/IP protocol.
The communication is realized via function codes, which are implemented into the data telegram.
Modbus TCP uses the Transport Control Protocol (TCP) for the transmission of the Modbus user protocol in Ethernet-TCP-IP networks.

Module bus
The module bus is the internal bus in a XI/ON station. The XI/ON modules communicate with the gateway via the module bus which is independent of the fieldbus.

MSB
Most Significant bit

Ping
Implementation of an echo-protocol, used for testing whether a particular host is operating properly and is reachable on the network from the testing host.

PLC
Programmable Logic Controller.

Potential compensation
The alignment of electrical levels of electrical components and external conductive components by means of an electrical connection.

Potential free
Galvanic isolation of the reference potentials in I/O-modules of the control and load circuits.

Potential linked
Electrical connection of the reference potentials in I/O-modules of the control and load circuits.

Protective earth
Electrical conductor for protection against dangerous shock currents. Generally represented by PE (protective earth).

Radiation coupling
A radiation coupling appears when an electromagnetic wave hits a conductive structure. Voltages and currents are induced by the collision. Typical sources of interference are for example, sparking gaps (spark plugs, commutators from electric motors) and transmitters (e. g. radio), that are operated near to conducting structures.

Reaction time
The time required in a bus system between a reading operation being sent and the receipt of an answer. It is the time required by an input module to change a signal at its input until the signal is sent to the bus system.

Reference potential
Potential from which all voltages of connected circuits are viewed and/or measured.

Repeater
Amplifier for signals transmitted via a bus.

Root-connecting
Creating a new potential group using a power supply module. This allows sensors and loads to be supplied individually.

RS 485
Serial interface in accordance with EIA standards, for fast data transmission via multiple transmitters.

Serial
Type of information transmission, by which data is transmitted bit by bit via a cable.

Setting parameters
Setting parameters of individual stations on the bus and their modules in the configuration software of the master.

Shield
Conductive screen of cables, enclosures and cabinets.

Shielding
Description of all measures and devices used to join installation components to the shield.

Short-circuit proof
Characteristic of electrical components. A short-circuit proof part withstands thermal and dynamic loads which can occur at its place of installation due to a short circuit.

Station
A functional unit or I/O components consisting of a number of elements.

TCP
Abbreviation for Transmission Control Protocol, connection-oriented transport protocol within the Internet protocol suite. Certain error detection mechanisms (i.e. acknowledgements, time-out monitoring) can guarantee a safe and error free data transport.

Terminating resistance
Resistor on both ends of a bus cable used to prevent interfering signal reflections and which provides bus cable matching. Terminating resistors must always be the last component at the end of a bus segment.

To ground
Connection of a conductive component with the grounding connection via a grounding installation.

Topology
Geometrical structure of a network or the circuitry arrangement.

UDP
Abbreviation for User Datagram Protocol. UDP is an transport protocol for the connectionless data between Ethernet hosts.

Unidirectional
Working in one direction.

10 Index