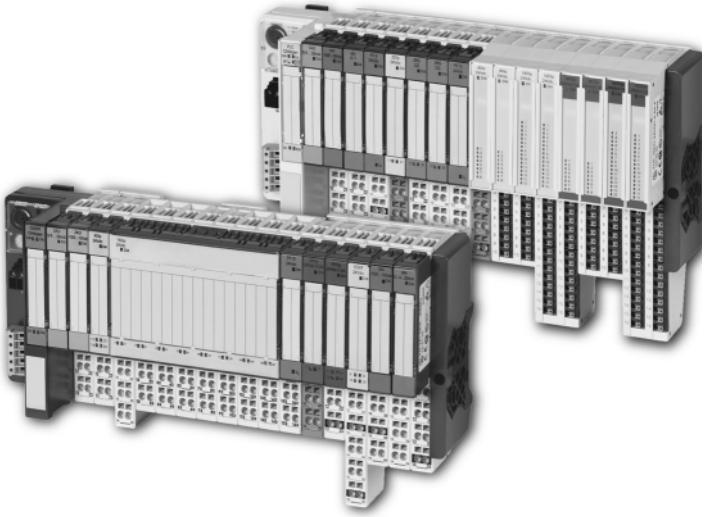
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# Gateways for DeviceNet



Powering Business Worldwide

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**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.

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**Warning!**
Dangerous electrical voltage!

**Before commencing the installation**

- Disconnect the power supply of the device.
- Ensure that the device cannot be accidentally restarted.
- Verify isolation from the supply.
- Earth and short circuit.
- Cover or enclose neighbouring 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.
- 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 tothe potential equalisation. 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 uncontrolled operation or restart.
- 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).

# Table of contents

**Table of contents** . . . . . 5

**1 Technical product description** . . . . . 7
Function . . . . . 7
Versions . . . . . 8
– Gateway XN-GW-DNET . . . . . 9
– Gateway XN-GWBR-DNET . . . . . 10
– Connections and switches on the housing . . . . . 11
Technical data . . . . . 12
– Structure of an XI/ON gateway . . . . . 12
– Technical data for the XI/ON station . . . . . 12
– Technical data for the terminals of XN standard gateways and base modules . . . . . 16
– Technical data for XN-GW-DNET . . . . . 17
– Technical data for XN-GWBR-DNET . . . . . 18
Data cables to XN-GW-DNET/ XN-GWBR-DNET . . . . 20
– Field bus connection via Open Style connector. . . . 20
Service interface connection . . . . . 23
MAC ID setting via ADDRESS switch . . . . . 25
Bit transmission rate and bus termination resistor. . . 26
Acceptance of the XI/ON configuration . . . . . 28
– SET button . . . . . 29
Diagnostics indications through the LEDs. . . . . 30

**2 Communication in DeviceNet** . . . . . 33
General DeviceNet info . . . . . 33
– Object model . . . . . 33
Standard classes for XN-GW-DNET / XN-GWBR-DNET . . . . . 36
Overview of the Vendor Specific Classes . . . . . 37
Gateway Class (VSC100) . . . . . 39
Terminal Slot Class (VSC 101) . . . . . 48
Process Data Class (VSC102). . . . . 52
Power Supply Module Class (VSC103) . . . . . 55

Configuration of the XI/ON station with configuration tool . . . . . 58
The DeviceNet communication profile . . . . . 60
– Predefined Master/Slave Connection Set . . . . . 61
– Communication profile for the XI/ON DeviceNet gateway . . . . . 62
Response to a module change . . . . . 65
– Exchanging a gateway . . . . . 65
Electronic Data Sheet – EDS file . . . . . 66
Mapping process data . . . . . 68
Status Word for the gateway . . . . . 71
Control Word for the gateway . . . . . 74
Maximum topology . . . . . 76
– Maximum system configuration . . . . . 76
– Maximale bus length . . . . . 78
Mixed operation with other types of station . . . . . 79

**3 Coupling to SLC 500 from Allen Bradley** . . . . . 81
Setting up communication, using „RSLinx“ . . . . . 81
Configuration of the network, using RSNetworx . . . . 84

**Index** . . . . . 101

# 1 Technical product description

**Function**

The XI/ON gateway enables the operation of an XI/ON station on DeviceNet. Communication between the XI/ON gateway and the higher-level control system is carried out according to the ODVA Specification Rel. V2.0, and complies with the communication model described therein. It handles the entire data traffic between the I/O level and the field bus. The service interface is used to provide information for the I/O*assistant* software.



XI/ON gateways for DeviceNet can only be used as DeviceNet servers.

The gateway supports the three DeviceNet bit transmission rates of 125 kBit/s, 250 kBit/s and 500 kBit/s.

## Versions

The gateways for the DeviceNet field bus system are available in two different versions:

XN-GW-DNET: XN-GWBR-DNET:



Figure 1: Versions of the gateways for DeviceNet

- XN-GW-DNET:
  XN standard gateway without integrated power supply module.
- XN-GWBR-DNET:
  XN standard gateway with integrated power supply module.

→ The XN-GW-DNET gateway does not have an internal power supply module!

- Install a bus refreshing module with the corresponding base module as the first module after the gateway!
- XI/ON stations with XN-GW-DNET can only be combined with XN standard modules.

### Gateway XN-GW-DNET

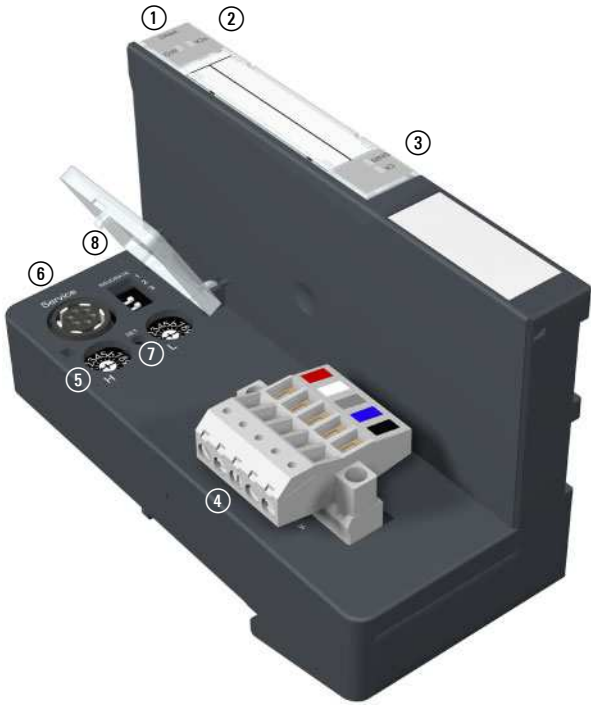



Figure 2: XN-GW-DNET

1. Type designation
2. LEDs for XI/ON module bus
3. LEDs for DeviceNet
4. Field bus connection via Open Style connector (5-pole / supplied with matching plug → Figure 5)
5. Decimal rotary encoding switch to set the MAC ID
6. Service interface
7. Configuration button to accept the present station configuration
8. DIP-switch to set the bit transmission rate

**Gateway XN-GWBR-DNET**

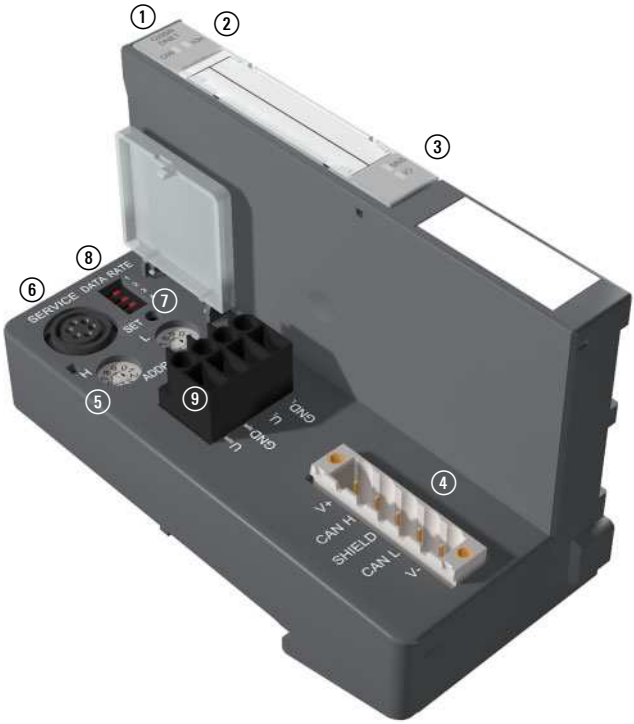



Figure 3: XN-GWBR-DNET

1. Type designation
2. LEDs for XI/ON module bus
3. LEDs for DeviceNet
4. Field bus connection via Open Style connector (5-pole / supplied with matching plug → Figure 5)
5. Decimal rotary encoding switch to set the MAC ID
6. Service interface
7. Configuration button to accept the present station configuration
8. DIP-switch to set the bit transmission rate
9. Screw terminals for field supply and system supply voltage

### Connections and switches on the housing

The XI/ON gateway is fitted with the following switches and connection options:

**PS/2 socket:** This is the service interface for the connection between the XN-GW-DNET and XN-GWBR-DNET using the software tool I/O*assistant*. The user can utilize this software to parameterize and configure the XI/ON stations, and to perform diagnoses. The interface is physically implemented as a 6-pole mini-DIN connector (socket). A special Eaton connecting cable is available for the connection to a serial interface on a PC.

### Decimal rotary encoding switch

This is used to set the MAC ID.

DIP-switch

This is used to set the bit transmission rate.

For XN-GW-DNET, it is also possible to switch in the bus termination resistor via a DIP-switch. A passive bus termination must be applied externally if the XI/ON gateway is the last station in the bus structure.

SET button

When the SET button is pressed, the Actual Station Configuration is stored in the non-volatile memory of the gateway.

**Technical data** **Structure of an XI/ON gateway**

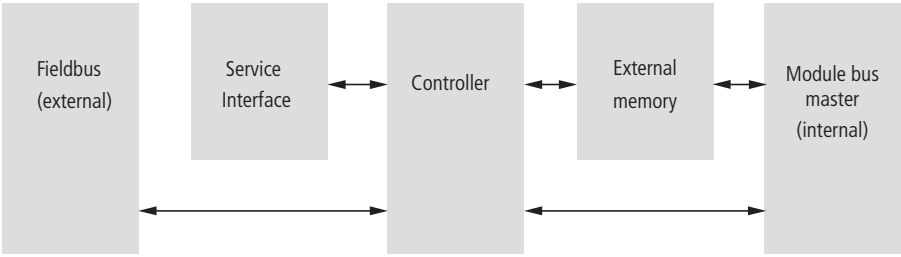



Figure 4: Gateway structure

### Technical data for the XI/ON station

**Attention!**
The auxiliary supply must meet the requirements for SELV (= Safety Extra Low Voltage) according to IEC 60364-4-41.

Table 1: Technical data for the XI/ON station

| Designation | Value |
|---|---|
| Supply voltage/auxiliary supply | |
| Nominal value (provided for other modules) | 24 V DC |
| Residual ripple | according to IEC/EN 61131-2 |
| Electrical isolation ($U_L$ to $U_{SYS}$ / $U_L$ to field bus / $U_{SYS}$ to field bus) | yes, through optocoupler |
| Environment/temperature | |
| Operating temperature, mounted horizontally | 0 to +55 °C |
| Operating temperature, mounted vertically | 0 to +55 °C |
| Storage temperature | -25 to +85 °C |
| Relative humidity according to IEC/EN 60068-2-30 | 5 to 95 % (indoor), Level RH-2, no condensation (storage at 45 °C, no functional test) |

| Designation | Value |
|---|---|
| Corrosive gases | |
| $SO_2$ | 10 ppm (rel. humidity < 75 %, no condensation) |
| $H_2S$ | 1.0 ppm (rel. humidity < 75 %, no condensation) |
| Vibration resistance | |
| 10 to 57 Hz, constant amplitude 0.075 mm, 1 g | yes |
| 57 to 150 Hz, constant acceleration 1 g | yes |
| Vibration type | Variable frequency runs at a rate of change of 1 octave/min |
| Vibration duration | 20 variable frequency runs per coordinate axis |
| Shock resistance according to IEC/EN 60068-2-27 | 18 shocks, half sine 15 g peak value/11 ms, for both +/- directions per spatial coordinate |
| Repeated shock resistance according to IEC/EN 60068-2-29 | 1000 shocks, half-sine 25 g peak value/6 ms, for both +/- directions per spatial coordinate |
| Drop and topple | |
| Fall height (weight< 10 kg) | 1.0 m |
| Fall height (weight 10 to 40 kg) | 0.5 m |
| Test runs | 7 |
| Instrument with packaging, electronics boards electrically tested | |
| Electromagnetic compatibility (EMC) according to IEC/EN 61000-6-2 (industrial) | |
| Static electricity according to IEC/EN 61000-4-2 | |
| Air discharge (direct) | 8 kV |
| Relay discharge (indirect) | 4 kV |

| Designation | Value |
|---|---|
| Electromagnetic HF fields according to IEC/EN 61000-4-3 | 10 V/m |
| Conducted interference, 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 |
| Radiated interference according to IEC/EN 61000-6-4 (industrial) | according to IEC/CISPR 11 / EN 55011, Class A[1)] |

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

Table 2: Approvals and tests for an XI/ON station

| Designation | Value |
|---|---|
| Approvals[1)] | CE, cULus |
| Tests (IEC/EN 61131-2) | |
| Cold | IEC/EN 60068-2-1 |
| Dry heat | IEC/EN 60068-2-2 |
| Damp heat, cyclical | IEC/EN 60068-2-30 |
| Temperature changes | IEC/EN 60068-2-14 |
| Operating life MTBF | 120 000 h[2)] |
| Removal/insertion cycles for electronics modules | 20 |
| Pollution level according to IEC/EN 60664 (IEC/EN 61131-2) | 2 |
| Degree of protection according to IEC/EN 60529 | IP 20 |

1) The approvals of newer XI/ON modules can still be pending
2) The lifespan of the relay module is not stated in hours. The number of operating cycles is relevant for the lifespan.

### Technical data for the terminals of XN standard gateways and base modules

Table 3: Technical data for the terminals of XN standard gateways and base modules

| Designation | Value |
|---|---|
| Measurement data | according to VDE 0611 Part 1/8.92 / IEC/EN 60947-7-1 |
| TOP connection technology | Tension clamp or screw connection |
| Protection class | IP20 |
| Insulation stripping length | 8.0 to 9.0 mm / 0.32 to 0.36 inch |
| Max. wire range | 0.5 to 2.5 $mm^2$ / 0.0008 to 0.0039 $inch^2$ / AWG 24 to AWG 14 |
| Crimpable wire | |
| "e" solid core H 07V-U | 0.5 to 2.5 $mm^2$ / 0.0008 to 0.0039 $inch^2$ |
| "f" flexible core H 07V-K | 0.5 to 1.5 $mm^2$ / 0.0008 to 0.0023 $inch^2$ |
| "f" with ferrules according to DIN 46228-1 (ferrules crimped gas-tight) | 0.5 to 1.5 $mm^2$ / 0.0008 to 0.0023 $inch^2$ |
| Test finger according to IEC/EN 60947-1 | A1 |

### Technical data for XN-GW-DNET

Table 4: Technical data for XN-GW-DNET

| Designation | Value |
|---|---|
| Maximum system extension | 74 modules (XN) in slice design or max. length of station: 1 m |
| Supply voltage (according to IEC/EN 61131-2) | |
| Nominal value (supply from bus refreshing module) | 5 V DC (4.8 to 5.2 V DC) |
| Restriction on IEC/EN 61131-2 | The supply energy required to bridge a supply interruption up to 10 ms is not stored. Please secure the $U_{sys}$ for XN-BR-24VDC-D modules by using an appropriate power supply unit! |
| Current consumption from module bus $I_{MB}$ | |
| Maximum | ~ 250 mA |
| Dimensions | |
| Width/length/height (mm) | 50.6 x 114.8 x 74.4 mm |
| Service | |
| Connections | PS/2 socket |
| Field bus connections | Open Style connector |
| Field bus shielding connection | yes, via DeviceNet cable |
| Transfer rate | 125 kBit/s, 250 kBit/s, 500 kBit/s |
| Field bus termination | via DIP-switch |
| 2 decimal rotary encoding switches, labelled for setting the MAC ID of the gateway. | |

### Technical data for XN-GWBR-DNET

Table 5: Technical data for XN-GWBR-DNET

| Designation | Value |
|---|---|
| Maximum system extension | 74 modules (XN, XNE) in slice design or max. length of station: 1 m |
| Supply | |
| Field supply | |
| $U_L$ nominal value (range) | 24 V DC (18 to 30 V DC) |
| $I_L$ max. field current | 10 A |
| Isolation voltage ($U_L$ to $U_{SYS}$ / $U_L$ to field bus / $U_L$ to FE) | 500 $V_{rms}$ |
| Connections | 2-pole screw terminal |
| System supply | |
| $U_{SYS}$ nominal value (range) | 24 V DC (18 to 30 V DC) |
| $I_{SYS}$ (for $I_{MB}$ = 1.2 A / $U_{SYS}$ = 18 V DC) | max. 900 mA |
| $I_{MB}$ (supply to the module bus participants) | 1.2 A |
| Isolation voltage ($U_{SYS}$ to $U_L$ / $U_{SYS}$ to field bus / $U_{SYS}$ to FE) | 500 $V_{rms}$ |
| Connections | 2-pole screw terminal |
| Physical interfaces | |
| Field bus | |
| Transfer rate | 125 kBit/s, 250 kBit/s, 500 kBit/s |
| Isolation voltage (field bus to $U_{SYS}$ / field bus to $U_L$ / field bus to FE) | 500 $V_{rms}$ |
| Field bus connections | Socket:<br>MSTBV 2,5/5-GF-5.08 GY AU/Phoenix Contact |
| | Plug:<br>TMSTBP 2,5/5-STF-5.08 AB GY AU/ Phoenix Contact (included in delivery) |

| Designation | Value |
|---|---|
| Field bus shielding connection | via connector |
| MAC ID setting | 2 rotary decimal encoding switches |
| Service | |
| Connections | PS/2 socket |
| Logical interfaces | |

**Data cables to XN-GW-DNET/ XN-GWBR-DNET**

### Field bus connection via Open Style connector

An Open Style connector (5-pole) is available for connecting the XN-GWBR-DNET to the DeviceNet field bus.

A passive bus termination must be applied externally if the XI/ON gateway is the last station in the bus structure. This external connection can be implemented as a separate termination resistor. The XN-GW-DNET offers the option of switching in the termination resistor via a DIP-switch.

→ "Bit transmission rate and bus termination resistor"

Table 6: Pin assignments for the DeviceNet socket

| No. - color | Designation | Meaning |
|---|---|---|
| 1,2 - red | V+ | Supply voltage (24 V DC) |
| 3,4 - white | CAN H | Non-inverted data signal (dominant high) |
| 5,6 - grey | SHIELD | Shielding braid, not isolated |
| 7,8 - blue | CAN L | Inverted data signal (dominant low) |
| 9,10 - black | V- | Ground reference |

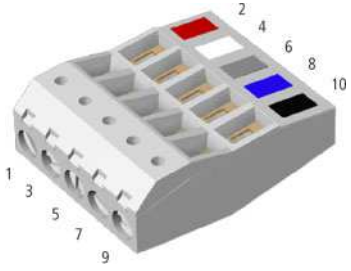



Figure 5: Open Style connector (female/top)

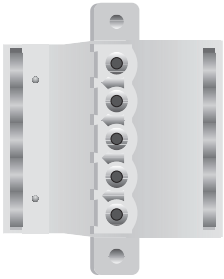


Figure 6: Open Style connector (female/bottom)

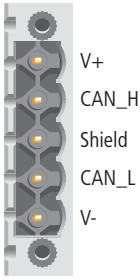



Figure 7: Open Style connector (male)

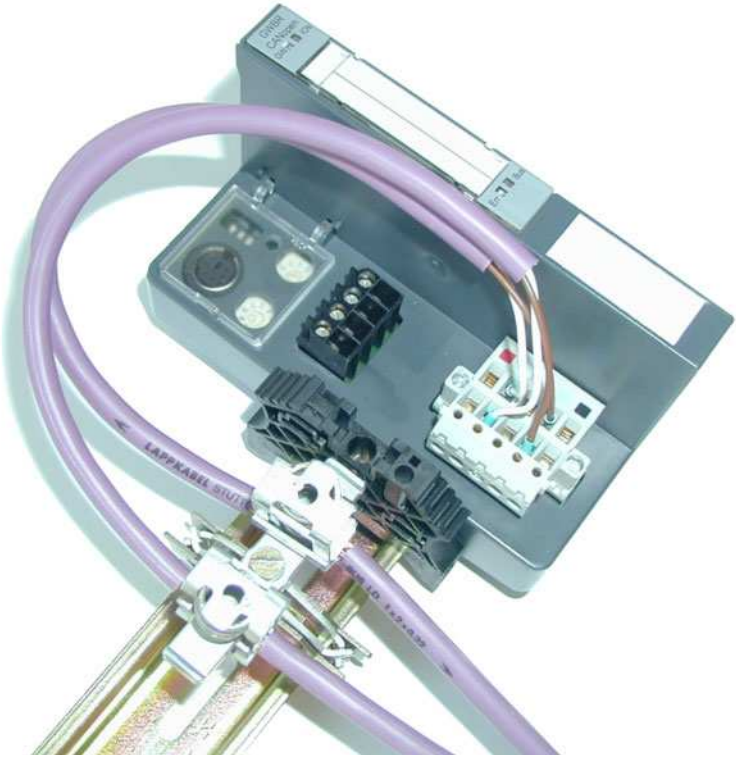


Figure 8: Shielding connection for an XN-GWBR-DNET

**Caution!**
No compensating current should flow through the shielding.
To achieve this, a reliable system of equipotential bonding must be installed.

**Service interface connection**

In order to be able to use the service interface of the gateway to connect to a PC with the tool I/O*assistant* (engineering and diagnostics software), you will have to use a cable with pin assignments that are different from the PS2 standard:

- XI/ON connecting cable (XN-PS2-CABLE)

**Caution!**
Standard commercial cables will have to be rewired!

**Connection through an XI/ON cable**
The XI/ON cable is fitted with a PS/2 plug (connection to the socket on the gateway) and a SUB-D socket (connection to the plug on the PC).

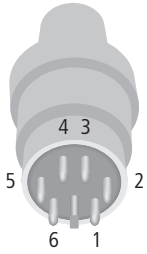



Figure 9: PS/2 plug on connecting cable to the gateway (plan view)

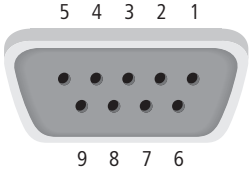



Figure 10: 9-pole SUB-D socket on connecting cable to PC (plan view)

Table 7: Pin assignments for PS/2 and SUB-D interfaces

| Pin | XI/ON gateway PS/2 socket | SUB-D interface on PC | Pin |
|---|---|---|---|
| 1 | +5V Gw | DTR, DSR | 4, 6 |
| 2 | GND | GND | 5 |
| 3 | – | – | – |
| 4 | TxD | RxD | 2 |
| 5 | /CtrlMode | RTS | 7 |
| 6 | RxD | TxD | 3 |

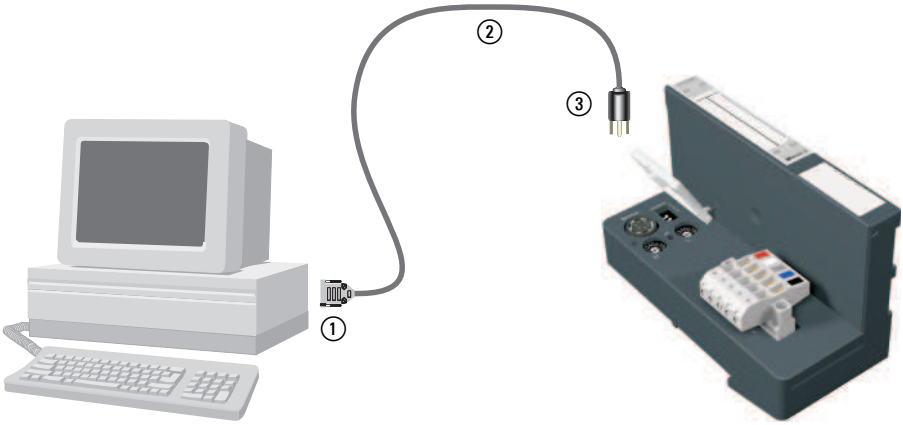



Figure 11: Connection between PC and XI/ON gateway via the XI/ON connecting cable

① SUB-D socket
② XI/ON connecting cable
③ PS/2 plug

## MAC ID setting via ADDRESS switch

The setting of the MAC ID for the DeviceNet gateway in the DeviceNet is made through 2 decimal rotary encoding switches on the gateway. These can be found underneath the cover, below the Service interface.



**Caution!**
A maximum of 64 MAC IDs can be assigned in DeviceNet (00 to 63). Each MAC ID can be assigned once only in the complete bus structure.

The rotary encoding switches are marked with H for High (more significant digit) and L für Low (less significant digit).

XN-GWBR-DNET / XN-GW-DNET:
The L switch is used to set L × $10^0$ (L = 0 to 9).
The H switch is used to set L × $10^1$ (H = 0 to 9).



To set the MAC ID, the supply voltage for the DeviceNet gateway must be switched off!



After setting the MAC ID, the protective cover above the switches must be closed again.

## Bit transmission rate and bus termination resistor




Figure 12: DIP-switch for setting the bit transmission rate and to switch in the bus termination resistor

### Bit transfer rate

The bit transmission rate is set with the help of the DIP-switches on the gateway. One of the 3 possible bit transmission rates will be supported, according to the setting:

Table 8: Setting the bit transmission rate

| Bit transfer rate (kbps) | DIP-switches (setting) | |
|---|---|---|
| | No. 1 | No. 2 |
| 125 | 0 | 0 |
| 250 | 0 | 1 |
| 500 | 1 | 0 |

| Bit transfer rate (kbps) | DIP-switches (setting) | |
|---|---|---|
| | No. 1 | No. 2 |
| reserved | 1 | 1 |

→ All other switch settings may cause error messages. Switch 3 has no function.

To set a bit transfer rate that is supported by DeviceNet, proceed as follows:

- ▶Switch off the supply voltage for the XI/ON gateway.
- ▶Set the DIP-switches according to the table above, to achieve the required transmission rate.

→ The DIP-switches are in the **1** position when they are set to the right, as viewed from the front.

- ▶Switch on the supply voltage for the gateway again.

**Switching in the bus termination resistor**
The bus termination resistor can be switched into circuit directly on the gateway, by DIP-switch number 4.

→ Switching in the termination resistor through a DIP-switch is only possible with XN-GW-DNET!

| Bus termination | DIP-switches (setting) |
|---|---|
| | No. 4 |
| not switched in | 0 |
| switched in | 1 |

**Acceptance of the XI/ON configuration**

The DeviceNet gateway has three different memory areas for storing the station configuration (Number and type of the I/O-modules following the gateway, and the module parameter settings ).

- **Actual Configuration memory**
  Saves the present arrangement of modules following the gateway, with their parameter settings.
- **Temp. Planned Configuration memory**
  Temporary storage of the station configuration, if it has been altered, e.g. by a configuration tool.
- **Planned Configuration Memory**
  Non-volatile storage of the complete station configuration. The module list in the Planned memory is taken as the reference list for exchanging process data.

### SET button

If the SET button on the gateway is pressed for about 10 seconds, the present station configuration is saved as the Actual Configuration, and taken over by both the Temp. Planned Configuration memory and the Planned Configuration memory. The GW LED flashes.




Figure 13: SET button for accepting the present station configuration

**Diagnostics indications through the LEDs**

Every XI/ON gateway has the following LED status indicators on the top cover of the housing:

2 LEDs for Modulbus communication (module bus LEDs): **GW** and **IOs**

2 LEDs for DeviceNet communication (field bus LEDs): **MNS** and **IO**

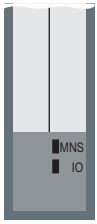
Table 9: LED indicators

| LED | Status | Meaning | Remedy |
|---|---|---|---|
| GW | OFF | Supply failure | Check the supply voltage to the bus refreshing module.<br>If the applied supply voltage is correct, please contact your Eaton partner. |
| | green | 5 V DC operating voltage is present; firmware is active; gateway is ready for operation and transfer. | – |
| | green, flashing slowly , 1 Hz and IOs LED is red | firmware is not active, software download is required. | Reload the firmware, or contact your Eaton representative. |
| | green, flashing rapidly, 4 Hz | Firmware active, gateway hardware is faulty. | Replace the gateway. |
| Additional diagnosis indication for XN-GWBR-PBDP | | | |
| GW | green, flashing, 1 Hz | $U_{SYS}$: undervoltage or overvoltage<br>$U_L$: undervoltage<br>V+: undervoltage (Open Style connector) | Check that the supply voltage is within the permissible range. → "Technical data for XN-GWBR-DNET"<br>→ "Pin assignments for the DeviceNet socket" |

| LED | Status | Meaning | Remedy |
|---|---|---|---|
| IOs | off and GW LED is off | Supply failure | Check the supply voltage to the bus refreshing module |
| | green | Module bus active; configured module list matches those on the gateway at present; communication active. | – |
| | green, flashing | Station is in the Force Mode of the I/O*assistant*. | Deactivate the Force Mode of the I/O*assistant* |
| | red and "GW" LED is OFF | Controller is not ready for operation, or the Vcc level is not within the required limits. | Test the bus refreshing module to the right of the gateway, and its wiring.<br>If the applied supply voltage is correct, please contact your Eaton partner. |
| | red | Module bus error | Check that the individual XI/ON modules are correctly installed. |
| | red, flashing slowly, 1 Hz | Non-adaptable alteration of the list of modules actually present. | Compare the engineering plans of your XI/ON station with the llist of modules actually present. Check the layout of your XI/ON station for faulty or wrongly inserted electronics modules. |
| | red, flashing rapidly, 4 Hz | no module bus communication | Check that the rules for the application of power supply modules have been observed. |
| | red/green flashing | The present list of modules does not match the list as planned. Data exchange is still functioning. | Check your XI/ON station for:<br>missing modules<br>incorrectly inserted modules<br>modules inserted at a later date |

The MNS and IO LEDs are precisely specified by the ODVA as to their function, significance, color, and frequency of flashing.

Table 10: LED indicators

| LED | Status | Meaning | Remedy |
|---|---|---|---|
| MNS   | OFF | Duplicate MAC ID check is running | – |
| | green | Connection(s) established, device status OK | – |
| | green, flashing slowly | No connection established, device status OK | – |
| | red | Network error | Check your devices for possible duplicate MAC IDs.<br>Check that the CAN controller is set to BUS OFF. |
| | red, flashing | Time-out for connection(s) | Check whether there is a break in the field bus.<br>Check whether a field bus connector has been removed.<br>Check the 24 V field bus voltage. |
| IO | green | Outputs are under control and data exchange is active. | – |
| | green, flashing slowly | At least one input/output is in the Idle state. | – |
| | red | At least one input/output indicates an error. | – |
| | red, flashing | At least one input/output is in the Fault State. | – |

# 2 Communication in DeviceNet

## General DeviceNet info

### Object model

In DeviceNet, all devices are described by an unambiguous object model. Every device is defined precisely with the help of objects.

The following diagram shows the most important objects for a device in DeviceNet.

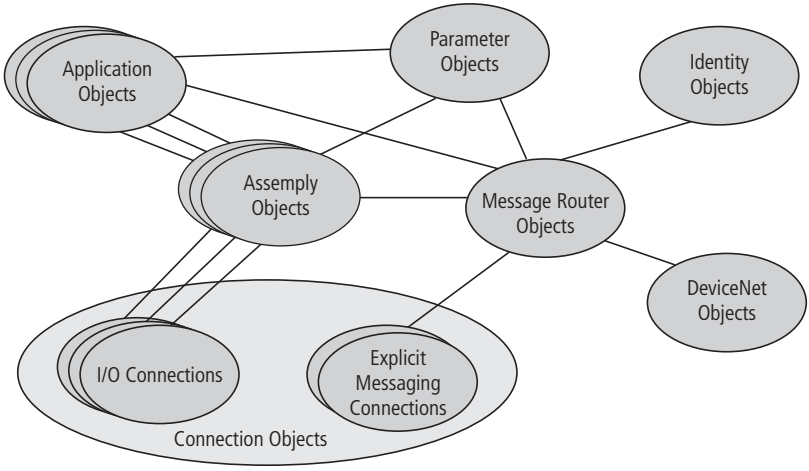



Figure 14: DeviceNet network

The objects shown in the diagram can be divided into 3 groups:

**Management Objects**
These define DeviceNet-specific data and functions, and must be supported by every device in DeviceNet:

- Identity Object
  The Identity Object (Class Code $01_{Hex}$) contains all the data for unambiguous identification of a node within the network, such as Vendor ID, Device Type and Product Code. In addition, it includes the present status of the device, its serial number, and the product name.
- Message Router Object
  The Message Router Object (Class Code $02_{Hex}$) enables access to all classes and instances in the device, via Explicit Messages.

**Connection Objects**
These define the messages that are exchanged through DeviceNet:

- DeviceNet Object
  The DeviceNet Object (Class Code $03_{Hex}$) must be supported by all devices. It defines the physical connection of a device to the DeviceNet network. This means that it includes, among other items, the MAC ID and the bit transmission rate that is set at present.
- Connection Object
  The Connection Object (Class Code $05_{Hex}$) is supported by every device in DeviceNet for at least one instance. It defines the connection to the data via I/O Messages or Explicit Messages, the path and the length of the data to be generated/used, the CAN Identifier used for the connection, time monitoring and the response in the event of a fault.

**Application-specific Objects**
These define device-specific data and functions (Application Objects, Parameter Object, Assembly Object).

- Application Objects
  Application objects describe simple applications in the field of automation technology. They are either predefined in the DeviceNet Object Library, or are defined by the users themselves.
- Parameter Object
  The Parameter Object (Class Code $0F_{Hex}$) is an interface for the configuration data and parameters of a device. For every parameter, it includes one instance that is linked to the parameter to be set.
- Assembly Objects
  An Assembly Object (Class Code $04_{Hex}$) is used to provide the user with the facility for Mapping, i. e. data from the attributes of different instances in various classes can be collected to form a single attribute for an instance of an Assembly Object.

**Standard classes for XN-GW-DNET / XN-GWBR-DNET**

The device profile for the XI/ON-DeviceNet gateway is:

Communications Adapter profile as per ODVA specification Rel. V2.0 (ODVA: Open DeviceNet Vendor Association).

The following classes are supported:

Table 11: DeviceNet, standard classes

| Class Code dec. | Class Code hex | Name | Description |
|---|---|---|---|
| 01 | $01_{hex}$ | Identity | This is used for unambiguous identification of the modules. It includes details such as manufacturer name, product name, product type, serial number (ordering number), revision number. |
| 02 | $02_{hex}$ | Message Router | This enables access to every class and every instance in the device, via Explicit Messages. |
| 03 | $03_{hex}$ | DeviceNet | This defines the physical connection of the device to the DeviceNet network. It includes, for instance, the MAC ID for the device, the bit transmission rate set at present, and describes any available switches for setting the MAC ID and bit transmission rate. |
| 04 | $04_{hex}$ | Assembly | This defines the data sent and received via I/O connections (produced/consumed data) for a device. |
| 05 | $05_{hex}$ | DeviceNet Connection | This defines, among other items, the connection to the data via I/O messages or explicit messages, as well as the path and length of the data sent and received. |
| 06 | $06_{hex}$ | Off-Link Connection Manager | This enables the later establishment of connections between DeviceNet and other networks. |
| 43 | $2B_{hex}$ | Acknowledge Handler | The Acknowledge Handler Object enables the setting up of acknowledged COS/Cyclic I/O connections. |

## Overview of the Vendor Specific Classes

In addition to the standard classes for DeviceNet mentioned above, the DeviceNet gateway also supports the following manufacturer-specific classes (VSC, Vendor Specific Classes):

Table 12: Vendor Specific Classes

| Class Code | | Name | Description |
|---|---|---|---|
| dec. | hex | | |
| 100 | 64 | Gateway Class | Includes data and settings that affect the gateway and the XI/ON system as a whole |
| 101 | 65 | Terminal Slot Class | Includes the data concerning base modules |
| 102 | 66 | Process Data Class | Includes the entire process data |
| 103 | 67 | Power Supply Module Class | Describes the supply modules |
| 104 | 68 | Digital Input Module Class | Describes the modules of type XN-#DI-… and XNE-#DI-… |
| 105 | 69 | Digital Output Module Class | Describes the modules of type XN-#DO-… and XNE-#DO-… |
| 106 | 6A | Analog Input Voltage Module Class | Describes the modules of type XN-#AI-U(-10/0…+10VDC) |
| 107 | 6B | Analog Output Voltage Module Class | Describes the modules of type XN-#AO-U(-10/0…+10VDC) |
| 108 | 6C | Analog Input Current Module Class | Describes the modules of type XN-#AI-I(0/4…20MA) |
| 109 | 6D | Analog Output Current Module Class | Describes the modules of type XN-#AO-I(0/4…20MA) |

| Class Code | | Name | Description |
|---|---|---|---|
| dec. | hex | | |
| 110 | 6E | Analog Input PT/NI Module Class | Describes the modules of type XN-#AI-PT/NI-2/3 |
| 111 | 6F | Analog Input THERMO Module Class | Describes the modules of type XN-#AI-THERMO-PI |
| 112 | 70 | Counter Module Class | Describes the modules of type XN-1CNT-24VDC |
| 113 | 71 | reserved | – |
| 114 | 72 | RS232 Module Class | Describes the modules of type XN-1RS232 |
| 115 | 73 | RS485/422 Module Class | Describes the modules of type XN-1RS485/422 |
| 116 | 74 | SSI Module Class | Describes the modules of type XN-1SSI |
| 117 | 75 | Digital Versatile Module Class | No XI/ON modules available in this class. |
| 118 | 76 | Analog Versatile Module Class | Describes the modules of the types XN-4AI-U/I XNE-8AI-U/I-4PT/NI XNE-4AO-U/I |
| 121 | 79 | SWIRE Module Class | Describes the modules of type XNE-1SWIRE |

A precise description of the classes and instances, with all attributes, can be found in the user manuals.

**Gateway Class (VSC100)**

The Gateway Class includs all the parameters that affect the XI/ON system and the gateway.

Table 13: Class Instance

| Attribute No. | | Attribute Name | Access | Type | Description |
|---|---|---|---|---|---|
| dec. | hex | | | | |
| 100 | 64h | CLASS REVISION | G | UINT | This specifies the revision nummer for the class (Maj.-Rel. *1000 + Min. Rel.). |
| 101 | 65h | MAX INSTANCE | G | USINT | Contains the number of the highest instance of an object created at 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 ATTR | G | USINT | Contains the number of the last class attribute that was implemented. |

Table 14: Object Instance1, Boot Instance

| Attribute No. dec | Attribute No. hex | Attribute Name | Access | Type | Description |
|---|---|---|---|---|---|
| 100 | 64h | MAX OBJECT ATTR | G | USINT | Contains the number of the last object attribute that was implemented. |
| 101 | 65h | HARD-WARE REVI-SION | G | STRUCT | Contains the hardware revision number for 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 is used as an identification number by the I/O*assistant* software. |
| 104 | 68h | HARD-WARE INFO | G | STRUCT | Contains the gateway hardware information:<br>UINT COUNT (number of following entries)<br>UINT CLOCK_FREQUENCY (in kHz),<br>UINT MAIN_FLASH (in KB),<br>UINT MAIN_FLASH_SPEED (in ns),<br>UINT SECOND_FLASH (in KB),<br>UINT SECOND_FLASH_SPEED (in ns),<br>UINT RAM (in KB),<br>UINT RAM_SPEED (in ns),<br>UINT RAM_DATA_WIDTH (in bit),<br>UINT SERIAL_EEPROM (in KBit),<br>UINT RTC_SUPPORT (in #),<br>UINT AUTO_SERVICE_-<br>BSL_SUPPORT (BOOL)<br>UINT HDW_SYSTEM |

Table 15: Object Instance 2, Gateway Instance

| Attribute No. dec | Attribute No. hex | Attribute Name | Access | Type | Description |
|---|---|---|---|---|---|
| 100 | 64h | MAX OBJECT ATTR | G | USINT | Contains the number of the last attribute that was implemented. |
| 101 | 65h | HARD-WARE REVI-SION | G | STRUCT | Contains the hardware revision number for the gateway (USINT Maj./USINT Min.). |
| 102 | 66h | FIRMWARE REVISION | G | UINT | Contains the revision number of the boot firmware for DeviceNet (Maj.-Rel. * 1000 + Min.-Rel.). |
| 103 | 67h | SERVICE TOOL IDENT NUMBER | G | UDINT | Contains the BOOT ID number that is used as an identification number by the I/O*assistant* soft-ware. |
| 104 | 68h | HARD-WARE INFO | G | STRUCT | Contains the gateway hardware information:<br>UINT COUNT (number of following entries)<br>UINT CLOCK_FREQUENCY (in kHz),<br>UINT MAIN_FLASH (in KB),<br>UINT MAIN_FLASH_SPEED (in ns),<br>UINT SECOND_FLASH (in KB),<br>UINT SECOND_FLASH_SPEED (in ns),<br>UINT RAM (in KB),<br>UINT RAM_SPEED (in ns),<br>UINT RAM_DATA_WIDTH (in bit),<br>UINT SERIAL_EEPROM (in kbit),<br>UINT RTC_SUPPORT (in #),<br>UINT AUTO_SERVICE_-<br>BSL_SUPPORT (BOOL)<br>UINT HDW_SYSTEM |

| Attribute No. | | Attribute Name | Access | Type | Description |
|---|---|---|---|---|---|
| dec | hex | | | | |
| 105 | 69h | GATEWAY ORDER NUMBER | G | UDINT | Contains the order number for the gateway. |
| 106 | 6Ah | COMPILER BUILD | G | SHORT_STRING | Contains the firmware creation date, e.g. "Mar 26 2001/11:22:01". |
| 107 | 6Bh | SYSTEM TIME | G | TIME | Shows the time (in ms) since the gateway was powered up . |
| 108 | 6Ch | STATUS ARRAY REGISTER | G | ARRAY | Contains all the status information for the gateway.<br>This status display indicates the status that is incorporated in the I/O data field which is created when an I/O Connection is set up. The status register for transmitted I/O data only saves the most significant status.<br>The STATUS ARRAY REGISTER enables the reading out of all the current status values.<br>ARRAY OF: USINT STAT (status information) |
| 109 | 6Dh | STATUS REGISTER2 | G | STRUCT | Status register for the gateway. This status display is linked to the CONTROL REGISTER2 and enables the reading out of the momentary status data.<br>STRUCT OF:<br>USINT STATUS REGISTER (status code)<br>BYTE STATUS FLAGS (defines bit-related status information) |

| Attribute No. | | Attribute Name | Access | Type | Description |
|---|---|---|---|---|---|
| dec | hex | | | | |
| 110 | 6Eh | CONTROL REGISTER2 | G/S | STRUCT | Control register for the gateway, enables the execution of commands.<br>STRUCT OF:<br>USINT COMMAND REGISTER (command code)<br>BYTE COMMAND FLAGS (defines bit-related commands) |
| 111 | 6Fh | GATEWAY CFG STATE | G | ENUM USINT | Configuration status register for the gateway.<br>ENUM USINT:<br>CFG_OK(0):<br>The non-volatile saved station configuration matches the temporary and the momentary configurations.<br>CFG_MISMATCH(1):<br>The non-volatile saved station configuration does not match the temporary configuration.<br>MODULE_SET_MODIFIED(2):<br>The momentary station configuration does not match the temporary configuration. |

| Attribute No. | | Attribute Name | Access | Type | Description |
|---|---|---|---|---|---|
| dec | hex | | | | |
| 112 | 70h | GATEWAY SET CFG COMMAND | G/S | ENUM USINT | Configuration command register for the gateway.<br>ENUM USINT:<br>IDLE(0): no action<br>SET_CFG_REQUEST(1):<br>The temporary saved station configuration is loaded into the non-volatile memory. This saves the power-up configuration.<br>LOAD_CURRENT_CFG(2):<br>The momentary station configuration is loaded into the temporary as well as into the non-volatile memory of the gateway. The nonvolatile memory saves the power-up configuration.<br>RESTORE_OLD_CFG(3):<br>The planned station configuration is loaded into the temporary memory. This means that data stored in the termporary memory will be lost and alterations will be overwritten. |

| Attribute No. | | Attribute Name | Access | Type | Description |
|---|---|---|---|---|---|
| dec | hex | | | | |
| 113 | 71h | ON MODULE SET MODIFIED WARNING | G/S | ENUM USINT | Response to an altered module list, caused by a module being removed or a slot being occupied that was planned as empty.<br>SWITCH_IO_FAULTED(0):<br>The modules will be switched into the Fault State.<br>SWITCH_IO_OFF(1):<br>The gateway switches the outputs of the modules off.<br>SWITCH_IO_HOLD(2):<br>The gateway makes no further changes to the data of the I/O modules. The outputs are frozen.<br>SWITCH_IO_PROCSSING(3):<br>The gateway continues to exchange I/O process data. |
| 114 | 72h | ON MODULE SET MODIFIED ERROR | G/S | ENUM USINT | Response to an alteration of the module list caused by insertion of an incorrect module, i.e. a module with an order number that does not match the number of the module that was removed.<br>SWITCH_IO_FAULTED(0):<br>The modules will be switched into the Fault State.<br>SWITCH_IO_OFF(1):<br>The gateway switches the outputs of the modules off.<br>SWITCH_IO_HOLD(2):<br>The gateway makes no further changes to the data of the I/O modules. The outputs are frozen. |

| Attribute No. | | Attribute Name | Access | Type | Description |
|---|---|---|---|---|---|
| dec | hex | | | | |
| 115 | 73h | ON IO CONNEC-TION TIMEOUT | G/S | ENUM USINT | Response to a time-out of the I/O connection.<br>SWITCH_IO_FAULT(0):<br>The modules will be switched into the Fault State.<br>SWITCH_IO_OFF(1):<br>The gateway switches the outputs of the modules off.<br>SWITCH_IO_HOLD(2):<br>The gateway makes no further changes to the data of the I/O modules. The outputs are frozen. |
| 116 | 74h | MODULE DIAG SUMMARY | G | ARRAY OF STRUCT | Contains the diagnostics information for all modules.<br>ARRAY OF STRUCT:<br>USINT SLOT #:<br>Shows the slot numbers with diagnostics messages.<br>BYTE SLOT FLAGS:<br>Provides slot-related information.<br>Bit7 = 1 module missing<br>Bit6 = 1 wrong module inserted<br>DWORD DIAG:<br>Contains the module diagnostics information. Unused module diagnotics bits are shown as 0. |
| Additional attribute for the XN-GWBR-DNET | | | | | |
| 119 | 77h | SUPPLY VOLTAGE SYSTEM | G | UINT | Shows the system supply voltage Usys in mV.<br>→ "Technical data for XN-GWBR-DNET" |

| Attribute No. dec | Attribute No. hex | Attribute Name | Access | Type | Description |
|---|---|---|---|---|---|
| 121 | 79h | SUPPLY VOLTAGE FIELD | G | UINT | Message for field supply voltage $U_L$ :<br>0: $U_L$ supply is missing/inadequate<br>1: $U_L$ supply is adequate (> 18 V DC)<br>→ "Technical data for XN-GWBR-DNET" |
| 122 | 7Ah | SUPPLY VOLTAGE FIELDBUS | G | UINT | Message for supply voltage V+ for the DeviceNet field bus:<br>0: V+ is missing/inadequate<br>1: V+ is adequate (> 11 V DC)<br>→ "Pin assignments for the DeviceNet socket" |

**Terminal Slot Class (VSC 101)**

This class includes parameters and data for the base modules.

Table 16: Class Instance

| Attribute No. dec | Attribute No. hex | Attribute Name | Access | Type | Description |
|---|---|---|---|---|---|
| 100 | 64h | CLASS REVISION | G | UINT | Contains the revision number for this class (Maj.-Rel. * 1000 + Min.-Rel.). |
| 101 | 65h | MAX INSTANCE | G | USINT | Contains the number of the highest instance of an object created at 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 ATTR | G | USINT | Contains the number of the last class attribute that was implemented. |

Table 17: Object Instances

| Attribute No. dec | Attribute No. hex | Attribute Name | Access | Type | Description |
|---|---|---|---|---|---|
| 100 | 64h | MAX OBJECT ATTR | G | USINT | Contains the number of the last object attribute that was implemented. |
| 101 | 65h | MODULE PRESENT | G | BOOL | FALSE: XI/ON module missing, vacant base module<br>TRUE: XI/ON module is inserted. |

| Attribute No. | | Attribute Name | Access | Type | Description |
|---|---|---|---|---|---|
| dec | hex | | | | |
| 102 | 66h | SLOT STATE | G | ENUM USINT | NOT_USED(0):<br>An unoccupied slot is not participating in process data traffic. It is not being accessed, neither for transmission nor for reception of data via I/O Connection Messages.<br>PROCESSING(1):<br>The slot contains an XI/ON module that is known to the field bus. Data transfer with other field bus devices is taking place via I/O Connection Messages.<br>ALLOCATED(2):<br>The slot is unoccupied, but reserved for a specific electronics module. The process data are set to 0.<br>WRONG_MODULE (3):<br>The slot is occupied by an incorrect module, e.g. it does not support the previously specified process data length, or is a different type of module. This incorrect module is not made known to the field bus and does not participate in process data traffic. The process data for this slot will be 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 | Indicates the number of diagnostics bits for the module. |
| 105 | 69h | MODULE PARAM BIT COUNT | G | UINT | Indicates the number of parameter bits for the module. |

| Attribute No. | | Attribute Name | Access | Type | Description |
|---|---|---|---|---|---|
| dec | hex | | | | |
| 106 | 6Ah | MODULE INPUT BIT COUNT | G | UINT | Indicates the number of input bits for the module (number of Produced Bits). |
| 107 | 6Bh | MODULE OUTPUT BIT COUNT | G | UINT | Indicates the number of input bits for the module (number of Consumed Bits). |
| 108 | 6Ch | MODULE SUBMODE | G | USINT | Contains the Submode ID of the XI/ON module. |
| 109 | 6Dh | MODULE GROUP COUNT | G | USINT | Indicates the number of internal groups for the module. |
| 110 | 6Eh | DIAG | G | ARRAY OF BYTE | Contains the diagnostics information for the module. |
| 111 | 6Fh | PARAM | G/S | ARRAY OF BYTE | Contains the module parameters. |
| 112 | 70h | INPUT | G | ARRAY OF BYTE | Contains the input data for the module (Produced Data). |
| 113 | 71h | OUTPUT | G/S | ARRAY OF BYTE | Contains the output data for the module (Consumed Data). |
| 114 | 72h | REFER-ENCED VSC | G | USINT | The VSC that represents this XI/ON module. If the module is included in the internal gateway library, then it is listed in a specific VSC that describes the typical attributes of the module. |
| 115 | 73h | REFER-ENCED VSC INSTANCE | G | USINT | The VSC instance that represents this XI/ON module. If this module is included in the internal gateway library, then it is listed in a specific VSC that describes the typical attributes of the module. |

| Attribute No. | | Attribute Name | Access | Type | Description |
|---|---|---|---|---|---|
| dec | hex | | | | |
| 116 | 74h | MODULE REGIS-TERED INDEX | G/S | ENUM USINT | Contains the index numbers found in all module lists. |

**Process Data Class (VSC102)**

This class contains the process-relevant information.

Table 18: Class Instance

| Attribute No. | | Attribute Name | Access | Type | Description |
|---|---|---|---|---|---|
| dec | hex | | | | |
| 100 | 64h | CLASS REVISION | G | UINT | Contains the revision number for this class (Maj.-Rel. * 1000 + Min.-Rel.). |
| 101 | 65h | MAX INSTANCE | G | USINT | Contains the number of the highest instance of an object created at this level in the class hierarchy. |
| 102 | 66h | # OF INSTANCES | G | USINT | Contains the number of object instances created at this class level. |
| 103 | 67h | MAX CLASS ATTR | G | USINT | Contains the number of the last class attribute that was implemented. |

Table 19: Object Instance 1, Standard Input Process Data (packed)

| Attribute No. | | Attribute Name | Access | Type | Description |
|---|---|---|---|---|---|
| dec | hex | | | | |
| 100 | 64h | MAX OBJECT ATTR | G | USINT | Contains the number of the last object attribute that was implemented. |
| 101 | 65h | ATTRIBUTE LIST | G | ARRAY OF USINT | A 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, packed. |
| 103 | 67h | PROCESS DATA BYTE COUNT | G | USINT | The number of bytes that are exchanged with this instance. |

Table 20: Object Instance 2, Standard Output Process Data (packed)

| Attribute No. | | Attribute Name | Access | Type | Description |
|---|---|---|---|---|---|
| dec | hex | | | | |
| 100 | 64h | MAX OBJECT ATTR | G | USINT | Contains the number of the last object attribute that was implemented. |
| 101 | 65h | ATTRIBUTE LIST | G | ARRAY OF USINT | A 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, packed |
| 103 | 67h | PROCESS DATA BYTE COUNT | G | USINT | The number of bytes that are exchanged with this instance. |

**Power Supply Module Class (VSC103)**

This class contains all the information and parameters which are relevant for the supply module.

Table 21: Class Instance

| Attribute No. dec | Attribute No. hex | Attribute Name | Access | Type | Description |
|---|---|---|---|---|---|
| 100 | 64h | CLASS REVISION | G | UINT | Contains the revision number for this class (Maj.-Rel. * 1000 + Min.-Rel.). |
| 101 | 65h | MAX INSTANCE | G | USINT | Contains the number of the highest instance of an object created at this level in the class hierarchy. |
| 102 | 66h | # OF INSTANCES | G | USINT | Contains the number of object instances created at this class level. |
| 103 | 67h | MAX CLASS ATTR | G | USINT | Contains the number of the last class attribute that was implemented. |

Table 22: Object Instances

| Attribute No. dec | Attribute No. hex | Attribute Name | Access | Type | Description |
|---|---|---|---|---|---|
| 100 | 64h | MAX OBJECT ATTR | G | USINT | Contains the number of the last object attribute that was implemented. |
| 101 | 65h | MODULE PRESENT | G | BOOL | FALSE: XI/ON modul is not inserted, vacant base module<br>TRUE: XI/ON module is inserted |

| Attribute No. | | Attribute Name | Access | Type | Description |
|---|---|---|---|---|---|
| dec | hex | | | | |
| 102 | 66h | TERMINAL SLOT NUMBER | G | USINT | The slot number of the base module belonging to the module concerned (base module next to the gateway, on the right, = No. 1). Corresponds to the particular 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 for the module, e.g. 225000. |
| 105 | 69h | MODULE ORDER NAME | G | SHORT_ STRING | Contains the module name, e.g. XN-PF-120/230VAC-D. |
| 106 | 6Ah | MODULE REVISION | G | USINT | Contains the revision number of the module. |
| 107 | 6Bh | MODULE TYPE ID | G | ENUM USINT | Describes the module type (digital, analog, counter ...). |
| 108 | 6Ch | MODULE COMMAND INTERFACE | G/S | ARRAY | The control interface for the XI/ON module.<br>ARRAY OF:<br>BYTE: control byte sequence |
| 109 | 6Dh | MODULE RESPONSE INTERFACE | G | ARRAY | Message interface for the XI/ON module.<br>ARRAY OF:<br>BYTE: message byte sequence |
| 110 | 6Eh | DIAG SIZE | G | UINT | Indicates the number of diagnostics bits for the module. |
| 111 | 6Fh | DIAG | G | WORD | Contains the diagnostics information for the module.<br>WORD: bit-wise assignment, depending on the module specification. |

| Attribute No. | | Attribute Name | Access | Type | Description |
|---|---|---|---|---|---|
| dec | hex | | | | |
| 112 | 70h | MODULE REGIS-TERED INDEX | G | ENUM USINT | Contains the index numbers found in all module lists. |

**Configuration of the XI/ON station with configuration tool**

During the configuration of a XI/ON station with the help of a configuration tool, the station configuration is temporarily saved in the Temp. Planned memory. In order to accept this configuration in the Planned memory as the reference configuration for process data traffic, the command SET_CFG _REQUEST (VSC100, Object Instance 2, Attribute No. 112) must be executed.



If the station configuration in the temporary memory does not match the Actual Station Configuration, then this will be indicated by flashing of the IOs LED (→ "Diagnostics indications through the LEDs").

The command LOAD_CURRENT_CFG (VSC100, Object Instance 2, Attribute No. 112) loads the present station configuration from the Actual Configuration memory into the Temp.Planned memory and the Planned Configuration memory.

The command RESTORE_OLD_GFG (VSC100, Object Instance 2, Attribute No. 112) loads the Planned Configuration into the temporary memory.



All the configuration changes that have been made through the configuration software and temporarily saved will be overwritten by the comands LOAD_CURRENT_CFG and RESTORE_OLD_GFG.

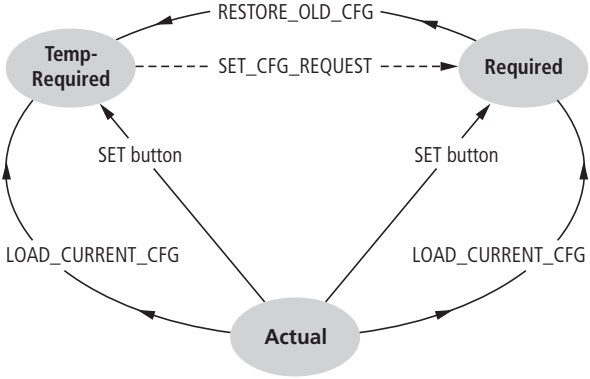



Figure 15: Acceptance of the station configuration

**The DeviceNet communication profile**

DeviceNet is based on a connection-oriented communication model. This means that data can only be exchange through specific connections which are assigned to the devices.

Communication between the nodes in the DeviceNet network can be made through either I/O Messages or Explicit Messages.

**I/O Messages**
I/O Messages are used for the exchange of high-priority process and applications data across the network. Communication between particpants on DeviceNet is carried out on the Client/Server model, i.e a producer application transmits data to one or more consumer applications, whereby it may well happen that several application objects are accessed in a single device.

Communication between devices via I/O Messages requires setting up an I/O Messaging Connection Object. This can be achieved either by activating a static I/O Connection Object that is already available in the device through the Predefined Master/Slave Connection Set, or via a dynamically established I/O Connection Object. The latter can be set up by an Explicit Messaging Connection Object that is already available in the device.

**Explicit Messages**
Explicit Messages are used to transmit configuration files with a low priority and general management data or diagnostics data between two specific devices. They are always implemented as a point-to-point connection in a client/server system, whereby a Request from a client must always be followed by a Response from the server.

As for I/O Messages, communication between devices by means of Explicit Messages first requires setting up a connection object, the

Explicit Messaging Connection Object. This can be achieved either by activating a static Connection Object that is already available in the device through the Predefined Master/Slave Connection Set, or dynamically, via the UCMM port (Unconnected Message Manager port) of a device.

#### Predefined Master/Slave Connection Set

The Group 2 Only Unconnected Explicit Message Port of the Predefined Master/Slave Connection Set makes an interface available with which up to 4 predefined connections can be assigned. The basis for this model is the master/slave principle.

The predefined connection objects occupy Instances 1 to 4 in the Connection Object (Class ID 5):

**Explicit Messages**

- Group 2 Explicit Request/Response Message (Class ID 5, Instance ID 1)
- I/O Messaging Connection
- Polled I/O Connection (Class ID 5, Instance ID 2)
- Bit Strobe I/O Connection (Class ID 5, Instance ID 3)
- Change of State (COS)/ Cyclic I/O Connection (Class ID 5, Instance ID 4)

### Communication profile for the XI/ON DeviceNet gateway

The DeviceNet gateway behaves as a DeviceNet server in the network, and the scanner of the supervisory control system functions as a DeviceNet client.

The following types of DeviceNet communication are supported:

- Polled I/O Connection
- COS Connection
- Cyclic I/O Connection
- Bit-Strobe I/O Connection
- UCMM
- Offline Connection Set
- Device Heartbeat Message
- Device Shut Down Message

**Polled I/O Connection**
A Polled I/O Connection is used to establish a classic Master/Slave link between a control system and a DeviceNet device. A Polled I/O Connection is a point-to-point connection between two field bus nodes. The master (client) sends a query in the form of a Poll-Request to the slave (server), which replies with a Poll-Response.

**COS I/O Connection**
When using COS (Change Of State) I/O Connections, event-controlled connections are established. This means that the devices on the DeviceNet generate messages autonomously, as soon as a change of state occurs.

**Cyclic I/O Connection**
For a Cyclic I/O Connection, messages are triggered at sepcified times by a timer.

**Bit-Strobe I/O Connection**
The Bit-Strobe I/O Connection is a connection between a DeviceNet client and an undefined number of servers, whereby these are polled by a command sent out by the client. The length of this command is limited to 8 bytes, whereby each possible MAC ID in the system is assigned to one bit within these 8 data bytes. The server also responds to the query with 8 bytes.

**UCMM**
The DeviceNet gateway provides the option of setting up dynamic connection objects via the UCMM port (Unconnected Message Manager port).

**Offline Connection Set**
The Offline Connection Set enables communication with a node that is in the Comunication Fault state as a result of a duplicate MAC ID, but not in the Bus-Off state. The node is usally no longer accessible via the network, and must be switched off by hand, or re-initialized by switching off and on again. With the help of the Offline Connection Set it is possible to access such a node across the network.

**Device Heartbeat Message**
Device Heartbeat Message can be used by a device in DeviceNet to announce its own status at configured time intervals. These messages are configured in the Identity Object.

**Device Shut Down Message**
If a device has to switch itself off, because of an internal error or status, then it can use the Device Shut Down Message for a defined log-off from the control system.

**Consistency Value**
With the help of Consistency Values, a successful write to the non-volatile Planned Configuration memory can be checked.

## Response to a module change

The replacement of an XI/ON module for maintenance can be made online or offline.

If the "old" and the "new" module are of the same type, measured by the identical order numbers, then the module bus communication will continue without any problems. All the parameter settings that were previously made for the removed module and saved in the non-volatile memory of the gateway can thus be transferred from the gateway to the new module.

Any deviation of the new station configuration from the old configuration will be indicated by flashing of the IOs LED (→ "Diagnostics indications through the LEDs").

→ If the present and the altered station configurations do not match, i.e. the new module is different form the old module, then the IOs LED flashs red. The new module will not participate in the exchange of process data, its process data will be set to **0**.

### Exchanging a gateway

If the gateway is exchanged, care must be taken that parameter settings from the gateway to be replaced which deviate from the gateway default parametrization are not transferred.

The stations can be started up again without using configuration tools. After exchanging a gateway, operating the SET button saves the station configuration in the new gateway.

The module parameters are stored in non-volatile memory, and can be read out by the gateway, so the no new parameterization is required.

**Electronic Data Sheet – EDS file**

The XI/ON cateway can be embedded in the DeviceNet structure with the help of a standardized EDS file (Electronic Data Sheet).

The EDS file contains the classes and instances for the XI/ON modules, together with the corresponding attributes.

XI/ON ofers 2 different types of EDS file:

- **XN225164V?.eds (XN-GW-DNET) XN270326V?.eds(XN-GWBR-DNET)**
- **XN225164V?_SP.eds(XN-GW-DNET) XN270326V?_SP.eds(XN-GWBR-DNET)**

which can be used according to the application. The EDS files **XN225164V?_SP.eds (XN270326V?_SP.eds)** enable the editing of the selected instance of a module.

→ Please note that the EDS file version must correspond to the firmware version of your gateway!

You can find the latest EDS files on our home page (www.eaton-automation.com), under „DOWNLOADS“.

The following table shows the limits to be observed when using the individual EDS files.

Table 23: EDS files

| | **XN225164V?.eds[1)]**<br>**XN270326V?.eds[1)]** | **XN225164V?_SP.eds[1)]**<br>**XN270326V?_SP.eds[1)]** |
|---|---|---|
| Engineering | online / offline | online / - |
| ADR | 3 | – |
| Supported instances | ≦ 74 (incl. supply modules) | ≦ 74 (incl. supply modules) |
| Gateway parameterization | 3 | 3 |
| Monitoring | Diagnostics/parameters | Diagnostics/parameters/input/output |
| Maximum number of configurable modules per type (the number of supported instances must not be exceeded; the appropriate number of supply modules must also be planned) | 16 XN-xAI-I(0/4..20MA)<br>16 XN-xAI-U(-10/0..+10V)<br>16 XN-xAI-PT/NI<br>16 XN-xAI-THERMO-PI<br>16 XN-xAO-I(0/4..20MA)<br>16 XN-xAO-U(-10/0..+10V)<br>8 XN-1CNT-24VDC<br>32 XN-xDI-x<br>32 XN-xDO-x<br>16 XS1-xS0-34x-xKx<br>8 XN-1RS232<br>8 XN-1RS485/422<br>8 XN-1SSI | 71 XN-xAI-I(0/4..20MA)<br>71 XN-xAI-U(-10/0..+10V)<br>71 XN-xAI-PT/NI<br>71 XN-xAI-THERMO-PI<br>71 XN-xAO-I(0/4..20MA)<br>71 XN-xAO-U(-10/0..+10V)<br>31 XN-1CNT-24VDC<br>72 XN-xDI-x<br>72 XN-xDO-x<br>16 XS1-xS0-34x-xKx<br>31 XN-1RS232<br>31 XN-1RS485/422<br>31 XN-1SSI |
| Advantage | Simplification for simultaneous gateway and mdule replacement | Quicker operation for the user;<br>the max. numer of modules is determined by the XI/ON system limits |

1) If you are looking for the appropriate EDS file for your gateway and its firmware:
XN-GW-DNET:XN225164V?.eds
XN-GWBR-DNET:XN270326V?.eds
XN-GW-DNET:XN225164V?_SP.eds)
XN-GWBR-DNET:XN270326V?_SP.eds
The ? stands for the version number, which must match the firmware in the gateway.

**Mapping process data**

The process image for the XI/ON gateway is represented in WORD format (16-bit). The process data for sequential modules of the same type, which each occupy less than 1 word of process data, will be put together until 16 bits have been reached. The process data will be written into a new word, if:

- the 16-bit input data have been reached, and additional input modules follow,
- the 16-bit output data have been reached, and additional output modules follow,
- an input module, with a process data length that does not fit completely into the previous word, follows another input module,
- an output module, with a process data length that does not fit completely into the previous word, follows another output module

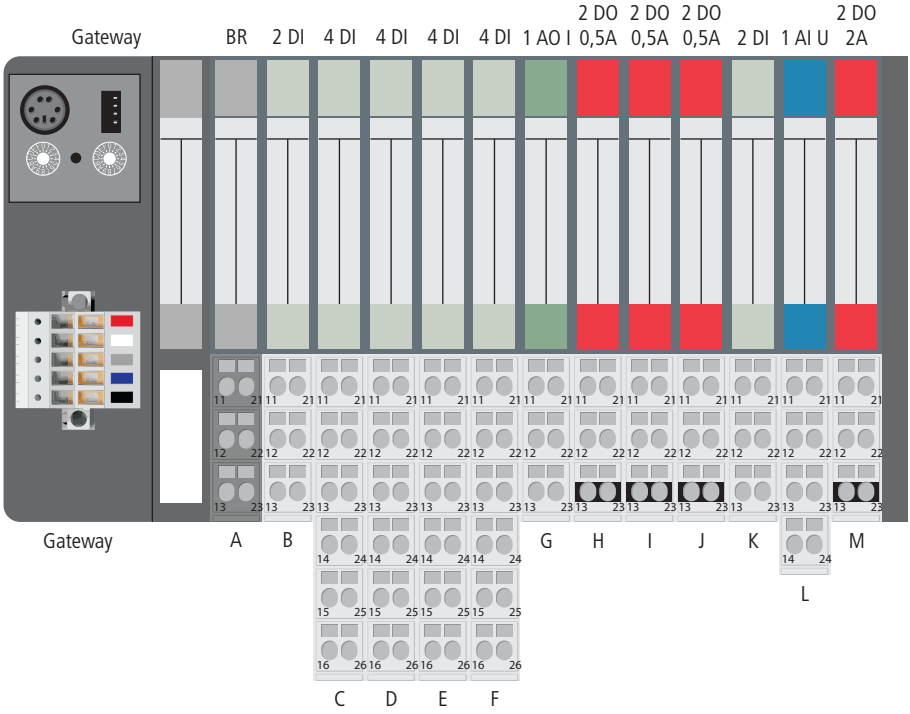



Figure 16: Station example

Table 24: Process image for the station example

| Produced Data (Word no.) | Input Data (WORD format) (bit 15 to bit 0) | Consumed Data (Word no.) | Output Data (WORD format) (bit 15 to bit 0) |
|---|---|---|---|
| 0 | Status Word for the gateway | 0 | Control Word for the gateway |
| 1 | E3, ..., E0; D3, ..., D0; C3, ..., C0; B1, B0 | 1 | G15, G14, ... G1, G0 |
| 2 | K1, K0, F3, ..., F0 | 2 | M1, M0, J1, J0; I1, I0; H1, H0 |
| 3 | L15, L14, ...L1, L0 | 3 | – |

The station in this example thus transmits 4 words of input data and 3 words of output data.

**Status Word for the gateway**

The Status Word for the gateway is assembled as follows:

Table 25: Meaning of the status bits

| Status bit No. | Designation | Meaning |
|---|---|---|
| 0 to 7 | MESSAGE REGISTER | The Message Register of the Status Word is viewed as an 8-bit group (00h to FFh). The listing of the Messages and Error Codes can be found in the tables below. |
| 8 | OUTPUTS NOT PROCESSING | The XI/ON outputs are no longer being controlled by the process data for an I/O connection. |
| 9 | MODULE LIST WARNING | The module list presently available on the gateway has been altered, i.e. a module has been added or removed, or a preconfigured empty slot has been occupied by a module. |
| 10 | LOCAL FORCE MODE | The Force Mode of the I/O***assistant*** is active, i.e the outputs are being controlled by the I/O***assistant***. |
| 11 | MODULE DIAG | There is a diagnostics message present from at least one module. Attribute 116 "MODULE DIAG SUMMARY" of Gateway Class 100, Gateway Instance 2, indicates which module is sending the diagnostics message and what type of diagnostics message it is. |
| 12 | NO FIELDBUS PWR[1)] | Voltage error in $U_L$ or $U_{SYS}$<br>→ "Technical data for XN-GWBR-DNET"<br>The field bus supply voltage V+ on the field bus connector (Open Style connector) is not present or the voltage is outside the permissible tolerance range. In this case, status Bit 12 can only be read out via the Service interface! |

| Status bit No. | Designation | Meaning |
|---|---|---|
| 13 | MODULE LIST ERROR | The module list presently available on the gateway has been altered, i,e, at least one module has been replaced by a module with a different order number. |
| 14 | MODULE BUS FAULT | Hardware error. Module bus communication has been interrupted. |
| 15 | CMD CONFIRMATION | This bit mirrors the ACTIVATE COMMAND bit in the Control Word.<br>Setting this bit confirms the execution of a command from the command register (Control Word). |

1) This bit can only be read out by the I/O***assistant*** via the Service interface on the gateway.

Table 26: Status Word Message Codes

| Message Codes | Designation | Description |
|---|---|---|
| 00h | MSG OK | No error |
| 01h to 0Fh | reserved | – |
| 10h | ADD EXPL ESTAB-LISHED | There is at least one Explicit Message between the gateway and another node. |
| 11h to 1Fh | reserved | |
| 20h | MODULE ID UNKNOWN | At least one module in the XI/ON station is not known, i.e. it is not represented by one of the existing vendor-specific classes, and is not listed in the EDS file. The module will nevertheless participate in the exchange of process data. |

Table 27: Status Word Error Codes

| Error Codes | Designation | Description |
|---|---|---|
| 80h to CF | reserved | – |
| D0h | DUP MAC ID ERROR[1)] | An error appeared during the duplicate MAC ID Check, since there is already a module with the same MAC ID in the network. |
| D1h | MAC ID ERROR | The MAC ID is set higher than 63. |
| D2h | BAUDRATE NOT PERMITTED | The bit transmission rate set on the DIP-switches is not permissible. |
| D3h to DFh | reserved | – |
| E0h | EEPROM ERROR[1)] | Internal error. The gateway must be exchanged. |
| E1h | ROTARY WHEEL DIP SWITCH ERROR[1)] | Internal error. The gateway must be exchanged. |
| E2h | ROM/FLASH CRC ERROR[1)] | Internal error. The gateway must be exchanged. |
| E3h to EF | reserved | – |
| F0h | CFG MODIFICATION IN PROGRESS | The station configuration on the gateway is being altered at the moment. |
| F1h to FE | reserved | – |
| FFh | CMD PROCESSING ERROR | An error appeared during the execution of a command. The command will no be executed. |

1) This status can only be read out by the I/O*assistant* via the Service interface on the gateway.

**Control Word for the gateway**

The Control Word for the gateway is assembled as follows:

Table 28: Meaning of the control bits

| Control bit no. | Designation | Meaning |
|---|---|---|
| 0 to 7 | COMMAND REGISTER | The Command Register of the Status Word is viewed as an 8-bit group (00h to FFh). The list of Command Codes can be found in the table below. |
| 9 to 14 | reserved | – |
| 15 | ACTIVATE COMMAND | Setting this bit (0 → 1) initiates the execution of a command from the Command Register (control bits 0 to 7). |

Table 29: Control Word Command Codes

| Command Codes | Designation | Description |
|---|---|---|
| 00h | ABORT CMD | Cancel a current commmand, without generating another command. |
| 01h to 7Fh | reserved | – |
| 80h | FORCE OUTPUTS OFF | The generation of output data (Consumed Data) is stopped. The outputs are no longer accessed through I/O Connections, but switched off. This command can be terminated through the FORCE OUTPUTS PROCESSING command or a reset. |
| 81h | FORCE OUTPUTS FAULT VALUES | The generation of output data (Consumed Data) is stopped. The outputs are no longer accessed through I/O Connections, but switched to substitute values. This command can be terminated through the FORCE OUTPUTS PROCESSING command or a reset. |

| Command Codes | Designation | Description |
|---|---|---|
| 82h | FORCE OUTPUTS HOLD | The generation of output data (Consumed Data) is stopped. The outputs are no longer accessed through I/O Connections, the output values are held (frozen). This command can be terminated through the FORCE OUTPUTS PROCESSING command or a reset. |
| 83h | FORCE OUTPUTS PROCESSING | The process data exchange continues once more. The outputs communicate again through I/O Connections. |
| 84h bis EFh | reserved | – |
| F0h | MODULE BUS SHUTDOWN | Data transfer across the module bus is stopped. The response of the individual XI/ON modules depends on their particular parameterization. |
| F1h | RESTART MODULE BUS | Data transfer across the module bus is started. The module list present on the gateway is read in. Data exchange between the gateway and the modules takes place again. |
| F2h to FFh | reserved | – |

## Maximum topology

A bus line must have at least two nodes. The connection of an XI/ON station to the DeviceNet network can only be made through the XI/ON gateway.

Incoming and outgoing cables are connected through an Open Style connector as per ODVA specification.

Each XI/ON gateway behaves as an active node, and thus has a MAC ID (→ "MAC ID setting via ADDRESS switch") assigned.

### Maximum system configuration

A DeviceNet bus line can have a maximum of 64 nodes. This maximum number must not be exceeded.

On the gateway, the MAC IDs 01 to 63 can be set through the two decimal rotary encoding switches. It is not possible to assign MAC IDs directly across the bus.

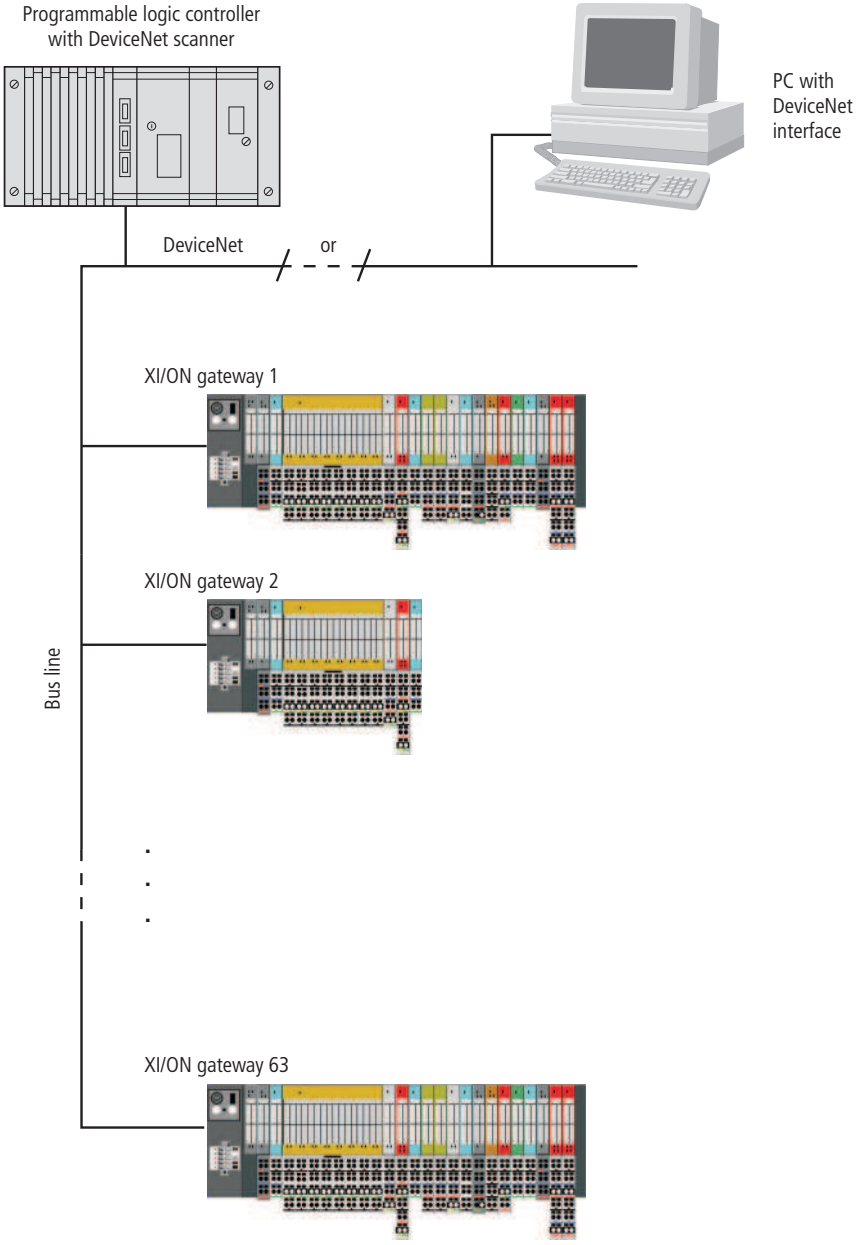



Figure 17: Maximum system configuration

### Maximale bus length

The maximum bus length for DeviceNet depends not only on the transmission rate, but also on the type of cable that is used. The following table presents an overview of the possible transmisison rates and the corresponding maximum cable lengths when Thick Cable is used:

Table 30: Maximum cable lengths (Thick Cable)

| **Bit transfer rate (kbps)** | **Maximum trunk line length** | **Maximum drop line length** | |
|---|---|---|---|
| | | total | referred to 1 drop line |
| 125 | 500 m (1640 ft) | 156 m (512 ft) | 6 m (20 ft) |
| 250 | 250 m (820 ft) | 78 m (256 ft) | |
| 500 | 100 m (328 ft) | 39 m (128 ft) | |

→ For precise details of maximum cable lengths when using other types of cable (Thin Cable, Flat Cable, Cable II, Cable I) please refer to the ODVA DeviceNet Specification Rel. V2.0, Appendix B.

**Mixed operation with other types of station**

In addition to the XI/ON gateways, other stations (e.g. other station types and modules from the *WIN* bloc series, or third-party devices that comply with the DeviceNet Communications Profile) can can be integrated into the field bus system, so that mixed operation is possible. The DeviceNet system is thus extremely flexible, and can be applied even in the most difficult industrial situations.

# 3 Coupling to SLC 500 from Allen Bradley

## Setting up communication, using „RSLinx“

In order to configure the coupling of an XI/ON gateway with an Allen Bradley SLC 500, the tool used is the Allen Bradley RSNetworx software tool (version 3.00.00) from Firma Rockwell Automation. Before a connection can be set up through this tool, the RSLinx software (version 2.20.02) from Rockwell Automation must be used to establish access to DeviceNet.

The following explains the establishment of a connection through node 1770-KFD.

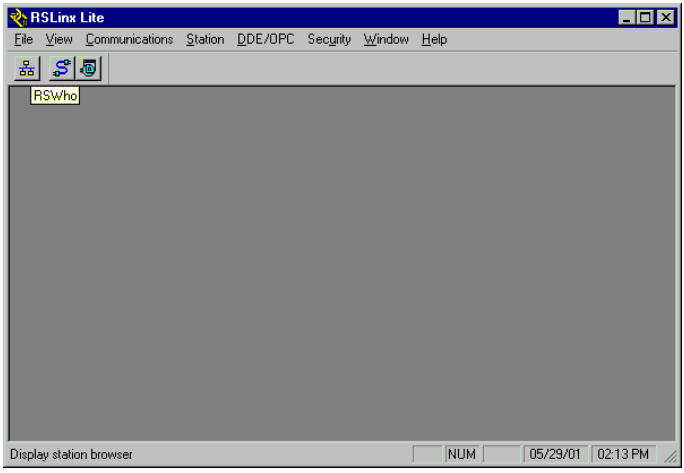



Figure 18: RSLinx software from Allen Bradley

The selection of the DeviceNet driver module is made in the menu item ‹Communications → Configure Drivers›.

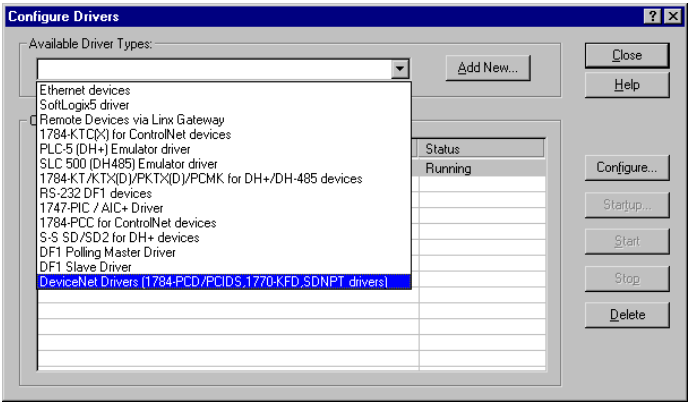



Figure 19: Selection of the driver category

After selecting the device types, the Add new button is used to select the driver modules to be used, e.g. 1770-KFD.

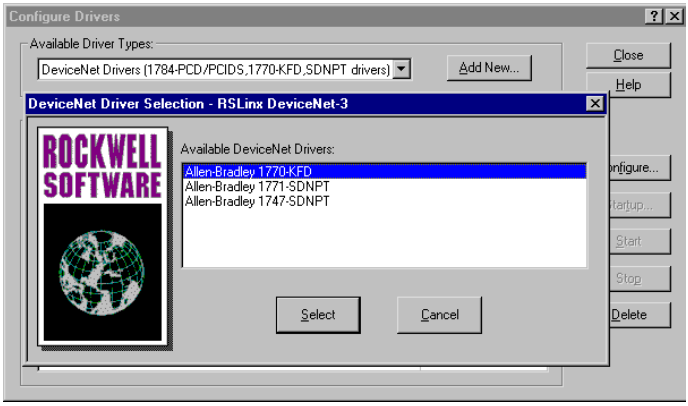



Figure 20: Selection of the DeviceNet driver module

The node is configured in the following window, which means that such entries as the data transmission rate, the serial interface, the MAC ID and the selection of the bit transmission rate are made here.

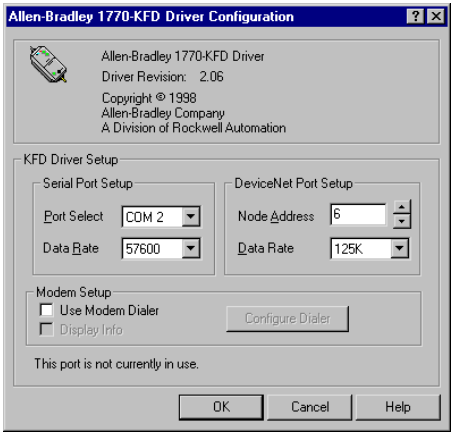



Figure 21: Configuration of the 1770-KFD

When the KFD tool has been successfully configured, the link to DeviceNet is set up.

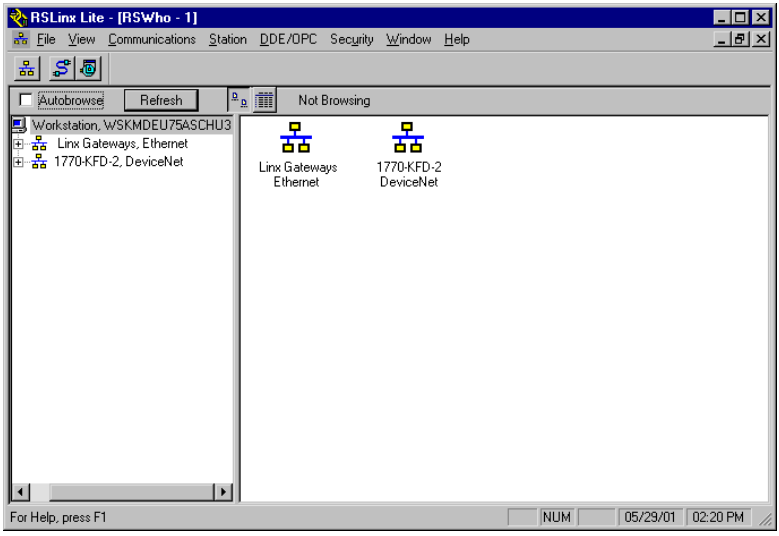



Figure 22: Representation of the DeviceNet network in RSLinx

**Configuration of the network, using RSNetworx**

The configuration software RSNetworx from Allen Bradley is used to link the XI/ON gateway into the DeviceNet network .

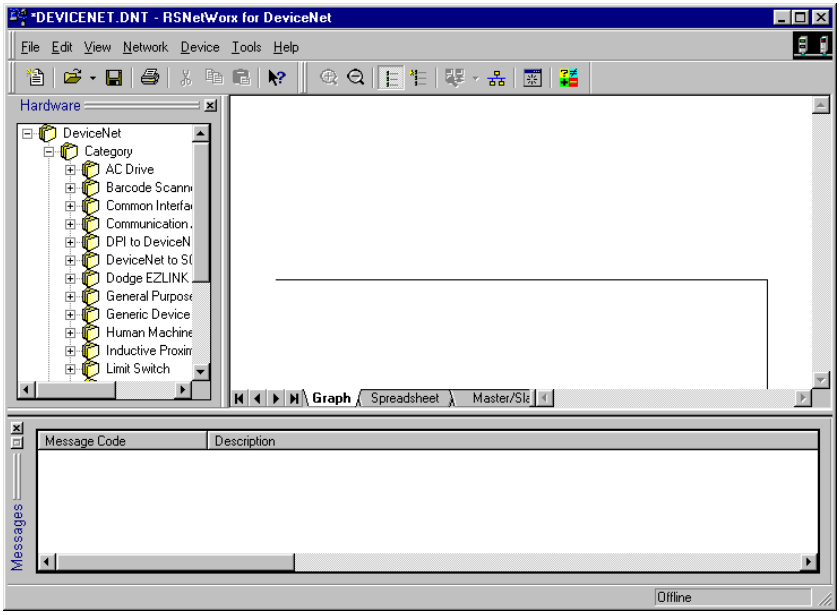



Figure 23: The RSNetworx software

### Reading in the EDS file

▶Open a new or existing project.

▶Open the EDS Wizard through the menu item ‹Tools → EDS Wizard›.

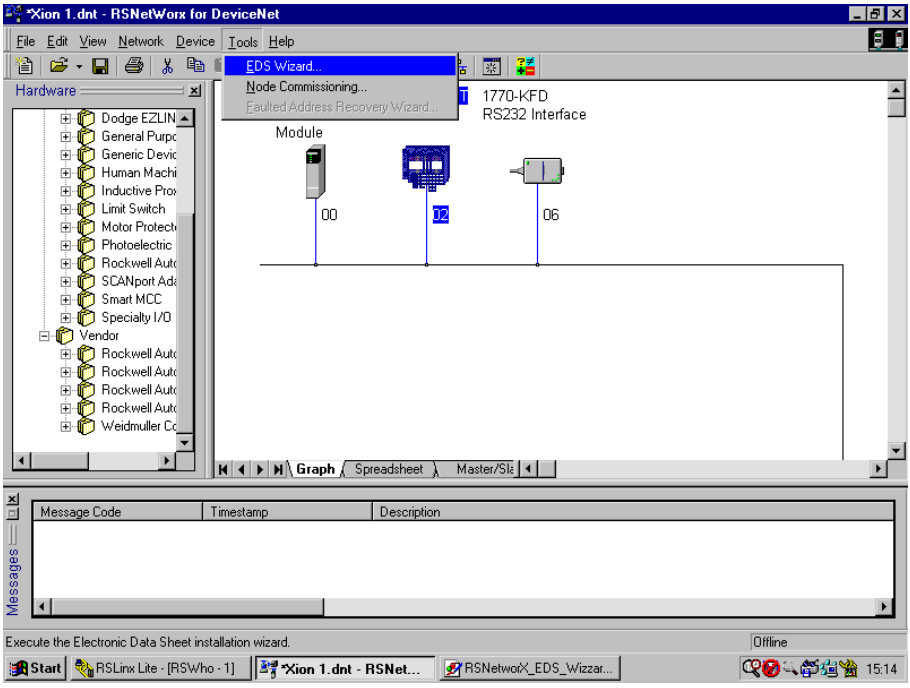



Figure 24: Opening the EDS Wizard

The EDS file to be registered, e.g. **XN225164V1.eds (** → "Electronic Data Sheet – EDS file"**)** is accepted into the database of the program by using the EDS files register button.

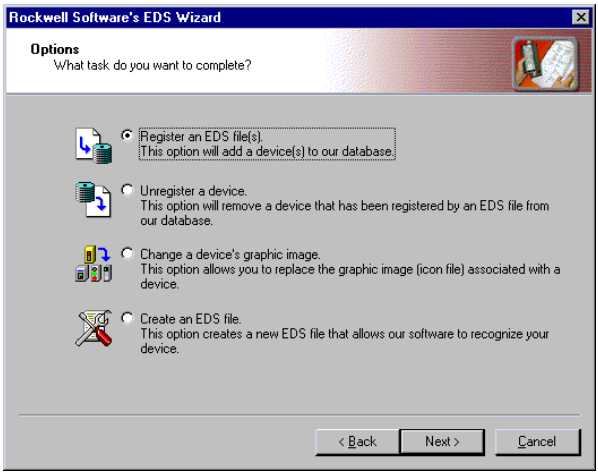



Figure 25: Registering the EDS file

When the EDS file has been correctly registered, the XI/ON gateway appears in the Hardware Catalog of the software.

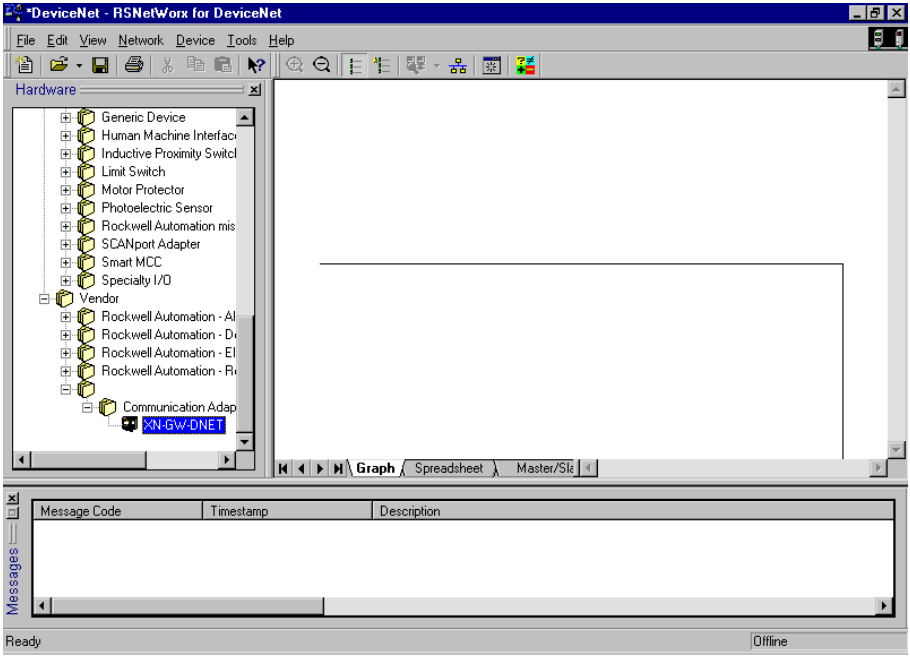



Figure 26: Hardware Catalog with XI/ON gateway

→ The XI/ON gateway will be listed under the manufacturer name Weidmüller ConneXt Inc. until the software database has been updated by Allen Bradley.

**Offline configuration of the network**

The network nodes are selected from the Hardware Catalog by the drag-and-drop method, or by a double-click on the product name. This example used not only the XI/ON gateway, but also the Allen Bradley Scanner Module 1747-SDN and the DeviceNet driver module 1770-KFD RS232 Interface.

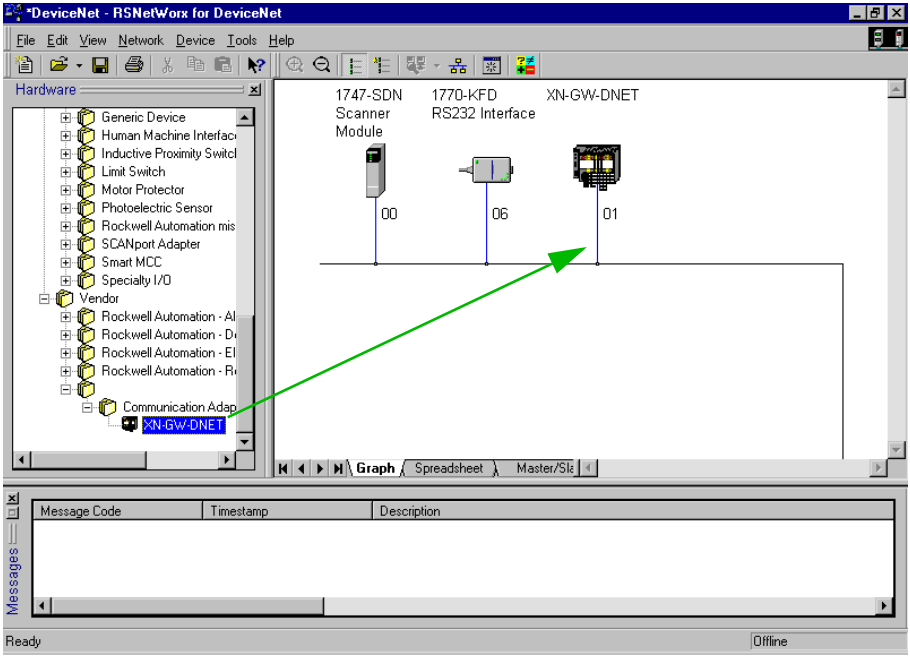



Figure 27: Selection of the XI/ON gateway

→ When configuring the network, care must be taken that the MAC ID of the KFD tool matches the MAC ID that was defined when setting up the communication in RSLinx.

### Configuration of the DeviceNet gateway and the attached XI/ON station

The DeviceNet gateway is configured through the menu item ‹Device → Device properties›.

The definition of a station name and the MAC ID (address) is made in the General register card.

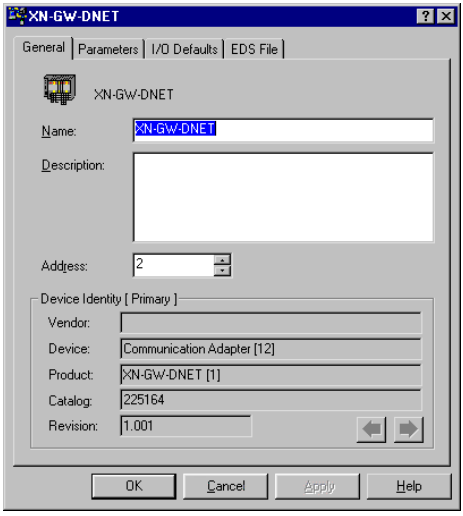



Figure 28: Setting the MAC ID for the XI/ON gateway

### Setting the gateway parameters

The gateway parameters are set in the register card for Device Parameters. Parameters for the gateway and the attached modules can already be set here in offline operation.

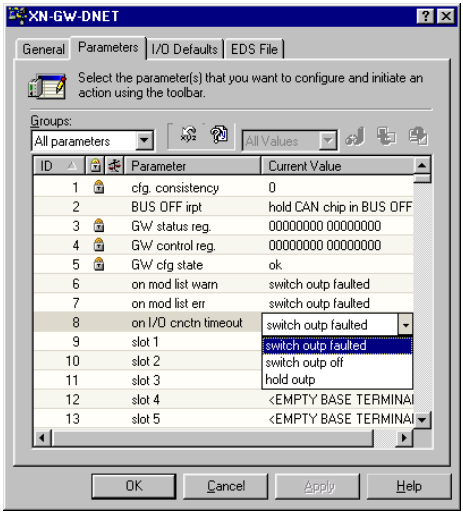



Figure 29: Setting the gateway parameters

The gateway parameters occupy the lines cfg. consistency to on I/O cnctn timeout. The IDs that follow are reserved for the XI/ON I/O modules.

### Offline configuration of the XI/ON station

The offline configuration of the XI/ON station is also made in this register.

Double-click on the text EMPTY BASE TERMINAL. The specific I/O modules can then be selected in the pull-down menu that now opens.

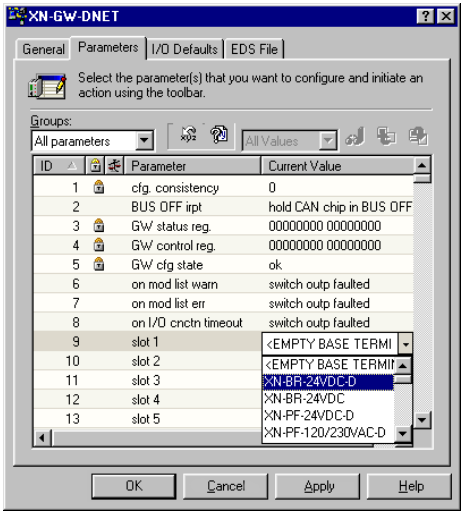



Figure 30: Selection of the XI/ON modules

### Online mode

After the offline configuration of the station, the menu item ‹Network → Online› or the corresponding button in the symbol bar is used to change the system over to online mode.

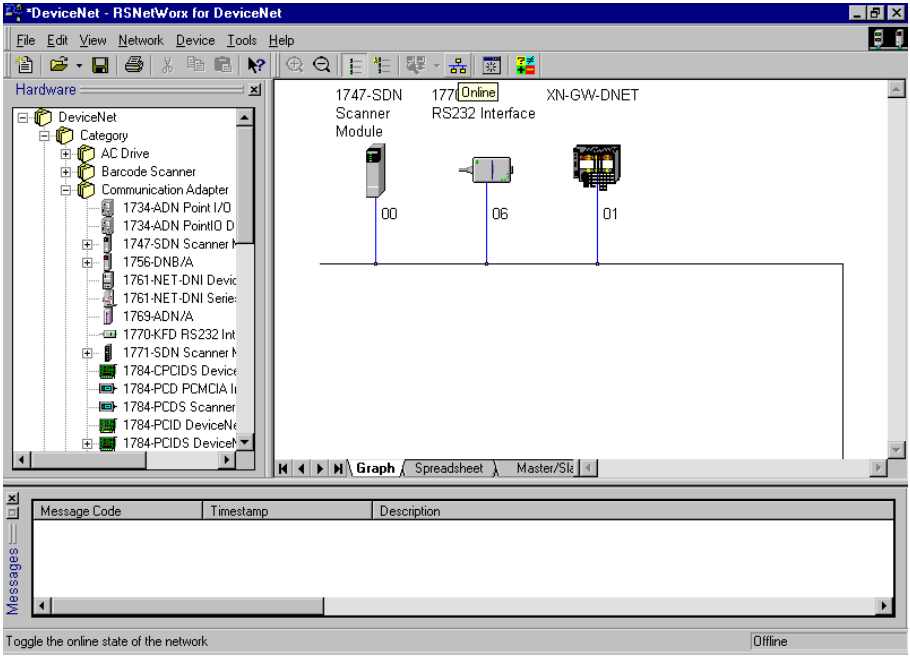



Figure 31: Changeover to online mode

### Acceptance of the XI/ON station in the scan list of the DeviceNet scanner

In order for the 1747-SDN scanner module of the SLC 500 to be able to communicate with the XI/ON gateway, the gateway must be accepted in its scan list.

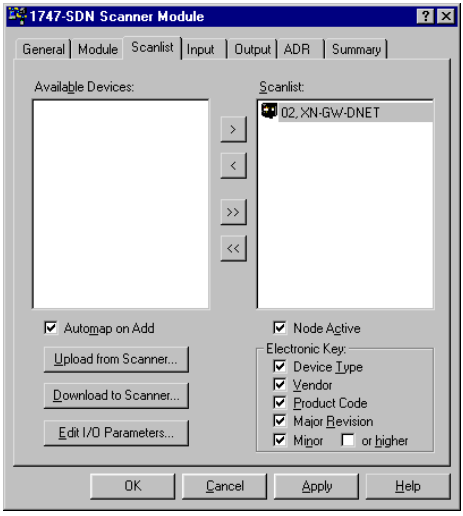



Figure 32: Acceptance of the XI/ON station in the scan list

The Edit I/O Parameters button is used to specify the type of process data exchange (Bit Strobe, COS, Cyclic, Polling) and the exact length of the input and output data for the particular station.

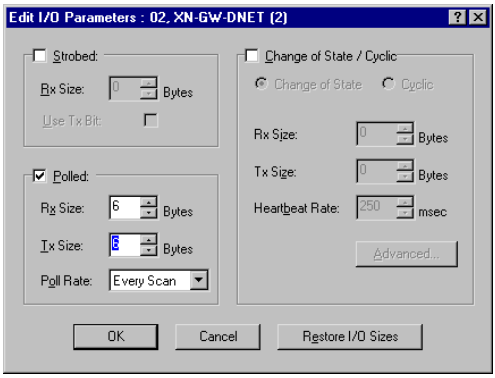



Figure 33: Setting the data transmission type

### Mapping input and output data

The Input and Output registers show the addresses for the input and output data in the control system. They can either be assigned automatically, using the AutoMap button, or through the setting up of a start word, using the Start Word button. The addresses that are set here are accessed by a program in the SLC 500.

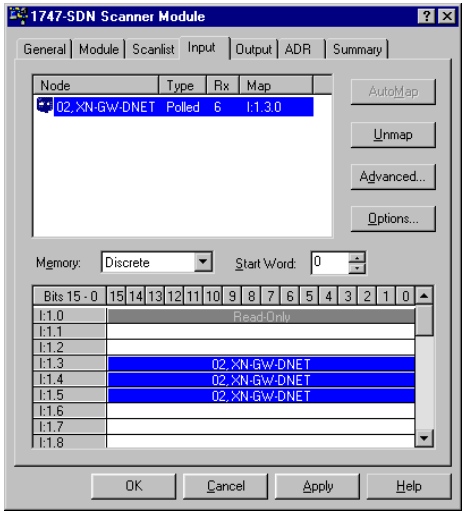



Figure 34: Mapping the input data

### Parameterization and diagnostics of the XI/ON station

A double-click on the symbol for the XI/ON gateway opens the XN-GW-DNET window. The Parameters register contains the parameters and diagnostics for all modules of the XI/ON station.

The lines cfg. consistency to on I/O cnctn timeout refer to the gateway, and are followed by the XI/ON I/O modules in the order in which they have been inserted into the gateway.

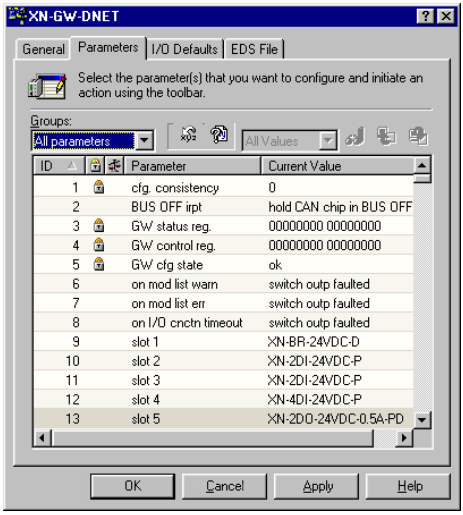



Figure 35: Station parameters

**Status and Control Words for the gateway**

The Status Word and the Control Word for the gateway are shown in positions 2 and 3 of the gateway-specific data.

The following representation shows the Status Word with the error message module list warning. This message indicates that the module list saved in the gateway does not match the list existing at present.

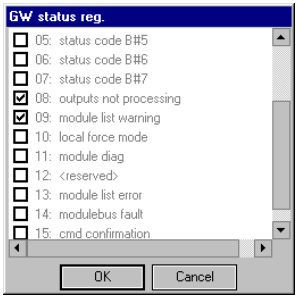



Figure 36: Status Word with module list warning

Diagnostics for the XI/ON station

In the pull-down menu Groups, select those module groups for which parameters and diagnostics are to be shown.

The following illustration shows the example of a bus refreshing module from the module group PWR Modules with a missing/inadequate field voltage undervolt. field supply.

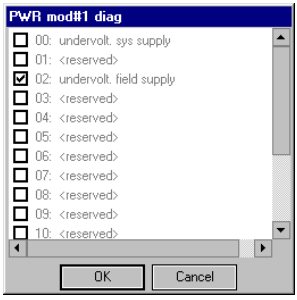



Figure 37: Diagnostics using the example of a bus refreshing module

**Parameterization of the XI/ON station**

The parameterization of the XI/ON modules is also carried out in the XN-GW-DNET window.

A double-click on the line for the parameters of the module concerned opens the window with the parameter settings.

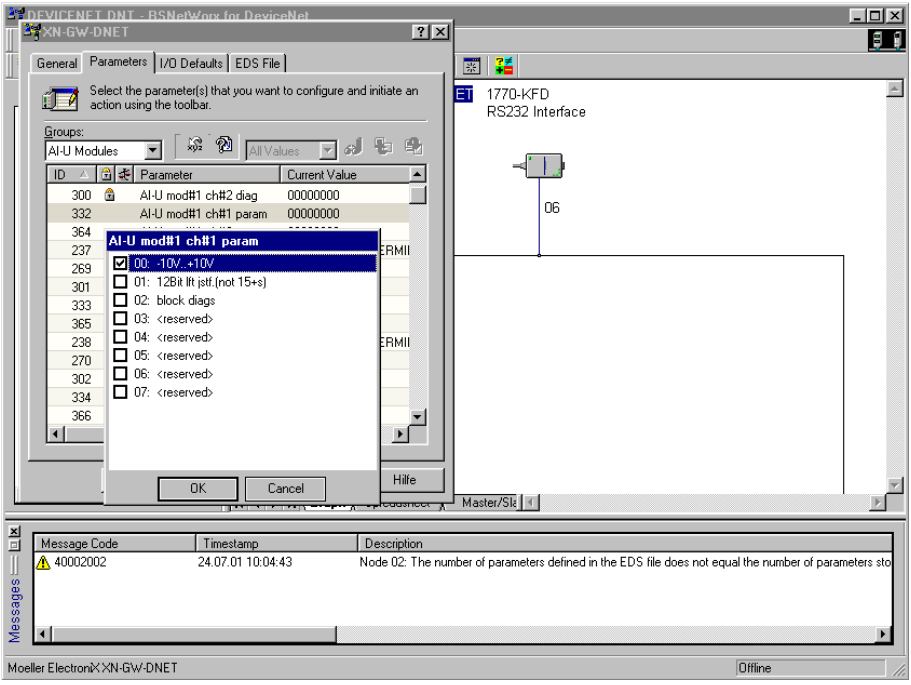



Figure 38: Setting the parameters for an XI/ON module

The altered parameter settings are then loaded into the XI/ON gateway by using the corresponding button.

### Explicit Messaging with the Class Instance Editor

The Class Instance Editor provides the facility of Explicit Messaging, in other words, direct writing or reading access to the classes and instances of the XI/ON modules.

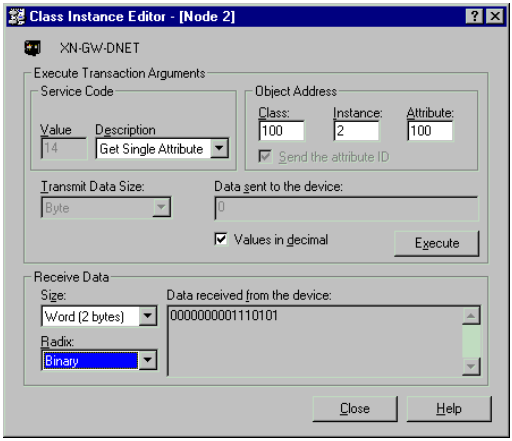



Figure 39: The Class Instance Editor

### Explicit Messaging through Transaction Blocks

Allen Bradley enables Explicit Messaging for the transmission of low-priority configuration data, general management data or diagnostics data between two specific devices, using Transaction Blocks from the control software.

→ Detailed information on using the software tools from Firma Allen Bradley are to be found in the corresponding manuals, which are included in the scope of delivery.

# Index


**A**
Actual Configuration memory ... 28
Application Objects ... 35
Approvals ... 15
Assembly Objects ... 35

**B**
Bit-Strobe ... 63
Bus length, maximum ... 78

**C**
Cable lengths ... 78
Classes ... 36
Command Codes ... 74
Communication model ... 60
Communication profile ... 62
Configuration ... 28
Connection Object ... 34
Consistency Value ... 64
Control bits ... 74
Control Word ... 74
COS ... 63
Cyclic ... 63

**D**
Degree of protection ... 15
Device Heartbeat Message ... 64
Device profile ... 36
Device Shut Down Message ... 64
DeviceNet Object ... 34

**E**
EDS file ... 66
Electromagnetic compatibility ... 13
Explicit Messages ... 60
Explicit Messaging ... 100

**F**
Fieldbus connection
Open Style connector ... 20

**G** GW ..... 30

**I** I/O Messages ..... 60
Identity Object ..... 34
IO ..... 32
IOs ..... 31

**L** LED
GW ..... 30
IO ..... 32
IOs ..... 31
MNS ..... 32
LED indicators ..... 30, 32

**M** Mapping ..... 68
Message Codes ..... 72
Message Router Object ..... 34
Mixed operation ..... 79
MNS ..... 32
Module change ..... 65

**O** Object model ..... 33
Offline Connection Set ..... 64
Operating life ..... 15

**P** Parameter Object ..... 35
Pin assignments ..... 20
Planned Configuration memoryr ..... 28
Polled ..... 63
Power Supply Module Class ..... 55
Predefined Master/Slave Connection Set ..... 61
Process Data Class ..... 52
Process image ..... 68

**R** Rotary encoding switches
decimal ..... 25

**S**
Service interface ..... 11, 23
SET button ..... 29
Station configuration ..... 28
Status bits ..... 71
Status indications ..... 30
Status Word ..... 71
Supply voltage ..... 12, 17
System configuration, maximum ..... 76

**T**
Temp. Planned Configuration memory ..... 28
Terminal Slot Class ..... 48
Termination resistor ..... 20
Topology, maximum ..... 76
Transaction Block ..... 100

**U**
UCMM ..... 63

**V**
Vendor Specific Classes ..... 37