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User Manual
**Anybus[®] X-gateway CANopen
EtherNet/IP**

Doc: HMSI-168-85
Rev. 2.10



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Important User Information

This document is intended to provide a good understanding of the functionality offered by the Anybus X-gateway CANopen - EtherNet/IP.

The reader of this document is expected to be familiar with high level software design, and communication systems in general. The use of advanced CANopen specific functionality may require in-depth knowledge in CANopen networking internals and/or information from the official CANopen specifications. In such cases, the people responsible for the implementation of this product should either obtain the CANopen specification to gain sufficient knowledge or limit their implementation in such a way that this is not necessary. Also knowledge of EtherNet/IP is expected.

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WARNING: This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

ESD Note: This product contains ESD (Electrostatic Discharge) sensitive parts that may be damaged if ESD control procedures are not followed. Static control precautions are required when handling the product. Failure to observe this may cause damage to the product.

WARNING: DO NOT REMOVE OR REPLACE USB CONNECTOR WHILE CIRCUIT IS LIVE UNLESS THE AREA IS KNOWN TO BE FREE OF IGNITIBLE CONCENTRATIONS OF FLAMMABLE GASES OR VAPORS.

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P. About This Document

For more information, documentation etc., please visit www.anybus.com

P.1 Related Documents

Document	Author
CiA Draft Standard 301 v4.2	CAN in Automation
CiA Draft Standard Proposal 302 Part 1-5	CAN in Automation
EtherNet/IP Specifications Vol 1, 2	ODVA

P.2 Document History

Revision List

Revision	Date	Author(s)	Chapter(s)	Description
1.00	2010-01-17	KeL	-	First official release
1.01	2011-02-04	KeL	-	Minor corrections and updates
1.02	2011-03-29	KeL	6, 7	Minor corrections
2.00	2011-12-01	KeL	All	General rewrite
2.01	2013-01-11	KeL	6	Minor correction
2.10	Nov 2014	SDa	Multiple	Removed references to PORT configuration software

P.3 Conventions & Terminology

The following conventions are used throughout this manual:

- Numbered lists provide sequential steps
- Bulleted lists provide information, not procedural steps
- The terms ‘Anybus’ or ‘module’ refers to the Anybus X-gateway module.
- Hexadecimal values are written in the format NNNNh, where NNNN is the hexadecimal value.
- A byte always consists of 8 bits

P.4 Sales and Support

For general contact information and support, please refer to the contact and support pages at www.anybus.com

1. Anybus X-gateway CANopen - EtherNet/IP

1.1 Introduction

The Anybus X-gateway CANopen is a series of network gateways, used to provide a seamless connection between a primary fieldbus/Ethernet network and a secondary CANopen sub-network. The gateway enables the master of the fieldbus/Ethernet network to exchange data to and from the secondary CANopen sub-network. This makes it possible to integrate CANopen devices into almost any other PLC system and their supported networks.

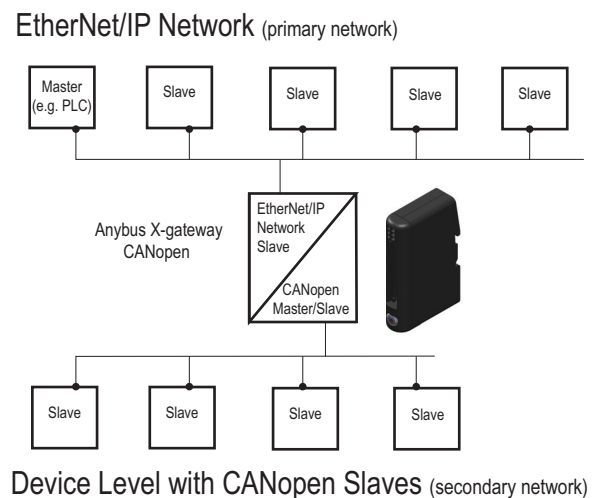
The gateway is based on patented Anybus technology, a proven industrial communication solution used all over the world by leading manufacturers of industrial automation products. Each module offers CANopen master/slave connectivity to one of these industrial networks: EtherCAT, PROFIBUS DPV1, DeviceNet, ControlNet, CANopen, Modbus RTU, EtherNet/IP, PROFINET IO (both RT and IRT) or Modbus TCP.

No proprietary configuration software is needed, though dedicated configuration tools are required when setting up the actual industrial network communications. Any standard CANopen configuration tool can be used to configure the CANopen interface.

The gateways transmit I/O data transparently between the two networks. I/O data from the primary fieldbus/Ethernet network is written into CANopen objects that can be mapped into CANopen PDOs, or read via CANopen SDOs, and vice versa.

The gateway described in this manual connects an EtherNet/IP network with a CANopen network. The module acts as a EtherNet/IP adapter/slave on the primary network and can act either as a slave or as a master on the sub-network, transmitting I/O data between the networks.

The EtherNet/IP adapter/slave interface, connected to the primary network, is configured with a standard device description file (GSD/EDS) and the standard configuration tool of the master of that network. No programming is required.



IMPORTANT: This product acts as a gateway between two industrial networks. One network is a CANopen sub-network, on which the module either acts as a master or as a slave, depending on configuration. Using the module, this CANopen sub-network is connected to and can exchange data with another kind of industrial network, e.g. PROFIBUS or EtherNet/IP, connected to the module. To make it easier to distinguish the two networks from each other, the CANopen sub-network will be called the secondary network throughout the manual. The other network will be called the primary network. In the product that this manual describes, the primary network is EtherNet/IP and the secondary network is CANopen.

1.2 Features

The Anybus CANopen X-gateway acts as an intelligent link between two industrial networks. On the secondary CANopen sub-network, it can perform either as a master (manager) or as a slave (server), depending on configuration, while it always will act as a slave on the primary fieldbus/Ethernet side. The implementation is based on HMS NP30 network microprocessor and is certified by CAN in Automation (CIA) for full conformance to the CANopen DS 301 v4.0.2 standard.

CANopen (sub-network, secondary network)

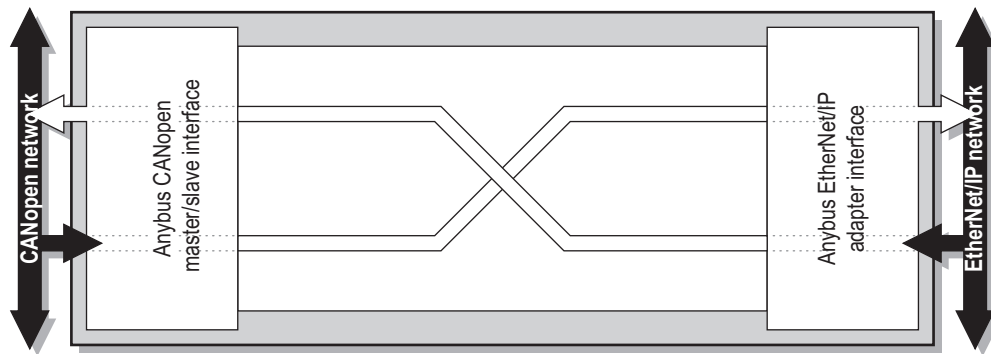
- CANopen master (manager) and slave functionality
- Connects up to 126 CANopen slave nodes
- Complies to the CANopen communication profile DS301 4.2 and DSP302 (part 1-5)
- Supports cyclic and acyclic synchronous as well as COS (change of state) PDO message types
- 20 kbps... 1 Mbps operation
- Heartbeat and node guarding mechanisms
- Sync objects
- 128 receive and 128 transmit PDOs available
- Up to 510 bytes of cyclic data in each direction (PDO)

EtherNet/IP Features (primary network)

- 10/100 Mbit operation in full or half duplex
- DHCP/Anybus IPconfig (HICP) support
- EtherNet/IP Adapter

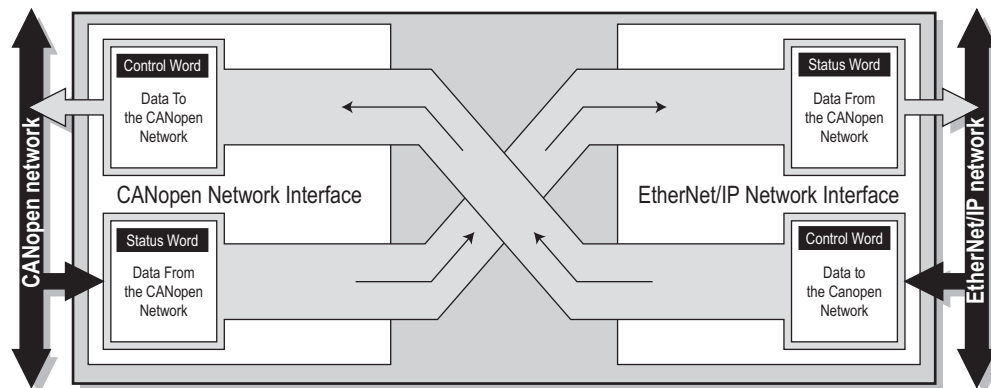
1.3 Functional Overview

Internally, the X-gateway consists of an intelligent gateway platform, an Anybus CANopen interface¹ and an Anybus EtherNet/IP interface. The CANopen interface and the Anybus EtherNet/IP interface are interconnected through the intelligent gateway platform, which basically forwards data from one network to the other and vice versa as shown below. This design allows almost any industrial network to be connected to a CANopen master or a slave on a separate CANopen network.



1.4 Data Exchange

Each of the two network interfaces exchanges data on its network through two buffers. The gateway forwards the data between these buffers as shown below. Note that this process is separated from the network data exchange. While the gateway ensures data consistency (where applicable), it does not feature any built-in mechanisms for synchronisation between the primary EtherNet/IP network and the secondary CANopen network.



Each buffer holds up to 512 bytes of data, where the first two bytes on the primary network side always are used for control/status information. The remaining 510 bytes gives the theoretical upper limit for the number of data bytes that can be exchanged in each direction. Please note that the actual number of bytes that can be exchanged is highly application and network dependent and can thus be noticeably less than 510 bytes.

Through the dedicated control word, the master on the primary EtherNet/IP network starts/stops the exchange of data on the secondary CANopen network (the sub-network). It can also reset the gateway

1. When started the first time, the Anybus X-gateway is set as slave on the secondary network. This can be changed during configuration, and will be remembered when restarting.

if needed. The master on the primary EtherNet/IP network can see the status of the secondary CANopen network in the corresponding status word.

The amount of data that shall be exchanged, and the use of the control- and status functionality, is specified separately for each application. This means that even though up to 510 bytes of data can be forwarded to an interface, the amount of data that will actually be exchanged on the primary EtherNet/IP network is determined by settings of the secondary CANopen network, with consideration taken to the limits of the interface.

The available control- and status functionality is described in “Data Exchange” on page 21. Also note that the terminology and definitions used for different types of data vary greatly between different networking systems. All data transported through the Anybus X-gateway CANopen is fast, cyclic data and is simply referred to as ‘I/O Data’ in this document.

2. About the Anybus X-gateway CANopen

2.1 External View

A: Status LEDs

See also...

- “Status LEDs” on page 7

B: Primary Network Connectors

This connector (connectors) are used to connect the Anybus X-gateway CANopen module to the primary EtherNet/IP network. They are described in “Primary Network” on page 8.

C: USB connector

This connector simulates a COM-port, used for software upgrade of the module. Please note that this connector can not be used for configuration of the module.

See also...

- “Secondary Network” on page 9

D: CANopen Connector

This connector is used to connect the gateway to the secondary CANopen network.

See also...

- “CANopen Connector” on page 9

E: Power Connector

This connector is used to apply power to the gateway.

See also...

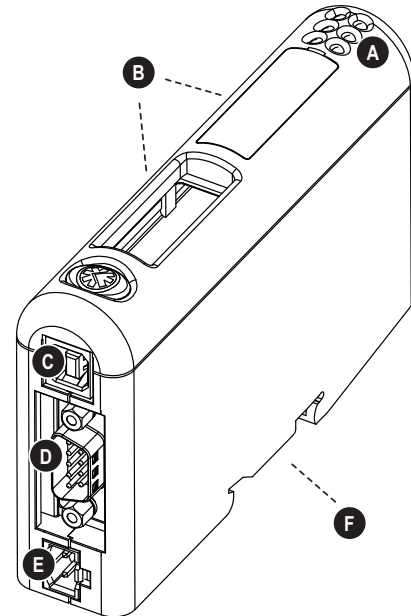
- “Power Connector” on page 10

F: DIN-rail Connector

The DIN-rail mechanism connects the gateway to PE (Protective Earth).

See also...

- “Hardware Installation” on page 11

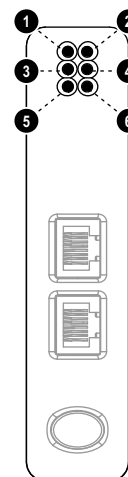


2.2 Status LEDs

The status LEDs on the front indicate the status of the module as shown in the table below. Their behavior is described in “Status LED Timing Diagrams” on page 44

Status LEDs 1 - 4 indicate the status of the primary EtherNet/IP network and status LEDs 5 - 6 indicate the status of the secondary CANopen (sub)network and the device.

#	State	Status
1 - Module status	Off	No power or initializing
	Green	Controlled by a scanner in Run state
	Flashing green	Not configured or scanner in Idle state
	Flashing red	Minor fault, recoverable
	Red	Major fault, unrecoverable
	Flashing green/red	Self test in progress
2 - Network Status	Off	No IP address
	Green	On-line, one or more connections (CIP class 1 or 3)
	Flashing green	On-line, no connection established
	Flashing red	One or more connections timed out (CIP class 1)
	Red	Duplicate IP address, fatal error
	Flashing green/red	Self test in progress
3 - Link/Activity 1	Off	No link sensed on port 1/2
4 - Link/Activity 2	Flashing green	Activity, receiving/transmitting Ethernet packets at 100 Mbit
	Flashing yellow	Activity, receiving/transmitting Ethernet packets at 10 Mbit
5 - CANopen subnet status ^a	Off	Power off
	Flickering green/red	The LSS services are in progress
	Blinking green	Preoperational state
	Single flash, green	Stopped state
	On, green	Operational state
	Blinking red	Configuration error
	Single flash, red	Warning limit reached in CAN controller, e.g. bad or no signal on CANopen network
	Double flash, red	Error control event
	Triple flash, red	Sync error
	Quadruple flash, red	Data communication timeout
6 - Device status	Off	Power off
	Blinking green	Bootup
	On, green	Running
	Single flash, red	Initialization error
	Double flash, red	Internal timeout
	Triple flash, red	Hardware failure
	Quadruple flash, red	Invalid switch settings
	On, red	Fatal error

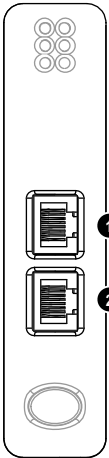
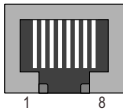


a. This LED shows the status of the secondary CANopen network.

2.3 Primary Network

2.3.1 Ethernet Port Connectors

Pin no	Description
1	TD+
2	TD-
3	RD+
6	RD-
4, 5, 7, 8	(reserved)

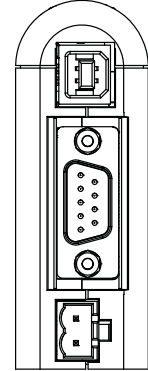
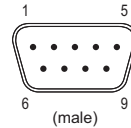


2.4 Secondary Network

2.4.1 CANopen Connector

At the bottom of the module you find the CANopen connector for the secondary network.

Pin no.	Description
2	CAN_L
5	Housing, CAN cable shield
7	CAN_H
1, 4, 8, 9	(reserved)
3, 6	CAN GND



This connector is also used to download the CANopen configuration to the module.

2.4.2 Configuration Switches

The on-board switches on the side of the module are used to set the CANopen node address and operating baud rate for the interface on the secondary network. These settings cannot be changed during runtime, i.e. the gateway must be restarted in order for any changes to have effect.

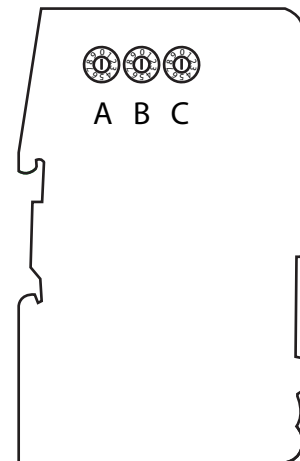
Note: When these switches have been set, cover them with the switch covers that accompany the module.

Baud Rate

The baud rate is set via switch A:

Switch Setting	Baud Rate(kbit/s)
0	20
1	50
2	125
3	250
4	500
5	800
6	1000
7	Auto ^a
8, 9	Not available

a. The automatic baud rate setting should not be used if there is only a small amount of traffic on the bus. This occurs e.g. if the interface is configured as a CANopen master or if the secondary network is small.



Node Address

The node address is configured using two rotary switches as follows:

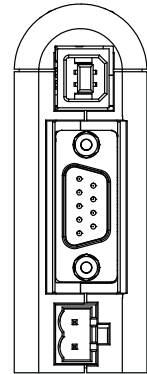
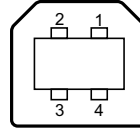
$$\text{Node Address} = (\text{Switch B} \times 10) + (\text{Switch C} \times 1)$$

Example: To set node address 42, set switch B to '4' and switch C to '2'.

2.5 USB Connector

At the bottom of the module, next to the CANopen connector for the secondary network, you find a USB connector that is only used for software upgrade of the module.

Pin no.	Description
1	+5 V input
2	USBDM (USB communication signals)
3	USBDP (USB communication signals)
4	Signal GND
Housing	Cable Shield



This port can only be used for software upgrade.

2.5.1 Power Connector

Pin no.	Description
1	24 V DC
2	GND



Notes:

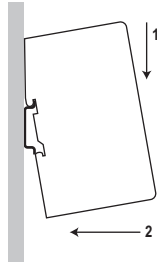
- Use 60/75 or 75° C copper (CU) wire only.
 - The terminal tightening torque must be between 5... 7 lbs-in (0.5... 0.8 Nm)
- See also...
- “Power Supply” on page 42

2.6 Hardware Installation

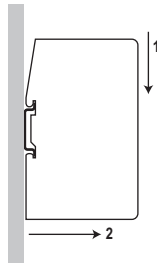
Perform the following steps when mounting the gateway:

1. Set the Node Address and the baud rate for the secondary CANopen network (see “Configuration Switches” on page 9).
2. Snap the gateway on to the DIN-rail (See “External View” on page 6)

The DIN-rail mechanism works as follows:



To snap the gateway *on*, first press it downwards (1) to compress the spring in the DIN-rail mechanism, then push it against the DIN-rail as to make it snap on (2).



To snap the gateway *off*, push it downwards (1) and pull it out from the DIN-rail (2), as to make it snap off from the DIN-rail.

3. Connect the gateway to the secondary CANopen network.
4. Connect the gateway to the EtherNet/IP network.
5. Connect the power cable and apply power

2.7 CANopen Electronic Data Sheet (EDS)

Each device on CANopen is associated with a CANopen Electronic Data Sheet (a.k.a EDS file), which holds a description of the device and its functions. Most importantly, the file describes the object dictionary implementation in the device. This file should be uploaded to the CANopen configuration tool when configuring the secondary CANopen network.

The latest version of the EDS file for the Anybus X-gateway CANopen can be downloaded from the HMS web site, 'www.anybus.com'.

2.8 EtherNet/IP Electronic Datasheet (EDS-file)

Each device in a EtherNet/IP network is associated with an Electronic Data Sheet (an EDS file), which describes the implementation of the product. This file is used by the network configuration tool during network configuration.

The latest version of the EDS file for the Anybus X-gateway EtherNet/IP interface can be downloaded from the HMS web site, 'www.anybus.com'.

3. Getting Started

The purpose of this chapter is to give a short description on how to install the module and get it up and running, transferring I/O data between the primary EtherNet/IP network and the secondary CANopen sub-network.

Note: The CANopen (secondary) sub-network interface is configured prior to the primary EtherNet/IP network interface. The Anybus X-gateway CANopen - EtherNet/IP module has to be restarted after this configuration has been finished.

Perform the following steps when installing the gateway:

1. Set the CANopen node ID and operating baud rate for the X-gateway on the secondary CANopen network (see “Configuration Switches” on page 9).
2. Snap the gateway on to the DIN-rail (See “Hardware Installation” on page 11).
3. Connect the gateway to the CANopen (secondary) sub-network, using the connector at the bottom of the module.
4. Connect the power cable and apply power.
5. Download the appropriate EDS file from HMS to the external CANopen configuration tool. See “CANopen Electronic Data Sheet (EDS)” on page 12.
6. Decide how much data will be transferred. This amount is always configured for the module’s interface to the secondary network. A description of how the data is mapped to the Anybus X-gateway CANopen is found in “I/O Buffer Addresses and Object Dictionary Indices Relation” on page 40.
7. Configure the module and the secondary CANopen network.
8. Connect the gateway to the primary EtherNet/IP network.
9. Restart the gateway.
10. Download the appropriate EDS file from HMS. See “EtherNet/IP Electronic Datasheet (EDS-file)” on page 12.
11. The actual configuration of the module is performed while configuring the EtherNet/IP master/scanner and the EtherNet/IP network, see “Configuration of the EtherNet/IP interface” on page 18. The I/O buffers of the module contains 512 bytes, but the amount of I/O data is decided by the CANopen configuration.

4. CANopen Fieldbus Functionality

The functionality of the Anybus X-gateway CANopen master/slave on the secondary network is defined by the CANopen DS301 Rev. 4.2 specification and DSP302 (part 1-5).

Note: The first time the module starts up, it starts as a slave on the secondary CANopen network. It can be set as master during configuration, see “Enabling Data Exchange” on page 53. This setting can be saved in the module so that it will start as a master the next time.

4.1 Supported Fieldbus Services

Communication and parameters in the CANopen protocol are built around objects. There are different services available to communicate with the objects and to perform other CANopen tasks like supervising the network. The following message types and objects are implemented in the Anybus X-gateway CANopen:

- NMT (Network Management)¹ messages configure and initialize the network, as well as monitor the network and handle errors. If the module is configured as a slave, startup is performed by a master on the network.
- CMT (Configuration Manager)¹ messages are used for configuration of CANopen devices. This primarily involves PDO parameters and mapping of information. If the module is configured as a slave, the configuration is performed by a master on the network.
- PDOs (Process Data Objects) are used for I/O communication. There are 128 Receive PDOs and 128 Transmit PDOs implemented in the Anybus X-gateway CANopen that each can transfer up to 8 bytes. Supported PDO message types are COS (Change of state), Cyclic Synchronous and Acyclic Synchronous.²
- SDOs (Service Data Objects) use asynchronous data transmission and are used to access objects without mapping them to an I/O (PDO) connection. Access is provided to all CANopen objects in the module and in the network nodes (master mode). The SDO messages are used to configure the module and they can transfer more than 8 bytes, which is the upper limit for a PDO. (Expedited Upload/Download Protocol and Segmented Upload/Download Protocol are supported)
- A SYNC (Synchronization Object) is used for synchronizing PDO communication. A master can be either a producer or a consumer of the synchronization. A slave can only be a consumer.
- The Heartbeat Mechanism helps a device to monitor the status of another node. The module can appear both as heartbeat producer and consumer.
- The Node Guarding Protocol provides active surveillance of a slave by the master. Slaves can be configured to expect a node guarding request from the master.
- An EMCY (Emergency Object) is used for error reporting when a fatal fault has occurred in the module itself or in other monitored/supervised modules.
- LSS (Layer Setting Services)¹. An LSS master can configure baud rate and node ID of all slaves that support LSS (i.e. the preconfigured baud rate and node ID of a slave can be changed by a master).

1. Only available when the module is configured as master.

2. The data exchange with the EtherNet/IP network is limited to 512 bytes, affecting the total number of PDOs that can be used in an application.

5. Configuration

This chapter describes the configuration of the secondary CANopen network interface as well as the configuration of the primary EtherNet/IP network adapter/slave interface of the module. The secondary CANopen network interface is configured prior to the primary EtherNet/IP network adapter/slave interface. The I/O data sizes configured for the secondary CANopen network decides the data sizes on the primary EtherNet/IP network adapter/slave interface.

5.1 Module Identification

The Anybus X-gateway CANopen to EtherNet/IP module identifies itself on the network as follows:

Description	Value
Vendor Code	90
Vendor Name	"HMS Networks"
Product Code	50
Product Type	12
Product Type String	"Communications Adapter"
Product Name	"Anybus X-gateway CANopen"
Catalog	"Anybus X-gateway CANopen"
Desc Text	"Anybus X-gateway CANopen"

5.2 CANopen Master/Slave Configuration

The nodes on the secondary CANopen network, including the interface of the Anybus X-gateway on this network, have to be configured using an external CANopen configuration tool running on a computer. The configuration is downloaded to the secondary CANopen network master using a CANopen adapter.¹

The module is by default configured as a slave at startup. To enable it to perform as a CANopen master, please set this during configuration. See “NMT Start-up, 1F80h” on page 33.

The following parameters must be defined:

Parameter	Description	Values	Comment
Node Number	Node ID on the secondary CANopen Network. Allowed values are 1 - 127.	1-127	Node ID (1-99) is set using rotary switches, see “Configuration Switches” on page 9. Node IDs above 99 can be set using the configuration tool or from the CANopen network.
Baud rate	This parameter defines the baud rate on the secondary CANopen network. If “Auto” is selected the baud rate will be automatically detected.	20 kbit/s 50 kbit/s 125 kbit/s 250 kbit/s 500 kbit/s 800 kbit/s 1000 kbit/s Auto	Set using rotary switches, see “Configuration Switches” on page 9 Automatic baud rate should only be used if the module is used as a slave on the secondary network.
Set master	Set the module to be CANopen master. At startup the module is a slave by default. This can be changed during configuration.		See “NMT Start-up, 1F80h” on page 33.
CANopen input data size	This parameter defines the size of the readable data array on the primary network interface. Data to the primary network from the secondary CANopen network.	2 - 512 ^a	The first 2 bytes in the array are used for the status word, so the maximum data size from the secondary CANopen network is 2 bytes less than the maximum value allowed for this parameter. See object 3000h on page 41.
CANopen output data size	This parameter defines the size of the writable data array on the primary network interface. Data from the primary network interface to the secondary CANopen network.	2 - 512 ^a	The first 2 bytes in the array are used for the control word, so the maximum data size to the secondary CANopen network is 2 bytes less than the maximum value allowed for this parameter. See object 3001h on page 41.

a. The data buffers in the Anybus X-gateway CANopen module can hold 512 bytes of data, but the actual maximum data size is highly dependent on network. Please consult the section on configuration of the controlling network further on in this chapter.

Note: The input and output data sizes are configured for the secondary CANopen network interface. The master of the primary network will have to take these values into consideration, as they will be used by the primary EtherNet/IP network adapter/slave interface of the module.

1. Please contact HMS support for further information, see “Sales and Support” on page 1.

5.3 Secondary CANopen Network Configuration

An external CANopen configuration tool is used to configure the nodes on the secondary CANopen network. Each node can be configured locally or a Concise DCF file can be downloaded to the CANopen network master using a CANopen adapter¹. At the next startup the CANopen master will configure the network, if this function was set in the configuration tool during initial configuration.

The first time the Anybus X-gateway CANopen is started it starts up as a slave. It can be configured as a master, and if it is, it will continue to start up as a master.

1. Download the EDS file² for the Anybus X-gateway CANopen from www.anybus.com to your PC.
2. Prepare EDS files for all other nodes present on the secondary network.
3. Open the CANopen configuration tool.
4. Upload the EDS files to the configuration tool.
5. Add nodes to the CANopen network.
6. Configure each node with the necessary parameters.
7. Set Input Data Size in object 3000h and Output Data Size in object 3001h, to define the I/O data size between the secondary CANopen network (sub-network) and the primary EtherNet/IP network (slave interface). Default values are 16 bytes (14 bytes of data exchanged between the networks + 2 bytes Control/Status Word). See “General Fieldbus Parameters” on page 41.
8. Download the configuration to the CANopen network as Concise DCF to the master or store the configuration locally in each module’s nonvolatile memory.

Please consult the user manual for the configuration tool for details and/or contact HMS support, see “Sales and Support” on page 1.

To configure the primary EtherNet/IP adapter/slave interface, restart the module, and then configure the EtherNet/IP network using appropriate configuration tools, see below. Please remember that the amount of data that can be exchanged already is decided by the previous configuration of the secondary CANopen network (CANopen objects 3000h and 3001h). The first two bytes of the input data and the output data are always used for status and control information.

5.3.1 LSS Routine

If there is a missing slave on the network after the boot timeout (defined in object 1F89h, page 37) the master will initiate the LSS routine. It will send an identify slave request. If one (and only one) slave responds to that message, the master sets the NodeID of that node to the first available NodeID. The master will then send a bootup request to the slave.

1. Please visit www.anybus.com or contact HMS support for further information, see “Sales and Support” on page 1.
2. The EDS file for the Anybus X-gateway CANopen can be downloaded from www.anybus.com.

5.4 Configuration of the EtherNet/IP interface

After the configuration of the CANopen master interface has been finalized, the module has to be re-started before the configuration of the EtherNet/IP adapter interface can be started.

The adapter interface is part of a EtherNet/IP network, and will have to be configured within this. This means that the interface must be assigned an IP address, see “IP Settings” on page 18. The configuration tool used when configuring the EtherNet/IP scanner and the EtherNet/IP network will have to be used to configure the adapter interface as well. Please note that the size of the I/O data that can be read from and written to the module is defined when configuring the CANopen sub-network interface.

There are a number of different configuration tools for EtherNet/IP available on the market. The choice of tool depends on the application and the EtherNet/IP scanner of the network. An EDS file for the adapter interface is available at ‘www.anybus.com’.

An application note, describing how to configure an Anybus EtherNet/IP slave interface with RS Logix and RS Networx, is available on the support pages for the Anybus X-gateway CANopen to EtherNet/IP module at ‘www.anybus.com’.

5.4.1 Connection parameters

I/O data is accessed in input and output assembly instances on the EtherNet/IP network as shown below. These values are set in the EDS file for the EtherNet/IP interface. Usually the configuration tool reads and uses these values, but there are tools where you have to define them manually.

	Assembly instance
Input	100
Output	150

5.4.2 IP Settings

Three different options for assigning an IP address to the EtherNet/IP slave interface of the module is described below.

DHCP/BootP (Default)

The module retrieves the TCP/IP settings from a DHCP or BootP server.

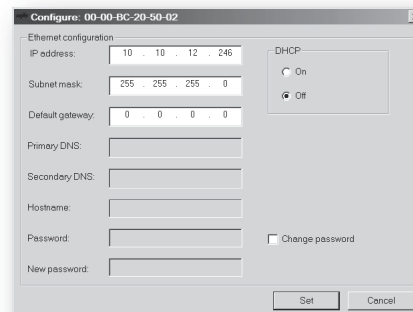
If it fails and no current settings are available, the module will indicate an error on the on-board status LEDs. The settings may however be configured using HICP, see “Anybus IPconfig (HICP)” on page 19.

Anybus IPconfig (HICP)

The module supports the HICP protocol used by the Anybus IPconfig utility from HMS, which can be downloaded free of charge from the HMS web site. This utility may be used to configure the network settings of any Anybus product connected to the network. Note that if successful, this will replace the settings currently stored.

Upon starting the program, the network is scanned for Anybus products. The network can be rescanned at any time by clicking 'Scan'. In the list of detected devices, the module will appear as 'Anybus X-gateway CANopen master'. To alter its network settings, double-click on its entry in the list.

A window will appear, containing the IP configuration and password settings. Validate the new settings by clicking 'Set', or click 'Cancel' to abort.



Optionally, the configuration may be protected from unauthorized access by a password. To enter a password, click on the 'Change password' checkbox, and enter the password under 'New password'. When protected, any changes in the configuration requires that the user supplies a valid password.

When done, click 'Set'. The adopted configuration will be stored in the ethernet configuration file.

Note: The HICP protocol communicates over UDP port 3250.

5.5 Enabling Data Exchange

Once both the interfaces of the X-gateway have been properly configured, the PLC (the master) on the primary network will have to explicitly allow the X-gateway to exchange I/O data, for any I/O data exchange to occur between the primary and secondary networks. To accomplish this, the PLC will write the command "OPERATIONAL" in the control word, see "Control Word" on page 22 for further information.

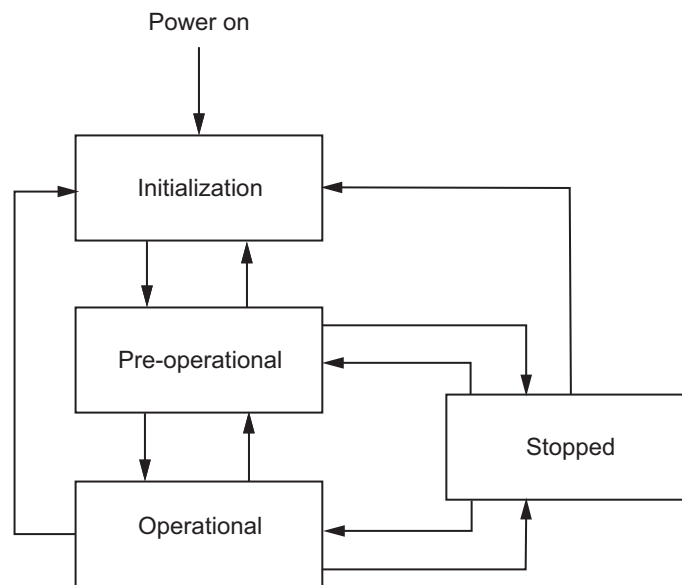
If the module is set as master, it will automatically be available, when the PLC has enabled data exchange. The module will control the secondary network, using the instructions sent in the control world from the PLC.

If the module is set as slave, it will wait for a request from the master of the secondary network before starting to exchange data. If it has not been enabled by the PLC to exchange data, it will return an error message to the secondary network.

6. CANopen Module Specification

6.1 NMT State Machine

The function of the Anybus X-gateway CANopen can be described as a state machine with four states.



State	Description
Initialization	When the power is switched on, the module starts initializing. The parameters are set to the so called power-on values, which are the default values or the latest stored values. If parameter values are stored from a previous configuration, these are used. If not, or if a <code>restore_default</code> command is issued, the parameters are reset to the default values according to the communication and device profile specifications.
Pre-operational	Once initialized, the module automatically enters the pre-operational state. The Anybus X-gateway CANopen can be configured, but no I/O data can be exchanged.
Operational	In the operational state all communication objects are active. I/O data is communicated according to the configuration made.
Stopped	All communication is stopped, except node guarding and heartbeat, if active. From this state any transition to another state is possible, depending on if a restart, reconfiguration or reset of the module is wanted.

The module changes states upon reception of a request from an NMT object, a hardware reset or Module Control Services locally initiated by application events.

6.2 Data Exchange

The Anybus X-gateway CANopen allows for the exchange of 512 bytes of data in each direction between the primary network and the X-gateway. The first two bytes (the first word) are allocated for a Control/Status word, decreasing the size of I/O data for CANopen to 510 bytes. The actual amount of data that can be exchanged is highly network dependent, see the section on configuration of the primary EtherNet/IP network in chapter 5.

The control and status words of the module are used by the master of the primary EtherNet/IP network to control the Anybus X-gateway CANopen and the secondary CANopen network, and to report the status back from this network. The rest of the I/O data area is available in the CANopen vendor specific object area for real-time data transfer using PDOs (Process Data Objects).

Note: The functionality of the Control/Status word differs depending on if the Anybus X-gateway CANopen interface is configured as a slave or as a master on the secondary network.