X-gateway Interface Addendum

CANopen Slave

Doc: HMSI-27-246, Rev: 2.00

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Important User Information

This document is intended to provide a good understanding of the functionality offered by the Interface described here.

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

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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.

Table of Contents

Appendix A   Technical Specification

P. About This Document

P.1. How To Use This Document

This document describes network specific features and procedures needed when operating the CANopen Slave Interface for the Anybus X-gateway. For general information and operating instructions for the Anybus X-gateway, consult the Anybus X-gateway User Manual.

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

P.2. Related Documents

Document	Author
Anybus X-gateway User Manual	HMS
Anybus-S CANopen Fieldbus Appendix	HMS
CANopen Slave Interface, Installation Sheet	HMS

P.3. Document History

Revision List

Revision	Date	Author	Chapter	Description
1.00	2004-04-06	PeP	All	First release
1.01	2005-09-01	Pal	(3)	Added chapter 3.
1.02	2006-01-11	PeP	1 A	Corrected LEDs Corrected pinout
1.10	2008-05-21	PeP	All	Major update
2.0	May 2014	SDa	All	New hardware and Anybus Configuration Manager

P.4. Conventions & Terminology

The following conventions are used throughout this document:

- Numbered lists provide sequential steps
- Bulleted lists provide information, not procedural steps
- The term 'X-gateway' refers to the Anybus X-gateway
- The term 'Slave Interface' refers to the CANopen Slave interface for the Anybus X-gateway.
- The term 'user manual' refers to the Anybus X-gateway User Manual.
- Hexadecimal values are written in the format NNNNh, where NNNN is the hexadecimal value.
- 16/32 bit values are generally stored in Motorola (big endian) format unless otherwise stated.

P.5. Support

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

1. About the CANopen Slave Interface

1.1. General Description

The CANopen Slave Interface for the Anybus X-gateway exchanges up to 512 bytes of data in each direction. The interface acts as a slave node, which means it can be accessed by a CANopen master, but it will not initiate communication by itself.

The interface exchanges data through two buffers as follows:

- **Input Buffer**

   This buffer holds data forwarded *from* the other network, i.e. data which can be read by the CANopen master.

- **Output Buffer**

   This buffer is forwarded *to* the other network, i.e. data which can be written by the CANopen master.
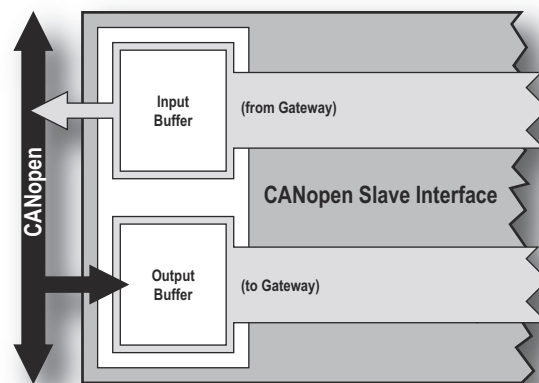
1.2. Features

- DS301 v4.02 compliant
- Galvanically isolated network electronics
- Up to 512 bytes of cyclic data in each direction (PDO)
- Up to 512 bytes of acyclic data in each direction (SDO)
- 10kbps... 1Mbit operation
- On-board configuration switches

1.3. External View

Front View

1.3.1. CANopen Status LEDs

LED	Color/State	Indication
Gateway Status	Consult the Gateway user manual for further details.	
RUN	On	Operational state
	Blinking	Pre-operational state
	Single flash	Stopped state
	Off	Device not powered
ERR	On	Bus off
	Single flash	Warning limit reached
	Double flash	Error Control Event
	Triple flash	Sync Error
	Off	No error
PWR	On	Device powered
	Off	Device not powered

1.3.2. Connectors and Switches

CANopen Connector

See A-19 "CANopen Connector Pinout".

Top-mounted Interface

Baud rate Switch

See 2-9 "Baud rate Configuration".

Node Address Switches

See 2-9 "Node Address Configuration".

Gateway Power Connector

Consult the Gateway user manual for further details.

Bottom-mounted Interface

USB Gateway Config Connector

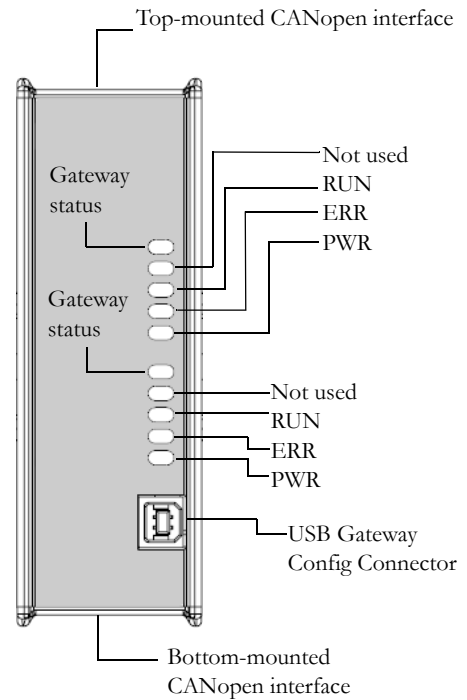Consult the Gateway user manual for further details.
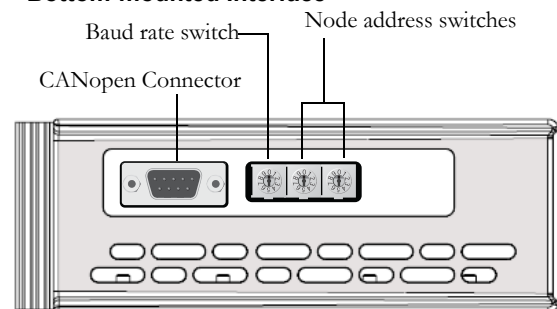
2. Installation and Configuration

2.1. Baud rate Configuration

The Slave interface allows baud rates from 10kbit/s to 1Mbit/s to be selected via an on-board switch. The switch is read once during startup, i.e. the gateway must be restarted for any changes to have effect.

Switch Value	Baud rate		Switch Value	Baud rate
0	(reserved)		5	250kbit/s
1	10kbit/s		6	500kbit/s
2	20kbit/s		7	800kbit/s
3	50kbit/s		8	1Mbit/s
4	125kbit/s		9	(reserved)

Example:

In this example, the baud rate will be 125kbit/s.
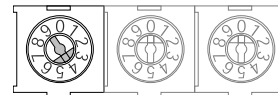
Note: Depending on if the Slave interface is top or bottom mounted, the orientation of the switches will be different.

2.2. Node Address Configuration

Each node on a CANopen network must be assigned a unique node address. Two switches are used to set the node address of the slave interface in decimal format. The switches are read once during startup, i.e. the gateway must be restarted for any changes to have effect.

x10 Switch	x1 Switch	Node Address		x10 Switch	x1 Switch	Node Address
0	0	(reserved)		5	0	50
0	1	1		5	1	51
0	2	2		5	2	52
...	...	...		...	...	...
4	8	48		9	8	98
4	9	49		9	9	99

Example:

In this example, the Modbus node ID will be 42.
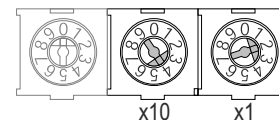
x10   x1

Note: Depending on if the Slave interface is top or bottom-mounted, the orientation of the switches will be different.

2.3. Gateway Config Interface

The X-Gateway and the CANopen interface may be configured by using the software tool **Anybus Configuration Manager** (ACM), which is available from www.anybus.com/support

When ACM is connected to the gateway via the USB configuration connector, the following settings are available:

Network Type	
Name	CANopen Slave
General	
Input Pdo Size (bytes)	20
Output Pdo Size (bytes)	20
Input Sdo Size (bytes)	0
Output Sdo Size (bytes)	0
Offline option	Clear ▼
Control word/Status word	Disable ▼
Fieldbus Specific	
Offline source	Standard ▼

See also...

- The Anybus X-gateway User Manual, for full details on using ACM.
- The online help in ACM, for further help on the available settings.
- 3-11 "Data Exchange"
- 4-13 "Object Dictionary Implementation"
- 4-15 "Manufacturer Specific Objects"

3. Data Exchange

3. General Information

On CANopen, the Input- and Output Data areas are represented as object entries in the manufacturer specific range (2000h...5FFFh). Separate object ranges are used for byte, word, and double-word access.

Time-critical I/O may be exchanged by means of Process Data Objects (PDO). The gateway supports up to 80 RPDOs and 80 TPDOs, each capable of carrying up to 8 bytes of data.

See also...

- 3-12 "Input Data (Gateway to CANopen)"3.0.1
- 3-12 "Output Data (CANopen to Gateway)"3.0.1
- 4-15 "Manufacturer Specific Objects"3.0.1

CANopen Slave Interface
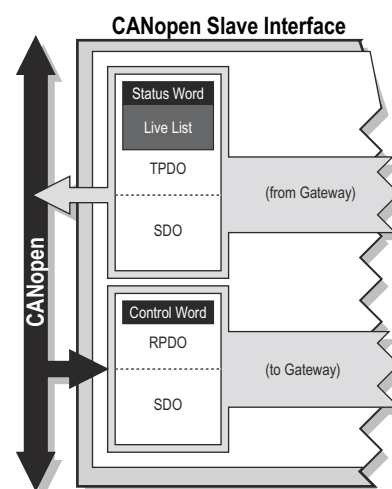
The gateway uses the following PDO mapping scheme by default:

RPDO no.	Default COB ID	Mapped to...	Notes
1	200h + Node ID	Output Data area, bytes 0... 7	Default Enabled
2	300h + Node ID	Output Data area, bytes 8... 15	
3	400h + Node ID	Output Data area, bytes 16... 23	
4	500h + Node ID	Output Data area, bytes 24... 31	
5... 80	0580h	-	Default Disabled

TPDO no.	Default COB ID	Mapped to...	Notes
1	180h + Node ID	Input Data area, bytes 0... 7	Default Enabled
2	280h + Node ID	Input Data area, bytes 8... 15	
3	380h + Node ID	Input Data area, bytes 16... 23	
4	480h + Node ID	Input Data area, bytes 24... 31	
5... 80	0500h	-	Default Disabled

Note: The Slave Interface will only map as many PDOs as required to hold the specified configuration.

3.0.1. Input Data (Gateway to CANopen)

Depending on the actual gateway configuration and how it has been set up to operate, parts of the data produced by the CANopen Slave Interface may be used to represent status information (i.e. Status Word, Live List etc.).
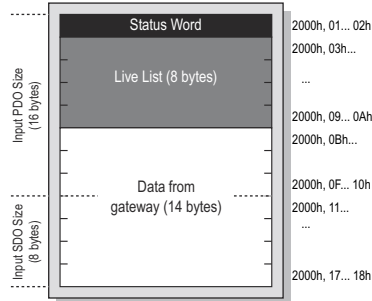
Example A:
Input PDO Size:16
Input SDO Size:8
Live List:Enabled
Control & Status Word:Enabled
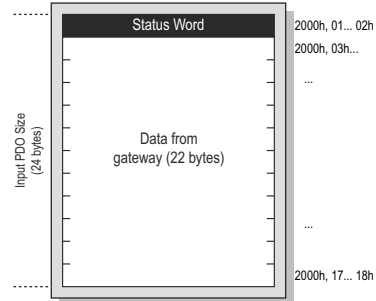
Example B:
Input PDO Size:24
Input SDO Size:0
Live List:Disabled
Control & Status Word:Enabled

Note: The Live List is only available on master-slave gateway configurations.

See also...

- 4-12 "Input Buffer"

3.0.2. Output Data (CANopen to Gateway)

Depending on the actual gateway configuration and how it has been set up to operate, the first two bytes consumed by the CANopen Slave Interface may be interpreted as control information (i.e. the Control Word).
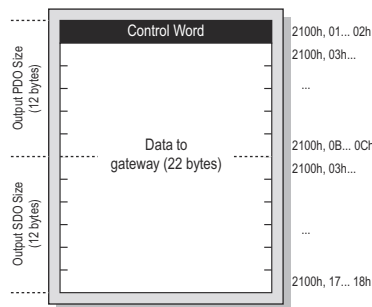
Example A:
Output PDO Size:12
Output SDO Size:12
Control & Status Word:Enabled
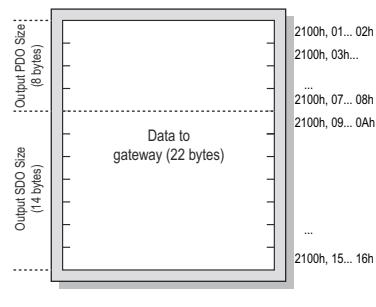
Example B:
Output PDO Size:8
Output SDO Size:14
Control & Status Word:Disabled

Note: The exact interpretation of the Control Word depends on the actual gateway configuration. Consult the main User Manual and X-gateway Interface Appendix for the other network interface for further information.

See also...

- 4-13 "Output Buffer"

4. Object Dictionary Implementation

4.1. Standard Objects

4.1.1. General

The standard object dictionary is implemented according to the DS301 specification (v4.02) from CiA (CAN in Automation).

4.1.2. Object Entries

Index	Object Name	Sub-Index	Description	Type	Access	Notes
1000h	Device Type	00h	Device Type	U32	RO	0000 0000h (No profile)
1001h	Error register	00h	Error register	U8	RO	-
1003h	Pre-defined error field	00h	Number of errors	U8	RW	-
		01h...05h	Error field	U32	RO	-
1005h	COB-ID Sync	00h	COB-ID Sync	U32	RW	-
1008h	Manufacturer device name	00h	Manufacturer device name	Visible string	RO	-
1009h	Manufacturer hardware version	00h	Manufacturer hardware version	Visible string	RO	Current hardware revision
100Ah	Manufacturer software version	00h	Manufacturer software version	Visible string	RO	Current software revision
100Ch	Guard time	00h	Guard time	U16	RW	-
100Dh	Life time factor	00h	Life time factor	U8	RW	-
1010h	Store Parameters[a]	00h	Largest sub index supported	U8	RO	01h
		01h	Store all parameters	U32	RW	-
1011h	Restore parameters	00h	Largest sub index supported	U8	RO	01h
		01h	Restore all default parameters	U32	RW	-
1014h	COB ID EMCY	00h	COB ID EMCY	U32	RO	-
1016h	Consumer Heartbeat Time	00h	Number of entries	U8	RO	01h
		01h	Consumer Heartbeat Time	U32	RW	Node ID + Heartbeat Time. Value must be a multiple of 1ms.
1017h	Producer Heartbeat Time	00h	Producer Heartbeat Time	U16	RW	-
1018h	Identity object	00h	Number of entries	U8	RO	04h
		01h	Vendor ID	U32	RO	-
		02h	Product Code	U32	RO	-
		03h	Revision Number	U32	RO	-
		04h	Serial Number	U32	RO	-
1400h ... 144Fh	Receive PDO parameter	00h	Largest sub-index supported	U8	RO	02h
		01h	COB ID used by PDO	U32	RW	-
		02h	Transmission type	U8	RW	-

Index	Object Name	Sub-Index	Description	Type	Access	Notes
1600h ... 164Fh	Receive PDO mapping	00h	No. of mapped application objects in PDO	U8	RW	-
		01h	Mapped object #1	U32	RW	-
		02h	Mapped object #2	U32	RW	-
		03h	Mapped object #3	U32	RW	-
		04h	Mapped object #4	U32	RW	-
		05h	Mapped object #5	U32	RW	-
		06h	Mapped object #6	U32	RW	-
		07h	Mapped object #7	U32	RW	-
		08h	Mapped object #8	U32	RW	-
1800h ... 184Fh	Transmit PDO parameter	00h	Largest sub-index supported	U8	RO	05h
		01h	COB ID used by PDO	U32	RW	-
		02h	Transmission type	U8	RW	-
		03h	Inhibit time	U16	RW	-
		05h	Event Timer (ms)	U16	RW	-
1A00h ... 1A4Fh	Transmit PDO mapping	00h	No. of mapped application objects in PDO	U8	RW	-
		01h	Mapped object #1	U32	RW	-
		02h	Mapped object #2	U32	RW	-
		03h	Mapped object #3	U32	RW	-
		04h	Mapped object #4	U32	RW	-
		05h	Mapped object #5	U32	RW	-
		06h	Mapped object #6	U32	RW	-
		07h	Mapped object #7	U32	RW	-
		08h	Mapped object #8	U32	RW	-

a. Only relevant for communication parameters

4.2. Manufacturer Specific Objects

4.2.1. Input Buffer, Byte Access

Index	Object Name	Sub-Index	Description	Type	Access	Notes
2000h	Input area	00h	No. of entries	U8	RO	129
		01h	Input area byte #0	U8	RO	-
		02h	Input area byte #1			
		...	...			
		80h	Input area byte #127			
2001h	Input area	00h	No. of entries	U8	RO	129
		01h	Input area byte #128	U8	RO	-
		02h	Input area byte #129			
		...	...			
		80h	Input area byte #255			
...	...	...	...			
2003h	Input area	00h	No. of entries	U8	RO	129
		01h	Input area byte #384	U8	RO	-
		02h	Input area byte #385			
		...	...			
		80h	Input area byte #511			
2004h ... 200Fh	-	-	-	-	-	(reserved)

4.2.2. Input Buffer, Word Access

Index	Object Name	Sub-Index	Description	Type	Access	Notes
2020h	Input area	00h	No. of entries	U8	RO	65
		01h	Input area word #0	U16	RO	-
		02h	Input area word #1			
		...	...			
		40h	Input area word #63			
2021h	Input area	00h	No. of entries	U8	RO	65
		01h	Input area word #64	U16	RO	-
		02h	Input area word #65			
		...	...			
		40h	Input area word #127			
...	...	...	...			
2023h	Input area	00h	No. of entries	U8	RO	65
		01h	Input area word #192	U16	RO	-
		02h	Input area word #193			
		...	...			
		40h	Input area word #255			
2024h ... 202Fh	-	-	-	-	-	(reserved)

4.2.3. Input Buffer, Double Word Access

Index	Object Name	Sub-Index	Description	Type	Access	Notes
2040h	Input area	00h	No. of entries	U8	RO	33
		01h	Input area dword #0	U32	RO	-
		02h	Input area dword #1			
		...	...			
		20h	Input area dword #31			
2041h	Input area	00h	No. of entries	U8	RO	33
		01h	Input area dword #32	U32	RO	-
		02h	Input area dword #33			
		...	...			
		20h	Input area dword #63			
...	...	...	...			
2043h	Input area	00h	No. of entries	U8	RO	33
		01h	Input area dword #96	U32	RO	-
		02h	Input area dword #97			
		...	...			
		20h	Input area dword #127			
2044h ... 204Fh	-	-	-	-	-	(reserved)

4.2.4. Output Buffer, Byte Access

Index	Object Name	Sub-Index	Description	Type	Access	Notes
2100h	Output area	00h	No. of entries	U8	RO	129
		01h	Output area byte #0	U8	R/W	-
		02h	Output area byte #1			
		...	...			
		80h	Output area byte #127			
2101h	Output area	00h	No. of entries	U8	RO	129
		01h	Output area byte #128	U8	R/W	-
		02h	Output area byte #129			
		...	...			
		80h	Output area byte #255			
...	...	...	...			
2103h	Output area	00h	No. of entries	U8	RO	129
		01h	Output area byte #384	U8	R/W	-
		02h	Output area byte #385			
		...	...			
		80h	Output area byte #511			
2104h ... 210Fh	-	-	-	-	-	(reserved)

4.2.5. Output Buffer, Word Access

Index	Object Name	Sub-Index	Description	Type	Access	Notes
2120h	Output area	00h	No. of entries	U8	RO	65
		01h	Output area word #0	U16	R/W	-
		02h	Output area word #1			
		...	...			
		40h	Output area word #63			
2121h	Output area	00h	No. of entries	U8	RO	65
		01h	Output area word #64	U16	R/W	-
		02h	Output area word #65			
		...	...			
		40h	Output area word #127			
...	...	...	...			
2123h	Output area	00h	No. of entries	U8	RO	65
		01h	Output area word #192	U16	R/W	-
		02h	Output area word #193			
		...	...			
		40h	Output area word #255			
2124h ... 212Fh	-	-	-	-	-	(reserved)

4.2.6. Output Buffer, Double Word Access

Index	Object Name	Sub-Index	Description	Type	Access	Notes
2140h	Output area	00h	No. of entries	U8	RO	33
		01h	Output area dword #0	U32	R/W	-
		02h	Output area dword #1			
		...	...			
		20h	Output area dword #31			
2141h	Output area	00h	No. of entries	U8	RO	33
		01h	Output area dword #32	U32	R/W	-
		02h	Output area dword #33			
		...	...			
		20h	Output area dword #63			
...	...	...	...			
2143h	Output area	00h	No. of entries	U8	RO	33
		01h	Output area dword #96	U32	R/W	-
		02h	Output area dword #97			
		...	...			
		20h	Output area dword #127			
2144h ... 214Fh	-	-	-	-	-	(reserved)

4.2.7. Anybus Status & Diagnostics

Index	Object Name	Sub-Index	Type	Access	Notes
2200h	Bus State Indicator	00h	U8	RO	Reflects the actual state of the bus. 1: Bus running 2: Bus error
2205h	Module State Indicator	00h	U8	RO	Reflects the state of the slave interface: 1: Init error 2: Prepared 3: Pre-operational 4: Operational
2210h ... 2263h	-	-	-	-	(reserved)
2800h	Bus-off timeout	00h	U16	R/W	Number of ms needed before the node re-initiates and enters pre-operational. (Default = 2000ms)

A. Technical Specification

A.1. CANopen Interface Details

- Cable: CANopen specific, twisted pair
- Isolation: Galvanically isolated bus electronics
- Baud rates: 10kbit/s - 1Mbit/s (specified via on-board switches)
- Node ID Range: 1 - 99 (specified via on-board switches)
- Max. Total I/O: 512 bytes
- Max. PDO data: 512 bytes
- Max. SDO data: 512 bytes

A.2. CANopen Connector Pinout

#	Signal
housing	CAN_SHLD
1	-
2	CAN_L
3	CAN_GND
4	-
5	CAN_SHLD
6	CAN_GND
7	CAN_H
8	-
9	(reserved)