Anybus® CompactCom™ B40 Modbus Serial

PROFIBUS

NETWORK GUIDE

SCM-1202-161 1.0 en-US ENGLISH

HMS Connecting Devices™

Important User Information

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1 Preface

1.1 About this Document

This document is intended to provide a good understanding of the functionality offered by the Anybus CompactCom B40 Modbus Serial - PROFIBUS.

The reader of this document is expected to be familiar with high level software design and communication systems in general. The information in this network guide should normally be sufficient to implement a design. However if advanced PROFIBUS specific functionality is to be used, in-depth knowledge of PROFIBUS networking internals and/or information from the official PROFIBUS specifications may be required. In such cases, the persons responsible for the implementation of this product should either obtain the PROFIBUS specification to gain sufficient knowledge or limit their implementation in such a way that this is not necessary.

For additional information, please visit the support website at www.anybus.com/support.

1.2 Related Documents

Document	Author	Document ID
Anybus CompactCom 40 Software Design Guide	HMS	HMSI-216–125
Anybus CompactCom B40 Design Guide	HMS	HMSI-27-230
Anybus CompactCom Host Application Implementation Guide	HMS	HMSI-27-334
Anybus CompactCom 40 PROFIBUS Network Guide	HMS	HMSI-27-210
PROFIBUS Profile Guidelines Part 1: Identification & Maintenance Functions	PNO	-
Specification for PROFIBUS Device Description and Device Integration Volume 1: GSD (order. no. 2.122)	PNO	-

1.3 Document History

Version	Date	Description
1.0	2020-06-30	First release

1.4 Document Conventions

Numbered lists indicate tasks that should be carried out in sequence:

1. First do this
2. Then do this

Bulleted lists are used for:

- Tasks that can be carried out in any order
- Itemized information

► An action

→ and a result

User interaction elements (buttons etc.) are indicated with bold text.

```
Program code and script examples
```

Cross-reference within this document: *Document Conventions, p. 3*

External link (URL): www.hms-networks.com

WARNING
Instruction that must be followed to avoid a risk of death or serious injury.

Caution
Instruction that must be followed to avoid a risk of personal injury.

Instruction that must be followed to avoid a risk of reduced functionality and/or damage to the equipment, or to avoid a network security risk.

Additional information which may facilitate installation and/or operation.

1.5 Document Specific Conventions

- The terms “Anybus” or “module” refers to the Anybus CompactCom module.
- The terms “host” or “host application” refer to the device that hosts the Anybus.
- Hexadecimal values are written in the format NNNNh or 0xNNNN, where NNNN is the hexadecimal value.
- A byte always consists of 8 bits.
- All dimensions in this document have a tolerance of ±0.10 mm unless otherwise stated.
- Outputs are TTL compliant unless otherwise stated.
- Signals which are “pulled to GND” are connected to GND via a resistor.
- Signals which are “pulled to 3V3” are connected to 3V3 via a resistor.
- Signals which are “tied to GND” are directly connected to GND,
- Signals which are “tied to 3V3” are directly connected to 3V3.

1.5.1 Pin Types

The pin types of the connectors are defined in the table below. The pin type may be different depending on which mode is used.

Pin type	Definition
I	Input
O	Output
I/O	Input/Output (bidirectional)
OD	Open Drain
Power	Pin connected directly to module power supply, GND or 3V3

1.6 Trademark Information

Anybus® is a registered trademark of HMS Industrial Networks AB.

All other trademarks are the property of their respective holders.

2 About the Anybus CompactCom B40 Modbus Serial - PROFIBUS

2.1 General Information

The Anybus CompactCom B40 Modbus Serial - PROFIBUS provides a quick and simple solution to sending process data easy and efficiently between a Modbus RTU network and a PROFIBUS network.

The Anybus CompactCom B40 Modbus Serial - PROFIBUS share footprint and electrical interface with the other members of the product family. The product has two connectors that provides communication with the host application board. The host application connector provides an interface between the host application (Modbus RTU) and the Anybus CompactCom, while the network connector provides access to PROFIBUS. The Anybus CompactCom acts as a Modbus RTU slave on the host application side.

All dimensions expressed in this document are stated in millimeters and have a tolerance of ±0.10 mm unless stated otherwise.

For general information about other products using the Anybus CompactCom 40 platform, go to www.anybus.com/support.

> **!** This 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.
>
> 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.

2.2 Features

- Supports PROFIBUS DP-V1 and DP-V0
- Automatic baud rate detection
- Galvanic isolation between the host application and the industrial network available if used with the CompactCom B40 connector board
- Max. read process data: 244 bytes
- Max. write process data: 244 bytes
- Max. process data (read + write, in bytes): 488 bytes
- Set Slave Address support
- Device identity customization

> **!** All Anybus CompactCom 40 Modbus Serial, where the host is running an example application, will be precertified for network conformance. This is done to ensure that the final product can be certified, but it does not necessarily mean that the final product does not require recertification. Contact HMS Industrial Networks for further information.

2.3 Overview

The picture below shows the data flow in the Anybus CompactCom B40 Modbus Serial - PROFIBUS. The Modbus master sets up the Modbus RTU communication, and the Anybus CompactCom maps the process data to the industrial network/fieldbus.

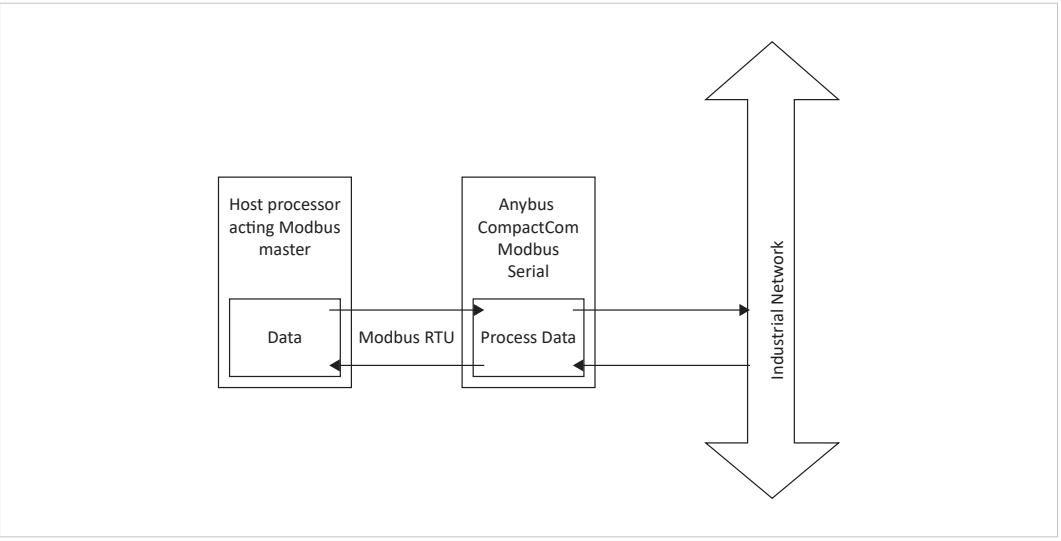


Fig. 1

3 Fieldbus Conformance and Certification

3.1 Fieldbus Conformance Notes

Using the GSD file supplied by HMS Industrial Networks AB, the module is precertified for network compliance. However, since parameter changes which require deviations from the standard GSD file are necessary, a recertification is advised, though not mandatory.

For further information, please contact HMS Industrial Networks AB.

3.2 Certification

The following items are necessary to perform to obtain a certification:

Change PNO Ident Number:

The PNO Ident Number can be requested from PNO (PROFIBUS Nutzerorganisation e.V.). Replace the default PNO Ident Number with this. This is done by implementing the PROFIBUS DP-V1 object (FDh), instance #1, attribute #1, and returning the PNO Ident Number when receiving a Get_Attribute request.

Add Node Address Information:

If the host application does not set a valid node address by messaging the Network Configuration Object (04h), instance 1 (“Node Address”), the PROFIBUS Set Slave Address (SSA) service is enabled.

If SSA functionality is enabled, it is mandatory to provide a mechanism for resetting the node address to its default value (126). This is because it is possible to lock the value from the network side. See *Set Slave Address, p. 13* for more information.

Change Manufacturer Id, Order Id, serial number and revision information:

This is done by implementing the PROFIBUS DP-V1 object (FDh), instance #1, attributes #8 - #12, and returning the corresponding attributes when receiving a Get_Attribute request.

The Manufacturer Id can be requested from PNO (PROFIBUS Nutzerorganisation e.V.).

Modify the GSD file:

Modify the PROFIBUS DP-V1 GSD file so that it corresponds to the changes made above.

In addition, all modules used in the application must be defined in the GSD file. For more information, see *GSD File Customization, p. 15*.

4 Basic Operation

4.1 General Information

4.1.1 Software Requirements

No additional network support code needs to be written in order to support the Anybus CompactCom B40 Modbus Serial - PROFIBUS, however certain restrictions must be taken into account:

- The order in which ADIs are mapped to Process Data is significant and must be replicated in the PROFIBUS master when setting up the network communication (i.e. the I/O modules must be set up in the same order, and with the same size and direction, as the mapped ADIs). If not taken into account, the network connection establishment will fail and no communication will take place.
- The use of advanced PROFIBUS specific functionality may require in-depth knowledge in PROFIBUS networking internals and/or information from the official PROFIBUS specification (IEC 61158). In such cases, the ones responsible for the implementation of this product should either obtain the PROFIBUS specification to gain sufficient knowledge or limit their implementation is such a way that this is not necessary.

4.1.2 Support for DP-V1 and DP-V0

The Anybus CompactCom PROFIBUS module supports both DP-V1 and DP-V0. At delivery the default settings give full DP-V1 functionality. However the PROFIBUS network master can choose to limit the functionality to DP-V0 via the parametrization telegrams during startup.

4.1.3 Electronic Data Sheet (GSD)

On PROFIBUS, the characteristics of a device is stored in an ASCII data file with the suffix GSD. This file is used by the PROFIBUS configuration tool when setting up the network.

HMS Industrial Networks AB provides an example GSD file, which corresponds to the default settings in the module. However, due to the flexible nature of the Anybus CompactCom concept, it is possible to alter the behavior of the product in a way that invalidates the example GSD file.

The example GSD file supports full DP-V1 functionality, another GSD file is needed if the module is to run only DP-V0 functionality.

See also...

- *Fieldbus Conformance Notes, p. 7*
- *GSD File Customization, p. 15*

4.2 Communication Settings

Node Address:

See the Anybus CompactCom 40 PROFIBUS Network Guide for more information

Baud Rate:

The baud rate is detected automatically by the module. The following baud rates are supported:

- 9.6 kbps
- 19.2 kbps
- 45.45 kbps
- 93.75 kbps
- 187.5 kbps
- 500 kbps
- 1.5 Mbps
- 3 Mbps
- 6 Mbps
- 12 Mbps

4.3 Startup and Identity Customization

To customize the identity of the Anybus CompactCom (e.g. Vendor ID, Product Code, etc.), Virtual Attributes are used.

This information will be reflected in the Identification and Maintenance record 0 (I&M0).

The most common customizations will be described here. For more detailed information, see the related documents listed in the beginning of this document.

Setting up the virtual attributes in the Anybus CompactCom can be accomplished in two different ways.

- Using the user-defined Modbus function code (Function code 70).

  The use of Function code 70 can be included in the Modbus master. Hence the CompactCom does not need to be preprogrammed before mounting it in the host application.

- Using the Anybus Virtual Attributes Manager.

  The Virtual Attributes Manager is recommended for use during development and for low volume production, since manual user operations are needed for every Anybus CompactCom that shall be programmed.

Once the virtual attributes are written to the Anybus CompactCom, they are saved in non-volatile memory. It is not necessary to write the virtual attributes at each startup.

4.3.1 Virtual Attributes with Specific Modbus Function Code 70

With Modbus function code 70, the Modbus master has access to the Anybus CompactCom internal messaging protocol. This means that all attributes within the Anybus CompactCom are potentially accessible.

When writing the virtual attributes to the Anybus CompactCom, the Anybus object, Object 01h, Instance 1, Attribute 17 is used. All information relevant for the basic virtual attributes will be covered here. For more information, refer to the related documents section in this document.

The example shows example values to the basic virtual attributes:

Virtual Attribute	Example Value
Ident Number:	0x1815
Manufacturer ID:	0x010C
Order ID:	Order ID
Revision Counter:	1
Serial Number:	0x12345678
Firmware Version:	1.2.3
Hardware Version:	3

To set the virtual attributes in the Anybus CompactCom to these values, using the Modbus function 70, create the request below:

Modbus function 70 Request

	Value	Note
Modbus Address	0xXX	
Function Code	0x46	FC70
Command	0x42	Set_Attribute
Object	0x01	Anybus Object
Instance	0x01	
	0x00	
Ext0	0x11	Attribute 17
Ext1	0x00	Not used
Data Size	0x41	The data size in this example is 65 bytes
	0x00	
Data	0xFD 0x01 0x00 0x01 0x02 0x00 0x15 0x18 0xFD 0x01 0x00 0x08 0x02 0x00 0x0C 0x01 0xFD 0x01 0x00 0x09 0x08 0x00 0x4F 0x72 0x64 0x65 0x72 0x20 0x49 0x44 0xFD 0x01 0x00 0x0D 0x02 0x00 0x01 0x00 0xFF 0x01 0x00 0x03 0x04 0x00 0x78 0x56 0x34 0x12 0xFF 0x01 0x00 0x0A 0x03 0x00 0x01 0x02 0x03 0xFF 0x01 0x00 0x0B 0x02 0x00 0x03 0x00	Ident Number Manuf. ID Order ID Revision Cnt Serial Number Firmware Ver. Hardware Ver.
CRC	0xXX	CRC-16
	0xXX	

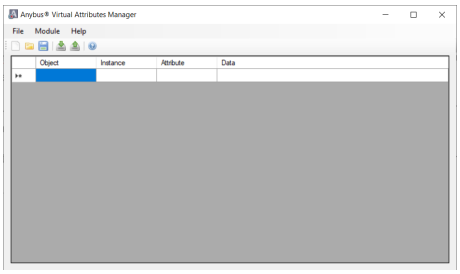
Response

	Value	Note
Modbus Address	0xXX	
Function Code	0x46	FC70
Command	0x02	Set_Attr_Resp
Object	0x01	Anybus Object
Instance	0x01	
	0x00	
Ext0	0x11	Attribute 17
Ext1	0x00	Not used
Data Size	0x00	
	0x00	
CRC	0xXX	CRC-16
	0xXX	

Requests with a size larger than 244 bytes will return Modbus exception code ILLEGAL DATA VALUE.

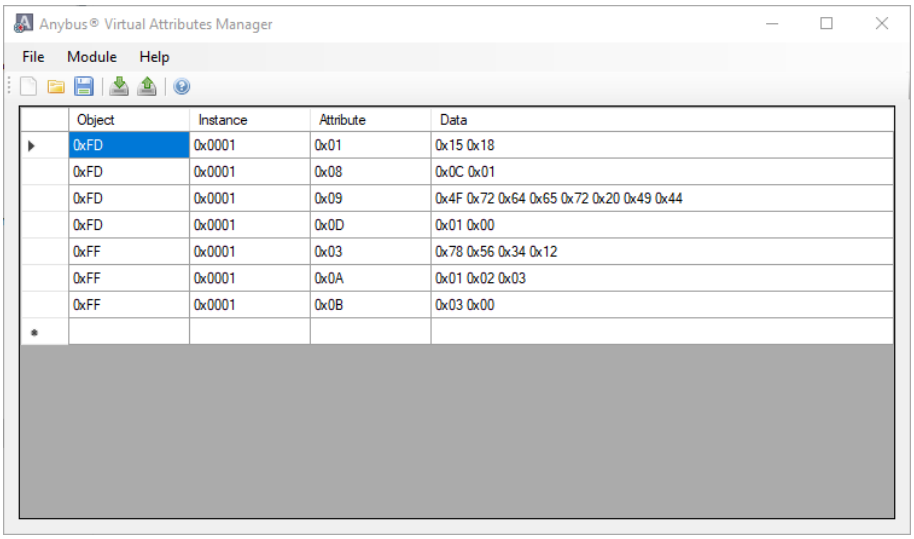
4.3.2 Virtual Attributes with Anybus Virtual Attributes Manager

1. Start the Anybus Virtual Attributes Manager

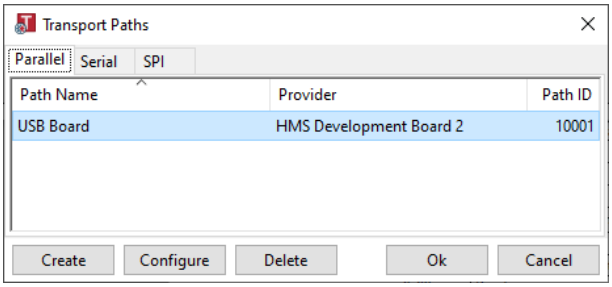


2. Enter the virtual attributes data for the attributes needed. The example below is setting up the attributes with the following values:

Virtual Attribute	Example Value
Ident Number:	0x1815
Manufacturer ID:	0x010C
Order ID:	Order ID
Revision Counter:	1
Serial Number:	0x12345678
Firmware Version:	1.2.3
Hardware Version:	3



3. Mount the Anybus CompactCom to the USB starterkit board.
4. Select Module->Download and select the correct Transport Path to your USB board.



5. The virtual attributes will be programmed and saved in non-volatile memory.

4.4 Set Slave Address

The module supports the Set Slave Address service, which enables a master or configuration tool to set the node address from the network.

This service features a flag which specifies whether or not it is allowed to change the device address from the network again at a later stage. If the service is accepted, the module saves the value of this flag in nonvolatile memory; the only way to restore it again is by manually setting a valid address (1-126), and then reverting back to SSA state (setting the address to 126 or higher). This behavior is mandatory for the application to pass PROFIBUS network certification.

It is possible to disable support for this service by implementing the SSA Enabled attribute in the PROFIBUS DP-V1 Object (FDh). In such a case, a new GSD file must be created, and fieldbus re-certification is necessary.

4.5 Network Data Exchange

4.5.1 Process Data

Modbus Register	Content	PROFIBUS Information
0x5100	Data Type 0x0004: UINT8 (Default) 0x0005: UINT16	-
0x5102	No of Write Parameters	Max 244 bytes
0x5103	No of Read Parameters	Max 244 bytes
0x0000 – (Depending on Data type and No of Parameters)	Write Process Data	Parameters are packed in PROFIBUS slots. PROFIBUS slots contain up to a maximum of 64 parameters (UINT8/UINT16) For examples, see *Mapping between Modbus Registers and PROFIBUS Slots, p. 14*.
0x1000 – (Depending on Data type and No of Parameters)	Read Process Data	Parameters are packed in PROFIBUS slots. PROFIBUS slots contain up to a maximum of 64 parameters (UINT8/UINT16) For examples, see *Mapping between Modbus Registers and PROFIBUS Slots, p. 14*.
0x5004	Network Type	0x0005

4.5.2 Mapping between Modbus Registers and PROFIBUS Slots

Example 1 (From GSD Example)

Data type: UINT16

No of Write Parameters: 100

No of Read Parameters: 3

PROFIBUS Slot	Modbus Register	Description
1	0x0000 - 0x0039	64 words
2	0x0040 - 0x0063	36 words
3	0x1000 - 0x1002	3 words

Example 2 (From GSD Example)

Data type: UINT8

No of Write Parameters: 66

No of Read Parameters: 10

PROFIBUS Slot	Modbus Register	Description
1	0x0000 - 0x0019	64 bytes
2	0x0020 - 0x0020	2 bytes
3	0x1000 - 0x1004	10 bytes

A GSD File Customization

A.1 General

The GSD file specifies the characteristics of the device, and is used by the PROFIBUS configuration tool when setting up the network.

HMS provides an example GSD file, which corresponds to the default settings in the module. However, due to the flexible nature of the Anybus CompactCom concept, it is possible to alter the behavior of the product in a way that invalidates the example GSD file. In such case, a custom GSD file must be created, and fieldbus recertification is necessary.

This chapter is intended to provide a brief overview of the GSD entries that may need alteration, and how they correspond to settings within the Anybus module. Some of the entries should not be changed, and the others are divided in the same way as the objects and object attributes, into the groups Basic and Extended.

For further information, consult the Specification for PROFIBUS Device Description and Device Integration Volume 1: GSD (order. no. 2.122).

The user is expected to have sufficient knowledge in the PROFIBUS networking system to understand the concepts involved when performing the changes specified in this chapter. In case of uncertainties, send the customized GSD file to HMS for verification.

A.2 Device Identification

A.2.1 General

By default, the module will appear as a generic Anybus implementation (“Anybus CompactCom 40 DPV1”) from HMS Industrial Networks (PROFIBUS ident no. 1815h).

However, the identity of the module can be customized to appear as a vendor specific implementation. See *Startup and Identity Customization, p. 10* for more information.

Contact PNO to obtain a unique Ident Number.

A.2.2 GSD File Entries

```
; Device identification
Vendor_Name         = "<vendor>"
Model_Name          = "<product>"
Revision            = "<prod_rev>"
Ident_Number        = <ident_no>
Protocol_Ident      = 0                ; DP protocol
Station_Type        = 0                ; Slave device
FMS_supp            = 0                ; FMS not supported
Slave_Family        = 0                ; General device
Hardware_Release    = "Version <hw_rev>"
Software_Release    = "Version <sw_rev>"
```

Basic

Setting	Description
<vendor>	Vendor name as text (e.g. “HMS Industrial Networks”)
<product>	Product name as text (e.g. “Anybus CompactCom DPV1”)
<prod_rev>	Product revision (major.minor) (e.g. “1.01”)
<ident_no>	PNO Ident Number in HEX. Written as 0xNNNN, where NNNN is the hexadecimal value.
<hw_rev>	Hardware revision (major.minor) (e.g. “Version 1.00”)
<sw_rev>	Software revision (major.minor) (e.g. “Version 1.00”)

A.3 I/O Related Keywords

A.3.1 GSD File Entries

```
; I/O related keywords
Modular_Station = 0
Modul_Offset = 1
```

Basic

Setting	Unit	Description
<module>	bytes	
<input>	bytes	
<output>	bytes	
<total>	bytes	

A.4 Definition of Modules

A.4.1 GSD File Entries

```
; Definition of modules
Module = "<name>" <identifier>
<module_id>
EndModule
```

Basic

Setting	Description
<name>	Name of module
<identifier>	Configuration Identifier; hexadecimal value (written as NNh where NN is the hexadecimal value) specifying the properties of the module (see below).
<module_id>	Decimal number, must be unique for each module. Max. 16 bits when converted to hexadecimal.

A.4.2 Identifier Explanation

The module will calculate the expected configuration as follows:

First Configuration Identifier for Each Slot

Header	
Bit 0 - 3:	Length of vendor specific data 0000 = No data 0001 - 1110 = 1 - 14 bytes 1111 = No data
Bit 4 - 5:	Special format (00)
Bit 6 - 7:	Input/output 00 = No I/O data specification follows 01 = One byte I/O data specification for input follows 10 = One byte I/O data specification for output follows 11 = Two bytes I/O data specification follows (**not valid**)

I/O Data Specification	
Bit 0 - 5:	Data length (max 64 elements) 000000 = 1 byte/word 111111 = 64 bytes/words
Bit 6:	Size 0 = Byte 1 = Word
Bit 7:	Data consistency 0 = Byte/word 1 = Whole length (The module will set this bit to 1 if the module only contains one ADI or only one ADI input and output)

Vendor Specific Data	
Byte 0: Bit 7:	More cfg follows
Byte 1 - 2:	ADI number

Example 1 in the GSD File

The application maps the following parameters to process data:

Data type: UINT16

No of Write Parameters: 100

No of Read Parameters: 3

Slot Number	Direction	Data Type	Number of Elements
1	Input	UINT16	64
2	Input	UINT16	36
3	Output	UINT16	3

The expected configuration will then look as follows:

```
0x43, 0xFF, 0x00, 0x01, 0x00, 0x43, 0xE3, 0x00,
0x02, 0x00, 0x83, 0xC2, 0x00, 0x03, 0x00
```

GSD Entries

```
;
;===========================================================================
;
;=== Example of 100 parameters input/3 parameters output (Data type:
UINT16) ===
;
;===========================================================================
;
Module = "Input 100 words/Output 3 words" 0x43,0xFF,0x00,0x01,0x00,
0x43,0xE3,0x00,0x02,0x00,  0x83,0xC2,0x00,0x03,0x00
1
EndModule
```

B Technical Specification

B.1 Front View

B.1.1 Operation Mode

LED State	Indication	Comments
Off	Not online / No power	-
Green	Online, data exchange	-
Flashing Green	Online, clear	-
Flashing Red (1 flash)	Parameterization error	-
Flashing Red (2 flashes)	PROFIBUS Configuration error	-

B.1.2 Status

LED State	Indication	Comments
Off	Not initialized	Anybus state = SETUP or NW_INIT
Green	Initialized	Anybus module has left the NW_INIT state
Flashing Green	Initialized, diagnostic event(s) present	Extended diagnostic bit is set
Red	Exception error	Anybus state = EXCEPTION

B.2 Functional Earth (FE) Requirements

In order to ensure proper EMC behavior, the module must be properly connected to functional earth via the FE pad / FE mechanism described in the general Anybus CompactCom B40 User Manual.

HMS Industrial Networks AB does not guarantee proper EMC behavior unless these FE requirements are fulfilled.

B.3 Power Supply

B.3.1 Supply Voltage

The module requires a regulated 3.3V power source as specified in the general Anybus CompactCom M40 Hardware Design Guide.

B.3.2 Power Consumption

The Anybus CompactCom B40 Modbus Serial - PROFIBUS is designed to fulfil the requirements of a Class A module. For more information about the power consumption classification used on the Anybus CompactCom platform, consult the general Anybus CompactCom B40 User Manual.

At 12 Mbit the current hardware design consumes up to 200 mA. This value is valid under the condition that no current is being drawn from bus connector pin 6 (+5 V termination power).

It is strongly advised to design the power supply in the host application based on the power consumption classifications described in the general Anybus CompactCom Hardware Design Guide, and not on the exact power requirements of a single product.

In line with HMS policy of continuous product development, we reserve the right to change the exact power requirements of this product without prior notification. Note however that in any case, the Anybus CompactCom B40 Modbus Serial - PROFIBUS will remain as a Class A module.

B.4 Environmental Specification

Consult the Anybus CompactCom B40 User Manual for further information.

B.5 EMC Compliance

Consult the Anybus CompactCom B40 User Manual for further information.

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