Network Guide

Anybus® CompactCom 40 CC-Link

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Connecting Devices™

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HMS Industrial Networks
Mailing address: Box 4126, 300 04 Halmstad, Sweden
Visiting address: Stationsgatan 37, Halmstad, Sweden

E-mail: info@hms-networks.com
www.anybus.com

Important User Information

This document is intended to provide a good understanding of the functionality offered by Anybus CompactCom 40 CC-Link. The document only describes the features that are specific to Anybus CompactCom 40 CC-Link. For general information regarding Anybus CompactCom 40, consult the Anybus CompactCom 40 design guides.

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 CC-Link specific functionality is to be used, in-depth knowledge of CC-Link networking internals and/or information from the official CC-Link specifications may be required. In such cases, the persons responsible for the implementation of this product should either obtain the CC-Link specification to gain sufficient knowledge or limit their 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.

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P. About This Document

For more information, documentation etc., please visit the HMS website, 'www.anybus.com'.

P.1 Related Documents

Document	Author
Anybus CompactCom 40 Software Design Guide	HMS
Anybus CompactCom 40 Hardware Design Guide	HMS
Anybus CompactCom 40 Software Driver User Guide	HMS
CC-Link Remote Device Station Conformance Test specification (publication BAP-C0401-012-F)	CLPA
CC-Link Specification (Profile) (publication BAP-05028-H)	CLPA
CC-Link Family System Profile (CSP+) Creation Guideline (publication BCN89000-0756-A)	CLPA

P.2 Document History

Summary of Recent Changes (0.95 ... 1.00)

Change	Page(s)
Conformance test comments added	8
Added timing and performance information	45
Latching event now supported	17, 20, 23, 40
Added command details to Diagnostic Object	24

Revision List

Revision	Date	Author(s)	Chapter(s)	Description
0.95	2014-12-19	KeL	All	Preliminary revision
1.00	2015-02-06	KeL	1, 4, 5, F	First official revision

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 CompactCom module.
- The terms ‘host’ or ‘host application’ refers to the device that hosts the Anybus module.
- Hexadecimal values are written in the format NNNNh or 0xNNNN, where NNNN is the hexadecimal value.
- A byte always consists of 8 bits.
- The terms ‘basic’, ‘extended’ and ‘advanced’ are used to classify objects, instances and attributes. Please refer to “Categorization of Functionality” on page 38 for more information.

P.4 Support

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

1. About the Anybus CompactCom CC-Link

1.1 General

The Anybus CompactCom 40 CC-Link communication module provides instant CC-Link slave functionality via the patented Anybus CompactCom host interface. Any device that supports this standard can take advantage of the features offered by the module, allowing seamless network integration regardless of network type.

This product conforms to all aspects of the host interface defined in the Anybus CompactCom 40 Hardware- and Software Design Guides, making it fully interchangeable with any other device following that specification. Generally, no additional network related software support is needed, however in order to take advantage of advanced network specific functionality, a certain degree of dedicated software support may be necessary.

1.2 Features

- CC-Link Remote Device
- I/O: up to 128 bit points and 16 word points of 16 bit data (CC-Link v.1.10, default)
- I/O: up to 896 bit points and 128 word points of 16 bit data (CC-Link v.2.00)[1]
- Automatic CC-Link System Area handshaking[2]
- Configuration file (CSP+) provided by HMS Industrial Networks AB.
- Possibility to customize Vendor Code, Model Code and Version via application interface
- Baud Rate and Station Number configuration via application interface
- Galvanically isolated bus

Please note that Anybus CompactCom 40 modular device and sync functionality are not supported in this version of Anybus CompactCom 40 CC-Link.

1.3 Differences Between 40 and 30 Series

- A new default Process Data (PD) mapping scheme has been implemented
- The specific CC-Link mapping commands have been removed
- A different diagnostics functionality has been implemented

[1] To use CC-Link v.2.00, the CC-Link Host Object (F7h) must be implemented.

[2] To turn on the automatic handshaking feature, the CC-Link Host Object (F7h) must be implemented.

1.4 Fieldbus Conformance Notes

- The Anybus CompactCom 40 CC-Link has been tested standalone and found to comply with the CC-Link Conformance Test specification, publication BAP-C0401-012-F. The end product will however need to be re-certified in order to comply with CC-Link certification policies.
- The application alone is responsible for maintaining compatibility with the profiles defined in the CC-Link Specification (Profile), publication BAP-05028-H. This documentation is available free of charge to all registered CLPA members. To sing up as a member, please contact the CLPA (www.cc-link.org).
- In order to pass the conformance test the application will have to show an error status when an erroneous baud rate or station number according to CC-Link is used. The Anybus CompactCom 40 CC-Link will not allow the setting of the Setup Complete attribute in the Anybus Object in such a case.
- If the host application handles the System area (no automatic handshake), it also must take full responsibility for all parts of the conformance test related to the system area.
- The CC-Link V.2.00 protocol is implemented without return check in the module.

2. Basic Operation

2.1 General Information

2.1.1 Software Requirements

No additional network support code needs to be written in order to support the Anybus CompactCom CC-Link, however due to the nature of the CC-Link networking system certain restrictions must be taken into account:

- No acyclic data exchange.
- ADIs must be mapped as Process Data, in accordance with the CC-Link mapping scheme, in order to be represented on the network.
- ADI Names, types and similar attributes cannot be accessed from the network.
- No support for network reset requests.
- Up to 5 diagnostic instances (see 5-23 “Diagnostic Object (02h)”) can be created by the host application during normal operation. An additional 6th instance may be created in event of a major fault.

For in depth information regarding the Anybus CompactCom software interface, consult the general Anybus CompactCom 40 Software Design Guide.

2.1.2 CC-Link Family System Profile (CSP+) File

Each device on CC-Link is associated with a CC-Link Family System Profile (CSP+) file, which holds a description of the device and its functions.

HMS Industrial Networks supplies a generic CSP+ file which can serve as a basis for new implementations. A tool for modifying the file is available at the CLPA web page (www.cc-link.org, membership is required).

2.1.3 Communication Settings

Network related communication settings, which can be accessed by the end user, are grouped in the Network Configuration Object (04h).

In the case of CC-Link, this includes:

- **Station Number**

  On CC-Link, each device on the network must be assigned a unique Station Number. The highest possible Station Number depends on the number of occupied stations.

- **Baud rate**

  The module supports all common CC-Link baud rates up to 10Mbps.

2.2 Data Exchange

2.2.1 Bit Area vs. Word Area

On CC-Link, data is divided into two categories as follows:

- **Bit Area**

  Data is accessed on a bit-by-bit basis. Data is commonly referred to as RX #nn (Slave->Master) and RY #nn (Master->Slave) where ‘nn’ represents an addressable point (i.e. a single bit) in the Bit Area.

- **Word Area**

  Data is accessed as 16-bit words. Data is commonly referred to as RWr #nn (Slave->Master) and RWw #nn (Master->Slave) where ‘nn’ represents an addressable point (i.e. a word) in the Word Area.

Direction	Bit Area Points (hex)	Word Area Points (dec)
Slave -> Master	RX00 .... RX37F	RWr0... RWr127
Master -> Slave	RY00 ... RY37F	RWw0 ... RWw127

2.2.2 Data Sizes

CC-Link Version 1

By default, the module automatically calculates the required number of occupied stations based on the mapped Process Data. The following data sizes are possible.

Occupied Stations	Bit Points	Word Points	Total (Bit + Word, in bytes)
1	32 bits	4 words	12
2	64 bits	8 words	24
3	96 bits	12 words	36
4	128 bits	16 words	48

CC-Link Version 2

By implementing the ‘Network Settings’-attribute (#4) in the CC-Link Host Object (F7h) it is possible to customize the implementation for CC-Link version 2 and use larger data sizes through extension cycles. In such case, the following sizes are possible:

Occupied Stations	1 Extension Cycle		2 Extension Cycles		4 Extension Cycles		8 Extension Cycles	
	Points	Total	Points	Total	Points	Total	Points	Total
1	32 bits	12 bytes	32 bits	20 bytes	64 bits	40 bytes	128 bits	80 bytes
	4 words		8 words		16 words		32 words	
2	64 bits	24 bytes	96 bits	44 bytes	192 bits	88 bytes	384 bits	176 bytes
	8 words		16 words		32 words		64 words	
3	96 bits	36 bytes	160 bits	68 bytes	320 bits	136 bytes	640 bits	272 bytes
	12 words		24 words		48 words		96 words	
4	128 bits	48 bytes	224 bits	92 bytes	448 bits	184 bytes	896 bits	368 bytes
	16 words		32 words		64 words		128 words	

Note 1: On CC-Link, certain parts of the Bit and Word data may be reserved and should not be used for data exchange. For more information, see "CC-Link System Area Implementation" on page 17.

Note 2: For conformance test of CC-Link version 2, it is necessary to enable the CC-Link conformance test mode, see "Network CC-Link Object (08h)" on page 30, command CCL_Conf_Test_Mode on page 31.

3. Process Data Mapping

3.1 Default CC-Link Buffer Memory Map

The default profile for Anybus CompactCom 40 CC-Link is “Generic Device”. It is up to the application to realize the implementation, including the mapping of ADIs to the corresponding memory. This makes it possible to comply with any profile buffer data layout.

Default Buffer Memory (Bit-points)

The table shows the layout of the bit areas in the default buffer memory. The addresses refer to the unit relative addresses, not the absolute addresses for the complete network.

Slave → Master		Master → Slave	
Point	**Signal name**	**Point**	**Signal name**
RX0 to RX Q-11h	User area	RY0 to RX Q-11h	User area
RX Q-10h	Reserved	RY Q-10h	Reserved
RX Q-Fh		RY Q-Fh	
RX Q-Eh		RY Q-Eh	
RX Q-Dh		RY Q-Dh	
RX Q-Ch		RY Q-Ch	
RX Q-Bh		RY Q-Bh	
RX Q-Ah		RY Q-Ah	
RX Q-9h		RY Q-9h	
RX Q-8h	Initial data processing request flag	RY Q-8h	Initial data processing complete flag
RX Q-7h	Initial data setting complete flag	RY Q-7h	Initial data setting request flag
RX Q-6h	Error status flag	RY Q-6h	Error reset request flag
RX Q-5h	Remote READY	RY Q-5h	Reserved
RX Q-4h	Reserved	RY Q-4h	
RX Q-3h		RY Q-3h	
RX Q-2h		RY Q-2h	
RX Q-1h		RY Q-1h	

CC-Link version 1 or Extension Cycles = 1:
Q = Number of occupied stations × 32
CC-Link version 2 and Extension Cycles >= 2:
Q = (Number of occupied stations × 32 – 16) × Extension Cycles

Default Buffer Memory (Word-points)

The table shows the layout of the word areas in the default buffer memory. The addresses refer to the unit relative addresses, not the absolute addresses for the complete network.

Slave → Master		Master → Slave	
Point	**Signal name**	**Point**	**Signal name**
RWr 0	User area	RWw 0	User area
to		to	
RWr Z-1	User area	RWw Z-1	User area

CC-Link version 1 or Extension Cycles = 1:
Z = Number of occupied stations × 4
CC-Link version 2 and Extension Cycles >= 2:
Z = Number of occupied stations × 4 × Extension Cycles

See also...

- “CC-Link System Area Implementation” on page 17
- “Network Object (03h)” on page 25

3.2 Mapping

This scheme is used when the host application uses the mapping commands:

- Map_ADI_Write_Area and Map_ADI_Write_Ext_Area map data to the RX (bit) and RWr (word) areas.
- Map_ADI_Read_Area and Map_ADI_Read_Ext_Area map data from the RY (bit) and RWw (word) areas.
- ADIs are mapped to consecutive locations in the respective areas in the same order as the mapping commands are issued.
- All bit data types (BITSx, BITx or PADx) are mapped to the CC-Link bit area as long as no previous mapping command with a non bit data type has been received. After that, for any following mapping command with a bit data type, the data will be mapped in the CC-Link word area, see the examples on the following pages.
- By default no padding is performed. Any padding or alignment demand to reach the profile layout is the responsibility of the application.
- The Map_ADI_Write_Area and Map_ADI_Read_Area commands are in byte granularity and can only be used for data types of 8, 16, 32 or 64 bit length.
  - Byte alignment during mapping will be enforced when using this command.
  - The use of e.g. the data type BIT3 will generate a NAK (negative acknowledgment) message in answer to the request.
  - The host application may need to perform padding, e.g. if word alignment is needed.

  See example on page 15.
- The Map_ADI_Write_Ext_Area and Map_ADI_Read_Ext_Area commands are in bit granularity and can be used for all data types.
  - Bit data will be mapped consecutively in the bit area as long as BITSx, BITx or PADx data types are used.
  - Once a command with any other data type has been received, all data will be mapped in the word area. This may disrupt the byte alignment, that is a condition. It is the responsibility of the host application to perform all padding to avoid error messages due to not aligned data mapping.
  - Not all elements in an ARRAY or STRUCT ADI need to be mapped.

  See example on page 16.
- In default mode, with no network settings implemented in the CC-Link Host Object (F7h), the number of stations are increased if the bits or words do not fit the starting configuration.
- ADIs with data type structure are put in the CC-Link word area as a complete chunk/blob, unless covered by any of the rules above.

Note: Implementation of CC-Link profiles might require that the application use some padding in the mapping to get the memory buffer layout as the profile requires. This can be done by using ADI # 0 or PADx for padding in the map directed to the CC-Link bit areas and using ADI# xx (dummy byte) for padding in the CC-Link word areas. These areas should be marked as reserved in the buffer memory description (towards the CC-Link network).

A faulty mapping will generate a NAK (negative acknowledgment). An exception will be generated if the settings in the CC-link Host Object do not fully comply with the selected mapping. Exception information will be available in the Network Object (03h). For more information see:

- “Network Object (03h)” on page 25
- “Exception Information” on page 42

Mapping example with standard command

This is an example of nine (A-I) Read mapping commands using the Map_ADI_Read_Area command.

Command	Data Type	No. of Elements
A	BITS8	3
B	BITS16	1
C	BOOL	1
D	UINT8	1
E	UINT16	1
F	BOOL	2
G	BITS32	1
H	BITS16	1
I	UINT32	1

This is the resulting RY mapping in the bit area:

<table>
<tr><th>Point</th><th colspan="8">Contents (Command number[Element:bit])</th></tr>
<tr><td>RY #7... 0</td><td>A[0:7]</td><td>A[0:6]</td><td>A[0:5]</td><td>A[0:4]</td><td>A[0:3]</td><td>A[0:2]</td><td>A[0:1]</td><td>A[0:0]</td></tr>
<tr><td>RY #15... 8</td><td>A[1:7]</td><td>A[1:6]</td><td>A[1:5]</td><td>A[1:4]</td><td>A[1:3]</td><td>A[1:2]</td><td>A[1:1]</td><td>A[1:0]</td></tr>
<tr><td>RY #23... 16</td><td>A[2:7]</td><td>A[2:6]</td><td>A[2:5]</td><td>A[2:4]</td><td>A[2:3]</td><td>A[2:2]</td><td>A[2:1]</td><td>A[2:0]</td></tr>
<tr><td>RY #31... 24</td><td>B[0:7]</td><td>B[0:6]</td><td>B[0:5]</td><td>B[0:4]</td><td>B[0:3]</td><td>B[0:2]</td><td>B[0:1]</td><td>B[0:0]</td></tr>
<tr><td>RY #39... 32</td><td>B[0:15]</td><td>B[0:14]</td><td>B[0:13]</td><td>B[0:12]</td><td>B[0:11]</td><td>B[0:10]</td><td>B[0:9]</td><td>B[0:8]</td></tr>
</table>

This is the resulting RWw mapping in the word area:

<table>
<tr><th></th><th colspan="16">Contents (Command number[bit/byte/word])</th></tr>
<tr><th>Point</th><th colspan="8">Contents (LSB)</th><th colspan="8">Contents (MSB)</th></tr>
<tr><td>RWw #0</td><td colspan="8">C</td><td colspan="8">D</td></tr>
<tr><td>RWw #1</td><td colspan="8">E[0]</td><td colspan="8">E[1]</td></tr>
<tr><td>RWw #2</td><td colspan="8">F[0]</td><td colspan="8">F[1]</td></tr>
<tr><td>RWw #3</td><td colspan="8">G[LSW]</td><td colspan="8">G[LSW]</td></tr>
<tr><td>RWw #4</td><td colspan="8">G[MSW]</td><td colspan="8">G[MSW]</td></tr>
<tr><td>RWw #5</td><td>H[7]</td><td>H[6]</td><td>H[5]</td><td>H[4]</td><td>H[3]</td><td>H[2]</td><td>H[1]</td><td>H[0]</td><td>H[15]</td><td>H[14]</td><td>H[13]</td><td>H[12]</td><td>H[11]</td><td>H[10]</td><td>H[9]</td><td>H[8]</td></tr>
<tr><td>RWw #6</td><td colspan="8">I[LSW]</td><td colspan="8">I[LSW]</td></tr>
<tr><td>RWw #7</td><td colspan="8">I[MSW]</td><td colspan="8">I[MSW]</td></tr>
</table>

Mapping example with extended mapping command

This is an example of three (A-C) Write mapping commands using the Map_ADI_Write_Ext_Area command.

Command	# mapping items	ADI #	Total Nbr of elements	Index first element[a]	Nbr of consecutive elements[a]	Nbr of type descriptors	Data type specifiers
A	2	3	1	0	1	1	65(BIT1)
	-	10	1	0	1	1	47(PAD15)

B	1	20	5	0	3	5	70(BIT6)
							34(PAD2)
							9(BITS8)
							36(PAD4)
							68(BIT4)

C	1	7	4	1	3	4	9(BITS8)
							5(UINT16)
							10(BITS16)
							0(BOOL)

[a] Please note that not all elements in an ADI need to be mapped. The elements to be mapped, are defined by the settings of “Index first element” and “Nbr of consecutive elements”.

This is the resulting RX mapping in the bit area:

Point	Command[mapping Item]:ADI[IndexElement]:(bit/byte/word)							
RX #7... 0	A[1]:10[0]:(b6)	A[1]:10[0]:(b5)	A[1]:10[0]:(b4)	A[1]:10[0]:(b3)	A[1]:10[0]:(b2)	A[1]:10[0]:(b1)	A[1]:10[0]:(b0)	A[0]:3[0]:(b0)
RX #15... 8	A[1]:10[0]:(b14)	A[1]:10[0]:(b13)	A[1]:10[0]:(b12)	A[1]:10[0]:(b11)	A[1]:10[0]:(b10)	A[1]:10[0]:(b9)	A[1]:10[0]:(b8)	A[1]:10[0]:(b7)
RX #23... 16	B[0]:20[1]:(b1)	B[0]:20[1]:(b0)	B[0]:20[0]:(b5)	B[0]:20[0]:(b4)	B[0]:20[0]:(b3)	B[0]:20[0]:(b2)	B[0]:20[0]:(b1)	B[0]:20[0]:(b0)
RX #31... 24	B[0]:20[2]:(b7)	B[0]:20[2]:(b6)	B[0]:20[2]:(b5)	B[0]:20[2]:(b4)	B[0]:20[2]:(b3)	B[0]:20[2]:(b2)	B[0]:20[2]:(b1)	B[0]:20[2]:(b0)

This is the resulting RWr mapping in the word area:

	Command[mapping Item]:ADI[IndexElement]:(bit/byte/word)															
Point	LSB								MSB							
RWr #0	C[0]:7[1]:(LSB)								C[0]:7[1]:(MSB)							
RWr #1	C[0]:7[2]:(b7)	C[0]:7[2]:(b6)	C[0]:7[2]:(b5)	C[0]:7[2]:(b4)	C[0]:7[2]:(b3)	C[0]:7[2]:(b2)	C[0]:7[2]:(b1)	C[0]:7[2]:(b0)	C[0]:7[2]:(b15)	C[0]:7[2]:(b14)	C[0]:7[2]:(b13)	C[0]:7[2]:(b12)	C[0]:7[2]:(b11)	C[0]:7[2]:(b10)	C[0]:7[2]:(b9)	C[0]:7[2]:(b8)
RWr #2	C[0]:7[3]:(byte)								-							

4. CC-Link System Area Implementation

4.1 System Area Modes

An essential part of the CC-Link communication is the CC-Link System Area. This area holds various status- and diagnostic flags, and can either be handled automatically by the Anybus module (default) or by the host application.

- **System Area handled by Anybus (Default, basic)**

  All flags in the System Area are handled automatically by the module, unless this functionality has been explicitly disabled by not implementing the 'System Area Handler'-attribute (#5) in the CC-Link Host Object (F7h).

  The error indication flag can only be set by a diagnostic latching event. Please refer to "Diagnostics" on page 20 for more information.

  The commands Initial_Data_Setting_Notification and Inital_Data_Processing_Notification in the CC-Link Host Object have to be supported. If any of these commands is not accepted by the host application, the host application must respond with 'Unsupported Object' or 'Unsupported Command', thus not acknowledging the request.

- **System Area handled by Host Application (Advanced)**

  If the 'System Area Handler'-attribute (#5) has been set to -1 (disabled), the host application alone is responsible for handling the CC -Link status flags in accordance with one of the profiles defined in the CC-Link specification. To achieve this, the host application must map one or several ADIs to the corresponding location(s) in the CC-Link memory map. Please refer to "System Area Location" on page 19 for more information.

4.2 System Area Layout

Note: This section is only relevant when the System Area is handled automatically by the module.

Slave -> Master		Master -> Slave	
Bit Offset	**Contents**	**Bit Offset**	**Contents**
0	(reserved)	0	(reserved)
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8	Initial Data Processing Request	8	Initial Data Processing Complete
9	Initial Data Setting Complete	9	Initial Data Setting Request
10	Error Status	10	Error Reset Request
11	Remote READY	11	(reserved)
12	(reserved)	12	
13		13	
14		14	
15		15	

The various flags listed in the table above are handled as described in "CC-Link Handshaking Implementation" on page 40.

See also...

- "System Area Location" on page 19
- "Diagnostics" on page 20
- "CC-Link Handshaking Implementation" on page 40

4.3 System Area Location

Note: This section is only relevant when the System Area is handled automatically by the module.

The default location of the System Area is at the very end of the Bit Area as follows:

Point	Contents	Point	Contents
RX #0	User area (holds Write Process Data)	RY #0	User area (holds Read Process Data)
RX #1		RY #1	
...		...	
RX #Q-18		RY #Q-18	
RX #Q-17		RY #Q-17	
RX #Q-16	(Reserved for CC-Link System Area)	RY #Q-16	(Reserved for CC-Link System Area)
RX #Q-15		RY #Q-15	
...		...	
RX #Q-2		RY #Q-2	
RX #Q-1		RY #Q-1	

(The table above illustrates how data is represented as seen from the CC-Link master. 'Q' represents the number of addressable points in the Bit Area of the ABCC.)

It is possible to change the location of the System Area by implementing the 'System Area Handler'-attribute (#5) in the CC-Link Host Object (F7h). It is also possible to disable it altogether by setting this attribute to -1. In such case, the host application is responsible for handling the CC-Link communication in consistency with one of the profiles defined in the CC-Link Specification (profile).

See also...

- "Mapping" on page 14
- "CC-Link Handshaking Implementation" on page 40

4.4 Diagnostics

Note: This section is only relevant when the System Area is handled automatically by the module.

The module supports up to 5 diagnostic entries during normal conditions, plus an additional 6th entry in case of a major unrecoverable event.

Diagnostics are represented through the 'Error Status'-flag and the 'Remote READY'-flag.

No information on the actual cause of a diagnostic event is forwarded to the network, apart from the severity, that is given implicitly by monitoring the 'Remote READY flag. A major event will remove this flag (if set).

Latching event functionality is supported and a latching event will set the 'Error Status'-flag. If the event has 'Major' severity, the 'Remote READY'-flag will be removed. Please note that only latching diagnostic events will set the 'Error Status'-flag.

- **'Error Status'-flag**
  This flag reflects the state of the Diagnostic Object as follow:
  1: Latching diagnostic events exist [1]
  0: No diagnostic events exists - *or* - 'Error Reset Request'-flag high

- **'Remote READY'-flag**
  1: Normal operation
  0: Diagnostic event with 'Major' severity exists[2] - *or* - 'Initial Data Setting Request'-flag high

See also...

- "System Area Modes" on page 17
- "CC-Link Handshaking Implementation" on page 40
- "Diagnostic Object (02h)" on page 23

[1] The flag stays high until the master has acknowledged the event through the 'Error Reset Request'-flag.

[2] Normal behavior is resumed when the event has been resolved (i.e. when the host application removes the corresponding diagnostic instance) - and - the master has acknowledged the event through the 'Error Reset Request'-flag (see also Error Status and Error Code above)

5. Anybus Module Objects

5.1 General Information

This chapter specifies the Anybus Module Object implementation and how they correspond to the functionality in the Anybus CompactCom CC-Link.

The following Anybus Module Objects are implemented:

- "Anybus Object (01h)" on page 22
- "Diagnostic Object (02h)" on page 23
- "Network Object (03h)" on page 25
- "Network Configuration Object (04h)" on page 27
- "Network CC-Link Object (08h)" on page 30
- "Anybus File System Interface Object (0Ah)" on page 32

5.2 Anybus Object (01h)

Category

Basic

Object Description

This object groups common Anybus information, and is described thoroughly in the general Anybus CompactCom Software Design Guide.

Supported Commands

Object:	Get_Attribute
Instance:	Get_Attribute Set_Attribute Get_Enum_String

Object Attributes (Instance #0)

(Consult the general Anybus CompactCom Software Design Guide for further information.)

Instance Attributes (Instance #1)

Basic

#	Name	Access	Type	Value
1	Module type	Get	UINT16	0403h (Anybus CompactCom 40)
2... 11	-	-	-	Consult the general Anybus CompactCom Software Design Guide for further information.

12	LED colors	Get	struct of:
			UINT8(LED1A)
			UINT8(LED1B)
			UINT8(LED2A)
			UINT8(LED2B)
				Value:Color:
				01h Green
				02h Red
				01h Green
				02h Red

13... 18	-	-	-	Consult the general Anybus CompactCom Software Design Guide for further information.
19	Network time	Get	UINT64	0 (not supported by CC-Link)

5.3 Diagnostic Object (02h)

Category

Basic

Object Description

This object provides a standardized way of handling host application events & diagnostics, and is thoroughly described in the general Anybus CompactCom Software 40 Design Guide.

In the case of CC-Link, diagnostics is represented through the CC-Link System Area flags. If the module handles the System Areas you have to create/remove one Diagnostics instance to pass the CC-Link conformance test. If the host application handles the System Area (advanced) the Diagnostic Object does not have to be implemented.

The module supports acknowledgment of latching diagnostic events if the System area handler functionality is enabled in the CC_Link Host Object (F7h), instance #1, attribute #5, see page 35. If a latching events cannot be created, a network specific error response will be returned, see page 24.

The module supports six instances of this object, where one is reserved for a major unrecoverable diagnostic event. No information about the actual cause of a diagnostic event will be forwarded to the network, only the severity.

See also...

- “System Area Modes” on page 17
- “System Area Layout” on page 18
- “Diagnostics” on page 20

Supported Commands

Object:	Get_Attribute Create (See “Command Details: Create” on page 24) Delete
Instance:	Get_Attribute

Object Attributes (Instance #0)

#	Name	Access	Data Type	Value
1	Name	Get	Array of CHAR	‘Diagnostic’
2	Revision	Get	UINT8	01h
3	Number of instances	Get	UINT16	See general Anybus CompactCom Software Design Guide
4	Highest instance no.	Get	UINT16	
11	Max no. of instances	Get	UINT16	5+1
12	Supported functionality	Get	BITS32	0000 0000h (Latching event not supported) or 0000 0001h (Latching event supported)

Instance Attributes

#	Name	Access	Type	Value
1	Severity	Get	UINT8	See general Anybus CompactCom 40 Software Design Guide
2	Event Code	Get	UINT8	
3-7	(reserved)			

Command Details: Create

Category

Basic

Details

Command Code: 03h

Valid for: Object Instance

Description

This command creates a new instance, in this case representing a new diagnostic event in the host application.

When a latching event can not be created, a network specific extended error response, as described below, will be returned.

- **Command details:**
  Please consult the Anybus CompactCom 40 Software Design Guide for more information.

- **Response details (Success):**

Field	Contents
MsgData[0-1]	The number of the created instance

- **Response details (Error):**

byte	item	description
MsgData[0]	FFh	Object specific error
MsgData[1]	FFh	Network specific error
MsgData[2]	01h 02h	CC-Link specific error code, see below

CC-Link specific error code	Description
01h	A latching event could not be created due to invalid state (the module is not in state WAIT_PROCESS).
02h	A latching event could not be created as the System Area functionality is not enabled.

5.4 Network Object (03h)

Category

Basic

Object Description

For more information regarding this object, consult the general Anybus 40 CompactCom Software Design Guide.

See also...

- "Network CC-Link Object (08h)" on page 30

Supported Commands

Object:	Get_Attribute
Instance:	Get_Attribute Set_Attribute Get_Enum_String Map_ADI_Write_Area Map_ADI_Read_Area Map_ADI_Write_Ext_Area Map_ADI_Read_Ext_Area

Object Attributes (Instance #0)

#	Name	Access	Data Type	Value
1	Name	Get	Array of CHAR	"Network"
2	Revision	Get	UINT8	02h
3	Number of instances	Get	UINT16	0001h
4	Highest instance no.	Get	UINT16	0001h

Instance Attributes (Instance #1)

Basic

#	Name	Access	Type	Value
1	Network type	Get	UINT16	0090h
2	Network type string	Get	Array of CHAR	‘CC-Link’
3	Data format	Get	ENUM	00h (LSB first)
4	Parameter data support	Get	BOOL	False
5	Write process data size	Get	UINT16	Current write process data size (in bytes) Updated on each successful Map_ADI_Write_Area[a] or Map_ADI_Write_Ext_Area[a]
6	Read process data size	Get	UINT16	Current read process data size (in bytes) Updated on each successful Map_ADI_Read_Area[a] or Map_ADI_Write_Ext_Area[a]
7	Exception Information	Get	UINT8	See “Exception Information” on page 42

[a] Consult the general Anybus CompactCom 40 Software Design Guide for further information.

5.5 Network Configuration Object (04h)

Category

Basic

Object Description

This object holds network specific configuration parameters that may be set by the end user. A reset command (factory default) issued towards this object will result in all instances being set to their default values, including resetting the NVS storage. The Station Number is set to “Not set” and the Baud Rate to 2 (2.5 Mbps).

See also...

- “Communication Settings” on page 9
- “CC-Link Host Object (F7h)” on page 34

Note: Instances #1 and #2 have to be implemented if the end-product is going to be re-certified according to CC-Link certification policies.

Supported Commands

Object:	Get_Attribute Reset
Instance:	Get_Attribute Set_Attribute Get_Enum_String

Object Attributes (Instance #0)

#	Name	Access	Data Type	Value
1	Name	Get	Array of CHAR	‘Network configuration’
2	Revision	Get	UINT8	01h
3	Number of instances	Get	UINT16	0002h
4	Highest instance no.	Get	UINT16	0002h

Instance Attributes (Instance #1, ‘Station number’)

This instance holds the actual CC-Link Station Number.

Basic

#	Name	Access	Type	Description
1	Name[a]	Get	Array of CHAR	‘Station number’
2	Data type	Get	UINT8	04h (UINT8)
3	Number of elements	Get	UINT8	01h (one element)
4	Descriptor	Get	UINT8	07h (get/set/shared access)
5	Value[b]	Get/Set	UINT8	Value:Setting: 0: Not set (invalid to use) 1... 64: Station Number (see note) >64: (not valid) **Notes:** The sum of the Station Number and the Number of Occupied Stations may not exceed 65. A value that is not valid will result in the Setup Complete command being not acknowledged.
6	Configured Value	Get	UINT8	Holds the configured value, which will be written to attribute #5. Value:Setting: 0: Not set (invalid to use) 1... 64: Station Number (see note) >64: (not valid)

[a] Multilingual, see “Multilingual Strings” on page 29.

[b] Any value written to this attribute after setup is finished, will be saved in attribute #6 instead of in attribute #5. After a power cycle has been performed, attribute #5 will be updated with the value saved in attribute #6.

Instance Attributes (Instance #2, ‘Baud rate’)

This instance holds the actual CC-Link data rate.

Basic

#	Name	Access	Type	Description
1	Name[a]	Get	Array of CHAR	‘Baud rate’
2	Data type	Get	UINT8	08h (ENUM)
3	Number of elements	Get	UINT8	01h (one element)
4	Descriptor	Get	UINT8	07h (get/set/shared access)
5	Value[b]	Get/Set	UINT8	Value:Speed/String: 0: 156 kbps 1: 625 kbps 2: 2.5 Mbps (default) 3: 5 Mbps 4: 10 Mbps other: (not valid) **Note**: A value that is not valid will result in the Setup Complete command being not acknowledged
6	Configured Value	Get	UINT8	Holds the configured value, which will be written to attribute #5. Value:Speed/String: 0: 156 kbps 1: 625 kbps 2: 2.5 Mbps 3: 5 Mbps 4: 10 Mbps other: (not valid)

[a] Multilingual, see “Multilingual Strings” on page 29.

[b] Any value written to this attribute after setup is finished, will be saved in attribute #6 instead of in attribute #5. After a power cycle has been performed, attribute #5 will be updated with the value saved in attribute #6.

Multilingual Strings

The instance names in this object are multilingual and are translated based on the current language settings as follows:

Instance	English	German	Spanish	Italian	French
1	Station no	Geräteadresse	Direcc nodo	Indirizzo	Adresse
2	Baud rate	Datenrate	Veloc transf	Velocità dati	Vitesse

5.6 Network CC-Link Object (08h)

Category

Basic, extended

Object Description

-

Supported Commands

Object:	Get_Attribute
Instance:	Get_Attribute CCL_Conf_Test_Mode (see “Command Details: CCL_Conf_Test_Mode” on page 31)

Object Attributes (Instance #0)

#	Name	Access	Data Type	Value
1	Name	Get	Array of CHAR	“Network CC-Link”
2	Revision	Get	UINT8	02h
3	Number of instances	Get	UINT16	0001h
4	Highest instance no.	Get	UINT16	0001h

Instance Attributes (Instance #1)

Basic

#	Name	Access	Type	Value
1	Network Settings[a]	Get	Struct of: UINT8 UINT8 UINT8	Current network settings: - CC-Link Version; 01h = v1.10, 02h = v2.00 - Number of occupied stations - Number of extension cycles
2	System Area Handler[a]	Get	SINT16	System Area location (or -1 in case the system area is handled by the host application)
3 - 4	(reserved)			
5	CC-Link V.2 Conformance test mode	Get	BOOL	TRUE if the special CC-Link version 2.00 conformance test mode is active (activated by the command CCL_Conf_Mode).

[a] These attributes are calculated automatically by the module unless the host application has specified other values in the CC-Link Host Object (F7h). The attribute values are valid from the first transition to WAIT_PROCESS, and can be used to establish the location of the CC-Link System Area during development etc.

Command Details: CCL_Conf_Test_Mode

Category

Extended

Details

Command Code: 12h

Valid for: Object Instance

Description

This command enables/disables the special CC-Link version 2 conformance test mode. For conformance test of CC-link version 2, it is necessary that a special version of the slave can loop all accepted data from RY/RWw to RX/RWx. This command can activate the functionality temporarily or permanently, or deactivate the functionality permanently. The command may only be issued during SETUP.

- **Command details:**

Field	Contents
CmdExt[0]	Conformance test mode Value: Description: 00h Deactivate conformance test mode permanently. 01h Activate conformance test mode temporarily. Conformance test mode will not be activated after a reset/power cycle. 02h Activate conformance test mode permanently.
CmdExt[1]	(reserved)

- **Response details (Success):**

Field	Contents
Data[0 .. n]	(not used)

- **Response details (Error):**

Error	Contents
Standard error codes	According to ABCC Functional Specification

5.7 Anybus File System Interface Object (0Ah)

Category

Advanced

Object Description

This object provides an interface to the built-in file system. in an Anybus CompactCom 40 CC-Link module, the file system consists of one folder, called “Firmware”. This folder is used to save a firmware file to upgrade the module. After a reset the firmware in the module will be upgraded and the file erased.

Please consult the Anybus CompactCom 40 Software Design Guide for more information.

Supported Commands

(Consult the Anybus CompactCom 40 Software Design Guide for more information)

Object Attributes (Instance #0)

(Consult the Anybus CompactCom 40 Software Design Guide for more information)

Instance Attributes

(Consult the Anybus CompactCom 40 Software Design Guide for more information)

6. Host Application Objects

6.1 General Information

This chapter specifies the host application object implementation in the module. The objects listed here may optionally be implemented within the host application firmware to expand the CC-Link implementation.

Network Specific Object:

- "CC-Link Host Object (F7h)" on page 34

6.2 CC-Link Host Object (F7h)

Category

Basic, extended, advanced

Object Description

This object implements CC-Link specific features in the host application.

The implementation of this object is optional; the host application can support none, some, or all of the attributes specified below. The module will attempt to retrieve the values of these attributes during start-up; if an attribute is not implemented in the host application, simply respond with an error message (06h, "Invalid CmdExt[0]"). In such case, the module will use its default value.

Supported Commands

Object:	Get Attribute Initial_Data_Setting_Notification (see "Command Details: Initial_Data_Setting_Notification" on page 36) Initial_Data_Processing_Notification (see "Command Details: Initial_Data_Processing_Notification" on page 37)
Instance:	Get Attribute

Object Attributes (Instance #0)

#	Name	Access	Data Type	Value
1	Name	Get	Array of CHAR	‘CC-Link’
2	Revision	Get	UINT8	01h
3	Number of instances	Get	UINT16	0001h
4	Highest instance no.	Get	UINT16	0001h

Instance Attributes (Instance #1)

Basic

#	Name	Access	Type	Default Value	Comment
1	Vendor Code	Get	UINT16	0212h (‘HMS’)	Assigned by the CLPA
2	SW Version	Get	UINT8	(Anybus firmware release no.)	Valid settings range from 1 to 3Fh.

Extended

#	Name	Access	Type	Default Value	Comment
3	Model Code	Get	UINT8	7Fh (‘Generic Device’)	For possible settings, consult the CC-Link Specification (Profile) for device type codes.
4	Network Settings	Get	Array of:		
			UINT8	01h	CC-Link Version: 01h:v1.10 (default) 02h:v2.00
			UINT8	(calculated automatically)	Number of Occupied Stations: Valid settings: 01h, 02h, 03h, 04h
			UINT8	1	Number of extension cycles. Valid settings, CC-Link v1: 01h Valid settings, CC-Link v2: 01h, 02h, 04h, 08h

Advanced

#	Name	Access	Type	Default Value	Comment
5	System Area Handler	Get	SINT16	(calculated automatically; last 16 bits in the bit area)	System Area handled by... -1:Host application 0...880[a]:Module. Value specifies the offset of the system area in the bit area. Must be located on an even 16-bit boundary.
6	Output Hold/Clear	Get	UINT8	1 (Hold)	Output action: 0:Clear 1: Hold This attribute indicates to the CC-Link master how the application handles the output data when there is an active error in the master (the master station application), that prevents the master to send an output value to the slave. This condition is signaled to the application by the Anybus State “ERROR”.

[a] Extended

Command Details: Initial_Data_Setting_Notification

Category

Basic

Details

Command Code: 10h

Valid for: Object Instance

Description

Note: This section is only relevant when the System Area is handled automatically by the module.

This command will be issued when the master initiates the Initial Data Setting cycle, i.e. on the rising edge of the 'Initial Data Setting Request'-flag.

The host application may either accept or reject (i.e. by responding with 'Unsupported Object' or 'Unsupported Command') the command; in either case, the module will continue the Initial Data Setting Cycle by setting the 'Initial Data Setting Complete'-flag once the response has been received.

- **Command Details**
  (No data)

- **Response Details**
  (No data)

Command Details: Initial_Data_Processing_Notification

Category

Basic

Details

Command Code:	11h
Valid for:	Object Instance

Description

Note: This section is only relevant when the System Area is handled automatically by the module.

This command informs the application when the state transition WAIT_PROCESS to PROCESS_ACTIVE has occurred during automatic handshaking. If the application has disabled the automatic handshake using the "System area handler" attribute of the CC-Link object, or if the CC-Link object is not present, this command will never be issued. No extra information is transmitted with the command, and no information is expected in the response message.

The host application may either accept or reject (i.e. by responding with 'Unsupported Object' or 'Unsupported Command') the command; in either case, the module will continue the Initial Data Setting Cycle by setting the 'Initial Data Processing Complete'-flag once the response has been received.

- **Command Details**
  (No data)
- **Response Details**
  (No data)

A. Categorization of Functionality

The objects, including attributes and services, of the Anybus CompactCom and the application are divided into three categories: basic, advanced and extended.

A.1 Basic

This category includes objects, attributes and services that are mandatory to implement or to use. They will be enough for starting up the Anybus CompactCom and sending/receiving data with the chosen network protocol. The basic functions of the industrial network are used.

Additional objects etc, that will make it possible to certify the product also belong to this category.

A.2 Extended

Use of the objects in this category extends the functionality of the application. Access is given to the more specific characteristics of the industrial network, not only the basic transfer of data to and from the network. Extra value is given to the application.

A.3 Advanced

The objects, attributes and services that belong to this group offer specialized and/or seldom used functionality. Most of the available network functionality is enabled and accessible. Access to the specification of the industrial network is normally required.

B. Implementation Details

B.1 SUP-Bit Definition

The Supervised-bit (SUP) indicates that the module is exchanging data with the CC-Link master.

B.2 Anybus State Machine

The table below describes how the Anybus State Machine relates to the CC-Link network.

Anybus State	**Implementation** **(System Area handled by Anybus module)**	**Implementation** **(System Area handled by Host Application)**
WAIT_PROCESS	Automatic CC-Link handshaking in progress	Waiting for the first refresh message
ERROR	Possible causes: - Timeout error (ERR21) - 0 channel carrier detection status (ERR22) - insufficient number of data for the host (ERR30...32) When the problem disappears, the module returns to the previous state.	
PROCESS_ACTIVE	The module enters this state on the rising edge of 'Initial Data Processing Complete'	The module enters this state when the first refresh message has been received
IDLE	PLC/Master in STOP mode	
	When the PLC/Master returns to RUN mode, the module returns to the previous state.	
EXCEPTION	Possible causes: - Configuration error - other error that cannot be indicated to the application in any other way Examples: - Illegal combinations of attribute settings in the CC-Link Host Object (F7h) - Illegal combinations of mapping commands and attribute settings in the CC-Link Host Object (F7h)	

B.3 Application Watchdog Timeout Handling

Upon detection of an application watchdog timeout, the module will cease network participation and shift to state 'EXCEPTION'. No other network specific actions are performed.

B.4 CC-Link Handshaking Implementation

Note: This section is only relevant when the System Area is handled automatically by the module.

When the System Area is handled by the Anybus module, all CC-Link handshaking is performed automatically as described in the table below.

Flag	Set when...	Cleared when...
Initial Data Processing Request	State changes from NW_INIT to WAIT_PROCESS	The following sequence has finished: **1. State transition from WAIT_PROCESS to PROCESS_ACTIVE** **2. The host application has responded to Initial_Data_Processing_Notification[a].** This purpose of this procedure is to ensure that the host application has detected that the module has shifted to the PROCESS_ACTIVE state.
Initial Data Setting Complete	The host application responds to Initial_Data_Setting_Notification[b]	At negative flank of 'Initial Data Setting Request'
Error Status[c]	When there is at least one latching event[d], and 'Error Reset Request' is false	'Error Reset Request' is set.
Remote READY[e]	(initial setting) - At the rising edge of 'Initial Data Processing Complete'	Either 'Initial Data Setting Request' is set or at least one latching event with major severity exist
	(runtime) - When 'Error Status' and 'Error Reset Request' is false	

[a] See "Command Details: Initial_Data_Processing_Notification" on page 37

[b] See "Command Details: Initial_Data_Setting_Notification" on page 36

[c] Additional functionality is handled through this flag, see "Diagnostics" on page 20

[d] See "Diagnostics" on page 20

[e] If both the Set and Clear conditions are true, the Clear functionality is given priority

Note: The initial value of the System Area is false, i.e. all flags are cleared during startup.

C. Certification Information

C.1 Basics

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

1. **Change Vendor Code:**

   Replace the HMS Vendor ID with a unique Vendor Code[1]. This is done by implementing the CC-Link Host Object (F7h), instance1, attribute 1 and returning the Vendor Code when receiving a Get_Attribute request.

2. **Increment SW Version:**

   Increment the SW version in the CC-Link Host Object (F7h) if you want to keep track of the versions. This number should be incremented at each change in functionality, leading to a new recertification. Implement the CC-Link Host Object (F7h), instance 1, attribute 2 and return the software version when receiving a Get_Attribute request.

3. **Check Hold/Clear Attribute Setting**

   The setting of the CC-Link Host Object (F7h), instance 1, attribute 6 (Output Hold/Clear), must comply with the corresponding output failstate on error, applied by the host (PLC).

4. **Generate a new CSP+ file**

   A CSP+ file, that complies with the customized implementation, must be generated.

These steps are the smallest possible amount of actions that you need to perform to obtain a certification.

C.2 Model Code

When the module is delivered, the Model Code (CC-Link Host Object (F7h), Instance 1, Attribute 3) is set to 7Fh (“Generic device”). If the host application is similar to an existing CC-Link profile, this code should be changed to reflect that profile.

C.3 CC-Link Version 2.00

By implementing the ‘Network Settings’-attribute (#4) in the CC-Link Host Object (F7h) it is possible to customize the implementation for CC-Link version 2.00 and use larger data sizes through extension cycles.

For conformance test of CC-Link version 2.00, it is necessary to enable the CC-Link conformance test mode, see “Network CC-Link Object (08h)” on page 30, command CCL_Conf_Test_Mode on page 31.

[1] Membership in the CLPA organization is necessary to obtain a vendor code. The vendor code consists of digits 5 - 8 in the CLPA ID number, issued when you join.

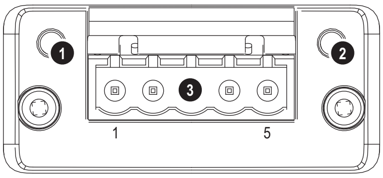
D. Exception Information

When the module has entered the EXCEPTION state, further CC-Link specific details about the problem can be read from the 'Exception Information'-attribute (#7) in the Network Object (03h)

Value	Meaning
00h	No information.
01h	Value out of range for SW Version attribute of CC-Link object.
02h	Value out of range for CC-Link version in the Network Settings attribute of the CC-Link object.
03h	Value out of range for Number of stations in the Network Settings attribute of the CC-Link object.
04h	Invalid value for Extension cycles in the Network Settings attribute of the CC-Link object.
05h	Invalid value for System area handler attribute of the CC-Link object.
06h	CC-Link version and extension cycles are incompatible.
07h	Data mapped at too high offset in CC-Link map for CC-Link version 1.
08h	Data mapped at offset were System area is automatically located.
09h	No room for automatically located System area in CC-Link version 1.
0Ah	Data mapped at too high offset in CC-Link map for specified network settings.
0Bh	System area location out of range specified in Network settings.
0Ch	System area located at too high offset in CC-Link map for CC-Link version 1.
0Dh	Data mapped at System area location.
0Eh	(not used)
0Fh	(not used)
10h	The set Device address is too high for the used number of occupied stations.
11h	Value out of range for the Hold/Clear status attribute (#6) of the CC-Link Host Object

E. Technical Specification

E.1 Front View (M40)

#	Item	
1	Run LED	
2	Error LED	
3	CC-Link connector	

E.1.1 Run LED

State	Meaning
Off	- No network participation, timeout status (no power)
Green	- Participating, normal operation
Red	- Major fault (FATAL error)

E.1.2 Error LED

State	Meaning
Off	- No error detected (no power)
Red	- Major fault (Exception or FATAL event)
Red, flickering	- CRC error (temporary flickering)
Red, flashing	- Station Number or Baud rate has changed since startup (flashing)

E.1.3 CC-Link Connector

Pin	Signal	Comment
1	DA	Positive RS485 RxD/TxD
2	DB	Negative RS485 RxD/TxD
3	DG	Signal Ground
4	SLD	Cable Shield
5	FG	Protective Earth

E.2 Protective Earth (PE) Requirements

In order to ensure proper EMC behavior, the module must be properly connected to protective earth via the PE pad / PE mechanism described in the general Anybus CompactCom Hardware Design Guide.

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

E.3 Power Supply

Supply Voltage

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

Power Consumption

The Anybus CompactCom CC-Link is designed to fulfill the requirements of a Class B module. For more information about the power consumption classification used on the Anybus CompactCom platform, consult the general Anybus CompactCom Hardware Design Guide.

The current hardware design consumes up to 280mA[1].

Note: 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.

E.4 Environmental Specification

Consult the Anybus CompactCom Hardware Design Guide for further information.

E.5 EMC Compliance

Consult the Anybus CompactCom Hardware Design Guide for further information.

[1] Note that 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 CC-Link will remain as a Class B module.

F. Timing & Performance

F.1 General Information

This chapter specifies timing and performance parameters that are verified and documented for the Anybus CompactCom 40 CC-Link.

The following timing aspects are measured:

Category	Parameters	Page
Startup Delay	T1, T2	45
NW_INIT Handling	T100	45
Event Based WrMsg Busy Time	T103	46
Event Based Process Data Delay	T101, T102	46

For further information, please consult the Anybus CompactCom 40 Software Design Guide.

F.2 Internal Timing

F.2.1 Startup Delay

The following parameters are defined as the time measured from the point where /RESET is released to the point where the specified event occurs.

Parameter	Description	Max.	Unit.
T1	The Anybus CompactCom 40 CC-Link module generates the first application interrupt (parallel mode)	11	ms
T2	The Anybus CompactCom 40 CC-Link module is able to receive and handle the first application telegram (serial mode)	11	ms

F.2.2 NW_INIT Handling

This test measures the time required by the Anybus CompactCom 40 CC-Link module to perform the necessary actions in the NW_INIT-state.

Parameter	Conditions
No. of network specific commands	Max.
No. of ADIs (single UINT8) mapped to Process Data in each direction	32[a]
Event based application message response time	> 1 ms
Ping-pong application response time	> 10 ms
No. of simultaneously outstanding Anybus commands that the application can handle	1

a. Or maximum amount in case the network specific maximum is less.

Parameter	Description	Communication	Max.	Unit.
T100	NW_INIT handling	Event based modes	14	ms

F.2.3 Event Based WrMsg Busy Time

The Event based WrMsg busy time is defined as the time it takes for the module to return the H_WRMSG area to the application after the application has posted a message.

Parameter	Description	Max.	Unit.
T103	H_WRMSG area busy time	16	µs

F.2.4 Event Based Process Data Delay

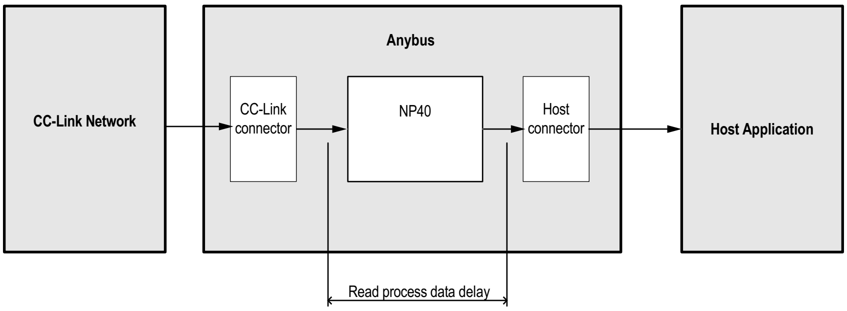
“Read process data delay” is defined as the time from when the last bit of the network frame has been received by the network interface, to when the RDPDI interrupt is asserted to the application.

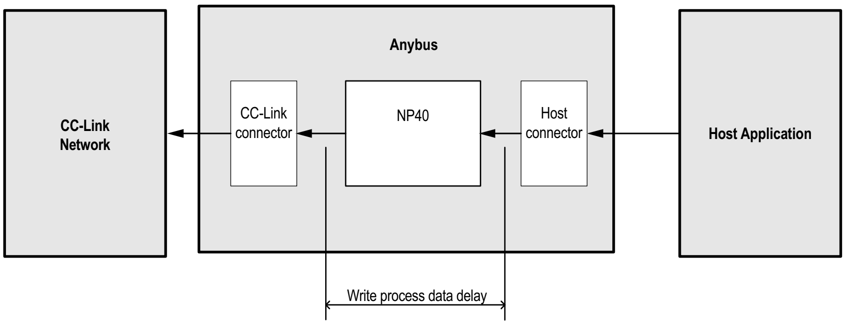
“Write process data delay” is defined as the time from when the application exchanges write process data buffers, to when the first bit of the new process data frame is sent out on the network.

The test was run in 16-bit parallel event mode, with interrupts triggered only for new process data events. The delay was measured in CC-Link Version 1.10 only. CC-Link Version 2.00 employs several CC-Link cycles(2, 4, 8) to transfer the data to/from the module, which means that the cycle time is a greater factor than the latency caused by the module.

The delay added by the transceiver and other hardware has not been included, as this delay is insignificant compared to the total process data delay.

Parameter	Description	Delay (max.)	Unit
T101	Read process data delay	33	µs
T102	Write process data delay	35	µs


CC-Link Network
Anybus
CC-Link connector
NP40
Host connector
Host Application
Read process data delay


CC-Link Network
Anybus
CC-Link connector
NP40
Host connector
Host Application
Write process data delay