Anybus® CompactCom™ 40

CC-Link IE Field

NETWORK GUIDE

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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 40 CC-Link IE Field. The document describes the features that are specific to Anybus CompactCom 40 CC-Link IE Field. 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 IE Field specific functionality is to be used, in-depth knowledge of CC-Link IE Field networking internals and/or information from the official CC-Link IE Field specifications may be required. In such cases, the persons responsible for the implementation of this product should either obtain the CC-Link IE Field specification to gain sufficient knowledge or limit their implementation in such a way that this is not necessary.

For additional related documentation and file downloads, 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 M40 Hardware Design Guide	HMS	HMSI-216-126
Anybus CompactCom B40 Design Guide	HMS	HMSI-27-230
Anybus CompactCom Host Application Implementation Guide	HMS	HMSI-27-334
CC-Link Specification (Device Profile)	CLPA	BAP-C2005-007 (E)
CC-Link Conformance Test Specifications	CLPA	BAP-C0401-037-D
CC-Link Family System Profile (CSP+) Creation Guidelines	CLPA	BCN89000-0756-A
Control & Communication System Profile Specification (CSP+)	CLPA	BAP-C2008-001
SLMP (Seamless Message Protocol) specification (Overview)	CLPA	BAP-C2006ENG-001-D
SLMP (Seamless Message Protocol) Conformance Test Specification (for Server)	CLPA	BAP-C0401-040-E

1.3 Document History

Version	Date	Description
1.0	2016-08-30	First version
1.1	2017-04-10	Support for SLMP added
1.2	2017-07-11	SLMP updated
1.3	2018-05-25	Updated certification information
1.4	2018-07-02	Added auto network number functionality
1.5	2019-02-27	Rebranding

1.4 Document Conventions

Ordered lists are used for instructions that must be carried out in sequence:

1. First do this
2. Then do this

Unordered (bulleted) lists are used for:

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

...and for action-result type instructions:

► This action...

→ leads to this result

Bold typeface indicates interactive parts such as connectors and switches on the hardware, or menus and buttons in a graphical user interface.

```
Monospaced text is used to indicate program code and other
kinds of data input/output such as configuration scripts.
```

This is a cross-reference within this document: *Document Conventions, p. 4*

This is an external link (URL): www.hms-networks.com

This is additional information which may facilitate installation and/or operation.

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

Caution
This instruction must be followed to avoid a risk of personal injury.

WARNING
This instruction must be followed to avoid a risk of death or serious injury.

1.5 Terminology

- 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.
- The terms “basic” and “extended” are used to classify objects, instances and attributes.

1.6 Trademark Information

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All other trademarks are the property of their respective holders.

2 About the Anybus CompactCom 40 CC-Link IE Field

2.1 General

The Anybus CompactCom 40 CC-Link IE Field communication module provides instant CC-Link IE Field 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.

2.2 Features

- CC-Link IE Field Network intelligent device station
- Sample configuration file (CSP+) provided by HMS Industrial Networks (requires adaptations).
- Possibility to customize Vendor Code, Model Code, Vendor Name, Model Type/Device Type, Model Name and Version via application interface
- Fixed 1 Gbit/s Baud Rate
- Network Number and Station Number configuration via application interface
- Seamless Message Protocol (SLMP) server supported
- Galvanically isolated bus
- I/O: up to 1536 bytes in total
- Transient server functionality supported.

Please note that Anybus CompactCom 40 modular device and sync functionalities are not supported in Anybus CompactCom 40 CC-Link IE Field

3 Basic Operation

3.1 General Information

3.1.1 Software Requirements

No additional network support code needs to be written in order to support the Anybus CompactCom 40 CC-Link IE Field, however due to the nature of the CC-Link IE Field networking system, certain restrictions must be taken into account:

- ADIs must be mapped as Process Data, in accordance with the Anybus CompactCom 40 CC-Link IE Field mapping scheme, in order to be correctly represented on the network.
- ADI Names, types and similar attributes cannot be accessed from the network.
- No support for network reset requests.
- One diagnostic instance can be created by the host application during normal operation. One additional (2nd) instance many be created in event of a major fault.

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

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

Each device on CC-Link can be 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).

If the product is not going to be certified there is no need for a CSP+ file. If the product is going to be certified, the generic CSP+ file has to be adapted to the application in order to pass certification tests. For more information see *Certification Information, p. 41*.

3.1.3 Communication Settings

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

In the case of CC-Link IE Field, this includes:

Station Number	On CC-Link IE Field, each device on the network must be assigned a unique Station Number.
Network Number	The network can be segmented into several parts, each with a unique network number, that is used for addressing.

3.2 Data Exchange

3.2.1 Bit Area vs. Word Area

On CC-Link IE Field, 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 .... RX7FF	768 points, e.g. RWr0... RWr767
Master —> Slave	RY00 .... RY7FF	768 points, e.g. RWw0... RWw767

Due to restrictions in the module, the maximum total amount of IO/Data in each direction is 1536 bytes

3.2.2 Acyclic Data Exchange

Transient/acyclic data exchange in server mode is supported by the Anybus CompactCom 40 CC-Link IE Field.

- Statistic Information acquisition
- Detailed Node Information acquisition
- Memory Read
- Memory Write

The Anybus CompactCom 40 CC-Link IE Field supports ADI #1 to 65535 and all ADI data types. The data is handled in 16–bit granularity.

Transient Server Memory Read and Memory Write

To access ADI data from the CC-Link IE Field network there are two dedicated functions that can be used by a CC-Link IE Field towards an intelligent device station:

Function	Description	Attribute Code	Access Code
RIRD	Reading Data from the target station	05h - Word access (external information). Other values reserved.	Reserved, set to 0h.
RIWT	Writing Data in target stations		

The module will only handle access on the complete ADI data value. The length given in the function “Number of write/read points” (S1 + 4) and (S + 4) is verified by the module on a byte granularity against ADI data size. The minimum returned value size is also in a byte granularity and the returned value is in a Little Endian word format.

Translation of RIWT

The RIWT function will be converted by the module to a Set_Attribute command to the Application Data object (FEh), Attribute # 5 (value).

RIWT data (master function)	Description	Value	Data Type	ABCC Cmd field	ABCC Resp field
Jn	Own network No.	(1 to 239)	16-bit	NA	NA
Un	Start I/O number of master (Not relevant for the module)	0 to FE	16-bit	NA	NA
(S1+0)	Completion status (see error code below) 0: Normal, no error.	-	16-bit	NA	No Error/Error Response (Error bit and data[0])
(S1+1)	Target station number	1-120	16-bit	NA	NA
(S1+2)	Access code (hi byte)/Attribute code (low byte) The attribute code should always be set to 05h by the user to indicate word access (external information.	0x00xx	16-bit	Always generate a Set_Attribute	Set_Attribute
(S1+3)	Device number (start number)	1-65535	16-bit	ADI number (Instance) CmdExt[0], Attribute = 5 (value)	ADI number (Instance) CmdExt[0], Attribute = 5 (value)
(S1+4)	Number of write points. (must be in same granularity as the data type, see access code in previous section)	1-480	16-bit	Data field size (bytes) and in Data[0-n]	NA
S2	Start device of the own station (in PLC) where data to be written is stored (Source)	-	16-bit	NA	NA
D2	Device of the own station turned ON for 1 scan upon completion of the instruction (D)+1 is turned ON as well when the instruction fails.	-	Bit	NA	NA

Data Transfer from Network to Application

When writing to an ADI with an odd (2*n+1) number of bytes, the number of points in the request should be n + 1, i.e. one extra byte should be padded in. The copying of data from the transient frame to the ADI is transparent. This means that because the transient write/read memory data is little endian on the network, the padded byte should be the high byte of the (n + 1):th word in the write request data.

Example with 3 byte ADI

Data layout in master

1122h	3344h

Data on network

22	11	44	33

Resulting ADI data

22	11	44

Translation of RIRD

The RIRD function will be converted by the module to a Get_Attribute command to the Application Data object FEh Attribute #5 (value).

RIRD data (master function)	Description	Value	Data Type	ABCC Cmd field	ABCC Resp field
Jn	Own network No.	(1 to 239)	16-bit	NA	NA
Un	Start I/O number of master (Not relevant for the module)	0 to FE	16-bit	NA	NA
(S+0)	Completion status (see error code below) 0: Normal, no error.	-	16-bit	NA	No Error/Error Response (Error bit and data[0])
(S+1)	Target station number	1-120	16-bit	NA	NA
(S+2)	Access code (hi byte)/attribute code (low byte) The attribute code should always be set t 05h by the user to indicate word access (external information.	0x00xx	16-bit	Always generate a Get_Attribute	NA
(S+3)	Device number (start number)	1-65535	16-bit	ADI number (Instance) CmdExt[0], Attribute = 5 (value)	NA
(S+4)	Number of read points (must be in same granularity as the data type, see access code in previous section)	1-480	16-bit	NA	Validated against Data field size (bytes) in response. (S+4) * 2 = Data field size.
D1	Start device of the own station (in PLC) where read data is stored (Destination)	-	16-bit	NA	NA
D2	Device of the own station turned ON for 1 scan upon completion of the instruction (D2)+1 is turned ON as well when the instruction fails.	-	Bit	NA	NA

Data Transfer from Application to Network

When reading from an ADI with an odd number of bytes, the high byte of the (n + 1):th word in the received read request data is padded and should be ignored on the master side.

Example

RIRD (transient2 read memory)

Data layout in ADI

11	22	33

Data on network

11	22	33	XX

Resulting data in the master

2211h	XX33h

Error Codes/Completion Status

In case of error, the following error codes are transferred to CC-Link IE Field network in the Transient response frames. The error code is returned according to the following table

Item name	Bit #	CC-Link IE Field Description	Detail	Usage
Error Code/ Completion Status	15-12	Vendor definition	Free error range to assign for vendor.	0xExxx is used as error base value.
	11-8	Error location	Grouped by each network hierarchy: Data Link layer, Application layer.	0000b = Application generated 0001b = Module generated 0010b = Internal application generated 0011b-1111b = reserved
	7	Error critically	0 = Warning, 1 = Major	Set to 0 for all errors.
	6-0	Error code	Vendor specific.	Error codes, see tables below, giving error code ranges and error code translations.

Error Code Range	Error codes
E0xxh	Application generated error codes
E1xxh	Module generated error codes
E2xxh	Internal application error codes

Error Code Translation

The low byte of the error code is translated as given in this table.

Number	Meaning	Description	CFN Error code	CFN Description
00h	Reserved	-	0000h	No error
01h	Reserved	-	XX01h	-
02h	Invalid message format	Command and error bit set	XX02h	Invalid Message Set
03h	Unsupported object	Object not registered	XX03h	Unsupported object
04h	Unsupported instance	The requested instance doesn't exist	XX04h	Application data unsupported
05h	Unsupported command	The target doesn't support the command	XX05h	Unsupported command
06h	Invalid CmdExt[0]	Invalid value of CmdExt[0]or invalid combination of CmdExt [0] and CmdExt[1]	XX06h	Invalid CmdExt[0]
07h	Invalid CmdExt[1]	Invalid value of CmdExt[1]	XX07h	Invalid CmdExt[0]
08h	Attribute not set-able	The requested attribute is not set-able	XX08h	Application data not set-able
09h	Attribute not get-able	The requested attribute is not get-able	XX09h	Application data not get-able
0Ah	Too much data	Too much data in message data field	XX0Ah	Too much data
0Bh	Not enough data	Not enough data in message data field	XX0Bh	Not enough data
0Ch	Out of range	The data is out of range Use this code only when code 11h or 12h cannot be used.	XX0Ch	Out of range
0Dh	Invalid state	The command is not supported in the current state	XX0Dh	Application in invalid state
0Eh	Out of resources	The target object cannot execute the command due to limited resources	XX0Eh	Out of resources
0Fh	Segmentation failure	Invalid handling of the segmentation protocol	XX0Fh	Segmentation failure

Number	Meaning	Description	CFN Error code	CFN Description
10h	Segmentation buffer overflow	Too much data received for the segmentation buffer	XX10h	Segmentation buffer overflow
11h	Value too high	Written data value is too high (extension to 0Ch (Out of range))	XX11h	Value too high
12h	Value too low	Written data value is too low (extension to 0Ch (Out of range))	XX12h	Value too low
13h	Attribute controlled from another channel.	Used to NAK writes to “read process data” mapped attributes.	XX13h	Application data controlled from another channel
14h	Message channel too small	The message read/write area in use by the host application does not support a message channel with large enough data field to fit the response data.	XX14h	Application message channel too small
15h	General error	An error not matching any of the other existing error codes has occurred.	XX15h	Application general error
21h	Illegal Access code	Illegal value	XX21h	Illegal Access code
22h	Illegal Attribute code	Illegal value	XX22h	Illegal Attribute code
23h	Not addressed to node	The module received a request that was not addressed to itself (wrong node number/network number).	XX23h	Not addressed to node
24h	Unsupported service	The module received an unsupported transient2 request, i.e. other than Read memory/ Write memory.	XX24h	Unsupported service
25h	Wrong quantity	The module only supports batch access, not random access.	XX25h	Wrong quantity
26h	Data size too big	The number of points times the data type size exceeds the maximum transient2 data size (480 words)	XX26h	Data size too big
7Fh	Object specific error (Not possible to represent due to 7 bits toward CFN)	The object returned an object specific error code	XX7Fh	Object specific error

Timeout Considerations

If a timeout is detected for a RIRD or RIWT function, please consult the CC-Link IE Field network master manual for timeout settings and retry factors.

4 CC-Link IE Field Implementation Details

4.1 Process Data Mapping

4.1.1 Default CC-Link Buffer Memory Map

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

If no mapping is done by the application, the Anybus CompactCom 40 CC-Link IE Field automatically generates the minimum CC-Link IE Field network configuration (16 bit points/4 word points), but with no connection/mapping towards the application. The module will be available on the network and can be used for parameter data exchange.

4.1.2 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 IE Field 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 IE Field 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 in section .
- 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 unaligned data mapping.
- Not all elements in an ARRAY or STRUCT ADI need to be mapped.

  See example in section .
- ADIs with data type structure are put in the CC-Link IE Field word area as a complete chunk/ blob, unless covered by any of the rules above.

Implementation of CC-Link IE Field profiles might require that the application uses 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 IE Field bit areas and using ADI# xx (dummy byte) for padding in the CC-Link IE Field word areas. These areas should be marked as reserved in the buffer memory description (towards the CC-Link IE Field network).

A faulty mapping will generate a NAK (negative acknowledgment).

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:

Point	Contents (Command number[Element:bit])							
RY #7... 0	A[0:7]	A[0:6]	A[0:5]	A[0:4]	A[0:3]	A[0:2]	A[0:1]	A[0:0]
RY #15... 8	A[1:7]	A[1:6]	A[1:5]	A[1:4]	A[1:3]	A[1:2]	A[1:1]	A[1:0]
RY #23... 16	A[2:7]	A[2:6]	A[2:5]	A[2:4]	A[2:3]	A[2:2]	A[2:1]	A[2:0]
RY #31... 24	B[0:7]	B[0:6]	B[0:5]	B[0:4]	B[0:3]	B[0:2]	B[0:1]	B[0:0]
RY #39... 32	B[0:15]	B[0:14]	B[0:13]	B[0:12]	B[0:11]	B[0:10]	B[0:9]	B[0:8]

This is the resulting RWw mapping in the word area:

	Contents (Command number[bit/byte/word])	
Point	Contents (LSB)	Contents (MSB)
RWw #0	C	D
RWw #1	E[0]	E[1]
RWw #2	F[0]	F[1]
RWw #3	G[LSW]	G[LSW]
RWw #4	G[MSW]	G[MSW]
RWw #5	H[7], H[6] , H[5], H[4], H[3], H[2], H[1] , H[0]	H[15], H[14], H[13], H[12], H[11], H[10], H[9], H[8]
RWw #6	I[LSW]	I[LSW]
RWw #7	I[MSW]	I[MSW]

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. 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”

Command	# mapping items	ADI #	Total Nbr of elements	Index first elementa	Nbr of consecutive elements	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)

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)	-

4.2 Diagnostics

The module supports one diagnostic entry during normal conditions, plus an additional second entry in case of a major unrecoverable event.

Information on the actual cause and the severity of a diagnostic event is forwarded to the network.

Latching event functionality is not supported.

Diagnostic object command from application		**Event displayed in master (Diagnostics)**
Create, CmdExt[0], Bit 4-6: Severity	0x00 – Minor, recoverable 0x10 – Minor, unrecoverable	“Continue error in progress”
	0x20 – Major, recoverable	“STOP PAUSE ERROR” “Stop error in process”
	0x30 – Major, unrecoverable (EXCEPTION state)	“Baton pas error” “Data link error”
Delete		Deleted severity 0x00, 0x10: “Continue error cancellation” Delete severity 0x20: “RUN or STEP RUN” “Stop error cancellation”

4.3 SLMP (Seamless Message Protocol)

SLMP is a feature of CC-Link IE Field that makes it possible to seamlessly connect field systems to information systems. If SLMP is implemented in a standard Ethernet device, the device can be accessed and also exchange data across the network.

The Anybus CompactCom 40 CC-Link IE Field supports SLMP server functionality in the configurations shown in the figures below.

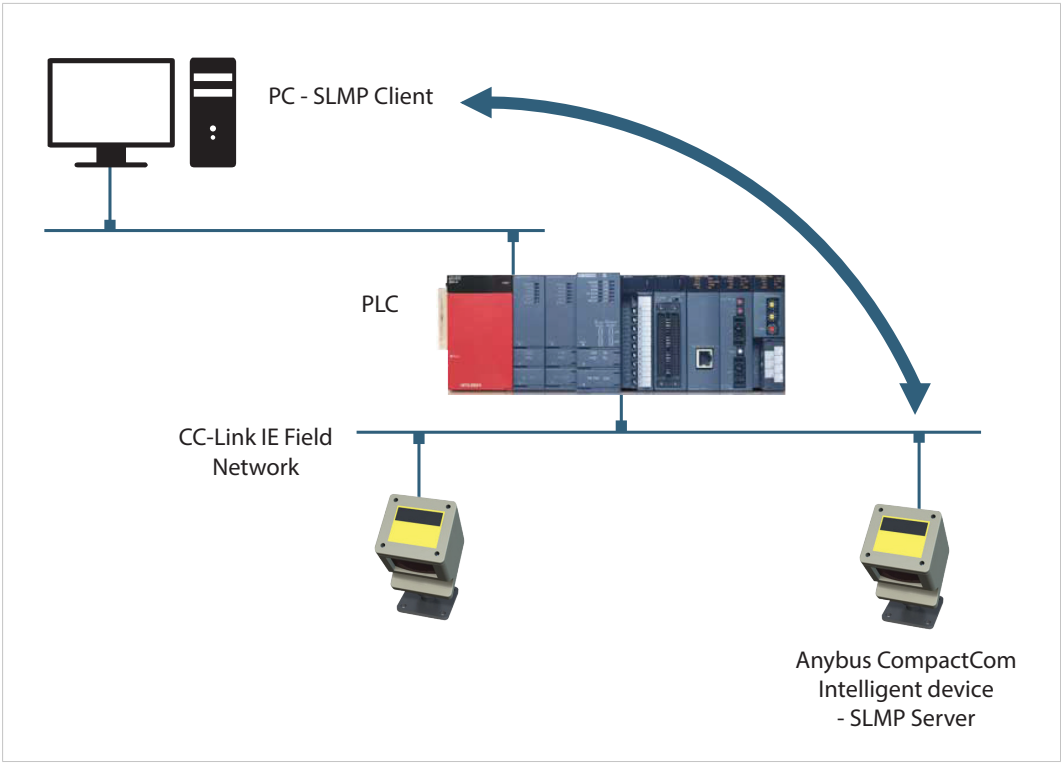


Fig. 1

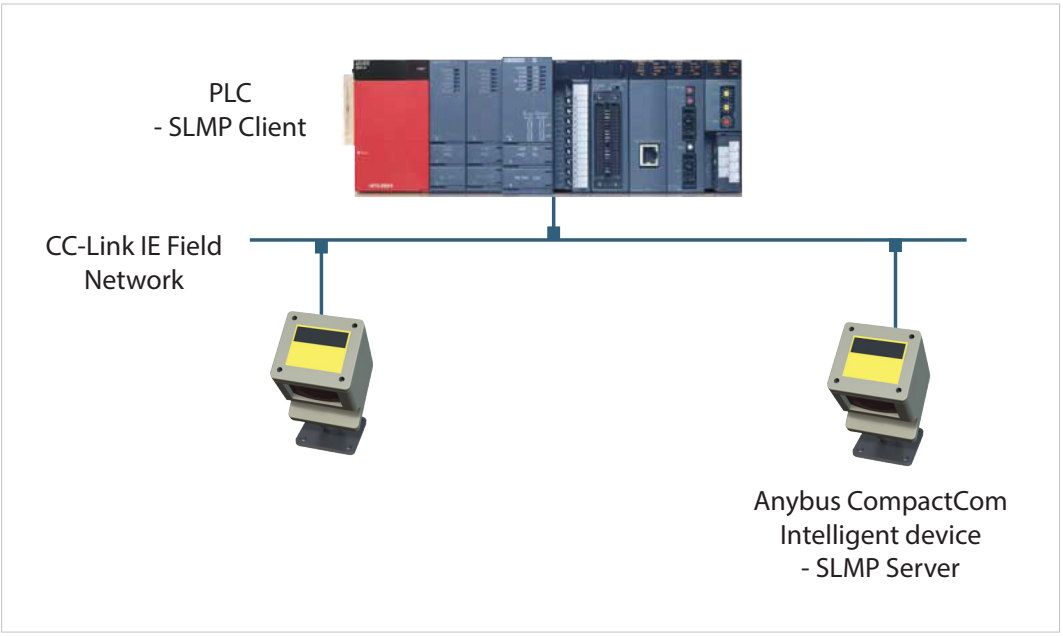


Fig. 2

SLMP is enabled by default in the device, but can be disabled by setting attribute #7 (Enable SLMP) in the CC-Link IE Field Network Host Object (E6h). The Anybus CompactCom 40 CC-Link IE

Field supports a limited set of SLMP commands by default. If attribute #8 (Enable SLMP forwarding) is enabled, the application can choose to handle SLMP requests, both implementing the commands, supported by the Anybus CompactCom 40, and implementing additional support for functions not supported by the device.

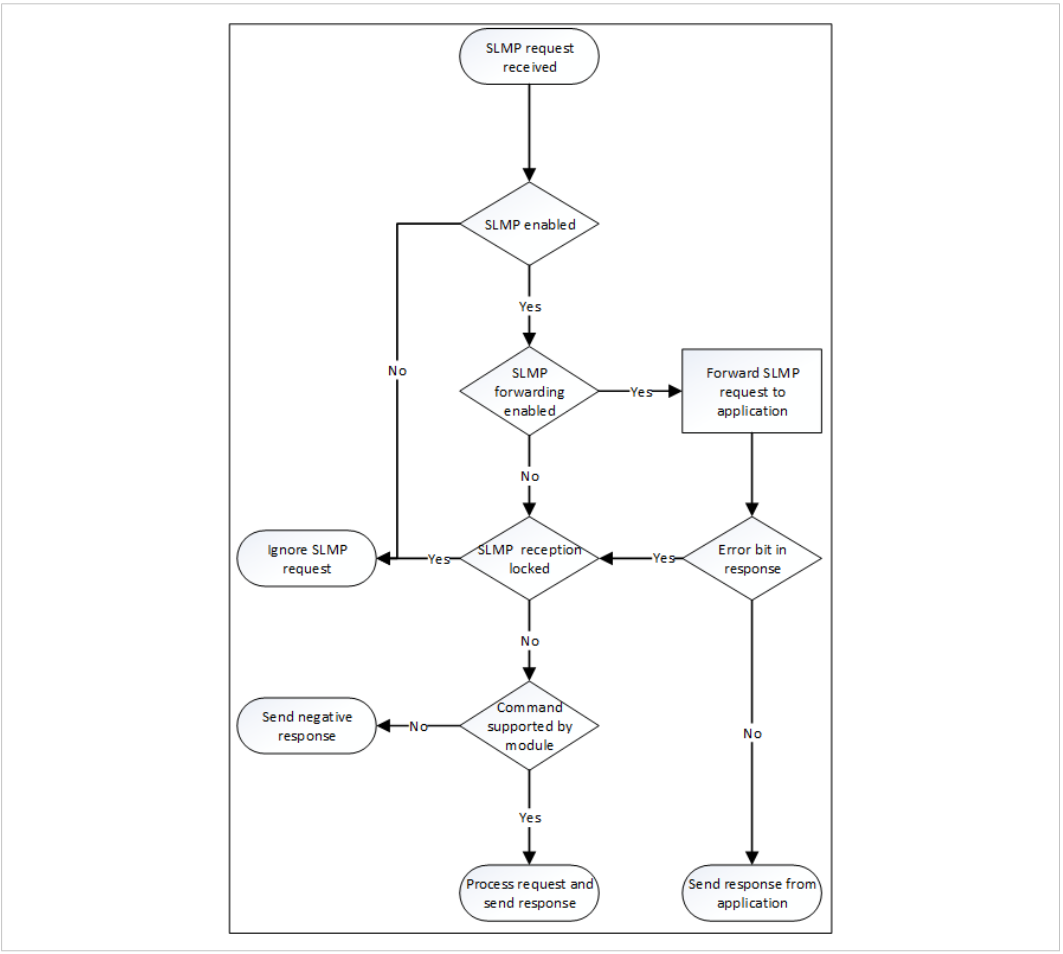


Fig. 3

4.3.1 SLMP (Default)

By default, the Anybus CompactCom 40 CC-Link IE Field supports the SLMP commands listed in the table below. An SLMP client data request, will automatically be handled in the same manner as for transient/acyclic data exchange, see *Acyclic Data Exchange, p. 7*. No action has to be taken by the host application.

Command #	Subcommand #	Command name	Description/Comments
0101h	0000h	Remote control — read processor type	This function returns the model code and the model name defined in the *CC-Link IE Field Network Host Object (E6h), p. 33* to the network. The model name will be truncated to 16 signs. According to the SLMP Conformance test, this is the only mandatory function. For more information please consult the SLMP Conformance Test (for Server), available at the CLPA web site (www.cc-link.org, membership is required).
0613h	0000h	Dual port batch read	Function to read from an ADI. “StartAddr” is translated to ADI number. “wl” must be the same as the ADI size in words. For end codes, see *SLMP Diagnostics, p. 20*
1613h	0000h	Dual port batch write	Function to write to an ADI. “StartAddr” is translated to ADI number. “wl” must be the same as the ADI size in words. “wdDataBlock” contains data to write to the ADI. For end codes, see *SLMP Diagnostics, p. 20*

The Anybus CompactCom 40 CC-Link IE Field will return diagnostic information to the requesting device. Requests, used to obtain diagnostic information are described in *SLMP Diagnostics, p. 20*.

4.3.2 SLMP (Advanced)

If SLMP forwarding (CC-Link IE Field Network Host Object (E6h), attribute #8) is enabled, all SLMP requests arriving are automatically forwarded to the application. The application can implement additional support for SLMP functionality. If the application can not handle a specific request, it should respond with the error bit set to 1.

SLMP based communication makes it possible to perform server remote control from a client. Setting attribute #3 (SLMP reception locked) in the Network CC-Link IE Field Object (12h) to 1 (locked), disables the SLMP based communication to the device, see the flowchart above. Setting the attribute to 0 (unlocked) enables the SLMP communication. This can be used e.g. when the functionality ”Remote Password” is implemented by the host application or if the customer, via a user interface, wants to stop SLMP requests from being handled. Please note that the SLMP reception can be locked in the device, but still be handled by the application, if SLMP forwarding is enabled.

It is recommended for the application not to handle requests for diagnostic information, as the application does not have all information regarding the port diagnostics. Instead the default handling by the device of diagnostic requests, should be used.

Below is an example of a request, forwarded to the application, and a successful response returned by the application

Example

This table shows a request (Dual Port Memory Batch Read), forwarded to the application.

SLMP request frame		Description	Value	Data Type
SLMP Header	Frametype	Binary mode with serial number	0054h	16-bit
	Serial No.	Indicates an arbitrary number for identifying the communication frame. Request communication frames and response communication frames have the same serial number.	0000h	16-bit
	Reserved	-	Xxxxh	16-bit
SLMP Sub Header	NetNumber	Shall be checked against configured network number. Network Configuration Object, Instance # 3 “Network number” – value (see *25*).	01h	8-bit
	NodeNumber	Shall be checked against configured node number. Network Configuration Object, Instance # 1 “Station number” – value (see *25*).	03h	8-bit
	DestProcNo	Indicates the processor number of the request destination station. In this example “Default (system definition) processor”	03FFh	16-bit
	Reserved	-	Xxh	8-bit
	Data Length	Request data length - indicates the octet length from the timer (timer) to the end of Request Data (Request Data[0 - N].	000Ch	16-bit
	Timer	Indicates the wait time in the network module from request reception to response return from the processor module. Wait time (unit: 250 ms)	0001h	16-bit
Command		Dual Port Memory Batch Read	0613h	16-bit
Subcommand		For this command - When data is to be read in word units, the value of the sub-command is 0000h. (When data is to be read in bit units, the value of the sub-command is 0001h).	0000h	16-bit
Request Data[0 - N]	startAddr	Head address	00000001h	4 Octets
	wl	Word length	0001h	2 Octets

This table shows a successful response, returned from the application:

SLMP response frame		Description	Value	Data Type
SLMP Header	Frametype	Binary mode with serial number	00D4h	16-bit
	Serial No.	Shall be the same as in the request	0000h	16-bit
	Reserved	-	0000h	16-bit
SLMP Sub Header	NetNumber	Shall be the same as in the request	01h	8-bit
	NodeNumber	Shall be the same as in the request	03h	8-bit
	DestProcNo	Shall be the same as in the request	03FFh	16-bit
	Reserved	-	00h	8-bit
	Data Length	Indicates the octet length from the end code (Endcode) to the end of Request Data (Request Data[0]	0004h	16-bit
	Endcode	0000h: if no error Xxxxh: if error, see *SLMP Diagnostics, p. 20*.	0000h	16-bit
Response Data [0]	wdDataBlock	Data (word units)	Xxxxh	16-bit

4.3.3 SLMP Diagnostics

By default, the Anybus CompactCom 40 CC-Link IE Field will respond with diagnostic information to the following requests:

Command #	Subcommand #	Command name	Description/Comments
3119h	0000h	Acquire Selected Station Information	The module will return LED status and selected information about the module.
3040h	0000h	Communication Test	The module mirrors the request, to confirm that it will respond to commands.
3050h	0000h	Cable Test	The module returns information on which ports are used.
0619h	0000h	Loop Back Test	The module mirrors the request.

4.3.4 Diagnostic Information and Error Code Translations

A positive response will hold the end code 0000h along with the information in the response. A negative response will hold one of the end codes in the table:

End Code	Description
C059h	• There is an error in specifying command or subcommand. • Received the command other than the specified sequence.
C05Ch	There is an error in the request message.
C061h	The request data length does not match the number of data.
CEE1h	The request message size has exceeded the effective processing range
CEE2h	The response message size has exceeded the effective processing range.
Exxxh	Errors specific for the Anybus CompactCom 40, see table below.

Error Code Translation (SLMP)

The low byte of the error code is translated as given in this table.

Number	Meaning	Description	End Code	CFN Description
00h	Reserved	-	X000h	No error
01h	Reserved	-	X001h	See meaning column.
02h	Invalid message format	Command and error bit set	X002h	See meaning column.
03h	Unsupported object	Object not registered	X003h	See meaning column.
04h	Unsupported instance	The requested instance doesn't exist	X004h	Application data unsupported
05h	Unsupported command	The target doesn't support the command	X005h	See meaning column.
06h	Invalid CmdExt[0]	Invalid value of CmdExt[0]or invalid combination of CmdExt[0] and CmdExt[1]	X006h	See meaning column.
07h	Invalid CmdExt[1]	Invalid value of CmdExt[1]	X007h	See meaning column.
08h	Attribute not set-able	The requested attribute is not set-able	X008h	Application data not settable
09h	Attribute not get-able	The requested attribute is not get-able	X009h	Application data not gettable
0Ah	Too much data	Too much data in message data field	X00Ah	Too much data
0Bh	Not enough data	Not enough data in message data field	X00Bh	Not enough data
0Ch	Out of range	The data is out of range Use this code only when code 11h or 12h cannot be used.	X00Ch	See meaning column.
0Dh	Invalid state	The command is not supported in the current state	X00Dh	Application in invalid state
0Eh	Out of resources	The target object cannot execute the command due to limited resources	X00Eh	See meaning column.
0Fh	Segmentation failure	Invalid handling of the segmentation protocol	X00Fh	See meaning column.
10h	Segmentation buffer overflow	Too much data received for the segmentation buffer	X010h	See meaning column.
11h	Value too high	Written data value is too high (extension to 0Ch (Out of range))	X011h	See meaning column.
12h	Value too low	Written data value is too low (extension to 0Ch (Out of range))	X012h	See meaning column.
13h	Attribute controlled from another channel.	Used to NAK writes to "read process data" mapped attributes.	X013h	Application data controlled from another channel
14h	Message channel too small	The message read/write area in use by the host application does not support a message channel with large enough data field to fit the response data.	X014h	Application message channel too small
15h	General error	An error not matching any of the other existing error codes has occurred.	X015h	Application general error
23h	Not addressed to node	The module received a request that was not addressed to itself (wrong node number/network number).	X023h	Not addressed to node
26h	Data size too big	The number of points times the data type size exceeds the maximum read size (727 words)	X026h	Data size too big
FFh	Object specific error	The object returned an object specific error code	X0FFh	See meaning column.

5 Anybus Module Objects

5.1 General Information

This chapter specifies the Anybus module object implementations and how they correspond to the functionality in the Anybus CompactCom 40 CC-Link IE Field.

The following Anybus module objects are implemented:

- *Anybus Object (01h), p. 23*
- *Diagnostic Object (02h), p. 24*
- *Network Object (03h), p. 25*
- *Network Configuration Object (04h), p. 25*
- *Anybus File System Interface Object (0Ah), p. 29*
- *Network CC-Link IE Field Object (12h), p. 30*

5.2 Anybus Object (01h)

Category

Basic

Object Description

This object groups common Anybus information, and is described thoroughly in the general Anybus CompactCom 40 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 40 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: 01h 02h 01h 02h	Color: Green Red Green 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 IE Field)	

5.3 Diagnostic Object (02h)

Category

Basic

Object Description

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

The module supports two instances of this object, where one is reserved for a major unrecoverable diagnostic event. Information about the actual cause and the severity of a diagnostic event will be forwarded to the network.

See also ....

- *Diagnostics, p. 15*

Supported Commands

Object:	Get_Attribute
	Create
	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 40 Software Design Guide
4	Highest instance no.	Get	UINT16	
11	Max no. of instances	Get	UINT16	1+1
12	Supported functionality	Get	BITS32	0000 0000h (Latching event not supported)

Instance Attributes (Instance #n)

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

5.4 Network Object (03h)

Category

Basic

Object Description

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

See also....

- *Network CC-Link IE Field Object (12h), p. 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	Data Type	Value
1	Network type	Get	UINT16	0x009E
2	Network type string	Get	Array of CHAR	“CC-Link IE Field Network”
3	Data format	Get	ENUM of of LSB First = 0 MSB First = 1	00h
4	Parameter data support	Get	BOOL	TRUE
7	Exception information	Get	UINT8	00h (No additional CC-Link IE Field network 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.

On a CC-Link IE Field network a control program can perform transient communication for all the devices connected to the network by specifying network numbers and station numbers. By exchanging messages using transient communication, any device can communicate with all the other devices on the network, regardless of the network type.

If the network number is set to 0 in instance #3, a network number will be retrieved from the network and the value will be updated to the retrieved value.

If the value of instance #3 (network number), attribute #5 is set to 0, a network number will be retrieved from the network. When the value has been retrieved, attribute #5 will be updated to the retrieved value.

See also ..

- *Communication Settings, p. 6*
- *CC-Link IE Field Network Host Object (E6h), p. 33*

Instances #1 and #3 have to be implemented if the end product is going to be recertified according to CC-Link IE Field 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	0003h

Instance Attributes (Instance #1, Station Number)

This instance holds the actual CC-Link IE Field station number.

Basic

#	Name	Access	Data Type	Value
1	Name	Get	Array of CHAR	"Station number" Multilingual, see *Multilingual Strings, p. 28*
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	Get/Set	UINT8	**Value** **Setting** 0 Not set (invalid to use) 1 — 120 Station number (default = 1) >120 (not valid)
6	Configured value	Get	UINT8	Holds the configured value. **Value** **Setting** 0 Not set (invalid to use) 1 — 120 Station number >120 (not valid)

Any value written to attribute #5 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. If no valid station number is entered the module will enter Anybus state EXCEPTION, when leaving Anybus state NW_INIT.

Instance Attributes (Instance #3, Network Number)

Basic

#	Name	Access	Data Type	Value
1	Name	Get	Array of CHAR	"Network no." Multilingual, see *Multilingual Strings, p. 28*
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	Get/Set	UINT8	**Value** **Setting** 0 Retrieve network number from network 1 — 239 Network number (Default =1) >239 (not valid)
6	Configured value	Get	UINT8	Holds the configured value **Value** **Setting** 0 Retrieve network number from network 1 — 239 Network number >239 (not valid)

If the value of attribute #5 is set to 0, a network number will be retrieved from the network. When the value has been retrieved, attribute #5 will be updated to the retrieved value.

Any value written to attribute #5 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. If no valid network number is entered the module will enter Anybus state EXCEPTION, when leaving Anybus state NW_INIT.

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.	Stationsnr.	Núm. Estación	No. Stazione	Num station
3	Network No.	Netzwerknr.	Núm. Red	No. Rete	Num réseau

5.6 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 IE Field, 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 (Instance #1)

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

5.7 Network CC-Link IE Field Object (12h)

Category

Basic

Object Description

This object implements CC-Link IE Field network specific services in the module. Reading instance #1, attribute #1, gives information on the cyclic data size that the node represents on the network.

Supported Commands

Object:	Get_Attribute
	Execute_External_Loopback_Test
Instance:	Get_Attribute

Object Attributes (Instance #0)

#	Name	Access	Data Type	Value
1	Name	Get	Array of CHAR	“Network CFN”
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	Data Type	Value	Comment
1	Allocated buffer memory size	Get	Struct of: UINT16 (RY points) UINT16 (RWw points) UINT16 (RX points) UINT16 (RWr points)	N/A	Not valid until response of first successful mapping command. After setup is complete, this attribute shall reflect how many points are allocated buffer memory size for this module (in point granularity).
2	Application operation status	Get/Set	UINT8	0	0: Detailed application operation status notification not supported 1: Application stopped 2: Application running
3	SLMP reception locked	Get/Set	UINT8	0	0: SLMP reception is allowed 1: No SLMP reception is allowed, all requests are forwarded if forwarding is enabled

Command Details: Execute_External_Loopback_Test

Category

Basic

Details

Command Code:	10h
Valid for:	Object Instance

Description

This command is used for executing the external Ethernet port loopback test from the application. Use of the test requires a connected Ethernet cable between port 1 and port 2. It is only valid during setup. The LED indication sequence is described in *External Loopback test, p. 44*.

- Command details:

Field	Contents
CMDExt[0–1]	Reserved (set to 0)

- Response details:

Field	Contents
MsgData[0]	Loopback test result.. 0: Success 1: Failure

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 IE Field implementation.

- *CC-Link IE Field Network Host Object (E6h), p. 33*
- *Ethernet Object (F9h), p. 38*
- Application Data Object (FEh), see Anybus CompactCom 40 Software Design Guide.
- Application Object (FFh), see Anybus CompactCom 40 Software Design Guide.

6.2 CC-Link IE Field Network Host Object (E6h)

Category

Basic, extended

Object Description

This object implements CC-Link IE Field 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 startup. 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
	Buffer_Data_Size_Notification
Instance:	Text

Object Attributes (Instance #0)

#	Name	Access	Data Type	Value
1	Name	Get	Array of CHAR	“CC-Link IE Field Network”
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	Data Type	Default Value	Comment
1	Vendor Code	Get	UINT16	0212h	HMS Industrial Networks
2	Vendor Name	Get	Array of CHAR	“HMS Industrial Networks”	Max 31 bytes
3	Model Type/ Device Type	Get	UINT16	007Fh	The model type value corresponds to a profile specified by CLPA, in this case “Generic Device”.
4	Model Name	Get	Array of CHAR	“CompactCom 40 CFN”	Max. 19 characters
5	Unit Model Code	Get	UINT32	0000 0002h	
6	Version	Get	UINT8	Current software version	The current software version is incremented each time new and/or changed CC-Link IE Field functionality is implemented, e.g. changes to the profile implementation (buffer memory layout) by the application or other functionality towards CC-Link IE Field.
7	Enable SLMP	Get	UINT8	01h	00h: SLMP support disabled The module will not report SLMP support on the network and all incoming SLMP requests will be ignored. 01h: SLMP support enabled The module will report SLMP support on the network and respond to all requests.
8	Enable SLMP request forwarding	Get	UINT8	00h	00h: SLMP request forwarding disabled 01h: SLMP request forwarding enabled All SLMP commands will be forwarded to the application, with the command Slmp_Server_ Request (11h). If the application responds with the error bit set the module will respond in the same way as if this attribute was set to 00h (disabled).

Command Details: Buffer_Data_Size_Notification

Category

Extended

Details

Command Code:	10h
Valid for:	Object Instance

Description

This command is used for notifying the application about a change in comparison between the setting of the active cyclic network buffer data size by the master (configuration) and the application settings in process data size. The size from the master will be set during the network initialization phase with the parameter frame. The command is sent on detection that the configuration from network has changed. It will not be sent at start-up if the configuration from master matches the application. The size is always referred from the start of the buffer memory.

It the application returns “Unsupported command” (05h) or any other error response, the Anybus CompactCom 40 CC-Link IE Field will hand over the indication to the master.

Indication will be done towards the network and the module will enter the Anybus state ERROR if these two configuration settings do not match.

- Command details:

Field	Contents
CMDExt[0–1]	Reserved (set to 0)
Data[0]	RySize (low byte) – New size of the RY data in bytes.
Data[1]	RySize (high byte) – New size of the RY data in bytes.
Data[2]	RWwSize (low byte) – New size of the RWw data in bytes.
Data[3]	RWwSize (high byte) – New size of the RWw data in bytes.
Data[4]	RxSize (low byte) – New size of the RX data in bytes.
Data[5]	RxSize (high byte) – New size of the RX data in bytes.
Data[6]	RWrSize (low byte)– New size of the RWr data in bytes.
Data[7]	RWrSize (high byte) –New size of the RWr data in bytes.

- Response details (error):

Field	Contents
CMDExt[0–1]	Reserved (set to 0)
Data[0]	05h — Unsupported Command

If the application returns a response with no error on the notification command, no other action is taken by the module and all actions must be handled by the application. Action required from the application depends on what is vital to be sent/received on the network as cyclic data to maintain a safe operation of the application. If the application evaluates the active size to be faulty or unsafe for the application, the action should be to generate a Diagnostic Event for the end user notification.

If the application return Unsupported command (0x05) or any other error response, the module will handle the indication to the master.

Command Details: Slmp_Server_Request

Category

Extended

Details

Command Code:	11h
Valid for:	Object Instance

Description

If SLMP request forwarding is enabled (attribute #8), the Anybus CompactCom 40 CC-Link IE Field forwards SLMP server requests to the application using this command.

The application evaluates the requests and returns a correct response, as well as acts upon the command, e.g. by setting the attribute #02 (Application operation status) of the Network CC-Link IE Field Object (12h) to an appropriate value if a remote RUN/STOP command is received.

If the application response with the error bit set, the module will handle the original SLMP request.

Note: It is recommended for the application to answer with the error bit set to SLMP requests not supported by the application instead of answering with an endcode that is not zero. Otherwise SLMP requests like “Cable test” will stop working.

- Command details:

  This is the normal layout for SLMP requests, there may be requests with a different layout depending the value of Frame type.

Field	Contents
CMDExt[0-1]	Reserved (set to 0)
Data[0-1]	Frame type
Data[2-3]	Serial number
Data[4-5]	(reserved)
Data[6]	netNo - Request destination station network number
Data[7]	nodeNo - Request destination station number
Data[8-9]	dstProcNo - Request destination station processor number
Data[10]	(reserved)
Data[11–12]	Dl - Indicates the octet length from the Timer to the end of the SLMP response
Data[13 - 14]	Timer
Data[15 - 16]	Command
Data[17 - 18]	Subcommand
Data[19 - N]	Request data

- Response details (success):

  This is the normal layout for SLMP requests, there may be requests with a different layout depending the value of Frame type.

Field	Contents
CMDExt[0–1]	Reserved (set to 0)
Data[0 - 1]	Frame type
Data[2 - 3]	Serial Number
Data[4 - 5]	(reserved)
Data[6]	netNo - Request destination station network number
Data[7]	nodeNo - Request destination station number
Data[8 - 9]	dstProcNo - Request destination station processor number
Data[10]	(reserved)
Data[11 - 12]	Dl - Indicates the octet length from the EndCode to the end of the SLMP response
Data[13 - 14]	EndCode
Data[15 - N]	Response data

- Response details (error):

Field	Contents
Command	Error bit set
CMDExt[0–1]	Reserved (set to 0)

6.3 Ethernet Object (F9h)

Category

Extended

Object Description

This object implements Ethernet features in the host application.

Supported Commands

Object:	Get_Attribute
Instance:	Get_Attribute
	Set_Attribute

Object Attributes (Instance #0)

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

Instance Attributes (Instance #1)

#	Name	Access	Data Type	Value	Comment
1	MAC Address	Get	Array of UINT8	MAC address, 6 bytes	If implemented, this attribute must be set during initialization (in Anybus state SET_UP). If not implementet, the value set at production will be used.
8	Network Status	Set	UINT16	N/A	Information about current network status, see below.

Network Status (Instance #1, Attribute #8)

Bit(s)	Name	Description
0	Link	Indicates the current link status. True: The module has a valid link False: There is no valid link.
1	(Not used)	
2	(Not used)	
3	Link port 1	Indicates the current link status for port 1. True: Link on port 1. False: No valid link on port 1.
4	Link port 2	Indicates the current link status for port 2. True: Link on port 2. False: No valid link on port 2.
5–15	Reserved	

A Categorization of Functionality

The objects, including attributes and services, of the Anybus CompactCom and the application are divided into two categories: basic 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 moving of data to and from the network. Extra value is given to the application.

Some of the functionality offered may be specialized and/or seldom used. As most of the available network functionality is enabled and accessible, access to the specification of the industrial network may be required.

B Implementation Details

B.1 SUP-Bit Definition

The Supervised bit (SUP) set to “1” indicates that a CC-Link IE Field master is present on the network with an error free application (PLC program) and that the cyclic transmission to the module is working. The SUP bit is set to “0” if a master is not present on the network, or if the application or the cyclic transmission is not working properly.

B.2 Anybus State Machine

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

Anybus State	Implementation
WAIT_PROCESS	Waiting for the network cyclic/status ok.
ERROR	Possible causes: • Buffer memory configuration set by the application does not match the configuration set by the master. • Error in the network controlling application (the PLC program) or not receiving Mystatus at all from the master.
PROCESS_ACTIVE	Everything is running normally on the network and in the controlling application.
IDLE	E.g. when a PLC CPU/application is not in RUN state.
EXCEPTION	Possible causes: • Configuration error • Other error that cannot be indicated to the application in any other way. Example: • Invalid node number set. • Invalid station number set.

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.

C Certification Information

C.1 Basics

The following steps are necessary to perform in the software design of the application to enable a certification:

1. Change Vendor Code

   Replace the HMS Vendor ID with a unique vendor code. This is done by implementing the CC-Link IE Field Host Object (E6h), instance #1, attribute #1, and returning the vendor code when receiving a Get_Attribute request.

   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.

2. Increment software Version

   Increment the software version in the CC-Link IE Field host object (E6h), instance #1, attribute #6, if you want to keep track of the versions. This number should be incremented at each change in network functionality, leading to a recertification. Implement the CC-Link IE Field host object (E6h) instance #1, attributes #6, and return the software version when receiving a Get:_Attribute request.

3. Generate a customized CSP+ file

   A customized CSP+ file must be generated if the product is going to be certified. See *CSP+ File Customization, p. 42*

These steps constitute the identification changes required to obtain a certification. For the complete conformance test requirements, please consult the Conformance Test Specifications (publication BAP-C0401-037-D) from CLPA. The Anybus CompactCom 40 CC-Link IE Field has passed the CC-Link IE Field Conformance Test, so the test item list in table 2 in the Overview section of the Conformance Test Specifications shall be used.

C.1.1 Exceptions to Test Item List

The application should be tested according to the Test Item List, with the following exceptions:

- The host application does not have to implement “Cyclic start/stop to host station” (item 2.3 (2) in test item list). If not implemented, this shall be reported as “not supported” in the test report.
- The host application does not have to implement “Synchronization slave station” (item 2.6 (1) in test item list). If not implemented, this shall be reported as “not supported” in the test report.
- It is not always necessary to perform the complete 1000BASE-T compliance test (item 1.6 in test item list). For more information, see *1000BASE-T Compliance, p. 42*

C.2 Model Type

When the module is delivered, the Model Type (CC-Link IE Field host object (E6h), instance #1, attribute #3, is set to 007Fh (Generic device). If the host application is similar to an existing CC-Link IE Field profile, this code should be changed to reflect that profile.

C.3 Other

C.3.1 1000BASE-T Compliance

The Anybus CompactCom 40 CC-Link IE Field, module version, is tested for 1000BASE-T compliance. When the end product is sent for compliance test, the HMS Industrial Networks certificate can be used, with the exception of the mandatory test “Common mode output voltage”.

When using the brick version, the HMS Industrial Networks certificate can not be used, and a full 1000BASE-T compliance test is mandatory.

C.3.2 SLMP Conformance

The SLMP function “Remote control - read processor type” is mandatory to implement. For more information see “SLMP Conformance Test (for Server)”, available at the CLPA web page (www.cc-link.org, membership is required).

C.3.3 Noise

The shield of the RJ45 connector is not connected to FE. If there are problems to pass the CC-Link IE Field noise test, the Ethernet cable shield may have to be connected to the chassis ground at each port, as described in *Cables, shielding connections, p. 45*.

C.4 CSP+ File Customization

An generic CSP+ file is provided by HMS Industrial Networks. This file is based on the example application that follows with the Anybus CompactCom 40 Starter Kit, but can be used as a basis for customizing to any other host application. A tool, “Profile Creation Tool”, for modifying the file is available at the CLPA web page (www.cc-link.org, membership is required). Also available at the CLPA web page is a document containing guidelines for creating CSP+ files, *CC-Link Family System Profile (CSP+) Creation Guidelines*.

Open the example file with the Profile Creation Tool, and change the entries given below. The entries will show as described in the GX Works 2 PLC and network configuration tool.

C.4.1 Fileinfo

In the “Fileinfo” section of the CSP+ file, change the following entries:

- ModDate
- ModTime

C.4.2 DeviceInfo

In the “DeviceInfo” section of the CSP+ file, change the following entries:

Entry	Description	Note
VendorName	Vendor name	All devices will be listed under this vendor name in the Module List window in GX Works 2.
DeviceModel	Device model name.	Defines the device model name in the Module list under the CC IE Field Configuration Module window in GX Works 2.
VendorCode	The code assigned by CLPA (taken from the member number).	These settings shall comply with any setting don in the CC-Link Field Network Host Object (E6h) in the application. The settings are not validated against the setting in the CSP+ file, but never the less shall comply. They are validated in a conformance test.
Product ID	The device product code (vendor specific),	

Entry	Description	Note
Version	Version of the network interface. Changed when network functionality change	
DeviceTypeID	Defines the profile used for the device in the GX Works Module list under your vendor name. PLC corresponds to 0x0001, Generic Device corresponds to 0x007F).	

C.4.3 CommIfInfo

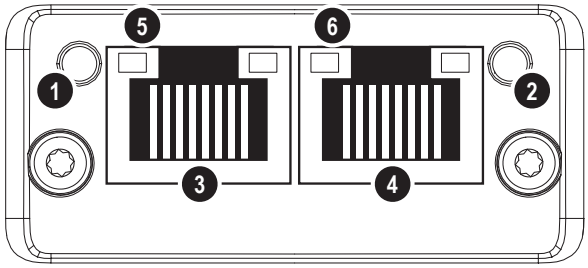
The “CommIFInfo” section of the CSP+ file, identifies the communcation interface information list. Change the following entries:

Entry	Description	Note
VendorName	Vendor name	All devices will be listed under this vendor name CC- IE Field module (VendorName) in the Module List window in the configuration tool.
VendorCode	Vendor code	The code assigned by CLPA (taken from the member number).
Version	Network interface version	Changed when network functionality change.
DeviceModel	Device model name	See corresponding entry in the DeviceInfo section
ModelCode	Model code	Set to same value as DeviceTypeID in section DeviceInfo.
RYSize	RY size used by module	Set to the RY size used by the module. Turns up in the RXRY Setting window (under Points) in the configuration tool.
RWwSize	RWw size used by module	Set to the RWw size used by the module. Turns up in the RWw/RWR Setting window (under Points in the configuration tool).
RXSize	RX size used by module	Set to the RX size used by the module. Turns up in the RXRY Setting window (under Points in the configuration tool).
RWrSize	RWr size used by module	Set to the RWr size used by the module. Turns up in the RWw/RWR Setting window (under Points in the configuration tool).

D Technical Specification

D.1 Front View

#	Item
1	NS/RUN
2	AS/ERROR
3	CC-Link IE Field port 1
4	CC-Link IE Field port 2
5	Link
6	Link



D.1.1 NS/RUN LED

This LED reflects the network status and the status of the CC-Link IE Field device.

LED State	Indication	Description
Off	No power Operation abnormal	
Green	Operation normal	
Red	(Fatal Event)	If NS/RUN and AS/ERR turn red, this indicates a fatal event.

D.1.2 AS/ERROR LED

This LED indicates Anybus status and CC-Link IE Field communication errors etc.

LED State	Indication	Description
Off	No error	No error (or no power)
Red	Error	An error occurred in the device. If NS/RUN is off, the device enters state EXCEPTION. If NS/RUN and AS/ERR turn red, this indicates a fatal event.

D.1.3 Link

These LEDs indicate the CC-Link IE Field link status.

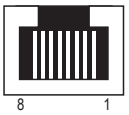
LED State	Indication	Description
Off	No link	Link is not up (or no power)
Green	Link is up	Link is up on port (Giga bit communication)

D.1.4 External Loopback test

An External Loopback test for port 1 and port 2 can be performed by the application. Connect a cable between port 1 and port 2 before the test is started.

Step #	LED	Indication
1	NS/RUN	GREEN (0.5 s) - RED (0.5 s) - OFF
2	AS/ERROR	GREEN (0.5 s) - RED (0.5 s) - OFF
3	Link, port 1 / Link, port 2	GREEN (1.0 s) on port 1/port 2 if Link is detected on the port.

D.1.5 Ethernet Connector (RJ45)

Pin	Signal	Notes	
1	TP1+	Transmit/Receive 1 positive	
2	TP1–	Transmit/Receive 1 negative	
3	TP2+	Transmit/Receive 2 positive	
4	TP3+	Transmit/Receive 3 positive	
5	TP3–	Transmit/Receive 3 negative	
6	TP2–	Transmit/Receive 2 negative	
7	TP4+	Transmit/Receive 4 positive	
8	TP4–	Transmit/Receive 4 negative	
Housing	Shield	Connected to FE through a 1 nF capacitor and a 1 Mohm resistor. Note that the connector shields are seperated to prevent ground currents.	

D.2 Functional Earth (FE) Requirements

In order to ensure proper EMC behavior, the Anybus CompactCom 40 CC-Link IE Field must be properly connected to functional earth via the FE pad / FE mechanism described in the general *Anybus CompactCom M40 Hardware Design Guide*. If the brick version is used, please make sure that the hardware is properly connected to FE.

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

D.2.1 Cables, shielding connections

Shielded cables must be used for the CC-Link IE Field network.

The shield of the RJ45 connector is not connected directly to FE. If a product using the Anybus CompactCom 40 has problems caused by noise, the network cable shield may have to be connected to the chassis ground at each port in the network. Strip a part of the jacket as shown in the figure and ground the exposed shield in the largest possible area, as close to the connector as possible.

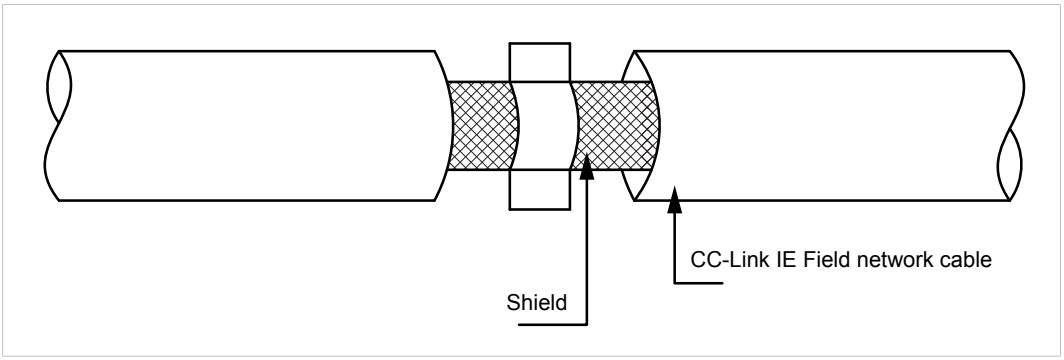


Fig. 4

D.3 Power Supply

D.3.1 Supply Voltage

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

D.3.2 Power Consumption

The Anybus CompactCom 40 CC-Link IE Field is designed to fulfil the requirements of a Class C module. For more information about the power consumption classification used on the Anybus CompactCom platform, consult the general *Anybus CompactCom M40 Hardware Design Guide*.

The current hardware design consumes up to 630 mA (RMS), with full Gigabit communication on both ports.

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 M40 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.

D.4 Environmental Specification

Consult the Anybus CompactCom Hardware M40 Design Guide for further information.

D.5 EMC Compliance

Consult the Anybus CompactCom Hardware M40 Design Guide for further information.

E Timing & Performance

E.1 General Information

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

The following timing aspects are measured:

Category	Parameters	Page
Startup Delay	T1, T2	*47*
NW_INIT Handling	T100	*47*
Event Based WrMsg Busy Time	T103	*47*
Event Based Process Data Delay	T101, T102	*48*

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

E.2 Internal Timing

E.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 IE Field module generates the first application interrupt (parallel mode)	6.7	ms
T2	The Anybus CompactCom 40 CC-Link IE Field is able to receive and handle the first application telegram (serial mode)	6.7	ms

E.2.2 NW_INIT Handling

This test measures the time required by the Anybus CompactCom 40 CC-Link IE Field 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. (If the network specific maximum is less than the value given here, the network specific value will be used.)	32
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

Parameter	Description	Communication	Average	Max.	Unit.
T100	NW_INIT handling	Event based modes	20.8	21.4	ms

E.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	Min.	Average	Max.	Unit.
T103	H_WRMSG area busy time	7.1	7.1	7.1	µs

E.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.

These values have been calculated by running a VHDL simulation and calculating the worst case value.

The delay added by the PHY circuit has not been included, as this delay is insignificant compared to the total process data delay.

Parameter	Description	Delay (min.)	Delay (typ.)	Delay (max.)	Unit
T101	Read process data delay	-	2	-	µs
T102	Write process data delay	-	2	-	µs

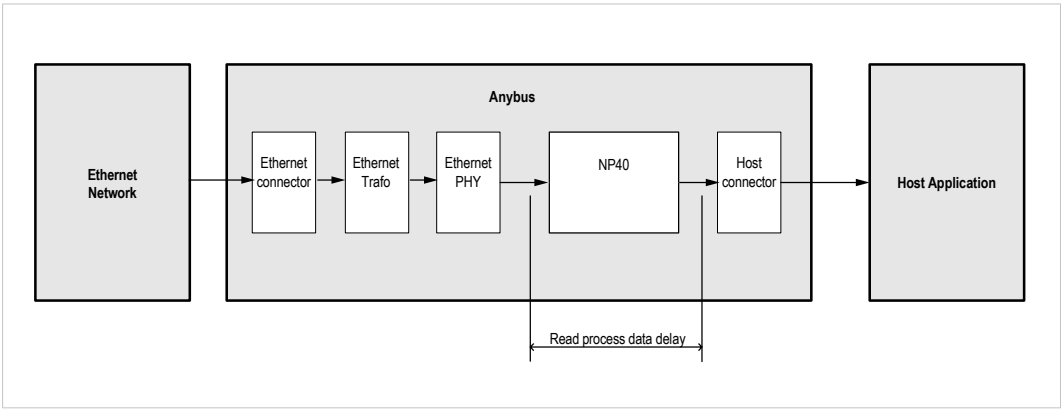


Fig. 5

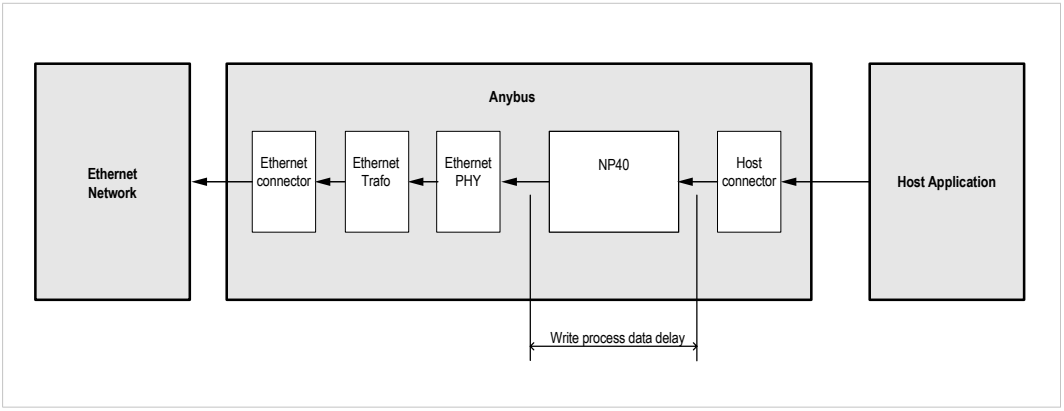


Fig. 6

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