

# Anybus<sup>®</sup> CompactCom<sup>™</sup> B40 Modbus Serial

CC-Link

## USER MANUAL

SCM-1202-178 1.0 en-US ENGLISH

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# Important User Information

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# 1 Preface

## 1.1 About this Document

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

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, along with the Anybus CompactCom B40 Modbus Serial user manual should normally be sufficient to implement a design. However, if advanced CC-Link specific functionality is required for the network interface of the device, 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.

For additional information, please visit the support website at [www.anybus.com/support](http://www.anybus.com/support).

## 1.2 Document History

Version	Date	Description
1.0	2021-03-03	First release

## 1.3 Document Conventions

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

1. First do this
2. Then do this

Bulleted lists are used for:

- Tasks that can be carried out in any order
- Itemized information
- An action
- and a result

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

Program code and script examples

Cross-reference within this document: [Document Conventions, p. 3](#)

External link (URL): [www.hms-networks.com](http://www.hms-networks.com)



### **WARNING**

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



### **Caution**

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



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



*Additional information which may facilitate installation and/or operation.*

## 1.4 Document Specific Conventions

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

### 1.4.1 Pin Types

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

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

## 1.5 Trademark Information

Anybus® is a registered trademark of HMS Networks.

All other trademarks are the property of their respective holders.

## 2 About the Anybus CompactCom B40 Modbus Serial - CC-Link

### 2.1 General Information

The Anybus CompactCom B40 Modbus Serial - CC-Link is a communication solution for simple industrial field devices. The host application communicates with the product using the Modbus RTU protocol. The Anybus CompactCom B40 Modbus Serial - CC-Link then communicates the data to the network. Typical applications are basic level I/O blocks, temperature controllers, measuring devices, and sensors.

The Anybus CompactCom B40 Modbus Serial - CC-Link software interface is designed to be network protocol independent, making it possible to support several networking systems using the same application software code/driver.

The Anybus CompactCom B40 Modbus Serial - CC-Link share footprint and electrical interface with the other members of the product family, independent of fieldbus or network. The host application connector provides an interface between the host application (Modbus RTU) and the Anybus CompactCom, while the network connector provides access to the chosen network. The Anybus CompactCom acts as a Modbus RTU slave on the host application side.



*The Anybus CompactCom 40 family offers a wide range of functionality. For advanced products and applications, we recommend the standard Anybus CompactCom 40.*

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For general information about other products using the Anybus CompactCom 40 platform, consult [www.anybus.com/support](http://www.anybus.com/support).



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.

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

## 2.2 Features

- CC-Link Remote Device
- I/O: up to 16 word points of 16 bit data (CC-Link v.1.10, default)
- I/O: up to 128 word points of 16 bit data (CC-Link v.2.00)  
To use CC-Link v.2.00, this must be set during start-up. See [Startup and Identity Customization, p. 7](#)
- Automatic CC-Link System Area handshaking
- Sample configuration file (CSP+) provided by HMS Industrial Networks
- Possibility to customize Vendor Code, Model Code and Version via application interface
- Baud Rate and Station Number configuration via application interface
- Galvanic isolation between the host application and the industrial network available if used with the CompactCom B40 connector board



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

## 2.3 Overview

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

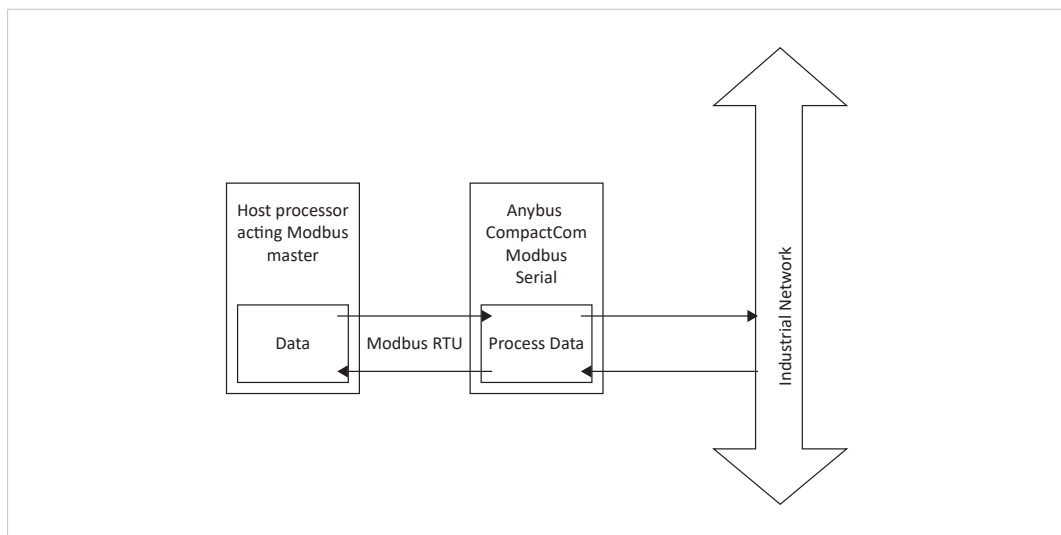


Fig. 1

## 2.4 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. For more information, see [Certification Information, p. 17](#).



## 3 Basic Operation

### 3.1 Software Requirements

No additional network support code needs to be written in order to support the Anybus CompactCom B40 Modbus Serial - CC-Link, however due to the nature of the CC-Link networking system certain restrictions must be taken into account:

- Parameter names, types and similar attributes cannot be accessed from the network.
- No support for network reset requests.

### 3.2 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 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](http://www.cc-link.org), membership is required).

### 3.3 Communications Settings

#### 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 10 Mbps.

### 3.4 Startup and Identity Customization

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

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

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

- Using the user-defined Modbus function code (Function code 70).  
The use of Function code 70 can be included in the Modbus master. Hence the CompactCom does not need to be preprogrammed before mounting it in the host application.
- Using the Anybus Virtual Attributes Manager.  
The Virtual Attributes Manager is recommended for use during development and for low volume production, since manual user operations are needed for every Anybus CompactCom that shall be programmed.

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

### 3.4.1 Virtual Attributes with Specific Modbus Function Code 70

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

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

The example shows example values to the basic virtual attributes:

Virtual Attribute	Example Value
Vendor Code:	0x0212
SW Version:	1

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

#### Modbus function 70 Request

	Value	Note
Modbus Address	0xXX	
Function Code	0x46	FC70
Command	0x42	Set_Attribute
Object	0x01	Anybus Object
Instance	0x01	
	0x00	
Ext0	0x11	Attribute 17
Ext1	0x00	Not used
Data Size	0x0F	The data size in this example is 15 bytes
	0x00	
Data	0xF7 0x01 0x00 0x01 0x02 0x00 0x12 0x02 0xF7 0x01 0x00 0x02 0x01 0x00 0x01	Vendor Code SW Version
CRC	0xXX	CRC-16
	0xXX	

#### Response

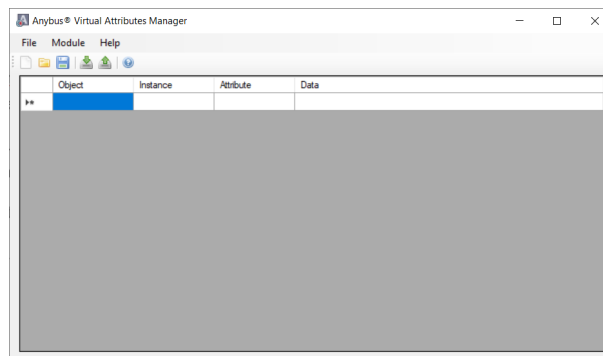
	Value	Note
Modbus Address	0xXX	
Function Code	0x46	FC70
Command	0x02	Set_Attr_Resp
Object	0x01	Anybus Object
Instance	0x01	
	0x00	
Ext0	0x11	Attribute 17
Ext1	0x00	Not used
Data Size	0x00	
	0x00	
CRC	0xXX	CRC-16
	0xXX	



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

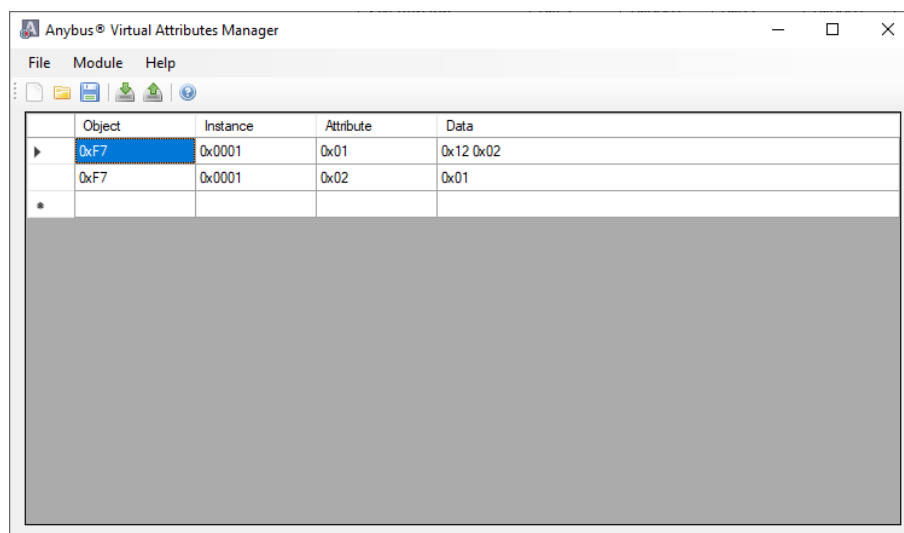
### 3.4.2 Virtual Attributes with Anybus Virtual Attributes Manager

1. Start the Anybus Virtual Attributes Manager

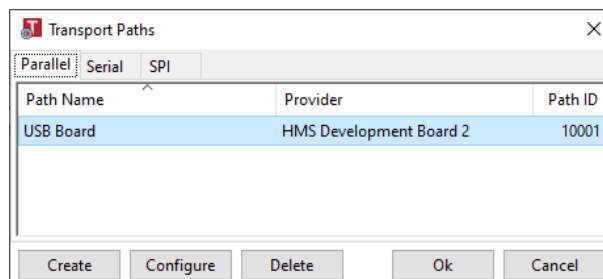


2. Enter the virtual attributes data for the attributes needed. The example below is setting up the attributes with the following values:

Virtual Attribute	Example Value
Vendor Code:	0x0212
SW Version:	1



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



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

## 3.5 Data Exchange

### 3.5.1 The Bit Area and Word Area

On the Anybus CompactCom B40 Modbus Serial - CC-Link, data is divided into two categories as follows:

#### Bit Area:

For this product, the Bit Area is not available. The System Area is only used for initial data handshaking between a Master and a Slave device. For detailed information about the System Area, please refer to [CC-Link System Area Implementation, p. 14](#).



*It is possible to disable the System Area by setting the CC-Link Host Object (F7h), instance attribute #5, to -1 (0xFFFF) during start-up. For more information, see [Startup and Identity Customization, p. 7](#).*

#### 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	Word Area Points (dec)
Slave -> Master	RWr0... RWr127
Master -> Slave	RWw0 ... RWw127

### 3.5.2 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	Word Points
1	4 words
2	8 words
3	12 words
4	16 words

#### CC-Link Version 2

By implementing the attribute Network Settings (#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	Points	Points	Points
1	4 words	8 words	16 words	32 words
2	8 words	16 words	32 words	64 words
3	12 words	24 words	48 words	96 words
4	16 words	32 words	64 words	128 words

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## A Implementation Details

### A.1 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)
WAIT_PROCESS	Automatic CC-Link handshaking in progress
ERROR	Possible causes: <ul style="list-style-type: none"> <li>• Timeout error (ERR21)</li> <li>• 0 channel carrier detection status (ERR22)</li> <li>• insufficient number of data for the host (ERR30...32)</li> </ul> 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'
IDLE	PLC/Master in STOP mode When the PLC/Master returns to RUN mode, the module returns to the previous state.
EXCEPTION	Possible causes: <ul style="list-style-type: none"> <li>• Configuration error</li> <li>• other error that cannot be indicated to the application in any other way</li> </ul>

### A.2 CC-Link Handshaking Implementation

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	State transition from WAIT_PROCESS to PROCESS_ACTIVE
Remote READY	(initial setting) - At the rising edge of "Initial Data Processing Complete"	-



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

## B CC-Link System Area Implementation

### B.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 is handled automatically by the Anybus device (default). Alternatively, it can be disabled by the host application.

#### B.1.1 System Area Handled by Anybus (Default)

All flags in the System Area are handled automatically by the module.

#### B.1.2 System Area Disabled by Host Application (Advanced)

To disable the System Area, the attribute "System Area Handler" (#5) in the CC-Link Host Object (F7h) must be set to -1 (disabled).

It is possible to change the location of the System Area by implementing the attribute System Area Handler (#5) in the CC-Link Host Object (F7h).

See also...

- [CC-Link Handshaking Implementation, p. 13](#)

### B.2 System Area Layout



*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	(reserved)	9	(reserved)
10	(reserved)	10	(reserved)
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, p. 13](#).

See also...

- [System Area Location, p. 15](#)



## B.3 System Area Location



*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	(reserved)	RY #0	(reserved)
RX #1		RY #1	
...		...	
RX #Q-18		RY #Q-18	
RX #Q-17	(Reserved for CC-Link System Area)	RY #Q-17	(Reserved for CC-Link System Area)
RX #Q-16		RY #Q-16	
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 Anybus CompactCom.)

### How to Calculate Q:

- CC-Link Version 1 OR Extension Cycles = 1:  
Q = The number of occupied stations x 32.
- CC-Link Version 2 AND Extension Cycles >= 2:  
Q = ((The number of occupied stations x 32) - 16) x Extension cycles.

## C LED Indications

### C.1 RUN LED

LED State	Indication/Description
Off	No network participation, time out status (no power)
Green	Participating, normal operation
Red	Major fault (FATAL error)

### C.2 ERROR LED

LED State	Indication/Description
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)

## D Certification Information

### D.1 General Information

- The Anybus CompactCom B40 Modbus Serial - CC-Link implements the Generic Device profile. Memory mapping is application specific.
- 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 B40 Modbus Serial - CC-Link will not allow setup to complete in such a case.
- The CC-Link V.2.00 protocol is implemented without return check in the module.

### D.2 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. This is done by implementing the CC-Link Host Object (F7h), instance #1, attribute #1. For information on how to do this, see [Startup and Identity Customization, p. 7](#).

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 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. For information on how to do this, see [Startup and Identity Customization, p. 7](#).

3. 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.

### D.3 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).

### D.4 CC-Link Version 2.00

By implementing the attribute Network Settings (#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. See [Startup and Identity Customization, p. 7](#) for more information.

