How to set up an Anybus CC-Link slave module with a Mitsubishi PLC

Document History

Revision	Date	Description	Responsible
1.00	2006-12-07	Released	Thorbjörn Palm
1.01	2007-05-05	Minor update	Thorbjörn Palm
1.02	2008-03-07	Updated layout	Thorbjörn Palm

More information about the network and products

For further information about the Anybus products, please consult the HMS webpage, www.anybus.com. The latest manuals, etcetera can be downloaded from that location.

The CC-Link user organisation has a webpage on the Internet, www.cc-link.org. Several technical guides are available in or via this page.

For more information concerning the PLC refer to the Mitsubishi Electric Automation Inc. webpage, www.meau.com.

Contents

1   Applicable Anybus products

Description	Name / Type
Anybus X-gateway	CC-Link
Anybus Communicator	CC-Link
Anybus Slave Interface	CC-Link
Anybus CompactCom	CC-Link

2   Requirements

Description	Name / Type	Version
Mitsubishi PLC ver. 2.0 and/or PLC ver 1.0	Q02CPU	n.a.
Mitsubishi Intelli.	QJ61BT11N	n.a.
Power supply 24VDC	n.a.	n.a.
GX IEC Developer	n.a.	6.10
Configuration Tool for Anybus Communicator	ABC Config Tool	2.27
Configuration cable to Anybus Communicator	n.a.	n.a.
Programming cable to the Mitsubishi PLC	n.a.	n.a
Anybus-S CC-Link Fieldbus Appendix	Appendix	1.51
Anybus-CC CC-Link Network Interface Appendix	Appendix	1.11
Anybus X-gateway CC-Link Slave Interface, Addendum	Addendum	1.0
User Manual Anybus Communicator for CC-Link	Manual	1.0

3 Solution overview

This application note describes how to configure an Anybus CC-Link Slave product with a Mitsubishi PLC ver 2.0 or ver 1.0. Below you can find an overview of the system described in this document. Other nodes may be attached to the network, but are not necessary.

The configuration is described in two steps.

- The configuration of the communication parameters and the I/O data of the Anybus module are described.
- The PLC configuration is explained.

Note: This document is valid for all Anybus CC-Link products, however sections written in *italics* describe the configuration of a specific product. Also the solution for version 1.0 respectively 2.0 is described separately when necessary.

The contents describe step by step how a configuration is done. This document assumes the reader is familiar with industrial communication, CC-Link networks and HMS Communicator and X-gateway.
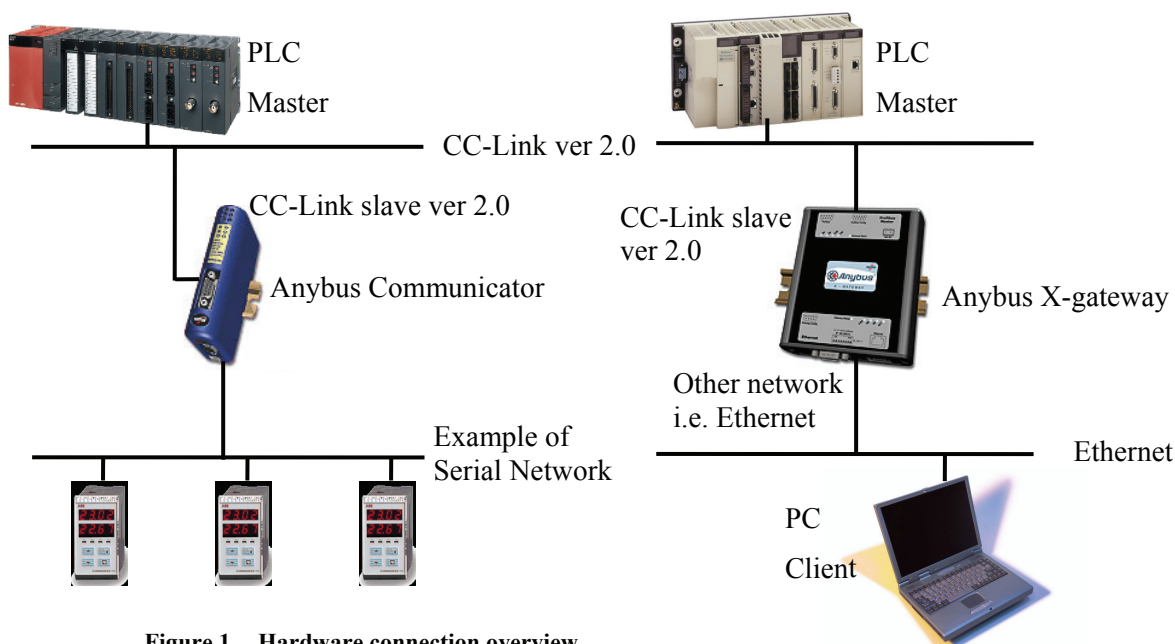

Figure 1   Hardware connection overview.

4 PLC setup

The first step is to configure the baudrate and station number. The PLC used in this case is configured by switches located on the CPU unit. Then start the tool GX IEC Developer to configure the PLC.

IMPORTANT Make sure when possible to use the button "End" in each dialog window. Otherwise the configuration will not be saved.

4.1 PLC module setup

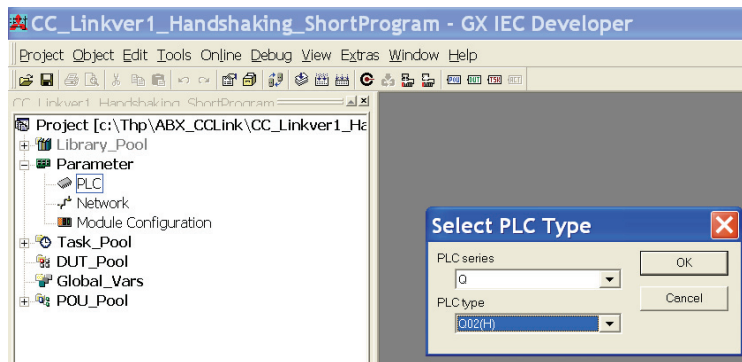Click on Project and then choose new. The following window will be visible.

Figure 2   Configuring the type of PLC.

Start with choosing the type of PLC. In this case a Q02 PLC is used. Make sure the correct type of PLC is selected.

The next step is to configure the modules. Double click on the "PLC" under "Parameter" and the window below will appear.
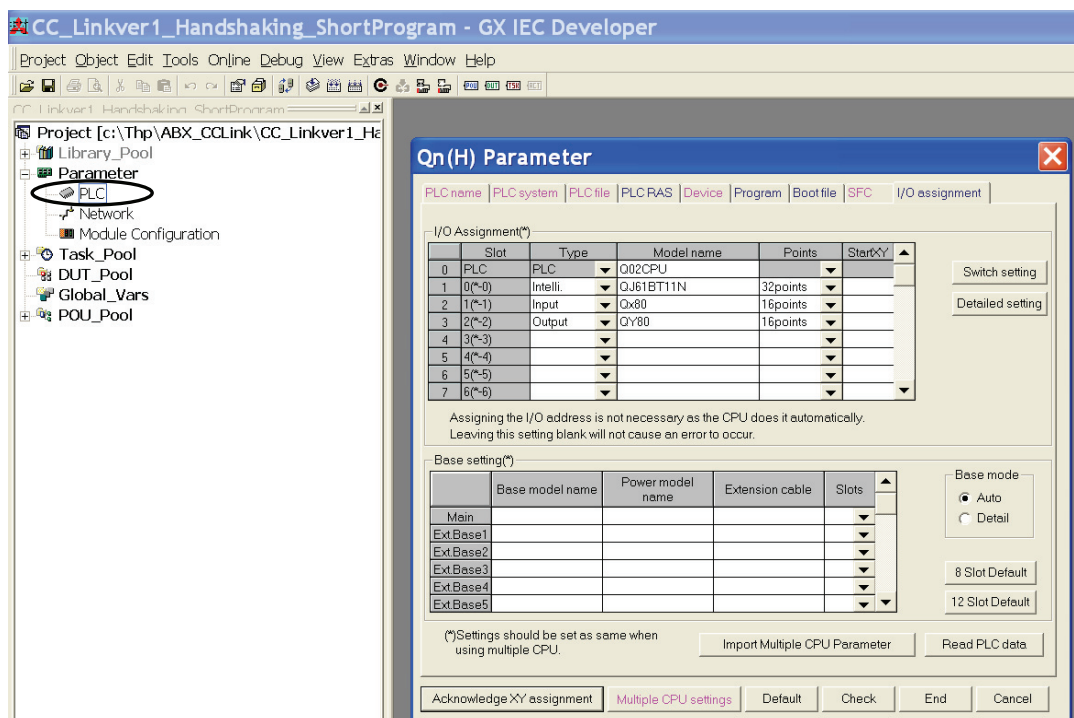

Figure 3   Module configuring.

Enter the type of PLC, Intelli. and Input/Output device. In this case four modules are used, one CPU, one Intelli, one Input and one Output device. For more information regarding the type and the number of points refer to the Mitsubishi manual.

4.2   CC-Link network configuration

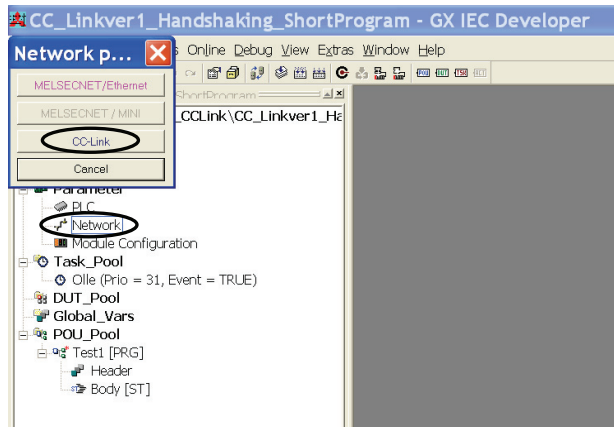To configure the network double click on the "Network" under "Parameter". Choose CC-Link.

Figure 4   Configuring the CC-Link network.
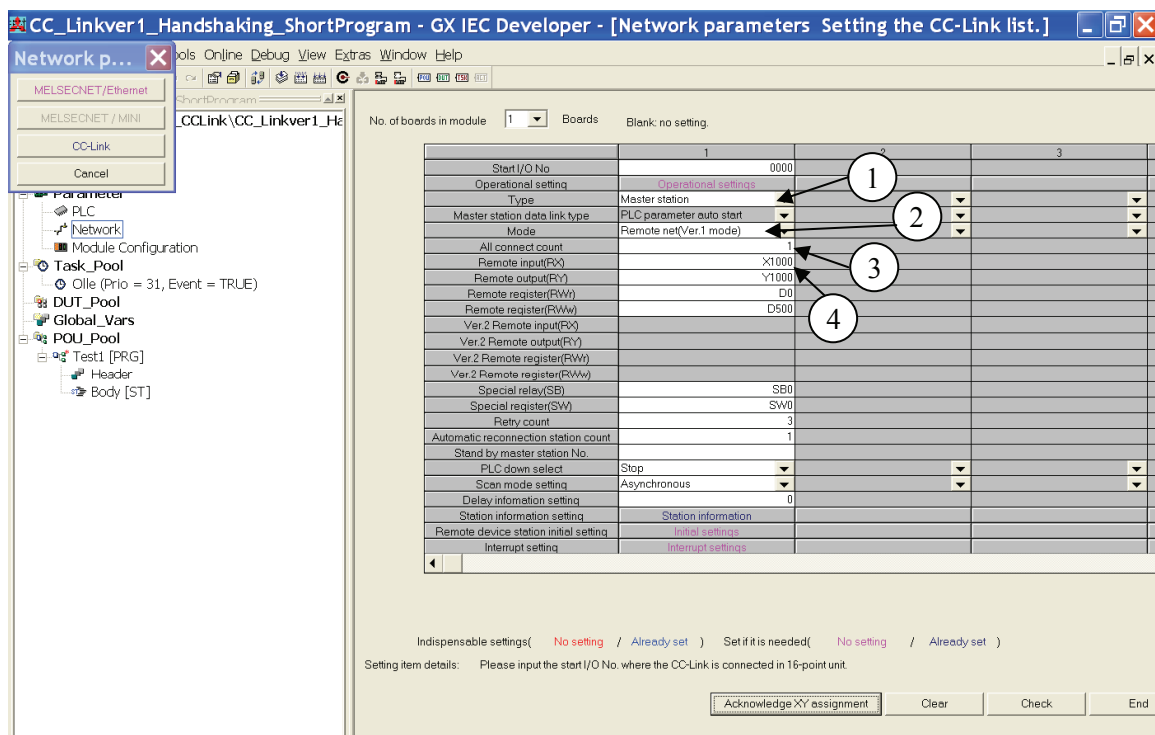
Specify the parameters as shown below.

Figure 5   Setting the CC-Link parameters.

The PLC is a master unit and the "Type"❶ is therefore selected to master. The next step is to select the version of CC-Link, version 1.0 or 2.0.❷. "All connect count"❸ specifies the number of connected stations. In this case the number of station is 1 since the Anybus module is the only connected station. In the fields Remote input(RX) and Remote output(RY) ❹ the offset for the I/O data is entered.

The last step is to configure the number of occupied stations. Click on the "Station information" as shown below.
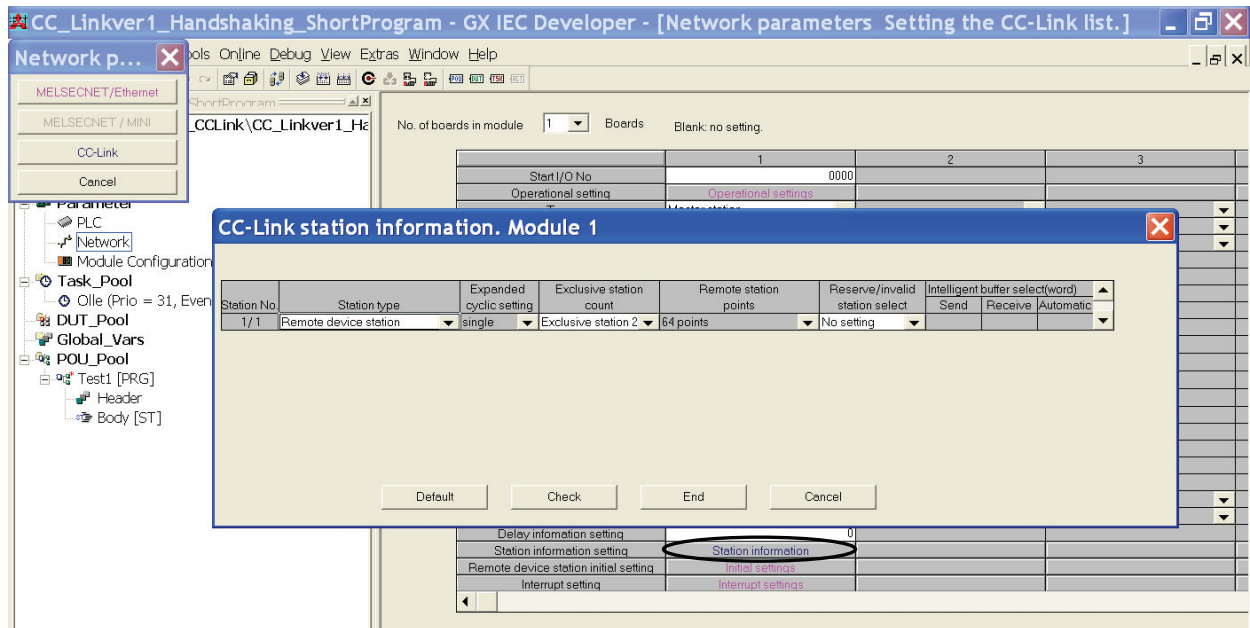
Figure 6   Configuring the station information.

Choose the desired settings in the scroll down windows. The "station type" is set to "Remote device station" for both the Communicator and X-gateway. The field "Exclusive station count" corresponds to the number of occupied stations. In this case 2 stations are used.

Version 2.0 When using the CC-Link version 2.0 the number of Expanded cyclic setting has to be configured. In this example double Expanded cyclic setting is used.

4.3 PLC handshaking

The Anybus module can be configured for handshaking or not.

Note: It is not necessary to use handshaking mode, it is used in this example for demonstrative purposes only. When configured for handshaking the Anybus module requires an answer from the PLC.

Version 1.0 The dividing of the 2 bytes in the handshaking area can be seen in the following table.

| Bit	Slave -> Master	Master -> Slave
0 – 7	Reserved	Reserved
8	Initial data processing request flag	Initial data processing complete flag
9	Initial data setting complete flag	Initial data setting request flag
A	Error status flag	Error reset request flag
B	Remote READY	Reserved
C – F	Reserved	Reserved

Figure 7   The handshaking area for version 1.0.

The memory offset of the handshaking area is depending on the number of occupied stations and the station number in the network. The table below shows the memory offset for the handshaking area.

Memory offset in Dec		Number of occupied stations			
		1	2	3	4
Station number	1	10	30	50	70
	2	30	50	70	90
	4	70	90	110	130
	8	150	170	190	210

Figure 8   Table showing the memory offset for different configurations.

In this example the station number is 1 and the number of occupied stations is 2. The Input and Output area in the PLC are configured to begin at address 1000 Hex, as can be seen in Figure 5 Setting the CC-Link parameters. The memory offset for the Handshaking area is then 1030 Hex in the memory of the PLC. In this case the offset for the Remote Ready flag will be 103B Hex.

Offset configured in the PLC   Offset to Remote Ready bit

The offset to the first bit in the handshaking area
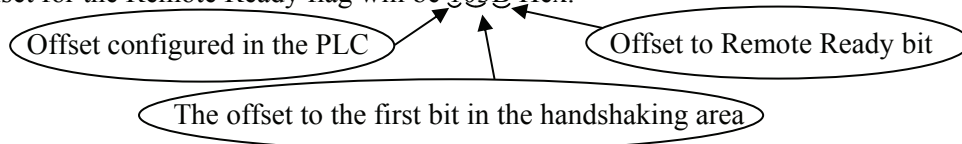
Formula

The formula for the memory offset in this case is 10(m+n)0 Hex, where m is depending on the station number and n on the number of occupied stations as shown in the figure above. The relations are:

m=(station number-1)*2 and

n=number of occupied stations*2-1.

In this example the station number is 1 therefore the m-factor is zero. The n-factor will have the values 1,3,5,7 for 1,2,3,4 occupied station(s). In this example the number of occupied stations is 2 and the m+n-factor consequently is 3. So the memory offset for the handshaking area is 1030 Hex and the complete address for the remote ready flag will be 103B as shown in figure 10.

Add a basic PLC-program to the configuration to perform the handshaking process. The alternative is to perform the handshaking manually by setting the bits directly in the Entry Data Monitor, see chapter 4 Testing for more details. Right click on the "POU_Pool" and choose New POU. Choose "PRG" and "structured text" as seen below.
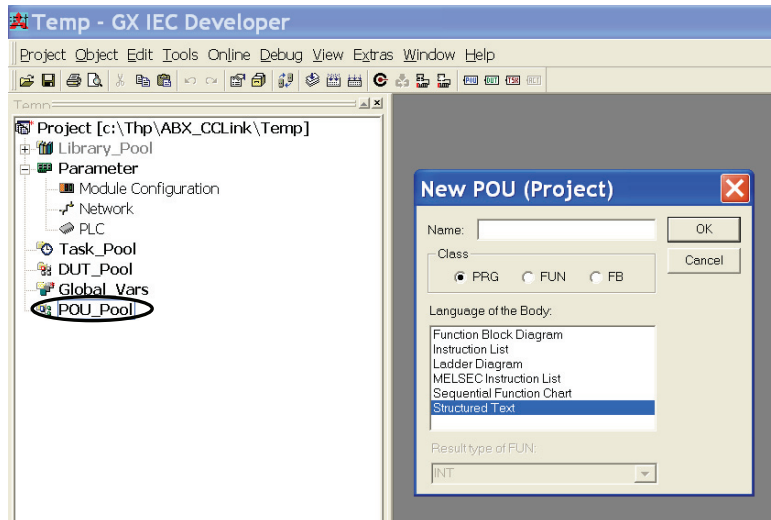

Figure 9   Creating a new PLC-program.

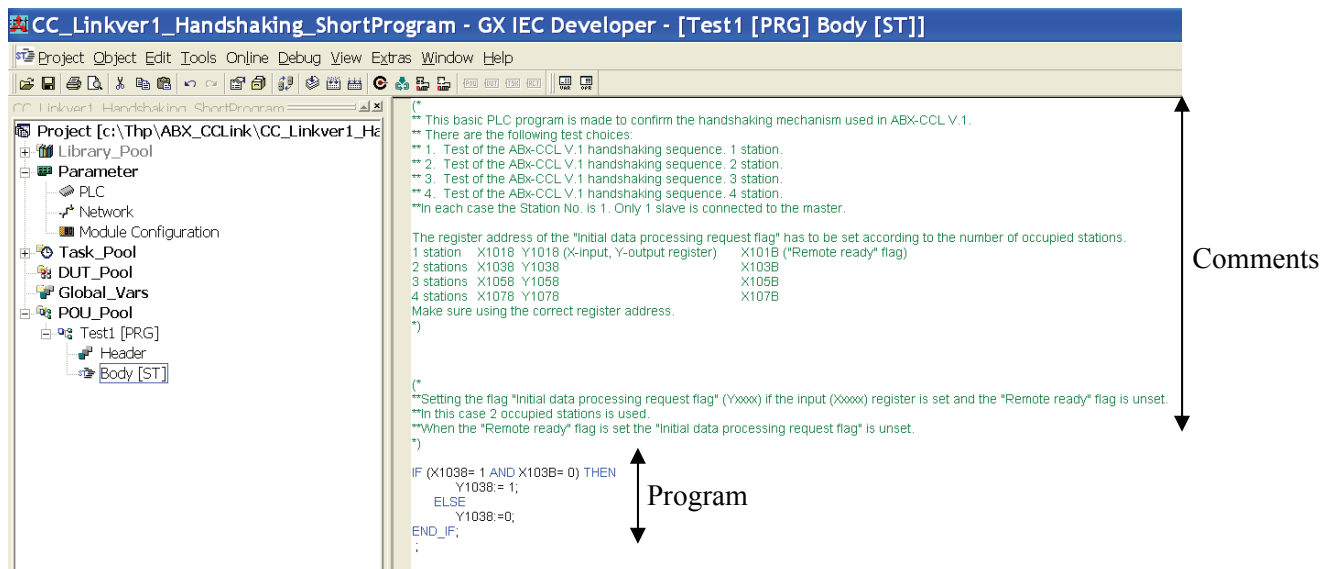An example of a PLC-program can be seen below.

Figure 10 Editing the PLC-program.

The program sends an answer to the Anybus X-gateway which returns a "Remote ready" flag. It is important the correct register address is used. The address is dependant on the number of occupied stations; see the program comments for more details.

Note: In the example in the figure above the station number is 1, for other station number refer to the formula above. Only the last 6 rows is a part of the program, the rest are just comments. Now the PLC is configured.

Version 2.0 For version 2.0 the process is slightly more complicated. In this case the addresses of the flags are depending on the number of occupied stations, the number of connected stations, but also the number of extension cycles.

Note: At first if several stations are added to the network the offset area is moved according to the offset of these stations. In this case one station is connected to the network.

The following table shows the memory offset for the handshaking process where Q is a variable. If Q for example has the value of 32 the Remote READY flag will have the memory offset 27 in Dec and 1B in Hex.

Bit	Slave -> Master	Bit	Master -> Slave
RX Q-(9 to 16)	Reserved	RY Q-(9 to 16)	Reserved
RX Q-8	Initial data processing request flag	RY Q-8	Initial data processing complete flag
RX Q-7	Initial data setting complete flag	RY Q-7	Initial data setting request flag
RX Q-6	Error status flag	RY Q-6	Error reset request flag
RX Q-5	Remote READY	RY Q-5	Reserved
RX Q-(1 to 4)	Reserved	RY Q-(1 to 4)	Reserved

Figure 11 The handshaking area for version 2.0.

The table below shows the value of Q in decimal format for different configurations.

Q in Dec		Number of occupied stations			
		1	2	3	4
Extension Cycles	1	32	64	96	128
	2	32	96	160	224
	4	64	192	320	448
	8	128	384	640	896

Figure 12 Table of values of Q for different number of occupied stations and extension cycles.

The Input and Output area is configured to begin at address 1000, as can be seen in Figure 5 Setting the CC-Link parameters. In this example the number of occupied stations is 2 and the number of extension cycles is 2. This makes Q take the value of 96. The offset for the remote ready flag will then be 96-5=91. In hex this will be 105B. The handshaking area will then have the offset of 1050. Please note, if several stations are attached to the network the offset area is moved according to the offset of these stations.

The handshaking can be done either manually or by a PLC-program. The manual alternative is to perform the handshaking by setting the bits directly in the Entry Data Monitor, see chapter 4 Testing for more details. The PLC-program for the handshaking process will look the same as for version 1.0, but the memory offset in this case will be 105B, see the previous section for version 1.0 for details of the program.

Formula

The formula for Q suggested by HMS is as follows:

CC-Link version 2.0 and Extension cycles=1:

Q=(Number of occupied stations*32)* Extension cycles

CC-Link version 2.0 and Extension cycles>=2:

Q=(Number of occupied stations*32-16)* Extension cycles

5 Anybus configuration

The Anybus product has to be configured for the same I/O sizes and parameter settings as set up in the CC-Link Master configuration. The parameters configured are the node ID and baudrate. The configuration procedure is depending on the type of module. See the sections below.

5.1 Parameter settings

Make sure the station number of the PLC and the Anybus module is not the same. The selected baudrate of the PLC and the Anybus module is to be set to the same rate.

Anybus X-gateway and Anybus Communicator

The Anybus Communicator and Anybus X-gateway can be configured by switches. The switches will be found next to the CC-Link fieldbus connector on the X-gateway and next to the indication LEDs on the Anybus Communicator. For further instructions see the respective manual or appendix.

Anybus Slave

The Anybus Slave can be configured by switches located next to the fieldbus connector or by mailbox commands. For details please see the Anybus-S Fieldbus Appendix.

Anybus CompactCom

The module is configured by messages send by the application. Refer to the Network Interface Appendix for details.

5.2 X-gateway configuration

Use the HyperTerminal on a PC and configure the Gateway. Connect a serial cable between the PC and the config port of the Gateway.

Open the "File" menu and click on new, choose the desired COM port and click OK. The following window will appear.
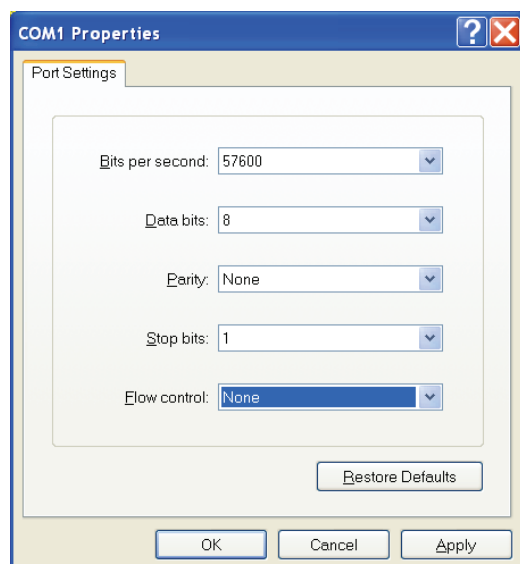
Figure 13 Configuring the connection in the HyperTerminal.

Make sure the settings are identical to those shown in the window. Alternative download HyperTerminal session file from HMS website, double click on it and select COM port.

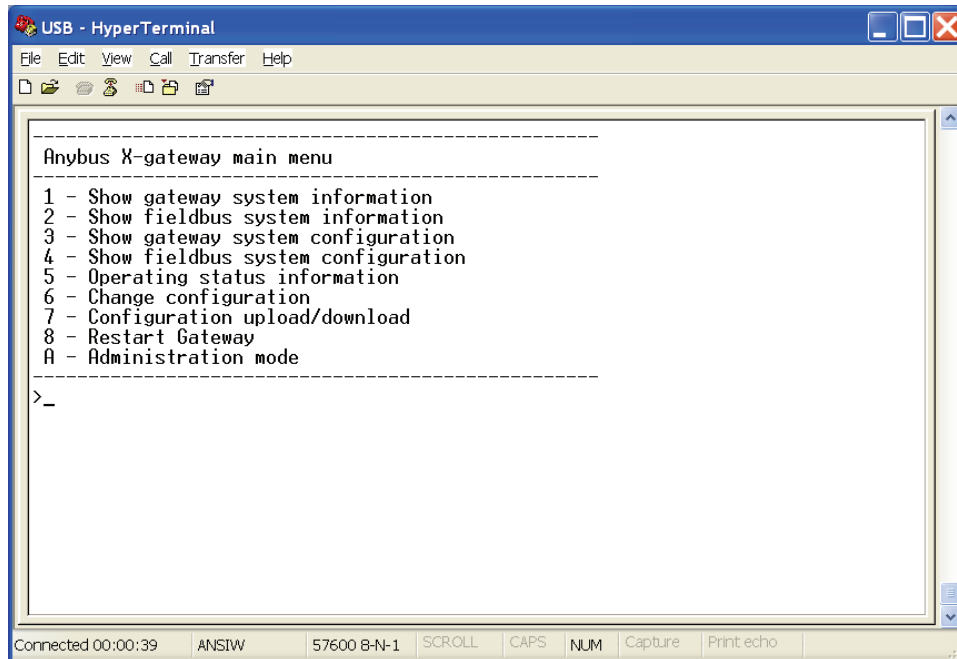Connect and press ESC and the following menu will appear.

Figure 14 Anybus Communicator Main menu.

Press 6 and enter the configuration as shown below. In the example below ver. 2.0 is configured.
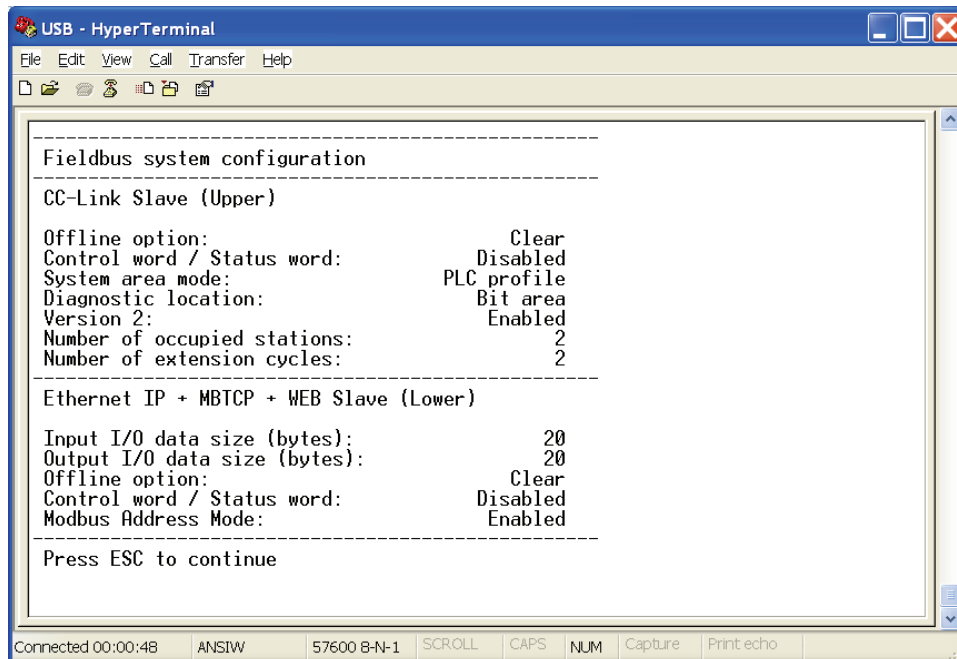

Figure 15 Editing the configuration.

The number of occupied stations has to be the same as configured in the GX IEC Developer. In this example 2 occupied stations and 2 extension cycles are used. The "System area mode" is selected to PLC profile. In this mode handshaking with the PLC is necessary.

Note: It is not necessary to use handshaking mode, it is used in this example for demonstrative purposes only.

5.3 Communicator configuration

Start the Anybus Communicator and create a new configuration. Choose the CC-link configuration and the desired number of occupied stations and extension cycles. In this case 2 occupied stations and 2 extension cycles are used. In the case with the communicator the version 2.0 is enabled. See the figure below.
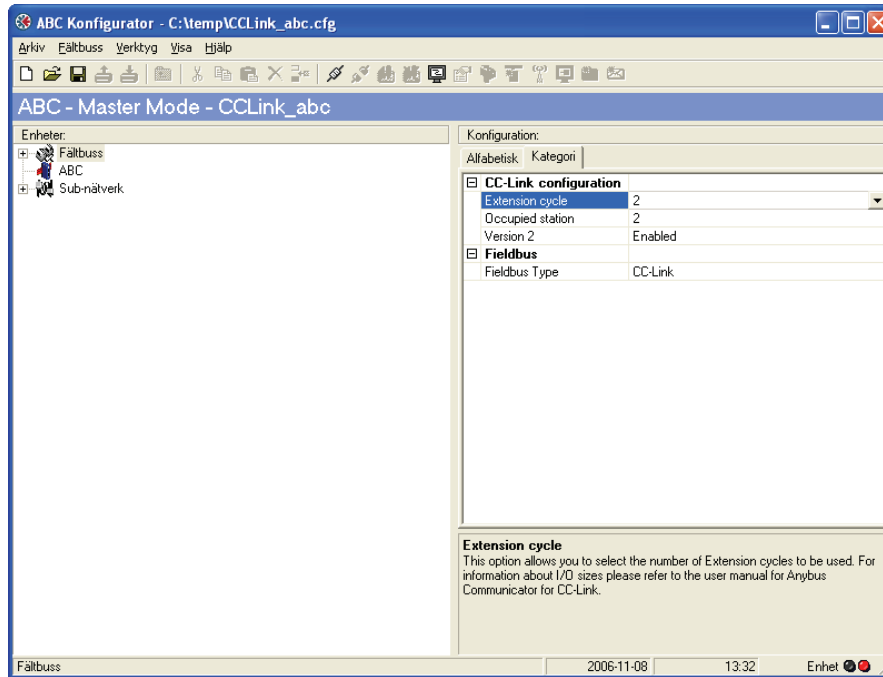

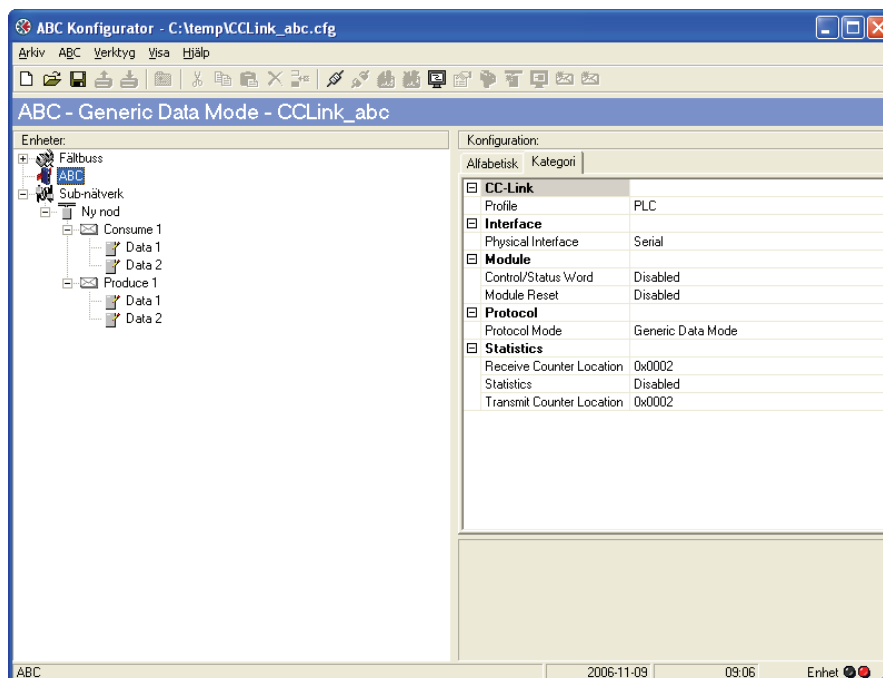**Figure 16 Configuring the fieldbus.**

Figure 17 Configuring the ABC.

In this case a loop back dongle at the serial connection of the Communicator is connected. To loop data the Generic Data Mode is selected, all other values are left at their defaults. When PLC profile is selected, as in this case, handshaking with the Communicator is necessary.

Note: It is not necessary to use handshaking mode, it is used in this example for demonstrative purposes only. The next step is to configure the sub-network.
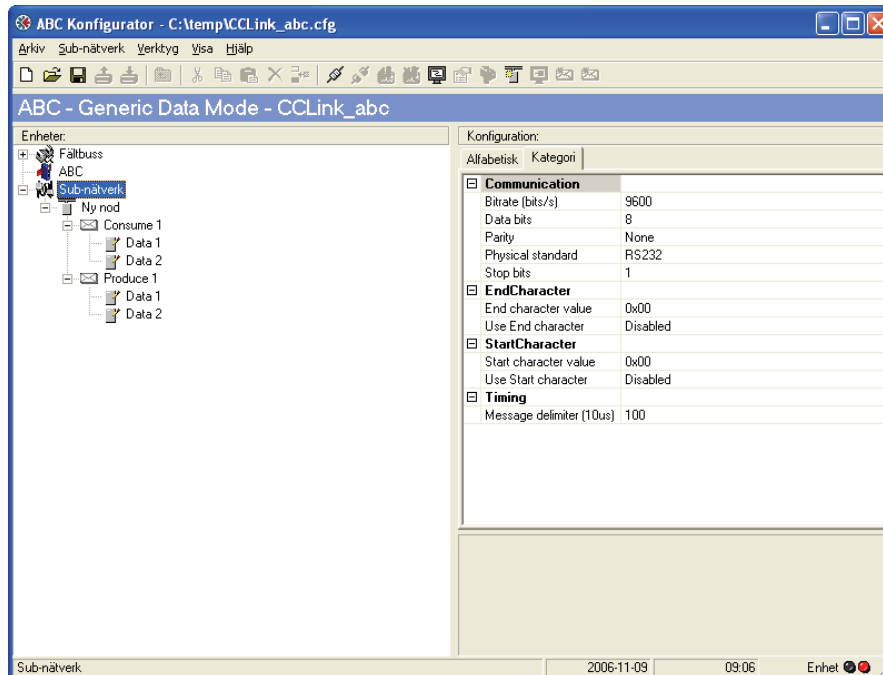

Figure 18 Configuring the sub network.

Right click on new node and add a consume and a produce transaction as shown above. Leave the settings for the consume transaction at the defaults.

Note: The update time for the produce transaction is to be set to less than the offline timeout time for the consume transaction; in this case the update time is set to 500ms as shown below.
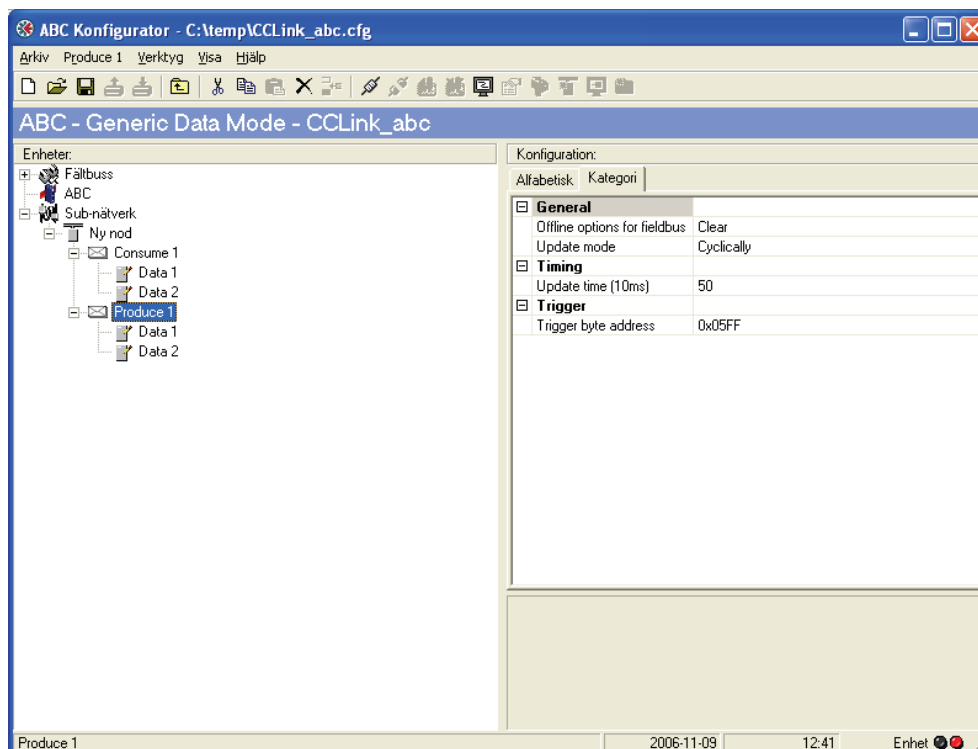

Figure 19 Configuring the produce transaction.

The next step is to configure the I/O data. Depending on the number of occupied stations and extension cycles the memory offset will be different. In this example 2 occupied stations and 2 extension cycles are used. The bit area is located at 0x0000 to 0x0009, handshaking area at 0x000A to 0x000B and the word area at 0x000C to 0x002B. For details refer to Anybus Communicator for CC-link User Manual.
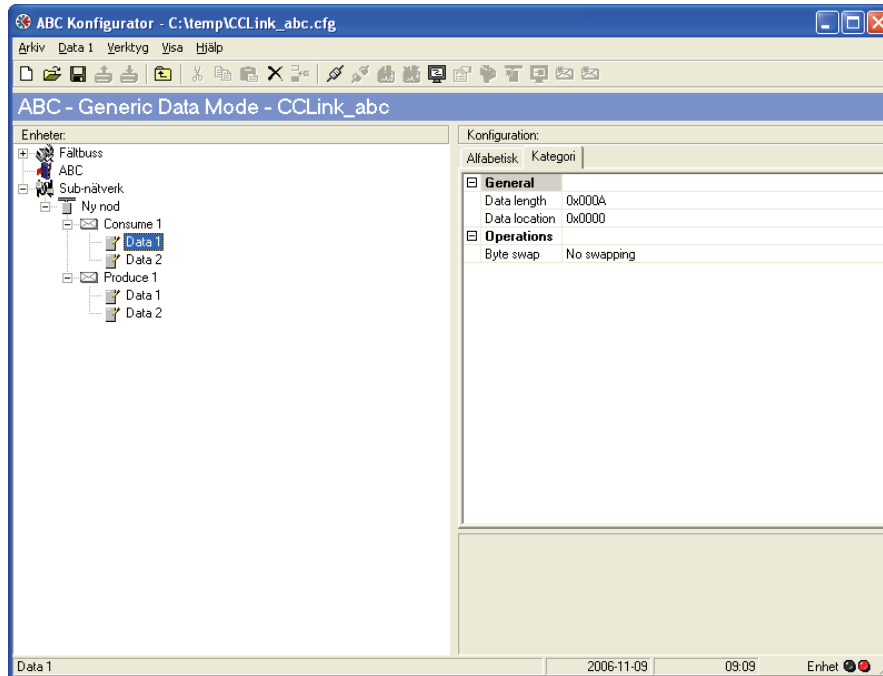
Figure 20   Configuring the consume Data 1 located in the bit area.

Right click on Consume and add data twice. Repeat this procedure for the Produce as well. The first data is configured for to be located in the bit area and the second data in the word area. It is not necessary to use both bit and word area, in this example both areas are used only in demonstrative purposes. The data can be seen in the picture above and below.
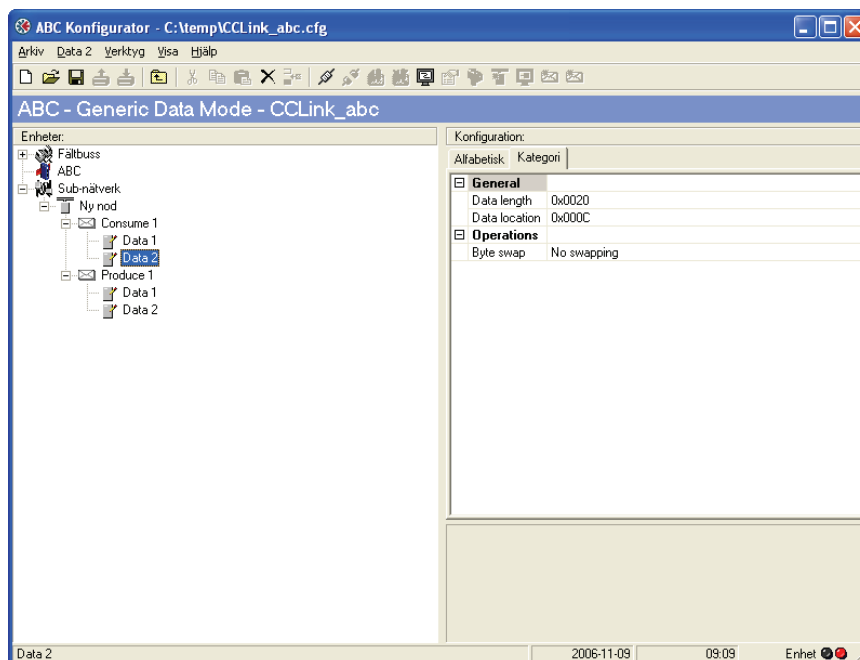
Figure 21   Configuring the consume Data 2 located in the word area.

6   Testing

The test procedure is the same for both version 1.0 and version 2.0, the only difference is the memory offset for the handshaking process.

Note: It is not necessary to use handshaking, it is used in this example for demonstrative purposes only. If not using handshaking it is possible to directly monitor the I/O data.

Version 1.0 The register address for the handshaking process is dependant on the number of occupied stations and station number for version 1.0. For more details of specific Register addresses see chapter 4.3 PLC handshaking.

To test the configuration, click on the "Online" menu and then on "Entry Data Monitor. The following window will appear.
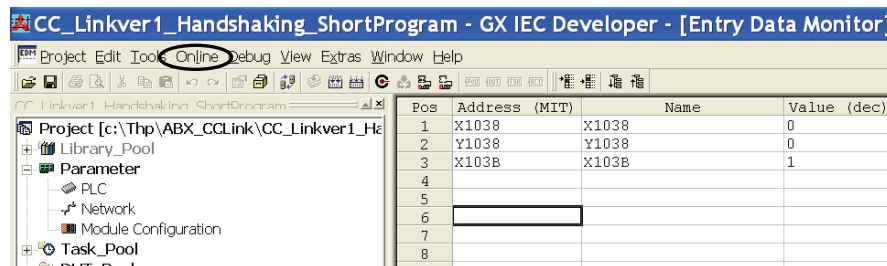

Figure 22   Setting up the registers to monitor.

Click on the first row and enter the desired register. In this case X1038 is used for version 1.0 and for version 2.0 please see Figure 24. In row two enter Y1038 and in row three X103B. In the first row you will be able to monitor the input "Initial data processing request" flag, in the second the output "Initial data processing request" flag and in the third the input "Remote ready" flag.

Download the latest configuration to the PLC and press the monitor button to monitor the I/O register. First the X1038 will be set and at the same time the Y1038 will be set. After a while the X103B will be set and the Gateway will be ready. The window below shows the status when the Gateway is ready.
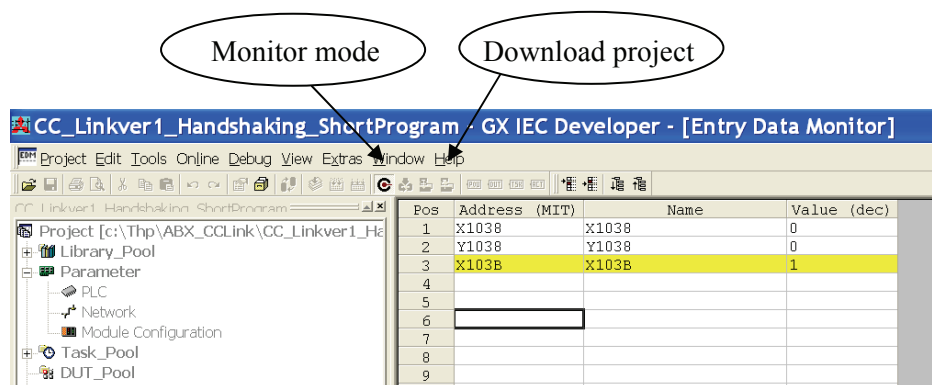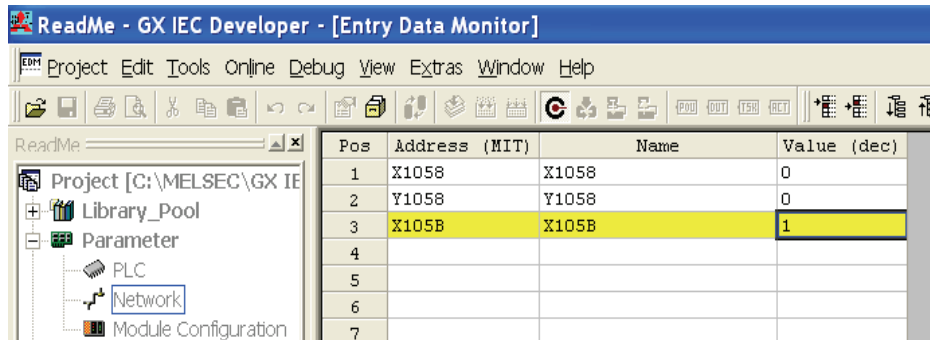

Figure 23   Monitoring the PLC configured for CC-Link version 1.0.

It is now possible to send data between the PLC and Anybus Communicator. This can be monitored in the same way as the handshaking process.

Version 2.0 For the memory offset of the version 2.0 refer to chapter 4.3 PLC handshaking. The procedure to test the configuration is the same as for version 1.0, see the previous section. The window below shows the monitoring window in GX IEC Developer when the Communicator is in Ready state.

Figure 24   Monitoring the PLC configured for CC-Link version 2.0.