Freelance Control System

DeviceNet for Freelance
Application Report

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Purpose

The purpose of this document is to provide a viable solution for customers that have existing DeviceNet devices and wish to connect them to the Freelance system. This application report will show two solutions for connecting DeviceNet devices to the Freelance system. One method will convert DeviceNet to Profibus, and the second method will convert DeviceNet to Modbus RTU.

Note:
This report describes two solutions, but these may not be the only two solutions. Other solutions may require different hardware and/or software.

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1.   Introduction

1.1   Scope

The following components are required for these solutions:

a. DeviceNet to Profibus:
   - AC 800F controller (AC 700F does not have Profibus capabilities with the current version 9.1) equipped with a power supply, Ethernet module, and Profibus master module (FI 830F)
   - Control Builder F and all appropriate licenses. Consult 3BDD012560R03 – Freelance Getting Started manual for more information on licensing.
   - HMS Anybus X-Gateway AB7663, DeviceNet Scanner/Profibus Slave
   - Anybus NetTool for DeviceNet (Rockwell Automation's RSNet Worx may also be used)
b. DeviceNet to Modbus RTU:
   - AC 800F controller equipped with a power supply, Ethernet module, and Modbus Master module (FI 820F)
     -or-
     AC 700F controller, need only the CPU (PM 783F) and Terminal Base (TB 711F)
   - Control Builder F and all appropriate licenses. Consult 3BDD012560R03 – Freelance Getting Started manual for more information on licensing.
   - HMS Anybus X-Gateway AB7817, DeviceNet Scanner/Modbus RTU Slave
   - Anybus NetTool for DeviceNet (Rockwell Automation's RSNet Worx may also be used)

Consult 2PAA103858R01 – Freelance AC 700F Mounting and Installation Instructions or 3BDD012501R0301 – Freelance Mounting and Installation Instructions manual for cabling of all Freelance hardware. Consult the Gateway Installation Sheet, and both Network Installation Sheets for each network for cabling of the gateway.

1.2   Before you start

This document is intended for those who have a basic understanding of Freelance, Profibus, Modbus RTU, and DeviceNet networks. This help file is not a replacement for the Freelance or HMS Anybus documentation and should only be used in conjunction with the manuals.

Recommended reading:
2PAA103858R0201 – Freelance 9.2 AC 700F Controller, Mounting and Installation
3BDD012501R0301 – Freelance 7.1 Mounting and Installation Instructions
3BDD012515R0301 – Engineering Reference Manual Communications and Field busses
HMS – User Manual: Anybus X-Gateway
HMS – Network Interface Addendum: X DeviceNet Scanner Interface
HMS – X-Gateway Interface Addendum: Profibus Slave
HMS – X-Gateway Interface Addendum: Modbus RTU Slave Interface
HMS – Application note-DeviceNet configuration: How to configure DeviceNet with Anybus
        NetTool for DeviceNet

1.3   Installation

Install the Anybus NetTool for DeviceNet and the Control Builder F software. The following versions have been tested:

   - Anybus NetTool for DeviceNet revision 3.4.1 build 3
   - Freelance version 9.1 RU1a

1.4 Architecture

The architecture of the hardware will be set up similar to the following diagrams:
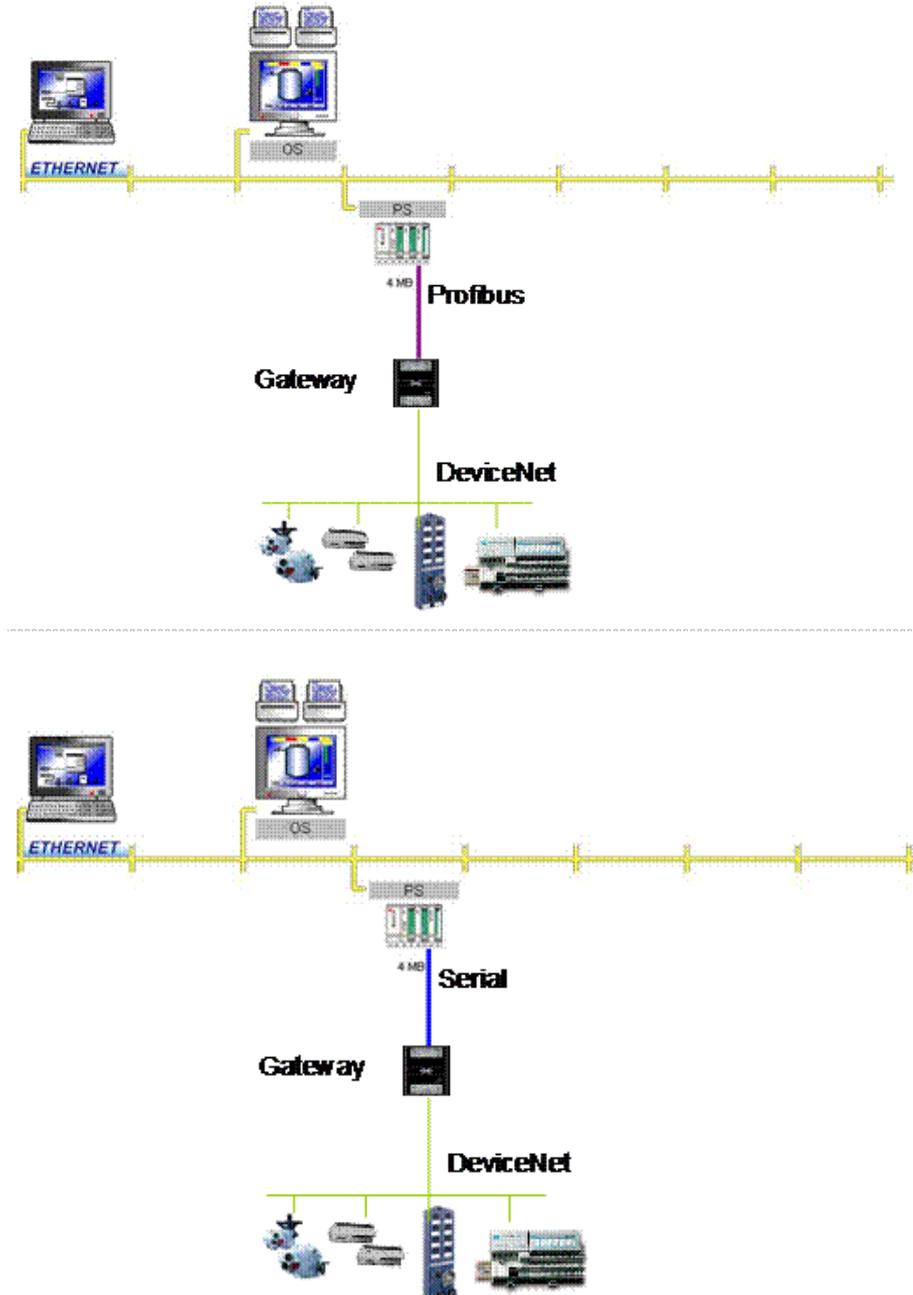
2. HMS Anybus-X Gateway Setup

Anybus-X Gateway has a theoretical upper limit of 512 bytes in and 512 bytes out. The actual value is highly network dependent.

The Anybus-X Gateway is configured through the serial COM-Port of the PC. Connect 24 VDC to the power terminal of the gateway, and then connect the RS232 9-pin serial cable from the COM-Port of the PC to the gateway Config Port. Open Microsoft Hyper Terminal and use the following parameters:

- Baud rate: 57600
- Data bits: 8
- Parity: None
- Stop bits: 1
- Flow control: None

Once the connection has been made, press the <Esc> key to enter the Main Menu (see below).
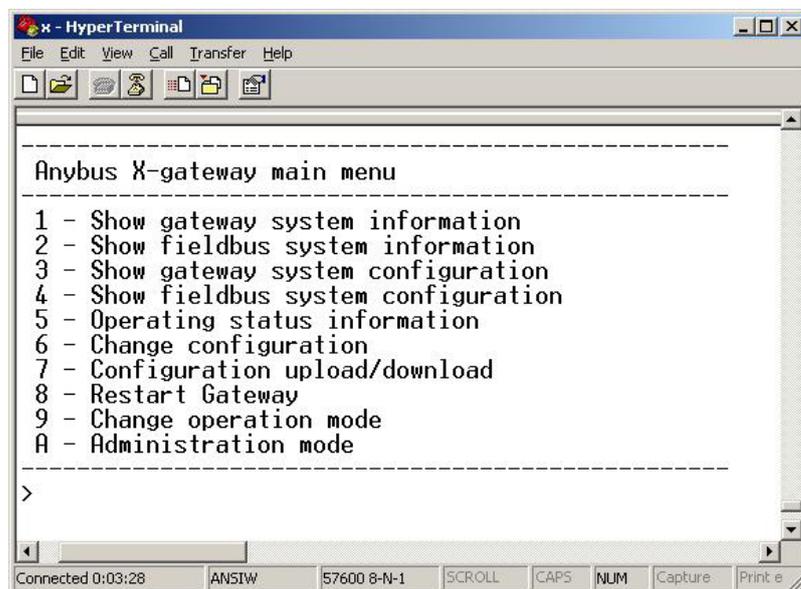
The gateway must be placed in Idle mode before any configuration changes can be made. To switch to Idle mode, press <9> for the Change operation mode menu, press the <-> key to choose Idle, then press <Enter> to select the mode, and <Esc> to return to the main menu.
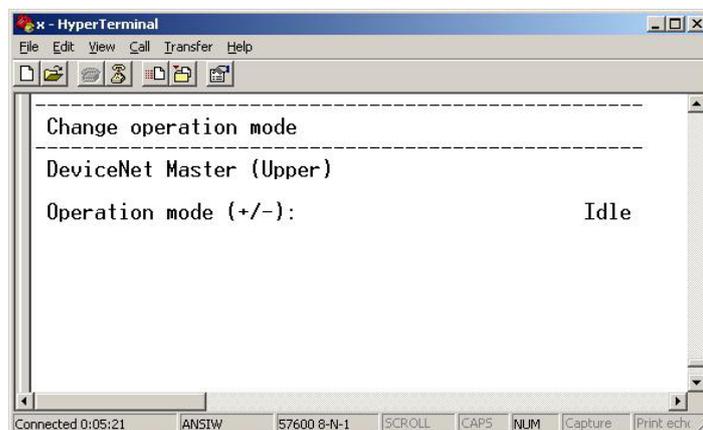
Most parameters should be sufficient for operation, but these should be checked with the process. The input and output data sizes are by default set to 20 bytes in and 20 bytes out. These parameters can each be set to the maximum of 512 bytes. To change the I/O data sizes, press <6> to enter the Change configuration menu and a message will appear explaining that both networks will go offline and ask if this is ok.
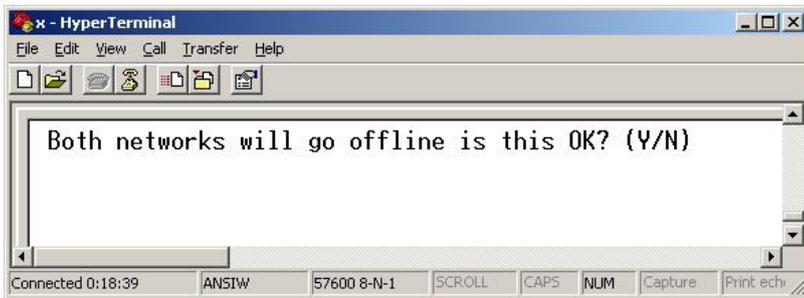
> **Note:**
> Since changing the configuration of the gateway will cause both networks to go offline, it is recommended to initially set the I/O data sizes to the best maximum value to reduce down time for later additions to the network. For an assistance determining the "best maximum value", see the setup section of the networks that are being used.

Press <y> to take both networks offline and enter the configuration menu, the I/O data size parameters may now be adjusted (see below).
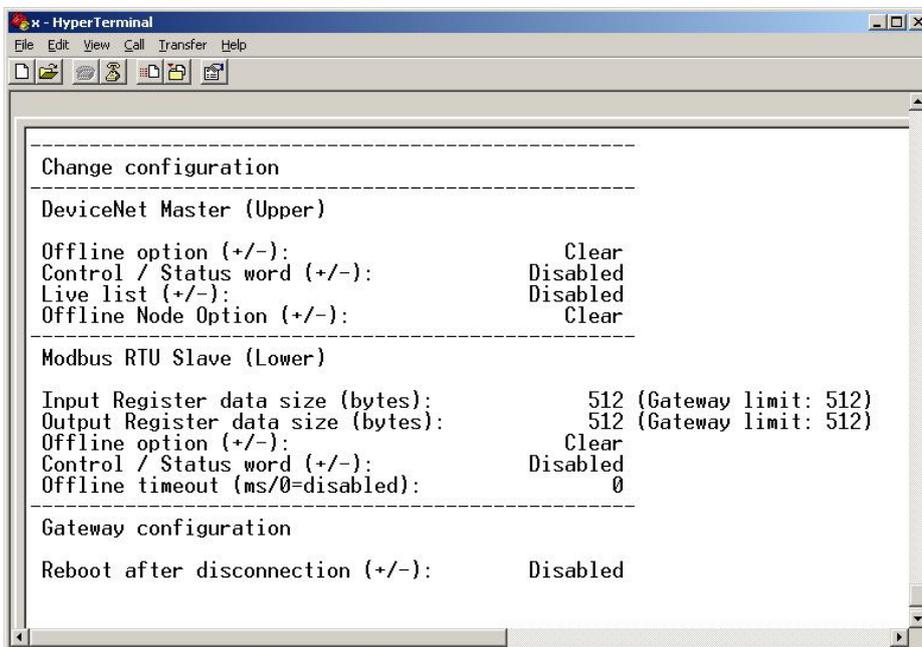
Press the <-> or <+> keys to change the values and press <enter>. After all parameters have been configured a message will ask for the configuration to be stored and to restart the gateway to execute the changes, press <y> for each of these questions.

```
x - HyperTerminal
File  Edit  View  Call  Transfer  Help

  Store Configuration (Y/N)?    Yes

  Please wait while configuration is being stored...

  Configuration stored!

  Restart gateway to execute all changes (Y/N)?    _

Connected 0:45:22      ANSIW      57600 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```
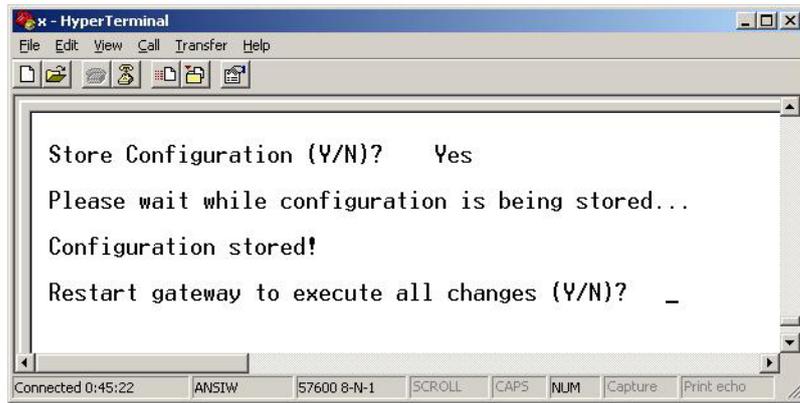
The gateway will then reboot and initialize with all the changes. The Hyper Terminal may now be disconnected and closed, and the serial cable may be removed.


```
x - HyperTerminal
File  Edit  View  Call  Transfer  Help

  Gateway initialising.....Please wait

  Verifying file system and generating configuration.....

  Both Anybus modules are OK. Exchanging data.

  Press ESC to enter configuration interface

Connected 0:47:48      ANSIW      57600 8-N-1    SCROLL   CAPS   NUM   Capture   Print echo
```
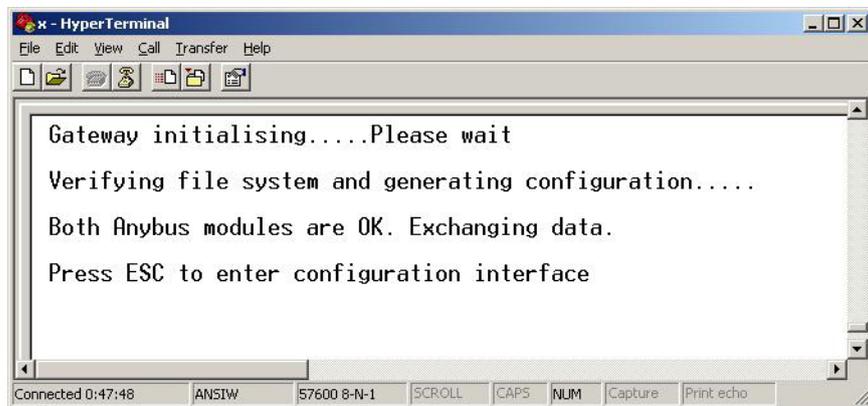
3. DeviceNet Setup

The HMS DeviceNet scanner can exchange data with up to 64 nodes. The scanner interface can handle up to 512 bytes of I/O data in each direction.

3.1 Wiring

Connect the DeviceNet device to the HMS Anybus-X Gateway DeviceNet Scanner. Use the necessary wiring and termination protocol as required by DeviceNet.

3.2 Configuration

DeviceNet requires either RSNet Worxs or Anybus NetTool for configuration of the DeviceNet network and devices. This section will explain the use of Anybus NetTool. First, go through Section 2 of this document to set up the gateway. Then, connect all DeviceNet devices to the HMS scanner and power all devices. Connect the RS232 9-pin serial cable from the COM-Port of the PC to the gateway Config Port. Open the Anybus NetTool for DeviceNet and install the EDS files for all DeviceNet devices being used, including the HMS gateway, by selecting Tools > Install EDS-file.

Drag and drop the network components into the blank network configuration, starting with the scanner. With each device that is inserted, the MAC ID of that device must be assigned.
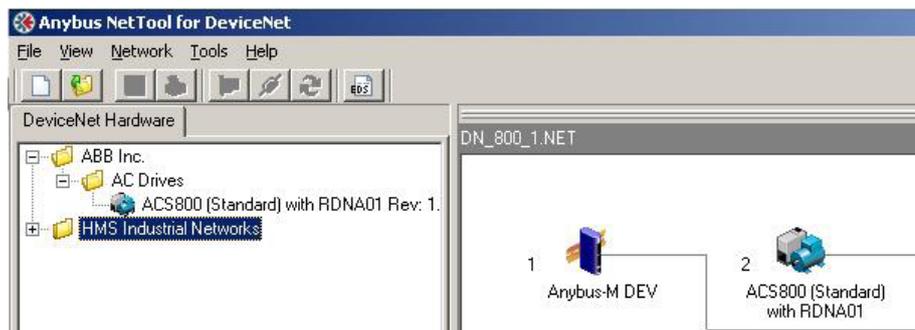
To bring the network online, select Tools > Configure Driver, then select Anybus-X Gateway (RS-232).
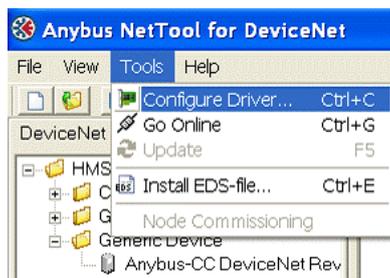
Select the Serial tab and create a transport path by selecting COM-Port Transport Provider, typing a name for the connection, and selecting the COM-Port that is connected.
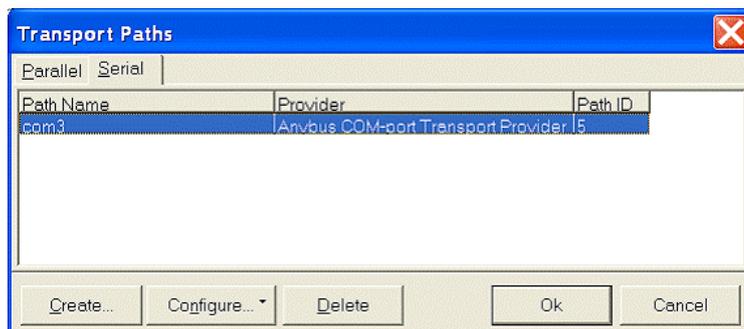
Once the path is created, select OK. Then, a window will pop up asking for Slot and Timeout. Select Upper and a timeout of 2 seconds.

Now with the network online, all devices may be configured. To configure the Anybus-M DEV, double click on the device and click yes to synchronize the parameters. The gateway must be in Idle mode in order to make any changes, select Idle and click download.
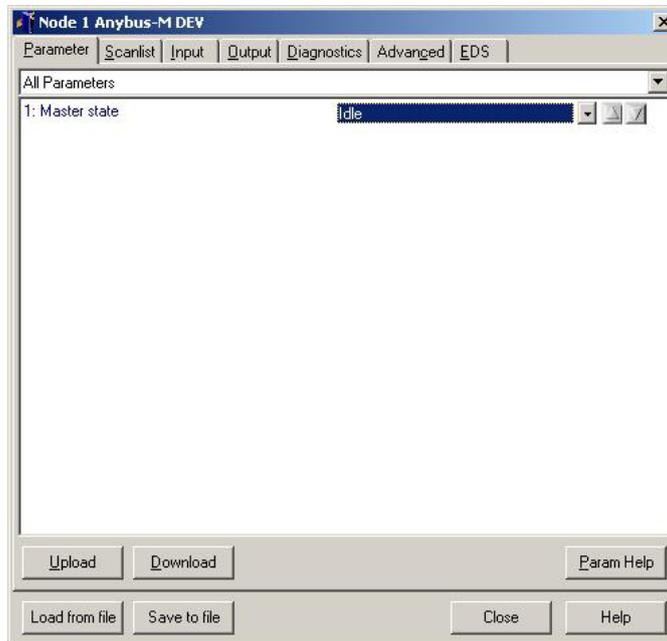
Click on the Scanlist tab, and again synchronize the data, then add the DeviceNet devices to the list.
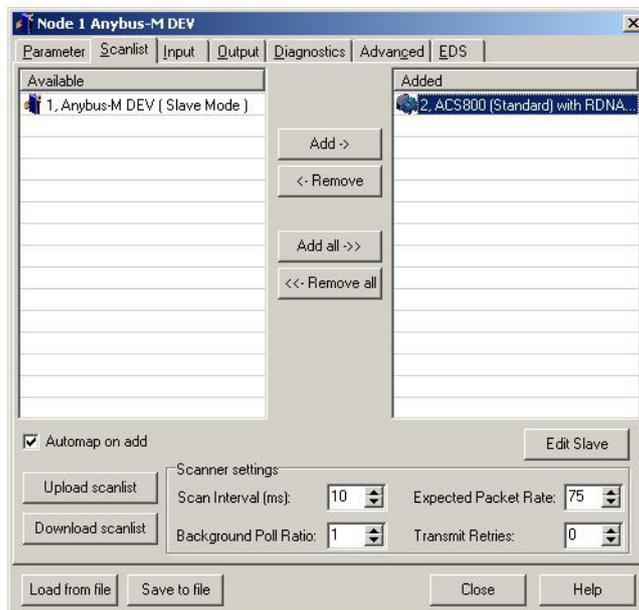
Click on the Edit Slave button for each device to set the number of bytes received (Rx) and transmitted (Tx).
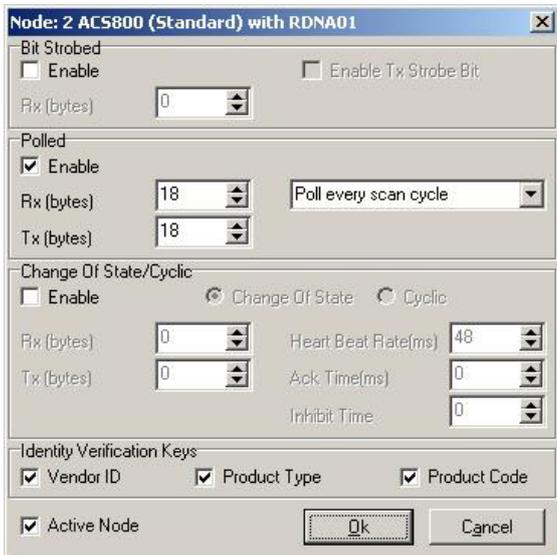
Switch back into Run mode and download before exiting. This tool may also be used to configure the devices on the network.
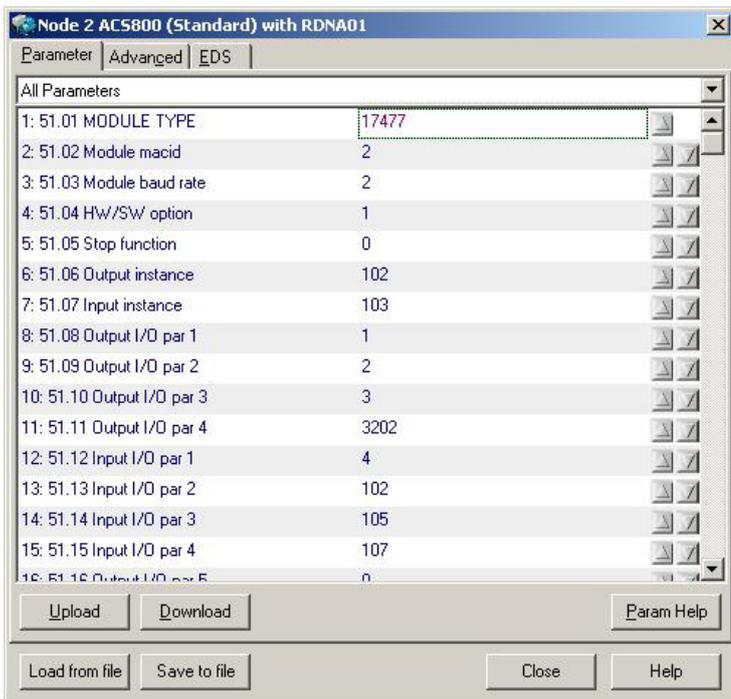
4. Modbus Setup

The Modbus slave interface can handle up to 512 bytes of I/O data in each direction.

4.1 Wiring

For connection and proper termination of Freelance to the HMS Anybus-X Gateway AB7817, consult the 3BDD012501R0301 - Freelance Mounting and Installation Instructions and HMS – X-Gateway Interface Addendum: Modbus RTU Slave Interface.

4.2 Configuration

On the Modbus RTU side of the AB7817 gateway, use the switches to set the Node ID, Baud rate, Parity, Stop Bits, and Interface Protocol. Reference the HMS – X-Gateway Interface Addendum: Modbus RTU Slave Interface manual for proper settings.

In the hardware structure of Control Builder F, insert a Modbus Master under the FI 820F module. Then double click on the Master node to set the Modbus parameters.
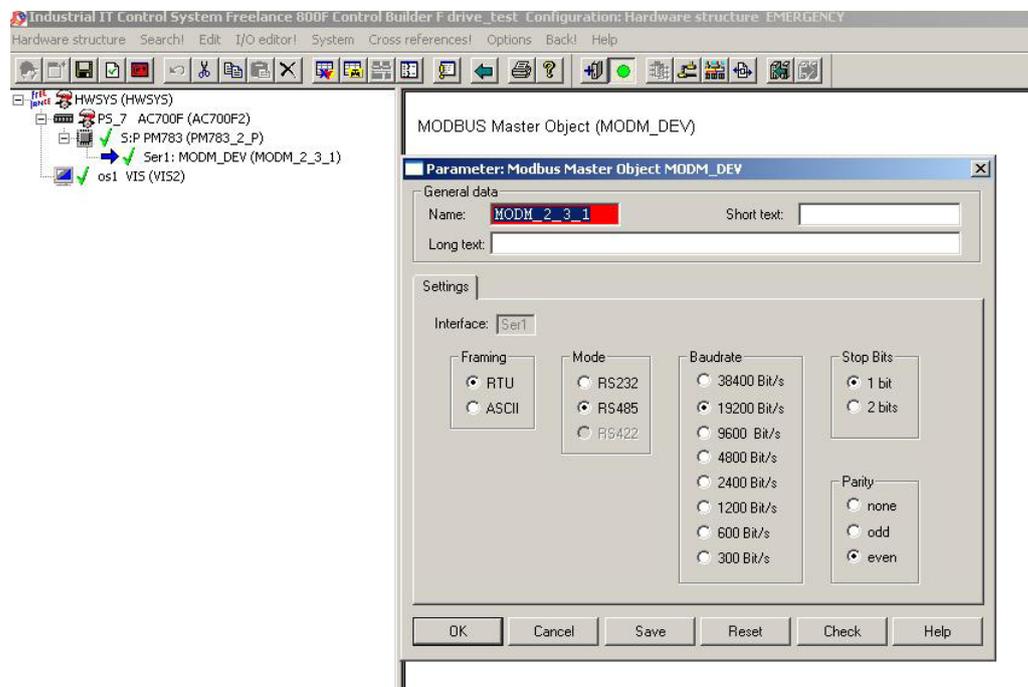
Note:

The Modbus parameters set in Control Builder F must be identical to the Modbus parameters set by the gateway switches.

The variables may now be used for programming. Due to the different protocols of Freelance and HMS, the bytes must be rearranged for each word. In the example below, Freelance is reading and writing to an ABB drive via the Modbus RTU – Gateway – DeviceNet method. The program is written in function block diagram.

Examples:

When reading or writing to the register, insert one of the Modbus Master function blocks: a Modbus Master Read or Write Register 1, 8, or 16. It is also necessary to insert the Unpack Word to Byte and Pack Byte to Word function blocks, and then cross the connections between them (see the following graphic).
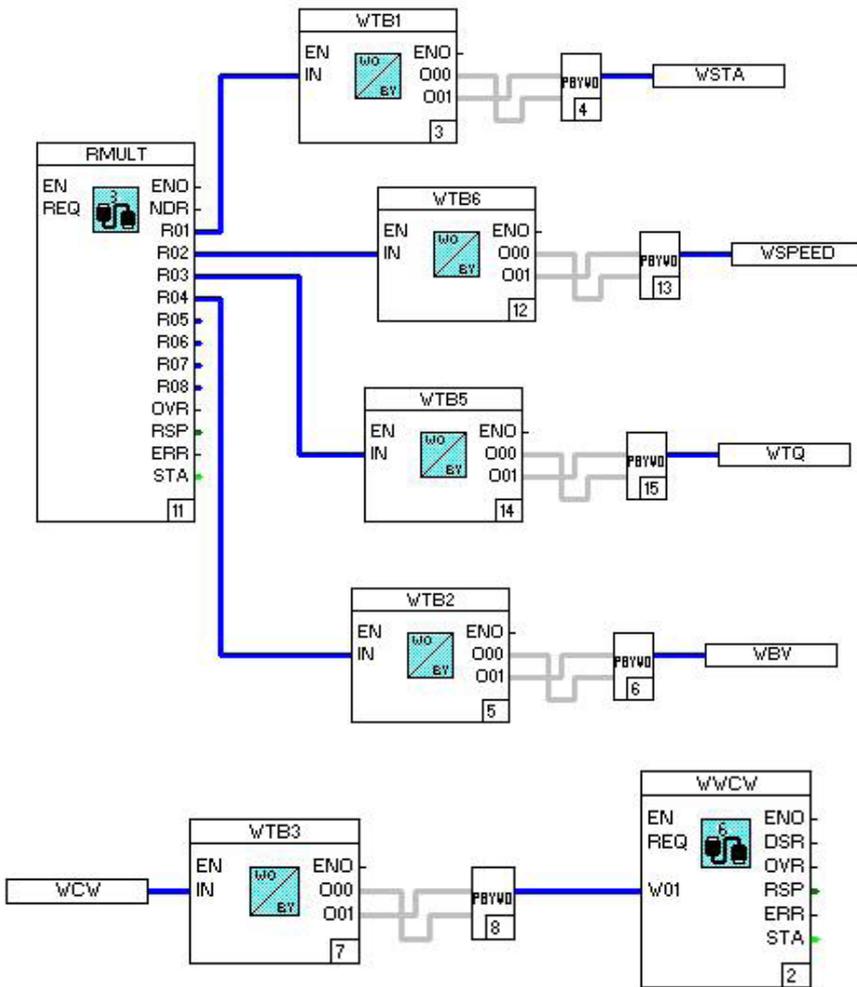
The Modbus Master function blocks must be parameterized. The Slave address is the Modbus address set on the HMS gateway, and the Interface name is the name of the Modbus Master inserted in the hardware structure (F2 will list available Masters). For information on register addresses consult the HMS – X-Gateway Interface Addendum: Modbus RTU Slave Interface manual.

When changing from word to another variable type, you may need to scale the value as well. In this example below, the top line reads an input, swaps the bytes, converts to real, and then scales the value with a scale block. The bottom line takes a real value, scales the value with a scale block, converts to word, swaps the bytes, and then writes to an output. The "WIN2" and "WOUT2" variables would then be connected to a Modbus Master function block.
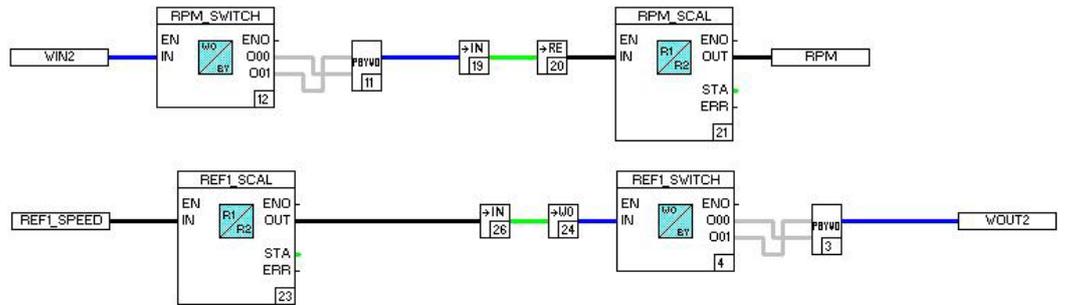
5. Profibus Setup

The HMS AB7663 gateway features automatic baud rate detection from 9.6 kb/s to 12 Mb/s. The slave interface can handle up to 244 bytes of I/O data in each direction. However, the total data size (input + output) cannot exceed 328 bytes.

5.1 Wiring

Connect a standard Profibus cable from the FI 830F Profibus Master module to the HMS Anybus-X Gateway AB7663. For information about correct cabling and termination consult the 3BDD012501R0301 - Freelance Mounting and Installation Instructions.

5.2 Configuration

On the Profibus side of the AB7663 gateway, set the two dials to the desired slave address.

In the hardware structure of Control Builder F, insert a slave using gsd.
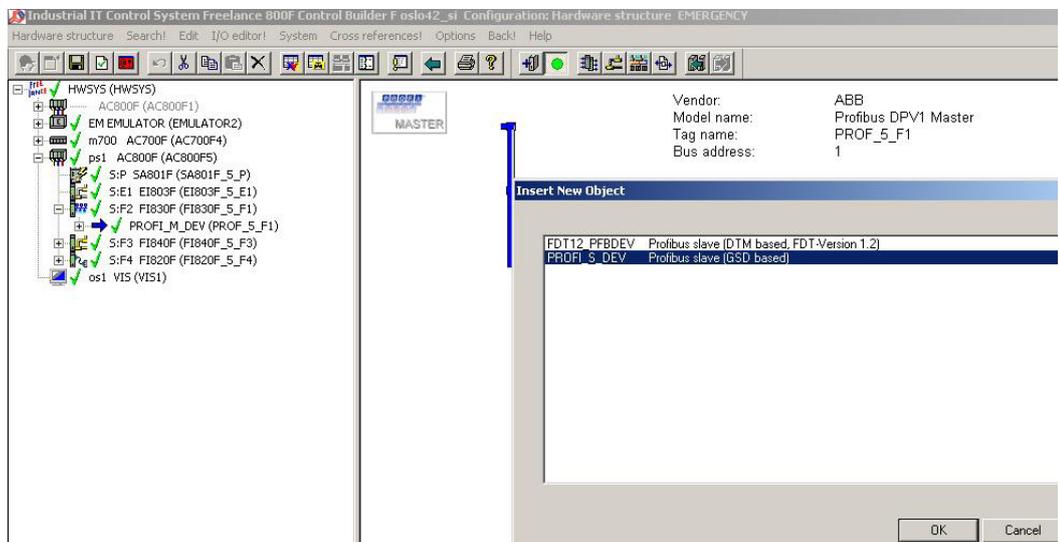
Select the node the gateway is on and the slave address that was set by the dials.
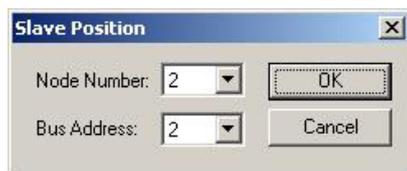
Select the gsd file provided for the HMS Anybus-X Gateway, and import.
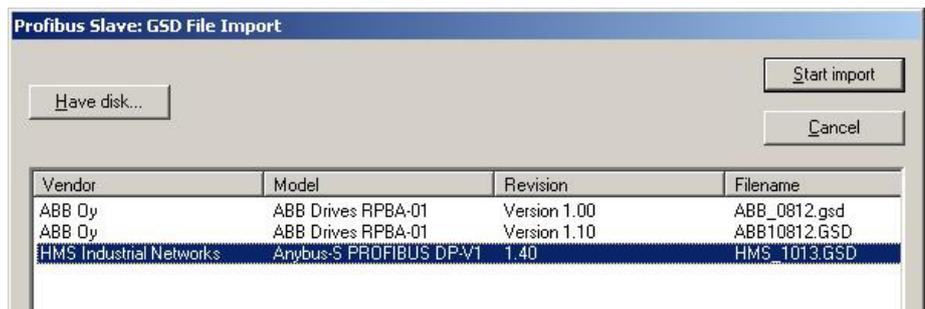
Insert the modules of the slave based on the number of word inputs and outputs being transferred.
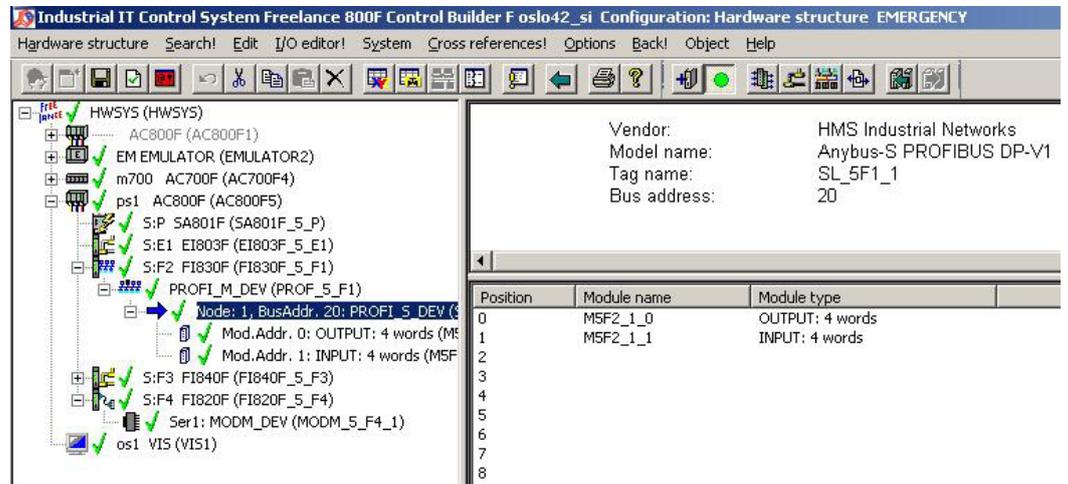
Enter the "I/O editor!" for the assignment of variables to the words.
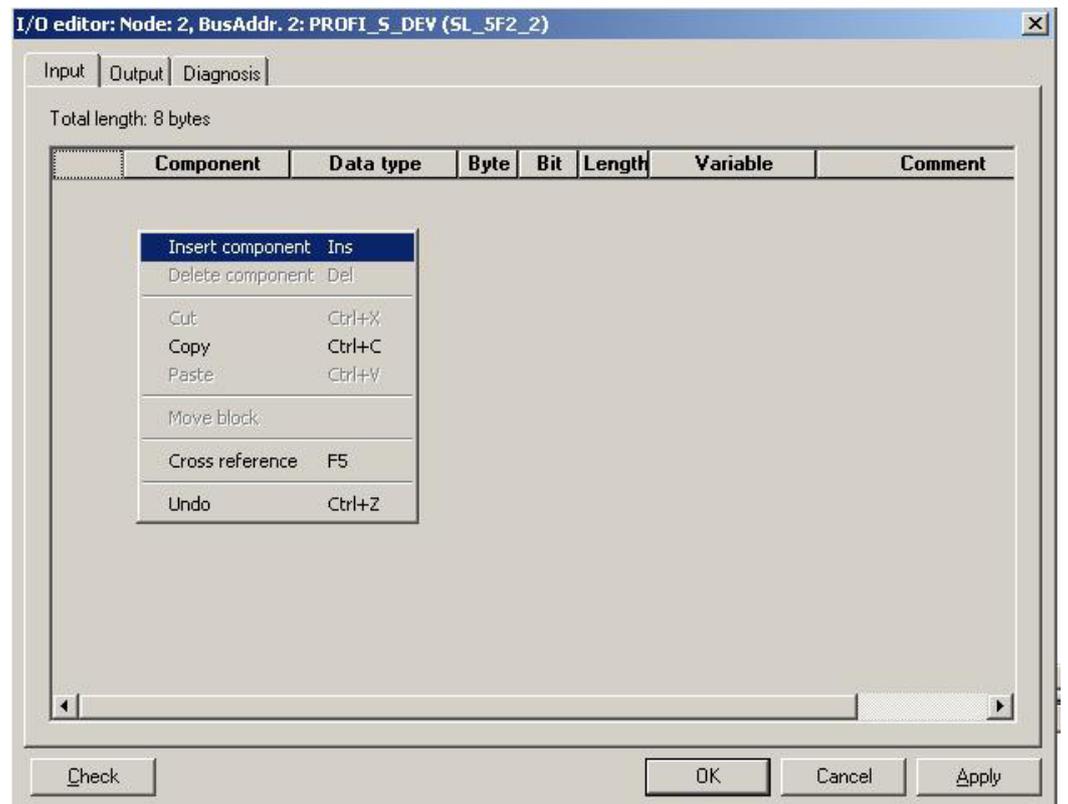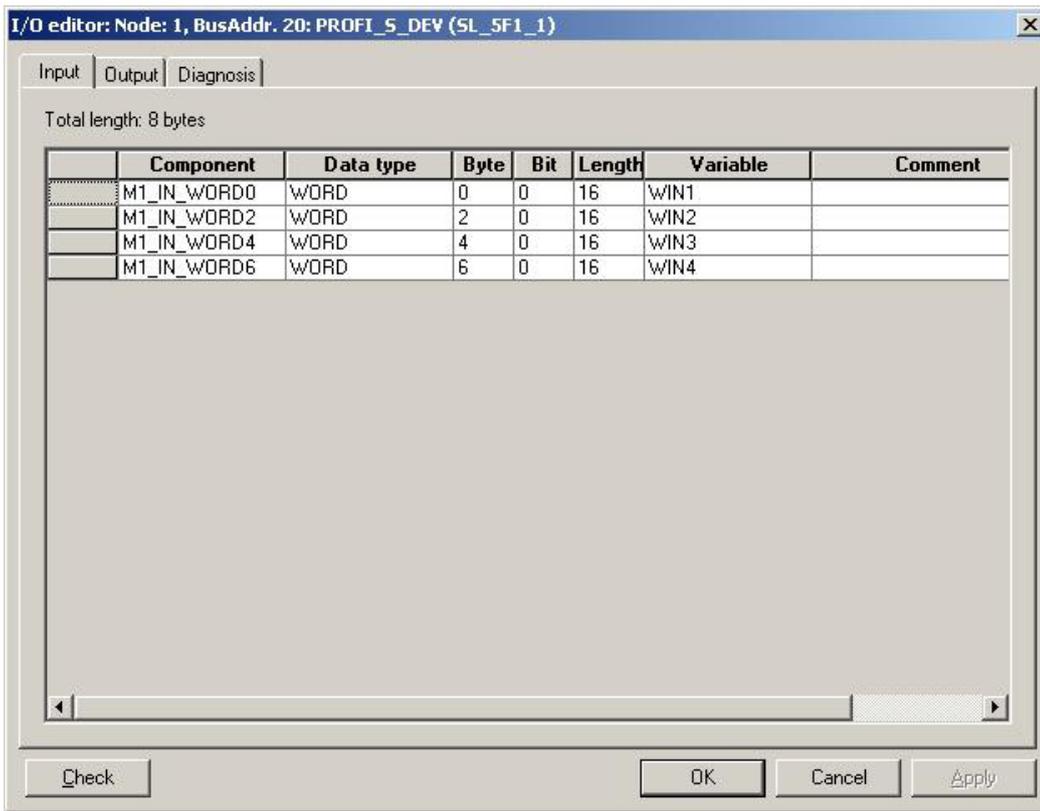
I/O editor: Node: 1, BusAddr. 20: PROFI_S_DEV (SL_5F1_1)

Input | Output | Diagnosis

Total length: 8 bytes

	Component	Data type	Byte	Bit	Length	Variable	Comment
	M1_IN_WORD0	WORD	0	0	16	WIN1	
	M1_IN_WORD2	WORD	2	0	16	WIN2	
	M1_IN_WORD4	WORD	4	0	16	WIN3	
	M1_IN_WORD6	WORD	6	0	16	WIN4	

Check   OK   Cancel   Apply

The variables may now be used for programming. Due to the different protocols of Freelance and HMS, the bytes must be rearranged for each word. In the example below, Freelance is reading and writing to an ABB drive via the Profibus – Gateway – DeviceNet method. The program is written in function block diagram.

Examples:
When reading or writing to the word variable, insert two function blocks: Unpack Word to Byte and Pack Byte to Word. Then, cross the connections between them (see below).
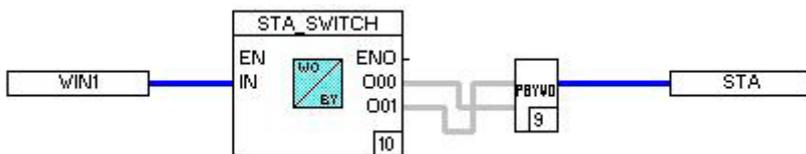
When changing from word to another variable type, you may need to scale the value as well. In this example below, the top line reads an input, swaps the bytes, converts to real, and then scales the value with a scale block. The bottom line takes a real value, scales the value with a scale block, converts to word, swaps the bytes, and then writes to an output.
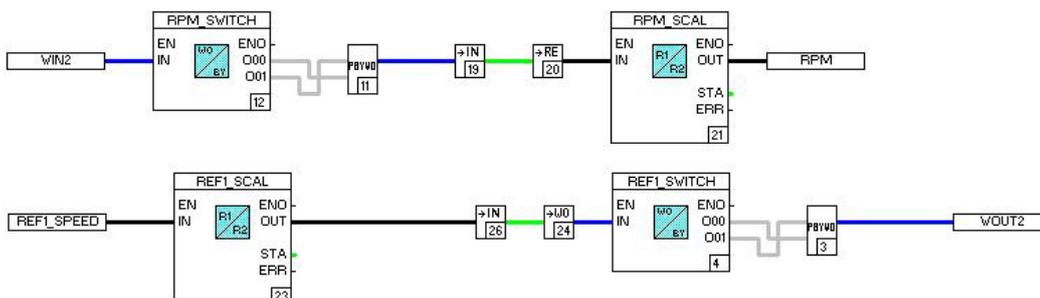
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