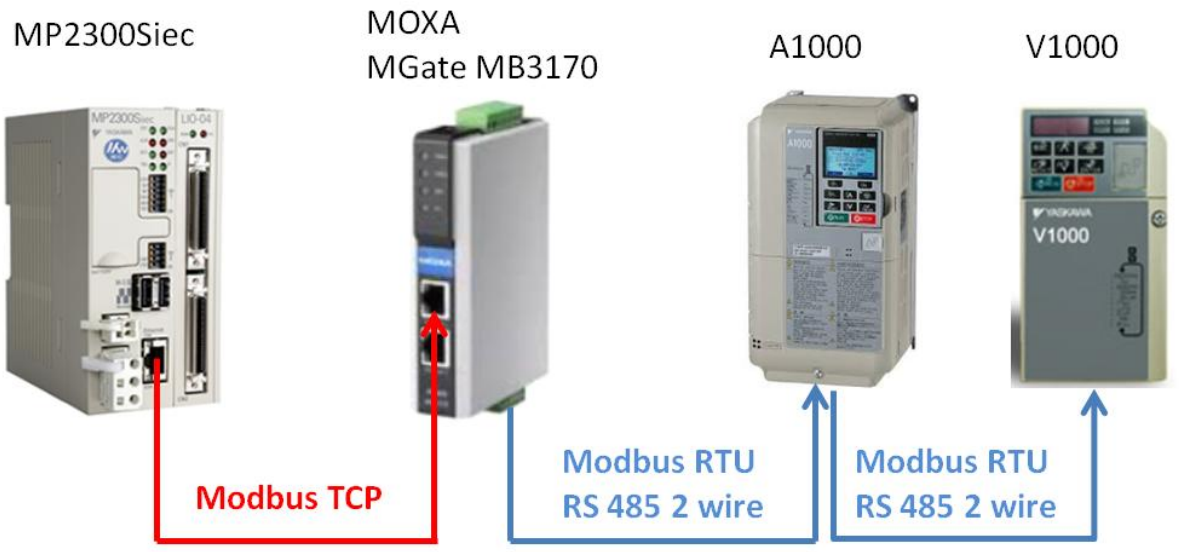
Application Note

MPiec Controllers Communicating Serially with VFDs



Subject: Application Note	Product: MPiec Controllers	Doc#: AN.MPIEC.06
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Application Overview:

This application note describes how to configure and program an MPiec controller to communicate with multiple VFDs serially. The configuration includes a Moxa MGate MB3170 module which converts Modbus TCP to Modbus RTU. The MPiec controller is a Modbus client in this configuration. The MOXA MB3170 module is configured for RS-485 2-wire.

Application Highlights:

1. Yaskawa VFDs support serial communication without adding an option card. The Moxa MGate MB3170 converter converts Modbus TCP messages from the MPiec controller to Modbus RTU messages with a unique Device ID.
2. One MB 3170 converter can support RS-485 multidrop communication for up to 31 serial devices.
3. All VFD parameters and I/O can be accessed from the MPiec controller using this approach.

Products Used:

Component	Product and Model Number
Controller	MPiec
Software	MotionWorks IEC
VFD	A1000, V1000
Third Party Devices	Moxa MGate MB3170 Modbus TCP to RTU converter

Implementation:

1. Configure the MPiec Controller as a Modbus Client (Master)

Launch the MotionWorks IEC Hardware Configuration. Add a new Modbus Device for each serial connection on the RS-485 network.

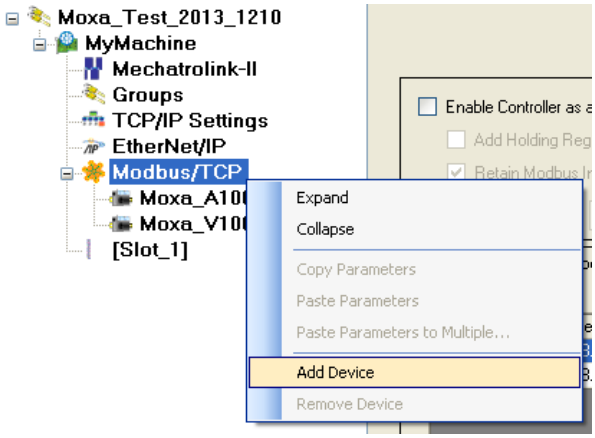

Figure 1: Adding a new Modbus slave device

Add the Modbus slave devices in the Hardware Configurator. The IP address field is referring to the address of the Moxa MB3170 converter. Assign a unique status variable and unit identifier for each slave on the network.

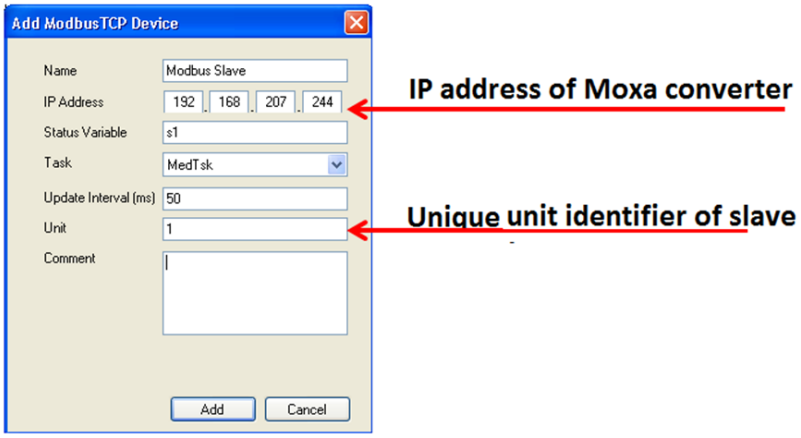

Figure 2: Modbus Slave Device Configuration

Figure 3 illustrates the Hardware Configuration with an A1000 with Unit ID 1 and a V1000 with Unit ID 2 which will be accessible via the Moxa MB3170 converter at IP address 192.168.207.244.

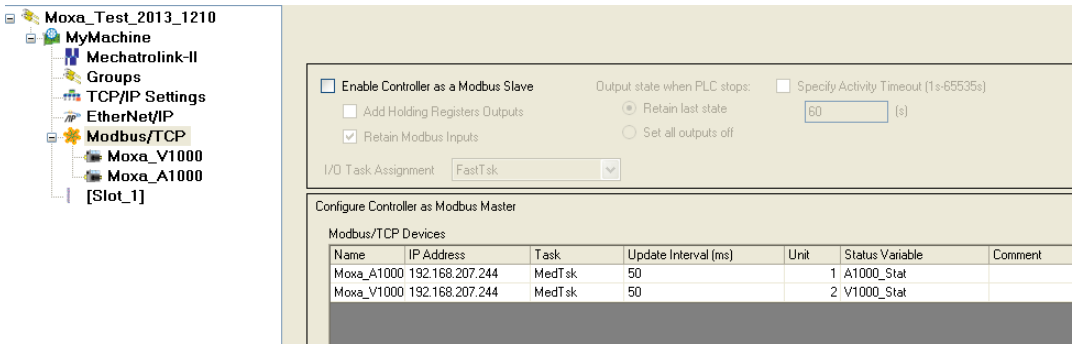

Figure 3: Two VFD slaves at ID 1 and 2

The configuration shown below explains how to add two Modbus data blocks (with two registers each) for each slave device. Select the Modbus slave from the device tree and add Modbus data blocks. In Figure 4, a snapshot of two data blocks created for the A1000 is shown. %IB43008 to %IB430011 is the MPiec memory to which 2 modbus registers (number of items = 2) starting at address 1H (starting address = 2) on the A1000 will be read using function code 03. %QB43008 to %QB430011 is the MPiec memory from where data will be written to 2 modbus registers (number of items = 2) starting at address 1H (starting address = 2) on the A1000 using function code 16.

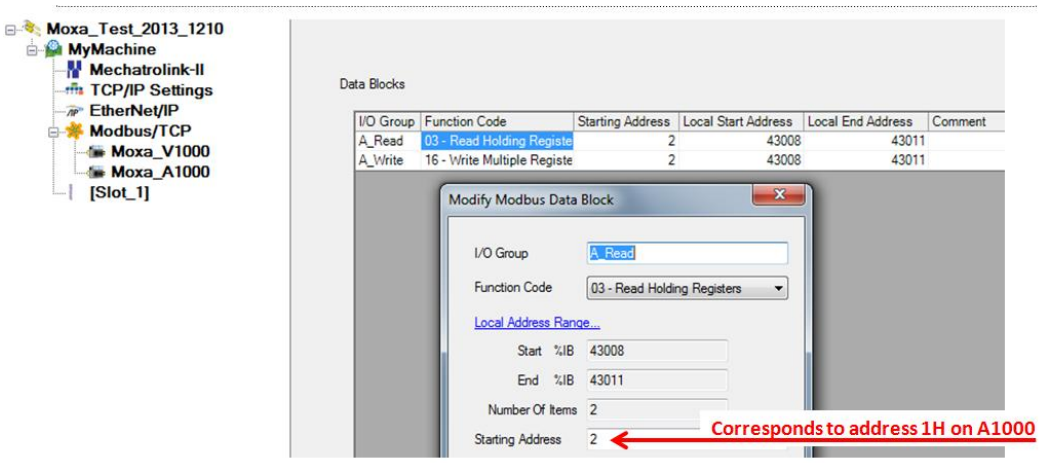

Figure 4: Modbus data blocks for the A1000

%IB43014 to %IB430017 is the MPiec memory to which 2 modbus registers (number of items = 2) starting at address 1H (starting address = 2) on the V1000 will be read using function code 03. %QB43012 to %QB430015 is the MPiec memory from where data will be written to 2 modbus registers (number of items = 2) starting at address 1H (starting address = 2) on the V1000 using function code 16.

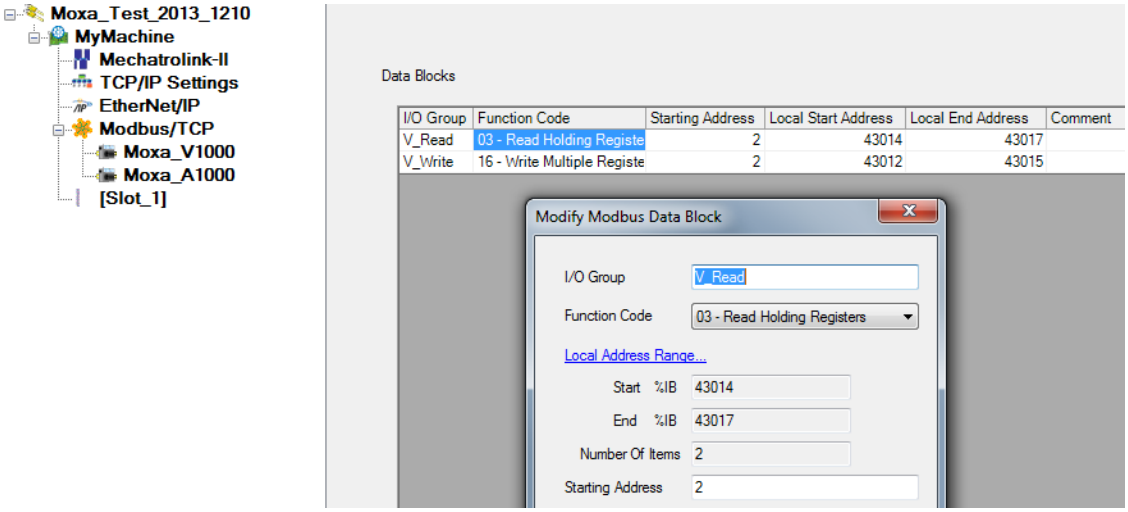

Figure 5: Modbus data blocks for the V1000

Save the Hardware Configuration. The map between the MPiec memory and the Modbus registers on the two slaves under the configuration described above can be seen in the table in figure 6. Cycle power to the MPiec controller to make sure that the configuration takes effect in the MPiec.

MPiec Memory	Function Code	Slave Register
%IB43008 %IB43009	FC 03	1H on A1000
%IB43010 %IB43011	FC 03	2H on A1000
%IB43012 %IB43013	Status of A1000	
%IB43014 %IB43015	FC 03	1H on V1000
%IB43016 %IB43017	FC 03	2H on V1000
%IB43018 %IB43019	Status of V1000	
%QB43008 %QB43009	FC 16	1H on A1000
%QB43010 %QB43011	FC 16	2H on A1000
%QB43012 %QB43013	FC 16	1H on V1000
%QB43014 %QB43015	FC 16	2H on V1000

Figure 6: Memory map on the different devices

The complete Modbus data table for A1000 drives can be accessed from section C9 (of the A1000 technical manual) at the location shown below:

http://www.yaskawa.com/site/dmdrive.nsf/SearchV/86256EC30069E43286257704005947B8?OpenDocument&Source=SearchResultPage

The complete Modbus data table for V1000 drives can be accessed from section C10 (of the V1000 technical manual) at the location shown below:

http://www.yaskawa.com/site/dmdrive.nsf/SearchV/86256EC30069E432862574CE0056C4C2?OpenDocument&Source=SearchResultPage

A maximum of 16 registers on the VFDs can be read out at a time. The registers also have to be contiguous. Therefore if the user wants to read the status of inputs and write outputs on the A1000 drive, additional read and write data blocks will have to be added to the hardware configuration as shown in figures 7 and 8.

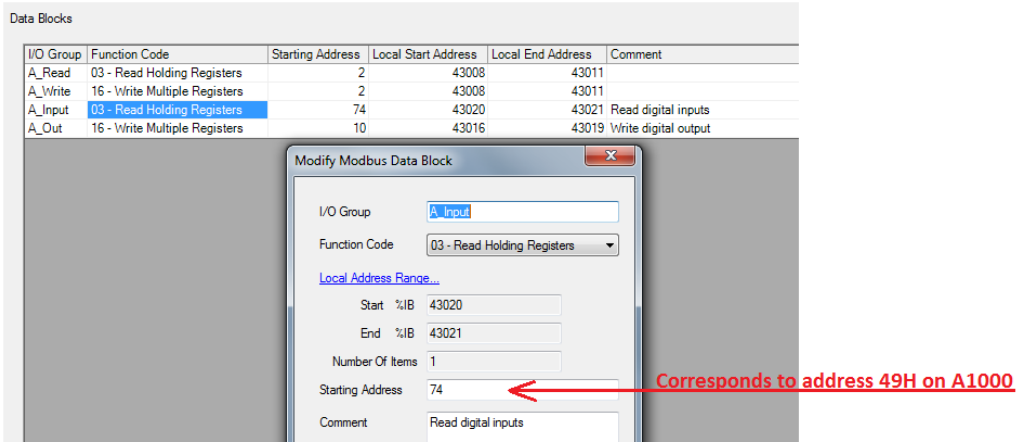

Figure 7: Configuring read data block for digital inputs

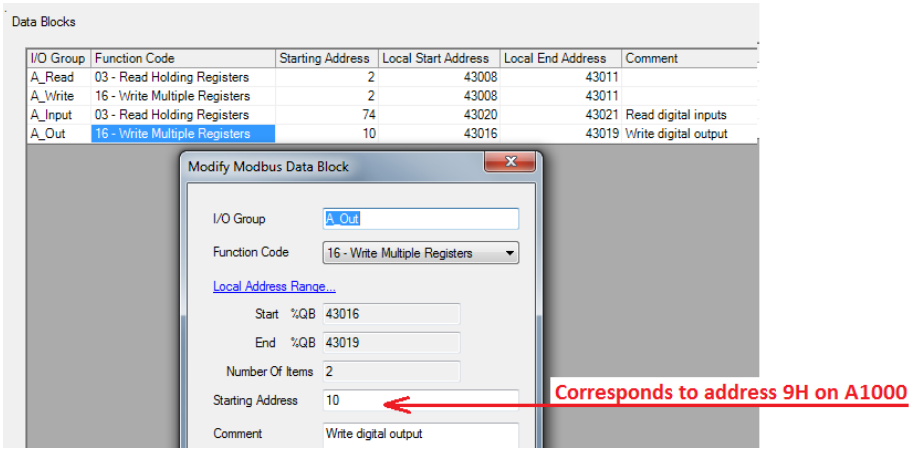

Figure 8: Configuring write data blocks for digital outputs

2. Configuring the Moxa MB 3170 Converter

The MB 3170 can be accessed using a web browser or Moxa's MGate Manager Configuration software. The various settings on the MB3170 are shown in figures 7 through 11.

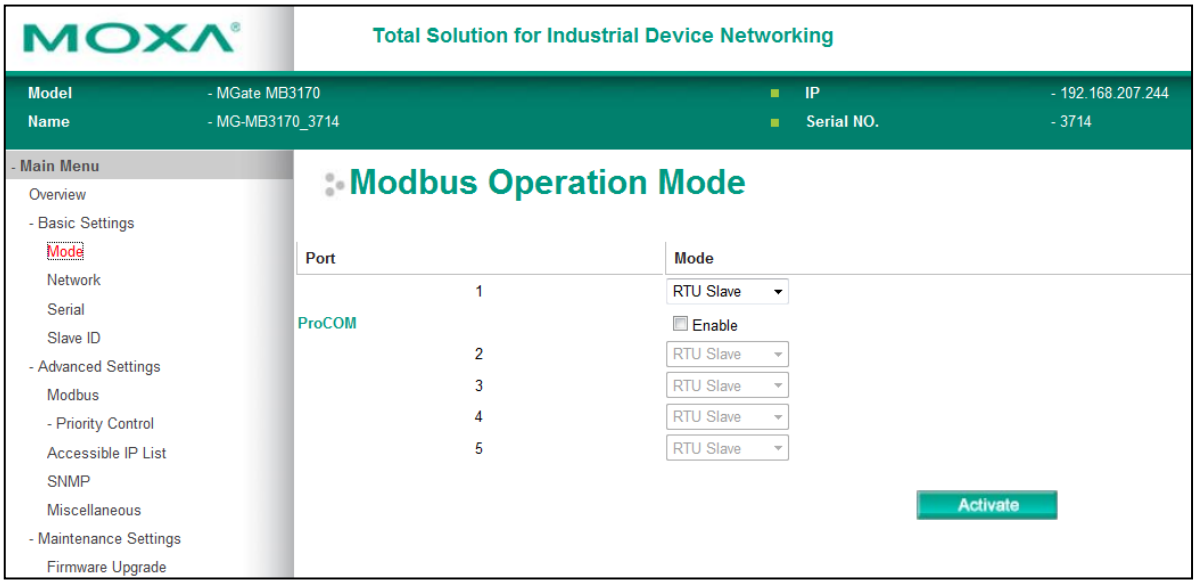

Figure 7: Modbus Operation Mode

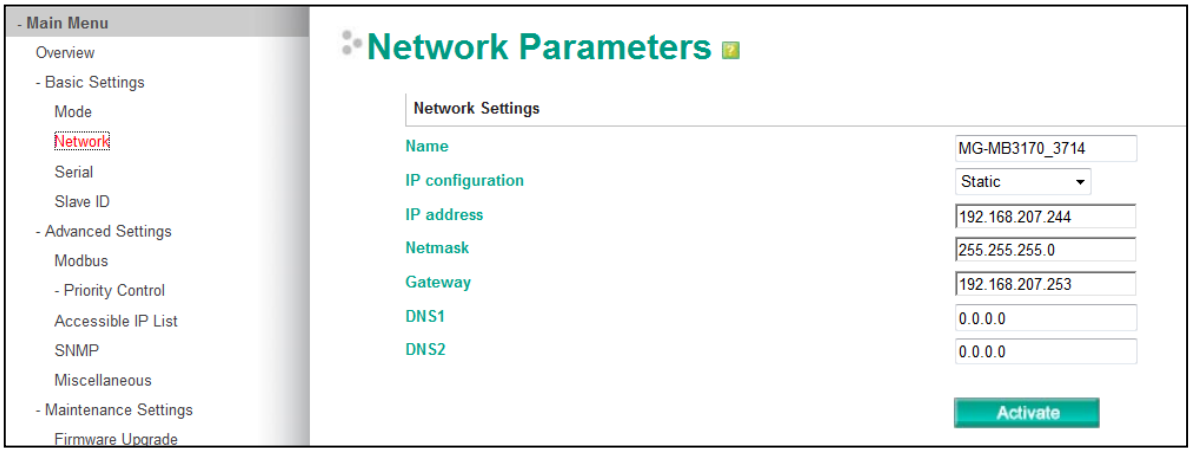

Figure 8: Network Parameters

Figure 9: Serial Parameters

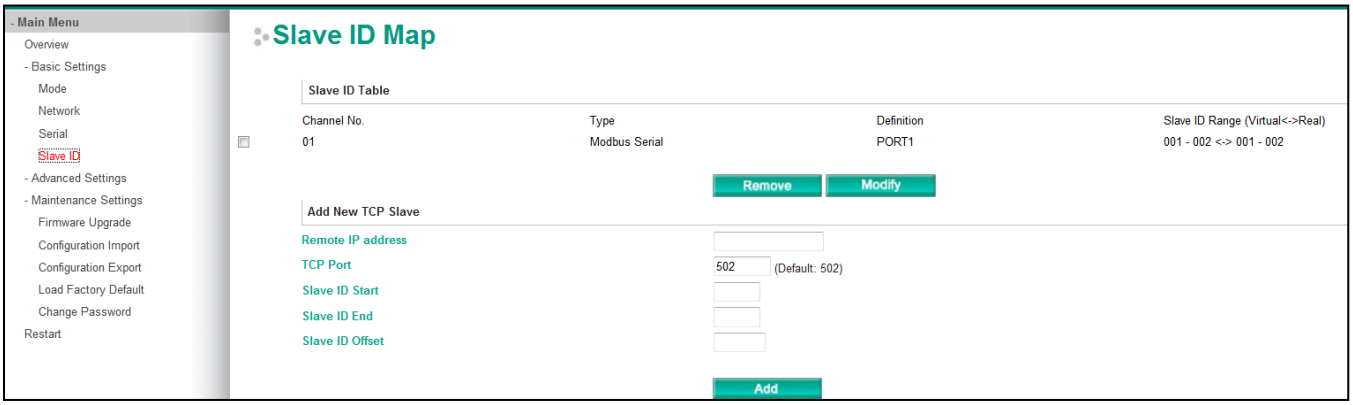

Figure 10: Slave ID map

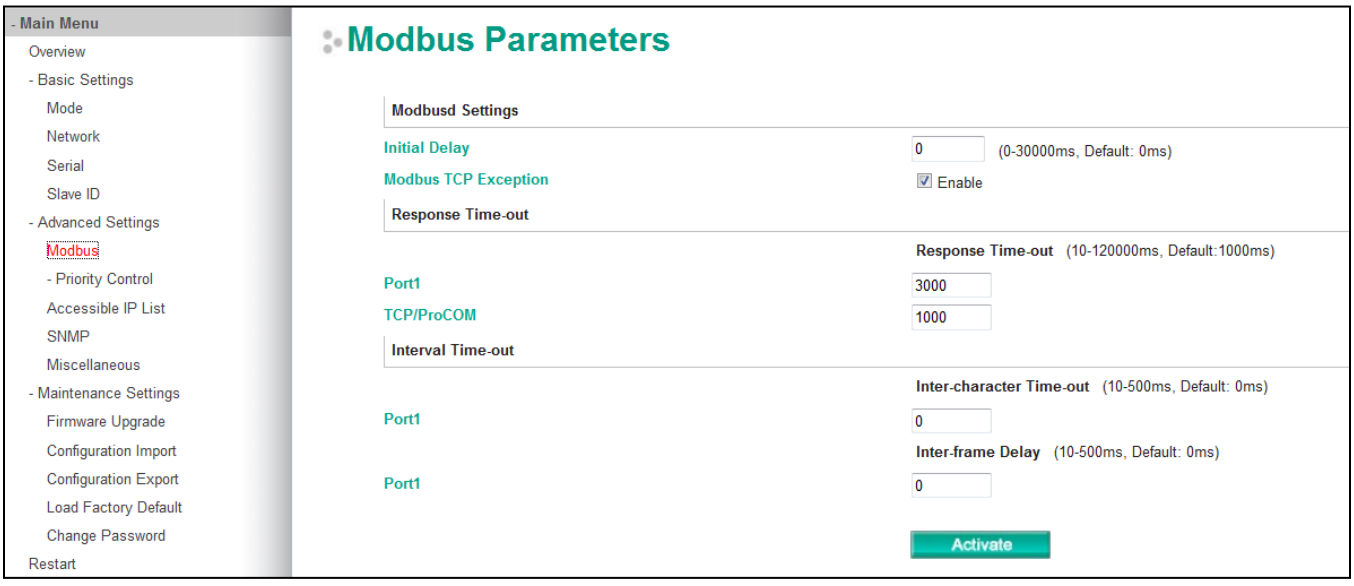

Figure 11: Modbus Parameters

3. Configuring the VFDs

Ensure that the VFDs are wired correctly for RS-485 communication. Follow guidelines from the A1000 / V1000 user's manual for correct wiring.

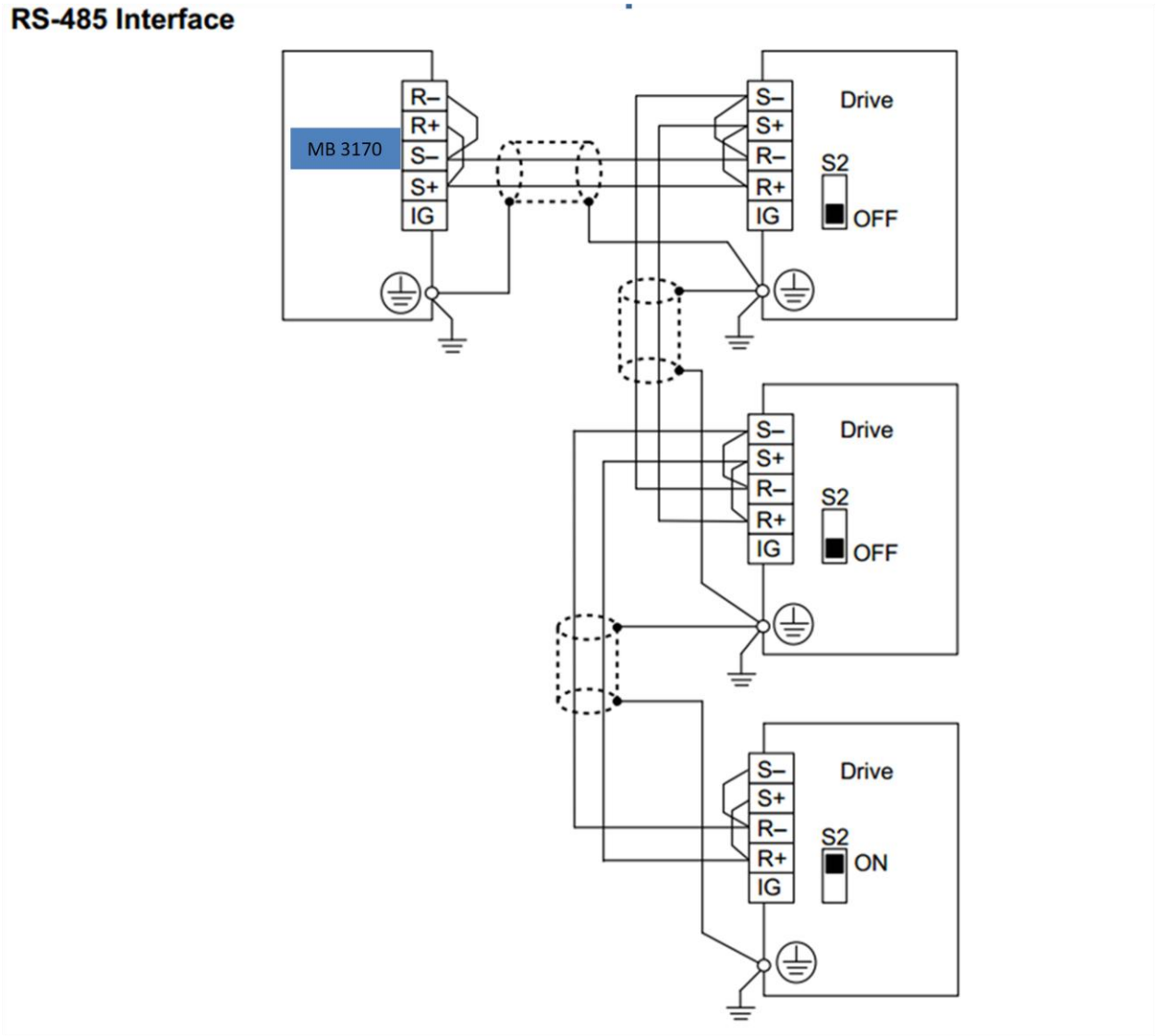

Figure 12: RS-485 connections for 2-wire communication

To configure the VFDs to accept frequency reference and run commands via Modbus communication, set VFD parameter b1-01 and b1-02 to a value of 2.

The other parameters that must be set to configure the VFD to respond to Modbus messages are:

- H5-01: Slave ID (Set for 1 for A1000 and 2 for V1000 in our example)
- H5-02: Communication speed selection (set to 3 representing 9600 bps)
- H5-03: Communication parity selection (set to 0 for no parity)
- H5-07: RTS control selection (set to 1 to enable multidrop communication)

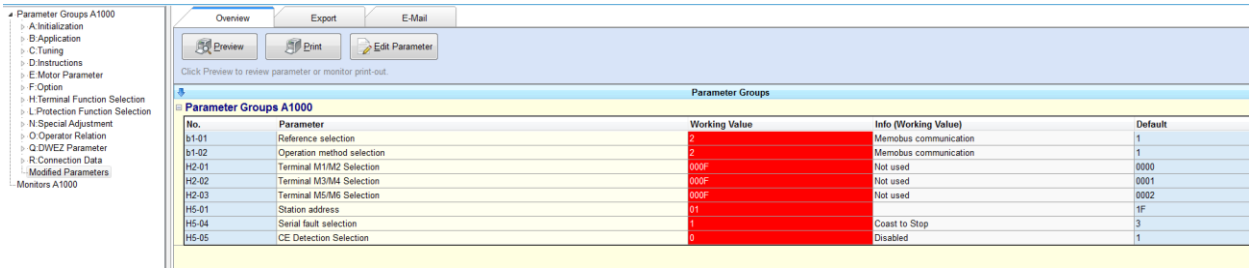

Figure 13: Modified Parameters on the A1000 when successfully communicating with an MPiec controller

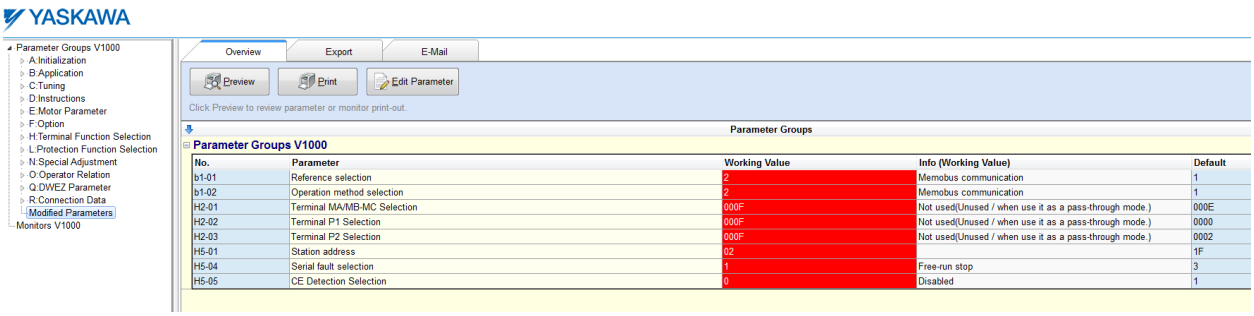

Figure 14: Modified Parameters on the V1000 when successfully communicating with an MPiec controller

4. Programming in MotionWorks IEC

After configuring the MPiec controller, the Moxa converter and the VFDs, the user will have to populate the MotionWorks IEC editor with Modbus variables. All variables that will be used in the project will have to be added in the global variables table. The Modbus groups will be ready for the user to populate. Data type and variable address are fields that the user should take care in entering correctly.

⊟ <Moxa_A1000> 'iA_Read' Address Range: %IB43008 - %IB43011 (* Do Not Modify Group Name or Status Variable. *)				
A1000_RunStatus	BOOL	VAR_GLOB...		%IX43008.0
A1000_FreqMonitor	WORD	VAR_GLOB...		%IW43010
A1000_Stat	WORD	VAR_GLOB...	(* Do Not Modify. *) Modbus Slave Status Variable	%IW43012
⊟ <Moxa_A1000> 'oA_Write' Address Range: %QB43008 - %QB43011 (* Do Not Modify Group Name or Status Variable. *)				
A1000_RunCommand	BOOL	VAR_GLOB...	Run FWD (1H bit 0)	%QX43008.0
A1000_FreqCommand	WORD	VAR_GLOB...	2H	%QW43010
⊟ <Moxa_V1000> 'iV_Read' Address Range: %IB43014 - %IB43017 (* Do Not Modify Group Name or Status Variable. *)				
V1000_RunStatus	BOOL	VAR_GLOB...		%IX43014.0
V1000_FreqMonitor	WORD	VAR_GLOB...		%IW43016
V1000_Stat	WORD	VAR_GLOB...	(* Do Not Modify. *) Modbus Slave Status Variable	%IW43018
⊟ <Moxa_V1000> 'oV_Write' Address Range: %QB43012 - %QB43015 (* Do Not Modify Group Name or Status Variable. *)				
V1000_RunCommand	BOOL	VAR_GLOB...		%QX43012.0
V1000_FreqCommand	WORD	VAR_GLOB...		%QW43014
⊟ User Variables				
⊟ <Moxa_A1000> 'iA_Input' Address Range: %IB43020 - %IB43021 (* Do Not Modify Group Name or Status Variable. *)				
Input0	BOOL	VAR_GLOB...		%IX43020.0
Input1	BOOL	VAR_GLOB...		%IX43020.1
Input2	BOOL	VAR_GLOB...		%IX43020.2
Input3	BOOL	VAR_GLOB...		%IX43020.3
Input4	BOOL	VAR_GLOB...		%IX43020.4
Input5	BOOL	VAR_GLOB...		%IX43020.5
Input6	BOOL	VAR_GLOB...		%IX43020.6
Input7	BOOL	VAR_GLOB...		%IX43020.7
⊟ <Moxa_A1000> 'oA_Out' Address Range: %QB43016 - %QB43019 (* Do Not Modify Group Name or Status Variable. *)				
Output0	BOOL	VAR_GLOB...		%QX43016.0
Output1	BOOL	VAR_GLOB...		%QX43016.1
Output2	BOOL	VAR_GLOB...		%QX43016.2

Figure 15: Global variables table in MotionWorks IEC

Once variables are added, the user can start coding in POUs. An example of setting up frequency command and run command are shown in figure 16.

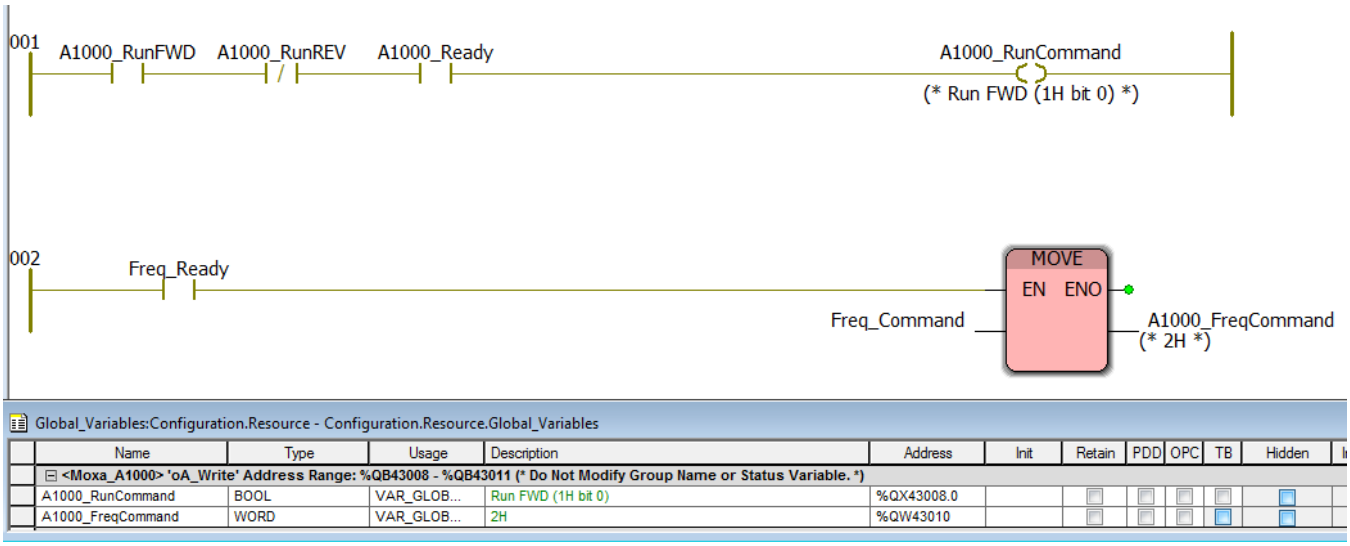

Figure 16: Programming example