Technical Note

QuickStart Guide

Configuring a RedLion HMI to communicate with an MPiec Controller via MODBUS/TCP using Crimson 3

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Subject: Tech Note	Product: MPiec Series Controllers	Doc#: AN.MPiec.05
Title: Configuring a RedLion HMI to communicate with an MPiec controller via Modbus TCP using Crimson 3		

Products Used

Motion Controller	Yaskawa MP2300Siec controller
HMI	RedLion G310
Servo	Yaskawa Sigma-5 Series Servopack and motor
Software	Yaskawa MotionWorks IEC, Red Lion Crimson 3.0

Configuration Procedure

I. Set the IP addresses of the HMI, controller, and PC. In the test set up, the IP addresses were:

- MPiec Controller: 192.168.1.1
- G3 HMI: 192.168.1.20
- PC: 192.168.1.3

The default IP address on the MPiec controller is 192.168.1.1 unless changed by the user.

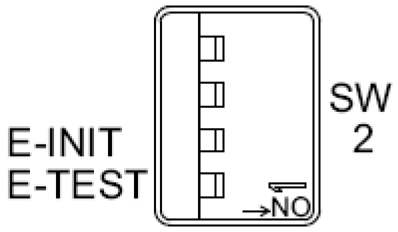
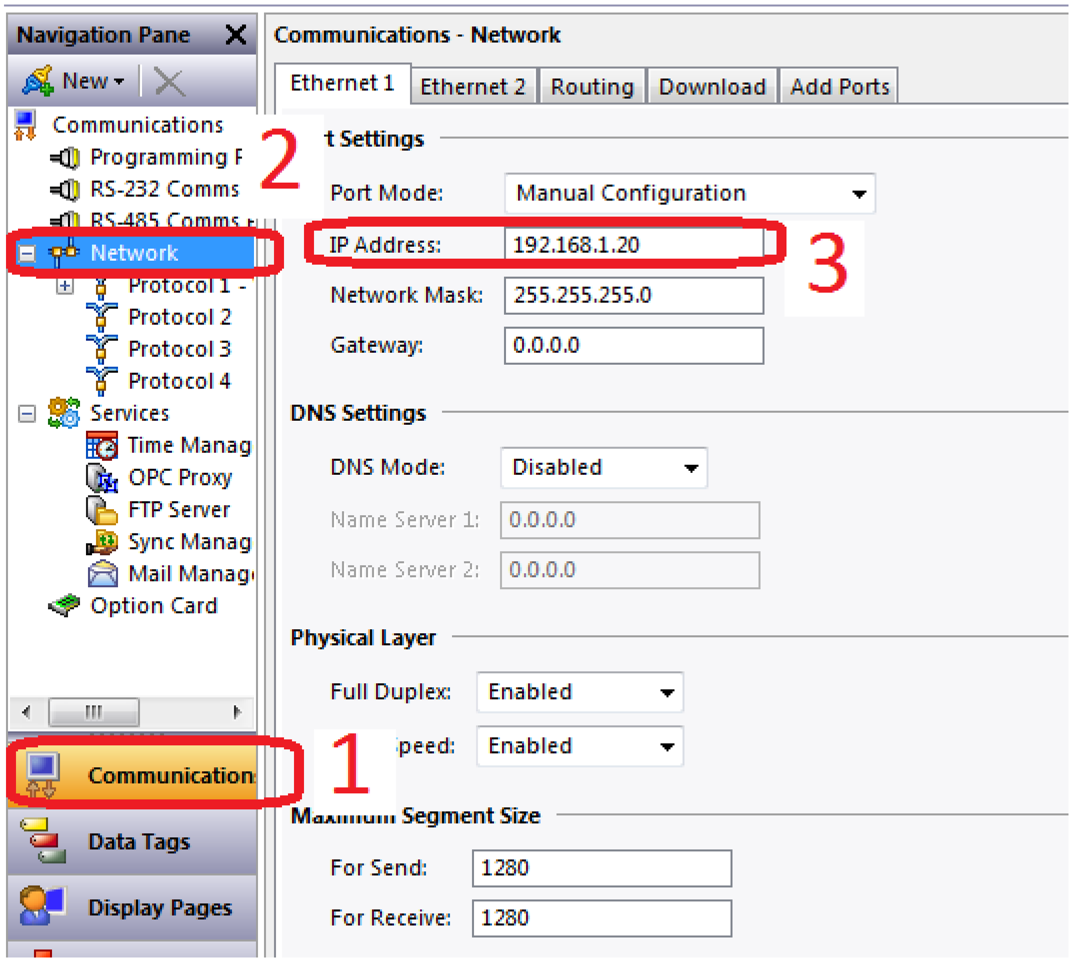


Figure 2: Set the IP address of controller

II. To set the IP address of the RedLion G310, click on the communications tab on the opening screen of Crimson 3.0.



t Settings
Port Mode: Manual Configuration
IP Address: 192.168.1.20
Network Mask: 255.255.255.0
Gateway: 0.0.0.0

DNS Settings
DNS Mode: Disabled
Name Server 1: 0.0.0.0
Name Server 2: 0.0.0.0

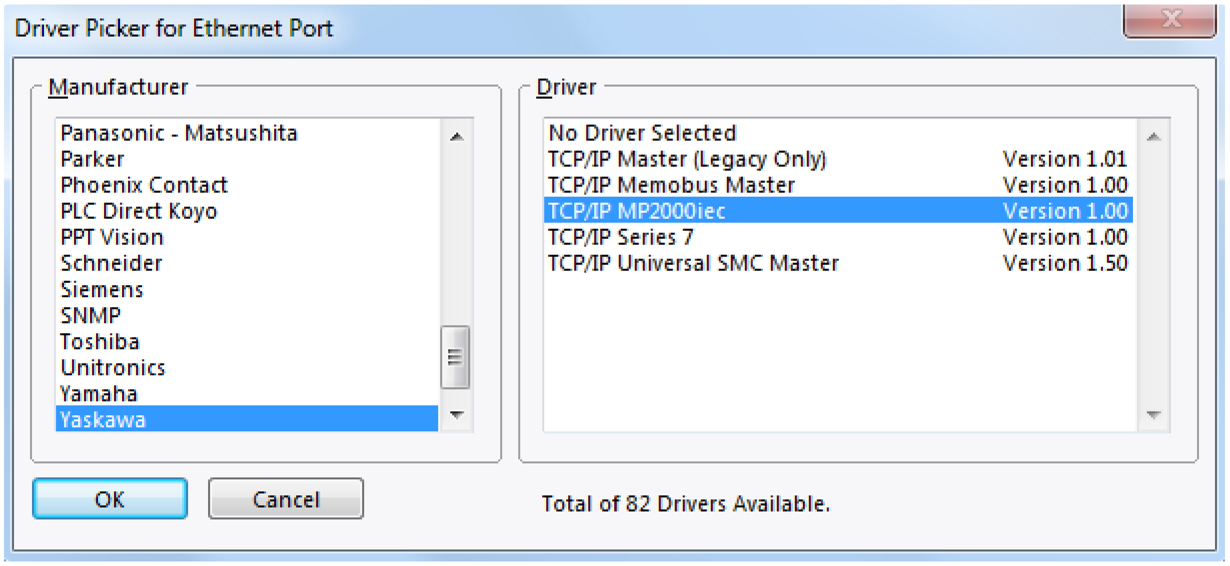
Physical Layer
Full Duplex: Enabled
peed: Enabled

Maximum Segment Size
For Send: 1280
For Receive: 1280

Figure3: Setting the HMI IP address

Click on Network and set the IP address of the HMI as shown in Figure 3.

Click on Protocol 1. Click to select a driver. Select Yaskawa as the manufacturer as shown in Figure 4.


Driver Picker for Ethernet Port

Manufacturer: Panasonic - Matsushita, Parker, Phoenix Contact, PLC Direct Koyo, PPT Vision, Schneider, Siemens, SNMP, Toshiba, Unitronics, Yamaha, Yaskawa

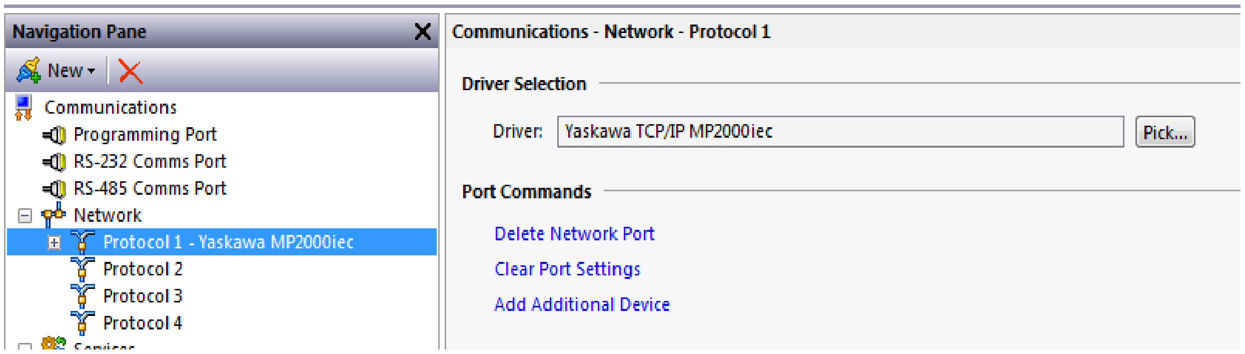
Driver	
No Driver Selected	
TCP/IP Master (Legacy Only)	Version 1.01
TCP/IP Memobus Master	Version 1.00
TCP/IP MP2000iec	Version 1.00
TCP/IP Series 7	Version 1.00
TCP/IP Universal SMC Master	Version 1.50

OK Cancel

Total of 82 Drivers Available.

Figure 4: Selecting a Yaskawa driver

Select Yaskawa TCP/IP MP2000iec driver.


Navigation Pane

- Communications
  - Programming Port
  - RS-232 Comms Port
  - RS-485 Comms Port
  - Network
    - Protocol 1 - Yaskawa MP2000iec
    - Protocol 2
    - Protocol 3
    - Protocol 4

Communications - Network - Protocol 1

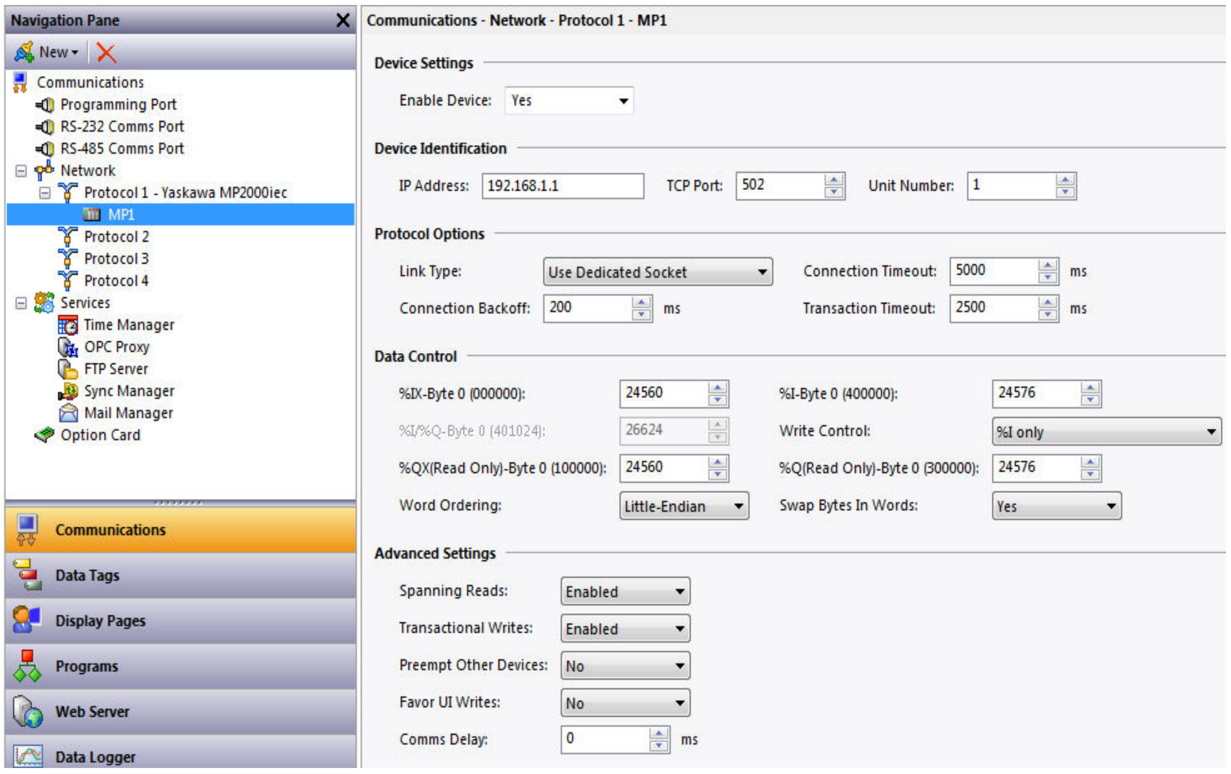
Driver Selection

Driver: Yaskawa TCP/IP MP2000iec

Port Commands: Delete Network Port, Clear Port Settings, Add Additional Device

Figure 5: Communication Protocol

This will create the slave configuration for protocol 1. When double clicking on the slave device created, the IP address of the slave in this communication process can be specified. (Figure 6).



Communications - Network - Protocol 1 - MP1

Device Settings

Enable Device: Yes

Device Identification

IP Address: 192.168.1.1 TCP Port: 502 Unit Number: 1

Protocol Options

Link Type: Use Dedicated Socket Connection Timeout: 5000 ms

Connection Backoff: 200 ms Transaction Timeout: 2500 ms

Data Control

%IX-Byte 0 (000000): 24560 %I-Byte 0 (400000): 24576

%I/%Q-Byte 0 (401024): 26624 Write Control: %I only

%QX(Read Only)-Byte 0 (100000): 24560 %Q(Read Only)-Byte 0 (300000): 24576

Word Ordering: Little-Endian Swap Bytes In Words: Yes

Advanced Settings

Spanning Reads: Enabled

Transactional Writes: Enabled

Preempt Other Devices: No

Favor UI Writes: No

Comms Delay: 0 ms

Figure 6: IP address of slave specified

III. Figure 7a shows the Modbus memory map, and how it relates to the Global Variables in MotionWorks IEC. Note that function codes 01 and 03 return data that was sent to the controller from the master and do not reflect data from the Global Variables in the application program.

The Modbus data memory is copied to the Global Variables at the task update rate.

Modbus coil 0 equates to the Global Variable at %IX24560. 128 coils are available.

Modbus register 40000 equates to the Global Variable at %IW28672. 1024 registers are available.

Modbus input 10000 equates to the Global Variable at %QX24560. 128 inputs are available.

Modbus register 30000 equates to the Global Variable at %QW28672. 1024 registers are available.

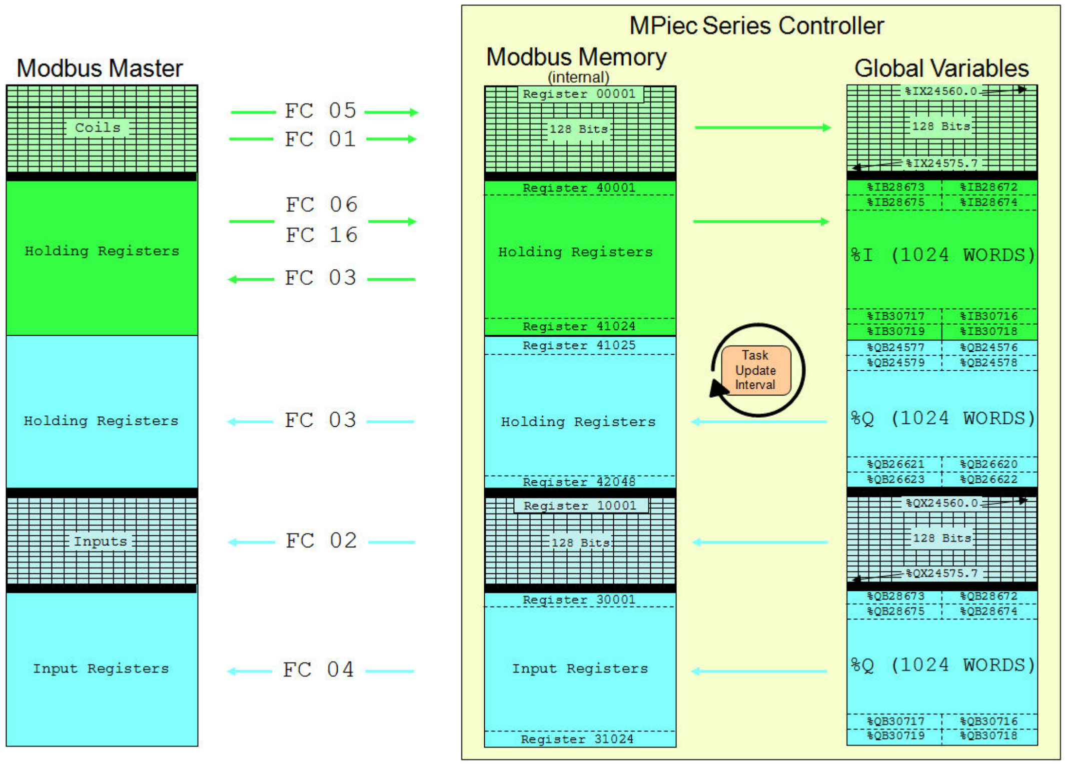
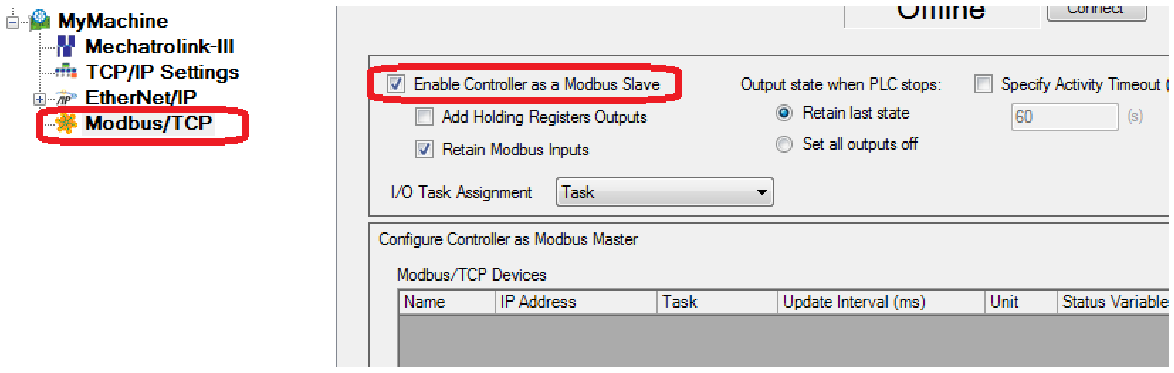


Figure 7a: Modbus mapping

As shown in Figure 7a, the input and output memory are in a different location even though they have the same numerical addressing.

IV. Launch the MotionWorks IEC Hardware Configuration. Go Online with the MPiec controller. Select Modbus TCP and configure the controller as a Modbus slave. Save this configuration and reboot the controller. These steps will activate the Modbus communication driver on the MPiec controller.



☑ Enable Controller as a Modbus Slave
☐ Add Holding Registers Outputs
☑ Retain Modbus Inputs

Output state when PLC stops:
● Retain last state
○ Set all outputs off

☐ Specify Activity Timeout
60 (s)

I/O Task Assignment: Task

Configure Controller as Modbus Master

Modbus/TCP Devices

Name	IP Address	Task	Update Interval (ms)	Unit	Status Variable

Figure 7b: Enabling the MPiec controller as a Modbus TCP slave (server)

V. The MotionWorks IEC Global Variables worksheet will now include Modbus TCP groups which must be populated by the user. These memory areas are generic: no variables are automatically created, the user must decide on the arrangement and type of data to populate within the communications memory region.

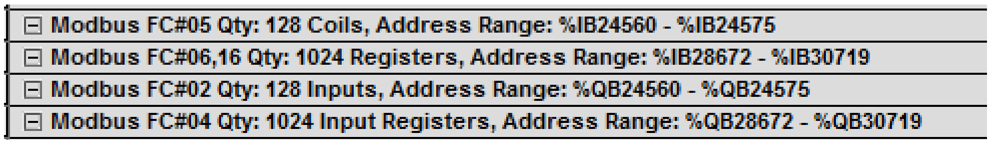

⊟ Modbus FC#05 Qty: 128 Coils, Address Range: %IB24560 - %IB24575
⊟ Modbus FC#06,16 Qty: 1024 Registers, Address Range: %IB28672 - %IB30719
⊟ Modbus FC#02 Qty: 128 Inputs, Address Range: %QB24560 - %QB24575
⊟ Modbus FC#04 Qty: 1024 Input Registers, Address Range: %QB28672 - %QB30719

Figure 8: Variable groups created in template

HMI variables

Create output bits/words on the HMI.

1. Servo Enable (bit)
2. Jog Speed

Create input bits/words on the HMI.

1. Servo Status
2. Actual Position

The variable tags have been defined in the data tags tab in the RedLion Crimson 3 project.

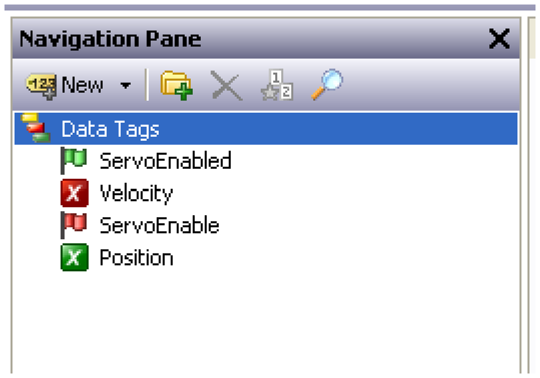
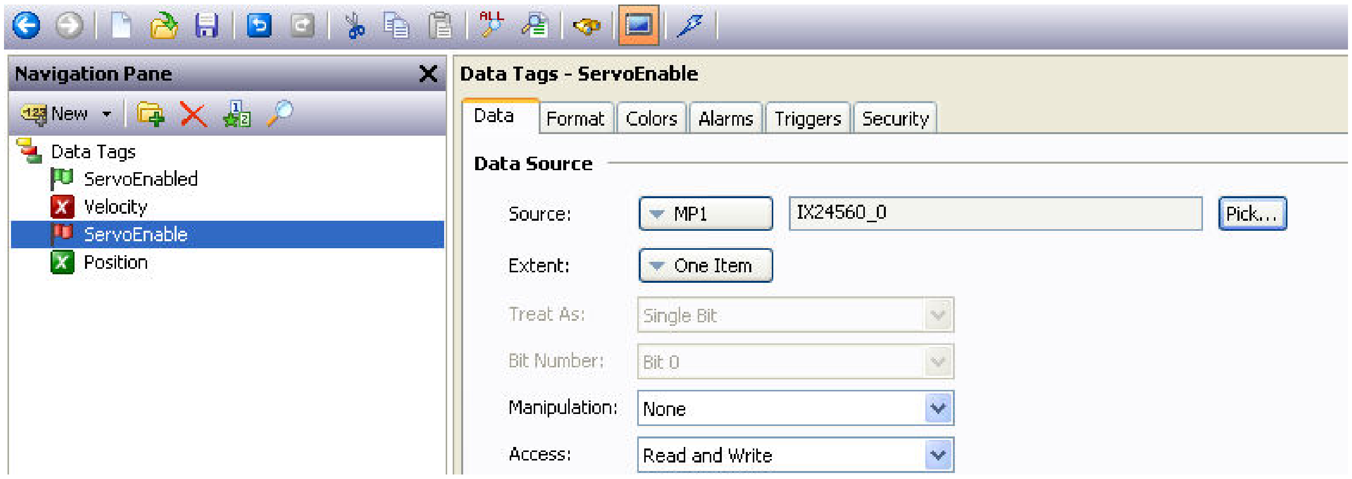


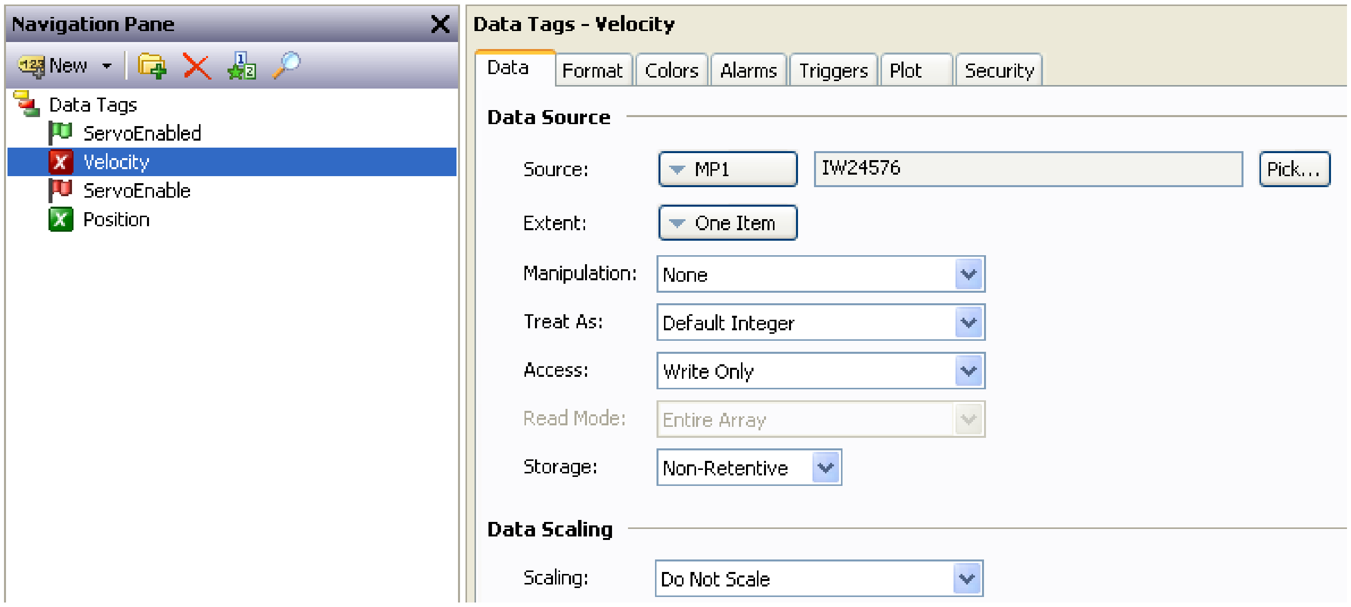
Figure 9: Data tags

When creating a new tag, the user can specify the data type of the tag. The user can also map the tag and specify the register that the tag is associated with. For example, the tag 'ServoEnable' is mapped to a location in PLC1, which is the MPiec controller. When clicking the edit button, the Modbus register and data type can be seen as shown in Figure 10. This bit will be mapped to the first bit under Function Code (FC) 5. Access to this tag is set as 'Write Only' as this variable is used for writing to the MPiec controller. The 'Velocity' tag mapping is shown in Figure 11. The Modbus register used for the word is 40001, however, this Modbus location does not have to be specified when the Yaskawa MP2000iec driver is used for communication. Figure 12 illustrates the mapping of the servo status from the controller to the HMI panel. Figure 13 illustrates the MPiec controller outputting a REAL variable displayed at the HMI.



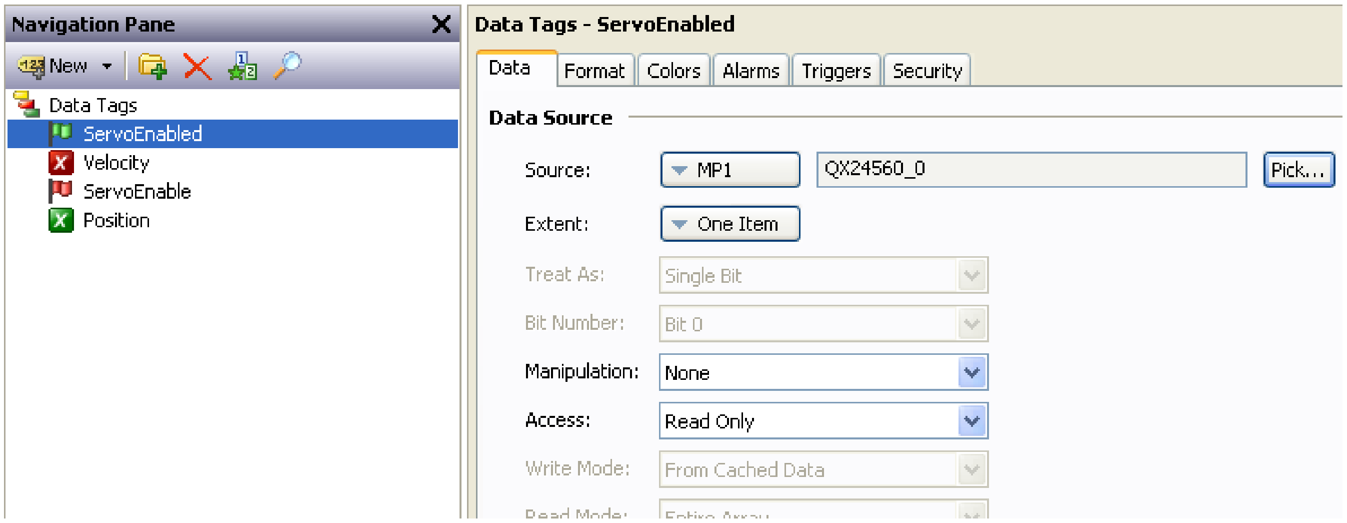
Source: MP1 IX24560_0
Extent: One Item
Treat As: Single Bit
Bit Number: Bit 0
Manipulation: None
Access: Read and Write

Figure 10: Mapping bit (FC: 5)



Source: MP1 IW24576
Extent: One Item
Manipulation: None
Treat As: Default Integer
Access: Write Only
Read Mode: Entire Array
Storage: Non-Retentive
Scaling: Do Not Scale

Figure 11: Mapping word (FC: 16)



Data Source

Source: MP1 QX24560_0

Extent: One Item

Treat As: Single Bit

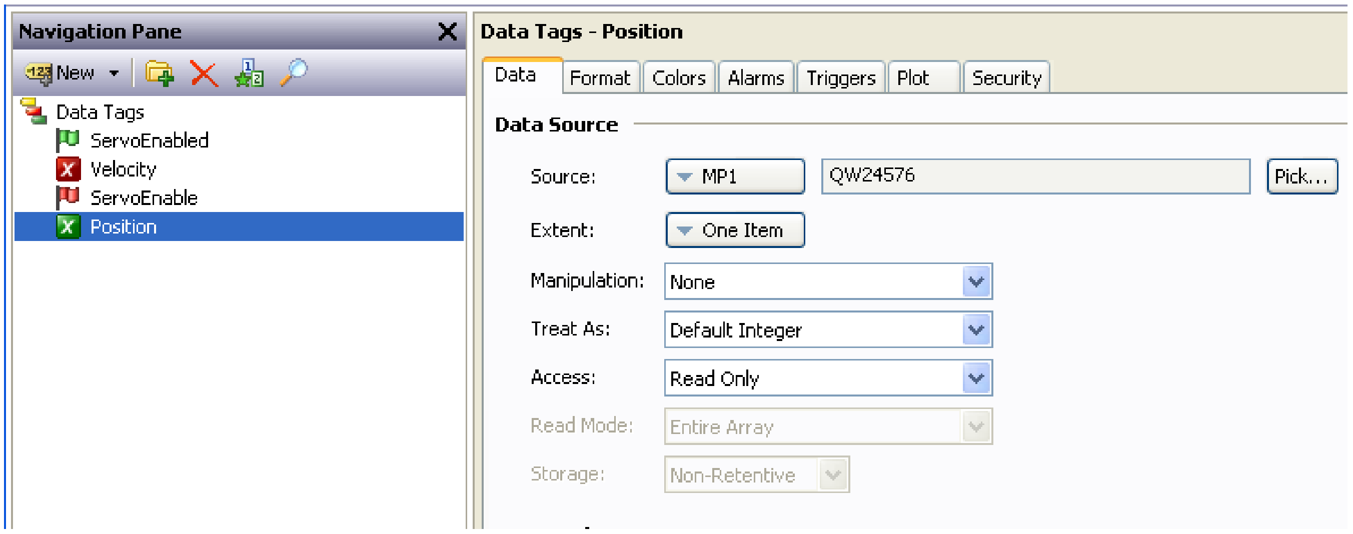
Bit Number: Bit 0

Manipulation: None

Access: Read Only

Write Mode: From Cached Data

Figure 12: Bit Mapping (FC: 2)



Data Source

Source: MP1 QW24576

Extent: One Item

Manipulation: None

Treat As: Default Integer

Access: Read Only

Read Mode: Entire Array

Storage: Non-Retentive

Figure 13: Word mapping (FC: 4)

The user interface on the HMI screen is as shown in Figure 14.

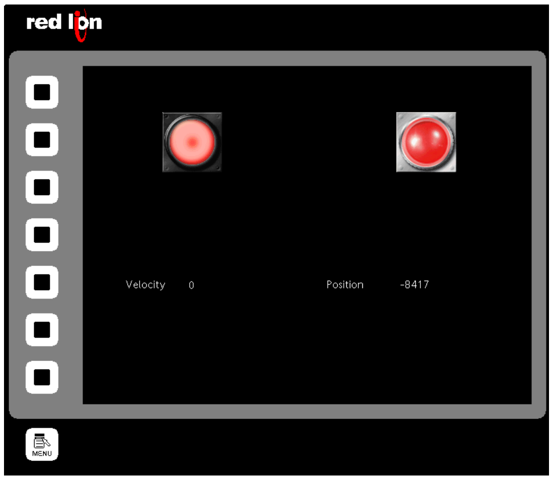
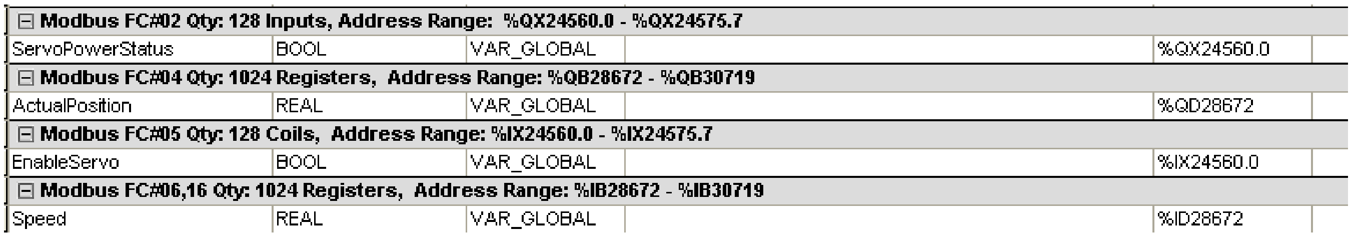


Figure 14: HMI user interface screen shot

MotionWorks IEC variable declaration



⊟ Modbus FC#02 Qty: 128 Inputs, Address Range: %QX24560.0 - %QX24575.7			
ServoPowerStatus	BOOL	VAR_GLOBAL	%QX24560.0
⊟ Modbus FC#04 Qty: 1024 Registers, Address Range: %QB28672 - %QB30719			
ActualPosition	REAL	VAR_GLOBAL	%QD28672
⊟ Modbus FC#05 Qty: 128 Coils, Address Range: %IX24560.0 - %IX24575.7			
EnableServo	BOOL	VAR_GLOBAL	%IX24560.0
⊟ Modbus FC#06,16 Qty: 1024 Registers, Address Range: %IB28672 - %IB30719			
Speed	REAL	VAR_GLOBAL	%ID28672

Figure 15: Variables in the MPiec controller

The global variable list with Modbus data is shown in Figure 15. The last two groups corresponding to function codes 05 and 16 are the input variables written from the HMI to the MPiec controller. The groups under function codes 02 and 04 transfer variables from the MPiec controller to the HMI. They are denoted by %QX and %QB. Table 1 shows the variable mapping of this sample project.

Table 1: variable mapping

EnableServo	%IX24560.0	←	IX24560_0	ServoEnable
Speed	%ID28672	←	IW24576	Velocity
ServoPowerStatus	%QX24560.0	→	QX24560_0	ServoEnabled
ActualPosition	%QD28672	→	QW24576	Position

Execution

Communication between the Red Lion HMI and the MPiec controller will commence when the projects start running on both devices.