Motion Control Products

Application note

Mint product IO expansion using AC500 PLC via Modbus

AN00211

Rev B (EN)

Use an AC500-eCo PLC with Modbus to increase the number of IO points available on Mint products such as the MicroFlex e190.

Introduction

The AC500-eCo PLC can be used as a low-cost solution to expand the number of IO points available on Mint products with Modbus capabilities such as the MicroFlex e190 and MotiFlex e180.
The additional IO points are updated cyclically allowing inputs to be read and outputs to be set.
Any inputs that need to be event driven should be connected locally on the Mint product.

This application note includes sample Mint programs and PLC projects required to get additional IO access on your Mint product with either Modbus TCP or RTU.
This application note will cover how to use the sample code to read inputs and write outputs in the Mint program and describe some key features of the PLC programs.

Firmware versions

MicroFlex e190 supports Modbus TCP as standard and RTU with the addition of the OPT-SIO-1. Modbus RTU and TCP operation on e190 products is included with firmware update 5869.10 (or later).

Physical connection

The table below shows the physical connection possibilities for AC500 PLCs and Mint products supporting integrated Modbus protocols.

Connection Type	MicroFlex e190 + OPT-SIO-1	MicroFlex e190	MicroFlex e180	AC500	AC500 Eco
RS232	No	No	No	Yes	No
2-wire RS485	Yes	No	No	Yes	Yes
Ethernet	Yes	Yes	Yes	Yes	Yes (by variant)

When using 2-wire RS485 be sure to include 120 ohm terminating resistors between data lines A and B at each end of the network to avoid data corruption.

4-wire RS422 is not supported by the AC500 PLCs and as such is not included in the above table.

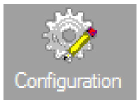
When using Modbus TCP / Ethernet, wire the network in a ‘star’ type configuration using an Ethernet switch between the client and the connected server(s). Straight-through or crossover cables may be used between the Mint product and the switch. If an e100 product is part of an Ethernet Powerlink (EPL) network then it is also necessary to include an EPL Router (Catalog No. OPT036-501) between the switch and the e100 device.

Important: The AC500 PLC use a non-standard RS232 pinout so be sure to check the relevant product manual before connecting other serial devices to these products. Failure to observe the correct pinout may result in damage to the connected device.

Note: If using a NextMove ESB-2 then netdata locations are not available for Modbus mappings. Please see the final section of this application note for further details of required changes to the Mint program and PLC project.

Configuration

To set up a MicroFlex e190 for Modbus communication we use a configuration wizard in Mint Workbench, if you are using a device other than the MicroFlex e190 please move on to the next section entitled Mint program.

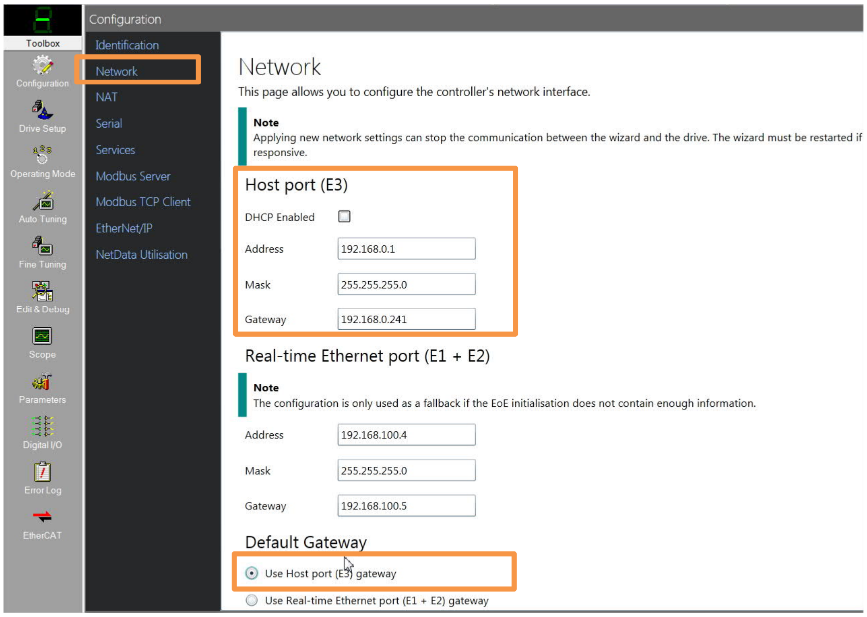


Select the Configuration wizard in Mint Workbench by clicking on this icon which can be found at the top of the toolbar on the left hand side of screen.

Use the right arrow to move through the wizard until you get to the Configure Communication Interfaces screen. This will present you with various interfaces that can be configured as required for your Modbus variant:

Modbus TCP

Under *Ethernet* set the IP address you want to use for the MicroFlex e190 in the Host Port (E3) settings and select this as the preferred port. The IP address will need to be on the same subnet as the PLC.



Network

This page allows you to configure the controller's network interface.

Note
Applying new network settings can stop the communication between the wizard and the drive. The wizard must be restarted if responsive.

Host port (E3)

DHCP Enabled □

Address 192.168.0.1

Mask 255.255.255.0

Gateway 192.168.0.241

Real-time Ethernet port (E1 + E2)

Note
The configuration is only used as a fallback if the EoE initialisation does not contain enough information.

Address 192.168.100.4

Mask 255.255.255.0

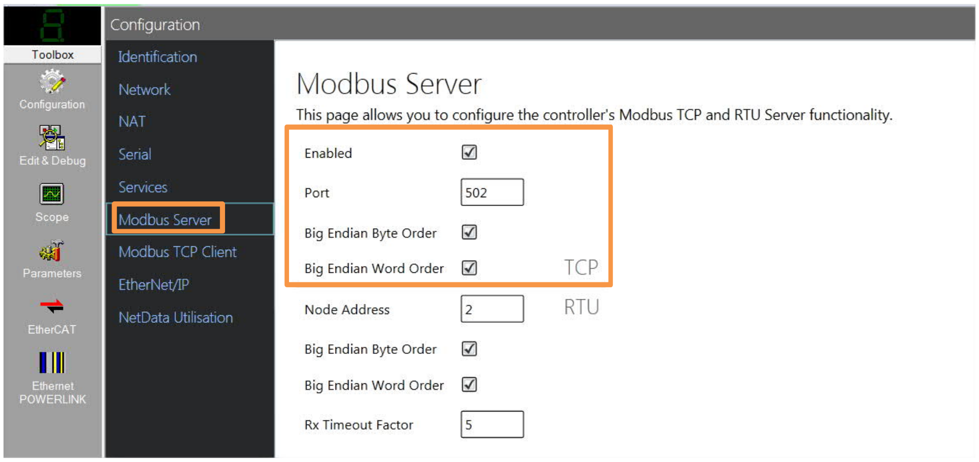
Gateway 192.168.100.5

Default Gateway

● Use Host port (E3) gateway

○ Use Real-time Ethernet port (E1 + E2) gateway

Under *Modbus TCP Server* select the correct byte and word order, for an ABB PLC this will be the default of big endian byte and word order.



Modbus Server

This page allows you to configure the controller's Modbus TCP and RTU Server functionality.

Enabled ☑

Port 502

Big Endian Byte Order ☑

Big Endian Word Order ☑

Node Address 2

Big Endian Byte Order ☑

Big Endian Word Order ☑

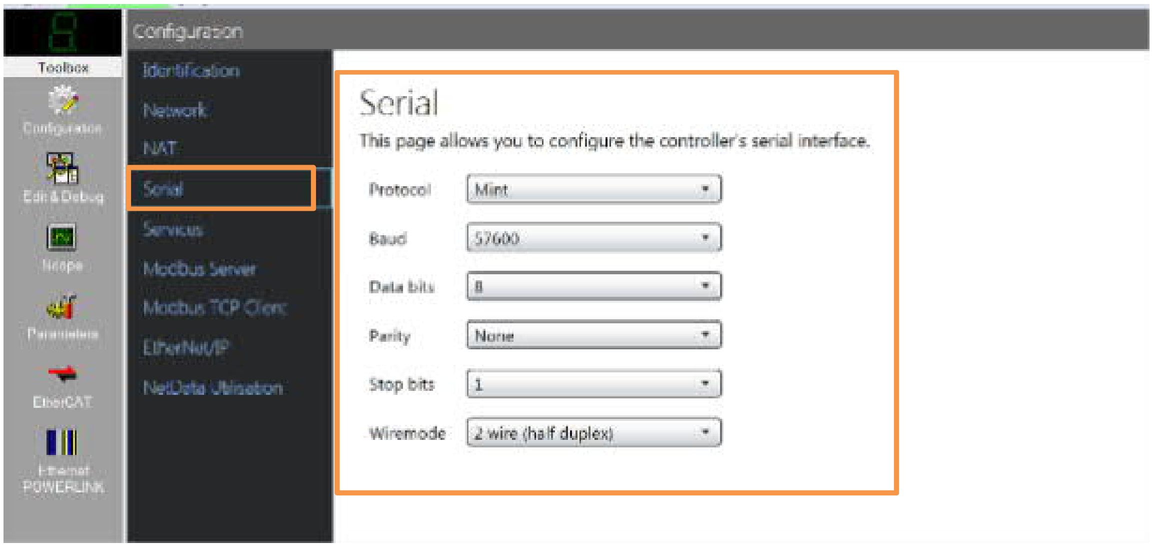
Rx Timeout Factor 5

Once these settings have been made click the Apply button which will apply the settings and reboot the drive.

Modbus RTU

Under *Serial* set Under *Serial* select the following settings:

Protocol – Modbus RTU
Baud rate – 57600 *(Can be changed to suit PLC setting)*
Data bits – 8
Parity – None
Stop bits – 1
Handshake – None
Wire mode – 2 wire (half duplex)



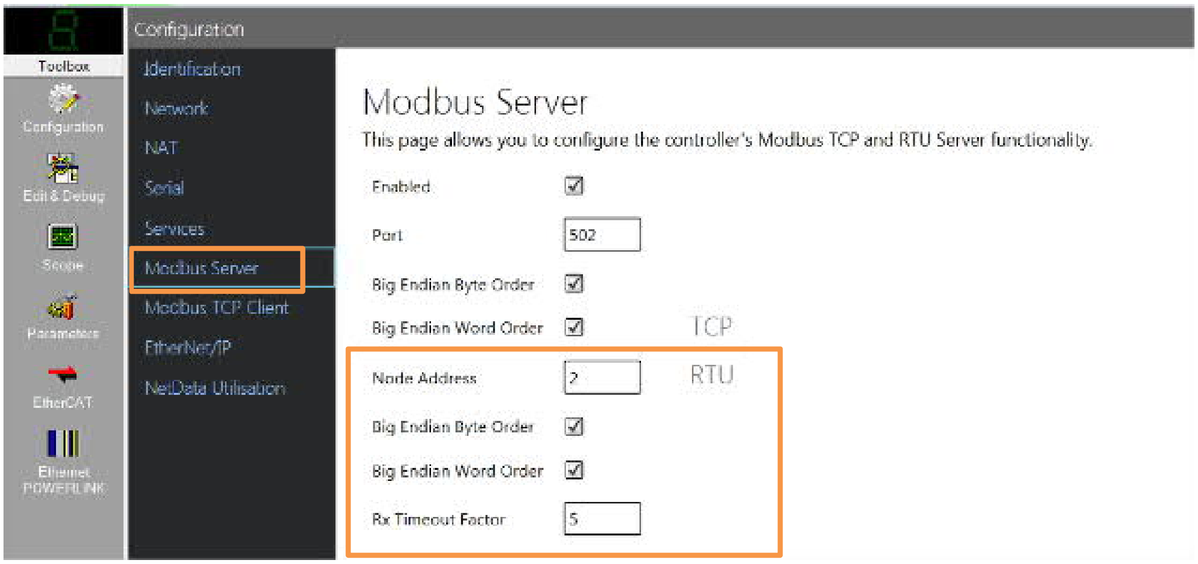
Serial

This page allows you to configure the controller's serial interface.

Protocol	Mint
Baud	57600
Data bits	8
Parity	None
Stop bits	1
Wiremode	2 wire (half duplex)

Under *Modbus Server* the we must;

Tick the enabled box
Set Station address – 2 onwards
Set the correct Byte order - big endian byte and word order
Framing timeout factor, for the ABB PLC this can be left at 5



Modbus Server

This page allows you to configure the controller's Modbus TCP and RTU Server functionality.

Enabled	☑
Port	502
Big Endian Byte Order	☑
Big Endian Word Order	☑
Node Address	2
Big Endian Byte Order	☑
Big Endian Word Order	☑
Rx Timeout Factor	5

Once these settings have been made click the Apply button which will apply the settings and reboot the drive.

Mint program

Included with this application note is a simple Mint program that includes:

- a watchdog timer to check Modbus comms are not lost
- a subroutine for setting a specified remote output on the PLC
- a function for reading a specified input on the PLC
- netdata locations containing bitmap data of the input and output banks

Watchdog timer

The watchdog timer is achieved using a netdata event. If NETINTEGER(31) is written to this event is called and checks that the correct value of 12345 has been entered into netdata. If the value has been written correctly then the task tskWatchdog is run and NETINTEGER(31) is set back to 1. This task is just a countdown timer that creates an error using ABORT and displays a message on the screen when the timer runs out. By running the task again from the netdata event the countdown timer is restarted.

Note: NETDATA31 is used as this is the final element that can be used to raise a Mint event, leaving NETDATA0-30 free for Mint program event use. Netdata locations 32 and 33 are used for the input and output banks as they do not require a mint event.

Setting outputs

This subroutine can be used to specify an output to turn on or off.
Usage:
  setRemoteOutX(*Output*, *State*)
For example to turn on output 3 issue:
  setRemoteOutX(3, 1)
To turn off output 4 issue:
  setRemoteOutX(4, 0)

Multiple outputs can be set using mdOUTPUT_BANK which is a bitmap value of the outputs. For example setting:
  mdOUTPUT_BANK = 2#101010
Will turn on outputs 1, 3 and 5. Outputs are 0-5 from right to left.
Setting all 1's will turn all the outputs on and setting all 0's will turn all the outputs off.

Reading inputs

This function allows you to query the state of a specific input.
Usage:
  state = getRemoteInStateX(*Input)*
For example to query input 2:
  value = getRemoteInStateX(2)
value will be either 1 if the input is active or 0 if the input is not active.

The state of all the inputs can be seen by looking at the bitmap value of mdINPUT_BANK. For example if mdINPUT_BANK is equal to 2#01010101 then inputs 0, 2, 4 and 6 are active. Inputs are 0-7 from right to left
All 1's would indicate that all of the inputs are active and all 0's would indicate none are active.

PLC project

Included with this application note are two PLC projects for use with either Modbus RTU or Modbus TCP.

Modbus RTU

The project sets the PLC station address (Node ID) to 0 and the serial baud rate to 57600.
Within the PLC program the COM port number being used for Modbus is defined

```
  ComPortNum: BYTE := 1;
```

The station address (NodeID) of the Mint product is also defined

```
  SlaveNodeID: BYTE := 2;
```

Modbus TCP

The project sets the Modbus TCP Connect timeout to 2000ms.
Within the PLC program the IP address of the Mint product is defined

```
  IP_ADDRESS: STRING := '192.168.100.110';
```

This is the default IP address for a MicroFlex e190.
The IP address needs to be on the same subnet as the PLC IP address. The PLC IP address can be set using Control Builder Plus.

PLC project

The following minimum changes are required in the PLC program:

- The following variable declarations need amending to the following:

```
  WriteStartAddr: WORD := 5;
  ReadStartAddr: WORD := 7;
```

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