MODBUS/SERIAL INTEGRATION KIT FOR PAC PROJECT

Form 1697-080703—July 2008

OPTO 22

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Modbus/Serial Integration Kit for PAC Project

Overview

The Modbus/Serial Integration Kit for PAC Project (Part # PAC-INT-MBSER) allows Opto 22 controllers, using PAC Control, to connect via RS-232 or RS-485 to a Modbus device and communicate using the Modbus RTU or ASCII protocol.

The Integration Kit contains:

- a set of PAC Control master subroutines that are added to a strategy to enable an Opto 22 controller to communicate as a Modbus master
- an example Modbus slave strategy containing the slave chart MB_Slave_Serial that is imported into a strategy to enable an Opto 22 controller to communicate as a Modbus slave

Both the master subroutines and the slave strategy transmit message strings as specified in the *Modbus Application Protocol Specification v1.1a* and *Modbus over Serial Line Specification & Implementation guide v1.0*. Both guides are available on the web at http://Modbus-IDA.org.

The master subroutines and slave strategy transmit and receive messages using Modbus standard register, input and coil numbers. The desired information is stored or retrieved using PAC Control numeric tables.

This manual assumes the user fully understands how to use PAC Control, Modbus/Serial, and the Modbus device to be used.

Data types 2 – 5 use two registers to transfer data. In the Holding or Input registers, place data in the odd indexes. The even registers are used internally.

What is Required

Before including the subroutines in your strategy, you will need:

- PAC Project Basic 8.1a or later
- a PC running PAC Control software and the Modbus/Serial Integration Kit for PAC Project

Protocol Supported

The following protocols are supported:

Index	Name
0	RTU protocol
1	ASCII protocol

Modbus/Serial Functions Supported

The following Modbus/Serial function codes are supported by PAC Control subroutines:

Modbus/Serial Function Code	Name	PAC Control Subroutine
01	Read Coils	MBMaster Read Coil Status
02	Read Discrete Inputs	MBMaster Read Input Status
03	Read Holding Registers	MBMaster Read Holding Registers
04	Read Input Registers	MBMaster Read Input Registers
05	Write Single Coil	MBMaster Force Single Coil
06	Write Single Register	MBMaster Preset Single Register
15	Write Multiple Coils	MBMaster Force Multiple Coils
16	Write Multiple Registers	MBMaster Preset Multiple Registers
23	Read/Write Multiple Registers	MBMaster Read Write Holding Registers

Data Types Supported

The following data types are supported:

Index	Name
0	16-bit unsigned (Modbus standard and default)
1	16-bit signed
2	Floating point (Uses two registers)
3	Floating point (Swapped. Uses two registers.)
4	32-bit signed (Uses 2 registers)
5	32-bit signed (Swapped. Uses 2 registers.)

Data types 2–5 use two registers to transfer data. In the Holding or Input registers, place data in the odd indexes. The even registers are used internally.

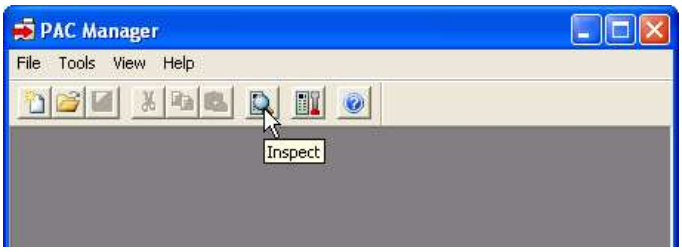
Installing the Integration Kit

To install the integration kit on your computer, unzip the ModbusSerialPAC8.1a.zip file to your C: drive. The expanded files will be placed automatically in C:\ModbusSerialPAC.

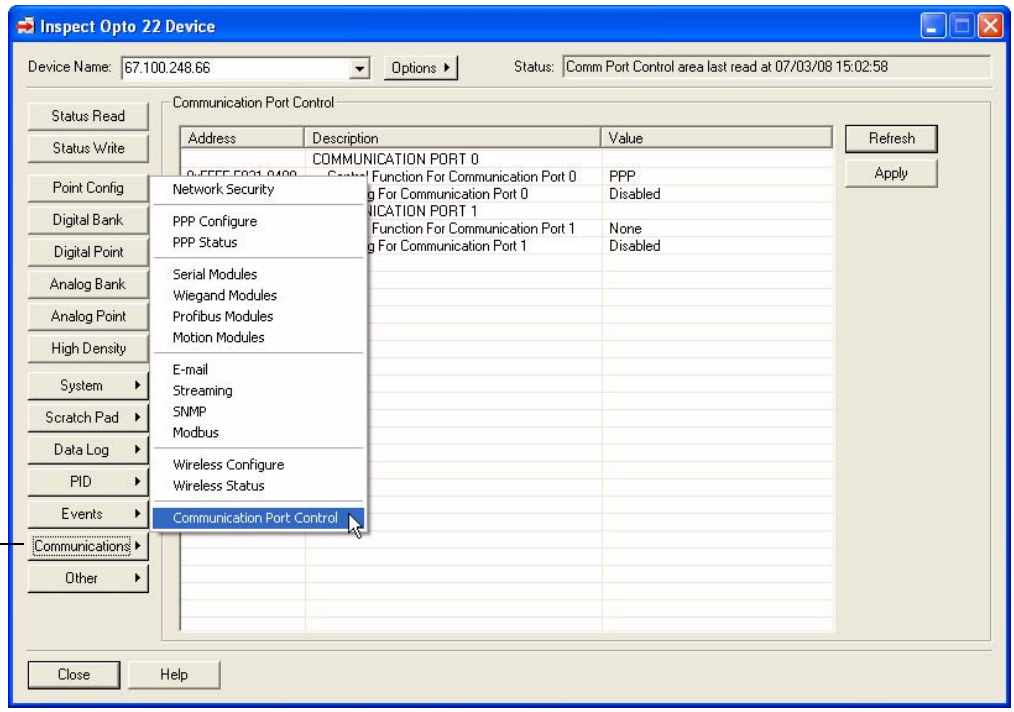
Using the Controller's Serial Port

If you are using the controller's built-in serial port with the Modbus/Serial Integration Kit, rather than using a Serial Communication Module (SCM), you must open PAC Manager to configure the control function for that port, and then store the configuration to flash.

1. On the PC, choose Start→Programs→Opto 22→PAC Project Software→PAC Manager.
2. Click the Inspect button to open the Inspect dialog box.



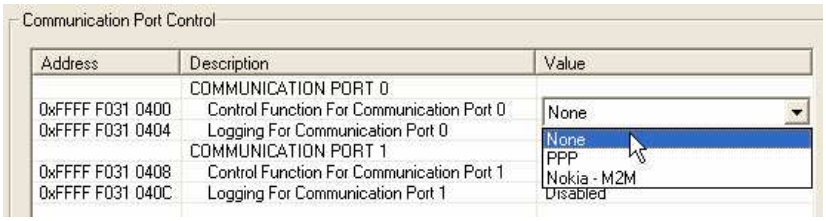
3. Click the Communications button and choose Communication Port Control from the pop-up menu.



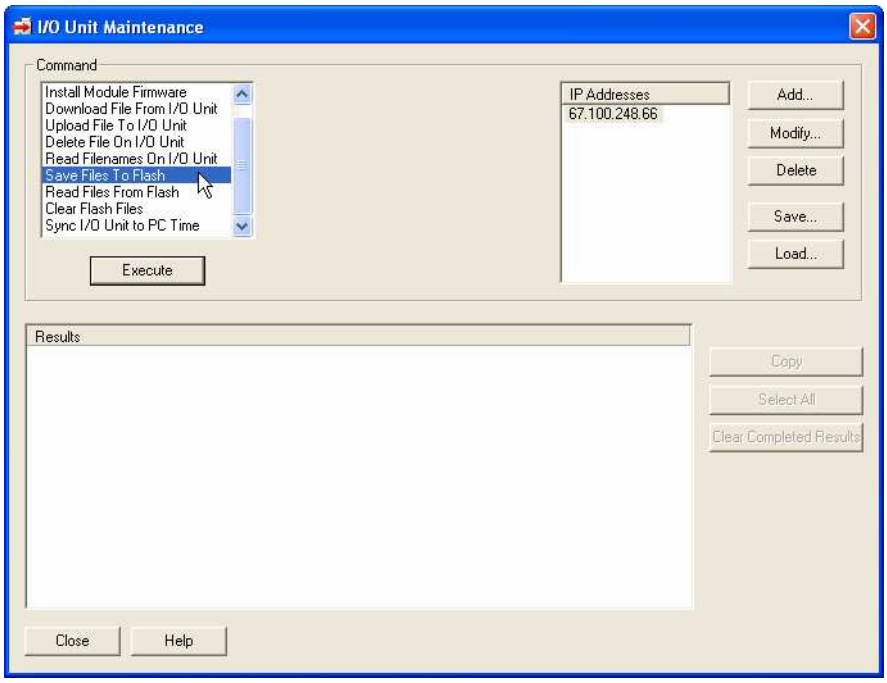
Communications button

The Inspect window shows the possible ports and settings.

4. In the Value field for Control Function for the serial port you will be using with the toolkit, choose None from the drop-down list.



5. In order for the configuration to take effect, click the Maintenance button to open the Maintenance dialog box. Then save the configuration to flash.



For more information, see the *PAC Manager User's Guide*, form 1704.

Running the Example Strategy

The kit includes an example strategy to demonstrate how to use the subroutines in a PAC Control strategy. Before including the subroutines into your own strategy, we recommend that you first run the example strategy to see how to use the subroutines in a PAC Control strategy, especially the strategy logic and the configuration of variables.

To run the example master strategy, start PAC Control, and then open the strategy file, MBMasterSerial.idb.

Importing the Slave Strategy

The Modbus/Serial slave strategy allows an Opto 22 controller to function as a Modbus slave device. Unlike the subroutines used in master strategies, which are run as needed, the MB_Slave_Serial chart is started in the Powerup chart and must run all the time. After the chart is started it continuously monitors the serial port for Modbus traffic.

To copy the Modbus Slave chart to your strategy, you must export the chart MB_Slave_Serial as a PAC Control chart export file (.cxf file) and then import it into your strategy. For more information, see Chapter 8 of form 1700, the *PAC Control User's Guide*.

Start the Modbus Slave chart in the Powerup chart of your strategy.

Using Communication Handles

Be sure to use a single communication handle for each of the controller's physical serial ports used with the subroutines.

In PAC Control, if two charts were to run simultaneously while sharing an open communication handle, it is possible for one serial port to transmit data (on the wire) at the same time the remote device is transmitting a response.

Adding Master Subroutines

The Modbus master subroutines allow an Opto 22 controller to function as a Modbus master device. Each master subroutine in the integration kit supports one Modbus function code and can function independently of the other subroutines. Therefore, you need only use the subroutines for the Modbus functions that you require. For more information about subroutines, see the *PAC Control User's Guide*.

When you decide which subroutines you need, include them in your strategy as follows:

1. Start PAC Control in Configure Mode and open the strategy that you intend to use with the integration kit.
2. Select Configure→Subroutines Included to open the Subroutine Files dialog.
3. Click the Add button and use the browser to select each subroutine file (.ISB extension) you wish to include in your strategy from the folder C:\ModbusSerialPAC\Subs.
4. Click OK.

   The subroutines appear in the Subroutines Included folder and are ready to be used in your strategy.

Configuration of Subroutines

The following tables list the parameters for each function code and describe the type of data for each parameter.

Starting Address is from 1 to 65536, while in Modbus, addresses start at 0. In order to correct for the offset between tables, the subroutines reduce the address by 1 in the packet sent to the Modbus slave.

Modbus Register 1 = Opto 22 Index 1

Modbus Register 4000 = Opto 22 Index 4000

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MBMaster Read Coil Status

Name	Description
Slave Address	Integer 32 Variable (1 – 255)
Starting Address	Integer 32 Variable (1 – 65536)
Quantity of Coils	Integer 32 Variable (1 – 2000)
Comm Mode	Integer 32 Variable (0 = RTU protocol, 1 = ASCII protocol)
Com Handle	Communication Handle
Wait Time(s)	Wait time in seconds for slave to respond)
MB Coils 0X	Integer 32 Table (The subroutine will support coils 1 – 65535)
Return Status	String No Port = Not able to open Port Timeout = No response within time limit Too Many Characters = More then 260 characters Address Mismatch = Send and receive address do not match CRC or LRC Mismatch = Checksum error Function and Exception code = Error from PDU OK = Success
Put Status In	Integer 32 Variable 0 = Success –67 = Out of memory –69 = Null object error

MBMaster Read Input Status

Name	Description
Slave Address	Integer 32 Variable (1 – 255)
Starting Address	Integer 32 Variable (1 – 65536)
Quantity of Inputs	Integer 32 Variable (1 – 2000)
Comm Mode	Integer 32 Variable (0 = RTU protocol 1 = ASCII protocol)
Com Handle	Communication Handle
Wait Time(s)	(Wait time in seconds for slave to respond)
MB Inputs 1X	Integer 32 Table (The subroutine will support Inputs 1 – 65535)
Return Status	String No Port = Not able to open Port Timeout = No response within time limit Too Many Characters = More then 260 characters Address Mismatch = Send and receive address do not match CRC or LRC Mismatch = Checksum error Function and Exception code = Error from PDU OK = Success
Put Status In	Integer 32 Variable 0 = Success –67 = Out of memory –69 = Null object error

MBMaster Read Holding Registers

Name	Description
Slave Address	Integer 32 Variable (1 – 255)
Starting Address	Integer 32 Variable (1 – 65536)
Qty of H Registers	Integer 32 Variable (1 – 125)
Comm Mode	Integer 32 Variable (0 = RTU protocol 1 = ASCII protocol)
Com Handle	Communication Handle
Wait Time(s)	(Wait time in seconds for slave to respond)
MB H Register 4X	Float Table (The subroutine will support registers 1 – 65535)
Data Type	Integer 32 Variable 0 = 16-bit unsigned (Modbus standard and default) 1 = 16-bit signed 2 = Floating Pt. 3 = Floating Pt. (swapped) 4 = 32-bit signed 5 = 32-bit signed (swapped)
Return Status	String No Port = Not able to open Port Timeout = No response within time limit Too Many Characters = More then 260 characters Address Mismatch = Send and receive address do not match CRC or LRC Mismatch = Checksum error Function and Exception code = Error from PDU OK = Success
Put Status In	Integer 32 Variable 0 = Success –67 = Out of memory –69 = Null object error

MBMaster Read Input Registers

Name	Description
Slave Address	Integer 32 Variable (1 – 255)
Starting Address	Integer 32 Variable (1 – 65536)
Qty of I Registers	Integer 32 Variable (1 – 125)
Comm Mode	Integer 32 Variable (0 = RTU protocol 1 = ASCII protocol)
Com Handle	Communication Handle
Wait Time(s)	(Wait time in seconds for slave to respond)
MB I Register 3X	Float Table (The subroutine will support registers 1 – 65535)
Data Type	Integer 32 Variable 0 = 16-bit unsigned (Modbus standard and default) 1 = 16-bit signed 2 = Floating Pt. 3 = Floating Pt. (swapped) 4 = 32-bit signed 5 = 32-bit signed (swapped)
Return Status	String No Port = Not able to open Port Timeout = No response within time limit Too Many Characters = More then 260 characters Address Mismatch = Send and receive address do not match CRC or LRC Mismatch = Checksum error Function and Exception code = Error from PDU OK = Success
Put Status In	Integer 32 Variable 0 = Success –67 = Out of memory –69 = Null object error

MBMaster Force Single Coil

Name	Description
Slave Address	Integer 32 Variable (1 – 255)
Output Address	Integer 32 Variable (1 – 65536)
Output State	Integer 32 Variable (0 = OFF 1 = ON)
Comm Mode	Integer 32 Variable (0 = RTU protocol 1 = ASCII protocol)
Com Handle	Communication Handle
Wait Time(s)	(Wait time in seconds for slave to respond)
Return Status	String No Port = Not able to open Port Timeout = No response within time limit Too Many Characters = More then 260 characters Address Mismatch = Send and receive address do not match CRC or LRC Mismatch = Checksum error Function and Exception code = Error from PDU OK = Success
Put Status In	Integer 32 Variable 0 = Success –67 = Out of memory –69 = Null object error

MBMaster Preset Single Register

Name	Description
Slave Address	Integer 32 Variable (1 – 255)
Register Address	Integer 32 Variable (1 – 65536)
Register Value	Float Variable
Comm Mode	Integer 32 Variable (0 = RTU protocol 1 = ASCII protocol)
Com Handle	Communication Handle
Wait Time(s)	(Wait time in seconds for slave to respond)
Data Type	Integer 32 Variable 0 = 16-bit unsigned (Modbus standard and default) 1 = 16-bit signed
Return Status	String No Port = Not able to open Port Timeout = No response within time limit Too Many Characters = More then 260 characters Address Mismatch = Send and receive address do not match CRC or LRC Mismatch = Checksum error Function and Exception code = Error from PDU OK = Success
Put Status In	Integer 32 Variable 0 = Success –67 = Out of memory –69 = Null object error

MBMaster Force Multiple Coils

Name	Description
Slave Address	Integer 32 Variable (1 – 255)
Starting Address	Integer 32 Variable (1 – 65536)
Quantity of Coils	Integer 32 Variable (1 – 1968)
Output Value	Integer 32 Table (The subroutine will support coils 1 – 65535)
Comm Mode	Integer 32 Variable (0 = RTU protocol 1 = ASCII protocol)
Com Handle	Communication Handle
Wait Time(s)	(Wait time in seconds for slave to respond)
Return Status	String No Port = Not able to open Port Timeout = No response within time limit Too Many Characters = More then 260 characters Address Mismatch = Send and receive address do not match CRC or LRC Mismatch = Checksum error Function and Exception code = Error from PDU OK = Success
Put Status In	Integer 32 Variable 0 = Success –67 = Out of memory –69 = Null object error

MBMaster Preset Multiple Registers

Name	Description
Slave Address	Integer 32 Variable (1 – 255)
Starting Address	Integer 32 Variable (1 – 65536)
Qty of Registers	Integer 32 Variable (1 – 120)
Register Value	Float Table (The subroutine will support registers 1 – 65535)
Comm Mode	Integer 32 Variable (0 = RTU protocol 1 = ASCII protocol)
Com Handle	Communication Handle
Wait Time(s)	(Wait time in seconds for slave to respond)
Data Type	Integer 32 Variable 0 = 16-bit unsigned (Modbus standard and default) 1 = 16-bit signed 2 = Floating Pt. 3 = Floating Pt. (swapped) 4 = 32-bit signed 5 = 32-bit signed (swapped)
Return Status	String No Port = Not able to open Port Timeout = No response within time limit Too Many Characters = More then 260 characters Address Mismatch = Send and receive address do not match CRC or LRC Mismatch = Checksum error Function and Exception code = Error from PDU OK = Success
Put Status In	Integer 32 Variable 0 = Success –67 = Out of memory –69 = Null object error

MBMaster Read Write Holding Registers

Name	Description
Slave Address	Integer 32 Variable (1 - 255)
R Start Address	Integer 32 Variable (1 - 65536)
R Qt H Registers	Integer 32 Variable (1 - 125)
W Start Address	Integer 32 Variable (1 - 65536)
W Qt H Registers	Integer 32 Variable (1 - 125)
Comm Mode	Integer 32 Variable (0 = RTU protocol 1 = ASCII protocol)
Com Handle	Communication Handle
Wait Time(s)	(Wait time in seconds for slave to respond)
MB H Register 4X	Float Table (The subroutine will support registers 1 - 65535)
Data Type	Integer 32 Variable 0 = 16bit unsigned (Modbus standard and default) 1 = 16bit signed 2 = Floating Pt. 3 = Floating Pt. (swapped) 4 = 32bit signed 5 = 32bit signed (swapped)
Return Status	String No Port = Not able to open Port Timeout = No response within time limit Too Many Characters = More then 260 characters Address Mismatch = Send and receive address do not match CRC or LRC Mismatch = Checksum error Function and Exception code = Error from PDUOK = Success
Put Status In	Integer 32 Variable 0 = Success -67 = Out of memory -69 = Null object error

PAC Display Examples

Two PAC Display example projects are included in the ZIP file to show what can be done using PAC Display. These are not necessary components of the toolkit. However, if desired, you can use the MBTCPMaster.UUI and MBTCPSlave.UUI projects to check PAC Control master and slave connections. For more information on using PAC Display, see the *PAC Display User's Guide*, form 1700.