

# C O N T R O L L E R   I N F O R M A T I O N   S H E E T

Maple Model(s)	PLC or Controller
HMI5000 Series	Modbus RTU



## Summary

Maple Systems' **HMI5000 Series** Human/Machine Interface Terminals (Maple HMIs) communicate with any device that uses the Modbus RTU protocol. The HMIs use Modbus RTU Master protocol driver to allow the Maple HMI to act as the master in a single master, (single slave or multiple slave) format. RS-485 networking is supported to connect multiple Modbus slave devices to a single Maple HMI

The Modbus RTU Master protocol driver in EZware also has the following features:

- Network support using RS-485 4-wire or RS-485 2-wire connection
- Ability to use High Word First format (4x) or Low Word First (5x) format for 32-bit data stored in 4x memory location.
- Ability to read/write to individual bits in 4x memory
- Ability to set a turnaround delay that can be used to slow the rate at which the HMI expects a reply from the PLC/controller for data
- Ability to force a Modbus function code 06 (6x) for controllers that do not support function code 16.
- Ability to address 32-bit registers.

## Communications Cable

The Maple HMI should be connected to the controller's serial port that supports Modbus. A list of communications cables offered by Maple Systems as well as cable assembly instructions to assist you in assembling your own communications cable are available on our website at [www.maplesystems.com](http://www.maplesystems.com).

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**WARNING** *If your communications cable is not wired exactly as shown in our cable assembly instructions, damage to the HMI or loss of communications can result.*  
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## PLC Controller Settings

The Modbus port on the controller must be set to RTU "slave" mode in order to properly communicate with the HMI (master).

## Accessible PLC Memory

### Register Memory

The following table lists the PLC's register memory ranges that the Maple HMIs are able to access. Please note that your PLC's memory range may be *smaller* or *larger* than that supported by these HMIs. The following register memory can be displayed in 16 or 32-bit format on the Maple HMI.

Controller Register	Type	Address	Controller Register Description
300001 - 365535	3x	1-65535	Input Registers, Read Only
400001 - 465535	4x	1-65535	Holding / Output Registers (high-word, low-word order)
500001 - 565535	5x*	1-65535	Same as 4x but does a word swap (for 32-bit word swapping - low word first)
600001 - 665535	6x**	1-65535	Force HMI to use function code 06 to write to this register.
40001 - 465535	4x_32bit	1-65535	Same as 4x but used for 32-bit registers.

**NOTES:** \* The 5x register type is exactly the same as the 4x memory area. Use the 5x memory area when reading/writing to a 32-bit register using the Low Word First format.

\*\* The 6x register type forces the HMI to execute a function code 06 to write a single register. (The HMI default is to use a function code 16 to write multiple registers, even if it is only writing to one register)

### Discrete Memory

The following table lists the PLC's discrete memory ranges that the Maple HMIs are able to access. Please note that your PLC's memory range may be *smaller* or *larger* than that supported by these HMIs. The following discrete memory is displayable in single-bit format on the Maple HMI.

Controller Bit	Type	Address	Controller Bit Description
00001 - 09999	0x <sup>1,2,3</sup>	1-65535	Discrete Coils / Outputs
00001-09999	0x_multi_coil 0x	1-65535	Discrete Coils/Outputs
10001 - 19999	1x <sup>1,2,3</sup>	1-65535	Discrete Inputs, Read Only
3x_Bit	3x_Bit <sup>1,2,3</sup>	100-6553515	Input Registers, (bit level access)
4x_Bit	4x_Bit <sup>1,2,3</sup>	100-6553515	Holding/Output Registers, (bit level access)
6x_bit	6x_Bit	100-6553515	Holding/Output Registers, (bit level access)

**NOTE:** The 4x\_Bit memory area is used to read/write to individual bits in the 4x memory area. To use this feature, select the 4x\_Bit as Device Type for bit-type objects such as Bit Lamps. Under **Device Address**, use the format nnnnbb to enter the word memory area, followed by the two-digit bit reference. For example, to target the 3rd bit of 40015, enter "1502" into the Device Address, (nn=15, bb=02). 3x\_Bit device type works the same as for the 4x\_Bit, except that it is for accessing bits in a 3x input register.

<sup>2</sup> The EasyBuilder Modbus driver reads a group of 16 bits at a time. Bit groups are 1-16, 17-32, 33-48,

49-69, etc. All bits in the group must be available in the controller for the HMI to read or errors will result.

Examples:

- A) If a Bit Lamp is programmed in the HMI that is addressed for bit 00038, then bits 00032 through 00048 must be available and programmed in the controller.
- B) If a Bit Lamp in the HMI is addressed as bit 1068, then bits 10065 through 10080 must be available and programmed in the controller.

<sup>3</sup> Unlike the read statements for bits, the EasyBuilder Modbus driver will write to just one bit at a time; however, whenever a bit write occurs, the HMI will automatically execute a read. Therefore, even if the intention is to only write to one bit, all sixteen bits must be available and programmed into the PLC that includes the bit being written to.

## Address Format when Networking

If you are connecting multiple PLCs/Controllers on a network to an HMI, you can specify the network node address for each object placed onto the HMI screen. To target a specific slave address, you must use the following format when entering the address in the Device Address box: `aaa#nnnn` where `aaa`=network address (1-255) and `nnnn`=memory address. The pound sign (#) is used as a placeholder. For example, to configure the Numeric Data object to read memory address 40015 of a PLC that has been assigned a network address of 2: Device Type=4x, Device Address=2#15.

## Network Settings

When connecting multiple PLCs/controllers to a single Maple HMI, you must also set the following in the *Edit-System Parameters* menu:

- In the *Device Properties*, select RS-485 4w for a 4-wire cabling scheme. Select RS-485 2w for a 2-wire cabling scheme (TXD+ and RXD+ connected together, TXD- and RXD- connected together).

The HMI uses the following Modbus codes:

Data Type	Read/ Write	Description	Uses Modbus Code
0x+0x_multi_coil	R	Read output bit [read coil]	01
0x	W	Write output bit [write coil]	05
0x_multi_coil	W	Write output bit	15
1x	R	Read input bit [read discrete input]	02
3x	R	Read input register [read input register]	04
3x_Bit	R	Read input register - bit level [read input register's bit]	04

Data Type	Read/Write	Description	Uses Modbus Code
4x	R	Read holding register (normal word order)	03
4x	W	Write holding register (normal word order)	16
4x_Bit	R	Read holding register - bit level	03
4x_Bit	W	Write holding register - bit level	16
5x	R	Read holding register (double word, swap word order)	03
5x	W	Write holding register (double word, swap word order)	16
6x	R	Read holding register	03
6x	W	Write holding register (force a function code 06 when writing)	06
4x_32Bit	R	Read holding register (32-bit)	03
4x_32Bit	W	Write holding register (32-bit)	16

## EZware Settings

The following table lists the communications settings that must be configured in EZware. These settings can be found in the *Edit-System Parameters* menu under the *Device Properties* tab. Please note:

- The **Recommended Settings** column provides the recommended setting based upon the default settings most commonly used in Modbus Devices.
- The **Options** column lists EZware's options; your PLC may not support every option

Name	Recommended Settings	Options	Important Notes
Name:	Modbus RTU Master		Description label
HMI or PLC	PLC		
Location	Local	Local, Remote	Select <i>Local</i> if PLC directly connected to HMI, <i>Remote</i> if PLC connected thru another HMI.
PLC type:	Modbus RTU Master		

Name	Recommended Settings	Options	Important Notes
PLC I/F:	RS-232	RS-232, RS-485 2W, RS-485 4W	Must match the controller port setting.
PLC default station no.:	1	0-255	Must match the node address assigned to the PLC.
Setting: COM:	COM1	COM1-COM3	Serial port of the HMI connected to the controller.
Settings: Baud rate	19200	9600, 19200, 38400, 57600, 115200	Must match the Modbus port setting. Use the fastest baud rate supported by the controller.
Settings: Data Bits	8	7 or 8	Must match the Modbus port setting.
Settings: Stop Bits	2	1 or 2	Must match the Modbus port setting.
Settings: Parity:	None	Even, Odd, None	Must match the Modbus port setting.
Settings: Timeout (sec)	1.0	0.1 to 25.5	Adjust if longer timeout is required.
Settings: Turn around delay (ms):	0	0-1000	Timeout period between HMI polls.
Settings: Reserved 1 :	0		Not Applicable
Settings: Reserved 2:	0		Not Applicable
Settings: Reserved 3:	0		Not Applicable
Settings: Reserved 4:	0		Not Applicable
Interval of block pack (words):	5	0-512	See <i>HMI5000 Series Programming Manual</i> (Maple p/n 1010-1007)
Max. read-command size (words):	16		Not Adjustable
Max. write-command size (words):	16		Not Adjustable

Note: (\*) The HMI does not support broadcast messages. The HMI always expects a reply message after it sends a request. Some Modbus controllers use address 0 as a broadcast message so that all node addresses will listen and process the command, but they will not reply back to the master (such as a broadcast 'RESET' command). If, however, the controller has a valid address of 0 and it is not used as a broadcast address, then address 0 can be used.