HG3F or HG4F Screen Modbus TCP/IP Communication and Control of an Emerson Drive

Date: 10/01/2006

Products used:

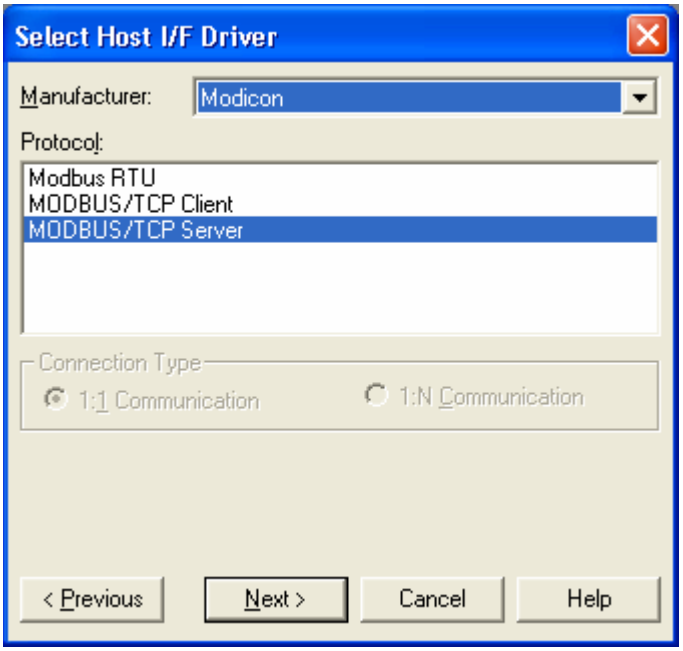
- Emerson Control Techniques Unidrive SP
- SM Ethernet module for the Unidrive SP
- Ethernet cross-over cable
- IDEC HG4F touchscreen

Notes prior to setup:
This setup procedure assumes that the programmer has a working knowledge of Ethernet networking and address methods.

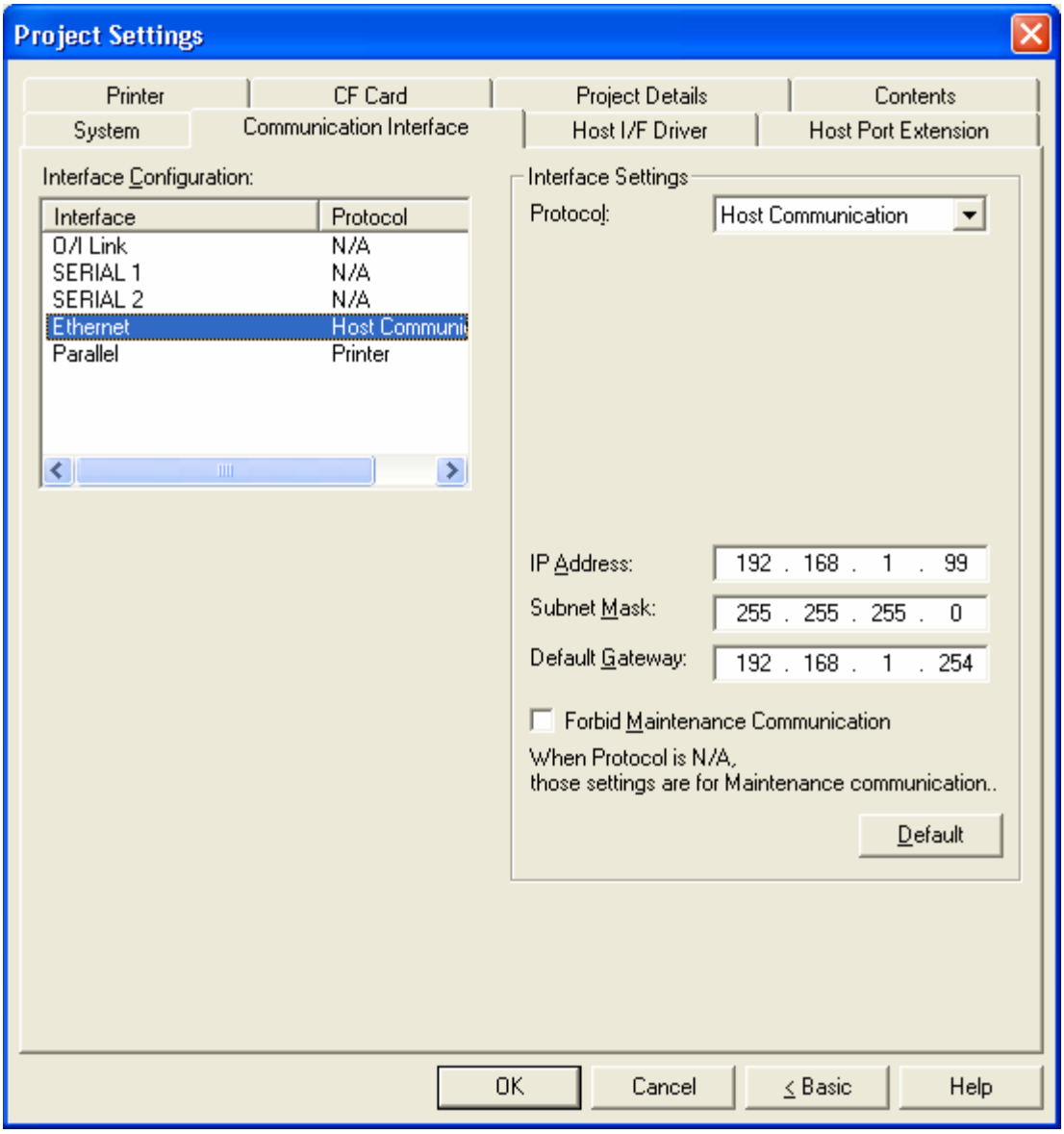
The Emerson drive uses an auxiliary SM Ethernet communication module. This module comes pre-programmed with an Ethernet address, Subnet mask and Gateway address. For further details on this card, please consult the drives User Guide Manual or Tech Support for your drive manufacturer. Please ensure that you understand the operation of the drive and have it wired according to the Users Manual. **Please follow all Safety precautions.**

Setup procedure (For simplicity, our example shows communication between one screen and one drive):

1. HG4F setup for Modbus TCP/IP communication is chosen when configuring the project settings. For this example, we chose the following:



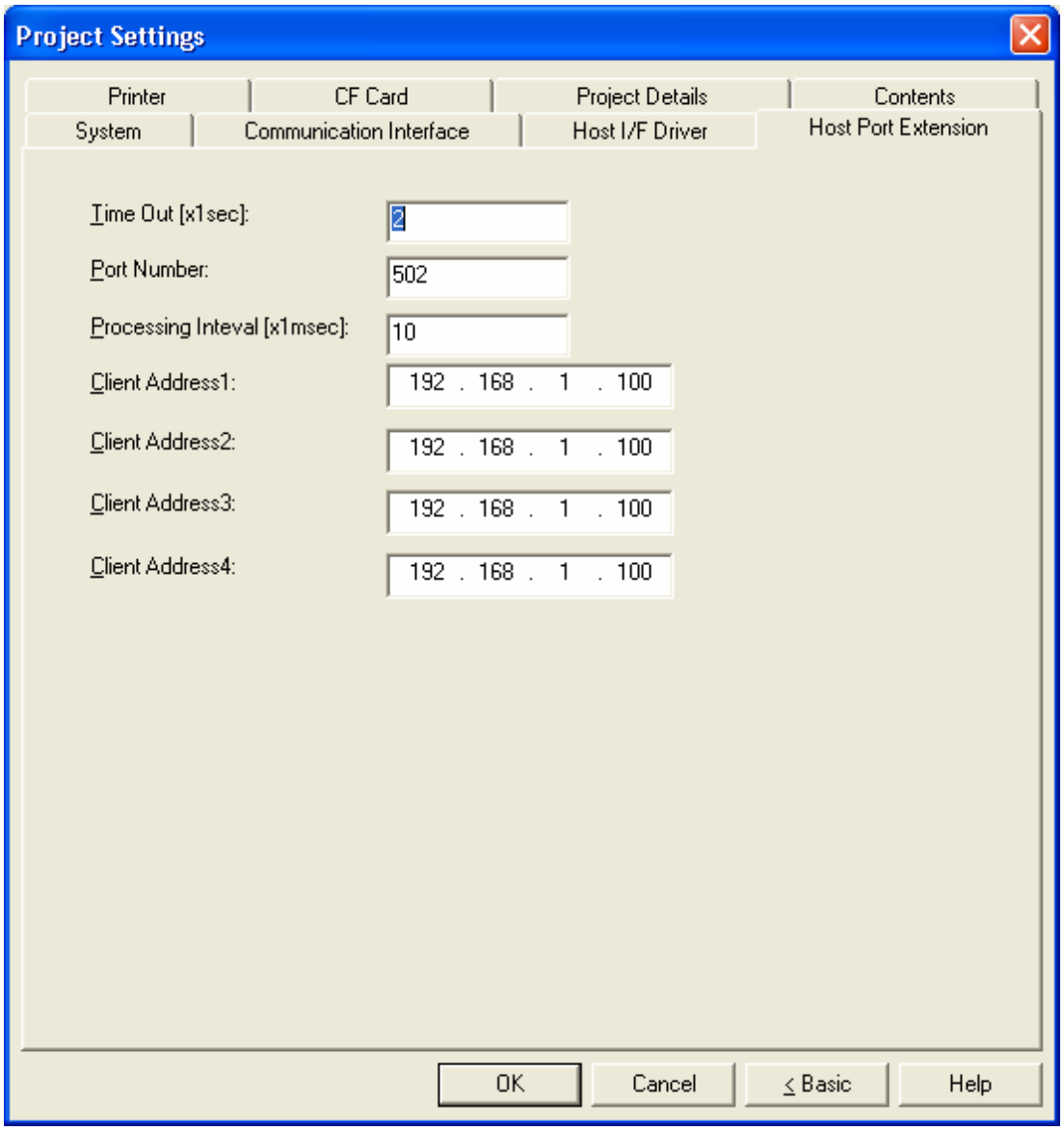
2. Clicking “Next” will bring up the Pop-up tool box. Select the **Communication Interface** tab. The TCP/IP address, Subnet mask and Gateway were set as shown for our drive. Again, consult the drive manuals for proper setup parameters.



3. Next select the **Host Port Extension** tab. The driver for the HG4F was chosen as a Server. This gives the option to set the devices on the Ethernet network, which we want to communicate with.

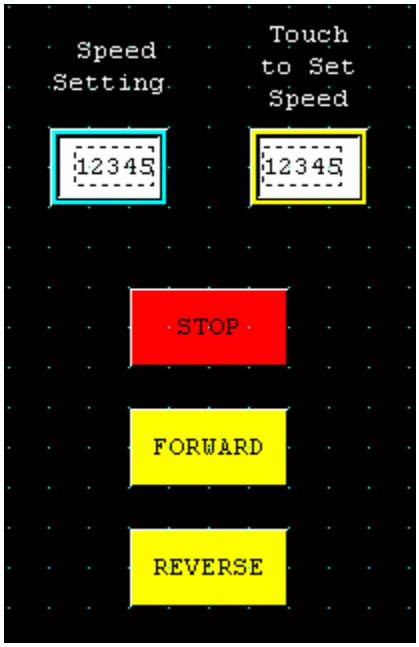
   In the example, we filled the table with the TCP/IP address of our drive. If there are different drives, we would have a corresponding number of different addresses to a maximum of four.

4. After downloading this screen data, the HG4F screen is now fully programmed to communicate with the drive.



5. With help from your **Drive supplier**, configure an HG screen to test control of the drive.

6. The test screen for this trial used one Numerical Data display, one Numerical Data Entry display (set to use a Pop Up screen #3001 for the Numerical keypad) and three Word Write Buttons.



7. Emerson Control Techniques overlaid the drives parameter set with the Modbus RTU Data Register Range. When reading and writing data information using the Modbus Protocol the drive data locations are specified as “HR”: Holding Registers staring at address 400000 (also as seen in the HG4F screen).

   To access a particular drive parameter such as **#X.Y** (where X is the drive menu number and Y is the parameter number) we will use parameter 1.21 (which is the selected speed reference). The Modbus equivalent in the HG4F would be **400121**. The period used as a separator is not used. Any value written to this register, which is outlined in the drive User Manual as a legitimate speed reference, would cause the drive to change speed to that reference. In our example we used the Numerical Data Entry tool to enter a new value.

8. In the Emerson Drive, a control word is supplied to provide a method of controlling the drive functions directly. This drive parameter is #6.42, as shown.

6.42	Control word															
Drive modes	Open-loop, Closed-loop vector, Servo, Regen															
Coding	Bit	SP	FI	DE	TE	VM	DP	ND	RA	NC	NV	PT	US	RW	BU	PS
										1				1	1	
Range	Open-loop, Closed-loop vector, Servo									0 to 32,767						
Default	Open-loop, Closed-loop vector, Servo, Regen									0						
Update rate	Bits 0 –7: 4ms read, Bits 8-15: Background read															

9. Each bit of the control word corresponds to a function in the drive. The table below (which is from the drives manual) gives a detailed explanation of the functions.

Menu 6	Parameter structure	Keypad and display	Parameter x.00	Parameter description format	**Advanced parameter descriptions**	Macros	Serial comms protocol	Electronic nameplate	Performance	Feature look-up table

Bits marked with * have no effect in Regen mode.

Bit	Function	Equivalent parameter
0	Drive enable	Pr 6.15
1*	Run forward	Pr 6.30
2*	Jog	Pr 6.31
3*	Run reverse	Pr 6.32
4*	Forward/reverse	Pr 6.33
5*	Run	Pr 6.34
6*	Not stop	Pr 6.39
7	Auto/manual	
8*	Analogue/Preset reference	Pr 1.42
9*	Jog reverse	Pr 6.37
10	Reserved	
11	Reserved	
12	Trip drive	
13	Reset drive	Pr 10.33
14	Keypad watchdog	

Bits 0-7 and bit 9: sequencing control
When the control word is enabled (Pr 6.43 = 1), and the Auto/manual bit (bit7) are both one, bits 0 to 6 and bit 9 of the control word become active. The equivalent parameters are not modified by these bits, but become inactive when the equivalent bits in the control word are active. When the bits are active they replace the functions of the equivalent parameters. For example, if Pr 6.43 = 1 and bit 7 of Pr 6.42 = 1 the drive enable is no longer controlled by Pr 6.15, but by bit 0 of the control word. If either Pr 6.43 = 0, or bit 7 of Pr 6.42 = 0, the drive enable is controlled by Pr 6.15.

Bit 8: Analog/preset reference
When the control word is enabled (Pr 6.43) bit 8 of the control word becomes active. (Bit 7 of the control word has no effect on this function.) The state of bit 8 is written to Pr 1.42. With default drive settings this selects analogue reference 1 (bit8 = 0) or preset reference 1 (bit8 = 1). If any other drive parameters are routed to Pr 1.42 the value of Pr 1.42 is undefined.

Bit12: Trip drive
When the control word is enabled (Pr 6.43) bit 12 of the control word becomes active. (Bit 7 of the control word has no effect on this function.) When bit 12 is set to one a CL.bit trip is initiated. The trip cannot be cleared until the bit is set to zero

Bit 13: Reset drive
When the control word is enabled (Pr 6.43) bit 13 of the control word becomes active. (Bit 7 of the control word has no effect on this function.) When bit 13 is changed from 0 to 1 the drive is reset. This bit does not modify the equivalent parameter (Pr 10.33).

Bit 14: Keypad watchdog
When the control word is enabled (Pr 6.43) bit 14 of the control word becomes active. (Bit 7 of the control word has no effect on this function.) A watchdog is provided for an external keypad or other device where a break in the communication link must be detected. The watchdog system can be enabled and/or serviced if bit 14 of the control word is changed from zero to one with the control word enabled. Once the watchdog is enabled it must be serviced at least once every second or an "SCL" trip occurs. The watchdog is disabled when an "SCL" trip occurs, and so it must be re-enabled when the trip is reset.

10. In our example we configured the three Word Write buttons on our screen in the HG4F to perform the following tasks by writing data to Modbus address 400642.
    a. Writing 193 will STOP the drive
    b. Writing 195 will run the drive FORWARD
    c. Writing 201 will run the drive REVERSE

11. Please take special note of bit #7 in the control word. This bit must be high for the control action to take effect.