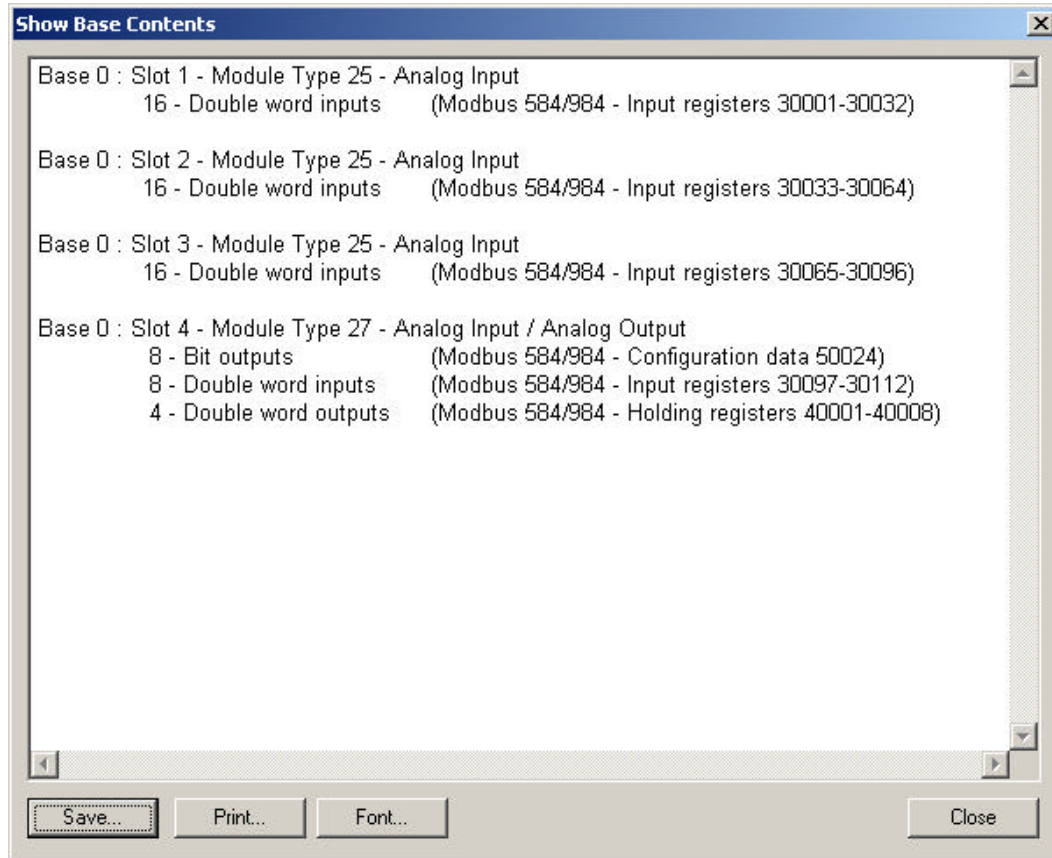


## FACTS Terminator Analog Modules and Modbus TCP (10/17/2007)

Use Host Engineering's Nedit3 to find and select the IP address of the T1H-EBC100. Select the 'EBC Settings' tab then the 'Show Base Contents' button to see the I/O modules in the T1H-EBC100 base and the Modbus addressing for those modules. You should see something like this:



The Modbus protocol defines four data types: Coils, Inputs, Input Registers, and Holding Registers.

Coils are discrete bits that can be read or written. Coil addresses start at 1. Coils are read with function code 1 (Read Coil Status) and written with function code 5 (Force Single Coil) or 15 (Force Multiple Coils). Coils are generally discrete outputs on the T1H-EBC100.

Inputs are discrete bits that are read only. Input addresses start at 10001. Inputs are read with function code 2 (Read Input Status). Inputs are generally discrete inputs on the T1H-EBC100.

Input Registers are words that are read only. Input Register addresses start at 30001. Input Registers are read with function code 4 (Read Input Registers). Input Registers are generally analog inputs on the T1H-EBC100.

Holding Registers are words that can be read or written. Holding register addresses start at 40001. Holding Registers are read with function code 3 (Read Holding Registers) and written with function code 6 (Preset Single Register) or 16 (Preset Multiple Registers). Holding Registers are generally analog outputs on the T1H-EBC100.

Use the addresses shown in Netedit3 'Show Base Contents' along with the following table to read/write your analog I/O with your Modbus TCP master.

**CONFIGURATION NOTE:**

Most Module Configuration is done with bits in the 'Configuration Data' address associated with the slot the I/O is in. See page 4-7:

<http://www.automationdirect.com/static/manuals/t1hebcm/ch4.pdf>

Configuration Data	50021 – 50052	32	1 word per slot to read/write module configuration data (See Analog I/O Module Configuration tables at the end of this chapter for bit definitions)	R / W
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**DIAGNOSTICS NOTE:**

See chapter 4 of T1H-EBC-M for Modbus TCP Mapping:

<http://www.automationdirect.com/static/manuals/t1hebcm/ch4.pdf>

**Error Addresses are on Page 4-7 and 4-8**

T1H-EBC100				
	Modbus Addressing Range (Decimal)	Words (16-bit)	Word Descriptions	Access
EBC Dynamic Module Data	50001 – 50020	20	1 – See Error Codes on p. 4–9. 2 – Error bit-per-slot for first 16 slots If any bit is set, see extended error info of Module Status data for specific problem 3 – Error bit-per-slot for second 16 slots (if present) If any bit is set, see extended error info of Module Status data for specific problem NOTE: Any write to [1], [2], or [3] above will clear the module / slot errors.	R / W

T1H-EBC100				
	Modbus Addressing Range (Decimal)	Words (16-bit)	Word Descriptions	Access
I/O Module Status	37401 – 38040	640 (20 words per slot)	1 – Flags with bits indicating presence of Error, Warning, Info Values Bit 0: If set, indicates that Error Value is non-zero Bit 1: If set, indicates that Warning Value is non-zero Bit 2: If set, indicates that Info Value is non-zero Bit 3: Reserved Bit 4: If set, indicates that Extended error info is present Bit 5: Reserved Bit 6: Reserved Bit 7: Reserved For Words 2–4, refer to Current/Last State Error Codes Table (p.4–9) 2 – Error Code 3 – Warning Code 4 – Info Code For Words 5–20, refer to Extended Error Codes Table (p.4–9) 5 – Extended Error Code 1 (i.e channel 1 of an analog module) 6 – Extended Error Code 2 (i.e channel 2 of an analog module) 7 – Extended Error Code 3 (i.e channel 3 of an analog module) 8 – Extended Error Code 4 (i.e channel 4 of an analog module) 9 – Extended Error Code 5 (i.e channel 5 of an analog module) 10 – Extended Error Code 6 (i.e channel 6 of an analog module) 11 – Extended Error Code 7 (i.e channel 7 of an analog module) 12 – Extended Error Code 8 (i.e channel 8 of an analog module) 13 – Extended Error Code 9 (i.e channel 9 of an analog module) 14 – Extended Error Code 10 (i.e channel 10 of an analog module) 15 – Extended Error Code 11 (i.e channel 11 of an analog module) 16 – Extended Error Code 12 (i.e channel 12 of an analog module) 17 – Extended Error Code 13 (i.e channel 13 of an analog module) 18 – Extended Error Code 14 (i.e channel 14 of an analog module) 19 – Extended Error Code 15 (i.e channel 15 of an analog module) 20 – Extended Error Code 16 (i.e. channel 16 of an analog module)	R only

Error Codes are on Page 4-9

## Current / Last State Error Codes

The following table lists the error codes for Words 2–4 in the Module Status System Memory area.

Error Code (Decimal)	Description
E0	No error.
E121	Channel failure.
E122	Unused analog input channels exist.
E139	Broken transmitter on one of the analog input channels (if supported by analog module)
E142	Multiple channels failed.
E153	The module which was in this slot is no longer responding. User has removed a module in a Terminator I/O slave system. If Automatic Reset (default) is enabled for this slave, it will reset itself once the replacement module is inserted. If Manual Reset is enabled for this slave, the user must 1) SET the slave disable flag for that slave in the first diagnostic output word, 2) wait for bits 8–15 in second diagnostic input word to equal 1, then 3) RESET the slave disable flag in the first diagnostic output word.
E154	I/O configuration has changed. See E153 for reset methods.
E200– E216	Unused analog input channels exist at channel xx [1–16], where xx = Value –200. (example: E212 indicates unused analog channel exists at channel 12.)

## Extended Error Codes

The following table lists the error codes for Words 5–20 in the Module Status System Memory area.

Error Code (Decimal)	Description														
E32– E68	Bitwise error where bit 5 is always SET. Look at bit 0 thru bit 4 to get a possible list of errors. Example 34 decimal =32 hexadecimal (Bit 5 SET and Bit 1 SET). <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>BIT</th> <th>Type of Error</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Terminal block off</td> </tr> <tr> <td>1</td> <td>External PVS voltage low</td> </tr> <tr> <td>2</td> <td>Fuse blown</td> </tr> <tr> <td>3</td> <td>Bus error</td> </tr> <tr> <td>4</td> <td>Module initialization error (Intelligent module)</td> </tr> <tr> <td>5</td> <td>Fault exists in module (this bit is SET if any of the above bits are SET)</td> </tr> </tbody> </table>	BIT	Type of Error	0	Terminal block off	1	External PVS voltage low	2	Fuse blown	3	Bus error	4	Module initialization error (Intelligent module)	5	Fault exists in module (this bit is SET if any of the above bits are SET)
BIT	Type of Error														
0	Terminal block off														
1	External PVS voltage low														
2	Fuse blown														
3	Bus error														
4	Module initialization error (Intelligent module)														
5	Fault exists in module (this bit is SET if any of the above bits are SET)														
E117	Write attempt to an invalid analog channel.														
E119	Data not valid. Subnet mask or IP address not allowed / EBC SDK data packet not constructed properly.														
E121	Analog input channel error.														
E122	Unused analog input channels exist.														
E139	Broken transmitter on one of the analog input channels.														
E142	Channel failure.														
E146	Communications failure. Hitachi drive on-board relay set.														
E153	The module which was in this slot is no longer responding. User has removed a module in a Terminator I/O slave system. If Automatic Reset is enabled for this slave, it will reset itself once the replacement module is inserted. If Manual Reset is enabled for this slave, the user must 1) SET the slave disable flag for that slave in the first diagnostic output word, 2) wait for bits 12–15 in second diagnostic input word to equal 1, then 3) RESET the slave disable flag in the first diagnostic output word.														
E154	One or more new modules has been inserted into the base. See E153 for reset methods.														
E155	Terminator module status error. One or more of the modules in the T1H–EBC100 base has an error. For more detail check extended errors.														
E200– E216	Unused analog input channels exist at channel xx [1–16], where xx = Value –200.														

To check module diagnostics you must read 'EBC Dynamic Data' to see if there is an error in a particular slot then read the 'I/O Module Status' to see what the error is. The 'Diagnostics' column refers to 'Error Code' and 'Info Code', these are the second and fourth words under 'I/O Module Status' on page 4-8 of T1H-EBC-M.

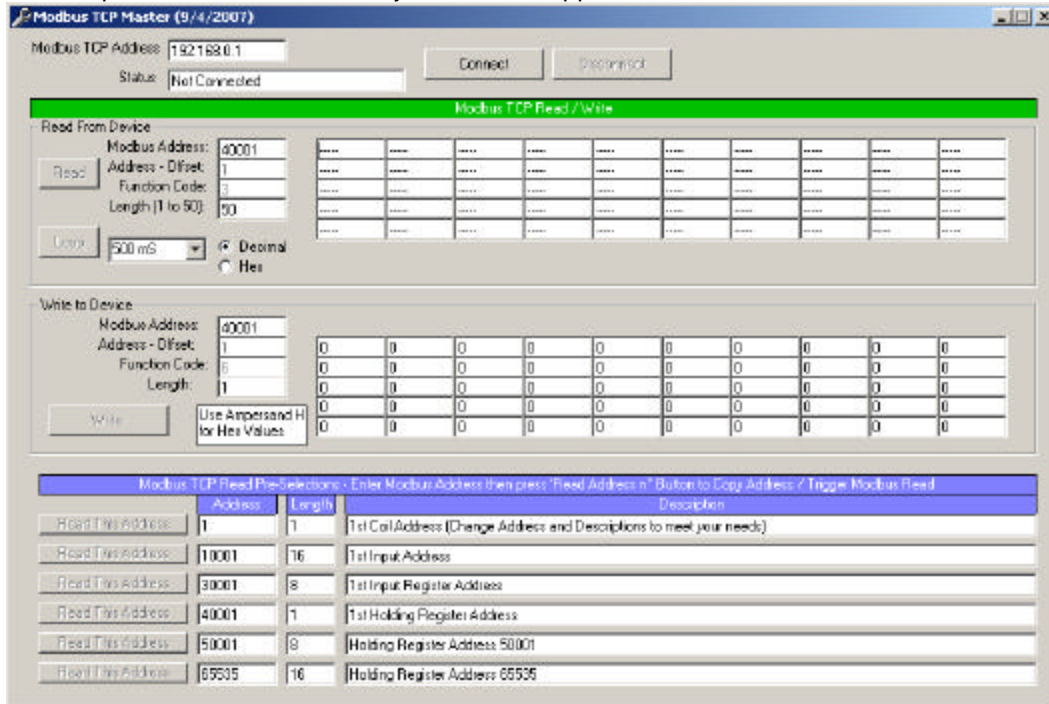
Part Number	Channel Data	Configuration Data	Diagnostic Data								
T1F-08AD-1	<p><b>Note: Channel Data Values use two words but unless the value is negative only the low word is needed.</b></p> <p><b>Input Registers</b>            Word 1 = Ch1            Word 3 = Ch2            ...            Word 13 = Ch7            Word 15 = Ch8</p>	<p><b>Analog Input Configuration</b></p> <table border="1" data-bbox="732 590 1089 793"> <tr> <td>Bit 0-4</td> <td>0 – All Channels Enabled 1-31 – Number of Channels Enabled</td> </tr> <tr> <td>Bit 5-6</td> <td>Reserved</td> </tr> <tr> <td>Bit 7</td> <td>0 – Normal Response 1 – Fast Response</td> </tr> <tr> <td>Bit 8-15</td> <td>Reserved</td> </tr> </table> <p>Input Range Depends on Input Signal            -20 to 20mA = -8192 to 8191            0 to 20mA = 0 to 8191            4 to 20mA = 1638 to 8191</p>	Bit 0-4	0 – All Channels Enabled 1-31 – Number of Channels Enabled	Bit 5-6	Reserved	Bit 7	0 – Normal Response 1 – Fast Response	Bit 8-15	Reserved	<p>See <b>DIAGNOSTICS NOTE</b> above</p> <p><b>Modbus Addresses Assume Slot 1 – See NedtEdit3 ‘Show Base Contents’ for Actual Address</b></p> <p>No Built-In Broken Transmitter Detection</p> <p>Monitor for counts less than 1638</p>
Bit 0-4	0 – All Channels Enabled 1-31 – Number of Channels Enabled										
Bit 5-6	Reserved										
Bit 7	0 – Normal Response 1 – Fast Response										
Bit 8-15	Reserved										
T1F-08AD-2	<p><b>Input Registers</b>            Word 1 = Ch1            Word 3 = Ch2            ...            Word 13 = Ch7            Word 15 = Ch8</p>	<p><b>Analog Input Configuration</b></p> <table border="1" data-bbox="732 1005 1089 1209"> <tr> <td>Bit 0-4</td> <td>0 – All Channels Enabled 1-31 – Number of Channels Enabled</td> </tr> <tr> <td>Bit 5-6</td> <td>Reserved</td> </tr> <tr> <td>Bit 7</td> <td>0 – Normal Response 1 – Fast Response</td> </tr> <tr> <td>Bit 8-15</td> <td>Reserved</td> </tr> </table> <p>Input Range Depends on Input Signal            0 to 5V = 0 to 4095            0 to 10V = 0 to 8191            +/-5V = -4095 to 4095            +/-10V = -8192 to 8191</p>	Bit 0-4	0 – All Channels Enabled 1-31 – Number of Channels Enabled	Bit 5-6	Reserved	Bit 7	0 – Normal Response 1 – Fast Response	Bit 8-15	Reserved	<p>No Broken Transmitter Detection (N/A for Voltage)</p>
Bit 0-4	0 – All Channels Enabled 1-31 – Number of Channels Enabled										
Bit 5-6	Reserved										
Bit 7	0 – Normal Response 1 – Fast Response										
Bit 8-15	Reserved										
T1F-16AD-1	<p><b>Input Registers</b>            Word 1 = Ch1            Word 3 = Ch2            ...            Word 29 = Ch15            Word 31 = Ch16</p>	<p><b>No Software Configuration</b></p> <p>Input Range Depends on Input Signal            -20 to 20mA = -8192 to 8191            0 to 20mA = 0 to 8191            4 to 20mA = 1638 to 8191</p>	<p>No Built-In Broken Transmitter Detection</p> <p>Monitor for counts less than 1638</p>								
T1F-16AD-2	<p><b>Input Registers</b>            Word 1 = Ch1            Word 3 = Ch2            ...            Word 29 = Ch15            Word 31 = Ch16</p>	<p><b>No Software Configuration</b></p> <p>Input Range Depends on Input Signal            0 to 5V = 0 to 4095            0 to 10V = 0 to 8191            +/-5V = -4095 to 4095</p>	<p>No Broken Transmitter Detection (N/A for Voltage)</p>								

		+/-10V = -8192 to 8191											
<b>T1F-14THM</b>	<p><b>Input Registers</b>  Word 1 = Ch1  Word 3 = Ch2  ...  Word 25 = Ch13  Word 27 = Ch14  Word 29 = Status  Word 31 = Status</p> <p>Status info is only available if T1F-14THM is date code 1205 or later. See Rev F Data Sheet for details.</p>	<p><b>No Software Configuration</b></p> <p>THM Type Set by Jumpers</p>	<p>'I/O Module Status' 37401 Indicates if an error is present  37405-20 Word Per Channel gives 1 if Broken Transmitter, 0 if OK</p> <p>Once error condition is corrected write zero to 50001 to clear errors</p> <p>See T1F-16RTD example at the end of document</p>										
<b>T1F-16RTD</b>	<p><b>Input Registers</b>  Word 1 = Ch1  Word 3 = Ch2  ...  Word 29 = Ch15  Word 31 = Ch16</p>	<p><b>No Software Configuration</b></p> <p>RTD Type Set by Jumpers</p>	<p>'I/O Module Status' 37401 Indicates if an error is present  37405-20 Word Per Channel gives 1 if Broken Transmitter, 0 if OK</p> <p>Once error condition is corrected write zero to 50001 to clear errors</p> <p>See T1F-16RTD example at the end of document</p>										
<b>T1F-8AD4DA-1</b>	<p><b>Input Registers</b>  Word 1 = Ch1  Word 3 = Ch2  ...  Word 13 = Ch7  Word 15 = Ch8</p> <p><b>Holding Registers</b>  Word 1 = Ch1  Word 3 = Ch2  Word 5 = Ch3  Word 7 = Ch4</p>	<p><b>Analog Output Configuration</b></p> <table border="1"> <tr> <td>Bit 0</td> <td>Output Enable 0 – Outputs OFF 1 – Outputs Enabled</td> </tr> <tr> <td>Bit 1</td> <td>N/A</td> </tr> <tr> <td>Bit 2</td> <td>N/A</td> </tr> <tr> <td>Bit 3</td> <td>0-20mA/4-20mA 0 – 0-20mA range 1 – 4-20mA range</td> </tr> <tr> <td>Bit 4-15</td> <td>Reserved</td> </tr> </table> <p>See T1F-8AD4DA-2 Example following this table</p> <p>Input Range Depends on Input Signal  -20 to 20mA = -8192 to 8191  0 to 20mA = 0 to 8191  4 to 20mA = 1638 to 8191</p>	Bit 0	Output Enable 0 – Outputs OFF 1 – Outputs Enabled	Bit 1	N/A	Bit 2	N/A	Bit 3	0-20mA/4-20mA 0 – 0-20mA range 1 – 4-20mA range	Bit 4-15	Reserved	<p>No Built-In Broken Transmitter Detection</p> <p>Monitor for counts less than 1638</p>
Bit 0	Output Enable 0 – Outputs OFF 1 – Outputs Enabled												
Bit 1	N/A												
Bit 2	N/A												
Bit 3	0-20mA/4-20mA 0 – 0-20mA range 1 – 4-20mA range												
Bit 4-15	Reserved												

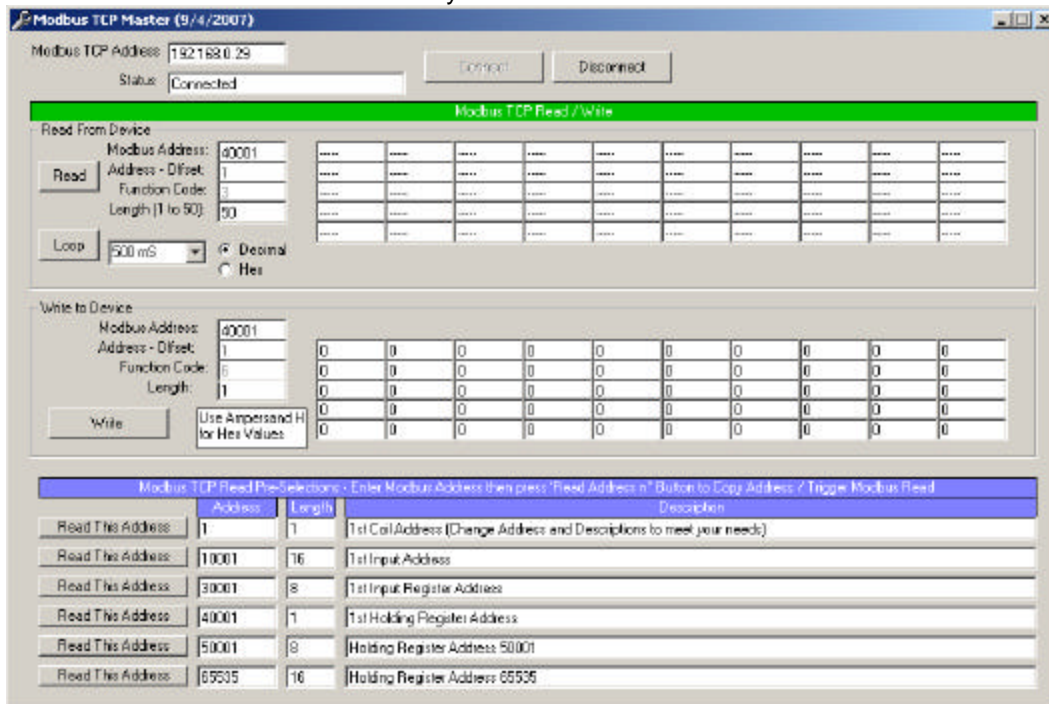
<b>T1F-8AD4DA-2</b>	<p><b>Input Registers</b> Word 1 = Ch1 Word 3 = Ch2 ... Word 13 = Ch7 Word 15 = Ch8</p> <p><b>Holding Registers</b> Word 1 = Ch1 Word 3 = Ch2 Word 5 = Ch3 Word 7 = Ch4</p>	<p><b>Analog Output Configuration</b></p> <table border="1"> <tr> <td>Bit 0</td> <td>Output Enable 0 – Outputs OFF 1 – Outputs Enabled</td> </tr> <tr> <td>Bit 1</td> <td>Unipolar/Bipolar 0 – Unipolar 1 – Bipolar</td> </tr> <tr> <td>Bit 2</td> <td>5V/10V Range 0 – 5V Range 1 – 10V Range</td> </tr> <tr> <td>Bit 3</td> <td>N/A</td> </tr> <tr> <td>Bit 4-15</td> <td>Reserved</td> </tr> </table> <p>See T1F-8AD4DA-2 Example following this table</p> <p>Input Range Depends on Input Signal 0 to 5V = 0 to 8191 0 to 10V = 0 to 8191 -/+ 5V = -4095 to 4095 -/+ 10V = -8192 to 8191</p>	Bit 0	Output Enable 0 – Outputs OFF 1 – Outputs Enabled	Bit 1	Unipolar/Bipolar 0 – Unipolar 1 – Bipolar	Bit 2	5V/10V Range 0 – 5V Range 1 – 10V Range	Bit 3	N/A	Bit 4-15	Reserved	No Broken Transmitter Detection (N/A for Voltage)
Bit 0	Output Enable 0 – Outputs OFF 1 – Outputs Enabled												
Bit 1	Unipolar/Bipolar 0 – Unipolar 1 – Bipolar												
Bit 2	5V/10V Range 0 – 5V Range 1 – 10V Range												
Bit 3	N/A												
Bit 4-15	Reserved												
<b>T1F-08DA-1</b>	<p><b>Holding Registers</b> Word 1 = Ch1 Word 3 = Ch2 ... Word 13 = Ch7 Word 15 = Ch8</p>	<p><b>Analog Output Configuration</b></p> <table border="1"> <tr> <td>Bit 0</td> <td>Output Enable 0 – Outputs OFF 1 – Outputs Enabled</td> </tr> <tr> <td>Bit 1</td> <td>N/A</td> </tr> <tr> <td>Bit 2</td> <td>N/A</td> </tr> <tr> <td>Bit 3</td> <td>0-20mA/4-20mA 0 – 0-20mA range 1 – 4-20mA range</td> </tr> <tr> <td>Bit 4-15</td> <td>Reserved</td> </tr> </table>	Bit 0	Output Enable 0 – Outputs OFF 1 – Outputs Enabled	Bit 1	N/A	Bit 2	N/A	Bit 3	0-20mA/4-20mA 0 – 0-20mA range 1 – 4-20mA range	Bit 4-15	Reserved	None
Bit 0	Output Enable 0 – Outputs OFF 1 – Outputs Enabled												
Bit 1	N/A												
Bit 2	N/A												
Bit 3	0-20mA/4-20mA 0 – 0-20mA range 1 – 4-20mA range												
Bit 4-15	Reserved												
<b>T1F-08DA-2</b>	<p><b>Holding Registers</b> Word 1 = Ch1 Word 3 = Ch2 ... Word 13 = Ch7 Word 15 = Ch8</p>	<p><b>Analog Output Configuration</b></p> <table border="1"> <tr> <td>Bit 0</td> <td>Output Enable 0 – Outputs OFF 1 – Outputs Enabled</td> </tr> <tr> <td>Bit 1</td> <td>Unipolar/Bipolar 0 – Unipolar 1 – Bipolar</td> </tr> <tr> <td>Bit 2</td> <td>5V/10V Range 0 – 5V Range 1 – 10V Range</td> </tr> <tr> <td>Bit 3</td> <td>N/A</td> </tr> <tr> <td>Bit 4-15</td> <td>Reserved</td> </tr> </table>	Bit 0	Output Enable 0 – Outputs OFF 1 – Outputs Enabled	Bit 1	Unipolar/Bipolar 0 – Unipolar 1 – Bipolar	Bit 2	5V/10V Range 0 – 5V Range 1 – 10V Range	Bit 3	N/A	Bit 4-15	Reserved	None
Bit 0	Output Enable 0 – Outputs OFF 1 – Outputs Enabled												
Bit 1	Unipolar/Bipolar 0 – Unipolar 1 – Bipolar												
Bit 2	5V/10V Range 0 – 5V Range 1 – 10V Range												
Bit 3	N/A												
Bit 4-15	Reserved												
<b>T1F-16DA-1</b>	<p><b>Holding Registers</b> Word 1 = Ch1 Word 3 = Ch2 ... Word 29 = Ch15 Word 31 = Ch16</p>	<p><b>Analog Output Configuration</b></p> <table border="1"> <tr> <td>Bit 0</td> <td>Output Enable 0 – Outputs OFF 1 – Outputs Enabled</td> </tr> <tr> <td>Bit 1</td> <td>N/A</td> </tr> <tr> <td>Bit 2</td> <td>N/A</td> </tr> <tr> <td>Bit 3</td> <td>0-20mA/4-20mA 0 – 0-20mA range 1 – 4-20mA range</td> </tr> <tr> <td>Bit 4-15</td> <td>Reserved</td> </tr> </table>	Bit 0	Output Enable 0 – Outputs OFF 1 – Outputs Enabled	Bit 1	N/A	Bit 2	N/A	Bit 3	0-20mA/4-20mA 0 – 0-20mA range 1 – 4-20mA range	Bit 4-15	Reserved	None
Bit 0	Output Enable 0 – Outputs OFF 1 – Outputs Enabled												
Bit 1	N/A												
Bit 2	N/A												
Bit 3	0-20mA/4-20mA 0 – 0-20mA range 1 – 4-20mA range												
Bit 4-15	Reserved												

<b>T1F-16DA-2</b>	<b>Holding Registers</b> Word 1 = Ch1 Word 3 = Ch2 ... Word 29 = Ch15 Word 31 = Ch16	<b>Analog Output Configuration</b> <table border="1" data-bbox="732 222 1089 501"> <tr> <td data-bbox="732 222 862 296">Bit 0</td> <td data-bbox="862 222 1089 296">Output Enable 0 – Outputs OFF 1 – Outputs Enabled</td> </tr> <tr> <td data-bbox="732 296 862 369">Bit 1</td> <td data-bbox="862 296 1089 369">Unipolar/Bipolar 0 – Unipolar 1 – Bipolar</td> </tr> <tr> <td data-bbox="732 369 862 443">Bit 2</td> <td data-bbox="862 369 1089 443">5V/10V Range 0 – 5V Range 1 – 10V Range</td> </tr> <tr> <td data-bbox="732 443 862 474">Bit 3</td> <td data-bbox="862 443 1089 474">N/A</td> </tr> <tr> <td data-bbox="732 474 862 501">Bit 4-15</td> <td data-bbox="862 474 1089 501">Reserved</td> </tr> </table>	Bit 0	Output Enable 0 – Outputs OFF 1 – Outputs Enabled	Bit 1	Unipolar/Bipolar 0 – Unipolar 1 – Bipolar	Bit 2	5V/10V Range 0 – 5V Range 1 – 10V Range	Bit 3	N/A	Bit 4-15	Reserved	None
Bit 0	Output Enable 0 – Outputs OFF 1 – Outputs Enabled												
Bit 1	Unipolar/Bipolar 0 – Unipolar 1 – Bipolar												
Bit 2	5V/10V Range 0 – 5V Range 1 – 10V Range												
Bit 3	N/A												
Bit 4-15	Reserved												

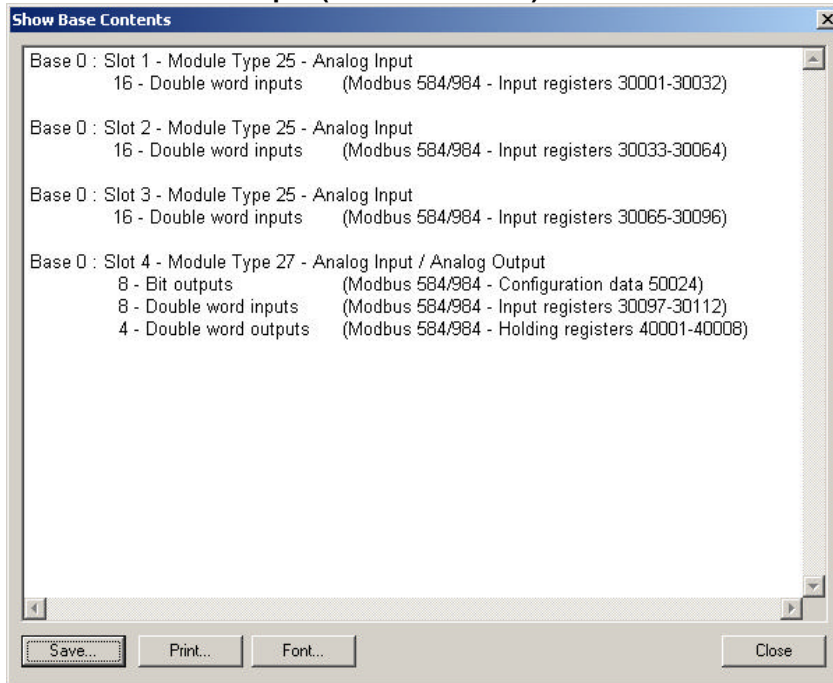
There is a generic Modbus TCP Master at [www.facts-eng.com/tech/Modbus\\_TCP\\_Master.zip](http://www.facts-eng.com/tech/Modbus_TCP_Master.zip) that you can use to test I/O on the T1H-EBC100 (or any Modbus TCP device). Download it and run setup.exe to install it. When you start the application it should look like this:



Use Netedit3 to determine what the address of your T1H-EBC100 is and put that in the 'Modbus TCP Address' field in the top left. Click 'Connect' to connect to that address. The 'Status' field should show 'Connected'. Hover the mouse pointer over any of the data fields to see the corresponding Modbus Address for that field. Use the 'Pre-Read Selections' to enter addresses if there are several different addresses you need to switch back and forth between.



## T1F-8AD4DA-2 Example (Module in Slot 4)



Input Ch1 = 30097,30098  
 Input Ch2 = 30099,30100  
 Input Ch3 = 30101,30102  
 Input Ch4 = 30103,30104  
 Input Ch5 = 30105,30106  
 Input Ch6 = 30107,30108  
 Input Ch7 = 30109,30110  
 Input Ch8 = 30111,30112

Output Ch1 = 40001,40002  
 Output Ch2 = 40003,40004  
 Output Ch3 = 40005,40006  
 Output Ch4 = 40007,40008

Control Byte = 50024

Bit 0	Output Enable 0 – Outputs OFF 1 – Outputs Enabled
Bit 1	Unipolar/Bipolar 0 – Unipolar 1 – Bipolar
Bit 2	5V/10V Range 0 – 5V Range 1 – 10V Range
Bit 3	N/A
Bit 4-15	Reserved

See Page 4-21 of T1K-INST-M

<http://www.automationdirect.com/static/manuals/t1kinstm/ch4.pdf>

Control Byte Value	Corresponding Selections		
	Output Enable/Disable	Unipolar/Bipolar	5V Range/10V Range
0	Disabled	Unipolar	5V
1	Enabled	Unipolar	5V
2	Disabled	Bipolar	5V
3	Enabled	Bipolar	5V
4	Disabled	Unipolar	10V
5	Enabled	Unipolar	10V
6	Disabled	Bipolar	10V
7	Enabled	Bipolar	10V

### T1F-8AD4DA-2 Example (Continued)

Set 50024 to 7 to Enable Output, Configure Bi-Polar Output, Configure 10V Output

The screenshot shows the Modbus TCP Master (9/4/2007) interface. The Modbus TCP Address is set to 192.168.0.29. The status is OK. The interface is divided into 'Read From Device' and 'Write to Device' sections.

**Read From Device:** Modbus Address: 50024, Address - Offset: 10024, Function Code: 3, Length: 1. The 'Loop' is set to 500 ms. The output data is shown as a grid of 10 columns and 4 rows, all containing question marks.

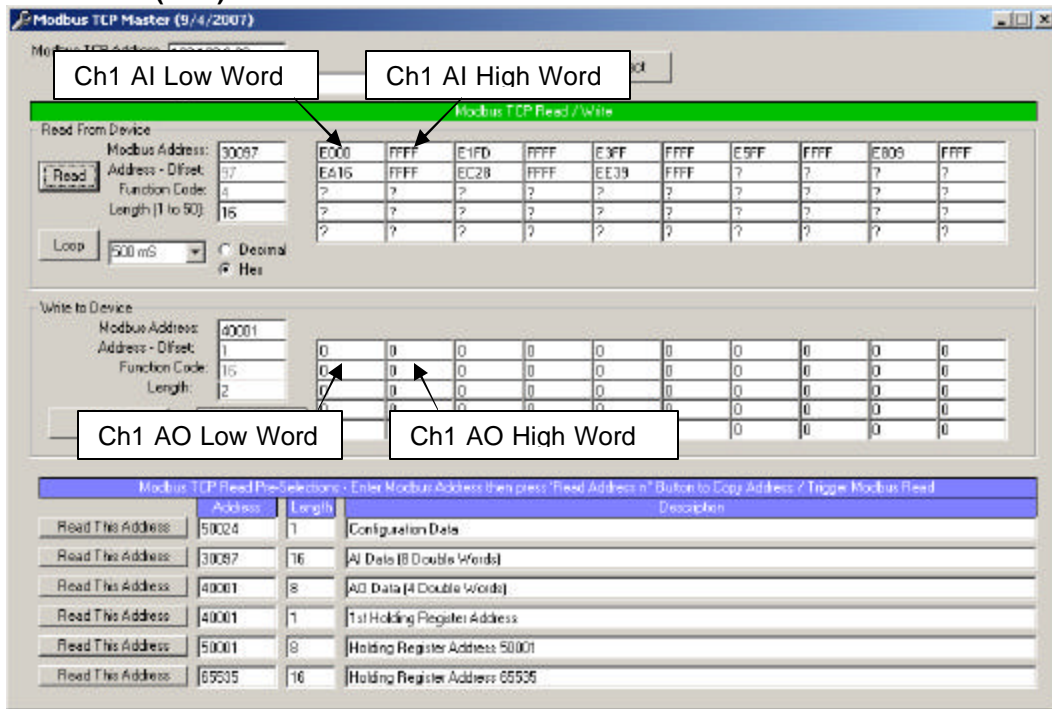
**Write to Device:** Modbus Address: 50024, Address - Offset: 10024, Function Code: 6, Length: 1. The 'Write' button is visible. The output data is shown as a grid of 10 columns and 4 rows, all containing zeros.

**Modbus TCP Read Pre-Selections:** Enter Modbus Address then press 'Read Address n' Button to Copy Address / Trigger Modbus Read

Read This Address	Address	Length	Description
Read This Address	50024	1	Configuration Data
Read This Address	30097	16	AI Data (8 Double Words)
Read This Address	40001	8	AO Data (4 Double Words)
Read This Address	40001	1	Total Holding Register Address
Read This Address	50001	8	Holding Register Address 50001
Read This Address	65535	16	Holding Register Address 65535

T1F-8AD4DA-2 Example (Continued)

Example using Ch1 AO tied to Ch1 AI, All other Inputs floating, Ch1 AO value shown below is 0 counts (-10V)

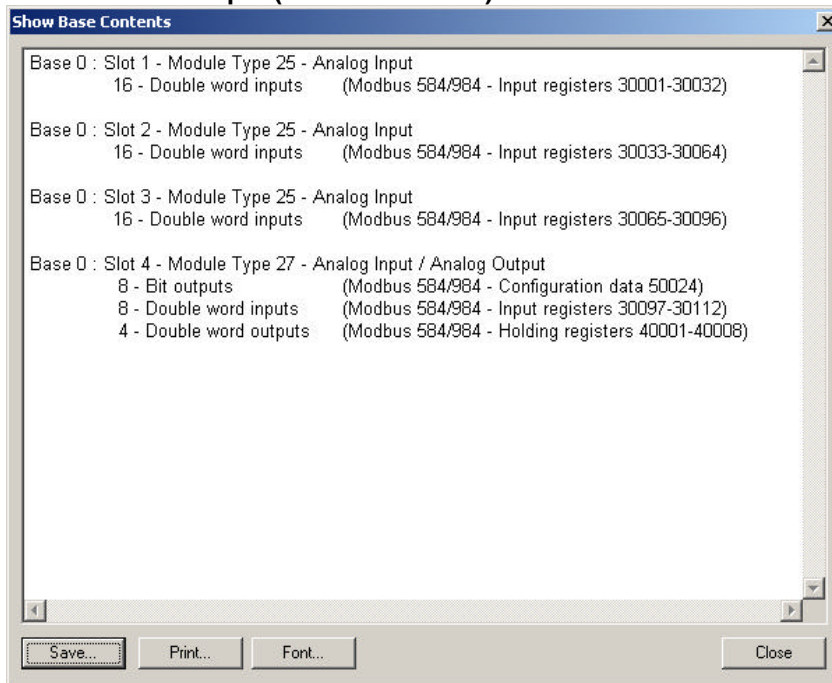


Ch1 AO (Counts / Voltage)	Ch1 AI (Hex)	Ch1 AI (Signed)
0 / -10V	FFFFE000h	-8191
1024 / -5V	FFFFEFFFh	-4096
2047 / 0V	0 flashing FFFFFFFEh	0 flashing -1
3072 / 5V	1000h	4096
4095 / 10V	1FFCh	8188

If 50024 is changed to a value of 1 (Enable Outputs, Unipolar, 5V Output) then the values would look like this:

Ch1 AO (Counts / Voltage)	Ch1 AI (Hex)	Ch1 AI (Signed)
0 / 0V	0 flashing FFFFFFFEh	0 flashing -1
1024 / 1.25V	3FF	1023
2047 / 2.5V	7FF	2047
3072 / 3.75V	BFF	3071
4095 / 5V	FFE	4094

## T1F-16RTD Example (Module in Slot 2)



Input Ch1 = 30033,30034  
Input Ch2 = 30035,30036  
Input Ch3 = 30037,30038  
Input Ch4 = 30039,30040  
Input Ch5 = 30041,30042  
Input Ch6 = 30043,30044  
Input Ch7 = 30045,30046  
Input Ch8 = 30047,30048  
Input Ch9 = 30049,30050  
Input Ch10 = 30051,30052  
Input Ch11 = 30053,30054  
Input Ch12 = 30055,30056  
Input Ch13 = 30057,30058  
Input Ch14 = 30059,30060  
Input Ch15 = 30061,30062  
Input Ch16 = 30063,30064

37421 is the Error Flag Word

37425 is the Extended Error Code for Ch1 (1 = Broken Transmitter)

37426 is the Extended Error Code for Ch2

...

37439 is the Extended Error Code for Ch15

37440 is the Extended Error Code for Ch16

50001 is the EBC Dynamic Module Data Error Code (Write zero to clear errors)

## T1F-16RTD Example (Continued)

T1F-16RTD module is configured to scan 16 channels, use Pt100 RTDs, and use Fahrenheit temperature units. RTDs are simulated with resistors (Resistors are connected between Ch+ and Ch- with a short between Ch- and 'RTD Returns' terminal). The resistor values used for this example are (5% resistors were used so actual values vary):

Ch1, Ch6 to 10, Ch15, Ch16 = ~120 Ohm = ~127F / 53C

Ch2 to 5 = ~82 Ohm = ~-49F / -45C

Ch11 to 14 = ~100 Ohm = ~32F / 0C

## Readings with all RTDs (resistors) connected

The screenshot shows the Modbus TCP Master interface. The 'Read From Device' section displays a table of data for 16 channels. The 'Read From Device' section is set to Modbus Address 30033, Address - Offset 33, Function Code 4, and Length 32. The data table shows the following values:

Channel	Low Word	High Word
Ch1	1325	64974
Ch2	64974	65535
Ch3	65535	64950
Ch4	64950	65535
Ch5	65535	64968
Ch6	64968	65535
Ch7	65535	64968
Ch8	64968	65535
Ch9	65535	64968
Ch10	64968	65535
Ch11	65535	64968
Ch12	64968	65535
Ch13	65535	64968
Ch14	64968	65535
Ch15	65535	64968
Ch16	64968	65535

The 'Write to Device' section shows Modbus Address 50001, Address - Offset 10001, Function Code 16, and Length 2. The data table shows all zeros.

The 'Modbus TCP Read Pre-Selections' table is as follows:

Read This Address	Address	Length	Description
Read This Address	50024	1	Configuration Data
Read This Address	30087	16	AI Data (8 Double Words)
Read This Address	40001	8	AO Data (4 Double Words)
Read This Address	30033	32	RTD Data (16 Double Words)
Read This Address	37421	1	Slot 1 (RTD) Error Flag Word
Read This Address	37425	16	Slot 1 (RTD) Extended Error Codes - 1 Per Channel

The Ch1 reading is 1325 which is 132.5 degrees F.

The Ch2 reading is 65535 in the high word and 64974 in the low word. The T1H-EBC100 sign extends negative values which means the high word will be 65535 if the temperature is negative. To find out the value subtract 65535 from the low word value,  $64974 - 65535 = -561 = -56.1$  degrees F. The control application Modbus TCP driver should give a data type option such as "Signed Integer" that will do this conversion for you.

Modbus address 37421 and 37425-37440 are all zero indicating no errors.



