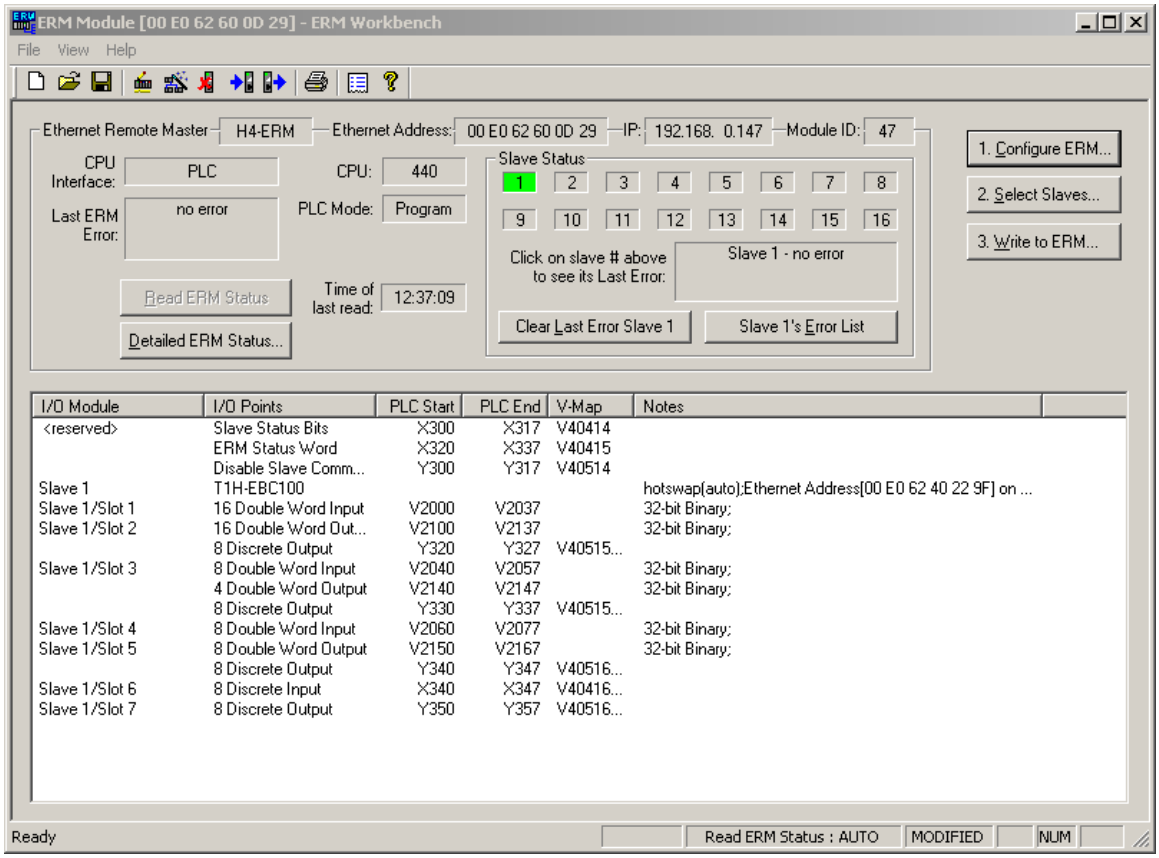
FACTS Terminator Analog Modules with T1H-EBC and ERM

The Host Engineering ERM (H2-ERM or H4-ERM) allows I/O in a T1H-EBC (or T1H-EBC100) base to act as remote I/O to the PLC that contains the ERM module. FACTS Analog module data in the T1H-EBC base is mapped to V-memory or Discrete I/O.

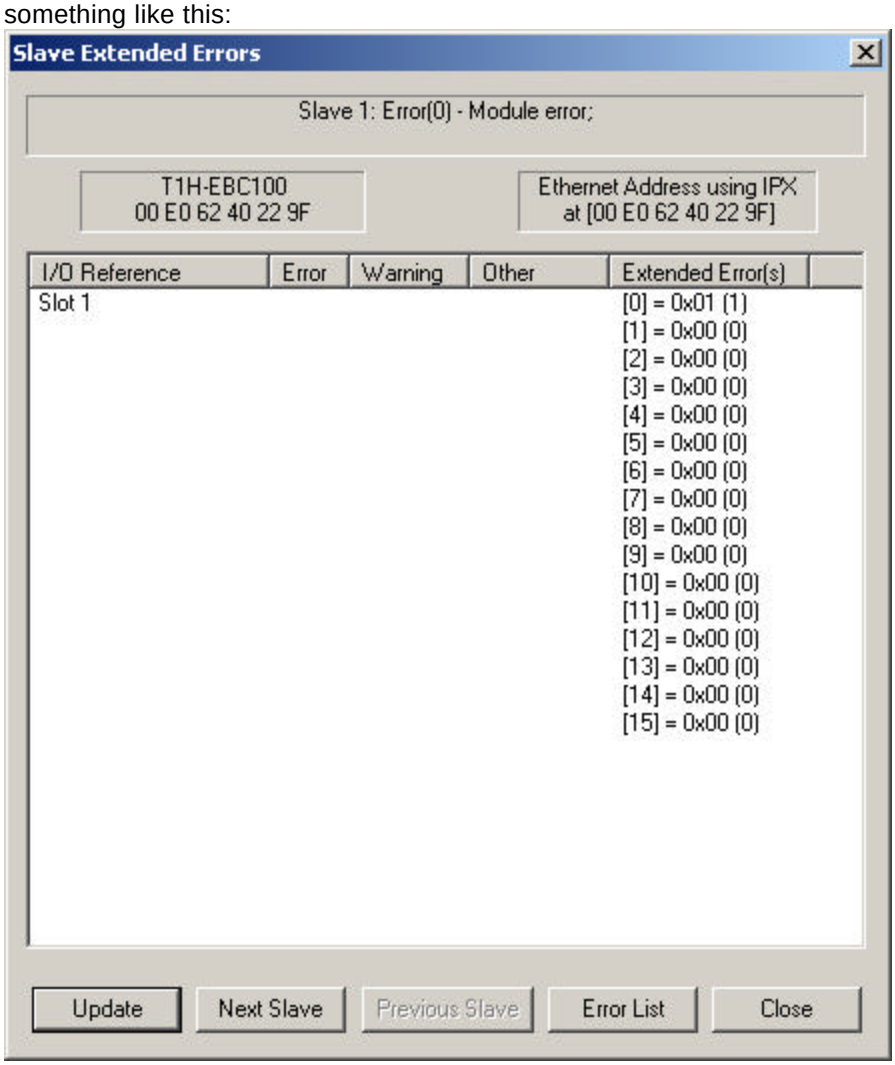
The ERM Workbench software will tell you what the mapping is for each I/O module in the T1H-EBC base. Once you have configured the ERM you will get a screen similar to this:



The I/O Configuration for the above screen shot is:
Slot 1 = T1F-14THM
Slot 2 = T1F-16DA-2
Slot 3 = T1F-8AD2DA-2
Slot 4 = T1F-08AD-2
Slot 5 = T1F-08DA-2
Slot 6 = T1K-08NA-1
Slot 7 = T1K-08TR

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.

DIAGNOSTICS NOTE:
Click on ‘Slave 1’s Error List’ to see any errors associated with that slave. It should look something like this:



Note that reading the error using ERM Workbench as shown above also clears the error if the error condition has been removed. In order to read and clear the error using ladder logic you would need to add logic as shown in Appendix B of the H24-ERM-M manual:
http://www.automationdirect.com/static/manuals/h24ermm/appxb.pdf

Part Number	Channel Data **Note: 'V' is the V-Memory Location listed under the 'PLC Start' column in ERM Workbench. The offset is in octal so if the 'PLC Start' address is V2000 then V+36=V2036.**	Configuration Data	Diagnostic Data **See DIAGNOSTICS NOTE above**
T1F-08AD-1	**Input Data** V+0 = Ch1 V+2 = Ch2 … V+14 = Ch7 V+16 = Ch8	**No Software Configuration** Input Range Depends on Input Signal -20 to 20mA = -8192 to 8191 0 to 20mA = 0 to 8191 4 to 20mA = 1638 to 8191	No Built-In Broken Transmitter Detection Monitor for counts less than 1638
T1F-08AD-2	**Input Data** V+0 = Ch1 V+2 = Ch2 … V+14 = Ch7 V+16 = Ch8	**No Software Configuration** 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	No Broken Transmitter Detection (N/A for Voltage)
T1F-16AD-1	**Input Data** V+0 = Ch1 V+2 = Ch2 … V+34 = Ch15 V+36 = Ch16	**No Software Configuration** Input Range Depends on Input Signal -20 to 20mA = -8192 to 8191 0 to 20mA = 0 to 8191 4 to 20mA = 1638 to 8191	No Built-In Broken Transmitter Detection Monitor for counts less than 1638

<table>
<tr>
<td>T1F-16AD-2</td>
<td>Input Data
V+0 = Ch1
V+2 = Ch2
…
V+34 = Ch15
V+36 = Ch16</td>
<td>No Software Configuration

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</td>
<td>No Broken Transmitter Detection (N/A for Voltage)</td>
</tr>
<tr>
<td>T1F-14THM</td>
<td>Input Data
V+0 = Ch1
V+2 = Ch2
…
V+30 = Ch13
V+32 = Ch14
V+34 = Status 1
V+36 = Status 2

Status info is only available if T1F-14THM is date code 1205 or later. See Rev F Data Sheet for details.</td>
<td>No Software Configuration

THM Type Set by Jumpers

Status 1 Data
<table>
<tr><td>Bit 0-3</td><td>Number of Channels Enabled (Inverted)
0001 = All Channels
1110 = One Channel</td></tr>
<tr><td>Bit 4</td><td>T/C Type Jumper 0
0=installed, 1=removed</td></tr>
<tr><td>Bit 5</td><td>T/C Type Jumper 1</td></tr>
<tr><td>Bit 6</td><td>T/C Type Jumper 2</td></tr>
<tr><td>Bit 7</td><td>T/C Type Jumper 3</td></tr>
<tr><td>Bit 8</td><td>Units 0 Jumper</td></tr>
<tr><td>Bit 9</td><td>Units 1 Jumper</td></tr>
<tr><td>Bit 10</td><td>Calibrate Enable Jumper</td></tr>
<tr><td>Bit 11</td><td>CJC Installed
0=Yes, 1=No</td></tr>
<tr><td>Bits 12,13</td><td>Always ON</td></tr>
<tr><td>Bits 14-15</td><td>Always OFF</td></tr>
<tr><td></td><td></td></tr>
</table>
Status 2 Data is the Temperature of the CJC with one implied decimal place.</td>
<td>Broken Thermocouple Indication. The channel data goes to zero and ERM Workbench ‘Slave Error List’ shows error in ‘Extended Error’ column.</td>
</tr>
</table>

<table>
<tr>
<td>T1F-16RTD</td>
<td>Input Data
V+0 = Ch1
V+2 = Ch2
…
V+34 = Ch15
V+36 = Ch16</td>
<td>No Software Configuration

RTD Type Set by Jumpers</td>
<td>Broken RTD Indication. The channel data goes to zero and ERM Workbench ‘Slave Error List’ shows error in ‘Extended Error’ column.</td>
</tr>
<tr>
<td>T1F-8AD4DA-1</td>
<td>Input Data
V+0 = Ch1
V+2 = Ch2
…
V+14 = Ch7
V+16 = Ch8

Output Data
V+0 = Ch1
V+2 = Ch2
V+4 = Ch3
V+6 = Ch4</td>
<td>8 Discrete Output Bits

Analog Output Configuration
<table>
<tr><td>Y+0</td><td>Output Enable
0 – Outputs OFF
1 – Outputs Enabled</td></tr>
<tr><td>Y+1</td><td>N/A</td></tr>
<tr><td>Y+2</td><td>N/A</td></tr>
<tr><td>Y+3</td><td>0-20mA/4-20mA
0 – 0-20mA range
1 – 4-20mA range</td></tr>
<tr><td>Y+4 to Y+7</td><td>Reserved</td></tr>
</table>
Input Range Depends on Input Signal
-20 to 20mA = -8192 to 8191
0 to 20mA = 0 to 8191
4 to 20mA = 1638 to 8191</td>
<td>No Built-In Broken Transmitter Detection

Monitor for counts less than 1638</td>
</tr>
<tr>
<td>T1F-8AD4DA-2</td>
<td>Input Data
V+0 = Ch1
V+2 = Ch2
…
V+14 = Ch7
V+16 = Ch8

Output Data
V+0 = Ch1
V+2 = Ch2
V+4 = Ch3
V+6 = Ch4</td>
<td>8 Discrete Output Bits

Analog Output Configuration
<table>
<tr><td>Y+0</td><td>Output Enable
0 – Outputs OFF
1 – Outputs Enabled</td></tr>
<tr><td>Y+1</td><td>Unipolar/Bipolar
0 – Unipolar
1 – Bipolar</td></tr>
<tr><td>Y+2</td><td>5V/10V Range
0 – 5V Range
1 – 10V Range</td></tr>
<tr><td>Y+3</td><td>N/A</td></tr>
<tr><td>Y+4 to Y+7</td><td>Reserved</td></tr>
</table>
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</td>
<td>No Broken Transmitter Detection (N/A for Voltage)</td>
</tr>
</table>

<table>
<tr>
<td>T1F-08DA-1</td>
<td>Output Data
V+0 = Ch1
V+2 = Ch2
…
V+14 = Ch7
V+16 = Ch8</td>
<td>8 Discrete Output Bits

Analog Output Configuration
<table>
<tr><td>Y+0</td><td>Output Enable
0 – Outputs OFF
1 – Outputs Enabled</td></tr>
<tr><td>Y+1</td><td>N/A</td></tr>
<tr><td>Y+2</td><td>N/A</td></tr>
<tr><td>Y+3</td><td>0-20mA/4-20mA
0 – 0-20mA range
1 – 4-20mA range</td></tr>
<tr><td>Y+4 to Y+7</td><td>Reserved</td></tr>
</table></td>
<td>None</td>
</tr>
<tr>
<td>T1F-08DA-2</td>
<td>Output Data
V+0 = Ch1
V+2 = Ch2
…
V+14 = Ch7
V+16 = Ch8</td>
<td>8 Discrete Output Bits

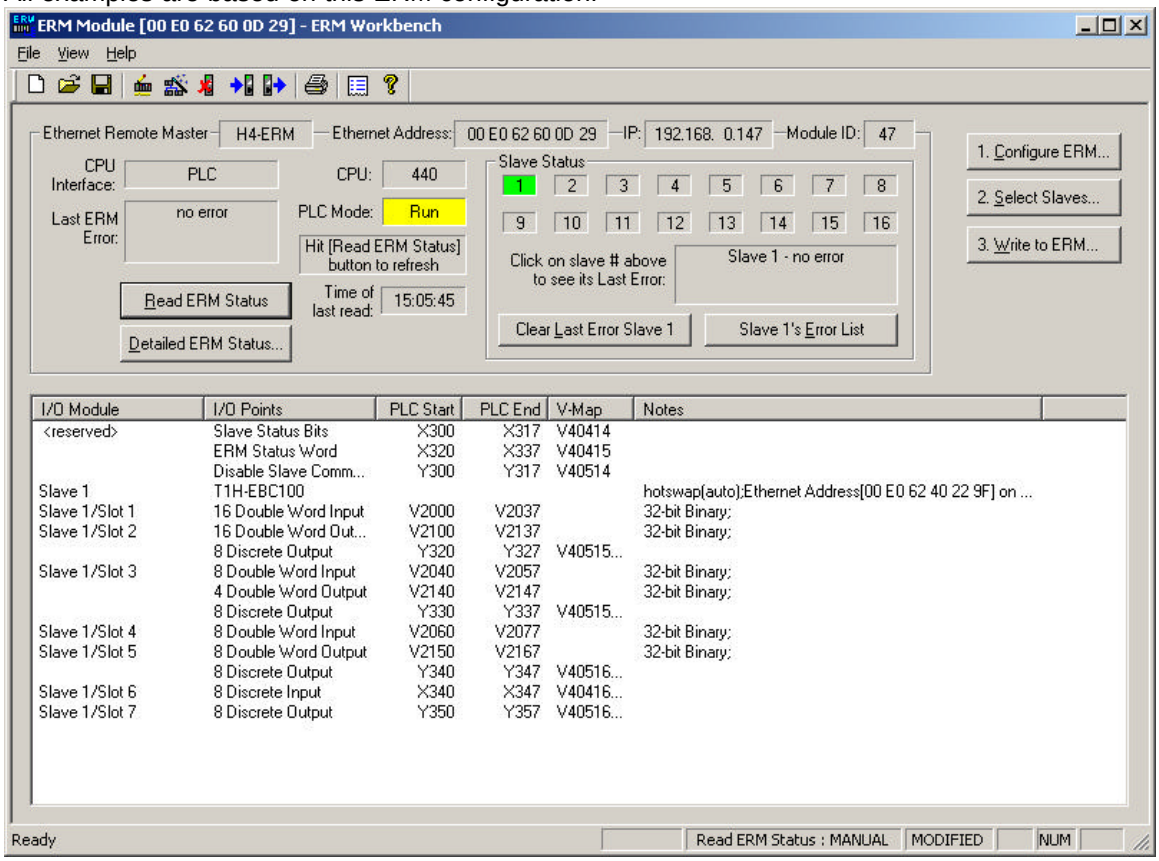
Analog Output Configuration
<table>
<tr><td>Y+0</td><td>Output Enable
0 – Outputs OFF
1 – Outputs Enabled</td></tr>
<tr><td>Y+1</td><td>Unipolar/Bipolar
0 – Unipolar
1 – Bipolar</td></tr>
<tr><td>Y+2</td><td>5V/10V Range
0 – 5V Range
1 – 10V Range</td></tr>
<tr><td>Y+3</td><td>N/A</td></tr>
<tr><td>Y+4 to Y+7</td><td>Reserved</td></tr>
</table></td>
<td>None</td>
</tr>
<tr>
<td>T1F-16DA-1</td>
<td>Output Data
V+0 = Ch1
V+2 = Ch2
…
V+34 = Ch15
V+36 = Ch16</td>
<td>8 Discrete Output Bits

Analog Output Configuration
<table>
<tr><td>Y+0</td><td>Output Enable
0 – Outputs OFF
1 – Outputs Enabled</td></tr>
<tr><td>Y+1</td><td>N/A</td></tr>
<tr><td>Y+2</td><td>N/A</td></tr>
<tr><td>Y+3</td><td>0-20mA/4-20mA
0 – 0-20mA range
1 – 4-20mA range</td></tr>
<tr><td>Y+4 to Y+7</td><td>Reserved</td></tr>
</table></td>
<td>None</td>
</tr>
<tr>
<td>T1F-16DA-2</td>
<td>Output Data
V+0 = Ch1
V+2 = Ch2
…
V+34 = Ch15
V+36 = Ch16</td>
<td>8 Discrete Output Bits

Analog Output Configuration
<table>
<tr><td>Y+0</td><td>Output Enable
0 – Outputs OFF
1 – Outputs Enabled</td></tr>
<tr><td>Y+1</td><td>Unipolar/Bipolar
0 – Unipolar
1 – Bipolar</td></tr>
<tr><td>Y+2</td><td>5V/10V Range
0 – 5V Range
1 – 10V Range</td></tr>
<tr><td>Y+3</td><td>N/A</td></tr>
<tr><td>Y+4 to Y+7</td><td>Reserved</td></tr>
</table></td>
<td>None</td>
</tr>
<tr><td></td><td></td><td></td><td></td></tr>
</table>

Examples

All examples are based on this ERM configuration:



T1F-14THM Example

Example Setup
24VDC is applied to the T1F-14THM in Slave 1 Slot 1 and all channels are shorted CH+ to CH-.

The V-memory mapping is:
V2000 = Channel 1 Temperature
V2002 = Channel 2 Temperature
V2004 = Channel 3 Temperature
V2006 = Channel 4 Temperature
V2010 = Channel 5 Temperature
V2012 = Channel 6 Temperature
V2014 = Channel 7 Temperature
V2016 = Channel 8 Temperature
V2020 = Channel 9 Temperature
V2022 = Channel 10 Temperature
V2024 = Channel 11 Temperature
V2026 = Channel 12 Temperature
V2030 = Channel 13 Temperature
V2032 = Channel 14 Temperature
V2034 = Status
V2036 = CJC Temperature

Data1

E↓ Decimal DWORD

	Element	Status
1		
2	V2000	806
3	V2002	809
4	V2004	811
5	V2006	815
6	V2010	811
7	V2012	819
8	V2014	821
9	V2016	813
10	V2020	799
11	V2022	803
12	V2024	805
13	V2026	809
14	V2030	806
15	V2032	788
16	V2034	0011010000000001
17	V2036	272

All V-memory in this DirectSoft Data View is displayed as Decimal DWORD except V2034 which is displayed as Binary WORD.

All Channels read the terminal block ambient temperature when shorted (degrees F in this configuration).

V2034 Is the Status Word

Bit 0-3	All Channels Enabled (0001)
Bit 4	T/C Type Jumper 0 Installed (0)
Bit 5	T/C Type Jumper 1 Installed (0)
Bit 6	T/C Type Jumper 2 Installed (0)
Bit 7	T/C Type Jumper 3 Installed (0)
Bit 8	Units 0 Jumper Installed (0)
Bit 9	Units 1 Jumper Installed (0)
Bit 10	Calibrate Enable Jumper Removed (1)
Bit 11	CJC Installed Yes (0)
Bits 12,13	Always ON
Bits 14-15	Always OFF

V2036 is the CJC temperature reading in degrees C with one implied decimal place. So 27.2C = 80.9F.

T1F-14THM Example (continued)

Broken Thermocouple

24VDC is applied to the T1F-14THM and all channels are shorted CH+ to CH- except Channel 8 which is open.

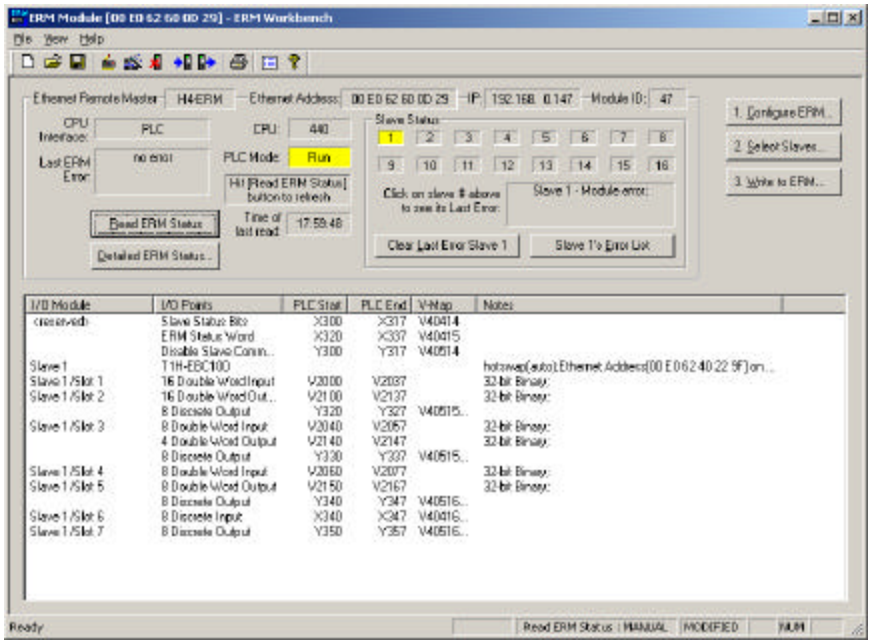
Data1

E↓ Binary WORD

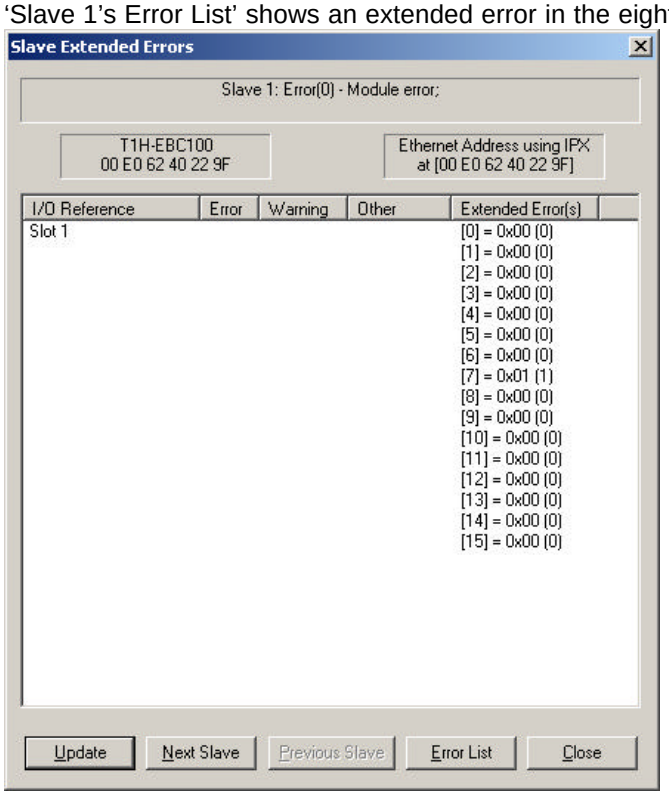
	Element	Status
1		
2	V2000	807
3	V2002	810
4	V2004	812
5	V2006	815
6	V2010	812
7	V2012	820
8	V2014	821
9	V2016	0
10	V2020	801
11	V2022	804
12	V2024	806
13	V2026	810
14	V2030	807
15	V2032	789
16	V2034	0011010000000001
17	V2036	272

All Channels read the terminal block ambient temperature when shorted (degrees F in this configuration) except the open channel 8 which reads 0.

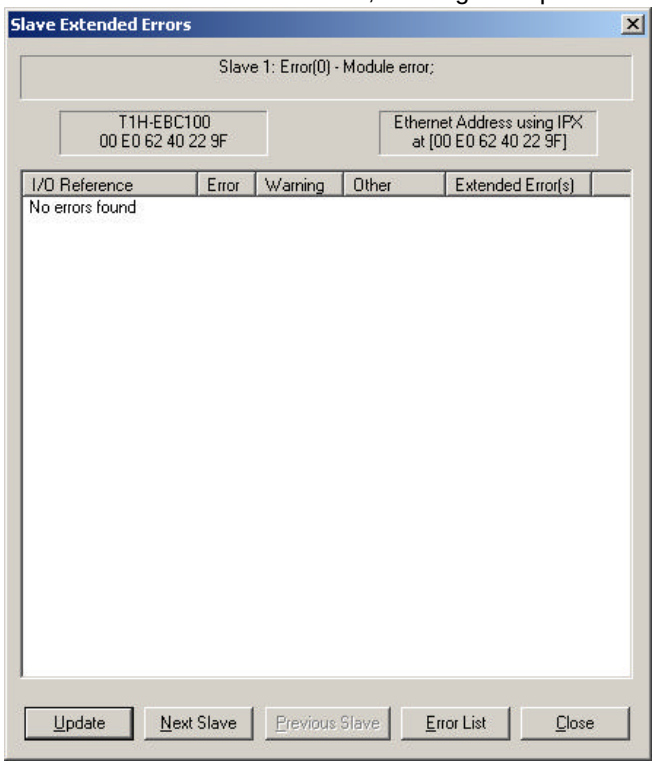
ERM Workbench indicates an error on slave 1.



‘Slave 1’s Error List’ shows an extended error in the eighth entry (7).



After Channel 8 is reconnected, clicking on ‘Update’ will show the error has cleared.



T1F-16DA-2 Example

Example Setup
24VDC is applied to the T1F-16DA2 in Slave 1 Slot 2 and a multi-meter is used to measure the output. The outputs are enabled and configured for -5 to +5V range.

Data1

Decimal | DWORD

	Element	Status	Edits
1			
2	V2100	0	0
3	V2102	270	270
4	V2104	525	525
5	V2106	780	780
6	V2110	1035	1035
7	V2112	1545	1545
8	V2114	1800	1800
9	V2116	2055	2055
10	V2120	2310	2310
11	V2122	2565	2565
12	V2124	2820	2820
13	V2126	3075	3075
14	V2130	3330	3330
15	V2132	3585	3585
16	V2134	3840	3840
17	V2136	4095	4095
18			
19	Y320	ON	ON OFF
20	Y321	ON	ON OFF
21	Y322	OFF	ON OFF
22	Y323	OFF	ON OFF
23	Y324	OFF	ON OFF
24	Y325	OFF	ON OFF
25	Y326	OFF	ON OFF
26	Y327	OFF	ON OFF

All V-memory in this DirectSoft Data View is displayed as Decimal DWORD.

V2100 = Channel 1 / 0 = -5V
V2102 = Channel 2 / 270 = -4.34V
V2104 = Channel 3 / 525 = -3.71V
V2106 = Channel 4 / 780 = -3.09V
V2110 = Channel 5 / 1035 = -2.47V
V2112 = Channel 6 / 1545 = -1.22V
V2114 = Channel 7 / 1800 = -0.60V
V2116 = Channel 8 / 2055 = 0.01V
V2120 = Channel 9 / 2310 = 0.64V
V2122 = Channel 10 / 2565 = 1.26V
V2124 = Channel 11 / 2820 = 1.88V
V2126 = Channel 12 / 3075 = 2.50V
V2130 = Channel 13 / 3330 = 3.13V
V2132 = Channel 14 / 3585 = 3.75V
V2134 = Channel 15 / 3840 = 4.37V
V2136 = Channel 16 / 4095 = 5V

Y320 = ON for Output Enable
Y321 = ON selects Bipolar output
Y322 = OFF selects 5V output range
Y323 to Y327 = N/A

T1F-8AD2DA-2 Example

Example Setup
24VDC is applied to the T1F-8AD4DA-2 in Slave 1 Slot 3. Ch1 output is tied to Ch1 and 2 input, Ch2 output is tied to Ch3 and 4 input, Ch3 output is tied to Ch5 and 6 input, Ch4 output is tied to Ch7 and 8 input. The outputs are enabled and configured for -10 to +10V range.

Data1

BCD/Hex | DWORD

	Element	Status	Edits
1			
2	V2040	-4096	0
3	V2040	FFFFF000	
4	V2042	-4097	0
5	V2042	FFFFEFFF	
6	V2044	1	0
7	V2046	1	0
8	V2050	4098	0
9	V2052	4099	0
10	V2054	8191	0
11	V2056	8191	0
12			
13	V2140	1024	1024
14	V2142	2048	2048
15	V2144	3072	3072
16	V2146	4095	4095
17			
18	Y330	ON	ON OFF
19	Y331	ON	ON OFF
20	Y332	ON	ON OFF
21	Y333	OFF	ON OFF
22	Y334	OFF	ON OFF
23	Y335	OFF	ON OFF
24	Y336	OFF	ON OFF
25	Y337	OFF	ON OFF

V2040 and V2042 are displayed as both Signed Decimal DWORD and BCD/Hex DWORD in this DirectSoft Data View.

V2044-V2056 are displayed as Signed Decimal DWORD.

V2140-V2146 are displayed as Decimal DWORD.

V2040 = Ch1 AI / -4096 = -10V
V2042 = Ch2 AI / -4096 = -10V
V2044 = Ch3 AI / 1 = 0V
V2046 = Ch4 AI / 1 = 0V
V2050 = Ch5 AI / 4098 = 5V
V2052 = Ch6 AI / 4099 = 5V
V2054 = Ch7 AI / 8191 = 10V
V2056 = Ch8 AI / 8191 = 10V

V2140 = Ch1 AO / 1024 = -10V
V2142 = Ch2 AO / 2048 = 0V
V2144 = Ch3 AO / 3072 = 5V
V2146 = Ch4 AO / 4095 = 10V

Y330 = ON for Output Enable
Y331 = ON selects Bipolar output
Y332 = ON selects 10V output range
Y333 to Y337 = N/A

T1F-08AD-2 Example

Example Setup
24VDC is applied to the T1F-08AD-2 in Slave 1 Slot 4. Voltage is applied to all eight channels.

Data3

BCD/Hex | DWORD

	Element	Status
1	V2060	-4097
2	V2060	FFFFEFFF
3	V2062	-4097
4	V2062	FFFFEFFF
5	V2064	1
6	V2066	1
7	V2070	4097
8	V2072	4097
9	V2074	8190
10	V2076	8191

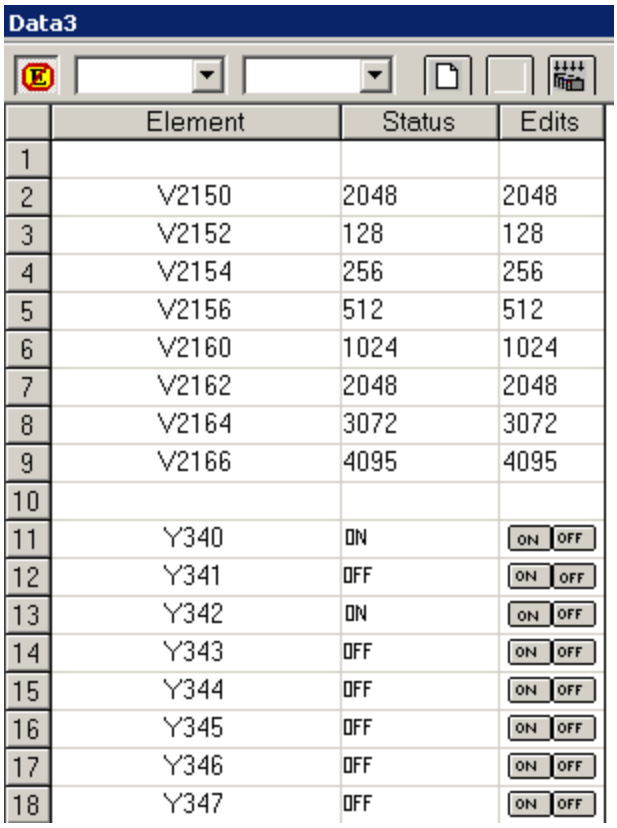
V2060 and V2062 are displayed as both Signed Decimal DWORD and BCD/Hex DWORD in this DirectSoft Data View.

V2064-V2076 are displayed as Signed Decimal DWORD.

V2060 = Ch1 AI / -4097 = -10V
V2062 = Ch2 AI / -4097 = -10V
V2064 = Ch3 AI / 1 = 0V
V2066 = Ch4 AI / 1 = 0V
V2070 = Ch5 AI / 4097 = 5V
V2072 = Ch6 AI / 4097 = 5V
V2074 = Ch7 AI / 8190 = 10V
V2076 = Ch8 AI / 8191 = 10V

T1F-08DA-2 Example

Example Setup
24VDC is applied to the T1F-08DA-2 in Slave 1 Slot 5 and a multi-meter is used to measure the output. The outputs are enabled and configured for 0 to 10V range.



	Element	Status	Edits
1			
2	V2150	2048	2048
3	V2152	128	128
4	V2154	256	256
5	V2156	512	512
6	V2160	1024	1024
7	V2162	2048	2048
8	V2164	3072	3072
9	V2166	4095	4095
10			
11	Y340	ON	ON OFF
12	Y341	OFF	ON OFF
13	Y342	ON	ON OFF
14	Y343	OFF	ON OFF
15	Y344	OFF	ON OFF
16	Y345	OFF	ON OFF
17	Y346	OFF	ON OFF
18	Y347	OFF	ON OFF

All V-memory in this DirectSoft Data View is displayed as Decimal DWORD.

V2150 = Channel 1 / 2048 = 5V
V2152 = Channel 2 / 128 = 0.32V
V2154 = Channel 3 / 256 = 0.63V
V2156 = Channel 4 / 512 = 1.25V
V2160 = Channel 5 / 1024 = 2.5V
V2162 = Channel 6 / 2048 = 5V
V2164 = Channel 7 / 3072 = 7.5V
V2166 = Channel 8 / 4095 = 10V

Y340 = ON for Output Enable
Y341 = OFF selects Unipolar output
Y342 = ON selects 10V output range
Y343 to Y347 = N/A