2.2.2 VitalSensors VS-3000 Sensor System - CompactLogix EtherNet/IP Setup

Connecting a VitalSensors VS-3000 System to CompactLogix PLC with EtherNet/IP

Objective:

- Integrating a VS-3000 Sensor System with a CompactLogix PLC using EtherNet/IP

Equipment:

- CompactLogix PLC
- CompactLogix Instruction Manual
- RS/Logix 5000/RSLinx
- EtherNet/IP interface
- PC or laptop
- VS-3000 Sensor System

While every effort was made to verify the following information, no warranty of accuracy or usability is expressed or implied.

Overview:

The purpose of this document is to describe the configuration steps necessary to establish a communication path between the VS-3000 Sensor System and a CompactLogix unit. You will need either a 1756-ENET/B or a 1756-ENBT/A together with a CompactLogix controller. It may be possible to upgrade a 1756-ENET/A to the required 1756-ENET/B by flashing the firmware; you should check the hardware version with your vendor before hand to ensure its suitability. You will also need Rockwell Software's RSLinx and RSLogix 5000 software configuration utilities.

In the following example, the CompactLogix will establish a Class1 connection and I/O data will be exchanged between the CompactLogix and the Modular Controller. The network parameters used in this example will almost certainly not apply to your application. Be sure to consult your network administrator when selecting appropriate values.

The VS-3000 Sensor System has the ability for two way communications (inputs and outputs) with a CompactLogix controller. Sensor measurement data can be sent real-time while tasks such as brand changes or system offsets can also set from the CompactLogix.

Initial setup of VS-300 / VS-200 SMS for EtherNet/IP

If you have requested EtherNet/IP functionality with your order, then steps 3 & 4 will be configured for you at the VitalSensors factory.

1. Connect the VS-300 / VS-200 SMS controller to the plant Ethernet network and PLC with an CAT-5 Ethernet cable. The Ethernet connection port is located on the bottom of the VS-300 / VS-200 SMS controller.

   NOTE: You may need to change the fixed IP address on your VS-300 / VS-200 to be in the same domain as the PLC / Plant Network. To do this you must first disable the Advantech Enhanced Write Lock Filter (which protects the system files from unintended changes).

2. Using a laptop or other networked computer, open Windows Remote Desktop Connection and connect to the VS-300/VS-200SMS (the default target IP address is 192.168.1.75). The username is "Administrator" and the password field is left blank.

3. The *VS-3000 DASHBOARD* program will already be running minimized on the Windows desktop. Maximize the program and click **Edit**>>Dashboard Parameters. Verify the number in the *Fieldbus* row; it should be "**4**" for EtherNet/IP. See the *Figure: 1* below.

4. Set the desired *Fieldbus Update Rate* (the speed at which VS-3000 Dashboard sends/receives information to/from the PLC). The default (recommended) value is 1000mses. Click *Save*, the *VS-3000 Dashboard* program will re-start

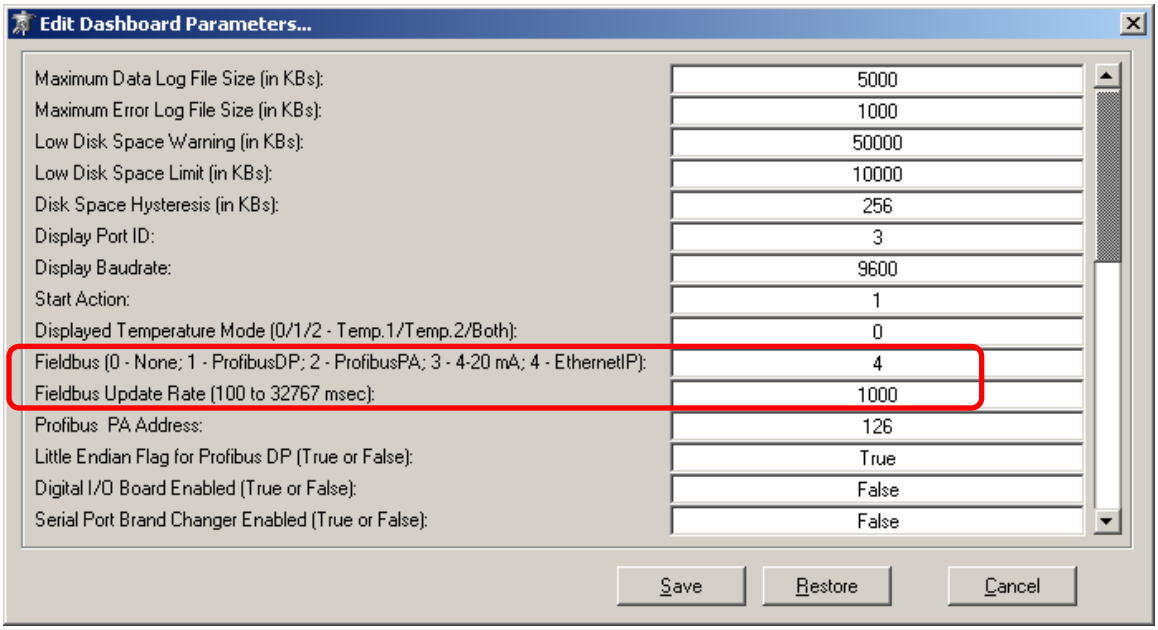

Figure: 1

5. After the VS-3000 Dashboard re-starts. Click on **Edit**>>EtherNetIP. The *EtherNet/IP* setup box will appear. See *Fig. 2* below.

4 Enter the IP address of the CompactLogix PLC.

5. The input and output tag names **must match** the tags set in the RSLogix 5000 software. The defaults are "VitalSensorsIn" and "VitalSensorsOut".

6. The timeout parameters can also be changed on this screen.

7. If you plan to enter product / brand ID's into the VS-300 / VS-200 SMS, you will need to specify if product changes are handled by the PLC or VS-300 / VS-200 SMS (to avoid conflicting signals). See *Change Product Handling* in *Fig. 2* below. If you plan to enter brands/products in the PLC and only use raw sensor outputs, then ignore this function.

8. The offset in Writing and Reading Parameters allows for memory location offsets.

9. Save any changes made. Click "X" in the top right corner to close this menu.

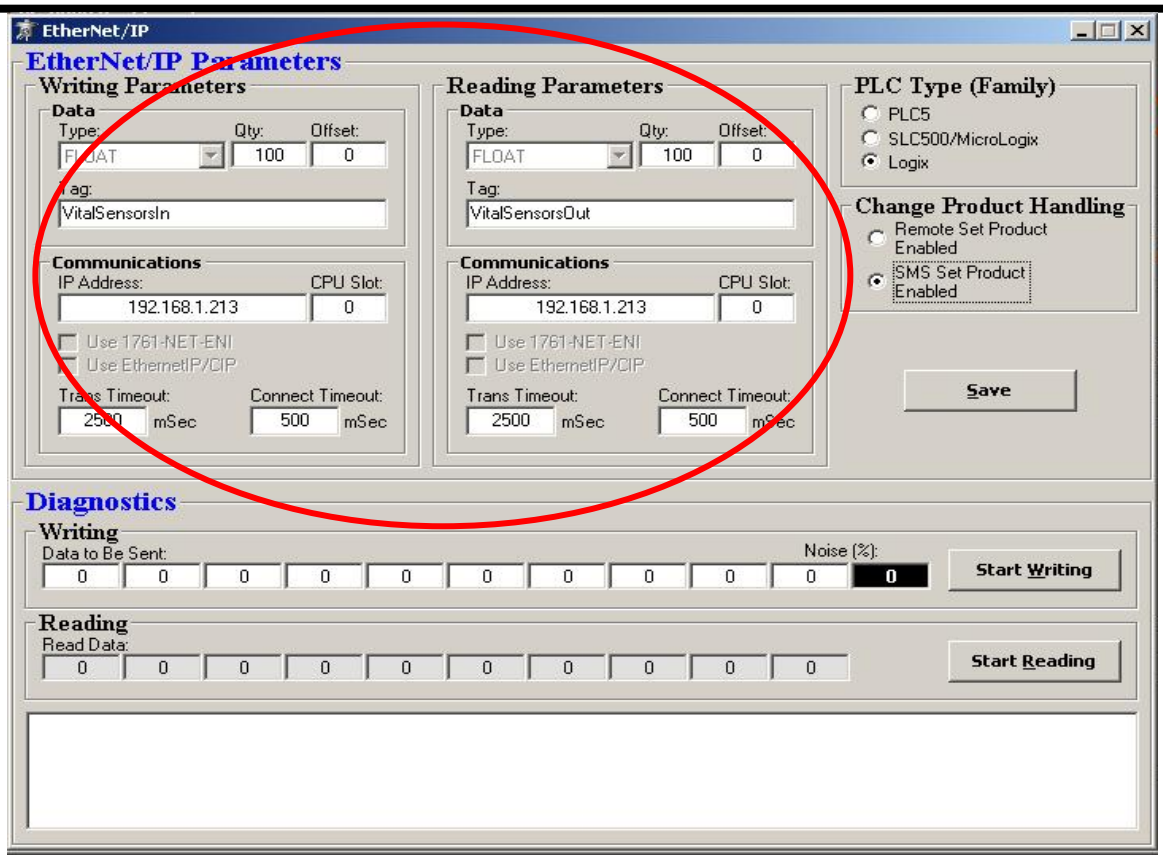

Figure: 2

COMPACTLOGIX SOFTWARE CONFIGURATION

1. Create a New Project in RSLogix 5000

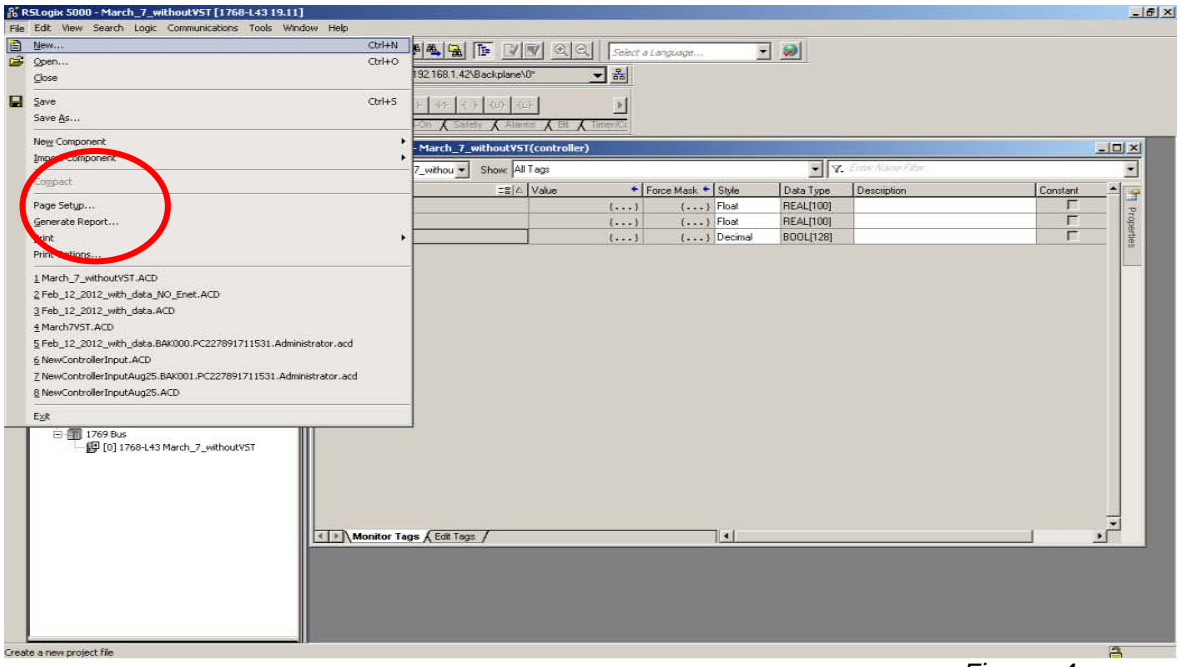

Figure: 4

2. Select appropriate PLC type and revision (find PLC type using RSLinx)

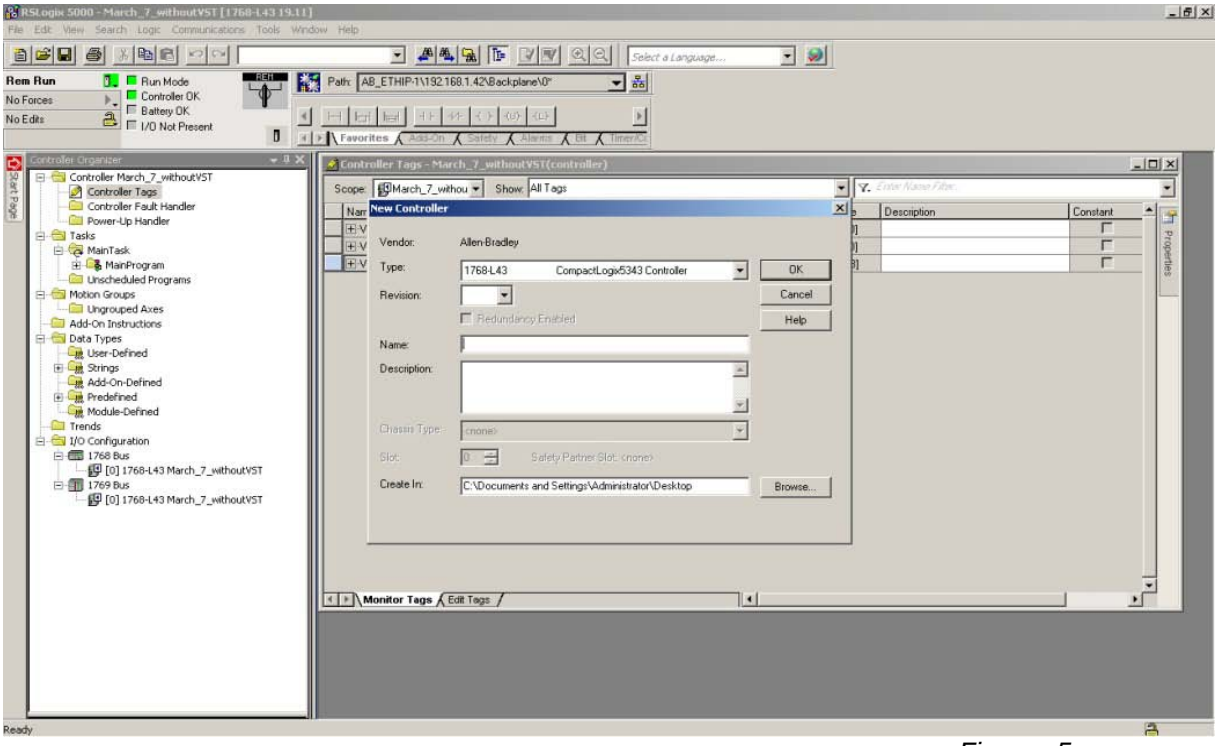

Figure: 5

3. Enter a name and save

4. Go to Communications>>Who Active. See *Figure 6* below

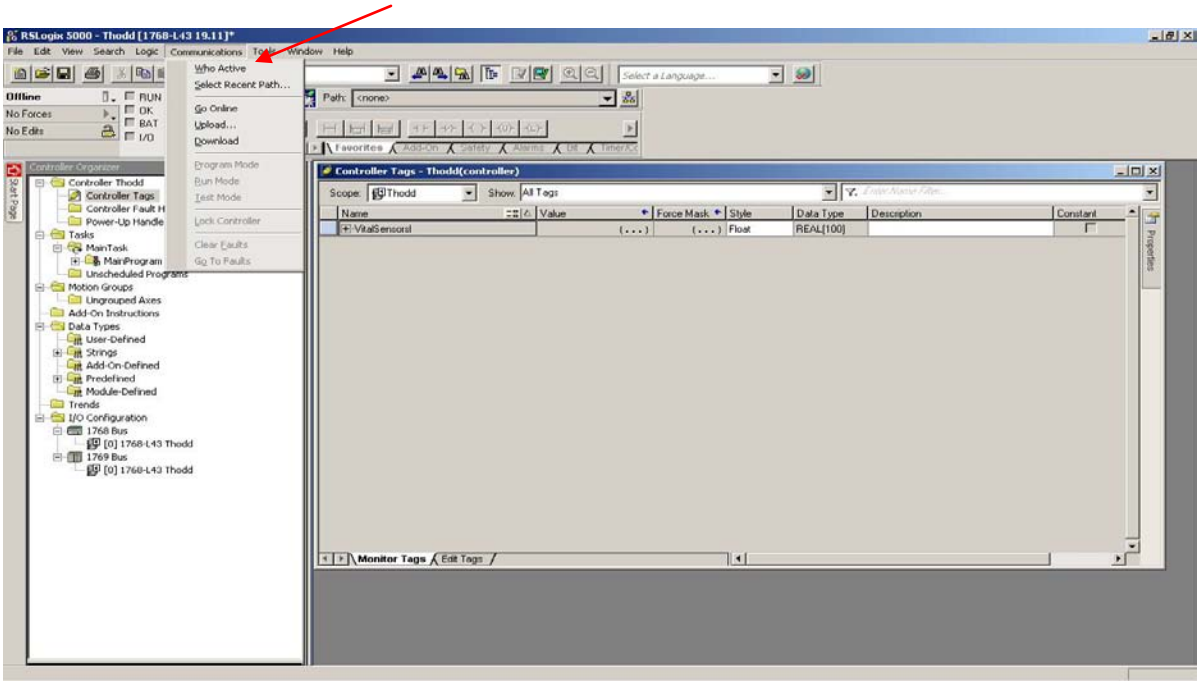

Figure: 6

5. Expand the ETHB node to find processor used and highlight

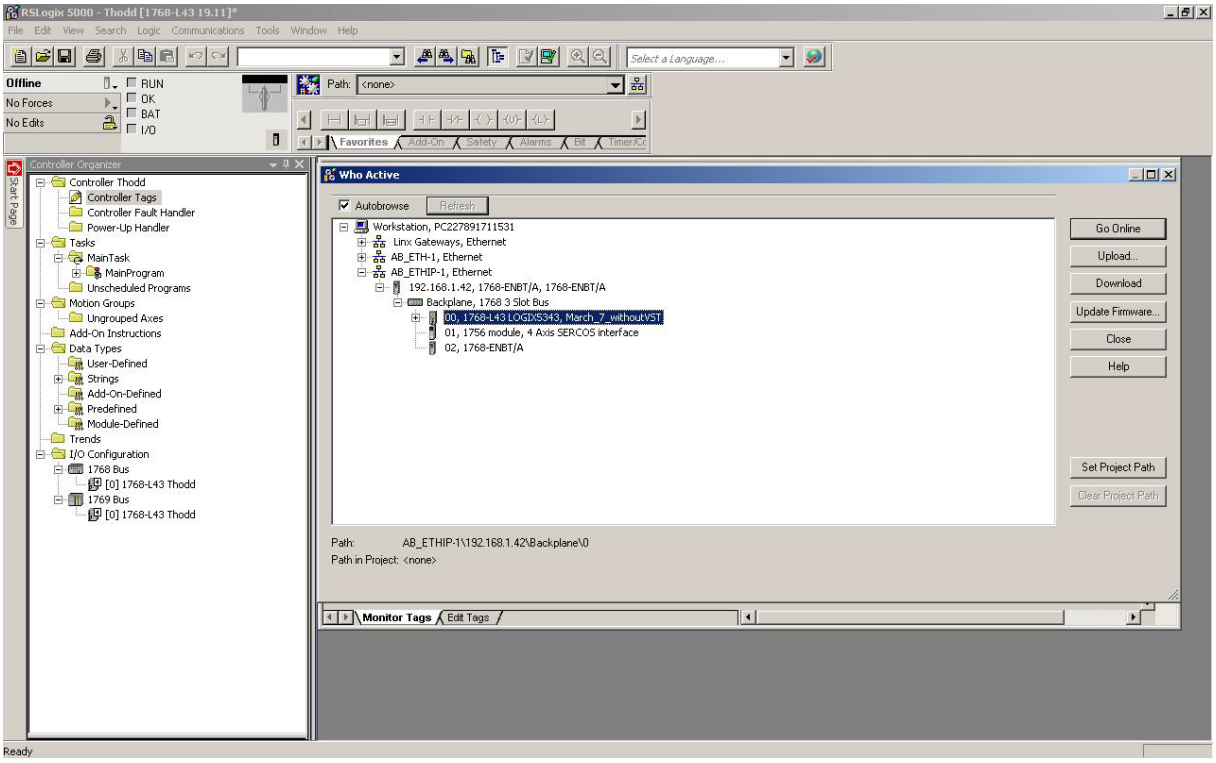

Figure: 7

6. In Controller Organizer double click on Controller Tags and click on *Edit Tags* tab. See *Figure 8* below.

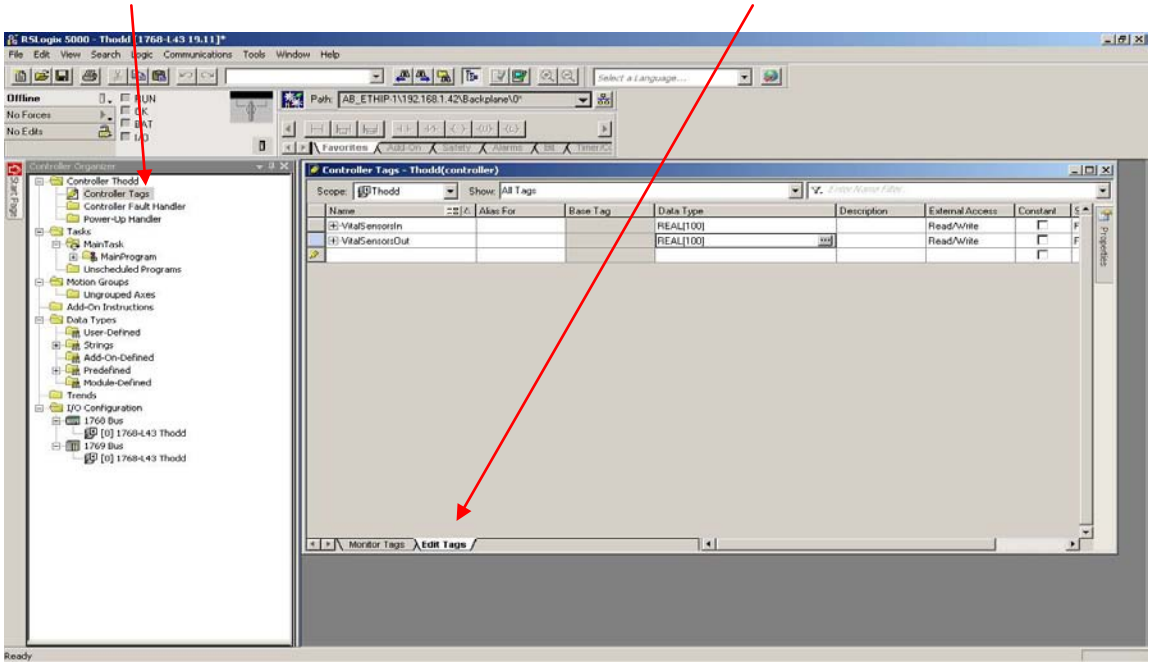

Figure: 8

7. Create Tag **VitalSensorsIn** for input, REAL, 100 elements. See *Figure 9* below.

8. Create Tag **VitalSensorsOut** for output REAL, 100 elements. See *Figure 9* below.

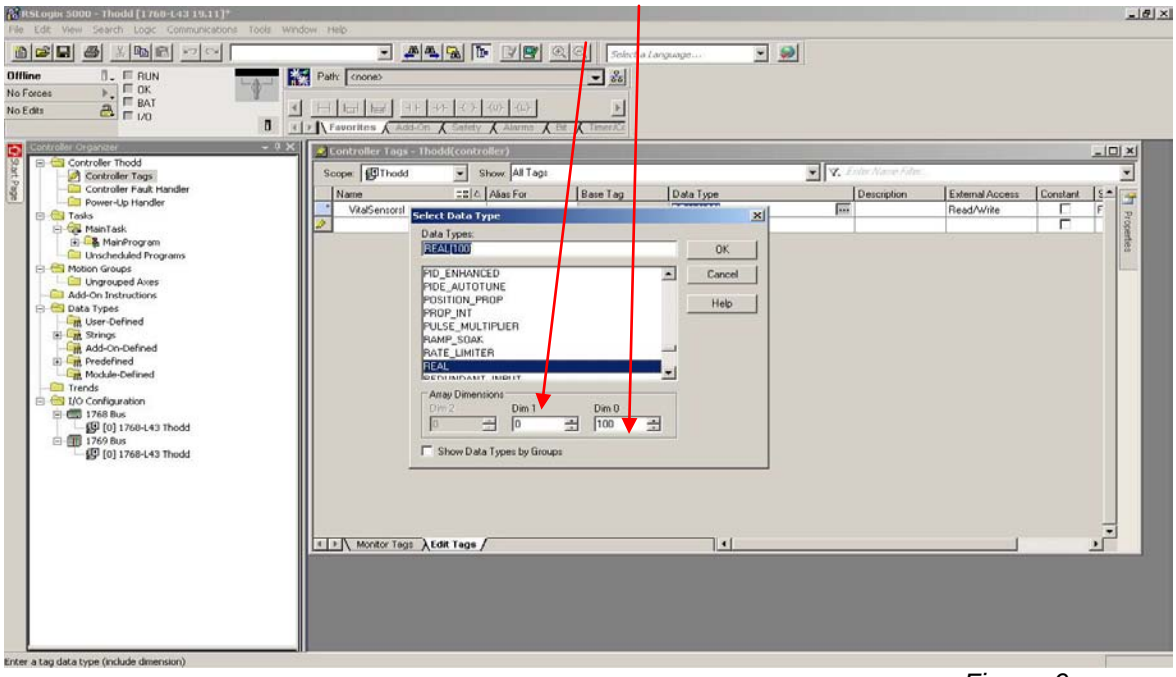

Figure: 9

9. Download new tag setup into PLC. See *Figure 10* below.

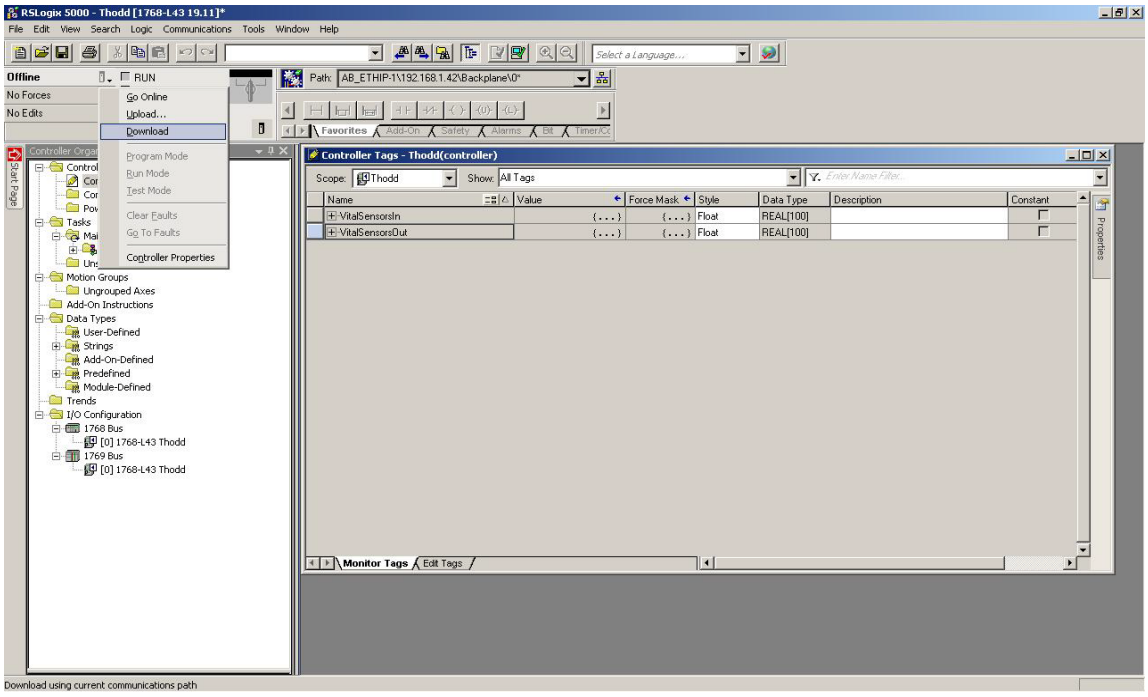

Figure: 10

10. Put PLC in run mode. See *Figure 11* Below.

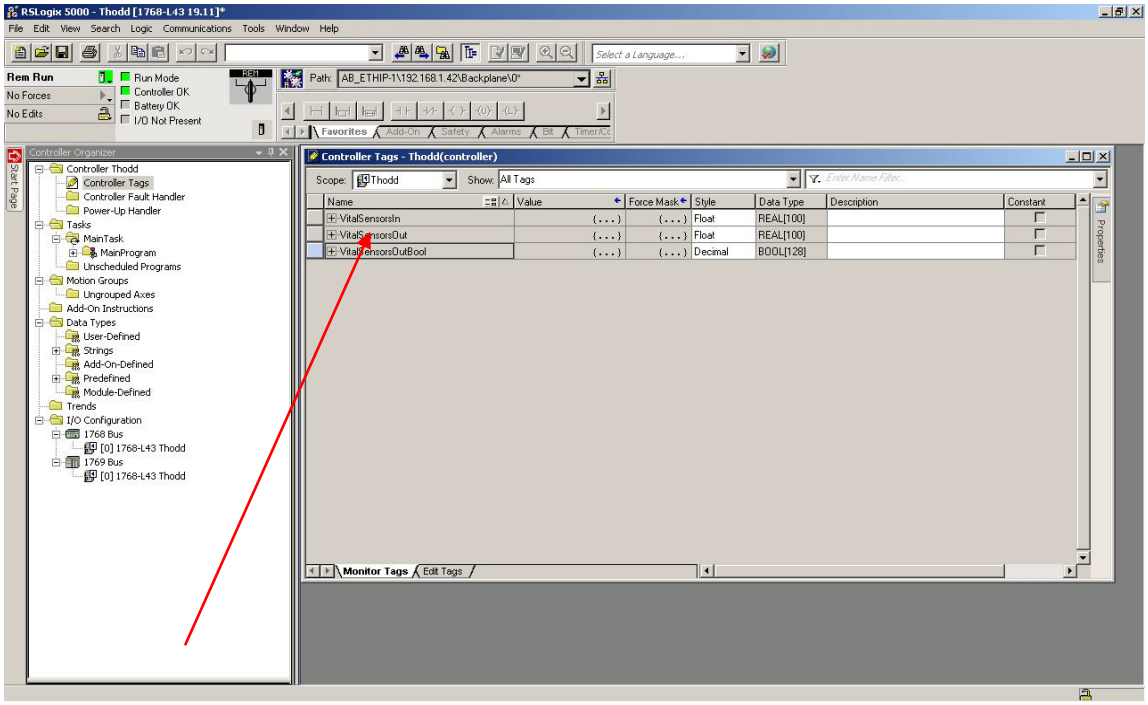

Figure: 11

Expanding the "+" signs on the tag names to see/edit the input and output values.

The instances and sizes are arbitrary, as long as the instance, size, and direction are matched in the configuration of the VitalSensors Controller.

Assembly instance direction is always relative to the originator, which in the case of the current VitalSensors Controller Ethernet/IP implementation is always the device and never the VitalSensors Controller. An *input* instance therefore specifies data flow from the VitalSensors Controller to the device, and an *output* instance specifies data flow from the device to the VitalSensors Controller.

You should now see a new "ETHERNET-MODULE VitalSensors" branch of the 1756-ENET/B node in the I/O Configuration view. You should also see 3 new entries in the Controller Tags

1. Download the new I/O configuration to the controller. Once the download is complete, the controller will automatically establish a new Class 1 connection with the VitalSensors Controller.

Working With Inputs and Outputs

VS-3000 Sensor Systems have the ability to generate data for up to three concentrations and temperature real-time. Depending on the type of sensor the sensor channels are as follows:

- VS-3000BSMA-SS: Beverage, Soft Drink and Juice Monitor

  Channel 1 = Brix *(if ordered)* *Calculated Measurement = Brix/Acid Ratio*
  Channel 2 = Acid *(if ordered)*
  Channel 3 = CO2 *(if ordered)*

- VS-3000BM-SS: Beer Monitor, Wine & Fermentation Monitor

Channel 1 = Ethanol	*(if ordered)*	*Calculated Measurement = Real Degree Fermentation (RDF)*
Channel 2 = Plato (RE)	*(if ordered)*	*Calculated Measurement = Original Extract (OE)*
Channel 3 = CO2	*(if ordered)*	*Calculated Measurement = Specific Gravity (SG)*

Figure 8 and *9* shown above depict the inputs and outputs of a VS-3000 BSMA Beverage, Soft Drink and Juice Monitor. The specific gravity and original gravity positions are for use with the VS-3000 Beer Monitor. The input settings represent all the important settings for the sensor. They include:

Inputs Description:

- Concentrations *(Ethanol, Brix, etc …)*
- Temperature
- Alarm Code
- Current Product ID – "Product 1" is the default unless product brands have been implemented in the VS-300 / VS-200 SMS
- FG = Field Gain by channel
- FO = Field Offset by channel
- PG = Product Gain by channel
- PO = Product Offset by channel

Output Description:

The implementation of outputs requires careful attention due to the fact that a mistake can change all sensor settings. In order to send outputs to the sensor the following process must be followed.

- The specific number required must be set in the "Data Outputs"
- Global Read Enable must be set to "1" from "0" (only "1" enables the function)
- The specific task Read Enable must be set to "1" from "0" (only "1" enables the function)

Example: Changing Product or Brands on the VS-300 / VS-200 SMS

1. Set New Product ID: "number of Product"
2. Set Global Read Enable to: 1 (only "1" enables the function)
3. Set New Product ID Read Enable to: 1 (only "1" enables the function)
4. The VS-300 / VS-200 SMS will send the changes to the "Data Inputs" for verification
5. Once the data is verified and received in "Data Inputs" it is a good practice to return all "Data Output" settings back to "0".

Output Description – Special Cases:

- Line Stop enabled puts system on hold until reset to "0"
- CIP in Progress enabled puts system on hold until reset to "0"

Legend for PLC Inputs

(from VS-300 / VS-200 SMS to PLC)

VitalSensors EtherNet/IP Outputs to PLC		
ID	**Floating Point (Real) Values**	**Type**
0	**Activity Monitor (Random Integer Value)**	DYNAMIC
1	**Ch. 1 Concentration *(if active)***	
2	**Ch. 2 Concentration *(if active)***	
3	**Ch. 3 Concentration *(if active)***	
4	**Detector Temperature**	
5	**Fluid Temperature**	
6	**Error *(Alarm)***	
7	**Specific Gravity *(if active)***	
8	**Original Extract *(if active)***	
9	***Real Degree of Fermentation (if active)***	
10	Current Product ID *(Number)*	STATIC
11	Ch. 1 Field Gain *(if active)*	
12	Ch. 1 Field Offset *(if active)*	
13	Ch. 1 Product Gain *(if active)*	
14	Ch. 1 Product Offset *(if active)*	
15	Ch. 2 Field Gain *(if active)*	
16	Ch. 2 Field Offset *(if active)*	
17	Ch. 2 Product Gain *(if active)*	
18	Ch. 2 Product Offset (if active)	
19	Ch. 3 Field Gain *(if active)*	
20	Ch. 3 Field Offset *(if active)*	
21	Ch. 3 Product Gain *(if active)*	
22	Ch. 3 Product Offset *(if active)*	
23	Detector Temperature Field Gain	
24	Detector Temperature Field Offset	
25	Fluid Temperature Field Gain	
26	Fluid Temperature Field Offset	
27	Fast Average for Reference	
28	Fast Average for Active 2	
29	Fast Average for Active 1	
30	Fast Average for Active 3	
31	Long Average for Reference	
32	Long Average for Active 1	

33	Long Average for Active 2
34	Long Average for Active 3
35	Current Product Long ID *(High Number)*
36	Current Product Long ID *(Low Number)*
37	Ch. 1 Low Spec. Limit
38	Ch. 1 High Spec. Limit
39	Ch. 1 Low Control Limit
40	Ch. 1 High Control Limit
41	Ch. 2 Low Spec. Limit
42	Ch. 2 High Spec. Limit
43	Ch. 2 Low Control Limit
44	Ch. 2 High Control Limit
45	Ch. 3 Low Spec. Limit
46	Ch. 3 High Spec. Limit
47	Ch. 3 Low Control Limit
48	Ch. 3 High Control Limit

Table: 1

Legend for PLC Outputs

(from PLC to VS-300 / VS-200 SMS)

Legend for VS-3000 Dashboard PLC Inputs	
ID	**Description**
0	**Global Read Enable *(1 - Enable, Else - Disable)***
1	New Product ID Read Enable *(1 - Enable, Else - Disable)*
2	New Product ID *(Number)*
3	Line Stop Read Enable *(1 - Enable, Else - Disable)*
4	Line Stop *(1 - Stopped, Else - Activated)*
5	CIP Read Enable *(1 - Enable, Else - Disable)*
6	CIP *(1 - In Progress, Else - Normal)*
7	Ch. 1 Concentration Channel Field Gain Read Enable *(1 - Enable, Else - Disable)*
8	Ch. 1 Concentration Channel Field Gain *(if applicable)*
9	Ch. 1 Concentration Channel Field Offset Read Enable *(1 - Enable, Else - Disable)*
10	Ch. 1 Concentration Channel Field Offset *(if applicable)*
11	Ch. 1 Concentration Channel Product Gain Read Enable *(1 - Enable, Else - Disable)*
12	Ch. 1 Concentration Channel Product Gain *(if applicable)*
13	Ch. 1 Concentration Channel Product Offset Read Enable *(1 - Enable, Else - Disable)*
14	Ch. 1 Concentration Channel Product Offset *(if applicable)*
15	Ch. 2 Concentration Channel Field Gain Read Enable *(1 - Enable, Else - Disable)*
16	Ch. 2 Concentration Channel Field Gain *(if applicable)*
17	Ch. 2 Concentration Channel Field Offset Read Enable *(1 - Enable, Else - Disable)*
18	Ch. 2 Concentration Channel Field Offset *(if applicable)*
19	Ch. 2 Concentration Channel Product Gain Read Enable *(1 - Enable, Else - Disable)*
20	Ch. 2 Concentration Channel Product Gain *(if applicable)*
21	Ch. 2 Concentration Channel Product Offset Read Enable *(1 - Enable, Else - Disable)*
22	Ch. 2 Concentration Channel Product Offset *(if applicable)*
23	Ch. 3 Concentration Channel Field Gain Read Enable *(1 - Enable, Else - Disable)*
24	Ch. 3 Concentration Channel Field Gain *(if applicable)*
25	Ch. 3 Concentration Channel Field Offset Read Enable *(1 - Enable, Else - Disable)*
26	Ch. 3 Concentration Channel Field Offset *(if applicable)*
27	Ch. 3 Concentration Channel Product Gain Read Enable *(1 - Enable, Else - Disable)*
28	Ch. 3 Concentration Channel Product Gain *(if applicable)*
29	Ch. 3 Concentration Channel Product Offset Read Enable *(1 - Enable, Else - Disable)*
30	Ch. 3 Concentration Channel Product Offset *(if applicable)*
31	Detector Temperature Field Gain Read Enable *(1 - Enable, Else - Disable)*

32	Detector Temperature Field Gain
33	Detector Temperature Field Offset Read Enable *(1 - Enable, Else - Disable)*
34	Detector Temperature Field Offset
35	Fluid Temperature Field Gain Read Enable *(1 - Enable, Else - Disable)*
36	Fluid Temperature Field Gain
37	Fluid Temperature Field Offset Read Enable *(1 - Enable, Else - Disable)*
38	Fluid Temperature Field Offset
39	Set Point / Target Read Enable *(1 - Enable, Else - Disable)*
40	Set Point / Target
41	Ch. 1 Concentration Channel Lab Read Enable *(1 - Enable, Else - Disable)*
42	Ch. 1 Concentration Channel Lab
43	Ch. 2 Concentration Channel Lab Read Enable *(1 - Enable, Else - Disable)*
44	Ch. 2 Concentration Channel Lab
45	Ch. 3 Concentration Channel Lab Read Enable *(1 - Enable, Else - Disable)*
46	Ch. 3 Concentration Channel Lab
47	Fast Average for Reference Read Enable *(1 - Enable, Else - Disable)*
48	Fast Average for Reference
49	Fast Average for Active 1 Read Enable *(1 - Enable, Else - Disable)*
50	Fast Average for Active 1
51	Fast Average for Active 2 Read Enable *(1 - Enable, Else - Disable)*
52	Fast Average for Active 2
53	Fast Average for Active 3 Read Enable *(1 - Enable, Else - Disable)*
54	Fast Average for Active 3
55	Long Average for Reference Read Enable *(1 - Enable, Else - Disable)*
56	Long Average for Reference
57	Long Average for Active 1 Read Enable *(1 - Enable, Else - Disable)*
58	Long Average for Active 1
59	Long Average for Active 2 Read Enable *(1 - Enable, Else - Disable)*
60	Long Average for Active 2
61	Long Average for Active 3 Read Enable *(1 - Enable, Else - Disable)*
62	Long Average for Active 3
63	New Product Long ID Read Enable *(1 - Enable, Else - Disable)*
64	New Product Long ID *(High Portion)*
65	New Product Long ID *(Low Portion)*
66	*Reserved*
67	Set "Zero" Enable *(1 - True, Else - False)*
68	Data Flow Enable *(1 - False, Else - True)*

69	Ch. 1 Low Spec. Limit - Read Enable
70	Ch. 1 Low Spec. Limit
71	Ch. 1 High Spec. Limit - Read Enable
72	Ch. 1 High Spec. Limit
73	Ch. 1 Low Control Limit - Read Enable
74	Ch. 1 Low Control Limit
75	Ch. 1 High Control Limit - Read Enable
76	Ch. 1 High Control Limit
77	Ch. 2 Low Spec. Limit - Read Enable
78	Ch. 2 Low Spec. Limit
79	Ch. 2 High Spec. Limit - Read Enable
80	Ch. 2 High Spec. Limit
81	Ch. 2 Low Control Limit - Read Enable
82	Ch. 2 Low Control Limit
83	Ch. 2 High Control Limit - Read Enable
84	Ch. 2 High Control Limit
85	Ch. 3 Low Spec. Limit - Read Enable
86	Ch. 3 Low Spec. Limit
87	Ch. 3 High Spec. Limit - Read Enable
88	Ch. 3 High Spec. Limit
89	Ch. 3 Low Control Limit - Read Enable
90	Ch. 3 Low Control Limit
91	Ch. 3 High Control Limit - Read Enable
92	Ch. 3 High Control Limit
93	Calibration Mode - Read Enable
94	Calibration Mode *("1" or "2")*

Table: 2

VS-3000 EtherNet/IP Error Codes:

The VS-300 / VS-200 Sensor Management Station (SMS) has the ability to output alarms to a PLC via EtherNet/IP when certain conditions arise during a product run. Alarms are output using numbers (the last value output over EtherNet/IP). Codes are displayed on the VS-300 Sensor Management Console software as well as over Fieldbus. Each code corresponds to a specific condition. See **Table 1**.

"Output codes" are sent in the order stated in **Table 1**. Lower "output code" numbers have priority if multiple error conditions are present. If two error conditions exist and the lower number code is disabled, the higher "output code" will be displayed and the lower code ignored.

LIST OF ERRORS

Error Number	Description	Comments
1	Sensor Disconnected	Sensor Errors
2	Sensor Occluded	
20	Disk Is Full	SMS Errors
21	Low Disk Space	
63	System on Hold	User Errors
3	Fieldbus Connection Error	
4	Invalid Product ID	
5	Sensor Ch. 1 Specification Low Limit Violated	Process Errors (Specification Limits)
6	Sensor Ch. 2 Specification Low Limit Violated	
7	Sensor Ch. 3 Specification Low Limit Violated	
8	Sensor Ch. 1 Specification High Limit Violated	
9	Sensor Ch. 2 Specification High Limit Violated	
10	Sensor Ch. 3 Specification High Limit Violated	
11	Sensor Ch. 1 Control Low Limit Violated	Process Errors (Control Limits)
12	Sensor Ch. 2 Control Low Limit Violated	
13	Sensor Ch. 3 Control Low Limit Violated	
14	Sensor Ch. 1 Control High Limit Violated	
15	Sensor Ch. 2 Control High Limit Violated	
16	Sensor Ch. 3 Control High Limit Violated	
17	4-20 Ports Disabled	4-20 Errors
18	4-20 Port 1 Disabled	
19	4-20 Port 2 Disabled	

NOTE: ***The list is sorted by priority (from highest to lowest)***

Table: 3

Reference: Other Supported PLC's

The following PLCs are supported. This list may change as processors are added, but all processors within a family (PLC5, SLC500, Logix) should be compatible.

- Remote ControlLogix CPU via ControlNet bridge
- Remote ControlLogix CPU via DH+ bridge
- MicroLogix 1100
- ControlLogix Gateway to PLC5 via DH+
- ControlLogix Gateway to SLC5/04 via DH+
- PLC5 E-Series
- PLC5 enhanced processors with 1785-ENET (Ethernet Side Car)
- SLC5/05
- ControlLogix family with 1756-ENET/ENBT module
- GuardLogix family with 1756-ENET/ENBT module
- FlexLogix family with 1756-ENET/ENBT module
- CompactLogix with Ethernet port
- SoftLogix5
- SoftLogix5800
- SLC500 via channel 0 with 1761-NET-ENI Module
- MicroLogix via channel 0 with 1761-NET-ENI Module
- PLC5 processors via channel 0 with 1761-NET-ENI Module