



SmartRail I/O - HE599ETX250

Ethernet Base

MAN1407-01-EN_599ETX250

Overview

SmartRail I/O is a real-time, modular I/O system – expanding the application of the OCS family of all-in-one controllers. The SmartRail I/O Ethernet Base (ETX250) utilizes Ethernet communications for the I/O connection with the OCS. The high-bandwidth, high-speed nature of Ethernet allows a significant amount of I/O to be added while maintaining fast I/O updates.

Any OCS Controller with a built-in 10/100 Ethernet port can utilize ETX250 Base units. Each Base can support up to 8 SmartRail I/O modules – addressed with up to 256 digital I/O and 32 analog I/O per base. The total number of bases and I/O modules is limited only by the Register/Variable space available within the OCS being used.

The ETX250 features a built-in unmanaged Ethernet switch for convenience of wiring and system expansion. SmartRail I/O is not complex to configure – it utilizes Cscope (9.1 or later) in an easy, straight forward process.

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General Specifications

Required Power (Steady State)	550mA @ 24 VDC CLASS 2 POWER SUPPLY ONLY
Primary Power Range	19.2 – 28.8VDC
Output Power	1500mA @ 5 VDC
Terminal Type	Spring-Clamp
Terminal Torque Rating	0.6 N-m (5.2 in-lbs)
Recommended Wire Size	18-22AWG (copper)
Wiring Stripping Length	7mm
Relative Humidity	5 to 95%, Non-Condensing
Operating Temperature	0°C to +55°C
Storage Temperature	-25°C to +70°C
Dimensions (H x W x D)	90 x 43.5 x 72.8mm [3.54 x 1.71 x 2.87 in]
Weight	4oz. (114g)
Noise Immunity	Per IEC1131-2, IEC61000-4-2, IEC61000-4-3, IEC61000-4-4
Certifications (UL/CE)	North America or Europe

Communications Specifications

Data Transmission	10/100/1000 Mbps
Flow Control	Full / Half-Duplex
Connectors	RJ-45 (8P8C), 2 ports (AutoMDIX)
Built-In Switch	Unmanaged Type
Protocols	Ethernet/IP
Inactivity Timeout	10 seconds
IP Configuration	From Cscope, using Boot/p
Cscope Version	Cscope 9,1 or later
Firmware Version	12.70 or later

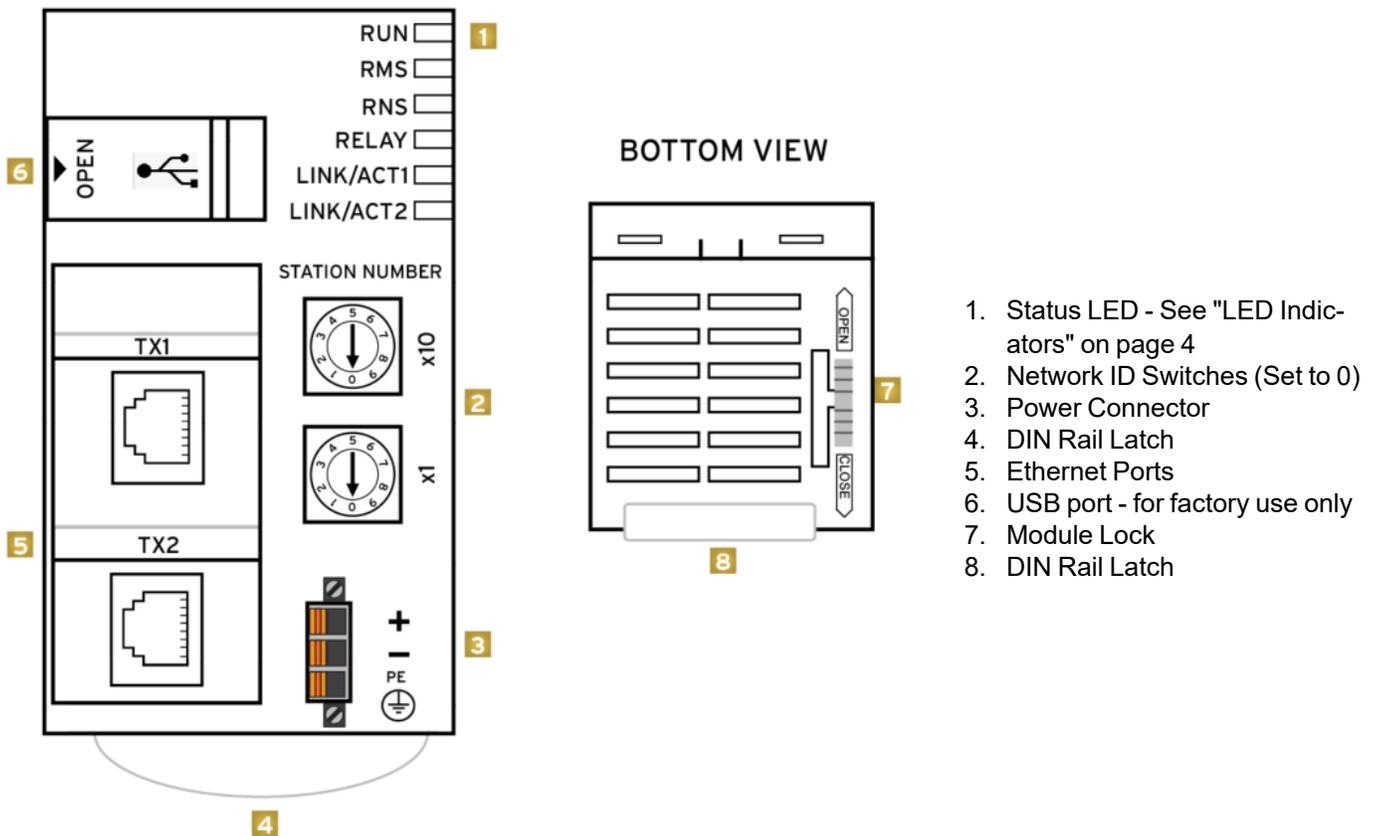
I/O Specifications

Compatible I/O	SmartRail I/O
Modules Supported (per base)	8
Digital I/O, max (per base)	256 (Inputs + Outputs)
Analog I/O, max (per base)	32 (Inputs + Outputs)
I/O Limitations (per system)	Limited only by the Register/Variable space available within the OCS being used.
Power Supplied for I/O Modules	1500mA @ 5V DC maximum

I/O Module 5V Power Usage - 1500mA Total Available

8 DC In DIM510 30mA	16 DC In DIM610 40mA	32 DC In DIM710 50mA	8 DC Out DQM506 40mA
16 DC Out DQM606 60mA	32 DC Out DQM706 120mA	8 Relay Out DQM502 230mA	16 Relay Out DQM602 420mA
8DC + 8 Relay DIQ512 250mA	4 Analog In ADC170 50mA	4 RTD In RTD100 100mA	4 Thermocouple In THM100 100mA
4 Analog Out (mA) DAC106 120mA	4 Analog Out (V) DAC101 70mA	2 Analog In + 2 Analog Out MIX116 100mA	

Product Overview



Installation

The ETX250 is compact (90mm W x 43.5mm H x 72.8mm D), and mounts on DIN-rail. Each I/O module installed adds width in increments of 20mm (for DC & analog I/O) or 27mm (for relay I/O).

NOTE: The distance between wiring duct and surrounding modules should be at least 50mm apart. Modules can be added either before or after the ETX250 base has been installed on the DIN-rail.

Add Extension I/O Module

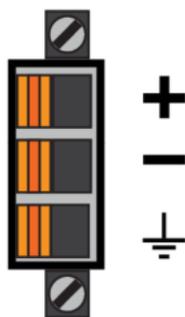
1. When an extension input/output module is to be installed, pull the two module locks (see #7 in "Product Overview" on the previous page) levers of adapter module towards the front of the unit. Push the I/O module towards the ETX250 and connect it with the hooks. Connect the I/O module bus connector to the ETX250 bus connector and push units together until housings are flush with each other.
2. Gently push the two module locks back to the "Close" positions (see #7 in "Product Overview" on the previous page).

Remove Extension I/O Module

1. When an extension input/output module is to be removed, gently push the two module locks back to the "Close" positions (see #7 in "Product Overview" on the previous page).
2. With two hands, gently pull the two products apart.

Wiring

Each SmartRail ETX250 Base requires 24VDC power, and an appropriate Earth Ground connection for normal operation. Port 1 & Port 2 are AutoMDIX RJ45 ports (8P8C), compatible with both straight through and crossover cables. Horner Automation offers high-quality cables in a variety of convenient lengths.



24VDC Power Supply & Earth Ground Terminals

LED Indicators

LED	State	Meaning
RUN	Off	Power Off
	Green	Master Run
	Red	Master Stop
	Green - Flashing	Service Standby State
RMS	Green	Normal Behavior
	Green - Flashing	Set up not complete
	Red	Unrecoverable error has occurred
	Red - Flashing	Recoverable error with settings, parameters, initialization or speed/duplex port error.
RNS	Green	At least 1 device is connected
	Green - Flashing	Device is not connected
	Red	Duplicate IP Address or Area Codes
	Red Flashing	Timeout with more than 1 device: Frame Error - if a Heartbeat Error occurs
RELAY	Off	Interport Relay OFF
	Green	Interport Relay ON
LINK/ACT1 LINK/ACT2	Off	Link = No, Activity = NA
	Green	1G Link=Yes, Activity = No
	Green - Flashing	1G Link = Yes, Activity =Yes
	Yellow	10/100M Link = Yes, Activity =No
	Yellow - Flashing	0/100M Link = Yes, Activity = Yes

Cscape Configuration

Each SmartRail ETX250 Base is configured from Cscape, under “Hardware Configuration”. Cscape 9.1 or later is required. What follows is the general configuration procedure:

1. In Cscape, select “Hardware Configuration”.
2. Make sure the OCS controller to be used in the application has been properly selected.
3. Select the “LAN I/O” Tab.
4. Select “Add Base”.
5. Assign the Base a convenient name, configurable in the upper left-hand corner of the dialog box. This is just for reference.
6. Check the box to “Assign IP using BOOT-P to MAC ID”.
7. In the “Device Mac ID” area, enter the Mac ID that is printed on the ETX250 Product Label.
8. If the Mac ID is not configured in Cscape, the OCS will NOT assign the IP address and Net Mask – and a third-party Boot/p utility must be used.
9. Assign an IP address in the IPv4 format (eg 192.168.0.100). The Net mask is the same as that configured for the OCS in the OCS Ethernet configuration.
10. Assign a 16-bit Status Register to the Base. This is the OCS reference address where real-time diagnostic status for this ETX250 Base will be reported.
11. Assign starting I/O references for each I/O type. Boolean types must be on a word boundary (1, 17, 33, etc). Typical reference types are %I (digital inputs), %Q (digital outputs), %AI (analog inputs) and %AQ (analog outputs). Make sure the addresses selected do not conflict with I/O used elsewhere in the application. This completes the base configuration.
12. The Base just added is now summarized in the “Base Information” section. To add an I/O module, click “Add Module”.
13. Select the desired I/O module to be added from the list, which is segregated by type (Digital In, Digital Out, etc.) through the use of Tabs. Click OK.
14. Click on the I/O module just added and select “Configure Module”. Set the parameters as desired for each module.
15. Sequentially add and configure I/O modules for each slot used (repeat steps 11-13 above).
16. Repeat steps 4-13 as many times as necessary to add all additional Bases as required.

Cscape Startup Sequence

The OCS that is configured to control the SmartRail I/O will use the I/O configuration data programmed in Cscape to configure each ETX250 base. The following sequence is followed:

1. The OCS must be in Run mode before the ETX250 is powered up. Power-up, the ETX250. The ETX250 will send periodic requests to the network asking for an IP address. This follows the Boot/P protocol convention.
2. The OCS will check its I/O configuration database, looking for a matching MAC ID entry.
3. If a match is found, the OCS will use the Boot/P protocol to assign the appropriate IP address, Net Mask, and Default Gateway to the ETX250 Base.
4. Once all bases are assigned IP addresses, and the OCS is in RUN mode:
 - a. The OCS will place the ETX250 base in RUN mode
 - b. Modbus/TCP communications will begin between the ETX250 and the OCS
 - c. Input and Output references will be updated.

ETX250 Base Status Registers

Value	Meaning	Value	Meaning
0	Communications OK	-106	OCS Ethernet Error
-103	Connection Timeout	-204	No Response
-104	No I/O Present	-205	Invalid Response
-105	Invalid Configuration	-208	Exception Response

NOTE: Unit must be in RUN mode.

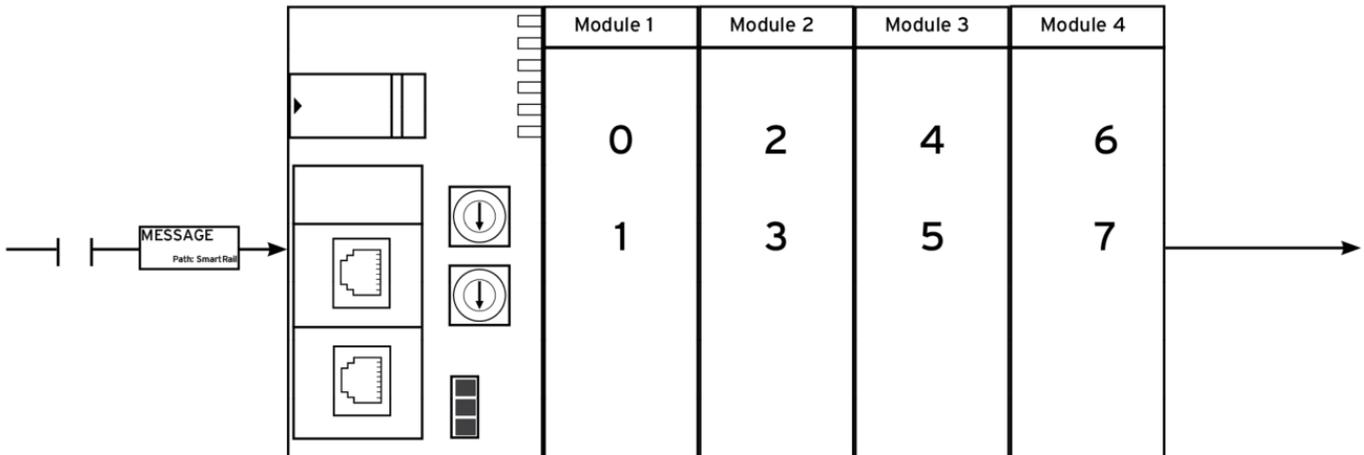
Ethernet/IP Configuration

Each SmartRail ETX250 can be configured using a variety of Ethernet/IP ready devices. Setup has two top-level steps: use Boot/P service to assign I/P address to the ETX250 module, then use UCMM (unconnected message manager) through the desired software package to configure parameters of the I/O modules attached to the ETX250 SmartRail Base.

Ethernet/IP Startup Sequence

The software that is configured to control the SmartRail I/O will use the I/O configuration data (programmed via UCMM in the following section) to configure each ETX250 base. The following sequence is followed:

1. Upon power-up, the ETX250 will broadcast the MAC address to be assigned I/P data. This follows the Boot/P protocol convention.
2. Once in RUN mode, the Boot/P protocol will check its I/O configuration database, looking for a matching MAC ID entry.
3. If a match is found, the Boot/P protocol to assigns the appropriate IP address, Net Mask, and Default Gateway to the ETX250 Base.
4. Once all bases are assigned IP addresses, setup I/O configuration in Logic software by entering IP address of the base module:
 - a. The PLC will place the ETX250 base in RUN mode
 - b. Then, send a UCMM message to the base unit to configure the I/O modules attached to it.
 - c. UCMM message will contain configuration parameters for the I/O attached to the base module for Ethernet I/P communication, assigning the arrays in the following order:

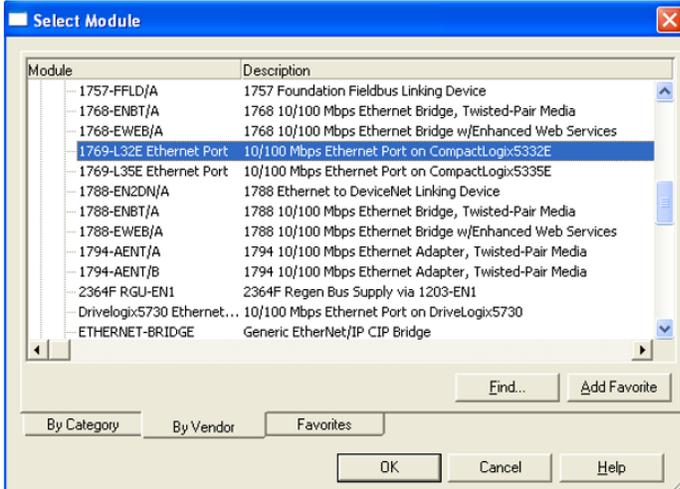


Configuration in RSLogix 5000

Setting up Communication

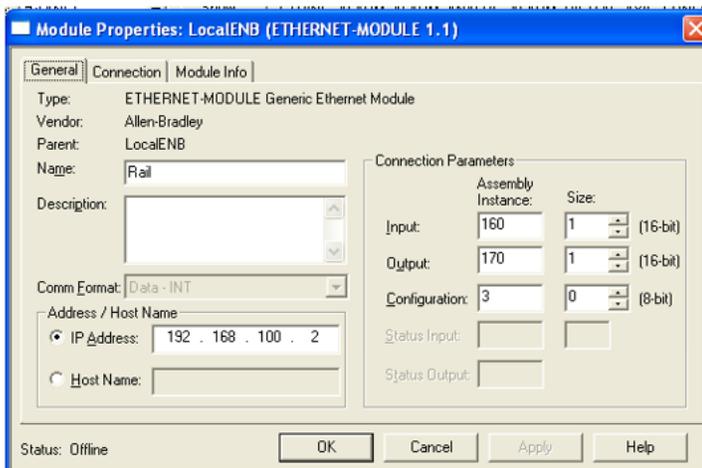
In the project, right-click I/O Configuration folder and select **New Module**.

1. Select the scanner being used, in this case: **1769-L32E Ethernet port on Compact Logix 5332E** (see image below), and press **OK**.



Enter revision number of the scanner and press OK.

2. Enter name and IP address for the scanner. Click Finish.
3. This will place the scanner module below the I/O Configuration folder in the folder explorer tab.
4. Right-click on the added scanner and select New Module
5. The same dialogue box from adding the scanner will appear. This time, select Generic Ethernet Module and press OK. Configure the Module Properties:
 - a. Enter a name that will be tagged later on (here "Rail")
 - b. Enter IP address on the ETX250 Module
 - c. Choose Assembly Instance Input, Output, and sizes
 - d. Configuration should always be set to Instance 3 and Size 0. **NOTE:** Choose an assembly instance for the input and output not in use. The size refers to words (1 16-bit word above) and is determined by the number of modules attached to the ETX250.



6. The next window will ask for **RPI Settings**. Start with **10ms** and adjust if needed.
7. Click **Next>** then **Finish>>**.
8. Check the tags under **Controller Tags** in the folder navigation menu to make sure they are desired for the installed ethernet module. The user can also add or edit tags from this pane, refer to the following section.

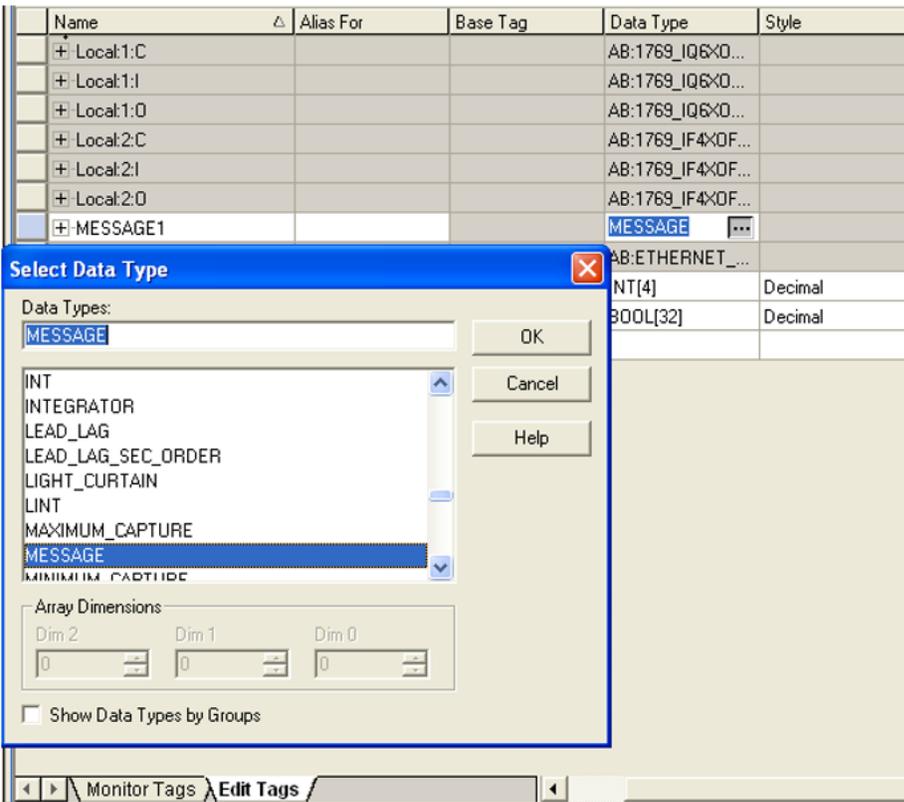
Explicit Messaging Tags

The first step of creating the Explicit message for parameter settings of the ETX250 modules is generating Tags that will be used to move information:

- Create a tag with MESSAGE type – The explicit message block will use this tag.
- Create a tag with INT type – This tag holds the parameter data that the explicit message uses.
- Assign the generated MESSAGE tag to the Message block
- Add required parameters ("Parameter Settings " on page 12) to the explicit message
- Create a path to the module; here "Rail"

Create a MESSAGE Tag

1. Open **Controller Tags** and click **Edit Tags**.
2. Click in the space next to blank line to add tag. Use desired name, here: "MESSAGE1".



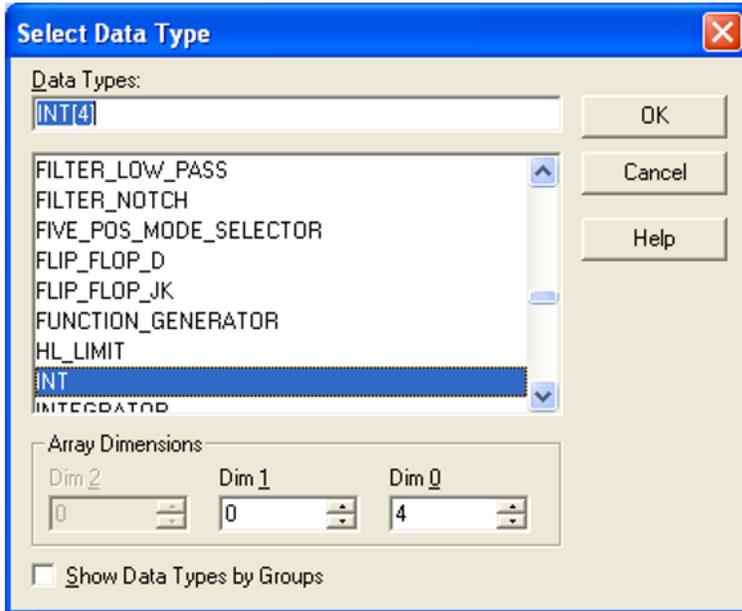
The screenshot shows the 'Edit Tags' window with a table of tags. A new tag named 'MESSAGE1' has been added. A 'Select Data Type' dialog box is open, showing a list of data types with 'MESSAGE' selected. The dialog also includes 'Array Dimensions' and a 'Show Data Types by Groups' checkbox.

Name	Alias For	Base Tag	Data Type	Style
+ Local:1:C			AB:1769_IQ6X0...	
+ Local:1:I			AB:1769_IQ6X0...	
+ Local:1:O			AB:1769_IQ6X0...	
+ Local:2:C			AB:1769_IF4XOF...	
+ Local:2:I			AB:1769_IF4XOF...	
+ Local:2:O			AB:1769_IF4XOF...	
+ MESSAGE1			MESSAGE	...
			AB:ETHERNET_...	
			NT[4]	Decimal
			BOOL[32]	Decimal

3. Click the [. . .] button under **Data Type** and change to **MESSAGE**. Press **OK**.

Create INT Tag

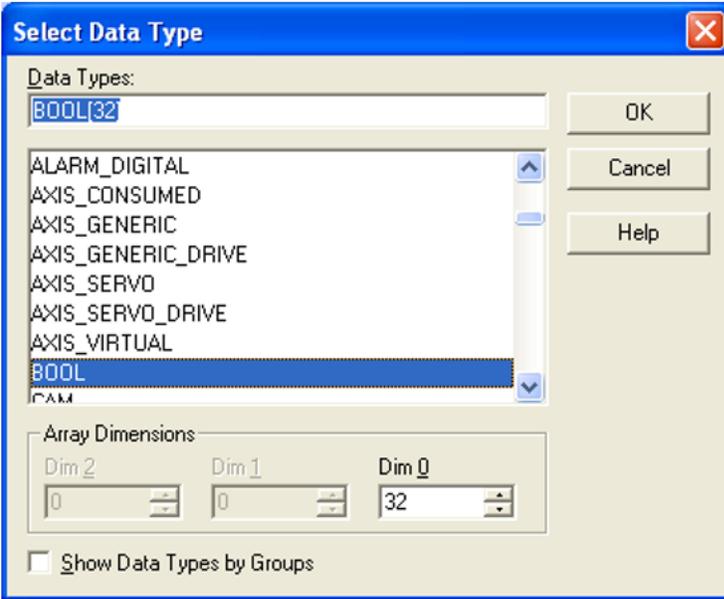
1. Create another tag with desired name, ex. "Test1".
2. Click the [. . .] under **Data Type** and change to **INT**. Change **DIM_0** to **4** array dimensions (byte address 0-3 will be accessed in parameter data). Press **OK**.



NOTE: Each module requires 2 words of configuration data (which are configured via the Array Dimensions)
Ex: 2 modules = 4 words of data. Use "0" Dim_1 through "3" Dim_0.

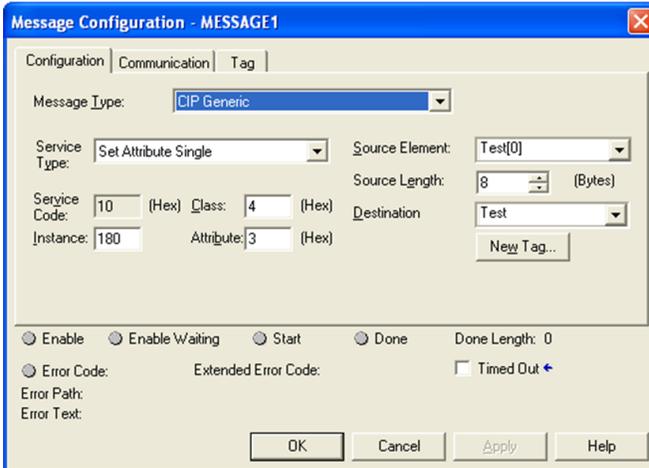
Create BOOL Tag

1. Create the last tag with the desired name, ex: "Test"
2. Click the [. . .] Data Type and change to INT. Change DIM_0 to 32. (Each module uses 32 bits of configuration data. 4 bytes from the INT tag above)

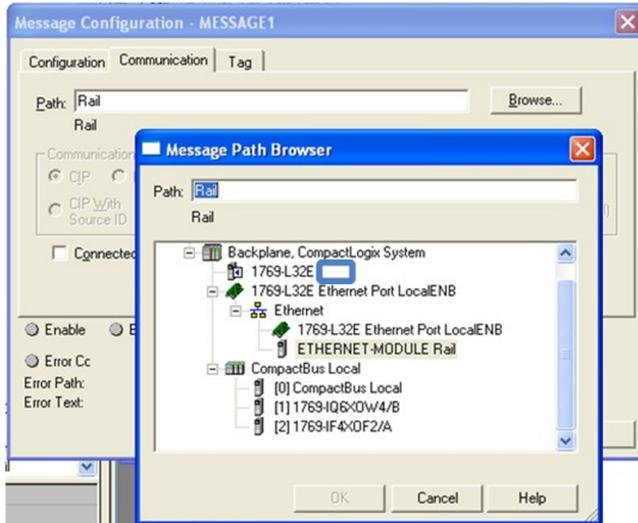


The second step is to create and configure the MESSAGE block in the Main Program:

1. Add a rung with a normally open contact and a Message block.
2. Double-click on the contact and assign the BOOL tag from step 6 above.
3. Assign the message block the MESSAGE tag.
4. Double-Click the [. . .] button on the message block to get to the following Message Configuration screen:



5. Enter the values above. Source Element is the first array of the Test INT [4] previously made. Source Length depends on how many modules attached. 2 bytes per array, 2 arrays per module = 32 bits per module. Destination is the INT[4] tag from before. Here: Test and open the Communication Tab:



6. From the Path section, click Browse and set the path to the Generic Ethernet Module set up in 4.2.1. Above: "Rail." Press OK
7. Click Tag tab and ensure Message1 is tagged:
8. To Change Parameters, Move parameter data into the added/established memory in the processor (INT[4] tagged above).

Example UCMM message

Service Code : 16 (0x10: Set)

Instance : 04 (0x04: Assembly Class)

Class : 180 (0xB4 : parameter setting Assembly Object)

Attribute : 03 (0x03: Data)

Data :XX XX (Parameter Setting Value)

Parameter Settings

NOTE: Byte addresses are formatted as such: 01 23. The first 8 bits, byte address "0", use bits 0-7. The second 8 bits, byte address "1" use bits 8-15. The Second word is addressed in the same fashion.

ADC170 – Analog Input										
Byte	Description	Bit								Configuration
Address		15 7	14 6	13 5	12 4	11 3	10 2	9 1	8 0	
0	Channel Used	-	-	-	-	Ch3	Ch2	Ch1	Ch0	Bit off (0): Disabled Bit on (1): Enabled
1	Input Voltage / Current Range	Ch3		Ch2		Ch1		Ch0		00: 0~10V 01: 0~20mA 10: 4~20mA
2	Output Data Range	Ch3		Ch2		Ch1		Ch0		00: 0~4000 01: -2000~2000 10: 0~1000(400~2000/0~2000) 11: 0~1000
3	-	-	-	-	-	-	-	-	-	-

DAC101 – Analog Output										
Byte	Description	Bit								Configuration
Address		15 7	14 6	13 5	12 4	11 3	10 2	9 1	8 0	
0	Channel Used	-	-	-	-	Ch3	Ch2	Ch1	Ch0	Bit off (0): Disabled Bit on (1): Enabled
1	Output type configuration	Ch3		Ch2		Ch1		Ch0		00: 4~20mA 01: 0~20mA
2	Input data range designation	Ch3		Ch2		Ch1		Ch0		00: 0~4000 01: -2000~2000 10: 0~1000(400~2000/0~2000) 11: 0~1000
3	Output status configuration	Ch3		Ch2		Ch1		Ch0		00: former value 01: minimum value 10: medium value 11: maximum value

DAC106 – Analog Output										
Byte	Description	Bit								Configuration
Address		15 7	14 6	13 5	12 4	11 3	10 2	9 1	8 0	
0	Channel Used	-	-	-	-	Ch3	Ch2	Ch1	Ch0	Bit off (0): Disabled Bit on (1): Enabled
1	Output Type Configuration	Ch3		Ch2		Ch1		Ch0		00: 4~20mA 01: 0~20mA
2	Input Data Range Designation	Ch3		Ch2		Ch1		Ch0		00: 0~4000 01: -2000~2000 10: 0~1000(400~2000/0~2000) 11: 0~1000
3	Output Status Configuration	Ch3		Ch2		Ch1		Ch0		00: former value 01: minimum value 10: medium value 11: maximum value

All Digital I/O SmartRail Modules										
Byte	Description	Bit								Configuration
Address		15 7	14 6	13 5	12 4	11 3	10 2	9 1	8 0	
0	Input Filter	-	-	-	-	Input Filter				0000:3ms 0100:20ms 0001:1ms 0101:70ms 0010:5ms 0110:100ms 0011:10ms
1	Maintaining Output Allowed	Configuration of Maintaining Output								01: Allow Other: Prohibit
2	Maintaining Output by Channels	56 to 63	48 to 55	40 to 47	32 to 39	24 to 31	16 to 23	8 to 15	0 to 7	01: Allow Other: Prohibit
3	Output Dstatus Configuration	-	-	-	-	-	-	-	-	-

MIX116 – Mixed Analog I/O Module										
Byte	Description	Bit								Configuration
Address		15 7	14 6	13 5	12 4	11 3	10 2	9 1	8 0	
0	Channels Used	-	-	-	-	Out Ch1	Out Ch0	In Ch1	In Ch0	Bit off (0): Disabled Bit on (1): Enabled
1	Output Type Configuration	Output Ch1		Output Ch0		Input Ch1		Input Ch0		00: 4~20mA 01: 0~20mA 10: 0~5V 11: 0~10V
2	Output Data Range Designation	Output Ch1		Output Ch0		Input Ch1		Input Ch0		00: 0~4000 01: -2000~2000 10: 0~1000 (400~2000/0~2000) 11: 0~1000
3	Output Status Configuration	Ch1				Ch0				00: former value 01: minimum value 10: medium value 11: maximum value

RTD100 – Resistance Temperature Detector Input										
Byte	Description	Bit								Configuration
Address		15 7	14 6	13 5	12 4	11 3	10 2	9 1	8 0	
0	Channel Used	-	-	-	-	Ch3	Ch2	Ch1	Ch0	Bit off (0): Disabled Bit on (1): Enabled
1	Output Type Configuration	Ch3		Ch2		Ch1		Ch0		00: PT100 01: JPT100
2	Input Data Range Designation	Ch3		Ch2		Ch1		Ch0		Bit Off(0): Centigrade Bit On (1): Fahrenheit
3	-	-	-	-	-	-	-	-	-	-

THM100 – Thermocouple Input										
Byte	Description	Bit								Configuration
Address		15 7	14 6	13 5	12 4	11 3	10 2	9 1	8 0	
0	Channel Used	-	-	-	-	Ch3	Ch2	Ch1	Ch0	Bit off (0): Disabled Bit on (1): Enabled
1	Output Type Configuration	Ch3		Ch2		Ch1		Ch0		00: K 01: J 10: T 11: R
2	Input Data Range Designation	Ch3		Ch2		Ch1		Ch0		Bit Off(0): Centigrade Bit On (1): Fahrenheit
3	-	-	-	-	-	-	-	-	-	-

ADC270 – Analog Mixed Module		
Memory Address	Description	Setting
0	Operating Channel	Bit off (0): stop Bit on (1): run
1	I/O Range (Ch0-Ch3)	0000: 4~20mA 0001: 0~20mA 0010: 1~5V
2	I/O Range (Ch4-Ch7)	0011: 0~5V 0100: 0~10V
3	Output Data Type	00: 0 ~ 4000 01: -2000 ~ 2000 10: precise value 11: 0 ~ 1000

SAFETY & WARNINGS

This equipment is suitable for use in Class I, Division 2, Groups A, B, C and D or Non-hazardous locations only.

WARNING - EXPLOSION HAZARD - Do not disconnect equipment unless power has been removed or the area is known to be non-hazardous

WARNING - EXPLOSION HAZARD - Substitution of any component may impair suitability for Class I, Division 2

WARNING – POSSIBLE EQUIPMENT DAMAGE - Remove power from the I/O Base and any peripheral equipment connected to this local system before adding or replacing this or any module.

When found on the product, the following symbols specify:



Warning: Consult user documentation.



Warning: Electrical Shock Hazard.

WARNING: To avoid the risk of electric shock or burns, always connect the safety (or earth) ground before making any other connections.

WARNING: To reduce the risk of fire, electrical shock, or physical injury it is strongly recommended to fuse the voltage measurement inputs. Be sure to locate fuses as close to the source as possible.

WARNING: Replace fuse with the same type and rating to provide protection against risk of fire and shock hazards.

WARNING: In the event of repeated failure, do not replace the fuse again as a repeated failure indicates a defective condition that will not clear by replacing the fuse.

WARNING: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

- All applicable codes and standards need to be followed in the installation of this product.
- For I/O wiring (discrete), use the following wire type or equivalent: Belden 9918, 18 AWG or larger.

Adhere to the following safety precautions whenever any type of connection is made to the module.

- Connect the green safety (earth) ground first before making any other connections.
- When connecting to electric circuits or pulse-initiating equipment, open their related breakers. Do not make connections to live power lines.
- Make connections to the module first; then connect to the circuit to be monitored.
- Route power wires in a safe manner in accordance with good practice and local codes.
- Wear proper personal protective equipment including safety glasses and insulated gloves when making connections to power circuits.
- Ensure hands, shoes, and floor are dry before making any connection to a power line.
- Make sure the unit is turned OFF before making connection to terminals. Make sure all circuits are de-energized before making connections.
- Before each use, inspect all cables for breaks or cracks in the insulation. Replace immediately if defective.
- I/O signal or communication line should be wired at least 100mm away from a high-voltage cable or power line.

Technical Support

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