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N-Tron® Series

# CIP™ Installation & User Manual
# NT24k™ Products

Software Manual | June 2016

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# PREFACE

**Purpose**  This manual gives specific information on how to apply and use the CIP™ functions on the N-Tron® series NT24k™ switches.

**Audience**  The manual is intended for use by personnel who are responsible for operating and maintaining network equipment; consequently, it assumes a basic working knowledge of general switch functions and the Internet Protocol (IP).

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**Certifications**  Red Lion Controls, Inc. ensures that this device meets all the ODVA technology and standards guidelines for the Common Industrial Protocol (CIP) for industrial automation.

**Conventions** ⓘ  The following conventions are used throughout this manual to show information:

> Note:   Emphasizes important information or calls your attention to related features or instructions.

**Related Publications and Document Updates**  This document is revised only at major releases and therefore,  may not always contain the latest product information. As needed, Tech Notes and or other product documentation  can be provided between major releases to describe any new information or document changes.

Also, as part of the NT24k software, there is an online web-based help that describes all management related features.

The latest online version of this document and all product updates can be accessed at the Technical Resources page on the Red Lion web site  at:
www.redlion.net/n-tron_documentation

Red Lion appreciates all comments that will help us to improve our documentation quality. The user can submit comments through the Red Lion Customer Service. Simply email us at customer.service@redlion.net

**References**   [1] The CIP Networks Library, Volume 1: Common Industrial Protocol (CIP™), Edition 3.16, Publication Number: PUB00001, Open DeviceNet™ Vendor Association, Inc., 4220  Varsity Drive, Suite A, Ann Arbor, MI 48108-5006 USA

[2] The CIP Networks Library, Volume 2: EtherNet/IP Adaptation of CIP™, Edition 1.17, Publication Number: PUB00002, Open DeviceNet Vendor Association, Inc., 4220  Varsity Drive, Suite A, Ann Arbor, MI 48108-5006 USA

**Revision History**   The following information lists the release history of this document.

| Issue / Revision Date | Content Description |
|---|---|
| July 2013 | Initial version with support for switches in the NT24k product line. |
| August 23, 2013 | Added missing documentation for the Power Configuration attribute of  the N-Tron object. |
| October  2013 | Added faceplate installation instructions and quick reference guide. |
| March 2014 | Added a description of the faceplate error messages. |
| October 2014 | Added support for NT24k-8TX, NT24k-8TX-POE, and NT24k-16TX switches. |
| November 2014 | Added 802.1X port role. |
| March 2015 | Revised face plates for NT24k-8TX, NT24k-8TX-POE, NT24k-16TX switches. Added support for: NT24k-10FX2, NT24k-10FX2-POE NT24k-10GX2, NT24k-10GX2-POE NT24k-11FX3, NT24k-11FX3-POE NT24k-11GX3, NT24k-11GX3-POE NT24k-12FX4, NT24k-12FX4-POE NT24k-12GX4, NT24k-12GX4-POE NT24k-14FX6, NT24k-14FX6-POE NT24k-14GX6, NT24k-14GX6-POE, NT24k-12SFP-DM4, NT24k-12SFP-DM4-POE |
| November 2015 | Revised to comply with updated ODVA requirements. Formatted to comply with updated Red Lion Controls technical documentation standards. |
| May 2016 | Added support for NT24k-16TX-POE switches |

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**Disclaimer**   Portions of this document are intended solely as an outline of CIP methodologies to be followed during the maintenance and operation of N-Tron® series NT24k equipment. It is not intended as a step-by-step guide or a complete set of all procedures necessary and sufficient to complete all operations.

While every effort has been made to ensure that this document is complete and accurate at the time of release, the information that it contains is subject to change. Red Lion is not responsible for any additions to or alterations of the original document. Industrial networks vary widely in their configurations, topologies, and traffic conditions. This document is intended as a general guide only. It has not been tested for all possible applications, and it may not be complete or accurate for some situations.

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# CHAPTER 1  INTRODUCTION TO CIP™ COMPONENTS

EtherNet/IP™, better known as the Common Industrial Protocol (CIP™), was designed for use in process control and industrial automation applications. CIP was designed to provide consistent device access to eliminate the need for vendor specific software for configuration and monitoring of individual devices.

Red Lion Controls N-Tron® series NT24k™ switches with CIP support can be used to communicate with other industrial devices, such as Rockwell controllers.

## 1.1  CIP™ Components

The following CIP components are available with Red Lion Controls N-Tron series NT24k CIP enabled switches.

### 1.1.1  Electronic Data Sheets

An electronic data sheet for each NT24k switch is provided.

In a Rockwell environment EDS files are installed using the "EDS Hardware Installation  Tool". This allows NT24k switches to be recognized in an RSLinx environment.

EDS and associated Icon files for each NT24k switch are included in the CIP_Install_Kit.zip file in the subdirectory "Cip".

### 1.1.2  CIP Objects

"Objects" are used to organize various information about the switch. There are four types  of objects provided. Three are specified by the ODVA™, and one is N-Tron series specific:

- Identity object
- TCP/IP Interface object
- Ethernet Link object
- N-Tron switch object

Standard "services" are associated with objects. Services exist for reading an attribute, setting an attribute, resetting a device, etc. See references [1] and [2] for specific details.

The following sections describe the attributes associated with each object type, such as  attribute Id number and data format. All attributes can be read, but only some can be set,  as shown by the "Set" column.

### 1.1.2.1    Identity Object

The identity object class (Class code = 0x01) and instance attributes are implemented as  defined by CIP Vol 1, 5-2 [1].   There is one instance (1) of this object. Service code (0x32) will get all attributes, including optional attributes. Table 1-1  summarizes the attributes in the Identity object.

**Table 1-1 Identity Object Attributes**

| ID | Name | Set | Format | Description |
|---|---|---|---|---|
| 1 | Vendor ID | | UINT (16) | 1006. This is N-Tron's ODVA EtherNet/IP  Vendor ID |
| 2 | Device Type | | UINT (16) | 0x0C.  Communications Adapter |
| 3 | Product Code | | UINT (16) | Switch product code:<br>NT24k -RM= 24001<br>NT24k-DR16= 24002<br>NT24k-DR24= 24003<br>NT24k-8TX= 24004<br>NT24k-8TX-POE= 24005<br>NT24k-16TX= 24006<br>NT24k-16TX-POE= 24077<br>NT24k-10FX2= 24008<br>NT24k-10GX2= 24009<br>NT24k-11FX3= 24010<br>NT24k-11GX3= 24011<br>NT24k-12FX4= 24012<br>NT24k-12GX4= 24013<br>NT24k-14FX6= 24014<br>NT24k-14GX6= 24015<br>NT24k-12SFP-DM4= 24016<br>NT24k-10FX2-POE= 24017<br>NT24k-10GX2-POE= 24018<br>NT24k-11FX3-POE= 24019<br>NT24k-11GX3-POE= 24020<br>NT24k-12FX4-POE= 24021<br>NT24k-12GX4-POE= 24022<br>NT24k-14FX6-POE= 24023<br>NT24k-14GX6-POE= 24024<br>NT24k-12SFP-DM4-POE= 24025 |
| 4 | Major Revision | | USINT (8) | Major version of CIP implementation |
| | Minor Revision | | USINT (8) | Minor version of CIP implementation |
| 5 | Status | | WORD (16) | Summary status of device. Bits:<br>Bit 0:  if set, device has an owner<br>Bit 1:  reserved<br>Bit 2:  if set, device has non-default configuration<br>Bit 3:  reserved<br>Bits 4-7:  Extended device status – not used<br>Bit 8:  Minor recoverable fault<br>Bit 9:  Minor unrecoverable fault<br>Bit 10:  Major recoverable fault<br>Bit 11:  Major unrecoverable fault<br>Bits 12-15:  reserved (see Table 1-2)<br><br>(see Identity Object Fault Table 1-2) |

| ID | Name | Set | Format | Description |
|---|---|---|---|---|
| 6 | Serial Number | | UDINT (32) | Serial number of the device. This is the last 4 octets of the base switch MAC |
| 7 | Product Name | | SHORT_STRING | Switch Model Name. EX: NT24k |
| 15 | Assigned_Name | Set | STRINGI | This is the user assigned switch name |
| 17 | Geographic_Location | Set | STRINGI | This is the user assigned switch location |

Table 1-2 defines fault bits within the Status attribute of the Identity Object.

**Table 1-2 Identity Object Fault Bit Definitions**

| Bit | Called | Definition |
|---|---|---|
| 8 | Minor Recoverable Fault | Power supply 1, Power supply 2, N-Ring Full, System, Port utilization, Temperature, N-Link partner is down, N-Link integrity fault |
| 9 | Minor Unrecoverable Fault | Configuration device error |
| 10 | Major Recoverable Fault | N-Ring partial low, N-Ring partial high, N-Ring multiple managers, Boot loader version, N-Link partner port unknown, N-Link multiple masters, N-Link control fault, N-Link configuration fault, Settings fault |
| 11 | Major Unrecoverable Fault | none |

### 1.1.2.2    TCP/IP Interface Object

The TCP/IP Interface object class (Class code = 0xF5) and instance attributes are implemented as defined by CIP Vol 2, 5-3 [2].  There is only one instance (1) of this object.  Table 1-3 summarizes the attributes in the TCP/IP Interface object.

**Table 1-3 TCP/IP Interface Object Attributes**

| ID | Name | Set | Format | Description |
|---|---|---|---|---|
| 1 | Status | | DWORD (32) | Interface status<br>Bit 0:  interface configuration attrib not configured<br>Bit 1:  interface configuration attrib is valid |
| 2 | Configuration Capability | | DWORD (32) | Interface capability flags. Bits:<br>Bit 0:  BOOTP client capable<br>Bit 1:  DNS client capable<br>Bit 2:  DHCP client capable<br>Bit 3:  DHCP-DNS update capable<br>Bit 4:  configuration is settable<br>Bit 5:  through Bit 31 reserved |

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| ID | Name | Set | Format | Description |
|---|---|---|---|---|
| 3 | Configuration Control | Set | DWORD (32) | Interface control flags<br>Bits 0-3:<br>0: use interface configuration previously stored<br>1: get interface configuration via BOOTP<br>2: get interface configuration via DHCP<br>3: through Bit 15 reserved<br>4 =1 device shall resolve host names by querying a DNS server |
| 4 | Physical Link Object | | STRUCT of: | |
| | Path Size | | UINT (16) | Size of Path |
| | Path | | Padded EPATH | Logical segments identifying the physical link object |
| 5 | Interface Configuration | | STRUCT of: | |
| | IP Address | Set | UDINT (32) | The device's IP address |
| | Network Mask | Set | UDINT (32) | The device's network mask |
| | Gateway Address | Set | UDINT (32) | Default gateway address |
| | Name Server | Set | UDINT (32) | Primary name server |
| | Name Server 2 | Set | UDINT (32) | Secondary name server |
| | Domain Name | Set | STRING | Default domain name |
| 6 | Host Name | Set | STRING | Host name |
| 8 | TTL Value | | USINT | TTL Value for EtherNet/IP multicast packets. Default is 1. Range is 1-255 |
| 9 | Mcast Config | | STRUCT of: | IP multicast configuration |
| | Alloc Control | | USINT | Multicast address allocation control word. Determines how addresses are allocated |
| | Reserved | | USINT | Reserved for future use. Shall be 0 |
| | Num Mcast | | UINT | Number of IP multicast addresses to allocate for EtherNet/IP |
| | Mcast Start Addr | | USDINT | Starting multicast address from which to begin allocation |
| 13 | Encapsulation Inactivity Timeout | Set | UINT | Number of seconds of inactivity before TCP connection is closed. 0 = Disable, 1-3600 = timeout in seconds, Default = 120 |

### 1.1.2.3    Ethernet Link Object

The Ethernet Link object class (Class code = 0xF6) and instance attributes are implemented as defined by CIP Vol 2, 5-4 [2]. There is one instance of this object per switch port where instance 1 = port 1, instance 2 = port 2, etc.  As per the CIP specification, the get all service code (0x01) will get all attributes, excluding vendor extensions. Service code (0x32) will get all attributes, including the N-Tron vendor extensions.  Table 1-4 summarizes the attributes in the Ethernet Link object.

**Table 1-4 Ethernet Link Object Attributes**

| ID | Name | Set | Format | Description |
|----|------|-----|--------|-------------|
| 1 | Interface Speed | | UDINT (32) | Interface speed currently in use. Speed in Mbps (e.g., 0, 10, 100, 1000, etc.) |
| 2 | Interface Flags | | DWORD (32) | Interface status flags Bit map of interface flags. See section 5-4.3.2.1. Includes Link status, duplex mode, auto-negotiation status, etc |
| 3 | Physical Address | | ARRAY of 6 USINTs (8) | MAC address of switch port |
| 4 | Interface Counters | | STRUCT of: | |
| | In Octets | | UDINT (32) | Octets received on the interface |
| | In Ucast Packets | | UDINT (32) | Unicast packets received on the interface |
| | In Nucast Packets | | UDINT (32) | Non-unicast packets received on the interface |
| | In Discards | | UDINT (32) | Inbound packets received on the interface but discarded |
| | In Errors | | UDINT (32) | = 0. Not available. Inbound packets that contain errors (does not include In Discards) |
| | In Unknown Protos | | UDINT (32) | = 0. Not available. Inbound packets with unknown protocol |
| | Out Octets | | UDINT (32) | Octets sent on the interface |
| | Out Ucast Packets | | UDINT (32) | Unicast packets sent on the interface |
| | Out Nucast Packets | | UDINT (32) | Non-unicast packets sent on the interface |
| | Out Discards | | UDINT (32) | Outbound packets discarded |
| | Out Errors | | UDINT (32) | = 0. Not available. Outbound packets that contain errors |
| 5 | Media Counters | | STRUCT of: | |
| | Alignment Errors | | UDINT (32) | Frames received that are not an integral number of octets in length |
| | FCS Errors | | UDINT (32) | Frames received that do not pass the FCS check |
| | Single Collisions | | UDINT (32) | Successfully transmitted frames which experienced exactly one collision |
| | Multiple Collisions | | UDINT (32) | Successfully transmitted frames which experienced more than one collision |
| | SQE Test Errors | | UDINT (32) | = 0. Not available. Number of times SQE test error message is generated |
| | Deferred Transmissions | | UDINT (32) | Frames for which first transmission attempt is delayed because the medium is busy |
| | Late Collisions | | UDINT (32) | Number of times a collision is detected later than 512 bit times into the transmission of a packet |
| | Excessive Collisions | | UDINT (32) | Frames for which transmission fails due to excessive collisions |

| ID | Name | Set | Format | Description |
|---|---|---|---|---|
| | MAC Transmit Errors | | UDINT (32) | = 0. Not available.<br>Frames for which transmission fails due to an internal MAC sub layer transmit error |
| | Carrier Sense Errors | | UDINT (32) | = 0. Not available.<br>Times that the carrier sense condition was lost or never asserted when attempting to transmit a frame |
| | Frame Too Long | | UDINT (32) | Frames received that exceed the maximum permitted frame size |
| | MAC Receive Errors | | UDINT (32) | = 0. Not available.<br>Frames for which reception on an interface fails due to an internal MAC sub layer receive error |
| 6 | Interface Control | | STRUCT of: | |
| | Control Bits | Set | WORD (16) | Interface Control Bits. Includes auto-negotiation and duplex settings. |
| | Forced Interface Speed | Set | UINT (16) | Speed at which the interface shall be forced to operate. Speed in Mbps (10, 100, 1000, etc.) |
| 7 | Interface Type | | USINT (8) | Type of interface: twisted pair, fiber, internal, etc |
| 8 | Interface State | | USINT (8) | Current state of the interface: operational, disabled, etc |
| 9 | Admin State | Set | USINT (8) | Administrative state: enable, disable |
| 10 | Interface Label | | SHORT_STRING | Human readable identification: TX1, FX1, GB1, A4, C8, etc |
| | | | | |
| 100 | Interface Description | | SHORT_STRING | Human readable description. For example: Port 1 - 10/100 Mbit TX Port 15 - 100 MBit FX |
| 101 | Interface Utilization | | USINT (8) | Percentage of entire interface bandwidth being used (0-100) |
| 102 | Utilization Alarm Upper Threshold | Set | USINT (8) | Upper percentage at which to declare utilization alarm (0-100) |
| 103 | Utilization Alarm Lower Threshold | Set | USINT (8) | Lower percentage at which to declare a utilization alarm (0-100) |
| 104 | Broadcast Limit | Set | USINT (8) | Broadcast limiting percentage (0-100). (BPCL) |
| 105 | TX Unicast Packet Rate | | UDINT32 | Number of TX unicast packets per second |
| 106 | RX Unicast Packet Rate | | UDINT32 | Number of RX unicast packets per second |
| 107 | TX Multicast Packet Rate | | UDINT32 | Number of TX multicast packets per second |
| 108 | RX Multicast Packet Rate | | UDINT32 | Number of RX multicast packets per second |
| 109 | TX Broadcast Packet Rate | | UDINT32 | Number of TX broadcast packets per second |
| 110 | RX Broadcast Packet Rate | | UDINT32 | Number of RX broadcast packets per second |
| 111 | TX Multicast Packets | | UDINT32 | Total number of TX multicast packets |
| 112 | RX Multicast Packets | | UDINT32 | Total number of RX multicast packets |

| ID | Name | Set | Format | Description |
|---|---|---|---|---|
| 113 | TX Broadcast Packets | | UDINT32 | Total number of TX broadcast packets |
| 114 | RX Broadcast Packets | | UDINT32 | Total number of RX broadcast packets |
| 115 | Port Role | | UDINT32 | Bit mask of port roles<br>Bit 0:  RSTP<br>Bit 1:  N-Ring<br>Bit 2:  N-Link Control<br>Bit 3:  N-Link Partner<br>Bit 4:  N-Link Coupler<br>Bit 5:  802.1X |

### 1.1.2.4    NT24k™ Object

The N-Tron object (Class code = 0xC0) is a vendor specific object and is implemented as  defined by CIP Vol 1, 4 [1]. There is only one instance (1) of this object. Table 1-5 summarizes the attributes of the N-Tron object.

**Table 1-5 N-Tron Object Attributes**

| ID | Name | Set | Format | Description |
|---|---|---|---|---|
| 1 | Device Up Time | | UDINT (32) | Number of seconds since device was powered up |
| 2 | Port Count | | UDINT (32) | Total port count |
| 3 | Valid Ports | | LWORD (64) AB: DINT[2] | 0 = Invalid Port, 1=Port Exists on device<br>Bit 0:  Port 1<br>Bit 1:  Port 2 etc |
| 4 | Global Admin Status | | LWORD (64) AB: DINT[2] | 0 = Port Disabled, 1 = Port Enabled<br>Bit 0:  Port 1<br>Bit 1:  Port 2 etc |
| 5 | Global Link Status | | LWORD (64) AB: DINT[2] | 0 = Link Down, 1 = Link Up<br>Bit 0:  Port 1<br>Bit 1:  Port 2 etc |
| 6 | System Faults | | DWORD (32) | Bit 00:  Power Supply 1<br>Bit 01:  Power Supply 2<br>Bit 02:  N-Ring Fault (complete)<br>Bit 03:  N-Ring Partial Fault (low port)<br>Bit 04:  N-Ring Partial Fault (high port)<br>Bit 05:  N-Ring Multiple Managers<br>Bit 06:  System error<br>Bit 07:  the configuration on an installed<br>          configuration device is invalid<br>Bit 08:  N-Link Fault<br>Bit 09:  Boot loader version mismatch<br>Bit 10:  Port Utilization Alarm<br>Bit 11:  Temperature Alarm<br>Bit 12:  Settings fault |
| 7 | IGMP Querier Status | | USINT (8) | Query Status:<br>0 = Disabled, 1 = Active (manual),<br>2 = Active  (Auto), 3 = Backup (Auto)<br>[enabled but not active] |
| 8 | IGMP Version | | USINT (8) | IGMP Version (V1, V2, V3, etc.) |
| 9 | IGMP Resource Usage | | USINT (8) | Percent of maximum capacity. Takes into account the number of groups used per max groups and any other possible resource limitations (0-100) |

| ID | Name | Set | Format | Description |
|---|---|---|---|---|
| 10 | IGMP Active Querier | | UDINT (32) | IP of the active IGMP querier |
| 11 | CPU Usage | | USINT (8) | Percent of usage (0-100) |
| 12 | Class 1 Connections | | UINT (16) | Number of CIP EtherNet/IP class 1 (multicast) connections |
| 13 | Class 3 Connections | | UINT (16) | Number of CIP EtherNet/IP class 3 (unicast) connections |
| 14 | Temperature Alarm Upper Threshold | Set | INT (16) | Upper temperature (C) at which to declare an alarm |
| 15 | Temperature Alarm Lower Threshold | Set | INT (16) | Lower temperature (C) at which to declare an alarm |
| 16 | Contact Status | | BYTE (8) | 2 Bits per contact. 00=Not Present, 01=Open, 10=Closed |
| 17 | Temperature_C | | INT (16) | Temperature in degrees C. 0x7FFF = Not Supported on device |
| 18 | Temperature_F | | INT (16) | Temperature in degrees F. 0x7FFF = Not Supported on device |
| 19 | Reset MIB Counts | Set | LWORD (64) | Reset port MIB counters. (1 bit per port to reset) |
| 20 | Device MAC Address | | ARRAY of 6 USINTs (8) | MAC address of device |
| 21 | Device Role | | UDINT (32) | Bit mask of device roles<br>Bit 0: N-Ring Manager<br>Bit 1: N-Ring Member<br>Bit 2: N-Ring AutoDetect<br>Bit 3: N-Link Master<br>Bit 4: N-Link Slave<br>Bit 5: N-Link Coupler |
| 22 | Config Device Status | | BYTE (8) | 0 = Not Supported, 1 = Not Present, 2 = Present |
| 23 | System Configuration | Set | UDINT (32) | Bit mask of system config. Bits=<br>Bit 0: GET: Changes have been made that have not been saved<br>SET: Save system configuration to flash.<br>Bit 1: GET: Changes have been made that require a reboot to take effect.<br>SET: Shutdown and reboot device* |
| 24 | System Firmware Version String | | SHORT_STRING | Human readable representation of firmware version string. |
| 25 | System Boot Loader Version String | | SHORT_STRING | Human readable representation of boot loader version string |
| 26 | System Fault String | | STRINGI | Human readable representation of error status. May contain multiple errors. Length is contained as part of the STRINGI data type |
| 27 | Power Configuration | | UDINT (32) | 4 Bits per power supply<br>0000 = DC Power, 0001 = AC Power, 1111 = Unknown.<br>Power supply 1 configuration is in bits 0-3<br>Power supply 2 configuration is in bits 4-7 |
| * ID 23 Bit 1 SET: This feature will be removed in a future release. | | | | |

### 1.1.2.5 CIP Services

Table 1-6 presents a summary of the supported services as defined by CIP Vol 1, Appendix A: Explicit Messaging Services [1].

**Table 1-6 Summary of Supported CIP Services**

| Service Code | Service Description | Identity | TCP/IP | Ethernet Link | N-Tron |
|---|---|---|---|---|---|
| 1 | Get_Attributes_All | yes | yes | yes | yes |
| 5 | Reset | Yes – reset switch or restore factory configuration | | | |
| 14 | Get_Attribute_Single | yes | yes | yes | yes |
| 16 | Set_Attribute_Single | Attributes 15,17 | Attributes 3,5 | Attributes 6,9, 102-104 | Attributes 14,15,19,23 |
| **Vendor Specific** | | | | | |
| 50 | Get_All_Attributes – including vendor defined attributes | yes | | yes | |
| **Object Specific** | | | | | |
| 76 | Get_And_Clear | | | Attributes 4,5 | |

## 1.1.3 Accessing Data

### 1.1.3.1 Explicit Messaging

Explicit messaging refers to a request/response form of communications over a CIP (TCP/IP) connection. Applications can use explicit messaging, for example, to invoke the "Get All Attributes" service and read all attributes of the Identity object.

### 1.1.3.2 I/O Connections

I/O connections are used to send data (grouped in assemblies) between devices periodically. The interval between sends is the "Requested Packet Interval", or RPI.

The N-Tron Series switch assemblies (Input, Output, and Configuration) are defined in Table 1-7.

**Table 1-7 Switch I/O and Configuration NT24k**

| Switch | Assembly Number | Size (bytes) |
|---|---|---|
| Input (to switch)* | 101 | 4 |
| Output (from switch) | 102 | 104 |
| Configuration* | 103 | 0 |

* - not currently used

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In an RSLogix 5000 environment, these assemblies are configured in the "Connection Parameters" panel of the Generic Ethernet Module.

> ⓘ    Note:  Input and output  assemblies are reversed.

More information is contained in Chapter 2 Rockwell RSLogix 5000 - AOI for Add-On  Instruction installation.

# CHAPTER 2  ROCKWELL RSLOGIX 5000 - AOI

## 2.2　　Material Prerequisites

- N-Tron® Series Switch

- RSLogix Add-On Instructions (AOI)

## 2.3　　Installation Instructions

### 2.3.1　Software Installation Prerequisites

- RSLogix 5000 version 17 or later

- N-Tron switch with firmware version that includes CIP support

### 2.3.2　Summary of Installation Steps

1. Import the Add-On Instruction (AOI)

2. Add your N-Tron switch to the I/O Configuration tree

3. Add an instance of the AOI in your application

4. Create and configure tags for the AOI

## 2.4　　Configuration of RSLogix Project

> Note:　The screen shots shown in the RSLogix5000 portion of this document are taken from the RSLogix5000 demonstration project file "N-Tron_Demo.ACD" which is included in the CIP_Install_Kit.zip file under the subdirectory "RSLogix5000".

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## 2.4.1 Importing an Add-On Instruction

All NT24k Add-On Instruction files are included in the CIP_Install_Kit.zip file in the subdirectory "RSLogix5000\AOI_export".

1. Open an RSLogix project.

2. Import the N-Tron Add-On Instruction (AOI).

3. In the controller organizer window, right click "Add-On Instructions" folder, select "Import Add-On Instruction" and browse to the folder containing AOI_N-Tron_*.L5X files. Import an AOI for each switch type installed.
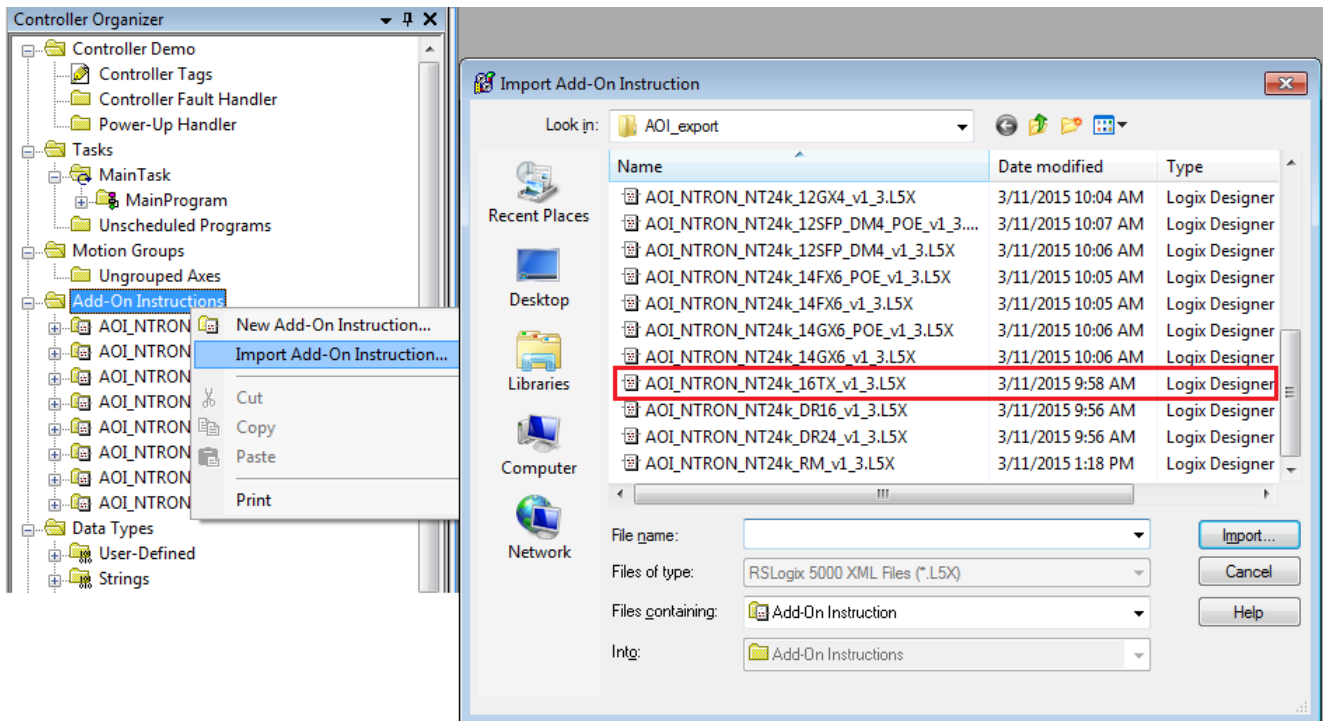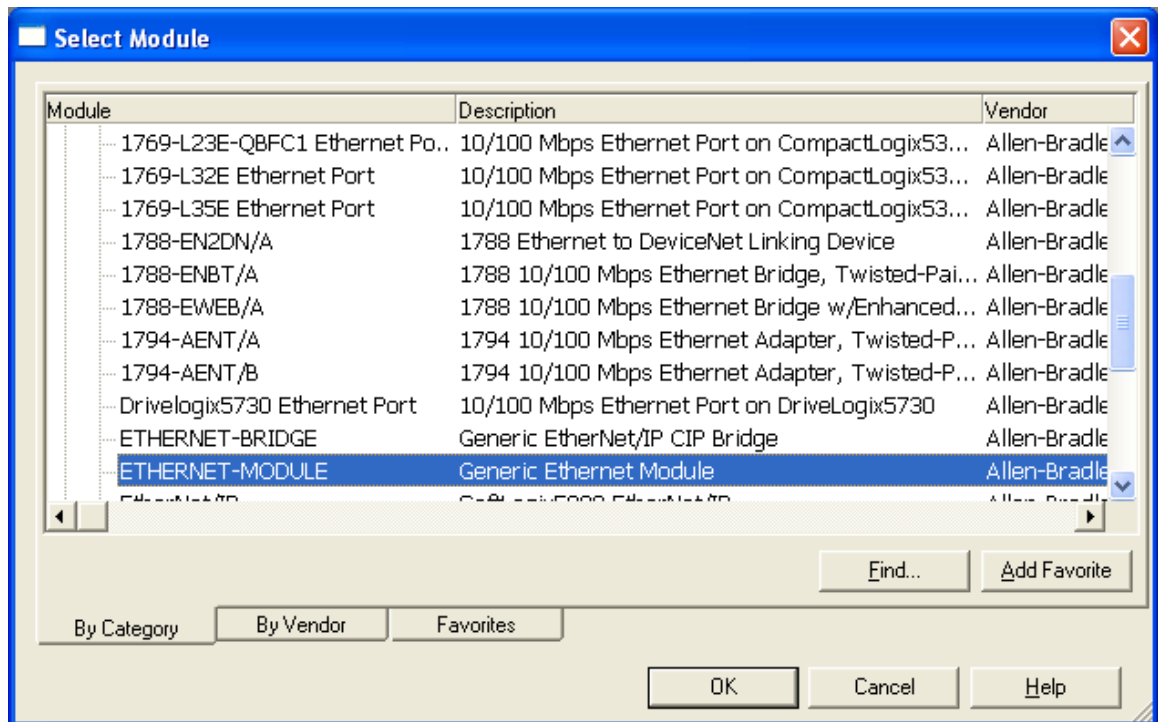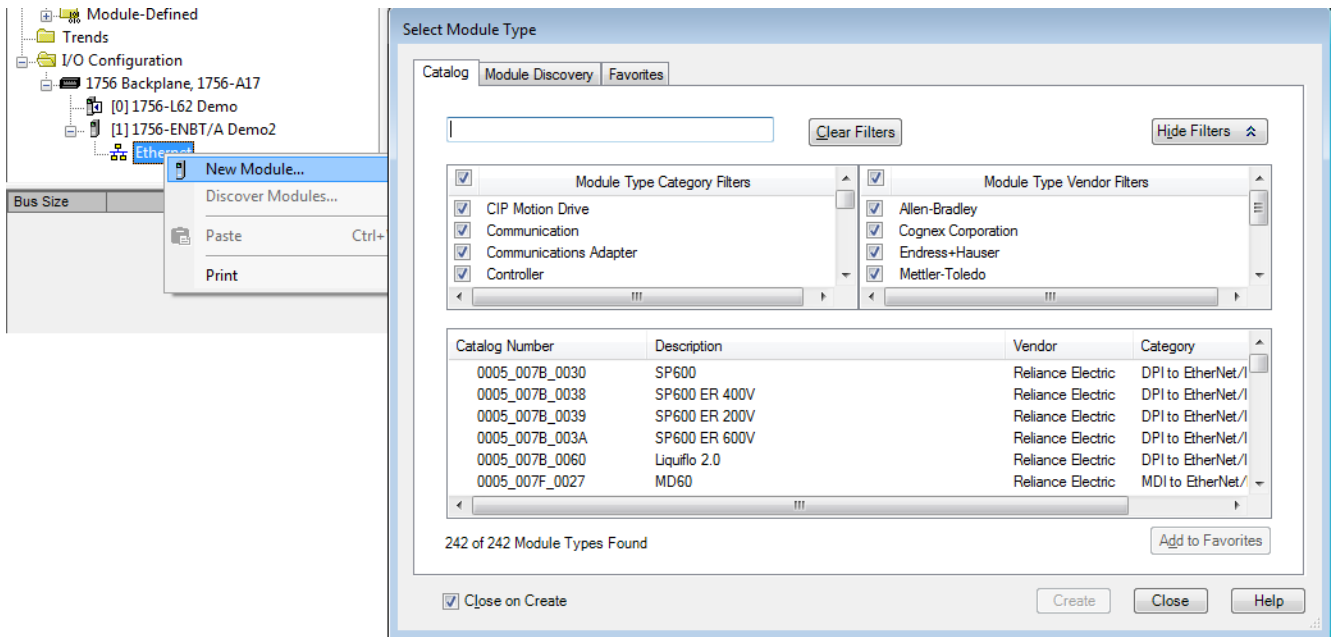


4. The Add-On Instruction tree showing an AOI for the NT24k switch, and several auxiliary AOIs which get loaded as part of the main AOI.
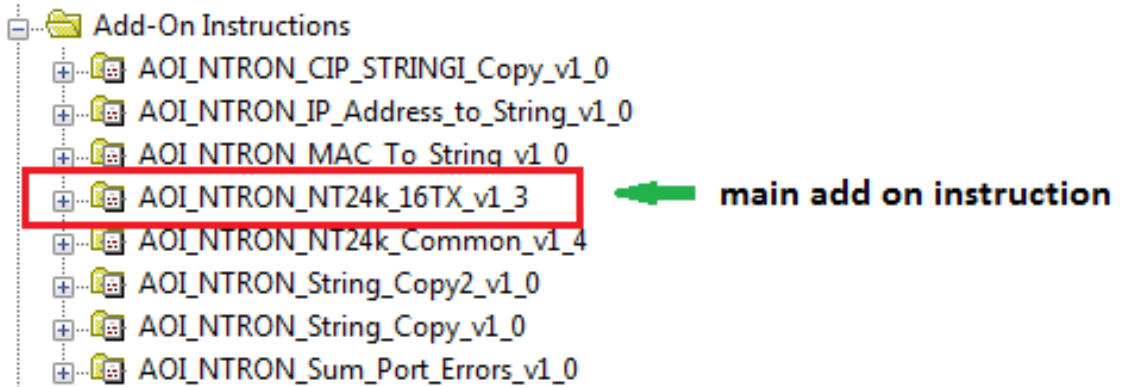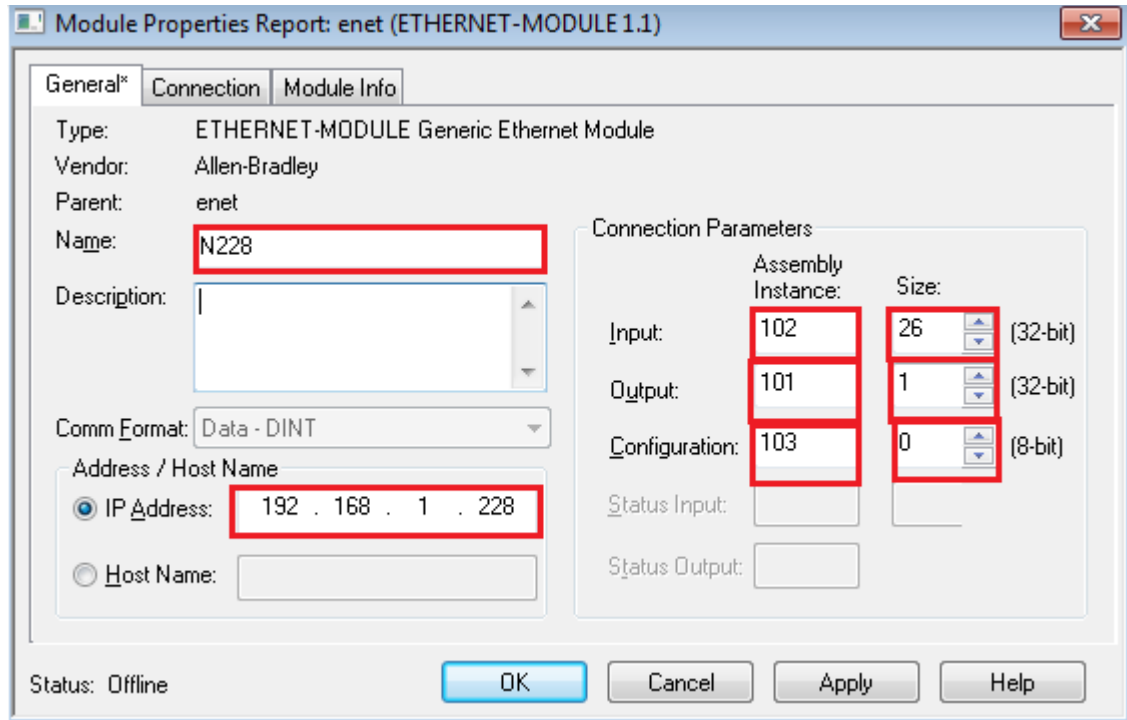
## 2.4.2    Add a Generic Ethernet Module to the I/O Configuration.

The Generic Ethernet Module is located under the "Communications" group:

Configure the module as shown. Use the proper IP address for the new switch and the connection parameters for your installation. For the purpose of demonstration, the module Name will be set to N228 throughout this document.
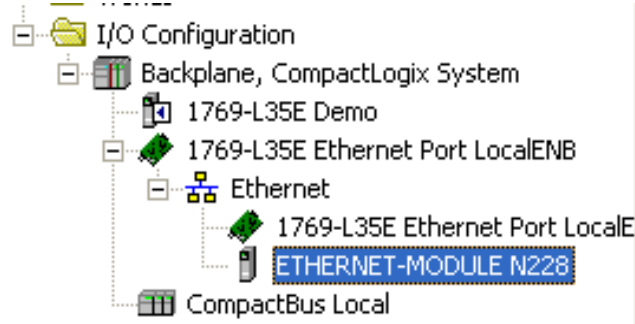


1.  Click the Connection tab and set the desired RPI. The input assembly will be received from the switch at the selected RPI.
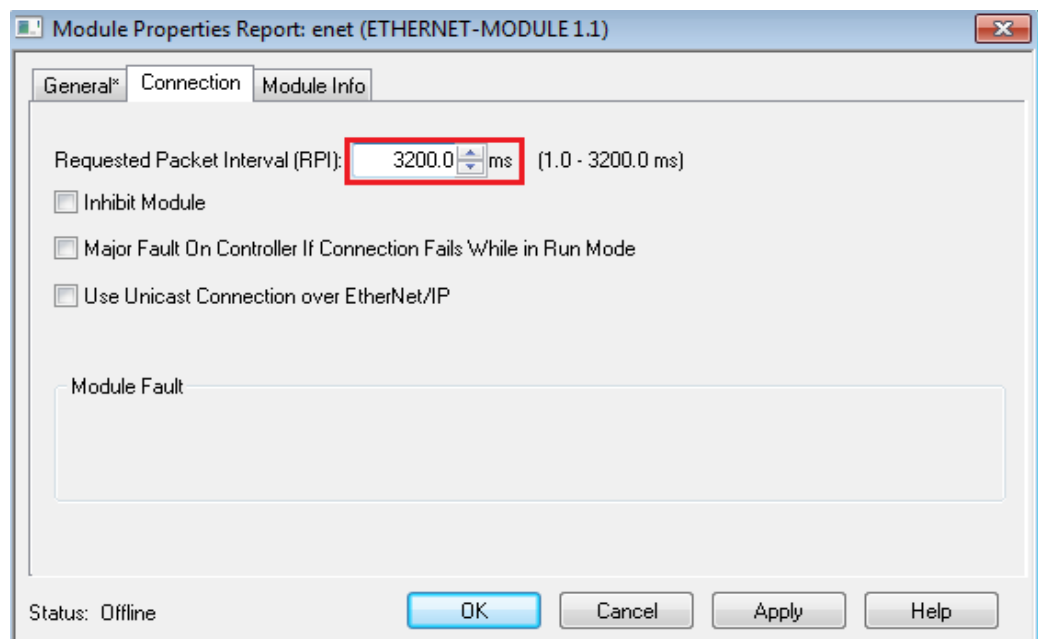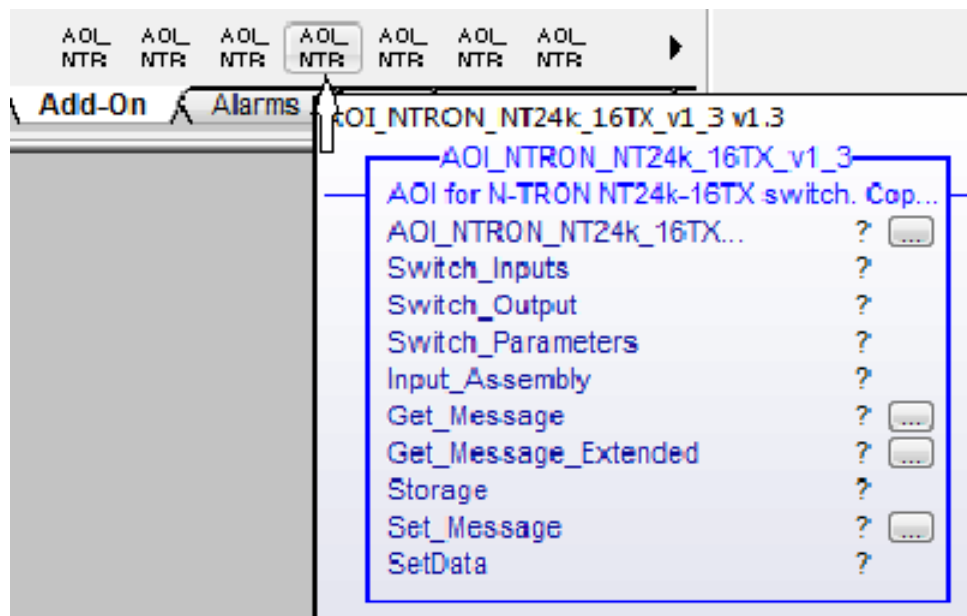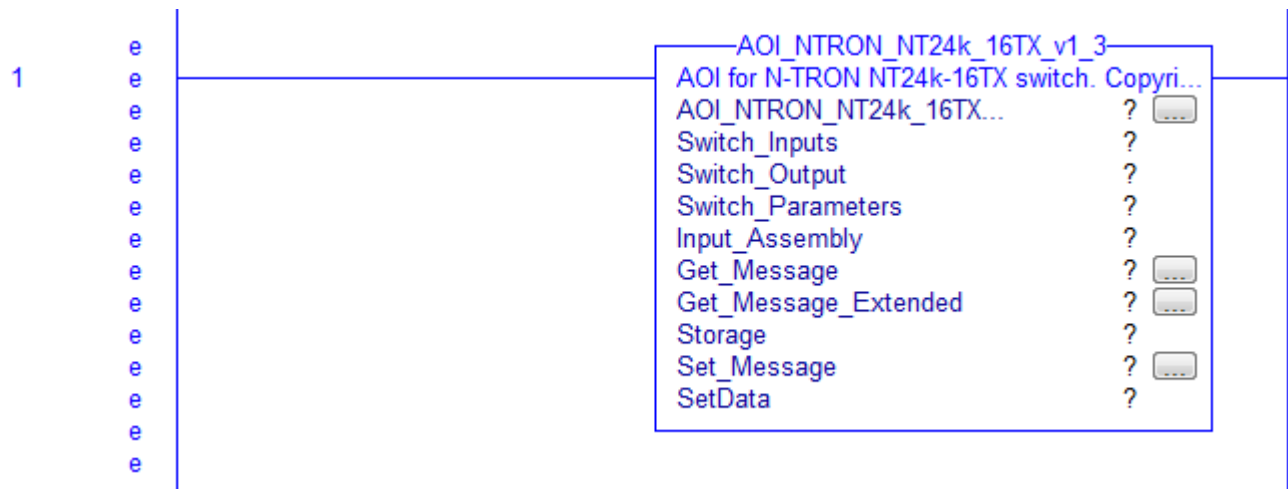
2. Click OK. The new module will appear in the I/O Configuration tree:



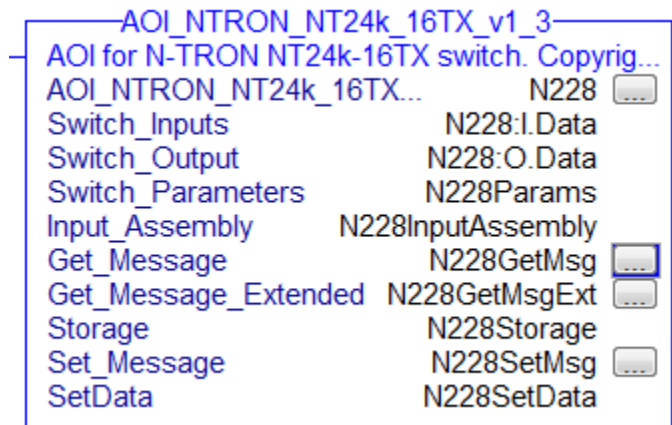### 2.4.3 Add an Instance of the AOI in your Application.

Create a new rung in the MainRoutine and add the AOI for your specific switch to the rung.

### 2.4.4    Create and Configure Tags for the AOI

Create and configure tags for the AOI Add tag names for the various fields. For example:



1.  Right click on each new tag name and create each tag.

Note:   The tags for  Switch_Inputs and Switch_Outputs, shown in the rectangle above, were created when the  Generic Ethernet     Module was added.
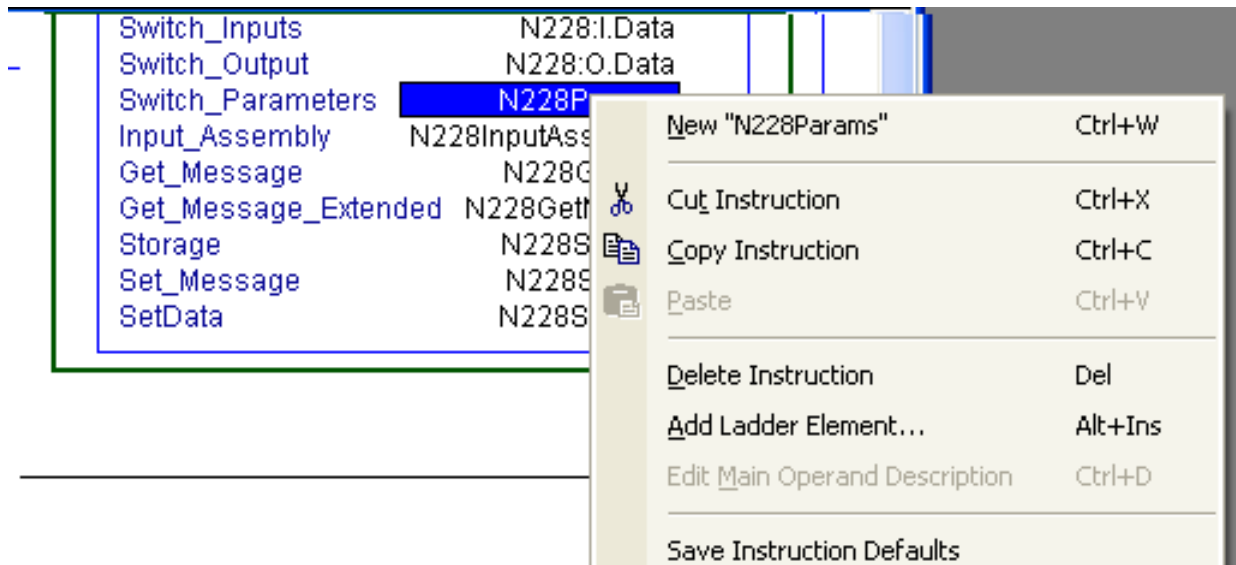
2. Click the button to the right of the "Get_Message" tag and configure as shown:
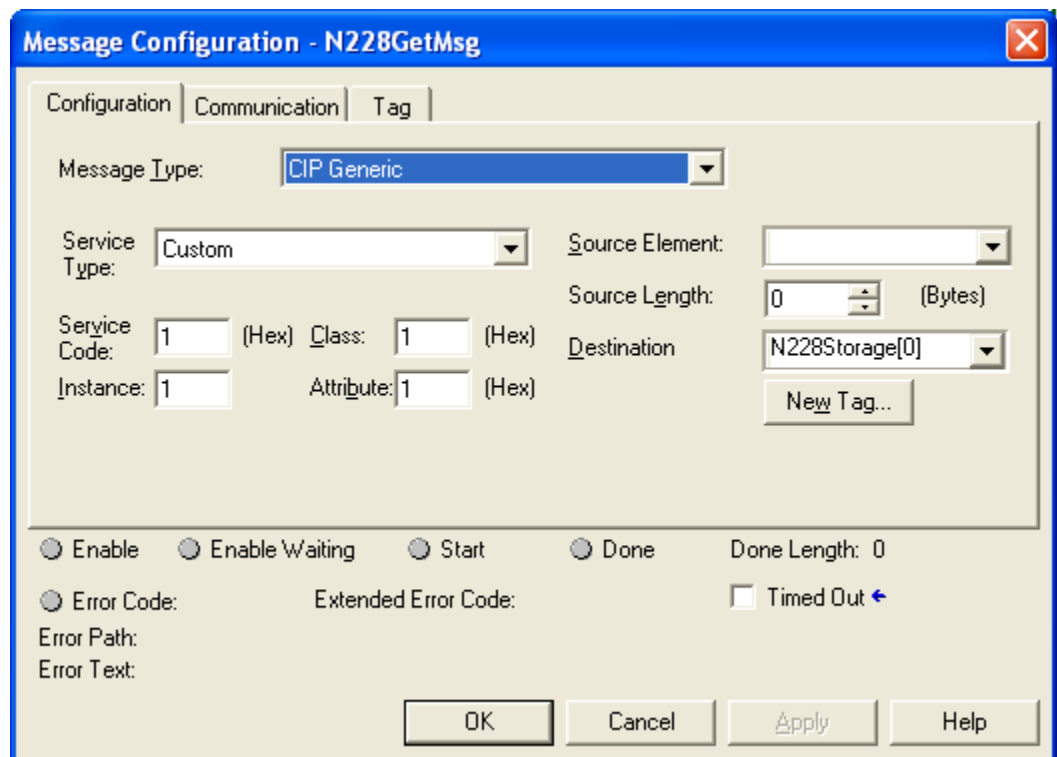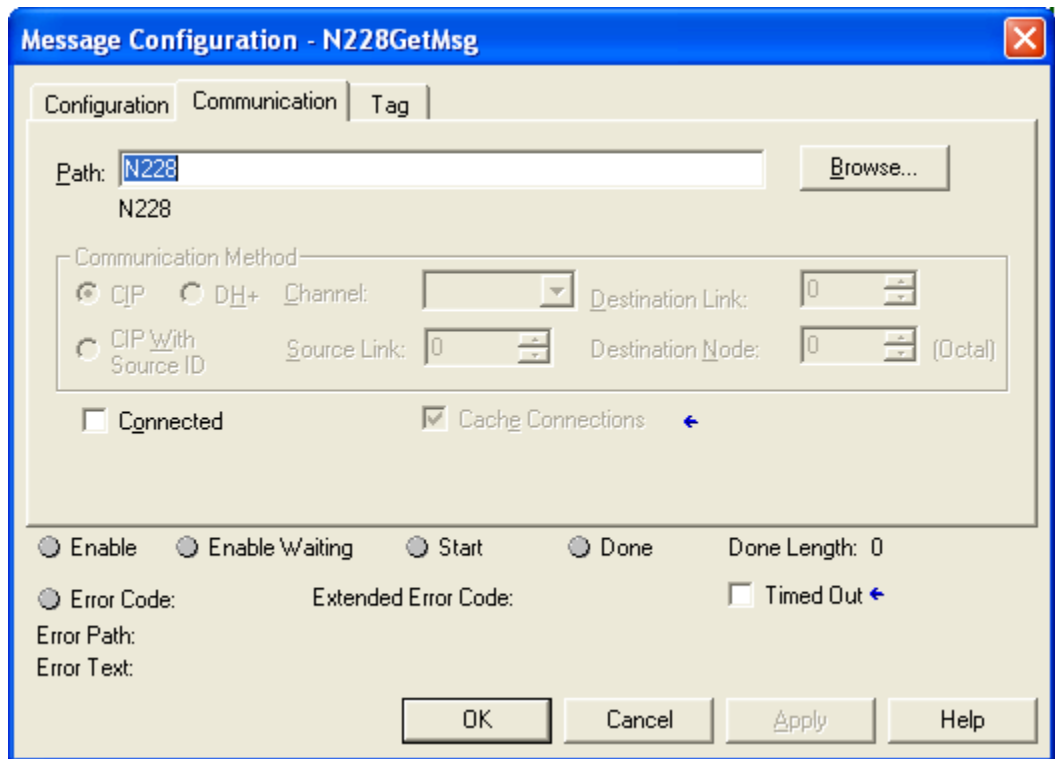
3. Click the button to the right of the "Get_Message_Extended" tag and configure as shown:

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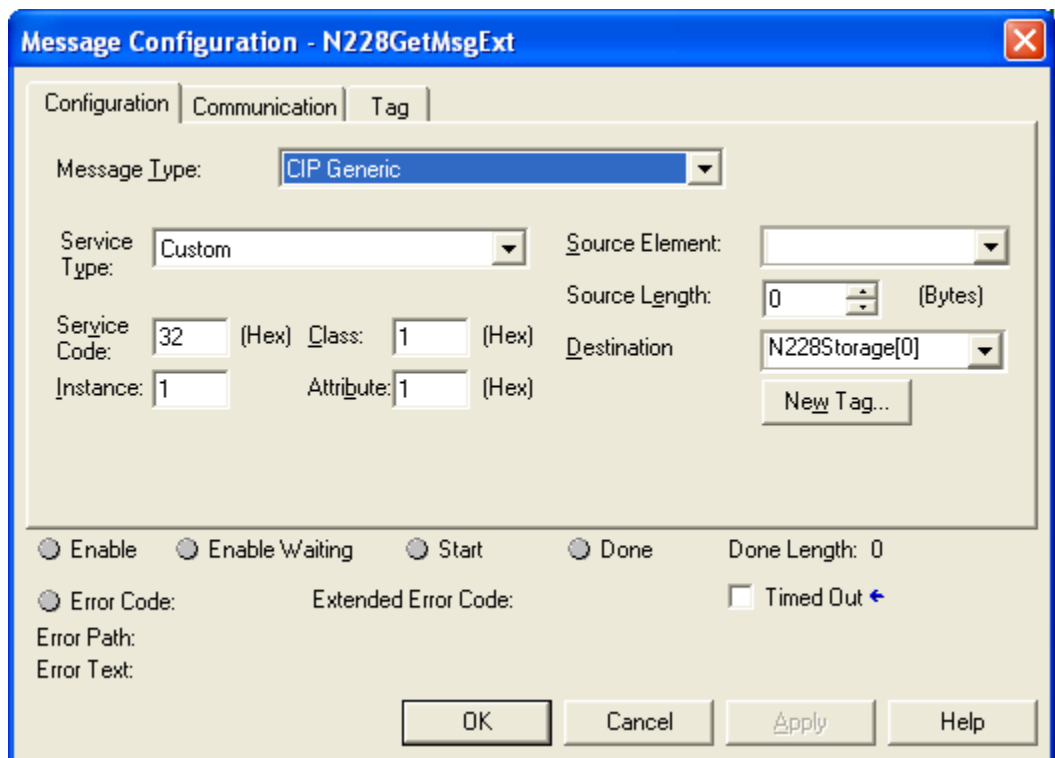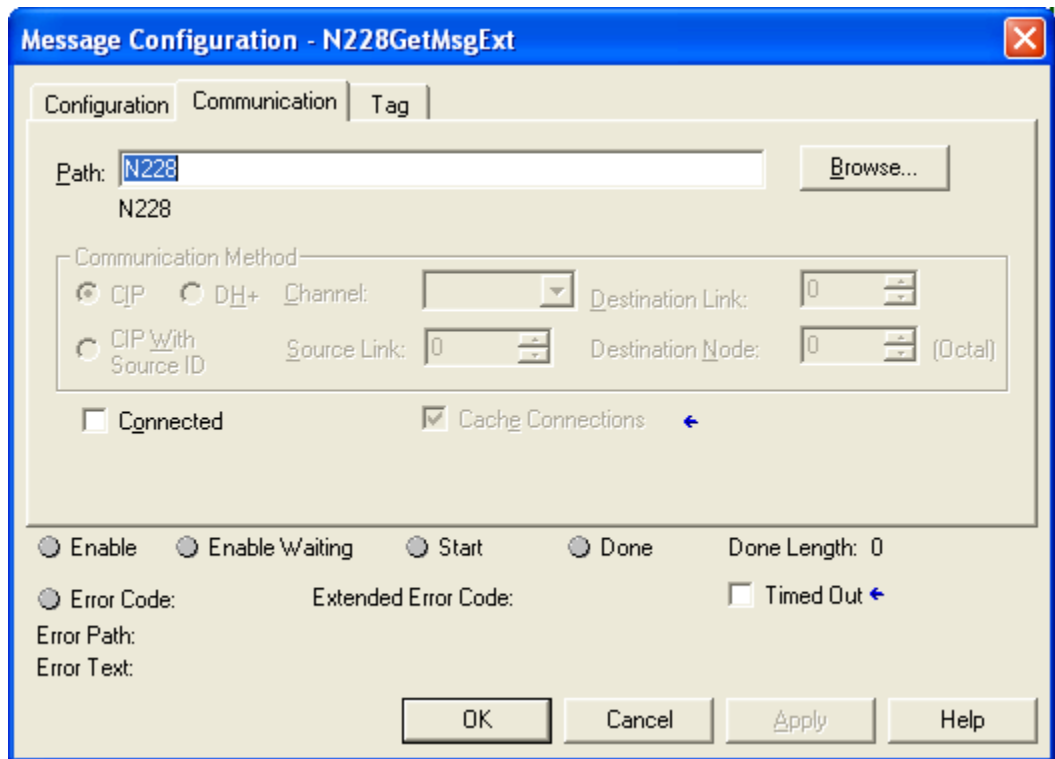
4.  Click the button to the right of the "Set_Message" tag and configure as shown:
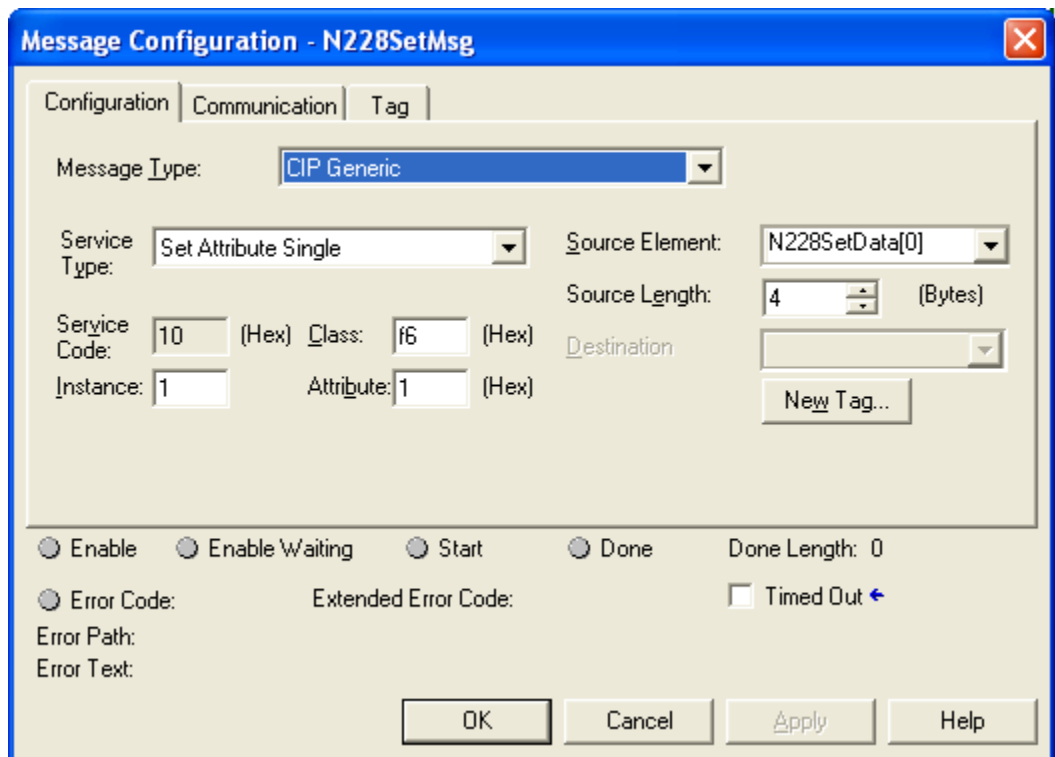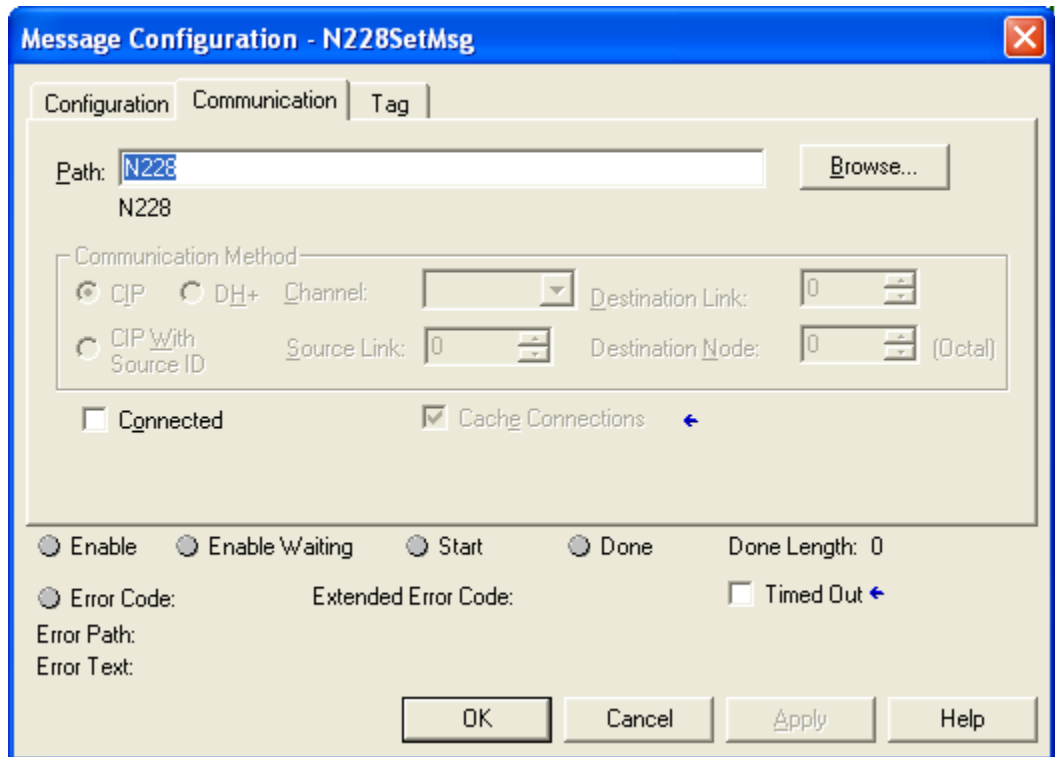
## 2.4.5      Verify the new RSLogix Configuration.

1. Verify your changes by clicking Logic > Verify > Controller. If there are no warnings or errors, the RSLogix configuration is complete.

2. If errors are reported, verify that the data types defined in Controller Demo->Controller Tags matches the data type expected by the AOI tags just created.

3. The settings for the sample switch are shown below:

## 2.5    Input_Assembly Parameter

Some data comes from the switch at the RPI (requested packet interval) set for the
Generic Ethernet Module. The data is available in tags like these in the following
screenshot (a mapping of the  Switch_Inputs data):

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```
─ N228InputAssembly
   + N228InputAssembly.System_Faults
   + N228InputAssembly.Admin_Status
     N228InputAssembly.Admin_Status_P1
     N228InputAssembly.Admin_Status_P2
     N228InputAssembly.Admin_Status_P3
     N228InputAssembly.Admin_Status_P4
     N228InputAssembly.Admin_Status_P5
     N228InputAssembly.Admin_Status_P6
     N228InputAssembly.Admin_Status_P7
     N228InputAssembly.Admin_Status_P8
     N228InputAssembly.Admin_Status_P9
     N228InputAssembly.Admin_Status_P10
     N228InputAssembly.Admin_Status_P11
     N228InputAssembly.Admin_Status_P12
     N228InputAssembly.Admin_Status_P13
     N228InputAssembly.Admin_Status_P14
     N228InputAssembly.Admin_Status_P15
     N228InputAssembly.Admin_Status_P16
   + N228InputAssembly.Link_Status
     N228InputAssembly.Link_Status_P1
     N228InputAssembly.Link_Status_P2
     N228InputAssembly.Link_Status_P3
     N228InputAssembly.Link_Status_P4
     N228InputAssembly.Link_Status_P5
     N228InputAssembly.Link_Status_P6
```

These tags represent a switch specific (NT24k-16TX) view of the assembly data.

## 2.6　　Switch_Parameters Parameter

The AOI requests additional information from the switch as needed by a faceplate display  (and when started). This includes the CIP Identity object, the CIP TCP/IP object, an  instance of the CIP Ethernet Link object, and the N-Tron Switch object.

The following RSLogix 5000 screenshot shows a top level view of some of the AOI "Switch_Parameters" structure:

| N228Params | {...} | {...} | | UDT_NTRON_Switch_Common_NT24k_v1 |
|---|---|---|---|---|
| ⊞ N228Params.Generic_Inputs | {...} | {...} | | UDT_NTRON_Switch_In_NT24k_v0 |
| ⊞ N228Params.Output | 0 | | Decimal | DINT |
| ⊞ N228Params.Identity | {...} | {...} | | UDT_NTRON_CIP_Identity_v0 |
| ⊞ N228Params.TCPIP | {...} | {...} | | UDT_NTRON_CIP_TCPIP_Interface_v0 |
| ⊞ N228Params.Switch | {...} | {...} | | UDT_NTRON_CIP_Switch_NT24k_v1 |
| ⊞ N228Params.Ethernet_Link | {...} | {...} | | UDT_NTRON_CIP_Ethernet_Link_v0[64] |
| ⊞ N228Params.Data | {...} | {...} | | UDT_NTRON_CIP_DATA_v0 |
| ⊞ N228Params.Control | {...} | {...} | | UDT_NTRON_CIP_Control_v0 |

N228Params.Generic_Inputs is a generic view of the assembly data from a switch.

## 2.7 Explicit Messaging Options

To direct the AOI to gather this information (via explicit messaging) for other purposes (example: not using faceplate's), use the members of the N228Params.Control tag: displayed in Table 2-8.

**Table 2-8 N228Params.Control Tag Members**

| Name | Data Type | Description |
|---|---|---|
| Selected_Port | INT | Use this member to read Ethernet Link object for one port. To read more than one port, use Read_Port_Mask. Set by the faceplate. Port data is copied to the UDT_N-Tron_CIP_DATA_v0 data type. |
| Request_Data | BOOL | 0 - explicit messaging is disabled; 1 - explicit messaging is enabled. |
| Read_Port_Mask | DINT | Set bit to read Ethernet Link object for port n+1. |
| Explicit_Messaging_Timer_Reset | DINT | Used to control time between each MSG call to read CIP Identity object, TCPIP object, N-Tron object, and selected Ethernet Link objects. Minimum is 200 ms. Default is 1000 ms.. |

Sample ladder logic rungs are available that show how to control explicit messaging.

## 2.8 Troubleshooting

Module Fault (Code 16#0315 Connection Request Error: Invalid segment type.

This error occurs when the assembly information specified for the Generic Ethernet Module does not match the assembly information on the N-Tron switch.

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## 2.9    Sample Project

A sample project is included in the CIP Installation Kit. It is named  N-Tron_Demo.ACD.

To use the sample project, you may need to change the controller type used in your environment, and you will need to setup the Project path.

If you have any suggestions for improving the AOI or the installation instructions, please  send them to support@redlion.net with subject "RSLogix5000 AOI".

# CHAPTER 3 ROCKWELL RSLOGIX 5000 - TAG REFERENCE

The assembly data received from an N-Tron® switch can be viewed with generic tags or switch specific tags.

Generic tags are defined by the data type  UDT_N-Tron_Switch_In_NT24k_v0. Switch specific tags are defined by a switch  specific data type as shown in Table 3-1.

**Table 3-1 NT24k Switch and Data Types**

| Switch | Data Type |
|---|---|
| NT24k-RM<br>NT24k-RM | UDT_NTRON_Switch_NT24k_In_v1 |
| NT24k-DR16 | UDT_NTRON_Switch_NT24kDR16_In_v1 |
| NT24k-DR24 | UDT_NTRON_Switch_NT24kDR24_In_v1 |
| NT24k-8TX | UDT_NTRON_Switch_NT24k8TX_In_v1 |
| NT24k-8TX-POE | UDT_NTRON_Switch_NT24k8TXPOE_In_v1 |
| NT24k-16TX | UDT_NTRON_Switch_NT24k16TX_In_v1 |
| NT24k-10FX2 | UDT_NTRON_Switch_NT24k10FX2_In_v1 |
| NT24K-16TX-POE | UDT_NTRON_Switch_NT24k_16TX_POE_In_v1". |
| NT24k-10GX2 | UDT_NTRON_Switch_NT24k10GX2_In_v1 |
| NT24k-11FX3 | UDT_NTRON_Switch_NT24k11FX3_In_v1 |
| NT24k-11GX3 | UDT_NTRON_Switch_NT24k11GX3_In_v1 |
| NT24k-12FX4 | UDT_NTRON_Switch_NT24k12FX4_In_v1 |
| NT24k-12GX4 | UDT_NTRON_Switch_NT24k12GX4_In_v1 |
| NT24k-14FX6 | UDT_NTRON_Switch_NT24k14FX6_In_v1 |
| NT24k-14GX6 | UDT_NTRON_Switch_NT24k14GX6_In_v1 |
| NT24k-12SFP-DM4 | UDT_NTRON_Switch_NT24k12SFPDM4_In_v1 |
| NT24k-10FX2-POE | UDT_NTRON_Switch_NT24k10FX2POE_In_v1 |
| NT24k-10GX2-POE | UDT_NTRON_Switch_NT24k10GX2POE_In_v1 |
| NT24k-11FX3-POE | UDT_NTRON_Switch_NT24k11FX3POE_In_v1 |
| NT24k-11GX3-POE | UDT_NTRON_Switch_NT24k11GX3POE_In_v1 |
| NT24k-12FX4-POE | UDT_NTRON_Switch_NT24k12FX4POE_In_v1 |
| NT24k-12GX4-POE | UDT_NTRON_Switch_NT24k12GX4POE_In_v1 |
| NT24k-14FX6-POE | UDT_NTRON_Switch_NT24k14FX6POE_In_v1 |
| NT24k-14GX6-POE | UDT_NTRON_Switch_NT24k14GX6POE_In_v1 |
| NT24k-12SFP-DM4-POE | UDT_NTRON_Switch_NT24k12SFPDM4POE_In_v1 |

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The following sections present some of the tag descriptions:.

## 3.1    Generic Assembly Tags

DATA TYPE: UDT_N-TRON_SWITCH_IN_NT24K_V0

**Table 3-2 Generic View of Assembly Data Received from an N-Tron Switch**

| Name | Data Type | Description |
|---|---|---|
| System_Faults | UDT_NTRON_System_Faults_NT24k_v 0 | Status of various system faults. |
| Admin_Status | DINT | Admin Status of first 32 ports. Also available as port specific tags. |
| Admin_Status_1 | | |
| Admin_Status_2 | | |
| Admin_Status_3 | | |
| … | BOOL | 1=enabled, 0=disabled |
| Admin_Status_30 | | |
| Admin_Status_31 | | |
| Admin_Status_32 | | |
| Admin_Status2 | DINT | Admin Status of second 32 ports. Also available as port specific tags. |
| Admin_Status_33 | | |
| Admin_Status_34 | | |
| Admin_Status_35 | | |
| … | BOOL | 1=enabled, 0=disabled |
| Admin_Status_62 | | |
| Admin_Status_63 | | |
| Admin_Status_64 | | |
| Link_Status | DINT | Link Status of first 32 ports. Also available as port specific tags. |
| Link_Status_1 | | |
| Link_Status_2 | | |
| Link_Status_3 | | |
| … | BOOL | 1=active, 0=inactive |
| Link_Status_30 | | |
| Link_Status_31 | | |
| Link_Status_32 | | |
| Link_Status2 | DINT | Link Status of second 32 ports. Also available as port specific tags. |

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| Name | Data Type | Description |
|---|---|---|
| Link_Status_33 | BOOL | 1=active, 0=inactive |
| Link_Status_34 | | |
| Link_Status_35 | | |
| … | | |
| Link_Status_62 | | |
| Link_Status_63 | | |
| Link_Status_64 | | |
| Utilization_Alarm | DINT | Bandwidth utilization alarms for first 32 ports. Also available as port specific tags. |
| Utilization_Alarm_1 | BOOL | 1=bandwidth utilization exceeds a high or low limit, 0=bandwidth utilization within limits |
| Utilization_Alarm_2 | | |
| Utilization_Alarm_3 | | |
| … | | |
| Utilization_Alarm_30 | | |
| Utilization_Alarm_31 | | |
| Utilization_Alarm_32 | | |
| Utilization_Alarm2 | DINT | Bandwidth utilization alarms for second 32 ports. Also available as port specific tags. |
| Utilization_Alarm_33 | BOOL | 1=bandwidth utilization exceeds a high or low limit, 0=bandwidth utilization within limits |
| Utilization_Alarm_34 | | |
| Utilization_Alarm_35 | | |
| … | | |
| Utilization_Alarm_62 | | |
| Utilization_Alarm_63 | | |
| Utilization_Alarm_64 | | |
| Class1_Connections | INT | Number of CIP EtherNet/IP class 1 (multicast) connections |
| Class3_Connections | INT | Number of CIP EtherNet/IP class 3 (unicast) connections |
| Temperature_C | INT | Temperature in degrees Celsius. 0x7FFF = Not supported on device. |
| Temperature_F | INT | Temperature in degrees Fahrenheit. 0x7FFF = Not supported on device. |
| CPU_Utilization | SINT | Percent of CPU usage, 0-100 |
| Contact_Status | SINT | 2 Bits per contact.  00=Not Present, 01=Open, 10=Closed. |

| Name | Data Type | Description |
|------|-----------|-------------|
| Utilization_1 | SINT | bandwidth utilization in percent |
| Utilization_2 | | |
| Utilization_3 | | |
| … | | |
| Utilization_62 | | |
| Utilization_63 | | |
| Utilization_64 | | |
| Update_Counter | INT | |

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# 3.2     NT24k  Assembly Tags

### DATA TYPE: UDT_N-TRON_SWITCH_NT24K_IN_V0

Specific view of assembly data received from an N-Tron NT24k Switch.

**Table 3-3 Generic View of Assembly Data Received from an N-Tron Switch**

| Name | Data Type | Description |
|---|---|---|
| System_Faults | UDT_N-Tron _System_Fa ult s_NT24k_v0 | Status of various system faults. |
| Admin_Status | DINT | Admin Status of first 32 ports. Also available as port specific tags. |
| Admin_Status_A1 | BOOL | 1=enabled, 0=disabled |
| … | | |
| Admin_Status_A8 | | |
| Admin_Status_B1 | | |
| … | | |
| Admin_Status_B8 | | |
| Admin_Status_C1 | | |
| … | | |
| Admin_Status_C8 | | |
| Link_Status | DINT | Link Status of first 32 ports. Also available as port specific tags. |
| Link_Status_A1 | BOOL | 1=active, 0=inactive |
| … | | |
| Link_Status_A8 | | |
| Link_Status_B1 | | |
| … | | |
| Link_Status_B8 | | |
| Link_Status_C1 | | |
| … | | |
| Link_Status_C8 | | |
| Utilization_Alarm | DINT | Bandwidth utilization alarms for first 32 ports. Also available as port specific tags. |

| Name | Data Type | Description |
|---|---|---|
| Utilization_Alarm_A1 | BOOL | 1=bandwidth utilization exceeds a high or low limit, 0=bandwidth utilization within limits |
| … | | |
| Utilization_Alarm_A8 | | |
| Utilization_Alarm_B1 | | |
| … | | |
| Utilization_Alarm_B8 | | |
| Utilization_Alarm_C1 | | |
| … | | |
| Utilization_Alarm_C8 | | |
| Class1_Connections | INT | Number of CIP EtherNet/IP class 1 (multicast) connections |
| Class3_Connections | INT | Number of CIP EtherNet/IP class 3 (unicast) connections |
| Temperature_C | INT | Temperature in degrees Celsius. 0x7FFF = Not supported on device. |
| Temperature_F | INT | Temperature in degrees Fahrenheit. 0x7FFF = Not supported on device. |
| CPU_Utilization | SINT | Percent of CPU usage, 0-100 |
| Contact_Status | SINT | 2 Bits per contact. 00=Not Present, 01=Open, 10=Closed. |
| Utilization_A1 | SINT | bandwidth utilization in percent |
| … | | |
| Utilization_A8 | | |
| Utilization_B1 | | |
| … | | |
| Utilization_B8 | | |
| Utilization_C1 | | |
| … | | |
| Utilization_C8 | | |

## 3.3    System Fault Tags

**Table 3-4 N-Tron Switch System Fault Tags**

| Name | Data Type | Description |
| --- | --- | --- |
| Faults | DINT | |
| Power_Supply_1 | BOOL | 1=Indicates a low voltage on power supply 1 |
| Power_Supply_2 | BOOL | 1=Indicates a low voltage on power supply 2 |
| NRing_Full | BOOL | 1=Indicates that an N-Ring connection is completely broken. |
| NRing_Part_Low | BOOL | 1=Indicates that an N-Ring connection is only broken in one direction. The lower N-Ring port is not receiving self-health frames around the N-Ring but the higher N-Ring port is. |
| NRing_Part_High | BOOL | 1=Indicates that an N-Ring connection is only broken in one direction. The higher N-Ring port is not receiving self-health frames around the N-Ring but the lower N-Ring port is. |
| NRing_Multiple_Managers | BOOL | 1=Indicates that more than one N-Ring Manager exists on an N-Ring. |
| System | BOOL | 1=Indicates a system fault. |
| Config_Device | BOOL | 1=Indicates a problem with the configuration device. |
| NLink | BOOL | 1=Indicates that the N-Link Master or Slave encountered a problem. |
| Boot_Loader_Version | BOOL | 1=Indicates a problem with the version of the boot loader firmware. |
| Port_Utilization | BOOL | 1=Indicates one or more ports have exceeded a high or low bandwidth utilization limit. |
| Temperature | BOOL | 1=Indicates the switch temperature has exceeded a high or low temperature limit. |
| Settings_Fault | BOOL | 1=Indicates that a settings misconfiguration needs to be resolved. |

## 3.4    CIP™ Tags

There are tags for each CIP™ object. The tags correspond to the object's attributes.

- Identity Object (Table 3-5)
- TCP/IP Interface Object (Table 3-6)
- Ethernet Link Object (Table 3-7)
- N-Tron switch Object (Table 3-8)

### 3.4.1 Identity Object

DATA TYPE: UDT_N-TRON_CIP_IDENTITY_v0

**Table 3-5 N-Tron Switch Identity Object Tags**

| Name | Data Type | Description |
|---|---|---|
| Vendor_ID | INT | ODVA Vendor ID. N-Tron = 1006 |
| Device_Type | INT | 0x0C. Communications Adapter |
| Product_Code | INT | NT24k-RM= 24001<br>NT24k-DR16= 24002<br>NT24k-DR24= 24003<br>NT24k-8TX= 24004<br>NT24k-8TX-POE= 24005<br>NT24k-16TX= 24006<br>NT24k-16TX-POE= 24007<br>NT24k-10FX2= 24008<br>NT24k-10GX2= 24009<br>NT24k-11FX3= 24010<br>NT24k-11GX3= 24011<br>NT24k-12FX4= 24012<br>NT24k-12GX4= 24013<br>NT24k-14FX4= 24014<br>NT24k-14GX4= 24015<br>NT24k-12SFP-DM4= 24016<br>NT24k-10FX2-POE= 24017<br>NT24k-10GX2-POE= 24018<br>NT24k-11FX3-POE= 24019<br>NT24k-11GX3-POE= 24020<br>NT24k-12FX4-POE= 24021<br>NT24k-12GX4-POE= 24022<br>NT24k-14FX6-POE= 24023<br>NT24k-14GX6-POE= 24024<br>NT24k-12SFP-DM4-POE= 24025 |
| Major_Revision | SINT | Major revision of the item the Identity Object represents |
| Minor_Revision | SINT | Minor revision of the item the Identity Object represents |
| Status | INT | Summary status of device |
| Serial_Number | DINT | Serial number of device |
| Product_Name | STRING | Human readable identification. Switch model number. Ex: N-Tron NT24k |
| Assigned_Name | UDT_NTRON_String1024 | User assigned switch name. |
| Geographic_Location | UDT_NTRON_String1024 | This is the user assigned switch location. |

## 3.4.2    TCPIP Object

DATA TYPE: UDT_N-TRON_CIP_TCPIP_INTERFACE_V0

**Table 3-6 N-Tron Switch TCPIP Object Tags**

| Name | Data Type | Description |
|------|-----------|-------------|
| Status | DINT | Interface status |
| Configuration_Capability | DINT | Interface capability flags |
| Configuration_Control | DINT | Interface control flags |
| Path_Size | INT | Size of Path |
| Object_Path_1 | INT | Logical segments identifying the physical link object |
| Object_Path_2 | INT | Logical segments identifying the physical link object |
| IP_Address | DINT | The device's IP address. |
| Network_Mask | DINT | The device's network mask |
| Gateway_Address | DINT | Default gateway address |
| Name_Server_1 | DINT | Primary name server |
| Name_Server_2 | DINT | Secondary name server |
| Domain_Name | STRING | Default domain name |
| Host_Name | STRING | Host name |

## 3.4.3    Ethernet Link Object

DATA TYPE: UDT_N-TRON_CIP_ETHERNET_LINK_V0

**Table 3-7 N-Tron Switch Ethernet Link Object Tags**

| Name | Data Type | Description |
|------|-----------|-------------|
| Interface_Speed | DINT | Interface speed currently in use. Speed in Mbps (e.g., 0, 10, 100, 1000, etc.) |
| Interface_Flags | UDT_NTRON_CIP_Interface_Flags_v0 | Interface status flags |
| Physical_Address | SINT[6] | MAC layer address |
| InOctets | DINT | Octets received on the interface |
| InUcastPackets | DINT | Unicast packets received on the interface |
| InNucastPackets | DINT | Non-unicast packets received on the interface |
| InDiscards | DINT | Inbound packets received on the interface but discarded |

| Name | Data Type | Description |
|---|---|---|
| InErrors | DINT | Inbound packets that contain errors (does not include In Discards) |
| InUnknownProtos | DINT | Inbound packets with unknown protocol |
| OutOctets | DINT | Octets sent on the interface |
| OutUcastPackets | DINT | Unicast packets sent on the  interface |
| OutNucastPackets | DINT | Non-unicast packets sent on  the  interface |
| OutDiscards | DINT | Outbound packets discarded |
| OutErrors | DINT | Outbound packets that contain  errors |
| Alignment_Errors | DINT | Frames received that are not an integral number of octets in length |
| FCS_Errors | DINT | Frames received that do not  pass  the FCS check |
| Single_Collisions | DINT | Successfully transmitted frames which experienced exactly one collision |
| Multiple_Collisions | DINT | Successfully transmitted frames which experienced more than one collision |
| SQE_Test_Errors | DINT | Number of times SQE test error  message is generated |
| Deferred_Transmissions | DINT | Frames for which first  transmission attempt is delayed because the medium  is busy |
| Late_Collisions | DINT | Number of times a collision is detected  later than 512 bit- times into the  transmission of  a packet |
| Excessive_Collisions | DINT | Frames for which transmission fails due  to excessive collisions |
| MAC_Transmit_Errors | DINT | Frames for which transmission fails due  to an internal MAC sub layer transmit  error |
| Carrier_Sense_Errors | DINT | Times that the carrier sense  condition  was lost or never asserted when  attempting to transmit a frame |
| Frame_Too_Long | DINT | Frames received that exceed the  maximum permitted frame size |
| MAC_Receive_Errors | DINT | Frames for which reception on  an interface fails due to an internal MAC  sub layer receive error |
| Control_Bits | INT | 0 Auto-negotiate 0 indicates 802.3 link auto-negotiation is disabled.  1 indicates  auto-negotiation is enabled. If auto- negotiation is disabled, then the device shall use the settings indicated by the  Forced Duplex Mode and Forced Interface Speed bits; 1 Forced Duplex Mode If the Auto-negotiate bit is 0, the Forced Duplex Mode bit indicates  whether the interface shall operate in  full or half duplex mode. 0 indicates the  interface duplex should be half duplex. 1 indicates the interface duplex |
| Forced_Interface_Speed | INT | Speed at which the interface shall be forced to operate. Speed in Mbps (10, 100, 1000, etc.) |

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| Name | Data Type | Description |
|---|---|---|
| Interface_Type | SINT | 0-unknown, 1-internal, 2-twisted pair, 3- optical |
| Interface_State | SINT | 0-unknown, 1-enabled and ready, 2- disabled, 3-testing |
| Admin_State | SINT | 1=enabled, 0=disabled |
| Interface_Label | STRING | Label like "A5" |
| Interface_Description | STRING | Something like: Port 1 - 10/100 Mbit TX  Port 15 - 100 MBit FX |
| Interface_Utilization | SINT | Percentage of entire interface bandwidth being used (0-100) |
| Utilization_Alarm_Upper_Thres hold | SINT | Upper percentage at which to declare a utilization alarm (0-100) |
| Utilization_Alarm_Lower_Thre shold | SINT | Lower percentage at which to declare a utilization alarm (0-100) |
| Broadcast_Limit | SINT | Broadcast limiting percentage (0-100). (BPCL) |
| TX_Unicast_Packet_Rate | DINT | Number of TX unicast packets per second |
| RX_Unicast_Packet_Rate | DINT | Number of RX unicast packets per second |
| TX_Multicast_Packet_Rate | DINT | Number of TX multicast packets per second |
| RX_Multicast_Packet_Rate | DINT | Number of RX multicast packets per second |
| TX_Broadcast_Packet_Rate | DINT | Number of TX broadcast packets per second |
| RX_Broadcast_Packet_Rate | DINT | Number of RX broadcast packets per second |
| TX_Multicast_Packets | DINT | Total number of TX multicast packets |
| RX_Multicast_Packets | DINT | Total number of RX multicast packets |
| TX_Broadcast_Packets | DINT | Total number of TX broadcast packets |
| RX_Broadcast_Packets | DINT | Total number of RX broadcast packets |
| Port_Role | DINT | Bit 0 = RSTP 1 = N-Ring 2 = N-Link Control 3 = N-Link Partner 4 = N-Link Coupler |

## 3.4.4    N-Tron Switch Object

DATA TYPE: UDT_N-TRON_CIP_SWITCH_NT24K_V1

**Table 3-8 N-Tron Switch Object Tags**

| Name | Data Type | Description |
|---|---|---|
| Device_Uptime | DINT | Number of seconds since device was powered up |
| Port_Count | DINT | Total port count |
| Valid_Ports | DINT[2] | 0 = Invalid port, 1 = Port exists on device Bit 0: Port 1 Bit 1: Port 2 etc |
| Global_Admin_Status | DINT[2] | 0 = Port disabled, 1 = Port enabled Bit n: Port n+1 |
| Global_Link_Status | DINT[2] | 0 = Link down, 1 = Link up Bit n: Port n+1 |
| System_Faults | UDT_NTRON_System_Faults_NT24k_v0 | See System Fault Tags |
| IGMP_Querier_Status | SINT | Query Status:  0 = Disabled, 1 = Active (manual), 2 = Active (Auto), 3 = Backup (Auto) [enabled but not active]. |
| IGMP_Version | SINT | IGMP Version (V1, V2, V3, etc). |
| IGMP_Resource_Usage | SINT | Percent of maximum capacity.  Takes into account the number of groups used per max groups and any other possible resource limitations. |
| IGMP_Active_Querier | DINT | IP of the active IGMP querier. |
| CPU_Usage | SINT | Percent usage |
| Class1_Connections | INT | Number of CIP EtherNet/IP class 1 (multicast) connections. |
| Class3_Connections | INT | Number of CIP EtherNet/IP class 3 (unicast) connections. |
| Temperature_Alarm_Upper_Threshold | INT | Upper temperature (C) at which to declare an alarm |
| Temperature_Alarm_Lower_Threshold | INT | Lower temperature (C) at which to declare an alarm |
| Contact_Status | SINT | 2 Bits per contact.  00=Not Present, 01=Open, 10=Closed. |
| Temperature_C | INT | Temperature in degrees C.  Only available on devices that support temperature. |
| Temperature_F | INT | Temperature in degrees F.  Only available on devices that support temperature. |
| Reset_MIB_Counts | DINT[2] | Reset port MIB counters.  (1 bit per port to reset). |
| Device_MAC_Address | SINT[6] | MAC address of device |

| Name | Data Type | Description |
| --- | --- | --- |
| Device_Role | DINT | Bit mask of device roles.  Bits=  0 = N-Ring Manager  1 = N-Ring Member  2 = N-Ring AutoDetect  3 = N-Link Master  4 = N-Link Slave  5 = N-Link Coupler |
| Config_Device_Status | SINT | 0 = Not Supported, 1 = Not Present, 2 =  Present |
| System_Configuration | DINT | Bit mask of system config.  Bits=  0 = Save system configuration to flash  1 = Shutdown and reboot device |
| System_Firmware_Version_String | STRING | Human readable representation of firmware version string. |
| System_Boot_Loader_Version_String | STRING | Human readable representation of boot loader version string. |
| System_Fault_String | UDT_NTRON_String1024 | Human readable representation of error status. May contain multiple errors.  Length is contained as part of the STRINGI data type. |
| Power_Configuration | DINT | 4 Bits per power supply. 0000 = DC Power, 0001 = AC Power, 1111 = Unknown. Power supply 1 configuration is in bits 0-3 and Power supply 2 configuration is in bits 4-7. |

# CHAPTER 4 ROCKWELL FACTORYTALK - FACEPLATE INSTALLATION

## 4.1 Material Prerequisites

- N-Tron® Series Switch

- FactoryTalk View ME/SE Faceplate Displays

## 4.2 Installation Instructions

### 4.2.1 Software Installation Prerequisites

- FactoryTalk View Studio – ME/SE version 5 or later
- N-Tron® Series switch with firmware version that includes CIP support

### 4.2.2 Summary of Faceplate Installation Steps

1. Create shortcut to PLC

2. Import global objects into your project

3. Add local messages

4. Add images

5. Import HMI tags

6. Create faceplate display

7. Configure display startup macro

8. Configure display parameter file

9. Optionally add composite switch image to display

10. Optionally add specific switch image to display

In the instructions below, "ME" refers to FactoryTalk View ME (Machine Edition) and "SE" refers to FactoryTalk View SE (Site Edition).

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## 4.3　　Configuration of FactoryTalk View Faceplate Displays

All faceplate files are included in the "CIP_Install_Kit.zip" file.

FactoryTalk View ME faceplate files are found in the subdirectory "FactoryTalk_View_ME\Display_export".

FactoryTalk View SE files are found in the subdirectory "FactoryTalk_View_SE\Display_export".

Files used by both FactoryTalk View ME and FactoryTalk View SE are found in the subdirectory "FactoryTalk_View_ME\Display_export".

The FactoryTalk View ME screen shots in this document were taken while using the "N-Tron_demo.apa" file in the subdirectory "FactoryTalk_View_ME".

The FactoryTalk View SE screen shots in this document were taken while using the "N-Tron_demo.apa" file in the subdirectory "FactoryTalk_View_SE".

Start with an existing FactoryTalk View ME/SE application.

### 4.3.1　　Configure a Shortcut to the PLC that is Running the Desired N-Tron Switch AOI

1.  Double click Communications Setup.
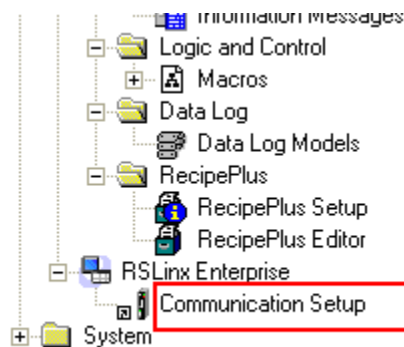


2.  In the following screenshot, the shortcut is named PLC.
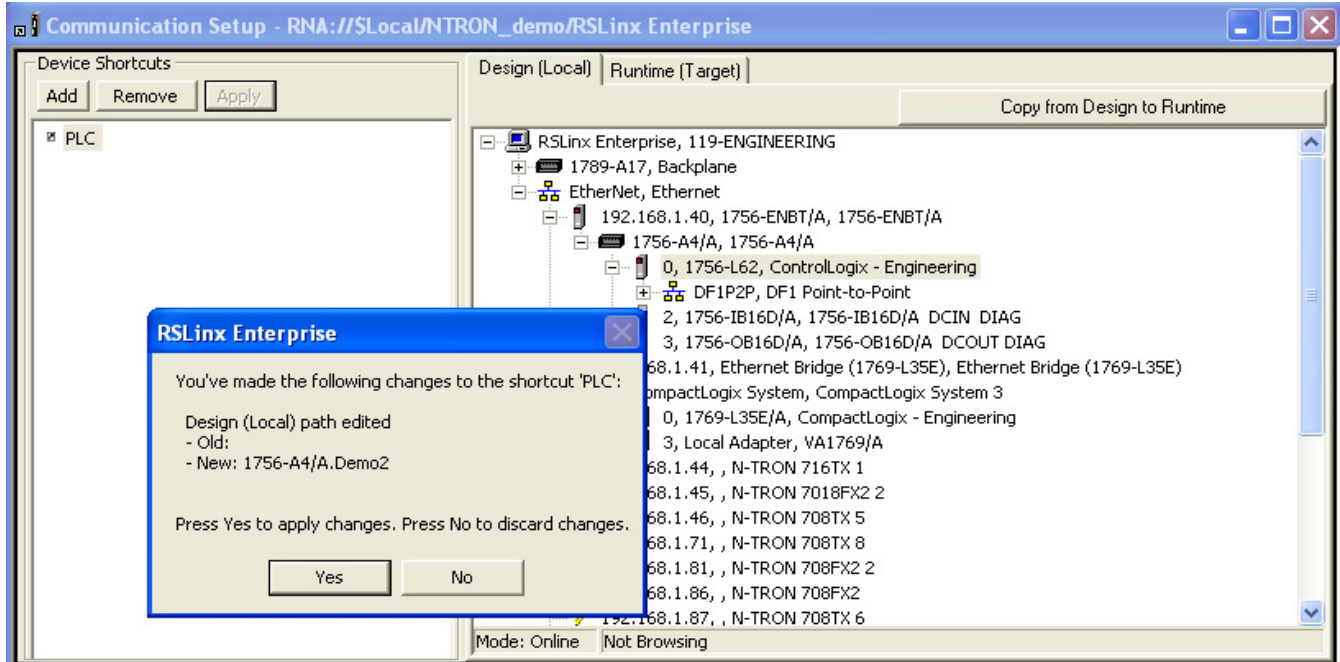
3.  Click the "Yes" button and if ME, click the "Copy from Design to Runtime" button.

## 4.3.2     Import Graphics into your Project

1.  Right-click on Global in the Graphics folder and select Import and Export from the pop up.
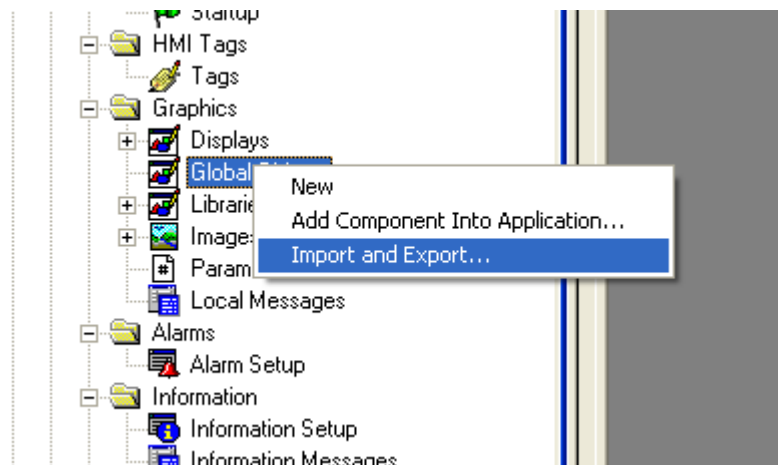
2.    Click on the radio button as shown and click Next.
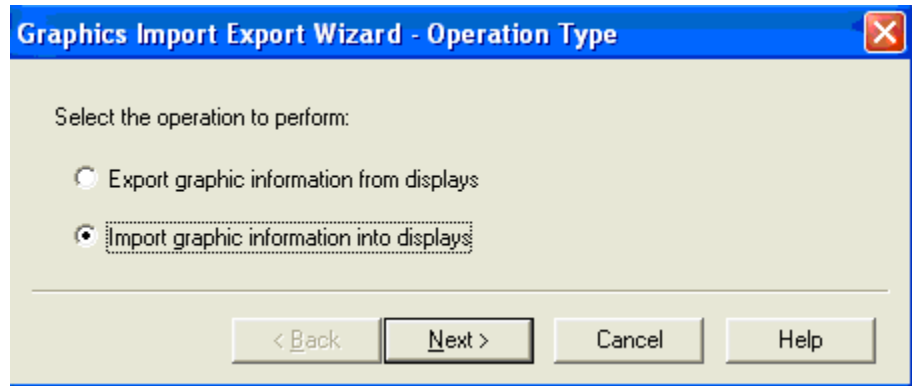


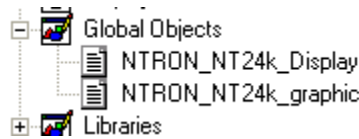3.    Click on the desired radio button as shown and click Next.:
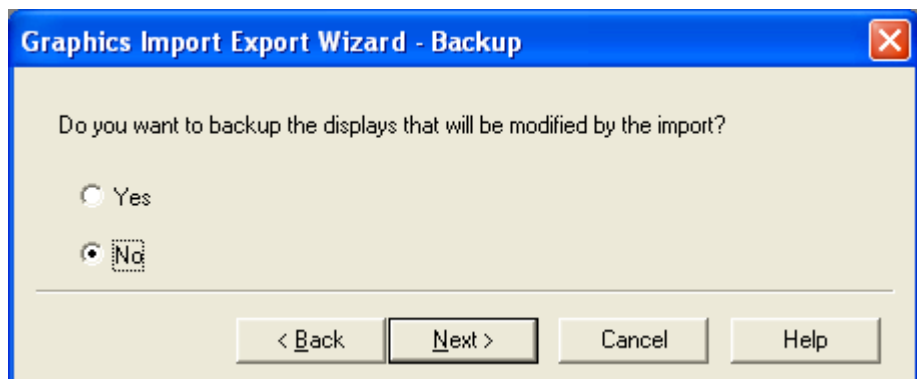


4.    Click on the desired option radio button as shown and click Next.
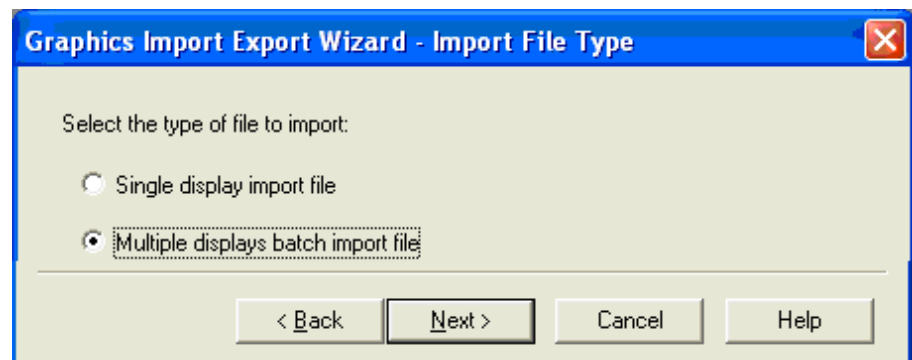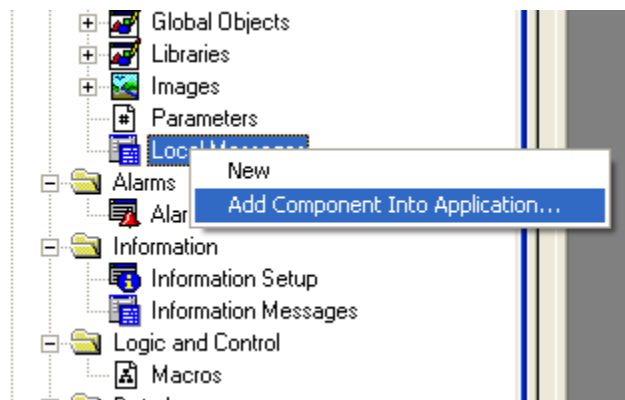


5.    The following dialog screen should appear.
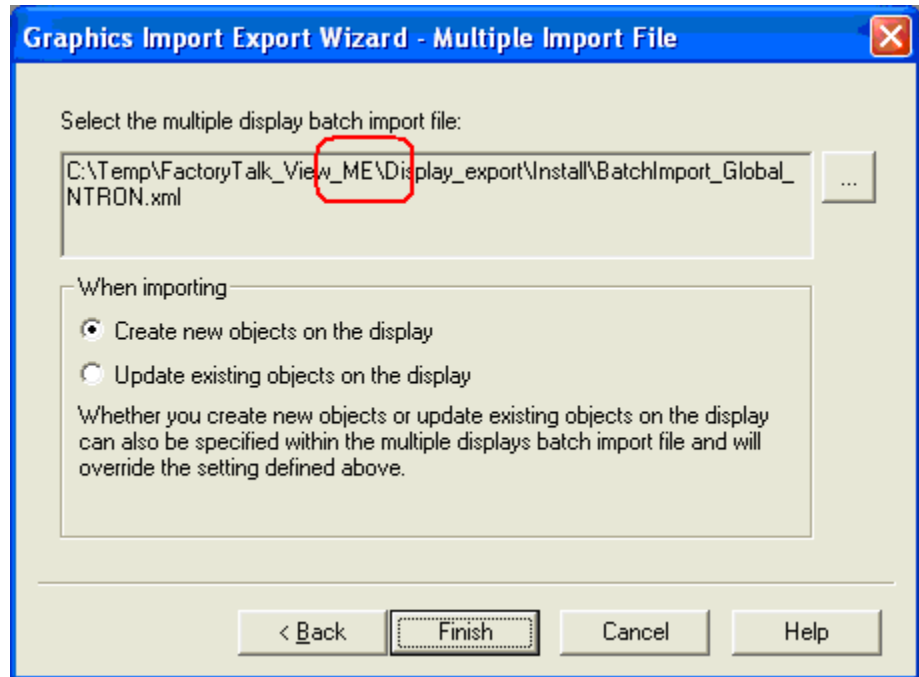
6. For SE, use the FactoryTalk_View_SE folder in the above dialog.

7. The following global objects should appear in the Explorer window.



## 4.3.3    Import Local Messages

1. Select the folder (FactoryTalk_View_ME\Display_export\local) containing the local   message files (.loc). Import all N-Tron*.loc files.
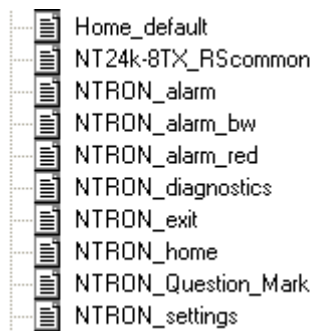


2. The Explorer window should show  these files:

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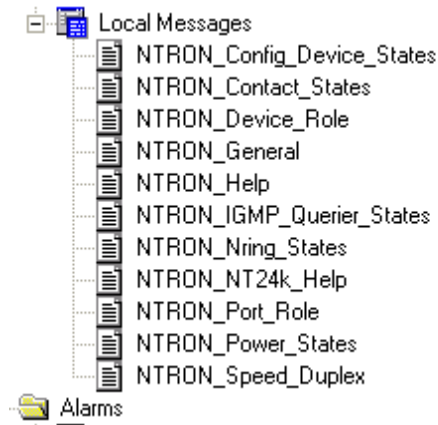
### 4.3.4 Import Images

1. Select the folder (FactoryTalk_View_ME\Display_export\images) containing the image   files (.bmp). Import all N-Tron*.bmp files..
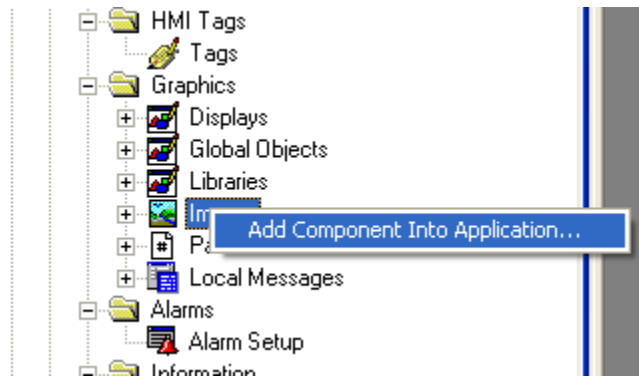


2. The Explorer window should show several  new files:

### 4.3.5     Import HMI tags

1. Use the Tag Import and Export Wizard.

2. Select the N-Tron-Tags.CSV to import (FactoryTalk_View_ME\Display_export\tags).

3. The result should be these tags:

| | Tag Name | Type | Description |
|---|---|---|---|
| 1 | NTRON_Help | Digital | |
| 2 | NTRON_Settings_Selection | Analog | |
| 3 | NTRON_Trend_Selection | Analog | |
| 4 | | | |

### 4.3.6     Create Faceplate Display

1. To access the faceplate displays, create a display using the global object N-Tron_NT24k_Display. (File > New > Display).

2. Select all objects in the N-Tron_NT24k_Display global object and paste them into the new display.

3. Save the new display.

### 4.3.7     Configure the Display Startup Macro.

1. Configure a macro for opening your display.

   Here is the ME form for this example: (This example uses the N228 information from the demo RSLogix 5000 project shown earlier in this manual)

| | NTRON_Open_228 - /NTRON_demo/ (Macros) | | | | |
|---|---|---|---|---|---|
| Form: <Tag> = <Expression> | | | | | |
| | Tag | Tag | Expression | Exprn |
| 1 | {[PLC]N228Params.Control.HMI[0].Display_Mode} | ••• | 1 | ••• |
| 2 | | ••• | | ••• |

Tag from screenshot: {[PLC]N228Params.Control.HMI[0].Display_Mode}

2.  Here is the SE form displayed:
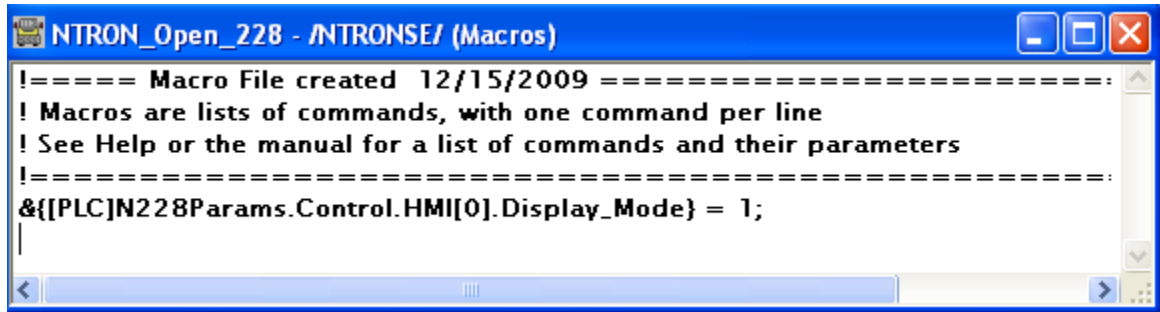


Tag from screenshot:  &{[PLC]N228Params.Control.HMI[0].Display_Mode} = 1;

ⓘ  Note:  In the macro definition (and later in the parameter file), the shortcut "PLC" was created  earlier. The other important piece is "N228Params", which must match the name of the  Switch_Parameters tag created for the N-Tron_SWITCH AOI in your RSLogix project..
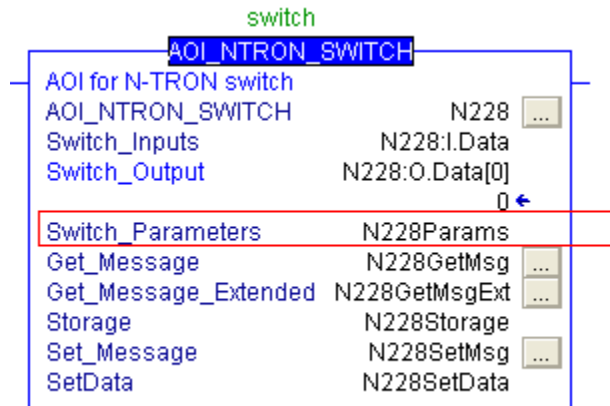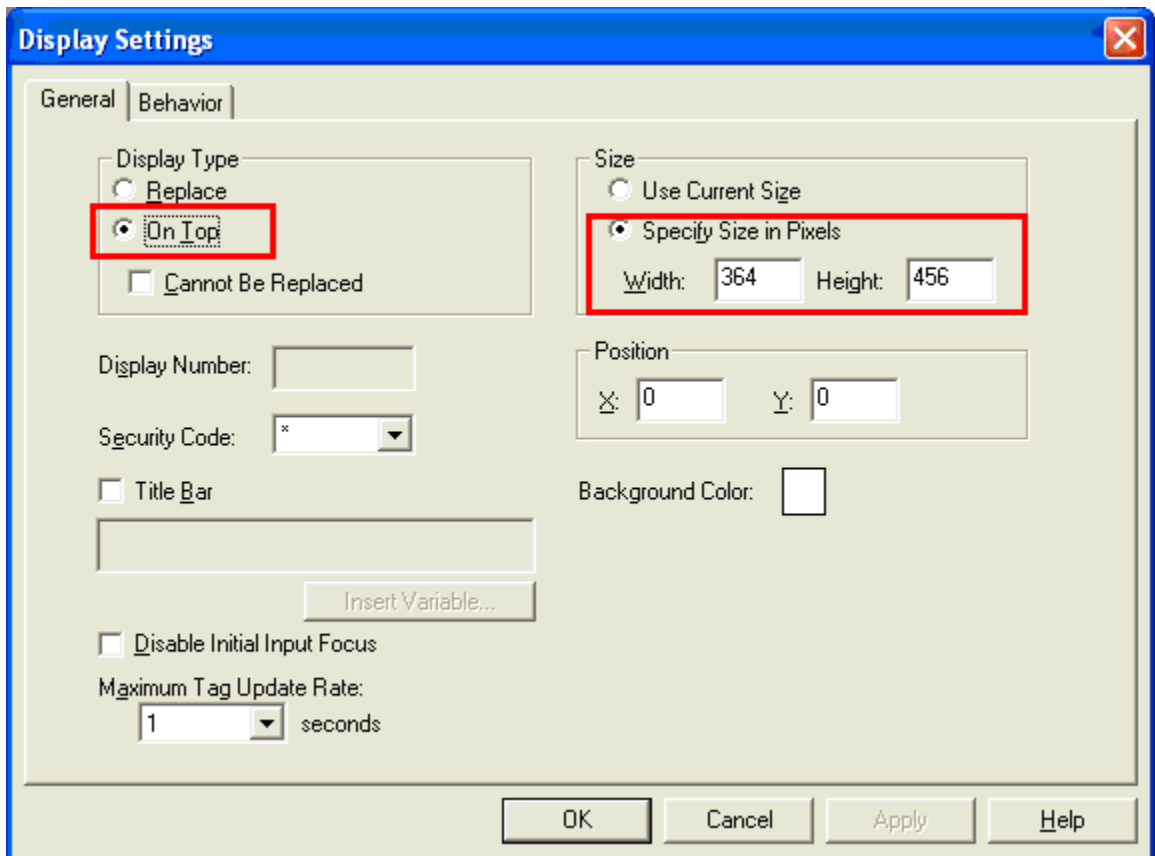


Example of RSLogix 5000 Switch Entry

3.  In the Display Settings for the N-Tron_NT24k_Display (open the  N-Tron_NT24k_Display display, Edit > Display Settings)

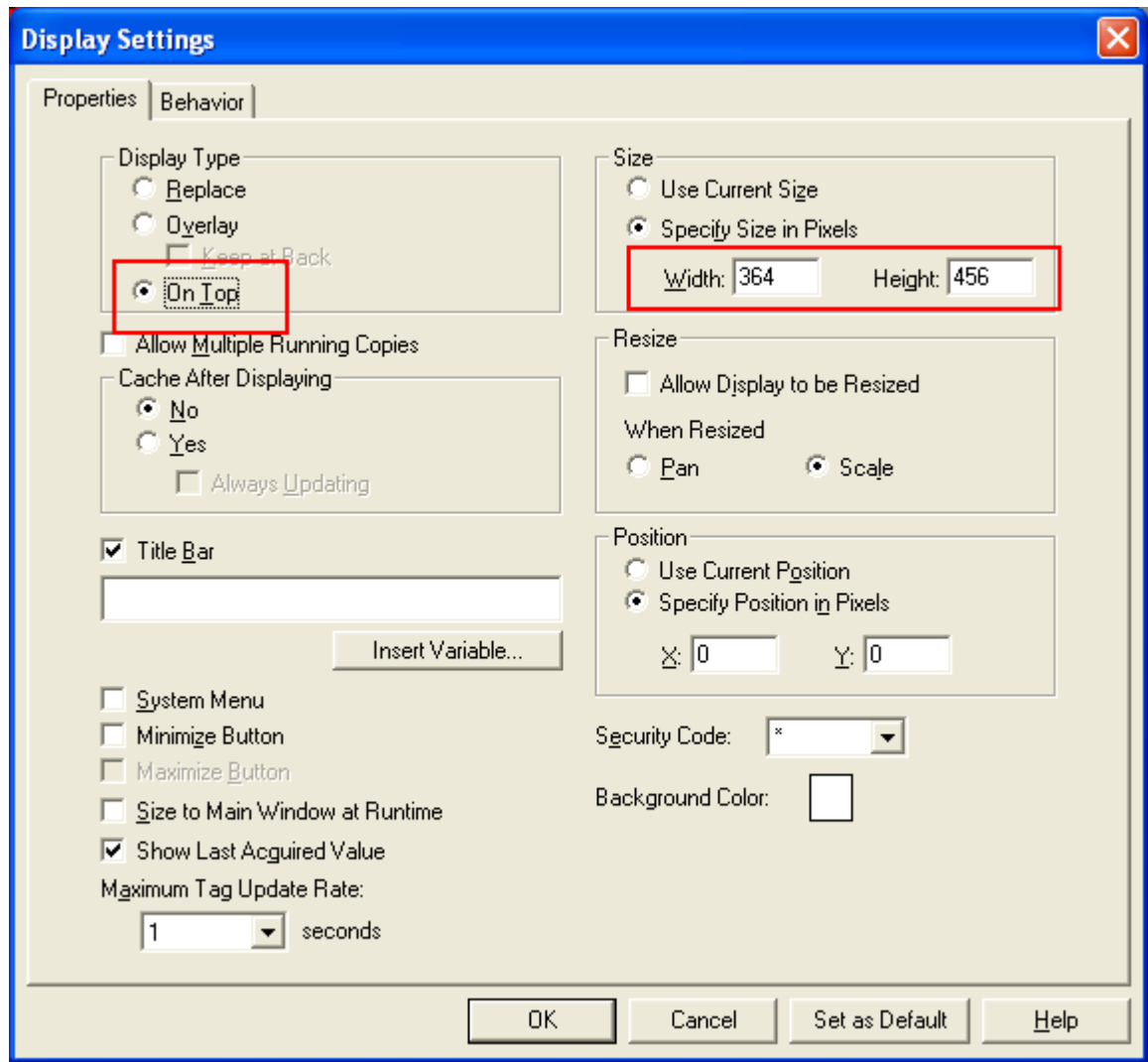4.  Click the Behavior panel and assign the newly created macro as the startup macro.
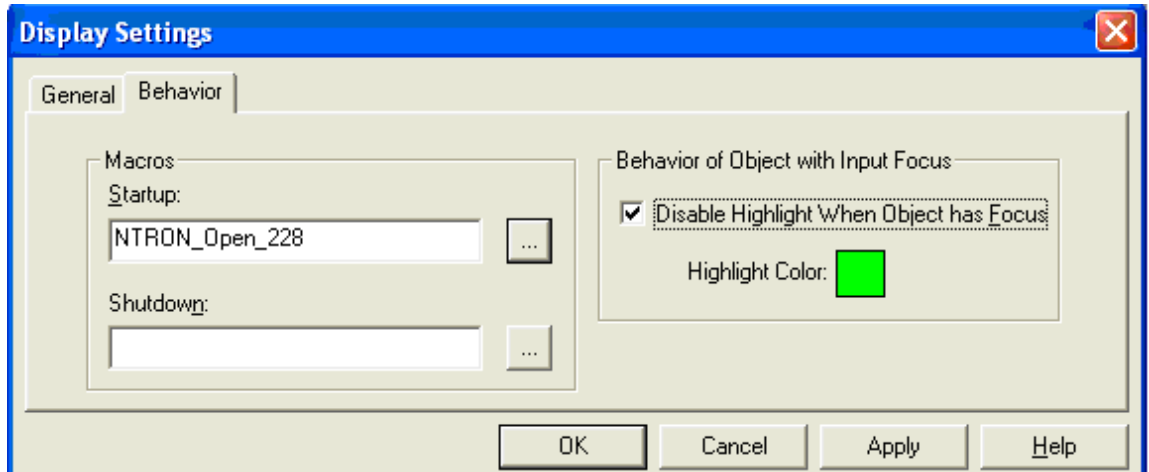


5.  Click the General tab and change Display Type and Size.
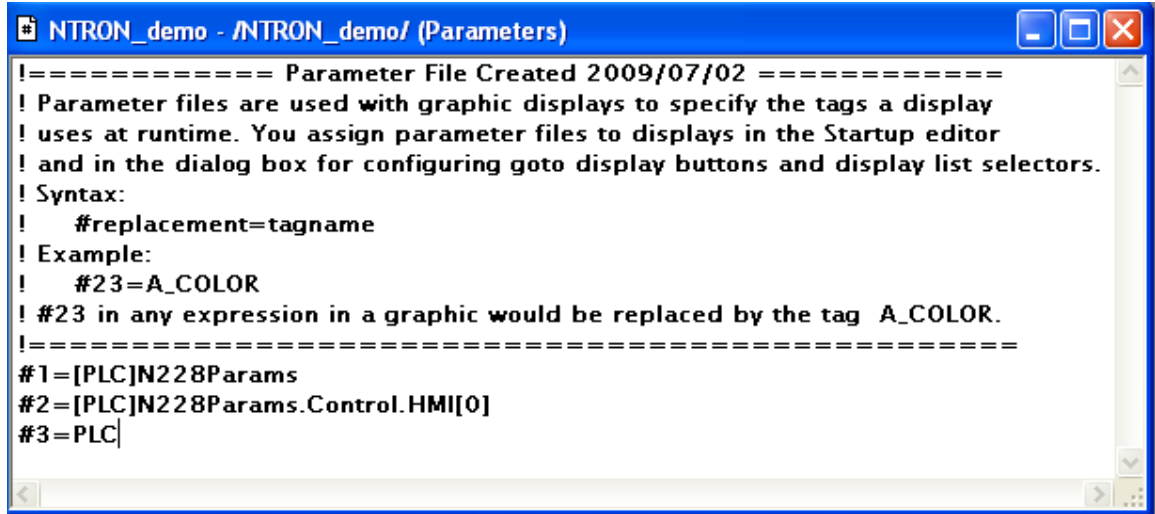
6.  Here is the ME form displayed:
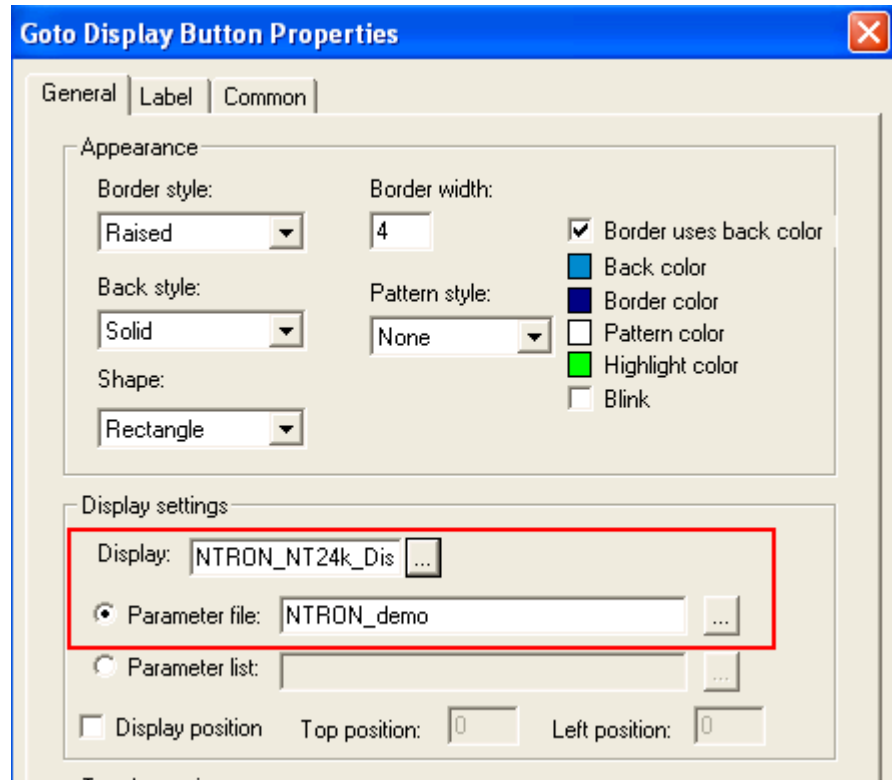


7.  Here is the SE form displayed:

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## 4.3.8    Configure Display Parameter File.

1.  On the display where you wish to show the faceplate, create a Goto Display button.

2.  Create a parameter file that will be associated with the button.

3. Substitute your shortcut for "PLC" and the name of your Switch_Parameters for N228Params, in the parameter file.

4. Assign a display and parameter file to the Goto Display in the Demo display button.

5. Here is the ME form displayed:



6. Here is the SE form displayed.
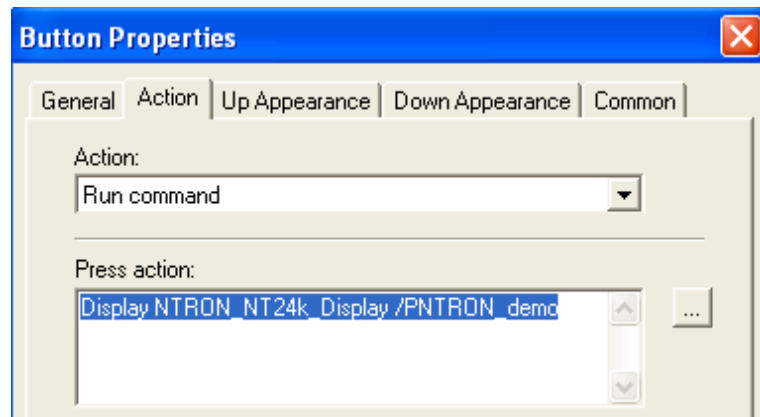
### 4.3.9 Optionally Add Composite Switch Image to Display

You can also display an image of an N-Tron switch using the global object N-Tron_NT24k_graphic.

When used, define Global Object Parameter #1 as shown here:



### 4.3.10 Optionally Add Specific Switch Image to Display

The N-Tron_NT24k_graphic global object is a composite of several N-Tron switches. Due to the number of switches, and the tags used for each switch, you may run into the limit for maximum tags allowed on a display.

To work around this limitation use individual global objects for each switch.

1.  Import individual global objects using the BatchImport_Global_N-Tron_Switches.xml import file.

    The global object names contain the switch name, such as N-Tron_NT24k_DR16.

2.  Setup Global Object Parameter #1 as described for the N-Tron_NT24k_-graphic object.

3.  For more information on the displays, including screen shots, see the Faceplate Quick Reference.

## 4.3.11 FactoryTalk View SE Client Setup:
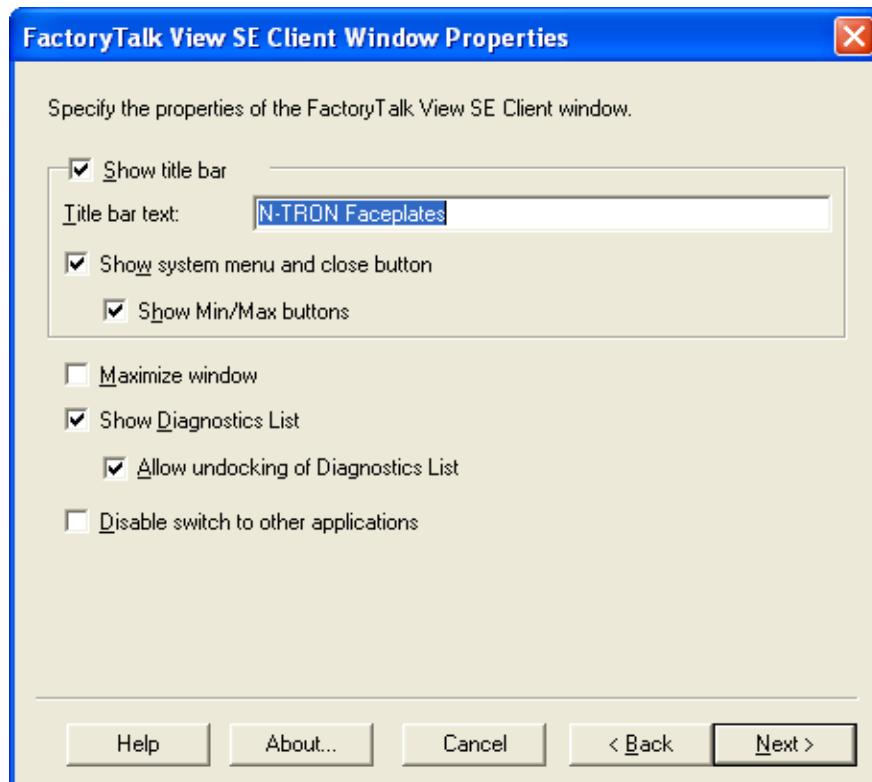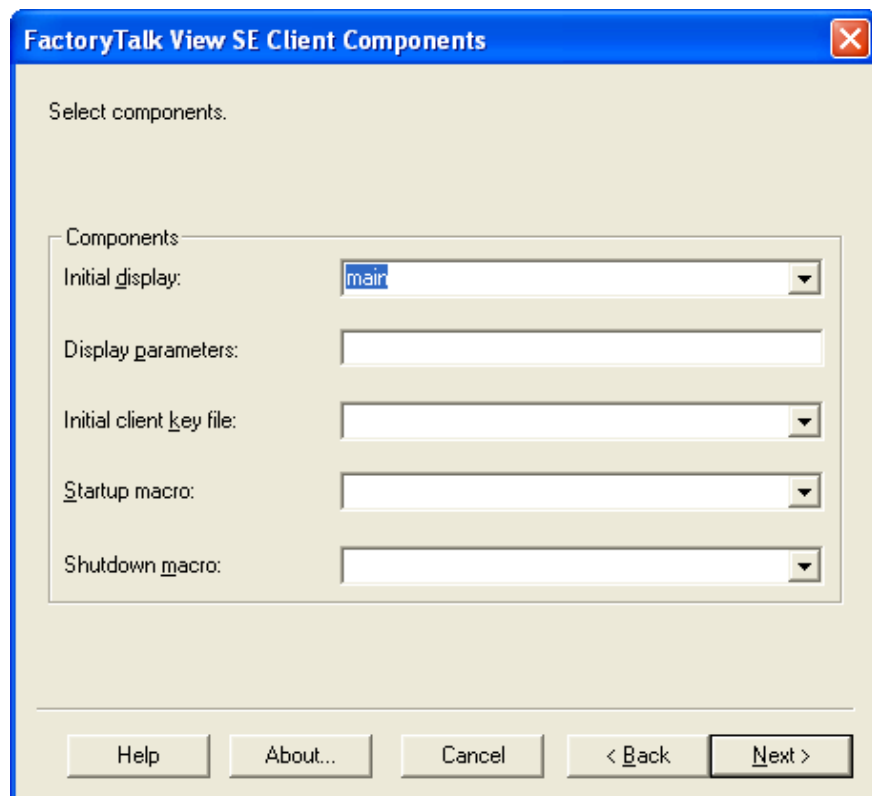
## 4.12   Sample Project

To view a sample project refer to the ME or SE sample project archive named N-Tron_demo.apa.

If you have any suggestions for improving the faceplates or the installation instructions,  please send them to [support@redlion.net](mailto:support@redlion.net) with subject "FactoryTalk Faceplates".

# CHAPTER 5  ROCKWELL FACTORYTALK QUICK REFERENCE GUIDE

## 5.1    Introduction

The Faceplate's consist of several displays:
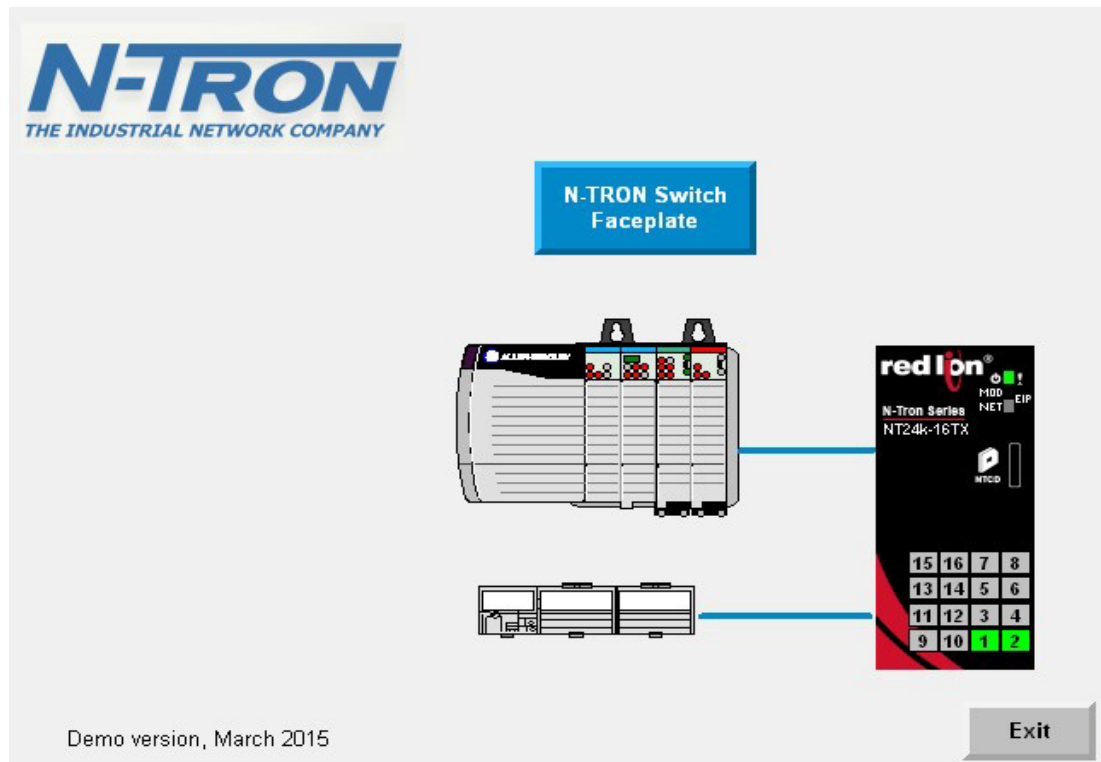
- Home
- Diagnostics
- Settings and
- Alarm

Click the buttons at the top of the screen to navigate between the displays.

The "?" button  is used to toggle the display of help text, and the "X" button is used to exit the Faceplate's.
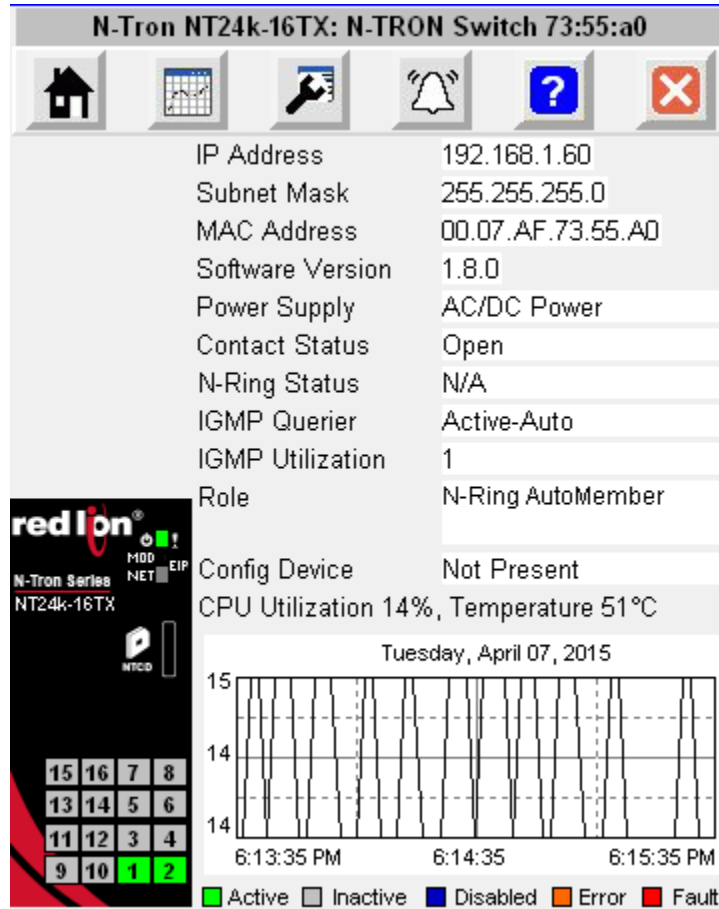


The caption at the top of the screen includes the switch product name and the user assigned switch  name, separated by a colon.

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## 5.2    Home Display

The home display shows general switch information. The trend shows CPU utilization.



Some fields show simple values, such as IP Address. Other fields, such as Device Role, show  values that depend on the switch configuration. Fields that do not apply to a specific  switch model will be hidden.

Table 5-1 describes the Home Display fields and values.

**Table 5-1 Home Display Fields**

| Field | Values | Description |
| --- | --- | --- |
| IP Address | Like 192.168.1.201 | Switch IP address |
| Subnet Mask | Like 255.255.255.0 | Switch subnet mask |
| MAC Address | Like 00:07:AF:FE:8F:A0 | MAC address of switch |
| Software Version | Like 3.0.2 | Software version of switch |

| Field | Values | Description |
|---|---|---|
| Power Supply | PSU1<br>PSU2<br>PSU and PSU2<br>Unknown<br>AC/DC Power | PSU1 – Power Supply 1<br>PSU2 – Power Supply 2 |
| Contact Status | Not Supported<br>Open<br>Closed | The status of the contact on the switch. |
| N-Ring Status | Fault<br>Partial-Low<br>Partial-High<br>Multiple-Managers<br>OK<br>N/A (if N-Ring auto-member,<br>    or N-Ring disabled)<br>Unknown (if N-Ring member) | The N-Ring status, if the switch is configured as an N-Ring manager. |
| IGMP Querier | Disabled<br>Active-Manual<br>Active-Auto<br>Backup-Auto<br>Unknown | Internet Group Management Protocol Querier status |
| IGMP Utilization | 0-100 percent | Internet Group Management Protocol Utilization |
| Config Device | Not Supported<br>Not Present<br>Present<br>Unknown | This field is displayed for switches that support a configuration device. |
| Role | N-Ring Manager<br>N-Ring Member<br>N-Ring AutoMember<br>N-Link Master<br>N-Ring Mem, N-Link Master<br>N-Ring Auto, N-Link Master<br>N-Link Slave<br>N-Ring Mem, N-Link Slave<br>N-Ring Auto, N-Link Slave<br>N-Link Coupler<br>N-Ring Mem, N-Link Coupler<br>N-Ring Auto, N-Link Coupler<br>Unknown | The role of the switch, which is based on the switch configuration. |
| CPU Utilization | 0-100 percent | CPU utilization percentage |
| CPU Trend | 0-100 percent | Trend of CPU utilization |

The color of each port, on the switch image, changes based on the port state as described in Table 5-2.

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**Table 5-2 Port Color/State Definition**

| Port Color | Port State |
|---|---|
| Active | The port is active |
| Inactive | The port is inactive |
| Disabled | The port is administratively disabled |
| Error | A port utilization limit, high or low, has been exceeded |

The LED at the top of the switch graphic will be green if there are no faults, red if a fault has occurred. Faults can be viewed on the alarms display.

# 5.3    Diagnostics Display

The diagnostics display shows information for a selected switch port. Use the buttons at  the bottom to select a switch port and use the buttons at the left to select a port variable to  trend. The highlighted variable is trended at the bottom.
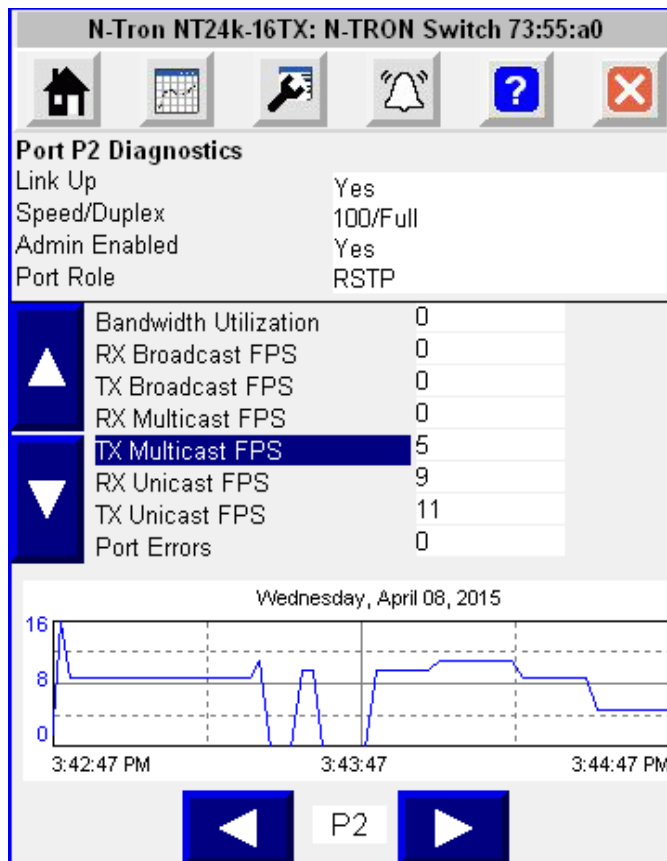


Table 5-3 describes the Diagnostic Display fields and values.

**Table 5-3 Diagnostic Display Fields and Values**

| Field | Values | Description |
|---|---|---|
| Link Up | Yes<br>No | Current link state |
| Speed/Duplex | 10/Full<br>100/Full<br>1000/Full<br>10/Half<br>100/Half<br>Unknown | This configurable field displays the current speed and mode of the port |
| Admin Enabled | Yes<br>No | This configurable field displays the existing status of the port whether it is Enabled/Disabled |
| Port Role | RSTP<br>N-Ring<br>N-Link Control<br>N-Link Partner<br>RSTP, N-Link Partner<br>N-Ring, N-Link Partner<br>N-Link Coupler<br>RSTP, N-Link Coupler<br>802.1X<br>RSTP, 802.1X | The role of the port, which is based on the switch configuration. Some combinations are possible. For more details, see the user manual for the NT24k switch family |
| Bandwidth Utilization | 0-100 percent | Bandwidth utilization displayed as a percentage |
| RX Broadcast FPS | | The frames per second rate of received broadcast frames |
| TX Broadcast FPS | | The frames per second rate of transmitted broadcast frames |
| RX Multicast FPS | | The frames per second rate of received multicast frames |
| TX Multicast FPS | | The frames per second rate of transmitted multicast frames |
| RX Unicast FPS | | The frames per second rate of received unicast frames |
| TX Unicast FPS | | The frames per second rate of transmitted unicast frames |
| Port Errors | | The sum of alignment errors, FCS errors, SQE Test errors, excessive collisions, MAC transmit errors, carrier sense errors, frame too long, and MAC receive errors |

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### 5.3.1 Settings Display

The settings display allows some switch port related settings to be changed.

Use the buttons at the bottom to select a switch port and use the buttons at the left to select a port setting to change. Use the wide up/down buttons toward the bottom to select a value, and the Enter button to accept the change.
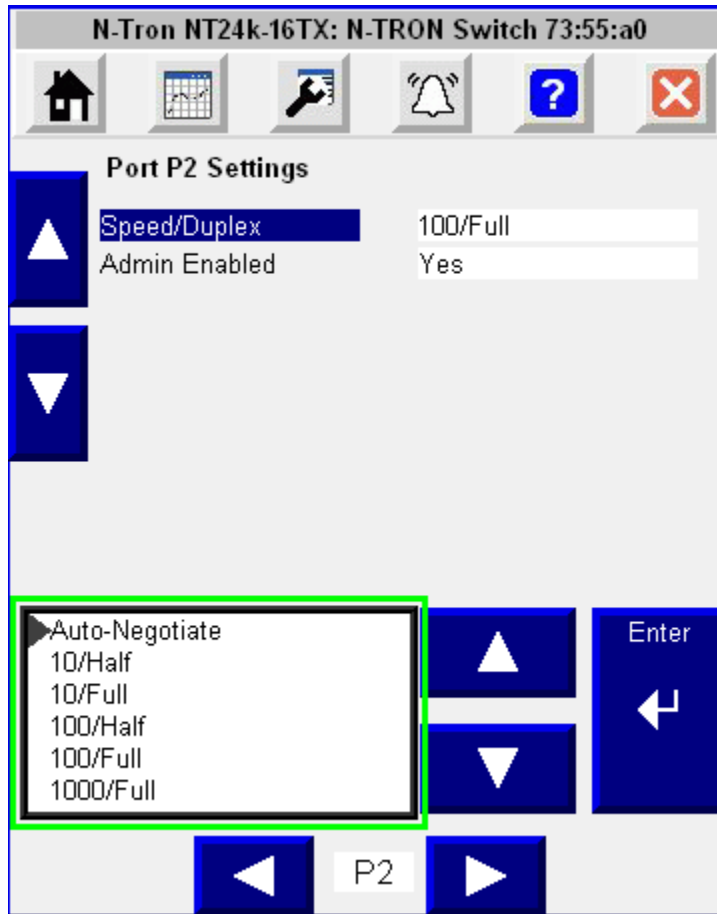


Table 5-4 describes the Settings Display fields and values.

**Table 5-4 Settings Display Fields and Values**

| Field | Values | Description |
|---|---|---|
| Speed/Duplex | 10/Full<br>100/Full<br>1000/Full<br>10/Half<br>100/Half<br>Unknown | This configurable field displays the current speed and mode of the port. |
| Admin Enabled | Yes<br>No | This configurable field displays the existing status of the port whether it is Enabled/Disabled. |

## 5.3.2    Alarm Display

The alarm display shows the status of several alarms. Alarms with a gray background and an "N/A" suffix do not apply for the switch type, or for the current configuration of the switch.
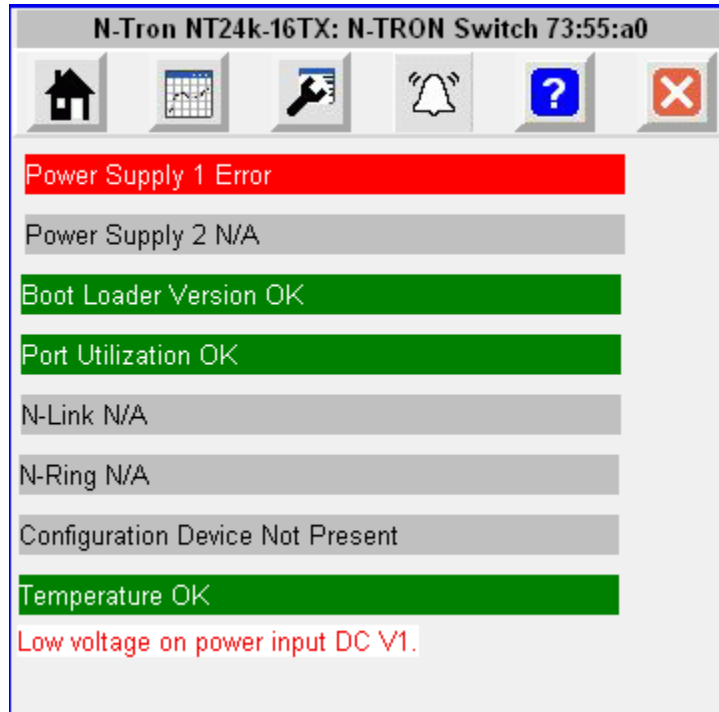


Values ending with "OK" will be green, values ending with "Error" will be red, and those with "N/A" will be gray. Fields that do not apply to a specific switch model will be hidden.

Table 5-5 describes the Alarm Display fields and values.

**Table 5-5 Alarm Display Fields and Values**

| Field | Values | Description |
|---|---|---|
| Power Supply 1 | Power Supply 1 OK Power Supply 1 Error | PSU1 |
| Power Supply 2 | Power Supply 2 OK Power Supply 2 Error | PSU2 |
| Boot Loader Version | Boot Loader Version OK Boot Loader Version Error | |
| Port Utilization | Port Utilization OK Port Utilization Error | Shows error if utilization limits on any port is exceeded. |
| N-Link | N-Link OK N-Link Error N-Link N/A | Shows N/A if not configured for N-Link |

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| Field | Values | Description |
|---|---|---|
| N-Ring | N-Ring Error (Redundancy Lost) N-Ring Error (Partial Low) N-Ring Error (Partial High) N-Ring Error (Multiple Managers) N-Ring Error (Redundancy Lost, Mult Mgrs) N-Ring Error (Partial Low, Mult Mgrs) N-Ring Error (Partial High, Mult Mgrs) N-Ring OK N-Ring N/A | Shows N/A if not configured as an N-Ring manager |
| Configuration Device | Configuration Device OK Configuration Device Error Configuration Device N/A | This field is displayed if the switch supports a configuration device |
| Temperature | Temperature OK Temperature Error Temperature N/A | This field is displayed if the switch supports a temperature sensor |

The system fault string is shown at the bottom of the display.

## 5.3.3    Error Messages

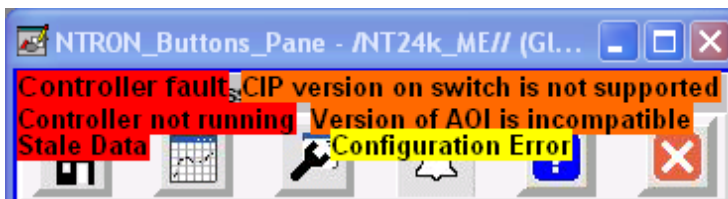There are a few messages that appear near the top on the faceplate when certain errors are detected.



Table 5-6 describes the error messages.

**Table 5-6 Error Messages**

| Background Color | Message | Description |
|---|---|---|
| Red | Controller fault | The controller[1] is in the "Faulted" mode. |
| Red | Controller not running | The controller[1] is not in the "Run" or "Remote Run" mode. |
| Red | Stale Data | The controller[1] has stopped receiving data updates from the switch[2]. |
| Orange | CIP version on switch is not supported | The CIP version on the switch[2] is not supported by the add-on instruction on the controller[1]. |

| Background Color | Message | Description |
|---|---|---|
| Orange | Version of AOI is incompatible | The add-on instruction on the controller[1] does not support the switch[2]. |
| Yellow | Configuration Error | The product code for the switch[2] is invalid or has not been read. |

[1] **Controller** *refers to the third replacement text (example: #3=PLC) of the* parameter *file associated with the display.*

[2] **Switch** *refers to the switch associated with the first replacement text (example: #1=[PLC]N228Params) of the* parameter file *associated with the display*

## LIMITED WARRANTY

(a) Red Lion Controls Inc., Sixnet Inc., N-Tron Corporation, or Blue Tree Wireless Data, Inc. (the "Company") warrants that all Products shall be free from defects in material and workmanship under normal use for the period of time provided in "Statement of Warranty Periods" (available at www.redlion.net) current at the time of shipment of the Products (the "Warranty Period"). **EXCEPT FOR THE ABOVE-STATED WARRANTY, COMPANY MAKES NO WARRANTY WHATSOEVER WITH RESPECT TO THE PRODUCTS, INCLUDING ANY (A) WARRANTY OF MER-CHANTABILITY; (B) WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE; OR (C) WARRANTY AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS OF A THIRD PARTY; WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE.** Customer shall be responsible for determining that a Product is suitable for Customer's use and that such use complies with any applicable local, state or federal law. (b) The Company shall not be liable for a breach of the warranty set forth in paragraph (a) if (i) the defect is a result of Customer's failure to store, install, commission or maintain the Product according to specifications; (ii) Customer alters or repairs such Product without the prior written consent of Company. (c) Subject to paragraph (b), with respect to any such Product during the Warranty Period, Company shall, in its sole discretion, either (i) repair or replace the Product; or (ii) credit or refund the price of Product provided that, if Company so requests, Customer shall, at Company's expense, return such Product to Company. (d) **THE REMEDIES SET FORTH IN PARAGRAPH (c) SHALL BE THE CUSTOMER'S SOLE AND EXCLU-SIVE REMEDY AND COMPANY'S ENTIRE LIABILITY FOR ANY BREACH OF THE LIMITED WARRANTY SET FORTH IN PARAGRAPH (a)**.