**Module Overview**

The AMCI NX2A4D is a four resolver input module that communicates on DeviceNet. The four resolvers connected to this module can either be configured as four single turn resolvers, two single turn resolvers and one multiturn resolver, or two multiturn resolvers.

The NX2A4D uses 21 input and 10 output words to communicate on DeviceNet.

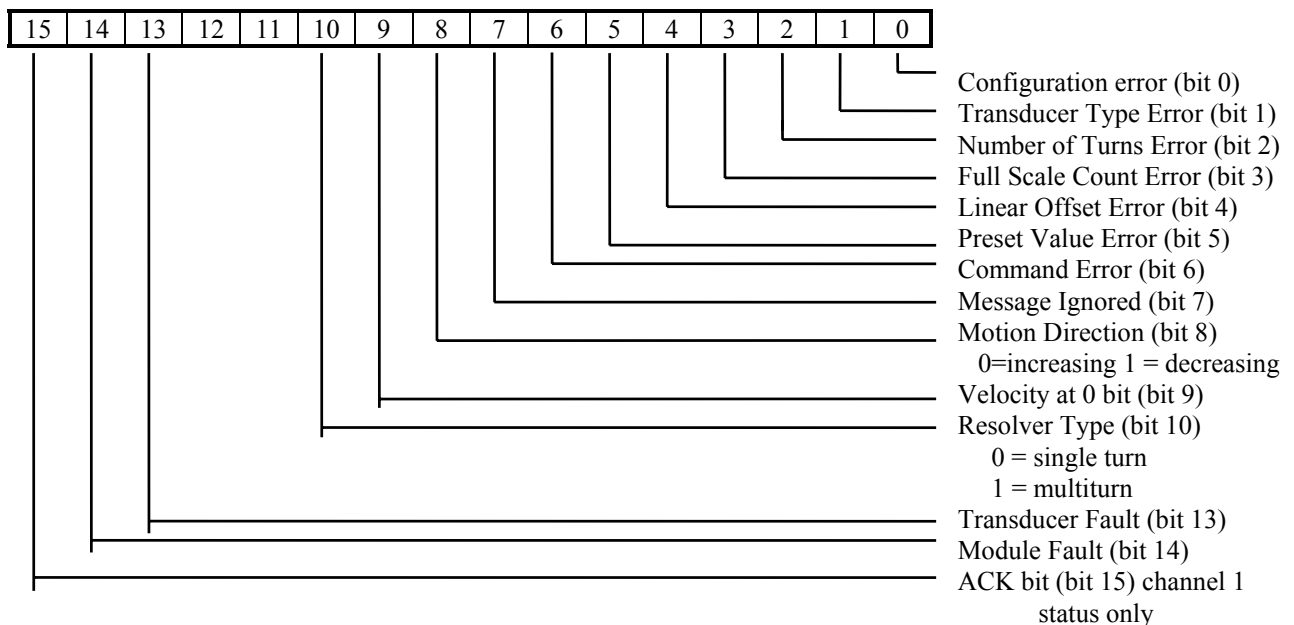**Input Words** (Data sent from the NX2A4D module to the network)

The following table shows the input data format for the NX2A4D module.

| Word Number | Single Turn Resolvers | Multiturn Resolvers |
|---|---|---|
| 0 | Channel 1 Status | Channel 1 Status |
| 1 | 0 | Channel 1 upper 3 digits position |
| 2 | Channel 1 Position | Channel 1 lower 3 digits position |
| 3 | Channel 1 Velocity | Channel 1 velocity |
| 4 | Channel 2 Status | 0 |
| 5 | 0 | 0 |
| 6 | Channel 2 Position | 0 |
| 7 | Channel 2 Velocity | 0 |
| 8 | Channel 3 Status | Channel 2 Status |
| 9 | 0 | Channel 2 upper 3 digits position |
| 10 | Channel 3 Position | Channel 2 lower 3 digits position |
| 11 | Channel 3 Velocity | Channel 2 velocity |
| 12 | Channel 4 Status | 0 |
| 13 | 0 | 0 |
| 14 | Channel 4 Position | 0 |
| 15 | Channel 4 Velocity | 0 |
| 16 | Stop Time | 0 |
| 17 | Stop Position | 0 |
| 18 | 0 | 0 |
| 19 | 0 | 0 |
| 20 | 0 | 0 |

**Input Data Notes**:

1. The Stop Time and Stop Position Input Parameters are only available on channel 1 if it is configured as a single turn resolver. These parameters are calculated on the 1 to 0 transition, on to off, of the brake input.
2. It is possible to configure the module for one multiturn and two single turn resolvers at the same time. If channel 1 multiturn is used, than the channel 1 and 2 single turn data is replaced by the channel 1 multiturn data. However, the channel 3 and 4 single turn data will remain. If channel 2 multiturn is used, than the channel 3 and 4 single turn data is replaced by the channel 2 multiturn data, and the channel 1 and 2 single turn data remains. It is not necessary to use the channel 1 multiturn data before using the channel 2 multiturn data.
3. If the module is configured to work with multiturn transducers, programming either of the single turn channels associated with the multiturn channel will replace the multiturn channel data with the data of both single turn channels. For example if multiturn channel 1 is being used, and single turn channel 2 is programmed, than single turn channel 1 and channel 2 data will replace multiturn channel 1 data in the input registers.
4. The data in the input registers remains in its last state if the Nexus module is removed from the network.

Status Word Layout (The status word for each channel will reflect any errors occurred when programming that channel. The ACK bit is located only in the channel 1 status data. A command error or message ignored error will be displayed in all status words.)

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|

Configuration error (bit 0)
Transducer Type Error (bit 1)
Number of Turns Error (bit 2)
Full Scale Count Error (bit 3)
Linear Offset Error (bit 4)
Preset Value Error (bit 5)
Command Error (bit 6)
Message Ignored (bit 7)
Motion Direction (bit 8)
  0=increasing 1 = decreasing
Velocity at 0 bit (bit 9)
Resolver Type (bit 10)
  0 = single turn
  1 = multiturn
Transducer Fault (bit 13)
Module Fault (bit 14)
ACK bit (bit 15) channel 1
  status only

Configuration Error: Set if any of the unused bits in the configuration word are set

Transducer Type Error: Multiturn Programming Error only. This bit is set if the transducer type is not equal to 100, 180, 1000, or 1800 if the module is configured for AMCI transducers, or 128 if the module is configured for Autotech transducers. This bit will always be reset when the module is being used as a single turn resolver.

Number of Turns Error: Multiturn Programming Error only. This bit is set if the number of turns is invalid for the transducer type selected. This bit will always be reset when the module is being used as a single turn resolver.

Full Scale Count Error:  Set if the Full Scale Count is outside of the range of:
>    2 to 8192 for Single turn resolvers
>    2 to (4096 * Number of Turns) for 100 or 180 turn transducer
>    2 to (409.6 * Number of Turns) for 1000 or 1800 turn transducer
>    2 to (1024 * Number of Turns) for an Autotech 128 turn transducer

Linear Offset Error: Set if the linear offset is outside of the range of:
>    0 to (32767 - Full Scale Count) for single turn resolvers
>    0 to 999,999 for multiturn resolvers

Preset Value Error: Set if the preset value is outside of the range of Linear Offset to (Linear Offset -(Full Scale Count -1))

Command Error: Set if any of unused bits in the command word are set, if you try to program a channel that is not present, if you try to program more than one channel at a time, or if you attempt to preset single channels 2 or 4 if they have been configured as multiturn channels.

Message Ignored:  Set if an attempt is made to program a parameter if an error already exits on a different parameter.

Motion Direction:  This bit will be "0" if the counts are increasing, or "1" if the counts are decreasing.  The bit will remain in its last state when there is no motion.

Velocity at Zero:  This bit will be set if there has been no motion for 125ms.

Resolver Type: This bit will be reset if the input channel is configured to be used with single turn resolvers, and set if the input channel is configured to be used with multiturn resolvers.

Transducer Fault:  This bit will be set if a transducer Fault has been detected.

Module Fault:  Set if there is a module fault, such as an EEPROM error.

Acknowledge Bit: Set when the transmit bit is set.  This bit is present only in the channel 1 status data.
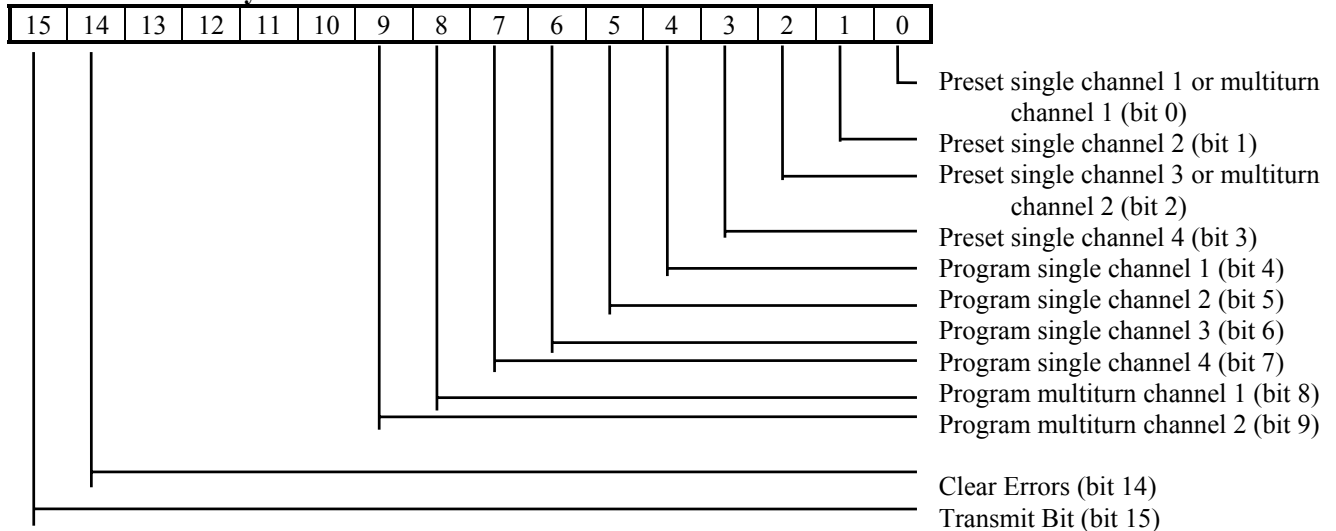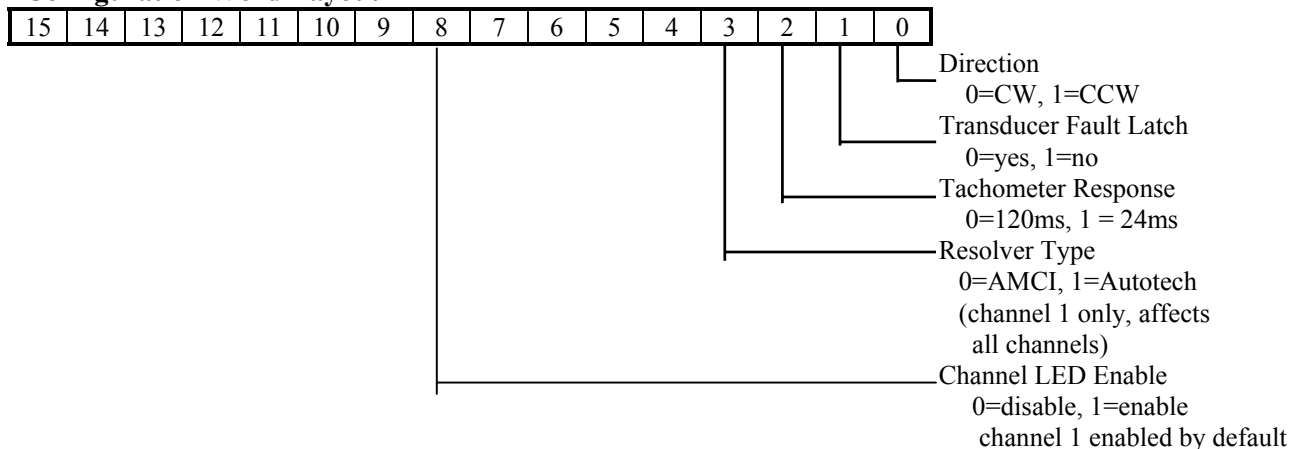
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**Output Data** (Words sent from the Network to the NX2A4D)

The format of the output data is shown in the table below.  Please note that only one channel can be programmed at a time.  However, the position of more than one channel can be preset, and a channel programmed, with one write operation.

| Word Number | Single Turn Resolvers | Multiturn Resolvers |
|:---:|:---:|:---:|
| 0 | Control | Control |
| 1 | Configuration | Configuration |
| 2 | 0 | Upper 3 Digits Full Scale Count |
| 3 | Full Scale Count | Lower 3 Digits Full Scale Count |
| 4 | 0 | Upper 3 Digits Linear Offset |
| 5 | Linear Offset | Lower 3 Digits Linear Offset |
| 6 | 0 | Upper 3 Digits Preset Value |
| 7 | Preset | Lower 3 Digits Preset Value |
| 8 | 0 | Transducer Type |
| 9 | 0 | Number of Turns |

**Output Data Notes**

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1. Words 8 and 9, the transducer type and number of turns parameter, apply only for multiturn channels and are not used for single turn resolvers. When programming single turn resolvers, words 8 and 9 are "don't cares."
2. When programming multiturn transducers for Autotech, channel 1 must be programmed before channel 2 because channel 1 configures the module for Autotech transducers.

**Control Word Layout**

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|

Preset single channel 1 or multiturn channel 1 (bit 0)
Preset single channel 2 (bit 1)
Preset single channel 3 or multiturn channel 2 (bit 2)
Preset single channel 4 (bit 3)
Program single channel 1 (bit 4)
Program single channel 2 (bit 5)
Program single channel 3 (bit 6)
Program single channel 4 (bit 7)
Program multiturn channel 1 (bit 8)
Program multiturn channel 2 (bit 9)

Clear Errors (bit 14)
Transmit Bit (bit 15)

**Configuration Word Layout**

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|

Direction
  0=CW, 1=CCW
Transducer Fault Latch
  0=yes, 1=no
Tachometer Response
  0=120ms, 1 = 24ms
Resolver Type
  0=AMCI, 1=Autotech
  (channel 1 only, affects
  all channels)
Channel LED Enable
  0=disable, 1=enable
  channel 1 enabled by default

<u>Transducer Type Range</u>: Single Turn: "don't care."
                     Multiturn: 100, 180, 1000, 1800 for AMCI or 128 for Autotech
<u>Number of Turns Range</u>: Single Turn: "don't care."
                     100 turn = 100, 50, 25, 20, 10, 5, 4, 2, or 1
     Multiturn     180 turn = 180, 90, 60, 45, 36, 30, 20, 18, 15, 12, 10, 9, 6, 5, 4, 3, 2, 1
                     1000 turn = 1000, 500, 250, 200, 100, 50, 40, 20, 10
                     1800 turn = 1800, 900, 600, 450, 360, 300, 200, 180, 150, 120, 100, 90
                              60, 50, 40, 30, 20, 10
                     128 turn = 128, 64, 32, 16, 8, 4, 2, 1

<u>Full Scale Count Range</u>: 2 to 8192 for Single Turn resolvers
                     2 to (4096 * Number of Turns) for 100 or 180 turn transducer
                     2 to (409.6 * Number of Turns) for 1000 or 1800 turn transducer

                    2 to (1024 * Number of Turns) for an Autotech 128 turn transducer
Linear Offset Range:  0 to (32767 - Scale Factor) for single turn resolvers
                    0 to 999,999 for multiturn resolvers
Preset Range: Linear Offset to (Linear Offset + (Full Scale Count -1))

**Programming Sequence**

1. The ladder logic program writes the data into the output registers.
2. The ladder logic program then sets the transmit bit.
3. When the module detects the 0 to 1 transition of the transmit bit, it will respond by setting any error bits and the Acknowledge bit in the input registers.
4. When the ladder logic program sees that the acknowledge bit is set, it will examine any error bits, and then reset the transmit bit.
5. The module will reset the Acknowledge bit.
6. The programming sequence is now complete.

**NX2A4D Hardware Overview**
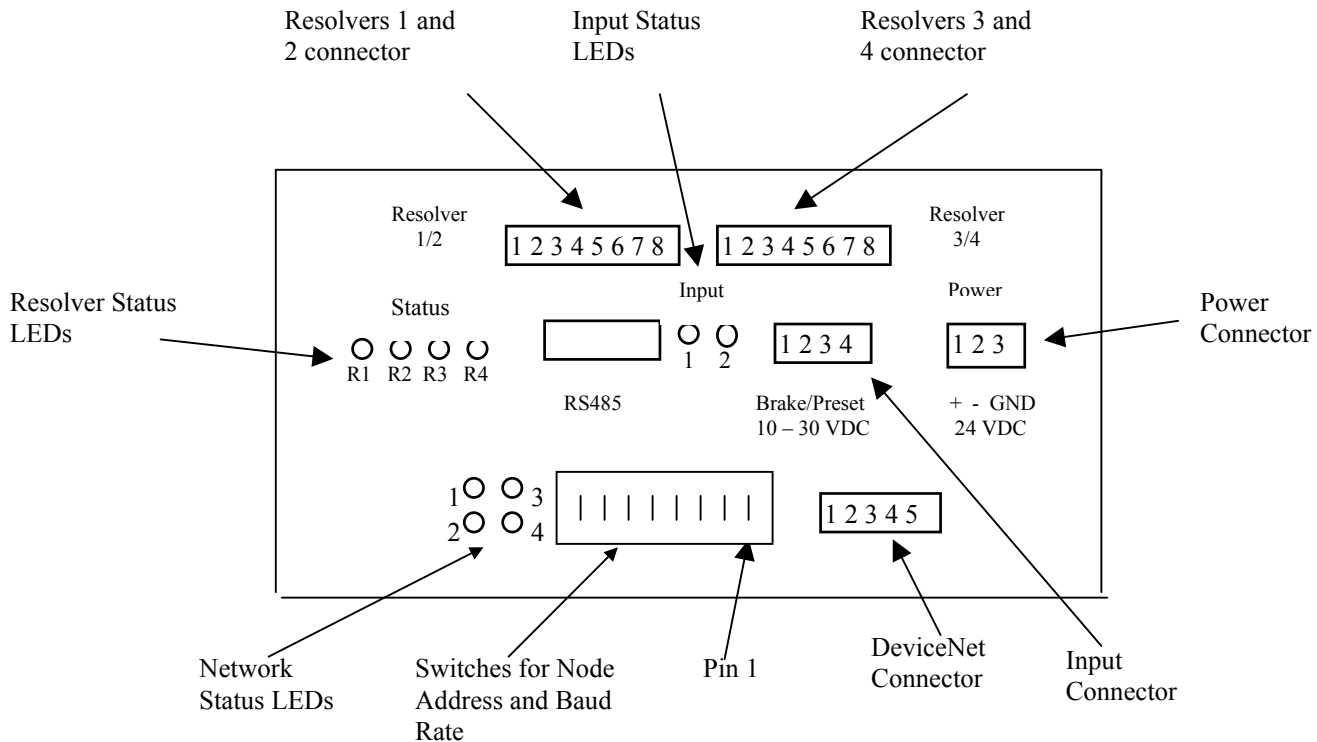


**Dimensions:**

Length = 5.75 inches
Height = 3 inches
Width = 3.76 inches

### Resolver Connectors

| Pin Number | Single Turn Function | Multiturn Function |
|---|---|---|
| 1 | R1 both channels | R1 |

| 2 | R2 both channels | R2 |
|---|---|---|
| 3 | Shields | Shields |
| 4 | S1 & S2 both channels | S3F, S2F, S1C, S2C |
| 5 | S4 channel 1 | S3C |
| 6 | S3 channel 1 | S4C |
| 7 | S4 channel 2 | S1F |
| 8 | S3 channel 2 | S4F |

**Note**: The reference voltage signal, R1 and R2, of both connectors, is common.

**Resolver Status LEDs**

The following table describes the function of the four resolver status LEDs.
1 = Resolver 1, 2= Resolver 2, 3 = Resolver 3, 4 = Resolver 4

| LED Pattern | Function |
|---|---|
| off | LED Disabled |
| solid green | Resolver OK |
| flashing green | Clearable Transducer Fault |
| flashing red | Non Clearable Transducer Fault |
| solid red | Module Fault |

**Input Status LEDs**

1 = Lit when the Brake Input is receiving power
2 = Lit when Input 2 is receiving power (The function of this input has not been defined)

**Input Connector**

| Pins | Function |
|---|---|
| 1 to 2 | Brake Input |
| 3 to 4 | Undefined Input |

The inputs are bipolar.  Connecting one of the inputs pins to 10Vdc to 30Vdc, and the other to GND will cause the input to activate.

**Power Requirements**

**Power Connector**

| Pin | Function |
|---|---|
| 1 | +24Vdc |
| 2 | DC Common |
| 3 | Shields |

The Nexus Module requires 500mA of current @24Vdc to operate.

**DeviceNet Connector**

The 5 pin DeviceNet Connector has the following wiring.

| Pin Number | Function | Standard Wire Color |
|:---:|:---:|:---:|
| 1 | +24Vdc | Red |
| 2 | Can High | White |
| 3 | Shields | Bare |
| 4 | Can Low | Blue |
| 5 | Common | Black |

**Node Address and Baud Rate Selection**

The NX2A4D uses eight DIP switches to select the Node Address and the Baud Rate. Switches 1 and 2 set the Baud rate and switches 3 to 8 set the node, with switch 8 being the least significant bit.   The following table shows the possible switch setting combinations.

The DIP switch package is mounted so that the numbers are upside down.  However, "1" or "ON" is still in the up position and "0" or "OFF" is in the down position.

| Baud Rate | Switches 1 & 2<br>1 2 |
|:---:|:---:|
| 125k | 0 0 |
| 250k | 0 1 |
| 500k | 1 0 |
| Reserved | 1 1 |

| Node Address | Switches 3 to 8<br>3 4 5 6 7 8 |
|:---:|:---:|
| 0 | 0 0 0 0 0 0 |
| 1 | 0 0 0 0 0 1 |
| 2 | 0 0 0 0 1 0 |
| 3 | 0 0 0 0 1 1 |
| 61 | 1 1 1 1 0 1 |
| 62 | 1 1 1 1 1 0 |
| 63 | 1 1 1 1 1 1 |

**Example**: For a Baud Rate = 250K and the Node Address = 5, switches 2, 6, and 8 would be ON, up towards the top of the module and switches 2, 3, 4, 5, and 7 would be OFF, down towards the bottom of the module.

**Note**: The state of the switch settings is only taken into account at power up.

**DeviceNet Status LEDs**

The following table describes the function of the four network status LEDs.

| LED Number | Name | LED Pattern | Description |
|---|---|---|---|
| 1 | Module Network Status | Steady Off<br>Steady Red<br>Steady Green<br>Flashing Red | No Power<br>Unrecoverable Fault<br>Device Operational<br>Minor Fault |
| 2 | Network Status | Steady Off<br>Steady Red<br>Steady Green<br>Flashing Red<br>Flashing Green | Not Powered / Not On Line<br>Critical link failure<br>Link OK, On Line, Connected<br>Connection Time Out<br>On Line not connected |
| 3 | Reserved | | |
| 4 | Reserved | | |

**Adding the NX2A4D to your network**

Before the NX2A4D can be attached to a network, it must be added to the RSNetWorx for DeviceNet software.  The EDS and icon files are available in the *Tech Library* section of our website, www.amci.com.  The following procedure to add the EDS file to RSNetWorx assumes that you have already downloaded and un-zipped these files.

1. With the power off, use the dip switches on the front of the NX2A4D to set the node address and the baud rate.
2. Start RSNetWorx for DeviceNet.
3. In the RSNetWorx program, click on **Tools** in the menu bar.
4. Click on **EDS Wizard…** from the pull down menu that appears.
5. Click on **Next>** in the window that appears.
6. Select **Register an EDS file(s)** and click on **Next>.**
7. Select **Register and EDS file**.
8. Click on **Choose File…** and navigate to the folder where you placed the un-zipped EDS and icon files.
9. Double click on **NX2A4D_r01.eds** file.
10. Click on **Next>**.
11. Click on **NX2A4D_r01.eds** file so that it is highlighted.
12. Click on **Next>** to assign an icon to the device.
13. Click on the NX2A4D and then click on **Change icon…** to select the icon for the Nexus unit.  You can choose one of the built in icons from Rockwell Automation or click on the **Browse…** button and select the **NX2A4D_r01.ico** icon file.
14. Click on **Next>** and then click on **Finish** to complete the installation of the AMCI NX2A4D EDS file to the RSNetWorx system.

Once the EDS file is added to your system, add the NX2A4D to your network as you would any other device, including adding it to the scanlist configuration of the scanner module.

Revision History

Revision 0.0 was released on 11/24/03 and was the initial release of the specifications.

Revision 0.1 was released on 3/30/04.  This revision corrected the setting of the baud rate switch functions.  Revision 0.0 had the function of switches 1 and 2 reversed.

File: NX2A4D_REV_0.1_SPECS.doc
date: 3/30/04