Module Overview

This AMCI Nexus module is a single resolver input programmable limit switch module that communicates on a network. The available networks, along with the corresponding AMCI part numbers, are shown in the following table.

Network	Part Number
ProfiNet	NX3A1A
ControlNet	NX3A1C
DeviceNet	NX3A1D
Ethernet	NX3A1E
Profibus	NX3A1P
Modbus TCP/IP	NX3A1T

Each module accepts a brushless resolver based transducer for position feedback and generates up to 16 limit switch outputs based on the transducers' position and velocity. The NX3A1X module has several modes of operation that allow you to enable or disable the outputs based on discrete inputs and the speed of the machine.

The NX3A1X module has two *modes* of operation, *Independent Mode* and *Group Mode*. While in Independent Mode, each output is independent of the others and has a corresponding input that is ANDed with the output. When in Group Mode, the outputs are combined into groups. The NX3A1X module has a maximum of six groups. Each group is assigned an *Operating Mode* that controls how the outputs fire. At this time, there are a total of seven Operating Modes. These Operating Modes are geared towards high speed packaging and assembly machines.

This unit has sixteen I/O points. Eight of the outputs and all sixteen inputs are located on the Nexus module itself, and the remaining eight outputs can be located on an external relay board.

The inputs can be programmed to be used either high true or low true, and provide ANDing functions and group control. The inputs are divided into two groups of eight, and can be used as either sinking or sourcing inputs. The status of the 16 inputs is also reported over the Network.

Each of the outputs has 8 On/Off setpoints, and can be programmed to operate in normal, timed, or pulse mode. The outputs can be ANDed with an input or with a motion detector, and can also be forced ON or OFF from the PLC. The outputs will turn off when there is a transducer fault condition, even if it is a clearable transducer fault. The status of the 16 outputs is reported to the PLC over The Network. **Outputs should not be programmed on the fly.**

The module contains a non-volatile memory so all of the setup data and On/Off setpoints will be saved on power down. Because the non-volatile memory is a battery backed RAM, all of the parameters can be changed often without damaging the module.

Sample programs for this and other AMCI products are available from the following page of our website.

https://www.amci.com/industrial-automation-support/sample-progams/

Table of Contents

General Information

Important User Information
The products and application data described in this manual are useful in a wide variety of different applications. Therefore, the user and others responsible for applying these products described herein are responsible for determining the acceptability for each application. While efforts have been made to provide accurate information within this manual, AMCI assumes no responsibility for the application or the completeness of the information contained herein. Throughout this manual, the following two notices are used to highlight important points.

WARNINGS tell you when people may be hurt or equipment may be damaged if the procedure is not followed properly.

CAUTIONS tell you when equipment may be damaged if the procedure is not followed properly. No patent liability is assumed by AMCI, with respect to use of information, circuits, equipment, or software described in this manual. The information contained within this manual is subject to change without notice. UNDER NO CIRCUMSTANCES WILL ADVANCED MICRO CONTROLS, INC. BE RESPONSIBLE OR LIABLE FOR ANY DAMAGES OR LOSSES, INCLUDING INDIRECT OR CONSEQUENTIAL DAMAGES OR LOSSES, ARISING FROM THE USE OF ANY INFORMATION CONTAINED WITHIN THIS MANUAL, OR THE USE OF ANY PRODUCTS OR SERVICES REFERENCED HEREIN.

Standard Warranty
ADVANCED MICRO CONTROLS, INC. warrants that all equipment manufactured by it will be free from defects, under normal use, in materials and workmanship for a period of [18] months. Within this warranty period, AMCI shall, at its option, repair or replace, free of charge, any equipment covered by this warranty which is returned, shipping charges prepaid, within one year from date of invoice, and which upon examination proves to be defective in material or workmanship and not caused by accident, misuse, neglect, alteration, improper installation or improper testing. The provisions of the "STANDARD WARRANTY" are the sole obligations of AMCI and excludes all other warranties expressed or implied. In no event shall AMCI be liable for incidental or consequential damages or for delay in performance of this warranty.

Returns Policy
All equipment being returned to AMCI for repair or replacement, regardless of warranty status, must have a Return Merchandise Authorization number issued by AMCI. Call (860) 585-1254 with the model and serial numbers along with a description of the problem. A "RMA" number will be issued. Equipment must be shipped to AMCI with transportation charges prepaid. Title and risk of loss or damage remains with the customer until shipment is received by AMCI.

24 Hour Technical Support Number
Technical Support, in the form of documents, FAQs, and sample programs, is available from our website, www.amci.com. 24 Hour technical support is also available on this product. For technical support, call (860) 583-7271. Your call will be answered at the factory during regular business hours, Monday through Friday, 8AM - 5PM EST. During non-business hours, an automated system will ask you to leave a detailed message and the telephone number where you can be reached. The system will page an engineer on call. Please have your product model number and a description of the problem ready before you call.

Chapter 1: Hardware Overview
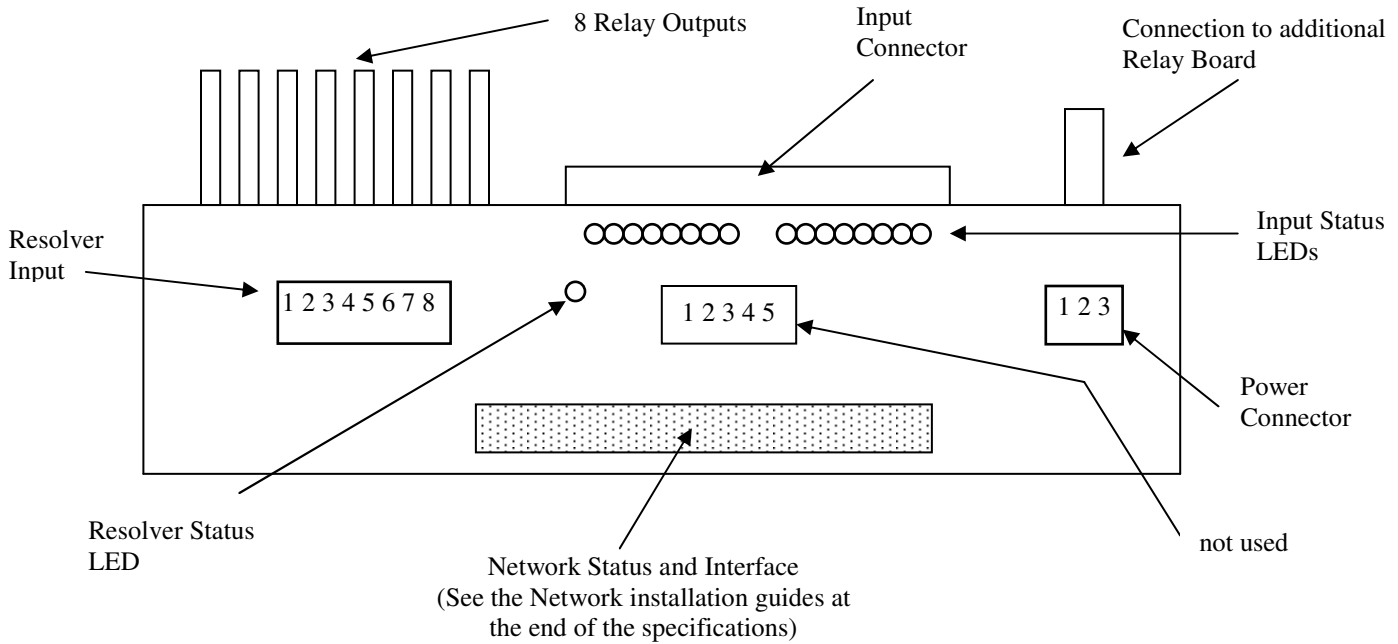
Resolver Status LED

LED Pattern	Function
solid green	Resolver OK
flashing green	Clearable Transducer Fault
flashing red	Non Clearable Transducer Fault
solid red	Module Fault

Power Requirements

Power Connector

Pin	Function
1	10 to 30Vdc
2	DC Common
3	Chassis Ground

Note: The Chassis Ground Pin is connected to the NX3A1X's body and <u>MUST</u> be connected to your earth ground bus for proper module operation.

The Nexus Module requires exactly 200mA @24Vdc to operate. If the reference voltage pins are shorted together, the unit will draw 300mA @24Vdc.

Even though the unit will operate within a voltage range of 10 to 30Vdc, it is recommended that the unit be powered with a supply that is within the operating range of the relays. The Opto 22 ODC24 have an operating range of 18 to 30Vdc.

Dimensions:

Length = 10 inches, Width = 4 inches (not including Network Connectors), and Height = 4.75 inches (including relays)

Wiring

A CTL-(x) cable, where (x) is the length in feet, is used to connect an AMCI single resolver transducer to an NX3A1X module. If you order a CTL-(x) cable from AMCI that is less than 100 feet long, we ship a cable that is made from a Belden 9873 or equivalent. If you order a CTL-(x) cable that is over 100 feet, we ship a cable made from a Belden 9730 or equivalent.

One end of the CTL-(x) has a Bendix MS connector that mates with all AMCI single resolver transducers that have a connector. The other end is pigtailed at the factory for easy connection to the MS-8 connector included with the NX3A1X. The following table and wiring diagram show how to connect an AMCI resolver to a NX3A1X.

Pin Number	Function
1	R1
2	R2
3	Shields
4	S1 & S2
5	S4
6	S3
7	no connection
8	no connection
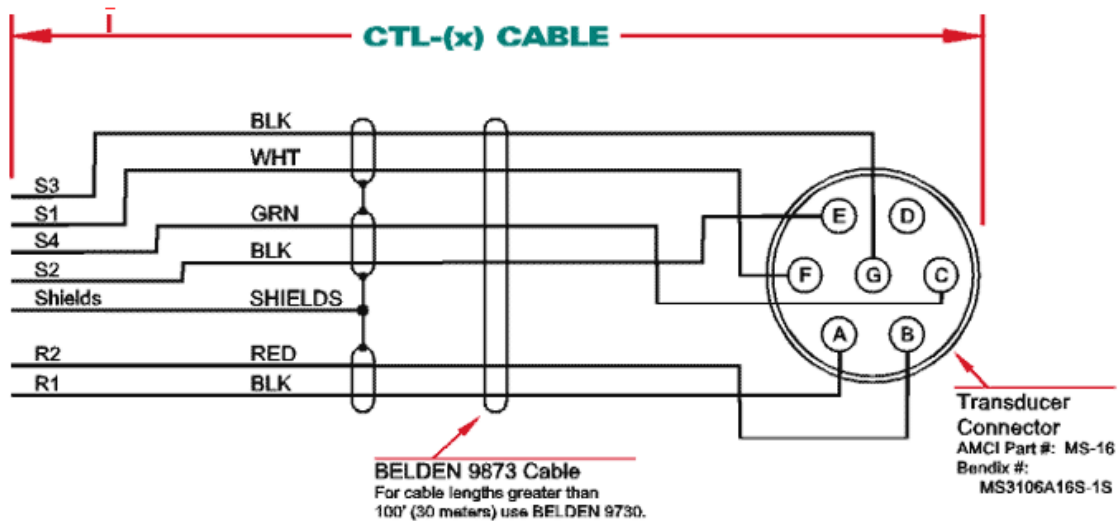
- Transducer signals are low voltage and low power. If you are using A-B guidelines for cabling installation, treat the transducer cable as a Category 2 cable. The transducer cable can be installed in conduit along with other low power cabling such as communication cables and low power ac/dc I/O lines. It cannot be installed in conduit with ac power lines or high power ac/dc I/O lines.
- The shield of the cable must be attached only to the NX3A1X. To properly drain the noise away from the unit, the chassis ground terminal of the three pin power terminal must be connected to your earth ground bus. If you must splice the transducer cable, it must be done in a grounded junction box. When splicing, treat the shield as a signal-carrying conductor. Do not connect the shield to earth ground at the junction box or transducer. If your transducer cable has individually shielded pairs, then ideally the shields in the cable are also kept isolated from each other in the junction box as well.

Compatible Transducers

This unit is compatible with any AMCI single resolver based transducer, including the HT-20 series, the H25-XX series, and the HT-20-X series. The use of other transducers may also be supported with the use of AMCI RM reference modules. Please visit our website, www.amci.com for more information on these resolver transducers. Click on www.amci.com/resolvers.asp for a direct link to the page containing the resolver information.

Mounting

The NX3A1X can be panel mounted in two ways, either on a DIN rail or panel mounted. The mounting kit, included with the unit, contains two DIN brackets, two panel brackets, and four #8 screws needed to attach your choice of brackets to the NX3A1X. Note that the enclosure is not sealed and the NX3A1X must be installed in an adequate enclosure to protect it from environmental contaminates.

Attaching the DIN Brackets

The following figure shows how to install the DIN brackets so that the NX3A1X can be mounted on EN 50 022 or EN 50 035 rail. Note that the bottom view of the unit is shown. The rear view is similar and the brackets are installed in the same fashion.

1) Remove a DIN bracket, two #8 screws, and two #8 lock washers from the mounting kit bag.
2) Slide the DIN bracket onto the unit.
3) Install the two #8 screws and lock washers to secure the bracket on the unit.
4) Repeat on the other side.

BOTTOM VIEW OF NX2A4C (INCOMPLETE) BACK VIEW IS SIMILIAR

DIN Bracket

#8 Screws and Lockwashers (2 places)
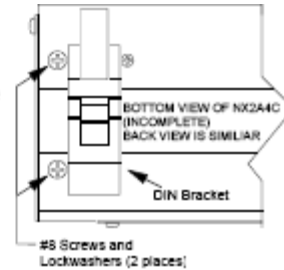
Attaching the Panel Brackets

The following figure shows how to install the panel brackets so that the NX3A1X can be securely mounted to an enclosure. Note that the bottom view of the unit is shown. The rear view is similar and the brackets are installed in the same fashion.

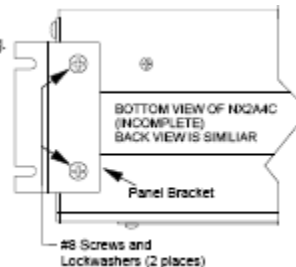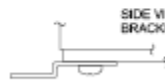1) Remove a panel bracket, two #8 screws, and two #8 lock washers from the mounting kit bag.
2) Position the panel bracket onto the unit.
3) Install the two #8 screws and lock washers to secure the bracket to the unit.
4) Repeat on the other side.

SIDE VIEW OF PANEL BRACKET INSTALLATION

BOTTOM VIEW OF NX2A4C (INCOMPLETE) BACK VIEW IS SIMILIAR

Panel Bracket

#8 Screws and Lockwashers (2 places)

Environmental Conditions

Operating Temperature: 0 to 60° C
Relative Humidity: 5 to 95%   (non-condensing)
Storage Temperature: -40 to 85° C

Throughput Time:

The NX3A1X has a typical throughput time of 100μs from input to output. The maximum throughput time from input to output is 200μs.

Data Transfer

Data updated automatically during the normal update of the Network. Programming the module is accomplished with a *Programming Cycle*, which uses two handshaking bits (Transmit and Acknowledge).

Data Available to Processor

Status Bits, Resolver Position Data, Tachometer Data (default units of RPM), Limit Switch Output Status, Input Status, and Group Position (group mode only)

Programmable Parameters

Apply Preset	Transducer Fault Latch
Scale Factor	Module Type (Independent or Group Mode)
Preset Value	Resolver Type (AMCI or Autotech)
Two Motion Detect Ranges	Limit Switch Type (Normal, Timed, or Pulsed)
Input Active State	Limit Switch Output On/Off setpoints
Tachometer Scalars	Limit Switch Output Speed Compensation Advances
Count Direction	Group Setup Programming
Tachometer Response	

Program Storage

Non-volatile memory, battery backed RAM

Input Function

The inputs to the NX3A1X have a debounce time of 0ms, and are scanned every 1ms. However, if the inputs will be scanned every 100µs if the NX3A1X is operating in Group Modes 1 or 2.

In Independent Mode, each input is ANDed with each output. That is, input 1is ANDed with output 1, input 2 is ANDed with output 2 … input 16 is ANDed with output 16. In group mode, the inputs have the following functions.

Input	Function
1	Group 1 Control
2	Group 2 Control
3	Group 3 Control
4	Group 4 Control
5	Group 5 Control
6	Group 6 Control
7	Limit Switch Enable Input
8	First Cycle Input
9 to 16	Not used in Group Mode

Input Status LEDs

The Nexus unit has 16 inputs that are divided into two groups, each with its own common. Depending on what is connected to the common, the inputs can be either sinking or sourcing.

Common Connection	Input Type	LED color when input active
Ground	Sinking	Red
+DC voltage	Sourcing	Green

Relay Output Wiring

Each Relay output, on both the NX3A1X and the external RB-8 relay board, has two terminals. One is labeled + and the other that is unlabeled. Connect your power supply to the + terminal and your load to the unlabeled terminal.
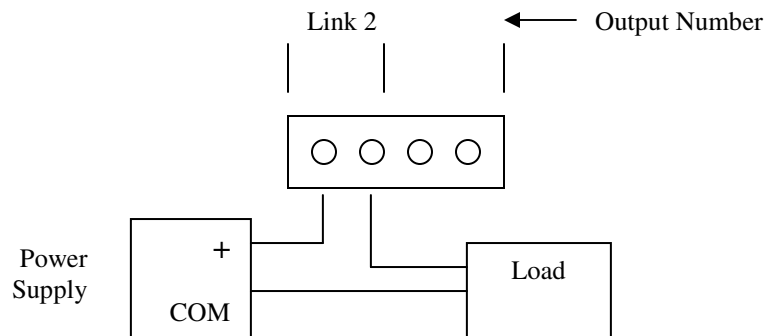
Relay Board Connections

An additional RB-8 relay board can be connected to the NX3A1X if more than the eight built in outputs are required.

Interconnections between the NX3A1X and relay board is made with a *CRP-(x)* cables, where (x) is the length in feet. Presently, two, six, and twelve foot cables are available from AMCI. CRP cables are shielded, fine pitch ribbon cables with drain lugs at both ends. Due to their complexity, AMCI strongly recommends that you purchase pre-assembled and tested CRP cables instead of making them yourself. Connections are made by inserting the blue IDC connector into the proper socket and connecting the drain wire to the screw terminal. Note that the IDC connector is keyed and can only be inserted in one way. The retaining clips on the IDC socket snap over the top of the connector to secure it in place. The drain wire on the CRP cable must be connected to the screw terminals next to the IDC sockets. The screw terminal on the NX3A1X module is connected to Earth Ground. The two screw terminals on the RB-8 relay boards are connected together.

- The CRP cable from the NX3A1X <u>must</u> be connected to the socket labeled "CN2" of the RB-8 relay board.
- The additional RB-8 relay board does not require any external power connections

Chassis Ground

When a relay board is DIN rail mounted the case is isolated from the panel by the plastic DIN rail adapters. You *MUST* run a heavy gauge wire from the Chassis GND terminal of the TB2 terminal block to your ground bus to ground the metal relay board case. When a relay board is panel mounted, the case is usually connected to chassis ground through the mounting hardware. If you believe that the ground is insufficient, then run a heavy gauge wire from the Chassis GND terminal to your ground bus.

RB-8 Sink / Source Inputs

The inputs on the additional RB-8 relay board do not have any function.

Compatible Relays

Every output requires a solid state relay. These relays are fused protected and have a retaining screw and indicator LED. These relays are available from AMCI under the following part numbers.

	Output Voltage	Rated Current
KD-6	3 to 60Vdc	3Adc
KA-3	120Vac	3Aac

Chapter 2: Programmable Parameters

The NX3A1X module is programmed from the Output Registers assigned to the network. The module is setup by setting its *Programmable Parameters*. The programmable parameters are broken down as follows:

> ➢ **Module Operation Parameters –** These functions allow the PLC to directly control the functions of the Groups and the Limit Switch Outputs.
> ➢ **Module Setup Parameters** – Parameters that set the modules' mode of operation, such as the active state of the physical inputs, parameters that scale the tachometer data, and parameters that program the range of the two motion detectors.
> ➢ **Transducer Setup Parameters** – Parameters that affect the resolver position data.
> ➢ **Limit Switch Parameters** – Parameters that program the type of limit switch, any ANDing functions that are to be used, the On/Off setpoints, and the speed compensation advance parameters.
> ➢ **Group Setup Parameters** – If you configure the module to operate in Group Mode then you also have to program the Group Setup Parameters. These parameters assign the number of limit switch outputs in the group, the Operating Mode of the group, the setpoints of the Group Channel, the Group Offset / Preset value, and the inputs that are used to enable the group outputs.

Module Operation Parameters

Output State without Network Connection
This setup parameter allows you to choose if the outputs will be disabled or remain enabled when the Network Connection is lost. By default, the outputs will be disabled when there is no network connection. Please note that forced outputs will always be disabled when the network connection is removed.

Increment/Decrement
This feature allows the PLC to either increase or decrease the On or Off setpoint of a Limit Switch output by one count at a time. It is possible to change just the On setpoint, just the Off setpoint, or both at the same time.

Please note that the Increment/Decrement function only changes the On/Off setpoints in the NX3A1X module's memory. The On/Off setpoints that are stored in the PLC's memory are not changed by the Increment/Decrement function.

Output Forces
You can force any output on or off by setting the appropriate bit in the output registers. A Force OFF bit takes precedence over the corresponding Force ON bit. That is, if both the Force Off and Force On bits are set at the same time, than the output will be Off, not On.

Input Forces
You can force any Physical Input on or off by setting the appropriate bit in the output registers. A Force OFF bit take precedence over the corresponding Force ON bit. That is, if both the Force Off and Force On bits are set at the same time, than the input will be Off, not On.

Module Setup Parameters

Tachometer Response
A bit value that sets how often the NX3A1X module updates the tachometer data to the processor. The two choices are 120 mSec and 504 mSec. The default value is 504 mSec. The NX3A1X modules have two motion detectors that can be used to disable outputs when the machine speed is outside of the motion detectors programmed range. These motion detectors are also updated at the programmed Tachometer Response time. Internally, the tachometer is updated every 24 mSec. This update time is used when calculating the limit output advance values.

The Tachometer Response does not affect the update time of the resolver's position data.

Module Type
A bit value that sets whether the NX3A1X will be used in *Independent Mode* or in *Group Mode*. While in Independent Mode, each output is independent of the others and has a corresponding input that is ANDed with the output. When in Group Mode, the outputs are combined into groups. The NX3A1X module has a maximum of six groups. Each group is assigned an *Operating Mode* and an Input that controls how the outputs fire.

Tachometer Scalars
The NX3A1X module allows you to scale the tachometer value reported to the processor. Therefore, you can have the NX3A1X report a tachometer value scaled to boxes per minute, inches per minute, or any other meaningful value instead of the default revolutions per minute. The tachometer is scaled with three values, *Tach Multiplier, Tach Divisor,* and *Tach Decimal Point*. The tachometer reports the rounded off integer value of the equation: (((Speed[RPM] * Tach Multiplier) / Tach Divisor) / Tach Decimal Point). The Tach Multiplier can be any integer between 0 and 1,100. The Tach Divisor can be any integer between 1 and 63. The Tach Decimal Point can be 1, 10, 100, or 1000. As an example, assume a speed of 100 RPM, a multiplier of 2, a divisor of 3. The table below shows the different Tachometer values based on the Tach Decimal Point value.

	Decimal Point Value			
	1	10	100	1000
Calculated Tach	66.67	6.67	0.67	0.067
Reported Tach	67	7	1	0

When programming the Tach Decimal Point, you enter 0, 1, 2, or 3 into your programming data. This corresponds to a Tach Decimal Point Value of 1, 10, 100 or 1000.

Physical Input Active State
These sixteen bit values program the active state of the Physical Inputs. When an Active State bit is set to its default value of zero, the corresponding input works like a normally closed relay. The input must have current flowing through it to be deactivated. When an Active State bits is set to one, the corresponding input works like a normally open contact. The input must have current flowing through it to be activated.

Motion Detector ON/OFF setpoints
The NX3A1X has two motion detectors, *MD1* and *MD2*, which function as speed based limit switches. You program a low speed setpoint and a high speed setpoint for each motion detector. If the low speed setpoint is less than the high speed setpoint then the output will be on when the velocity is between the two setpoints and off at all other speeds. If the low speed setpoint is greater than the high speed setpoint

then the output will be off when the velocity is between the two setpoints and on at all other speeds. You can logically AND any limit switch output with the state of either motion detector, but not both at the same time. This disables the limit switch output unless the machine is running at a speed that is within the programmed range. The motion detector setpoints are always programmed in RPM, regardless of the values of the Tachometer Scalars. The setpoints have a range of zero to 32,767 RPM.

How often the ON/OFF state of the motion detectors are updated is based on the Tachometer Response parameter. Like the tachometer, they will update either every 120 mSec or 504 mSec.

Note: If you are using the motion detectors to disable limit switch outputs and your machine accelerates to its final speed quickly, you may have to change the Tachometer Response from its default of 504 mSec to 120 mSec. This insures that the limit switches will be enabled as quickly as possible once the machine is running at operating speed.

Transducer Setup Parameters

Apply Preset
Setting the Apply Preset bit while programming the NX3A1X module will cause the Machine Position data to be changed to the Preset value that was previously programmed with the setup data. The result of the Apply Preset operation is saved through power down.

   Note: Programming the setup data will undo the result of an Apply Preset operation.

Count Direction
A bit value that sets the direction the transducer shaft must rotate to increment the position count. It can be set to clockwise or counter-clockwise with a default of clockwise. Note that it is also possible to reverse the count direction by switching the S2 S4 signal pair in the transducer cable.

Transducer Fault Latch
A bit value that determines if a detected transducer fault is self clearing or latched. Transducer faults can be caused by improper wiring, electrical noise, or a damaged transducer. When the module detects a transducer fault, it sets an error bit in the data it transmits over the network. By default, the NX3A1X latches the fault until it sees a clear error command. It is also possible to program the NX3A1X to clear the fault message as soon as a working transducer has been attached. The Limit Switch Outputs are always disabled when there is a transducer fault.

Resolver Type
A bit value that determines if the NX3A1X will interface with either AMCI or Autotech resolvers. By default the NX3A1X will interface with AMCI resolvers that have a transformation ratio of 0.95. Setting this bit will allow the NX3A1X to interface with Autotech resolvers that have a transformation ratio of 1.40.

Scale Factor
Sets the position resolution of the NX3A1X module. It is programmable to any value between 2 and 8192 counts per turn.

Preset Value

This parameter sets the value that the *Machine Position* will be set to when the Apply Preset command bit is set in the setup data. Its default is zero and it is programmable to any value between zero and (Scale Factor - 1). The *Machine Position* is the position that the NX3A1X module reports to the processor. As you will see later, when operating the NX3A1X in Group Mode, you can offset the position that the *group* uses when determining the on/off state of its outputs. When this happens, the manual will use the term *Group Position* to distinguish this position count from the *Machine Position*.

Limit Switch Parameters

Limit Switch Type Parameter

Programs the type of limit switch the output channel will be. The three choices are *Normal*, *Pulse*, and *Timed.* Normal outputs turn on and off based only on resolver's position. Pulse outputs generate a pulse train between two position values. Timed outputs are position on, time off or position off, whichever occurs first, outputs.

Motion ANDing Parameter

You can disable a limit switch output by ANDing it with one of the two motion detectors. This prevents the output from firing until the machine is running at a speed within the programmed motion detector range. This parameter give you the choice of no Motion ANDing or ANDing it with either MD1 or MD2.

Enable ANDing Parameter

When in Group Mode you can disable a limit switch output by ANDing it with an input. Use this bit value to attach the *LS Enable Input* to the limit switch output. This parameter is not used when in Independent Mode because each output has a corresponding, dedicated input that can be used to disable the output.

Limit Switch ON / OFF Setpoints

Limit Switch Setpoints are a pair of position values at which the outputs turns on and off. The limit switch is on when the position value is between the two setpoints. Setpoints can be programmed to any value between 0 and (Scale Factor -1).

Normal Limit Switch: Eight pairs of ON / OFF setpoints that give you the ability to turn the output on and off eight times per cycle.

Pulse Limit Switch: One ON / OFF setpoint pair that sets the leading edge of the pulse train and the trailing edge of the pulse train. Two additional parameters, *Total Number of Pulses* and Pulse *Duration,* must also be programmed. The Total Number of Pulses is the number of pulses in the train. The Pulse Duration is the number of counts that each pulse is On. The difference between the ON and OFF setpoints must be greater than or equal to: ((Total Number of Pulses *Pulse Duration) + (Total Number of Pulses -1)).

Timed Limit Switch: One ON / OFF setpoint pair that sets the ON position and OFF position of the limit. A third parameter sets the amount of time the output is on. Usually, the output will turn on at the ON setpoint and remain on for the specified length of time. However, if the OFF setpoint is reached before the timer times out, the output turns off immediately. The maximum length of time an output can be on is 9.999 seconds. All 16 outputs of the NX3A1X can be programmed as a timed output. In Independent Mode or Group Mode 3, timing does not start until the input is active. Timing will start immediately if the Enable Input is used.

Limit Switch ON / OFF Advances

Two parameters that allow the limit switch channel to compensate for fixed delays in the system. The maximum compensation is ±99.9 mSec. Setting the Advance to a positive value will cause the output to turn on earlier in the cycle. Setting the Advance to a negative value will cause the output to turn on later in the cycle.

Because most PLCs do not support numbers with decimal points in them, the Speed Compensation value entered will appear to be ten times the desired value. For example, a Speed Compensation value of 5.2ms would be entered as 52.

If the programmed advance time is greater than the time for one rotation, then the actual measured advance will be equal to (Programmed Advance – Time for Rotation).

Group Setup Parameters

The Group Setup Parameters must also be programmed if you are using the NX3A1X module in Group Mode. There are a maximum of six groups available.

Output Quantity

This parameter sets the number of limit switch outputs in the group. Outputs are assigned to a group in consecutive order. As an example, assume that Group 1 is assigned six outputs and Group 2 assigned eight outputs. Then limit switch outputs 1 to 6 are assigned to Group 1 and limit switch outputs 7 to 14 are assigned to Group 2. This leaves two outputs for another group. If you try to assign more than two outputs to another group, the NX3A1X will respond with an error message.

Group Operating Mode

This parameter specifies the groups' Operating Mode. Seven different modes are presently available.

Mode 0: Outputs operating in Mode 0 function as a simple limit switch and are not affected by the input terminal or group channel.

Mode 1: Outputs operating in Mode 1 are always enabled to turn on at their programmed setpoints. When the group input is activated, the group's position is preset to the group's preset value. The input is ignored until the group control position is reached. The input must transition from 0 to 1 after the group control position is reached.

Mode 2: Outputs operating in Mode 2 are disabled until the group input is activated, at which time the group's position is preset to the preset value. The outputs will be active until the group control position is reached. The input is ignored until the group control position is reached. The input must transition from 0 to 1 after the group control position is reached.

Mode 3: Outputs operating in Mode 3 can be active only when the group control input is active. The group channel On/Off points are not used in mode 3.

Mode 4: Outputs operating in Mode 4 will be active for one cycle only when the group's input transitions from 0 to 1 between the group channel's On and Off points. The cycle ends when either the group channel On or Off point is reached, at which point the outputs turn off.

Mode 5: Outputs operating in Mode 5 will be active for one cycle only when the group's input is active in the range between the group channel's On and Off points. The outputs will be active only when the resolver's shaft is turning, or if the first cycle input is active. The outputs will turn off after there is no change in position for either 504ms or 120ms, depending on how the tachometer response parameter is set. The cycle ends when either the group channel On or Off setpoint is reached, at which point the outputs turn off.

Mode 6: Mode 6 is similar to mode 5 except that the outputs will be disabled when the group's position data rolls over to zero.

Group Channel ON / OFF Setpoints

Each Group has an internal limit switch called the Group Channel. Its use is dependent on the groups' Operating Mode. It is typically used either to enable or disable the group's inputs and outputs. The state of the Group Channel is only used internally by the group.

Group Offset / Preset Value

Each group has an offset / preset value to adjust the machine position for the group. In Operating Modes 0, 3, 4, 5, and 6, this value acts as a position offset. In Operating Modes 1 and 2 this value acts as a preset. These values do not affect the Machine Offset that adjusts the position value reported over the backplane. They only affect the position value used by the group when calculating the on/off status of the limit switch outputs assigned to the group.

Chapter 3: INDEPENDENT MODE OPERATIONS

When To Use Independent Mode

You should use Independent Mode when your only requirement is for resolver position based limit switches. Group Mode adds powerful functionality to the NX3A1X that can decrease the operations performed by the PLC by off loading a substantial amount of logic to the NX3A1X. However, if you do not need this functionality, operating the NX3A1X module in Independent Mode eliminates all of the Group Mode programming which simplifies module setup. When in Independent Mode, the Enable ANDing Parameter and all of the Group Setup Parameters are not used.

Independent Mode Features

The following limit switch features are available while in Independent Mode.

Limit Switch Output Type

You can program the type of limit switch the output channel will be, Normal, Pulse, or Timed. Normal outputs turn on and off based on position. Pulse outputs generate a pulse train between two position values. Timed outputs are position on, and either time off or position off, whichever occurs first.

Speed Compensation

Separate ON/OFF advances for each limit switch are still available to compensate for fixed delays in the system. The maximum compensation is ±99.9mSec. Setting the Advance to a positive value will force the output to turn on earlier in the cycle. Setting the Advance to a negative value will force the output to turn on later in the cycle. Because most PLCs do not support numbers with decimal points in them, the Speed Compensation value entered will appear to be ten times the desired value. For example, a Speed Compensation value of 5.2ms would be entered as 52.

Motion ANDing

Both motion detectors are available in Independent Mode. You can disable a limit switch output by ANDing it with either of the two motion detectors. This prevents the output from firing until the machine is running within the speed range programmed into the motion detector.

Physical Limit Switch Disable Inputs
A feature not available in Group Mode is the Physical LS Disable Inputs. While in Independent Mode, each output can be disabled by the corresponding Physical input. That is, each Output is ANDed with each Input.

Output 1 is attached to Input 1, Output 2 to Input 2, etc. The outputs will not fire unless the corresponding Physical input is active. By default, this feature is automatically disabled. If you leave the Physical Input Active State parameters to their default values of zero, the inputs will act like normally closed relays. If you do not use the input, the outputs will then fire normally. While in Group Mode, a single input per group can be used to disable the outputs assigned to the group.

Chapter 4: GROUP MODE OPERATIONS

When To Use Group Mode
You should use Group Mode when you want to control multiple Limit Switch outputs from a single input. The Group Mode functions allow you to fire the outputs only after a product has been detected, or only if a product has been detected while it is in the correct location.

In addition to all of the features available in Independent Mode (Limit Switch Output Type, Speed Compensation, and Motion ANDing), the following features are also available in Group mode.

Assigning Limit Outputs to Groups
Each Group has an *Output Quantity* parameter. This parameter defines the number of outputs assigned to the group. Outputs are assigned in consecutive order. The maximum number of outputs per group is sixteen. When operating the NX3A1X module in Group Mode you must assign an output to a group before using it. The module will give you an error if you try to program Limit Switch Parameters for a limit switch output that is not assigned to a group.

Group Inputs
Each of the six groups has a dedicated input. The Operating Mode assigned to the group defines the function of the input.

When the NX3A1X module is in Group Mode, there are also two additional inputs available. The first is the *LS Enable Input*. Any output can be tied to the LS Enable Input. The output is tied to the LS Enable Input with an ANDing function. That is to say, every output tied to the corresponding LS Enable Input will only fire if the LS Enable Input is active. Timed outputs do not start timing again if the Enable Input transitions from On to Off to ON.

The second of the inputs is the *First Cycle Input*. This input only applies to groups operating in Modes 5 or 6. The purpose of the First Cycle Input is to enable the group outputs to fire on the first machine cycle if other conditions are also met. Its use is fully described below in the Mode 5 section of this chapter.

Note: In group modes 4, 5 and 6, the inputs will be acted on only if the position data is scanned between the programmed group channel's On and Off points. If the resolver position data passes through the group channel in less than 1ms, the input may not be detected.

Each Group has its own dedicated input. That is, Group 1 is always controlled by Input 1, Group 2 by Input 2, etc. The table below lists the input numbers for all of the Groups, LS Enable, and First Cycle Inputs.

	Physical Input
Group 1 Input	1
Group 2 Input	2
Group 3 Input	3
Group 4 Input	4
Group 5 Input	5
Group 6 Input	6
LS Enable Input	7
First Cycle Input	8
Not used in Group Mode	9 to 16

Mode 0

When a group is placed in Mode 0 its outputs will function as normal limit switches. Inputs assigned to the group are not used and the Group Channel need not be programmed. Outputs in the group can still be conditioned by tying them to the LS Enable Input and/or either of the two motion detectors. The outputs assigned to the group will cycle their outputs once per transducer rotation. The group also has a Group Offset parameter that can be used to make the Group Position different from the Machine Position. If the Group Offset equals zero then the Group Position will equal the Machine Position.

Mode 1

When a group is placed in Mode 1 its outputs will function as normal limit switches. Outputs in the group can be conditioned by tying them to the LS Enable Input and/or either of the two motion detectors. The difference between Mode 1 and Mode 0 is that you can use the Group Input to Apply a Preset to the Group Position. Typically the Group Input is tied to a sensor that detects a registration mark on the machine or a product. When the mark is sensed the Group Position is preset to the value programmed in the Group Preset parameter. This synchronizes the outputs in the group to the registration mark or the product. The position can be preset to any value between zero and (Scale Factor -1). Any transitions of the Group Input are ignored until either of the Group Channel's On/Off setpoints are reached.

Mode 2

Mode 2 is very similar in operation to Mode 1. The only difference between the two Operating Modes is that the outputs in Mode 2 are normally disabled. The Group Input is used to preset the Group Position to the value stored in the Group Preset parameter. As in mode 1, the group position can be preset to any value between zero and (Scale Factor -1). When the Group Position is preset, the outputs are enabled, and the Group Input disabled, until the dwell in the Group Channel is reached. Outputs in the group can be further conditioned by tying them to the LS Enable Input and/or either of the two motion detectors. Typically, the Group Input is tied to a sensor that detects the presence of product. When the product is sensed, the group outputs are synchronized to the product and are allowed to fire. If a product is not present on the next transducer rotation, the outputs will not fire again.

Mode 3

When a group is placed in Mode 3 the Group Input is used to enable the outputs in the group. The Group Channel has no affect and need not be programmed. The Group Input is typically tied to a sensor that detects the presence of material. The outputs will only fire when material is present. Outputs in the group can be further conditioned by tying them to the LS Enable Input and/ or either of the two motion detectors. The outputs assigned to the group will cycle their outputs once per transducer rotation. The group has a Group Offset that can be used to make the Group Position different from the Machine Position. If the Group Offset equals zero then the Group Position will equal the Machine Position.

In Mode 3, timed outputs will start timing again if the Group Input transitions from On to Off to ON.

Mode 4

When a group is placed in Mode 4 the Group Input is used to enable the outputs for one cycle. The positive transition, (inactive state to active), on the Group Input must occur between the programmed Group On and Off Channel Setpoints in order for the outputs to be enabled. The outputs are enabled until the dwell on the Group Channel is again reached. The Group Input is typically tied to a sensor that detects the presence of material. The outputs will then only fire when material is present and correctly positioned. Outputs in the group can be further conditioned by tying them to the LS Enable Input and/or either of the two motion detectors. The outputs assigned to the group will cycle their outputs once per transducer rotation. The group has a Group Offset that can be used to make the Group Position different from the Machine Position. If the Group Offset equals zero then the Group Position will equal the Machine Position.

In Mode 4, timed outputs will start timing again if the Group Input transitions from On to Off to ON.

Mode 5

When a group is placed in Mode 5 the Group Input is used to enable the outputs for one cycle. In Mode 4, a positive transition on the Group Input must occur between the Group Channels' On and Off setpoints in order for the outputs to be enabled. In Mode 5, the outputs are enabled if the Group Input is active at any time between the programmed Group On and Off Channel Setpoints. The outputs are enabled for one cycle. The Group Input is typically tied to a sensor that detects the presence of material. The outputs will then only fire when material is present. Outputs in the group can be further conditioned by tying them to the LS Enable Input and/or either of the two motion detectors.

In Mode 5, the outputs are disabled within the programmed update time of the Tach Response if the machine stops for any reason. In gluing applications this shuts off the glue gun if the machine stops while glue is being applied. The First Cycle Input can be used to re-enable the outputs once the machine has started again. The group has a Group Offset that can be used to make the Group Position different from the Machine Position. If the Group Offset equals zero then the Group Position will equal the Machine Position.

In Mode 5, timed outputs <u>will not</u> start timing again if the Group Input transitions from On to Off to ON.

Mode 6

Mode 6 is similar to mode 5 except that the outputs will be disabled when the group's position data rolls over to zero.

In Mode 6, timed outputs <u>will not</u> start timing again if the Group Input transitions from On to Off to ON.

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Chapter 5: Input Registers

The NX3A1X module reports the resolver position and velocity data, as well as module status and programming errors to the PLC using 20 sixteen bit input registers. These registers have the following function.

Note: A ControlLogix system using ControlNet will require 22 input words. The first two words will always be zero, and the Module Status Word will be located in word 2.

Input Word	Function
0	Module Status (see description below)
1	Machine Position Data
2	Resolver Velocity Data (default units of RPM) The Velocity Data will be zero if there is a clearable transducer fault.
3	Limit Switch Output Status (bit 0 = output 1, bit 1 = output 2 … bit 15 = output 16)
4	Input Status (bit 0 = input 1, bit 1 = input 2 … bit 15 = input 16)
5	Setup Programming Errors (see description below)
6	Group Programming Errors (see description below)
7	Group Number with error
8	Group 1 position data (Zero if the group is not used)
9	Group 2position data (Zero if the group is not used)
10	Group 3position data (Zero if the group is not used)
11	Group 4position data (Zero if the group is not used)
12	Group 5position data (Zero if the group is not used)
13	Group 6position data (Zero if the group is not used)
14	Output Programming Errors (see description below)
15	Output Number with error
16	Output Setpoint Number with error
17	Reserved
18	Reserved
19	Reserved

Word 0: Module Status
> Bit 0: set when setup data is invalid (see input register 5 for a detailed description of the error)
> Bit 1: set when group data is invalid (see input registers 6 and 7 for a detailed description of the error)
> Bit 2: set when Limit Switch data is invalid (see input registers 14 to 16 for a detailed description of the error)
> Bit 3: set when Increment / Decrement Output Number is invalid (range 1 to 16). Also set if any of the unused bits are set in the control word are set, if neither the increment or decrement setpoint bits are selected, or if you try to increment or decrement an output that has not yet been programmed.
> Bit 4: set when the Increment / Decrement Setpoint Number is invalid (range 1 to 9, 9 programs all of the on/off setpoints), if you try to increment an on setpoint past the off setpoint or vice versa, or if you try to increment or decrement a setpoint that has not been programmed.

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Bit 5: set when Message Ignored Error (generated by trying to program the module when a programming error exists). This bit will also be set when Setup Word 12 is not equal to zero.

Bit 6: set when Module Fault (generated if the NX3A1X fails its power up test) This bit will also be set if there is no reference voltage present.

Bit 7: set when Transducer Fault. If the fault is clearable, the position data will be updated, the velocity data will be zero, and the outputs will be disabled.

Bit 8: MD1 bit, set when the transducer's velocity in RPM is within the range programmed into Motion Detector 1. This MD1 bit is based on the rpm velocity and not on the velocity calculated by applying the multiplier and divisor setup parameters.

Bit 9: MD2 bit, set when the transducer's velocity in RPM is within the range programmed into Motion Detector 2. This MD2 bit is based on the rpm velocity and not on the velocity calculated by applying the multiplier and divisor setup parameters.

Bit 10: Tachometer Overflow, set when the scaled tachometer value in input register 2 exceeds 32,767.

Bit 11: Set when the output registers are being used to force the outputs and inputs on and off.

Bit 12: Command Error. Set when more than one of the bits 1 to 5 are set, if reserved bits 6 to 12 are set during a programming cycle, or if you try to program groups when the module is operating in independent mode.

Bit 13: reserved, always equal to zero

Bit 14: Mode status bit, 0 = independent mode, 1 = group mode

Bit 15: Acknowledge bit. Set when the NX3A1X module sees that the Transmit bit in output register 0 is set.

Word 1: Machine Position (The position data is reported if there is a clearable transducer fault)

Word 2: Scaled Resolver Velocity Data (The velocity data will be zero if there is a clearable transducer fault.

Word 3: Limit Switch Output Status (bit 0 = output 1, bit 1 = output 2 … bit 15 = output 16)

Word 4: Input Status (bit 0 = input 1, bit 1 = input 2 … bit 15 = input 16) (If the input is configured to be active high, than these bits will be on when the input is receiving power. If the input is configured to be active low, than these bits will be on when the input is not receiving power.)

Word 5: Setup Programming Errors

Bit 0: Scale Factor Error. Set if the Scale Factor is outside of the range of 2 to 8192.

Bit 1: Preset Value Error. Set if the Preset Value is outside of the range of 0 to (SF-1).

Bit 2: reserved, will always be zero.

Bit 3: Motion Detect 1 Error. Set if one or both Motion Detector 1 setpoints are outside the range of 0 to 32,767, or if the setpoints are equal but not zero.

Bit 4: Motion Detect 2 Error. Set if one or both Motion Detector 2 setpoints are outside the range of 0 to 32,767, or if the setpoints are equal but not zero.

Bit 5: Tachometer Scalars Errors. Set if the Tachometer Multiplier, Tachometer Divisor, or Tachometer Decimal Point parameters are outside of their programmable ranges. The bit will also be set if the Tachometer Multiplier $\neq$ 0 and the Tachometer Divisor = 0.

Bits 6 to 14: Reserved, will always set to zero.

Bit 15: Setup Command Word Error. Set if one or more of the reserved bits in the setup command word are set to "1" during a setup programming cycle.

Word 6: Group Programming Errors

Bit 0: Group Offset/Preset Error. Set if the Group Offset/Preset value is outside of the range of 0 to (SF-1)

Bit 1: Group Programming Error. Set if the output quantity or operating mode parameter is invalid.

Bit 2: Group Channel Setpoint Error. Set when one or both of the group channel setpoints are outside of the range of 0 to (SF-1) or if both setpoints are equal but not zero.

Bits 3 to 14: Reserved, will always be set to zero.

Bit 15: Group Command Word Error. Set when one or more of the reserved bits in the group command word are set to "1" during a group programming cycle.

Word 7: Group Number with error. If any of the bits 0 to 2 are set in input register 6, than this word will indicate which group, 1 to 6, has the programming error.

Word 8: Group 1 position data

Word 9: Group 2 position data

Word 10: Group 3 position data

Word 11: Group 4 position data

Word 12: Group 5 position data

Word 13: Group 6 position data

Word 14: Output Programming Errors

Bit 0: On Setpoint Error. Set when a Limit Switch ON Setpoint is outside of the range of 0 to (SF – 1). Input registers 15 and 16 will report which output and setpoint have the error.

Bit 1: Off Setpoint Error. Set when a Limit Switch OFF Setpoint is outside of the range of 0 to (SF – 1) or if the on and off setpoints are equal but not zero. Input registers 15 and 16 will report which output and setpoint have the error.

Bit 2: Advance Error. Set when an advance value is outside of the range of ±4999. (The range is ±999 for units with a serial number below 02170001.) Input register 15 will report which output has the error.

Bit 3: Timed Output Error. Set when a timed output range is outside of the range of (1 to 9999) or if the on/off setpoints of a timed output are outside of the range of 0 to (SF-1).

Bit 4: Reserved, will always be equal to zero.

Bit 5: Pulsed Output Error. Set if there is an error with one or more of the pulsed output parameter. The difference between the leading and trailing edge setpoints must be greater than ((Pulse Quantity * On count) + (Pulse Quantity – 1)). This bit will also be set if the on/off setpoints of the pulsed outputs are outside of the range of 0 to (SF-1).

Bit 6: Output Quantity Programming Error. This bit will be set if you try to program more than two outputs at a time in Output Programming Block word 1, if no outputs are selected in word 1, or if you try to program outputs not assigned to a group.

Bit 7: Reserved, will always be equal to zero.

Bit 8: Limit Switch Disabled. Set to "1" when the outputs are disabled because the outputs have not been programmed, if there is a transducer fault, or if the outputs have been disabled by the disable output command. The outputs will also be disabled, and this bit set, after either the Setup or the Group data have been programmed.

Bits 9 to 14: Reserved, will always be equal to zero.

Bit 15: Limit Switch Command Word Error. Set under the following three conditions

1. Set when one or more of the reserved bits in the output command word are set to "1" during a group programming cycle.
2. Set if you try to use both motion detect ANDing on a single output.

Word 15: Output Number where output programming error occurred, range of 1 to 16.

Word 16: Setpoint Number where output programming error occurred, range of 1 to 8

Words 17 to 19: Reserved, set to zero

Chapter 6: Output Registers

The NX3A1X module is programmed through 40 sixteen bit output registers. Because of the amount of data that is required to totally program the module, and to limit the number of words transferred over the Network, five different programming blocks are used to program the module. Output register 0 always has the same function, and the function of registers 1 to 39 will vary depending on the data contained in register 0. Because of this programming method, a maximum of 10 programming cycles will be required to completely program the module. The following table outlines the five programming blocks.

Programming Block	Function
Setup	Count Direction, Tachometer Response, Module type, Transducer Fault Latch, Transducer Input Type, Scale Factor, Preset Value, Motion Detect Values, and Input Active State.
Group	Number of outputs assigned to group, group mode, group channel on and off setpoints, group preset/offset value. All six groups are programmed with one cycle.
Output	Limit switch type, ANDing type, on/off advances, 8 on/off setpoints. Two outputs can be programmed with each programming cycle, requiring 8 programming cycles to program all 16 outputs.
Increment / Decrement	Select increment/decrement type, limit switch to be adjusted, and setpoint to be adjusted. Only one output can be changed with each programming cycle.
Force	Force outputs and inputs on or off. Sending this programming block places the module in a "Force Mode" in which any changes to the appropriate output registers will be acted on without a programming cycle.

Word 0: Control Word (This Command word will be used to select which programming block is to be sent to the NX3A1X. Setting more than one of the bits 1 to 5, or setting bits 6 to 12 during a programming cycle will generate a command error, Input register 0, bit 12)

    Bit 0: Apply Preset Value to Machine Position
    Bit 1: Program Setup
    Bit 2: Program Groups
    Bit 3: Program Outputs
    Bit 4: Program Increment / Decrement Function
    Bit 5: Place Output Registers in Force mode
    Bit 6: Exit Force Mode **(Only available on units with a serial number above 09170001)**
    Bits 7 to 12: Reserved, must be equal to zero
    Bit 13: Set to disable all outputs, reset to enable all outputs (This parameter is not saved on power down.)
    Bit 14: Clear Errors **(On units with a serial number below 09170001, issuing the Clear Error command will not cause the NX3A1X to exit force mode.)**
    Bit 15: Transmit bit

Note: If the PLC is powered, and the transmit bit is set when the Nexus unit is powered up, then the Nexus unit will act on any valid data contained in the output registers. However, if the PLC is powered up with the transmit bit on, then the Nexus unit will ignore any valid data in the output registers.

Setup Programming Block, Words 1 to 39

Note: Programming the Setup Block with valid data clears both the Group and Limit Switch Output Programming.

Word	Function
1	Bit Level Setup Parameters (See description below)
2	Scale Factor (2 to 8192)
3	Preset Value (0 to (SF-1))
4	Motion Detect 1 Low RPM (0 to 32,767)
5	Motion Detect 1 High RPM (0 to 32,767)
6	Motion Detect 2 Low RPM (0 to 32,767)
7	Motion Detect 2 High RPM (0 to 32,767)
8	Real Input Active State. Reset if the input is active low, set if the input is active high. (bit 0 = input 1, bit 1 = input 2, … bit 15 = input 3)
9	Tachometer Multiplier (0 to 1100)
10	Tachometer Divisor (0 to 63, 0 only if Tachometer Multiplier is 0)
11	Tachometer Decimal Point (0 to 3)
12	Reserved, must be set to zero.
13 to 39	Not used. These words should be "don't cares."

Word 1: Bit Level Setup Parameters

Bit 0: Count Direction (0 = CW, 1 = CCW)

Bit 1: Tachometer Response (0 = 504ms, 1 =120ms update time. The update time applies to the tachometer data reported over The Network, and the ON/OFF status of the motion detectors. The Tachometer Response <u>does not</u> affect the update time of the resolver's position data.)

Bit 2: Module Type (0 = Independent Mode, 1 = Group Mode)

Bit 3: Reserved, must be set to zero.

Bit 4: Transducer fault latch (0 = fault latched, 1 = fault cleared. Default value is latched)

Bit 5: Resolver Type (0 = AMCI, 1 = Autotech, default is AMCI)

Bit 6: Reserved, must be set to zero.

Bit 7: Reset to disable the outputs when there is no network connection. Set to have the outputs remain enabled when there is no network connection. If set, the outputs will turn on and off based on the resolver's position. Please note that forced outputs are always disabled when the network connection is removed, regardless of the state of this bit.

Bits 8 to 15: Reserved, must be equal to zero

Group Programming Block, Words 1 to 39

Note: Programming the Group Setup clears the Limit Switch Output programming

Word	Function
1	Group 1Setup Programming Bits (See description below)
2	Group 1 Channel On Point (0 to Scale Factor – 1)
3	Group 1 Channel Off Point (0 to Scale Factor –1)
4	Group 1 Offset or Preset Value (mode dependent) (0 to Scale Factor –1)
5	Group 2 Setup Programming Bits (See description below)
6	Group 2 Channel On Point (0 to Scale Factor – 1)
7	Group 2 Channel Off Point (0 to Scale Factor –1)
8	Group 2 Offset or Preset Value (mode dependent) (0 to Scale Factor –1)
9	Group 3 Setup Programming Bits (See description below)
10	Group 3 Channel On Point (0 to Scale Factor – 1)
11	Group 3 Channel Off Point (0 to Scale Factor –1)
12	Group 3 Offset or Preset Value (mode dependent) (0 to Scale Factor –1)
13	Group 4Setup Programming Bits (See description below)
14	Group 4 Channel On Point (0 to Scale Factor – 1)
15	Group 4 Channel Off Point (0 to Scale Factor –1)
16	Group 4 Offset or Preset Value (mode dependent) (0 to Scale Factor –1)
17	Group 5Setup Programming Bits (See description below)
18	Group 5 Channel On Point (0 to Scale Factor – 1)
19	Group 5 Channel Off Point (0 to Scale Factor –1)
20	Group 5 Offset or Preset Value (mode dependent) (0 to Scale Factor –1)
21	Group 6Setup Programming Bits (See description below)
22	Group 6 Channel On Point (0 to Scale Factor – 1)
23	Group 6 Channel Off Point (0 to Scale Factor –1)
24	Group 6 Offset or Preset Value (mode dependent) (0 to Scale Factor –1)
25 to 39	Not used. These words should be "don't cares."

The Setup Programming bits of all six groups has the following layout:

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 09	Bit 08	Bit 07	Bit 06	Bit 05	Bit 04	Bit 03	Bit 02	Bit 01	Bit 00
Set to enable group	0	0	0	0	The mode used in the group, range of 0 to 6			0	0	The number of limit switch outputs assigned to the group, range of 1 to 16					

Output Programming Block, Words 1 to 39

Word 1: Outputs Programmed

This word controls which two outputs are programmed in output registers 2 to 39. Each bit in this word corresponds to an output, that is bit 0 = output 1, bit 1 = output 2, … bit 15 = output 16. Any two bits can be set during an output programming cycle. The output assigned to the least significant bit of the two will be programmed in words 2 through 20 and is called the *Lower Output*. The most significant bit of the two will be programmed in words 21 through 39 and is called the *Upper Output*. If only one bit is set, only registers 2 through 20 will be used, and the data in words 21 through 39 will be ignored. Setting more than two bits will generate an Output Quantity Error, which is indicated by input word 14, bit 6. Any errors in the output programming data will cause even valid changes to be ignored.

The function of Output Programming Words 2 through 39 is shown in the following table.

Lower Output Word	Upper Output Word	Normal Output Function	Pulsed Output Function	Timed Output Function
2	21	Output Setup Bits (See description below)		
3	22	On Advance (0 to $\pm$4999) *		
4	23	Off Advance (0 to $\pm$4999) *		
5	24	On Setpoint 1 (0 to SF-1)	On position, leading edge of 1st pulse	On Setpoint
6	25	Off Setpoint 1 (0 to SF-1)	Off Position, trailing edge of last pulse	Off Setpoint
7	26	On Setpoint 2 (0 to SF-1)	Total Number of Pulses	Dwell Time (1 to 9999ms)
8	27	Off Setpoint 2 (0 to SF-1)	Pulse Duration	0
9	28	On Setpoint 3 (0 to SF-1)	0	0
10	29	Off Setpoint 3 (0 to SF-1)	0	0
11	30	On Setpoint 4 (0 to SF-1)	0	0
12	31	Off Setpoint 4 (0 to SF-1)	0	0
13	32	On Setpoint 5 (0 to SF-1)	0	0
14	33	Off Setpoint 5 (0 to SF-1)	0	0
15	34	On Setpoint 6 (0 to SF-1)	0	0
16	35	Off Setpoint 6 (0 to SF-1)	0	0
17	36	On Setpoint 7 (0 to SF-1)	0	0
18	37	Off Setpoint 7 (0 to SF-1)	0	0
19	38	On Setpoint 8 (0 to SF-1)	0	0
20	39	Off Setpoint 8 (0 to SF-1)	0	0

*Notes on Advances

- The On and Off Advances are programmed in units of 0.1ms. For example, an advance of 1234 would advance the output by 123.4ms.
- The On and Off Advance parameters have a range of $\pm$999 on units with a serial number below 02170001.

OUTPUT SETUP WORDS: The first word of each of the two output programming blocks, words 2 and 21, contain the Output Setup Word. These words define the type of output (normal, timed, or pulsed) and if any ANDing will be used. The description of these output setup words is shown below.

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 09	Bit 08	Bit 07	Bit 06	Bit 05	Bit 04	Bit 03	Bit 02	Bit 01	Bit 00
Group Mode Enable ANDing	Motion ANDing Control Bits		0	0	0	0	0	0	0	0	0	0	0	Output Type	

Output Type

Bit 1	Bit 0	Function
0	0	Output not used
0	1	Pulse Output
1	0	Timed Output (Starts timing only after the input is active. This does not include the group mode enable bit.)
1	1	Normal Output

Motion ANDing

Bit 14	Bit 13	Function
0	0	No Motion ANDing
0	1	Motion ANDing 1
1	0	Motion ANDing 2
1	1	Reserved for future use

bit 15: In Group Mode only, this bit is set for Output Enable ANDing (by input) and reset for no ANDing. In group mode, enable ANDed timed outputs start timing regardless of the state of the enable input. This bit is a "don't care" in independent mode.

Output Programming Notes

- Because most PLCs do not support numbers with decimal points in them, the Speed Compensation value entered will appear to be ten times the desired value. For example, a Speed Compensation value of 5.2ms would be entered as 52.
- When programming a Timed Output, the dwell time has a range of 1 to 9999 (for 1ms to 9999ms) and the On/Off setpoints have a range of 0 to (Scale Factor-1).
- Pulsed outputs have two additional parameters. The *Total Number of Pulses* is the number of pulses in the train. The *Pulse Duration* is the number of counts that each pulse is On.
- When programming a Pulsed Output, the difference between the On and Off setpoints must be greater than or equal to: ((Total Number of Pulses * Pulse Duration) + (Total Number of Pulses - 1)). Also, the range of the On and Off setpoints is 0 to (Scale Factor –1).

Increment / Decrement Programming Block, Words 1 to 39

Word 1: control bits
    Bit 0: set to change on setpoint
    Bit 1: set to change off setpoint
    Bit 2: reset to increment setpoint, set to decrement setpoint
    Bits 3 to 15: reserved, must be reset to zero
Word 2: Increment/Decrement Limit Switch Number (range 1 to 16)
Word 3: Increment/Decrement Setpoint Number (range 1 to 9) (if the value equals 9, than all of the on/off setpoints will be incremented or decremented.)
Words 4 to 39: Not used. These words should be "don't cares."

Note: The Increment/Decrement function cannot be used on outputs that have not been programmed.

Force Function Programming Block, Words 1 to 39

The force function works differently than the other programming blocks. Once the output registers are in force mode, any changes to the data will be acted on immediately. That is it will not be necessary to use a programming cycle to change the force values. Input register 0, bit 11 will be set to indicate that the module is in force mode.

Word 1: Force Outputs On
Word 2: Force Outputs Off
Word 3: Force Inputs On
Word 4: Force Inputs Off
Words 5 to 39: Not used, should be considered "don't cares."

Note 1: Force Off takes priority over Force On. That is, if both the Force Off and Force On bits are set, than the output will be Off not On.
Note 2: It is not necessary to program the outputs before the force will take affect.
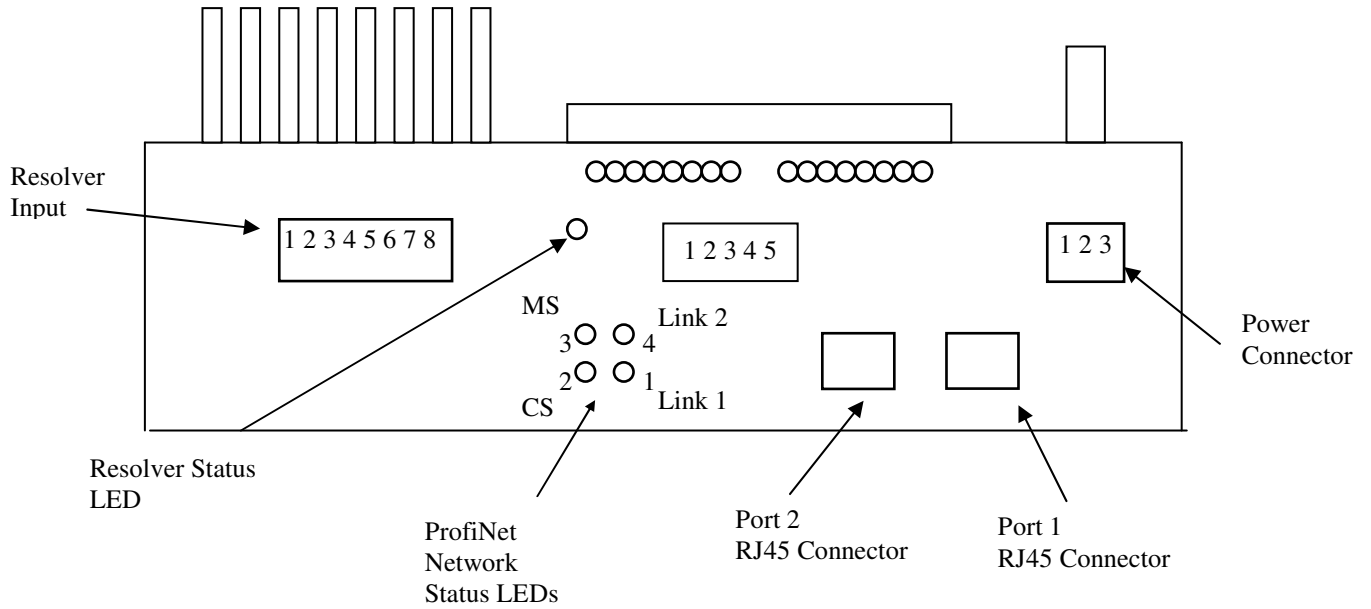Note 3: Cycling power to the unit takes the module out of force mode.
Note 4: Transmitting any of the other programming blocks to the Nexus will take the unit out of force mode.
Note 5: Outputs that have been forced on will remain on even if the unit is in transducer fault.

Chapter 7: Network Connections

NX3A1A ProfiNet Hardware Overview

Resolver Input

1 2 3 4 5 6 7 8

1 2 3 4 5

1 2 3

MS

3   4   Link 2

2   1   Link 1

CS

Power Connector

Resolver Status LED

ProfiNet Network Status LEDs

Port 2 RJ45 Connector

Port 1 RJ45 Connector

The NX3A1A ships from the factory with a default IP address of **192.168.0.50** and a Device name: **NX3A1A** .

The NX3A1A's network ports are autosensing, so the use of a switch or crossover cable is not required.

LED #	Indication	State	Description
1	**Link / Activity (Port 1)**	Green	Link established on Ethernet Port 1
		Green, flashing	Receiving / Transmitting data on Ethernet Port 1
		Off	Link not established on Ethernet Port 1
2	**Communication Status**	Green	On line, RUN - Connection with IO Controller established - IO Controller is in RUN state
		Green, 1 flash	On line, STOP - Connection with IO Controller established - IO Controller in STOP state
		Red	Almost finished installing firmware or repairing errors. Will be ready for use within 5 seconds.
		Off	Off line - No connection with IO Controller
3	**Module Status**	Green	Initialized, no error
		Green, 1 flash	Diagnostic data available
		Green, 2 flashes	Blink. Used by an engineering tool to identify the Anybus module
		Red, 1 flash	Configuration Error - Too many modules / submodules - I/O size derived from IO Controller configuration is too large - Configuration mismatch (no module, wrong module)
		Red, 3 flashes	No Station Name or no IP address assigned
		Red, 4 flashes	Internal error
		Off	No power or not initialized
4	**Link / Activity (Port 2)**	Green	Link established on Ethernet Port 2
		Green, flashing	Receiving / Transmitting data on Ethernet Port 2
		Off	Link not established on Ethernet Port 2

Changing the IP Address using a web browser:

A web browser can be used to access and change the IP address of the NX3A1A.

Connect the NX3A1A unit to your PC Ethernet port, either directly or through an Ethernet switch, and power up the unit.

Launch your web browser and enter the NX3A1A's current address. The factory default is **192.168.0.50**.

The Configuration screen shown in Figure 1 should appear.

If the NX3A1A does not appear, please verify that your PC's Ethernet Port is on the correct subnet. The default subnet is 192.168.0.XXX.
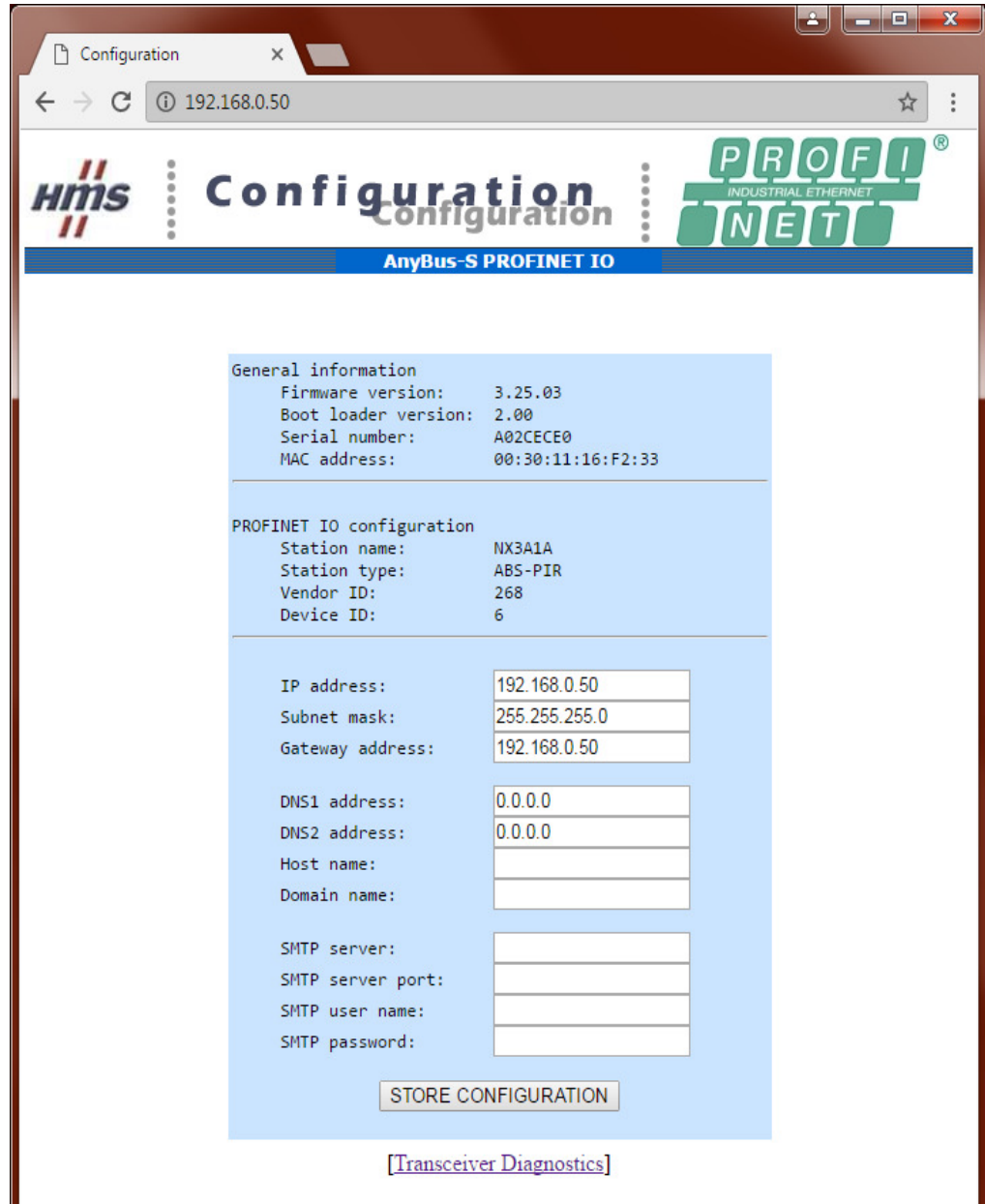
Enter the desired IP address and save it by clicking on **STORE CONFIGURATION** button.

Cycle Power to the NX3A1A. The new IP address will not be used until power has been cycled.

Figure 1

Changing the IP Address using the IPConfig program:

The IP address of the NX3A1A can also be changed by using the *Anybus IPconfig* program. This program can be downloaded from the Anybus website.

https://www.anybus.com/support/file-doc-downloads/anybus-master-slave-specific/?ordercode=AB4474

Unzip the *IPconfig Setup.zip* file and install the program by executing the *IPconfig Setup 3.1.1.2.exe* file. Connect the NX3A1A unit to your PC Ethernet port, either directly or through an Ethernet switch, and power up the unit. Run the installed program *Anybus IPconfig*. The **IPconfig** window will appear.

If the NX3A1A is not listed, click on **Settings** button, set up the correct network interface, and click the **Scan** button. The unit should appear with its current IP address. The factory default is 192.168.0.50.

If the NX3A1A does not appear, please verify that your PC's Ethernet Port is on the correct subnet. The factory default subnet is 192.168.0.XXX.

Double-click on unit's current IP address. A new window, shown in Figure 2 below, will open. Enter the desired IP address and save it by clicking on **Set** button.

Exit the *Anybus IPconfig* application.

Cycle Power to the NX3A1A. The new IP address will not be used until power has been cycled.
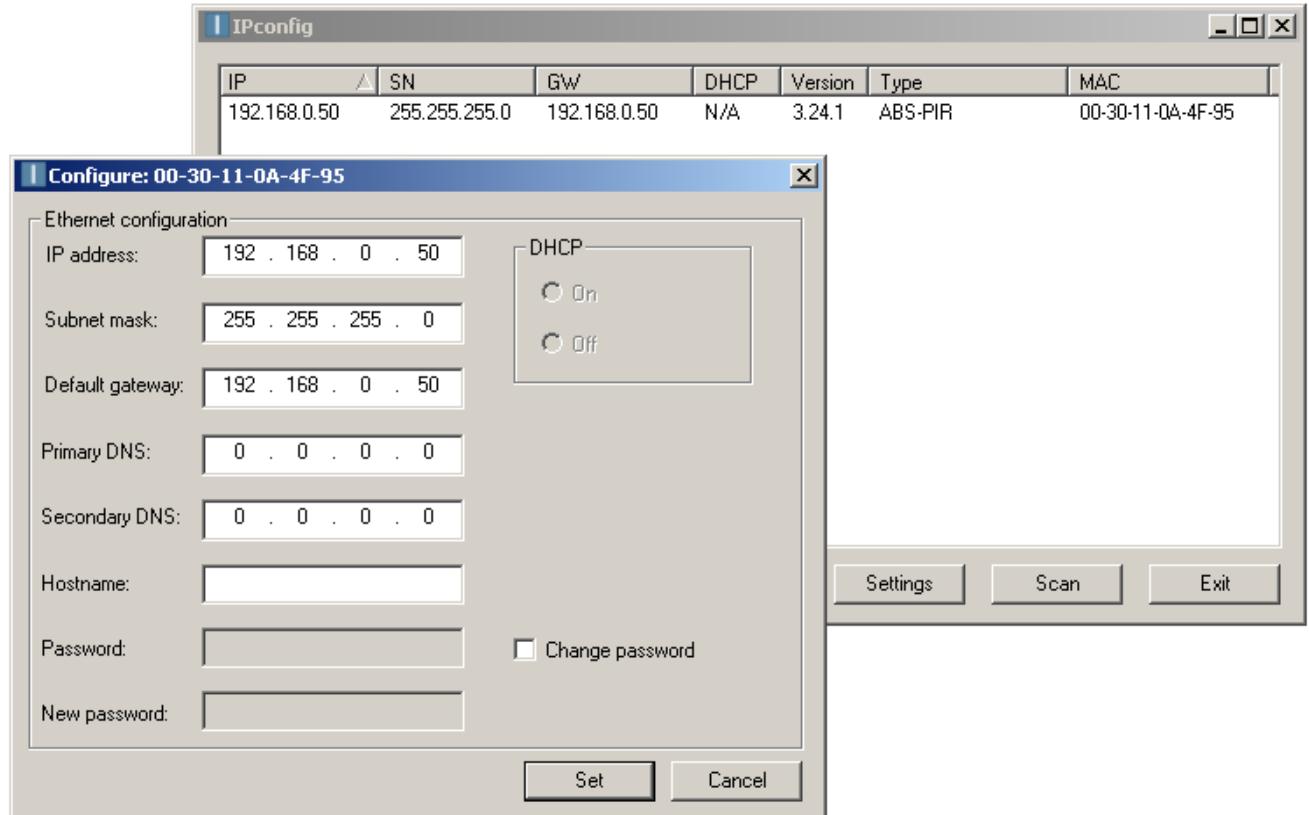
Figure 2

Adding the NX3A1A to your network

Installing the GSDML file

The first step of adding new hardware to a ProfiNet network is to register the appropriate GSDML file(s).

The GDSML and icon files are available in the *Configuration Files* section of our website, amci.com. Unzip the **AMCI-NEXUS-GSDML.zip** file and store it at some known location. Read the Readme.txt file for more information about accompanying files. There are two files: *GDSML-V2.3-HMS-ABSPIR-20130227.xml* and *GSDML-010C-0006-AMCI-NEXUS.bmp*.

From the Toolbar of the **HW Config** window, select *"Option > Install GSD File …"* An **Install GSD Files** window will open. Browse to the location where you saved the GSDML file, select it, and click on the **Install** button.

Click on OK when the message **[Installation was completed successfully]** appears. Close the GSD installation window.

Update the hardware catalog list by selecting *"Option> Update Catalog"*, from the Toolbar Menu.

PROFINET IO Configuration

From the Catalog, expand the **PROFINET IO** listing, then the **Additional Field Devices** folder, the **General** folder, and finally, the **Anybus-S PIR** folder. Drag-and-drop the **RT Standard** icon over the *Ethernet(1): PROFINET–IO–System(100)* line.

Note: You can choose any other **RT** version that is suitable for your particular type of network.

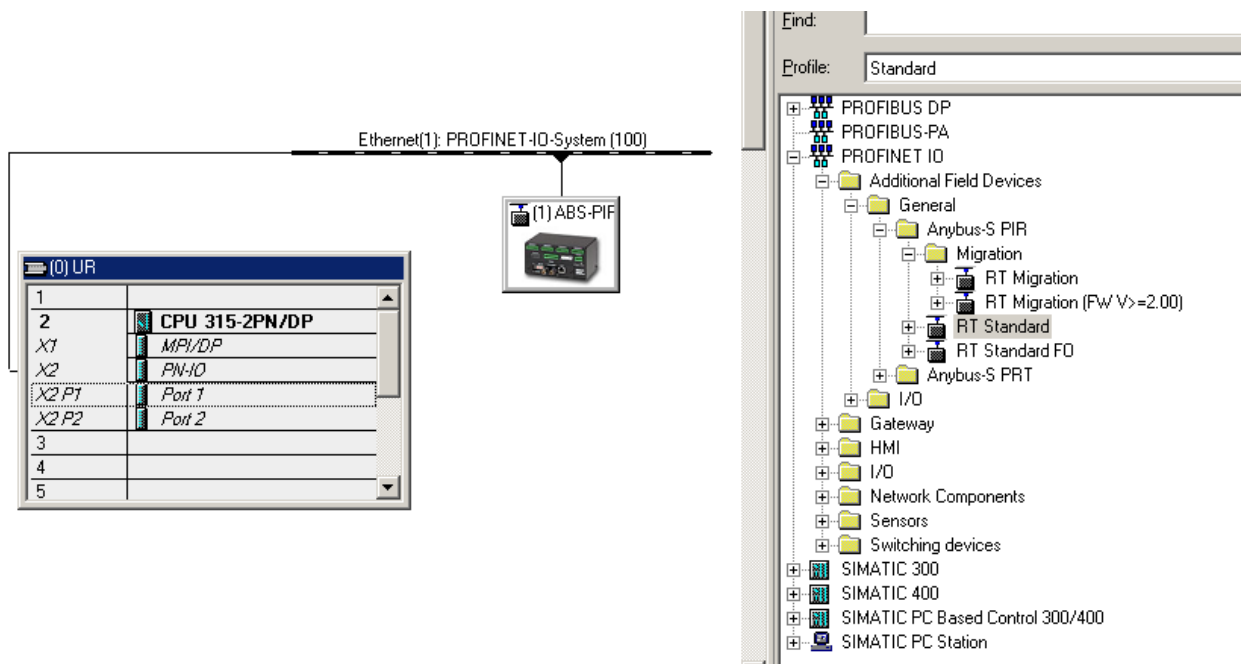

Figure 3

Open the Properties Window by double clicking on the new icon in your network. Enter the desired **Device name**. Click on the *Ethernet…* button and enter the IP address of the NX3A1A, the default 192.168.0.50 is shown in this example, in the window that opens. Close both pop-up windows.
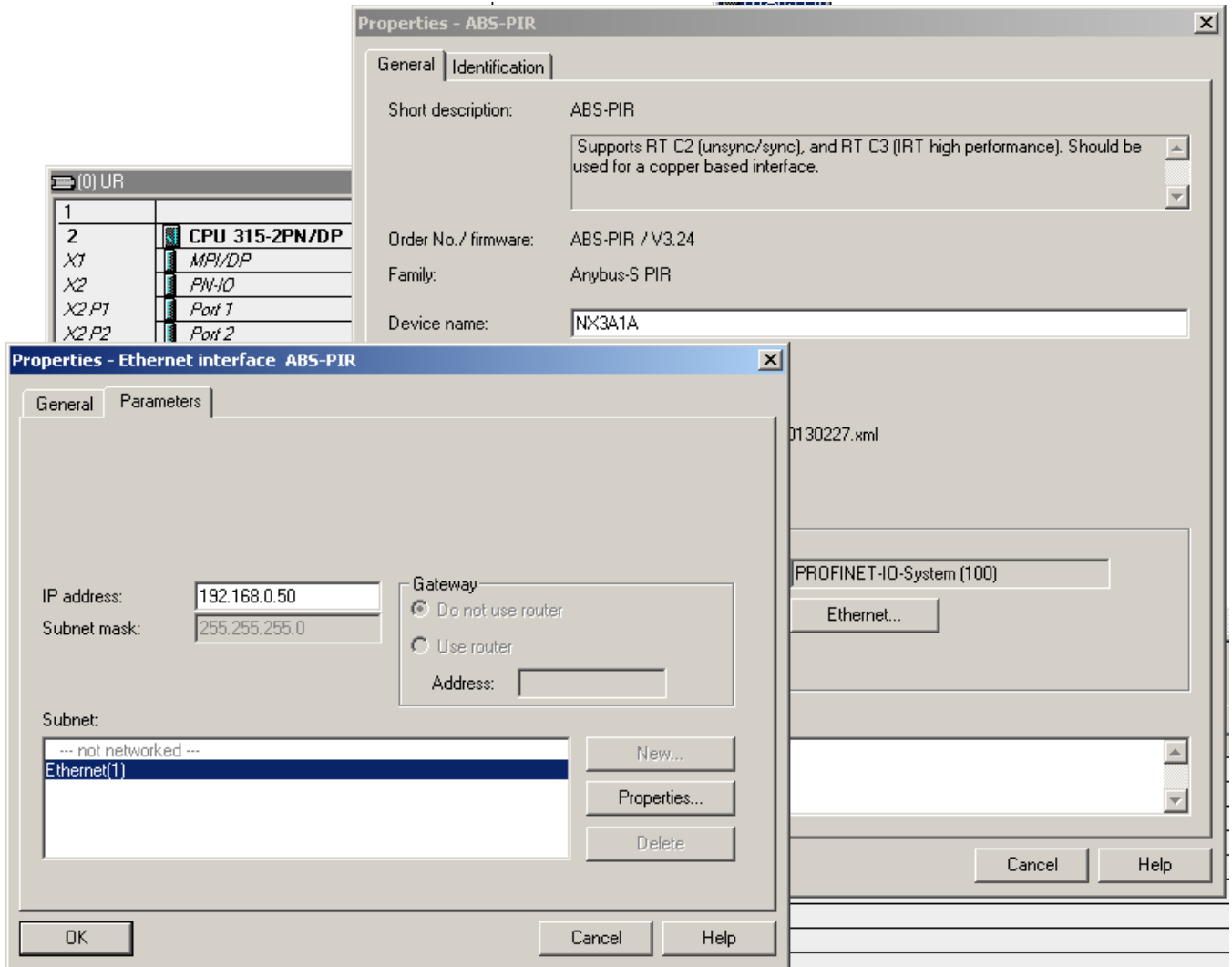

<div align="center">Figure 4</div>

I/O Configuration

The NX3A1A requires 20 Input Words (40 Input Bytes) and 40 Output Words (80 Output Bytes). All required Input and Output Bytes are divided into suitable modules, as defined by the GSDML file, and are shown in the Table 1.

Expand the **RT Standard** tree (or any other **RT** tree that is used) in the Hardware Catalog. Expand the **Input modules** and **Output modules** folders. Fill the four slots as shown in Figure 5, either by double-clicking on specific Input and Output modules, or by dragging and dropping the specific modules into place.

Input / Output Bytes of NX3A1A	Input / Output Modules to be used
40 Input Bytes	Input Module 1 – Slot 1: 32 bytes
	Input Module 2 – Slot 2: 8 bytes
80 Output Bytes	Output Module 1 – Slot 3: 64 bytes
	Output Module 2 – Slot 4: 16 bytes

Table 1

Figure 5

Downloading and verifying new configuration to the PLC

Verify that the PC, the PLC and the NX3A1A are connected and powered up. As shown in Figure 6, click on the **Save and Compile** button and then on the **Download** button.
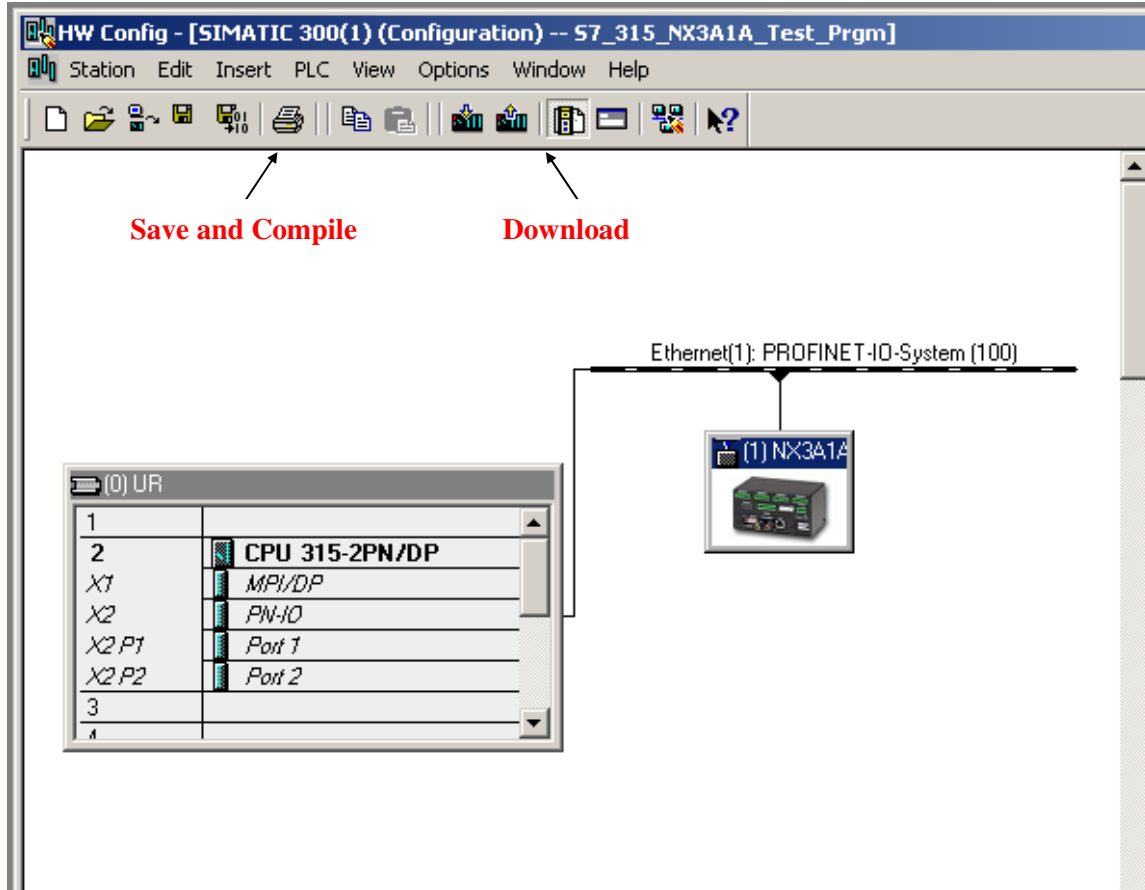
Figure 6

After the configuration has successfully downloaded to the PLC, the Device Name that is assigned to the NX3A1A unit must also be assigned to the PLC network configuration.

Select the NX3A1A unit icon and, from the Toolbar Menu select *"PLC> Ethernet>Assign Device Name …"* The window shown in figure 7 should appear.

Select the device with required MAC address, and verify that the required Device Name appears in the *Device name* field. Click on the **Assign name** button and a new Device name will be assigned to the selected device. Close the pop up window.
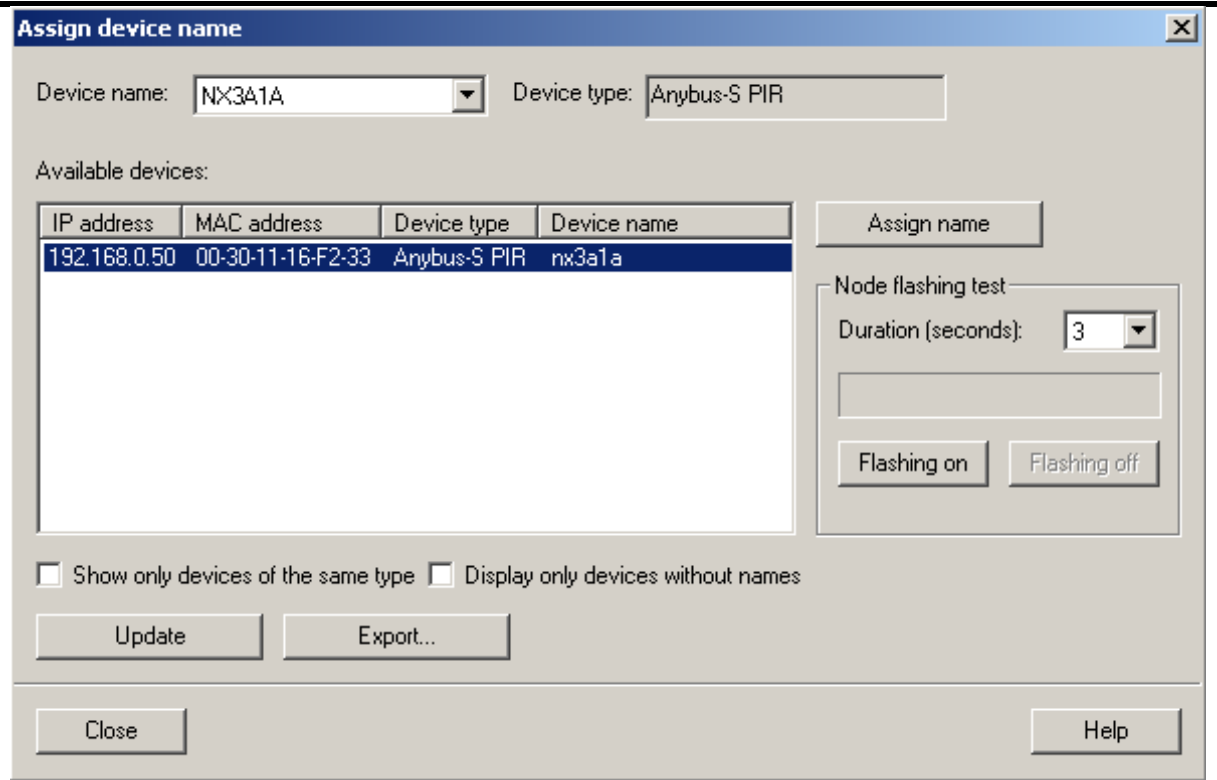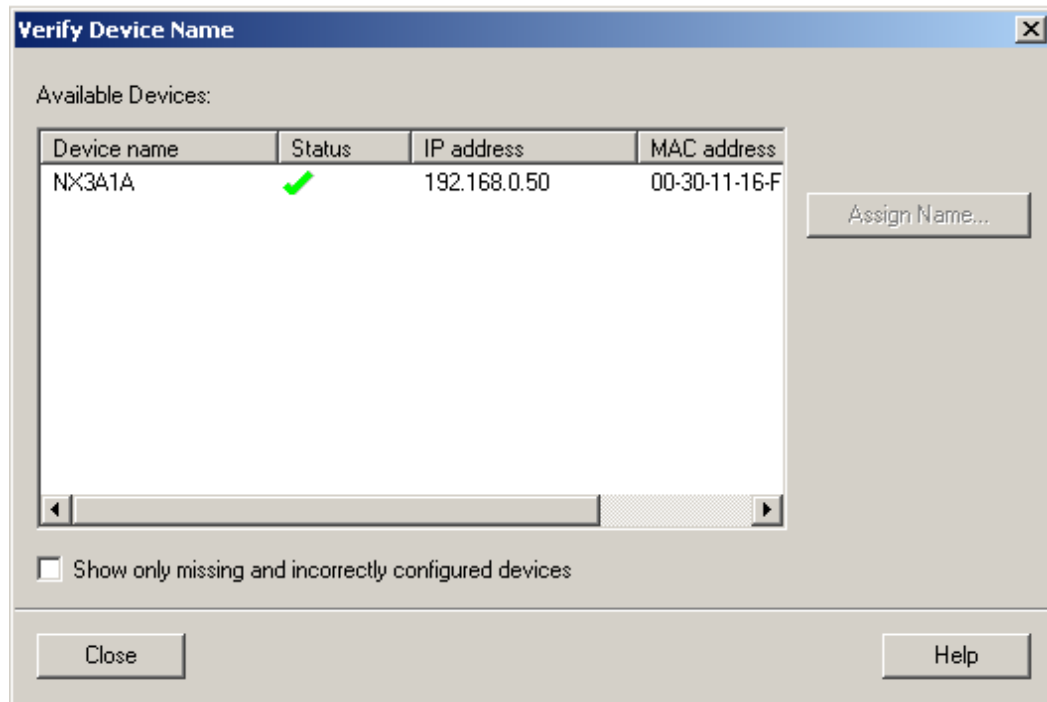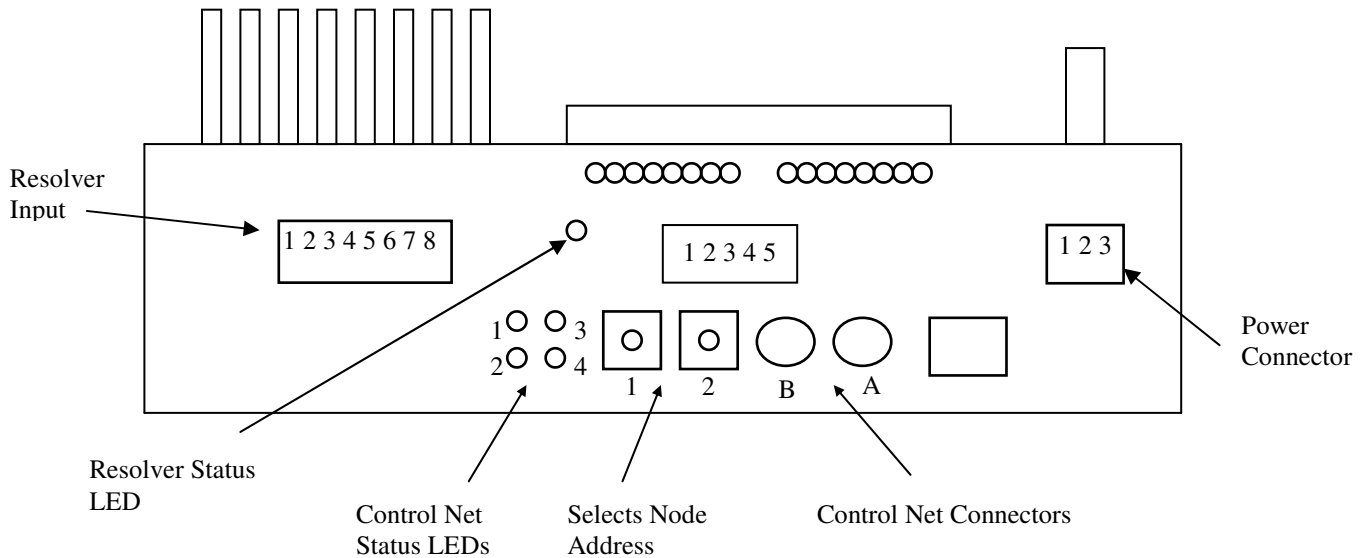
Figure 7

To verify that the NX3A1A has successfully been added to the network, select the Nexus unit icon, and from the Toolbar Menu, select *"PLC> Ethernet>Verify Device Name …"* The following window should appear:

ControlNet Hardware Overview

ControlNet Connectors

The Nexus module has two BNC network connections labeled A and B.

Node Address Selection

The Nexus module has two rotary switches used to set the module's address on the network. Any node from 0 to 99 can be selected. Switch 1 sets the one digit and switch 2 sets the 10s digit of the address. For example, if the Nexus is to be installed at node 46, switch 1 would be set to 6, and switch 2 would be set to 4. Note, changing the node address only takes affect at power up. Changing the address while power is applied to the Nexus module will generate a minor fault.

Throughput Time

The NX3A1C has a typical throughput time of 100μs from input to output. The maximum throughput time from input to output is 200μs.

Network Update Time

The NX3A1C has a minimum network update time of 5ms.

Note: A ControlLogix system using ControlNet will require 22 input words. The first two words will always be zero, and the module Status Word will be located in word 2.

ControlNet Status LEDs

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

LED Number	Name	LED Pattern	Function
1	Channel B status	Solid Green Flashing Red/Off Solid Off	Channel Operating Correctly Channel Disconnected from Network Channel Disabled
2	Channel A status	Solid Green Flashing Red/Off Solid Off	Channel Operating Correctly Channel Disconnected from Network Channel Disabled
3	Module Owned	Solid Green Off Solid Red	Network Card is communicating with Nexus Network Card is not communicating with Nexus Incorrectly Configured Network. Possible causes are incorrect Node #, Number of I/O words, or Comm format.
4	Module Status	Flashing Green Solid Green Flashing Red Solid Red	Network Card is waiting for initialization Module is initialized and operating correctly Minor Fault (For example Node address changed) Major Fault, module must be restarted

Note: If the Nexus module is removed from the Network, than both LEDs 1 and 2 will flash RED.

Quick Start Guide
AMCI Nexus to ControlLogix

1. With the power off, use the rotary switches on the Nexus to select the desired node address.
2. Connect the Nexus to the ControlNet using a ControlNet Tap to coax media. Either the A or B port can be used, depending on how your network is configured.
3. Apply power to the Nexus unit.
4. Start RSLogix 5000.
5. Start RSLinx and establish communications to the ControlLogix system.
6. Configure the ControlLogix hardware system, processor and discrete I/O. If it is not already present, also add the ControlNet adapter 1756-CNB(R) module to the system.
7. Right-click on the 1756-CNB(R) module and Click on **New Module…**
8. Define the NX3A1X as a generic CONTROLNET-MODULE. Click on **OK** and define the properties as follows.

Name:	*Your Choice*
Description:	*Your Choice*
Comm Format:	Data-INT (must be Data_INT)
Node:	Set it to the same value as the Node address on the NX3A1X

Assembly Instance – 100, **Input** –   22 for the NX3A1C
Assembly Instance – 150, **Output** –   40 for the NX3A1C
Assembly Instance – 110, **Config** –   0 for the NX3A1C

9. Click on **Next>**

10. Define the RPI. The minimum value is 5.0ms, however the value may be set higher.
11. Click **Finish**.
12. Save and Download the file to the Processor
13. Start RSNetworx for ControlNet and either open an existing project or create a new one.
14. If this is the first time using the NX3A1C, register the appropriate EDS and icon files. These files are available from AMCI's website www.AMCI.com.
15. Go Online. RSNetWorx will scan the ControlNet network and should discover the NX3A1C.
16. Click on the Enable Edits checkbox and then save the project.

At this point, the 1756-CNB(R) should be communicating; steady green LED and the top right LED (ControlNet Status LED #3) for the NEXUS communication should be on.

Go online to the ControlLogix processor. Select the **Logic** menu, followed by **Monitor Tags**. The data associated with the NX3A1X is available under the name you chose when configuring it.

Quick Start Guide
AMCI Nexus to PLC-5

1. With the power off, use the rotary switches on the Nexus to select the desired node address.
2. Connect the Nexus to the ControlNet using a ControlNet Tap to coax media. Either the A or B port can be used, depending on how your network is configured.
3. Apply power to the Nexus unit.
4. Start RSNetworx. If this is the first time using the NX3A1X, register the appropriate EDS and icon files. These files are available from AMCI's website www.AMCI.com.
5. From RSNetworx for ControlNet, go Online. After browsing the network, the NX3A1C will appear as an "Extra Device" at the node selected by the Nexus' rotary switches.
6. Click the **Enable Edits** checkbox and choose "Use online data (upload)". Click **OK**. At this point you can right click on the NX3A1C icon and select **Properties** from the pop-up menu. In the properties window, you can change the name associated with the unit and add a description.
7. Go Offline.
8. Click the **Enable Edits** checkbox.
9. Right Click on the PLC-5 icon and click on **Scanlist Configuration** in the pop-up menu.
10. In the Device Name column, right click on the name of the Nexus unit, and click on **Insert Connection** in the pop-up menu. The Connection Properties window will appear on the screen.
11. If needed, set the Input Size and Input Address of the Data Input File. This file resides in the PLC-5 and is used by all of the ControlNet nodes. Therefore, it must be large enough to hold all of the input data on the network. The number of words that the NX3A1C transfers to the PLC-5 is shown below.

    20 Input words for the NX3A1C

12. If needed, set the Output Size and Output Address of the Data Output File. This file resides in the PLC-5 and is used by all of the ControlNet Nodes. Therefore, it must be large enough to hold all of the output data on the network. The number of words that the NX3A1C receives from the PLC-5 is shown below.

   40 Output words for the NX3A1C

13. Set the Request Packet Interval time. This has a minimum acceptable value of five milliseconds, but can be set higher.
14. Click OK to close the Connection Properties window. In the Scanlist Configuration window, save the changes and close the window.
15. Go Online.
16. Verify that the PLC is in Program Mode.
17. Click on **Network** in the toolbar select **Download to Network** from the pull down menu that appears. After the download is complete, the Nexus unit should be communicating with the PLC.

NX3A1D Hardware Overview
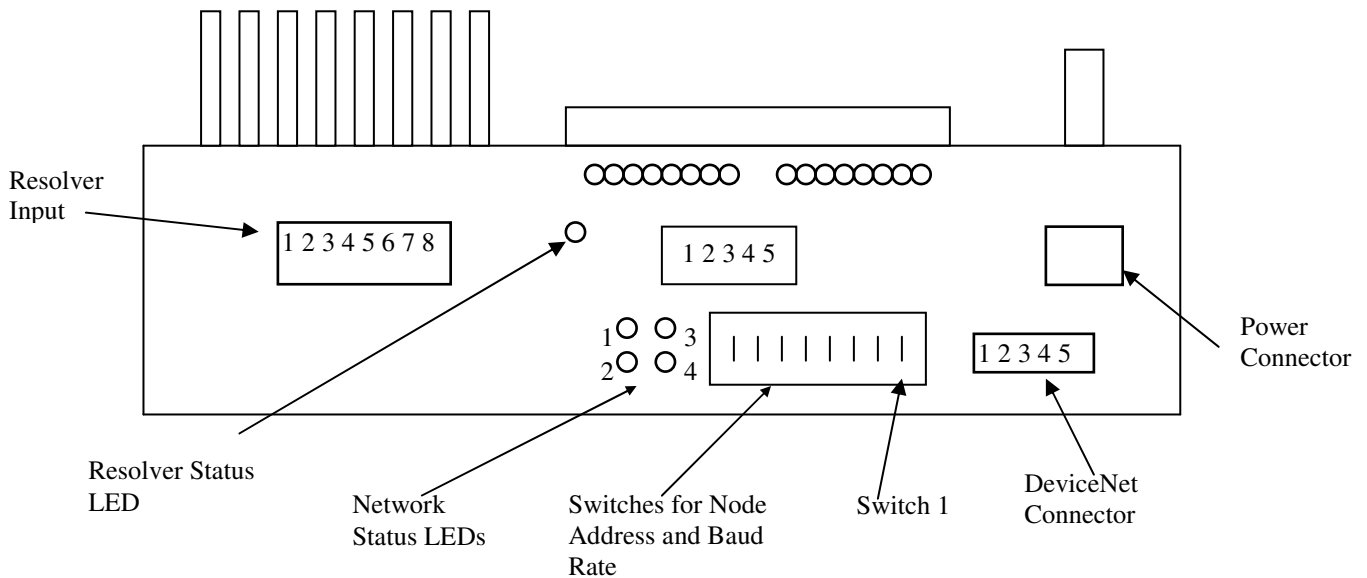
DeviceNet Connector

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

The Network Current Draw is 16mA @24Vdc.

Node Address and Baud Rate Selection

The NX3A1D 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 1 2
125k	0 0
250k	0 1
500k	1 0
Reserved	1 1

Node Address	Switches 3 to 8 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

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 1, 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 Steady Red Steady Green Flashing Red	No Power Unrecoverable Fault Device Operational Minor Fault
2	Network Status	Steady Off Steady Red Steady Green Flashing Red Flashing Green	Not Powered / Not On Line Critical link failure Link OK, On Line, Connected Connection Time Out On Line not connected
3	Reserved		
4	Reserved		

Network Update Time

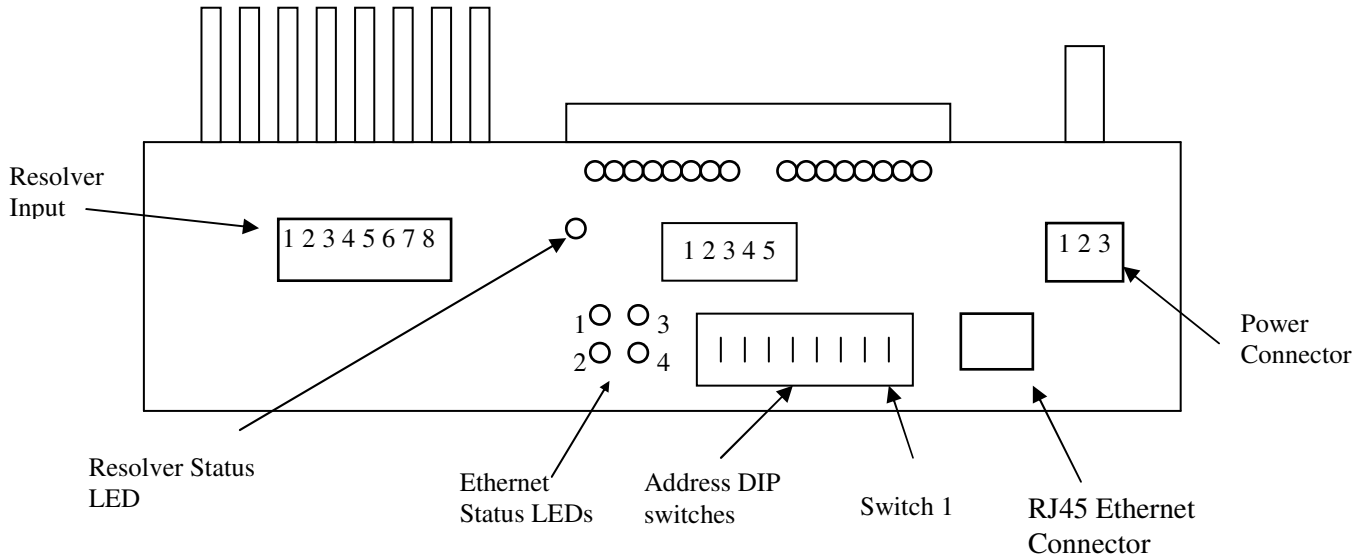The NX3A1D has a minimum network update time of 5ms.

Adding the NX3A1D to your network

Before the NX3A1D 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 *Driver File Download* section of our website, www.amci.com. The following procedure to add the EDS file to RSNetWorx assumes that you have already downloaded these files and un-zipped them.

1. With the power off, use the dip switches on the front of the NX3A1D 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 **NX3A1D_r01.eds** file.
10. Click on **Next>**.
11. Click on **NX3A1D_r01.eds** file so that it is highlighted.
12. Click on **Next>** to assign an icon to the device.
13. Click on the NX3A1D 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 **NX3A1D_r01.ico** icon file.
14. Click on **Next>** and then click on **Finish** to complete the installation of the AMCI NX3A1D EDS file to the RSNetWorx system.

Once the EDS file is added to your system, add the NX3A1D to your network as you would any other device, including adding it to the scanlist configuration of the scanner module.

NX3A1E Hardware Overview

Resolver Input

Resolver Status LED

Ethernet Status LEDs

Address DIP switches

Switch 1

RJ45 Ethernet Connector

Power Connector

Network Update Time

The NX3A1E has a minimum network update time of 5ms.

Ethernet Status LEDs

LED Number	Name	LED Pattern	Function
1	Network Status	Steady Off Steady Green Flashing Green Flashing Red Steady Red Flashing Green/Red	The module has no power or no IP address has been assigned. The module has at least one established Ethernet/IP connection. There are no Ethernet/IP connections established to the module One or more of the connections in which this module is the target has timed out The module has detected that its IP address is already in use The module is performing a power on self test
2	Module Status	Steady Off Steady Green Flashing Green Flashing Red Steady Red Flashing Green/Red	No Power. The module is operating correctly. The module has not been initialized. A minor recoverable fault has been detected. A major internal error has been detected. The module is performing a power on self test.
3	Activity LED		This LED flashes green each time a packet is received or transmitted
4	Link		This LED indicates that the module is connected to an Ethernet network

Setup Example
AMCI NX3A1E to Rockwell Automation 1756-ENET/B module

1. With power removed, use the dip switches to set the address of the NX3A1E.
2. Open an existing or create a new ControlLogix program.
3. From the project tree, right click on I/O configuration and select New Module.
4. From the Module Type list that appears, select 1756-ENET/B, the 1756 Ethernet Bridge module.
5. Type a name for the Bridge module, which must begin with a letter, in the Name field.
6. Enter the slot number where the 1756-ENET/B module is located in the ControlLogix rack.
7. In the Address/Host Name field, select the IP Address and enter the address 192.168.000.XXX where XXX can be a unique number between 1 and 254.
8. Click the Finish button.
9. From the project tree, right click on the 1756-ENET/B module and select New Module.
10. Select ETHERNET-MODULE Generic Ethernet Module from the list that appears and click on OK.
11. In the module properties that appear, enter the following parameters.

   Name: **Your Choice** (must begin with a letter)
   Comm Format: **Data-INT** (must be Data-INT)
   IP Address: **192.168.000.XXX** where XXX is the number entered on the DIP switches

	Assembly Instance	Size
Input	**100**	**20**
Output	**150**	**40**
Configuration	**110**	**0**

12. Click on Next.
13. Select the RPI time, minimum = 3ms.
14. Click on Finish.
15. Save and download the program to the ControlLogix rack.
16. While online with the PLC, right click on the Ethernet Bridge module and select Properties.
Click on the Port Configuration tab and modify the following fields.

Enable Bootp: **Unselected** (This will allow the data to be manually entered in the IP
   address and Domain Name fields.)
IP Address: **192.168.000.XXX** (must be the same as step 7 above)
Subnet Mask: **255.255.255.0**

The Gateway Address, Domain Name, Primary DNS Server Address, and Secondary DNS Server Addresses all remain unchanged.

NX3A1P Hardware Overview
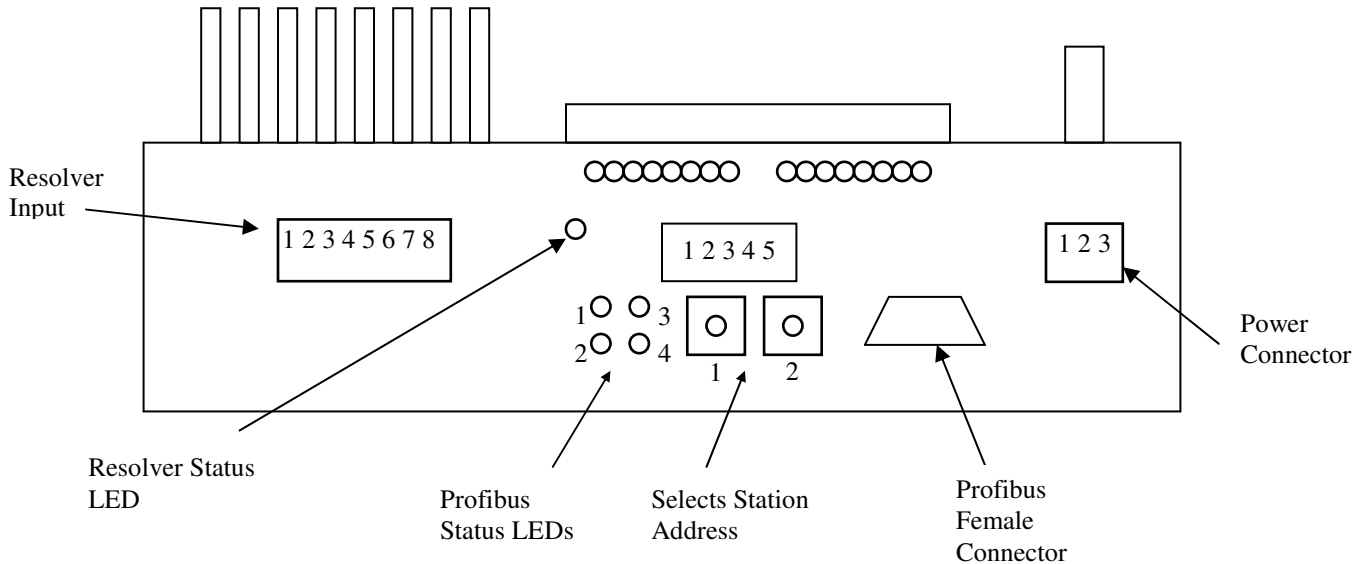
Profibus Connector

The Nexus module uses a 9 pin female D-sub connector to communicate with the Profibus network.

Station Address Selection

The Nexus module has two rotary switches used to set the module's address on the network. Any station from 0 to 99 can be selected. Switch 1 sets the one digit and switch 2 sets the 10s digit of the address. For example, if the Nexus is to be installed at station 46, switch 1 would be set to 6, and switch 2 would be set to 4. Note, changing the station address only takes affect at power up. Changing the address while power is applied to the Nexus module will generate a minor fault.

Profibus Status LEDs

LED Number	LED Pattern	Function
1	Red	Module is Offline and no data exchange is possible
	Off	The module is Online
2	Green	Module is Online and data exchange is possible
	Off	The module is Off line
3	Flashing Red 1Hz	Error in configuration: IN and/or OUT length set during initialization of the module is not equal to the length set during the configuration of the network
	Flashing Red 2Hz	Error in User Parameter data: The length/contents of the user parameter data set during initialization of the module is not equal to the length/contents set during configuration of the network.
	Flashing Red 4Hz	Error in initialization of the Profibus communication ASIC.
	Off	No diagnostic present
4	Off	Not Used

Network Baud Rate

The NX1F2P supports the following network baud rates

9.6 kbits/sec, 19.2 kbits/sec, 93.75 kbits/sec, 187.5 kbits/sec, 500 kbits/sec, 1.5 Mbits/sec, 3 Mbits/sec, 6 Mbits/sec, and 12 Mbits/sec

Siemens S7 Installation

1. Select the Universal Module under the Anybus Driver.
2. For the Input Type, select the starting address and sum up the number of available input options until you have reached 20 sixteen bit words (40 bytes).
3. For the Output Type, select the starting address and sum up the number of available output options until you have reached 40 sixteen bit words (80 bytes).

Quick Start Guide
AMCI Nexus to SST-PFB-SLC Profibus interface module

1. If it is not already present, install the SST-PFB-SLC module in the SLC rack and configure the rack (the ID code is 13635) for the module.
2. Place the PLC in program mode.
3. Connect a serial cable from the computer's COM port to the RS232 port of the SST-PFB-SLC module.
4. With the power off, use the rotary switches on the Nexus unit to select the desired station address. The left switch sets the 1s digit and the right switch sets the 10s digit of the station address.
5. Attach the Nexus unit to the Profibus network.
6. Apply power to the Nexus unit.
7. Start the SST Profibus Configuration software. (Current Version 1.9)
8. Either create a new or open an existing network.
9. If it has not already present, register the Nexus units GSD file.

   Click on Library in the toolbar and then select Add GSD file. Choose the directory where the GSD file is located, and then select the AnyBPRfB file.

   When registered this module will appear under Slaves as:

   HMS Fieldbus Systems AB
       ANYBUS-S PDP

10. If SST-PBF-SLC module is not already present, click on Masters. Click and drag the Master (Rev 1.4) into the network. Right click on it and configure it according to your system's requirements.
11. Under slaves, click and drag the ANYBUS-S PDP module into the network. The setup window will appear.

    - Under the **General** tab, set the station number to match the station number set by the rotary switches on the Nexus unit.
    - Click on the **Modules** tab and then click on Add. The NX3A1P must be set for 20 input words and 40 output words. If a different number of words is programmed,

Network LED 3 will flash indicating an Error in Configuration. The input words can be located in either the Input Image table or in the M1 file, however, all 20 input words must be located in one file. The 40 output words must be located in the M0 file.

- Click on Input 32 Byte (16 word) and then on OK.
- Click on the **SLC Address** tab and then select the Input Type, either I or M1, and the offset value, that is where in the I or M1 table the data begins. It is important not to leave gaps between an existing Profibus module and the data used by the Nexus unit.
- Again click on the **Modules** tab and click on Add.
- Click on Input 8 Byte (4 word) and then on OK.
- Click on the **SLC Address** tab and then select the Input Type to be the same as was selected above. Set the offset value to the value assigned to the value assigned above plus 16.
- Again click on the **Modules** tab and click on Add.
- Click on Output 64 Byte (32 word) and then on OK.
- Click on the **SLC Address** tab and then select the Output Type to be M0 and then select an offset value. As before, it is important not to leave gaps between an existing Profibus module and the data used by the Nexus unit.
- Again click on the **Modules** tab and click on Add.
- Click on Output 16 Byte (8 word) and then on OK.
- Click on the **SLC Address** tab and then select the Output Type to be M0. Set the offset value to the value assigned to the 64 Byte plus 32.
- Click on OK to accept.
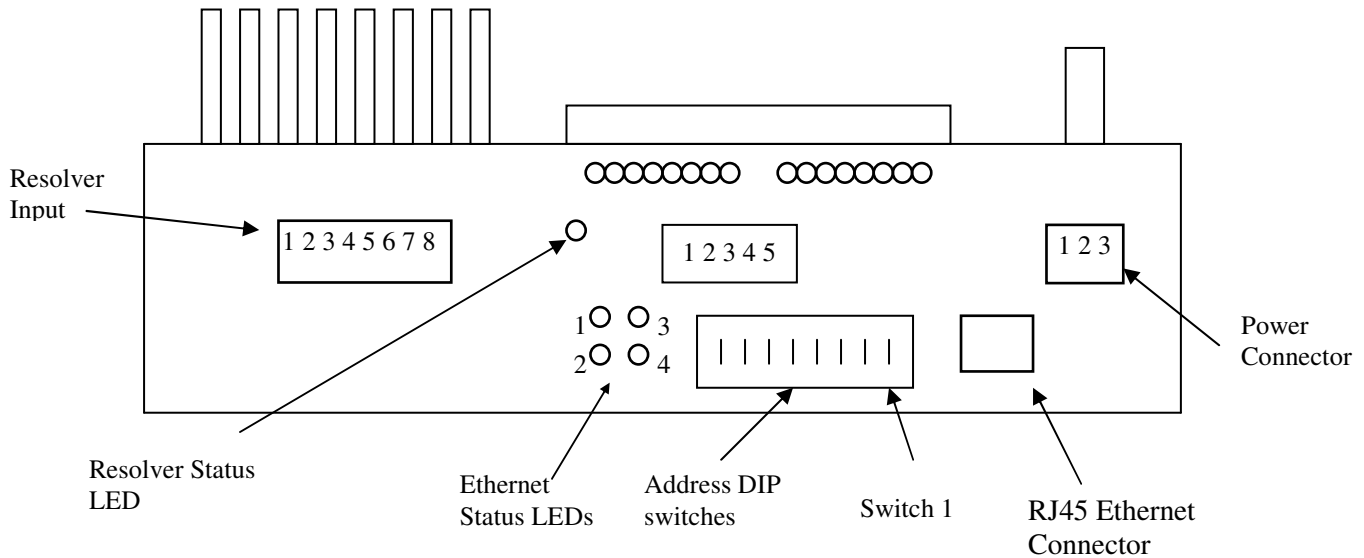
12. Save the network file.
13. Right click on the Master Module and select Connect from the menu that appears.
14. Click on Yes if asked to retain the configuration.
15. Again right click on the Master Module and then select Load Configuration from the menu that appears.
16. Place the PLC in Run mode.

NX3A1T Modbus TCP/IP Hardware Overview

See Chapter 8 starting on page 42 for instructions on changing the IP address.

Modbus TCP/IP Ethernet Status LEDs

LED Number	Name	LED Pattern	Function
1	Network Status	Flashing Green with 2 seconds interval	This LED indicates the number of established Modbus/TCP connections to the module. The number of connections is equal to the number of flashes on this LED.
		Flashing Green/Red	Power-on self test
2	Module Status	Steady Off	No Power
		Steady Green	The module is operating correctly
		Flashing Green	The module has not been initialized
		Flashing Red	Minor recoverable fault
		Steady Red	Major internal error
		Flashing Green/Red	Power-on self test
3	Activity	Flashing Green	This LED flashes green each time a packet is received or transmitted
4	Link	Steady Green	This LED indicates that the module is connected to an Ethernet network

Setup Example

AMCI NX3A1T to Group Schneider's 140 NOE 771 01 module

This setup example assumes that the 140 NOE 771 01 module has already been installed in the PLC system.

1. With power removed, use the dip switches to set the IP address of the NX3A1T.
2. Open an existing or create a new Unity program.
3. Open the Project Browser and click on the ☐+☐ symbol next to Communication.
4. Click on the ☐+☐ symbol next to Networks to show the available networks.
5. If you are creating a new network for the NX3A1T, right click on Networks and select New Network from the window that appears. If you are adding the NX3A1T to an existing network, ignore this step.

   Click on the down arrow to the right of the *List of available Networks* field and select *Ethernet* from the drop down menu that appears.

   Type the new networks name in the Change Name field

   Click on OK to create the new network.

6. Right click on the existing network and select open from the window that appears. The following window will appear.
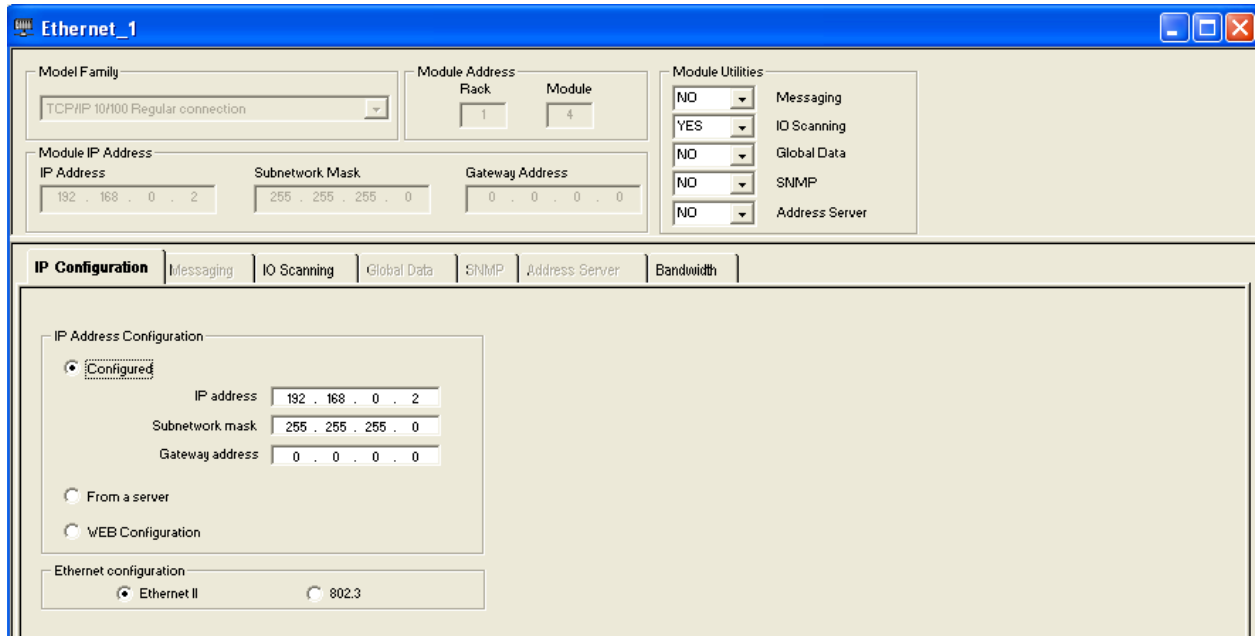
7. Enter the following parameters.

Module Family:	TCP/IP 10/100 Regular Connection
Module Address:	Location of the 140 NOE 771 01 module
IP Address:	The TCP/IP address of the 140 NOE 771 01 module
Subnet Mask:	255.255.255.000

8. Click on the I/O scanning tab. The following screen will appear.
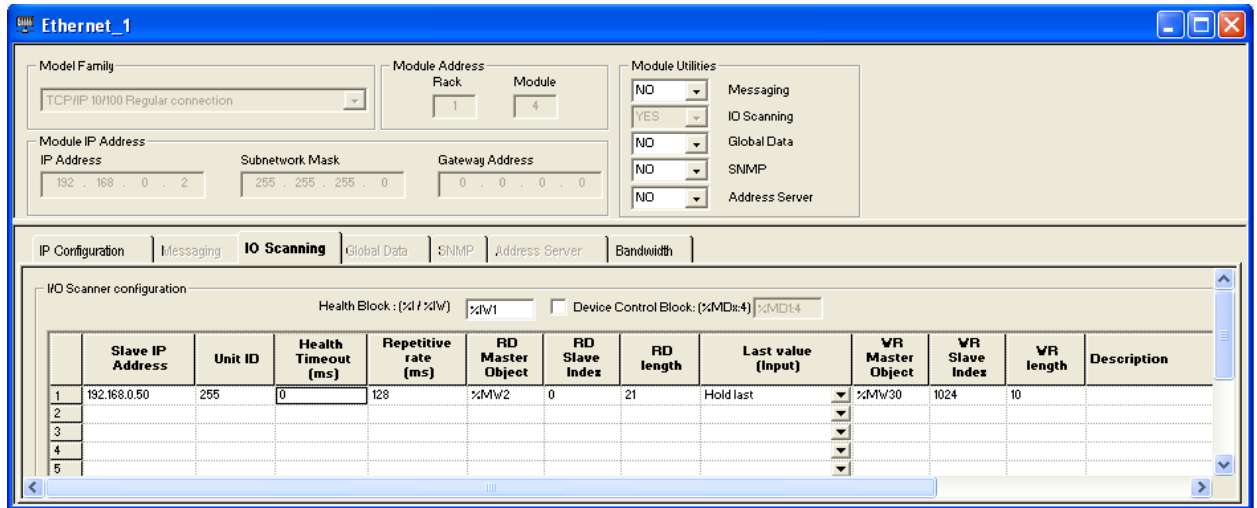
9. Enter the following parameters.

Slave IP Address:	IP Address of the NX3A1T module.
Unit ID:	Not necessary for the NX3A1T module. The default value of 255 can remain.
Health Timeout:	Timeout value measured in ms. Can be any value for the NX3A1T module
Repetitive Rate:	Update time of the NX3A1T in ms. A value of zero will result in the fastest transfer of data between the NX3A1T and the NOE module. A value other than zero must be in a multiple of 16.
RD Master Object.	First destination address register where the data transmitted from the NX3A1T will be located.
RD Slave Index:	Must be 0.
RD Length:	Must be set to 20. (The NX3A1T uses 20 16 bit input words)
Last Value (input):	Status of the input registers, either last state or zero, in the event of an error. The data from the NX3A1T will remain in the registers if communications are lost.
WR Master Object:	First source address register location where the data sent from the PLC to the NX3A1T is located.
WR Slave Index:	Must be set to 1024
WR Length:	Must be set to 40 (The NX3A1T uses 40 16 bit output words)
Description:	Your choice of text or leave blank.

10. Close the network.
11. Click on Yes when asked "Do you want to save your modifications?"
12. Click on Yes when asked "Do you Confirm the Modification?"
13. On the Project Tree, expand the I/O configuration by clicking on the + symbol to the left of Configuration.
14. Further expand the I/O configuration by clicking on + symbol to the left of the Local Bus.
15. Continue to expand the I/O configuration by clicking on the + symbol to the left of the Local Quantum Drop.
16. Continue to expand the I/O configuration by clicking on + symbol to the left of the rack that contains the 140 NOE 771 01 module.
17. Expand the networks attached to the NOE module by clicking on the + symbol to the left of the 140 NOE 771 01 module.
18. Right click on the network associated with the 140 NOE 771 01 module and select OPEN from the window that appears.
19. Click on the down arrow on the field just below where it asks you to "Please choose a Network." Select the network that was created above.
20. Save and build the project, and download it to the PLC. If the NX3A1T is powered up and attached to the network, network LED 3 (the upper right network status LED) should now be flashing and network LED 4 (the lower right network status LED) should now be on solid.

Chapter 8: Setting IP Address of the NX3A1E and NX3A1T

Setting the Ethernet IP Address of an AMCI Nexus unit using AMCI software

1. This software will only work with AMCI Ethernet units that have a serial number of 02110001 or above. A crossover cable will be required to connect units with serial numbers below 07140001 directly, without a switch, to your PC.
2. Download, extract, and run the **AMCI Ethernet Configuration software** from the following page of AMCI's website.

   https://www.amci.com/industrial-automation-support/software/

   The following window will open.
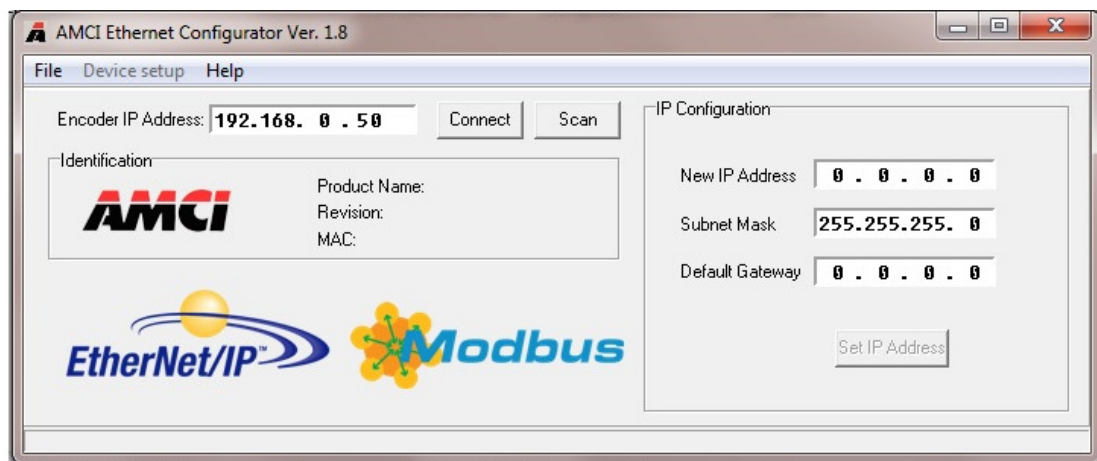
3. The Nexus units ship with a default IP address of 192.168.0.50, where the 50 portion of the address is set by the dip switches. You can use this address, or set all of the dip switches to the ON, up, position if you want to use a previously programmed IP address.

4. Set the Ethernet Port of your PC to be on the same network as the current address IP address of your AMCI Nexus unit. It may be necessary to disable your PC's firewall.

5. Enter the AMCI Ethernet unit's current IP address in the "Encoder IP Address" field.

6. Click on Connect. The button will change from Connect to Disconnect and the lower left hand portion of the window will change from "Idle…" to "Connected to: XXX.XXX.XXX.XXX." The device type and MAC ID will also appear in the Identification field.

7. Enter the new IP address, the subnet mask, and the default gateway in the IP Configuration field. The Default Gateway is required and, unless you have an address that you use for the default gateway, we suggest setting it to the address of the host controller.

8. Click the Set IP Address button. An "IP configuration written successfully" window will be displayed. Click on OK to close this window.

9. Click on Disconnect.

10. Remove power from the Nexus unit. The Nexus unit will not use the new IP address until power has been cycled.

11. **Set all of the switches to the ON (up) position.** This will prevent the Nexus unit for outputting BOOTP requests at power up and lock the new IP address in the Nexus unit's memory.

Using a DHCP/BOOTP Server to change the IP Address of an AMCI Nexus unit

1. Remove power from the Nexus Unit.
2. Set the unit's DIP switches to the OFF (Down) position. This will set the unit's IP address to 0000 0000.
3. Connect your PC to the Ethernet network.   A crossover cable will be required to connect units with serial numbers below 07140001 directly, without a switch, to your PC.
4. Start your BOOTP program.
5. Click on **Tools** in toolbar and select **Network Settings**. Verify that the Subnet Mask and the Gateway Address match those of your network. If necessary, change the values to match your network.
6. Click on OK to close the Network Settings window.
7. Click on **New** in the **Relation List**. (Do not click on **Enable BOOTP**, the Ethernet Nexus units do not support this function.) The Relation List is located in the lower pane of the BOOTP window.
8. Every Ethernet device is assigned its own MAC ID value. This value is located on a label on the side of the Nexus unit. Enter this value in the Ethernet Address (MAC) field.
9. Enter the desired IP address in the IP Address field and click on OK.
10. Apply power to the Nexus unit. The IP Address of a Nexus unit can only be changed at power up.

The Nexus unit sends out several BOOTP requests for the first thirty seconds after power up. It will use the IP address currently stored in its memory if it does not detect a BOOTP server during this time.

11. Once power has been restored, the Nexus unit should be listed at the top of the Request History panel with its new IP address.
12. The IP address has now been changed and will remain at this new value until the next time the Nexus unit detects a BOOTP server at power up that supplies it with a new IP address.
13. Remove power from the Nexus unit.

    If your Nexus unit has a serial number above 0211001, set all of the switches to the up, ON, position. This will lock the programmed IP address in the Nexus unit's memory and prevent the Nexus unit from outputting BOOTP requests at power up.

14. Close the BOOTP server program <u>without</u> clicking on the Disable BOOTP/DHCP program. The AMCI Nexus units <u>do not support the Disable BOOTP/DHCP function.</u> Click on NO when asked if you want to save the changes.

Ethernet Address Selection using the DIP switches

The NX2E4E uses an IP address of 192.168.000.XXX where "XXX" can be any number between 1 and 254. Eight dip switches on the NX3M1E are used to set the "XXX" portion of the address. Switch 8, the left most switch, is the least significant bit and switch 1, the right most switch, is the most significant bit. The address is programmed using the following procedure.

1. Determine the address of the NX3M1E. It can be any unused address between 1 and 254.
2. Convert the address to a binary number. A value of 50 will be 0011 0010.
3. Enter the address on the dip switches. Continuing the above example, switches 8, 6, 5, 2 and 1 will be off (down) and switches 7, 4, and 3 will be on (up).

Chapter 9: Manual Revision History

Revision 0.0 was released on 10/29/2004. This version combined all four of the network options into one document. Expanded descriptions of the various programmable parameters were also added.

Revision 0.1 was released on 4/28/2005. This version added a note to the functionality of ControlNet LED 3.

Revision 1.0 was released on 7/14/2006. This version added mounting information, module specifications, relay output wiring, and Modbus TCP/IP connections.

Revision 2.0 was released on 6/16/2016. This revision added a section of Siemens S7 installation, and a chapter on the various methods of changing the IP address of NX3A1E and NX3A1T units.

Revision 3.0 was released on 1/16/2017. This revision added the ProfiNet NXA1 to the specifications

Revision 3.1 was released on 9/12/2017. This revision added the Exit Force Mode command bit and added details on how various inputs will affect timed outputs. The advance range is now ±4999 on all NX3A1X units