The NX3A1E2-M Nexus unit combines the functionality of a 16 output resolver PLS unit, a 16 input Die Monitoring unit, and a four channel strain gauge module. The ability to monitor the Stopping Time of the resolver is also included in the functionality.

This unit uses 112 16 bit input words (data sent from the NX3A1E2-M to the network) and 146 16 bit output words (data sent from network to the NX3A1E2-M) and communicates with the controller over an Ethernet IP network.

Starting with V2, the NX3A1E-M was renamed NX3A1E2-M with the introduction of a new two port network board. These two ports allow for daisy chaining or Device Level Ring (DLR) configurations. This new board has a built in web server, that provides an easy method of changing the IP address and also allows the selection of the Network Protocol. The three protocol options are Ethernet IP, ProfiNet, and Modbus TCP. However, because of the number of words transferred over the network, Modbus TCP cannot be used by the NX3A1E2-M.

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Chapter 1: Parameter Overview

Resolver and Setup Parameters

Apply Preset
This bit level function is part of Resolver Setup Programming block. Setting the Apply Preset bit while programming the NX3A1E2-M module's Resolver Setup data will cause the Resolver Position data to be changed to the Preset value that is also programmed in the setup data. The result of the Apply Preset operation is saved through power down.

> **Note**: Programming the setup data without setting the Apply Preset bit 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.

- The Count Direction Parameter can be set to Clockwise or Counter Clockwise
- The default setting is Clockwise.
- It is also possible to reverse the count direction by switching the S2 S4 signal pair in the transducer cable.

Tachometer Response
A bit value that sets how often the NX3A1E2-M module updates the tachometer data to the network, and the (on / off) status of the motion detector.

- The two options are 24 ms and 48 ms
- The default value is 24 ms
- The Tachometer Response does not affect the update time of the resolver's position data.

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 NX3A1E2-M latches the fault until it sees a clear error command. It is also possible to program the NX3A1E2-M 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.

Output State without Network Connection
This bit level 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.

Master/Slave Mode
A bit value that determines if the NX3A1E2-M is operating as a Master or as a Slave. The resolver is attached to the Master module. A serial link is used to send the position data to the Slave NX3A1E2-M. This increases the number of outputs that can be controlled from one resolver.

The Slave unit will be in transducer fault if the master is in transducer fault. Once the fault is cleared on the Master Unit, the slave unit will change to indicating a clearable fault.

Scale Factor
This parameter sets the resolver's position resolution (counts per turn) of the NX3A1E2-M module.

- The Scale Factor Parameter has a range of 2 to 1024 counts per turn.
- The Default Value is 1024.
- This position data is used with all Die Monitoring, PLS (Dwell) Output, and Strain Gauge functions.

Preset Value
This parameter sets the value that the *Resolver Position* will be changed to when the Apply Preset command bit is set in the setup data. The *Resolver Position* is the position that the NX3A1E2-M module reports to the PLC.

- The Preset Value has a range of 0 to (Scale Factor - 1).
- The Preset Value has a default value of zero.

Offset Value
This parameter is added to the absolute resolver position when the NX3A1E2-M calculates the Resolver Position. The Offset Value gives you the ability to set the Resolver Position to any value without rotating the transducer's shaft. The *Resolver Position* is the position that the NX3A1E2-M module reports to the PLC.

- The Offset Value has a range of 0 to (Scale Factor – 1)
- The Offset Value has a default value of zero.

Applying the Preset causes the module to recalculate the internally stored Offset Value.

Motion Detector ON/OFF setpoints
The NX3A1E2-M has a motion detector, which functions as speed based limit switch, activating a relay and setting a status bit in the input registers.

- This parameter is programmed with two words, low speed and high speed setpoints.
- Both of these words have a range of 0 to 32767
- The default value of both words is 0.
- The Motion Detect Parameter is always programmed in RPM

If the low speed setpoint is less than the high speed setpoint then the relay and status bit 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 relay and status bit will be off when the velocity is between the two setpoints and on at all other speeds.

How often the ON/OFF state of the motion detector is updated is based on the Tachometer Response parameter. Like the tachometer, they will update either every 24 ms or 48 ms

Clutch Pole Advances

Outputs 12 to 15 can be advanced either in ms or with a Clutch Pole Advance. The Clutch Pole advance is programmed with two parameters, a Fixed Delay and a Variable Delay.

- The Fixed Delay has a range of 0 to 255ms.
- The Variable Delay has a range of 0 to 9,999µs/rpm.
- Both parameters have a default value of 0.
- The calculated Clutch Pole advance value (in counts) is reported to the PLC in an input register.
- The Clutch Pole Advance = Fixed Delay (in ms) + ½ * speed (in rpm) * variable delay (in µs/rpm) * (1ms / 1000µs)

Outputs 12 to 15 will use the Clutch Pole advance only if the output's Advance Parameter in <u>all four</u> of the Output Programming blocks are equal to zero.

Stop Time Count Value

This value determines the number of counts out of 1024counts / turn that the position can change by in 125ms and still be considered stopped during a stop time operation.

- The Stop Time Count Value has a range of 0 to 63
- The Default value is 0.
- If a value of 0 is entered, a value of 1 will be used.

Please note that the larger this value, the smaller the measured stopping time will be.

Time for Revolution

This function of the NX3A1E2-M causes it to calculate the time, in 100µs increments, that it takes the resolver to travel between two consecutive zero points. It is based on the offset position, that is, the position that is reported to the input registers. If the resolver's position does not pass through its zero position twice within 3276.7ms, a value of zero will be placed in this register.

Die Monitoring Parameters

Die Monitor Check Type

Each Die Monitor channel can be configured to verify that an expected condition occurred during the press operation. Depending on how the NX3A1E2-M has been configured, an unexpected event will cause status bits to be set; a fault output to be activated, the input number where the first error occurred to be captured, and a counter incremented to indicating the number of errors detected.

- There are five types of Die Monitoring checks; Normally True, Normally False, Cyclical, Constant, and Quick.
- The Die Monitor Input Check programming also includes up to four resolver position based (on / off) check windows. Depending on the checking type used, the expected input must be active at some point within these windows.

Input sensor enable mask

Each bit in this word individually enables the Die Monitoring sensor check of each of the 16 inputs. Bit 0 = input 1, bit 1 = input 2 ... bit 15 = input 16. Resetting a bit in this word will disable the Die Monitor testing on the corresponding input.

Fault Output Control Word

(Bit 0 controls input 1, bit 1 controls input 2 ... bit 15 controls input 16)

When the bits are reset, a detected die protection fault will cause the error bits to turn on, the count of the die protection fault to increment, the input number of the first die protection fault detected to be captured, and the fault output to turn off.

When the bits are set, a detected die protection fault will only set the error bits, increment the count, and capture the input number. The fault output will not turn off.

Counting Type of Die Protection Inputs

This function counts how many times each of the sixteen die protection inputs have detected a fault. Each counter can count from 0 to 255. If the count exceeds 255, the counter will roll over to zero and start counting again. The counter for each input will function whenever the sensor check has been enabled.

“0” = continuous count mode “1” = self-resetting count mode.

In continuous count mode, the count operation is independent of whether or not a die protection fault affects the fault output, and the counters are reset to zero only at power up or when a clear error command has been issued by the PLC.

In self resetting count mode, the counters are reset to zero if no error is detected between two consecutive check-window off setpoints, and cannot control the fault output.

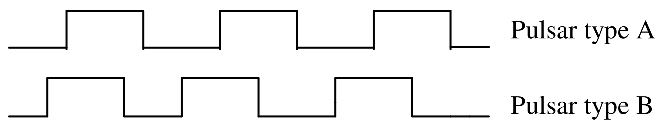
PLS Output (Dwell) Parameters

Limit Switch Output Type Parameter

Programs the type of limit switch the output channel will be. The four choices are *Normal*, *Pulsar Type A, Pulsar Type B*, and *Timed outputs.*

Normal outputs turn on and off based only on resolver's position. Eight pairs of ON / OFF, each with a range of 0 to (Scale Factor –1), setpoints give you the ability to turn the output on and off eight times per cycle.

Pulsar Outputs have a range of 1 to 255 and defines the number of equal ON and OFF steps that are output in one complete rotation. As shown in the following diagram, the two types of pulsar output types, A or B, are offset by 90 degrees from each other.



Timed Outputs use one ON / OFF setpoint pair, with a range of 0 to (Scale Factor –1), to set the ON position and OFF position of the limit. A third parameter, the time duration, sets the amount of time that the output is to be on. This parameter has a range of 0 to 9999ms. Timed outputs turn on at the ON setpoint and off at either the OFF setpoint or at the Time Value, whichever occurs first

Timed outputs with equal ON and OFF setpoints will be based only on the time. That is, they will turn on at the setpoint and off at the time value. If the resolver makes more than one rotation before the timer has expired, the internal time value will be reset to zero and the timing operation will begin again.

Up to four of the NX3A1E2-M outputs can be programmed as timed outputs.

For Timed Outputs to function correctly, the minimum dwell time (On to Off) or (Off to On) must be at least 1.5ms. This restriction is caused by the internal scanning rate that the NX3A1E2-M assigns to timed outputs.

Limit Switch Advances

This parameter, which has a range of 0 to 256ms, allows the limit switch channel to compensate for fixed delays in the system by turning the output on and off in advance of its programmed setpoints as a function of the shaft speed. The same advance value is applied to both the ON and OFF setpoints.

Note: Advancing an output by more than the time to make one rotation will result in the output being advanced by (Programmed Advance – Time for Rotation).

Increment/Decrement Output Dwells

This programming feature is used to individually change the NX3A1E2-M's On/Off dwells setpoints. The following restrictions must be observed when using the Increment / Decrement function.

1. Only Normal and Timed Outputs can be modified. It is not possible to Increment or Decrement a Pulsar type output
2. The ON setpoint can only be changed by ¼ of the scale factor.
3. The OFF setpoint can only be changed by ¼ of the scale factor.
4. If both the ON and OFF setpoints are being changed in opposite directions, for example if the ON setpoint is decreased and the OFF setpoint is increased, than the combined changes of both setpoints cannot exceed ¼ of the Scale Factor.
5. The Increment / Decrement feature must not be used to change one setpoint of two overlapping output dwells. The result will be two non-overlapping dwells that are a combination of the original and new setpoints.
6. A programming error will result if the Increment / Decrement function is used to change the timed output type from Position / Time to Time only, or vice versa.

Please note that the Increment/Decrement function only changes the On/Off setpoints in the NX3A1E2-M module's memory. The On/Off setpoints that are stored in the PLC's memory are not changed by the Increment/Decrement function.

Increment/Decrement Die Monitor Check Windows

This programming feature is used to individually change the NX3A1E2-M's On/Off dwells setpoints. The following restrictions must be observed when using the Increment / Decrement function.

1. The ON setpoint can only be changed by ¼ of the scale factor.
2. The OFF setpoint can only be changed by ¼ of the scale factor.
3. If both the ON and OFF setpoints are being changed in opposite directions, for example if the ON setpoint is decreased and the OFF setpoint is increased, than the combined changes of both setpoints cannot exceed ¼ of the Scale Factor.
4. The Increment / Decrement feature must not be used to change one setpoint of two overlapping input windows. The result will be two non-overlapping windows that are a combination of the original and new setpoints.

Please note that the Increment/Decrement function only changes the On/Off setpoints in the NX3A1E2-M 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.

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.

Strain Gauge Parameters

Number of Channels

Tonnage is measured through strain gauges mounted on the press. The gauges are mounted so that the tonnage developed by the press is evenly distributed between the gauges. Depending on the type of press used, two or four strain gauges are mounted on the press.

- The NX3A1E2-M accepts up to four gauges and can be configured to use two or four.

Machine Rating

The Machine Rating is the maximum value that can be developed by the press on a continuous basis without damage. Most presses are designed to handle 125% of rating tonnage on an intermittent basis without damage. When the Machine Rating is entered, the module defaults some of its tonnage limits to 125% of what was entered.

- The Machine Rating parameter has a range of Number of Channels to 10,000 and is programmed with an implied decimal point.

An implied decimal point means that the Machine Rating can be specified with a resolution higher than 1 ton. Entering "1000" for a press whose machine rating is 100 tons will yield measurements with 0.1 ton resolution. Entering "10000" for the same press will yield a resolution of 0.01 tons. Note that if you use an implied decimal point for the Machine Rating, all other tonnage programming data must be formatted with the same implied decimal point. Also be aware that the NX3A1E2-M will use the same implied decimal point in the data sent back to the PLC. For example, if the implied resolution is 0.1 tons and the NX3A1E2-M is reporting a value of 42 tons, the actual value sent to the PLC will be 420.

Zero Integration Time

Strain gauges are basically resistive bridges and their output is subject to drift over time and temperature. TheNX3A1E2-M can be programmed to compensate for this drift by measuring the output of the gauges when they are not subject to stress. The module monitors the output of each gauge from 270° to 356°. After a programmable amount of time, the NX3A1E2-M integrates (averages) the values from each gauge and uses each average as the new zero output for the respective gauge.

- The *Zero Integration Time* parameter sets the amount of time between integrations and is programmable to 0.5, 1.0, 1.5, or 2.0 seconds.
- The offset generated by the Zero Integration time is not automatically saved through power down. The save in Flash Memory command must be used to save this offset value in the unit's Flash Memory.
- The time to pass through the integration window is summed over multiple rotations until the programmed time value is reached. This means that several strokes may be needed to complete the integration time on high speed presses.

Sample Window

The sample window defines two resolver positions between which the tonnage is to be monitored. The Sample Window is defined by two parameters, Start Sample Window and End Sample Window.

- Both Sample Window parameters are programmed in units of Scale Factor based resolver counts.
- The Start Sample Window has a range of ((40 * Scale Factor)/360) to ((1/2 Scale Factor) - 1)
- The End Sample Window has a range of (1/2 Scale Factor) to ((340 * Scale Factor)/360)

Alarm Masks

Use these parameters to selectively enable or disable the alarm flags that are reported to the PLC. The NX3A1E2-M stores the state of the alarm masks on power down. Once disabled, the only way to re-enable an alarm is by using this command a second time.

- Each channel has its own mask word, with the Data Window and Channel Limit masks occupying the same positions in each word.
- For each mask, setting the bit enables the alarm, resetting the bit disables the alarm.

Derating Curve

Because the press clutch generates a constant torque, the amount of tonnage developed varies with crankshaft angle, with the minimum amount available at 90° (midstroke) and the maximum at 180° (bottom). Press builders publish derating curves that describe the total amount of tonnage that can be developed at different points in the stroke and the NX3A1E2-M can be programmed to ensure that the tonnage developed does not exceed the derating curve. This monitoring occurs between 90° and 180°. Seven data points, for the 90, 126.5, 149, 163, 171.5, 177, and 180 degree points, are entered into the NX3A1E2-M that form a six-segment straight line approximation of the derating curve. Note that these crankshaft angles are fixed in the NX3A1E2-M.

The Derating Curve values are entered as the maximum allowable percentage of Machine Rating at these points and the NX3A1E2-M automatically calculates the straight line approximation between these points.

- The Derating curve values are entered in units of 0.1%
- The Derating Curve values are mirrored about the 180 degree point, up to the end of the sample window. These mirrored values are checked at the 183, 188.5, 197, 211, and 233.5 degree points.
- Each setpoint has a range of 1 to 1250.
- The NX3A1E2-M will set the Total Error Alarm bit if the total tonnage, that is if the sum of all channels, exceeds the value of the approximation at the specified resolver positions.
- The Derating Curve function will be disabled when all of the Derating Curve parameters are set to zero.

Channel Low, High, and Reverse Limits

Each channel has a programmable High Limit, Low Limit, and Reverse Limit that monitors the tonnage on the channel. During the sample window, the maximum tonnage *measured on the channel* must fall between the programmed *Channel Low, Channel High*, and the magnitude of the reverse tonnage must not exceed the magnitude of the *Channel Reverse* Limit. The NX3A1E2-M will set Alarm bits if the measured tonnage is outside of these programmed limits.

The Channel Low, High, and Reverse limits are programmed in units of Actual Tonnage and use the same implied decimal point as the Machine Rating parameter. The limits on the actual tonnage values for each channel are:

- **Channel Low Limit:** 0 to (Machine Rating / # of Channels) * 1.25
- **Channel High Limit:** (Low Limit + 1) to (Machine Rating / # of Channels) * 1.25
- **Channel Reverse Limit:** – (Machine Rating / # of Channels) to 0.
- Channel Nominal Rating is set as Channel High Limit/1.25 or Channel Reverse Limit, whichever is the greater. The strain gauge signal is amplified in a way to cover from (-) Channel Nominal Rating to (+) 1.25*Channel Nominal Rating.
- The channel Low Limit must be reached at some point during the Sample Window. This differs from the High and Reverse limits which must not be exceeded during the Sample Window.
- The Channel Low, High, and Reverse alarms are not reported until the end of the Sample Window.

Data Window On / Off Position

Data Windows are sub-windows within the programmed Sample Window, with their own programmable Start and End points. The NX3A1E2-M can be programmed with up to four Data Windows. The position of the four Data Windows is the same on all of the strain gauge channels. However, each channel can be programmed with its own High and Low Limits tonnage limits for each window.

- The Data Window parameters are programmed in units of Scale Factor based resolver counts.
- The Data Window On parameter must be contained within the programmed Sample Window.
- The Data Window Off parameter has a range of Data Window On to End of Sample Window.
- The Data Window function is disabled by entering zero in both the ON and OFF Data Window parameters.
- It is possible to overlap Data Windows.

Data Window Low and High Limit Setpoints

Each Data Window has a programmable High Limit and Low Limit that monitors the tonnage of the channel while the resolver's position data is located in the Data Window. During the Data Window, the maximum tonnage *measured on the channel* must fall between the programmed *Data Window Low* and *Data Window High* parameters. The NX3A1E2-M will set Alarm bits if the measured tonnage is outside of these programmed limits.

The Data Window Low and High limits are programmed in units of Actual Tonnage and use the same implied decimal point as the Machine Rating parameter. The limits on the actual tonnage values for each channel are:

- **Data Window Low Limit:** (Channel Reverse Limit) to (Channel High Limit)
- **Data Window High Limit:** (Data Window Low Limit + 1) to (Channel High Limit)
- The Data Windows alarms are reported immediately upon detection.

Quick Calibration Values

The Quick Calibration can only be performed after a Full Calibration has been performed. During a Full Calibration, the NX3A1E2-M will generate the Quick Calibration values and place them in input registers 94 to 109. If for some reason the NX3A1E2-M needs to be replaced, these values can be placed in output registers 68 to 83, and sent to the NX3A1E2-M as part of the Strain Gauge Configuration programming block. Setting registers 68 to 83 to zero will disable the Quick Calibration function.

Diagnostics Analog Outputs

The NX3A1E2-M has five analog outputs. Four of these provide test points for measuring the signals on the four Strain Gauge inputs. The fifth is a 0 to 10Vdc output that represents the position data. This output can be programmed to output its full range over one complete turn, over the Sample Window, or over any of the four Data Windows.

- By default, the Position Analog Output's Full Range is over one complete turn of the resolver.
- The Position Analog Output is disabled when there is a Transducer Fault.
- The Position Analog Output is NOT disabled when the Network Connection is lost.

The voltages on Strain Gauge test outputs of the NX3A1E2-M are proportional to the signals received on the analog inputs and depend on the performed Zero Offset, Gain calibration and scaling. In general they represent the loading of the press as a percentage of the full machine rating.

General Commands

Clear Error

This command can be used to clear a latched transducer fault error, the Count of Die Protection Faults detected, the Strain Gauge Alarm Values, and all programming errors.

Save Data in Flash Memory

This command is used to copy the setup data from the NX3A1E2-M's RAM memory to its Flash memory. If this command is not used, the module will lose any setup data that was not saved in the Flash Memory the next time its power is cycled.

Chapter 2: Input Words (112 16 bit words transferred from the NX3A1E2-M to the network)

Word 0: Status Word 1 (Resolver / PLS / Die Monitor Status)

bit 0: Sensor Fault - set if the one or more of the input checks fail, that is, if any of the bits in Input Word 12 are set.
bit 1: Programming Fault - set if the PLC writes invalid data to the NX3A1E2-M
bit 2: Transducer Fault - set if no transducer is attached, if the transducer is faulty, if the cable is improperly wired, or if the transducer is incompatible. This bit will also be set if you are operating in slave mode and there are no signals on the Serial Data Connector.
bit 3: Reserved for future use
bit 4: set if the NX3A1E2-M output registers are operating in force mode
bit 5: Motion Bit - set when the velocity data is between the programmed Motion Detect Range
bit 6: set if the PLS outputs are disabled. This can be caused by either a resolver transducer fault, or if the outputs have not yet been programmed. It is possible to Force Outputs that have not been programmed.
bit 7: set when there is a Command Word Format Error, such as setting bits in command word that should be zero, setting multiple programming block bits, or setting the transmit bit without setting any other bits.
bit 8: set if the scale factor is outside of the range of 2 to 1024.
bit 9: set if the preset value is outside of the range of 0 to (Scale Factor – 1)
bit 10: set if the offset value is outside of the range of 0 to (Scale Factor – 1)
bit 11: set if the Motion detect lower limit is invalid
bit 12: set if the Motion detect upper limit is invalid
bit 13: set if the programmed stop time value is outside of the range of 0 to 63.
bit 14: set when there are unused bits set in the Resolver Bit Level Setup Word
bit 15: Acknowledge bit - set to 1 in response to the Transmit bit being set

Word 1: Status Word 2 (Resolver / PLS / Die Monitor Status)

bit 0: Input sensor window Off position error
bit 1: Input sensor window On position error
bit 2: Input type check error - set when the input type programmed is not valid
bit 3: Limit Switch Advance Error (valid range = 0 to 256ms)
bit 4: Limit Switch On setpoint error (valid range = 0 to Scale Factor –1)
bit 5: Limit Switch Off setpoint error (valid range = 0 to Scale Factor –1). Also set if the output type is Normal and On setpoint = Off setpoint, or if an output is enabled but all of the On/Off setpoints are equal to zero.
bit 6: Limit Switch Type Error (valid range = 0 to 4)
bit 7: Pulsar Limit Switch Error (valid range = 0 to 255) Also set if the remaining On Off setpoints are not equal to zero.
bit 8: Timed Output Error (valid range = 0 to 9999ms, if setpoint value ≠ 1, or if the maximum number of four timed outputs is exceeded.) This bit will also be set if the remaining On Off setpoints are not equal to zero.
bit 9: set if the Clutch Pole advance fixed value is invalid (valid range = 0 to 255ms)
bit 10: set if the Clutch Pole advance variable value is invalid (valid range = 0 to 9999µs/rpm)
bit 11: set if the values programmed with the Increment / Decrement output function are outside of their valid ranges. This bit will also be set if the Increment / Decrement function that is being used as a pulsar type output, or if you change the timed output type from Position Time to Time only or vice versa.
bit 12: set if the Increment / Decrement Die Monitor Window function is invalid. This bit will also be set if you try to Increment / Decrement a Die setpoint that has not been programmed.
bits 13 to 15: reserved for future use.

Word 2: Output or Input Number that is invalid, 1 to 16. If the number of Timed Outputs exceeds 4, the number of the first timed output will be reported here. The Output number with a Speed Compensation Advance error will also be reported here.

Word 3: Output or Input Setpoint that is invalid, 1 to 8 if an output is in error or 1 to 4 if an input is in error.

Word 4: Resolver position data. The position data is still reported even if there is a clearable transducer fault.

Word 5: Resolver Tachometer Value in RPM. The velocity data is not reported when there is a clearable transducer fault.

Word 6: Time for rotation. This register contains the time, in 100µs increments, that it took the resolver to travel between two consecutive zero points, and is based on the offset position, the position reported to the input registers. If the resolver's position is changing but does not pass through zero twice within 3276.7ms, a value of zero will be placed in this register. If the resolver stops, the last calculated value will be placed in this register.

Word 7: Stopping Time, measured in milliseconds (will be 33ms if no motion was occurring when brake input became active)

Word 8: Position where power was removed from the Stopping Time Input. This value is immediately reported when the brake input becomes active.

Word 9: Limit Switch output status, sets a bit to indicate that the output is active. The outputs must first be enabled by the Output Setup Word, which is the first word in each of the output programming blocks. bit 0 = output 1, bit 1 = output 2 ... bit 15 = output 16

Word 10: Clutch Pole Advance Angle (measured in counts)

Word 11: Input sensor states, sets a bit to indicate that the input is active. That is, when the input is connected to GND. Bit 0 = input 1, bit 1 = input 2 ... bit 15 = input 16.

Word 12: Input sensor fault bits, sets a bit to indicate that the input was not TRUE at the correct time. Bit 0 = input 1, bit 1 = input 2 ... bit 15 = input 16

Word 13: Captured Die Protection Input Number

If the Die Protection inputs have been enabled, then the input number on which the first fault was detected will be captured and placed in this register. In this word, bit 0 indicates a fault on input 1, bit 1 indicates a fault on input 2 ... and bit 15 indicates a fault on input 16.

Multiple bits will be set in this word to indicate that more than one fault was detected at one time.

The bit(s) in this word will remain set until the module receives a clear error command.

Words 14 to 21: Count of die protection faults detected.

These registers, two counters per register, contain the count of how many times each of the sixteen die protection inputs have detected a fault. Each counter can count from 0 to 255. If the count exceeds 255, the counter will roll over to zero and start counting again. The counter for each input will function whenever the sensor check has been enabled by the Input Sensor Enable Mask, which is word 49 in the Output and Input Attribute Programming Block. In continuous count mode, the count operation is independent of whether or not a die protection fault affects the fault output, and the counters are reset to zero only at power up or when a clear error command has been issued by the PLC. When in self resetting count mode, the counters are reset to zero if no errors are detected between two consecutive check-window off setpoints, and cannot control the fault output. The following table shows the location of each of the counters.

Input Word	Bits 0 to 7	Bits 8 to 15
14	Input 1	Input 2
15	Input 3	Input 4
16	Input 5	Input 6
17	Input 7	Input 8
18	Input 9	Input 10
19	Input 11	Input 12
20	Input 13	Input 14
21	Input 15	Input 16

Words 22 → 53: These registers will report the position of the rising and falling edges of the inputs. The following table shows the registers that are used for each of the inputs.

Word	Function
22	Input 1 On transition position
23	Input 1 Off transition position
24	Input 2 On transition position
25	Input 2 Off transition position
26	Input 3 On transition position
27	Input 3 Off transition position
28	Input 4 On transition position
29	Input 4 Off transition position
30	Input 5 On transition position
31	Input 5 Off transition position
32	Input 6 On transition position
33	Input 6 Off transition position
34	Input 7 On transition position
35	Input 7 Off transition position
36	Input 8 On transition position
37	Input 8 Off transition position
38	Input 9 On transition position
39	Input 9 Off transition position
40	Input 10 On transition position
41	Input 10 Off transition position
42	Input 11 On transition position
43	Input 11 Off transition position
44	Input 12 On transition position
45	Input 12 Off transition position
46	Input 13 On transition position
47	Input 13 Off transition position
48	Input 14 On transition position
49	Input 14 Off transition position
50	Input 15 On transition position
51	Input 15 Off transition position
52	Input 16 On transition position
53	Input 16 Off transition position

On = rising edge
(Connected to GND)
Off = falling edge
(Removed from GND)

The captured values reported here will be reset to zero when clearing faults, or when programming the resolver and die monitor setup data.

Word 54: Status Word 3: Strain Gauge Status

Bit 0 = *Command Ignored*. The Command cannot be accepted because of the present state of the module. For example, monitoring the press before the strain gauges have been calibrated.

Bit 1 = *Flash Memory Fault*. This bit will be set if the units Flash Memory is not functioning correctly. The unit will still function with a Flash Memory Error, but it will be necessary to program the unit at every power up.

Bit 2 = *Invalid Strain Gauge Parameter*. Set under the following conditions.

- Any Strain Gauge parameter that is outside of its valid range.
- Performing a Full Calibration Procedure with the Desired Forward Peak Tonnage values different from the Current Peak Tonnage values reported in input registers 64 to 67.
- If any of the reserved bits are set in the Strain Gauge configuration bits setup word.
- If any of reserved bits 3 to 7 are set in the Alarm Mask setup words.
- If only some of the Derating Curve parameters are equal to zero. All seven words must be zero to disable the Derating Curve Function
- Programming any of the channel 3 or 4 parameters when the unit has been configured to use only two strain gauges.
- Any Low, High, and Reverse Limits that are required by the programmed number of channels, but are not present. Values for channels 1 and 2 must always be present. Values for channels 3 and four must only be present if the unit has been configured for four strain gauge inputs.
- Selecting the 0 to 10Vdc analog output to be active over a Data Window without also programming the Data Window.
- Programming Data Windows outside the range of the Sample Window.
- If the Data Window tonnage limits are outside the range set by the Sample Window tonnage limits.
- Programming a Data Window's position data without also programming the Data Window's low and high limits.

Bit 3 = *Alarm Fault*. Global Alarm bit that indicates that there is a Sensor Fault, a Calibration Error, or any non-masked measured tonnage values exceeds the programmed limits within the Sample or Data Windows. The individual Strain Gauge Alarm status words will indicate the exact kind of fault. This bit will not be set if there is a Total Alarm.

Bit 4 = *Total Alarm.* Set if the sum of the tonnage on all of the channels exceeds 125% of the Machine Rating. If the Derating Curve is programmed, then the alarm triggers if the total tonnage exceeds the derating curve.

Bit 5 = Signature Buffer Updated. Set when the signature data is prepared for reading by message instruction.

Bit 6 = Signature Build Locked. It is the response to the command Prepare Signature Data Word 1, Bit 0. This bit indicates that the signature buffer of the last 5 cycles will be no more updated.

Bits 7 to 15: Reserved for future use.

Words 55 to 58: Strain Gauge Alarms (Each of these four words represents the possible faults on each of the four Strain Gauge channels.)

Word	Function
55	Channel 1 Alarms
56	Channel 2 Alarms
57	Channel 3 Alarms
58	Channel 4 Alarms

Bit 0 = *Channel Low Alarm*. Set if the tonnage within the Sample Window does not reach the channel's programmed lower limit. This alarm is reported at the end of the Sample Window.
Bit 1 = *Channel High Alarm*. Set if the tonnage within the Sample Window is greater than the channel's programmed upper limit. This alarm is reported at the end of the Sample Window.
Bit 2 = *Channel Reverse Alarm*. Set if the tonnage within the Sample Window exceeds the channel's programmed Reverse Limit. This alarm is reported at the end of the Sample Window.
Bit 3 = *Sensor Fault*. Set if no sensor is attached, if the sensor voltage values are outside of their valid ranges, or if the Resolver is in Transducer Fault.
Bit 4 = *Calibration Error*. Set if the strain gauges input circuitry has not been correctly calibrated, or if the signal on the Strain Gauge inputs exceeds the calibrated high limit. (This is true even outside of the Sample Window and is done to ensure that the A to D converter is decoding the analog signals in the most efficient manner.) A calibration operation or the Clear Error command will reset this status bit.
Bits 5 to 7 = Not Used
Bit 8 = *Data Window 1 Low Alarm*. Set if the tonnage within the Data Window 1 is less than the window's programmed lower limit. This bit is set immediately upon the detection of an alarm condition.
Bit 9 = *Data Window 1 High Alarm*. Set if the tonnage within the Data Window 1 is greater than the window's programmed upper limit. This bit is set immediately upon the detection of an alarm condition.
Bit 10 = *Data Window 2 Low Alarm*. Set if the tonnage within the Data Window 2 is less than the window's programmed lower limit. This bit is set immediately upon the detection of an alarm condition.
Bit 11 = *Data Window 2 High Alarm*. Set if the tonnage within the Data Window 2 is greater than the window's programmed upper limit. This bit is set immediately upon the detection of an alarm condition.
Bit 12 = *Data Window 3 Low Alarm*. Set if the tonnage within the Data Window 3 is less than the window's programmed lower limit. This bit is set immediately upon the detection of an alarm condition.
Bit 13 = *Data Window 3 High Alarm*. Set if the tonnage within the Data Window 3 is greater than the window's programmed upper limit. This bit is set immediately upon the detection of an alarm condition.
Bit 14 = *Data Window 4 Low Alarm*. Set if the tonnage within the Data Window 4 is less than the window's programmed lower limit. This bit is set immediately upon the detection of an alarm condition.
Bit 15 = *Data Window 4 High Alarm*. Set if the tonnage within the Data Window 4 is greater than the window's programmed upper limit. This bit is set immediately upon the detection of an alarm condition.

Word 59: Channel 1 Current Tonnage
Word 60: Channel 2 Current Tonnage
Word 61: Channel 3 Current Tonnage
Word 62: Channel 4 Current Tonnage
Word 63: Current Total Tonnage
Word 64: Channel 1 Forward Peak Tonnage
Word 65: Channel 2 Forward Peak Tonnage
Word 66: Channel 3 Forward Peak Tonnage
Word 67: Channel 4 Forward Peak Tonnage
Word 68: Total Forward Peak Tonnage
Word 69: Channel 1 Reverse Peak Tonnage
Word 70: Channel 2 Reverse Peak Tonnage
Word 71: Channel 3 Reverse Peak Tonnage
Word 72: Channel 4 Reverse Peak Tonnage
Word 73: Total Reverse Tonnage
Word 74: Channel 1, Data Window 1, Peak Tonnage
Word 75: Channel 2, Data Window 1, Peak Tonnage
Word 76: Channel 3, Data Window 1, Peak Tonnage
Word 77: Channel 4, Data Window 1, Peak Tonnage
Word 78: Total Peak Tonnage in Data Window 1
Word 79: Channel 1, Data Window 2, Peak Tonnage
Word 80: Channel 2, Data Window 2, Peak Tonnage
Word 81: Channel 3, Data Window 2, Peak Tonnage
Word 82: Channel 4, Data Window 2, Peak Tonnage
Word 83: Total Peak Tonnage in Data Window 2
Word 84: Channel 1, Data Window 3, Peak Reverse Tonnage
Word 85: Channel 2, Data Window 3, Peak Reverse Tonnage
Word 86: Channel 3, Data Window 3, Peak Reverse Tonnage
Word 87: Channel 4, Data Window 3, Peak Reverse Tonnage
Word 88: Total Peak Tonnage in Data Window 3
Word 89: Channel 1, Data Window 4, Peak Reverse Tonnage
Word 90: Channel 2, Data Window 4, Peak Reverse Tonnage
Word 91: Channel 3, Data Window 4, Peak Reverse Tonnage
Word 92: Channel 4, Data Window 4, Peak Reverse Tonnage
Word 93: Total Peak Tonnage in Data Window 4
Word 94: Quick Calibration Value 1 (C) Channel 1
Word 95: Quick Calibration Value 2 (G)
Word 96: Quick Calibration Value 3 (O)
Word 97: Quick Calibration Value 4 (S)
Words 98 to 101: Quick Calibration Values – Channel 2
Words 102 to 105: Quick Calibration Values – Channel 3
Words 106 to 109: Quick Calibration Values – Channel 4
Word 110: Reserved for Future Use
Word 111: Reserved for Future Use

Note 1: All Peak Tonnage Values are cleared when you issue a clear error command or program the Strain Gauge setup.
Note 2: All Tonnage values are frozen at their last value when there is a Calibration Error.

Starting with firmware version 6, data windows 3 and 4, reported in input words 84 to 87 and 89 to 92, now report the maximum reverse tonnage. Only negative values are reported in these registers.

Strain Gauge Signature Data

The NX3A1E2-M unit captures 360 bytes of Strain Gauge Signature Data on every cycle of the press and stores it in internal buffer. This data is not shown as part of the Input Words but can be read by the PLC using message instruction (Service Code = 0e – Get Attribute Single, Class = B0, Instance = 1, Attribute = 1 for Channel 1, = 2 for Channel 2, = 3 for Channel 3 and =4 for Channel 4). It is also possible for another device on the network, like HMI, to read this data by sending messages to the NX3A1E2-M unit. The Nexus unit will respond back with 256 bytes of data representing the total measured tonnage as function of the press position.

Each byte of data corresponds to approximately one degree of the full resolver revolution and represents average measured tonnage at that position. The data is 8 bit unsigned value with offset and shows the tonnage as percentage of the configured Nominal Rating of the respective Channel. The Nominal Rating for a channel is defined by its High and Reverse Limits in the Strain Gauge Configuration. The offset in the data allows for proper presentation of both normal and reverse tonnages in the range of -100% to + 125%. The offset has a value of 109 which corresponds to unloaded press. The following table shows the relation between the Signature Data and the press position and tonnage.

Press Tonnage	Approximate Byte Value
-100%	9
-75%	34
-50%	59
-25%	84
No Load	109
25%	134
50%	159
75%	184
100%	209
125%	234

The Signature Data is captured as long as there are no Strain Gauge errors or faults present, i.e. both *Alarm Fault* and *Total Alarm* (bits 3 and 4 in Word 54: Status Word 3 – Strain Gauge Status) are zero. When Strain Gauge Alarm goes active the unit will finish data capturing for the current cycle but will suspend further capture, retaining Signature Data corresponding to the cycle when the fault condition occurred. The normal data capture will resume again when all faults are removed and both alarm bits are cleared.

The signature data from the last press cycle is transferred to an internal buffer holding data for the last five cycles. This transfer can be blocked with setting the Lock Bit of the Prepare Signature Command. With this command also the signature data of the one of the last five cycles is prepared for reading by Message Instructions. With receiving the command Bit 5 (Signature Buffer Updated) of Input Word 54 (Status Word 3) is reset. When the data is ready this bit is set, which can trigger a reading by Message Instruction.

The Message Instructions use vendor specific object, Class = 0xB0, Service = Get_Attribute_Single (0x0E), Instance = Attributes (0x01), Attribute 1…4 for channels 1…4.

Chapter 3 Output Words (146 16 bit words transferred from the Network to the NX3A1E2-M)

The NX3A1E2-M module is programmed through 146 sixteen bit output registers. This data is transferred over the Network in twelve different programming blocks. Output register 0 always has the same function, and the function of registers 1 to 145 will vary depending on the data contained in register 0.

Word 0: Control Word

Programming Block	Function
Resolver & Setup	Count Direction, Tachometer Response, Module type, Transducer Fault Latch, Scale Factor, Preset Value, and Motion Detect Values. Sending the Resolver and Setup programming block to the NX3A1E2-M will clear the Die Monitoring, PLS Output, and Strain Gauge Configuration programming.
Die Monitor Input Programming	Inputs 1 to 16 are programmed with one programming cycle. Input Sensor Enable Mask, Input Type, and four Input On/Off ranges
PLS Output Programming Outputs 1 to 8	Outputs 1 to 8 are programmed with one programming cycle. The Limit switch type, the on/off advance value, and 8 on/off setpoints are programmed.
PLS Output Programming Outputs 9 to 16	Outputs 9 to 16 are programmed with one programming cycle. The Limit switch type, the on/off advance value, and 8 on/off setpoints are programmed
Increment / Decrement Output Dwells	Select the limit switch and setpoint to be adjusted. Only one output dwell can be changed with each programming cycle.
Force	Force outputs 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.
Strain Gauge Configuration	Number of Channels, Zero Integration Time, Derating Curve, Channel Sample Limits, Data Window Setpoints, Data Window Limits, Alarm Masks, Quick Calibration Values
Strain Gauge Zero Offset	This programming block is part of the Full Calibration Procedure and determines the Zero Offset value by measuring the Strain Gauge inputs when the gauges are unloaded.
Strain Gauge Gain Calibration	This programming block is part of the Full Calibration Procedure and is used after the press has been cycled. This programming block uses both the measured and desired tonnage values to set the gain values.
Save Data in Flash Memory	This block is used to copy the setup data from the NX3A1E2-M's RAM memory to its Flash memory. If this bit pattern is not sent to the NX3A1E2-M, the module will lose any setup data that was not saved in the Flash Memory the next time its power is cycled.
Increment / Decrement Die Monitor Check Windows	Select the Die Monitor Input and setpoint to be adjusted. Only one input check window can be changed with each programming cycle.

Word 0: *Control Word* (This Command word will be used to select which programming block is to be sent to the NX3A1E2-M. Setting bits 1 to 5 to an invalid pattern will generate a command error, Input register 0, bit 12)

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
Transmit Bit	Clear Errors	Strain Gauge Factory Calibration	Analog Input Range Type, Used with Jumpers.	0	0	0	0	0	0	Programming Block Command					Apply Preset

Bit 05	**Bit 04**	**Bit 03**	**Bit 02**	**Bit 01**	**Programming Block Function of words 1 to 145**
0	0	0	0	0	No Action Taken
0	0	0	0	1	Program Resolver & Setup
0	0	0	1	0	Program Die Monitoring Input setup
0	0	0	1	1	Program Outputs 1 to 8
0	0	1	0	0	Program Outputs 9 to 16
0	0	1	0	1	Increment / Decrement Limit Switch Outputs
0	0	1	1	0	Force Function
0	0	1	1	1	Program Strain Gauge Configuration
0	1	0	0	0	Strain Gauge Zero Offset
0	1	0	0	1	Strain Gauge Gain Calibration
0	1	0	1	0	Save Data in Flash Memory (see note below)
0	1	0	1	1	Increment / Decrement Die Monitor Check Windows
0	1	1	0	0	Reserved
0	1	1	0	1	Reserved

- Setting the Clear Error bit (bit 14), either by itself or in combination with any other programming bits, will clear any programming or transducer fault errors. It will also clear the Input Transition positions, the Count of Die Monitor fault values, and the current peak tonnage values.
- Analog Input Range Type is set by the jumpers on the board. A value of ZERO for Bit 12 of the Control Word reflects a setting of 0...+5V for Strain Gauge. A value of ONE reflects a setting of +/-10V for amplified analog Inputs.
- It is possible to program outputs 9 to 16 before programming outputs 1 to 8.
- The *Save Data in Flash Memory* programming block is used to copy the setup data from the NX3A1E2-M's RAM memory to its Flash memory. If this bit pattern is not sent to the NX3A1E2-M, the module will lose any setup data that was not saved in the Flash Memory the next time its power is cycled.
- A Factory Calibration is intended for use only during initial test at the factory. It must be performed when the strain gauge inputs are at 0Vdc. For example when a simulator has been set to output 0mV/V. It must not be used with unloaded Strain Gauge sensors.
- A Command Word Format error (Status Word 1 bit 7) will be generated if any of the Programming Block bit patterns are set at the same time as the Factory Calibration bit.

Resolver & Setup

Word	Function
1	Bit Level Setup Parameters (See description below)
2	Scale Factor (2 to 1024) (default = 360)
3	Preset Value (0 to (Scale Factor-1))
4	Offset Value (0 to (Scale Factor-1))
5	Motion Detect 1 low RPM (0 to 32,767)
6	Motion Detect 1 high RPM (0 to 32,767)
7	Clutch Pole time based advance (fixed delay in milliseconds, 0 → 255)
8	Clutch Pole time based advance (variable delay in µs/rpm, 0 → 9,999)
9	Stop Time Count Value: Range 0 to 63. This value determines the number of counts out of 1024counts / turn that the position can change by in 125ms and still be considered stopped during a stop time operation. If a value of 0 is entered, then a value of 1 is used. Please note that the larger this value, the smaller the measured stopping time will be.
10	Fault output control word. (bit 0 controls input 1, bit 1 controls input 2, ... bit 15 controls input 16) When the bits are reset, a detected die protection fault will cause the error bits to turn on, the count of the die protection fault to increment, the input number of the first die protection fault detected to be captured, and the fault output to turn off. When the bits are set, a detected die protection fault will only set the error bits, increment the count, and capture the input number. The fault output will not turn off.
11	Counting Type of Die Protection Inputs: Bit 0 = input 1, bit 1 = input 2 … bit 15 = input 16. "0" = continuous count mode "1" = self-resetting count mode. Each bit sets the counting type of each input. When in self resetting mode, the fault output is always disabled. That is, inputs in self resetting mode cannot affect the fault output. Also in self resetting mode, the sensor status bits in will be reset when the counter value is reset.
12 to 145	Not used. These words will be "don't cares."

Word 1: Bit Level Setup Parameters

- Bit 0: Resolver Count Direction (0 = CW, 1 = CCW) (Changing the count direction does not affect the signals outputted by the dedicated Quadrature Output)
- Bit 1: Tachometer Response (0 = 24ms, 1 =48ms 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 does not affect the update time of the resolver's position data.)
- Bit 2: Transducer fault latch (0 = fault latched, 1 = fault cleared. Default value is latched)
- Bit 3: 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. Forced outputs are always disabled when the network connection is removed, regardless of the state of this bit.
- Bit 4: "0" = Master Mode, "1" = Slave Mode
- Bit 5 to 15: Reserved, must be equal to zero

Die Monitoring (Check Window) Programming

This programming block is used to program the Die Monitoring Type and On/Off setpoints. The following table shows the word layout.

Note: Programming the Resolver & Setup data with firmware version 3.1 or lower will always clear the Die Monitoring programming.

With firmware version 3.2 or higher (7/2013), programming the Resolver and Setup data without making any changes, or only changing the Fault Output Control Word or the Counting Type, will not clear the Die Monitor programming. Making changes to any of the other Resolver and Setup parameters will still clear the Die Monitor programming.

Word	Function
1	Input sensor enable mask. Each bit enables the sensor check of each of the 16 inputs. Bit 0 = input 1, bit 1 = input 2 ... bit 15 = input 16.
2 to 10	Input 1 Type and On / Off setpoints programming block
11 to 19	Input 2 Type and On / Off setpoints programming block
20 to 28	Input 3 Type and On / Off setpoints programming block
29 to 37	Input 4 Type and On / Off setpoints programming block
38 to 46	Input 5 Type and On / Off setpoints programming block
47 to 55	Input 6 Type and On / Off setpoints programming block
56 to 64	Input 7 Type and On / Off setpoints programming block
65 to 73	Input 8 Type and On / Off setpoints programming block
74 to 82	Input 9 Type and On / Off setpoints programming block
83 to 91	Input 10 Type and On / Off setpoints programming block
92 to 100	Input 11 Type and On / Off setpoints programming block
101 to 109	Input 12 Type and On / Off setpoints programming block
110 to 118	Input 13 Type and On / Off setpoints programming block
119 to 127	Input 14 Type and On / Off setpoints programming block
128 to 136	Input 15 Type and On / Off setpoints programming block
137 to 145	Input 16 Type and On / Off setpoints programming block

Programming Block Word	Function
N	Input Type (See Description Below)
N+1	On setpoint 1 (0 to (Scale Factor-1))
N+2	Off setpoint 1 (0 to (Scale Factor-1))
N+3	On setpoint 2 (0 to (Scale Factor-1))
N+4	Off setpoint 2 (0 to (Scale Factor-1))
N+5	On setpoint 3 (0 to (Scale Factor-1))
N+6	Off setpoint 3 (0 to (Scale Factor-1))
N+7	On setpoint 4 (0 to (Scale Factor-1))
N+8	Off setpoint 4 (0 to (Scale Factor-1))

The Output Word in this table defines which of the 145 words used in the Die Monitoring Programming. For example, if Input 3 is being programmed, than Word “N” would be 20, Word “N+1” = 21, Word “N+2” = 22, up to Word “N+8”= 28.

Input type

There are five types of input checks, and they are programmed in bits 0, 1, and 2 of the Input Type Programming Word.

Note: The True State is defined when the input is connected to GND. The False State is when the input is open.

0 0 0 = Normally True. This is defined as the input being true over the entire turn of the resolver. The fault will be detected and the count incremented immediately each time the input goes from true to false. When in continuous count mode, the counter will increment every time the input transitions from true to false. When in self resetting count mode, the counter will become one when the input is false, and then be reset to zero when the input becomes true.

0 0 1 = Normally False. This is defined as the input being false over the entire turn of the resolver. The fault will be detected and the count incremented immediately each time the input goes from false to true. When in continuous count mode, the counter will increment every time the input transitions from false to true. When in self resetting count mode, the counter will become one when the input is true, and then be reset to zero when the input becomes false.

0 1 0 = Cyclical Check. This is defined as the input being true at least once inside the programmed range, and false at least once outside of the programmed range. The fault will be detected and the count incremented at the trailing edge of the window if the sensor is never ON within the window, or at the leading edge of the window if the sensor is never OFF outside of the window. In self resetting mode, the counter will be reset to zero if no errors are detected between two consecutive check-window off setpoints. In either counting mode, the counter will increment only once between two consecutive check window off setpoints

The Cyclical check type begins checking immediately after the unit is programmed, even if machine operations begin in the middle of the check window. An input pulse that had occurred in the window before the unit was programmed will be ignored.

0 1 1 = Constant Check. This is defined as the input being TRUE inside the entire programmed range, and false at least once outside of the programmed range. The fault will be detected and the count incremented immediately if the sensor is OFF at any point in the window, or at the leading edge of the window if the sensor is never OFF outside of the window. In self-resetting mode, the counter will be reset to zero if no errors are detected between two consecutive check- window off setpoints. In either counting mode, the counter will increment only once between two consecutive check window off setpoints

1 0 0 = Quick Check. This is defined as being TRUE at least once inside the programmed range and FALSE outside of the entire range. The fault will be detected and the count incremented immediately if the sensor is ever ON at any point outside of the window, or at the trailing edge of the window if the sensor is never ON inside the window. In self resetting mode, the counter will be reset to zero if no errors are detected between two consecutive check-window off setpoints. In either counting mode, the counter will increment only once between two consecutive check window off setpoints

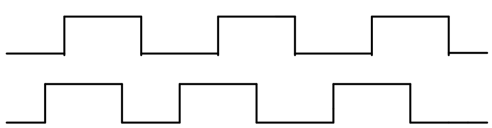
PLS Output (Dwell) Programming

This programming block is used to program the Outputs On/Off setpoints. Because of the limitations of Ethernet IP, programming all 16 outputs will require two programming cycles, one for Outputs 1 to 8, and a second for outputs 9 to 16.

- Programming the Resolver & Setup data with firmware version 3.1 or lower will always clear the PLS Output programming.

  With firmware version 3.2 or higher (7/2013), programming the Resolver and Setup data without making any changes, or only changing the Fault Output Control Word or the Counting Type, will not clear the PLS output programming. Making changes to any of the other Resolver and Setup parameters will still clear the PLS Output programming.

- Each On/Off setpoint has a range of 0 to (Scale Factor – 1)
- The Advance Value has a range of 0 to 256ms. Both the On and Off output setpoints use the same advance value.
- Outputs 1 to 11 and 16 have their advances programmed in milliseconds. If the advances on outputs 12 to 15 are equal to zero, than the clutch / pole advance values programmed in words 7 and 8 of the Resolver and Setup programming block are used to advance the output. If the advances on outputs 12 to 15 are not equal to zero, they will be advanced, in milliseconds, using the time value programmed with the output.
- The Pulse Count has a range of 1 to 255 and defines the number of equal On and Off steps that are output in one complete rotation. There are two pulse output types.



Pulse type A
Pulse type B

  The Time Dwell has a range of 0ms to 9999ms.
- Time outputs turn on at the On setpoint and off at either the Off setpoint or at the Time Value, whichever occurs first.
- Timed outputs with equal On and Off setpoints will be based only on the time. That is, they will turn on at the setpoint and off at the time value. If the resolver makes more than one rotation before the timer has expired, the internal time value will be reset to zero and the timing operation will begin again.
- A maximum of four Timed Outputs can be programmed.
- For Timed Outputs to function correctly, the minimum dwell time (On to Off) or (Off to On) must be at least 1.5ms. This restriction is caused by the internal scanning rate that the NX3A1E2-M assigns to timed outputs.

PLS Output Programming

These programming blocks are used to program the output type (Normal, Timed, Pulsar A, or Pulsar B), the On/Off advances, and the On/Off setpoints. The PLS outputs are programmed in two blocks, outputs 1 to 8 and outputs 9 to 16.

Word	Function
1 to 18	Output 1 or 9 Programming Block
19 to 36	Output 2 or 10 Programming Block
37 to 54	Output 3 or 11 Programming Block
55 to 72	Output 4 or 12 Programming Block
73 to 90	Output 5 or 13 Programming Block
91 to 108	Output 6 or 14 Programming Block
109 to 126	Output 7 or 15 Programming Block
127 to 144	Output 8 or 16 Programming Block
145	Not used. These words will be "don't cares."

Programming Block Word	Normal Limit Switch Function	Timed Output Funtion	Pulsar Type A or B
N	Output Type (See Description Below)		
N+1	Advance (0 to 256) in 1ms increments		
N+2	On Setpoint 1 (0 to SF-1)	On Setpoint (0 to SF –1)	Pulse count (1 to 256)
N+3	Off Setpoint 1 (0 to SF-1)	Off Setpoint (0 to SF –1)	0
N+4	On Setpoint 2 (0 to SF-1)	Dwell Time (0 to 9.999ms)	0
N+5	Off Setpoint 2 (0 to SF-1)	0	0
N+6	On Setpoint 3 (0 to SF-1)	0	0
N+7	Off Setpoint 3 (0 to SF-1)	0	0
N+8	On Setpoint 4 (0 to SF-1)	0	0
N+9	Off Setpoint 4 (0 to SF-1)	0	0
N+10	On Setpoint 5 (0 to SF-1)	0	0
N+11	Off Setpoint 5 (0 to SF-1)	0	0
N+12	On Setpoint 6 (0 to SF-1)	0	0
N+13	Off Setpoint 6 (0 to SF-1)	0	0
N+14	On Setpoint 7 (0 to SF-1)	0	0
N+15	Off Setpoint 7 (0 to SF-1)	0	0
N+16	On Setpoint 8 (0 to SF-1)	0	0
N+17	Off Setpoint 8 (0 to SF-1)	0	0

The Output Word in this table defines which of the 145 words used in Output programming is assigned to the Output Programming Block. For example, if Output 3 is being programmed, than Word "N" would be 37, Word "N+1" = 38, Word "N+2" = 39, up to Word "N+17"=

Output type

Bit 2	Bit 1	Bit 0	Function
0	0	0	Output not used
0	0	1	Pulse Type A output
0	1	0	Pulse Type B output
0	1	1	Normal output
1	0	0	Timed Output

Increment / Decrement Output Dwells

This programming block is used to individually change the NX3A1E2-M's On/Off dwells setpoints. Each time the Transmit transitions from 0 to 1, the On/Off setpoint specified by word 1 and 2 will be changed to the new value located in words 3 and 4.

Word	Normal Output Type Increment / Decrement Function	Timed Output Type Increment / Decrement Function
1	Output # (1 to 16)	Output # (1 to 16)
2	Setpoint # (1 to 8)	Must be 0
3	On Value (0 to Scale Factor – 1)	On Value (0 to Scale Factor – 1)
4	Off Value (0 to Scale Factor – 1)	Off Value (0 to Scale Factor – 1)
5	0	Time Value (0 to 9999ms)
6 to 145	Not used. These words will be "don't cares."	Not used. These words will be "don't cares."

Notes and Restrictions

1. The output must have been previously programmed by the appropriate PLC Output programming block before it can be modified.
2. Only Normal and Timed Outputs can be modified. Trying to Increment or Decrement a Pulsar type output will result in an Increment / Decrement Error. That is, bit 11 in Status Word 2 will be set.
3. The ON setpoint can only be changed by ¼ of the scale factor.
4. The OFF setpoint can only be changed by ¼ of the scale factor.
5. If both the ON and OFF setpoints are being changed in opposite directions, for example if the ON setpoint is decreased and the OFF setpoint is increased, than the combined changes of both setpoints cannot exceed ¼ of the Scale Factor.
6. You cannot modify a setpoint past an existing setpoint. For example, if the ON setpoint is initially less than the OFF setpoint, you cannot modify the ON setpoint so that it is greater than the OFF setpoint. However, it is possible to move a setpoint through the zero point, as long as the ¼ Scale Factor restriction is not exceeded.
7. Warning: Modifying an output setpoint that has not been previously programmed may affect existing ON/OFF setpoints. For example, modifying an unprogrammed setpoint 2 may affect setpoint 1's ON/OFF setpoints.
8. The Increment / Decrement feature must not be used to change one setpoint of two overlapping output dwells. The result will be two non-overlapping dwells that are a combination of the original and new setpoints.
9. A programming error will result if the Increment / Decrement function is used to change the timed output type from Position / Time to Time only, or vice versa.

Increment / Decrement Die Monitor Check Windows

This programming block is used to individually change the NX3A1E2-M's Die Monitor window On/Off setpoints. Each time the Transmit transitions from 0 to 1, the On/Off setpoint specified by word 1 and 2 will be changed to the new value located in words 3 and 4.

Word	Die Monitor Window Increment / Decrement Function
1	Output # (1 to 16)
2	Setpoint # (1 to 4)
3	On Value (0 to Scale Factor – 1)
4	Off Value (0 to Scale Factor – 1)
5	0
6 to 145	Not used. These words will be "don't cares."

Notes and Restrictions

1. The input must have been previously programmed by the Die Monitor programming block before it can be modified.
2. The ON setpoint can only be changed by ¼ of the scale factor.
3. The OFF setpoint can only be changed by ¼ of the scale factor.
4. If both the ON and OFF setpoints are being changed in opposite directions, for example if the ON setpoint is decreased and the OFF setpoint is increased, than the combined changes of both setpoints cannot exceed ¼ of the Scale Factor.
5. You cannot modify a setpoint past an existing setpoint. For example, if the ON setpoint is initially less than the OFF setpoint, you cannot modify the ON setpoint so that it is greater than the OFF setpoint. However, it is possible to move a setpoint through the zero point, as long as the ¼ Scale Factor restriction is not exceeded.
6. Warning: Modifying an output setpoint that has not been previously programmed may affect existing ON/OFF setpoints. For example, modifying an unprogrammed setpoint 2 may affect setpoint 1's ON/OFF setpoints.
7. The Increment / Decrement feature <u>must not be used</u> to change one setpoint of two overlapping input dwells. The result will be two non-overlapping dwells that are a combination of the original and new setpoints.

Forcing

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 4 will be set to indicate that the unit is in force mode.

Word	Force Function
1	Force On Control Word
2	Force Off Control Word
3 to 145	Not used. These words will be "don't cares."

Notes on Forcing

1. Each bit in the Force Control Words represents an output. Bit 0 represents output 1, bit 1 represents output 2 … bit 15 represents output 16.
2. 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.
3. It is not necessary to program the outputs before the force will take effect.
4. Cycling power to the unit takes the module out of force mode.
5. Transmitting any of the other programming blocks to the Nexus unit will take the unit out of force mode.
6. Outputs that have been forced on will remain on even if the unit is in transducer fault.

Strain Gauge Configuration

Note 1: Programming the Resolver & Setup data with firmware version 3.1 or lower will always clear the Strain Gauge programming.

With firmware version 3.2 or higher (7/2013), programming the Resolver and Setup data without making any changes, or only changing the Fault Output Control Word or the Counting Type, will not clear the Strain Gauge programming. Making changes to any of the other Resolver and Setup parameters will still clear the Strain Gauge programming.

Note 2: The minimum required information when programming the Strain Gauge Configuration is the Sample Window, the Machine Rating, and Channel 1 and 2 tonnage limits.

Note 3: All Channel 3 and 4 parameters must be set to zero on applications where only two Strain Gauges are being used. The Invalid Parameter error in the Strain Gauge status word will be set if these parameters are not zero.

Note 4: Set any unused parameters to zero to disable the function. For example, resetting the Calibration Values in words 68 to 83 will disable the Quick Calibration Function.

Note 5: All sample and data windows are based on the resolver's Scale Factor parameter programmed in the Resolver & Setup programming block.

Note 6: Output words 9 to 15 must ALL be set to zero to disable the Derating Curve function.

<table>
<tr><th>Word</th><th>Function</th></tr>
<tr><td>1</td><td>Configuration Bits
Bit 0: 0 = 2 channels, 1 = 4 channels
Bits 1 to 2: Zero Integration Time

Bit 2 Bit 1 Time
0 0 0.5 seconds
0 1 1.0 seconds
1 0 1.5 seconds
1 1 2.0 seconds

Bit 3: 0 = Automatic Zero Adjustment outside the sample window;
1 = No change of Zero value
Bits 4 to 6: Resolver Position over which the 0 to 10Vdc Analog Output will be active

Bit 6 Bit 5 Bit 4 Location
0 0 0 Complete turn
0 0 1 Data Window 1
0 1 0 Data Window 2
0 1 1 Data Window 3
1 0 0 Data Window 4
1 0 1 Sample Window
1 1 0 Reserved
1 1 1 Reserved
Bits 8 to 10: Averaging number for the 50uS-samplings of Strain Gauge data

Bit 8 Bit 9 Bit 10 Averaging
0 0 0 2^7 (128) times (default)
0 0 1 2^6 (64) times
0 1 0 2^5 (32) times
0 1 1 2^4 (16) times
1 0 0 2^3 (8) times
1 0 1 2^2 (4) times
1 1 0 2^1 (2) times
1 1 1 2^0 (1) time direct reading

Bits 7, 11 to 15: reserved, must be zero</td></tr>
<tr><td>2</td><td>Start Sample Window
((20 * Scale Factor)/360) to 1/2(Scale Factor)</td></tr>
</table>

3	End Sample Window 1/2(Scale Factor)/360) to ((340 * Scale Factor)/360)
4	Machine Rating (# of channels to 10,000), can include an implied decimal point)
5	Channel 1 Alarm Masks **(0=disable the alarm, 1=enable the alarm)** Bit 0 = Channel Low Alarm. Bit 1 = Channel High Alarm Bit 2 = Channel Reverse Alarm Bits 3 to 7 = Reserved for future use Bit 8 = Data Window 1 Low Alarm Bit 9 = Data Window 1 High Alarm Bit 10 = Data Window 2 Low Alarm Bit 11 = Data Window 2 High Alarm Bit 12 = Data Window 3 Low Alarm Bit 13 = Data Window 3 High Alarm Bit 14 = Data Window 4 Low Alarm Bit 15 = Data Window 4 High Alarm
6	Channel 2 Alarm Masks (see Channel 1 Alarm Masks)
7	Channel 3 Alarm Masks (see Channel 1 Alarm Masks)
8	Channel 4 Alarm Masks (see Channel 1 Alarm Masks)
9	Derating Curve, Percent Machine Capacity at the 90 degree position Range = 1 to 1250 (0 to disable the Derating Curve Function)
10	Derating Curve, Percent Machine Capacity at the 126.5 and 233.5 degree position. Range = 1 to 1250 (0 to disable the Derating Curve Function)
11	Derating Curve, Percent Machine Capacity at the 149 and 211degree position Range = 1 to 1250 (0 to disable the Derating Curve Function)
12	Derating Curve, Percent Machine Capacity at the 163 and 197 degree position Range = 1 to 1250 (0 to disable the Derating Curve Function)
13	Derating Curve, Percent Machine Capacity at the 171.5 and 188.5 degree position. Range = 1 to 1250 (0 to disable the Derating Curve Derating Curve Function)
14	Derating Curve, Percent Machine Capacity at the 177 and 183 degree position Range = 1 to 1250 (0 to disable the Derating Curve Function)
15	Derating Curve, Percent Machine Capacity at the 180 degree position Range = 1 to 1250 (0 to disable the Derating Curve Function)
16	Channel 1 Low Limit expressed as actual tonnage (0 to (Machine Rating / # of Channels) * 1.25)
17	Channel 1 High Limit expressed as actual tonnage ((Low Limit + 1) to (Machine Rating / # of Channels) * 1.25)
18	Channel 1 Reverse Limit expressed as actual tonnage (–(Machine Rating / # of Channels) to 0)
19	Channel 2 Low Limit expressed as actual tonnage (0 to (Machine Rating / # of Channels) * 1.25)
20	Channel 2 High Limit expressed as actual tonnage ((Low Limit + 1) to (Machine Rating / # of Channels) * 1.25)
21	Channel 2 Reverse Limit expressed as actual tonnage (–(Machine Rating / # of Channels) to 0)

22	Channel 3 Low Limit expressed as actual tonnage (0 to (Machine Rating / # of Channels) * 1.25)
23	Channel 3 High Limit expressed as actual tonnage ((Low Limit + 1) to (Machine Rating / # of Channels) * 1.25)
24	Channel 3 Reverse Limit expressed as actual tonnage (–(Machine Rating / # of Channels) to 0)
25	Channel 4 Low Limit expressed as actual tonnage (0 to (Machine Rating / # of Channels) * 1.25)
26	Channel 4 High Limit expressed as actual tonnage ((Low Limit + 1) to (Machine Rating / # of Channels) * 1.25)
27	Channel 4 Reverse Limit expressed as actual tonnage (–(Machine Rating / # of Channels) to 0)
28	Data Window 1 On Position Setpoint (in Scale Factor based resolver counts) (Must be contained within the programmed Sample Window Limits)
29	Data Window 1 Off Position Setpoint (in Scale Factor based resolver counts) (Data Window On to End of Sample Window)
30	Channel 1, Data Window 1, low limit (Channel 1 Reverse Limit to Channel 1 High Limit)
31	Channel 1, Data Window 1, high limit (Channel 1 Data Window Low Limit + 1) to (Channel 1 High Limit)
32	Channel 2, Data Window 1, low limit (Channel 2 Reverse Limit to Channel 2 High Limit)
33	Channel 2, Data Window 1, high limit (Channel 2 Data Window Low Limit + 1) to (Channel 2 High Limit)
34	Channel 3, Data Window 1, low limit (Channel 3 Reverse Limit to Channel 3 High Limit)
35	Channel 3, Data Window 1, high limit (Channel 3 Data Window Low Limit + 1) to (Channel 3 High Limit)
36	Channel 4, Data Window 1, low limit (Channel 4 Reverse Limit to Channel 4 High Limit)
37	Channel 4, Data Window 1, high limit (Channel 4 Data Window Low Limit + 1) to (Channel 4 High Limit)
38	Data Window 2 On Position Setpoint (in Scale Factor based resolver counts) (Must be contained within the programmed Sample Window Limits)
39	Data Window 2 Off Position Setpoint (in Scale Factor based resolver counts) (Data Window On to End of Sample Window)
40	Channel 1, Data Window 2, low limit (Channel 1 Reverse Limit to Channel 1 High Limit)
41	Channel 1, Data Window 2, high limit (Channel 1 Data Window Low Limit + 1) to (Channel 1 High Limit)
42	Channel 2, Data Window 2, low limit (Channel 2 Reverse Limit to Channel 2 High Limit)
43	Channel 2, Data Window 2, high limit (Channel 2 Data Window Low Limit + 1) to (Channel 2 High Limit)
44	Channel 3, Data Window 2, low limit (Channel 3 Reverse Limit to Channel 3 High Limit)
45	Channel 3, Data Window 2, high limit (Channel 3 Data Window Low Limit + 1) to (Channel 3 High Limit)

46	Channel 4, Data Window 2, low limit (Channel 4 Reverse Limit to Channel 4 High Limit)
47	Channel 4, Data Window 2, high limit (Channel 4 Data Window Low Limit + 1) to (Channel 4 High Limit)
48	Data Window 3 On Position Setpoint (in Scale Factor based resolver counts) (Must be contained within the programmed Sample Window Limits)
49	Data Window 3 Off Position Setpoint (in Scale Factor based resolver counts) (Data Window On to End of Sample Window)
50	Channel 1, Data Window 3, low limit (Channel 1 Reverse Limit to Channel 1 High Limit)
51	Channel 1, Data Window 3, high limit (Channel 1 Data Window Low Limit + 1) to (Channel 1 High Limit)
52	Channel 2, Data Window 3, low limit (Channel 2 Reverse Limit to Channel 2 High Limit)
53	Channel 2, Data Window 3, high limit (Channel 2 Data Window Low Limit + 1) to (Channel 2 High Limit)
54	Channel 3, Data Window 3, low limit (Channel 3 Reverse Limit to Channel 3 High Limit)
55	Channel 3, Data Window 3, high limit (Channel 3 Data Window Low Limit + 1) to (Channel 3 High Limit)
56	Channel 4, Data Window 3, low limit (Channel 4 Reverse Limit to Channel 4 High Limit)
57	Channel 4, Data Window 3, high limit (Channel 4 Data Window Low Limit + 1) to (Channel 4 High Limit)
58	Data Window 4 On Position Setpoint (in Scale Factor based resolver counts) (Must be contained within the programmed Sample Window Limits)
59	Data Window 4 Off Position Setpoint (in Scale Factor based resolver counts) (Data Window On to End of Sample Window)
60	Channel 1, Data Window 4, low limit (Channel 1 Reverse Limit to Channel 1 High Limit)
61	Channel 1, Data Window 4, high limit (Channel 1 Data Window Low Limit + 1) to (Channel 1 High Limit)
62	Channel 2, Data Window 4, low limit (Channel 2 Reverse Limit to Channel 2 High Limit)
63	Channel 2, Data Window 4, high limit (Channel 2 Data Window Low Limit + 1) to (Channel 2 High Limit)
64	Channel 3, Data Window 4, low limit (Channel 3 Reverse Limit to Channel 3 High Limit)
65	Channel 3, Data Window 4, high limit (Channel 3 Data Window Low Limit + 1) to (Channel 3 High Limit)
66	Channel 4, Data Window 4, low limit (Channel 4 Reverse Limit to Channel 4 High Limit)
67	Channel 4, Data Window 4, high limit (Channel 4 Data Window Low Limit + 1) to (Channel 4 High Limit)
68	Quick Calibration Value 1 (user copies from input word 94, set to zero to disable the Quick Calibration function)
69	Quick Calibration Value 2 (user copies from input word 95, set to zero to disable the Quick Calibration function))

70	Quick Calibration Value 3 (user copies from input word 96, set to zero to disable the Quick Calibration function)
71	Quick Calibration Value 4 (user copies from input word 97, set to zero to disable the Quick Calibration function)
72	Quick Calibration Value 5 (user copies from input word 98, set to zero to disable the Quick Calibration function)
73	Quick Calibration Value 6 (user copies from input word 99, set to zero to disable the Quick Calibration function))
74	Quick Calibration Value 7 (user copies from input word 100, set to zero to disable the Quick Calibration function)
75	Quick Calibration Value 8 (user copies from input word 101, set to zero to disable the Quick Calibration function)
76	Quick Calibration Value 9 (user copies from input word 102, set to zero to disable the Quick Calibration function)
77	Quick Calibration Value 10 (user copies from input word 103, set to zero to disable the Quick Calibration function))
78	Quick Calibration Value 11 (user copies from input word 104, set to zero to disable the Quick Calibration function)
79	Quick Calibration Value 12 (user copies from input word 105, set to zero to disable the Quick Calibration function)
80	Quick Calibration Value 13 (user copies from input word 106, set to zero to disable the Quick Calibration function)
81	Quick Calibration Value 14 (user copies from input word 107, set to zero to disable the Quick Calibration function))
82	Quick Calibration Value 15 (user copies from input word 108, set to zero to disable the Quick Calibration function)
83	Quick Calibration Value 16 (user copies from input word 109, set to zero to disable the Quick Calibration function)
84 to 145	Not used. These words will be "don't cares."

Strain Gauge Calibration

There are two ways to calibrate the Strain Gauge Inputs of the NX3A1E2-M. One is a Quick Calibration and the other is a Full Calibration.

Strain Gauge Quick Calibration

The Quick Calibration can only be performed after a Full Calibration has been performed. During a Full Calibration, the NX3A1E2-M will generate the Quick Calibration values and place them in input registers 94 to 109. If for some reason the NX3A1E2-M needs to be replaced, these values can be placed in output registers 68 to 83, and sent to the NX3A1E2-M as part of the Strain Gauge Configuration programming block. Setting registers 68 to 83 to zero will disable the Quick Calibration function.

Strain Gauge Full Calibration

Two separate programming blocks, Zero Offset and a Gain Calibration, will be used to calibrate the press. The Full Calibration will require the following steps.

1 Send the Strain Gauge Zero Offset programming block to the NX3A1E2-M to measure strain gauge outputs unloaded.

Note: This measurement operation will be repeated, and the measured values averaged together, until the press starts moving.

2 Run the press, allowing the NX3A1E2-M to determine and report the peak forward tonnage in input words 64 to 67.

3 Transfer these measured tonnage values, along with the desired tonnage values, into output registers 1 to 8. Set the programming block bit pattern and transmit bit to send this information to the NX3A1E2-M as part of the Strain Gauge Gain Calibration programming block. The unit will adjust the gain and calculate and place Quick Calibration Values in input words 94 to 109.

4 Repeat the previous three steps until the press is properly calibrated.

Strain Gauge Zero Offset (Strain Gauge Sensors unloaded)

Word	Function
0	Transmit Bit and Zero Offset Calibration Bit pattern
1 to 145	Not used. These words will be "don't cares."

Strain Gauge Gain Calibration (After the press has been cycled and the peak forward tonnage measured)

Word	Function
0	Transmit Bit and Strain Gauge Gain Calibration Bit Pattern
1	Channel 1 actual forward peak tonnage (must equal input word 64)
2	Channel 1 desired forward peak tonnage (cannot exceed channel 1 rating)
3	Channel 2 actual forward peak tonnage (must equal input word 65)
4	Channel 2 desired forward peak tonnage (cannot exceed channel 2 rating)
5	Channel 3 actual forward peak tonnage (must equal input word 66)
6	Channel 3 desired forward peak tonnage (cannot exceed channel 3 rating)
7	Channel 4 actual forward peak tonnage (must equal input word 67)
8	Channel 4 desired forward peak tonnage (cannot exceed channel 4 rating)
9 to 145	Not used. These words will be "don't care."

The following jumper settings are required for Strain Gauge functionality. These jumpers are located on the bottom board and will be installed at the factory.

JP1, JP3, JP4, JP5, JP11, JP15, JP16, and JP17. These are all three pin headers and the jumper strap must be installed on pins 2 and 3. JP7 must be removed for Strain Gauge functionality.

Reading Signature Data with Message Instruction

The NX3A1E2-M measures the current tonnage value every 250µs. Based on these readings, a Signature Analysis profile is generated made up of 360 values, one for every one degree of travel of the resolver's shaft for each strain gauge channel.

The Signature Analysis value is transferred as a percentage of the Machine Rating.

- A value of 109 indicates an unloaded press
- A value of 159 indicates a 50% load reading
- A value of 229 indicates a 120% load reading
- A value of 59 indicates a -50% load reading

If the press is moving slowly enough, the NX3A1E2-M will average the multiple values captured at each position value together.

The NX3A1E2-M reports its Signature Analysis data for the last full cycle of the press. That is, if you read the data in the middle of a cycle, it will send the collected data from the previous cycle.

The Signature Analysis profile is stored in the NX3A1E2-M's memory and is transferred to the PLC using a Message Instruction located in the Ladder Logic program. The following procedure shows how to create the Message Instruction.

1. Create the controller tag with the Message Data type.

   If the Controller Tags window is not already open, click on Logic in the menu bar and then click on Edit Tags... If the window is already open, you may need to click on the Edit Tags tab at the bottom of the window.

   At the bottom of the controller tags table is a blank row marked by an asterisk (*). In this row, enter the name for your new message controller tag in the Tag Name column. The name must begin with a letter.

   After you press the Enter key, the program assumes a controller tag type of Integer and jumps to a new controller tag name field. You must set the tag type to Message. With your mouse, move the cursor to the Type column of the message controller tag you are creating. When the field gets the program focus, you will see an ellipsis "..." button appear. Press this button. In the window that opens, scroll through the list and select Message. Click on OK to close the window.

2. Create the controller tags with the SINT Data Type

   In addition to the controller tag defined above, you also need to create a 360 byte tag array that will hold the Signature Data read from the NX3A1E2-M. These tags are defined in the same way as the Message Data type above with the following exceptions:

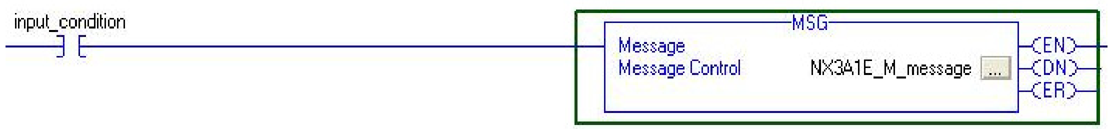
   Data type is **Short Integer (SINT)**.

   The number of bytes you associate with the tag is **360**. Choose Attribute 1, 2, 3 or 4 for reading 360 bytes of signature data for channel 1, 2, 3 or 4. Enter this value in the Dim 0 list box at the bottom of the window.

3. Add Message Instructions to Ladder Logic

The Message Instruction executes only when the rung makes a 0 to 1 transition. Therefore you must add some type of input condition to the Message Instruction rung.

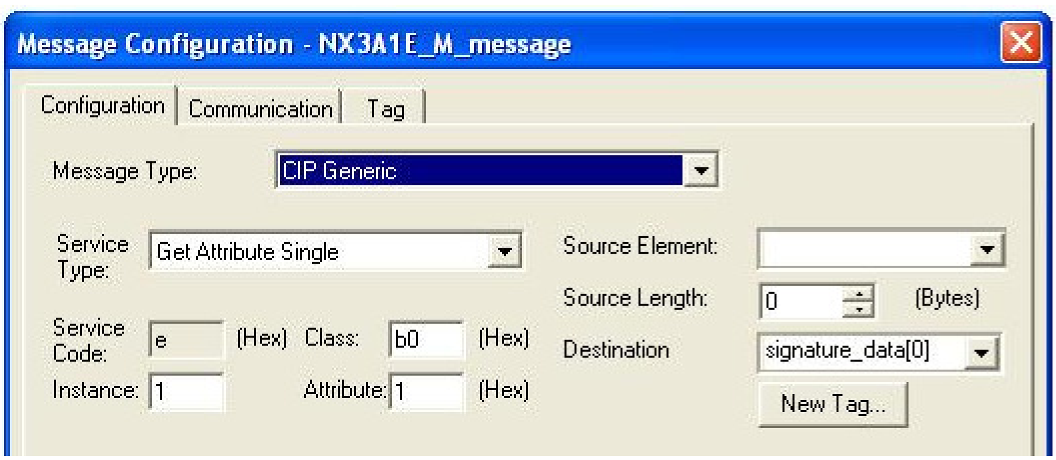
Open the ladder logic window that will contain the Message Instruction. Add your input condition(s). Add the Message Instruction. If you are using the Language Element toolbar, the Message icon is under the Input/Output tab. If you are entering instructions in the text bar that appears when you double click the rung, the mnemonic is MSG. If you enter the instruction this way, you can also enter the name of the message controller tag.



Before you can use the message instruction, you must configure it by clicking on the ellipsis "..." button.

4. Configure the Message Instruction

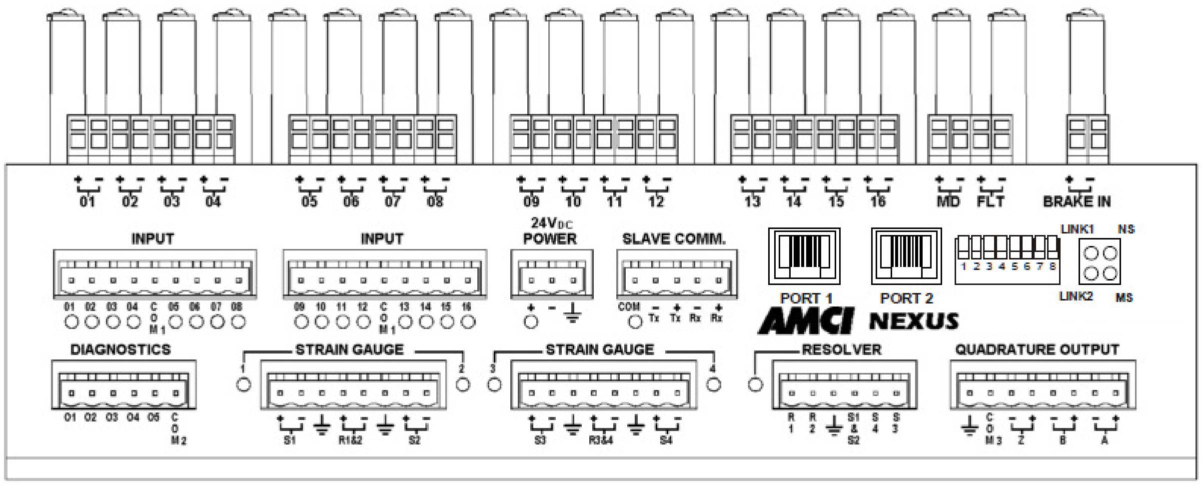
Once you click on the ellipsis button, the following Message Configuration window will appear. On the Configuration tab enter the following data into the fields:



Note: The value entered in the Destination Field will be the SINT tag array created in Step 2 above.

Click on the Communications tab in the Message Configuration window. You must then set the path parameter to point to the NX3A1E2-M unit. All of the remaining parameters, including everything under the Tag tab, can be left at their defaults. Click on OK to close the window.

Chapter 4: Specifications



LED Function

LED	Pattern	Meaning
Power	Off On Solid Green Red-Green-Red-Green-Off Green-Red-Off	NX3A1E2-M not functioning Unit passed power up checks Relay board not detected Ethernet board not detected
Strain Gauge 1 to 4	Off Solid Green Blinking Green Solid Red Blinking Red	Strain Gauge Configuration Not Programmed Measured value inside limits Measured value outside of limits Sensor Fault or Resolver in Transducer Fault Calibration Error or Input Voltage outside of calibrated range
Resolver	Solid Green Blinking Green Blinking Red Solid Red Off	Resolver connected, no motion Resolver connected, motion occurring Clearable Transducer Fault Non-Clearable Transducer Fault Unit operating in Slave Mode
Slave Communication	Solid Green Blinking Green Blinking Red Solid Red Off	Serial connection OK, no motion Serial connection OK, motion occurring Clearable Transducer Fault Non-Clearable Transducer Fault Unit operating in Master Mode
Inputs	Off On Orange	

Module Status (MS) LED

The Module Status LED is a bi-color red/green LED. The unit will blink the Module Status LED green during initialization. After initialization, the state of the LED depends on the state of the network adapter module.

LED State	EtherNet/IP Definition	Modbus TCP Definition	PROFINET Definition
Off	No Power	No Power	No power
Alternating Red/Green	Initializing: Power up Self-Test		
	Communications failure. There is a communications error between the main processor and the ethernet co-processor within the unit. You must cycle power to the NX2A4E2 to attempt to clear this fault.		
Flashing Green	Initializing: Waiting for valid physical connection to the network.		
Steady Green	Module and Network are operational.		Device Name or IP Address are set.
Flashing Red	Initializing: IP Address conflict		Initializing: Device Name or IP Address are not set.
	If the Network Status LED is also flashing, the IP Address or Network Protocol has been changed. Cycle power to the unit to continue. If the Network Status LED is in any other state, a write to flash memory has failed. Cycle power to the unit to clear this fault.		

Network Status (NS) LED

The Network Status LED is a bi-color red/green LED. The state of this LED depends on the network Protocol that the NX3A1E2-M is configured for.

LED State	EtherNet/IP Definition	Modbus TCP Definition	PROFINET Definition
Off	No Power	No power or no TCP connections	No power, duplicate IP address on the network, mismatch in Device Name, or no connection to IO Controller.
Alternating Red/Green	Power up Self-Test	Power up Self-Test	Power up Self-Test
Blinking Green	Ethernet connection, but no CIP connections	Indicates number of connections with 2 second delay between group. The NX2A4E2 supports up to five concurrent connections.	On-line, Stop state. A connection with the IO Controller is established and it is in its STOP state.
Steady Green	Valid Ethernet network and CIP connections	Not Implemented	On-line, Run state. A connection with the IO Controller is established and it is in its RUN state.
Blinking Red	If the MS LED is steady green: Network Connection Timeout	Not Implemented	Not Implemented
	If the MS LED is blinking green: IP Address or Network Protocol changed: Cycle power		
Steady Red	Duplicate IP address on network.		Not Implemented.

Table R1.4 Network Status LED States

Link1 and Link2 LEDs

These are the Link Activity LEDs for the two ports. They are amber LEDs that are on when a valid hardware connection exists on the port and blinking when data is being transferred over the link.

Power Supply

- 670 mA @ 24Vdc (Does not include load on Strain Gauges)
- 10 to 30Vdc. However, for proper relay operations, an 18 to 30Vdc supply is recommended.
- A separate power supply that is not powering any other of the press control devices is recommended.

Resolver Reference Voltage

- 2Vrms, 4KHz

Die Monitor Inputs:

- The NX3A1E2-M has 16 discrete sourcing inputs. To make the input active, simply connect it to the common terminal in the middle of the input connector(s). **Applying power to the input will damage the circuitry**.
- Each input sources 0.5 mA of current.
- When the input is active, the corresponding Input LEDs will be lit orange.
- Inputs 1 to 4 are High Impedance Inputs and are specified at 10 KΩ closed and 160 KΩ open.
- Inputs 5 to 16 are Low Impedance inputs and are specified at 2 KΩ closed and 35 KΩ open.
- The inputs are scanned every 500 µs.

Strain Gauge Inputs

- Reference Voltage = 5 Vdc
- Current Supplied = 100 mA maximum
- Unused Inputs should have the two pins tied together.

Brake Input

- The Brake Function will occur when the input transitions from ON to OFF.
- 15mA @ 24Vdc Required (Input Relay Dependent)

Quadrature Outputs

- Fixed at 4096 cycles (A and B pulses) per turn
- Drive Capability = 30mA Differential
- One Z pulse per revolution that is approximately half the width of the A and B pulses
- The Z pulse occurs at the electrical zero point of the resolver, not at the resolver position data that can be offset.

Diagnostic Analog Outputs

- Output 1 is a 0 to 10V analog output that can be programmed to output its full range over one complete turn, the Sample Window, or any of the four Data Windows.
- Output 1 can supply 80mA of current.
- Outputs 2 to 5 will be approximately -4Vdc to +4.75Vdc outputs and will be proportional to the signals measured on Strain Gauge Inputs 1 to 4. These outputs will continue to function even if there is a calibration error. At full scale, these outputs will be at about 3.8Vdc.
- A soft gain was introduced with firmware version 3.3 in April 2014 because the signals feeding the strain gauge inputs were significantly less than what the NX3A1E2-M was designed to work with. This additional amplification is done outside of the hardware that feeds the analog diagnostics outputs and is the reason that the voltage on the diagnostics outputs will be lower than the expected full scale value when the extra soft gain is being utilized.

  You will see 3.8V on the diagnostics outputs when there is no soft gain (i.e. soft gain = 1). When the soft gain is more than 1, the soft gain is represented by the QuickCal4 value, soft gain = QuickCal4/256.

  For example, if the soft gain is 3.5, then you will see voltages on the diagnostics outputs that are about 3.5 times lower than expected.

Environmental Specifications:

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

Throughput Time:

- The PLS outputs are updated every 50µs.
- The Die Monitor Inputs are updated every 500µs.

Fault Output:

- Standard Relay Output
- On = No Fault Condition Exists, Off = Fault Condition Exists
- There is a 50ms delay at power up before the relay activates indicating that no fault exists.

Product Code and Product Type

The NX3A1E2-M has a Product Code of 17 (16#0011) and a Product Type of 12 (16#000C).

WARNING The NX3A1E2-M may lose communication with a 10Mb/sec network.

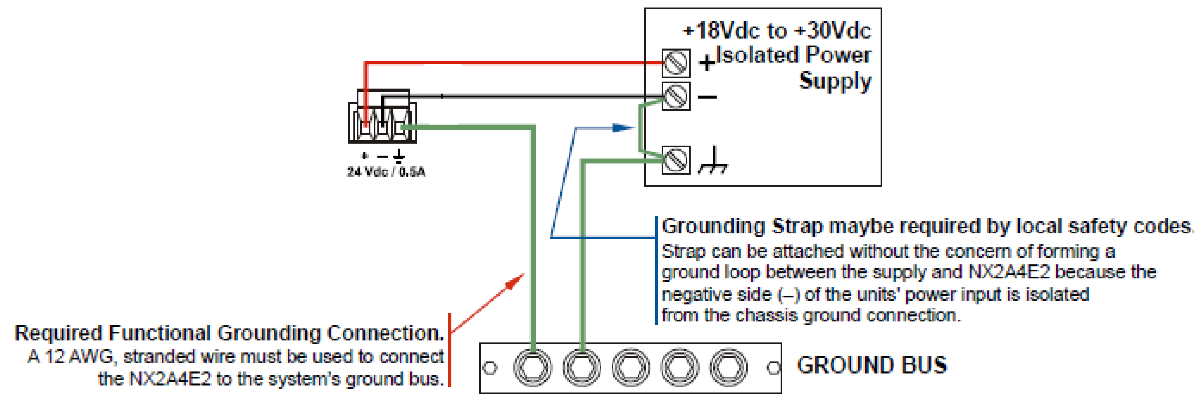
Chapter 5: Installation and Setup

Power Wiring and Grounding

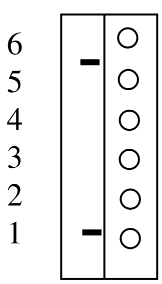
The NX3A1E2-M accepts 24 Vdc as its input power. The input range is 10 to 30Vdc with 18 to 30 Vdc recommended.

The three pin power connector is located in the middle of the unit. Power connections should be tight, as loose connections may lead to arcing which will heat the connector. Phoenix Contact specifies a tightening torque of 4.4 to 5.4 lb-in (0.5 to 0.6 Nm).

The power supply is connected to the pins marked "+" and "–". The ground pin is used to attach the NX2A4E2 to earth ground. The use of a 12 AWG, stranded wire for the earth ground connection is strongly recommended.



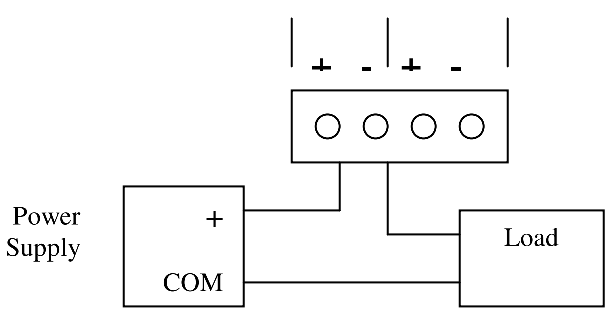
Resolver Connector



Pin	Signal	Belden 9730 wire color
6	S3	Black (White)
5	S4	Green
4	S1 & S2	Black (Green) & White
3	Shields	
2	R2	Red
1	R1	Black (Red)

Solid State Relay Wiring

Each Relay output has two terminals. One is labeled "+" and the other labeled "-". Connect your power supply to the "+" terminal the load to the "–"terminal.

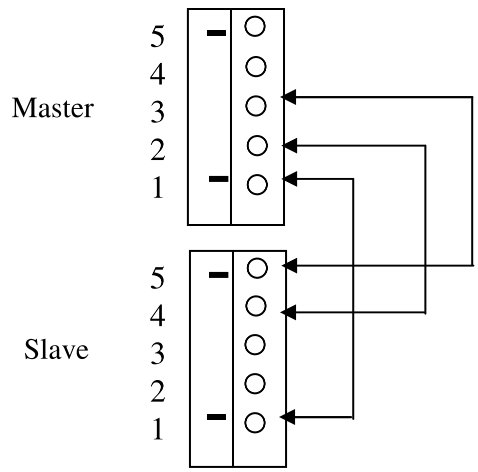


Slave Mode Wiring

The NX3A1E2-M can operate either as a Master or as a Slave. In this mode, the Master NX3A1E2-M uses a serial link to send the encoder data to a Slave NX3A1E2-M. This increases the number of outputs that can be controlled from one resolver. The following tables and diagram show how to connect the Master and Slave units together.

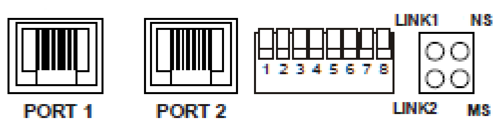
Connector for Slave Communication

Pin Number	Function
1	Isolated Ground
2	- TxD
3	+ TxD
4	- RxD
5	+ RxD



Network Connections

As shown in the following image, the NX3A1E2-M has two Ethernet ports. An internal two port Ethernet switch connects the two. In non-redundant applications, either port can be used to attach the module to the network. The remaining port can be used to extend the network to another device if this would reduce wiring costs.



In Device Level Ring applications, the NX3A1E2-M modules function as Beacon-Based Ring Nodes. In these applications, both ports are used when wiring the ring, daisy chaining from one unit in the ring to the next.

In Media Redundancy Protocol applications, the NX3A1E2-M modules function as a Media Redundancy Client (MRC). In these applications, both ports are used when wiring the ring, daisy chaining from one unit in the ring to the next.

Chapter 6: Changing the Ethernet IP Address

There are three methods to change the IP address of the NX3A1E2-M unit.

1. Dip Switches
2. Using the Embedded Web Server
3. Using AMCI's Ethernet Configuration Software

Using the Dip Switches

When using the DIP switches, a switch in its ON position represents a logic '1'. Physically, the switch is pushed "down". A logic '0' is when the switch is in its OFF position, (pushed up).

When all of the DIP switches are in their logic '1' position, (ON), the NX3A1E2-M will use the IP address it has stored in flash memory. When all of the switches are in their logic '0' position, (OFF), the NX3A1E2-M will start searching for a DHCP server on power up.

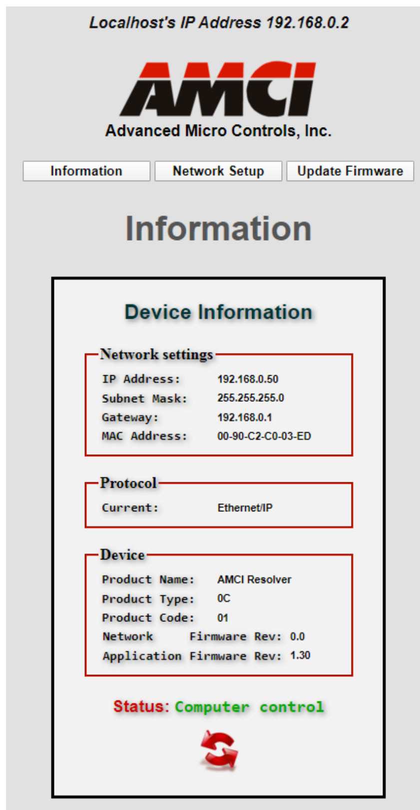
- When the eight DP switches are set to any other ON/OFF combination, these switches set the lowest octant of the IP address.
- Switch 1, which is the closest to Port 2, is the *Most Significant Bit*. Switch 8, which is closest to the Status LED's, is the *Least Significant Bit*.
- As an example, '50' equals '0011 0010' in binary. To program this value into the NX3A1E2-M, set switches 3, 4, 7 to their ON position, and all other switches to their OFF position.
- When using the dip switches the upper three octets of the IP address use what is saved in the NX3A1E2-M's memory.
- If the dip switches are set to a value between 1 and 254, the upper three octets of the IP address can be changed using either of the methods described below, but the lowest octet must match what is set by the dip switches. For example, with the switches set to an address of 50, one of the programming methods can be used to change the IP address from 192.168.0.50 to 192.168.1.50.

Changing the Ethernet IP Address using the embedded Web Server

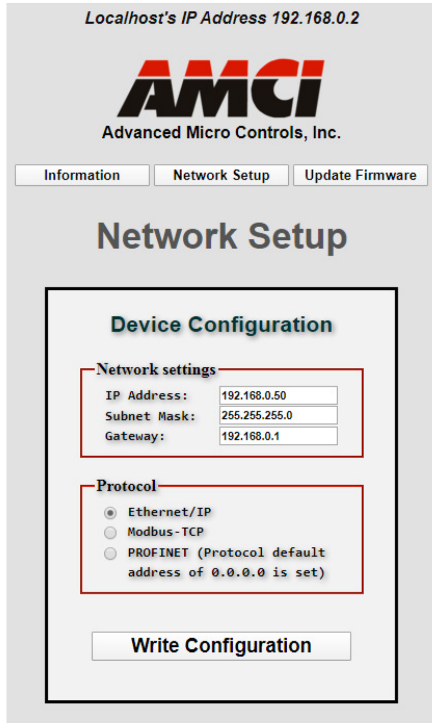
Set all of the dip switches to the ON, down, position if you want to change all four octets of the IP address.

As described above, set the dip switches to a value between 1 and 254 if you want to use the embedded web server to change only the first three octets of the IP address.

The internal HTML pages should work with any browser. Once your web browser is running, enter the present IP address of the NX3A1E2-M into the address bar. The default address is 192.168.0.50. The unit will respond with the following page. Note that the Product Name and Firmware Version number may be different.



Click on the [Network Setup] button to switch to the Network Setup page shown below. This page shows the current IP address settings, as well as the configured protocol.



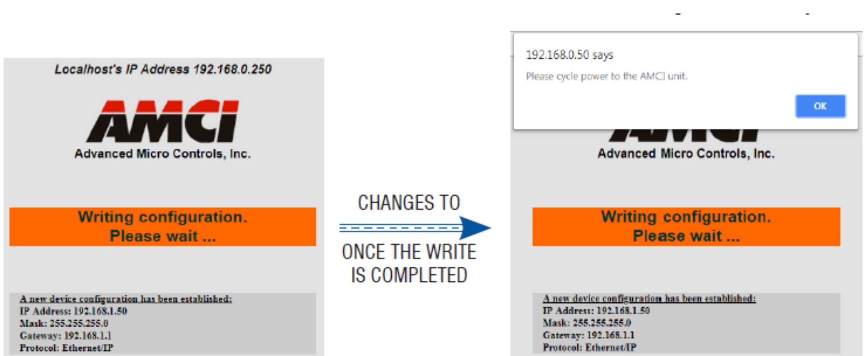
Enter your desired values into the IP Address, Subnet Mask, and Default Gateway fields.

The Default Gateway setting is not optional! It must be set to a valid address on the chosen subnet. Because the Default Gateway is often not used in device level networks, if you do not have a defined value for it, AMCI suggests setting the Default Gateway to the IP address of your host controller.

If need be, click on the proper radio button to select the required protocol. <u>Please note that Modbus TCP cannot be used by the NX3A1E2-M.</u>

Click on the [Write Configuration] button to write the new configuration to the unit. If there are any errors with the data, the unit will display a warning message instead of accepting the new values.

If the values are accepted, the following pages will be displayed while the data is being written to the unit.



Wait for the pop up window to appear before cycling power to the NX3A1E2-M. Cycling power before this window appears may corrupt the non-volatile memory of the NX3A1E2-M. The NX3A1E2-M will also flash the Network Status LED red to indicate that power must be cycled.

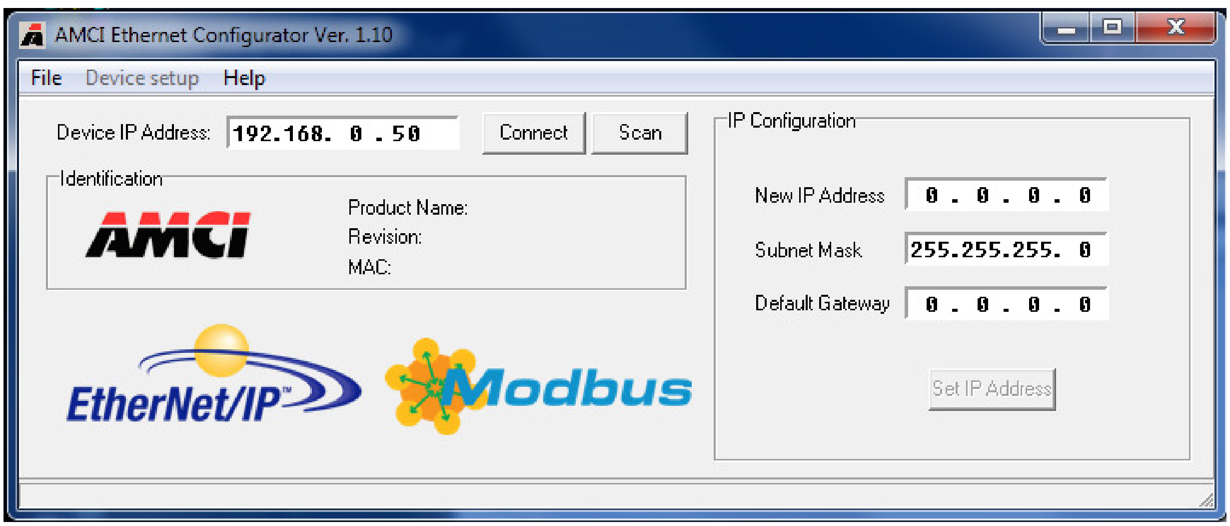
Once instructed to, cycle power to the unit. You can now enter the new IP address into the address bar of your web browser to reconnect with the NX3A1E2-M.

Changing the Ethernet IP Address using AMCI's Ethernet Configuration software

The AMCI Ethernet Configurator utility is available on our website, ***www.amci.com***. The latest version available should be used. It can be found in our *Support* section under *Software*. The program exists as a ZIP file, and at the time of this writing, the link was "AMCI Ethernet Configuration Software."

1. Download, extract, and run the **AMCI Ethernet Configuration software** from AMCI's website.

   The following window will open.



2. The NX3A1E2-M units ship with a default IP address of 192.168.0.50.

   Set all of the dip switches to the ON, down, position if you want to change all four octets of the IP address.

   As described above, set the dip switches to a value between 1 and 254 if you want to use this software to set only the first three octets of the IP address.

3. Set the Ethernet Port of your PC to be on the same network as the current address IP address of your NX3A1E2-M unit. It may be necessary to disable your PC's firewall.
4. Enter the NX3A1E2-M current IP address in the "Device IP Address" field.

5. 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.
6. Enter the desired IP address, subnet mask, and 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.

7. Click the Set IP Address button. An “IP configuration written successfully” window will be displayed. Click on OK to close this window.
8. Click on Disconnect.
9. Remove power from the NX3A1E2-M. The NX3A1E2-M will not use the new IP address until power has been cycled.

Setup Example

Configuring AMCI NX3A1E2-M with RSLogix 5000

1. Set the IP address of the NX3A1E2-M.
2. Open an existing or create a new RSLogix 5000 program.
3. From the project tree, right click on the Ethernet scanner with which the NX3A1E2-M will be used.
4. Select New Module.
5. Select ETHERNET-MODULE Generic Ethernet Module from the list that appears and click on OK.
6. In the module properties that appear, enter the following parameters.

   Name: *Your Choice* (must begin with a letter)
   Comm Format: *Data-INT* (must be changed from the default Data-DINT to Data-INT)
   IP Address: Must match the address set with the BootP server or the dip switches

   Connection Parameters

	Assembly Instance	Size
Input	**100**	**112**
Output	**150**	**146**
Configuration	**110**	**0**

7. Click on OK. The Connection Parameter window will open.
8. Select the RPI time. The minimum time for the NX3A1E2-M is 3ms.
9. Click on OK.
10. Save and download the program to the PLC.
11. While online with the PLC, right click on the scanner and select Properties.
12. 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**
    Subnet Mask: **255.255.255.0**

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

Chapter 7: Specification Revision History

Version 0.1 was the initial release of the specifications.

Version 0.2 was released on 11/1/06. The following changes were made.

- Added a table of contents
- Changed the maximum scale factor to 1024 counts per turn
- Reduced the number of output words used from 153 to 72
- Changed the programming control word. A binary bit pattern is now used to determining the programming block
- Outputs and Inputs are now programmed one On/Off setpoint at a time
- Force and Increment and Decrement functions were added
- Ethernet Configuration added

Version 0.3 was released on 1/16/07. The following changes were made.

- The scale factor value in the Resolver Setup data was incorrectly left at 8192 in version 0.2. This was changed to the correct value of 1024.
- Returned to programming all of the inputs and output setpoints at one time. However, two programming cycles will still be required to program all 16 outputs.
- Increased number of output words from 72 to 146.
- Removed separate On/Off Advance values. The same value now affects both the On and Off setpoints.
- Note added that the dedicated Quadrature output is not affected by the resolver count direction parameter programmed in the Resolver Setup Data.
- Added Strain Gauge Quick Calibration values to input registers 94 to 97.

Version 0.4 was released on 2/19/07. The following changes were made.

- Because there was no discernable function, the Module Fault bit, Status Word 1 bit 3, was removed.
- A new status bit, Status Word 1 bit 14, was created to indicate when an unused bit has been set in the Resolver Bit Level Setup word.
- The programming structure for Time and Pulsar outputs was added to the PLS Dwell (output) programming block
- The precision of the Strain Gauge dwell windows was changed from 3600 to the programmed Scale Factor value.
- The save in Flash Memory programming was changed from a bit to a programming block bit pattern.
- The Reference Voltage Programming instruction was removed.
- The Strain Gauge quick calibration values, which are determined during a full calibration cycle, were added to input words 94 to 97.
- The Strain Gauge Full calibration procedure was reduced to two programming cycles, one for the Zero Offset and One for determining the gain.
- The Product Code and Product Type was added to the specifications.
- Removed the Monitor Press bit.

Version 0.5 was released on 2/23/07. The following changes were made.

- Added a section on Parameter Overview
- Added hardware overview
- Removed the number of Data Windows programming from the Strain Gauge configuration
- The location of Zero Integration time setup bits was moved
- Valid ranges added to Strain Gauge programming words

Version 0.6 was released on 3/14/07. The following changes were made.

- The number of input words was changed from 100 to 104.
- Details added to the parameter overview section
- Information added on the Analog Outputs
- The four Zero Integration time options were modified.
- Details added to what will cause the status bits to be set.
- Detail that Die Monitor inputs are true when connected to GND, and false when open, was added.
- The Strain Gauge Total alarm was moved out of the channel alarm words to the Strain Gauge Status word.
- Hardware errors were added to the Strain Gauge alarm words.
- The number of Quick Calibration words was increased from 4 to 8.
- Analog Output range selection was added to the Strain Gauge configuration programming block.
- Strain Gauge LED functions changed
- Input and Output specifications added

Version 0.7 was released on 5/8/07. The following changes were made.

- A note was added that to function correctly, the minimum dwell time for timed outputs must be at least 1.5ms.
- A Programming Block for Incrementing and Decrementing the Die Monitor check windows was added.
- A note that the Increment / Decrement function must not be used on overlapping on/off setpoint pairs was added.
- The Zero Integration Time options were changed to 0.5, 1.0, 1.5, and 2.0 seconds.
- The Derating Curve is now symmetrical around the 180 degree point, up to the end of the Sample Window.
- Channel Alarms are now reported at the end of the Sample Window.
- The function of the Low Channel Limit Alarm was changed so that it will only be set if the measured tonnage does not reach the programmed value during the Sample Window.
- A note was added that Data Window Alarms are reported immediately upon detection.
- The Data Window limits were changed. They are now based directly on the Channel Limits.
- Information on the Strain Gauge Calibration was added.
- A Strain Gauge Factory Calibration bit was added.
- Information was added to the Hardware Overview, specifically on the LED function and Strain Gauge inputs.

V0.8 was released on

- Information on how the Diagnostic Outputs function work was added

V1.0 was released on 1/14/2011.

- Specifications updated to reflect changes in firmware 3.1 release – improvement of the Strain Gauge functionality to allow for better measurement of small input signals (less than 1mV/V) and implementation of Signature Data capture.
- The number of Input Words was changed from 104 to 112, to accommodate 8 additional Quick Calibration values. Now there are total of 16 quick calibration words, 4 per strain gauge channel.
- 256 bytes of Strain Gauge Signature Date available, accessible through Message Instructions.
- Added Setup Example on how to configure and use Message Instructions.
- Information on how the Diagnostic Outputs work was revised.

V1.1 was released on 7/17/2013

- Added notes to the Die Monitor, PLS Output, and the Strain Gauge programming sections that with V3.2 firmware and above, programming the Resolver Setup data and not making any changes, or only changing the Fault Output Control or the Counting Type parameters, will no longer clear the Die Monitor, PLS Output, and the Strain Gauge programming.
- Added text to the Strain Gauge Calibration section about proper jumper location.
- The Die Monitor Input specifications now state that to function, the input must be connected to the common of the input connector, not to ground.
- Changed the diagnostic output range from -4Vdc to 5Vdc to -4Vdc to 4.75Vdc. Also added text that at full scale, the output will be at about 3.8Vdc.

V1.2 was released on 5/5/2017

- Added notes on why the Diagnostic Analog outputs will be lower than expected if the soft gain introduced with the version 3.3 firmware is greater than 1.

Version 2.0 was released on 1/7/2021

- The Ethernet interface board was changed to a two port version and the specifications were modified describing the changes, including new methods of changing the IP address.
- Added a note that in the version 6 firmware, data windows 3 and 4, reported in input words 84 to 87 and 89 to 92, now report the maximum reverse tonnage. Only negative values are reported in these registers.
- As with the previously released V3.3 version of the firmware, the data window tonnage values reported in data windows 1 to 4 are reset to zero when the resolver position data enters the data window.
- This V6 firmware also includes the unreleased changes for firmware versions 4 and 5. V4 made the NX3A1E2-M compatible with ProfiNet, and the V5 firmware added ability to disable the autozero function and to make the strain gauge measuring averaging programmable. Leaving these programmable bits in word 1 of the Strain Gauge programming block causes the unit to act exactly as it does in the V3.3 firmware.