Node Controller Hardware User Manual

Catalog Numbers 700-0871-00, 700-1573-00, 700-1842-00, MMI-NC-ENET-01, MMI-NC-SER08-01

Allen-Bradley
by ROCKWELL AUTOMATION

User Manual

Original Instructions

Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

Rockwell Automation recognizes that some of the terms that are currently used in our industry and in this publication are not in alignment with the movement toward inclusive language in technology. We are proactively collaborating with industry peers to find alternatives to such terms and making changes to our products and content. Please excuse the use of such terms in our content while we implement these changes.

Additional Safety Information

Although every effort is made to keep this manual accurate and up-to-date, MagneMotion and Rockwell Automation assumes no responsibility for any errors, omissions, or inaccuracies. Information that is provided in this manual is subject to change without notice. Any sample code that is referenced in this manual or included with MagneMotion® software is included for illustration only and is, therefore, unsupported.

ATTENTION: For additional safety notices and definitions, see the Safety Considerations section and/or the Symbol Identification section.

Contents

Changes

Overview

This manual is changed as required to keep it accurate and up-to-date to provide the most complete documentation possible for the node controllers. This section provides a brief description of each significant change.

NOTE: Distribution of this manual and all addenda and attachments is not controlled. To identify the current revision, contact *Rockwell Automation Support*.

Rev. A

Initial release.

Rev. B

Added the following:

- Added support for the NC-S node controller.
- In *Chapter 6, Maintenance*, added the *Repair* section with information on *Upgrading Node Controllers*.

Updated the following:

- In *Chapter 2, Safety*, updated the *Recycling and Disposal Information* section.
- In *Chapter 3, Node Controller Overview*, updated the *Node Controller Loading* section.
- In *Chapter 6, Maintenance*, updated the contact *Rockwell Automation Support* section.

Rev. C

Added the following:

- Added support for the NC-E Series B node controller throughout this document.

- NC-E Series A product specific information was moved to *Appendix B* of this document.
- Publication MMI-UM035 was consolidated and migrated throughout this document.
- Publication MMI-TD039 was added to *Appendix B* of this document.

Removed the following:

- Figures reference chapter was removed.
- Tables reference chapter was removed.
- Glossary was removed.
- Restricted parameters information was removed.

About This Manual

Overview

This section provides information about the use of this manual, including the manual structure, additional resources, format conventions, and safety conventions.

Purpose

This manual explains how to install and maintain the node controllers that are used with MagneMover® LITE™ and QuickStick® transport systems. Node controllers are used to monitor vehicles and control the motors of a transport system based on the commands from the host controller.

This manual is not intended to provide a design guide or reference for the installation or operation of a transport system. Use this manual in combination with the other manuals and documentation that accompanies the transport system to install, configure, test, and operate a transport system. Rockwell Automation offers instructor-led training classes that provide additional instruction in the use of the node controllers.

Audience

This manual is intended for all users of transport systems and provides information on how to install and maintain the node controllers in the transport system.

Prerequisites

The information and procedures that are provided in this manual assume the following:

- Basic familiarity with general-purpose computers and with the Windows® operating system, web browsers, and terminal emulators.
- That full documentation for the transport system is available.
- All personnel operating the transport system are properly trained.

Notes, Safety Notices, and Symbols

Notes, Safety Notices, and Symbols that are used in this manual have specific meanings and formats. Examples of notes, the different types of safety notices and their general meanings are provided in this section. Adhere to all safety notices provided throughout this manual to achieve safe installation and use.

Notes

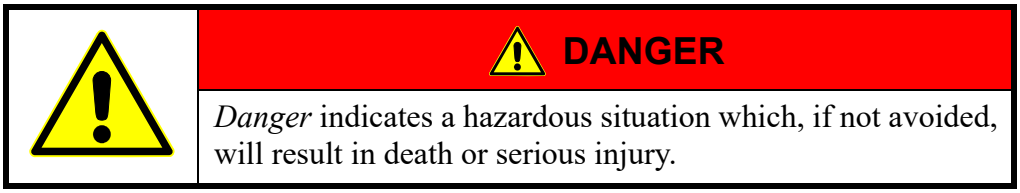
Notes are set apart from other text and provide additional or explanatory information. The text for Notes is in standard type as shown in the following example.

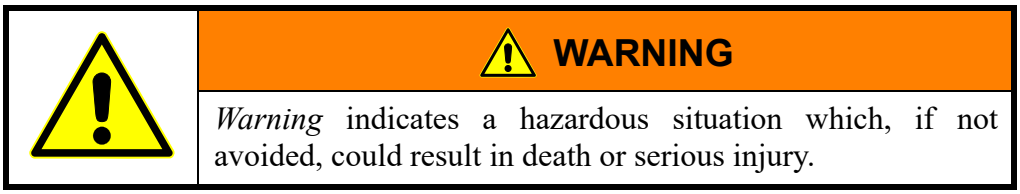
NOTE: A note provides additional or explanatory information.

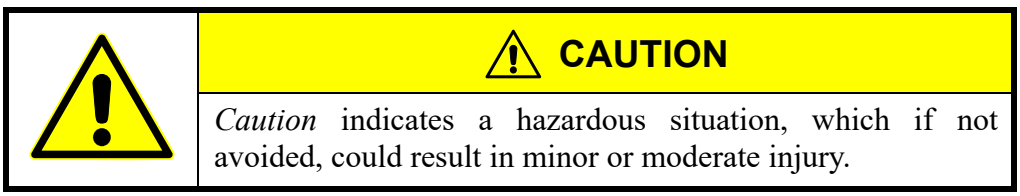
Safety Notices

Safety Notices are set apart from other text. The color of the panel at the top of the notice and the text in the panel indicates the severity of the hazard. The symbol on the left of the notice identifies the type of hazard (see *Symbol Identification* on page 28 for symbol descriptions). The text in the message panel identifies the hazard, methods to avoid the hazard, and the consequences of not avoiding the hazard.

Examples of the standard safety notices that are used in this manual are shown in the following examples. Each example includes a description of the hazard level indicated.







NOTICE

Notice indicates practices that are not related to personal injury that could result in equipment or property damage.

Additional Resources

Before configuring or running the transport system, consult the following documentation:

Resource	Description
MagneMotion System Configurator User Manual, publication MMI-UM046	This manual explains how to use the MagneMotion® Configurator to create and modify the Node Controller Configuration File (Configuration File) for the transport systems.
MagneMotion Node Controller Interface User Manual, publication MMI-UM001	This manual explains how to use the supplied interfaces to configure and administer node controllers that are used with MagneMotion transport systems. This manual also provides basic troubleshooting information.
MagneMotion NCHost TCP/IP Interface Utility User Manual, publication MMI-UM010	This manual explains how to use the NCHost TCP/IP Interface Utility to run a transport system for testing and debugging. This manual also explains how to develop Demo Scripts to automate vehicle motion for that testing.
MagneMotion Host Controller TCP/IP Communication Protocol User Manual, publication MMI-UM003	These manuals describe the communication protocols between the high level controller and a host controller. These manuals also provide basic troubleshooting information.
MagneMotion Host Controller EtherNet/IP Communication Protocol User Manual, publication MMI-UM004	
MagneMotion QuickStick and QuickStick HT Design Guide, publication MMI-RM001	This manual explains how to design and configure the track layout and transport system.
MagneMover LITE User Manual, publication MMI-UM002	This manual explains how to install, operate, and maintain the MagneMover LITE transport system. This manual also provides information about basic troubleshooting.
QuickStick 100 User Manual, publication MMI-UM006	This manual explains how to install, operate, and maintain the QuickStick 100 transport system. This manual also provides information about basic troubleshooting.
QuickStick 150 User Manual, publication MMI-UM047	This manual explains how to install, operate, and maintain the QuickStick 150 motors and magnet arrays. This manual also provides information about basic troubleshooting.
QuickStick® HT™ User Manual, publication MMI-UM007	This manual explains how to install, operate, and maintain the QuickStick High Thrust (QSHT) transport system. This manual also provides information about basic troubleshooting.
MagneMotion LSM Synchronization Option User Manual, publication MMI-UM005	This manual explains how to install, operate, and maintain the LSM Synchronization Option for use with transport systems.
MagneMotion Virtual Scope Utility User Manual, publication MMI-UM011	This manual explains how to install and use the MagneMotion Virtual Scope utility. This utility provides real-time feedback of the change in Linear Synchronous Motor performance parameters.

Additional Documentation

Release Notes

The release notes supplied with the MagneMotion software include special instructions, identification of software versions, identification of new features and enhancements, and a list of known issues. Reading this file is recommended before using the software.

Upgrade Procedure

The upgrade procedures supplied with the MagneMotion software provide instructions for upgrading from MagneMotion software, and procedures for file and driver upgrades associated with the software.

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Introduction 1

Overview

This chapter provides an overview of the node controllers and the transport system hardware and software. The basic set of tasks for using the node controllers with a transport system are also described.

Use this manual to install the node controllers for proper transport system operation. Some procedures may vary based on the transport system configuration, communications, and other variables.

This manual supports:

- MagneMover® LITE™ transport systems.
- QuickStick® transport systems.
- QuickStick® HT™ transport systems.

Included in this chapter are overviews of:

- The transport system components.
- The transport system software.
- Getting started with the node controller.

Node Controller Interface Overview

The node controllers are used to monitor vehicles and control the motors of a transport system as commanded by the host controller. Each node controller provides both a web interface and a console interface (see the *MagneMotion® Node Controller Interface User Manual*, publication MMI-UM001). These interfaces are used to configure and administer both the node controller and the transport system.

The transport system is a configuration of linear synchronous motors that are placed end-to-end to form long chains, or paths. These chains move vehicles with integral magnet arrays in a controlled manner at various acceleration/deceleration and velocity profiles while carrying a wide range of payloads with high precision.

The transport system consists of the following components at a minimum:

- MagneMover LITE, QuickStick, or QuickStick HT motors.
- Node controllers.
- Vehicles with magnet arrays.
- Paths and nodes.
- User-supplied host controller.

Transport System Components Overview

This section identifies the components of a transport system as shown in Figure 1-1 and described after the figure

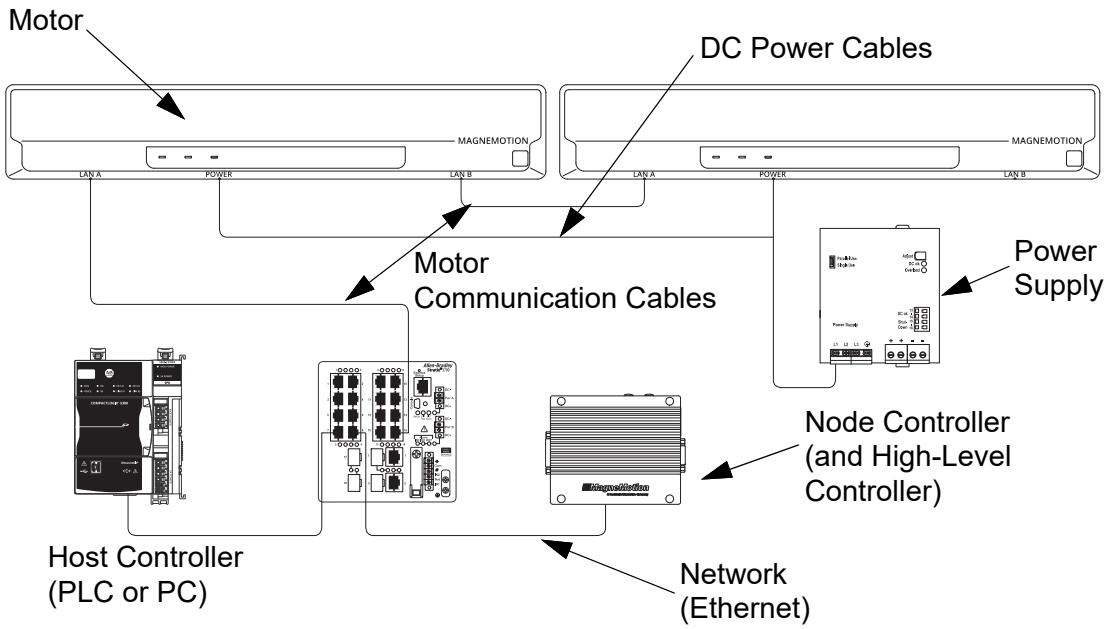

Figure 1-1: Simplified View of the Transport System Components

- **DC Power Cables and Communication Cables** – Distributes DC power to the motors and carries communications between the components of the transport system.
- **High-Level Controller** (HLC) – Software application that is enabled on one node controller. This application handles all communication with the user-supplied host controller and directs communication as appropriate to individual node controllers.
- **Host Controller** – Provides user control and monitoring of the transport system. This component is user-supplied.
- **Motor** – Refers to a linear synchronous motor (LSM).
- **Network** – Ethernet network providing communications (TCP/IP or EtherNet/IP™) between the host controller and the HLC (TCP/IP is used between node controllers).
- **Node Controller** (NC) – Coordinates motor operations and communicates with the HLC. Three types of node controllers are available:
  - **NC-12** – Provides one network port, two RS-232 ports, 12 RS-422 ports, 16 digital inputs, and 16 digital outputs.
  - **NC LITE** – Provides one network port and four RS-422 ports.
  - **NC-E Series B** – Provides one active network port, eight digital inputs, and eight digital outputs. For Ethernet motor communications only.
  - **NC-S** – Provides one active network port and eight RS-422 ports.
- **Power Supply** – Provides DC power to the motors.

- **Vehicle with Magnet Array** – Carries a payload through the transport system as directed. The magnet array is mounted to the vehicle and interacts with the motors, which moves each vehicle independently.

Transport System Software Overview

Several software applications are used to configure, test, and administer a transport system as shown in Figure 1-2 and described after the figure. See *Additional Resources* on page 12 for the reference manuals for these applications.

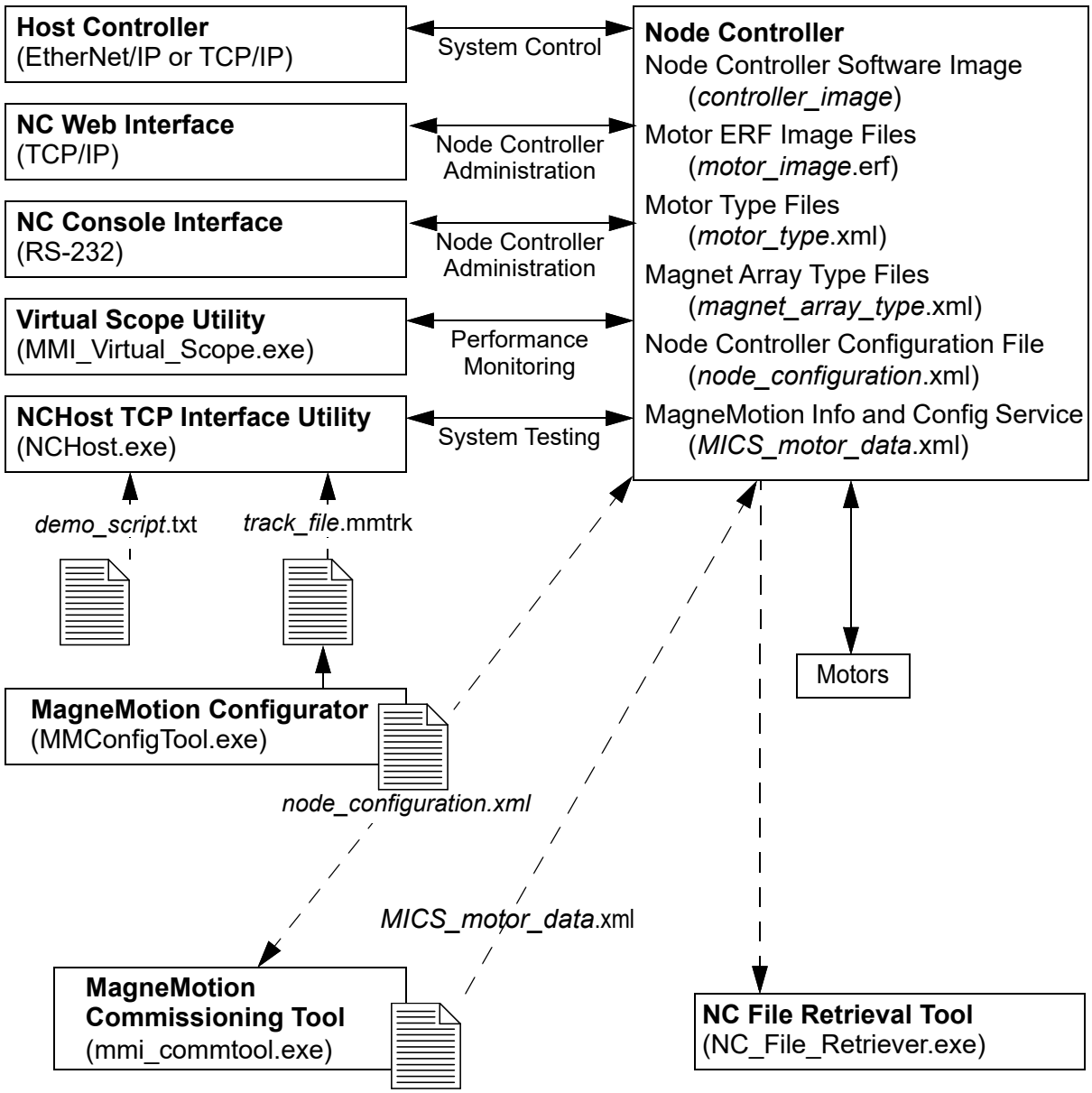

Figure 1-2: Simplified View of Transport System Software Organization

Getting Started with the Node Controllers

Use this manual as a guide and reference when installing or servicing the node controllers. Follow the steps in this section to get the node controllers operational quickly with the aid of the other manuals (see *Additional Resources* on page 12).

NOTE: Make sure that all components and complete design specifications, including the physical layout of the transport system, are available before starting to install or test transport system operation.

To get started quickly with the node controllers:

1. Save the files and folders from the transport system software package to a folder on a computer for user access. See rok.auto/pcdc for additional system software package information.

   NOTE: The minimum requirements for running software applications are a general-purpose computer (PC) running Microsoft® Windows 7 with .NET 4.0, an Ethernet port (web interface), and an RS-232 port (console interface).

2. Install the Configurator on a computer for user access (see the *MagneMotion System Configurator User Manual*, publication MMI-UM046). When using Ethernet communications with the motors, make sure to install the MagneMotion Commissioning Tool.

   A. For MagneMover LITE systems, create the Track Layout File (*track_layout*.ndx) to define the motors and paths graphically and their relationships in the transport system.

   B. For all transport systems, create the Node Controller Configuration File (node_configuration.xml) to define the components and operating parameters of the transport system.

   C. When using Ethernet communications with the motors, use the MagneMotion Commissioning Tool to generate a MagneMotion Information and Configuration Service (MICS) file for the system.

3. Configure all node controllers in the system for operation. Set the IP address for each node controller and specify the node controller to be used as the high-level controller. Upload the configuration, MICS (if required), image, and type files to each node controller using the node controller web interface (see the *MagneMotion Node Controller Interface User Manual*, publication MMI-UM001).

   Once configured, the node controllers can be used to simulate the transport system. See the *MagneMover LITE User Manual*, publication MMI-UM002, the *QuickStick 100 User Manual*, publication MMI-UM006, *QuickStick 150 User Manual*, publication MMI-UM047, or the *QuickStick HT User Manual*, publication MMI-UM007.

4. Install the components of the transport system as described in either the *MagneMover LITE User Manual*, publication MMI-UM002, the *QuickStick 100 User Manual*, publication MMI-UM006, *QuickStick 150 User Manual*, publication MMI-UM047, or the *QuickStick HT User Manual*, publication MMI-UM007.

5. Install the node controllers as described in *Chapter 5, Installation*.

6. Test and debug the transport system by using the NCHost TCP Interface Utility and Demo Scripts (see the *MagneMotion NCHost TCP/IP Interface Utility User Manual,* publication MMI-UM010). NCHost provides an easy method to verify proper operation and make adjustments such as refining the control loop tuning.

   NOTE: The NCHost TCP Interface Utility is for test and verification trials only. The host controller must be used to control the transport system after verification of functionality.

7. Configure the host controller (either a general-purpose computer or PLC) to control the transport system as required to meet the material movement needs of the facility where the system is installed. See the *MagneMotion Host Controller TCP/IP Communication Protocol User Manual*, publication MMI-UM003 or the *MagneMotion Host Controller EtherNet/IP Communication Protocol User Manual*, publication MMI-UM004.

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Safety 2

Overview

This chapter describes safety guidelines for the node controllers and their use in a transport system. All personnel that are involved in the installation, operation, or maintenance of the transport system must be familiar with the safety precautions that are outlined in this chapter.

NOTE: These safety recommendations are basic guidelines. If the facility where the node controllers are installed has additional safety guidelines, they must be followed along with the applicable local and national safety codes.

If any additional safety-related upgrades or newly identified hazards that are associated with the node controllers are identified, *Rockwell Automation Support* notifies the owner of record.

Included in this chapter are:

- Regulatory compliance information.
- Personnel and equipment safety guidelines.
- Symbol identification.
- Label identification and locations.
- Identification of electrical hazards.
- Recycling and disposal Information.

Regulatory Compliance

The node controllers are CE-compliant. To determine if a specific node controller is CE-compliant, check for the CE marking on the component. If necessary, request the official Declaration of Conformity (DoC) from Rockwell Automation.

The node controllers are UL Recognized in Canada and the United States. To determine if a specific node controller is UL Recognized, check for the UL Recognized Mark on the component. Some examples of the Mark may not display the ‘C’ and ‘US’.

Other sections of this manual may include additional regulatory information. These components comply with the regulations from the organizations that are indicated in Table 2-1.

Table 2-1: Regulatory Information

Organization	Regulations
CE (Conformité Européenne) – The European safety requirements	• Machinery Directive • Low Voltage Directive • EMC Directive
UL	• 61010-1

NOTICE

It is the responsibility of the end user/third party integrator to make sure that the installed node controllers comply with the appropriate facility, local, and national regulations.

Equipment Regulatory Guidelines

The following regulatory guidelines are provided to aid in the use and service of the node controllers in a transport system.

- *Rockwell Automation Support* issues Technical Advisories to notify the owners of record of any field retrofits.
- Contact Rockwell Automation Support for information regarding repair and maintenance service policies, both during the production of the node controllers and after production is discontinued. See the back cover of this manual for *Rockwell Automation Support* information.

- Any user-caused damage during integration of the node controllers into their equipment is the responsibility of the user.
- Responsibility for work that Rockwell Automation authorized technicians has performed or for equipment that the owner of record transports or resells, is determined on a case-by-case basis by *Rockwell Automation Support*.
- Any parts being returned to Rockwell Automation must be packaged according to the instructions provided in the *Packing Procedure* on page 127.
- Rockwell Automation provides training for the node controllers as integrated into a transport system. Any personnel that are performing service procedures on the node controllers must be properly qualified and trained. Damage that results from improperly performing a procedure or not following cautions is not covered under warranty or service agreements.

Safety Considerations

Personnel Safety Guidelines

Node controllers can provide several direct safety hazards to personnel if not properly installed or operated. General safety guidelines are provided in this section, specific cautions are provided as needed (see *Electrical Hazards* on page 33).

- Personnel operating or servicing the node controller must be properly trained.
- The following safety equipment, used according to the instructions provided by the manufacturer, must be donned before installing, testing, or servicing components:
  - Eye protection
    Breaking material can produce flying shards. When running a setup or test procedure, always wear protective eyewear to guard against possible eye injuries.
  - Foot protection
    Always wear shoes with protective toes to help protect feet from falling tools or parts.
- It may be recommended that the use of hazardous materials, such as cleaning fluids, be used during routine maintenance procedures. Read and understand the hazardous materials policies for the facility and the SDS (provided by the manufacturer) for each substance.
- Make sure that the node controllers are properly decontaminated before performing any service by following the decontamination procedures at the facility. Follow all facility, local, and national procedures for the disposal of any hazardous materials.
- Ergonomic hazards can exist with certain installation or service operations that are related to the node controllers.

Equipment Safety Guidelines

The following safety considerations are provided to aid in the placement and use of the Rockwell Automation node controllers.

- If hazardous materials are to be present, proper safety precautions must be observed. Make sure that all materials that are used are compatible with the materials from which the node controllers are fabricated.
- If the node controllers are to be installed in an earthquake prone environment, install the equipment appropriately.
- Do not place the power and communications cables for the node controllers where they could cause a trip hazard.
- Do not place the node controllers in a location where they can be subject to physical damage.

- Make sure that all electrical connections to the node controllers are made in accordance with the appropriate facility, local, and national regulations.
- Make sure that the node controllers receive proper airflow for cooling.
- Do not remove safety labels or equipment identification labels.
- Turn off power supplies before inserting or removing the node controller power cables.
- Use of the node controllers for any purpose other than as controllers for a linear transport system is not recommended and can damage the node controllers or the equipment they are connected to.
- Keep cables and connectors away from heated surfaces.
- Do not modify the connectors or ports.

Symbol Identification

Symbols are used in this manual to identify hazards, mandatory actions, and prohibited actions. The symbols that are used in this manual and their descriptions are provided in the following tables.

Table 2-2: Hazard Alert Symbol Identification

Symbol	Description
	**General Hazard Alert** – Indicates that failure to follow recommended procedures can result in unsafe conditions, which could cause injury or equipment damage.
	**Automatic Start Hazard** – Indicates the possibility of machinery automatically starting or moving, which could cause personal injury.
	**Hazardous Voltage** – Indicates that a severe shock hazard is present that could cause personal injury.
	**Pinch/Crush Hazard** – Indicates that there are exposed parts that move, which could cause personal injury from the squeezing or compression of fingers, hands, or other body parts between those parts.

Table 2-3: Mandatory Action Symbol Identification

Symbol	Description
	**Lockout Required** – Indicates that all power must be disconnected using a method that helps prevent accidental reconnection.

Label Identification and Location

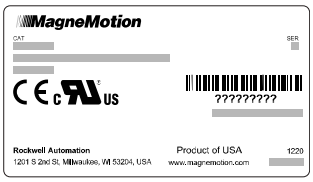
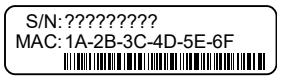
Identification labels are placed on the node controllers. These labels provide operators and service personnel with information about the node controllers at the point of use. This section describes each label and identifies its location.

NOTE: Label images are representational only. Actual labels include all appropriate regulatory symbols and can differ in appearance.

Label placement can cause labels to be visible only during maintenance operations.

The following tables list the labels that are affixed to the node controllers. The figure after each table shows the location of each label that is identified in the table. To replace a lost or damaged label, contact Rockwell Automation and reference its name.

Table 2-4: Labels Used on the NC-S Node Controller

	Product Information Label Qty: 1 Location: On the top of the NC-S node controller
	MAC ID Label Qty: 1 Location: On the top of the NC-S node controller

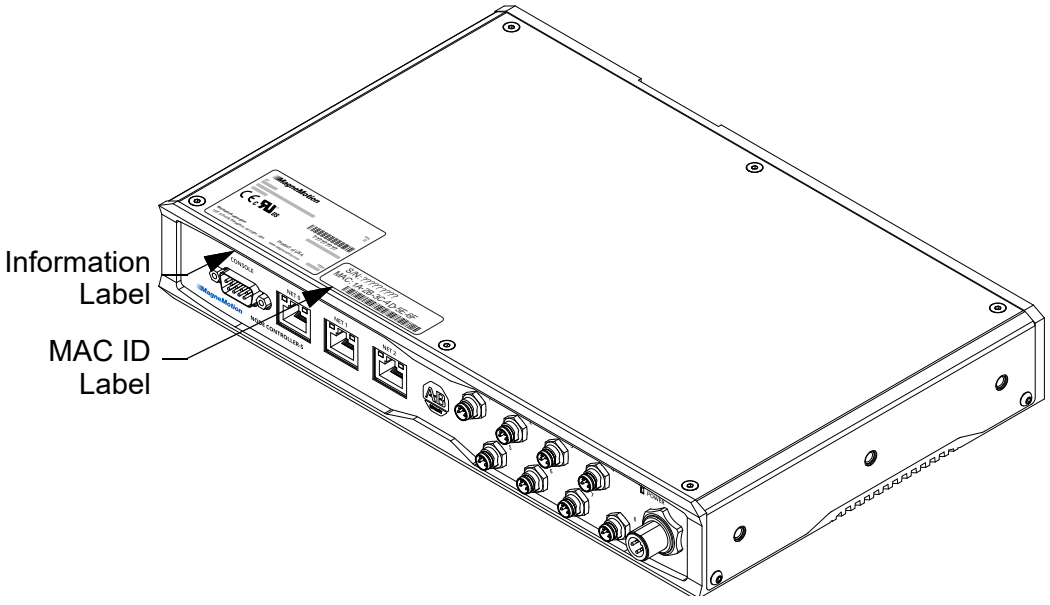
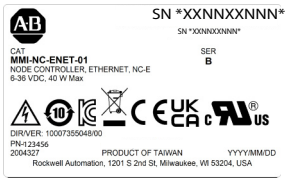


Figure 2-1: Label Locations on the NC-S Node Controller

Table 2-5: Labels Used on the NC-E Series B Node Controller

	Product Information Label Qty: 1 Location: On the back of the NC-E Series B node controller

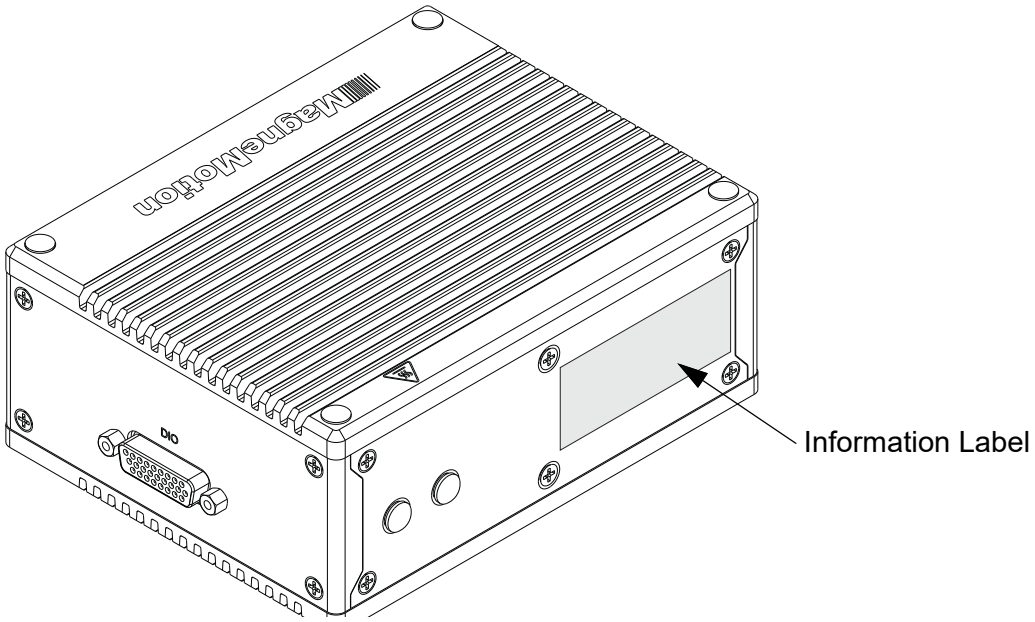
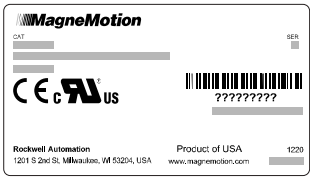
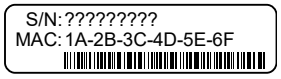


Figure 2-2: Label Locations on the NC-E Series B Node Controller

Table 2-6: Labels Used on the NC-12 Node Controller

	Product Information Label Qty: 1 Location: On the back of the NC-12 node controller
	MAC ID Label Qty: 1 Location: On the back of the NC-12 node controller

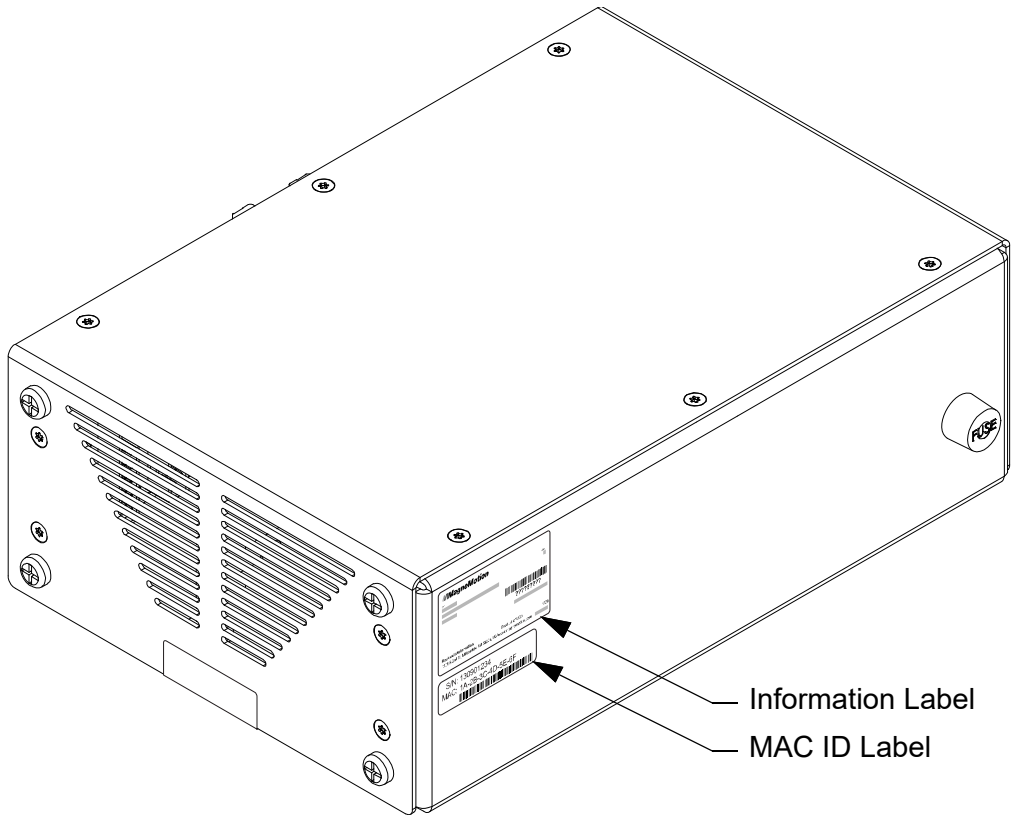
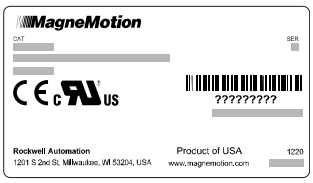
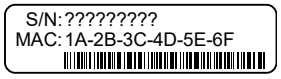


Figure 2-3: Label Locations on the NC-12 Node Controller

Table 2-7: Labels Used on the NC LITE

	Product Information Label Qty: 1 Location: On the top of the NC LITE
	MAC ID Label Qty: 1 Location: On the top of the NC LITE

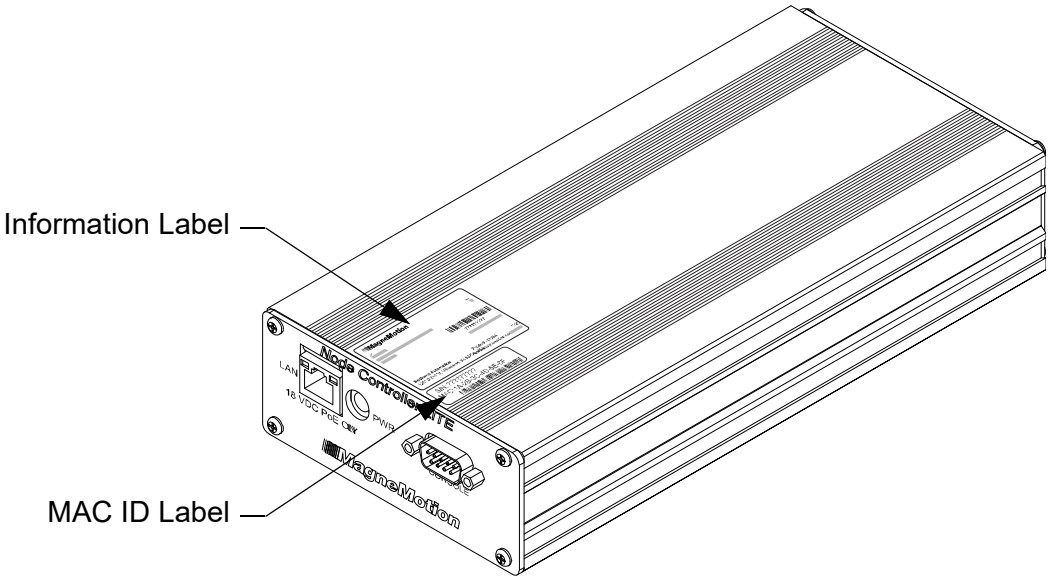


Figure 2-4: Label Locations on the NC LITE

Electrical Hazards

The node controllers are classified as low voltage devices, no additional safety precautions are required.

The power supplies for the node controllers are connected to the AC Mains of the facility and can generate hazardous energy. The proper precautions for operating and servicing electrical equipment must be observed. These precautions include following facility lockout/tagout procedures, and any other specified action within the facility where the node controllers are being used.

CAUTION

Electrical Hazard

To avoid electric shock, do not open any node controller. Node controllers do not contain any user-serviceable parts.

Do not turn on electrical power to the node controllers until after connecting all other transport system components.

NOTICE

To avoid equipment damage:

- Make sure that the node controllers are properly grounded.
- Do not connect or disconnect any components while the transport system has power.

Recycling and Disposal Information

Information regarding disposal and recycling are provided in this section. The node controllers use the following items that require special handling for disposal or recycling. At the end of its life, this equipment must be collected separately from any unsorted municipal waste and disposed of as described in this section.

For China RoHS information, see https://literature.rockwellautomation.com/idc/groups/literature/documents/td/pec-td003_-en-e.pdf and reference Table B.

Node Controllers

The node controllers contain the following materials and must be disposed of by following all facility, local, and national procedures for the disposal or recycling of electronic equipment:

- Aluminum/Anodized Aluminum.
- Circuit board with connectors and semiconductors.
- Zinc-plated Low Carbon Steel Screws.
- Stainless Steel Screws.
- Lithium battery (NC-12, NC LITE, NC-E Series B).
- Alkaline battery (NC-S).

Packaging

The packaging for the node controllers contains the following materials. If the packaging is not being saved, it must be disposed of by following all facility, local, and national procedures for the disposal of packaging material:

- Cardboard.
- Polyethylene Foam.

Node Controller Overview 3

Overview

This chapter provides an overview of the types of node controllers available for use with transport systems.

Included in this chapter are:

- Node controller descriptions, including an overview of operations.
- Node controller specifications, including connector identification for all node controller types.

Node Controller Description

The node controller is the controller that is used to monitor and control the motors in a transport system in response to commands from the host controller. The node controller also provides status information to the host controller as requested. There can be multiple node controllers in a transport system, each responsible for a subset of the transport system. Each node controller is connected to the local area network (LAN) for the transport system. Using a LAN to provide all communication to the node controllers allows them to be located near the motors they are controlling, which minimizes the length of all cabling.

Each node controller is responsible for coordinating all vehicle movement through the nodes that are assigned to it and along the paths that are connected to those nodes. The node controllers are also used to program the motors on the paths that are connected to it.

One node controller in the transport system also functions as the high-level controller (HLC). The HLC provides one point of contact for all communications with the host controller through either TCP/IP for a general-purpose computer-based controller or EtherNet/IP for a PLC. The HLC then distributes any communications to the appropriate node controller through the LAN using TCP/IP and passes any messages from the node controllers to the host controller. The HLC also assigns vehicle IDs and tracks vehicle movement as vehicles move from a path that one node controller controls to a path that another node controller controls. Tracking of vehicle movement between node controllers is to make sure that vehicle IDs are maintained throughout the transport system.

NOTE: All TCP communications is unicast. Additionally, do not connect the node controllers to a network with large amounts of broadcast traffic as this extra traffic can impact node controller communication.

Node Controller Types

All node controllers support Ethernet communication and, depending on the model, provide RS-422 ports for communication with the motors. Some node controller models also provide Digital I/O for external devices such as switches, E-stops, and interlocks.

NC-S Node Controller

Node controller that supports both RS-422 and Ethernet motors with one active network port (NET 0) and eight RS-422 ports (see page 50).

NC-E Series B Node Controller

Node controller that supports Ethernet motors with one active network port, 8 digital inputs, and 8 digital outputs (see page 53). Check the product label to see which series of node controller you have (see Figure 2-2). NC-E Series B node controllers are labeled with “SRS B”. For Series A specific information, see *Appendix B*.

NC-12 Node Controller

Node controller that supports both RS-422 and Ethernet motors with one network port, 12 RS-422 ports, two RS-232 ports, 16 digital inputs, and 16 digital outputs. This node controller is available with an RJ45 Ethernet connector (see page 54) or an M12 Ethernet connector (see page 55).

NC LITE Node Controller

Node controller that supports both RS-422 and Ethernet motors with one network port and four RS-422 ports (see page 58).

Node Controller Communications

System Communication

All node controllers constantly communicate with the node controller configured as the HLC through a LAN. Additionally, the node controller that is designated as the HLC communicates with the host controller through the same network.

All node controllers have the same IP address when they leave the factory. Individual node controllers with the same IP address cannot be distinguished on a network and must not be connected to the network until configured with unique IP addresses. The *MagneMotion Node Controller Interface User Manual*, publication MMI-UM001, describes how to configure the node controller IP address so it matches the addressing structure of the network for the transport system.

NOTE: When setting the IP addresses on the node controllers for the first time, make sure that they are not all connected to the network simultaneously to avoid address conflicts.

User Communication

For normal operations, the node controller is accessed through a web-based user interface. To access the web interface, use any web browser that supports frames (for example, Chrome, Firefox, or Internet Explorer) on a service computer. Connect the computer to the same network as the node controller and enter the IP address of the node controller in the address bar for the browser and log in.

For some setup tasks, the node controller can be accessed through an RS-232 console interface. To access the console interface, use any terminal emulator that supports serial communication (for example, PuTTY) on a service computer. Connect the computer directly to the console port (COM1) on the node controller and log in.

Ethernet Motor Communication

In trasnsport systems, paths are defined as an uninterrupted string of motors placed end-to-end. Nodes are used to manage interactions between paths. Each node has a set of connections from the motors at the path-ends to a node controller. When a node controller owns a node, all connections from that node are associated with the node controller. A singular node controller can own multiple nodes.

All Ethernet motors communicate with immediate neighboring upstream and downstream motors and the node controller if the motor-end in question is also a path-end. Every motor on a path communicates with the node controller at the upstream path-end. The MagneMotion Information and Configuration Service (MICS) file is used to define the IP addresses of all

motors so they match the addressing structure of the transport system network. The motor user manual describes how to create the MICS file.

Motors that use Ethernet communication can use different network connection schemes depending on the application. When using Ethernet, all motors must be on the same LAN as the node controllers that own them.

The motor user manual describes different motor network topologies and provides examples.

Configuration Recommendations

- Recommended Ethernet addressing scheme (see Figure 3-1):
  - 10.Network.Path.Motor
  - Class B subnet mask of 255.255.0.0
  - Network addresses are used for network configuration.
  - Path 0 addresses are used for Subnet configuration:

    10.n.0.m

    Where:

    m – Node controllers/Network devices

    n – Network
  - Path p addresses are used for motors on that path:

    10.n.p.m

    Where:

    p – path
    m – motor

NOTE: In Figure 3-1 below, n is set to .20.

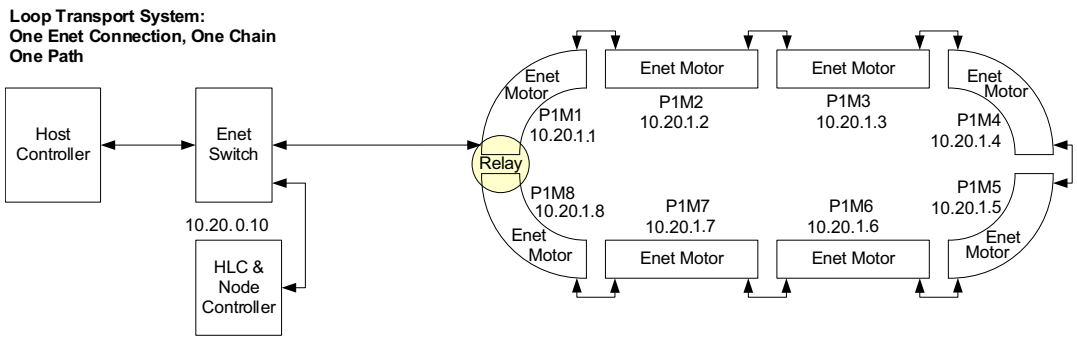


Figure 3-1: Ethernet Motor Wiring Example

- MagneMover® LITE™ switches are two logical track paths, only one IP address is assigned.

- Maximum number of motors per Ethernet chain = 50.
- Factory network design must minimize extra traffic on the physical network that the transport system is using.
  - Only use Chain or Star Ethernet connection topologies.
  - Closed-loop (ring) Ethernet connections must be avoided to help prevent network saturation.
  - Large amounts of traffic can degrade the performance of the transport system. Only pass transport system communication through the Ethernet chains in the transport system.
- Standard IP UDP communication, low latency.
- 100BASE-TX Fast Ethernet (IEEE 802.3u) compliant.
- Minimum of CAT 5 cabling is required.
- Ethernet communication topology is independent of transport system configuration (Ethernet chaining does not have to follow the physical path layout).
- The use of Allen-Bradley® Stratix® Managed Ethernet Switches is recommended to deliver the required network performance.
- Ethernet chains can consist of multiple paths (as defined in the transport system layout drawing).
- Chains do not need to start at the beginning of a path.
- If all motors in a path are not part of the same Ethernet chain, all chains the path is a member of must connect to the same network as the node controller.

Node Controller Loading

When using RS-422 for motor communication, the load on the node controllers is physically limited by the number of nodes that can be connected to a node controller. When using Ethernet for motor communication, there is no physical limit to the number of nodes that are connected to the node controller.

When running as the HLC, an additional load is placed on the node controller, due to communication with the host. For large systems, such as those with 50 or more paths or 100 or more vehicles, it is recommend to install a separate node controller as a standalone HLC. In this scenario, the node controller only handles communication between the host and other node controllers in the system and should not own any nodes.

Using RS-422 Communication

When using RS-422, the total load on the NC-S, NC LITE, and NC-12 node controllers is limited by the number of connections to the node controller. Even though there is a physical limit to the number of nodes that can be owned by a node controller, connections must be limited based on the load they place on the processor as shown in Table 3-1.

When using RS-422, all motors in a specific path are daisy chained together. The ends of the motor chains that start or end at a node are connected to a node controller. The number of RS-422 connections on a node controller determines the maximum number of motor chains that can be connected.

Using Ethernet Communication

When using Ethernet, the total load on the node controllers is limited by the processing power of the node controller. Since there is no physical limit to the number of nodes that can be owned by a node controller, connections must be limited based on the load they place on the processor as shown in Table 3-1.

When using Ethernet, all motors must be on the same LAN as the node controller(s) that own them.

Multi-port node types are nodes that connect multiple paths such as Relay, Merge, Diverge, Merge-Diverge, and Moving Path nodes. These types of nodes result in the same amount of load on the node controller, even if they have different numbers of paths involved in the node, because only one vehicle is allowed to own or transit the node at a time. Single-port node types (Simple, Overtravel, Terminus, and Gateway) present a negligible load. When using two Terminus or Gateway nodes to pass vehicles between paths, they count as one multi-port node due to the increased communication load. In systems with multiple node controllers, split the load evenly between all node controllers.

The processor loading on the node controllers when using Ethernet to communicate with the motors has been determined based on the various use cases as shown in Table 3-1.

Table 3-1: Node Controller Loading

Configuration	NC LITE	NC-12	NC-E Series B	NC-S
Ethernet Only	2 Nodes	6 Nodes	16 Nodes	8 Nodes
Serial Only	2 Nodes†	6 Nodes†	None (no serial ports)	4 Nodes†
Hybrid Only*	2 Nodes	6 Nodes		6 Nodes
Combination of Nodes	Any 2 + HLC	Any 6 + HLC	Ethernet Only	NC-S loading‡

* Hybrid Only has not been tested, these are theoretical numbers.

† Limited by number of RS-422 ports.

‡ For NC-S node controllers, use the following calculation to determine NC-S loading when using a combination of node connection types (that is, some Ethernet nodes and some RS-422 nodes). Serial Nodes × 25% + Hybrid Nodes × 16.67% + Eth Nodes × 12.5% ≤ 100%

General Purpose Digital I/O

When using a node controller that supports digital I/O, digital inputs and outputs can be monitored and controlled, respectively. These circuits can be wired directly to the digital I/O terminals on the node controller for monitoring and control of local options or for any user-defined use. These optional circuits are the responsibility of the user and require additional user-supplied hardware including a power supply.

E-stops and interlocks can be configured as part of transport system operation. See the *MagneMotion System Configurator User Manual*, publication MMI-UM046 for information on digital I/O configuration and use.

The host controller can issue commands to set the value of the Digital Outputs, or read the value of the Digital Inputs. See the *MagneMotion Host Controller TCP/IP Communication Protocol User Manual*, publication MMI-UM003 or the *MagneMotion Host Controller EtherNet/IP Communication Protocol User Manual*, publication MMI-UM004 for details on the use of the digital I/O.

NOTE: An external power supply for the digital I/O circuits is required (see Figure 3-2).

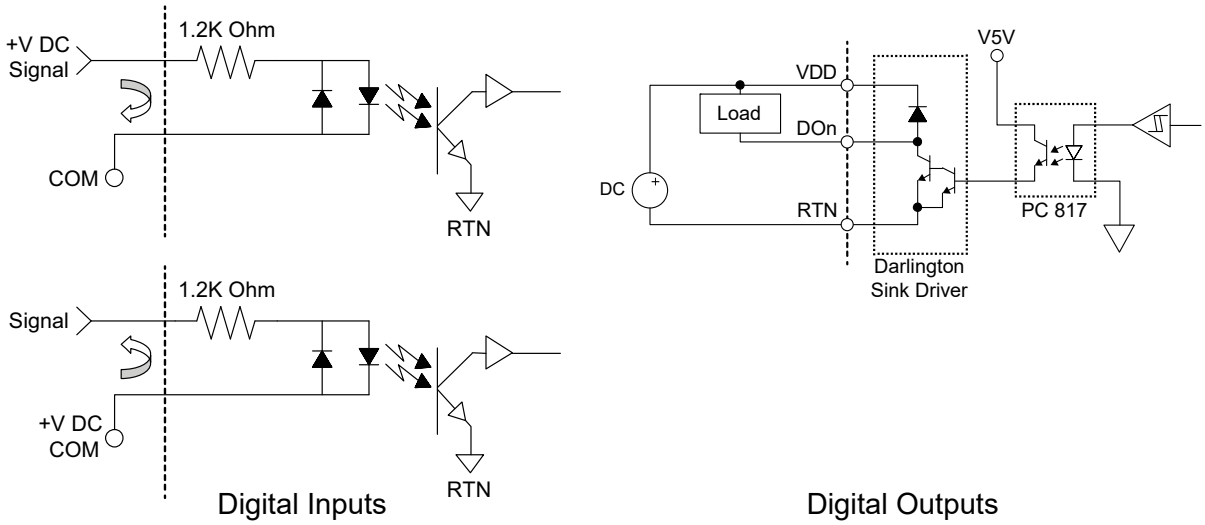


Figure 3-2: Digital I/O Equivalent Circuits

Table 3-2: Digital I/O Power Requirements

	NC-E
Digital Inputs (+V DC)	+5…24V DC
Digital Outputs* (DC)	+5…35V DC

* Digital outputs have a +5…35V DC 100mA sink current

NC-E Series B Digital I/O Connection

The NC-E Series B node controller provides eight optically isolated digital input bits and eight optically isolated digital output bits. See Figure 4-12 for the location of these connections on the node controller and Table 4-13 for the pinout. See Figure 3-2 for the digital I/O equivalent circuits and Figure 3-2 for the power specification.

The digital inputs can be wired as a sink, where a +5…24V DC signal is wired to the appropriate digital input and COM is connected to the return (minus) side of the signal as shown in Figure 3-2. The digital inputs can also be wired as a source, where +5…24V DC is wired to the COM and the appropriate input is wired through the signal to ground as shown in Figure 3-2.

The digital outputs can only be wired as a sink, where a +5…35V DC supply is wired through a load and sunk when the digital output in use is turned on by the node controller as shown in Figure 3-2.

NC-12 Digital I/O Connection

The NC-12 node controller provides 16 optically isolated digital input bits and 16 optically isolated digital output bits. See Figure 4-13 for the location of these connections on the node controller and Table 4-22 for the pinout. See Figure 3-2 for the digital I/O equivalent circuits and Figure 3-2 for the power specification.

The digital inputs can be wired as a sink, where a +3…24V DC signal is wired to the appropriate digital input and COM is connected to the return (minus) side of the signal as shown in Figure 3-2. The digital inputs can also be wired as a source, where +3…24V DC is wired to the COM and the appropriate input is wired through the signal to ground as shown in Figure 3-2.

NOTE: The GND pin on the node controllers is not used for the digital inputs even though there is a spring clamp on the “Inputs” side for GND.

The digital outputs can only be wired as a sink, where a +5…35V DC supply is wired through a load and sunk when the digital output in use is turned on by the node controller as shown in Figure 3-2.

To make digital I/O connections, use 12…26 AWG insulated wires and connect them to the appropriate input or output bits and to the respective COM, GND, or VDD connections. Insert a small flat-blade screwdriver into the connector release slot above the appropriate connector as shown in Figure 3-3. Rotate it to open the connector and insert the wire. Once the wire is fully seated, release and remove the screwdriver. Make sure that the connector blades are making direct contact with the wire and are not in contact with the insulation.

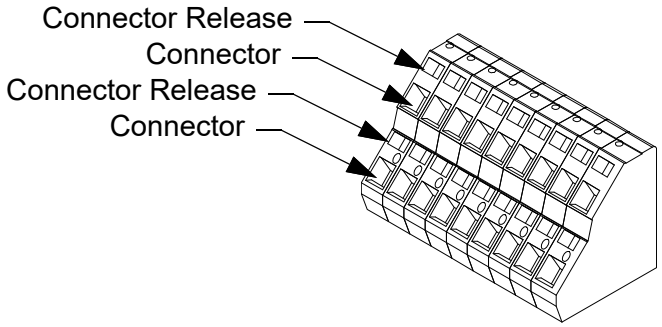


Figure 3-3: Digital I/O Connections

Digital I/O Uses

E-stop Circuit

Any node controller that has digital I/O can support E-stops utilizing an E-stop circuit as shown in Figure 3-4 and Figure 3-5. An E-stop is a user-supplied circuit with a locking button that an operator can press if an emergency situation arises to halt all motion on the specified paths. When the node controller detects that the E-stop button is activated, it commands all paths that are associated with that E-stop to suspend vehicle movement. All motors on those paths suspend vehicle target requests and permissions and all vehicles come to a controlled stop and are held in position by the motors. Stopping time for each vehicle is dependent on the mass of the vehicle, including any load, and the acceleration setting of the current movement command for the vehicle.

⚠ CAUTION

High Voltage Hazard:
Automatic Movement Hazard

The E-stop is not the same as an EMO (Emergency Off), which removes power to the transport system.

The E-stop only executes the actions that are described, it is not the same as an EMO (Emergency Off), which removes power to the transport system.

Multiple E-stop circuits can be connected to a node controller that supports digital I/O. Each path can then be configured to be associated with a specific E-stop bit. Any or all paths can be associated with the same E-stop bit. See the *MagneMotion System Configurator User Manual*, publication MMI-UM046 for information on E-stop configuration and use.

NOTE: An external power supply for the E-stop circuit is required.

An E-stop circuit can have multiple buttons that are wired together in series as shown in Figure 3-4 so that pressing any button initiates an E-stop. The same E-stop circuit can be used for multiple paths that are connected to different node controllers by wiring the E-stop circuit to each node controller in series as shown in Figure 3-5 to a maximum of eight node controllers. The E-stop must be configured to reference the appropriate Digital Input Bit on each path. The E-stop is cleared by releasing the button that was pressed and having the host issue a Resume command.

NOTE: Motion cannot resume until the button is released and the host controller issues a Resume command to the paths associated with the E-stop.

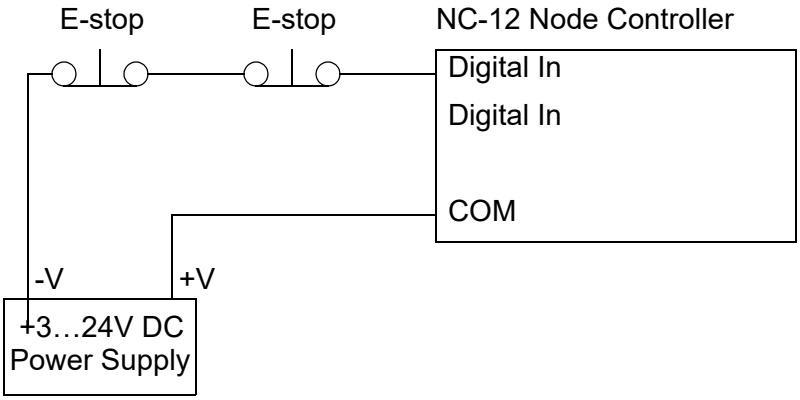


Figure 3-4: E-stop Wiring Diagram, Single Node Controller

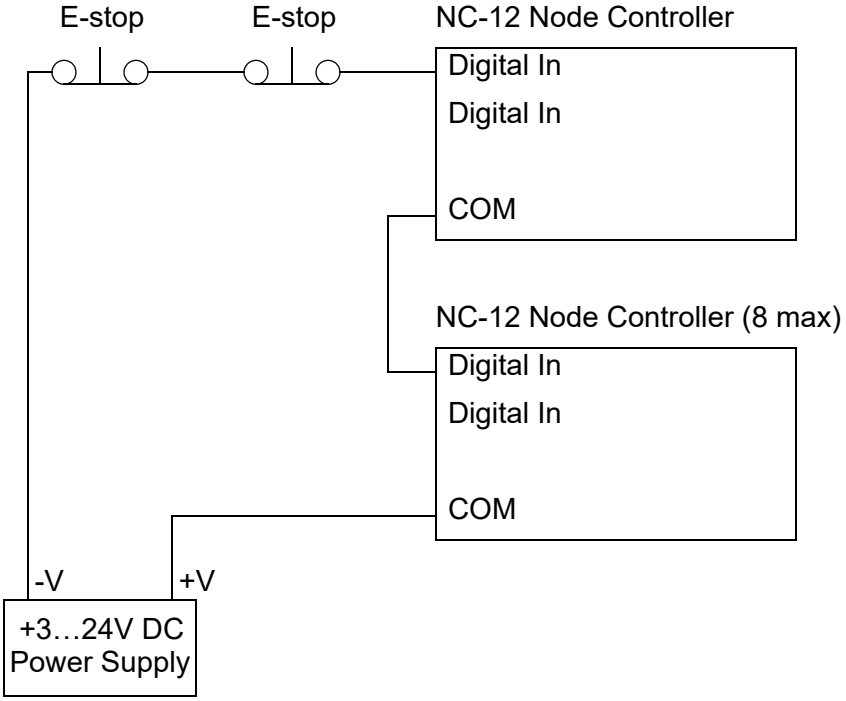


*Figure 3-5: E-stop Wiring Diagram, Multiple Node Controllers**

* In this configuration other digital I/O functions are not available.

Interlock Circuit

Any node controller that has digital I/O can support interlocks utilizing an interlock circuit as shown in Figure 3-6. An interlock is a user-installed circuit that another piece of equipment in the facility activates to halt all motion on the specified paths temporarily. When the node controller detects that the interlock circuit is activated, it commands all paths that are associated with that interlock to suspend vehicle movement. All motors on those paths suspend vehicle target requests and permissions and all vehicles come to a controlled stop and are held in position by the motors. Stopping time for each vehicle is dependent on the mass of the vehicle, including any load, and the acceleration setting of the current movement command for the vehicle.

Multiple interlock circuits can be connected to a node controller that supports digital I/O. Each path can then be configured to be associated with a specific interlock bit. Any or all paths can be associated with the same interlock bit. See the *MagneMotion System Configurator User Manual*, publication MMI-UM046 for information on interlock configuration and use.

NOTE: An external power supply for the interlock circuit is required.

The interlock circuit, which is shown in Figure 3-6, is connected to a digital output on the host controller such that breaking the circuit activates the interlock. The interlock is cleared by taking the interlock signal High.

⚠ CAUTION

High Voltage Hazard:
Automatic Movement Hazard

When the interlock is cleared movement of the vehicles on the transport system is automatically resumed, which could result in personal injury.

The interlock is not the same as an EMO (Emergency Off), which removes power to the transport system.

The interlock only executes the actions that are described, it is not the same as an EMO (Emergency Off), which removes power to the transport system.

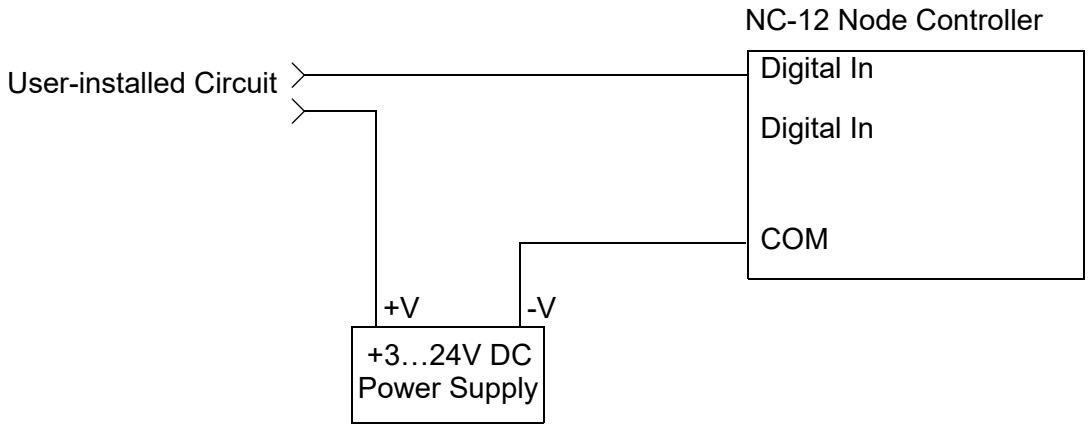


Figure 3-6: Interlock Wiring Diagram

Specifications and Site Requirements 4

Overview

This chapter describes specifications for the node controllers and the requirements for installation.

Included in this chapter are:

- Mechanical specifications for all node controllers, including dimensions.
- Electrical specifications for power and communications, including connector pinouts.
- Site requirements, including environmental and service access.

Mechanical Specifications

All drawings within this manual are generic and may not reflect specific configurations of the node controllers. To obtain current drawings, visit Proposal Works and search by product type and catalog number.

NC-S Node Controller

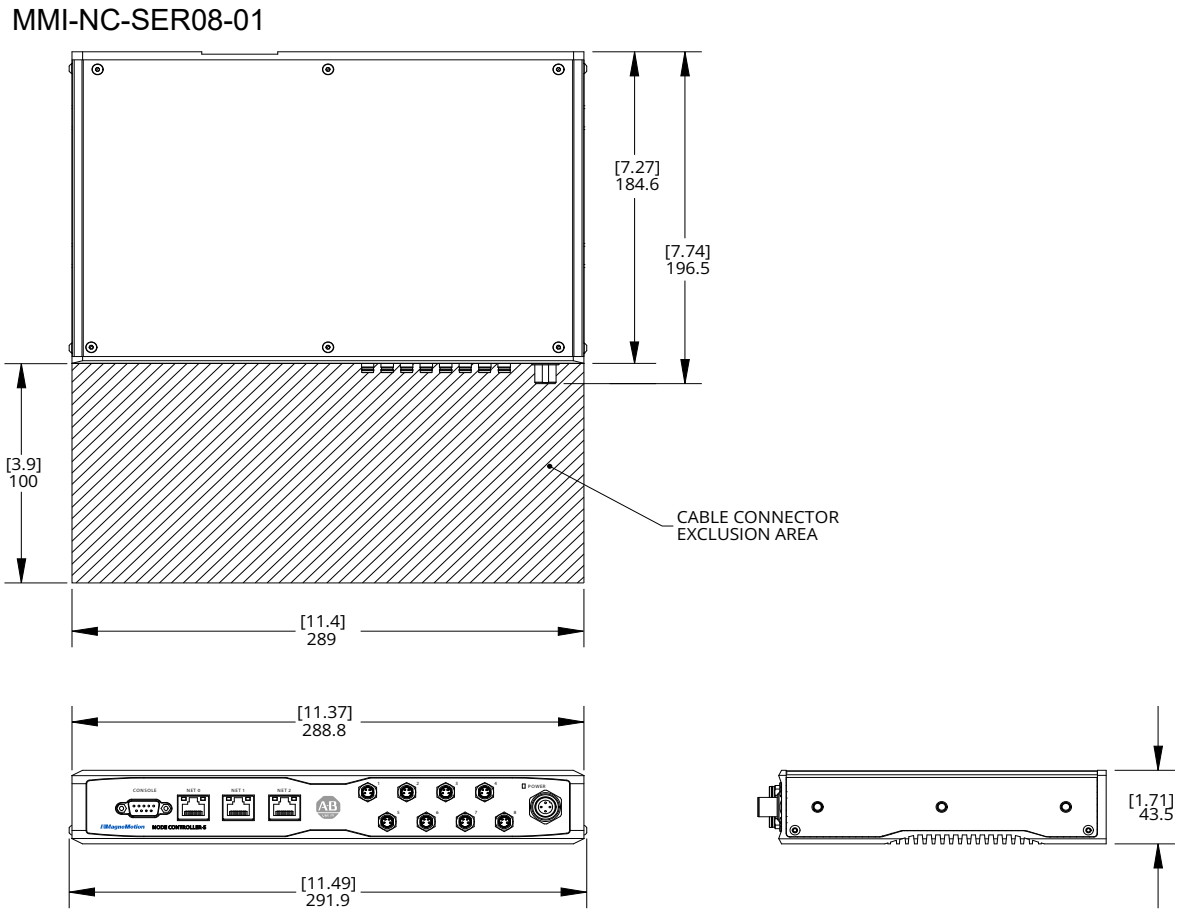


Figure 4-1: NC-S Node Controller Mechanical Drawing

NOTE: Mounting kits for surface mounting, 19 inch rack mounting, and DIN rail mounting are available.

Ingress Protection Rating: Designed for IP20.

See *NC-S Node Controller* on page 60 for the electrical specifications.

Exposed Materials

The node controller has unprotected openings and must not be installed in locations where harsh conditions exist.

NC-S Mounting Plate

Two mounting plates can be used for mounting the NC-S node controller to any flat surface.

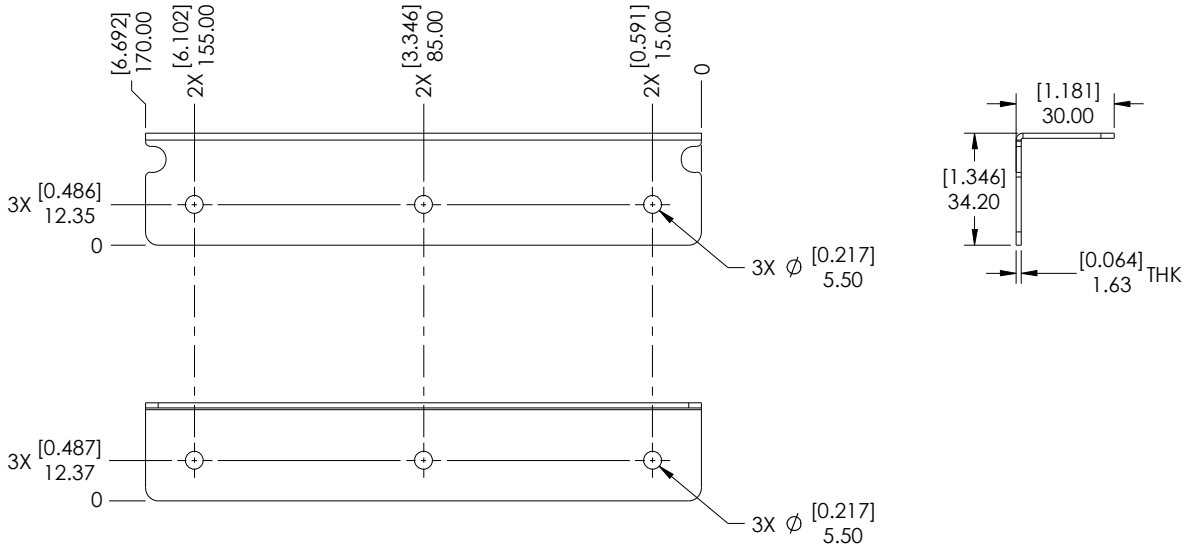


Figure 4-2: NC-S Mounting Plate Mechanical Drawing

Exposed Materials

- 5052-H32 Aluminum.
- Epoxy powder coat paint.

NC-S Rack Mounting Bracket

The 1U rack mounting brackets can be used for mounting the NC-S node controller in a standard 19 in electronics rack.

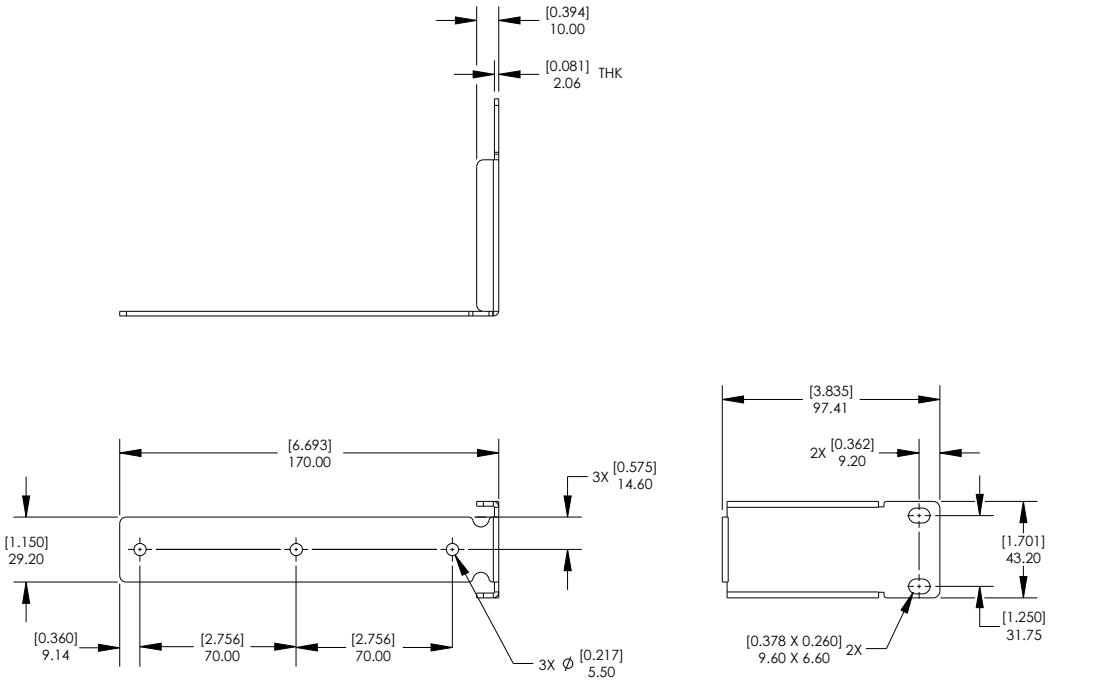


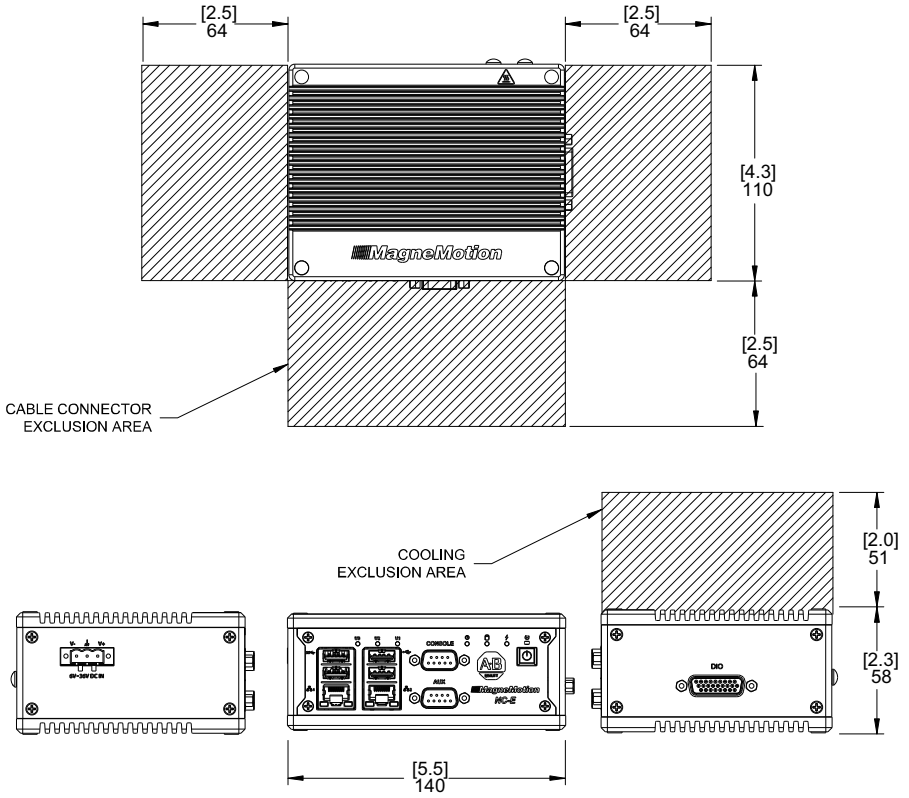
Figure 4-3: NC-S Rack Mounting Bracket Mechanical Drawing

Exposed Materials

- 5052-H32 Aluminum.
- Epoxy powder coat paint.

NC-E Series B Node Controller

MMI-NC-ENET-01



Weight: 0.65 kg [1.43 lb] All Dimensions in Millimeters [Inches]

Figure 4-4: NC-E Series B Node Controller Mechanical Drawing

NOTE: Mounting kits for surface mounting and DIN rail mounting are supplied with the node controller.

Ingress Protection Rating: Designed for IP30.

See *NC-E Series B Node Controller* on page 64 for the electrical specifications.

Exposed Materials

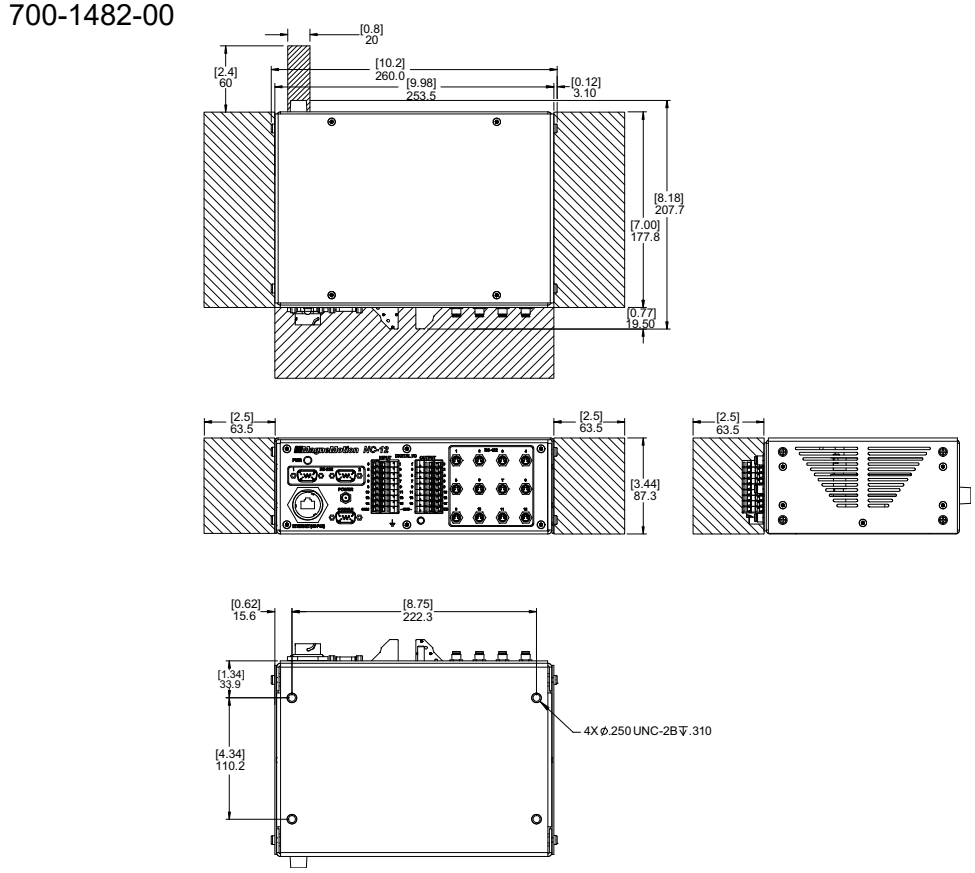
The node controller has unprotected openings and must not be installed in locations where harsh conditions exist.

NC-12 Node Controller

The NC-12 node controller is available in two different configurations. The 700-1482-00 version provides a standard RJ45 network connection and a 2 mm coax power connection. The 700-1573-00 version provides an M12 Eurofast® network connection and an M12 Eurofast power connection.

NC-12 Node Controller, RJ45 Ethernet

700-1482-00



Weight: 3.6 kg [8 lb]

All Dimensions in Millimeters [Inches]

Figure 4-5: NC-12 Node Controller Mechanical Drawing, RJ45 Ethernet

NOTE: A minimum of 50% of each vent must be clear for unobstructed airflow.

A mounting kit is available for standard 19 in electronics racks (see *NC-12 Rack Mounting Bracket* on page 57).

Ingress Protection Rating: IP20.

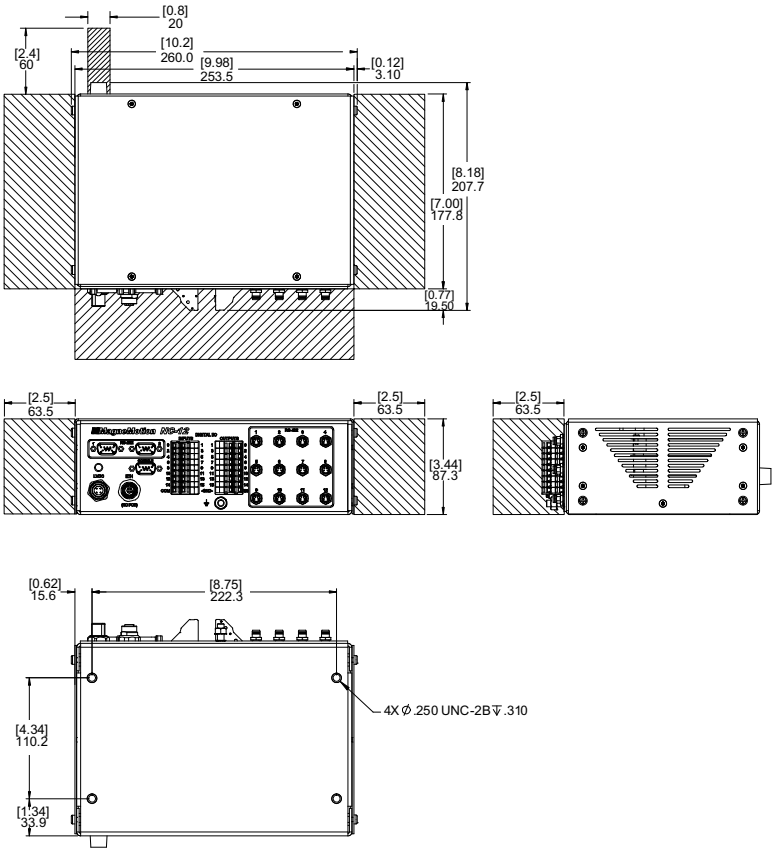
See *NC-12 Node Controller* on page 69 for the electrical specifications.

Exposed Materials

The node controller provides openings for airflow and must not be installed where harsh conditions exist.

NC-12 Node Controller, M12 Ethernet

700-1573-00



Weight: 3.6 kg [8 lb] All Dimensions in Millimeters [Inches]

Figure 4-6: NC-12 Node Controller Mechanical Drawing, M12 Ethernet

NOTE: A minimum of 50% of each vent must be clear for unobstructed airflow.

A mounting kit is available for standard 19 in electronics racks (see *NC-12 Rack Mounting Bracket* on page 57).

Ingress Protection Rating: IP20.

See *NC-12 Node Controller* on page 69 for the electrical specifications.

Exposed Materials

The node controller provides openings for airflow and must not be installed where harsh conditions exist.

NC-12 Mounting Plate

Two mounting plates can be used for mounting the NC-12 node controller to any flat surface.

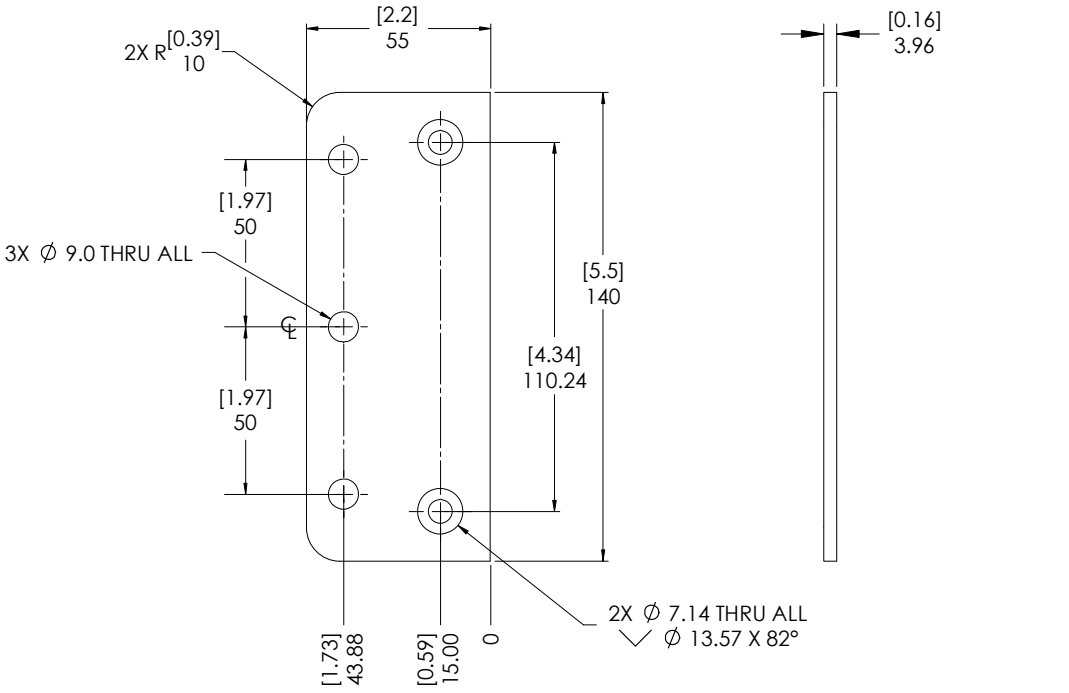


Figure 4-7: NC-12 Mounting Plate Mechanical Drawing

Exposed Materials

- 6061-T6 Aluminum.

NC-12 Rack Mounting Bracket

The 2U rack mounting brackets can be used for mounting the NC-12 node controller in a standard 19 in electronics rack.

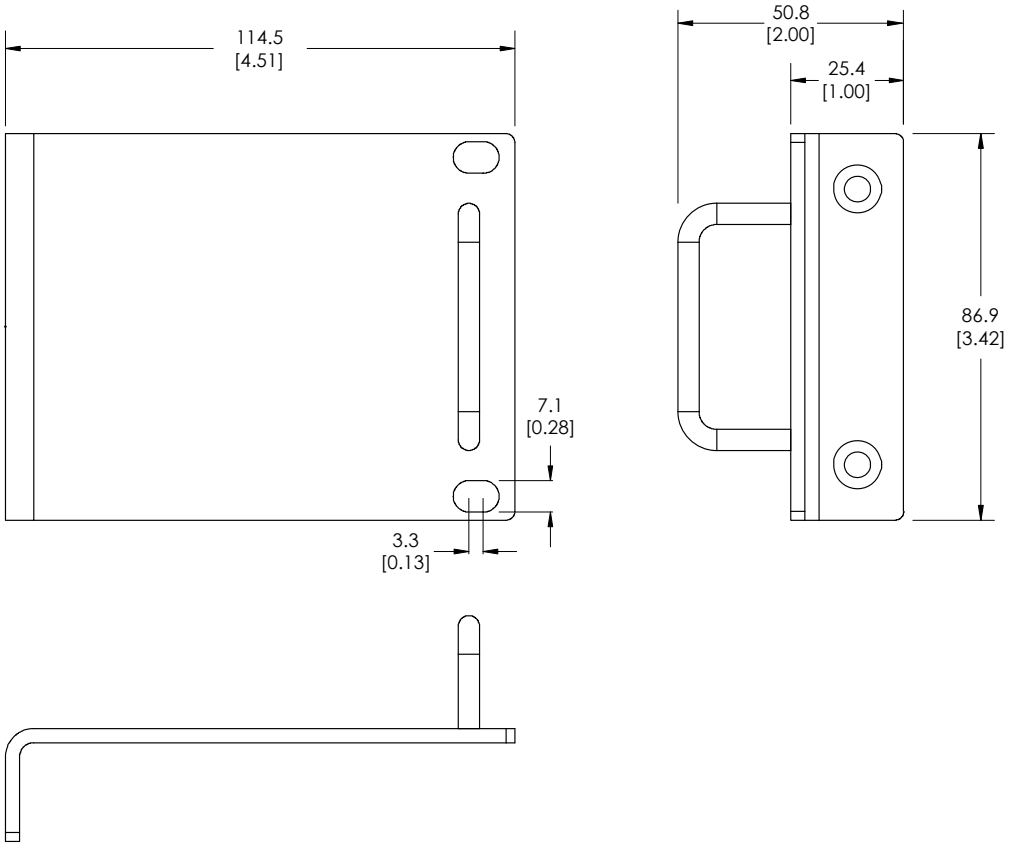


Figure 4-8: NC-12 Rack Mounting Bracket Mechanical Drawing

Exposed Materials

- Carbon Steel.
- 1018 Steel.
- Anodized Aluminum.

NC LITE

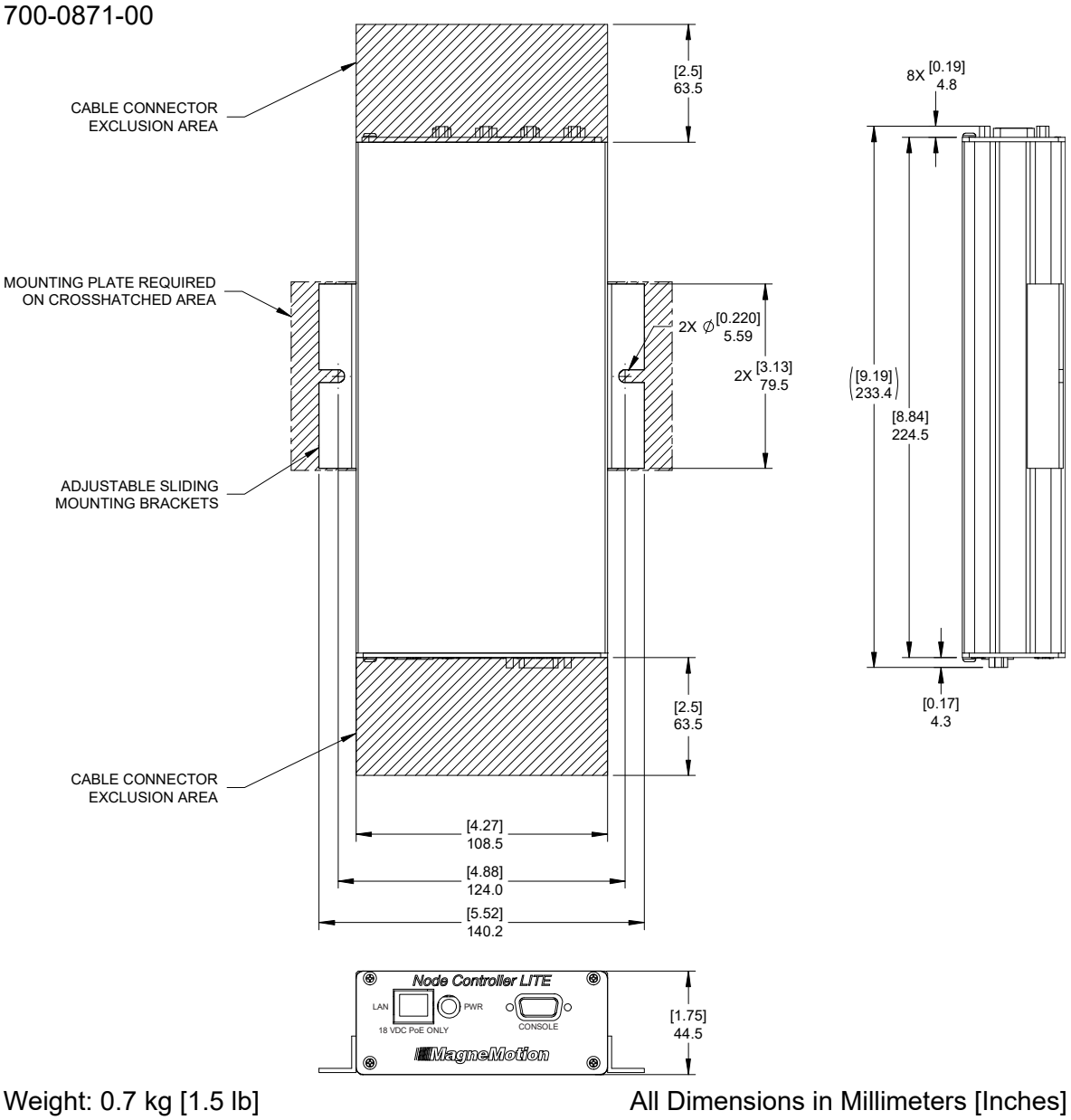


Figure 4-9: NC LITE Mechanical Drawing

NOTE: A plate is available for mounting (see *Electronics Mounting Plate* on page 59).

Ingress Protection Rating: IP30.

See *NC LITE* on page 76 for the electrical specifications.

Exposed Materials

The node controller has unprotected openings and must not be installed in locations where harsh conditions exist.

Electronics Mounting Plate

The Electronics Mounting Plate can be used for mounting the NC LITE, the SYNC IT controller, and Ethernet Switches.

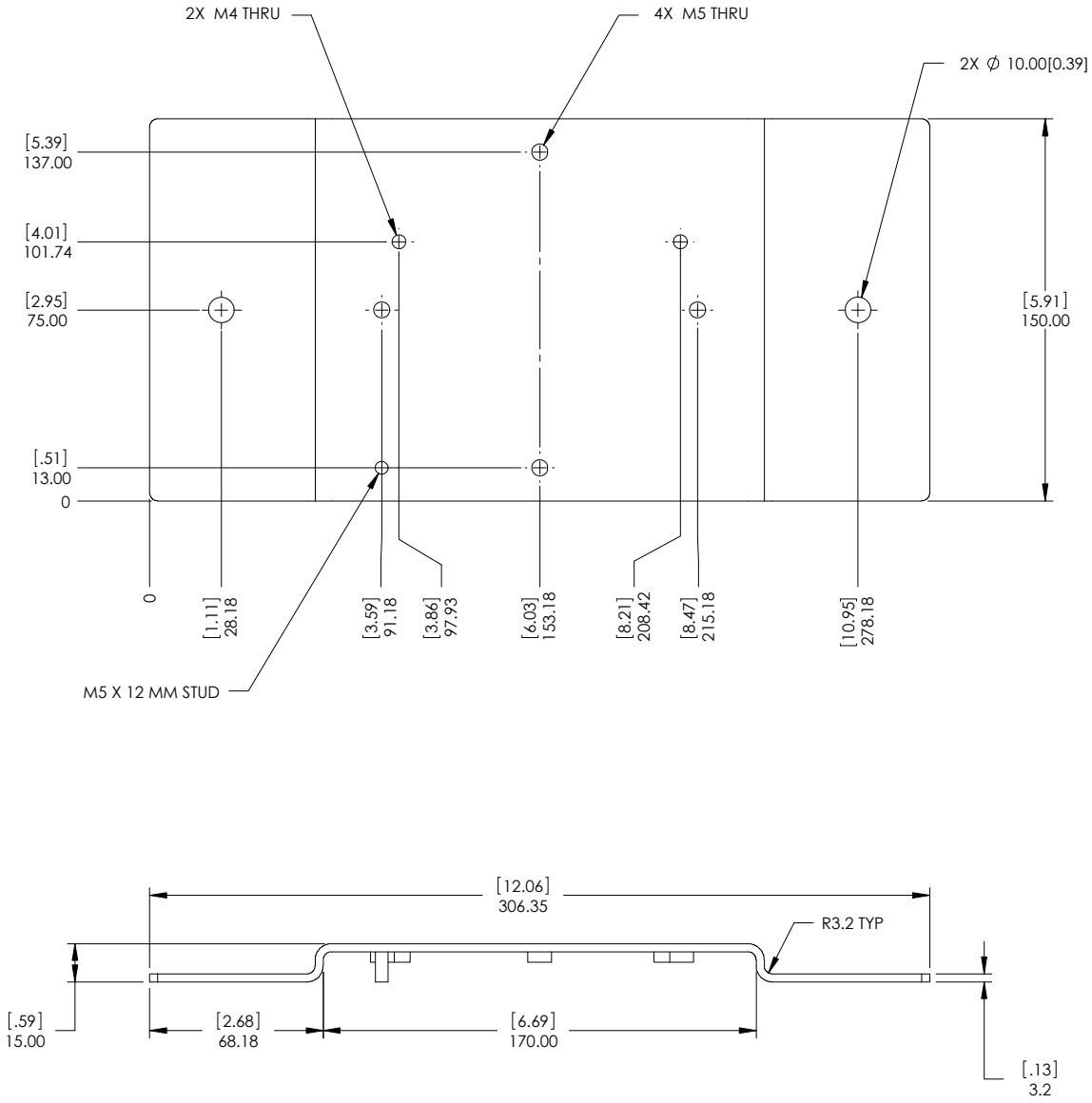


Figure 4-10: Electronics Mounting Plate Mechanical Drawing

Exposed Materials

- 5052-H32 Aluminum.
- 300 Series Stainless Steel.
- A-286 Hardened Stainless Steel.

Electrical Specifications

NC-S Node Controller

24…48V DC ±10%, 10 W max based on configuration and operating mode. See *NC-S Node Controller* on page 50 for the mechanical drawing.

AC Power Option

The optional remote power supply for the NC-S node controller requires 90…264V AC @ 47…63 Hz, single-phase (phase-to-phase or phase-to-neutral), 0.7 A at 100V AC (25 W max). Inrush current 45 A/240V AC max The actual power being drawn depends on the operations being performed. However, all power wiring must be designed to carry the full load. See the data sheet provided by the power supply manufacturer for mechanical information.

⚠ CAUTION

High-Voltage Hazard

90…264V AC, 25 W

AC power must be disconnected before servicing.

AC Power Cable

The optional remote power supply for the NC-S node controller is supplied with a power cable. Contact Rockwell Automation for replacement cables. The AC power cable plugs directly into the power supply.

DC Power Option

DC power from a user-supplied power supply requires 24…48V DC, 10 W.

NOTICE

Any user-supplied power supply must be NRTL/ATL approved.

The actual power being drawn depends on the operations being performed. Make sure that all power wiring can carry the full load and has a limited power source or the power source is fused to the maximum rating of the wiring.

NOTICE

The NC-S node controller does not support Power over Ethernet. Never connect these node controllers to a powered network as damage to internal components can result.

NOTICE

Connecting to the DC power connector on the NC-S node controller must be done with the power supply off. Connecting with the power supply on can cause a short circuit at the connector, which can damage the power supply or any other equipment being powered by that power supply.

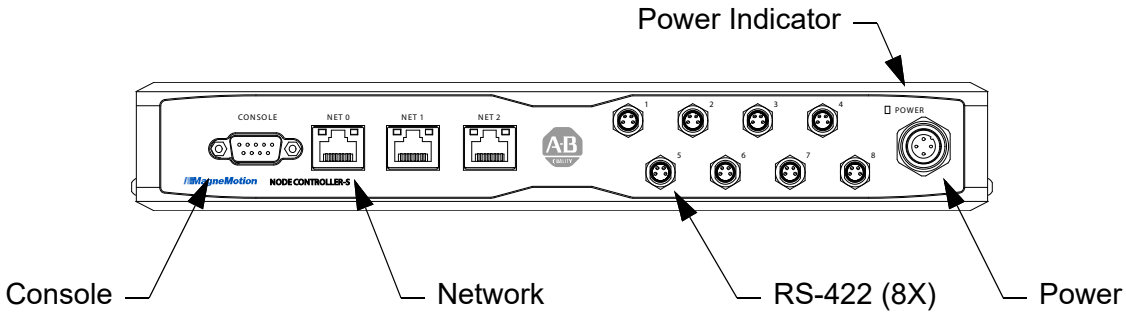


Figure 4-11: NC-S Node Controller Electrical Connections, Controls, and Indicators

Table 4-1: NC-S Node Controller Electrical Connections

Label	Description	Connector Type
CONSOLE	External terminal	DE-9, Plug
NET0	Ethernet - 10/100/1000 Base-Tx (auto-MDIX, auto-negotiation)	RJ45, Socket
NET1, NET2	not used	RJ45, Socket
1-8	RS-422 motor communications	M8 Nano-Mizer, 4-Pin, Plug*
POWER	24-48V DC ±10%, 10 W	M12 Eurofast, 4-Pin, Plug†

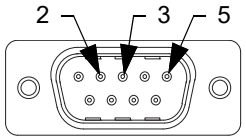
* Rockwell Automation recommends that the odd number connectors be used for upstream connections and the even number connectors be used for downstream connections.

† Rockwell Automation requires grounding the NC-S through the chassis ground connection on the power connector.

Table 4-2: NC-S Node Controller Indicators

Label	Description	Indicator Type
POWER	ON – Indicates that DC power is on.	Green light

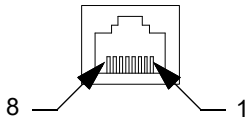
Table 4-3: NC-S Node Controller Console Pinout



DE-9, Plug

—	1
Rx	2
Tx	3
—	4
RTN	5
—	6
—	7
—	8
—	9

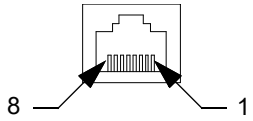
Table 4-4: NC-S Node Controller Ethernet Pinout



RJ45, Socket

TD+	1
TD-	2
RD+	3
—	4
—	5

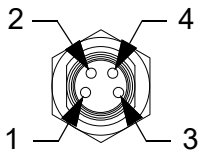
Table 4-4: NC-S Node Controller Ethernet Pinout



RJ45, Socket

RD-	6
—	7
—	8

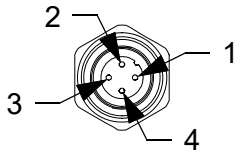
Table 4-5: NC-S Node Controller RS-422 Pinout



M8 Nano-Mizer, 4-Pin, Plug

RxD+	1
RxD-	2
TxD+	3
TxD-	4

Table 4-6: NC-S Node Controller Power Pinout



M12 Eurofast, FSFD,
4-Pin, Plug

PWR	1
—	2
RTN	3
GND	4

NC-E Series B Node Controller

6…36V DC, 40 W max based on configuration and operating mode. See *NC-E Series B Node Controller* on page 53 for the mechanical drawing.

DC Power Option

DC power from a user-supplied power supply requires 6…36V DC, 40 W.

NOTICE

Any user-supplied power supply must be NRTL/ATL approved.

The actual power being drawn depends on the operations being performed. Make sure that all power wiring can carry the full load and has a limited power source or the power source is fused to the maximum rating of the wiring.

NOTICE

The NC-E Series B node controller does not support Power over Ethernet. Never connect these node controllers to a powered network as damage to internal components can result.

NOTICE

Connecting to the DC power connector on the NC-E node controller must be done with the power supply off. Connecting with the power supply on can cause a short circuit at the connector, which can damage the power supply or any other equipment being powered by that power supply.

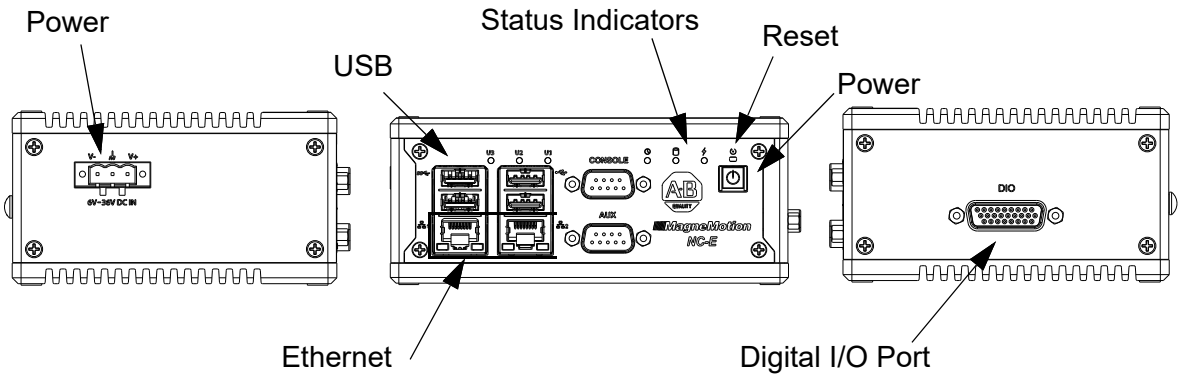


Figure 4-12: NC-E Series B Node Controller Electrical Connections, Controls, and Indicators

Table 4-7: NC-E Series B Node Controller Electrical Connections

Label	Description	Connector Type
Digital I/O	Optically isolated, 8 input bits and 8 output bits	26-pin high-density D-sub connector
SS (USB SuperSpeed)	Not used	USB 3.0, Socket
(USB)	Not used	USB 2.0, Socket
1 (Network 1)	Ethernet – 10/100/1000 BaseTx (auto-MDIX, auto-negotiation)	RJ45, Socket (active Ethernet port)
2 (Network 2)	Not used	RJ45, Socket
AUX	Not used	DE-9, Plug
Console	External terminal	DE-9, Plug
6V…36V DC IN	6…36V DC, 40 W	3P pluggable connector with latch (V-, GND, V+)*

* Rockwell Automation requires grounding the NC-E Series B through the chassis ground connection on the power connector.

Table 4-8: NC-E Series B Node Controller Controls

Label	Description	Control Type
(Reset)	Forced reset of node controller.	Recessed push button
(Power)	Power on/off for the node controller. Press and hold ~10 sec to turn off the NC-E Series B.	Push button

Table 4-9: NC-E Series B Node Controller Indicators

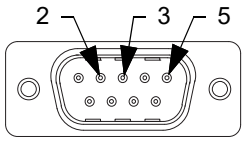
Label	Description	Indicator Type
U1	*Reserved*	—
U2	*Reserved*	—
U3	*Reserved*	—
(Watchdog)	Indicates the watchdog timer status. Blinks when the watchdog timer starts. When the timer is expired, the node controller auto-reboots.	Yellow light
(Hard Disk)	When blinking, indicates that the hard disk drive is active*.	Orange light

Table 4-9: NC-E Series B Node Controller Indicators (Continued)

Label	Description	Indicator Type
⚡ (Standby)	Indicates that the node controller is in power standby mode.	Blue light
⏻ (Power)	Indicates that the NC-E Series B is on.	Blue light

* This applies to Next Gen node controller images. The hard disk light remains solid on legacy node controller images.

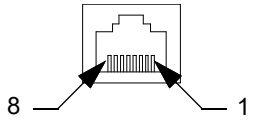
Table 4-10: NC-E Series B Node Console Pinout



DE-9, Plug

—	1
Rx	2
Tx	3
—	4
RTN	5
—	6
—	7
—	8
—	9

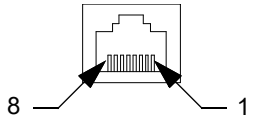
Table 4-11: NC-E Series B Node Controller Ethernet Pinout



RJ45, Socket

BI_DA+	1
BI_DA-	2

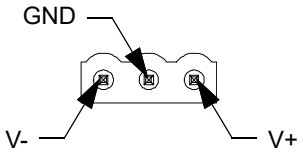
Table 4-11: NC-E Series B Node Controller Ethernet Pinout



RJ45, Socket

BI_DB+	3
BI_DC+	4
BI_DC-	5
BI_DB-	6
BI_DD+	7
BI_DD-	8

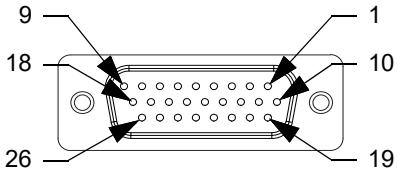
Table 4-12: NC-E Series B Node Controller Power Pinout



2.0 mm Coax, Plug

RTN	1
GND	2
PWR	3

Table 4-13: NC-E Series B Node Controller Digital I/O Pinout



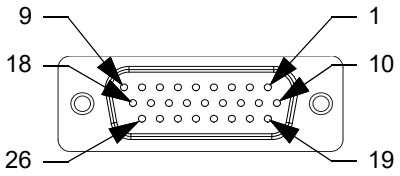
DA-26, Socket

+CN_DI0_L	1
+CN_DI1_L	2

CN_DI0_H	10
CN_DI1_H	11

CN_DO_0	19
CN_DO_1	20

Table 4-13: NC-E Series B Node Controller Digital I/O Pinout



DA-26, Socket

CN_DI2_L	3	**CN_DI2_H**	12	**CN_DO_2**	21
CN_DI3_L	4	**CN_DI3_H**	13	**CN_DO_3**	22
CN_DI4&5_L	5	**CN_DI4_H**	14	**CN_DO_4**	23
DIO_GND	6	**CN_DI5_H**	15	**CN_DO_5**	24
CN_DI6&7_L	7	**CN_DI6_H**	16	**CN_DO_6**	25
P_+VDIO_EXT	8	**CN_DI7_H**	17	**CN_DO_7**	26
P_+5V0_DIO_CN	9	**DIO_GND**	18		

NC-12 Node Controller

The NC-12 node controller is available in two different configurations. The 700-1482-00 version provides a standard RJ45 network connection and a 2 mm coax power connection. The 700-1573-00 version provides an M12 Eurofast network connection and an M12 Eurofast power connection.

22…30V DC, 20 W max based on configuration and operating mode. See *NC-12 Node Controller* on page 54 or *NC-12 Node Controller, M12 Ethernet* on page 55 for the mechanical drawing.

AC Power Option

The optional remote power supply for the NC-12 node controller requires 90…264V AC @ 47…63 Hz, single-phase (phase-to-phase or phase-to-neutral), 0.7 A at 100V AC (25 W max). Inrush current 45 A/240V AC max The actual power being drawn depends on the operations being performed. However, all power wiring must be designed to carry the full load. See the data sheet provided by the power supply manufacturer for mechanical information.

CAUTION

High-Voltage Hazard

90…264V AC, 25 W

AC power must be disconnected before servicing.

AC Power Cable

The optional remote power supply for the NC-12 node controller is supplied with a power cable. Contact Rockwell Automation for replacement cables. The AC power cable plugs directly into the power supply.

DC Power Option

DC power from a user-supplied power supply requires 22…30V DC, 20 W.

NOTICE

Any user-supplied power supply must be NRTL/ATL approved.

The actual power being drawn depends on the operations being performed. Make sure that all power wiring can carry the full load and has a limited power source or the power source is fused to the maximum rating of the wiring.

NOTICE

Connecting to the DC power connector on the NC-12 node controller must be done with the power supply off. Connecting with the power supply on can cause a short circuit at the connector, which can damage the power supply or any other equipment being powered by that power supply.

NOTICE

The NC-12 node controller does not support Power over Ethernet. Never connect these node controllers to a powered network as damage to internal components can result.

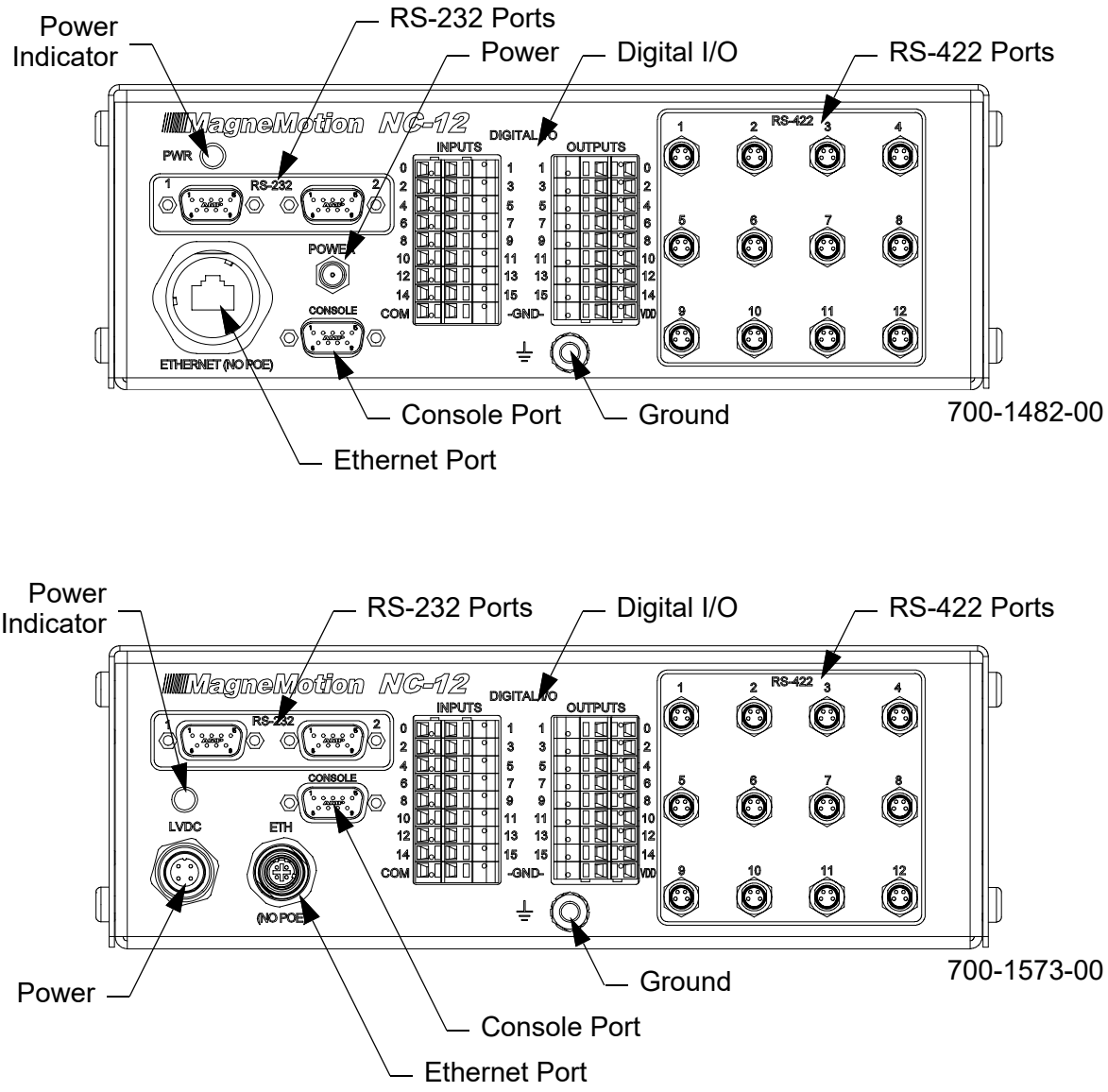


Figure 4-13: NC-12 Node Controller Electrical Connections and Indicators

Table 4-14: NC-12 Node Controller Connections, 700-1482-00

Label	Description	Connector Type
CONSOLE	External terminal	DE-9, Plug
ETHERNET	Ethernet – 10/100/1000 BaseTx (auto-MDIX, auto-negotiation)	RJ45, Socket, IP67*
DIGITAL I/O	Digital I/O, optically isolated, 16 input bits and 16 output bits, see *General Purpose Digital I/O* on page 43	Spring-cage clamp
RS-232	RS-232 external communications	DE-9, Plug

Table 4-14: NC-12 Node Controller Connections, 700-1482-00 (Continued)

Label	Description	Connector Type
RS-422	RS-422 motor communications	M8 Nano-Mizer, 4-Pin, Plug†
POWER	22…30V DC, 20 W	DC Power Jack, 2.0 mm Coax, Plug
⏚	Ground	M6 threaded stud‡

* IP67 rated mating connector is not required.

† Rockwell Automation recommends that the odd number connectors be used for upstream connections and the even number connectors be used for downstream connections.

‡ Rockwell Automation requires grounding the NC-12 through the ground stud with a minimum of 14 AWG wire.

Table 4-15: NC-12 Node Controller Connections, 700-1573-00

Label	Description	Connector Type
CONSOLE	External terminal	DE-9, Plug
ETH	Ethernet – 10/100/1000 BaseTx (auto-MDIX, auto-negotiation)	M12, Eurofast, 4-Pin, Socket
DIGITAL I/O	Digital I/O, optically isolated, 16 input bits and 16 output bits, see *General Purpose Digital I/O* on page 43	Spring-cage clamp
RS-232	RS-232 external communications	DE-9, Plug
RS-422	RS-422 motor communications	M8 Nano-Mizer, 4-Pin, Plug*
LVDC	22…30V DC, 20 W	M12 Eurofast, 4-Pin, Plug
⏚	Ground	M6 threaded stud†

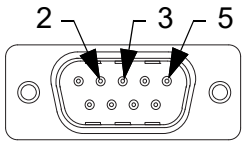
* Rockwell Automation recommends that the odd number connectors be used for upstream connections and the even number connectors be used for downstream connections.

† Rockwell Automation requires grounding the NC-12 through the ground stud with a minimum of 14 AWG wire.

Table 4-16: NC-12 Node Controller Indicators

Label	Description	Indicator Type
PWR/LVDC	ON – Indicates that DC power is on.	Green light

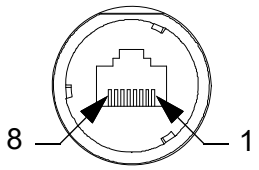
Table 4-17: NC-12 Node Controller Console Pinout



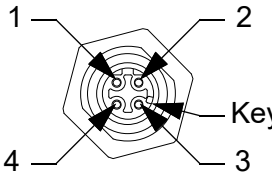
DE-9, Plug

—	1
-Rx	2
+Tx	3
—	4
GND	5
—	6
—	7
—	8
—	9

Table 4-18: NC-12 Node Controller Ethernet Pinout



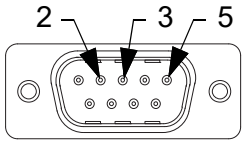
700-1482-00
RJ45, Socket



700-1573-00
M12 Eurofast, FKFDD, Socket

TD+	1	1
TD-	2	3
RD+	3	2
—	4	
—	5	
RD-	6	4
—	7	
—	8	

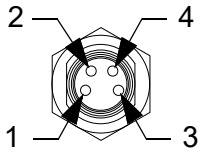
Table 4-19: NC-12 Node Controller RS-232 Pinout



DE-9, Plug

—	1
-Rx	2
+Tx	3
—	4
GND	5
—	6
—	7
—	8
—	9

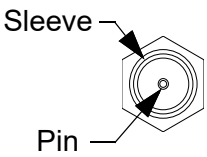
Table 4-20: NC-12 Node Controller RS-422 Pinout



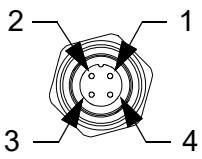
M8 Nano-Mizer, 4-Pin, Plug

RxD+	1
RxD-	2
TxD+	3
TxD-	4

Table 4-21: NC-12 Node Controller Power Pinout



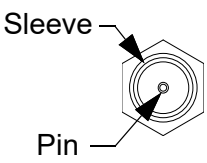
700-1482-00
2.0 mm Coax, Plug



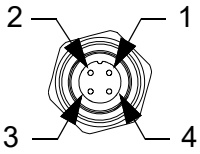
700-1573-00
M12 Eurofast, FSFD, 4-Pin, Plug

PWR	Pin	1
—	—	2

Table 4-21: NC-12 Node Controller Power Pinout



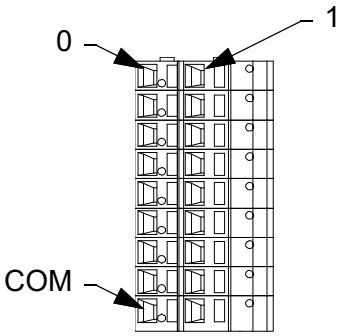
700-1482-00
2.0 mm Coax, Plug



700-1573-00
M12 Eurofast, FSFD, 4-Pin, Plug

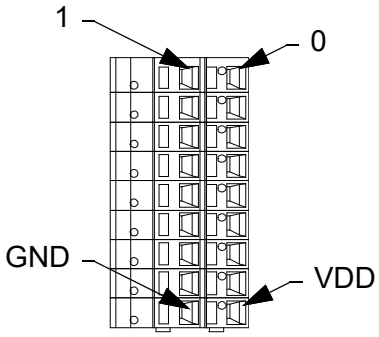
—	—	3
RTN	Sleeve	4

Table 4-22: NC-12 Node Controller Digital I/O Pinout



Cage Clamp – Input*

0	Input
1	Input
2	Input
. . .	Inputs repeat for a total of 16 inputs
15	Input
COM	+3…24V DC
GND†	—



Cage Clamp – Output*

0	Output
1	Output
2	Output
. . .	Outputs repeat for a total of 16 outputs
15	Output
VDD	+5…35V DC
GND	DC RTN

* See Figure 3-2 on page 43 for the digital I/O equivalent circuits.

† The GND pin is not used for the digital inputs.

NC LITE

7…18V DC, 5 W max based on configuration and operating mode. See *NC LITE* on page 58 for the mechanical drawing.

AC Power Option

The optional remote power supply for the NC LITE requires 90…264V AC @ 47…63 Hz, single-phase (phase-to-phase or phase-to-neutral), 0.7 A at 100V AC (25 W max). Inrush current 45 A/240V AC max The actual power being drawn depends on the operations being performed. However, all power wiring must be designed to carry the full load. See the data sheet provided by the power supply manufacturer for mechanical information.

⚠ CAUTION

High-Voltage Hazard

90…264V AC, 25 W

AC power must be disconnected before servicing.

AC Power Cable

The optional remote power supply for the NC LITE is supplied with a power cable. Contact Rockwell Automation for replacement cables. The AC power cable plugs directly into the power supply. The remote power supply and AC cable for the NC LITE is not required if Power over Ethernet is being used.

DC Power Option

DC power from a user-supplied power supply requires 7…18V DC, 5 W.

NOTICE

Any user-supplied power supply must be NRTL/ATL approved.

The actual power being drawn depends on the operations being performed. Make sure that all power wiring can carry the full load and has a limited power source or the power source is fused to the maximum rating of the wiring.

Or, power for the NC LITE can be provided using the Power over Ethernet network. The remote power supply is not required in this case.

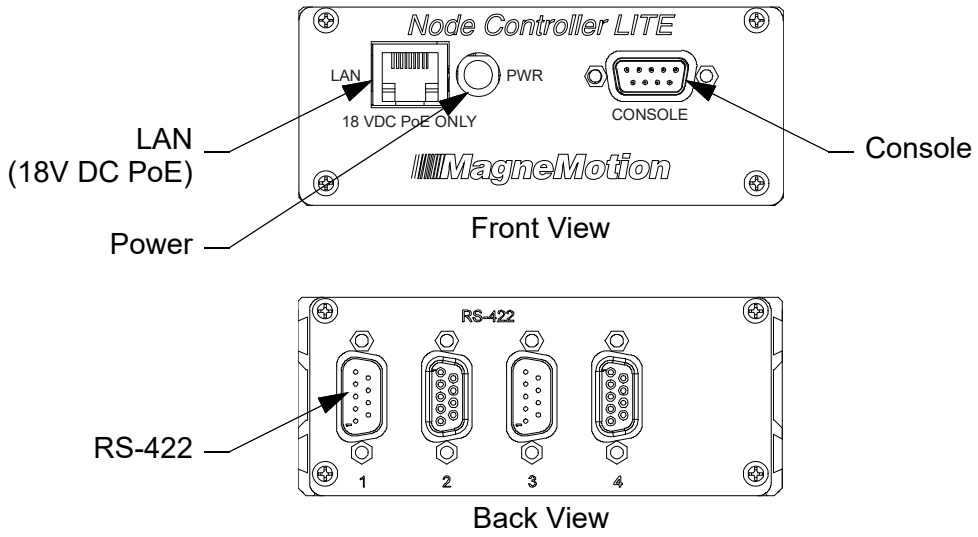


Figure 4-14: NC LITE Electrical Connections

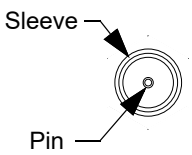
Table 4-23: NC LITE Electrical Connections

Label	Description	Connector Type
LAN	Ethernet – 10/100 BaseTx (auto-MDIX, auto-negotiation) (Passive PoE, 18V DC)	RJ45, Socket
PWR	7…18V DC, 5 W*	DC Power Jack, 2.0 mm Coax, Plug
CONSOLE	External terminal	DE-9, Plug
RS-422	RS-422 motor communications	DE-9, Plug and Socket†

* Rockwell Automation requires grounding the NC LITE by mounting to a grounded surface.

† Rockwell Automation recommends that the odd number (male) connectors be used for upstream connections and the even number (socket) connectors be used for downstream connections.

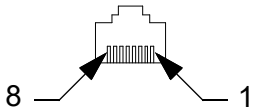
Table 4-24: NC LITE Power Pinout



2.0 mm Coax, Plug

PWR	Pin
RTN	Sleeve

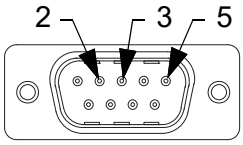
Table 4-25: NC LITE LAN Pinout



RJ45, Socket

TD+	1
TD-	2
RD+	3
+18V DC	4
+18V DC	5
RD-	6
RTN	7
RTN	8

Table 4-26: NC LITE Console Pinout

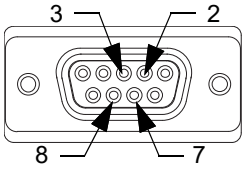


DE-9, Plug

—	1
Rx	2
Tx	3
—	4
RTN	5
—	6
—	7
—	8
—	9

Table 4-27: NC LITE RS-422 Pinout

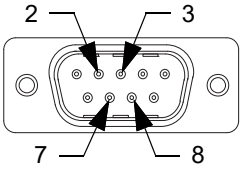
Downstream



J2, J4 – DE-9, Socket

—	1
RxD-	2
TxD+	3
—	4
—	5
—	6
RxD+	7
TxD-	8
—	9

Upstream



J1, J3 – DE-9, Plug

—	1
TxD-	2
RxD+	3
—	4
—	5
—	6
TxD+	7
RxD-	8
—	9

Ethernet Switch with Power over Ethernet Injector

The Power over Ethernet switch provides +18V DC @ 2 A max/port for the NC LITE.

18V DC, 100 W max based on configuration and operating mode.

NOTICE

The voltage that is provided by the Power over Ethernet switch is non-standard (18V DC) and the switch does not disable power at any port.

Connecting any device other than an NC LITE to the PoE switch can damage the device.

AC Power Option

The optional remote power supply for the Ethernet switch requires 85…264V AC @ 47…63 Hz, single-phase (phase-to-phase or phase-to-neutral), <1.0 A rms (100 W max), based on configuration and operating mode. Inrush current <37 A at 230V AC cold start. The actual power being drawn depends upon operations being performed, however all power wiring and all Ethernet cables that are used for PoE must be sized to carry the full load. See the data sheet provided by the power supply manufacturer for mechanical information.

⚠ CAUTION

High-Voltage Hazard

85…264V AC, 100 W

AC power must be disconnected before servicing.

AC Power Cable

The Ethernet Switch with PoE power supply is supplied with a power cable. Contact Rockwell Automation for replacement cables. The AC power cable plugs directly into the power supply.

DC Power Option

DC power from a user-supplied power supply requires 18V DC, 100 W.

NOTICE

Any user-supplied power supply must be NRTL/ATL approved.

The actual power being drawn depends on the operations being performed. Make sure that all power wiring can carry the full load and has a limited power source or the power source is fused to the maximum rating of the wiring.

Site Requirements

Environment

NC-S

Temperature:

Operating: 0 °C…50 °C [32 °F…122 °F]
Storage: -18 °C…60 °C [0 °F…140 °F]

Humidity:

85% Maximum (relative, noncondensing)

NC-E

Temperature:

Operating: 0 °C…50 °C [32 °F…122 °F]
Storage: -40 °C…85 °C [-40 °F 185 °F]

Humidity:

~95% @ 40 °C [104 °F] (noncondensing)

NC-12

Temperature:

Operating: 0 °C…50 °C [32 °F…122 °F]
Storage: -18 °C…50 °C [0 °F…122 °F]

Humidity:

85% Maximum (relative, noncondensing)

NC LITE

Temperature:

Operating: 0 °C…50 °C [32 °F…122 °F]
Storage: -18 °C…50 °C [0 °F…122 °F]

Humidity:

85% Maximum (relative, noncondensing)

Derating at High Altitude

When operating in a high altitude environment with lower air pressure, the operating temperature range must be derated compared to that of sea level.

Lighting, Site

No special lighting is required for proper operation of the node controllers. Maintenance can require a user-supplied service lamp (for example, a flashlight).

Floor Space and Loading

The location for each node controller must meet the minimum space requirements as defined in the *Mechanical Specifications* on page 50 to make sure that there is proper clearance for installation, operation, and servicing. The dimensions that are given are for the node controllers only. Make sure that there is adequate space around the equipment for operation and service that is based on their needs.

Facilities

The facility is responsible for providing power as specified in *Electrical Specifications* on page 60 to support proper operation of the node controllers. See *Electrical Connections* on page 99 for all connections to the node controllers.

The facility is responsible for the main disconnect device between the node controllers and the power source, making sure it complies with the appropriate facility, local, and national electrical codes. Service to the node controllers must have the appropriate circuit breaker rating.

Service Access

The node controllers require adequate space for service access and for proper operation. Typical service space that is required for the node controllers is shown in Figure 4-4, Figure 4-5, Figure 4-6, and Figure 4-9. Make sure that installation of the node controller is such that it provides access to items required for service after installation, such as power and communication connections.

NOTE: The exclusion zones that are shown are for the node controllers only. Additional exclusion zones may be required based on the design of the transport system.

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Installation 5

Overview

This chapter provides complete installation procedures for the various configurations of the transport systems. To upgrade an existing node controller, see *Upgrading Node Controllers* on page 123.

Included in this chapter are:

- Unpacking and inspection of the transport system components.
- Component installation including: hardware installation, facilities connections, and software installation and configuration.
- Initial power-up and check-out.

Unpacking and Inspection

The node controllers are shipped in separate packages. Open each package carefully following the steps that are provided in *Unpacking and Moving* on page 86; inspect and verify the contents against the shipping documents. Report any damage or missing items immediately to the shipper and to Rockwell Automation.

One set of shipping documents is attached to the outside of the main shipping crate for easy access.

NOTE: The number and contents of the shipping packages depends on the items that are purchased and their configuration (that is, shipped as components or shipped as a system). See the shipping documents for the exact contents. Table 5-1, is an example and is provided for reference only.

Table 5-1: Node Controller Packing Checklist Reference

Package	Contents	Catalog Numbers
NC-S Node Controller	• Node controller	MMI-NC-SER08-01
NC-E Series B Node Controller	• Node controller • Miscellaneous hardware	MMI-NC-ENET-01
NC-12, RJ45 Ethernet Node Controller	• Node controller	700-1482-00
NC-12, M12 Ethernet Node Controller	• Node controller	700-1573-00
NC LITE Node Controller	• Node controller • Power supply • Miscellaneous hardware • Cables	700-0871-00

Unpacking and Moving

The node controller arrives from the factory as an individual component ready for final installation. The information required to install the node controllers is provided in *Node Controller Installation* on page 88.

NOTE: Save the shipping packaging for possible future use. If the node controllers are shipped, the original shipping packaging must be used. If the original packaging has become lost or damaged, contact Rockwell Automation for replacements.

1. Upon receiving the packages, visually verify that the packaging is not damaged. Inform the freight carrier and Rockwell Automation of any inspection discrepancy.

2. Open each shipping package and verify the contents against the shipping documents. Do not remove any protective wrapping.

3. Carefully inspect each package for signs of shipping damage. Report any damage immediately to the shipper and to Rockwell Automation.

4. Move all items to their destination (see *Node Controller Installation* on page 88).

Node Controller Installation

Locate the node controllers close to the nodes they are responsible for to minimize the length of all wiring.

NOTICE

Make sure that all mounting surfaces and mounting hardware provide a conductive path to the transport system ground connection.

Mounting NC-S Node Controllers

Locate the NC-S close to the nodes it is responsible for to minimize the length of all wiring. The node controller can be oriented in any direction that is required, make sure the service and exclusion zones that are identified in Figure 4-1 on page 50 are maintained. Typical mounting methods for the NC-S use either *DIN Rail Mounting*, *Surface Mounting*, or *Rack Mounting*.

DIN Rail Mounting

The NC-S can be mounted to a DIN Rail by attaching the optional DIN rail mounting bracket as shown in Figure 5-1.

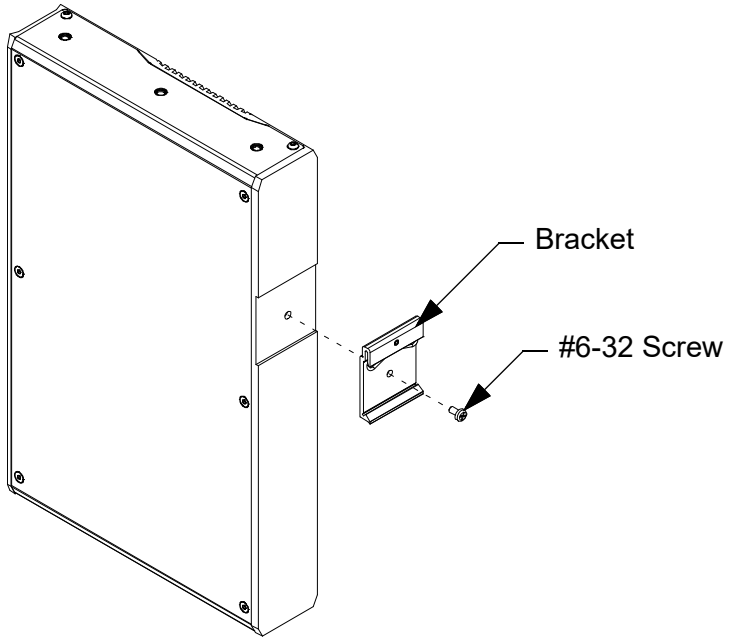


Figure 5-1: NC-S Node Controller DIN Rail Mounting

1. Install the DIN mounting bracket onto the node controller with the supplied #6-32 Phillips head screw. Tighten to 1.1 N•m [10 in•lb].

2. Clip the node controller onto the DIN rail in the appropriate location. Make sure that the service and exclusion zones are maintained.

3. Install cable management as required to secure the cables that are connected to the node controller.

Surface Mounting

The NC-S can be mounted to a convenient surface by attaching the optional mounting brackets are shown in Figure 5-2.

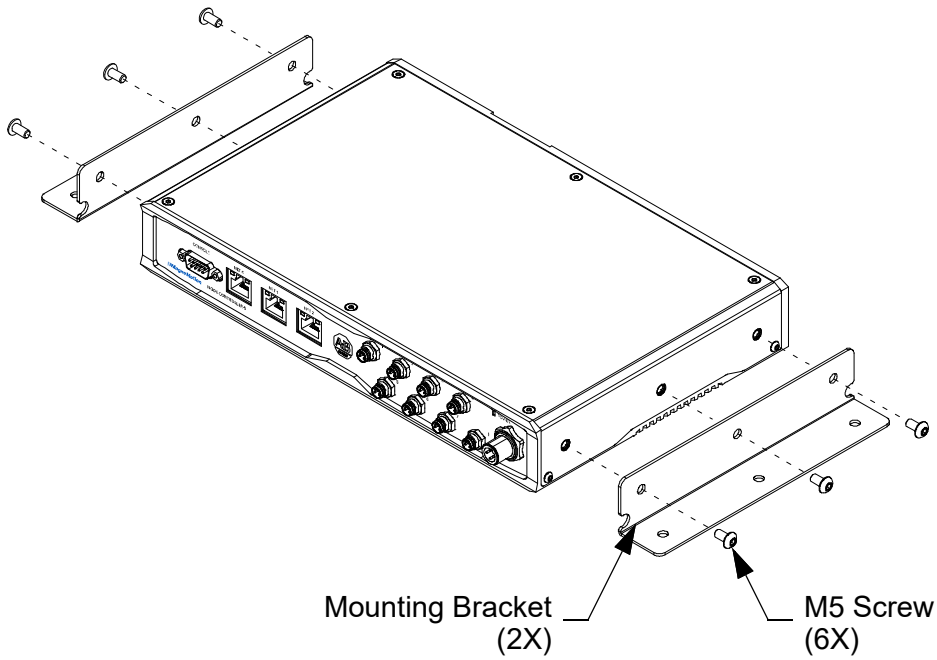


Figure 5-2: NC-S Node Controller Surface Mounting

1. Align each mounting bracket to the node controller and secure them with the supplied M5 screws. Tighten to 1.1 N•m [10 in•lb].

2. Locate the node controller as required and secure it with a minimum of two screws per mounting bracket. Make sure that the service and exclusion zones are maintained.

3. Install cable management as required to secure the cables that are connected to the node controller.

Rack Mounting

The NC-S can be mounted in a standard 19 inch equipment rack by attaching the optional 1U rack mounting brackets as shown in Figure 5-3.

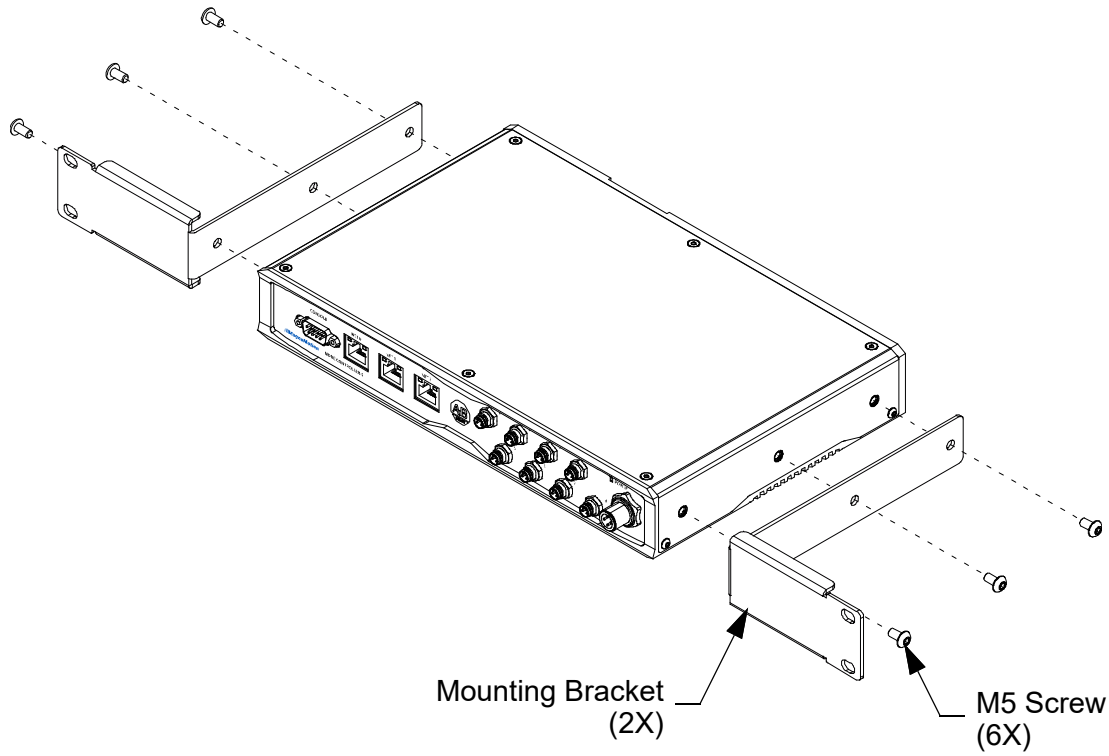


Figure 5-3: NC-S Node Controller Rack Mounting

1. Align each rack mounting bracket to the node controller and secure them with the supplied M5 screws. Tighten to 1.1 N•m [10 in•lb].

2. Locate the node controller in the rack and secure it with four screws (two per mounting bracket) as specified by the rack manufacturer. Make sure that the service and exclusion zones are maintained.

3. Install cable management as required to secure the cables that are connected to the node controller.

Mounting NC-S Power Supplies

Locate the power supply close to the node controller it is powering to minimize the length of all wiring. The power supply can be oriented in any direction required.

Mounting NC-E Series B Node Controllers

Locate the NC-E Series B close to the nodes it is responsible for to minimize the length of all wiring. The node controller can be oriented in any direction that is required, make sure the service and exclusion zones that are identified in Figure 4-4 on page 53 are maintained. Typical mounting methods for the NC-E Series B use either *DIN Rail Mounting* or *Surface Mounting*.

DIN Rail Mounting

The NC-E can be mounted to a DIN Rail by attaching the optional DIN rail mounting bracket as shown in Figure 5-4.

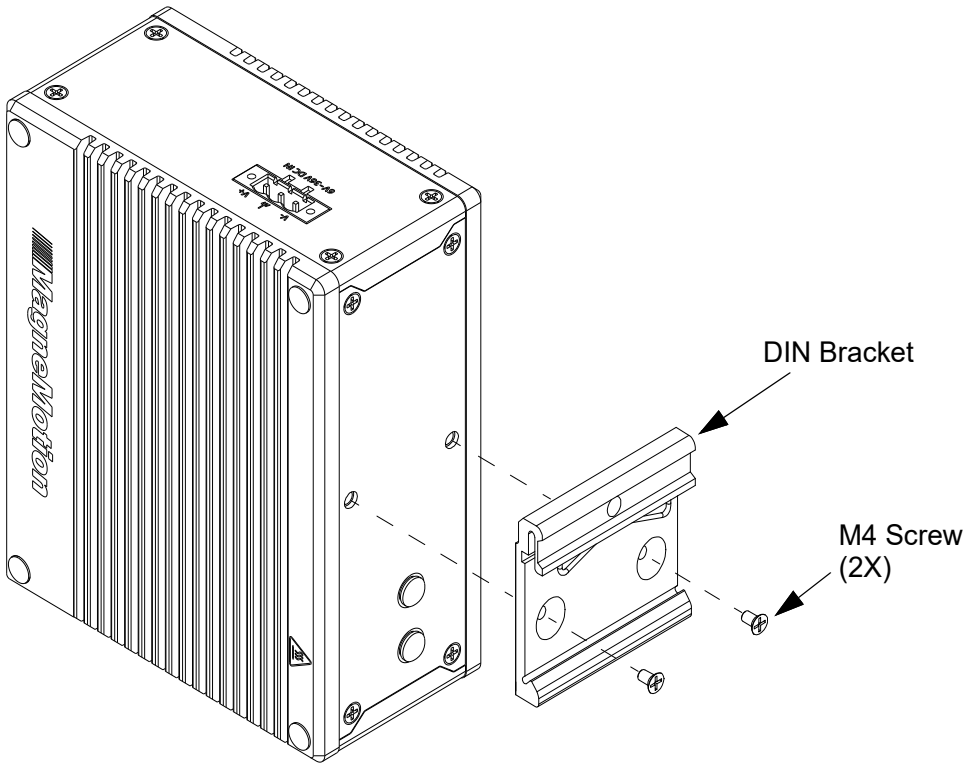


Figure 5-4: NC-E Series B Node Controller DIN Rail Mounting

1. Remove the hole plugs from the back of the node controller.

2. Install the DIN mounting bracket onto the node controller with the two supplied M4 flat head screws. Apply Loctite® 243 to the screws and tighten to 1.1 N•m [10 in•lb].

   NOTE: The Loctite must cure for 2 hours at 22 °C [72 °F] before using the transport system.

3. Clip the node controller onto the DIN rail in the appropriate location. Make sure that the service and exclusion zones are maintained.

4. Install cable management as required to secure the cables that are connected to the node controller.

Surface Mounting

Typical methods for mounting the NC-E Series B to a surface by attaching the optional mounting brackets are shown in Figure 5-5.

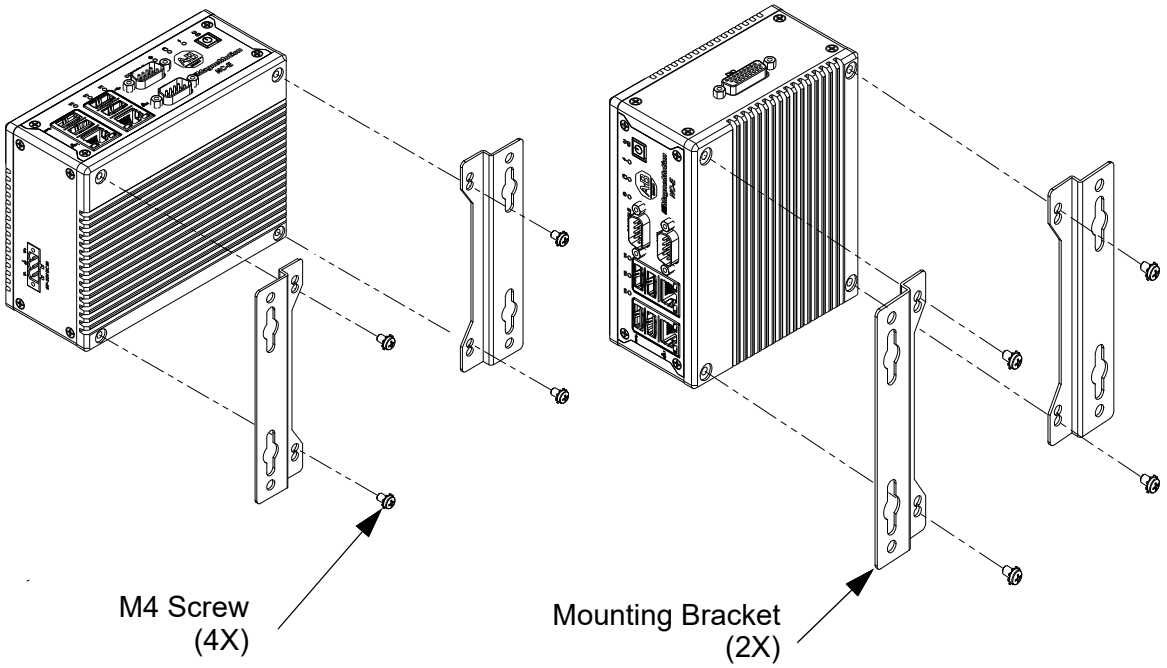


Figure 5-5: NC-E Series B Node Controller Surface Mounting

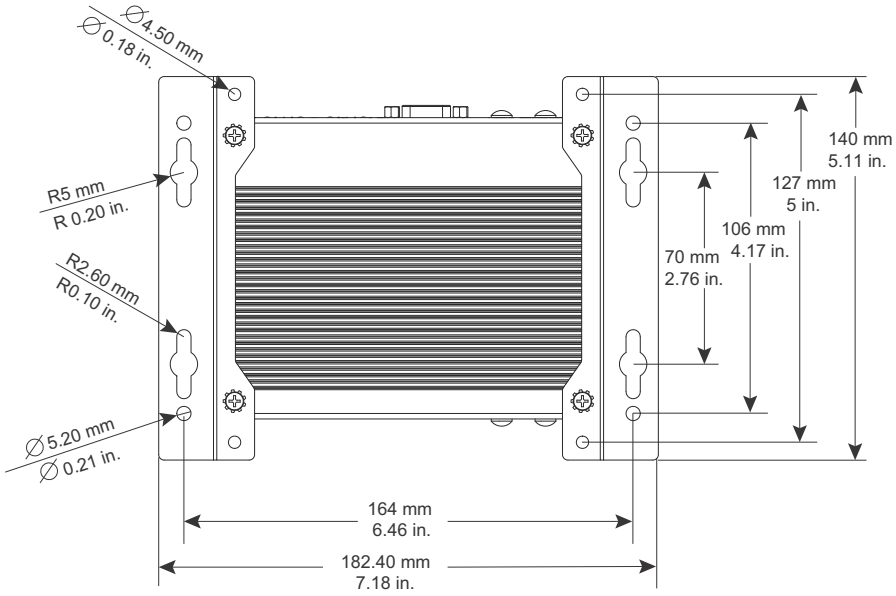


Figure 5-6: NC-E Series B Node Controller Surface Mounting Dimensions

1. Remove the four feet from the bottom of the node controller.

2. Align each mounting bracket to the NC-E Series B and secure them to the node controller with the supplied M4 screws. Apply Loctite 243 and tighten to 1.1 N•m [10 in•lb].

   NOTE: The Loctite must cure for 2 hours at 22 °C [72 °F] before using the transport system.

3. Locate the node controller as required and secure it with four screws (two per mounting bracket) make sure that the service and exclusion zones are maintained.

4. Install cable management as required to secure the cables that are connected to the node controller.

Mounting NC-12 Node Controllers

Locate the NC-12 close to the nodes it is responsible for to minimize the length of all wiring. The node controller can be oriented in any direction that is required. Make sure that the service and exclusion zones that are identified in Figure 4-5 on page 54 and Figure 4-6 on page 55 are maintained. Typical mounting methods for the NC-12 use either *Surface Mounting* or *Rack Mounting*.

Surface Mounting

The NC-12 can be mounted to a convenient surface by attaching the optional mounting plates as shown in Figure 5-7. See Figure 4-7 on page 56 for dimensions.

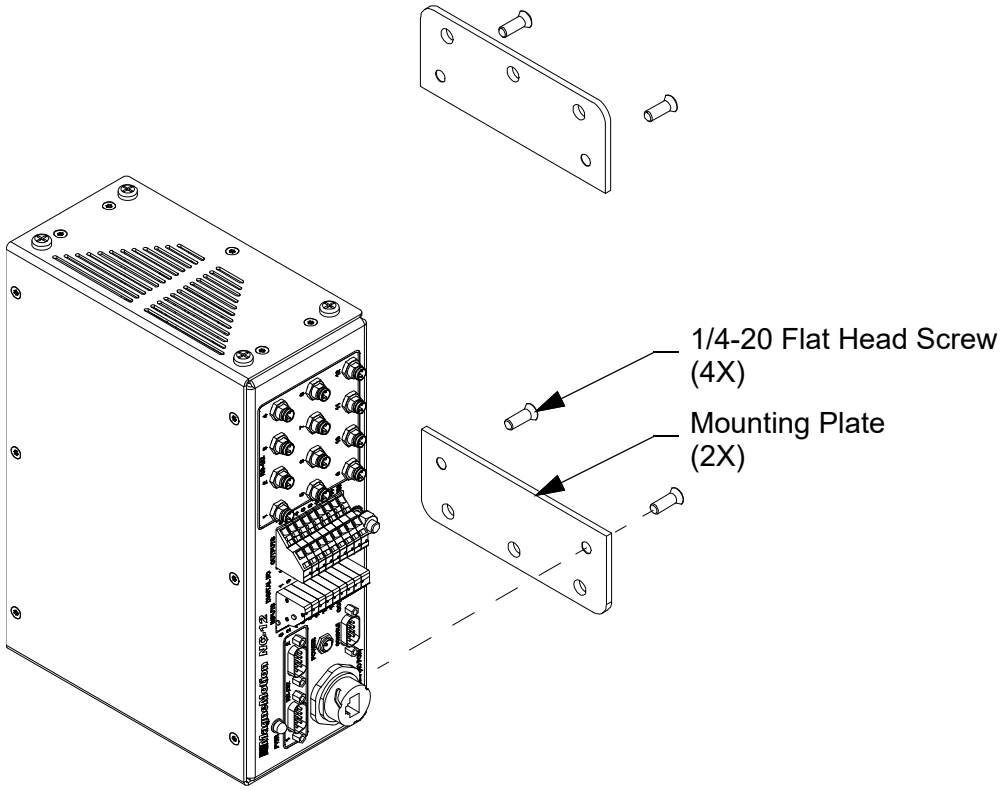


Figure 5-7: NC-12 Node Controller Surface Mounting

1. Align each mounting plate to the NC-12 and secure it to the node controller with two 1/4-20 flat head screws with Loctite 243 per plate. Tighten the screws to 10.1 N•m [90 in•lb] (four screws total). The maximum thread length into the threaded hole is 7.87 mm [0.310 in].

   NOTE: The Loctite must cure for 2 hours at 22 °C [72 °F] before using the transport system.

2. Orient the node controller with brackets as required and secure it with a minimum of two M8 screws with M8 split lock washers (one per mounting plate). Tighten the screws to 26 N•m [230 in•lb]. Make sure that the service and exclusion zones are maintained.

3. Install cable management as required to secure the cables that are connected to the node controller.

Rack Mounting

The NC-12 can be mounted in a standard 19 inch rack by attaching the optional 2U rack mounting brackets as shown in Figure 5-8. See Figure 4-8 on page 57 for dimensions.

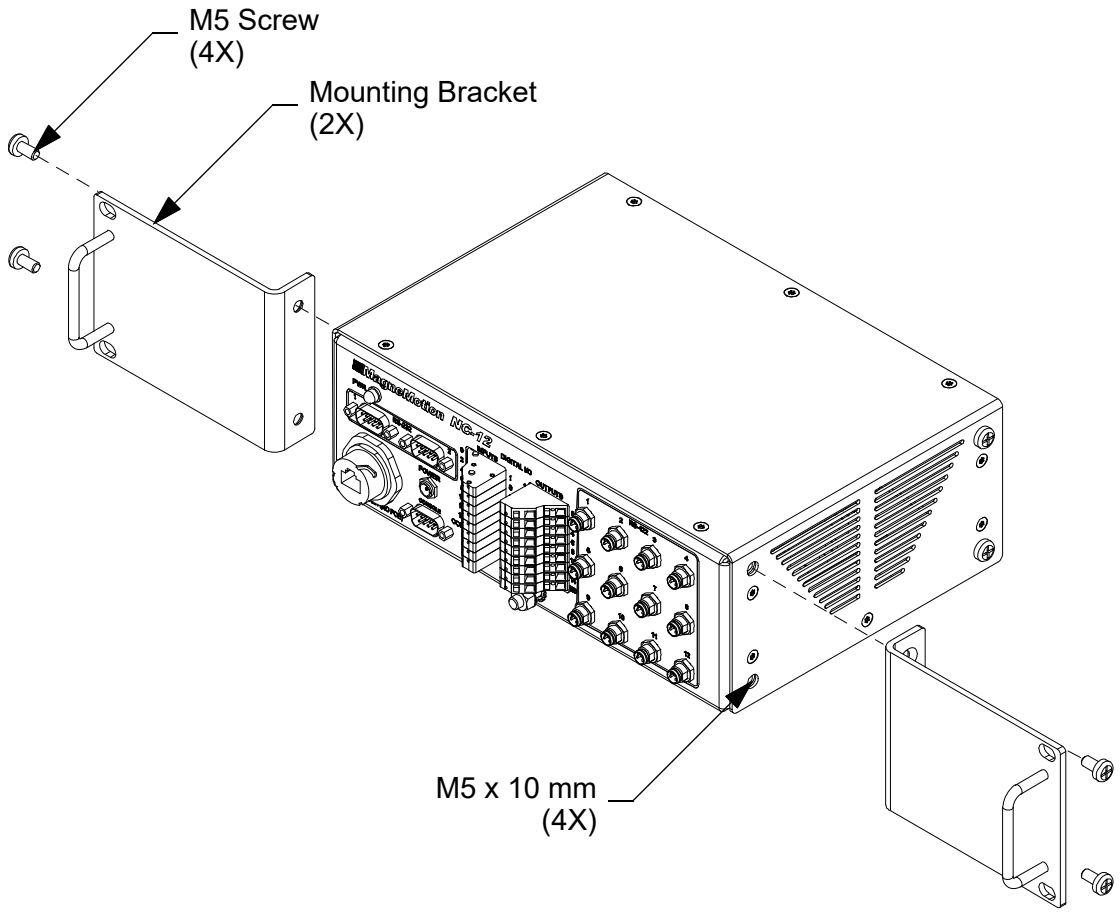


Figure 5-8: NC-12 Node Controller Rack Mounting

1. Remove the two M5 x 10 mm screws from the front of each side (four screws total).

2. Align each rack mounting bracket to the NC-12 and secure them to the node controller with two M5 X 12 mm flat head screws. Tighten to 2.0 N•m [18 in•lb] (four screws total).

3. Locate the node controller in the rack and secure it with four screws (two per mounting bracket) as specified by the rack manufacturer. Make sure that the service and exclusion zones are maintained.

4. Install cable management as required to secure the cables that are connected to the node controller.

Mounting NC-12 Power Supplies

Locate the power supply close to the node controller it is powering to minimize the length of all wiring. The power supply can be oriented in any direction required.

Mounting NC LITE Node Controllers

Locate the NC LITE close to the nodes it is responsible for to minimize the length of all wiring. The node controller can be oriented in any direction that is required, make sure that the service and exclusion zones that are identified in Figure 4-9 on page 58 are maintained.

Surface Mounting

Typical methods for mounting the NC LITE on the mounting plate are shown in Figure 5-9. See Figure 4-10 on page 59 for dimensions.

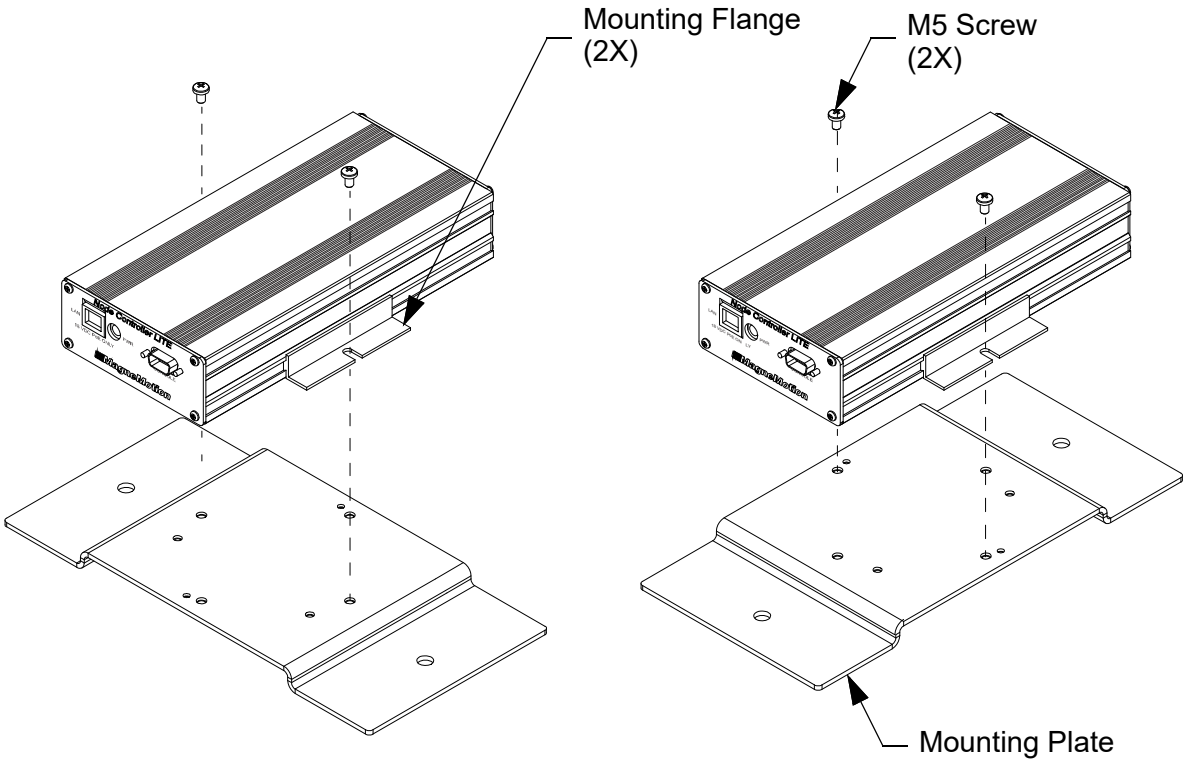


Figure 5-9: NC LITE Surface Mounting

1. Install the mounting flanges onto the NC LITE, if not already installed.

2. Orient the NC LITE on the mounting plate as required and secure it to the plate with two M5 x 10 mm screws with Loctite 243. Tighten the screws to 2.7 N•m [24 in•lb].

   NOTE: The Loctite must cure for 2 hours at 22 °C [72 °F] before using the transport system.

3. Orient the bracket with the node controller as required and secure it with two M8 screws with M8 split lock washers. Tighten the screws to 26 N•m [230 in•lb]. Make sure that the service and exclusion zones are maintained.

4. Install cable management as required to secure the cables that are connected to the node controller.

Mounting NC LITE Power Supplies

If the node controller is powered using the remote power supply (instead of using PoE), locate the power supply close to the node controller it is powering to minimize the length of all wiring. The power supply can be oriented in any direction required.

Electrical Connections

The standard configuration of the transport system requires user-supplied electrical power and communications connections. See *Electrical Specifications* on page 60 for descriptions and specifications of all required facilities.

Power Connections

Electrical power is connected to the transport system for operation of the motors and other subsystems. An AC electrical connection is provided on those components that require facility power. See *Electrical Specifications* on page 60 for electrical requirements. Make sure that all electrical connections are for the appropriate voltage and power rating.

NOTICE

Do not turn on facility power until all installation procedures have been completed.

Connecting to the DC power connector on the controller must be done with the power supply off. Connecting with the power supply on can cause a short circuit at the connector, which can damage the power supply or any other equipment being powered by that power supply.

1. Connect power to each NC-S:

NOTICE

The NC-S node controller does not support Power over Ethernet. Never connect these node controllers to a powered Ethernet network as damage to internal components can result.

- Connect the AC power cable from either the optional remote power supply or a user-supplied power supply to the power distribution from the main power disconnect. Then, connect the DC power cable to the power connector on each NC-S node controller as shown in Figure 4-11, tighten the connector shell finger tight only – do not overtighten.

2. Connect power to each NC-E:

NOTICE

The NC-E node controller does not support Power over Ethernet. Never connect these node controllers to a powered Ethernet network as damage to internal components can result.

- Connect the AC power cable from either the optional remote power supply or a user-supplied power supply to the power distribution from the main power disconnect. Then, connect the DC power cable to the power connector on each NC-E node controller as shown in Figure 4-12, tighten the mounting screws to 3 in•lb [0.34 N•m] – do not overtighten.

3. Connect power to each NC-12:

NOTICE

The NC-12 node controller does not support Power over Ethernet. Never connect these node controllers to a powered Ethernet network as damage to internal components can result.

- Connect the AC power cable from either the optional remote power supply or a user-supplied power supply to the power distribution from the main power disconnect. Then, connect the DC power cable to the power connector on each NC-12 node controller as shown in Figure 4-13, tighten the connector shell finger tight only – do not overtighten.

4. Connect power to each NC LITE:

NOTICE

The NC LITE node controller supports Power over Ethernet (+18V DC). Never connect the NC LITE to a standard powered Ethernet network as damage to internal components can result.

- When supplying Power over Ethernet to the NC LITE, make sure that the Ethernet connection goes to a PoE enabled switch then plug the switch power supply into the power distribution from the main power disconnect. Then, connect the cable from the switch power supply to the switch.
- When supplying power directly to each NC LITE, connect the AC power cable from either the optional remote power supply or a user-supplied power supply to the power distribution from the main power disconnect. Then, connect the cable from the NC LITE power supply to the NC LITE as shown in Figure 4-14.

Network Connections

The node controllers use communication over an Ethernet network with a host controller for transport system control and for communication between node controllers. The following procedure provides the information that is required to make all network communications and Power over Ethernet connections to the node controllers as shown in Figure 5-10.

NOTE: The network for the transport system must be a dedicated, separate subnet to minimize any unrelated network traffic.

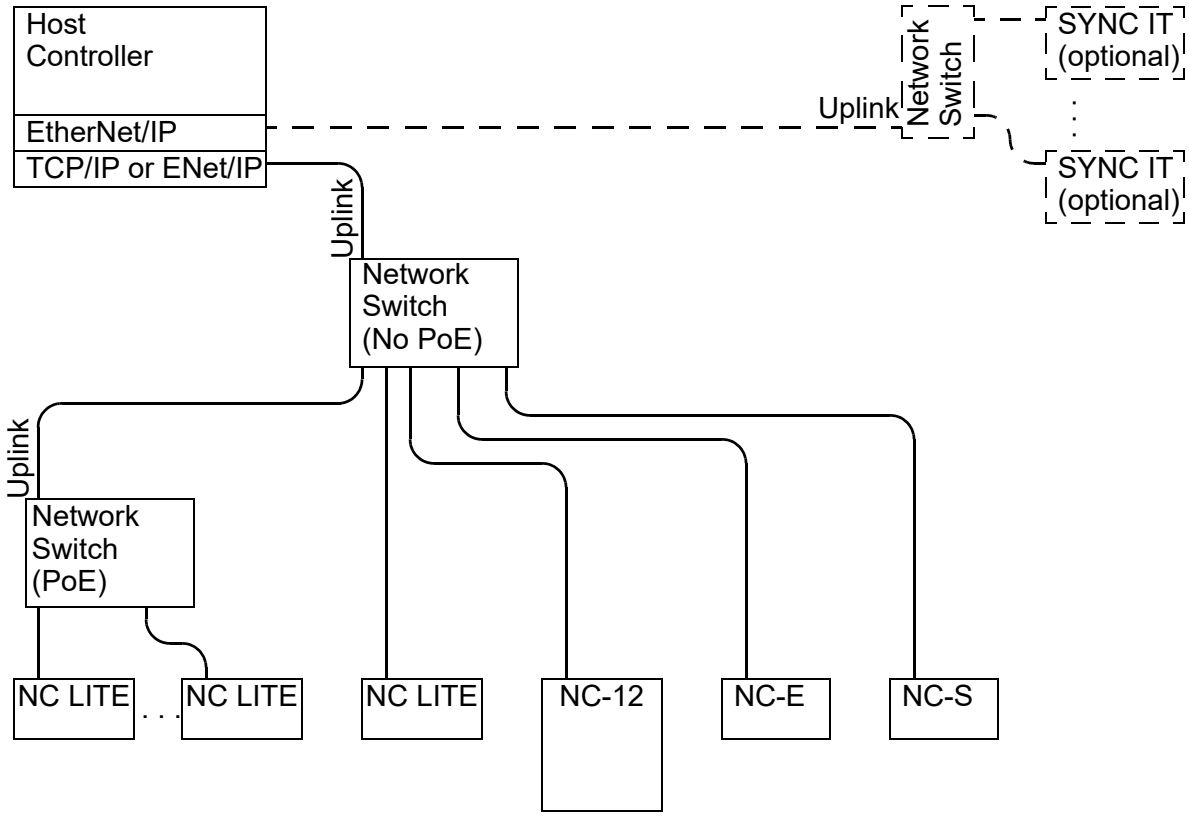


Figure 5-10: Network Wiring

1. Connect a Cat 5 or better network cable for transport system network communications from the host controller to the Uplink connector on the network switch.

NOTICE

The Ethernet cable that connects a Power over Ethernet switch to the host controller or other network switches must connect to the Uplink port. Connecting to other ports can damage the switch or other devices that are connected to the switch.

NOTE: When using multiple network switches to connect all node controllers, use one switch as a central hub and connect all other switches to it as shown in Figure 5-10.

When using multiple Power over Ethernet network switches, connect the Uplink from each switch to a central hub switch as shown in Figure 5-10, do not daisy chain these switches.

When using the optional SYNC IT controllers, use a network switch that is dedicated to those controllers connected directly to the EtherNet/IP port on the PLC dedicated to synchronization as shown in Figure 5-10.

2. Connect a cable for network communications from the network switch to each node controller as shown in Figure 5-10.

   - For NC-S node controllers, connect the Ethernet cable to the NET 0 connector as shown in Figure 4-11.

     NOTICE

     The NC-S node controller does not support PoE. Connecting the controller to a powered Ethernet network can damage it.

   - For NC-E node controllers, connect the Ethernet cable to the lower Network connector as shown in Figure 4-12.

     NOTICE

     The NC-E node controller does not support PoE. Connecting the controller to a powered Ethernet network can damage it.

   - For NC-12 node controllers, connect the Ethernet cable to the ETHERNET/ETH connector as shown in Figure 4-13.

     NOTICE

     The NC-12 node controller does not support PoE. Connecting the controller to a powered Ethernet network can damage it.

   - For NC LITE node controllers, connect the Ethernet cable to the LAN connector as shown in Figure 4-14.

     NOTICE

     The NC LITE only supports Power over Ethernet. Never connect the NC LITE to a standard PoE network as damage to internal components can result.

Motor Connections

The NC-S, NC-12, and NC LITE node controllers can use either RS-422 or Ethernet to communicate with the motors as shown in Figure 5-11, Figure 5-12, and Figure 5-13. The NC-E Series B node controllers only use Ethernet to communicate with the motors as shown in Figure 5-12. The following procedure provides the information that is required to make all motor connections to the node controllers.

NOTE: The network for the transport system must be a dedicated, separate subnet to minimize any unrelated network traffic.

RS-422 Only Motor Connections

RS-422 is one method for connecting the motors to other motors and to the node controllers using daisy chained RS-422 communications as shown in Figure 5-11. The NC-S, NC-12, and NC LITE node controllers can use this connection scheme. See the *MagneMover® LITE™ User Manual*, publication MMI-UM002 the *QuickStick® 100 User Manual*, publication MMI-UM006, or the *QuickStick 150 User Manual*, publication MMI-UM047 for detailed connection information.

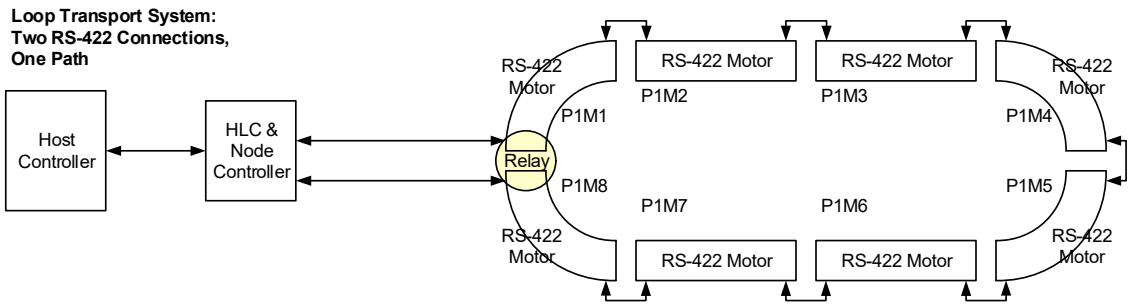


Figure 5-11: RS-422 Motor Wiring Example

1. Connect an RS-422 cable from an RS-422 port on the node controller to the upstream connection on the first motor in a path.
   - When connecting a DE-9 connector, tighten the mounting screws to 3 in•lb [0.34 N•m] – do not overtighten.
   - When connecting a Nano-Mizer connector, tighten the connector shell finger tight only – do not overtighten.
2. Connect an RS-422 cable from the downstream connection on the motor to the upstream connection on the next motor in the path.
   - When connecting a DE-9 connector, tighten the mounting screws to 3 in•lb [0.34 N•m] – do not overtighten.
   - When connecting a Nano-Mizer connector, tighten the connector shell finger tight only – do not overtighten.

3. Continue making motor-to-motor RS-422 connections until the last motor in the path is reached.

4. If the motor meets other motors in a node, connect an RS-422 cable to an RS-422 port on the node controller.

   - When connecting a DE-9 connector, tighten the mounting screws to 3 in•lb [0.34 N•m] – do not overtighten.
   - When connecting a Nano-Mizer connector, tighten the connector shell finger tight only – do not overtighten.

Ethernet Only Motor Connections

In Ethernet only motor connections, Ethernet is used to connect motors to other motors and node controllers that use Ethernet communication, as shown in Figure 5-12. This method is only used with Ethernet motors and can use any node controller type. See the *MagneMover LITE User Manual*, publication MMI-UM002, or the *QuickStick 150 User Manual*, publication MMI-UM047 for detailed connection information.

NOTE: When using Ethernet to communicate with the motors, other connection schemes such as multiple chains per path and Ethernet star topologies are possible. Closed-loop Ethernet connections must be avoided to help prevent network saturation. The simple daisy chain that is shown in Figure 5-12 is typical, but not required.

NOTE: In the following example, the subnet 10.20.x.x is used.

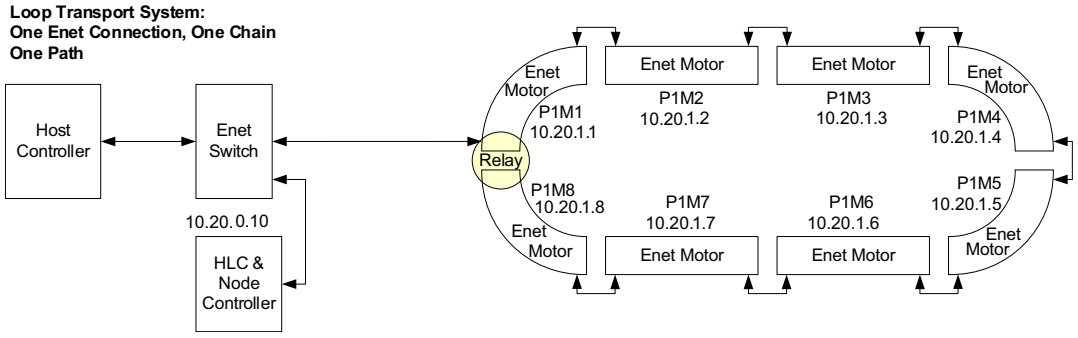


Figure 5-12: Ethernet Motor Wiring Example

1. Connect a Cat5 Ethernet cable from the switch where the node controller is connected to the first motor in the Ethernet chain.

2. Connect a Cat5 or better Ethernet cable from the downstream connection on the motor to the upstream connection on the next motor in the chain.

3. Continue making motor-to-motor Ethernet connections until the last motor in the path is reached.

4. Create a MICS file to define the Ethernet motor connections.

RS-422 and Ethernet Motor Connections

This method mixes the traditional RS-422 connection scheme for connecting the motors to other motors and to the node controllers and the new Ethernet connection scheme as shown in Figure 5-13. This method is only used with NC-S, NC-12, and NC LITE node controllers when combining RS-422 motors and Ethernet motors in the same transport system. See the *QuickStick 100 User Manual*, publication MMI-UM006 or *QuickStick HT™ User Manual*, publication MMI-UM007 for detailed connection information.

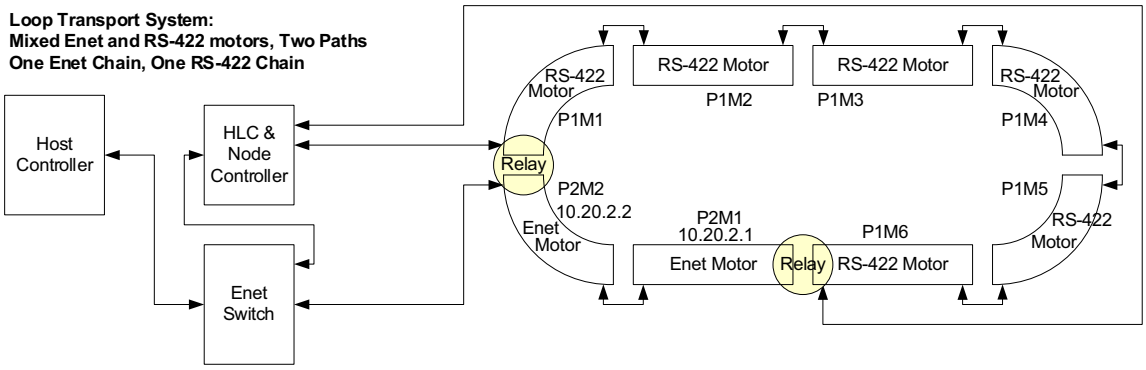


Figure 5-13: RS-422 and Ethernet Motor Wiring Example

1. Connect the motors that use RS-422 communications as described in *RS-422 Only Motor Connections*.

2. Connect a Cat5 or better Ethernet cable from the switch where the node controller is connected to the first motor in the Ethernet chain.

3. Connect a Cat5 or betterEthernet cable from the downstream connection on the motor to the upstream connection on the next motor in the chain.

4. Continue making motor-to-motor Ethernet connections until the last motor in the path is reached.

5. Create a MICS file to define the Ethernet motor connections.

Configuration

The transport systems require user-creation of the Node Controller Configuration File and creation of host controller software to direct and monitor vehicle movement for the particular application. A number of software tools are provided to simplify the creation of configuration files and for monitoring and testing the system. See *Transport System Software Overview* on page 19 for identification and descriptions of all software components and tools.

1. Set the unique IP address for each node controller. See the *MagneMotion Node Controller Interface User Manual*, publication MMI-UM001 for more details. If EtherNet/IP is being used, see the *MagneMotion System Configurator User Manual*, publication MMI-UM046 for additional configuration information.

2. Configure one node controller as a high-level controller. See the *MagneMotion® Node Controller Interface User Manual*, publication MMI-UM001 for more details.

Software Configuration

Create the Node Controller Configuration File (node_configuration.xml) using the Configurator to define the components of the transport system and their relationship to each other. See the *MagneMotion System Configurator User Manual*, publication MMI-UM046 for more details. The Configuration File must then be uploaded to each node controller in the transport system before using the system. See the *MagneMotion Node Controller Interface User Manual*, publication MMI-UM001 for details.

When using Ethernet communications with the motors, use the MagneMotion Commissioning Tool to generate a MagneMotion Information and Configuration Service (MICS) file for the system. The MICS file must then be uploaded to each node controller in the transport system before using the system. See the *MagneMotion Node Controller Interface User Manual*, publication MMI-UM001 for details.

Configure the host controller to control the transport system. See the *MagneMotion Host Controller TCP/IP Communication Protocol User Manual*, publication MMI-UM003 or the *MagneMotion Host Controller EtherNet/IP Communication Protocol User Manual*, publication MMI-UM004 depending on the host controller type.

Software Installation

1. Use the web interface on the node controller to upload the node controller image files to each node controller. See *MagneMotion Node Controller Interface User Manual*, publication MMI-UM001 for details.

   NOTE: Activate the image and reboot the node controller for the changes to take effect.

2. Use the web interface on the node controller to upload the configuration files to each node controller. See the *MagneMotion Node Controller Interface User Manual*, publication MMI-UM001 for details.

   NOTE: Restart the node controller for the changes to take effect.

Software

Software Overview

Node controllers leave the factory without runtime software installed. All system files (configuration files, NC image, motor images and type files, and magnet array type files) must be uploaded to the node controller and activated before using the transport system. See the *MagneMotion Node Controller Interface User Manual*, publication MMI-UM001 for details.

All motors leave the factory without runtime software installed. The Motor ERF Image files must be uploaded to the motors through the node controller.

Upgrades to the software can be uploaded through the network communications link. See the Upgrade Procedure in the Release Notes supplied with the software upgrade.

NOTE: Only qualified personnel or personnel that are directed by Rockwell Automation should make alterations or changes to the software.

NOTICE
All software running on the transport system must be part of the same release. See the release notes provided with the software for additional information.

Check-out and Power-up

Node Controller Check-out

Before the node controllers are started for the first time, or after servicing, it is necessary to check all operating and safety features.

The following startup procedure is used to apply power to the node controllers in an orderly manner to make sure that they are in known conditions. This procedure is used to prepare the node controllers for full operation.

Mechanical Checks

- Make sure that the node controllers are properly and securely installed.
- Make sure that all connections are secure.
- If the optional E-stop circuit is being used, make sure that the button is functional.

Facility Checks

- Make sure that all facilities meet, or exceed, the requirements as described in the *Electrical Specifications* on page 60 and *Site Requirements* on page 82.
- Make sure that the power and communications connections are complete.
- Check all cables. Verify that the connectors are fully seated and screws/locks are secured to make sure good continuity.
- Verify that all cables are routed in a safe place and away from any travel areas.
- Inspect all cables for restricting bend radii, excessive tension, or physical damage.

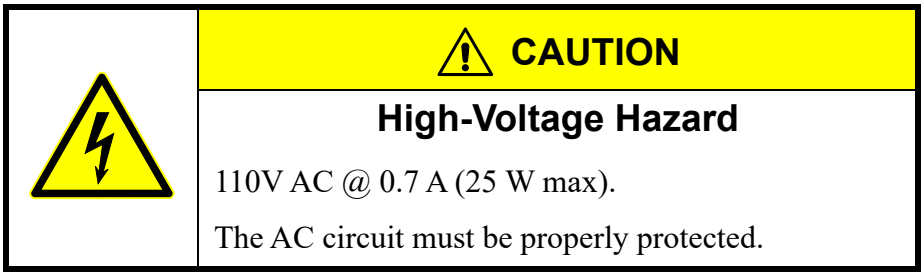
Node Controller Power-up

Node controllers can be powered up and tested without being connected to the transport system. Once the node controller has been installed, check all connections and perform an initial power-up. This section describes the procedure for the initial installation check-out.

1. Make sure that all installation procedures that are described in this chapter have been completed.

2. Make sure that the node controller is properly grounded.

3. Connect the node controller to the main power disconnect. Make sure that power remains off.



4. Perform a Ground Continuity check from the surfaces of the node controller to a known good ground.

5. Apply power to the node controller.

   The indicators on the node controllers light as shown in Table 5-2.

Table 5-2: Startup Indicators

Component	Indicator	Status
Node Controller, NC-S	Power	On
Node Controller, NC-E	⏻ (Power)	On
Node Controller, NC-12	Power	On
Node Controller, NC LITE	None	—

6. If power-up was successful, the node controller is ready to accept commands. However, if the power-up sequence was unsuccessful, see *Troubleshooting* on page 119.

7. For new installations, set the node controller IP addresses and specify the node controller to be used as the high-level controller (see *Configuration* on page 107).

8. For new installations, upload the image and type files to each node controller (see the *MagneMotion Node Controller Interface User Manual*, publication MMI-UM001).

9. For new installations, create and upload the Node Controller Configuration File for the transport system (see *Software Configuration* on page 107.

10. If Ethernet motors are being used, create and upload the MICS file for the transport system (see *Software Configuration* on page 107 or the *MagneMotion System Configurator User Manual*, publication MMI-UM046.

11. Program the motors with the Motor ERF Image files (see the *MagneMotion Node Controller Interface User Manual*, publication MMI-UM001).

12. Review the log files for each node controller to make sure that the system has been programmed and configured properly (see the *MagneMotion Node Controller Interface User Manual*, publication MMI-UM001).

System Testing

Test the transport system to verify proper operation of all nodes, paths, and vehicles. Use the NCHost application that is supplied to move vehicles without the host controller to verify proper operation before integrating a transport system into a production environment. Create Demo Scripts to perform repetitive testing throughout the transport system. See the *MagneMotion NCHost TCP/IP Interface Utility User Manual,* publication MMI-UM010, for details. If any problems are encountered, see *Troubleshooting* on page 119.

⚠ CAUTION

Crush Hazard

Moving mechanisms have no obstruction sensors.

Do not operate the transport system without barriers in place or personal injury could result in the squeezing or compression of fingers or other body parts between moving mechanisms.

1. Make sure that the transport system is fully configured.
   A. Make sure that the Node Controller Configuration File is fully defined and has been uploaded to all node controllers (see the *MagneMotion Node Controller Interface User Manual*, publication MMI-UM001).
   B. Make sure that the web interface for each node controller shows a status of running/valid (see the *MagneMotion Node Controller Interface User Manual*, publication MMI-UM001).
2. The HLC has the capability of restarting services on all node controllers. Use the HLC to restart services on all the node controllers (see the *MagneMotion Node Controller Interface User Manual*, publication MMI-UM001).
3. Issue a Reset command for all paths from NCHost.

   All motors on the paths in the transport system are reset.
4. Issue a Startup command to all paths from NCHost.

   Motion on all paths is enabled, all vehicles on the paths are identified and located, and the paths become operational.
5. Verify that the host controller has identified all vehicles in the transport system (see the *MagneMotion NCHost TCP/IP Interface Utility User Manual,* publication MMI-UM010).

6. Move vehicles individually or create a Demo Script for repetitive testing (see the *MagneMotion NCHost TCP/IP Interface Utility User Manual,* publication MMI-UM010).

7. Use the NCHost TCP Interface Utility to monitor transport system operation.

Node Controller Shutdown

The following shutdown procedure is used to remove power from the node controllers in an orderly manner and place the components of the transport system in known conditions. This procedure is used to prepare the components for removal, replacement, or maintenance. Before shutting down the host controller, shut down the node controllers.

1. Complete all material transfers (move all material to appropriate locations).
2. Command all vehicles to known positions.
3. Issue a Suspend Movement command for all Paths.

   All vehicles come to a controlled stop.
4. Once all motion has stopped, issue a Reset command for all Paths.

   Clears all vehicle records.
5. Turn off all electrical power to the motors.
6. Turn off electrical power to the Node Controllers.
7. Turn off electrical power to the Host Controller.
8. Turn off the main power disconnect for the transport system.

NOTE: This procedure only shuts down facilities to the motors, their subsystems, and the Host Controller. Any user equipment remains powered up.

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Maintenance 6

Overview

This chapter provides maintenance schedules and procedures for the node controllers. Only trained, qualified personnel should attempt to perform maintenance or troubleshooting on the node controllers. Rockwell Automation provides training in the troubleshooting and repair of the transport systems and components.

Included in this chapter are:

- Preventive maintenance procedures.
- Troubleshooting procedures.
- Basic repair procedures.
- Component and system shipping procedures.

Preventive Maintenance

The motors, node controllers, and power supplies of the transport system are self-contained components that are designed for use in a clean, inert environment, and require no maintenance other than that described here. Any deviation from this basic environment can affect the maintenance requirements. See *Troubleshooting* on page 119 if any problems are detected.

Table 6-1: Preventive Maintenance Schedule

Component	Maintenance Action	Frequency*	Page #
Node Controllers	*Transfer Log Files*	3 months or as required	118

* The specified frequency is based on a certified clean, inert environment. Adjust the facility Preventative Maintenance Schedule to account for any deviations from this environment.

Transfer Log Files

Log files can be transferred from the node controller or SysLog server to a network server so they can be archived. See the *MagneMotion Node Controller Interface User Manual*, publication MMI-UM001.

In the event of system anomaly, and before resetting the system, use the Log Retrieval tool to capture the current system state.

Troubleshooting

This section describes the common difficulties that can be encountered with the node controllers and software components.

For assistance, see *Rockwell Automation Support*.

Initial Troubleshooting

This section covers the initial determination of the problem area within the node controllers and provides direction to the second step of the troubleshooting process. If a specific problem is suspected, see that problem in Table 6-2. If the problem has not been identified, review each of the symptoms that are identified in Table 6-2 to help determine the problem area.

Table 6-2: Initial Troubleshooting

Symptom	Possible Problem Area
Node controller logs do not indicate correct time.	See *Node Controller Troubleshooting* on page 120
Communication to the node controller is lost or intermittent.	See *Communications Troubleshooting* on page 121

Node Controller Troubleshooting

This section covers the determination of problems within the node controllers.

Table 6-3: Node Controller Related Troubleshooting

Symptom	Problem Description	Corrective Action
Node controller logs do not indicate the correct time.	The battery for the clock in the node controller has lost its charge.	Manually correct the time each time the node controller is powered up or return the node controller to Rockwell Automation for repair.
		Use the node controller web interface **Set Clock** function to set the time (see the *MagneMotion Node Controller Interface User Manual*, publication MMI-UM001).

Communications Troubleshooting

This section covers the determination of communications-related problems within the transport system.

Table 6-4: Communications Related Troubleshooting

Symptom	Problem Description	Corrective Action
Intermittent communication with the host controller.	Communication is lost or intermittent.	Make sure that all network cables are properly seated.
		Verify that there are no IP address collisions.
Intermittent communication with the motors.	Communication is lost or intermittent.	Make sure that all network cables are properly seated.
Communications problems when using multiple node controllers (ping message dropped).	Either faulty network cables or a network switch that cannot keep up with the traffic.	Check all network wiring and hardware to make sure it is operating properly.
The transport system responds to the host controller but motors do not operate.	Digital I/O E-stop or interlock circuit is activated.	Make sure any E-stops or interlocks that are configured for the paths where the motors are located are in the operate state.

Repair

If a component of the transport system malfunctions, see *Troubleshooting* on page 119 in this manual for diagnostic procedures. Once the failed unit has been identified, a replacement unit can be installed.

NOTE: The components of the transport system are designed for easy replacement. Motors, controllers, and other modules do not contain any user serviceable parts.

NOTICE

Only a qualified service representative can service the components of the transport system. Any attempt to open the transport system modules by anyone other than a qualified Rockwell Automation® service representative voids the warranty.

Table 6-5: MagneMover LITE Repair Procedures

Component	Maintenance Action	Page #
NC-S Node Controller	*Upgrading Node Controllers*	123

Upgrading Node Controllers

This procedure provides the steps necessary to upgrade from an NC-12 node controller to NC-S node controllers. The NC-12 supports twelve RS-422 connections while the NC-S supports eight RS-422 connections. If more that eight of the RS-422 connections on the NC-12 are being used, two NC-S node controllers are required and must be configured as described in this procedure.

Installation Preparation

1. Backup the transport system.
   A. Run the web interface and connect to the HLC.
   B. Select **Configuration Files** on the Main Menu (see the *MagneMotion Node Controller Interface User Manual*, publication MMI-UM001).
   C. Select **Download** for each file in use (for example, Node Controller Configuration File, MICS file, Motor Type files, and Magnet Array Type files) and save the file.
   D. Select **Upgrade Software** on the Main Menu.
   E. Select **Download** for each file in use (for example, Node Controller Software Image file and Motor ERF Image files) and save the file.
2. Shutdown the transport system.
   A. Complete all material transfers (move all material to appropriate locations).
   B. Command all vehicles to known safe positions.
   C. Issue a reset command to all paths.
   D. Once the reset has completed, turn off the main power disconnect for the transport system.
3. Unplug the power cable to the old node controller.
4. Make sure all communication and signal wiring that is connected to the old node controller are labeled.
5. Disconnect all communication and signal wiring that is connected to the old node controller.
6. Remove the old node controller from the transport system.

NC-S Installation

There are several mounting options for the NC-S node controllers. See *Mounting NC-S Node Controllers* on page 88. Use the appropriate mounting method to install the NC-S node

controllers. Once the node controllers are mounted, they must be connected and configured for operation as described in *Configure and Connect the New Node Controllers*.

Configure and Connect the New Node Controllers

All node controllers in the system must be running the same software version. Therefore, when upgrading any node controller to the NC-S it is necessary to upgrade all other node controllers in the system to the same software version. Upgrading to the NC-S may also require upgrading the motor software in all motors in the system.

Table 6-6 identifies the minimum software versions that are required for proper operation of the NC-S node controller.

Table 6-6: Required Software Versions

Motor Type	Minimum Required Software
MagneMover® LITE™ Gen 3	4.1.42
MagneMover LITE Gen 4	15.12.01
QuickStick® 100	15.8.16
QuickStick 150	17.4.3
QuickStick® HT™	15.8.16

If using a version of software on a transport system that incorporates a lookup table (**On Curve** is selected in the Node Controller Configuration File for any motor) contact *Rockwell Automation Support* for further guidance. The new motor software images exclude the system-specific software for the transport system and will not perform in the same manner.

1. Connect a power cable from the remote power supply to the Power connector on the first NC-S node controller.

2. Connect a service computer directly to the NET0 Ethernet connector on the node controller.

3. Turn on the power to the node controller.

4. Set the IP address of the NC-S node controllers.

   - Open a web browser and connect to the node controller to configure it (see the *MagneMotion Node Controller Interface User Manual*, publication MMI-UM001).

     For a direct replacement, use the address of the node controller that was removed.

If the node controller being replaced was the High-Level Controller, configure the new NC-S as the HLC. When using two NC-S node controllers, do not configure the second NC-S as an HLC.

5. Repeat Step 1 through Step 4 for each additional node controller.
   - When replacing an NC-12 with two NC-S node controllers, use the next available IP address for the second NC-S.
6. Upload the new Node Controller Software Image file (see the *MagneMotion Node Controller Interface User Manual*, publication MMI-UM001).
7. Update the Node Controller Configuration File to reference the new node controllers if necessary (see Update the Node Controller Configuration File).
8. Upload the Node Controller Configuration File (see the *MagneMotion Node Controller Interface User Manual*, publication MMI-UM001). Use the updated file if any changes were made.
9. Upload the MagneMotion® Information and Configuration Service (MICS) File, if present on the previous node controller.
10. Upload the new Motor ERF Image files, Motor Type files, and Magnet Array Type file to the new node controllers (see the *MagneMotion Node Controller Interface User Manual*, publication MMI-UM001).
11. Install the new node controllers into the transport system (see *Mounting NC-S Node Controllers* on page 88).
12. Connect all communication, signal, and power wiring to the NC-S node controllers.
    - Connect the RS-422 communication wiring to the Nano-Mizer connectors.
    - Connect the network cable to the NET0 Ethernet connector.
13. Bundle and dress all cables (use nylon cable-ties) as needed for clean cable routing.
14. Turn on the main power disconnect for the transport system.
15. Make sure that all node controllers in the transport system are running the same version of software (see Table 6-6).
    - Upload the new versions of all system files to all node controllers in the transport system if the software version has been updated.
    - Program all motors on all node controllers if the software version has been updated.
16. Return the system to operation.

- From the host controller, issue a Reset command for all paths, once all paths have completed their reset issue a Startup command to all paths.
- Review the node controller log file to verify that the NC-S is operating properly.
- Start the host application to begin normal operation.

Update the Node Controller Configuration File

If the node controller being replaced had more than eight RS-422 connections, the Node Controller Configuration File must be updated to distribute those connections between two new NC-S node controllers. Typically, connections to ports 1…8 are connected to ports 1…8 of the first NC-S and connections to ports 9…12 are connected to ports 1…4 of the second NC-S. Keep the port number as consistent with the original layout as possible without splitting a node.

NOTE: All connections from a node must go to the same node controller. This reconnection strategy might not work for all system configurations, depending on the node types that were previously owned by the NC-12. Modify this strategy as needed to accomplish the goal of moving as many nodes as required to the second NC-S.

If the node controller being replaced had eight or fewer connections, only one NC-S is required for replacement. If the connections used only Ports 1…8, no changes are required. If any connections used Ports 9…12, those connections must be reconfigured to one of the available ports on the NC-S.

When redistributing the connections, make sure that all connections for a node are made to the same node controller.

1. Run the MagneMotion Configurator and open a copy of the current Node Controller Configuration File.
2. In the **Node Controllers** section of the **Configuration Tree**, open the **Node Controller Details** page for the node controller being replaced.
   - Remove ownership of those nodes that are connected to Comm Ports 9…12.
3. In the **Node Controllers** section of the **Configuration Tree**, add a new node controller.
   A. Set the IP address of the new node controller to match the IP address of the second NC-S added.
   B. Take ownership of those nodes that were connected to Comm Ports 9…12.
   C. Select the appropriate Comm Port for each connection.
4. Save the revised Node Controller Configuration File with a new name to identify it.

Shipping

If a node controller must be shipped, it must be packaged properly to make sure it arrives undamaged. The following procedure provides the correct method for handling and packaging node controllers for shipment.

CAUTION

Electrical Hazard

Before beginning this procedure, the transport system must be shut down following the procedure that is provided in *Node Controller Shutdown* on page 115.

Packing Procedure

When node controllers are shipped, they must be properly packaged to make sure they arrive undamaged. The following procedure provides the correct method for handling and packaging components for shipment.

1. Turn off and disconnect all electrical power as detailed in *Node Controller Shutdown* on page 115.
2. Disconnect all communications connections as detailed in *Node Controller Shutdown* on page 115.
3. Make sure that the system or component has been properly decontaminated following the facilities decontamination procedures. Follow all facility, local, and national procedures for the disposal of any hazardous materials.
4. When shipping individual components, remove all components that will be shipped (reverse the sequence to install the components) and see *Shipping* on page 127.

Shipping

1. Wrap, bag, and pack each component following standard packing procedures.
2. Use the container that the component was originally shipped in. Set the component into the container and secure using the supplied packing material.
3. Close the shipping container and secure.

4. Make sure that the container is properly labeled (This End Up, Caution – Heavy, and so forth) and all shipping documents are attached to the outside of the container.

5. When shipping, make sure that the RMA number is clearly visible on the outside of the box.

Appendix A

Overview

The following appendices are included to provide the user with one location for additional information that is related to the node controller interfaces.

File Maintenance

Backup Files

Making regular backups of all files that have been changed is recommended. Keep copies of all original and backup files at a remote location for safety.

Creating Backup Files

Backup files are not created automatically. It is the responsibility of the user to create backups of all files by copying them to a safe location.

Restoring from Backup Files

Damaged files can be restored by copying the backup files into the appropriate locations.

Transport System Limits

For transport system limits information, see the *MagneMotion® Node Controller Interface User Manual*, publication MMI-UM001.

Appendix B

NC-E Series A Node Controller

The following appendix contains information on the NC-E Series A node controller. Check the product label to see which series of node controller you have (see *NC-E Series B Node Controller* on page 36). For information related to NC-E Series B node controllers, reference the main body of this document.

Digital I/O Connection

The NC-E node controller provides four optically isolated digital input bits and four optically isolated digital output bits. See Figure B-4 for the location of these connections on the node controller and Table B-8 for the pinout configuration.

When using a node controller that supports digital I/O, digital inputs and outputs can be monitored and controlled respectively. These circuits can be wired directly to the digital I/O terminals on the node controller to monitor and control local options, or used for any other user-defined options. See Figure 3-2 for the digital I/O equivalent circuits and Figure 3-2 for the power specification. See *General Purpose Digital I/O* on page 43 for additional information.

Node Controller Loading

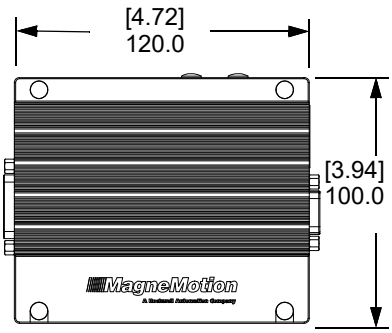
Node controller that supports Ethernet motors with one active network port, 4 digital inputs, and 4 digital outputs.

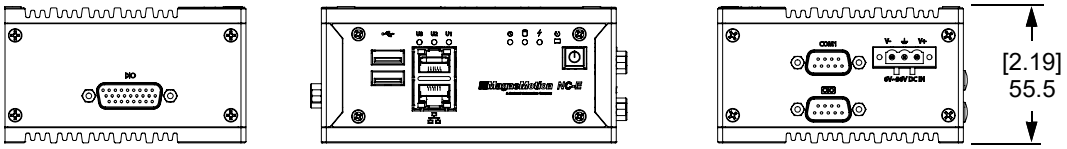
Table B-1: Node Controller Loading

Configuration	NC-E Series A
Ethernet Only	18 Nodes
Serial Only	None (no serial ports)
Hybrid Only*	
Combination of Nodes	Ethernet Only

* Hybrid Only has not been tested, these are theoretical numbers. Hybrid nodes are those multi-port nodes where some of the node connections are made using RS-422 and some connections are made using Ethernet. This typically occurs when a node (for example, a Relay node) is being used to connect RS-422 motors to Ethernet motors.

NC-E Series A Node Controller Mechanical Specifications



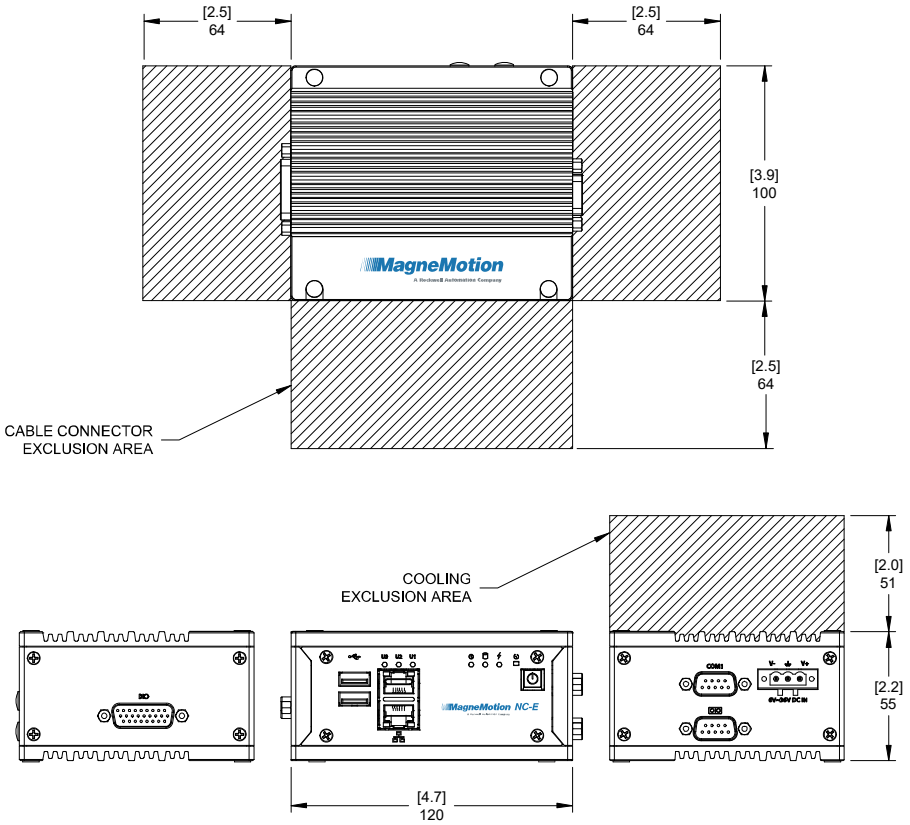


- Supports up to 36 nodes based on configuration.
- Digital I/O (4 bits in/4 bits out) available for user supplied external devices such as E-stops.
- CE Certified, UL Recognized.
- Mounting kit supplied for DIN-rail/wall mounting.

Table B-2: NC-E Node Controller Specifications

Physical Specifications		Environmental Specifications	
Dimensions*	120.0 W x 100.0 L x 55.5 H [4.72 W x 3.94 L x 2.19 H]	**Ambient Temperature:**	0 °C…50 °C [32 °F…113 °F]
		Relative Humidity:	~95% @ 40 °C [104 °F] (noncondensing)
Weight:	0.65 kg [1.43 lb]	**Power Dissipation:**	40 W (max)

* All dimensions are millimeters [inches].



Weight: 0.65 kg [1.43 lb] All Dimensions in Millimeters [Inches]

Figure B-1: NC-E Node Controller Cooling and Cable Exclusion Areas

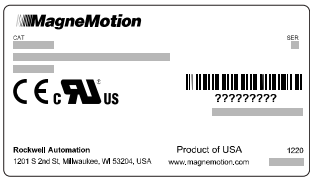
NOTE: Mounting kits for surface mounting and DIN rail mounting are supplied with the node controller.

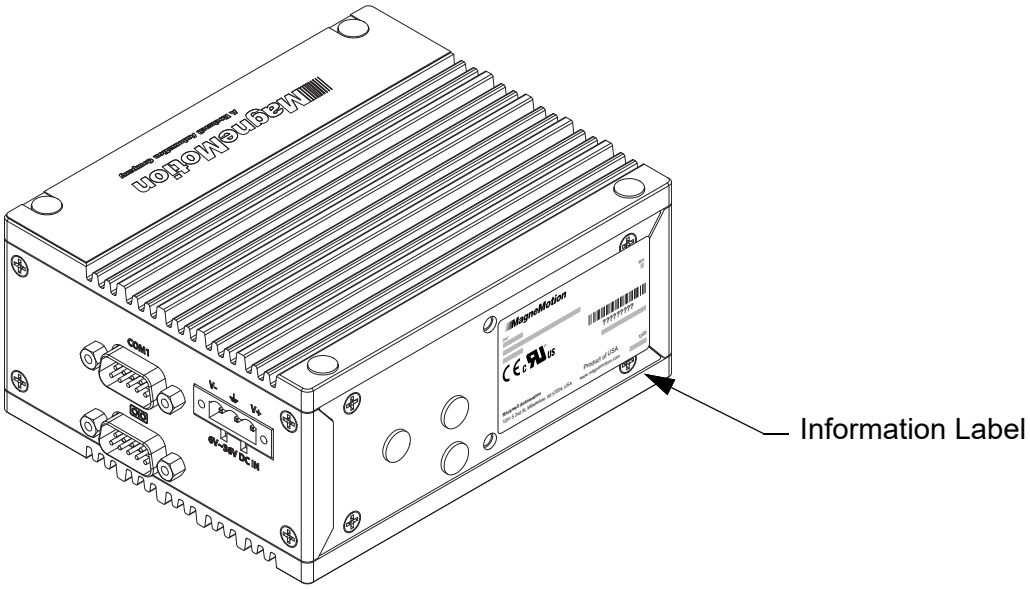
NOTE: Ingress Protection Rating: Designed for IP30.

Exposed Materials

NOTE: The node controller has unprotected openings and must not be installed in locations where harsh conditions exist.

Table B-3: Labels Used on the NC-E Node Controller

	Product Information Label Qty: 1 Location: On the back of the NC-E node controller



NOTE: For NC-E Series B Node labels, please see *Table 2-5*.

Mounting Node Controllers

The DIN rail and surface mounting instructions for Series A and Series B are the same. For information related to mounting NC-E node controllers, see *Mounting NC-E Series B Node Controllers* on page 91.

DIN Rail Mounting

The NC-E Series A can be mounted to a DIN Rail by attaching the optional DIN rail mounting bracket as shown in Figure B-2

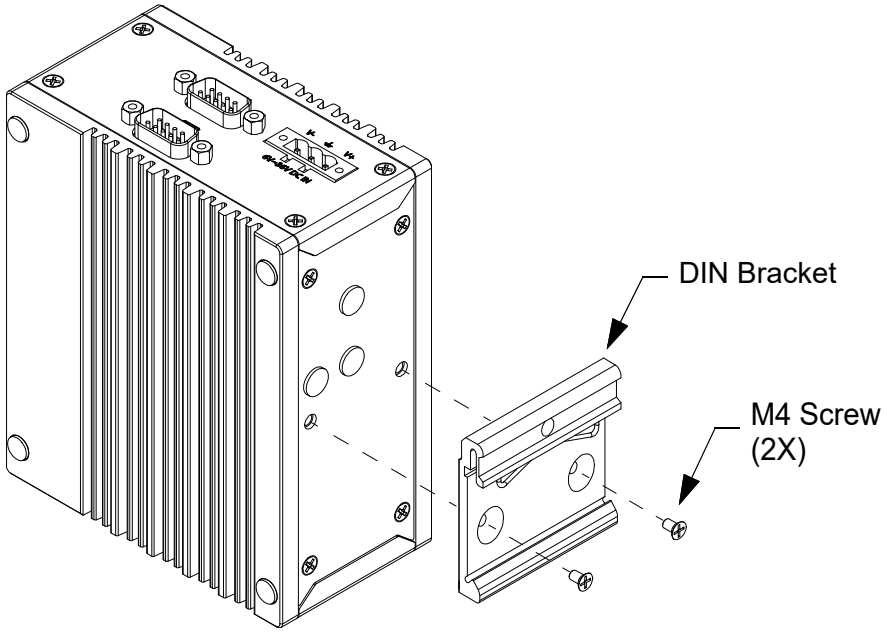


Figure B-2: NC-E Node Controller DIN Rail Mounting

Surface Mounting

Typical methods for mounting the NC-E to a surface by attaching the optional mounting brackets are shown in Figure B-3.

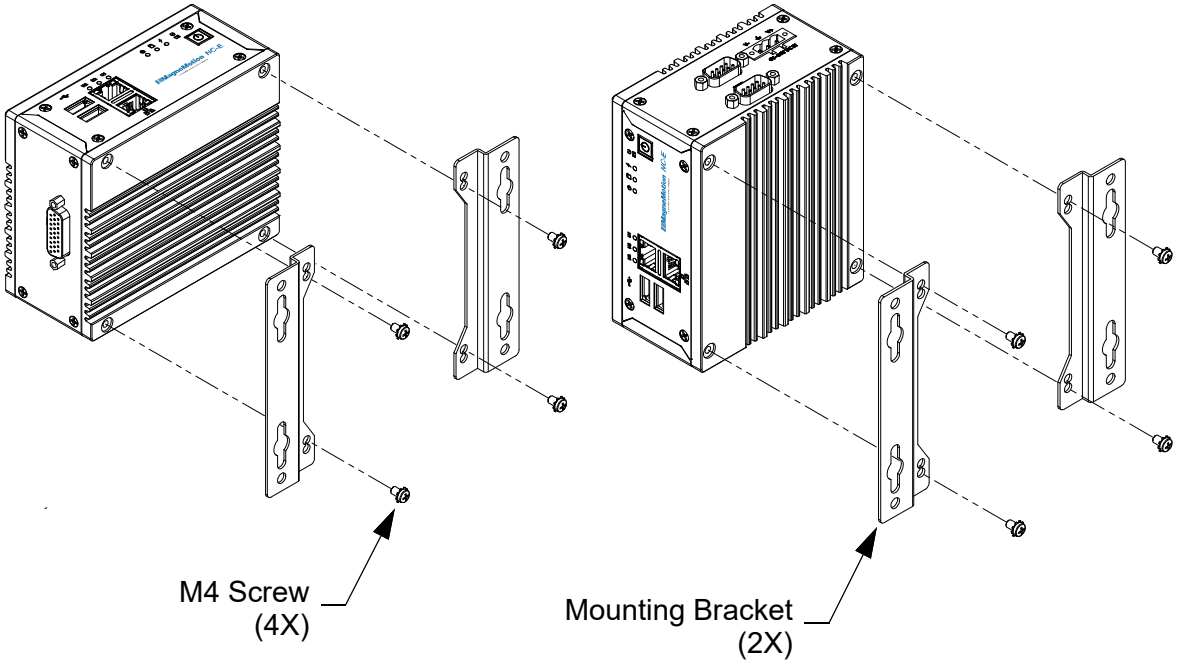


Figure B-3: NC-E Node Controller Surface Mounting

NC-E Series A Node Controller Electrical Specifications

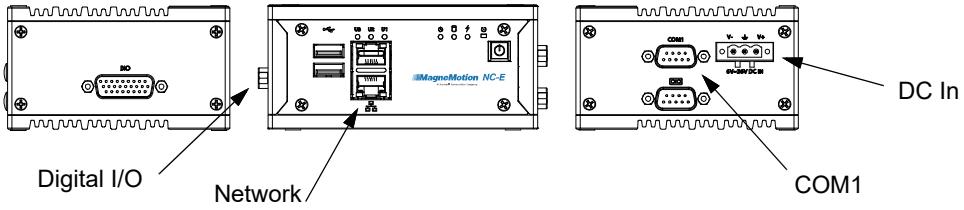


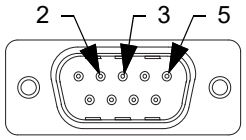
Table B-4: NC-E Node Controller Electrical Specifications

Power Rating:	6…36V DC, 40 W (max) based on configuration and operating mode 3P pluggable connector with latch (GND, V-, V+)*.
Network:	Standard 10/100/1000 BaseTx (auto-MDIX, auto-negotiation), Ethernet (RJ45, Socket). Only the lower connector is active.
COM1:	For connection of user-supplied terminal for setting the IP address (DE-9, Plug).
Digital I/O:	4 optically isolated digital input bits and 4 optically isolated digital output bits (DA-26, Socket).

* Rockwell Automation requires grounding the NC-E through the chassis ground connection on the power connector.

Cables and Pinouts

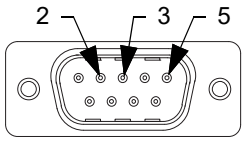
Table B-5: COM1 (Console) Pinout



DE-9, Plug

—	1
Rx	2
Tx	3
—	4
RTN	5
—	6
—	7

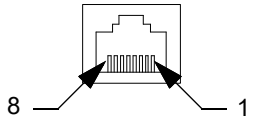
Table B-5: COM1 (Console) Pinout



DE-9, Plug

—	8
—	9

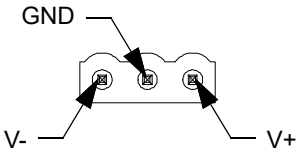
Table B-6: Ethernet Pinout



RJ45, Socket

BI_DA+	1
BI_DA-	2
BI_DB+	3
BI_DC+	4
BI_DC-	5
BI_DB-	6
BI_DD+	7
BI_DD-	8

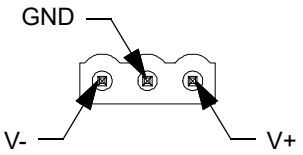
Table B-7: Power Pinout



2.0 mm Coax, Plug

RTN	1

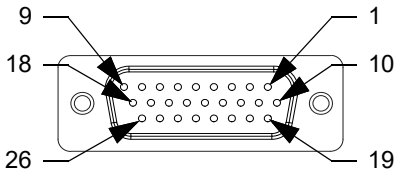
Table B-7: Power Pinout



2.0 mm Coax, Plug

GND	2
PWR	3

Table B-8: Digital I/O Pinout



DA-26, Socket

+VDD	1	**DO1**	10	**DI0_L**	19
+VDD	2	**DI2_L**	11	**EOGND**	20
+V5DIO_CN_ISO	3	**EOGND**	12	**NC**	21
EOGND	4	**DI1_H**	13	**NC**	22
DI3_H	5	**DO2**	14	**NC**	23
DO0	6	**DI1_L**	15	**NC**	24
DI3_L	7	**EOGND**	16	**NC**	25
EOGND	8	**DI0_H**	17	**NC**	26
DI2_H	9	**DO3**	18		

DC Power Option

DC power from a user-supplied power supply requires 6…36V DC, 40 W.

NOTICE

Any user-supplied power supply must be NRTL/ATL approved.

The actual power being drawn depends on the operations being performed. Make sure that all power wiring can carry the full load and has a limited power source or the power source is fused to the maximum rating of the wiring.

NOTICE

The NC-E node controller does not support Power over Ethernet. Never connect these node controllers to a powered network as damage to internal components can result.

Connect the AC power cable from either the optional remote power supply or a user-supplied power supply to the power distribution from the main power disconnect. Then, connect the DC power cable to the power connector on each NC-E Series A node controller as shown in Figure B-4, tighten the mounting screws to 3 in•lb [0.34 N•m] – do not overtighten.

NOTICE

Connecting to the DC power connector on the NC-E node controller must be done with the power supply off. Connecting with the power supply on can cause a short circuit at the connector, which can damage the power supply or any other equipment being powered by that power supply.

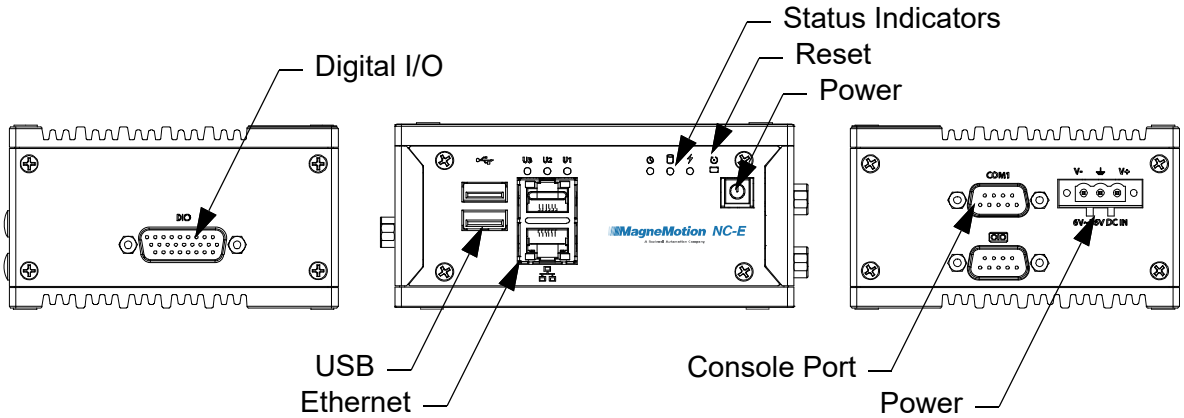


Figure B-4: Electrical Connections, Controls, and Indicators

Table B-1: Electrical Connections

Label	Description	Connector Type
Digital I/O	Optically isolated, 4 input bits and 4 output bits	DA-26, Socket
(USB)	Not used	USB 2.0, Socket
(Network)	Ethernet – 10/100/1000 BaseTx (auto-MDIX, auto-negotiation)	RJ45, Socket
COM1	External terminal	DE-9, Plug
6V~36V DC IN	6…36V DC, 40 W	3P pluggable connector with latch (V-, GND, V+)*

* Rockwell Automation requires grounding the NC-E through the chassis ground connection on the power connector.

Table B-2: Controls

Label	Description	Control Type
(Reset)	Forced reset of node controller.	Recessed push button
(Power)	Power on/off for the node controller. Press and hold ~10 sec to turn off the NC-E.	Push button

Table B-3: Indicators

Label	Description	Indicator Type
U1	*Reserved*	—
U2	*Reserved*	—
U3	*Reserved*	—
(Watchdog)	Indicates the watchdog timer status. Blinks when the watchdog timer starts. When the timer is expired, the node controller auto-reboots.	Yellow light
(Hard Disk)	When blinking, indicates that the hard disk drive is active*.	Orange light
(Standby)	Indicates that the node controller is in power standby mode.	Blue light
(Power)	Indicates that the NC-E is on.	Blue light

* This applies to Next Gen node controller images. The hard disk light remains solid on legacy node controller images.

NC-E Series A Node Controller Additional Information

Site Requirements

For NC-E Node Controller site requirements, see *Site Requirements* on page 82

Unpacking and Inspection

For information to unpack, inspect, or move the NC-E Node Controller, see *Unpacking and Inspection* on page 86.

Network Connections

The network connection and wiring for Series A and Series B is the same. For information related to NC-E node controller communication and wiring, see *Network Connections* on page 101.

Motor Connections

The motor connection information for Series A and Series B is the same. For information on how to connect a motor to an NC-E node controller, see *Motor Connections* on page 103.

Configuration

The check-out and power-up, system testing, and shutdown procedures for the Series A and Series B are the same. For information on how to preform these procedures on an NC-E node controller, see the respective heading in the *Configuration* section starting on page 107.

Maintenance

The maintenance information for Series A and Series B are the same. For additional information on preventive maintenance, transfer log files, troubleshooting, repair, and upgrading node controllers for the NC-E node controllers, see the respective heading in the *Maintenance* section starting on page 117.

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Rockwell Automation Support

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Local Technical Support Phone Numbers	Locate the telephone number for your country.	rok.auto/phonesupport
Technical Documentation Center	Quickly access and download technical specifications, installation instructions, and user manuals.	rok.auto/techdocs
Literature Library	Find installation instructions, manuals, brochures, and technical data publications.	rok.auto/literature
Product Compatibility and Download Center (PCDC)	Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes.	rok.auto/pcdc

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Waste Electrical and Electronic Equipment (WEEE)

At the end of life, this equipment should be collected separately from any unsorted municipal waste.

Rockwell Automation maintains current product environmental compliance information on its website at rok.auto/pec.

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