

Instruction Bulletin

POWERLINK[®] G3 Controller

NF500G3 for use with POWERLINK G3 Systems

Retain for future use.



HAZARD CATEGORIES AND SPECIAL SYMBOLS

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER

DANGER indicates an immediately hazardous situation which, if not avoided, **will result in** death or serious injury.

WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** property damage.

NOTE: Provides additional information to clarify or simplify a procedure.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified electrical personnel. This document is not intended as an instruction manual for untrained persons. No responsibility is assumed by Square D for any consequences arising out of the use of this manual.

Class A FCC Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designated to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

U.S. Patent Statement

The products described herein are protected under one or more of the following U.S. Patents: 4,901,219; 4,964,058; 5,028,853; 4,940,903; 4,623,859; 4,965,694; D317,906; 5,083,103; 5,180,051; 5,184,278; 5,231,565; 5,233,511; 5,249,115; 5,253,159; 5,315,499; 5,323,307; 5,455,760; 5,532,660; 5,892,449; 5,909,180; 6,055,144; 6,612,873; and 6,813,525. Additional patents pending.

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CHAPTER 1—INTRODUCTION

OVERVIEW

This bulletin explains how to install and operate the POWERLINK® G3 NF500G3 Controller, which is used to control the operation of a POWERLINK G3 system. The controller uses remotely operated circuit breakers to control up to 168 remotely operated branch circuits. Control signals originate externally from dry-contact inputs, or from commands received via the communications network. Typical control devices include low voltage pushbutton wall switches, occupancy sensors, photocell controllers, and security and building management systems.

KIT CONTENTS

The following items are provided for installation of the POWERLINK NF500G3 controller:

- NF500G3 controller
- Class 2 barrier
- Connector hardware kit
 - 8 three-terminal connectors
 - 1 five-terminal connector
 - 1 two-terminal connector
- Miscellaneous hardware kit
 - screwdriver
 - tie wrap
 - panelboard reference label

FIRMWARE

This bulletin also describes the features and operation of a controller using version 5 firmware. To find your controller's firmware version, see "Displaying the Firmware Version" on page 49.

FRONT PANEL OVERVIEW

Figure 1–1 shows the parts of the controller's front panel. A brief description of each part follows in Table 1–1.

Figure 1–1: Controller Front Panel

- A. SETUP LED
- B. POWER LED
- C. LEDs 1–8
- D. ADD/DELETE Key
- E. ADD/DELETE LED
- F. Wiring Compartment
- G. Cover
- H. RS-232 Port
- I. ON/OFF LEDs
- J. TEST Key
- K. INPUT Key
- L. Reset Button
- M. RX and TX LEDs
- N. CPU LED
- O. SETUP Key

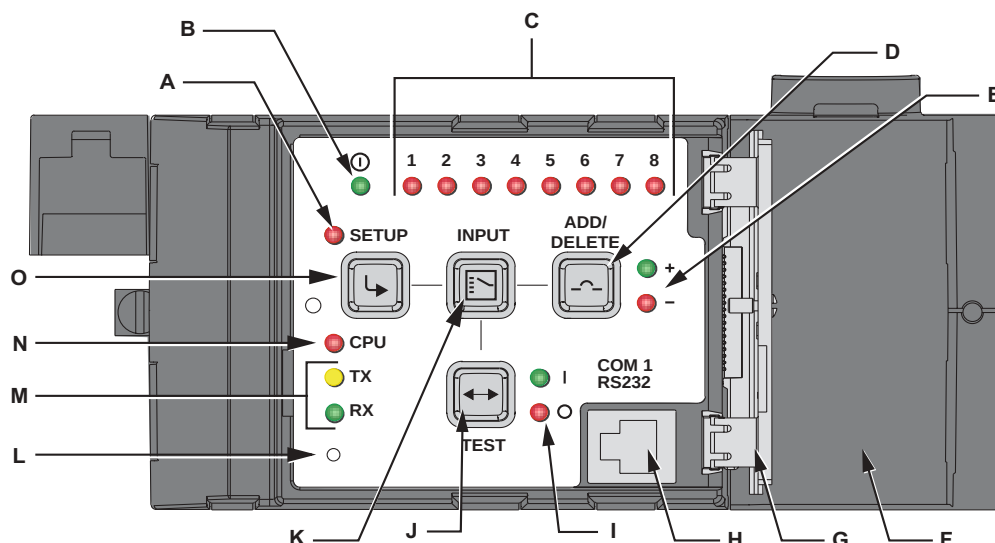


Table 1–1: Parts of The Controller Front Panel

Component	Description
A. SETUP LED	- The SETUP LED is lit when the unit is in SETUP mode. - When the SETUP LED is blinking the controller is in COMMUNICATIONS SETUP mode.
B. POWER LED	The POWER LED is always ON when the controller is powered.
C. LEDs 1–8	- In RUN mode, each LED indicates the status of the associated input. - A blinking LED indicates that the circuit breakers mapped to that input have been overridden from communications. - In SETUP mode, a lit LED indicates the selected input number. - The selected LED rotates to the left or right when all inputs are commanded to Maintained N.C. or Maintained N.O. respectively (see Chapter 8—Control Setup). - The LEDs also indicate communication parameters when in COMMUNICATIONS SETUP mode (see Chapter 9—Communications).
D. ADD/DELETE Key	The ADD/DELETE key toggles between ADD and DELETE modes, with the associated LED lit accordingly. Any circuit breaker that changes state while in ADD mode is added to the zone for the selected input. Any circuit breaker that changes state while in DELETE mode is removed from the zone for the selected input.
E. ADD/DELETE LEDs	- The ADD (+) and DELETE (–) LEDs indicate whether circuit breakers will be added or deleted from a zone. - The ADD and DELETE LEDs will blink to indicate that a circuit breaker has been added or deleted from the selected zone.
F. Wiring Compartment Cover	The wiring compartment cover protects the input and communications port terminals located in the Class 2 wiring compartment. See "Wiring Compartment Overview" on page 8 for an overview of the wiring compartment terminals.
G. Cover	The hinged cover can be screwed shut to discourage unauthorized use.
H. RS-232 Port	The RS-232 serial communications port is used for a temporary connection to a PC or modem. To connect to a PC or modem, the controller front panel serial cable NFFPCG3 is required.
I. ON/OFF LEDs	- The ON and OFF LEDs indicate the command state of the TEST key. - If the ON LED is lit, all circuit breakers associated with the selected input will be commanded ON. - If the OFF LED is lit, all circuit breakers associated with the selected input will be commanded OFF.
J. TEST Key	- The TEST key is used to determine which circuit breakers are mapped to a selected zone. - Circuit breakers can be remotely toggled ON and OFF by pressing this key while the controller is in the SETUP mode. Individual circuit breakers should be in AUTOMATIC mode when using the TEST key (see Chapter 8—Control Setup).

Table 1–1: Parts of The Controller Front Panel

Component	Description
K. INPUT Key	- The INPUT key is used to select an input while in SETUP mode. - Inputs can be set to Maintained N.O. or Maintained N.C. operation by pressing and holding the INPUT key while in SETUP mode .
L. Reset Button	The Reset button reboots the controller.
M. RX and TX LEDs	The RX and TX LEDs indicate communication activity. While using the RS232 ports, transmitted data is indicated by the flashing TX LED and received data is indicated by the flashing RX LED. Since the RS485 port is bi-directional, all communications activity are indicated on the TX LED.
N. CPU LED	The CPU LED indicates the status of program operation. If the CPU LED is blinking, the controller is operating.
O. SETUP Key	- The SETUP key toggles between RUN and SETUP modes. Setup can be locked using PCS software. - Enables the INPUT, ADD/DELETE, and TEST keys in SETUP mode. - The controller can be placed in COMMUNICATIONS SETUP mode by pressing and holding the SETUP key for 3 seconds.

WIRING COMPARTMENT OVERVIEW

Figure 1–2 shows the parts of the controller's wiring compartment. A brief description of each part follows in Table 1–2.

Figure 1–2: Controller Wiring Compartment

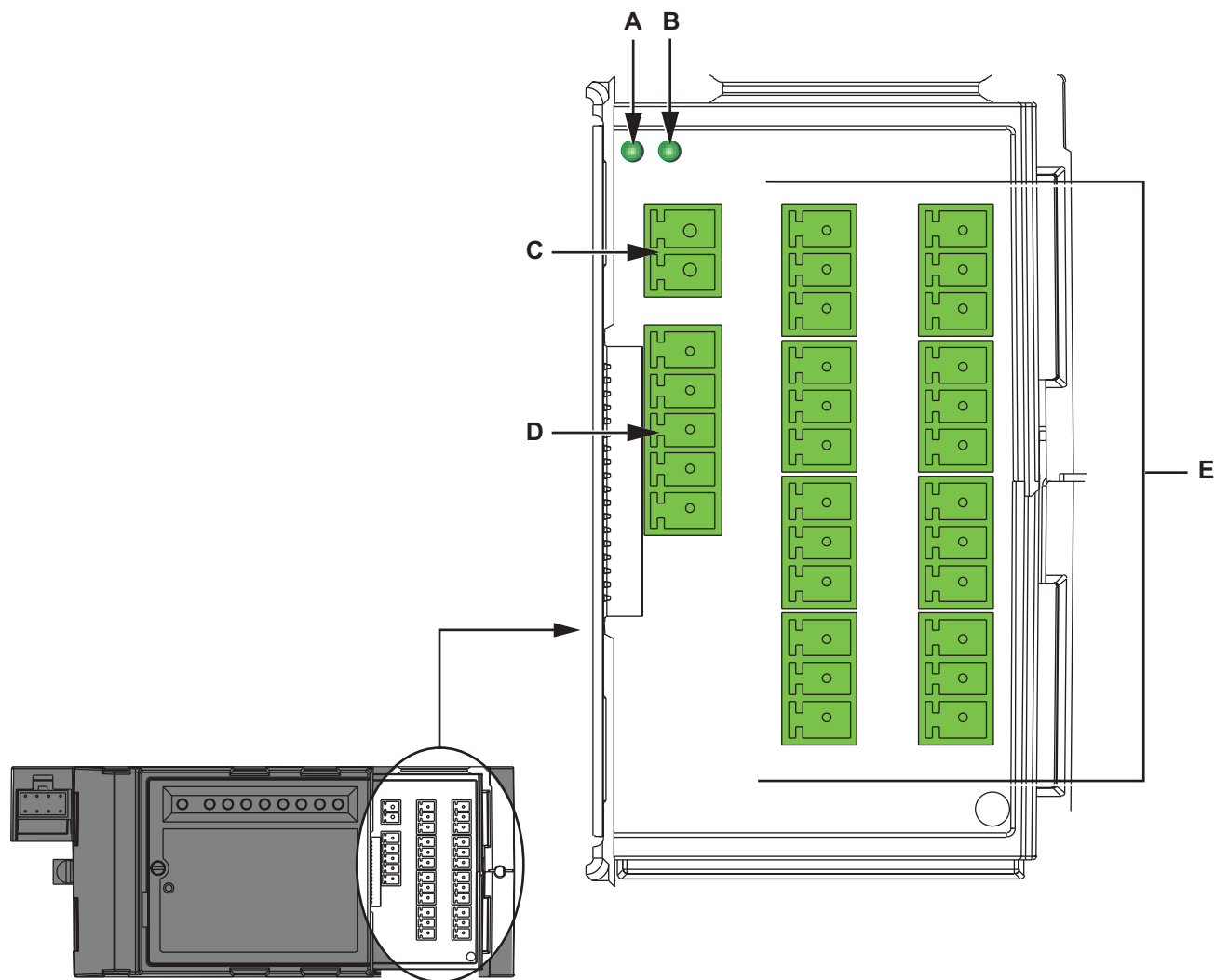


Table 1–2: Wiring Compartment Components

Component	Description
A. Status Power LED	When lit, indicates that the status feedback power source is operating properly.
B. Auxiliary Power LED	When lit, indicates that the 24 Vdc auxiliary power source is operating properly.
C. Auxiliary Power Terminals	Use these terminals to supply 24 Vdc at 100 mA (maximum) power to external devices.
D. Communications Terminals	Use these terminals to connect to external RS-232 or RS-485 communication circuits.
E. Input Terminals (1–168)	Use these terminals to connect to an external dry-contact switching device.

CHAPTER 2—SAFETY PRECAUTIONS

This chapter contains important safety precautions that must be followed before attempting to install, service, or maintain electrical equipment. Carefully read and follow the safety precautions below.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- This equipment must be installed and serviced only by qualified electrical personnel.
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm that power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.
- Before energizing panelboard, all unused spaces must be filled with blank fillers.

Failure to follow this instruction will result in death or serious injury.

CHAPTER 3—QUICK START GUIDE

INTRODUCTION

This chapter is a quick reference listing the steps necessary to install an NF500G3 controller in a POWERLINK G3 system. The steps in this chapter are provided as an installation checklist. For complete installation instructions, refer to the chapter listed.

QUICK START CHECKLIST

Use the following table as a quick start checklist for the controller:

Table 3–1: Quick Start Checklist

Steps	Reference
1. Install all POWERLINK G3 components according to their instruction bulletins. Typical components include, but aren't limited to, the following: • circuit breakers • controller • control bus • power supply • slave address selector	See appropriate instruction bulletins. Chapter 4—Installation on page 15
2. Wire all POWERLINK G3 components according to their instruction bulletins. This includes input wiring and class 2 barrier installation.	See appropriate instruction bulletins. Chapter 5—Input Wiring on page 17 Chapter 7—Class 2 Barrier Installation on page 39
3. If necessary, connect the controller to a communications network or a modem.	Chapter 6—Communications Wiring on page 25
4. Assign remotely operated circuit breakers to inputs.	Chapter 8—Control Setup on page 35
5. If networked or using with software, set the address for each controller, and enter the communications parameters.	Chapter 9—Communications on page 37
6. If your POWERLINK G3 system does not operate as expected, verify that everything is installed and programmed correctly.	Appendix A—Troubleshooting on page 121

CHAPTER 4—INSTALLATION

INSTALLING THE CONTROLLER

Follow these steps to install the controller in an NF panelboard (refer to Figure 4–2):

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- Turn off all power supplying this device and the equipment it is installed before working on it.
- Use a properly rated voltage sensing device to confirm that power is off.

Failure to follow this instruction will result in will result in death or serious injury.

1. Turn off all power supplying this device and the equipment it is installed.
2. Remove the panelboard cover and deadfront. Verify that the power is off using a properly rated voltage sensing device.
3. Insert the controller's two bus connectors into the vertical bus connections on the right control bus (see Figure 4–2).

NOTE: If you are using a standard NF panelboard, the controller is installed at the top of the right control bus. If you are using a column-width NF panelboard, the controller is installed at the top of the panelboard (see Figure 4–2).

Figure 4–1: Controller Installation

- A. Captive screw
- B. Panelboard bus bar
- C. Mounting feet
- D. Controller
- E. Bus connectors
- F. Vertical bus connections
- G. Right control bus
- H. Vertical bus connections

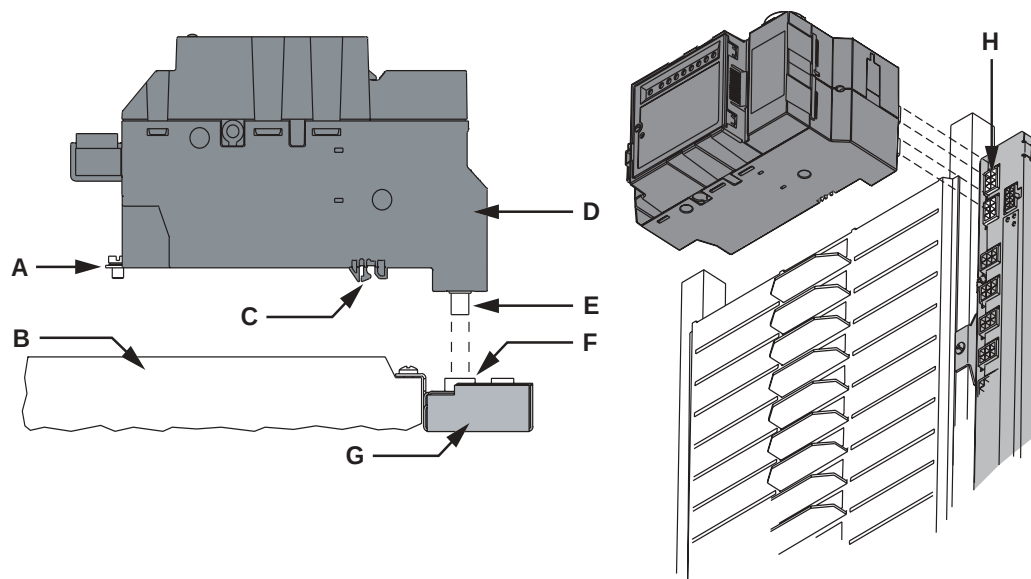
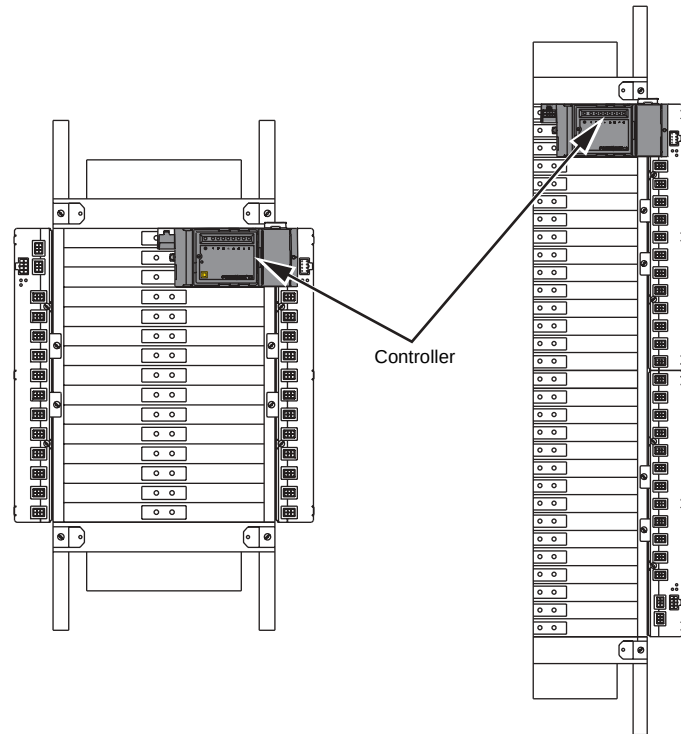


Figure 4-2: Controllers On Standard and Column-width Panelboards



4. Push the controller onto the control bus until the mounting feet snap onto the panelboard interior.

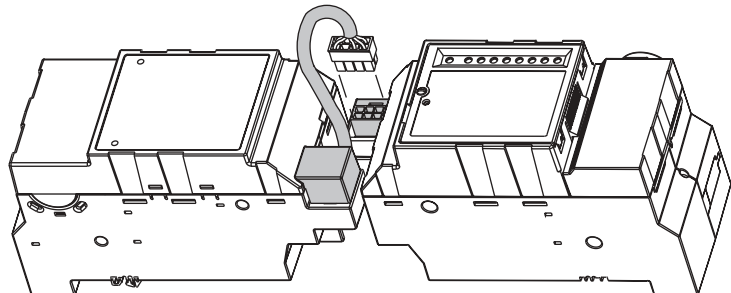
A captive screw on the left side of the controller is lined up with a hole on the panelboard interior. Use a screwdriver to secure the screw. Torque to 20–30 in-lbs.

NOTE: If not already installed, install the power supply according to its instruction bulletin.

5. Push the power supply connector plug into the power connection on the controller (see Figure 4-3).

NOTE: If you are using a column-width NF panelboard, the column-width controller cable NFCWG3 is required to connect the power supply and controller.

Figure 4-3: Connecting The Power Supply to The Controller



REMOVING THE CONTROLLER

To remove the controller, follow these steps:

1. Turn off all power supplying this device and the equipment it is installed.
2. Remove the panelboard cover and deadfront. Verify that power is off using a properly rated voltage sensing device.
3. Unplug the controller's power supply connector from the power supply.
4. Loosen the controller's captive screw from the panelboard interior.
5. Grasping the controller by the edges, lift straight out until the controller disengages.

NOTE: POWERLINK G3 control buses include a mode where all POWERLINK G3 circuit breakers are turned ON approximately 10 minutes after communication is lost with a controller as long as the control buses are still receiving power.

CHAPTER 5— INPUT WIRING

INTRODUCTION

POWERLINK G3 controllers provide a local set of Class 2 terminals for wiring to external control devices such as wall switches, photocells, occupancy sensors, relays, and pilot lights. These terminals provide the following connection points:

- **Physical Inputs** — All POWERLINK G3 controllers provide 16 input connection points and eight 24 Vdc source voltage points so that the dry-contacts of an external control device can act as a control source for an associated zone. These input terminals are designed to work with two-wire and three-wire switching devices. Eight of these terminals are bi-directional and are shared with the output function, described below. See “Physical vs. Communications” below for a comparison between physical inputs and communication inputs.
- **Outputs** — All POWERLINK G3 controllers provide eight status outputs that can be used to operate pilot lights or relays. The output terminal is bi-directional and is not available for use as an output when it is used as an input connection. The total current for all outputs combined is 60 mA. This limits the current available for each output to 7.5 mA, if all eight outputs are used. Choose devices that are capable of operating within these parameters.
- **Auxiliary Power** — All POWERLINK G3 controllers provide a 24 Vdc, 100 mA auxiliary power source for use with occupancy sensors or other external devices. Review the power requirements of the external device to determine whether this power source is suitable.
- **Communication Inputs** — All POWERLINK G3 controllers provide 64 communication inputs. These inputs do not exist physically, but are control points that receive commands from the communications network. ON or OFF commands may be written to POWERLINK G3 by any device that supports the industry-standard Modbus open protocol. Typical devices with Modbus capability are Building Automation Systems (BAS) and programmable logic controllers (PLC). See “Physical vs. Communications” below for a comparison between physical inputs and communication inputs.

Physical vs. Communications

The controller supports up to 8 physical inputs and up to 64 communication inputs. Physical inputs receive their signals to turn ON or OFF from dry-contact type switches (such as wall switches and occupancy sensors) that are wired to a controller’s input terminals. Communications inputs do not exist physically, rather they receive commands to turn ON or OFF across the communications network. For example, a building management system can send a command (by writing to a specific register in the controller) to turn a communication input ON or OFF across Ethernet or RS-485 communications.

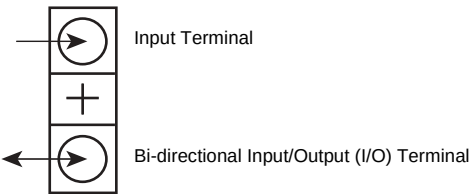
All inputs (1-64) on POWERLINK G3 controllers can be controlled via the communications network — both manually, from the switch, and automatically via commands from the network. For example, even though a wall switch wired to input 1 is ON, you can use the controller or PCS101 to turn input 1 OFF via communications.

Because inputs 9–64 do not exist physically, no input type configuration is available. However, input timers, zone override capabilities, and the “default action on comms loss” feature are available for all 64 zones/inputs.

CONNECTIONS

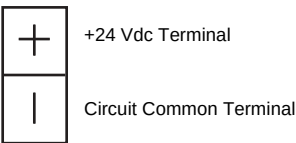
A connector plug is provided for each of the eight sets of terminals. The wiring compartment label identifies each terminal as shown below in Figure 5–1.

Figure 5–1: Input/Output Connector Diagram



The auxiliary power connector provides access to the 24 V Class 2 power supply. A solid state fuse limits the current available from this terminal to 100 mA. The wiring compartment label identifies each terminal as shown below in Figure 5–2.

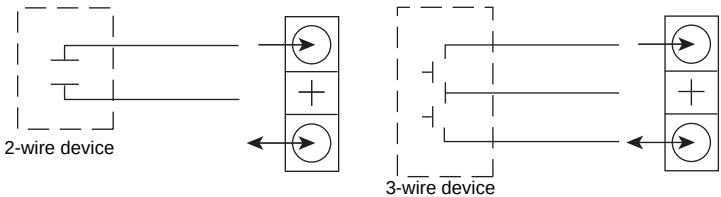
Figure 5–2: Auxiliary Power Connector



EXTERNAL DEVICE WIRING

External control devices, such as wall switches, photocells, occupancy sensors, and relays can be easily connected to the controller's input terminals. Most of these devices have a single set of contacts that provide a control signal, requiring two wires for connection (see Figure 5–3). Some devices use two sets of contacts to provide a control signal, requiring three wires for connection (see Figure 5–3). The contact closure activity is monitored by the controller and is interpreted according to an input type configuration setting that is appropriate for the external device. The bi-directional terminal shown in Figure 5–3 is used as an input when a 3-wire device is used.

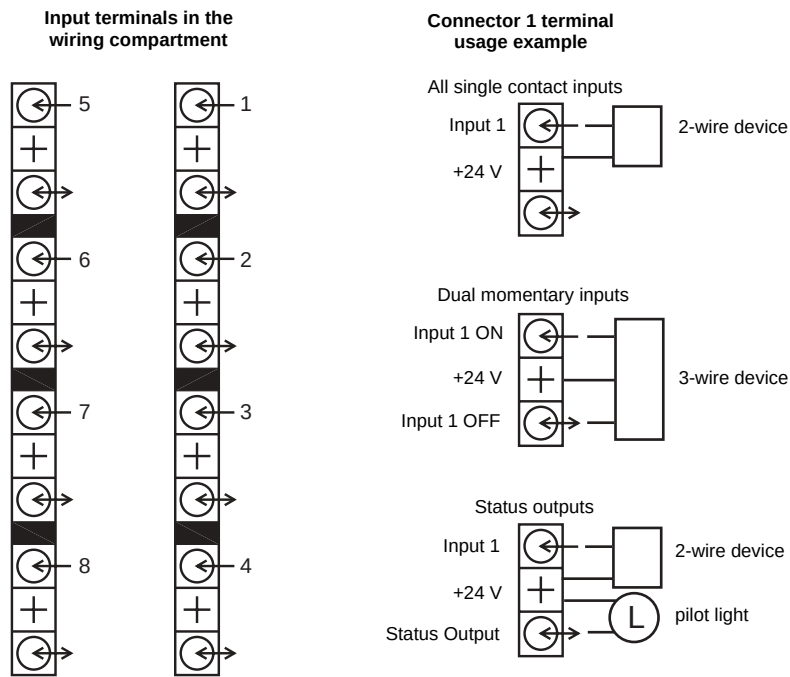
Figure 5–3: 2- and 3-wire Input Connections



Terminals

The diagram below illustrates the position of each connector in a controller. Numbered terminals are input terminals. An example of how a connector is used is also in the illustration.

Figure 5-4: Terminal Diagram



In the figure above, Connector 1 can be used three different ways:

1. **Single contact inputs:** A device is connected to input 1. The bi-directional I/O terminal is available for configuration as a status output if desired.
2. **Dual momentary inputs:** A three-wire device is connected to the connector. The bi-directional I/O terminal is not available for configuration as a status output.
3. **Status outputs:** The bi-directional I/O terminal is used as an output terminal for a status output, such as an LED pilot light. Input 1 is used to connect an input.

NOTE: In order to operate as intended, the input type must be set up. See “Changing Input Types” on page 40 for instructions.

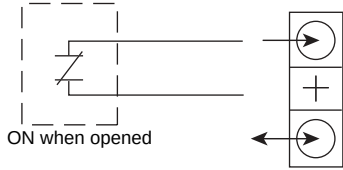
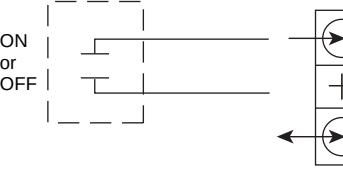
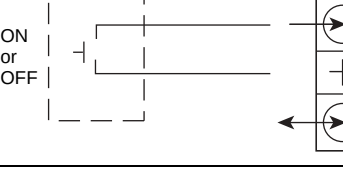
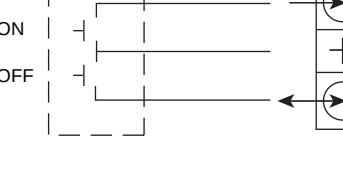
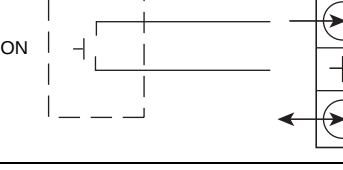
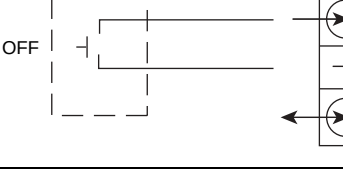
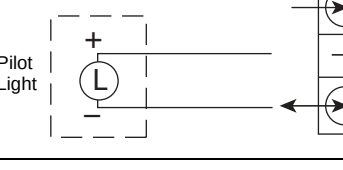
COMMON INPUT TYPES

Table 5-1 describes the types of typical input configurations used in POWERLINK G3 systems. The contact activity of the external device is monitored by the controller and is interpreted according to the selected input type configuration.

Table 5-1: Common Input Types

Input Type	Application	Operation	Connection Diagram
Maintained Normally Open	External control devices such as photocells, time clocks and occupancy sensors that contain a normally open contact.	The input state is commanded ON when the contacts are closed and is commanded OFF when the contacts are opened.	
Maintained Normally Open with Blink	Notifies an occupant when the lights are about to turn OFF.	Same as above. Associated breakers will blink (if configured with Blink Type) in response to an OFF command.	

Table 5–1: Common Input Types

Input Type	Application	Operation	Connection Diagram
Maintained Normally Closed	External control devices such as photocells, time clocks and occupancy sensors that contain a normally closed contact.	The input state is commanded OFF when the contacts are closed and is commanded ON when the contacts are opened.	
Maintained Normally Closed With Blink	Notifies an occupant when the lights are about to go OFF.	Same as above. Associated breakers will blink (if configured with Blink Type) in response to an OFF command.	
Maintained Toggle	Maintained switches used to switch lights ON and OFF	The input state alternates between ON and OFF each time the switch changes position.	
Momentary Toggle	Pushbutton switches used to switch lights ON and OFF.	The input state alternates between ON and OFF each time the contacts are closed.	
Dual Momentary	Dual pushbutton or return-to-center momentary switches in which one contact is used to turn lights ON and the other is used to turn lights OFF.	The input state is commanded ON or OFF depending on which contacts are closed. (3-wire device.)	
Momentary ON	Pushbutton switches used with a timer to switch lights ON for a preset period.	The input state is commanded ON when the contacts are closed. Typically used with a timer.	
Momentary OFF	Pushbutton switches used with a timer to switch lights OFF for a preset period.	The input state is commanded OFF when the contact is closed. Typically used with a timer.	
Status Output	Used to annunciate the ON/OFF state of the lights when they are not visible from the position of the control device.	The bi-directional terminal provides a status output voltage for use with a pilot light or relay.	

Inputs 1–8 of the controller can be configured from the front panel for either Maintained Normally Open or Maintained Normally Closed operation. PCS-101 software is required to configure any other input type, to configure for a mix of normally open and normally closed maintained contacts, or to configure an input timer. The bi-directional terminal is automatically configured as a status output unless the input type selected is dual

momentary. The bi-directional terminals are not available for configuration as independent inputs.

INPUT TIMERS

Any input can be configured with a timer that will automatically turn OFF the input after a period of time. The duration of the input timer can be set for up to 18 hours. See Table 5–2 for a description of the available timer types.

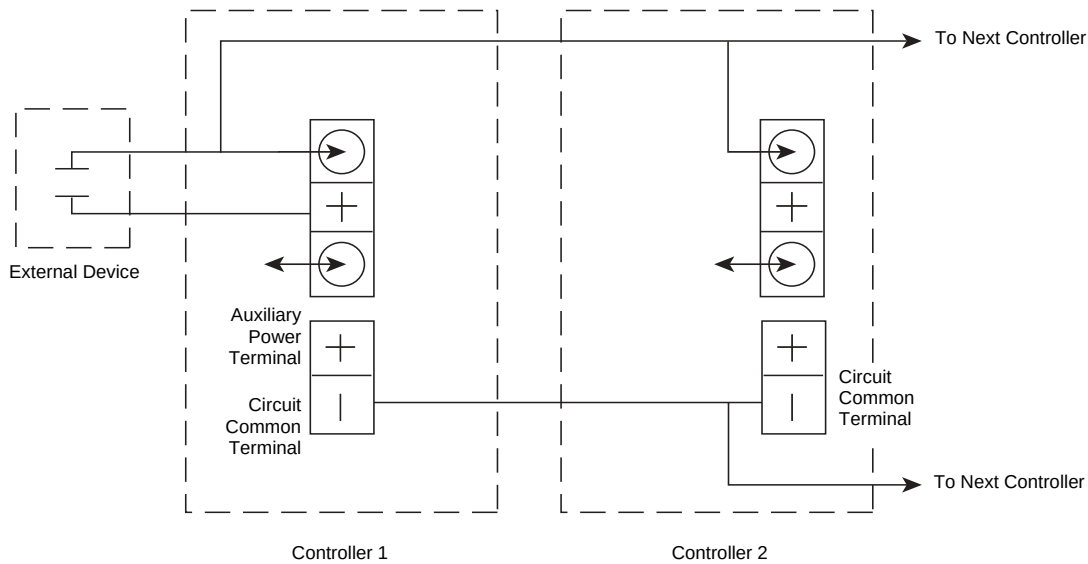
Table 5–2: Timer Types

Timer Type	Operation
No Timer	The input is not affected by the timer.
Timed ON	The timer countdown starts or restarts whenever the input is turned ON. The input is commanded OFF when the timer value reaches zero.
OFF-Delay	The timer countdown starts or restarts whenever the input is commanded OFF, but the input remains ON until the timer reaches zero.
ON-Delay	The timer countdown starts or restarts whenever the input is commanded ON, but the input remains OFF until the timer reaches zero.

WIRING AN EXTERNAL DEVICE TO TWO OR MORE CONTROLLERS

An external device may be wired to multiple controllers. It is recommended that the source voltage be provided to the external device by one controller. The input signal from the external device and the circuit common terminal on the auxiliary power connector are connected to the other controllers.

Figure 5–5: Connecting an External Device To Multiple Controllers



APPLICATIONS FOR COMMON INPUT TYPES

The following table shows how the input configuration types can be used in common applications.

Table 5–3: NF500G3 Common Input Applications

Application	Switch Type/Input	Switch Diagram	Branch Circuit Diagram ⌚	Action
ON/OFF wall switch	Momentary Switch (configured for momentary toggle)			Switch toggles lights ON and OFF.
Multi-level switching	Momentary Switch Input 1: Momentary Toggle Input 2: Momentary Toggle			SW1 is mapped to Circuit 1 for 67% level lighting. Successive presses of SW1 will switch Circuit 1 ON and OFF. SW2 is mapped to Circuit 2 for 33% level lighting. Successive presses of the SW2 will switch Circuit 2 ON and OFF. Use SW1 and SW2 to turn ON both circuits for 100% lighting.
Timer with wall switch override	Third party time clock wired to Input 1 (configured for maintained N.O. with blink) One momentary switch wired to Input 2 (configured for momentary toggle with timer)			SW1 (time clock) is mapped to Circuit 1. Lights will remain ON during programmed time periods (SW1 contact closed). Circuits configured with blink notice will blink when SW1 turns OFF. SW2 (wall switch) is mapped to Circuit 1. Toggling SW2 has no control while SW1 is closed. However, during OFF periods (SW1 contact open), SW2 will toggle lights ON/OFF. A timer on SW2 will switch lights OFF after preset period, unless they are manually toggled OFF.
Two switches controlling the same group of lights (such as typical 3-way line voltage switch arrangement)	Two momentary switches (configured for momentary toggle)			Either switch SW1 or SW2 will toggle lights ON and OFF.
Occupancy sensor controlling a group of circuit breakers	Occupancy-rated sensor wired to Input 1 (configured for maintained N.O.) Control power supplied by auxiliary power supply.			Input 1 is mapped to Circuit 1 and Circuit 2. When motion is detected, the occupancy sensor contact will close, causing circuit breakers 1 and 2 to close.

⌚ Circuit numbers are based on circuit numbering in a panelboard.

N.O. = Normally Open

N.C. = Normally Closed

— 1-pole

— 2-pole

Florescent Light

High Intensity Discharge (HID) Light

Optional LED Pilot Light

Table 5–3: NF500G3 Common Input Applications

Application	Switch Type/Input	Switch Diagram	Branch Circuit Diagram	Action
Photo sensor	Photo controller contact N.O. wired to Input 1 (configured for maintained N.O.)			When SW1 closes, the circuit breaker that feeds circuits 1 and 3, input will switch ON and remain ON until SW1 contact opens.
Photo sensor with manual override	Photo controller contact N.O. wired to Input 1 (configured for maintained N.O.) Momentary Switch wired to Input 2 (configured for momentary toggle with timer)			When SW1 closes, the circuit breaker feeding circuits 1 and 3 will switch ON and remain ON until SW1 contact opens. Override SW2 is provided to switch lights ON for periods when photo controller has open contact. Timer prevents override from remaining ON indefinitely.
Photo sensor with clock override	Third party time clock with a N.C. contact that is wired in series to Input 1 with a N.O. photo controller (configured for maintained N.O.) Momentary switch wired to Input 2 (configured for momentary toggle with timer)			Time clock contact prevents photo cell from switching lights ON during preset scheduled periods. SW2 provides a timed override.

Circuit numbers are based on circuit numbering in a panelboard.

N.O. = Normally Open

N.C. = Normally Closed

1-pole

2-pole

Florescent Light

High Intensity Discharge (HID) Light

Optional LED Pilot Light

CHAPTER 6—COMMUNICATIONS WIRING

INTRODUCTION

The NF500G3 controller includes MODBUS digital communications as a standard feature. ASCII and RTU slave modes are supported (see **Chapter 9—Communications** on page 41). A computer or building automation system (BAS) may be connected to a controller in one of the following ways:

- A temporary local connection using the front panel RS-232 serial port and a NFFPCG3 front panel cable accessory
- A permanent connection, either to a local computer or to a remote computer via modem that is wired into the wiring compartment's RS-232 or RS-485 serial port.

NOTE: All connection methods share the same serial port. Potential communication errors may occur if multiple computers access any controller's serial port at the same time. DO NOT attempt to communicate through the front panel connection while a permanent computer connection, such as a BAS, is actively communicating with the controller.

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POWERLINK G3 COMMUNICATIONS OVERVIEW

The POWERLINK G3 system contains two levels of communication networks, *subnet* and *automation*, as illustrated in Figure 6–1.

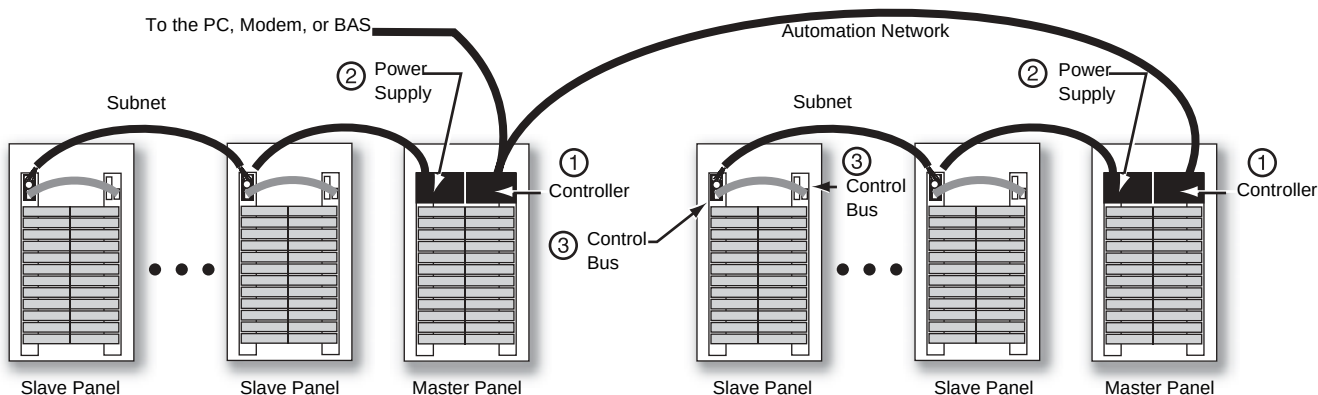
The first level of communications is the device-level network called the *subnetwork, or subnet*. The subnet connects these POWERLINK G3 components:

- ① controller
- ② power supply
- ③ control buses

Up to eight control buses, which can be located in multiple panelboards, can be controlled from a single controller. The subnet carries command signals from the controller to the appropriate control bus, which in turn, instructs the proper circuit breakers to remotely switch. Through the subnet, the controller also polls the control buses for the status of the remotely operated circuit breakers. In addition to providing the communications path to the control buses, the subnet wiring also provides a 24 Vdc source for powering the control buses and providing power to operate the remotely operated circuit breakers.

The second level of the communication network connects the system (one or more controllers) to devices such as personal computers, modems, or a building management system with the appropriate interface drivers. This communication network is referred to as the *automation network* (see Figure 6–1).

Figure 6–1: Automation and Subnet Communications Networks



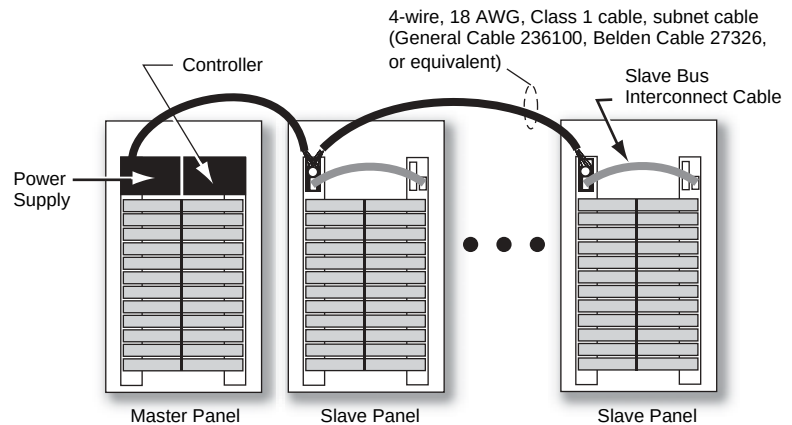
SUBNET COMMUNICATIONS

Subnet Components

A subnet communications network is necessary whenever two or more panels are to be controlled from a single controller.

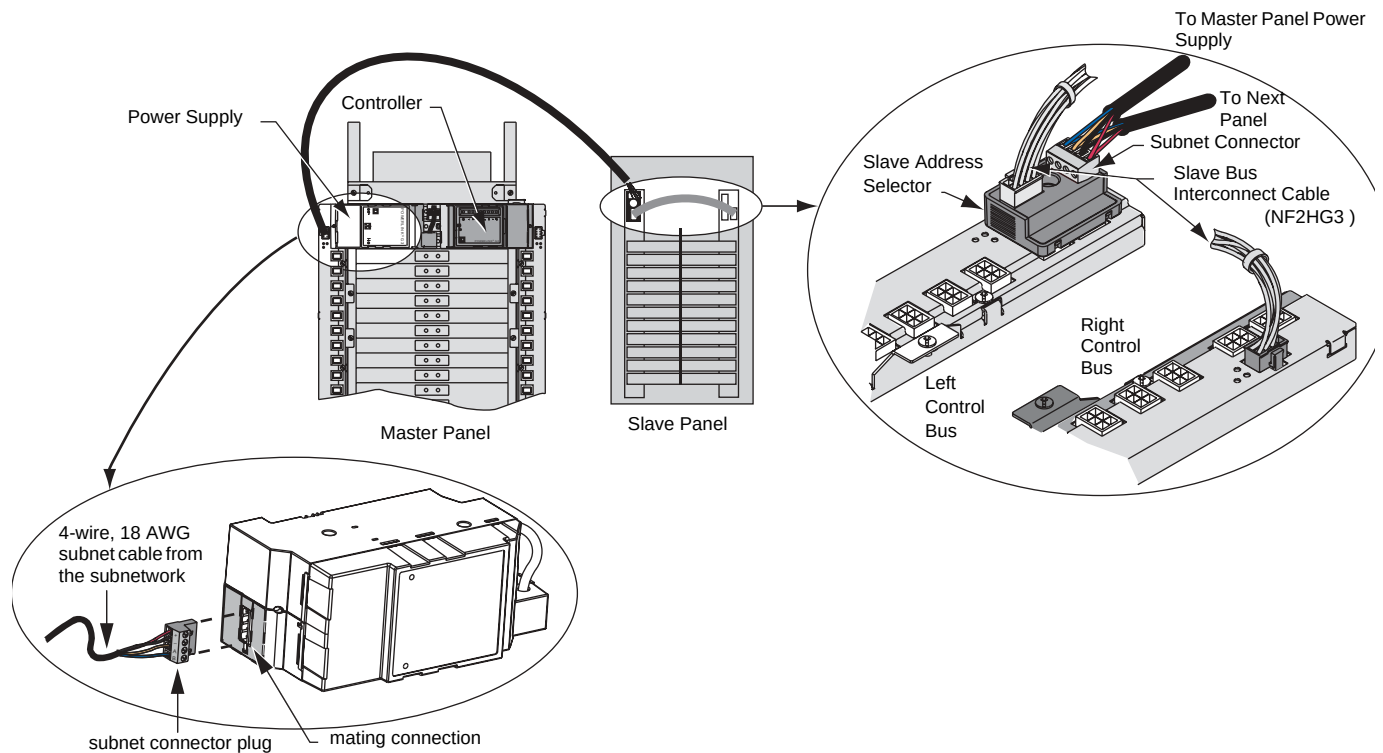
In a subnet network, the master panel contains the controller and power supply. Other panels connected to the controller are referred to as slave panels. Figure 6–2 illustrates these components.

Figure 6–2: Subnet System Communications Wiring



The components of the subnet communications wiring are the controller, power supply, control buses, slave address selectors, and slave bus interconnect cable as illustrated in Figure 6–3.

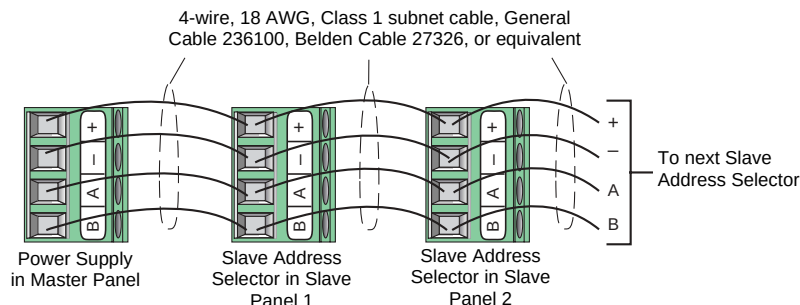
Figure 6–3: Detail of the Components in Subnet Communications Wiring



Subnet Wiring

The power supply, located in the master panel, is connected to each slave address selector in a daisy chain as shown in Figure 6–4. Only one slave address selector is required for each slave panel.

Figure 6–4: Subnet Wiring Detail

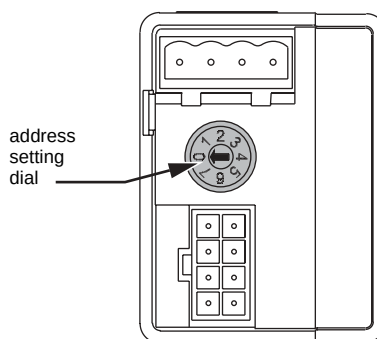


Wiring the controller to the subnet is not necessary. The connection between the controller and the power supply provides the subnet communications for the controller.

Slave Address Selector

The slave address selector enables you to set the address of the slave panel. A dial switch on the face of the selector is labeled 0–7, with each number representing a unique address. Address 0 is reserved for the master panelboard. If the power supply or controller is plugged into any control bus on the subnet, address 0 should not be used as a slave address.

Figure 6–5: Dial switch On The Address Selector



Only two control buses may be connected to a slave address selector. If a second control bus is located in the same slave panelboard, a slave bus interconnect cable is required for connecting the slave address selector to the second bus (see Figure 6–3 on page 26). For proper operation of the system, always install the slave address selector on the left control bus. Each slave address selector must also have its own unique address. If two or more selectors contain the same address, improper operation may result.

Subnet Conductors

The National Electrical Code (NEC) classifies the POWERLINK G3 subnet communications wiring as a Class 1 circuit. Thus, the conductors must be sized and insulated for the line voltage of the panelboard. To meet Class 1 requirements, conductors should be 18 AWG and installed in conduit or an appropriate raceway.

Four conductors are required for the subnet. Two conductors carry 24 Vdc power to the control buses, while the other two are used for the data path. Approved cables are 4-wire, 18 AWG, Class 1 subnet cables such as General Cable 236100, Belden 27326, or equivalent.

The total distance of the conductor length from the power supply to the farthest control bus depends on the power supply voltage. Table 1 list maximum wiring distances based on nominal voltages.

Table 6–1: Maximum Wiring Distances

Nominal Voltage ^①	Power Supply Part Number	Maximum Cable Length
120 V	NF120PSG3	400 ft (122 m)
220 V	NF240PSG3	100 ft (30 m)
240 V	NF240PSG3	400 ft (122 m)
277 V	NF277PSG3	400 ft (122 m)

^① Phase to neutral voltage

NOTE: If you are using a T-connection to connect the power supply to the subnet, the subnet distance limits above apply to each direction of the T-connection. Star connections are not recommended

With the exception of setting the slave address selectors, no additional setup is required for commissioning the subnet communications network.

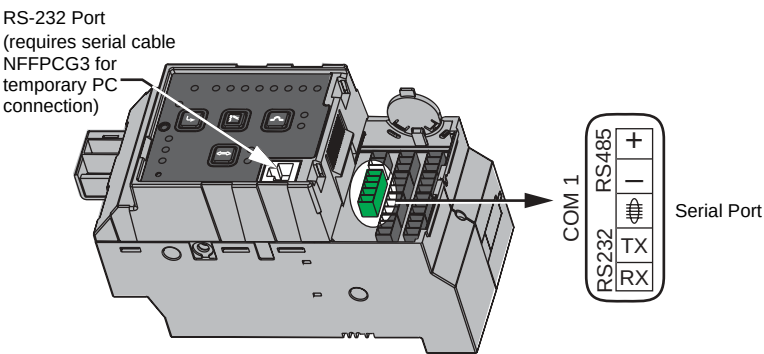
**AUTOMATION NETWORK
COMMUNICATIONS**

All POWERLINK G3 controllers feature an automation network for communicating with other controllers. Two communication ports are available on the controller: RS-232 and RS-485 as shown in Figure 6–6.

The RS-232 and RS-485 ports are connected internally to the same controller serial communication port. Therefore, only one master device can be connected through one of the ports to the controller. For example, you cannot simultaneously connect a computer to the RS-485 port and a PC to the RS-232 serial port. Attempting to do so may result in improper operation.

An internal RS-232 communication port also is available externally. The NFFPCG3 front panel serial cable is required to temporarily connect the controller to a notebook computer. Refer to the “Controller Front Panel Serial Cable” instruction bulletin 63249-405-01 for the serial cable installation procedures.

Figure 6–6: Ports On The Controller



RS-485 Communications

Multiple controllers can be networked together by wiring the system using the RS-485 port on the controllers. Figure 6–7 illustrates a typical configuration where three master panels are shown (each controlling its own independent subnet.)

A maximum of 247 controllers can be connected together. Use a line repeater for each group of 32 controllers. The maximum cable distances at various baud rates are listed in Table 6–2.

Figure 6–7: RS485 Automation Level Communications Wiring

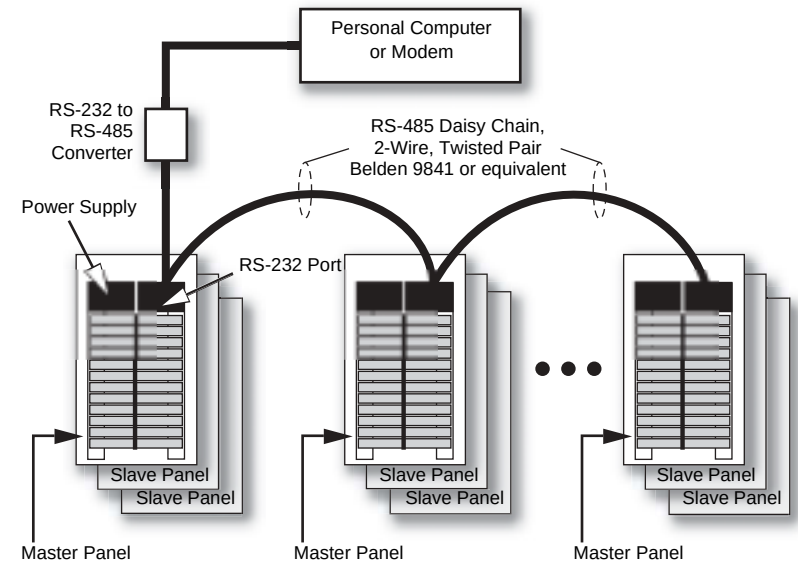


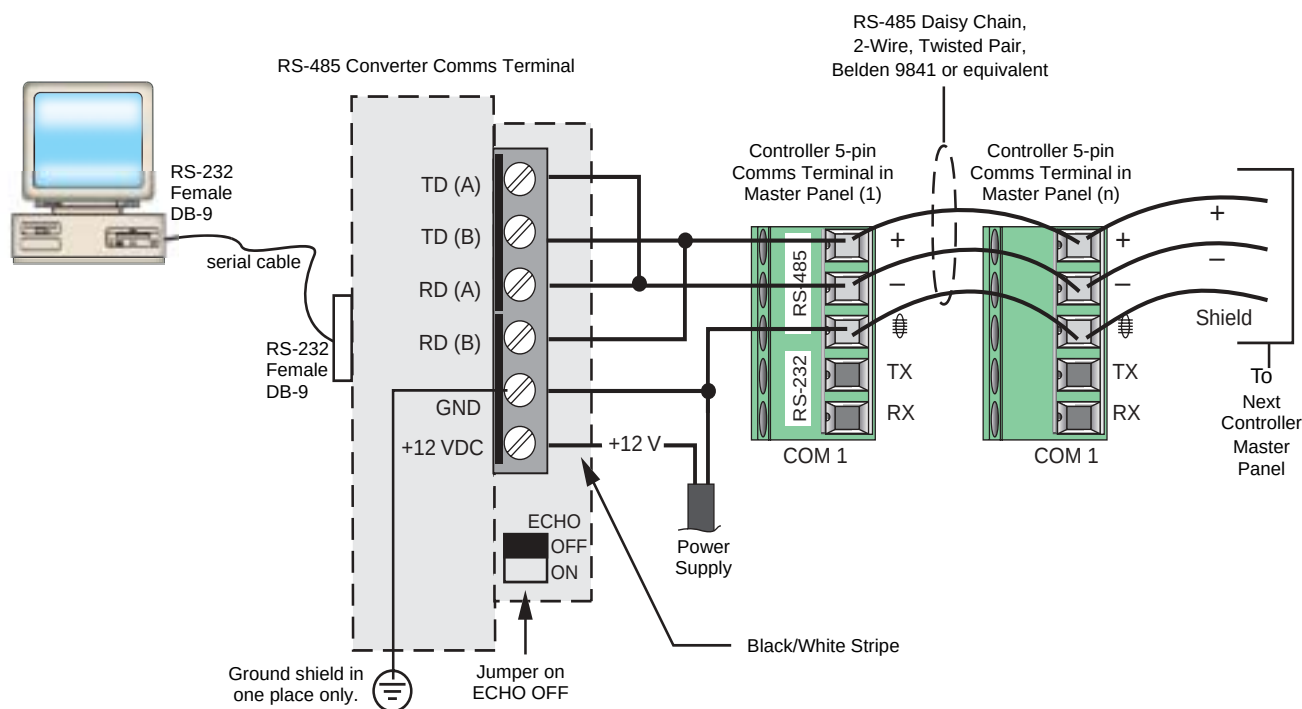
Table 6–2: Maximum Communication Cable Distances

Baud Rate	Maximum Distances		
	1–8 Controllers	9–16 Controllers	17–32 Controllers
38,400	4,000 ft (1,219 m)	4,000 ft (1,219 m)	3,000 ft (914 m)
19,200	5,000 ft (1,524 m)	4,000 ft (1,219 m)	4,000 ft (1,219 m)
9,600	5,000 ft (1,524 m)	5,000 ft (1,524 m)	4,000 ft (1,219 m)
4,800	5,000 ft (1,524 m)	5,000 ft (1,524 m)	4,000 ft (1,219 m)
2,400	5,000 ft (1,524 m)	5,000 ft (1,524 m)	4,000 ft (1,219 m)
1,200	5,000 ft (1,524 m)	5,000 ft (1,524 m)	4,000 ft (1,219 m)

RS-485 Controller Connections Using a RS-232/485 Converter

Connection from the network to a personal computer, modem, or a building management system with the appropriate interface drivers often requires the use of a converter that will convert the RS-485 signal to an RS-232 signal. When the automation network is connected to the serial port (comms port) on the computer, the POWERLINK Controller Software (PCS-101) can be used. A female DB9 to female DB9 cable is required for the connection from the computer serial port to the converter. Square D offers a standard RS-232/485 converter kit that includes the converter, power supply, and serial cable (Square D catalog number 6382RS485G3KIT). Connection of this kit to the automation network is shown in Figure 6–8. The communication wires are daisy-chained from one controller RS-485 port to the next in the following manner: positive to positive (+ to +), negative to negative (– to –), and shield to shield.

Figure 6–8: 2-wire, RS-485 Connection Using a Converter Kit



Other types of third-party converters are available, depending on the application needs. When using a third-party converter, make sure it has biasing configurable by the user.

Automation Communications Wiring Specifications

The National Electric Code (NEC) classifies automation communications wiring as a Class 2 circuit. Conductors may range in size from 24 to 18 AWG and consist of a single set of twisted pair conductors with a shield (Belden 9841 or equal). Maximum wiring distance should not exceed 5000 ft (1524 m) at 19,200 baud for eight controllers. See Table 6–2 on page 30 for the maximum communication cable distances at various baud rates.

Shielding and Grounding

The automation network shield should be grounded in one place only, typically at the RS-232/485 converter as shown in Figure 6–9 on page 33.

The controller circuitry and associated Class 2 wiring is electrically isolated from all system voltages and earth ground. Maintaining the integrity of this isolation is important for proper operation and performance.

The controller's input terminals and auxiliary power source are part of the Class 2 circuitry. External devices connected to the controller must meet the isolation requirements and other Class 2 wiring standards. Do not connect the controller to external voltage sources or earth ground.

The RS-485 network communications circuit is also part of the Class 2 circuitry. In most applications, the shield of each communications cable will be interconnected at the center terminal of the communications connector. This connection ensures networked controllers are tied together to a common reference potential. The shield must be grounded at only one point in the system. Grounding the shield at multiple points will create a "ground loop" that may disrupt communications or cause damage to the controller circuitry.

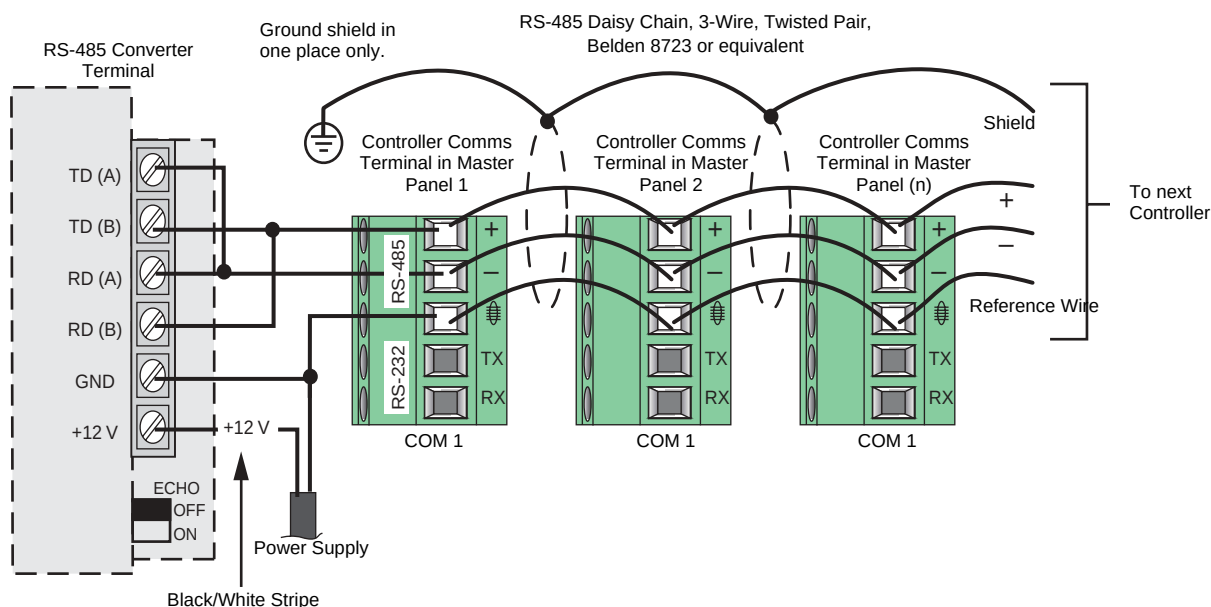
Alternate RS-485 Wiring

An alternate RS-485 wiring scheme that uses a third reference wire is preferred in certain applications:

- When you cannot avoid connecting the Class 2 input circuitry to earth ground.
- When an external device's isolation from ground is minimal.
- When the controller is installed on a network with non-isolated devices.

This 3-wire method uses a separate reference wire, or pair of wires, to interconnect the center terminal of all communications connectors (Figure 6–9). The shield should remain isolated from the controller and should not be connected to this point. Instead, interconnect the shields using a wire nut. Connect the shield to ground at only one point.

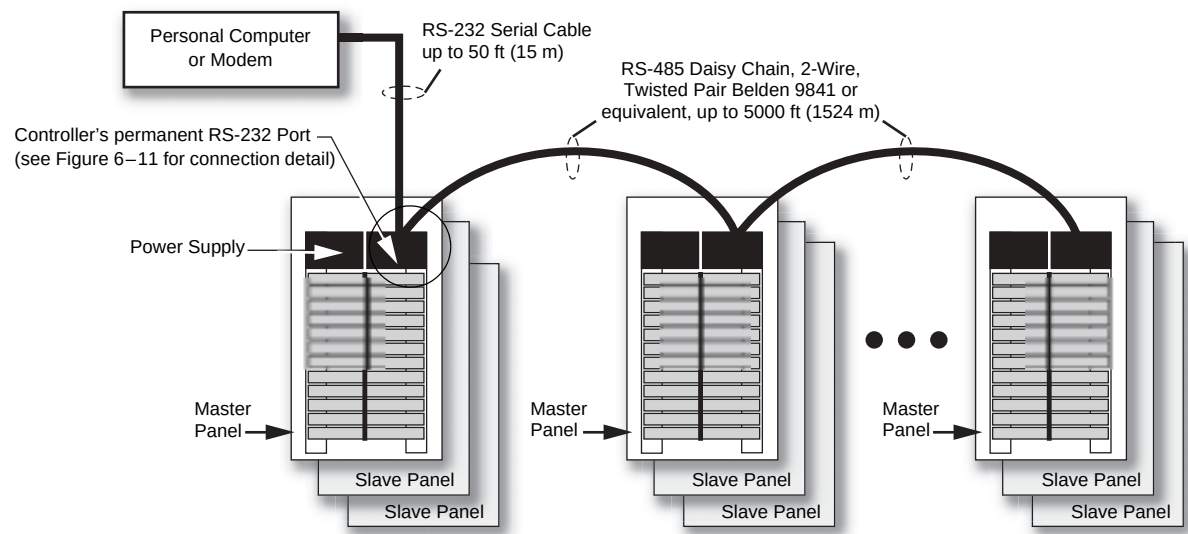
Figure 6–9: Alternate Controller Communications Wiring Detail for 3-wire, RS-485 Systems



RS-232 Serial Communications

In addition to the RS-485 communications port, the controller has an RS-232 port for direct connection to personal computers, modems, or other devices that support MODBUS ASCII or RTU communications as shown in Figure 6–10. Because it is a direct RS-232 connection, no converter is required. However, the total length of the RS-232 wiring should not exceed 50 ft (15 m).

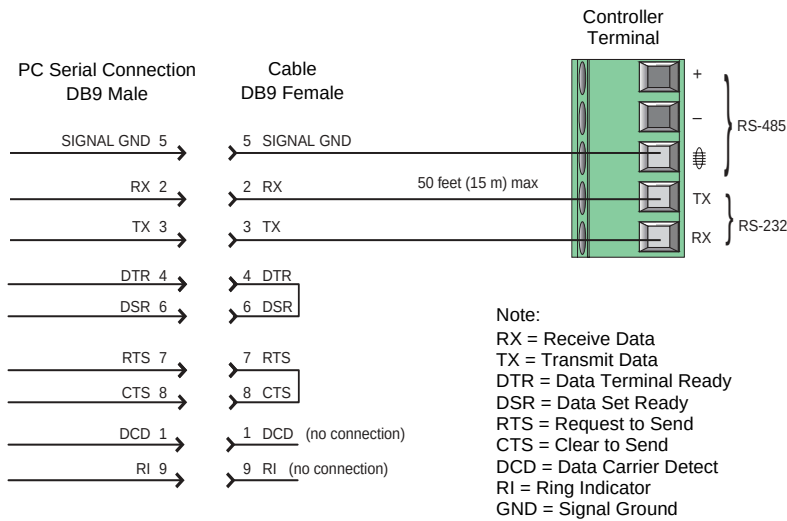
Figure 6–10: RS-232 Controller Serial Connections



RS-232 Connection to a Personal Computer

To make the serial communications connection using the RS-232 port of the controller, use a standard RS-232, 9-pin DB-9 connector and serial cable. Figure 6–11 shows these connections.

Figure 6–11: RS-232 Controller Serial Connection Detail



CHAPTER 7—CLASS 2 BARRIER INSTALLATION

INTRODUCTION

All connections to the wiring compartment of the NF500G3 are classified as Class 2 circuits. As such, these circuits must be separated from Class 1, electric light, and power circuits. There are two ways to separate the wiring. The first is to maintain a minimum amount of spacing between the circuits. The second is to install a Class 2 barrier.

A flexible barrier is provided with the NF500G3 controller. The barrier provides circuit separation in situations where maintaining minimum spacing is not practical.

INSTALLING THE CLASS 2 BARRIER

Follow the instructions below to install the Class 2 barrier.

⚠ DANGER

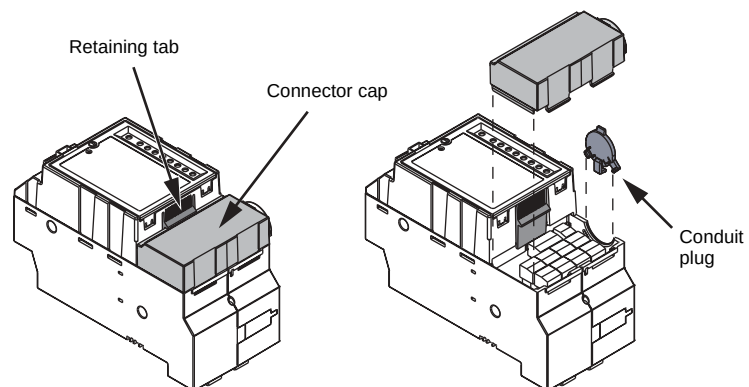
DANGER OF ELECTRIC SHOCK, BURN OR ARC FLASH

- Turn off all power supplying this equipment before working on or inside the equipment.
- Always use a properly rated voltage sensing device to confirm that power is off.

Failure to follow this instruction will result in death or serious injury.

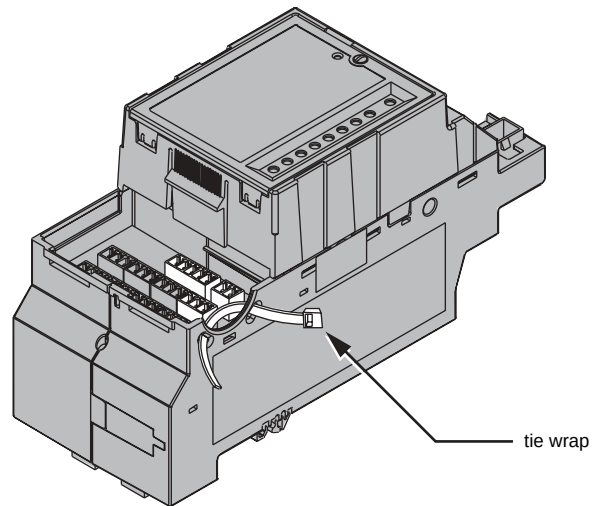
1. Turn off all power supplying this device and the equipment it is installed. Verify that the power is off using a properly rated voltage sensing device.
2. Remove the connector cap by pressing in on the retaining tab that secures the cap, then slide the cap up and away from the controller (see Figure 7–1).
3. Remove the conduit plug by pulling down and out on the conduit plug.

Figure 7–1: Removing The Connector Cap



4. Thread the supplied tie wrap through the holes on the controller (see Figure 7–2).

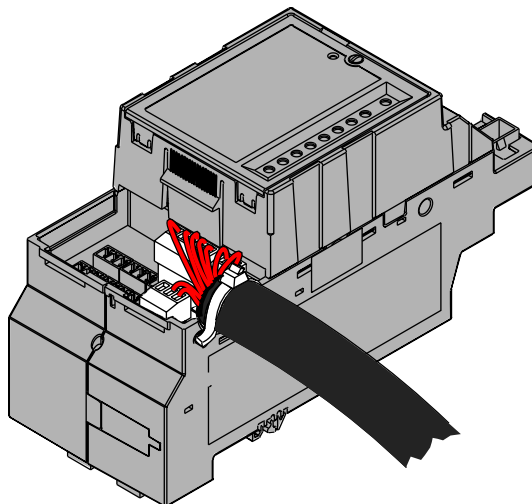
Figure 7–2: Threading The Tie Wrap Through The Controller



5. Locate and remove a knockout on the top of the panelboard near the controller.
6. If not using a conduit, apply a fitting where the knockout was removed. This will protect the wires coming into the panelboard.
7. Pull the Class 2 wires into the panelboard through the hole in the panelboard.
8. Determine the length of the barrier by measuring the distance from where the wires enter the panelboard to the controller wiring compartment.
9. Cut the barrier slightly longer than the measured length to allow enough of the barrier to enter the wiring compartment.
10. Thread the wires into the barrier and slide the barrier up to the hole in the panelboard.
11. Cut the wires to length and terminate them according to the input wiring and communication wiring requirements, as described in **Chapter 5—Input Wiring** and **Chapter 6—Communications Wiring**.

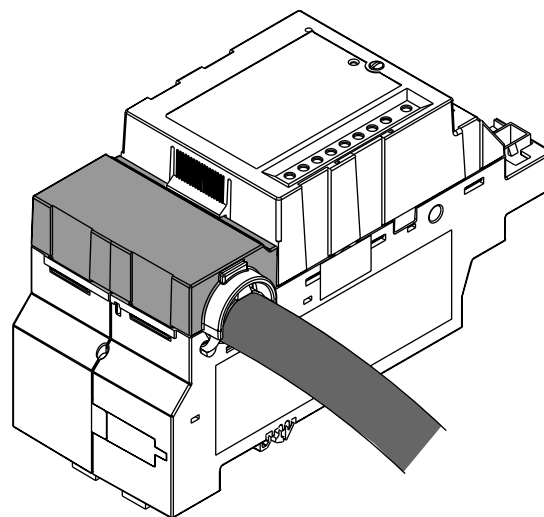
12. Close the tie wrap around the barrier to secure the wires and barrier to the controller (see Figure 7–3).

Figure 7–3: The Secured Tie Wrap



13. Slide the connector cap on until it snaps into place.

Figure 7–4: The installed Class 2 Barrier



CHAPTER 8—CONTROL SETUP

INTRODUCTION

The main function of the NF500G3 controller is to control the operation of groups, or zones, of circuit breakers. These zones are assigned to an input device that is connected to one of the controller's eight, 3-terminal connectors. An input type can also be selected based on the normal state of the input device. This chapter explains how to add, delete, and test zones of circuit breakers and how to switch input types.

ADDING AND DELETING CIRCUIT BREAKERS

After the hardware installation and wiring are complete, the NF500G3 controller can be used to create zones to be controlled by each input. A zone is a group of circuit breakers that is controlled by an assigned input device. When a zone is ON, all circuit breakers assigned to that zone are turned ON. Zones are created by entering SETUP mode. First, an input is selected from one of the eight available inputs on the controller. Next, circuit breakers are assigned to the selected input creating a zone. When creating zones, the circuit breakers do not have to be on the same control bus or in the same panelboard. However, the controller must be able to communicate with the circuit breakers via subnet communications.

A breaker may be assigned to more than one zone. If a circuit breaker is commanded ON by any zone, it will remain ON until all zones commanding it are OFF.

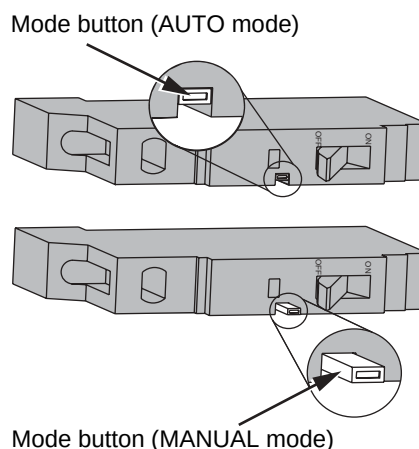
NOTE: The controller learns which circuit breakers are to be added or deleted by monitoring voltage changes at the circuit breaker load terminal. As such, panelboards must be energized while creating zones.

Follow the steps below to add or delete circuit breakers to or from a zone. The panelboard cover and deadfront should be in place while setting the zones.

NOTE: All panelboards that are assigned to a zone must have power.

1. Place the desired circuit breakers into MANUAL mode by releasing the white Mode buttons with a small screwdriver or similar tool (see Figure 8–1).

Figure 8–1: Changing Circuit Breakers From AUTO to MANUAL Mode



2. Press the SETUP key  to place the unit in SETUP mode. The SETUP LED illuminates to indicate SETUP mode is active.

3. Select an input device by pressing the INPUT key  until the input device's numbered LED (1 through 8) is lit. You must press the INPUT key each time to advance to the next input number.
4. To add or delete circuit breakers for this input, do the following:
 - a. To add circuit breakers to a zone, press the ADD/DELETE key  until the ADD LED is on. To delete circuit breakers from a zone, press the ADD/DELETE key until the DELETE LED is on.
 - b. Turn the desired circuit breaker handle(s) OFF and ON again. The ADD or DELETE LED will blink indicating that a circuit breaker has either been added to or deleted from the zone.
 - c. Place the circuit breakers back in AUTO mode by returning the white Mode buttons to the depressed position.
5. To clear all circuit breakers set for this input, press and hold the ADD/DELETE key  for three seconds.
6. Repeat the above steps for the next input, or press the SETUP key  to return to RUN mode.

TESTING CIRCUIT BREAKERS

Follow these steps to test the circuit breaker configuration of an input:

1. Verify that all circuit breakers you want to test are in AUTO mode. If they are not, return the white Mode buttons to the depressed position using a small screwdriver or similar tool according to Figure 8–1 on page 39.
2. If you are not already in SETUP mode, press the SETUP key .
3. Press the INPUT key  (repeatedly) to advance to the input number that corresponds to the input you want to test.
4. Press the TEST key  to toggle all circuit breakers mapped to the input between ON and OFF.
5. Press the SETUP key  to return to RUN mode.

CHANGING INPUT TYPES

By default, the NF500G3 controller has all inputs set for Maintained N.O. operation. All inputs can be changed to Maintained N.C. operation from the front panel of the controller. The type selection depends on whether the input devices connected are normally open or normally closed. Refer to **Chapter 5—Input Wiring** for more information.

To change the input type for all inputs, follow the steps below. If you want to configure individual inputs, you must use POWERLINK Controller Software (PCS).

NOTE: The default input type is Maintained N.O.

1. Press the SETUP key  to place the unit in SETUP mode.
2. Press and hold the INPUT key  for three seconds to change to the next input type.

The change from Maintained N.O. to Maintained N.C. is signified by an LED cycle through all eight inputs from left to right. The change from Maintained N.C. to Maintained N.O. is signified by an LED cycle through all eight inputs from right to left.

3. Press the SETUP key  to return to RUN mode.

CHAPTER 9—COMMUNICATIONS

INTRODUCTION

The NF500G3 controller accommodates both RS-232 and RS-485 wiring for connecting to a personal computer or other similar devices that are used to configure, monitor, or control the POWERLINK G3 system. To communicate with a controller, communication settings must be defined. This includes setting a controller's address and communication parameters.

SETTING COMMUNICATIONS

The SETUP key is used to place the controller in COMMUNICATIONS SETUP mode. The SETUP LED blinks to indicate the unit is in COMMUNICATIONS SETUP mode. Pressing the SETUP key again returns the unit to RUN mode. An internal timer is started upon entering COMMUNICATIONS SETUP mode, which returns to RUN mode if no keys are pressed for 60 seconds. Changes to communications parameters, whether automatic or intentional, are saved upon exiting the communications setup mode.

The eight LEDs are used as a communications value display for either the ADDRESS or the COMMS PARAMETERS modes. The INPUT key toggles between these two displays. To change the address or the communications parameter values, see the associated section below.

The controller's address is used by the automation network to distinguish an individual controller from other controllers on the network. A controller can have an address from 1 to 247. LEDs 1 through 8 will illuminate in various patterns based on the 8-bit binary number equivalent of the address selected. Wherever a bit equals 1, an LED illuminates. For example, address 1 is 00000001 in binary. The LED light pattern would be all LEDs OFF except for the last LED. Refer to Figure 9–1 on page 42 for a complete list of controller addresses and LED patterns.

NOTE: The ADDRESS mode is the default mode when setup is started. While in the COMMS PARAMETER mode, LEDs 2 and 5 continuously blink.

Setting the Address

To set the controller address, follow these steps:

1. Press and hold the SETUP key  for 3 seconds to place the unit in COMMUNICATIONS SETUP mode.

The SETUP LED will blink to indicate the unit is in COMMUNICATIONS SETUP mode. The address is displayed on LEDs 1–8.

2. Use the ADD/DELETE key  to set whether the TEST key increases or decreases the displayed value.

The default is the ADD mode when entering the ADDRESS mode.

3. Use the TEST key  to change the address value on the display. Refer to Figure 9–1 on page 42 for the address number and corresponding LED pattern.

NOTE: The value increases or decreases by one count each time you press the key (see Step 3). If you have the last address pattern displayed and the TEST key is set to increase by one, the next address pattern displayed is for address 1.

NOTE: The range of values is limited to 1–247. Do not use address 58 if the communications mode is set to RTU/ASCII. For more information, see "Communication Parameters" on page 43.

4. Press the SETUP key  to return to RUN mode.

- Unlit LED
- Lit LED

Address	LED Pattern	Address	LED Pattern	Address	LED Pattern	Address	LED Pattern	Address	LED Pattern
1		51		100		150		200	
2		52		101		151		201	
3		53		102		152		202	
4		54		103		153		203	
5		55		104		154		204	
6		56		105		155		205	
7		57		106		156		206	
8		58		107		157		207	
9		59		108		158		208	
10		60		109		159		209	
11		61		100		160		210	
12		62		111		161		211	
13		63		112		162		212	
14		64		113		163		213	
15		65		114		164		214	
16		66		115		165		215	
17		67		116		166		216	
18		68		117		167		217	
19		69		118		168		218	
20		70		119		169		219	
21		71		120		170		220	
22		72		121		171		221	
23		73		122		172		222	
24		74		123		173		223	
25		75		124		174		224	
26		76		125		175		225	
27		77		126		176		226	
28		78		127		177		227	
29		79		128		178		228	
30		80		129		179		229	
31		81		130		180		230	
32		82		131		181		231	
33		83		132		182		232	
34		84		133		183		233	
35		85		134		184		234	
36		86		135		185		235	
37		87		136		186		236	
38		88		137		187		237	
39		89		138		188		238	
40		90		139		189		239	
41		91		140		190		240	
42		92		141		191		241	
43		93		142		192		242	
44		94		143		193		243	
45		95		144		194		244	
46		96		145		195		245	
47		97		146		196		246	
48		98		147		197		247	
49		99		148		198			
50				149		199			

COMMUNICATION PARAMETERS

After an address is selected, the communication parameters must be set. The parameters include baud rate, parity, and mode. There are 35 different parameter combinations, but they do not follow the same 8-bit binary pattern that the address settings use. Table 9–1 on page 44 lists the different LED patterns and pattern numbers based on the desired parameter settings. Using the two tables together, you can determine the LED pattern for the parameters you want to set. LEDs 2 and 5 are not used for any of the parameter settings, but they will blink to indicate that you are in COMMS PARAMETER mode.

The first parameter is baud rate. Baud rate is the number of bits of information transferred per second. The baud rate you choose is dependent on your network. The next parameter, parity, is set to EVEN, ODD, or NONE. This communication parameter sets an extra bit to allow for communication error detection. The extra bit is added so that all of the bytes sent have either an odd or even number of set bits, meaning a byte will have an odd or even amount of 1s. For example, if parity is ODD and the number of set bits is odd, the parity bit is set to 0. If the number of set bits is even, the parity bit is set to 1. However, parity set to NONE does not include the parity bit. The last parameter, mode, can be ASCII or RTU/ASCII. If a controller is set to ASCII mode, the controller can only communicate with the master controller if the master is set to ASCII mode. RTU/ASCII mode is more flexible because it is able to determine the mode used by the master and use either RTU or ASCII mode.

If only one controller is connected to the system and is used with PCS software, the factory defaults stored in the controller do not need to be modified. Simply connect the controller to your computer, and you are ready to communicate.

NOTE: The controller's default address is 1, and the default communication parameter is set to 19.2 KB, No Parity, RTU/ASCII mode.

Setting the Baud Rate, Parity, and Mode

To set the controller communication parameters, follow these steps:

1. If you are not in SETUP mode, press the SETUP key  and hold for 3 seconds.
2. Press the INPUT key  to select the COMMS PARAMETERS mode.

NOTE: The LEDs in input positions 2 and 5 blink when in this mode. The COMMS PARAMETERS are displayed in Table 9–1.

3. Press the ADD/DELETE key  to set whether the TEST key increases or decreases the displayed value (the default is the ADD mode when entering the communications setup mode).
4. Press the TEST key  to change the COMMS PARAMETERS value on the display. Refer to Table 9–1 for the values and patterns for the selected parameters.

NOTE: The value either increases or decreases each time the key is pressed (see Step 3). The increase or decrease is circular, such that the next increment after the last pattern is the first pattern. Pattern 4 is the default pattern.

NOTE: Parity must be set to NONE and mode must be set to RTU/ASCII in order to use PCS software.

5. If you are satisfied with the communication settings, press the SETUP key  to return to RUN mode

Table 9-1: COMMS PARAMETER List

LED Pattern	Pattern #	Mode	Parity	Baud Rate
○*○○*○○○	0	RTU/ASCII	NONE	1200
○*○○*○○●	1	RTU/ASCII	NONE	2400
○*○○*○○●○	2	RTU/ASCII	NONE	4800
○*○○*○○●●	3	RTU/ASCII	NONE	9600
○*○○*●○○○	4 (Default)	RTU/ASCII	NONE	19.2K
○*○○*●○○●	5	RTU/ASCII	NONE	38.4K
○*○○●○○○○	6	RTU/ASCII	EVEN	1200
○*○○●○○○○●	7	RTU/ASCII	EVEN	2400
○*○○●○○○○●○	8	RTU/ASCII	EVEN	4800
○*○○●○○○○●●	9	RTU/ASCII	EVEN	9600
○*○○●●○○○	10	RTU/ASCII	EVEN	19.2K
○*○○●●○○●	11	RTU/ASCII	EVEN	38.4K
○*●○○○○○○○	12	RTU/ASCII	ODD	1200
○*●○○○○○○●	13	RTU/ASCII	ODD	2400
○*●○○○○○○●○	14	RTU/ASCII	ODD	4800
○*●○○○○○○●●	15	RTU/ASCII	ODD	9600
○*●○○●○○○	16	RTU/ASCII	ODD	19.2K
○*●○○●○○●	17	RTU/ASCII	ODD	38.4K
●*○○○○○○○	18	ASCII ONLY	NONE	1200
●*○○○○○○●	19	ASCII ONLY	NONE	2400
●*○○○○○○●○	20	ASCII ONLY	NONE	4800
●*○○○○○○●●	21	ASCII ONLY	NONE	9600
●*○○○○●○○	22	ASCII ONLY	NONE	19.2K
●*○○○○●○○●	23	ASCII ONLY	NONE	38.4K
●*○○●○○○○	24	ASCII ONLY	EVEN	1200
●*○○●○○○○●	25	ASCII ONLY	EVEN	2400
●*○○●○○○○●○	26	ASCII ONLY	EVEN	4800
●*○○●○○○○●●	27	ASCII ONLY	EVEN	9600
●*○○●●○○○	28	ASCII ONLY	EVEN	19.2K
●*○○●●○○●	29	ASCII ONLY	EVEN	38.4K
●*●○○○○○○	30	ASCII ONLY	ODD	1200
●*●○○○○○○●	31	ASCII ONLY	ODD	2400
●*●○○○○○○●○	32	ASCII ONLY	ODD	4800
●*●○○○○○○●●	33	ASCII ONLY	ODD	9600
●*●○○●○○○	34	ASCII ONLY	ODD	19.2K
●*●○○●○○●	35	ASCII ONLY	ODD	38.4K

○ Unlit LED
● Lit LED
* Blinking LED

APPENDIX A — TROUBLESHOOTING

TROUBLESHOOTING THE CONTROLLER

Use the following table if you need to troubleshoot the NF500G3 controller:

⚠ DANGER
HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH • This equipment must be installed and serviced only by qualified electrical personnel. • Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E. • Carefully inspect the work area for tools and objects that may have been left inside the equipment. • Use caution while removing or installing panels so that they do not extend into the energized bus; avoid handling the panels, which could cause personal injury. Failure to follow this instruction will result in death or serious injury.

Table A–1: NF500G3 Controller Troubleshooting

CONDITION	POSSIBLE CAUSES	SOLUTION
Controller LEDs and status indicators do not illuminate.	Power supply is not energized.	Verify that the power supply's LED status indicators are ON. The indicator marked CL2 must be ON for the controller to operate. If it is not ON and your power supply obtains its power from the panelboard bus, verify that the main power to the panelboard is properly connected and turned ON. Also verify that the power supply line terminal is secured. If your power supply is connected to an external power source, such as a UPS, verify that the power supply is properly connected to the external power source and that this source is turned ON. Refer to the Power Supply instruction bulletin for installation and safety information.
	Controller is not receiving power from the power supply.	The POWERLINK G3 power supply may not be the proper model for your system's voltage. Verify that the proper power supply is installed. Refer to the Power Supply Instruction Bulletin for more information.
	Power supply is not operating.	The power supply must be plugged into the controller. Verify that the power supply connector is seated properly in the controller's mating connector. Refer to Chapter 4—Installation for more information.
Controller serial port is not communicating.	Baud rate, address, or other communications parameters are not set up properly.	Verify that all controller communications setup information matches your software settings. Refer to Chapter 9—Communications for more information on how to review and set these parameters from the controller front panel.
	Communications wiring errors.	Verify that your network or serial communications connections are wired properly and the proper signal polarity is observed. Ensure that the TX and RX wires are not reversed. Refer to Chapter 6—Communications Wiring for more information.
Controller will not enter Setup mode.	Controller keys are locked.	Connect to the controller using POWERLINK Controller Software (PCS). Clear the Front Panel Disable setting found on the PCS Setup screen, and send the updated configuration to the controller. This re-enables local front panel access.
Pilot light on switch connected to input does not illuminate.	Wiring error.	Verify wiring of inputs with respect to the external switching device and its pilot light. An LED pilot light must be wired observing the proper polarity. Refer to Chapter 5—Input Wiring for more information.
	Excessive current draw.	The total draw of all devices connected to all status feedback terminals must not exceed 60 mA. The status feedback power source is internally protected and will shut down if this limit is exceeded. A status indicator LED for this source is located in the upper-left corner of the wiring terminal compartment. Refer to Chapter 5—Input Wiring for more information.

Table A–1: NF500G3 Controller Troubleshooting

CONDITION	POSSIBLE CAUSES	SOLUTION
Circuit breaker does not respond to input change or does not respond as desired.	Controller or power supply is not powered or operating properly.	Verify that both the controller and power supply are energized by observing that all power LEDs are illuminated. Verify that the controller is operating by observing that the CPU LED is blinking.
	Controller is in Setup mode.	The controller will not respond to inputs while in setup mode. Return controller to run mode by pressing the Setup key.
	Circuit breaker handle is OFF.	Turn circuit breaker handle to ON.
	Circuit breaker is tripped.	Reset the circuit breaker by turning it OFF and then back ON.
	Circuit breaker Manual mode is engaged.	Restore the circuit breaker to Auto mode by engaging the white button located on the face of the circuit breaker.
	Input is not connected or wired properly.	Verify that the input wiring is properly connected. Wiring specifics depend on the type of external switching device being used. Refer to Chapter 5—Input Wiring for more information.
	Input is inhibited.	Connect to the controller using PCS. From the Status/Inputs & Override Control screen, open the Input Control dialog box by clicking the ">" for the desired input. Clear the Input Inhibit box and send the update to the controller. This re-enables the input.
	Input is not configured properly.	Verify that the input commands the correct zone by manually operating the external switching device and observing whether the corresponding input status LED illuminates when the input is ON. An input's proper response may require it to be re-configured for your switching device. Refer to Chapter 5—Input Wiring and Chapter 8—Control Setup for more information. Some input types require PCS for configuration.
	Circuit breaker is not included in zone, or an incorrect circuit breaker is included in zone.	To test all circuit breakers assigned to a zone, first verify that all circuit breakers are in Auto mode. Next, press the controller Setup key to enter Setup mode. Select the input corresponding to the zone to be tested. Press the Test key to toggle all circuit breakers assigned to that zone. If the circuit breakers are not responding as desired, refer to Chapter 8—Control Setup for more information on how to add or delete a circuit breaker in a zone.
	Circuit breaker is included in more than one zone.	Circuit breakers assigned to more than one zone remain on until all zones commanding the circuit breakers are off. In many cases, this is desired operation. If not desired, review the circuit breaker assignment of all zones, and delete circuit breakers from any incorrect zone. Refer to Chapter 8—Control Setup for more information.
	Circuit breaker is overridden from communications.	A zone is overridden from communications if the corresponding input status LED on the front panel is blinking. To clear the override, connect to the controller using PCS software. From the Status/Inputs & Override Control screen, open the Override Control dialog box by clicking the ">" for the desired zone. Clear the Override Enable box, and send the update to the controller.
	Sub-net wiring error.	Circuit breakers in slave panels must have properly wired sub-net communications and power. Refer to Chapter 6—Communications Wiring , as well as instruction bulletins for the control bus, power supply, and slave address selector, for more information.
	Sub-net addressing error.	Each slave panel must have a unique address. Verify that no two slave address selectors have the same address setting and that no slave address selector is set to zero, unless the power supply and controller are remotely mounted with no control bus attached. Refer to the Slave Address Selector instruction bulletin for more information.
	Circuit breaker is overridden by comms loss action	Loss of communications can automatically trigger a zone override. Comms loss action should be disabled using PCS unless this type of action is desired.

TESTING CONTROL BUS CONNECTIONS

The input LEDs (LEDs 1–8) of the NF500G3 controller provide a diagnostic display to indicate which subnet control buses are connected and communicating. When you perform this procedure, all of the input LEDs blink before displaying the active control buses for the first four panelboards of a subnetwork (see Figure A–1). The LEDs will blink again and then display the active control buses for the last four panelboards in the subnetwork.

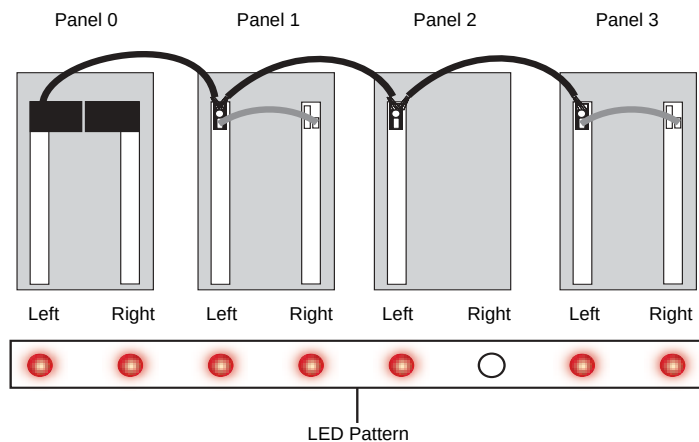
NOTE: A panelboard can have one or two control buses, and the subnetwork to which the panelboard belongs can only contain a total of eight control buses.

Follow the steps below to test the control buses on a subnetwork:

1. In RUN mode, press and hold the ADD/DELETE key  for 3 seconds. All eight input LEDs will blink indicating that the controller is attempting to communicate with all of the control buses on the subnetwork.
2. The individual LEDs will light if a control bus is active in the first four panelboards. Refer to Figure A-1.
3. All eight input LEDs will blink again before displaying the active control buses for the next four panelboards.

Each panelboard can potentially have two control buses, one on the left and one on the right. If a control bus is present and communicating, its associated LED will light. If a control bus is not installed or is not communicating, the associated LED will not light.

Figure A-1: LED Patterns For Control Buses In A Subnetwork



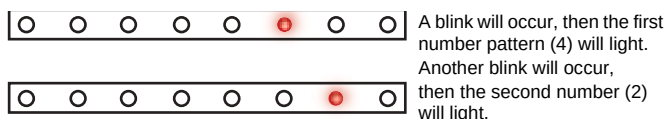
DISPLAYING THE FIRMWARE VERSION

The operation of the controller is determined by its internal programming. This programming is contained in a firmware file that is downloaded at the factory and can be reloaded or upgraded using a special software utility.

Follow the steps below to determine the firmware version of the controller:

1. In RUN mode, press and hold the INPUT key  for 3 seconds.
All eight input LEDs blink to indicate that the controller is preparing to display the firmware version.
2. Observe the LED pattern displayed. The LED pattern is the firmware version in binary. Use Figure 9–1 on page 42 to convert the binary pattern into a decimal number. The version number is viewable for 3 seconds.

Figure A–2: Example LED Pattern Displaying Firmware Version 4.02



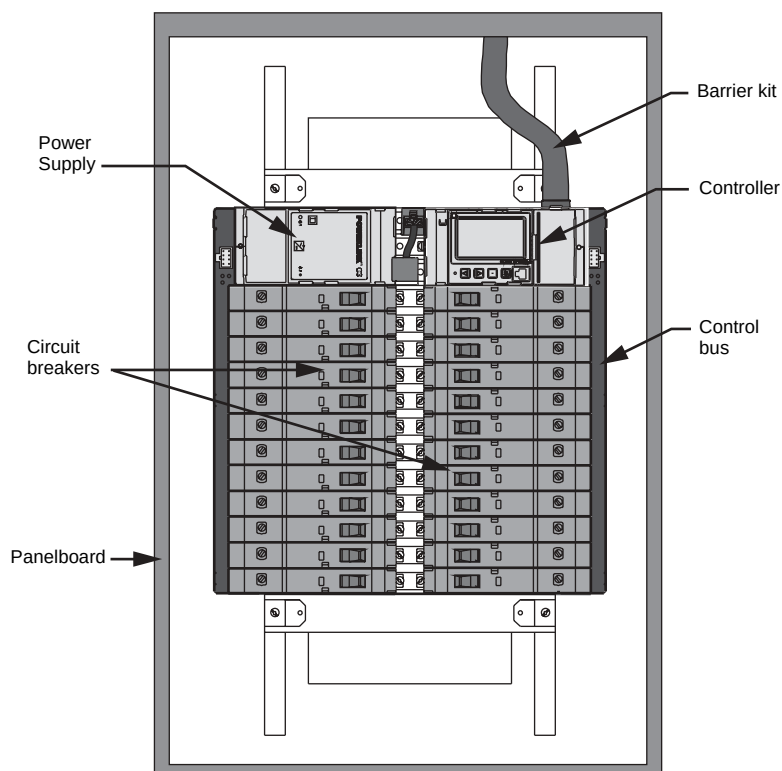
3. After the version number is displayed, all eight input LEDs blink to indicate that the controller is preparing to display the firmware revision number.
4. Observe the LED pattern displayed. The LED pattern is the firmware version number in binary. Use Figure 9–1 on page 42 to convert the binary pattern into a decimal number. The version number is viewable for 3 seconds.

APPENDIX B — SYSTEM COMPONENTS

POWERLINK G3 SYSTEM COMPONENTS

The POWERLINK G3 system consists of control buses, a panelboard, remotely operated circuit breakers, a power supply, and a controller. If external control wiring is needed, a Class 2 barrier kit is required. Figure B–1 identifies main components which are described in this appendix.

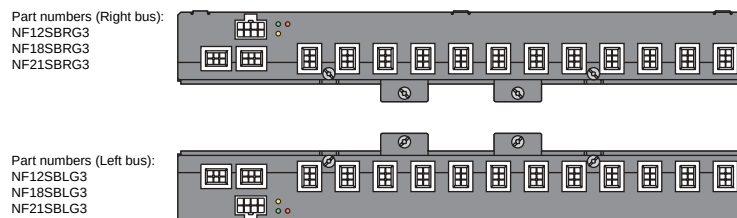
Figure B–1: POWERLINK System Components



Control Bus

The control buses provide control and data monitoring for POWERLINK G3 remotely operated circuit breakers and are connected to the POWERLINK G3 power supply and controller. Installed control buses will not interfere with the installation of standard circuit breakers into the panelboard.

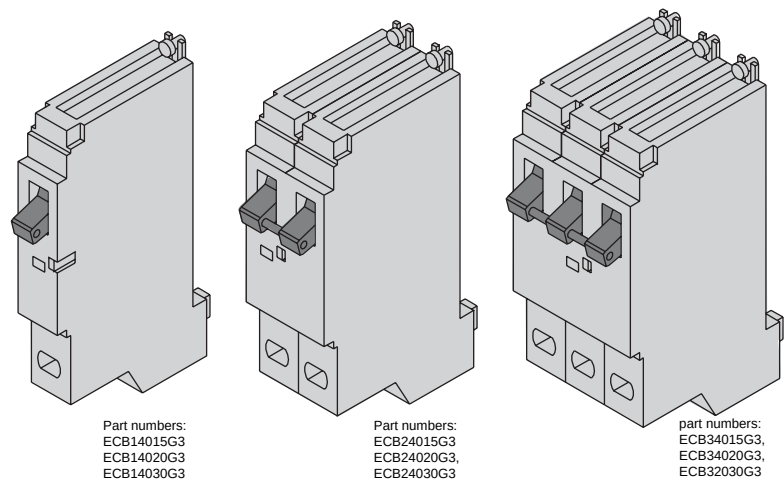
Figure B–2: Control Buses



Remotely Operated Circuit Breakers

POWERLINK G3 Remotely Operated Circuit Breakers provide the same overcurrent protection as standard circuit breakers, and have an integral operator that can remotely switch the circuit breaker ON and OFF. The circuit breaker works with the POWERLINK G3 controller, power supply, and control buses to provide a remote power switching system in a panelboard.

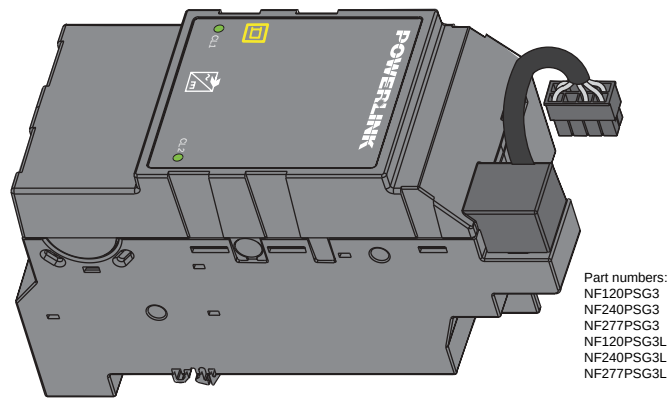
Figure B–3: Remotely Operated Circuit Breakers



Power Supply

The POWERLINK G3 Power Supply provides power to the POWERLINK G3 system.

Figure B–4: Power Supply



Controller

The POWERLINK G3 NF500G3 Controller provides control logic for the operation of a POWERLINK G3 system. The controller uses remotely operated circuit breakers to control up to 168 remotely operated branch circuits. Also, it provides input channels for connecting external dry-contact control devices, a keypad and display for setting up features, and external ports for connecting to a computer directly or through a modem.

Figure B-5: Controller



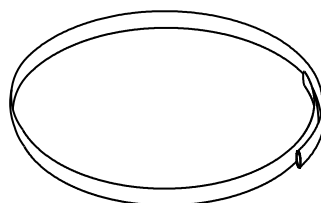
Part number: NF500G3

Barrier Kit

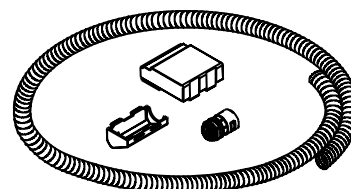
If external control wiring is used, a Class 2 barrier is recommended. Two types of barrier kits (shown below) are available: standard and fixed. The standard barrier kit ships with the controller, while the fixed barrier kit is optional.

The fixed barrier kit provides an expanded wiring compartment and fittings for a wider range of barrier types. A piece of corrugated plastic conduit is included with the kit.

Figure B-6: Class 2 Barrier Kits



Standard barrier kit



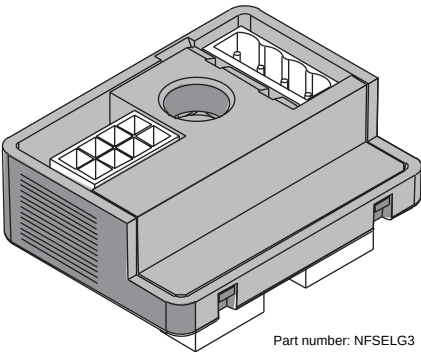
Fixed barrier kit

Part number: NFASBK3

Slave Address Selector

The slave address selector is used to set an address for a slave panelboard in a POWERLINK G3 subnetwork. A slave panelboard can have an address setting from 0–7.

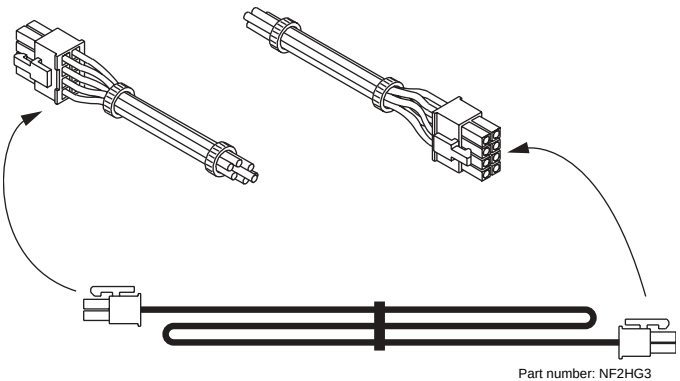
Figure B–7: Slave Address Selector



Slave Bus Connect Harness

The slave bus connect harness (NF2HG3) is used to connect a right control bus to the slave address selector on the left control bus so that the right control bus is able to communicate with the rest of the subnetwork components. The tie wrap on the cable can be removed if the cable is not at the required length.

Figure B–8: Slave Bus Connect Harness



CONTROLLER SPECIFICATIONS

The following sections list the specifications for the controller:

Table B-1 Controller Specifications

Inputs	Eight (8) independently configurable dry-contact inputs
Input Types	• 2-wire maintained N.O. • 2-wire maintained N.C. • 2-wire maintained toggle • 2-wire momentary pushbutton • 2-wire momentary timed ON • 2-wire momentary delayed OFF • 3-wire dual momentary
Input Timer	1 second to 18 hours
Status Output	• 24 Vdc (60mA maximum load for all outputs combined) • available for 2-wire input types only
Auxiliary Power Supply	24 Vdc (100mA maximum current)
Communication Interface	COM 1 (four methods of connection): • RS-485 (2-wire MODBUS ASCII/RTU) inside terminal compartment • RS-232 (MODBUS ASCII/RTU) inside terminal compartment • RS-232 (MODBUS ASCII/RTU) on front panel
Circuit Breaker Blink Notice	• No blink (default) • Single blink (2–30 minutes) • Dual blink (1st blink: 2–30 minutes; 2nd blink: 1 minute) • Delay with no blink (2–30 minutes)* • Pulse duration (1-10 seconds)* • Pulse repeat (1-240 minutes)*
Circuit Breaker Stagger Delay	0.10 second (default) to 1 second
Terminals	• Inputs (removable Phoenix): #24–18AWG • Auxiliary Power (removable Phoenix): #24–18AWG • Network (removable Phoenix): #24–18AWG • Front Panel: RJ-11
Environmental Standards	• Operating Temperature: –5°C to +65°C (internal panelboard temperature) • Storage Temperature: –20°C to 85°C • Operating Humidity: 5% to 95%
Time Clock	Operation during absence of power = 30 days
Memory Retention	Program: > 20 years
Standards	UL Listed 916 Energy Management Equipment
ESD Immunity	IEC 1000, Level 4
RF Susceptibility	IEC 1000, Level 3
Electrical Fast Transient Susceptibility	IEC 1000, Level 3
Electrical Surge Susceptibility – power line	IEC 1000, Level 4
Electrical Surge Susceptibility – data line	IEC 1000, Level 3

FCC—Part 15, Class A

(* Software configurable only)

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