LN Application Specific, Remote I/O, and Free Programmable Controllers

Installation Instructions

LN-RTUL-1, LN-FCUL-1, LN-UVL-1, LN-HPUL-1, LN-IOxxx-1, LN-PRG203-2, LN-PRG300-2, LN-PRG4x0-2, LN-PRG5x0-2

Code No. LIT-12011320
Issued December 2017

Application

Follow these recommendations for proper installation and subsequent operation of each controller:

- Properly inspect the product for shipping damage. Do not install damaged controllers.
- Record the 12-digit Neuron® ID located on either end of the device (shown on the sticker below the barcode) for commissioning.
- Operate the controller under the following conditions:
  - Ambient temperature:

    LN-PRG203-2, LN-PRG300-2, LN-PRG4x0-2, LN-RTUL-1, LN-FCUL-1, LN-UVL-1, LN-HPUL-1: 32 to 158°F (0 to 70°C), LN-IO301-1, LN-IO401-1 and LN-PRG5x0-2: 32 to 122°F (0 to 50°C)

  - Relative humidity: 0 to 90%, noncondensing

IMPORTANT: Prevent any static electric discharge to the controller. Static discharge can damage the controller and void the warranties.

North American Emissions Compliance

United States

Compliance Statement (Part 15.19)
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
This device may not cause harmful interference, and
This device must accept any interference received, including interference that may cause undesired operation.
Warning (Part 15.21)
Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Canada

The term **IC** before the certification/registration number only signifies that the Industry Canada technical specifications were met.
Industry Canada Statement
Le terme «IC» précédant le numéro d'accréditation/inscription signifie simplement que le produit est conforme aux spécifications techniques d'Industry Canada.

Installation

Dimensions

Figure 1: LN-PRG4x0-2, LN-PRG5x0-2, LN-IO401-1, and LN-IO520-1 Dimensions, mm (in.)

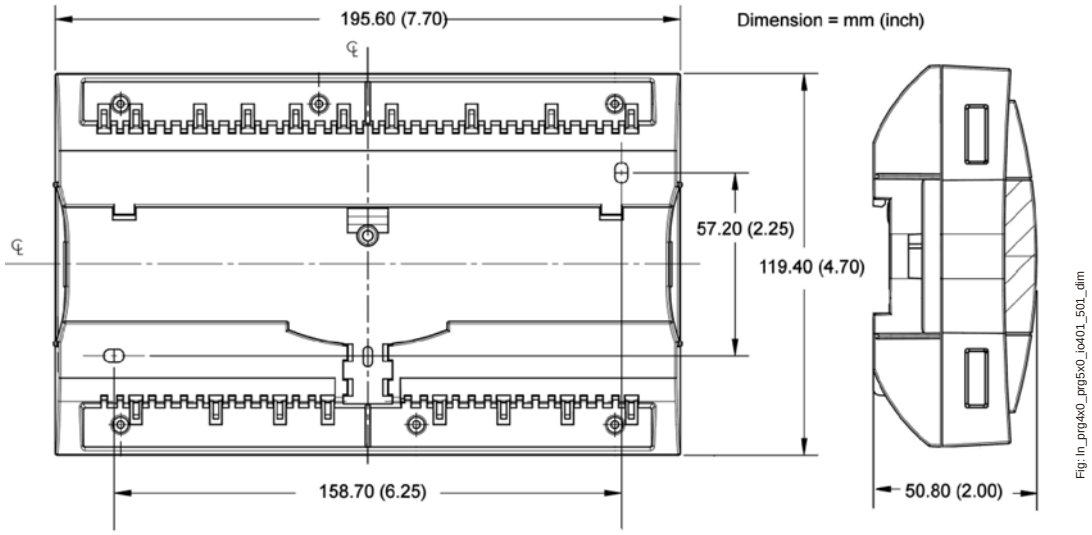
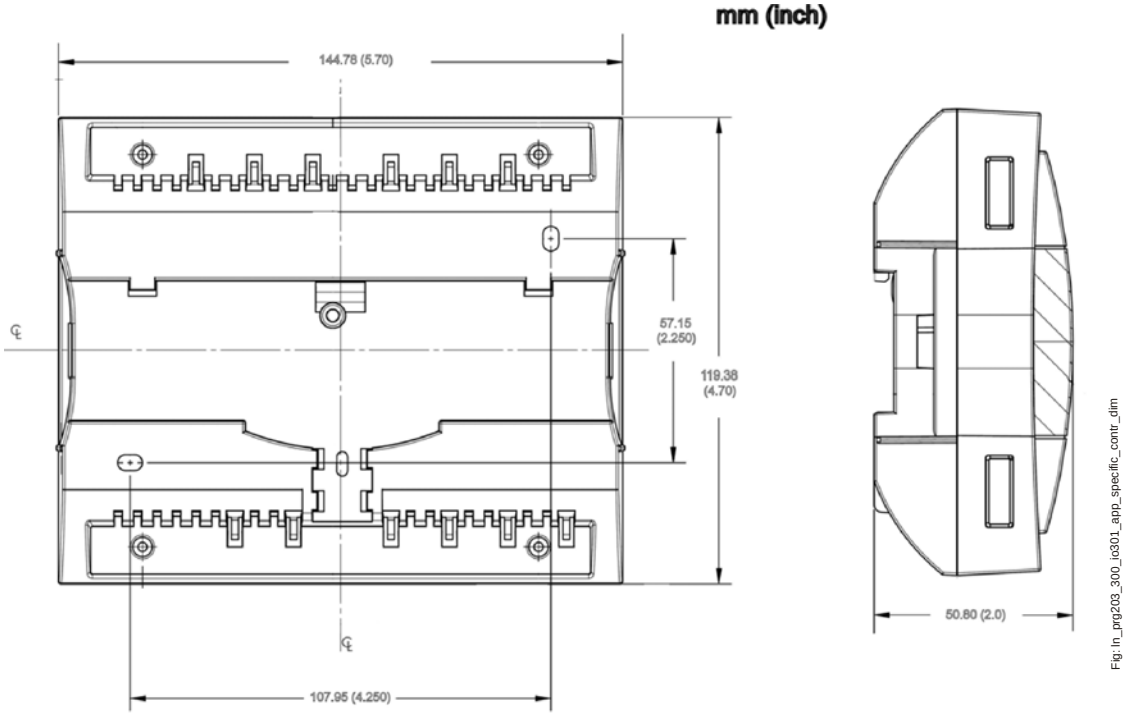


Figure 2: LN-PRG203-2, LN-PRG300-2, LN-IO301-1, and Application Specific Controller Dimensions, mm (in.)



Mounting

You can mount each controller on a DIN rail, on a wall, or in a panel. The controllers are equipped with two mounting holes 0.25 x 0.165 in. (6.36 x 4.191 mm).

Location Considerations

Observe these guidelines when mounting an LN Application Specific or Remote I/O Module:

- Provide for sufficient space around the device for cable and wire connections, access to service pin, hardware configuration, maintenance, easy cover removal, and good ventilation.
- Ensure proper ventilation of each device and avoid areas where corroding, deteriorating, or explosive vapors, fumes, or gases may be present.
- Orient each controller with the ventilation slots and power supply/output terminal block connector towards the top to permit proper heat dissipation.
- Do not mount the controller on surfaces prone to vibration, such as duct work, or in areas where electromagnetic emissions from other devices or wiring can interfere with communication.

DIN Rail

To mount the controller on a DIN rail:

1. Ensure the DIN rail is properly mounted on the wall.
2. Clip the controller onto the DIN rail.

Wall Mount

To mount the device on a wall:

1. Press on the side clips to separate the device’s front and back plates.
2. Use the holes on the back plate to mark the wall location.
3. Drill the holes.
4. Clean the surface and mount the unit using the appropriate screws.

Wiring

⚠ CAUTION

Risk of Electric Shock.
Disconnect the power supply before making electrical connections to avoid electric shock.

⚠ ATTENTION

Risque de décharge électrique.
Débrancher l'alimentation avant de réaliser tout raccordement électrique afin d'éviter tout risque de décharge électrique.

IMPORTANT: All wiring must comply with electrical diagrams as well as national and local electrical codes.

Follow these wiring recommendations:

- Remove the front plate from the back plate to facilitate in the wiring process. Use a small flat screwdriver to tighten the terminal connector screws once you have inserted the wires.
- Keep power cables apart from other types of wiring to avoid ambient noise transmission to other wires (for example, for power, 3-wire voltage, and current inputs and outputs).
- Use wires or flat cables ranging from 22 to 12 AWG (0.645 to 2.052 mm diameter) per pole. Power cables must remain between 18 to 14 AWG (1.024 to 1.628 mm) diameter.
- Keep all wires away from high-speed data transmission cables (for example, Ethernet cable).
- Keep input and output wires in conduits, trays, or close to the building frame whenever possible.

Power Wiring

IMPORTANT: Voltage: 24 VAC/DC; ±15%, Class 2. This is a Class 2 Product. Use a Class 2 transformer only (rated at 100 VA or less at 24 VAC) to power the device.

For more information and requirements for powering a device that uses a LONWORKS network for communications, refer to the *LONWORKS LN-Series Network Communication and Interface Guide Technical Bulletin (LIT-12011253)*.

We recommend wiring only one device per 24 VAC transformer. When only one transformer is available, determine the maximum number of devices that can be supplied using the following method for calculating the required power transformer capacity:

1. Add up the maximum power consumption of all controllers and multiply this sum by 1.3.
2. If the resulting number is higher than 100 VA, consider using multiple transformers.

Use an external fuse on the 24 VAC/DC side (secondary side) of the transformer to protect all units against power link spikes (Figure 3).

Maintain consistent polarity when you connect the controllers (or modules) and devices to the transformer.

IMPORTANT: Failure to maintain consistent polarity throughout the entire network will result in a short circuit and damage to the controller.

IMPORTANT: The COM terminals of the controller are internally wired to the 24 V COM terminal of the power supply. Connecting a peripheral or another controller to the same transformer without maintaining polarity between these devices will cause a short circuit.

Use an external fuse on the 24 VAC/DC side (secondary side) of the transformer to protect all controllers against power link spikes.

Figure 3: Power Wiring – AC

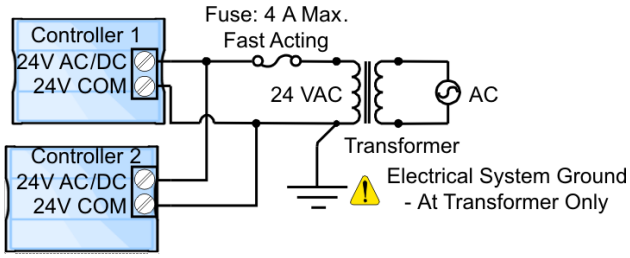
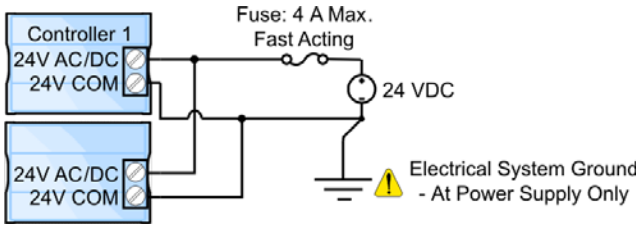


Figure 4: Power Wiring – DC



Input Wiring

The devices have physical connections for inputs (marked UIx), which are software configurable from within the device's LNS® plug-in or wizard. Therefore, hardware configuration is not required.

Each input can be configured for digital, resistive, current, or voltage signals. You must configure the input types properly in the software plug-in or wizard to ensure proper input readings.

IMPORTANT: Before connecting any sensor to the device, refer to the installation guide of the equipment manufacturer.

Note: For a wire of less than 75 feet (23 m), use either a shielded or unshielded 19 AWG wire.

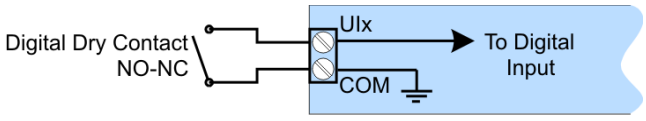
Note: For a wire from 75 feet (23 m) to 200 feet (61 m), we recommend a shielded 18 AWG wire.

Note: The wire should be shielded on the controller or module side, and the shield length should be kept as short as possible.

Wiring Digital Inputs

Use the input configuration in Figure 5 to monitor digital dry contacts.

Figure 5: Digital Input – Digital Dry Contact (N.O. and N.C.)



Wiring Resistive Inputs

Use this input configuration to monitor 100k ohm RTDs, 10k ohm Type 2 and Type 3 thermistors, and potentiometers (Figure 6 and Figure 7).

Figure 6: Resistive Input – RTD/Thermistor

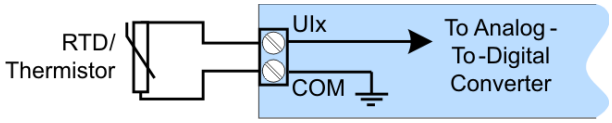
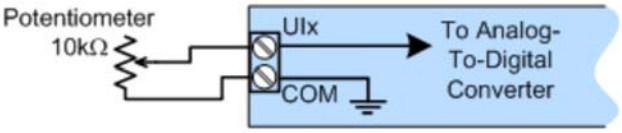


Figure 7: Resistive Input – 10k Ohm



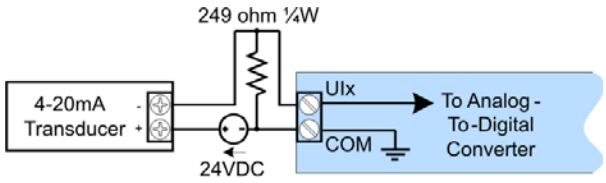
Note: The Application Specific Controllers do not support 100 or 1,000 ohm inputs.

Note: When using a 100 ohm input, the wire length should be kept short to avoid a possible temperature offset; for example, an 18 AWG wire, 25 feet long (7.6 m) can create an offset of 2°F (1.1°C).

Wiring Current Inputs

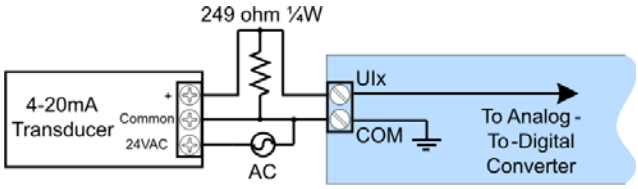
Current inputs have a range of 4 to 20 mA. Connect the current input according to Figure 8 if you are using a 2-wire, 4-20 mA transducer.

Figure 8: Current Input – 2-Wire Transducer



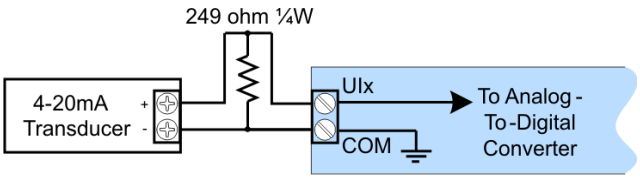
Connect the current input according to Figure 9 if you are using a 3-wire, 4-20 mA transducer.

Figure 9: Current Input – 3-wire Transducer



Connect the current input according to Figure 10 if you are using a transducer powered by its own power.

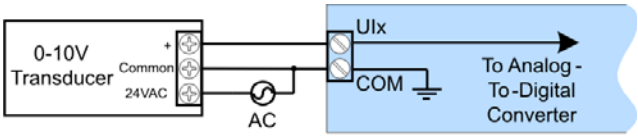
Figure 10: Current Input – Transducer With Its Own Power Source



Wiring Voltage Inputs

Voltage inputs have a range of 0 to 10 VDC. Connect the voltage input according to Figure 11 if you are using a 3-wire 0 to 10 V transducer.

Figure 11: Voltage Input



Output Wiring

Each controller has physical connections for triac outputs and/or universal outputs, depending on the type and model. The outputs are all software configurable. Table 1 shows the controller outputs.

Table 1: Controller Outputs (Part 1 of 2)

Controller	Triac Outputs	Universal Outputs	Jumper 0-10 VDC/4-20 mA
LN-FCUL-1	5	2	
LN-HPUL-1	5	2	
LN-RTUL-1	5	2	
LN-ULVL-1	5	2	

Table 1: Controller Outputs (Part 2 of 2)

Controller	Triac Outputs	Universal Outputs	Jumper 0-10 VDC/4-20 mA
LN-PRG203-2	5	3	
LN-PRG300-2		8	
LN-PRG400-2		12	X
LN-PRG410-2		12	X
LN-IO301-1	8		
LN-IO401-1	12		
LN-IO520-1			

IMPORTANT: Before connecting any sensor to the device, refer to the installation guide of the equipment manufacturer.

Note: For wire length less than 75 feet (23 m), use either a shielded or unshielded 19 AWG wire.

Note: For a wire up to 200 feet (61 m), we recommend a shielded 18 AWG wire.

Note: The wire should be shielded on the controller/module side, and the shield length should be kept as short as possible.

Wiring Triac Outputs

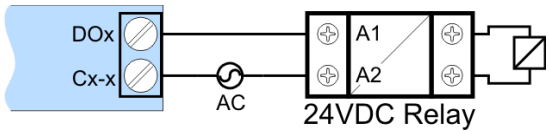
Digital outputs are all made of triacs and voltage is no present on the output terminals; therefore, you need to add an external power source, if necessary.

Note: You must add an external power source, typically 24 VAC.

IMPORTANT: To measure the state of a digital output (triac), an external load must be connected.

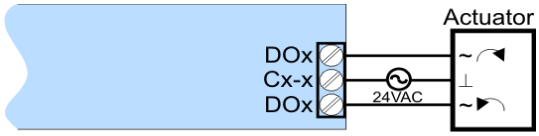
If a 24 VAC relay is being controlled, connect the digital output according to Figure 12.

Figure 12: Digital Triac Output – Relay



If a floating actuator is being controlled, connect the digital output according to Figure 13.

Figure 13: Digital Triac Output – Floating



Wiring Universal Outputs (UOx)

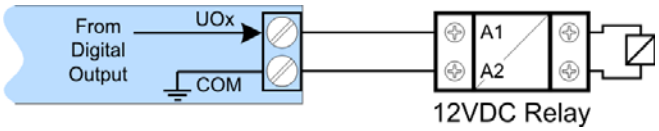
Universal outputs can be configured to provide either a linear signal ranging from 0 to 12 VDC or a linear signal of 0 to 10 VDC. The discrete signal can be used to generate a PWM or a simple two-state signal. These outputs are protected by an auto-reset fuse.

When controlling a relay with a universal output, a diode must be connected in parallel to protect the controller from back-emf current that occurs when the relay is turned off.

Wiring Discrete Outputs

If a 12 VDC relay is being controlled, connect it to a universal output according to Figure 14.

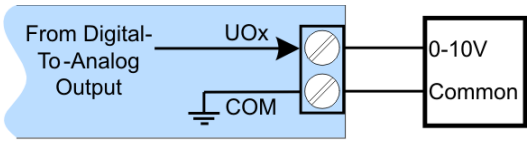
Figure 14: Discrete 0 to 12 VDC



Wiring Voltage Inputs

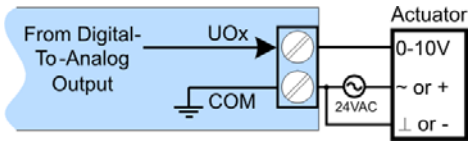
Connect the 0 to 10 VDC output according to Figure 15.

Figure 15: Voltage 0 to 10 VDC Universal Output



If an analog actuator is being controlled, connect the 0 to 10 VDC output, along with an external 24 VAC power source, to the analog actuator according to Figure 16.

Figure 16: Voltage 0 to 10 VDC Universal Output – Analog Actuator



Two network terminators are required for the bus topology network configuration. Place one network terminator at each end of the bus topology channel.

One network terminator is required for the free topology network configuration. You can put the network terminator anywhere on the channel.

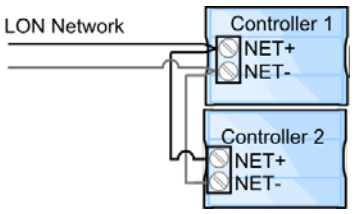
Communications Wiring

The recommended cable type for LONWORKS® communications is 22 AWG (0.65 mm), twisted pair, **UNSHIELDED** wire. The LONWORKS communication wire is polarity insensitive and can be laid out in a bus, star, or free topology. For loop topology, take special care to maintain the polarity when connecting the LONWORKS network to avoid a short circuit.

Note: We recommend you use the bus topology network configuration for all LONWORKS communication wiring. This configuration allows you to troubleshoot the network easily.

Connect both wires to the LON terminals (LON1 and LON2) of the controller (Figure 17). When you insert multiple wires into the terminals, ensure you properly twist the wires together before you insert them into the terminal connectors.

Figure 17: Communications Wiring



For more information and detailed explanations on network topology and wire length restrictions, refer to the *LONWORKS LN-Series Network Communication and Interface Guide Technical Bulletin (LIT-12011253)* or Echelon Corporation's *Junction Box and Wiring Guideline for Twisted Pair LONWORKS® Networks.*

IMPORTANT: Use the proper network terminators for the network topology. Failure to use the correct network terminators may result in communication errors between units. Do not use multiple gauges of cable on the same communication bus.

LN Sensor Wiring

The controllers in this document are compatible with the LN Sensor line of standard room sensors. Refer to the *LN Series Sensor Installation Instructions (LIT-1201871)* for wiring details.

Memory Erase Jumper

Each Application Specific Controller and Remote I/O Module features a memory erase jumper. Use the memory erase jumper to erase the Neuron chip's memory. If an incorrect APB or NXE file is loaded into the device, the Neuron chip's memory is corrupted and you cannot communicate with the device. Use the memory erase jumper to correct this problem by resetting the Neuron chip's memory; the chip is then in an application-less state.

The memory erase jumper is labeled J2 on the Application Specific Controllers (Figure 19), J4 on the LN-IO301-1 Remote I/O Module (Figure 20), and J20 on the LN-IO401-1 and LN-IO520-1 Remote I/O Modules (Figure 18).

To erase the Neuron chip's memory using the memory erase jumper, do the following:

1. Disconnect the power to the device.
2. Place a jumper on the proper pins on the controller or module.
3. Reconnect the power to the device.

Note: The orange colored service LED blinks rapidly indicating that it is erasing the Neuron chip's memory. When the service LED stops blinking and remains solid, the erase procedure is complete.

Note: The erase procedure normally takes between 2 and 10 seconds to complete.

4. Disconnect the power to the device and remove the jumper.
5. Reconnect the power. The service LED blinks twice and becomes solid indicating the controller or module is application-less.
6. Download the correct APB file.

Figure 18: Memory Erase Jumper

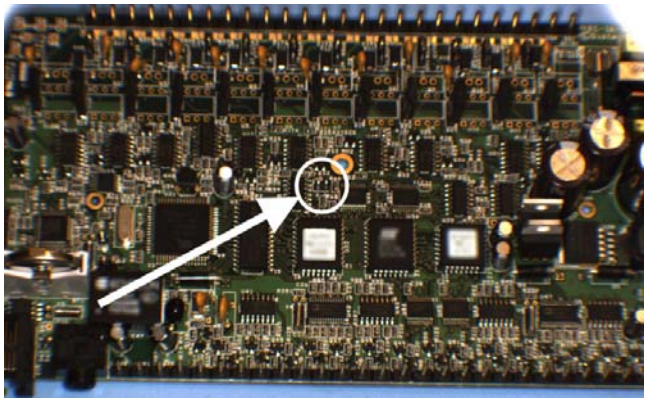


Figure 19: Memory Erase Jumper Location (J2) on Application Specific Controllers

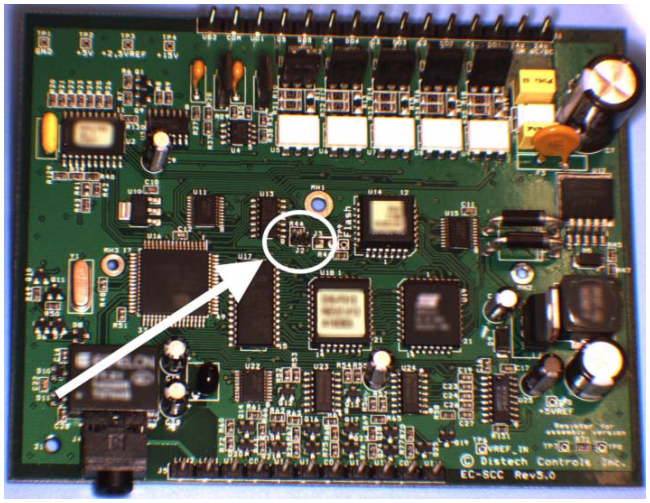
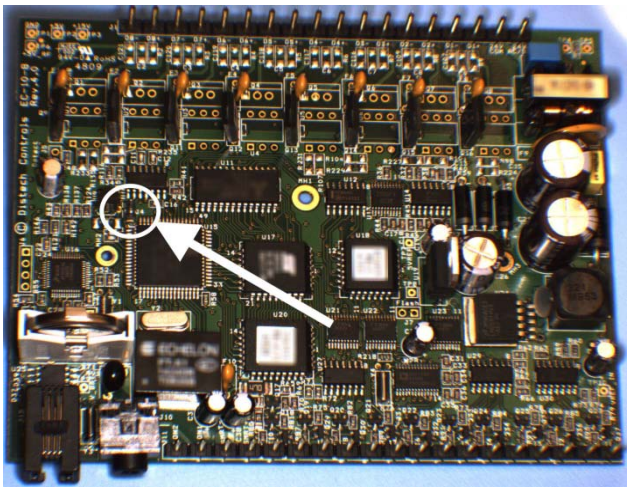


Figure 20: Memory Erase Jumper Location (J4)

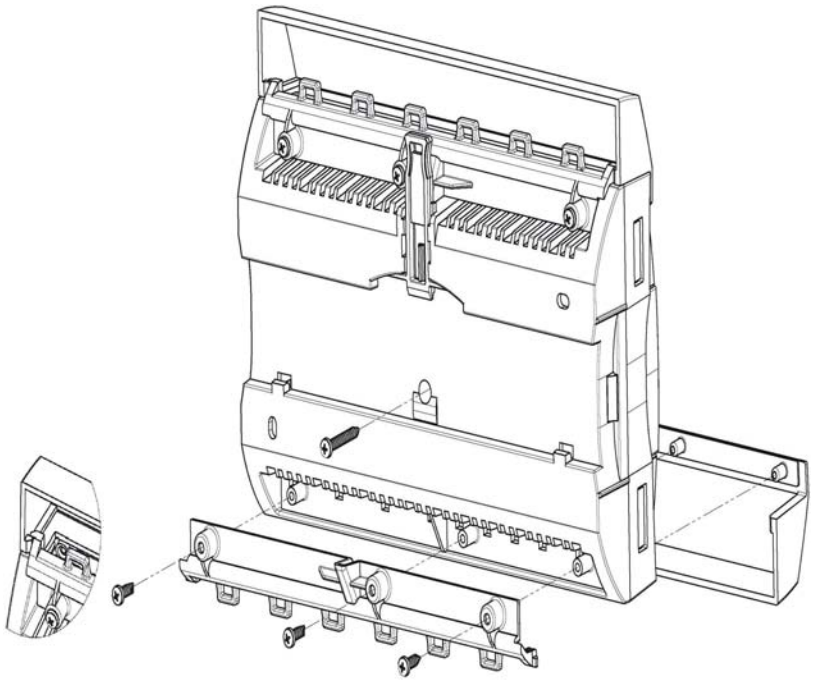


Strain Relief and Terminal Block Cover

In certain jurisdictions, terminal block covers are required to meet local safety regulations. Strain reliefs and terminal block covers are available for controllers housed in the large enclosures and are used to relieve tension on the wiring and conceal the controllers' wire terminals. Strain reliefs and terminal block covers are optional and are sold separately.

Prior to connecting all wires, it is recommended that you install the strain relief. Three screws are provided for its installation under the bottom part of the enclosure. You can then use tie wraps to group wires together and attach them securely to the strain relief in an effort to relieve undue tension. If necessary, clip the terminal block cover to the strain relief as shown in Figure 21.

Figure 21: Large Enclosure Strain Relief and Terminal Block Cover Installation



Maintenance

⚠ CAUTION

Risk of Electric Shock.
Disconnect the power supply before making electrical connections to avoid electric shock.

⚠ ATTENTION

Risque de décharge électrique.
Débrancher l'alimentation avant de réaliser tout raccordement électrique afin d'éviter tout risque de décharge électrique.

Each controller requires minimal maintenance, but it is important to:

- clean the outside of the front plate an/or the inside of the back plate, use a dry cloth.
- verify the tension of all wires and cables each time you service the controller.

Disposal

The Waste Electrical and Electronic Equipment (WEEE) Directive sets regulations for the recycling and disposal of products. The WEEE2002/96/EG Directive applies to stand-alone products that can function on their own and are not a part of another system or piece of equipment.

For this reason, Johnson Controls® products are exempt from the WEEE Directive. Nevertheless, they are marked with the WEEE symbol, indicating the devices are not disposed with municipal waste.

Dispose of products at the end of their useful life according to local regulations and the WEEE Directive.

Troubleshooting

Table 2 describes some troubleshooting scenarios.

Table 2: Troubleshooting (Part 1 of 2)

Problem	Possible Solution
Controller is powered but does not turn on.	
Fuse Is Blown	Disconnect power from the device and check the fuse integrity. Then wait a few seconds to allow the auto-reset fuse to cool down. Reconnect power.
Power Supply Polarity	Verify that consistent polarity is maintained between all controllers and the transformer. Ensure that the COM terminal of each controller is connected to the same terminal on the secondary side of the transformer. See Figure 3.
Device cannot communicate on a FTT network.	
Absent or Incorrect Supply Voltage	1. Check power supply voltage between 24 VAC/DC ±15% and COM pins, and ensure that it is between acceptable limits. 2. Check for tripped fuse or circuit breaker.
Overloaded Power Transformer	Verify the transformer is powerful enough to supply all devices.
Network Not Wired Properly	Double-check the wire connections are correct.
Absent or Incorrect Network Termination	Check the network terminations.
Service Pin Not Working	Use the memory erase jumper to reset the Neuron chip's memory, then load the proper APB or NXE into the controller using LN-Builder 3.4 or another network management tool.
Device communicates well over a short network but does not communicate on large network.	
Network Length	Check that the total wire length does not exceed the specifications of the *Junction Box and Wiring Guideline for Twisted Pair LONWORKS Networks.*

Table 2: Troubleshooting (Part 2 of 2)

Problem	Possible Solution
Wire Type	Check that the wire type agrees with the specification of the *LN-Series Network Communications and Interface Guide (LIT-1201253)* or *Junction Box and Wiring Guideline for Twisted Pair LONWORKS Networks*.
Network Wiring Problem	Check that the wire connections are correct.
Absent or Incorrect Network Termination	Check the termination(s). Incorrect or broken termination(s) make the communication integrity dependent upon a controller's position on the network.
Extra Capacitance	Ensure no extra capacitance is connected to the network other than the standard FTT circuit, and a maximum of a 3 meter stub (in bus topology).
Number of Devices on Network Segment Exceeded	The number of controllers on a channel should never exceed 64. Use a router or a repeater in accordance with LONWORKS *LN-Series Network Communications and Interface Guide (LIT-1201253)* or *Junction Box and Wiring Guideline for Twisted Pair LONWORKS Networks*.
Network Traffic	Query node statistic to check errors. Use a LONWORKS protocol analyzer to check network traffic.
Hardware input is not reading the correct value.	
Input Wiring Problem	Check that the wiring is correct according to this manual and according to the peripheral device's manufacturer.
Open Circuit or Short Circuit	Using a voltmeter, check the voltage on the input terminal. A short circuit has a 0 V value and an open circuit shows approximately 5 V.
Configuration Problem	Check the configuration of the input using the device configuration plug-in or wizard. Refer to the device's user guide for more information.
Over-Voltage or Over-Current at an Input	An over-voltage or over-current at one input can affect the reading of other inputs. Respect the allowed voltage/current range limits of all inputs. See *Technical Specifications*.
Hardware output is not operating correctly.	
Fuse Has Blown (auto-reset fuse)	Disconnect the power and output terminals. Wait a few seconds to allow the auto-reset fuse to cool down. Check the power supply and the output wiring. Reconnect the power.
Output Wiring Problem	Check that the wiring is correct according to this manual and according to the device's manufacturer.
Configuration Problem	Using the device configuration wizard (LN-GPI), check the configuration of the output. Refer to the device's user guide for more information.
0 to 10 V Output, 24 VAC Powered Actuator Is Not Moving	Check the polarity of the 24 VAC power supply connected to the actuator while connected to the device. Reverse the 24 VAC wire if necessary.

Service LED Operation Guide

Table 3: Service LED Operation Guide – Normal Operation

Operation	Service
Off	The device is in normal operation.
On	The device is application-less. Appropriate action: reload the APB or NXE.
Slow Blink **(1 second On, 1 second Off)**	The device is not configured. Appropriate action: Commission the device.
Fast Blink **(0.3 seconds On, 1 second Off)**	Watchdog timeout. Application corrupted. Appropriate action: Use the memory erase jumper to reset the Neuron chip's memory, then load the proper APB or NxE into the device using LN-Builder or another network management tool.

Repair Information

If the LN Series Application Specific Controller or Remote I/O Module fails to operate within its specifications, replace the unit. For a replacement controller or module, contact the nearest Johnson Controls® representative.

Technical Specifications

Table 4: LN Application Specific Controllers

Product Codes	LN-RTUL-1, LN-FCUL-1, LN-UVL-1, LN-HPUL-1
Power Requirement	**Voltage:** 24 VAC, ±15%, 50/60HZ, Class 2 **Protection:** 1.35 A auto reset fuse **Power Consumption:** 6 VA **Maximum Consumption:** 15 VA
Environmental	**Operating Temperature:** 0 to 70ºC, (32 to 158ºF) **Storage Temperature:** -20 to 70ºC, (-4 to 158ºF) **Relative Humidity:** 0 to 90% noncondensing
General	**Standard:** LN-RTUL-1: Roof Top Unit Controller #8030 LN-FCUL-1: Fan Coil Controller #8020 LN-UVL-1: Unit Ventilator #8080 LN-HPU-1: Heat Pump with Temperature Control #8051 **Processor:** Neuron™ 3150®; 8 bits **Processor Speed:** 10 MHz **Memory:** Nonvolatile Flash 64k (APB application and configuration properties) **Communication:** LonTalk® protocol **Media Channel:** TP/FT-10; 78 Kbps **Transceiver:** FT-X1 **Status Indicator:** Green LED – power status and LON TX, Orange LED – service and LON RX **Communication Jack:** LON audio jack mono 1/8 in (3.5 mm)
Enclosure	**Material:** ABS type PA-765A **Dimensions (with screws):** 5.7 x 4.7 x 2.0 in. (144.8 x 119.4 x 50.8 mm) **Shipping Weight:** 0.77 lbs. (0.35 kg)
Inputs	Quantity: 6 **Input Types:** universal software configurable Voltage: 0 to 10 VDC , Accuracy +0.5% Current: 4 to 20 mA with a 249 ohm external resistor (wired in parallel), Accuracy +0.5% Digital: dry contact **Resistor:** RTD: 1k ohm (nickel and platinum), 100 ohm (platinum) Thermistor: Type 2 and Type 3 10k ohm, accuracy: +0.9°F, +5°C range: -40° to 257°F; resolution: 0.1°C; 0.18°F. **Potentiometer:** translation table configurable on several points; accuracy +0.5% **Input Resolution:** 12-bit analog/digital converter
Outputs	**Quantity:** 7 **5 Digital:** Triac 1.0 A at 24 VAC External power supply **2 Universal: 0 to 10 VDC (linear), digital 0 to 12 VDC (on/off) or PWM** PWM output: adjustable period from 2 second to 15 minutes 60 mA max. at 12 VDC (140°F; 60°C) Maximum load 200 ohms Auto-reset fuse: 60 mA at 140°F; 60°C; 100 mA at 68°F, 20°C **Output Resolution:** 8-bit digital/analog converter

Table 4: LN Application Specific Controllers

Electromagnetic Compatibility	**CE Emission:** (CDN and US) **CE Immunity:** Material EN61000-4-2: 1995, level 2 by contact EN61000-4-3: 1996, level 2 EN61000-4-4: 1995, level 2 EN61000-4-6: 1996, level 2 ENV 5024: 1995, level 2 **FCC:** This device complies with FCC rules part 15, subpart B, class B
Compliance	**United States:** UL916 Energy Management Equipment **Material**[1]**:** UL94-5VA
	Canada: UL916 Energy Management Equipment **Material**[1]**:**UL94-5VA
CE	**Europe:** CE Mark – Johnson Controls, Inc. declares that the products are in compliance with the essential requirements and other relevant provisions of EMC Directive 2004/108/EC.

1. All materials and manufacturing processes comply with the RoHS directive and are marked according to the Waste Electrical and Electronic Equipment (WEEE) directive.

Table 5: LN Remote I/O Modules

Product Codes	LN-IO301-1, LN-IO401-1, LN-IO520-1
Power Requirement	**Voltage:** 24 VAC/DC; ±15%, 50/60 Hz, Class 2 **Protection:** 1.35 A auto-reset fuse **Power Consumption:** 6 VA typical **Maximum Consumption:** 15 VA
Environmental	**Operating Temperature:** 0 to 50°C, (32 to 122°F) **Storage Temperature:** -20 to 70°C, (-4 to 158°F) **Relative Humidity:** 0 to 90% noncondensing
General	**Processor:** Neuron® 3150™; 8 bits **Processor Speed:** 10 MHz **Memory:** 64k Nonvolatile Flash (APB application and configuration properties) **Communication:** LonTalk® protocol **Transceiver:** FT-X1 **Status Indicator:** Green LED - power status and LON TX, Orange LED - service and LON RX **Communication Jack:** LON® mono audio jack 1/8 in. (3.5 mm)
Enclosure	**Material:** ABS PA-765A **Dimensions (with screws):** LN-IO301-1: 5.7 x 4.7 x 2.0 in. (144.8 x 119.4 x 50.8 mm) LN-IO401-1 and LN-IO520-1: 7.7 x 4.7 x 2.0 in. (195.6 x 119.4 x 50.8 mm) **Shipping Weight:** LN-IO301-1:.77 lb (0.35 kg) LN-IO401-1 and LN-IO520-1: .86 lb (0.39kg)

Table 5: LN Remote I/O Modules

Inputs	**Input Types:** universal software configurable Voltage: 0 to 10 VDC , Accuracy ±0.5% Current: 4 to 20 mA with a 249 ohm external resistor (wired in parallel) Digital: dry contact **Resistor:** Thermistor: Type 2 and Type 3 10k ohm, 10k ohm at 25°C; 77°F Range: -40° to 302°F; -40° to 150°C Platinum: Pt1000 (100 ohms at 32°F; 0°C) Range: -40° to 275°F; -40° to 135°C **Potentiometer**: Translation table configurable on several points **Input Resolution:** 16-bit analog/digital converter
Electromagnetic Compatibility	**CE Emission:** EN61000-6-3: 2007; Generic standards for residential, commercial, and light-industrial environments. **CE Immunity:** EN61000-6-1: 2007; Generic standards for residential, commercial, and light-industrial environments. **IC:** This Class (A) digital apparatus meets all requirements of the Canadian Interference Causing Equipment Regulations. **FCC:** This device complies with FCC rules part 15, subpart B, class B
Compliance CE	**United States:** UL 916, Energy Management Equipment **Material:** UL94-5VA
	Canada: UL 916, Energy Management Equipment **Material:** UL94-5VA.
	Europe: CE Mark – Johnson Controls declares that the products are in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC.

Table 6: LN-PRG203-2 Programmable Controller (Part 1 of 2)

Product Code	LN-PRG203-2
Power Requirement	**Voltage:** 24 VAC/DC; ±15%, 50/60 Hz, Class 2 **Protection:** 1.85 A user-replaceable fuse **Power Consumption:** 18 VA with 2 triac outputs ON and 2 outputs with 20 mA load at 12 VDC **Maximum Consumption:** 25 VA
Environmental	**Operating Temperature:** 0 to 70°C, (32 to 158°F) **Storage Temperature:** -20 to 70°C, (-4 to 158°F) **Relative Humidity:** 0 to 90% noncondensing
General	**Processor:** Neuron® 3150™, 8 bits, 10 MHz **Processor Speed:** 10 MHz **Memory:** Nonvolatile Flash 64k (APB application); Nonvolatile Flash 128k (storage) **Media Channel:** TP/FT-10; 78 Kbps **Communication:** LonTalk® protocol **Status Indicator:** Green LED – power status and LON TX, Orange LED – service and LON RX **Communication Jack:** LON® mono audio jack mono 1/8 in (3.5 mm) **LONMARK® Interoperability:** Version 3.4 **Device Class:** Multi I/O Module **LONMARK Functional Profile:** Input Objects: Open-Loop Sensor #1, Output Objects: Open-Loop Sensor #3
Enclosure	**Material:** ABS type PA-765A **Dimensions (with screws):** 5.7 x 4.7 x 2.0 in. (144.8 x 119.4 x 50.8 mm) **Shipping Weight:** 0.97 lb (0.44 kg)

Table 6: LN-PRG203-2 Programmable Controller (Part 2 of 2)

Inputs	Universal software configurable **Input Types:** Digital: Dry Contact Pulse: Dry Contact; 500 milliseconds minimum ON/OF Voltage: 0 to 10 VDC, Current: 4 to 20 mA with 249 ohms external resistor (wired in parallel) **Resistor Support:** Thermistor: Type 2 and Type 3 10k ohms (10k ohms at 25°C [77°F]) Range: -40 to 150°C (-40 to 302°F) Platinum: PT1000: 1k ohm (1k ohms at 0°C [32°F]) Range: -40 to 150°C (-40 to 302°F) PT100: 100 ohms (100 ohms at 0°C [32°F]) Range: -40 to 135°C (-40 to 275°F) Nickel: RTD Ni1000 (1k ohm at 0°C [32°F]) Range: -40 to 150°C (-40 to 302°F) **Potentiometer:** Translation table configurable on several points **Input Resolution:** 16-bit analog/digital converter
Outputs	**Digital:** 24 VAC Triac, digital (on/off), PWM, or floating software configurable 0.5 A continuous 1.0 A at 15% duty cycle for a 10-minute period **PWM control:** adjustable period from 2 seconds to 15 minutes **Floating control:** requires two consecutive output minimum plus on/off: 500 milliseconds adjustable drive time period External or internal power supply (jumper selectable) **Universal:** 0-10 VDC, digital 0-12 VDC (on/off), PWM, or floating **PWM control:** adjustable period from 2 seconds to 15 minutes **Floating control:** requires two consecutive outputs minimum plus on/off: 500 milliseconds adjustable drive time period 60 mA maximum at 12 VDC (60°C [140°F]) minimum resistance 200 ohms Auto reset fuse 60 mA at 60°C (140°F) 100 mA at 20°C (68°F) **Output Resolution:** 10-bit digital/analog converter
Electromagnetic Compatibility	**CE Emission:** EN61000-6-3: 2007 Generic standards for residential, commercial, and light-industrial environments (pending). **CE Immunity:** EN61000-6-1: 2007; Generic standards for residential, commercial, and light-industrial environments (pending). **FCC:** This device complies with FCC rules part 15, subpart B, class B
Compliance	**UL Listed:** UL916 Energy management equipment **Material[1]:** UL94-5VA
	UL Listed: UL916 Energy management equipment **Material[1]:** UL94-5VA

1. All materials and manufacturing processes comply with the RoHS directive and are marked according to the Waste Electrical and Electronic Equipment (WEEE) directive.

Table 7: LN-PRG300-2 Programmable Controller (Part 1 of 2)

Product Code	LN-PRG300-2
Power Requirement	**Voltage:** 24 VAC/DC; ±15%, 50/60 Hz, Class 2 **Protection:** 1.85A auto-reset fuse **Power Consumption:** 18 VA, all outputs with 20 mA load at 12 VDC **Maximum Consumption:** 33 VA
Environmental	**Operating Temperature:** 0 to 70°C, (32 to 158°F) **Storage Temperature:** -20 to 70°C, (-4 to 158°F) **Relative Humidity:** 0 to 90%
General	**Processor:** Neuron 3150, 8 bits, 10 MHz **Memory:** Nonvolatile Flash 64k (APB application), Nonvolatile Flash 128k (storage) **Media Channel**: TP/FT-10; 78 Kbps **Communication:** LonTalk protocol **Clock:** Real-time clock chip, CR2032 lithium battery (for clock) **Status Indicator:** Green LED - power status and LON TX, Orange LED - service and LON RX **Communication Jack:** LON audio jack mono 1/8 in (3.5 mm) **LONMARK Interoperability:** Version 3.4 **Device Class:** Multi I/O Module **LONMARK Functional Profile:** Input Objects: Open-Loop Sensor #1, Output Objects: Open-Loop Sensor #3
Enclosure	**Material:** ABS type PA-765A **Dimensions (with screws):** 5.7 x 4.7 x 2.0 in. (144.8 x 119.4 x 50.8 mm) **Shipping Weight:** 0.97 lb (0.44 kg)
Inputs	Universal software configurable **Input Types:** Digital: Dry Contact Pulse: Dry Contact, 500ms minimum ON/OFF Analog Voltage: 0 to 10 VDC, Analog current: 4 to 20 mA with 249 ohms external resistor (wired in parallel), Resistor Support: **Thermistor:** Type 2, Type 3 10k ohms (10k ohms at 25ºC [77ºF]) Range: -40 to 150ºC, (-40 to 302ºF) Platinum: Pt1000: (1k ohm at 0ºC [32ºF]) Range: -40 to 150ºC (-40 to 302ºF) PT100: 100 ohms (1k ohm at 0ºC [32ºF]) Range: -40 to 135ºC (-40 to 275º) Nickel: Ni1000 (1k ohm at 0ºC [32ºF]) Range: -40 to 150ºC (-40 to 302ºF) **Potentiometer:** Translation table configurable on several points **Input Resolution:** 16-bit analog/digital converter

Table 7: LN-PRG300-2 Programmable Controller (Part 2 of 2)

Outputs[1]	**Quantity:** 8 (software configurable) 0 to 10 VDC, digital 0 to12 VDC (on/off), PWM, or Floating **PWM output:** adjustable period from 2 seconds to 15 minutes **Floating control:** requires two consecutive outputs minimum pulse on/off: 500 millisecond adjustable drive time period 60 mA maximum at 12 VDC (60°C [140°F]) Minimum load: 200 ohms Auto reset fuse 60 mA at 60ºC (140°F) 100 mA at 20ºC (68°F) **Output Resolution:** 10-bit digital/analog converter
Electromagnetic Compatibility	**CE Emission:** EN61000-6-3: 2007 Generic standards for residential, commercial, and light-industrial environments (pending). **CE Immunity:** EN61000-6-1: 2007; Generic standards for residential, commercial, and light-industrial environments (pending).
Compliance	**United States:** UL Listed: UL916 Energy management equipment **Material**[2]**:** UL94-5VA
	Canada: UL Listed: UL916 Energy management equipment **Material**[2]**:** UL94-5VA

1. Floating available when programmed with LN GPI software.
2. All materials and manufacturing processes comply with the RoHS directive and are marked according to the Waste Electrical and Electronic Equipment (WEEE) directive.

Table 8: LN-PRG400-2 and LN-PRG410-2 Programmable Controllers (Part 1 of 2)

Product Codes	LN-PRG400-2 and LN-PRG410-2
Power Requirement	**Voltage:** 24 VAC/DC; ±15%, 50/60 Hz, Class 2 **Protection:** 3.0 A user-replaceable fuse **Typical Consumption:** 25 VA **Maximum Consumption:** 50 VA **Power Supply:** 15 VDC output used to power 4 to 20 mA inputs
Environmental	**Operating Temperature:** 0 to 70°C, (32 to 158°F) **Storage Temperature:** -20 to 70°C, (-4 to 158°F) **Relative Humidity:** 0 to 90%
General	**Standard:** LONMARK Functional Profile: SCC-VAV Controller #8502 **Processor:** Neuron 3150, 8 bits, 10 MHz **Memory:** Nonvolatile Flash 64k (APB application), Nonvolatile Flash 128k (storage) **Media Channel:** TP/FT-10; 78 Kbps **Communication:** LonTalk protocol **Clock:** Real-time clock chip, CR2032 lithium battery (for clock) **Status Indicator:** Green LED - power status and LON TX, Orange LED - service and LON RX **Communication Jack:** LON audio jack mono 1/8 in (3.5 mm) **LONMARK Interoperability:** Version 3.4 **Device Class:** Multi I/O Module **LONMARK Functional Profile:** Input Objects: Open-Loop Sensor #1, Output Objects: Open-Loop Sensor #3
Enclosure	**Material:** ABS type PA-765A **Dimensions (with screws):** 7.7 x 4.7 x 2.0 in. (195.6 x 119.4 x 50.8 mm) **Shipping Weight:** 1.17 lb (0.53 kg)
Inputs	Universal software configurable **Input Types:** Digital: Dry Contact Pulse: Dry Contact (500 milliseconds minimum ON/OFF Analog Voltage: 0 to 10 VDC Analog current: 4 to 20 mA with 249 ohms external resistor (wired in parallel) **Resistor Support:** Thermistor: Type 2, Type 3 10k ohms (10k ohms at 25ºC [77ºF]) Range: -40 to 150ºC (-40 to 302ºF) Platinum: Pt1000: (1k ohm at 0ºC [32ºF]) Range: -40 to 150ºC (-40 to 302ºF) PT100: 100 ohms (1k ohm at 0ºC [32ºF]) Range: -40 to 135ºC (-40 to 275ºF) Nickel: Ni1000 (1k ohm at 0ºC [32ºF]) Range: -40 to 150ºC (-40 to 302ºF) **Potentiometer:** Translation table configurable on several points, **Input Resolution:** 16-bit analog/digital converter

Table 8: LN-PRG400-2 and LN-PRG410-2 Programmable Controllers (Part 2 of 2)

Outputs[1]	Software and jumper configurable 0 to 10 VDC, digital 0 to12 VDC (on/off), PWM, or Floating **PWM output:** adjustable period from 2 seconds to 15 minutes **Floating control:** requires two consecutive output minimum pulse on/off: 500 milliseconds adjustable drive time period 60 mA maximum at 12 VDC (60ºC [140ºF]) Minimum load 200 ohms Auto reset fuse 60 mA at 60ºC (140ºF) 100 mA at 20ºC (68ºF) **Output Resolution:** 10-bit digital/analog converter **Power Supply Output:** 15 VDC, maximum 240 mA
Electromagnetic Compatibility	**CE Emission:** EN61000-6-3: 2007 Generic standards for residential, commercial, and light-industrial environments. **CE Immunity:** EN61000-6-1: 2007; Generic standards for residential, commercial, and light-industrial environments.
Compliance	**United States:** UL Listed: UL916 Energy management equipment **Material**[2]**:** UL94-5VA
	Canada: UL Listed: UL916 Energy management equipment **Material**[2]**:** UL94-5VA

1. Floating available when programmed with LN GPI software.
2. All materials and manufacturing processes comply with the RoHS directive and are marked according to the Waste Electrical and Electronic Equipment (WEEE) directive.

Table 9: LN-PRG500-2 and LN-PRG510-2 Controllers (Part 1 of 2)

Product Codes	LN-PRG500-2 and LN-PRG510-2
Power Requirements	**Voltage:** 24 VAC/DC; +/- 15%, 50/60 Hz, Class 2 **Protection:** 3.0 A user-replaceable fuse **Typical Consumption:** 25 VA all outputs with 20mA load at 12 VDC and 15 VDC output 80mA (4 x 20 mA) **Maximum Consumption:** 50 VA
Environmental	**Operating Temperature:** 0 to 70°C, (32 to 158°F) **Storage Temperature:** -20 to 70°C, (-4 to 158°F) **Relative Humidity:** 0 to 90%
General	**Standard:** LONMARK Functional Profile: SCC-VAV Controller #8502 **Processor:** Neuron 3150, 8 bits, 10 MHz **Memory:** Nonvolatile Flash 64k (APB application), Nonvolatile Flash 64k (storage) **Media Channel:** TP/FT-10; 78 Kbps **Communication:** LonTalk protocol **Transceiver:** FTX-1 **LONMARK Interoperability:** Version 3.4 **Device Class:** Multi I/O Module **LONMARK Functional Profile:** Input Objects: Open-Loop Sensor #1, Output Objects: Open-Loop Sensor #3
Enclosure	**Material:** ABS type PA-765A **Dimensions (with screws):** 7.7 x 4.7 x 2.0 in. (195.6 x 119.4 x 50.8 mm) **Shipping Weight:** 1.17 lb (0.53 kg))

Table 9: LN-PRG500-2 and LN-PRG510-2 Controllers (Part 2 of 2)

Inputs	Universal software configurable **Input Types:** Digital: Dry Contact Pulse: Dry Contact Analog Voltage: 0 to 10 VDC, Accuracy: ±0.5%, Analog current: 4 to 20 mA with 249 ohms external resistor (wired in parallel) **Resistor Support:** Thermistor: Type 2, Type 3 10k ohms (10k ohms at 25ºC [77ºF]) Range: -40 to 150ºC (-40 to 302ºF) Platinum: Pt1000: (1k ohm at 0ºC [32ºF]) Range: -40 to 150ºC (-40 to 302ºF) PT100: 100 ohms (1k ohm at 0ºC [32ºF]) Range: -40 to 135ºC (-40 to 275ºF) Nickel: Ni1000 (1k ohm at 0ºC [32ºF]) Range: -40 to 150ºC (-40 to 302ºF) **Potentiometer:** Translation table configurable on several points **Input Resolution:** 16-bit analog/digital converter
Outputs	Universal 0 to10 VDC, digital 0 to12 VDC (on/off), 0-20 mA, PWM, or floating[1] **PWM output:** adjustable period from 2 seconds to 15 minutes **Floating control:** requires two consecutive output minimum pulse on/off: 500 milliseconds adjustable drive time period 60 mA maximum at 12 VDC (60ºC; 140ºF) Minimum load 200 ohms Auto reset fuse 60 mA at 60°C (140°F) 100 mA at 20°C (68°F) **Output Resolution:** 10-bit digital/analog converter **Power Supply Output:** 15 VDC, maximum 240 mA
Electromagnetic Compatibility	**CE Emission:** EN61000-6-3: 2007; Generic standards for residential, commercial, and light-industrial environments. **CE Immunity:** EN61000-6-1: 2007; Generic standards for residential, commercial, and light-industrial environments.
Compliance	**United States:** UL Listed: UL916 Energy management equipment **Material:** UL94-5VA
	Canada: UL Listed: UL916 Energy management equipment **Material:** UL94-5VA

1. Available when programmed with LN GPI software.

The performance specifications are nominal and conform to acceptable industry standard. For application at conditions beyond these specifications, consult the local Johnson Controls® office. Johnson Controls shall not be liable for damages resulting from misapplication or misuse of its products.

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