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# Hardware Installation Guide

## Fully Programmable Controllers VS-PRG-1600 VS-PRG-2400

### 1. Product Description

Voyant Solutions' Fully Programmable series of controllers is designed to control and monitor various HVAC equipment, such as chillers, air handling units, and boilers. Moreover, it is suitable for any lighting control and power measurement applications.

These controllers are based on the LONWORKS® technology for peer-to-peer communication between controllers and are LONMARK®-certified, according to the Interoperability Guidelines, Version 3.3.

This document describes the hardware installation procedures for the following controllers: VS-PRG-1600, and the VS-PRG-2400.

**Note:** These devices are all built on a similar platform, but have different numbers of inputs and outputs. Typically they are provided with universal inputs and outputs, but can be ordered with a specific number of digital and analog outputs. For more information on the specific layout and functionality of each controller, please refer to their individual data sheets and user guides.

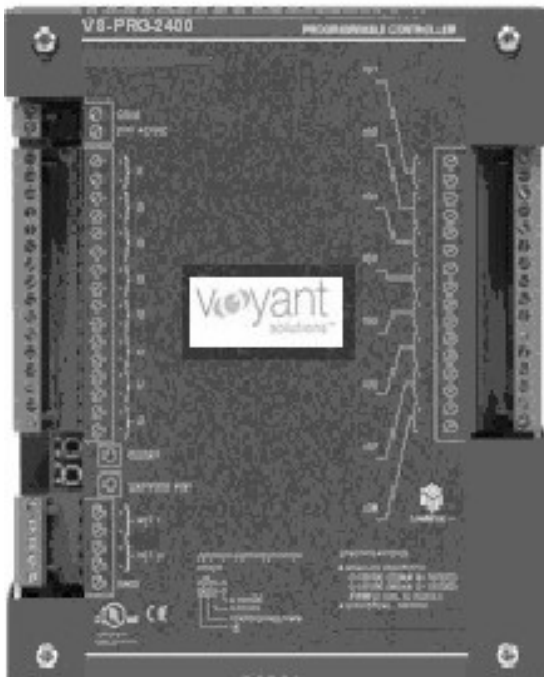


Figure 1-1: VS-PRG-2400, Free Programmable Controller

### 2. General Installation Requirements

For proper installation and subsequent operation of the Free Programmable line of controllers, pay special attention to the following recommendations:

- Allow for proper clearance of device casing, wiring terminals and service pin for easy access, hardware configuration and maintenance. Remember to record the Neuron ID (also in bar-code format), located on the bottom of the device, for later commissioning.
- Recommended installation environment conditions are:
  - Ambient temperature between 32°F to 158°F (0°C to 70°C)
  - Relative humidity from 0% to 95%, noncondensing.
- Ensure proper ventilation of devices, and avoid areas where corroding, deteriorating or explosive vapors, fumes or gasses may be present. Recommended orientation of the device is with ventilation slots or terminal block connector toward the top, to permit proper heat dissipation.



Take reasonable precautions to prevent static discharges when installing, servicing or operating the device (discharge accumulated static electricity by touching a securely grounded object).

### 3. General Wiring Recommendations

- All wiring must comply with electrical wiring diagrams, as well as national and local electrical codes.
- All wiring connections are done by using the removable terminal connectors, which must be disconnected from the device for wiring. Use a small flat screwdriver to tighten the terminal connector screws once you have inserted the wires.
- Analog-type cables (i.e., for power, voltage and current inputs, as well as triac outputs) should be kept apart from other types of wiring, to avoid any ambient noise transmission among wires. However, unswitched power wiring can be in the same conduit as the LONWORKS communication cable.
- The board connectors accept wires or flat cables ranging from 22 to 12 AWG (0.645–2.052 mm diameter) per pole. However, power cables must remain between 18 and 14 AWG (1.024–1.628 mm diameter).
- Do not connect the analog/digital inputs or outputs to ground (only if otherwise stated).
- Do not connect the common terminals to ground (only if otherwise stated).
- Do not leave device powered when connecting any type of wire to the controller: fully disconnect power terminal to ensure that the device is not powered.

### 4. Mounting Instructions

Voyant's FP product line has been specially designed for easy installation. All four mounting slots (1) have a diameter of 0.17" (4.3 mm), and are spaced to fit on a 1/4" perfboard. The device can be mounted in a panel or on a wall by using appropriate screw types (use sheet metal, thread-forming or self-tapping screws accordingly). The controller can also be mounted on a DIN rail (DIN rail brackets are mounted by Voyant Solutions, if ordered).

#### Without DIN Rail

Remove terminal blocks, and use the controller-mounting slots (1) to mark the location of any holes that need to be drilled. Remove device and drill holes. Finally, clean the perforated surface, and fasten the device using the appropriate screw types.

#### With DIN Rail

Make sure that the DIN rail is properly mounted on the wall. Simply clip controller onto the DIN rail using the mounting brackets.



Figure 4-1: DIN rail mounting bracket

### 5. Controller Dimensions

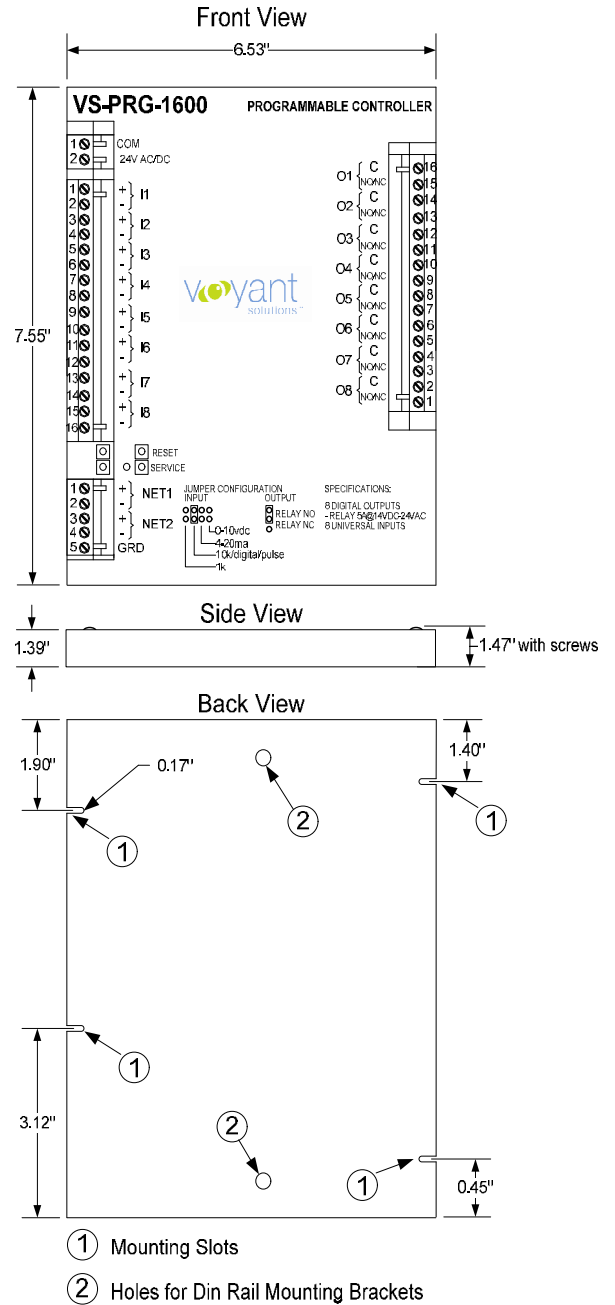


Figure 5-1: VS-PRG-1600 controller dimensions

**5. Controller Dimensions (Continued)**

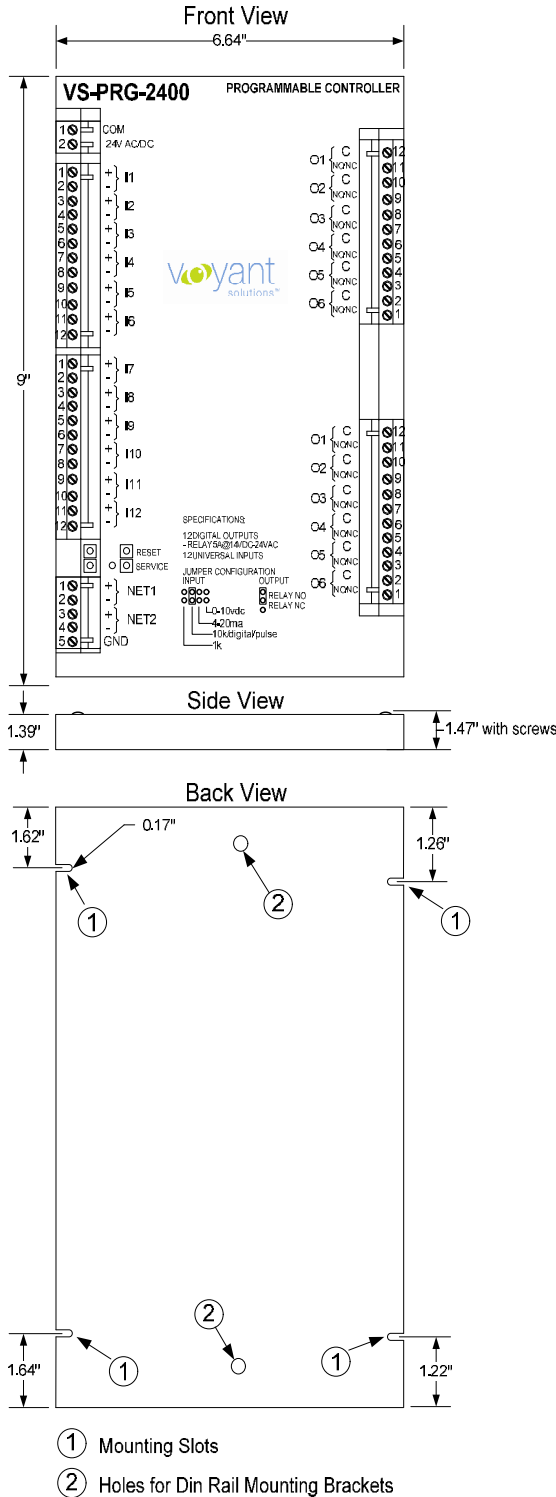


Figure 5-2: VS-PRG-2400 Controller dimensions

**6. Power Wiring**

**Device Power Requirements: 24Vac/Vdc; +/- 15%, Class 2**

**⚠** To conform to Class 2 US requirements, use transformers of 100 VA or less.

Minimum cable section for power wiring is of 18 AWG. For power and ground wiring, it is recommended to use the heaviest gauge wire, based on a maximum of 14 AWG and a minimum of 18 AWG.

Connect the ground terminal from each controller to a verified earth ground. Failure to do so might result in a damaged device if subject to power-line spikes or intensive ambient noise.

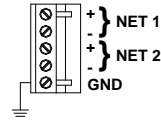


Figure 6-1: Ground terminal

If powering more than one device, use the following method to calculate power requirements of transformer:

- Add maximum power consumption of all devices, and multiply by 1.3.
- If resulting number is higher than 100VA, consider using multiple transformers.

For multiple devices powered from the same transformer, maintain consistent polarity between all controllers: connect the COM terminals from each controller to the same terminal on the secondary side of the transformer.

It is recommended to use an external fuse on the 24Vac secondary side of the transformer, as shown in Figure 6-2, to protect all devices against power-line spikes.

**⚠** The FP controllers use a half-wave power supply, therefore connecting two controllers to the same transformer without maintaining polarity will cause a short circuit.

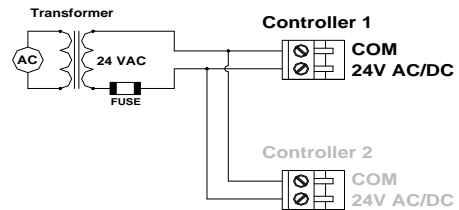


Figure 6-2: Power wiring

**⚠** The negative input terminals of the FP controllers are internally wired to the COM terminal of the power input. Therefore, if powering peripherals and controllers with the same transformer, it is essential to maintain polarity. Failure to do so will result in a short circuit and may damage the device.

## 7. Input Wiring

The FP controllers have physical connections for either 4, 8 or 12 inputs. These inputs need a hardware configuration according to the required input types. Each input can be configured for either digital, resistive, current or voltage signals. Jumper configuration and input wiring must be done accordingly.

It should be noted that the FP controllers are shipped with every input configured as a 10k thermistor/digital/pulse input.

### Wiring Digital and Resistive 10kΩ Inputs

This input configuration is used to monitor digital dry contacts as well as 10kΩ potentiometers and 10kΩ NTC thermistors.

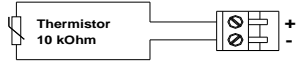


Figure 7-1: 10kΩ NTC Thermistor input

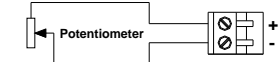
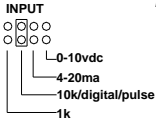


Figure 7-2: 10kΩ Potentiometer Input

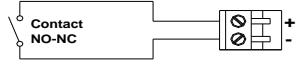


Figure 7-3: Digital dry contact (NO & NC)



Note

1. A resistive input that is less than 110Ω is detected as a short, and an input that is more than 800kΩ is detected as an open.
2. For Type 2 10kΩ thermistor inputs (@25°C), the temperature to resistance range is of 337kΩ to 390kΩ, which translates into -40°F to 248°F (-40°C to 120°C)

### Resistive 1kΩ Inputs

This input configuration is used to monitor 1kΩ thermistors.

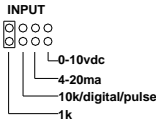


Figure 7-4: 1kΩ Thermistor input

### Wiring Current Inputs

Current inputs have a range of 4 to 20 mA. Connect current input, according to the following figure, if transducer is externally powered.

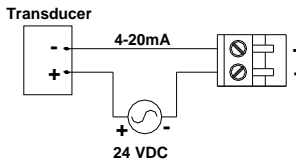
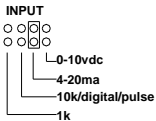


Figure 7-5: Current input with external source

### Wiring Voltage Inputs

Voltage inputs have a range of 0 to 10 Vdc, with ±0.5% accuracy. Connect voltage input, according to the following figure.

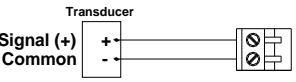
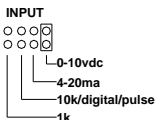


Figure 7-6: Voltage input

## 8. Output Wiring

The FP controllers have physical connections for either digital outputs or analog outputs, depending on the model. These outputs are all software-configurable. Therefore, hardware configuration is not required for outputs, except when using relays on digital outputs, as these can be configured as normally closed or normally open contacts.

It should be noted that FP controllers are shipped with every output configured normally opened.

### Wiring Digital Outputs

Digital outputs are all “dry contacts,” meaning that there is no voltage present on the output terminals. Therefore, an external power source can be added, if necessary.

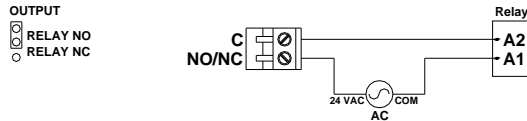


Figure 8-1: Digital output with external power supply

### Wiring Analog Outputs

Analog outputs can be configured to provide either a linear signal ranging from 0 to 10 Vdc, or a discrete signal of 0 or 12 Vdc. The discrete signal can be used to generate a PWM or a simple two-state signal. The maximum current rating of these outputs is of 60 mA @ 12 Vdc, with a total maximum load of 200 Ω, or of 50 mA @ 10 Vdc. These outputs are protected by an autoreset fuse with a rating of 100 mA @ 68°F (20°C), or 60 mA @ 140°F (60°C).

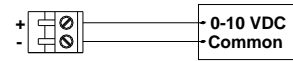


Figure 8-2: 0 to 10Vdc Analog output

When driving a relay with an analog output, a diode must be connected in parallel to protect the controller from back-emf current, which occurs when the relay is turned off. Recommended diodes are 1N4004 (I<sub>r</sub>=1A @ V<sub>r</sub>=25V).

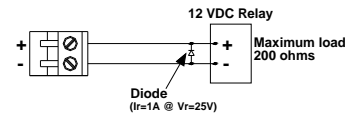


Figure 8-3: 0 or 12 Vdc discrete analog output

## 9. Communications Wiring

Approved cable types for LON<sup>®</sup> communications is Level IV 22AWG (0.65 mm), **UNSHIELDED**. You can use both one pair and two pair wires. The LON communication wire is polarity-insensitive, and can be laid out in either bus, star, loop or free topology.



**Note** Voyant Solutions strongly recommends using the bus topology network configuration for all LON communication wiring, as it allows for easy network trouble-shooting.

Connect both wires to the NET 1 or 2 terminals of the controller. If inserting multiple wires in the terminals, ensure to properly twist wires together prior to inserting them in the terminal connectors.



**Note** When daisy-chaining the LON communication wire from one controller to another and using both sets of LONWORKS NET terminals, be aware that the LONWORKS Bus is broken when the terminal connector is unplugged.

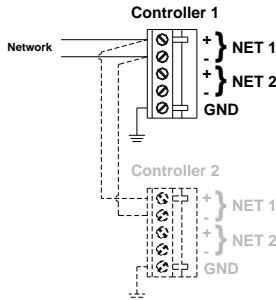


Figure 9-1: Communications Wiring

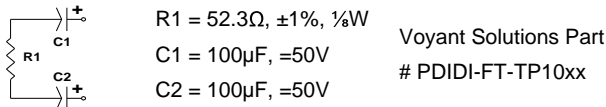
For more information and detailed explanations on network topology and wire length restrictions, please refer to the *Junction Box and Wiring Guideline for Twisted Pair LonWorks<sup>®</sup> Networks*, part.# 005-0023-01, published by Echelon Corporation.



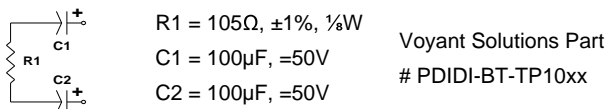
It is very important to use proper terminations on the network, according to the type of network topology used. Failure to do so might result in communication errors between controllers. Do not use multiple gauges of cable on the same communication bus, as this may also result in communication errors.

### Selecting Network Terminators

For **free topology**-type networks (TP/FT-10 only), use only the following terminator for each free topology channel in any location:



For **bus topology**-type networks (TP/FT-10 only), use the following terminator at each end of the bus topology channel (2 terminators per channel in total):



## 10. Networking guide

### Commissioning\*

To commission a device and add it to a LONWORKS network, you must use the device plug-in, as well as the .xif and .apb files. To obtain these files, please follow this procedure:

1. Visit the Voyant Solutions website ([www.voyantsolutions.com](http://www.voyantsolutions.com)), and download the latest version of the plug-in installation setup. You can also contact your sales representative to obtain this file.
2. Run the installation setup. This will install the device plug-in and the latest versions of the .xif and .apb files onto your computer. The .xif and .apb files will be installed in the C:\LonWorks\Import\ Voyant folder.
3. Register the plug-in onto the network database. This will create the device template that must be used to commission the device.
4. Commission the device using the proper device template and .apb file, with your network management tool.



Downloading an improper .apb or .nxe into the device may damage the Neuron chip in your controller. The controller may become unusable.

*\*These instructions on commissioning a device only apply when using an LNS<sup>®</sup>-network management tool, such as Lonwatcher<sup>™</sup>. For detailed instructions about device commissioning on either LNS or Niagara Framework<sup>™</sup> platforms, please refer to the device's user guide.*

### Neuron ID and Service Pin

To commission a device and add it to a LONWORKS network, you will need the Neuron ID of the device. There are two methods to obtain this number:

1. Manual entry: The Neuron ID address and bar code are located on the right panel of the device.
2. Service pin: Pressing the service pin on the device will broadcast the Neuron ID on the LONWORKS network.

## Troubleshooting Guide

Device is powered but does not turn on	
Fuse has blown Power supply polarity	Check the fuse integrity. 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 <i>Figure 6-2</i> .
Device cannot communicate on a FTT network	
Absent or incorrect supply voltage  Overloaded power transformer Network not wired properly Absent or incorrect network termination	1. Check power supply voltage between 24 VAC/DC and COM pins, and ensure that it is between acceptable limits. 2. Check for tripped fuse or circuit breaker. Verify that the transformer used is powerful enough to supply all controlled devices. Doublecheck that the wire connections are correct. Check the termination(s).
Device communicates well over a short network, but does not communicate on large network	
Network length Wire type  Network wiring problem Absent or incorrect network termination  Extra capacitance  Number of devices on network segment exceeded Network traffic	Check that the total wire length does not exceed the specifications of the FTT user guide. Check that the wire type agrees with the specification of the FTT user guide. Remember, the wire must be UNSHIELDED. Doublecheck that the wire connections are correct. Check the termination(s). Incorrect or broken termination(s) will make the communication integrity dependent upon a device's position on the network. Make sure that no extra capacitance is being connected to the network other than the standard FTT circuit, and a maximum of a 3-meter stub (in bus topology). The number of devices on a channel should never exceed 64. Use a router or a repeater in accordance to the FTT user guide. Query node statistic to check errors. Use a LON protocol analyzer to check network traffic.
Hardware input is not reading the correct value	
Input wiring problem Open circuit or short circuit Configuration problem	Check that the wiring is correct according to this manual and to the device manufacturer. Using a voltmeter, check the voltage on the input terminal. Short circuit (0 V) and Open circuit (10V). Using the device configuration plug-in, check the configuration of the input. Refer to the device user's guide for more information.
Hardware output is not operating correctly	
Output wiring problem Configuration problem  0–10 V output, 24 VAC-powered actuator is not moving.	Check that the wiring is correct, according to this manual and to the device manufacturer. Using the device configuration plug-in, check the configuration of the output. Refer to the device User's Guide for more information. 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.
Status LED	
Off  On  Repeated Blink  Slow Blink (1 sec. On, 1 sec. Off) Fast Blink (0.3 sec. On, 1 sec. Off)	The code is stopped, OR the device is not powered. (If the device is powered and the LED is off, pressing the Service Pin will light up the LED) The device is application-less. Appropriate action: Reload the application file (.apb) The device is in normal operation. The LED will blink with respect to the device code execution time.  The device is unconfigured. Appropriate action: Commission the device. Watchdog time out. Application corrupted. Appropriate action: Call Voyant Solutions to report the problem.

### Hardware Installation Guide- VS-PRG-1600, VS-PRG-2400

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