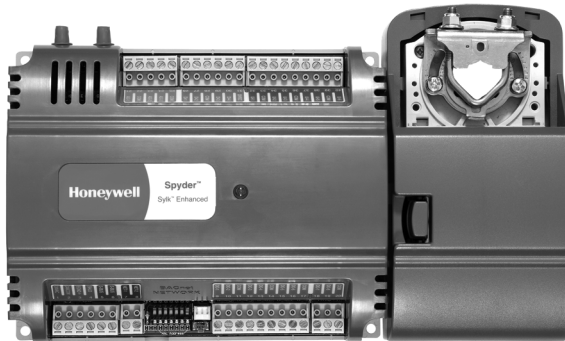


# Spyder<sup>®</sup> BACnet<sup>®</sup> Programmable Controllers

## SPECIFICATION DATA



## APPLICATION

The PUB and PVB controllers are part of the Spyder family. The three controllers are BACnet MS/TP network devices designed to control HVAC equipment. These controllers provide many options and advanced system features that allow state-of-the-art commercial building control. Each controller is programmable and configurable using the NIAGARA FRAMEWORK<sup>®</sup> software.

The Spyder BACnet controllers require the Spyder BACnet Programmable Feature to be licensed in the WEBpro workbench tool and the WEBS AX JACE Controller for programming and downloading. The Spyder BACnet Models are also available as Individually Licensed Controllers (ILC). The ILC versions are identical in design and capability in every detail except for the licensing. The Individual Licensing of the Spyder ILCs (the License is built in) allows them to be programmed and downloaded with any brand of the Niagara Workbench or JACE controller. The Spyder ILCs are identified with a suffix on the Part Number of -ILC. Example: PUB6438S-ILC follows all the same Installation Instructions information as the PUB6438S.

The controllers are for use in VAV (Variable Air Volume), Unitary, and advanced HVAC control applications. Each controller contains a host microcontroller to run the main HVAC application and a second microcontroller for BACnet MS/TP network communications. Each controller provides flexible, universal inputs for external sensors, digital inputs, and a combination of analog outputs and digital Triac outputs.

The photo shown is the PVB6436AS, which includes the Series 60 floating actuator.

## FEATURES

- Uses BACnet MS/TP network communication.
- EIA-485 communications network. Capable of baud rates between 9.6 and 115.2 kbits/s.
- Capable of stand-alone operation, but can also use BACnet MS/TP network communications.
- Syk<sup>™</sup> bus for use with Syk-enabled sensors.
- Support for up to 30 controllers per BACnet MS/TP segment.
- Field configurable and programmable for control, input, and output functions using the NIAGARA FRAMEWORK<sup>®</sup> software.
- Function Block engine, which allows the application designer to program the controller to perform a wide variety of HVAC applications.
- Built-in Zone Control functions include a remote wall module interface and a scheduler.
- Pressure-independent or pressure-dependent single or dual duct Variable Air Volume (VAV) control as well as Unitary equipment control.
- Microbridge air flow sensor with dual integral restrictor design (PVB0000AS, PVB4022AS, PVB4024NS, PVB6436AS, and PVB6438NS).
- Easy user access to air flow sensor inputs.
- Actuator (PVB0000AS, PVB4022AS, and PVB6436AS) mounts directly onto VAV box damper shaft and has up to 44 lb-in. (5 Nm) torque, 90-degree stroke, and 90 second timing at 60 Hz.
- All wiring connections are made to removable terminal blocks to simplify controller installation and replacement.
- Both controller housing and actuator are UL plenum rated.



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63-1328-03

## DESCRIPTION

The programmable VAV/Unitary controllers are available in three models, as described in Table 1.

**Table 1. Controller Configurations.**

Controller Model	Programmable Type	UI (Universal Input)	DI (Digital Input)	AO (Analog Output)	DO (Digital Output)	Velocity Pressure Sensor (Microbridge)	Series 60 Floating Actuator
PUB1012S	Unitary	1 <sup>a</sup>	0	1	2	NO	NO
PUB4024S	Unitary	4 <sup>a</sup>	0	2	4	NO	NO
PUB6438S	Unitary	6	4	3	8	NO	NO
PVB0000AS	VAV	0	0	0	0	YES	YES
PVB4022AS	VAV	4 <sup>a</sup>	0	2	2	YES	YES
PVB4024NS	VAV	4 <sup>a</sup>	0	2	4	YES	NO
PVB6436AS	VAV	6	4	3	6	YES	YES
PVB6438NS	VAV	6	4	3	8	YES	NO

Each controller is programmable because the user chooses which function blocks to use and how to connect them. It is configurable because each Function Block has user-defined behavior.

The PVB6436AS and PVB6438NS models are Variable Air Volume (VAV) controllers, and the PUB6438S model is a Unitary controller.

### VAV Equipment Control (PVB0000AS, PVB4022AS, PVB4024NS, PVB6436AS, and PVB6438NS)

The VAV controllers provide pressure-independent air flow control and pressure-dependent damper control. VAV systems generally provide cool air only to zones. However, each controller has additional programmable inputs and outputs that may be used to control devices, such as a fan or VAV box reheat coils. Heaters can be staged electric or modulating hot water. Supply and exhaust pressurization control are provided on a zone basis.

### Unitary Equipment Control (PUB1012S, PUB4024S, and PUB6438S)

Unitary equipment includes natural convection units, radiant panels, unit heaters, unit ventilators, fan coil units, and heat pumps. Unitary equipment does not require a central fan. Depending on design, unitary equipment may perform one or all of the functions of HVAC—ventilation, filtration, heating, cooling, humidification and distribution. Unitary equipment frequently requires a distribution system for steam or hot and or chilled water.

## SPECIFICATIONS

### Electrical

**Rated Voltage:** 20-30 Vac; 50/60 Hz

**Power Consumption:**

100 VA for controller and all connected loads (including the actuator on model PVB6436AS)

**Controller only Load:** 5 VA maximum; models PVB6438NS and PUB6438S

**Controller and Actuator Load:** 9 VA maximum; model PVB6436AS

**External Sensors Power Output:** 20 Vdc  $\pm$ 10% @ 75 mA maximum

### Environmental

**VAV Operating & Storage Temperature Ambient Rating (models PVB0000AS, PVB4022AS, PVB4024NS, PVB6436AS, and PVB6438NS):**

Minimum 32° F (0° C); Maximum 122° F (50° C)

**Unitary Operating & Storage Temperature Ambient Rating (models PUB1012S, PUB4024S, and PUB6438S):**

Minimum -40° F (-40° C); Maximum 150° F (65.5° C)

**Relative Humidity:** 5% to 95% non-condensing

### Dimensions (H/W/D)

See Fig. 1 to Fig. 4 beginning on page 6 for dimensioned drawings.

**PUB1012S, PUB4024S, and PUB4024NS:** 6.25 x 4.81 x 2.26 in. (15.92 x 12.20 x 5.74 cm)

**PVB0000AS, PUB4022AS (including Actuator):** 6.60 x 8.28 x 2.26 in. (16.70 x 21.10 x 5.74 cm)

**PVB6436AS (including Actuator):** 6.27 x 10.316 x 2.26 in. (15.92 x 26.20 x 5.74 cm)

**PVB6438NS:** 5.76 x 6.85 x 2.26 in. (14.62 x 17.40 x 5.74 cm)

**PUB6438S:** 5.45 x 6.85 x 2.26 in. (13.84 x 17.40 x 5.74 cm)

## Approval Bodies

UL/cUL (E87741) listed under UL916 (Standard for Open Energy Management Equipment) with plenum rating.

CSA (LR95329-3) listed.

Meets FCC Part 15, Subpart B, Class B (radiated emissions) requirements.

Meets Canadian standard C108.8 (radiated emissions).

Conforms to the following requirements per European Consortium standards:

- EN 61000-6-1; 2001 (EU Immunity).
- EN 61000-6-3; 2001 (EU Emissions)
- BTL B-ASC (BACnet Testing Laboratories, BACnet Application Specific Controller)

## Real Time Clock

**Operating Range:** 24 hour, 365 day, multi-year calendar including day of week and configuration for automatic day-light savings time adjustment to occur at 2:00 a.m. local time on configured start and stop dates

**Power Failure Backup:** 24 hours at 32°F to 100°F (0°C to 38°C), 22 hours at 100°F to 122°F (38°C to 50°C)

**Accuracy:** ±1 minute per month at 77° F (25° C)

## Velocity Pressure Sensor (PVB0000AS, PVB4022AS, PVB4024NS, PVB6436AS, and PVB6438NS)

**Operating Range:** 0 to 1.5 in. H<sub>2</sub>O (0 to 374 Pa)

## Series 60 Floating Actuator (PVB0000AS, PVB4022AS, and PVB6436AS)

**Rotation Stroke:** 95° ± 3° for CW or CCW opening dampers

**Torque Rating:** 44 lb-in. (5 Nm)

**Run Time for 90° rotation:** 90 seconds at 60 Hz

## Inputs and Outputs

Each controller has four digital inputs (DI), six or eight digital Triac outputs (DO), three analog outputs (AO), and six universal input (UI) circuits.

The PVB6436AS has only 6 digital Triac outputs available, and the PVB6438NS and PUB6438S each have eight digital Triac outputs available.

### Digital Input (DI) Circuits

**Voltage Rating:** 0 to 30 Vdc open circuit

**Input Type:** Dry contact to detect open and closed circuit

**Operating Range:** Open circuit = False; Closed circuit = True

**Resistance:** Open circuit > 3,000 Ohms; Closed circuit < 500 Ohms

### Digital Triac Output (DO) Circuits

**Voltage Rating:** 20 to 30 Vac @ 50-60Hz

**Current Rating:** 25 mA to 500 mA continuous, 800 mA (AC rms) for 60 milliseconds

### Analog Output (AO) Circuits

Analog outputs are individually configurable for current or voltage.

#### ANALOG CURRENT OUTPUTS:

**Current Output Range:** 4.0 to 20.0 mA

**Output Load Resistance:** 550 Ohms maximum

#### ANALOG VOLTAGE OUTPUTS:

**Voltage Output Range:** 0.0 to 10.0 Vdc

**Maximum Output Current:** 10.0 mA

Analog outputs may be configured as digital outputs and operate as follows:

- False (0%) produces 0 Vdc, (0 mA)
- True (100%) produces the maximum 11 Vdc, (22 mA)

## Universal Input (UI) Circuits

See Table 2 for the UI specifications:

**Table 2. Universal Input Circuit Specifications.**

Input Type	Sensor Type	Operating Range
Room/Zone Discharge Air Outdoor Air Temperature	20K Ohm NTC	-40° F to 199° F (-40° C to 93° C)
Outdoor Air Temperature	C7031G <sup>a</sup>	-40° to 120°F (-40° to 49°C)
	C7041F <sup>a</sup>	-40° to 250°F (-40° to 121°C)
	PT1000 (IEC751 3850)	-40° F to 199° F (-40° C to 93° C)
TR23 Setpoint Potentiometer	500 Ohm to 10,500 Ohm	-4° DDC to 4° DDC (-8° DDF to 7° DDF) or 50° F to 90° F (10° C to 32° C)
Resistive Input	Generic	100 Ohms to 100K Ohms
Voltage Input	Transducer, Controller	0 - 10 Vdc
Discrete Input	Dry Contact closure	OpenCircuit ≥ 3000Ohms ClosedCircuit < 3000Ohms

<sup>a</sup> C7031G and C7041F are recommended for use with these controllers, due to improved resolution and accuracy when compared to the PT1000.

## Hardware (PUB6438S, PVB6436AS, and PVB6438NS)

### CPU

Each controller uses a pair of microprocessors. The first is a 16-bit Texas Instruments MSP430 family microprocessor that is used to manage the Inputs, Outputs and Control. The second is a 32-bit ATMEL ARM 7 microprocessor that manages communication for the Spyder BACnet.

### Memory Capacity

**Flash Memory:** 372 kilobytes. The controller is able to retain Flash memory settings for up to ten (10) years.

**RAM:** 72 kilobytes

## Hardware (PVB0000AS, PUB1012S, PUB4024S, PVB4022AS, and PVB4024NS)

### CPU

Each controller uses a 32 bit ATMEL ARM 7 microprocessor.

### Memory Capacity

**Flash Memory:** 512 kilobytes. The controller is able to retain Flash memory settings for up to ten (10) years.

**RAM:** 128 kilobytes

## Controller Status LED

The LED on the front of the controller provides a visual indication of the status of the device. When the controller receives power, the LED appears in one of the following allowable states, as described in Table 3.

**Table 3. Status LED States.**

LED State	Blink Rate	Status or Condition
OFF	not applicable	No power to processor, LED damaged, low voltage to board, first second of power up, or loader damaged.
ON	ON steady; not blinking	Processor not operating. Application Program CRC being checked. This takes 1-2 seconds and occurs on each restart (power up, reset and reflash, and following configuration file download).
Very Slow Blink (continuous)	1 second ON, 1 second OFF	Controller is operating normally.
Slow Blink (continuous)	0.5 second ON, 0.5 second OFF	Controller alarm is active or controller in process of configuration file download.
Medium Blink (continuous)	0.3 second ON, 0.3 second OFF	Controller is in reflash mode or awaiting/receiving reflash data via the BACnet network.

### BACNET STATUS LED:

The LED on the front of the controller, between the BACnet MS/TP terminals and MAC Address DIP Switches, provides a visual indication of the BACnet MS/TP communication status. When the controller receives power, the LED appears in one of the following allowable states, as described in Table 4.

**Table 4. BACnet Status LED States.**

<b>BACnet LED Status</b>	<b>Status or Condition</b>
Solid on	Controller has power, loader is not running.
Solid on, blinking off once in 2.5 sec.	Controller is in reflash mode, no MS/TP communication.
Solid on, blinking off twice in 2.5 sec.	Controller is in reflash mode, MS/TP communication present.
Solid on, blinking off three times in 2.5 sec.	Controller is in reflash mode, MS/TP communication data transfer in progress.
Solid off, there is no power	No power to processor, LED damaged, low voltage to board, or loader damaged.
Solid off, blinking on once in 2.5 sec.	Controller is running, no MS/TP communication.
Solid off, blinking on twice in 2.5 sec.	Controller is running, MS/TP communication present.
Solid off, blinking on three times in 2.5 sec.	Controller is running, MS/TP communication data transfer in progress.

## Communications

Each controller uses a BACnet MS/TP communications port. The controller's data is presented to other controllers over a twisted-pair MS/TP network, which uses the EIA-485 signaling standard capable of the following baud rates: 9.6, 19.2, 38.4, 76.8, or 115.2 kilobits per second (configured at global controller). The Spyder BACnet controllers are master devices on the MS/TP network. Each Spyder BACnet controller uses a high-quality EIA-485 transceiver and exerts 1/4 unit load on the MS/TP network.

Cabling should be selected that meets or exceeds the BACnet Standard which specifies the following: an MS/TP EIA-485 network shall use shielded, twisted-pair cable with characteristic impedance between 100 and 130 ohms. Distributed capacitance between conductors shall be less than 100 pF per meter (30 pF per foot). Distributed capacitance between conductors and shield shall be less than 200 pF per meter (60 pF per foot). Foil or braided shields are acceptable. The Honeywell tested and recommended MS/TP cable is Honeywell Cable 3322 (18 AWG, 1-Pair, Shielded, Low Cap, Plenum cable), alternatively Honeywell Cable 3251 (22 AWG, 1-Pair, Shielded, Plenum cable) is available and meets the BACnet Standard requirements ([www.honeywellcable.com](http://www.honeywellcable.com)).

The BACnet MS/TP network is polarity sensitive. The maximum BACnet MS/TP network Bus segment length is 4,000 ft. (1,219 m) using recommended wire. Repeaters must be used when making runs longer than 4,000 ft. (1,219 m). A maximum of three repeaters can be used between any two devices.

## MS/TP MAC Address

The MS/TP MAC address for each device must be set to a unique value in the range of 0-127 on an MS/TP network segment. DIP switches on the Spyder BACnet controller are used to set the controller's MAC address.

## Device Instance Number

The Device Instance Number must be unique across the entire BACnet system network because it is used to uniquely identify the BACnet devices. It may be used to conveniently identify the BACnet device from other devices during installation. The Spyder BACnet Controllers Device Instance Number is automatically set when it is added to a WEBStation-AX project. The Device Instance Number can be changed by the user, which may be necessary when integrating with a third party or when attempting to replace an existing controller and it is desired to maintain the existing Device Instance Number.

**NOTE:** For complete instructions on how to set the MS/TP MAC address or set the Device Instance Number refer to the Installation Instructions, form 62-0310.

## Termination Resistors

Matched terminating resistors are required at each end of a segment bus wired across (+) and (-). Use matched precision resistors rated 1/4W  $\pm 1\%$  / 80 - 130 Ohms. Ideally, the value of the terminating resistors should match the rated characteristic impedance of the installed cable. For example, if the installed MS/TP cable has a listed characteristic impedance of 120 Ohm, install 120 Ohm matched precision resistors.

**NOTE:** The controller does not provide any network biasing.

## Shield Terminating

Following proper MS/TP cabling shield grounding procedures is important to minimize the risk of communication problems and equipment damage caused by capacitive coupling. Capacitive coupling is caused by placing MS/TP cabling close to lines carrying higher voltage. The shield should be grounded on only one end of the MS/TP segment (typically the router end). Tie the shield through using the SHLD (terminal 4) on the Spyder BACnet Controller.

## Sylk™ Bus

Sylk is a two wire, polarity insensitive bus that provides both 18 VDC power and communications between a Sylk-enabled sensor and a Sylk-enabled controller. Using Sylk-enabled sensors saves I/O on the controller and is faster and cheaper to install since only two wires are needed and the bus is polarity insensitive. Sylk sensors are configured using the latest release of the Spyder Tool for WEBPro and WEBStation.

**Table 5. BACnet Interoperability Building Blocks (BIBBs) Supported.\***

BIBB	Service	Initiates	Responds to
DS-RP-A/B	ReadProperty	X	X
DS-RPM-B	ReadPropertyMultiple		X
DS-WP-A/B	WriteProperty	X	X
DS-WPM-B	WritePropertyMultiple		X
DM-BR-B	AtomicReadFile		X
DM-BR-B	AtomicWriteFile		X
DM-BR-B	ReinitializeDevice		X
DM-DDB-A/B	Who-Is	X	X
DM-DDB-A/B	I-Am	X	X
DM-DOB-B	Who-Has		X
DM-DOB-B	I-Have	X	
DM-DCC-B	DeviceCommunicationControl		X
DM-TS-B	TimeSynchronization		X
DM-UTC-B	UTCTimeSynchronization		X

\* Refer to the PICS (Protocol Implementation Conformance Statement) for complete details.

## Accessories

- TR70, TR70-H Zio LCD Wall Module
- 201052A,B,C Auxiliary Switches (one, two or three switches)
- C7041B,C,D,P,R Air Temperature Sensor (indoor)
- C7770A Air Temperature Sensor (indoor/plenum)
- C7031G Air Temperature Sensor (outdoor)
- C7041F Air Temperature Sensor (outdoor)
- TR23 Wall Module
- C7400A Enthalpy Sensor
- P7640 Pressure Transducer Family
- C7232 CO<sub>2</sub> Sensor Family
- C7600 Humidity Sensor Family
- H7625, H7635, and H7655 Humidity and Temperature Sensors

Refer to the “Sensors Product Overview,” form 63-9285, for additional accessories.

## Mounting

The controller enclosure is constructed of a plastic base plate and a plastic factory-snap-on cover. The cover does not need to be removed from the base plate for either mounting or wiring. Removable terminal blocks are used for all wiring connections, which allow the controller to be wired before or after mounting.

The controller can be mounted in any orientation. Ventilation openings are designed into the cover to allow proper heat dissipation, regardless of the mounting orientation.

**NOTE:** The controller must be mounted in a position that allows clearance for wiring, servicing, and removal.

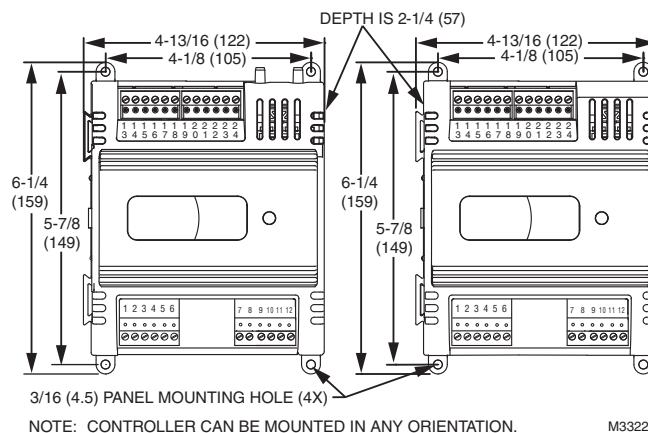
**NOTE:** For complete mounting information, refer to the Installation Instructions, form 62-0310.

## PVBXXXXAS Mounting (Controllers with actuators)

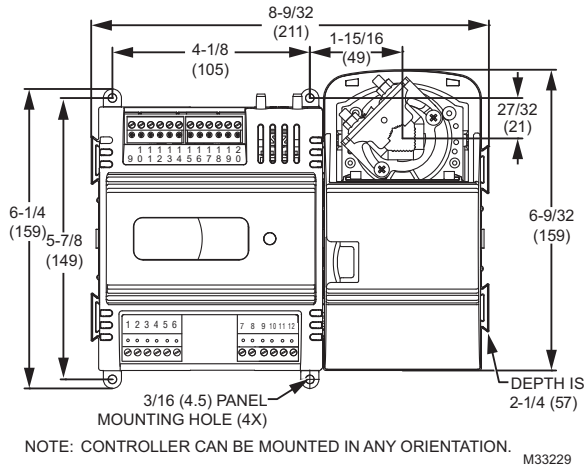
The PVBXXXXAS controllers include the direct-coupled actuator with Declutch mechanism, which is shipped hard-wired to the controller (using digital outputs 7 and 8).

The actuator mounts directly onto the VAV box damper shaft and has up to 44 lb-in. (5 Nm) torque, 90-degree stroke, and 90 second timing at 60 Hz. The actuator is suitable for mounting onto a 3/8 to 1/2 in. (10 to 13 mm) square or round VAV box damper shaft. The minimum VAV box damper shaft length is 1-9/16 in. (40 mm).

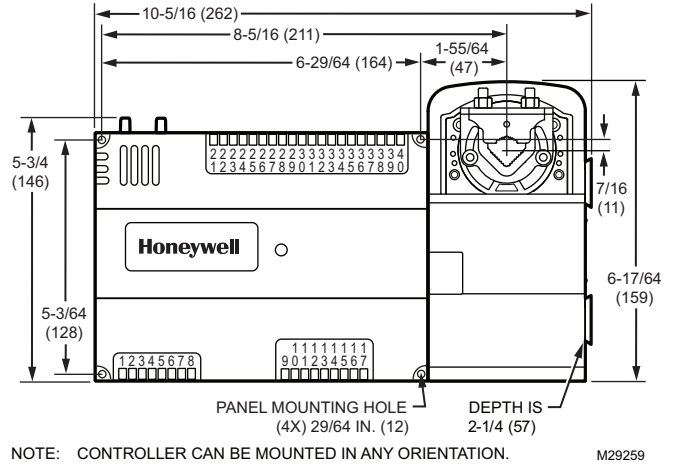
After the actuator is mounted to the damper shaft, the controller mounts to a panel by using four No. 6 or No. 8 machine or sheet metal screws inserted through the corners of the base plate.



**Fig. 1. Panel mounting—controller dimensions in inches (mm) for PUB1012S, PUB4024S, and PVB4024NS only (PUB4024S and PVB4024NS shown).**



**Fig. 2. Panel mounting—controller and actuator dimensions in inches (mm) for PVB0000AS and PVB4022AS only (PVB4022AS shown).**

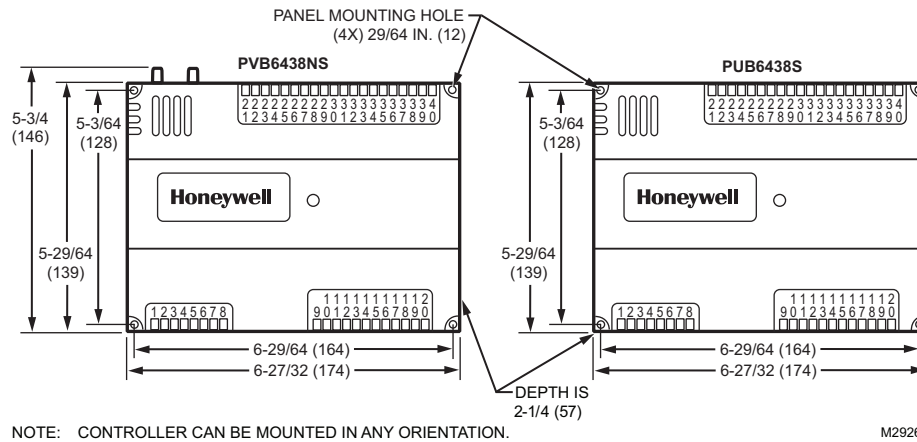


**Fig. 3. Panel Mounting Model PVB6436AS, Dimensions in inches (mm).**

### PVBXXXXS and PUBXXXXNS Mounting (Controllers with no actuators)

The controller mounts to either a panel or DIN rail (standard EN50022; 7.5mm x 35mm).

- For panel mounting, use four No. 6 or No. 8 machine or sheet metal screws inserted through the corners of the base plate.
- For DIN rail mounting, refer to the Installation Instructions, form 62-0310.



**Fig. 4. Panel Mounting Models PVB6438NS and PUB6438S, Dimensions in inches (mm).**

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## **Automation and Control Solutions**

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