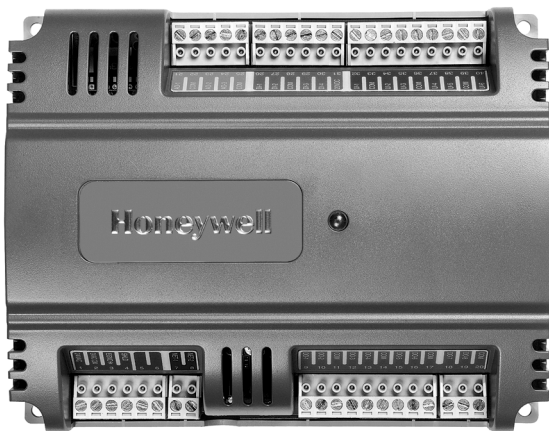


## PUL6438S, PVL6436AS, PVL6438NS Programmable, Unitary/VAV Controllers

### SPECIFICATION DATA



### GENERAL

The PUL6438S, PVL6436AS, and PVL6438NS controllers are part of the Excel 10 product line family. The three controllers are Free Topology Transceiver (FTT) LONMARK®-compliant 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® software.

The controllers are for use in VAV (Variable Air Volume) and Unitary HVAC control applications. Each controller contains a host microcontroller to run the main HVAC application and a second microcontroller for LONWORKS® 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 to the left is the PVL6436AS, which includes the Series 60 floating actuator.

### FEATURES

- Uses the Echelon® LONWORKS® network protocol.
- Free Topology Transceiver (FTT) high-speed 78 kilobit communications network.
- Capable of stand-alone operation, but can also use LONWORKS® Bus network communications.
- Sylk™ bus for use with Sylk-enabled sensors.
- 120 controllers per Excel 10 Q7751A,B Router when configured as a repeater.
- Field configurable and programmable for control, input, and output functions using the NIAGARA FRAMEWORK® software.
- User-defined network variables.
- Function Block engine, which allows the application designer to program the controller to perform a wide variety of HVAC applications.
- Significant Event Notification, Periodic Update capability, and Failure Detect (FD) when network inputs fail to be detected within their configurable time frame.
- 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 (PVL6436AS and PVL6438NS only).
- Easy user access to air flow sensor inputs.
- Actuator (PVL6436AS only) 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.



## DESCRIPTION

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

**Table 1. Controller Configurations.**

Controller Model	Programmable Type	Universal Inputs (UI)	Digital Inputs (DI)	Analog Outputs (AO)	Digital Outputs (DO)	Velocity Pressure Sensor (Microbridge)	Series 60 Floating Actuator
PUL6438S	Unitary	6	4	3	8	NO	NO
PVL6436AS	VAV	6	4	3	6	YES	YES
PVL6438NS	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 the PUL6438S model is a Unitary controller and the PVL6436AS and PVL6438NS models are Variable Air Volume (VAV) controllers.

### Unitary Equipment Control (Model PUL6438S)

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.

### VAV Equipment Control (Models PVL6436AS and PVL6438NS)

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.

## 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 PVL6436AS)

**Controller only Load:** 20 VA maximum; models PVL6438NS and PUL6438S

**Controller and Actuator Load:** 21 VA maximum; model PVL6436AS

**External Sensors Power Output:** 20 Vdc ±10% @ 75 mA maximum

### Environmental

**VAV Operating & Storage Temperature Ambient Rating (models PVL6436AS and PVL6438NS):**

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

**Unitary Operating & Storage Temperature Ambient Rating (model PUL6438S):**

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 and Fig. 2 beginning on page 6, for dimensioned drawings.

**PUL6438S:** 5.45 x 6.85 x 2.26 in. (13.84 x 17.40 x 5.74 cm)

**PVL6436AS (including Actuator):** 6.27 x 10.316 x 2.26 in. (15.92 x 26.20 x 5.74 cm)

**PVL6438NS:** 5.76 x 6.85 x 2.26 in. (14.62 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)

### 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 to 122° F (0 to 50° C)

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

## Velocity Pressure Sensor (models PVL6436AS and PVL6438NS only)

**Operating Range:** 0 to 1.5 in. H<sub>2</sub>O (0 to 374 Pa)  
**Accuracy:** ±2% of full scale at 32 to 122° F (0 to 50° C); ±1% of full scale at null pressure

## Series 60 Floating Actuator (model PVL6436AS only)

**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 PVL6436AS has only 6 digital Triac outputs available, and the PVL6438NS and PUL6438S 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

All three analog outputs must be configured for either current or voltage. Configuring analog outputs individually for current or voltage is not possible.

#### ANALOG CURRENT OUTPUTS:

**Current Output Range:** 4.0 to 20.0 mA  
**Output Load Resistance:** 550 Ohms maximum

#### ANALOG VOLTAGE OUTPUTS:

**Voltage Output Range:** 2.0 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)
T7770 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

### CPU

Each controller uses a Texas Instruments MSP430 family microprocessor. The processor contains on-chip FLASH program memory, FLASH information memory, and RAM.

### Memory Capacity

**Flash Memory:** 116 kilobytes with 8 kilobytes available for user program. The controller is able to retain Flash memory settings for up to ten (10) years.

**RAM:** 8 kilobytes

## Status Information

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, or controller damaged.
ON	ON steady; not blinking	Processor and/or controller is not operating.
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, controller in process of download, or controller lost its configuration.
Medium Blink (continuous)	0.25 second ON, 0.25 second OFF	Controller firmware is loading.
Fast Blink (continuous)	0.10 second ON, 0.10 second OFF	Controller is in manual mode under control of the PC-based software tool.

## Communications

Each controller uses an FTT transformer-coupled communications port. The controller's Manchester encoded data is presented to other controllers and devices on the LONWORKS® Bus at 78 kilobits per second (kbs) via Echelon® communication protocol. The transformer-coupled communications interface offers a much higher degree of common mode-noise rejection while assuring dc isolation. The LONWORKS® Bus is polarity insensitive, eliminating installation errors due to miswiring.

The maximum LONWORKS® Bus network length is 4,600 ft. (1,400 m). For LONWORKS® Bus network lengths greater than the above, see "LONWORKS® Bus Wiring Guidelines," form no. 74-2865.

The theoretical limit for each LONWORKS® Bus segment is 60 controllers. Up to 120 controllers can be configured when the Excel 10 Q7751A,B Router (configured as a repeater) is used, and the bus must be either singly or doubly terminated. Actual installations may have a lower limit, depending on the devices connected.

Honeywell-provided cable types for LONWORKS® Bus communications wiring are Level IV 22 AWG (0.34 sq. mm) plenum or non-plenum rated unshielded, twisted pair, stranded conductor wire.

- For non-plenum areas, U.S. part AK3798 (single-pair stranded) can be used.
- For plenum areas, U.S. part AK3797 (single-pair stranded) or U.S. part AK3799 (two-pair stranded) can be used.

Contact Echelon Corp. Technical Support for the recommended vendors of Echelon approved cables.

Refer to the "LONWORKS® Bus Wiring Guidelines," form 74-2865, for a complete description of LONWORKS® Bus network topology rules and approved cable types.

If a longer LONWORKS® Bus network is required, the Excel 10 Q7751A,B Router (configured as a repeater) can be added to extend the length of the LONWORKS® Bus. Each network segment can have a maximum of one repeater.

NOTE: Connection for operator access to the LONWORKS® Bus is provided by plugging the Serial LONTALK® Adapter (SLTA) connector into the LONWORKS® Bus jack on the controller.

## Sylk™ Bus

Sylk is a two wire, polarity insensitive bus that provides both 24VAC 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.

## Network Variables Profile

Network variables, as described in Table 4 on page 5, are communicated over the LONWORKS® Bus. User-defined variables provide for customized configurations. The controller's built-in functions provide for the selection of variables, which are available from/to the network. Each network variable is named and configured using the NIAGARA FRAMEWORK® software.

Each controller supports a range of network variables, depending on the byte count (storage requirements) of each variable. In most typical installations, a maximum of 30-37 variables are configured.

NOTE: The maximum number of variables that a controller supports is 62, and the maximum byte count per variable is 31.

The controller is capable of supporting up to 1,922 separate data values.

In Table 4 on page 5, the network variable prefixes have the following meaning:

- nvi — Network Variable Input
- nvo — Network Variable Output
- nci — Configuration Property Network Variable Input stored in Non-Volatile Memory
- nro — Network Variable Output stored in Non-Volatile memory

**Table 4. Network Object Variables List.**

Network Object Variables		
→ Input	Mandatory	Output →
nviNodeRequest * <sup>a</sup>		nvoNodeStatus *
→ Input	Optional	Output →
nviTimeSet *		nvoFileStatus *
nviFileRequest		
nviFilePos *		
→ Input	Manufacturer Defined	Output →
nviDebugIndx *		nvoTime *
nviInUse *		nvoConfigError *
nviManVal *		nvoDebug1 *
		nvoDebug2 *
		nvoAlarmH *
		nvoAlarmStatus *
		nvoError *
		nvoIO1 *
		nvoIO2 *
		nvoIO3 *
→ Input	Configuration (Manufacturer Defined)	Output →
nciApplVerNew *		nroPgmVer *
nciDeviceName *		
nciSendHrtBt *		
nciRcvHrtBt *		
nciUICalOffset *		
→ Input	User-defined (Examples of) <sup>b</sup>	Output →
nviSpaceTemp		nvoSpaceTemp
nviSetPoint		nvoEffectSetPt
nviManOverride		nvoUnitStatus
nviEmergCmd		nvoTerminalLoad
nviEnergyHoldOff		nvoEnergyHoldOff
nviFanSpeed		nvoBoxFlow

<sup>a</sup> Network variables marked with an asterisk (\*) are fixed. All network variables, other than those that are user-defined, are fixed and not configurable.

<sup>b</sup> User-defined network variables are created using the NIAGARA FRAMEWORK® software. The variables listed in the table are a few examples. A wide range of variables are user-definable.

## Accessories

- 201052A,B,C Auxiliary Switches (one, two or three switches)
- 205979 Excel 10 Connector Cable from the Excel 10 Q7752A Serial Interface Adapter to Excel 10 Controller or Wall Module
- 209541B Excel 10 Termination Module
- Excel 10 C7041B,C,D,P,R Air Temperature Sensor (indoor)
- Excel 10 C7770A Air Temperature Sensor (indoor/plenum)
- Excel 10 C7031G Air Temperature Sensor (outdoor)
- Excel 10 C7041F Air Temperature Sensor (outdoor)
- Excel 10 Q7751A,B Router (configured as a repeater)
- Excel 10 Q7752A,B Serial Interface Adapter
- Excel 10 T7770 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, removal, connection of the LONWORKS® Bus Jack, and access to the NEURON® Service Pin.

NOTE: For complete mounting information, refer to the “PVL6436AS, PVL6438NS, PUL6438S Programmable, VAV/Unitary Controllers - Installation Instructions” form 95-7732).

## PVL6436AS Mounting

The PVL6436AS controller includes the direct-coupled actuator with Declutch mechanism, which is shipped hard-wired to the controller (using digital outputs 7 and 8).

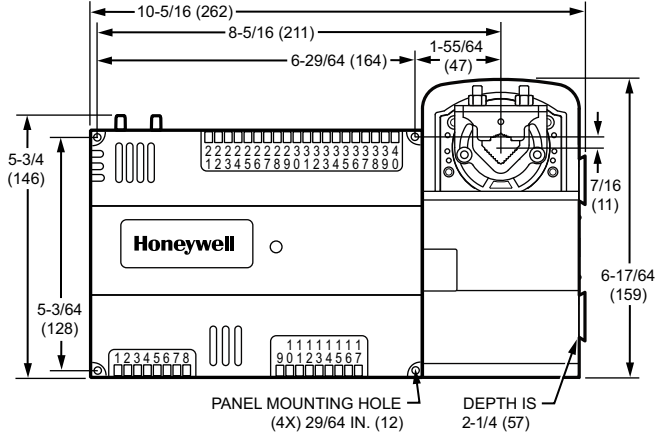
The actuator mounts directly onto the VAV box damper shaft and has up to 44 lb-in. (5 Nm) torque, 90-degree stroke, and 90 second timing at 60 Hz. The actuator is suitable for mounting onto a 3/8 to 1/2 in. (10 to 13 mm) square or round VAV box damper shaft. The minimum VAV box damper shaft length is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

### PVL6438NS and PUL6438S Mounting

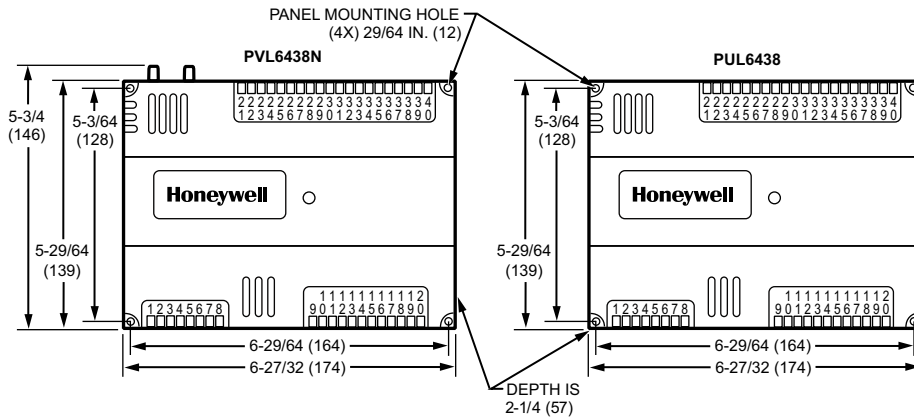
The controller mounts to either a panel or DIN rail (standard EN50022; 7.5mm x 35mm).

- 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 95-7732.



NOTE: CONTROLLER CAN BE MOUNTED IN ANY ORIENTATION. M23590

**Fig. 1. Panel Mounting Model PVL6436AS, Dimensions in inches (mm).**



NOTE: CONTROLLER CAN BE MOUNTED IN ANY ORIENTATION. M23589

**Fig. 2. Panel Mounting Models PVL6438NS and PUL6438S, Dimensions in inches (mm).**



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