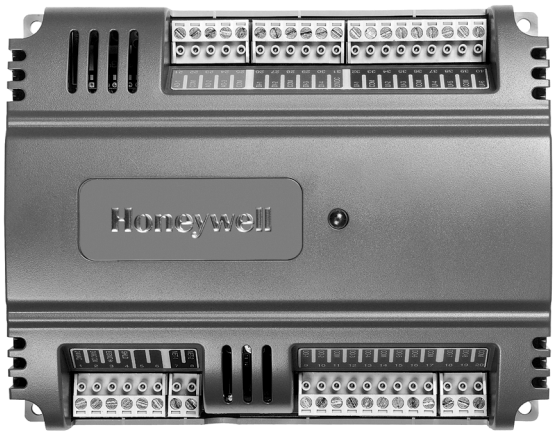
Honeywell

PUL6438, PVL6436A, PVL6438N Programmable, Unitary/VAV Controllers

SPECIFICATION DATA



GENERAL

The PUL6438, PVL6436A, and PVL6438N 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 PVL6436A, 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.**
- **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 (PVL6436A and PVL6438N only).**
- **Easy user access to air flow sensor inputs.**
- **Actuator (PVL6436A 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.**

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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
PUL6438	Unitary	6	4	3	8	NO	NO
PVL6436A	VAV	6	4	3	6	YES	YES
PVL6438N	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 PUL6438 model is a Unitary controller and the PVL6436A and PVL6438N models are Variable Air Volume (VAV) controllers.

Unitary Equipment Control (Model PUL6438)

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 PVL6436A and PVL6438N)

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 PVL6436A)
Controller only Load: 20 VA maximum; models PVL6438N and PUL6438
Controller and Actuator Load: 21 VA maximum; model PVL6436A
External Sensors Power Output: 20 Vdc ±10% @ 75 mA maximum

Environmental

VAV Operating & Storage Temperature Ambient Rating (models PVL6436A and PVL6438N):
Minimum 32° F (0° C); Maximum 122° F (50° C)
Unitary Operating & Storage Temperature Ambient Rating (model PUL6438):
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.

PUL6438: 5.45 x 6.85 x 2.26 in. (13.84 x 17.40 x 5.74 cm)

PVL6436A (including Actuator): 6.27 x 10.316 x 2.26 in. (15.92 x 26.20 x 5.74 cm)

PVL6438N: 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 PVL6436A and PVL6438N only)

Operating Range: 0 to 1.5 in. H_2O (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 PVL6436A 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 PVL6436A has only 6 digital Triac outputs available, and the PVL6438N and PUL6438 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 [a]	-40° to 120°F (-40° to 49°C)
	C7041F [a]	-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	Open Circuit ≥ 3000 Ohms Closed Circuit < 3000 Ohms

[a] 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: 60 kilobytes with 8 kilobytes available for user program. The controller is able to retain Flash memory settings for up to ten (10) years.

RAM: 2 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.

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 * [a]	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) [b]	Output →
nviSpaceTemp	nvoSpaceTemp
nviSetPoint	nvoEffectSetPt
nviManOverride	nvoUnitStatus
nviEmergCmd	nvoTerminalLoad
nviEnergyHoldOff	nvoEnergyHoldOff
nviFanSpeed	nvoBoxFlow

[a] Network variables marked with an asterisk (*) are fixed. All network variables, other than those that are user-defined, are fixed and not configurable.

[b] 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_2 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 “PVL6436A, PVL6438N, PUL6438 Programmable, VAV/Unitary Controllers - Installation Instructions,” form 95-7732).

PVL6436A Mounting

The PVL6436A 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.

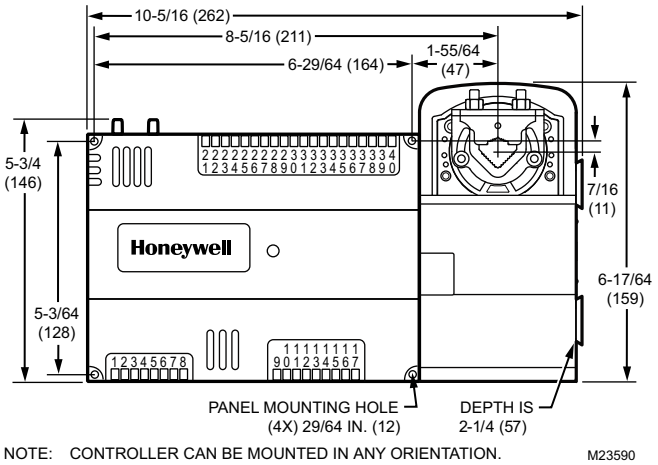

Fig. 1. Panel Mounting Model PVL6436A, Dimensions in inches (mm).

PVL6438N and PUL6438 Mounting

The controller mounts to either a panel or DIN rail (standard EN50022; 7.5mmm 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.

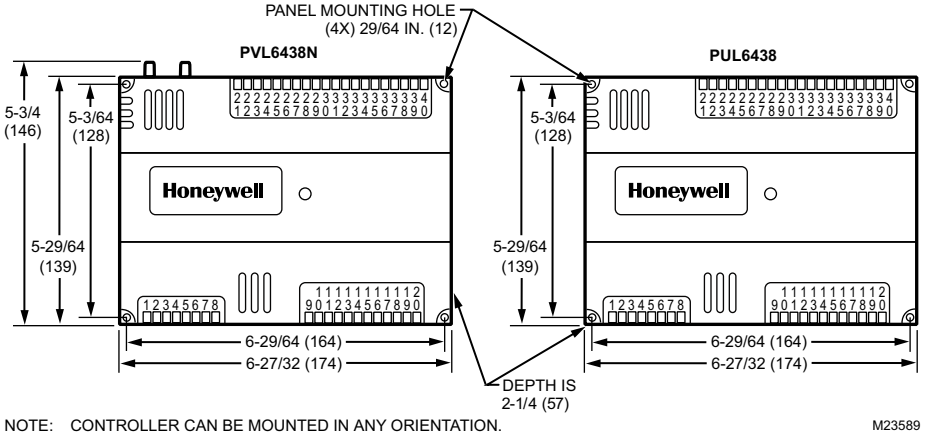

Fig. 2. Panel Mounting Models PVL6438N and PUL6438, Dimensions in inches (mm).

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