Description

The CP-VL6436A, CP-VL6438N, and CP-UL6438 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 through software.

These controllers are for use in VAV (Variable Air Volume) and Unitary HVAC control applications. Each controller contains a host micro controller to run the main HVAC application and a second micro controller for LONWork® network communications. Each controller has flexible, universal inputs for external sensors, digital inputs, and a combination of analog and digital Triac outputs. The three models are described in Table 1. The photo to the left is the model CP-VL6436A, which includes the actuator.

Table 1. Controller Configurations.

<table>
<thead>
<tr>
<th>Controller Model</th>
<th>Programmable Type</th>
<th>Universal Inputs (UI)</th>
<th>Digital Inputs (DI)</th>
<th>Analog Outputs (AO)</th>
<th>Digital Outputs (DO)</th>
<th>Velocity Pressure Sensor (Microbridge)</th>
<th>Series 60 Floating Actuator</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP-VL6436A</td>
<td>VAV</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>6</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>CP-VL6438N</td>
<td>VAV</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>8</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>CP-UL6438</td>
<td>Unitary</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>8</td>
<td>NO</td>
<td>NO</td>
</tr>
</tbody>
</table>

Each controller communicates via the 78 kbps Echelon® LonWork Network, using the FTT-10A LonWork interface, and is LonMARK compliant. Controllers are field-mountable to either a panel or a DIN rail.
SPECIFICATIONS

General Specifications
Rated Voltage: 20-30 Vac; 50/60 Hz
Power Consumption: 100 VA for controller and all connected loads (including the actuator on model CP-VL6436A)
Controller Only Load: 20 VA maximum; models CP-VL6438N and CP-UL6438
Controller and Actuator Load: 21 VA maximum; model CP-VL6436A
External Sensors Power Output: 20 Vdc ±10% @ 75 mA maximum

VAV Operating & Storage Temperature Ambient Rating
(models CP-VL6436A and CP-VL6438N):
Minimum 32° F (0° C); Maximum 122° F (50° C)
Unitary Operating & Storage Temperature Ambient Rating
(model CP-UL6438):
Minimum -40° F (-40° C); Maximum 150° F (66° C)
Relative Humidity: 5% to 95% non-condensing

Velocity Pressure Sensor (models CP-VL6436A and CP-VL6438N only)
Operating Range: 0 to 1.5 in. H2O (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 CP-VL6436A only)
Rotation Stroke: 95° ± 3° for CW or CCW opening dampers
Torque Rating: 44 lb-in. (5 N•m)
Run Time for 90° rotation: 90 seconds at 60 Hz
Operating Temperature: -4 to 140° F (-20 to 60° C)

Real Time Clock
Operating Range: 24 hour, 365 day, multi-year calendar including day of week and configuration for automatic daylight 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)

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, and 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 circuit specifications:

<table>
<thead>
<tr>
<th>Input Type</th>
<th>Sensor Type</th>
<th>Operating Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Room/Zone</td>
<td>20K Ohm NTC</td>
<td>-40° to 199° F</td>
</tr>
<tr>
<td></td>
<td>C7031G</td>
<td>(-40° to 93° C)</td>
</tr>
<tr>
<td>Discharge Air</td>
<td>C7041F a</td>
<td>-40° to 120°F</td>
</tr>
<tr>
<td>Outdoor Air</td>
<td>C7041F</td>
<td>(-40° to 49°C)</td>
</tr>
<tr>
<td>Temperature</td>
<td>PT1000 (IIEC751 3850)</td>
<td>-40° to 199°F</td>
</tr>
<tr>
<td></td>
<td>T7770</td>
<td>(-40° to 93° C)</td>
</tr>
</tbody>
</table>

Resistive Input
Generic
100 Ohms to 100K Ohms

Voltage Input
Transducer, Controller
0 - 10 Vdc

Discrete Input
Dry Contact closure
Open Circuit 3000ohms
Closed Circuit  < 3000ohms

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

BEFORE INSTALLATION

The controller is available in three models (See Table 1).

Review the power, input, and output specifications on page 2 before installing the controller.

— Hardware driven by the Triac outputs must have a minimum current draw, when energized, of 25 mA and a maximum current draw of 500 mA.
— Hardware driven by the analog current outputs must have a maximum resistance of 550 Ohms, resulting in a maximum voltage of 11 volts when driven at 20 mA.
If resistance exceeds 550 Ohms, voltages up to 18 Vdc are possible at the analog output terminal.
**WARNING**

Electrical Shock Hazard. 
Can cause severe injury, death or property damage. 
Disconnect power supply before beginning wiring or making wiring connections to prevent electrical shock or equipment damage.

**INSTALLATION**

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 (Refer to Fig. 14 on page 13).

The controller may be mounted in any orientation.

**IMPORTANT**

Avoid mounting in areas where acid fumes or other deteriorating vapors can attack the metal parts of the controller, or in areas where escaping gas or other explosive vapors are present. Refer to Figures 4 and 5 on page 5 for mounting dimensions.

For the CP-VL6436A model only, the actuator is mounted first and then the controller is mounted. For the other models, go to “Mount Controller” on page 5 to begin the installation.

**Mount Actuator Onto Damper Shaft**

(CP-VL6436A only)

The CP-VL6436A 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 N•m) 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).

The two mechanical end-limit set screws control the amount of rotation from 12° to 95°. These set screws must be securely fastened in place. To ensure tight closing of the damper, the shaft adapter has a total rotation stroke of 95° (See Fig. 1).

**NOTE:** The actuator is shipped with the mechanical end-limit set screws set to 95 degrees of rotation. Adjust the two set screws closer together to reduce the rotation travel. Each “hash mark” indicator on the bracket represents approximately 6.5° of rotation per side.

The Declutch button, when pressed, allows you to rotate the universal shaft adapter (See Fig. 1).

**IMPORTANT**

Determine the damper rotation and opening angle prior to installation. See Fig. 2 and Refer to Fig. 3 on page 4 for examples.

**Before Mounting Actuator Onto Damper Shaft**

(CP-VL6436A only)

Tools required:

- Phillips #2 screwdriver - end-limit set screw adjustment
- 8 mm wrench - centering clamp

Before mounting the actuator onto the VAV box damper shaft, determine the following:

1. Determine the damper shaft diameter. It must be between 3/8 in. to 1/2 in. (10 to 13 mm).
2. Determine the length of the damper shaft. If the length of the VAV box damper shaft is less than 1-9/16 in. (40 mm), the actuator cannot be used.
3. Determine the direction the damper shaft rotates to open the damper (CW or CCW); see Fig. 3. Typically, there is an etched line on the end of the damper shaft that indicates the position of the damper. In Fig. 2 on page 3, the indicator shows the damper open in a CW direction.
4. Determine the damper full opening angle (45, 60, or 90 degrees). In Fig. 2, the damper is open to its full open position of 90 degrees.

![Fig. 2. Damper Opening Direction]

**Fig. 2. Damper Opening Direction**

**Mounting Actuator Onto Damper Shaft (CP-VL6436A only)**

The unit is shipped with the actuator set to rotate open in the clockwise (CW) direction to a full 95 degrees. The extra 5 degrees ensures a full opening range for a 90 degree damper. The installation procedure varies depending on the damper opening direction and angle:

1. If the damper rotates clockwise (CW) to open, and the angle of the damper open-to-closed is 90 degrees:
   a. Manually open the damper fully (rotate counterclockwise).
   b. Using the Declutch button, rotate the universal shaft adapter fully clockwise.
   c. Mount the actuator to the VAV damper box and shaft.
   d. Tighten the two bolts on the centering clamp 8 mm wrench; 70.8-88.5 lb-in. (8-10 N•m) torque. When the actuator closes, the damper rotates CW 90 degrees to fully close.

2. If the damper rotates clockwise (CW) to open, and the angle of the damper open-to-closed is 45 or 60 degrees:
   a. Manually open the damper fully (rotate clockwise).
   b. The actuator is shipped with the mechanical end-limits set at 95 degrees. Adjust the two mechanical end-limit set screws to provide the desired amount of rotation. Adjust the two set screws closer together to reduce the rotation travel.
   c. Tighten the two mechanical end-limit screws Phillips #2 screwdriver; 26.5-31 lb-in. (3.0-3.5 N•m) torque.
   d. Using the Declutch button, rotate the universal shaft adapter fully counter-clockwise.
   e. Mount the actuator to the VAV damper box and shaft.
   f. Tighten the two bolts on the centering clamp 8 mm wrench; 70.8-88.5 lb-in. (8-10 N•m) torque.
   g. When the actuator closes, the damper rotates CW either 45 or 60 degrees to fully close.

3. If the damper rotates counterclockwise (CCW) to open, and the angle of the damper open-to-closed is 90 degrees:
   a. Manually open the damper fully (rotate counter clockwise).
   b. Using the Declutch button, rotate the universal shaft adapter fully counterclockwise.
   c. Mount the actuator to the damper box and shaft.
   d. Tighten the two bolts on the centering clamp 8 mm wrench; 70.8-88.5 lb-in. (8-10 N•m) torque. When the actuator closes, the damper rotates CW 90 degrees to fully close.

4. If the damper rotates counterclockwise (CCW) to open, and the angle of the damper open-to-closed is 45 or 60 degrees:
   a. Manually open the damper fully (rotate counterclockwise).
   b. The actuator is shipped with the mechanical end-limits set at 95 degrees. Adjust the two mechanical end-limit set screws to provide the desired amount of rotation. Adjust the two set screws closer together to reduce the rotation travel.
   c. Tighten the two mechanical end-limit screws Phillips #2 screwdriver; 26.5-31 lb-in. (3.0-3.5 N•m) torque.
   d. Using the Declutch button, rotate the universal shaft adapter fully counter-clockwise.
   e. Mount the actuator to the VAV damper box and shaft.
   f. Tighten the two bolts on the centering clamp 8 mm wrench; 70.8-88.5 lb-in. (8-10 N•m) torque.
   g. When the actuator closes, the damper rotates CW either 45 or 60 degrees to fully close.

**IMPORTANT**

Special precautions must be taken for dampers that open in a CCW direction. The actuator is shipped with its rotation direction set to CW to Open, which applies to the damper direction in steps 1 and 2 above. If the damper shaft rotates in the CCW direction to open, the controller software must be programmed to change the rotation to "Reverse to Open," which applies to the damper direction in steps 3 and 4 above.

It is advisable to leave the dampers in an open position after installation to avoid the possibility of over-pressurizing the duct work on fan startup. Use the Declutch button (see Fig. 1 on page 3) to open the box damper on controllers that are powered down, to prevent over-pressurization in the duct work on fan startup. To Declutch, press and hold the button to disengage the motor. Turn the damper shaft until the damper is open and release the button. When power is restored to the controller, the controller synchronizes the damper actuator, so that the damper is in the correct position upon startup.

**Mount Controller**

**NOTE:** The controller may be wired before mounting to a panel or DIN rail.

Terminal blocks are used to make all wiring connections to the controller. Attach all wiring to the appropriate terminal blocks. Refer to “Wiring” on page 9.

Refer to Figures 4 and 5 for panel mounting dimensions. Refer to Fig. 6 on page 6 for DIN rail mounting.
Panel Mounting

The controller enclosure is constructed of a plastic base plate and a plastic factory-snap-on cover.

NOTE: The controller is designed so that the cover does not need to be removed from the base plate for either mounting or wiring.

The controller mounts using four screws inserted through the corners of the base plate. Fasten securely with four No. 6 or No. 8 machine or sheet metal screws.

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.

DIN Rail Mounting (CP-VL6438N and CP-UL6438 Only)

To mount the CP-VL6438N or CP-UL6438 controller on a DIN rail [standard EN50022; 1-3/8 in. x 9/32 in. (7.5 mm x 35 mm)], refer to Fig. 6 and perform the following steps:

1. Holding the controller with its top tilted in towards the DIN rail, hook the two top tabs on the back of the controller onto the top of the DIN rail.
2. Push down and in to snap the two bottom flex connectors of the controller onto the DIN rail.

IMPORTANT

To remove the controller from the DIN rail, perform the following:

1. Push straight up from the bottom to release the top tabs.
2. Rotate the top of the controller out towards you and pull the controller down and away from the DIN rail to release the bottom flex connectors.
Piping (CP-VL6436A and CP-VL6438N only)

Air flow Pickup
For CP-VL6436A and CP-VL6438N only, connect the air flow pickup to the two restrictor ports on the controller. Refer to Fig. 7 on page 7.

NOTES:
- Use 1/4 inch (6 mm) outside diameter, with a 0.040 in. (1 mm) wall thickness, plenum-rated 1219 FR (94V-2) tubing.
- Always use a fresh cut on the end of the tubing that connects to the air flow pickups and the restrictor ports on the controller.

Connect the high pressure or upstream tube to the plastic restrictor port labeled (+), and the low pressure or downstream tube to the restrictor port labeled (-). Refer to labeling in Fig. 7. When twin tubing is used from the pickup, split the pickup tubing a short length to accommodate the connections.

NOTES:
- If controllers are mounted in unusually dusty or dirty environments, an inline, 5-micron disposable air filter\(^a\) is recommended for the high pressure line (marked as +) connected to the air flow pickup.
- The tubing from the air flow pickup to the controller should not exceed three feet (0.914 m). Any length greater than this will degrade the flow sensing accuracy.
- Use caution when removing tubing from a connector. Always pull straight away from the connector or use diagonal cutters to cut the edge of the tubing attached to the connector. Never remove by pulling at an angle.

\(^a\) Use 5-micron filters compatible with pneumatic controls.
Power

Before wiring the controller, determine the input and output device requirements for each controller used in the system. Select input and output devices compatible with the controller and the application. Consider the operating range, wiring requirements, and the environment conditions when selecting input/output devices. When selecting actuators for modulating applications consider using floating control. In direct digital control applications, floating actuators will generally provide control action equal to or better than an analog input actuator for lower cost.

Determine the location of controllers, sensors, actuators and other input/output devices and create wiring diagrams. Refer to Figures 15 through 21 beginning on page 15 for illustrations of typical controller wiring for various configurations.

The application engineer must review the control job requirements. This includes the sequences of operation for the controller, and for the system as a whole. Usually, there are variables that must be passed between the controller and other Excel 10 controller(s) that are required for optimum system wide operation. Typical examples are the TOD, Occ/Unocc signal, the outdoor air temperature, the demand limit control signal, and the smoke control mode signal.

It is important to understand these interrelationships early in the job engineering process, to ensure proper implementation when configuring the controllers. Refer to the controller Application Guides.

Power Budget

A power budget must be calculated for each device to determine the required transformer size for proper operation. A power budget is simply the summing of the maximum power draw ratings (in VA) of all the devices to be controlled. This includes the controller itself and any devices powered from the controller, such as equipment actuators (ML6161 or other motors) and various contactors and transducers.

**IMPORTANT**

- If a controller is used on Heating and Cooling Equipment (UL 1995, U.S. only) and transformer primary power is more than 150 volts, connect the transformer secondary common to earth ground. Refer to Fig. 10 on page 10.
- When multiple controllers operate from a single transformer, connect the same side of the transformer secondary to the same power input terminal in each device. The earth ground terminal (terminal 3) must be connected to a verified earth ground for each controller in the group. Refer to Fig. 11 on page 10.

**POWER BUDGET CALCULATION EXAMPLE**

Table 3 is an example of a power budget calculation for a typical CP-VL6436ACP-VL6436A controller. While the example is shown for a CP-VL6436A, the process is applicable for all controller models.

<table>
<thead>
<tr>
<th>Device</th>
<th>VA Information</th>
<th>Obtained From</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP-VL6436A Controller (includes Series 60 Floating Damper Actuator)</td>
<td>21.0</td>
<td>See “SPECIFICATIONS” on page 2.</td>
</tr>
<tr>
<td>R8242A Contactor fan rating</td>
<td>21.0</td>
<td>TRADELINE® Catalog inrush rating</td>
</tr>
<tr>
<td>D/X Stages</td>
<td>0.0</td>
<td>For example, assume cooling stage outputs are wired into a compressor control circuit and have no impact on the budget.</td>
</tr>
<tr>
<td>M6410A Steam Heating Coil Valve</td>
<td>0.7</td>
<td>TRADELINE Catalog, 0.32A 24 Vac</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>42.7</strong></td>
<td></td>
</tr>
</tbody>
</table>

The system example above requires 42.7 VA of peak power. Therefore, a 100 VA AT92A transformer could be used to power one controller of this type. Because the total peak power is less than 50 VA, this same transformer could be used to power two of these controllers and meet NEC Class 2 restrictions (no greater than 100 VA).

Refer to Figures 9 through 11 on page 10 for illustrations of controller power wiring. Refer to Table 4 for VA ratings of various devices.
Table 4. Ratings for Transformer Sizing.

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
<th>VA</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP-VL6436A</td>
<td>Controller and Actuator</td>
<td>21.0</td>
</tr>
<tr>
<td>or CP-VL6438N or CP-UL6438</td>
<td></td>
<td>20.0</td>
</tr>
<tr>
<td>ML6161</td>
<td>Damper Actuator, 35 lb-in.</td>
<td>2.2</td>
</tr>
<tr>
<td>R8242A</td>
<td>Contactor</td>
<td>21.0</td>
</tr>
<tr>
<td>R6410A</td>
<td>Valve Actuator</td>
<td>0.7</td>
</tr>
<tr>
<td>ML684</td>
<td>Versadrive Valve Actuator</td>
<td>12.0</td>
</tr>
<tr>
<td>ML6464</td>
<td>Damper Actuator, 66 lb-in.</td>
<td>3.0</td>
</tr>
<tr>
<td>ML6474</td>
<td>Damper Actuator, 132 lb-in.</td>
<td>3.0</td>
</tr>
<tr>
<td>ML6185</td>
<td>Damper Actuator SR 50 lb-in.</td>
<td>12.0</td>
</tr>
</tbody>
</table>

For contactors and similar devices, the in-rush power ratings should be used as the worst case values when performing power budget calculations. Also, the application engineer must consider the possible combinations of simultaneously energized outputs and calculate the VA ratings accordingly. The worst case, which uses the largest possible VA load, should be determined when sizing the transformer.

Each controller requires 24 Vac power from an energy-limited Class II power source. To conform to Class II restrictions (U.S. only), transformers must not be larger than 100 VA. A single transformer can power more than one controller.

GUIDELINES FOR POWER WIRING ARE AS FOLLOWS:

1. Use a larger transformer. For example, if an 80 VA model is used, an output of 24.4 volts, minus the four volt line-loss, supplies 20.4V to the controller. Refer to Fig. 8 on page 9. Although acceptable, the four-volt line-loss in this example is higher than recommended.

2. Use heavier gauge wire for the power run. 14 AWG (2.0 sq mm) wire has a resistance of 2.57 ohms per 1,000 ft. Using the preceding formula results in a line-loss of only 1.56 volts (compared with 4.02 volts). This would allow a 40 VA transformer to be used. 14 AWG (2.0 sq mm) wire is the recommended wire size for 24 Vac wiring.

3. Locate the transformer closer to the controller. This reduces the length of the wire run, and the line-loss. The output wiring is also important in the case of the output wiring connected to the Triac digital outputs. The same formula and method are used. Keep all power and output wire runs as short as practical. When necessary, use heavier gauge wire, a bigger transformer, or install the transformer closer to the controller.

Line-Loss

Controllers must receive a minimum supply voltage of 20 Vac. If long power or output wire runs are required, a voltage drop due to Ohms Law (I x R) line-loss must be considered. This line-loss can result in a significant increase in total power required and thereby affect transformer sizing. The following example is an I x R line-loss calculation for a 200 ft. (61m) run from the transformer to a controller drawing 37 VA and using two 18 AWG (1.0 sq mm) wires.

The formula is:

\[ \text{Loss} = [\text{length of round-trip wire run (ft.)} \times \text{resistance in wire (ohms per ft.)}] \times [\text{current in wire (amperes)}] \]

From specification data:

18 AWG twisted pair wire has a resistance of 6.52 ohms per 1000 feet.

\[ \text{Loss} = [(400 \text{ ft.}) \times (6.52/1000 \text{ ohms per ft.})] \times [(37 \text{ VA})/(24\text{V})] = 4.02 \text{ volts} \]

This means that four volts are going to be lost between the transformer and the controller. To assure the controller receives at least 20 volts, the transformer must output more than 24 volts. Because all transformer output voltage levels depend on the size of the connected load, a larger transformer outputs a higher voltage than a smaller one for a given load. Fig. 8 on page 9 shows this voltage load dependence.

In the preceding I x R loss example, even though the controller load is only 37 VA, a standard 40 VA transformer is not sufficient due to the line-loss. Looking at Fig. 8 on page 9, a 40 VA transformer is just under 100 percent loaded (for the 37 VA controller) and has a secondary voltage of 22.9 volts. (Use the lower edge of the shaded zone in Fig. 8 that represents the worst case conditions.) When the I x R loss of four volts is subtracted, only 18.9 volts reaches the controller. This is not enough voltage for proper operation.

In this situation, the engineer has three alternatives:

1. Use a larger transformer. For example, if an 80 VA model is used, an output of 24.4 volts, minus the four volt line-loss, supplies 20.4V to the controller. Refer to Fig. 8 on page 9. Although acceptable, the four-volt line-loss in this example is higher than recommended.

IMPORTANT

No installation should be designed where the line-loss is greater than two volts. This allows for nominal operation if the primary voltage drops to 102 Vac (120 Vac minus 15 percent).

2. Use heavier gauge wire for the power run. 14 AWG (2.0 sq mm) wire has a resistance of 2.57 ohms per 1,000 ft. Using the preceding formula results in a line-loss of only 1.56 volts (compared with 4.02 volts). This would allow a 40 VA transformer to be used. 14 AWG (2.0 sq mm) wire is the recommended wire size for 24 Vac wiring.

3. Locate the transformer closer to the controller. This reduces the length of the wire run, and the line-loss. The output wiring is also important in the case of the output wiring connected to the Triac digital outputs. The same formula and method are used. Keep all power and output wire runs as short as practical. When necessary, use heavier gauge wire, a bigger transformer, or install the transformer closer to the controller.
To meet the National Electrical Manufacturers Association (NEMA) standards, a transformer must stay within the NEMA limits. The chart in Fig. 8 shows the required limits at various loads.

With 100 percent load, the transformer secondary must supply between 23 and 25 volts to meet the NEMA standard. When a purchased transformer meets the NEMA standard DC20-1986, the transformer voltage regulating ability can be considered reliable. Compliance with the NEMA standard is voluntary.

Fig. 8. NEMA Class 2 Transformer Voltage Output Limits.

The Honeywell transformers listed in Table 5 meet the NEMA standard DC20-1986.

Table 5. Transformer Types.

<table>
<thead>
<tr>
<th>Transformer Type</th>
<th>VA Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT40A</td>
<td>40</td>
</tr>
<tr>
<td>AT72D</td>
<td>40</td>
</tr>
<tr>
<td>AT87A</td>
<td>50</td>
</tr>
<tr>
<td>AK3310 Assembly</td>
<td>100</td>
</tr>
</tbody>
</table>

NOTE: The AT88A and AT92A transformer do not meet the voluntary NEMA standard DC20-1986.

Wiring

All wiring must comply with applicable electrical codes and ordinances, or as specified on installation wiring diagrams. Controller wiring is terminated to the screw terminal blocks located on the top and the bottom of the device.

⚠️ WARNING

Electrical Shock Hazard.
Can cause severe injury, death or property damage.
Disconnect power supply before beginning wiring, or making wiring connections, to prevent electrical shock or equipment damage.

NOTES:

— For multiple controllers operating from a single transformer, the same side of the transformer secondary must be connected to the same power input terminal in each controller. (Controller configurations will not necessarily be limited to three devices. But the total power draw, including accessories, can not exceed 100 VA when powered by the same transformer (U.S. only). For power and wiring recommendations Refer to “Power” on page 7. The earth ground terminal (terminal 3) must be connected to a verified earth ground for each controller in the group. Refer to Fig. 11 on page 10.
— All loads on the controller must be powered by the same transformer that powers the controller itself. A controller can use separate transformers for controller power and output power.
— Keep the earth ground connection (terminal 3) wire run as short as possible.
— Do not connect the universal input COM terminals (33, 36, 39), analog output COM terminals (22, 25) or the digital input/output COM terminals (11, 14, 17, 20, 28) to earth ground. Refer to Figures 15 through 20 beginning on page 15 for wiring examples.

The 24 Vac power from an energy limited Class II power source must be provided to the controller. To conform to Class II restrictions (U.S. only), the transformer must not be larger than 100 VA.

Fig. 9 on page 10 depicts a single controller using one transformer.

IMPORTANT

Power must be off prior to connecting to or removing connections from terminals 1, 2, 3, and 31.

Use the heaviest gauge wire available, up to 14 AWG (2.0 sq mm), with a minimum of 18 AWG (1.0 sq mm), for all power and earth ground wiring.

Screw-type terminal blocks are designed to accept up to one 14 AWG (2.0 sq mm) conductor or up to two 18 AWG (1.0 sq mm) conductors. More than two wires that are 18 AWG (2.0 sq mm) can be connected with a wire nut. Include a pigtail with this wire group and attach the pigtail to the terminal block.

If the controller is used on Heating and Cooling Equipment (UL 1995, U.S. only) and the transformer primary power is more than 150 volts, connect terminal 2, (the 24 Vac common (24 VAC COM) terminal) to earth ground, (Refer to Fig. 10). For these applications, only one controller can be powered by each transformer.

NOTE:

— Unswitched 24 Vac power wiring can be run in the same conduit as the LONWORKS cable.
— Maintain at least a 3 in. (7.6 cm) separation between Triac outputs and LONWORKS wiring throughout the installation.
Fig. 9. Power Wiring Details for One Controller per Transformer.

More than one controller can be powered by a single transformer. Fig. 11 shows power wiring details for multiple controllers.

Fig. 10. Transformer Power Wiring Details for One Controller used in UL 1995 Equipment (U.S. only).

NOTE: Controller configurations are not necessarily limited to three devices. But the total power draw, including accessories, cannot exceed 100 VA when powered by the same transformer, U.S. only. For power wiring recommendations, Refer to “Power” on page 7.

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

Honeywell provided cable types for LONWORKS Bus communications wiring are Level IV 22 AWG (0.34 sq mm) plenum or non-plenum rated unsheilded, twisted pair, stranded conductor wire.
- For non-plenum areas, U.S. part AK3798 (single-pair stranded) can be used.
- In 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.

Communications wiring can be run in a conduit, if needed, with non-switched 24 Vac or sensor wiring. If a longer LONWORKS® Bus network is required, a 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.

Pull the cable to each controller on the LONWORKS Bus and connect to the controller’s communication terminals 7 and 8. (Refer to Table 6 on page 12 and Fig. 14 on page 13 for location of terminals 7 and 8.)

NOTE: Connection for operator access to the LONWORKS Bus is provided by plugging the Serial LONTALK® Adapter (SLTA) connector into the LONWORKS Bus jack. (Refer to Fig. 14 on page 13)
**Wiring Method**

**WARNING**

Electrical Shock Hazard.  
Can cause severe injury, death or property damage.  
Disconnect power supply before beginning wiring, or making wiring connections, to prevent electrical shock or equipment damage.

**NOTE:** When attaching two or more wires to the same terminal, other than 14 AWG (2.0 sq mm), be sure to twist them together.  Deviation from this rule can result in improper electrical contact (See Fig. 13).

Each terminal can accommodate the following gauges of wire:

- Single wire: from 22 AWG to 14 AWG solid or stranded
- Multiple wires: up to two 18 AWG stranded, with 1/4 watt wire-wound resistor

---

**IMPORTANT**

Notes on Communications Wiring:

- All field wiring must conform to local codes and ordinances (or as specified on installation drawings).
- Do not bundle device output wires with sensor, digital input or communications LONWORKS Bus wires.
- Do not use different wire types or gauges on the same LONWORKS Bus segment. The step change in line impedance characteristics causes unpredictable reflections on the LONWORKS Bus.
- In noisy (high EMI) environments, avoid wire runs parallel to noisy power cables, motor control centers, or lines containing lighting dimmer switches.  Keep at least 3 in. (76 mm) of separation between noisy lines and the LONWORKS Bus cable.
- The theoretical limit for each LONWORKS Bus segment is 60 controllers.  Up to 120 controllers can be configured when 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.
- The singly terminated bus must have one 209541B Excel 10 FTT Termination Module for T tap or Star configurations.
- The doubly terminated bus must have two 209541B Excel 10 FTT Termination Modules, one at each end of the daisy chain (Bus style) wiring run.  Note that the Q7751A,B router (configured as a repeater) has onboard terminating networks that can be jumper-selected on each segment.
- Make sure that neither of the LONWORKS Bus wires are grounded.

**NOTE:** If a 209541B Termination Module is required at the controller, connect two of the three termination module wires to the LONWORKS Bus terminals 7 and 8, which are labeled Net-1 and Net-2 on the controller. Selecting the appropriate two wires depends on the LONWORKS Bus network topology.  Refer to the “LONWORKS Bus Wiring Guidelines,” form 74-2865, and the “Excel 10 FTT Termination Module Installation Instructions,” form 95-7554.  For example, on a doubly terminated daisy-chained bus topology, where controllers are on either end of an LONWORKS Bus wire run, mount the termination module on the appropriate terminals, as shown in Fig. 12.

---

**Fig. 12.** Termination Modules (LONWORKS Daisy Chain Connections).
Prepare wiring for the terminal blocks, as follows:
1. Strip 1/2 in. (13 mm) insulation from the conductor.
2. Cut a single wire to 3/16 in. (5 mm). Insert the wire in the required terminal location and tighten the screw.
3. If two or more wires are being inserted into one terminal location, twist the wires together a minimum of three turns before inserting them (See Fig. 13).
4. Cut the twisted end of the wires to 3/16 in. (5 mm) before inserting them into the terminal and tightening the screw.
5. Pull on each wire in all terminals to check for good mechanical connection.

![Diagram of terminal block connections](image)

Fig. 13. Attaching Two or More Wires at Terminal Blocks.

Wiring Details
Each controller is shipped with the digital outputs, which switch the 24 Vac to the load (High Side).

The three analog outputs (AO) are used to control modulating heating, cooling and economizer equipment. Any AO may be used as a digital output, as follows:
- False (0%) produces 0 Vdc, (0 mA).
- True (100%) produces the maximum 11 Vdc (22 mA).

The wiring connection terminals described in Fig. 6 are shown in Fig. 14 on page 13.

Table 6. Description of Wiring Terminal Connections.

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Label</th>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>24 Vac</td>
<td>24 Vac Power</td>
</tr>
<tr>
<td>2</td>
<td>24 Vac COM</td>
<td>24 Vac Power</td>
</tr>
<tr>
<td>3</td>
<td>EGND</td>
<td>Earth Ground</td>
</tr>
<tr>
<td>4</td>
<td>SHLD</td>
<td>Shield</td>
</tr>
<tr>
<td>5</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Not used</td>
<td></td>
</tr>
</tbody>
</table>

Table 6. Description of Wiring Terminal Connections. (Continued)

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Label</th>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>NET-1</td>
<td>LONWORKS communications</td>
</tr>
<tr>
<td>8</td>
<td>NET-2</td>
<td>LONWORKS communications</td>
</tr>
<tr>
<td>9</td>
<td>DO-1</td>
<td>Digital Output</td>
</tr>
<tr>
<td>10</td>
<td>DO-2</td>
<td>Digital Output</td>
</tr>
<tr>
<td>11</td>
<td>COM</td>
<td>Common</td>
</tr>
<tr>
<td>12</td>
<td>DO-3</td>
<td>Digital Output</td>
</tr>
<tr>
<td>13</td>
<td>DO-4</td>
<td>Digital Output</td>
</tr>
<tr>
<td>14</td>
<td>COM</td>
<td>Common</td>
</tr>
<tr>
<td>15</td>
<td>DO-5</td>
<td>Digital Output</td>
</tr>
<tr>
<td>16</td>
<td>DO-6</td>
<td>Digital Output</td>
</tr>
<tr>
<td>17</td>
<td>COM</td>
<td>Common</td>
</tr>
<tr>
<td>18</td>
<td>DO-7</td>
<td>Digital Output</td>
</tr>
<tr>
<td>19</td>
<td>DO-8</td>
<td>Digital Output</td>
</tr>
<tr>
<td>20</td>
<td>COM</td>
<td>Common</td>
</tr>
</tbody>
</table>

ANALOG OUTPUTS

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Label</th>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>AO-1</td>
<td>Analog Output</td>
</tr>
<tr>
<td>22</td>
<td>COM</td>
<td>Common</td>
</tr>
<tr>
<td>23</td>
<td>AO-2</td>
<td>Analog Output</td>
</tr>
<tr>
<td>24</td>
<td>AO-3</td>
<td>Analog Output</td>
</tr>
<tr>
<td>25</td>
<td>COM</td>
<td>Common</td>
</tr>
</tbody>
</table>

DIGITAL INPUTS

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Label</th>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>DI-1</td>
<td>Digital Input</td>
</tr>
<tr>
<td>27</td>
<td>DI-2</td>
<td>Digital Input</td>
</tr>
<tr>
<td>28</td>
<td>COM</td>
<td>Common</td>
</tr>
<tr>
<td>29</td>
<td>DI-3</td>
<td>Digital Input</td>
</tr>
<tr>
<td>30</td>
<td>DI-4</td>
<td>Digital Input</td>
</tr>
</tbody>
</table>

ATTACHED DEVICE(S) POWER

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Label</th>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>31</td>
<td>20 Vdc</td>
<td>20 Vdc Power</td>
</tr>
</tbody>
</table>

UNIVERSAL INPUTS

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Label</th>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
<td>UI-1</td>
<td>Universal Input</td>
</tr>
<tr>
<td>33</td>
<td>COM</td>
<td>Common</td>
</tr>
<tr>
<td>34</td>
<td>UI-2</td>
<td>Universal Input</td>
</tr>
<tr>
<td>35</td>
<td>UI-3</td>
<td>Universal Input</td>
</tr>
<tr>
<td>36</td>
<td>COM</td>
<td>Common</td>
</tr>
<tr>
<td>37</td>
<td>UI-4</td>
<td>Universal Input</td>
</tr>
<tr>
<td>38</td>
<td>UI-5</td>
<td>Universal Input</td>
</tr>
<tr>
<td>39</td>
<td>COM</td>
<td>Common</td>
</tr>
<tr>
<td>40</td>
<td>UI-6</td>
<td>Universal Input</td>
</tr>
</tbody>
</table>

Table 6. Description of Wiring Terminal Connections. (Continued)

a For the CP-VL6436A controller ONLY, terminals 18, 19, and 20 (DO7, DO8, & COM) are not present. The actuator is internally hardwired to these terminals.
b 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)
c Digital inputs: Open circuit = False; Closed circuit = True
**IMPORTANT**

If the controller is not connected to a good earth ground, the controller’s internal transient protection circuitry is compromised and the function of protecting the controller from noise and power line spikes cannot be fulfilled. This could result in a damaged circuit board and require replacement of the controller. Refer to installation diagrams for specific wiring.

**NEURON® SERVICE PIN**

The NEURON Service Pin pushbutton (when pressed) transmits the Service Message to the network, regardless of the controller’s current mode of operation (See Fig. 14).

**CAUTION**

Equipment Damage Hazard. Can cause controller damage or failure. Do not use any metal object to press the NEURON Service Pin. Use a plastic rod or wood device (such as a pencil with the lead broken off) to press the pin. Using a metal object can damage the circuitry of the controller.

**LONWORKS® BUS CONVENIENCE JACK**

The LONWORKS Bus connection is provided by plugging the Serial LONTALK Adapter (SLTA) connector into the LONWORKS Bus Jack. (See Fig. 14)

**Wiring Applications (Examples)**

Figures 15 through 21, beginning on page 15, illustrate typical controller wiring for the following configurations:

- Typical controller wiring for VAV application using the T7770C Wall Module and a C7770A Air Temperature Sensor (Refer to Fig. 15 on page 14).
- Typical controller wiring for VAV application with staged reheat (Refer to Fig. 16 on page 15).
- Typical controller wiring for PWM reheat and PWM peripheral heat valve actuator (Refer to Fig. 17 on page 16).
- Typical controller wiring for AHU application (Refer to Fig. 18 on page 17).
- Typical controller wiring for 4 to 20 mA enthalpy sensors and digital inputs (Refer to Fig. 19 on page 18).
- Typical controller wiring for 4 to 20 mA heating, cooling, and model ML6161 floating motor control (Refer to Fig. 20 on page 19).
- Typical controller wiring for a pneumatic transducer, model RP7517B (Refer to Fig. 21 on page 20).
Fig. 15. Controller Wiring Diagram (Model CP-VL6438N Shown) for Typical VAV Application, Using the T7770C Wall Module and a C7770A Air Temperature Sensor (For Note 2, refer to Fig. 13).

- Earth ground wire length should be held to a minimum. Use the heaviest gauge wire available, up to 14 AWG (2.0 mm²) with a minimum of 18 AWG (1.0 mm²), for earth ground wire.
- To assure proper electrical contact, wires must be twisted together before insertion into the terminal block.
- Contacts must be suitable for dry switching, 5V at 10 mA. Use sealed type, gold flashed or pimpled contacts.
Fig. 16. Controller Wiring Diagram (Model CP-VL6436A Shown) for Typical VAV Application with Staged Reheat
(For Note 2, refer to Fig. 13).
Fig. 17. Controller Wiring Diagram (Model CP-UL6438 Shown) for Typical PWM Reheat and PWM Peripheral Heat Valve Actuator (For Note 2, refer to Fig. 13).

**NOTE:** Make sure to set the Configuration DIP Switch as shown in Fig. 17. Switches 1 through 3 set the timing of the ML7984B valve actuator to match the controller outputs (0.1 second minimum with a maximum time of 25.6 seconds). Switch 4 determines the action of the actuator (Off = Direct Acting, On = Reverse Acting).
Fig. 18. Controller Wiring Diagram (Model CP-UL6438 Shown) for Typical AHU Application (For Note 2, refer to Fig. 13).
Fig. 19. Controller Wiring Diagram (Model CP-UL6438 Shown) with 4 to 20 mA Enthalpy Sensors and Digital Inputs
(For Note 2, refer to Fig. 13).
Fig. 20. Controller Wiring Diagram (Model CP-UL6438 Shown) with 4 to 20 mA Heating, Cooling, and Model ML6161 Damper Actuator (For Note 2, refer to Fig. 13).
CHECKOUT

Step 1. Check Installation and Wiring
Inspect all wiring connections at the controller terminals, and verify compliance with installation wiring diagrams. If any wiring changes are required, first be sure to remove power from the controller before starting work. Pay particular attention to:

- 24 Vac power connections. Verify that multiple controllers being powered by the same transformer are wired with the transformer secondary connected to the same input terminal numbers on each controller. Use a meter to measure 24 Vac at the appropriate terminals. Refer to Fig. 11 on page 10. (Controller configurations are not necessarily limited to three devices, but the total power draw, including accessories, cannot exceed 100 VA when powered by the same transformer (U.S. only).

- Be sure that each controller has terminal 3 wired to a verified earth ground, using a wire run as short as possible with the heaviest gauge wire available, up to 14 AWG (2.0 sq mm) for each controller in the group. See Fig. 11 on page 10.

- Verify that Triac wiring of the digital outputs to external devices use the proper load power and 24 Vac common terminal (terminals 11, 14, 17, and 20) for High-Side switching.

NOTE: All wiring must comply with applicable electrical codes and ordinances or as specified on installation wiring diagrams.

For guidelines for wiring run lengths and power budget, Refer to “Power” on page 7.

VERIFY TERMINATION MODULE PLACEMENT (MULTIPLE CONTROLLERS ONLY)
The installation wiring diagrams should indicate the locations for placement of the 209541B Termination Module(s). Refer to Fig. 12 on page 11 and refer to the “LonWorks Bus Wiring Guidelines,” form 74-2865, and the “Excel 10 FTT Termination Module Installation Instructions,” form 95-7554.

Correct placement of the termination module(s) are required for proper LonWorks Bus communications.

Step 2. Startup
Refer to Fig. 22 and the following text for startup information.

BROADCAST THE SERVICE MESSAGE
The Service Message allows a device on the LonWorks Bus to be positively identified. The Service Message contains the controller’s Neuron ID number and node type. This is used to confirm the physical location of a particular Excel 10 device in a building.

- To send the Service Message from the controller, press the NEURON Service Pin pushbutton on the controller (See Fig. 22). This button sends out the Service Message when it is pressed, regardless of the controller’s current mode of operation.

CAUTION
Equipment Damage Hazard.
Can cause controller damage or failure.
Do not use any metal object to press the NEURON Service Pin. Use a plastic rod or wood device (such as a pencil with the lead broken off) to press the pin. Using a metal object can damage the circuitry of the controller.
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 7

<table>
<thead>
<tr>
<th>LED State</th>
<th>Blink Rate</th>
<th>Status or Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>not applicable</td>
<td>No power to processor, LED damaged, low voltage to board, or controller damaged.</td>
</tr>
<tr>
<td>ON</td>
<td>ON steady; not blinking</td>
<td>Processor and/or controller is not operating.</td>
</tr>
<tr>
<td>Very Slow Blink</td>
<td>1 second ON, 1 second OFF</td>
<td>Controller is operating normally.</td>
</tr>
<tr>
<td>Slow Blink</td>
<td>0.5 second ON, 0.5 second OFF</td>
<td>Controller alarm is active, controller in process of download, or controller lost its configuration.</td>
</tr>
<tr>
<td>Medium Blink</td>
<td>0.25 second ON, 0.25 second OFF</td>
<td>Controller firmware is loading.</td>
</tr>
<tr>
<td>Fast Blink</td>
<td>0.10 second ON, 0.10 second OFF</td>
<td>Controller is in manual mode under control of the PC-based software tool.</td>
</tr>
</tbody>
</table>

Step 3. Checkout Completion
At this point the controller is installed and powered. To complete the checkout, the NIAGARA FRAMEWORK® application (run on a PC) is used to configure the I/O and functions of the controller. Refer to the Programming Tool User Guide, form no. 74-4042, for controller configuration and programming details.

CONTROLLER REPLACEMENT

There are no serviceable or repairable parts inside the controller.

WARNING
Fire, Explosion, or Electrical Shock Hazard.
Can cause severe injury, death or property damage.
Do not attempt to modify the physical or electrical characteristics of this device in any way. Replace it if troubleshooting indicates a malfunction.

Disconnect power supply before beginning controller replacement to prevent electrical shock or equipment damage.

Terminal Block Removal
To simplify controller replacement, all terminal blocks are designed to be removed with the wiring connections intact and then re-installed on the new controller. See Fig. 23 and refer to the following procedure:

Controller Replacement (CP-VL6436A only)
For CP-VL6436A controllers, which are hard-wired to an actuator, perform the following to replace the complete assembly (controller and actuator):

1. Remove all power from the controller.
2. Remove the two air flow pickup connections from the pressure sensor.
4. Remove the old controller and actuator assembly from its mounting.
   a. Loosen the two bolts on the actuator clamp to release the actuator from the shaft.
   b. Remove the controller’s mounting screws.
   c. Gently pull the controller and actuator assembly straight out, until the assembly is clear of the actuator shaft.
5. Mount the new controller and actuator assembly. Refer to “Installation” on page 3.
6. Reconnect the two air flow pickup tubes to the pressure sensor.
   a. Refer to “Piping (CP-VL6436A and CP-VL6438N only)” on page 6.
7. Replace the terminal blocks:
   • Insert each terminal block onto its alignment pins.
   • Press straight down to firmly seat it.
   • Repeat for each terminal block.
8. Restore power to the controller.

Controller Replacement (CP-VL6438N only)
Perform the following to replace the CP-VL6438N controller:
1. Remove all power from the controller.
2. Remove the two air flow pickup connections from the pressure sensor.
4. Remove the old controller from its mounting.

IMPORTANT
(FOR CONTROLLERS MOUNTED TO A DIN RAIL):
1. Push straight up from the bottom to release the top pins.
2. Rotate the top of the controller outwards to release the bottom flex connectors (Refer to Fig. 6 on page 6).
3. Mount the new controller. Refer to “INSTALLATION” on page 3.
4. Reconnect the two air flow pickup tubes to the pressure sensor.
   • Refer to “Piping (CP-VL6436A and CP-VL6438N only)” on page 6.

Controller Replacement (CP-UL6438 only)
Perform the following to replace the CP-UL6438 controller:
1. Remove all power from the controller.
2. Remove the terminal blocks. Refer to “Terminal Block Removal” on page 21.
3. Remove the old controller from its mounting.

IMPORTANT
(FOR CONTROLLERS MOUNTED TO A DIN RAIL):
1. Push straight up from the bottom to release the top pins.
2. Rotate the top of the controller outwards to release the bottom flex connectors (Refer to Fig. 6 on page 6).
4. Mount the new controller. Refer to “INSTALLATION” on page 3.
5. Replace the terminal blocks:
   • Insert each terminal block onto its alignment pins.
   • Press straight down to firmly seat it.
   • Repeat for each terminal block.
6. Restore power to the controller.

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