

## Description

The LX Series VAV controllers are tailored for variable air volume (VAV) box applications and are LonMark® certified as Space Comfort Control (SCC) VAV devices. The LX-VAV04060-0 is a configurable and programmable VAV controller designed to control any VAV box. Factory pre-loaded applications allow this controller to operate standard VAV equipment with a proven energy-efficient sequence of operation without the need for programming. The LX-VAVLF-1 and LX-VAVLN-1 are configurable VAV controllers designed to meet the requirements of single duct VAV applications.

**Figure 1: LX-VAV04060-0 Controller**



## Features and benefits

### Flexible inputs and outputs

Allows multiple signal options to provide input and output flexibility.

### Models with built-in actuator with integrated position feedback

Minimizes installation time by incorporating all control components into a single mountable package. Position feedback reassures users and field technicians of the VAV box damper's actual position and eliminates periodic damper re-initialization.

### Built-in air-flow sensor

Provides precise air-flow monitoring and control at low and high air flow rates, allowing the design for maximum

energy efficiency while maintaining an optimal comfort level.

### LonMark certified

Ensures interoperability with other LonMark devices. LonMark International has independently tested and certified these products.

The following features are specific to the LX-VAV04060-0 model:

### Preloaded applications

Saves field technician's setup time, by enabling them to configure a VAV controller using a standard preloaded application, without the need to custom program an application.

### Fully programmable

Flexibility for technicians to create custom control sequences capable of meeting the most demanding control requirements.

### Highly accurate universal inputs

Freedom to use your preferred or engineer-specified sensors. Support for thermistors and resistance temperature detectors (RTDs) that range from 0 Ω to 350 kΩ, as well as support for inputs that require 0 to 10 VDC or 0 to 20 mA with an external resistor.

### Rugged inputs and outputs

Eliminates the need for external protection components, such as diodes for 12 VDC relays.

### Integrated VAV performance assessment control charts (VPACC) control sequences

Automatically detects when the VAV is operating outside of its design parameters.

### Extended daisy-chaining

Allows for up to 20 VAV controllers or up to 950 feet of wiring to be connected to the same transformer offering an opportunity to save on installation costs.

### Optimized air balancing

Saves field technician's time during commissioning. The flow sensor requires no zero flow calibration, and its variable-speed motor goes to minimum and maximum flow position in half the time of typical VAV actuators.

## LX-VAV04060-0 Model

Factory pre-loaded applications allow this controller, straight out of the box, to operate standard VAV equipment with a proven energy-efficient sequence of operation. This eliminates the need for programming. For rapid deployment select the pre-loaded application using an LN Series Communicating Sensor even before the network has been installed. The LX-VAV04060-0 controller is fully programmable allowing you to create your own control sequences capable of meeting the most demanding control requirements.

### LX-Graphical Programming Interface Wizard

The Johnson Controls Graphical Programming Interface (GPI) wizard is a programming tool that allows you to create control sequences by using a drag-and-drop operation to move block objects and then linking the objects with a simple click, select, and release. Select objects from an extensive library of over 100 commonly used functions; you can also create your own custom blocks. Refer to the *LX Graphical Interface Programming Tool (GPI) Technical Bulletin (LIT-12011489)* for more information.

The GPI Wizard offers these advantages:

- Johnson Controls supplies the wizard as freeware with no associated licensing costs.

- The wizard features live debugging, which allows you to view code execution and input/output values, and to detect errors in real time.
- The wizard contains a code library to manage your favorite or most commonly used code or code sections.

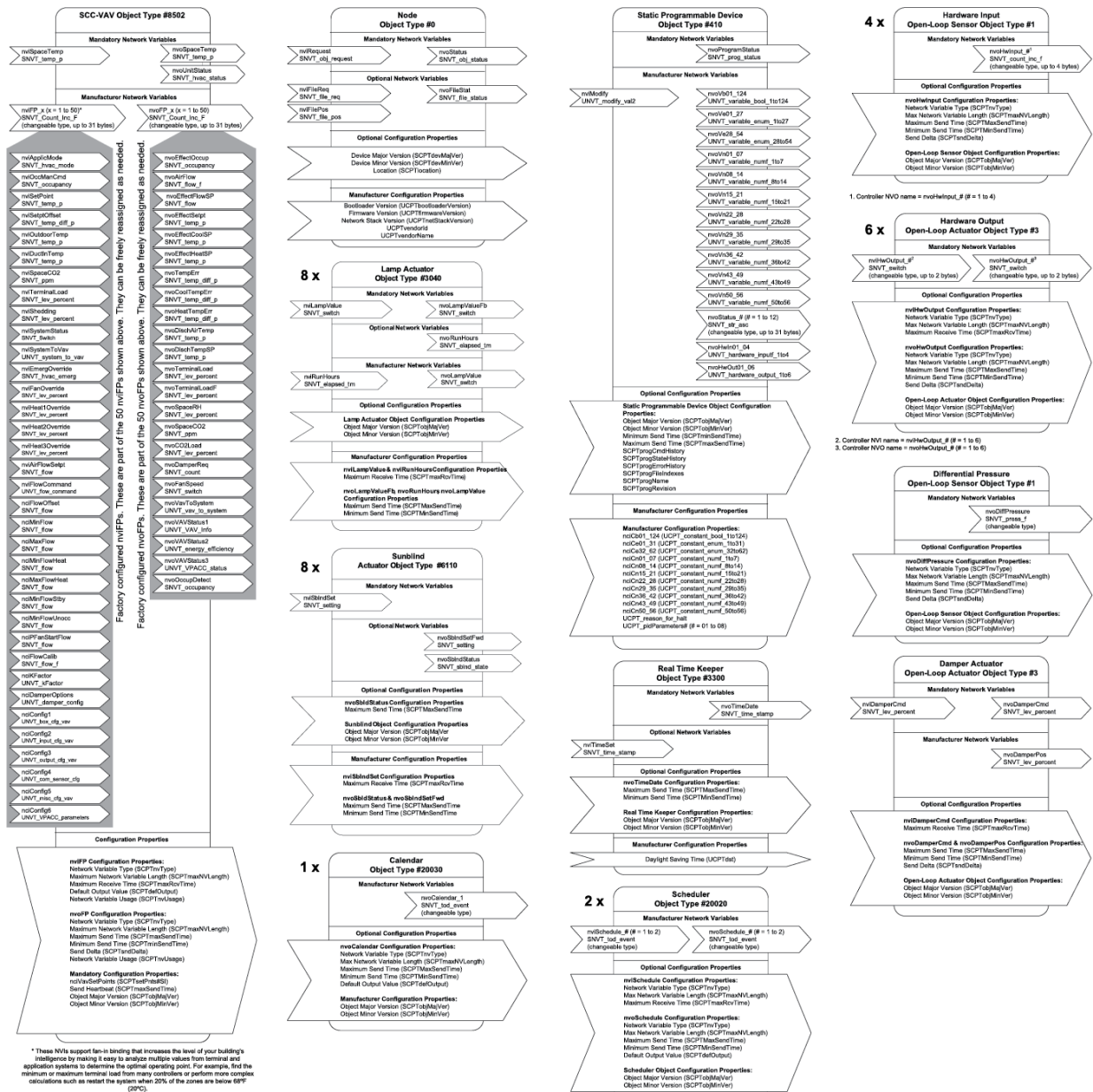
### Configure schedules and holidays

Configure the controller's built-in schedules and holidays directly from the LX GPI wizard with an easy-to-use point, drag, and click interface. It features a weekly schedule for regular repeating events by time-of-day and day-of-week, while a holiday schedule is available to define events for specific days. The LX-VAV04060-0 controller allows you to complete the following actions:

- Configure schedules using a graphical slider.
- Copy and paste entries, and duplicate a schedule entry for Monday to Friday.
- Set exceptions to a schedule, such as holidays, with **Special Events**.
- Set holidays for recurring events such as, for example, the third Thursday of a given month.
- Create a schedule as an effective period during which the schedule is active.
- Create a schedule that provides **Next State** and **Time to Next State** — ideal for use with programming functions such as **Optimum Start** and morning **Warm Up**.

# LonMark® Object and Network Variables

Figure 2: LonMarks objects and network variables for LX-VAV04060-0



## LX-VAVLF-1 and LX-VAVLN-1 models

The LX-VAVLF-1 and LX-VAVLN-1 controllers feature the following input and output capabilities:

- four universal (analog-digital) inputs
- four digital outputs
- two universal control outputs
- six network outputs

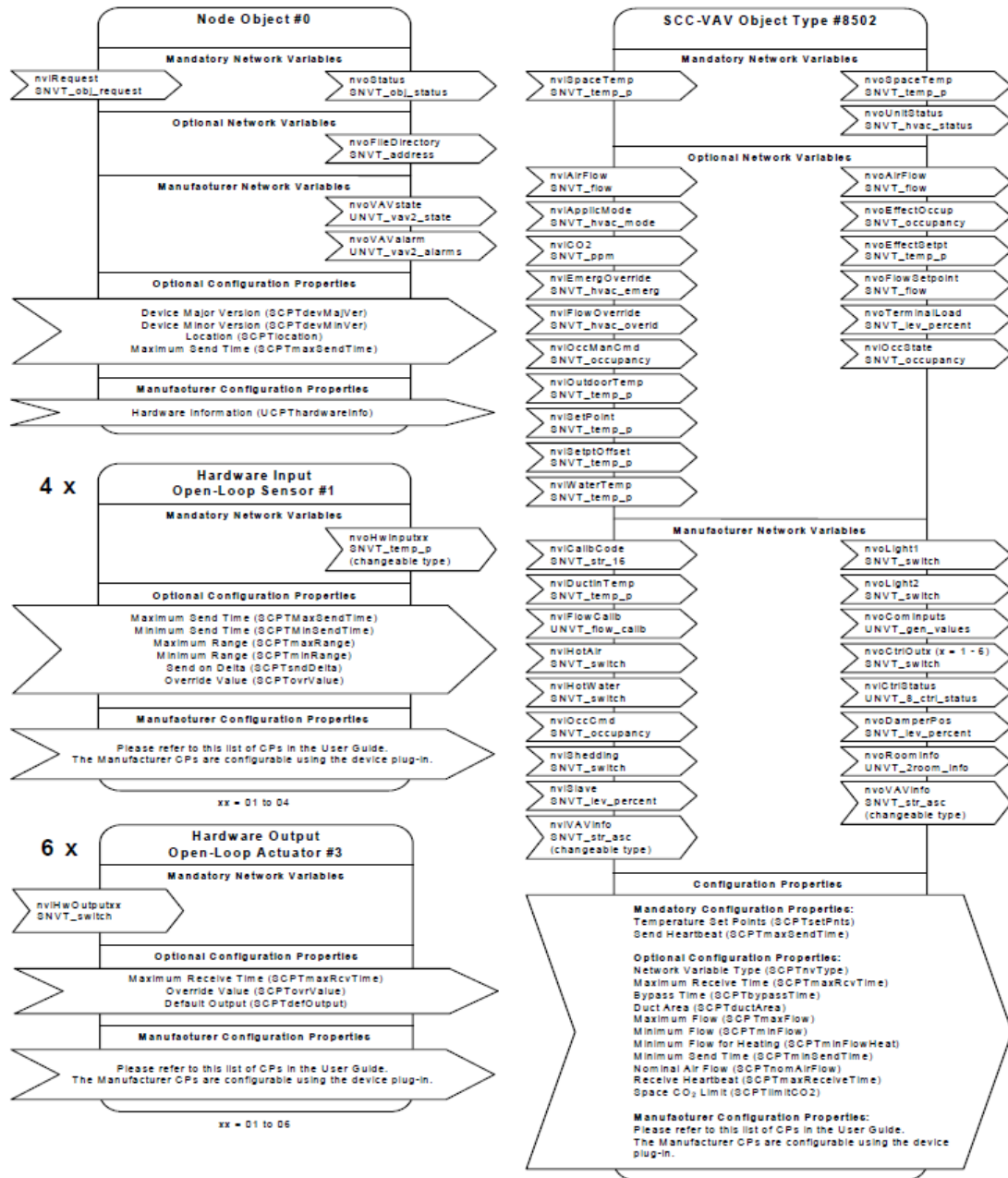
These allow you to simultaneously control eight instances of any type of any HVAC equipment including duct heaters, fans, multi-stage heaters, coolers, analog and floating valve actuators, and lights.

The network outputs are bound to the physical outputs of other controllers on the network. The universal inputs similarly allow for the connection of any HVAC equipment or peripheral. The controller dynamically adapts its sequence of operations based on the connected equipment without any need for user intervention. You can also link spare I/O points to other controllers on the network to allow for efficient control of devices that are close to the LX-VAVLF-1 and LX-VAVLN-1.

The LX-VAVLF-1 has an integrated brushless constant torque actuator, which has a longer life expectancy than standard brushed motors. The 16-bit analog-digital converter provides high accuracy input and flow pressure sensor readings and allows for precise VAV balancing.

# LONMARK® Object and Network Variables

Figure 3: LonMark Objects and Network Variables for LX-VAVLF-1 and LX-VAVLN-1 models



## Model information

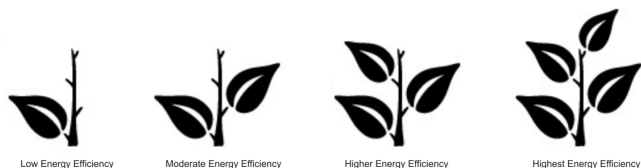
**Table 1: LX-VAV information**

| Controller features          | LX-VAV04060-0 | LX-VAVLF-1   | LX-VAVLN-1   |
|------------------------------|---------------|--------------|--------------|
| Points                       | 10-Point VAV  | 10-Point VAV | 10-Point VAV |
| Universal Inputs             | 4             | 4            | 4            |
| Ability to use spare inputs  | Yes           | Yes          | Yes          |
| Built-in flow Sensor         | Yes           | Yes          | Yes          |
| Digital (triac) Outputs      | 4             | 4            | 4            |
| Universal Outputs            | 2             | 2            | 2            |
| Network Outputs (using NVOs) | 27            | 6            | 6            |
| Ability to use spare outputs | Yes           | Yes          | Yes          |
| Built-in Actuator            | Yes           | Yes          | No           |

## LN Series Communicating Sensors

The LN Series Communicating Sensors feature a backlit display and graphical menus. You can use the sensors as a handheld tool to start VAV commissioning immediately after you install it. Use the sensor to select the appropriate VAV controller application for the VAV box configuration in use, to perform air balancing of the system without requiring an on-site controls engineer, and to troubleshoot the system. The LN Communicating Sensor capabilities include a **Leaf** icon that displays the efficiency of your setpoints.

**Figure 4: Leaf icon**



The LN Series Communicating Sensors are available in two versions:

- The LN-SVSEN-0 room temperature sensor with backlight display, graphic menus, and **Leaf** icon.

## Ordering information

**Table 2: LX-VAV ordering information**

| Code number   | Description  |
|---------------|--|
| LX-VAV04060-0 | Configurable and programmable VAV Controller, built-in actuator with integrated position feedback and air-flow sensor. Includes 10 points (4 Universal Inputs (UIs), 2 Universal Outputs (UOs), and 4 triac Digital Outputs (DOs)) and wizard. |
| LX-VAVLF-1    | Configurable VAV controller, Built-In Actuator with Integrated Position Feedback, and Air Flow Sensor. Includes 10 points (4 UIs, 2 UOs, 4 triac DOs) and wizard.  |
| LX-VAVLN-1    | Configurable VAV controller, with Air Flow Sensor. Includes 10 points (4 UIs, 2 UOs and 4 triac DOs ) and wizard. No Actuator.   |

- The LN-SVSENH-0 room temperature and humidity sensor with backlight display, graphic menus, and **Leaf** icon.

**Figure 5: LN Series Communicating Sensor**



## Repair Information

If controller fails to operate within its specifications, replace the product. For a replacement product, contact the nearest Johnson Controls® representative.

## Technical specifications

**Table 3: Technical specifications for LX-VAV04060-0, LX-VAVLF-1, and LX-VAVLN-1**

|                                     |  |
|-------------------------------------|--|
| <b>Product codes</b>                | <p><b>LX-VAV04060-0:</b> Configurable and programmable VAV Controller, built-in actuator with integrated position feedback and air flow sensor</p> <p><b>LX-VAVLF-1:</b> Configurable VAV controller, built-in actuator with integrated position feedback and air flow sensor.</p> <p><b>LX-VAVLN-1:</b> Configurable VAV controller, with an air flow sensor. No actuator.</p>  |
| <b>Power requirement</b>            | <p><b>Voltage:</b> 24 VAC/DC; +/-15%; Class 2 <b>Frequency:</b> 50/60 Hz <b>Protection:</b> Field replaceable fuse</p> <p> ⓘ <b>Note:</b> 24 VDC does not support DO (triac outputs).</p>  |
| <b>Power consumption</b>            | <p><b>LX-VAV04060-0</b> consumption: 4 VA typical plus all external loads (75 VA max)</p> <p> ⓘ <b>Note:</b> External loads must include the power consumption of any connected modules such as subnet devices, wireless module (1 VA) and triac outputs. Refer to the respective module's datasheet for related power consumption information.</p> <p><b>LX-VAVLF-1 and LX-VAVLN-1</b> consumption: 18 VA (70 VA max if internal power supply is used)</p>  |
| <b>Environmental conditions</b>     | <p><b>Operating temperature:</b> 0°C to 50°C, (32°C to 122°F)</p> <p><b>Storage temperature:</b> -20° to 50°C (-4° to 122°F)</p> <p><b>Relative humidity:</b> 0 to 90% non-condensing</p>  |
| <b>Processor</b>                    | <p><b>LX-VAV04060-0:</b> Processor STM32 (ARM Cortex™ M3) MCU, 32 bit</p> <p><b>LX-VAVLF-1 and LX-VAVLN-1:</b> Neuron® 3150™, 8 bits, 10 MH</p>  |
| <b>Memory</b>                       | <p><b>LX-VAV04060-0:</b> Memory 384 kB Non-volatile Flash (applications)<br/>1 MB Non-volatile Flash (storage)<br/>64 kB RAM</p> <p><b>LX-VAVLF-1 and LX-VAVLN-1:</b> Nonvolatile Flash 64k (APB application)</p>  |
| <b>Universal Input capabilities</b> | <p><b>Universal Inputs (UI)</b> - software configurable</p> <p><b>Quantity:</b> 4</p> <p><b>LX-VAV04060-0 Input Types:</b></p> <p>Current: 0 to 20 mA with 249 Ω external resistor wired in parallel</p> <p>Digital: Dry Contact</p> <p>Pulse: Dry Contact; 1 Hz maximum frequency; 500 milliseconds minimum On/Off</p> <p>Voltage: 0 to 10 VDC (40 kΩ input impedance), 0 to 5 VDC (high input impedance)</p> <p><b>Resistor Support:</b> 0 to 350 KΩ. Supports all thermistor types that operate within this range. Pre-configured temperature sensor types:</p> <p>Thermistor: 10 KΩ Type 2 and Type 3 (10 KΩ at 25°C [77°F])</p> <p>Platinum: PT1000 (1 KΩ at 0°C [32°F])</p> <p>Nickel:</p> <ul style="list-style-type: none"> <li>• RTD Ni1000 (1 KΩ at 0°C [32°F])</li> <li>• RTD Ni1000 (1 KΩ at 21°C [69.8°F])</li> </ul> |

**Table 3: Technical specifications for LX-VAV04060-0, LX-VAVLF-1, and LX-VAVLN-1**

|   |   |
|---|---|
| <p><b>Digital Output capabilities</b></p>   | <p><b>Digital Output (DO)</b> - software configurable<br/> <b>Quantity:</b> 4<br/> <b>Maximum Current Per Output:</b> 0.5A continuous; 1A @ 15% duty cycle for a 10 minute period<br/> <b>Power Supply:</b> External or Internal (jumper selectable)<br/> <b>LX-VAV04060-0: Output Types:</b><br/>                 Digital (On/Off): 0 or 24 VAC<br/>                 Floating: minimum 500 ms pulse On/Off, adjustable drive time period<br/>                 PWM: adjustable period from 2 to 65 seconds<br/> <b>LX-VAVLF-1 and LX-VAVLN-1:</b><br/>                 Digital LED Occupancy: 0 to 10 VDC dedicated output for occupancy sensor LED, 20 mA maximum<br/>                 Floating: requires two consecutive outputs, minimum 500 ms pulse On/Off, adjustable drive time period<br/>                 PWM: adjustable period from 2 seconds to 15 minutes</p>  |
| <p><b>Universal Output capabilities</b></p> | <p><b>Universal Output (UO):</b> software configurable<br/> <b>Quantity:</b> 2<br/> <b>LX-VAV04060-0 Output Types:</b><br/>                 Digital (On/Off): 0 or 12 VDC<br/>                 Floating: minimum 500 ms pulse On/Off, adjustable drive time period<br/>                 Linear: 0 to 10 VDC; Source Current - maximum 20 mA at 10 VDC, minimum resistance 600 Ω; Sink Current - maximum 2.5 mA at 1 VDC, minimum resistance 4 kΩ<br/>                 PWM: adjustable period from 2 to 65 seconds; adjustable warm up and cool down time<br/> <b>Output Protection:</b> Built-in snubbing diode to protect against back-EMF for example when used with a 12 VDC relay. Output is internally protected against short circuits.<br/> <b>LX-VAVLF-1 and LX-VAVLN-1:</b><br/>                 Digital (On/Off): 0 or 12 VDC<br/>                 Floating: requires two consecutive outputs, minimum 500 ms pulse On/Off, adjustable drive time period<br/>                 Linear: 0-10 VDC; Source Current-maximum 20 mA at 12 VDC, minimum resistance 600 Ω<br/>                 PWM: adjustable period from 2 seconds to 15 minutes</p> |
| <p><b>Input and Output resolution</b></p>   | <p>Input Resolution 16-bit analog to digital converter<br/>                 Output Resolution 10-bit digital to analog converter</p>  |
| <p><b>Differential pressure sensor</b></p>  | <p><b>LX-VAV04060-0:</b> Differential Pressure Range ±2.0 in. W.C. (±500 Pa)<br/>                 Polarity-free high-low sensor connection<br/>                 Input Resolution 0.00007 in. W.C. (0.0167 Pa)<br/>                 Air Flow Accuracy ±4.0% at &gt; 0.05 in. W.C. (12.5 Pa)<br/>                 ±1.5% once calibrated through air flow balancing at &gt; 0.05 in. W.C. (12.5 Pa)<br/>                 Pressure Sensor Accuracy (±0.2 Pa +3% of reading)<br/> <b>LX-VAVLF-1 and LX-VAVLN-1:</b><br/>                 Differential Pressure Range 0 to 250 Pa (0 to 1 in. H<sub>2</sub>O)<br/>                 Resolution 0.000162 millinches H<sub>2</sub>O<br/>                 Accuracy ±0.3% full scale</p>   |
| <p><b>Actuator rating</b></p>               | <p><b>LX-VAV04060-0:</b> Integrated Damper Actuator<br/>                 Motor Belimo® brushless DC motor<br/>                 Torque: 45 in-lb, 5 Nm<br/>                 Angle of Rotation: 95° adjustable<br/>                 Fits Shaft Diameter: 5/16 to 3/4 in. (8.5 to 18.2 mm)<br/>                 Acoustic Noise Level: &lt; 35 dB (A) at 95° rotation in 95 seconds<br/> <b>LX-VAVLF-1:</b><br/>                 Torque: 35 in-lb, 4 Nm<br/>                 Angle of Rotation: 95° adjustable<br/>                 Fits Shaft Diameter: 5/16 to 3/4 in. (8.5 to 18.2 mm)</p>   |

