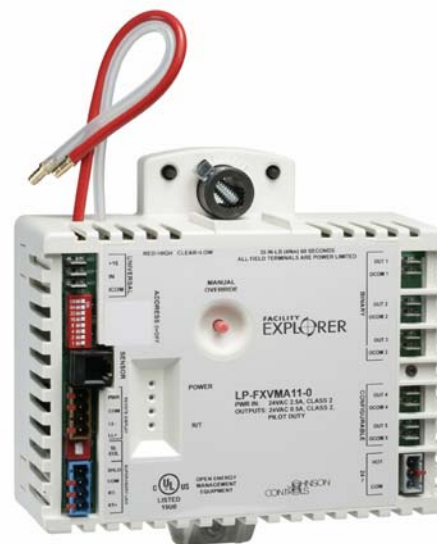


# FXVMA Variable Air Volume (VAV) Box Controller

The FXVMA is an integrated assembly used to control Variable Air Volume (VAV) boxes. The FXVMA consists of a high performance digital controller, a fast response actuator, and an accurate Differential Pressure Transducer (DPT), all of which are pre-wired together and integrated inside a single enclosure.

The FXVMA controller runs advanced application software with self-tuning algorithms to precisely control the room temperature. The FXVMA application software includes multiple configuration options (for example, box type, box heating type, or supplemental heating type) that you can easily select using the FX Tools software package.

Various software and accessories are available to assist you during the commissioning of the FXVMA and the VAV box, including a local Medium User Interface (MUI) with balancer functions and an automated box flow test.



**Figure 1: FXVMA Controller**

Features and Benefits	
<input type="checkbox"/> <b>Controller, Actuator, and Pressure Sensor Pre-wired Together and Integrated inside a Single Enclosure</b>	Reduce installation time.
<input type="checkbox"/> <b>60-Second Actuator</b>	Provides more responsive air volume control and reduces commissioning time.
<input type="checkbox"/> <b>Configurable Application Software</b>	Can be easily tailored to meet specific VAV box control requirements.
<input type="checkbox"/> <b>Self-Tuning Control Algorithms</b>	Provide precise control of the room temperature without over-cycling the actuator.
<input type="checkbox"/> <b>Predefined User Interface Configuration</b>	Provides local balancing and monitoring capabilities (for example, drive open, drive closed, or calculate K factor) via the Medium User Interface.
<input type="checkbox"/> <b>Automated Box Flow Test</b>	Helps identify configuration or installation issues.

## Hardware

The FXVMA comprises a digital controller, actuator, and differential pressure transducer. These components are wired together and securely housed inside a durable, plenum-rated, Acrylonitrile Butadiene Styrene (ABS) plastic enclosure. Only one sheet metal screw is required to mount the FXVMA to the VAV box.

### Digital Controller

The FXVMA contains a high performance digital controller that is well suited to run VAV box control applications.

See Table 1 for a list of supported inputs and outputs.

**Table 1: FXVMA Inputs and Outputs**

Type	Signals	FXVMA1x
<b>Universal Input (UI)</b>	Analog Input (0-10 V, 0-2 k ohm, 1 k Ni, 1k Pt, A99, 10 k NTC, 2.225 k NTC) Binary Input (dry contact)	1
<b>Binary Output (BO)</b>	24 VAC triac	3
<b>Configurable Output (CO)</b>	Analog Output (0-10 V) Binary Output (24 VAC triac)	2
<b>Integrated Actuator</b>	Internal	1
<b>Integrated Pressure Transducer</b>	Internal	1
<b>Room Temperature Sensor Input</b>	Networked	1

Light-Emitting Diodes (LEDs) on the front of the FXVMA provide diagnostic information, including:

- power
- fault
- communication status

The FXVMA includes either an N2 Open or a BACnet® Master-Slave/Token-Passing (MS/TP) network interface allowing a supervisory-class controller to monitor and control the FXVMA data points.

## Actuator

The actuator inside the FXVMA is a 4 N-m (35 lb-in) non-spring return M9000 Series actuator. The actuator provides fast response during operation, driving the damper from fully open to fully closed (90°) in 60 seconds.

You secure the actuator coupling to the VAV box damper shaft using a single set screw. The actuator coupling accommodates damper shafts from 10 mm (3/8 in.) square up to 13 mm (1/2 in.) diameter round. The actuator coupling is serrated. This provides grip between the actuator coupling and the damper shaft, minimizing shaft slippage during operation.

A push button on the face of the FXVMA allows you to position the actuator manually throughout its entire rotation range.

### Pressure Transducer

The FXVMA differential pressure transducer provides consistent and accurate pressure readings with minimal drift. The pressure transducer has no filters to change and requires minimal auto-zero calibration. Color-coded pneumatic tubes allow you to easily identify the high (red) and low (clear) pressure connections and then match them to the corresponding VAV box flow pickups. The effective range of the pressure transducer is from 0 to 1.5 inch WC (0-375 Pa).

## Application Software

Like all FX controllers, the FXVMA is a fully programmable controller, allowing you to create a customized control application using FX Builder.

In addition, a predefined, standard application incorporates all features and functions required to control a typical single duct VAV box. The application software uses advanced, state-based control algorithms to maintain the desired room temperature precisely without over-cycling the actuator.

The standard VAV box control application is configurable, allowing you to select the desired control strategies and options using FX Builder's Application Wizard (Table 2).

**Table 2: Configuration Options**

Configuration Setting	Available Options
<b>Box Type</b>	No fan Parallel fan Series fan
<b>Box Heating Type</b>	None Incremental Proportional Staged (1-3 stages)
<b>Supplemental Heating Type</b>	None Incremental Proportional Staged (1 stage)

The standard VAV application software also includes a predefined display configuration targeted for the MUI Version 3. The MUI features a 4-line by 26-character, backlit Liquid Crystal Display (LCD), 6 push buttons, and 10 status LEDs. When connected to the FXVMA, the MUI provides all the necessary information and command capabilities needed to commission and balance the VAV box, including:

- monitoring actual space temperature and setpoints
- calibrating the differential pressure transducer
- overriding VAV box damper position
- manually entering parameters (for example, minimum and maximum flows, box area, gain, and stroke time)
- calculating the gain based on actual flow



**Figure 2: Medium User Interface**

Another feature of the VAV box control application is the automatic VAV box flow test. When initiated, the FXVMA drives the VAV box damper fully open and then fully closed in user-defined increments of full travel, and then takes flow measurements at each interval. The FXVMA analyzes these flow measurements and identifies error conditions, including the following examples:

- large difference between measured and expected airflow (indicative of loose, sticking, poorly adjusted, or reversed damper)
- nonresponding damper
- insufficient or excessive flow (relative to design air flow)
- excessive hysteresis (indicative of loose or sticking damper)

### **Network Room Module (NRM)**

The NRM is an electronic room temperature sensor that communicates with the FXVMA via the Remote Display bus. The NRM includes an internal temperature sensor and other optional operating controls, including:

- a dial that allows occupants to adjust the temperature setpoint value or request a warmer or cooler setpoint. This dial also initiates a period of temporary occupancy when the area is in unoccupied mode.
- an LCD that displays the actual room temperature and the desired temperature setpoint
- a push button that allows the occupant to toggle the displayed values between °F and °C

The NRM is housed in an attractively styled plastic enclosure, designed for easy wall mounting.



**Figure 3: Network Room Modules (NRMs)**

## FX Tools

Use the FX Tools software suite to program, download, test, and commission Facility Explorer Field Controllers, including the FXVMA. FX Tools software contains:

- **FX Builder**

Used to create control application software for the FXVMA controller. FX Builder provides full programmability as well as an Application Wizard used to select and configure a predefined VAV control application.

- **FX CommPro**

Used to download, test, and commission the FXVMA controller.

**IMPORTANT:** Use the FXVMA controller only as an operating control. Where FXVMA failure or malfunction could lead to personal injury or damage to the controlled equipment or other property, you must design additional precautions into the control system. Incorporate and maintain other devices, such as supervisory systems, alarm systems, or safety or limit controls, intended to warn or protect against failure or malfunction of the FXVMA controller.

## Repair Information

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

## Ordering Codes

Table 3 through Table 5 gives ordering information for FXVMA Controllers, Network Room Modules, and Accessories.

**Table 3: FXVMA VAV Box Controllers and Accessories Ordering Information**

Product Code Number	Description
LP-FXVMA11-1C	FXVMA VAV Box Controller: Cooling with reheat version with N2 Open communications
LP-FXVMA14-1C	FXVMA VAV Box Controller: Cooling with reheat version with BACnet MS/TP communications
LP-DIS60P20-0C	Remote Medium User Interface (MUI Version 3) - Local Mount (non-isolated model)
LP-DIS60P21-0C	Remote Medium User Interface (MUI Version 3) - Remote Mount (isolated model)
NS-WALLPLATE-0	Wall plate kit used to mount an 80 x 80 mm (3.15 x 3.15 in.) NRM onto a 2 x 4 in. wall box.
LP-FXTPRO-0	FX Tools Pro CD-Rom (FX Builder, FX CommPro N2, FX CommPro LON, FX CommPro BACnet, FX Loader, MD LON Loader)

**Table 4: Network Room Modules Ordering Information (North American Models)**

Product Code Number	Description
LP-NRM001-000C	Network Room Module: Includes temperature sensor only (no LCD or dial). Housed in an 80 x 80 mm (3.15 x 3.15 in.) enclosure.
LP-NRM052-000C	Network Room Module: Includes temperature sensor, LCD, setpoint adjustment dial, °C/°F toggle button, and occupancy function. Housed in an 80 x 80 mm (3.15 x 3.15 in.) enclosure.
LP-NRM101-000C	Network Room Module, temperature sensor only, no display, no setpoint dial Housed in a 120 x 80 mm (4.72 x 3.15 in.) enclosure.
LP-NRM152-000C	Network Room Module: Includes temperature sensor, LCD, setpoint adjustment dial, °C/°F toggle button, and occupancy function. Housed in a 120 x 80 mm (4.72 x 3.15 in.) enclosure.

**Table 5: Network Room Modules Ordering Information (European Models)**

Product Code Number	Description
LP-NRM001-000C	Network Room Module: Includes temperature sensor only (no LCD or dial). Housed in an 80 x 80 mm (3.15 x 3.15 in.) enclosure.
LP-NRM002-000C	Network Room Module: Includes temperature sensor, LCD, setpoint adjustment dial, and occupancy function. Housed in an 80 x 80 mm (3.15 x 3.15 in.) enclosure.

## Technical Specifications

**Table 6: FXVMA VAV Box Controller**

<b>Product Codes</b>	LP-FXVMA1x-xxx	
<b>Power Requirements</b>	20-30 VAC/DC, 50/60 Hz – Safety Extra-Low Voltage (SELV) (Europe) – Class 2 North America	
<b>Power Consumption</b>	10 VA typical, 14 VA maximum. Power delivered to the devices connected to the binary outputs (for example, valves and relays) is not included in this rating.	
<b>Ambient Operating Conditions</b>	0 to 50°C (32 to 122°F), 10 to 95% RH (noncondensing)	
<b>Ambient Storage Conditions</b>	-40 to 70°C (-40 to 158°F), 10 to 95% RH (noncondensing)	
<b>Power Supply for MUI</b>	15 VDC on Remote Display connector at 100 mA maximum	
<b>Terminations</b>	6.33 mm (1/4 in) spade lugs, except communications and 24 VAC power, which are screw terminals	
<b>Controller Addressing</b>	DIP switch set (1-255)	
<b>Communication Buses</b>	Supervisory: 3-wire isolated N2 or BACnet MS/TP between FXVMA and supervisory class controller Remote Display: 4-wire non-isolated N2 between FXVMA and Network Room Module and/or Medium User Interface (MUI)	
<b>Dimensions</b>	Width: 182 mm (7 3/16 in.) Length: 182 mm (7 3/16 in.) Height: 64 mm (2 1/2 in.) Center of output hub to center of anti-rotation slot: 160 mm (6 5/16 in.)	
<b>Weight</b>	0.86 kg (1.9 lb)	
<b>Actuator Ratings</b>	4 N·m (35 lb-in), 60 seconds full rotation (90°) time	
<b>Supported VAV Box Damper Shafts</b>	Mount to damper shafts from 10 mm (3/8 in.) square up to 13 mm (1/2 in.) diameter round. Minimum shaft length = 44 mm (1 3/4 in.)	
<b>BACnet Compliance</b>	BACnet Testing Laboratories™ (BTL) Listing (Pending) BACnet Interoperability Building Blocks (BIBBs): BACnet Application Specific Controller (B-ASC) Protocol Implementation Conformance Statement (PICS) available on request	
<b>Compliance</b>	<b>United States</b>	UL Listed, File E107041, CCN PAZX, UL916 Energy Management Equipment
	<b>Canada</b>	UL Listed, File E107041, CCN PAZX7, CAN/CSA C22.2 No. 205 Signal Equipment
	<b>Europe</b>	CE Mark, EMC Directive 89/336/EED, in accordance with EN 61000-6-3 (2001) Generic Emission Standard for Residential and Light Industry and EN 61000-6-2 (2001) Generic Immunity Standard for Heavy Industrial Environment, and the Low Voltage Directive 73/23/EEC in accordance with EN 60730-1 (1999) Automatic electrical controls for household and similar use.

*The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls® office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.*



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