

Metasys® System Field Equipment Controllers and Related Products Product Bulletin

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Overview

The Metasys® system family of Field Equipment Controllers comprises a group of versatile BACnet®, Master-Slave/Token-Passing (MS/TP) network compliant field controllers designed to monitor, control, and integrate a wide variety of HVAC and other building equipment. This family of controllers includes the Advanced Application Field Equipment Controller (FAC), Field Equipment Controller (FEC), Input/Output Module (IOM), and VMA16 (16- and 32-bit) Series Controllers, which integrate into the web-based Metasys system.

The FAC, FEC, IOM, and VMA16 (32-bit) models feature an advanced design that provides optimum performance and easy access to power, network, and field terminations. These controllers come with 32-bit microprocessors to meet and exceed ever demanding industry standards. Some FEC models include an intuitive UI with an integral LCD screen and a 6-button navigation touch pad that provides enhanced local monitoring of your controlled field equipment.

For demanding environments, such as rooftop applications, extended temperature range models are available which provide accurate control over a wider operational temperature range. Look for the ET (Extended Temperature) suffix in the controller model.

The Field Equipment Controller family integrates easily with the NS Series Network Sensors, the ZFR1800 Series Wireless Field Bus system, and WRZ Series Wireless Sensors. The VMA1615 and VMA1630 support the WRZ Series Wireless Sensors using the WRZ-78xx Many-to-One ZigBee™ Wireless Receiver. These products complement the FEC family of controllers and enable enhanced capabilities in both wired and wireless field controller network applications.

Figure 1: Metasys System Field Equipment Controllers



A wide variety of network sensor models provides options for measuring and displaying zone temperature, duct temperature, zone humidity, carbon dioxide level, setpoint adjustments, fan speed control, and discharge air temperatures.

The ZFR1800 Series devices use open wireless technology standards, including Institute of Electrical and Electronic Engineers (IEEE) 802.15.4 and ZigBee technology, to provide flexibility and reliability.

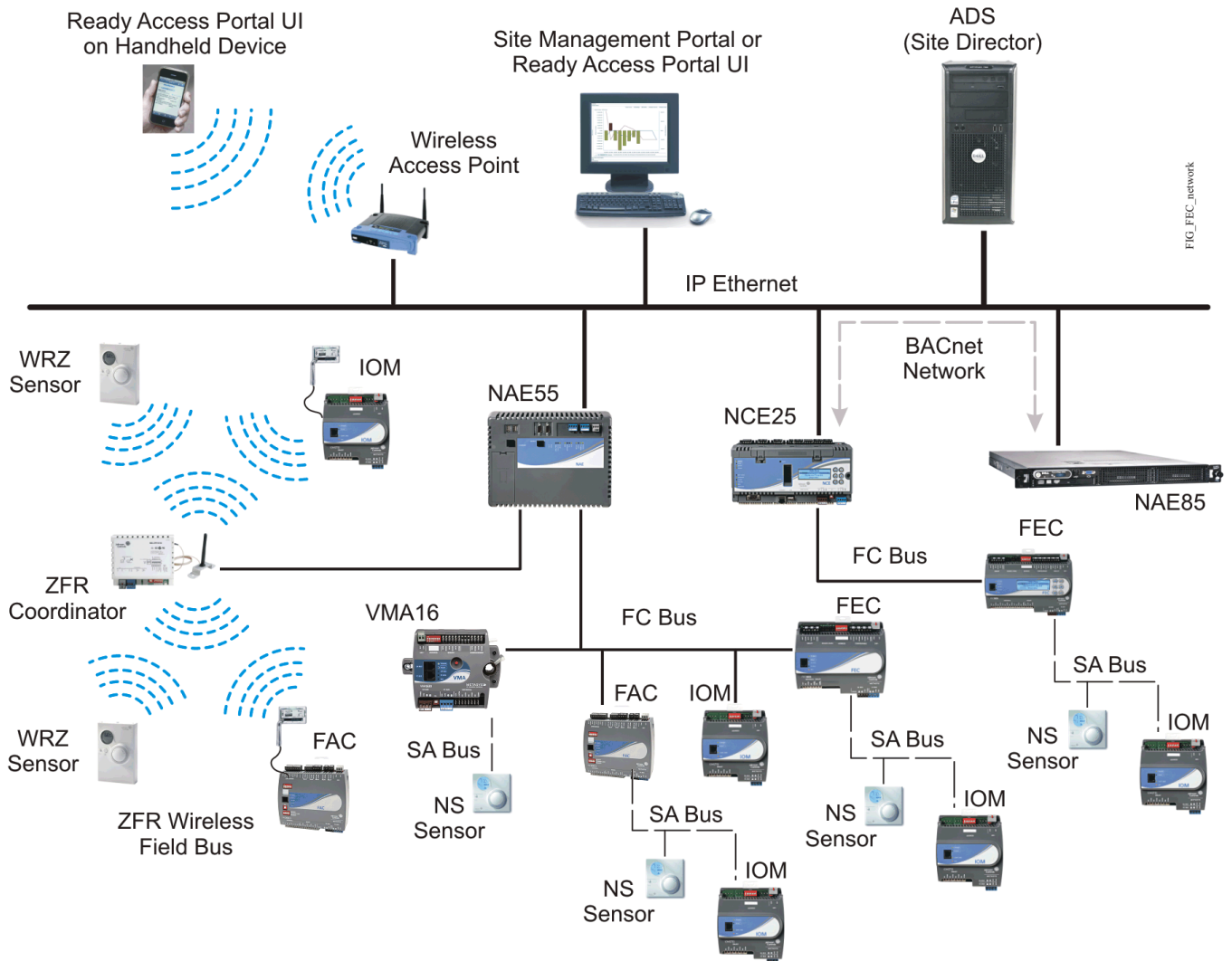
Table 1: Features and Benefits

Features	Benefits
Standard BACnet Protocol	Provides interoperability with other Building Automation System (BAS) products that use the widely accepted BACnet standard.
Standard Hardware and Software Platform	Uses a common hardware design throughout the family line to support standardized wiring practices and installation workflows. Also uses a common software design to support use of a single tool for control applications, commissioning, and troubleshooting to minimize technical training.
ZigBee Wireless Field Controller (FC)/Sensor/Actuator (SA) Bus Interface	Provides a wireless alternative to hard-wired Metasys system counterparts, providing application flexibility and mobility with minimal disruption to building occupants.

Table 1: Features and Benefits

Features	Benefits
Bluetooth® Wireless Commissioning Interface	Provides an easy-to-use connection to the configuration and commissioning tool.
Auto Tuned Control Loops	Reduce commissioning time, eliminate change-of-season re-commissioning, and reduce wear and tear on mechanical devices.
Universal Inputs, Configurable Outputs, and Point Expansion Modules	Allow multiple signal options to provide input/output flexibility.
Optional Local User Interface Display	Allows convenient monitoring and adjusting capabilities at the local device.
BACnet Testing Laboratories™ (BTL) Listing	Ensures interoperability with other BTL-listed devices. BTL is a third-party agency which validates that BAS vendor products meet the BACnet industry-standard protocol.

Figure 2: Metasys System with Field Equipment Controllers



Integration to the Metasys System Supervisory Devices

The FEC family is designed to integrate seamlessly into the Metasys system by connecting and communicating directly with a Network Automation Engine (NAE) or Network Control Engine (NCE). This seamless integration of field controllers with Metasys supervisory controllers enables building operators to monitor and adjust field controllers directly from the Metasys system UI.

In addition, service personnel can view field controller information locally via the integral LCD (included on some FEC models) or via an optional local controller display (MS-DIS1710-0) available for field controllers.

BACnet Protocol Compatible

The Metasys system field controllers and network sensors communicate using the standard BACnet protocol, based on the American National Standards Institute (ANSI)/ American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) 135-2004.

The BACnet protocol is a standard for ANSI, ASHRAE, and the International Standards Organization (ISO) for building controls.

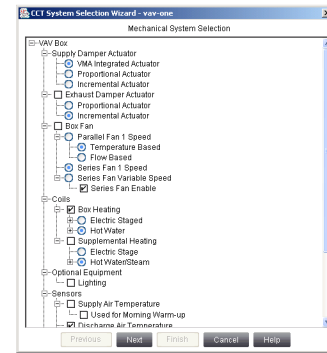
FEC, IOM, and VMA16 field controllers are BTL tested and listed as BACnet Application Specific Controllers (BASCs). FAC field controllers are BTL listed as BACnet Advanced Application Controllers (B-AACs). The NS Series Sensors are BTL listed as BACnet Smart Sensors (B-SSs).

Controller Configuration Tool

The Controller Configuration Tool (CCT) is used in conjunction with the Metasys system to configure, simulate, and commission the FECs, IOMs, and VMA16s on an MS/TP Bus.

The **Configuration** mode allows you to select a number of mechanical and control logic options through System Selection Trees for typical air handling, terminal unit, VAV box, and central plant mechanical systems. When required, you can customize the standard logic provided by the system selection process to meet your specialized control logic requirements. Configuration mode also allows you to customize certain display options available to Field Equipment Controllers that use a local controller display ([Figure 3](#)).

Figure 3: Mechanical Selection in CCT



The **Simulation** mode allows you to review, run, or simulate the application logic as if you were commissioning a live system. You can make adjustments to setpoints, inputs, or sensors during a simulation session to validate the logic before assigning the configuration to a specific controller.

The **Commissioning** mode manages the downloading of files to the field equipment controllers through two different network connection points. You can connect using the Wireless Commissioning Converter between your laptop and the MS/TP Bus, or using the Ethernet Passthru mode in conjunction with the System Configuration Tool (SCT) through an NAE or NCE.

After downloading the controllers, you can use the CCT Commissioning mode to validate the sensor and control point interfaces and adjust key setpoints and setup parameters ([Figure 4](#)).

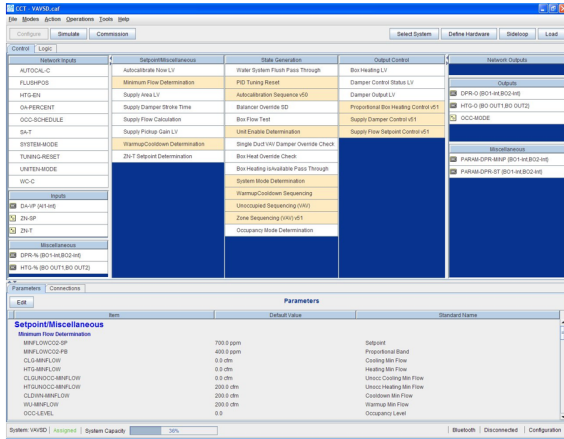
CCT includes integrated productivity features with utilities to facilitate mass application uploads and downloads, including upgrades of entire trunks of controllers with just a few mouse clicks. Template files provide an intuitive method of reading and writing configuration parameters to multiple controllers, reducing the time it takes to commission your field controller networks.

For VAV applications, CCT features an optional box flow test to automatically exercise all the VAV boxes to ensure correct mechanical installation and proper configuration of the key flow setup parameters. Additionally, the Metasys system provides multiple configurations of room network sensors and a handheld VAV balancing tool that you can use to perform VAV balancing tasks.

In addition, the Commissioning wizard has a Balancer tab for VAV applications to easily auto calibrate VAV boxes and set flow constants in one location.

A Commissioning mode only version of the CCT software is available to the Johnson Controls® branch offices for jobs or individuals having only commissioning tasks (for example, balancing contractors). The Configuration and Simulation modes are disabled in the CCT Commissioning software.

Figure 4: CCT User Interface



Features

- capability to customize standard control system logic that is created from simple system selection trees
- consistent user interface across the Configuration, Simulation, and Commissioning modes
- flexible connection capabilities for loading and commissioning controllers

Field Equipment Controller Family

The Metasys Field Equipment Controller Family includes the FEC, FAC, VMA16, and IOM Series Field Controller models.

All Metasys Field Equipment Controllers run pre-engineered and user-programmed applications and provide the I/O required to monitor and control a wide variety of HVAC equipment.

This large family of diverse field controllers is designed to install easily and communicate via standard RS485 BACnet MS/TP protocol, enabling you to build an almost endless variety of field controller network applications, ranging from simple fan coil, heat pump, or VAV control applications to very advanced central plant management and stand-alone applications.

Metasys Field Controller Features

Features and benefits common to the FAC, FEC, IOM, and VMA16 Series field controllers include the following:

- 32-bit microprocessor ensures optimum performance and meets industry specifications.
- BACnet Automatic Discovery support enables easy controller integration into Metasys BAS.
- Integral End-of-Line (EOL) switch enables field controller as a terminating device on the communications bus.
- Pluggable communications bus and supply power terminal blocks expedite installation and troubleshooting.
- Wireless capabilities via a ZFR1800 Series Wireless Field Bus System enable wireless mesh connectivity between Metasys field controllers to WRZ Series Wireless Room Temperature Sensors and to supervisory controllers, facilitating easy initial location and relocation.

Additional features and benefits common to FAC, FEC, and VMA16 field controllers include the following:

- Patented proportional adaptive control (P-Adaptive) and Pattern Recognition Adaptive Control (PRAC) technologies provide continuous loop tuning.
- Writable flash memory allows standard or customized applications to be downloaded from the CCT and enables persistent application data.
- Large product family provides a wide range of point mix to meet application requirements and allows for the addition of one or more IOMs and/or Network Sensors to provide even more I/O capacity.
- Local UI display provides enhanced local monitoring.
- User-friendly graphic theme and clear push-button identification facilitate easy navigation of the integral or optional UI/display.

Hardware and Installation

Metasys field controllers are encased in a durable plastic housing. The plastic housing may eliminate the need for a separate enclosure for plenum-rated construction. Check specific controller documentation and regional, national, and local code requirements for appropriate applications.

Metasys field controllers feature bright, color-coded LEDs, visible on the controller cover, that indicate the supply power, communications bus, and EOL switch status, as well as a variety of fault conditions to aid troubleshooting the controller and bus.

An integral EOL switch on each field controller allows you to enable the controller as a bus terminating device, which when properly configured, reduces reflected noise on the bus and improves bus communication.

Each field controller has an easily accessible eight-position DIP switch that allows you to set a valid and unique device address for each field controller on the bus. A blank space is included on the controller cover for recording the device address.

The field controllers feature removable, color-coded, keyed, and labeled terminal block plugs for the supply power and communications bus terminations. Most models have fixed, color-coded, and labeled terminal blocks for the input and output terminations, which facilitate installing and servicing the controllers.

The I/O terminations on the VMA16 models are spade lugs. Screw terminal adapters that connect to the I/O spade terminations are also available as optional accessories.

FAC2612 models have removable, color-coded, and labeled terminal block plugs for the I/O terminations.

On FAC, FEC, and IOM Series Controllers, integral mounting clips and a DIN rail track on the controller back-plate allow you to easily mount the field controller either on a horizontal section of 35 mm DIN rail or directly to a wall or flat vertical surface.

Some FEC models have a backlit user interface display with adjustable brightness and contrast to ensure readability in low-light environments. The easy-to-use display provides convenient local monitoring and adjusting of key setpoints and control parameters. For the FEC and FAC models without a display, a stand-alone DIS1710 Local Controller Display module is available that connects directly to the SA Bus port. For details, refer to the *DIS1710 Local Controller Display Product Bulletin (LIT-12011273)*.

Field Equipment Controller (FEC)

The FEC Series products are programmable BACnet Application Specific Controllers (B-ASCs) with integral MS/TP communications. FEC models include the 10-point FEC16 Series and the 17-point FEC26 Series.

FECs feature 32-bit microprocessor architecture, patented continuous tuning adaptive control, peer-to-peer communications, and are available with an optional built-in LCD screen local UI.

A full range of FEC models combined with the IOM models can be applied to a wide variety of building applications ranging from simple fan coil or heat pump control to advanced central plant management.

All FEC Series Controllers support wireless communications using the ZigBee Field Router (ZFR) Series accessories.

Important: You cannot purchase a similar third-party device and install it in a UL/ULC Listed smoke control system. Doing so voids the UL/ULC Smoke Control Listing. Third-party devices must be provided and labeled by the factory as described in the UL/ULC Smoke Control Listing.

Important: Only those Johnson Controls products identified for use in smoke control applications have been tested and listed by UL for use in a Metasys System UL 864 9th Edition UUKL/ORD-C100-13 UUKLC Smoke Control System. Installation of a product that is not UL/ULC Listed and labeled for this application prevents the entire system from being UL/ULC Listed for smoke control.

Figure 5: FEC2621 Field Equipment Controller with Integral Local Display

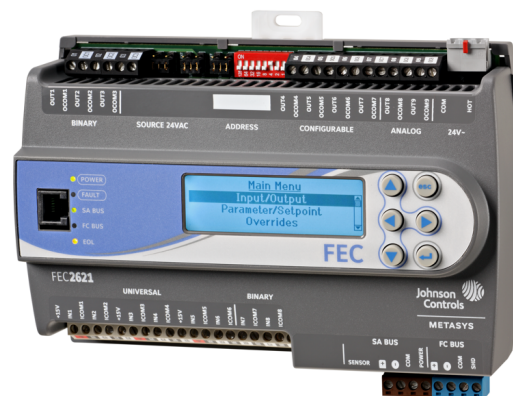


Table 2: FEC Series Point Type Counts per Model

Point Types	Signals Accepted	FEC16	FEC26
Universal Input (UI)	Analog Input, Voltage Mode, 0–10 VDC Analog Input, Current Mode, 4–20 mA ¹ Analog Input, Resistive Mode, 0–2k ohm, Resistance Temperature Device (RTD) (1k NI [Johnson Controls], 1k PT, A99B SI), Negative Temperature Coefficient (NTC) (10k Type L, 2.252k Type 2) Binary Input, Dry Contact Maintained Mode	2	6
Binary Input (BI)	Dry Contact Maintained Mode Pulse Counter/Accumulator Mode (High Speed), 100 Hz	1	2
Analog Output (AO)	Analog Output, Voltage Mode, 0–10 VDC Analog Output, Current Mode, 4–20 mA		2
Binary Output (BO)	24 VAC Triac	3	3
Configurable Output (CO)	Analog Output, Voltage Mode, 0–10 VDC Binary Output Mode, 24 VAC Triac	4	4

1 Analog Input, Current Mode is set by hardware for the FEC26, and by software for the FEC16.

Advanced Application Field Equipment Controller (FAC)

The FAC Series Controllers are BACnet Advanced Application Controllers (B-AACs) with integral RS-485 MS/TP communications.

FAC Series Controllers feature an integral real-time clock and support time-based tasks, which enables these field controllers to monitor and control schedules, calendars, alarms, and trends. FACs can continue time-based control and monitoring when offline for extended periods of time from a Metasys system network.

FAC Series Controllers can also operate as stand-alone controllers in applications that do not require a networked supervisory device or for network applications where it is preferred to have the scheduling, alarming, and/or trending performed locally in the field controllers.

The FAC2612 controller features line-voltage relay outputs, making this controller well suited for use in terminal units. The FAC2612-2 model uses a line-voltage power supply, eliminating the need for a 24 VAC transformer in line-voltage applications.

A full range of FAC and FEC models combined with the IOM models can be applied to a wide variety of building applications ranging from simple fan coil or heat pump control to advanced central plant management.

All FAC controllers support wireless communications using the ZFR Series accessories.

Figure 6: FAC2612 Advanced Application Field Equipment Controller



Features

In addition to the features and benefits listed in [Metasys Field Controller Features](#), FACs also provide the following:

- Support for the DIS17 remote display for monitoring and commanding of I/O and configuration parameters
- NAE and NCE Automatic Discovery ability for easy controller integration

Table 3: FAC Series Point Type Counts Per Model

Point Types	Signals Accepted	FAC2611	FAC2612	FAC3611 ¹
Universal Input (UI)	Analog Input, Voltage Mode, 0–10 VDC Analog Input, Current Mode, 4–20 mA Analog Input, Resistive Mode, 0–2k ohm, RTD (1k NI [Johnson Controls], 1k PT, A99B SI), NTC (10k Type L, 2.252k Type 2) Binary Input, Dry Contact Maintained Mode	6	5	8
Binary Input (BI)	Dry Contact Maintained Mode Pulse Counter/Accumulator Mode (High Speed), 100 Hz	2	4	6
Analog Output (AO)	Analog Output, Voltage Mode, 0–10 VDC Analog Current Mode, 4–20 mA	2		6
Binary Output (BO)	24 VAC Triac	3		6
Configurable Output (CO)	Analog Output, Voltage Mode, 0–10 VDC Binary Output Mode, 24 VAC Triac	4	4	
Relay Output (RO)	Relay Output: Single-Pole, Double-Throw (SPDT) Relay Output: Single-Pole, Single-Throw (SPST)		2 - SPDT 3 - SPST	

1 This model is currently available only in Asia; contact your local Johnson Controls representative for more information.

Input/Output Module (IOM)

The IOM Series Controllers are BACnet® Application Specific Controllers (B-ASCs) with integral RS-485 MS/TP communications. IOM controllers integrate into the web-based Metasys system.

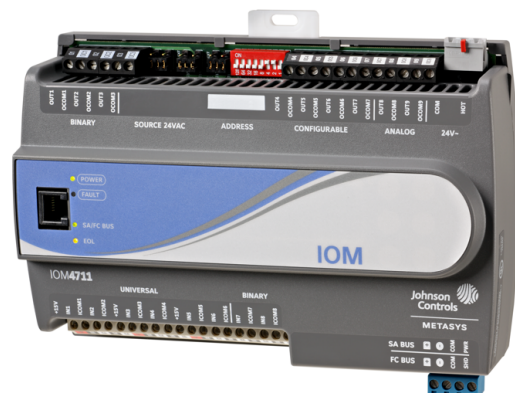
IOMs can serve in one of two capacities, depending on where they are installed in the Metasys system. When installed on the SA Bus of an FEC, FAC, or VMA controller, the IOMs expand the point count of these controllers. When installed on the FC Bus, IOMs can be used as I/O point multiplexors to support monitoring and control from an NAE or NCE. The point multiplexor can also be useful for sharing points between other field controllers on the FC Bus using peer-to-peer connectivity.

A full range of FEC models combined with the IOM models can be applied to a wide variety of building applications ranging from simple fan coil or heat pump control to advanced central plant management.

Important: You cannot purchase a similar third-party device and install it in a UL/ULC Listed smoke control system. Doing so voids the UL/ULC Smoke Control Listing. Third-party devices must be provided and labeled by the factory as described in the UL/ULC Smoke Control Listing.

Important: Only those Johnson Controls products identified for use in smoke control applications have been tested and listed by UL for use in a Metasys System UL 864 9th Edition UUKL/ORD-C100-13 UUKLC Smoke Control System. Installation of a product that is not UL/ULC Listed and labeled for this application prevents the entire system from being UL/ULC Listed for smoke control.

Figure 7: IOM4711



Features

In addition to the features and benefits listed in [Metasys Field Controller Features](#), IOMs provide the following:

- Ability to reside on the FC Bus or SA Bus provides application flexibility.

Table 4: IOM Series Point Type Counts Per Model

Point Types	Signals Accepted	IOM 1711	IOM 2711	IOM 2721	IOM 3711	IOM 3721	IOM 3731	IOM 4711
Universal Input (UI)	Analog Input, Voltage Mode, 0–10 VDC Analog Input, Current Mode, 4–20 mA Analog Input, Resistive Mode, 0–2k ohm, RTD (1k NI [Johnson Controls], 1k PT, A99B SI), NTC (10k Type L, 2.252k Type 2) Binary Input, Dry Contact Maintained Mode		2	8	4			6
Binary Input (BI)	Dry Contact Maintained Mode Pulse Counter/Accumulator Mode (High Speed), 100 Hz	4				16	8	2
Analog Output (AO)	Analog Output, Voltage Mode, 0–10 VDC Analog Output, Current Mode, 4–20 mA			2				2
Binary Output (BO)¹	24 VAC Triac						8	3
Universal Output (UO)	Analog Output, Voltage Mode, 0–10 VDC Binary Output Mode, 24 VAC/DC FET Analog Output, Current Mode, 4–20 mA		2		4			
Configurable Output (CO)	Analog Output, Voltage Mode, 0–10 VDC Binary Output Mode, 24 VAC Triac							4
Relay Output (RO) (-0 models only)	120/240 VAC		2		4			
Relay Output (RO) (-1 models only)	24 VAC, SELV		2		4			
Relay Output (RO) (-2 models only)	240 VAC		2		4			

¹ The BOs on the IOM3731-0A model require an external low-voltage power source.

VMA16 (16-bit) VAV Modular Assembly Series

VMA16 (16-bit) VAV Modular Assembly controllers are programmable B-ASC® Application Specific Controllers (B-ASCs) with RS-485 MS/TP communications. VMA controllers feature an integral 4 N·m damper actuator and Differential Pressure Transducer (DPT) with models for cooling only or cooling with reheat applications and fan control.

Note: The active 16-bit models are only available for UL 864 9th Edition UUKL/ORD-C100-13 UUKLC Smoke Control System applications.

The differential pressure sensor in the VMA16 (16-bit) controllers provides consistent flow readings with minimal drift and requires minimal auto-zero calibration. There are no filters to change, which helps to ensure very close tolerance to published accuracy.

The VMA16 (16-bit) controllers can be configured single-duct, dual-duct, and supply/exhaust applications. Note that some of these applications may require an additional actuator and DPT.

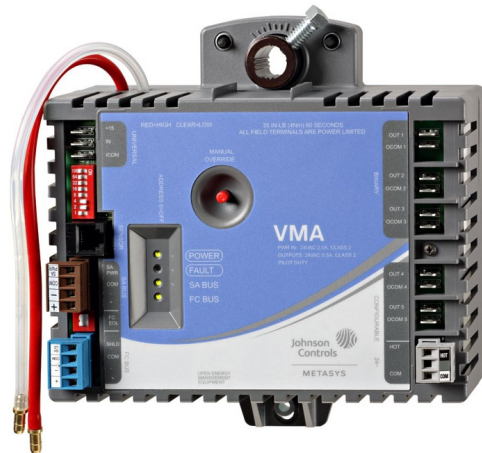
VMA16 (16-bit) controllers support NS and WRZ Series Communicating Network Sensors for temperature sensing, fan override, and occupancy override control.

All VMA16 (16-bit) Series Controllers support wireless communications using the ZFR Series accessories.

Important: You cannot purchase a similar third-party device and install it in a UL/ULC Listed smoke control system. Doing so voids the UL/ULC Smoke Control Listing. Third-party devices must be provided and labeled by the factory as described in the UL/ULC Smoke Control Listing.

Important: Only those Johnson Controls products identified for use in smoke control applications have been tested and listed by UL for use in a Metasys System UL 864 9th Edition UUKL/ORD-C100-13 UUKLC Smoke Control System. Installation of a product that is not UL/ULC Listed and labeled for this application prevents the entire system from being UL/ULC Listed for smoke control.

Figure 8: VMA16 (16-bit) Controller



Features

In addition to the features and benefits listed in [Metasys Field Controller Features](#), VMAs (16-bit) provide the following:

- Integrated differential air-pressure sensor and actuator reduces installation time.
- Fast response actuator drives the damper from full open to full closed (90°) in 60 seconds to reduce commissioning time.
- Point capacity can be expanded by adding IOMs to the SA Bus, providing further application flexibility.

Installation

Field mounting the VMA16 controllers is straightforward. The VMA16 controllers require minimal wiring and are mounted to the terminal box using a single sheet metal screw and a single set screw to lock the actuator to the damper shaft. The set screw has a self-locking cup point end to resist loosening due to vibration.

The actuator coupling is serrated, providing additional damper shaft grip and minimizing shaft slippage during operation. The coupling accommodates shafts from 10 mm (3/8 in.) square and up to 13 mm (1/2 in.) diameter round. A gear release lever allows easy resetting of the damper to fully open or fully closed.

The housing dimensions of the VMA16 controllers meet industry mounting requirements and make the controllers easy to handle.

The controller address can be unique for each VMA using the DIP switches that are accessible through the VMA controller housing.

VMA16 (32-bit) VAV Modular Assembly Controller Series

VMA16s (32-bit) are programmable digital controllers tailored for VAV applications that communicate via the BACnet MS/TP protocol. The VMA16 (32-bit) controllers feature an integral digital pressure sensor, an integral damper actuator, and a 32-bit microprocessor. The controllers' small package size facilitates quick field installation and efficient use of space, while not compromising high-tech control performance. The VMA16 (32-bit) controllers connect easily to the NS Series Network Sensors for zone and discharge air temperature sensing.

These features make the VMA16 (32-bit) the product of choice for VAV systems. The wide variety of network sensor models provides options for measuring and displaying zone temperature, occupancy detection, duct temperature, zone humidity and dewpoint determination, carbon dioxide (CO₂) level, setpoint adjustments, VAV box fan speed control, and discharge air temperatures.

Figure 9: VMA1630 Controller



VMA16 (32-bit) Features

In addition to the features and benefits listed in [Metasys Field Controller Features](#), VMA16s (32-bit) provide the following:

- A 33 percent smaller package than the VMA16s (16-bit)
- Two additional Universal Inputs that provide more low-cost sensor options
- A state-of-the-art digital non-flow pressure sensor to provide 14-bit resolution with bidirectional flow operation that supports automatic correction for polarity on high- and low-pressure DP tube connections; this pressure sensor eliminates high- and low-pressure connection mistakes
- The phone jack-style connector on the FC Bus and SA Bus of the VMA1615 and VMA1630 to support quick connection to the BTCVT Wireless Commissioning Converter, ZFR1811 wireless router, and network sensors
- A fast response actuator that drives the damper from full open to full closed (90°) in 60 seconds to reduce commissioning time

Table 5: VMA16 (16-bit) Series Point Type Counts per Model (For Smoke Control Applications Only)

Point Types	Signals Accepted	VMA1610-OU and -1U	VMA1620-OU and -1U
Universal Input (UI)	Analog Input, Voltage Mode, 0–10 VDC Analog Input, Resistive Mode, 0–2k ohm, RTD (1k NI [Johnson Controls], 1k PT, A998 SI), NTC (10k Type L, 2.252k Type 2) Binary Input, Dry Contact Maintained Mode	1	1
Binary Output (BO)	24 VAC Triac		3
Configurable Output (CO)	Analog Output, Voltage Mode, 0–10 VDC Binary Output Mode, 24 VAC Triac		2
Integrated Actuator	Internal	1	1
Integrated Flow Sensor	Internal	1	1

Table 5: VMA16 (16-bit) Series Point Type Counts per Model (For Smoke Control Applications Only)

Point Types	Signals Accepted	VMA1610-OU and -1U	VMA1620-OU and -1U
Zone Sensor Input	On SA Bus ¹	Up to 4 NS Series Network Zone Sensors	
		Up to 9 WRZ sensors when using the ZFR1811 wireless router configuration and up to 5 WRZ sensors when using the one-to-one WRZ-78xx wireless configuration	

1 A total of 10 MS/TP master addresses (IOMs), not including sensor addresses (MS/TP slaves), can be used in a single VMA controller.

Table 6: VMA16 (32-bit) Series Point Type Counts per Model

Point Types	Signals Accepted	VMA1615	VMA1630	VMA1617 ²	VMA1632 ²
Modular Jacks		6-pin SA Bus with four communicating sensors and 6-pin FC Bus for tool support		8-pin SA Bus supports analog non-communicating sensor	
Universal Input (UI)	Analog Input, Voltage Mode, 0–10 VDC Analog Input, Resistive Mode, 0–2k ohm, RTD (1k NI [Johnson Controls], 1k PT, A998 SI), NTC (10k Type L, 2.252k Type 2) Binary Input, Dry Contact Maintained Mode	3	3	3	3
Binary Output (BO)	24 VAC Triac	2	3	2	3
Configurable Output (CO)	Analog Output, Voltage Mode, 0–10 VDC Binary Output Mode, 24 VAC Triac		2		2
Integrated Actuator	Internal	1	1	1	1
Integrated Flow Sensor	Internal	1	1	1	1
Zone Sensor Input	On SA Bus ¹	Up to 4 NS Series Network Zone Sensors			
		Up to 9 WRZ sensors when using the ZFR1811 wireless router configuration and up to 5 WRZ sensors when using the one-to-one WRZ-78xx wireless configuration			

1 A total of 10 MS/TP master addresses (IOMs), not including sensor addresses (MS/TP slaves), can be used in a single VMA controller.

2 This model is currently available only in Asia; contact your local Johnson Controls representative for more information.

Panel and Sub-Panel Assembly Options

FEC, FAC, and IOM field controllers are also available in pre-wired panels and sub-panel assemblies. The panelized controller options provide all of the controllers necessary for a complete application solution, including a pre-wired power source and a latching or lockable door.

Wireless Commissioning Converter

The Wireless Commissioning Converter provides a temporary Bluetooth connection between Metasys system field controllers and the laptop computer used to commission them. It allows technicians to commission and service the controllers over a wireless connection ([Figure 10](#)).

The Wireless Commissioning Converter provides communication from the BACnet MS/TP FC Bus or the SA Bus to a Bluetooth-enabled computer running the CCT software. Any controller on an FC Bus can be commissioned by connecting to any other controller, any sensor, or any IOM connected to any controller on the bus.

The 2.4 GHz Bluetooth connection allows you to be up to 10 m (33 ft) away while you commission the controller with a laptop computer and the CCT software.

Figure 10: Wireless Commissioning Converter



Features

The Wireless Commissioning Converter provides the following features:

- Bluetooth wireless communication provides a secure and reliable untethered connection between the laptop and the Metasys system hardware.
- Standard connection jacks on both the Metasys system sensors and controllers provide multiple connection points to the system.
- The Wireless Commissioning Converter allows online access to controllers while the technician is using the Bluetooth-enabled laptop.
- Standard Bluetooth technology allows you to use a Bluetooth-enabled laptop or any laptop with a commercial off-the-shelf Bluetooth adapter.

Handheld VAV Balancing Tool

The Handheld VAV Balancing Tool lets you set the parameters for VAV applications that reside on Metasys system VMA16 Series, FEC Series, or FAC Series Controllers.

The VAV balancing parameters appear on the tool's LCD. A dial and two buttons let you navigate through intuitive menus to balance the VAV box. The menus are customized to the type of application residing in the controller. The balancing operation features an adjustable time-out parameter that returns the tool and controller to normal operation if you leave the controller in balancing mode.

The Handheld VAV Balancing Tool is lightweight and portable. It can plug into any model of network sensor to access the VAV controller.

The Handheld VAV Balancing Tool is compatible with the following Metasys system BACnet protocol devices:

- FEC or FAC loaded with a VAV application
- VMA16 loaded with a VAV application
- NS Series Network Sensor connected to an FEC, FAC, or VMA16 loaded with a VAV application

Figure 11: Handheld VAV Balancing Tool



Features

The Handheld VAV Balancing Tool provides the following features:

- Allows VAV balancing and commissioning without a laptop.
- Connects directly to the controller or the controller NS Series Network Sensor via standard RJ-12 plug.
- Intuitive, menu-driven operation simplifies balancing tasks.

Network Sensors

The NS Series Network Sensor offering includes NS Series Network Zone Sensors and NS Series Network Discharge Air Sensors ([Figure 12](#)).

Figure 12: Network Zone Sensors and Discharge Air Sensors



The NS Series Network Zone Sensors are designed to function directly with Metasys system FECs, IOMs, and the VMA16s. Several models of network zone sensors monitor room temperature. Options are available to also monitor zone humidity, carbon dioxide (CO₂), local temperature setpoint adjustments, and other variables. This data is transmitted to a field controller on the SA Bus.

The NS Series Network Zone Sensors include models with a temperature setpoint dial and LCD that allows occupants to view the zone temperature and view and adjust the zone temperature setpoint. A fan mode push button is included to set the desired fan speed (AUTO-OFF-low-medium-high). An occupancy override function allows the user to signal the controller that the zone is occupied to override the scheduled mode. Some models have DIP switches to set a unique address for applications that require multiple sensors.

For communication wiring flexibility, the wires connecting the network zone sensor to a controller can be terminated using a modular jack or screw terminals.

Each network zone sensor includes an SA Bus access port to allow accessories to access the SA Bus. This plug allows accessories to service or commission the connected controller or gain access to any other controller on the same FC Bus.

The NS Series Network Discharge Air Sensors are electronic duct sensors designed to function directly with the Johnson Controls FEC family of digital controllers in HVAC systems. Models in this series monitor the duct temperature, typically at the discharge of the VAV box, and transmit this data to an FEC, a VMA16, or an NCE on the SA Bus using the 10 ft (305 cm) wiring lead included with the unit. The 10 ft (305 cm) wiring lead consists of four 22 AWG trade size color-coded wires encased in a plenum-rated jacket. Each of the wires is stripped and tinned for easy connection to the SA Bus screw terminal block.

The NS Series Network Discharge Air Sensors are available with either a 4 or 8 in. (102 or 203 mm) temperature probe. All models include DIP switches for applications requiring multiple discharge air sensors, each with a unique DIP switch address.

Refer to the *NS Series Network Sensors Product Bulletin (LIT-12011574)* for important product application information, ordering information, and technical specifications.

ZFR1800 Series Wireless Field Bus System

The ZFR1800 Series System provides wireless monitoring and control of HVAC equipment within multiple levels of a Metasys system using the BACnet protocol over 2.4 GHz ZigBee Wireless to communicate between supervisory engines, field controllers, and room temperature sensors.

Any Metasys FEC, IOM, and VMA16 field controller can be wirelessly enabled using a ZFR1811 Wireless Field Bus Router. One router is required per field controller. This pairing is referred to as a Wireless Enabled Field Controller (WEFC).

Figure 13: ZFR1811 Router, ZFR1810 Coordinator, WRZ-TTx Series Sensors



A ZFR1800 Series System consists of:

- up to 8 ZFR1810 Wireless Field Bus Coordinators per field bus
- up to 35 WEFCs per coordinator
- up to 100 WEFCs per field bus
- up to 9 WRZ-TTx Series sensors per controller
- additional ZFR1811 Wireless Field Bus Routers connected to ZFR-RPTs, as required, acting as repeaters

Together, these components create a wireless mesh network that allows the exchange of data between the collection of devices within the ZFR1800 Series System's wireless network and wired BACnet MS/TP devices.

Use the MS-ZFRRPT-0 optional repeater power supply with a ZFR1811 router to serve as a repeater to extend wireless mesh networks and provide multiple wireless transmission pathways.

Features of the ZFR1800 Series Wireless Field Bus System

The ZFR1800 Series Wireless Field Bus System provides the following features:

- Wireless communications for a Metasys system provides a wireless platform for Metasys BACnet devices across multiple levels of a Metasys BAS – from supervisory engines, to field controllers, to room temperature sensors. Enables wireless devices to coexist with hard-wired devices on the same Metasys network. Offers simple add-on hardwired to seamlessly enable standard hard-wired Metasys BACnet field controllers to function wirelessly.
- Wireless mesh network enables quick, economical, and low-maintenance installation; minimizes MS/TP BACnet hard wiring; enhances reliability through automatically forming wireless links and redundant wireless data transmission paths.
- Support of up to nine wireless room temperature sensors per wirelessly enabled field controller facilitates temperature averaging and high/low selection to optimize comfort in larger zones.

Refer to the *ZFR1800 Series Wireless Field Bus System Product Bulletin (LIT-12011336)* for additional information.

ZigBee Wireless USB Dongle

Figure 14: ZigBee Wireless USB Dongle



The ZigBee Wireless USB Dongle allows a laptop computer to connect to a ZigBee Field Router (ZFR) wireless field bus for the purpose of commissioning and downloading applications to wirelessly enabled field controllers using the CCT or for analyzing a ZFR wireless mesh using the ZFR Checkout Tool (ZCT). The ZigBee Wireless USB Dongle requires a USB software driver which is installed automatically with CCT version 5.3 or higher. No user configuration is required.

Conclusion

The Metasys FEC family of BACnet controllers, network sensors, and ZFR1800 wireless solution continue to affirm Johnson Controls' position as a leader in the BAS marketplace, and as an innovator of solutions for complete building management. As the leading systems integrator, the Metasys system leverages open protocols to combine the benefits of global communications and control industries into one system.

Repair Information

If a Metasys system field equipment controller, network sensor, or any related product fails to operate within its specifications, replace the product. For replacement products, contact the nearest Johnson Controls representative.

Ordering Information

Contact your Johnson Controls representative to order Metasys field controllers and related products. See [FEC Series Ordering Information](#), [FAC Series Ordering Information](#), [IOM Series for Smoke Control Ordering Information](#), and [VMA16 Series for Smoke Control Ordering Information](#) for product code numbers and product descriptions.

See [FEC for Smoke Control Ordering Information](#) and [IOM Series for Smoke Control Ordering Information](#) for product code numbers and descriptions of field controllers used in smoke control applications.

Table 7: FEC Series Ordering Information

Product Code Number	Description
MS-FEC1611-0	10-Point Field Equipment Controller with 2 UI, 1 BI, 3 BO, and 4 CO; 24 VAC; FC and SA Bus Support
MS-FEC1611-0ET	FEC1611 Extended Temperature Controller for Rooftop Applications. Supports Operational Temperature Range of -40 to 70°C.
MS-FEC1621-0	10-Point Field Equipment Controller with 2 UI, 1 BI, 3 BO, and 4 CO; 24 VAC; FC and SA Bus Support; Integral Display and 6-Button Navigation Touch Pad
MS-FEC2611-0	17-Point Field Equipment Controller with 6 UI, 2 BI, 3 BO, 2 AO, and 4 CO; 24 VAC; FC and SA Bus Support
MS-FEC2611-0ET	FEC2611 Extended Temperature controller for rooftop applications. Supports Operational Temperature Range of -40 to 70°C.
MS-FEC2621-0	17-Point Field Equipment Controller with 6 UI, 2 BI, 3 BO, 2 AO, and 4 CO; 24 VAC; FC and SA Bus Support; Integral Display and 6-Button Navigation Touch Pad

Table 8: FAC Series Ordering Information

Product Code Number	Description
MS-FAC2611-0	17-Point Advanced Application Field Equipment Controller with 6 UI, 2 BI, 4 CO, 3 BO, and 2 AO; 24 VAC; SA Bus; FC Bus; Integral Real-time Clock
MS-FAC2612-1	18-Point Advanced Application Field Equipment Controller with 5 UI, 4 BI, 4 CO, 2 SPDT RO, and 3 SPST RO; 24 VAC; SA Bus; FC Bus; Integral Real-time Clock
MS-FAC2612-2	18-Point Advanced Application Field Equipment Controller with 5 UI, 4 BI, 4 CO, 2 SPDT RO, and 3 SPST RO; 100–240 VAC; SA Bus; FC Bus; Integral Real-time Clock
MS-FAC3611-0A ¹	26-Point Advanced Application Field Equipment Controller with 8 UI, 6 BI, 6 BO, and 6 AO; 24 VAC; SA Bus; FC Bus; Integral Real-time Clock

1 This model is currently available only in Asia; contact your local Johnson Controls representative for more information.

Table 9: IOM Series Ordering Information

Product Code Number	Description
MS-IOM1711-0	4-Point IOM with 4 BI, FC Bus and SA Bus Support
MS-IOM2711-0 ²	6-Point IOM with 2 UI, 2 UO, 2 BO, FC Bus, and SA Bus Support. Relays are rated for 120/240 VAC.
MS-IOM2711-1 ³	6-Point IOM with 2 UI, 2 UO, 2 BO, FC Bus, and SA Bus Support. Relays are rated for 24 VAC.
MS-IOM2711-2 ³	6-Point IOM with 2 UI, 2 UO, 2 BO, FC Bus, and SA Bus Support. Relays are rated for 240 VAC.
MS-IOM2721-0	10-Point IOM with 8 UI, 2 AO, FC Bus, and SA Bus Support
MS-IOM3711-0 ²	12-Point IOM with 4 UI, 4 UO, 4 BO, FC Bus, and SA Bus Support. Relays are rated for 120/240 VAC.
MS-IOM3711-1 ³	12-Point IOM with 4 UI, 4 UO, 4 BO, FC Bus, and SA Bus Support. Relays are rated for 24 VAC
MS-IOM3711-2 ³	12-Point IOM with 4 UI, 4 UO, 4 BO, FC Bus, and SA Bus Support. Relays are rated for 240 VAC
MS-IOM3721-0	16-Point IOM with 16 BI, FC Bus, and SA Bus Support
MS-IOM3731-0	16-Point IOM with 8 BI, 8 BO, FC Bus, and SA Bus Support
MS-IOM3731-0A ¹	16-Point IOM with 8 BI, 8 BO, FC Bus, and SA Bus Support Note: Binary Outputs (BOs) on MS-IOM3731-0A controllers do not supply power for the outputs; the BOs require external low-voltage (<30 VAC) power sources.
MS-IOM4711-0	17-Point IOM with 6 UI, 2 BI, 3 BO, 2 AO, 4 CO, FC and SA Bus Support

1 This model is currently available only in Asia; contact your local Johnson Controls representative for more information.

2 UL Listed

3 CE Marked

Table 10: VMA16 (32-bit) Series Ordering Information

Product Code Number	Description
MS-VMA1615-0	32-bit, Integrated VAV Controller/Actuator/Pressure Sensor, 3 UI and 2 BO; 24 VAC; FC Bus, and SA Bus
MS-VMA1630-0	32-bit, Integrated VAV Controller/Actuator/Pressure Sensor, 3 UI, 3 BO, and 2 CO; 24 VAC; FC Bus, and SA Bus
MS-VMA1617-0 ¹	Same description as VMA1615, but includes 8-pin TSTAT Port for use with TE-7xx Series Non-Communicating Sensors
MS-VMA1632-0 ¹	Same description as VMA1630, but includes 8-pin TSTAT Port for use with TE-7xx Series Non-Communicating Sensors

1 This model is currently available only in Asia; contact your local Johnson Controls representative for more information.

Table 11: FEC Series for Smoke Control Ordering Information

Product Code Number ^{1, 2}	Description
MS-FEC1611-0U	10-Point Field Equipment Controller with 2 UI, 1 BI, 3 BO, and 4 CO; 24 VAC, SA Bus, Mounting Base
MS-FEU1610-0U	10-Point Field Equipment Controller with 2 UI, 1 BI, 3 BO, and 4 CO; 24 VAC; FC and SA Bus Support; Mounting Base and Cover
MS-FEC2611-0U	17-Point Field Equipment Controller with 6 UI, 2 BI, 3 BO, 2 AO, and 4 CO; 24 VAC, SA Bus, Mounting Base
MS-FEU2610-0U	17-Point Field Equipment Controller with 6 UI, 2 BI, 3 BO, 2 AO, and 4 CO; 24 VAC; FC and SA Bus Support; Mounting Base and Cover

1 These devices are UL/ULC 864 Listed, File S4977, 9th Edition UUKL/ORD-C100-13 UUKLC Smoke Control System.

2 You cannot purchase a similar third-party device and install it in a UL/ULC Listed smoke control system. Doing so voids the UL/ULC Smoke Control Listing. Third-party devices must be provided and labeled by the factory as described in the UL/ULC Smoke Control Listing.

Table 12: IOM Series for Smoke Control Ordering Information

Product Code Number ^{1, 2}	Description
MS-IOM1710-0U	4-Point IOM with 4 BI; 24 VAC; FC Bus and SA Bus Support
MS-IOM1711-0U	4-Point IOM with 4 BI; 24 VAC; FC Bus and SA Bus Support
MS-IOM2710-0U	6-Point IOM with 2 UI, 2 UO, 2 BO; 24 VAC; FC Bus and SA Bus Support
MS-IOM2711-0U	6-Point IOM with 2 UI, 2 UO, 2 BO; 24 VAC; FC Bus and SA Bus Support
MS-IOM3710-0U	12-Point IOM with 4 UI, 4 UO, 4 BO; 24 VAC; FC Bus and SA Bus Support
MS-IOM3711-0U	12-Point IOM with 4 UI, 4 UO, 4 BO; 24 VAC; FC Bus and SA Bus Support
MS-IOU4710-0U	17-Point IOM with 6 UI, 2 BI, 3 BO, 2 AO, 4 CO; 24 VAC; FC Bus and SA Bus Support with Mounting Base
MS-IOM4711-0U	17-Point IOM with 6 UI, 2 BI, 3 BO, 2 AO, 4 CO; 24 VAC; FC Bus and SA Bus Support with Mounting Base

1 These devices are UL/ULC 864 Listed, File S4977, 9th Edition UUKL/ORD-C100-13 UUKLC Smoke Control System.

2 All field controllers in a smoke control system must be mounted in Johnson Controls custom or standard UL 864 panels or in panels that are ordered from Johnson Controls. If these field controllers are used with panels that are not supplied by Johnson Controls, they are not compliant with the UL 864 9th Edition UUKL/ORD-C100-13 UUKLC Smoke Control System listing.

Table 13: VMA16 (16-bit) Series for Smoke Control Ordering Information

Product Code Number ¹	Description
MS-VMA1610-0U	1-Point Variable Air Volume Modular Assembly with Integrated VAV Controller, Actuator and Pressure Sensor; 1 UI; 24 VAC; FC and SA Bus Support (Cooling only)
MS-VMA1610-1U	Integrated VAV Controller/Actuator/Pressure Sensor (Cooling Only), FC Bus and SA Bus, 3.3 Volt Model
MS-VMA1620-0U	6-Point Variable Air Volume Modular Assembly with Integrated VAV Controller, Actuator, and Pressure Sensor; 1 UI, 3 BO, and 2 CO; 24 VAC; FC Bus, and SA Bus (with Reheat and Fan Control)
MS-VMA1620-1U	Integrated VAV Controller/Actuator/Pressure Sensor (with Reheat and Fan Control), FC Bus and SA Bus, 3.3 Volt Model

- 1 These devices are UL/ULC 864 Listed, File S4977, 9th Edition UUKL/ORD-C100-13 UUKLC Smoke Control System.
- 2 You cannot purchase a similar third-party device and install it in a UL/ULC Listed smoke control system. Doing so voids the UL/ULC Smoke Control Listing. Third-party devices must be provided and labeled by the factory as described in the UL/ULC Smoke Control Listing.

Table 14: Field Equipment Controller Family Accessories (Order Separately)

Product Code Number	Description
MS-DIS1710-0	Local Controller Display: Refer to <i>Local Controller Display Product Bulletin (LIT-12011273)</i> for more information.
MS-BTCVT-1	Wireless Commissioning Converter with Bluetooth Technology
NS-ATV7003-0	Handheld VAV Balancing Tool
LP-KIT204-000C	BACnet IP to MS/TP Router for Connecting a Computer with CCT to MS/TP Field Controllers
MS-ZFR1810	Wireless Field Bus Coordinator, 10 mW Transmission Power. Functions with NAE35, NAE45, NAE55, and NCE25 Models
MS-ZFR1811	Wireless Field Bus Router, 10 mW Transmission Power. Functions with Metasys BACnet FECs, VMA16s, and WRZ-TT Series Wireless Mesh Room Temperature Sensors
MS-ZFRCBL-0	Wire Harness for Use with ZFR1811 Router. Allows ZFR1811 Router to function with FEC16 Series, VMA16 Series, FAC26 Series, and FEC26 Series Controllers in Conjunction with NS Series Sensors, Wireless Commissioning Converter, or DIS1710 Local Controller Display
MS-BTCVTCBL-700	Cable Replacement Set for the MS-BTCVT-1 or the NS-ATV7003-0; Includes One 5 ft (1.5 m) Retractable Cable
WRZ Series Sensors	WRZ Series Wireless Room Sensors: Refer to the <i>WRZ Series Wireless Room Sensors Product Bulletin (LIT-12011653)</i> for specific sensor model descriptions.
NS Series Sensors	NS Series Network Sensors: Refer to the <i>NS Series Network Sensors Product Bulletin (LIT-12011574)</i> for specific sensor model descriptions.
Y64T15-0	Transformer, 120/208/240 VAC Primary to 24 VAC Secondary, 92 VA, Foot Mount, 30 in. Primary Leads and 30 in. Secondary Leads, Class 2
Y65A13-0	Transformer, 120 VAC Primary to 24 VAC Secondary, 40 VA, Foot Mount (Y65AS), 8 in. Primary Leads and 30 in. Secondary Leads, Class 2
Y65T42-0	Transformer, 120/208/240 VAC Primary to 24 VAC Secondary, 40 VA, Hub Mount (Y65SP+), 8 in. Primary Leads and Secondary Screw Terminals, Class 2
Y65T31-0	Transformer, 120/208/240 VAC Primary to 24 VAC Secondary, 40 VA, Foot Mount (Y65AR+), 8 in. Primary Leads and Secondary Screw Terminals, Class 2
AP-TBK1002-0	2-Position Screw Terminal that Plugs onto VMA Output Point Spade Lug
AP-TBK1003-0	3-Position Screw Terminal that Plugs onto VMA Output Point Spade Lugs
AP-TBK4SA-0	Replacement MS/TP SA Bus Terminal, 4-Position Connector, Brown, Bulk Pack
AP-TBK4FC-0	Replacement MS/TP FC Bus Terminal, 4-Position Connector, Blue, Bulk Pack
AP-TBK3PW-0	Replacement Power Terminal, 3-Position Connector, Gray, Bulk Pack

Table 14: Field Equipment Controller Family Accessories (Order Separately)

Product Code Number	Description
AP-TBK2PW-0	Replacement Power Terminal, 2-Position Connector, Gray, Bulk Pack
MS-TBKLV03-0	Terminal Block Kit - FAC Line Voltage AC Power - 3 Pieces
MS-TBKRO02-0	Terminal Block Kit - FAC 2-Position Relay Output - 9 Pieces
MS-TBKRO03-0	Terminal Block Kit - FAC 3-Position Relay Output - 6 Pieces
MS-TBKCO04-0	Terminal Block Kit - FAC 4-Position Configurable Output - 6 Pieces
MS-TBKUI04-0	Terminal Block Kit - FAC 4-Position Universal Input - 3 Pieces
MS-TBKUI05-0	Terminal Block Kit - FAC 5-Position Universal Input - 3 Pieces
MS-VMAACT-701	VMA Actuator Assembly Gearbox Replacement Kit (Canada Only)
NS-WALLPLATE-0	Network Sensor Wall Plate
TL-BRTRP-0	Portable BACnet IP to MS/TP Router
TE730-29C-0	Sensor with Temperature Setpoint Adjustment and without Occupancy Button
TE730-39C-0	Sensor with Temperature Setpoint Adjustment and Occupancy Button
WRZ-7860-0	Receiver for One-to-One Wireless Room Sensing Systems
WRZ-SST-100	Wireless Sensing System Tool Kit
WRZ-SST-120	Wireless System Survey Tool
ZFR-USBHA-0	<p>USB Dongle with ZigBee™ Driver provides a wireless connection through CCT to allow wireless commissioning of the wirelessly enabled FEC, FAC, IOM, and VMA16 controllers. Also allows use of the ZFR Checkout Tool (ZCT) in CCT.</p> <p>Note: The ZFR-USBHA-0 replaces the IA OEM DAUBI_2400 ZigBee USB dongle. For additional information on the ZFR-USBHA-0 ZigBee dongle, refer to the <i>ZFR1800 Series Wireless Field Bus System Technical Bulletin (LIT-12011295)</i> or <i>ZFR1800 Series Wireless Field Bus System Quick Reference Guide (LIT-12011630)</i>.</p>

FEC Series Technical Specifications

Table 15: FEC Series

Product Code Numbers	<p>MS-FEC1611-0: 10-Point FEC</p> <p>MS-FEC2611-0: 17-Point FEC</p> <p>MS-FEC1621-0: 10-Point FEC with Integral Display and Push Button User Interface</p> <p>MS-FEC2621-0: 17-Point FEC with Integral Display and Push Button User Interface</p> <p>Smoke Control Models:</p> <p>MS-FEC1611-0U: 10-Point FEC</p> <p>MS-FEU1610-0U: 10-Point FEC</p> <p>MS-FEC2611-0U: 17-Point FEC</p> <p>MS-FEU2610-0U: 17-Point FEC</p>
Supply Voltage	24 VAC (nominal, 20 VAC minimum/30 VAC maximum), 50/60 Hz, Power Supply Class 2 (North America), Safety, Extra-Low Voltage (SELV) (Europe)
Power Consumption	<p>14 VA maximum for FEC1611 and FEC2611 (no integral display)</p> <p>20 VA maximum for FEC1621 and FEC 2621 (with integral display)</p> <p>Note: VA ratings do not include any power supplied to the peripheral devices connected to Binary Outputs (BOs) or Configurable Outputs (COs), which can consume up to 12 VA for each BO or CO, for a possible total consumption of an additional 84 VA (maximum).</p>

Table 15: FEC Series

Ambient Conditions	<p>Operating: 0 to 50°C (32 to 122°F); 10 to 90% RH noncondensing</p> <p>Storage: -40 to 80°C (-40 to 176°F); 5 to 95% RH noncondensing</p> <p>Note: FEC models with an -0ET suffix have an operating temperature range of -40 to 70°C (-40 to 158°F).</p>
Controller Addressing	<p>DIP switch set; valid field controller device addresses 4–127</p> <p>(Device addresses 0–3 and 128–255 are reserved and not valid field controller addresses.)</p>
Communications Bus¹	<p>BACnet MS/TP, RS-485:</p> <p>3-wire FC Bus between the supervisory controller and field controllers</p> <p>4-wire SA Bus between field controller, network sensors, and other sensor/actuator devices, includes a lead to source 15 VDC supply power (from field controller) to bus devices</p>
Processor	H8SX/166xR Renesas® 32-bit microcontroller
Memory	1 MB Flash Memory and 512 KB Random Access Memory (RAM)
Input and Output Capabilities	<p>FEC16 Models:</p> <p>2 - Universal Inputs: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact</p> <p>1 - Binary Inputs: Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode</p> <p>3 - Binary Outputs: Defined as 24 VAC Triac (selectable internal or external source power)</p> <p>4 - Configurable Outputs: Defined as 0–10 VDC or 24 VAC Triac BO</p> <p>FEC26 Models:</p> <p>6 - Universal Inputs: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact</p> <p>2 - Binary Inputs: Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode</p> <p>3 - Binary Outputs: Defined as 24 VAC Triac (selectable internal or external source power)</p> <p>4 - Configurable Outputs: Defined as 0–10 VDC or 24 VAC Triac BO</p> <p>2 - Analog Outputs: Defined as 0–10 VDC or 4–20 mA</p>
Analog Input/Analog Output Resolution and Accuracy	<p>Analog Input: 16-bit resolution</p> <p>Analog Output: 16-bit resolution and ±200 mV in 0–10 VDC applications</p>
Terminations	<p>Input/Output: Fixed Screw Terminal Blocks</p> <p>FC Bus, SA Bus, and Supply Power: 3-wire and 4-wire Pluggable Screw Terminal Blocks</p> <p>FC Bus Port and Sensor Port: RJ-12 6-pin Modular Jacks</p>
Mounting	Horizontal on single 35 mm DIN rail mount (preferred), or screw mount on flat surface with three integral mounting clips on controller
Housing	Enclosure material: ABS and polycarbonate UL94 5VB; self-extinguishing; Plenum-rated protection class: IP20 (IEC529)
Dimensions (Height x Width x Depth)	<p>FEC16 Models: 150 x 164 x 53 mm (5-7/8 x 6-7/16 x 2-1/8 in.) including terminals and mounting clips</p> <p>FEC26 Models: 150 x 190 x 53 mm (5-7/8 x 7-1/2 x 2-1/8 in.) including terminals and mounting clips</p> <p>Note: Mounting space for all field controllers requires an additional 50 mm (2 in.) space on top, bottom, and front face of controller for easy cover removal, ventilation, and wire terminations.</p>
Weight	<p>FEC16 Models: 0.4 kg (0.9 lb)</p> <p>FEC26 Models: 0.5 kg (1.1 lb)</p>

Table 15: FEC Series

Compliance	United States: UL Listed, File E107041, CCN PAZX, UL 916, Energy Management Equipment; UL/ULC 864 Listed, File S4977, 9th Edition UUKL/ORD-C100-13 UUKLC Smoke Control System (models with U product code suffix only); FCC Compliant to CFR47, Part 15, Subpart B, Class A
	Canada: UL Listed, File E107041, CCN PAZX7, CAN/CSA C22.2 No. 205, Signal Equipment; Industry Canada Compliant, ICES-003
	Europe: CE Mark – Johnson Controls, Inc. declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC.
	Note: For FEC26 models, conducted RF Immunity within EN 61000-6-2 meets performance criteria B.
	Australia and New Zealand: C-Tick Mark, Australia/NZ Emissions Compliant
	BACnet International: BACnet Testing Laboratories (BTL) Protocol Revision 4 Listed BACnet Application Specific Controller (B-ASC)

¹ For more information, refer to the *MS/TP Communications Bus Technical Bulletin (LIT-12011034)*.

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.

FAC Series Technical Specifications

Table 16: FAC Series

Product Code Numbers	MS-FAC2611-0: 17-Point FAC with Integral Real-Time Clock and 24 VAC Supply Power MS-FAC2612-1: 18-Point FAC with Integral Real-Time Clock and 24 VAC Supply Power MS-FAC2612-2: 18-Point FAC with Integral Real-Time Clock and 100–240 VAC Supply Power MS-FAC3611-0A¹: 26-Point FAC with Integral Real-Time Clock and 24 VAC Supply Power
Supply Voltage	MS-FAC2611-0, MS-FAC2612-1, and MS-FAC3611-0A: 24 VAC (nominal, 20 VAC minimum/30 VAC maximum), 50/60 Hz, Power Supply Class 2 (North America), SELV (Europe) MS-FAC2612-2: 100–240 VAC 50/60 Hz
Power Consumption	14 VA maximum for MS-FAC2611-0 and MS-FAC3611-0A 30 VA maximum for MS-FAC2612-1 40 VA maximum for MS-FAC2612-2 Note: VA ratings do not include any power supplied to the peripheral devices connected to Binary Outputs (BOs) or Configurable Outputs (COs), which can consume up to 12 VA for each BO or CO, for a possible total consumption of an additional 84 VA (maximum).
Ambient Conditions	Operating: 0 to 50°C (32 to 122°F), 10 to 90% RH noncondensing; Pollution Degree 2 Storage: -40 to 80°C (-40 to 176°F), 5 to 95% RH noncondensing
Controller Addressing	DIP switch set; valid field controller device addresses 4–127 (Device addresses 0–3 and 128–255 are reserved and not valid field controller addresses.)
Communications Bus	BACnet MS/TP, RS-485: 3-wire FC Bus between the supervisory controller and field controllers 4-wire SA Bus between field controller, network sensors, and other sensor/actuator devices, includes a lead to source 15 VDC supply power (from field controller) to bus devices.
Processor	H8SX/166xR Renesas® microcontroller MS-FAC3611-0A uses RX630 32-Bit Renesas® microcontroller
Memory	4 MB Flash Memory and 1 MB Random Access Memory (RAM)

Table 16: FAC Series

<p>Input and Output Capabilities</p>	<p>FAC2611-0:</p> <p>6 - Universal Inputs: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact</p> <p>2 - Binary Inputs: Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode</p> <p>2 - Analog Outputs: Defined as 0–10 VDC or 4–20 mA</p> <p>3 - Binary Outputs: Defined as 24 VAC Triac (selectable internal or external source power)</p> <p>4 - Configurable Outputs: Defined as 0–10 VDC or 24 VAC Triac BO</p> <p>FAC2612-1 and FAC2612-2:</p> <p>5 - Universal Inputs: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact</p> <p>4 - Binary Inputs: Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode</p> <p>4 - Configurable Outputs: Defined as 0–10 VDC or 24 VAC Triac BO</p> <p>2 - Relay Outputs (Single-Pole, Double-Throw): UL 916: 1/4 hp 120 VAC, 1/2 hp 240 VAC; 360 VA Pilot Duty at 120/240 VAC (B300); 3 A Non-inductive 24-240 VAC; EN 60730: 6 (4) A N.O. or N.C. only</p> <p>3 - Relay Outputs (Single-Pole, Single-Throw): UL 916:1/4 hp 120 VAC, 1/2 hp 240 VAC; 360 VA Pilot Duty at 120/240 VAC (B300); 3 A Non-inductive 24-240 VAC; EN 60730: 6 (4) A N.O. or N.C. only</p> <p>FAC3611-0A:¹</p> <p>8 - Universal Inputs: Defined as 0-10 VDC, 4-20 mA, 0-600k ohms, or Binary Dry Contact</p> <p>6 - Binary Inputs: Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode</p> <p>6 - Binary Outputs: Defined as 24 VAC Triac (external power source only)</p> <p>6 - Analog Outputs: Defined as 0-10 VDC or 4-20 mA</p>
<p>Analog Input/Analog Output Resolution and Accuracy</p>	<p>Analog Input: 15-bit resolution</p> <p>Analog Output: 15-bit resolution, +/- 200 mV accuracy in 0-10 VDC applications</p>
<p>Terminations</p>	<p>Input/Output: Fixed Screw Terminal Blocks on MS-FAC2611-0 and MS-FAC3611-0A and Pluggable Terminal Blocks on MS-FAC2612-1 and MS-FAC2612-2</p> <p>FC Bus, SA Bus, and Supply Power: 3-wire and 4-wire Pluggable Screw Terminal Blocks</p> <p>FC Bus and SA Bus: RJ-12 6-pin Modular Jacks</p>
<p>Mounting</p>	<p>Horizontal on single 35 mm DIN rain mount (preferred), or screw mount on flat surface with three integral mounting clips on controller</p>
<p>Housing</p>	<p>Enclosure material: ABS and polycarbonate UL94 5VB, self-extinguishing; Plenum-rated Protection Class: IP20 (IEC529) (except the FAC2612 controller)</p>
<p>Dimensions (Height x Width x Depth)</p>	<p>FAC2611-0: 150 x 190 x 53 mm (5-7/8 x 7-1/2 x 2-1/8 in.) including terminals and mounting clips</p> <p>FAC2612 Models: 150 x 164 x 53 mm (5-7/8 x 6-7/16 x 2-1/8 in.) including terminals and mounting clips</p> <p>FAC3611-0A¹: 150 x 220 x 57.5 mm (5-7/8 x 8-3/4 x 2-3/8 in.) including terminals and mounting clips</p> <p>Note: Mounting space for FAC models requires an additional 50 mm (2 in.) space on top, bottom, and front face of controller for easy cover removal, ventilation, and wire terminations.</p>
<p>Weight</p>	<p>0.5 kg (1.1 lb)</p>

Table 16: FAC Series

Compliance	United States: UL Listed, File E107041, CCN PAZX, UL 916, Energy Management Equipment; FCC Compliant to CFR47, Part 15, Subpart B, Class A
	Canada: UL Listed, File E107041, CCN PAZX7, CAN/CSA C22.2 No. 205, Signal Equipment; Industry Canada Compliant, ICES-003
	Europe: CE Mark – Johnson Controls, Inc., declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC. Johnson Controls, Inc., declares that the FAC2612-2 models are also in compliance with the essential requirements and other relevant provisions of the Low Voltage Directive 2006/95/EC. Declared as Independently Mounted, Intended for Panel Mounting, Operating Control Type 1.B, 4kV rated impulse voltage, 100°C ball pressure test.
	Australia and New Zealand: C-Tick Mark, Australia/NZ Emissions Compliant
	BACnet International:
	FAC26 Models -BACnet Testing Laboratories (BTL) Protocol Revision 7 Listed BACnet Advanced Application Controller (B-AAC) FAC3611-0A¹ - BACnet Testing Laboratories™ Protocol Revision 9 (BTL) Listed BACnet Advanced Application Controller (B-AAC)

1 This model is currently available only in Asia; contact your local Johnson Controls representative for more information.

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.

IOM Series Technical Specifications

Table 17: IOM Series

Product Code Numbers	<p>MS-IOM1711-0: 4-Point IOM with 4 BI, FC Bus and SA Bus Support</p> <p>MS-IOM2711-0: 6-Point IOM with 2 UI, 2 UO, 2 BO, FC Bus, and SA Bus Support. Relays are rated for 120/240 VAC</p> <p>MS-IOM2711-1: 6-Point IOM with 2 UI, 2 UO, 2 BO, FC Bus, and SA Bus Support. Relays are rated for 24 VAC</p> <p>MS-IOM2711-2: 6-Point IOM with 2 UI, 2 UO, 2 BO, FC Bus, and SA Bus Support. Relays are rated for 240 VAC.</p> <p>MS-IOM2721-0: 10-Point IOM with 8 UI, 2 AO, FC Bus, and SA Bus Support</p> <p>MS-IOM3711-0: 12-Point IOM with 4 UI, 4 UO, 4 BO, FC Bus, and SA Bus Support. Relays are rated for 120/240 VAC</p> <p>MS-IOM3711-1: 12-Point IOM with 4 UI, 4 UO, 4 BO, FC Bus, and SA Bus Support. Relays are rated for 24 VAC</p> <p>MS-IOM3711-2: 12-Point IOM with 4 UI, 4 UO, 4 BO, FC Bus, and SA Bus Support. Relays are rated for 240 VAC</p> <p>MS-IOM3721-0: 16-Point IOM with 16 BI, FC Bus, and SA Bus Support</p> <p>MS-IOM3731-0: 16-Point IOM with 8 BI, 8 BO, FC Bus, and SA Bus Support</p> <p>MS-IOM3731-0A¹: 16-Point IOM with 8 BI, 8 BO, FC Bus, and SA Bus Support</p> <p>MS-IOM4711-0: 17-Point IOM with 6 UI, 2 BI, 3 BO, 2 AO, 4 CO, FC and SA Bus Support</p> <p>Smoke Control Models:</p> <p>MS-IOM1710-0U: 4-Point IOM with 4 BI, FC Bus and SA Bus Support</p> <p>MS-IOM1711-0U: 4-Point IOM with 4 BI, FC Bus and SA Bus Support</p> <p>MS-IOM2710-0U: 6-Point IOM with 2 UI, 2 UO, 2 BO, FC Bus, and SA Bus Support</p> <p>MS-IOM2711-0U: 6-Point IOM with 2 UI, 2 UO, 2 BO, FC Bus, and SA Bus Support</p> <p>MS-IOM3710-0U: 12-Point IOM with 4 UI, 4 UO, 4 BO, FC Bus, and SA Bus Support</p> <p>MS-IOM3711-0U: 12-Point IOM with 4 UI, 4 UO, 4 BO, FC Bus, and SA Bus Support</p> <p>MS-IOU4710-0U: 17-Point IOM with 6 UI, 2 BI, 3 BO, 2 AO, 4 CO, FC Bus and SA Bus Support with Mounting</p> <p>MS-IOM4711-0U: 17-Point IOM with 6 UI, 2 BI, 3 BO, 2 AO, 4 CO, FC Bus and SA Bus Support with Mounting</p>
Supply Voltage	24 VAC (nominal, 20 VAC minimum/30 VAC maximum), 50/60 Hz, Power Supply Class 2 (North America), Safety Extra-Low Voltage (SELV) Europe
Power Consumption	14 VA maximum Note: VA ratings do not include any power supplied to the peripheral devices connected to Binary Outputs (BOs) or Configurable Outputs (COs), which can consume up to 12 VA for each BO or CO, for a possible total consumption of an additional 84 VA (maximum), depending on the IOM model.
Ambient Conditions	<p>Operating: 0 to 50°C (32 to 122°F); 10 to 90% RH noncondensing</p> <p>Storage: -40 to 80°C (-40 to 176°F); 5 to 95% RH noncondensing</p>
Addressing	DIP switch set; valid field controller device addresses 4–127 (Device addresses 0–3 and 128–255 are reserved and not valid IOM addresses).

Table 17: IOM Series

Communications Bus²	<p>BACnet MS/TP, RS-485</p> <p>3-wire FC Bus between the supervisory controller and field devices</p> <p>4-wire SA Bus between field controller, network sensors, and other sensor/actuator devices. Includes a lead source 15 VDC supply power (from field controller) to bus devices.</p>
Processor	<p>H8SX/166xR Renesas® 32-bit microcontroller</p>
Memory	<p>512 KB Flash Memory and 128 KB Random Access Memory (RAM)</p>
Input and Output Capabilities	<p>IOM1711:</p> <p>4 - Binary Inputs: Defined as Dry Contact Maintained or Pulse Counter/ Accumulator Mode</p> <hr/> <p>IOM2711:</p> <p>2 - Universal Inputs: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact</p> <p>2 - Universal Outputs: Analog Output: Voltage Mode, 0-10 VDC; Binary Output Mode: 24 VAC/DC FET; Analog Output: Current Mode, 4-20 mA</p> <p>2 - Relay Outputs: (Single-Pole, Double-Throw);</p> <p>UL 916 (-0 model only): 1/4 hp 120 VAC, 1/2 hp 240 VAC; 360 VA Pilot Duty at 120/240 VAC (B300); 3 A Non-inductive 24-240 VAC;</p> <p>EN 60730 (-1 model only): 6 (4) A N.O. or N.C. only, 24 VAC, SELV</p> <p>EN 60730 (-2 model only): 6 (4) A N.O. or N.C. only, 240 VAC</p> <hr/> <p>IOM2721:</p> <p>8 - Universal Inputs: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact</p> <p>2 - Analog Outputs: Defined as 0–10 VDC or 4–20 mA</p> <hr/> <p>IOM3711:</p> <p>4 - Universal Inputs: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact</p> <p>4 - Universal Outputs: Analog Output: Voltage Mode, 0-10 VDC; Binary Output Mode: 24 VAC/DC FET; Analog Output: Current Mode, 4-20 mA</p> <p>4 - Relay Outputs: (Single-Pole, Double-Throw);</p> <p>UL 916 (-0 model only): 1/4 hp 120 VAC, 1/2 hp 240 VAC; 360 VA Pilot Duty at 120/240 VAC (B300); 3 A Non-inductive 24-240 VAC;</p> <p>EN 60730 (-1 model only): 6 (4) A N.O. or N.C. only, 24 VAC, SELV</p> <p>EN 60730 (-2 model only): 6 (4) A N.O. or N.C. only, 240 VAC</p> <hr/> <p>IOM3721:</p> <p>16 - Binary Inputs: Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode</p> <hr/> <p>IOM3731:</p> <p>8 - Binary Inputs: Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode</p> <p>8 - Binary Outputs: Defined as 24 VAC Triac (Require external low-voltage power source.)</p> <p>Note: Binary Outputs (BOs) on MS-IOM3731-0A controllers do not supply power for the outputs; the BOs require external low-voltage (< 30 VAC) power sources.</p> <hr/> <p>IOM4711:</p> <p>6 - Universal Inputs: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact</p> <p>2 - Binary Inputs: Defined as Dry Contact Maintained or Pulse/Counter Accumulator Mode</p> <p>3 - Binary Outputs: Defined as 24 VAC Triac (selectable internal or external source power)</p> <p>4 - Configurable Outputs: Defined as 0–10 VDC or 24 VAC Triac BO</p> <p>2 - Analog Outputs: Defined as 0–10 VDC or 4–20 mA</p>

Table 17: IOM Series

Analog Input/Analog Output Resolution and Accuracy	Analog Input: 16-bit resolution Analog Output: 16-bit resolution and ± 200 mV in 0–10 VDC applications
Terminations	Input/Output: Fixed Screw Terminal Blocks SA/FC Bus and Supply Power: 4-wire and 3-wire Pluggable Screw Terminal Blocks SA/FC Bus Port: RJ-12 6-Pin Modular Jacks
Mounting	Horizontal on single 35 mm DIN rail mount (preferred), or screw mount on flat surface with three integral mounting clips on controller
Housing	Enclosure material: ABS and polycarbonate UL94 5VB; self-extinguishing, Plenum-rated protection class: IP20 (IEC529)
Dimensions (Height x Width x Depth)	IOM17 and IOM27 Family Models: 150 x 120 x 53 mm (5-7/8 x 4-3/4 x 2-1/8 in.) including terminals and mounting clips IOM2721, IOM3721, and IOM3731 Models: 150 x 164 x 53 mm (5-7/8 x 6-7/16 x 2-1/8 in.) including terminals and mounting clips IOM37 and IOM47 Family Models: 150 x 190 x 53 mm (5-7/8 x 7-1/2 x 2-1/8 in.) including terminals and mounting clips Note: Mounting space for all field controllers requires an additional 50 mm (2 in.) space on top, bottom, and front face of controller for easy cover removal, ventilation, and wire terminations.
Weight	0.5 kg (1.1 lb) maximum
Compliance	United States: UL Listed, File E107041, CCN PAZX, UL 916, Energy Management Equipment; UL/ULC 864 Listed, File S4977, 9th Edition UUKL/ORD-C100-13 UUKLC Smoke Control System (models with U product code suffix only); FCC Compliant to CFR47, Part 15, Subpart B, Class A Note: Except IOM2711-1 and IOM2711-2; IOM 3711-1 and IOM3711-2 Canada: UL Listed, File E107041, CCN PAZX7, CAN/CSA C22.2 No. 205, Signal Equipment; Industry Canada Compliant, ICES-003 Note: Except IOM2711-1 and IOM2711-2; IOM 3711-1 and IOM3711-2 Europe: CE Mark – Johnson Controls, Inc. declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC. Declared as Independently Mounted, Intended for Panel Mounting, Operating Control Type 1.B, 4kV rated impulse voltage, 100.7°C ball pressure test. Note: Except IOM2711-0 and IOM3711-0 Note: For IOM47xx Models , Conducted RF Immunity within EN 61000-6-2 meets performance criteria B. Australia and New Zealand: C-Tick Mark, Australia/NZ Emissions Compliant Note: Except IOM2711-0 and IOM3711-0 BACnet International: BACnet Testing Laboratories (BTL) Protocol Revision 4 Listed BACnet Application Specific Controller (B-ASC)

1 This model is currently available only in Asia; contact your local Johnson Controls representative for more information.

2 For more information, refer to the *MS/TP Communications Bus Technical Bulletin (LIT-12011034)*.

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.

VMA (16-bit) Series Technical Specifications

Table 18: VMA16 (16-bit) Series For Smoke Control Ordering Information

Product Code Numbers	Smoke Control Models: MS-VMA1610-0U: 1-Point VMA (Cooling Only) MS-VMA1610-1U: Integrated VAV Controller/Actuator/Pressure Sensor (Cooling Only), 3.3 Volt Model MS-VMA1620-0U: 6-Point VMA (Cooling with Reheat and Fan Control) MS-VMA1620-1U: Integrated VAV Controller/Actuator/Pressure Sensor (with Reheat and Fan Control), 3.3 Volt Model
Supply Voltage	24 VAC (nominal, 20 VAC minimum/30 VAC maximum), 50/60 Hz, Power Supply Class 2 (North America), Safety Extra-Low Voltage (SELV) (Europe)
Power Consumption	10 VA typical, 14 VA maximum Note: VA ratings do not include any power supplied to the peripheral devices connected to Binary Outputs (BOs) or Configurable Outputs (COs), which can consume up to 12 VA for each BO or CO, for a possible total consumption of an additional 60 VA (maximum).
Ambient Conditions	Operating: 0 to 50°C (32 to 122°F) Storage: -40 to 70°C (-40 to 158°F)
Terminations	Inputs/Outputs: 6.3 mm (1/4 in.) Spade Lugs FC Bus, SA Bus, and Supply Power: 4-Wire and 3-Wire Pluggable Screw Terminal Blocks Sensor Port: RJ-12 6-Pin Modular Jacks
Controller Addressing	DIP switch set; valid field controller device addresses 4–127 (Device addresses 0–3 and 128–255 are reserved and not valid field controller addresses.)
Communications Bus²	BACnet MS/TP, RS-485: 3-wire FC Bus between the supervisory controller and field controllers 4-wire SA Bus from the VMA controller, network sensors, and other sensor/actuator devices, includes a terminal to source 15 VDC supply power from VMA to SA Bus devices
Processor	Renesas® 16-bit H8S/239x microcontroller
Memory	1 MB Flash Memory and 512 KB Random Access Memory (RAM)
Input and Output Capabilities	VMA1610: 1 - Universal Input: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact VMA1620: 1 - Universal Input: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact 3 - Binary Outputs: Defined as 24 VAC Triac (internal power source) 2 - Configurable Outputs: Defined as 0–10 VDC or 24 VAC Triac BO
Analog Input/Analog Output Resolution and Accuracy	Analog Input: 15-bit resolution Analog Output: 16-bit resolution and ±200 mV in 0–10 VDC applications

Table 18: VMA16 (16-bit) Series For Smoke Control Ordering Information

Air Pressure Differential Sensor	<p>Setra transducer, differential pressure to electrical, 0 to 0.375 kPa (0 to 1.5 in. WC) , 0.5 to 4.5 VDC output, 5 VDC supply, aluminum plated.</p> <p>Performance Characteristics</p> <p>Combined Repeatability and Hysteresis Error: $\pm 0.05\%$ of Full Span Maximum</p> <p>Non-linearity Errors (Best Fit Method): $\pm 1.0\%$ of Full Span Maximum</p> <p>Response Time (to within 63% of Full Scale Pressure with Step Change on Input): 15 ms</p> <p>Temperature Error from 15.6 to 48.9°C (60 to 120°F)</p> <p>Null: $\pm 0.06\%$ of Full Span per °F Maximum</p> <p>Span: $\pm 1.5\%$ of Full Span Maximum</p> <p>Stability, Null: $\pm 0.5\%$ of Full Scale Maximum, 1 Year Minimum</p> <p>Stability, Span: $\pm 2.0\%$ of Full Scale Maximum, 1 Year Minimum</p>
Mounting	Mounts to damper shaft using single set screw and to duct with single mounting screw.
Housing	Enclosure Material: ABS polycarbonate UL94 5VB; Self-extinguishing, Plenum Rated Protection Class: IP20 (IEC529)
Actuator Rating	4 N•m (35 lb•in.) minimum shaft length = 44 mm (1-3/4 in.)
Dimensions	<p>Height x Width x Depth: 182 x 182 x 64 mm (7-3/16 x 7-3/16 x 2-1/2 in.)</p> <p>Center of Output Hub to Center of Anti Rotation Slot: 160 mm (6-5/16 in.)</p> <p>Note: Mounting space for all field controllers requires an additional 50 mm (2 in.) space on top, bottom, and front face of controller for easy cover removal, ventilation, and wire terminations.</p>
Weight	0.86 kg (1.9 lb)
Compliance	<p>United States: UL Listed, File E107041, CCN PAZX, UL 916, Energy Management Equipment; UL/ULC 864 Listed, File S4977, 9th Edition UUKL/ORD-C100-13 UUKLC Smoke Control System (models with U product code suffix only); FCC Compliant to CFR47, Part 15, Subpart B, Class A</p> <p>Canada: UL Listed, File E107041, CCN PAZX7, CAN/CSA C22.2 No. 205, Signal Equipment; Industry Canada Compliant, ICES-003</p> <p>Europe: CE Mark – Johnson Controls, Inc., declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC and the Low Voltage Directive 2006/95/EC.</p> <p>Australia and New Zealand: C-Tick Mark, Australia/NZ Emissions Compliant</p> <p>BACnet International: BACnet Testing Laboratories (BTL) Protocol Revision 7 Listed BACnet Application Specific Controller (B-ASC)</p>

1 For more information, refer to the *MS/TP Communications Bus Technical Bulletin (LIT-12011034)*.

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.

VMA16 (32-bit) Series Technical Specifications

Table 19: VMA16 (32-bit) Series

Product Code Numbers	<p>MS-VMA1615-0: 32-bit, Integrated VAV Controller/Actuator/Pressure Sensor, 3 UI and 2 BO; 24 VAC; FC and SA Bus</p> <p>MS-VMA1630-0: 32-bit, Integrated VAV Controller/Actuator/Pressure Sensor, 3 UI, 3 BO, 2 CO; 24 VAC; FC and SA Bus</p> <p>MS-VMA1617-0¹: Same description as VMA1615 but includes 8-pin TSTAT Port for use with TE-7xx Series Non-Communicating Sensors</p> <p>MS-VMA1632-0¹: Same description as VMA1630 but includes 8-pin TSTAT Port for use with TE-7xx Series Non-Communicating Sensors</p>
Supply Voltage	24 VAC (nominal, 20 VAC minimum/30 VAC maximum), 50/60 Hz, Power Supply Class 2 (North America), Safety Extra-Low Voltage (SELV) (Europe)
Power Consumption	<p>10 VA typical, 14 VA maximum</p> <p>Note: VA ratings do not include any power supplied to the peripheral devices connected to Binary Outputs (BOs) or Configurable Outputs (COs), which can consume up to 12 VA for each BO or CO, for a possible total consumption of an additional 60 VA (maximum).</p>
Ambient Conditions	<p>Operating: 0 to 50°C (32 to 122°F)</p> <p>Storage: -40 to 70°C (-40 to 158°F)</p>
Terminations	<p>VMA1615 and VMA1630:</p> <p>Inputs/Outputs: 6.3 mm (1/4 in.) Spade Lugs</p> <p>FC Bus, SA Bus, and Supply Power: 4-Wire and 2-Wire Pluggable Screw Terminal Blocks</p> <p>FC and SA Bus Modular Ports: RJ-12 6-Pin Modular Jacks</p> <p>VMA1617 and VMA1632:</p> <p>Inputs/Outputs, SA Bus, and Supply Power: 6.3 mm (1/4 in.) Spade Lugs</p> <p>FC Bus Pluggable Screw Terminal Block</p> <p>TSTAT Modular Port: RJ-45 8-Pin Modular Jack</p>
Controller Addressing	<p>DIP switch set; valid field controller device addresses 4–127</p> <p>(Device addresses 0–3 and 128–255 are reserved and not valid field controller addresses.)</p>
Communications Bus²	<p>BACnet MS/TP, RS-485:</p> <p>3-wire FC Bus between the supervisory controller and field controllers</p> <p>4-wire SA Bus from the VMA controller, network sensors, and other sensor/actuator devices, includes a terminal to source 15 VDC supply power from VMA to SA Bus devices.</p>
Processor	RX630 32-bit Renesas® microcontroller
Memory	1 MB Flash Memory and 512 KB Random Access Memory (RAM)
Input and Output Capabilities	<p>1 - Universal Input: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact</p> <p>3 - Binary Outputs: Defined as 24 VAC Triac (internal power source)</p> <p>2 - Configurable Outputs: Defined as 0–10 VDC or 24 VAC Triac BO</p>
Analog Input/Analog Output Accuracy	<p>Analog Input: 15-bit resolution on UIs</p> <p>Analog Output: 0–10 VDC ± 200 mV</p>
Air Pressure Differential Sensor	<p>Range: -1.5 in. to 1.5 in. W.C.</p> <p>Performance Characteristics:</p> <p>Accuracy +/-1.3% Full Span Maximum³ (+/- .039 in. w.c.)</p> <p>Typical accuracy at zero (null) pressure is +/-0.2% full scale⁴</p>

Table 19: VMA16 (32-bit) Series

Mounting	Mounts to damper shaft using single set screw and to duct with single mounting screw.
Actuator Rating	4 N•m (35 lb•in.) minimum shaft length = 44 mm (1-3/4 in.)
Dimensions	Height x Width x Depth: 165 x 125 x 73 mm (6.5 x 4.92 x 2.9 in.) Center of Output Hub to Center of Captive Spacer: 135 mm (5-5/16 in.)
Weight	0.65 kg (1.45 lb)
Compliance	<p>United States: UL Listed, File E107041, CCN PAZX, UL 916, Energy Management Equipment. Suitable for use in other environmental air space (plenums) in accordance with Section 300.22(C) of the National Electric Code (VMA1615 and VMA1630 only). FCC Compliant to CFR47, Part 15, Subpart B, Class A.</p> <p>Canada: UL Listed, File E107041, CCN PAZX7, CAN/CSA C22.2 No. 205, Signal Equipment; Industry Canada Compliant, ICES-003</p> <p>Europe: CE Mark – Johnson Controls, Inc. declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC.</p> <p>Australia and New Zealand: C-Tick Compliant (N1813), Australia/NZ Emissions Compliant.</p> <p>BACnet International: BACnet Testing Laboratories (BTL) Protocol Revision 7 Listed BACnet Application Specific Controller (B-ASC)</p>

- 1 This model is currently available only in Asia; contact your local Johnson Controls representative for more information.
- 2 For more information, refer to the *MS/TP Communications Bus Technical Bulletin (LIT-12011034)*.
- 3 Combined error due to offset, non-linearity, and temperature variation.
- 4 Includes error due to non-linearity.

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.

Wireless Commissioning Converter Technical Specifications

Table 20: Wireless Commissioning Converter

Product Code	MS-BTCVT-1
Power Requirement	Nominal 15 VDC, supplied by the field controller SA/FC Bus Port
Power Consumption	1.35 watts maximum
Ambient Conditions	Operating: 0 to 50°C (32 to 122°F), 5 to 95% RH, Noncondensing, 30°C (86°F) Maximum Dew Point Storage: -40 to 85°C (-40 to 185°F), 5 to 95% RH, Noncondensing
Transmission Power	2.5 mW maximum
Transmission Speed	Wireless Communication: 115.2 bits per second (bps) Serial Communication (SA/FC Bus): 9600, 19.2k, 38.4k, or 76.8k bps
Transmission Range (Typical)	Wireless Communication: 10 m (33 ft) Line-of-Sight
Wireless Security	Security Mode 3 - Link Level Enforced Security
Network and Serial Interfaces	Bluetooth Wireless Technology One RS-485 Bus
Dimensions	116 x 75 x 35 mm (4.6 x 3.0 x 1.4 in.)
Housing	Black ABS Plastic Housing Blue PVC Protective Boot
Weight	0.165 kg (0.365 lb) without hanging components

Table 20: Wireless Commissioning Converter

Compliance	United States: UL 916 Energy Management; Plenum-rated per UL1995 UL94-5VB Flammability Rating Transmitter complies with FCC Part 15.247 regulations for low-power unlicensed transmitters (Transmitter FCC Identification: CB2-MS-BTCVT-0) Receiver complies with FCC Part 15.109 regulations for low-power unlicensed receivers (Transmitter FCC Identification: CB2-MS-BTCVT-0)
	Canada: Industry Canada (IC: 279A-MSBTCVT0)
	Europe: CE Mark – Johnson Controls, Inc. declares that this product is in compliance with the essential requirements and other relevant provisions of the R&TTE Directive 1999/05/EC.
	Japan: Telecommunications Certification - 003NY05068 0000

Handheld VAV Balancing Tool Technical Specifications

Table 21: Handheld VAV Balancing Tool

Product Code	NS-ATV7003-0
Supply Voltage	9.8 to 16.5 VDC; 15 VDC Nominal, supplied by the Sensor Actuator (SA) Bus Port
Current Consumption	90 mA maximum
Terminations	RJ-12, 6-Position Modular Jack
Transmission Speed	Serial Communication (SA Bus) 9600, 19.2k, 38.4k, or 76.8k bps
Sensor Addressing	Fixed address of 198
Ambient Conditions	Operating : 0 to 50°C (32 to 122°F); 5 to 95% RH, Noncondensing; 30°C (86°F) Maximum Dew Point Storage: -40 to 85°C (-40 to 185°F); 5 to 95% RH, Noncondensing
Dimensions	80 x 80 x 25 mm (3.2 x 3.2 x 1.0 in.)
Weight	0.165 kg (0.365 lb)
Compliance	United States: UL Listed, File E107041, CCN PAZX, UL 916, Energy Management Equipment; FCC Compliant to CFR47, Part 15, Subpart B, Class A Canada: UL Listed, File E107041, CCN PAZX7, CAN/CSA C22.2 No. 205, Signal Equipment Industry Canada, ICES-003 Europe: CE Mark – Johnson Controls, Inc. declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC. Australia and New Zealand: C-Tick Mark, Australia/NZ Emissions Compliant BACnet International: BACnet Testing Laboratories (BTL) Listed BACnet Smart Sensor (B-SS)

North American Emissions Compliance for FEC Series, IOM Series, and VMA16 Series Controllers

United States

This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when this equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area may cause harmful interference, in which case the users will be required to correct the interference at their own expense.

Canada

This Class (A) digital apparatus meets all the requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la Classe (A) respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

North American Emissions Compliance for Wireless Commissioning Converters

United States

This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the Federal Communications Commission (FCC) Rules. These limits are designed to provide reasonable protection against harmful interference when this equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area may cause harmful interference, in which case the users will be required to correct the interference at their own expense.

RF Transmitters: Compliance Statement (Part 15.19)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. this device must accept any interference received, including interference that may cause undesired operation.

Warning (Part 15.21)

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Canada

This Class (A) digital apparatus meets all the requirements of the Canadian Interference-Causing Equipment Regulations. Cet appareil numérique de la Classe (A) respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

RF Transmitters: Industry Canada Statement

The term IC before the certification/registration number only signifies that the Industry Canada technical specifications were met. Le terme «IC» précédant le numéro d'accréditation/inscription signifie simplement que le produit est conforme aux spécifications techniques d'Industry Canada.

Section 5.5 of RSS-210

This device has been designed to operate with an antenna having a maximum gain of 2 dB. Antenna having a higher gain is strictly prohibited per regulations of Industry Canada. The required antenna impedance is 50 ohms. Cet appareil a été conçu pour fonctionner avec une antenne d'un gain maximum de 2 dBi. En application des réglementations d'Industry Canada, l'utilisation d'une antenne de gain supérieur est strictement interdite. L'impédance d'antenne requise est de 50 ohms.

Section 5.11 of RSS-210

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (EIRP) is not more than that required for successful communication. Pour réduire les interférences radio potentielles avec les dispositifs d'autres utilisateurs, le type d'antenne et son gain doivent être choisis de façon à ce que la puissance isotrope rayonnée équivalente (PIRE) ne soit pas supérieure à la puissance nécessaire pour une bonne communication.



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