

# Metasys® System Field Equipment Controllers and Related Products

## Product Bulletin

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Refer to the [QuickLIT Web site](#) for the most up-to-date version of this document.

### Overview

The Metasys® system family of Field Equipment Controllers comprise 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 Heating, Ventilating, and Air Conditioning (HVAC) and other building equipment.

This family of controllers includes the Field Equipment Controller (FEC), Input/Output Module (IOM), and the Variable Air Volume (VAV) Modular Assembly (VMA) 16 controller. The FEC and IOM Series Controllers 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. Specific restyled FEC models include a more intuitive push-button User Interface (UI) with Liquid Crystal Display (LCD) that provides enhanced local monitoring of your controlled field equipment.

The Field Equipment Controller family also includes NS Series network sensors, the ZFR1800 Series Wireless Field Bus system, and WRZ Series wireless sensors. These additional controllers enable both wired and wireless capabilities in your field network applications.



**Figure 1: Metasys System Field Equipment Controllers**

Our wide variety of network sensor models provides options for measuring and displaying zone temperature, duct temperature, zone humidity, Carbon Dioxide (CO<sub>2</sub>) level, setpoint adjustments, fan speed control, and discharge air temperatures.

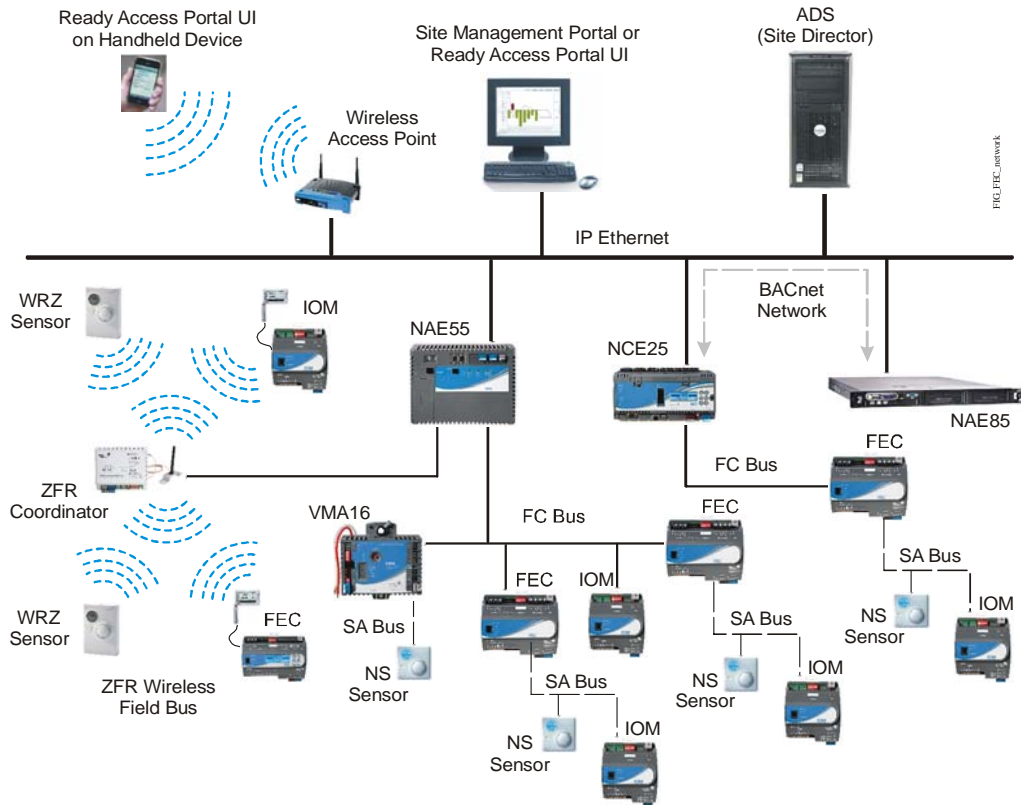
The ZFR1800 Series uses open wireless technology standards, including Institute of Electrical and Electronic Engineers (IEEE) 802.15.4 and ZigBee™ technology, to provide flexibility and mobility advantages.

**Table 1: Features and Benefits (Part 1 of 2)**

Features	Benefits
<b>Metasys Release 5.0 Redesign</b>	Provides an improved style with user-friendly graphic theme and clear push-button identification.
<b>32-Bit Microprocessor</b>	Meets industry specifications and ensures optimum performance.
<b>Standard BACnet Protocol</b>	Allows controllers to use standard open protocol for building systems coordination.
<b>Standard Hardware Platform</b>	Uses a common design throughout the family line to support standardized wiring practices.
<b>Zigbee Wireless Field Controller (FC)/Sensor Actuator (SA) Bus Interface</b>	Provides a wireless alternative to hard-wired Metasys system counterparts, providing application flexibility, mobility, and minimal disruption to building occupants.
<b>Bluetooth® Wireless Commissioning Interface</b>	Provides an easy-to-use connection to the configuration and commissioning tool.
<b>Complete Product Family</b>	Provides the ability to meet any HVAC control requirement.
<b>Auto Tuned Control Loops</b>	Reduce commissioning time, eliminate change-of-season recommissioning, and reduce wear and tear on mechanical devices.

**Table 1: Features and Benefits (Part 2 of 2)**

Features	Benefits
<b>Universal Inputs, Configurable Outputs, and Point Expansion Modules</b>	Allow multiple signal options and provide input/output flexibility.
<b>Optional Local User Interface Display</b>	Allows convenient monitoring and adjusting capabilities at the local device.
<b>BACnet Testing Laboratories (BTL) Listing</b>	Provides compliance with BACnet Testing Laboratories™ Testing and Interoperability, which measures meeting their universal protocol.



**Figure 2: Metasys System with Field Equipment Controllers**

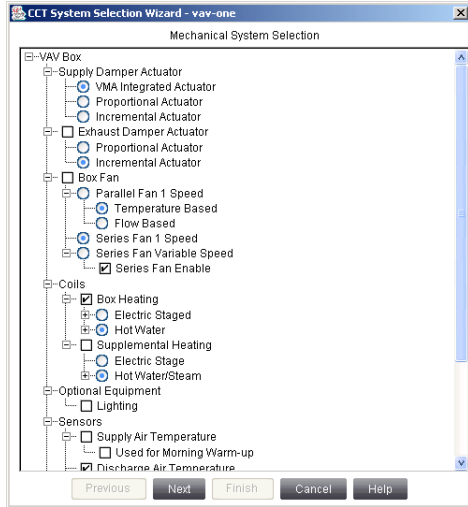
### Integration to the Metasys System Supervisory Devices

The Field Equipment Controller family is designed to integrate seamlessly into the Metasys system by connecting and communicating directly to the Network Automation Engine (NAE) or Network Control Engine (NCE). With this integration, the building operator can view the Field Equipment Controllers directly from the Metasys system User Interface (UI). In addition, the operator can view Field Equipment Controller information locally with the local display (Figure 2).

### ***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.

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



**Figure 3: Mechanical Selection**

The family of controllers and input/output modules is BACnet Testing Laboratory (BTL) tested and listed as Application Specific Controllers (B-ASC). The Network Sensors are BTL listed as Smart Sensors (B-SS).

### 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).

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.

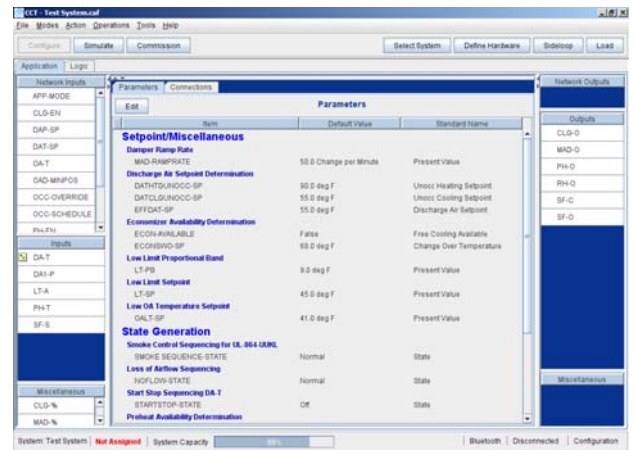
The **Commissioning** mode manages the downloading of files to the field equipment controllers through two different network connection points. You can connect using the Wireless Commissioning Converter between your laptop and the MS/TP bus, or using the Ethernet Passthru mode in conjunction with the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

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 can be used 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 of the CCT

- 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



Figure 5: FEC



Figure 6: IOM

### **Field Equipment Controller (FEC)**

The FEC is a programmable digital controller that communicates via BACnet MS/TP protocol. The FEC models include the 10-point FEC16 and the 17-point FEC26. FEC models include a 32-bit microprocessor, intuitive design, and are available with an optional built-in LCD screen local UI (Figure 5).

#### **Features of the FEC**

- Patented proportional adaptive control (P-Adaptive) and Pattern Recognition Adaptive Control (PRAC) technologies provide continuous loop tuning.
- User-friendly graphic theme and clear push-button identification facilitate easy controller use.
- Writable flash memory allows you to download standard or customized applications from the CCT software.
- 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 application capacity.
- NAE and NCE Automatic Discovery ability allows for easy controller integration.
- Local UI display option (integral display or stand-alone display) provides enhanced local monitoring.

### **Input/Output Module (IOM)**

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 or VMA controller, the IOMs expand the point count of these controllers. When installed on the FC Bus as point multiplexors, IOMs allow an NAE or NCE to monitor and control supervisory points directly (Figure 6).

#### **Features of the IOM**

- Large product family provides a wide range of input/output point combinations to best fit the applications.
- Ability to reside on the FC Bus or SA Bus provides application flexibility.
- Pluggable communications bus, Inputs/Outputs, and power terminals expedite installation.

#### **Features Common to both the FEC and IOM**

- BACnet MS/TP communication provides open system compatibility.
- 32-bit microprocessor ensures optimum performance and meets industry specifications.
- Wireless capabilities via ZFR1800 Series Wireless Field Bus System enable wireless mesh connectivity between FECs/IOMs to WRZ Series Wireless Room Temperature Sensors, and to NAE/NCE devices, facilitate easy initial location and relocation.
- Universal and configurable inputs and outputs support multiple signal options and increase controller application flexibility.

## FEC and IOM Applications

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.

## FEC and IOM Hardware

The FECs and IOMs are assembled in a durable, plenum-rated, plastic housing. The plastic housing may eliminate the need for a separate enclosure for plenum-rated construction. Check code requirements for appropriate applications.

Light-Emitting Diodes (LEDs), visible through the housing, indicate the status of power to the controller, communications status, and a number of diagnostic indicators.

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 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)*.

## FEC and IOM Installation

Mounting clips allow the FEC or IOM to be mounted directly on a wall or other flat surface, or allow the FEC or IOM to be mounted on 35-mm DIN rail.

You can make the controller address unique for each FEC or IOM using the DIP switches that are accessible through the controller or module housing.

The AC power input is electrically isolated from the DC inputs and outputs by an internal transformer. This isolation eliminates polarity issues, ground loops, and the need for a separate isolation transformer. Power, MS/TP communications, and binary outputs are all separately isolated.

## FEC and IOM Models and Capabilities

Table 2 lists the point type counts for the FEC Series controllers. Table 3 lists the point type counts for the IOM Series controllers

### Panelized Options (North America Only)

The Field Controllers and Input/Output Modules are also available in pre-built panels. The panelized options provide all of the controllers necessary for a complete application solution, including a pre-wired power source and a lockable door.

**Table 2: FEC Series Point Type Counts per Model**

Point Types	Signals Accepted	FEC16x1	FEC26x1
<b>Universal Input (UI)</b>	Analog Input, Voltage Mode, 0–10 VDC Analog Input, Current Mode, 4–20 mA <sup>1</sup> 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	6
<b>Binary Input (BI)</b>	Dry Contact Maintained Mode Pulse Counter/Accumulator Mode (High Speed), 100 Hz	1	2
<b>Analog Output (AO)</b>	Analog Output, Voltage Mode, 0–10 VDC Analog Output, Current Mode, 4–20 mA		2
<b>Binary Output (BO)</b>	24 VAC Triac	3	3
<b>Universal Output (UO)</b>	Analog Output, Voltage Mode, 0–10 VDC Binary Output Mode, 24 V AC/DC FET Analog Output, Current Mode, 4–20 mA		
<b>Configurable Output (CO)</b>	Analog Output, Voltage Mode, 0–10 VDC Binary Output Mode, 24 VAC Triac	4	4
<b>Relay Output</b>	120/240 VAC		

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

**Table 3: IOM Series Point Type Counts per Model**

Point Types	Signals Accepted	IOM 1711	IOM 2711	IOM 2721 <sup>1</sup>	IOM 3711	IOM 3721 <sup>1</sup>	IOM 3731 <sup>1</sup>	IOM 4711
<b>Universal Input (UI)</b>	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
<b>Binary Input (BI)</b>	Dry Contact Maintained Mode Pulse Counter/Accumulator Mode (High Speed), 100 Hz	4				16	8	2
<b>Analog Output (AO)</b>	Analog Output, Voltage Mode, 0–10 VDC Analog Output, Current Mode, 4–20 mA			2				2
<b>Binary Output (BO)</b>	24 VAC Triac						8 <sup>2</sup>	3
<b>Universal Output (UO)</b>	Analog Output, Voltage Mode, 0–10 VDC Binary Output Mode, 24 V AC/DC FET Analog Output, Current Mode, 4–20 mA		2		4			
<b>Configurable Output (CO)</b>	Analog Output, Voltage Mode, 0–10 VDC Binary Output Mode, 24 VAC Triac							4
<b>Relay Output</b>	120/240 VAC		2		4			

1. This model is currently available only in Asia. Contact your local Johnson Controls Sales Representative for more information.
2. The BOs on the IOM3731-0A model require an external low-voltage power source.

## VMA16 Variable Air Volume Controllers



Figure 7: VMA16

The VMA16 controllers are programmable digital controllers that communicate via BACnet MS/TP Protocol. Both the VMA1610 and VMA1620 controllers have a pressure sensor and actuator in a pre-wired unit. The VMA16 controllers connect easily to the NS Series Network Sensors for zone and discharge air temperature sensing (Figure 7).

### Features of the VMA16 Controllers

- BACnet MS/TP protocol communication provides open system compatibility.
- Writable flash memory allows standard or customized applications to be downloaded from the CCT.
- Integrated pressure sensor and actuator reduces installation time.
- The fast response actuator drives the damper from full open to full closed (90°) in 60 seconds to reduce commissioning time.

- Wireless capabilities via the ZFR1800 Series Wireless Field Bus System enable wireless mesh connectivity between VMA16s to WRZ Series Wireless Room Temperature Sensors, and to NAE/NCE devices, facilitate easy initial location and relocation.
- Point capacity can be expanded by adding IOMs to the Sensor Actuator bus, providing further application flexibility.
- Patented proportional adaptive control (P-Adaptive) and Pattern Recognition Adaptive Control (PRAC) technologies provide continuous loop tuning.

### Applications

The VMA16 controllers can be configured for both single-duct and dual-duct VAV applications. The VMA1610 and VMA1620 controllers require an additional damper actuator and Differential Pressure Transducer (DPT) sensor for dual-duct or supply/exhaust applications.

### Hardware

The VMA16 controllers are in a durable, plenum-rated, ABS plastic housing. The controller, transducer, and actuator are all integrated into a single enclosure.

The VMA16 controllers' plenum-rated housing may eliminate the need for a separate enclosure for plenum applications. Check code requirements for appropriate applications.

The FC Bus and SA Bus communication connectors have removable screw terminals. Input/Output (I/O) connections to the VMA are easy-to-use spade lugs. Screw terminal I/O connectors are available as optional accessories.

The differential pressure sensor in the VMA16 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.

LEDs, visible through the housing, indicate the status of power to the controller, communications status, and a number of diagnostic indicators.

## Installation

Field mounting the VMA16 controller is easy. The VMA16 controller requires minimal wiring and is 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 full open or full close.

The housing dimensions of the VMA16 controllers (182 x 182 x 64 mm [7-1/4 x 7-1/4 x 2-1/2 in.]) meet industry mounting requirements and make the controllers easy to handle.

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

The AC power input is isolated from the DC inputs and outputs by an internal transformer. This arrangement eliminates polarity issues, ground loops, and the need for a separate isolation transformer. Power, MS/TP communications, and binary outputs are all separately isolated.

## Models and Capabilities

Table 4 lists the point type counts for the VMA16 controllers.

**Table 4: VMA Series Point Type Counts per Model**

Point Types	Signals Accepted	VMA1610	VMA1620
<b>Universal Input (UI)</b>	Analog Input, Voltage Mode, 0–10 VDC 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	1	1
<b>Binary Output (BO)</b>	24 VAC Triac		3
<b>Configurable Output (CO)</b>	Analog Output, Voltage Mode, 0–10 VDC Binary Output Mode, 24 VAC Triac		2
<b>Integrated Actuator</b>	Internal	1	1
<b>Integrated Flow Sensor</b>	Internal	1	1
<b>Zone Sensor Input</b>	On SA Bus	up to 4 NS Series Network Zone sensors up to 9 WRZ wireless zone sensors	
<b>Discharge Air Sensor Input</b>	On SA Bus	up to 5 discharge air sensors	

## Network Sensors



**Figure 8: Network Zone Sensors and Discharge Air Sensors**

The NS Series Network Sensor offering includes NS Series Network Zone Sensors and NS Series Network Discharge Air Sensors (Figure 8).

The NS Series Network Zone Sensors are designed to function directly with Metasys system FECs, IOMs, and the VMA16. Several models of network zone sensors monitor room temperature. Options are available to also monitor zone humidity, Carbon Dioxide (CO<sub>2</sub>), 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, Relative Humidity (RH), 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 Field Controller (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 a FEC, a VMA16, or a 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.



**Figure 9: Handheld VAV Balancing Tool**

### **Handheld VAV Balancing Tool**

The VAV Balancing Tool allows you to easily adjust and set the required parameters for VAV applications that reside on the Metasys system VMA16 Series or FEC Series controllers.

The VAV balancing parameters appear on the tool's LCD. You use the dial and two buttons on the tool to navigate through simple, intuitive menus to balance the VAV box. The menus are customized to the type of application residing in the controller. The balancing operation also 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 VAV Balancing Tool is compatible with the following Metasys system BACnet protocol devices:

- FEC loaded with a VAV application
- VMA16 loaded with a VAV application
- Network Zone Sensors connected to an FEC or VMA16 loaded with a VAV application

#### **Features of the Handheld VAV Balancing Tool**

- Handheld balancing tool allows VAV balancing and commissioning without a laptop.
- Standard plug connects directly to the controller or the controller NS Series Network Sensor.
- Intuitive, menu-driven operation simplifies balancing tasks.

#### **ZFR1800 Series Wireless Field Bus System**

A ZFR1800 Series System provides wireless monitoring and control of HVAC equipment within multiple levels of a Metasys system using BACnet protocol—from supervisory engines, to field controllers, to room temperature sensors. Any Metasys FEC, IOM, or 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).

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

**Note:** 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.

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 (Figure 10).



**Figure 10: ZFR1811 Routers (left), ZFR1810 Coordinator (center), and WRZ-TTx Series Sensors (right)**

#### **Features of the ZFR1800 Series Wireless Field Bus System**

- Wireless communications for a Metasys system provides a wireless platform for Metasys BACnet devices across multiple levels of a Metasys Building Automation System (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.

## Bluetooth Wireless Commissioning Converter



**Figure 11: Wireless Commissioning Converter**

The Wireless Commissioning Converter is a communications converter that provides a temporary Bluetooth wireless connection between the 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 11).

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

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

### Features of the Bluetooth Wireless Commissioning Converter

- 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 wireless enabled laptop.
- Standard Bluetooth wireless technology allows you to use a Bluetooth wireless-enabled laptop or laptop with a commercial off-the-shelf Bluetooth wireless adapter.

## Additional BACnet Protocol Connected Devices

### TEC2600 Series Network Thermostat Controllers

The TEC2600 Series Network Thermostat Controllers control a variety of commercial HVAC equipment. The features include a backlit LCD, easy-to-use three or five button interface, and BACnet MS/TP network communications. The network interface supports remote programming and monitoring, enabling each thermostat controller to be easily customized for the most efficient operation. From the thermostat controller or a supervisory controller, you can easily adjust heating or cooling setpoints, view the room or outside air temperatures, select mode of operation (Day/Night), and more (Figure 12).

TEC2600 Series models are also available with an onboard occupancy sensor (Figure 12). Provided by Passive Infrared (PIR) motion detecting technology, this occupancy sensing capability maximizes up to 30% energy savings in high-energy usage light commercial buildings, such as schools and hotels. The occupancy sensor saves energy by using additional standby setpoint strategies during occupied times.

The TEC260x Series Staged Thermostat Controllers can be used with rooftop units (with and without economizers), heat pumps, and single-stage and multi-stage heating/cooling equipment.

The TEC2645, TEC26x6, and TEC26x7 Series Thermostat Controllers provide single and dual outputs. These outputs offer On/Off, Floating, or Proportional control and optional one-speed, two-speed, or three-speed fan control for two-pipe or four-pipe systems such as cabinet unit heaters, perimeter heat, fan coils, zoning equipment, and others.



**Figure 12: TEC26x6H-4+PIR Series Network Thermostat Controller**

For more information on the TEC2600 Series Network Thermostat Controllers, refer to the following documents:

- *TEC2645-4 BACnet MS/TP Networked Thermostat Controller with Single Proportional Output and One-Speed Fan Control Product Bulletin (LIT-12011586)*
- *TEC26x6(H)-4 and TEC26x6H-4+PIR Series BACnet MS/TP Networked Thermostat Controllers with Dehumidification Capability, Fan Control, and Occupancy Sensing Capability Product Bulletin (LIT-12011587)*

- *TEC26x7-4 Series BACnet MS/TP Networked Thermostat Controllers with Two Outputs Product Bulletin (LIT-12011584)*
- *TEC260x-4 and TEC260x-4+PIR Series BACnet MS/TP Networked Thermostat Controllers Product Bulletin (LIT-12011585)*

### Conclusion

The Metasys Field Equipment Controller 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.

### Ordering Information

Contact your Johnson Controls representative to order Metasys system FECs, IOMs, VMA1600s, and related products. Specify the desired product code number from Table 5 for the FEC, IOM, VMA, Wireless Commissioning Converter, or VAV balancing tool.

### Repair Information

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

**Table 5: FEC, VMA, IOM, Wireless Commissioning Converter, Handheld VAV Balancing Sensor, and ZFR1800 Series Wireless Field Bus System Ordering Information (Part 1 of 2)**

Product Code Number	Description
MS-FEC1611-0	10-Point Field Equipment Controller with 2 UI, 1 BI, 3 BO, and 4 CO; 24 VAC; SA Bus; Mounting Base
MS-FEC1621-0	10-Point Field Equipment Controller with 2 UI, 1 BI, 3 BO, and 4 CO; 24 VAC; SA Bus; Mounting Base; Integral Display
MS-FEC2611-0	17-Point Field Equipment Controller with 6 UI, 2 BI, 3 BO, 2 AO, and 4 CO; 24 VAC; SA Bus; Mounting Base
MS-FEC2621-0	17-Point Field Equipment Controller with 6 UI, 2 BI, 3 BO, 2 AO and 4 CO; 24 VAC; SA Bus; Integral Display; Mounting Base
MS-IOM1711-0	4-Point IOM with 4 BI, FC Bus and SA Bus Support
MS-IOM2711-0	6-Point IOM with 2 UI, 2 UO, 2 BO, FC Bus, and SA Bus Support
MS-IOM2721-0 <sup>1</sup>	10-Point IOM with 8 UI, 2 AO, FC Bus, and SA Bus Support
MS-IOM3711-0	12-Point IOM with 4 UI, 4 UO, 4 BO, FC Bus, and SA Bus Support
MS-IOM3721-0 <sup>1</sup>	16-Point IOM with 16 BI, FC Bus, and SA Bus Support
MS-IOM3731-0A <sup>1</sup>	16-Point IOM with 8 BI, 8 BO, FC Bus, and SA Bus Support
MS-IOM4711-0	17-Point IOM with 6 UI, 2 BI, 3 BO, 2 AO, 4 CO, 24 VAC, and SA Bus with Mounting Base

**Table 5: FEC, VMA, IOM, Wireless Commissioning Converter, Handheld VAV Balancing Sensor, and ZFR1800 Series Wireless Field Bus System Ordering Information (Part 2 of 2)**

<b>Product Code Number</b>	<b>Description</b>
<b>MS-VMA1610-0</b>	Integrated VAV Controller/Actuator/Pressure Sensor (Cooling only), FC Bus, and SA Bus
<b>MS-VMA1620-0</b>	Integrated VAV Controller/Actuator/Pressure Sensor (with Reheat and Fan Control), FC Bus, and SA Bus
<b>NS-ATV7003-0</b>	Handheld VAV balancing tool
<b>MS-BTCVT-1</b>	Wireless Commissioning Converter, with Bluetooth technology
<b>MS-ZFR1810-0</b>	Wireless Field Bus Coordinator, 10 mW Transmission Power. Functions with NAE35xx, NAE45xx, NAE55xx, and NCE25xx Models
<b>MS-ZFR1811-0</b>	Wireless Field Bus Router, 10 mW Transmission Power. Functions with Metasys BACnet FECs, VMA1600s, and WRZ-TTx Series Wireless Mesh Room Temperature Sensors
<b>WRZ-TTB0000-0</b>	Display with Setpoint Adjustment, F/C Button
<b>WRZ-TTD0000-0</b>	Display with Setpoint Adjustment, F/C Button, Fan Speed Control
<b>WRZ-TTP0000-0</b>	Wireless Mesh Room Temperature Sensor, Warmer/Cooler (+/-) Setpoint Adjustment, 10 mW Transmission Power
<b>WRZ-TTR0000-0</b>	Wireless Mesh Room Temperature Sensor, No Setpoint Adjustment, 10 mW Transmission Power
<b>WRZ-TTS0000-0</b>	Wireless Mesh Room Temperature Sensor, Set Point Adjustment Scale: 13 to 29°C/55 to 85°F, 10 mW Transmission Power
<b>WRZ-STR-0000-0</b>	Refrigerator/Freezer Remote Probe and Transmitter
<b>MS-ZFRRPT-0</b>	Optional Repeater Accessory for use with ZFR1811 Router as a repeater. Includes 24 VAC to 15 VDC power supply, and 4 x 4 in. electrical box with cover.
<b>MS-ZFRCBL-0</b>	Wire Harness for use with ZFR1811 Router. Allows ZFR1811 Router to function with FEC1620; and with FEC1610, VMA1610, or VMA1620 controllers in conjunction with NS Series Sensors, Wireless Commissioning Converter, or DIS1710 Local Controller Display.

1. This model is currently available only in Asia. Contact your local Johnson Controls Sales Representative for more information.

**Table 6: FEC, VMA, IOM Ordering Information for UL Listed, File S4977, UUKL 864 - 9th Edition, Smoke Control Equipment**

<b>Product Code Number<sup>1</sup></b>	<b>Description</b>
<b>MS-FEU1610-0U</b>	10-Point Field Equipment Controller with 2 UI, 1 BI, 3 BO, and 4 CO; 24 VAC; SA Bus; (includes Mounting Base and Cover)
<b>MS-FEU1620-0U</b>	10-Point Field Equipment Controller with 2 UI, 1 BI, 3 BO, and 4 CO; 24 VAC; SA Bus; Mounting Base; Integral Display
<b>MS-FEU2610-0U</b>	17-Point Field Equipment Controller with 6 UI, 2 BI, 3 BO, 2 AO, and 4 CO; 24 VAC; SA Bus; Mounting Base
<b>MS-FEU2620-0U</b>	17-Point Field Equipment Controller with 6 UI, 2 BI, 3 BO, 2 AO, and 4 CO; 24 VAC; SA Bus; Mounting Base; Integral Display
<b>MS-IOM1710-0U</b>	4-Point IOM with 4 BI, FC Bus and SA Bus Support
<b>MS-IOM2710-0U</b>	6-Point IOM with 2 UI, 2 UO, 2 BO, FC Bus, and SA Bus Support
<b>MS-IOM3710-0U</b>	12-Point IOM with 4 UI, 4 UO, 4 BO, FC Bus, and SA Bus Support
<b>MS-IOM4710-0U</b>	17-Point IOM with 6 UI, 2 BI, 3 BO, 2 AO, 4 CO, 24 VAC, and SA Bus with Mounting Base
<b>MS-VMA1610-0U</b>	Integrated VAV Controller/Actuator/Pressure Sensor (Cooling only), FC Bus, and SA Bus
<b>MS-VMA1620-0U</b>	Integrated VAV Controller/Actuator/Pressure Sensor (with Reheat and Fan Control), FC Bus, and SA Bus

1. These devices are UL Listed, File S4977, UUKL 864 - 9th Edition, Smoke Control Equipment.

**Table 7: FEC Family Accessories (Order Separately)**


<b>Product Code Number</b>	<b>Description</b>
<b>Y64T15-0</b>	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
<b>Y65A13-0</b>	Transformer, 120 VAC Primary to 24 VAC Secondary, 40 VA, Foot Mount (Y65AS), 8 in. Primary Leads and 30 in. Secondary Leads, Class 2
<b>Y65T42-0</b>	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
<b>Y65T31-0</b>	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
<b>AP-TBK1002-0</b>	2-Position Screw Terminal that Plugs onto VMA output point Spade Lugs
<b>AP-TBK1003-0</b>	3-Position Screw Terminal that Plugs onto VMA output point Spade Lugs
<b>AP-TBK4SA-0</b>	Replacement MS/TP SA Bus Terminal, 4-Position Connector, Brown, Bulk Pack
<b>AP-TBK4FC-0</b>	Replacement MS/TP FC Bus Terminal, 4-Position Connector, Blue, Bulk Pack
<b>AP-TBK3PW-0</b>	Replacement Power Terminal, 3-Position Connector, Gray, Bulk Pack
<b>MS-BTCVTCBL-700</b>	Cable replacement Set for the MS-BTCVT-1 or the NS-ATV7003-0; includes one 5 ft (1.5 m) retractable cable.
<b>MS-DIS1710-0</b>	Local Controller Display for FEC1611 and FEC2611 models
<b>NS-WALLPLATE-0</b>	Network Sensor wall plate
<b>WRZ-SST-100</b>	Wireless Sensing System Tool Kit

## Technical Specifications

### FEC Series (Part 1 of 2)

<b>Product Code Numbers</b>	MS-FEC1611-0 – Field Equipment Controller MS-FEC2611-0 – Field Equipment Controller MS-FEC1621-0 – Field Equipment Controller with Display and Push Button User Interface MS-FEC2621-0 – Field Equipment Controller with Display and Push Button User Interface
<b>Supply Voltage</b>	24 VAC (nominal, 20 VAC minimum/30 VAC maximum), 50/60 Hz, power supply Class 2 (North America), Safety Extra-Low Voltage (SELV) (Europe)
<b>Power Consumption</b>	14 VA maximum for FEC1611 and FEC2611 (no integral display) 20 VA maximum for FEC1621 and FEC2621 (with integral display) <b>Note:</b> 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).
<b>Ambient Conditions</b>	<b>Operating:</b> 0 to 50°C (32 to 122°F); 10 to 90% RH noncondensing <b>Storage:</b> -40 to 80°C (-40 to 176°F); 5 to 95% RH noncondensing
<b>Controller Addressing</b>	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.)
<b>Communications Bus</b>	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. <sup>1</sup>
<b>Processor</b>	H8SX/166xR Renesas® microcontroller
<b>Memory</b>	1 MB Flash Memory and 512 KB Random Access Memory (RAM)
<b>Input and Output Capabilities</b>	<b>FEC16 Models:</b> 2 - Universal Inputs: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact 1 - Binary Inputs: Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode 3 - Binary Outputs: Defined as 24 VAC Triac (selectable internal or external source power) 4 - Configurable Outputs: Defined as 0–10 VDC or 24 VAC Triac BO <b>FEC26 Models:</b> 6 - Universal Inputs: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact 2 - Binary Inputs: Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode 3 - Binary Outputs: Defined as 24 VAC Triac (selectable internal or external source power) 4 - Configurable Outputs: Defined as 0–10 VDC or 24 VAC Triac BO 2 - Analog Outputs: Defined as 0–10 VDC or 4–20 mA
<b>Analog Input/Analog Output Resolution and Accuracy</b>	Analog Input: 16-bit resolution Analog Output: 16-bit resolution and ±200 mV in 0–10 VDC applications
<b>Terminations</b>	Input/Output: Fixed Screw Terminal Blocks FC Bus, SA Bus, and Supply Power: 3-Wire and 4-Wire Pluggable Screw Terminal Blocks FC Bus and SA Bus: RJ-12 6-Pin Modular Jacks
<b>Mounting</b>	Horizontal on single 35 mm DIN rail mount (preferred), or screw mount on flat surface with three integral mounting clips on controller
<b>Housing</b>	Enclosure material: ABS and polycarbonate UL94 5VB; Self-extinguishing, Plenum-rated Protection Class: IP20 (IEC529)
<b>Dimensions (Height x Width x Depth)</b>	<b>FEC16 Models:</b> 150 x 164 x 53 mm (5-7/8 x 6-7/16 x 2-1/8 in.) including terminals and mounting clips <b>FEC26 Models:</b> 150 x 190 x 53 mm (5-7/8 x 7-1/2 x 2-1/8 in.) including terminals and mounting clips <b>Note:</b> Mounting space for FEC16 and FEC26 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.
<b>Weight</b>	<b>FEC16 Models:</b> 0.4 kg (0.9 lb) <b>FEC26 Models:</b> 0.5 kg (1.1 lb)

## FEC Series (Part 2 of 2)

	<b>United States:</b> UL Listed, File E107041, CCN PAZX, UL 916, Energy Management Equipment; FCC Compliant to CFR47, Part 15, Subpart B, Class A
	<b>Canada:</b> UL Listed, File E107041, CCN PAZX7, CAN/CSA C22.2 No. 205, Signal Equipment Industry Canada Compliant, ICES-003
	<b>Europe:</b> 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 <b>FEC26 Models</b> , Conducted RF Immunity within EN 61000-6-2 meets performance criteria B.
	<b>Australia and New Zealand:</b> C-Tick Mark, Australia/NZ Emissions Compliant
	<b>BACnet International:</b> BACnet Testing Laboratories™ (BTL) 135-2004 Listed BACnet Application Specific Controller (B-ASC)

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


## IOM Series (Part 1 of 3)

<b>Product Code Numbers</b>	MS-IOM17xx-0 – Input/Output Module MS-IOM27xx-0 – Input/Output Module MS-IOM37xx-0x – Input/Output Module MS-IOM47xx-0 – Input/Output Module
<b>Supply Voltage</b>	24 VAC (nominal, 20 VAC minimum/30 VAC maximum), 50/60 Hz, power supply Class 2 (North America), Safety Extra-Low Voltage (SELV) Europe
<b>Power Consumption</b>	14 VA maximum <b>Note:</b> VA rating does 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).
<b>Ambient Conditions</b>	<b>Operating:</b> 0 to 50°C (32 to 122°F); 10 to 90% RH noncondensing <b>Storage:</b> -40 to 80°C (-40 to 176°F); 5 to 95% RH noncondensing
<b>Addressing</b>	DIP switch set; valid field controller device addresses 4–127 (Device addresses 0–3 and 128–255 are reserved and not valid IOM addresses).
<b>Communications Bus</b>	BACnet MS/TP, RS-485 3-wire FC Bus between the supervisory controller and field devices 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. <sup>1</sup>
<b>Processor</b>	H8SX/166xR Renesas® 32-bit microcontroller
<b>Memory</b>	<b>IOM17xx, IOM27xx, and IOM37xx Models:</b> 640 KB Flash Memory and 128 KB Random Access Memory (RAM) <b>IOM47xx Models:</b> 1 MB Flash Memory and 512 KB RAM

## IOM Series (Part 2 of 3)

<b>Input and Output Capabilities</b>	<b>IOM1711:</b> 4 - Binary Inputs: Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode
	<b>IOM2711:</b> 2 - Universal Inputs: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact 2 - Universal Outputs: Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode 2 - Relay Outputs (Single-Pole, Double-Throw) Rate as: 240 VAC maximum voltage 1/3 hp 125 VAC, 1/2 hp 250 VAC 400 VA Pilot Duty at 240 VAC 200 VA Pilot Duty at 120 VAC 3 A Noninductive 24–240 VAC
	<b>IOM2721<sup>2</sup>:</b> 8 - Universal Inputs: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact 2 - Analog Outputs: Defined as 0–10 VDC or 4–20 mA
	<b>IOM3711:</b> 4 - Universal Inputs: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact 4 - Universal Outputs: Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode 4 - Relay Outputs (Single-Pole, Double-Throw) Rate as: 240 VAC maximum voltage 1/3 hp 125 VAC, 1/2 hp 250 VAC 400 VA Pilot Duty at 240 VAC 200 VA Pilot Duty at 120 VAC 3 A Noninductive 24–240 VAC
	<b>IOM3721<sup>2</sup>:</b> 16 - Binary Inputs: Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode
	<b>IOM3731-0A<sup>2</sup>:</b> 8 - Binary Inputs: Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode 8 - Binary Outputs: Defined as 24 VAC Triac (Require external low-voltage power source.)
	<b>IOM4711:</b> 6 - Universal Inputs: Defined as 0–VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact 2 - Binary Inputs: Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode 3 - Binary Outputs: Defined as 24 VAC Triac (selectable internal or external source power) 4 - Configurable Outputs: Defined as 0–10 VDC or 24 VAC Triac BO 2 - Analog Outputs: Defined as 0–10 VDC or 4–20 mA
	<b>Analog Input/Analog Output Resolution and Accuracy</b>
<b>Terminations</b>	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
<b>Mounting</b>	Horizontal on single 35 mm DIN rail mount (preferred), or screw mount on flat surface with three integral mounting clips on controller
<b>Housing</b>	Enclosure material: ABS and polycarbonate UL94 5VB; Self-extinguishing, Plenum-rated Protection Class: IP20 (IEC529)
<b>Dimensions (Height x Width x Depth)</b>	<b>IOM17xx and IOM27xx Models:</b> 150 x 120 x 53 mm (5-7/8 x 4-3/4 x 2-1/8 in.) including terminals and mounting clips <b>IOM37xx and IOM47xx Models:</b> 150 x 190 x 53 mm (5-7/8 x 7-1/2 x 2-1/8 in.) including terminals and mounting clips <b>Note:</b> For all models, mounting space requires an additional 50 mm (2 in.) space on top, bottom, and front face of controller for easy removal, ventilation, and wire terminations.
<b>Weight</b>	0.5 kg (1.1 lb) maximum

### IOM Series (Part 3 of 3)


	<b>United States:</b> UL Listed, File E107041, CCN PAZX, UL 916, Energy Management Equipment; FCC Compliant to CFR47, Part 15, Subpart B, Class A
	<b>Canada:</b> UL Listed, File E107041, CCN PAZX7, CAN/CSA C22.2 No. 205, Signal Equipment; Industry Canada Compliant, ICES-003
	<b>Europe:</b> 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. <b>Note:</b> For IOM47 Models, Conducted RF Immunity within EN 61000-6-2 meets performance criteria B.
	<b>Australia and New Zealand:</b> C-Tick Mark, Australia/NZ Emissions Compliant
	<b>BACnet International:</b> BACnet Testing Laboratories (BTL) 135-2004 Listed BACnet Application Specific Controller (B-ASC) (IOM2721, IOM3721, and IOM3731-0A models pending.)

- For more information, refer to the *MS/TP Communications Bus Technical Bulletin (LIT-12011034)*.
- This model is currently available only in Asia. Contact your local Johnson Controls Sales Representative for more information.

### VMA16 Variable Air Volume Controllers (Part 1 of 2)

<b>Product Code Numbers</b>	<b>MS-VMA1610-0:</b> Cooling Only <b>MS-VMA1620-0:</b> Cooling with Reheat and Fan Control
<b>Supply Voltage</b>	24 VAC (nominal, 20 VAC minimum/30 VAC maximum), 50/60 Hz, power supply Class 2 (North America), Safety Extra-Low Voltage (SELV) (Europe)
<b>Power Consumption</b>	10 VA typical, 14 VA maximum <b>Note:</b> VA rating does 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).
<b>Ambient Conditions</b>	<b>Operating:</b> 0 to 50°C (32 to 122°F) <b>Storage:</b> -40 to 70°C (-40 to 158°F)
<b>Terminations</b>	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
<b>Controller Addressing</b>	DIP switch set; valid field controller device addresses 4–127 (Device addresses 0–3 and 125–255 are reserved and not valid field controller addresses.)
<b>Communications Bus</b>	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. <sup>†</sup>
<b>Analog Input/Analog Output Resolution and Accuracy</b>	<b>Analog Input:</b> 15-bit resolution <b>Analog Output:</b> 16-bit resolution and ±200 mV in 0-10 VDC applications

## VMA16 Variable Air Volume Controllers (Part 2 of 2)


<b>Air Pressure Differential Sensor</b>	Setra transducer, differential pressure to electrical, 0 to 38.1 mm (0 to 1.5 in) WC, 0.5 to 4.5 VDC, 5 VDC supply, aluminum plated. <b>Performance Characteristics:</b> Combined Repeatability and Hysteresis Error: $\pm 0.05\%$ of Full Span Maximum Non-linearity Errors (Best Fit Method): $\pm 1.0\%$ of Full Span Maximum Response Time (to within 63% of Full Scale Pressure with Step Change on Input): 15 ms Temperature Error from 15.6 to 48.9°C (60 to 120°F) Null: $\pm 0.06\%$ of Full Span per °F Maximum Span: $\pm 1.5\%$ of Full Span Maximum Stability, Null: $\pm 0.5\%$ of Full Scale Maximum, 1 Year Minimum Stability, Span: $\pm 2.0\%$ of Full Scale Maximum, 1 Year Minimum
<b>Mounting</b>	Mounts to damper shaft using single set screw, and to duct with single mounting screw.
<b>Actuator Rating</b>	4 N·m (35 lb-in) minimum shaft length = 44 mm (1-3/4 in.)
<b>Dimensions</b>	<b>(Height x Width x Depth):</b> 182 x 182 x 64 mm (7-3/16 x 7-3/16 x 2-1/2 in.) <b>Center of Output Hub to Center of Anti-rotation Slot:</b> 160 mm (6-5/16 in.)
<b>Weight</b>	0.86 kg (1.9 lb)
<b>Compliance</b>  	<b>United States:</b> UL Listed, File E107041, CCN PAZX, UL 916, Energy Management Equipment; UL Listed, File S4977, UUKL 864 - 9th Edition, Smoke Control Equipment (MS-VMA1610-0U, MS-VMA1620-0U only); FCC Compliant to CFR47, Part 15, Subpart B, Class A
	<b>Canada:</b> UL Listed, File E107041, CCN PAZX7, CAN/CSA C22.2 No. 205, Signal Equipment; Industry Canada Compliant, ICES-003
	<b>Europe:</b> 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.
	<b>Australia and New Zealand:</b> C-Tick Mark, Australia/NZ Emissions Compliant.
	<b>BACnet International:</b> BACnet Testing Laboratories (BTL) 135-2004 Listed BACnet Application Specific Controller (B-ASC)

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

## Handheld VAV Balancing Tool (Part 1 of 2)

<b>Product Code</b>	NS-ATV7003-0
<b>Supply Voltage</b>	9.8 to 16.5 VDC; 15 VDC Nominal, Provided through the Sensor Actuator (SA) Bus Port
<b>Current Consumption</b>	90 mA maximum
<b>Terminations</b>	RJ-12, 6-Position Modular Jack
<b>Transmission Speed</b>	<b>Serial Communication (SA BUS)</b> 9600, 19.2k, 38.4k, or 76.8k bps
<b>Sensor Addressing</b>	Fixed Address of 198
<b>Ambient Conditions</b>	<b>Operating:</b> 0 to 50°C (32 to 122°F); 5 to 95% RH, Noncondensing; 30°C (86°F) Maximum Dew Point <b>Storage:</b> -40 to 85°C (-40 to 185°F); 5 to 95% RH, Noncondensing
<b>Dimensions</b>	80 x 80 x 25 mm (3.2 x 3.2 x 1.0 in.)
<b>Weight</b>	0.165 kg (0.365 lb)


## Handheld VAV Balancing Tool (Part 2 of 2)

	<b>United States:</b> UL Listed, File E107041, CCN PAZX, Under UL 916, Energy Management Equipment; FCC Compliant to CFR 47, Part 15, Subpart B, Class A
	<b>Canada:</b> UL Listed, File E107041, CCN PAZX7, Under CAN/CSA C22.2 No. 205, Signal Equipment Industry Canada, ICES-003
	<b>Europe:</b> 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.
	<b>Australia and New Zealand:</b> C-Tick Mark, Australia/NZ Emissions Compliant
	<b>BACnet International:</b> BACnet Testing Laboratories (BTL) 135-2004 Listed BACnet Smart Sensor (B-SS)


## ZFR1810 Wireless Field Bus Coordinator (Part 1 of 2)

<b>Product Code Number</b>	MS-ZFR1810-0
<b>Power Supply Input</b>	<b>One of the following:</b> <ul style="list-style-type: none"> <li>• 24 VAC +10%/-15%, 50/60 Hz, Class 2. Transformer allowance should be 2.5 VA maximum, 2 VA typical. Provided through the 3-Position 24 V~ screw terminal pluggable block.</li> <li>• 15 VDC, 180 mA (7 to 18 VDC, 185 mA maximum current draw) on the FC Bus provided through the FC/SA BUS IN RJ-12 jack from the FC Bus Jack on a Field Controller or NxE supervisory engine.</li> </ul>
<b>Power Supply Output</b>	15 VDC; Provided through the FC/SA BUS, FC/SA BUS OUT RJ-12 jack for external devices.
<b>Addressing</b>	DIP Switches, Field Adjustable
<b>Wireless Band</b>	Direct-Sequence Spread-Spectrum, 2.4 GHz Industrial, Scientific and Medical (ISM) Bands
<b>Transmission Power</b>	10 mW Maximum
<b>Transmission Range</b>	76.2 m (250 ft) Maximum Line-of-Sight 15 m (50 ft) Practical Average
<b>Ambient Conditions</b>	<b>Operating:</b> 0 to 50°C (32 to 122°F), 5 to 95% RH, Noncondensing <b>Storage:</b> -20 to 70°C (-4 to 158°F), 5 to 90% RH, Noncondensing
<b>Materials</b>	White Plastic Housing with Plenum rating per UL1995 UL94-5VB Flammability Rating
<b>Terminations</b>	Pluggable screw terminal block for 24 VAC power supply input. Pluggable screw terminal block for RS-485 communications. RJ-12 IN jack for 15 VDC power supply and communications connection from an NxE or FEC FC Bus jack. RJ-12 OUT jack supplies 15 VDC and communications to BTCVT Wireless Commissioning Converter.
<b>Dimensions</b>	146 x 122 x 52 mm (5.8 x 4.8 x 2.1 in.)
<b>Mounting Hardware</b>	Four No. 6 Trade Size Sheet Metal Screws
<b>Shipping Weights</b>	0.45 kg (1.0 lb)

### ZFR1810 Wireless Field Bus Coordinator (Part 2 of 2)

	<p><b>United States:</b>            Intended for Connection to an NEC Class 2 Power Source;            UL 916 Energy Management            Plenum-rated per UL1995 UL94-5VB Flammability Rating            FCC Compliant to CFR47, Part 15, Subpart B, Class A            Transmission Complies with FCC Part 15.247 Regulations for Low Power Unlicensed Transmitters            Transmitter FCC Identification: TFB-MATRIXL</p> <p><b>Canada:</b>            CAN/CSA C22.2 No. 205, Signal Equipment            Industry Canada (IC) Compliant to Canadian ICES-003, Class B Limits            Industry Canada IC: 5969A-MATRIXL</p> <p><b>Europe:</b>            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>
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### ZFR1811 Wireless Field Bus Router

<b>Product Code Number</b>	MS-ZFR1811-0
<b>Supply Voltage</b>	8 to 18 VDC, 15 VDC Nominal, Provided from the FC/SA BUS RJ-12 jack on the FEC or VMA1600
<b>Current Consumption</b>	90 mA maximum
<b>Addressing</b>	DIP Switches, Field Adjustable
<b>Wireless Band</b>	Direct-Sequence Spread-Spectrum, 2.4 GHz ISM Bands
<b>Transmission Power</b>	10 mW Maximum
<b>Transmission Range</b>	76.2 m (250 ft) Maximum Line-of-Sight 15 m (50 ft) Practical Average
<b>Ambient Conditions</b>	<b>Operating:</b> 0 to 50°C (32 to 122°F), 5 to 95% RH, Noncondensing <b>Storage:</b> -20 to 70°C (-4 to 158°F), 5 to 90% RH, Noncondensing
<b>Materials</b>	Translucent Plastic Housing with Plenum rating per UL1995 UL94-5VB Flammability Rating
<b>Terminations</b>	RJ-12 plug for connection to FEC or VMA1600 FC/SA Bus jack
<b>Dimensions</b>	136 x 100 x 18 mm (5-3/8 x 3-15/16 x 3/4 in.)
<b>Mounting Hardware</b>	1/2 in. trade size Electrical Mechanical Tubing (EMT) connector
<b>Shipping Weights</b>	0.095 kg (0.21 lb)
	<p><b>United States:</b>            Intended for Connection to an NEC Class 2 Power Source;            UL 916 Energy Management            Plenum-rated per UL1995 UL94-5VB Flammability Rating            FCC Compliant to CFR47, Part 15, Subpart B, Class A            Transmission Complies with FCC Part 15.247 Regulations for Low Power Unlicensed Transmitters            Transmitter FCC Identification: TFB-MATRIXL</p> <p><b>Canada:</b>            CAN/CSA C22.2 No. 205, Signal Equipment            Industry Canada (IC) Compliant to Canadian ICES-003, Class B Limits            Industry Canada IC: 5969A-MATRIXL</p> <p><b>Europe:</b>            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>

## WRZ-TTx0000 Series Wireless Room Temperature Sensors

<b>Product Codes</b>	<b>WRZ-TTP0000-0:</b> Warmer/Cooler (+/-) Setpoint Adjustment <b>WRZ-TTR0000-0:</b> No Setpoint Adjustment <b>WRZ-TTS0000-0:</b> Setpoint Adjustment Scale: 13 to 29°C/55 to 85°F <b>WRZ-TTB0000-0:</b> Display with Setpoint Adjustment, F/C Button <b>WRZ-TTD0000-0:</b> Display with Setpoint Adjustment, F/C Button, and Fan Speed Control
<b>Power Requirements</b>	3 VDC Supplied by Two 1.5 VDC AA Alkaline Batteries (Included with Sensor); Typical Battery Life: 48 Months (36 Months Minimum)
<b>Addressing</b>	DIP Switches, Field Adjustable. MS/TP Address, Network Number, and Zone Address
<b>Ambient Conditions</b>	<b>Operating:</b> 0 to 50°C (32 to 122°F), 5 to 95% RH, Noncondensing <b>Storage:</b> -40 to 71°C (-40 to 160°F), 5 to 95% RH, Noncondensing <b>Storage for Models with LCD Display:</b> -20 to 60°C (-4 to 140°F), 5 to 95% RH, Noncondensing
<b>Wireless Band</b>	Direct-Sequence Spread-Spectrum, 2.4 GHz ISM Band
<b>Transmission Power</b>	10 mW Maximum
<b>Transmission Range</b>	30 m (100 ft) Maximum Line-of-Sight; 15 m (50 ft) Practical Average
<b>Transmissions</b>	Every 60 Seconds ( $\pm 20$ Seconds)
<b>Temperature System Accuracy</b>	0.6C°/1.0F° Over the Range of 13 to 29°C (55 to 85°F); 0.9C°/1.5F° Over a Range of 0 to 13°C (32 to 55°F) and 29 to 43°C (85 to 110°F)
<b>Temperature Sensor Type</b>	Internal 10k ohm Negative Temperature Coefficient (NTC) Thermistor
<b>Temperature Resolution (Models with LCD)</b>	$\pm 0.5C^{\circ}/\pm 0.5F^{\circ}$
<b>Materials</b>	NEMA 1 White Plastic Housing
<b>Mounting</b>	Screw Mount or Double-Sided Adhesive Foam Tape Mount; Double-Sided Adhesive Foam Tape Included
<b>Dimensions</b>	120 x 80 x 38 mm (4.7 x 3.1 x 1.5 in.)
<b>Shipping Weight</b>	0.14 kg (0.3 lb)
<b>Compliance</b>	<b>United States:</b> Transmission Complies with FCC Part 15.247 Regulations for Low Power Unlicensed Transmitters Transmitter FCC Identification: TFB-MATRIXL <b>Canada:</b> Industry Canada IC: 5969A-MATRIXL <b>Europe:</b> 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.



## WRZ-STR0000-0 Wireless Refrigerator/Freezer Temperature Transmitter and Probe Assembly

<b>Power Requirements</b>	3 VDC Supplied by Two 1.5 VDC AA Alkaline Batteries (Included with Transmitter); Typical Battery Life: 5 Years or More
<b>Addressing</b>	DIP Switches, Field Adjustable; MS/TP Address, Network Number, and Zone Address
<b>Transmitter Ambient Conditions</b>	<b>Operating:</b> -5 to 44°C (23 to 111°F), 5 to 95% RH, Noncondensing <b>Storage:</b> -20 to 60°C (-4 to 140°F), 5 to 95% RH, Noncondensing
<b>Temperature Sensor Probe Ambient Conditions</b>	<b>Operating:</b> -40 to 35°C (-40 to 95°F) <b>Storage:</b> -40 to 60°C (-40 to 140°F), 5 to 98% RH, Noncondensing
<b>RF Band</b>	Direct-Sequence, Spread-Spectrum; 2.4 GHz ISM Band

**WRZ-STR0000-0 Wireless Refrigerator/Freezer Temperature Transmitter and Probe Assembly**


<b>Transmission Power</b>	10 mW Maximum
<b>Transmission Range</b>	<b>Mesh Network Application:</b> 30 m (100 ft) Maximum Indoor Line-of-Sight; 15 m (50 ft) Practical Average Indoor <b>Non-Mesh Network, One-to-One Application:</b> 45 m (150 ft) Maximum Indoor Line-of-Sight; 30 m (100 ft) Practical Average Indoor
<b>Transmissions</b>	Every 120 Seconds (±20 Seconds)
<b>Temperature System Broad Range Accuracy</b>	±1.0C°/±1.8F° Over the Range of -40 to 35°C (-40 to 95°F)
<b>Refrigerator/Freezer Narrow Range Accuracy</b>	±0.5C°/±0.9F° Over the Range of -23 to 5°C (-9 to 41°F)
<b>Temperature Sensor Type</b>	External 3k ohm Negative Temperature Coefficient (NTC) Thermistor
<b>Materials</b>	<b>Transmitter:</b> NEMA 1 White Plastic Housing <b>Temperature Sensor Probe:</b> Clear Acrylic Cylinder
<b>Mounting</b>	<b>Transmitter:</b> Surface Mounted Using Factory-Installed, Double-Sided Adhesive Foam Tape <b>Temperature Sensor Probe:</b> Surface Mounted Using Factory-Installed Probe Mounting Strap with Double-Sided Adhesive Foam Tape Installed
<b>Weight</b>	0.25 kg (0.55 lb)
<b>Compliance</b>	<b>United States:</b> Transmission Complies with FCC Part 15.247 Regulations for Low Power Unlicensed Transmitters; Transmitter FCC Identification: TFB-MATRIXL <b>Canada:</b> Industry Canada IC: 5969A-MATRIXL <b>Europe:</b> 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.



**Bluetooth Wireless Commissioning Converter (Part 1 of 2)**

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

## Bluetooth Wireless Commissioning Converter (Part 2 of 2)

	<b>United States:</b> 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)
	<b>Canada:</b> Industry Canada (IC: 279A-MSBTCVT0)
	<b>Europe:</b> 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.
	<b>Japan:</b> Telecommunications Certification - 003NY05068 0000

### 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 is likely to cause harmful interference, in which case the user will be required to correct the interference at his/her 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 NS Series Network Sensors, VAV Series Balancing Sensors, ZFR1800 Series Wireless Field Bus System, and 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 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 is likely to cause harmful interference, in which case the user will be required to correct the interference at his/her 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 [x] dB. Antenna having a higher gain is strictly prohibited per regulations of Industry Canada. The required antenna impedance is [y] ohms.

Cet appareil a été conçu pour fonctionner avec une antenne d'un gain maximum de [x] 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 [y] 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.



### Building Efficiency

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