

Overview

The Facility Explorer General Purpose Application Controllers (CGs), VAV Box Controllers (CVs), and Input/Output Expansion Modules (XPMs) are a new, modernized family of equipment controllers which integrate in the web-based Facility Explorer system.

CG and CV Series Equipment Controllers

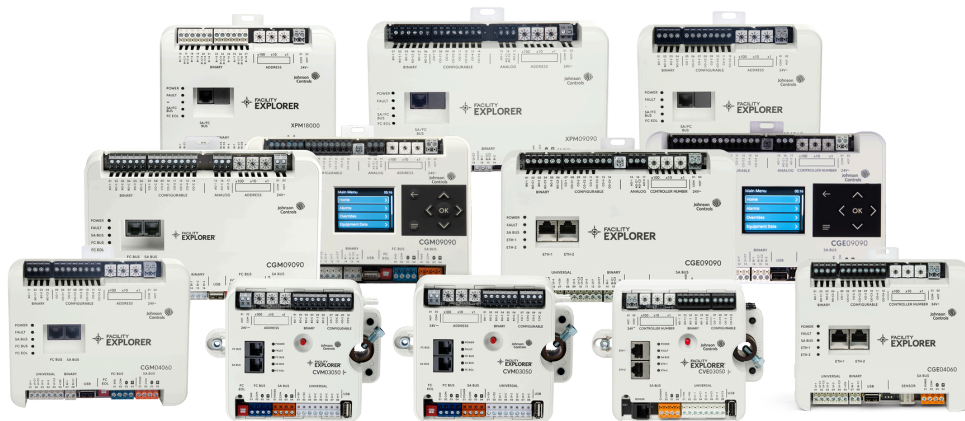
The CG series general purpose application controllers are well-suited for controlling a wide variety of facility and HVAC equipment, including fan coils, air handling units, packaged HVAC equipment, and central plant equipment. CG series controllers run pre-engineered and user-programmed applications. Some models feature an integral color display with a navigation keypad that enables enhanced local monitoring of controlled field equipment.

The CV series equipment controllers which include the CVM and CVE models, are designed for variable air volume (VAV) box applications. These controllers are fully programmable, but also feature a set of preloaded applications allowing these controllers to be made fully operational by selecting the appropriate VAV box

application using the MAP. CV series controllers feature an integral damper actuator, and a digital Differential Pressure Transducer (DPT) sensor. Certain models also feature an integral potentiometer to sense actual VAV box damper position. CG series and CV series controllers include an integral real-time clock, which enables the controllers to monitor and control schedules, calendars, and trends, and operate for extended periods of time as stand-alone controllers when offline from the Facility Explorer system network.

These controllers feature an advanced design that provides optimum performance and easy access to power, network, and field terminations. These controllers are designed to install easily and communicate through standard RS485 BACnet® MS/TP, BACnet Secure Connect (BACnet/SC), or BACnet/IP protocols, which enables you to build a variety of equipment controller network applications, ranging from simple fan coil, heat pump, or VAV control applications to advanced central plant management and stand-alone applications. CGM and CVM controllers are switchable to N2 communications. Controllers running in N2 mode can be used to maintain or modernize sites with installed legacy Johnson Controls® controllers.

Figure 1: FX CG and CV Series Equipment Controllers and XPM Expansion Modules



XPM Series Expansion Modules

The F4-XPM series I/O expansion modules can serve in one of two capacities depending on where they are installed in the Facility Explorer system. When installed on the Sensor/Actuator (SA) Bus of a Facility Explorer controller, an XPM expands the input and output interfaces that you can use with that equipment controller. When installed on the Field Controller (FC) Bus of a Facility Explorer supervisory controller, you can use an XPM as I/O point multiplexors to support monitoring and control from a supervisory controller. The point multiplexor can also

be useful for sharing points between other equipment controllers on the FC Bus using peer-to-peer connectivity.

Features and benefits

Sleek and modern packaging and styling

Provides a modern, aesthetically pleasing industrial design.

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.

High memory capacity and fast processing power

Provides application engineers with the horsepower to meet sophisticated control requirements.

Auto-Tuned Control Loops

Proportional Adaptive Control (P-Adaptive) and Pattern Recognition Adaptive Control (PRAC) delivers continuous control loop tuning, which reduces commissioning time, eliminates change-of-season re-commissioning, and reduces wear and tear on actuators.

Standard BACnet protocol

Provides interoperability with other Building Automation System (BAS) products that use the widely accepted BACnet standard.

Models to support BACnet/SC and BACnet/IP communications

BACnet/IP and BACnet/SC use Ethernet cabling for higher speed communication and improved bandwidth. BACnet/SC is a new protocol that provides a secure method of communication on IP networks. It uses standards widely accepted by the IT community, eliminating many concerns of the IT community.

Models to support wired BACnet MS/TP, ZFR wireless, and N2 with streamlined workflow

CGM and CVM controllers can support multiple communication protocols without the need to purchase a special model per protocol and without extra manual setup. If an application configured for N2 communication is loaded on the controller, it automatically communicates through N2. Controllers otherwise default to MS/TP communication. If a ZFR Pro Wireless Field Bus Router is connected to the controller when the controller is initially powered on, it automatically enters wireless mode.

BACnet Testing Laboratories (BTL) listed and certified

Ensures openness and interoperability with other BTL-listed devices. BTL is a third-party agency, which validates that BAS vendor products meet the BACnet industry-standard protocol.

BACnet automatic discovery

Supports easy controller integration into a Facility Explorer (FX) BAS.

Device Security

Ensures device integrity while the system is rebooting and during normal operation. Embedded software in the CGE and CVE controllers provides secure boot

operation, firmware protection, secure communications, and secure firmware updates comply with cyber security best practices.

FIPS 140-2 Level 1 compliance

CGE and CVE controllers are FIPS 140-2 Level 1 compliant. FIPS 140-2 is a U.S. government cyber security standard used to approve cryptographic modules and algorithms used for encryption. Assures operators that Facility Explorer uses leading cyber security techniques to help prevent unauthorized access to systems and data.

Wireless ZFR and ZFR Pro support

Wireless ZFR and ZFR Pro support provides a wireless alternative to hard-wired MS/TP networking, offering application flexibility and mobility with minimal disruption to building occupants, and also simplifies and speeds up replacements.

Integral real-time clock

An integral real-time clock, which enables the controllers to monitor and control schedules, calendars, and trends, and operate for extended periods of time as stand-alone controllers when offline from the FX system network.

Pluggable screw terminal blocks

Pluggable input/output wiring terminal blocks provide electrical installers and field technicians the ability to quickly and easily install and service a controller without the need to disconnect and reconnect the input/output wiring.

Rotary switches for controller address/controller number

Easy-to-use rotary switches set the MS/TP address or controller number in decimal format.

Universal Inputs and Configurable Outputs

Allows multiple signal options to provide input/output flexibility.

End-of-Line (EOL) switch in MS/TP devices

Enables equipment controllers and I/O expansion modules to be terminating devices on the communications bus.

Default configuration for equipment controller Input/Output wiring validation

Enables validation of the input and output terminals' wiring without having to download an application file.

Background transfer coupled with enable/disable logic options in Controller Configuration Tool (CCT) and System Configuration Tool (SCT)

Saves field technicians' time, enables productivity and minimizes equipment disruption, since the controllers are operating while file updates take place in the background and you can leave the application disabled until the system is ready to run.

SA Bus commissioning improvements

Saves field technicians' time when commissioning SA Bus devices by enabling an equipment controller to transfer and apply firmware files to all the SA Bus devices (XPM, PCX, NS8000) connected to it.

Small, convenient package size

Facilitates quick field installation and efficient use of space without compromising control performance

Models with onboard display and navigation keypad

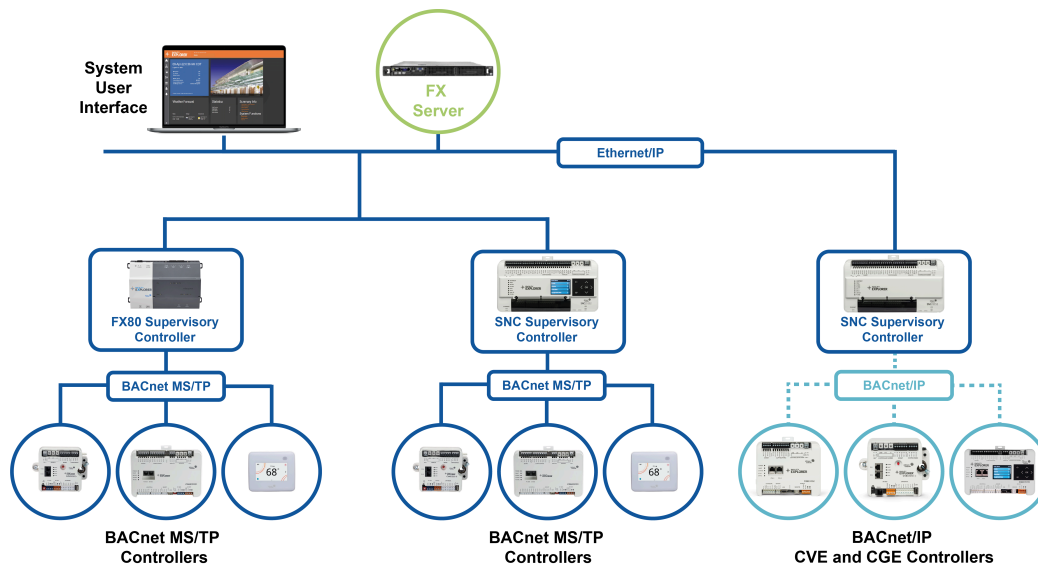
Provides an intuitive local interface for users to monitor point values and status, view alarms, view trends, override outputs, and adjust setpoints and parameters. The easy-to-use display provides the ability to quickly troubleshoot issues and restore control while being near the associated mechanical equipment.

Local Controller Display and the Mobile Access Portal (MAP) Gateway Support

Enable monitoring and commanding of I/O and configuration parameters.

Network diagram with equipment controllers

Figure 2: FX system with controllers



Integration to the FX system supervisory devices

The CG and CV series equipment controllers are designed to integrate seamlessly into the FX system by connecting and communicating directly with a SNC or FX80. This seamless integration of equipment controllers with FX supervisory controllers enables building operators to monitor and adjust equipment controllers directly from the FX system UI.

In addition, service personnel can view equipment controller information locally through an optional local controller display (F4-DLK0350-0 or FX-DIS1710-0) available for equipment controllers, or through the optional Mobile Access Portal (MAP) Gateway.

Communications protocols

The CG and CV series controllers communicate using multiple communication protocols depending on the model and configuration. The CGE and CVE controllers communicate using BACnet/SC or BACnet/IP communication protocols. The CGM and CVM controllers communicate using BACnet MS/TP, N2, or ZFR wireless.

If you load an application configured for N2 communication on a CGM controller, it automatically communicates through N2. Controllers otherwise default to MS/TP communication. If you connect a ZFR Pro Wireless Field Bus Router to the CGM controller when the controller is initially powered on, it automatically enters wireless mode. This enables the same controller to support multiple communication protocols without the need to purchase a special model for each protocol, and without extra manual setup. Equipment controllers in BACnet/SC, BACnet/IP, or BACnet MS/TP communication mode are BACnet network-compliant devices.

The XPM expansion modules communicate using BACnet MS/TP, or wireless Zigbee® using a ZFR/ZFR Pro Wireless Field Bus Router (on the FC Bus only). By default, the XPM expansion modules communicate using the BACnet MS/TP protocol.

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

You can use the CGM and CVM controllers as functional replacements for legacy N2 controllers. The N2-capable MS/TP equipment controller models provide a cost-

effective upgrade and modernization path for customers with existing N2 controllers.

You can also install the CGM and CVM controllers in a wireless application using a ZFR/ZFR Pro Wireless Field Bus Router, see [Related products](#).

Hardware and installation

FX controllers and expansion modules 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.

FX CG, CV family devices 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.

The equipment controllers ship with a default configuration that can assist in validating the wiring of the input and output terminals before you download an application file. When the controller is powered on in this configuration, the Fault LED will flash in a pattern of two quick blinks and then a long pause.

CG, CV family devices feature removable, color-coded, keyed, and labeled terminal block plugs for the input and output, supply power, and communications bus terminations.

CG, CV family devices feature rotary switches that allow you to set a valid and unique device address or controller

number for each device on the bus. A blank space is included on the cover for recording the device address.

Integral mounting clips and a DIN rail track on the back plate of the CGM controllers and XPM devices allow you to easily mount the device either on a horizontal section of 35 mm DIN rail, or screw mount on a flat surface with three integral mounting clips on the device.

An integral EOL switch on MS/TP devices allows you to enable the device as a bus terminating device, which when properly configured, reduces reflected noise on the bus and improves bus communication.

Some CG series models feature an onboard display and navigation keypad that provides an intuitive local interface for users to monitor point values and status, view alarms, view trends, override outputs, and adjust setpoints and parameters. You can use the display to quickly troubleshoot issues and restore control while being near the associated mechanical equipment. You can adjust the brightness of the screen for readability in low-light environments. For equipment controllers that do not feature an onboard display, a remote mountable DLK0350 Local Controller Display model or the MAP Gateway are available that connect directly to the SA Bus port of the equipment controller. For more information, refer to the *F4-DLK0350 Product Bulletin (LIT-12014010)* and the *Mobile Access Portal Gateway Product Bulletin (LIT-1201184)*.

CG and CV Series Controllers

CG series model information

Table 1: CG series information including point type counts

Communication protocol	CGM09090-0/0H and CGM04060-0: BACnet MS/TP, N2, or Zigbee Wireless (using add-on modules) CGE09090-0/0H and CGE04060-0: BACnet/SC or BACnet/IP		
Modular jacks	CGM09090-0/0H and CGM04060-0: FC and SA Bus Modular Ports: RJ-12 6-Pin Modular Jacks CGE09090-0/0H and CGE04060-0: RJ-12 6-Pin Sensor Port		
Point types	Signals accepted	CGM09090-0/0H CGE09090-0/0H	CGM04060-0 CGE04060-0
Universal Input (UI)	15 VDC Power Source (Provide 100mA total current) Analog Input - Voltage Mode (0-10 VDC) Analog Input - Current Mode (4-20 mA) Analog Input - Resistive Mode (0-600k ohm), RTD (1k Nickel [Johnson Controls sensor], 1k PT, A998 SI), NTC (10k Type L, 2.252k Type 2) Binary Input - Dry Contact Maintained Mode Universal Input Common	7	3
Binary Input (BI)	Binary Input - Dry Contact Maintained Mode Binary Input - Pulse Counter/Accumulator Mode Binary Input Common	2	1
Binary Output (BO)	Binary Output - 24 VAC Triac (External Power Source) Binary Output Common	3	2
Configurable Output (CO)	Analog Output - Voltage Mode (0-10 VDC) Binary Output - 24 VAC Triac Analog Output Signal Common Binary Output Signal Common	4	4

Table 1: CG series information including point type counts

Analog Output (AO)	Analog Output - Voltage Mode (0–10 VDC) Analog Output - Current Mode (4–20 mA) Analog Output Signal Common	2	0
SA Bus	Supports up to 10 total wired SA Bus devices, including the XPM and IOM series expansion I/O modules.		
	Supports up to four NS Series Network Sensors.		
WRZ sensors	Supports up to nine WRZ sensors when using the ZFR or ZFR Pro Series wireless router configuration.		
	Supports up to five WRZ sensors when using the one-to-one WRZ-78xx wireless configuration.		

Note: The models that end in **H** feature a built-in display.

Panel and sub-panel assembly options

CG series controllers and XPM expansion modules are optionally available in pre-wired panels and sub-panel assemblies. The panelized options provide all of the controllers necessary for a complete application solution, including a pre-wired power source and a latching or lockable door.

For more information about panel and sub-panel assembly options, refer to *F4-CGM/XPM Series Standard Control Panel and Subpanel Assemblies Catalog Page (LIT-1901131)*.

CV series features

In addition to the features listed in [Features and benefits](#), CV series equipment controllers provide the following benefits:

An integrated damper actuator and digital Differential Pressure Transducer (DPT) sensor

Reduces installation time

Fast response actuator

Drives the damper from full open to full closed (90°) in 60 seconds to reduce commissioning time

Preloaded, selectable applications

The CV series VAV box controller is shipped with a factory-installed library of the most popular VAV box control applications. You can make this controller fully operational by using the MAP to select the appropriate VAV box application, thereby, saving field technicians' time by eliminating the provisioning workflow.

Optional integrated feedback potentiometer

Users and field technicians of a VAV box damper can get reassurance on the damper's actual position, can confirm and troubleshoot VAV controller operations, confirm actuator is at the correct position, and track damper position.

CV installation

Field mounting the CV series controllers is straightforward. These controllers require minimal wiring and are mounted to the VAV 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 CV series controllers meet industry mounting requirements and make the controllers easy to handle.

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

For more information about installing CV controllers, refer to *F4-CV Series VAV Terminal Equipment Controllers Installation Guide (Part No. 24-10143-01817)*.

CV series model information

Table 2: CV series information including point type counts

		F4-CVM03050-0	F4-CVM03050-0P	F4-CVE03050-0P
Communication protocols	CVM models: BACnet MS/TP, N2, or Zigbee Wireless using add-on modules CVE models: BACnet/SC or BACnet/IP			
Modular jacks	CVM models: FC and SA Bus modular ports: RJ-12 6-pin modular jacks CVE models: RJ-12 6-pin sensor port			
Point types	Signals accepted:			
Universal Input (UI)	15 VDC Power Source (Provides 35mA total current source) Analog Input - Voltage Mode (0-10 VDC) Analog Input - Resistive Mode (0-600k ohm), RTD (1k Nickel [Johnson Controls sensor], 1k PT, A998 SI), NTC (10k Type L, 2.252k Type 2) Binary Input - Dry Contact Maintained Mode	3	3	3
Configurable Output (CO)	Analog Output - Voltage Mode (0-10 VDC) Binary Output - 24 VAC Triac Analog Output Signal Common Binary Output Signal Common	2	2	2
Binary Output (BO)	Binary Output - 24 VAC Triac	3	3	3
Integrated actuator	Internal	1	1	1
Differential pressure transducer	Internal	1	1	1
Integrated feedback potentiometer	Internal	No	Yes	Yes
SA Bus	Supports up to 10 total wired SA Bus devices, including the XPM and PCX series expansion I/O modules and up to 4 NS series network sensors.			
WRZ sensors	Support up to 9 WRZ sensors when using the ZFR or ZFR Pro Series wireless router configuration			
	Support up to 5 WRZ sensors when using the one-to-one WRZ-78xx wireless configuration			

Panel and sub-panel assembly options

CG series controllers and XPM expansion modules are optionally available in pre-wired panels and sub-panel assemblies. The panelized options provide all of the controllers necessary for a complete application solution, including a pre-wired power source and a latching or lockable door.

For more information about panel and sub-panel assembly options, refer to *F4-CGM/XPM Series Standard Control Panel and Subpanel Assemblies Catalog Page (LIT-1901131)*.

XPM Expansion Modules

Compatibility

You can connect XPM series expansion modules to the SA Bus of the following device types:

- CG series General Purpose Application Controllers
- CV series VAV Box Controllers

- PCA series Advanced Application Programmable Controllers
- PCG series General Purpose Programmable Controllers
- PCV16, PCV18, PCV19, and VAV17 series Programmable Variable Air Volume Box Controllers
- F4-SNC series supervisory controllers

Note: XPM series expansion modules may coexist on the SA Bus with PCX series input/output expansion modules.

You can connect XPM series expansion modules to the FC bus of the following supervisory controller types:

- FX80 Supervisory Controller
- F4-SNC series Supervisory Controllers

Note: XPM series expansion modules may coexist on the FC Bus with PCX series input/output expansion modules.

XPM series model information

Table 3: XPM series information including point type counts

		F4-XPM04060-0	F4-XPM09090-0	F4-XPM18000-0
Communication protocols	BACnet MS/TP			
Modular jacks	SA/FC Bus Port: RJ-12 6-Pin Modular Jack			
Point types	Signals accepted	Number of points		
Universal Input (UI)	15 VDC Power Source (Provide 100mA total current) Analog Input - Voltage Mode (0-10 VDC) Analog Input - Current Mode (4-20 mA) Analog Input - Resistive Mode (0-600k ohm), RTD (1k Nickel [Johnson Controls sensor], 1k PT, A998 SI), NTC (10k Type L, 2.252k Type 2) Binary Input, Dry Contact Maintained Mode Universal Input Common	3	7	0
Binary Input (BI)	Binary Input, Dry Contact Maintained Mode Binary Input - Pulse Counter/Accumulator Mode Binary Input Common	1	2	18
Configurable Output (CO)	Analog Output - Voltage Mode (0-10 VDC) Binary Output 24 VAC Triac Analog Output Signal Common Binary Output Signal Common	4	4	0
Analog Output (AO)	Analog Output - Voltage Mode (0-10 VDC) Analog Output - Current Mode (4-20 mA) Analog Output Signal Common	0	2	0
Binary Output (BO)	Binary Output - 24 VAC Triac (External Power Source) Binary Output Common	2	3	0

Related products

For information about the FX system and related products, refer to *FX80 Supervisory Controller Product Bulletin (LIT-12012250)*.

Controller Configuration Tool (CCT)

The CCT is used in conjunction with the FX system to configure, simulate, and commission equipment controllers.

For information about using CCT for configuration, simulation, and commissioning of the equipment controllers, refer to *Controller Configuration Tool (CCT) Catalog Page (LIT-1900386)*.

Mobile Access Protocol (MAP) Gateway

The MAP Gateway is a pocket-sized web server that provides a wireless mobile user interface to SMART Equipment and Johnson Controls branded equipment controllers and thermostats.

For more information on the MAP Gateway, refer to the *Mobile Access Portal Gateway Product Bulletin (LIT-12011884)*.

Handheld VAV Balancing Tool

The Handheld VAV Balancing Tool lets you set the parameters for VAV applications that reside on CV series equipment controllers.

For more information on the Handheld VAV Balancing Tool, refer to the *Handheld VAV Balancing Tool Catalog Page (LIT-1090348)*.

Network Sensors

The NS Series Network Sensor offering includes NS Series Network Zone Sensors and NS Series Network Discharge Air Sensors. The NS Series Network Zone Sensors are designed to function directly with the FX equipment controllers.

For more product application information, ordering information, and technical specifications, refer to the *NS Series Network Sensors Product Bulletin (LIT-12011574)*.

WNC1830/ZFR183x Pro Series Wireless Field Bus System

The WRG1830/ZFR183x Pro (ZFR Pro) Series Wireless Field Bus System provides a wireless platform for BACnet MS/TP controllers using BACnet protocol over 2.4 GHz wireless ISM band. For more information, refer to the *WRG1830/FX-ZFR183x Pro Series Wireless Field Bus System Technical Bulletin (LIT-12013553)*.

Ordering information

Table 4: Ordering information

Product code number	Description
F4-CGM09090-0	18-point General Purpose Application MS/TP Controller Includes: MS/TP and N2 communication; 18 points (7 UI, 2 BI, 4 CO, 2 AO, 3 BO); real-time clock; 24 VAC input
F4-CGM09090-0H	18-point General Purpose Application MS/TP Controller Includes: MS/TP and N2 communication; 18 points (7 UI, 2 BI, 4 CO, 2 AO, 3 BO); real-time clock; 24 VAC input; Integral 2.4 inch color display and navigation keypad
F4-CGM04060-0	10-point General Purpose Application MS/TP Controller Includes: MS/TP and N2 communication; 10 points (3 UI, 1 BI, 4 CO, 2 BO); real-time clock; 24 VAC input
F4-CGE09090-0	18-point General Purpose Application Ethernet Controller Includes: BACnet/SC and BACnet/IP communication; 18 points (7 UI, 2 BI, 4 CO, 2 AO, 3 BO); real-time clock; 24 VAC input
F4-CGE09090-0H	18-point General Purpose Application Ethernet Controller Includes: BACnet/SC and BACnet/IP communication; 18 points (7 UI, 2 BI, 4 CO, 2 AO, 3 BO)); real-time clock; 24 VAC input; Integral 2.4 inch color display and navigation keypad
F4-CGE04060-0	10-point General Purpose Application Ethernet Controller Includes: BACnet/SC and BACnet/IP communication; 10 points (3 UI, 1 BI, 4 CO, 2 BO); real-time clock; 24 VAC input
F4-CVM03050-0	VAV Box Controller with Integrated Actuator and Digital Differential Pressure Transducer (DPT) Sensor Includes MS/TP and N2 communication; 8 points (3 UI, 2 CO, and 3 BO); real-time clock; 24 VAC input.
F4-CVM03050-0P	VAV Box Controller with Integrated Actuator, Position Feedback, and DPT Sensor Includes MS/TP and N2 communication; 8 points (3 UI, 2 CO, and 3 BO); real-time clock; 24 VAC input
F4-CVE03050-0P	VAV Box Controller with Integrated Actuator, Position Feedback, and DPT Sensor Includes BACnet/SC and BACnet/IP communication; 8 points (3 UI, 2 CO, and 3 BO); real-time clock; 24 VAC input.
F4-XPM04060-0	10-point Input/Output Expansion Module Includes: MS/TP communication; 10 points (3 UI, 1 BI, 4 CO, 2 BO); 24VAC input
F4-XPM09090-0	18-point Input/Output Expansion Module Includes: MS/TP communication; 18 points (7 UI, 2 BI, 4 CO, 2 AO, 3 BO); 24VAC input
F4-XPM18000-0	18-point Input Expansion Module Includes: MS/TP communication; 18 points (18 BI); 24VAC input

Note: The following CVM03050 models are also available:

- Bulk Pack Models: F4-CVE03050-0PD

Table 5: Accessories (order separately)




Product code number	Description
FX-PCX Series Expansion Modules	Refer to the <i>FX-PC Series Programmable Controllers and Related Products Product Bulletin (LIT-12011657)</i> for a complete list of available Expansion Modules.
TL-CCT-0	License enabling Controller Configuration Tool (CCT) software for one user
FX-FCP-0	License enabling Facility Explorer Equipment Controller Firmware Package Files required for CCT
Mobile Access Portal (MAP) Gateway	Refer to the <i>Mobile Access Portal Gateway Catalog Page (LIT-1900869)</i> to identify the appropriate product for your region.
F4-DLK0350-0	Local Controller Display, 3.5 in. (89 mm) color display with navigation keypad.
FX-DIS1710-0	Local Controller Display, 3.0 in. (76 mm) monochrome display with navigation keypad.
NS Series Network Sensors	Refer to the <i>NS Series Network Sensors Product Bulletin (LIT-12011574)</i> for specific sensor model descriptions.
AS-CBLTSTAT-0	Cable adapter for connection to 8-pin TE-6700 Series sensors
NS-WALLPLATE-0	Network Sensor Wall Plate
WRZ Series Wireless Room Sensors	Refer to the <i>WRZ Series Wireless Room Sensors Product Bulletin (LIT-12011653)</i> for specific sensor model descriptions.
WRZ-7860-0	Refer to the <i>WRZ-7860 Receiver for One-to-One Wireless Room Sensing Product Bulletin (LIT-12011640)</i> for a list of available products.
WRZ-SST-120	Refer to the <i>WRZ-SST-120 Wireless Sensing System Tool Installation Instructions (LIT-24-10563-55)</i> for usage instructions.
ZFR-HPSST-0	Wireless System Survey Tool. For use with the higher power WRG1830/ZFR183x System and lower power WRZ Sensors (10 mW). Refer to the <i>High Power Wireless Sensing System Tool Installation Instructions (LIT-24-11461-00012)</i> for usage instructions.
WRG1830/ZFR183x Pro Series Wireless Field Bus System	For more information on products needed for wireless field bus installations and for a list of available products, refer to the <i>WRG1830/FX-ZFR183x Pro Series Wireless Field Bus System Catalog Page (LIT-1901153)</i> .
ZFR-USBHA-0	ZFR USB Dongle provides a wireless connection through CCT to allow wireless commissioning of the wirelessly enabled CGM and CVM controllers. It also allows use of the ZFR Checkout Tool (ZCT) in CCT. <i>ⓘ Note:</i> The ZFR-USBHA-0 is not compatible with the WRG1830/ZFR183x Pro Series. <i>ⓘ Note:</i> The ZFR-USBHA-0 replaces the IA OEM DAUBI_2400 ZFR USB dongle. For additional information about the ZFR-USBHA-0 ZFR dongle, refer to the <i>ZCT Checkout Tool Help LIT-12012292</i> or the <i>WNC1800/ZFR182x Pro Series Wireless Field Bus System Technical Bulletin (LIT-12012356)</i> .
Y64T15-0	Transformer, 120/208/240 VAC Primary to 24 VAC Secondary, 92 VA, Foot Mount, 72.2 cm (30 in.), Primary Leads and 76.2 cm (30 in.) Secondary Leads, Class 2
Y65A13-0	Transformer, 120 VAC Primary to 24 VAC Secondary, 40 VA, Foot Mount (Y65AS), 20.32 cm (8 in.), Primary Leads and 76.2 cm (30 in.) Secondary Leads, Class 2
Y65T31-0	Transformer, 120/208/240 VAC Primary to 24 VAC Secondary, 40 VA, Foot Mount (Y65AR+), 20.32 cm (8 in.), Primary Leads and Secondary Screw Terminals, Class 2
Y65T42-0	Transformer, 120/208/240 VAC Primary to 24 VAC Secondary, 40 VA, Hub Mount (Y65SP+), 20.32 cm (8 in.), Primary Leads and Secondary Screw Terminals, Class 2
MS-FIT100-0	The Field Inspection Tool or (FIT) is a portable handheld device with a user interface that is used to test and troubleshoot the BACnet protocol MS/TP RS-485 communications bus that connects supervisory controllers and equipment controllers to field point interfaces. You can use the FIT to check out the wiring of the MS/TP RS-485 bus as well as verify proper communications of supervisory controllers and equipment controllers connected to the bus. You can use the FIT on both the FC Bus and SA Bus.
TL-BRTRP-0	Portable BACnet/IP to MS/TP Router
ACC-TBKPWFCSA-0	Power, FC Bus, and SA Bus terminal block replacement kit for SNC, CG, CV, and XPM products. Kit includes 5 of each terminal block type. 15 terminal blocks in total.
ACC-TBKINOUT-0	Input and Output terminal block replacement kit for SNC, CG, CV, and XPM products. Kit includes 5 of each 2, 3, and 4 position Input and Output terminal blocks. 30 terminal blocks in total.
F4-CVACT-0R	Actuator Assembly Replacement Kit for F4-CV series controllers.

CG series technical specifications

Table 6: Technical specifications for CG series controllers

Specification	Description
Power requirement	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>F4-CGM models: 14 VA maximum¹</p> <p>F4-CGE models: 15 VA maximum</p> <p>Note: The USB feature is not currently supported.</p>
Power source	<p>+15 VDC power source terminals provide 100 mA total current.</p> <p>F4-CGM09090, F4-CGE09090: Two +15VDC power sources terminal located in Universal IN terminals for active (3-wire) input devices</p> <p>F4-CGM04060, F4-CGE04060: One +15VDC power sources terminal located in Universal IN terminals for active (3-wire) input devices</p>
Ambient conditions	<p>Operating: 0°C to 50°C (32°F to 122°F); 10 to 90% RH noncondensing</p> <p>Storage: -40°C to 80°C (-40°F to 176°F); 5 to 95% RH noncondensing</p>
Communications protocol	<p>F4-CGM models: BACnet MS/TP, N2, ZFR Wireless also supported (at FC Bus and for Sensors) with additional hardware.</p> <p>F4-CGE models: BACnet/IP or BACnet/SC</p>
Device addressing for BACnet MS/TP	Decimal address set using three rotary switches: valid controller device addresses 4-127
Device addressing for N2	Decimal address set using three rotary switches: valid controller device addresses 1-254
Controller number for Ethernet controllers	Three rotary switches to assign a unique number for each controller to physically identify the controller and relate it to the building drawings; valid controller numbers 0-999
Communications bus	<p>F4-CGM models BACnet MS/TP (default); N2 3-wire FC Bus between the supervisory controller and equipment controllers</p> <p>F4-CGE models BACnet/IP (default); BACnet/SC Two Ethernet ports; 10/100 Mbps; 8-pin RJ-45 connector</p> <p>All F4-CG models 4-wire SA Bus between equipment controller, network sensors and other sensor/actuator devices, includes a lead to source 15 VDC supply power, from equipment controller, to bus devices.</p>
Processor	RX64M Renesas® 32-Bit microcontroller
Memory	16 MB flash memory and 8 MB SDRAM
Real-time clock backup power supply	Super capacitor maintains power to the onboard real-time clock for a minimum of 72 hours when supply power to the controller is disconnected.
Input and Output capabilities	<p>F4-CGM09090, F4-CGE09090 7 - Universal Inputs: Defined as 0–10 VDC, 4–20 mA, 0–600k ohms, or Binary Dry Contact 2 - Binary Inputs: Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode 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 3 - Binary Outputs: Defined as 24 VAC Triac (external power source only)</p> <p>F4-CGM04060, F4-CGE04060 3 - Universal Inputs: Defined as 0–10 VDC, 4–20 mA, 0–600k ohms, or Binary Dry Contact 1 - Binary Inputs: Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode 4 - Configurable Outputs: Defined as 0-10 VDC or 24 VAC Triac BO 2 - Binary Outputs: Defined as 24 VAC Triac (external power source only)</p>

Table 6: Technical specifications for CG series controllers

Specification	Description
Universal Input (UI) resolution/ Analog Output (AO) accuracy	Input: 24-bit Analog to Digital converter Output: +/- 200 mV accuracy in 0–10 VDC applications
Terminations	Input/Output: Pluggable Screw Terminal Blocks FC Bus, SA Bus, and Supply Power: 4-Wire and 2-Wire Pluggable Screw Terminal Blocks FC and SA Bus Modular Ports: RJ-12 6-Pin Modular Jacks Note: The FC Bus Terminal and FC Bus Port are only available on the CGM models
Mounting	Horizontal on single 35 mm DIN rail mount (recommended), or screw mount on flat surface with three integral mounting clips on controller
Housing	Enclosure material: ABS and polycarbonate UL94 5VB; Self-extinguishing Protection Class: IP20 (IEC529)
Dimensions (Height x Width x Depth)	F4-CGM09090, F4-CGE09090: 150 mm x 190 mm x 44.5 mm (5-7/8 in. x 7-1/2 in. x 1-3/4 in.) including terminals and mounting clips. F4-CGM04060, F4-CGE04060: 150 mm x 152 mm x 44.5 mm (5-7/8 in. x 6 in. x 1-3/4 in.) including terminals and mounting clips Note: Mounting space 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	F4-CGM04060, F4-CGE04060: 0.29 kg (0.64 lb) F4-CGM09090, F4-CGE09090: 0.4 kg (0.89 lb) F4-CGM09090-0H, F4-CGE09090-0H: 0.47 kg (1.04 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 Compliant, ICES-003
	Europe: Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive and RoHS Directive.
	Australia and New Zealand: RCM Mark, Australia/NZ Emissions Compliant
	BACnet International: BACnet Testing Laboratories™ (BTL) Protocol Revision 18 Listed and Certified BACnet Advanced Application Controller (B-AAC), based on ANSI/ASHRAE 135-2020
	United Kingdom: Johnson Controls declares that this product is in compliance with Electromagnetic Compatibility Regulations, The Electrical Equipment (Safety) Regulations, and Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations.

¹ The VA rating does **not** include any power supplied to the peripheral devices connected to Configurable Outputs (COs) or Binary Outputs (BOs), which can consume up to 12 VA for each CO or BO; for a possible total consumption of an additional 84 VA (maximum).




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

CV series technical specifications

Table 7: Technical specification for CV Series Controllers

Specification	Description
Power requirement	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 ¹ ① Note: The USB feature is not currently supported.
Power source	+15 VDC power source terminals provide 35 mA total current. Quantity 1 located in Universal IN terminals - for active (3-wire) input devices
Ambient conditions	Operating: 0°C to 50°C (32°F to 122°F) Storage: -40°C to 70°C (-40°F to 158°F)
Network engines	F4-CVM models: All network engine model types F4-CVE03050-0P: All network engine model types at R9.0 or later.
Communications protocol	F4-CVM models: BACnet MS/TP, N2, Zigbee Wireless also supported (at FC Bus and for Sensors) with additional hardware. F4-CVE03050-0P: BACnet/SC or BACnet/IP
Device addressing for BACnet MS/TP	Decimal address set using the three rotary switches: valid controller device addresses 4-127
Controller number for Ethernet controller	3 rotary switches to assign a unique number for each controller to physically identify the controller and relate it to the building drawings; valid controller numbers 0-999
Device addressing for N2	Decimal address set using the three rotary switches: valid controller device addresses 1-254
Communications bus	F4-CVM models: BACnet MS/TP (default), N2. CV Series controllers support wireless functionality for the FC bus and for sensors with additional hardware. 3-wire FC Bus between the supervisory controller and equipment controllers ① Note: For more information, refer to the <i>FX MS/TP Communications Bus Technical Bulletin (LIT-12011670)</i> . F4-CVE03050-0P: BACnet/IP (default); BACnet/SC Two Ethernet ports; 10/100 Mbps; 8-pin RJ-45 connector ① Note: For more information, refer to the <i>Facility Explorer IP Networks for BACnet/IP Controllers Configuration Guide (LIT-12012980)</i> . All CV series models: 4-wire SA Bus between equipment controller, network sensors and other sensor/actuator devices, includes a lead to source 15 VDC supply power (from equipment controller) to bus devices
Processor	RX64M 32-bit Renesas microcontroller
Memory	16MB Flash Memory and 8MB SDRAM
Real-time clock backup power supply	Super capacitor maintains power to the onboard real-time clock for a minimum of 72 hours when supply power to the controller is disconnected.
Input and output capabilities	3 - Universal Inputs: Defined as 0-10 VDC, 0-600k ohms, or Binary Dry Contact 2 - Configurable Outputs: Defined as 0-10 VDC or 24 VAC Triac BO 3 - Binary Outputs: Defined as 24 VAC Triac (external power source only)
Universal Input (UI) Resolution/ Configurable Output (CO) accuracy	UI Analog Input Mode: 15-bit resolution on UIs CO Analog Output Mode: 0-10 VDC ± 200 mV
Air pressure differential sensor	Range: -2 in. to 2 in. H2O Performance Characteristics: Typical accuracy at ambient operating conditions: +/- 0.5 % in. Water column full scale Typical accuracy at zero (null) pressure is +/- 0.0006 in. Water column
Actuator rating	4 N·m (35 lb·in) minimum shaft length = 44 mm (1-3/4 in.) (if provided)

Table 7: Technical specification for CV Series Controllers

Specification	Description
Terminations	Inputs/Outputs: Pluggable Screw Terminal FC Bus, SA Bus, and Supply Power: 4-Wire and 2-Wire Pluggable Screw Terminal Blocks SA Bus Modular Ports: RJ-12 6-Pin Modular Jacks ① Note: The FC Bus Terminal and FC Bus Port are only available on the CVM models
Mounting	Mounts to damper shaft using single set screw and to duct with single mounting screw
Housing	Enclosure material: ABS and polycarbonate UL94 5VB; Self-extinguishing Protection Class: IP20 (IEC529)
Dimensions (height x width x depth)	165 mm x 125 mm x 73 mm (6.5 in. x 4.92 in. x 2.9 in.) Center of Output Hub to Center of Captive Spacer: 135 mm (5-5/16 in.)
Weight	0.69 kg (1.52 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. Suitable for Use in Other Environmental Air Space (Plenums) in Accordance with Section 300.22(C) of the National Electrical Code.
	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 declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive and RoHS Directive.
	Australia and New Zealand: RCM Mark, Australia/NZ Emissions Compliant.
	BACnet International: BACnet Testing Laboratories™ (BTL) Protocol Revision 18 Listed and Certified BACnet Advanced Application Controller (B-AAC), based on ANSI/ASHRAE 135-2020
	United Kingdom: Johnson Controls declares that this product is in compliance with Electromagnetic Compatibility Regulations, the Electrical Equipment (Safety) Regulations, and the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations.

¹ The VA rating does not include any power supplied to the peripheral devices connected to Configurable Outputs (COs) or Binary Outputs (BOs), which can consume up to 12 VA for each CO or BO, for a possible total consumption of an additional 60 VA (maximum).

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

XPM Expansion Modules technical specifications



Table 8: Technical specifications

Specification	Description
Power requirement	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 ① Note: The 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).

Table 8: Technical specifications

Specification	Description
Power source	+15 VDC power source terminals provide 100 mA total current. Note: Only present on XPM09090 and XPM04060 models. <ul style="list-style-type: none"> F4-XPM09090-0: Quantity 2-located in Universal Input terminals for active (3-wire) input devices. F4-XPM04060-0: Quantity 1-located in Universal Input terminals for active (3-wire) input devices.
Ambient conditions	Operating: 0°C to 50°C (32°F to 122°F); 10% to 90% RH noncondensing Storage: -40°C to 80°C (-40°F to 176°F); 5% to 95% RH noncondensing
Communications protocol	BACnet MS/TP; Zigbee Wireless also supported (at FC Bus and for Sensors) with additional hardware. XPM expansion modules support Zigbee wireless functionality for the FC bus and for sensors with additional hardware.
Device addressing for BACnet MS/TP	Decimal address set using the three rotary switches; valid controller device addresses 4-127
Communications bus	RS-485 3-wire FC Bus between the supervisory controller and expansion modules 4-wire SA Bus between equipment controller, network sensors and other sensor/actuator devices, includes a lead to source 15 VDC supply power (from equipment controller) to bus devices.
Processor	RX64M Renesas® 32-Bit microcontroller
Memory	16 MB flash memory and 8 MB SDRAM
Input and output capabilities	Universal Inputs: Defined as 0–10 VDC, 4–20 mA, 0–600k ohms, or Binary Dry Contact Binary Inputs: Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode Configurable Outputs: Defined as 0-10 VDC or 24 VAC @500mA Triac BO Analog Outputs: Defined as 0–10 VDC or 4–20 mA Binary Outputs: Defined as 24 @500mA VAC Triac (external power source only)
Universal Input (UI) Resolution / Analog Output (AO) Accuracy	Input: 24-bit Analog to Digital converter Output: +/- 200 mV accuracy in 0–10 VDC applications
Terminations	Input/Output: Pluggable Screw Terminal Blocks SA/FC Bus and Supply Power: 4-Wire and 2-Wire Pluggable Screw Terminal Blocks SA/FC Bus Port: RJ-12 6-Pin Modular Jack
Mounting	Horizontal on single 35 mm DIN rail mount (recommended), or screw mount on flat surface with three integral mounting clips on controller
Housing	Enclosure material: ABS and polycarbonate UL94 5VB; Self-extinguishing Protection Class: IP20 (IEC529)
Dimensions (height x width x depth)	XPM09090-0: 150 mm x 190 mm x 44.5 mm (5-7/8 in. x 7-1/2 in. x 1-3/4 in.) including terminals and mounting clips XPM04060-0 and XPM18000-0: 150 mm x 152 mm x 44.5 mm (5-7/8 in. x 6 in. x 1-3/4 in.) including terminals and mounting clips Note: Mounting space 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	XPM09090-0: 0.5 kg (1.1 lb) XPM04060-0 and XPM18000-0: 0.29 kg (0.64 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 Compliant, ICES-003

Table 8: Technical specifications

Specification	Description
	Europe: Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive and RoHS Directive.
	Australia and New Zealand: RCM Mark, Australia/NZ Emissions Compliant
	BACnet International: BACnet Testing Laboratories™ (BTL) Protocol Revision 18 Listed and Certified BACnet Smart Actuator (B-SA), based on ANSI/ASHRAE 135-2020
	United Kingdom: Johnson Controls declares that this product is in compliance with Electromagnetic Compatibility Regulations, The Electrical Equipment (Safety) Regulations, and Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations.

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

Compliance for CG Series and CV Series Controllers

North American emissions compliance

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.

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.

Industry Canada Statement(s)

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

1. This device may not cause interference, and

2. This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1. L'appareil ne doit pas produire de brouillage, et
2. L'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Repair information

If a 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.

Product warranty

This product is covered by a limited warranty, details of which can be found at www.johnsoncontrols.com/buildingswarranty.

Patents

Patents: <https://jciapat.com>

Single point of contact

APAC	EU	UK	NA/SA
JOHNSON CONTROLS C/O CONTROLS PRODUCT MANAGEMENT NO. 32 CHANGJIANG RD NEW DISTRICT WUXI JIANGSU PROVINCE 214028 CHINA	JOHNSON CONTROLS VOLTAWEG 20 6101 XK ECHT THE NETHERLANDS	JOHNSON CONTROLS TYCO PARK GRIMSHAW LANE MANCHESTER M40 2WL UNITED KINGDOM	JOHNSON CONTROLS 5757 N GREEN BAY AVE. GLENDALE, WI 53209 USA