Metasys CG, CV Equipment Controllers and XPM Expansion Modules Product Bulletin

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Overview

The Metasys 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 Metasys system.

CG and CV Series Equipment Controllers

The CG and CV series equipment controllers are versatile equipment controllers designed to monitor, control, and integrate a wide variety of HVAC and other building equipment. CGM controllers support BACnet® MS/TP and N2 communication protocols, and auto-detect which protocol is connected to it. In MS/TP mode, these equipment controllers are BACnet network-compliant devices. Controllers running in N2 mode can be used to maintain or modernize sites with installed legacy Johnson Controls® controllers.

The CG and CV series equipment controllers feature an advanced design that provides optimum performance. These controllers run pre-engineered and user-programmed applications and provide the I/O required to monitor and control a wide variety of HVAC equipment. These controllers are designed to install easily and communicate through standard RS485 BACnet MS/TP protocol, 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. The CG and CV series equipment controllers also provide easy access to power, network, and field terminations.

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

XPM Series Expansion Modules

The M4-XPM series I/O expansion modules can serve in one of two capacities depending on where they are installed in the Metasys system. When installed on the Sensor/Actuator (SA) Bus of a Metasys equipment controller, an XPM expands the input and output interfaces that can be used with that equipment controller. When installed on the Field Controller (FC) Bus of a Metasys network engine, an XPM can be used as I/O point multiplexors to support monitoring and control from a Metasys network engine. 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

Reduce commissioning time, eliminate change-of-season re-commissioning, and reduce wear and tear on mechanical devices.

Patented Proportional Adaptive Control (P-Adaptive) and PRAC

Provides continuous loop tuning.

Standard BACnet protocol

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

Models to support both BACnet MS/TP and N2, with auto-detection of the communications protocols

Controller auto-detects the BACnet MS/TP or N2 protocol that is connected to it, which enables the same controller to support multiple communication protocols without the need to purchase a special model per protocol, and without extra manual setup.

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 Metasys BAS.

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 Metasys 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.

Decimal MS/TP address set with three rotary switches

Easy-to-use rotary switches set the MS/TP address 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 state for equipment controller Input/Output wiring validation

Enables validation of the input and output terminals' wiring prior to download of an application file.

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

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

SA Bus commissioning improvements

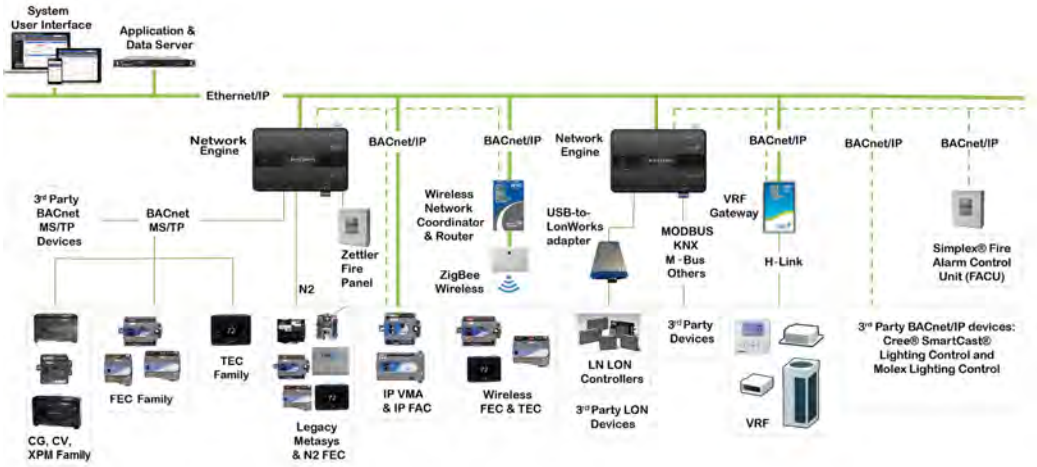
Saves field technicians time when commissioning SA Bus devices by enabling an equipment controller to transfer and apply firmware files to all the SA Bus devices (XPM, IOM, NS8000) connected to it at the same time.

Small, convenient package size

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

Network Diagram with Equipment Controllers

Figure 2: Metasys System with Equipment Controllers



Integration to the Metasys system supervisory devices

The CG and CV series equipment controllers are designed to integrate seamlessly into the Metasys system by connecting to, communicating with, and being supervised by Metasys network engines (including SNE, SNC, NAE, NIE, and NCE series network engines). This seamless integration of equipment controllers with Metasys network engines delivers coordinated, system-wide control and enables building operators to monitor and adjust equipment controllers from the Metasys system UI.

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

Communications protocols

The CGM and CVM controllers can communicate using BACnet MS/TP, N2, or wireless Zigbee. The controllers auto-detect the protocol that is connected, which enables the same controller to support multiple communication protocols without the need to purchase a special model per protocol, and without extra manual setup.

The XPM expansion modules can 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.

The CGM and CVM controllers can be used 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.

The CGM and CVM controllers can also be installed in a wireless application using a ZFR/ZFR ProWireless Field Bus Router, see Related products.

Hardware and installation

Metasys equipment 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.

Metasys 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 state that can assist in validating the wiring of the input and output terminals prior to download of an application file. When the controller is powered on in this state, 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 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.

CG and CV Series Equipment Controllers

General Purpose Application Controllers (CG Series)

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. There are two models of CG series controllers available with two different sets of onboard input/output interfaces (Table 1). You can expand their I/O interfaces by connecting XPM or IOM series I/O expansion modules.

CG series equipment 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 standalone controllers when offline from the Metasys system network.

CG model information

Table 1: CG series information including point type counts

		M4-CGM09090-0	M4-CGM04060-0
Communication protocol	BACnet MS/TP, N2, or Wireless (using add-on modules)		
Supported Network Engines	All network engine model types Refer to the *Network Engines Product Bulletin (LIT-12012138)* for details.		
Modular Jacks	FC and SA Bus Modular Ports: RJ-12 6-Pin Modular Jacks		
Point Types	**Signals Accepted**		
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
Analog Output (AO)	Analog Output - Voltage Mode (0–10 VDC) Analog Output - Current Mode (4–20 mA) Analog Output Signal Common	2	
SA Bus	Supports up to 10 total wired SA Bus devices, including the XPM and IOM series expansion I/O modules and up to 4 NS series network sensors.	Up to 4 NS Series Network Sensors Up to 9 WRZ sensors when using the ZFR or ZFR Pro Series wireless router configuration and 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 *M4-CGM/XPM Equipment Controller Standard Control Panel Assembly Catalog Page (LIT-1901089)*.

VAV Box Controllers (CV Series)

The CV series equipment controllers 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. The CVM03050-0P model features an integral potentiometer to sense actual VAV box damper position. These 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 Metasys system network. These controllers also connect easily to the wired and wireless network sensors for zone and discharge air temperature sensing.

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

Reassures users and field technicians of the VAV box damper's actual position and enables them to easily confirm and troubleshoot VAV controller operations, confirm actuator is at the desired 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 *CVM03050 VAV Terminal Equipment Controllers Installation Instructions (Part No. 24-10143-01590)*

CV model information

Table 2: CV Series information including point type counts

		M4-CVM03050-0	M4-CVM03050-0P
Communication Protocols	BACnet MS/TP, N2, or Wireless (using add-on modules)		
Network Engines	All network engine model types Refer to the *Network Engines Product Bulletin (LIT-12012138)* for details.		
Modular Jacks	FC and SA Bus Modular Ports: RJ-12 6-Pin Modular Jacks		
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
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

Table 2: CV Series information including point type counts

		M4-CVM03050-0	M4-CVM03050-0P
Binary Output (BO)	Binary Output - 24 VAC Triac	3	3
Integrated Actuator	Internal	1	1
Differential Pressure Transducer	Internal	1	1
Integrated Feedback Potentiometer	Internal	No	Yes
SA Bus	Supports up to 10 total wired SA Bus devices, including the XPM and IOM series expansion I/O modules and up to 4 NS series network sensors.	Up to 4 NS Series Network Sensors Up to 9 WRZ sensors when using the ZFR or ZFR Pro Series wireless router configuration and up to 5 WRZ sensors when using the one-to-one WRZ-78xx wireless configuration	

XPM Expansion Modules

Compatibility

XPM series expansion modules can be connected to the SA Bus of the following equipment controller device types:

- CG series General Purpose Application Equipment Controllers
- CV series VAV Box Controllers
- FAC series Advanced Application Field Equipment Controllers
- FEC series Field Equipment Controllers
- VMA16, VMA18, and VMA19 series VAV Box Controllers
- SNC series Network Control Engines
- NCE series Network Control Engines

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

XPM series expansion modules can be connected to the FC bus of the following network engine types:

- SNE series Network Engines
- SNC series Network Control Engines
- NAE35, NIE39, NAE45, NAE49, NAE55, and NAE59 series Network Automation and Integration Engines
- NCE25 and NIE29 series Network Control Engines

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

XPM model information

Table 3: XPM Series information including point type counts

		M4-XPM04060	M4-XPM09090	M4-XPM18000
Communication Protocols	BACnet MS/TP			
Network Engines	For a list of compatible Network Engines, see Compatibility. Refer to the *Network Engines Product Bulletin (LIT-12012138)* for details.			
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	
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	
Analog Output (AO)	Analog Output - Voltage Mode (0–10 VDC) Analog Output - Current Mode (4–20 mA) Analog Output Signal Common		2	
Binary Output (BO)	Binary Output - 24 VAC Triac (External Power Source) Binary Output Common	2	3	

Related products

For information about the Metasys system and related products, refer to *Metasys System Product Bulletin (LIT-1201526)*.

Controller Configuration Tool (CCT)

The CCT is used in conjunction with the *Metasys* 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 *Metasys* 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
M4-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
M4-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
M4-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.
M4-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.
M4-XPM04060-0	10-point Input/Output Expansion Module Includes: MS/TP communication; 10 points (3 UI, 1 BI, 4 CO, 2 BO); 24VAC input
M4-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
M4-XPM18000-0	18-point Input Expansion Module Includes: MS/TP communication; 18 points (18 BI); 24VAC input

Table 5: Accessories (order separately)

Product code number	Description
IOM Series Expansion Modules	Refer to the *Metasys® System Field Equipment Controllers and Related Products Product Bulletin (LIT-12011042)* for a complete list of available Expansion Modules.
TL-CCT-0	License enabling Controller Configuration Tool (CCT) software for one user
MS-FCP-0	License enabling Metasys Equipment Controller Firmware Package Files required for CCT
Mobile Access Portal (MAP) Gateway	Refer to the *Mobile Access Portal Gateway Catalog Page (LIT-1900869)* to identify the appropriate product for your region.
MS-DIS1710-0	Local Controller Display
NS-ATV7003-0	Handheld VAV Balancing Tool
NS Series Network Sensors	Refer to the *NS Series Network Sensors Product Bulletin (LIT-12011574)* 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 *WRZ Series Wireless Room Sensors Product Bulletin (LIT-12000653)* for specific sensor model descriptions.
WRZ-7860-0	Refer to the *WRZ-7860 Receiver for One-to-One Wireless Room Sensing Product Bulletin (LIT-12011640)* for a list of available products.
WRZ-SST-120	Refer to the *WRZ-SST-120 Wireless Sensing System Tool Installation Instructions (LIT-24-10563-55)* for usage instructions.
WRG1830/ZFR183x Pro Series Wireless Field Bus System	Refer to the *WRG1830/FX-ZFR183x Pro Series Wireless Field Bus System Technical Bulletin (LIT-12013553)* for a list of available products.
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. **Note:** 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 *ZCT Checkout Tool Help LIT-12012292* or the *WNC1800_ZFR182x Pro Series Wireless Field Bus System Technical Bulletin (LIT-12012356)*.
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

Table 5: Accessories (order separately)

Product code number	Description
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. The FIT can be used 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. The FIT can be used 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.

CG Series technical specifications

Table 6: Technical Specifications for CG Series Controllers

Product Code Numbers	**M4-CGM09090-0** General Purpose Application 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 **M4-CGM04060-0** General Purpose Application Controller Includes: MS/TP (and N2) communication; 10 points (3 UI, 1 BI, 4 CO, 2 BO); real-time clock; 24 VAC input
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 USB feature is not currently supported.
Power Source	+15 VDC power source terminals provide 100 mA total current. **M4-CGM09090-0:** Quantity 2 located in Universal IN terminals for active (3-wire) input devices **M4-CGM04060-0:** 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); 10 to 90% RH noncondensing **Storage:** -40°C to 80°C (-40°F to 176°F); 5 to 95% RH noncondensing
Supported Network Engines	All network engine model types
Communications Protocol	BACnet MS/TP; N2. Wireless also supported (at FC Bus and for Sensors) with additional hardware.
Device Addressing for BACnet MS/TP	Decimal address set via three rotary switches: valid controller device addresses 4-127
Device Addressing for N2	Decimal address set via three rotary switches: valid controller device addresses 1-254
Communications Bus	BACnet MS/TP (default); N2 3-wire FC Bus between the supervisory controller and equipment controllers 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
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.

Table 6: Technical Specifications for CG Series Controllers

Input and Output Capabilities	**M4-CGM09090-0** 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) **M4-CGM04060-0** 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)
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
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)	**M4-CGM09090-0:** 150 mm x 190 mm x 44.5 mm (5-7/8 in. x 7-1/2 in. x 2-1/8 in.) including terminals and mounting clips. **M4-CGM04060-0:** 150 mm x 125 mm x 44.5 mm (5-7/8 in. x 4-7/8 in. x 2-1/8 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	**M4-CGM04060-0:** 0.29 kg (0.64 lb) **M4-CGM09090-0:** 0.5 kg (1.1 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
CE	**Europe:** Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive nd 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 135-2016

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

Product code numbers	**M4-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. **M4-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.
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] **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	All network engine model types
Communications protocol	BACnet MS/TP; N2. Wireless also supported (at FC Bus and for Sensors) with additional hardware.
Device addressing for BACnet MS/TP	Decimal address set via three rotary switches: valid controller device addresses 4-127
Device addressing for N2	Decimal address set via three rotary switches: valid controller device addresses 1-254
Communications bus[2]	BACnet MS/TP (default), N2 3-wire FC Bus between the supervisory controller and equipment controllers 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. H2O Typical accuracy at zero (null) pressure is +/- 0.0006 in. H2O
Actuator rating	4 N·m (35 lb·in) minimum shaft length = 44 mm (1-3/4 in.) (if provided)
Terminations	**Inputs/Outputs**: Pluggable Screw Terminal **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
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)

Table 7: Technical specification for CV Series Controllers

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
CE	**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 135-2016

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).

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

The performance specifications are nominal and conform to acceptable industry 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 Series technical specifications

Table 8: Technical specifications

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 ⓘ **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).
Power Source	+15 VDC power source terminals provide 100 mA total current. Only present on XPM09090 and XPM04060 models. • **M4-XPM09090-0:** Quantity 2-located in Universal IN terminals for active (3-wire) input devices. • **M4-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
Network Engines	All network engine model types
Communications Protocol	BACnet MS/TP; Wireless also supported (at FC Bus and for Sensors) with additional hardware.
Device Addressing for BACnet MS/TP	Decimal address set via three rotary switches; valid controller device addresses 4-127
Communications Bus	BACnet MS/TP (default); 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)	**M4-XPM09090-0:** 150 mm x 190 mm x 44.5 mm (5-7/8 in. x 7-1/2 in. x 2-1/8 in.) including terminals and mounting clips **M4-XPM04060-0 and M4-XPM18000-0:** 150 mm x 125 mm x 44.5 mm (5-7/8 in. x 4-7/8 in. x 2-1/8 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	**M4-XPM04060-0 and XPM18000-0** 0.29 kg (0.64 lb) **M4-XPM09090-0** 0.5 kg (1.1 lb)

Table 8: Technical specifications

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
CE	**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 135-2016

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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.

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.

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://jcipat.com

Single point of contact

APAC	Europe	NA/SA
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