BAC-A1616BC (and CAN-A168EIO)
BACnet Building Controller (and Expansion Modules)

Quick Install Guide

Contents

Important Notices and More Information

This document gives BASIC MOUNTING AND WIRING INFORMATION ONLY! For configuration, programming, operation, and other information, see the full Installation and Operation Guide available on the KMC web site (and downloadable via the QR code at the right)!

For support documents, see the BAC-A1616BC series product page on the **KMC Controls Partner Portal web site (partners.kmccontrols.com)**. You will need to log into the Partner site to see all available documents and files.
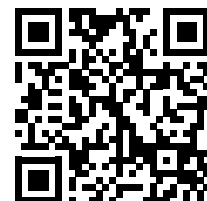
The material in this document is for information purposes only. **The contents and the product it describes are subject to change without notice.** KMC Controls, Inc. makes no representations or warranties with respect to this document. In no event shall KMC Controls, Inc. be liable for any damages, direct or incidental, arising out of or related to the use of this document.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. This Class B digital apparatus complies with Canadian ICES-003.

NOTE: In this document, a NOTE provides additional information that is important.

⚠ CAUTION

In this document, a CAUTION indicates potential personal injury or equipment or property damage if instructions are not followed.
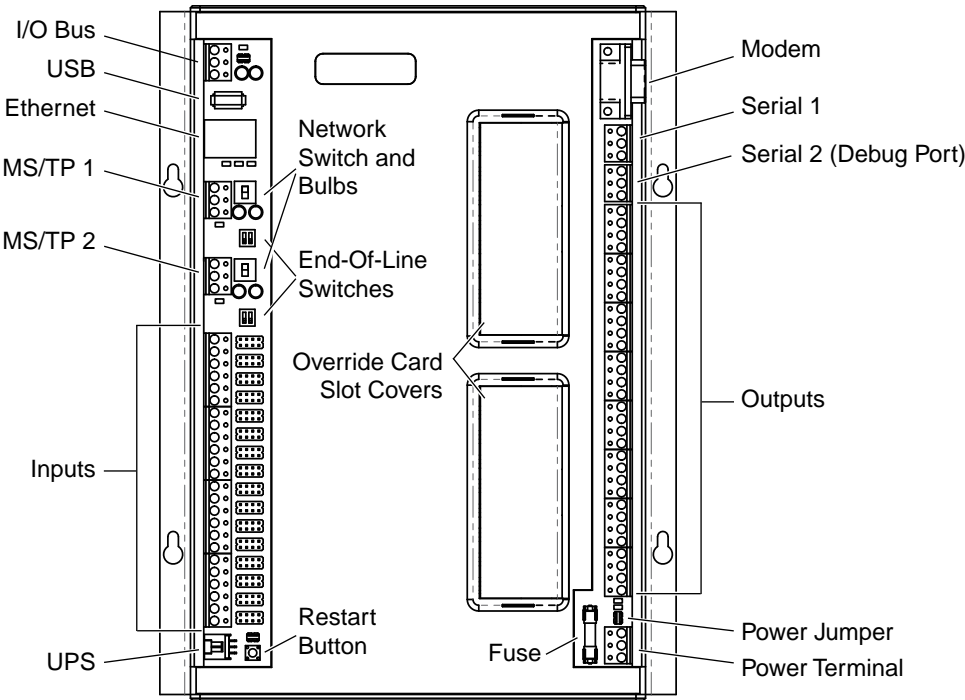
Diagram and Dimensions

I/O Bus
USB
Ethernet
MS/TP 1
MS/TP 2
Network Switch and Bulbs
End-Of-Line Switches
Override Card Slot Covers
Inputs
Restart Button
UPS

Modem
Serial 1
Serial 2 (Debug Port)
Outputs
Power Jumper
Fuse
Power Terminal

Illustration 1—Indicators and Connectors
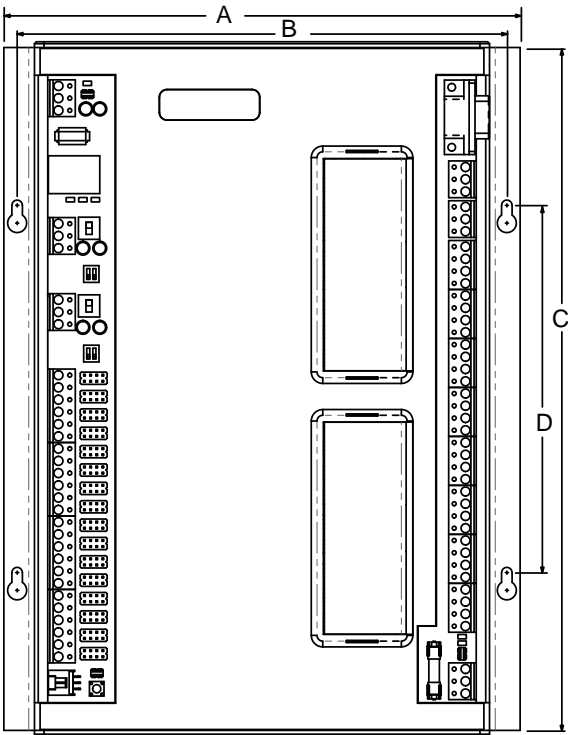
A	B	C	D	Depth (not shown)
8.4 in.	8.0 in.	11.2 in.	6.0 in.	1.1 in. (w/o HPO covers), 1.9 in. (with)
214 mm	203 mm	283 mm	152 mm	27 mm, 48 mm

Illustration 2—Building Controller Dimensions

Mounting

Mount the Building Controller inside of a metal enclosure. KMC Controls recommends using a UL-approved enclosed energy management equipment panel such as a KMC model HCO-1035 or HCO-1036. Insert #6 or #8 (or metric equivalents) hardware through the two mounting holes on each side of the controller to securely fasten it to a flat surface. See *Diagram and Dimensions on page 2* for mounting hole locations and dimensions. To maintain RF emission specifications, use either shielded connecting cables or enclose all cables in conduit.

Connecting Inputs

The Building Controller has 16 universal inputs. Each input can be configured to receive either analog or binary signals. After selecting the appropriate jumper position for each input, a variety of active or passive devices may be connected to the inputs. (Active devices have their own external power supply.)
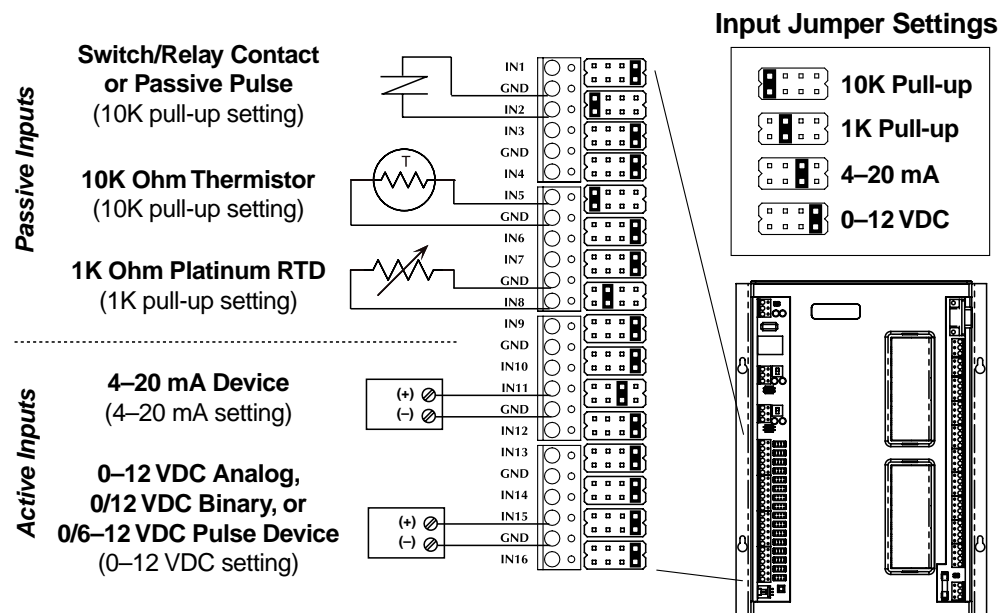

Illustration 3—Typical Inputs and Input Jumper Settings

For inputs to work properly, you must correctly:

• Attach sensors/switches to terminal blocks. See *Illustration 3 on page 3*.

• Check/change input jumper settings. See *Illustration 3 on page 3* and *Illustration 4 on page 4*.

• Configure input objects. See the **Installation and Operation Guide** for more information.

• For analog input (AI) objects, check/select/import/configure the relevant lookup table as needed. See the Tables section in the **Installation and Operation Guide** for more information.

0–12 VDC inputs

For an active voltage input, set the jumper to the *0–12 VDC* position. See *Illustration 3 on page 3* for the jumper positions. (For active pulse inputs, see below.)

4–20 mA inputs

For a 4–20 mA current loop input, set the jumper to the *4–20 mA* position.

Passive Inputs

Passive input signals, such as thermistors or switch contacts, need a pull-up resistor in the circuit. For KMC thermistors and most other applications set the jumper to the *10K Pull-up* position. For 1K ohm platinum RTDs, use the *1K Pull-up* position. (For troubleshooting inputs with a voltmeter, see *Illustration 4 on page 4*.)

NOTE: **For pulse inputs, read the Pulse inputs section below carefully! Active voltage pulses of less than 6 VDC require an external voltage divider.**

Pulse Inputs

Connect pulse inputs in the following manner:

- If the pulse input is a **passive** input such as switch contacts, then place the input pull-up in the *10K Pull-up* position.

- If the pulse is an **active** voltage **from 6 VDC up to a maximum of 12 VDC**, then place the input jumper in the *0–12 VDC* position.

- If the pulse is an **active** voltage **LESS than 6 VDC, then remove the input jumper and use an external resistor voltage divider to provide a 3 VDC maximum**. See *Illustration 4 on page 4.*
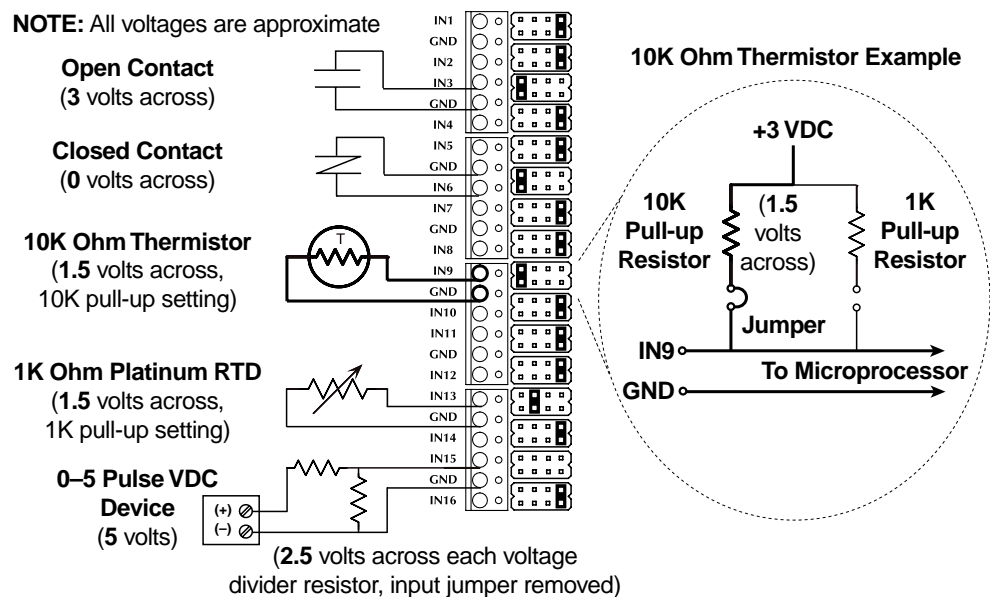

Illustration 4—Input Pull-Up Resistors, Voltage Values, and Resistance Values

Ground Terminals

Input ground terminals are located next to the input terminals. Up to two wires, size 14–22 AWG, can be clamped into each ground terminal. If more than two wires must be joined at a common point, use an external terminal strip to accommodate the additional wires.

NOTE: Input and Output GND terminals are **circuit** grounds and should not be connected to **earth** ground (or ground loops may result).

Connecting Outputs

All 16 onboard outputs are universal, software selectable to produce either analog or binary signals. For loads that exceed the output specifications of the controller, including loads that require AC, use an output override card. See *Installing Override Boards (Optional) on page 6*.

For outputs to work properly, you must correctly:

- Attach output devices to terminal blocks. See *Illustration 5—Output Terminals and Banks on page 5*.

- Configure output objects. See the **Installation and Operation Guide** for more information.

Maximum current for universal outputs:
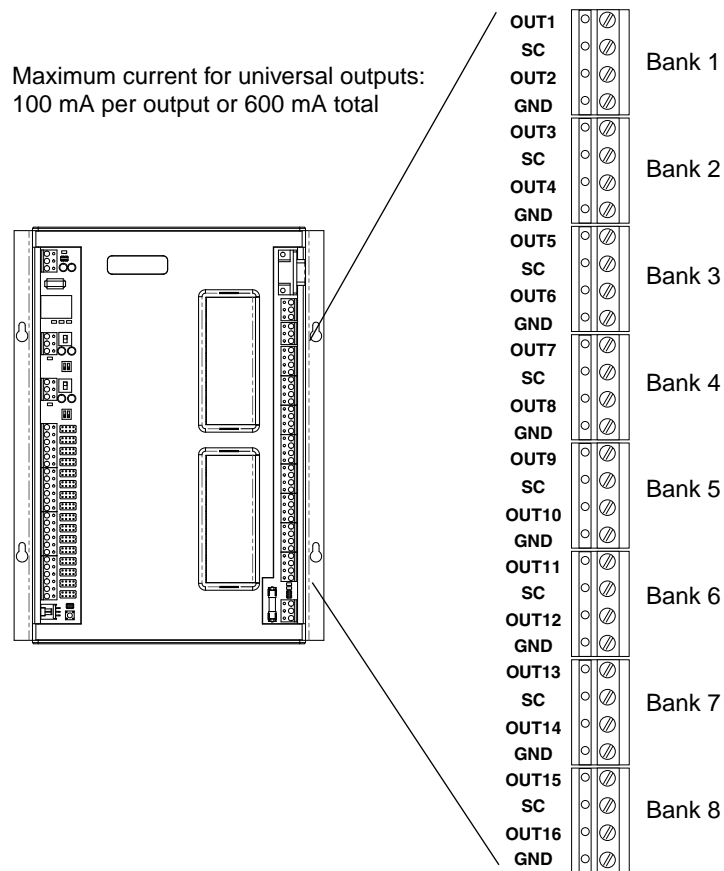100 mA per output or 600 mA total

Illustration 5—Output Terminals and Banks

Universal Outputs

Connect the device under control between the output terminal and the ground (GND) terminal on the same bank. Switched common (SC) terminals are only used with some of the output override boards. See the **Installation and Operation Guide**. The universal KMC BACnet controller outputs can be configured as: analog objects (0 **TO** 12 volts DC) or binary objects—0 **OR** 12 volts DC.

For either type of output, the DC voltage signals can—within the specification of the output (**100 mA per output** or **600 mA total)**—connect directly to most equipment.

Installing Override Boards (Optional)

⚠ CAUTION

If optional HPO-670x Output Override Boards are to be used for outputs, review the "Installing Override Boards (Optional)" and "Grounds and Switched (Relay) Commons" sections in the Installation and Operation Guide before installing.

Connecting to an MS/TP Network

Connections and Wiring

The building controller connects to three different types of networks:

- MS/TP (see *Illustration 6 on page 7*)

- BACnet IP over Ethernet (see *Connecting to an Ethernet Network on page 8*)

- Ethernet 8802-3

⚠ CAUTION

Review the Installation and Operation Guide and the applications note AN0404A *Planning BACnet Networks* **when planning the network wiring.**

NOTE: The Building Controller's EIA-485 terminals are labeled –*A*, +*B*, and *S*. The S terminal is provided as a connecting point for the shield. The terminal is not connected to the ground of the controller. When connecting to controllers from other manufacturers, verify the shield connection is not connected to ground.
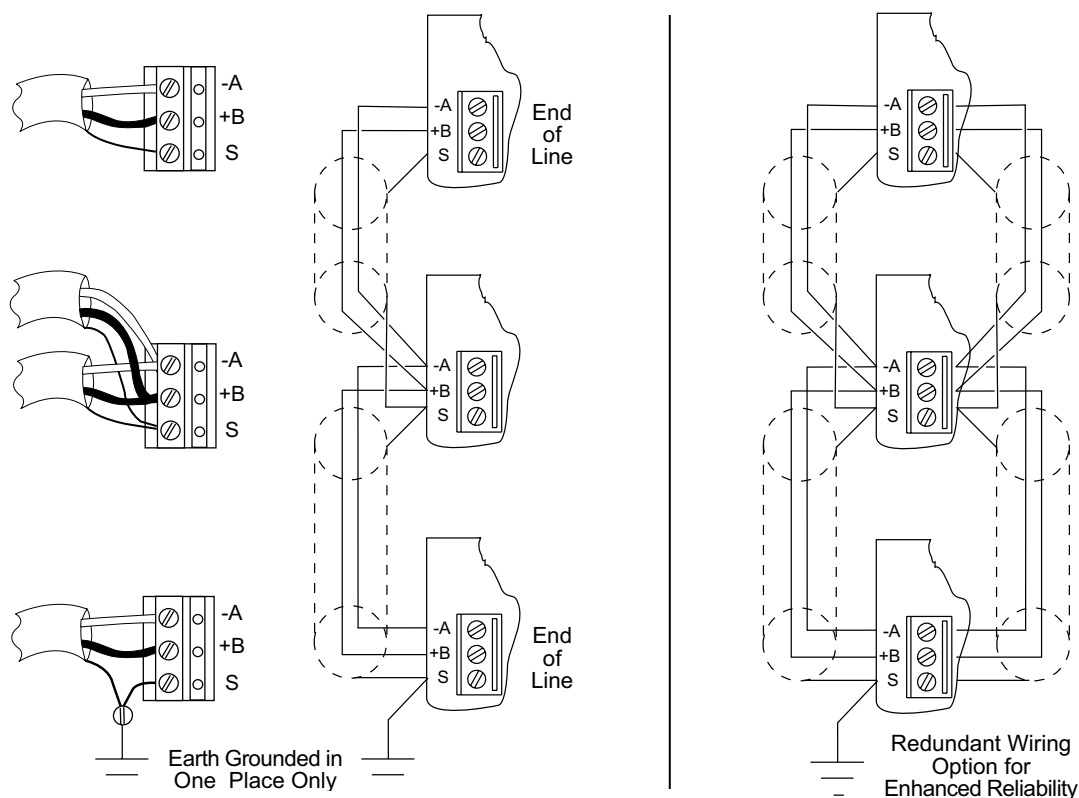
Illustration 6—MS/TP Network Wiring (Standard and Redundant Wiring)

End of Line Termination Switches

The controllers on the physical ends of the EIA-485 wiring segment must have end-of-line termination installed for proper network operation. In the end controllers, set the end-of-line termination to *On* using the EOL switches. See *Illustration 7 on page 7* and *Illustration 8 on page 8*.

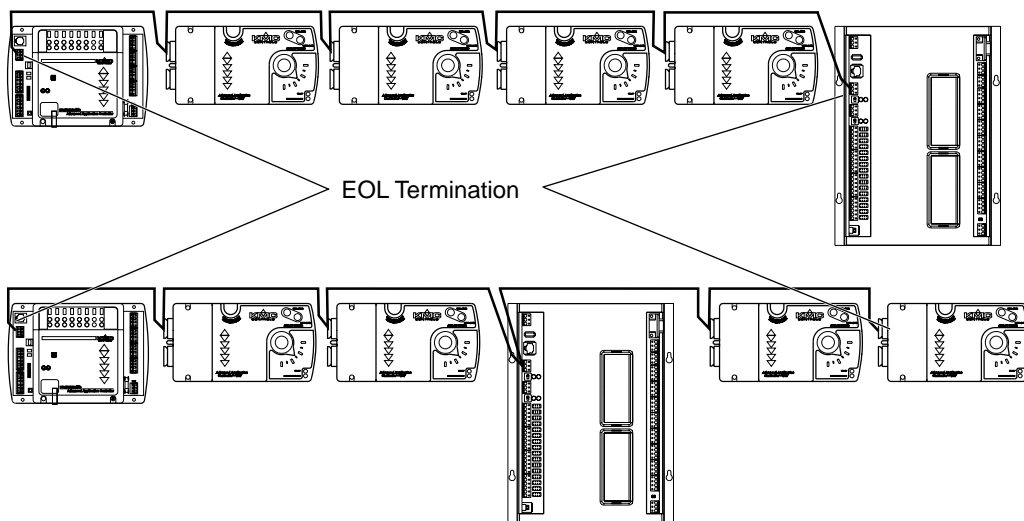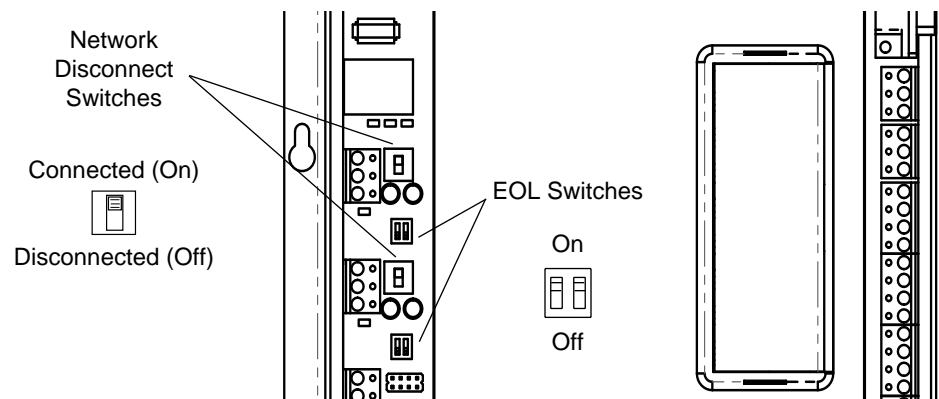*Illustration 7—End-of-Line Termination*

Illustration 8—Location of Network Disconnect and EOL Switches

Connecting to an Ethernet Network

⚠ CAUTION

Placing the Building Controller on an Ethernet network without proper configuration and assigning the correct IP address could cause disruption to the Ethernet LAN network service. Review the Installation and Operation Guide and the applications note AN0404A *Planning BACnet Networks* **before connecting a Building Controller or router to a network.**

The Building Controller connects to the Ethernet LAN in the same manner as other Ethernet devices. Connect a standard CAT 5 or CAT 6 Ethernet cable from the Ethernet port on the router to a network router, switch, or hub.

Connecting for Point-to-Point Operation

Modem Connection for Point-to-Point

The point-to-point method is the only standard BACnet method for a dial-up connection. See the Installation and Operation Guide for more details.

NOTE: KMC Controls does not guarantee compatibility with any modem other than the KMD-5569.

Debug Port Connection

To aid in troubleshooting, use a KMD-5672 PC-to-Controller cable and connect it to the *Serial 2 Debug port*. See the Installation and Operation Guide for more details.

Controller-to-Controller over Null Modem Cable

Use a standard DB-9 to DB-9 null modem cable to connect two BAC-A1616BCs with a PTP link. See the Installation and Operation Guide for more details.

Connecting to CAN-A168EIO Expansion Modules
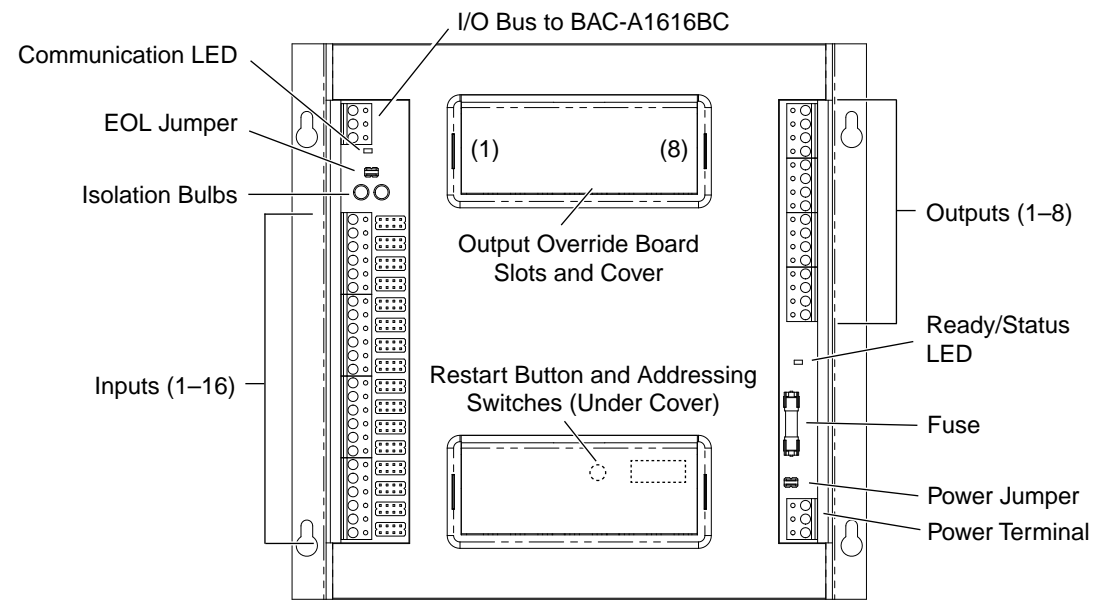
Diagram and Dimensions

Illustration 9—CAN-A168EIO Overview

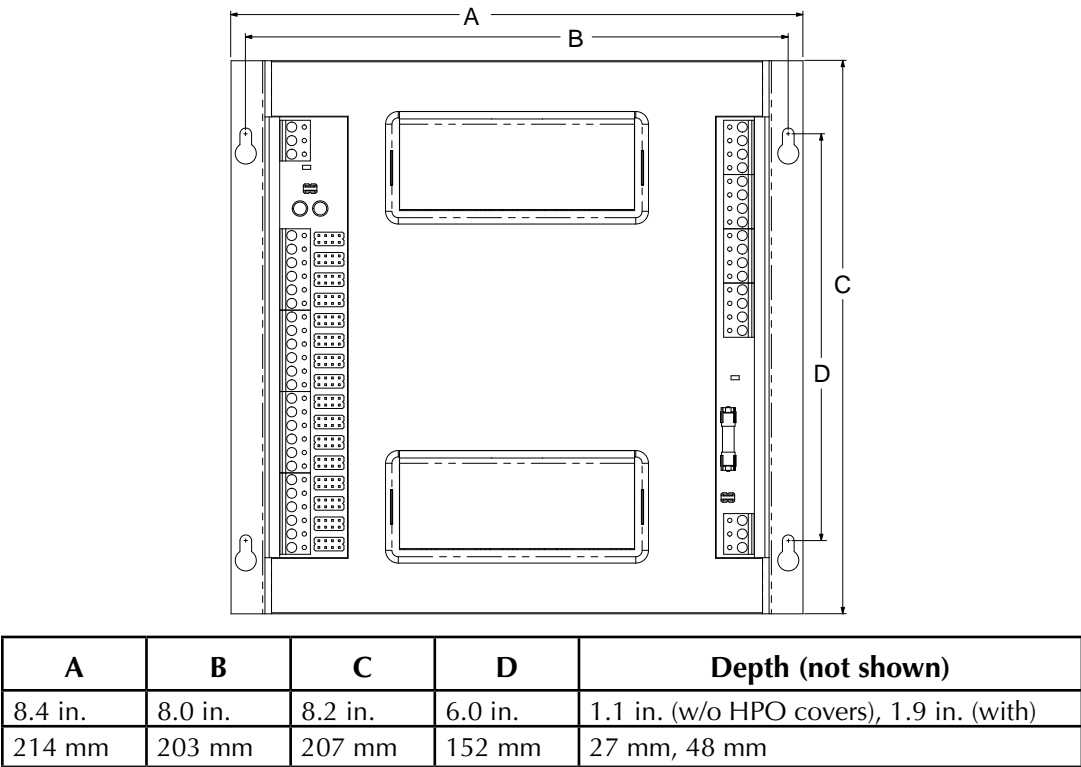| A	B	C	D	Depth (not shown)
8.4 in.	8.0 in.	8.2 in.	6.0 in.	1.1 in. (w/o HPO covers), 1.9 in. (with)
214 mm	203 mm	207 mm	152 mm	27 mm, 48 mm

Illustration 10—CAN-A168EIO Dimensions

Mounting

Mount the CAN-A168EIO inside of a metal enclosure in the same manner as the Building Controller. See *Mounting on page 3*.

Inputs, Outputs, and Power

The onboard 16 inputs and 16 outputs can be expanded up to a total of 128 inputs and 72 outputs by using up to 7 expansion I/O modules installed up to 200 feet away.

Connect the CAN-A168EIO **inputs and outputs** in the same manner as the Building Controller. See *Connecting Inputs on page 3* and *Connecting Outputs on page 5*.

NOTE: The maximum output current is **100 mA per output** (at 0–12 VDC) or **450 mA total** for all outputs.

Connect the CAN-A168EIO **power** in the same manner as the Building Controller. See *Connecting Power on page 12*.

NOTE: **The CAN-A168EIO is controlled by the BAC-A1616BC. If they are on separate electrical circuits, the possibility exists that power could fail to the BAC-A1616BC but remain on to the CAN-A168EIO. If this occurs, the outputs of the CAN-A168EIO would remain in their current state until (at least) the BAC-A1616BC has its power restored. Having the BAC-A1616BC and all expansion modules on the same electrical circuit is recommended.**

⚠ CAUTION

If the CAN-A168EIO will control a device that has a minimum required "off" time (e.g., a large compressor), for proper operation after a power failure, power the CAN-A168EIO from the same electrical circuit as the BAC-A1616BC. The CAN-A168EIO should restart at the same time as the BAC-A1616BC after a power failure.

I/O Bus

Connect the **I/O Bus connector** of the CAN-A168EIO to the I/O Bus connector of the Building Controller. The modules can be installed up to 200 feet away (of total wiring) using standard twisted-pair wiring on the serial I/O bus. Use the following principles when connecting the Building Controller to one or more expansion modules:

- Use 18 gauge, twisted pair, shielded cable with capacitance of no more than about 50 picofarads per foot for all network wiring. Belden cable model #82760 meets KMC requirements.

- The total wire length from the Building Controller to the CAN-A168EIO should be **no more than 200 feet**. If there is a daisy chain of multiple modules, the total, combined wire length to the farthest CAN-A168EIO from the Building Controller should be no more than 200 feet.

- Connect the – terminal in parallel with all other – terminals, and connect the + terminal in parallel with all other + terminals.

- Connect the shields of the cable together at each module using the *S* terminal. **Connect the shield to an earth ground at one end only.**

The devices on the physical **ends** of the I/O bus network must have **end-of-line termination jumpers** installed/on (default) for proper network operation. (See *Illustration 11 on page 11*.) If one expansion module is installed, it and the Building Controller must both have the jumper installed. If multiple expansion modules are installed, the devices **not** on the ends must have the jumper removed/off (reinsert the jumper on one pin only for possible future use).

NOTE: The Building Controller does not need to be on an end.
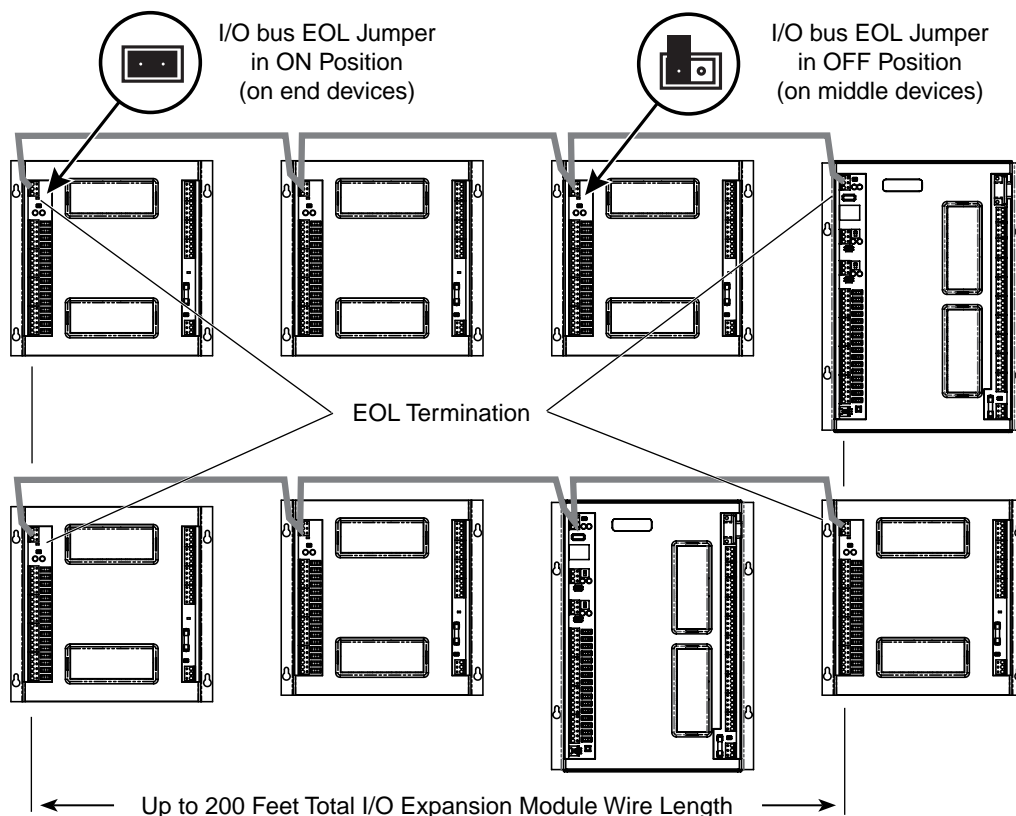
Illustration 11—End-Of-Line Termination and Maximum Wire Length

Addresses

The expansion modules must each be addressed to identify the inputs and outputs. Under the lower cover are four DIP switches used for addressing. See *Illustration 12 on page 12* and *Illustration 10 on page 9*.

Inputs and Outputs Addresses			
Module	Inputs	Outputs	Address
B-BC	1–16	1–16	0
EIO_1	17–32	17–24	1
EIO_2	33–48	25–32	2
EIO_3	49–64	33–40	3
EIO_4	65–80	41–48	4
EIO_5	81–96	49–56	5
EIO_6	97–112	57–64	6
EIO_7	113–128	65–72	7

ON/UP ■ ■ OFF/DOWN		Address 1	ON ■ ■ ■ ■ 1 2 3 4
Address 2	ON ■ ■ ■ ■ 1 2 3 4	Address 3	ON ■ ■ ■ ■ 1 2 3 4
Address 4	ON ■ ■ ■ ■ 1 2 3 4	Address 5	ON ■ ■ ■ ■ 1 2 3 4
Address 6	ON ■ ■ ■ ■ 1 2 3 4	Address 7	ON ■ ■ ■ ■ 1 2 3 4

Illustration 12—Expansion Module Address Switch Positions

NOTE: Input and output numbers must correspond with the appropriate module number set by the address switches.

NOTE: Switch 4 is always down, and at least one switch of 1 through 3 must be up.

NOTE: If the EIO modules are not addressed in consecutive order, gaps will exist between the input and output objects. For example, B-BC, EIO_1, and EIO_3 (only) would have Inputs 1–32, 49–64 and Outputs 1–24, 33–40. B-BC and EIO_2 (only) would have Inputs 1–16, 33–48 and Outputs 1–16, 25–32.

Connecting USB and UPS Ports (Future Upgrades)

The USB 2.0 port and the UPS port are currently unused but included for future enhancements. See *Illustration 1 on page 2*.

Connecting Power

The Building Controller requires an external, 24 volt, AC power source. See *Illustration 13 on page 13*. Use the following guidelines when choosing and wiring transformers. Use a KMC Controls Class-2 transformer of the appropriate size to supply power to the controllers. KMC Controls recommends powering only one controller from each transformer.

- When installing a controller in a system with other controllers, you may power multiple controllers with a single transformer as long as the total power drawn from the transformer does not exceed its rating and phasing is correct.

- If several controllers are mounted in the same cabinet, you can share a transformer between them provided the transformer *does not exceed* 100 VA or other regulatory requirements.

- Do not run 24 volt, AC power from within an enclosure to external controllers.

- (For future release reference, the transformer must be powered by the same UPS as is connected to the Building Controller's UPS communications port.)

Connect the 24 volt AC power supply to the power terminal block on the lower right side of the controller near the power jumper. **Connect the neutral lead from the transformer to the – terminal (middle terminal of the block) and the AC phase to the ~ (phase) terminal.** Power is applied to the controller when the transformer is plugged in and the power jumper is in place.

Connect an **earth** ground to the *E* terminal. This terminal grounds the USB and Ethernet connector shields, but it is not circuit/signal ground (–). It does **not** ground the input GND terminals, output GND terminals, or S terminals on the MS/TP connectors.

NOTE: If a CAN-A168EIO expansion module is being used, see the important notes on powering **both** in *Inputs, Outputs, and Power on page 10*.

Power Jumper

E Earth Ground

— Circuit/Signal Ground (Neutral/Common)

~ AC Phase (R)

Fuse
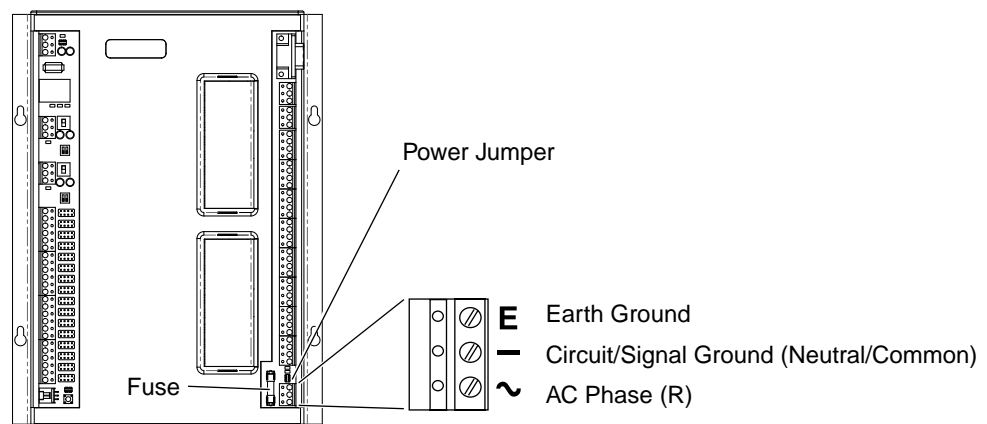
Illustration 13—Power Terminal and Jumper

⚠ CAUTION

Do not mistakenly connect 24 VAC to an analog output ground. This is not the same as a relay's switched common.

Additional Information
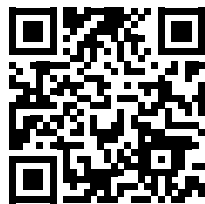
For **specifications and other information**, see the **BAC-A1616BAC Building Controller Data Sheet**.
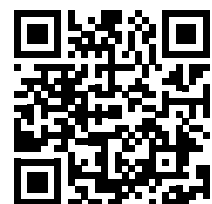
For **accessories and explanations of new features**, see the **BAC-A1616BC Applications Guide**.

The latest support files are always available on **https://partners.kmccontrols.com/**, the Partner site of the KMC Controls public web site (**www.kmccontrols.com**).

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