KMC CONTROLS

Installation and Operation Guide

CE

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KMD-5801 and KMD-5802 (8 x 8) Direct Digital Controllers

Important notices

Disclaimer

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SECTION 1

About the KMD-5801/5802

This section provides a general description of these controllers. It also introduces safety information. Review this material before installing or operating the controller.

The KMD-5801/5802 is a Tier 2, PLC-16, direct digital controller that features eight inputs and eight outputs. Use this versatile, general purpose controller in stand-alone environments or networked to other KMD series controllers to build a KMC peer-to-peer network. As part of a complete facilities management system, the controller provides precise monitoring and control of connected points. Controller features include:

◆ Connect to other KMC controllers through EIA-485 network
◆ Easy to install, simple to configure, and intuitive to program
◆ Controls room temperature, humidity, fans, lighting, and many other building automation functions
◆ NetSensor compatible

If using this controller in a smoke control system application, see Smoke Control Manual For KMDigital Systems (000-35-09). Note that inputs and outputs of this controller are not supervised in (non-dedicated) smoke control applications.

Specifications

Inputs	8
Key features	Universal inputs programmable for analog or binary input signals
	Standard and custom units of measure
	NetSensor compatible
	Overvoltage input protection
Pull-up resistors	Switch select none or 10K ohms
Connector	Removable screw terminal blocks, wire size 14–22 AWG
Conversion	10-bit analog-to-digital
Pulse counting	Up to 16 Hz
Analog input range	0–5 volts DC (4–20 milliamperes DC with external resistor)
Digital input range	0 or 5 volts DC and pulse counting
NetSensor	Compatible with KMD-1160/1180 series NetSensors

Outputs	8
Key features	Universal outputs, software programmable for analog or digital signals
	Standard and custom units of measure
	Output short protection
	Slots for HPO-6700 series output override boards
Connector	Removable screw terminal blocks, wire size 14–22 AWG
Conversion	8-bit digital-to-analog
Analog output range	0–10 volts DC
Digital output range	0–12 volts DC
Output current	100 mA per output maximum; 350 mA total

Programmable features	
Control Basic programs	5 user-definable program areas
Networked points in	124
Networked points out	63
PID control loops	8 control loops
Program variables	64, software selectable as analog or digital with standard and custom units of measure
Time keeping	Real-time clock with power backup (KMD-5801 only)
	Programmable for automatic daylight saving time by date, day of month, and time of day
Tables	3 user defined

Logging	
Trend logs	8 trend logs each supporting up to 4 analog, digital, or virtual elements or points
	Trend logs displayed as text or graphics
Runtime logs	8 runtime logs with time and date stamp and cumulative runtime

Custom graphics	4 system groups, each of which can manage 32 points with animated and color graphics.
	Requires WinControl XL Plus to view and edit graphics

Schedules	
Weekly schedules	4 each with 2 override days
Annual schedules	2

Security	
Operator access levels	6
Operators	27 with passwords

|	
Alarms	Alarm buffering up to 10 alarms On-board 68-character alarm or maintenance text messages
Power loss	Auto restart on power failure Programs and program parameters are stored in non-volatile memory
Communications	
NetSensor	Compatible with models KMD-1160/1180 series NetSensors via modular jack that supplies 5 volts DC @ 25 mA, typical
EIA-485	Supports up to 124 Tier 2 controllers at rates up to 38,400 baud Removable screw terminal block connector, wire size 14–22 AWG Network connections are supervised in smoke control applications
Regulatory	FCC Class B, Part 15, Subpart B CE compliant UL 916 Energy Management Equipment UL864 Smoke Control Equipment listed (for smoke control applications, see Smoke Control Manual for KMDigital Systems, P/N 000-035-09)
Environmental limits	
Operating	32 to 120° F (0 to 49° C)
Shipping	–40 to 140° F (–40 to 60° C)
Humidity	0 to 95% relative humidity (non-condensing)
Installation	
Supply voltage	24 volts AC (–15%, +20%), 60 Hz, 36 VA, Class 2 only, non-supervised (all circuits including supply voltage are power limited circuits)
Weight	14 ounces (395 grams)
Case material	Black flame-retardant plastic
Models	
KMD-5801	Tier 2 controller with real-time clock
KMD-5802	Tier 2 controller without real-time clock

Dimensions
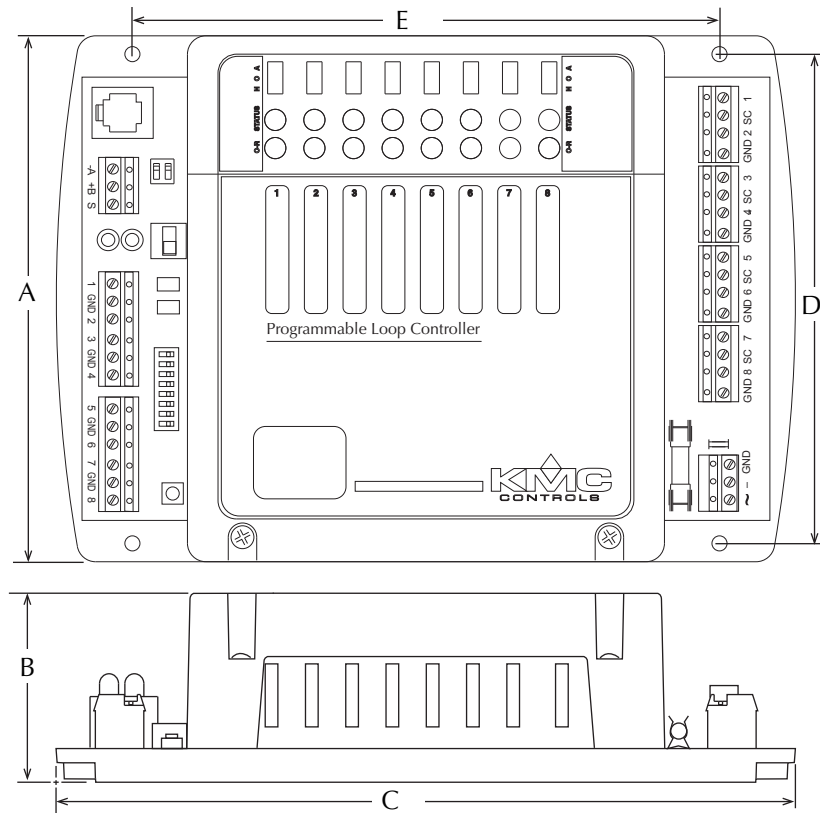
Table 1-1 KMD-5801 dimensions

A	B	C	D	E
5.38 in.	1.98 in.	7.55 in.	5.00 in.	6.00 in.
137 mm	50 mm	192 mm	127 mm	152 mm

Accessories   **Output override cards**   For more details, see the HPO-6700 Series data sheet (P/N 902-035-10); only the HPO-6701 and HPO-6704 are approved for smoke control applications

HPO-6701*   Triac output with zero-cross switching
HPO-6702   0–10 VDC analog with override potentiometer
HPO-6703   Relay, normally open contacts
HPO-6704*   4–20 mA current loop with override potentiometer
HPO-6705   Relay, normally closed contacts

Connectors and fuses

902-602-04	Replacement three-pin removable terminal block
031-602-02	Replacement four-pin removable terminal block
883-602-17	Replacement six-pin removable terminal block
902-600-04	Replacement fuse, 1.0 A, fast acting, 5 x 20 mm
HPO-0054	Replacement isolation bulb
HPO-0063	Replacement two-pin jumper

Power transformer

XEE-6111-40	Transformer, 120-to-24 VAC, 40 VA, single-hub
XEE-6112-40	Transformer, 120-to-24 VAC, 40 VA, dual-hub
XEE-6112-100	Transformer, 120-to-24 VAC, 96 VA, dual-hub (the XEE-6112-100 must be used in smoke control applications)

Surge suppressors

HPO-0070	Twelve-output transient suppressor board
HPO-0071	Eight-input transient suppressor board
KMD-5567	EIA-485 surge suppressor

Enclosures

HCO-1102	Controller Enclosure 10.1 x 2.4 x 7.1 inches (257 x 62 x 181 mm)
HCO-1034	Energy Management Equipment Enclosure 16 x 18 x 6 inches (406 x 457 x 152 mm)
HCO-1035	Energy Management Equipment Enclosure 20 x 24 x 6 inches (508 x 610 x 152 mm)
HCO-1036	Energy Management Equipment Enclosure 24 x 36 x 6 inches (610 x 914 x 152 mm)

Note

For smoke control applications, the controller must be mounted in a UL Listed FSCS enclosure or listed enclosure with minimum dimensions. A KMD-5567 is also required for the EIA-485 terminals of every controller and repeater. HPO-0070/0071s are also required on the controller inputs and outputs. See Smoke Control Manual for KMDigital Systems (000-035-09) for smoke control application information.

Safety considerations

KMC Controls assumes the responsibility for providing you a safe product and safety guidelines during its use. Safety means protection to all individuals who install, operate, and service the equipment as well as protection of the equipment itself. To promote safety, we use hazard alert labeling in this manual. Follow the associated guidelines to avoid hazards.

⚠ Danger

Danger represents the most severe hazard alert. Bodily harm or death will occur if danger guidelines are not followed.

Warning

Warning represents hazards that could result in severe injury or death.

Caution

Caution indicates potential personal injury or equipment or property damage if instructions are not followed.

Note

Notes provide additional information that is important.
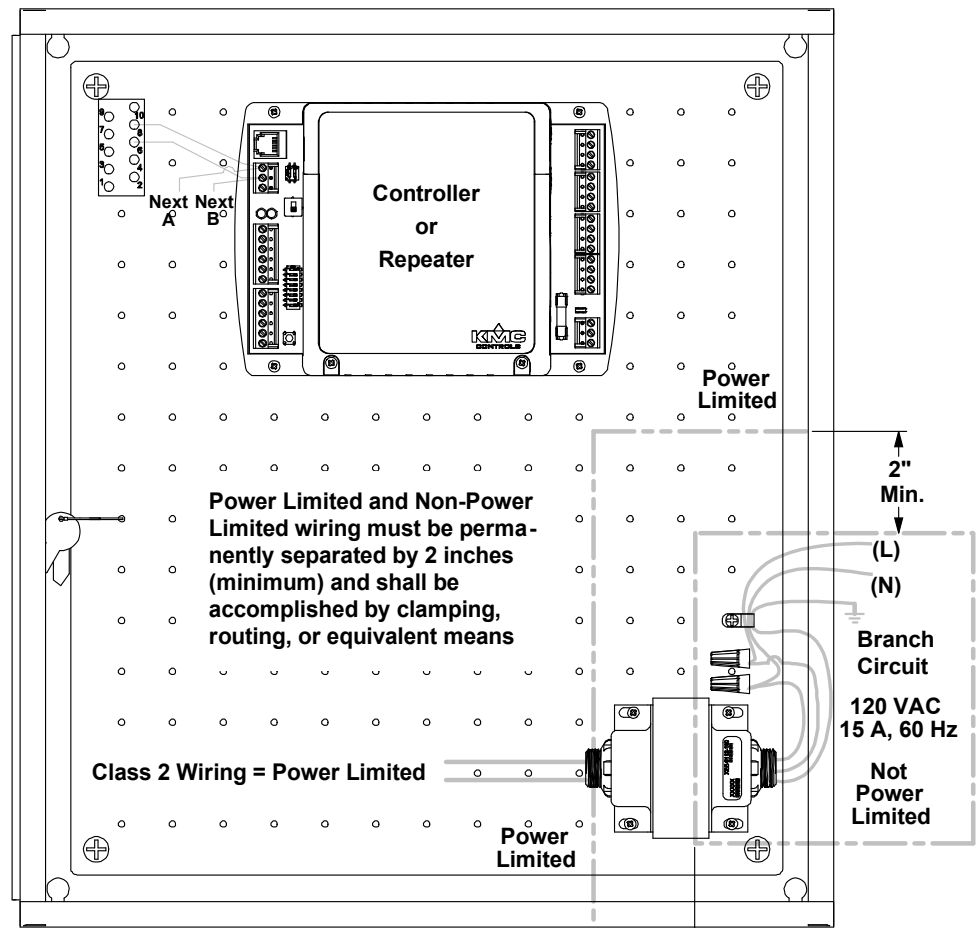
SECTION 2

Installing the controller

This section provides important instructions and guidelines for installing the KMD-5801/5802 controller. Carefully review this information before installation.

Mounting

Mount the controller inside of a metal enclosure. For **HVAC** applications, KMC Controls recommends using a UL Listed Enclosed Energy Management Equipment Panel such as a KMC model HCO-1034, HCO-1035 or HCO-1036. The HCO-1102 enclosure will hold one BAC-5801/5802.

Next A **Next B**

Controller or Repeater

Power Limited

2" Min.

(L)
(N)

Power Limited and Non-Power Limited wiring must be permanently separated by 2 inches (minimum) and shall be accomplished by clamping, routing, or equivalent means

Branch Circuit

120 VAC 15 A, 60 Hz

Class 2 Wiring = Power Limited

Not Power Limited

Power Limited

Provide 15 Amp Branch Circuit:
120 VAC, 60 Hz, 60° C, Cu Wire 14 AWG
Panel Disconnect Provided by Installer
Follow all local regulations and wiring codes when installing these products

2" Min.

Class 1 Wiring = Not Power Limited

Illustration 2-1 Enclosure mounting and wiring

For **smoke control** applications, the controller must be mounted in a UL Listed Firefighter's Smoke Control Station enclosure or listed enclosure with minimum dimensions. The minimum enclosure size is 16 x 18 x 6 inches. See *Illustration 2-1 on page 9* and Smoke Control Manual For KMDigital Systems (P/N 000-035-09).

Use the four mounting holes on the top and bottom of the controller to fasten it securely to a flat surface with #6 or #8 hardware. Refer to *Dimensions on page 6* for mounting hole locations and dimensions. To maintain RF emission specifications, use either shielded connecting cables or enclose all cables in conduit.

Wiring and terminal blocks

Terminal blocks are removable for wiring convenience. Wire sizes 14–22 AWG can be clamped into each terminal. No more than two (16 AWG) wires can be joined at a common point.

Connecting inputs

The KMD-5801/5802 controller has eight universal inputs. Each input can be configured to receive either analog or digital signals. Inputs of this controller are *not* supervised in smoke control applications.

For smoke control applications, an HPO-0071 Transient Suppressor Board must be used with all inputs. See the HPO-0070/0071 installation guide (717-019-11) for installation details.

By using the optional pull-up resistors, either passive or active devices may be connected to the inputs.

Pull-up resistors

For passive input signals, such as thermistors or switch contacts, use a pull-up resistor. For KMC thermistors and most other applications set the switch to the

On position. For active voltage devices, set the switch to the *Off* (left) position. See [Illustration 2-2](#) and [Illustration 2-3](#).
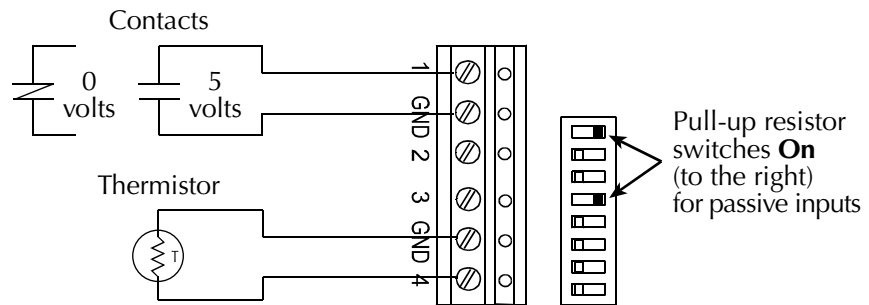

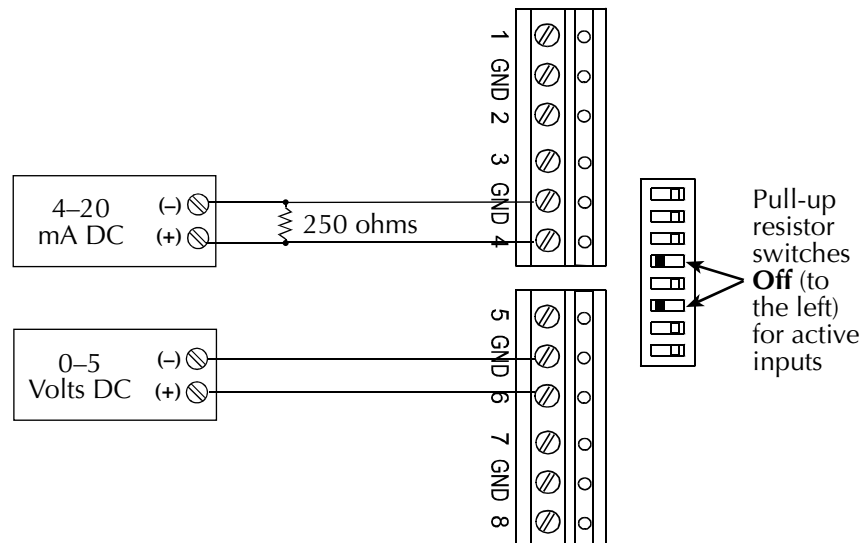***Illustration 2-2 Pull-up resistors On with passive devices***

Illustration 2-3 Pull-up resistors Off with active devices

4–20 mA inputs

To use a 4–20 current loop input, connect a 250 ohm resistor from an input to ground. See [Illustration 2-3](#). The resistor will convert the current input to a voltage which can be read by the controller analog-to-digital converter. Set the pull-up switch to the *Off* position.

Ground terminals

Input ground terminals are located next to the input terminals.

Pulse inputs

Connect pulse inputs by the relevant means:
- If the pulse input is a passive input such as switch contacts, then place the input pull-up switch in the *On* position.
- If the pulse is an active voltage (up to a maximum of +5 volts DC), then place the input pull-up switch in the *Off* position.

For a **smoke control** Style "A" (Class B), contact only, initiating circuit (non-supervised): 5 VDC nominal circuit voltage, 0.5 mA maximum short-circuit current, 5K ohms maximum line impedance.

Connecting outputs

All eight controller outputs are universal. Use WinControl to program the outputs to produce either analog or binary signals. (Outputs of this controller are *not* supervised in smoke control applications.) For loads that exceed the output specifications of the controller, including loads that require AC, use an output override card (see *Override boards (HPO-6700 series)* on page 13).

For smoke control applications, an HPO-0070 Transient Suppressor Board must be used with all outputs. See the HPO-0070/0071 installation guide (717-019-11) for installation details.
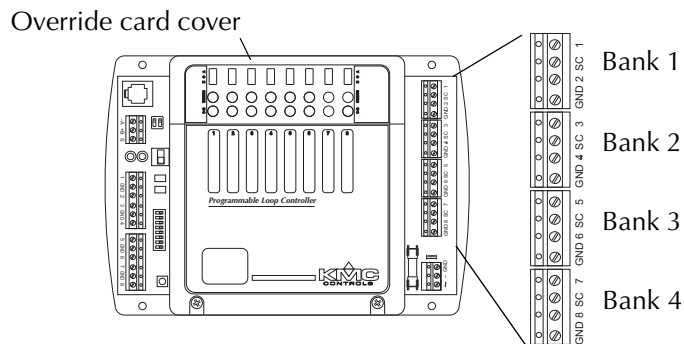

Override card cover

Bank 1

Bank 2

Bank 3

Bank 4

Illustration 2-4 Output terminals

Universal outputs

Connect the device under control between the output terminal and one of the ground (G) terminals on the same bank. The universal KMC KMDnet controller outputs can be configured two different ways with WinControl or TotalControl:
- Analog signals 0-10 volts DC
- Digital output 0 or 12 volts DC

For either type of output, the DC voltage signals can—within the specification of the output—connect directly to most equipment.
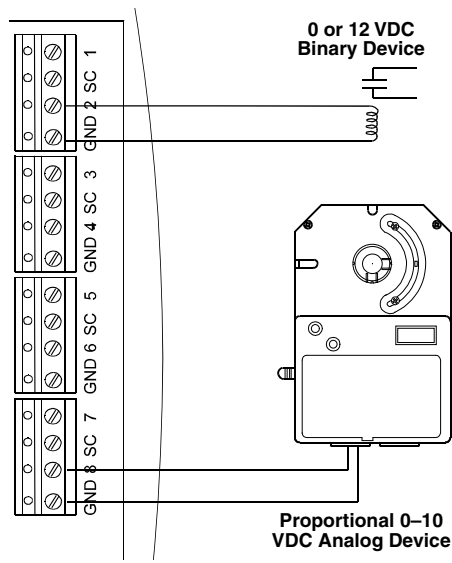
Illustration 2-5 Typical digital (binary) and analog output devices

Override boards (HPO-6700 series)

For enhanced output options, such as manual control or using large relays or devices that cannot be powered directly from a standard output, install output override boards (also called "cards"). The following output boards are available from KMC Controls (but only the HPO-6701 and HPO-6704 are approved for smoke control applications).

Table 2-1 Output override boards

Model number	Output type
HPO-6701*	**Triac (AC only):** zero-cross switching, optical isolation, 12 VAC min. and 30 VAC max. voltage, 20 mA min. current and max. current = 1A for 1 board (0.8 A max. for 2 boards, 0.6 A max. for 3–4 boards, and 0.5 A max. for 5–8 boards)
HPO-6702	**0–10 VDC analog:** short protection, 100 mA max., adjustable override potentiometer
HPO-6704**	**4–20 mA** (@ 10 VDC) **current loop:** short protection, 100 ohm min. and 500 ohm max., adjustable override potentiometer (since the HPO-6704 supplies the power, it will not work with a 4–20 mA device that also supplies its own power)
HPO-6703*	**Normally open relay:** 30 VAC/VDC, 2 A max., power factor 0.4
HPO-6705*	**Normally closed relay:** 30 VAC/VDC, 2 A max., power factor 0.4

☞ **Note**

*With the HPO-6701 triac and HPO-6703/6705 relays, use only the Switched Common instead of Ground.

☞ **Note**

> **The HPO-6704 4–20 mA board supplies the power and will not work with a 4–20 mA device that also supplies its own power.

Install the output override cards in the area under the plastic cover at the top of the controller.

❗ **Caution**

> Connecting 24 volts AC or other signals that exceed the operation specifications of the controller before the supply power to the controller is removed will damage the controller. Remove the supply power and install the override board before connecting AC or other voltage to output terminals of the controller.
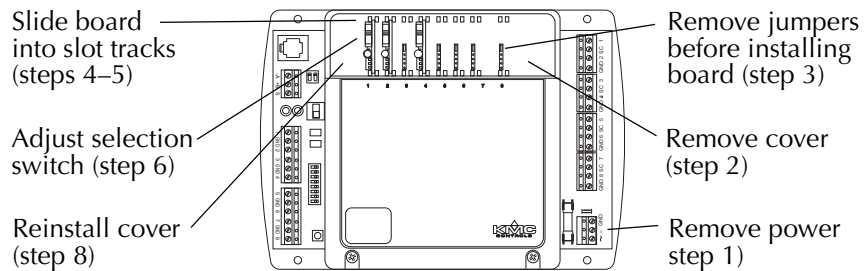

Slide board into slot tracks (steps 4–5)

Adjust selection switch (step 6)

Reinstall cover (step 8)

Remove jumpers before installing board (step 3)

Remove cover (step 2)

Remove power step 1)

Illustration 2-6 Output override boards

Installing override boards

Review the installation guide supplied with the override boards for complete operating and wiring instructions. To install an Override Board:
  1. Disconnect the power.
  2. Remove the override board cover by squeezing on both sides of the cover and lifting off.
  3. Remove the jumper from the mounting header.
  4. Position the board above the relevant slot with the Hand-Off-Auto selection switch positioned toward the top.
  5. Slide it down the integral board tracks onto the header pins.
  6. If required, set the selection switch on the override board to the appropriate position. A (Automatic) is the upper position of the switch, O (Off) is the middle position, and H ("Hand" or On) is on the lower position.
  7. Repeat steps 3 through 6 for all desired boards.
  8. Reinstall the cover over the boards.
  9. Connect output devices to the controller.
  10. Reconnect the power.

Grounds and switched commons

! **Caution**

Connecting 24 volts to an analog ground will result in improper operation and may result in equipment damage. **Use the appropriate Switched Common terminals instead of Ground with the HPO-6701 triac and HPO-6703/6705 relays.**

Switched Common (SC) output terminals are unconnected in the controller unless an appropriate override output board is installed. Use only the Switched Common instead of Ground (GND) with the HPO-6701 triac and HPO-6703/6705 relays. The Switched Common terminals are isolated from the circuit grounds used for the universal output analog circuitry in the controller.

Use the *SC* terminal in the same output bank as the output terminal. See for bank locations. See also for wiring details (but only the HPO-6701 and HPO-6704 are approved for smoke control applications).
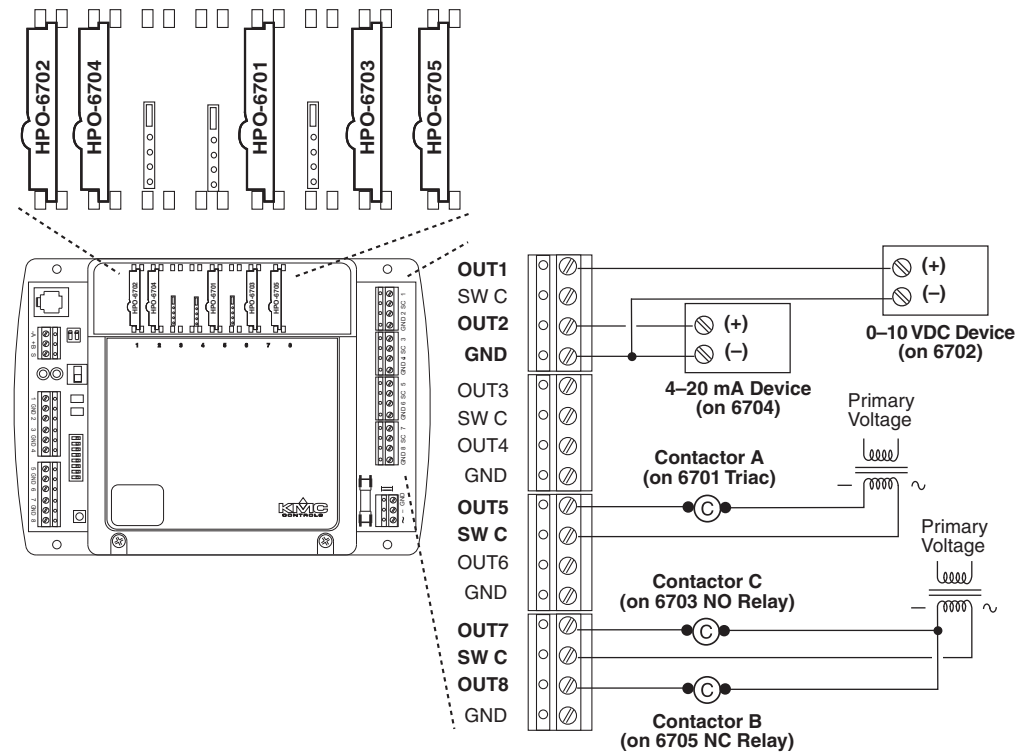

Illustration 2-7 Output override board options and connections

Connecting to a NetSensor

The modular connector provides a connection port to a KMD-1160/1180 series NetSensor. Link the controller to a NetSensor with a KMC Controls approved cable up to 75 feet long. See the installation guide supplied with the NetSensor for complete NetSensor installation instructions. (NetSensors are not part of smoke control applications.)
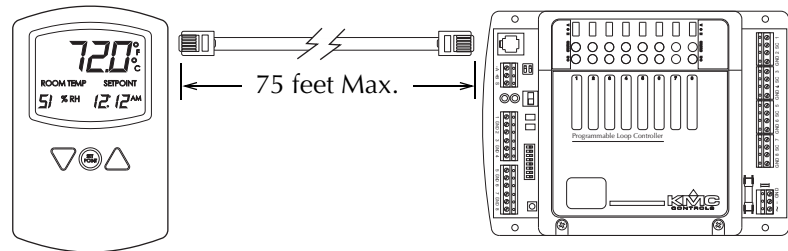

Illustration 2-8 Connection to a NetSensor

Connecting to a Tier 2 network

Network wiring

For **HVAC** applications, use the following general principles when connecting a controller to a Tier 2 (sub LAN) network:

- Connect no more than 124 KMDigital addressable controllers or devices to one Tier 2 network. (For smoke control applications, limit the network size to 60 controllers.)
- Use 18 gauge, twisted pair, shielded cable with capacitance of no more than 50 picofarads per foot for all network wiring. Belden cable model #82760 meets the cable requirements.
- Connect the *–A* terminals in parallel with all other *–A* terminals and the *+B* terminals in parallel with all other *+B* terminals. See <u>Illustration 2-9   on page 17</u>.
- To maintain communications in case of an open conductor on the network cable (especially recommended in smoke control applications), redundant wiring routed separately enhances reliability.
- Connect the shields of the cable together at each device. Connect the shield to a good earth ground at one end only. For (newer model) KMDigital controllers use the *S* terminal. If the controller has a *G* terminal in the place of the *S*, do not connect the shields to the *G* terminal—use a wire nut or other means to connect the shields together instead. See <u>Illustration 2-10 on page 18</u>.
- Use a KMC KMD-5575 repeater **after every 31** Tier 2 devices (controllers or KMC KMD-5540 series CommTalk) or if the cable length exceeds 4,000 feet (1,220 meters). Generally, use no more than **four** repeaters per Tier 2 network. (For smoke control applications, the maximum **total** length of the network cable, including all repeaters, is 4,000 feet.) Do not connect the cable shield to the circuit GND terminal on the KMD-5575. For each

network segment, connect the shields to a good earth ground at only one end of the segment; tape back the shield ground at the other end.

◆ Place a KMC KMD-5567 surge suppressor in the cable where it exits a building.

For **smoke control** applications, the maximum total length of the network cable, including all repeaters, is 4,000 feet. The communications network is supervised in smoke control applications, and the ground fault impedance value for the circuit is 0 ohms. The KMC KMD-5575 repeater must also be powered by an approved XEE-6112-100 (96 VA) transformer in smoke control applications. A KMD-5567 surge suppressor is also required for the EIA-485 terminals of every controller and repeater. For specific information on smoke control systems, see Smoke Control Manual For KMDigital Systems (000-35-09).
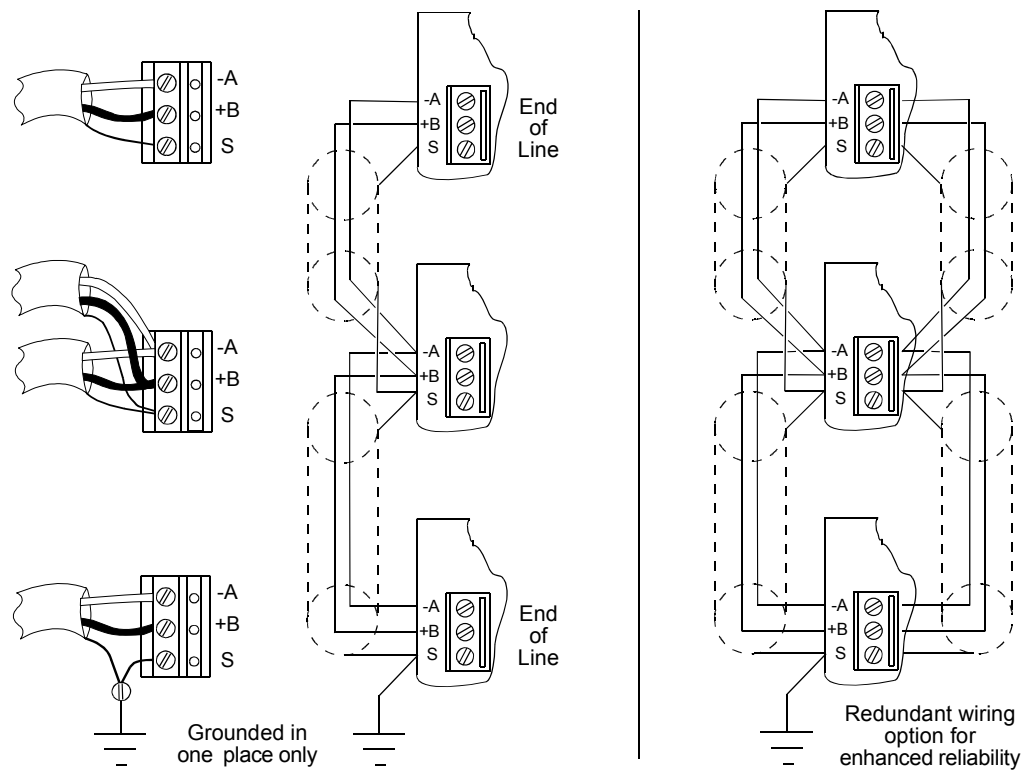

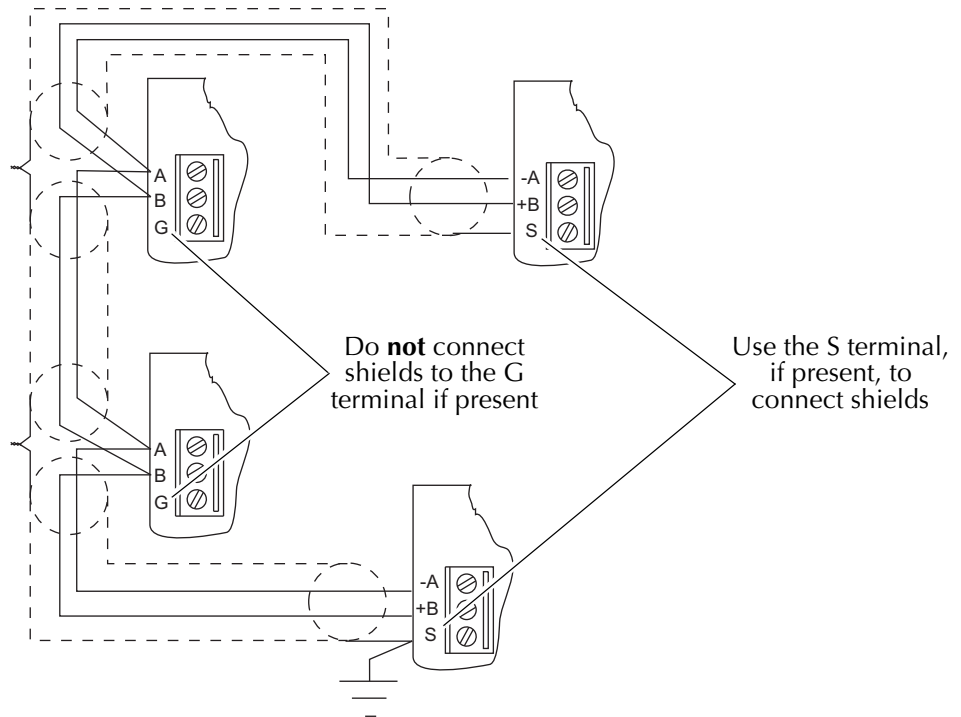*Illustration 2-9 EIA-485 network wiring (standard and redundant options)*

Do **not** connect
shields to the G
terminal if present

Use the S terminal,
if present, to
connect shields

Illustration 2-10 Network terminals G vs. S

End-of-line (EOL) 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. See
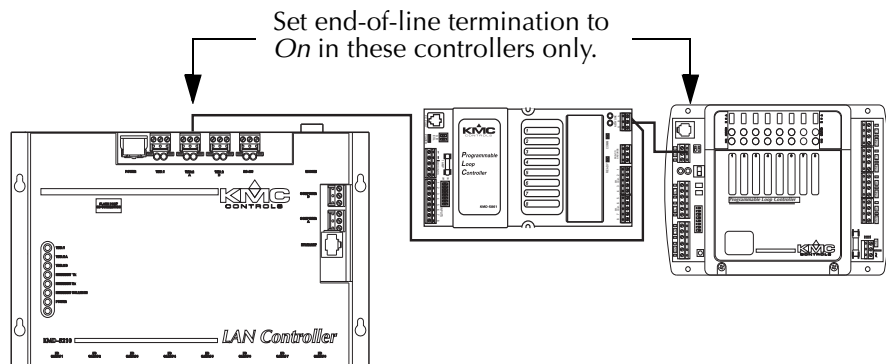*Illustration 2-11*. Set the end-of-line termination to *On* using the EOL switches.

Set end-of-line termination to
On in these controllers only.

Illustration 2-11 End of line termination

Illustration 2-12 shows the position of the EOL switches in the KMD-5801/5802 controller.
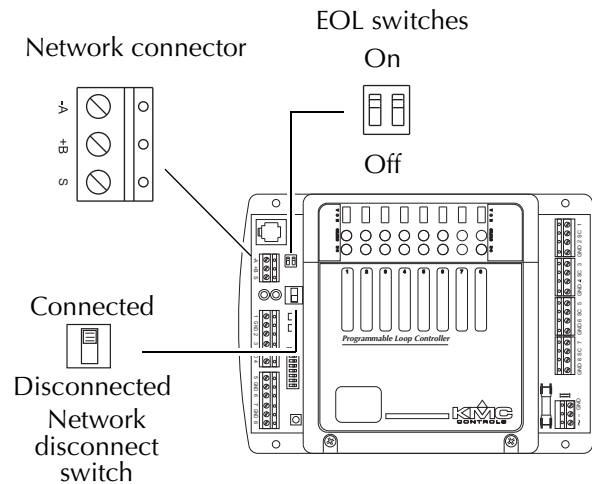

Illustration 2-12 Location of EOL switch

Connecting power

The KMD-5801/5802 requires an external, 24 volt, AC power source. 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. (Only transformer model XEE-6112-100 is approved for smoke control applications.)
◆ All circuits, including supply voltage, are power limited circuits.
◆ AC power is non-supervised in smoke control applications.
◆ 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.

Connect the 24 volt AC power supply to the power terminal block on the lower right side of the controller near the power jumper. (See _Illustration 2-13 on page 20_.) Connect the ground side of the transformer to the **–** or GND terminal 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. See also _Illustration 2-1 on page 9_.
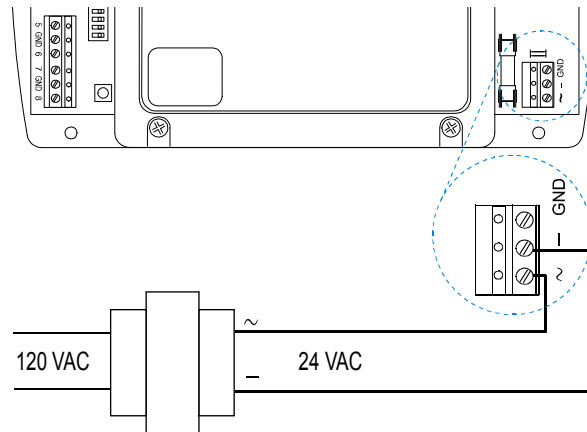
Illustration 2-13 Power terminal

Configuration and programming

Before connecting a controller to a network, use Hardware Configuration Manager (HCM) to set the following:

- ◆ Controller number
- ◆ Last panel status
- ◆ Network baud

Use WinControl or TotalControl to setup and program the controller. See the software documentation for details about configuring and programming the controller.

SECTION 3

Operating the controller

This section provides a brief overview of KMD-5801/5802 operation. Review this material before you attempt to install the controller.

Normal operation

Once configured, programmed, and powered up, the controller requires very little user intervention.

Controls and indicators

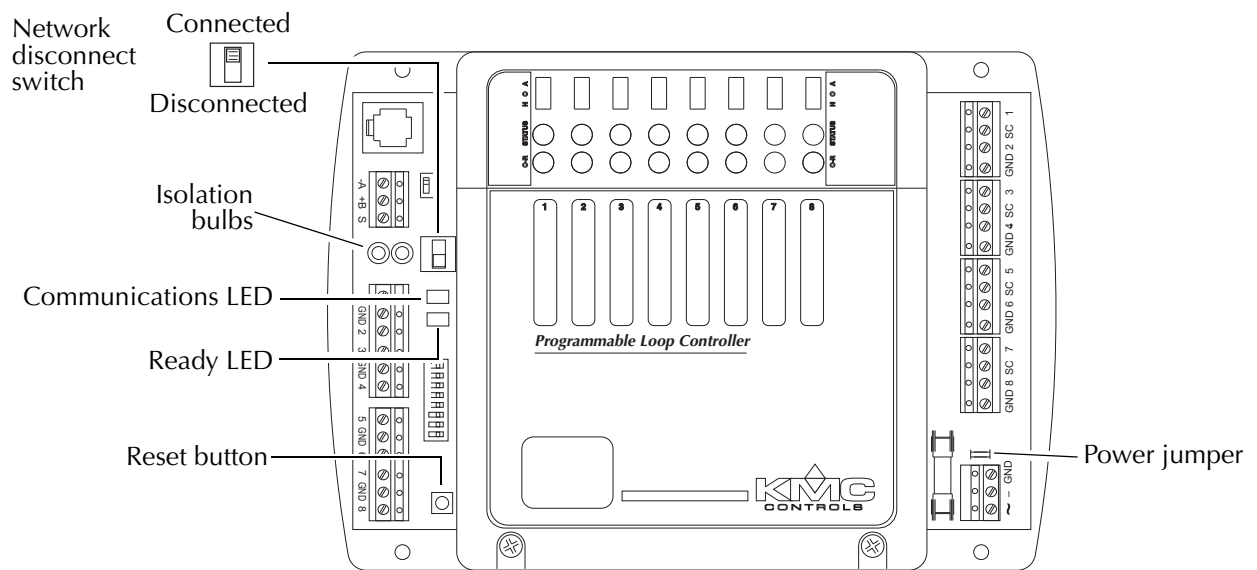The following sections describe the controls and indicators found on the controller.

Illustration 3-1 Controls and indicators

Network disconnect switch

The network disconnect switch is located on the left side of the controller. Use this switch to enable or disable the Tier 2 network connection. When the switch is *On* the controller can communicate on the network; when it is *Off*, the controller is isolated from the network.

Alternately, you may remove the isolation bulbs to isolate the controller from the network.

Status LEDs

The two status LEDs, located on the left side of the controller next to the network disconnect switch, indicate the following:

- The green **Ready** LED flashes approximately once per second when the controller is operating normally.
- The yellow **Communications** LED flickers (periodically) when the controller transmits on the EIA-485 network. If the controller becomes disconnected from a network with other controllers (such as by sliding the Network switch to the Off position), the LED will go out for approximately 15 to 20 seconds and then begin to flash rapidly until the network connection is restored.

If neither LED is illuminated, check the fuse, power, and connections to the controller.

Isolation lamps

Two isolation lamps are located near the network switch. These lamps serve these functions:

- **Removing** the lamps will open the Tier 2 network circuit and isolate the controller from the network.
- If **one, or both, lamps are lit**, it indicates the **network is improperly phased**. This means that the ground potential of the controller is not the same as other controllers on the network

Replacing the fuse

KMC controllers do not require routine maintenance. If a fuse blows, investigate the cause, and then replace the fuse. To replace the fuse:

1. Disconnect the supply power.
2. Carefully pull out the blown fuse from the fuse holder.
3. Carefully snap an identical (KMC P/N 902-600-04) 1 A, fast-acting, 5 x 20 mm fuse into the fuse holder.
4. Reconnect the supply power.

Viewing the firmware version

The controller's firmware is viewable through the software. To view the controller's firmware version in **WinControl**:

1. Start WinControl and select System List from under the Access menu.
2. Click the # of the appropriate network and enter the appropriate user name and password.
3. Select Network Status from under the Panel menu.
4. Select the appropriate controller from the Sub Network Status list.
5. Select About Current Panel from the Help menu, and that controller's firmware build version will be displayed near the top of the About Current Panel dialog box.

To view the controller's firmware version in **TotalControl**:

1. Log on to the site with Design Studio.
2. Expand the Network Manager list to reveal the device.
3. Point to the device.

4. TotalControl displays a Tool Tip with the model number and firmware build revision.

Resetting the controller

Cycling the power ("cold start")

If the controller appears to be operating incorrectly or is not responding to commands, you may need to reset the controller.

Cycling the power by momentarily removing the 24 volts AC to the controller or removing the power jumper performs a controller "cold start."

❗ **Caution**

Before cycling power to a controller, you may want to manually switch output override cards or temporarily remove output terminal blocks to avoid inadvertently putting an output device into an undesired state.

During a cold start, the controller's universal outputs are turned to *Logic Off* (0 volts DC unless configured as an inverted range). They remain in the *Logic Off* state until the Control Basic programs turn them back to *Logic On*.

If an output has been configured with an inverted range, *Logic Off* may result in an output of 12 volts DC.

During a cold start, any installed HPO-6700 series output override boards go to their default "off" states (unless configured with an inverted range). An HPO-6705 relay board, therefore, goes to its default Normally Closed state until the appropriate Control Basic command changes its state.

Restoring factory default settings

If cycling power to the controller does not clear up the problem, you may need to restore the controller to the factory default settings and then initialize and reprogram the controller.

❗ **Caution**

Resetting the controller will restore the factory default configuration. It will be necessary to initialize and reprogram the controller to establish normal communications and operation.

To restore the factory default configuration in the controller:
1. Locate the red reset button (see).
2. Locate and remove the power jumper from the current position.
3. Depress and **hold** the reset button.
4. Reinstall the power jumper. (Do **not** release the reset button.)
5. Continue to hold the reset button until the communications LED flashes rapidly.
6. Release the reset button.

This completes the reset sequence for the controller. Initialize and reprogram the controller as needed.