

## Excel 10 W7761A Remote Input/Output Device



### SYSTEM ENGINEERING

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# INTRODUCTION

## Description of Devices

The W7761A, Excel 10 Remote Input/Output device, provides auxiliary inputs and outputs for use with an Excel 10 Zone Manager and Excel 10 controllers over the Echelon® LonWorks® E-Bus. These I/O points are configured with the E-Vision tool. The W7761A device uses Echelon® LonWorks® communication technology and a new free topology twisted pair transceiver (FTT) for greater network installation flexibility. The Excel 10 RIO device can be combined with the Excel 10 Zone Manager (FTT), other Excel Controllers, and the Excel Building Supervisor, to provide a complete and low cost control solution for small to large commercial buildings.

The Q7750A Excel 10 Zone Manager is a communications interface that allows devices on the E-Bus network to communicate with devices on the standard EXCEL 5000® System C-Bus. Fig. 1 shows an overview of a typical system layout. The Q7750A also provides some control and monitoring functions.

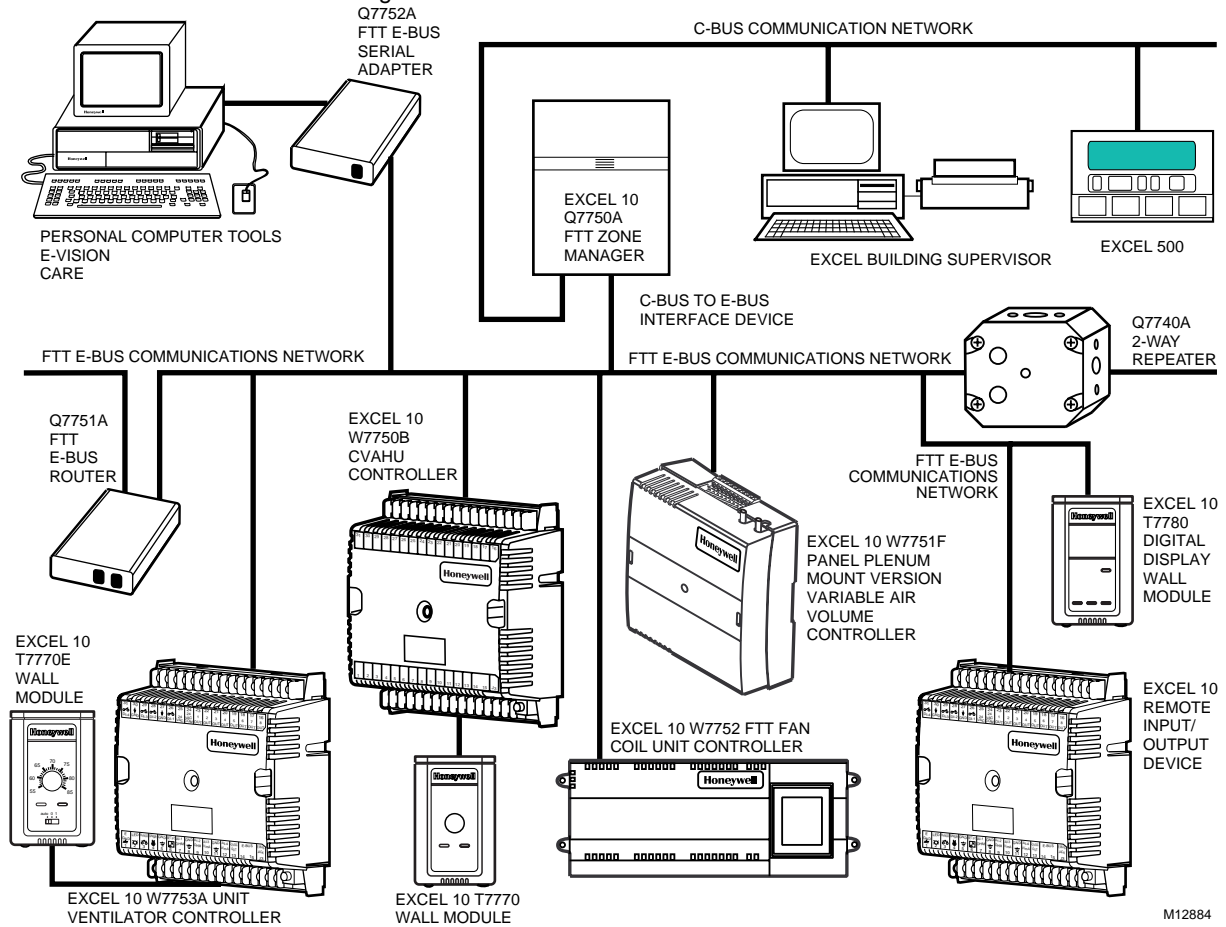


Fig. 1. Typical system overview.

## Control Application

The W7761A, Excel 10 Remote Input/Output device, provides auxiliary inputs and outputs for use with an Excel 10 Zone Manager and Excel 10 controllers over the Echelon® LonWorks® E-Bus. The W7761A Remote Input/Output Device can be connected to outdoor air temperature and humidity sensors that can be used by other Excel 10 controllers on the E-Bus or Excel 5000 controllers on the C-Bus through the Excel 10 Zone Manager. This would allow the controllers to use their physical inputs for monitoring other elements such as return humidity, IAQ, etc. to achieve better control. The W7761A can be used to average many space temperature sensors that are located in a zone that is controlled by the W7750 Constant Volume AHU Controller. The W7761A device has 8 Digital Outputs which may be Discrete, Modulating or Floating. For example, this allows the control of lighting zones, miscellaneous exhaust or ventilation fans, miscellaneous pumps, and can enable freeze protection. See Fig. 2.

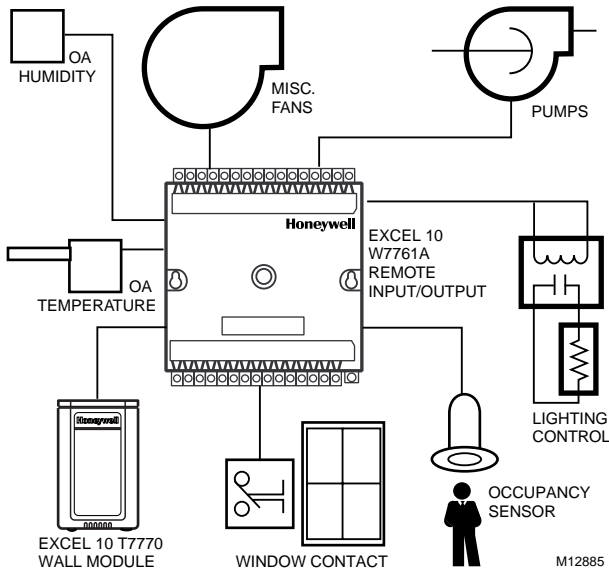


Fig. 2. Typical W7761A control application.

## Control Provided

The W7761A was not intended to control staged or modulating heating/cooling coils, mixed air economizer dampers, or system fan/heat pump units. The W7761A contains inputs and outputs, but no control software. All control that would be associated with the inputs and outputs in the W7761A would be accomplished through the Excel Zone Manager and would not be suitable for VAV control, temperature control, or any control function that would require less than a 30 second update rate.

## Products Covered

This System Engineering Guide describes how to apply the W7761A Excel 10 Remote Input/Output Device and related accessories to typical applications. The specific devices covered include:

- W7761A Remote I/O device.
- T7770 A through D Wall Modules.
- Q7750A Excel 10 Zone Manager.
- Q7751A Router (FTT to FTT only).
- Q7752A Serial Interface Adapter.
- Q7740A,B Repeaters (2-way and 4-way).
- 209541B FTT Termination Module.

## Organization of Manual

This manual is divided into three basic parts: the Introduction, the Application Steps, and the Appendices that provide supporting information. The Introduction and Application Steps 1 through 5 provide the information needed to make accurate material ordering decisions. Application Step 6 and the Appendices include configuration engineering that can be started using Excel E-Vision PC Software after the devices and accessories are ordered. Application Step 7 is troubleshooting. The organization of the manual assumes a project is being engineered from start to finish. If an operator is adding to, or is changing an existing system, the Table of Contents can provide the relevant information.

## Applicable Literature

The following list of documents contains information related to the Excel 10 W7761 Remote I/O Device and the EXCEL 5000® System in general.

Form No.	Title
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74-2698	Excel 10 W7761A Device Specification Data
74-2956	Excel 10 W7750A,B Controller Specification Data
74-2697	T7770A through G Wall Module Specification Data
74-2955	T7780 Digital Display Wall Module Specification Data
74-2950	Excel 10 Q7750A, Zone Manager Specification Data
74-2952	Excel 10 Q7751A Router Specification Data
74-2954	Excel 10 Q7752A Serial Interface Specification Data
74-2858	Excel 10 Q7740A,B FTT Repeaters Specification Data
95-7539	Excel 10 W7761A Device Installation Instructions
95-7521	Excel 10 W7750A,B Controller Installation Instructions
95-7538	T7770 Wall Module Installation Instructions
95-7558	T7780 Digital Display Wall Module Installation Instructions
95-7509	Excel 10 Q7750A Zone Manager Installation Instructions
95-7510	Excel 10 Q7751A Router Installation Instructions
95-7511	Excel 10 Q7752A Serial Interface Installation Instructions
95-7516	Excel 10 SLTA Connector Cable Installation Instructions
95-7555	Excel 10 Q7740A,B FTT Repeaters Installation Instructions
95-7554	Excel 10 209541B FTT Termination Module Installation Instructions
74-2588	Excel E-Vision User's Guide
74-5587	CARE User's Manual
74-5577	CARE Icon Guide
74-2039	XBS User's Manual
74-5018	XBS Application Guide

## Product Names

The W7761A Remote I/O Device is available in one model:

- **W7761A** Remote Input/Output Device.

The T7770 Wall Module is available in five models:

- **T7770A1xxx** Wall Module with temperature sensor only - *not applicable to the RIO device* (jumper switches the sensor from 20Kohm NTC to a linearized version of a 20 Kohm NTC used with the W7751A,C,E,G).
- **T7770A2xxx** Wall Module with temperature sensor and E-Bus network connection.
- **T7770B** Wall Module with temperature sensor—(current feature that can be used with the RIO Device), setpoint, and E-Bus network connection for use with all Excel 5000 controllers (except W7751A,C,E,G).
- **T7770C** Wall Module with temperature sensor—(current feature that can be used with the RIO Device), setpoint, Bypass button and LED, and E-Bus network connection for use with all Excel 5000 controllers (except W7751A,C,E,G).
- **T7770D** Wall Module with temperature sensor—(current feature that can be used with the RIO Device), Bypass button and LED, and E-Bus network connection for use with all Excel 5000 controllers (except W7751A,C,E,G).

NOTE: The T7770B,C Models are available with a relative scale plate adjustable in E-Vision °F ( $\pm 5^{\circ}\text{C}$ ).

Only one PT3000 sensor is supported with the W7761A device.

The T7780 Digital Display Wall Module (DDWM) is available in one model:

- **T7780** DDWM displays and provides space temperature, setpoint, Occ/Unocc override, Application Mode, and Fan mode/speed selection for all Excel 10 controllers (except W7751 A,C,E,G).

Other products:

- **Q7750A** Excel 10 Zone Manager.
- **Q7751A** Bus Router.
- **Q7752A** Serial Adapter.
- **Q7740A,B** FTT Repeaters.
- **209541B** FTT Termination Module.
- **ML6161** Series 60 Damper Actuator.
- **M6410A** Series 60 Valve Actuator (use with V5812 or V5813 Valves).
- **ML684A** Series 60 Versadrive Valve Actuator (use with V5011 and V5013 Valves).
- **MMC325-010** Transducer, Series 60 to pneumatic 0 to 10 psi.
- **MMC325-020** Transducer, Series 60 to pneumatic 0 to 20 psi.
- **ML6464A** Direct Coupled Damper Actuator, 66 lb-in. torque, Series 60.
- **ML6474** Direct Coupled Damper Actuator, 132 lb-in. torque, Series 60.
- **ML6185A** Direct Coupled Damper Actuator, Spring Return, Series 60.
- **ML7984B** Direct Coupled Valve Actuator, PWM (use with V5011 or V5013F,G Valves).
- **EL7680A1008** Wall Module Infrared Occupancy Sensor.
- **EL7628A1007** Ceiling Mounted Infrared Occupancy Sensor.
- **EL7611A1003** Ultrasonic Occupancy Sensor.
- **EL7612A1001** Ultrasonic Occupancy Sensor.

Refer to Table 8 in Application Step 5. Order Equipment for a complete listing of all available part numbers.

NOTE: The Q7750A Zone Manager is referred to as (E-Link) in internal software and CARE.

## Agency Listings

Table 1 provides information on agency listings for Excel 10 products.

**Table 1. Agency Listings.**

Device	Agency	Comments
<b>W7761A Input/Output Device</b>	UL	Tested and listed under UL916 (file number E87741).
	cUL	Listed (E87741).
	CE	General Immunity per European Consortium Standards EN50081-1 (CISPR 22, Class B) and EN 50082-1:1992 (based on Residential, Commercial, and Light Industrial). EN 61000-4-2: IEC 1000-4-2 (IEC 801-2) Electromagnetic Discharge. EN 50140, EN 50204: IEC 1000-4-3 (IEC 801-3) Radiated Electromagnetic Field. EN 61000-4-4: IEC 1000-4-4 (IEC 801-4) Electrical Fast Transient (Burst).  Radiated Emissions and Conducted Emissions: EN 55022: 1987 Class B. CISPR-22: 1985.
	FCC	Complies with requirements in FCC Part 15 rules for a Class B Computing Device. Operation in a residential area can cause interference to radio or TV reception and require the operator to take steps necessary to correct the interference.
<b>T7770A through D Wall Modules</b>	UL	(Not applicable.)
	CSA	(Not applicable.)
	FCC	(Not applicable.)
<b>T7780 DDWM</b>	CE	Emissions; EN50081-1, En55022 (CISPR Class B), Immunity 50082-1
	UL &cUL	Tested and listed under UL916, S8L9 Energy Management Equipment.
	FCC	Complies with requirements in FCC Part 15 rules for a Class B Computing Device.
<b>Q7750A Excel 10 Zone Manager</b>	UL	Tested and listed under UL916, file number S4804 (QVAX, PAZY).
	CSA	Listing pending.
	FCC	Complies with requirements in FCC Part 15 rules for a Class A Computing Device. Operation in a residential area can cause interference to radio or TV reception and require the operator to take steps necessary to correct the interference.
<b>Q7751A,B Router, Q7752A Serial Adapter Q7740A,B FTT Repeaters</b>	UL	UL1784.
	CSA	Listed.
	FCC	Complies with requirements in FCC Part 15 rules for a Class B Computing Device.

## Abbreviations and Definitions

**AHU** - Air Handling Unit; the central fan system that includes the blower, heating equipment, cooling equipment, ventilation air equipment, and other related equipment.

**CO** - Carbon Monoxide. Occasionally used as a measure of indoor air quality.

**CO2** - Carbon Dioxide. Often used as a measure of indoor air quality.

**CARE** - Computer Aided Regulation Engineering; the PC based tool used to configure C-Bus and E-Bus devices.

**C-Bus** -Honeywell proprietary Control Bus for communications between EXCEL 5000® System controllers and components.

**CPU** - Central Processing Unit; an EXCEL 5000® System controller module.

**cUL** - Underwriters Laboratories Canada.

**CVAHU** -Constant Volume AHU; refers to a type of air handler with a single-speed fan that provides a constant amount of supply air to the space it serves.

- DDF** - Delta Degrees Fahrenheit.
- D/X** - Direct Expansion; refers to a type of mechanical cooling where refrigerant is (expanded) to its cold state, within a heat-exchanging coil that is mounted in the air stream supplied to the conditioned space.
- E-Bus** - Honeywell implementation of Echelon® LonWorks® network for communication among Excel 10 Controllers.
- E-Bus Segment** - An E-Bus section containing no more than 60 Excel 10s. Two segments can be joined together using a router.
- Echelon®** - The company that developed the LON® bus and the Neuron® chips used to communicate on the E-Bus.
- Economizer** - Refers to the mixed-air dampers that regulate the quantity of outdoor air that enters the building. In cool outdoor conditions, fresh air can be used to supplement the mechanical cooling equipment. Because this action saves energy, the dampers are often referred to as *economizer dampers*.
- EMI** - Electromagnetic Interference; electrical noise that can cause problems with communications signals.
- E-Link** - Refers to the Q7750A Zone Manager. This name is used in internal software and in CARE software.
- EMS** - Energy Management System; refers to the controllers and algorithms responsible for calculating optimum operational parameters for maximum energy savings in the building.
- EEPROM** - Electrically Erasable Programmable Read Only Memory; the variable storage area for saving user setpoint values and factory calibration information.
- EPROM** - Erasable Programmable Read Only Memory; the firmware that contains the control algorithms for the Excel 10 Controller.
- Excel 10 Zone Manager** - A controller that is used to interface between the C-Bus and the E-Bus. The Excel 10 Zone Manager also has the functionality of an Excel 100 Controller, but has no physical I/O points.  
NOTE: The Q7750A Zone Manager can be referred to as E-Link in the internal software, CARE.
- FCU** - Fan Coil Unit.
- Firmware** - Software stored in a nonvolatile memory medium such as an EPROM.
- Floating Control** - Refers to Series 60 Modulating Control of a valve or damper. Floating Control utilizes one digital output to pulse the actuator open, and another digital output to pulse it closed.
- FTT** - Free Topology Transceiver.
- IAQ** - Indoor Air Quality. Refers to the quality of the air in the conditioned space, as it relates to occupant health and comfort.
- I/O** - Input/Output; the physical sensors and actuators connected to a controller.
- I x R** - I times R or current times resistance; refers to Ohm's Law:  $V = I \times R$ .
- K** - Degrees Kelvin.
- Level IV** - Refers to a classification of digital communication wire. Formerly known as UL Level IV, but *not* equivalent to Category IV cable. If there is any question about wire compatibility, use Honeywell-approved cables (see Step 5 Order Equipment section).
- NEC** - National Electrical Code; the body of standards for safe field-wiring practices.
- NEMA** - National Electrical Manufacturers Association; the standards developed by an organization of companies for safe field wiring practices.
- Node** - A Communications Connection on a network; an Excel 10 Controller is one node on the E-Bus network.
- NV** - Network Variable; an Excel 10 parameter that can be viewed or modified over the E-Bus network.
- PC** - An IBM compatible Personal Computer with 386 or higher processor and capable of running Microsoft® Windows™ Version 3.1.
- Pot** - Potentiometer. A variable resistance electronic component located on the T7770B,C Wall Module; used to allow user-adjusted setpoints to be input into the Excel 10 Controller.

**PWM** - Pulse Width Modulated output; allows analog modulating control of equipment using a digital output on the controller.

**RTD** - Resistance Temperature Detector; refers to a type of temperature sensor whose resistance output changes according to the temperature change of the sensing element.

**RIO** - Remote Input/Output Device. Provides auxiliary inputs and outputs for use with an Excel 10 Zone Manager and Excel 10 controllers.

**Subnet** - An E-Bus segment that is separated by a router from its Q7750A Zone Manager.

**TOD** - Time-Of-Day; the scheduling of Occupied and Unoccupied times of operation.

**TPT** - Twisted Pair Transceiver.

**UV** - Unit Ventilator Controller.

**VA** - Volt Amperes; a measure of electrical power output or consumption as applies to an ac device.

**Vac** - Voltage alternating current; ac voltage rather than dc voltage.

**VAV** - Variable Air Volume; Refers to either a type of air distribution system, or to the W7751 Excel 10 VAV Box Controller that controls a single zone in a variable air volume delivery system.

**VOC** - Volatile Organic Compound; refers to a class of common pollutants sometimes found in buildings. Sources include out-gassing of construction materials, production-line by-products, and general cleaning solvents. A VOC is occasionally used as a measure of indoor air quality.

**W7750** - The model number of the Excel 10 CVAHU Controllers (also see CVAHU).

**W7751** - The model number of the Excel 10 VAV Box Controllers (also see VAV).

**W7752** - The model number of the Excel 10 FCU Controllers (also see FCU).

**W7753** - The model number of the Excel 10 UV Controllers (also see UV).

**W7761** - The model number of the Excel 10 RIO Device (also see RIO).

**Wall Module** - The Excel 10 Space Temperature Sensor and other optional controller inputs are contained in the T7770 or T7780 Wall Modules. See Application Step 5. Order Equipment for details on the various models of Wall Modules.

**XBS** - Excel Building Supervisor; a PC based tool for monitoring and changing parameters in C-Bus devices.

## Construction

### Controllers

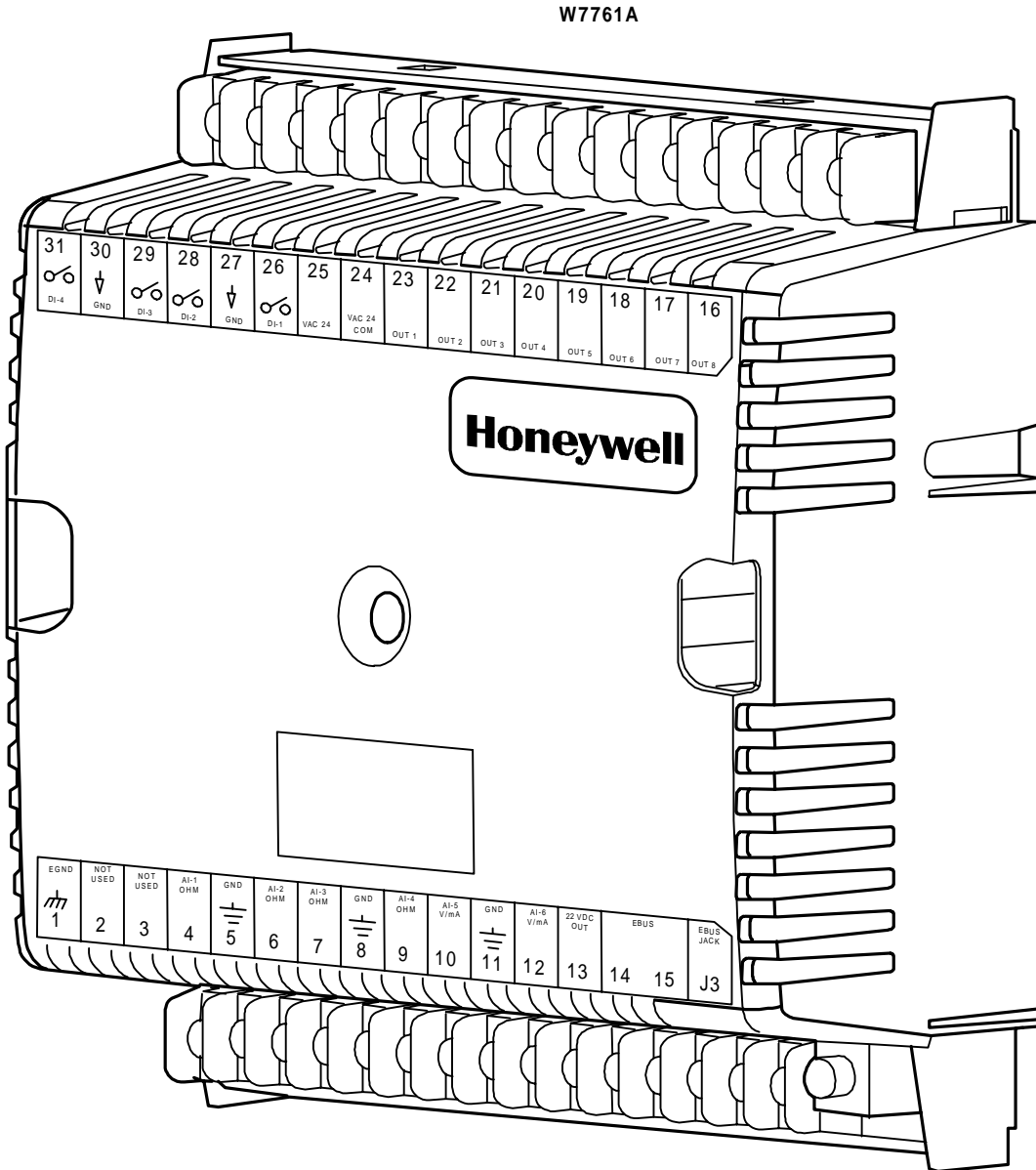
The Excel 10 W7761A RIO Device is available in one model. It contains 4 resistive inputs that can be configured for either 20Kohm NTC or PT3000 sensors, 2 voltage or current inputs, 4 digital inputs and 8 Digital Outputs (Triacs) which may be Discrete (maintained or momentary), Modulating (PWM) or Floating.

The W7761A consists of a single circuit board that is mounted in a sheet metal subbase and protected by a factory snap-on cover. The device mounts with two screws (see Fig. 3 or 4). Using DIN rail adapters (see Fig. 5) they can also be snapped onto standard EN 50 022 35 mm by 7.5 mm (1-3/8 in. by 5/16 in.) DIN rail. DIN rail is available through local suppliers. If using DIN rail also purchase from Augat Inc. part number 2TK2D DIN rail (adapter) two each for every device (see Fig. 5). Wires are attached to the screw terminal blocks on both sides of the device. Connection for operator access to the E-Bus is provided by plugging the SLTA connector cable into the communications jack.

A channel in the cover allows the device status LED to be visible when the cover is in place. There are no field-serviceable parts on the circuit board and, therefore, *it is intended that the cover never be removed.*

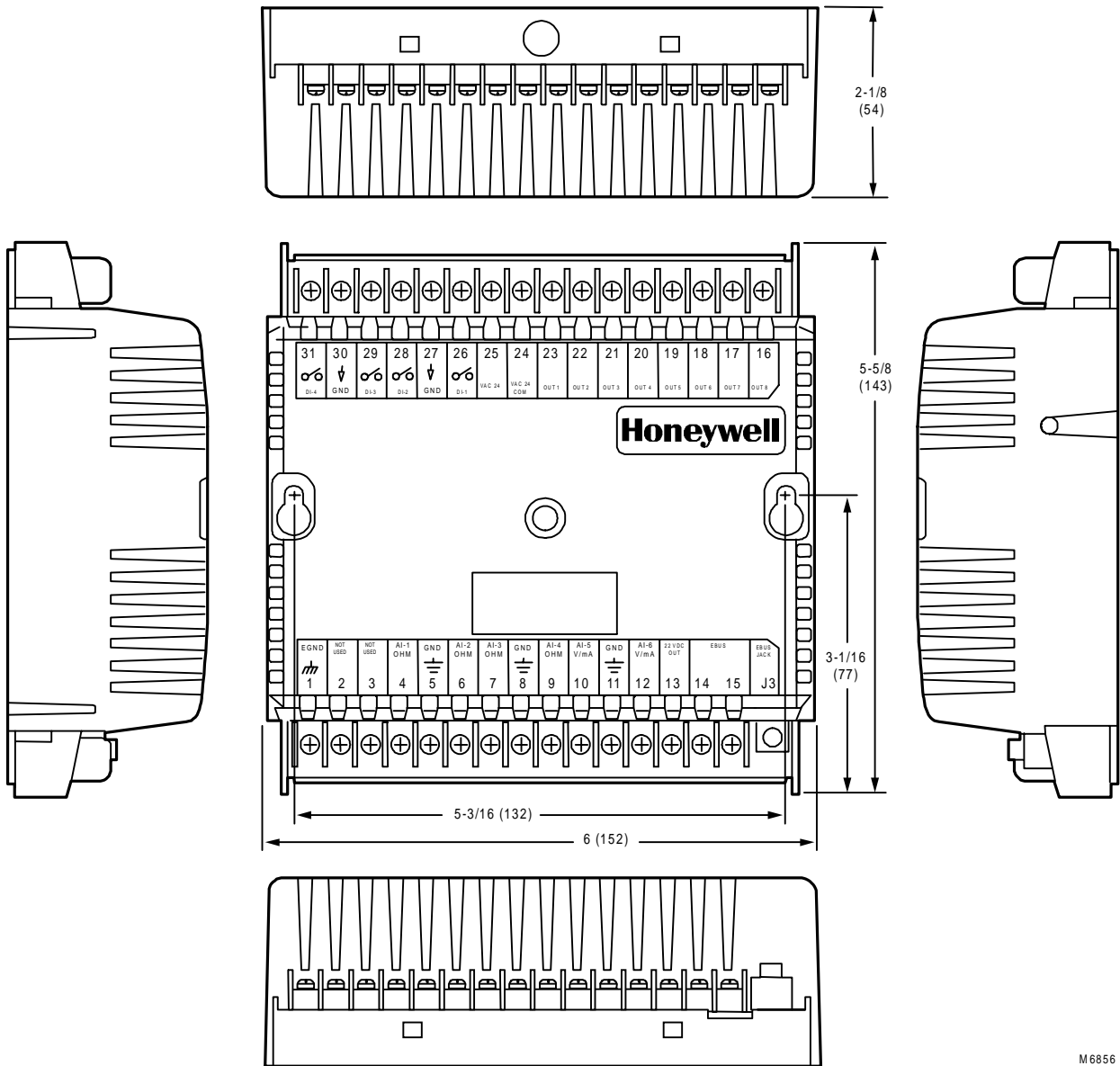
The W7761A can be mounted in any orientation. Ventilation openings were designed into the cover to allow proper heat dissipation regardless of the mounting orientation. See Fig. 3 and 4.





M10118

Fig. 3. Excel 10 W7761A Remote I/O Device.



M6856

Fig. 4. W7761A construction in in. (mm).

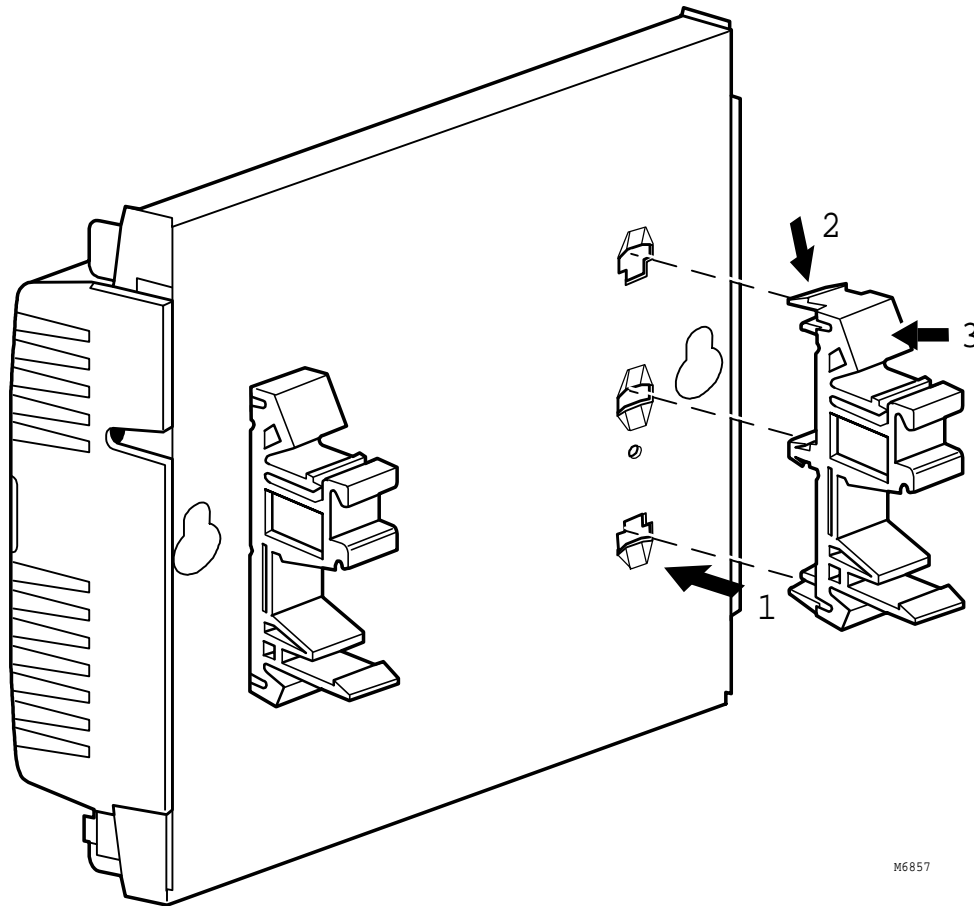


Fig. 5. DIN rail adapters.

The input/output points are summarized in Table 2.

Table 2. List Of Available Points.

	W7761A
Digital Outputs	8 Triac Outputs
Digital Inputs	4
Analog Inputs	6 (4 Resistive and 2 Voltage/Current Inputs)
DC Power	20 Vdc available to power optional sensors (50 mA max.)
Floating (Series 60) Control	Heating or Cooling
PWM Control	Heating or Cooling

**Performance Specifications**

**Power:**

24 Vac with a minimum of 20 Vac and a maximum of 30 Vac at either 50 or 60 Hz. The W7761A power consumption is 6 VA maximum at 50 or 60 Hz. The W7761A is a NEC Class 2 rated device. This listing imposes limits on the amount of power the product can consume or directly control to a total of 100 VA (U.S. only).

The individual Triac outputs incorporate an internal common connection with the input power transformer. The Triacs provide a switched path from the hot side (R) of the transformer through the load to the common of the transformer. The W7761A Device design *must* use the same power transformer for any loads connected to that device; see Fig. 19.

Each individual Triac is rated 500mA at 30 Vac maximum. Under all operating conditions, the maximum load/source power budget for the W7761A Device is 100 VA.

**CPU:**

Motorola or Toshiba 3150 Neuron™ processor, containing three eight-bit CPU's. Each Neuron™ has a unique 48-bit network identification number.

**Memory Capacity:**

64K ROM/PROM (6K reserved for network operations, 58K usable for control algorithm code).  
512 bytes EEPROM.  
2K RAM.

**Specified Space Temperature Sensing Range:**

45 to 99°F (7 to 37°C) with an allowable control setpoint range from 50 to 90°F (10 to 32°C) when initiated from the network and 55 to 85°F (13 to 29°C) when configured and connected to T7770 Wall Modules or T7780 DDWM.

**Communications:**

The W7761A Device uses a transformer-coupled communications port with differential Manchester-encoded data at 78 kilobits per second (kbs). The transformer-coupled communications interface offers a much higher degree of common-mode noise rejection while ensuring dc isolation.

Approved cable types for E-Bus communications wiring is Level IV 22 AWG (0.34 mm<sup>2</sup>) plenum or non-plenum rated unshielded, twisted pair, solid conductor wire. For non-plenum areas, use Level IV 22 AWG (0.34 mm<sup>2</sup>) such as U.S. part AK3781 (one pair) or U.S. part AK3782 (two pair). In plenum areas, use plenum-rated Level IV, 22 AWG (0.34 mm<sup>2</sup>) such as U.S. part AK3791 (one pair) or U.S. part AK3792 (two pair). (See Tables 6 and 8 for part numbers.) Contact Echelon® Corp. Technical Support for the recommended vendors of Echelon® approved cables.

The Free Topology Transceiver (FTT) supports polarity insensitive free topology wiring. This frees the system installer from the need to wire using a bus topology. Star, bus, mixed, and loop wiring are all supported by this architecture. The maximum E-Bus length when using a combination of star, loop, and bus wiring (singly terminated) is 1640 ft (500m) with the maximum node-to-node length of 1312 ft (400m). In the event that the total wire length is exceeded, then a Q7740A 2-Way Repeater or a Q7740B 4-Way Repeater can be used to allow the number of devices to be spread out as well as increasing the length of wire over which they communicate. The maximum number of repeaters per segment is one (on either side of the router). A Q7751A E-Bus Router can also be used to effectively double the maximum E-Bus length. The advantage of using the router is that it will segregate traffic to a segment while when using the repeater, all traffic is repeated on each segment. When utilizing a doubly terminated E-Bus structure, use a continuous daisy-chain with no stubs or taps from the main backbone. The maximum E-Bus length is 4593 ft (1400m) with the maximum node-to-node length of 3773 ft (1150m).

FTT networks are very flexible and convenient to install and maintain, but it is imperative to carefully plan the network layout and create and maintain accurate documentation. Unknown or inaccurate wire run lengths, node-to-node distances, node counts, total wire length, and misplaced or missing terminators can cause poor network performance. Refer to E-Bus Wiring Guidelines form, 74-2865 for complete description of network topology rules.

**LonMark® Functional Profile**

W7761A Device supports the LonMark® Preliminary Functional Profile for a Remote Input/Output Device.

**Environmental:****Operating Temperature:**

-40° to 150°F (-40° to 65.5°C).

**Shipping Temperature:**

-40° to 150°F (-40° to 65.5°C).

**Relative Humidity:**

5% to 95% noncondensing.

**Vibration:**

Rated V2 level compliant.

**Inputs/Outputs:**

The W7761A Unit supports the following hardware features:

- Four 20KNTC (1000 through 150,000 ohm) or PT3000 (250 through 12,000 ohm) resistive analog inputs.
- Two 0.2 to 10 VDC or 2 to 20 mA (user selectable) analog inputs.
- Four dry contact digital inputs.
- Eight 24 Vac Triac digital outputs (500 mA MAX).
- One 22 Vdc power supply for auxiliary devices with a maximum current of 50 mA.

**Analog Inputs:**

Space Temperature:

Type: RTD.

Supported Sensors: T7770A,B,C,D sensor—(current feature that can be used with the RIO Device) and T7780 DDWM.

**Discharge Air Temperature:**

Type: RTD.

Supported Sensors: C7100A1015\*, C7770A1006, C7031B1033, C7031C1031, C7031D1062, C7031J1050, C7031K1017.

**Outdoor Air Temperature:**

Type: RTD.

Supported Sensors: C7170A1002.

**Return Air Temperature:**

Type: RTD.

Supported Sensors: C7100A1015\*, C7770A1006, C7031B1033, C7031C1031, C7031D1062, C7031J1050, C7031K1017.

**Mixed Air Temperature:**

Type: RTD.

Supported Sensors: C7100A1015\*, C7770A1006, C7031B1033, C7031C1031, C7031D1062, C7031J1050, C7031K1017.

\*The PT3000 sensor is not recommended for floating control (real time - discharge or return configured as space sensor). The PT3000 sensor is intended for monitoring or differential (staged) control.

**Outdoor Air Humidity:**

Type: Voltage/Current.

Supported Sensors: C7600B1000 and C7600B1018 (2 to 10V), C7600C1008 (4 to 20mA).

**Return Air Humidity:**

Type: Voltage/Current.

Supported Sensors: C7600B1000 and C7600B1018 (2 to 10V), C7600C1008 (4 to 20mA).

**Outdoor Air Enthalpy:**

Type: Current.

Supported Sensors: C7400A1004 (4 to 20mA).

**Return Air Enthalpy:**

Type: Current.

Supported Sensors: C7400A1004 (4 to 20mA).

**Air Filter Differential Pressure:**

Type: Voltage.

Supported Sensors: Third party 2 to 10V, 0 to 5 inw ( 0 to 1.25 kPa) differential pressure sensors.

**Space CO<sub>2</sub> Sensor:**

Type: Voltage.

Supported Sensors: Third party 0 to 10V, 0 to 2000 ppm CO<sub>2</sub> sensors.

**Outdoor Air CO<sub>2</sub> Sensor:**

Type: Voltage.

Supported Sensors: Third party 0 to 10V, 0 to 2000 ppm CO<sub>2</sub> sensors.

**Outdoor Air CO Sensor:**

Type: Current.

Supported Sensors: Third party 4 to 20mA, 0 to 300 ppm CO sensor.

**Monitor Sensor for network use:**

Type: Voltage.

Supported Sensors: Third party 2 to 10V, 2 to 10 volts displayed.

**Digital Inputs:**

Dry-contact inputs are sensed using a 9 milliamp at 4.8 volts detection circuit. It is very important that the device used contains high quality, noncorroding contacts with resistivity that does not degrade; that is, increase over time. Use noble metal (such as gold or silver) or pimpled or sealed contacts to assure consistent, long-term operation.

**Triac Outputs:**

Triac Outputs on the RIO:

— Power ratings: 20 Vac to 30 Vac at 25 mA MIN to 500 mA MAX current for any voltage.

# CAUTION

When any device is energized by a Triac, the device must be able to sink a minimum of 25 mA.

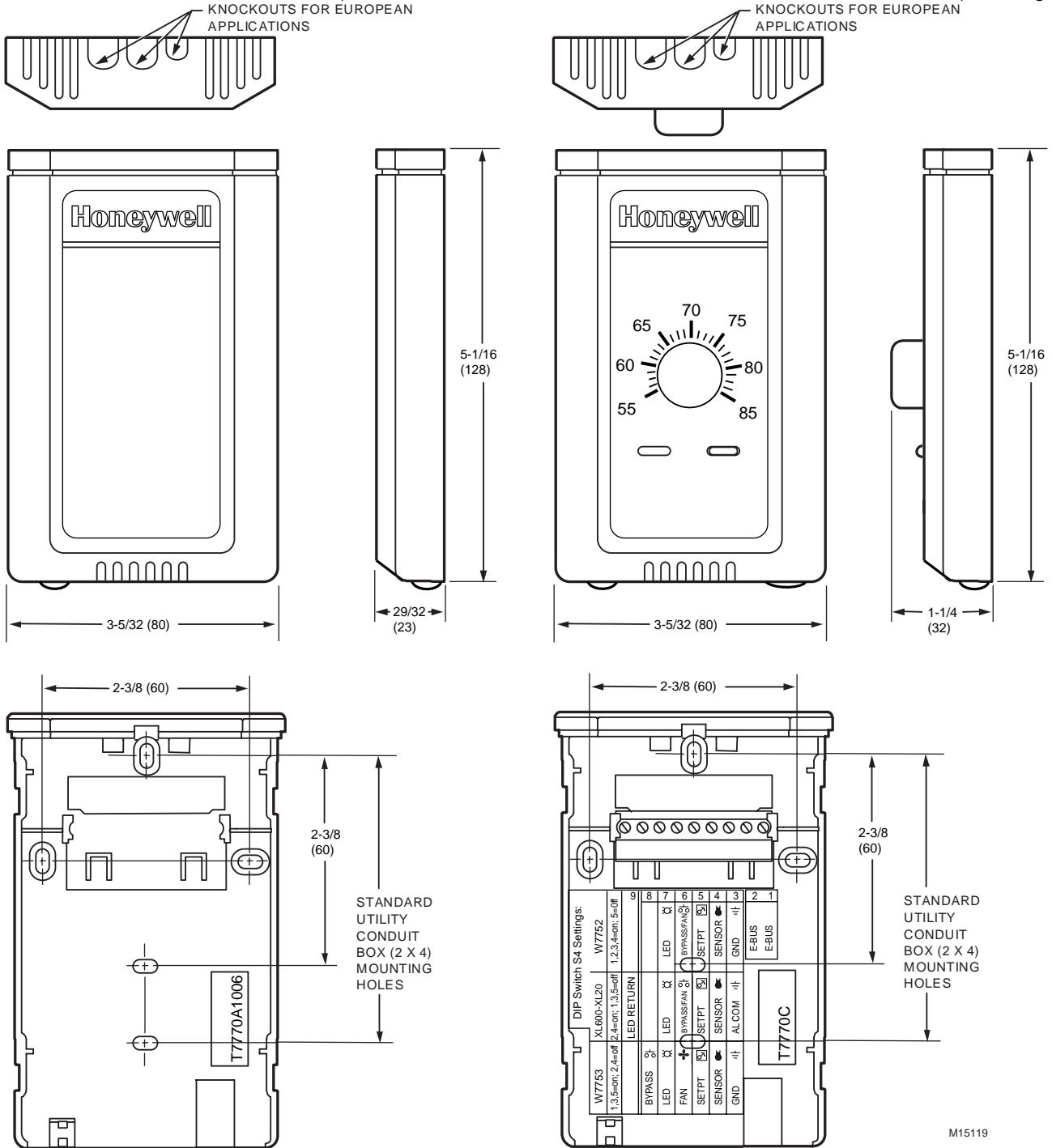
NOTE: Triacs sink current to the 24 Vac common (COM terminal on the W7761A); see Fig. 19 for wiring example.

**IMPORTANT:**

*If non-Honeywell motors, actuators, or transducers are to be used with Excel 10 Controllers, Triac compatibility must be verified (see previous NOTE).*

## Wall Modules

The T7770A,B,C,D Wall Module sensor—(current feature that can be used with the Excel 10 W7761A RIO Device). See Fig. 6.



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Fig. 6. T7770A,B,C,D (T7770A,C shown) construction in in. (mm), sensor—(current feature that can be used with RIO Device).

The T7780 DDWM for the Excel 10 Controllers (see Product Names section) is shown in Fig. 7.

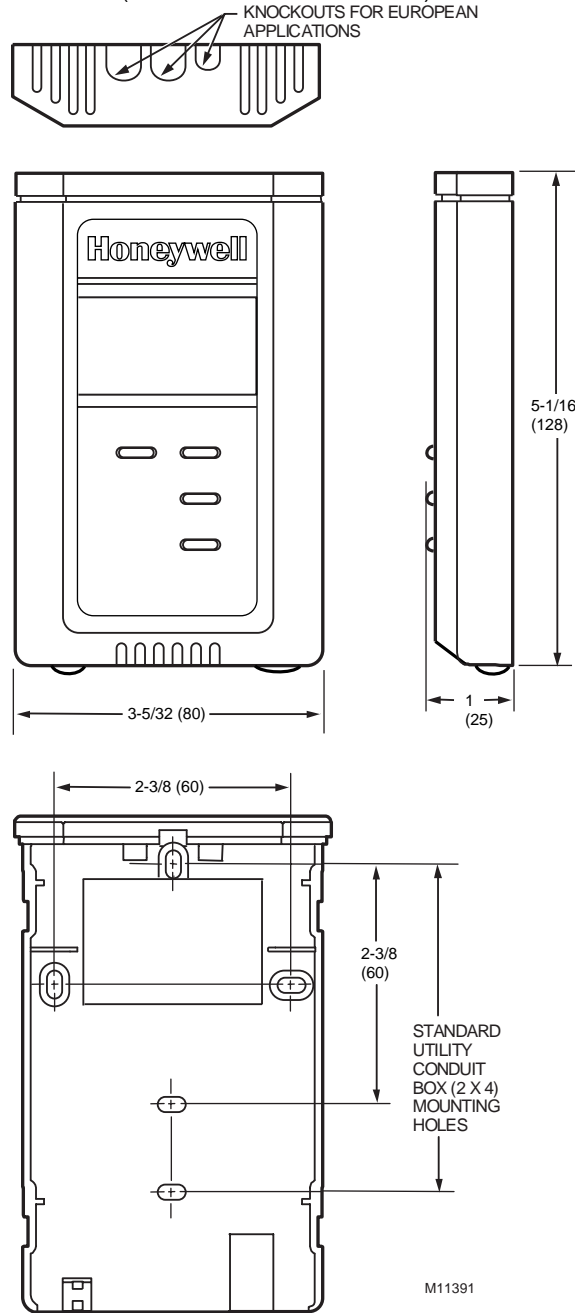


Fig. 7. T7780 construction, subbase dimensions in in. (mm).

## Configurations

Each W7761A device can control or monitor a variety of different types of mechanical equipment. The W7761A was not intended to control staged or modulating heating/cooling coils, mixed air economizer dampers, or system fan/heat pump units. The W7761A contains inputs and outputs, but no control software. All control that would be associated with the inputs and outputs in the W7761A would be accomplished through the Excel Zone Manager and would not be suitable for VAV control, temperature control, or any control function that would require less than a 30 second update rate.

It would be suitable to control miscellaneous exhaust or ventilation fans, lighting zones that are spread out through a building which need to be linked to a start/stop time program through the Zone Manager or to enable freeze protection. The W7761A device can be connected to outdoor air temperature and humidity sensors that can be used by other Excel 10 controllers on the E-Bus or Excel 5000 controllers on the C-Bus through the Excel 10 Zone Manager. The W7761A can be used to monitor Occupancy, Window, Dirty filter, Indoor air quality, and Smoke control sensors. This allows the controllers to use their physical inputs for monitoring other elements such as return humidity, IAQ, etc. to achieve better control. The W7761A can be used to

average many space temperature sensors that are located in a zone that is controlled by the W7750 Constant Volume AHU Controller.

### Mixed-Output-Type Control

The W7761A Device can control mixed-output-types of applications such as PWM and staged control occurring simultaneously with Series 60 Floating Control.

### Occupancy Sensor

Excel 10 W7761A device can be connected to an occupancy sensor through a digital input. This is a device, such as a passive infrared motion detector, that contains a dry contact (see following NOTE) closure to indicate whether or not people are present in the space. The Excel 10 W7761A Device expects a contact closure to indicate the space is Occupied. See Fig. 18 in Application Step 4, Prepare Wiring Diagrams, for details on wiring connections. This occupancy sensor can then be bound to other Excel 10 controllers on the E-Bus or Excel 5000 controllers on the C-Bus through the Excel 10 Zone Manager. This would allow the other Excel 10 controllers to use their physical inputs for monitoring other elements such as return humidity, IAQ, etc. to achieve better control.

**NOTE:** The Excel 10 Controllers (W7750 CVAHU and W7761A RIO) have limited power available (only 9 mA at 4.8 volts) for checking the digital inputs for contact closures. It is very important that the device used contains high quality, noncorroding contacts with resistivity that does not degrade; that is, increase over time. Use noble metal (such as gold or silver), pimpled or sealed contacts to assure consistent, long-term operation.

The recommended devices for use with the Excel 10 W7750 Controller and W7761A Device are the EL7628A1007 Ceiling Mounted Infrared or the EL7680A1008 Wall Mounted Wide View Infrared Occupancy Sensors. If ultrasonic sensors are required, the EL7611A1003 and the EL7612A1001 Occupancy Sensors are recommended. An EL76XX Power Supply/Control Unit is required for use with these occupancy sensors. The EL7630A1003 can power up to four sensors, and is multi-tapped for several line voltages. The EL7621A1002 can power three sensors and it connects to 120 Vac line voltage. The EL7621A1010 can also power three sensors but it connects to 277 Vac line voltage.

### Window Open/Closed Digital Input

Excel 10 W7761A device can be connected to a window sensor to indicate whether a window in the space was opened. The Excel 10 W7761A device can be connected to a dry contact (see the NOTE for the Occupancy Sensor and Fig. 18 in Application Step 4, Prepare Wiring Diagrams, for details) or a set of contacts wired in series (for monitoring multiple windows) to verify that the window(s) are closed. This window(s) sensor can then be bound to other Excel 10 controllers on the E-Bus or Excel 5000 controllers on the C-Bus through the Excel 10 Zone Manager. The algorithm in the other Excel 10 controllers expects a contact closure to indicate the window is closed. If an open window is detected, the algorithm in the other Excel 10 controllers changes the mode of operation to FREEZE\_PROTECT, which shuts down the control functions, and watches for low space temperature conditions. The freeze protection setpoint is 46.4°F (8°C), and the frost alarm occurs at 42.8°F (6°C).

### Wall Module Options

As previously discussed, there are five basic varieties of the T7770. There is one variety of the PT3000 sensor and the T7780 DDWM (see the Product Names and the Construction sections). The T7770A,B,C,D 20Kohm NTC sensor—(current feature that can be used with the RIO Device) and one PT3000 sensor can be configured on any of the four resistive inputs. The T7780 is an E-Bus node and would not be directly connected to the RIO Device.

### Dirty Filter Monitor

The air filter in the air handler can be monitored by the W7761A RIO device and an alarm issued by the Zone Manager when the filter media needs replacement. The two methods of monitoring the filter are:

1. Connecting a differential pressure switch to a digital input on the W7761A.
2. Wiring a 2-to-10V differential pressure sensor to a voltage input on the W7761A. If the analog input sensor is used, its measured value 0 to 5 inw (0 to 1.25 kPa) is compared to a user-selectable setpoint. The comparison is done in the Zone Manager—valid range: 0 to 5 inw (0 to 1.25 kPa), and the Dirty Filter alarm is issued when the pressure drop across the filter exceeds the setpoint.

### Indoor Air Quality (IAQ)

The Excel 10 W7761A device can monitor IAQ using one of two different methods of detecting poor air quality. The first is with an IAQ switch device connected to a digital input on the W7761A, where a contact closure indicates poor air quality, and an alarm can be issued by the Zone Manager. The device can detect poor air quality using any desired measure such as CO<sub>2</sub>, VOC, CO, etc. The second method, is through an analog input that connects to a CO<sub>2</sub> sensor (0 to 10V). The measured value of CO<sub>2</sub> from this sensor (0 to 2000 ppm) is compared to a user-selectable setpoint (the comparison is done in the Zone Manager—valid range: 0 to 2000 ppm), and an IAQ alarm can be issued when the CO<sub>2</sub> level exceeds the setpoint. The IAQ sensor that is connected to the W7750 RIO, can be bound to other W7750 CVAHU Excel 10 controllers on the E-Bus.



# APPLICATION STEPS

## Overview

The seven application steps shown in Table 3 are planning considerations for engineering an Excel 10 W7761 Remote Input/Output Device. These steps are guidelines intended to aid understanding of the product I/O options, bus arrangement choices and the Excel 10 W7761A Devices role in the overall EXCEL 5000® System architecture.

**Table 3 . Application Steps.**

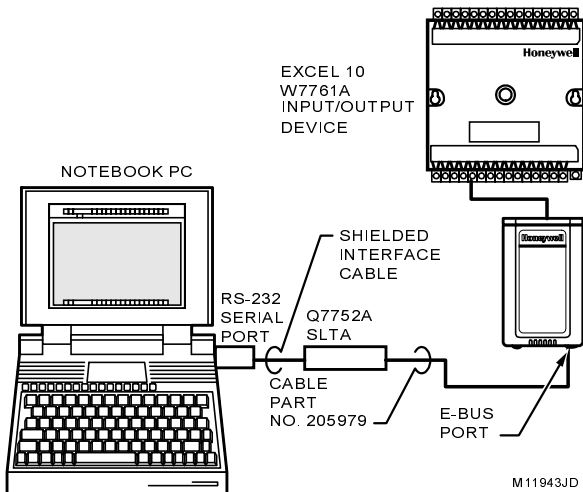
Step No.	Description
1	Plan The System
2	Determine Other Bus Devices Required
3	Lay Out Communication and Power Wiring
4	Prepare Wiring Diagrams
5	Order Equipment
6	Configure Devices
7	Troubleshooting

## Step 1. Plan The System

Plan the use of the W7761A Devices according to the job requirements. Determine the location, functionality and sensor or actuator usage. Verify the sales estimate of the number of W7761A Devices and the number and type of output actuators and other required accessories.

When planning the system layout, consider potential expansion possibilities to allow for future growth. Planning is very important to be prepared for adding HVAC systems and controllers in future projects.

T7770A,B,C,D Wall Modules (sensor—current feature that can be used with the RIO Device) can be installed as either hardwired I/O-only devices or additional wiring can be run to them (for the E-Bus network ) to allow a CARE/E-Vision operator terminal to have access to the E-Bus. The application engineer needs to determine how many wall modules or other input sensors are required. This information is required during installation to ensure that the proper number and type of wires are pulled to the wall modules, and the building operators are informed about where they can plug in to the E-Bus network with a portable operator terminal (see Fig. 8 through 10).



**Fig. 8. Connecting the portable operator terminal to the E-Bus.**

The FTT communication loop, (E-Bus) between controllers is a free topology wiring scheme that supports star, loop, and/or bus wiring. Refer to the E-Bus Wiring Guidelines form, 74-2865 for complete description of network topology rules. See Application Step 3. Lay Out Communications and Power Wiring, for more information on bus wiring layout, and see Fig. 16 through 19 in Application Step 4. Prepare Wiring Diagrams, for wiring details.

The application engineer must review the Direct Digital Control (DDC) job requirements. This includes the Sequences of Operation for the Excel 10 controllers, and for the system as a whole. Usually there are variables that must be passed between the W7750 (CVAHU), Q7750A Zone Manager, W7761 (RIO), and other Excel 10 controller(s), or central plant controller(s) that are required for optimum system-wide operation. Typical examples are the TOD Occ/Unocc signal, the outdoor air temperature, demand limit control signal, and smoke control mode signal.

It is important to understand these interrelationships early in the job engineering process to ensure implementing when configuring the controllers. (See Application Step 6. Configure Devices, for information on the various Excel 10 parameters and on Excel 10 point mapping.)

## Step 2. Determine Other Bus Devices Required

A maximum of 62 nodes can communicate on a single E-Bus segment. Each W7761A (RIO), W7750 (CVAHU), W7751 (VAV) Controller or T7780 Wall Module constitutes one node. If more nodes are required, a Q7751A Router is necessary. Using a router allows up to 125 nodes, divided between two E-Bus segments. The router accounts for two of these nodes (one node on each side of the router); a Q7750A Excel 10 Zone Manager takes one node and two nodes are available for operator terminal nodes, leaving 120 nodes available for Excel 10 Controllers and T7780 Wall Modules. All 120 controllers and T7780 Wall Modules are able to talk to each other through the router. A Q7750A Excel 10 Zone Manager is required to connect the E-Bus to the standard EXCEL 5000® System C-Bus. Each Excel 10 Zone Manager can support no more than 120 Excel 10 Controllers and T7780 Wall Modules. This limit is set in the Excel 10 Zone Manager database as an absolute maximum. Each E-Bus segment is set up with two unused nodes to allow for a CARE/E-Vision or Hand Held Tool (HHT) to be connected to the E-Bus. Multiple CARE/E-Vision or HHT terminals can be connected to the bus at the same time. Table 4 summarizes the E-Bus segment configuration rules.

**Table 4 . E-Bus Configuration Rules And Device Node Numbers.**

<b>One E-Bus Segment Example</b>	<b>Maximum Number of Nodes Equals 62</b>
One Q7750A Excel 10 Zone Manager	1 node
Port for operator terminal access (CARE/E-Vision or HHT)	1 node
Maximum number of Excel 10s and T7780s	60 nodes (Only T7780 Wall Modules are E-Bus nodes)
Total	62 nodes
<b>Two E-Bus Segments Example</b>	
Maximum Number of Nodes Equals 125	
One Q7750A Excel 10 Zone Manager	1 node
One Q7751A Router	2 nodes (1 in each Bus Segment)
Ports for operator terminal access (two CARE/E-Vision or HHT terminals)	2 nodes (1 in each Bus Segment)
Maximum number of Excel 10s and T7780s in segment number one	60 nodes (Only T7780 Wall Modules are E-Bus nodes)
Maximum number of Excel 10s and T7780s in segment number two	60 nodes (Only T7780 Wall Modules are E-Bus nodes)
Total	125 nodes

Refer to the E-Bus Wiring Guidelines form, 74-2865 for complete description of network topology rules and the maximum wire length limitations. If longer runs are required, a Q7740A 2-way or Q7740B 4-way repeater can be added to extend the length of the E-Bus. A Q7751A Router can be added to partition the system into two segments and effectively double the length of the E-Bus. Only one router is allowed with each Excel 10 Zone Manager and each network segment can have a maximum of 1 repeater. In addition, all E-Bus segments require the installation of a Bus Termination Module for a singly terminated E-Bus or two Bus Termination Modules for a doubly terminated E-Bus. For more details on E-Bus termination, refer to the E-Bus Wiring Guidelines form, 74-2865, or see Application Step 3. Lay Out Communications and Power Wiring, and the E-Bus Termination Module subsection in Application Step 4.

## Step 3. Lay Out Communications and Power Wiring

### E-Bus Layout

The communications bus, E-Bus, is a 78-kilobit serial link that uses transformer isolation and differential Manchester encoding. Approved cable types for E-Bus communications wiring is Level IV 22 AWG (0.34 mm<sup>2</sup>) plenum or non-plenum rated unshielded, twisted pair, solid conductor wire. For nonplenum areas, use Level IV 22 AWG (0.34 mm<sup>2</sup>), such as U.S. part AK3781 (one pair) or U.S. part AK3782 (two pair). In plenum areas, use plenum-rated Level IV, 22 AWG (0.34 mm<sup>2</sup>) such as U.S. part AK3791 (one pair) or U.S. part AK3792 (two pair). See Tables 9 and 10 for part numbers. Contact Echelon® Corp. Technical Support for the recommended vendors of Echelon® approved cables. The FTT communications bus, E-Bus, supports a polarity insensitive, free topology wiring scheme that supports star, loop, and/or bus wiring. E-Bus networks can be configured in a variety of ways, so refer to the E-Bus Wiring Guidelines form, 74-2865 for a complete description of network topology rules and Table 4. Fig. 9 and 10 depict two typical E-Bus network topologies; one as a singly terminated bus segment that has 60 nodes or less, and one showing a doubly terminated segment. The bus configuration is set up using the Network Manager tool from within CARE (see the CARE User's Manual form, 74-5587 or Excel E-Vision User's Guide form, 74-2588).

NOTE: For wiring details see the E-Bus Termination Module subsection in Step 4. For wall module wiring, US part AK3782 (non-plenum) or US part AK3792 (plenum) can be used. These cables contain two twisted pairs (one for the run down to the wall module, and one for the run back up to the controller) for ease of installation.

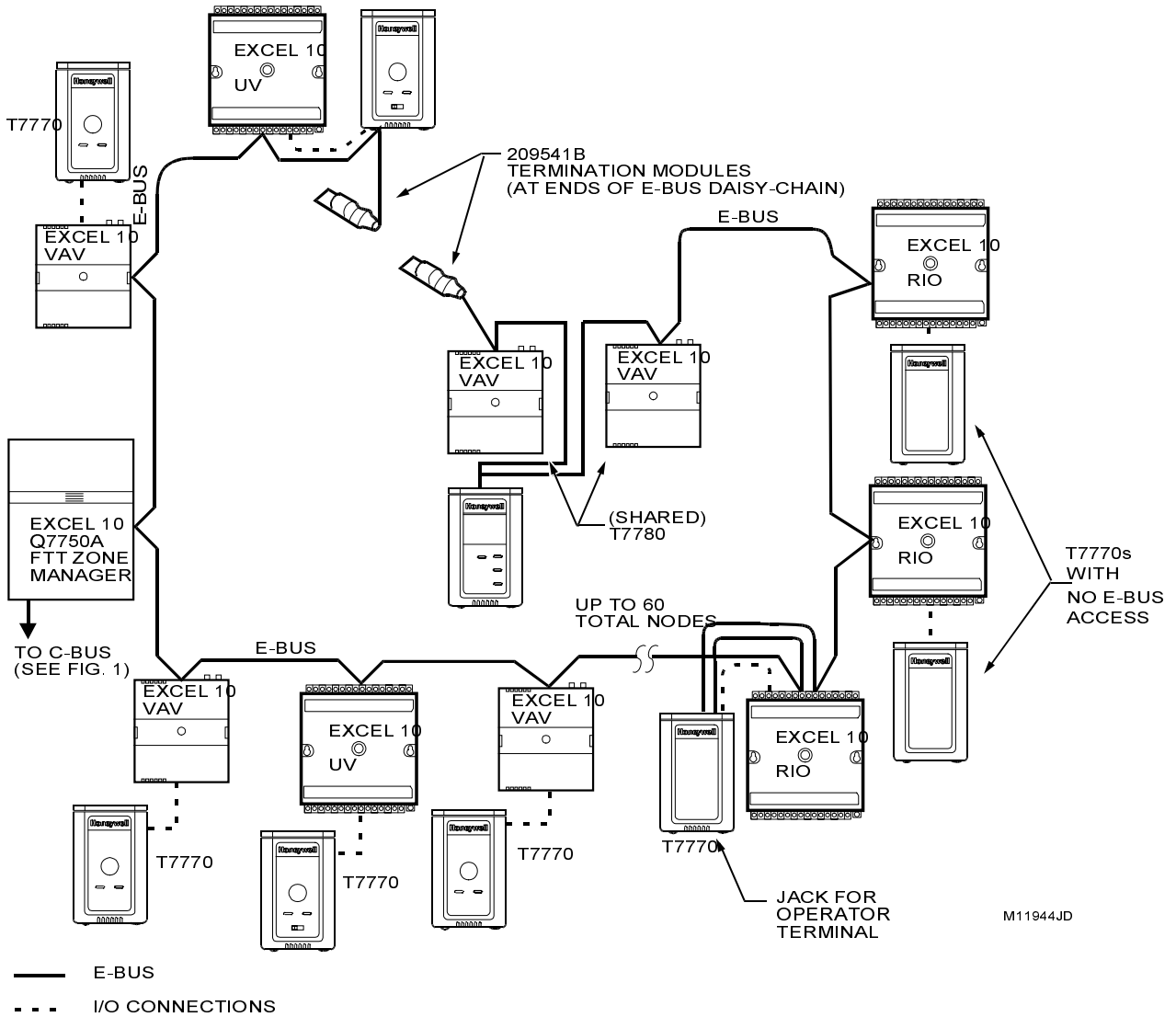


Fig. 9. Bus wiring layout for doubly terminated daisy-chain E-Bus segment.

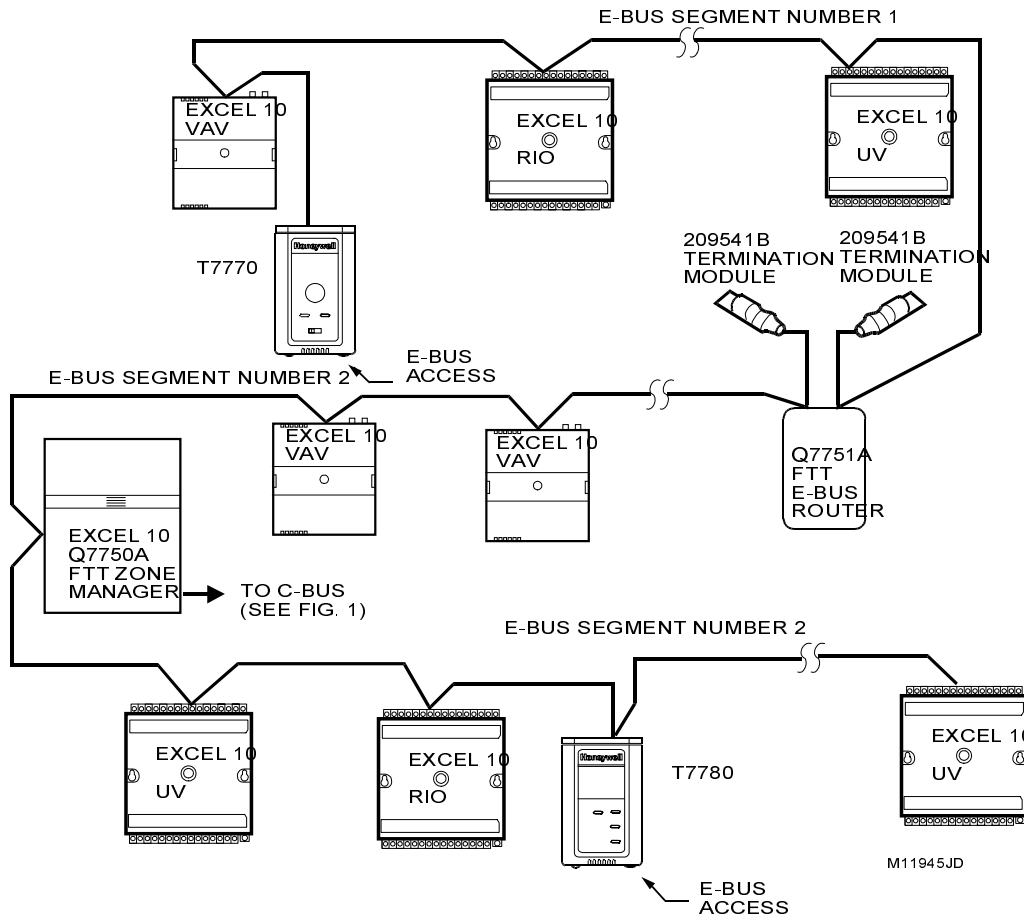


Fig. 10. Bus wiring layout for two singly terminated E-Bus segments.

NOTE: See the E-Bus Termination Module section for wiring details.

**IMPORTANT**

Notes on communications wiring:

- All field wiring must conform to local codes and ordinances.
- Approved cable types for E-Bus communications wiring is Level IV 22 AWG (0.34 mm<sup>2</sup>) plenum or non-plenum rated unshielded, twisted pair, solid conductor wire. For nonplenum areas, use Level IV 22 AWG (0.34 mm<sup>2</sup>), such as U.S. part AK3781 (one pair) or U.S. part AK3782 (two pair). In plenum areas, use plenum-rated Level IV, 22 AWG (0.34 mm<sup>2</sup>) such as U.S. part AK3791 (one pair) or U.S. part AK3792 (two pair). See Tables 9 and 10 for part numbers. Contact Echelon® Corp. Technical Support for the recommended vendors of Echelon® approved cables.
- Unswitched 24 Vac power wiring can be run in the same conduit as the E-Bus cable.
- Do not use different wire types or gauges on the same E-Bus segment. The step change in line impedance characteristics causes unpredictable reflections on the bus. When using different types is unavoidable, use a Q7751A Router at the junction.
- In noisy (high EMI) environments, avoid wire runs parallel to noisy power cables, or lines containing lighting dimmer switches, and keep at least 3 in. (76 mm) of separation between noisy lines and the E-Bus cable.
- Make sure that neither of the E-Bus wires is grounded.

**Power Wiring**

A power budget must be calculated for each Excel 10 W7761 Device to determine the required transformer size for proper operation. A power budget is simply the summing of the maximum power draw ratings (in VA) of all the devices to be controlled by an Excel 10 W7761 Device. This includes the device itself, the equipment actuators (ML6161, or other motors) and various contactors and transducers, as appropriate, for the Excel 10 configuration.

**Power Budget Calculation Example**

The following is an example power budget calculation for a typical W7761A Excel 10 Device.

Device	VA	Information Obtained from the
Excel 10 W7761 Device	6.0 VA	W7761 Specification Data

ML6161 Damper Actuator	2.2 VA	TRADELINE® Catalog
R8242A Contactor for fan	21.0 VA	TRADELINE® Catalog in-rush rating
M6410A Steam Heating Coil Valve	0.7 VA	TRADELINE® Catalog, 0.32A at 24 Vac
TOTAL: 29.9 VA		

The Excel 10 System example requires 29.9 VA of peak power; therefore, a 40 VA AT72D Transformer is able to provide ample power for this device and its accessories. Alternatively, a 75 VA AT88A Transformer could be used to power two Excel 10 Systems of this type, or a 100 VA AT92A Transformer could be used to power three of these controllers and meet NEC Class 2 restrictions (no greater than 100 VA). See Fig. 12 through 14 for illustrations of power wiring details. See Table 5 for VA ratings of various devices.

**Table 5 . VA Ratings For Transformer Sizing.**

Device	Description	VA
W7761A	Excel 10 W7761 Device	6.0
ML6161A/B	Damper Actuator, 35 lb-in.	2.2
R8242A	Contactor	21.0
R6410A	Valve Actuator	0.7
MMC325	Pneumatic Transducer	5.0
ML684	Versadrive Valve Actuator	12.0
ML6464	Damper Actuator, 66 lb-in.	3.0
ML6474	Damper Actuator, 132 lb-in.	3.0
ML6185	Damper Actuator SR 50 lb-in.	12.0

For contactors and similar devices, the in-rush power ratings should be used as the worst case values when performing power budget calculations. Also, the application engineer must consider the possible combinations of simultaneously energized outputs and calculate the VA ratings accordingly. The worst case, that uses the largest possible VA load, should be determined when sizing the transformer.

**Line Loss**

Excel 10 Controllers must receive a minimum supply voltage of 20 Vac. If long power or output wire runs are required, a voltage drop due to Ohms Law (I x R) line loss must be considered. This line loss can result in a significant increase in total power required and thereby affect transformer sizing. The following example is an I x R line-loss calculation for a 200 ft (61m) run from the transformer to a W7761 Device drawing 37 VA using 18 AWG (1.0 mm<sup>2</sup>) wire.

The formula is:

$$\text{Loss} = [\text{length of round-trip wire run (ft)}] \times [\text{resistance in wire (ohms per ft)}] \times [\text{current in wire (amperes)}]$$

From specification data:

18 AWG twisted pair wire has 6.52 ohms per 1000 feet.

$$\text{Loss} = [(200 \text{ ft}) \times (2 - \text{round-trip}) \times (6.52/1000 \text{ ohms per ft})] \times [(37 \text{ VA})/(24\text{V})] = 4.02 \text{ volts}$$

This means that four volts are going to be lost between the transformer and the device; therefore, to assure the device receives at least 20 volts, the transformer must output more than 24 volts. Because all transformer output voltage levels depend on the size of the connected load, a larger transformer outputs a higher voltage than a smaller one for a given load. Fig. 11 shows this voltage load dependence.

In the preceding I x R loss example, even though the device load is only 37 VA, a standard 40 VA transformer is not sufficient due to the line loss. From Fig. 11, a 40 VA transformer is just under 100 percent loaded (for the 37 VA device) and, therefore, has a secondary voltage of 22.9 volts. (Use the lower edge of the shaded zone in Fig. 11 that represents the worst case conditions.) When the I x R loss of four volts is subtracted, only 18.9 volts reaches the device, which is not enough voltage for proper operation.

In this situation, the engineer basically has three alternatives:

1. Use a larger transformer; for example, if an 80 VA model is used, see Fig. 11, an output of 24.4 volts minus the four volt line loss supplies 20.4V to the device. Although acceptable, the four-volt line-loss in this example is higher than recommended. See the following **IMPORTANT**.
2. Use heavier gauge wire for the power run. 14 AWG (2.0 mm<sup>2</sup>) wire has a resistance of 2.57 ohms per 1000 ft which, using the preceding formula, gives a line-loss of only 1.58 volts (compared with 4.02 volts). This would allow a 40 VA transformer to be used. 14 AWG (2.0 mm<sup>2</sup>) wire is the recommended wire size for 24 Vac wiring.
3. Locate the transformer closer to the device, thereby reducing the length of the wire run, and the line loss.

The issue of line-loss is also important in the case of the output wiring connected to the Triac digital outputs. The same formula and method are used. The rule to remember is to keep all power and output wire runs as short as practical. When necessary, use heavier gauge wire, a bigger transformer, or install the transformer closer to the device.

**IMPORTANT**

No installation should be designed where the line loss is greater than two volts to allow for nominal operation if the primary voltage drops to 102 Vac (120 Vac minus 15 percent).

To meet the National Electrical Manufacturers Association (NEMA) standards, a transformer must stay within the NEMA limits. The chart in Fig. 11 shows the required limits at various loads.

With 100 percent load, the transformer secondary must supply between 23 and 25 volts to meet the NEMA standard. When a purchased transformer meets the NEMA standard DC20-1986, the transformer voltage-regulating ability can be considered reliable. Compliance with the NEMA standard is voluntary.

The following Honeywell transformers meet this NEMA standard:

Transformer Type	VA Rating
AT20A	20
AT40A	40
AT72D	40
AT87A	50
AK3310 Assembly	100

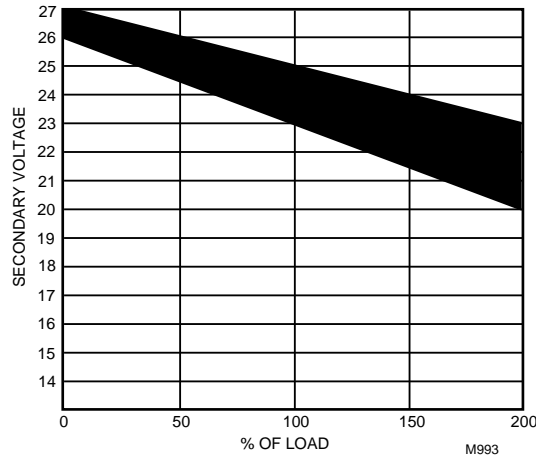


Fig. 11. NEMA class 2 transformer voltage output limits.

Attach earth ground to W7761 Device terminal 1. See Fig. 12, 13 and 14, 16 through 20.

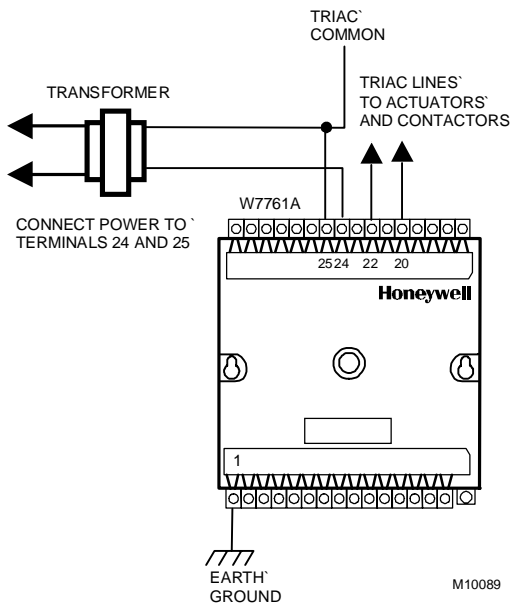


Fig. 12. Power wiring details for one Excel 10 per transformer.

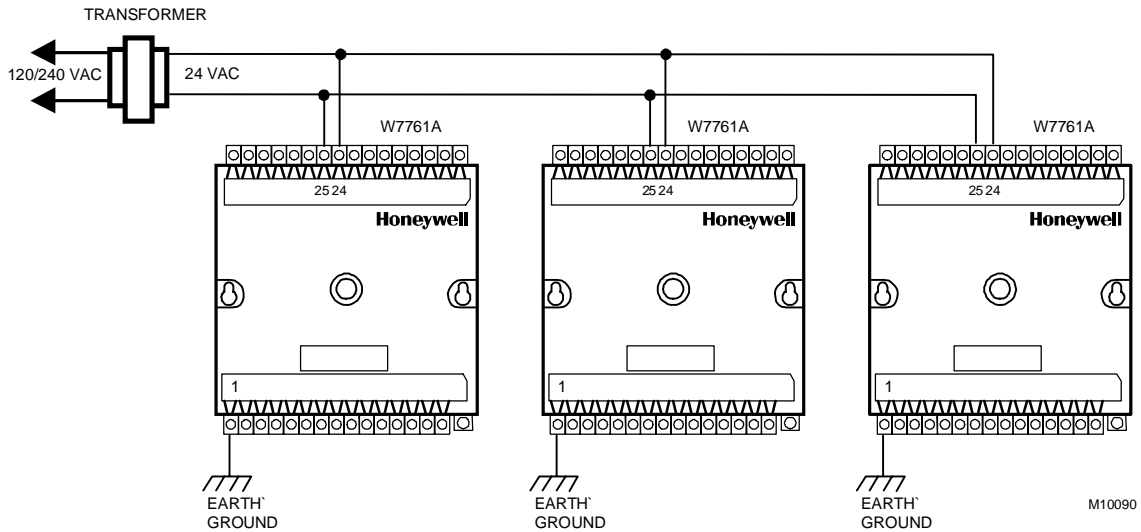
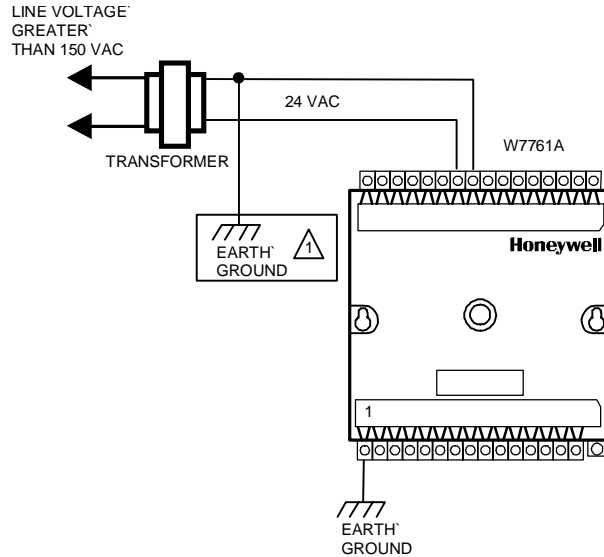


Fig. 13. Power wiring details for two or more Excel 10s per transformer.

**IMPORTANT**

If the W7761A Device is used on Heating and Cooling Equipment (UL 1995 US only) devices and the transformer primary power is more than 150 volts, connect the transformer secondary to earth ground, see Fig. 14.



⚠ IF THE W7761 CONTROLLER IS USED IN UL 1995 EQUIPMENT AND THE PRIMARY POWER IS MORE THAN 150 VOLTS, GROUND ONE SIDE OF TRANSFORMER SECONDARY.

M10088

Fig. 14. Transformer power wiring details for one Excel 10 used in UL 1995 equipment (U.S. only).

**IMPORTANT**

Notes on power wiring:

- All field wiring must conform to local codes and ordinances.
- To maintain NEC Class 2 and UL ratings, the installation must use transformers of 100 VA or less capacity.
- For multiple controllers operating from a single transformer, the same side of the transformer secondary must be connected to the same input terminal in each device and the ground terminals (1 on the W7761A) must be connected to a verified earth ground for each device in the group. See Fig. 13. (Device configurations are not necessarily limited to three devices per transformer.)
- For the W7761A Device (which has Triac outputs), all output devices must be powered from the same transformer as the one powering the Excel 10 W7761A Device.
- Use the heaviest gauge wire available, up to 14 AWG (2.0 mm<sup>2</sup>) with a minimum of 18 AWG (1.0 mm<sup>2</sup>) for all power and earth ground connections.
- To minimize EMI noise, do not run Triac output wires in the same conduit as the input wires or the E-Bus communications loop.
- Unswitched 24 Vac power wiring can be run in the same conduit as the E-Bus cable.

- Make earth ground connections with the shortest possible wire run using 14 AWG (2.0 mm<sup>2</sup>) wire. A good earth ground is essential for W7761A operation. Ideally, connect the earth ground to the ground bus at a motor control center or circuit breaker panel. However, if the nearest ideal earth ground is inaccessible, consider an alternate source for earth ground. Metal water pipe is generally a good ground, but do not use sprinkler pipe if prohibited by local codes. Attention must be given when duct work, conduit, or rebar are to be considered as ground sources. It is the responsibility of the installer to assure that these structures are tied back to a known earth ground.

## Step 4. Prepare Wiring Diagrams

### General Considerations

The purpose of this step is to assist the application engineer in developing job drawings to meet job specifications. Wiring details are included for the W7761A device the T7770A,B,C,D wall module (sensor—current feature that can be used with the RIO Device) and the T7780 DDWM. The drawings detail I/O, power, and communication bus wiring connections.

NOTE: For field wiring, when two or more wires are to be attached to the same connector block terminal, be sure to twist them together. Deviation from this rule can result in improper electrical contact. See Fig. 15.

The connector block terminals on the W7761A and on the T7770 accept 14 through 22 AWG (2.0 to 0.34 mm<sup>2</sup>) wire. Table 6 lists wiring types, sizes, and length restrictions for Excel 10 products.

**Table 6 . Field Wiring Reference Table.**

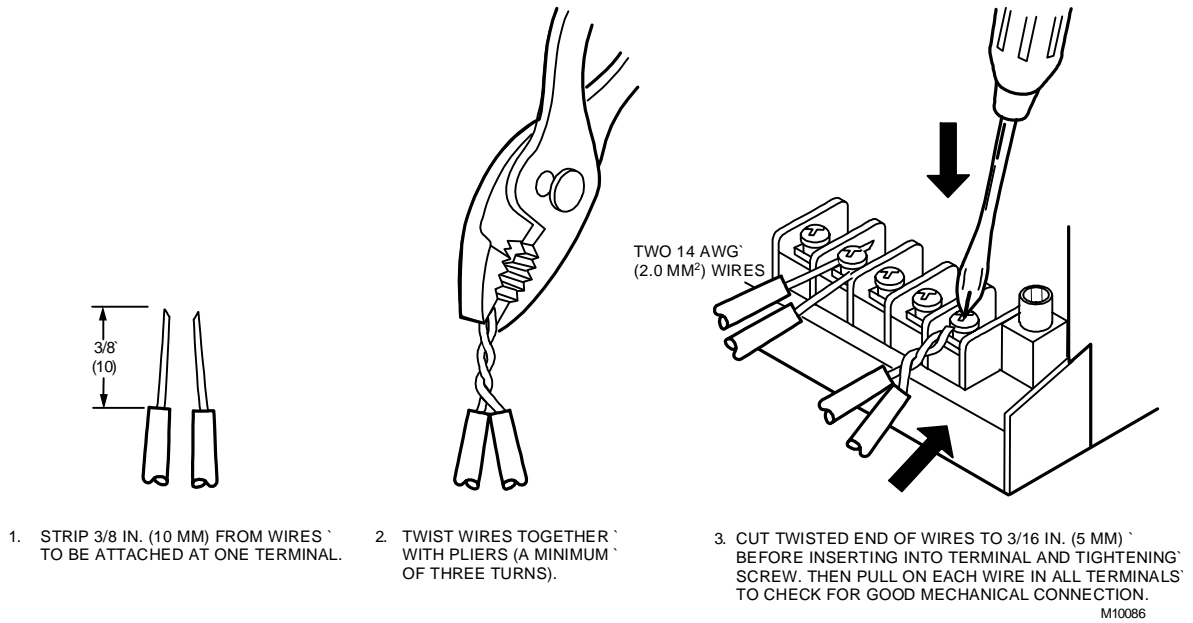
Wire Function	Recommended Minimum Wire Size AWG (mm <sup>2</sup> )	Construction	Specification or Requirement	Vendor Wire Type	Maximum Length ft (m)
E-Bus (Plenum)	22 AWG (0.34 mm <sup>2</sup> )	Twisted pair solid conductor, nonshielded or Echelon® approved shielded cable.	Level IV 140°F (60°C) rating	Honeywell AK3791 (one twisted pair) AK3792 (two twisted pairs)	Refer to E-Bus Wiring Guidelines for maximum length
E-Bus (Non-Plenum)	22 AWG (0.34 mm <sup>2</sup> )	Twisted pair solid conductor, nonshielded or Echelon® approved shielded cable.	Level IV 140°F (60°C) rating	Honeywell AK3781 (one twisted pair) AK3782 (two twisted pairs)	Refer to E-Bus Wiring Guidelines for maximum length
Input Wiring Sensors Contacts	18 to 22 AWG (1.0 to 0.34 mm <sup>2</sup> )	Multiconductor (usually five-wire cable bundle). For runs >200 ft (61m) in noisy EMI areas, use shielded cable.	140°F (60°C) rating	Standard thermostat wire	1000 ft (305m) for 18 AWG 200 ft (61m) for 22 AWG
Output Wiring Actuators Relays	14 AWG (2.0 mm <sup>2</sup> ) (18 AWG (1.0 mm <sup>2</sup> ) acceptable for short runs)	Any pair nonshielded (use heavier wire for longer runs).	NEC Class 2 140°F (60°C) rating	Honeywell AK3702 (18 AWG) AK3712 (16 AWG) AK3754 (14 AWG) or equivalent	Limited by line-loss effects on power consumption. (See Line Loss subsection.)
Power Wiring	14 AWG (2.0 mm <sup>2</sup> )	Any pair nonshielded (use heavier wire for longer runs).	NEC Class 2 140°F (60°C) rating	Honeywell AK3754 (14 AWG) twisted pair AK3909 (14 AWG) single conductor or equivalent	Limited by line-loss effects on power consumption. (See Line Loss subsection.)

### W7761A Devices

Fig. 16 through 20 illustrate W7761A Device wiring for various configurations. Connections to the wall module terminals (4 through 6) and the communications terminals (14 and 15) are made at terminal blocks. Connection for access to the E-Bus is provided by plugging the connector into the communications jack.

NOTE: If an Excel 10 W7761A Device or Zone Manager is not connected to a good earth ground, the device internal transient protection circuitry is compromised and the function of protecting the device from noise and power line spikes cannot be fulfilled. This can result in a damaged circuit board and require replacing the device.





**Fig. 15. Attaching two or more wires at terminal blocks.**

See Table 7 for a description of the W7761A terminals.

**Table 7 . W7761A I/O Description.**

Terminal	Terminal Number	Description
OUT 8	16	Digital Output 8
OUT 7	17	Digital Output 7
OUT 6	18	Digital Output 6
OUT 5	19	Digital Output 5
OUT 4	20	Digital Output 4
OUT 3	21	Digital Output 3
OUT 2	22	Digital Output 2
OUT 1	23	Digital Output 1
+24Vac (H)	25	Power for the device
COM (N)	24	Return for power to device
E-Bus	15	Echelon® communications screw terminals
E-Bus	14	Echelon® communications screw terminals
DI -4	31	Digital Input 4
DGND	30	Digital Ground
DI -3	29	Digital Input 3
DI -2	28	Digital Input 2
DGND	27	Digital Ground
DI -1	26	Digital Input 1
22 VDC out	13	22 Vdc power supply for auxiliary devices with a maximum current of 50 mA.
AI-6	12	Analog Input 6 voltage or current
AGND	11	Analog ground
AI-5	10	Analog Input 5 voltage or current
AI-4	9	Analog Input 4 resistance
AGND	8	Analog ground
AI -3	7	Analog Input 3 resistance
AI-2	6	Analog Input 2 resistance

GROUND	5	Analog ground
AI-1	4	Analog Input 1 resistance
	3	Not Used
	2	Not Used
EGND	1	Earth Ground

See Fig. 20 to wire a pneumatic transducer to a W7761A.

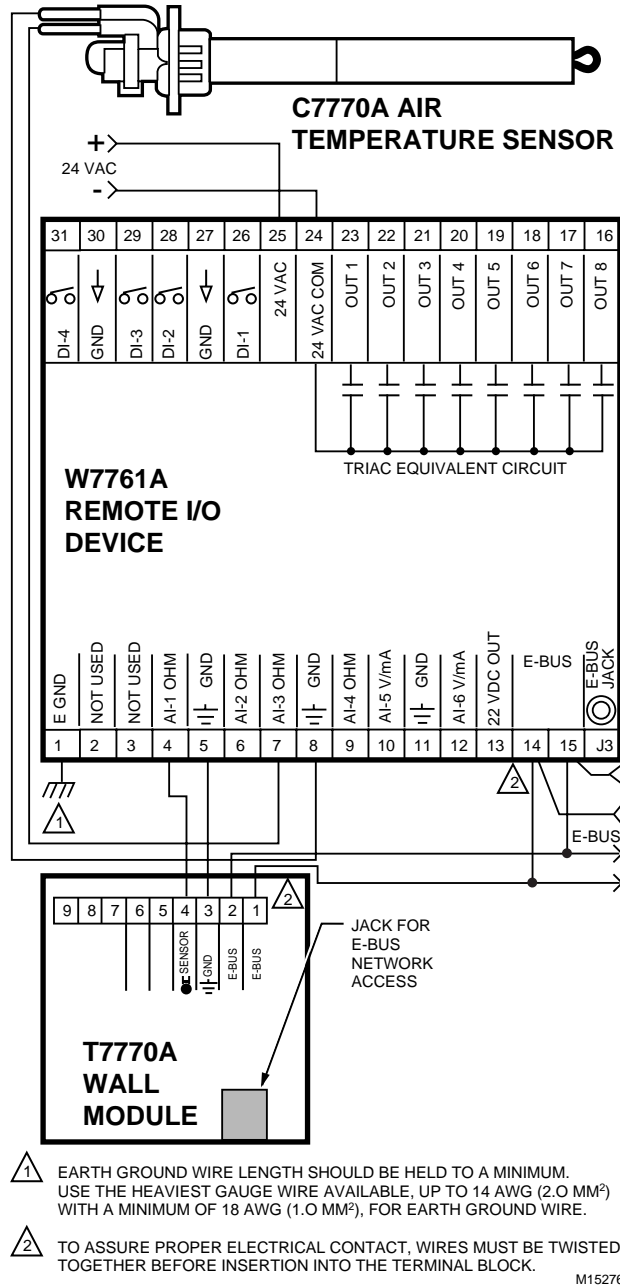
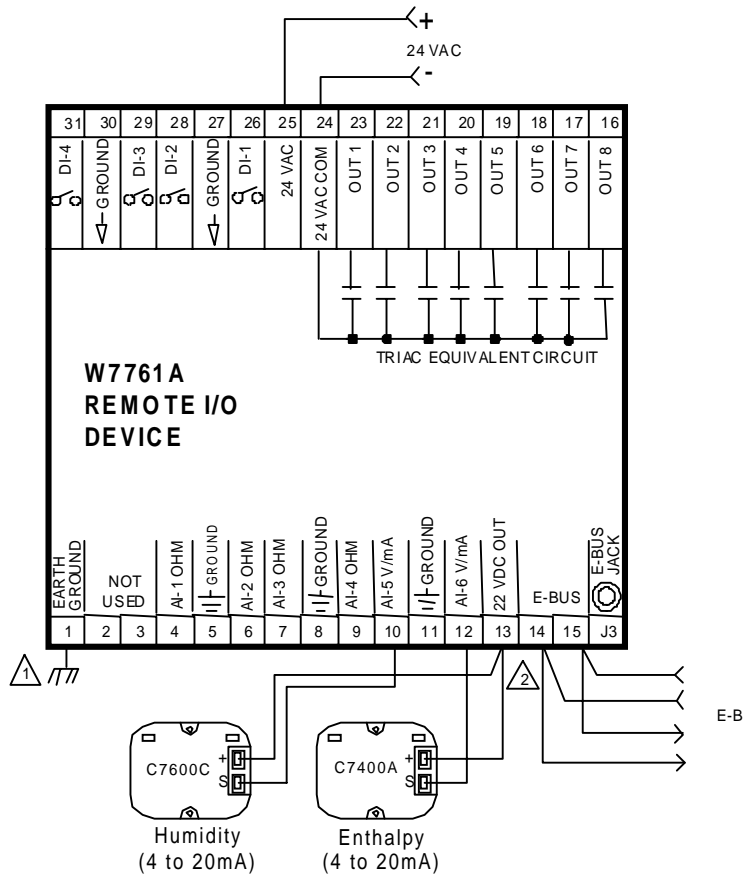


Fig. 16. Typical T7770A and C7770A wiring diagram. (For note 2, refer to Fig. 15.)



- ⚠ 1 EARTH GROUND WIRE LENGTH SHOULD BE HELD TO A MINIMUM. USE THE HEAVIEST GAUGE WIRE AVAILABLE, UP TO 14 AWG (2.0 MM<sup>2</sup>) WITH A MINIMUM OF 18 AWG (1.0 MM<sup>2</sup>), FOR EARTH GROUND WIRE.
- ⚠ 2 TO ASSURE PROPER ELECTRICAL CONTACT, WIRES MUST BE TWISTED TOGETHER BEFORE INSERTION INTO THE TERMINAL BLOCK.

Fig. 17. Typical Humidity and Enthalpy (4 to 20mA) sensor wiring diagram. (For note 2, refer to Fig. 15.)

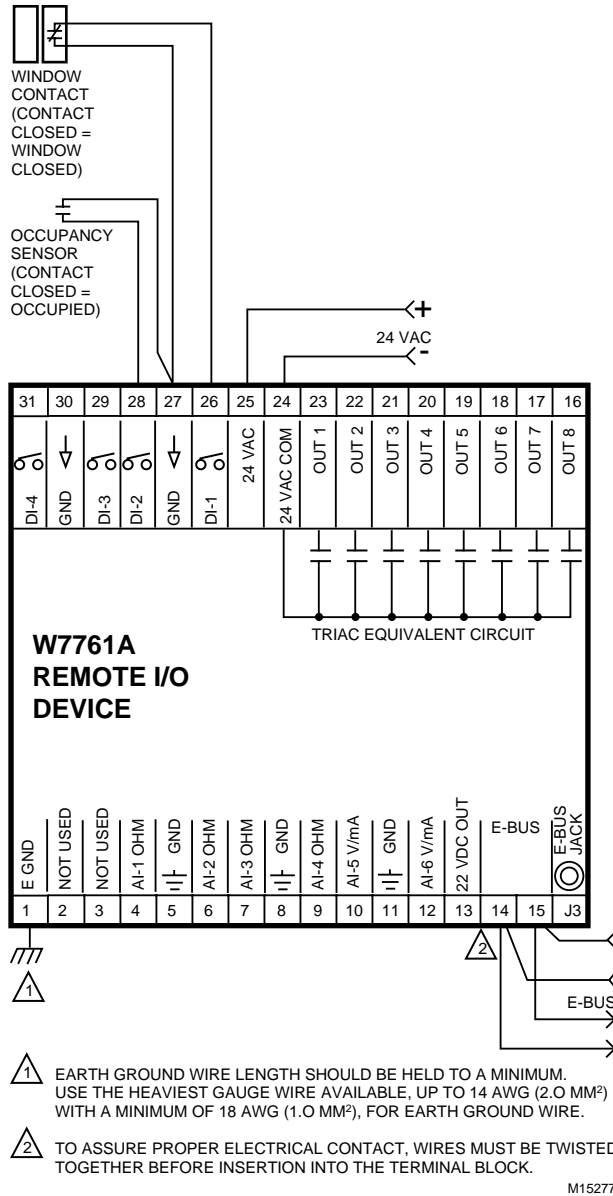


Fig. 18. Typical Window and Occupancy sensor wiring diagram. (For note 2, refer to Fig. 15.)

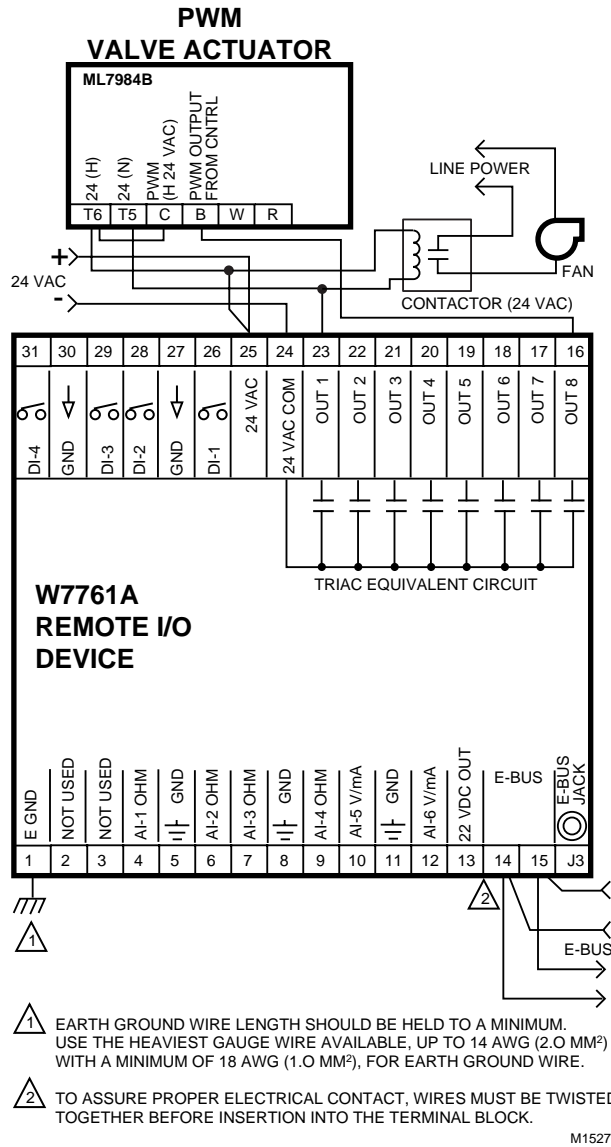
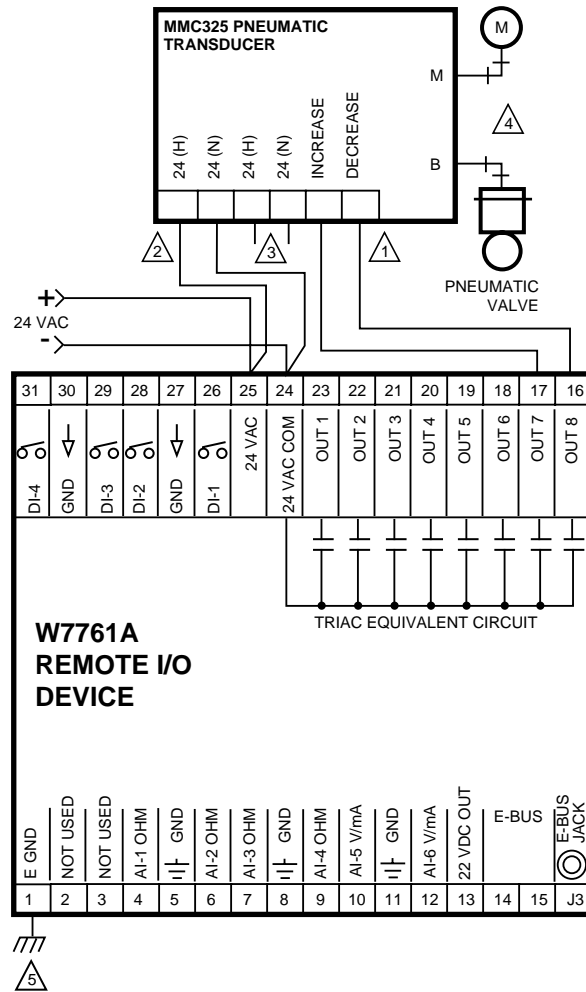


Fig. 19. Typical PWM Valve Actuator and miscellaneous fan control to W7761A. (For note 2, refer to Fig. 15.)



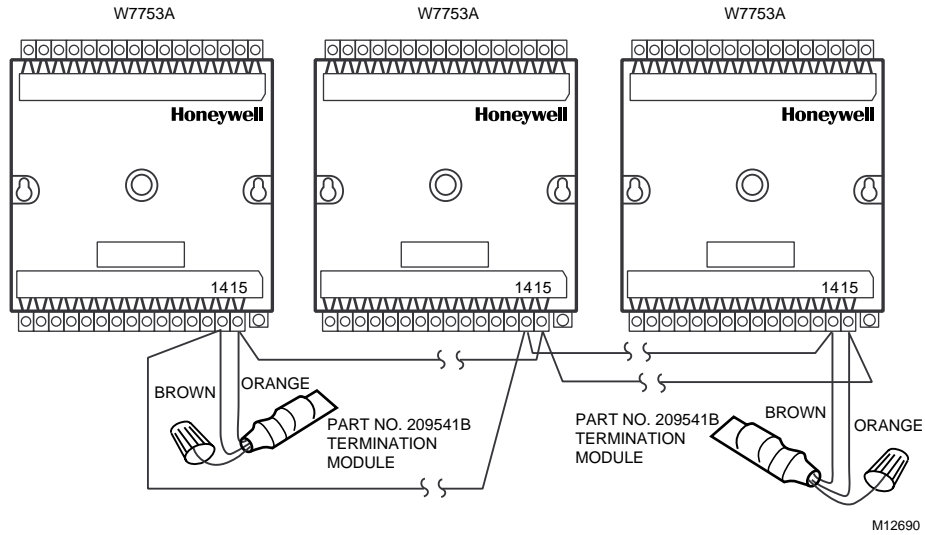
- 1 REVERSE WIRES (INCREASE/DECREASE) TO REVERSE ACTION (DIRECT/REVERSE).
- 2 MAKE SURE ALL TRANSFORMER/POWER WIRING IS AS SHOWN: REVERSING TERMINATIONS WILL RESULT IN EQUIPMENT MALFUNCTION.
- 3 OPTIONAL 24 VAC WIRING TO NEXT CONTROLLER.
- 4 USE 1/4 IN (6 MM) PNEUMATIC TUBING. MINIMUM BRANCH LINE MUST BE 6 FT. (1.8M) OR LONGER.
- 5 EARTH GROUND WIRE LENGTH SHOULD BE HELD TO A MINIMUM. USE THE HEAVIEST GAUGE WIRE AVAILABLE, UP TO 14 AWG (2.0 MM<sup>2</sup>) WITH A MINIMUM OF 18 AWG (1.0 MM<sup>2</sup>), FOR EARTH GROUND WIRE.

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Fig. 20. Typical Pneumatic transducer (Series 60 - Floating) to W7761A.

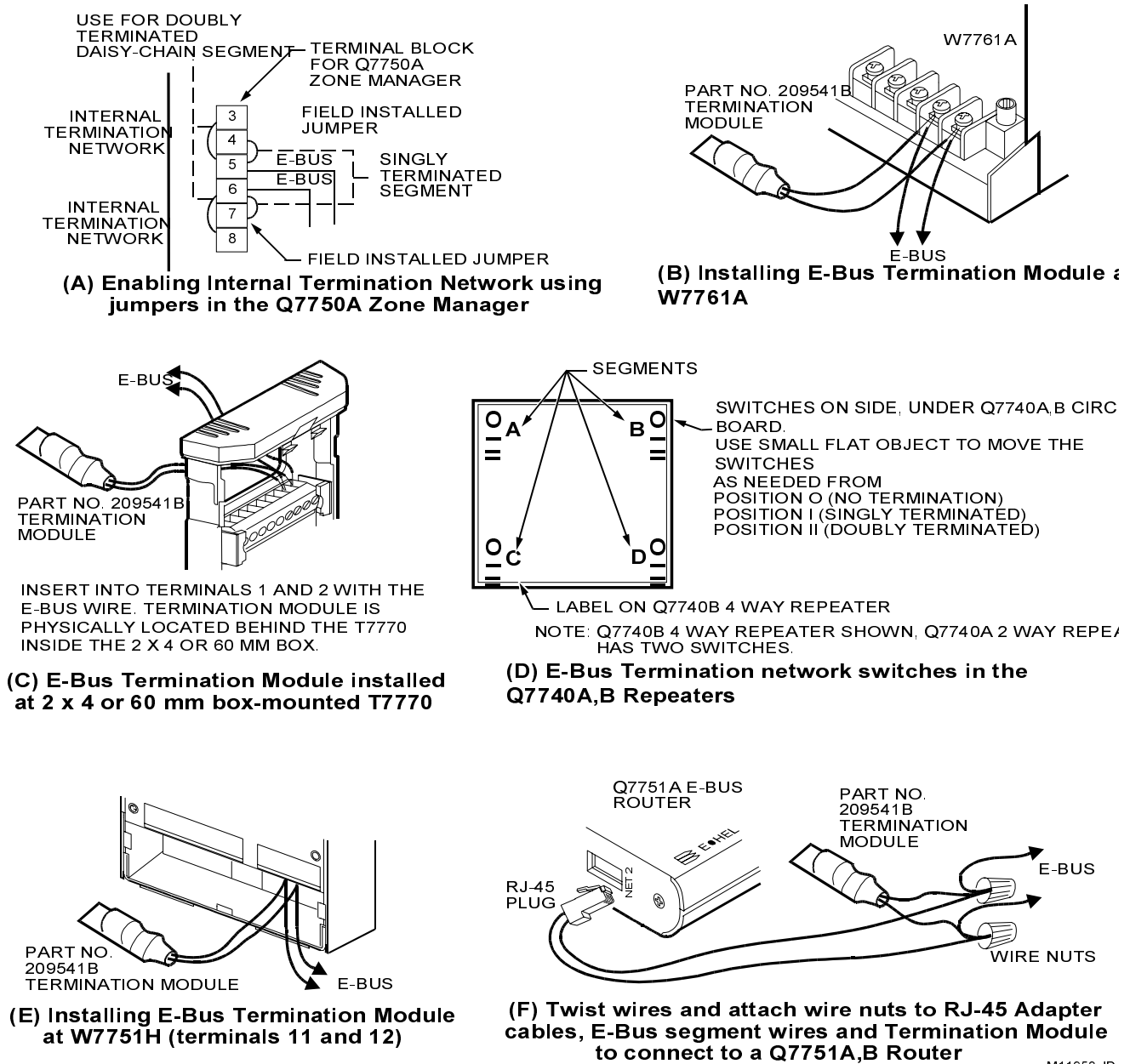
### E-Bus Termination Module

One E-Bus Termination Module, part number 209541B is required for a single terminated E-Bus or two E-Bus Termination Module, part number 209541B for a double terminated E-Bus (see Fig. 21). Refer to the E-Bus Wiring Guidelines form, 74-2865 for termination module placement rules.



**Fig. 21. Typical E-Bus termination module wiring diagrams (place a wire nut on each remaining wire that is not connected to a controller or device).**

See Fig. 22 for E-Bus termination wiring options.



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Fig. 22. E-Bus termination wiring options.



### Step 5. Order Equipment

After compiling a bill of materials through completion of the previous application steps, refer to Table 8 for ordering information. Contact Honeywell for information about Controllers and Wall Modules with no logo.

**Table 8. Excel 10 W7761A Device Ordering Information.**

Part Number	Product Description	Comments
<b>Excel 10 W7761A</b>		
W7761A2002	Remote Input/Output Device	
<b>Excel 10 W7750 Controllers:</b>		
W7750A1007	Constant Volume AHU Controller (W7750A)	—
W7750B1005	Constant Volume AHU Controller (W7750B)	—
<b>T7770 Wall Modules:</b>		
T7770A1006	Sensor with Honeywell Logo (Not used with RIO)	Used with Excel 5000 and Excel 10 Controllers
T7770A1014	Sensor with No Logo (Not used with RIO)	Used with Excel 5000 and Excel 10 Controllers
T7770A2004	Sensor with Network Jack and Honeywell Logo	Used with Excel 5000 and Excel 10 Controllers
T7770A2012	Sensor with Network Jack and No Logo	Used with Excel 5000 and Excel 10 Controllers
T7770B1004	Sensor with Setpoint and Network Jack, Honeywell Logo	Degrees F Absolute. Sensor—(current feature that can be used with the RIO Device).
T7770B1046	Sensor with Setpoint and Network Jack, Honeywell Logo	Relative Setpoint. Sensor—(current feature that can be used with the RIO Device).
T7770B1012	Sensor with Setpoint and Network Jack, No Logo	Degrees F Absolute. Sensor—(current feature that can be used with the RIO Device).
T7770B1020	Sensor with Setpoint and Network Jack, Honeywell Logo	Degrees C Absolute. Sensor—(current feature that can be used with the RIO Device).
T7770B1053	Sensor with Setpoint and Network Jack, No Logo	Relative Setpoint. Sensor—(current feature that can be used with the RIO Device).
T7770B1038	Sensor with Setpoint and Network Jack, No Logo	Degrees C Absolute. Sensor—(current feature that can be used with the RIO Device).
T7770C1002	Sensor with Setpoint, Bypass/LED and Network Jack, Honeywell Logo	Degrees F Absolute. Sensor—(current feature that can be used with the RIO Device).
T7770C1044	Sensor with Setpoint, Bypass/LED and Network Jack, Honeywell Logo	Relative Setpoint. Sensor—(current feature that can be used with the RIO Device).
T7770C1010	Sensor with Setpoint, Bypass/LED and Network Jack, No Logo	Degrees F Absolute. Sensor—(current feature that can be used with the RIO Device).
T7770C1028	Sensor with Setpoint, Bypass/LED and Network Jack, Honeywell Logo	Degrees C Absolute. Sensor—(current feature that can be used with the RIO Device).
T7770C1051	Sensor with Setpoint, Bypass/LED and Network Jack, No Logo	Relative Setpoint. Sensor—(current feature that can be used with the RIO Device).
T7770C1036	Sensor with Setpoint, Bypass/LED and Network Jack, No Logo	Degrees C Absolute. Sensor—(current feature that can be used with the RIO Device).
T7770D1000	Sensor with Bypass/LED and Network Jack, Honeywell Logo	Degrees F Absolute. Sensor—(current feature that can be used with the RIO Device).
T7770D1018	Sensor with Bypass/LED and Network Jack, No Logo	Degrees C Absolute. Sensor—(current feature that can be used with the RIO Device).
T7780A1004	Sensor, Digital Display Wall Module with Network Jack, Honeywell Logo	Degrees F Absolute (default)
T7780A1012	Sensor, Digital Display Wall Module with Network Jack, No Logo	Degrees F Absolute (default)
<b>Sensors:</b>		
C7770A1006	Air Temperature Sensor. 20 Kohm NTC nonlinearized	Duct-mounted sensor that functions as a primary and/or secondary sensor.

(continued)

Table 8. Excel 10 W7761A Device Ordering Information (Continued).

Part Number	Product Description	Comments
<b>Sensors (Continued):</b>		
C7031J1050	Averaging Discharge/Return Air Temperature Sensor. 20 Kohm NTC	Duct element cord length 12 ft. (3.7m)
C7031B1033	Discharge Air or Hot Water Temperature Sensor. 20 Kohm NTC	Use 112622AA Immersion Well
C7031C1031	Duct Discharge/Return Air Sensor. 20 Kohm	18 in. (457mm) insertion length.
C7031D1062	Hot or chilled Water Temperature Sensor. 20 Kohm NTC	—
C7031K1017	Hot or chilled Water Temperature Sensor. 20 Kohm NTC	Strap-on
C7100A1015	Averaging Discharge/Return Air Temperature Sensor. PT3000	13 in. (330mm) insertion length.
C7170A1002	Outdoor Air Temperature Sensor. PT3000	—
<b>Echelon® Based Components and Parts:</b>		
Q7750A1003	Excel 10 Zone Manager	Free Topology Transceiver (FTT)
Q7751A2002	Router	(FTT)
Q7752A2001	Serial Interface	(FTT)
Q7740A1008	Excel 10 2-Way Repeater	Used to extend the length of the E-Bus. Contains built in termination modules.
Q7740B1006	Excel 10 4-Way Repeater	Used to extend the length of the E-Bus. Contains built in termination modules.
XD 505A	Standard C-Bus Communications Submodule	—
XD 508	C-Bus Communications Submodule (1 megabit baud rate)	—
209541B	Termination Module	One or two required per E-Bus segment
205979	Operator Terminal Cable for E-Bus	Serial interface to wall module or controller
<b>Accessories:</b>		
EL7680A1008	Wall Mounted Wide View Infrared Occupancy Sensor	—
EL7628A1007	Ceiling Mounted Infrared Occupancy Sensor	—
EL7611A1003, EL7612A1001	Ultrasonic Occupancy Sensors	—
EL7630A1003, EL7621A1002, EL7621A1010	Power Supply/Control Units for Occupancy sensors	—
C7400A1004	Solid State Enthalpy Sensor (4 to 20 mA)	For outdoor and return air enthalpy
C7600B1000	Solid State Humidity Sensor (2 to 10 V)	For outdoor and return air humidity
C7600C1008	Solid State Humidity Sensor (4 to 20 mA)	For outdoor and return air humidity
C7600C1018	Solid State Humidity Sensor (2 to 10 V)	For outdoor and return air humidity
MMC325-010, MMC325-020	Pneumatic Retrofit Transducers. Select pressure range: (010) 0 to 10 psi (68.97 kPa) or (020) 0 to 20 psi (137.93 kPa).	Use to control Pneumatic reheat valves
MMCA530	DIN rail adapter for MMC325 Transducers	—
MMCA540	Metal enclosure for MMC325 Transducers	—
ML7984B3000	Valve Actuator Pulse Width Modulation (PWM)	Use with V5011 or V5013 F and G Valves
ML6161B1000	Damper Actuator Series 60	—
M6410A	Valve Actuator Series 60	Use with V5812/V5813 Valves
ML684A1025	Versadrive Valve Actuator with linkage, Series 60	Use with V5011 and V5013 Valves
ML6464A1009	Direct Coupled Actuator, 66 lb-in., Series 60	—

(continued)

Table 8. Excel 10 W7761A Device Ordering Information (Continued).

Part Number	Product Description	Comments
<b>Accessories (Continued):</b>		
ML6474A1008	Direct Coupled Actuator, 132 lb-in. torque, Series 60	—
ML6185A1000	Direct Coupled Actuator, 50 lb-in. spring return	Series 60
EL7680A1008	Wall Mounted Wide View Infrared Occupancy Sensor	—
EL7628A1007	Ceiling Mounted Infrared Occupancy Sensor	—
EL7611A1003, EL7612A1001	Ultrasonic Occupancy Sensors	—
EL7630A1003, EL7621A1002, EL7621A1010	Power Supply/Control Units for Occupancy sensors	—
C7400A1004	Solid State Enthalpy Sensor (4 to 20 mA)	For outdoor and return air enthalpy
C7600B1000	Solid State Humidity Sensor (2 to 10 V)	For outdoor and return air humidity
C7600C1008	Solid State Humidity Sensor (4 to 20 mA)	For outdoor and return air humidity
C7600C1018	Solid State Humidity Sensor (2 to 10 V)	For outdoor and return air humidity
MMC325-010, MMC325-020	Pneumatic Retrofit Transducers. Select pressure range: (010) 0 to 10 psi (68.97 kPa) or (020) 0 to 20 psi (137.93 kPa).	Use to control Pneumatic reheat valves
MMCA530	DIN rail adapter for MMC325 Transducers	—
MMCA540	Metal enclosure for MMC325 Transducers	—
ML7984B3000	Valve Actuator Pulse Width Modulation (PWM)	Use with V5011 or V5013 F and G Valves
ML6161B1000	Damper Actuator Series 60	—
M6410A	Valve Actuator Series 60	Use with V5812/V5813 Valves
ML684A1025	Versadrive Valve Actuator with linkage, Series 60	Use with V5011 and V5013 Valves
ML6464A1009	Direct Coupled Actuator, 66 lb-in., Series 60	—
ML6474A1008	Direct Coupled Actuator, 132 lb-in. torque, Series 60	—
ML6185A1000	Direct Coupled Actuator, 50 lb-in. spring return	Series 60
V5812A	Two-way terminal unit water valve; 0.19, 0.29, 0.47, 0.74, 1.2, and 1.9 C <sub>v</sub> 1/2 in. npt (13 mm) or 2.9 and 4.9 C <sub>v</sub> 3/4 in. npt (19 mm)	Use with M6410 Valve Actuator. Close-off rating for 0.19 to 1.9 C <sub>v</sub> is 65 psi; for 2.9 and 4.9, C <sub>v</sub> is 45 psi. (Coefficient of volume or capacity index C <sub>v</sub> = gallons per minute divided by the square root of the pressure drop across the valve.)
V5813A	Three-way mixing terminal unit hot water valve; 0.19, 0.29, 0.47, 0.74, 1.2, and 1.9 C <sub>v</sub> 1/2 in. npt (13 mm) or 2.9 and 4.9 C <sub>v</sub> 3/4 in. npt (19 mm)	Use with M6410 Valve Actuator. Close-off rating 0.19 to 0.74 C <sub>v</sub> is 55 psi; 1.2, and 1.9 C <sub>v</sub> is 22 psi; 2.9 and 4.9 C <sub>v</sub> is 26 psi.
R8242A	Contactors, 24 Vac coil, DPDT	—
AT72D, AT88A, AK3310, etc.	Transformers	—
EN 50 022	DIN rail 35 mm by 7.5 mm (1-3/8 in. by 5/16 in.)	Obtain locally: A controller requires 5 in.
—	Augat Inc. part number 2TK2D DIN rail (adapter)	Purchase from Augat Inc. two DIN rail adapters for each controller
—	Serial Interface Cable, male DB-9 to female DB-9 or female DB-25.	Obtain locally from any computer hardware vendor.
<b>Cabling</b>		
Honeywell AK3791 (one twisted pair) AK3792 (two twisted pairs)	E-Bus (plenum): 22 AWG (0.34 mm <sup>2</sup> ) twisted pair solid conductor, nonshielded or Echelon® approved cable.	Level IV 140°F (60°C) rating
Honeywell AK3781 (one twisted pair) AK3782 (two twisted pairs)	E-Bus (nonplenum): 22 AWG (0.34 mm <sup>2</sup> ) twisted pair solid conductor, nonshielded or Echelon® approved cable.	Level IV 140°F (60°C) rating
Honeywell AK3725	Inputs: 18 AWG (1.0 mm <sup>2</sup> ) five wire cable bundle	Standard thermostat wire

(continued)

**Table 8. Excel 10 W7761A Device Ordering Information (Continued).**

Part Number	Product Description	Comments
<b>Cabling (Continued):</b>		
Honeywell AK3752 (typical or equivalent)	Outputs/Power: 14 to 18 AWG (2.0 to 1.0 mm <sup>2</sup> )	NEC Class 2 140°F (60°C) rating
Honeywell AK3702 (typical or equivalent)	18 AWG (1.0 mm <sup>2</sup> ) twisted pair	Non-plenum
Honeywell AK3712 (typical or equivalent)	16 AWG (1.3 mm <sup>2</sup> ) twisted pair	Non-plenum
Honeywell AK3754 (typical or equivalent)	14 AWG (2.0 mm <sup>2</sup> ) two conductor	Non-plenum

## Step 6. Configure Devices

Excel E-Vision PC Software is used to configure W7761A Devices to match their intended application. The E-Vision User Guide form, 74-2588 provides details for operating the PC software.

## Step 7. Troubleshooting

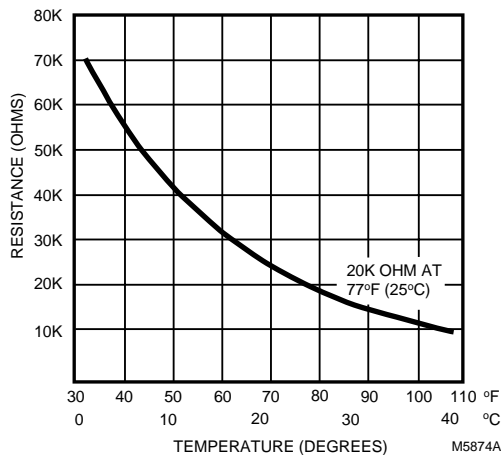
### Troubleshooting Excel 10 Controllers and Wall Modules

In addition to the following information, refer to the Installation Instructions and Checkout and Test manual for each product. See the Applicable Literature section for form numbers.

### Temperature Sensor and Setpoint Potentiometer Resistance Ranges

The T7770 Wall Module or the C7770A Air Temperature Sensor has the following specified calibration points, which are plotted in Fig. 23:

Temperature (°F)	Resistance Value (ohms)
99	11,520
85	16,301
70	24,039
55	36,280
45	48,000



**Fig. 23. Temperature sensor resistance plots.**

## Alarms

When an Excel 10 has an alarm condition, it reports it to the central node on the E-Bus (typically, the Excel 10 Zone Manager). See Table 9. Information contained in an alarm message is:

- **Subnet Number:**  
E-Bus subnet that contains the Excel 10 node that has the alarm condition. Subnet 1 is on the Zone Manager side of the router; Subnet 2 is on the other side.
- **Node Number:**  
Excel 10 node that has the alarm condition (see Network Status).
- **Alarm Type:**  
Specific alarm being issued. An Excel 10 can provide the alarm types listed in Table 9.

**Table 9. Excel 10 Alarms.**

Name of alarm or error bit	Alarm type number	Meaning of alarm code or error bit
RETURN_TO_NORMAL	128U	Return to no alarm after being in an alarm condition. This code is added numerically to another alarm code to indicate that the alarm condition has returned to normal.
ALARM_NOTIFY_DISABLED	255U	The alarm reporting has been turned off by the DestManMode. No more alarms are reported via nvoAlarm until DestManMode turns on alarm report or upon application restart.
NO_ALARM	0	No alarms presently detected.
INPUT_NV_FAILURE	1	One or more NV inputs have failed in receiving an update within their spec FAILURE_DETECT_TIME.
NODE_DISABLED	2	The control algorithm has stopped because the RIO device is in DISABLED_MODE, MANUAL, or FACTORY_TEST mode. No more alarms reported when the device is in the DISABLED_MODE. Alarms continue to be reported if the device is in the MANUAL or FACTORY_TEST mode. The control is shut down and disabled until power is cycled or the node is reset. See note 1 below.
SENSOR_FAILURE	3	One or more sensors have failed.

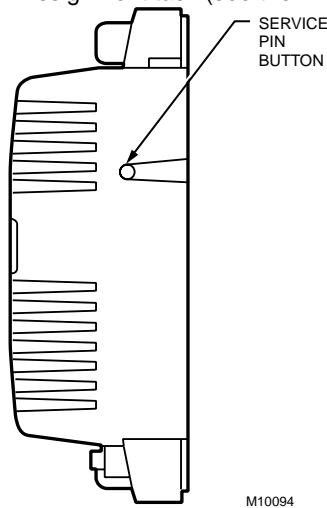
NOTE: The node can be reset by switching the node to MANUAL and then to the normal operating mode.

Also, the Excel 10 variables, *AlarmLogX* where *X* is 1 through 5, that store the last five alarms to occur in the device, are available. These points can be viewed through XBS or E-Vision.

### Broadcasting the Service Message

The Service Message allows a device on the E-Bus to be positively identified. The Service Message contains the device ID number and, therefore, can be used to confirm the physical location of a particular Excel 10 in a building. There are two methods of broadcasting the Service Message from an Excel 10 W7761A Device. One uses a hardware service pin button on the side of the device (see Fig. 24). The other involves using the PC Configuration tool, as follows.

The commissioning tool is used to perform the ID Assignment task (see the E-Vision User's Guide form, 74-2588).



**Fig. 24. Location of the Service Pin Button.**

### W7761A Device Status LED

The LED on the front and center of a W7761A Device provides a visual indication of the status of the device. See Fig. 25. When the W7761A receives power, the LED should appear in one of the following allowable states (see Table 10):

Table 10. LED States.

Alarm Condition	Hardware or Software Failure	Service LED Blink Rate (Cycles per second)
None	None	1
Any alarm condition	None	2
Don't Care	Failed	steady ON or OFF

1. Off—no power to the processor.
2. Continuously On—processor is in initialized state.
3. Slow Blink—controlling, normal state.
4. Fast Blink—when the Excel 10 has an alarm condition.

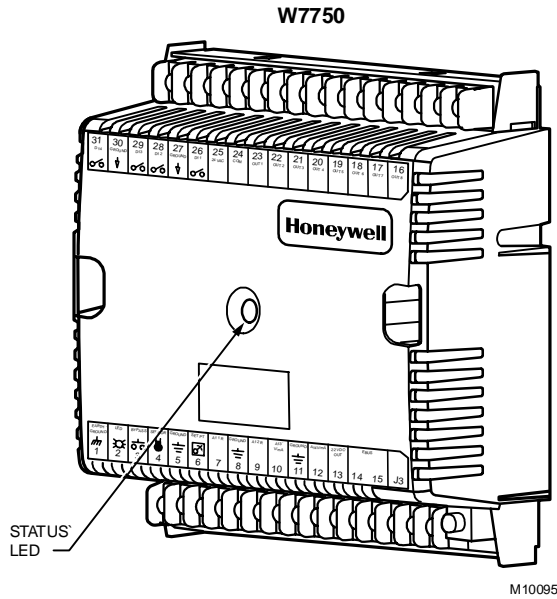


Fig. 25. LED location on W7761A.

### T7780 DDWM Bypass Pushbutton

See Fig. 26 for the T7780 DDWM bypass pushbutton location (occupied or unoccupied). The T7780 DDWM has two methods for generating its neuron ID, shorting two pads or winking.

1. Pressing the bypass pushbutton whenever a Carat (∇) on the bottom of the LCD display is flashing (Menu Selection Mode).
2. Pressing the bypass pushbutton when the T7780A DDWM is in wink mode (LCD display shows **WINK** when E-Vision sends a Service Message out on the E-Bus).

When the space covered by the T7780 DDWM is in Occupied mode, the sun symbol is shown on the left side of the LCD display. When the space is in Standby mode, the half-sun symbol is shown. When the space is in Unoccupied mode, the moon symbol is shown.

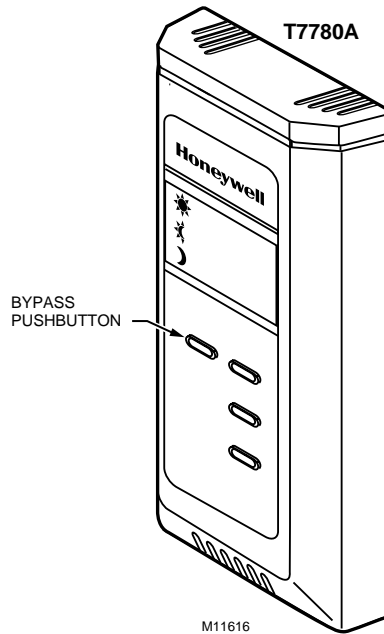


Fig. 26. Bypass pushbutton location on T7780 DDWM.

## APPENDICES

### Appendix A. Using E-Vision to Commission a W7761 Device.

CARE/E-Vision must be used to configure the W7761 device. The inputs and outputs will be configured through the application selection menu (see E-Vision user guide form, 74-2588). The RIO does not contain control loops for directly controlling the digital outputs, therefore the Zone Manager or some other device has to be bound to the outputs to perform the control function. Refer to the CARE User's Manual form, 74-5587 to add Control Strategy, Switching Logic, or Time Programs for control of the RIO digital outputs. Refer to the E-Vision user guide (form, 74-2588 for the RIO commissioning procedure and updating/downloading of the Zone Manager files.

NOTE: The RIO device does not synchronize the floating digital outputs. This function (position is synchronized whenever an endpoint is reached (full open or full close), and when the elapsed time since the last synchronization is 24 hours) must be done by the controlling device (such as the Zone Manager).

### SENSOR CALIBRATION

The resistive temperature sensors and *voltage/current* inputs can all be calibrated. The wall module setpoint potentiometer *is not supported on the W7761A*. Perform the sensor calibration by adding an offset value (either positive or negative) to the sensed value using E-Vision menus (see E-Vision user guide form, 74-2588). When calibrating voltage/current sensors on the W7761A, the offset amount entered by the user is in volts, regardless of the inputs actual engineering units. See Appendix E for information on how to derive the proper voltage value to enter as an offset during calibration.

### CUSTOM MAPPING

The RIO default CARE plant contains all available points that are supported on the RIO device. If the RIO plant was customized by deleting unused points, then the Custom mapping feature will have to be used to add points back into the plant so that they can be used or monitored by other devices. The following procedures will describe the Custom mapping process for adding analog/digital inputs and digital outputs.

#### ADDING ANALOG INPUTS - ENTHALPY (4 to 20 mA)

To add an enthalpy (outdoor or return air) sensor to an RIO plant, the user must add a software point (pseudo analog) that can be mapped to the actual hardware input through the Custom Mapping function of E-Vision. The following procedure will instruct the user on adding the pseudo analog and using the Custom Mapping function. This allows the enthalpy input to be used with other Excel 10 controllers (referenced) on the E-Bus, used in Zone Manager control strategy or switching logic, or be used with Excel 5000 controllers on the C-Bus.

1. With CARE running, open an existing RIO plant. The user can go into either switching logic or control strategy to add the pseudo analog point. If the user does not have an existing control loop through control strategy, use switching logic to add the pseudo point, otherwise a control loop will have to be created along with unnecessary RACL to add the point.

This procedure will use switching logic to add the pseudo analog point. With the RIO plant having the focus, go into switching logic. Select the *Software Points* menu item and then *Pseudo Analog*. The *Create/Select Software Point <Va>* dialog box will be displayed. Type in a New point name for the enthalpy sensor (such as *OaEnthalpy*) and click on the *OK* button. The new point that was just created will be added to the screen as the header point for switching logic table and also added to the *Point List*. Select the *Cancel* button to exit the *Create/Select Software Point <Va>* dialog box. Exit switching logic by selecting the *File* menu item and *Exit*. CARE will display the *Delete Unused Software Points* list box. Click the *Cancel* button to continue.

2. Go into the *Data Point Editor (Controller/Edit/Data Point Editor)* and under *Point* select the pseudo analog point that was just created and click the *OK* button. Select the drop down list for the *Engineering Unit* and scroll through the list until the mA (mA matches the engineering unit of the RIO input) engineering units are displayed. Select the mA engineering unit that is shown with one decimal place (number 66) and click the *OK* button to save the selection. Cancel the *User Address* list box and select *File/Exit* to exit out of the Data Point Editor.
3. Translate the Zone Manager and Export the Zone Manager files to E-Vision by selecting the *Project* and *Export to E-Vision* menu items. Type in the name of the Zone Manager Export file when the *Export Zone Manager* dialog box is displayed. Select the project and the Zone manager within that project that is being exported and click the *Export* button. Exit CARE and Start E-Vision. Select the E-Vision project to open and the CARE Export Filename created above. Once the project is open, select the RIO device that the enthalpy sensor is connected to and go into the *Application Selection* screen (offline) by selecting the *Controller*, then the *Application Selection* menu items. From the *Inputs* tab of the *Application Selection* dialog box, add *Oa\_Enthalpy* to either analog input 5 or 6 and select the *OK* button to save the selection.
4. Select the *Controller* menu item and then *Import* from CARE to import the Zone Manager files with the new pseudo analog point. If this function has already been performed before, the user will be prompted with the message CARE Export File has already been imported, do you want to import again?. Select *Yes* to continue with the Import. When the import is finished, E-Vision displays the message CARE Export File has been imported. Select *OK* to continue.
5. Select the *Network* menu item and then *Map C-Bus Points*. Select *RIO1* as the Controller Type from the *Map C-Bus Points* dialog box. Under *Unmapped CARE*, select the name of the RIO device that the enthalpy sensor was added to in CARE. Under *Unmapped Excel 10*, select the name of the RIO device that the actual enthalpy sensor was added to (both names should be the same). Next, select the *Custom* button and the *Custom Mapping CARE Points* dialog box will be displayed. Select the *OaEnthalpy* point under *CARE Points* and *CurrentAI* under *Excel 10*. CurrentAI is the user address in the RIO device that contains the actual sensor value for the OaEnthalpy (C7400A1004, 4 to 20 mA device). Select the *Map* button to add the OaEnthalpy point to the list of *Mapped Points*. Click on the *Close* button to exit the *Custom Mapping CARE Points* dialog box. Click on the *Close* button to exit the *Map C-Bus Points* dialog box.
6. To use the OaEnthalpy custom mapped point with other Excel 10 controllers on the E-Bus, select the *Network* menu item and *Refer Excel 10 Points*. Select the RIO device name as the *Source Excel 10* and then scroll down the list of *Excel 10 Points*: until you reach *CurrentAI* and select it. Select an Excel 10 controller from the *Destination Excel 10* list. For example if the user had selected a CVAHU controller from the *Destination Excel 10* list, the user would select from the *Excel 10 Points* list as the destination point and then click on the *Add* button to add the point association (Binding) between the RIO and CVAHU controllers. If *DestOaEnth* is already being used in an association, then the message *At Least one of the output network variables is in an existing connection and E-Vision will not allow this association to be added*. In order to add this association, the user has to remove any other associations with the *DestOaEnth* point. Select the *Close* button to exit out of the *Refer Excel 10 Points* dialog box. Any controllers involved in the new association or change in an existing association will require commissioning.
7. Select the *Controller* menu item and the *Update Zone Manager Files*. E-Vision will add the custom mapping information to the Zone Manager files. When the *Update Zone Manager Files* function is done, commission any controllers that need to be commissioned, then close the E-Vision project and exit out of E-Vision.
8. Start CARE and open the Zone Manager that was just updated through the *Update Zone Manager Files* function and start XI584 by selecting the *Controller, Tools and XI584* menu items. Once XI584 is started, select the *Utilities* and *File Transfer* menu items and select *CARE Import*. Select the project and the Zone Manager that was just updated and select *Import* and click *OK* on the *Select Target Controller* dialog box. When the CARE Import is complete, close the *CARE Import* dialog box. If this is the initial loading of the Zone Manager, then it will have to be reset and the CPU address set by the XI581 Emulation function (*Applications, XI581 Emulation* menu). Select the *Utilities, File Transfer* menu items and select *Download*. The *Download* dialog box will be displayed. Check the *All* selection and click the *Controller* button. When the *Select Controller/Subsystem* dialog box is displayed, make sure that the correct CPU address or name is high lighted and select the *OK* button. Click the *Download* button and click *Yes* to the message *Replace updated application part in controller (CPU address or Controller name)*. When the download is complete, exit out of the *Download* dialog box. From the XI584 main menu, select the *Data, Access by User Address* menu items. Type *OaEnthalpy* in the *Search For User Address* and click the *Search* button. When the *OaEnthalpy* point displays in the *User Addresses* list, click on the point and select the *Attributes* button. XI584 will now display the value of the enthalpy sensor connected to the RIO device. This point can now be used in the Zone Manager control strategy or switching logic. This point can be used in other Excel 5000 (C-Bus) controllers by assigning a global analog point in the destination controller with the user address name of *OaEnthalpy*. Refer to the CARE User's Manual form, 74-5587 for information on creating global points in Excel 5000 controllers.

## ADDING OTHER VOLTAGE/CURRENT SENSORS

See Table A-1 for the supported Voltage/Current analog input sensors that can be connected to the RIO Device. The user must add a software point (pseudo analog - in RIO CARE Plant) that can be mapped to the actual hardware input (RIO Plant) through the Custom Mapping function of E-Vision. The procedure described previously for adding an enthalpy ( 4 to 20 mA) sensor should be followed and instructs the user on adding the pseudo analog point in the RIO CARE Plant and using the



Custom Mapping function. From there it can be used with other Excel 10 controllers (referenced) on the E-Bus, that are used in the Zone Manager control strategy or switching logic, or are used with Excel 5000 controllers on the C-Bus.

**Table A-1. Supported Voltage And Current Input Sensors.**

E-Vision Enumerated Name in the Input Application Selection Tab	RIO Network Variable that contains the Hardware Input Value
RA_Hum_C7600C	Humidity1 or Humidity2
OA_Hum_C7600C	Humidity1 or Humidity2
Filter_Diff_Pres	Pressure1 or Pressure2
RA_Hum_C7600B	Humidity1 or Humidity2
OA_Hum_C7600B	Humidity1 or Humidity2
RA_Enthalpy	CurrentAI
OA_Enthalpy	CurrentAI
Space_CO2	CO2Level
Voltage_Monitor	VoltageAI

**ADDING DIGITAL INPUTS**

See Table A-2 for the supported Digital input types that can be connected to the RIO Device. The user must add a software point (pseudo digital nstate - in RIO CARE Plant) that can be mapped to the actual hardware input (RIO Plant) through the Custom Mapping function of E-Vision. The procedure described previously for adding an enthalpy ( 4 to 20 mA) sensor should be followed. The user will add a *Pseudo Digital nstate point (<Vd>)* in step one instead of the Pseudo Analog to the RIO CARE Plant and then use the Custom Mapping function. From there it can be used with other Excel 10 controllers (referenced) on the E-Bus, that are used in Zone Manager control strategy or switching logic, or are used with Excel 5000 controllers on the C-Bus.

**Table A-2. Supported Digital Input Types.**

E-Vision Enumerated Name in the Input Application Selection Tab	RIO Network Variable that contains the Hardware Input Value
Digital Input 1: Active_Short / Active_Open	SrcDigIn1Sts
Digital Input 2: Active_Short / Active_Open	SrcDigIn2Sts
Digital Input 3: Active_Short / Active_Open	SrcDigIn3Sts
Digital Input 4: Active_Short / Active_Open	SrcDigIn4Sts

**ADDING DIGITAL OUTPUTS**

See Table A-3 for the supported digital output types that can be connected to the RIO Device. The user must add a software point (pseudo analog) that can be mapped to the actual hardware output through the Custom Mapping function of E-Vision. The following procedure will instruct the user on adding the pseudo analog and using the Custom Mapping function so that the Digital Output can be used in the Zone Manager control strategy or switching logic, or be used with Excel 5000 controllers on the C-Bus.

1. With CARE running, open an existing RIO plant. The user can go into either switching logic or control strategy to add the pseudo analog point. If the user does not have an existing control loop through control strategy, use switching logic to add the pseudo point, otherwise a control loop will have to be created along with unnecessary RACL to add the point. This procedure will use switching logic to add the pseudo analog point. With the RIO plant having the focus, go into switching logic. Select the *Software Points* menu item and then *Pseudo Analog*. The *Create/Select Software Point <Va>* dialog box will be displayed. Type in a New point name for the Digital Output (such as *MiscExhFan*) and click on the *OK* button. The new point that was just created will be added to the screen as the header point for switching logic table and also added to the *Point* list. Select the *Cancel* button to exit the *Create/Select Software Point <Va>* dialog box. Exit switching logic by selecting the *File* menu item and *Exit*. CARE will display the *Delete Unused Software Points* list box. Click the *Cancel* button to continue.
2. Go into the *Data Point Editor (Controller/Edit/Data Point Editor)* and under *Point* select the pseudo analog point that was just created and the *OK* button. Select the drop down list for the *Engineering Unit* and scroll through the list until the *Pct engineering units* are displayed. Select the Pct engineering unit that is shown with one decimal place (number 55) and the *OK* button to save the selection. *Cancel* the *User Address* list box and select *File/Exit* to exit out of the *Data Point Editor*.
3. Translate the Zone Manager and Export the Zone Manager files to E-Vision by selecting the *Project* and *Export* to E-Vision menu items. Type in the name of the Zone Manager Export file when the *Export Zone Manager* dialog box is

displayed. Select the project and the Zone manager within that project that is being exported and the *Export* button. Exit CARE and Start E-Vision. Select the E-Vision project to open and the CARE Export Filename created previously. Once the project is open, select the RIO device that the Digital Output is connected to and go into the *Application Selection* screen (offline) by selecting the *Controller, Application Selection* menu items. From the *Outputs* tab of the *Application Selection* dialog box, select the first Unused\_DigOutput and scroll up until *Discrete1* is displayed and select it. Select the *OK* button to save the selection.

4. Select the *Controller* menu item and then *Import* from CARE to import the Zone Manager files with the new pseudo analog point. If this function has already been performed before, the user will be prompted with the message *CARE Export File has already been imported, do you want to import again?*. Select *Yes* to continue with the Import. When the import is finished, E-Vision displays the message *CARE Export File has been imported*. Select *OK* to continue.
5. Select the *Network* menu item and then *Map C-Bus Points*. Select *RIO1* as the Controller Type from the *Map C-Bus Points* dialog box. Under *Unmapped CARE*, select the name of the RIO device that the Digital Output was added to in CARE. Under *Unmapped Excel 10*, select the name of the RIO device that the actual Digital Output was added to (both names should be the same). Next, select the *Custom* button and the *Custom Mapping CARE Points* dialog box will be displayed. Select the *MiscExhFan* point under *CARE Points* and *DigOut1Cmd* under *Excel 10*. Select the *Map* button to add the *MiscExhFan* point to the list of *Mapped Points*. Click on the *Close* button to exit the *Custom Mapping CARE Points* dialog box. Click on the *Close* button to exit the *Map C-Bus Points* dialog box.
6. Re-commission the RIO device that had the custom mapping done.
7. Select the *Controller* menu item and the *Update Zone Manager Files*. E-Vision will add the custom mapping information to the Zone Manager files. When the Update Zone Manager Files function is done, close the E-Vision project and exit out of E-Vision.
8. Start CARE and open the Zone Manager that was just updated through the *Update Zone Manager Files* function and start XI584 by selecting the *Controller, Tools* and *XI584* menu items. Once XI584 is started, select the *Utilities, File Transfer* menu items and select *CARE Import*. Select the project and the Zone Manager that was just updated and select *Import* and click *OK* on the *Select Target Controller* dialog box. When the CARE Import is complete, close the *CARE Import* dialog box. If this is the initial loading of the Zone Manager, then it will have to be reset and the CPU address set by the XI581 Emulation function (*Applications, XI581 Emulation* menu). Select the *Utilities, File Transfer* menu items and select *Download*. The *Download* dialog box will be displayed. Check the *All* selection and click the *Controller* button. When the *Select Controller/Subsystem* dialog box is displayed, make sure that the correct CPU address or name is highlighted and select the *OK* button. Click the *Download* button and *Yes* to the message *Replace updated application part in controller (CPU address or Controller name)*. When the download is complete, exit out of the *Download* dialog box. From the *XI584* main menu, select the *Data, Access by User Address* menu items. Type *MiscExhFan* in the *Search For User Address* and click on the *Search* button. When the *MiscExhFan* point displays in the *User Addresses* list, click on the point and select the *Attributes* button. XI584 will now display the value of the Digital Output connected to the RIO device. To command the *MiscExhFan* to the *On* mode, put the point in the *Manual* mode and enter a value of *1.0* or *greater*. To command the *MiscExhFan* to the *Off* mode, put the point in the *Manual* mode and enter a value of *0.0*. This point can now be used in the Zone Manager control strategy or switching logic and Time Programs. This point can be used in other Excel 5000 controllers (C-Bus) by assigning a global analog point in the destination controller with the user address name of *MiscExhFan*. Refer to the CARE User's Manual form, 74-5587 for information on creating global points in Excel 5000 controllers.

**Table A-3. Supported Digital Output Types.**

E-Vision Enumerated Name in the Output Application Selection Tab	RIO Network Variable that contains the Hardware Output Value
Float1_Open through Float8_Open (Series 60 - requires two outputs assigned. Float1_Open must be assigned before Float1_Close)	DigOut1Cmd through DigOut8Cmd
Float1_Close through Float8_Close (Series 60 - requires two outputs assigned. Float1_Open must be assigned before Float1_Close)	DigOut1Cmd through DigOut8Cmd
Discrete1 through Discrete8 (Maintained On/Off outputs)	DigOut1Cmd through DigOut8Cmd
Modulate1 through Modulate8 (PWM outputs)	DigOut1Cmd through DigOut8Cmd

## Appendix B. Sequences of Operation.

### Common Operations

The Excel 10 W7761A Device contains inputs and outputs, but no control software. All control that would be associated with the inputs and outputs in the W7761A would be accomplished through the Excel Zone Manager and would not be suitable for VAV control, temperature control, or any control function that would require less than a 30 second update rate. The analog and digital sensors could be shared or bound to other Excel 10 controllers on the E-Bus or Excel 5000 controllers on the C-Bus through the Excel 10 Zone Manager. This would allow the other Excel 10 controllers to use their physical inputs for monitoring other elements such as return humidity, IAQ, etc. to achieve better control.

### Room Temperature Sensor (RmTemp)

The T7770A,B,C,D wall module is the room space temperature sensor—(current feature that can be used with the RIO Device). When it is configured, it provides the temperature input that can be shared with the W7750 or W7751 controllers. If there are multiple space sensors in a area controlled by one W7750 CVAHU, then the space temperatures can be wired into the W7761A controller and mapped to the Zone Manager. The Zone Manager can average all of the space temperatures and then have that value can be bound to the W7750 controlling that area.

### Window Sensor (StatusWndw)

The digital input for a window contact can be wired into the W7761A device and then bound to a W7750 CVAHU to disable its temperature control algorithm if someone has opened a window or door in the room or area that the W7750 is serving. When a window is detected to be Open (digital input contacts Open equals window open), the normal temperature control is disabled, and the W7750 Controller enters the Freeze Protect mode. Freeze Protect mode sets the space setpoint to 50 °F (10°C) and brings on the fan and heat if the space temperature falls below this setpoint. Normal temperature control resumes on window closure.

### Dirty Filter Monitor

The air filter in the air handler can be monitored by a digital input in the W7761A and an alarm issued by the Zone Manager when the filter media needs replacement. The two methods of monitoring the filter are:

1. A differential pressure switch whose contacts are connected to a digital input on the W7761A and;
2. A 2 to 10V differential pressure sensor wired to a voltage input on the W7761A. If the analog input sensor is used, its measured value 0 to 5 inw (0 to 1.25 kPa) is compared to a user-selectable setpoint in the Zone Manager, the comparison is done in the Zone Manager - valid range: 0 to 5 inw (0 to 1.25 kPa), and the Dirty Filter alarm is issued by the Zone Manager when the pressure drop across the filter exceeds the setpoint.

### Series 60 Modulating Control

Series 60 Control is also commonly referred to as Floating Control. The Excel 10 W7761A Device can drive Series 60 type actuators to control a modulating damper or valve actuator. The W7761A device contains no control software, so these outputs would have to be bound to either the Zone Manager or other Excel 10 controllers. When floating control is used, the full-stroke motor drive time of the actuator must be entered into the configuration parameter DO1FISpeed (for output 1), DO2FISpeed (for output 2). When Floating control is configured, two digital outputs are required, so the user has to change the configuration parameter for the appropriate digital outputs.

### Pulse Width Modulating (PWM) Control

The Excel 10 W7761A device can drive a PWM-type actuator to control a modulating actuator. The W7761A device contains no control software, so these outputs would have to be bound to either the Zone Manager or other Excel 10 controllers. PWM control positions the actuator based on the length, in seconds, of the pulse from the digital output. The controller outputs a pulse whose length consists of two parts, a minimum and a maximum. The minimum pulse time represents the analog value of zero percent (also indicates a signal presence) and the maximum pulse length that represents an analog value of 100 percent. If the analog value is greater than zero percent, an additional time is added to the minimum pulse time. The length of time added is directly proportional to the magnitude of the analog value. If PWM control is used, the configuration parameters for the PWM operation must be specified. These parameters are DO1PWMPeriod and PWMZeroScale, and PWMFullScale.

Example: To find the pulse width of a valve actuator (for example stroke mid position - 50 percent) with the PWMZeroScale = 0.1 seconds, PWMFullScale = 25.5 seconds, and the PWMPeriod = 25.6 seconds. There are 256 increments available, so the number of increments required for 50 percent would be  $(0.5 \times 256)$  or 128. The time for each increment for this industry standard pulse time is 0.1 seconds. The pulse width is the minimum time (0.1 second) + the number of increments (128 times the seconds added 0.1) = 12.9 seconds. The W7750B Controller would command the valve output on for 12.9 seconds every 25.6 seconds to maintain the valve position at 50 percent.

### Indoor Air Quality (IAQ) Override

The Excel 10 W7761A Device can monitor an IAQ sensor and that input can be bound to a W7750 CVAHU Controller that supports an IAQ override feature, that upon detection of poor air quality in the space, allows the economizer dampers to be opened above the standard minimum position setting to a value set in EconIAQPos (parameter located in W7750). Two different methods of detecting poor air quality are supported, The first is by using an IAQ switch device connected to a digital input on the W7761A Device, where a contact closure indicates poor air quality. This digital input would then be bound to the W7750 Controller that is serving the area being monitored and would initiate the IAQ override mode. The second is through an analog input that connects to a CO<sub>2</sub> Sensor (0 to 10V). The measured value of CO<sub>2</sub> from this sensor (0 to 2000 ppm) is mapped into the Zone Manager where it is compared to a setpoint (parameter located in the Zone Manager). When the CO<sub>2</sub> level is higher than the setpoint, the Zone Manager can initiate an IAQ alarm. A pseudo digital point in the Zone Manager can be bound to the W7750 CVAHU Controller which can initiate the IAQ override mode.

## Appendix C. Complete List of Excel 10 W7761A Remote I/O Device User Addresses.

- C1. Input/Output Points.
- C2. Control Parameters.
- C3. Status Points.
- C4. Configuration Parameters.
- C5. Direct Access And Special Points.

Table C0 lists the applicable Engineering Units for the analog points found in the W7761A.

**Table C0. Engineering Units For Analog Points.**

Measured Item	English Units (Inch-Pound)		Standard International Units (SI)	
	Description	Abbreviation	Description	Abbreviation
Temperature	Degrees Fahrenheit	F	Degrees Celsius	C
Relative Temperature	Delta Degrees Fahrenheit	DDF	Degrees Kelvin	K
Relative Humidity	Percent	%	Percent	%
Air Flow	Cubic Feet per Minute	CFM	Meters cubed per hour	m3h
CO <sub>2</sub> Concentration	Parts Per Million	PPM	Parts Per Million	PPM
Enthalpy	British Thermal Units per Pound of Air	btu/lb	kiloJoules/kilogram	kJ/kg
Differential Pressure	Inches of Water Column	inw	kiloPascal	kPa

Tables C1 through C5 list all network variables associated with the W7761A Controller and the default User Address names. Table C1 lists the Network Variable Inputs and Outputs, which are stored in RAM memory. Table C2 lists the Control Parameters, which are the values stored in the controllers EEPROM memory.

NOTE: Table C2. User Addresses For W7761A Control Parameters. (Control Parameters are stored in EEPROM - limited to 10,000 writes. Do NOT use as outputs from Control Strategies, Time Programs, or Switching Tables. If these points are changed more than 10,000 times, irreversible hardware failure results).

Tables provides point attributes as follows:

Engineering

Units— This field indicates the point valid range and displayed Engineering Unit. For digital points, the valid states and the corresponding enumerated values are shown.

Default— The value or state of the point on controller start-up.

Shareable— The point can be set up for data sharing in Command Multiple Points, Read Multiple Points, or Refer Excel 10 Points as either a data source or a destination.

Mappable— The point can be converted into a C-Bus point used by C-Bus devices. A mappable point has a one-to-one relationship with a C-Bus User Address.

Direct

Access— The point is accessible through the Subsystem Points mechanism in XBS.

E-Vision

Monitor— These points are viewable within the E-Vision Controller Monitoring on-line screen. PAR refers to control parameters that are set in the Application Selection dialog boxes in E-Vision.

Hardware

Config— These are points that involve controller I/O configuration. Any change to HW Config. points causes the W7761A to perform an application reset; therefore, these points can only be modified off-line.

Manual— These points are used to set the controller outputs when in manual mode. The W7761A is placed in manual mode through a menu selection in the E-Vision Controller Monitor screen.

Fixable— These input points can be set to a constant value in the E-Vision Controller Monitor screen.

NOTES:

1. Mapped points can be viewed and changed, *if applicable*, on C-Bus devices such as an XI581, XI582 and XI584 and on an XBS central and E-Vision.
2. All Excel 10 points, mappable, calibration, configuration and internal data sharing points, can be viewed and changed, *as allowed*, via Direct Access (DA) mode in the XBS subsystem menu or via XI584.
3. E-Vision - These points are displayed to the user and polled during the E-Vision monitor function. Monitor (M) indicates the point appears in the Software list box. Schematic (S) indicates the point is to be displayed on the schematic air handler diagram directly. Calibrate (C) - These points are calibratable and the calibration dialog (either the temperature or air flow dialog) is displayed. These points are displayed in a listbox by selection of the menu item Controller, Calibration. When the user double clicks on these points the calibration dialog is displayed. Parameter (P) - This information is displayed to the user in the Application Selection screens. These fields are read/write when offline and read only when online.
4. Manual - These points can be placed in the manual mode. When the user double clicks on these points the manual dialog is displayed, this contains radio buttons; one for Auto and one for Manual.

**Table C1. Input/Output Points (Left).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
AI1RType	ncirioloSelect	ResistiveIn0	DA_Temp_PT3000 OA_Temp_PT3000 RA_Temp_PT3000 Custom_PT3000 DA_Temp_20KNTC RA_Temp_20KNTC Space_Temp_T7770 Custom_20KNTC Unused_Res_AI	0 1 2 3 4 5 6 7 255	Unused_Res_AI
AI2RType	ncirioloSelect	ResistiveIn1	See AI1RType Eng. Units/States column for selections		Unused_Res_AI
AI3RType	ncirioloSelect	ResistiveIn2	See AI1RType Eng. Units/States column for selections		Unused_Res_AI
AI4RType	ncirioloSelect	ResistiveIn3	See AI1RType Eng. Units/States column for selections		Unused_Res_AI
AI5VType	ncirioloSelect	VoltageIn0	RA_Hum_C7600C OA_Hum_C7600C Filter_Diff_Pres RA_Hum_C7600B OA_Hum_C7600B RA_Enthalpy OA_Enthalpy Space_CO2 Voltage_Monitor Unused_Volt_AI	0 1 2 3 4 5 6 7 8 255	Unused_Volt_AI
AI6VType	ncirioloSelect	VoltageIn1	See AI5VType Eng. Units/States column for selections		Unused_Volt_AI

(continued)

**Table C1. Input/Output Points (Right).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
SH	MA	DA	EV	HW	MN	TS	
	X			X			AI1RType specifies which logical sensor is assigned to which physical analog input sensor channel according to the enumerated list shown in the Eng. Units/States column.
	X			X			AI2RType: Refer to the description for AI1RType.
	X			X			AI3RType: Refer to the description for AI1RType.
	X			X			AI4RType: Refer to the description for AI1RType.
	X			X			AI5VType specifies which logical voltage or current sensor is assigned to which physical analog input sensor channel according to the enumerated list that is shown in the Eng. Units/States column.
	X			X			AI6VType: Refer to the description for AI5VType.

(continued)

**Table C1. Input/Output Points (Left Continued).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
DestOut1Cmd	nviRemoteCmd(0)		percent -163 to 163		0
DestOut2Cmd	nviRemoteCmd(1)		percent -163 to 163		0
DestOut3Cmd	nviRemoteCmd(2)		percent -163 to 163		0
DestOut4Cmd	nviRemoteCmd(3)		percent -163 to 163		0
DestOut5Cmd	nviRemoteCmd(4)		percent -163 to 163		0
DestOut6Cmd	nviRemoteCmd(5)		percent -163 to 163		0
DestOut7Cmd	nviRemoteCmd(6)		percent -163 to 163		0
DestOut8Cmd	nviRemoteCmd(7)		percent -163 to 163		0
DI1Sel1Type	ncirioloSelect	DigitalIn0S1	Active_Short Active_Open Unused_DigInput	0 1 255	Unused_DigInput
DI2Sel1Type	ncirioloSelect	DigitalIn1S1	See DI1Sel1Type Eng. Units/States column for selections.		Unused_DigInput

(continued)

**Table C1. Input/Output Points (Right Continued).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
SH	MA	DA	EV	HW	MN	TS	
X	X	X	M				DestOut1Cmd: DestOut1Cmd through DestOut8Cmd corresponds to DO1 through DO8. Refer to the Eng. Units/States column for DO1Type for the enumerated values that can be assigned to any output channels. Note that a selection of FLOAT means that the two DO channels are used for output. RIO assumes that the tool makes the proper assignment of enumerated values to DO1 through DO8 and also takes the responsibility to avoid assignment of multiple or overlapping commands on the same output channels. An example of the relationship between nviRemoteCmd and ncirioloSelect is described below: RIO is receiving a command to DestOut4Cmd. This can be mapped as one of the three output types (Discrete, Modulate, Float_Open, or Float_Close) by DO3Type. If the user selects an enumerated value of Discrete2 for DO3Type, this value would be stored in (DO2). Then the DestOut4Cmd will command DO2.
X	X	X	M				DestOut2Cmd: Refer to the description for DestOut1Cmd.
X	X	X	M				DestOut3Cmd: Refer to the description for DestOut1Cmd.
X	X	X	M				DestOut4Cmd: Refer to the description for DestOut1Cmd.
X	X	X	M				DestOut5Cmd: Refer to the description for DestOut1Cmd.
X	X	X	M				DestOut6Cmd: Refer to the description for DestOut1Cmd.
X	X	X	M				DestOut7Cmd: Refer to the description for DestOut1Cmd.
X	X	X	M				DestOut8Cmd: Refer to the description for DestOut1Cmd.
		X		X			DI1Sel1Type specifies the sensor type and function connected to DigitalIn0S1 through DigitalIn3S1. The valid enumerated list of logical digital states for DigitalIn0S1 is listed in the Eng. Units/States column.
		X		X			DI2Sel1Type: Refer to the description for DI1Sel1Type.

(continued)



**Table C1. Input/Output Points (Left Continued).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
DI3Sel1Type	ncirioloSelect	DigitalIn2S1	See DI1Sel1Type Eng. Units/States column for selections.		Unused_DigInput
DI4Sel1Type	ncirioloSelect	DigitalIn3S1	See DI1Sel1Type Eng. Units/States column for selections.		Unused_DigInput
DI1Sel2Type	ncirioloSelect	DigitalIn0S2	Momentary Maintained Unused_DigInput	0 1 255	Maintained
DI2Sel2Type	ncirioloSelect	DigitalIn1S2	See DI1Sel2Type Eng. Units/States column for selections.		Maintained
DI3Sel2Type	ncirioloSelect	DigitalIn2S2	See DI1Sel2Type Eng. Units/States column for selections.		Maintained
DI4Sel2Type	ncirioloSelect	DigitalIn3S2	See DI1Sel2Type Eng. Units/States column for selections.		Maintained
DO1Type	ncirioloSelect	DigitalOut0	Discrete1 Discrete2 Discrete3 Discrete4 Discrete5 Discrete6 Discrete7 Discrete8 Modulate1 Modulate2 Modulate3 Modulate4 Modulate5 Modulate6 Modulate7 Modulate8 Float1_Open Float2_Open Float3_Open Float4_Open Float5_Open Float6_Open Float7_Open Float8_Open Float1_Close Float2_Close Float3_Close Float4_Close Float5_Close Float6_Close Float7_Close Float8_Close Unused_DigOutput	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 255	Unused_DigOutput

**Table C1. Input/Output Points (Right Continued).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
SH	MA	DA	EV	HW	MN	TS	
		X		X			DI3Sel1Type: Refer to the description for DI1Sel1Type.
		X		X			DI4Sel1Type: Refer to the description for DI1Sel1Type.
		X		X			DI1Sel2Type specifies the sensor type and function connected to DigitalIn0S2 through DigitalIn3S2. The valid enumerated list of logical digital states for DI1Sel2Type is listed in the Eng. Units/States column.
		X		X			DI2Sel2Type: Refer to the description for DI1Sel2Type.
		X		X			DI3Sel2Type: Refer to the description for DI1Sel2Type.
		X		X			DI4Sel2Type: Refer to the description for DI1Sel2Type.
		X		X			DO1Type specifies which logical digital output function is assigned to the digital physical output according to the enumerated list that is shown in the Eng. Units/States column.

**Table C1. Input/Output Points (Left Continued).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
DO2Type	ncirioloSelect	DigitalOut1	Refer to the Eng. Units/States column for DO1Type for selections available.		Unused_DigOutput
DO3Type	ncirioloSelect	DigitalOut2	Refer to the Eng. Units/States column for DO1Type for selections available.		Unused_DigOutput
DO4Type	ncirioloSelect	DigitalOut3	Refer to the Eng. Units/States column for DO1Type for selections available.		Unused_DigOutput
DO5Type	ncirioloSelect	DigitalOut4	Refer to the Eng. Units/States column for DO1Type for selections available.		Unused_DigOutput
DO6Type	ncirioloSelect	DigitalOut5	Refer to the Eng. Units/States column for DO1Type for selections available.		Unused_DigOutput
DO7Type	ncirioloSelect	DigitalOut6	Refer to the Eng. Units/States column for DO1Type for selections available.		Unused_DigOutput
DO8Type	ncirioloSelect	DigitalOut7	Refer to the Eng. Units/States column for DO1Type for selections available.		Unused_DigOutput
FiftySixtyHz	nciloSelect	FiftySixtyHz	Sixty Fifty	0 1	Sixty
SrcCO2Level	nvoRemoteCO2		PPM 0 to 65535		0
SrcCurrentAI	nvoRemoteCurrent		milliamps -20.0 to 200.0		0
SrcDigIn1Sts	nvoRemoteDigIn(0)	DI1Value	0 to 255		0
	nvoRemoteDigIn(0)	DI1State	ST_OFF ST_LOW ST_MED ST_HIGH ST_ON ST_NUL	0 1 2 3 4 255	ST_NUL

(continued)

**Table C1. Input/Output Points (Right Continued).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
SH	MA	DA	EV	HW	MN	TS	
		X		X			DO2Type: Refer to the description for DO1Type.
		X		X			DO3Type: Refer to the description for DO1Type.
		X		X			DO4Type: Refer to the description for DO1Type.
		X		X			DO5Type: Refer to the description for DO1Type.
		X		X			DO6Type: Refer to the description for DO1Type.
		X		X			DO7Type: Refer to the description for DO1Type.
		X		X			DO8Type: Refer to the description for DO1Type.
		X		X			FiftySixtyHz specifies the power supply frequency. Correctly selecting FiftySixtyHz decreases the noise picked up by analog sensor wiring from the power supply. When FiftySixtyHz is 1, the power supply frequency is Fifty Hz and when FiftySixtyHz is 0, the power supply frequency is Sixty Hz.
X	X	X	M				SrcCO2Level is an output network variable corresponding to the voltage or current input channel (AI5 or AI6) if the selection for a CO2 sensor was made via ncioloSelect.
X	X	X	M				SrcCurrentAI is an output network variable corresponding to the voltage or current input channel (AI5 or AI6) if the selection for a current sensor was made via ncioloSelect.
							SrcDigIn1Sts: There are four digital input channels (DI1 through DI4). If any of the four channels are configured, the corresponding output network variable will be updated with the value whose data type is SNVT_switch.
X	X	X	M				DI1State: There are four digital input channels (DI1 through DI4). If any of the four channels are configured, the corresponding output network variable will be updated with the value whose data type is SNVT_switch. Refer to the enumerated list that is shown in the Eng. Units/States column.

(continued)

**Table C1. Input/Output Points (Left Continued).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
SrcDigIn2Sts	nvoRemoteDigIn(1)	DI2Value	0 to 255		0
	nvoRemoteDigIn(1)	DI2State	Refer to the DI1State enumerated list shown in the Eng. Units/States column.		ST_NUL
SrcDigIn3Sts	nvoRemoteDigIn(2)	DI3Value	0 to 255		0
	nvoRemoteDigIn(2)	DI3State	Refer to the DI1State enumerated list shown in the Eng. Units/States column.		ST_NUL
SrcDigIn4Sts	nvoRemoteDigIn(3)	DI4Value	0 to 255		0
	nvoRemoteDigIn(3)	DI4State	Refer to the DI1State enumerated list shown in the Eng. Units/States column.		ST_NUL
SrcHumidAI5	nvoRemoteHum(0)		percent -163 to 163		0
SrcHumidAI6	nvoRemoteHum(1)		percent -163 to 163		0
SrcPressAI5	nvoRemotePres(0)		inw -131.5 to 131.5 kPa (-32.768 to 32.767)		0
SrcPressAI6	nvoRemotePres(1)		inw -131.5 to 131.5 kPa (-32.768 to 32.767)		0
SrcTempAI1	nvoRemoteTemp(0)		degrees F -40 to 240 degrees C (-40 to 116)		0
SrcTempAI2	nvoRemoteTemp(1)		degrees F -40 to 240 degrees C (-40 to 116)		0
SrcTempAI3	nvoRemoteTemp(2)		degrees F -40 to 240 degrees C (-40 to 116)		0
SrcTempAI4	nvoRemoteTemp(3)		degrees F -40 to 240 degrees C (-40 to 116)		0
SrcVoltageAI	nvoRemoteVolt		Volts 0.0 to 10.5		0

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**Table C1. Input/Output Points (Right Continued).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
SH	MA	DA	EV	HW	MN	TS	
							SrcDign2Sts: Refer to the description for SrcDign1Sts.
X	X	X	M				DI2State: Refer to the description for DI1State.
							SrcDign3Sts: Refer to the description for SrcDign1Sts above.
X	X	X	M				DI3State: Refer to the description for DI1State.
							SrcDign4Sts: Refer to the description for SrcDign1Sts above.
X	X	X	M				DI4State: Refer to the description for DI1State.
X	X	X	M				SrcHumidAI5 is an output network variable corresponding to the voltage or current input channel (AI5) if the selection for humidity sensor was made via ncioloSelect for AI5.
X	X	X	M				SrcHumidAI6 is an output network variable corresponding to the voltage or current input channel (AI6) if the selection for humidity sensor was made via ncioloSelect for AI6.
X	X	X	M				SrcPressAI5 is an output network variable corresponding to the voltage or current input channel (AI5) if the selection for a pressure sensor was made via ncioloSelect for AI5.
X	X	X	M				SrcPressAI6 is an output network variable corresponding to the voltage or current input channel (AI6) if the selection for a pressure sensor was made via ncioloSelect for AI6.
X	X	X	M				SrcTempAI1 is an output network variable corresponding to the analog input channel (AI1). This NV will contain AI1 temperature value with the OffsetCal1AI1 applied to it.
X	X	X	M				SrcTempAI2 is an output network variable corresponding to the analog input channel (AI2). This NV will contain AI2 temperature value with the OffsetCal1AI2 applied to it.
X	X	X	M				SrcTempAI3 is an output network variable corresponding to the analog input channel (AI3). This NV will contain AI3 temperature value with the OffsetCal1AI3 applied to it.
X	X	X	M				SrcTempAI4 is an output network variable corresponding to the analog input channel (AI4). This NV will contain AI4 temperature value with the OffsetCal1AI4 applied to it.
X	X	X	M				SrcVoltageAI is an output network variable corresponding to the voltage or current input channel (AI5 or AI6) if the selection for a voltage sensor was made via ncioloSelect.

Table C2. Control Parameters (Left).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
	nviInUse	InUseNumber	0 to 65534		0xFFFF

**Table C2. Control Parameters (Right).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
SH	MA	DA	EV	HW	MN	TS	
							<p>nvilnUse is used by a management node to indicate to all other management nodes that it is logged on, to the Excel 10 node and that they should not try to interact with any of the Excel 10s network variables. Before the management node reads or writes any network variables, the management node checks nvilnUse for a zero value meaning no other management nodes are already logged on and that a management node may log on, to the node. Then the management node writes a number, 1 through 65534, to nvilnUse and periodically writes the same value to indicate that the management node is still logged on. If there are no writes made to nvilnUse for approximately 60 seconds, then the Excel 10 resets nvilnUse to zero to automatically log off the management node. Before interacting with any network variables, the management node verifies that the nvilnUse has not changed. The management node logs off by writing 0 to nvilnUse.</p> <p>During power up, an application restart, or return to on-line from off-line, the Excel 10 sets nvilnUse to 65535 to indicate to the management node that it has returned to on-line.</p>



**Table C3. Status Points (Left).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
AlarmNode	nvoAlarm	node	0 to 127		0
AlarmSubnet	nvoAlarm	subnet	1 to 255		0
AlarmType	nvoAlarm	type 0 to 255	NO_ALARM INPUT_NV_FAILURE NODE_DISABLED SENSOR_FAILURE rINPUT_NV_FAILURE rNODE_DISABLED rSENSOR_FAILURE ALARM_NOTIFY_DISABLED	0 1 2 3 129 130 131 255	NO_ALARM
AlarmTypeLog0	nvoAlarmLog	type0	Refer to the AlarmType enumerated list shown in the Eng. Units/States column.		NO_ALARM
AlarmTypeLog1	nvoAlarmLog	type1	Refer to the AlarmType enumerated list shown in the Eng. Units/States column.		NO_ALARM
AlarmTypeLog2	nvoAlarmLog	type2	Refer to the AlarmType enumerated list shown in the Eng. Units/States column.		NO_ALARM
AlarmTypeLog3	nvoAlarmLog	type3	Refer to the AlarmType enumerated list shown in the Eng. Units/States column.		NO_ALARM
AlarmTypeLog4	nvoAlarmLog	type4	Refer to the AlarmType enumerated list shown in the Eng. Units/States column.		NO_ALARM
Errorbyte1	nvoError	error_bit(0) Byte Offset = 0 Bit Offset = 0 ResSensor1Error(A11)	FALSE TRUE	0 1	FALSE

(continued)

**Table C3. Status Points (Right).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
SH	MA	DA	EV	HW	MN	TS	
							AlarmNode: is the LonWorks® node number (in domain entry 1 of the nodes domain table) assigned to the node.
							AlarmSubnet: is the LonWorks® subnet number (in domain entry 1 of the nodes domain table) to which the node is assigned.
							AlarmType: is the alarm type being issued. When an alarm condition is no longer TRUE, type is set to the sum of the alarm conditions numeric value and the RETURN_TO_NORMAL numeric value. The type also is recorded in AlarmTypeLog0 through AlarmTypeLog4. When a new alarm is detected, just the corresponding numeric value for the alarm is reported. Refer to table 9 (Excel 10 Alarms) in the System Engineering Guide for all the error conditions that may be reported.
		X	M				AlarmTypeLog0 (0, 1, 2, 3, 129, 130, 131, 255) A supervisory node may poll the AlarmTypeLog output for a short alarm history. The last five alarm reports sent via nvoAlarm are reported via AlarmTypeLog. When ALARM_NOTIFY_DISABLED is entered into the log, further alarms or return to normals are not entered into the log, until alarm reporting is again enabled. If nvoAlarm is bound and not being acknowledged, the last alarm report entered into the AlarmTypeLog is the one that was not acknowledged. See nvoAlarm and for related subjects. type ( n ) specifies the alarm that was issued via nvoAlarm. See nvoAlarm for the alarm types used in AlarmTypeLog. The newest alarm is reported in type( 0 ) and the oldest is reported in type( 4 ). When a new entry is made to the log, the oldest entry is lost.
		X	M				AlarmTypeLog1: Refer to the description for AlarmTypeLog0.
		X	M				AlarmTypeLog2: Refer to the description for AlarmTypeLog0.
		X	M				AlarmTypeLog3: Refer to the description for AlarmTypeLog0.
		X	M				AlarmTypeLog4: Refer to the description for AlarmTypeLog0.
		X	M				ResSensor1Error(AI1): The nvoError is a polled output containing a list of the current errors detected by the node. A search for error conditions in the node is made periodically. A diagnostic tool may poll nvoError for all of the current errors. nvoError uses one bit for each possible error condition. nvoError contains all the detected current errors even though they may be suppressed for reporting by nvoAlarm. There is a correspondence between the error conditions and alarm types. nvoError includes sensor failure errors and input network variable failure detect errors. Any sensor failure errors result in a SENSOR_FAILURE alarm. Failure to receive any bound network variable periodically results in an INPUT_NV_FAILURE alarm. nvoError tells which sensor(s) or network variable(s) have failed. See nvoAlarm, AlarmTypeLog for related subjects.

(continued)

Table C3. Status Points (Left Continued).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
Errorbyte2	nvoError	error_bit(0) Byte Offset = 0 Bit Offset = 1 ResSensor2Error(AI2)	FALSE TRUE	0 1	FALSE
Errorbyte3	nvoError	error_bit(0) Byte Offset = 0 Bit Offset = 2 ResSensor3Error(AI3)	FALSE TRUE	0 1	FALSE
Errorbyte4	nvoError	error_bit(0) Byte Offset = 0 Bit Offset = 3 ResSensor4Error(AI4)	FALSE TRUE	0 1	FALSE
BugFixVer	nroPgmVer	BugVer			3
	nroPgmVer	NodeType			RIO1
MajorVer	nroPgmVer	MajorVer			2
MinorVer	nroPgmVer	MinorVer			1
	nroPgmVer	NodeType			6
	nvoStatus	CommFailure	FALSE TRUE	0 1	FALSE
	nvoStatus	disabled	FALSE TRUE	0 1	FALSE
	nvoStatus	ElectricalFault	FALSE TRUE	0 1	FALSE
	nvoStatus	FailSelfTest	FALSE TRUE	0 1	FALSE
	nvoStatus	FeedbackFailure	FALSE TRUE	0 1	FALSE
	nvoStatus	InAlarm	FALSE TRUE	0 1	FALSE
	nvoStatus	InvalidId	FALSE TRUE	0 1	FALSE
	nvoStatus	InvalidRequest	FALSE TRUE	0 1	FALSE

(continued)

**Table C3. Status Points (Right Continued).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
SH	MA	DA	EV	HW	MN	TS	
		X	M				ResSensor2Error(AI2): Refer to the description of ResSensor1Error(AI1).
		X	M				ResSensor3Error(AI3): Refer to the description of ResSensor1Error(AI1).
		X	M				ResSensor4Error(AI4): Refer to the description of ResSensor1Error(AI1).
		X					Software version.
							A four byte ASCII string indicating the type of node (model).
		X					Software version.
		X					Software version.
							The NodeType is a numeric identifier that is stored in EPROM that identifies the Excel 10 node type. Whenever a new software version or upgrade is issued, this is reflected in nroPgmVer which typically is read by a network management node to identify the node type. The contents of nroPgmVer contain compatible model type information and is fixed at the time when the node software is compiled.
							CommFailure: This field is not supported and is set to 0 (FALSE).
							disabled: disabled reports 1 if nvoIO mode is set to DISABLED_MODE or FACTORY_TEST mode. Otherwise disabled is set to 0.
							ElectricalFault: This field is not supported and is set to 0 (FALSE).
							FailSelfTest: This field is not supported and is set to 0 (FALSE).
							FeedbackFailure: This field is not supported and is set to 0 (FALSE).
							InAlarm: If there are currently any active alarms reported by InAlarm, or InAlarm is set to AlarmNotifyDisabled, then InAlarm is set to True, if not InAlarm is set to False.
							InvalidId: If object_id is not a valid object, invalid_id is set to 1 (TRUE) otherwise it is set to 0 (FALSE).
							InvalidRequest: If object_request is not a valid request for the object addressed, InvalidRequest is set to 1 (TRUE) otherwise it is set to 0 (FALSE).

(continued)

**Table C3. Status Points (Left Continued).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
	nvoStatus	InOverride	FALSE TRUE	0 1	FALSE
	nvoStatus	LockedOut	FALSE TRUE	0 1	FALSE
	nvoStatus	ManualControl	FALSE TRUE	0 1	FALSE
	nvoStatus	MechanicalFault	FALSE TRUE	0 1	FALSE
	nvoStatus	ObjectId	0 TO 65535		0
	nvoStatus	OpenCircuit	FALSE TRUE	0 1	FALSE
	nvoStatus	OutOfLimits	FALSE TRUE	0 1	FALSE
	nvoStatus	OutOfService	FALSE TRUE	0 1	FALSE
	nvoStatus	OverRange	FALSE TRUE	0 1	FALSE
	nvoStatus	SelfTestInProgress	FALSE TRUE	0 1	FALSE
	nvoStatus	UnableToMeasure	FALSE TRUE	0 1	FALSE
	nvoStatus	UnderRange	FALSE TRUE	0 1	FALSE

**Table C3. Status Points (Right Continued).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
SH	MA	DA	EV	HW	MN	TS	
							InOverride: This field is not supported and is set to 0 (FALSE).
							LockedOut: This field is not supported and is set to 0 (FALSE).
							ManualControl: This field is not supported and is set to 0 (FALSE).
							MechanicalFault: This field is not supported and is set to 0 (FALSE).
							ObjectId: is set to the current value of nviRequest.object_id
							OpenCircuit: This field is not supported and is set to 0 (FALSE).
							OutOfLimits: This field is not supported and is set to 0 (FALSE).
							OutOfService: This field is not supported and is set to 0 (FALSE).
							OverRange: This field is not supported and is set to 0 (FALSE).
							SelfTestInProgress: This field is not supported and is set to 0 (FALSE).
							UnableToMeasure: This field is not supported and is set to 0 (FALSE).
							UnderRange: This field is not supported and is set to 0 (FALSE).

**Table C4. Configuration Parameters (Left).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
	nciAppIVer	ApplicationType	0 to 255		0
	nciDeviceName	DeviceName			ASCII Blanks
	nciAppIVer	Time1Jan70	seconds		0
	nciAppIVer	VersionNumber	0 to 255		0
AI LowLimit	nciEUConvrtRes	LowerLimitS7	degrees F -40 to 240 degrees C (-40 to 116)		0
AI OutputRHigh	nciEUConvrtRes	OutputResHighS7	degrees F -40 to 240 degrees C (-40 to 116)		0
AI OutputRLow	nciEUConvrtRes	OutputResLowS7	degrees F -40 to 240 degrees C (-40 to 116)		0
AI ResHigh	nciEUConvrtRes	ResHigh	Ohms 10 to 150000		0
AI ResLow	nciEUConvrtRes	ResLow	Ohms 10 to 150000		0

(continued)

**Table C4. Configuration Parameters (Right).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
SH	MA	DA	EV	HW	MN	TS	
							ApplicationType identifies the current application number of the Excel 10.
							nciDeviceName is an 18 character field used to identify the node uniquely as one object at the site or project. The contents of the nciDeviceName is maintained by a management node. If nciDeviceName is all ASCII blanks, it is considered unconfigured.
							The time stamp of the last change to the Excel 10 application configuration. Time meets the ANSI C time stamp requirement specifying the number of seconds elapsed since midnight (0:00:00), January 1, 1970. It is represented in the Intel Format.
							VersionNumber identifies the version number of the Excel 10 application.
		X	M	X			AIOutputRHigh: This is the equivalent temperature degrees F (degrees C) value for the resistance entered for AIResHigh. Using the resistance example for AIResHigh of 48,000 ohms, you would enter the equivalent temperature of 45.0 degrees F (7.2 degrees C) for the AIOutputRHigh value.
		X	M	X			AIOutputRLow: This is the equivalent temperature degrees F (degrees C) value for the resistance entered for AIResLow. Using the resistance example for AIResLow of 11,520 ohms, you would enter the equivalent temperature of 99.0 degrees F (37.2 degrees C) for the AIOutputRLow value.
		X	M	X			AIResHigh: This is the highest resistance value of the user specified range for a custom resistive input as selected through E-Vision in the input Tab of the Application selection screen. The user can select between a PT3000 (Custom_PT3000) or a 20 Kohm NTC (Custom_20 Kohm NTC) sensor. This value is specified in ohms with LSB in 10 Ohms. This means that if your high resistance value for a 20 Kohm NTC sensor was 48,000 ohms, 45.0 degrees F (7.2 degrees C), the value that would be entered for AIResHigh would be 4800 (the resistance value divided by ten).
		X	M	X			AIResLow: This is the lowest resistance value of the user specified range for a custom resistive input as selected through E-Vision in the input Tab of the Application selection screen. The user can select between a PT3000 (Custom_PT3000) or a 20 Kohm NTC (Custom_20 Kohm NTC) sensor. This value is specified in ohms with LSB in 10 Ohms. This means that if the low resistance value for a 20 Kohm NTC sensor was 11,520 ohms, 99.0 degrees F (37.2 degrees C), the value that would be entered for AIResLow would be 1152 (the resistance value divided by ten).

(continued)



**Table C4. Configuration Parameters (Left Continued).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
AIUpperLimit	nciEUConvrtRes	UpperLimitS7	degrees F -40 to 240 degrees C (-40 to 116)		0
DeltaC	nciDelta	deltacurrent	mA 0 to 256		0
DeltaCO2	nciDelta	deltaCO2	PPM 0 to 2000		0
DeltaH	nciDelta	deltahum	percent 0 to 163		0
DeltaP	nciDelta	deltapres	inw 0 to 32 kPa (0 to 7.97)		0
DeltaT1	nciDelta	deltatemp(0)	degrees F 0 to 256 degrees C (0 to 124)		0
DeltaT2	nciDelta	deltatemp(1)	degrees F 0 to 256 degrees C (0 to 124)		0
DeltaT3	nciDelta	deltatemp(2)	degrees F 0 to 256 degrees C (0 to 124)		0
DeltaT4	nciDelta	deltatemp(3)	degrees F 0 to 256 degrees C (0 to 124)		0
DeltaV	nciDelta	deltaVolt	0 to 10.5 volts		0
DO1FISpeed	nciFloatConfig	DO0	seconds 0 to 900		90
DO2FISpeed	nciFloatConfig	DO1	seconds 0 to 900		90
DO3FISpeed	nciFloatConfig	DO2	seconds 0 to 900		90
DO4FISpeed	nciFloatConfig	DO3	seconds 0 to 900		90

(continued)

**Table C4. Configuration Parameters (Right Continued).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
SH	MA	DA	EV	HW	MN	TS	
		X	M	X			AIUpperLimit: This is the high limit value or the highest value that will be displayed for this sensor. This value must be between the AIOutputRLow and AIOutputRHigh and higher than the value specified for AILowLimit.
		X	M P	X			DeltaC: The default value of delta for all RIO sensor types is set to zero. With this default value, the RIO will send the sensor values at the fastest rate of 2 seconds update rate. However, if the user desires to reduce the network traffic or not receive the noisy sensor values, a delta value can be specified. This value will force the RIO to transmit the sensor value when the current value exceeds the last sent value by the delta amount. RIO will also send the sensor value whenever the time of update exceeds nciRioSendT. RIO will send the sensor value at the rate of nciRioSendT regardless of delta change.
		X	M P	X			DeltaCO2: Refer to the description for DeltaC.
		X	M P	X			DeltaH: Refer to the description for DeltaC.
		X	M P	X			DeltaP: Refer to the description for DeltaC.
		X	M P	X			DeltaT1: Refer to the description for DeltaC.
		X	M P	X			DeltaT2: Refer to the description for DeltaC.
		X	M P	X			DeltaT3: Refer to the description for DeltaC.
		X	M P	X			DeltaT4: Refer to the description for DeltaC.
		X	M P	X			DeltaV: Refer to the description for DeltaC.
		X		X			DO1FISpeed is how long it takes for the actuator motor to move one cycle of travel from closed to open. This value would be required if DO1Type were configured to either Float_Open or Float_Close.
		X		X			DO2FISpeed is how long it takes for the actuator motor to move one cycle of travel from closed to open. This value would be required if DO2Type were configured to either Float_Open or Float_Close.
		X		X			DO3FISpeed is how long it takes for the actuator motor to move one cycle of travel from closed to open. This value would be required if DO3Type were configured to either Float_Open or Float_Close.
		X		X			DO4FISpeed is how long it takes for the actuator motor to move one cycle of travel from closed to open. This value would be required if DO4Type were configured to either Float_Open or Float_Close.

(continued)

**Table C4. Configuration Parameters (Left Continued).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
DO5FISpeed	nciFloatConfig	DO4	seconds 0 to 900		90
DO6FISpeed	nciFloatConfig	DO5	seconds 0 to 900		90
DO7FISpeed	nciFloatConfig	DO6	seconds 0 to 900		90
DO8FISpeed	nciFloatConfig	DO7	seconds 0 to 900		90
DO1PWMPeriod	nciPWMConfig1	DO0.si_period_pwm	seconds 0.0 to 3000		25.6
DO1PWMZero	nciPWMConfig1	DO0.si_pnct_time	seconds 0.0 to 3000		0.1
DO1PWMFull	nciPWMConfig1	DO0.si_delta_time	seconds 0.0 to 3000		25.5
DO2PWMPeriod	nciPWMConfig1	DO1.si_period_pwm	seconds 0.0 to 3000		25.6
DO2PWMZero	nciPWMConfig1	DO1.si_pnct_time	seconds 0.0 to 3000		0.1
DO2PWMFull	nciPWMConfig1	DO1.si_delta_time	seconds 0.0 to 3000		25.5
DO3PWMPeriod	nciPWMConfig1	DO2.si_period_pwm	seconds 0.0 to 3000		25.6
DO3PWMZero	nciPWMConfig1	DO2.si_pnct_time	seconds 0.0 to 3000		0.1
DO3PWMFull	nciPWMConfig1	DO2.si_delta_time	seconds 0.0 to 3000		25.5
DO4PWMPeriod	nciPWMConfig1	DO3.si_period_pwm	seconds 0.0 to 3000		25.6
DO4PWMZero	nciPWMConfig1	DO3.si_pnct_time	seconds 0.0 to 3000		0.1
DO4PWMFull	nciPWMConfig1	DO3.si_delta_time	seconds 0.0 to 3000		25.5
DO5PWMPeriod	nciPWMConfig2	DO4.si_period_pwm	seconds 0.0 to 3000		25.6
DO5PWMZero	nciPWMConfig2	DO4.si_pnct_time	seconds 0.0 to 3000		0.1
DO5PWMFull	nciPWMConfig2	DO4.si_delta_time	seconds 0.0 to 3000		25.5

(continued)

**Table C4. Configuration Parameters (Right Continued).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
SH	MA	DA	EV	HW	MN	TS	
		X		X			DO5FISpeed is how long it takes for the actuator motor to move one cycle of travel from closed to open. This value would be required if DO5Type were configured to either Float_Open or Float_Close.
		X		X			DO6FISpeed is how long it takes for the actuator motor to move one cycle of travel from closed to open. This value would be required if DO6Type were configured to either Float_Open or Float_Close.
		X		X			DO7FISpeed is how long it takes for the actuator motor to move one cycle of travel from closed to open. This value would be required if DO7Type were configured to either Float_Open or Float_Close.
		X		X			DO8FISpeed is how long it takes for the actuator motor to move one cycle of travel from closed to open. This value would be required if DO8Type were configured to either Float_Open or Float_Close.
		X	M	X			DO1PWMPeriod is a intermittent voltage pulse whose width varies in proportion to the desired actuator position. The PWM signal has three parameters that have to be configured in order for the output to function correctly. The period, is the overall pulse length in seconds. The percent_time (signal presence) is the zero percent position of the actuator output. The actuator requires this signal (pulse width) sent once every period, so that it knows that it is still connected to the controller and where the zero position starts. The variable width (delta_time) portion is incremented in proportion to the signal percentage. There are 255 increments available (for example 0.1 second). Thus, the pulse width will be the minimum width (percent_time) plus the number of increments (delta_time/ 255). The smallest time that can be used with the RIO controller is 0.1 second. An example stroke at mid position is: 0.1 second (percent_time) + 128 x 0.1 (255/0.5 - 50 percent position) = 12.9 seconds. The period would equal the percent_time plus the delta_time (for example 0.1 seconds) + 255 x 0.1 seconds = 25.6 seconds.
		X	M	X			DO1PWMZero: Refer to the description for DO1PWMPeriod.
		X	M	X			DO1PWMFull: Refer to the description for DO1PWMPeriod.
		X	M	X			DO2PWMPeriod: Refer to the description for DO1PWMPeriod.
		X	M	X			DO2PWMZero: Refer to the description for DO1PWMPeriod.
		X	M	X			DO2PWMFull: Refer to the description for DO1PWMPeriod.
		X	M	X			DO3PWMPeriod: Refer to the description for DO1PWMPeriod.
		X	M	X			DO3PWMZero: Refer to the description for DO1PWMPeriod.
		X	M	X			DO3PWMFull: Refer to the description for DO1PWMPeriod.
		X	M	X			DO4PWMPeriod: Refer to the description for DO1PWMPeriod.
		X	M	X			DO4PWMZero: Refer to the description for DO1PWMPeriod.
		X	M	X			DO4PWMFull: Refer to the description for DO1PWMPeriod.
		X	M	X			DO5PWMPeriod: Refer to the description for DO1PWMPeriod.
		X	M	X			DO5PWMZero: Refer to the description for DO1PWMPeriod.
		X	M	X			DO5PWMFull: Refer to the description for DO1PWMPeriod.

(continued)

**Table C4. Configuration Parameters (Left Continued).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
DO6PWMPeriod	nciPWMConfig2	DO5.si_period_pwm	seconds 0.0 to 3000		25.6
DO6PWMZero	nciPWMConfig2	DO5.si_pnct_time	seconds 0.0 to 3000		0.1
DO6PWMFull	nciPWMConfig2	DO5.si_delta_time	seconds 0.0 to 3000		25.6
DO7PWMPeriod	nciPWMConfig2	DO6.si_period_pwm	seconds 0.0 to 3000		25.6
DO7PWMZero	nciPWMConfig2	DO6.si_pnct_time	seconds 0.0 to 3000		0.1
DO7PWMFull	nciPWMConfig2	DO6.si_delta_time	seconds 0.0 to 3000		25.5
DO8PWMPeriod	nciPWMConfig2	DO7.si_period_pwm	seconds 0.0 to 3000		25.6
DO8PWMZero	nciPWMConfig2	DO7.si_pnct_time	seconds 0.0 to 3000		0.1
DO8PWMFull	nciPWMConfig2	DO7.si_delta_time	seconds 0.0 to 3000		25.5

**Table C4. Configuration Parameters (Right Continued).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
SH	MA	DA	EV	HW	MN	TS	
		X	M	X			DO6PWMPeriod: Refer to the description for DO1PWMPeriod.
		X	M	X			DO6PWMZero: Refer to the description for DO1PWMPeriod.
		X	M	X			DO6PWMFull: Refer to the description for DO1PWMPeriod.
		X	M	X			DO7PWMPeriod: Refer to the description for DO1PWMPeriod.
		X	M	X			DO7PWMZero: Refer to the description for DO1PWMPeriod.
		X	M	X			DO7PWMFull: Refer to the description for DO1PWMPeriod.
		X	M	X			DO8PWMPeriod: Refer to the description for DO1PWMPeriod.
		X	M	X			DO8PWMZero: Refer to the description for DO1PWMPeriod.
		X	M	X			DO8PWMFull: Refer to the description for DO1PWMPeriod.

**Table C5. Direct Access And Special Points (Left).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
DestManMode	nviManualMode		MODE_ENABLE MODE_DISABLE MODE_MANUAL SUPPRESS_ALARMS UNSUPPRESS_ALARMS	0 1 2 3 4	MODE_ENABLE

**Table C5. Direct Access And Special Points (Right).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
SH	MA	DA	EV	HW	MN	TS	
	X	X	M P				<p>DestManMode: is an input which is used to manually set the physical outputs. DestManMode remains unchanged until another mode has been commanded or an application restart has been performed. The valid enumerated values are: MODE_ENABLE enables the node so that the RIO controls the physical outputs as the normal mode. MODE_ENABLE is the default state after power is restored or an application restart occurs. If the mode was MANUAL and DestManMode is set to MODE_ENABLE, the node then goes through application restart. MODE_DISABLED sets the node into the DISABLED mode. The alarm NODE_DISABLED is initiated, and the physical outputs are turned off. The physical inputs, network variable inputs, and network variable outputs are still functioning when the node is in the DISABLED mode. MODE_MANUAL sets the node into the MANUAL mode. The alarm NODE_DISABLED is initiated, and the physical outputs are controlled manually as commanded by DestManMode. The nodes configuration variables and DestManMode are used to set valves, dampers, and/or digital output to the desired manual positions or state(s). The physical inputs, network variable inputs, and network variable outputs are still functioning when the node is in the MANUAL mode. SUPPRESS_ALARMS causes AlarmType to be set to ALARM_NOTIFY_DISABLED, and AlarmTypeLog to no longer record alarms. If alarms are suppressed, UNSUPPRESS_ALARMS causes AlarmType and AlarmTypeLog to be returned to reporting alarms. See nvoAlarm for more details. All unspecified values are the same as MODE_ENABLE.</p>

## Appendix D. Q7750A Excel 10 Zone Manager Point Estimating Guide.

Memory size approximation is shown below: (all sizes in bytes)

When *memory size* is less than 110,000 bytes, the size is OK.

When *memory size* is between 110,000 and 128,000 bytes, the application may be too large. The user must expect to reduce the application complexity, reduce the number of attached Excel 10s or distribute the Excel 10s over more than one Zone Manager.

When *memory size* is greater than 128,000, the size is too large. The application size must be reduced as described above.

### Approximate Memory Size Estimating Procedure.

1. Determine the number of points per controller required at the Central (for example, XBS).  
NOTE: All remaining points that are not mapped can be accessed through the *Direct Access* feature.
2. Calculate the number of Excel 10 Zone Manager program points that are used in control logic and in the switching table.
3. Estimate the program complexity of the Zone Manager (one of three levels).
  - a. No time programs, control logic, or switching tables.
  - b. 10K of control logic (one time program, five switching tables, and five control loops).
  - c. 20K of control logic (multiple time programs, ten switching tables, and ten control loops).
 Use Fig. D-1 to determine the number of Excel 10s that can be connected to the Zone Manager.  
NOTE: More than 60 Excel 10s requires a Router.
4. Repeat for each Q7750A Excel 10 Zone Manager in a project.

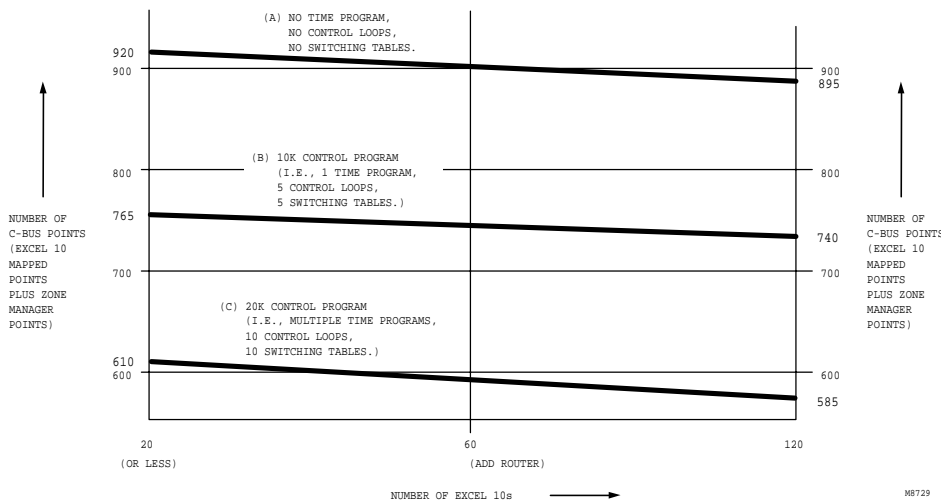


Fig. D-1. Point capacity estimate for Zone Manager.

The exact equation for calculating memory size follows:

Memory size = 21,780

- + 4096 (in case of a time program).
- + CARE Control Program.
- + 14 x time points x Excel 10 units.
- + 50 x Excel 10 units.
- + map complexity x Excel 10 units x mapped points.
- + 57 x C-Bus points.
- + 7488 x Excel 10 types.

Where:

Time points = number of switch points in time program per Excel 10.

Excel 10 units = number of attached Excel 10s.

C-Bus points = including mapped points and others; for example, remote points.

Mapped points = number of mapped points per Excel 10, including One-to-Many and Many-to-One mechanism.

Excel 10 types = number of different Excel 10 types (currently three)

Map complexity =

- 20 = using One-to-Many and not using points with read/write.
- 30 = average.
- 45 = many points with read/write ability.

## Appendix E. Sensor Data for Calibration.

### Resistance Sensors.

**Sensor Type:**

C7100A1015, (and C7170A1002).

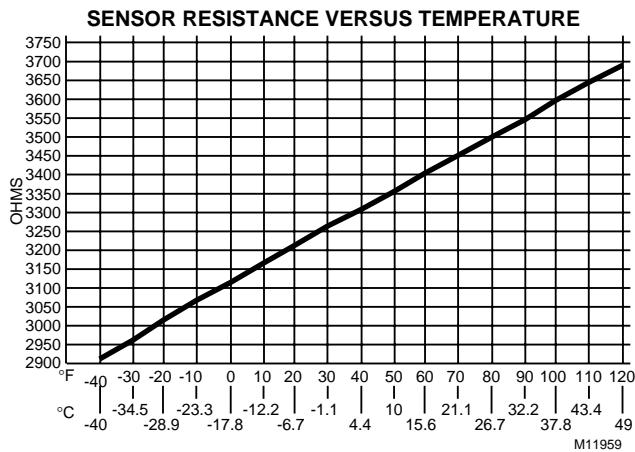
**Sensor Use:**

Discharge air, Outdoor air.

Table E-1 lists the points for Sensor Resistance versus Temperature. Fig. E-1 shows the graph of these points.

**Table E-1. Sensor Resistance Versus Temperature.**

°F (°C)	Resistance Ohms
-40 (-40)	2916.08
-30 (-34.5)	2964.68
-20 (-28.9)	3013.28
-10 (-23.3)	3061.88
0 (-17.8)	3110.48
10 (-12.2)	3159.08
20 (-6.7)	3207.68
30 (-1.1)	3256.28
40 (4.4)	3304.88
50 (10)	3353.48
60 (15.6)	3402.08
70 (21.1)	3450.68
80 (26.7)	3499.28
90 (32.2)	3547.88
100 (37.8)	3596.48
110 (43.4)	3645.08
120 (49)	3693.68



**Fig. E-1. Graph of Sensor Resistance versus Temperature.**

**Sensor Type:**

C7031B1033, C7031C1031, C7031D1062, C7031F1018, C7031J1050, C7031K1017.

**Sensor Use:**

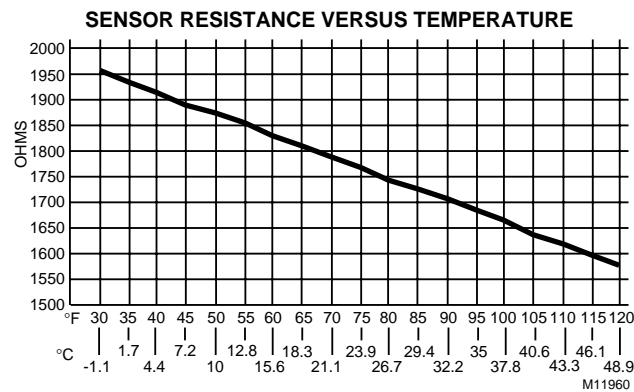
Return Air, Discharge Air Temperature.



Table E-2 lists the points for Sensor Resistance versus Temperature. Fig. E-2 shows the graph of these points.

**Table E-2. Sensor Resistance Versus Temperature.**

°F (°C)	Resistance Ohms
30 (-1.1)	1956.79
35 (1.7)	1935.79
40 (4.4)	1914.79
45 (7.2)	1893.79
50 (10)	1872.79
55 (12.8)	1851.79
60 (15.6)	1830.79
65 (18.3)	1809.79
70 (21.1)	1788.79
75 (23.9)	1767.79
80 (26.7)	1746.79
85 (29.4)	1725.79
90 (32.2)	1704.78
95 (35)	1683.78
100 (37.8)	1662.78
105 (40.6)	1641.78
110 (43.3)	1620.78
115 (46.1)	1599.78
120 (48.9)	1578.78



**Fig. E-2. Graph of Sensor Resistance versus Temperature.**

**Sensor Type:**

T7770A,B,C,D sensor—(current feature that can be used with the RIO Device) and C7770A.

**Sensor Use:**

Space Temperature and Discharge/Return Air Temperature.

Table E-3 lists the points for Sensor Resistance versus Temperature. Fig. E-3 shows the graph of these points.

**Table E-3 Sensor Resistance Versus Temperature.**

°F (°C)	Resistance Ohms
40 (4.4)	9961.09
45 (7.2)	9700.90
50 (10)	9440.72
55 (12.8)	9180.53
60 (15.6)	8920.35

65 (18.3)	8660.16
70 (21.1)	8399.98
75 (23.9)	8139.79
80 (26.7)	7879.61
85 (29.4)	7619.42
90 (32.2)	7359.24
95 (35)	7099.06
100 (37.8)	6838.87

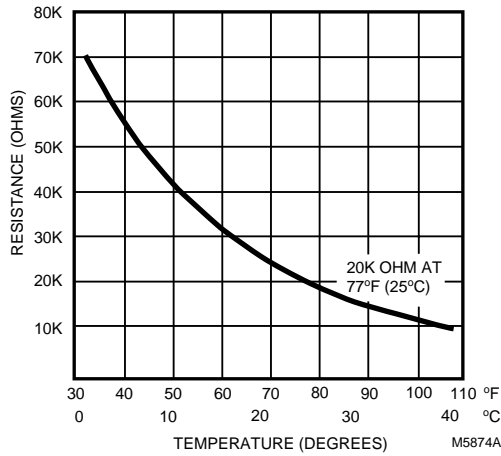


Fig. E-3. Graph of Sensor Resistance versus Temperature.

**Voltage/Current Sensors.**

**Sensor Type:**

C7600B1000 (Decorative Wall Mount) and C7600C1018 2 to 10V.

**Sensor Use:**

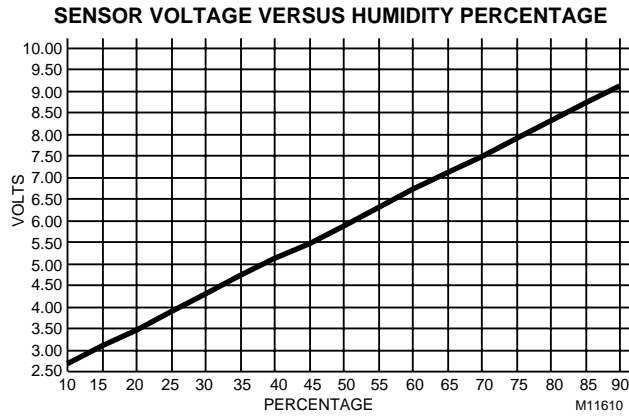
Humidity.

Table E-4 lists the points for Sensor Voltage versus Humidity. Fig. E-4 shows the graph of these points.

**Table E-4. Sensor Voltage Versus Humidity.**

Humidity Percentage	Sensor Voltage
10	2.67
15	3.08
20	3.48
25	3.88
30	4.28
35	4.68
40	5.08
45	5.48
50	5.88
55	6.28
60	6.69
65	7.09
70	7.49
75	7.89
80	8.29

85	8.69
90	9.09



**Fig. E-4. Graph of Sensor Voltage versus Humidity.**

**Sensor Type:**  
C7600C1008 (4 to 20 mA).

**Sensor Use:**  
Humidity.

Table E-5 lists the points for Sensor Current versus Humidity. Fig. E-5 shows the graph of these points.

**Table E-5. Sensor Current Versus Humidity.**

Humidity Percentage	Sensor Current
10	5.6
15	6.4
20	7.2
25	8.0
30	8.8
35	9.6
40	10.4
45	11.2
50	12.0
55	12.8
60	13.6
65	14.4
70	15.2
75	16.0
80	16.8
85	17.6
90	18.4

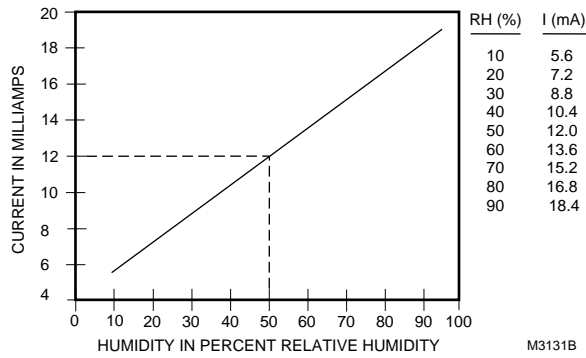


Fig. 5. C7600C output current vs. humidity.

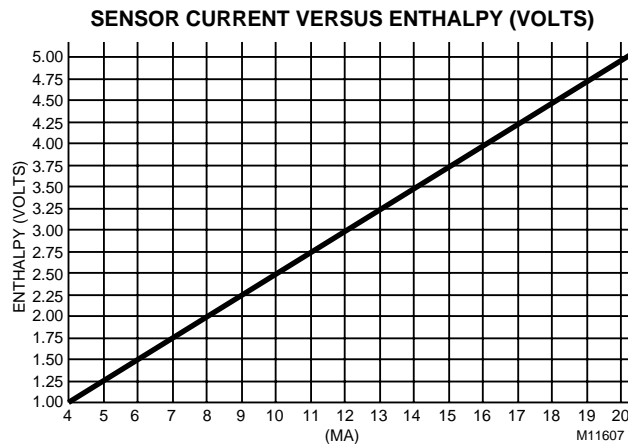
**Sensor Type:**  
C7400A1004.

**Sensor Use:**  
Enthalpy.

Table E-6 lists the points for Sensor Current versus Enthalpy (volts). Fig. E-6 shows the graph of these points.

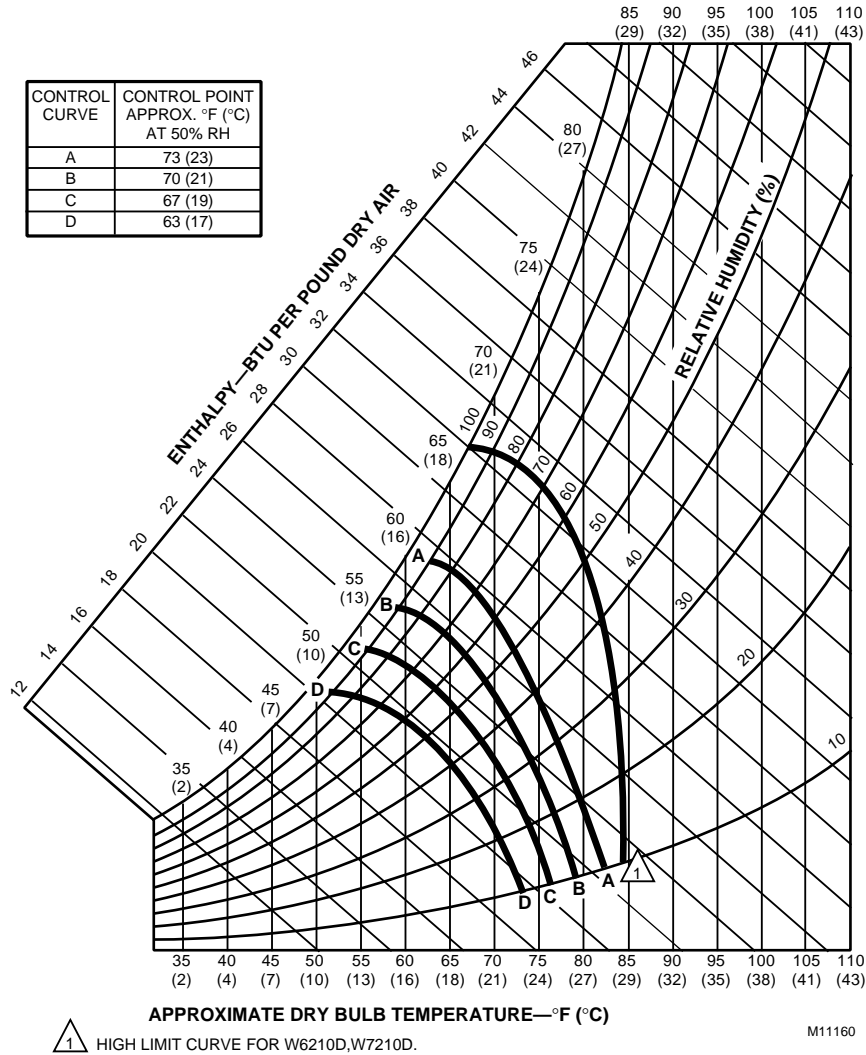
Table E-6. Sensor Current Versus Enthalpy (Volts).

Enthalpy (volts)	Sensor Current (mA)
4	1
5	1.25
6	1.49
7	1.74
8	1.99
9	2.24
10	2.49
11	2.74
12	2.99
13	3.24
14	3.49
15	3.74
16	3.98
17	4.23
18	4.48
19	4.73
20	4.98



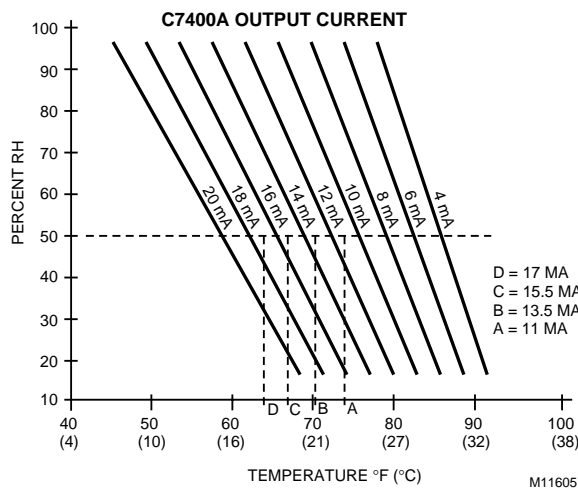
**Fig. E-6. Graph of Sensor Current versus Enthalpy (volts).**

See Fig. E-7 for a partial psychrometric chart for the a C7400A Solid State Enthalpy Sensor.



**Fig. E-7. Partial psychrometric chart for a C7400A Solid State Enthalpy Sensor.**

See Fig. E-8 for a C7400A Solid State Enthalpy Sensor output current versus relative humidity.



**Fig. E-8. C7400A Solid State Enthalpy Sensor output current vs. relative humidity.**

**Sensor Type:**

T7242 or equivalent.

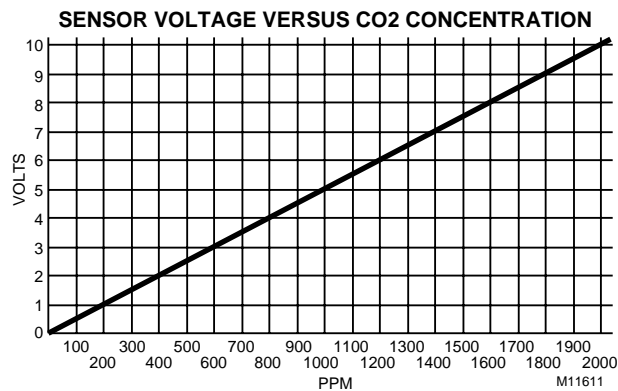
**Sensor Use:**

CO<sub>2</sub> concentration.

Table E-9 lists the points for Sensor Voltage versus CO<sub>2</sub> concentration. Fig. E-9 shows the graph of these points.

**Table E-9. Sensor Voltage Versus CO<sub>2</sub> Concentration.**

CO <sub>2</sub> Concentration PPM	Sensor Voltage
0	0.00
100	0.50
200	1.00
300	1.50
400	2.00
500	2.50
600	3.00
700	3.50
800	4.00
900	4.50
1000	5.00
1100	5.50
1200	6.00
1300	6.50
1400	7.00
1500	7.50
1600	8.00
1700	8.50
1800	9.00
1900	9.50
2000	10.00



**Fig. E-9. Graph of Sensor Voltage versus CO<sub>2</sub> concentration.**

**Sensor Type:**

Third party (2 to 20V).

**Sensor Use:**

Monitor voltage.

Table E-10 lists the points for Sensor Voltage versus input Voltage to A/D. Fig. E-10 shows the graph of these points.

**Table E-10. Sensor Voltage Versus Input Voltage To A/D.**

Voltage to A/D	Sensor Voltage
0.00	0.00
0.50	0.25
1.00	0.50
1.50	0.75
2.00	1.00
2.50	1.25
3.00	1.50
3.50	1.75
4.00	2.00
4.50	2.25
5.00	2.50
5.50	2.75
6.00	3.00
6.50	3.25
7.00	3.50
7.50	3.75
8.00	4.00
8.50	4.25
9.00	4.50
9.50	4.75
10.00	5.00

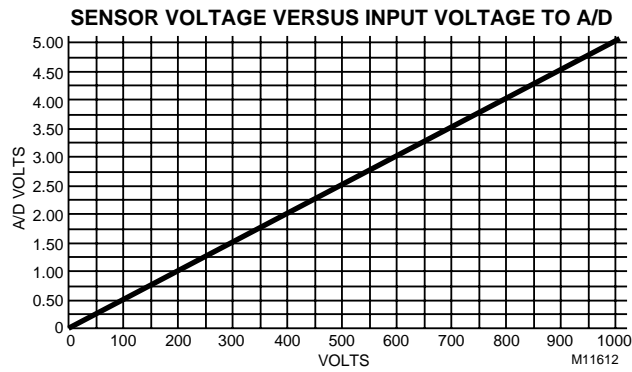


Fig. E-10. Graph of Sensor Voltage versus input Voltage to A/D.

**Sensor Type:**

Third party.

**Sensor Use:**

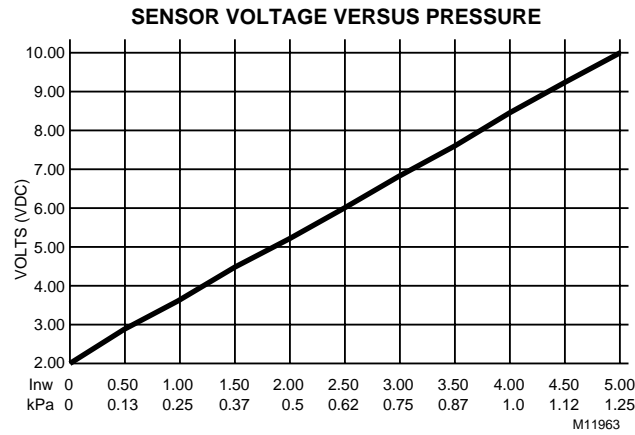
Sensor Voltage (Vdc)/Pressure Inw (kPa) 2 to 10V, 0 to 5 inw (0 to 1.25 kPa).

Table E-11 lists the points for Sensor Voltage (Vdc) versus Pressure (Inw). Fig. E-11 shows the graph of these points.

**Table E-11. Sensor Voltage (Vdc) Versus Pressure (Inw).**

Pressure Inw (kPa)	Sensor Voltage (Vdc)
0.00 (0.00)	2.00
0.50 (0.13)	2.80
1.00 (0.25)	3.60
1.50 (0.37)	4.40
2.00 (0.5)	5.20
2.50 (0.62)	6.00

3.00 (0.75)	6.80
3.50 (0.87)	7.60
4.00 (1.00)	8.40
4.50 (1.12)	9.20
5.00 (1.25)	10.00



**Fig. E-11. Graph of Sensor Voltage (Vdc) versus Pressure (Inw).**

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