Honeywell

Excel 10

W7762A,B HYDRONIC CONTROLLERS

HONEYWELL EXCEL 5000 OPEN SYSTEM

SYSTEM ENGINEERING

CONTENTS

REVISION OVERVIEW

On the following pages, changes have been made compared to the previous release of this document:

Page:	Change:
App. C	Minor corrections in Appendix C

INTRODUCTION

Description of Devices

The W7762A and B Controllers are two Hydronic Controllers in the Excel 10 family product line. They cover a wide range of control applications including radiators, induction units, and fan coil units with manual fan switching, and are suitable for either wall mounting or unit mounting. Heating systems can be water or electric, and cooling systems can be chilled water supply or compressors. Extensive timing and interlock features make the W7762 especially suitable for systems using electric heat and compressors. The W7762 Controllers are capable of stand-alone operation; however, optimum functional benefits are achieved when the network communication capabilities are used.

The zone controlled by the W7762 Controllers will typically use an Excel 10 wall module with a temperature sensor for space temperature measurement, analog setpoint input, bypass digital input push-button, and override status LED. See page 4 for form numbers of Excel 10 wall module literature for further information.

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

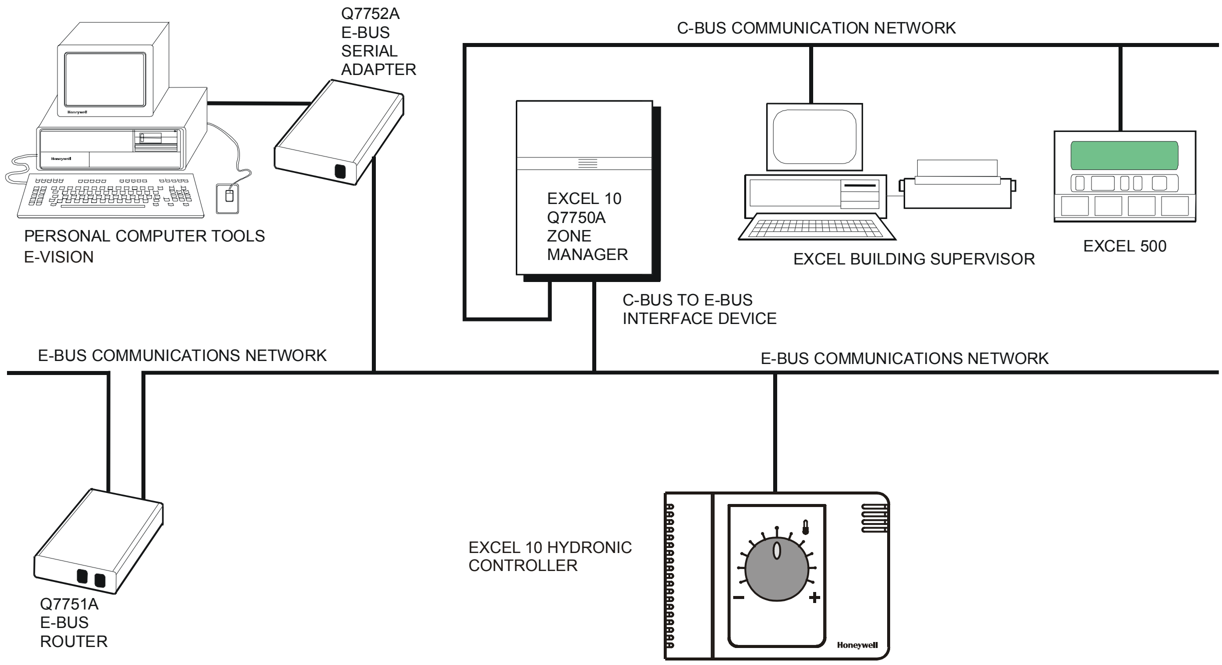

Fig. 1. Typical system overview

Products Covered

This System Engineering Guide describes how to apply the Excel 10 Hydronic Controller and the accessories to typical Hydronic applications. The specific devices covered include:
- W7762A,B Hydronic Controllers.
- T7460 Wall Modules.
- T7560 Wall Modules.
- T7770 Wall Modules.
- Q7750A Excel 10 Zone Manager.
- Q7751A Bus Router (US part number; US only).
- Q7752A Serial Adapter (US part number; US only).

Organization of Manual

The Introduction and Application Steps 1 through 5 provide the information needed to make accurate ordering decisions. Application Step 6 and the Appendices include configuration engineering that can be started using E-Vision software after the devices and accessories are ordered. Application Step 7 is troubleshooting. Information provided in support of the use of third-party E-bus communication packages to configure Hydronic Controllers is found in the Appendices.

The organization of the manual assumes a project is being engineered from start to finish. If you are adding to, or changing an existing system, the Table of Contents can guide you to the relevant information.

Applicable Literature

The following is a list of documents that contains information related to the Excel 10 Hydronic Controller and the EXCEL 5000 System in general.

Form No.	Title
74-2934	Excel 10 W7762A,B Hydronic Controller Specification Data
95-7563	Excel 10 W7762A,B Hydronic Controller Installation Instructions
74-3083	Excel 10 T7460 Wall Modules Specification Data
95-7610	Excel 10 T7460 Wall Modules Installation Instructions
74-3097	Excel 10 T7560 Wall Modules Specification Data
95-7620	Excel 10 T7560 Wall Modules Installation Instructions
74-2697	Excel 10 T7770 Wall Modules Specification Data
95-7538	Excel 10 T7770 Wall Modules Installation Instructions
74-2950	Excel 10 Q7750A, Excel 10 Zone Manager Specification Data
95-7509	Excel 10 Q7750A Zone Manager Installation Instructions.
95-7554	Excel 10 FTT/LPT 209541B Termination Module Installation Instructions
95-7510	Excel 10 Q7751A Router Installation Instructions (US only)
95-7511	Excel 10 Q7752A Serial Interface Installation Instructions (US only)
74-2039	XBS User's Manual
74-5018	XBS Application Guide

Product Names

The W7762 Hydronic Controller can use any of the following Excel 10 wall modules:
- **T7460A** with temperature sensor.
- **T7460B** with temperature sensor and setpoint adjustment.
- **T7460C** with temperature sensor, setpoint adjustment, and bypass button and LED.
- **T7560A** with temperature sensor, unit enable button, setpoint adjustment, bypass button, LCD display and configurable fan override with up to five settings.
- **T7770A** Wall Module with temperature sensor and optional E-Bus jack.
- **T7770B** Wall Module with temperature sensor, setpoint adjustment, and E-Bus jack.
- **T7770C** Wall Module with temperature sensor, setpoint adjustment, bypass button and LED, and E-Bus jack.
- **T7770D** Wall Module with temperature sensor, bypass button and LED, and E-Bus jack.

Other products:
- **Q7750A** Excel 10 Zone Manager.
- **Q7751A** Bus Router (US only).
- **Q7752A** Serial Adapter (US only).
- **AK3781** E-Bus (non-plenum): 22 AWG (0.325 mm^2) twisted pair solid conductor, non-shielded wire (one twisted pair) (US only).
- **AK3782** E-Bus (non-plenum): 22 AWG (0.325 mm^2) twisted pair solid conductor, non-shielded wire (two twisted pairs) (US only).
- **AK3791** E-Bus (plenum): 22 AWG (0.325 mm^2) twisted pair solid conductor, non-shielded wire (one twisted pair) (US only).
- **AK3792** E-Bus (plenum): 22 AWG (0.325 mm^2) twisted pair solid conductor, non-shielded wire (two twisted pairs) (US only).
- **C7608A** Return Air Sensor (Europe only).

Refer to the Table 12 (see Application Steps, Step 5. Order Equipment) for complete listing of all available part numbers.

Control Application

Hydronic systems in commercial buildings control room temperature through the control of heat and/or cold water valves. The Hydronic controller is typically connected to an Excel 10 wall module that incorporates a temperature sensor, setpoint and a bypass or override button. Fig. 2 shows a typical Hydronic control application.

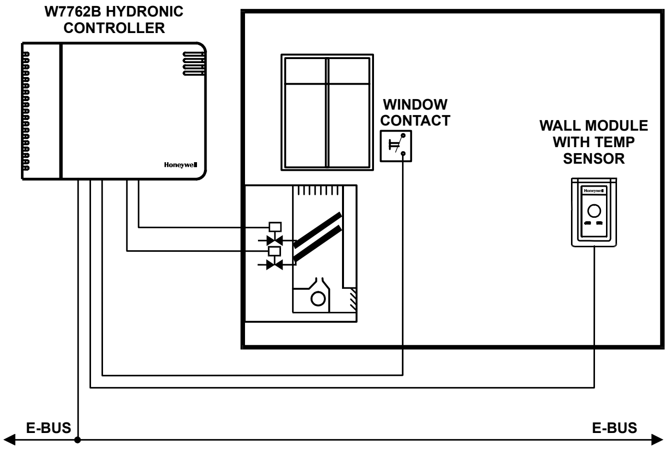

Fig. 2. Typical W7762 Hydronic control application.

Control Provided

The W7762 Hydronic Controllers provide room temperature control for two and four pipe fan coil units. The basic control sequence is shown in Fig. 3. As space temperature falls below the heating setpoint, the heating output is increased. As space temperature increases above the cooling setpoint, the cooling output is modulated to 100%. Switching levels for staged heating/cooling are configurable.

W7762 Hydronic controllers use a PID control algorithm where each of the three parameters can be configured. There are additional configurable boost parameters (HeatBoost and CoolBoost) that specify a range outside of which the heating or cooling outputs are turned on fully for faster response (for thermal actuators this specifies the control hysteresis). The controllers are delivered with factory defaults for each of the parameters.

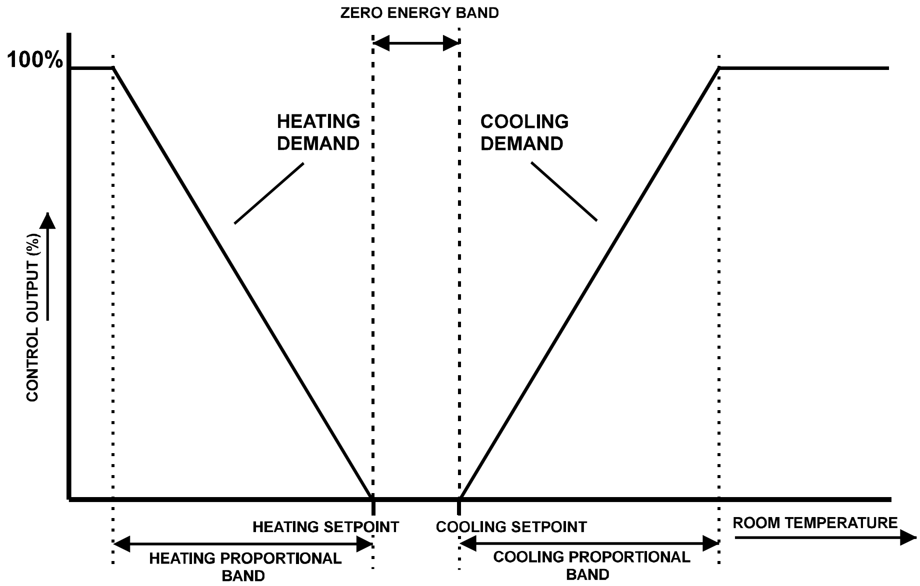

Fig. 3. Control sequence diagram.

Setpoints

Setpoint Knob

W7762A Hydronic controllers have a built-in setpoint potentiometer. W7762B controllers may have an Excel 10 wall module with setpoint potentiometer connected to them. When configured (UseWallModSpt), the value from the setpoint knob is used to calculate the cooling or heating Occupied setpoint. There are two options (SptKnob) that determine how the setpoint to be used by the control algorithm is calculated: Relative (or Offset) and Absolute Middle. When configured for Relative, the Wall Module setpoint knob represents a number from -5° to +5°C (-9° to +9°F) that is added to the software occupied setpoints for the heat and the cool modes (SptCoolOcc and SptHeatOcc). When SptKnob is set to Absolute Middle, the setpoint knob becomes the center of the Zero Energy Band (ZEB) between the cooling and heating occupied setpoints. The range of the ZEB is found by taking the difference between the configured heating and cooling occupied setpoints; therefore, for Absolute Middle, the actual setpoints are found as follows:

SrcRmTempSptEff (in cooling mode) = SrcRmTempSptHw + (SptCoolOcc - SptHeatOcc) / 2
SrcRmTempSptEff (in heating mode) = SrcRmTempSptHw - (SptCoolOcc - SptHeatOcc) / 2

During Standby and Unoccupied modes, the remote setpoint knob is ignored, and the configured setpoints for those modes are used instead.

Setpoint Limits

Setpoint knob limits are provided by SptKnobLoLim and SptKnobHiLim. The occupied setpoints used in the control algorithms are limited by these parameters. When the setpoint knob is configured to be Absolute Middle, the lowest actual setpoint allowed is equal to SptKnobLoLim, and the highest actual setpoint allowed is equal to SptKnobHiLim. When the setpoint knob is configured to be Relative, the lowest actual setpoint allowed is equal to SptHeatOcc - SptKnobLoLim, and the highest allowed is equal to SptCoolOcc + SptKnobHiLim.

Setpoint from Network

When not configured for UseWallModSpt, DestRmTempSpt must be bound to another node that provides a setpoint. When bound and a valid update is received, DestRmTempSpt is used with the appropriate ZEB:

ZEBoccupied = SptCoolOcc - SptHeatOcc
ZEBstandby = SptCoolStby - SptHeatStby

The Unoccupied setpoint does not depend on DestRmTempSpt at all.

Setpoint Offset

Third party nodes may be bound to DestSptOffset to shift the setpoint in the range of -10 delta °C to +10 delta °C.

Table 1. Example setpoint values based upon default configuration - Absolute Middle setpoint knob (°C).

Occupancy Mode	Configured Cooling Spt.	Configured Heating Spt.	ZEB	Setpoint Knob[1]	Effective Cooling Spt.[2,3]	Effective Heating Spt.[2,4]
Occupied	23	21	2	21	22	20
Standby	25	19	6	21	24	18
Unoccupied	28	16	12	X	28	16

NOTES:
1. Sample value shown. Limited by default configuration settings to the range of 12 to 30°C.
2. Limited to the range of 10 to 35°C.
3. = Setpoint Knob + (ZEB/2)
4. = Setpoint Knob – (ZEB/2)

Table 2. Example setpoint values based upon default configuration - Relative setpoint knob (°C).

Occupancy Mode	Configured Cooling Spt.	Configured Heating Spt.	ZEB	Setpoint Knob[1]	Effective Cooling Spt.[2,3]	Effective Heating Spt.[2,4]
Occupied	23	21	2	-2	21	19
Standby	25	19	6	-2	23	17
Unoccupied	28	16	12	X	28	16

NOTES:
1. Sample value shown. Limited by default configuration settings to the range of -5 to 5°C.
2. Limited to the range of 10 to 35°C.
3. = Configured Cooling Setpoint + Setpoint Knob
4. = Configured Heating Setpoint + Setpoint Knob

Bypass

Bypass Mode

During Unoccupied periods, the bypass push-button on the Wall Module may be used to cause the Occupied setpoints to be used by the control algorithm. The mode may also be initiated by setting DestManOcc to OC_BYPASS via the network The controller remains in Bypass mode until:

1. The bypass timer has timed out, or
2. The user again presses the Wall Module push-button to cancel Bypass mode, or
3. The occupancy schedule (DestSchedOcc network input) switches the mode to Occupied.
4. The network input DestManOcc is set to to OC_NUL.

The Excel 10 wall module indicates the current bypass mode status (see Excel 10 wall module literature for further information).

Bypass Timer

When the bypass mode has been activated, the bypass timer is set to BypTime (default of 180 minutes), at the end of which the mode reverts to the original occupancy state (see Excel 10 wall module literature for further information).

Continuous Unoccupied Mode

This mode is entered when an Excel 10 wall module is configured to allow it and:
- T7460 and T7770: The bypass button is pressed for four to seven seconds (until the LED blinks),
- T7560: The bypass button is pressed for more than five seconds (until flashing moon appears).

This mode can also be entered via a network command (DestManOcc set to OC_UNOCCUPIED). The controller uses the Unoccupied setpoints. The controller remains in this mode indefinitely, or until the bypass button is pressed to exit the mode, or a network command is sent to clear the mode.

Bypass Push-Button

The Hydronic Controller may have an Excel 10 wall module with bypass push-button connected to it. There are three ways to configure the bypass push-button (see Table 14 for further information):

NONE
BYPASS_UNOCCUPIED
BYPASS_ONLY

Override Priority

The Hydronic controller can be configured to arbitrate overrides coming from the Wall Module and the network. There are two possible states that have the following meanings:

LAST_WINS-Specifies that the last command received from either the wall module or DestManOcc determines the effective override state.
NETWORK_WINS-Specifies that when DestManOcc is not OC_NUL, then the effective occupancy is DestManOcc regardless of the wall module override state.

LED/LCD

LED Override

The wall module's LED shows the override from the bypass button or from the network.
- LED on ⇒ Override Bypass
- One flash per second ⇒ Override Unoccupied
- Two flashes per second ⇒ Override Standby or Occupied
- LED off ⇒ No Override
- Four flashes per second ⇒ Controller answers network management wink command.

LED Occupancy

The wall module's LED shows the effective occupancy mode.
- LED on ⇒ Effective Occupied or Bypass
- One flash per second ⇒ Effective Standby
- LED off ⇒ Effective Unoccupied
- Four flashes per second ⇒ Controller answers network management wink command.

LCD Display

This mode is only used for T7560 Wall Modules. The occupancy mode is represented by the following symbols:
 ⇒ Effective Occupied or Bypass
 ⇒ Effective Standby
 ⇒ Effective Unoccupied
OFF ⇒ Controller is off
OFF and  ⇒ Controller is off, frost protection is enabled.

Flashing symbols represent the Override mode:
 ⇒ Override Occupied or Bypass
 ⇒ Override Standby
 ⇒ Override Unoccupied
 ⇒ Controller answers the network management wink command.

Energy-Saving Features

Standby Mode

The digital input for an occupancy sensor (usually a motion detector) provides the controller with a means to enter an energy-saving Standby mode whenever there are no people in the room. Standby mode occurs when the scheduled occupancy is Occupied and the occupancy sensor indicates no people currently in the room. If no occupancy sensor is connected directly to the controller, an occupancy sensor from another node may be bound to the network input DestOccSensor. The controller can also be put in Standby mode by settin DestManOcc to OC_STANDBY via the network. When in Standby mode, the Hydronic Controller uses the Standby Cooling or Heating setpoint (SptCoolStby or SptHeatStby).

Window Sensor

The digital input for a window contact provides the algorithm with a means to disable its temperature control activities if someone has opened a window or door in the room. If no window sensor is connected to the controller, the sensor from another node may used by binding it to DestWindow. Frost protection remains active (controller enables heating circuit with room temperatures below 46°F (8°C)). Normal temperature control resumes when the window closes.

Demand Limit Control

When a high-electrical-demand signal is received from an energy management system via the E-Bus network (DestDldShed), the controller uses DlcStptBump to shift the current setpoint (down for heating and up for cooling) by the configured value to save energy.

Optimum Start Gradients

There are two parameters, RecRampCool and RecRampHeat, that can be configured to cause the cooling and heating setpoints respectively to ramp up to their Occupied settings from their Unoccupied or Standby settings prior to scheduled Occupancy. The Hydronic controller uses the configured rates to determine the optimum time to start increasing the heating or cooling demand. See the following figures. The configuration parameters are in K/hour.

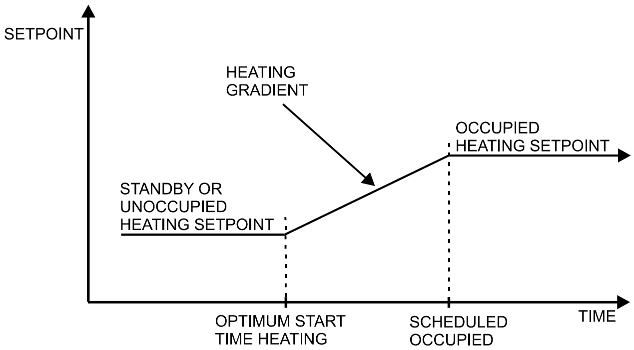

Fig. 4. Optimum start - heating.

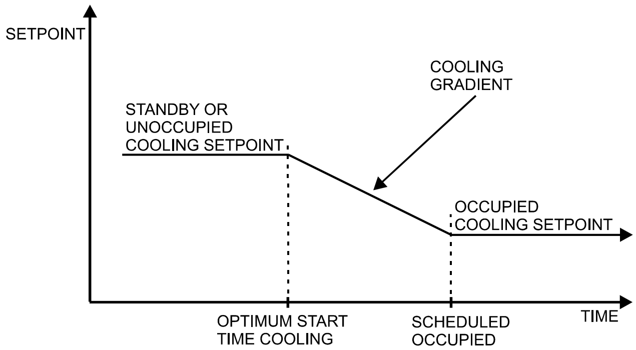

Fig. 5. Optimum start - cooling.

Occupancy Status

The occupancy status is determined based upon the following table. Manual override may come from the network input DestManOcc or from the bypass push-button.

Table 3. Effective Occupancy Mode Arbitration

Scheduled occupancy mode	Occupancy sensor status	Manual override status	Effective operating mode
Occupied	Occupied	Not assigned	OC_OCCUPIED
Occupied	Not occupied	Not assigned	OC_STANDBY
X	X	Occupied	OC_OCCUPIED
X	X	Unoccupied	OC_UNOCCUPIED
X	X	Standby	OC_STANDBY
Occupied	X	Bypass	OC_OCCUPIED
Standby	X	Not assigned	OC_STANDBY
Standby	X	Bypass	OC_OCCUPIED
Unoccupied	X	Not assigned	OC_UNOCCUPIED
Unoccupied	X	Bypass	OC_BYPASS

X=Don't care

Operating Modes

The possible modes of operation are listed in Table 4.

Table 4. Modes of Operation for Excel 10 Hydronic Controller.

Mode	Description	Events Causing a Controller to Switch to This Mode
Operational Modes (User Address: SrcHydModeS)		
START-UP AND WAIT	Control algorithms are disabled. Outputs stay in their initial positions. Physical inputs are periodically read and digital filtering of analog inputs is turned off to speed up settling time. Network input variables are received and output variables are sent periodically.	This is the first mode after an application restart.
FLOATING OUTPUTS SYNCH	The Hydronic Controller drives the floating control valves to their initial positions and then transitions to one of the control modes.	When the effective occupancy changes to unoccupied or standby, after start-up or 24 hours have elapsed since the last start-up, the Hydronic Controller transitions to this mode..
COOLING	The Excel 10 Hydronic Controller is controlling in the Cooling mode.	Network input (DestHvacMode) has a value of HVAC_COOL or HVAC_AUTO and the space temperature is above the cooling setpoint.
HEATING	The Excel 10 Hydronic Controller is controlling in the Heating mode.	Network input (DestHvacMode) has the value of HVAC_HEAT or HVAC_AUTO and the space temperature is below the heating setpoint..
MANUAL	No control algorithms are active. Physical inputs are periodically read and digital filtering of analog inputs is turned off to speed up settling time. Network input variables are received and output variables are sent periodically Outputs may be turned on or off by settings in network input nviTest.	Network input (DestManMode) has value of MODE_MANUAL.
FACTORY TEST	Control algorithm is disabled; special factory test program runs.	This mode is for factory testing only.
DISABLED	Control algorithms are terminated, outputs are turned off (turn-off sequences and interlocks are active). Frost protection is disabled.	Network input (DestManMode) has a value of MODE_DISABLED.

Agency Listings

Table 5 provides information on agency listings for Excel 10 Hydronic Controller products.

Table 5. Agency listings.

Device	Agency	Comments
W7762 Hydronic Controller	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.

Design

The Excel 10 W7762 Hydronic Controller is available in two basic models. The W7762A has a built-in setpoint adjustment knob, available in relative or degrees C absolute scales. The W7762B has no built-in setpoint adjustment and as such requires either a setpoint input from a direct-connected wall module or from the E-Bus network. All of the controllers are powered by 24 Vac.

All wiring connections to the controllers are made at screw terminal blocks accessible beneath a plastic safety cover. Mounting dimensions are shown in Fig. 6.

CAUTION

Turn off power prior to connecting to or removing connections from any terminals to avoid electrical shock or equipment damage.

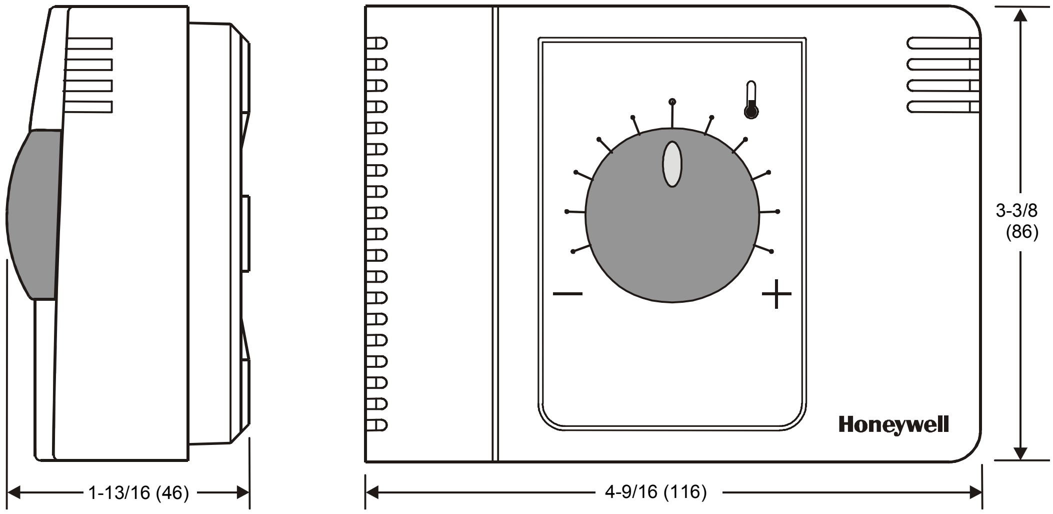

Fig. 6. W7762 construction in inches (mm).

Controller Performance Specifications

Power Supply:

24 Vac ± 20%, 50/60 Hz.

Operating Temperature:

32° to 122°F (0° to 50°C).

Shipping/Storage Temperature:

-40° to 158°F (-40° to 70°C).

Relative Humidity:

5% to 95% non-condensing

Inputs:

Temperature Sensor:
20k ohm NTC

Setpoint Potentiometer:
10k ohm

Digital Input:
Closed ≤ 400 ohms (1.5 mA)
Open ≥ 10k ohms (4.8 V)

Outputs:

Triac voltage range:
24 Vac ± 20%.
Triac maximum current ratings:
250 mA continuous
650 mA surge for 30 sec.

IMPORTANT:

When any device is energized by a Triac, the device must be able to sink a minimum of 15 mA. If non-Honeywell motors, actuators, or transducers are to be used with Excel 10 Hydronic Controllers, compatibility must be verified.

Interoperability

The W7762 Controllers use the Echelon Bus (E-Bus) LonTalk protocol. They support the LONMARK Functional Profile # 8020 “Fan Coil Unit Controller”, version 2.0. Fig. 7 shows the implementation used.

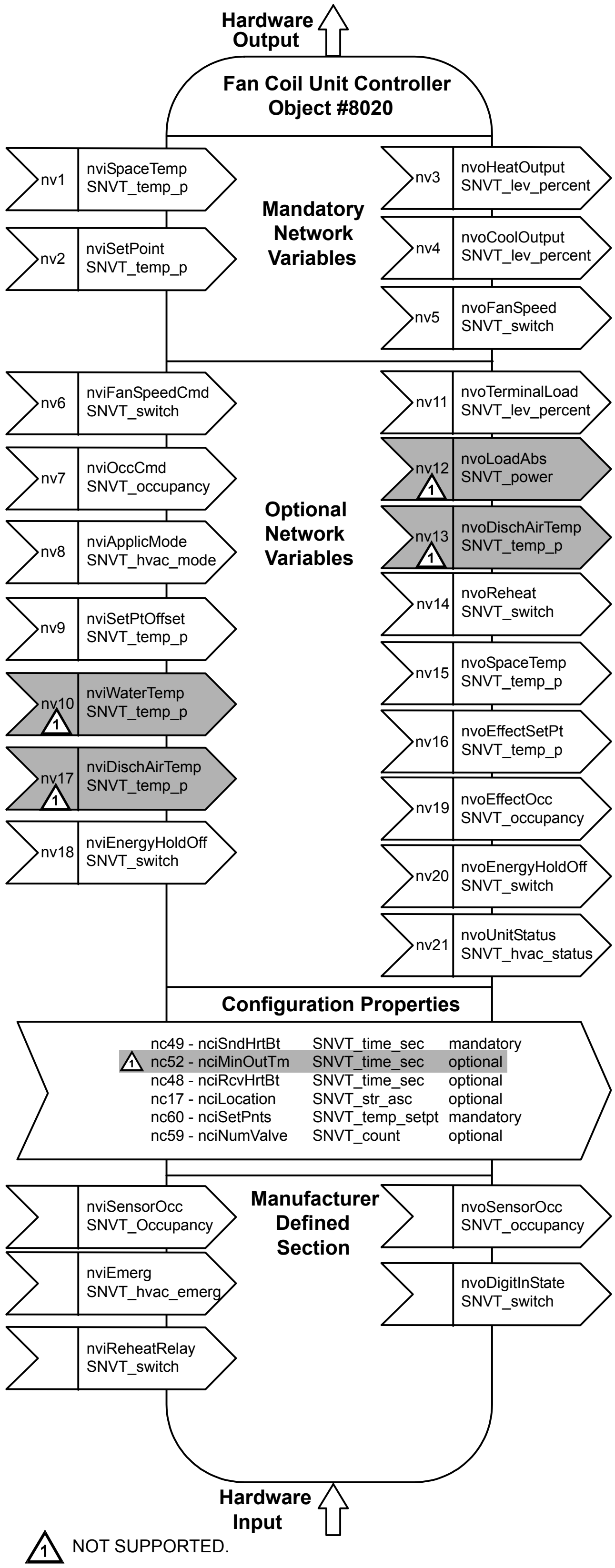

Fig. 7. LONMARK Fan Coil Unit object profile.

Configurations

General

The following sections provide an overview of the Excel 10 Hydronic Controller options related to inputs and outputs. See Application Step 6. Configure Controllers for complete list of configuration options and defaults.

Table 6. Hardware options summary.

Option	Possible Configurations
Fan interlock	enabled disabled
Hydronic system type	two-pipe four-pipe
Heating actuator type	floating floating-mid (one for heat/cool)[1] one-stage two-stage three-stage PWM thermal
Cooling actuator type	floating floating-mid (one for heat/cool)[1] one-stage two-stage three-stage PWM thermal
Digital input	not used window closed occupied sensor airflow detector cool changeover movement window open unoccupied sensor no airflow heat changeover input no movement
Wall module option	local shared
Temperature sensor type	none NTC non-linearized

NOTE:
[1] The floating-mid option is only for changeover applications and uses only one of the two outputs.

Fan Interlock (not available through E-Vision)

A fan interlock can be configured that prevents heating or cooling outputs from being turned on in the event of a fan failure (where an airflow detector is installed to detect fan failure). As the Hydronic Controller has no fan outputs, the interlock feature is applicable only to systems with manual fan switches.

Type of Heating and Cooling Equipment

W7762 controllers can operate with either two-pipe or four-pipe systems. A two-pipe system requires a changeover input to the controller (hardware or network input).

W7762 controllers can operate with a variety of actuators for heating and cooling equipment. Floating actuators requiring that the valve run time be specified during configuration of the controller can be used. Valve action can be configured as either direct or reverse. When in a two-pipe system with a changeover input, a floating actuator can be used that has the middle position (50%) as the zero energy position. The cool range is then 0 to 50% and the heat range 50 to 100%. The output must be configured as floating-mid.

Multi-stage systems can be controlled with up to three different stages of heating/cooling control. Switching levels are specified in % of control level (see Fig. 8) as is a hysteresis setting that applies to all switching levels. Heating and Cooling switching levels and hysteresis are specified separately. Minimum off times can be configured, and a minimum on time can also be configured.

PWM electronic valves and thermal actuators can also be connected and can be configured as either direct or reverse action. The cycle time must be specified during configuration. For PWM valves the zero and full positions must also be configured.

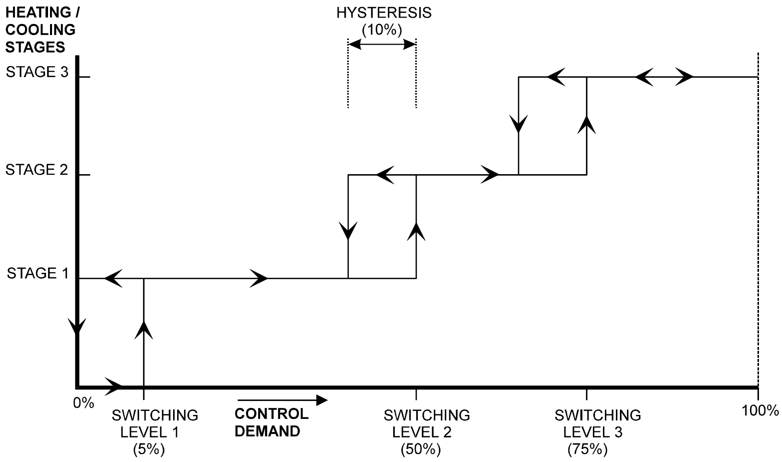

Fig. 8. Three-stage heating/cooling switching (defaults for switching levels and hysteresis shown).

Digital Input

There is a single digital input to the W7762 Controller that may be configured to accommodate an occupancy sensor, a window open/closed contact, an airflow detector for fan failure detection (not available through E-Vision), or a changeover input. It is possible to configure the input for either normally open or normally closed contacts for any of the switches. Choose the option that corresponds to the condition of a closed contact (input high).

The control algorithm in the Hydronic Controller uses the Occupancy Sensor, if configured, to determine the Effective Occupancy mode of operation (see Table 3). If the Time Of Day (TOD) schedule indicates an Occupied state, and the Occupancy Sensor contact is closed, the Effective Occupancy mode will be Occupied. However, if the TOD schedule indicates an Occupied state and the Occupancy Sensor contact is open, then the Effective Occupancy mode will be Standby. The flow control algorithm will then control to the Standby Cooling and Heating Setpoints.

Configuring the digital input for movement or no movement (dependent upon normally-open or normally-closed contacts) adds a delay of 15 minutes to the occupancy sensor such that the space is considered occupied until 15 minutes has elapsed since the last movement is detected.

If the digital input is configured as a window open/closed contact, heating and cooling control will be disabled while the window is detected open. Frost protection will be in effect, however, and heating control will be enabled if the temperature drops below 46°F (8°C). A set of contacts may be wired in series for multiple windows.

If the digital input is configured for an airflow detector (fan status), heating and cooling control will be disabled for a fan failure (no airflow detected). This option is not available through E-Vision.

The input may also be configured for changeover for a two-pipe system. The input can accommodate a switch that is closed for heating and open for cooling or open for heating and closed for cooling.

NOTE: The Excel 10 Hydronic Controller has limited power available (only 1.5 mA/4.8 V) for checking the digital input for contact closures. Ensure that contacts used remain within the specified resistance tolerance range (closed ≤ 400 ohms) even when aged.

Excel 10 Wall Module Options

A typical Hydronic installation will include an Excel 10 wall module containing a 20k ohm NTC room temperature sensor and additional features depending on the wall module type (see Excel 10 wall module literature for further information).

IMPORTANT

Wall modules with fan speed switches must not be used with W7762 Hydronic Controllers.

The Hydronic Controller can be configured to use a return air sensor rather than the sensor in the wall module. Setpoint adjustments can be configured as relative or absolute, and upper and lower limits can be set. The bypass button can be configured to override the control mode to occupied for a configurable bypass time and to override the control mode indefinitely to unoccupied or it may be configured to only override to occupied. The button may also be used to cancel the override.

Common Temperature Control (Master/Slave Controllers)

When one or more Hydronic Controllers serve a common area and a single temperature sensor is to be used, a master/slave arrangement can be configured. One Excel 10 Hydronic Controller is configured for the local wall module with the desired options. The other Excel 10 Hydronic Controller(s) will be configured without wall modules and with certain network variables bound with the master controller. Refer to Appendix B of this document for more details.

IMPORTANT

The slave units must have the same HVAC equipment connected to it as the master units.

The slave units will not use any internal temperature setpoints or control algorithms. The master controller determines heating/cooling output based upon setpoints and occupancy and command mode status and communicates this to the slave via the network. See Appendix B, Configuring for Master/Slave Operation, for more information,

Abbreviations and Definitions

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

E-Bus - 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 LONWORKS® network and the Neuron® chips used to communicate on the E-Bus.

EMI - Electromagnetic Interference; electrical noise that can cause problems with communications signals.

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.

E-Vision - PC-based tool used for configuration and commissioning of Excel 10 devices.

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 may be referred to as E-Link.

Firmware - Software stored in a nonvolatile memory medium such as an EPROM.

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 Ohms Law: V = I x R.

K - Kelvin.

LiveCARE - The PC based tool used to monitor and change parameters in C-Bus devices.

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.

NV - Network Variable; an Excel 10 Controller parameter that can be viewed or modified over the E-Bus network.

OEM - Original Equipment Manufacturer; the company that builds the fan coil units.

PC - Personal Computer.

Pot - Potentiometer. A variable resistance electronic component located on Excel 10 wall modules. Used to allow user-adjusted Setpoints to be input into the Excel 10 Controller.

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.

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

Vac - Voltage alternating current; ac voltage as opposed to dc voltage.

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

APPLICATION STEPS

Overview

Steps one through seven, see Table 7, address considerations for engineering an Excel 10 Hydronic System. These steps are guidelines intended to aid understanding of the product I/O options, bus arrangement choices, configuration options and the Excel 10 Hydronic Controllers' role in the overall EXCEL 5000® System architecture.

Table 7. 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 Controllers
7	Troubleshooting

Step 1. Plan The System

Plan the use of the W7762 Controllers according to the job requirements. Determine the location, functionality and sensor or actuator usage. Verify the sales estimate of the number of W7762 Controllers and wall modules required for each model type. Also check the number and type of output actuators and other accessories required.

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.

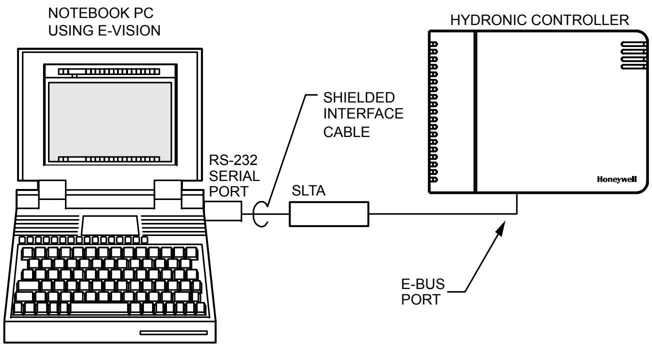

Fig. 9. Connecting the portable operator terminal to the E-Bus.

The E-Bus communication loop between controllers must be laid out according to the guidelines applicable for that topology. Hydronic Controllers use FTT technology that allows daisy chain, star, loop or combinations of these bus configurations. See Application Step 3. Lay Out Communications and Power Wiring, for more information on bus wiring layout, and see Fig. 10, Fig. 11, and Fig. 12 in Application Step 4. Prepare Wiring Diagrams, for wiring details.

It is important to understand the interrelationships between controllers on the E-Bus early in the job engineering process to ensure their implementation when configuring the controllers. (See Application Step 6. Configure Controllers, for information on the various Excel 10 Hydronic Controller parameters and on Excel 10 Hydronic Controller point mapping).

The T7770 Wall Modules can be installed only as I/O 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. It must be determined and documented prior to installation that T7770 Wall Modules will have their E-Bus network jacks connected.

Step 2. Determine Other Bus Devices Required

A maximum of 62 nodes can communicate on a single E-Bus segment. If more nodes are required, a 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 can take one node and two slots are available for operator terminal nodes, leaving 120 nodes available for Excel 10 Hydronic Controllers. All 120 controllers are able to communicate 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 W7762s. This is a limit set in the Excel 10 Zone Manager database and is an absolute maximum.

Each E-Bus segment is set up with two unused nodes to allow for an E-Vision operator terminal to be connected to the E-Bus. Multiple E-Vision terminals can be connected to the bus at the same time. Table 8 summarizes the E-Bus segment configuration rules.

Table 8. E-Bus configuration rules and device node numbers.

One E-Bus Segment Example	Maximum Number of Nodes Equals 62
One Q7750A Excel 10 Zone Manager	1 node
Port for operator terminal access (E-Vision)	1 node
Maximum number of Excel 10 Controllers	60 nodes (wall modules are **not** E-Bus nodes)
Total	**62** nodes
Two E-Bus Segments Example	**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 E-Vision terminals)	2 nodes (1 in each Bus Segment)
Maximum number of Excel 10 Controllers in segment number one	60 nodes (wall modules are **not** E-Bus nodes)
Maximum number of Excel 10 Controllers in segment number two	60 nodes (wall modules are **not** E-Bus nodes)
Total	**125** nodes

The maximum length of an FTT E-Bus segment is 4600 ft (1400 m) for a daisy chain configuration or 1650 ft (500 m) total wire length and (400 m) node-to-node for any other type of configuration.

NOTE: For FTT E-Bus segments the distance from each transceiver to all other transceivers and to the termination must not exceed the maximum node-to-node distance. If multiple paths exist, the longest one should be used for the calculation.

If longer runs are required, add a Q7751A Router to partition the system into two segments. It is not legal to use more than one router per Excel 10 Zone Manager.

In addition, all E-Bus segments require the installation of a Bus Termination Module. For an FTT E-Bus segment, one or two Termination Modules may be required depending upon the bus configuration. See Application Step 3. Lay Out Communications and Power Wiring, and the E-Bus Termination Module subsection in Application Step 4. for more details.

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. Wire the E-Bus using level IV 22 AWG or plenum rated level IV 22 AWG non-shielded, twisted pair, solid conductor wire as the recommended wire size (see Table 10 for part numbers). An FTT E-Bus can be wired in daisy chain, star, loop or any combination thereof as long as the maximum wire length requirements given in Step 2 are met.

NOTE: Due to the transformer isolation, the bus wiring does not have a polarity; that is, it is not important which of the two E-Bus terminals are connected to each wire of the twisted pair.

E-Bus networks can be configured in a variety of ways, but the rules listed in Table 8 always apply. Fig. 10 and Fig. 11 depict two typical daisy chain E-Bus network layouts; one as a single bus segment that has 60 nodes or less, and one showing two segments. Fig. 12 shows examples of free topology bus layouts using 2000-series devices. The bus configuration is set up using the Network Manager tool from within E-Vision (see the E-Vision User Guide).

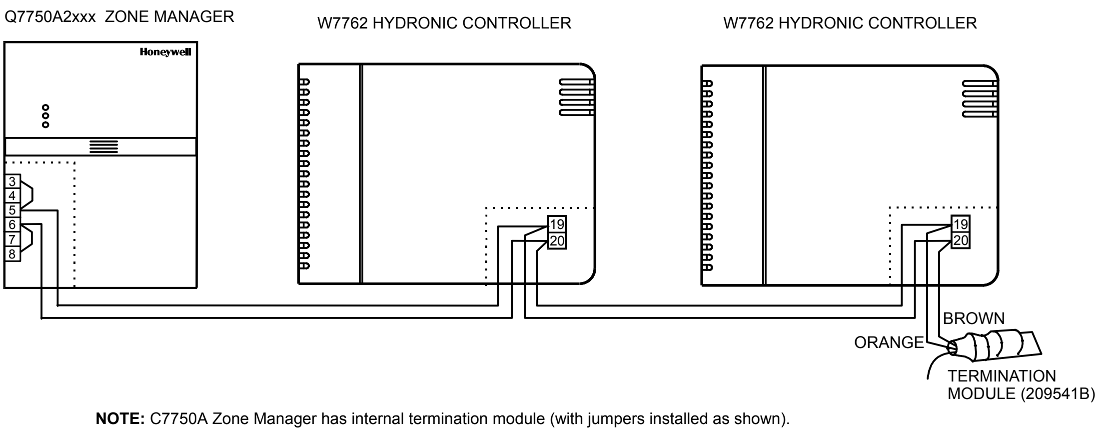

Fig. 10. E-Bus wiring layout for one daisy-chain network segment.

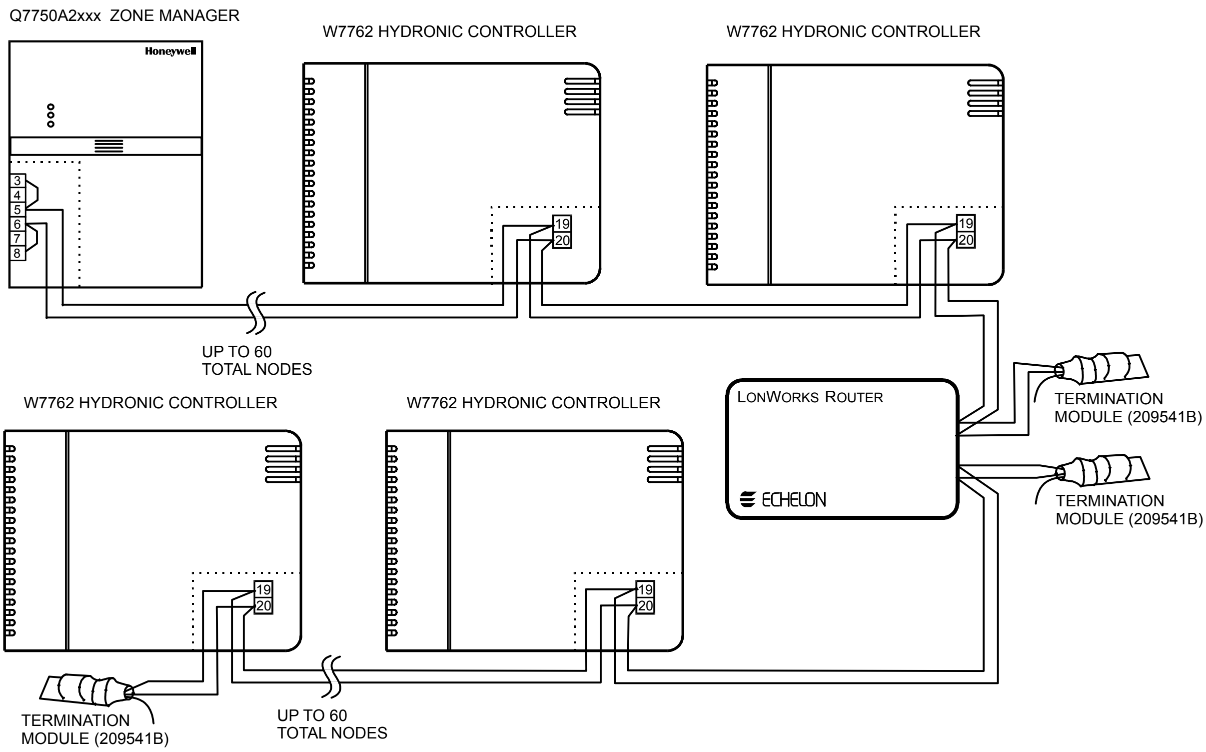

Fig. 11. E-Bus wiring layout for two daisy-chain network segments.

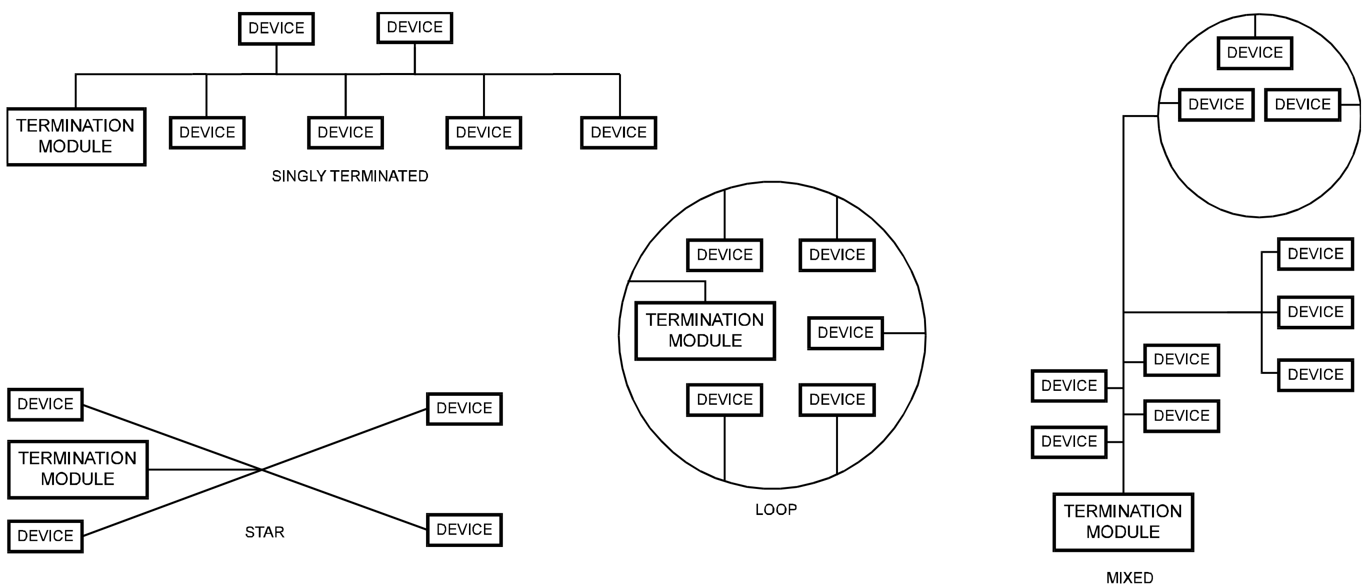

Fig. 12. Free topology E-Bus layout examples.

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

IMPORTANT
Notes on Communications Wiring:

- *All field wiring must conform to local codes and ordinances.*
- *Do not use different wire types or gauges on the same E-Bus segment. The step change in line impedance characteristics would cause unpredictable reflections on the bus. When the use of different types is unavoidable, use a Q7751A Router at the junction.*

- *Do not use shielded cable for E-Bus wiring runs. The higher capacitance of the shielded cable will cause degradation of communications throughput. 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 W7762 Controller 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 W7762 Controller. This includes the controller itself, the equipment 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 W7762 Excel 10 Hydronic Controller.

Assume a W7762 unit with a thermal actuator for cooling control and an electric actuator for heating. The power requirements are:

Device	VA	Information obtained from
Excel 10 W7762 Hydronic Controller	0.5	W7762 Specification Data
Z100A Thermal actuator	12.0	Product Data
M7410A Electric Actuator	0.7	Product Data
TOTAL:	13.2 VA	

The Excel 10 System example requires 13.2 VA of peak power; therefore, a 48 VA CRT 2 (20 VA AT20A for US) Transformer is able to provide ample power for this controller and its accessories.

Table 9. VA Ratings For Transformer Sizing.

Device	Description	VA
W7762A,B	Excel 10 Hydronic Controller	0.5
T7560A	DWM	0.2
Z100A	Thermal actuator	12.0
M7410A	Electric actuator	0.7

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, which 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 a transformer to a W7750 CVAHU Controller drawing 37 VA using two 18 AWG (1.0 mm^2) wires.

The formula is:
Loss = [length of round-trip wire run (ft)] x [resistance in wire (ohms per ft)] x [current in wire (amperes)]

From specification data:
18 AWG twisted pair wire has 6.38 ohms per 1000 feet.
Loss = [(400 ft) x (6.38/1000 ohms per ft)] x [(37 VA)/(24V)] = 4.0 volts

This means that four volts are going to be lost between the transformer and the controller; therefore, to ensure that the controller 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. 13 shows this voltage load dependence.

In the preceding I x R loss example, even though the controller load is only 37 VA, a standard 40 VA transformer is not sufficient due to the line loss. From Fig. 13, a 40 VA transformer is just under 100 percent loaded (for the 37 VA controller) and, therefore, has a secondary voltage of 22.9 volts. (Use the lower edge of the shaded zone in Fig. 13 that represents the worst-case conditions.) When the I x R loss of four volts is subtracted, only 18.9 volts reaches the controller, 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. 13, an output of 24.4 volts minus the four volt line loss supplies 20.4 volts to the controller. 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^2) wire has a resistance of 2.57 ohms per 1000 ft that, 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^2) wire is the recommended wire size for 24 Vac wiring.
3. Locate the transformer closer to the controller, 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 controller.

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%) or 193 Vac (230 minus 15%).

To meet the National Electrical Manufacturers Association (NEMA) standards, a transformer must stay within the NEMA limits. The chart in Fig. 13 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

I*MPORTANT (US ONLY)*

*If the W7762 Controller is used on **Heating and Cooling Equipment (UL 1995)** devices and the transformer primary power is more than 150 volts, connect the transformer secondary to earth ground, see Fig. 14.*

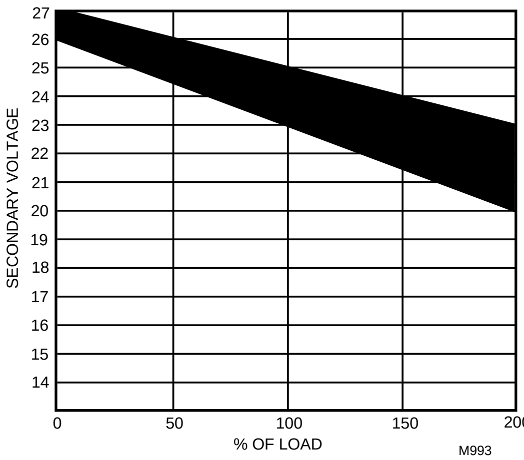

Fig. 13 NEMA class 2 transformer voltage output limits.

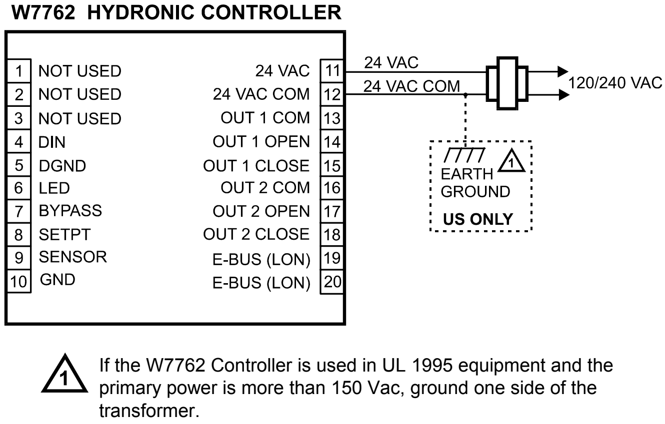

Fig. 14 Power wiring details for one Excel 10 per transformer.

IMPORTANT

Notes on power wiring:

- *All field wiring must conform to local codes and ordinances or as specified on installation wiring diagrams.*
- *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 controller.*
- *For the W7762 Controller (which has Triac outputs), all output devices must be powered from the same transformer as the one powering the W7762 Controller.*
- *Use the heaviest gauge wire available, up to 14 AWG (2.0 mm^2) with a minimum of 18 AWG (1.0 mm^2) for all power and earth ground connections.*
- *To minimize EMI noise, do not run Triac and/or relay output wires in the same conduit as the input wires or the E-Bus communications wiring.*
- *Unswitched 24 Vac power wiring can be run in the same conduit as the E-Bus cable.*

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 for the W7762 Hydronic Controller are shown in Fig. 16. Table 11 gives additional details for output 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.

Table 10 lists wiring types, sizes, and length restrictions for Excel 10 Hydronic Controller products.

Table 10. Field wiring reference table (US part numbers shown).

Wire Function	Recommended Minimum Wire Size AWG (mm^2)	Construction	Specification or Requirement	Vendor Wire Type	Maximum Length ft (m)
E-Bus (Plenum)	22 AWG	Twisted pair solid conductor, non-shielded.	Level IV 140°F (60°C) rating	Honeywell (US) AK3791 (one twisted pair) AK3792 (two twisted pairs) (Europe: Belden 9H2201504)	See Step 2
E-Bus (Non-plenum)*	22 AWG	Twisted pair solid conductor, non-shielded.	Level IV 140°F (60°C) rating	Honeywell (US) AK3781 (one twisted pair) AK3782 (two twisted pairs) (Europe: Belden 9D220150)	See Step 2
Input Wiring Sensors Contacts	14 to 20 AWG (2.0 to 0.5 mm^2)	Multiconductor (usually five-wire cable bundle). For runs >100 ft (30 m) twisted pair or shielded cable is recommended.	140°F (60°C) rating	Standard thermostat wire	82.5 ft (25m)
Output Wiring Actuators Relays	14 AWG (2.5 mm^2) (18 AWG (1.0 mm^2) acceptable for short runs)	Any pair non-shielded (use heavier wire for longer runs).	NEC Class 2 140°F (60°C) rating	Honeywell (US) AK3702 (18 AWG) AK3712 (16 AWG) AK3754 (14 AWG) or equivalent	200 ft (60m)
Power Wiring	14 AWG (2.5 mm^2)	Any pair non-shielded (use heavier wire for longer runs).	NEC Class 2 140°F (60°C) rating	Honeywell (US) AK3754 (14 AWG) (twisted pair) AK3909 (14 AWG) single conductor or equivalent	Limited by line loss effects on power consumption. (See Line Loss subsection.)

NOTE: PVC wire must not be used where prohibited by local fire regulations.

W7762 Controller

Fig. 16 illustrates W7762 Controller terminal block assignments and wiring for a sample Hydronic installation. All connections are made at terminal blocks.

Table 11 lists wiring information for wiring all of the possible actuator types.

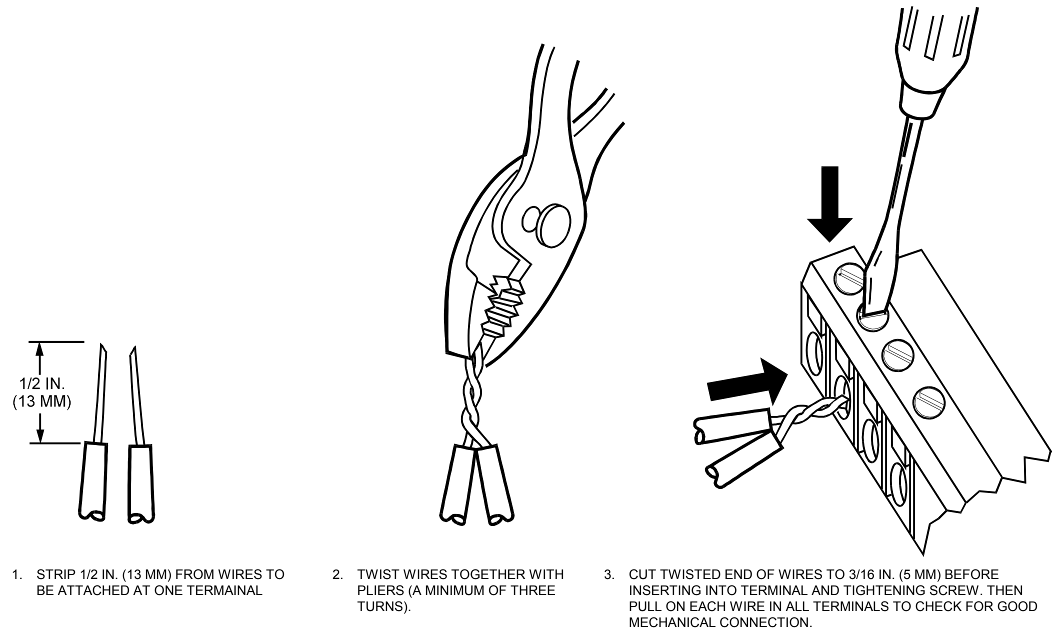

Fig. 15. Attaching two or more wires at terminal blocks.

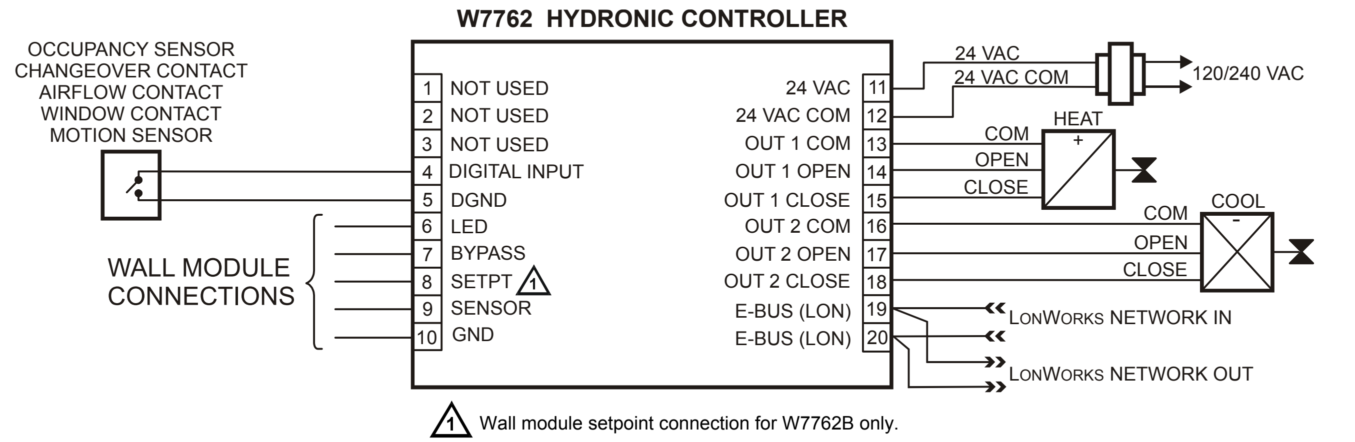

Fig. 16. W7762 Hydronic Controller wiring example.

Table 11. Output assignments for various actuator types.

Output type	Out 1 Terminal			Out 2 Terminal		
	13	**14**	**15**	**16**	**17**	**18**
Floating	24 Vac	open	close	24 Vac	open	close
1-stage	24 Vac	on/off	—	24 Vac	on/off	—
2-stage	24 Vac	stage 1	stage 2	24 Vac	stage 1	stage 2
3-stage	24 Vac	stage 1	stage 2	24 Vac	stage 1	stage 2
		stage 3			stage 3	
PWM	24 Vac	PWM	—	24 Vac	PWM	—
Thermal	24 Vac	on/off	—	24 Vac	on/off	—

E-Bus Termination Module

One or two E-Bus Termination Modules, part no. 209541B, are required for an E-Bus with FTT devices on it, depending upon the configuration. Double termination is only required when the network is a daisy-chain configuration and the total wire length is greater than 1640 ft (500 m). The maximum lengths described in Step 2 must be adhered to for either a daisy chain or free topology E-Bus layout. See Fig. 17 for connection details for a doubly terminated bus. See Fig. 18 for connection details for a singly terminated bus.

NOTE: The Q7750A Zone Manager has an internal termination circuit, although jumpers are required at the terminal block to connect it. See form number 95-7509-2 for details.

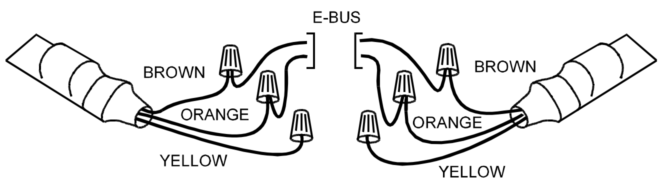

Fig. 17. Termination Module connections for a doubly-terminated FTT network.

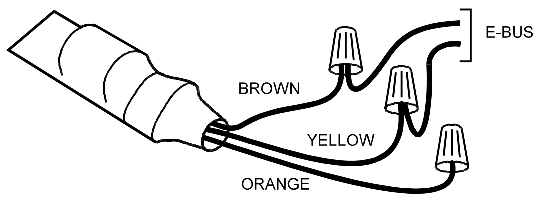

Fig. 18. Termination Module connections for a singly-terminated FTT network.

Step 5. Order Equipment

After compiling a bill of materials through completion of the previous application steps, refer to Table 12 for ordering information. Contact Honeywell for information about Controllers and Wall Modules with no logo.

Table 12. Excel 10 Hydronic Controller ordering information.

Part Number	Product Description	Comments
	Excel 10 Hydronic Controllers	
W7762A1045	with setpoint knob	°C absolute
W7762A1052	with setpoint knob	+/- relative
W7762B1019	no setpoint knob	
	Excel 10 Wall Modules	
T7460 T7560 T7770		See Excel 10 wall module literature for details.
	Excel 10 Sensors	
C7068A1007 (Europe)	Air Temperature Sensor	Return air
	Echelon-Based Components and Parts	
Q7751A2002 (US) (UK) (Europe)	FTT E-Bus Router	Order from local Echelon supplier (Europe)
Q7752A2001 (US) (UK) (Europe)	FTT E-Bus Serial Interface (SLTA)	Order from local Echelon supplier (Europe)
209541B	FTT Termination Module	Two required per E-Bus segment.
205979A (US only)	SLTA Connector Cable for E-Bus	Serial interface to wall module or controller.
	Excel 10 Zone Manager	
Q7750A2003	FTT E-Bus Zone Manager	C-Bus to E-Bus interface
XD 505A	9600 Baud C-Bus Communications Submodule	—
XD 508	(1 Megabit Baud Rate) C-Bus Communications Submodule	—
	Cabling	
—	Serial Interface Cable, male DB-9 to female DB-9 or female DB-25.	Obtain locally from any computer hardware vendor.
Honeywell (US) AK3791 (one twisted pair) AK3792 (two twisted pairs) Belden 9H2201504 (Europe)	E-Bus (plenum): 22 AWG twisted pair solid conductor, non-shielded.	Level IV 140°F (60°C) rating
Honeywell (US) AK3781 (one twisted pair) AK3782 (two twisted pairs) Belden 9D220150 (Europe)	E-Bus (non-plenum): 22 AWG twisted pair solid conductor, non-shielded.	Level IV 140°F (60°C) rating
Honeywell (US) AK3725	Inputs: 18 AWG (1.0 mm^2) five wire cable bundle.	Standard thermostat wire
Honeywell (US) AK3752 (typical or equivalent)	Outputs/Power: 14 to 18 AWG (2.5 to 1.0 mm^2).	NEC Class 2 140°F (60°C) rating
Honeywell (US) AK3702 (typical or equivalent)	18 AWG (1.0 mm^2) twisted pair.	Non-plenum
Honeywell (US) AK3712 (typical or equivalent)	16 AWG (1.5 mm^2) twisted pair.	Non-plenum
Honeywell (US) AK3754 (typical or equivalent)	14 AWG (2.5 mm^2) two conductor.	Non-plenum

Step 6. Configure Controllers

General

The process of configuring Excel 10 Hydronic Controllers is the same for all models. In all cases, the process involves giving the Excel 10 Hydronic Controller information using the E-Vision PC tool. Details on the use of E-Vision are found in the E-Vision User Guide. The E-Vision User Guide provides detailed steps for defining the Excel 10 Zone Manager (if required); creating or starting an existing E-Vision project; creating or selecting an existing network; building or modifying the network; defining and copying controllers; mapping points between controllers, the Zone Manager, and third-party devices; connecting to controllers for commissioning, monitoring and uploading; and various other functions. This section will provide details on the configuration options found in E-Vision for W7762 Controllers. If another E-Bus communication tool is used for set-up, see Appendix C for reference information.

Using E-Vision

The configuration process is primarily performed in a series of screens seen as file tabs under the menu option **Application Selection** and is easily followed using the tables included in this section. There are 8 file tabs:

- Output
- Input
- Equipment Control
- Switching Levels
- Zone Options
- Miscellaneous
- PID
- Wiring (information only, no configuring).

The specific parameters to be configured in each of these four categories are tabulated in the following subsections. For a complete list of all Excel 10 Hydronic Controller User Addresses, see Appendix C.

The configuration of the setpoints as either absolute or relative is performed in E-Vision in the **Project Defaults** screen.

NOTE: To set the following configuration parameters, use the E-Vision PC tool. These sections describe the various parameters and the allowable settings. For details on using E-Vision, refer to the E-Vision User Guide.

Outputs

The available options for output configurations with the default values shown are listed in Table 13. See Configurations section above for more information about parameters.

Table 13. Hydronic Controller output configuration options.

Function	Configuration options	Default
System type	two pipe (1 valve) four pipe (2 valves)	four pipe
Output1 (triac 1 and 2) control[1]	not used cooling heating heat/cool changeover	heating
Output 1 (triac 1 and 2) type	floating floating-mid[2] 1-stage 2-stage 3-stage PWM thermal	floating
Output 2 (triac 3 and 4) control[1]	not used cooling heating heat/cool changeover	cooling
Output 2 (triac 3 and 4) type	floating floating-mid[2] 1-stage 2-stage 3-stage PWM thermal	floating

NOTES:
1. The output mode settings only apply to a 4-pipe system. In a 2-pipe system output1 will always operate in changeover mode.
2. The floating-mid option is only for changeover applications and uses only one of the two outputs.

The operation of the triacs based upon the output type is given in Table 11.

Inputs

The available options for input configurations with the default values shown are listed in Table 14. Setpoint knob settings may apply to the built-in setpoint knob (W7762A only) or remote wall module (for W7762B controllers). See Control Provided and Configurations sections above for more information on parameters.

Table 14. Hydronic Controller input configuration options.

Function	Configuration options	Default
Space temperature sensor	no sensor sensor	sensor
Bypass button	none - bypass button is disabled. bypass unoccupied - bypass button overrides current mode to occupied for configurable bypass time for button press of 1.1 to 4 seconds (single press with T7560) or permanently overrides to unoccupied for button press of 4.1 to 7 seconds (more than 5 seconds with T7560). bypass - bypass button only overrides current mode to occupied and to cancel the override again.	bypass unoccupied
LED/LCD	LED override - shows override from bypass button or from network. LED occupancy - shows effective occupancy mode. LCD display - only used with T7560 Wall Modules; occupancy mode is represented by different symbols.	LED override
Setpoint knob	no knob relative absolute middle	relative
Minimum limit setpoint pot	limit for setpoint knob in either degrees F (absolute setpoint, 53.6 to 86°F) or DDF (relative setpoint, -9 to 9 DDF) (limit for setpoint knob in either degrees C (absolute setpoint, 12 to 30°C) or K (relative setpoint, -5 to 5 K))	-9 DDF (53.6°F for absolute setpoint) (-5 K (12°C for absolute setpoint))
Maximum limit setpoint pot	limit for setpoint knob in either degrees F (absolute setpoint, 53.6 to 86°F) or DDF (relative setpoint, -9 to 9 DDF) (limit for setpoint knob in either degrees C (absolute setpoint, 12 to 30°C) or K (relative setpoint, -5 to 5 K))	9 DDF (86°F for absolute setpoint) (5 K (30°C for absolute setpoint))
Digital input	not used window closed occupied sensor cool changeover window open unoccupied sensor heat changeover movement no movement	not used

NOTES:
1. The temperature sensor option **no sensor** requires that either the Hydronic controller is configured as a slave unit receiving heating and cooling control levels from the master unit via the network, or that it is receiving temperature information over the network from another device.
2. The digital input option to be selected is the condition in which the input will be high (switch contact closed).

Equipment Control

The available options for equipment control configurations with the default values shown are listed in the following table. See Configurations section above for more information on parameters.

Table 15. Hydronic Controller equipment control configuration options.

Function	Configuration options	Default
Output 1 valve direction[1]	direct reverse	direct
Output 2 valve direction[1]	direct reverse	direct
Output 1 minimum stage off time	0 to 600 seconds	90 s
Output 2 minimum stage off time	0 to 600 seconds	90 s
Output 1 valve run time/PWM period/minimum stage on time	floating/floating-mid - valve run time (20 to 600 seconds) PWM - cycle time (20 to 600 seconds) 1, 2, and 3-stage - minimum on time (0 to 1200 seconds)	150 s
Output 2 valve run time/PWM period/minimum stage on time	floating/floating-mid - valve run time (20 to 600 seconds) PWM - cycle time (20 to 600 seconds) 1, 2, and 3-stage - minimum on time (0 to 1200 seconds)	150 s
PWM zero position[2]	0 to 100%	0%
PWM full position[2]	0 to 100%	100%

NOTES:
1. Valve action settings apply to floating, PWM, or thermal types.
2. Settings apply to both actuators if both are PWM.

Switching Levels

The available options for switching level configurations with the default values shown are listed in the following table. See Configurations section above for more information on parameters.

Table 16. Hydronic Controller switching levels configuration options.

Function	Configuration options	Default
Cooling stage 1 switching level	0 to 100%	5%
Heating stage 1 switching level	0 to 100%	5%
Cooling stage 2 switching level	0 to 100%	50%
Heating stage 2 switching level	0 to 100%	50%
Cooling stage 3 switching level	0 to 100%	75%
Heating stage 3 switching level	0 to 100%	75%
Cooling hysteresis	0 to 100%,	10%
Heating hysteresis	0 to 100%	10%

Zone Options

The available options for input configurations with the default values shown are listed in the following table.

Table 17. Hydronic Controller zone configuration options.

Function	Configuration options	Default
Cooling occupied setpoint1[1,2]	50 to 95°F (10 to 35°C)	73.4°F (23°C)
Heating occupied setpoint[1,2]	50 to 95°F (10 to 35°C)	69.8°F (21°C)
Cooling standby setpoint[1,2]	50 to 95°F (10 to 35°C)	77°F (25°C)
Heating standby setpoint[1,2]	50 to 95°F (10 to 35°C)	66.2°F (19°C)
Cooling unoccupied setpoint[1,2]	50 to 95°F (10 to 35°C)	82.4°F (28°C)
Heating unoccupied setpoint[1,2]	50 to 95°F (10 to 35°C)	60.8°F (16°C)

NOTES:

1. Default setpoints are used when there is no setpoint knob and no network setpoint input.
2. Ensure that unoccupied heating<occupied heating<occupied cooling<unoccupied cooling and standby heating<standby cooling.

Miscellaneous

The available options for the miscellaneous tab with the default values shown are listed in the following table. See Control Provided and Configurations sections above for more information on parameters.

Table 18. Hydronic Controller miscellaneous configuration options.

Function	Configuration options	Default
Bypass time	0 to 1080 minutes	180 minutes
Override priority	last wins - the last command from either the wall module or from the network has priority. network wins - a network command always has priority until canceled.	Last wins
Demand limit control bump	0 to 10 K	2 K
Cool rec ramp (Cooling optimum start gradient)	-20 to 0 K/hour	0
Heat rec ramp (Heating optimum start gradient)	0 to 20 K/hour	0

PID

The available options for configuring the PID parameters with the default values shown are listed in the following table. See Control Provided section above for more information on parameters.

Table 19. Hydronic Controller PID configuration options.

Function	Configuration options	Default
Cooling proportional gain[1]	4 to 100 K (0 = disable)	4 K
Heating proportional gain[1]	4 to 100 K (0 = disable)	4 K
Cooling reset time	10 to 3200 seconds (0 = disable)	300 s
Heating reset time	10 to 3200 seconds (0 = disable)	300 s
Cooling derivative time	1 to 3200 seconds (0 = disable)	0
Heating derivative time	1 to 3200 seconds (0 = disable)	0
Cooling boost temperature	0.5 to 10 K (0 = disable)	1 K
Heating boost temperature	0.5 to 10 K (0 = disable)	1 K

NOTES:

1. With version 1.0.2 and later firmware, it is possible to configure the proportional gain as low as 2 for PI control or 1.25 for P control.

Commissioning

Commissioning refers to the activities performed to optimize the Hydronic operation to meet the job specification requirements and overall fine-tuning of the Hydronic control. E-Vision is the tool used to perform these activities, as described in Appendix B.

Job Commissioning

The CARE database that is generated for the Excel 10 Hydronic Controllers and associated Zone Managers contains information concerning interrelationships and network identifications. For this reason, it is mandatory to commission (assign ID and download) all Excel 10 Hydronic Controllers and the Zone Managers from a *single* database.

This project database can be backed up and restored to be placed onto various PCs during the commissioning phase (but only a single copy can be used at a time) and then must be redesignated as the *master* and given to the next PC for further commissioning.

⚠ CAUTION

If more than one copy of the same database is used in multiple PCs to assign IDs and download to Excel 10 Hydronic Controllers, there is currently no means to recombine the multiple copies into a single database for any project. If multiple copies are used, it is necessary to designate one database as the master and recommission the controllers that do not indicate being commissioned. If E-Vision displays an assigned ID only the application needs to be downloaded to the controller. If no ID has been assigned, assign ID(s) and download the application to the controller(s). In both of these cases, parameter changes (Setpoints, Temperature Sensor Calibration, etc.) made with the other PC database are lost and have to be re-entered.

ID Number

Each Excel 10 Hydronic Controller is shipped with an internal Identification Number from the factory called the Neuron ID©. This ID number is on a removable sticker on the side of the W7762 housing and is required for identifying the controller on the E-Bus network through E-Vision. The ID number can either be manually entered or it can be received from the network. Pressing the bypass push-button on the wall module when the Hydronic controller is in its Service Mode or pressing the service pin button on the controller itself causes it to broadcast a service message containing its Neuron ID number. E-Vision is used to perform both methods (see E-Vision User Guide).

Configuring the Zone Manager

The Q7750A Excel 10 Zone Manager sends out a one-time LONWORKS message containing its 48-bit Neuron ID after any power-up *WARMSTART* or when the Excel 10 Zone Manager is reset by pressing the reset button.

IMPORTANT

Pressing the reset button on the Excel 10 Zone Manager causes all application files in the Q7750A, including the C-Bus setup, to be lost.

The LONWORKS message is sent out one time and only on the E-Bus, not on the B-Port. The message will be the same as the one generated after pressing the service button, which is available on Excel 10 Hydronic Controllers via the wall module bypass push-button. E-Vision uses this message to assign the node address.

The *Assign ID* procedure is the same as for an Excel 10 Hydronic Controller except, instead of pressing the bypass button, the reset button must be pressed or the power must be cycled (down then up) on the Q7750A Excel 10 Zone Manager.

Excel 10 Hydronic Controller Point Mapping

In typical Excel 10 Hydronic Systems, there are often variables that contain values or information that must be shared with devices on the C-Bus. E-Vision is used to perform these operations through the Point Mapping function. Mapped points are available to the C-Bus. Table 20 lists Hydronic Controller source variables for mapping, and Table 21 lists variables from other sources that may be mapped to Hydronic Controller input variables. See Appendix D for a complete list of all Excel 10 Hydronic Controller User Addresses.

Table 20. List of Excel 10 Hydronic Controller source variables for mapping: Hydronic Controller source points with receivers elsewhere on E-Bus or C-Bus

Source (Excel 10 Hydronic Controller) variable name	Description (including receiver information)	Allowable values	Typical destination
SrcOccEff	This signal contains the effective occupancy status of the Excel 10 Hydronic Controller.	Occupied Standby Unoccupied	XBS for monitoring.
SrcOccOvrdHwS	This signal contains the state of the remote override button.	Unoccupied Bypass Not Assigned	XBS for monitoring and tenant logging.
SrcHydModeS	Indicates the current Control mode of the Excel 10 Hydronic Controller.	10 possible values. See Table 4.	XBS for monitoring.
SrcAlarmNode	Indicates latest alarm detected by the node (if any) and return to normal.	22 possible values. See Table 22.	XBS for monitoring.
SrcTermLoad	This indicates the current calculated terminal cooling load as a percentage of what the unit is designed to handle. Positive value indicates a cooling load. Negative value indicates a heating load.	-160 to 160 percent	XBS for monitoring.
SrcRmTempSptEffS	This indicates the current temperature control point calculated from the various Setpoints and Operating modes.	50 to 95°F (10 to 35°C)	XBS for monitoring.

NOTE: E-Vision handles the mapping process for C-Bus accessible Excel 10 points. If custom mapping arrangements are required, see Appendix D for a complete listing of the Excel 10 Hydronic Controller User Addresses.

Table 21. Mapping of source points elsewhere on E-Bus or C-Bus to Excel 10 Hydronic Controller receiver points.

Typical source (non-Excel 10 Controller) variable name	Description	Allowable values	Typical destination (Excel 10 Hydronic Controller) name
OccSignal	Signal containing TOD Schedule mode command from the Excel 10 Zone Manager or a C-Bus controller.	Occupied Unoccupied Standby	DestSchedOcc
HvacMode	Signal from main equipment controller to command the Excel 10 Hydronic Controller into a particular mode of operation.	Cooling Heating Auto Off	DestHvacMode
DmndShed	Signal containing the Shed mode command (based on electrical demand) from the Excel 10 Zone Manager, or a C-Bus controller. When signal is TRUE, the value in DlcStptBump is added to the Space Temperature Setpoint.	Shed not Active Shed Active	DestDlcShed
SetPtReset	Amount (in degrees) to add to the temperature setpoint reading for energy savings. Typically sent from another controller doing EMS calculations.	-5 to +5°F (-3 to +3°C)	DestSptOffset

Step 7. Troubleshooting

Troubleshooting Excel 10 Hydronic Controllers and Wall Modules

In addition to the following information, refer to the various Checkout and Test manuals for these products. See Applicable Literature section for form numbers.

Alarms

When an Excel 10 Hydronic Controller has an alarm condition, it reports it to the central node on the E-Bus (typically, the Excel 10 Zone Manager) via the variable nvoAlarm. See Table 22. The information contained in nvoAlarm is:

- Subnet Number: The E-Bus subnet that contains the Excel 10 Hydronic Controller node that has the alarm condition. Subnet 1 is on the Zone Manager side of the router; Subnet 2 is on the opposite side.
- Node Number: The Excel 10 Hydronic Controller node that has the alarm condition.
- Alarm Type: The specific alarm being issued and return to normal. An Excel 10 Hydronic Controller can provide the alarm types listed in Table 22.

All current alarms are contained in a variable called nvoAlarmStatus (User Addresses SrcAlarmStatus1, SrcAlarmStatus2, and SrcAlarmStatus3) that is composed of three bytes (nvoAlarmStatus.alarm_bit[n] with n = 0 through 2) with a bit corresponding to each of the alarms listed in Table 22. The coding is ordered in that the least significant bit of nvoAlarmStatus.alarm_bit[0] corresponding to alarm type 1, the most significant bit corresponding to alarm type 8, the least significant bit of nvoAlarmStatus.alarm_bit[1] corresponding to alarm type 9, and so on. Even alarms that are suppressed in nvoAlarm (see below) are contained in nvoAlarmStatus.

Also, the Excel 10 Hydronic Controller variables, nvoAlarmLog.type[n], where n is 0 through 4, (User Addresses SrcAlarmLog1 through SrcAlarmLog5) that store the last five alarms to occur in the controller, are available. These points can be viewed through XBS or E-Vision.

Certain alarm conditions are suppressed conditionally as follows:

If an input network variable with failure detect is bound to the same node as nvoAlarm, then nvoAlarm and nvoAlarmLog do not report the related Hydronic Controller variable receive failure error and its associated return to normal. Suppression occurs only when the nvoAlarm is bound to only one node using LONWORKS subnet/node addressing and only after the input variable has actually received a network variable from the node since the latest application restart (or power-up condition

Table 22. Excel 10 Hydronic Controller alarms.

Name of alarm or alarm bit	Alarm type number	Meaning of alarm code or alarm bit
No Alarm/Return to Normal:		
RETURN_TO_NORMAL	128	Return to no error after being in an error condition. This code is added numerically to another alarm code to indicate that the error condition has returned to normal.
ALARM_NOTIFY_DISABLED	255	The alarm reporting has been turned off by the nviManualMode =SUPPRESS_ALARMS. No more alarms are reported until nviManualMode turns on alarm reporting or upon application restart.
NO_ALARM	0	No errors since last application restart; initial condition
Hydronic Alarms:		
ALARM_NODE_OFF	1	Control algorithm has stopped due to controller disabled, or in test mode, or other conditions
ALARM_FROST	2	The space temperature is below the frost alarm limit. The alarm condition remains until the temperature exceeds the alarm limit plus hysteresis.
ALARM_INVALID_SETPOINTS	3	One of the setpoints is not in the valid range
ALARM_TEMP_SENSOR	4	Temperature sensor failed
ALARM_SETPOINT_KNOB	5	Remote setpoint potentiometer failed
ALARM_FAN_FAILURE	7	The fan feedback input does not detect airflow.
ALARM_FD_SPACE_TEMP	8	nviSpaceTemp is bound and has failed in receiving an update within its specified FAILURE_DETECT_TIME
ALARM_FD_APPL_MODE	9	nviApplicMode is bound and has failed in receiving an update within its specified FAILURE_DETECT_TIME
ALARM_FD_SETPT_OFFSET	10	nviSetPtOffset is bound and has failed in receiving an update within its specified FAILURE_DETECT_TIME
ALARM_FD_TOD_EVENT	11	nviTodEvent is bound and has failed in receiving an update within its specified FAILURE_DETECT_TIME
ALARM_FD_DLC_SHED	12	nviDlcShed is bound and has failed in receiving an update within its specified FAILURE_DETECT_TIME
ALARM_FD_TEMP_RESET	13	nviTempReset is bound and has failed in receiving an update within its specified FAILURE_DETECT_TIME
ALARM_FD_OD_TEMP	14	nviOdTemp is bound and has failed in receiving an update within its specified FAILURE_DETECT_TIME
ALARM_FD_SENSOR_OCC	15	nviSensorOcc is bound and has failed in receiving an update within its specified FAILURE_DETECT_TIME
ALARM_FD_WINDOW	16	nviWindow is bound and has failed in receiving an update within its specified FAILURE_DETECT_TIME
ALARM_FD_MAN_HEAT	17	nviManHeat is bound and has failed in receiving an update within its specified FAILURE_DETECT_TIME
ALARM_FD_MAN_COOL	18	nviManCool is bound and has failed in receiving an update within its specified FAILURE_DETECT_TIME
ALARM_HARDWARE_SOFTWARE_ NOT_COMPATIBLE	19	The software is not compatible with the hardware configuration specified by the hardware configuration resistor value. Compatibility is checked only once after application restart.

Broadcasting the Service Message

The Service Message allows a device on the E-Bus to be positively identified. The Service Message contains the controller Neuron ID number and can therefore be used to confirm the physical location of a particular Excel 10 Hydronic Controller in a building.

When an *Assign Neuron ID* command is issued from E-Vision, the node goes into the SERVICE_MESSAGE mode for one minute. In the SERVICE_MESSAGE mode, pressing the occupancy override button on the remote wall module causes the Service Message to be broadcast on the network. All other functions are normal in the SERVICE_MESSAGE mode. If a Hydronic Controller does not have a wall module with a bypass push-button connected, press the service button on the controller itself located as shown in the following figure.

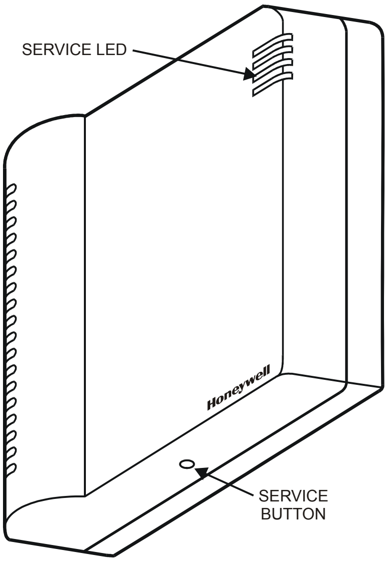

Fig. 19. Hydronic Controller LED and service button.

E-Vision is used to perform the ID Assignment task during commissioning (see E-Vision User Guide, Step 12. Commission Controllers).

W7762 Controller Status LED

The LED at the top right of the controller provides an indication of device status. The LED has the following states:

1. Off—no power to the processor.
2. Continuous on—processor is initialized state.
3. Slow blink—controlling, normal state.
4. Fast blink—controller in alarm.

Manual Mode

The Hydronic Controller can be put into a manual mode that disables the control algorithms and allows manual setting of outputs for system checkout. The variable nviManualMode must be set to Mode_Manual using the E-Vision PC tool. Inputs are read and digital filtering of analog inputs is turned off to speed up settling time. Input network variables are received, and output network variables are sent periodically. Triac outputs can be set to any combination of on/off or can be set to a test position based upon the configured valve runtime/cycle time. The override LED can be commanded on/off in this mode also. See the E-Vision User Guide section for Manual Mode for detailed procedures.

APPENDIX A. USING E-VISION TO COMMISSION A HYDRONIC CONTROLLER

Temperature Sensor Calibration

The temperature sensor in the Excel10 wall modules can be calibrated to correct for sensor inaccuracies, wire resistance, etc. This allows the Excel 10 Hydronic Controller to sense the space temperature with a high degree of accuracy.

Procedure

Select the controller being worked on with E-Vision (see the E-Vision User Guide for details on using E-Vision

From within E-Vision, with the desired Hydronic plant loaded and the SLTA (Q7752A) connected to the E-Bus or via the B-Port of an Excel 10 Zone Manager, perform the following procedure:

1. Select a controller symbol from a network diagram.
2. Click on **Calibrate** from the **Controller** menu. Once E-Vision logs on to the controller, the **Room Temperature Calibration** dialog box appears.
3. The box displays the **Current Value** of the sensor and the current **Offset**; it also contains a field for entering the actual **Measured Value**. When a value is typed in and **Calibrate** is clicked, the offset value is automatically calculated, displayed, and written to the Excel 10 Hydronic Controller.

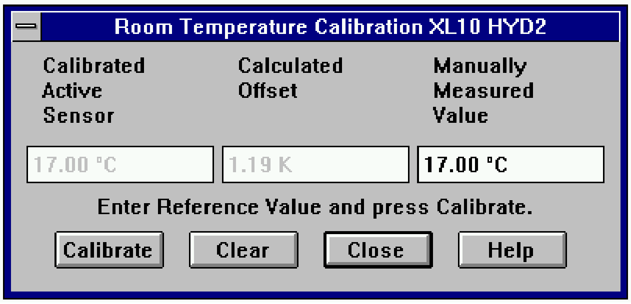

Fig. 20. Calibration dialog box.

NOTE: Record the offset value to be manually restored if additional downloads are performed.

4. Click on **Close** after completing adjustments.

APPENDIX B. CONFIGURING FOR MASTER/SLAVE OPERATION

More than one W7762 Hydronic Controller may be used to control the temperature of a room. In this situation one controller must be identified as the master unit that will perform the temperature control algorithm. The other Hydronic controllers in the room are designated as slave units, and their control algorithms are disabled. The slave units receive heating and cooling output information from the master controller via network variables sent across the E-Bus. There can be a maximum of one wall module active in the room, and it must be wired directly to the master controller. If a slave controller has a wall module connected to it, the wall module will be ignored.

Configuration of the master controller is the same as for any controller operating alone in a room. Configuration of the slave controllers must follow the rules described in this section. The following sections correspond to the screens in E-Vision used for configuring Hydronic controllers. An additional section discusses binding of network variables to support master/slave configurations.

Output Configuration Options

Slave devices must have their outputs configured identically with the master controller. The same system type and actuator types must be used. Valve run times, cycle times, and PWM zero and full position configuration options must be the same as well.

Input Configuration Options

Slave controllers may have wall modules connected to them, but they must be deactivated while the controllers are operating as slave units. They must be configured for **no temperature sensor**. The digital input may be used on the slave units for window open/closed or airflow (fan fail) detection and must be configured as such. In the case of window sensing, the window status network variable must be mapped to the master controller as the slave controller does not execute the control algorithm.

Equipment Control Options

Valve action and fan interlock settings must be the same as for the master controller. Output staging hysteresis and minimum stage off times should be the same as in the master controller.

All heating and cooling stage switching levels should be identical to those of the master controller.

Zone Control Options

All zone temperature control options including PID settings and miscellaneous settings are used only by the master controller and are ignored in the slave units.

Network Variable Binding

In a master/slave configuration, the control algorithm is executed in the master controller only. Heating and cooling output as calculated by the control algorithm is then sent via the network to the slave controllers. The master controller output variables nvoHeatOutput (user address - SrcHeatPos) and nvoCoolOutput (user address - SrcCoolPos) must be bound using E-Vision (see E-Vision User Guide) to the slave input variables nviManHeat (user address - DestManHeat) and nviManCool (user address - DestManCool), respectively.

For a master/slave system using heat/cool changeover, the master controller output variable nvoApplicMode (user address SrcHvacMode) must be bound to the slave controllers' input variable nviApplicMode (user address - DestHvacMode).

The active wall module must be connected to the master controller.

APPENDIX C. COMPLETE LIST OF EXCEL 10 HYDRONIC CONTROLLER USER ADDRESSES.

Table C1. Analog points engineering units.

Measured Item	English Units (Inch-Pound)		Standard International Units (SI)	
	—	Abbreviations (used in CARE and E-Vision)	—	Abbreviations (used in CARE and E-Vision)
Temperature	Degrees Fahrenheit	F	Degrees Celsius	C
Relative Temperature	Delta Degrees Fahrenheit	DDF	Kelvin	K

The following tables list all network variables associated with the W7762 Controller and the default User Address names. Point attributes given are defined as follows:

SHD— Sharable (bindable) points 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.
MAP— Mappable can be converted into a C-Bus point use by C-Bus devices. A mappable point has a one-to-one relationship with a C-Bus User Address.
DIR— Direct Access points are accessible through the Subsystem Points mechanism in XBS.
MON— These points are viewable within the E-Vision Controller Monitoring on-line screen. PAR refers to control parameters settable in the Application Selection dialog boxes in E-Vision.
Heartbeat These points are either sent out on the network (outputs) or received from the network (inputs) at a certain fixed interval.

NOTES:

1. Mapped points can be viewed and changed, on C-Bus devices such as an XI581, XI582 and XI584 and on an XBS central and LiveCARE.
2. All Excel 10 points, mappable and 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.

The tables are divided as follows:

Table C2—Configuration variables
Table C3—Input variables
Table C4—Output variables
Table C5—Unused variables

NOTE: Table C5 includes network variables related to fan control and reheat. The W7762 Hydronic Controller does not have outputs for direct connection of these devices, however the network inputs and outputs could be used for a master/slave configuration with a slave controller that does have such outputs (e.g., W7752D). Such a configuration is not recommended. For more information about these network variables, see form number 74-2961, W7752 Fan Coil Unit System Engineering.

Table C2. Configuration Variables for W7762 Controllers (left).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value	Default
ApplType	nciApplVer	application_type	UBYTE, 0 to 255		0
ApplVer	nciApplVer	version_no	UBYTE, 0 to 255		0
ApplTime0	nciApplVer	time[0]	UBYTE, 0 to 255		0
ApplTime1	nciApplVer	time[1]	UBYTE, 0 to 255		0
ApplTime2	nciApplVer	time[2]	UBYTE, 0 to 255		0
ApplTime3	nciApplVer	time[3]	UBYTE, 0 to 255		0
	nciDeviceName	ch[0-17]	UBYTE, 0 to 255		0
	nciLocation		SNVT_str_asc		0x00
	nciMaxSendTime		SNVT_temp_p 0 to 6553 seconds		0 s from factory, 60 s default from E-Vision
	nciRcvHrtBt		SNVT_time_sec 0 to 6553 seconds 0 = Disabled		0 s from factory, 300 s default from E-Vision
	nciSndHrtBt		SNVT_time_sec 0 to 6553 seconds 0 = Disabled		0 s from factory, 300 s default from E-Vision

(continued)

Table C2. Configuration Variables for W7762 Controllers (right).

Share (SH), Map (MA), Direct Access (DA) Monitor (M), Heartbeat (HBT)					
SH	MA	DA	M	HBT	Comments
		X			ApplicationType identifies the current application number of the Excel 10.
		X			VersionNo identifies the version number of the Excel 10 application.
		X			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 and is four bytes in length.
		X			See above.
		X			See above.
		X			See above.
					nciDeviceName contains the name of each device. This is an ASCII string with the a size of 18 characters. A name with all NULLs means that the device has not been configured.
					This configuration property can be used to provide more descriptive physical loacation information than can be provided by the Neuron Chip's 6 byte location string.
					This is the configuration property used to control the maximum time that expires before the node object automatically transmits nvoStatus. This provides a heartbeat output that can be used by the destination objects to ensure that the node is still healthy. The heartbeat output may be disabled by setting nciMaxSendTime = 0.
					This is the configuration property used to control the maximum time that elapses after the last update to • nviApplicMode • nviDlcShed • nviWindow • nviManCool • nviManHeat • nviSensorOcc • nviSetPtOffset • nviSpaceTemp • nviTodEvent before these NV inputs adopt their default values. Setting nciRcvHrtBt = 0 means, that the assigned NV input does not wait for an periodic update, and that it will never revert to any default when not receiving an update. If nviSpaceTemp and nviApplicMode are not received at regular intervals that are less than the heartbeat time, the controller will assume that there is a communication failure and revert to Occupied mode.
					This is the configuration property used to control the maximum time that expires before the object automatically transmits the current value of • nvoActiveSetPt • nvoAlarm • nvoApplicMode • nvoCoolOutput • nvoWindow • nvoHeatOutput • nvoHydStatus • nvoSensorOcc • nvoSpaceTemp • nvoTerminalLoad • nvoUnitStatus This provides a heartbeat output that can be used by the destination objects to ensure that the node is still healthy. The heartbeat output may be disabled by setting nciSndHrtBt = 0.

(continued)

Table C2. Configuration Variables for W7762 Controllers (left).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value	Default
FirstStageCooL	nciCntrlSettings	switch_level_cool[0]	SNVT_lev_percent 0 to 100%, 0 = Disable		5%
SecondStageCool	nciCntrlSettings	switch_level_cool[1]	SNVT_lev_percent 0 to 100%, 0 = Disable		50%
ThirdStageCool	nciCntrlSettings	switch_level_cool[2]	SNVT_lev_percent 0 to 100%, 0 = Disable		75%
FirstStageHeat	nciCntrlSettings	switch_level_heat[0]	SNVT_lev_percent 0 to 100%, 0 = Disable		5%
SecondStageHeat	nciCntrlSettings	switch_level_heat[1]	SNVT_lev_percent 0 to 100%, 0 = Disable		50%
ThirdStageHeat	nciCntrlSettings	switch_level_heat[2]	SNVT_lev_percent 0 to 100%, 0 = Disable		75%
StageHyst1	nciCntrlSettings	staging_hysteresis[0]	SNVT_lev_percent 0 to 100%		10%
StageHyst2	nciCntrlSettings	staging_hysteresis[1]	SNVT_lev_percent 0 to 100%		10%
DlcStptBump	nciEnergyManag	si_dlc_setpt_bump	SNVT_temp_p 0 to 10 K		2 K
RecRampCool	nciEnergyManag	si_optstart_grad[0]	SNVT_temp_p -20 to 0 K/hr		0 K/hr
RecRampHeat	nciEnergyManag	si_optstart_grad[1]	SNVT_temp_p 0 to 20 K/hr		0 K/hr

(continued)

Table C2. Configuration Variables for W7762 Controllers (right).

Share (SH), Map (MA), Direct Access (DA) Monitor (M), Heartbeat (HBT)					
SH	MA	DA	M	HBT	Comments
		X			This is the switching level to turn on stage 1 of the cooling equipment (if configured as multistage).
		X			This is the switching level to turn on stage 2 of the cooling equipment (if configured as multistage).
		X			This is the switching level to turn on stage 2 of the cooling equipment (if configured as multistage).
		X			This is the switching level to turn on stage 1 of the heating equipment (if configured as multistage).
		X			This is the switching level to turn on stage 2 of the heating equipment (if configured as multistage).
		X			This is the switching level to turn on stage 3 of the heating equipment (if configured as multistage).
		X			This value only applies to cool outputs configured as multistage outputs and specifies the hysteresis between switching the cool stages ON and OFF.
		X			This value only applies to heat outputs configured as multistage outputs and specifies the hysteresis between switching the heat stages ON and OFF.
		X			This is used to shift the temperature setpoint during demand limit control load shedding. When nviDlcShed is different from zero, the current occupancy setpoint will be decreased by this value for heating and increased for cooling.
		X			This is the cooling gradient used by the optimum start function to calculate the optimum time for starting to decrease the effective setpoint smoothly from the unoccupied or standby cooling setpoint to the occupied cooling setpoint.
		X			This is the heating gradient used to determine the optimum time to start increasing the current effective setpoint smoothly to the occupied setpoint at the beginning of scheduled occupancy.

(continued)

Table C2. Configuration Variables for W7762 Controllers (left).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value	Default
	nciHydConfig	room_temp_sensor	BYTE NO_TEMP_SENSOR NTC_NON_LINEARIZED	 0 2	NTC_NON_LINEARIZED
	nciHydConfig	DI1_config	BYTE DI_WINDOW_CLOSED DI_OCCUPIED_SENSOR DI_AIR_FLOW DI_CHANGEOVER_COOL DI_WINDOW_OPEN DI_UNOCCUPIED_SENS DI_NO_AIR_FLOW DI_CHANGEOVER_HEAT DI_MOVEMENT DI_NO_MOVEMENT DI_NOT_USED	 0 1 2 3 4 5 6 7 8 9 255	DI_NOT_USED
	nciHydConfig	output_mode[0]	BYTE OUTP_COOLING OUTP_HEATING OUTP_CHANGEOVER OUTP_NOT_USED	 0 1 2 255	OUTP_HEATING
	nciHydConfig	output_mode[1]	BYTE OUTP_COOLING OUTP_HEATING OUTP_CHANGEOVER OUTP_NOT_USED	 0 1 2 255	OUTP_COOLING
	nciHydConfig	output_type[0]	BYTE FLOATING ONE_STAGE TWO_STAGE THREE_STAGE PWM THERMAL FLOATING_MID	 0 1 2 3 4 5 6	FLOATING
	nciHydConfig	output_type[1]	BYTE FLOATING ONE_STAGE TWO_STAGE THREE_STAGE PWM THERMAL FLOATING_MID	 0 1 2 3 4 5 6	FLOATING
	nciHydConfig	valve_reverse_0	Bit DIRECT REVERSE	 0 1	DIRECT
	nciHydConfig	valve_reverse_1	Bit DIRECT REVERSE	 0 1	DIRECT

(continued)

Table C2. Configuration Variables for W7762 Controllers (right).

Share (SH), Map (MA), Direct Access (DA) Monitor (M), Heartbeat (HBT)					
SH	**MA**	**DA**	**M**	**HBT**	**Comments**
					This specifies whether a direct wired room temperature sensor is connected to the node or room temperature value from the network is used.
					This variable specifies the digital input function and type of switch. The option to be selected is the one which is the condition for a closed switch contact (e.g., normally-closed window switch contact = DI_WINDOW_CLOSED, normally-open window switch contact = DI_WINDOW_OPEN). **NOTE:** The digital input cannot be configured for an airflow detector with E-Vision. DI_MOVEMENT and DI_NO_MOVEMENT are supported starting with HYD2 version 1.0.2. These configuration settings cause the controller to retain the occupied state for 15 minutes after the last movement is detected.
					This specifies the operating mode of the output 1.
					This specifies the operating mode of the output 2. This setting is ignored for nciNumValve = TWO_PIPE.
					This specifies the output type to drive the connected actuator for the output 1: FLOATING/FLOATING_MID - This setting considers valve_reverse[] and cycle_time[]. Synchronization is performed at every restart and at least once per day. ONE_STAGE - Triac 2 is not used. TWO_STAGE/THREE_STAGE - Triac 1 and 2 used (triac 1 and 2 both on for stage 3). When configured as multistage, cycle_time and min_stage_off_time are considered. PWM/THERMAL - Triac 2 is not used. Triac 1 operates as a pulse-width modulated output, and the cycle time must be specified in cycle_time[]. For PWM outputs, PwmZeroPosn and PwmFullPosn must also be specified.
					This specifies the output type to drive the connected actuator for the output 2 (see above).
					This setting applies to outputs only that have been configured as FLOATING, PWM, or THERMAL and specifies the direct/reverse operation of output 1.
					This setting applies to outputs only that have been configured as FLOATING, PWM, or THERMAL and specifies the direct/reverse operation of output 2.

(continued)

Table C2. Configuration Variables for W7762 Controllers (left).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value	Default
	nciHydConfig	cycle_time[0]	SNVT_time_sec 0 to 1200 s for stage output 0 to 600 s for floating output 20 to 600 s for PWM output		150 s for floating
	nciHydConfig	cycle_time[1]	SNVT_time_sec 0 to 1200 s for stage output 0 to 600 s for floating output 20 to 600 s for PWM output		150 s for floating
MinOffTime1	nciHydConfig	min_stage_off_time[0]	SNVT_time_sec 0 to 600 seconds		90 s
MinOffTime2	nciHydConfig	min_stage_off_time[1]	SNVT_time_sec 0 to 600 seconds		90 s
	nciHydConfig	PwmZeroPosn	SNVT_lev_percent 0 to 100%		0%
	nciHydConfig	PwmFullPosn	SNVT_lev_percent 0 to 100%		100%
GainCoolProp	nciHydGains	si_pid_Xp[0]	SNVT_temp_p 1.25 to 100 K, 0 = Disable		4 K
GainHeatProp	nciHydGains	si_pid_Xp[1]	SNVT_temp_p 1.25 to 100 K, 0 = Disable		4 K
GainCoolInt	nciHydGains	si_pid_Tn[0]	SNVT_time_sec 10 to 3200 seconds 0 = Disable		300 s
GainHeatInt	nciHydGains	si_pid_Tn[1]	SNVT_time_sec 10 to 3200 seconds 0 = Disable		300 s
GainCoolDer	nciHydGains	si_pid_Tv[0]	SNVT_time_sec 10 to 3200 seconds 0 = Disable		0 s
GainHeatDer	nciHydGains	si_pid_Tv[1]	SNVT_time_sec 10 to 3200 seconds 0 = Disable		0 s
CoolBoost	nciHydGains	si_boost[0]	SNVT_temp_p 0.5 to 10 K 0 = Disable		1 K
HeatBoost	nciHydGains	si_boost[1]	SNVT_temp_p 0.5 to 10 K 0 = Disable		1 K
	nciNumValve		SNVT_count TWO_PIPE FOUR_PIPE	 1 2	FOUR_PIPE

(continued)

Table C2. Configuration Variables for W7762 Controllers (right).

Share (SH), Map (MA), Direct Access (DA) Monitor (M), Heartbeat (HBT)					
SH	MA	DA	M	HBT	Comments
					This specifies for the output 1 configured as • FLOATING: the runtime of the valve (time to run from fully closed to fully open) • PWM: the cycle time • ONE_STAGE, TWO_STAGE, and THREE_STAGE: minimum ON time before switching to the next stage.
					This specifies for the output 2 configured as • FLOATING: the runtime of the valve (time to run from fully closed to fully open) • PWM: the cycle time • ONE_STAGE, TWO_STAGE, and THREE_STAGE: minimum ON time before switching to the next stage.
		X			This is only used for ONE_STAGE, TWO_STAGE, and THREE_STAGE output 1 and specifies the minimum OFF time before switching to the next stage.
		X			This is only used for ONE_STAGE, TWO_STAGE, and THREE_STAGE output 2 and specifies the minimum OFF time before switching to the next stage
					This specifies the zero position for PWM actuators. This setting applies to PWM actuators only and is used for both actuators if both are configured as PWM actuators.
					This specifies the fully open position for PWM actuators. This setting applies to PWM actuators only and is used for both actuators if both are configured as PWM actuators.
		X			This is the throttling range for use in the proportional portion of the PID loop gain for the cooling mode. Since HYD2 version 1.0.2, the range of configurable values is 2 to 100K for PI or 1.25 for P control. For older versions, the valid range is 4 to 100K.
		X			This is the throttling range for use in the proportional portion of the PID loop gain for the heating mode. Since HYD2 version 1.0.2, the range of configurable values is 2 to 100K for PI or 1.25 for P control. For older versions, the valid range is 4 to 100K.
		X			This is the integral time for use in the integral portion of the PID loop gain for the cooling mode.
		X			This is the integral time for use in the integral portion of the PID loop gain for the heating mode.
		X			This is the derivative time for use in the derivative portion of the PID loop gain for the cooling mode.
		X			This is the derivative time for use in the derivative portion of the PID loop gain for the heating mode.
		X			This is the temperature range to be added to the cooling setpoint, above which the cooling output is fully open to allow a faster response. For thermal actuators it is the hysteresis for thermal control algorithm.
		X			This is the temperature range to be subtracted from the heating setpoint, below which the heating output is fully open to allow a faster response. For thermal actuators it is the hysteresis for thermal control algorithm.
					This is the configuration property used to specify a two-pipe system (one valve) or a four-pipe system (two valves). If set to TWO_PIPE, only the output terminals for output1 are used. If set to FOUR_PIPE, output1 and output2 are defined by nciHydConfig.output_mode[].

(continued)

Table C2. Configuration Variables for W7762 Controllers (left).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value	Default
SptCoolOcc	nciSetPnts	occupied_cool	SNVT_temp_p 10 to 35°C		23°C
SptCoolStby	nciSetPnts	standby_cool	SNVT_temp_p 10 to 35°C		25°C
SptCoolUnocc	nciSetPnts	unoccupied_cool	SNVT_temp_p 10 to 35°C		28°C
SptHeatOcc	nciSetPnts	occupied_heat	SNVT_temp_p 10 to 35°C		21°C
SptHeatStby	nciSetPnts	standby_heat	SNVT_temp_p 10 to 35°C		19°C
SptHeatUnocc	nciSetPnts	unoccupied_heat	SNVT_temp_p 10 to 35°C		16°C
BypTime	nciWallMod	ui_bypass_time	UWORD 0 to 1080 minutes		180 min
SptKnobLowLim	nciWallMod	si_low_setpt	SNVT_temp_p -5 to 5 K for relative 12 to 30°C for absolute		-5 K (relative)
SptKnobHiLim	nciWallMod	si_high_setpt	SNVT_temp_p -5 to 5 K for relative 12 to 30°C for absolute		5 K (relative)
	nciWallMod	si_space_temp_zero_cal	SNVT_temp_p -5 to 5 K		0 K
UseWallModSpt	nciWallMod	use_wall_mod_st_pt	Bit NO YES	 0 1	YES
SptKnob	nciWallMod	set_pnt_knob	2 Bits OFFSET ABSOLUTE_MIDDLE	 0 2	OFFSET
	nciWallMod	override_type	2 Bits NO_BUTTON BYPASS_UNOCCUPIED BYPASS	 0 1 2	BYPASS_UNOCCUPIED
	nciWallMod	override_priority	Bit LAST_WINS NETWORK_WINS	 0 1	LAST_WINS
	nciWallMod	display_type	Bit LED_OVERRIDE LED_OCCUPANCY LCD_DISPLAY	 0 1 2	LED_OVERRIDE

Table C2. Configuration Variables for W7762 Controllers (right).

Share (SH), Map (MA), Direct Access (DA) Monitor (M), Heartbeat (HBT)					
SH	**MA**	**DA**	**M**	**HBT**	**Comments**
	X	X			This is the default setpoint for the occupied cooling setpoint that is used in case there is no locally wired setpoint knob or nviSetpoint has not been bound. Where the ZEB for occupied is used, this derives from the difference of occupied_cool and occupied_heat.
	X	X			This is the configured setpoint that applies to the standby cooling mode. Where the ZEB for standby is used, it derives from the difference of standby_cool and standby_heat.
	X	X			This is the configured setpoint that applies to the unoccupied cooling mode.
	X	X			This is the default setpoint for the occupied heating setpoint that is used in case there is no locally wired setpoint knob or nviSetpoint has not been bound. Where the ZEB for occupied is used, this derives from the difference of occupied_cool and occupied_heat.
	X	X			This is the configured setpoint that applies to the standby heating mode. Where the ZEB for standby is used, it derives from the difference of standby_cool and standby_heat.
	X	X			This is the configured setpoint that applies to the unoccupied heating mode.
		X			This is the parameter that determines the time the controller remains in OCCUPIED mode before reverting to the original occupancy mode after pressing the override button at the wall module or initiating BYPASS via the network. When the bypass mode has been activated, the bypass timer is set to ui_bypass_time. When the timer expires, nvoHydStatus.occ_status.hw_override reverts from OC_BYPASS to OC_NUL to quit the bypass override function.
	X	X			This is the low limit for the setpoint knob. It can be relative or absolute depending on the configuration in nciWallMod.set_pnt_knob.
	X	X			This is the high limit for the setpoint knob. It can be relative or absolute depending on the configuration in nciWallMod.set_pnt_knob.
					The space temperature sensor is corrected by adding this calibration setting (an offset value) to the sensed value.
					This specifies whether the setpoint used is from the knob on the wall module connected to the controller or ifrom the network via nciTempSetPts. If set to NO, all setpoints to be used come from the network via nciTempSetPts. If set to YES, an additional option set_pnt_knob must be set to specify type of setpoint adjustment (see below).
					This setting specifies the usage of the setpoint knob on the wall module for the occupied setpoint. OFFSET specifies a relative scale on the wall module where the setpoint is calculated by adding the setpoint potentiometer value (± 5 K) to the appropriate value of nciTempSetPts. ABSOLUTE_MIDDLE specifies an absolute scale on the wall module. The setpoint knob directly determines the center point of occupied cooling and heating setpoints. The respective cooling and heating setpoint is determined by the setpoint knob position adding or subtracting half of the user selectable ZEB defined in nciSetPnts.<occ_mode>_cool or nciSetPnts.<occ_mode>_heat . This applies to <occ_mode> OCCUPIED and STANDBY.
					This setting determines the behavior of the override button. BYPASS_UNOCCUPIED allows overriding the current occupancy mode to OCCUPIED for a configurable bypass time, or causing a permanent override to UNOCCUPIED. BYPASS allows only the temporary override to OCCUPIED and canceling it.
					This setting configures the priority of the local (wall module) or central (network interface) override concerning override button. If NETWORK_WINS is set and the network sends value NUL, then the override button is active.
					This setting configures the display of occupancy and/or override. LED_OVERRIDE shows the override from the bypass button or from the network. LED_OCCUPANCY shows the effective occupancy mode. LCD_DISPLAY is only used for T7560 Wall Modules. The display shows the occupancy mode with different symbols, and the override mode with flashing symbols.

Table C3. Input Variables for W7762 Controllers (left).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value	Default
DestHvacMode	nviApplicMode		SNVT_hvac_mode HVAC_AUTO HVAC_HEAT HVAC_COOL HVAC_OFF HVAC_NUL	 0 1 3 6 255	HVAC_AUTO (if bound but fails to be received or at application restart)
DestDlcShed	nviDlcShed		BYTE -128 to 127 NORMAL SETPOINT_SHIFT	 0 1	0 (if bound but fails to be received or at application restart)
DestEmerg	nviEmerg		SNVT_hvac_emerg EMERG_NORMAL EMERG_PRESSURIZE EMERG_DEPRESSURIZE	 0 1 2	EMERG_NORMAL (at application restart)
	nviInUse		UWORD 0 to 65535		0 (if bound but fails to be received), 65535 (for 60 s at application restart)
DestManCool	nviManCool		SNVT_lev_percent 0 to 100% 163.835% = INVALID		
DestManHeat	nviManHeat		SNVT_lev_percent 0 to 100% 163.835% = INVALID		
DestManOcc	nviManOccCmd		SNVT_occupancy OC_OCCUPIED OC_UNOCCUPIED OC_BYPASS OC_STANDBY OC_NUL	 0 1 2 3 255	OC_NUL (at application restart)
DestManMode	nviManualMode		BYTE MODE_ENABLE MODE_DISABLE MODE_MANUAL SUPPRESS_ALARMS UNSUPPRESS_ALARMS	 0 1 2 3 4	MODE_ENABLE and UNSUPPRESS_ALARMS (at application restart)

(continued)

Table C3. Input Variables for W7762 Controllers (right).

Share (SH), Map (MA), Direct Access (DA) Monitor (M), Heartbeat (HBT)					
SH	**MA**	**DA**	**M**	**HBT**	**Comments**
X	X	X	X	X	This is an input that coordinates the controller operation with the main equipment controller. Dependent on the supply energy available, the main equipment controller commands the Hydronic controller to operate in heat mode only, cool mode only or heat and cool mode if appropriate to the configuration. HVAC_AUTO means that both heating and cooling equipment are available, and the current mode is determined by the control algorithm depending upon the room temperature and effective setpoint. HVAC_AUTO is invalid for changeover applications. When the Digital input is configured as Heat/Cool changeover input, this input will always have priority over the network nviApplicMode's HVAC_HEAT or HVAC_COOL.
X	X	X	X	X	This is an input from an energy management system (e.g. Zone Manager). When it is 0, the temperature control algorithm operates in a normal mode. When it is 1, the effective setpoint will be shifted by the amount defined in nciEmergyManag.si_dlc_setpt_bump. For cooling the effective setpoint will be increased, for heating the effective setpoint will be decreased always regarding the frost limits.
X	X	X	X		It is an emergency input from a device that determines the correct action during a given emergency (such as a fire). • EMERG_NORMAL: terminates EMERG_PRESSURIZE or EMERG_DEPRESSURIZE and restores the control algorithm. • EMERG_PRESSURIZE: heat/cool outputs off. • EMERG_DEPRESSURIZE: heat/cool outputs closed.
				X	This is used by the engineering tool or other supervisory node that it is "logged on" to the controller node. It should be set every minute, or the controller will reset it after 60s to automatically log off the supervisory node.
X	X	X	X	X	This can be used for master/slave installations where the cool output is controlled by an external controller node. In this case, the output signal of the external cool control algorithm (0-100%) has to be bound to nviManCool that would take over the task of the local (slave) control algorithm while the switch levels operate as locally configured. The heating output will be closed.
X	X	X	X	X	This can be used for master/slave installations where the heat output is controlled by an external controller node. In this case, the output signal of the external heat control algorithm (0-100%) has to be bound to nviManHeat that would take over the task of the local (slave) control algorithm while the switch levels operate as locally configured. The cooling output will be closed.
X	X	X	X		This is an input from an network connected operator interface or other node that indicates the state of manual occupancy control (schedule override). It has priority over the time program (DestSchedOcc). When the BYPASS mode is set, then the Bypass time is active. When the bypass time is elapsed, the master controller automatically sets nviManOccCmd to OC_NUL. nviManOccCmd does not provide a failure detect mechanism in case no periodic update is received.
	X	X	X		This is an input that is used to disable the controller's control algorithms in order to manually set its physical outputs. The controller still responds to smoke purge even when disabled or set to manual or factory test mode. It remains unchanged until another mode has been commanded or an application restart has been performed. • MODE_ENABLE: starts the control algorithm at an initial state after MODE_DISABLE or MODE_MANUAL. • MODE_DISABLE: all outputs switched off, the alarm ALARM_NODE_OFF is issued. • MODE_MANUAL: all control loops are disabled and the alarm ALARM_NODE_OFF is issued. The outputs can be controlled manually via the nviTest command. • SUPPRESS_ALARMS: nvoAlarm is not sent and nvoAlarmStatus and nvoAlarmLog are not updated until UNSUPPRESS_ALARMS is set or an application restart. • UNSUPPRESS_ALARMS: releases alarm suppression after SUPPRESS_ALARMS.

(continued)

Table C3. Input Variables for W7762 Controllers (left).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value	Default
DestRequestObjId	nviRequest	object_id	SNVT_obj_request UWORD 0=Node Object 1=Fan Coil Object		
	nviRequest	object_request	object_request_t Enum from Echelon defined RQ_NORMAL RQ_UPDATE_STATUS RQ_UPDATE_ALARM RQ_REPORT_MASK	 0 2 4 5	
DestOccSensor	nviSensorOcc		SNVT_occupancy OC_OCCUPIED OC_UNOCCUPIED OC_BYPASS OC_NUL	 0 1 2 255	OC_NUL (if bound but fails to be received or at application restart)
DestRmTempSpt	nviSetPoint		SNVT_temp_p 10 to 35°C 327.67°C = INVALID		INVALID (at application restart)
DestSptOffset	nviSetPtOffset		SNVT_temp_p -10 to 10 K 327.67°C = INVALID		0 (if bound but fails to be received or at application restart)
DestRmTemp	nviSpaceTemp		SNVT_temp_p 0 to 40°C 327.67°C = INVALID		INVALID (if bound but fails to be received or at application restart)
	nviTest	output1_cmd	BYTE NORMAL_HC_MODE OFF1_OFF2 ON1_OFF2 OFF1_ON2 ON1_ON2 TESTPOSITION		NORMAL_HC_MODE (at application restart)
	nviTest	output1_test_pos	SNVT_lev_percent 0 to 100%		0 (at application restart)
	nviTest	output2_cmd	BYTE NORMAL_HC_MODE OFF1_OFF2 ON1_OFF2 OFF1_ON2 ON1_ON2 TESTPOSITION	 0 1 2 3 4 5	NORMAL_HC_MODE (at application restart)
	nviTest	output2_test_pos	SNVT_lev_percent 0 to 100%		0 (at application restart)
	nviTest	override_LED	BYTE NORMAL_LED_MODE LED_OFF LED_ON	 0 1 2	NORMAL_LED_MODE (at application restart)

(continued)

Table C3. Input Variables for W7762 Controllers (right).

Share (SH), Map (MA), Direct Access (DA) Monitor (M), Heartbeat (HBT)					
SH	MA	DA	M	HBT	Comments
X					This input variable belongs to the Node Object and provides the mechanism to request a particular mode for a particular object within a node.
					See above. Commanding any modes other the ones listed will result in an “invalid_request” when reading nvoStatus.
X		X			This allows an occupancy sensor of another Excel 10 controller to be used to indicate the sensed occupancy state of the space. OC_NUL means no input is available because it is not bound, bound but not received periodically, or not configured by nciHydConfig.DI1_config. More than one occupancy sensor may be bound to nviSensorOcc. If any one sensor detects occupancy, the controller considers the space occupied.
X	X	X	X		This is an input intended for binding third party nodes to authorize them for setpoint modifications. When this has been bound and a valid update is received, the local configured setpoints will no longer be directly used to determine the current occupancy setpoint. For OCCUPIED and STANDBY modes, this is used with the appropriate ZEB (derived from the configured setpoints), for UNOCCUPIED mode the setpoint does not depend on this input, but on nciTempSetPts.unoccupied_cool/_heat only. nviSetpoint is stored in RAM and gets lost after power failure. In this case, the setpoints of nciTempSetPts will be used until a valid nviSetpoint is received.
X	X	X	X	X	This is an input intended for binding third party nodes to authorize them for setpoint shifting. nviSetPtOffset is stored in RAM and will be initialized to zero after application restart or power failure. If nviSetPtOffset is bound and fails to be received periodically as configured with nciRcvHrtBt, it will be reset to zero.
X	X	X	X	X	This is the space temperature transmitted from another Excel 10 controller or another node that has a temperature sensor wired to it. If bound or has a value other than INVALID, then it is used as the sensed space temperature instead of the wired wall module's temperature. nviSpaceTemp may be set to a value other than INVALID using a network management tool when nviSpaceTemp is not bound to set the temperature to a fixed value.
					This is used by factory test, OEM field test, field installation, and field testing to manually command the physical output 1 when the node has been put into manual mode (nviManualMode = MODE_MANUAL). NORMAL_HC_MODE: output 1 remains in its current position OFF1_OFF2, ON1_OFF2, OFF1_ON2, ON1_ON2: set the individual triacs on or off TESTPOSITION: sets output based on output1_test_pos.
					This is used for the TESTPOSITION of the output1_cmd and is based on the configured runtime/cycle time.
					Same as output1_cmd for output 2.
					Same as output1_test_pos for output 2
					This can be used to test the wall module LED when nviManualMode = MODE_MANUAL.

(continued)

Table C3. Input Variables for W7762 Controllers (left).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value	Default
DestSchedOcc	nviTodEvent	current_state	SNVT_tod_event.current_state OC_OCCUPIED OC_UNOCCUPIED OC_STANDBY OC_NUL	 0 1 3 255	OC_OCCUPIED (if bound but fails to be received or at application restart)
DestSchedOccNext	nviTodEvent	next_state	SNVT_tod_event.next_state OC_OCCUPIED OC_UNOCCUPIED OC_STANDBY OC_NUL	 0 1 3 255	OC_OCCUPIED (if bound but fails to be received or at application restart)
DestSchedOccTime	nviTodEvent	time_to_next_state	SNVT_tod_event.time_to_next_state UWORD 0 to 2880 minutes		0 (if bound but fails to be received or at application restart)
DestWindow	nviWindow	value	SNVT_switch.value 0 to 100%		0 (if bound but fails to be received or at application restart)
	nviWindow	state	SNVT_switch.state CLOSED OPEN NO_WINDOW	 0 1 255	NO_WINDOW (if bound but fails to be received or at application restart)

Table C3. Input Variables for W7762 Controllers (right).

Share (SH), Map (MA), Direct Access (DA) Monitor (M), Heartbeat (HBT)					
SH	**MA**	**DA**	**M**	**HBT**	**Comments**
	X	X	X	X	This indicates to the node whether the space is currently scheduled to be occupied, standby or unoccupied.
		X	X	X	This indicates to the node whether the next scheduled occupancy mode will be occupied, standby or unoccupied. This information is required by the controller to perform the optimum start strategy.
		X	X	X	This is the time in minutes until the next change of scheduled occupancy state. This time is updated by the Zone Manager once every 60 seconds. This data is also used by the optimum start calculation (see nciEnergyManag).
X		X	X	X	This allows a window contact node or another controller to be used as remote window contact. More than one nvoWindow may be bound to one nviWindow, which allows one node to be used to handle several distributed window contacts. In this case, the control process assumes an open window, if at least one bound window node detects an open window. 'Window Closed' would be assumed if all nvoWindows bound to nviWindow indicate the window being closed for at least the failure detect time (nciSndHrtBt).
				X	See above.

Table C4. Output Variables for W7762 Controllers (left).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value	Default
SrcRmTempSptEff	nvoActiveSetPt		SNVT_temp_p 10 to 35°C 327.67=INVALID		
SrcAlarmSubnet	nvoAlarm	subnet	UBYTE 0 to 255		
SrcAlarmNode	nvoAlarm	node	UBYTE 0 to 255		
	nvoAlarm	type	UBYTE ALM_NO_ALARM ALM_NODE_OFF ALM_FROST ALM_INVALID_SETPNT ALM_TEMP_SENSOR_FAIL ALM_SETPNT_KNOB_FAIL ALM_FAN_SPEED_SW_FAIL ALM_FAN_FAILURE ALM_COMFAIL_SPACETEMP ALM_COMFAIL_HVACMODE ALM_COMFAIL_SETPTOFFS ALM_COMFAIL_SCHEDOCC ALM_COMFAIL_DLC ALM_COMFAIL_TEMPRESET ALM_COMFAIL_ODTEMP ALM_COMFAIL_OCCSENSOR ALM_COMFAIL_WINDOW ALM_COMFAIL_MANHEAT ALM_COMFAIL_MANCOOL ALM_HW_SW_MISMATCH RETURN_TO_NORMAL RTN_NODE_OFF RTN_FROST RTN_INVALID_SETPNT RTN_TEMP_SENSOR_FAIL RTN_SETPNT_KNOB_FAIL RTN_FAN_SPEED_SW_FAIL RTN_FAN_FAILURE RTN_COMFAIL_SPACETEMP RTN_COMFAIL_HVACMODE RTN_COMFAIL_SETPTOFFS RTN_COMFAIL_SCHEDOCC RTN_COMFAIL_DLC RTN_COMFAIL_TEMPRESET RTN_COMFAIL_ODTEMP RTN_COMFAIL_OCCSENSOR RTN_COMFAIL_WINDOW RTN_COMFAIL_MANHEAT RTN_COMFAIL_MANCOOL RTN_HW_SW_MISMATCH ALARM_NOTIFY_DISABLED	 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 255	RETURN_TO_NORMAL (at application restart)

(continued)

Table C4. Output Variables for W7762 Controllers (right).

Share (SH), Map (MA), Direct Access (DA) Monitor (M), Heartbeat (HBT)					
SH	**MA**	**DA**	**M**	**HBT**	**Comments**
X				X	This is an output showing the active setpoint of the control algorithm. It is based on the occupancy setpoints, the offset and recovery ramping.
		X			The subnet is the LONWORKS subnet number (in domain entry 1 of the node's domain table).
		X			The node is the LONWORKS node number (in domain entry 1 of the node's domain table).
					This is an output reporting the latest changed error condition detected in the node. The first 5 bits are used for the alarm type number, and this number is added to RETURN_TO_NORMAL (128) when the error condition is no longer true. Each error condition/return-to-normal is issued only once. The type is also recorded in nvoAlarmLog and nvoHydStatus.alarm_type. Alarm reporting is suppressed by settin nviManualMode to SUPPRESS_ALARMS, in which case nvoAlarm.type is set to ALARM_NOTIFY_DISABLEd. Alarm reporting is turned on again by setting nviManualMode to UNSUPPRESS_ALARMS, after which all existing alarms (or ALM_NO_ALARM) are reported one at a time.

(continued)

Table C4. Output Variables for W7762 Controllers (left).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value	Default
SrcAlarmLog1	nvoAlarmLog	alarm_type[0]	Same as nvoAlarm.type		See nvoAlarm.type
SrcAlarmLog2	nvoAlarmLog	alarm_type[1]	Same as nvoAlarm.type		See nvoAlarm.type
SrcAlarmLog3	nvoAlarmLog	alarm_type[2]	Same as nvoAlarm.type		See nvoAlarm.type
SrcAlarmLog4	nvoAlarmLog	alarm_type[3]	Same as nvoAlarm.type		See nvoAlarm.type
SrcAlarmLog5	nvoAlarmLog	alarm_type[4]	Same as nvoAlarm.type		See nvoAlarm.type
SrcAlarmStatus1	nvoAlarmStatus	error_bit[0]	UBYTE Bit coded Alarm: ALM_NODE_OFF ALM_FROST ALM_INVALID_SETPNT ALM_TEMP_SENSOR_FAIL ALM_SETPNT_KNOB_FAIL ALM_FAN_SPEED_SW_FAIL ALM_FAN_FAILURE ALM_COMFAIL_SPACETEMP	 1 2 4 8 16 32 64 128	
SrcAlarmStatus2	nvoAlarmStatus	error_bit[1]	UBYTE Bit coded Alarm: ALM_COMFAIL_HVACMODE ALM_COMFAIL_SETPTOFFS ALM_COMFAIL_SCHEDOCC ALM_COMFAIL_DLC ALM_COMFAIL_TEMPRESET ALM_COMFAIL_ODTEMP ALM_COMFAIL_OCCSENSOR ALM_COMFAIL_WINDOW	 1 2 4 8 16 32 64 128	
SrcAlarmStatus3	nvoAlarmStatus	error_bit[2]	UBYTE Bit coded Alarm: ALM_COMFAIL_MANHEAT ALM_COMFAIL_MANCOOL ALM_HW_SW_MISMATCH	 1 2 4	
SrcHvacMode	nvoApplicMode		SNVT_hvac_mode HVAC_AUTO HVAC_HEAT HVAC_COOL HVAC_OFF	 0 1 3 6	HVAC_OFF (at application restart)
SrcCoolPos	nvoCoolOutput		SNVT_lev_percent 0 to 100% 163.835% = INVALID		
SrcStateDI1	nvoDigitInState	value	SNVT_switch.value 0 to 100%		
	nvoDigitInState	state	SNVT_switch.state OFF ON NOT_ASSIGNED	 0 1 255	
SrcOccEff	nvoEffectOcc		SNVT_occupancy OC_OCCUPIED OC_UNOCCUPIED OC_BYPASS OC_STANDBY	 0 1 2 3	

(continued)

Table C4. Output Variables for W7762 Controllers (right).

Share (SH), Map (MA), Direct Access (DA) Monitor (M), Heartbeat (HBT)					
SH	MA	DA	M	HBT	Comments
		X			A central node may poll the nvoAlarmLog output for a short history of alarms. It contains the last five alarms reported via nvoAlarm. At the time a new nvoAlarm is issued, nvoAlarmLog is updated.
		X			See above.
		X			See above.
		X			See above.
		X			See above. nvoAlarmLog.alarm_type[4] is the oldest alarm.
		X			This is a polled output containing a list of all the current errors detected by the node. A search for error conditions in the node is made periodically. A central node may poll the nvoAlarmStatus output for all of the current errors. nvoAlarmStatus contains all the current detected errors even though they may be suppressed for reporting by nvoAlarm.
		X			See above.
		X			See above.
X				X	This is an output used to coordinate the slave devices with the master controller. It reflects the current heat/cool medium based on supply energy available. This is required for configurations with heat/cool changeover. HVAC_OFF switches the heat/cool control off while still providing frost protection and and reporting status and alarms.
X				X	This is the cooling output that is typically used for monitoring or bound to a cooling actuator node or another controller operating as slave. nvoCoolOutput will be transmitted immediately when its value has changed significantly (>= 1%), and periodically according to nciSndHrtBt. The output value represents the output of the control algorithm but is limited to a range of 0% to 100%.
X	X	X	X		This indicates the binary states of the controller's digital input that can be configured to support a window contact, an occupancy sensor, an airflow contact, heat/cool changeover contact or monitoring contact. It can be bound to another Excel 10 controller or a third party node.
					See above.
X					This is the output reflecting the effective occupancy mode derived from the time schedule, occupancy sensor, override button, and network occupancy override.

(continued)

Table C4. Output Variables for W7762 Controllers (left).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value	Default
	nvoHydStatus	field_no	UBYTE FIELD_EFFECT_OCC FIELD_HW_OVERRIDE FIELD_SCHED_OCC FIELD_EFF_SEN_OCC FIELD_NET_MAN_OCC FIELD_HW_SEN_OCC FIELD_R_O_LED FIELD_MODE FIELD_ALARM_TYPE FIELD_DLC_SHED FIELD_EFF_WINDOW_OPEN FIELD_HW_WINDOW_OPEN FIELD_FAN_FEEDBACK FIELD_EXTERNAL_ACTIVE FIELD_FAN_STAGES_ACTIVE FIELD_OUTPUT_POS_1 FIELD_OUTPUT_POS_2 FIELD_REHEAT_RELAY FIELD_ACTIVE_SET_PT FIELD_SPACE_TEMP FIELD_REST_BYPASS_TIME	 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	
SrcOccEffS	nvoHydStatus	effect_occ	SNVT_occupancy OC_OCCUPIED OC_UNOCCUPIED OC_BYPASS OC_STANDBY	 0 1 2 3	
SrcOccOvrdHwS	nvoHydStatus	hw_override	SNVT_occupancy OC_UNOCCUPIED OC_BYPASS OC_NUL (No Override)	 0 2 255	
SrcOccSchedS	nvoHydStatus	sched_occ	SNVT_occupancy OC_OCCUPIED OC_UNOCCUPIED OC_BYPASS OC_STANDBY OC_NUL (No Override)	 0 1 2 3 255	
SrcOccSensorS	nvoHydStatus	eff_sen_occ	SNVT_occupancy OC_OCCUPIED OC_UNOCCUPIED OC_NUL (No Override)	 0 1 255	
SrcOccOvrdNetS	nvoHydStatus	net_man_occ	SNVT_occupancy OC_OCCUPIED OC_UNOCCUPIED OC_BYPASS OC_STANDBY OC_NUL	 0 1 2 3 255	
SrcOccSensorHwS	nvoHydStatus	hw_sen_occ	SNVT_occupancy OC_OCCUPIED OC_UNOCCUPIED OC_NUL	 0 1 255	

(continued)

Table C4. Output Variables for W7762 Controllers (right).

Share (SH), Map (MA), Direct Access (DA) Monitor (M), Heartbeat (HBT)					
SH	**MA**	**DA**	**M**	**HBT**	**Comments**
				X	This is used to indicate which other data field in nvoHydStatus has changed since the last time nvoHydStatus was sent on the network. If any field has had a significant change, only that field is updated, and field_no indicates which field. If three or more fields have changed significantly, then all fields are updated and field_no is set to 0. All fields are also updated every refresh time (55 s).
	X		X	X	This is the effective occupancy mode resulting from scheduled occupancy mode, occupancy sensor information, bypass push-button, or manual operator interface.
	X		X	X	It reports the current state of the remote override button.
			X	X	It reports the current scheduled occupancy received via the network.
	X		X	X	This reports the effective state of occupancy sensor(s) connected either to the input terminals from the network.
			X	X	This reports the manual occupancy from the network.
	X		X	X	It reports the state of the occupancy sensor wired to the node.

(continued)

Table C4. Output Variables for W7762 Controllers (left).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value	Default
SrcOvrdLedS	nvoHydStatus	r_o_led	SNVT_occupancy OC_OCCUPIED OC_UNOCCIPIED OC_BYPASS OC_STANDBY OC_NUL	 0 1 2 3 255	
SrcHydModeS	nvoHydStatus	mode	BYTE CTL_COOL CTL_HEAT CTL_PRESSURIZE CTL_DE_PRESSURIZE CTL_MODE_MANUAL CTL_MODE_FACTORY_TEST CTL_FLOATING_OUT_SYNCH CTL_FAN_SWITCH_OFF CTL_START_UP_WAIT CTL_DISABLED	 0 1 2 3 4 5 6 7 8 255	
	nvoHydStatus	alarm_type	Same as nvoAlarm.type		
SrcDlcShed	nvoHydStatus	dlc_shed	Bit NOT ACTICE ACTIVE	 0 1	
SrcWindowS	nvoHydStatus	eff_window_open	Bit CLOSED or NOT_ASSIGNED OPEN	 0 1	
SrcWindowHwS	nvoHydStatus	hw_window_open	Bit CLOSED or NOT_ASSIGNED OPEN	 0 1	
SrcOutput1S	nvoHydStatus	output_position[0]	SNVT_lev_percent 0 to 100% 163.835% = INVALID		
SrcOutput2S	nvoHydStatus	output_position[1]	SNVT_lev_percent 0 to 100% 163.835% = INVALID		
SrcRmTempSptEffS	nvoHydStatus	active_set_pt	SNVT_temp_p 10 to 35°C 327.67°C = INVALID		
SrcRmTempEffS	nvoHydStatus	space_temp	SNVT_temp_p 0 to 40°C 327.67°C = INVALID		
SrcRestBypassTimeS	nvoHydStatus	rest_bypass_time	UWORD 0 to 65535 Min		

(continued)

Table C4. Output Variables for W7762 Controllers (right).

Share (SH), Map (MA), Direct Access (DA) Monitor (M), Heartbeat (HBT)					
SH	**MA**	**DA**	**M**	**HBT**	**Comments**
			X	X	This variable reports the current state of the remote override LED that indicates the effective schedule override resulting from the bypass push-button or a network override. OC_OCCUPIED: 2 flashes per second OC_UNOCCIPIED: 1 flash per second OC_BYPASS: on OC_STANDBY: 2 flashes per second OC_NUL: off
	X		X	X	This is the current operating mode of the node determined by many inputs and arbitrated by control logic. CTL_PRESSURIZE and CTL_DE_PRESSURIZE disable the heat/cool outputs. CTL_MODE_MANUAL allows turning on and off outputs manually through nviTest. CTL_MODE_FACTORY_TEST is intended only for the factory. CTL_FLOATING_OUT_SYNCH allows enough time (150% valve run time) for the valve(s) are at their initial positions (control algorithms are active). The controller then goes into one of the normal operating modes, such as CTL_COOL. When the effective occupancy changes to unoccupied or 24 hours have elapsed since the last start-up or CTL_FLOATING_OUT_SYNCH mode, the controller enters this mode again to reset the floating output position tracking. CTL_START_UP_WAIT is the first mode after an application restart. No control algorithms are active, and heat/cool outputs stay in their default positions. CTL_FLOATING_OUT_SYNCH follows. CTL_DISABLED disables heat/cool control.
				X	This is the latest alarm detected by the node (if any) and has the same value as nvoAlarm.type.
			X	X	This indicates the state of the demand limit control.
	X		X	X	This indicates the real status of the window detection, either from the digital input or from the network.
	X		X	X	This indicates the status of the digital input configured as window detection.
			X	X	This indicates the position of the output 1.
			X	X	This indicates the position of the output 2.
	X		X	X	This reports the current temperature control point calculated from the various setpoints, operating modes, and optimum start-up gradients.
	X		X	X	This reports the current space temperature used for the control algorithm.
			X	X	This shows the current value in minutes of the active bypass timer

(continued)

Table C4. Output Variables for W7762 Controllers (left).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value	Default
	nvoHydStatusP	field_no	Same as nvoHydStatus.		
SrcOccEffP	nvoHydStatusP	effect_occ	Same as nvoHydStatus.		
SrcOccOvrdHwP	nvoHydStatusP	hw_override	Same as nvoHydStatus.		
SrcOccSchedP	nvoHydStatusP	sched_occ	Same as nvoHydStatus.		
SrcOccSensorP	nvoHydStatusP	eff_sen_occ	Same as nvoHydStatus.		
SrcOccOvrdNetP	nvoHydStatusP	net_man_occ	Same as nvoHydStatus.		
SrcOccSensorHwP	nvoHydStatusP	hw_sen_occ	Same as nvoHydStatus.		
SrcOvrdLedP	nvoHydStatusP	r_o_led	Same as nvoHydStatus.		
SrcHYDModeP	nvoHydStatusP	mode	Same as nvoHydStatus.		
	nvoHydStatusP	alarm_type	Same as nvoHydStatus.		
SrcDlcShedP	nvoHydStatusP	dlc_shed	Same as nvoHydStatus.		
SrcWindowP	nvoHydStatusP	eff_window_open	Same as nvoHydStatus.		
SrcWindowHwP	nvoHydStatusP	hw_window_open	Same as nvoHydStatus.		
SrcOutput1P	nvoHydStatusP	output_position[0]	Same as nvoHydStatus.		
SrcOutput2P	nvoHydStatusP	output_position[1]	Same as nvoHydStatus.		
SrcRmTempSptEffP	nvoHydStatusP	active_set_pt	Same as nvoHydStatus.		
SrcRmTempEffP	nvoHydStatusP	space_temp	Same as nvoHydStatus.		
SrcRestBypassTimeP	nvoHydStatusP	rest_bypass_time	Same as nvoHydStatus.		
SrcHeatPos	nvoHeatOutput		SNVT_lev_percent 0 to 100% 163.835% = INVALID		
	nvoSensor	override_button	Bit NOT_PRESSED PRESSED	 0 1	
	nvoSensor	contact_state_DI1	Bit CONTACT_OPEN CONTACT_CLOSED	 0 1	
	nvoSensor	raw_data[0]	UWORD 0 to 65535 for Space Temp		
	nvoSensor	raw_data[2]	UWORD 0 to 65535 for Setpoint Knob		
SrcRmTempSptHw	nvoSensor	remote_set_point	SNVT_temp_p -5 to 5 K for relative 12 to 30°C for absolute		
SrcRmTempHw	nvoSensor	space_temp	SNVT_temp_p 0 to 40°C 327.67°C for INVALID		
	nvoSensor	ub_hard_config	BYTE INITIAL W7762A W7762B INVALID	 0 1 2 255	INITIAL (at application restart)

(continued)

Table C4. Output Variables for W7762 Controllers (right).

Share (SH), Map (MA), Direct Access (DA) Monitor (M), Heartbeat (HBT)					
SH	**MA**	**DA**	**M**	**HBT**	**Comments**
					Same as nvoHydStatus except not sent as heartbeat. This variable is sent only in response to a poll request, typically from a supervisory device.
		X			Same as nvoHydStatus.
		X			Same as nvoHydStatus.
		X			Same as nvoHydStatus.
		X			Same as nvoHydStatus.
		X			Same as nvoHydStatus.
		X			Same as nvoHydStatus.
		X			Same as nvoHydStatus.
		X			Same as nvoHydStatus.
					Same as nvoHydStatus.
		X			Same as nvoHydStatus.
		X			Same as nvoHydStatus.
		X			Same as nvoHydStatus.
		X			Same as nvoHydStatus.
		X			Same as nvoHydStatus.
		X			Same as nvoHydStatus.
		X			Same as nvoHydStatus.
		X			Same as nvoHydStatus.
X				X	This is the heating output that is typically used for monitoring or bound to a heat actuator node or another Excel 10 controller operating as slave. nvoHeatOutput will be transmitted immediately when its value has changed significantly (>= 1%), and periodically according to nciSndHrtBt. The output value represents the output of the control algorithm but is limited to a range of 0% to 100%.
					This indicates the status of the override pushbutton.
					This indicates the state of the digital input.
					This contains the analog to digital converter count measured from the analog value. This count represents the measured time during the second part of each a/d conversion.
					See above.
		X			This is the set point from the wall module setpoint knob and may be absolute or relative depending upon nciWallMod.set_pnt_knob .
		X			This is the measured space temperature accurately reported between 0°C and 40°C.
					This is used to establish hardware-dependent factory default configuration settings for the Hydronic controller.

(continued)

Table C4. Output Variables for W7762 Controllers (left).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value	Default
SrcOccSensor	nvoSensorOcc		SNVT_occupancy OC_OCCUPIED OC_UNOCCUPIED OC_NUL (No Sensor)	 0 1 255	OC_NUL (at application restart)
SrcRmTempEff	nvoSpaceTemp		SNVT_temp_p 0 to 40°C 327.67°C = INVALID		INVALID (at application restart)
SrcObjId	nvoStatus	object_id	UWORD NODE_OBJECT HYD_OBJECT	 0 1	
	nvoStatus	invalid_id	Bit VALID_ID INVALID_ID	 0 1	
	nvoStatus	invalid_request	Bit VALID_REQUEST INVALID_REQUEST	 0 1	
	nvoStatus	disabled	Bit ENABLED DISABLED	 0 1	
	nvoStatus	comm_failure	Bit COMMUNICATION_OK COMMUNICATION_FAILURE	 0 1	
	nvoStatus	in_alarm	Bit NO_ALARM IN_ALARM	 0 1	
	nvoStatus	report_mask	Bit NO_REPORT_MASK REPORT_MASK	 0 1	

(continued)

Table C4. Output Variables for W7762 Controllers (right).

Share (SH), Map (MA), Direct Access (DA) Monitor (M), Heartbeat (HBT)					
SH	**MA**	**DA**	**M**	**HBT**	**Comments**
X		X	X	X	This is an output showing the state of the hard wired occupancy sensor, if one is configured by nciHydConfig.DI1_config. OC_NUL means no input is available because it is not bound or not configured by nciHydConfig.DI1_config.
X				X	This is the sensed space temperature at the node taken from the locally wired sensor. It is typically bound to nviSpaceTemp of another node that may not have its own space temperature sensor but controls the same space. It is also used for monitoring purposes, showing the current space temperature used for the control algorithm. nvoSpaceTemp is transmitted immediately when its value has changed significantly (> 0.5 delta°C). The reported space temperature includes the offset correction nciWallMod.si_space_temp_zero_cal. If a space temperature sensor is not connected or is shorted or if nviSpaceTemp is bound to another node, nvoSpaceTemp is not reported on the network.
X				X	This output belongs to the Node Object and reports the status for any object on a node. This is the answer to the nviRequest.
				X	This indicates whether nviRequest uses a fault object ID.
				X	This indicates whether nviRequest uses a fault request.
				X	This indicates whether the device is enabled or disabled (nviManualMode = DISABLE).
				X	This indicates whether an update nviRcvHrtBt is missing.
				X	This indicates whether an alarm occured. See nvoAlarm.
				X	This shows the answer to nviRequest > REPORT_MASK

(continued)

Table C4. Output Variables for W7762 Controllers (left).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value	Default
SrcTermLoad	nvoTerminalLoad		SNVT_lev_percent -163..163% 163.835% = INVALID		
SrcHvacModeU	nvoUnitStatus	mode	SNVT_hvac_mode HVAC_HEAT HVAC_COOL HVAC_OFF	 1 3 6	
SrcHeat	nvoUnitStatus	heat_output_primary	SNVT_lev_percent 0 to 100% 163.835% = INVALID		
SrcCool	nvoUnitStatus	cool_output	SNVT_lev_percent 0 to 100% 163.835% = INVALID		
SrcAlarmUnit	nvoUnitStatus	in_alarm	UBYTE NO_ALARM ALARM ALARM_NOTIFY_DISABLED	 0 1 255	
SrcWindow	nvoWindow	value	SNVT_switch.value 0 to 100%		0 (at application restart)
	nvoWindow	state	SNVT_switch.state CLOSED OPEN NO_WINDOW	 0 1 255	NO_WINDOW (at application restart)
NodeType0	nroPgmVer	id[0]	UBYTE, 70 = H		
NodeType1	nroPgmVer	id[1]	UBYTE, 67 = Y		
NodeType2	nroPgmVer	id[2]	UBYTE, 85 = D		
NodeType3	nroPgmVer	id[3]	UBYTE, 50 = 2		
NodeVerMajor	nroPgmVer	major_ver	UBYTE, 0 to 255		
NodeVerMinor	nroPgmVer	minor_ver	UBYTE, 0 to 255		
NodeVerBug	nroPgmVer	bug_ver	UBYTE, 0 to 255		
NodeTypeNumber	nroPgmVer	node_type	UBYTE, 11 = HYD2		

Table C4. Output Variables for W7762 Controllers (right).

Share (SH), Map (MA), Direct Access (DA) Monitor (M), Heartbeat (HBT)					
SH	**MA**	**DA**	**M**	**HBT**	**Comments**
X	X	X	X	X	This is an output showing the terminal load, which is a percentage between -160% and +160% based on the control output level. Negative values indicate heating load and positive values indicate cooling load. 100% is the full terminal capacity. An absolute terminal load value of more than 100% indicate that the terminal is not able to supply the required heating or cooling energy which at the zone controller should cause a demand for more supply energy. nvoHeatOutput will be transmitted immediately when its value has changed significantly (>= 1%).
X	X	X	X	X	This output variable reports the last operating mode of the control algorithm. It is not set to HVAC_OFF if the Heating and Cooling Output shows 0%. HVAC_OFF is set when the Device is disabled from nviRequest, nviManualMode or nviApplicMode.
	X	X	X	X	This reports the actual heating output value. Any change forces nvoUnitStatus to be transmitted immediately.
	X	X	X	X	This reports the actual cooling output value. A change of more than 1% forces nvoUnitStatus to be transmitted immediately.
		X	X	X	This reports the actual alarm status of the controller and is set to ALARM_NOTIFY_DISABLE when nviManualMode = SUPPRESS_ALARMS.
X		X	X	X	This reports the status of the window sensor. It allows the hard wired window sensor to be used by other nodes on the network.
				X	See above.
		X			This identifies the Excel 10 node type by an eight byte constant describing the node type, major and minor functional release number and bug fix. First character.
		X			Second character.
		X			Third character.
		X			Fourth character.
		X			Major Functional Release Number: 1. Add or delete a network variable (NV), nv field. 2. Change the name of a nv or nv field. 3. Range or type (short / long) of data in a nv field is changed. 4. Enumerated value list of a nv field is changed. **NOTE:** Algorithm changes or bug fixes may also be included.
		X			Minor Functional Release Number: 1. Network variables are unchanged. 2. Functionality of the control algorithm has been revised and affects compatibility with other nodes or the equipment being controlled. 3. The network interface or physical input / output subsystem was revised and affects compatibility with other nodes. **NOTE:** Bug fixes may also be included in a minor functional release.
		X			Bug Fix Number: Network variables are unchanged. A change to the algorithm, network interface, or physical input/output subsystem was made that does not affect compatibility with other nodes or the equipment controlled by the node.
		X			Node type number.

Table C5. Unused Variables for W7762 Controllers (left).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value	Default
	nciApplVer	not_used1	UBYTE		
	nciApplVer	not_used2	UBYTE		
	nciCntrlSettings	fan_auto_mode	CONTINUOUS AUTO_MODE	0 1	AUTO_MODE
	nciCntrlSettings	fan_run_up_time	SNVT_time_sec 0 to 600 seconds		0
	nciCntrlSettings	fan_overrun_time	SNVT_time_sec 0 to 600 seconds		0
	nciCntrlSettings	reheat_switch_level	SNVT_lev_percent 0 to 100%		100%
	nciCntrlSettings	reheat_hysteresis	SNVT_lev_percent 0 to 100%		5%
	nciCntrlSettings	fan_min_on_time	SNVT_time_sec 0 to 1200 seconds		0
	nciCntrlSettings	fan_min_off_time	SNVT_time_sec 0 to 1200 seconds		0
	nciCntrlSettings	reserve	7 bits		
	nciHydConfig	fan_speed_switch	BYTE NO_SWITCH	 0	NO_SWITCH
	nciHydConfig	fan_config	BYTE NO_FAN	 0	NO_FAN
	nciHydConfig	fan_interlock_0	Bit NO YES	 0 1	
	nciHydConfig	fan_interlock_1	Bit NO YES	 0 1	
	nciHydConfig	not_used	4 bits		
	nciHydConfig	reheat_config	BYTE REHEAT FREE_USE REL_NOT_USED	 0 1 255	REL_NOT_USED
	nciHydConfig	unused1	2 bits		
	nciHydConfig	spare_field[0]	UBYTE		
	nciHydConfig	spare_field[1]	UBYTE		
	nciWallMod	spare_field[0]	UBYTE		
	nciWallMod	spare_field[1]	UBYTE		
	nviFanSpeedCmd	value	SNVT_switch 0 to 100%		
	nviFanSpeedCmd	state	SNVT_switch OFF ON NUL	 0 1 255	
	nviReheatRelay	value	SNVT_switch 0 to 100%		

(continued)

Table C5. Unused Variables for W7762 Controllers (right).

Share (SH), Map (MA), Direct Access (DA) Monitor (M), Heartbeat (HBT)					
SH	MA	DA	M	HBT	Comments

(continued)

Table C5. Unused Variables for W7762 Controllers (left).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value	Default
	nviReheatRelay	state	SNVT_switch OFF ON NUL		
	nviTest	reheat_cmd	BYTE NORMAL_HC_MODE OFF1_OFF2 ON1_ON2	 0 1 4	NORMAL_HC_MODE
	nviTest	fan_control	BYTE NORMAL_FAN_MODE OFF1_OFF2_OFF3 ON1_OFF2_OFF3 OFF1_ON2_OFF3 ON1_ON2_OFF3 OFF1_OFF2_ON3 ON1_OFF2_ON3 OFF1_ON2_ON3 ON1_ON2_ON3	 0 1 2 3 4 5 6 7 8	NORMAL_FAN_MODE
	nvoFanSpeed	value	SNVT_switch.value 0 to 100%		
	nvoFanSpeed	state	SNVT_switch.state OFF ON NO_FAN		
	nvoFanSpeedSw	value	SNVT_switch.value 0 to 100%		
	nvoFanSpeedSw	state	SNVT_switch.state OFF ON NO_FAN_SPEED_SW		
	nvoHydStatus	fan_feedback	Bit FAN_OFF_AFTER_ON_CMD FAN_RUNS	 0 1	
	nvoHydStatus	external_active	Bit EXTERNAL_NOT_ACTICE EXTERNAL_ACTIVE	 0 1	
	nvoHydStatus	not_used	3 bits		
	nvoHydStatus	fan_stages_active	UBYTE F_OFF F_SPEED1 F_SPEED2 F_SPEED3 F_NO_FAN	 0 1 2 3 255	
	nvoHydStatus	reheat_active	SNVT_lev_disc ST_OFF ST_ON ST_NUL (No Reheat)	 0 4 255	
	nvoHydStatus	spare_field[0]	WORD		
	nvoHydStatusP	fan_feedback	Same as nvoHydStatus		
	nvoHydStatusP	external_active	Same as nvoHydStatus		

(continued)

Table C5. Unused Variables for W7762 Controllers (right).

Share (SH), Map (MA), Direct Access (DA) Monitor (M), Heartbeat (HBT)					
SH	MA	DA	M	HBT	Comments
				X	
				X	
				X	
				X	
				X	

(continued)

Table C5. Unused Variables for W7762 Controllers (left).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value	Default
	nvoHydStatusP	not_used	Same as nvoHydStatus		
	nvoHydStatusP	fan_stages_active	Same as nvoHydStatus		
	nvoHydStatusP	reheat_active	Same as nvoHydStatus		
	nvoHydStatusP	spare_field[0]	Same as nvoHydStatus		
	nvoReheat	value	SNVT_switch.value 0 to 100%		
	nvoReheat	state	SNVT_switch.state OFF ON NO_REHEAT	 0 1 2	
	nvoSensor	not_used	6 bits		
	nvoSensor	raw_data[1]	UWORD 0 to 65535		
	nvoSensor	fan_speed_switch	SNVT_lev_disc ST_OFF ST_LOW ST_MED ST_HIGH ST_NUL (No Switch)	 0 2 3 4 255	
	nvoStatus	out_of_limits	Bit not supported		
	nvoStatus	open_circuit	Bit not supported		
	nvoStatus	out_of_service	Bit not supported		
	nvoStatus	mechanical_fault	Bit not supported		
	nvoStatus	feedback_failure	Bit not supported		
	nvoStatus	over_range	Bit not supported		
	nvoStatus	under_range	Bit not supported		
	nvoStatus	electrical_fault	Bit not supported		
	nvoStatus	unable_to_measure	Bit not supported		
	nvoStatus	fail_self_test	Bit not supported		
	nvoStatus	self_test_in_progress	Bit not supported		
	nvoStatus	locked_out	Bit not supported		
	nvoStatus	manual_control	Bit not supported		
	nvoStatus	in_override	Bit not supported		
	nvoStatus	reserved1	Bit not supported		
	nvoStatus	reserved2	Bit not supported		
	nvoUnitStatus	heat_output_secondary	SNVT_lev_percent 0 to 100% 163.835% = INVALID		
	nvoUnitStatus	econ_output	SNVT_lev_percent not supported		
	nvoUnitStatus	fan_output	SNVT_lev_percent 0 to 100%		
	nvoUnitStatus	fan_output	SNVT_lev_percent 0 to 100%		

Table C5. Unused Variables for W7762 Controllers (right).

Share (SH), Map (MA), Direct Access (DA) Monitor (M), Heartbeat (HBT)					
SH	MA	DA	M	HBT	Comments
				X	
				X	
				X	
				X	
				X	
				X	
				X	
				X	
				X	
				X	
				X	
				X	
				X	
				X	
				X	
				X	
				X	
				X	
				X	
				X	
				X	
				X	

APPENDIX D. Q7750A EXCEL 10 ZONE MANAGER POINT ESTIMATING GUIDE.

Memory size approximation is shown in Fig. 21: (All sizes in bytes.) When *memory size* is less than 110 Kbytes, the size is adequate.

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

When *memory size* is greater than 128 Kbytes, 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 are available for accessing through the *Direct Access* feature.

2. Calculate the number of Excel 10 Zone Manager program points that will be used in the 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. 10 Kbytes of control logic (one time program, five switching tables, and five control loops).
   c. 20 Kbytes of control logic (multiple time programs, ten switching tables, and ten control loops).

   Use Fig. 21 to determine the number of Excel 10 Controllers that can be connected to the Zone Manager.

   NOTE: Where the number of Excel 10 Controllers exceeds 60 a router is required.

4. Repeat the calculation for each Q7750A Excel 10 Zone Manager in the project.

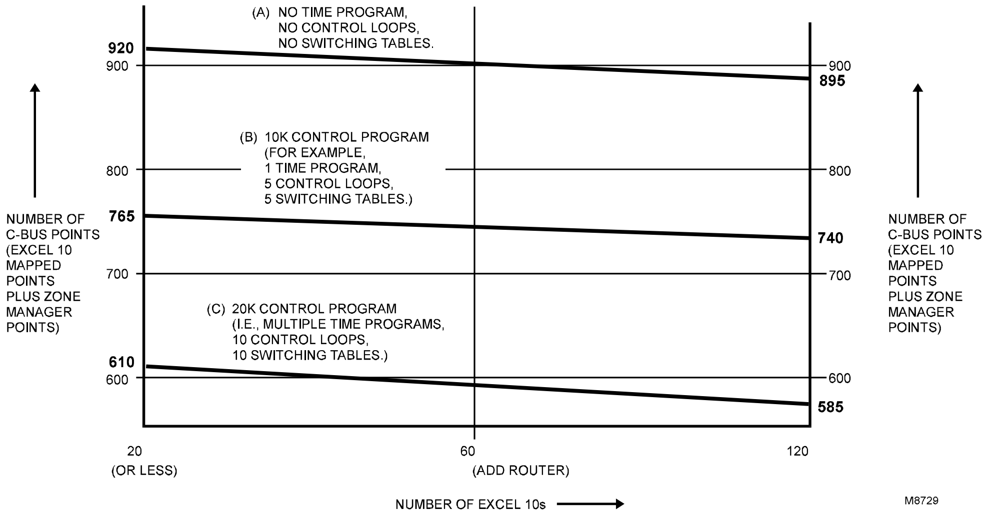

Fig. 21. Point capacity estimate for Zone Manager.

The exact equation to use to calculate memory size is:

Memory size = 21,780 byte
+ 4096 byte (in case of a time program)
+ CARE Control Program
+ 14 byte x time points x Excel 10 Controllers
+ 50 byte x Excel 10 Controllers
+ map complexity x Excel 10 Controllers x mapped points
+ 57 byte x C-Bus points
+ 7488 byte x Excel 10 Controller types

Where:

time points = number of switch points in time program per Excel 10 Hydronic Controller
Excel 10 Controllers = number of attached Excel 10 Hydronic Controllers
C-Bus points = including mapped points and others; for example, Remote Points
Mapped points = number of mapped points for each Hydronic Controller, including One-to-Many and Many-to-One mechanism
Excel 10 Controller types = number of different Excel 10 Controller types (currently one)
Map complexity =
20 = using One-to-Many and not using points with read/write ability
30 = average
45 = many points with read/write ability

Honeywell

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Automation and Control Solutions
Honeywell GmbH
Böblinger Strasse 17
71101 Schönaich
Germany
Phone: (49) 7031 63701
Fax: (49) 7031 637493
http://ecc.emea.honeywell.com
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