

## PIC-HP

Price Intelligent Controller - Hydronic Products

### Product Information

#### Introduction

Radiant systems are gaining in popularity due to their ability to offer increased energy efficiency and cost savings when compared with traditional all air systems. As more experience is gained in designing Radiant systems, it is recognized that the control systems and accessories associated with these systems carry unique characteristics and opportunities. For this reason, Price controls for Radiant systems have been designed to be as versatile and modular as possible, and the accessories and options have been chosen to compliment both the controls and system.

#### Price Intelligent Controller for Radiant Products (PIC-HP)

The PIC-HP is a standalone or networkable, fully digital and programmable controller. This control solution is ideal for managing the sequences of Price radiant heating and cooling products. The PIC-HP is an advanced and configurable proportional integral (PI) controller and allows for exceptional user comfort and energy efficiency. It is designed specifically to manage the control requirements of radiant systems.

The PIC-HP is designed with a modular architecture and includes BACnet networking as standard. This allows flexibility to the customer by providing both the "core" controller as well as powerful control and communication options with the use of the expansion modules.

#### Typical Application Overview

The PIC-HP can be factory configured to any one of the 8 standard control sequences, as well as custom sequences, if required. There are six standard sequences that control the water flow only and two standard sequences that control the water flow and VAV Air (Variable Air Volume). The standard control sequences are available for either 2-pipe or 4-pipe operation and indicate the control output used with the associated actuator type (On/Off or 0-10Vdc modulating). Typical control sequences for water and air include:

#### On/Off, 2-pipe, Constant Air Volume Chilled Water Supply Only (Sequence #9701)

On an increase in room temperature above the set point, the air volume will remain at its pre-selected level while the cold radiant valve opens fully. When the room temperature decreases to the set point, the cold water actuator turns off the flow.

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#### On/Off, 2-pipe, Constant Air Volume Hot Water Supply Only (Sequences #9703)

On a decrease in room temperature below the room set point, the air volume will remain at its pre-selected level while the hot radiant valve opens fully. When the room temperature increases to the set point, the hot water actuator turns off the flow.

#### Modulating, 2-pipe, Constant Air Volume Chilled Water Supply Only (Sequences #9700)

On an increase in room temperature above the room set point, the air volume will remain at its pre-selected level while the cold radiant valve modulates from closed to open in proportion to the room temperature. On a decrease in room temperature, the cold radiant valve modulates closed.

#### Modulating, 2-pipe, Constant Air Volume Hot Water Supply Only (Sequences #9702)

On a decrease in room temperature below the room set point, the air volume will remain at its pre-selected level while the hot radiant valve modulates from closed to open in proportion to the room temperature. On an increase in room temperature, the hot radiant valve modulates closed.

#### On/Off, 4-pipe, Constant Air Volume Chilled Water Supply (Sequence #9705)

On an increase in room temperature above the set point, the air volume will remain at its pre-selected level while the cold radiant valve opens fully. When the room temperature decreases to the set point, the cold water actuator turns off the flow. The hot water valve remains fully closed.

#### Dead Band

With no demand in the space, ie. when the temperature is at or close to the set point, the water valves (hot and cold) remain closed, and the air volume remains constant.

#### Hot Water Supply

On a decrease in room temperature below the room set point, the air volume will remain at its pre-selected level while the hot radiant valve opens fully. When the room temperature increases to the set point, the hot water actuator turns off the flow. The cold water valve remains fully closed.

#### Modulating, 4-pipe, Constant Air Volume (Sequence #9704)

#### Chilled Water Supply

On an increase in room temperature above the room set point, the air volume will remain at its pre-selected level while the cold radiant valve modulates from closed to open in proportion to the room temperature. On a decrease in room temperature, the cold radiant valve modulates closed. The hot radiant valve is always fully closed.

#### Dead Band

With no demand in the space, ie. when the temperature is at or close to the set point, the water valves (hot and cold) remain closed, and the air volume remains constant.

#### Hot Water Supply

On a decrease in room temperature below the room set point, the air volume will remain at its pre-selected level while the hot radiant valve modulates from closed to open in proportion to the room temperature. On an increase in room temperature, the hot radiant valve modulates closed. The cold radiant valve is fully closed.

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#### Note: Dynamic Heat/Cool Changeover for 2-Pipe Systems (HCCO)

The controller will modulate the water valve when heating or cooling is required.

Ex. If the space set point is at 72°F and water temperature is below set point then the system is in cooling mode. If the space set point is at 72°F and water temperature is above set point then the system is in heating mode.

PIC-HP HCCO sequences are available for 2-pipe configurations, where both cold and hot water are supplied. The supplied changeover probe (PIC-PRB) allows HCCO operation. If no probe is connected to the thermostat, the controller assumes that it is receiving chilled water supply and acts accordingly.

#### Modulating, 2-pipe, Variable Air Volume Chilled Water Supply Only (Sequence #9706)

On an increase in room temperature above the room set point, the air volume will remain at minimum ventilation to meet building code and latent load requirements while the cold radiant valve modulates from closed to open in proportion to the room temperature. The air volume will modulate from minimum position to full open as a secondary stage of cooling in proportion to the room temperature, when required. On a decrease in room temperature or during off-peak hours, the cold radiant valve modulates closed and the air volume is modulated to minimum ventilation.

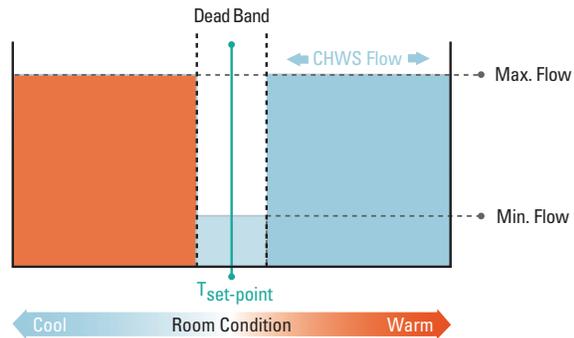
#### Modulating, 4-pipe, Variable Air Volume Chilled Water Supply (Sequence #9707)

On an increase in room temperature above the room set point, the air volume will remain at minimum ventilation to meet building code and latent load requirements while the cold radiant valve modulates from closed to open in proportion to the room temperature. The air volume will modulate from minimum position to full open as a secondary stage of cooling in proportion to the room temperature, when required. On a decrease in room temperature or during off-peak hours, the cold radiant valve modulates closed and the air volume is modulated to minimum ventilation. The hot radiant valve is always fully closed.

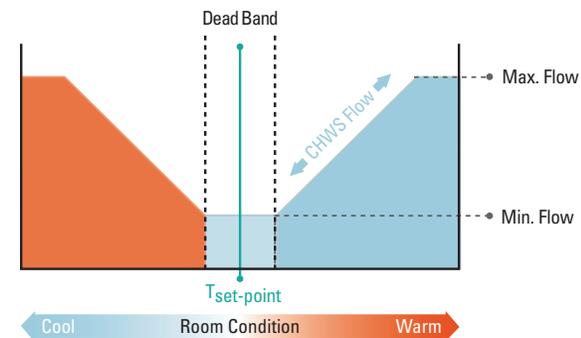
#### Dead Band

With no demand in the space, ie. when the temperature is at or close to the set point, the water valves (hot and cold) remain closed, and the air volume remains at minimum ventilation.

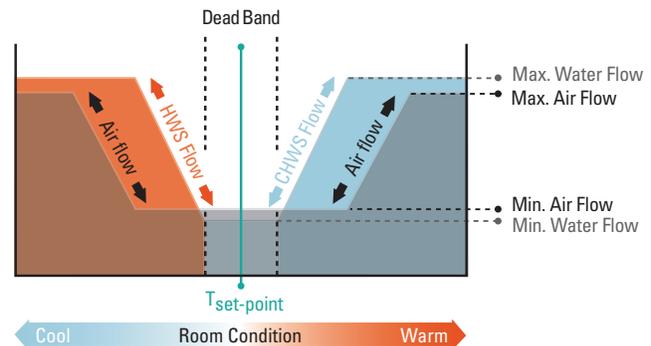
#### Dynamic Heat/Cool Changeover for 2-Pipe Systems (HCCO)



#### Modulating, 2-pipe, Variable Air Volume - Chilled Water Supply Only



#### Modulating, 4-pipe, Variable Air Volume - Chilled Water Supply



#### Hot Water Supply

On a decrease in room temperature below the room set point, the air volume will remain at minimum ventilation to meet building code while the hot radiant valve modulates from closed to open in proportion to the room temperature. The air volume will modulate from minimum position to

full open as a secondary stage of heating in proportion to the room temperature, when required. On an increase in room temperature or during off-peak hours, the hot radiant valve modulates closed and the air volume is modulated to minimum ventilation. The cold radiant valve is fully closed.

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### Sensor Options

Various sensors for improved zone communication and control are also available as an add-on option to the module. The sensors available as options are a condensate sensor, window interlock sensor, CO2 sensor and an occupancy sensor. The PIC-HP comes with a standard temperature sensor which can be used for heat/cool changeover by monitoring the water supply.

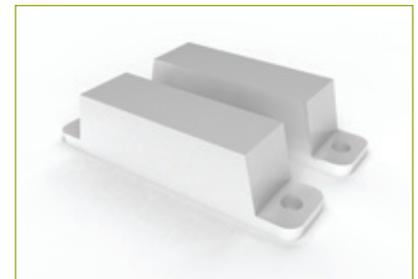
#### Condensate Sensor

The condensate sensor can be used to sense the formation of condensation on the chilled water piping in radiant products. The sensor is installed on the chilled water connection and signals the controller, if condensation is detected, to take appropriate action (typically, shutting off the coil). See page ??? for more information about the Price Condensate Sensor.



#### Window Interlock Sensor

The window interlock sensor can be used to detect when the window on which it is installed is opened. The sensor indicates the event to the controller which can take the appropriate action (typically, shutting off the coil).



#### Occupancy Sensor

The occupancy sensor can be used to detect when the space is occupied and is a useful energy conservation tool. The sensor is located on the thermostat and can be used to turn the space into unoccupied mode after a programmed amount of inactivity.



#### CO2 Sensor (VAV sequences)

The CO2 sensor can be used to monitor indoor air quality and detect when the space is occupied. The sensor is located in the occupied space and will send a signal to the controller to increase/decrease air volume to meet minimum ventilation requirements. See page ??? for more information about the Price CO2 Sensor.

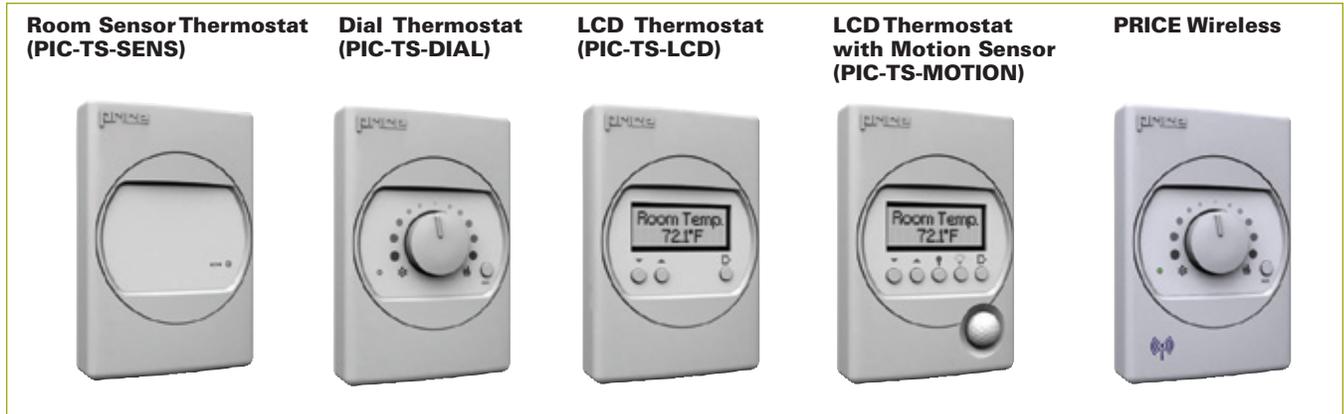


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### Thermostat Options



The PIC-HP is also available with several thermostat options allowing the engineer to select the applicable features. All Price thermostats feature an RJ-12 service port allowing setup and configuration access without having to access the plenum.

#### Room Sensor Thermostat (PIC-TS-SENS)

This economical model of thermostat measures room temperature. The set point can be set from a hidden dial on the back of the T-Stat, through free setup software, or through a BACnet system. This eliminates the problem of unauthorized tampering without the need for visually unappealing thermostat lock boxes.

#### Dial Thermostat (PIC-TS-DIAL)

This model measures room temperature and features a dial adjustment and an occupancy button. Temperature set point limits are set through software/BACnet.

#### LCD Thermostat (PIC-TS-LCD)

This model measures room temperature and features an LCD screen with an advanced menu structure and three pushbuttons. Temperature set point limits are set through software/BACnet.

Balancing and modification to the controller setup can be accomplished from the LCD screen.

#### LCD Thermostat with Motion Sensor (PIC-TS-MOTION)

This model possesses the same features as the LCDT-Stat with the addition of a passive infrared motion sensor. The motion sensor allows for automatic detection of space occupancy and therefore can save energy by shutting down during unoccupied periods.

#### PRICE Wireless Dial Thermostat and Base

This model possesses the same features as the Dial T-Stat and includes a base receiver with a range of up to 100ft. The base receiver features an LCD screen for wireless setup and RJ-45 connection to the controller. This model is a FCC certified wireless module.

#### PIC-HP Features

The Price Intelligent Controller for Radiant Products comes with the following standard features:

- BACnet network operation (with the optional BACnet expansion module).
- Service port on all thermostat models

provides a computer interface (using the Price USB LINKER) for setup/balancing when LCD thermostat is not available/sufficient.

- A range of thermostat options from a room sensor thermostat up to a motion controlled LCD thermostat.
- Fast and error proof RJ-45 thermostat controller wiring.
- LED's on the PIC indicate the status of all outputs, aiding with troubleshooting.
- Adjustment of sequence parameters and settings are possible from the password-protected service menu of LCD thermostats.
- 24 VAC binary switched outputs field switchable between hot and common.
- Analog (0-10 VDC) outputs fully configurable for heating, cooling, and auxiliary.
- BACnet module provides a native BACnet MS/TP interface.

### Expansion Modules

#### BACnet Module (PIC-BAC)

Any PIC-HP ordered will ship with the BACnet module installed and mounted. Modules may also be field mounted and connected to the PIC-HP with a single ribbon-type cable.

With native BACnet MS/TP compatibility, the PIC-HP can tie into an existing or future BACnet compliant BAS network.

When connected, the network can monitor all of the controller's functions and variables, assign set-points, and initiate occupied, unoccupied, and night setback modes, taking advantage of the level of control and

visibility inherent to BAS systems.

A computer on the BACnet network can also be used to configure the PIC instead of using the keypad on the LCD-Stat.

Each PIC on the BACnet network can relay data that contains a variety of setup and room condition information. This can be read by other controllers (such as the Price Digital Rooftop Controller, PDRC) allowing for intelligent decisions to be made at the air supplier level. See the Section G—System Controls Engineering Guide for more information.

#### BACnet Module (PIC-BAC)



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### Installation and Setup

Installation and configuration of the PIC-HP is simple. All wiring terminals are of the pluggable type – allowing the contractor to make connections quickly and easily.

Thermostat and BACnet network connections are made using modular (RJ-45) connectors. Plenum-rated and factory tested RJ-45 cables are provided by Price, where required.

The PIC-HP comes factory calibrated and can be installed in mechanical rooms for easy access. For active beams, the PIC-HP can also be installed on ceiling plenums or be included as part of the factory mounted controls option, if desired.

#### Installing the PIC-HP

1. Mount and secure the controller to a surface in the mechanical room or, for active beams, on the ceiling plenum if desired. Optional Price Factory Mounted Controls are also available.
2. Connect any of the controller's outputs as required.
3. Power the PIC-HP using 24 VAC.

#### Installing a Thermostat

1. Install the thermostat backplate to a standard electrical box or directly to drywall using anchors (supplied by others).
2. Connect the T-stat to the PIC-HP's T-stat jack using the supplied plenum-rated modular (network type) cable.
3. Clip the thermostat onto the backplate and tighten the set screw.

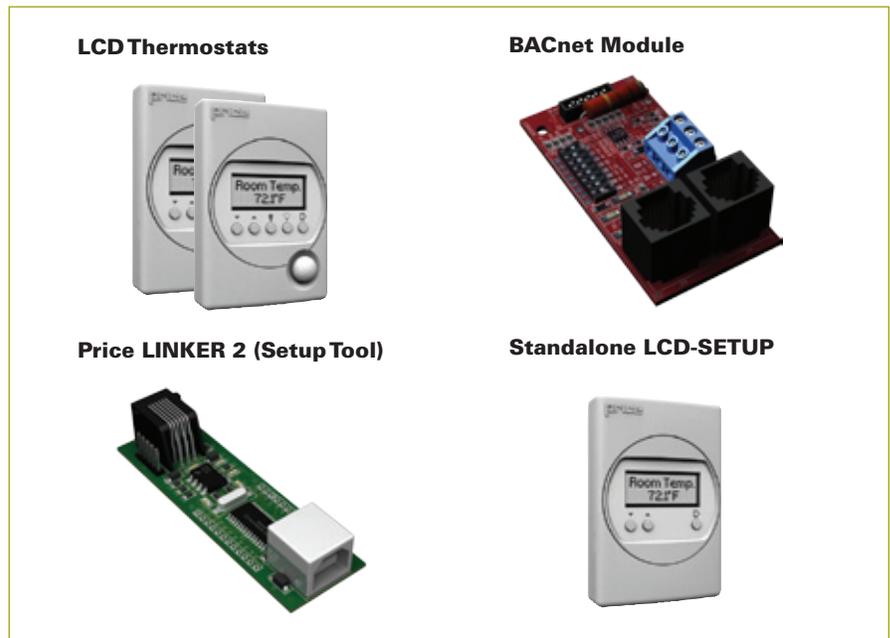
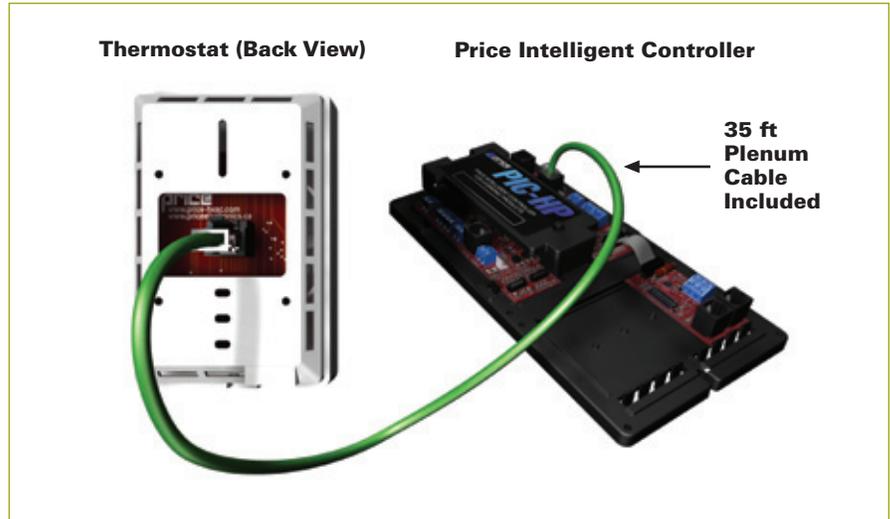
#### Setup of the PIC-HP

The PIC-HP comes pre-calibrated from the factory; however, if field conditions require adjustments, service/maintenance personnel have the ability to change the PIC-HP settings in several ways:

1. Through the password-protected menu structure built into the LCD thermostats.
2. Through the BACnet network.
3. Through the service jack located on the bottom of each thermostat and the Price LINKER 2.

The LINKER 2 is a USB 2.0 interface for Price controls. It is used in conjunction with free setup and balancing software available from Price.

4. Using the standalone setup tool, LCD-SETUP. This special setup tool resembles the LCD thermostat in both appearance and menu function. It can be plugged into either the dial thermostat or the room sensor thermostat and used to set up the controller when a computer is not available.



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### Networking

With native BACnet MS/TP compatibility, the PIC-HP can tie into an existing or future BACnet compliant BAS system for maximum flexibility. When connected, the network monitors all of the controller's functions and variables, assigns set-points, and initiates occupied, unoccupied and night setback modes, taking advantage of the level of control and visibility inherent to BAS systems.

A computer running BACnet communication software can connect to each controller.

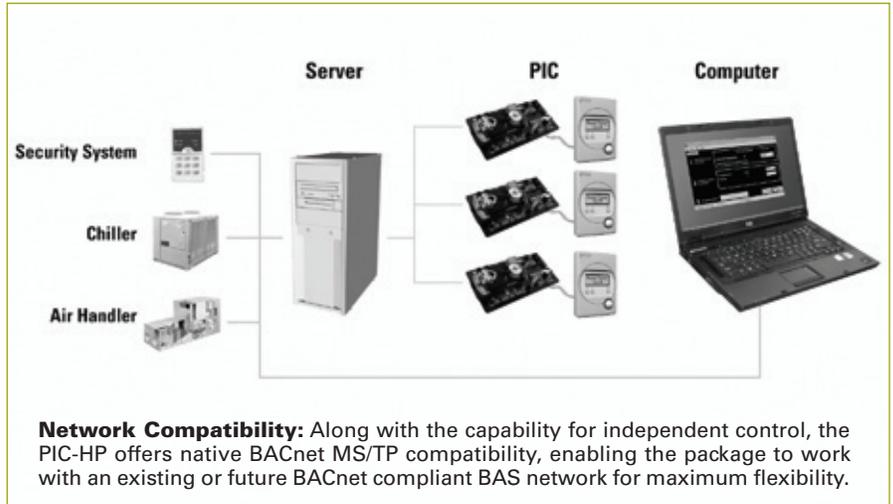
#### Master Slave Token Passing (MS/TP)

MS/TP stands for Master Slave Token Passing, which is a robust low-cost strategy for networking controllers. BACnet MS/TP uses the RS-485 standard, which uses one pair (two wires) and a shield.

The network wire is connected in a daisy chain configuration to each controller. Typically the terminals are labeled plus (+) and minus (-), but sometimes can be labeled (A) and (B).

MS/TP is much more robust and economical than Ethernet. For example, Ethernet can only be run a maximum of 330 feet without a repeater, while RS-485 (MS/TP) can be run up to 4000 feet without a repeater. It is presently not cost effective to put Ethernet on each device.

Once a network of controllers is set up using MS/TP, the network segment is



typically connected to a computer running a graphical software package (sometimes referred to as a front-end).

The software package graphics can typically show all networked controllers and their variables, trend log, and schedule devices and objects. This allows for energy savings and easier setup and maintenance of the system. See the Price Digital Rooftop Controller (PDRC) for more information.

#### PIC-HP, PIC, and PDRC

The PIC-HP can be used in conjunction with the Price Digital Rooftop Controller (PDRC) or other Price Intelligent Controller (PIC). This allows for polling of each zone's demand so that intelligent decisions can be made by the rooftop controller.

For more information on the PDRC, refer to Section G—System Controls.

