

The logo for Price HVAC, featuring the word "PRICE" in a bold, stylized, sans-serif font with a registered trademark symbol (®) to the upper right.

PRODIGY®

PPD1, PPD2, PPD3, PPDD

PERSONAL SELF-MODULATING DIFFUSERS

INSTALLATION MANUAL

Important Safeguards

When using electrical appliances, basic safety precautions should always be followed including the following:

1. Read all instructions.
2. Do not touch hot surfaces.
3. To protect against electrical shock do not immerse cord, plugs, or Control Box in water or other liquids.
4. Unplug the unit when not in use and before cleaning.
5. Do not operate any appliance with a damaged cord or plug or after the appliance malfunctions or has been damaged in any manner. Return appliance to the nearest authorized service facility for examination, repair or adjustment.
6. The use of accessory attachments not recommended by the appliance manufacturer may cause injuries.
7. Do not use outdoors.
8. Do not let cord hang over edge of a table or counter, or touch hot surfaces.
9. Do not place on or near a hot gas or electric burner, or in a heated oven.
10. Always attach plug to appliance first, then plug into the power source. To disconnect, turn any control to "off", then remove plug from power source.
11. Do not use appliance for other than intended use.
12. Save these instructions.

Date: 05/10

Reference #: C-12

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Having Difficulty installing this product? Price is here to help.

Application support by Phone:
(Monday – Friday 8:30 A.M. – 4:30 P.M. (CST))
Please call 204-661-7807

Application support by Email:
bradc@price-hvac.com

Literature:
www.price-hvac.com/literature

Prodigy (PPD Series) – installation and service manual
– V2.00 - 0512K

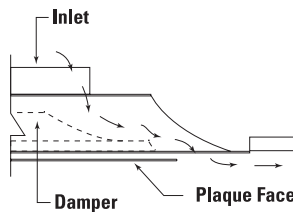


General Description

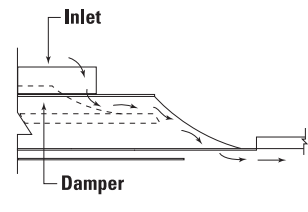
The Prodigy® is designed to enhance traditional system design by adding the element of personal control. As room load varies, the Prodigy® modulates its inner damper to control the flow of supply air into the space. Master models (PPD1, 2, & 3) have onboard controls, while the drone model (PPDD) imitates the master.

Figure 1

Maximum Flow



Minimum Flow

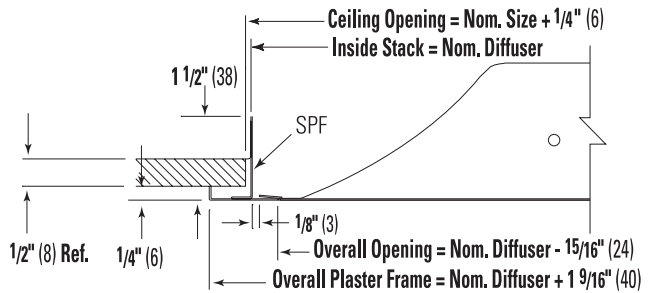


Installation into Ceiling

All Prodigy® models are provided with 6, 8, 10, 12 or 14" inlets for standard connection to supply ductwork. Allow clearance for full stroke of actuation of the motor (approximately 2") beyond shipped position of actuator.

The following five frame styles are available: **Type 1** Surface Mount (see Figure 2); **Type 2** Snap-In; **Type 3** T-Bar Mount; **Type 4** Spline, and **Type 17** Narrow Member.

Figure 2 - Type 1 Surface Mount



Power Supply to Master

All Prodigy diffusers (PPD1, PPD2 & PPD3) require a 24 VAC power supply.

1. Field Supplied 24 VAC

Connect 24 VAC and common lines to optional TP (Terminal Plug). (One TP is supplied as a standard item in the AUX HEAT output, and may be relocated for power input if not required for AUX HEAT.)

2. TR115 / TR277 20 VA Transformer

Master units supplied with transformer mounted to Prodigy Diffuser require field connection of primary power supply and grounding. Secondary power supply will be factory connected to pluggable 24 VAC PWR terminal block.

See Mounting / Installation instructions on Page 7 if transformer is shipped separately.

3. Price Power Module (PPM)

(Mounting/Installation Instructions on Page 7)

Use a C35 (35' Plenum rated snap-in cable) to connect power output jack on PPM to power input jack on Prodigy.

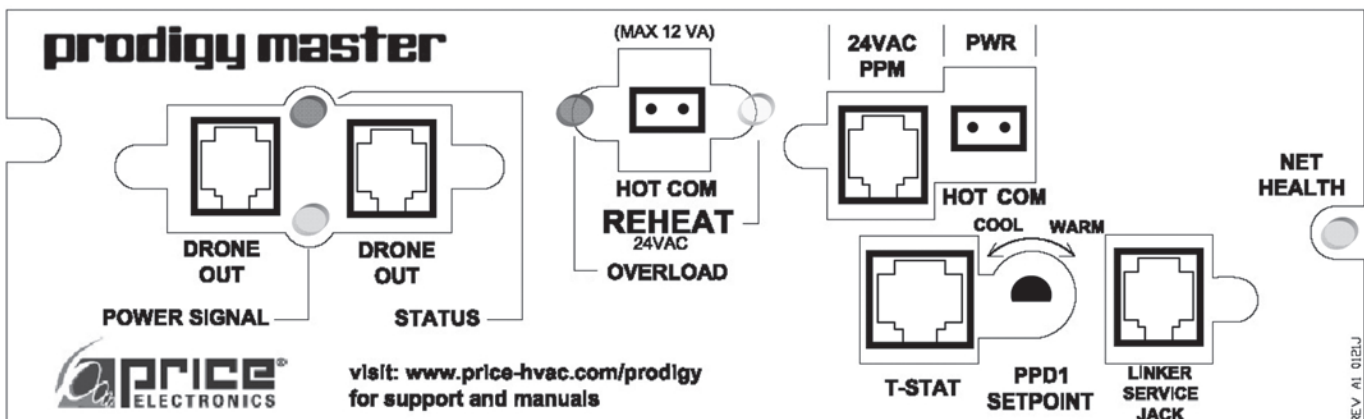
Additional Prodigy Master Units can be powered by daisy-chain connections if optional CS (Splitter Jack), is used. See notes in PPM for limitations on Page 7.



Note:

HOT and COMMON 24 VAC polarity is critical and must be consistent. 24 VAC COMMON must be EARTH ground in field to ensure proper BACnet network communication.

Figure 3 - Master Junction Panel



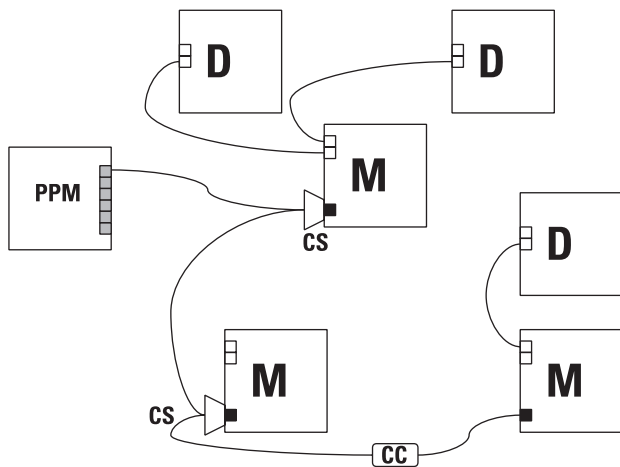
Drone Power Supply Connection

PPDD - See Figure 3, Figure 4, Figure 5, Figure 6

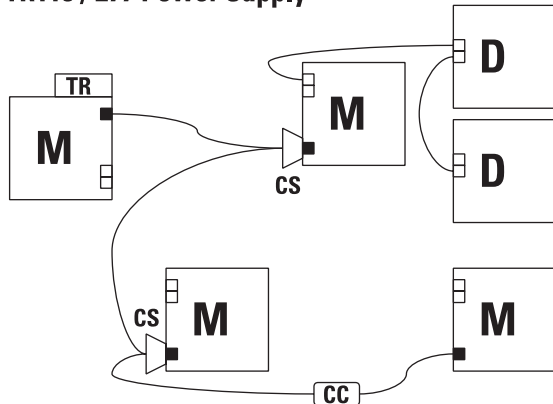
- Unit has two RJ12 Jacks to make daisy chain connections for 24 VAC and 2-10 VDC control signal from master unit.
- C35 (35' plenum rated cable) supplied with RJ12 modular plugs at both ends. Use cable to connect unit with Jack 3 (Fig. 3) on Prodigy Master (PPD1, PPD2 or PPD3) or previously connected PPDD using a free Drone output Drone Jack (Fig. 5). Multiple cables can be connected by using a CC (cable connector) for longer runs.
- A maximum of five PPDDs can be supported by one Prodigy Master (PPD1, PPD2 or PPD3).
- Each PPDD draws 3.0 VA.

Figure 4 - Layout Examples

PPM 115 / 277 Power Supply (One Output Jack)

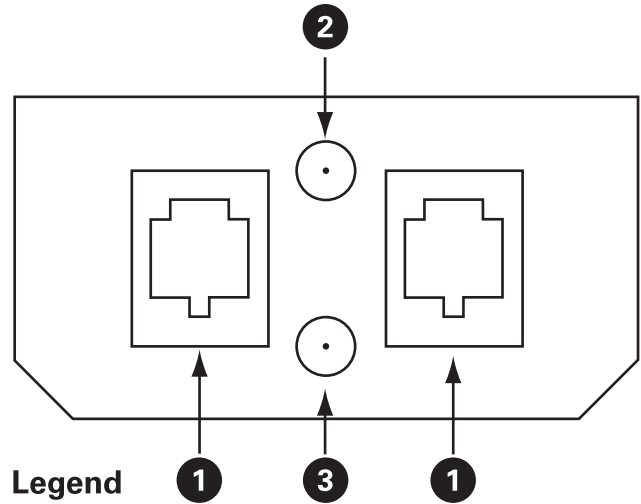


TR115 / 277 Power Supply



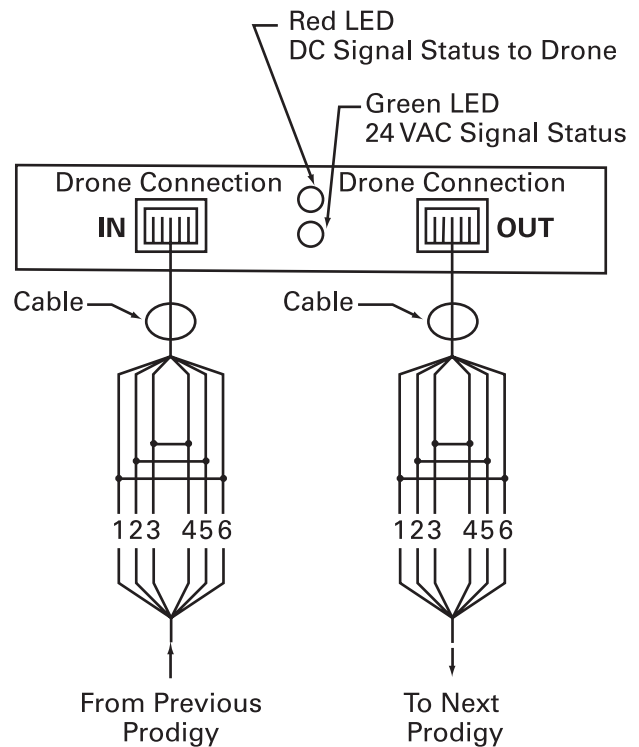
M = Master ■ Power Jack
D = Drone □ Drone Jack
 Use C35 Cables

Figure 5 - Drone Junction Panel



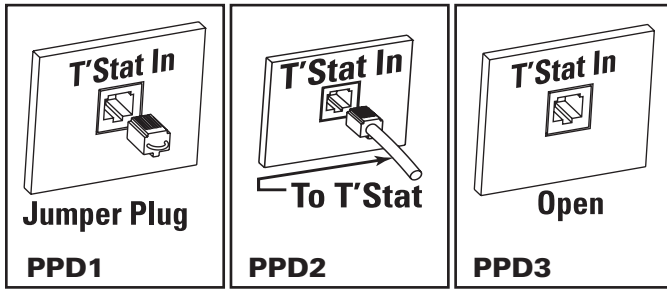
- Legend**
- ① Drone Input / Output
 - ② Red LED (2-10 VDC Drone Signal)
 - ③ Green LED (24 VAC Power)

Figure 6 - Drone Wiring Diagram



Internal Wiring 1 & 6 = 2 - 10 VDC
 2 & 5 = Common
 3 & 4 = 24 VAC

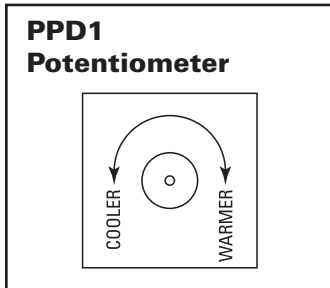
Model Configuration / Setpoint Adjustment



PPD1, VAV Cooling, CV (Full Flow) Heating - Setpoint is adjusted at potentiometer on top of diffuser. The potentiometer is activated by inserting a jumper plug into the **T'Stat In** jack (Figure 3). Units are shipped in midpoint position.

PPD2, VAV Cooling, VAV Heating - Connecting a wall mounted T'stat activates the PPD2 model. Connect the T'stat to Prodigy using a supplied C35 (35' plenum rated cable) by snapping one side of the plug into jack inside of thermostat, and the other side into the **T'Stat In** jack (Figure 3). Setpoint is adjusted using the wall mounted sensor.

PPD3, VAV Cooling, CV (Full Flow) Heating - An Open **T'stat In** jack on the Master Junction Board (Figure 3) activates the PPD3 model. Setpoint is adjusted using buttons on IR remote.



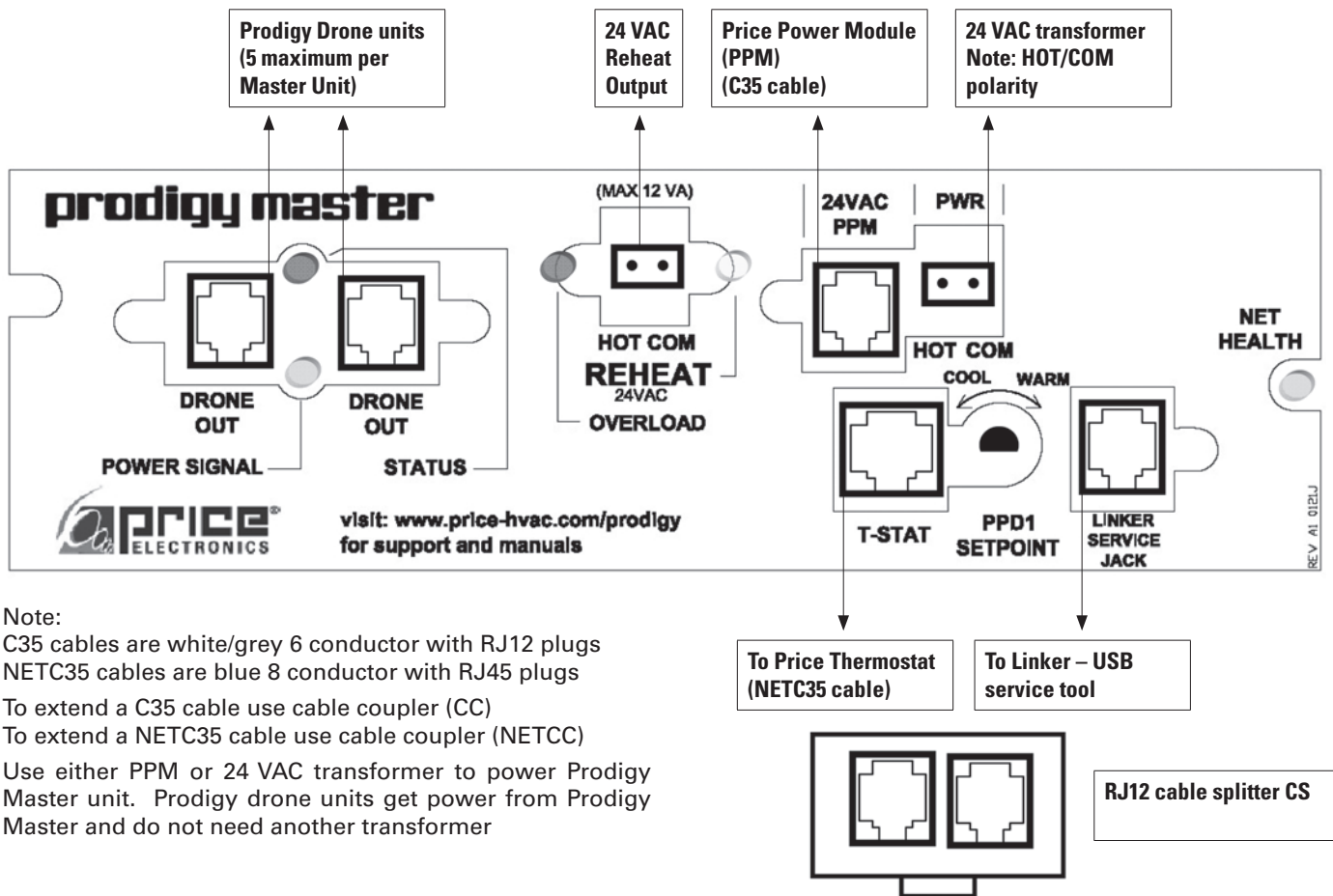
- **RESET** - Restores midpoint setting (Prodigy beeps/ flashes once).
- **WARMER** - Increases setpoint by approximately 1°F (0.5°C) (Prodigy beeps / flashes twice).
- **COOLER** - Decreases setpoint by approximately 1°F (0.5°C) (Prodigy beeps / flashes three times).



Auxiliary Heat

- All Prodigy Master control units (PPD1, PPD2 & PPD3) will provide a 24 VAC pulsed output signal for supplemental auxiliary heating. Two terminals are located on the junction board for this purpose (Figure 7). The signals can be wired to an intermediate relay to control a auxiliary heating system.
 - The internal reheat relay is limited to 12 VA and should not be used to directly drive valves or radiant panels. It is intended to switch power to the primary coil of an intermediate relay (see Figure 7).
 - Three options of reheat algorithms are available:
 - On/Off** - Acts more like a traditional thermostat and cycles least of all three options. Control is over a larger temperature band ($\pm 2^{\circ}\text{F}$). *Suitable for mechanical relay interface (Maximum 12 VA relay coil).*
 - PDM** (default, if not specified) (Pulse Delay Modulation) - Reheat relay is on for a minimum of 2 minutes when required. OFF Cycle is proportional to heating requirement. *Suitable for hydronic systems where entire system is flushed with hot water during each heating charge to ensure uniform heating. Electronic Solid State Relay interface recommended, but not required.*
 - PWM** (Pulse Width Modulation) - Reheat relay is on for a percentage of the duty cycle, proportionate to calculated heating load. *Suitable for radiant panels and other electric heaters. Electronic Solid State Relay interface absolutely required - rapid pulse, 2 second cycle.*
- Note:** Auxiliary heat option can be reconfigured in the field if necessary using LCD thermostat (SERVICE MENU).

Figure 7 - Master Wiring Diagram



PRICE Power Module - Optional Accessory

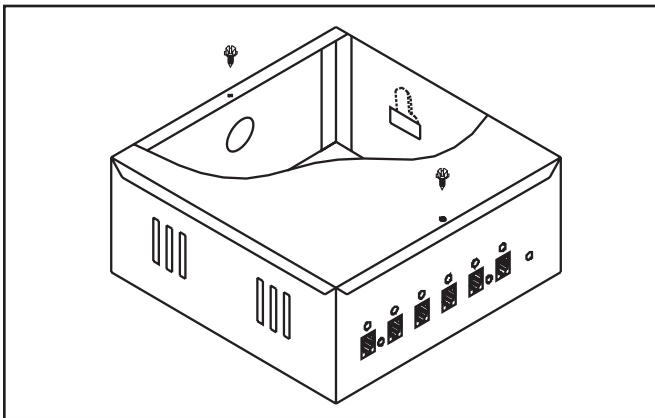
The Prodigy® Power Module (PPM) supports up to fifteen (15) Prodigy master units and associated drone units. It provides the most economical and convenient method of powering multiple Prodigy diffusers because electrician time is minimized. Designed to be ceiling mounted during any phase of a project, the enclosed 96 VA Class 2 transformer is offered for 120V, 240V, 277V and 480V primary voltage supply. Final power connections to the Prodigy diffusers are completed via plenum cables with RJ (Snap-In) plugs. Since the cables are all low voltage, commissioning or relocation of Prodigy diffusers is simple.

Features

- 96 VA Class 2 Transformer (120 / 240/277/480 to 24 VAC) with breaker resettable overload protection.
- 6 parallel power jacks each of which support up to 6 Prodigy units (or PIC controllers) - any combination of masters and associated drones. Overload indicator LEDs on each line light up if too many Prodigy's (or PIC's) are connected or if there is a short in the cable.
- Max 15 Prodigy or PIC controllers per PPM
- C35 (35' plenum rated cable) with RJ plugs provides flexible and convenient power connection. One required for each master unit (order separately). Multiple cables can be connected by using a CC (Cable Connector) for longer runs.
- Power switch with indicator LED.

Installation of the PRICE Power Module (PPM)

1. Turn off power switch. Remove cover.
2. Secure box to surface in plenum using 3 mounting holes. Orientation irrelevant.
3. Supply power and ground to terminal per wiring diagram.
4. Replace cover.
5. Turn on power switch. Green LED indicates power.

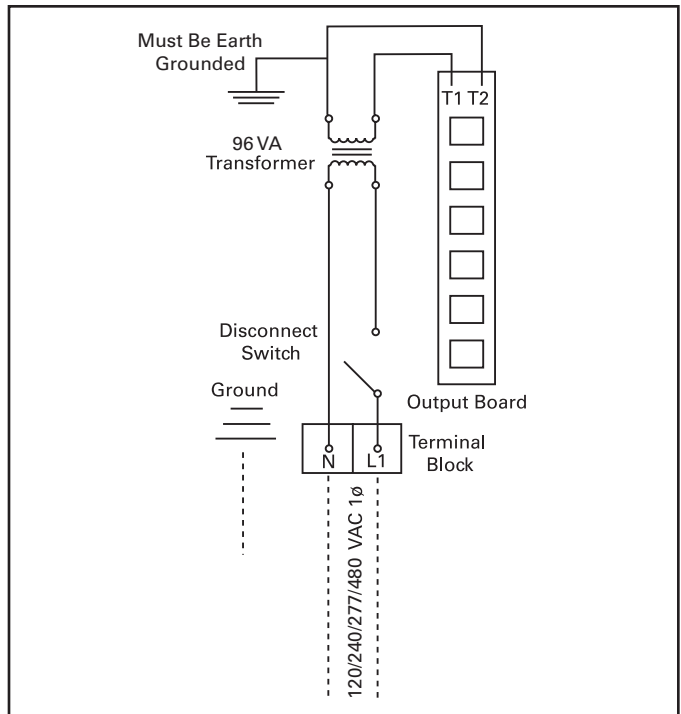


Connecting a Prodigy Master to the PPM

1. Plug C35 power cable into an output jack on power module.
2. Plug other end of cable into power input jack of Prodigy Master Junction Panel. (Multiple C35 cables can be connected with CC - Cable Connectors for longer runs.) (Max two 35ft cables)
3. Green Power LED and Red Drone Signal LED on Prodigy Master indicate proper connection.
4. An additional Master unit may be supported from second side of an optional CS (cable splitter jack) inserted into the Prodigy Master power input jack. (see example layout on page 6.)

Specification and Limitations

1. Total connected load not to exceed 96 VA (or 15 devices)
 - Each Prodigy unit (Master or Drone) draws 3.0 VA.
 - Mechanical heat relays can draw up to 12 VA.
2. Specification for each of the 6 output jacks:
 - 20 VA auto-reset thermal fuse with fault indicator LED.
 - Supports up to 4 Prodigy diffusers up to a maximum distance of 140' from the PPM
 - Supports only one mechanical relay (12 VA max.) for aux. heat output up to a maximum distance of 35'. (No limitation applies to electronic solid state.)



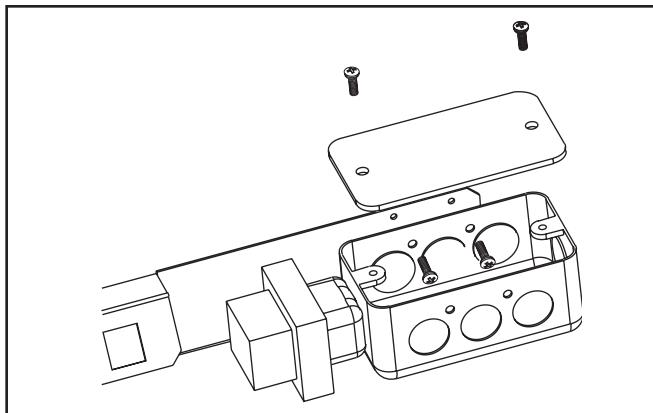
TR115 / TR277 Transformer - Optional Accessory

Optional 20 VA transformer mounts to the junction bracket of Prodigy Diffuser. Support up to 6 Prodigy units - any combination of masters and associated drones.

Installation Instructions

1. Remove lid from junction box.
2. Fasten to Prodigy junction bracket using two #8 screws provided.
3. Connect primary power supply and grounding.
4. Replace cover.
5. Connect secondary transformer leads to power jack of Prodigy (TP - Terminal Plug provided).

Additional masters units may be powered using C35 cables and CS (cable splitters) to daisy-chain power jacks (see example layouts on page 3).

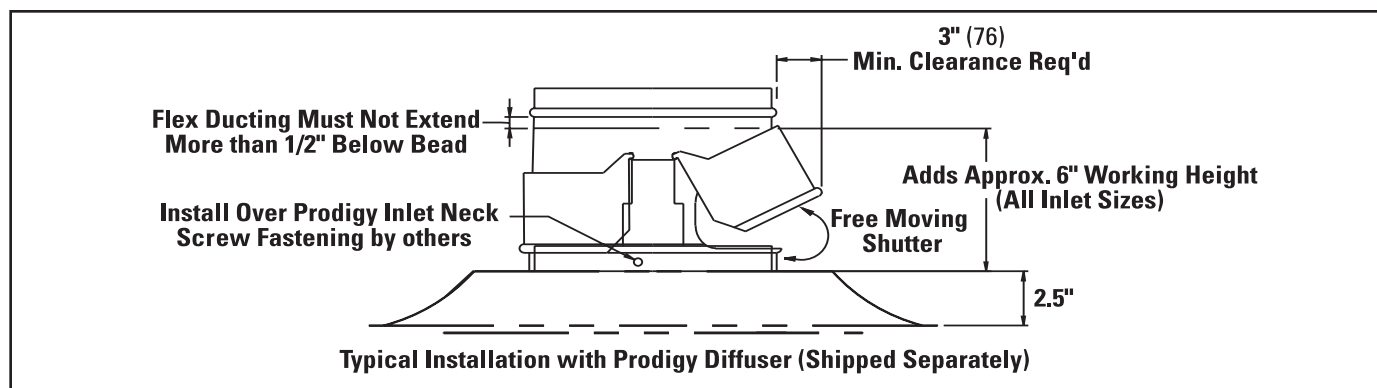
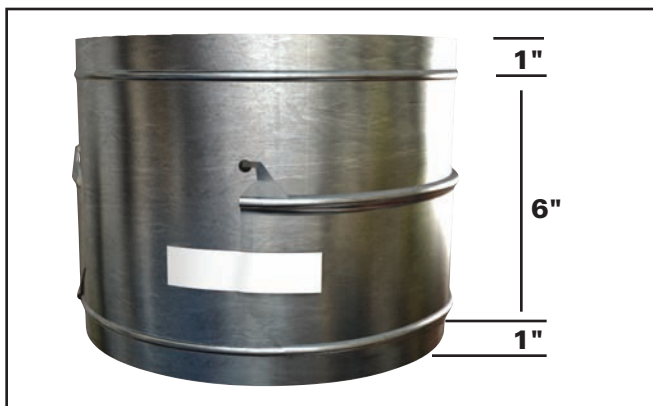


Prodigy Pressure Relief Collar - Optional Accessory

The Prodigy® Pressure Relief Collar (PRC) slips over the Prodigy inlet to provide a simple and inexpensive method to control duct static pressure. The PRC's dual shutters are designed to gradually open in response to pressure in excess of approximately 0.25" w.g. and allow some of the supply air to escape into the return air plenum.

Installation Instructions

1. **The PRC is intended for use only in systems that have a non-ducted return air plenum.**
2. Mount PRC directly over Prodigy inlet, with shutters hanging down. Two mounting holes are provided for fastening with #8 sheet metal screws.
3. Mount ducting to top of PRC. A bead is provided on the top of the PRC as a stop for hard ducting. Flex duct may be banded below the bead providing it does not extend more than 1/2" below the stop bead as it will obstruct the proper operation of the shutters.
4. The PRC is shipped with shutters taped shut. DO NOT REMOVE the tape until the system is completely balanced. This will ensure that the balancer can provide maximum design cfm without excess air being relieved into the plenum. Premature removal of the tape may impair proper air system balancing.



Optional Baffle

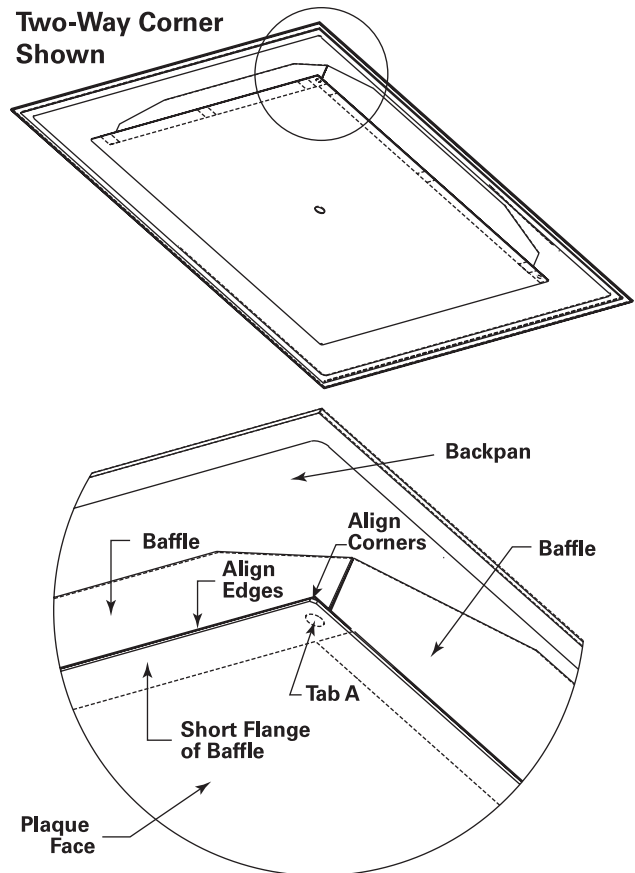
An optional baffle is available to provide 3-way and 2-way air patterns.

Installation

CAUTION: Adhesive tape bonds quickly. Price recommends a practice installation to locate the baffle BEFORE removing the tape pads.

1. Clean backside edge of plaque where baffle is to be installed.
2. With short flange of baffle facing away from opening, tilt top edge of baffle into opening on side of diffuser to be blocked. Short flange on baffle must face out.
3. Carefully align outer corner of reference tab A with corner of plaque.
4. Remove protective film from 3 tape pads.
5. Rotate bottom edge of baffle into opening until edge of flange is flush with edge of plaque.
6. Apply firm pressure at three tape tabs to secure baffle in place.

Additional openings can be blocked for 2-way air patterns using the same procedure.



Supply Air Temperature Sensing

All master units (PPD1, PPD2, and PPD3) have a temperature sensor located near the motor for automatic heating / cooling changeover.

For automatic changeover the Prodigy uses a dynamic neutral mode for optimal use of the supply air. Basically if the supply air can help the Prodigy meet the room set point it is used as such. For example if the supply air is 70F and the room temperature is 80F with a set point of 72F, the Prodigy will consider the supply air as cold and modulate appropriately. Please note however its typically difficult to cool a room with supply air temperatures above 60F.


If Dynamic neutral mode is not required user can force HOT and COLD switch points in the LCD thermostat menu. This method is not recommended, but is available for unique circumstances.

1. **Heating Mode** - Supply air temperature warmer than room temperature by 2°F (1°C)
2. **Neutral Mode** - Supply air within 2°F (1°C) of room air
3. **Cooling Mode** - Supply air temperature 2°F (1°C) below room temperature)

Damper regulation is as follows based on model, supply air temperature and demand.

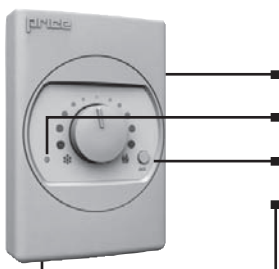
Prodigy (PPD2) Thermostat Options

All thermostats are connected with a CAT-5 cable (RJ-45) connection from the Prodigy to the back of the selected thermostat. Each thermostat has an RJ-12 Service Port on the bottom, providing a computer interface using the USB LINKER service tool for setup and balancing, and without having to access the plenum.



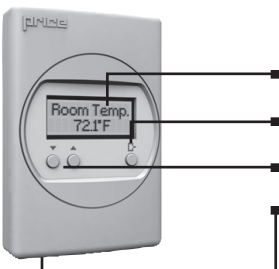
Room Sensor Thermostat: PIC-TS-SENS

- Set point adjust from hidden dial on the back
- Service Port - Linker Connection



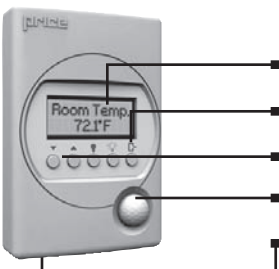
Dial Thermostat: PIC-TS-DIAL

- Dial Adjustment for Temperature
- LED – 1 blink cooling mode, 2 – heating, 3 - neutral
- Occupancy Override Button
- Service Port - Linker Connection



LCD Thermostat: PIC-TS-LCD

- LCD screen for menu display
- Menu Button
- Increase and decrease push buttons for day temperature setpoint adjustment
- Service Port - Linker Connection



LCD Thermostat w/ Motion Sensor: PIC-TS-MOTION

- LCD screen for menu display
- Menu Button
- Increase and decrease push buttons for day temperature setpoint adjustment
- Motion sensor allows for automatic detection of occupancy
- Service Port – Linker connection

Thermostat Installation

General Description

The Prodigy thermostats are all physically the same size and mounting instructions will be typical.

Location

1. Thermostats must be mounted to a wall and wired to the controller via the supplied plenum rated 35ft CAT-5 cable. This cable plugs into the thermostat and the Prodigy with the ease of RJ-45 connections. Note: the cable run can be extended to 70 ft using a Price cable coupler and additional 35ft cable.

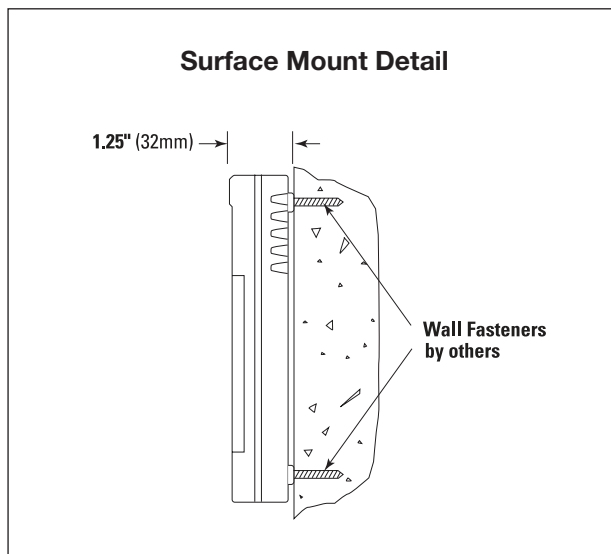
2. Mount the required thermostat in a place that is convenient for the end user, but the following should be taken into consideration:

- Do not mount a thermostat in direct sunlight i.e. across from a window where heat can alter the temperature reading.
- Should not be installed on an outside wall.
- Keep away from hot equipment like computers, monitors and heaters etc.
- Ensure nothing will restrict vertical air circulation to the thermostat. (Do Not Cover)
- Ensure wall is NOT pressurized! Hot/cold air from a pressurized wall will direct blow onto the thermostat's temperature sensor causing 'bad' readings.



Installation

1. The back plate on each thermostat is removable and can be mounted to a standard electrical box or directly to drywall using anchors supplied by others.
2. Run the CAT-5 cable through the center hole in the plate. Connect the cable to the thermostat, then secure the thermostat onto the wall plate inserting top portion of the thermostat first, then snapping the bottom half in.
3. All thermostats will come equipped with a 0.050" Allen key for the set screw at the bottom.



(PIC-CABLE) - 35 foot plenum rated cable included with thermostat.



TECH TIP: Careful thermostat installation will reduce field issues! **Do not twist or kink the blue CAT5 thermostat cable.** Damaged cables are difficult to troubleshoot!

Thermostat cable product code: **PIC-CABLE**

Thermostat Operations



How to use the Room Sensor Thermostat

- The Room Sensor Thermostat is powered from the controller.
- Measures room temperature.
- Set point can be adjusted from a hidden dial on the back of the T-Stat using a small flat-head screw driver.
- Setpoint limits can be adjusted through free setup software using the Price LINKER, or through a BACnet system.
- Eliminated problem of unauthorized tampering to the thermostat.



How to use the Dial Thermostat

- The Dial Thermostat is powered from the controller.
- Measures room temperature & features a dial adjustment & an occupancy button.
- Temperature Setpoint limits can be adjusted through free setup software using the Price LINKER, or through a BACnet system.
- Simply use the adjustable dial for temperature adjustment.



How to use the LCD Thermostat

- The LCD Thermostat is powered from the controller and has a variety of features.
- Measures room temperature and features an LCD screen with push button day setpoint adjustment.
- Temperature set point limits are set through free setup software using the Price LINKER, or through a BACnet system.
- LCD Thermostat can also be used as a balancing tool for the Price Intelligent Controller system by simply connecting the RJ-45 cable to the back of the thermostat.



How to use the LCD Thermostat with Motion Sensor

- The LCD Thermostat with Motion Sensor is powered from the controller and has a variety of features as well.
- This model measures room temperature, features an LCD screen with day Setpoint adjustment, and motion sensor with lighting control.
- Temperature set point limits are set through free setup software using the Price LINKER, or through a BACnet system.
- The LCD Thermostat with Motion Sensor can be used as a balancing tool for the Price Intelligent Controller system by simply connecting the RJ-45 cable to the back of the thermostat.
- This thermostat can also be used as a motion sensor for occupied and unoccupied times in a space. It also has the capability to act as a lighting controller for occupied/unoccupied schedules.

Initial Startup – LCD Thermostat Only

When the LCD thermostat is powered from the Prodigy, it will display the following information:

Price Electronics	Start up screen
LCD Thermostat Standard Model	Displays firmware version of thermostat
LCD Thermostat Version X.XX	
Loading xx%	Loading parameters
PPDX Version X.XX	PPD1, PPD2, PPD3
Sequence xxxx	Displays sequence programmed into stat
Inlet Size XX Inches	Displays inlet size
MAC Address XXX	Displays current MAC Address
Device Inst. XXXXXXXX	Displays current Device Instance
Room Temp. 75.0°F	(For Example)

Day Setpoint Adjustment

Increase and decrease push buttons for Day set point adjustment



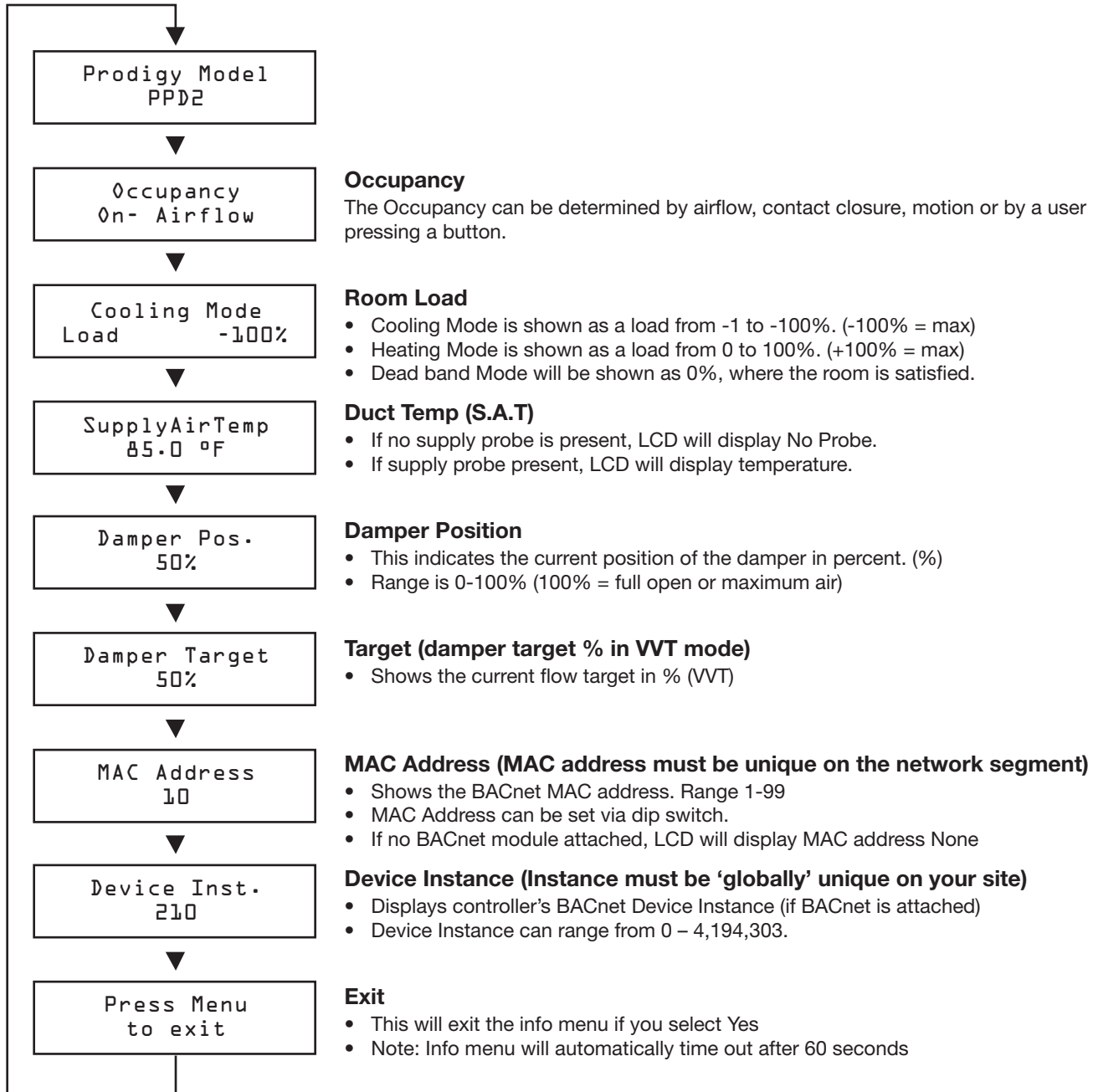
Day Setpoint
75.0° F

Day Setpoint
Saving...

Info Menu – LCD Stat Only

The info menu shows information about the controller status regarding room load, damper position and BACnet address info. No values can be changed from this menu and it is not locked or protected in any way.

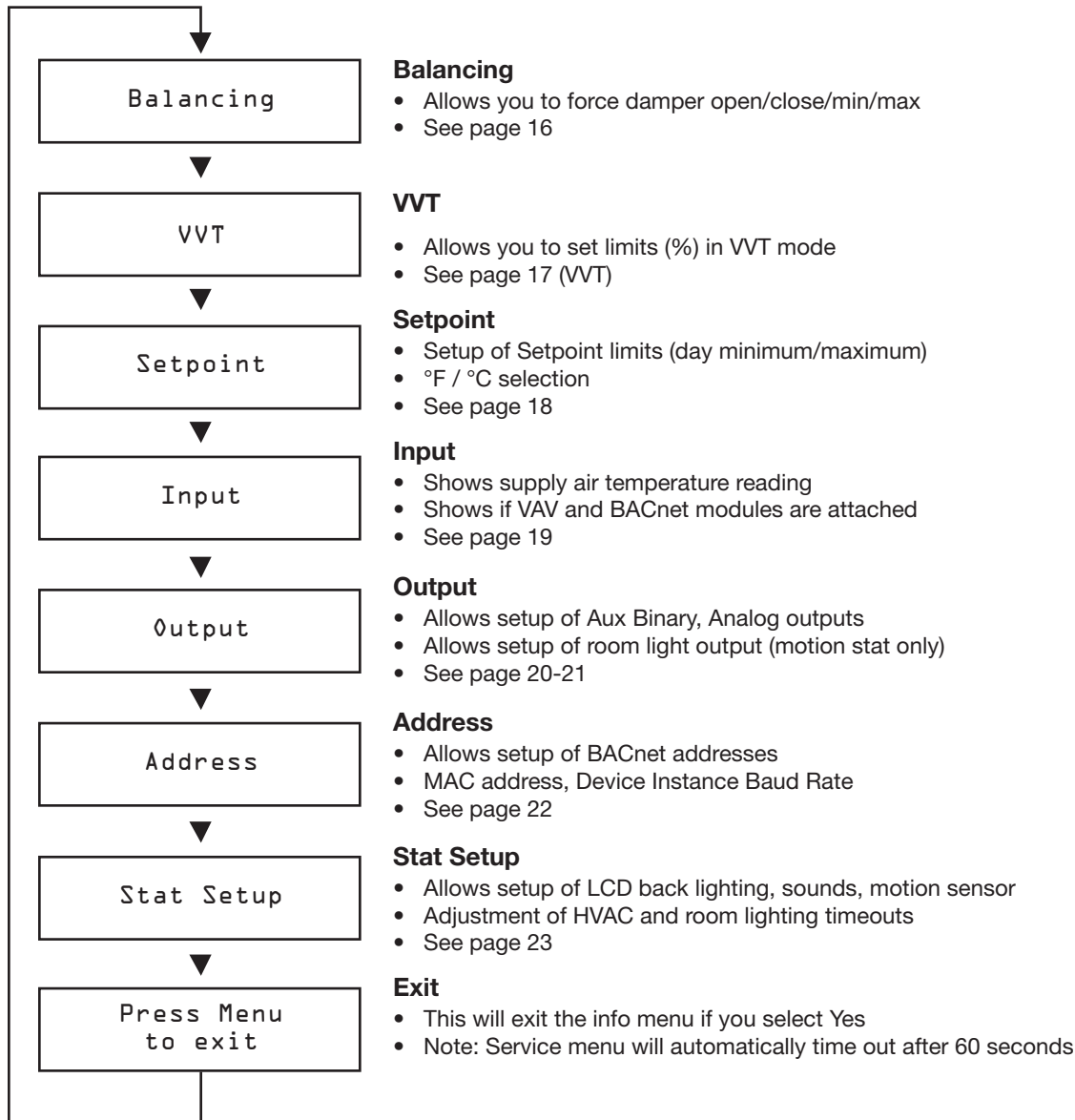
- The User Menu is accessed by hitting the Menu button (⏏)
- Scroll through with the UP (▲) and DOWN (▼) buttons



Service Menu – LCD Stat Only

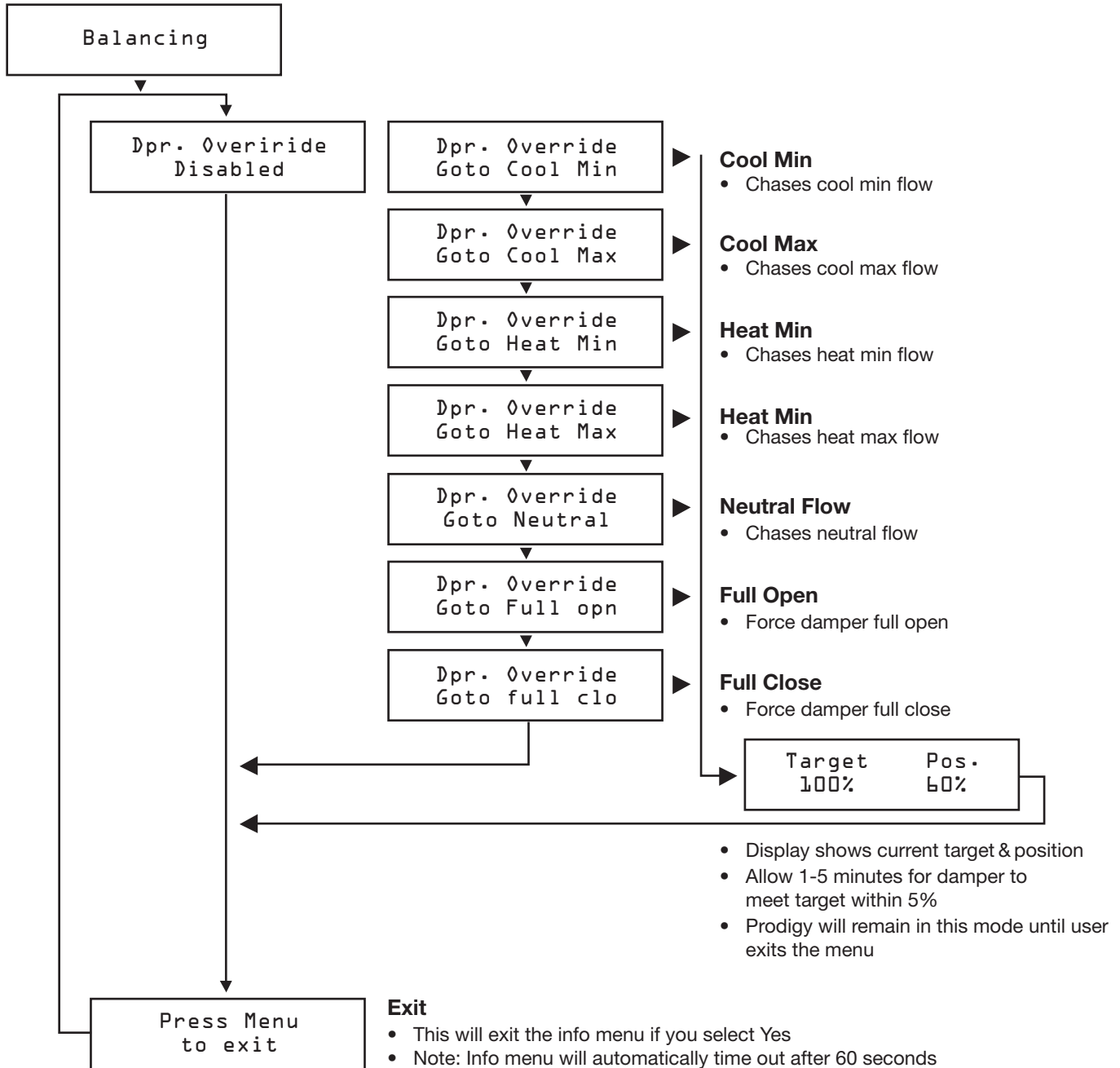
The service menu allows the balancer/installer to access to the controller setup to change settings. For example setting flows, heating outputs, etc.

- Hold down the Menu button for 5 seconds (Ⓜ)
- Display shows
- Use the up and down buttons to enter the password in this sequence:



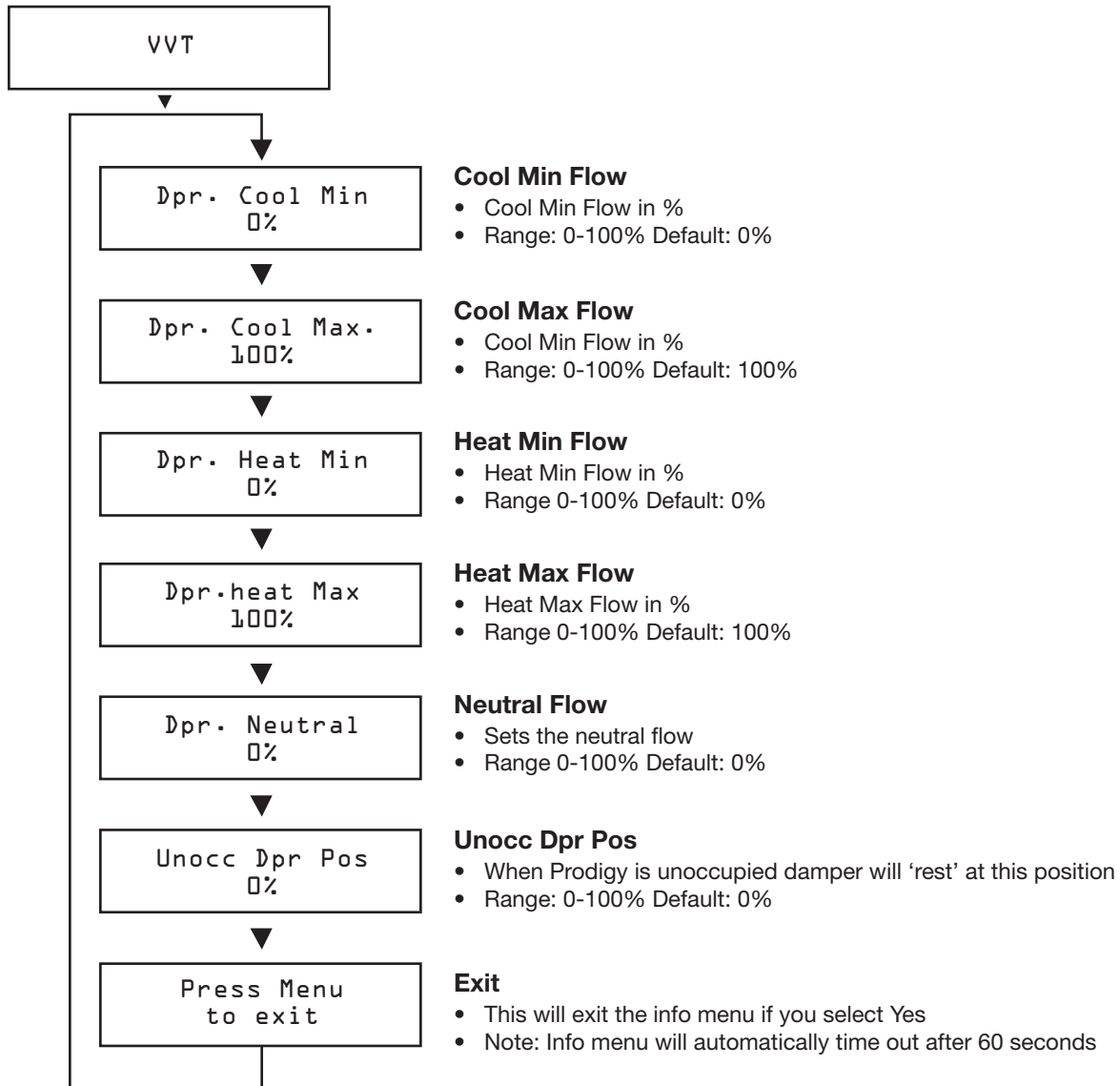
Balancing Menu

- Scroll through with the UP ▲ and DOWN ▼ buttons
- Press Enter to apply your changes (↵)
- *---wait---* will display as your changes are applied



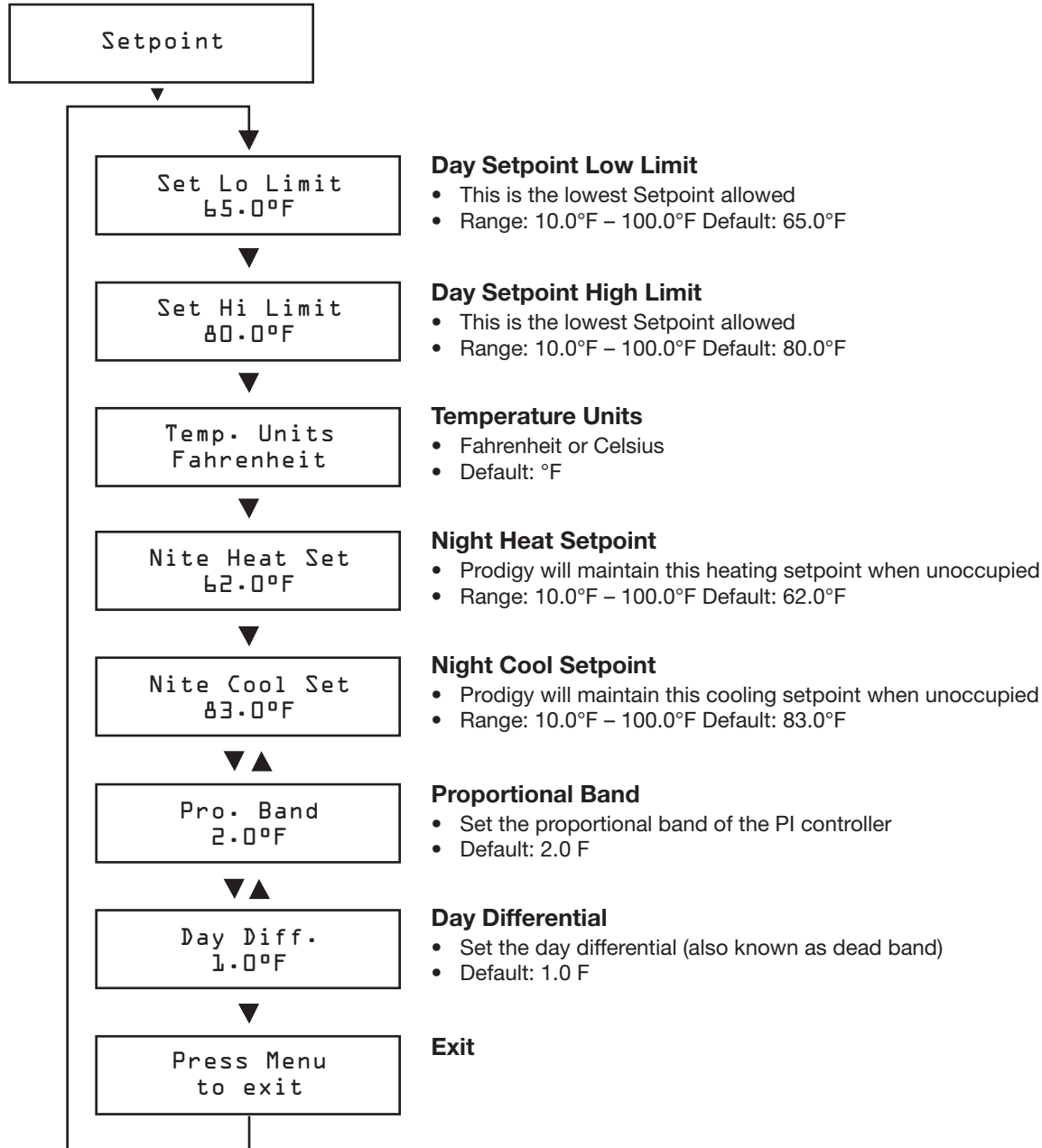
VVT Menu - Pressure Dependent Mode

- Scroll through with the UP ▲ and DOWN ▼ buttons
- Press Enter to apply your changes (⏏)
- *---wait---* will display as your changes are applied



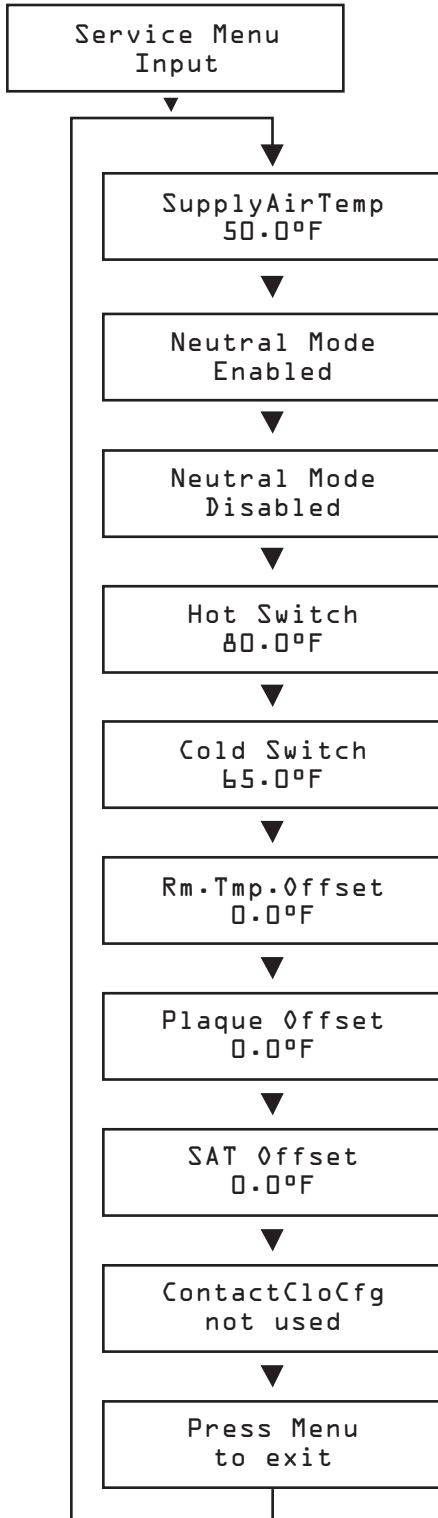
Setpoint Menu - Setpoint Limits and Temperature Units

- Scroll through with the UP (▲) and DOWN (▼) buttons
- Press Enter to apply your changes (↵)
- *---Saving...---* will display as your changes are applied



Input Menu - Supply Air Temp and Neutral Mode

- Scroll through with the UP ▲ and DOWN ▼ buttons
- Press Enter to apply your changes (↵)
- *---Saving...---* will display as your changes are applied



Supply Air Temperature (S.A.T.) readout

- Shows current SAT reading
- Range: -59.0°F – 300.0°F
- No probe, means no sensor is connected

Neutral Mode = enabled

- Uses hot/cold switch points which are hard set
- Not recommended

Neutral Mode = disabled

- When supply air temp (SAT) is below room temp it is considered cooling
- When supply air temp (SAT) is above room temp it is considered heating
- This mode is recommended because PIC will always use the supply air if it can help satisfy the room load

Hot Switch – Only active/visible when Neutral mode = enabled

- Prodigy will consider the supply air warm if at the hot switch temp or above
- Default: 0.0°F – uses dynamic neutral mode (neutral mode disabled)
- * Will not display if neutral mode disabled

Cold Switch – Only active/visible when Neutral mode = enabled

- Prodigy will consider the supply air cold if at the cold switch temp or below
- Default: 0.0°F – uses dynamic neutral mode (neutral mode disabled)
- * Will not display if neutral mode disabled

Room Temperature Offset

- Offsets the room temperature sensor
- Default: 0.0°F

Plaque Temperature Offset

- Offsets the plaque temperature sensor
- Default: 0.0 F

Supply Air Temperature Offset

- Offsets the supply temperature sensor
- Default: 0.0 F

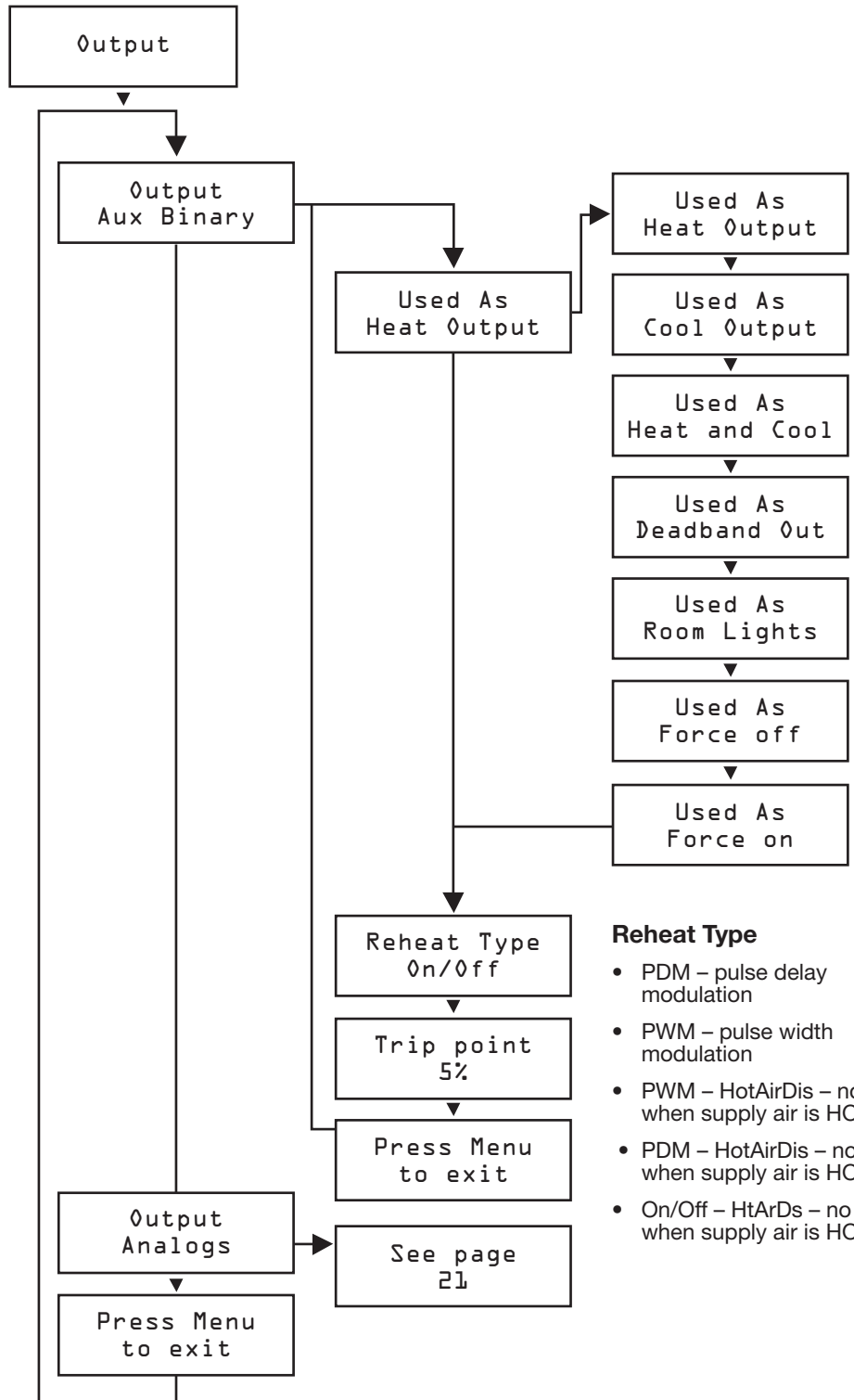
Contact closure config options

- Not Used unocc on clo.
- unocc on clo.
- dpr full opn.
- dpr full clo.

Exit

Output Menu (Aux Binary) - Setup of Auxiliary Binary output

- Scroll through with the UP (▲) and DOWN (▼) buttons
- Press Enter to apply your changes (↵)
- *---Saving...---* will display as your changes are applied



Aux Binary Used As:

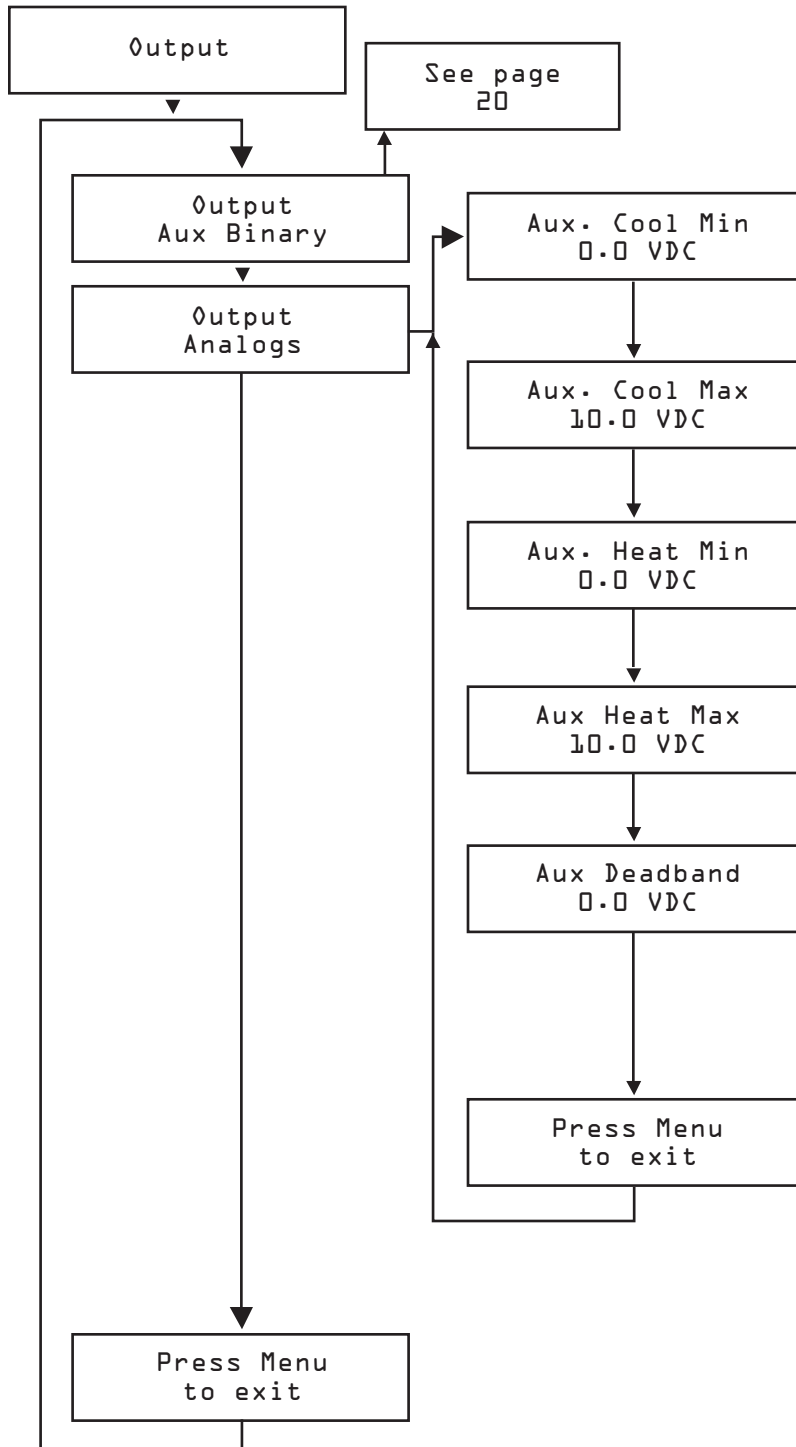
- Heat Output (Default)
 - o Output energized when the room demand is heating and the heat load is at or above trip point (below)
- Cool Output
 - o Output energized when the room demand is cooling and the cool load is at or above trip point.
- Heat and Cool
 - o Output energized when the room demand is heating or cooling and load is above trip point.
- Deadband Output
 - o Output energized with room is satisfied.
- Room Lights
 - o When using Motion T-Stat, output controls room lights.
- Force On
 - o Output energized at all times.
- Force Off
 - o Output de-energized at all times.

Reheat Type

- PDM – pulse delay modulation
- PWM – pulse width modulation
- PWM – HotAirDis – no heat when supply air is HOT
- PDM – HotAirDis – no heat when supply air is HOT
- On/Off – HtArDs – no heat when supply air is HOT

Output Menu (Analog Outputs) - Setup of Analog Outputs

- Scroll through with the UP ▲ and DOWN ▼ buttons
- Press Enter to apply your changes (Ⓜ)
- *---wait---* will display as your changes are applied



Auxiliary Cool Min Voltage

- Outputs this voltage on Auxiliary Analog pin when there is a minimum call for cooling
- Default: 0.0 VDC

Auxiliary Cool Max Voltage

- Outputs this voltage on Auxiliary Analog pin when there is a maximum call for cooling
- Default: 10.0 VDC

Auxiliary Heat min Voltage

- Outputs this voltage on Auxiliary Analog pin when there is a minimum call for heating
- Default: 0.0 VDC

Auxiliary Heat Max Voltage

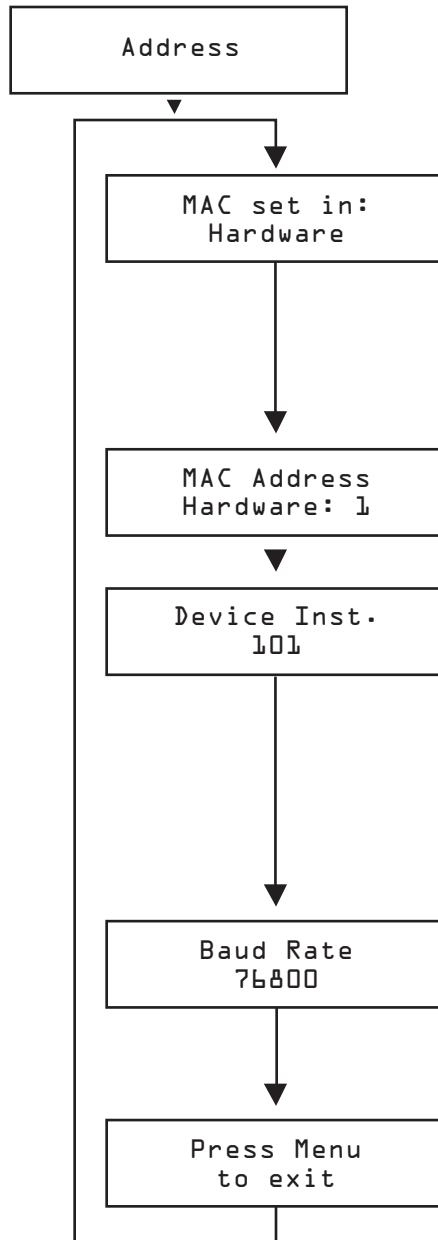
- Outputs this voltage on Auxiliary Analog pin when there is a maximum call for heating
- Default: 10.0 VDC

Auxiliary Idle Voltage

- Outputs this voltage on Auxiliary Analog pin when there is no call for heating or cooling (deadband)
- Default: 0.0 VDC

Address Menu - BACnet Addressing Setup

- Scroll through with the UP ▲ and DOWN ▼ buttons
- Press Enter to apply your changes (↵)
- *---wait---* will display as your changes are applied



MAC address

- Hardware – uses DIP switch on BACnet module for MAC address – default - recommended
- Software – uses STAT to set MAC address – this OVERRIDES the hardware switches and could be confusing if you’re not careful
- Note: the MAC address (range 1-99) is added to the device instance
- Example: MAC address = 1, Device instance = 100 – total address for this Prodigy would be 101.

Mac address

- Display current MAC address
- Note: DIP switches and software MAC address are only read on startup! See Device Instance below.

Device Instance

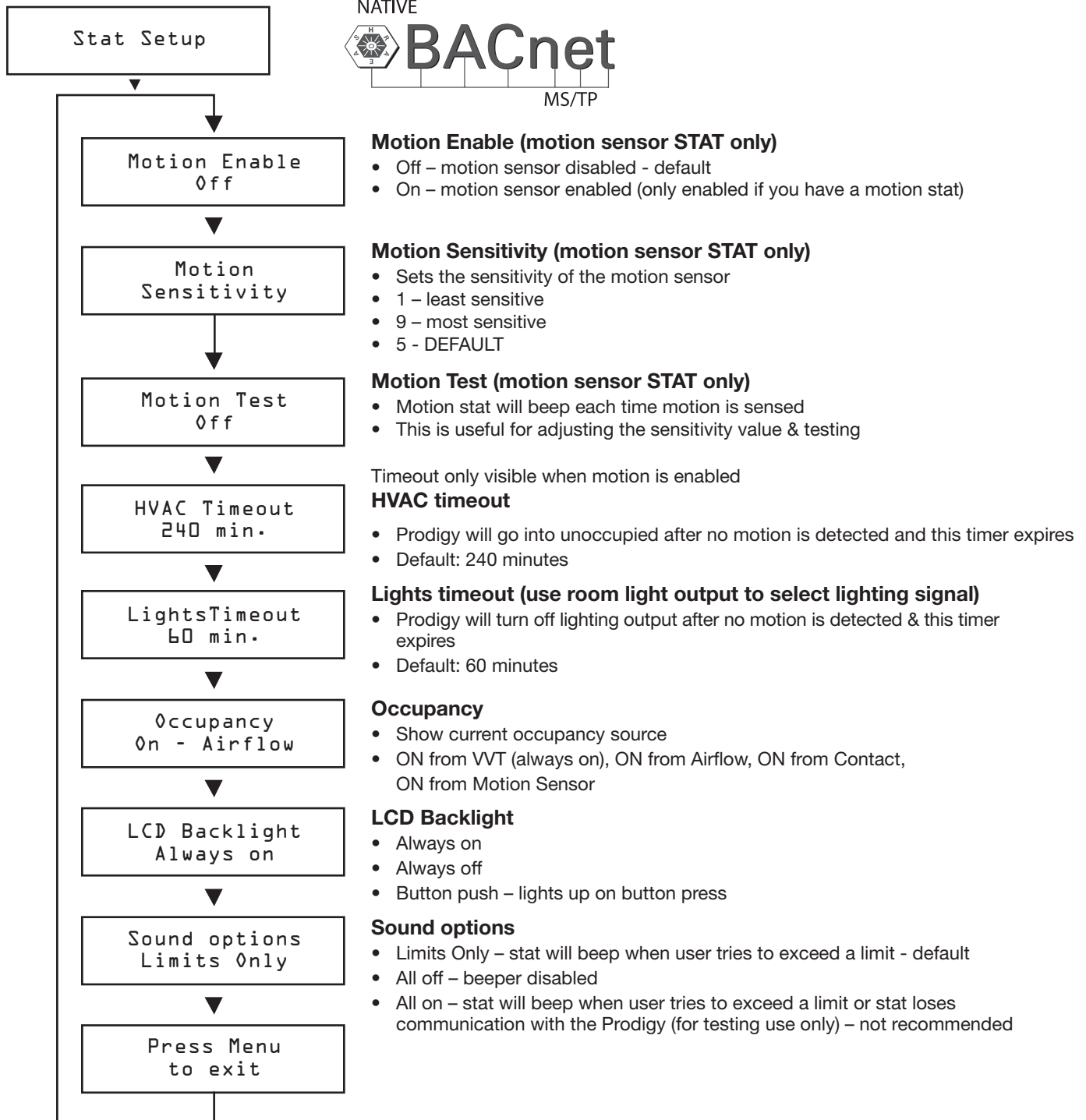
- This is the ‘software’ BACnet address & MUST be unique on your building site.
- Range: 1 – 4,194,303
- Note: After changing device instance the STAT will send a RESET command to the Prodigy to apply the ADDRESS changes. Addresses are only READ on startup, so after any changes you must reset the controller either via STAT (which is automatic) or cycle 24 VACpower.
- Note: Addresses are only read on startup to prevent a controller with faulty damaged/improperly set DIP switches from popping up all over a network, which would be extremely difficult to troubleshoot

Baud Rate

- This sets the BACnet MS/TP baud rate
- 9600 baud (all BACnet devices must at least support at least this speed) - slowest
- 19200 baud
- 38400 baud
- 76800 baud (default baud rate for PRICE products) - fastest

Setup Menu - Options

- Scroll through with the UP ▲ and DOWN ▼ buttons
- Press Enter to apply your changes (⏎)
- *---Saving...---* will display as your changes are applied



Networking

Networking

Networking allows building systems, including the HVAC system to share information with each other such as set points, room temperatures, room loads and much more. This HVAC devices to work together as a system resulting in:

- Increased energy efficiency
 - o Using schedules (Day/Night/Weekend)
 - o Monitoring room load data
 - o Shutting down unoccupied zones
- Control and monitoring of several devices from a single workstation (typically a personal computer or laptop)
- Easier troubleshooting

Networking with BACnet

Using the ASHRAE network standard BACnet allows the Prodigy® to communicate with other BACnet devices. This allows interoperability between different devices even if they are made by different manufacturers. For more information on networking and different communication protocols please see the Price catalog.

Once the Prodigy® diffusers are networked, a software package (typically with graphics) can be used to show any device connected to the network. This allows for accurate information that is both current and accurate to be accessed by the user.

Also, once networked, it is possible to setup scheduling to shut down certain zones during the day or at night based on occupancy.

MS/TP Network

The Prodigy® uses the BACnet network type MS/TP (Master Slave Token Passing) which uses 2 wires in a daisy chain configuration. This network type is based RS-485 physical layer and is very robust in industrial environments while being economical enough to be implemented on each device.

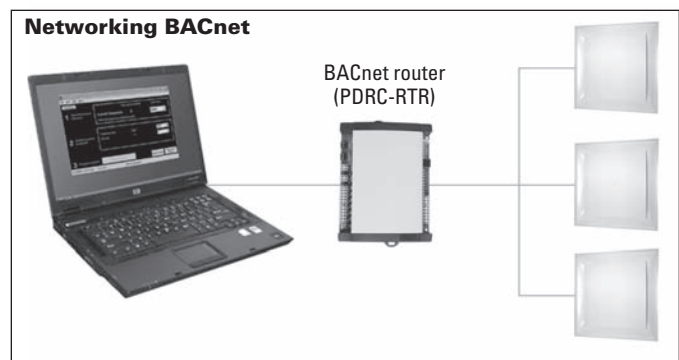
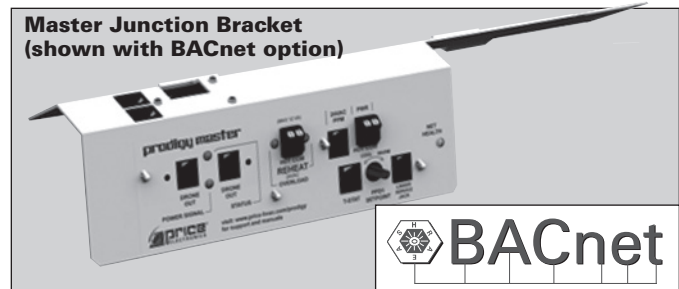
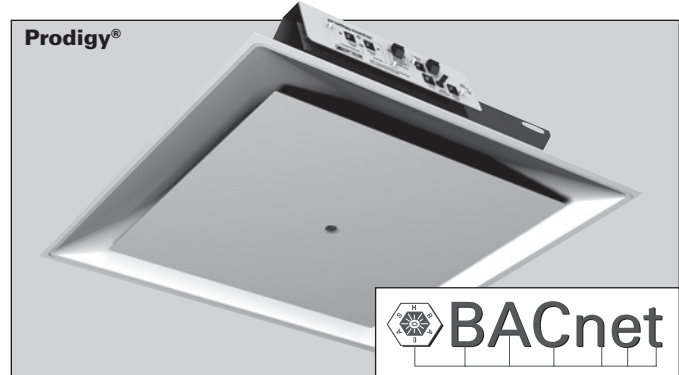
The network connection between Prodigy® (with BACnet option) diffusers is done with the included plenum rated network cable. No tools needed!

Connecting the Prodigy® diffusers with the BACnet interface option is very simple and efficient. Dual RJ-45 jacks on each diffuser allow daisy chaining each device without splitters or any tools. Included with each Prodigy diffuser is a 35 foot plenum rated network cable to simplify installation in the field.

Local addresses can be set at each Prodigy® diffuser using the on-board DIP switches. The media access control (MAC) address range is 1-99. Each device on the network segment must have a unique address, otherwise communication errors will occur.

To show proper data exchange TX (transmit) and RX (receive) LEDs indicate when data is being sent and received. This provides a visual check of how the network is performing. For example if the RX LED is not blinking this could indicate a cable is unplugged at the other end.

Standard baud rates for the BACnet MS/TP network are 9600, 19200, 38400 and 76800. All devices on the network segment must be set to communicate at the same speed. Otherwise communication errors will occur.



Prodigy® Control Variables

There are several control variables that can be monitored and/or adjusted via the network. These include, but are not limited to:

- Room Temperature
- Room Set point
- Supply Air Temperature
- Supply Air Temperature switch over points (hot/cold/neutral temperatures)
- Inlet Size
- Reheat Type
- Damper Position
- Damper Target
- Model Type (PPD1, PPD2, PPD3)
- Ping (Sounds the Prodigy beeper helping you locate the unit)
- Day/Night Mode
- Cooling/Heating Load (100% auto + 100%)

These variables allow the user to determine the current status of a zone. This information can also be relayed to a main controller allowing it to calculate the total heating or cooling loads.

BACnet Network Option

The BACnet interface option allows the Prodigy Master units to connect to a MS/TP network (sometimes referred to as RS-485). Using the ASHRAE standard BACnet allows interoperability between a new or existing building automation system (BAS). A standard communication protocol such as BACnet will ensure future updates and expansions can be done with minimal problems.

A proprietary system would only allow products to be networked if they are all from the same company. This can cause problems if that one company cannot provide all the products and solutions needed for a job.

Information Sharing

The BACnet interface allows the Prodigy Master units to share information with the building automation system. This allows for more intelligent control of the entire building automation system. The values that can be shared are room temperature, room set point, room load and many more. The values are passed through the MS/TP network as analog variables.



Connection

To allow fast and easy field connection the network uses standard RJ-45 jacks. No tools are needed to hook up the network connection; it is as easy as plugging in a laptop computer.

Also included with each Prodigy Master Unit is a 35 foot plenum rated cable. This reduces field installation costs greatly since cables do not need to be sourced and assembled on site.

Addressing

Addresses are set at the Prodigy Master junction bracket using field adjustable DIP switches. Status LED's show network receive and transmit activity to aid in troubleshooting.

MS/TP Network Termination

Each Prodigy Master has a terminator built in and it can be enabled by clicking a DIP switch. This saves wiring cost and reduces complexity in the field.

If termination is used on an MS/TP network, it can only be enabled twice on a segment. Once at the start and once at the end. Multiple termination points throughout the network will cause communication errors.

The Prodigy Series is constantly evolving to include new features. Please contact Price for more information or visit www.price-hvac.com/prodigy.

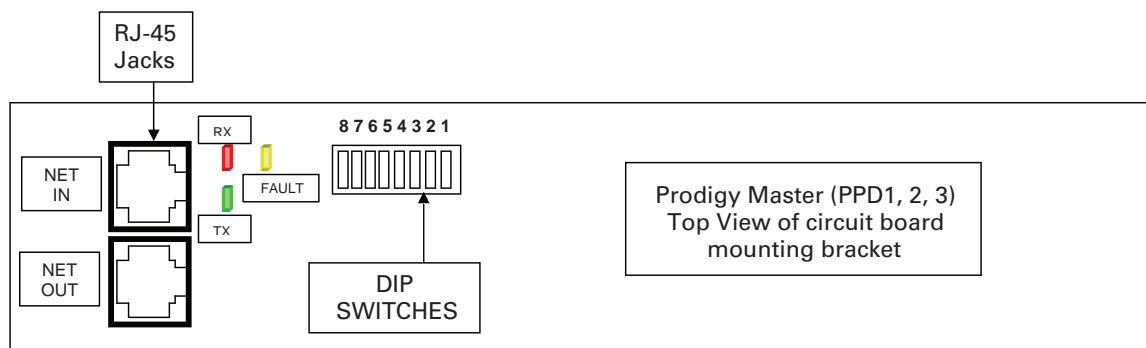
Prodigy BACnet Option

Prodigy PPD1, 2 & 3 units with BACnet option allow integration into a Building Automation System. The Prodigy supports the BACnet server protocol on a MS/TP (master slave token passing) network. A complete BACnet points list can be found at the end of this manual.

Before adding to or creating a BACnet network some items must be considered:

1. Network type
 2. Network speed
 3. Number of devices
 4. Addressing scheme
 5. Working with existing devices/networks
 6. Terminating
 7. Wire type
1. Network Type –The network type using BACnet on lower level devices is typically MS/TP (Master Slave Token Passing). MS/TP allows for several devices to operating on a single network segment. MS/TP has benefits such as being lower cost and less demanding on controllers than Ethernet. MS/TP uses the EIA-485 signaling standard. This is a robust standard that uses 1 twisted pair with a ground to transfer data.
 2. Network Speed –All devices running together on a network segment must be using the same speed also known as baud rate. The BACnet standard currently allows devices to use 4 speeds. These are:
 - a. 9600
 - b. 19200
 - c. 38400
 - d. 76800 – (Price factory default speed)
 3. Number of devices - On a MS/TP network the maximum number up devices is technically up to 127. However due to system noise, grounding and general EMI interface this is not a practical number for the real world. Price recommends keeping MS/TP networks to 30 devices or less. This recommendation allows for fast and stable networks that are much easier to troubleshoot. Also remember if a BACnet device on the MS/TP network goes down and clamps/shorts the network it will take down the entire segment. A large segment will also be very difficult to troubleshoot.

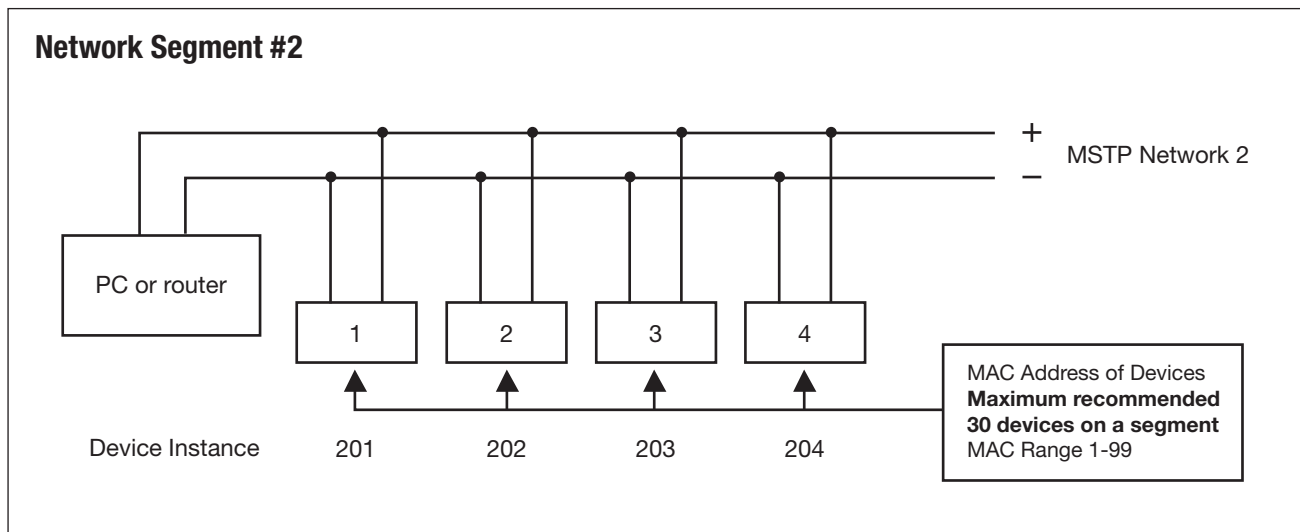
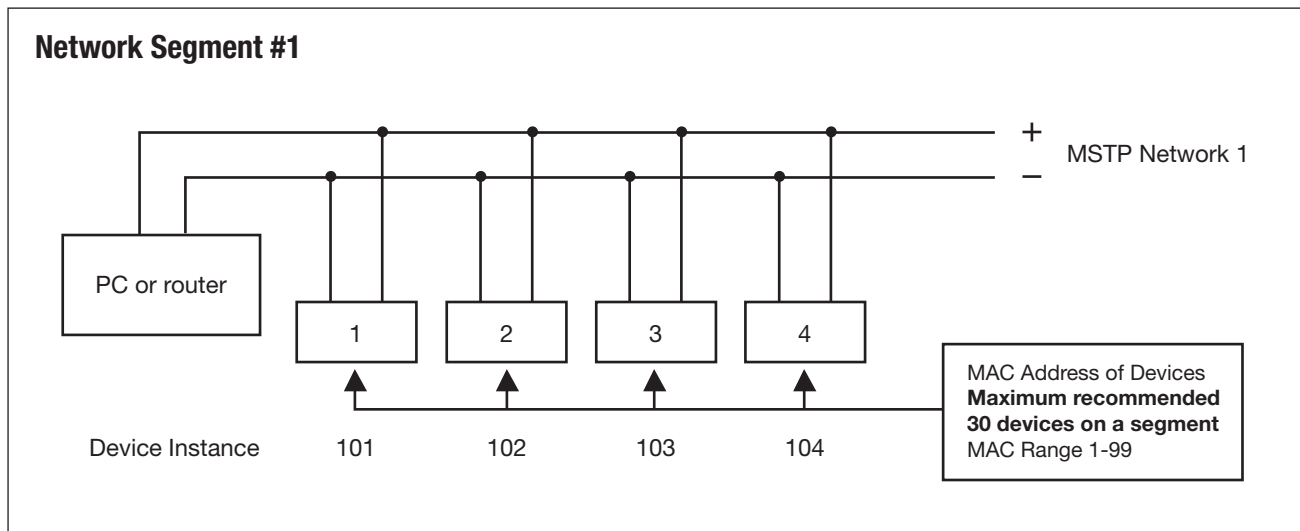
4. Addressing Scheme – Addressing is very important with BACnet especially if you are building the foundation for a larger network. There are two types of addresses used with BACnet. The base level address is the MAC address, which is the physical network address. The MAC must be unique on the network segment. While the MAC can technically go from 0-127, Price recommends limiting the MAC address from 1 – 99. This allows special devices (such as routers) to use MAC 0 and not exceeding 99 allows an elegant network scheme. The second type of address is the device instance. This is the software address for BACnet and of course allows BACnet to support more that 127 devices in a building/campus. The device instance is typically added to the BACnet MAC address has a range from 1 – 4,194,303. This allows for the creation of very large networks. Price recommends a logical addressing scheme. For example once the MAC addresses (DIP switches) have been assigned add 10,000 (device instance) to all devices on the first floor. Then add 20,000 to all devices on the second floor and so on. For different areas/building use other device instances such as 15,000 (first floor – expansion) and so on. Also ensure that any existing addressing scheme is followed.
5. Working with existing devices/networks – If a BACnet network already exists in the building ensure any new devices get a unique MAC addresses on their network segment. Therefore you must know exactly what is already on the network and what (if any) addresses are free. Also you must ensure the devices added to an existing network segment are running at the same speed. If you add a new device at a different BAUD rate it will crash the network.
6. Terminating – MS/TP networks can be terminated using a resistor and/or resistor capacitor (RC). The intent of the terminating is to reduce network reflections/noise. When termination is required DIP switch number 8 (TRM) on the Prodigy BACnet module will enable an R/C across the network (A/B).
7. Wire Type – The MS/TP network requires good quality, low capacitance network wire to ensure reliable data communications. Therefore you cannot use standard “thermostat wire” for network wiring. Price supplies a 35 foot plenum rated CAT5 cable with each Prodigy with BACnet option. CAT5 cable is an excellent choice for MS/TP networks due to its low cost and excellent performance. Also it is very popular and available to most installers.



BACnet Networking and Setup

Setting the MAC Address:

- **MAC Address:**
MAC (media access control) must be **UNIQUE** on an MS/TP network segment within building. An installer setting up an MS/TP segment with 30 devices must ensure each device has a **UNIQUE** MAC address (Range 1-99). The MAC address is set with dip switches on the BACnet Module. This is the hardware setup for the MAC address. The MAC address can also be set in software, through the LCD thermostat. This option of setting the address through software is available when the controller is not accessible to the user (finished drywall ceiling for example).



TECH TIP: Each device needs a **unique MAC and device instance**. All devices must be at the same baud rate. 24 VAC hot and common polarities are critical and must not be reversed on ANY devices! Reverse polarity will stop communication on that MS/TP segment.

Prodigy V2.05 - BACnet Object Points list

Object	Name	Units	Default	Range	Description	R/W
AI1	Room Temperature	°F , °C	N/A	(-59)-300	Current Room Temperature	R
AI2	N/A		0	0	N/A	R
AI3	Supply Air Temperature	°F , °C	N/A	(-59)-300	"Current Supply Air Temperature "	R
AI4	Analog Input J18	V	N/A	0-10	Spare Analog	R
AI5	Analog Input 5	V	N/A	0-10	Spare Analog	R
AI6	Analog Input 6	V	N/A	0-10	Spare Analog	R
AI7	Wireless Signal Strength or N/A	%	N/A	0-100	Signal strength from wireless stat when connected	R
AI8	Wireless Battery Code or N/A		N/A	0-5	Battery code from wireless stat when connected	R
AV1	PPD Model		N/A	1/2/3	Indicates model of PPD. 1 = Dial Setpoint 2 = Thermostat Setpoint 3 = IR remote Setpoint	R
AV2	Occupancy		N/A	0/1	"Occupancy Status: 0 = Unoccupied 1 = Occupied"	R
AV3	Occupancy Source		N/A	0/1	"Source of occupancy: 0 = VVT mode ON 3 = ON from T-Stat button press 4 = ON from Motion Sensor 5 = ON from Network Override 14 = OFF from Motion Sensor 15 = OFF from Network Override"	R
AV4	Room Setpoint - low limit	°F , °C	65°F (18°C)	0-250	Lowest user-adjustable setpoint	R/W
AV5	Room Setpoint - high limit	°F , °C	80°F (26°C)	0-250	Highest user-adjustable setpoint	R/W
AV6	Room Setpoint	°F , °C	72°F (22°C)	0-250	Current Room Setpoint	R
AV7	Night Heat Setpoint	°F , °C	62°F (17°C)	0-250	Setpoint at which controller will enter Heating mode during unoccupied periods	R/W
AV8	Night Cool Setpoint	°F , °C	83°F (28°C)	0-250	Setpoint at which controller will enter Cooling mode during unoccupied periods	R/W
AV9	Binary Output Application	N/A	N/A	N/A	Diagnostic Info	R
AV10	Binary Output Signal Type	N/A	N/A	N/A	Diagnostic Info	R
AV11	Binary Output Status	N/A	N/A	N/A	Diagnostic Info	R
AV12	Unoccupied (Night) Damper Position	%	0	0-100	Position at which the damper is held during unoccupied periods	R/W
AV13	PING		0	0-250	Number of times the LCDT-Stat will beep. Useful for locating a box/T-Stat. (For example, if the number 30 is written to this variable, the T-Stat will beep 30 times before zeroing this variable)	R/W
AV14	Controller Status	%	N/A	(-100)-100	"Current Room Load (PI value) 1%-100% = Heating load 0% = Deadband (room satisfied) (-1%) - (-100%) = Cooling Load"	R
AV15	Proportional Band	°F , °C	2°F (1°C)	0-25	Temperature band through which the PI controller travels through 1% to 100% load	R/W
AV16	Day Differential	°F , °C	1°F (0.5°C)	0-25	"Temperature band on either side of the setpoint within which the controller is deemed satisfied. (for example, with a Day Differential of 1°F, and a setpoint of 72°F, the controller is satisfied between 71°F and 73°F)"	R/W
AV17	Inlet Size (inches)		8	6/8/10/12	Inlet Size for the Prodigy unit. Note: 12/14 inlets have the same stroke time.	R/W
AV18	Current Damper Position	%	N/A	0-100	Current damper position in percent	R

Object	Name	Units	Default	Range	Description	R/W
AV19	Damper Target	%	N/A	0-100	Damper target in percent	R
AV20	Damper Neutral Supply Position	%	50	0-100		R/W
AV21	Damper Cool Min Position	%	0	0-100		R/W
AV22	Damper Cool Max Position	%	100	0-100		R/W
AV23	Damper Heat Min Position	%	0	0-100		R/W
AV24	Damper Heat Max Position	%	100	0-100		R/W
AV25	Remote Mode Flag		0	0-7	"Remote Mode - Damper Override 0 = Automatic control (normal run mode) 1 = Target Cool Min 2 = Target Cool Max 3 = Target Heat Min 4 = Target Heat Max 5 = Target Neutral Airflow 6 = Open damper 100% 7 = Close Damper (0%)"	R/W
AV26	Drone Output Voltage	V	N/A	0-10	VDC output to Prodigy Drone Units	R
AV27	Aux Analog Output Voltage	V	N/A	0-10	Spare Voltage Output	R
AV28	Net Setpoint	°F , °C	0	0-250	Network setpoint override. Set this to any value other than 0 will override local setpoint	R/W
AV29	Net Room Temp	°F , °C	0	0-250	Set this to any value other than 0 to override local temperature sensor	R/W
AV30	Net Occupancy		0	0-2	"Network Override of Occupancy 0 = Local Control 1 = Network force Occupied 2 = Network force Unoccupied "	R/W
AV31	Net Lights		0	0-2	"Network Override of Lights 0 = Local Control 1 = Network force Lights ON 2 = Network force Lights OFF "	R/W

Setting the Device Instance

Setting the MAC Address:

- MAC Address:

A device instance number identifies a device within an entire building, therefore giving it a unique number or address, much like a telephone ext. number. A building can have one telephone number, but all the extensions have a unique number to identify them. A device instance number would work the same way and must be unique throughout the building. The Device Instance number is user set through the LCD thermostat or the USB LINKER tool.

Below is a table defining how a device instance number is obtained.

*Note: Each device on a network segment must be set to run at the same speed or baud rate.

Description	Default Value (Factory)	Notes
MAC Address	Set by DIP switch	Value: limited to 1-99
Tier1 (x100)	58	Value: limited to 0-99
Tier2 (x10,000)	1	Value: limited to 0-99
Tier3 (x1,000,000)	0	Value: limited to 0-4

Example Device instance setup with default settings:

- MAC Address = 4 (4 x 1 = 4) – Set by DIP Switches on BACnet module, or through software.

+

TIER 1 = 3 (3 x 100 = 300) – Set through software

+

TIER 2 = 2 (2 x 10,000 = 10,000) – Set through software

+

TIER 3 = 1 (1 x 1,000,000 = 1,000,000) – Set through software

=

Final Device instance = 1,020,304

Final Device instance =

1	02	03	04
Tier3 Multiplier	Tier2 Multiplier	Tier1 Multiplier	MAC Address

Network Wiring

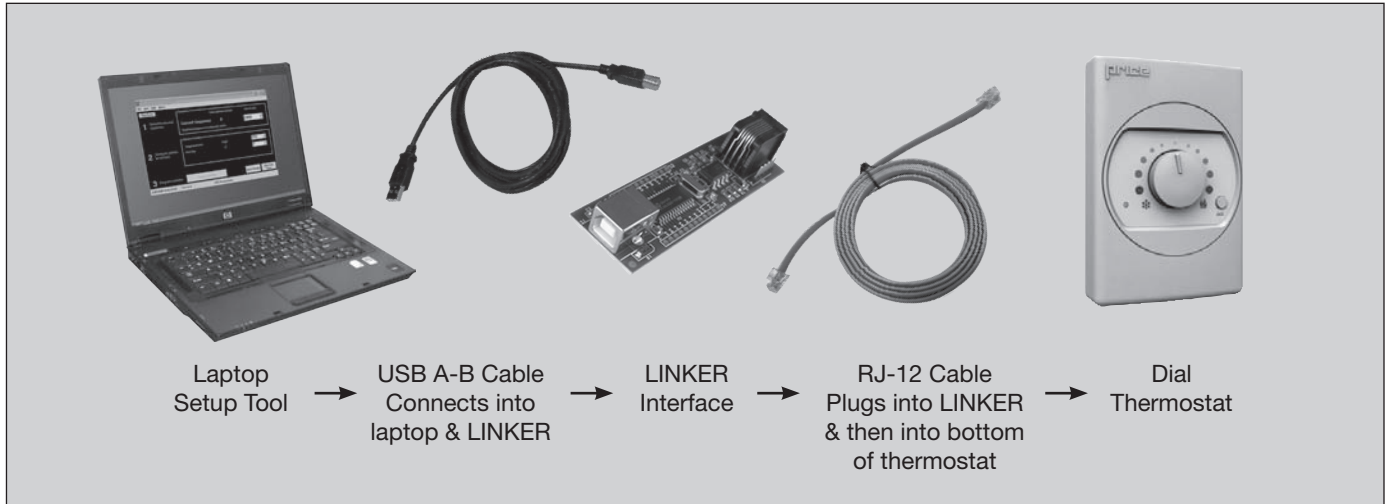
The connections to the BACnet MS/TP network are done through the RJ-45 connections (NET IN & NET OUT). Please note the RJ-45 connections are not Ethernet, but actually BACnet MS/TP. Using the RJ-45 connections for the BACnet network is fast and reduces errors in reverse wiring.

To network the Prodigy units to the Building Automation System (BAS), cut off the LAST end of one of the SUPPLIED blue RJ-45 network cables and use the following wires:

*Using the RJ-45 cables allows for easy networking and only having to terminate ONE connection!

Blue Network Cable Wire Number	Color	Description
1	Orange Complement (Orange/White)	MS/TP – A
2	Orange	MS/TP – B
3-6	No connection (N/C)	Not used
7-8	Brown & Brown Complement (Brown/White)	Connected to 24VAC common/ground through a 100 ohm ½ watt resistor.

Linker - USB Service Tool



The Price USB LINKER is the interface that can be used with any of the Price thermostats for the PIC. The LINKER connects to a laptop (not supplied) via a Type A USB A to B cable supplied by Price, and then connects to the service jack of the thermostat via an RJ-12 Cable supplied by Price. The laptop is required as a setup tool to setup up your parameters for your VAV application. If a laptop is not available, an LCD Thermostat can be purchased as an upgrade and used as a setup/balancing tool. The LCD Thermostat provides full functionality for setting up system parameters.

LCD Thermostat



TECH TIP: When using a with a Prodigy DIAL thermostat, the USB LINKER is one option for setting up the controller. Or you can purchase a single LCD thermostat (PIC-TS-LCD) and use that for setup. Remember all settings are stored in Prodigy, not the STAT!

Calibration Cycle

On power up (and approximately weekly during normal operation) all Prodigy models will temporarily cycle fully open. During a calibration cycle the Red Drone Signal LED (Figure 3 – Item 4) is Continuously ON. After calibration, regular.



Tech TIP: To force prodigy unit OPEN for balancing cycle power to diffuser, allow unit to drive open, then remove power. Damper will stay fully open allowing proper system balancing.

Troubleshooting Guide

The following information is provided in the event that a Prodigy diffuser does not appear to function properly after installation. Since all master units (PPD1, 2 & 3) are auto-changeover controllers, response will be dependent on the supply air temperature. Connected drone units (PPDD) will synchronize damper position with master unit.

Supply Air Temperature	Test Procedure	Prodigy Response (Response Time Varies allow at least 5 minutes)
COLD Supply Air Temperature 2°F (1°C) cooler than Room Temperature	Adjust setpoint for maximum cooling PPD1 & 2 – setpoint dial. PPD3– Press RESET button once, then COOLER button 4 times	Damper moves towards maximum air flow position <i>provided room temperature is not below setpoint.</i>
	Adjust setpoint for minimum cooling PPD1 & 2 – setpoint dial. PPD3– Press RESET button once, then WARMER button 4 times	Damper moves towards minimum air flow position <i>provided room temperature is not above setpoint.</i>
Neutral Supply Air Temperature within 2°F (1°C) of Room Temperature	All Units	Damper will move to neutral position. Default: 50%. Adjustable through LCD thermostat or LINKER software.
HOT Supply Air Temperature 2°F (1°C) warmer than Room Temperature	Adjust setpoint for minimum heating PPD2 – setpoint dial.	Damper moves towards minimum air flow position <i>provided room temperature is not below setpoint.</i>
	Adjust setpoint for maximum heating PPD2 – setpoint dial.	Damper moves towards maximum air flow position <i>provided room temperature is not above setpoint.</i>
	PPD1 & 3 – Constant Volume Heating (No response to Setpoint)	Damper moves to maximum air flow position.

Troubleshooting Guide Continued

Status LED's are provided on the Junction Panel of all Prodigy Diffusers to aid in field diagnostics. Green LED – Indicates presence of 24 VAC power supply. Red LED – Indicates presence of 2 - 10 VDC Drone Signals.

Status Lights on Junction Panel			Action Required
Master	Green	Red	
No Drone Connected to Master	OFF	OFF	Unit is not receiving power. Check 24 VAC supply line and connections.
	ON	OFF	Thermal resettable fuse has tripped. Remove 24 VAC power supply for 15 seconds, then repower unit.
	ON	Flashing	Normal operation status (after initial 2 minute calibration cycle).
Drone	Green	Red	
Test One Drone at a time with Master functioning properly	OFF	OFF	No connection between Master and Drone. Check cable connections.
	ON	OFF	Drone has caused resettable fuse on master to trip. Remove 24 VAC power supply from Master for 15 seconds, then reapply power. If condition reoccurs, contact Price.
	ON	Flashing	Normal operation status (after initial 2 minute calibration cycle).

PPM

Condition	Possible Cause	Remedy
Green Power Light Off	Disconnect Switch Off	Turn Switch On
	Transformer Circuit Breaker Tripped	Disconnect Power. Unplug all output cables. Remove lid. Reset breaker on transformer. Replace Lid. Reconnect Power. Reconnect all plugs one at a time.
	No Power Supply	Check Line Connections.
Red Fault Light On above Output Jack	Too many Prodigy Units or Heat Relays supported on Line	Reroute some power cables to another jack.
	Faulty Cable or Connector	First - Disconnect all cables and connectors originating from problem outlet. Next - Reconnect first C35 cable only. If Red fault LED lights, cable is faulty. Replace. If Red fault LED remains off, reconnect remaining components (CS, CC, C35, Prodigy Masters) one at a time until LED lights. Replace faulty component.
	Redundant Power Supply	Eliminate Redundant Power Supply
Auxiliary Heat		
Red Fault LED on	Mechanical Relay draws more than 12 VA	Replace with smaller relay or electronic SSR.
Insufficient Power to mechanical relay	Cable distance from PPM exceeds 35 feet	Relocate PPM or Mechanical Relay, or use electronic SSR.

Prodigy Specifications

Specifications	Prodigy Master (PPD1, PPD2, PPD3)
Power Supply	24 VAC (+-10%) 60Hz; Class 2
Power Consumption	3 VA for diffuser (+ Prodigy Drones and any reheat load)
Electrical Connection	2 position pluggable terminal block OR RJ12 jack from Power Module
Certification	ETL listed
Outputs	1 Binary Triac zero crossing output at 24 VAC (thermally protected) 12VA maximum
	2x RJ12 jacks for Prodigy Drone units (maximum 6 total per master)
Input	1x RJ45 Thermostat jack (works with Price line of thermostats and Prodigy PPD1 jumper)
Communication	BACnet Master MS/TP module supports 9600/19200/38400/76800 baud rates, 2x RJ45 connections, Green Transmit LED, Red Receive LED, MAC address settable through DIP switches or LCD thermostat, Device Instance settable through LCD thermostat, or LINKER service tool.
Proportional Band	2.0°F (or 1.0°C) cooling and heating (adjustable via LCD thermostat or LINKER service tool)
Processor	8-bit 128kB flash based microcontroller with EEPROM
Temperature Sensors	10K NTC plaque thermistor, 10 K NTC supply air temperature thermistor, 10 K NTC Thermostat thermistor
Temperature Sensor Range	-40°F - +175°F (-40.0°C - + 79.4°C)

Prodigy Drone Specifications

Power Supply	24 VAC (+-10%) 60Hz; Class 2 (supplied by Prodigy Master via RJ12 cable (C35))
Power Consumption	3 VA
Electrical Connection	RJ12 jack
Certification	ETL listed
Outputs	2x Binary 24 VAC for Damper Motor supplied via RJ12 (C35)
Input	2 – 10 VDC signal (supplied by Prodigy Master) All Drone inlet sizes accept 2 – 10 VDC.



PRICE
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Auburn, Georgia USA 30011



PRICE
INDUSTRIES

999 North Thornton Road
Casa Grande, Arizona USA 85222-3809



e.h. price
LIMITED

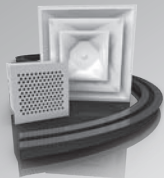
638 Raleigh Street
Winnipeg, Manitoba Canada R2K 3Z9
Ph: 204.669.4220 Fax: 204.663.2715

The founding principles of our company have never changed - business integrity, first class service and a commitment to people. Price manufacturing endeavors arose from our belief that we could supply superior products and services at a reasonable price. Our mission is to become the world-wide supplier of preference for air distribution products and services. You can rely on Price – our products and services – with confidence.

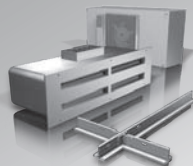
Warranty: The Company warrants and guarantees that all goods within this catalog that have been manufactured by the Company have been manufactured in accordance with the specifications published herein and will be free from defects in material and workmanship for a period of twelve (12) months from the date of Bill of Lading issued by the Company. The Company will replace defective product at its option, but will not be responsible for labor or material charges in replacing product or consequential damages. Any installation not conforming with the Company's specifications, manuals, bulletins or instructions or any misuse or any modification not authorized by the Company voids this warranty. This warranty is in lieu of all Provincial, State, and Federal statutory warranties and the conditions herein are in substitution and replacement of such warranties, statutory or otherwise.

Your Local Price Representative:

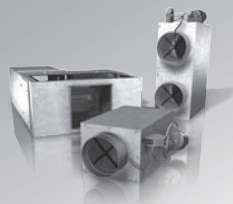
Grilles & Diffusers



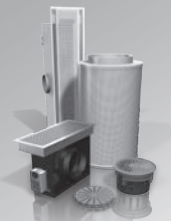
Critical Environments



Terminals



Sustainable Building



Noise Control

