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# Equipment

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## Starzone 4000 Master Control Panel

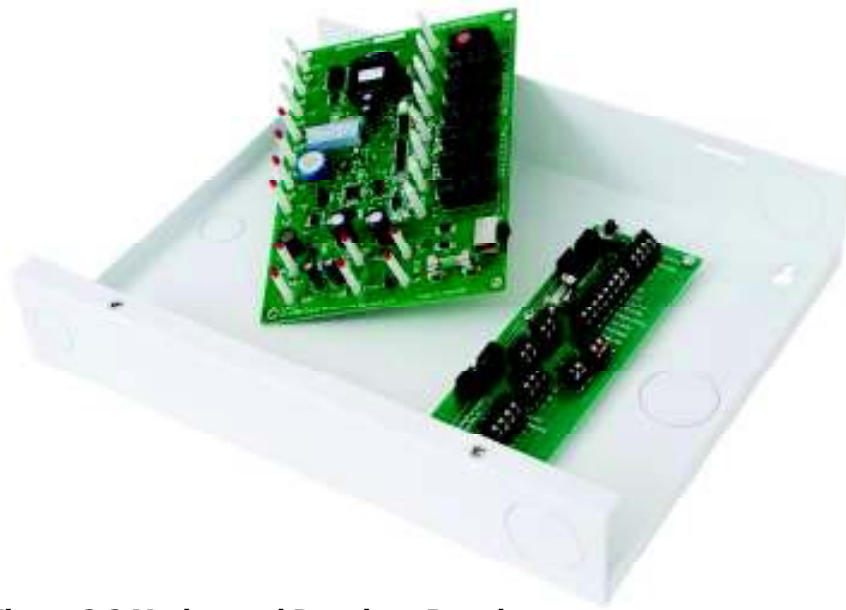


**Figure 2.1 Master Control Panel**

The heart of the Starzone 4000 system is the Starzone Master controller (SZM-4000). Each AHU that is to be zoned will have its own SZM-4000 Master control panel and each panel can operate independently or be networked together via a 3-wire, RS485 communication bus back to a central PC.

To make servicing the SZM-4000 Master easier, the controller has two parts: a motherboard, which has all the connectors for field wiring, and an electronic daughter board which plugs into the motherboard.

### **SZM-4000 Master Daughter Board**



**Figure 2.2 Mother and Daughter Boards**

Swapping out a Master daughter board with a known good board is a simple and time efficient method of confirming whether or not a problem exists with the daughter board or elsewhere.

Removing the board is accomplished by turning off the power switch, and removing the two mounting screws on the left hand side. While supporting the board by the connectors, simply rock it out of the connectors until it is free. Installing the new board is as simple as plugging in the replacement, installing the mounting screws, and turning the power on.

When the system is connected to a PC it may be necessary to re-serialize the board to match the board it replaced. This is accomplished by pulling down dip switch #10 and entering 'SET SERIAL NUMBER' under the 'SETUP' menu in the Starcom Building software. Once serialized it will be necessary to transmit all of the user settings to the new board. This is done by selecting the 'UPDATE MASTERS' form which is also located under the 'SETUP' menu.

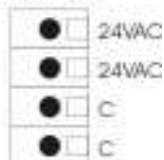
### **SZM-4000 Master Motherboard**

Normally there shouldn't be any need to replace the motherboard as there are no electronic components. The motherboard contains all of the connectors that are used to connect the SZM-4000 Master to the Starzone

system. Should the motherboard require replacing carefully disconnect and isolate each wire. Remove the mounting screws and replace the board.

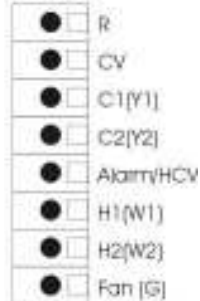
## Motherboard Terminal Connections

### Power



**24VAC, C** The first set of 24VAC and C terminals are connected to a 40VA 24V transformer. A second set of 24VAC and C contacts are provided to enable the installer to connect the model RAD Bypass Damper's 24V supply in parallel.

### HVAC



**R** This terminal connects an external 24V control signal from the AHU. The signal is kept electrically isolated from the 24V supply voltage on the Starzone 4000 system.

**CV** The CV terminal is energized whenever the Starzone system switches into unoccupied mode. The CV contact serves a different function when placed into Heat Pump mode. While in Heat Pump mode the CV contact controls the cooling change over valve and will be energized shortly before any cooling demand.

**C1,C2** C1, and C2 (Cooling 1 and 2) is connected to the first and second stages of cooling on the AHU.

**Alarm/HCV** The Alarm/HCV terminal serves different purposes in Rooftop and Heat Pump modes. When the system is in Rooftop mode the HCV terminal serves as an Alarm contact output. While in Heat Pump mode this terminal is used for the Heating Changeover Valve contact and is energized shortly before any heating demand.

**H1,H2** H1 and H2 (Heating 1 and 2) is connected to the first and second stages of heat on the AHU.

**FAN** The fan terminal is connected to the G or fan control of the AHU and is de-energized when the system switches to unoccupied mode.

### WET



**WET** The WET port terminal is a non-polarized alarm contact terminal which can accept any 24VAC or DC alarm signal. When a voltage is detected a user defined message is displayed on the Starcom Building software, the alarm LED on the control panel will light, and the HCV alarm contact will energize provided the system is in Rooftop mode.

## 2.4 Equipment

NS/DP



### NS/DP

The NS/DP (Night Setback/Dry Port Alarm) terminal serves a dual purpose. The default mode is to serve as a control input for Occupied/Unoccupied mode. When a dry contact closure is present (a closed switch for example) the system will operate in occupied mode, in the absence of a dry contact the system will switch to unoccupied mode. Through software the terminal can be switched to an alarm port which will display a custom alarm message on the Starcom Building software, an alarm LED on the control panel will light, as well the HCV alarm contact will energize when the system is in Rooftop mode.

TOA



### TOA

The TOA (Temperature Outdoor Air) terminal is a non-polarized terminal for connecting the TOA sensor. Polarity does not matter however the conductor should not be shared with any other devices. Never combine the TOA sensor with the same cable used to connect the AHU.

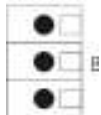
TSA



### TSA

The TSA (Temperature Supply Air) terminal is a non-polarized terminal for connecting the TSA sensor. Polarity does not matter however the conductor should not be shared with other devices. For example never combine the TSA sensor with a cable connecting the Bypass damper.

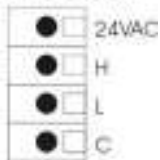
HUB



### HUB A,B,C

The HUB terminal is used to connect all of the SZM-4000 Master Controllers, and Starcom Hub together. This communication cable is a twisted 3-wire non-shielded cable that daisy chains all of the Masters to the Starcom Hub. On each device A connects to A, B-B, and C-C.

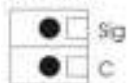
Zone  
Communication



### Zone Comm.

The Zone Communications terminal provides 24VAC power and High and Low communications to each zone sensor. This communication cable should be a twisted 4-wire, non-shielded cable that daisy chains all of the model AVD zone dampers to the SZM-4000 Master Control panel. Each AVD zone damper has two sets of zone communication terminals and it does not matter which one is connected because all four terminals are in parallel. The second set of terminals on the AVD zone damper is used to continue the power and communication cable to the next AVD zone damper. On each device 24VAC connects to 24VAC, H-H, L-L, and C-C.

RS232



### RS232 Sig, C

The RS232 terminal provides an RS232 output signal that can be connected to any communications serial port on a PC. When the SZM-4000 Master control panel is not connected to a Starcom Hub the Master panel will perform a memory dump every 2 minutes.

## LED's

- HVAC Terminals** The LED's associated with the HVAC terminals are connected in parallel to the terminal contacts and are used to indicate when each relay has been energized.
- Zone Dampers** The Zone Dampers are displayed in groups of 8. Dip switches 1 and 2 on the SZM-4000 Master allow the user to toggle between subsequent groups of 8 zones. The Starzone 4000 system can have a total of 32 zones or 4 groups of 8. Each LED is a bi-color LED which means that it can display either RED or Green. Green indicates the associated damper is either fully open or in the process of opening. RED indicates the zone damper is either fully closed or in the process of closing. Because the zone dampers are fully modulating there may be times when a damper is parked in a mid position, during which time the LED will be off.
- NIGHT** The night LED indicates whenever the system switches into unoccupied Mode. The LED is off during occupied mode.
- LIMIT** During normal operation the Limit LED is off. There are two possible limit conditions:
- Low Limit - LED ON – This indicates the supply air temperature has fallen below the user adjustable cut-off. The SZM-4000 Master will turn off the second stage of cooling, and if the temperature continues to fall will turn off the first stage of cooling. The cooling will remain off for a period of 5 minutes after the temperature has resumed to normal.
- High Limit - LED FLASHING – This indicates the supply air temperature has risen above the user adjustable cut-off. Like the low limit the SZM-4000 Master will stage off both the second and first stages of heating also with a 5 minute delay.
- POWER** The LED is on whenever the SZM-4000 Master panel is on. If this LED is not on check to ensure there is 24VAC at the L and C terminals. Make certain the power switch located on the top right hand side is in the ON position, and check the fuse located below the power switch.
- FAULT** The SZM-4000 Master control panel contains a state of the art 'Watch Dog' circuit. This is a separate stand alone circuit that monitors the operation of the main CPU processors. If for any reason a processor should stop working the Watch Dog circuit will flash the FAULT LED while cycling the power to the processor. Should this not rectify the problem the Watch Dog timer will continue to cycle power indicated by a flashing FAULT LED every 15–20 seconds.
- DP** The DP (Dry Port) LED is used to indicate whenever a closed circuit is present on the DP contact. A jumper located beside the LED is used to disable this LED function while the DP contact is configured in occupied/unoccupied mode.

## 2.6 Equipment

**WP** The WP (Wet Port) LED is used to indicate whenever a voltage is present on the WP contact.

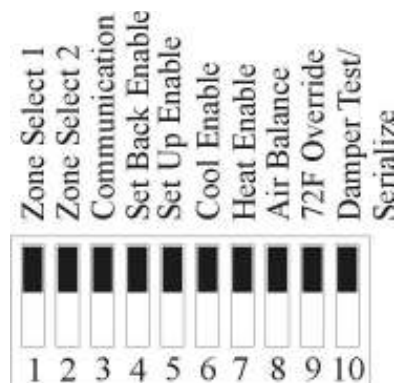
## Jumpers

There are three jumpers located on the SZM-4000 Master Daughter board:

Jumper	Description
1	Located on the right hand side of the main CPU, Jumper 1 selects the operation between rooftop mode and heat pump mode. Heat pump mode should only be selected when connecting to heat pump units that require a control signal for a reversing valve. While in heat pump mode the SZM-4000 Master utilizes the CV contact for the cooling changeover valve, and the HCV/ALARM contact for the heating changeover valve.
2	Located directly to the right of Jumper 1, Jumper 2 selects between Run and Test mode. Test mode should only be selected for troubleshooting purposes as a number of time delays are dropped out allowing the system to switch between demands before pre-positioning the zone dampers. Under no circumstances should the system be allowed to operate normally while in test mode.
3	Located to the left of the DP LED, Jumper 3 is used to disable the LED when the DP contact is configured for Occupied/Unoccupied operation.

## DIP Switches

Figure 2.3 shows the recommended position of the dip switches during normal operation.



**Figure 2.3 DIP Switch, Normal Settings**

<b>DIP Switch</b>	<b>Description</b>
1, 2	<b>Zone Select</b> - The SZM-4000 Master control panel can connect up to 32 or 4 groups of 8 zones. Dip switches 1 and 2 are used to select which bank of 8 is displayed by the zone damper LED's.
3	<b>Communication</b> - When dip switch 3 is enabled the damper LEDs display the serial communication between the master and zone sensors. This mode is used for troubleshooting communication problems when in contact with Zone All technical support. For normal operation this dip switch should be left in the disabled position allowing the zone damper operation to be displayed.
4	<b>Set Back Enable</b> - This dip switch will disable the system from going into Night Set Back.
5	<b>Set Up Enable</b> - This dip switch will disable the system from going into Night Set Up. When both dip switches are disabled the system will not be able to enter unoccupied mode.
6	<b>Cool Enable</b> - For heat only systems this dip switch can be used to disable the cooling.
7	<b>Heat Enable</b> - For cool only systems this dip switch can be used to disable the heat.
8	<b>Disable Air Balance</b> - For air balancing it is necessary to drive all zone dampers to the full open position while keeping the fan energized. During normal operation this dip switch must be in the disabled position.
9	<b>72 Degree Override</b> - Enabling the 72°F (22°C) override locks the set point on all zone sensors to 72°F (22°C).
10	<b>Damper Test Mode</b> - When enabled, the system enters damper test mode. Any zone sensor that has a set point temperature set higher than 22°C (72°F) will drive the associated zone damper to the full open position. Conversely, any zone sensor turned below 22°C (72°F) drives the zone damper to the full closed position.

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### DIP Switch

### Description

**Set Serial Number** – Only one SZM-4000 Master can accept a serial number at a time, so it is essential that when transmitting a new serial number only one Master has the Set Serial Number dip switch enabled. Once enabled the user can transmit a new serial number to the master through the 'SET SERIAL NUMBER' form located under the 'SETUP' main menu in the Starcom Building software.

## SZT-4000 Thermostat

### Introduction

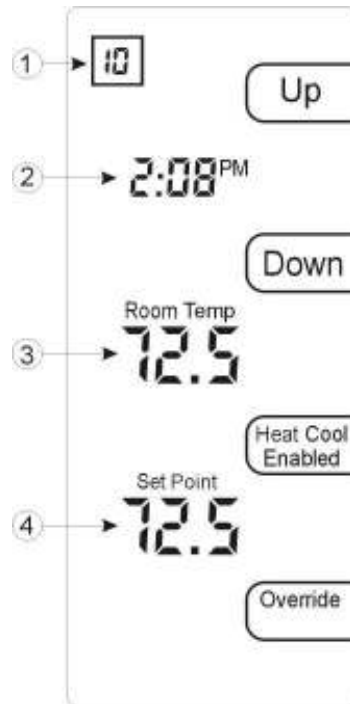
The SZT-4000 thermostat communicates with the SZM-4000 Master control panel through the associated zone damper's Motor Controller Board (MCB). The SZT-4000 thermostat has several features including 2-hour night set-back override, 24-hour trend logging, and damper test mode. The set point and ambient temperatures can be viewed locally, or remotely on a PC when used with the Starcom Hub and Starcom Building Software.



Figure 2.4 SZT-4000 Thermostat

Wiring the thermostat is done by running a 5-conductor non-shielded, twisted, solid 18 gauge wire to the associated AVD zone damper Motor Controller Board (MCB).

## Display



**Figure 2.5 Display**

**Zone number** – To communicate with the Master Controller each room sensor must be given a unique channel number from 1-32 (sub-menu option #4). When more than one Master Controller exists it may be preferred to display the thermostat's zone number (1-99). This number can be set through menu option #7. Setting the zone number in menu option #7 to 00 will revert the display back to the channel number selected from menu option #4.

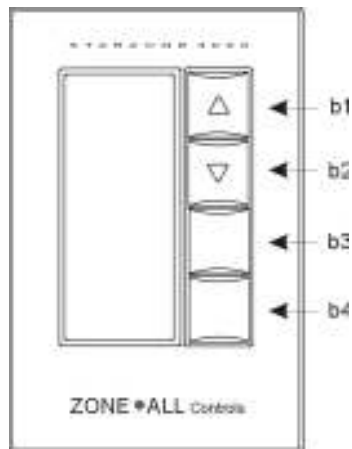
When selecting any of the 6 sub-menus this number will indicate the current menu option that has been selected.

**Current time** – Once the SZT-4000 thermostat has established communication with the SZM-4000 Master, the current system time will be displayed. When the system is first powered up, or if there is a communications problem, the time will remain frozen at 12:00PM.

**Room temp** – This temperature is the current space or ambient temperature that is being measured by the room sensor.

**Set point** – This temperature indicates the current set point that the system will control the room temperature to.

## Buttons



**Figure 2.6 Thermostat buttons**

**b1&2) UP/DOWN Displays** – During normal operation when the ‘UP’ and ‘DOWN’ is displayed these buttons can be used to adjust the room’s set point. A blank display indicates that either the buttons or the set point has been locked out and the ability to locally adjust the room’s temperature has been disabled.

**b3) HEAT/COOL Enabled** – The room thermostat's ability to respond to heating and cooling demands can be limited to being either heat or, cool only, or both heating and cooling disabled. If the thermostat's demand capability has been overridden from the computer then the word ‘ENABLED’ will be blanked out and the setting cannot be changed locally at the sensor. It should be noted that disabling heating or cooling will prevent the thermostat from generating a heating or cooling demand but does not prevent the zone damper from responding to demands generated by other zones.

**b4) OVERRIDE/SET** – During evenings and weekends or whenever the SZM-4000 Master controller is operating in the ‘UNOCCUPIED’ mode a user may provide a 2-hour ‘override’ condition where the space temperature for that one zone only will be returned to the sensor’s normal set point temperature. After the 2-hour period has elapsed that zone will return back to its normal ‘unoccupied’ setting. The 2-hour override condition is indicated by the ‘OVERRIDE’ display flashing.

## Sub-Menu Options

There are 8 sub-menu options available to access different features. Simultaneously pressing the UP and DOWN buttons will place the room sensor into the first menu option #1 – Trend Log. Using the ‘SET’ button the user can scroll through the available menu options. At any time B3 can be pressed to return the room sensor back to normal operation.

### Menu Option #1 – 24 Hour Trend Log

Pressing the UP/DOWN buttons allows you to effectively scroll back in time for the past 24 hours of operation. The set point and room temperatures will be displayed in 5-minute increments.

### Menu Option #2 – Set Time

Pressing the UP/DOWN buttons allows you to adjust the system’s current time. Once an adjustment has been made the new time will be transferred to the Master control panel and all other zone sensors connected to that Master Controller. Once the time has been changed on one sensor that change will be reflected on all other sensors that are connected to the same Master. This change will not be reflected on thermostats that are connected to other SZM-4000 Masters.

### Menu Option #3 – Damper Test Mode

In damper test mode the user can override the damper to the full open or closed position, and also turn on and off the auxiliary heat contact. Pressing the Up button opens the damper, and turns on the auxiliary heat contact while pressing the Down button closes the damper and turns off the auxiliary heat. The damper's current position will be displayed as a percentage ranging from 0% (closed) to 100% (fully open).

### Menu Option #4 – Set Stat Number (1-32)

Each room sensor must be assigned a unique communication channel between 1 and 32 for each Master control panel. While the stat number is flashing, pressing the Up/Down buttons will adjust the stat number between 1 and 32.

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### **Menu Option #5 – Thermostat De-calibration**

At times when the thermostat's location is not ideal, it may be beneficial to de-calibrate the stat to better represent an average or adjacent location's temperature. This option allows the ambient temperature to be increased or decreased by several degrees.

### **Menu Option #6 – Set point range adjustment**

When several zones are shared with a common AHU it is best to have a restricted range of set point values so that the difference in temperature between two adjacent zones is not so great as to cause a conflict. However if a wider set point range is desired the range can be widened from 68–77°F (20–25°C) to 66–80°F (19–27°C).

### **Menu Option #7 – Set Zone Number (1–99)**

When connecting a system to a PC each thermostat is assigned a unique zone number. When there are more than one Master control panels it makes sense to label each thermostat with a unique number corresponding to the zone number. Whenever a zone number greater than 00 is entered, the display will show the zone number and not the individual channel number selected from menu option #4. It should be noted that setting the Zone ID number has no affect on the operation of the system and it is still necessary to set the Stat number in menu option #4.

### **Menu Option #8 – Restore Factory Defaults**

When changes to the thermostat's defaults have been made through software this menu allows the user to clear all settings and restore the thermostat to its original settings. Simultaneously pressing the UP and DOWN buttons will restore all factory settings.

## **DIP Switches**

Located on the back of the room sensor are 4 dip switches that can be used to configure the operation of the sensor.

**Dip Switch #1** – Fahrenheit/Celsius display. [Up = °C; Down = °F]

**Dip Switch #2** – Keyboard lockout. This option allows the keyboard to be disabled, preventing the user from making any changes. [Up = Locked out; Down = Keyboard Enabled.]

**Dip Switch #3** – This dip switch provides the option of locking out menu options 4-8. [Up =Menus 4-8 Enabled; Down 4-8 Disabled.]

**Dip Switch #4** – Termination resistor. Normally this dip switch should be left in the down position. However on long communication runs the last room sensor on the communication line should be terminated by the dip switch. [Up = Line terminated (last stat only); Down = No termination (normal)]

## Starcom Hub and Software



**Figure 2.7 Starcom Hub and Software**

The Starcom Hub comes complete with everything you need to interface the Starzone 4000 system to a Microsoft PC computer. This package includes the Starcom Hub, power adaptor, and software CD with the Starcom Building Software and the drivers required for the USB port. For more information on installing the software please refer to the communication section in our manual.

## Wiring

Communication between the Master Controllers and Starcom Hub is accomplished by an RS-485 bus. The A, B, and C terminals of the Hub are daisy chained to each of the A, B, and C terminals on each Master Control panel.

## Installing USB Drivers

1. Ensure that the USB cable is unplugged from the computer before installing the USB drivers located on our installation CD.

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2. Double-click the Driver Install icon and follow the on-screen instruction.
3. Once the drivers have been successfully installed, plug the Starcom Hub into the computer. There should be a quick flicker of the send and transmit LED's indicating that the PC has recognized the Starcom Hub.
4. From the Starcom software main menu select 'SETUP' and from the sub-menu select 'STARCOM SETUP'.
5. Under the section 'Local Hub Port' a drop down box lists the available Comm. ports.
6. Select the one just installed by the USB adaptor and you should be ready to communicate with the Starzone system.
7. If the comm. port installed by the USB driver is out of range of the ports available through software, the USB driver's comm. port assignment can be changed through Windows. Select Control Panel, followed by System, then select Hardware Device Manager. In the list of hardware properties you should see the USB comm. port driver. Right click and select properties followed by the advanced button. From there you will be able to change the comm. port assignment to a channel within the range of the Starcom Software. The exact path differs between different versions of Windows. If you are unfamiliar with the your computers operating system contact Zone All Technical support for assistance.

### LED's

Three LED's on the Starcom Hub indicate Power, TX, and RX. The TX and RX LED's are useful for troubleshooting communication problems. The TX LED flickers when the software polls the Master controller for information. If the Master controller recognizes the data and responds you will see the RX LED flicker. Normal communication appears as successive TX and RX pulses.

### Model AVD Zone Dampers

The fully modulating zone dampers are available in 6", 8", 10", 12", 14", and 16" diameter sizes.



**Figure 2.8 AVD Terminal**

Upon request we can provide any size of rectangular damper.

The dampers feature elliptical blades for a more linear response and consist of two steel blades separated by an air tight neoprene gasket for quiet operation. The dampers meet SMACHNA and ASHRAE standards and are furnished with a 24V, 3-wire floating electric actuator.

A line at the end of the shaft indicates the blades position. A set screw allows the damper's minimum position to be field adjusted.

## Selecting the AVD Terminal

Recommended velocities are the same as for conventional low pressure duct design:

MAIN DUCTS	1100 to 1500 fpm
BRANCH DUCTS	800 to 1100 fpm

Generally the size of the AVD terminal will be the same size as the duct that it is being installed in. If the AVD is installed within 8 feet of an outlet, velocities above 1500 fpm should be avoided.

Table 2-1 is used to select the appropriate damper from the calculated CFM requirements and air velocities with respect to static pressure drop and air noise.

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**Table 2.1 AVD/STA Capacities**

Velocity (fpm)	AVD/STA Selection			2000
	800	1100	1500	
Model & Size (in.)	CFM			
AVD-6"/STA-6"	(.04 pd) – 157	216	287	
AVD-8"/STA-8"	(.03 pd) – 280	385	525	
AVD-10"/STA-10"	(.02 pd) – 435	600	817	1090
AVD-12"/STA-12"	(.015 pd) – 628	865	1180	1572
AVD-14"/STA-14"	(.01 pd) – 854	1177	1604	2139
AVD-16"/STA-16"	(.01 pd) – 1135	1537	2095	2790

Pd – Pressure drop in inches of water gauge is shown for 800 fpm      0.12" w.g. pd

## Model RAD Bypass Dampers

The Relief Air Damper (RAD) is used to bypass excess air from the supply to the return of the AHU. The RAD is necessary on all systems to avoid excessive air noise as a result of increased static pressure. The RAD automatically adjusts to these changes and bypasses air so that the velocities maintained in the duct system remain constant.



**Figure 2.9 RAD Bypass Damper**

The RAD's construction is the same as the AVD zone damper. A static pressure sensor is equipped with indicator lights to indicate whether the damper is driving open or closed. Completely self contained, the bypass damper requires only 24VAC power. The damper actuator travels at the same speed as the AVD

terminals and as a result the RAD tracks the static pressure at the same rate of change as is being imposed on the system by the opening and closing AVD's.

The RAD should be installed directly off the supply main on a straight piece of duct before any duct branches outlets. The static pressure sensor is located on the inlet of the RAD. If the RAD damper cannot be located in an acceptable location then the sensor tube can be removed and extended, to within 12 feet of the sensor, to a straight piece of duct where the turbulence is not apparent.

## Selecting the RAD Bypass Damper

RAD dampers are selected to operate at a higher fpm range than the zone dampers and should be selected for an operating range of 2000–2500 fpm. Two methods are used to select the RAD depending on the system's size.

### Small Systems (6 zones or less)

The size of the damper is based on the worst case scenario. The smallest zone's CFM is subtracted from the total CFM size of the AHU. If minimum damper positions are specified the sum total of these CFM's can also be subtracted from the total, although it should be noted that if anytime in the future the minimum position are reduced the resulting increase in air will mean the bypass damper is undersized.

### Systems with 7 or more zones

Depending on the size of the system more than 1 RAD may be required. For larger systems an arbitrary factor of 0.75 X the total AHU CFM can be used to determine the total bypass air requirements.

Table 2-2 is used to select the correct bypass damper given from the calculated velocity and total CFM to be bypassed.

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**Table 2.2 RAD Capacities**

Velocity (fpm)	RAD Selection			
	800	1100	1500	2000
Model & Size (in.)	CFM			
RAD-6"	285			
RAD-8"	525			
RAD-10"	817	1090		
RAD-12"	1180	1572	2670	
RAD-16"	2095	2790	3490	4180

**Note:** Maximum recommended velocity is 3000 fpm  
pd - Pressure drop in inches of water gauge 0.35" w.g. pd

### Adjusting the Bypass Damper

Before the bypass damper can be adjusted all of the zone dampers must be driven to the full open position. This is done by enabling the air balance mode, dip switch #8, located on the master control panel. Once all of the zone dampers have driven fully open and the bypass damper is closed, the bypass damper can be adjusted to "just" remain closed at that reference static pressure. This is accomplished by turning the set screw counter clockwise to the point where the LED indicator turns green, then backing off just to the point the LED returns to red. The set screw should be left so that after a period of time the bypass damper remains in the fully closed position. If the LED indicators flicker back and forth between open and closed this is fine provided the damper remains closed. If more than one bypass damper exists on a system then the remaining dampers are adjusted in a similar fashion. To check RAD operation, close the smallest zone and ensure the damper senses the relative increase in static pressure and begins to open to maintain a constant static pressure.

### TSA and TOA Sensors

The Temperature Supply Air (TSA) and Temperature Outdoor Air (TOA) sensors are 10K ohm thermistors mounted on either a gang plate (TOA) or duct probe (TSA).



**Figure 2.10** TSA and TOA Sensors

## **TSA**

The TSA sensor is included with the Master Control panel and is used to monitor the supply air temperature of the system. Accurate monitoring of the supply air in a bypass system is critical because as zone dampers become satisfied they close down thereby increasing the amount of bypass air back to the return. This in turn will cause a dramatic decrease in supply air temperature during cooling demands, and an increase in supply air temperature during heating demands. The Master control panel uses the TSA to turn off the 1st or 2nd stages of heating or cooling to maintain a supply air temperature that is within the AHU's specifications.

## **TOA**

The TOA is optional and is used to expand the control of the heating functions and the maximum damper position during cooling demands.

When a TOA is installed, the user can select different outdoor air temperatures to disable either Master or auxiliary heat functions. The sensor can also be used to allow each zone damper to have an individual maximum cool position which only takes effect based the outdoor temperature.

## **2.20 Equipment**