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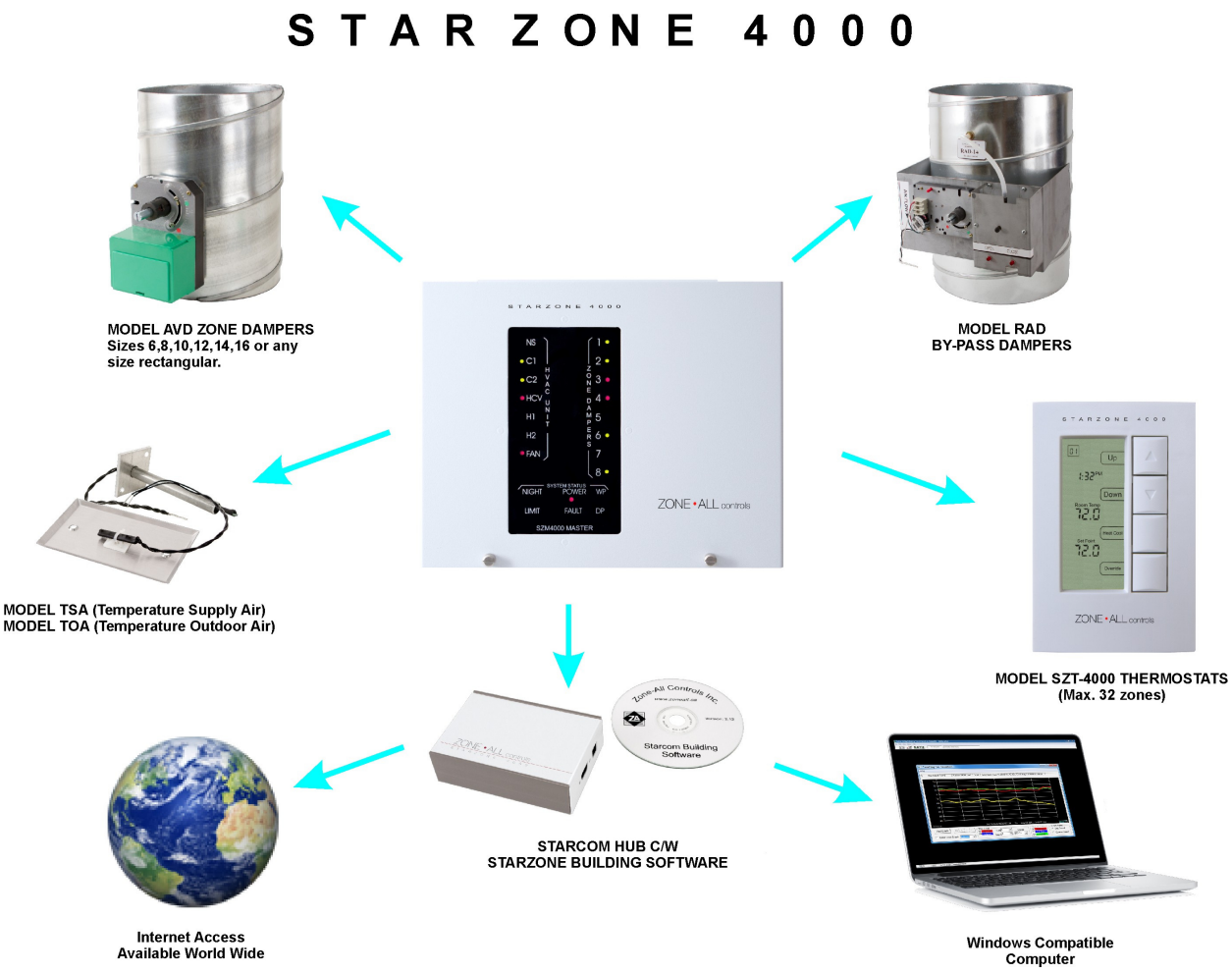


The Starzone 4000 system is the premier VVT system that has evolved from the accumulation of the experience and knowledge Zone All Controls has acquired in manufacturing easy to use packaged VVT temperature control systems since 1987.

Many heating and ventilation systems in commercial buildings are designed with incremental heating and cooling units. These units can be in the form of rooftop gas or electric packaged units, water source heat pumps, hot and cold water fan coils and fan powered mixing boxes, just to name a few.

All of these systems have the same flaw. They do not have the zoning flexibility necessary to satisfy the varying conditions occurring within the area served by the individual unit. Multiple zoning capability is a necessity. Incremental systems must have the flexibility to satisfy the difficult and changing demands placed on them. Zone All's Starzone 4000 system has been designed to solve these problems.

The Starzone 4000 system brings **big building control** to the small building owner. The design has accomplished three important goals in dealing with both small and large HVAC systems:

1. Fully modulating dampers proportion the air to the space based on the differential between the set point and ambient temperatures providing true Variable Air Volume (VAV) control. Because the system is capable of responding to both heating and cooling demands separated by a ventilation cycle we have taken the next important step to providing full Variable Volume and Temperature (VVT) control.
2. An easy-to-operate interface with a variety of test features allows the system to be easily operated and serviced. Our "plug and play" devices mean that the average building operator can easily troubleshoot and repair any problem.
3. A communications system allows building owners/operators to control and monitor their HVAC systems from any PC. Our free technical support line offers, at no charge, remote monitoring and assistance over the internet.

The Starzone 4000 System

The Starzone 4000 system works on a first-come-first-served temperature control basis. Because the system features fully modulating dampers, once a heating or cooling demand is met, all zones within that demand are satisfied simultaneously thus freeing the system to either switch demands or proceed to its ventilation cycle. Also because the system is capable of full two-way communication with each thermostat during any heating or cooling demand cycle, the system can identify the main demanding zone and hold that area's damper in the fully open position thus pushing the greatest demand areas towards becoming satisfied. This feature plus the

fully modulating dampers means that the system is always driving towards the ventilation cycle thus providing solid temperature control and excellent ventilation characteristics.

SZM-4000 Master Controller

The heart of the Starzone 4000 system is the Starzone Master Controller (SZM-4000). The SZM-4000 Master controller interfaces to the air handling unit (AHU) through a series of industry standard isolation relays, and acts as the main connection point for all of the zone thermostats, sensors, and Starcom Hub communications. Each AHU that is to be zoned will have its own SZM-4000 Master controller 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 system easier, the controller uses two printed circuit boards: the daughter board, having all of the electronic components, simply plugs into the motherboard which has all the connectors for field wiring.

SZT-4000 Thermostat

The Starzone 4000 thermostat (SZT-4000) is a fully programmable microprocessor-based thermostat with several features. It offers 2-hour night set back override, 24-hour trend log history, damper override test mode, and can be interfaced to an auxiliary heat source such as an electric or hot water baseboard, or duct heater.

The set point and ambient temperatures can be viewed locally or the set point can be overridden from the Starcom Building software program.

Zone Dampers

The fully modulating zone dampers, model AVD's, are available in 6", 8", 10", 12", 14" and 16" round sizes. Upon request we can provide any size of rectangular damper. Our dampers feature elliptical blades for a more linear response and consist of two steel blades fastened together separated by an air tight neoprene gasket for quiet operation. See table 2.1 AVD/STA capacities in the Equipment section for sizing information.

Bypass Damper

As the individual zone dampers modulate close during a heating or cooling demand, the static pressure in the remaining zones would normally increase proportionately. The Relief Air Damper (RAD) modulates to maintain a constant static pressure by relieving or bypassing the system air back to the return air inlet or ceiling space.

RAD bypass dampers, like the zone dampers, are available in 6", 8", 10", 12", 14" and 16" round sizes or any custom rectangular size. See table 2.2 RAD Capacities in the Equipment section for sizing information.

Starcom Hub and Building Software

Each SZM-4000 Master control panel can communicate via a 3-wire RS485 communication bus back to the Starcom Hub. The Starcom Hub translates the RS485 signal to either an RS-232 serial or USB communication protocol for any PC-based computer. The Starcom Building Software communicates with each Master controller and provides a wide variety of options including trend logging, set point temperature override, occupied scheduling, and remote interface over the internet, damper maximum and minimum positions, and much more.

While the Starcom Building Software offers all of the features of a full energy management system at a fraction of the cost, what separates it most from all other systems is the easy-to-use, easy-to-understand interface. The Starcom Building Software was designed to be used by the end user, not a highly trained building maintenance technician.

TSA and TOA Sensors

The Temperature Supply Air (TSA) and Temperature Outdoor Air (TOA) sensors connect directly to the SZM-4000 Master control panel and allow the system to monitor both the outdoor and supply air conditions. The system operates more efficiently by controlling the first and second stages of heating/cooling to maintain a consistent discharge temperature.

Outdoor temperatures monitored by the TOA can be used to change the system's response for heating and auxiliary heating as well as to control the maximum air flow that individual zones receive during cooling.

Auxiliary Heat Control

Each zone damper contains a low voltage dry relay contact that can be used to interface electric or hot water baseboards, or duct heaters. The heat contact is controlled by the individual zone thermostat in conjunction with the SZM-4000 Master control panel allowing the design engineer the most flexibility when integrating supplemental heat sources.

Equipment

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

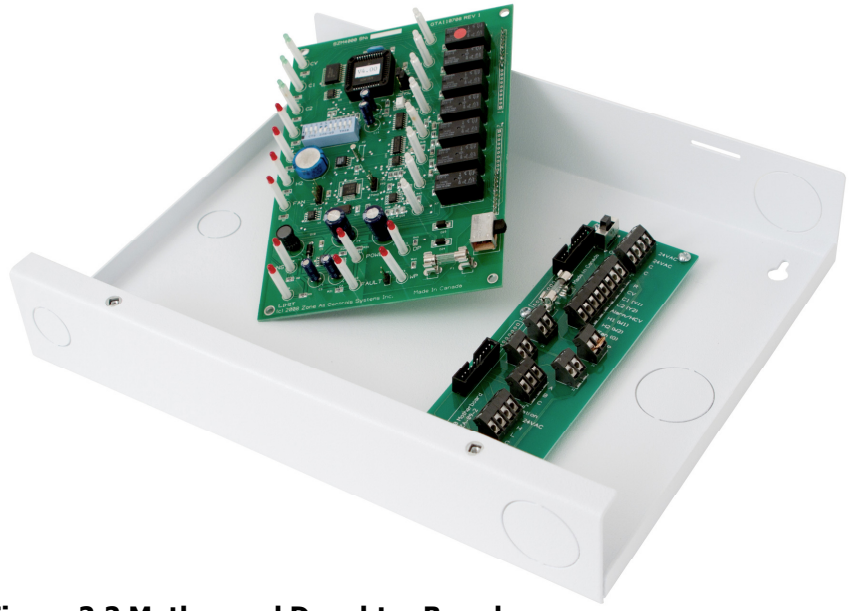


Figure 2.2 Mother and Daughter Boards

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.

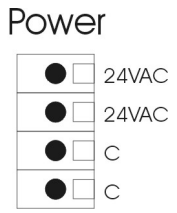
When the system is connected to a PC it may be necessary to re-serialize the board to match the board it replaced. This is accomplished by pulling down dip switch #10 and entering 'SET SERIAL NUMBER' under the 'SETUP' menu in the Starcom Building software. Once serialized it will be necessary to transmit 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

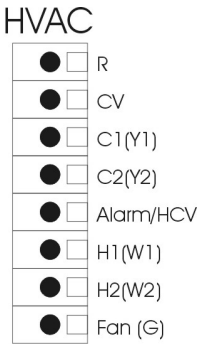
system. Should the motherboard require replacing carefully disconnect and isolate each wire. Remove the mounting screws and replace the board.

Motherboard Terminal Connections



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.

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.



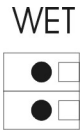
CV The CV terminal is energized whenever the Starzone system switches into unoccupied mode. The CV contact serves a different function when placed into Heat Pump mode.
While in Heat Pump mode the CV contact controls the cooling change over valve and will be energized shortly before any cooling demand.

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

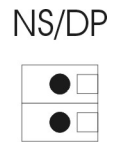
Alarm/ HCV The Alarm/HCV terminal serves different purposes in Rooftop and Heat Pump modes. When the system is in Rooftop mode the HCV terminal serves as an Alarm contact output.
While in Heat Pump mode this terminal is used for the Heating Changeover Valve contact and is energized shortly before any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

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

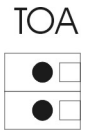
FAN The fan terminal is connected to the G or fan control of the AHU and is de-energized when the system switches to unoccupied mode.



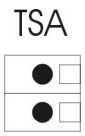
WET The WET port terminal is a non-polarized alarm contact terminal which can accept any 24VAC or DC alarm signal. When a voltage is detected a user defined message is displayed on the Starcom Building software, the alarm LED on the control panel will light, and the HCV alarm contact will energize provided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



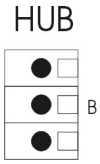
NS/DP The NS/DP (Night Setback/Dry Port Alarm) terminal serves a dual purpose. The default mode is to serve as a control input for Occupied/Unoccupied mode. When a dry contact closure is present (a closed switch for example) the system will operate in occupied mode, in the absence of a dry contact the 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.



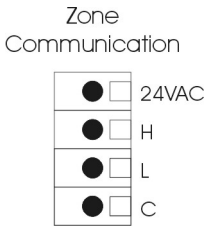
TOA The TOA (Temperature Outdoor Air) terminal is a non-polarized terminal for connecting the TOA sensor. Polarity does not matter however the conductor should not be shared with any other devices. Never combine the TOA sensor with the same cable used to connect the AHU.



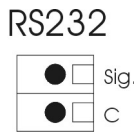
TSA The TSA (Temperature Supply Air) terminal is a non-polarized terminal for connecting the TSA sensor. Polarity does not matter however the conductor should not be shared with other devices. For example never combine the TSA sensor with a cable connecting the Bypass damper.



HUB 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 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 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.

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.

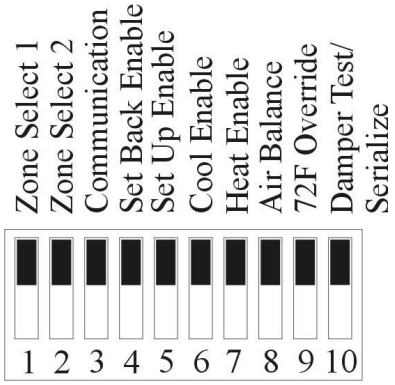


Figure 2.3 DIP Switch, Normal Settings

DIP Switch	Description
1, 2	**Zone Select -** 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	**Communication -** 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	**Set Back Enable –** This dip switch will disable the system from going into Night Set Back.
5	**Set Up Enable –** 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	**Cool Enable –** For heat only systems this dip switch can be used to disable the cooling.
7	**Heat Enable –** For cool only systems this dip switch can be used to disable the heat.
8	**Disable Air Balance –** 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	**72 Degree Override –** Enabling the 72°F (22°C) override locks the set point on all zone sensors to 72°F (22°C).
10	**Damper Test Mode –** 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.

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

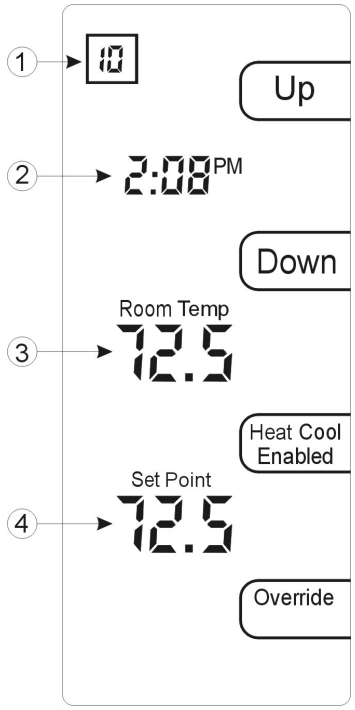


Figure 2.5 Display

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

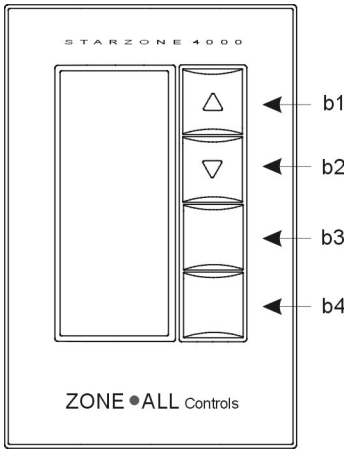


Figure 2.6 Thermostat buttons

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) View Parameters – The display panel located to the immediate left of the button indicates the thermostats current Heat/Cool mode, and whether this mode can be changed locally. A thermostat can be selected to operate as heat only, cool only, heat and cool, or no call (sub menue #9). If the stats mode has been overridden at the computer then the "enabled" will not be displayed and these setting cannot be changed locally.

Pressing the b3 button will toggle the display to indicate the current duct temperature.

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.

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 effect 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.

Menu Option #9 – Set Heat/Cool Mode

Provided “enabled” is displayed the heat/cool demand setting may be changed at the thermostat. This determines the thermostat’s ability to place the system into a heating or cooling demand. When a thermostat is configured not to generate a heating or cooling demand the associated damper will still operate to maintain the space temperature. These modes can be toggled using the b3 button. To exit this menu simply use the Up button (b1) to advance to the next menu and then exit using the b3 button.

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.
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 your computer's 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 and RX LED's will flicker as the Starcom Hub transmits and receives data from the Master Controllers.

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.

Table 2.1 AVD/STA Capacities

	AVD/STA Selection			
Velocity (fpm)	**800**	**1100**	**1500**	**2000**
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.

Table 2.2 RAD Capacities

	RAD Selection			
Velocity (fpm)	**1500**	**2000**	**2500**	**3000**
Model & Size (in.)	**CFM**			
RAD-6″	285			
RAD-8″	525			
RAD-10″	817	1090		
RAD-12″	1180	1572	1950	
RAD-14″	1600	2100	2625	3100
RAD-16″	2095	2790	3490	4180

Pd – Pressure drop in inches of water gauge. 0.35" w.g. pd
NOTE: Maximum recommended velocity is 3000 fpm

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

Engineering

Introduction

Reasons for utilizing a VVT system like the Starzone 4000 are initial cost savings, energy efficiency, reduced operating costs, and the ability to track varying or transitional loads.

The Starzone 4000 system has been designed to provide zoning capability to any AHU. If the system can be connected to an ordinary thermostat then it can be controlled by the Starzone 4000 system.

The biggest challenge facing any system is the ability to respond to different heating/cooling demands coming from the same area. The key to solving this problem is to remove the random nature of the demands. This ensures that there will only be one heating or cooling cycle for all areas allowing the system to spend the maximum amount of time in ventilation. The Starzone 4000 accomplishes this by the following methods.

Full two way communication with each zone

Because the Master control panel supports full send and receive communication with each thermostat, it does not rely on voting schemes, temperature averaging, or designating certain thermostats as “masters”. By allowing each thermostat to communicate individually with the Starzone Master we are able to respond to individual heating or cooling demands on a first-come-first-served basis.

Modulating control dampers

To control a diverse and changing load, the “random” nature of heating and cooling demands must be eliminated. It is essential to organize all of the heating or cooling zones into groups, so that each group becomes satisfied within the same timeframe. Because Zone-All dampers are capable of modulating, the system is able to satisfy all zones that require any amount of heat or cooling. Consequently, once a heating or cooling

cycle has completed, all zones including those that had not yet reached a demand state will have been satisfied.

Holding the demand zone open

When satisfying alternating heat/cool demands it is important to reduce the length of time the system spends in heating or cooling. The disadvantage of traditional VAV systems is that as the space temperature approaches the set point the damper begins to modulate closed, prolonging the heating or cooling cycle. The Starzone 4000 system is different. By holding the furthest demanding zones open, and only modulating the zones that are closer to set point, we decrease the amount of time the system remains in a heating or cooling cycle.

It should be noted that alternating heat/cool demands typically occur during spring and fall. During this time both the heating and cooling loads are significantly reduced. It is during this time the system will spend most of the time in a ventilation state waiting for either a heating or cooling demand to occur.

Ventilation

A problem with conventional VAV systems is that zones which do not require heating or cooling are driven closed or to a minimum position during a demand. What's missing is a ventilation cycle.

The Starzone 4000 system has been designed to solve this problem. Unlike a conventional VAV system, the Starzone 4000 system does not work to drive the zone dampers closed, but rather works to drive the system to its ventilation cycle. During the ventilation cycle all dampers are driven open, and while in occupied mode the fan is never turned off. The ventilation cycle is important for two reasons. First, fresh air that has been brought into the building during the heat/cool demand is distributed throughout the space. Second, the ventilation cycle helps to reduce temperature stratification because air is mixed throughout the space.

Power Requirements

The Starzone 4000 system is powered by a 40VA, 24VAC transformer. A maximum of 10 zones can be powered from the same transformer that powers the Master Control panel. If the Master has more than 10 zones, then additional zones should be supplied from a separate 40VA transformer.

Supplementary Heat

The Starzone 4000 is fully capable of controlling all forms of supplementary heat including electric or hot water baseboards and duct heaters. Supplementary heat can be added to a system for various reasons. Consideration however must be given not to create a situation where the supplementary heat conflicts with the space thermostat driving the space thermostat into cooling. Consequently it is recommended that whenever supplementary heat is used, it must be controlled by the Starzone 4000 thermostats.

A concern when using baseboard heat along the glass of an exterior zone, is that the zone thermostat, which is normally located on the opposite wall, cannot properly sense the conditions where the baseboard is located. To solve this problem we recommend placing a room sensor only (i.e., no zone damper) within 2–3 feet of the perimeter wall and setting this room sensor to "no call" so that it will not generate a heating or cooling demand from the AHU. This ensures that the baseboard heat is used only to eliminate the skin effect along the exterior walls. The space heating will still be done by the AHU.

Designing for Load Diversity

One of the primary advantages in designing a system with the Starzone 4000 system is its ability to take advantage of load diversity. Calculating for load diversity not only reduces equipment and installation costs, but also makes the system more energy efficient. Because the Starzone 4000 system, unlike other systems, features full two-way communication with all of the zone sensors, the Master is able to track or follow changing load patterns. This means the engineer does not have to size the cooling load for the sum of all the peak loads in every individual zone or space. Load diversity is defined as the ratio of the individual peak loads to the total peak load subjected to the system. Load diversity can be divided into two categories: climate and building orientation, and internal use.

Climate and Building Orientation

Varying loads can be presented as the sun moves across a building during the day. This changing load is even more dramatic in northerly and southerly locations when the sun is at a lower inclination. Consider a building with a northeast exposure in the morning: the zones in the east exposure will have a greater demand for cooling while the areas in the west exposure will not, resulting in them becoming satisfied more quickly.

As the sun moves from the east side of the building the AVD terminals sensing this increased load in the west will increase the air supply in the west while simultaneously satisfying and reducing the amount of air in the east exposure. If this same area were zoned with two separate HVAC units, each would have to be sized to deliver a constant demand matched to the peak load resulting in too much capacity during "off peak" times.

Internal Use

Loads can vary internally as people shift from one area of the building to another. This load shift allows us the opportunity to reduce the total cooling capacity of the system. Peak loading in an office building occurs at different times of the day, and depends on how areas such as offices, boardrooms, lunchrooms, and staff rest areas are used. For example, during the lunch period the lunchroom and rest areas will have peak loading while the offices and boardrooms will be at a minimum or reduced load.

A more extreme example might be a church having a worship and congregation area: during normal usage, all of the building's occupants will be located in one area or the other.

It is also important to recognize when a space would not qualify for diversity. Consider a training room when most participants come from outside the building. In these cases it may be necessary to consider either a dedicated unit or a supplementary system to augment the peak demands.

Load Calculation and Unit Selection

Today many software programs can be utilized to perform load simulations and they can be an excellent way to calculate the diversity present in a given area. While these programs can be very useful it is also important to understand how load diversity is calculated.

The first step is to calculate the base cooling loads for each zone, not including transitional or changing demands on the system. This will provide a base line load and will be added to the total capacity of the AHU. Next, for each individual zone, calculate the peak loads related to climate and building orientation, or internal traffic. Factoring for the "worst case" scenario (e.g. early morning southerly exposure plus boardroom filled to capacity) select the zone with the largest peak demand for a given period of time. This value, plus the baseline load previously calculated, provides the total size of the AHU. In many instances this total capacity is much less than the total capacity required if

each space were served by a dedicated unit each sized for the peak demand for that space.

Duct Distribution Sizing

The main supply branch must be sized to meet the air supply requirements of the main AHU. Individual branch ducts for each zone, however, must be sized to meet the air flow requirements during the peak demand period. For example if several spaces have a total peak load of 7-½ tons of cooling, but, after factoring in diversity, a 5-ton unit is selected, the individual zone branch ducts would be sized as though they were connected to a 7-½ ton unit while the main supply branch is sized for the 5 ton unit.

RAD Damper Selection and Setup

Selecting the correct RAD bypass damper follows the same guidelines as described in Chapter 2 Equipment, Table 2.2.

The setup of the RAD must be done to ensure that the peak static pressure is maintained and not the ventilation rate. To determine the correct static pressure in the main duct, select a group of AVD zone dampers that equal the total CFM capacity of the AHU. In the previous example if the branch duct's total 7-½ tons of cooling are connected to a 5-ton unit, 2-½ tons or 1000 CFM of air would be closed. Now the remaining capacity of open AVD zone dampers matches the actual size of the AHU. This also matches the reference static pressure that must be maintained within the main supply. Consequently while the duct work may be sized for 7-½ tons the bypass damper must match the AHU and maintain the static pressure that would be present when a maximum of 5 tons (2000 CFM) of air is being delivered.

Air Balancing

Air balancing is a little more involved when working with a system that has diversity because the total load is greater than the capacity of the unit. For example when the AHU is sized equal to the load (i.e., no diversity) the system is air balanced by opening all of the zone dampers, ensuring the bypass damper is fully closed. In this case, the capacity of the open zones equals the capacity of the AHU. Similarly when diversity is applied it is necessary to ensure that air balancing is performed while the open zones equal the capacity of the AHU. This means that air balancing will be performed in two steps. First a group of zones is selected that matches the

total capacity of the AHU. All other zones are fully closed. Air balancing is performed ensuring that the designed air flows are established in each of the open zones. The next step is to open the previously closed zones and select a number of zones from the previously balanced section to close. Once these zones have been adjusted the system is now fully air balanced.

Applications

This section has been removed.

Communications

5.0 Introduction

Figure 5.1 Starcom Hub Software

The Starcom building software is used with the Starcom Hub to allow an IBM compatible PC to communicate with one or more Starzone 4000 Master controllers. The Master controllers are stand alone units and do not require the software interface to operate. The software is used only to receive and transmit information from the controllers to the PC.

The IBM compatible PC is connected via a 3-wire RS-485 communication bus to the Master controllers through a Starcom Hub.

5.1 Minimum System Requirements

IBM PC or compatible with Windows XP or newer.

CD-ROM Drive, mouse, and keyboard

External serial com port **or** USB port

Internet access (Recommended)

5.2 Main Starcom Features

The following lists just some of the features provided when interfacing the Starzone 4000 system to a PC:

- Thermostat set point override
- Access to thermostat set point and ambient temperatures.

- Occupied scheduling for night set back including holiday scheduling.
- Graphical trend logging.
- Error and problem search
- Master, zone, group database reports in printed format.
- Auto-create zone database
- Thermostat demand capability: heat/cool, cool only, heat only, no call
- Ability to set damper max and min position separately for heating, cooling and ventilation
- Access to damper positions and required positions
- Access to discharge air and outdoor air temperatures

5.3 Quick Start

Table 5.1 How Do I?...

To...	See...
View all or sections of thermostat temperatures and set points	5.7.1 Zone Scan
Adjust thermostat set point remotely from computer	5.6.2 Zone Setup
Set occupied/unoccupied times and holiday schedule	5.6.3 Group Setup
Troubleshoot problems or respond to temperature complaints	5.7.1 Technical support: (204) 774-1665.
Start trend logging and view graphs Initiate trend logging View Trend Log	5.8.1 Trend Logging 5.7.2 Trend Logging
Download past 24-hour trend log	5.7.2 Trend Logging
Adjust damper max and min positions	5.6.2 Zone Setup
Edit rooftop or heat pump settings	5.6.1 Master Setup
Set individual thermostats to heat/cool, heat only, cool only, or no call	5.6.2 Zone Setup
Set individual masters to heat/cool, cool only, or no call	5.6.1 Master Setup
Install software and connect Starcom Hub Software Installation Connect Starcom Hub Configure correct com port Create Master database Create Zone database (auto zone create recommended) Set Occupied/Unoccupied times and holiday schedule	 5.4 5.10.2 (5) 5.10.2 (4) 5.6.1 5.6.2 5.6.3

5.4 Software Installation

Installing the Starzone building software is fully automated making installation as easy as possible. Follow the steps below and our installation software will guide you through the entire setup procedure.

1. Make certain that the Starcom Hub is connected to an available com port or USB port, and correctly wired to the Master controllers. See section 4.0
2. Close out all software programs to ensure that no information will be lost.
3. Insert the installation CD and from the START menu run the program INSTALL.EXE

5.5 Main Menu <FILE>

LOG IN Not required if program is not password protected (See Starcom Setup Section 2.6.4). When the program is password protected the user must enter a User Name and Password to edit or change the Master, Zone or Group data. (Note: User name can be any name you choose to identify yourself)

LOG OUT Not required if program is not password protected. When the program is password protected logging out will prevent unauthorized access to change the Master Zone or Group data.

BUILDING Not required if a PC is used to access only one building or system. When multiple buildings are accessed through the same software program, the Building menu option allows the user to switch between different building databases, and delete old or unused databases.

PRINTER SETUP Allows user to adjust local printer settings.

PRINT DATABASE This menu option allows the user to view and print a summary of the current database including any changes that have been made to the default settings.

EXIT Exits program

5.6 Main Menu <EDIT>

5.6.1 Master Setup

The Master Setup menu, Figure 5.2, is used to create, view, and edit information relating to each Master controller.

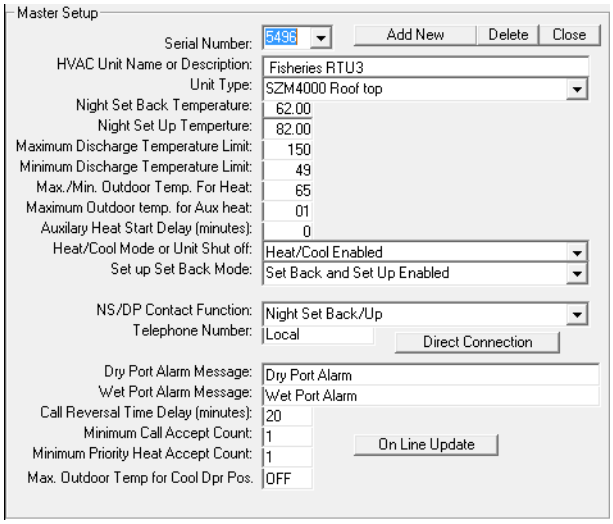


Figure 5.2 Master Setup

Each AHU unit has a Master controller so any information relating to the control of these units can be found in the Master Setup database. The following settings in Table 5.2 are usually performed during installation and will not need to be adjusted later.

Table 5.2 Master Setup

Field	Description	Default
SERIAL NUMBER	To create a Master enter the serial number of the Master controller and press the [Add New] button. The serial number can be found on a sticker on the top relay on the Master Daughter board.	
HVAC UNIT NAME OR DESCRIPTION	Enter a name or description that best describes the HVAC unit that the Master controller is connected e.g., Fourth Floor SW Corner	
NIGHT SET BACK TEMPERATURE	Sets the temperature that each Master will allow the zones to drop to during unoccupied mode.	62°F
NIGHT SETUP TEMPERATURE	Sets the temperature that each Master will allow the zones to rise to during unoccupied mode.	82°F
MAX. DISCHARGE TEMPERATURE LIMIT	Sets the maximum discharge temperature that the Master will allow before initiating a High Limit Alarm	150°F (rooftop) 115°F (heat pump)
MIN. DISCHARGE TEMPERATURE LIMIT	Sets the minimum discharge temperature that the Master will allow before initiating a Low Limit Alarm.	49°F
MAX/MIN OUTDOOR TEMPERATURE FOR HEAT	**Rooftop** - Sets the maximum outdoor temperature that a HVAC unit can operate in heating mode. **Heat Pump** - Sets the minimum outdoor temperature that an air to air heat pump unit can operate in heating mode. Below this temperature	Rooftop 65°F Heat Pump 35°F

Field	Description	Default
	auxiliary heat source should be controlled by the HP2H controller.	
MAX OUTDOOR TEMPERATURE FOR AUX. HEAT	At temperatures above the maximum outdoor temperature, the auxiliary heat is turned off. Auxiliary heat is any heat source such as duct heaters or electric baseboards that are controlled by the auxiliary heat contact on the damper Motor Controller board.	OFF
AUX. HEAT START DELAY	Setting is in minutes and determines how long auxiliary heat sources controlled by the thermostats will remain off, after the Master comes out of unoccupied mode.	0 minutes
HEAT/COOL MODE AND UNIT SHUTOFF	Switches Master controller between Heat/Cool, Heat or Cool only and unit shutoff.	Heat/Cool
SETUP/ SETBACK MODE	Enables/Disables Setup and Setback. Set up refers to allowing the space temperature to 'Rise Up' while set back refers to allowing the space temperature to 'Fall Back' during unoccupied mode.	Setup/Setback Enabled
NS/DP CONTACT FUNCTION	Selects NS/DP port on the Master controller to serve as either Night Setback or Dry Port Alarm input.	Night Set Back UP
TELEPHONE #	Enter the phone number for remote connections when the system is being remotely operated by a modem. Otherwise press the [Direct Connection] button when accessing the system locally.	Local
DRY PORT ALARM MESSAGE	Enter the message you wish to be displayed when a Dry Port Alarm occurs.	"Dry Port Alarm"
WET PORT ALARM MESSAGE Default:	Enter the message you wish to be displayed when a Wet Port Alarm occurs.	"Wet Port Alarm"
CALL REVERSAL TIME DELAY	Sets the delay in minutes that an individual thermostat will not be able to switch from Heat into Cool or Cool into Heat. Delay is automatically reset when the thermostat's set point is changed.	20 minutes
MIN CALL ACCEPT COUNT	Sets the minimum number of thermostats that must generate a demand before the Master will switch into Heating or Cooling.	1
MIN. PRIORITY HEAT ACCEPT COUNT	Sets the minimum number of thermostats that must generate a priority heat demand before the Master will switch out of cooling and into a heat demand.	1
MAX. OUTDOOR TEMP FOR COOL DAMPER POSITION	This setting is used in conjunction with the Max Damper Position for cooling found in the zone setup menu. This allows the user to set what outdoor temperature the max. damper position for cooling	OFF

Field	Description	Default
	will take effect. Below this temperature the zone dampers will only open to the max. cool position set in the zone setup menu. When the outdoor temperature is above this setting the zone dampers will drive to the full open position. When a TOA sensor is not present or if this setting is set to 'OFF' then the maximum position for cooling will always be maintained.	

5.6.2 Zone Setup

The Zone Setup screen, Figure 5.3, is used to create, view, and edit information as it relates to each zone. A zone is considered to be the area controlled by a zone damper and its thermostat.

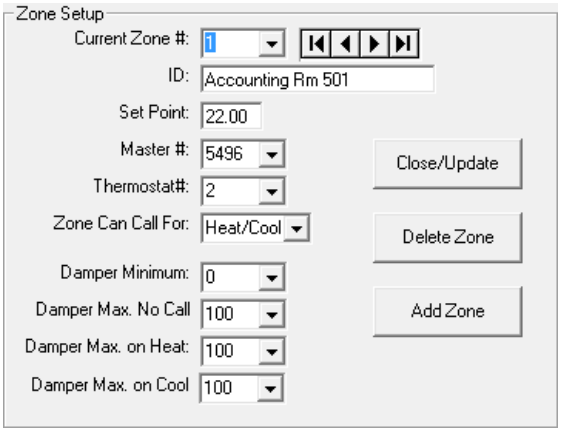


Figure 5.3 Zone Setup

The following settings in Table 5.3 are usually performed during installation and will not need to be adjusted later.

Table 5.3 Zone Setup

Field	Description	Default
CURRENT ZONE #	Zone numbers must be consecutive starting at one. To add a new zone enter the zone number and press the [Add New] button. When creating a new database it is recommended to use the [Auto Create] feature found under the Edit Zones menu option. When using auto create simply create zone #1 which will be used as a model for the rest of the zones then press the [Auto Create] button.	
ID	Enter a name or description that best describes the area which is controlled by the zone; e.g., Mr. Smith's Office	
SET POINT	Enter the desired set point temperature when overriding the set point control on a thermostat. If the thermostat's	OFF

Field	Description	Default
	set point is to be controlled from its location then enter the letter 'O' for OFF.	
MASTER#	Select from the drop down box the master's serial number to which the thermostat is connected.	
THERMOSTAT#	Select from the drop down box the thermostat channel number. Each master controller has a total of 32 channels for a total of 32 thermostats that can be connected to any one Master controller.	
ZONE CAN CALL FOR	Selects the thermostat's demand capabilities. Options are Heat/Cool, Cool only Heat only, or No Calls. If 'No Calls' is selected the thermostat and damper will continue to operate as a stand alone unit. The thermostat cannot generate a heat or cool demand, if the system is in heat while the space requires heat, the damper will modulate open accordingly. The same is true for cooling.	Heat/Cool
DAMPER MINIMUM	Sets the damper's minimum position for all modes of operation. This adjustment is made when minimum ventilation amounts are required. The setting of minimum positions in heat/cool systems is not recommended.	0%
DAMPER NO CALL MAXIMUM	Sets the damper's maximum position during ventilation mode when there is neither a heating nor cooling demand coming from the Master controller.	100%
DAMPER MAX. ON HEAT	Sets the damper's maximum position when the Master is in a heating demand.	100%
DAMPER MAX. ON COOL	Sets the damper's maximum position when the Master is in a cooling demand. When an outdoor air sensor is connected to the master this maximum position will only take affect when the outdoor air temperature is below the Max. Outdoor Temp for Cool Damper Position setting found under the Master Setup menu.	

5.6.3 Group Setup

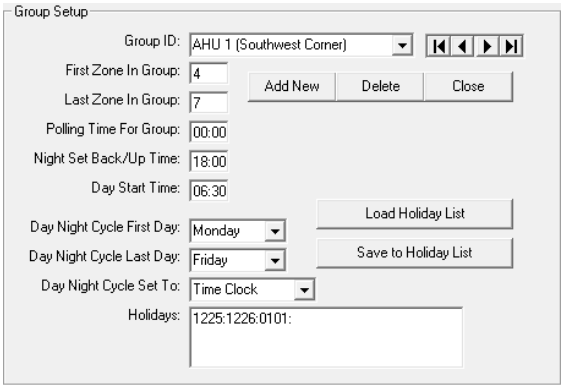


Fig 5.4 Group Setup

A group refers to a collection of Master Controllers (Figure 5.4) that are encompassed between a starting and ending number of zones. Any information relating to the user defined collection of Masters can be viewed and edited from the group setup. The Group Setup form (Table 5.4) can be used to configure an area's occupied/unoccupied setting, holiday schedules, etc.

Table 5.4 Group Setup

Field	Description	Default
GROUP ID	Enter a name which best describes the collection of Masters which will be represented by this group. e.g., Fourth Floor. To create a new group enter the Group ID then press the [Add New] button.	
FIRST ZONE IN GROUP	Enter the zone number which corresponds to the first Master controller which will be encompassed within the group.	
LAST ZONE IN GROUP	Enter the zone number which corresponds to the last Master controller which will be encompassed within the group.	
NIGHT SET BACK/UP TIME	Enter the time (24HR) that the Masters contained within the group will enter Unoccupied mode. 00:00 represents off.	00:00 (OFF)
DAY START TIME	Enter the time (24Hr) that the Masters contained within the group will enter Occupied Mode. 00:00 represents off.	00:00 (OFF)
DAY NIGHT CYCLE FIRST DAY	Select the day of week that the Masters contained within the group will enter Occupied Mode.	Sunday
DAY NIGHT CYCLE LAST DAY	Select the day of week that the Master's contained within the group will enter Unoccupied Mode.	Sunday
DAY NIGHT CYCLE SET TO	Select whether Masters contained within a group will operate from the internal time clock or be forced to Occupied or Unoccupied mode.	Time Clock

Field	Description	Default
HOLIDAYS	Enter the holiday information that will determine what days the Masters will enter Unoccupied mode. Format information as MMDD; e.g., 1225;0101 Holidays can be saved and used for other groups.	

5.7 Main Menu <VIEW>

5.7.0 Master Status

"View Master" allows the user to scan a Master controller and all of its connected thermostats. See Figure 5.5.

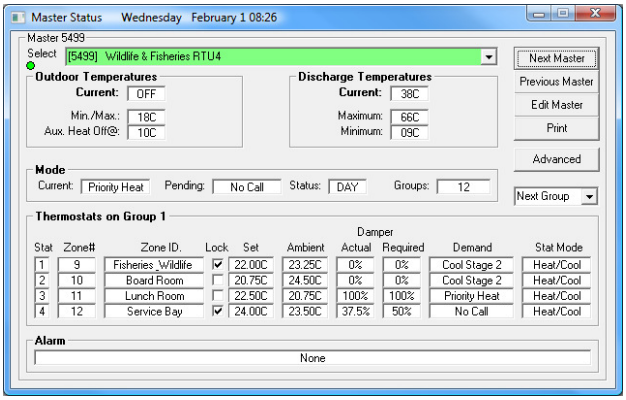


Figure 5.5 Master Status

Viewing a Master controller is useful during system start up and troubleshooting to determine what the Master controller is doing and what parameters have been set. The discharge air temperature should be compared to the Master's current mode of operation to ensure the HVAC unit is discharging the correct air temperature.

5.7.1 Zone Scan

A "Zone Scan" (Figure 5.6) allows the user to view all of the current information relating to a zone (thermostat and damper) from a starting zone number to an ending zone number.

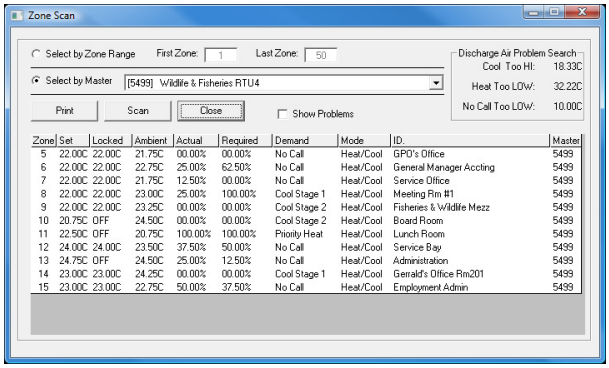


Figure 5.6 Zone Scan

The user can select the zones that correspond to selected masters or any group of zones desired. The default first and last zones are the first and last zones in the zone database allowing the user to view the operation of the entire building. By double clicking on any zone the user can view the Master controller that corresponds to that zone. Checking the “Show Problems” check box initiates a problem check mode where the computer scans the selected information searching for problems. Thermostats that appear in the database but read ‘N/A’, missing controllers, or discharge temperatures that do not match the current demand are all flagged as possible problems.

Note: When the problem check mode detects a discharge temperature that does not match the current HVAC mode, ensure that the unit has not just recently switched into or out of heating or cooling. A problem only exists if the same warning message is displayed over a significant period of time (10–15 minutes). Warning messages that appear only for a short period of time should be ignored.

5.7.2 Trend Log

When the “Trend Log” function is activated (see Trend Logging) the user can view information, as shown in Figure 5.7, relating to the thermostats (set point and ambient temperatures) and information relating to the HVAC unit (Outdoor Air, Discharge Air, Unit Demand) in a graphical format. Before viewing a graph the user must select the graph file from the <File> menu at the top of the graph form.

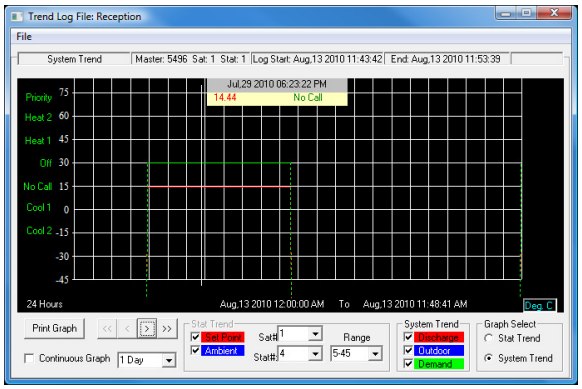


Figure 5.7 Trend Log

If you would prefer to download the past 24 hours of operation from the controller select the <File> menu at the top of the graph form, then select download. You will be prompted to enter a file name which must end with the extension '.log'. Next you will be prompted to select the Master you wish to download and for what time period. Once the graph has been created you can view it by selecting the graph file from the <File> menu.

5.7.3 Dumb Terminal

"Dumb Terminal" mode, Figure 5.8, makes the computer act as a dumb terminal for troubleshooting purposes. When placed in dumb terminal mode any information transmitted to the selected com port will appear on the screen. Also, any information typed on the keyboard is transmitted to the comm. port.

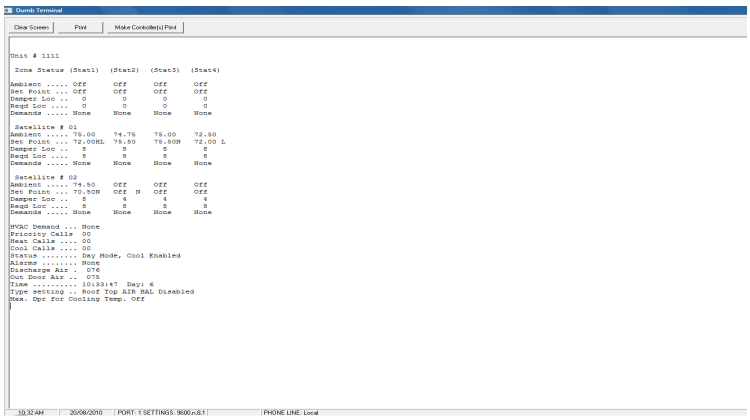


Figure 5.8 Dumb Terminal

When a communication problem occurs, perform the following checks to isolate the problem:

1. Turn the Master controller off, then on again. On power-up the Master should immediately perform a memory dump. The receive light on the

Starcom Hub will flash indicting the information has been received and the information should appear on the screen. (**Note**: On power up the Master dumps its memory immediately and every two minutes thereafter.) If the information appears correctly on the screen proceed to Step 2. If no information appears on the screen, check that the receive (RX) light on the Starcom Hub blinks on power up. If the light does not blink there is likely a wiring problem between the Master and the Starcom Hub. If the receive light blinks but no information is displayed on the computer, check that the correct com port is selected.

2. Randomly type characters on the keyboard. Check to see if the transmit light on the Starcom Hub blinks whenever a key is pressed. If the light does not blink and the correct com port is selected there may be a problem with your computer or USB cable.

5.7.5 Show Communications

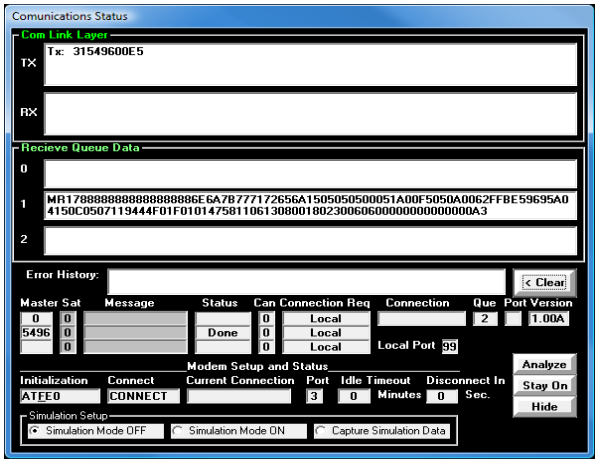


Figure 5.9 Show Communications

The "Show Communications" screen (Figure 5.9) monitors the communication between the Master and the Starcom software. The information displayed is only provided as a troubleshooting aid when diagnosing problems with Zone All Control's Technical Support.

5.8 Main Menu <SETUP>

Update Masters (Figure 5.10) allows the user to transmit the information from the computer's database to any or all of the selected Masters. The update function should only be performed when changes have been made to either the Master, Zone or Group databases, or if a Master controller or thermostat has been replaced.

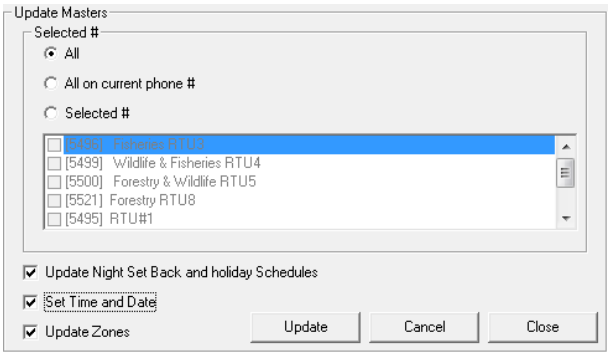


Figure 5.10 Update Masters

When exiting any of the Setup menus, the Update Masters form is already filled out, changes can be saved by pressing the Update button.

5.8.1 Trend Logging

The trend log menu, Figure 5.11, allows the user to enable or disable the trend log feature as well as select which Master controller will be logged.

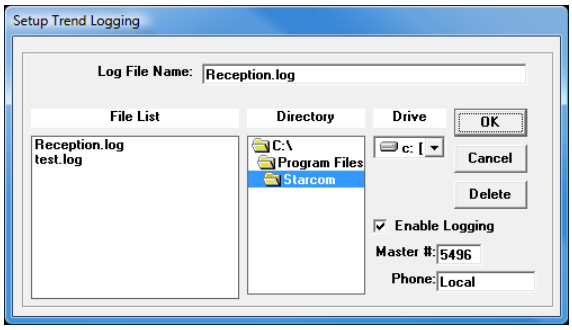


Figure 5.11 Trend Logging

Remember that the computer must remain on with the Starcom program running for trend logging to take place.

5.8.2 Set Serial Number

The Master controllers are serialized at the factory so serializing a Master controller in the field should not be necessary. Before a Master controller can have its internal serial number changed, dip switch #10 must be placed in the down position before the new serial number is transmitted to the controller. See Figure 5.12.

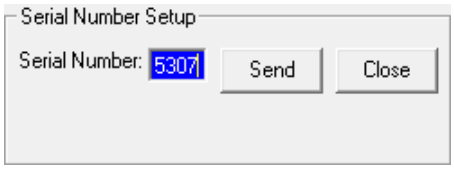


Figure 5.12 Serial Number Setup

Only one Master at a time can have dip switch #10 pulled down. Master controllers can have serial numbers ranging from 1000–9999. SC-100 controllers accept serial numbers from 1–999.

5.8.3 Starcom Setup

Starcom setup menu, Figure 5.13, contains the internal settings for the Starcom program. The user can select the appropriate com port for either the modem or local hub. From this screen Celsius or Fahrenheit temperature settings and displays can be selected.

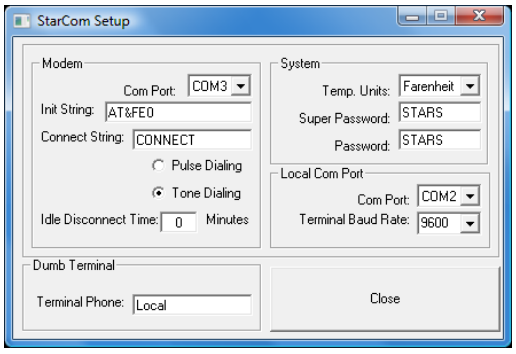


Figure 5.13 Starcom Setup

Settings relating to modem communication, baud rate, etc. are factory set and should not be changed.

5.9 Communications Network Description

5.9.0 Communications Starcom Hub Unit

Communication is accomplished using a serial port on the PC. When directed by the PC to communicate with the Starzone 4000 system the Starcom Hub translates serial information at 9600 baud from the PC to the Starcom signal levels on the Starcom Hub. On the system side of the Hub, Masters can be daisy chained using only 3 wires for communication. Up to 100 Masters can be connected to a single Hub and the total run length can be up to 2000 feet.

5.9.1 LED Indicators

PWR – On continuously once power supply has been connected

RX – Receive from masters - flickering

TX – Transmit from IBM PC - flickering

5.9.2 Hardware Start-up

1. Connect all Master controllers together by wiring the AB&C terminals in parallel. Communication wire can be any unshielded, twisted, 3-wire, minimum 22 gauge.
2. Once all the master are connected, connect the Starcom Hub's ABC terminal to the ABC terminal of the closest Master controller.
3. Plug the power supply adaptor provided with the Starcom Hub into a wall outlet and plug into the DC jack on the Hub. Check to ensure that the power LED is on.
4. Turn on one Master only and monitor the Rx LED on the Starcom Hub. The LED should flicker approximately every 2 minutes when the Master controller performs its memory dump.
5. Install the Starcom Hub software in the PC and from the <SETUP> menu select <STARCOM SETUP>. Then select the correct comm. port.
6. On the Starcom CD there is a folder called "USB Driver". Open this folder and run the program. Now plug a USB cable between the computer and the Starcom Hub. Windows should recognize the Hub and automatically install it. From the Windows Control Panel under 'System' right click the comm. port and select properties then change the assigned comm. port to any available port between 1 and 8. Ensure that the selected comm. port is not being used by another application.
7. From the main menu select <VIEW> and then select <DUMB TERMINAL>. Every 2 minutes when the Master controller performs its memory dump, information should appear across the screen.
8. Step #6 confirms that the Starcom Hub is connected properly. You are now ready to fill in the Master, Zone and Group database. See section 5.3 'Quick Start' for more information on setting up the Master, Zone and Group databases.

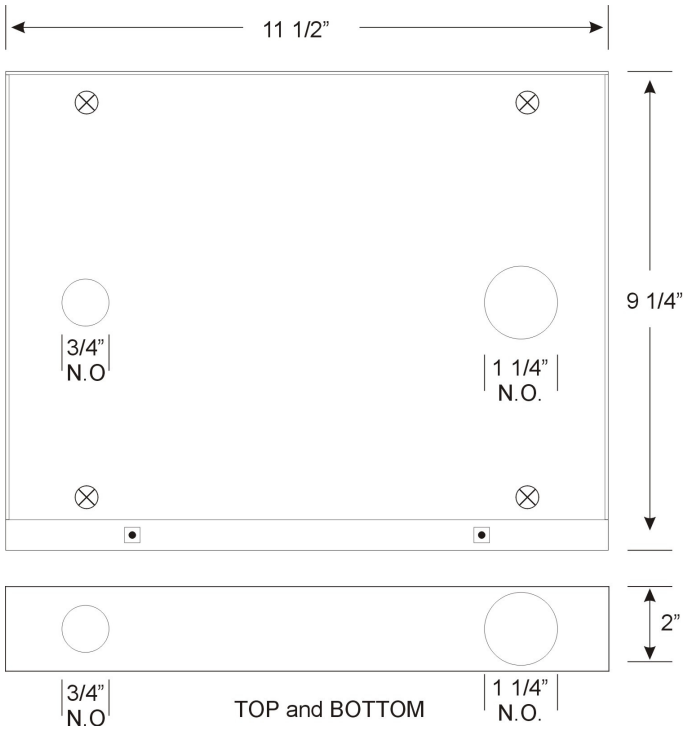
Submittals

SZM-4000 Master Controller

Specifications

Construction	18 gauge painted steel case. Cover is connected with thumb screws
Dimensions	Height 9 ¼" (235 mm) Width 11½" (292 mm) Depth 2" (51 mm)
Power	24VAC/40VA transformer provided with controller
Max No. Zones	32
Temperature Range of operation	15°F to 170°F (–9°C to 70°C)
AHU Interface	Seven electrically isolated relays 1 x fan, 2 x cool, 2 x heat, 2 x heat/cool changeover valve (heat pumps)
Time clock	Capacitor backup

Dimensions

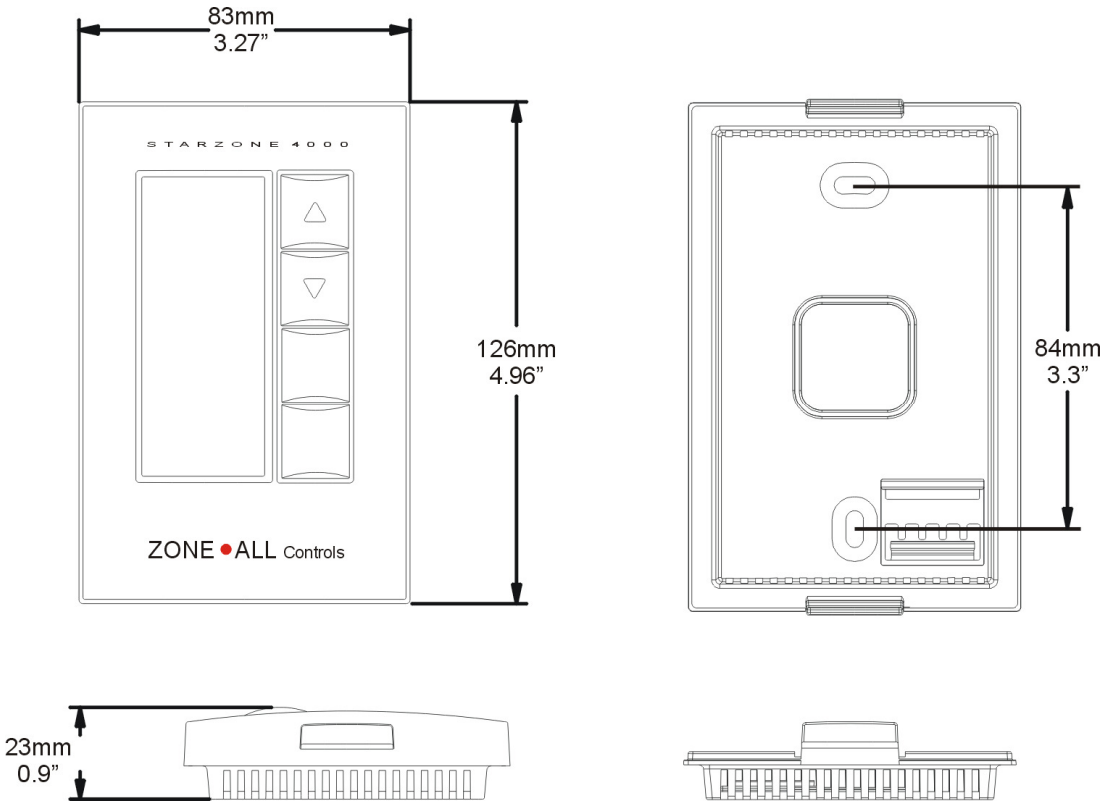


Model SZT-4000 Thermostat

Specifications

Construction	White injection molded plastic
Dimensions	Height 4.96" (126 mm) Width 3.27" (83 mm) Depth 0.9" (23 mm)
Power	12 VDC supplied from damper actuator
Dead band	2°F or 1°C
Set Point Range	66°F to 80°F (19°C to 27°C) or 68°F to 77°F (20°C to 25°C) default

Dimensions

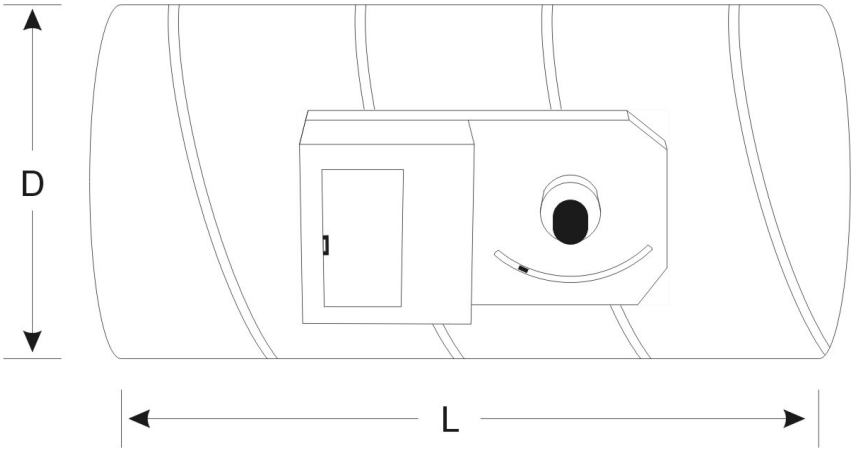


Model AVD Zone Dampers

Specifications

Construction	Coated steel, spiral pipe with riveted motor support plates meeting ASHRAE and SMACHNA standards. Spiral pipe 22 gauge steel
Bearings	Two brass bushings
Power	24 VAC
Actuator	3-wire floating powered open powered close

Dimensions



Capacities

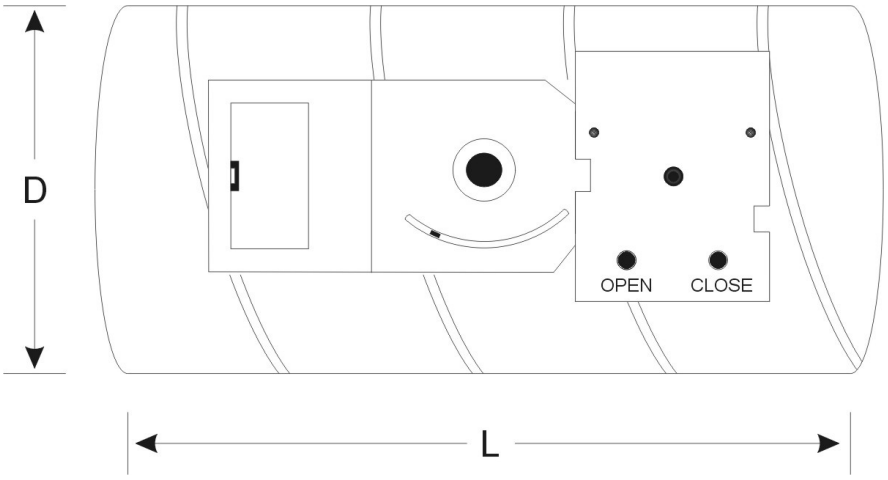
Diameter	Length	Recommended Range (CFM)
6″	12″	0–216
8″	12″	216–385
10″	12″	385–600
12″	18″	600–1180
14″	18″	1180–1604
16″	20″	1604–2095

Model RAD Bypass Dampers

Specifications

Construction	Coated steel, spiral pipe with riveted motor support plates meeting ASHRAE and SMACHNA standards. Spiral pipe 22 gauge steel
Bearings	Two brass bushings
Power	24 VAC
Actuator	3-wire floating powered open powered close
Static Pressure Sensor	Switch response ranges from 0.1"SP to 5"SP

Dimensions



Capacities

Diameter	Length	Recommended Range (CFM)
6″	12″	0–285
8″	12″	285–525
10″	12″	525–1090
12″	18″	1090–2000
14″	18″	2000–2670
16″	20″	2670–3490

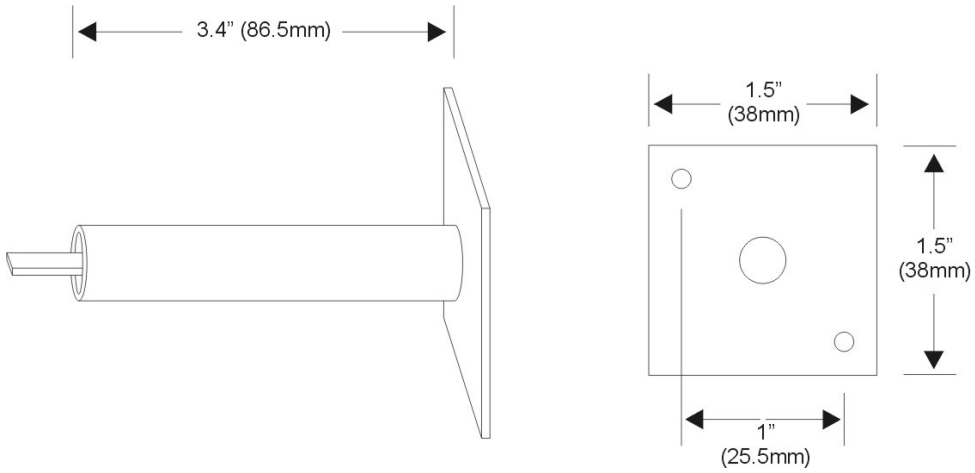
Supply Air and Outdoor Sensors

TSA Supply Air Sensor

Specifications

Construction	Anodized aluminum base, aluminum probe with 10K ohm thermistor sensor
Installation	Base and holes are compatible to mount inside a standard 2½" X 4" electrical box
Wiring	Sensor is provided with 6" of stranded 22 gauge wire which can be tied to any 2-wire, non-shielded cable. Do not combine TSA sensor with any other electrical device on cable

Dimensions

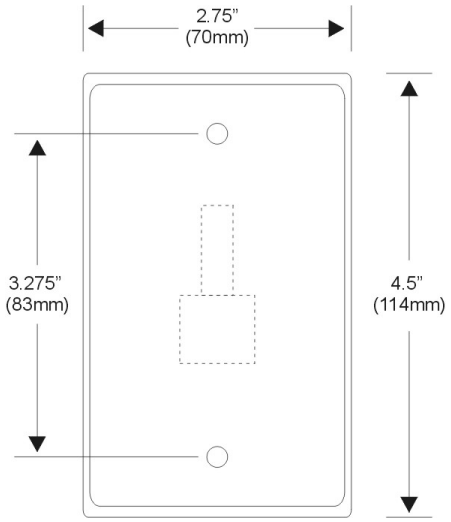


TOA Outdoor Air Sensor

Specifications

Construction	Stainless steel plate with 10K ohm thermistor sensor
Installation	Stainless steel plate is mounted as cover onto a standard 2½" X 4" electrical box (included).
Wiring	Sensor is provided with 6" of stranded 22 gauge wire which can be tied to any 2 wire non-shielded cable. Do not combine TOA sensor with any other electrical device on cable.

Dimensions

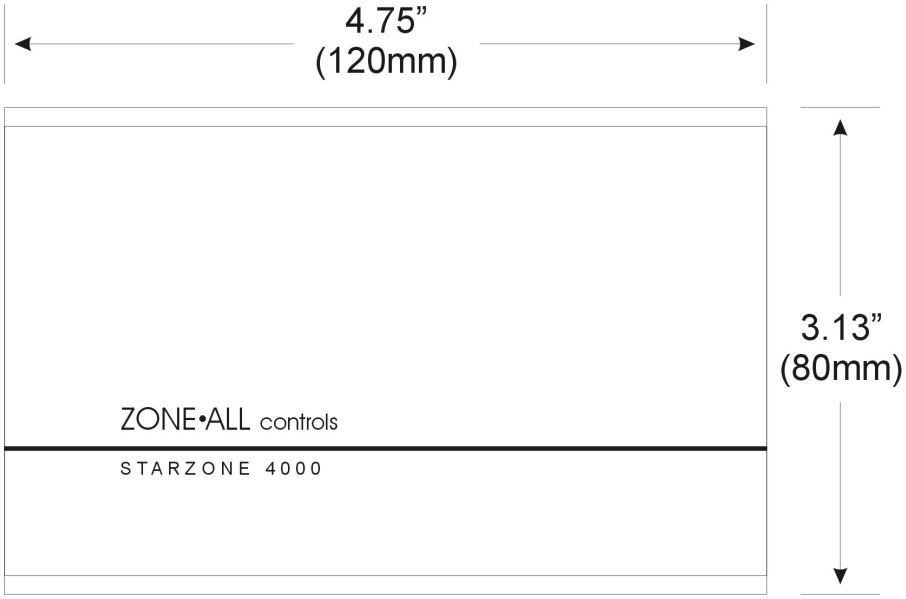


Starcom Hub

Specifications

Construction	Extruded plastic base c/w painted steal cover plate
Power	12VDC – Power Adaptor included
LED Indicators	Transmit, Receive, Power
Starcom Building Software	Included compatible with Windows XP, Vista, Seven, and Eight
Communication	USB, RS485, and SCOM

Dimensions



6.8 Submittals

Installation

Figure 7.1 shows the wiring diagram of the complete Starzone 4000 system.

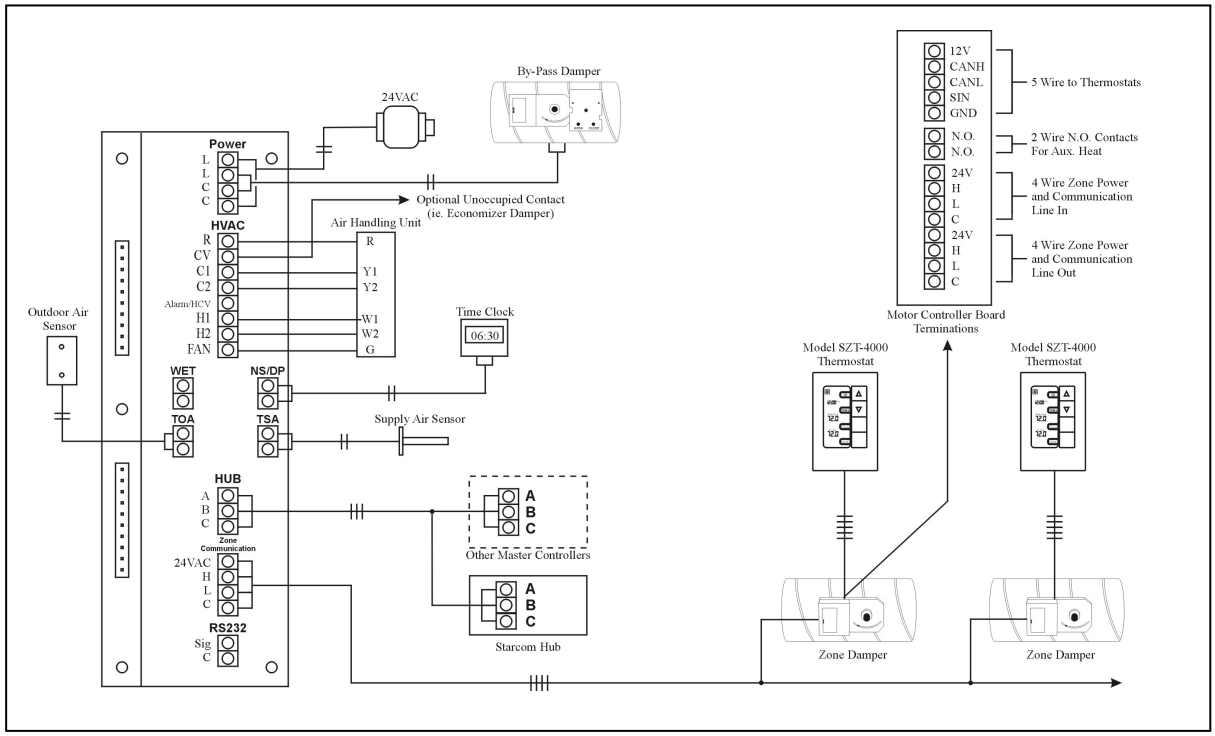


Figure 7.1 Wiring Diagram

Acceptable Control Wire

When selecting an appropriate control wire to use with the Starzone 4000 system, several factors must be considered. Wire jacket and insulation must meet local and federal standards for fire code and electrical isolation.

Non-shielded, twisted, 18 gauge solid 'Control' or 'Fire Alarm' wire is generally recommended although lighter gauges of wire can be used as well. Wires or cables designed for audio, telephone, video, high frequency

data communications etc, are not designed for control applications and are not recommended.

Start-up Procedure

An important part of any installation is the start up procedure where any wiring or component problems are discovered and corrected. The following steps will ensure the Starzone system is installed and operating correctly. When performing your first start up, or if you have any questions, please do not hesitate to contact Zone-All Control's technical support department. A complete operations and maintenance manual can be found on the inside cover of each Master control panel.

When performing a start-up at a remote or distant location it is a good idea to have spare parts. Spare circuit boards provide a quick method of isolating problems, and confirming whether or not a part is defective. The spare parts required depend on the kind of equipment being installed. If you require any spare parts for a start-up please contact our service department.

The following steps are required for a start up:

1. With the daughter board removed, measure all contact points against each other ensuring there are no shorts. Sometimes an impedance will be measured for a short time increasing in size before becoming an open circuit. This is usually a filter capacitor in the circuitry and is normal.
2. Confirm the wiring is correct for the thermostats and motor controllers. Double check to ensure the 24VAC and communication wires have not been reversed.
3. Measure the impedance across the TSA and TOA sensor inputs. The impedance should be approximately 10K ohms. Ensure both the TSA and TOA sensors have their own cable. If either sensor is using a cable that contains wires with 24VAC, this can affect the sensor's accuracy.
4. Confirm 24VAC at the L & C terminals before turning power on. Voltages as high as 29VAC are normal.
5. After turning the power on, all damper lights will turn green for at least 4 minutes indicating the dampers are opening. The fan should turn on and stay on. It is now necessary to set the channel and zone number for each thermostat. See the following sections for instructions. The ambient values may be a few degrees low until the thermostats have had a chance to warm up. Also, ensure the Master is

in day mode, there are no alarms, and the TSA and TOA are working properly.

6. After 4 minutes have elapsed locate the dip switches on the Master and pull dip switch #8 down to place the system into air balance mode. The zone dampers, which should have opened during the power-on sequence, should all be in the fully open position. Once you have visually confirmed all the dampers are fully open, pull down dip switch #'s 9 & 10. All of the damper lights should turn red and all of the dampers should drive to the fully closed position. It is recommended to disconnect the AHU's 'R' wire to ensure that the fan is not running while all zone dampers are being driven fully closed.

Thermostat Setup

After confirming power and wiring as described in the previous section it is safe to plug in all of the thermostats. Initially all thermostats will come from the factory programmed to channel 1. The channel number (1-32) serves as the thermostats address number for the Master controller so each thermostat must be given a consecutive and unique number. To set the channel number enter the sub-menu by simultaneously pressing and holding both the UP and DOWN buttons. Using button #4 scroll through the menu options until you reach sub-menu option #4. The thermostat's channel number will blink in the top left corner. Using the UP and DOWN buttons set the thermostat's channel number.

When there are more than 1 Master controllers in a building it is often desirable to label each thermostat with a zone number ranging between 1-99. This zone number is for visual and identification purposes only and does not affect the operation of the system. If you do not want to have the zone label displayed set the value = 0. Setting the zone label is accomplished by selecting sub-menu option #7. Using the UP and DOWN buttons select the zone label you wish to be displayed.

You may exit the sub-menu and return to the main screen at any time by pressing button #3. All segments on the display will show for a short period of time indicating you are returning to the main screen.

Bypass Damper Setup

Now that all of the zone dampers have been confirmed operational, you are ready to set up the bypass damper. The following provides a brief summary on setting up the bypass damper; a more detailed instruction sheet for air balancing the system is attached to each bypass damper.

1. Locate the set screw adjustment on the bypass damper and turn it CCW until the green LED turns on indicating the damper is opening. Once the damper has fully opened, turn the set screw CW until the red LED comes on and allow the damper to drive to the fully closed position.
2. Pull dip switch #8 down on the Master control panel. This places the system into Air Balance mode. Before balancing the system ensure all AVD dampers are fully open, and the bypass damper is fully closed.
3. Slowly turn the adjustment screw CCW just to the point where the green LED comes on and the damper begins to open, then back off the adjustment until the LED turns red. The objective is to have the set screw adjustment as close to opening the bypass damper as possible while still remaining fully closed. At this point even the slightest increase in static pressure will cause the bypass damper to open thus maintaining the correct static pressure.
4. If the bypass damper is rapidly switching back and forth it may mean the static pressure switch is located too close to an elbow, at the end of the plenum, or near some other turbulent location. It may be necessary to extend the sensing tube farther down the duct where there is less turbulence. The tube should not be extended farther than 10 feet from the static pressure sensor.

Troubleshooting/Replacing the SZM-4000 Master

If you have not already done so it is strongly recommended to contact our Technical Support department. In the meantime, check to see if the controller's failures match one of the symptoms listed below:

- The fan cycles on and off approximately every 15–30 seconds.

  This indicates a problem with the Master's main CPU recognizing an electronic problem and attempting to reset itself. This usually indicates a failure with the Master daughter board. Change this board with a known good one and see if the problem resolves itself.

- The unit goes into a heating or cooling demand then a short time later turns off. After a short period of time, normally 5 minutes, the cycle repeats.

  Check to ensure that the Limit alarm LED is not 'ON' or 'Flashing'. If this problem repeats itself regularly it could indicate clogged filters on the AHU unit, or a bypass damper that is stuck in the open position. Normally

this would not indicate a problem with the Master board but rather an air supply issue with the AHU.

- All damper LEDs remain off.

  This would normally indicate a problem with communication to the thermostats. First swap the daughter board with a known good one to ensure the board is working properly. Another possible cause may be a problem with the communication wire to any of the thermostats. At some point half way down the communication line disconnect the communication wire and see if communication is restored to some of the thermostats. If it is, then you know the problem lies somewhere between the disconnected wire and the last thermostat. Continue splitting the communication wire in half narrowing down where the problem is originating from.

Troubleshooting/Replacing SZT-4000 Thermostat

To replace a thermostat, first turn the power off to the system at the Master control panel. Gripping the thermostat towards the bottom of the base remove the top portion of the thermostat from the base. After installing the replacement thermostat, set the correct stat number from menu option #4. This is critical otherwise the Master controller will not be able to address the thermostat. Instructions on setting the stat number can be found in the thermostat's instruction manual.

Once the thermostat has been installed you can confirm communication with the Master when the clock switches from 12:00PM and begins to keep track of the time.

Even if the thermostat is unable to communicate with the Master it will still allow the user to adjust the set point (provided that this function has not been disabled through software) and should display a valid ambient temperature. If none of these functions appear to work then the problem may lie with the thermostat or wiring between the thermostat and Motor controller.

Troubleshooting the Motor Controller Board

The motor controller LED indicates whether the actuator is driving open (green) or closed (red). If the LED is flashing green then the Motor Controller Board (MCB) has just powered up and is going through its damper calibration routine. After approximately 4 minutes the damper

drives to the fully open position and the MCB will resume normal operation. If the LED is flashing (red) this indicates the MCB has lost communication with the thermostat. Check the wiring between the MCB and thermostat, and swap the thermostat with a known good one to ensure the thermostat is not the problem.

From menu option #3 on the thermostat you can place the stat into a damper test mode. From this menu option you can override the damper actuator to the fully open or fully closed position. For further information on the damper test mode refer to the thermostat operations manual.

Terms and Conditions

ONE YEAR WARRANTY: Zone All Controls Inc. hereinafter referred to as the Seller warrants for a period of twelve (12) months from the date of shipment by the Seller that all goods sold hereunder will be free from defects in material and workmanship, and will meet the specifications shown on face hereof. THIS EXPRESS WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES EXPRESSED OR IMPLIED BY OPERATION OF LAW OR OTHERWISE INCLUDING WARRANTY THAT THE GOODS ARE FIT FOR ANY PARTICULAR PURPOSE. Defective material may be returned to Seller after inspection by Seller and upon of definite shipping instruction form Seller. Goods so returned will be replaced or repaired by Seller without charge, but Seller shall not be liable for any consequential damages or for loss, damage, or expense directly or indirectly arising from the use of the material or from any other cause. Seller's liability is expressly limited to the replacement or repair of defective material, and not for work deemed waived by Buyer unless made in writing within thirty (30) days from the date of the receipt of goods to which such claims relates. No freight will be allowed on any credit.

PATENTS: The sale of material covered by this order shall not grant to Buyer any right or license of any kind under any patent owned or controlled by Seller or under which Seller is license, but the foregoing shall not be understood to limit in any way the right of Buyer to use and sell such material, in the event that such material as sold hereunder is covered by any such patent. Buyer agrees it will save Seller or its agents harmless form any loss, damage or liability which may be incurred on account of infringement of any patent, copyright or trademark rights with respect to the use of this article and that it will at its own expense defend any action suit or claim in which such infringement is alleged with respect to the sale or use of the article delivered to the Buyer. Material sold by Seller to Buyer's design shall not impose any liability upon Seller.

CHANGES OF PRICE: The prices and charges stated herein for the materials and other items covered by this order shall be adjusted to the materials and other items shall be invoiced at Sellers prices and charges in effect at time of shipment.

FORCE MAJEURE: Seller shall not be liable for any failure or delay of performance under this order arising in any way form any action, order or requirement of any local, state or federal government agency which would curtail or force cessation of facilities operations intended for use in producing this order or make such operation economically unfeasible in Seller's opinion, including unavailability of government owned equipment for any reason, and Seller shall not be liable for any failure or delay of performance hereunder due to causes beyond its control including, but not restricted to, acts of God or the public enemy, floods, fires, earthquakes, hostilities, war (declared or undeclared), acts of either general or particular application of any de jure or de facto government or any of its subdivisions, bureaus or agencies, strikes or other labour troubles whether direct or indirect, riots insurrections civil commotions loss or shortage of labour, transportation raw materials or energy sources or failure of usual means of supply.

Should a failure or delay in Seller's performance occur because of any of the foregoing, Seller shall have the option of either cancelling this order, or delaying performance hereunder for any reasonable period of time during which time this agreement shall remain in full force and effect. Seller shall promptly notify Buyer as to the reason for its failure or delay in performance, and as to the period of time during which the delay is likely to continue. Seller shall have the further right to then allocate its available goods between its own end uses and its customers in such manner as Seller may consider equitable.

For any cause whatsoever whether beyond Seller's control or not. Seller's liability for failure or delay in performance shall not include incidental and consequential damages.

CANCELLATION: (A) Seller reserves the right to cancel this order in the event of breach of any of the terms hereof by the Buyer. (B) In the event of cancellation by Buyer for any reason whatsoever, in addition to all other charges and damages, Buyer will be required to pay for raw materials and service charges.

GENERAL TERMS: No waiver of a breach of any provision hereof shall constitute a waiver of any other breach or of such provision. Seller's failure to object to provisions contained in any communication from Buyer shall not be deemed a waiver of provisions of this acknowledgement of order which shall not be liable under any circumstances whatsoever for Seller. Seller shall not be liable under any circumstances whatsoever for loss, damage or expense directly or indirectly arising from use of the material; nor shall Seller be liable for consequential or any other damages with respect to this purchase order. It is specifically agreed that any purchase order which may be issued by Buyer shall in no way constitute a modification hereof. All oral representations are merged herein and this constitutes the whole of the understanding of the parties.

8.2 Terms and Conditions