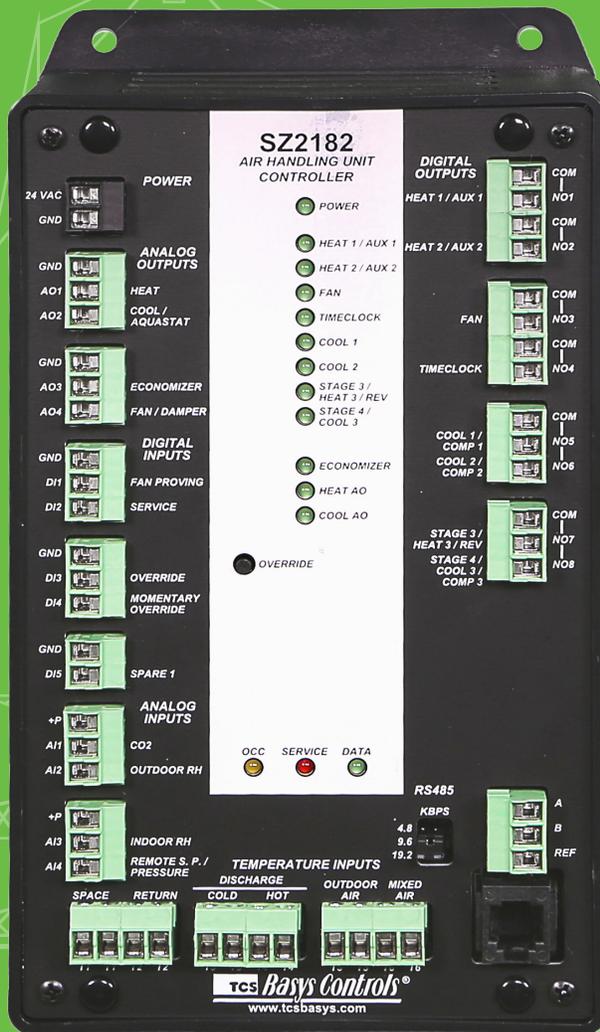# SZ2182

Advanced Air Handling Unit Controller

The SZ2182 is designed to control constant volume and variable air volume air handling units that require advanced control functionality such as dehumidification, face & bypass control or humidity & carbon dioxide sensor sharing.

Features

- Stand-alone or network operation
- 365-day time clock with two holiday schedules with automatic leap year and daylight savings correction
- Discharge air sensor input with high and low limits and reset.
- Hot deck/cold deck control with night zone option
- Outdoor air sensor input with heating & cooling lockouts
- Six stages for either heating or cooling
- Modulating output for heating and/or cooling
- Modulating economizer output with digital or analog enthalpy options
- Modulating output for fan or damper control
- Programmable minimum run times
- Adjustable delay on power-up for soft starts
- PIO control options
- Smart Recovery

- Fifteen status LEDs
- Remote setpoint capability
- User setpoint adjustment limits
- Local override and remote override capability
- Carbon dioxide demand control ventilation
- Auxiliary time clock output
- Fan interlock safety option
- Equipment monitoring inputs and indication
- External time clock input
- Dehumidification sequences with integrated or external reheat
- Face & Bypass control sequence
- Outdoor air humidity sharing capability
- Carbon dioxide sensor sharing capability
- Pre-occupied purge sequence
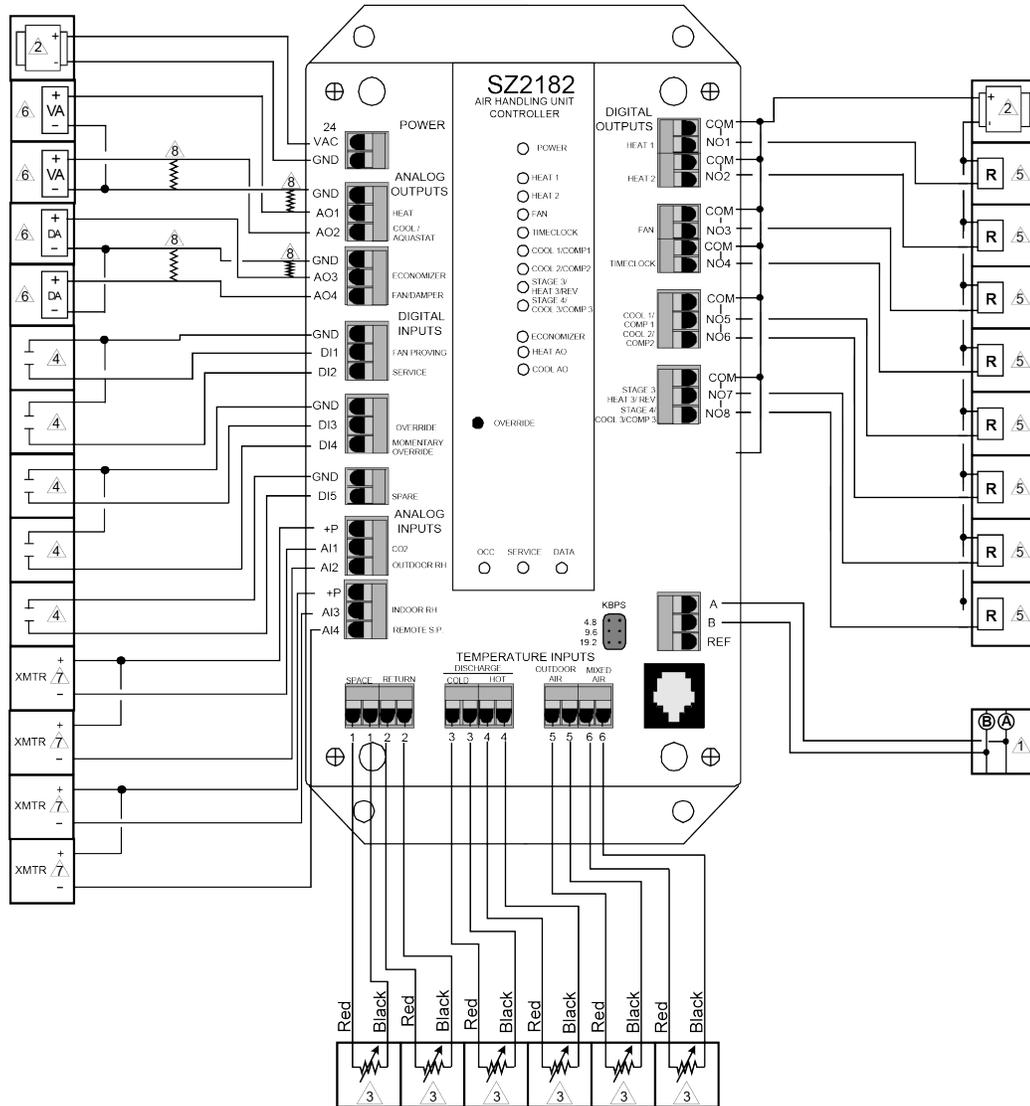- Heat pump control functions

Contents

Mounting

The SZ2182 is designed for mounting using four #10 sheet metal screws. Prior to mounting, the jumpers should be placed. (See setup instructions.) If the unit will be stand-alone, all programming should be completed before installation. If the unit will be wired for communications, a unique address should be programmed into the unit. (See programming instructions.)

Wiring

The SZ2182 terminal designations are shown below.

REMOTE SENSOR WIRING

The SZ2182 accepts six 1000 Ω two-wire platinum sensors. Consult the TS Series Temperature Sensor submittal data-sheet for a complete listing of packaging and application styles. When using TCS Basys Controls three-wire sensors, use the black and red leads, and either clip or twist off the white lead. The wiring length should not exceed 250 feet.

1	For communication wiring, use twisted, shielded 22 AWG. Must be run separately.	6	4 to 20 mA output. 600 ohm max. Do not power actuator with power from the controller. The controllers are half-wave rectified, whereby the power ground is common with the signal ground.
2	24 VAC transformer. See powering instructions.		
3	Sensor input wiring 18 AWG, twisted, shielded pair.	7	2-wire, 4-20mA transmitter 18AWG, twisted, shielded pair.
4	Dry contact. Must not be powered.	8	Add 500 ohm resistor (included in bag) to convert 0/4 to 20mA to 0/2 to 10 VDC.
5	External relay. 24 VAC Coil		

WIRING

POWERING THE SZ2182

The SZ2182 is powered from 24 VAC +/- 20 %. If wiring for communications, dedicated power must be used to power the SZ2182. Several S-series controllers may be powered from the same transformer, provided that the transformer has enough power.

Caution: Do not connect to 120VAC. When multiple TCS/Basys Controls devices are using a single transformer, the polarity of the power wiring must be maintained because all TCS devices are half-wave rectified and have common return paths.

**SZ2182 Addendum
PX1060 & QE82 Wiring**
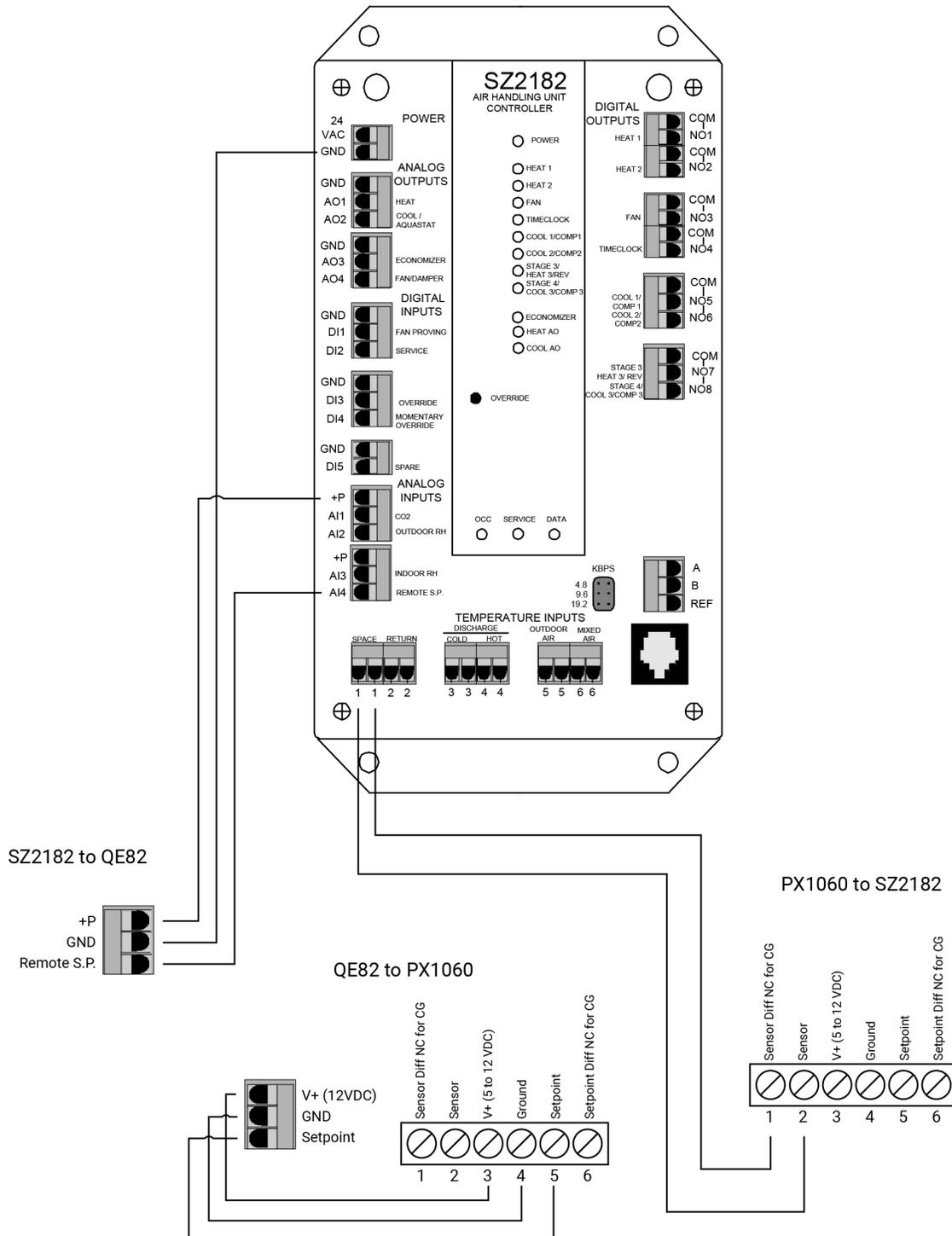
Setup

BAUD RATE SELECTION

The SZ2182 must be programmed using a PC and TCS Basys Controls software. A communication baud rate must be set by placing one jumper in the area shown. This baud rate must be the same for all devices.

Programming

The SZ2182 must be programmed with a PC. A jack on the face allows local access for programming. If you plan to program the controller while it is on a network, prior to putting the controller on the network, a unique address must be set in the controller by accessing it through the port on the front.
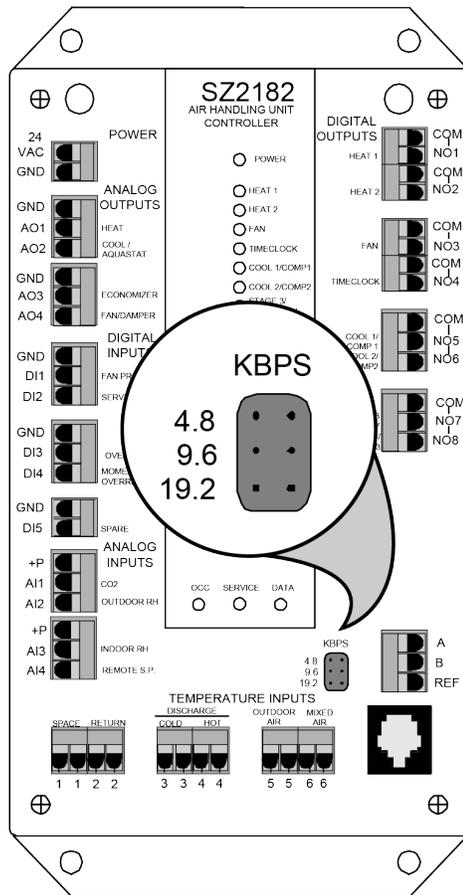
For more information on programming through the PC, consult your TCS software manuals.

CONTROLLER ADDRESS

The factory default address for an SZ2182 is 182 . On the "Network> Poll" tab, right click on the desired controller and select "Change Address from the menu that appears. Next, select the desired address from the use the drop-down menu and hit ENTER. Finally, click "Yes" in the Change Controller Address window that appears.
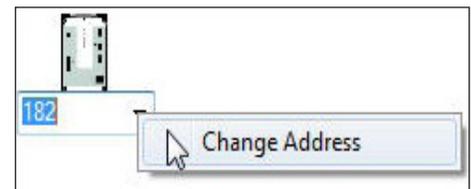
INTERNAL TIME CLOCK

On the "Schedules> Date and Time" tab, you can see and modify the controller's time (military time), day of the week, date and year. Click on "Read" if you would like to see the current time, day of week and date in the controller. Click on "To PC Time" read these parameters from your computer instead and automatically program them into the SZ2182. Finally you can click on "Write" to send the updated time, day of week, and date to the controller.
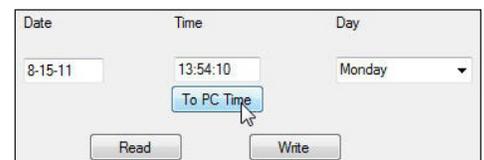
OCCUPANT OVERRIDE

This is the number of minutes from 0 to 255 (4 hr., 15 min.) which the controller will bring an unoccupied system occupied, when its override button is pressed.

EVENT SCHEDULING

On the "Schedules> Schedules" tab there are four occupied time periods per day, and thus four time schedules (A, B, C, and D). Let us say that the occupied time for a particular day is from 8:00AM to 12:00PM and from 1:00PM to 5:00PM. In the "A" schedule you could enter 8:00 to 12:00, and in the "B" schedule you could enter 13:00 to 17:00. You can reverse the "A" and "B" schedules also. You can also enter 8:00 to 17:00 for the "A" schedule and 0:00 to 0:00 for the "B" schedule. 0:00 (12:00AM)starts the day, and 24:00 (12:00AM) ends the day.

NOTE: Occupied times that span midnight have to be coordinated using two days' time schedules.

NOTE: The start of an occupied period is delayed by the power-on delay value.

HOLIDAY 1/ HOLIDAY 2

Two sets of holidays can be programmed, each using a different occupied/unoccupied time schedule. To program holidays into the controller, enter the dates as well as the length in days, for all of your holidays.

MONITORING

The "Monitoring" tab displays the current temperatures and the status of all inputs and outputs. These values are automatically read when accessing this tab initially and are automatically refreshed periodically while viewing the tab. By right clicking on a particular point, you can view a live graph of that point over time.

DIGITAL INPUTS

Select whether you want "DI1", "DI2", "DI3", "DI4" or"DI5" to be "Local" or "Remote". Local means that the controller uses its own control program when looking at these inputs. Remote means that it will take a PC to make any changes to these inputs.

DI1 can be used for "Fan Proving" or just "Monitoring". If Fan Proving is selected, the controller will turn on the Fan and then wait 30 seconds to make sure the Fan is on (DI1 is shorted). This can be accomplished with a flow switch, current switch or some other device. Any time the fan is on but DI1 is not shorted, the System Mode will be turned Off and will need to be manually restarted by placing the controller into a system mode other than Off. Also, the system can be restarted by powering down the SZ2182, or by holding down the Override Button for five seconds.

DI2 can be used for "Aquastat", "Monitoring" or "Service". If Aquastat is chosen, when DI2 is Off (Open) the analog output AO2 will function in cooling mode. If DI2 is On (Shorted) the analog output will function in heating mode, and the control action will be reversed from its programmed setting. If Monitoring is chosen, DI2 will have a "Setpoint Shift" function. When DI2 is On (Shorted), the heating setpoint is shifted down by an adjustable number of degrees, and the cooling setpoint is shifted up by that same number of degrees. The number of degrees +/- for this setpoint shift function is entered in the "Setpoint" section. If Service is chosen, the Service LED will be lit anytime DI2 is On (Shorted).

DI3 can be used for "Monitor", "External Override" or "External Time Clock". If External Override is selected, the controller will use its built in time clock and schedule to determine whether to be occupied or unoccupied, and will also be occupied as long as DI3 is On (Shorted). If External Time Clock is chosen, the controller will not use its built in time clock and schedule to determine whether to be occupied or unoccupied. The controller will be occupied as long as DI3 is On (Shorted) and unoccupied as long as DI3 is Off (Open).

DI4 can be used for a "Monitor" or "Toggle Override". Toggle Override allows a remote momentary normally open switch to be connected to DI4 which will have the same function as the override push button on the face of the SZ2182.

DI5 can be used for "Monitoring", and has no other function.

HOT DECK / COLD DECK CONTROL

Place a check in the box labeled "Enable Hot Deck/Cold Deck Control" if using this type of system.

NOTE: When checking and unchecking this function, you must turn the system mode off and then back to what you want (Auto for example). Otherwise the control operation will be unpredictable.

If using the SZ2182 to provide hot deck / cold deck control, select whether or not to have the unoccupied control instead be based simply on space or return air temperature. Then enter the desired unoccupied temperatures for heating and cooling, and whether the control will be based on Space or Return Air. The normal unoccupied control will control two streams of air (Hot Deck and Cold Deck)during the unoccupied periods.

Enter the Hot Deck setpoint for both occupied and unoccupied mode here. Also enter the Cold Deck setpoint for both occupied and unoccupied mode here.

Select whether control will be based on hot deck temperature (No Hot Deck Reset), hot deck temperature reset by the zone (space) air temperature, hot deck temperature reset by the return air temperature or hot deck temperature reset by the outdoor air temperature. If using one of the 3 reset options, enter the reset setpoint and reset factor here as well.

The reset ratio factor is the number of degrees that the hot deck setpoint is raised when the reset temperature falls by 1 degree for heating.

Select whether control will be based on cold deck temperature (No Cold Deck Reset), cold deck temperature reset by the zone (space) air temperature, cold deck temperature reset by the return air temperature or cold deck temperature reset by the outdoor air temperature. If using one of the 3 reset options, enter the reset setpoint and reset factor here as well.

The reset ratio factor is the number of degrees that the cold deck setpoint is lowered when the reset temperature rises by 1 degree for cooling.

NOTE: When Hot Deck/Cold Deck operation is selected, the hot deck and cold deck operations are completely independent of each other. Hot Deck control uses the Discharge Hot sensor; Cold Deck control uses the Discharge Cold sensor.

ZONING DISCHARGE AIR CONTROL

If "Enable Zoning Discharge Air Control" is selected, then you will need to enter heating and cooling setpoints for morning warmup, occupied and unoccupied time periods. The Morning Warmup Setpoint is used as part of our Ubiquity VAV sub-system. Additional programming will be required within Ubiquity. The occupied and unoccupied setpoints are used as part of normal operation.

When using the SZ2182 with a QD2040 in a discharge zone control mode, select whether space/return air will be used for control if there is a loss of communication detected. This function is independent of the "Communication Loss Function", but it uses the same delay time.

NOTE: This feature is only useful IF the SZ2182 is connected to a QD2040 or QD2010 and is part of a sub-system. This feature would not be used with an SZ2182 in standalone configuration.

ZONE CONTROL

Enter the Heating and Cooling setpoints for both occupied and unoccupied mode here. There are four time periods (A, B, C, and D) which use the four corresponding heating and cooling setpoints. Each heating setpoint should never exceed its paired cooling setpoint and the cooling setpoint should never be less than its paired heating setpoint for occupied or unoccupied mode.

Select whether you will be using the Space temperature input or the Return temperature input or the Discharge Cold Temperature input as the control point.

The DI2 Setpoint Shift value is the shift amount (in degrees) used with the function described under DI2 in the Digital Inputs section. See that section for details.

If "Enable AI4 Remote Occupied Setpoint" is selected, the controller will use a remote 4-20mA signal as the Setpoint for the SZ2182. Then you will need to enter a deadband, and Remote Setpoint Low and High Limits. "Dead Bands" are used to generate "Heating" and "Cooling" setpoints within the specified remote setpoint range (between the low and high limits). The dead band is the +/- space around the setpoint where no heating or cooling is done.

If "Discharge Air Reset" control is selected for either Heat or Cool (or both), you need to enter a discharge air temperature setpoint and a reset ratio factor. The reset ratio factor is the number of degrees that the discharge air setpoint is raised when the space temperature falls by 1 degree for heating, or the number of degrees that the discharge air setpoint is lowered when the space temperature rises by 1 degree for cooling.

There is an option to Enable Minimum Discharge Air for Heating. By checking the box, whenever the SZ2182 goes into heating mode, it will maintain the discharge air setpoint until a call for cooling happens. Without using this feature, the SZ2182 will stop all heating when the heating setpoint is reached.

SYSTEM

Select the "System" mode for the controller as either "Heat Only", "Cool Only", "Automatic" (Heat or Cool), or "Off" in which no control is done.

OUTPUTS

For a "Cooling" output, the relay energizes when the input equals the "Cooling Setpoint" + "Offset" + "Differential" and de-energizes when the input falls to the "Cooling Setpoint" + "Offset".

For a "Heating" output, the relay energizes when the input equals the "Heating Setpoint" - "Offset" - "Differential" and de-energizes when the input rises to the "Heating Setpoint" - "Offset".

Enter the "Offset" and "Differential" values here.

DELAYS

Enter the "Minimum ON" and "Minimum OFF" for all of the output stages (in minutes) and the fan (in seconds).

STAGE 3 AND 4

Stage 3 & 4 can be programmed to be stages of heat or a stages of cool, or one stage of heating and one stage of cooling. If stage three and four are enabled, select whether they will be heating or cooling stages, or one stage of each. If one stage of heat and one stage of cool is selected, Stage 3 becomes the third stage of heating and Stage 4 becomes the third stage of cooling.

P+I FOR RELAYS

P + I Setting for Relays 0

The Proportional + Integral function implements a way to anticipate the need for heating using the heating and cooling stages. This function works in conjunction with the programmed offsets and differentials. Select whether to enable the Proportional + Integral function. By default, this function is disabled when the "Integral Setting" is zero. When enabled, the integral setting can be from 1 to 255. Larger numbers speed up the response, while smaller numbers slow down the response.

FAN

Fan Status
Occupied Mode On Unoccupied Mode On Min On Time 30 seconds Min Off Time 30 seconds
Disable Minimum Fan On Delay Fan Source Local Remote Override Off

Select the Fan mode for the controller as either "On", "Cool" or "Auto" (Heat or Cool) for occupied and unoccupied times. On means on, and Auto means the fan will come on for heating or cooling, and Cool means that the fan will only come on for cooling. Select whether you want the Fan to be "Local" or "Remote". Local means that the controller uses its own control program to manipulate the fan. Remote means that it will take a PC to make any changes to the fan output and you will select the Fan to be On or Off.

There is an option to "Disable the Minimum Fan On Delay". This setting allows the controller to skip the default Fan On Delay and immediately turn on heating or cooling when needed.

TIME CLOCK RELAY

Time Clock
Output Mode Open - Occupied Output during Override Normal

Select whether you want the Time Clock Output to be "Open" or "Closed" during occupied periods. Select how you want the Time Clock Output to work during an override condition "Normal" or "Same as Unoccupied". "Normal" means the time clock output will work like it normally would during occupied time. "Same as Occupied" means the time clock will ignore the override and work as if the controller was in unoccupied mode.

TEMPERATURE INPUT CALIBRATION

The six temperature inputs are factory calibrated. However, depending on the application (long wire runs, etc.), there may need to be a field adjustment done to these readings. The "Adjusted Reading" is the reading that the SZ2182 actually uses for control. The "Offset Value" is the number of degrees that the actual input temperature has been adjusted. For example: You measure the space temperature and it reads 71°. The SZ2182 reading is 72° and the space temperature already has an offset of -2.0°. All you need to do is change the offset value to -3.0° and you're done. The SZ2182 will now read 71°.

The Space and Return temperature inputs are scaled 20 to 120°F (-6.7 to 48.9°C). Both Discharge Air temperature inputs are scaled 20 to 220°F (-6.7 to 104.4°C). The Mixed Air temperature input is scaled 20 to 220°F (-6.7 to 104.4°C). The Outdoor input is scaled -40 to 160°F (-40 to 71.1°C). These ranges are fixed and cannot be changed.
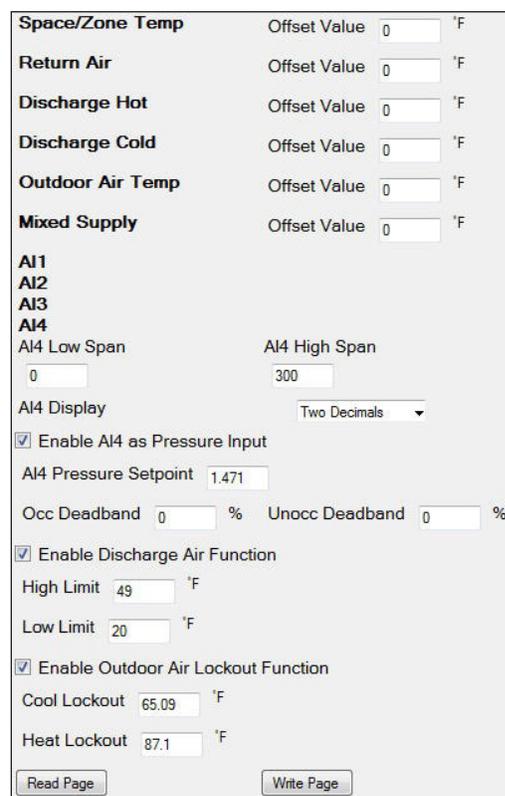
CO$_2$ - ANALOG INPUT 1 (AI1)

A 4-20mA CO$_2$ (carbon dioxide) or Air Quality sensor (PC Series) may be connected to AI1. It is scaled to 0 to 2000 ppm.

Space/Zone Temp Offset Value 0 °F
Return Air Offset Value 0 °F
Discharge Hot Offset Value 0 °F
Discharge Cold Offset Value 0 °F
Outdoor Air Temp Offset Value 0 °F
Mixed Supply Offset Value 0 °F
AI1
AI2
AI3
AI4
AI4 Low Span AI4 High Span
0 300
AI4 Display Two Decimals
☑ Enable AI4 as Pressure Input
AI4 Pressure Setpoint 1.471
Occ Deadband 0 % Unocc Deadband 0 %
☑ Enable Discharge Air Function
High Limit 49 °F
Low Limit 20 °F
☑ Enable Outdoor Air Lockout Function
Cool Lockout 65.09 °F
Heat Lockout 87.1 °F
Read Page Write Page

OUTDOOR HUMIDITY - ANALOG INPUT 2 (AI2)

A 4-20mA humidity senor may be connected to AI2. It is scaled to 0 to 100 %RH (relative humidity).

INDOOR HUMIDITY - ANALOG INPUT 3 (AI3)

A 4-20mA humidity senor may be connected to AI2. It is scaled to 0 to 100 %RH (relative humidity).

ANALOG INPUT 4 (AI4) LIMITS

You will need to enter High and Low Limits for AI4. These numbers should match your input transmitter range(s), i.e., if 4 to 20mA equals 0 to 3 "wcd, you would enter 0 for the Low Limit and 300 for the High Limit. This input can be used as a remote setpoint, a pressure input, or simply as a monitoring point.

ANALOG INPUT 4 (AI4) DECIMAL POINT

For monitoring purposes, the SZ2182 allows a decimal point to be turned on for AI4. No scaling is done. Choose the position of the decimal point for AI4. For the range used above, select the Decimal Point at 10's Digit.

ANALOG INPUT 4 (AI4) AS PRESSURE INPUT

Select whether AI4 will be used as a pressure input. Select the pressure setpoint, and the occupied and unoccupied deadbands. The deadband is the +/- space around the setpoint where no heating or cooling is done or necessary. If AI4 is not selected as a pressure input, its span is 20 to 120 °F and is used as a remote setpoint input.

NOTE: AI4 doesn't have to be a pressure input, and can be used with AO4 to control another input if desired.

DISCHARGE AIR FUNCTION

The Discharge Air function looks at the discharge air temperature. If the discharge air temperature is greater than the "High Limit", no heating is allowed. If the discharge air temperature is lower than the "Low Limit", no cooling is allowed. In either case, the fan will still run. The discharge air temperature is monitored whether or not this function is enabled. Choose whether to enable the Discharge Air function, and if it is enabled, enter the values for the high and low limits.

OUTDOOR AIR LOCKOUT FUNCTION

The Outdoor Air Lockout function looks at the outdoor air temperature. If the outdoor air temperature is greater than the "Heat Lockout" setting, no heating is allowed. If the outdoor air temperature is lower than the "Cool Lockout" setting, no cooling is allowed. When heating or cooling is locked out, the fan will still run. The outdoor air temperature is monitored whether or not this function is enabled. Choose whether to enable the Outdoor Air function, and if it is enabled, enter the values for the heating and cooling lockouts.

HEATING - ANALOG OUTPUT 1 (AO1)

A proportional band (throttling range), whether you want the analog output to modulate from 4 to 20mA or 0 to 20mA, and direct or reverse action must be programmed.

For control without "Integral" and "Derivative", enter 0 for both. The proportional band is 0 to 100%, while the integral and derivative values are numbers from 0 to 255. The default PID values for AO1 are P=5, I=0, D=0 (basic proportional control). See the PID Control Factors section for more details and the suggested starting values for full PID control.

During the occupied time, analog output one modulates to maintain the occupied heating setpoint. During the unoccupied time you will need to choose whether each analog output will modulate, remain at 20mA, or remain at (0 or 4)mA.

You can also enter a setpoint offset. This is a value offset from the heating setpoint where the analog output begins to modulate.

COOLING - ANALOG OUTPUT 2 (AO2)

A proportional band (throttling range), whether you want the analog output to modulate from 4 to 20mA or 0 to 20mA, and direct or reverse action must also be programmed.

For control without "Integral" and "Derivative", enter 0 for both. The proportional band is 0 to 100%, while the integral and derivative values are numbers from 0 to 255. The default PID values for AO2 are P=5, I=0, D=0 (basic proportional control). See the PID Control Factors section for more details and the suggested starting values for full PID control.

During the occupied time, analog output two modulates to maintain the occupied cooling setpoint. During the unoccupied time you will need to choose whether each analog output will modulate, remain at 20mA, or remain at (0 or 4)mA.

You can also enter a setpoint offset. This is a value offset from the cooling setpoint where the analog output begins to modulate.

If using AO2 as an aquastat output (i.e., AO2 is used for both heating and cooling), place a check here. In order to use the aquastat function, it must be enabled here and also on SZ2182 Screen B under DI2. This function is used for 2 pipe systems where in the summer cooling is supplied and in the winter heating is supplied. When DI2 is open, this output will do cooling. When DI2 is closed, this output will switch its action (direct / reverse) and do heating.

ECONOMIZER - ANALOG OUTPUT 3 (AO3)

Analog output three on the SZ2182 is used to control an economizer. Both outdoor air and discharge (or mixed) air temperature sensors are needed to accomplish this. Also, both the Outdoor Air Lockout Function and the Discharge Air Function need to be enabled for the economizer output to work correctly.

NOTE: Some people use a discharge air sensor while others use a mixed air sensor. This all depends on what type of control is desired. The SZ2182 can accommodate both sensors, and control can be switched between them.

During occupied time, the outside air dampers are held at a minimum position (Outdoor Damper Minimum Position), until economizer operation is enabled. During unoccupied time, the outside air dampers are closed.

Enter an outdoor air setpoint. The outdoor air temperature must fall below this setpoint before economizer operation will be enabled. A call for cooling is also required to enable economizer operation. A typical value is 65°F.

Enter a discharge (or mixed) air setpoint. The discharge (or mixed) air temperature will be controlled to this setting by modulating the outdoor air dampers when economizer operation is enabled. Also enter a discharge (or mixed) air low limit setpoint. If the discharge (or mixed) air falls to this setpoint, the outside air dampers modulate closed.

A proportional band (throttling range), whether you want analog output three to modulate from 4 to 20mA or 0 to 20mA, and direct or reverse action must also be programmed.

For control without "Integral" and "Derivative", enter 0 for both. The proportional band is 0 to 100%, while the integral and derivative values are numbers from 0 to 255. The default PID values for AO3 are P=10, I=0, D=0 (basic proportional control). See the PID Control Factors section for more details and the suggested starting values for full PID control.

You will need to select whether control will be based on Discharge Air temperature or Mixed Air Temperature.

The economizer operation can be activated by Outdoor Air temperature compared to the Outdoor Air Setpoint, or by a comparison between the Outdoor Air temperature compared to the Return Air temperature. In the case of the Setpoint comparison, the Econ Differential is used. In the case of the Return Air comparison, both the Return Air Offset and the Econ Differential are used.

ADDITIONAL ECONOMIZER FUNCTIONS

If using the economizer (AO3), select whether or not you want the economizer to be used during the unoccupied time periods also. If using indoor and outdoor enthalpy comparison to determine when the economizer will be activated, select whether the space temperature or the return temperature will be used in the indoor enthalpy calculation.

ENTHALPY

Rather than using Outdoor Air Dry Bulb temperature or Outdoor and Return Air Dry Bulb temperature comparison, either Outdoor Air Enthalpy or Outdoor and Return Air Enthalpy comparison can be used. To use either of these features, place a check in the appropriate box. If Outdoor Air Enthalpy is used by itself, enter the enthalpy setpoint below which the economizer is allowed to operate here also. Note, in order to use either one of these comparisons, one or two 4-20mA relative humidity sensor (TH Series) need(s) to be connected to the SZ2182. In order to use Outdoor Air / Return Air Enthalpy comparison, both boxed must be checked.

DEMAND CONTROL VENTILATION

If using a CO_2 sensor into AI1, you can select "Enable Demand Control Ventilation". Then you will be able to enter a setpoint and proportional band (%) such that when CO_2 levels exceed this setpoint, the damper is modulated open in excess of where the economizer function may have wanted to place the damper. This function is used to bring in more fresh air and rid the building of excess CO_2.

FAN SPEED/DEHUMIDIFICATION REHEAT - ANALOG OUTPUT 4 (AO4)

In order to use Analog Output 4 on the SZ2182 to control a modulating device (actuator, VFD, etc.) you must select "Enable AI4 as Pressure Input" on the Analog Inputs Tab. You

need to choose whether the analog output will be used for heating or cooling. Heating refers to the output modulating when the input is below the setpoint. Cooling refers to the output modulating when the input is above the setpoint.

NOTE: If AO4 is used to provide reheat during dehumidification, Heat Mode must be selected.

During the occupied time, the analog output modulates to maintain the setpoint. During the unoccupied time you will need to choose whether the analog output will modulate, remain at 20mA, or remain at (0 or 4)mA.

Whether you want the analog output to modulate from 4 to 20mA or 0 to 20mA, and direct or reverse action must also be programmed.

For control without "Integral" and "Derivative", enter 0 for both. The proportional band is 0 to 100%, while the integral and derivative values are numbers from 0 to 255. The default PID values for AO4 are P=10, I=0, D=0 (basic proportional control). See the PID Control Factors section for more details and the suggested starting values for full PID control.

PID CONTROL FACTORS

There are three main factors involved in PID control - the proportional, the integral and the derivative factors. The proportional factor dictates how much gain the input signal error should be given with respect to the derivative and the integral error terms. A large integral factor will cause the output to respond quickly to changes on the input however the output could oscillate and overshoot the setpoint. A large derivative factor will cause the output response to be sluggish and slow to change and the output will settle above the desired set point. The derivative term is divided by the PID delay. The suggested starting values for full PID control are P=4, I=25, D=200. Those values should be adjusted/tuned as needed for your particular installation to achieve the desired operation.

PID OPTIONS

The default values are Step Constant=1, PID delay=10 and PID Error DB=0. The Step Constant determines how large of step

the output takes - the larger the number, the smaller the step size. The Step Constant is typically 1, but should NEVER be 0 (doing so will cause the system to stay at full output). The Delay parameter specifies how quickly the output should evaluate error between the current output and the desired output. The PID delay can be used to offset a slow moving motor allowing the motor to catch up to its input signal before the error term is reevaluated. The Error Deadband allows the system to overlook error between the desired setpoint and the input signal to help the system stabilize. The Error Deadband is typically 0. It is predominantly used in a situation where a small amount of error would cause a large swing in the output or response (for example, CFM output versus supply or input pressure).

PROGRAMMING

OVERRIDE STATUS

The "Time Allowed" field is the number of minutes from 0 to 255 (4 hr., 15 min.) which the controller will hold an unoccupied system occupied, when its override button is pressed. You can also enable "Occupied Override" which allows the override to work during occupied periods. In that case, the controller would go from occupied to unoccupied when its override button is pressed.

REMOTE OVERRIDE

In order to override the controller (put it to Occupied Mode), select "ON" from the drop-down and then click on WRITE PAGE. This will bring the controller to occupied mode for the amount of time set on the previous screen in the "Time Allowed" box. If the override time needs to be extended, make sure that "On" is selected and then click WRITE PAGE. This will restart the override timer. To stop the override, select "OFF" from the drop-down and then click on WRITE PAGE.

DELAY ON POWER

On a loss of power, when the power comes back or on occupancy start-up, the controller will wait this amount of time before starting to control. Different controllers in one building can have different delays so that all units don't come on at the same time. Enter a delay time (in seconds) that you want the Controller to use on power- up or start-up.

SMART RECOVERY

Smart Recovery implements a setpoint ramp function prior to occupancy. The ramp is 4 degrees per hour for both heating and cooling. The space temperature is slowly brought up or down prior to the occupied time so that when the occupied time occurs, the space temperature will be at the desired setting. Select whether to enable the Smart Recovery function.

DAYLIGHT SAVING TIME

Daylight Saving Time (DST) in the U.S. is currently from the 2nd Sunday of March to the 1st Sunday of November. Products shipped starting in 2007 with firmware version 1.5 or higher accommodate the new DST schedule. Products shipped starting in 2008 with firmware version 2.0 or higher accommodate the new DST schedule and have the ability to be programmed to accommodate any future schedules that may be used. Should the schedule change and you need to customer program the DST start and end dates, simply enable the "Daylight Saving Time" option within the software and enter the starting month + week and the ending month + week.

HOLIDAY VANISHING

Choose whether to enable the Holiday Vanishing Feature. If checked, the SZ2182 will make the number of days for a holiday 0 after the holiday is over. This will keep the holiday from occurring in subsequent years if it is not reprogrammed.

COMMUNICATIONS LOSS FUNCTION

If "Enable Comm. Loss Function" is selected, the SZ2182 will go into occupied control mode if communications with it is lost and it will stay in the mode until communications returns. The "Delay Before Loss of Comm Function" value is the number of seconds the unit will wait after communications are lost before engaging the Comm. Loss Function. Be sure to set the Comm. Delay time to at least 60 seconds as the QD2040 and QD2010 poll the local controller network once per minute.

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PRE-OCCUPANT PURGE

When the economizer is being used, a pre-occupant purge can be used. Once you select this option, choose the time prior to occupancy you want the purge to start and also choose the position of the damper you want during the purge cycle.

FACE AND BYPASS CONTROL

Select whether Face and Bypass control will be used. When face and bypass control is used, AO1 is used to control a damper and AO4 is used to control a hot water valve. You will need to select an outdoor air temperature setpoint which will determine whether AO1 or AO4 will modulate while AO4 or AO1 is at full open position.

HEAT PUMP OPERATION

Select whether to enable Heat Pump operation. This changes the control of the relays into heat pump mode. Heat pump mode assumes there is a reversing valve that needs to be controlled. Select whether the reversing valve will be open (not energized) or closed (energized) for cooling. If necessary, you can enable Emergency Heat Mode.

DEHUMIDIFICATION / REHEAT

Select whether to enable dehumidification. Choose the occupied and unoccupied dehumidification setpoints. Choose whether to use the reheat setpoints during the normal heating sequence, and if so, choose the occupied and unoccupied reheat setpoints. Select whether Dedicated Reheat will be used, and if so whether the Time Cock Output or AO4 will be used to provide this dedicated reheat.

Operations

FACE AND BYPASS CONTROL

Face and Bypass control involves a hot water valve and a face and bypass damper. When the outdoor air temperature is below the outdoor air face and bypass setpoint, the valve (AO4) is full open and the face and bypass damper (AO1) modulates. When the outdoor air temperature is above the outdoor air face and bypass setpoint, the face and bypass damper (AO1) is full open to the face, and the valve (AO4) modulates.

HEAT PUMP CONTROL

When the SZ2182 is used to control a heat pump, the cooling stages are used to provide both heating and cooling depending on the position of the reversing valve. The auxiliary heat is provided by the heating stages. When heat pump mode is selected, the stage 3 output is used for the reversing valve and the stage 4 output is used as a third compressor output. **IMPORTANT: When switching between heat pump control and conventional control, the system mode should be set to off and then back to Auto,or (Heat or Cool). Switching between these modes is a significant change and it is important to cycle off all heating and cooling before the new mode takes effect. Fortunately, this selection should only be necessary during startup. You will also need to change the offset and differential parameters for compressors and/or stages, as well as run times, when switching between conventional and heat pump modes.**

DEHUMIDIFICATION AND REHEAT

The SZ2182 can be used to provide dehumidification in addition to providing heating and cooling functions. The cooling outputs, both analog output 2 and the cooling stages are used to provide dehumidification. Reheat will be provided by analog output 1 and the heating stages, unless the dedicated reheat option is selected. The normal heating setpoint will be used for reheat unless you choose to use the reheat setpoints. If dedicated reheat is used, you need to choose whether the time clock output or AO4 will be used. Note: If AO4 is used to provide reheat during dehumidification, Heat Mode must be selected.

Checkout & Troubleshooting

CHECKOUT

1. Be sure to check and verify all wiring before powering the SZ2182.

2. Turn power on. The SZ2182 "Power" LED should light up. Then the Service LED will blink for 15 seconds while the electronics stabilize.

3. If the SZ2182 has not been pre-programmed, It should be programmed at this time.

4. Increase and decrease the Heat and Cool setpoints. This must be done from a PC. Observe the operation of the relay stages and/or analog output(s).

5. Note that the operation of the SZ2182 will depend on how it is programmed.

The SZ2182 is now ready for operation.

TROUBLESHOOTING

Power LED will not come on

Check for 24 VAC on terminals "24 VAC" and "GND". The rest of the trouble shooting must be done with a PC and the Revelation Professional software.

No communications

Make sure baud rate selection jumper for the QD1010 and the SZ2182 are the same, and that Revelation is configured for that same baud rate. Address 248 will always work provided that the SZ2182 is NOT connected to a network.

Inputs do not read correctly

The SZ2182 is calibrated at the factory. For the supply temperature and other temperature readings make slight adjustments (+/- 12% of the input span). on "Screen D" of the SZ2182 programming screens. (See Temperature Input Calibration on page 6.)

Output operation is not correct

Check programmed parameters, in particular "Reverse" and "Direct" acting selections and "Heat" or "Cool" selections for the analog outputs, and "Offset"and "Differential" selections and "Delay Times" for the relay outputs. Check wiring.

LED Description

Fifteen LEDs on the unit allow the occupant to view the current operating status of the SZ2182.

POWER: This LED will be lit whenever the unit has power.

DIGITAL OUTPUTS: These LEDs will be lit when the corresponding relay outputs are on. Relay outputs include heating and cooling stages, fan and timeclock output.

OCC: This LED will be on whenever the unit is operating in the occupied mode. This LED will blink when "Fan Proving" fails.

SERVICE: This LED will be on whenever the unit has a service condition. This LED also blinks on powerup until the electronics stabilize.

DATA: This LED will blink when the unit is being accessed by a PC.

HEAT AO: This LED will be on whenever unit is calling for modulating heat.

COOL AO: This LED will be on whenever unit is calling for modulating cooling.

ECONOMIZER: This LED will be on whenever the unit is calling for economizer operation.