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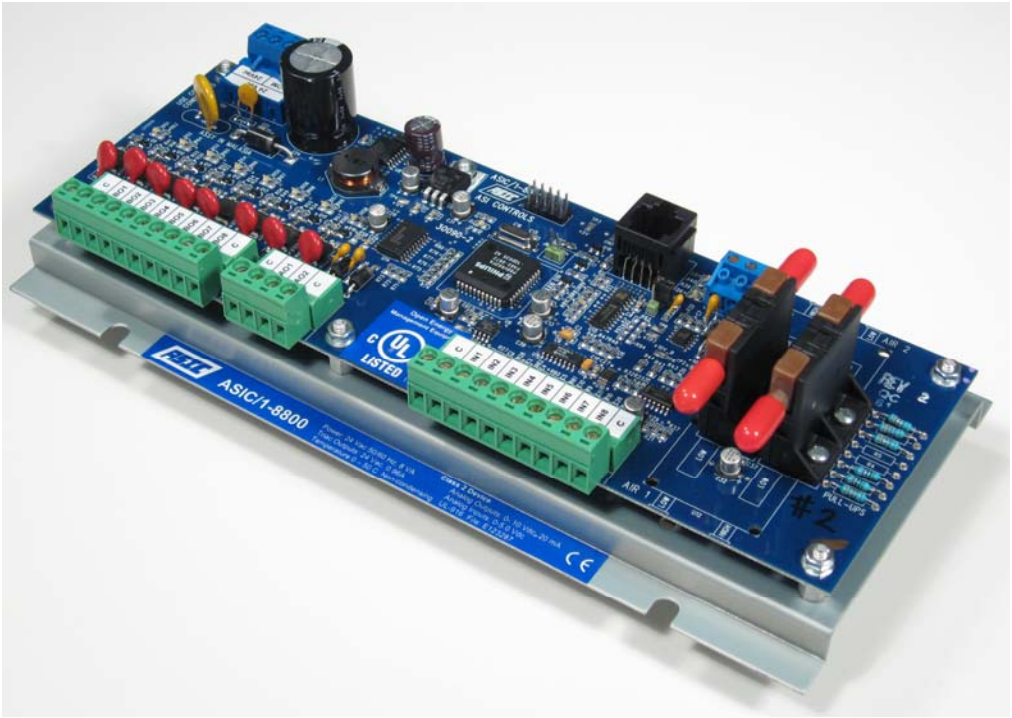
ASIC/1-8800

Application Bulletins

By ASI Controls



January 2009

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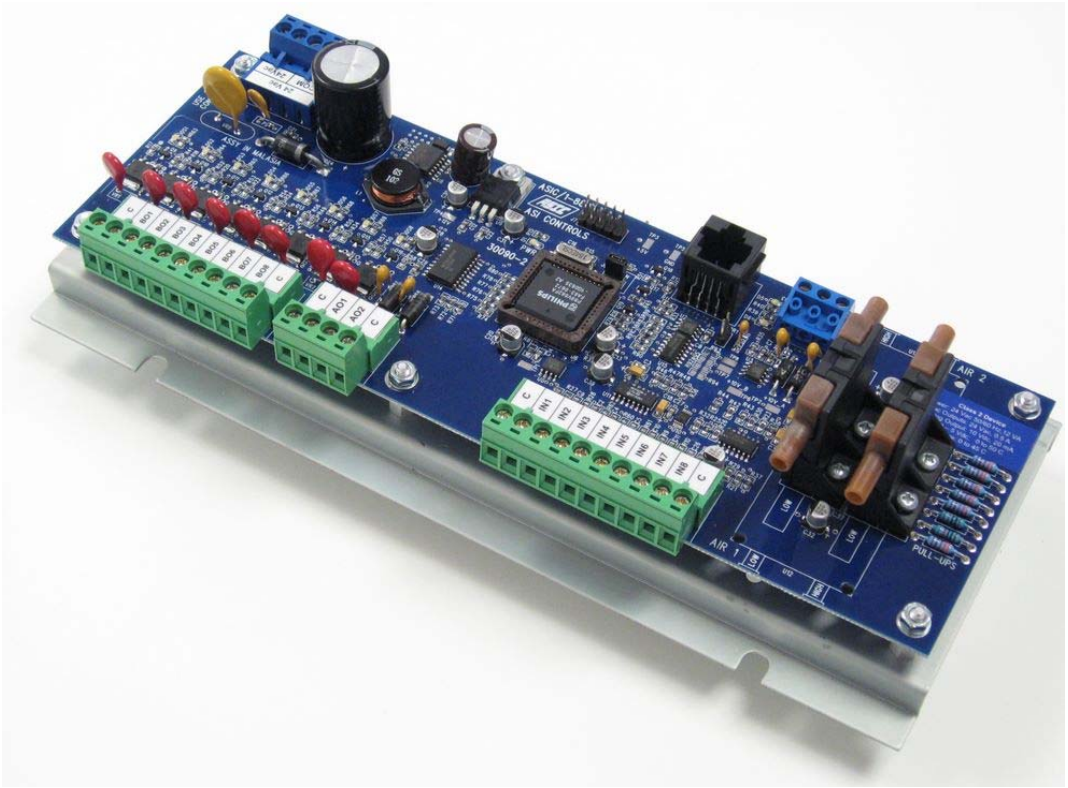
Tracking VAV 84-1

Introduction

ASIC/1-8800 VAV Controllers

The ASIC/1-8800 is a pre-programmed digital controller for the control of pressure independent Variable Air Volume (VAV), Fan-Powered VAV, Dual Duct and Volume Tracking terminal units. The controller includes one or two on-board airflow sensor and maintains the space temperature by varying the air volume. The controller monitors zone temperature through the WS-0X1 Wall Sensor and calculates the correct air volume to be distributed to the space based upon comparing this temperature with the cooling and heating setpoints.



This pressure independent controller is mounted directly on the VAV terminal being controlled. Connect the 24 Vac power. The Fan and Electric or Hot Water Heat are connected as required. An AF-001 airflow filter is connected to the Hi side of each airflow sensor.

The ASI WS-0xx wall sensor is connected using the standard ASI SCP-0xx cable. RS-485 communication is connected to the + and – positons on the T3 terminal block. If shielded cable is used, the shield is connected at only one end to the cerminal marked COM. The controller is given a unique address with ASI Expert software.

Each ASIC/1 has a 24-hour, 8-day software clock. The clock in each controller automatically sets the appropriate operating parameters based on the schedules programmed into non-volatile memory.

To use scheduled operation, the controllers must be synchronized regularly by time broadcast on the communication line by an ASIC/2 controller or other device, such as an ASI EtherLink/2. Two-way communications allows information to be transmitted throughout the control system.

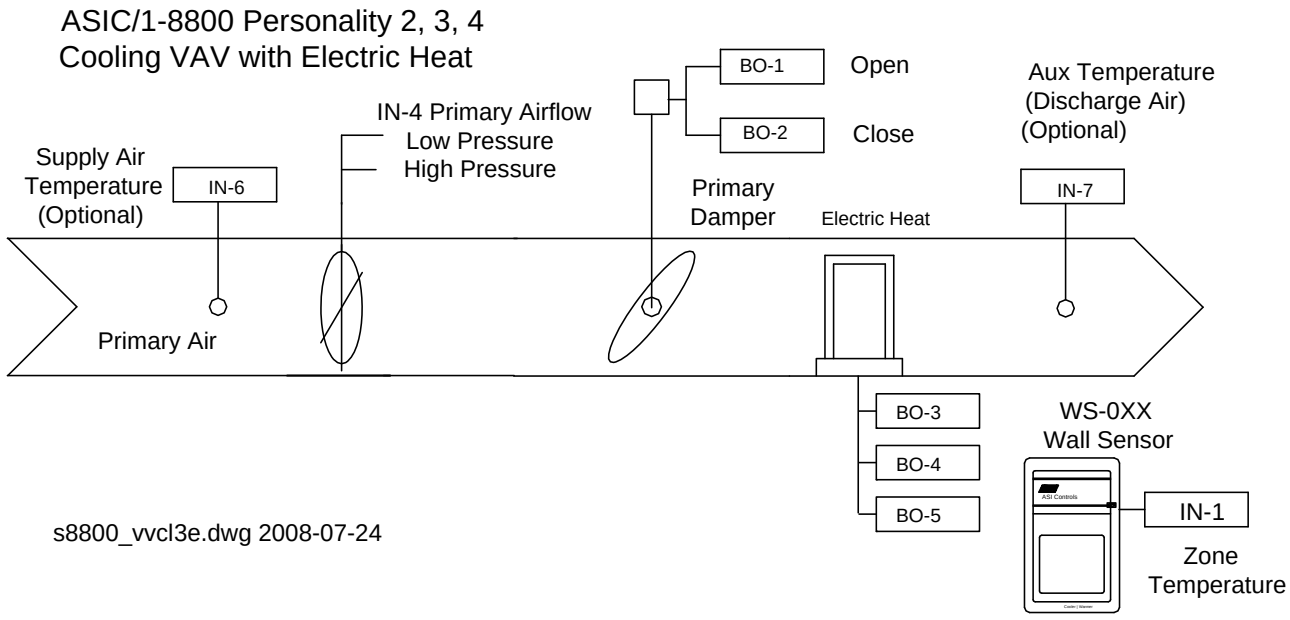
To set the controller into operation the operator needs only to enter a unique device address, select the correct personality for the application and verify or modify duct area and airflow K-factors.

The pre-programmed controller allows newly installed zones to be started up quickly and efficiently. Pre-tuned PI algorithms mean that controllers can accurately maintain space temperature.

The controllers include after-hours override, user temperature setpoint adjustment, minimum and maximum airflow setpoints and lighting control features. Afterhours usage is automatically stored at each unit for retrieval by the building operator. Time-based features such as scheduled changes in setpoints and lighting control may be used when the controller is connected in a network that can synchronize the ASIC/1 internal software clock.

The ASIC/1-8800 can operate-stand alone or as part of a communicating control network with other ASI controllers. Communication at speeds up to 19,200 baud means rapid access to information. This enables integrated control of the complete mechanical system to ensure optimum building performance. Temperatures, airflow, setpoints, and other controller information may be easily reported to ASI WebLink, or to any Windows based software that is a client for OLE for Process Control (OPC).

VAV Personalities



The ASIC/1-8800 is preprogrammed with different personalities for single duct cooling VAV terminals. The Zone Temperature is compared with the Active Heating and Cooling Temperature Setpoints.

If Cooling is required, a PI calculation is used to determine the Cooling Requirement, and the Primary Airflow Setpoint is calculated between Cooling Minimum and Cooling Maximum Airflow. The Primary Air Damper is then modulated to meet the Primary Airflow Setpoint giving Pressure Independenent operation.

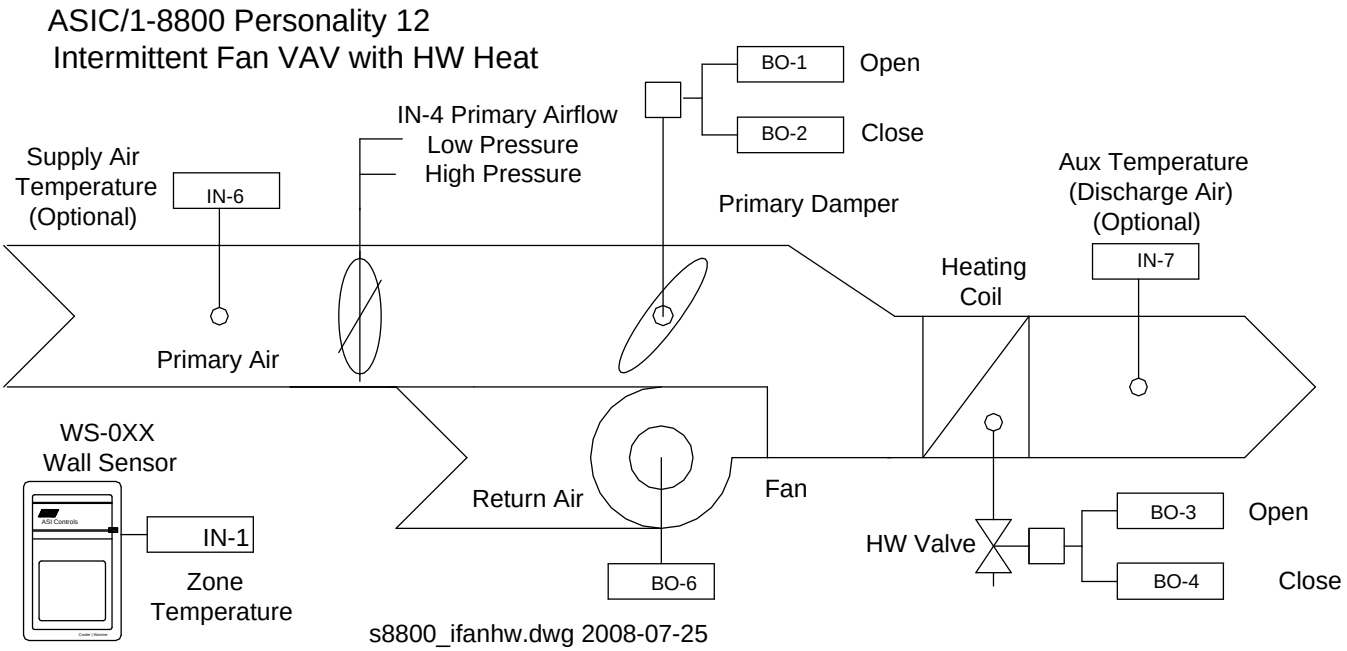
In the Deadband Control Mode the Primary Airflow is set to minimum.

If Heating is required and available the Primary Airflow is set to the Heating Minimum Airflow Setpoint and a Heating Requirement is calculated. Depending on the type of heat available, the Hot Water Valve is modulated open or closed based on drive time; one two or three stages of electric heat are duty cycled, or the Thermic Valve is pulsed on and off.

The operation of the singled duct VAV terminal is determined by the Personality selected. Please see the Application Bulletin 80, Single Duct VAV for further details.

	No Reheat	1 Stage Electric	2 Stage Electric	3 Stage Electric	HW Valve Open/Close	Thermic Valve
VAV	1	2	3	4	5	18

Intermittent Fan Personalities



The ASIC/1-8800 is preprogrammed with different personalities for fan-powered parallel VAV system with intermittent fan.

The Zone Temperature is compared with the Active Heating and Cooling Temperature Setpoints.

If Cooling is required, a PI calculation is used to determine the Cooling Requirement, and the Primary Airflow Setpoint is calculated between Cooling Minimum and Cooling Maximum Airflow. The Primary Air Damper is then modulated to meet the Primary Airflow Setpoint giving Pressure Independenent operation.

If the Primary Airflow falls below the Fan Energize Airflow Setpoint then the Fan is turned On.

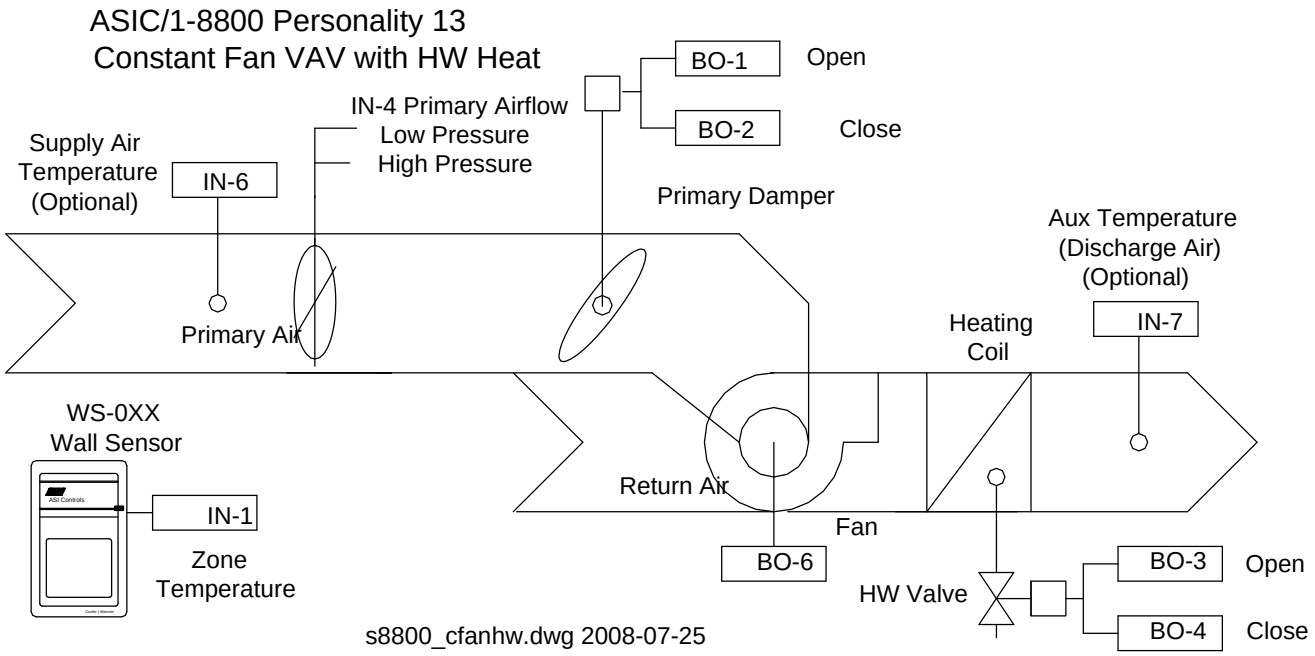
In the Deadband Control Mode the Primary Airflow is set to minimum.

If Heating is required and available the Primary Airflow is set to the Heating Minimum Airflow Setpoint and a Heating Requirement is calculated. Depending on the type of heat available, the Hot Water Valve is modulated open or closed based on drive time; one two or three stages of electric heat are duty cycled, or the Thermic Valve is pulsed on and off.

The operation of fan-powered parallel VAV terminal is determined by the Personality selected. Please see the Application Bulletin 81, Intermittent Fan VAV for further details.

	No Reheat	1 Stage Electric	2 Stage Electric	3 Stage Electric	HW Valve Open/Close	Thermic Valve
Intermittent Fan	16	6	7	8	12	19

Constant Fan Personalities



The ASIC/1-8800 is preprogrammed with different personalities for fan-powered series VAV terminals with constant fan.

The Zone Temperature is compared with the Active Heating and Cooling Temperature Setpoints.

If Cooling is required, a PI calculation is used to determine the Cooling Requirement, and the Primary Airflow Setpoint is calculated between Cooling Minimum and Cooling Maximum Airflow. The Primary Air Damper is then modulated to meet the Primary Airflow Setpoint giving Pressure Independenent operation.

In the Deadband Control Mode the Primary Airflow is set to minimum.

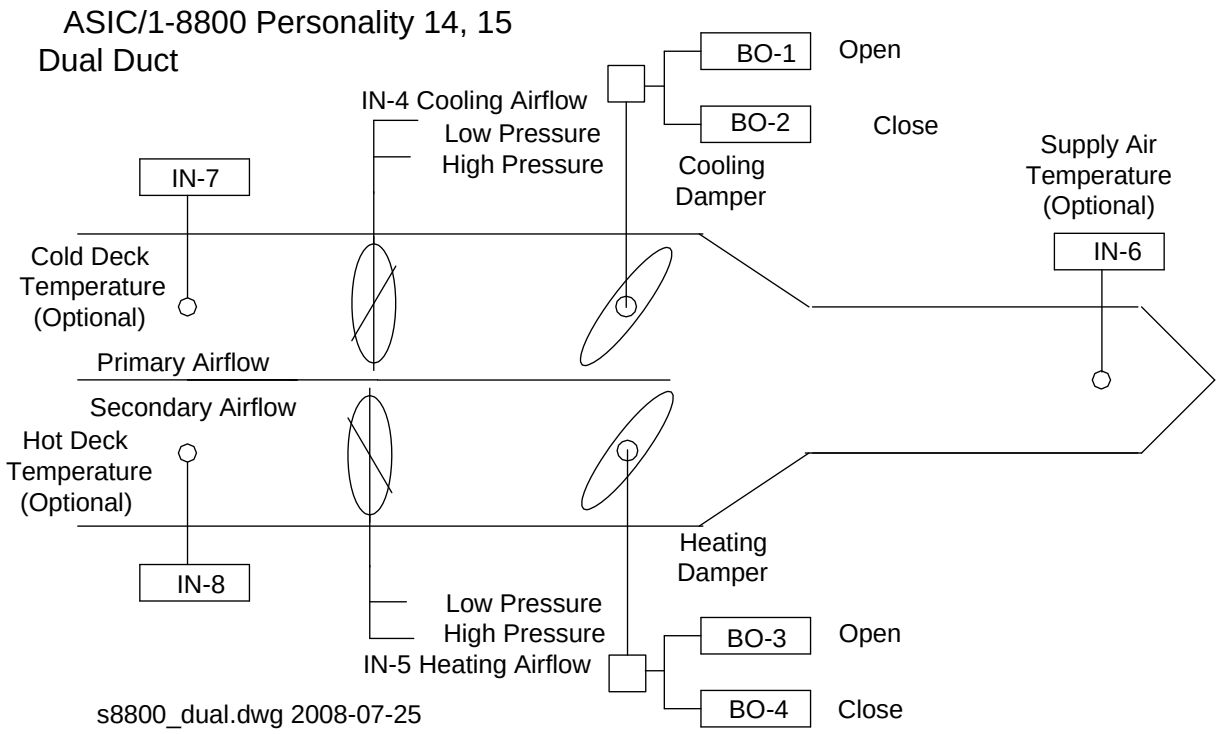
If Heating is required and available the Primary Airflow is set to the Heating Minimum Airflow Setpoint and a Heating Requirement is calculated. Depending on the type of heat available, the Hot Water Valve is modulated open or closed based on drive time; one two or three stages of electric heat are duty cycled, or the Thermic Valve is pulsed on and off.

For Series Fan Powered Terminal box control, the constant fan operation is based on the control state, and mode. In Deadband the fan is on or off depending on the sequence selected. The fan is ON whenever the primary air damper is not closed. In the morning warm up state, the fan is on. In night setback or unoccupied states, the fan is off unless the system is in heating mode.

The operation of fan-powered series VAV terminal is determined by the Personality selected. Please see the Application Bulletin 82, Constant Fan VAV for further details.

	No Reheat	1 Stage Electric	2 Stage Electric	3 Stage Electric	HW Valve Open/Close	Thermic Valve
Constant Fan	17	9	10	11	13	20

Dual Duct VAV Personalities



The ASIC/1-8800 is preprogrammed with two personalities for dual duct VAV system with or without blending.

The ASIC/1-8800 uses an primary airflow sensor to give pressure independent control of the variable air volume cooling. The Zone Temperature is compared with the Active Heating and Cooling Temperature Setpoints.

If Cooling is required, a PI calculation is used to determine the Cooling Requirement, and the Primary Airflow Setpoint is calculated between Cooling Minimum and Cooling Maximum Airflow. The Primary Air Damper is then modulated to meet the Primary Airflow Setpoint giving Pressure Independenent operation. In the Deadband Control Mode the Primary Airflow is set to minimum.

It uses a secondary airflow sensor to give pressure independent control of the variable air volume heating. If the blending personality, 15, is selected, then the cooling and heating airflow are modulated, so that a minimum total airflow is maintained.

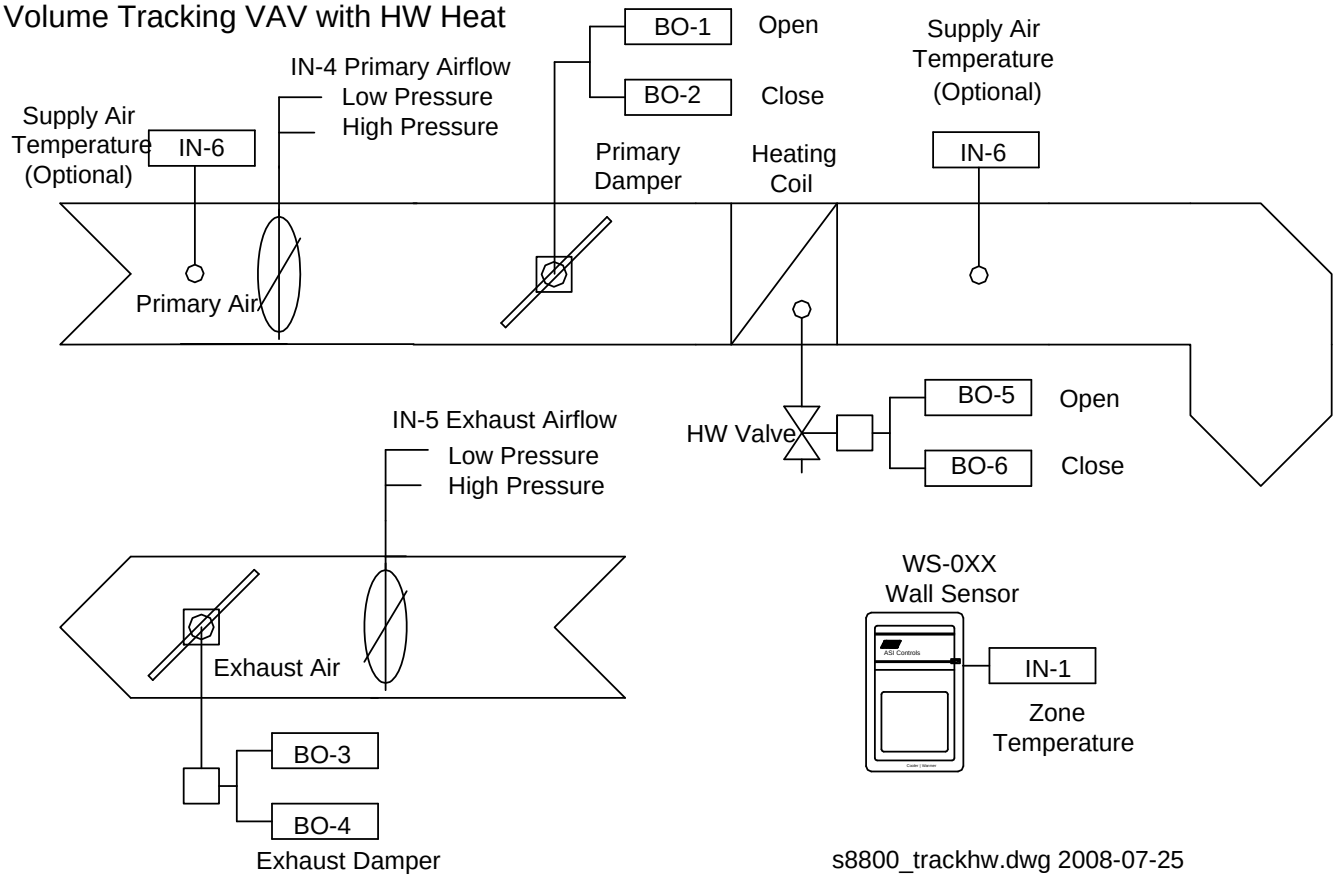
Please see the Application Bulletin 83, Dual Duct VAV for further details.

Dual Duct Personalities

	Without Blending	With Blending
Dual Duct	14	15

Volume Tracking VAV Personalities

ASIC/1-8800 Personality 24
Volume Tracking VAV with HW Heat



The primary air supply airflow for cooling and heating is controlled solely based on zone temperature as in normal single duct VAV. Tracking control sequences do not support fan operation.

The ASIC/1-8800-TRK comes with two airflow sensor for tracking sequences and those requiring monitor of total and primary and exhaust airflows..

Volume Tracking options for VAV(Personality 21), 1 Stage Electric Heat (Personality 22), 2 Stage Electric Heat (Personality 23), HW Valve(Personality 24), and Thermic Valve (Personality 25).

The tracking personalities control the secondary airflow based on exhaust volume independent of the zone state being occupied or unoccupied.. An optional flag determines whether the Volume tracking is Positive (less air leaving the zone) or Negative (more air leaving the zone)..

We will **not** implement pressure tracking or indicators or switches.

	No Reheat	1 Stage Electric	2 Stage Electric	3 Stage Electric	HW Valve Open/Close	Thermic Valve
Volume Tracking	21	22	23	NA	24	25

Exhaust Volume Control

A separate velocity sensor in the secondary air duct measures the exhaust air volume. An exhaust volume setpoint is calculated once a second based on the measured Primary Airflow, the active Tracker Airflow Setpoint, and the ratio of duct sizes and K-factors. The exhaust airflow is maintained at the calculated exhaust airflow setpoint in all control

modes. An optional flag determines which Tracker Positive or Negative Airflow Setpoint is active.

> A Positive Volume Setpoint will control so more air enters the space than is exhausted from the space.
>
> A Negative Volume Setpoint will control so less air enters the space than is exhausted from the space.

Please see the Application Bulletin 84, Tracking VAV for further details.

ECM-Motor Fan Speed

We have implemented an Analog Output for Fan Speed control in the ASIC/1-8800 for Fan VAV Personalities.

The Analog Fan Speed Option is selected by choosing the Analog Output Assignment 5, Fan Speed. It generates a 0 to 10 Vdc based on the Fan Speed Setpoint, 0..100%.. If the Fan is Off, then the output is zero.

The Fan Speed Analog Output can be used with an EVO/ECM-ACU-O Motor Speed Controller to control a GE ECM motor. When the Fan Output goes Off, the Fan Relay is used to remove power to the Motor Speed Controller thereby stopping the Fan. The Fan Output is typically on BO-6.

ASIC/1 WS-051 Digital Display

The ASIC/1-8800 supports the WS-051 Digital Display Wall Sensor. The Digital Display has a zone temperature sensor that is read by the ASIC/1 controller. The Digital Display is connected to the ASIC/1-8800 using the standard SCP-0xx wall sensor cable. A jumper, JMPR1, must be set on the controller and Digital Display Enable must be set to yes using ASI Expert software. You can talk to the controller through the wall sensor using a SINC/1-1030 Portable Mini-SINC.

If User Adjust Enable is yes, the WS-051 can be used to change the Occupied Cooling and Heating Temperature setpoints. If Single Setpoint Enable is yes, then single setpoint adjustment is supported where the Occupied Cooling Temperature Setpoint is changed and the Occupied Heating Temperature Setpoint is lower, by the Single Setpoint Deadband [Default 5]..

If Afterhours Enable is yes, the WS-051 can be used to start afterhours operation.

If Half Degree Enable is yes, then the temperature setpoints are maintained in 0.5 deg increments in the controller

If the Input 1 Type is Zone Temp deg C, then the temperature reading and setpoints are in Celsius units. If the Input 1 Type is Zone Temp deg F, then the temperature reading and setpoints are in Fahrenheit units.

Please see the Application Bulletin 69, ASIC/1 Digital Display for further details.

ASIC/1 Occupancy Sensor

The ASIC/1-8800 supports an occupancy sensor on Input 8. If the Occupancy Sensor Enable is set, the control state is determined by the daily event schedule or by the switch attached to input 5. The switch can be sense a voltage threshold or may be two-position normally open or normally closed switch.

In the Occupied State the sensor or switch forces the controller to the Unoccupied State using the unoccupied setpoints and sequence.

In the Night Setback or Unoccupied States if Occupancy Afterhours Enable is yes, the Occupancy Sensor can initiate afterhours operation when the sensor indicates that the room is occupied.

January 2009

Please see the Application Bulletin 66, ASIC/1 Occupancy Sensor for further details.

About This Document

This manual was produced using *Doc-To-Help*®, by Component One, LCC. This manual, ASIC/1-8800 Applications, DOC-1684 and Windows™ help system was last revised on 2009-01-19. ASI Controls is always working to improve our products. Should you have any questions, or suggestions that would help our products better meet your needs, or that would help us serve you better, please call, write, or e-mail to:

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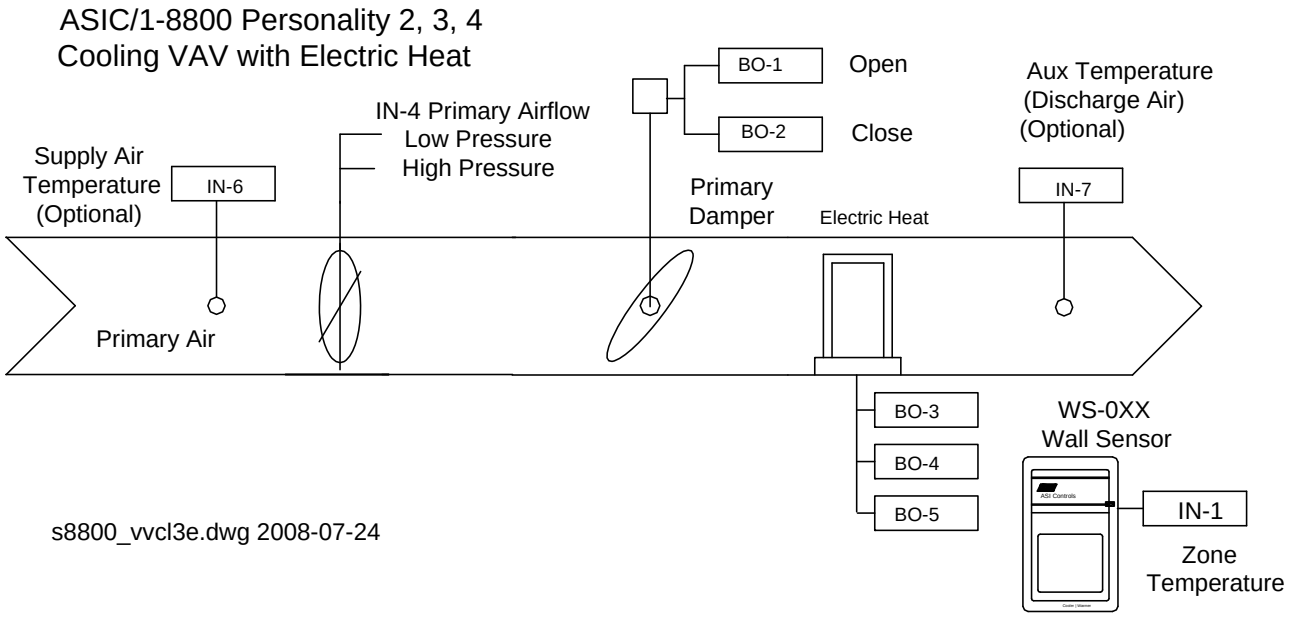
Single Duct VAV

Application



This application bulletin describes the sequence of operation used by the ASIC/1-8800 to control zone temperature with a single duct variable air volume system. The ASIC/1-8800 uses an primary airflow sensor to give pressure independent control of the variable air volume cooling. Heating is provided with optional proportional or thermic valve hot water heat, or up to 3 stages of electric heating. The ASIC/1-8800 is preprogrammed with different personalities for single duct cooling VAV terminals.

Single Duct VAV Personalities

	No Reheat	1 Stage Electric	2 Stage Electric	3 Stage Electric	HW Valve Open/Close	Thermic Valve
VAV	1	2	3	4	5	18

Inputs

The ASIC/1-8800 controller has specific inputs for zone temperature, primary airflow, and optional secondary airflow, and optional supply air temperature, and optional occupancy sensor. The default input types are set at the factory. Inputs that are not required for the sequence may be used for monitoring.

Primary Airflow

The ASIC/1-8800 uses a primary airflow sensor to give pressure independent control of the variable air volume. The primary airflow sensor is installed on input 4 in the pin-sockets at AIR1. It is calibrated at zero airflow. An airflow filter, AF-001, is required on the inlet side of the airflow transducer, HIGH, as marked on the ASIC/1-8800.

The controller measures the air velocity in feet per minute (ft./min) assuming a standard velocity K-factor of 2338 ft/min. The velocity K-factor is the air velocity in ft/min required to generate a velocity pressure of 1 inch water column (1 "wc =249 Pa) The velocity K-factor is provided by the VAV box manufacturer for a particular box size and flow cross. The airflow volume Q in CFM is calculated based on the actual K-factor in feet per minute , and duct area in square feet.

$$Q\ (CFM) = Area\ (ft^2) * Velocity(ft/min) * (K\text{-}factor/2338)$$

Field adjustment of the velocity K-factor may be done by the air balancer using the air balance screen on the setup software.

> Note: The airflow sensor requires an airflow filter, AF-001, on the high pressure side, to prevent dust from contaminating the sensor.

Secondary Airflow (optional)

A optional secondary airflow sensor may be used to monitor additional airflow. A secondary airflow sensor may be installed on input 5 in the pin-sockets at AIR2. It is calibrated at zero airflow and has separate K-factors and duct areas.

Wall Sensor Connections

Zone temperature sensor is normally on input 1. Typically, the zone temperature on the WS-0xx, wall sensor, is connected to the controller using a SCP-XXX sensor cable. Alternately, a zone or return air temperature sensor may be attached on input terminal, IN1. If there is no zone temperature sensor , then the zone sensor input is in fault, all outputs are off, and it does not try to control.

The afterhours push-button on the WS-0X1 wall sensor if used, is always on input 2. If Afterhours Enable is Yes, then shorting the input to zero will initiate afterhours override mode for an Afterhours Time Allowed.

Input 3 is used for Interlock and may be used for variable user adjust with the WS-0XX wall sensor. When User Adjust Enable is set and input 3 is configured for Variable User adjust, 10k to 30 kohm, the zone temperature setpoint may be adjusted up or down by the User Adjust Setpoint, based on the condition of input 3.

Support is also provided for the WS-051 Digital Display Wall Sensor. The WS-051 has a zone temperature sensor on input 1 and provides both Occupied Temperature Setpoint change and afterhours override. A jumper, JMPR1, is set to provide power to the WS-051 via input 2. Digital Display Enable must be set to yes.

Auxiliary Temperature Sensors

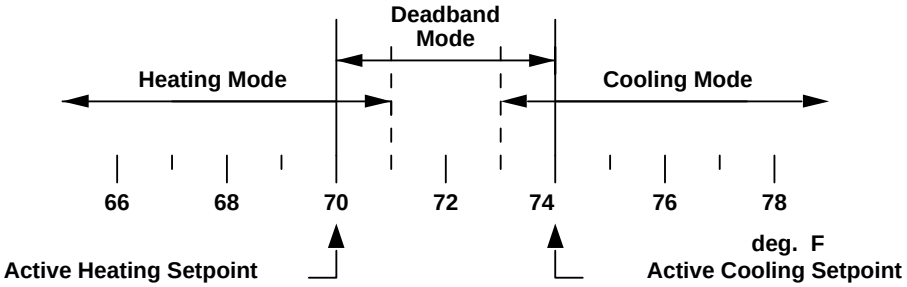
An optional duct temperature sensor, TS-DO, may be placed on input 6, 7, or 8 for temperature monitoring. The auxiliary temperature sensors use the factory provided 3.32 kohm pull-up resistors.

The duct sensor on Input 6 measures Discharge Air Temperature and is used for auto-changeover if Changeover Setpoint is not zero. If input 6 is in fault, then changeover is ignored. Changeover operation is described below.

An optional occupancy sensor or switch may be used on Input 8 to change the control state from occupied to unoccupied. When the occupancy sensor is used in combination with a temperature sensor, then the temperature sensor is not read when the contacts are closed.

Control Mode

The controller determines the Control Mode, Heating, Deadband, or Cooling by comparing the zone temperature to the Active Heating Temperature Setpoint and Active Cooling Temperature Setpoint.



The controller enters the Cooling Control Mode when the zone temperature equals or is greater than the Active Cooling Temperature Setpoint. The control reenters the Deadband mode, when the zone temperature is 1 ^{o}F below the Active Cooling Temperature Setpoint and the calculated Cooling Requirement is equal to zero.

The control enters the heating mode when the zone temperature is equal to or less than the Active Heating Temperature Setpoint. The control reenters the Deadband mode when the zone temperature is 1 ^{o}F greater than the Active Heating Temperature Setpoint and the calculated Heating Requirement is equal to zero.

Note: A 2 degree separation is required between the Active Cooling and Heating Temperature Setpoints.

Active Temperature Setpoints

The controller maintains the zone temperature between Active Cooling and Heating Temperature Setpoints. The Active Cooling and Heating Temperature Setpoints are based on Control State, the Active User Adjust based on the position of the Variable User Adjust, and the Active Demand Limit Reset.

Temperatures may be in degrees Fahrenheit or Celsius, depending on the input convert type that has been selected. If Half Degree Enable is set then the Temperature Setpoints are in half-degree (Fahrenheit or Celsius) increments.

If User Adjust Enable is set, the Active Temperature Setpoints may be modified by the variable user adjust potentiometer on a WS-0XX wall sensor depending on the input configuration. The Active Heating Temperature Setpoint is adjusted up and the Active Cooling Temperature Setpoint is adjusted down a fraction of the User Adjust Setpoint.

If the Active Demand Level is non-zero, the Active Temperature Setpoints are also modified by a fraction of the Demand Reset Range as the Active Demand Level goes from 0 to 6. The Active Cooling Temperature Setpoint is reset upwards and the Active Heating Temperature Setpoint is reset downwards.

Cooling and Heating Requirement

In Deadband Control Mode, the Heating and Cooling Requirements are zero.

In the Cooling or Heating Control Mode, the Cooling or Heating Requirement is calculated using a PI control loop.

The change in heating or cooling requirement is calculated every 30 seconds.

In heating: Error = Active HTG SP - Zone Temp
Δ Error = Previous Zone Temp - Zone Temp

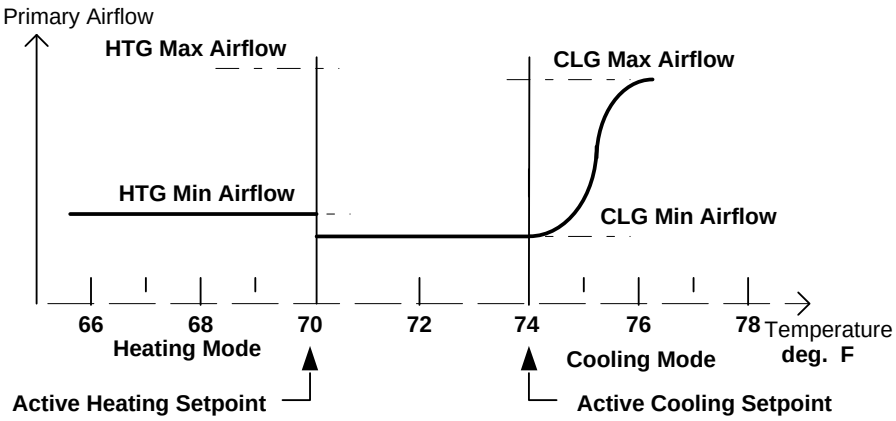
or in cooling: Error = Zone Temp - Active CLG SP
Δ Error = Zone Temp - Previous Zone Temp.

ΔRequirement = (100%/ThrottleRange)*[Error*(CalcTime/Int Time) +Δ Error]

The factory setting for throttle range is 4.0 degrees, and for integral time is 2.5 minutes.

Primary Airflow Modulation

In the Cooling Mode the primary airflow modulates between the Active Cooling Minimum and Maximum Airflow Setpoints as the cooling requirement goes from zero to 100 %.



In the Deadband Mode the Primary Airflow is typically at the Active Cooling Minimum Airflow Setpoint.

In the Heating Mode the Primary Airflow is at the Active Heating Minimum Airflow Setpoint and the Local Heat is modulated with the Heating Requirement to maintain the Active Heating Temperature Setpoint. If Dual Heating Enable is yes, then the primary airflow also modulates between Heating Minimum and Maximum Airflow as the heating requirement goes from 0 to 100%.

Pressure Dependent Operation

If Pressure Dependent Enable is yes, then the position of the Primary Damper motor is controlled based on Damper Drive Time rather than airflow. The Cooling and Heating Damper Minimum and Maximum Positions are a percentage of the Damper Drive Time.

In the Cooling Mode the damper modulates between the Active Cooling Damper Minimum and Maximum Positions as the zone Cooling Requirement goes from zero to 100 %.

In the Deadband Mode the damper is typically at the Active Cooling Damper Minimum Position.

In the Heating Mode the damper is at the Active Heating Damper Minimum Position and the Local Heat is modulated to maintain the Active Heating Temperature Setpoint. If Dual Heating Enable is set then the damper also modulates between Heating Minimum and Maximum Airflow as the heating requirement goes from 0 to 100%.

To maintain indexing of damper position the Damper is driven fully closed for a Damper Drive Time: On reset of Power, On return from Damper Override, or Emergency Mode.

Control State

The Control State determines which Cooling and Heating Temperature Setpoints are used for zone temperature control. Four control states are possible: Occupied, Unoccupied, Night Setback, and. Morning Warm-up. If the clock is not synchronized, the Control State is Occupied unless Default State Unoccupied is set. . If synchronized, the Control State is changed by an exact match of the Daily Event Schedule.

The Control State may be overridden via a message broadcast over the communication bus from software or an ASIC/2 controller. The controller state may be returned to OCC from NSB or Unocc when the Afterhours Enable is yes and the push-button on the Wall Sensor is pushed. The controller state may be also forced to Unoccupied from Occupied by an Occupancy Sensor on input 8.

The Active Cooling and Heating Minimum and Maximum Airflow Setpoints are typically given by the Occupied Cooling and Heating Minimum and Maximum Airflow Setpoints.

However, if Multiple Airflow Enable is set, the Active Cooling and Heating Minimum and Maximum Airflow Setpoints are given by: the Occupied Cooling and Heating Minimum and Maximum Airflow Setpoints in the Occupied and Morning Warm-up States; the Unoccupied Cooling and Heating Minimum and Maximum Airflow Setpoints in the Unoccupied State; or.the Night Setback Cooling and Heating Minimum and Maximum Airflow Setpoints in the Night Setback State.

Deadband Mode

In the Deadband Mode, the operation of the primary air damper depends on the Control State and option selections.

In Occupied Deadband the Primary Airflow is at the Active Cooling Minimum Airflow Setpoint.

In Unoccupied Deadband the Primary Airflow is at the Active Cooling Minimum Airflow Setpoint, unless UNO Option 2 Enable is yes, then the primary air damper is closed in Deadband

Primary Damper Control - VAV

	Occupied	Changeover	UNOCC Option 2 = No	UNOCC Option 2 = Yes	NSB Option 2 = No	NSB Option 2 = Yes	MWU Option 2 = No	MWU Option 2 = Yes
Cooling	Modulate	Min CLG	Modulate	Modulate	Modulate	Modulate	Min HTG	Min HTG
Deadband	Min CLG	Min HTG	Min CLG	Closed	Min CLG	Closed	Min HTG	Min HTG
Heating	Min HTG	Modulate	Min HTG	Min HTG	Min HTG	Min HTG	Max HTG	Min HTG

In Night Setback Deadband Mode the primary Airflow is at the Active Cooling Minimum Airflow Setpoint, unless NSB Option 2 Enable is yes, then the primary air damper is closed in Deadband.

Morning Warm-up (MWU) State

Morning Warm-up is meant as a prelude to Occupied state, to ready the building for daily use. For Morning Warm-up, the control sequence operates at full-capacity heating until the zone temperature is moved into the Deadband region.

Two MWU sequences can be selected: central heating, and local heating. In central heating MWU hot air is distributed through the primary air ducts. In local heating MWU, all heat is provided from the VAV terminal.

MWU, Central Heating

If Morning Warm-up Option 2 Enable is not set, then central heating is assumed where hot air is in the duct as in changeover heating, which is described below. If the control is initially in cooling or heating mode, the opposite mode is locked-out until the end of Morning Warm-up.

All local heat is typically OFF during this sequence. However, if Local Heat Enable is yes, then local heat is used in addition to central heat.

Morning warm up differs from changeover because the controller goes into heating once, while in changeover it can go in and out of the heating mode many times.

MWU, Local Heat

If Morning Warm-up Option 2 Enable is set then local heating is assumed. The airflow is maintained at Occupied Heating Minimum Airflow Setpoint and all heating is provided by local hot water or electric heat. If Dual Heating is enabled, the primary damper ramps to maximum with heating.

If zone temperature is less than Occupied Heating Setpoint when the control enters MWU state, the heating requirement is 100%, the local hot water or electric heat is at 100%.

When zone temperature reaches Occupied Heating Temperature Setpoint the heating requirement is at 0% and the heat turns OFF. If the zone temperature falls 2 ^{o}F below the Occupied Heating Temperature setpoint, the heating requirement is again at 100% to maintain temperature setpoint. This cycle continues while in MWU state.

Changeover

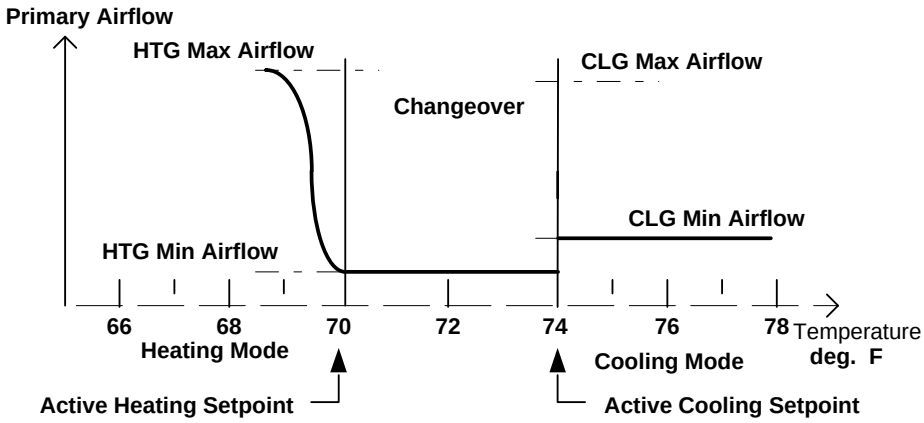
A changeover feature is available which modifies the modes of operation in Heating, Deadband, and Cooling Control Modes. In changeover it is assumed that the primary supply air temperature is appropriate for heating. Changeover is useful for applications where a single duct serves both heating and cooling at different times.

In the changeover heating mode, the Active Primary Minimum and Maximum Airflow setpoints are given by the Active Heating Minimum Airflow and Heating Maximum Airflow Setpoints. The airflow modulates based on the zone Heating Requirement.

If Local Heat Enable is set, the local heat also comes on in addition to central heat whenever the controller is operating in changeover heating.

In changeover Deadband the supply air is maintained at Active Heating Minimum Airflow Setpoint.

In changeover cooling the airflow is maintained at the Active Cooling Minimum Airflow Setpoint.



Auto-changeover

Auto-changeover requires installation of a supply air temperature sensor on input 6. If the measured supply air temperature is greater than the Changeover Setpoint, the controller goes into a heating only changeover mode. If the Changeover Setpoint is 0 F (default), the auto-changeover feature is disabled.

Remote Changeover

A remote communications command to set changeover ON, forces the system to control in the changeover heating mode. A remote command to set changeover OFF forces prevents all changeover control action. Remote commands always take priority over auto-changeover. A remote command to restore changeover clears changeover ON and changeover OFF and enables the auto-changeover control action.

Pressure Dependent Changeover

In changeover it is assumed that the primary supply air temperature is appropriate for heating.

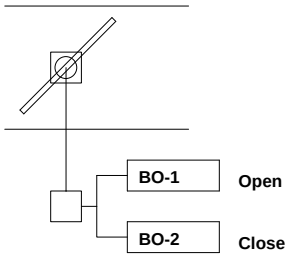
If Pressure Dependent Enable is yes, then in changeover heating, the damper modulates between the Active Heating Damper Minimum and Maximum Positions based on the zone Heating Requirement.

If Local Heat Enable is set, the local heat also comes on in addition to central heat whenever the controller is operating in changeover heating.

In changeover Deadband the supply air is maintained at Active Heating Damper Minimum Position.

In changeover cooling the airflow is maintained at the Active Cooling Damper Minimum Position.

Outputs



Primary Air Damper

Primary Air Damper

In Single Duct personalities in Cooling Control mode, the controller modulates the Primary Airflow Setpoint between the Active Cooling Minimum and Maximum Airflow setpoints based on the Cooling Requirement.

The Primary Airflow is compared with the Primary Airflow Setpoint every a second. As the damper drives the airflow toward the setpoint, the output begins to pulse, where the pulse size in 1/6 s increments is given by 4*Airflow Error/AF Hysteresis. The smallest non-zero Airflow Hysteresis gives the fastest approach to setpoint.

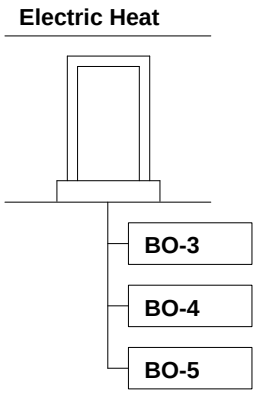
As control approaches the setpoint, the airflow error is summed over time. The Airflow Integration Time [Default 4] is the time required for a 25 ft/min error to sum to give an additional pulse. To enable this algorithm you must give the Airflow Integration Time [Default 4] a non-zero value. If Airflow Integration Time is zero, then it drives to the Airflow Setpoint, and waits until airflow exceeds hysteresis.

Secondary Air Damper (Optional)

An optional Outdoor Air feature controls the Secondary Airflow measured on Input 5 in the occupied state. When Outside Airflow Enable is yes, the secondary damper is modulates the Secondary Airflow to the Outside Air Volume Setpoint within an Outside Airflow Hysteresis. In Night Setback, Unoccupied, and Morning Warmup states, the Outside Air Damper is driven closed continuously. Any unused binary outputs can be assigned to Secondary Damper Open and Closed Outputs.

Outdoor Air Control is not available in Dual Duct or Tracking Personalities.

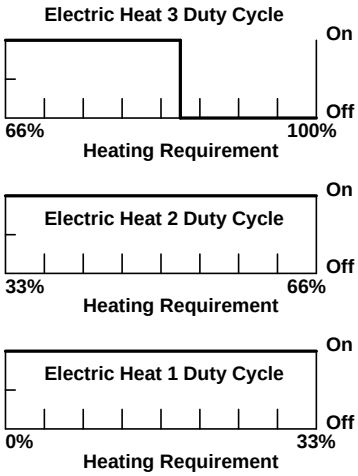
Electric Heat Output



Up to 3 stages of Electric Heating output may be used to maintain the calculated heating requirement in VAV Personality 2, 3, and 4.

For a controller with 1 stage of electric heat (Personality 2,6,9): Stage 1 duty cycles in proportion to the Electric Heat Base Time; from 0 to 100% as the Heating Requirement goes from 0 to 100%

For a controller with 2 stages of electric heat (Personality 3,7,10): Stage 1 duty cycles in proportion to the Electric Heat Base Time from 0 to 100% as the Heating Requirement goes from 0 to 50%; and Stage 2 does not turn ON until stage 1 is on for 100% of the duty cycle time and duty cycles in proportion to the Electric Heat Base Time from 0 to 100% as the Heating Requirement goes from 50% to 100%.

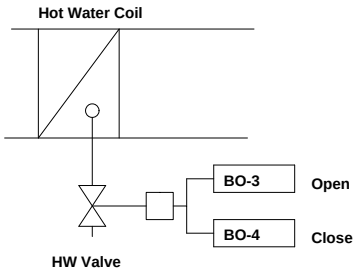


3 Stage Electric Heat at ~80% HTG

For a controller with 3 stages of electric heat (Personality 4,8,11): Stage 1 duty cycles in proportion to the Electric Heat Base Time from 0 to 100% as the Heating Requirement goes from 0 to 33%; stage 2 does not turn ON until stage 1 is on for 100% of the Electric Heat Base Time and duty cycles from 0 to 100% as the Heating Requirement goes from 33% to 66%; and Stage 3 does not turn ON until stage 2 is ON for 100% of the duty cycle time and duty cycles from 0 to 100 % as the Heating Requirement goes from 66% to 100%.

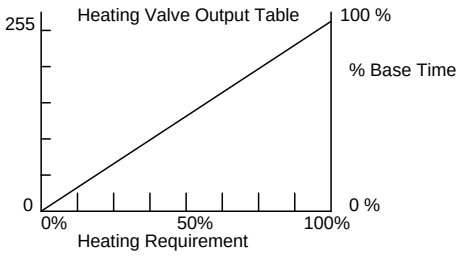
The output to be controlled is identified by the Electric Heat 1,2,3 Masks . The functional status of the Electric Heat Outputs is shown by the Electric Heat 1,2,3 Output Status bits.

Hot Water Heat Output

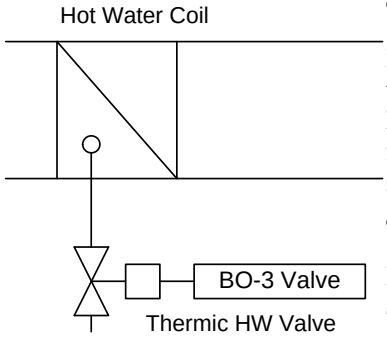


In a controller with modulated hot water heat (Personality 5,12,or 13), the valve is opened or closed a fraction of the HW Valve Base Time in proportion to the Heating Requirement. The output to be controlled is identified by the HW Valve Open Mask and HW Valve Closed Masks. The functional status of the HW Valve output is shown by the HW Valve Output Status

For a controller with modulated hot water heat, the valve is opened or closed a fraction of the valve time base in proportion to the Heating Requirement based on the five-value Heating Valve Output Table.



Thermic Valve On/Off (Optional)



The output to be used is assignable using the Thermic Valve On/Off Mask

In a controller with thermic valve hot water heat (Personality 18, 19, or 20), the valve is energized for a fraction of the HW Valve Base Time in proportion to the Heating Requirement. The thermic Valve is normally off and will be ON for a fraction of the HW Heating Base Time. It will be initially on and once it goes off it stays off for the remainder of the HW Heating Base.

Timer On Time = (HW Output/255)* HW Base Time.

If Thermic Valve Reversed is set the output will be normally on, and will be OFF for a fraction of the HW Heating Base Time.

Other Outputs

Analog Outputs

The ASIC/1-8800 has two 0 to 10 Vdc Analog outputs that can drive upto 20 mA. The outputs can be assigned to Cooling Requirement, Heating Requirement, or Changeover Heating/Cooling. Because some actuators are 6 to 9 V and others are 2 to 10 Vdc, the analog outputs can be scaled from Minimum Output (Fully Closed) to Maximum Output (Fully Open) as the control signal goes from 0 to 100%.

In Changeover Heating/Cooling the analog output follows the Cooling Requirement, but if the Changeover status is ON, then the analog output follows the Heating Requirement. The Changeover status is set by a command on the communication line, or by comparing the Duct Temperature with the Changeover Setpoint.

Auxiliary Cooling Output (Optional)

An optional auxiliary cooling output is provided. If Auxiliary Cooling Enable is set, and the Cooling Requirement is 100 % and the zone temperature exceeds the active cooling setpoint by an Auxiliary Cooling Offset [Default 2 ^{o}F] for an Auxiliary Cooling Delay Time [Default: 120 s], then an auxiliary cooling output is energized. The output to be used is assignable using the Auxiliary Cooling Output Mask [Default: Output #5]. Once energized, the auxiliary cooling output remains on until the zone temperature falls below the active cooling temperature setpoint, and the cooling airflow falls below the maximum cooling setpoint by an amount given by the Auxiliary Cooling Hysteresis. [Default: 125 ft/min]

Auxiliary Heating Output (Optional)

If Auxiliary Heating Enable is set, the auxiliary heating output goes on whenever the controller is in the heating mode. This output is completely independent of the hot water valve or electric heat operation. It may be used to control baseboard heat used in conjunction with terminal boxes.

Auxiliary 1, 2, 3 Output (Optional)

The ASIC/1-8800 allows up to 3 outputs for auxiliary outputs which do not follow any schedule. They can be overridden On or Off, and remain in the last state commanded. The output to be controlled is identified by the Aux 1, 2, 3 Masks which are initially un-assigned. The functional status of the Aux 1, 2, 3 Outputs is shown by the Auxiliary 1, 2,3 Output Status.

Lighting Output

Each ASIC/1 has the ability to control lighting. The Lighting schedule automatically turns the lights on and off. By equipping the ASIC/1 with a WS-0XX wall sensor with push button override, the lights can be operated manually by the occupant during Occupied and Morning Warm-up States by pressing the button on the side of the zone sensor without affecting HVAC operation.

During Unoccupied and Night Setback States, depressing the push button will return the control to Occupied, and the lights will come on and stay on for Afterhours Time Allowed. During Emergency 1 and Emergency 2, the push-button has no effect.

If Lights Occupied Enable is yes then the lights are on whenever the Lighting Schedule is On, or the Control State is occupied.

Blink Warning: One minute before automatic shut off of lights as designated in the daily event schedule, or at the end of the afterhours override period, the lights will blink off and back on again. Pressing the afterhours button on the wall sensor re-starts the lights.

Alarms

Zone Temperature Alarm

If the zone temperature is above the Active Cooling Temperature Setpoint by the Zone Temperature Alarm Range, a High Zone Temperature Alarm is set. If the Zone temperature is below the Active Heating Temperature Setpoint by the Zone Temperature Alarm Range, a low Zone Temperature Alarm is set. No other actions are taken in response to a zone temperature alarm.

Primary Airflow Alarm

If the primary airflow is above the Primary Airflow Setpoint by the Airflow Alarm Range, then a High PrimaryAirflow Alarm is set. If the Primary Airflow is below the Primary Airflow Setpoint by the Airflow Alarm Range, then a Low Primary Airflow Alarm is set. No other actions are taken in response to a Primary Airflow Alarm.

Emergency Modes

The emergency modes, Emergency 1, and Emergency 2, are overrides which are received over the communication line and remain in effect until cleared over the communication line.

Emergency 1 Mode

The control may only enter or exit Emergency 1 as a result of commands received on communications line. While in Emergency 1, no other state may be entered until Emergency 1 has been cleared via the communications line. Emergency is maintained through loss of power.

While in Emergency 1 state the controller immediately drives the damper to Maximum Cooling Airflow Setpoint, turns ON the lighting output, and turns OFF any other outputs including electric heat.

Emergency 2 Mode

The control can enter and exit Emergency 2 as the result of commands received on the communications line. If in Emergency 2, no other state except Emergency 1 may be entered until Emergency 2 has been cleared via the communications line. Emergency is maintained through loss of power.

While in Emergency 2 state the controller immediately drives the damper closed, turns ON the lighting output and turns OFF any other outputs, including electric heat.

Communications

The ASIC/1-8800 communicates at 1200 baud, 9600 baud, or 19,200 baud on the remote bus using RS-485 twisted pair communication wire, connected to remote screw terminal connector, TB-4. Access to the ASI communication bus is through an ASIC/2 configurable controller or ASI EtherLink/2 serial router which can also be used to broadcast time to synchronize the network of ASIC/1 controllers.

Communication with the remote bus can also be established through the WS-0XX wall sensor using a SINC/1-1030 Portable Interface connected to a lap-top computer running ASI Expert software.

Each controller has a unique 16-bit address [Default 18800], and may also have a separate 8 bit group address. It will also respond to the global addresses 23125(5A55h) and 23130 (5A5Ah).

Communication with the ASIC/1-8800 is largely compatible with the ASIC/1-8055 which it replaces. The ASIC/1-8800 may co-exist on the communication line with other ASIC/1 controllers. It is compatible with the ASI LinkOPC Server for seamless communication with Windows based graphic user interfaces.

System Component Checklist

Inputs

Description	Part Number	Quantity
Airflow Filter	AF-001	1,2
Optional Duct Temperature Sensor (IN-06)	TS-DO-8	0,1
Optional Duct Temperature Sensor (IN-07)	TS-DO-8	0,1
Optional Duct Temperature Sensor (IN-08)	TS-DO-8	0,1
Optional Occupancy Switch (BI-08)		0,1
Wall Mounted Zone Temperature Sensor	WS-0X1	1
Sensor Cable	SCP-0XX	1
Communication Cable twisted pair.	22-24 ga twisted	

Note: The inlet side of the airflow transducer, HIGH, is marked on the ASIC/1-8800 is same as the ASIC/1-8055 controller. An airflow filter, AF-001, is required on the inlet side of the airflow transducer.

NOTE: Consult ASIC/1-8800 Installation manual for configuration of inputs.

Outputs

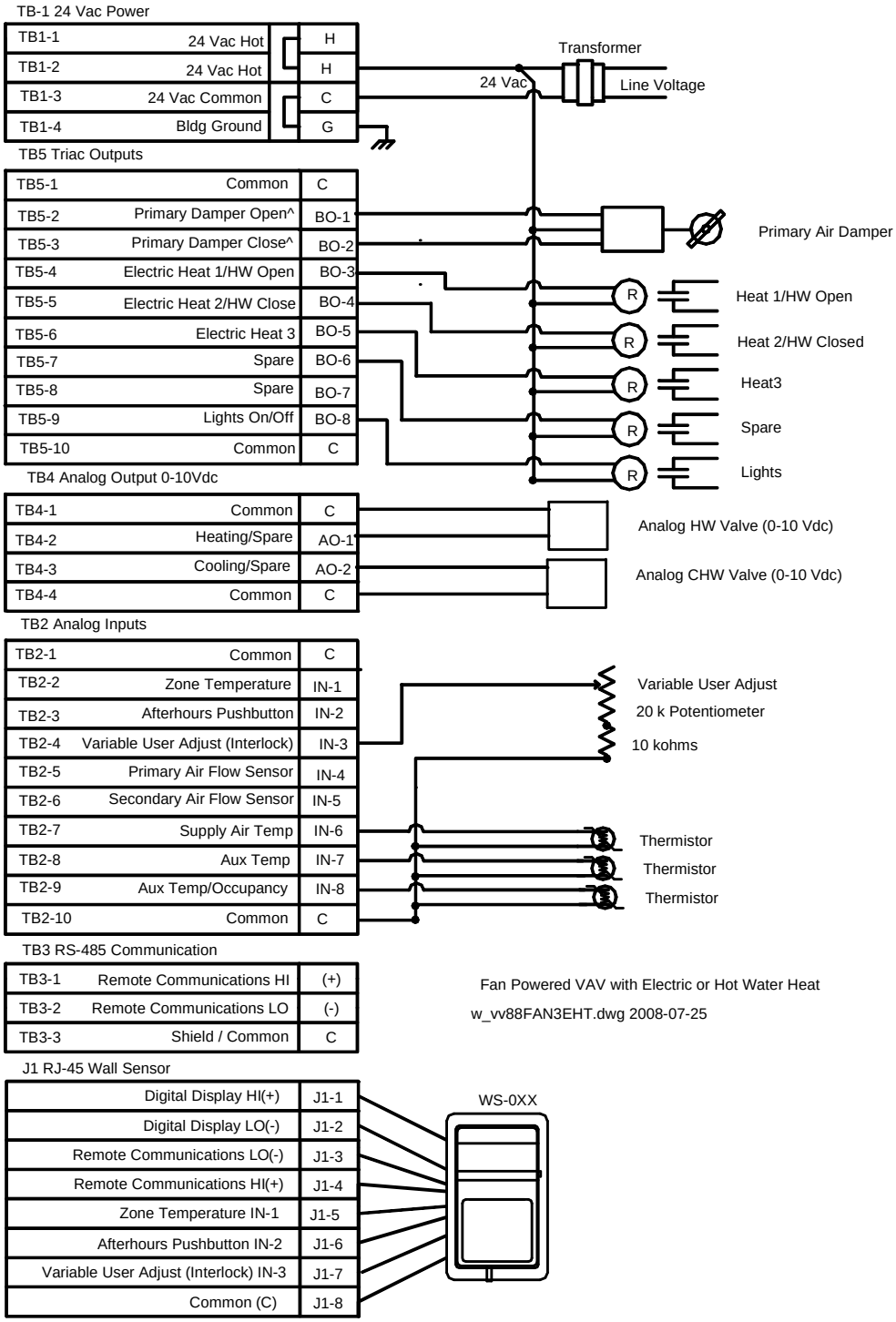
Description	Part Number	Quantity
VAV Controller	ASIC/1-8800	1
24 Vac Transformer		1
24 Vac Tri-state Primary Damper Operator		1
HW Valve with 24 Vac Tri-state Operator		0,1
24 Vac Thermic Valve (Optional)		0,1
24 Vac Electric Heat Relay		0,1,2,3
24 Vac Auxiliary CLG Output Relay (Optional)		0,1
24 Vac Auxiliary HTG Output Relay(Optional)		0,1
24 Vac Auxiliary Output Relay (Optional)		0,1,2,3
24 Vac Lighting Relay (Optional)		0,1

NOTE: . The ASIC/1-8800 must be connected to a solid building ground. Metallic-oxide Varistors, MOV, may also be used across relay contacts to provide further protection from transients. If current interrupting relays are in series with the output circuits they must be protected with MOVs across the Relay Contacts

Wiring Layout

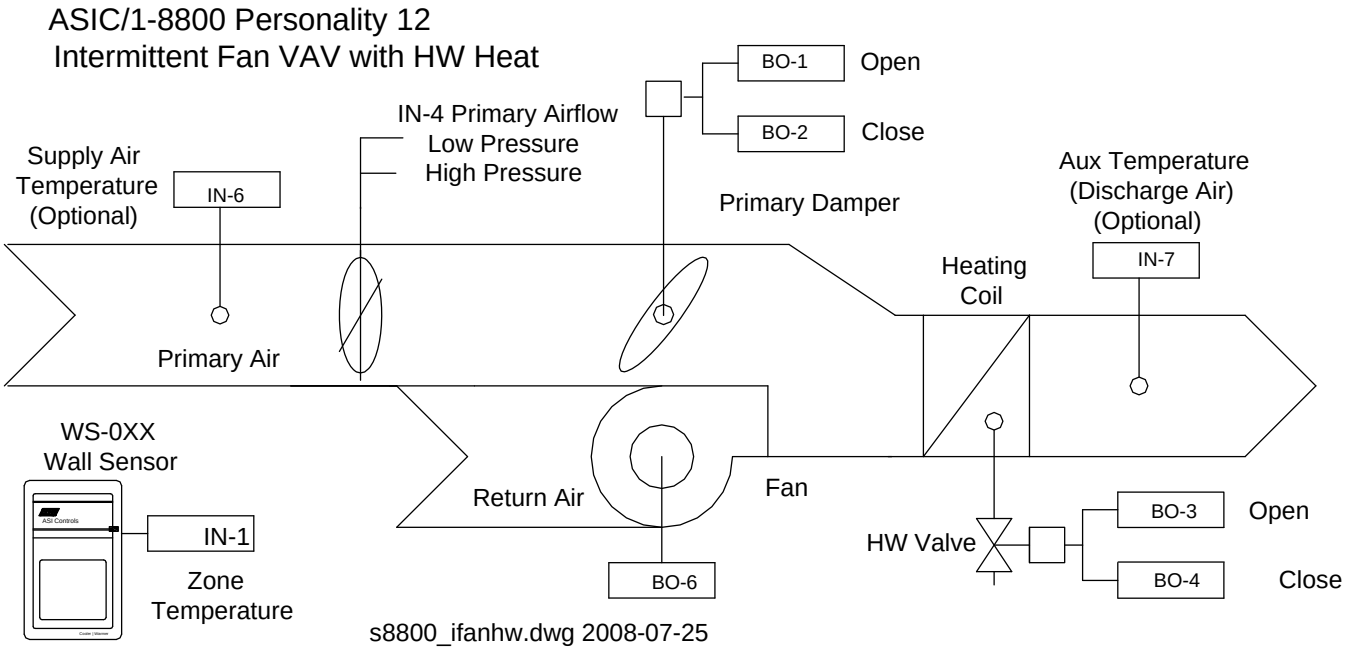
VAV with Hot Water or Electric Heat

Typical single duct cooling VAV with 3 Stages of Electric Heat, for use with the following personalities: Personality 1, cooling only; Personality 2, 1 stage of electric heat Personality 3, 2 stages of electric heat: or Personality 4, 3 stages of electric heat., or Personalty 5 Hot Water Heat



Intermittent Fan VAV

Application



This application bulletin describes the sequence of operation used by the ASIC/1-8800 to control zone temperature with a fan-powered parallel VAV system with intermittent fan. The ASIC/1-8800 uses a primary airflow sensor to give pressure independent control of the variable air volume cooling. Heating is provided with optional proportional or thermic valve hot water heat, or up to 3 stages of electric heating. The ASIC/1-8800 is preprogrammed with different personalities for fan-powered parallel VAV terminals.

Intermittent Fan Personalities

	No Reheat	1 Stage Electric	2 Stage Electric	3 Stage Electric	HW Valve Open/Close	Thermic Valve
Intermittent Fan	16	6	7	8	12	19

Inputs

The ASIC/1-8800 controller has specific inputs for zone temperature, primary airflow, and optional secondary airflow, and optional supply air temperature, and optional occupancy sensor. The default input types are set at the factory. Inputs that are not required for the sequence may be used for monitoring.

Primary Airflow

The ASIC/1-8800 uses an primary airflow sensor to give pressure independent control of the variable air volume. The primary airflow sensor is installed on input 4 in the pin-sockets at AIR1. It is calibrated at zero airflow. An airflow filter, AF-001, is required on the inlet side of the airflow transducer, HIGH, as marked on the ASIC/1-8800.

The controller measures the air velocity in feet per minute (ft./min) assuming a standard velocity K-factor of 2338 ft/min. The velocity K-factor is the air velocity in ft/min required to generate a velocity pressure of 1 inch water column (1 "wc =249 Pa) The velocity K-factor is provided by the VAV box manufacturer for a particular box size and flow cross. The airflow volume Q in CFM is calculated based on the actual K-factor in feet per minute , and duct area in square feet.

$$Q\ (CFM) = Area\ (ft^2) * Velocity(ft/min) * (K\text{-}factor/2338)$$

Field adjustment of the velocity K-factor may be done by the air balancer using the air balance screen on the setup software.

> Note: The airflow sensor requires an airflow filter, AF-001, on the high pressure side, to prevent dust from contaminating the sensor.

Secondary Airflow (optional)

A optional secondary airflow sensor may be used to monitor additional airflow. A Secondary airflow sensor may be installed on input 5 in the pin-sockets at AIR2. It is calibrated at zero airflow and has separate K-factors and duct areas.

Wall Sensor Connections

Zone temperature sensor is normally on input 1. Typically, the zone temperature on the WS-0xx, wall sensor, is connected to the controller using a SCP-XXX sensor cable. Alternately, a zone or return air temperature sensor may be attached on input terminal, IN1. If there is no zone temperature sensor, then the zone sensor input is in fault, all outputs are off, and it does not try to control.

The afterhours push-button on the WS-0X1 wall sensor if used, is always on input 2. If Afterhours Enable is Yes, then shorting the input to zero will initiate afterhours override mode for an Afterhours Time Allowed.

Input 3 is used for Interlock and may be used for variable user adjust with the WS-0XX wall sensor. When User Adjust Enable is set and input 3 is configured for Variable User adjust, 10k to 30 kohm, the zone temperature setpoint may be adjusted up or down by the User Adjust Setpoint, based on the condition of input 3.

Support is also provided for the WS-051 Digital Display Wall Sensor. The WS-051 has a zone temperature sensor on input 1 and provides both Occupied Temperature Setpoint change and afterhours override. A jumper, JMPR1, may be set to provide power to the WS-051 via input 2. Digital Display Enable must be set to yes.

Auxiliary Temperature Sensors

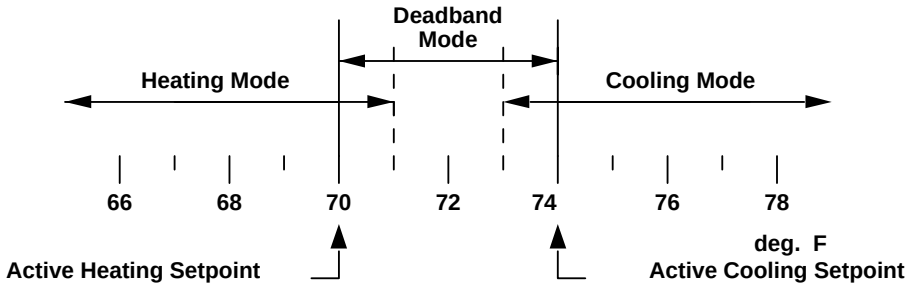
An optional a duct temperature sensor, TS-DO, may be placed on input 6, 7, or 8 for temperature monitoring. The auxiliary temperature sensors use the factory provided 3.32 kohm pull-up resistors.

The duct sensor on input 6 measures Discharge Air Temperature and is used for auto-changeover if Changeover Setpoint is not zero. If input 6 is in fault, then changeover is ignored. Changeover operation is described below.

An optional occupancy sensor or switch may be used on input 8 to change the control state from occupied to unoccupied. When the occupancy sensor is used in combination with a temperature sensor, then the temperature sensor is not read when the contacts are closed.

Control Mode

The controller determines the Control Mode, Heating, Deadband, or Cooling by comparing the zone temperature to the Active Heating Temperature Setpoint and Active Cooling Temperature Setpoint.



The controller enters the Cooling Control Mode when the zone temperature equals or is greater than the Active Cooling Temperature Setpoint. The control reenters the Deadband mode, when the zone temperature is 1 ^{o}F below the Active Cooling Temperature Setpoint and the calculated Cooling Requirement is equal to zero.

The control enters the heating mode when the zone temperature is equal to or less than the Active Heating Temperature Setpoint. The control reenters the Deadband mode when the zone temperature is 1 ^{o}F greater than the Active Heating Temperature Setpoint and the calculated Heating Requirement is equal to zero.

Active Temperature Setpoints

The controller maintains the zone temperature between Active Cooling and Heating Temperature Setpoints. The Active Cooling and Heating Temperature Setpoints are based on Control State, the Active User Adjust based on the position of the Variable User Adjust, and the Active Demand Limit Reset.

Temperatures may be in degrees Fahrenheit or Celsius, depending on the input convert type that has been selected. If Half Degree Enable is set then the Temperature Setpoints are in half-degree (Fahrenheit or Celsius) increments.

If User Adjust Enable is set, the Active Temperature Setpoints may be modified by the variable user adjust potentiometer on a WS-0XX wall sensor depending on the input configuration. The Active Heating Temperature Setpoint is adjusted up and the Active Cooling Temperature Setpoint is adjusted down a fraction of the User Adjust Setpoint.

If the Active Demand Level is non-zero, the Active Temperature Setpoints are also modified by a fraction of the Demand Reset Range as the Active Demand Level goes from 0 to 6. The Active Cooling Temperature Setpoint is reset upwards and the Active Heating Temperature Setpoint is reset downwards.

Cooling and Heating Requirement

In Deadband Control Mode, the Heating and Cooling Requirements are zero.

In the Cooling or Heating Control Mode, the Cooling or Heating Requirement is calculated using a PI control loop.

The change in heating or cooling requirement is calculated every 30 seconds.

In heating: Error = Active HTG SP - Zone Temp
Δ Error = Previous Zone Temp - Zone Temp

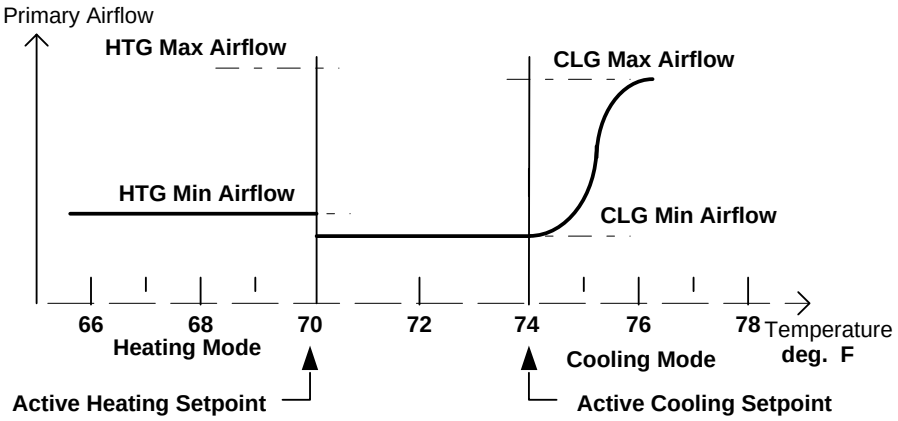
or in cooling: Error = Zone Temp - Active CLG SP
Δ Error = Zone Temp - Previous Zone Temp.

ΔRequirement = (100%/ThrottleRange)*[Error*(CalcTime/Int Time) +Δ Error]

The factory setting for throttle range is 4.0 degrees, and for integral time is 2.5 minutes.

Primary Airflow Modulation

In the Cooling Mode the primary airflow modulates between the Active Cooling Minimum and Maximum Airflow Setpoints as the cooling requirement goes from zero to 100 %.



In the Deadband Mode the Primary Airflow is typically at the Active Cooling Minimum Airflow Setpoint.

In the Heating Mode the Primary Airflow is at the Active Heating Minimum Airflow Setpoint and the Local Heat is modulated with the Heating Requirement to maintain the Active Heating Temperature Setpoint. If Dual Heating Enable is set then the primary airflow also modulates between Heating Minimum and Maximum Airflow as the heating requirement goes from 0 to 100%.

Pressure Dependent Operation

If Pressure Dependent Enable is yes, then the position of the Primary Damper motor is controlled based on Damper Drive Time rather than airflow. The Cooling and Heating Damper Minimum and Maximum Positions are a percentage of the Damper Drive Time.

In the Cooling Mode the damper modulates between the Active Cooling Damper Minimum and Maximum Positions as the zone Cooling Requirement goes from zero to 100 %.

In the Deadband Mode the damper is typically at the Active Cooling Damper Minimum Position.

In the Heating Mode the damper is at the Active Heating Damper Minimum Position and the Local Heat is modulated to maintain the Active Heating Temperature Setpoint. If Dual Heating Enable is set then the damper also modulates between Heating Minimum and Maximum Airflow as the heating requirement goes from 0 to 100%.

To maintain indexing of damper position the Damper is driven fully closed for a Damper Drive Time: On reset of Power, On return from Damper Override, or Emergency Mode.

Control State

The Control State determines which Cooling and Heating Temperature Setpoints are used for zone temperature control. Four control states are possible: Occupied, Unoccupied, Night Setback, and. Morning Warm-up. If the Clock is not synchronized, the Control State is Occupied unless Default State Unoccupied is set. Otherwise the Control State is determined by the Daily Event Schedule.

The Control State may be overridden via a message broadcast over the communication bus from software or an ASIC/2-7040 controller. The controller state may be returned to OCC from NSB or Unocc when the Afterhours Enable is yes and the push-button on the Wall Sensor is pushed. The controller state may be also overridden to Unoccupied from Occupied by an the Occupancy Sensor on input 8.

The Active Cooling and Heating Minimum and Maximum Airflow Setpoints are typically given by the Occupied Cooling and Heating Minimum and Maximum Airflow Setpoints.

However, if Multiple Airflow Enable is set, the Active Cooling and Heating Minimum and Maximum Airflow Setpoints are given by: the Occupied Cooling and Heating Minimum and Maximum Airflow Setpoints in the Occupied and Morning Warm-up States; the Unoccupied Cooling and Heating Minimum and Maximum Airflow Setpoints in the Unoccupied State; or the Night Setback Cooling and Heating Minimum and Maximum Airflow Setpoints in the Night Setback State.

Deadband Mode

In the Deadband Mode, the operation of the primary air damper (and the fan if any) depends on the Control State and option selections.

In Occupied Deadband the Primary Airflow is at the Active Cooling Minimum Airflow Setpoint.

In Unoccupied Deadband the Primary Airflow is at the Active Cooling Minimum Airflow Setpoint, unless UNO Option 2 Enable is yes, then the primary air damper is closed (and the fan if any is OFF) in Deadband

In Night Setback Deadband Mode the primary Airflow is at the Active Cooling Minimum Airflow Setpoint, unless NSB Option 2 Enable is yes, then the primary air damper is closed (and the fan if any is OFF) in Deadband.

Primary Damper Control - -Intermittent Fan

	Occupied	Changeover	UNOCC Option 2 = No	UNOCC Option 2 = Yes	NSB Option 2 = No	NSB Option 2 = Yes	MWU Option 2 = No	MWU Option 2 = Yes
Cooling	Modulate	Min CLG	Modulate	Modulate	Modulate	Modulate	Min HTG	Min HTG
Deadband	Min CLG	Min HTG	Min CLG	Closed	Min CLG	Closed	Min HTG	Min HTG
Heating	Min HTG	Modulate	Min HTG	Min HTG	Min HTG	Min HTG	Max HTG	Min HTG

Morning Warm-up (MWU) State

Morning Warm-up is meant as a prelude to Occupied state, to ready the building for daily use. For Morning Warm-up, the control sequence operates at full-capacity heating until the zone temperature is moved into the Deadband region.

Two MWU sequences can be selected: central heating, and local heating. In central heating MWU hot air is distributed through the primary air ducts. In local heating MWU, all heat is provided from the VAV terminal.

MWU, Central Heating

If Morning Warm-up Option 2 Enable is not set, then central heating is assumed where hot air is in the duct as in changeover heating, which is described below. If the control is initially in cooling or heating mode, the opposite mode is locked-out until the end of Morning Warm-up.

All local heat is typically OFF during this sequence. However, if Local Heat Enable is yes, then local heat is used in addition to central heat.

Morning warm up differs from changeover because the controller goes into heating once, while in changeover it can go in and out of the heating mode many times.

MWU, Local Heat

If Morning Warm-up Option 2 Enable is set then local heating is assumed. The airflow is maintained at Occupied Heating Minimum Airflow Setpoint and all heating is provided by local hot water or electric heat .

If zone temperature is less than Occupied Heating Setpoint when the control enters MWU state, the heating requirement is 100%, the local hot water or electric heat is at 100%.

When zone temperature reaches Occupied Heating Temperature Setpoint the heating requirement is at 0% and the heat turns OFF. If the zone temperature falls 2 °F below the Occupied Heating Temperature setpoint, the heating requirement is again at 100% to maintain temperature setpoint. This cycle continues while in MWU state.

Changeover

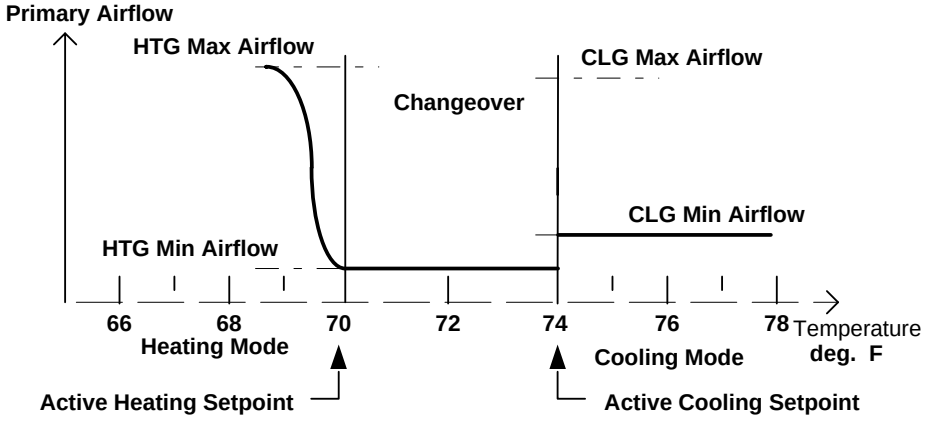
A changeover feature is available which modifies the modes of operation in Heating, Deadband, and Cooling Control Modes. In changeover it is assumed that the primary supply air temperature is appropriate for heating. Changeover is useful for applications where a single duct serves both heating and cooling at different times.

In the changeover heating mode, the Active Primary Minimum and Maximum Airflow setpoints are given by the Active Heating Minimum Airflow and Heating Maximum Airflow Setpoints. The airflow modulates based on the zone Heating Requirement.

An option Local Heat Enable, if set allows local heat to come on in addition to central heat whenever the controller is operating in changeover.

In changeover Deadband the supply air is maintained at Active Heating Minimum Airflow Setpoint.

In changeover cooling the airflow is maintained at the Active Cooling Minimum Airflow Setpoint.



Auto-changeover

Auto-changeover requires installation of a supply air temperature sensor on input 6. If the measured supply air temperature is greater than the Changeover Setpoint, the controller goes into a heating only changeover mode. If the Changeover Setpoint is 0 F (default), the auto-changeover feature is disabled.

Remote Changeover

A remote command on the communications line to set changeover ON forces the system to control in the changeover heating mode. A remote command to set changeover OFF forces prevents all changeover control action. Remote commands always take priority over auto-changeover. A remote command to restore changeover clears changeover ON and changeover OFF and enables the auto-changeover control action.

Pressure Dependent Changeover

In changeover it is assumed that the primary supply air temperature is appropriate for heating.

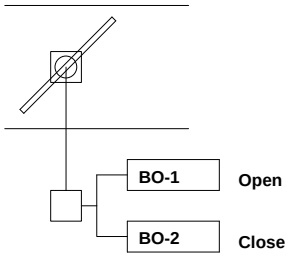
If Pressure Dependent Enable is yes, then in changeover heating, the damper modulates between the Active Heating Damper Minimum and Maximum Positions based on the zone Heating Requirement.

If Local Heat Enable is set, the local heat also comes on in addition to central heat whenever the controller is operating in changeover heating.

In changeover Deadband the supply air is maintained at Active Heating Damper Minimum Position.

In changeover cooling the airflow is maintained at the Active Cooling Damper Minimum Position.

Outputs



Primary Air Damper

Primary Air Damper

In Single Duct personalities in Cooling Control mode, the controller modulates the Primary Airflow Setpoint between the Active Cooling Minimum and Maximum Airflow setpoints based on the Cooling Requirement.

The Primary Airflow is compared with the Primary Airflow Setpoint every a second. As the damper drives the airflow toward the setpoint, the output begins to pulse,where the pulse size in 1/6 s increments is given by 4*Airflow Error/AF Hysteresis. The smallest non-zero Airflow Hysteresis gives the fastest approach to setpoint.

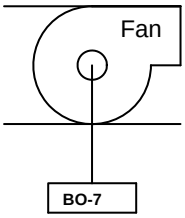
As control approaches the setpoint, the airflow error is summed over time. The Airflow Integration Time [Default 4] is the time required for a 25 ft/min error to sum to give an additional pulse. To enable this algorithm you must give the Airflow Integration Time [Default 4] a non-zero value. If Airflow Integration Time is zero, then it drives to the Airflow Setpoint, and waits until airflow exceeds hysteresis.

Secondary Air Damper (Optional)

An optional Outdoor Air feature controls the Secondary Airflow measured on Input 5 in the Occupied state. When Outside Airflow Enable is yes, the secondary damper is modulates the Secondary Airflow to the Outside Air Volume Setpoint within an Outside Airflow Hysteresis. In Night Setback, Unoccupied, and Morning Warmup states, the Outside Air Damper is driven closed continuously. Any unused binary outputs can be

assigned to Secondary Damper Open and Closed Outputs. Outdoor Air Control is not available in Dual Duct or Tracking Personalities.

Intermittent Fan



For Parallel Fan Powered Terminal box control, the intermittent fan is based on the operating state, mode, and whether the supply airflow is greater than the Fan Energize Setpoint.

In Deadband the fan is on or off depending on the sequence selected.
The fan is ON whenever the primary airflow is less than or equal to the Fan Energize Setpoint. If Ifan Heating Only Enable is true, the fan is on ONLY in the heating mode independent of the Fan Energize Setpoint.

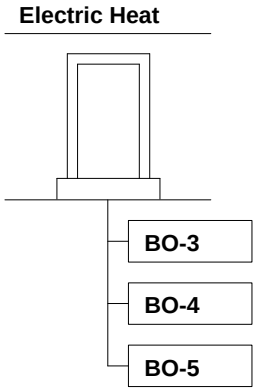
- In the occupied state, the fan is on only if the supply airflow is less than the Fan Energize Setpoint.
- In the morning warm up state, the fan is on.
- In night setback or unoccupied states, the fan is off unless the system is in heating mode and the supply airflow is less than the Fan Energize Setpoint.
- In Emergency 1 the Fan is overridden On. In Emergency 2 the Fan is overridden Off.

Intermittent Fan Control

(* Primary Airflow < Fan Energize SP)

	Occupied	UNOCC Option 2 = No	UNOCC Option 2 = Yes	NSB Option 2 = No	NSB Option 2 = Yes	MWU Option 2 = Yes or No
Cooling	Fan On*	Fan Off	Fan Off	Fan Off	Fan Off	Fan On
Deadband	Fan On*	Fan Off	Fan Off	Fan Off	Fan Off	Fan On
Heating	Fan On*	Fan On*	Fan On*	Fan On*	Fan On*	Fan On

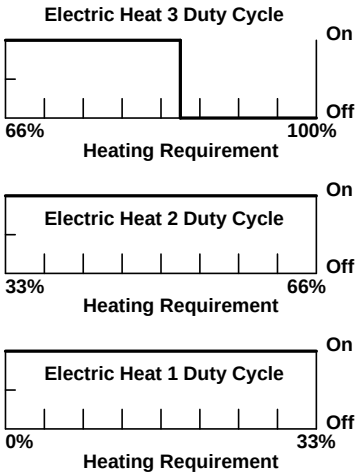
Electric Heat Output



Up to 3 stages of Electric Heating output may be used to maintain the calculated heating requirement in personalities 6, 7, and 8.

For a controller with 1 stage of electric heat (Personality 2,6,9): Stage 1 duty cycles in proportion to the Electric Heat Base Time; from 0 to 100% as the Heating Requirement goes from 0 to 100%

For a controller with 2 stages of electric heat (Personality 3,7,10): Stage 1 duty cycles in proportion to the Electric Heat Base Time from 0 to 100% as the Heating Requirement goes from 0 to 50%; and Stage 2 does not turn ON until stage 1 is on for 100% of the duty cycle time and duty cycles in proportion to the Electric Heat Base Time from 0 to 100% as the Heating Requirement goes from 50% to 100%.

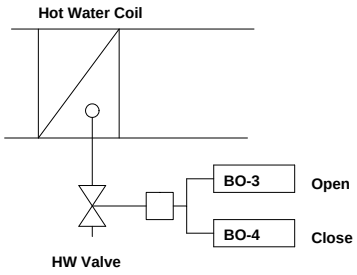


3 Stage Electric Heat at ~80% HTG

For a controller with 3 stages of electric heat (Personality 4,8,11): Stage 1 duty cycles in proportion to the Electric Heat Base Time from 0 to 100% as the Heating Requirement goes from 0 to 33%; stage 2 does not turn ON until stage 1 is on for 100% of the Electric Heat Base Time and duty cycles from 0 to 100% as the Heating Requirement goes from 33% to 66%; and Stage 3 does not turn ON until stage 2 is ON for 100% of the duty cycle time and duty cycles from 0 to 100 % as the Heating Requirement goes from 66% to 100%.

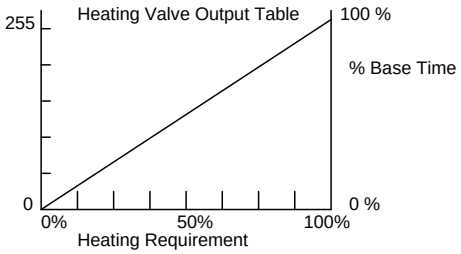
The output to be controlled is identified by the Electric Heat 1,2,3 Masks . The functional status of the Electric Heat Outputs is shown by the Electric Heat 1,2,3 Output Status bits.

Hot Water Heat Output

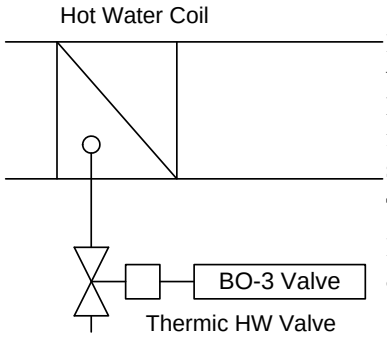


In a controller with modulated hot water heat (Personality 5, 12, or 13), the valve is opened or closed a fraction of the HW Valve Base Time in proportion to the Heating Requirement. The output to be controlled is identified by the HW Valve Open Mask and HW Valve Closed Masks. The functional status of the HW Valve output is shown by the HW Valve Output Status

For a controller with modulated hot water heat , the valve is opened or closed a fraction of the valve time base in proportion to the Heating Requirement based on the five-value Heating Valve Output Table.



Thermic Valve On/Off (Optional)



The output to be used is assignable using the Thermic Valve On/Off Mask

In a controller with thermic valve hot water heat (Personality 18, 19, or 20), the valve is energized for a fraction of the HW Valve Base Time in proportion to the Heating Requirement. The thermic Valve is normally off and will be ON for a fraction of the HW Heating Base Time. It will be initially on and once it goes off it stays off for the remainder of the HW Heating Base.

Timer On Time = (HW Output/255)* HW Base Time.

If Thermic Valve Reversed is set the output will be normally on, and will be OFF for a fraction of the HW Heating Base Time.

Other Outputs

Analog Outputs

The ASIC/1-8800 has two 0 to 10 Vdc Analog outputs that can drive upto 20 mA. The outputs can be assigned to Cooling Requirement, Heating Requirement, or Changeover Heating/Cooling. One can also be used for Fans Speed Adjust for an ECM Motor. Because some actuators are 6 to 9 V and others are 2 to 10 Vdc, the analog outputs can be scaled from Minimum Output (Fully Closed) to Maximum Output (Fully Open) as the control signal goes from 0 to 100%.

In Changeover Heating/Cooling the analog output follows the Cooling Requirement, but if the Changeover status is ON, then the analog output follows the Heating Requirement. The Changeover status is set by a command on the communication line, or by comparing the Duct Temperature with the Changeover Setpoint.

Auxiliary Cooling Output (Optional)

An optional auxiliary cooling output is provided. If Auxiliary Cooling Enable is set, and the Cooling Requirement is 100 % and the zone temperature exceeds the active cooling setpoint by an Auxiliary Cooling Offset [Default 2 ^{o}F] for a Auxiliary Cooling Delay Time [Default: 120 s], then an auxiliary cooling output is energized. The output to be used is assignable using the Auxiliary Cooling Output Mask [Default: Output #5]. Once energized, the auxiliary cooling output remains on until the zone temperature falls below the active cooling temperature setpoint, and the cooling airflow falls below the maximum cooling setpoint by an amount given by the Auxiliary Cooling Hysteresis. [Default: 125 ft/min]

Auxiliary Heating Output (Optional)

If Auxiliary Heating Enable is set, the auxiliary heating output goes on whenever the controller is in the heating mode. This output is completely independent of the hot water valve or electric heat operation. It may be used to control baseboard heat used in conjunction with terminal boxes.

Auxiliary 1, 2, 3 Output (Optional)

The ASIC/1-8800 allows up to 3 outputs for auxiliary outputs which do not follow any schedule. They can be overridden On or Off, and remain in the last state commanded. The output to be controlled is identified by the Aux 1, 2, 3 Masks which are initially un-assigned.. The functional status of the Aux 1, 2, 3 Outputs is shown by the Auxiliary 1, 2,3 Output Status.

Lighting Output

Each ASIC/1 has the ability to control lighting. The Lighting schedule automatically turns the lights on and off. By equipping the ASIC/1 with a WS-0XX wall sensor with push button override, the lights can be operated manually by the occupant during Occupied and Morning Warm-up States by pressing the button on the side of the zone sensor without affecting HVAC operation.

During Unoccupied and Night Setback States, depressing the push button will return the control to Occupied, and the lights will come on and stay on for Afterhours Time Allowed. During Emergency 1 and Emergency 2, the push-button has no effect.

If Lights Occupied Enable is yes then the lights are on whenever the Lighting Schedule is On, or the Control State is occupied.

Blink Warning: One minute before automatic shut off of lights as designated in the daily event schedule, or at the end of the afterhours override period, the lights will blink off and back on again. Pressing the afterhours button on the wall sensor re-starts the lights.

Alarms

Zone Temperature Alarm

If the zone temperature is above the Active Cooling Temperature Setpoint by the Zone Temperature Alarm Range, a High Zone Temperature Alarm is set. If the Zone temperature is below the Active Heating Temperature Setpoint by the Zone Temperature Alarm Range, a low Zone Temperature Alarm is set. No other actions are taken in response to a zone temperature alarm.

Primary Airflow Alarm

If the primary airflow is above the Primary Airflow Setpoint by the Airflow Alarm Range, then a High PrimaryAirflow Alarm is set. If the Primary Airflow is below the Primary Airflow Setpoint by the Airflow Alarm Range, then a Low Primary Airflow Alarm is set. No other actions are taken in response to a Primary Airflow Alarm.

Emergency Modes

The emergency modes, Emergency 1, and Emergency 2, are overrides which are received over the communication line and remain in effect until cleared over the communication line.

Emergency 1 Mode

The control may only enter or exit Emergency 1 as a result of commands received on communications line. While in Emergency 1, no other state may be entered until Emergency 1 has been cleared via the communications line. Emergency is maintained through loss of power.

While in Emergency 1 state the controller immediately drives the damper to Maximum Cooling Airflow Setpoint, turns ON the lighting output, and turns OFF any other outputs including electric heat. In EM1 the Fan is On.

Emergency 2 Mode

The control can enter and exit Emergency 2 as the result of commands received on the communications line. If in Emergency 2, no other state except Emergency 1 may be entered until Emergency 2 has been cleared via the communications line. Emergency is maintained through loss of power.

While in Emergency 2 state the controller immediately drives the damper closed, turns ON the lighting output and turns OFF any other outputs, including electric heat.

Communications

The ASIC/1-8800 communicates at 1200 baud, 9600 baud, or 19,200 baud on the remote bus using RS-485 twisted pair communication wire, connected to remote screw terminal connector, TB-4. Access to the ASI communication bus is through a ASIC/2 configurable controller or ASI EtherLink/2 serial router which can also be used to broadcast time to synchronize the network of ASIC/1 controllers.

Communication with the remote bus can also be established through the WS-0XX wall sensor using a SINC/1-1030 Portable Interface connected to a lap-top computer running ASI Expert software.

Each controller has a unique 16-bit address [Default 18800], and may also have a separate 8 bit group address. It will also respond to the global addresses 23125(0x5A55) and 23130 (0x5A5A).

Communication with the ASIC/1-8800 is largely compatible with the ASIC/1-8055 which it replaces. The ASIC/1-8800 may co-exist on the communication line with other ASIC/1 controllers. It is compatible with the ASI LinkOPC Server for seamless communication with Windows based graphic user interfaces.

System Component Checklist

Inputs

Description	Part Number	Quantity
Airflow Filter	AF-001	1,2
Optional Duct Temperature Sensor (IN-06)	TS-DO-8	0,1
Optional Duct Temperature Sensor (IN-07)	TS-DO-8	0,1
Optional Duct Temperature Sensor (IN-08)	TS-DO-8	0,1
Optional Occupancy Switch (BI-08)		0,1
Wall Mounted Zone Temperature Sensor	WS-0X1	1
Sensor Cable	SCP-0XX	1
Communication Cable twisted pair.	22-24 ga twisted	

Note: The inlet side of the airflow transducer, HIGH, is marked on the ASIC/1-8800 is the same as of the ASIC/1-8055 controller. An airflow filter, AF-001, is required on the inlet side of the airflow transducer.

NOTE: Consult ASIC/1-8800 Installation manual for configuration of inputs.

Outputs

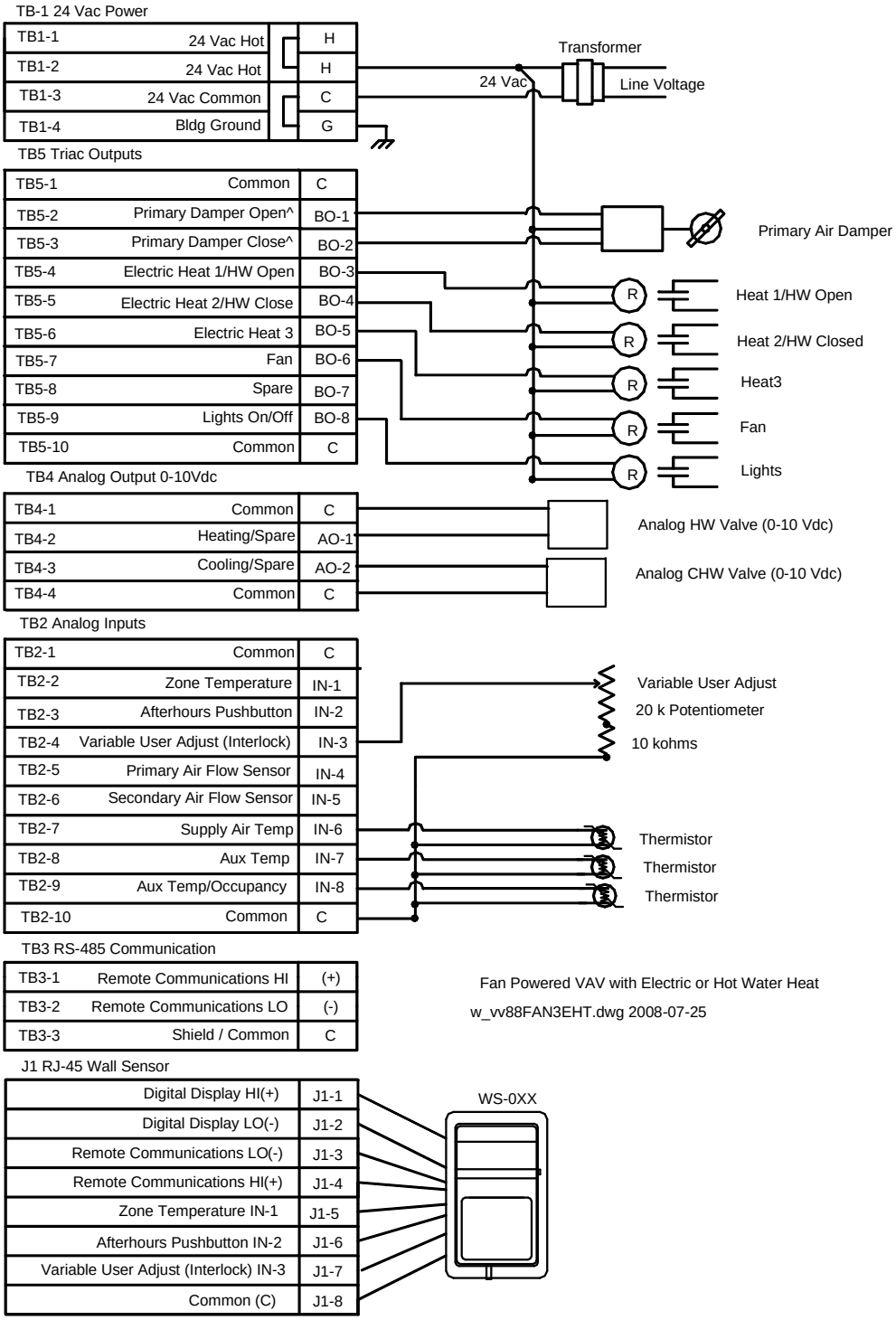
Description	Part Number	Quantity
VAV Controller	ASIC/1-8800	1
24 Vac Transformer		1
24 Vac Tri-state Primary Damper Operator		1
24 Vac Fan Control Relay		1
HW Valve with 24 Vac Tri-state Operator		0,1
24 Vac Thermic Valve (Optional)		0,1
24 Vac Electric Heat Relay		0,1,2,3
24 Vac Auxiliary CLG Output Relay (Optional)		0,1
24 Vac Auxiliary HTG Output Relay(Optional)		0,1
24 Vac Auxiliary Output Relay (Optional)		0,1,2,3
24 Vac Lighting Relay (Optional)		0,1

NOTE: . The ASIC/1-8800 must be connected to a solid building ground. Metallic-oxide Varistors, MOV, may also be used across relay contacts to provide further protection from transients. If current interrupting relays are in series with the output circuits they must be protected with MOVs across the Relay Contacts

Wiring Layout

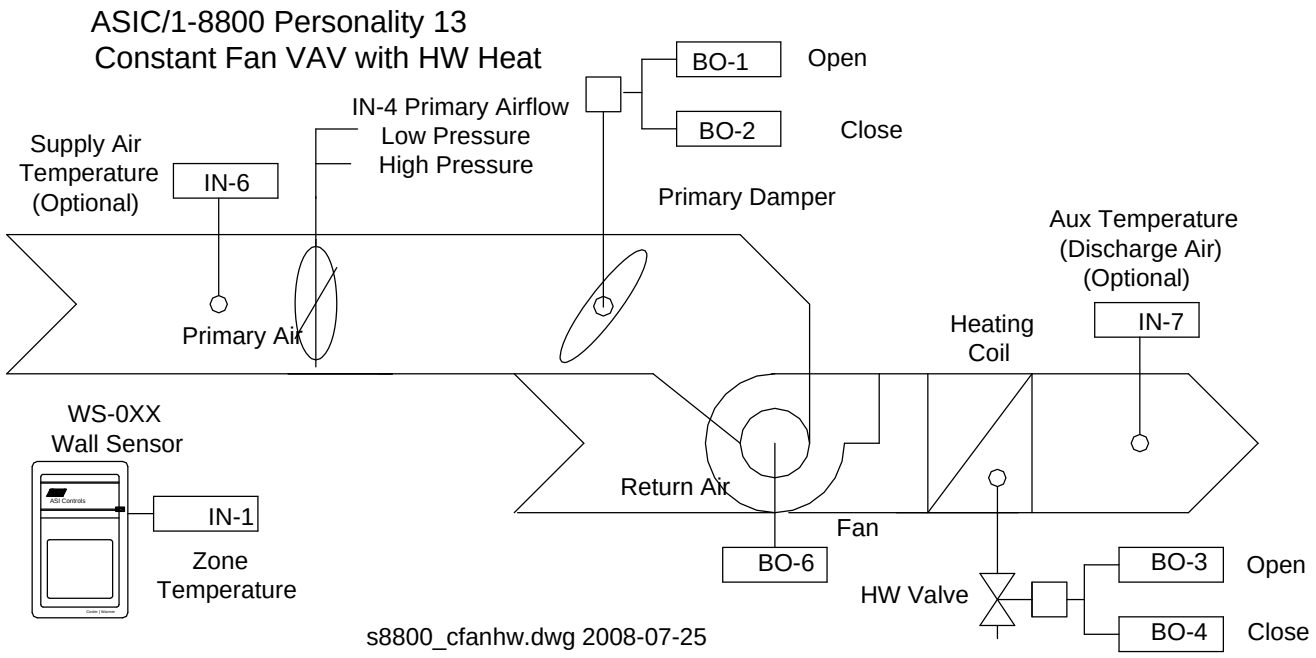
Intermittent Fan with Electric or HW Heat

Typical Intermittent Fan Powered VAV with 3 Stages of Electric Heat, for use with the following personalities: Personality 6, 1 stage of electric heat; Personality 7, 2 stages of electric heat ; and Personality 8, 3 stages of electric heat, or Hot Water Heat for Personality 12. or with Thermic Valve Heat for Personality 19



Constant Fan VAV

Application



This application bulletin describes the sequence of operation used by the ASIC/1-8800 to control zone temperature with a fan-powered series VAV system with constant fan. The ASIC/1-8800 uses a primary airflow sensor to give pressure independent control of the variable air volume cooling. Heating is provided with optional proportional or thermic valve hot water heat, or up to 3 stages of electric heating. The ASIC/1-8800 is preprogrammed with different personalities for fan-powered series VAV terminals.

Constant Fan Personalities

	No Reheat	1 Stage Electric	2 Stage Electric	3 Stage Electric	HW Valve Open/Close	Thermic Valve
Constant Fan	17	9	10	11	13	20

Inputs

The ASIC/1-8800 controller has specific inputs for zone temperature, primary airflow, and optional secondary airflow, and optional supply air temperature, and optional occupancy sensor. The default input types are set at the factory. Inputs that are not required for the sequence may be used for monitoring.

Primary Airflow

The ASIC/1-8800 uses a primary airflow sensor to give pressure independent control of the variable air volume. The primary airflow sensor is installed on input 4 in the pin-sockets at AIR1. It is calibrated at zero airflow.

The controller measures the air velocity in feet per minute (ft./min) assuming a standard velocity K-factor of 2338 ft/min. The velocity K-factor is the air velocity in ft/min required to generate a velocity pressure of 1 inch water column (1 "wc =249 Pa) The velocity K-factor is provided by the VAV box manufacturer for a particular box size and flow cross. The airflow volume Q in CFM is calculated based on the actual K-factor in feet per minute , and duct area in square feet.

$$Q\ (CFM) = Area\ (ft^2) * Velocity(ft/min) * (K\text{-}factor/2338)$$

Field adjustment of the velocity K-factor may be done by the air balancer using the air balance screen on the setup software.

> Note: The airflow sensor requires an airflow filter, AF-001, on the high pressure side, to prevent dust from contaminating the sensor.

Secondary Airflow

A optional secondary airflow sensor may be used to monitor additional airflow. A Secondary airflow sensor may installed on input 5 in the pin-sockets at AIR2. It is calibrated at zero airflow and has separate K-factors and duct areas.

Wall Sensor Connections

Zone temperature sensor is normally on Input 1. Typically, the zone temperature on the WS-0xx, wall sensor is connected to the controller using a SCP-XXX sensor cable. Alternately, a zone or return air temperature sensor may be attached on input blade, IN1. If there is no zone temperature sensor, then the zone sensor input is in fault, all outputs are off, and it does not try to control.

The afterhours push-button on the WS-0X1 wall sensor if used, is always on Input 2. If Afterhours Enable is Yes, then shorting the input to zero will initiate afterhours override mode for an Afterhours Time Allowed.

Input 3 is used for Interlock and may be used for variable user adjust with the WS-0XX wall sensor. When User Adjust Enable is set and input 3 is configured for Variable User adjust, 10k to 30 kohm, the zone temperature setpoint may be adjusted up or down by the User Adjust Setpoint, based on the condition of input 3.

Support is also provided for the WS-051 Digital Display Wall Sensor. The WS-051 has a zone temperature sensor on input 1 and provides both Occupied Temperature Setpoint change and afterhours override. A jumper, JMPR1, may be set to provide power to the WS-051 via input 2. Digital Display Enable must be set to yes.

Auxiliary Temperature Sensors

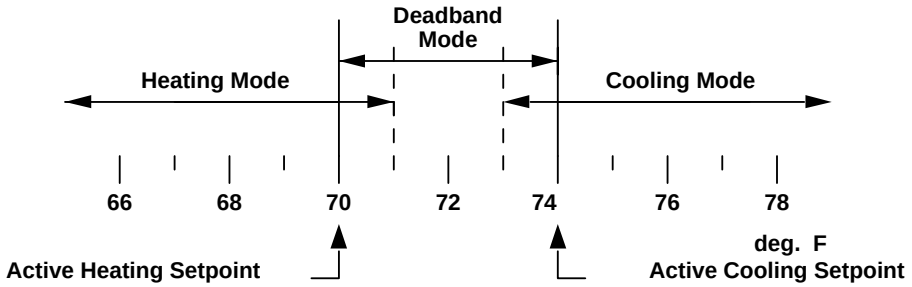
An optional a duct temperature sensor, TS-DO, may be placed on input 6, 7, or 8 for temperature monitoring. The auxiliary temperature sensors use the factory provided 3.32 kohm pull-up resistors.

The duct sensor on input 6 measures Discharge Air Temperature and is used for auto-changeover if Changeover Setpoint is not zero. If input 6 is in fault, then changeover is ignored. Changeover operation is described below.

An optional occupancy sensor or switch may be used on input 8 to change the control state from occupied to unoccupied. When the occupancy sensor is used in combination with a temperature sensor, then the temperature sensor is not read when the contacts are closed.

Control Mode

The controller determines the Control Mode, Heating, Deadband, or Cooling by comparing the zone temperature to the Active Heating Temperature Setpoint and Active Cooling Temperature Setpoint.



The controller enters the Cooling Control Mode when the zone temperature equals or is greater than the Active Cooling Temperature Setpoint . The control reenters the Deadband mode, when the zone temperature is 1 ^{o}F below the Active Cooling Temperature Setpoint and the calculated Cooling Requirement is equal to zero.

The control enters the heating mode when the zone temperature is equal to or less than the Active Heating Temperature Setpoint. The control reenters the Deadband mode when the zone temperature is 1 ^{o}F greater than the Active Heating Temperature Setpoint and the calculated Heating Requirement is equal to zero.

Active Temperature Setpoints

The controller maintains the zone temperature between Active Cooling and Heating Temperature Setpoints. The Active Cooling and Heating Temperature Setpoints are based on Control State, the Active User Adjust based on the position of the Variable User Adjust, and the Active Demand Limit Reset.

Temperatures may be in degrees Fahrenheit or Celsius, depending on the input convert type that has been selected. If Half Degree Enable is set then the Temperature Setpoints are in half-degree (Fahrenheit or Celsius) increments.

If User Adjust Enable is set, the Active Temperature Setpoints may be modified by the variable user adjust potentiometer on a WS-0XX wall sensor depending on the input configuration. The Active Heating Temperature Setpoint is adjusted up and the Active Cooling Temperature Setpoint is adjusted down a fraction of the User Adjust Setpoint.

If the Active Demand Level is non-zero, the Active Temperature Setpoints are also modified by a fraction of the Demand Reset Range as the Active Demand Level goes from 0 to 6. The Active Cooling Temperature Setpoint is reset upwards and the Active Heating Temperature Setpoint is reset downwards.

Cooling and Heating Requirement

In Deadband Control Mode, the Heating and Cooling Requirements are zero.

In the Cooling or Heating Control Mode, the Cooling or Heating Requirement is calculated using a PI control loop.

The change in heating or cooling requirement is calculated every 30 seconds.

In heating: Error = Active HTG SP - Zone Temp
Δ Error = Previous Zone Temp - Zone Temp

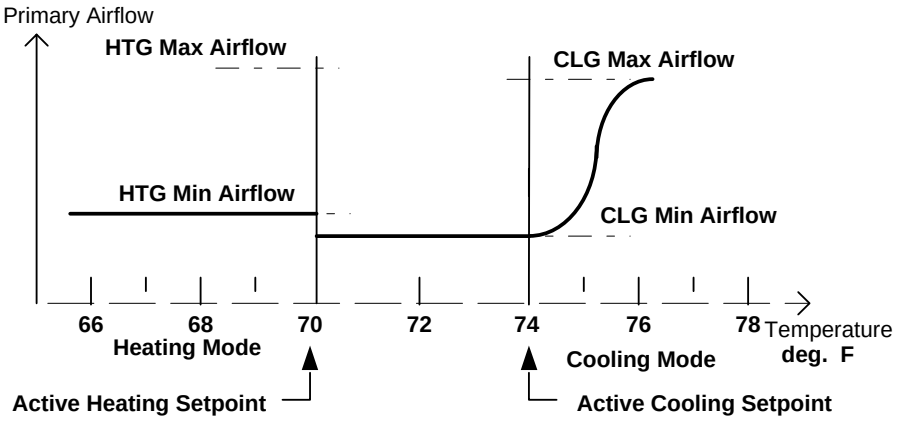
or in cooling: Error = Zone Temp - Active CLG SP
Δ Error = Zone Temp - Previous Zone Temp.

ΔRequirement = (100%/ThrottleRange)*[Error*(CalcTime/Int Time) +Δ Error]

The factory setting for throttle range is 4.0 degrees, and for integral time is 2.5 minutes.

Primary Airflow Modulation

In the Cooling Mode the primary airflow modulates between the Active Cooling Minimum and Maximum Airflow Setpoints as the cooling requirement goes from zero to 100 %.



In the Deadband Mode the Primary Airflow is typically at the Active Cooling Minimum Airflow Setpoint.

In the Heating Mode the Primary Airflow is at the Active Heating Minimum Airflow Setpoint and the Local Heat is modulated with the Heating Requirement to maintain the Active Heating Temperature Setpoint. If Dual Heating Enable is set then the primary airflow also modulates between Heating Minimum and Maximum Airflow as the heating requirement goes from 0 to 100%.

Pressure Dependent Operation

If Pressure Dependent Enable is yes, then the position of the Primary Damper motor is controlled based on Damper Drive Time rather than airflow. The Cooling and Heating Damper Minimum and Maximum Positions are a percentage of the Damper Drive Time.

In the Cooling Mode the damper modulates between the Active Cooling Damper Minimum and Maximum Positions as the zone Cooling Requirement goes from zero to 100 %.

In the Deadband Mode the damper is typically at the Active Cooling Damper Minimum Position.

In the Heating Mode the damper is at the Active Heating Damper Minimum Position and the Local Heat is modulated to maintain the Active Heating Temperature Setpoint. If Dual Heating Enable is set then the damper also modulates between Heating Minimum and Maximum Airflow as the heating requirement goes from 0 to 100%.

To maintain indexing of damper position the Damper is driven fully closed for a Damper Drive Time: On reset of Power, On return from Damper Override, or Emergency Mode.

Control State

The Control State determines which Cooling and Heating Temperature Setpoints are used for zone temperature control. Four control states are possible: Occupied, Unoccupied, Night Setback, and. Morning Warm-up. If the Clock is not synchronized, the Control State is Occupied by default. Otherwise the Control State is determined by the Daily Event Schedule.

The Control State may be overridden via a message broadcast over the communication bus from software or an ASIC/2controller. The controller state may be returned to OCC from NSB or Unocc when the Afterhours Enable is yes and the push-button on the Wall Sensor is pushed. The controller state may be also overridden to Unoccupied from Occupied by an the Occupancy Sensor on input 8.

The Active Cooling and Heating Minimum and Maximum Airflow Setpoints are typically given by the Occupied Cooling and Heating Minimum and Maximum Airflow Setpoints.

However, if Multiple Airflow Enable is set, the Active Cooling and Heating Minimum and Maximum Airflow Setpoints are given by: the Occupied Cooling and Heating Minimum and Maximum Airflow Setpoints in the Occupied and Morning Warm-up States; the Unoccupied Cooling and Heating Minimum and Maximum Airflow Setpoints in the Unoccupied State; or the Night Setback Cooling and Heating Minimum and Maximum Airflow Setpoints in the Night Setback State.

Deadband Mode

In the Deadband Mode, the operation of the primary air damper (and the fan if any) depends on the Control State and option selections.

In Occupied Deadband the Primary Airflow is at the Active Cooling Minimum Airflow Setpoint.

In Unoccupied Deadband the Primary Airflow is at the Active Cooling Minimum Airflow Setpoint, unless UNO Option 2 Enable is yes, then the primary air damper is closed (and the fan if any is OFF) in Deadband

In Night Setback Deadband Mode the primary Airflow is at the Active Cooling Minimum Airflow Setpoint, unless NSB Option 2 Enable is yes, then the primary air damper is closed (and the fan if any is OFF) in Deadband.

Primary Damper Control - Constant Fan

*Cooling is locked out in MWU.

	Occupied	Changeover	UNOCC Option 2 = No	UNOCC Option 2 = Yes	NSB Option 2 = No	NSB Option 2 = Yes	MWU Option 2 = No	MWU Option 2 = Yes
Cooling	Modulate	Min CLG	Closed	Modulate	Closed	Modulate	Min HTG	Min HTG
Deadband	Min CLG	Min HTG	Closed	Closed	Closed	Closed	Min HTG	Min HTG
Heating	Min HTG	Modulate	Closed	Min HTG	Closed	Min HTG	Max HTG	Min HTG

Morning Warm-up (MWU) State

Morning Warm-up is meant as a prelude to Occupied state, to ready the building for daily use. For Morning Warm-up, the control sequence operates at full-capacity heating until the zone temperature is moved into the Deadband region.

Two MWU sequences can be selected: central heating, and local heating. In central heating MWU hot air is distributed through the primary air ducts. In local heating MWU, all heat is provided from the VAV terminal.

MWU, Central Heating

If Morning Warm-up Option 2 Enable is not set, then central heating is assumed where hot air is in the duct as in changeover heating, which is described below. If the control is initially in cooling or heating mode, the opposite mode is locked-out until the end of Morning Warm-up.

All local heat is typically OFF during this sequence. However if Local Heat Enable is yes, then local heat is used in addition to central heat.

Morning warm up differs from changeover because the controller goes into heating once, while in changeover it can go in and out of the heating mode many times.

MWU, Local Heat

If Morning Warm-up Option 2 Enable is set then local heating is assumed. The airflow is maintained at Occupied Heating Minimum Airflow Setpoint and all heating is provided by local hot water or electric heat .

If zone temperature is less than Occupied Heating Setpoint when the control enters MWU state, the heating requirement is 100%, the local hot water or electric heat is at 100%.

When zone temperature reaches Occupied Heating Temperature Setpoint the heating requirement is at 0% and the heat turns OFF. If the zone temperature falls 2 °F below the Occupied Heating Temperature setpoint, the heating requirement is again at 100% to maintain temperature setpoint. This cycle continues while in MWU state.

Changeover

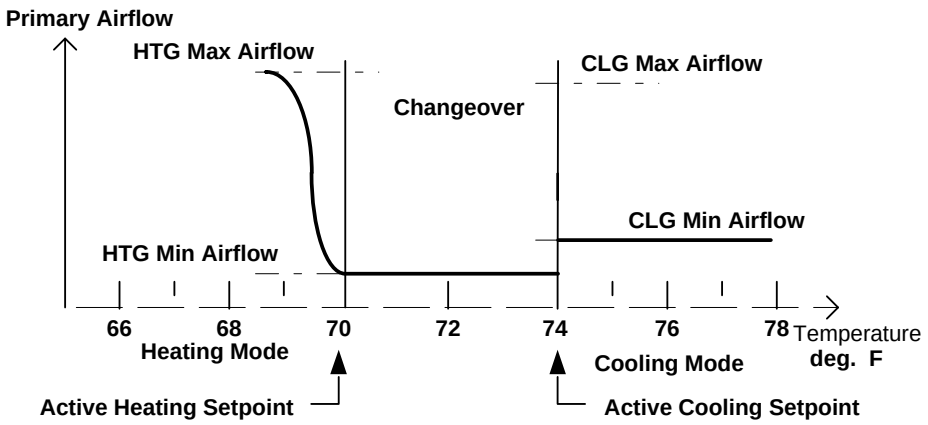
A changeover feature is available which modifies the modes of operation in Heating, Deadband, and Cooling Control Modes. In changeover it is assumed that the primary supply air temperature is appropriate for heating. Changeover is useful for applications where a single duct serves both heating and cooling at different times.

In the changeover heating mode, the Active Primary Minimum and Maximum Airflow setpoints are given by the Active Heating Minimum Airflow and Heating Maximum Airflow Setpoints. The airflow modulates based on the zone Heating Requirement.

If Local Heat Enableis set, the local heat to come on in addition to central heat whenever the controller is operating in changeover.

In changeover Deadband the supply air is maintained at Active Heating Minimum Airflow Setpoint.

In changeover cooling the airflow is maintained at the Active Cooling Minimum Airflow Setpoint.



Auto-changeover

Auto-changeover requires installation of a supply air temperature sensor on input 6. If the measured supply air temperature is greater than the Changeover Setpoint, the controller goes into a heating only changeover mode. If the Changeover Setpoint is 0 F (default), the auto-changeover feature is disabled.

Remote Changeover

A remote communications command to set changeover ON, forces the system to control in the changeover heating mode. A remote command to set changeover OFF forces prevents all changeover control action. Remote commands always take priority over auto-changeover. A remote command to restore changeover clears changeover ON and changeover OFF and enables the auto-changeover control action.

Pressure Dependent Changeover

In changeover it is assumed that the primary supply air temperature is appropriate for heating.

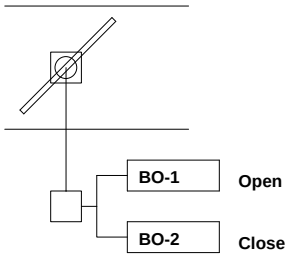
If Pressure Dependent Enable is yes, then in changeover heating, the damper modulates between the Active Heating Damper Minimum and Maximum Positions based on the zone Heating Requirement.

If Local Heat Enable is set, the local heat also comes on in addition to central heat whenever the controller is operating in changeover heating.

In changeover Deadband the supply air is maintained at Active Heating Damper Minimum Position.

In changeover cooling the airflow is maintained at the Active Cooling Damper Minimum Position.

Outputs



Primary Air Damper

Primary Air Damper

In Single Duct personalities in Cooling Control mode, the controller modulates the Primary Airflow Setpoint between the Active Cooling Minimum and Maximum Airflow setpoints based on the Cooling Requirement.

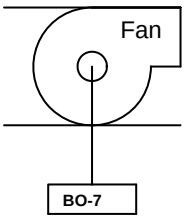
The Primary Airflow is compared with the Primary Airflow Setpoint every a second. As the damper drives the airflow toward the setpoint, the output begins to pulse, where the pulse size in 1/6 s increments is given by 4*Airflow Error/AF Hysteresis. The smallest non-zero Airflow Hysteresis gives the fastest approach to setpoint.

As control approaches the setpoint, the airflow error is summed over time. The Airflow Integration Time [Default 4] is the time required for a 25 ft/min error to sum to give an additional pulse. To enable this algorithm you must give the Airflow Integration Time [Default 4] a non-zero value. If Airflow Integration Time is zero, then it drives to the Airflow Setpoint, and waits until airflow exceeds hysteresis.

Secondary Air Damper (Optional)

An optional Outdoor Air feature controls the Secondary Airflow measured on Input 5 in the Occupied state. When Outside Airflow Enable is yes, the secondary damper is modulates the Secondary Airflow to the Outside Air Volume Setpoint within an Outside Airflow Hysteresis. In Night Setback, Unoccupied, and Morning Warmup states, the Outside Air Damper is driven closed continuously. Any unused binary outputs can be assigned to Secondary Damper Open and Closed Outputs.

Outdoor Air Control is not available in Dual Duct or Tracking Personalities.



Constant Fan

For Series Fan Powered Terminal box control, the constant fan operation is based on the operating state, and mode.

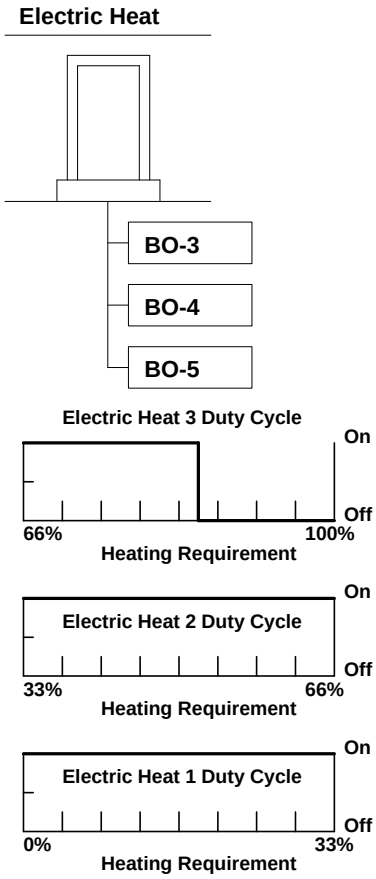
In Deadband the fan is on or off depending on the sequence selected.
The fan is ON whenever the primary air damper is not closed..

- In the morning warm up state, the fan is on.
- In night setback or unoccupied states, the fan is off unless the system is in heating mode.
- In Emergency 1 the Fan is overridden On. In Emergency 2 the Fan is overridden Off.

Constant Fan Control

	Occupied	UNOCC Option 2 = No	UNOCC Option 2 = Yes	NSB Option 2 = No	NSB Option 2 = Yes	MWU Option 2 = Yes or No
Cooling	Fan On	Fan Off	Fan On	Fan Off	Fan On	Fan On
Deadband	Fan On	Fan Off	Fan Off	Fan Off	Fan Off	Fan On
Heating	Fan On	Fan On	Fan On	Fan On	Fan On	Fan On

Electric Heat Output



3 Stage Electric Heat at ~80% HTG

Up to 3 stages of Electric Heating output may be used to maintain the calculated heating requirement in personalities 9, 10, and 11.

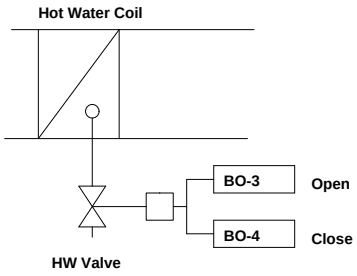
For a controller with 1 stage of electric heat (Personality 2,6,9): Stage 1 duty cycles in proportion to the Electric Heat Base Time; from 0 to 100% as the Heating Requirement goes from 0 to 100%

For a controller with 2 stages of electric heat (Personality 3,7,10): Stage 1 duty cycles in proportion to the Electric Heat Base Time from 0 to 100% as the Heating Requirement goes from 0 to 50%; and Stage 2 does not turn ON until stage 1 is on for 100% of the duty cycle time and duty cycles in proportion to the Electric Heat Base Time from 0 to 100% as the Heating Requirement goes from 50% to 100%.

For a controller with 3 stages of electric heat (Personality 4,8,11): Stage 1 duty cycles in proportion to the Electric Heat Base Time from 0 to 100% as the Heating Requirement goes from 0 to 33%; stage 2 does not turn ON until stage 1 is on for 100% of the Electric Heat Base Time and duty cycles from 0 to 100% as the Heating Requirement goes from 33% to 66%; and Stage 3 does not turn ON until stage 2 is ON for 100% of the duty cycle time and duty cycles from 0 to 100 % as the Heating Requirement goes from 66% to 100%.

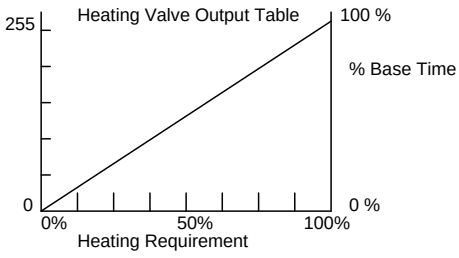
The output to be controlled is identified by the Electric Heat 1,2,3 Masks . The functional status of the Electric Heat Outputs is shown by the Electric Heat 1,2,3 Output Status bits.

Hot Water Heat Output

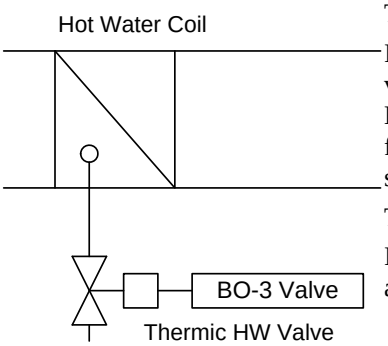


In a controller with modulated hot water heat (Personality 5, 12, or 13), the valve is opened or closed a fraction of the HW Valve Base Time in proportion to the Heating Requirement. The output to be controlled is identified by the HW Valve Open Mask and HW Valve Closed Masks. The functional status of the HW Valve output is shown by the HW Valve Output Status

For a controller with modulated hot water heat , the valve is opened or closed a fraction of the valve time base in proportion to the Heating Requirement based on the five-value Heating Valve Output Table.



Thermic Valve On/Off (Optional)



The output to be used is assignable using the Thermic Valve On/Off Mask

In a controller with thermic valve hot water heat (Personality 18, 19, or 20), the valve is energized for a fraction of the HW Valve Base Time in proportion to the Heating Requirement. The thermic Valve is normally off and will be ON for a fraction of the HW Heating Base Time. It will be initially on and once it goes off it stays off for the remainder of the HW Heating Base.

Timer On Time = (HW Output/255)* HW Base Time.

If Thermic Valve Reversed is set the output will be normally on, and will be OFF for a fraction of the HW Heating Base Time.

Other Outputs

Analog Outputs

The ASIC/1-8800 has two 0 to 10 Vdc Analog outputs that can drive upto 20 mA.. The outputs can be assigned to Cooling Requirement, Heating Requirement, or Changeover Heating/Cooling. One can also be used for Fans Speed Adjust for an ECM Motor. Because some actuators are 6 to 9 V and others are 2 to 10 Vdc, the analog outputs can be scaled from Minimum Output (Fully Closed) to Maximum Output (Fully Open) as the control signal goes from 0 to 100%.

In Changeover Heating/Cooling the analog output follows the Cooling Requirement, but if the Changeover status is ON, then the analog output follows the Heating Requirement. The Changeover status is set by a command on the communication line, or by comparing the Duct Temperature with the Changeover Setpoint.

Auxiliary Cooling Output (Optional)

An optional auxiliary cooling output is provided. If Auxiliary Cooling Enable is set, and the Cooling Requirement is 100 % and the zone temperature exceeds the active cooling setpoint by an Auxiliary Cooling Offset [Default 2 ^{o}F] for a Auxiliary Cooling Delay Time [Default: 120 s], then an auxiliary cooling output is energized. The output to be used is assignable using the Auxiliary Cooling Output Mask [Default: Output #5]. Once energized, the auxiliary cooling output remains on until the zone temperature falls below the active cooling temperature setpoint, and the cooling airflow falls below the maximum cooling setpoint by an amount given by the Auxiliary Cooling Hysteresis. [Default: 125 ft/min]

Auxiliary Heating Output (Optional)

If Auxiliary Heating Enable is set, the auxiliary heating output goes on whenever the controller is in the heating mode. This output is completely independent of the hot water valve or electric heat operation. It may be used to control baseboard heat used in conjunction with terminal boxes.

Auxiliary 1, 2, 3 Output (Optional)

The ASIC/1-8800 allows up to 3 outputs for auxiliary outputs which do not follow any schedule. They can be overridden On or Off, and remain in the last state commanded. The output to be controlled is identified by the Aux 1, 2, 3 Masks which are initially un-assigned.. The functional status of the Aux 1, 2, 3 Outputs is shown by the Auxiliary 1, 2,3 Output Status .

Lighting Output

Each ASIC/1 has the ability to control lighting. The Lighting schedule will automatically turns the lights on and off. By equipping the ASIC/1 with a WS-0XX wall sensor with push button override, the lights can be operated manually by the occupant during Occupied and Morning Warm-up States by pressing the button on the side of the zone sensor without affecting HVAC operation.

During Unoccupied and Night Setback States, depressing the push button will return the control to Occupied, and the lights will come on and stay on for Afterhours Time Allowed. During Emergency 1 and Emergency 2, the push-button has no effect.

If Lights Occupied Enable is yes then the lights are on whenever the Lighting Schedule is On, or the Control State is occupied.

Blink Warning: One minute before automatic shut off of lights as designated in the daily event schedule, or at the end of the afterhours override period, the lights will blink off and back on again. Pressing the afterhours button on the wall sensor re-starts the lights.

Alarms

Zone Temperature Alarm

If the Zone temperature is above the Active Cooling Temperature Setpoint by the Zone Temperature Alarm Range, a High Zone Temperature Alarm is set. If the Zone temperature is below the Active Heating Temperature Setpoint by the Zone Temperature Alarm Range, a low Zone Temperature Alarm is set. No other actions are taken in response to a zone temperature alarm.

Primary Airflow Alarm

If the primary airflow is above the Primary Airflow Setpoint by the Airflow Alarm Range, then a High PrimaryAirflow Alarm is set. If the Primary Airflow is below the Primary Airflow Setpoint by the Airflow Alarm Range, then a Low Primary Airflow Alarm is set. No other actions are taken in response to a Primary Airflow Alarm.

Emergency Modes

The emergency modes, Emergency 1, and Emergency 2, are overrides which are received over the communication line and remain in effect until cleared over the communication line.

Emergency 1 Mode

The control may only enter or exit Emergency 1 as a result of commands received on communications line. While in Emergency 1, no other state may be entered until Emergency 1 has been cleared via the communications line. Emergency is maintained through loss of power.

While in Emergency 1 state the controller immediately drives the damper to Maximum Cooling Airflow Setpoint, turns ON the lighting output, and turns OFF any other outputs including electric heat. In EM1 the Fan is On.

Emergency 2 Mode

The control can enter and exit Emergency 2 as the result of commands received on the communications line. If in Emergency 2, no other state except Emergency 1 may be

entered until Emergency 2 has been cleared via the communications line. Emergency is maintained through loss of power.

While in Emergency 2 state the controller immediately drives the damper closed, turns ON the lighting output and turns OFF any other outputs, including electric heat.

Communications

The ASIC/1-8800 communicates at 1200 baud, 9600 baud, or 19,200 baud on the remote bus using RS-485 twisted pair communication wire, connected to remote screw terminal connector, TB-4. Access to the ASI communication bus is through an ASIC/2 configurable controller or ASI EtherLink/2 serial router which can also be used to broadcast time to synchronize the network of ASIC/1 controllers.

Communication with the remote bus can also be established through the WS-0XX wall sensor using a SINC/1-1030 Portable Interface connected to a lap-top computer running ASI Expert software.

Each controller has a unique 16 bit address [Default 18800], and may also have a separate 8 bit group address. It will also respond to the global addresses 23125(0x5A55) and 23130 (0x5A5A).

Communication with the ASIC/1-8800 is largely compatible with the ASIC/1-8055 which it replaces. The ASIC/1-8800 may co-exist on the communication line with other ASIC/1 controllers. It is compatible with the ASI LinkOPC Server for seamless communication with Windows based graphic user interfaces.

System Component Checklist

Inputs

Description	Part Number	Quantity
Airflow Filter	AF-001	1,2
Optional Duct Temperature Sensor (IN-06)	TS-DO-8	0,1
Optional Duct Temperature Sensor (IN-07)	TS-DO-8	0,1
Optional Duct Temperature Sensor (IN-08)	TS-DO-8	0,1
Optional Occupancy Switch (BI-08)		0,1
Wall Mounted Zone Temperature Sensor	WS-0X1	1
Sensor Cable	SCP-0XX	1
Communication Cable twisted pair.	22-24 ga twisted	

Note: The inlet side of the airflow transducer, HIGH, is marked on the ASIC/1-8800 is the same as of the ASIC/1-8055 controller. An airflow filter, AF-001, is required on the inlet side of the airflow transducer.

NOTE: Consult ASIC/1-8800 Installation manual for configuration of inputs.

Outputs

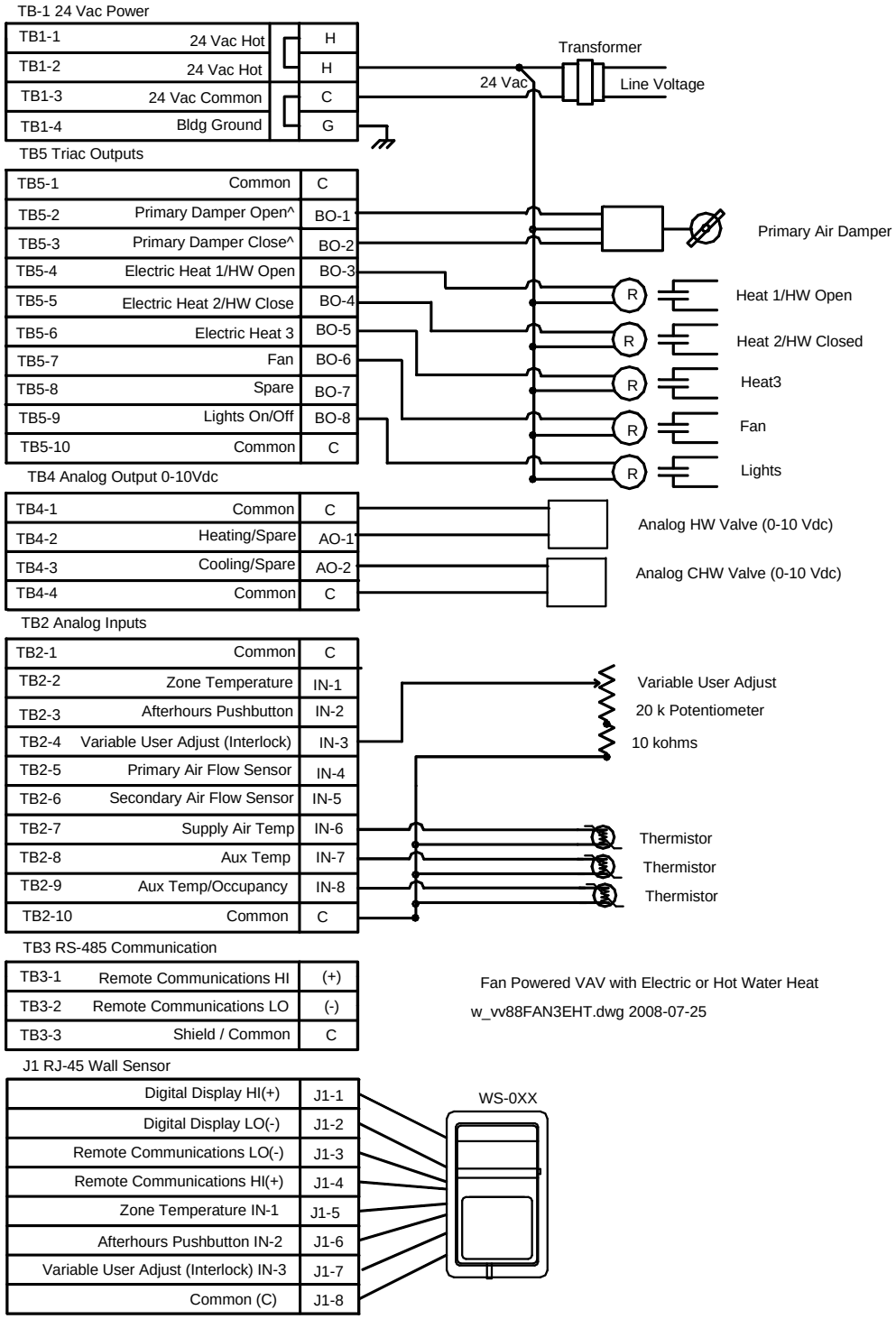
Description	Part Number	Quantity
VAV Controller	ASIC/1-8800	1
24 Vac Transformer		1
24 Vac Tri-state Primary Damper Operator		1
24 Vac Fan Control Relay		1
HW Valve with 24 Vac Tri-state Operator		0,1
24 Vac Thermic Valve (Optional)		0,1
24 Vac Electric Heat Relay		0,1,2,3
24 Vac Auxiliary CLG Output Relay (Optional)		0,1
24 Vac Auxiliary HTG Output Relay(Optional)		0,1
24 Vac Auxiliary Output Relay (Optional)		0,1,2,3
24 Vac Lighting Relay (Optional)		0,1

NOTE: . The ASIC/1-8800 must be connected to a solid building ground. Metallic-oxide Varistors, MOV, may also be used across relay contacts to provide further protection from transients. If current interrupting relays are in series with the output circuits they must be protected with MOVs across the Relay Contacts

Wiring Layout

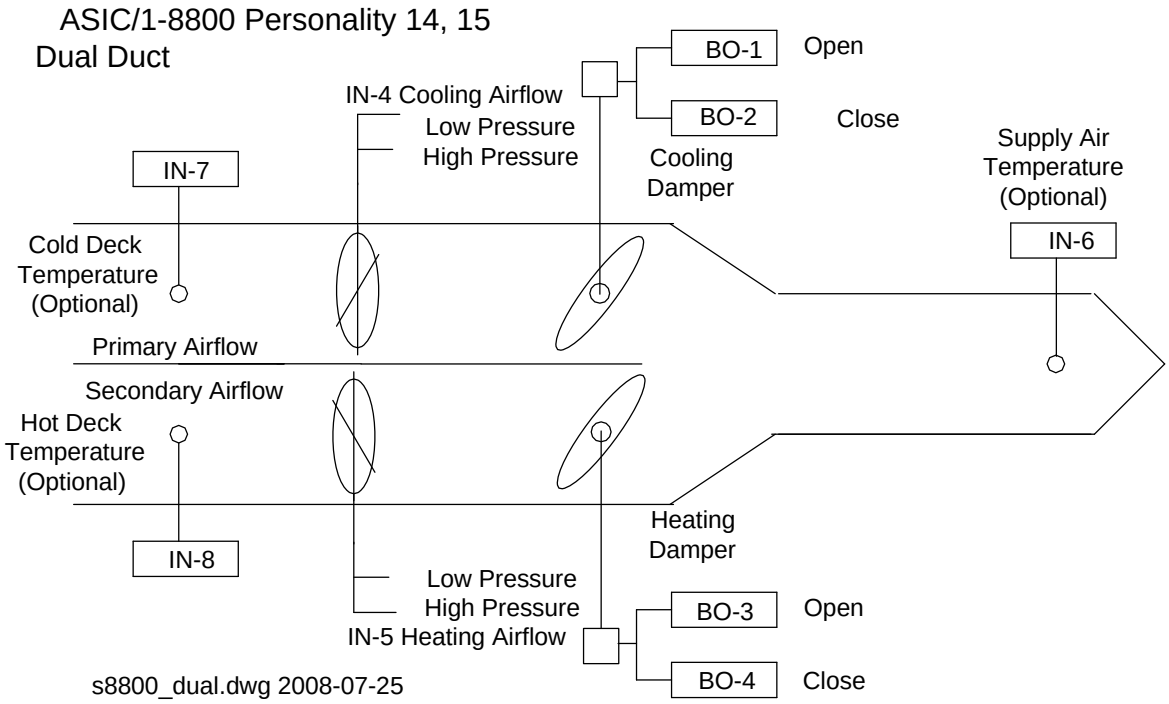
Constant Fan with Electric or HW Heat

Typical Constant Fan Powered VAV with 3 Stages of Electric Heat, for use with the following personalities: Personality 9, 1 stage of electric heat; Personality 10, 2 stages of electric heat ; and Personality 11, 3 stages of electric heat; with Hot Water Heat for Personality 13; or with Thermic Valve Heat for Personality 20



Dual Duct VAV

Application



This application bulletin describes the sequence of operation used by the ASIC/1-8800 to control zone temperature with a dual duct VAV system with or without blending. The ASIC/1-8800 uses a primary airflow sensor to give pressure independent control of the variable air volume cooling. It uses a secondary airflow sensor to give pressure independent control of the variable air volume heating. If the blending personality is selected, then the cooling and heating airflow are modulated, so that a minimum total airflow is maintained. The ASIC/1-8800 is preprogrammed with two dual duct personalities.

Dual Duct Personalities

	Without Blending	With Blending
Dual Duct	14	15

Inputs

The ASIC/1-8800 controller has specific inputs for zone temperature, primary cooling airflow, and secondary heating airflow, and optional supply air temperature, and optional occupancy sensor. The default input types are set at the factory. Inputs that are not required for the sequence may be used for monitoring.

Primary Airflow

The ASIC/1-8800 uses an primary airflow sensor to give pressure independent control of the cooling air volume. The primary airflow sensor is installed on input 4 in the pin-sockets at AIR1. It is calibrated at zero airflow.

The controller measures the air velocity in feet per minute (ft./min) assuming a standard velocity K-factor of 2338 ft/min. The velocity K-factor is the air velocity in ft/min required to generate a velocity pressure of 1 inch water column (1 "wc =249 Pa) The velocity K-factor is provided by the VAV box manufacturer for a particular box size and flow cross. The airflow volume Q in CFM is calculated based on the actual K-factor in feet per minute , and duct area in square feet.

$$Q\ (CFM) = Area\ (ft^2) * Velocity(ft/min) * (K\text{-}factor/2338)$$

Field calibration of the velocity K-factor can be done by the air balancer using the air balance screen on the Setup software.

Note: Both airflow sensors require an airflow filter, AF-001, on the high pressure side, to prevent dust from contaminating the sensor.

Secondary Airflow

The secondary airflow is required for dual duct personalities. The secondary airflow sensor is used with a properly positioned airflow cross to control the heating air volume. A secondary airflow sensor is installed on input 5 in the pin-sockets at AIR2. It is calibrated at zero airflow and has separate K-factors and duct areas.

Wall Sensor Connections

Zone temperature sensor is normally on input 1. Typically, the zone temperature on the WS-0xx, wall sensor, is connected to the controller using a SCP-XXX sensor cable. Alternately, a zone or return air temperature sensor may be attached on input terminal, IN1. If there is no zone temperature sensor , then the zone sensor input is in fault, all outputs are off, and it does not try to control.

The afterhours push-button on the WS-0X1 wall sensor if used, is always on input 2. If Afterhours Enable is Yes, then shorting the input to zero will initiate afterhours override mode for an Afterhours Time Allowed.

Input 3 is used for Interlock and may be used for variable user adjust with the WS-0XX wall sensor. When User Adjust Enable is set and input 3 is configured for Variable User adjust, 10k to 30 kohm, the zone temperature setpoint may be adjusted up or down by the User Adjust Setpoint, based on the condition of input 3.

Support is also provided for the WS-051 Digital Display Wall Sensor. The WS-051 has a zone temperature sensor on input 1 and provides both Occupied Temperature Setpoint change and afterhours override. A jumper, JMPR1, is set to provide power to the WS-051 via input 2. Digital Display Enable must be set to yes.

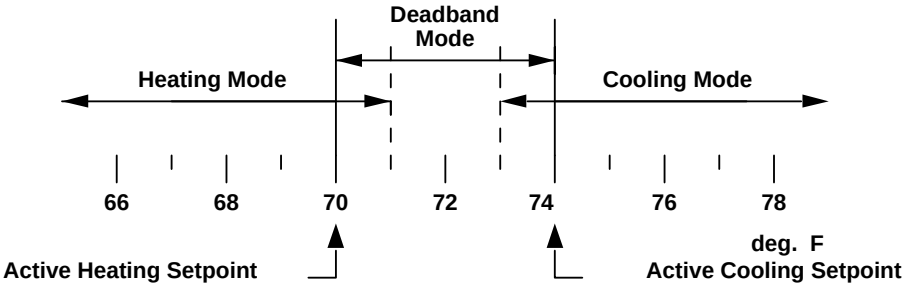
Auxiliary Temperature Sensors

An optional a duct temperature sensor, TS-DO, may be placed on input 6, 7, or 8 for temperature monitoring. The auxiliary temperature sensors use the factory provided 3.32 kohm pull-up resistor.

An optional occupancy sensor or switch may be used on input 8 to change the control state from occupied to unoccupied. When the occupancy sensor is used in combination with a temperature sensor, then the temperature sensor is not read when the contacts are closed.

Control Mode

The controller determines the Control Mode, Heating, Deadband, or Cooling by comparing the zone temperature to the Active Heating Temperature Setpoint and Active Cooling Temperature Setpoint.



The controller enters the Cooling Control Mode when the zone temperature equals or is greater than the Active Cooling Temperature Setpoint . The control reenters the Deadband mode, when the zone temperature is 1 ^{o}F below the Active Cooling Temperature Setpoint and the calculated Cooling Requirement is equal to zero.

The control enters the heating mode when the zone temperature is equal to or less than the Active Heating Temperature Setpoint. The control reenters the Deadband mode when the zone temperature is 1 ^{o}F greater than the Active Heating Temperature Setpoint and the calculated Heating Requirement is equal to zero.

Active Temperature Setpoints

The controller maintains the zone temperature between Active Cooling and Heating Temperature Setpoints. The Active Cooling and Heating Temperature Setpoints are based on Control State, the Active User Adjust based on the position of the User Adjust Switch or Variable User Adjust, and the Active Demand Limit Reset.

Temperatures may be in degrees Fahrenheit or Celsius, depending on the input convert type that has been selected. If Half Degree Enable is set then the Temperature Setpoints are in half-degree (Fahrenheit or Celsius) increments.

If User Adjust Enable is set, the Active Temperature Setpoints may be modified by the variable user adjust potentiometer on a WS-0XX wall sensor depending on the input configuration. The Active Heating Temperature Setpoint is adjusted up and the Active Cooling Temperature Setpoint is adjusted down a fraction of the User Adjust Setpoint.

If the Active Demand Level is non-zero, the Active Temperature Setpoints are also modified by a fraction of the Demand Reset Range as the Active Demand Level goes from 0 to 6. The Active Cooling Temperature Setpoint is reset upwards and the Active Heating Temperature Setpoint is reset downwards.

Cooling and Heating Requirement

In Deadband Control Mode, the Heating and Cooling Requirements are zero.

In the Cooling or Heating Control Mode, the Cooling or Heating Requirement is calculated using a PI control loop.

The change in heating or cooling requirement is calculated every 30 seconds.

In heating: Error = Active HTG SP - Zone Temp
Δ Error = Previous Zone Temp - Zone Temp

or in cooling: Error = Zone Temp - Active CLG SP
Δ Error = Zone Temp - Previous Zone Temp.

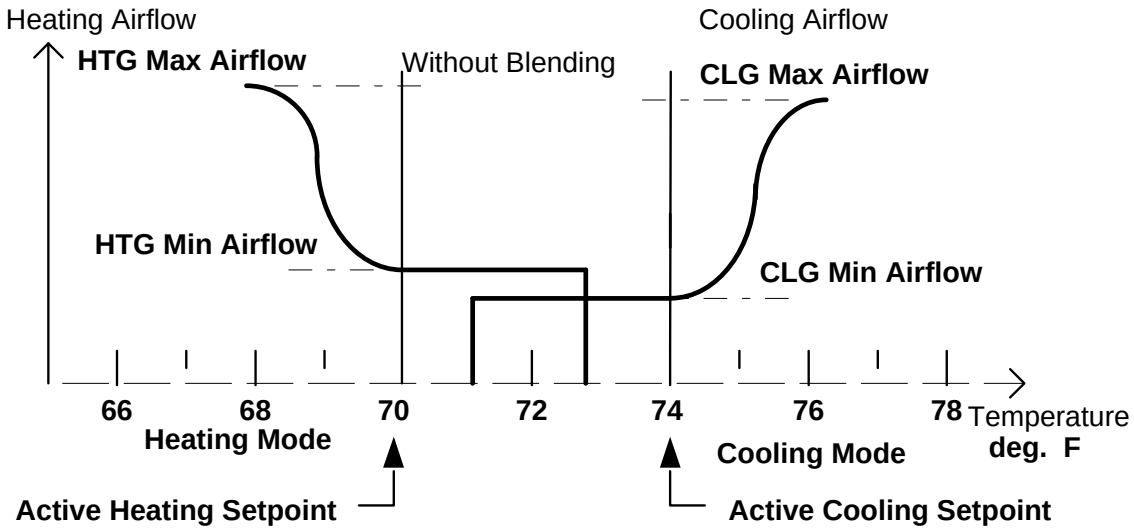
ΔRequirement = (100%/ThrottleRange)*[Error*(CalcTime/Int Time) +Δ Error]

The factory setting for throttle range is 4.0 degrees, and for integral time is 2.5 minutes.

Cooling Airflow Modulation

When in the cooling mode the controller modulates Primary Airflow Setpoint is modulated between the Active Cooling Minimum and Maximum Airflow Setpoints as the Cooling Requirement goes from zero to 100 %.

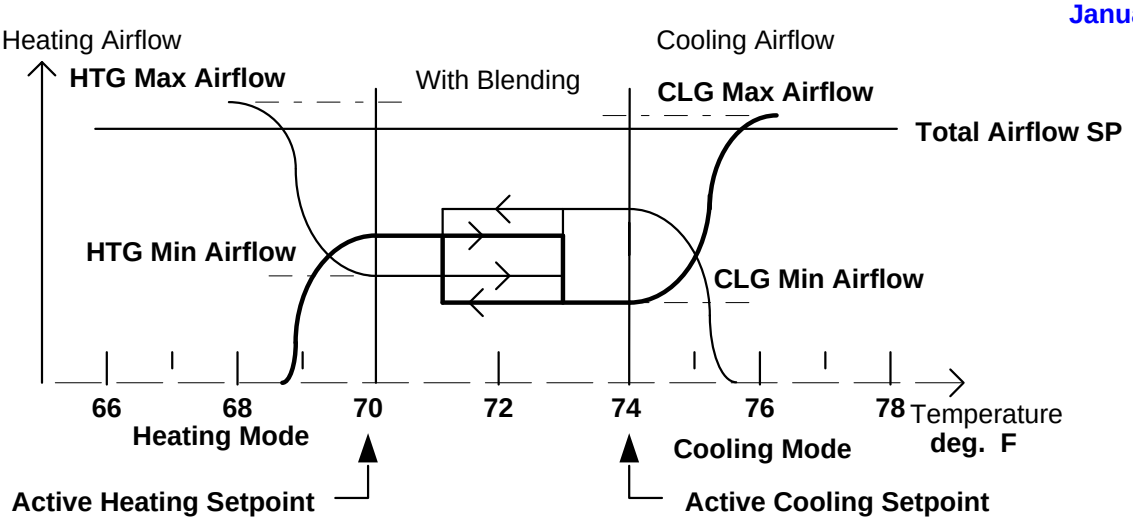
If blending is used (personality 15) in the Cooling Mode, the heating airflow is modulated so that the total delivered airflow does not fall below the Total Minimum Airflow Setpoint. If blending is not used (personality 14) the heating damper is CLOSED.



Heating Airflow Modulation

When in the heating mode the controller modulates Secondary Airflow Setpoint is modulated between the Active Heating Minimum and Maximum Airflow Setpoints as the Heating Requirement goes from zero to 100 %.

If blending is used (personality 15) in the heating mode the cooling airflow is modulated so that the total delivered airflow does not fall below the Total Minimum Airflow setpoint. If blending is not used (personality 14) the cooling damper is CLOSED.



Deadband Airflow Modulation

In Deadband Control Mode, the controlling airflow is maintained at Active Cooling Minimum Airflow Setpoint or Active Heating Minimum Airflow Setpoint depending on the position of zone temperature with respect to Deadband midpoint and direction of temperature change.

When entering Deadband from Cooling, cooling is the controlling airflow and the heating is the blending airflow. The controlling Cooling airflow remains at Cooling Minimum Setpoint until the zone temperature falls 1 ^{o}F below the midpoint between the Heating and Cooling Temperature Setpoints. If the zone temperature falls 1 ^{o}F below the midpoint between the Heating and Cooling Temperature Setpoints, then heating air becomes the controlling airflow, and cooling becomes the blending airflow until the zone temperature rises 1 ^{o}F above the midpoint temperature.

When entering Deadband from heating, heating is the controlling airflow and cooling is the blending airflow. The controlling heating airflow remains at Heating Minimum Setpoint until the zone temperature rises 1 ^{o}F above the midpoint between the Heating and Cooling Temperature Setpoints. If the zone temperature rises 1 ^{o}F above the midpoint between the Heating and Cooling temperature setpoints, then Cooling air becomes the controlling airflow, and Heating becomes the blending airflow until the zone temperature falls 1 ^{o}F below the midpoint temperature.

If blending is used (personality 15) in the Deadband Control Mode, the blending airflow is modulated, so that the total delivered airflow does not fall below the Total Minimum Airflow Setpoint.

When cooling is the controlling airflow the Heating Airflow Setpoint is given by :

Heating Airflow Setpoint =
(Blend Ratio Numerator/Denominator)
*(Total Minimum Airflow Setpoint - Cooling Airflow Setpoint)

When heating is the controlling airflow the Cooling Airflow Setpoint is given by :

Cooling Airflow Setpoint =
(Total Minimum Airflow Setpoint -
(Blend Ratio Numerator/Denominator)*(Heating Airflow Setpoint)

If blending is not used (personality 14) the blending damper is CLOSED.

Control State

The Control State determines which Cooling and Heating Temperature Setpoints are used for zone temperature control. Four control states are possible: Occupied, Unoccupied, Night Setback, and. Morning Warm-up. If the Clock is not synchronized, the Control State is Occupied by default. Otherwise the Control State is determined by the Daily Event Schedule.

The Control State may be overridden via a message broadcast over the communication bus from software or an ASIC/2 controller. The controller state may be returned to OCC from NSB or Unocc when the Afterhours Enable is yes and the push-button on the Wall Sensor is pushed. The controller state may be also overridden to Unoccupied from Occupied by an the Occupancy Sensor on input 8.

The Active Cooling and Heating Minimum and Maximum Airflow Setpoints are typically given by the Occupied Cooling and Heating Minimum and Maximum Airflow Setpoints.

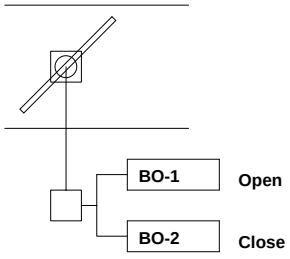
However, if Multiple Airflow Enable is set, the Active Cooling and Heating Minimum and Maximum Airflow Setpoints are given by: the Occupied Cooling and Heating Minimum and Maximum Airflow Setpoints in the Occupied and Morning Warm-up States; the Unoccupied Cooling and Heating Minimum and Maximum Airflow Setpoints in the Unoccupied State; or the Night Setback Cooling and Heating Minimum and Maximum Airflow Setpoints in the Night Setback State.

In the Night Setback State if NSB Option 2 is Yes, then both the Heating and Cooling Dampers are closed in deadband.

In the Unoccupied State if Unoccupied Option 2 is Yes, then both the Heating and Cooling Dampers are closed in deadband.

Morning Warm-up is meant as a prelude to Occupied state, to ready the building for daily use. For Morning Warm-up, the dual duct control sequence operates exactly as in the occupied state.

Outputs



Primary Air Damper

Primary Air Damper

In Dual Duct personalities in Cooling Control mode, the controller modulates the Primary Airflow Setpoint between the Active Cooling Minimum and Maximum Airflow setpoints based on the Cooling Requirement.

If blending is used (personality 15), the heating airflow is also modulated, so that the total delivered airflow does not fall below the Total Occupied Minimum Airflow setpoint.

The Primary Airflow is compared with the Primary Airflow Setpoint every a second. As the damper drives the airflow toward the setpoint, the output begins to pulse,where the pulse size in 1/6 s increments is given by 4*Airflow Error/AF Hysteresis. The smallest non-zero Airflow Hysteresis gives the fastest approach to setpoint.

As control approaches the setpoint, the airflow error is summed over time. The Airflow Integration Time [Default 4] is the time required for a 25 ft/min error to sum to give an additional pulse. To enable this algorithm you must give the Airflow Integration Time [Default 4] a non-zero value. If Airflow Integration Time is zero, then it drives to the Airflow Setpoint, and waits until airflow exceeds hysteresis.

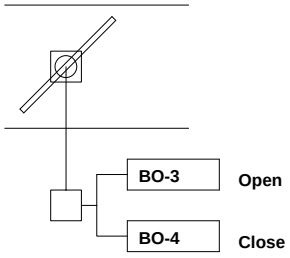
Primary Damper Control - Dual Duct Blending (Personality 15)

* opposite damper modulates to maintain Total Airflow SP.

For Blending Dual Duct in deadband the midpoint between the Active Cooling and Heating Temperature Setpoints is used, with 1 degree of hysteresis to determine whether the heating duct or the cooling duct is the primary duct.

	Occupied	UNO Option 2 = No	UNO Option 2 = Yes	NSB Option 2 = No	NSB Option 2 = Yes	MWU Option 2 = Yes, or No
Cooling	Modulate	Modulate	Modulate	Modulate	Modulate	Modulate
Deadband	Modulate 50/50	Modulate 50/50	Closed	Modulate 50/50	Closed	Modulate 50/50
Heating	Modulate*	Modulate*	Modulate*	Modulate*	Modulate*	Modulate*

Secondary Air Damper



Secondary Air Damper

In the Heating Mode the primary airflow modulates between the Active Heating Minimum and Maximum Airflow Setpoints as the Heating requirement goes from zero to 100 %.

In dual duct personalities, 14 and 15, the Secondary Air Damper is opened or controlled to maintain a Secondary Airflow Setpoint. As the damper drives the airflow toward the setpoint, the output begins to pulse. As control approaches the setpoint, the airflow error is summed over time.

If blending is used (personality 15), the cooling airflow is also modulated, so that the total delivered airflow does not fall below the Total Occupied Minimum Airflow setpoint. .

Secondary Damper Control - Dual Duct Blending (Personality 15)

* opposite damper modulates to maintain Total Airflow SP.

	Occupied	UNO Option 2 = No	UNO Option 2 = Yes	NSB Option 2 = No	NSB Option 2 = Yes	MWU Option 2 = Yes or No
Cooling	Modulate*	Modulate*	Modulate*	Modulate*	Modulate*	Modulate*
Deadband	Modulate 50/50	Modulate 50/50	Closed	Modulate 50/50	Closed	Modulate 50/50
Heating	Modulate	Modulate	Modulate	Modulate	Modulate	Modulate

Other Outputs

Analog Outputs

The ASIC/1-8800 has two 0 to 10 Vdc Analog outputs that can drive upto 20 mA. The outputs can be assigned to Cooling Requirement, or Heating Requirement... Because some actuators are 6 to 9 V and others are 2 to 10 Vdc, the analog outputs can be scaled from Minimum Output (Fully Closed) to Maximum Output (Fully Open) as the control signal goes from 0 to 100%.

Auxiliary Cooling Output (Optional)

An optional auxiliary cooling output is provided. If Auxiliary Cooling Enable is set, and the Cooling Requirement is 100 % and the zone temperature exceeds the active cooling setpoint by an Auxiliary Cooling Offset [Default 2 ^{o}F] for an Auxiliary Cooling Delay Time [Default: 120 s], then an auxiliary cooling output is energized. The output to be used is assignable using the Auxiliary Cooling Output Mask [Default: Output #5]. Once energized, the auxiliary cooling output remains on until the zone temperature falls below the active cooling temperature setpoint, and the cooling airflow falls below the maximum cooling setpoint by an amount given by the Auxiliary Cooling Hysteresis. [Default: 125 ft/min]

Auxiliary Heating Output (Optional)

If Auxiliary Heating Enable is set, the auxiliary heating output goes on whenever the controller is in the heating mode. This output is completely independent of the hot water valve or electric heat operation. It may be used to control baseboard heat used in conjunction with terminal boxes.

Auxiliary 1, 2, 3 Output (Optional)

The ASIC/1-8800 allows up to 3 outputs for auxiliary outputs which do not follow any schedule. They can be overridden On or Off, and remain in the last state commanded. The output to be controlled is identified by the Aux 1, 2, 3 Masks which are initially un-assigned.. The functional status of the Aux 1, 2, 3 Outputs is shown by the Auxiliary 1, 2,3 Output Status .

Lighting Output

Each ASIC/1 has the ability to control lighting. The Lighting schedule automatically turns the lights on and off. By equipping the ASIC/1 with a WS-0XX wall sensor with push button override, the lights can be operated manually by the occupant during Occupied and Morning Warm-up States by pressing the button on the side of the zone sensor without affecting HVAC operation.

During Unoccupied and Night Setback States, depressing the push button will return the control to Occupied, and the lights will come on and stay on for Afterhours Time Allowed. During Emergency 1 and Emergency 2, the push-button has no effect.

If Lights Occupied Enable is yes then the lights are on whenever the Lighting Schedule is On, or the Control State is occupied.

Blink Warning: One minute before automatic shut off of lights as designated in the daily event schedule, or at the end of the afterhours override period, the lights will blink off and back on again Pressing the afterhours button on the wall sensor re-starts the lights.

Alarms

Zone Temperature Alarm

If the Zone temperature is above the Active Cooling Temperature Setpoint by the Zone Temperature Alarm Range, a High Zone Temperature Alarm is set. If the Zone temperature is below the Active Heating Temperature Setpoint by the Zone Temperature Alarm Range, a low Zone Temperature Alarm is set. No other actions are taken in response to a zone temperature alarm.

Primary Airflow Alarm

If the primary airflow is above the Primary Airflow Setpoint by the Airflow Alarm Range, then a High PrimaryAirflow Alarm is set. If the Primary Airflow is below the Primary Airflow Setpoint by the Airflow Alarm Range, then a Low Primary Airflow Alarm is set. No other actions are taken in response to a Primary Airflow Alarm.

Secondary Airflow Alarm

If the secondary airflow is above the Secondary Airflow Setpoint by the Airflow Alarm Range, then a High Secondary Airflow Alarm is set. If the secondary airflow is below the Secondary Airflow Setpoint by the Airflow Alarm Range, then a Low Secondary Airflow Alarm is set. No other actions are taken in response to a Secondary Airflow Alarm.

Emergency Modes

The emergency modes, Emergency 1, and Emergency 2, are overrides which are received over the communication line and remain in effect until cleared over the communication line.

Emergency 1 Mode

The control may only enter or exit Emergency 1 as a result of commands received on communications line. While in Emergency 1, no other state may be entered until Emergency 1 has been cleared via the communications line. Emergency is maintained through loss of power.

While in Emergency 1 state the controller immediately drives the damper to Maximum Cooling Airflow Setpoint, turns ON the lighting output, and turns OFF any other outputs.

Emergency 2 Mode

The control can enter and exit Emergency 2 as the result of commands received on the communications line. If in Emergency 2, no other state except Emergency 1 may be entered until Emergency 2 has been cleared via the communications line. Emergency is maintained through loss of power.

While in Emergency 2 state the controller immediately drives the damper closed, turns ON the lighting output and turns OFF any other outputs.

Communications

The ASIC/1-8800 communicates at 1200 baud, 9600 baud, or 19,200 baud on the remote bus using RS-485 twisted pair communication wire, connected to remote screw terminal connector, TB-4. Access to the ASI communication bus is through a ASIC/2 configurable controller or ASI EtherLink/2 serial router which can also be used to broadcast time to synchronize the network of ASIC/1 controllers.

Communication with the remote bus can also be established through the WS-0XX wall sensor using a SINC/1-1030 Portable Interface connected to a lap-top computer running ASI Expert software.

Each controller has a unique 16 bit address[Default 18800], and may also have a separate 8 bit group address. It will also respond to the global addresses 23125(0x5A55) and 23130 (0x5A5A).

Communication with the ASIC/1-8800 is largely compatible with the ASIC/1-8055 which it replaces. The ASIC/1-8800 may co-exist on the communication line with other ASIC/1 controllers. It is compatible with the ASI LinkOPC Server for seamless communication with Windows based graphic user interfaces.

System Component Checklist

Inputs

Description	Part Number	Quantity
Airflow Filter	AF-001	2
Optional Duct Temperature Sensor (IN-06)	TS-DO-8	0,1
Optional Duct Temperature Sensor (IN-07)	TS-DO-8	0,1
Optional Duct Temperature Sensor (IN-08)	TS-DO-8	0,1
Optional Occupancy Switch (BI-08)		0,1
Wall Mounted Zone Temperature Sensor	WS-0X1	1
Sensor Cable	SCP-0XX	1
Communication Cable twisted pair.	22-24 ga twisted	

Note: The inlet side of the airflow transducer, HIGH, is marked on the ASIC/1-8800 is same as the ASIC/1-8055 controller. An airflow filter, AF-001, is required on the inlet side of the both airflow transducers.

NOTE: Consult ASIC/1-8800 Installation manual for configuration of inputs.

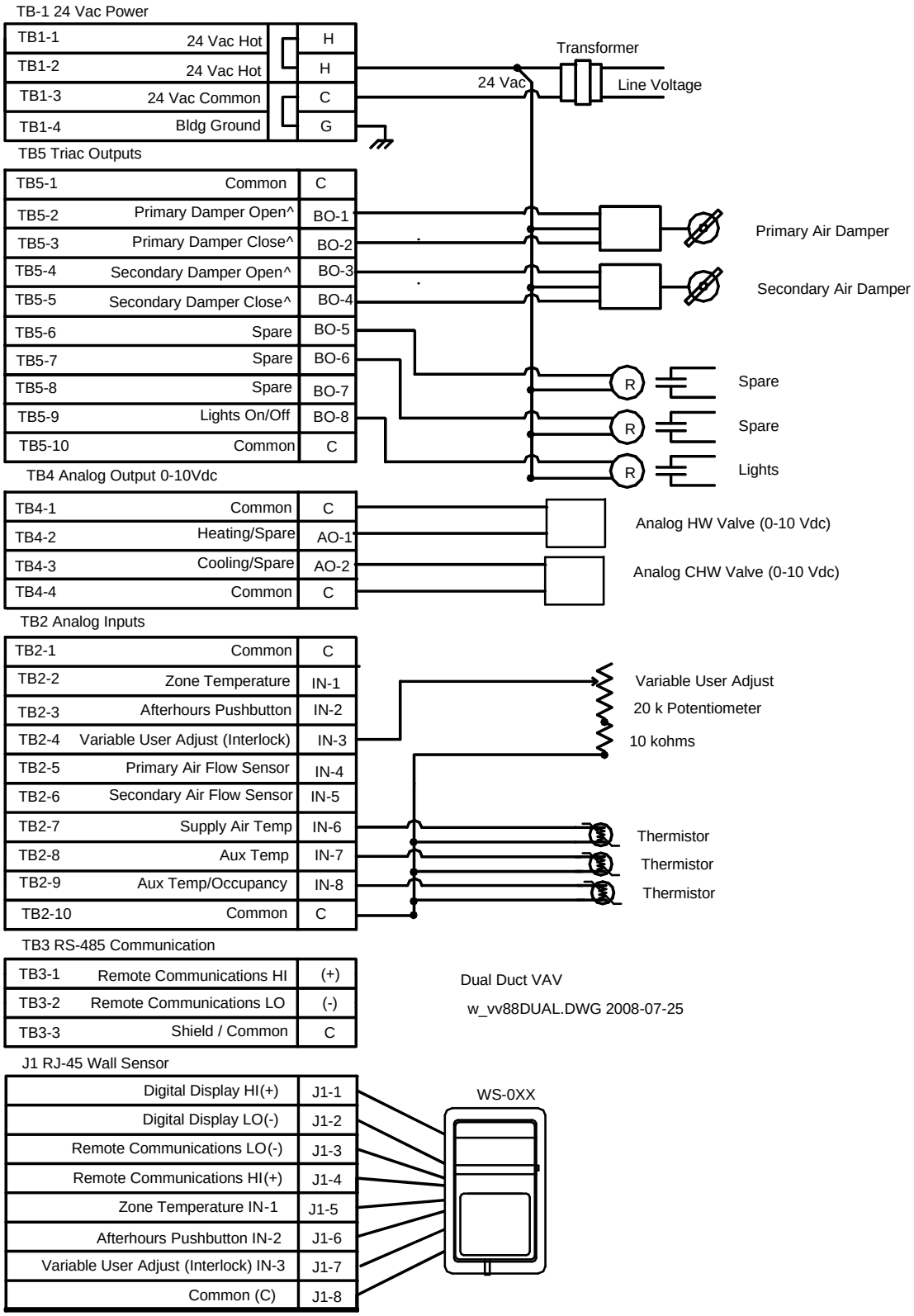
Outputs

Description	Part Number	Quantity
VAV Controller with 2 airflow sensors	ASIC/1-8800-D	1
24 Vac Transformer		1
24 Vac Tri-state Primary Damper Operator		1
24 Vac Tri-state Secondary Damper Operator		1
24 Vac Auxiliary CLG Output Relay (Optional)		0,1
24 Vac Auxiliary HTG Output Relay(Optional)		0,1
24 Vac Auxiliary Output Relay (Optional)		0,1,2,3
24 Vac Lighting Relay (Optional)		0,1

NOTE: . The ASIC/1-8800 must be connected to a solid building ground. Metallic-oxide Varistors, MOV, may also be used across relay contacts to provide further protection from transients. If current interrupting relays are in series with the output circuits they must be protected with MOVs across the Relay Contacts

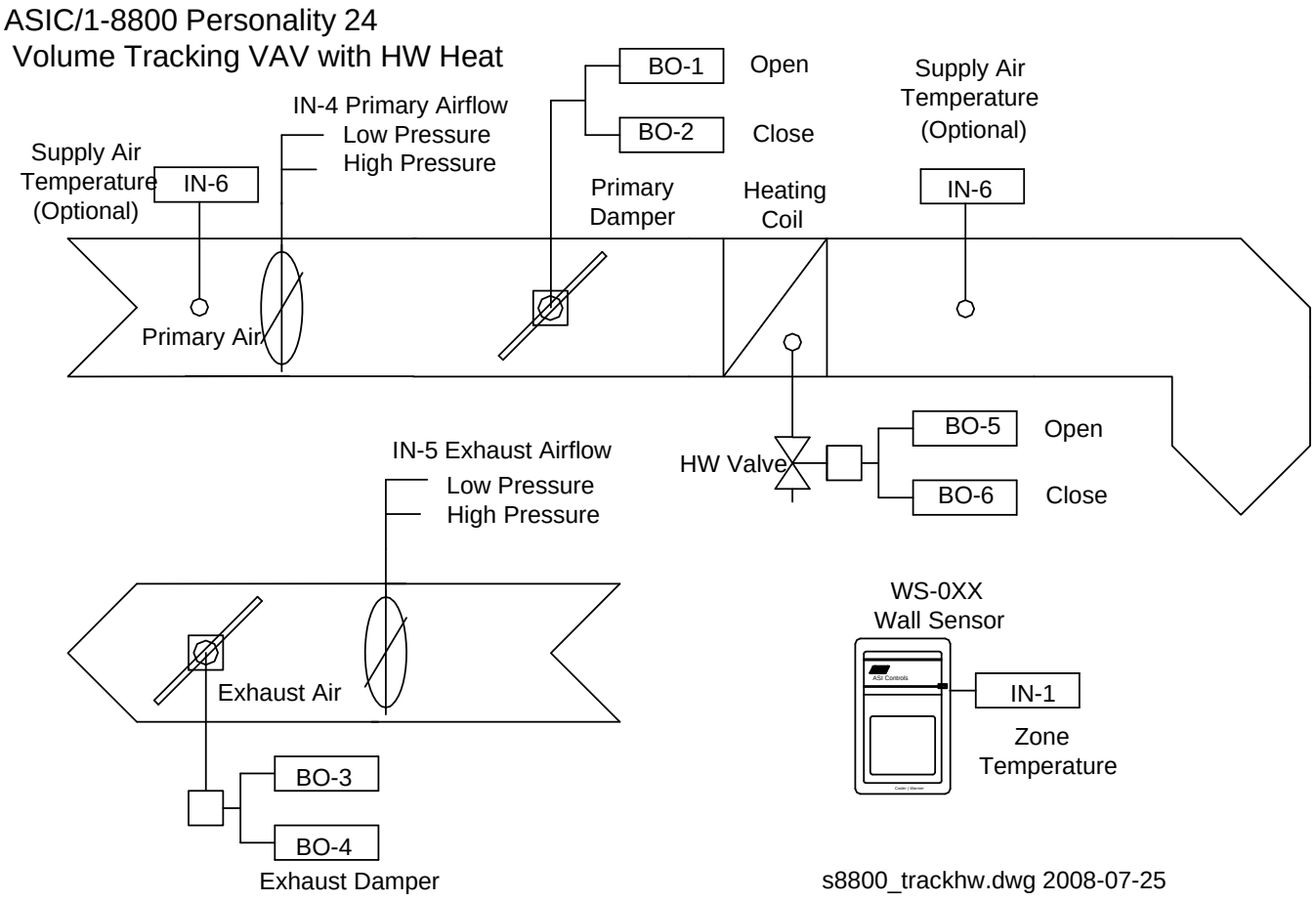
Wiring Layout

Dual Duct with or without blending



Tracking VAV

Application



This application bulletin describes the sequence of operation used by the ASIC/1-8800 to control zone temperature with a VAV system and to control room pressurization based on Exhaust Airflow volume tracking.

The ASIC/1-8800 uses a Primary Airflow sensor to give pressure independent control of the variable air volume cooling. Heating is provided with optional proportional or thermic valve hot water heat, or up to 2 stages of electric heating.

It uses an Exhaust Airflow sensor to give pressure independent control of the Exhaust Airflow volume to maintain a Positive or Negative Airflow difference.

The ASIC/1-8800 controller has specific inputs for zone temperature, Primary Airflow, and Exhaust Airflow, optional supply air temperature, and optional occupancy sensor. The default input types are set at the factory. Inputs that are not required for the sequence may be used for monitoring.

Volume Tracking VAV Personalities

The ASIC/1-8800 is preprogrammed with different personalities for single duct cooling VAV and exhaust terminals.

	No Reheat	1 Stage Electric	2 Stage Electric	HW Valve Open/Close	Thermic Valve
VAV	21	22	23	24	25

Primary Airflow

The ASIC/1-8800 uses a primary airflow sensor to give pressure independent control of the cooling air volume. The primary airflow sensor is installed on input 4 in the pin-sockets at AIR1. It is calibrated at zero airflow.

The controller measures the air velocity in feet per minute (ft/min) assuming a standard velocity K-factor of 2338 ft/min. The velocity K-factor is the air velocity in ft/min required to generate a velocity pressure of 1 inch water column (1 "wc =249 Pa) The velocity K-factor is provided by the VAV box manufacturer for a particular box size and flow cross. The airflow volume Q in CFM is calculated based on the actual K-factor in feet per minute , and duct area in square feet.

$$Q\ (CFM) = Area\ (ft^2) * Velocity(ft/min) * (K\text{-}factor/2338)$$

Field calibration of the velocity K-factor can be done by the air balancer using the air balance screen on ASI Expert software.

Note: Both primary and secondary airflow sensors require an airflow filter, AF-001, on the high pressure side, to prevent dust from contaminating the sensor

Exhaust Airflow

The Exhaust Airflow sensor is required for Tracking personalities and is used with a properly positioned airflow cross to control the Exhaust air volume. A Exhaust airflow sensor is installed on input 5 in the pin-sockets at AIR2. It is calibrated at zero airflow and has separate K-factors and duct areas.

Wall Sensor Connections

Zone temperature sensor is normally on input 1. Typically, the zone temperature on the WS-0xx, wall sensor, is connected to the controller using a SCP-XXX sensor cable sensor. Alternately, a zone or return air temperature sensor may be attached on input terminal, IN1. If there is no zone temperature sensor , then the zone sensor input is in fault, all outputs are off, and it does not try to control.

The afterhours push-button on the WS-0X1 wall sensor if used, is always on input 2. If Afterhours Enable is Yes, then shorting the input to zero will initiate afterhours override mode for an Afterhours Time Allowed.

Input 3 is used for Interlock and may be used for variable user adjust with the WS-0XX wall sensor. When User Adjust Enable is set and input 3 is configured for Variable User adjust, 10k to 30 kohm, the zone temperature setpoint may be adjusted up or down by the User Adjust Setpoint, based on the condition of input 3.

Support is also provided for the WS-051 Digital Display Wall Sensor. The WS-051 has a zone temperature sensor on input 1 and provides both Occupied Temperature Setpoint change and afterhours override. A jumper, JMPR1, is set to provide power to the WS-051 via input 2. Digital Display Enable must be set to yes.

Auxiliary Temperature Sensors

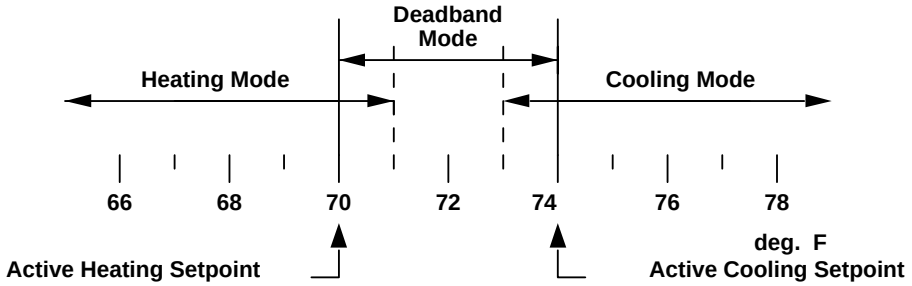
An optional a duct temperature sensor, TS-DO, may be placed on input 6, 7, or 8 for temperature monitoring. The auxiliary temperature sensors use the factory provided 3.32 kohm pull-up resistor.

The duct sensor on input 6 measures Supply Air Temperature and is used for auto-changeover if Changeover Setpoint is not zero. If the input on input 6 is in fault, then changeover is ignored. Changeover operation is described below.

An optional occupancy sensor or switch may be used on input 8 to change the control state from occupied to unoccupied. When the occupancy sensor is used in combination with a temperature sensor, then the temperature sensor is not read when the contacts are closed.

Control Mode

The controller determines the Control Mode, Heating, Deadband, or Cooling by comparing the zone temperature to the Active Heating Temperature Setpoint and Active Cooling Temperature Setpoint.



The controller enters the Cooling Control Mode when the zone temperature equals or is greater than the Active Cooling Temperature Setpoint. The control reenters the Deadband mode, when the zone temperature is 1 ^{o}F below the Active Cooling Temperature Setpoint and the calculated Cooling Requirement is equal to zero.

The control enters the heating mode when the zone temperature is equal to or less than the Active Heating Temperature Setpoint. The control reenters the Deadband mode when the zone temperature is 1 ^{o}F greater than the Active Heating Temperature Setpoint and the calculated Heating Requirement is equal to zero.

Note: A 2 degree separation is required between the Active Cooling and Heating Temperature Setpoints.

Active Temperature Setpoints

The controller maintains the zone temperature between Active Cooling and Heating Temperature Setpoints. The Active Cooling and Heating Temperature Setpoints are based on Control State, the Active User Adjust based on the position of the User Adjust Switch or Variable User Adjust, and the Active Demand Limit Reset.

Temperatures may be in degrees Fahrenheit or Celsius, depending on the input convert type that has been selected. If Half Degree Enable is set then the Temperature Setpoints are in half-degree (Fahrenheit or Celsius) increments.

If User Adjust Enable is set, the Active Temperature Setpoints may be modified by the variable user adjust potentiometer on a WS-0XX wall sensor depending on the input configuration. The Active Heating Temperature Setpoint is adjusted up and the Active Cooling Temperature Setpoint is adjusted down a fraction of the User Adjust Setpoint.

If the Active Demand Level is non-zero, the Active Temperature Setpoints are also modified by a fraction of the Demand Reset Range as the Active Demand Level goes from 0 to 6. The Active Cooling Temperature Setpoint is reset upwards and the Active Heating Temperature Setpoint is reset downwards.

Cooling and Heating Requirement

In Deadband Control Mode, the Heating and Cooling Requirements are zero.

In the Cooling or Heating Control Mode, the Cooling or Heating Requirement is calculated using a PI control loop.

The change in heating or cooling requirement is calculated every 30 seconds.

In heating: Error = Active HTG SP - Zone Temp
Δ Error = Previous Zone Temp - Zone Temp

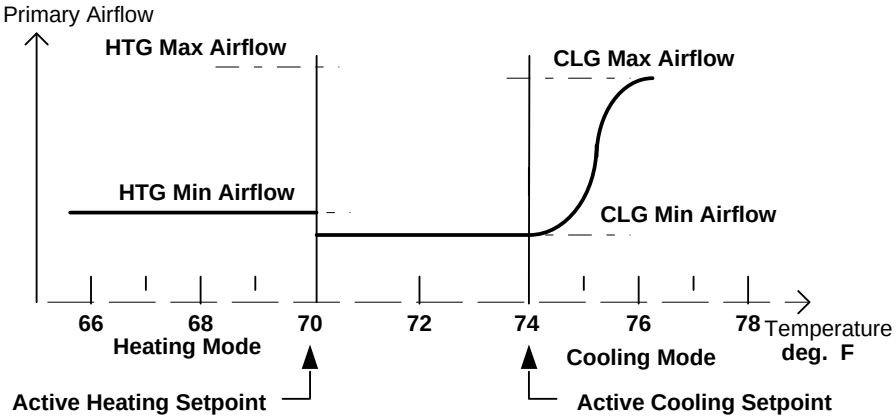
or in cooling: Error = Zone Temp - Active CLG SP
Δ Error = Zone Temp - Previous Zone Temp.

ΔRequirement = (100%/ThrottleRange)*[Error*(CalcTime/Int Time) +Δ Error]

The factory setting for throttle range is 4.0 degrees, and for integral time is 2.5 minutes.

Primary Airflow Modulation

In the Cooling Mode the primary airflow modulates between the Active Cooling Minimum and Maximum Airflow Setpoints as the cooling requirement goes from zero to 100 %.



In the Deadband Mode the Primary Airflow is typically at the Active Cooling Minimum Airflow Setpoint.

In the Heating Mode the Primary Airflow is at the Active Heating Minimum Airflow Setpoint and the Local Heat is modulated to maintain the Active Heating Temperature Setpoint. If Dual Heating Enable is set then the primary airflow also modulates between Heating Minimum and Maximum Airflow as the heating requirement goes from 0 to 100%.

Exhaust Airflow Modulation

A separate Exhaust Airflow sensor in the exhaust duct measures the exhaust air velocity. The Exhaust Airflow Setpoint is calculated once a second based on the measured Primary Airflow, the active Tracker Airflow Setpoint, and the ratio of duct sizes and K-

factors. The Exhaust Airflow is maintained at the calculated Exhaust Airflow Setpoint in all control modes.

A Tracker Positive Airflow Setpoint controls so that more air enters the space than is exhausted from the space.

If Tracker Negative Enable is yes, then the Tracking Negative Airflow Setpoint is active.

A Tracker Negative Airflow Setpoint controls so that less air enters the space than is exhausted from the space.

The Primary Airflow and Tracker Positive and Negative Volume Setpoints are referenced to the Primary Duct Area's and K-factors. The Exhaust Airflow is referenced to the Exhaust Duct Area's and K-factors. If the Primary and Exhaust Duct Areas, and Kfactor are different we must use their ratio in determining the Exhaust Airflow Setpoint.

(Tracking Ratio Numerator/Tracking Ratio Denominator) =
(Kfsupply*Areasupply/Kfexh*Areaexh)

The flow velocity in feet/minute is given by the product of the raw airflow velocity in units of 25 fpm, Vraw, (0-255) and the Secondary K-factor divided by 2338. The air volume in cfm is given by the product of the flow velocity and the Secondary Duct Area.

Volume (cfm) = Area*(Kf/2338)*25*Vraw

For accurate volume tracking the minimum flow velocity should be maintained above 200 ft/minute.

The Exhaust velocity setpoint, Vexh, is calculated every second using the measured Primary (supply) velocity, Vsupply, and the Tracking Airflow Setpoint velocity, Vdiff .

For Positive Tracking the exhaust velocity is given by

Vexh = (Kfsupply*Areasupply/Kfexh*Areaexh)*(Vsupply-Vdiff)

Exhaust Airflow Setpoint= Areaexh*(Kfexh/2338)*25*Vexh

If the Primary or Secondary Areas and K-factors are changed, then the ASI Expert should calculate and download new Tracking Ratio values.

The Exhaust damper position is modulated by closed loop control to maintain the calculated tracking Exhaust Airflow Setpoint in all Control Modes and Control States.

Control State

The Control State determines which Cooling and Heating Temperature Setpoints are used for zone temperature control. Four Control States are possible: Occupied, Unoccupied, Night Setback, and. Morning Warm-up. If the clock is not synchronized, the Control State is Occupied by default, unless Default State Unoccupied is Yes. If synchronized the Control State is changed by an exact match of the Daily Event Schedule.

The Control State may be overridden via a message broadcast over the communication bus from software or an ASIC/2 controller. The controller state may be returned to OCC from NSB or Unocc when the Afterhours Enable is yes and the push-button on the Wall Sensor is pushed. The controller state may be also forced to Unoccupied from Occupied by an the Occupancy Sensor on input 8.

The Active Cooling and Heating Minimum and Maximum Airflow Setpoints are typically given by the Occupied Cooling and Heating Minimum and Maximum Airflow Setpoints.

However, if Multiple Airflow Enable is set, the Active Cooling and Heating Minimum and Maximum Airflow Setpoints are given by: the Occupied Cooling and Heating Minimum and Maximum Airflow Setpoints in the Occupied and Morning Warm-up States; the Unoccupied Cooling and Heating Minimum and Maximum Airflow Setpoints in the Unoccupied State; or the Night Setback Cooling and Heating Minimum and Maximum Airflow Setpoints in the Night Setback State.

Deadband Mode

In the Deadband Mode, the operation of the primary air damper depends on the Control State and option selections.

In Occupied Deadband the Primary Airflow is at the Active Cooling Minimum Airflow Setpoint.

In Unoccupied Deadband the Primary Airflow is at the Active Cooling Minimum Airflow Setpoint, unless UNO Option 2 Enable is yes, then the primary air damper is closed in Deadband

In Night Setback Deadband Mode the primary Airflow is at the Active Cooling Minimum Airflow Setpoint, unless NSB Option 2 Enable is yes, then the primary air damper is closed in Deadband.

Morning Warm-up (MWU) State

Morning Warm-up is meant as a prelude to Occupied state, to ready the building for daily use. For Morning Warm-up, the control sequence operates the primary (supply) box at full-capacity heating until the zone temperature is moved into the Deadband region.

Two MWU sequences can be selected: central heating, and local heating. In central heating MWU hot air is distributed through the primary air ducts. In local heating MWU, all heat is provided from the VAV terminal.

MWU, Central Heating

If Morning Warm-up Option 2 Enable is not set, then central heating is assumed where hot air is in the duct as in changeover heating, which is described below. If the control is initially in cooling or heating mode, the opposite mode is locked-out until the end of Morning Warm-up.

All local heat is typically OFF during this sequence. However, if Local Heat Enable is yes, then local heat is used in addition to central heat.

Morning warm up differs from changeover because the controller goes into heating once, while in changeover it can go in and out of the heating mode many times.

MWU, Local Heat

If Morning Warm-up Option 2 Enable is set then local heating is assumed. The airflow is maintained at Occupied Heating Minimum Airflow Setpoint and all heating is provided by local hot water or electric heat. If Dual Heating is enabled, the primary damper ramps to maximum with heating.

If zone temperature is less than Occupied Heating Setpoint when the control enters MWU state, the heating requirement is 100%, the local hot water or electric heat is at 100%.

When zone temperature reaches Occupied Heating Temperature Setpoint the heating requirement is at 0% and the heat turns OFF. If the zone temperature falls 2 °F below the Occupied Heating Temperature setpoint, the heating requirement is again at 100% to maintain temperature setpoint. This cycle continues while in MWU state.

Changeover

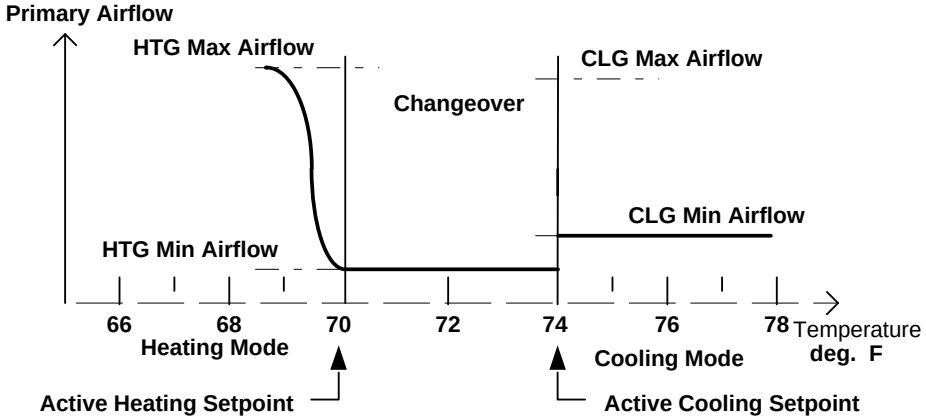
A changeover feature is available which modifies the modes of operation in Heating, Deadband, and Cooling Control Modes. In changeover it is assumed that the primary supply air temperature is appropriate for heating. Changeover is useful for applications where a single duct serves both heating and cooling at different times.

In the changeover heating mode, the Active Primary Minimum and Maximum Airflow setpoints are given by the Active Heating Minimum Airflow and Heating Maximum Airflow Setpoints. The airflow modulates based on the zone Heating Requirement.

If Local Heat Enable is set, the local heat also comes on in addition to central heat whenever the controller is operating in changeover heating.

In changeover Deadband the supply air is maintained at Active Heating Minimum Airflow Setpoint.

In changeover cooling the airflow is maintained at the Active Cooling Minimum Airflow Setpoint.



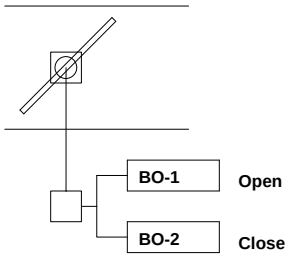
Auto-changeover

Auto-changeover requires installation of a supply air temperature sensor on input 6. If the measured supply air temperature is greater than the Changeover Setpoint, the controller goes into a heating only changeover mode. If the Changeover Setpoint is 0 F (default), the auto-changeover feature is disabled.

Remote Changeover

A command on the communications line to set changeover ON forces the system to control in the changeover heating mode. A remote command to set changeover OFF forces prevents all changeover control action. Remote commands always take priority over auto-changeover. A remote command to restore changeover clears changeover ON and changeover OFF and enables the auto-changeover control action.

Outputs



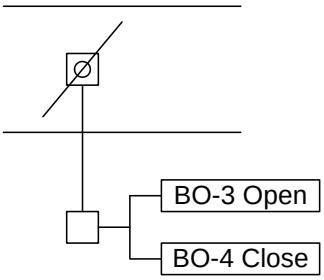
Primary Air Damper

Primary Air Damper

In Single Duct personalities in Cooling Control mode, the controller modulates the Primary Airflow Setpoint between the Active Cooling Minimum and Maximum Airflow setpoints based on the Cooling Requirement.

The Primary Airflow is compared with the Primary Airflow Setpoint every a second. As the damper drives the airflow toward the setpoint, the output begins to pulse, where the pulse size in 1/6 s increments is given by 4*Airflow Error/AF Hysteresis. The smallest non-zero Airflow Hysteresis gives the fastest approach to setpoint.

As control approaches the setpoint, the airflow error is summed over time. The Airflow Integration Time [Default 4] is the time required for a 25 ft/min error to sum to give an additional pulse. To enable this algorithm you must give the Airflow Integration Time [Default 4] a non-zero value. If Airflow Integration Time is zero, then it drives to the Airflow Setpoint, and waits until airflow exceeds hysteresis.



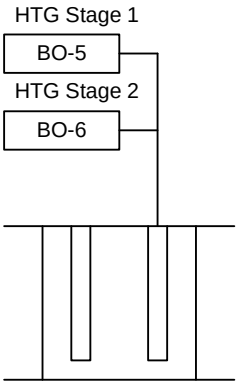
Exhaust Air Damper

Exhaust Air Damper

The Exhaust Air Damper is controlled so that the Exhaust Airflow measured on Input 5 equals the Exhaust Airflow Setpoint.

The Exhaust Airflow Setpoint is calculated every second based on the measured Primary Airflow and the active Tracker Positive or Negative Airflow Setpoint to maintain a difference in air volume. As the damper drives the airflow toward the setpoint, the output begins to pulse. As control approaches the setpoint, the airflow error is summed over time.

A Positive Volume Setpoint controls so more air enters the space than is exhausted from the space. A Negative Airflow Setpoint controls so less air enters the space than is exhausted from the space and is used if Tracker Negative Enable is set in the controller.



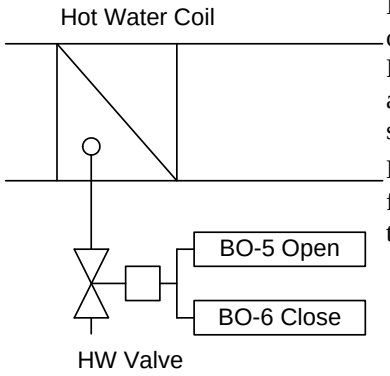
Electric Heat Output

Up to 3 stages of Electric Heating output may be used to maintain the calculated heating requirement in VAV Personality 22 and 23.

For a controller with 1 stage of electric heat (Personality 22): Stage 1 duty cycles in proportion to the Electric Heat Base Time; from 0 to 100% as the Heating Requirement goes from 0 to 100%

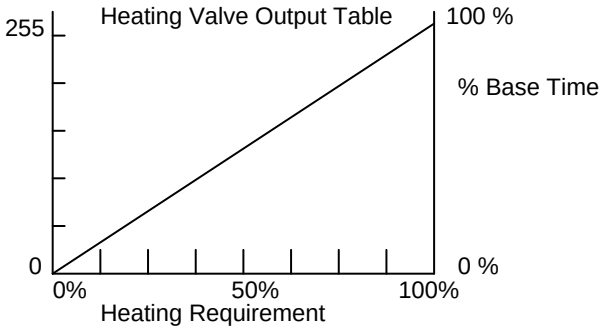
For a controller with 2 stages of electric heat (Personality 23): Stage 1 duty cycles in proportion to the Electric Heat Base Time from 0 to 100% as the Heating Requirement goes from 0 to 50%; and Stage 2 does not turn ON until stage 1 is on for 100% of the duty cycle time and duty cycles in proportion to the Electric Heat Base Time from 0 to 100% as the Heating Requirement goes from 50% to 100%. The output to be controlled is identified by the Electric Heat 1,2, Masks . The functional status of the Electric Heat Outputs is shown by the Electric Heat 1,2 Output Status.

Hot Water Heat Output

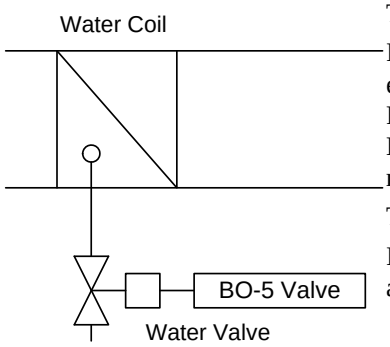


In a controller with modulated hot water heat (Personality 24), the valve is opened or closed a fraction of the HW Valve Base Time in proportion to the Heating Requirement. The output to be controlled is identified by the HW Valve Open Mask and HW Valve Closed Masks. The functional status of the HW Valve output is shown by the HW Valve Output Status

For a controller with modulated hot water heat , the valve is opened or closed a fraction of the valve time base in proportion to the Heating Requirement based on the five-value Heating Valve Output Table.



Thermic Valve On/Off (Optional)



The output to be used is assignable using the Thermic Valve On/Off Mask

In a controller with thermic valve hot water heat (Personality 25), the valve is energized for a fraction of the HW Valve Base Time in proportion to the Heating Requirement. The thermic Valve is normally off and will be ON for a fraction of the HW Heating Base Time. It will be initially on and once it goes off it stays off for the remainder of the HW Heating Base.

Timer On Time = (HW Output/255)* HW Base Time.

If Thermic Valve Reversed is set the output will be normally on, and will be OFF for a fraction of the HW Heating Base Time.

Other Outputs

Analog Outputs

The ASIC/1-8800 has two 0 to 10 Vdc Analog outputs that can drive upto 20 mA. The outputs can be assigned to Cooling Requirement or Heating Requirement. Because some actuators are 6 to 9 V and others are 2 to 10 Vdc, the analog outputs can be scaled from Minimum Output (Fully Closed) to Maximum Output (Fully Open) as the control signal goes from 0 to 100%.

Auxiliary Cooling Output (Optional)

An optional auxiliary cooling output is provided. If Auxiliary Cooling Enable is set, and the Cooling Requirement is 100 % and the zone temperature exceeds the active cooling

setpoint by an Auxiliary Cooling Offset [Default 2 °F] for a Auxiliary Cooling Delay Time [Default: 120 s], then an auxiliary cooling output is energized. The output to be used is assignable using the Auxiliary Cooling Output Mask [Default: Output #5]. Once energized, the auxiliary cooling output remains on until the zone temperature falls below the active cooling temperature setpoint, and the cooling airflow falls below the maximum cooling setpoint by an amount given by the Auxiliary Cooling Hysteresis. [Default: 125 ft/min]

Auxiliary Heating Output (Optional)

If Auxiliary Heating Enable is set, the auxiliary heating output goes on whenever the controller is in the heating mode. This output is completely independent of the hot water valve or electric heat operation. It may be used to control baseboard heat used in conjunction with terminal boxes.

Auxiliary 1, 2, 3 Output (Optional)

The ASIC/1-8800 allows up to 3 outputs for auxiliary outputs which do not follow any schedule. They can be overridden On or Off, and remain in the last state commanded. The output to be controlled is identified by the Aux 1, 2, 3 Masks which are initially un-assigned.. The functional status of the Aux 1, 2, 3 Outputs is shown by the Auxiliary 1, 2,3 Output Status .

Lighting Output

Each ASIC/1 has the ability to control lighting. The Lighting schedule will automatically turns the lights on and off. By equipping the ASIC/1 with a WS-0XX wall sensor with push button override, the lights can be operated manually by the occupant during Occupied and Morning Warm-up States by pressing the button on the side of the zone sensor without affecting HVAC operation.

During Unoccupied and Night Setback States, depressing the push button will return the control to Occupied, and the lights will come on and stay on for Afterhours Time Allowed. During Emergency 1 and Emergency 2, the push-button has no effect.

If Lights Occupied Enable is yes then the lights are on whenever the Lighting Schedule is On, or the Control State is occupied.

Blink Warning: One minute before automatic shut off of lights as designated in the daily event schedule, or at the end of the afterhours override period, the lights will blink off and back on again. Pressing the afterhours button will re-start the lights.

Alarms

Zone Temperature Alarm

If the Zone temperature is above the Active Cooling Temperature Setpoint by the Zone Temperature Alarm Range, a High Zone Temperature Alarm is set. If the Zone temperature is below the Active Heating Temperature Setpoint by the Zone Temperature Alarm Range, a low Zone Temperature Alarm is set. No other actions are taken in response to a zone temperature alarm.

Primary Airflow Alarm

If the primary airflow is above the Primary Airflow Setpoint by the Airflow Alarm Range, then a High PrimaryAirflow Alarm is set. If the Primary Airflow is below the Primary Airflow Setpoint by the Airflow Alarm Range, then a Low Primary Airflow Alarm is set. No other actions are taken in response to a primary airflow alarm.

Exhaust Airflow Alarm

If the Exhaust airflow is above the Exhaust Airflow Setpoint by the Airflow Alarm Range, then a High Exhaust Airflow Alarm is set. If the Exhaust Airflow is below the Exhaust Airflow Setpoint by the Airflow Alarm Range, then a Low Exhaust Airflow Alarm is set. No other actions are taken in response to a secondary airflow alarm.

Emergency Modes

The emergency modes, Emergency 1, and Emergency 2, are overrides which are received over the communication line and remain in effect until cleared over the communication line.

Emergency 1 Mode

The control may only enter or exit Emergency 1 as a result of commands received on communications line. While in Emergency 1, no other state may be entered until Emergency 1 has been cleared via the communications line. Emergency is maintained through loss of power.

While in Emergency 1 state the controller immediately drives the damper to Maximum Cooling Airflow Setpoint, turns ON the lighting output, and turns OFF any other outputs.

The Exhaust Airflow continues to track the primary airflow.

Emergency 2 Mode

The control can enter and exit Emergency 2 as the result of commands received on the communications line. If in Emergency 2, no other state except Emergency 1 may be entered until Emergency 2 has been cleared via the communications line. Emergency is maintained through loss of power.

While in Emergency 2 state the controller immediately drives the damper closed, turns ON the lighting output and turns OFF any other outputs.

The Exhaust Airflow continues to track the primary airflow.

Communications

The ASIC/1-8800 communicates at 1200 baud, 9600 baud, or 19,200 baud on the remote bus using RS-485 twisted pair communication wire, connected to remote screw terminal connector, TB-4. Access to the ASI communication bus is through a ASIC/2 configurable controller or ASI EtherLink/2 serial router which can also be used to broadcast time to synchronize the network of ASIC/1 controllers.

Communication with the remote bus can also be established through the WS-0XX wall sensor using a SINC/1-1030 Portable Interface connected to a lap-top computer running ASI Expert software.

Each controller has a unique 16 bit address[Default 18800], and may also have a separate 8 bit group address. It will also respond to the global addresses 23125(0x5A55) and 23130 (0x5A5A).

Communication with the ASIC/1-8800 is largely compatible with the ASIC/1-8055 which it replaces. The ASIC/1-8800 may co-exist on the communication line with other ASIC/1 controllers. It is compatible with the ASI LinkOPC Server for seamless communication with Windows based graphic user interfaces.

System Component Checklist

Inputs

Description	Part Number	Quantity
Airflow Filter for AF1 and AF2	AF-001	2
Optional Duct Temperature Sensor (IN-06)	TS-DO-8	0,1
Optional Duct Temperature Sensor (IN-07)	TS-DO-8	0,1
Optional Duct Temperature Sensor (IN-08)	TS-DO-8	0,1
Optional Occupancy Switch (BI-08)		0,1
Wall Mounted Zone Temperature Sensor	WS-0X1	1
Sensor Cable	SCP-0XX	1
Communication Cable twisted pair.	22-24 ga twisted	

Note: The inlet side of the airflow transducer, HIGH, is marked on the ASIC/1-8800 is the same as of the ASIC/1-8055 controller. An airflow filter, AF-001, is required on the inlet side of the airflow transducer.

NOTE: Consult ASIC/1-8800 Installation manual for configuration of inputs.

Outputs

Description	Part Number	Quantity
VAV Controller with 2 airflow sensors	ASIC/1-8800-DD	1
24 Vac Transformer		1
24 Vac Tri-state Primary Damper Operator		1
24 Vac Tri-state Secondary Damper Operator		1
HW Valve with 24 Vac Tri-state Operator		0,1
24 Vac Thermic Valve (Optional)		0,1
24 Vac Electric Heat Relay		0,1,2
24 Vac Auxiliary CLG Output Relay (Optional)		0,1
24 Vac Auxiliary HTG Output Relay(Optional)		0,1
24 Vac Auxiliary Output Relay (Optional)		0,1,2,3
24 Vac Lighting Relay (Optional)		0,1

NOTE: . The ASIC/1-8800 must be connected to a solid building ground. Metallic-oxide Varistors, MOV, may also be used across relay contacts to provide further protection from transients. If current interrupting relays are in series with the output circuits they must be protected with MOVs across the Relay Contacts

Wiring Layout

Volume Tracker with Hot Water or Electric Heat