

ASIC/1-8755 Sequence

Exhaust Volume Control

Exhaust Air Velocity

A separate velocity sensor in the exhaust air duct measures the exhaust air velocity. An exhaust velocity 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 air airflow setpoint in all control modes. Tracker Switch conditions determine which Tracker Positive, Neutral, or Negative Airflow Setpoint is active.

Exhaust Volume

The flow velocity in feet/minute is given by the product of the raw airflow measurement, V_{raw} , (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.

$$\text{Volume (cfm)} = \text{Area} * (\text{Kf}/2338) * 25 * V_{raw}$$

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

Exhaust Airflow Setpoint

The Secondary (Exhaust) Volume Setpoint is maintained as a signed integer between -3200 fpm and + 3175 fpm in increments of 25 fpm at $Kf = 2338$. (-128 raw to +127 raw)

The Secondary (exhaust) airflow setpoint, V_{exh} , is calculated every second using the measured Primary (supply) airflow, V_{supply} , and the Tracking Airflow Setpoint, V_{diff} . The Tracking Airflow Setpoint, V_{diff} , is selected based on the Tracker Switch settings as describe in this manual.

$$V_{exh} = (K_{supply} * \text{Area}_{supply} / K_{fexh} * \text{Area}_{exh}) * (V_{supply} - V_{diff})$$

A Positive Volume Setpoint will control so more air enters the space than is exhausted from the space. The room pressurization is Positive with respect to the reference zone.

A Negative Airflow Setpoint will control so less air enters the space than is exhausted from the space. The room pressurization is Negative with respect to the reference zone. (New FW175A1.1)

If the Primary or Secondary Areas and K-factors are changed, then the Setup Software will calculate and download new Tracking Ratio values. These are the same parameters and serve the same function as the Blend Ratio in dual duct.

The Secondary (exhaust) damper position is modulated by closed loop control to maintain the calculated tracking Secondary (exhaust) Airflow Setpoint.

Table 10, Entry 18, Secondary Airflow Value (25 ft/min).

Table 10, Entry 36, Secondary Airflow SP (25 ft/min).

The Secondary (Exhaust) Airflow Setpoint is in raw units (25 ft/min) and can be displayed in engineering units in the Setup software.

$$\text{Secondary (Exhaust) Airflow Setpoint} = (\text{Kfexh}/2338) * \text{Areaexh} * 25\text{ft/min} * \text{Vexh}$$

Tracker Airflow Setpoints

The ASIC/1-8755 has three differential Tracker Airflow Setpoints, Positive, Neutral, and Negative in units of primary airflow.

TABLE	ENTRY	TAGNAME
2	19	TR_TrackerPosAFSP
2	20	TR_TrackerNegAFSP
3	14	TR_TrackerNeutralAFSP

The Tracker Positive Airflow Setpoint is the same parameter as Blend Total Occupied Airflow Setpoint. It was known as the Tracking Volume Occupied Setpoint in the ASIC/1-8715.

The Tracker Neutral Airflow Setpoint is a new parameter.

Note: A positive value for Positive and Neutral Setpoints will cause the zone to be positive.

The Tracker Negative Airflow Setpoint is the same parameter as Blend Total Unoccupied Airflow Setpoint. It was known as the Tracking Volume Unoccupied Setpoint in the ASIC/1-8715.

A positive value for Negative Setpoint will cause the zone to be negative.(FW175A1.1)

The choice of which Tracker Airflow Setpoint to used depends on the Tracker Switch conditions as described below.

Zone Pressure Control

The Zone Pressure is maintained by cascade control of the exhaust airflow in all control modes. A PI control loop calculates the Tracking Airflow Setpoint, Vdiff, by comparing the measured zone pressure with the active Zone Pressure Setpoint every 30 seconds to compute the required Tracker Airflow Setpoint. The Tracker Switch conditions determine which Zone Pressure Setpoint is active. The differential Exhaust Airflow Setpoint is limited between the Tracker Positive and (minus)Tracker Negative Airflow Setpoint

The Secondary (Exhaust) Airflow Setpoint is calculated in the same manner as the Volume Tracker. The Secondary (Exhaust) Airflow is maintained at the calculated Secondary (Exhaust) Airflow Setpoint in all control modes.

A Door Switch can be used to hold the tracker airflow setpoint at its last value for a Door Wait Time whenever the door is opened. The Tracker Positive, Neutral, or Negative Airflow Setpoints are used if the door has open longer than the Door Wait Time.

Zone Pressure Setpoints

There are three possible Zone Pressure Setpoints, Positive, Negative, and neutral. The setpoints are signed values between -128 and +127 in the same units as the Zone Pressure input.

TABLE	ENTRY	WW_TAGNAME
3	6	TR_ZonePressurePosSP
3	7	TR_ZonePressureNeutralSP
3	8	TR_ZonePressureNegSP
3	9	TR_ZonePressureAlarmRang

The choice of which Zone Pressure Setpoints to used depends on the Tracker Switch conditions as described later in the manual.

Zone Pressure Control

Every 30 seconds the measured Zone Pressure is compared with the Active Zone Pressure Setpoint.

At power reset the Exhaust Volume Differential, Vdiff, is set to the Tracker Neutral Airflow Setpoint. The change in Vdiff is calculated every 30 seconds. Control is direct acting: if the Zone Pressure is greater than the Zone Pressure setpoint, then the exhaust volume differential, Vdiff, must increase.

$$Vdiff (new) = Vdiff (old) + (Pressure K1/Pressure K3)*(Pressure - Pressure SP) + (Pressure K2/Pressure K3)*(Pressure - Pressure(Prev))$$

The value of Vdiff(new) is limited between the Tracker Positive and Negative Airflow Setpoints.

The Zone Pressure K1 term is the Integral term and accumulates so long as there is an error in the Zone Pressure compared to Zone Pressure Setpoint.

- Zone Pressure K1, Integral Coefficient
- Zone Pressure K2, Proportional Coefficient
- Zone Pressure K3, Denominator

TABLE	ENTRY	WW_TAGNAME
3	21	TR_ZonePressureK1
3	22	TR_ZonePressureK2
1	14	TR_ZonePressureK3

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The Zone Pressure K2 term is the Proportional term, and accumulates whenever there is a change in the Zone Pressure.

The Zone Pressure K3 term is the Denominator term, which corresponds to a throttling range..

Exhaust Airflow Setpoint

The tracking exhaust airflow, V_{exh} , is calculated every second using the measured supply airflow, V_{supply} , and the new exhaust volume differential, $V_{diff}(new)$

The tracking exhaust airflow setpoint in units of 25 feet per minute is given by

$$V_{exh} = (K_{fsupply} * A_{reasupply} / K_{fexh} * A_{reaexh}) * (V_{supply} - V_{diff})$$

This is identical to the Volume Tracking control.

The exhaust damper position is modulated by closed loop control to maintain the calculated exhaust volume setpoint.

Door Switch Option

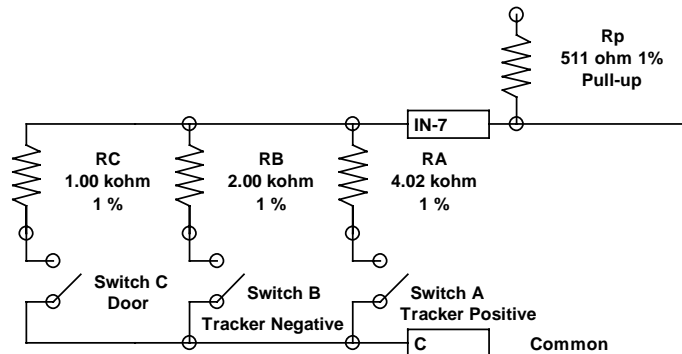
If Door Switch Enable is yes, a dry contact input from a door switch holds the Tracking Airflow Setpoint at its last value while the door is open for a Door Wait Time of up to 255 seconds.

If the door is not closed in a Door Wait Time, a Door Alarm is set, and controller reverts to Volume Tracking using the Active Tracking Positive, Neutral, or Negative Airflow Setpoint. When the door is finally closed the Door Alarm is cleared, and control reverts to Pressure Tracking Control.

If Door Switch Enable is no, the door switch is ignored.

Tracker Switches (IN-7)

Tracker Switches on input 7 are wired on a resistor ladder, MUX-124, identical to the tri-mux multiplex inputs in the ASIC/2 controllers. Input 7 must be configured as Type 8_2, Triple Binary. If the Switch Options are not enabled, then the switch is ignored.



Tracker Setpoints

Two Tracker Switches on input 7 are used to determine which setpoints to use.

TABLE	ENTRY	Type	WW_TAGNAME
6	4	Bit 4	TR_TrackerPosSWEnable
6	4	Bit 5	TR_TrackerNegSWEnable
6	4	Bit 6	TR_TrackerDoorSwEnable
6	5	Bit 0	TR_TrackerORPos
6	5	Bit 1	TR_TrackerORNeg

If Tracker Positive Switch Enable, Table 6,4,Bit4, is set and the input connected Switch A is closed and Switch B is open, then the Tracker Positive Airflow or Zone Pressure Setpoints are used for control.

If Tracker Negative Switch Enable, Table 6, 4,Bit5, is set and the input connected to Switch A is open and Switch B is closed, then the Tracker Negative Airflow or Zone Pressure Setpoints are used for control.

If both Switch A and Switch B are closed or open, the Tracker Neutral Airflow or Zone Pressure Setpoints are used for control.

If both Tracker Positive Switch Enable and Tracker Negative Switch Enable are No, then the unit will control at the Neutral Setpoint unless the tracker is overridden through software.

Switch A Tracker Positive	Switch B Tracker Negative	Volume or Pressure Setpoint
Open or Not Enabled	Open or Not Enabled	Neutral
Closed & Enabled	Open or Not Enabled	Positive
Open or Not Enabled	Closed & Enabled	Negative
Closed & Enabled	Closed & Enabled	Neutral

Tracker Overrides

If both Tracker Positive Switch Enable and Tracker Negative Switch Enable are No, then the tracker mode can be overridden through software. If Tracker Override Positive is set then the tracker is overridden as if the Positive switch were enabled and closed.

If Tracker Override Negative is set then the tracker is overridden as if the Negative switch were enabled and closed.

If either Tracker Positive Switch Enable or Tracker Negative Switch Enable is yes, then the tracker mode can not be overridden through software. Tracker Override Positive and Tracker Override Negative are ignored.

TABLE	ENTRY	Type	WW_TAGNAME
6	5	Bit 0	TR_TrackerORPos
6	5	Bit 1	TR_TrackerORNeg

Door Switch

If Door Switch Enable is Yes, Switch C is used in Zone Pressure tracking to indicate the presence of an open door. Switch C closed and enable indicates the door is closed. Switch C open and enabled indicates the door is open.

TABLE	ENTRY	Type	WW_TAGNAME
6	4	Bit 6	TR_TrackerDoorSwEnable
10	55	Bit 6	TR_DoorOpenStatus
10	55	Bit 7	TR_DoorOpenWarning

If Door Switch Enable is No, the door switch option is ignored and Zone Pressure Tracking will continue to attempt to maintain pressure control even if the door is open.

Tracker Status

The Tracker Negative Mode and Positive Mode indicate which setpoints are being used for control. If both are no, then the tracker uses the Neutral Setpoints.

The Tracker Negative Status and Positive Status indicate which switches have been closed or overridden. If both are yes, or both are no, then the tracker uses the Neutral Setpoints.

TABLE	ENTRY	Type	WW_TAGNAME
10	55	Bit 0	TR_TrackerNegativeMode
10	55	Bit 1	TR_TrackerPositiveMode
10	55	Bit 4	TR_TrackerPosSWStatus
10	55	Bit 5	TR_TrackerNegSWStatus
10	55	Bit 6	TR_DoorOpenStatus

Alarms

Alarm 3 - Secondary (Exhaust) Airflow Alarm

For tracking personalities, the measured Exhaust Airflow is compared with the Exhaust Airflow Setpoint. If they differ by more than the Secondary Airflow Alarm Range(T2,E16) then a high or low Exhaust Airflow Alarm is set.

Alarm 3 - HI, Heating (Exhaust) Airflow too high;

Alarm 3 - LO, Heating (Exhaust) Airflow too low;

When in Exhaust Airflow Alarm, the indicator lights will flash at a 1-second rate to indicate the presence of an alarm.

Alarm 4 - HI, Door Alarm

If the Door Switch Enable is Yes, a dry contact from a door switch holds the exhaust airflow setpoint at its last value while the door is open for an adjustable Door Wait Time of up to 255 seconds.

If the door is open for more than the Door Wait Time the Alarm 4- HI, Door Alarm is set.

When in Door Alarm, the indicator lights will flash at a 1-second rate to indicate the presence of an alarm.

If the Door Switch Enable is No[Default No], the Door Switch is ignored.

Alarm 5 - Zone Pressure Alarm

If the measured Zone Pressure differs from the Active Zone Pressure Setpoint by more than the Zone Pressure Alarm Range (T3, E9) then a high or low Zone Pressure Alarm will be set.

Alarm 5 HI Zone Pressure Alarm (FW175A..)

Alarm 5 LO Zone Pressure Alarm (FW175A..)

When in Zone Pressure Alarm, the indicator lights will flash at a 1-second rate to indicate the presence of an alarm.

If the Zone Pressure Sensor is in Fault for Volume Trackers, then the Zone Pressure Alarm is ignored. (New)

Pressure Alarm Enable enables pressure alarms for Volume Trackers (T6,E4,Bit7)
Pressure Alarms are always enabled for Pressure Trackers

Indicator Lamps

The ASIC/1 has three outputs assigned to indicate Positive, Neutral, or Negative Tracker Setpoint status.. This output is typically used to light indicator lamps (provided by others) mounted in the zone being controlled.

If Tracker Positive Setpoints Enable is true, while using the Positive Tracker Airflow or Zone Pressure Setpoints, the Aux 1 Output is On. Otherwise the output is off unless overridden.

In tracker personalities, while using the Neutral Tracker Airflow or Zone Pressure Setpoints, the Aux 2 Output is On. Otherwise the output is off unless overridden.

If Tracker Negative Setpoints Enable is true, while using the Negative Tracker Airflow or Zone Pressure Setpoints, the Aux 3 Output is On. Otherwise the output is off unless overridden.

TABLE	ENTRY	WW_TAGNAME
3	44	TR_TrackerPosIndMask
3	45	TR_TrackerNeuIndMask
3	46	TR_TrackerNegIndMask

These three outputs are not assigned by the brain dump. To use the indicator lights, then they must be assigned to spare outputs.

Note: If tri-state HW heat or two stages of electric heat are used in tracking, then there are only two spare outputs. The Positive and Neutral Tracker Setpoints should be used with a single Tracker switch and Aux1 and Aux 2 outputs should be assigned for Positive and Neutral Indicators.

Alarm Indication

The Positive, Neutral, or Negative Indicator output is on steady whenever the Tracking controller is within alarm limits. If the tracking controller is in Secondary (Exhaust) Airflow Alarm, Zone Pressure Alarm, or Door Alarm, the indicator output flashes on and off at 1 second intervals to indicate the presence of an alarm. Alarms can be monitored on the communication line and viewed at the host terminal.

System Component Checklist

Generic List of components.

ID	Description	Part Number	Quantity
	Tracking VAV Controller with 2 Airflow Sensors	ASIC/1-8755	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 (Optional)		0,1,2
	24 Vac Tracker Indicator Lamp Output (Optional)		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/1-8055 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

Inputs

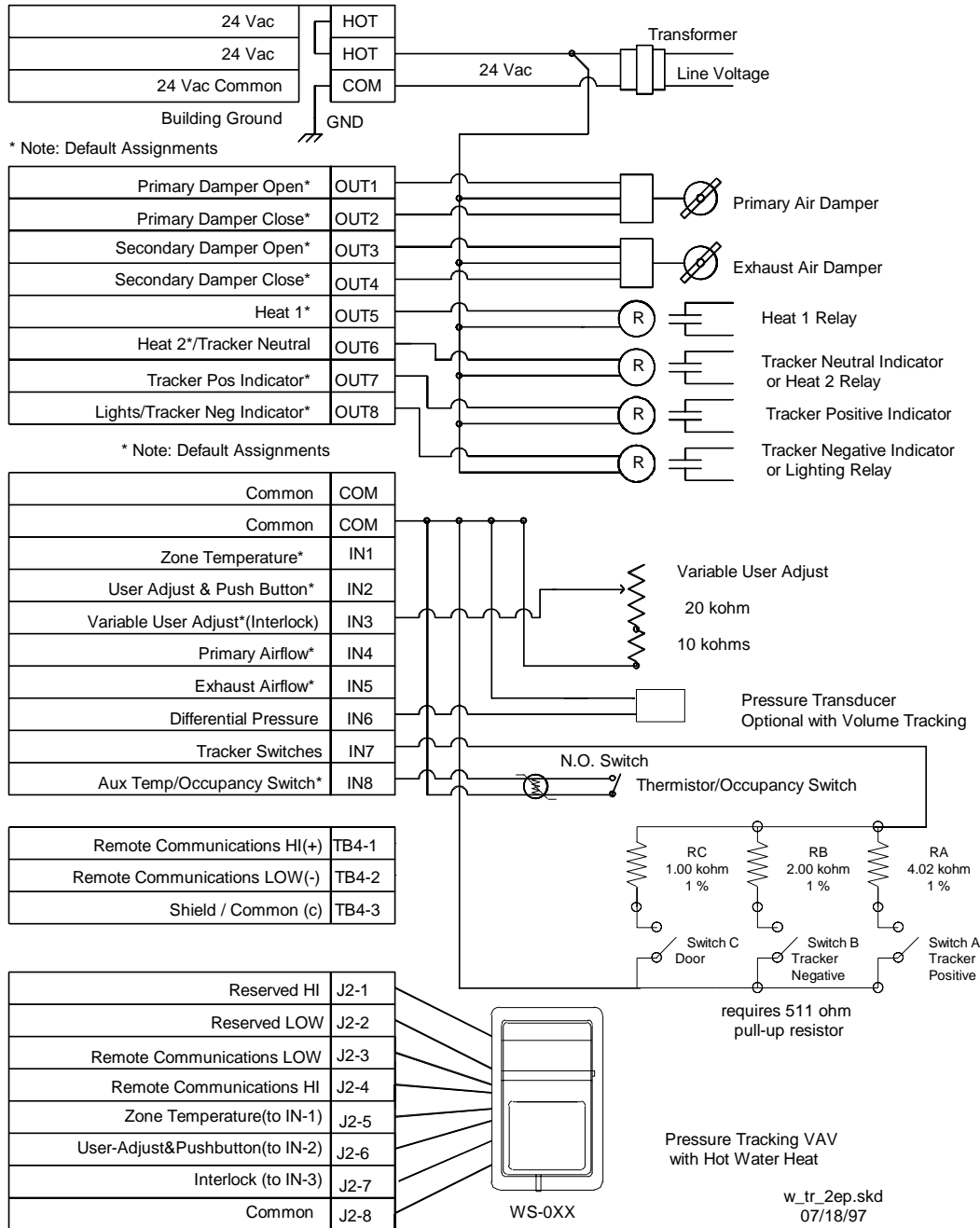
	Pressure Transducer (IN-06) (Optional for Volume Tracking)	PS Series	0,1
	Duct Temperature Sensor (IN-06) (Optional for Volume Tracking)	TS Series	0,1
	Duct Temperature Sensor (IN-07) (Optional)	TS Series	0,1
	Tracker Switches (IN-07) (Optional)	MUX-124	0,1,2,3
	Duct Temperature Sensor (IN-08) (Optional)		0,1
	Occupancy Switch (BI-08) (Optional)	MOT Series	0,1
	Zone Temperature Sensor	WS-0X1	1
	Sensor Cable	SCP-0XX	1
	Communication Cable twisted pair.	22-24 ga twisted	
	ASIC/1-8x55 Enclosure Cover Kit	CE-055	0,1

NOTE: Consult ASIC/1-8X55 Installation manual for configuration of inputs.

Wiring Layout (Electric Heat)

Volume or Pressure Tracker VAV with 2 Stages of Electric Heat, for use with the following personalities:

- A VAV Volume Tracker with cooling only (Personality 21), 1 stage of electric heat (Personality 22), 2 stages of electric heat (Personality 23), or thermic valve (Personality 25). Pressure sensor is optional.
- A VAV Pressure Tracker with cooling only (Personality 26), 1 stage of electric heat (Personality 27), 2 stages of electric heat (Personality 28), or thermic valve of electric heat (Personality 30).



Wiring Layout (Hot Water)

Pressure or Volume Tracker VAV with Hot Water Heat , for use with the following personalities:
 VAV Volume Tracker with Hot Water Heat (Personality 24).

A

Pressure sensor is optional

- o A VAV Pressure Tracker with Hot Water Heat (Personality 29).

