cycle is initiated when the RTRM communicates ignition information to the Ignition module (IGN).

Modulating Gas Heat 2.5:1

Turndown, in a modulating heat unit, when a call for heat is received, the burner will light at full fire (100%). After the burner is lit, the unit controls will monitor the discharge air temperature and modulate the input rate down to match the load.

Ignition Control Module

Two-Stage (IGN) runs self-check (including verification that the gas valve is de-energized). IGN checks the highlimit switches (TC01 and TC02) for normally closed contacts. With power supplied to the ignition module (IGN), the hot surface ignition probe (IP) is Preheated. The gas valve (GV) is energized for a few seconds for trial for ignition, to ignite the burner. Once the burner is ignited, the hot surface ignition probe (IP) is de-energized by the ignition module (IGN) and functions as the flame sensing device. If the burner fails to ignite, the ignition module will attempt two retries before locking out. The green LED will indicate a lockout by two fast flashes. An ignition lockout can be reset by:

1. Opening for 3 seconds and closing the main power disconnect switch.
2. By switching the "Mode" switch on the zone sensor to "OFF" and then to the desired position.
3. Allowing the ignition control module to reset automatically after one hour. Refer to Table 18, p. 44 for the LED diagnostic definitions.

When the fan selection switch is set to the "Auto" position, the RTRM energizes the indoor fan relay (F) coil approximately 30 seconds after initiating the heating cycle to start the indoor fan motor (IDM). The automatic reset high limit (TCO1), located in the bottom right corner of the burner compartment, protects against abnormally high leaving air temperatures. The automatic reset fan fail limit (TCO2), located in the upper middle section of the indoor fan board, protects against abnormally high heat buildup which could occur because of extended cycling of the high limit (TCO1) or if the indoor fan motor (IDM) fails to operate. Should TCO2 open, the RTRM will energize the indoor fan relay (F) in an attempt to start the fan motor. The RTRM signals that a heat failure has occurred by flashing the "Heat" LED on the zone sensor. There is a green LED located in the Ignition Control Module. Table 18, p. 44 lists the diagnostics and the status of the LED during the various operating states.

Ignition Control Module Diagnostics

At any time the control is powered, a green LED indicator light shall be lit using the following signal:

Table 18. Ignition module diagnostics

Steady OFF:	No Power/Failure/Internal Failure
Steady ON:	Normal
Slow Flash Rate:	Normal, call for heat (¾ second on, ¼ second off).
Fast Flash Rate:	Used for error indication only (¼ second off, ¾ second on).
Error Code Fast Flash Rate:	
1 Flash	Communication Issue between Refrigeration Module and 3SH control.
2 Flashes	System Lockout: Failed to detect or sustain flame.
3 Flashes	Not implemented.
4 Flashes	High Limit switch protection device open.
5 Flashes	Flame sensed and gas valve not energized or flame sensed and no call for heat.
6 Flashes	Not implemented.

Note: The pause between groups of fast flashes is approximately two seconds. Additionally, the LED indicator light shall flash for one second at power-up.

Dehumidification

The dehumidification cycle is only permitted above 40 ºF and is not permitted during a heating cycle or during a demand for 2nd stage cooling. Otherwise, when an installed zone humidity sensor indicates a relative humidity equal to or greater than the RH set point as adjusted on the ReliaTel Options Module (RTOM), a dehumidification cycle is initiated.

Notes:

- *Dehumidification takes priority over a call for one stage cooling.*
- *Heating or 2 stage cooling takes priority over dehumidification, and a relative humidity sensor takes priority over a humidistat.*

Dehumidification Coil Purge Cycle (for units with the Dehumidification option)

On multiple circuit units with Dehumidification/Reheat configured, a purge cycle will be active for compressor reliability. The purpose of this function is to properly distribute refrigerant and lubricant throughout the system by temporarily switching to the unused section of the coil for 3 minutes (purge cycle). The function operates as follows:

1. A purge cycle will be initiated after 90 minutes of accumulated compressor run time in only one mode: cooling or dehumidification, without transitioning to the other mode.
2. A purge cycle will consist of transitioning to the mode that hasn't run in 90 minutes of total compressor operation. The cycle will last for a period of 3 minutes.
3. The 90-minute cycle count will be reset anytime there is a normal transition between cooling and dehumidification.

Transitioning from one of these modes to any other mode (off or heat) will not reset the counter.

4. If the purge cycle is a cooling cycle, only the first circuit will be activated. If it is a dehumidification cycle then the normal 2-compressor dehumidification mode cycle will be used.
5. The purge cycle will ignore the Low Ambient Dehumidification lockout feature.
6. A purge cycle takes priority over normal cooling or dehumidification requests, but will discontinue for all high priority lockouts and alarms.

Two-Speed Indoor Fan (Title 24) Control

For units equipped with two-speed indoor fan control, standard unit operation for cooling, heating, and dehumidification will continue and all unit functions will operate normally, except for the control of the indoor fan speed. All units configured with any type of heating or reheat/dehumidification will heat and reheat/dehumidify the supply air and space as normal utilizing full speed indoor fan by energizing the appropriate outputs. The twospeed indoor fan unit will only utilize two speeds during the cooling operation modes described below.

Cooling Operation

For cooling operation, the unit will operate at Low Fan Speed during Fan Only, Economizer Only, and the first stage of compressor unit modes by Default. When the unit receives a call for cooling, if the economizer is enabled, the unit will energize the associated Low Speed output and begin to modulate the OA Damper open above minimum position up to 100% as necessary. By default, the supply fan will remain at low speed for the duration of Economizer-Only cooling. If the OA damper reaches 100% and remains there for a few minutes, the unit will begin to stage up compressors. If the supply fan is on when the first stage compressor is energized, it will remain energized or energize at low speed for the duration of Cool 1. When there is a call for Cool 2, the second compressor is energized and the Supply Fan will switch to High Speed.

Note: *For 3-step cool units the unit will utilize Low Fan Speed during requests for Cool 1 and Cool 2 during cooling operation. High Fan Speed will be used only for Cool 3.*

The unit will stage down compressors for cooling in reverse order that they were staged and the supply fan will follow the unit mode transitions. Once it is determined through normal cooling control that the second compressor is no longer necessary to meet cooling demand, the second compressor will be staged back and the supply fan will switch to Low Speed until the unit stages all cooling off or receives a call for Cool 2 again. Once the Supply Fan is no longer requested ON after a Cooling call is cleared, the Supply Fan will remain energized at Low Speed for 60 seconds as on traditional units.

For units under thermostat control, if the economizer is enabled and is being utilized as the first stage of cooling (Y1 active), if the unit receives a Y2 request, the unit will energize the first compressor and will switch the supply fan to high speed until the Y2 request is cleared.

Economizer Minimum Position Handling for 2-Speed Fan

Due to the low and high speeds of the indoor fan, when the unit is in Fan Only, Cool 1, or Economizer Only and the indoor fan is at low speed, the unit will not be bringing in as much fresh air as normal. By setting a higher minimum damper position this problem could be solved, but that would mean more fresh air than may be desired when the supply fan is at high speed. To overcome these situations, the control will require the setting of two economizer minimum positions to be used when the fan is at low and high speed to compensate for the lower amount of fresh air at lower fan speeds and the potential for more fresh air than desired at higher fan speeds. These minimum positions will be obtained from the Bldg Design Min Position and DCV Min Position pots on the RTEM. The economizer minimum position that will be utilized while the supply fan is at low speed will be set with the DCV Min Position pot with a range of 0-100% and the minimum position that will be utilized while the supply fan is at high speed will be set with the Building Design Min Position pot with a range of 0-50%. If the Building Design Min Position is set to be higher than the DCV Min Position, the setpoints will be capped at the DCV Min Position and the setpoint for the min position at low and high fan speed will be the DCV Min Position.

Demand Controlled Ventilation Operation

Demand Controlled Ventilation for units with 2-Speed Supply Fans will require an additional module (RTVM) for the 2 additional setpoint potentiometers necessary in order to overcome the non-linear characteristics of the airflow through the outside air damper along with the multiple supply fan speeds.

The new Demand Controlled Ventilation scheme will require the user to select 4 OA Damper Minimum Position setpoints in addition to the Design and DCV CO2 Setpoints:

1. Design Min Position @ Low Fan Speed Command (RTVM R130)
2. Design Min Position @ High Fan Speed Command (RTEM Design Min)
3. DCV Min Position @ Low Fan Speed Command (RTVM R41)
4. DCV Min Position @ High Fan Speed Command (RTEM DCV Min)

The speed at which the Supply Fan operates will dictate which Design and DCV Minimum Position setpoint is used in the calculation for the OA Damper Minimum Position Target for Demand Controlled Ventilation. All other functionality for Demand Controlled Ventilation will operate as on traditional units.

Low Ambient Operation on Units with 2Speed Indoor Fan

The indoor fan motor (IDM) will continue to operate at 100% fan speed during this evaporator defrost cycle (EDC) and the compressor and outdoor fan will return to normal operation once

the defrost cycle has terminated and the compressor “Off” time delay has been satisfied.

Heating Operation

Standard unit operation for heating will continue on units equipped with a two-speed indoor fan. During heat mode, all units configured with gas heat, modulating gas heat,or reheat/dehumidification will heat and reheat/dehumidify the supply air and space as normal utilizing full speed indoor fan by energizing the RTRM supply fan output.

Failure and Override Modes

- Supply Fan Proving - If there is a supply fan failure condition all outputs associated with the supply fan output control will be de-energized.
- Ventilation Override Mode - For all VOM modes that require supply fan operation (Purge and Pressurize), the supply fan will operate at high speed.
- All failure modes that require the Supply Fan to operate, the Supply Fan will energize at high speed. For instance if the Frostat switch closes, the Supply Fan will operate at high speed.

Single Zone Variable Air Volume (Single Zone VAV) Control

Note: *Single Zone VAV is designed to be used with a zone sensor. If a unit is configured for single zone VAV operation but is connected to a thermostat, the control will revert to multi-speed (2-speed) indoor fan control.*

For normal Cooling operation, available cooling capacity will be staged or modulated in order to meet the calculated discharge air setpoint between the user selected upper and lower limits. If the current active cooling capacity is controlling the discharge air within the deadband no additional Cooling capacity change will be requested. As the Discharge Air Temperature rises above the deadband the control will request additional capacity as required (additional compressor operation or economizer). As the Discharge Air Temperature falls below the deadband the algorithm will request a reduction in active capacity.

Cooling Operation

If the control determines that there is a need for compressor stages in order to meet the discharge air requirements, once supply fan proving has been made, the unit will begin to stage compressors. As the zone cooling demand continues to increase, if additional capacity is required, the supply fan output will be modulated above minimum speed in order to meet the zone requirements. Note that the supply fan speed will remain at the compressor stage's associated minimum value until the control requires additional capacity to meet the zone demand. As the cooling load in the zone decreases the control will reduce the speed of the fan down to minimum per compressor stage and control the compressor outputs accordingly. As the compressors begin to de-energize, the Supply Fan speed will fall back to the Cooling Stage's associated minimum fan speed but not below. As the load in the zone continues to drop, cooling capacity will be reduced in order to maintain the calculated discharge air setpoint.

Minimum Fan Speeds for Cooling Stages

As the unit begins to stage compressors to meet the cooling demand, the following minimum Supply Fan Speeds will be utilized for each corresponding Cooling Stage. Note that the Supply Fan Speed will be allowed to ramp up beyond the minimum speed in order to meet the zone cooling demand.

2-Stage Cooling Units

The minimum fan speed for units with 2 stages of DX Cooling will be 63% of the unit's full airflow capacity. At Stage 1 of DX Cooling the Fan Speed will be at a minimum of 63% and at Stage 2 of DX Cooling the Fan Speed will be at a minimum of 83%.

3-Stage Cooling Units (High Efficiency Units with Short Orifice)

The minimum fan speed for units with 3 stages of DX Cooling will be 63% of the unit's full airflow capacity. At Stages 1 and 2 of DX Cooling the Fan Speed will be at a minimum of 63% and at Stage 3 of DX Cooling the Fan Speed will be at a minimum of 83%.

Economizer Cooling

During normal Economizer Cooling, the fan speed will operate at its minimum. However, if the economizer is able to meet the demand alone, due to desirable ambient conditions, the supply fan speed will be allowed to increase above the minimum prior to utilizing mechanical cooling.

Note: *Economizer Enable/Disable decisions will be made based on the previous sections; however, the economizer control point will now be variable based on the zone cooling demand.*

Demand Controlled Ventilation

Units configured for SZVAV and Demand Controlled Ventilation (CO_2 sensor value available) require a new control scheme comprised of 2 existing schemes that have been traditionally mutually exclusive; DCV and OA CFM Compensation. Units configured with DCV will invoke the new Demand Controlled Ventilation scheme which allows variable Bldg. Design and DCV Minimum Positions and OA Damper Position Target setpoints based on the supply fan speed and space CO_2 requirements.

Economizer Damper Position Set-Up with DCV

This new scheme will require the setting of 5 OA Damper position setpoints; 3 more than on non-SZ VAV. These new setpoints are located on the RTVM module:

1. Design Min Position @ Minimum Fan Speed Command (RTVM R130)
2. Design Min Position @ Middle Fan Speed Command (RTVM R136)
3. Design Min Position @ Full Fan Speed Command

(RTEM Design Min Position)

4. DCV Min Position @ Minimum Fan Speed Command (RTVM R41)
5. DCV Min position @ Full Fan Speed Command (RTEM DCV Min Position)

As the supply fan speed command varies between minimum and maximum, the Building Design and DCV Minimum Position Targets will be calculated between the user selected setpoints based on the instantaneous supply fan speed. The Bldg. Design and DCV Minimum Position Targets will be used to calculate the Active OA Damper Minimum Position Target, as on traditional units, based on the Space CO_2 relative to the active Design and DCV CO_2 setpoints.

By default, the Design Minimum Position schedule will be a linear line through all user selectable Design Minimum
Position setpoints. The user will have the ability to set the Design Minimum Position at Middle fan speed command to a point that would be lower than the calculated linear line between the Design Minimum Position setpoints at 0% and 100% fan speed command in order to compensate for the non-linear outside airflow through the fan and damper modulation range. However, if the Design Minimum Position at Middle fan speed command is set to a point that would be higher than the calculated linear line between the Design Minimum Position setpoints at Minimum and Full fan speed command, the minimum position will be limited to the point that would make the Design Minimum Position schedule linear.

Provisions have been made in Service Test Mode to allow for proper damper minimum position setup:

1. To set the Design and DCV Minimum Position setpoints at Minimum Fan Speed, set the unit to operate at Step 1 (Fan ON) or Step 2 (Economizer Open) and make the proper adjustments.
2. To set the Design Minimum Position setpoint at Middle Fan Speed, set the unit to operate at Step 3 (Cool 1) and make the proper adjustment.
3. To set the Design and DCV Minimum Position setpoints at Full Fan Speed, set the unit to operate at Step 4 (Cool 2) and make the proper adjustments.

Economizer Damper Position Set-Up without DCV

For units not configured with DCV (no CO_2 sensor value available), additional minimum position setpoints to increase outdoor airflow accuracy will be supported. The operation will be similar to OA CFM Compensation on Traditional VAV units with the addition of a Design
Minimum Position setpoint at Middle Fan Speed Command. The following setpoint potentiometers will be used on the RTEM:

1. Design Min at Minimum Fan Speed Command (RTEM DCV Min)
2. Design Min at Middle Fan Speed Command (RTEM DCV Setpoint LL)
3. Design Min at Full Fan Speed Command (RTEM Design Min)

The controller will calculate the active OA Damper Minimum position between the user-selected setpoints based on the supply fan speed command. By Default, the Design Minimum Position schedule will be a linear line through all user selectable Design Minimum Position setpoints. As with Demand Controlled Ventilation, if the Design Minimum Position at Middle fan speed command is set to a point that would be higher than the calculated linear line between the Design Minimum Position setpoints at Minimum and Maximum fan speed command, the minimum position will be limited to the point that would make the Design Minimum Position schedule linear.

Provisions have been made in Service Test Mode to allow for proper damper minimum position setup:

1. To set the Design Minimum Position setpoint at Minimum Fan Speed, set the unit to operate at Step 1 (Fan ON) or Step 2 (Economizer Open) and make the proper adjustment.
2. To set the Design Minimum Position setpoint at Middle Fan Speed, set the unit to operate at Step 3 (Cool 1) and make the proper adjustment.
3. To set the Design Minimum Position setpoint at Full Fan Speed, set the unit to operate at Step 4 (Cool 2) and make the proper adjustment.

Heating Operation

Heating operation on units configured with Single Zone VAV control will utilize two separate control methodologies based on heating configurations. For all “Staged” Heating types the unit will utilize 100% full airflow during all active heating periods like traditional Constant Volume units. For Modulating Gas heat units, the unit will have the ability to control the discharge air temperature to the calculated discharge air heating setpoint in order to maintain the Zone Temperature to the Zone Heating setpoint.

Staged Heating Operation

For units configured with Staged Heat once the control determines that there is an active heating capacity request, the unit will energize the Supply Fan and ramp up to full speed. The control methodology during Active Heating on units configured with Staged Heat types will be identical to traditional Constant Volume units; heating stages will be energized/de-energized to meet the Zone Heating demand.

Note: *All heat staging sequences will be identical to Constant Volume unit staging sequences.*

Modulating Heat Operation with SZVAV Heating

Units configured with Modulating Gas Heat will utilize true Single Zone VAV control in the same manner as during Active Cooling.

Heating Sequence

Once the unit control determines that there is a space heating demand, the unit will transition into zone heating. Once the Discharge Air Temperature falls below the calculated discharge air temperature setpoint, the unit will initiate the Modulating Heat output request and control the supply fan at minimum speed. At

this point, the Modulating Heat output will be controlled to maintain the discharge air temperature requirements and the supply fan speed will be controlled between 63%-100% to meet the zone heating requirements.

As the heating load in the zone decreases the fan speed will decrease down to minimum (63%) and control the modulating heat output as necessary to meet the discharge air heating requirements. As the load in the zone continues to drop the fan speed will be maintained at this minimum airflow and the modulating heat output will be controlled accordingly.

Low Ambient Operation

The indoor fan motor (IDM) will operate at 100% fan speed during this evaporator defrost cycle (EDC) and the compressor and outdoor fan will return to normal operation once the defrost cycle has terminated and the compressor "Off" time delay has been satisfied.

Dehumidification

Entering Dehumidification

At startup a zone heating or cooling demand will prevent dehumidification operation as on a non-Single Zone VAV unit. At this point the unit will perform normal sensible cooling or heating control until the respective setpoint is satisfied.

After startup, the unit will monitor the unit conditions to determine when to enter and leave dehumidification mode. As long as the unit is not actively heating or actively cooling with more than half the unit design mechanical cooling capacity and it has not been disabled due to the Override limits described below, dehumidification mode will be allowed.

Dehumidification Overrides

Sensible cooling or heating control overrides dehumidification control. Any heating request will terminate dehumidification control. If heating is active at the time a call for dehumidification control is received the heating operation must complete and an additional 5 minutes from the time heat is terminated must elapse before dehumidification will be allowed. Dehumidification will also be disabled if any of the functional disables that apply to CV or traditional VAV have gone active.

Purge Mode (Comfort and Dehumidification)

Purge cycle operation will operate identically to Purge on non-Single Zone VAV Dehumidification units; if the Reheat Circuit operates in one mode (dehumidification or cooling) for a cumulative 60 minutes the unit will initiate a 3-minute Purge cycle with all compressors energized.

During an active Purge Cycle the Supply Fan Speed will operate at the appropriate speed based on the active compressor step. If a dehumidification purge is initiated, the unit will run at 82%, if performing a cooling purge the supply fan will track based on the appropriate minimum speed for the associated number of compressors energized. After the Purge Cycle is complete, the Supply Fan will be released to normal control based on the Cooling/Dehumidification demand.

Dehumidification - Humidistat Operation

A humidistat input located on the options module will be supported as on non-SZ VAV.

Failure and Override Modes

Certain failure and overriding conditions require special handling of the Supply Fan Speed on units configured with Single Zone VAV. See below for a list of these conditions:

- Supply Fan Proving Failure - If a Supply Fan Proving failure is detected, the Supply Fan will be de-energized after 40s of run time and the Fan Speed output will go to 0 Vdc (0%).
- Ventilation Override Mode - If a VOM goes active in which the Supply Fan is commanded ON (Purge, Pressurize, etc.), the Supply Fan will be energized and the Fan Speed output will ramp to 100%.
- Zone Temperature Sensor Failure - If the Active Zone Temperature input goes out of range, the unit will discontinue all Heating, Cooling, and Dehumidification operation.
- Supply Air Temperature Sensor Failure - If the Supply Air Temperature input goes out of range, the unit will revert back to Full Airflow, Traditional CV control. The unit will call out a Supply Air Temperature Sensor Failure Alarm, the RTRM System LED will flash the 2blink error code, and the Zone Sensor Heat (Modulating Heat Only) and Cool LEDs will flash.
- Frostat Failure - If a Frostat failure occurs, all active Heating, Cooling, and Dehumidification will be deenergized immediately and the Supply Fan will ramp up to 100%.
- Heat Failure (High Temp. Limit Trip) - If a unit configured with Gas Heat has a High Temp. Limit trip, the Supply Fan will be requested to remain ON and the Fan Speed output will ramp to full speed.

Variable Air Volume Applications (Traditional VAV)

Supply Air Temperature Control - Occupied Cooling and Heating

The RTRM is designed to maintain a selectable supply air temperature of 40°F to 90°F with a +/- 3.5°F deadband.

Note: *To reduce the risk of coil freezing, it is not recommended to set the supply air temperature below 50°F.*

In cooling, if supply air temperature is more than 3.5 degrees warmer than the selected temperature, a stage of cooling will be turned "On" (if available). Then if the supply air temperature is more than 3.5 degrees cooler than the selected temperature, a stage of cooling will be turned "Off". At very low airflows the unit may cycle stages "On" and "Off" to maintain an average discharge air temperature outside the 7 degree deadband.

If the unit has modulating heat, the unit can be made to do discharge heating with VAV control. This is done by placing a contact closure across the "Changeover Input" on the RTAM. During this mode, the unit will heat to the Supply Air Heating

Setpoint +/- 3.5°F. During low load or low airflow conditions the actual temperature swing of the discharge air will likely be greater.

The RTRM utilizes a proportional and integral control scheme with the integration occurring when the supply air temperature is outside the deadband. As long as the supply air temperature is within the setpoint deadband, the system is considered to be satisfied and no staging up or down will occur.

Supply Air Temperature Control with an Economizer

The economizer is utilized to control the supply air cooling at +1.5°F around the supply air temperature setpoint range of 40°F and 90°F providing the outside air conditions are suitable. While economizing, the mechanical cooling is disabled until the economizer dampers have been fully open for three minutes. If the economizer is disabled due to unsuitable conditions, the mechanical cooling will cycle as though the unit had no economizer.

VHR Relay Output

During unoccupied mode, daytime warm-up (DWU) and morning warm-up (MWU) the VFD will open to 100%. All VAV boxes must be opened through an ICS program or by the VHR wired to the VAV boxes. The RTRM will delay 100% fan operation approximately 6.5 minutes when switching from occupied cooling mode to a heating mode.

Zone Temperature Control without a Night Setback Panel or ICS - Unoccupied Cooling

When a field supplied occupied/unoccupied switching device is connected between RTRM J6-11 and RTRM J6-12, both the economizer and the mechanical cooling will be disabled.

Zone Temperature Control without a Night Setback Panel or ICS - Unoccupied Heating

When a field supplied occupied/unoccupied switching device is connected between RTRM J6-11 and J6-12 and DWU is enabled, the zone temperature will be controlled at 10°F below the Morning Warm-up setpoint, but not less than 50°F, by cycling one or two stages of either gas or electric heat, whichever is applicable.

Morning Warm-up (MWU) Control

Morning Warm-up is activated if the zone temperature is at least 1.5°F below the MWU setpoint whenever the system switches from Unoccupied to Occupied status. The MWU setpoint may be set from the unit mounted potentiometer or a remotely mounted potentiometer. The setpoint ranges are from 50°F to 90°F. When the zone temperature meets or exceeds the MWU setpoint, the unit will switch to the “Cooling” mode. The economizer will be held closed during the morning warm-up cycle.

Daytime Warm-up (DWU) Control

Daytime Warm-up is applicable during occupied status and when the zone temperature is below the initiation temperature. It can be activated or deactivated through ICS or a night setback zone sensor. If ICS or a night setback zone sensor is not utilized, DWU can be activated by setting the DWU enable DIP switch (RTAM) to ON and supplying a valid morning warm-up setpoint. The unit is shipped with a Morning Warm-up setpoint configured and the Daytime Warm-up function is activated (switch on). Opening the DWU enable switch will disable this function. If the system control is local, the DWU initiation setpoint is 3°F below the Morning Warm-up setpoint. The termination setpoint is equal to the Morning Warm-up setpoint. If the system control is remote (Tracer™), the DWU setpoint is equal to the Tracer Occupied heating setpoint. The initiation and termination setpoints are selectable setpoints designated by Tracer. When the zone temperature meets or exceeds the termination setpoint while the unit is in an Occupied, “Auto” Mode or switched to the “Cooling” Mode, the unit will revert to the cooling operation. If an Occupied “Heating” Mode is selected, the unit will only function within the DWU perimeters until the system is switched from the “Heat” Mode or enters an Unoccupied status.

Note: *When a LCI is installed on a VAV unit, the MWU setpoint located on the RTAM board is ignored. The MWU and DWU setpoints come from the higher priority LCI-R DAC.*

Table 19. Variable air volume mode operation

System Mode		Fan “Auto”	Fan “On”
Heat	DWU Active DWU Off	DWU[2] Off[4]	DWU[2] VAV Heating[4]
Cool		VAV Cooling[1]	VAV Cooling[1]
Auto	DWU Active DWU Off	DWU or Cooling[1,2,3,4] VAV Cooling[1]	DWU or Cooling[1,2,3,4] VAV Cooling or Heating[1]
Off		Off[4]	Off[4]

Notes:
1. If Cooling is selected the supply fan will run continuously. If VAV Heating is activated the supply fan will run continuously.
2. If Daytime Warmup is Activated, the supply fan will run continuously.
3. Auto changeover between Cooling and Daytime Warmup depends upon the DWU initiate setpoint.
4. The fan will be Off any time the system selection switch is “Off”.

Supply Duct Static Pressure Control

The supply duct static pressure is measured by a transducer with a 0.25 to 2.125 Vdc proportional output which corresponds to an adjustable supply duct static pressure of 0.3" w.c. to 2.5" w.c. respectively with a deadband adjustment range from 0.2" w.c. to 1.0" w.c. The setpoint is adjustable on the RTAM Static Pressure Setpoint potentiometer or through ICS.

Example:

Supply Duct Static setpoint = 2.0" w.c. (RTAM)

Deadband = 0.2" w.c. (RTAM)

Duct Static Control Range = 1.9" w.c. to 2.1" w.c.

Mechanical Cooling with an Economizer

The economizer is utilized to control the zone temperature when the outside air conditions are suitable. The method used to determine economizer effectiveness, depending on the available data, is described below in descending order of complexity.

Table 20. Economizer effectiveness

Method used to determine economizer effectiveness	Required
Comparative Enthalpy	OAT, OAH, RAT, RAH
Reference Enthalpy	OAT, OAH
Reference Dry Bulb	OAT
Unable to determine effectiveness	OAT data is invalid or unavailable

The most sophisticated method available is always used. Two of the three methods for determining the suitability of the outside air can be selected utilizing the potentiometer on the Economizer Actuator, as described below:

1. Ambient Temperature - controlling the economizing cycle by sensing the outside air dry bulb temperature. Table 21 lists the selectable dry bulb values by potentiometer setting.
2. Reference Enthalpy - controlling the economizer cycle by sensing the outdoor air humidity. Table 21 lists the selectable enthalpy values by potentiometer setting. If the outside air enthalpy value is less than the selected value, the economizer is allowed to operate.

Table 21. Economizer configuration

Selection	Dry Bulb	Enthalpy Value
A	73°F	27 BTU/LB Air
B	70°F	25 BTU/LB Air
C	67°F	23 BTU/LB Air
D	63°F	22 BTU/LB Air
E	55°F	19 BTU/LB Air

3. Comparative Enthalpy - By utilizing a humidity sensor and a temperature sensor in both the return air stream and the outdoor air stream, the economizer will be able to establish which conditions are best suited for maintaining the zone temperature, i.e., indoor conditions or outdoor conditions.

Off Mode

This mode is set at the zone sensor or by ICS. During this status, no heating, ventilation, or mechanical cooling is being performed. When switching the "System" selector to the "Off" mode from any other mode, any diagnostic data and diagnostic indication signal will be retained as long as the system remains in the "Off" status. Switching the "System" selector from the "Off" mode back to any other mode of operation will reset all diagnostics.

Heating Operation

Heating operation on units configured with Traditional Multi-Zone VAV control will utilize two separate control methodologies based on heating configurations. For all "Staged" Heating types, the unit will utilize 100% full airflow during all active heating periods like traditional

Constant Volume units. If the unit has modulating heat, the unit can be made to do discharge heating with VAV control. This is done by placing by placing a contact closure across the "Changeover Input" on the RTAM. During this mode, the unit will heat to the Supply Air Heating Setpoint ± 3.5°F. During low load or low airflow conditions the actual temperature swing of the discharge air will likely be greater.

Zone Temperature - Unoccupied Heating

While a building is in an unoccupied period as designated by a remote panel with night setback or ICS, the necessary heating capacity will be controlled to maintain the zone temperature to within the unoccupied setpoint deadband. For traditional VAV systems, the VFD will operate at 100% during this mode. It will be necessary to drive VAV boxes to their maximum position through ICS programming or the factory provided VHR relay. For Modulating Gas Heat units, Full Airflow is not required but can be enabled by connecting the changeover mode input J5-1 and J5-2 on the RTAM module. For all Staged Heating types, the Supply Fan will be controlled at maximum fan speed during active heating operation as during Occupied periods.

Gas Heat Control

The ignition sequence and timing are provided by a separate heat control module. The RTRM only provides the heating outputs to initiate 1st and 2nd stages and control the combustion blower relay. Both stages of the furnace will start and operate for one minute and then cycle back if only one stage is required. Units with modulating heat capabilities will light on high fire for one minute and then modulate to the appropriate heating rate for the building load present.

Constant Volume or Variable Air Volume Applications (SZVAV or Traditional)

Clogged Filter Option

The unit mounted clogged filter switch monitors the pressure differential across the return air filters. It is mounted in the indoor section and is connected to the RTOM. The clogged filter switch is normally open and will automatically close when the pressure differential across the filters falls below the clogged filter setpoint. The RTOM will generate a SERVICE diagnostic that will be sent to the zone sensor or remote panel when the clogged filter switch has been closed for at least 2 minutes during supply fan operation. The system will continue to operate regardless of the status of the clogged filter switch.

Ventilation Override

Note: *Applying 24 volts to one of the three Ventilation Override Inputs manually activates ventilation override. One input is provided to request the Pressurize Mode, the second input the Purge Mode, and the third input the Exhaust Mode.*

When the Pressurize Mode is selected, activating Ventilation Override will cause the supply fan to run, the economizer to open to 100%, the exhaust fan to turn (remain) off, or the VFD to run at full speed (SZ VAV and Traditional VAV), and the VAV boxes to fully open.

When Purge is selected, activating Ventilation Override will cause the supply fan to run, the economizer to open to 100%, the exhaust fan to run, or the VFD to run at full speed (SZ VAV or Traditional VAV), and the VAV boxes to fully open.

When Exhaust is selected, activating Ventilation Override will cause the supply fan to turn off, the economizer to close to 0%, the exhaust fan to run (exhaust damper at 100% if configured for Statitrac), or the VFD to stop, and the VAV boxes to operate normally.

If more than one mode is requested at the same time, the Pressurize request will have priority followed by Purge. When any Ventilation Override Mode is active, all heating and cooling is turned off. For the case where the unit is required to turn off, the Emergency Stop input is used. The ICS can also initiate any ventilation override mode. Table 22 lists the sequence of events within the system for each ventilation mode. Refer to the unit wiring diagram for contact switching and wiring.

Note: *Fresh air tracking will not work with VOM.*

Table 22. Ventilation override sequence

Affected Function	Mode and Priority		
	Pressurize	**Purge**	**Exhaust[a]**
	1	2	3
Heat/Cool	off	off	off
VFD	full speed	full speed	full speed
Supply Fan	on	on	off
Exhaust Fan	off	on(b)	on
Economizer	open	open	closed
VAV Boxes	forced open	forced open	normal operation

(a)Exhaust mode 3 is not available with the tracking power exhaust option.
(b)For units configured with the Statitrac option, the Exhaust Damper will open during Ventilation Override modes that request the exhaust fan to operate.

Emergency Stop

When this binary input is opened, all outputs are immediately turned off and the system will not be allowed to restart until the binary input is closed for approximately 5 seconds minimum. The shutdown is communicated to Tracer™ if applicable and the Heat and Cool LED outputs (RTRM J6-7 and J6-8) will blink at a nominal rate of 1 blink per second.

Phase Monitor

The Phase Monitor is a 3 phase line monitor module that protects against phase loss, phase reversal and phase unbalance. It is intended to protect compressors from reverse rotation. It has an operating input voltage range of 190-600 VAC, and LED indicators for ON and FAULT. There are no field adjustments and the module will automatically reset from a fault condition.

Low Pressure Control

This input incorporates the low pressure cutout of each refrigeration circuit and can be activated by opening a field supplied contact.

If this circuit is open before a compressor(s) is started, neither compressor in that circuit will be allowed to operate.

Anytime this circuit is opened for 5 continuous seconds, the compressor(s) in that circuit are turned off immediately. The compressor(s) will not be allowed to restart for a minimum of 3 minutes.

If four consecutive open conditions occur during the first three minutes of operation, the compressor(s) in that circuit will be locked out, a diagnostic communicated to Tracer, and a manual reset will be required to restart the compressor(s).

High Pressure Cutout and Temperature Discharge Limit

The high pressure controls and temperature discharge limit are wired in series between the compressor outputs on the RTRM and the compressor contactors. If the high pressure safety or temperature discharge limit opens, the compressor(s) on the affected circuit is locked out. If the compressor output circuit is opened four consecutive times during compressor operation, the RTRM will generate a manual reset lockout.

Lead/Lag Control

Lead/Lag is a selectable input located on the RTRM. The RTRM is configured from the factory with the Lead/Lag control disabled. To activate the Lead/Lag function, simply cut the wire that connects J3-8 to common at the RTRM Lead/Lag input. When it is activated, each time the designated lead compressor(s) is shut off due to the load being satisfied, the lead compressor or refrigeration circuit switches. When the RTRM is powered up, i.e. after a power failure, the control will default to the number one compressor.

Coil Frost Protection

The Frostat™ control monitors the evaporator coil temperature to prevent the evaporator from freezing due to low operating temperatures whenever there is a demand for cooling. When a closed circuit has occurred for 5 seconds minimum, the RTRM turns off all of the cooling outputs. The Supply Fan will be held "On" until the Frostat has been opened for 5 continuous seconds

or for 60 seconds after the last compressor was shut “Off”, whichever is the longest. The compressor shutdown is communicated to Tracer, if applicable. There is no local diagnostic for this condition.

Maintenance

Make sure all personnel are standing clear of the unit before proceeding. The system components will start when the power is applied.

Fan Belt Adjustment—Belt Drive Units

⚠ WARNING

Rotating Components!

The following procedure involves working with rotating components. Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in rotating components cutting and slashing technician which could result in death or serious injury.

The fan belts must be inspected periodically to assure proper unit operation.

Replacement is necessary if the belts appear frayed or worn. Units with dual belts require a matched set of belts to ensure equal belt length.

When removing or installing the new belts, do not stretch them over the sheaves. Loosen the belts using the belt tension adjustment bolts on the motor mounting base.

Once the new belts are installed, using a Browning or Gates tension gauge (or equivalent) illustrated in Figure 37; adjust the belt tension as follows;

1. To determine the appropriate belt deflection;
   a. Measure the center-to-center shaft distance (in inches) between the fan and motor sheaves.
   b. Divide the distance measured in Step 1a by 64; the resulting value represents the amount of belt deflection that corresponds to the proper belt tension.
2. Set the large O-ring on the belt tension gauge at the deflection value determined in Step 1b.
3. Set the small O-ring at zero on the force scale of the gauge plunger.
4. Place the large end of the gauge at the center of the belt span; then depress the gauge plunger until the large O-ring is even with the top of the next belt or even with a straightedge placed across the fan and motor sheaves.

   Refer to Table 23, p. 53.
5. Remove the belt tension gauge. The small O-ring now indicates a number other than zero on the plunger's force scale. This number represents the force (in pounds) required to give the needed deflection.
6. Compare the "force" scale reading (Step 5) with the appropriate "force" value listed in Table 23, p. 53. If the "force" reading is outside the range, readjust the belt tension.

Note: *Actual belt deflection "force" must not exceed the maximum "force" value shown in Table 23, p. 53.*

7. Recheck the belt tension at least twice during the first 2 to 3 days of operation. Belt tension may decrease until the new belts are "run in".

Figure 37. Belt tension gauge

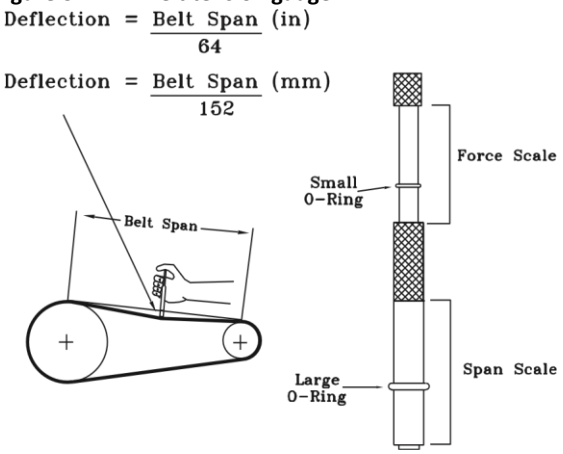

Table 23. Belt tension measurement and deflection ranges

Belts Cross Section	Small P.D Range (in.)	Deflection Force (lb)					
		Super Gripbelts (in.)		Gripnotch (in.)		Steel Cable Gripbelts (in.)	
		Min.	Max.	Min.	Max	Min.	Max.
A	3.0–3.6	3	4 1/2	3 7/8	5 1/2	3 1/4	4
	3.8–4.8	3 1/2	5	4 1/2	6 1/4	3 3/4	4 3/4
	5.0–7.0	4	5 1/2	5	6 7/8	4 1/4	5 1/4
B	3.4–4.2	4	5 1/2	5 3/4	8	4 1/2	5 1/2
	4.4–5.6	5 1/8	7 1/8	6 1/2	9 1/8	5 3/4	7 1/4
	5.8–8.8	6 3/8	8 3/4	7 3/8	10 1/8	7	8 3/4

Belts Cross Section	Small P.D Range (mm)	Deflection Force (kg)					
		Super Gripbelts (mm)		Gripnotch (mm)		Steel Cable Gripbelts (mm)	
		Min.	Max.	Min.	Max.	Min.	Max
A	13.3–16.0	13.3	20.0	17.2	24.5	14.5	17.8
	16.9–21.4	15.6	22.2	20.0	27.8	16.7	21.1
	22.0–31.1	17.8	24.5	22.2	30.6	18.9	23.4
B	15.1–18.7	17.8	24.5	25.6	35.6	20.0	24.5
	19.6–24.9	22.8	31.7	28.9	40.6	25.6	32.3
	25.8–39.1	28.4	38.9	32.8	45.0	31.1	38.9

Monthly Maintenance

Before completing the following checks, turn the unit OFF and lock the main power disconnect switch open.

⚠WARNING

Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

Filters

Inspect the return air filters. Clean or replace them if necessary. Refer to the unit Service Facts for filter information.

Return Air Smoke Detector Maintenance

Airflow through the unit is affected by the amount of dirt and debris accumulated on the indoor coil and filters.

To insure that airflow through the unit is adequate for proper sampling by the return air smoke detector, complete adherence to the maintenance procedures, including recommended intervals between filter changes, and coil cleaning is required.

Periodic checks and maintenance procedures must be performed on the smoke detector to insure that it will function properly.

For detailed instructions concerning these checks and procedures, refer to the appropriate section(s) of the smoke detector Installation and Maintenance Instructions provided with the literature package for this unit.

Condensate Overflow Switch

During maintenance, the switch float (black ring) must be checked to ensure free movement up and down.

Cooling Season

- Check the unit's drain pans and condensate piping to ensure that there are no blockages.
- Inspect the evaporator and condenser coils for dirt, bent fins, etc. If the coils appear dirty, clean them according to the instructions described in "Condenser Coil Cleaning," p. 54.
- Manually rotate the condenser fan(s) to ensure free movement and check motor bearings for wear. Verify that all of the fan mounting hardware is tight.
- Inspect the F/A-R/A damper hinges and pins to ensure that all moving parts are securely mounted. Keep the blades clean as necessary.
- Verify that all damper linkages move freely; lubricate with white grease, if necessary.
- Check supply fan motor bearings; repair or replace the motor as necessary.
- Check the fan shaft bearings for wear. Replace the bearings as necessary.
- Check the supply fan belt. If the belt is frayed or worn, replace it. Refer to "Fan Belt Adjustment—Belt Drive Units," p. 53 for belt replacement and adjustments.
- Verify that all wire terminal connections are tight.
- Remove any corrosion present on the exterior surfaces of the unit and repaint these areas.
- Generally inspect the unit for unusual conditions (e.g., loose access panels, leaking piping connections, etc.).
- Make sure that all retaining screws are reinstalled in the unit access panels once these checks are complete.
- With the unit running, check and record the: ambient temperature; compressor suction and discharge pressures (each circuit); superheat (each circuit); Record this data on an "operator's maintenance log" like the one shown in Table 24, p. 55. If the operating pressures indicate a refrigerant shortage, measure the system superheat. For guidelines, refer to "Compressor Start-Up," p. 38.

Note: *Do NOT release refrigerant to the atmosphere! If adding or removing refrigerant is required, the service technician must comply with all federal, state and local laws.*

Heating Season

- Inspect the unit's air filters. If necessary, clean or replace them.
- Check supply fan motor bearings; repair or replace the motor as necessary.
- Inspect both the main unit control panel and heat section control box for loose electrical components and terminal connections, as well as damaged wire insulation. Make any necessary repairs.

Condenser Coil Cleaning

Regular coil maintenance, including annual cleaning, enhances the unit's operating efficiency by minimizing: compressor head pressure and amperage draw; evaporator water carryover; fan brake horsepower, due to increase static pressure losses; airflow reduction.

At least once each year, or more often if the unit is located in a "dirty" environment, clean the condenser coils using the instructions outlined below. Be sure to follow these instructions as closely as possible to avoid damaging the coils.

Microchannel (MCHE) Coils

NOTICE:

Coil Damage!

DO NOT use any detergents with microchannel coils. Use pressurized water or air ONLY, with pressure no greater than 600psi. Failure to do so could result in coil damage.

For additional information regarding the proper microchannel coil cleaning procedure, refer to RTSVB83-EN.*

Due to the soft material and thin walls of the MCHE coils, the traditional field maintenance method recommended for Round Tube Plate Fin (RTPF) coils does not apply to microchannel coils.

Moreover, chemical cleaners are a risk factor to MCHE due to the material of the coil. The manufacturer does not recommend the use of chemical cleaners to clean microchannel coils. Using chemical cleaners could lead to warranty claims being further evaluated for validity and failure analysis.

The recommended cleaning method for microchannel coils is pressurized water or air with a non-pinpoint nozzle and an ECU of at least 180 with pressure no greater than 600 psi. To minimize the risk of coil damage, approach the cleaning of the coil with the pressure washer aimed perpendicular to the face of the coil during cleaning. Optimum clearance between the sprayer nozzle and the microchannel coil is 1”–3”.

For future reference, you may find it helpful to record the unit data requested below in the blanks provided.

(1) Complete Unit Model Number:

____

(2) Unit Serial Number:

____

(3) Wiring Diagram Numbers (from unit control panel)

— schematic(s)

____

____

— connection(s)

____

____

Table 24. Sample maintenance log

		Refrigerant Circuit #1						Refrigerant Circuit #2					
Date	Current Ambient Temp F/C	Compr. Oil Level	Suct. Press. Psig/kPa	Disch. Press Psig/kPa	Liquid Press Psig/kPa	Super-heat F/C	Sub-cool F/C	Compr. Oil Level	Suct. Press. Psig/kPa	Disch. Press Psig/kPa	Liquid Press Psig/kPa	Super-heat F/C	Sub-cool F/C
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					

Maintenance Final Process –

Troubleshooting

⚠WARNING

Hazardous Service Procedures!

The maintenance and troubleshooting procedures recommended in this section of the manual could result in exposure to electrical, mechanical or other potential safety hazards. Always refer to the safety warnings provided throughout this manual concerning these procedures. Unless specified otherwise, disconnect all electrical power including remote disconnect and discharge all energy storing devices such as capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. When necessary to work with live electrical components, have a qualified licensed electrician or other individual who has been trained in handling live electrical components perform these tasks. Failure to follow all of the recommended safety warnings provided, could result in death or serious injury.

ReliaTel Control

The RTRM has the ability to provide the service personnel with some unit diagnostics and system status information.

Before turning the main power disconnect switch "Off", follow the steps below to check the ReliaTel™ Refrigeration Module (RTRM). All diagnostics and system status information stored in the RTRM will be lost when the main power is turned "Off".

To prevent injury or death from electrocution, it is the responsibility of the technician to recognize this hazard and use extreme care when performing service procedures with the electrical power energized.

1. Verify that the Liteport LED on the RTRM is burning continuously. If the LED is lit, go to Step 3.
2. If the LED is not lit, verify that 24 Vac is presence between J1-1 and J1-2. If 24 Vac is present, proceed to Step 3.

   If 24 Vac is not present, check the unit main power supply, check transformer (TNS1). Proceed to Step 3 if necessary.
3. Utilizing "Method 1" or "Method 2" in the "System Status Checkout Procedure, check the following:

   System status Heating status Cooling status

   If a System failure is indicated, proceed to Step 4. If no failures are indicated, proceed to Step 5.
4. If a System failure is indicated, recheck Step 1 and Step 2. If the LED is not lit in Step 1, and 24 Vac is present in Step 2, the RTRM has failed. Replace the RTRM.
5. If no failures are indicated, use one of the TEST mode procedures described in "Start Up," p. 38 to start the unit. This procedure will allow you to check all of the RTRM outputs, and all of the external controls (relays, contactors, etc.) that the RTRM outputs energize, for each respective mode. Proceed to Step 6.
6. Step the system through all of the available modes, and verify operation of all outputs, controls, and modes. If a problem in operation is noted in any mode, you may leave the system in that mode for up to one hour while troubleshooting. Refer to the sequence of operations for each mode, to assist in verifying proper operation. Make the necessary repairs and proceed to Step 7 and Step 8.
7. If no abnormal operating conditions appear in the test mode, exit the test mode by turning the power "Off" at the main power disconnect switch.
8. Refer to the individual component test procedures if other microelectronic components are suspect.

System Status Checkout Procedure

"System Status" is checked by using one of the following two methods:

Method 1

If the Zone Sensor Module (ZSM) is equipped with a remote panel with LED status indication, you can check the unit within the space. If the ZSM does not have LEDs, use "Method 2," p. 57.

BAYSENS110* and BAYSENS119* have the remote panel indication feature.

The LED descriptions are listed below. •

LED 1 (System)

- "On" during normal operation.
- "Off" if a system failure occurs or the LED fails.
- "Flashing" indicates test mode.

• LED 2 (Heat)

- "On" when the heat cycle is operating.
- "Off" when the heat cycle terminates or the LED fails.
- "Flashing" indicates a heating failure.

• LED 3 (Cool)

- "On" when the cooling cycle is operating.
- "Off" when the cooling cycle terminates or the LED fails.
- "Flashing" indicates a cooling failure.

• LED 4 (Service) – "On" indicates a clogged filter.

- "Off" during normal operation.
- "Flashing" indicates an evaporator fan failure or a Condenser Overflow Switch (COF) failure.

The following is the complete listing of indication causes:

System Failure

Check the voltage between terminals and 9 on J6, it should read approximately 32 Vdc. If no voltage is present, a System failure has occurred. Refer to Step 4 in the previous section for the recommended troubleshooting procedure.

Heating Failure

Verify Heat Failure by Ignition Module (IGN) LED indicator:

OFF: No Power or Failure

ON: Normal Slow Flash: Normal,

Heat Call Fast Flash: Error Code:

1 Flash: Communication Failure

2 Flashes: System Lockout

4 Flashes TC01 or TC02 Open

5 Flashes: Flame w/o Gas Valve

Cooling Failure

1. Cooling and heating set point (slide pot) on the zone sensor has failed. Refer to "Zone Temperature Sensor (ZTS) Test," p. 58.
2. Zone temperature thermistor ZTEMP on ZTS failed. Refer to "Zone Temperature Sensor (ZTS) Test," p. 58.
3. CC1 or CC2 24 Vac control circuit has opened, check CC1 and CC2 coils, and any of the controls below that apply to the unit (HPC1, HPC2).
4. LPC1 has opened during the three-minute minimum "on time" during consecutive compressor starts, check LPC1 or LPC2 by testing voltage between the J1-8 and J3-2 terminals on the RTRM and ground. If Vac is present, the LPCs has not tripped. If no voltage is present, LPCs has tripped.

Service Failure

1. If the supply fan proving switch has closed, the unit will not operate (when connected to RTOM), check the fan motor, belts, and proving switch.
2. If the clogged filter switch has closed, check the filters.

Simultaneous Heat and Cool Failure

- Emergency Stop is activated.

Method 2

The second method for determining system status is done by checking voltage readings at the RTRM (J6). The system

indication descriptions and the approximate voltages are listed below.

System Failure

Measure the voltage between terminals J6-9 and J6-6.

- Normal Operation = approximately 32 Vdc
- System Failure = less than 1 Vdc, approximately 0.75 Vdc
- Test Mode = voltage alternates between 32 Vdc and 0.75 Vdc

Heat Failure

Measure the voltage between terminals J6-7 and J6-6.

- Heat Operating = approximately 32 Vdc
- Heat Off = less than 1 Vdc, approximately 0.75 Vdc
- Heating Failure = voltage alternates between 32 Vdc and 0.75 Vdc

Cool Failure

Measure the voltage between terminals J6-8 and J6-6.

- Cool Operating = approximately 32 Vdc
- Cool Off = less than 1 Vdc, approximately 0.75 Vdc
- Cooling Failure = voltage alternates between 32 Vdc and 0.75 Vdc

Service Failure

Measure the voltage between terminals J6-10 and J6-6.

- Clogged Filter = Approximately 32 Vdc.
- Normal = Less than 1 Vdc, approximately 0.75 Vdc
- Fan Failure = voltage alternates between 32 Vdc and 0.75 Vdc.

Note: *If the Condensate Overflow Switch is closed, the unit will not operate. Check to make sure the float position is not in a tripped condition and verify an "open" between wires connecting to RTOM J6-1, J6-2.*

To use LEDs for quick status information at the unit, purchase a BAYSENS110* ZSM and connect wires with alligator clamps to terminals 6 through 10. Connect each respective terminal wire (6 through 10) from the Zone Sensor to the unit J6 terminals 6 through 10.

Note: *If the system is equipped with a programmable zone sensor, (BAYSENS119*), the LED indicators will not function while the BAYSENS110* is connected.*

Resetting Cooling and Heating Lockouts

Cooling Failures and Heating Lockouts are reset in an identical manner.

"Method 1," p. 58 explains resetting the system from the space; "Method 2," p. 58 explains resetting the system at the unit.

Note: *Before resetting Cooling Failures and Heating Lockouts check the Failure Status Diagnostics by the methods previously explained. Diagnostics will be lost when the power to the unit is disconnected.*

Method 1

To reset the system from the space, turn the "Mode" selection switch at the zone sensor to the "Off" position. After approximately 30 seconds, turn the "Mode" selection switch to the desired mode, i.e. Heat, Cool or Auto.

Method 2

To reset the system at the unit, cycle the unit power by turning the disconnect switch "Off" and then "On".

Lockouts can be cleared through the building management system. Refer to the building management system instructions for more information.

Zone Temperature Sensor (ZTS) Service Indicator

The ZSM SERVICE LED is a generic indicator, that will signal the closing of a Normally Open switch at any time, providing the Indoor Motor (IDM) is operating.

This indicator is usually used to indicate a clogged filter, or an air side fan failure.

The RTRM will ignore the closing of this Normally Open switch for 2 (±1) minutes. This helps prevent nuisance SERVICE LED indications. The exception is the LED will flash 40 seconds after the fan is turned "On" if the Fan Proving Switch is not made.

Clogged Filter Switch

This LED will remain lit the entire time that the Normally Open switch is closed. The LED will be turned off immediately after resetting the switch (to the Normally Open position), or any time that the IDM is turned "Off".

If the switch remains closed, and the IDM is turned "On", the SERVICE LED will be turned "On" again after the 2 (±1) minute ignore delay.

This LED being turned "On", will have no other affect on unit operation. It is an indicator only.

Fan Failure Switch

When the "Fan Failure" switch is wired to the RTOM, the LED will remain flashing the entire time the fan proving switch is closed, indicating a fan failure, and it will shut the unit operations down.

Condensate Overflow Switch

When the condensate overflow switch is closed, a drain pan overflow condition is indicated and it will shut unit operations down.

Zone Temperature Sensor (ZTS) Test

Note: *These procedures are not for programmable or digital models and are conducted with the Zone Sensor Module electrically removed from the system.*

Test 1

Zone Temperature Thermistor (ZTEMP)

This component is tested by measuring the resistance between terminals 1 and 2 on the Zone Temperature Sensor. Below are some typical indoor temperatures, and corresponding resistive values.

Table 25. Temps and resistance values

Zone Temperature		Nominal ZTEMP Resistance (K-Ohms)	Nominal CSP or HSP Resistance (Ohms)
(°F)	(°C)		
50	10.0	19.9	889
55	12.8	17.47	812
60	15.6	15.3	695
65	18.3	13.49	597
70	21.1	11.9	500
75	23.9	10.50	403
80	26.7	9.3	305
85	29.4	8.25	208
90	32.2	7.3	110

Test 2

Cooling Set Point (CSP) and Heating Set Point (HSP) The resistance of these potentiometers are measured between the following ZSM terminals. Refer to Table 25 for approximate resistances at the given setpoints.

Cool SP = Terminals 2 and 3

Range = 100 to 900 Ohms approximate

Heat SP = Terminals 2 and 5

Range = 100 to 900 Ohms approximate

Test 3

System Mode and Fan Selection

The combined resistance of the Mode selection switch and the Fan selection switch can be measured between terminals 2 and 4 on the Zone Sensor. The possible switch combinations are listed Table 27, p. 59 with their corresponding resistance values.

Test 4

LED Indicator Test, (SYS ON, HEAT, COOL & SERVICE) Method 1

Testing the LED using a meter with diode test function. Test both forward and reverse bias. Forward bias should measure a voltage drop of 1.5 to 2.5 volts, depending on your meter. Reverse bias will show an Over Load, or open circuit indication if LED is functional.

Method 2

Testing the LED with an analog Ohmmeter. Connect Ohmmeter across LED in one direction, then reverse the leads for the opposite direction. The LED should have at least 100 times more resistance in reverse direction, as compared with the forward direction. If high resistance in both directions, LED is open. If low in both directions, LED is shorted.

Method 3

To test LEDs with ZSM connected to unit, test voltages at LED terminals on ZSM. A measurement of 32 Vdc, across an unlit LED, means the LED has failed.

Table 26. Default operation for mechanical ZSM (CV only)

J6 Input/Connection	If no input/connection this happens
J6-7[a] - Heat indication	LED will not come on while heating LED will not flash during heat fail
J6-8[a] - Cool indication	LED will not come on while cooling LED will not flash during cool fail[a]
J6-9[a] - System indication (sys on)	LED will not come on while unit has power
J6-10[a] - Service indication	LED will not come on when CFS or FFS trips

(a)these connections are only on certain model ZSMs

Note: *Measurements should be made from LED common (ZSM terminal 6 to respective LED terminal). Refer to Table 26, p. 59.*

Table 27. System mode and fan selection

Resistance Valves (K-Ohms)	Zone Sensor Unit/Fan Mode	Local Unit Mode	Local Fan Mode
2.32	Off/Auto	Off	Auto
4.87	Cool/Auto	Cool	Auto
7.68	Auto/Auto	Auto	Auto
10.77	Off/On	Off	On
13.32	Cool/On	Cool	On
16.13	Auto/On	Auto	On

Table 27. System mode and fan selection

19.48	Heat/Auto	Heat	Auto
27.93	Heat/On	Heat	On
35.0	Emergency Heat/Auto	Emergency Heat	Auto
43.45	Emergency Heat/On	Emergency Heat	On
Out of Range (Short)	INVALID/Short	Invalid (CV), Auto (VAV)	Invalid
Out of Range (Open)	INVALID/Open	Invalid (CV), Off (VAV)	Invalid

Programmable and Digital Zone Sensor Test

Testing Serial Communication Voltage

1. Verify 24 Vac is present between terminals J6-14 and J6-11.
2. Disconnect wires from J6-11 and J6-12. Measure the voltage between J6-11 and J6-12, should be about 32 Vdc.
3. Reconnect wires to terminals J6-11 and J6-12. Measure voltage again between J6-11 and J6-12, voltage should flash high and low every 0.5 seconds. The voltage on the low end will measure about 19 Vdc, while the voltage on the high end will measure from approximately 24 to 38 Vdc.
4. Verify all modes of operation, by running the unit through all of the steps in the "Test Modes" section discussed in "Start Up," p. 38".
5. After verifying proper unit operation, exit the test mode. Turn the fan on continuously at the ZSM, by pressing the button with the fan symbol. If the fan comes on and runs continuously, the ZSM is good. If you are not able to turn the fan on, the ZSM is defective.

ReliaTel Refrigeration Module (RTRM) Default Chart

If the RTCI loses input from the building management system, the RTRM will control in the default mode after approximately 15 minutes. If the RTRM loses the Heating and Cooling setpoint input, the RTRM will control in the default mode instantaneously.

The temperature sensing thermistor in the Zone Sensor Module is the only component required for the "Default Mode" to operate.

Unit Operation Without a Zone Sensor

This procedure is for temporary operation only. The economizer and condenser fan cycling functions are disabled.

Troubleshooting

⚠WARNING

Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

1. Open and Lock the unit disconnect switch.
2. Remove the Outside Air Sensor (OAS) from the condenser section of unit.
3. Use two (2) wire nuts, to individually cap the wires.
4. Locate the RTRM (J6). Connect two (2) wires to terminals J6-1 and 2.
5. Connect the sensor (OAS) using two wire nuts to the two (2) field supplied wires that were connected to terminals 1 and 2 on J6.

Unit Economizer Control (ECA) Troubleshooting ReliaTel Control

Verify Economizer Status by Economizer Actuator (ECA) LED indicator:

- OFF: No Power or Failure
- ON: Normal, OK to Economize
- Slow Flash: Normal, Not OK to Economize
- Fast Flash - 1/4 Second On / 2 Seconds Off:
  - Error Code: Communications Failure
- Pulse Flash: 1/30 Second On / 1/4 Second Off: (2 Seconds between pulse sequences) **Error Code:**
- 1 Flash: Actuator Fault
- 2 Flashes: CO_2 Sensor
- 3 Flashes: RA Humidity Sensor
- 4 Flashes: RA Temp Sensor
- 5 Flashes: OA Quality Sensor
- 6 Flashes: OA Humidity Sensor
- 7 Flashes: OA Temp Sensor
- 8 Flashes: MA Temp Sensor
- 9 Flashes: RAM Fault
- 10 Flashes: ROM Fault
- 11 Flashes: EEPROM Fault

Wiring Diagrams

Note: *Wiring diagrams can be accessed via e-Library by entering the diagram number in the literature order number search field or by contacting technical support.*

Table 28. Wiring diagrams

Schematic Type	Voltage	Diagram Number	Description
Power	200-575	1213-2099	YS/H*150-300 50/60HZ, 2 Stage Gas Heat
		1213-2100	YS/H*150-300 50/60HZ, Modulating Gas Heat
Controls		1213-2119	YS/H*150-300 50/60HZ, 2 Stage Gas Heat or Modulating Gas Heat, with or without Dehumidification
Modules		1213-1015	YS/H*150-300 Gas Heat
Component layout		1213-2242	YS/H*150-300 Gas Heat

Table 29. Wiring diagrams for units with High Short Circuit Rating (SCCR)

Schematic Type	Voltage	Diagram Number	Description
Power	200-575	1213-2122	YS/H*150-300 50/60HZ, 2 Stage Gas Heat
		1213-2123	YS/H*150-300 50/60HZ, Modulating Gas Heat
Controls		1213-2127	YS/H*150-300 50/60HZ, 2 Stage Gas Heat or Modulating Gas Heat, with or without Dehumidification
Modules		1213-1015	YS/H*150-300 Gas Heat
Component layout		1213-2243	YS/H*150-300 Gas Heat

Warranty

YS*YH* (Parts Only)

Models Less than 20 Tons for Commercial Use*

This warranty is extended by Trane, to the original purchaser and to any succeeding owner of the real property to which the Air Conditioner is originally affixed, and applies to products purchased and retained for use within the U.S.A. and Canada. There is no warranty against corrosion, erosion or deterioration. If any part of your air conditioner fails because of a manufacturing defect within one year from the date of the original purchase, Warrantor will furnish without charge the required replacement part.

If the heat exchanger fails because of a manufacturing defect within five years from the date of start-up, Warrantor will furnish without charge a replacement heat exchanger.

In addition, if the optional, factory installed, stainless steel heat exchanger fails because of a manufacturing defect within ten years from the date of start-up, Warrantor will furnish without charge a replacement heat exchanger. Any local transportation, related service labor and diagnosis calls are not included.

In addition, if the sealed motor-compressor fails because of a manufacturing defect within the second through fifth year from the date of original purchase, Warrantor will furnish without charge the required replacement compressor.

Warrantor's obligations and liabilities under this warranty are limited to furnishing F.O.B. Warrantor factory or warehouse replacement parts for Warrantor's products covered under this warranty.

Warrantor shall not be obligated to pay for the cost of lost refrigerant.

No liability shall attach to Warrantor until products have been paid for and then liability shall be limited solely to the purchase price of the equipment under warranty shown to be defective.

THE WARRANTY AND LIABILITY SET FORTH HEREIN ARE IN LIEU OF ALL OTHER WARRANTIES AND LIABILITIES, WHETHER IN CONTRACT OR IN NEGLIGENCE, EXPRESS OR IMPLIED, IN LAW OR IN FACT, INCLUDING BUT NOT SPECIFICALLY LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR USE, AND IN NO EVENT SHALL WARRANTOR BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.

Some states do not allow limitations on how long an implied warranty lasts or do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Trane

2701 Wilma Rudolph Blvd.

Clarksville, TN 37040-1008

Attention: Manager, Product Service
GW-602-4800

Models 20 Tons and Greater for Commercial Use*

The Company warrants for a period of 12 months from initial start-up or 18 months from date of shipment, whichever is less, that the Company products covered by this order (1) are free from defects in material and workmanship and (2) have the capacities and ratings set forth in the Company's catalogs and bulletins, provided that no warranty is made against corrosion, erosion or deterioration.

In addition, if the sealed motor-compressor fails because of a manufacturing defect within the second through fifth year from the date of original purchase, Warrantor will furnish without charge the required replacement compressor.

Finally, if the optional, factory installed, stainless steel heat exchanger fails because of a manufacturing defect within ten years from the date of start-up, Warrantor will furnish without charge a replacement heat exchanger. Any local transportation, related service labor and diagnosis calls are not included.

The Company's obligations and liabilities under this warranty are limited to furnishing f.o.b. factory or warehouse at Company designated shipping point, freight allowed to Buyer's city (or port of export for shipment outside the conterminous United States) replacement equipment (or at the option of the Company parts therefore) for all Company products not conforming to this warranty and which have been returned to the manufacturer.

The Company shall not be obligated to pay for the cost of lost refrigerant.

No liability whatsoever shall attach to the Company until said products have been paid for and then said liability shall be limited to the purchase price of the equipment shown to be defective.

The Company makes certain further warranty protection available on an optional extra-cost basis. Any further warranty must be in writing, signed by an officer of the Company.

The warranty and liability set forth herein are in lieu of all other warranties and liabilities, whether in contract or in negligence, express or implied, in law or in fact, including implied warranties of merchantability and fitness for particular use.

In no event shall the Company be liable for any incidental or consequential damages. Trane

2701 Wilma Rudolph Blvd.

Clarksville, TN 37040-1008

Attention: Manager, Product Service

* This warranty is for commercial usage of said equipment and not applicable when the equipment is used for a residential application. Commercial use is any application where the end purchaser uses the product for other than personal, family or household purposes.

*A 5 year limited warranty is provided for the optional Low Leak Economizer, when combined with the optional FDD (Fault Detection & Diagnostics) option.

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