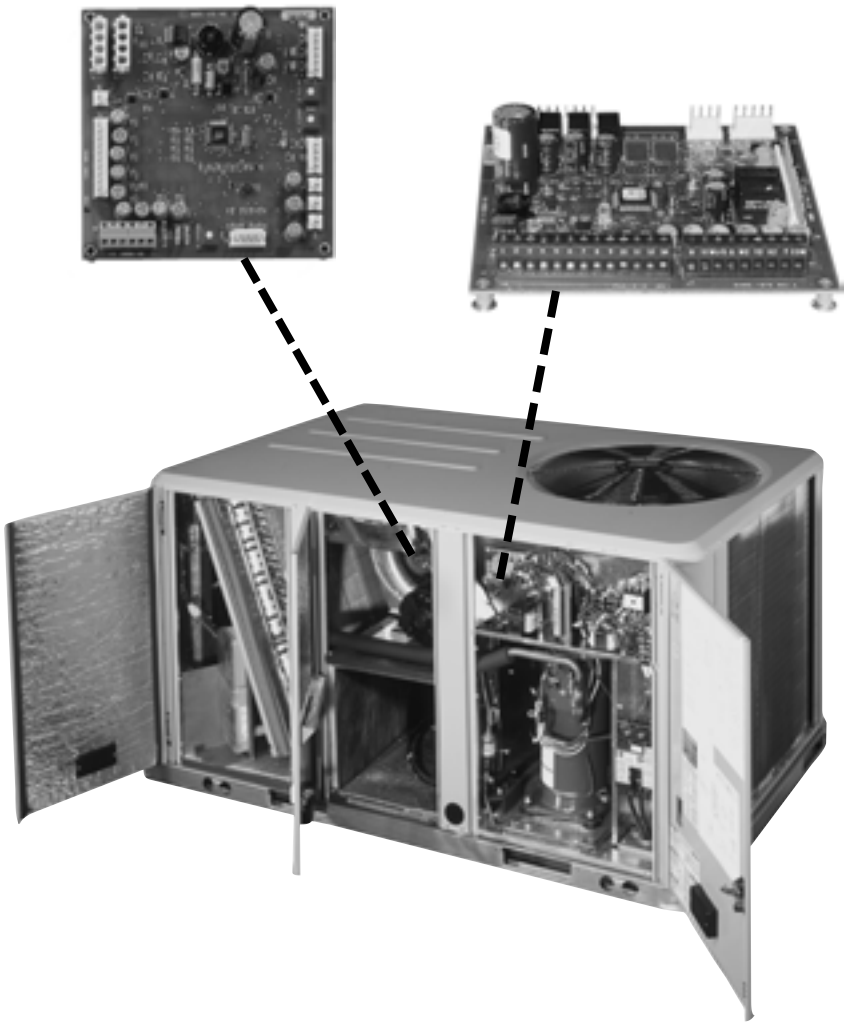
# ReliaTel™ Microprocessor Controls



September 2005 RT-SVD03D-EN

# Introduction

## 3 to 10 ton Convertible and 12½ to 50 ton Dedicated Packaged Rooftops

3 to 10 ton cooling only and gas electric convertible packaged units can be built with either electromechanical or ReliaTel™ controls. 12½ to 50 ton units are built with ReliaTel controls only. All Heat pumps are built exclusively with ReliaTel controls. This publication covers both electromechanical and ReliaTel controls. Due to the more complex application and service opportunities, greater emphasis is placed on units with ReliaTel controls.

This publication does not cover all aspects of service. It assumes that the service person is an experienced commercial service technician with a strong background in electrical controls and DC circuits. If you are not experienced and fully qualified in HVAC service, do not attempt to use this manual to service equipment. Doing so could cause personal injury to yourself or others and could result in expensive equipment or property damage.

## ReliaTel Introduction

ReliaTel is not the name of a circuit board, but rather an overall communicating control system consisting of up to five communicating modules. The next section covers various aspects of ReliaTel and Electromechanical controls.

ReliaTel is the name given to the second generation microprocessor controls developed by Trane/American Standard. ReliaTel controls were first used in the 3-10 ton convertible packaged cooling with electric heat, gas electric, and heat pumps. ReliaTel has now been added to other commercial products as well. In April 2003, 12½-25 ton dedicated units were converted to ReliaTel controls. In April 2004, ReliaTel controls were added to 27½ to 50 ton dedicated units

**Why change?**

The Micro has proven itself to our customers in thousands of applications around the world. A microprocessor based unit provides superior comfort, unmatched reliability and much greater flexibility than conventional systems. ReliaTel has even more flexibility, is more compact, has additional system reliability enhancements and more.

Much of what ReliaTel does will be very familiar to service technicians accustomed to the previous generation Micro. Testing and troubleshooting is similar, and in many cases the same. There are, however, some significant differences, so it is important that the service person use the correct material for the unit being serviced.

# Contents

# Contents, continued

# General Information

## ReliaTel vs. Electromechanical

Three to ten ton convertible packaged gas/electric (YSC, YHC) and cooling only (TSC, THC) are available without microprocessor controls.[1] With electromechanical controls, zone sensors cannot control the units, nor can building automation systems communicate with it. Electromechanical units require the use of a thermostat or relay based control system to directly control relays, contactors, etc. The ignition control and economizer are different than the ones used with ReliaTel. Service information for these components are handled separately in this book.

1. ReliaTel Controls: 9th digit "R"
Electromechanical Controls: 9th digit "E"

***27.5-50 Ton: ReliaTel controls 10th digit "M" or greater.***

## ReliaTel – Module Descriptions

*Each ReliaTel Module is a communicating control.*

**ReliaTel Refrigeration Module (RTRM)**
Every ReliaTel unit uses an RTRM. The RTRM provides primary unit control for heating and cooling. In addition, it has built-in logic that controls heating and cooling staging, minimum run times, diagnostics, heat pump defrost control, short cycle timing and more. It can be controlled directly by any of the following:

Zone Sensor Module (BAYSENS006-11B, AYSTAT661-664B)

Programmable Zone Sensor (BAYSENS019*, 20*, AYSTAT666*)

Conventional Thermostat (such as BAYSTAT036-038A, ASYSTAT701-703)

***Note: Unlike the previous Micro, a conventional thermostat does not require any sort of interface. It can be wired directly to the RTRM.***

In addition, the unit can be controlled using Trane® ICS systems by applying the appropriate interface. The RTRM is configured through the unit wiring harness. The same module is used on gas/electric, cooling only with electric heat, and heat pumps. The following additional inputs are connected to the RTRM:
Outdoor Air Sensor (OAS)
Coil Temperature Sensor (CTS) heat pump only
*Smoke detector (*unless it is factory installed*) or other shutdown device.*

**(See (RTOM) outlines on the following pages)**

The RTOM gets power from and communicates with the RTRM.

Any of these optional ReliaTel devices require the use of an RTOM:

- Frostat (FOS)
- Clogged Filter Switch (CFS)
- Fan Failure Switch (FFS)
- Discharge Air Sensor (DAS) used for supply air tempering and ICS input data
- Smoke Detector, Factory Installed

***Note: A factory installed Smoke Detector provides instant shutdown and ICS alarm output.***

***(27.5-50 Ton) Note: RTOM is standard.***

**(See (ECA) outlines on the following pages)**

**Economizer Actuator w/ Module (ECA)**
The economizer can be used with or without the Options module. The actuator has a detachable communicating module, which can be replaced separately. The outdoor air sensor, connected to the RTRM, provides outdoor temperature information for the changeover decision.

The ECA accepts the following inputs:

Mixed Air Sensor (MAS)

Return Air Sensor (RAS) for comparative enthalpy or ICS input data

Outdoor Humidity Sensor (OHS) for reference or comparative enthalpy

Return Air Humidity Sensor (RHS) for comparative enthalpy

$CO_2$ Sensor 0-10VDC input

Remote Minimum Potentiometer (RMP)

The Power Exhaust relay is connected to the ECA module as well.

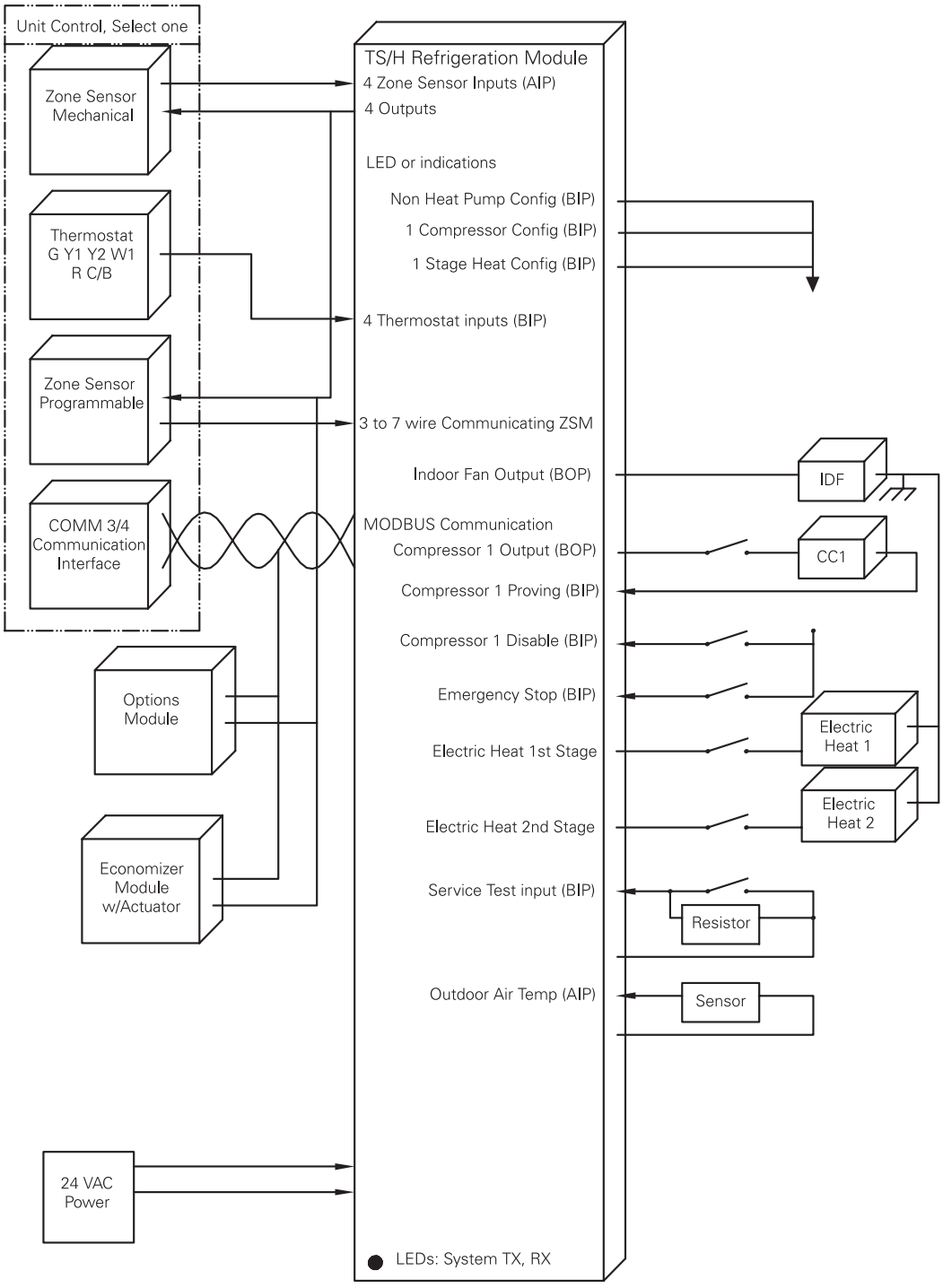
**(See (COMM3/4) outlines on the following pages)**

**COMM3/4 Communication Interface**
Allows ICS communication between a ReliaTel unit and Trane ICS systems as follows:
Tracer™ 100 series
Tracer™ Summit
Tracker™
ComforTrac™
VariTrac™ 1 (Comfort Manager)
VariTrac 2 (Central Control Panel)

**LonTalk® Communication Interface**
Allows ICS communication between a ReliaTel unit and LonTalk Communication Interface (LCI).

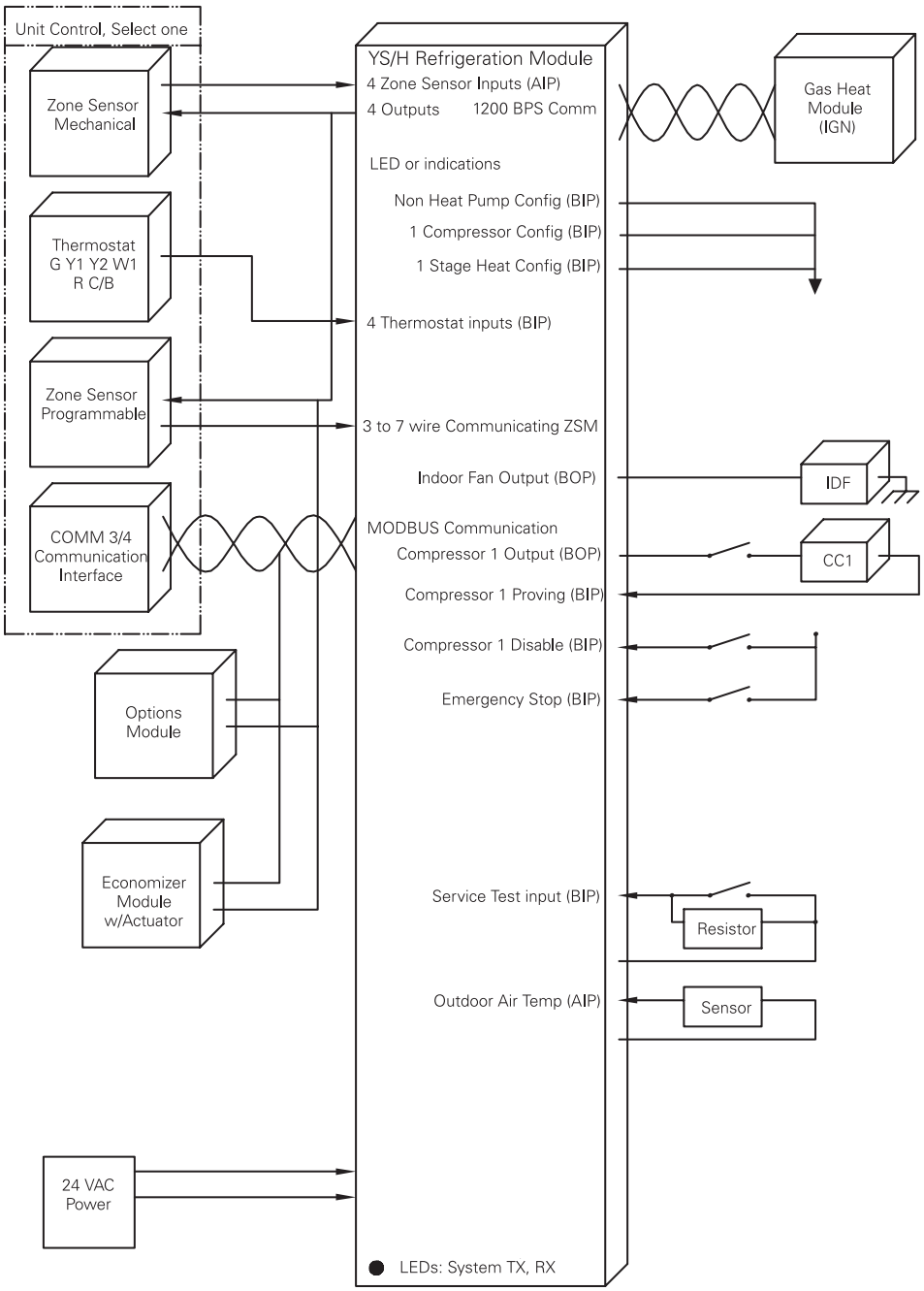
# Refrigeration Module Flow Diagram (RTRM)

## TSC/THC Refrigeration Module (RTRM) Electric Heat/No Heat



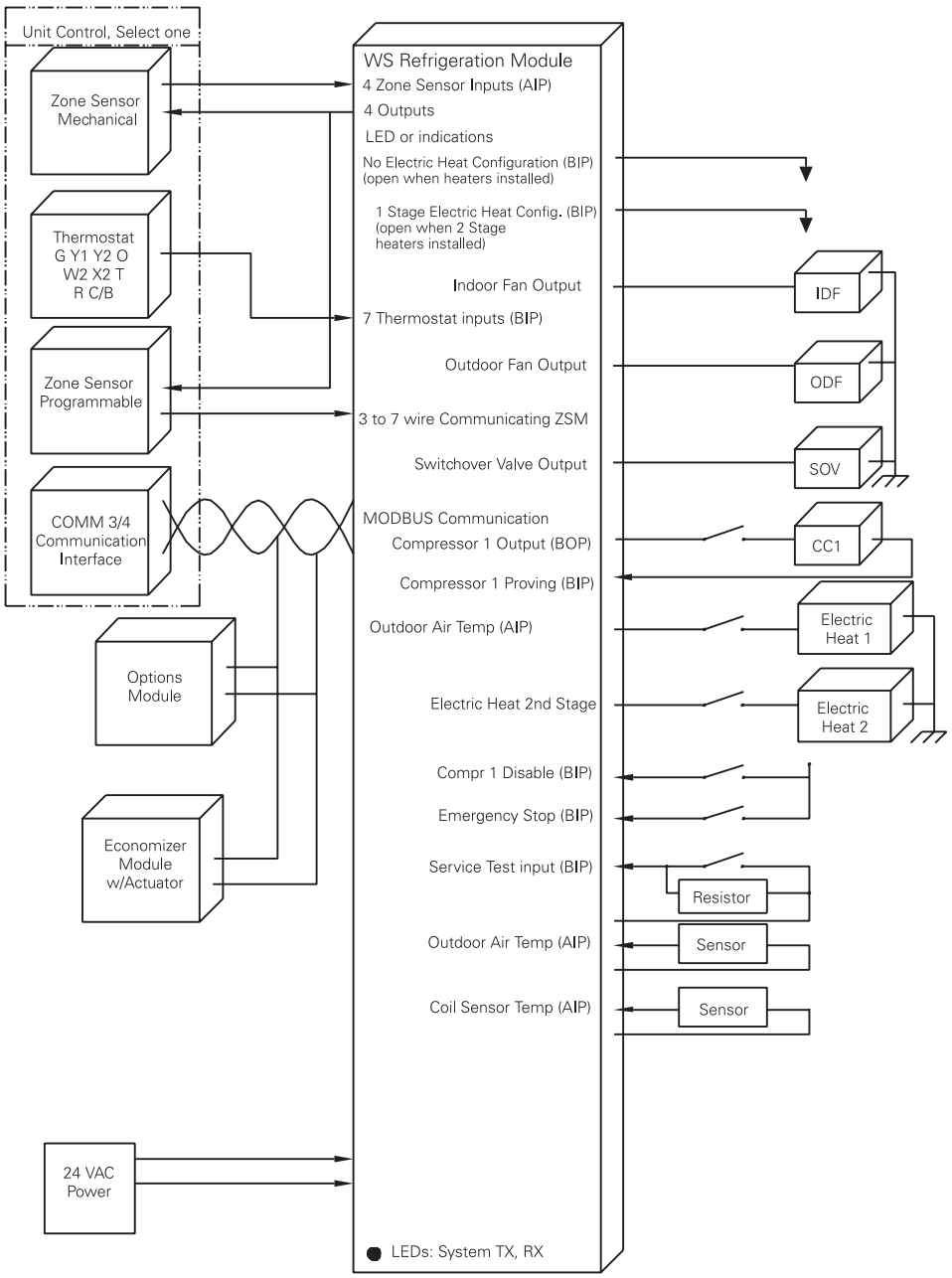
# Refrigeration Module Flow Diagram (RTRM)

## YSC/YHC Refrigeration Module (RTRM) Gas Heating



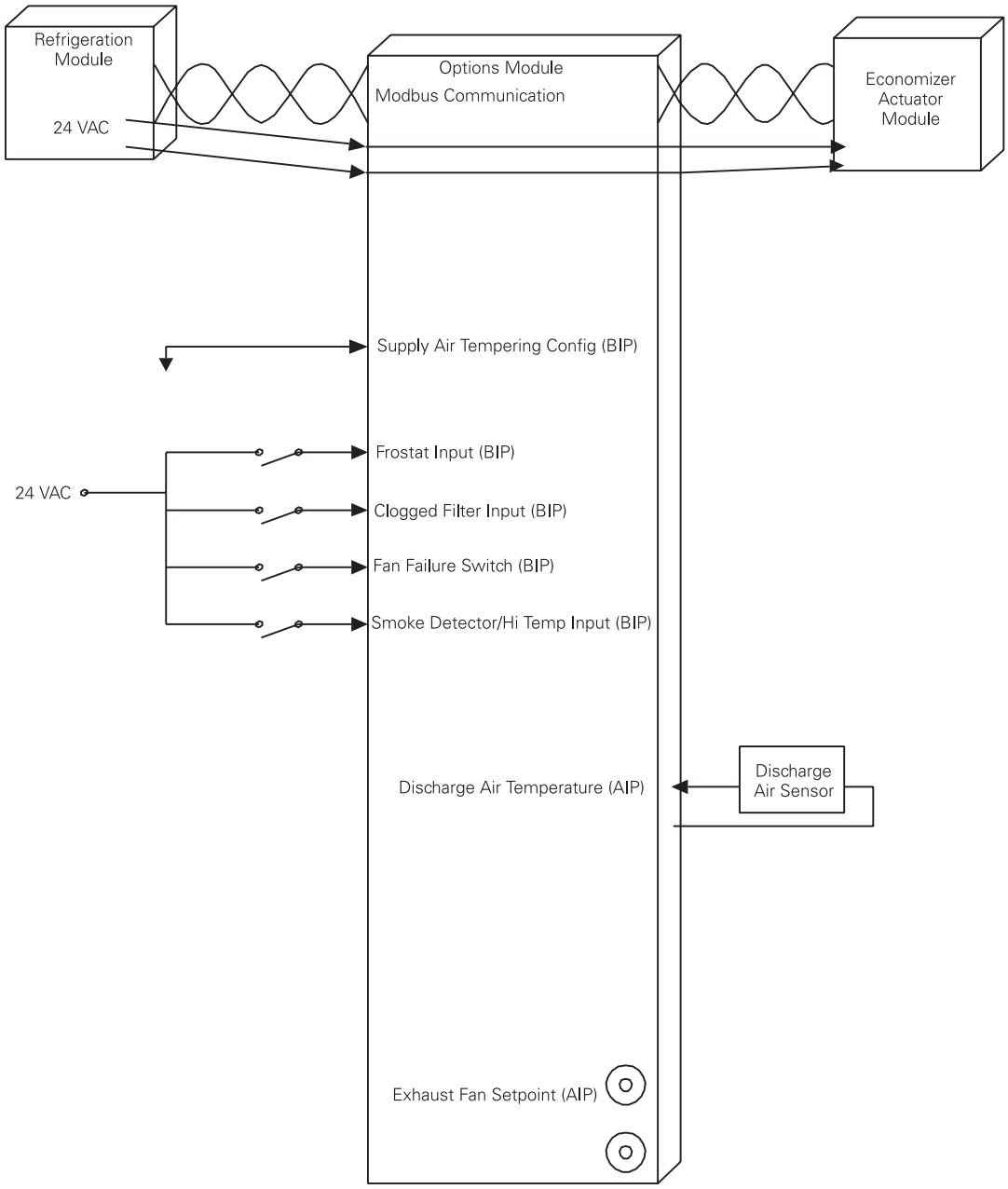
# Refrigeration Module Flow Diagram (RTRM)

## WSC Refrigeration Module (RTRM) Heat Pump



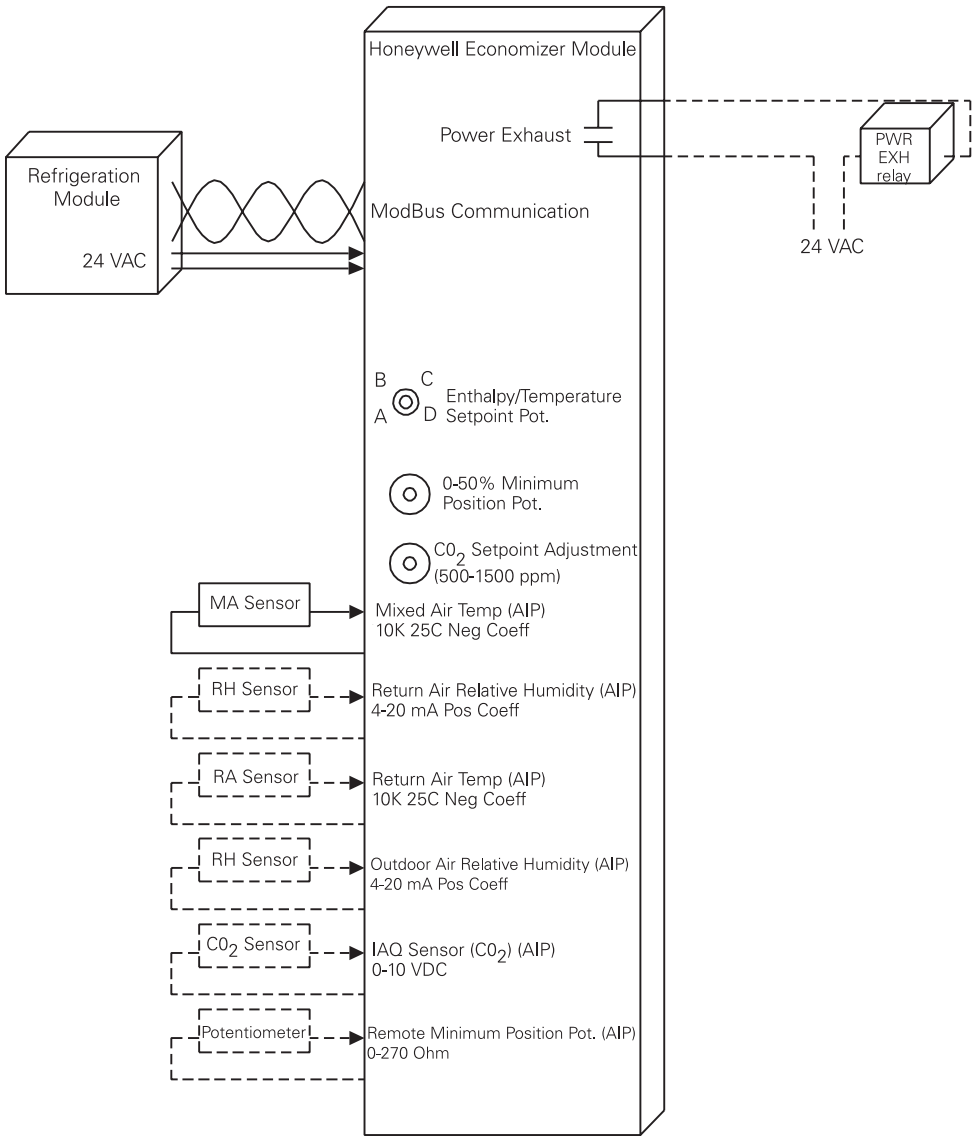
# Options Module Flow Diagram (RTOM)

## Options Module (RTOM)



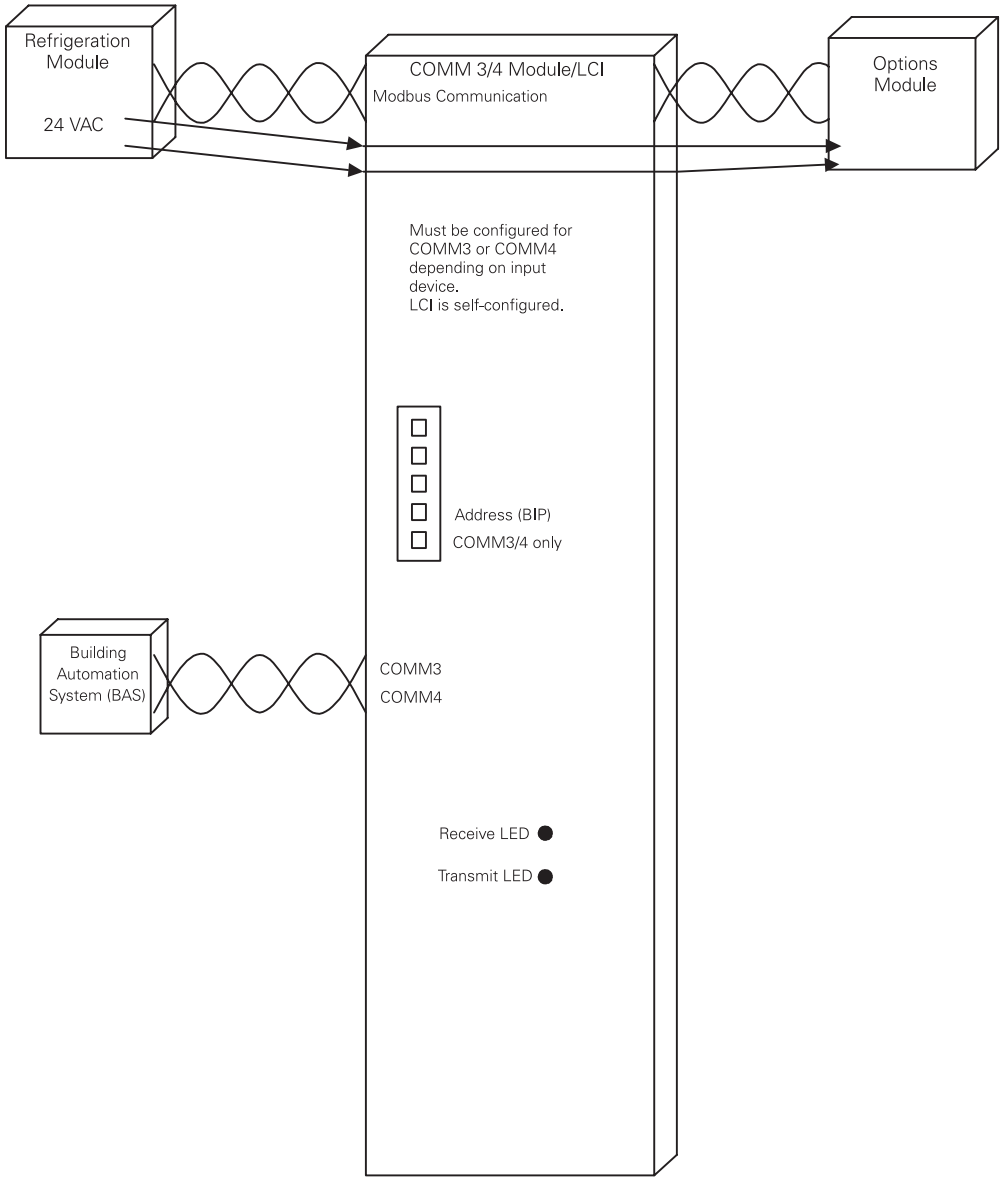
# Economizer Module Flow Diagram (ECA)

## Economizer Module (ECA)



# Communication Module Flow Diagram (TCI/LCI)

## COMM3/4 Module for ICS Communication/LonTalk Communication Interface (LCI)



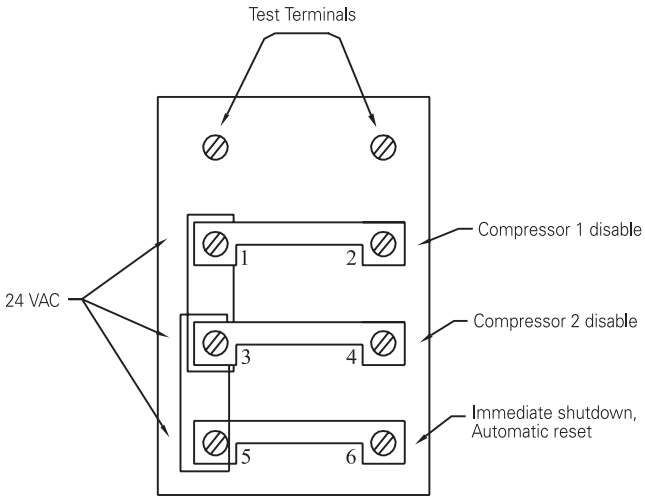
# Low Voltage Terminal Strip

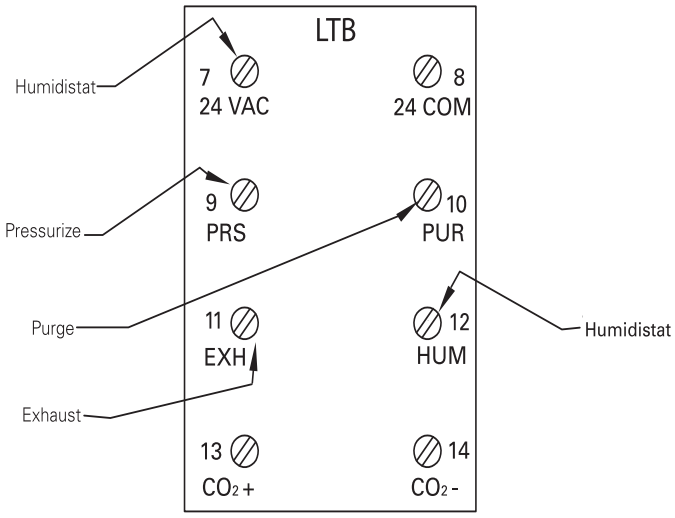
**TEST terminals**
By jumpering from TEST1 to TEST2, the service technician can test the unit or start it with or without any controls attached. See TEST MODE section for details.

**Compressor 1 disable**
If the factory installed jumper from 1 to 2 is removed (Compressor 1 disable), compressor 1 will not run, even in the TEST MODE. This is where a load shedding device could be connected.

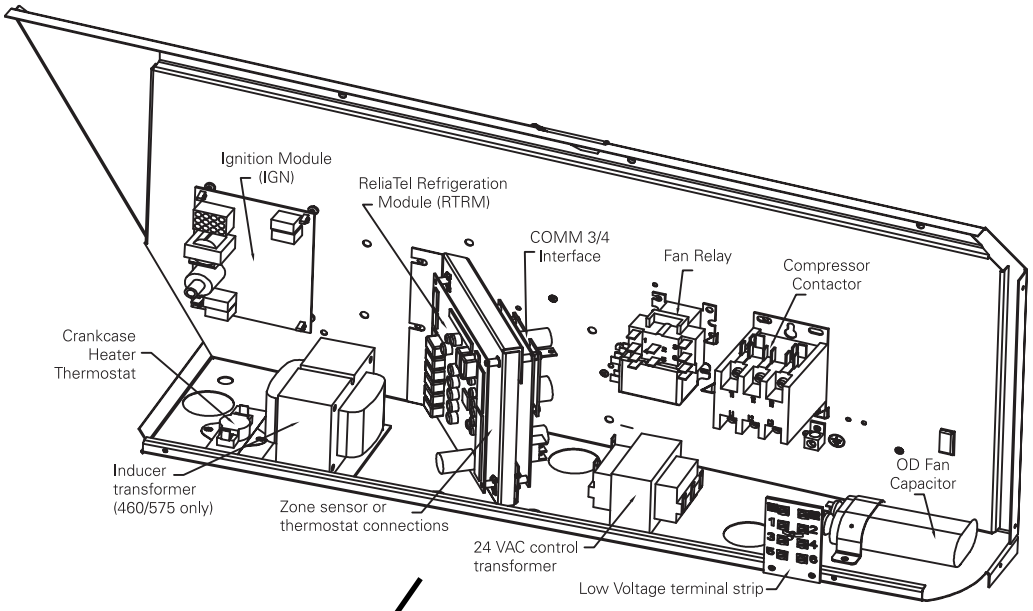
**Compressor 2 disable**
If the factory installed jumper from 3 to 4 is removed (Compressor 2 disable), compressor 2 will not run, even in the TEST MODE. This is where a load shedding device could be connected.

**Emergency Stop**
If the factory installed jumper from 5 to 6 is removed (Emergency Stop), the unit will not run. The RTRM system LED will be on. The unit will have Heat + Cool diagnostic. An external smoke detector or other interlock device can be added here.

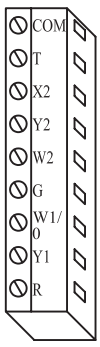


# Typical Control Box Layout (3-5 ton)

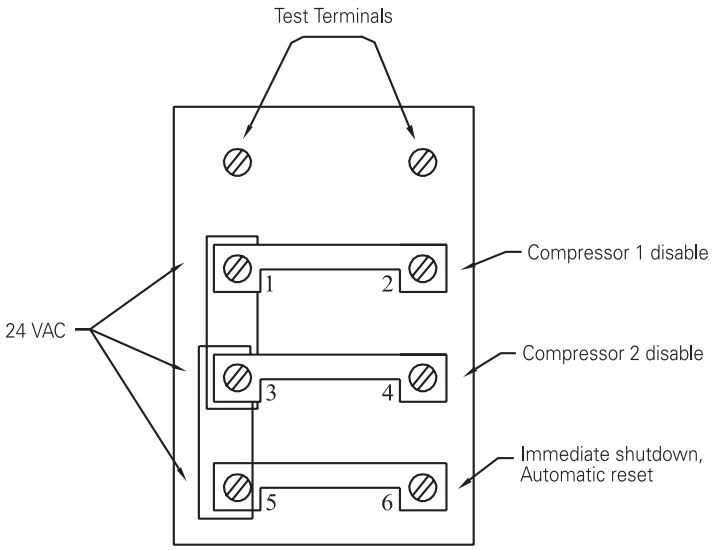



Thermostat

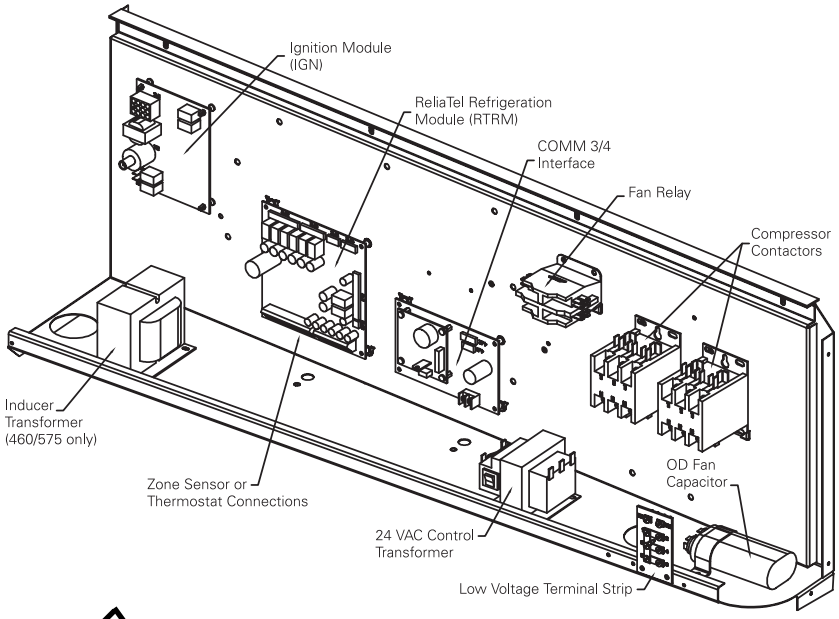


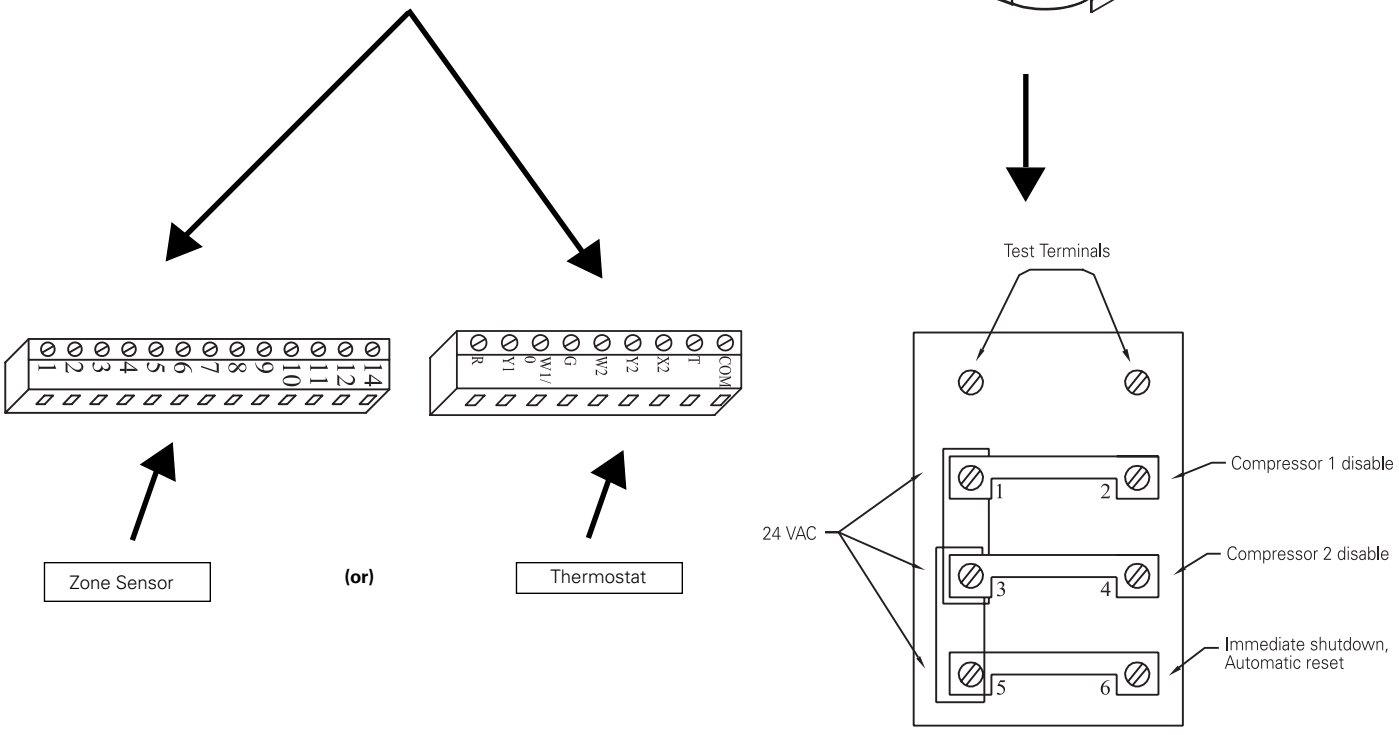

**(or)**

Zone Sensor

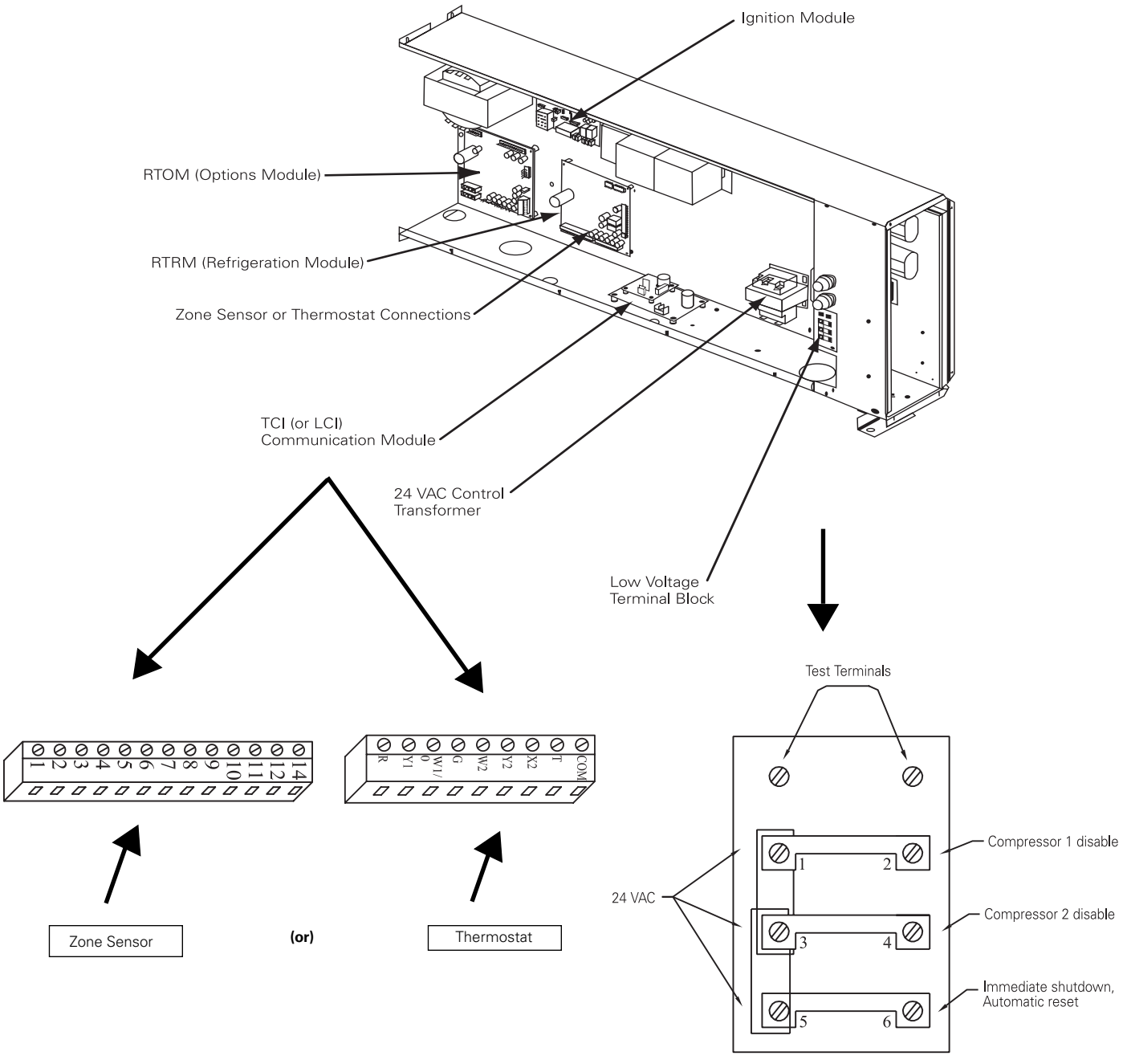



# Typical Control Box Layout (6-10 Tons)

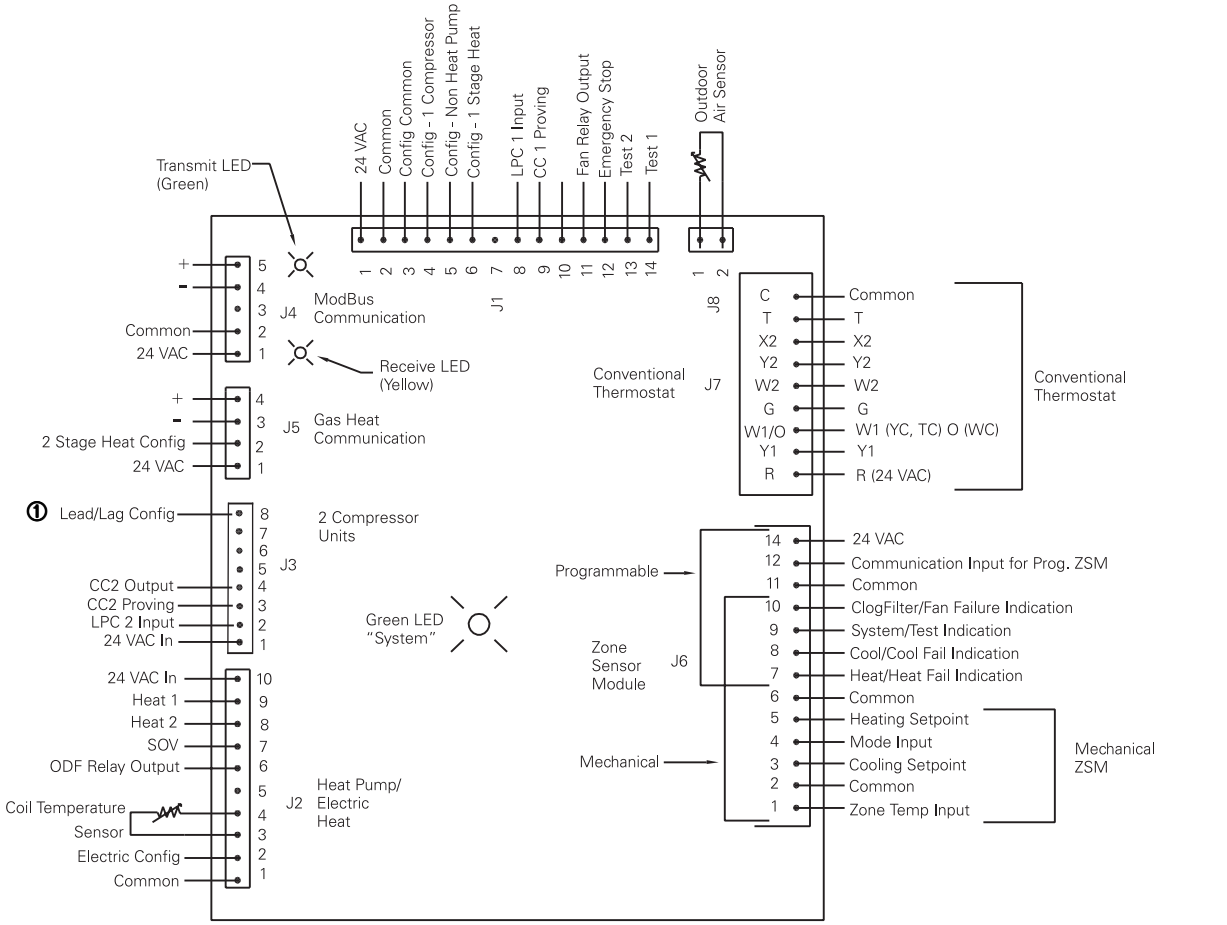


# Typical Control Box Layout (12½ - 25 Tons)

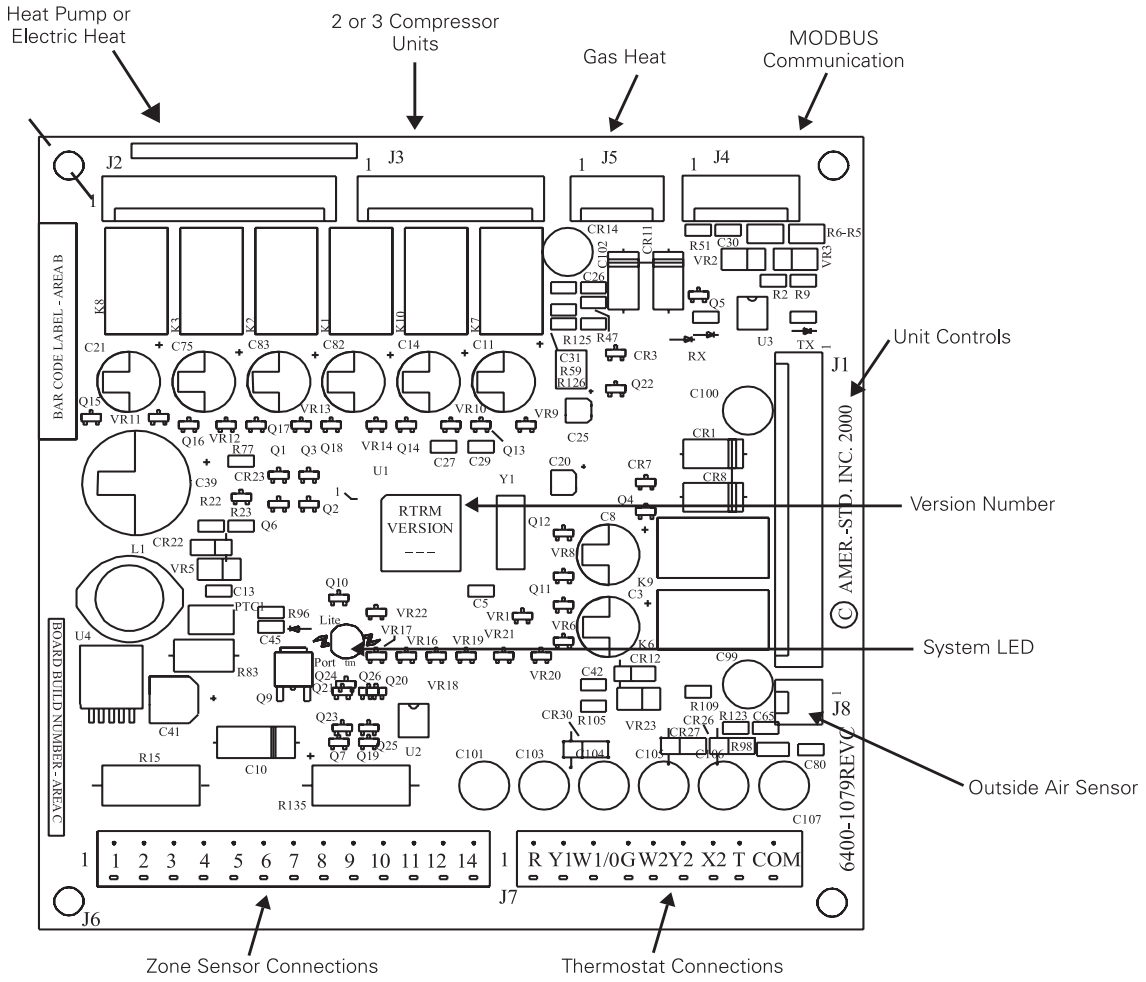


# ReliaTel Refrigeration Module (RTRM) (Layout)




①To enable lead/lag on multiple compressor units, cut wire connected to J3-8.

# ReliaTel Refrigeration Module (RTRM) (Board Connections)




***For production, several versions of the RTRM are used depending on unit functions. There is one replacement module for all units.***

# ReliaTel Refrigeration Module (RTRM) (Diagnostics)

**RTRM System LED Diagnostic Indicator**
On RTRM version 4.0 or higher, the green system LED on the RTRM module can provide a quick visual indication of the presence of certain diagnostics. If the green LED on the RTRM is blinking with two ¼ second blinks every two seconds, one or more of the following diagnostics is present:

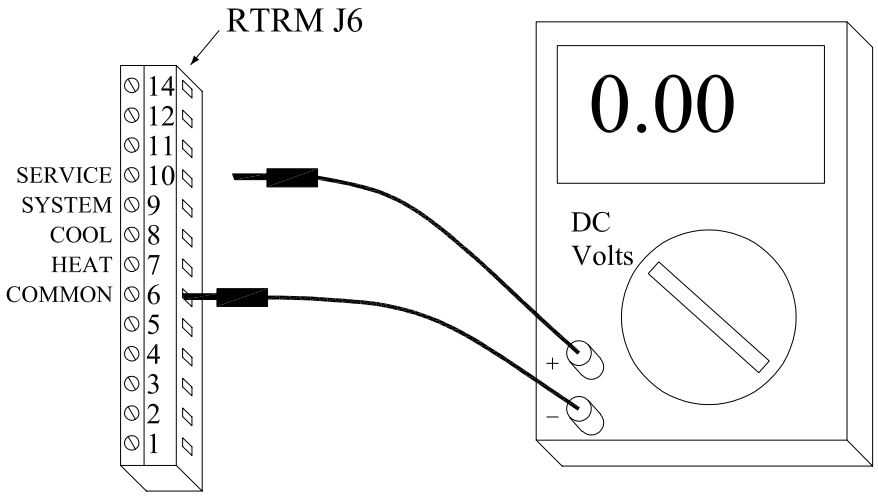
**3-50 ton units**
Supply fan fail
Zone temperature sensor input failure
Programmable ZSM communication failure
Manual compressor lockout (one or both circuits)
Invalid outdoor coil temp sensor failure (heat pumps only)
Defrost fault condition (heat pumps only)
Gas heat failure

**27½ to 50 ton units:**
Zone temperature sensor failure during unoccupied mode (VAV only)
Static pressure transducer output failure (VAV only)
High duct static pressure trip (VAV only)
Discharge air sensor failure (VAV only)
If the service technician sees the RTRM fault indication, the next step is to check for diagnostics as indicated on the following pages to help determine which of the above diagnostics is present.

***Note: Since Constant Volume (CV) units 3-50 ton may use a conventional thermostat, the RTRM will not display a diagnostic if a zone sensor is not attached when power is applied to the unit. Also, the RTRM ignores a zone sensor if it is attached to a powered-up unit (after a brief time-out). Therefore, always reset power after installing a mechanical ZSM such as a BAYSENS006 – 010 to terminals RTRM J6-1 through J6-10.***

The RTRM provides certain diagnostic information to the end user or service technician depending on the type of controls used. Regardless of controls used however, a service technician with a DC voltmeter can read the diagnostics at the RTRM as shown below.

***Note: when a voltmeter is first applied, allow 2-3 seconds for the reading to stabilize.***




The actual readings obtained vary depending on the controls used. The following charts show what readings to expect, as well as what the readings mean.

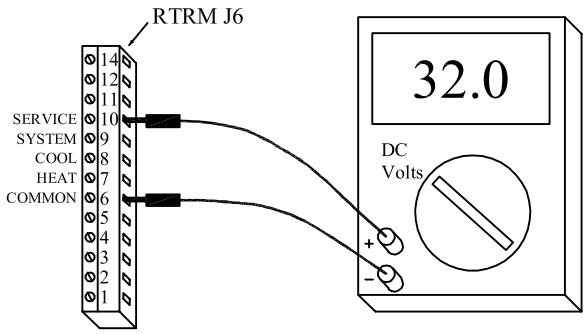
| | Approximate voltage readings (depending on control used) | | |
|---|---|---|---|
| See "What The Readings Mean" on the following pages. | Thermostat or mechanical ZSM without indicators or with no controls attached at all | Programmable ZSM with indicators | Mechanical ZSM with indicators |
| **ON** | 32 VDC ± 10% | 26 VDC ± 10% | 2.0 VDC ± 10% |
| **OFF** | 0.75 VDC ± 10% | 0.75 VDC ± 10% | 0.75 VDC ± 10% |
| **PULSING** | 20 TO 30VDC | 1.5 TO 2.5VDC | 14 TO 30VDC |

# ReliaTel Refrigeration Module (RTRM) (Diagnostics)

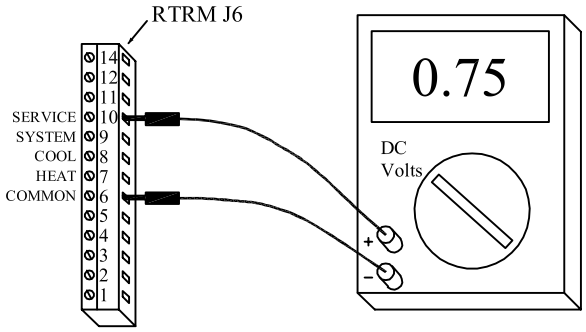
**What the readings mean**

**Service**

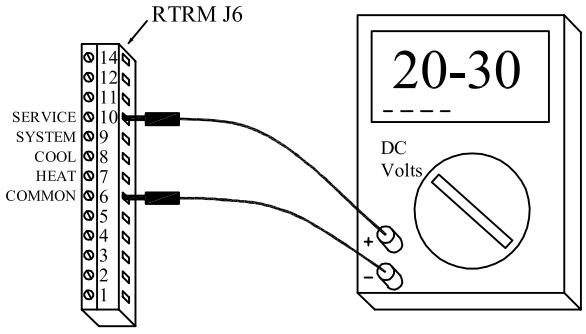
**ON** – Clogged filter switch has been closed for at least 2 minutes, indicating a clogged filter.
This example illustrates what would be seen if the unit did not have a zone sensor with indicator LEDs, such as would be the case with an ICS system. Page 17 lists voltages seen if a zone sensor is attached. Volt meter readings should be within 10%.




**OFF** –
1) Clogged filter switch is in open position or no switch is installed.
2) Fan Fail switch (if installed) has opened within the first 40 seconds, proving that the fan has started.

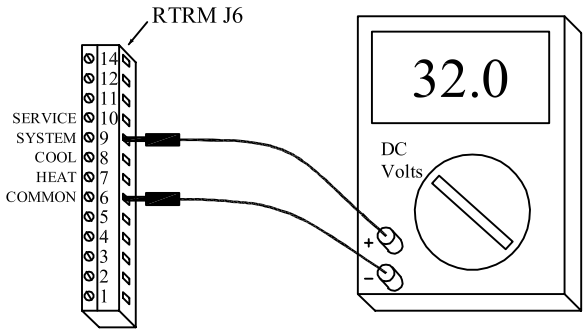



**PULSING** – Fan Proving switch (also called Fan Fail Switch FFS) has failed to open after 40 seconds.
During this condition, the unit will run for 40 seconds and then stop. Only the fan will run during theTEST mode, except during the first 40 seconds. Note that at the bottom of the meter display, the "analog bar" will pulse back and forth. Some meters do not have this extra feature.



# ReliaTel Refrigeration Module (RTRM) (Diagnostics)

What the readings mean
**System**
**ON** – System is powered up. This output should be on whenever the RTRM System LED (Lite Port) is on. Incidentally, the Lite Port flickers as part of its normal function.

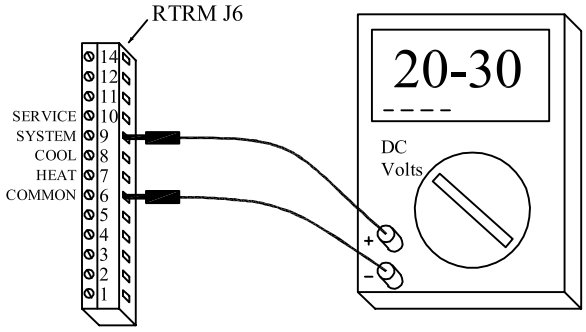



**OFF** – If 0VDC is seen, the RTRM does not have power, the output wiring is shorted, or there is an internal failure. Remove any wires connected to this terminal and check again.

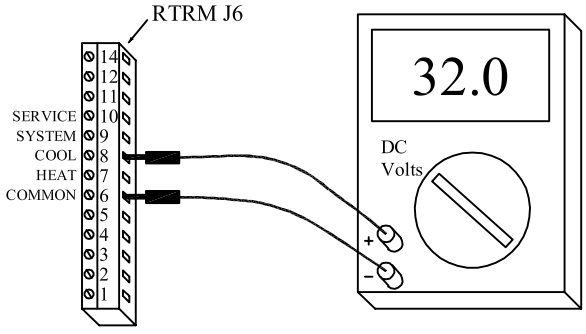
**PULSING** – Unit is in the TEST mode.

Also during the TEST mode the System LED will pulse on and off.

This output does not provide any diagnostic information, but is a good place to confirm that voltage readings taken are consistent with what should be seen on other outputs.

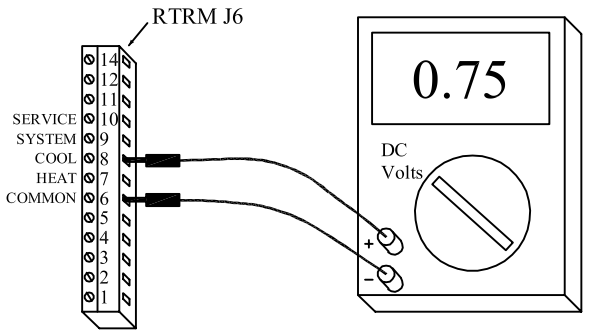



What the readings mean
**Cooling**
**ON** – System is in the cooling mode and actively cooling. The unit could be economizing or have one or both compressors on. If the unit is a heat pump, the reversing valve is energized as well.

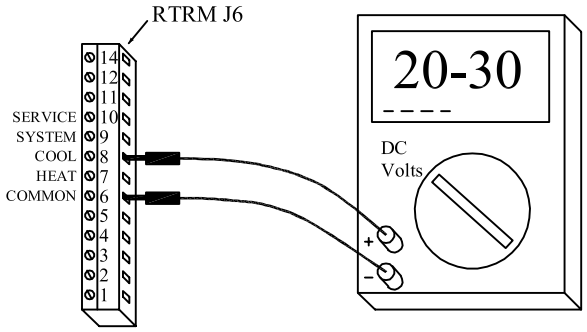


# ReliaTel Refrigeration Module (RTRM) (Diagnostics)

**OFF** – System is not actively cooling.
It may or may not be in the cooling mode.




**PULSING** –This indicator can mean one or more of the following:




Any controls

1) CC1 or CC2 opens during cooling, or is open when a call for compressor occurs. The unaffected circuit will still run. With RTRM version 4.0 or greater, CC1 or CC2 circuit must open on 3 consecutive cycles. On the 3rd trip, the unit will lockout.
2) CPR1 Disable or CPR 2 Disable input has opened during a compressor cycle each time a compressor starts (within the first 3 minutes) for 3 consecutive cycles. It locks out on the fourth cycle.The unaffected circuit will still run.

Mechanical ZSM

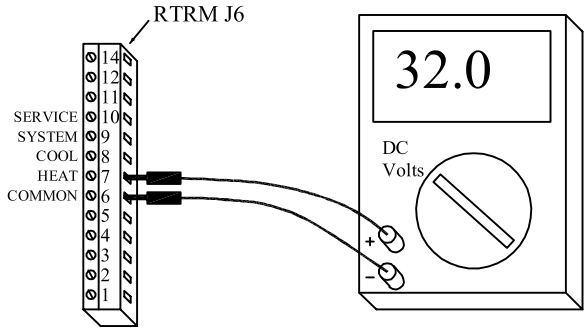
1) Zone temperature input failure after a successful input.
2) Both heating and cooling setpoint inputs have failed or are not attached (such as when using a 2 - wire sensor on terminals 1 & 2).

Programmable ZSM

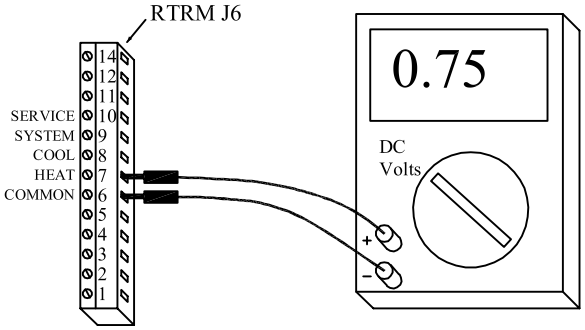
The ZSM has failed to communicate for 15 consecutive minutes after successful communication has occurred.

# ReliaTel Refrigeration Module (RTRM) (Diagnostics)

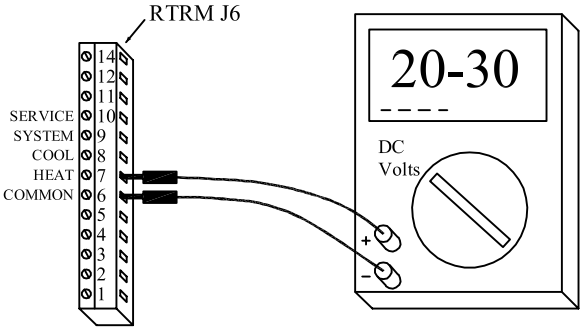
What the readings mean
**Heating**
**ON** – System is actively heating.




**OFF** – System is not actively heating.




**PULSING** –
Gas Heat
If any failure occurs such as loss of flame, limit switch trip, flame rollout etc, this indication is present. Further diagnostics are available by examining the Ignition Module LED. See the gas heat section for details.




Electric heat
These units have safety limit switches in the electric heat control circuit. Should they trip however, no indication will occur. The HEAT indication will stay ON.

Heat Pump
1) Unit is in the EMERGENCY HEAT mode.
2) If the Compressor Disable circuit or CC1, CC2 circuits create a lockout during heating mode, a COOL FAIL (pulsing) indication will occur, not a HEAT FAIL (pulsing) indication. See COOL indications for details.

HEAT FAIL and COOL FAIL at the same time:
1) Coil temperature sensor is open or shorted.
2) Unit has failed to defrost properly. See Heat Pump section for further details.
3) Outdoor air sensor is open or shorted. (RTRM version 4.0 or greater.)

# ReliaTel Refrigeration Module (RTRM) VAV Only (Diagnostics)

**27½ to 50 ton unit Additional Diagnostics (VAV only)**
If only one diagnostic is present, refer to that diagnostic. If more than one diagnostic is present, refer to combination diagnostics such as COOL + HEAT as appropriate. On a BAYSENS020*, the display will show HEAT FAIL or COOL FAIL or SERVICE (or an appropriate combination) if a diagnostic is present.

**HEAT (YC only)**
1. TCO1, TCO2, or TCO3 has opened
2. IGN Module lockout (see gas heat section for troubleshooting)

**COOL**
1. Discharge air sensor (DTS) is open, shorted, or has failed.
2. Zone temp input (RTRM J6-1) is open, shorted, or failed during an unoccupied mode. If the unit has a default mode input (jumper from RTRM J6-2 to RTRM J6-4, a valid zone temp input is needed for unoccupied heating, MWU and DWU.
3. CC1 or CC2 24 VAC control circuit has opened 3 times during a cooling mode. Check CC1, CC2 coils or any control in series with the coils (winding thermostat, HPC, circuit breaker auxiliary contacts).
4. LPC 1 or LPC 2 has opened during the 3 minute minimum “on” time during 4 consecutive compressor starts. Check LPC 1 circuit by measuring voltage from RTRM J1-8 to chassis ground. Check LPC 2 circuit by measuring voltage from RTRM J3-2 to chassis ground. If 24 VAC is not present, the circuit is open. 24 VAC should present at these terminals at all times.

**SERVICE**
1. The supply fan proving switch (FFS) has failed to open within 40 seconds after the fan starts or has closed during fan operation.

**COOL + SERVICE**
1. Static Pressure Transducer output voltage at RTAM J1-3 is less than 0.25VDC. The transducer output is open, shorted, or the transducer is reading a negative supply air pressure.

**HEAT + COOL**
1. The Emergency Stop input (TB1-5 and TB1-6) is open. Check this input at the RTRM by measuring voltage from RTRM J1-12 to chassis ground. 24 VAC should be present whenever the Emergency Stop input is closed.
2. Outdoor air sensor (OAS) input is open, shorted, or has failed.

**HEAT + COOL + SERVICE**
1. Static Pressure High Duct Static Trip. The static pressure has exceeded 3.5" W.C. three consecutive times.

# ReliaTel Refrigeration Module (RTRM) (Default Operation)

The ReliaTel Refrigeration Module (RTRM) can accept input from any of the following:
Mechanical Zone Sensor Module (ZSM) BAYSENS006-11B, AYSTAT661-664B
Programmable Zone Sensor BAYSENS019*, AYSTAT666*
Conventional thermostat BAYSTAT036-038A (or similar)

ICS systems – Tracer, Tracker, VariTrac
With each installed device, default modes of operation come into play, depending on that device's inputs. Following is a summary of functions and defaults:

**Default operation for Mechanical ZSM (CV Only):**

| J6 Input / connection | If no input / connection this happens: |
|---|---|
| J6-1 - Zone temperature | Unit stops |
| J6-2 – Common terminal for 1-5 | Unit stops |
| J6-3 - Cooling Set Point (CSP) | HSP + 4F |
| J6-5* - Heating Set Point (HSP) | CSP – 4F |
| J6-3&5 - No CSP or HSP from unit | 74F CSP, 71F HSP |
| J6-4 - Mode Input from ZSM | Auto Changeover with continuous fan |
| J6-6* – Common terminal for 7-10 | LED's will not function any time |
| J6-7* – Heat indication | LED will not come on while heating<br>LED will not flash during heat fail |
| J6-8* – Cool indication | LED will not come on while cooling<br>LED will not flash during cool fail* |
| J6-9* – System indication | LED will not come on while unit has power |
| J6-10* – Service indication | LED will not come on when CFS or FFS trips |

**** these connections are only on certain model ZSM's.***

**Default operation for Programmable ZSM:**

| J6 Input / connection | If no input / connection this happens: |
|---|---|
| J6-7 – Heat indication | "HEAT" will not be displayed while heating<br>"HEAT FAIL" will not be displayed during heat fail |
| J6-8 – Cool indication | "COOL" will not be displayed while cooling<br>"COOL FAIL" will not be displayed during cool fail* |
| J6-9 – System indication | Colon (:) will not blink during normal operation<br>"TEST" will not be displayed during TEST mode |
| J6-10 – Service indication | "SERVICE" will not be displayed when clogged filter switch has tripped<br>"SERVICE" will not flash when the FFS has tripped |
| J6-11 – Common | No display, no communication |
| J6-12 - Communication | No communication – "COOL FAIL" indication |
| J6-14 – 24VAC power | No display, no communication |

****cool fail indication can occur for several reasons. See diagnostic section for more on this.***

***Note: Version 1.1 and 1.3 RTRM do not provide Heat, Cool, Service, Cool Fail, Heat Fail indications for Programmable ZSM. Later versions (with a higher number) do.***

# ReliaTel Refrigeration Module (RTRM) (Default Operation)

**Default operation for ICS control:**
COMM3/4 and COMM5 Communication Interface Modules use MODBUS communication directly with the RTRM. Tracker and Tracer require inputs as shown:

| J6 Input / connection | If no input this happens: |
|---|---|
| J6-1 - Zone temperature | Unit stops (unless Tracer is providing this input) |
| J6-2 – Common terminal for 1-3 | Unit stops |
| J6-3 - Cooling Set Point (CSP) | Tracer /Tracker set points are used. |

***Note: VariTrac does not require any input to J6***

Conventional thermostat – default operation
See section on Conventional Thermostat Operation for more on this.

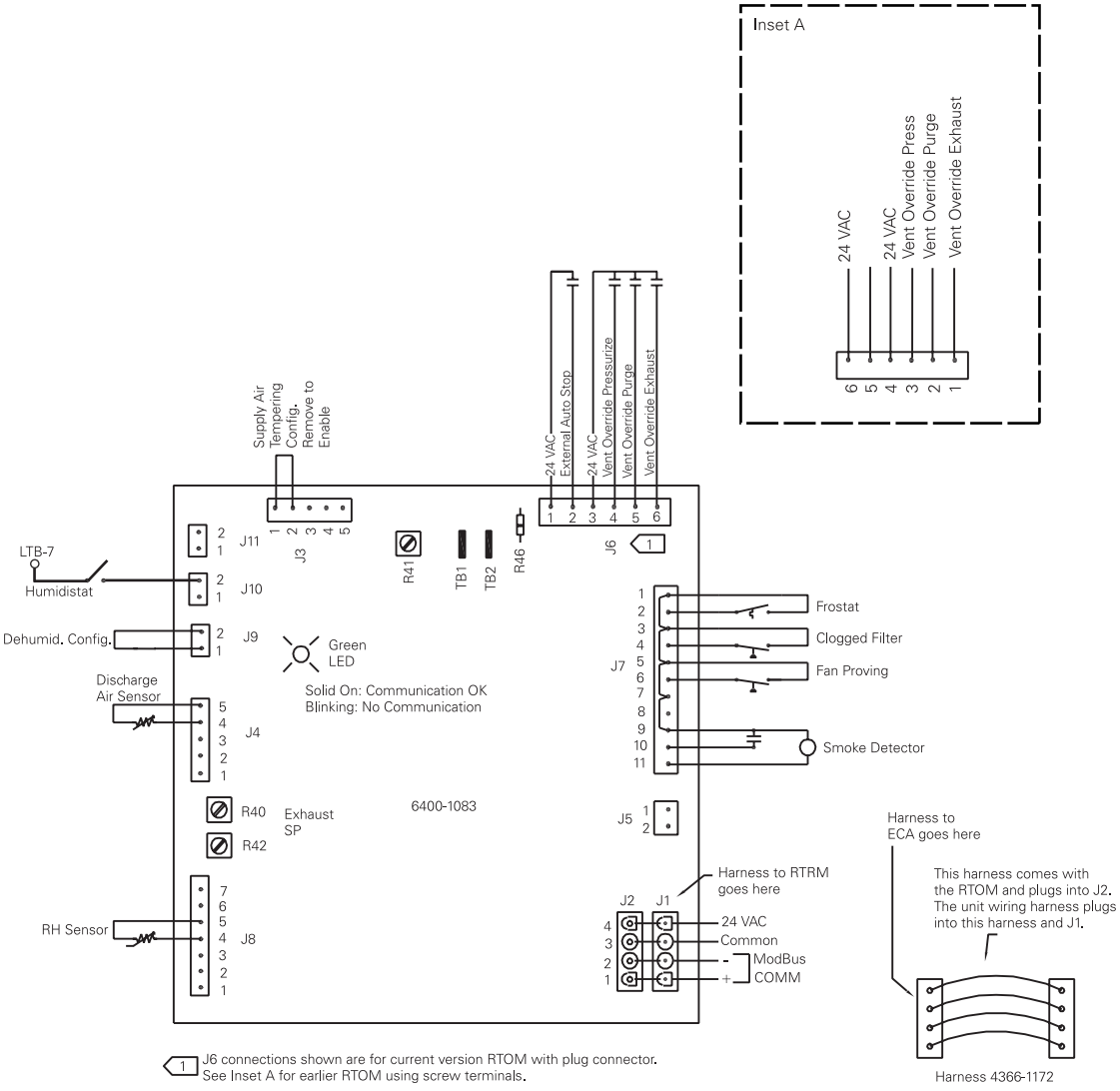
| Input / connection | If no input, this happens: |
|---|---|
| G (Indoor fan)<br>The purpose of G is to provide a way to run the fan continuously. | A heat or cool call will also enable the fan. |

| Input / connection (27½ to 50 ton VAV only) | If no input, this happens: |
|---|---|
| Default mode input jumper J6-2 to J6-4.<br>Zone temperature input J6-2 to J6-1. | Without a mode input, the unit will not run.<br>Unoccupied mode (short J6-11 to J6-12).<br>Gives cool fail diagnostic. |

# ReliaTel Options Module (RTOM) (Layout)

**3 to 10 ton**
The RTOM is installed in the indoor fan section. When field installed, it comes with a short harness which allows both ends of the unit control harness to be attached.

**12½ to 50 ton**
The RTOM is installed in the control panel.



# ReliaTel Options Module (RTOM) (Inputs)

**J1, J2 Inputs:**
J1 provides 24VAC power and MODBUS communication to and from the RTRM (via the COMM 3/4 if used). J2 sends power and communication to the ECA (if used).

**J3 Inputs:**
J3-1 to J3-2 – Allows supply air tempering when using a mechanical ZSM such as BAYSENS006-11/AYSTAT664. Removed = supply air tempering enabled, installed = disabled. Supply air tempering can also be enabled or disabled by using the BAYSENS019*/ AYSTAT666* or a Trane ICS system. The other inputs are not used on this unit.

**J4 Inputs:**
Discharge air sensor (10K @ 77°F/25°C) allows supply air tempering, also discharge air information for Building Automation systems (BAS) using COMM5 such as Tracer Summit™ V13 and Tracker™ Version 10. Earlier versions of Tracker (V6.5 and below) and any Tracer system using COMM3 or COMM4 do not recognize this input.
The input seen by Tracer (using COMM3 or COMM4) and Tracker (prior to Version 10) is "Supply Air Temperature", which is actually the Mixed Air Temperature input from the ECA to the RTRM. The other inputs on J4 are not used.

**J5 Input** is not used on this unit.

**J6 Inputs:**
Ventilation override inputs J6-1, 2, 3 are explained in the application section of this manual.
Remote Shutdown – when this input is open, the unit runs normally. When closed, the unit shuts down after minimum run times are met, up to 4 minutes. This is not the same as the emergency stop inputs on LTB 5&6.

**J7 Inputs:**
**Frostat** closes at 10°F+-2°. When closed, compressors will shut off after minimum run times are met. The Frostat opens at 60°F+-2°. When the Frostat opens, the compressors will re-start. There is no diagnostic during Frostat trip.
**Clogged filter switch** is factory set to close at 0.45", however is adjustable from 0.05" to 12.0". A 7/32" allen wrench is required for this adjustment. When the switch is closed for 2 minutes, the service indicator on the ZSM will be on (see diagnostics section for details). When the switch opens, the indicator is off (auto reset).
**Fan proving switch (3-25 tons)** is factory set to open at 0.07", and is adjustable from 0.05" to 12.0", though adjustment is not recommended. If the switch does not open within 40 seconds after the fan starts, the unit stops, requiring manual reset from the Zone Sensor or BAS system, or by resetting power to the unit. The SERVICE indicator on the ZSM will pulse during fan fail mode.
**Fan proving switch (27½-50 tons)** is factory set to close at 0.15", and is adjustable from 0.05" to 12.0", though adjustment is not recommended. If the switch does not close within 40 seconds after the fan starts, the unit stops, requiring manual reset from the Zone Sensor or BAS system, or by resetting power to the unit. The SERVICE indicator on the ZSM will pulse during fan fail mode.
**Smoke detector** contacts are open during normal operation. When closed, the unit shuts down immediately. When the contacts are re-opened, the unit will automatically restart. *Ventilation override option will override smoke detector input through the RTOM.*
**Exhaust setpoint potentiometer** sets the point to which the exhaust fan will come on. It can be set from 0% (whenever supply fan is on exhaust is on) to 100% (exhaust fan comes on when economizer is 100% outside air). Turn clockwise to increase setpoint.

**J8 Input:**
**Relative humidity sensor** provides input for humidity sensor. When the input is for humidity sensor. When the input is valid, the reheat value is energized. When the humidity sensor is satisfied, the input is removed and the reheat value de-energizes.

**J10 Input:**
**Humidistat** provides binary input to energize the reheat valve for dehumidification. When the humidistat is satisfied, the reheat valve is de-energized.

# ReliaTel (LED Functions)

**ReliaTel Refrigeration Module (RTRM)**
Green System LED

On: Normal operation (slight pulsing is normal) Blinking: Test mode

Off: No power, board failure

Blink 1/4 second on/off every 2 seconds - a diagnostic is present (version 4.0 or greater) [see page 18 for list of diagnostics]

Green Transmit LED

Very fast flash: Normal operation, information being sent to other modules.

Off: System failure

Yellow Receive LED

Very fast flash .5 second, off 1.5 second:

Normal communication

1/4 second wink every 2 seconds:

Not communicating with any other module

Off: Board failure

**ReliaTel Options Module (RTOM)**
Green system LED

On: Normal communication with RTRM

1/4 second on, 2 seconds off: No communication

Off: No power or board failure

**Economizer Actuator Module (ECA)**
Green system LED

On: OK to economize

Slow flash: Not OK to economize

Fast flash: Not communicating with RTRM

OFF: No power or system failure

Error codes — 1/2 second on, 1/4 second off

1 flash – Actuator fault

2 flash – $CO_2$ sensor

3 flash – RA humidity sensor

4 flash – RA temp sensor

6 flash – OA humidity sensor

7 flash – OA temperature sensor (On power up: No communication with RTRM)

8 flash – MA temp sensor

9-11 flash – Internal fault

**Ignition Control (IGN)**
(See ignition control section for specific flash code schedule.)

Green

On: Normal no call for heat

Slow flash: Active call for heat

Fast flash: Not communicating with RTRM

Error codes

2 flash – system lockout – failure to sense flame

3 flash – pressure switch failure to close when CBM stops or open when CBM starts (not applicable to 12½ to 50 tons)

4 flash –TCO circuit open

5 flash – Flame being sensed yet gas valve not energized

6 flash - Flame Rollout (FR) circuit open (Not applicable to 12½ to 50 tons)

**COMM3/4 Interface**
Yellow receive (RX) LED

Flashing intermittently: ICS line activity

Off: Communication down or no power

Green transmit (TX) LED

Flashing intermittently: Unit is communicating OK with ICS system

Off yet RX light flashes – address wrong, COMM3/4 board in wrong position

**LCI**
LED1 Green MODBUS LED

Flashing intermittently: Unit is communicating to RTRM

LED4 Green LCI status LED

Flashing intermittently: Unit is connected to a LonTalk link.

LED2 Red Service LED

OFF: Normal

Flashing 1 second on, 1 second off, LCI is in unconfigured state.

# ReliaTel Control (Protocol of Communications)

It is possible, though not recommended, to connect multiple control devices to a ReliaTel system. The terminal strip is arranged such that simultaneous connection of ICS communication (Tracker, Tracer, Summit, VariTrac), Mechanical Zone Sensor Module (ZSM), Programmable Zone Sensor, and a conventional thermostat is possible. Of course, only one device can control the unit at a time. Following is a protocol of communication; if communication fails, the RTRM seeks the next lower priority level device. If no device is connected, the unit will not run except during the TEST MODE.

On power up, the RTRM looks for a zone temperature input (J6-1, J6-2). If it doesn't see one, it then ignores zone sensor inputs and looks for thermostat (RGYW) inputs. However, if the unit does see a valid zone temperature input on startup then the thermostat (RGYW) inputs are ignored. A programmable zone sensor will take priority over either input when connected, and an ICS system takes the highest priority.

ICS (Tracker*, Tracer*, VariTrac, Summit*) ..... (highest priority)
*Using BAYSENS013, 014, 017 as needed

Programmable Zone Sensor ..... (next priority)
(BAYSENS019*, AYSTAT666*, BAYSENS020*)

Mechanical ZSM ..... (next priority)
(BAYSENS006-11B, AYSTAT661-664)

Conventional Thermostat (R,G,Y,W,C) ..... (least priority)

Although it's possible to connect multiple devices, doing so increases the chance for error in application and troubleshooting.

***Note:***
***27½ - 50 Tons VAV - conventional thermostat inputs do not work and are ignored by the RTRM.***

# ReliaTel Control (Test Mode)

Service Test mode allows the qualified service technician or installer to activate all functions of the unit, regardless of thermostat, sensor, or ICS input. Test Mode is activated using either a fixed resistance or a jumper as explained below. In Service Test mode, the unit can be operated in any of several pre-defined operating modes that exercise all unit functions. The operating modes include Supply Fan On, Economizer open and close, Cool 1, Cool 2, Reheat Valve, Heat 1, Heat 2, Emergency Heat (heat pumps only), and Outdoor Coil Defrost (heat pump only). If a unit does not have a component, such as an economizer, that test stage is skipped.
There are 3 ways to use the Test Mode; in each case, the unit can be running in any mode or not running at all. Service Test Mode can be initiated any time the unit is powered and an open condition has been detected on the Service Test Terminal at some time since power-up.

1) **Auto-Cycle Test** –Place a jumper from TEST 1 to TEST 2. The unit will run in each mode for 30 seconds, scrolling through all modes, then exiting the Test mode automatically. To go through Test Mode again, remove then restore the jumper. If the jumper is removed at any time during the test mode, the unit will stay in the selected mode for 1 hour (except for the defrost mode on heat pumps), then revert to normal operation. Unused states, such as Heat 2 when no Heat 2 is present, shall be skipped.

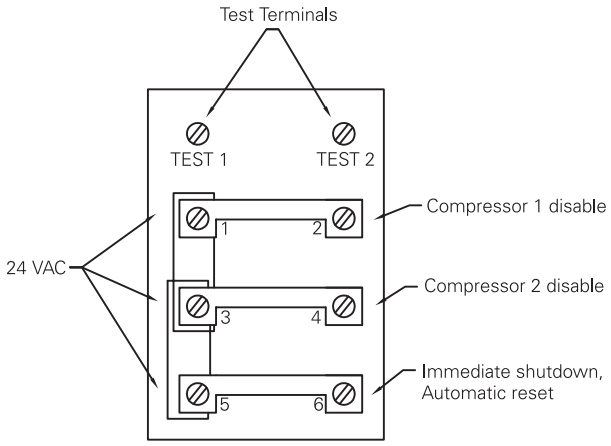
2) **Resistance Test** -Specific operating states can be selected by applying an appropriate resistance from TEST 1 to TEST 2. Operating modes can be changed in any order by applying the correct resistance values. Operation in any one mode is limited to 60 minutes as with the jumper method.

Resistance Test Table:

| | | |
|---|---|---|
| 1 | Indoor fan on | 2.2k ohms |
| 2* | Economizer open | 3.3k ohms |
| 3 | Cool 1 | 4.7k ohms |
| 4* | Cool 2 | 6.8k ohms |
| 5 | Heat 1 | 10k ohms |
| 6* | Heat 2 | 15k ohms |
| 7* | Heat 3 | 22k ohms |
| 8** | Defrost cycle/reheat | 33k ohms |
| 9* | Emergency heat | 47k ohms |

*optional components.
** defrost cycle in test mode runs for at least 1 minute, up to 10 minutes, depending on outdoor ambient and outdoor coil temperature. Reheat step is valid only with dehumidification option and will be step 5 of the test..

3) **Step Test** - By placing a jumper from TEST 1 to TEST 2 for 2 continuous seconds nominal, allowing the unit to energize the mode for at least 2 seconds, then placing the jumper again, the unit can be scrolled through modes as in method 1 but more quickly. Unused states, such as Heat 2 when no Heat 2 is present, shall be skipped.



# ReliaTel Control (Test Mode)

**TEST MODE - Service Tips:**
To ensure appropriate unit restart after operating in Service TEST MODE, Service TEST MODE termination causes a system reset resulting in execution of the startup sequence identical to initial power-on startup.
To prevent undesired activation of Service TEST MODE at startup, Service TEST MODE can only be activated after an open condition has been detected on the Service Test terminals.
The TEST MODE bypasses timing functions including minimum run times. TEST MODE does not bypass safety controls such as the high temperature limit switch, high pressure control or smoke detector circuits.
To help with troubleshooting, unplug J4 from the RTRM. This removes all optional components such as the COMM3/4, ECA and RTOM.

**Emergency Stop input, LTB 5&6 (3J1-12 on RTRM)** – if this input is open, the *indoor fan, heat & cooling will not run* in the TEST MODE. The diagnostic for this condition is HEAT FAIL + COOL FAIL. When this input is closed, the unit will restart.

**Fan Proving input, 5J2-6 on RTOM** – The indoor fan will run in the TEST MODE for 40 seconds and then stop if this input fails to open (3-25 ton) or CLOSE (27.5-50 ton) within 40 seconds. The diagnostic for this failure is SERVICE (pulsing 1.5 – 2.5VDC from J6-6 to J6-10).

**Compressor disable inputs, 3J1-8, 3J3-2 (2 compressor units) on RTRM** – if this input is open, ie. 24VAC not present, that compressor circuit will not run during TEST MODE. No diagnostic will be seen.

**Compressor proving circuits, 3J1-9, 3J3-3 (2 compressor units) on RTRM** – if this input is open when the contactor is energized by the RTRM, that circuit will not run during TEST MODE. The diagnostic for this failure is COOL FAIL (pulsing 1.5 – 2.5VDC from J6-6 to J6-8).

**Gas heat failures, such as TCO, PS, FR** (see wiring diagram) will not be bypassed during TEST MODE. Diagnostics can be picked up at the Ignition Control Module. Also, an additional diagnostic for this failure is HEAT FAIL (pulsing 1.5 – 2.5VDC from J6-6 to J6-7).

**Ventilation Override mode (VOM), J6 on the RTOM** – while in the test mode, if a VOM is activated, test mode will temporarily be halted. When the VOM is terminated, the test mode will continue from where it was halted.

**$CO_2$ Option through DCV Input on ECA** – test mode will operate normally with a $CO_2$ signal. When the economizer step is initiated, the $CO_2$ signal is overridden. When the test mode goes to the next step, the $CO_2$ signal is re-established. The economizer will drive to the closed position and then proceed to drive open from the $CO_2$ signal.

**Frostat Input** – J7-1, J7-2 on RTOM - if this input closes indicating a frosted suction line, the compressors will not run during the TEST MODE. No diagnostic will be seen.

# ReliaTel Control (3-25 Ton Test Mode)

**Electric/Electric Units**

| Step | Mode | IDM | Econ | CPR1 | CPR2 | HT1 | HT2 | ODM1 | ODM2 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Fan On | On | Min | Off | Off | Off | Off | Off | Off |
| 2* | Econ. | On | Open | Off | Off | Off | Off | Off | Off |
| 3 | Cool 1 | On | Min | On | Off | Off | Off | On | ** |
| 4 | Cool 2 | On | Min | On | On | Off | Off | On | ** |
| 5* | Reheat | On | Mln | On | On | Off | Off | On | ** |
| 6* | Heat 1 | On | Min | Off | Off | On | Off | Off | Off |
| 7* | Heat 2 | On | Min | Off | Off | On | On | Off | Off |

* With Optional Accessory
** **"Off"** If temperature falls below 60° (±2° )F, **"On"** if temperature rises above 65° (±2°)F.

***Note:*** *Steps for optional accessories and modes not present in unit will be skipped.*

**Heat Pump Units**

| Step | Mode | IDM | Econ | CPR1 | CPR2 | HT1 | HT2 | SOV | ODM1 | ODM2 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Fan On | On | Min | Off | Off | Off | Off | Off | Off Off | |
| 2* | Econ. | On | Open | Off | Off | Off | Off | Off | Off Off | |
| 3 | Cool 1 | On | Min | On | Off | Off | Off | On | On ** | |
| 4 | Cool 2 | On | Min | On | On | Off | Off | On | On ** | |
| 5 | Heat 1 | On | Min | On | On | Off | Off | Off | On On | |
| 6* | Heat 2 | On | Min | On | On | On | Off | Off | On On | |
| 7* | Heat 3 | On | Min | On | On | On | On | Off | On On | |
| 8*** | Defrost | On | Min | On | On | On | On | On | Off Off | |
| 9 | Em Heat | On | Min | Off | Off | On | On | Off | Off Off | |

* With Optional Accessory
** **"Off"** If temperature falls below 60° (±2° )F, **"On"** if temperature rises above 65° (±2°)F.
*** defrost cycle in test mode runs for at least 1 minute, up to 10 minutes, depending on outdoor ambient and outdoor coil temperature

***Note: Steps for optional accessories and modes not present in unit will be skipped.***

**Gas/Electric Units**

| Step | Mode | IDM | Econ | CPR1 | CPR2 | HT1 | HT2 | ODM1 | ODM2 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Fan On | On | Min | Off | Off | Off | Off | Off | Off |
| 2* | Econ. | On | Open | Off | Off | Off | Off | Off | Off |
| 3 | Cool 1 | On | Min | On | Off | Off | Off | On | ** |
| 4 | Cool 2 | On | Min | On | On | Off | Off | On | ** |
| 5* | Reheat | On | Mln | On | On | Off | Off | On | ** |
| 6 | Heat 1 | On | Min | Off | Off | On | Off | Off | Off |
| 7 | Heat 2 | On | Min | Off | Off | On | On | Off | Off |

* With Optional Accessory
** **"Off"** If temperature falls below 60° (±2° )F, **"On"** if temperature rises above 65° (±2°)F.

***Note: Steps for optional accessories and modes not present in unit will be skipped.***

# ReliaTel Control (27½-50 Ton Test Mode)

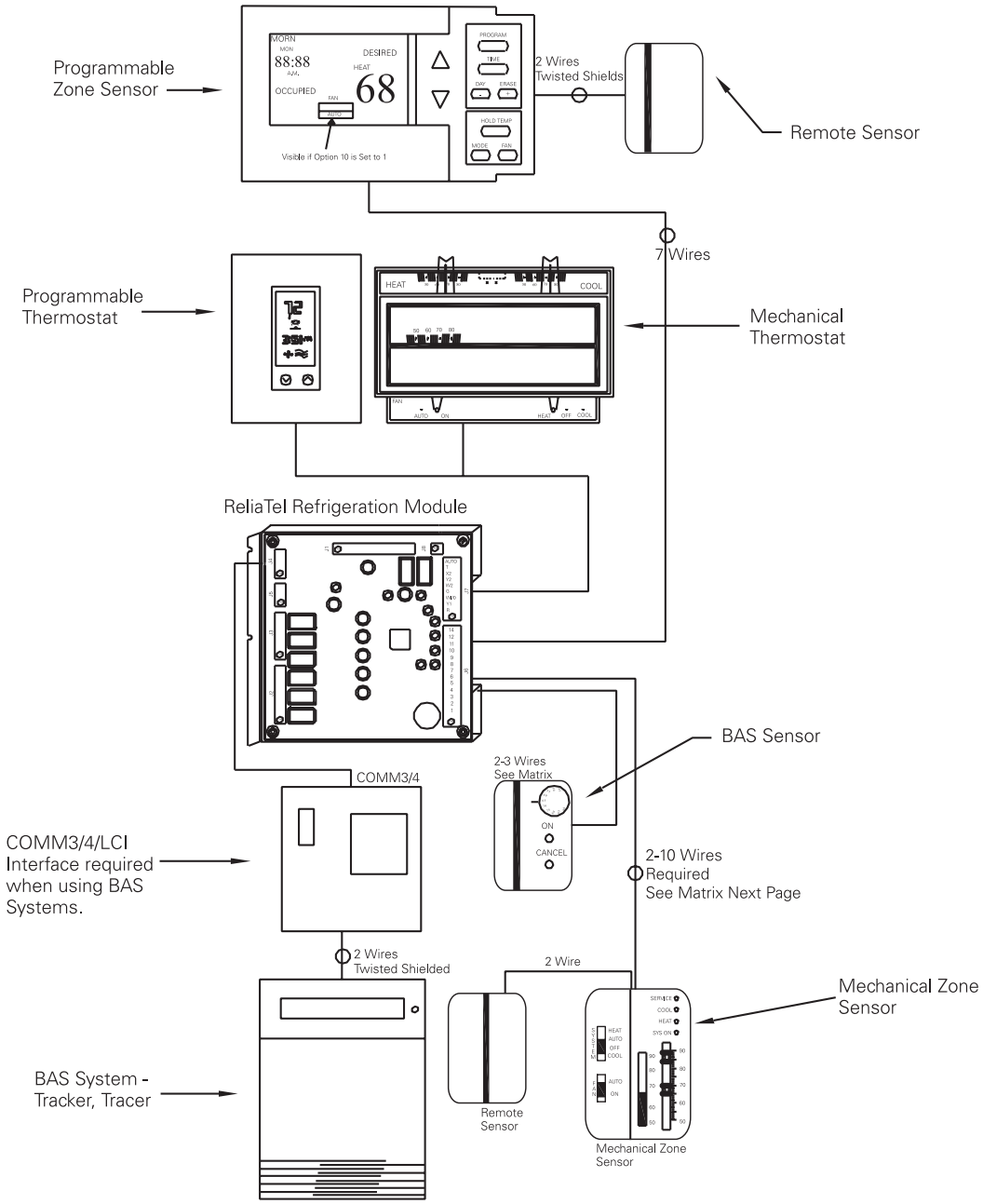
| TEST STEP | MODE | IGV/VFD (Note 1) | FAN | ECON (Note 6) | COMP 1 | COMP 2 | HEAT 1 | HEAT 2 | VHR RELAY (Note 7) | OHMS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | IGV/VFD TEST | OPEN/100% | OFF | CLOSED | OFF | OFF | OFF | OFF | ON | 2.2k |
| 2 | IGV/VFD TEST | CLOSED/OFF | OFF | CLOSED | OFF | OFF | OFF | OFF | ON | 3.3k |
| 3 | MINIMUM VENTILATION | (Note 2) IN CONTROL | ON ON | MINIMUM POSITION | OFF | OFF | OFF | OFF | ON | 4.7k |
| 4 | ECONOMIZER | IN CONTROL | ON | OPEN | OFF | OFF | OFF | OFF | ON | 6.8k |
| 5 | COOL STAGE 1 | IN CONTROL | (Note 2) ON | MINIMUM POSITION | (Note 4) ON | OFF | OFF | OFF | ON | 10k |
| 6 | COOL STAGE 2 | IN CONTROL | (Note 2) ON | MINIMUM POSITION | (Note 5) OFF | (Note 4,5) ON | OFF | OFF | ON | 15k |
| 7 | COOL STAGE 3 | IN CONTROL | (Note 2) ON | MINIMUM POSITION | (Note 4) ON | (Note 4) ON | OFF | OFF | ON | 22k |
| 8 | HEAT STAGE 1 | (Note 3) OPEN | (Note 2) ON | CLOSED | OFF | OFF | (Note 3) ON | OFF | ON | 33k |
| 9 | HEAT STAGE 2 | (Note 3) OPEN | (Note 2) ON | CLOSED | OFF | OFF | (Note 3) ON | (Note 3) ON | ON | 47k |
| 10 | RESET | | | | | | | | | |

***CV Test Modes (Also VAV w/o IGV)***

| TEST STEP | MODE | FAN | ECON (Note 6) | COMP 1 | COMP 2 | HEAT 1 | HEAT 2 | OHMS |
|---|---|---|---|---|---|---|---|---|
| 1 | MINIMUM VENTILATION | ON | MINIMUM POSITION | OFF | OFF | OFF | OFF | 4.7k |
| 2 | ECONOMIZER TEST OPEN | ON | OPEN | OFF | OFF | OFF | OFF | 6.8k |
| 3 | COOL STAGE 1 | ON | MINIMUM POSITION | (Note 4) ON | OFF | OFF | OFF | 10k |
| 4 | COOL STAGE 2 | ON | MINIMUM POSITION | (Note 5) OFF | (Note 4,5) ON | OFF | OFF | 15k |
| 5 | COOL STAGE 3 | ON | MINIMUM POSITION | (Note 4) ON | (Note 4) ON | OFF | OFF | 22k |
| 6 | HEAT STAGE 1 | ON | CLOSED | OFF | OFF | ON | OFF | 33k |
| 7 | HEAT STAGE 2 | ON | CLOSED | OFF | OFF | ON | ON | 47k |

Notes:
1. The IGV/VFD will be controlled to the supply pressure setpoint unless test mode has been running for 6 minutes or longer. After 6 minutes, the IGV damper will drive to the full open position/VFD will drive to 100%. (This note applies to RTRM version 4.0 only).
2. The supply fan will not be allowed to go from an off state to an on state until the IGV are fully closed.
3. The Heat outputs will not be allowed to come on until the IGV are at the full open position/VFD will drive to 100%.
4. The condenser fans will operate any time a compressor is ON providing the outdoor air temperatures are within normal operating range.
5. For 27.5 to 35 Ton units, cool stage 2 is not used and cool stage 3 becomes the active sequence.
6. The exhaust fan will turn on anytime the economizer damper position is equal to or greater than the exhaust fan setpoint.
7. The VHR relay output will be energized at the start of the test mode to allow time for the VAV boxes to open. It takes 6 minutes for the boxes to drive from the full closed position to the full open position. The timing cannot be changed in the field.

# Thermostat, Sensor and ICS Layout

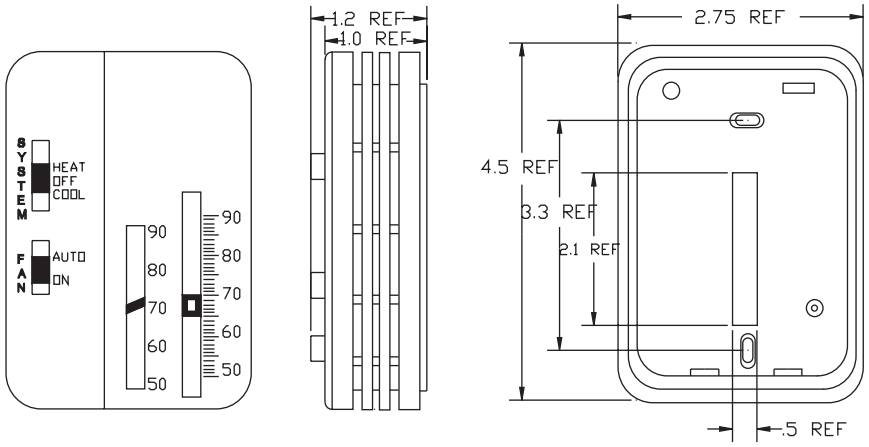


# Thermostat and Sensor Descriptions

| Accessory Model # | Zone Sensor Module Description | Required # Conductors | Terminal Connections at J6 |
|---|---|---|---|
| **Heat/Cool** | | | |
| BAYSENS006B<br>ASYSTAT661B | Single Set Point<br>Manual Change Over | 4 | 1,2,3,4 |
| BAYSENS008B<br>ASYSTAT663B | Dual Set Point<br>Manual / Auto<br>Change Over | 5 | 1,2,3,4,5 |
| BAYSENS010B | Dual Set Point with<br>LEDs Manual / Auto<br>Change Over | 10 | 1,2,3,4,5,<br>6,7,8,9,10 |
| BAYSENS019*<br>ASYSTAT666* | Programmable with<br>Night Setback and<br>LCD Indicators | 3-7 | 7,8,9,10,<br>11,12,14,<br>(7-10 are optional) |
| BAYSENS017B | Remote sensor | 2 | 1, 2 |
| BAYSENS032 | Averaging Remote sensor<br>(2 required) | 2 | 1, 2 |
| BAYSENS035A<br>ASYSTAT709A | Digital Dual Setpoint<br>with Manual/Auto<br>Changeover | 10 | 1,2,3,4,5,<br>6,7,8,9,10 |
| **Heat Pump** | | | |
| BAYSENS007B<br>ASYSTAT662B | Single Set Point<br>Manual Change Over | 6 | 1,2,3,4,5<br>6,7 |
| BAYSENS009B<br>ASYSTAT664B | Dual Set Point<br>Manual / Auto<br>Change Over | 7 | 1,2,3,4,5<br>6,7 |
| BAYSENS011B | Dual Set Point with<br>LEDs Manual / Auto<br>Change Over | 10 | 1,2,3,4,5,<br>6,7,8,9,10 |
| BAYSENS019*<br>ASYSTAT666* | Programmable with<br>Night Setback and<br>LCD Indicators | 3-7 | 7,8,9,10,<br>11,12,14,<br>(7-10 are optional) |
| BAYSENS017B | Remote sensor | 2 | 1, 2 |
| BAYSENS032 | Averaging Remote sensor<br>(2 required) | 2 | 1, 2 |
| BAYSENS031A | Digital Heat Pump Dual<br>Setpoint with Manual/Auto<br>Changeover | 10 | 1,2,3,4,5,<br>6,7,8,9,10 |
| **VAV 27½ - 50 tons** | | | |
| BAYSENS020* | Programmable with<br>Night Setback and LCD indicators | 3-7 | 7,8,9,10,11,12,14<br>(7-10 are optional) |
| BAYSENS021 | VAV Setpoint Panel w/LED's | 9 | 1,2,3,4,6,7,8,9,10 |
| **Tracer /Tracker ICS** | | | |
| BAYSENS013C | Override Sensor with<br>Override / Cancel | 2 | 1,2 |
| BAYSENS014C | Override Sensor with<br>Setpoint and Override / Cancel | 3 | 1,2,3 |

# Zone Sensor Diagrams

**BAYSENS006B/ASYSTAT661B**
Accessory Heat / Cool Zone Sensor Module (ZSM), single set point, manual change over. Four conductors required. Manufactured by Sunne, introduced 12/93.



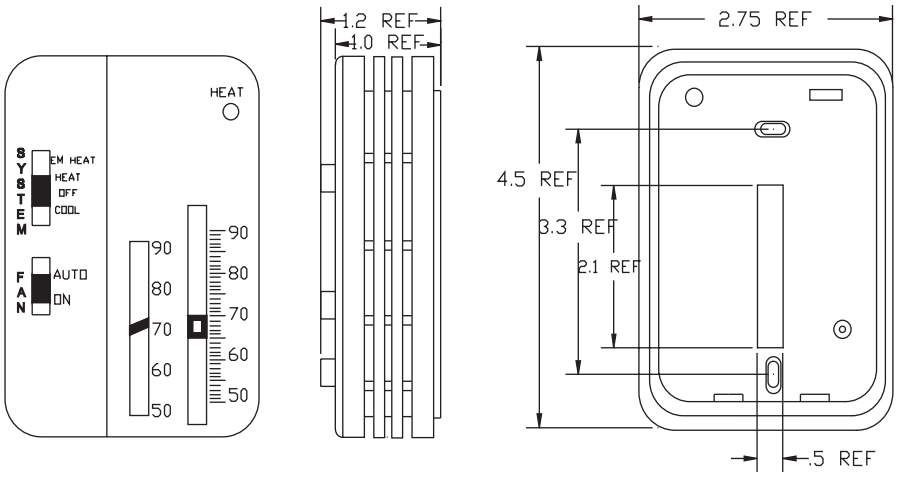

TB1

| | |
|---|---|
| 4 | MODE |
| 3 | COOL SETPOINT |
| 2 | COMMON |
| 1 | ZONE TEMP. |

**Component Description**
BAYSENS006B [Sunne part# 62822]
ASYSTAT661B [Sunne part# 62830]

**Part Number**
SEN-0410
SEN-0417

**BAYSENS007B/ASYSTAT662B**
Accessory Heat Pump Zone Sensor Module (ZSM), single set point, manual change over. Six conductors required. Manufactured by Sunne, introduced 12/93.




TB1

| | |
|---|---|
| 4 | MODE |
| 3 | COOL SETPOINT |
| 2 | COMMON |
| 1 | ZONE TEMP. |

TB2

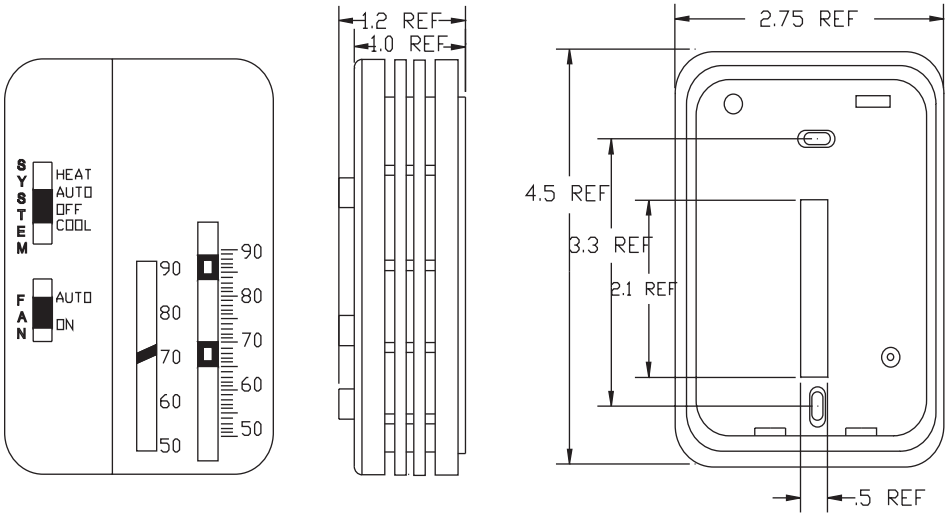
| | |
|---|---|
| 6 | COMMON |
| 7 | HEAT STATUS |

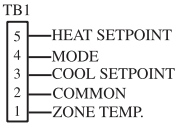
**Component Description**
BAYSENS007B [Sunne part# 62821]
ASYSTAT662B [Sunne part# 62831]

**Part Number**
SEN-0411
SEN-0418

# Zone Sensor Diagrams

**BAYSENS008B/ASYSTAT663B**
Accessory Heat / Cool Zone Sensor Module (ZSM), dual set point, manual / auto change over. Five conductors required.
Manufactured by Sunne, introduced 12/93

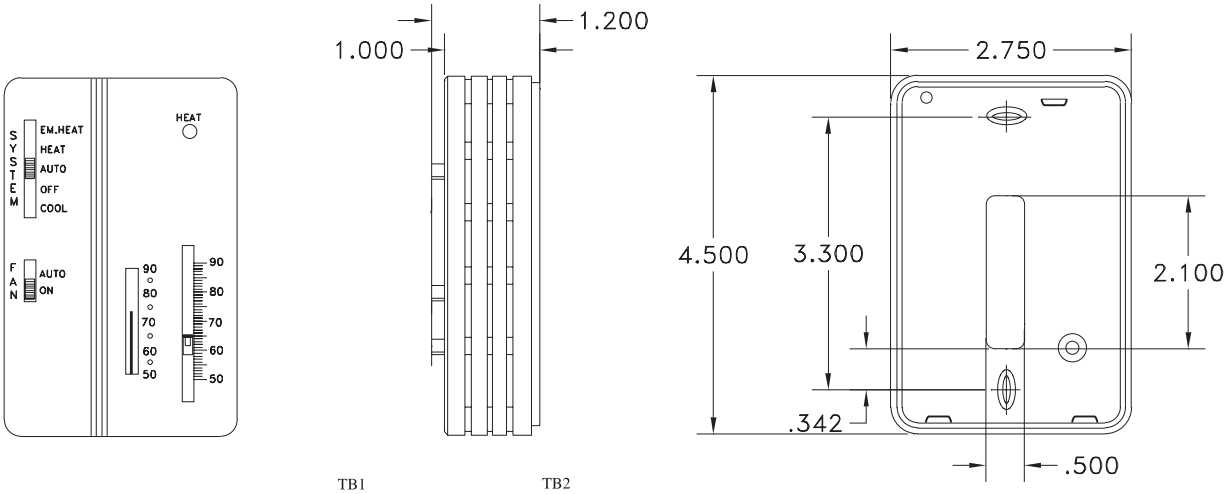


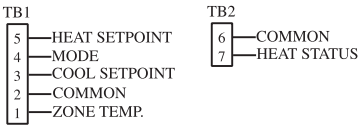




**Component Description**
BAYSENS008B [Sunne part# 62826]
ASYSTAT663B [Sunne part# 62833]

**Part Number**
SEN-0408
SEN-0419

**BAYSENS009B/ASYSTAT664B**
Accessory Heat Pump Zone Sensor Module (ZSM), dual set point, manual / auto change over. Seven conductors required.
Manufactured by Sunne, introduced 12/93.



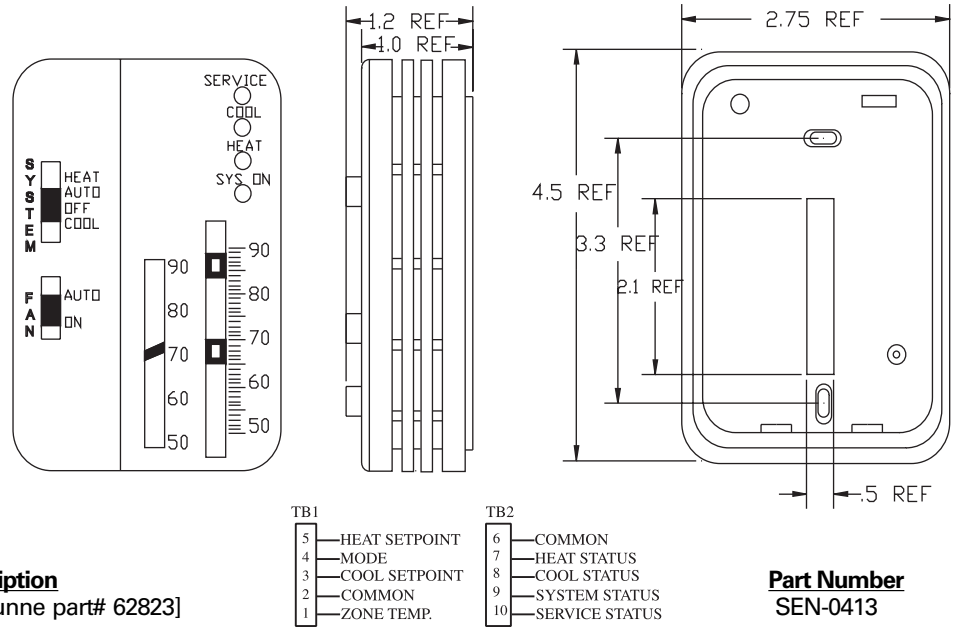




**Component Description**
BAYSENS009B [Sunne part# 62825]
ASYSTAT664B [Sunne part# 62832]

**Part Number**
SEN-0412
SEN-0420

# Zone Sensor Diagrams

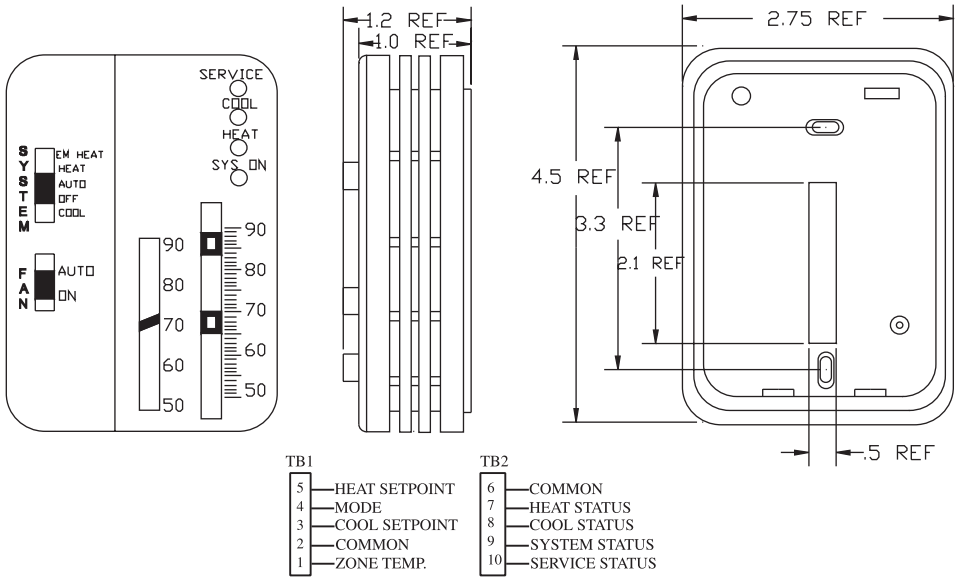
**BAYSENS010B**
Accessory Heat / Cool Zone Sensor Module (ZSM), dual set point with LEDs, manual / auto change over. Ten conductors required. Manufactured by Sunne, introduced 12/93.




**Component Description**
BAYSENS010B [Sunne part# 62823]

**Part Number**
SEN-0413

**BAYSENS011B**
Accessory Heat Pump Zone Sensor Module (ZSM), dual set point with LEDs, manual / auto change over. Ten conductors required. Manufactured by Sunne, introduced 12/93.

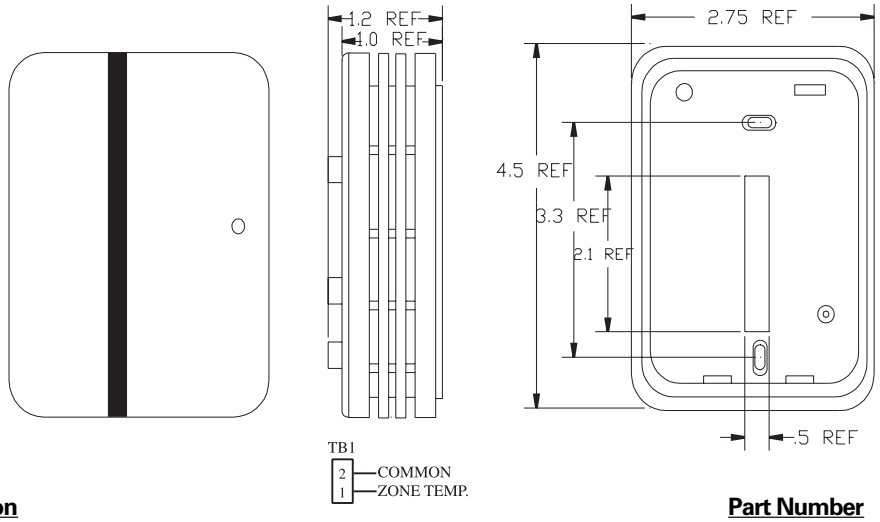



**Component Description**
BAYSENS011B [Sunne part# 62824]

**Part Number**
SEN-0414

# Zone Sensor Diagrams

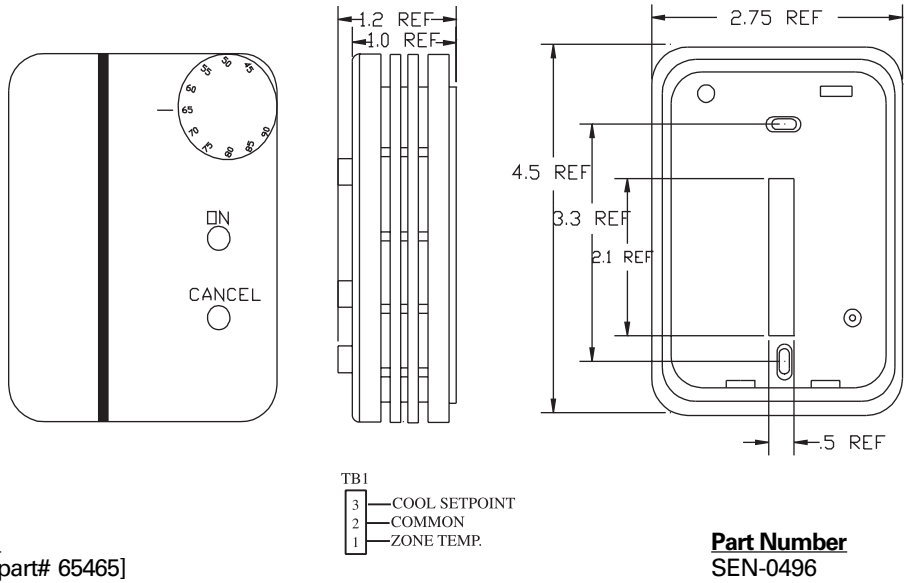
**BAYSENS013C**
Accessory ICS (Tracer/Tracker/ComforTrac) Zone Sensor Module (ZSM), with override button, and override cancel button. Two conductors required. Manufactured by Sunne, introduced 08/95.




**Component Description**
BAYSENS013C [Sunne part# 65464]

**Part Number**
SEN-0495

**BAYSENS014C**
Accessory ICS (Tracer/Tracker/ComforTrac) Zone Sensor Module (ZSM), with override button, set point, and override cancel button. Three conductors required. Manufactured by Sunne, introduced 08/95.




**Component Description**
BAYSENS014C [Sunne part# 65465]

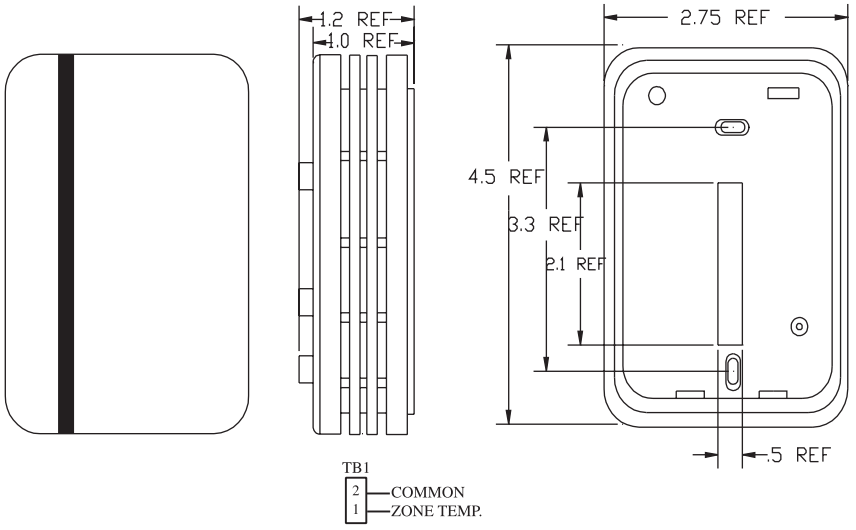
**Part Number**
SEN-0496

# Sensor Diagrams

**BAYSENS016A**
**Thermistor Sensor (OAS, SAS, RAS, CTS)**
**Outdoor Air Sensor**: Located in the condenser section, lower left corner. The compressor access panel has a slotted opening to provide airflow across the sensor. Standard with all ReliaTel controlled units.
**Return Air Sensor**: Field or factory installed accessory. Located on the return air damper of the economizer, used with comparative enthalpy control only.
**Coil Temperature Sensor**: Located in a 3/8" copper tube well, which is brazed to the lowest circuit entering the outdoor coil (2-10 ton heat pumps only).
**Mixed Air Sensor:** Field or factory installed in the supply fan section, protruding through the fan housing.
**Discharge Air Sensor:** Field or factory installed in the supply fan section, using an averaging tube located downstream of the heat section.


| Component Description | Part Number |
|---|---|
| Thermistor Sensor (OAS, SAS, RAS, MAS, CTS) | SEN-0339 |

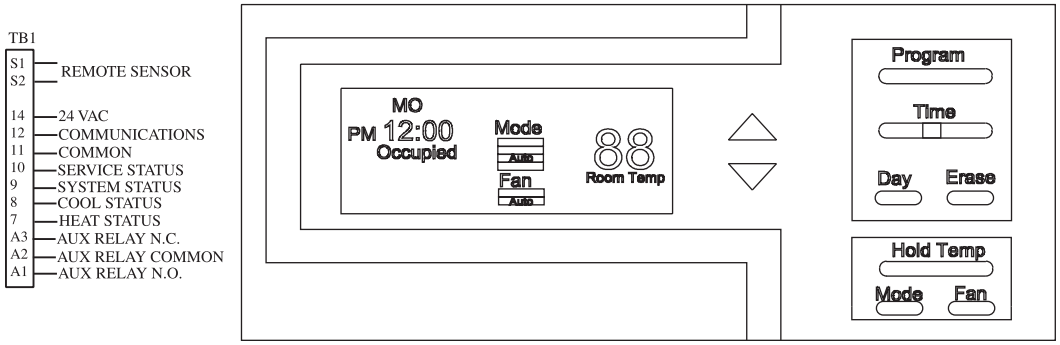
**BAYSENS017B/ASYSTAT669A**
Accessory Zone Sensor Remote, used with all **current** zone sensors. Two conductors required. Manufactured by Sunne, introduced 12/93.




| Component Description | Part Number |
|---|---|
| BAYSENS017B [Sunne part# 62828] | SEN-0435 |
| ASYSTAT669A [Sunne part# 65541] | SEN-0493 |

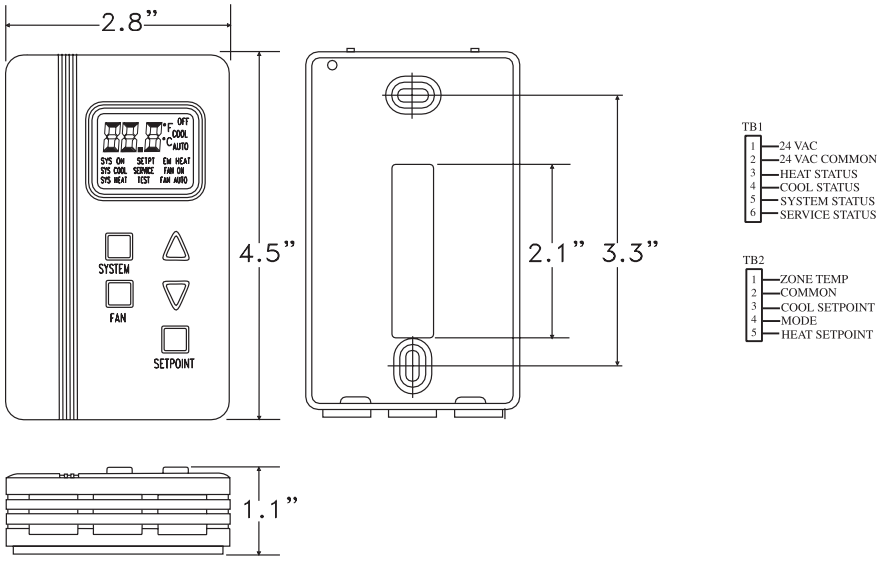
# Zone Sensor Diagrams

**BAYSENS019*/ASYSTAT666***
**(CV 3-50 Ton)**
Accessory Heat/Cool, programmable night set back Zone Sensor Module (ZSM), with LCD status / diagnostic indicators. Seven conductors: terminals 11, 12 & 14 required, 7 through 10 optional. Manufactured by Caradon, introduced 06/98.




| **Component Description** | | **Part Number** |
|---|---|---|
| BAYSENS019* | [Caradon part# 91K91] | SEN-0874 |
| ASYSTAT666* | [Caradon part# 91K92] | SEN-0907 |

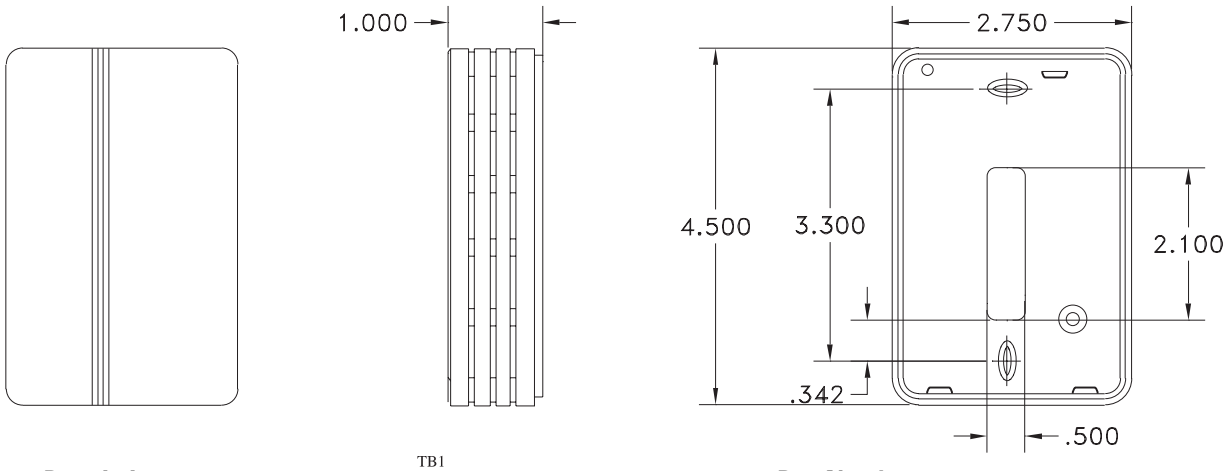
**BAYSENS031A/ASYSTAT707A**
Accessory Digital Heat Pump Zone Sensor Module (ZSM), Dual Set Point, Manual/Auto Changeover. Ten Conductors required. Manufactured by Sunne, introduced 5/03.




| **Component Description** | | **Part Number** |
|---|---|---|
| BAYSENS031A | [Sunne part# SD155-002] | SEN01078 |
| ASYSTAT707A | [Sunne part# SD155-005] | SEN01235 |

# Zone Sensor Diagrams

**BAYSENS0032A**
**(CV 3-50 Ton)**
Accessory Averaging, Remote Zone Sensor, Dual Thermistors, Two conductors required.

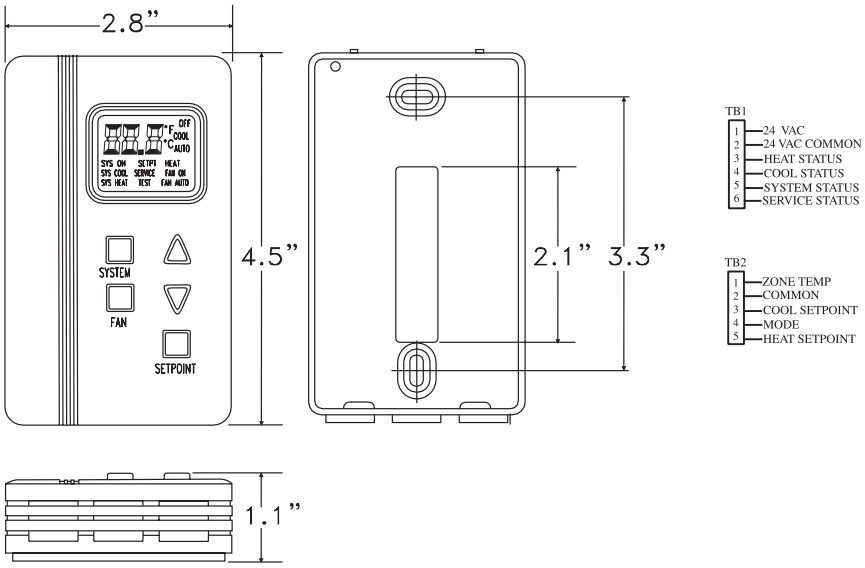




**Component Description**
BAYSENS032A

**Part Number**
SENS01120

**BAYSENS035A/AYSTAT709A**
Accessory Digital Heat/Cool Zone Sensor Module (ZSM), Dual SetPoint, Manual/Auto Changeover. Ten conductors required.




**Component Description**
BAYSENS035A [Sunne part# SD155-004]
ASYSTAT709A [Sunne part# SD155-006]

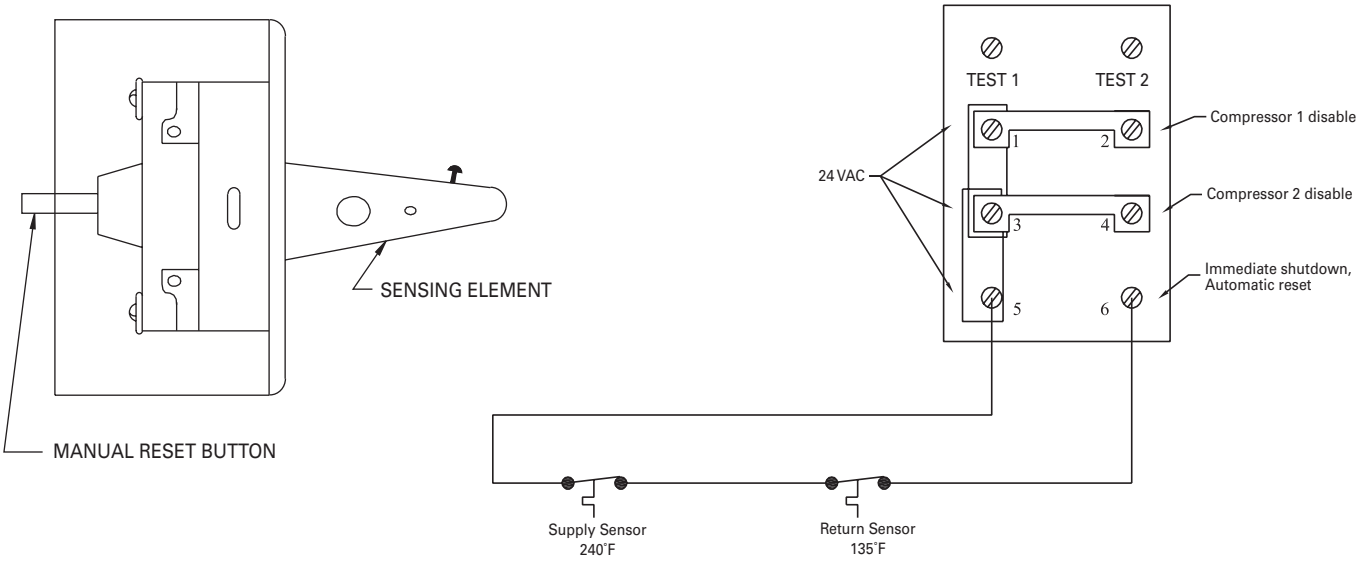
**Part Number**
SEN001130
SEN01237

# High Temperature Sensor Diagrams

**High Temperature Sensor**
The high temperature sensor accessory (BAYFRST001A) provides high limit cutout with manual reset in ICS device Tracer/ Tracker/ComforTrac/ VariTrac systems. The sensors are wired to the LTB5 and LTB6 in the control panel. Jumper must be removed.
The sensors may be used to detect excessive heat in air conditioning or ventilation ducts and provide system shut down. Immediately after sensor opens, the associated unit will completely shut down. The sensors come with case and cover, and mount directly to the ductwork. There are two sensors that are included in the accessory. Both sensors are factory set; one opens at 135° F and should be installed in the return air duct, the other opens at 240° F and should be installed in the supply duct.

***Note: This accessory can also be applied in Non-ICS applications. The wiring on the unit is the same. The unit will shut down immediately when the sensor opens.***

To reset a sensor which has opened, push and release the button protruding through the cover. See reset button. The sensor temperature must drop 25° F below the cut out point before it will reset. There are no field adjustments that can be made to the sensor; if a problem exists, the sensor must be replaced. Part Number "CNT-0637" = 135° F sensor. Part Number "CNT-0638" = 240° F sensor.




**Component Description**
BAYFRST001A

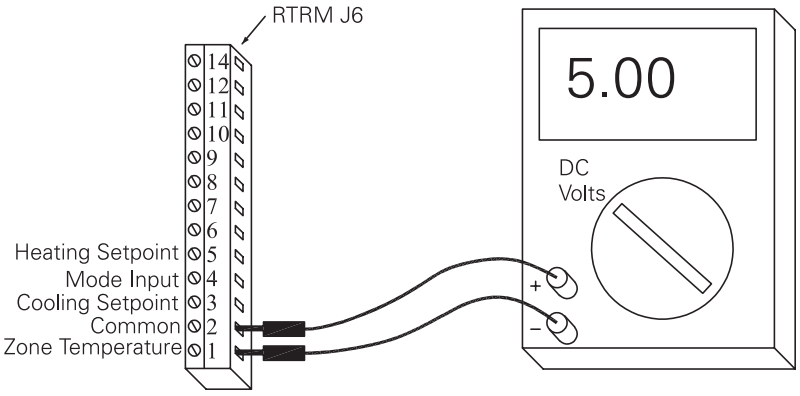
**Part Number**
CNT-0637 & CNT-0638

# ZSM Testing (Zone Temperature Input)

**BAYSENS006–11, 14, 17/AYSTAT661–664**

**Terminals to read voltage: RTRM J6-1, J6-2**

Read DC voltage with the sensor attached. If voltage does not appear to be correct, read the resistance of the circuit, then the sensor itself, to see if a problem exists in the sensor or the wiring. With the sensor not attached there should be 5.00 VDC at the terminals as shown.




| Temperature°F | Resistance (K ohms) | DC Volts | Temperature °F | Resistance (K ohms) | DC Volts |
|---|---|---|---|---|---|
| 40 | 26.097 | 3.613 | 68 | 12.435 | 2.770 |
| 41 | 25.383 | 3.585 | 69 | 12.126 | 2.739 |
| 42 | 24.690 | 3.557 | 70 | 11.827 | 2.708 |
| 43 | 24.018 | 3.528 | 71 | 11.535 | 2.677 |
| 44 | 23.367 | 3.500 | 72 | 11.252 | 2.646 |
| 45 | 22.736 | 3.471 | 73 | 10.977 | 2.616 |
| 46 | 22.123 | 3.442 | 74 | 10.709 | 2.58 |
| 47 | 21.530 | 3.412 | 75 | 10.448 | 2.554 |
| 48 | 20.953 | 3.383 | 76 | 10.194 | 2.523 |
| 49 | 20.396 | 3.353 | 77 | 9.949 | 2.493 |
| 50 | 19.854 | 3.324 | 78 | 9.710 | 2.462 |
| 51 | 19.330 | 3.294 | 79 | 9.477 | 2.432 |
| 52 | 18.821 | 3.264 | 80 | 9.250 | 2.402 |
| 53 | 18.327 | 3.233 | 81 | 9.030 | 2.372 |
| 54 | 17.847 | 3.203 | 82 | 8.815 | 2.342 |
| 55 | 17.382 | 3.173 | 83 | 8.607 | 2.312 |
| 56 | 16.930 | 3.142 | 84 | 8.404 | 2.283 |
| 57 | 16.491 | 3.111 | 85 | 8.206 | 2.253 |
| 58 | 16.066 | 3.080 | 86 | 8.014 | 2.224 |
| 59 | 15.654 | 3.050 | 87 | 7.827 | 2.195 |
| 60 | 15.253 | 3.019 | 88 | 7.645 | 2.166 |
| 61 | 14.864 | 2.988 | 89 | 7.468 | 2.137 |
| 62 | 14.486 | 2.957 | 90 | 7.295 | 2.109 |
| 63 | 14.119 | 2.926 | 91 | 7.127 | 2.080 |
| 64 | 13.762 | 2.895 | 92 | 6.963 | 2.052 |
| 65 | 13.416 | 2.864 | 93 | 6.803 | 2.024 |
| 66 | 13.078 | 2.832 | 94 | 6.648 | 1.996 |
| 67 | 12.752 | 2.801 | 95 | 6.497 | 1.969 |

**Problems to look for:**

- Miswire/short/open
- Excessive resistance in circuit (corroded or loose connection)
- Sensor inaccurate (should be +– 2F of chart)
- Moisture in sensor (becomes accurate when dry)
- Induced voltage (high voltage wires in same conduit)

**Service Tips:**

To check for induced voltage, read AC voltage to ground from each sensor wire. Should be less than 1 VAC.

# BAYSENS019B,C AYSTAT666B,C (Programmable Zone Sensor)

The BAYSENS019B, C Programmable Zone sensor is a digital display sensor that communicates to micro controls. The sensor is compatible with UCP Micro controls used with Voyager products as well as the new ReliaTel controls used certain packaged and split system products. It is also now used with Large Commercial Voyager III products. Operation of the sensor and electrical connections are the same for both UCP and ReliaTel control systems, which makes programming, operation and troubleshooting easier. For programming information, refer to literature ACC-SVN28A-EN.

**Testing the Programmable Zone Sensor (PZS)**

**Step 1.** Verify unit operation by running unit through test mode.

**Step 2.** Verify that the PZS has a normal display of time, temperature, fan and system status.

**Step 3.** For UCP Micro, disconnect wires from LTB-11 (-) and LTB-12 (+); For ReliaTel controls, disconnect wires from J6-11 and J6-12. Measure the dc voltage between terminals 11 and 12. Voltage should read between 28 to 32 vdc. If no voltage is present for UCP micro, check wiring between UCP and LTB.

**Step 4.** Reconnect wires to terminals 11 and 12. Measure the voltage between 11 and 12 again. Voltage should flash at 0.5 second rate, with a voltage value randomly changing from approximately 24 to 32 vdc.

**Step 5.** On the PZS, press the FAN button to turn the fan ON. If the fan comes on, the PZS is good; if the fan does not come on, the PZS may be defective and will need to be replaced.

***Note: The sensor will not communicate if the wrong baud rate is selected. The PZS is shipped with the baud rate set to 1200. See Option Menu setup in the literature to verify proper baud rate. The baud rate may need to be changed to 1024 for units built before 1/96.***

**Troubleshooting the Programmable Zone Sensor**

Because the PZS is a communicating sensor, troubleshooting is very limited. Steps 2 through 5 of testing the sensor are the first steps to verify. The following table will provide other troubleshooting tips for diagnosing the sensor and unit operations.

| Symptom | Probable cause and solution |
|---|---|
| Display does not come on. | Check for 24 vac on terminals 11 and 12 of the sensor. |
| No communication with unit. | Verify a varying voltage per step 2 of testing the sensor. If no voltage is present, check with wiring to unit. |
| Sensor is communicating, but unit won't run. | Check option 18 in Option Menu setup for correct baud rate. |
| Displayed zone temperature is different from actual temperature. | Follow Option Menu setup in literature to calibrate the display. |
| Zone temperature is not displayed. | Check option selection in Option Menu setup. |
| Displayed zone temperature reads "99". | Space temperature is above or below the measurable range of the sensor. |
| Displayed zone temperature reads Sh and the COOL FAIL icon is illuminated. | Verify that option 11 in Option Menu is set correctly. If correct, check the wiring from the remote sensor at terminals S1 and S2 for a shorted condition. |
| Displayed zone temperature reads oP and the COOL FAIL icon is illuminated. | Verify that option 11 in Option Menu is set correctly. If correct, check remote sensor wiring at terminals S1 and S2 for an open circuit condition. |
| Programmable sensor will not respond to keypad selections. | Check lower left corner of display for a padlock icon. If displayed, press and hold the Time (+) and (-) key until the icon goes away. |
| Fan mode is set to on, but does not run during unoccupied mode. periods. | Check option 6 in Option Menu setup for Auto selection during unoccupied |
| Buzzer indicates System Failure, Check Filter or Service is required. | Press erase key to reset filter lapse timer. Buzzer will be reset until noon of the next day if a System Failure has not been corrected. |
| Sensor will not hold override changes. | Press the HOLD TEMP button within 20 seconds after changes are made. |
| COOL FAIL flashes and unit doesn't run. Check for varying voltage on terminals | Sensor not communicating with unit. 11 and 12 at the unit. If voltage is steady at approximately 30 vdc, check for open circuit in wiring. |
| COOL FAIL + HEAT FAIL icons flash simultaneously. | Check for defective outside air sensor. Emergency input is open. (RTRM version 4.0 or greater.) |
| HEAT FAIL flashing. | A heat failure has occurred. If HP unit, the unit may be in Emergency Heat, or there is a defrost problem. |

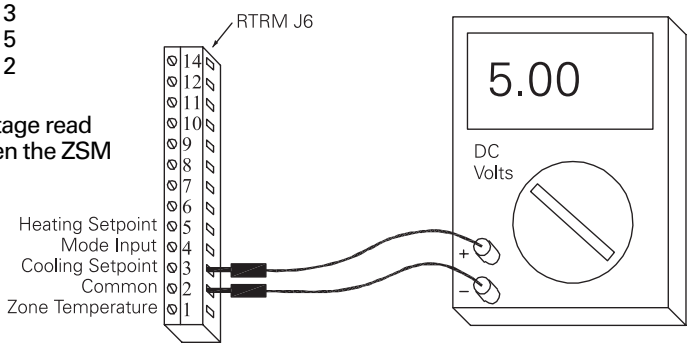
If all wiring and preliminary tests do not indicate any defects, disconnect the PZS from the wall and take to the unit, and with a short (approx. two feet) length of thermostat wire, connect the PZS and see if symptoms still exist. If not, check for thermostat wire routing in close proximity of high voltage wires and fluorescent lights.

# Setpoint/Mode Inputs (Mechanical Zone Sensor Module)

**BAYSENS006–11, 14, 17, 031A, 035A AYSTAT661–664**

| Setpoint Inputs | Read voltage here | or here |
|---|---|---|
| **Cooling setpoint** | RTRM J6-3 | ZSM terminal 3 |
| **Heating setpoint** | RTRM J6-5 | ZSM terminal 5 |
| **Common** | RTRM J6-2 | ZSM terminal 2 |

Read DC voltage with Zone Sensor Module (ZSM) attached. If voltage read does not appear to be correct, read the resistance of the circuit, then the ZSM itself, to see if a problem exists in the ZSM or the wiring. With the ZSM not attached there should be 5.00 VDC at the terminals as shown. To check for induced voltage, read AC voltage to ground from each sensor wire. Should be less than 2VAC.




| Temperature °F | Resistance (K ohms) | DC Volts | Temperature °F | Resistance (K ohms) | DC Volts |
|---|---|---|---|---|---|
| | open | 5.00 (open circuit) | 67.0 | .5584 | 1.792 |
| 40.0 | 1.0841 | 2.601 | 68.0 | .5390 | 1.751 |
| 41.0 | 1.0656 | 2.579 | 69.0 | .5195 | 1.709 |
| 42.0 | 1.0472 | 2.557 | 70.0 | .5000 | 1.667 |
| 43.0 | 1.0287 | 2.535 | 71.0 | .4805 | 1.623 |
| 44.0 | 1.0102 | 2.513 | 72.0 | .4610 | 1.578 |
| 45.0 | .9918 | 2.490 | 73.0 | .441.6 | 1.532 |
| 46.0 | .9733 | 2.466 | 74.0 | .4221 | 1.484 |
| 47.0 | .9548 | 2.442 | 75.0 | .4026 | 1.435 |
| 48.0 | .9363 | 2.418 | 76.0 | .3832 | 1.385 |
| 49.0 | .9179 | 2.393 | 77.0 | .3637 | 1.333 |
| 50.0 | .8994 | 2.368 | 78.0 | .3442 | 1.280 |
| 51.0 | .8787 | 2.338 | 79.0 | .3247 | 1.226 |
| 52.0 | .8580 | 2.309 | 80.0 | .3053 | 1.169 |
| 53.0 | .8373 | 2.278 | 81.0 | .2858 | 1.111 |
| 54.0 | .8166 | 2.247 | 82.0 | .2663 | 1.051 |
| 55.0 | .7958 | 2.216 | 83.0 | .2468 | 0.990 |
| 56.0 | .7751 | 2.183 | 84.0 | .2273 | 0.926 |
| 57.0 | .7544 | 2.150 | 85.0 | .2079 | 0.860 |
| 58.0 | .7337 | 2.116 | 86.0 | .1884 | 0.793 |
| 59.0 | .7142 | 2.083 | 87.0 | .1689 | 0.723 |
| 60.0 | .6948 | 2.050 | 88.0 | .1495 | 0.650 |
| 61.0 | .6753 | 2.015 | 89.0 | .1301 | 0.575 |
| 62.0 | .6558 | 1.980 | 90.0 | .1106 | 0.498 |
| 63.0 | .6363 | 1.944 | (shorted/no power) | | 0.000 |
| 64.0 | .6169 | 1.908 | | | |
| 65.0 | .5974 | 1.870 | | | |
| 66.0 | .5779 | 1.831 | | | |

# Setpoint/Mode Inputs (Mechanical Zone Sensor Module)

**Problems to look for:**
- Miswire/short/open
- Excessive resistance in circuit (corroded or loose connection)
- Setpoint lever inaccurate (should be +-2F of chart)
- Induced voltage (high voltage wires in same conduit)

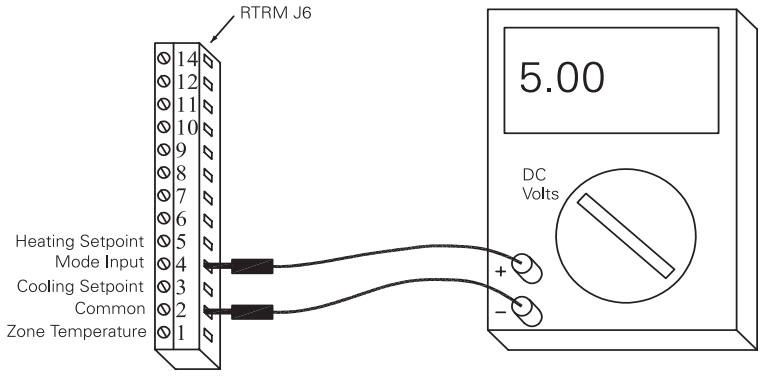
**Mode Input:**

| | | |
|---|---|---|
| **Mode Input** | **RTRM J6-4** | **ZSM terminal 4** |
| **Common** | **RTRM J6-2** | **ZSM terminal 2** |

Read DC voltage with Zone Sensor Module (ZSM) attached. If voltage read does not appear to be correct, read the resistance of the circuit, then the ZSM itself, to see if a problem exists in the ZSM or the wiring. With the ZSM not attached there should be 5.00 VDC at the terminals listed above. To check for induced voltage, read AC voltage to ground from each sensor wire. Should be less than 2VAC.

**Problems to look for:**
- Miswire/short/open
- Excessive resistance in circuit (corroded or loose connection)
- Induced voltage (high voltage wires in same conduit)

| System Switch | Fan Switch | OHms Rx1K | Volts DC+-5% |
|---|---|---|---|
| Short to common | | 0 | 0.00 |
| **OFF** | **AUTO** | 2.32 | 0.94 |
| **COOL** | **AUTO** | 4.87 | 1.64 |
| **AUTO** | **AUTO** | 7.68 | 2.17 |
| **OFF** | **ON** | 10.77 | 2.59 |
| **COOL** | **ON** | 13.32 | 2.85 |
| **AUTO** | **ON** | 16.13 | 3.08 |
| **HEAT** | **AUTO** | 19.48 | 3.30 |
| **HEAT** | **ON** | 27.93 | 3.68 |
| **EM HEAT** | **AUTO** | 35.00 | 3.88 |
| **EM HEAT** | **ON** | 43.45 | 4.06 |
| Open circuit | | | 5.00 |



# RTRM / RTOM (Temperature Inputs)

**Outdoor Air Sensor**
**Discharge Air Sensor**
**Coil Temperature Sensor**

**Terminals to read voltage:**
Outdoor Air Sensor – RTRM J8-2, J8-1
Discharge Air Sensor – RTOM J4-5, J4-4
Coil Temperature Sensor– RTRM J2-3, J2-4

***Note: These are RTRM, RTOM inputs only. Economizer inputs (MAS, RAS, OHS, RHS, $CO_2$) are in the ReliaTel Economizer inputs section.***

Read DC voltage with the sensor attached. If voltage does not appear to be correct, read the resistance of the circuit, then the sensor itself, to see if a problem exists in the sensor or the wiring. With the sensor not attached there should be 5.00 VDC at the terminals listed above.

**Service Tips:**
The second sensor terminal listed above is common. All common terminals are grounded, therefore one volt meter lead can be attached to ground for voltage tests. To check for induced voltage, read AC voltage to ground from each sensor wire. Should be less than 1 VAC.

**Problems to look for:**
- Miswire / short / open
- Excessive resistance in circuit (corroded or loose connection)
- Sensor inaccurate (should be +– 2F of chart)
- Moisture in sensor (becomes accurate when dry)
- Induced voltage (high voltage wires in same conduit)

| Temperature °F | Resistance (K ohms) | DC Volts | Temperature °F | Resistance (K ohms) | DC Volts |
|---|---|---|---|---|---|
| | open circuit | 5.000 | | | |
| -40 | 345.684 | 4.856 | -15 | 143.192 | 4.670 |
| -39 | 333.237 | 4.851 | -14 | 138.435 | 4.660 |
| -38 | 321.274 | 4.845 | -12 | 129.449 | 4.638 |
| -37 | 309.777 | 4.840 | -11 | 125.199 | 4.627 |
| -36 | 298.724 | 4.834 | -10 | 121.100 | 4.615 |
| -35 | 288.097 | 4.828 | -9 | 117.146 | 4.603 |
| -34 | 277.879 | 4.823 | -8 | 113.331 | 4.591 |
| -33 | 268.053 | 4.816 | -7 | 109.652 | 4.579 |
| -32 | 258.603 | 4.810 | -6 | 106.102 | 4.566 |
| -31 | 249.523 | 4.804 | -5 | 102.676 | 4.553 |
| -30 | 240.810 | 4.797 | -4 | 99.377 | 4.540 |
| -29 | 232.425 | 4.790 | -3 | 96.197 | 4.526 |
| -28 | 224.355 | 4.783 | -2 | 93.127 | 4.512 |
| -27 | 216.590 | 4.776 | -1 | 90.163 | 4.498 |
| -26 | 209.114 | 4.768 | 0 | 87.301 | 4.483 |
| -25 | 201.918 | 4.760 | 1 | 84.537 | 4.468 |
| -24 | 194.991 | 4.752 | 2 | 81.868 | 4.453 |
| -23 | 188.320 | 4.744 | 3 | 79.291 | 4.437 |
| -22 | 181.904 | 4.736 | 4 | 76.802 | 4.421 |
| -21 | 175.738 | 4.727 | 5 | 74.403 | 4.404 |
| -20 | 169.798 | 4.718 | 6 | 72.087 | 4.388 |
| -19 | 164.076 | 4.709 | 7 | 69.849 | 4.371 |
| -18 | 158.562 | 4.700 | 8 | 67.687 | 4.353 |
| -17 | 153.248 | 4.690 | 9 | 65.597 | 4.336 |
| -16 | 148.127 | 4.680 | 10 | 63.577 | 4.317 |

# RTRM / RTOM (Temperature Inputs)

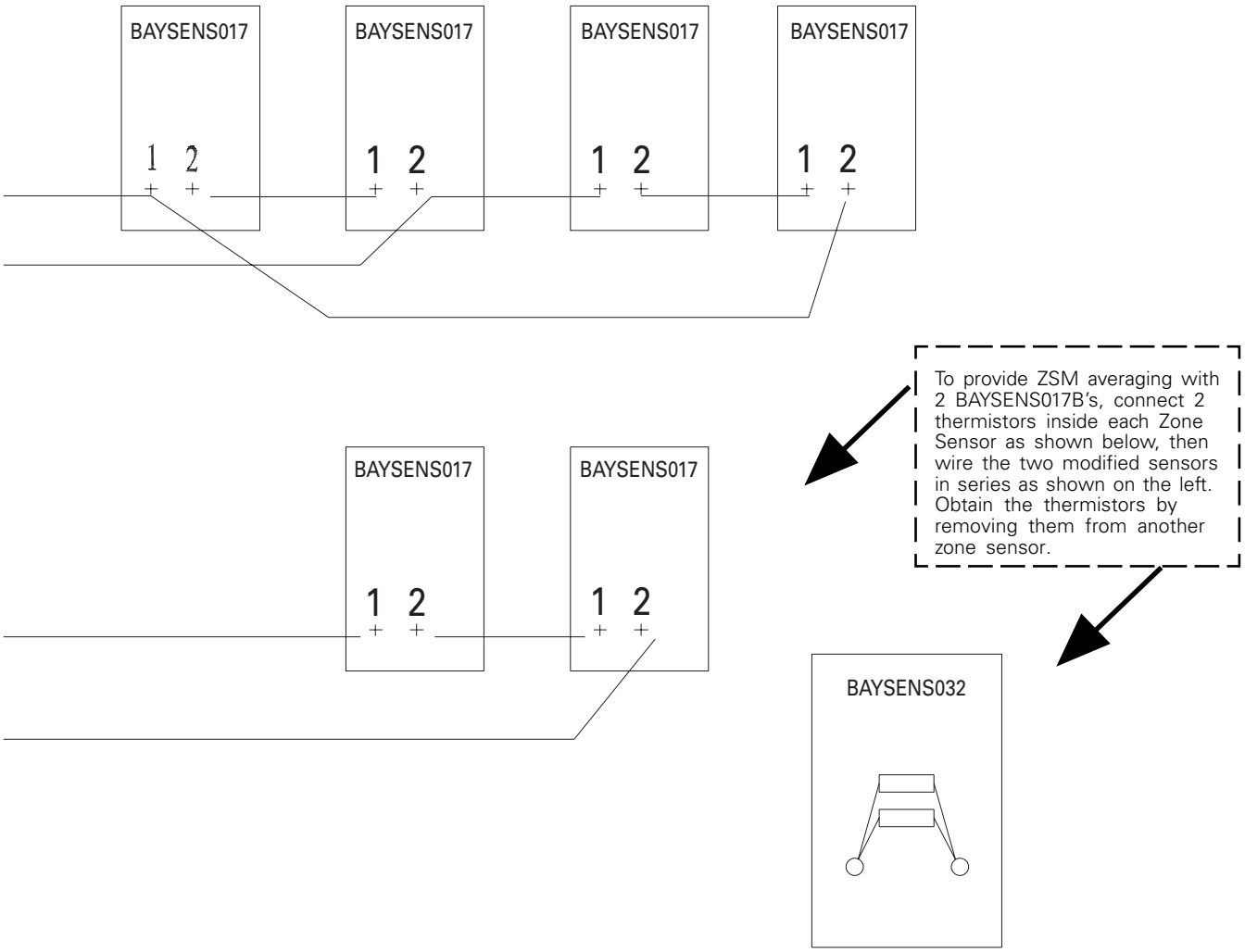
| Temperature °F | Resistance (K ohms) | DC Volts | Temperature °F | Resistance (K ohms) | DC Volts |
|---|---|---|---|---|---|
| 11 | 61.624 | 4.299 | 64 | 13.762 | 2.895 |
| 12 | 59.737 | 4.280 | 65 | 13.416 | 2.864 |
| 13 | 57.913 | 4.261 | 66 | 13.078 | 2.832 |
| 14 | 56.153 | 4.241 | 67 | 12.752 | 2.801 |
| 15 | 54.452 | 4.221 | 68 | 12.435 | 2.770 |
| 16 | 52.807 | 4.201 | 69 | 12.126 | 2.739 |
| 17 | 51.216 | 4.180 | 70 | 11.827 | 2.708 |
| 18 | 49.677 | 4.159 | 71 | 11.535 | 2.677 |
| 19 | 48.188 | 4.138 | 72 | 11.252 | 2.646 |
| 20 | 46.748 | 4.116 | 73 | 10.977 | 2.616 |
| 21 | 45.354 | 4.094 | 74 | 10.709 | 2.585 |
| 22 | 44.007 | 4.072 | 75 | 10.448 | 2.554 |
| 23 | 42.705 | 4.049 | 76 | 10.194 | 2.523 |
| 24 | 41.446 | 1.026 | 77 | 9.949 | 2.493 |
| 25 | 40.226 | 4.002 | 78 | 9.710 | 2.462 |
| 26 | 39.046 | 3.978 | 79 | 9.477 | 2.432 |
| 27 | 37.904 | 3.954 | 80 | 9.250 | 2.402 |
| 28 | 36.797 | 3.929 | 81 | 9.030 | 2.372 |
| 29 | 35.726 | 3.904 | 82 | 8.815 | 2.342 |
| 30 | 34.689 | 3.879 | 83 | 8.607 | 2.312 |
| 31 | 33.686 | 3.853 | 84 | 8.404 | 2.283 |
| 32 | 32.720 | 3.827 | 85 | 8.206 | 2.253 |
| 33 | 31.797 | 3.801 | 86 | 8.014 | 2.224 |
| 34 | 30.903 | 3.775 | 87 | 7.827 | 2.195 |
| 35 | 30.037 | 3.749 | 88 | 7.645 | 2.166 |
| 36 | 29.198 | 3.722 | 89 | 7.468 | 2.137 |
| 37 | 28.386 | 3.695 | 90 | 7.295 | 2.109 |
| 38 | 27.599 | 3.668 | 91 | 7.127 | 2.080 |
| 39 | 26.836 | 3.641 | 92 | 6.963 | 2.052 |
| 40 | 26.097 | 3.613 | 93 | 6.803 | 2.024 |
| 41 | 25.383 | 3.585 | 94 | 6.648 | 1.996 |
| 42 | 24.690 | 3.557 | 95 | 6.497 | 1.969 |
| 43 | 24.018 | 3.528 | 96 | 6.350 | 1.942 |
| 44 | 23.367 | 3.500 | 97 | 6.207 | 1.915 |
| 45 | 22.736 | 3.471 | 98 | 6.067 | 1.888 |
| 46 | 22.123 | 3.442 | 99 | 5.931 | 1.861 |
| 47 | 21.530 | 3.412 | 100 | 5.798 | 1.835 |
| 48 | 20.953 | 3.383 | 101 | 5.668 | 1.809 |
| 49 | 20.396 | 3.353 | 102 | 5.543 | 1.783 |
| 50 | 19.854 | 3.324 | 103 | 5.420 | 1.757 |
| 51 | 19.330 | 3.294 | 104 | 5.300 | 1.732 |
| 52 | 18.821 | 3.264 | 105 | 5.184 | 1.707 |
| 53 | 18.327 | 3.233 | 106 | 5.070 | 1.682 |
| 54 | 17.847 | 3.203 | 107 | 4.959 | 1.658 |
| 55 | 17.382 | 3.173 | 108 | 4.851 | 1.633 |
| 56 | 16.930 | 3.142 | 109 | 4.745 | 1.609 |
| 57 | 16.491 | 3.111 | 110 | 4.642 | 1.585 |
| 58 | 16.066 | 3.080 | 111 | 4.542 | 1.562 |
| 59 | 15.654 | 3.050 | 112 | 4.444 | 1.539 |
| 60 | 15.253 | 3.019 | 113 | 4.349 | 1.516 |
| 61 | 14.864 | 2.988 | 114 | 4.256 | 1.493 |
| 62 | 14.486 | 2.957 | 115 | 4.165 | 1.470 |
| 63 | 14.119 | 2.926 | | | |

# RTRM / RTOM (Temperature Inputs)

| Temperature °F | Resistance (K ohms) | DC Volts |
|---|---|---|
| 116 | 4.076 | 1.448 |
| 117 | 3.990 | 1.426 |
| 118 | 3.906 | 1.405 |
| 119 | 3.824 | 1.383 |
| 120 | 3.743 | 1.362 |
| 121 | 3.665 | 1.341 |
| 122 | 3.589 | 1.321 |
| 123 | 3.514 | 1.301 |
| 124 | 3.442 | 1.281 |
| 125 | 3.371 | 1.261 |
| 126 | 3.302 | 1.241 |
| 127 | 3.234 | 1.222 |
| 128 | 3.169 | 1.204 |
| 129 | 3.104 | 1.185 |
| 130 | 3.041 | 1.166 |
| 131 | 2.980 | 1.148 |
| 132 | 2.919 | 1.130 |
| 133 | 2.861 | 1.113 |
| 134 | 2.804 | 1.095 |
| 135 | 2.748 | 1.078 |
| 136 | 2.693 | 1.061 |
| 137 | 2.640 | 1.045 |
| 138 | 2.587 | 1.028 |
| 139 | 2.536 | 1.012 |
| 140 | 2.486 | 0.996 |
| 141 | 2.438 | 0.981 |
| 142 | 2.390 | 0.965 |
| 143 | 2.343 | 0.950 |
| 144 | 2.298 | 0.935 |
| 145 | 2.253 | 0.920 |
| 146 | 2.210 | 0.906 |
| 147 | 2.167 | 0.891 |
| 148 | 2.125 | 0.877 |
| 149 | 2.085 | 0.863 |
| 150 | 2.044 | 0.849 |
| 151 | 2.006 | 0.836 |
| 152 | 1.967 | 0.823 |
| 153 | 1.930 | 0.810 |
| 154 | 1.894 | 0.797 |
| 155 | 1.859 | 0.784 |
| 156 | 1.823 | 0.772 |
| 157 | 1.789 | 0.759 |
| 158 | 1.756 | 0.747 |
| 159 | 1.723 | 0.736 |
| 160 | 1.691 | 0.724 |
| 161 | 1.659 | 0.712 |
| 162 | 1.629 | 0.701 |
| 163 | 1.599 | 0.690 |
| 164 | 1.570 | 0.679 |
| 165 | 1.541 | 0.688 |
| 166 | 1.512 | 0.658 |
| 167 | 1.485 | 0.647 |
| 168 | 1.458 | 0.637 |
| 169 | 1.432 | 0.627 |
| 170 | 1.406 | 0.617 |
| 171 | 1.380 | 0.607 |
| 172 | 1.356 | 0.598 |
| 173 | 1.331 | 0.588 |
| 174 | 1.308 | 0.579 |
| 175 | 1.284 | 0.570 |
| 176 | 1.261 | 0.561 |
| 177 | 1.239 | 0.552 |
| 178 | 1.217 | 0.543 |
| 179 | 1.196 | 0.535 |
| 180 | 1.174 | 0.526 |
| 181 | 1.154 | 0.518 |
| 182 | 1.133 | 0.510 |
| 183 | 1.113 | 0.502 |
| 184 | 1.094 | 0.494 |
| 185 | 1.076 | 0.487 |
| 186 | 1.057 | 0.479 |
| 187 | 1.038 | 0.471 |
| 188 | 1.020 | 0.464 |
| 189 | 1.003 | 0.457 |
| 190 | .986 | 0.450 |
| 191 | .969 | 0.443 |
| 192 | .952 | 0.436 |
| 193 | .397 | 0.429 |
| 194 | .920 | 0.422 |
| 195 | .905 | 0.416 |
| 196 | .890 | 0.410 |
| 197 | .875 | 0.403 |
| 198 | .860 | 0.397 |
| 199 | .846 | 0.391 |
| 200 | .831 | 0.385 |
| | Shorted or no power | 0 |

# Zone Sensor Averaging

In some applications, 1 zone sensor does not give a good representation of zone temperature. The internal thermistors, 10K ohm resistance @ 25C/77F, can be wired as shown below in order to provide an average input to the mechanical or programmable Zone Sensor Module (BAYSENS006-11/AYSTAT661-663, BAYSENS019*/AYSTAT666*). If using a Programmable ZSM, the remote sensor wiring must be twisted/shielded. Connect the shield to terminal J6-11.

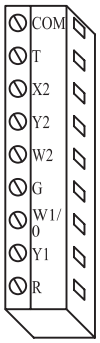


# Operation with a Conventional Thermostat

The ReliaTel module has conventional thermostat connections as well as Zone Sensor Module connections. When a conventional thermostat is controlling the unit, operation differs as follows.

- Supply Air Tempering feature is not available. If outdoor air is being introduced through the equipment, discharge air temperature may be cold when not actively heating.
- Proportional Integral (PI) control is not available.
- Zone Sensor Diagnostics are only available on the RTRM module on the J6 terminals, instead of at the Zone Sensor in the space.
- Intelligent Fall-Back is not available. If a failure occurs in the device controlling the equipment, operation will cease.
- Heat Pump Smart Recovery and Smart Staging is not available. Heat Pump operation becomes more costly unless the generic control being applied can accomplish this.
- Remote Sensing Capabilities are not available on most mechanical thermostats.
- Space Temperature Averaging capabilities are not available on most mechanical thermostats.
- 27½ to 50 VAV - Conventional thermostat input terminals are inactive.
- Built in Night Set Back and Unoccupied Functions function differently with a conventional mechanical thermostat.
- A built-in algorithm which allows for automatic reset of the discharge air temperature while economizing is not available.

The terminal strip for attaching the thermostat wires is located on the RTRM module in the control compartment.
The purpose of each terminal is discussed in the next section.



# Operation with a Conventional Thermostat

Customers occasionally require operation with a conventional thermostat rather than a zone sensor. In some cases there is a preference for a specific thermostat model, and in others there is reluctance to adopt newer technology that may not be as well understood as conventional thermostats. In addition, non-Trane Building Controllers typically provide an interface to HVAC equipment based on a conventional thermostat interface. Units applied with this type of controller need to accept conventional thermostat inputs.

Conventional thermostat signals represent direct calls for unit functions. In their simplest applications, thermostat contacts directly control contactors or other load switching devices. This function provides inputs for the thermostat signals and processing to enhance reliability and performance. Compressor protection and reliability enhancement functions (HPC, LPC, Minimum On/Off timers, etc.). All operate the same whether applied with zone sensors or a conventional thermostat. Logic is also provided to cause appropriate unit functions when inappropriate thermostat signals are provided. Simultaneous calls for heating and cooling will be ignored, and the fan will be turned on with a call for heating or cooling even if the fan request is not detected.

If the thermostat is immediately changed from a heating to a cooling call, or vice versa, there will be a five minute delay before the new call will initiate.

**Thermostat signals are as follows:**

| | |
|---|---|
| R | 24VAC power to thermostat |
| Y1 | Call for compressor 1 or first stage cooling |
| Y2 | Call for compressor 2 or 2nd stage cooling |
| G | Call for supply fan |
| W1 | Call for heat 1 |
| W2 | Call for heat 2 |

Heat pump only:

| | |
|---|---|
| X2 | Call for emergency heat |
| O | Switchover valve On = cooling, Off = heating |
| T | Bias for heat anticipation for those mechanical thermostats that use this function |

**Conventional thermostat – Gas/ Electric, Electric Heat:**

| **Input/connection** | **Function when energized*:*** |
|---|---|
| **G** (fan) | Fan runs continuously except during unoccupied mode (see next page) |
| **Y1** (compressor 1 or economizer) operates | Compressor #1 runs or economizer |
| **Y2** (compressor 2 or compressor 1 while economizing) | Compressor #2 also runs, or #1 compressor runs while economizing |
| **W1** (gas / electric heat first stage) | 1st stage heat |
| **W2** (gas / electric heat 2nd stage) | 2nd stage heat (if available) |

**Conventional thermostat – Heat Pump**

| **Input/connection** | **Function when energized** |
|---|---|
| **Cooling mode:** | |
| **G** (fan) | Fan runs continuously except during unoccupied mode (see next page) |
| **O** (reversing valve during cooling) | Reversing valve in cool mode |
| **Y1 + O** (first stage cooling) | Compressor #1 runs or economizer operates |
| **Y1 +Y2 + O** (2nd stage cool) | Compressor #2 also runs, or #1 compressor runs while economizing. |

# Operation with a Conventional Thermostat

**Heating mode:**

| | |
|---|---|
| **G** (fan) | Fan runs continuously except during unoccupied mode (see below) |
| **Y1** (both compressors 1st stage heat) | Both compressors run |
| **Y2** (during heating – nothing happens) | No change |
| **W2** (electric heat 2nd stage) | 2nd stage (electric) heat |
| **X2** (electric heat only) | Electric heat only – no compressors |

**T** (provides heat anticipation signal for those mechanical thermostats that use this feature. If the thermostat used does not have a "T" terminal, disregard this terminal.

Unoccupied mode: If the thermostat being used is programmable, it will have its own strategy for unoccupied mode and will control the unit directly. If a mechanical thermostat is being used, a field applied time clock with relay contacts connected to J6-11 and J6-12 can initiate an unoccupied mode as follows:

| | |
|---|---|
| Contacts open: | Normal occupied operation. |
| Contacts closed: | Unoccupied operation as follows - Fan in auto mode regardless of fan switch position. Economizer closes except while economizing regardless of minimum position setting. |

**Cooling/Economizer Operation:**
If unit does not have an economizer, the Cool/Econ Stage 1 and Stage 2 will call directly for mechanical cooling (compressor) stages. If the unit has an economizer, the Cool/Econ stages will function as follows.

***Cooling/Economizer Operation with Thermostat***

| OK to Economize? | Thermostat Y1 | Call for Thermostat Y2 | Economizer Cooling | Compressor Staging Request |
|---|---|---|---|---|
| No | On | Off | Inactive | Compressor Output 1 |
| No | Off | On | Inactive | Compressor Output 2 |
| No | On | On | Inactive | Compressor Outputs 1 & 2 |
| Yes | On | Off | Active | Off |
| Yes | Off | On | Active | Off |
| Yes | On | On | Active | Compressor Output 1 |

Notes:
40 to 50 ton CV only
This unit has 3 stages of cooling if using a zone sensor or binary inputs as shown above.
If using a conventional thermostat it has 2 stages as follows:

Y1 = 1st stage

Y1 +Y2 = 3rd stage

VAV
Thermostat inputs are ignored on VAV units.

# COMM3/4 Interface Operation & Troubleshooting

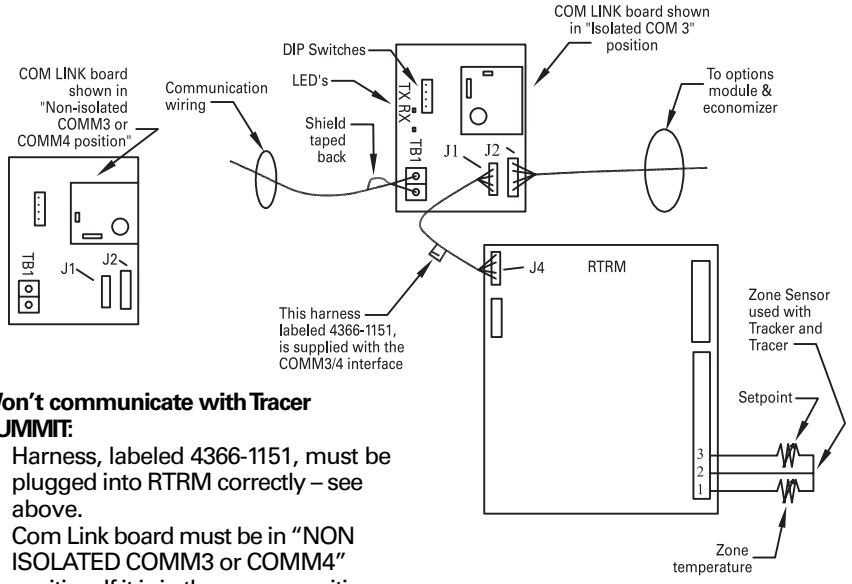
**Wiring:**
The COMM3/4 board communicates with the RTRM via the MODBUS link using the harness, labeled 4366-1151. The connections to the board are shown below.
Communication wires must be twisted/shielded as specified by the BAS system being applied. Do not attach the shield to the COMM3/4 board. It must be taped back to prevent it from touching the unit.

**LED's:**
Amber receive (RX) LED: Blinks whenever communication is occurring with any device. This tells the service technician that the BAS system is communicating or trying to communicate with other devices as well as this one.
Green transmit (TX) LED: Blinks once every several seconds, sometimes up to 45 seconds between blinks, when the unit is sending data to the BAS system. This tells the service technician that this unit is communicating information to the BAS system. When the TX LED is blinking, the unit is communicating.

**Communication problems:**

**Won't communicate with Tracker**

**3-25 Ton only**
- Harness, labeled 4366-1151, must be plugged into RTRM correctly – see previous page.
- Com Link board must be in "ISOLATED COM 3" position. If it is in the wrong position or not installed, the unit will not communicate.
- Each unit must have a unique address by setting the DIP switches according to the IOM. If 2 units have the same address, neither will communicate. If the unit has a DIP switch setting other than the ones specified in the IOM, Tracker will not recognize it.
- Once the unit communicates with Tracker, the Tracker panel will automatically recognize the unit.
- Resistor missing at last unit in daisy chain (depending on length of line run).




**Won't communicate with Tracer SUMMIT:**
- Harness, labeled 4366-1151, must be plugged into RTRM correctly – see above.
- Com Link board must be in "NON ISOLATED COMM3 or COMM4" position. If it is in the wrong position or not installed, the unit will not communicate.
- Each unit must have a unique address by setting the DIP switches according to the IOM. If 2 units have the same address, neither will communicate. If the unit has a DIP switch setting other than the ones specified in the IOM, Tracer will not recognize it.
- Once the unit communicates with Tracer, the Tracer panel will automatically recognize the unit.

**Won't communicate with VariTrac CCP zoning system:**
- Harness, labeled 4366-1151, must be plugged into RTRM correctly – see above.
- Com Link board must be in "NON ISOLATED COMM3 or COMM4" position. If it is in the wrong position or not installed, the unit will not communicate.

**VariTrac I Comfort Manager and VariTrac II Center Control Panel:**
- The DIP switches must all be in the ON position. If not, the VariTrac CCP will not recognize it.
- The communication wires must be in the same daisy chain link as the dampers.
- VariTrac III central control panel (optional touch screen) — All DIP switches must be in the off position. If not, the VariTrac CCP will not recognize it.

**Communicates but will not run, even in TEST mode:**
- Emergency stop input is open (RTRM 3J1-12).

**Communicates but will not run; fan (but not heating or cooling) runs in TEST mode for 40 seconds only.**

**3-25 Tons**
- Fan proving circuit (RTOM 5J7-6) is closed; should open when fan is on. If not, the fan will run in TEST mode for 40 seconds and then stop.

**27½-50 Tons**
- Fan proving circuit (RTOM 5J7-6) is opened; should close when fan is on. If not, the fan will run in TEST mode for 40 seconds and then stop.

**Communicates but will not run compressor(s); fan and heating run in TEST mode:**
- Compressor disable circuit(s) (RTRM 3J1-8, 3J3-2) open due to loss of charge or LTB jumper removal.

**Communicates but will not run compressors, yet everything runs in TEST mode:**
- FROSTAT circuit (RTOM 5J7-2) is closed; should open when indoor coil is frost free. There is no diagnostic output when this occurs.
- 27.5-50 Tons VariTrac CCP with constant volume unit with bypass VAV: Unit must have a discharge air sensor installed at RTOM J4-4, J4-5.

# Direct Spark Ignition Control (Texas Instruments)

This microprocessor based, communicating solid state device provides gas valve control, proof of ignition, ignition retries, 1 hour reset, operation of the inducer and diagnostics through an LED as well as communication to the refrigeration module. Inputs to the control include a pressure switch, rollout switch and limit switch as well as a flame proving circuit. This device takes control of the ignition, timings related to the ignition cycle, and supervision of the gas components.

The RTRM controls all functions via a MODBUS communication link.
The remote flame sensor is located on the top burner which ensures that all burners are lit. Field measured flame sensor voltage can vary significantly due to the construction of typical voltmeters used.
The control has a 20 second pre-purge cycle as well as a 60 second inter-purge between cycles should a flame not be established on the first try.

**Ignition Module Specifications**

| | |
|---|---|
| Voltage range | 18-32 VAC, 50/60Hz |
| Power consumption | 350mA @ 24vac |
| Spark Voltage | 25,000 volts max @ 10-13 mJ |
| Flame sense voltage | Nominal 90Vrms |
| Flame sense signal | Nominal 4.5 micro amps, minimum 1.2 micro amps |
| Pre-purge | 20 seconds |
| Post-purge | 5 Seconds |
| Inter-purge | 60 seconds |
| Flame establishment period | 2 to 7 seconds |
| Flame failure response time | 0.8 seconds |
| Loss of flame lockout | 3 tries, locks out after 3rd try |
| Lockout reset | Interrupt power for 3 seconds minimum |
| Auto reset | 1 hour |
| Loss of communication lockout (with RTRM) | 10 seconds |

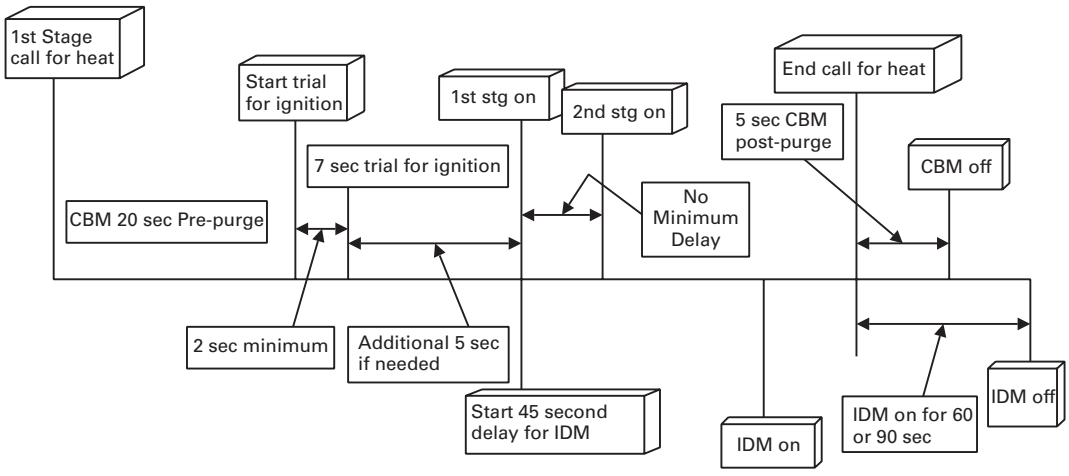
**Ignition Module Diagnostics**
The ignition module has a green LED for diagnostics:

—Steady light ..... Module is powered up, but no active call for heat.
—Blinking at continuous steady rate ..... Active call for heat.
—One blink ..... Loss of communication.
—Two blinks ..... System lockout (failure to ignite, no spark, low/no gas pressure, etc.
—Three blinks ..... Pressure switch (no vent air flow, bad CBM, closed at initial call for heat). Auto reset.
—Four blinks ..... High limit (excessive heat in combustion chamber, low airflow). Auto reset.
—Five blinks ..... Flame sensed and gas valve not energized or flame sensed and no call for heat.
—Six blinks ..... Flame rollout (CBM failure, incorrect gas pressure, incorrect primary air). *Requires manual reset of the switch.*
—ReliaTel module will communicate a heat fail diagnostic back to the RTRM.

# Direct Spark Ignition Control (Sequence of Operation)

**1-stage units**
Ignition control (IGN) runs a self check (including verification that the gas valve is de-energized). IGN checks the high limit switch (TCO 1) for closed contacts, the pressure switch (PS) for open contacts, flame rollout (FR) for closed contacts. IGN energizes inducer blower. When PS closes, 20 second pre-purge begins. After 20 seconds, the IGN energizes the spark and gas valve at the same time. The spark will stay energized for at least 2 seconds attempting to establish flame. If a flame is not established, the spark will continue up to 7 seconds. Once a flame is established, spark is de-energized and indoor blower motor (IBM) timing begins. 45 seconds later, the RTRM energizes the IBM. When the zone sensor or thermostat is satisfied, the gas valve is de-energized, the inducer runs for 5 seconds then stops (post-purge), and the IBM runs for 60 seconds then stops unless being requested to run continuously.

**2-stage units**
Ignition control (IGN) runs a self check (including verification that the gas valve is de-energized). IGN checks the high limit switches (TCO 1 &TCO 2) for closed contacts, the pressure switch (PS) for open contacts, flame rollout (FR) for closed contacts.
IGN energizes inducer blower on high speed. When PS closes, 20 second (15 seconds on high, 5 seconds on low) pre-purge begins. After 20 seconds, the IGN energizes the spark and gas valve at the same time. The spark will stay energized for at least 2 seconds attempting to establish flame. If a flame is not established, the spark will continue up to 7 seconds. Once a flame is established, spark is de-energized and indoor blower motor (IBM) timing begins. 45 seconds later, the RTRM energizes the IBM. If deviation from setpoint is great enough, there is no minimum delay before 2nd stage is energized. When the zone sensor or thermostat is satisfied, the gas valve is de-energized, the inducer runs for 5 seconds then stops (post-purge), and the IBM runs for 60 seconds then stops unless being requested to run continuously.



# ReliaTel Hot Surface Ignition Control (Sequence of Operation)

This microprocessor base, communicating solid state device provides gas valve control, proof of ignition, ignition retries, one hour reset, operation of the inducer and diagnostics through an LED, as well as communication to the refrigeration module via a MODBUS. Inputs to the control include high limits and flame sensor operation. Unlike the 3 through 10 ton units that use direct spark ignition, there is no combustion fan proving switch or flame rollout. This device takes control of the ignition, timings related to the ignition cycle and supervision of the gas components.

**Ignition Module Specifications**

| | |
|---|---|
| Voltage range | 18-32 vac, 50/60 Hz |
| Ignitor voltage | 115vac, 50/60 Hz |
| Flame sense current | 4.5 microamps (nominal), 1 microamp minimum |
| Pre-purge | 45 sec |
| Flame establishment period | 2 sec min, 7 sec max |
| Flame failure response time | 0.8 sec or less |
| Loss of flame lockout | 3 tries, locks out after 3rd try |
| Lockout reset | Interrupt power for 3 seconds minimum |
| Auto reset | 1 hour |
| Loss of communication lockout (with RTRM) | 10 sec |

**Ignition Control Module Diagnostics**

There is a green LED located on the ignition module. The table below lists the diagnostics and the status of the LED during the various operating states.

Any time the Ignition module is powered, the LED will be lit to provide status of the ignition system. At initial power-up, the LED will flash for one second.

| | |
|---|---|
| Steady OFF | No power/ Internal failure |
| Steady ON | Normal power-up, with no heat call. |
| Slow flash rate | Normal call for heat, ¾ second on, ¼ second off. |
| Fast flash rate | Used for error indication only |

**Error Code Flashes-**

| | |
|---|---|
| One flash | Communication loss between RTRM and IGN |
| Two flashes | System lockout; failed to detect or sustain flame |
| Three flashes | Not used |
| Four flashes | High limit switch open |
| Five flashes | Flame sensed and gas valve not energized; or flame sensed and no call for heat |

The pause between groups of flashes is approximately two seconds.

# ReliaTel Hot Surface Ignition Control (Sequence of Operation)

The 12½ through 25 ton packaged units use a drum and tube heat exchanger with a negative pressure gas valve and hot surface ignition. This design is the same as was used with the UCP micro controls, but the control circuitry for ignitions has changed to take advantage of ReliaTel MODBUS communications.

When the system switch is set to the "Heat" position and the zone temperature falls below the heating setpoint, a heat cycle is initiated when the RTRM communicates ignition information to the ignition module (IGN).

The IGN runs a self-check (including verification that the gas valve is de-energize). IGN checks the high-limit switches (TC01 &TCO2) for normally closed contacts. With 115 vac supplied to the ignition module (IGN), the hot surface ignitor probe (IP) is preheated for approximately 45 seconds. The gas valve (GV) is energized for approximately 7 seconds for trial ignition to ignite the burner. Once the burner is ignited, the hot surface ignition probe (IP) is de-energized by the ignition module and then functions as the flame sensor. The unit initially fires on high heat, but after approximately 60 seconds, if no additional heating is required, the ignition module will drop back to low heat.

When the fan selection switch is set to the "AUTO" position, the RTRM energizes the indoor fan relay (F) approximately 30 seconds after initiating the heating cycle to start the indoor fan motor (IDM).

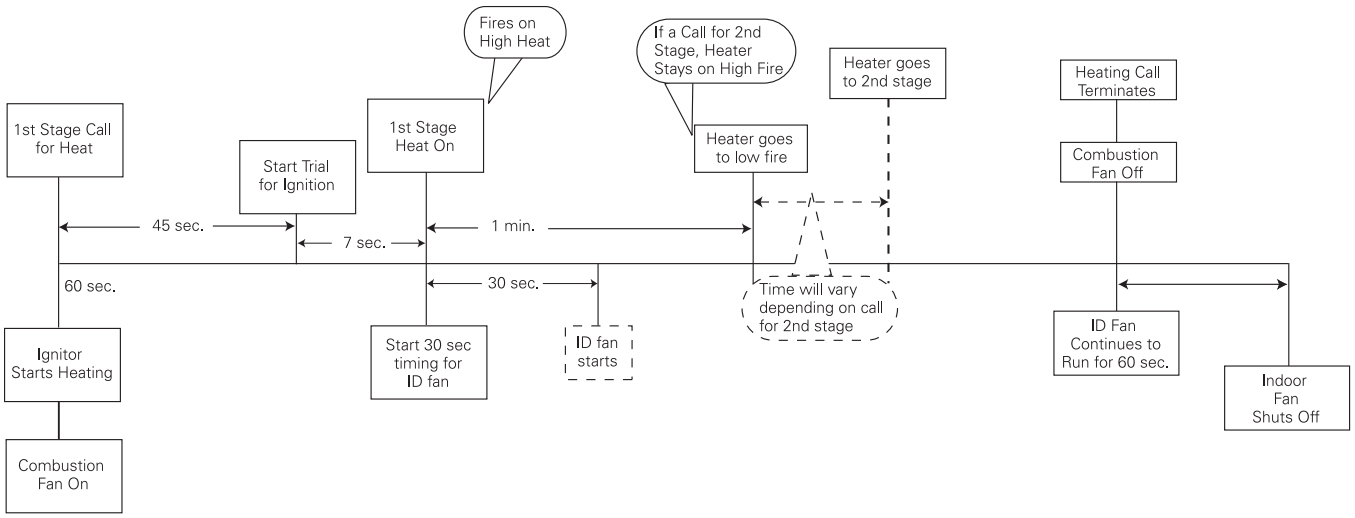
If the burner fails to ignite, the ignition module will attempt two more ignition cycles before locking out. The green LED will indicate a lockout by two fast flashes. An ignition lockout can be reset by:

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, or
3. Allowing the ignition control module to reset automatically after one hour.

When the RTRM is communicating with the ignition module (IGN), the MODBUS voltage can be measured at the 3J5 plug, pins 3 (negative) and 4 (positive).

The voltage will be flashing at approximately 10.7 to -9.6 vdc at a rate of once every three seconds. If the 3J5 plug is disconnected, the measured voltage at pins 3 and 4 on the RTRM will be approximately 10.5 to 11.2 vdc and will be flashing.

Flame current measurements can also be made at two pins on the ignition module labeled "FLAME CHECK" located at the bottom of the module. Flame current can be measured with a DC voltmeter. One volt dc equals one microamp of flame current (1vdc = 1mA)



# 3-5 Tons Gas Heat Specifications — Low Heat

| Model Number Digit18 =(B,C) Denotes Through the Base Gas | Y#C036A#L | Y#C048A#L | YSC060A#L | YHC060A#L |
|---|---|---|---|---|
| Unit Size (Tonnage) | 3 | 4 | 5 | 5 |
| Cabinet Size | A | A | A | B |
| Input (BTUh) | 60000 | 60000 | 60000 | 60000 |
| Output (BTUh) | 48000 | 48000 | 48000 | 48000 |
| Minimum Input (BTUh) | 60000 | 60000 | 60000 | 60000 |
| High Altitude Maximum Input (BTUh) | 54000 | 54000 | 54000 | 54000 |
| High Altitude Minimum Input (BTUh) | 43200 | 43200 | 43200 | 43200 |
| Temperature Rise Range (F) | 25-55 | 15-45 | 10-40 | 10-40 |
| Maximum Outlet (F) | 180 | 180 | 180 | 180 |
| Maximum External Static (in. w.c.) | 0.2 | 0.2 | 0.2 | 0.2 |
| NG Orifice Drill (0-2000ft.) | 38 | 38 | 38 | 38 |
| Maximum Gas Supply Pressure (in. w.c.) | 14 | 14 | 14 | 14 |
| Minimum Gas Supply Pressure (in. w.c.) | 4.5 | 4.5 | 4.5 | 4.5 |
| Manifold Pressure (in. w.c.) | 3.3 | 3.3 | 3.3 | 3.3 |
| Maximum Input (BTUh) | 60000 | 60000 | 60000 | 60000 |
| LP Orifice Drill # | 52 | 52 | 52 | 52 |
| Burner Insert Inside Diameter (in.) | 0.6 | 0.6 | 0.6 | 0.6 |
| Air Orifice Diameter (in.) | 1.281 | 1.281 | 1.281 | 1.281 |
| TCO1 High Limit Value (F) | 170 | 170 | 170 | 155 |
| Rate Per PRI Tube (BTUh) | 30000 | 30000 | 30000 | 30000 |
| Number of Primary Tubes | 2 | 2 | 2 | 2 |
| Number of Secondary Tubes | 2 | 2 | 2 | 2 |
| Final Restrictor Height (in.) (If Used) | | | | |
| Turbulator Length (in.) (If Used) | 12 | | | 12 |
| TCO2 High Limit Value (F) | 120 | 120 | 120 | 120 |

Notes:
The primary tubes are constructed of .049" minimum T1 40 Aluminized Steel, 2.25" OD, 29.8" long.
All Y*036-060 units will use a FASCO 7021-11054 combustion blower as described in the report.
All Y*036-060 units will use a 240 F Flame Rollout device as described in the report.
All Y*036-060 units will use a 120 F Fan Limit as described in the report.
All Y*36-060 units will be factory set for high speed indoor fan.

# 3-5 Tons Gas Heat Specifications — Medium Heat

| Model # Digit 18 =(B,C)<br>Denotes Through the Base Gas | Y*C036A*M | Y*C048A*M | YSC060A*M | YHC060A*M |
|---|---|---|---|---|
| Unit Size (Tonnage) | 3 | 4 | 5 | 5 |
| Cabinet Size | A | A | A | B |
| Input (BTUh) | 80000 | 80000 | 80000 | 80000 |
| Output (BTUh) | 64000 | 64000 | 64000 | 64000 |
| Minimum Input (BTUh) | 80000 | 80000 | 80000 | 80000 |
| High Altitude Maximum Input (BTUh) | 72000 | 72000 | 72000 | 72000 |
| High Altitude Minimum Input (BTUh) | 57600 | 57600 | 57600 | 57600 |
| Temp Rise Range (F) | 35-65 | 20-50 | 15-45 | 15-45 |
| Maximum Outlet (F) | 180 | 180 | 180 | 200 |
| Maximum External Static (in. w.c.) | 0.2 | 0.2 | 0.2 | 0.2 |
| NG Orifice Drill (0-2000 ft) | #32 | #32 | #32 | #32 |
| Maximum Gas Supply Pressure (in.w.c.) | 14 | 14 | 14 | 14 |
| Minimum Gas Supply Pressure (in.w.c) | 4.5 | 4.5 | 4.5 | 4.5 |
| Manifold Pressure (in.w.c.) | 3.3 | 3.3 | 3.3 | 3.3 |
| Maximum Input (BTUh) | 80000 | 80000 | 80000 | 80000 |
| LP Orifice Drill # | 50 | 50 | 50 | 50 |
| Burner Insert inside Diameter (in.) | 0.6 | 0.6 | 0.6 | 0.6 |
| Air Orifice Diameter (in.) | 1.593 | 1.593 | 1.593 | 1.593 |
| TCO1 High Limit Value (F) | 220 | 170 | 170 | 155DF / 170 HZ |
| Rate Per PRI Tube (BTUh) | 40000 | 40000 | 40000 | 40000 |
| Number of Primary Tubes | 2 | 2 | 2 | 2 |
| Number of Secondary Tubes | 3 | 3 | 3 | 3 |
| Final Restrictor Height (in.) (If Used) | 0.375 | | | |
| Turbulator Lenght (in.) (If Used) | 12 | 12 | 12 | 12 |
| TCO2 High Limit Value (F) | 120 | 120 | 120 | 120 |

Notes:
The primary tubes are constructed of .049" minimum T1 40 Aluminized Steel, 2.25" OD, 29.8" long.
All Y*036-060 units will use a FASCO 7021-11054 combustion blower as described in the report.
All Y*036-060 units will use a 240 F Flame Rollout device as described in the report.
All Y*036-060 units will use a 120 F Fan Limit as described in the report.
All Y*36-060 units will be factory set for high speed indoor fan.

# 3-5 Tons Gas Heat Specifications — High Heat

| Model Number Digit 18 =(B,C) Denotes Through the Base Gas | Y#C036A#H | Y#C048A#H | Y#C060A#H |
|---|---|---|---|
| Unit Size (Tons) | 3 | 4 | 5 |
| Cabinet Size | B | B | B |
| Input (BTUh) | 120000 | 120000 | 130000 |
| Output (BTUh) | 96000 | 96000 | 108000 |
| Minimum Input (BTUh) | 120000 | 120000 | 130000 |
| High Altitude Maximum Input (BTUh) | 108000 | 108000 | 117000 |
| High Altitude Minimum Input (BTUh) | 86400 | 86400 | 97200 |
| Temperature Rise Range (F) | 55-85 | 40-70 | 35-65 |
| Maximum Outlet (F) | 200 | 200 | 200 |
| Maximum External Static (in. w.c.) | 0.2 | 0.2 | 0.2 |
| NG Orifice Drill (0-2000FT) | #32 | #32 | 31 |
| Maximum Gas Supply Pressure (in.w.c.) | 14 | 14 | 14 |
| Minimum Gas Supply Pressure (in. w.c.) | 4.5 | 4.5 | 4.5 |
| Manifold Pressure (in. w.c.) | 3.3 | 3.3 | 3.3 |
| Maximum Input (BTUh) | 120000 | 120000 | 130000 |
| LP Orifice Drill # | 50 | 50 | 49 |
| Burner Insert Inside Diameter (in.) | 0.6 | 0.6 | 0.7 |
| Air Orifice Diameter (in.) | 2.25 | 2.25 | 2.75 |
| TCO1 High Limit Value (F) (Df/Hz) | 190F/210F | 180F/220F | 170F/200F |
| Rate Per PRI Tube (BTUh) | 40000 | 40000 | 43000 |
| Number of Primary Tubes | 3 | 3 | 3 |
| Number of Secondary Tubes | 4 | 4 | 4 |
| Final Restrictor Height (in.) (If Used) | 0.25 | 0.25 | |
| Turbulator Length (in.) (If Used) | 12 | 12 | 12 |
| TCO2 High Limit Value (F) | 120 | 120 | 120 |

Notes:
The primary tubes are constructed of .049" minimum T1 40 Aluminized Steel, 2.25" OD, 29.8" long.
All Y*036-060 units will use a FASCO 7021-11054 combustion blower as described in the report.
All Y*036-060 units will use a 240 F Flame Rollout device as described in the report.
All Y*036-060 units will use a 120 F Fan Limit as described in the report.
All Y*36-060 units will be factory set for high speed indoor fan.

# 6-10 Tons Gas Heat Specifications — Low Heat

| Model Number | Y*C072A-L | YSC(090,092)A-L | YHC092A-L | Y*C102A-L | Y*C120A-L |
|---|---|---|---|---|---|
| Unit Size (Tons) | 6 | 7.5 | 7.5 | 8.5 | 10 |
| Cabinet Size | C | C | D | D | D |
| Input (BTUh) | 80000 | 120000 | 120000 | 120000 | 150000 |
| Output (BTUh) | 64000 | 96000 | 96000 | 96000 | 120000 |
| Minimum Input (BTUh) | 60000 | 90000 | 90000 | 90000 | 105000 |
| Temperature Rise Range | 15-45 | 20-50 | 20-50 | 15-45 | 20-50 |
| Maximum Outlet | 180 | 160 | 160 | 160 | 180 |
| Maximum External Static | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| NG Orifice Drill (0-2000 ft) | #32 | #32 | #32 | #32 | 3.3mm |
| Maximum Gas Supply Pressure (in. w.c.) | 14 | 14 | 14 | 14 | 14 |
| Minimum Gas Supply Pressure (in. w.c.) | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 |
| Manifold Pressure (Low/ High) (in. w.c.) | 3.3 | 3.3 | 3.3 | 3.3 | 1.8/ 3.5 |
| Maximum Input | 80000 | 120000 | 120000 | 120000 | 150000 |
| LP Orifice Drill | 49 | 49 | 49 | 49 | 46 |
| Burner Insert Inside Diameter | 0.6 | 0.6 | 0.6 | 0.6 | 0.7 |
| Air Orifice Diameter | 1.593 | 3.25 | 3.25 | 3.25 | 1.844 |
| TCO1 High Limit Trip Temperature | 200 | 200 | 225 | 225 | 200 |
| FASCO Part Number | 7021-11054 | 7021-11054 | 7021-11054 | 7021-11054 | 7062-5033 |
| Combustion Blower Motor Number of Speeds | 1 | 1 | 1 | 1 | 2 |
| Combustion Blower Motor HP | 1/35 | 1/35 | 1/35 | 1/35 | 1/15 |
| Combustion Blower Motor FLA | 0.7 | 0.7 | 0.7 | 0.7 | 0.42 |
| Combustion Blower Motor (volts/ph/ hz) | 208-230/1/60 | 208-230/1/60 | 208-230/1/60 | 208-230/1/60 | 208-230/1/60 |
| Combustion Blower Motor RPM | 3000 | 3000 | 3000 | 3000 | 3250 |
| Rate per Primary Tube | 40 | 40 | 40 | 40 | 50 |
| Number Primary Tubes | 2 | 3 | 3 | 3 | 3 |
| Number Secondary Tubes | 2 | 3 | 3 | 3 | 4 |
| Air Baffle Required | No | No | No | No | No |
| Turbulator | 12 | 12 | 12 | 12 | 12 |
| Inlet Pipe Size (in.) | 1/2 | 1/2 | 1/2 | 1/2 | 3/4 |
| TCO2 High Limit Value (F) | 120 | 120 | 120 | 120 | 120 |

Notes:
Primary tubes are 35.8" long, T1 40 Aluminized Steel, 2.25" OD.
Secondary tubes are constructed of .042" minimum T1 40aluminized steel, 1.75" OD. They are 32.25" long.
All units will use a 240 flame rollout device as described in the report.
All units will use a 120 F fan limit as described in the report.
All units will use 12" long turbulators in the primary tubes.

# 6-10 Tons Gas Heat Specifications — Medium Heat

| Model Number | Y*C072A-M | YSC(090,092)A-M | YHC092A-M | Y*C102A-M | Y*C120A-M |
|---|---|---|---|---|---|
| Unit Size (Tons) | 6 | 7.5 | 7.5 | 8.5 | 10 |
| Cabinet Size | C | C | D | D | D |
| Input (BTUh) | 120000 | 150000 | 150000 | 150000 | 200000 |
| Output (BTUh) | 96000 | 120000 | 120000 | 120000 | 160000 |
| Minimum Input (BTUh) | 90000 | 105000 | 105000 | 105000 | 140000 |
| Temperature Rise Range | 20-50 | 25-55 | 25-55 | 20-50 | 25-55 |
| Maximum Outlet | 160 | 200 | 200 | 180 | 200 |
| Maximum External Static | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| NG Orifice Drill (0-2000 ft) | #32 | 3.3mm | 3.3mm | 3.3mm | 3.3mm |
| Maximum Gas Supply Pressure (in. w.c.) | 14 | 14 | 14 | 14 | 14 |
| Minimum Gas Supply Pressure (in. w.c.) | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 |
| Manifold Pressure (Low/ High) (in. w.c.) | 3.3 | 1.8/ 3.5 | 1.8/ 3.5 | 1.8/ 3.5 | 1.8/ 3.5 |
| Maximum Input | 120000 | 150000 | 150000 | 150000 | 200000 |
| LP Orifice Drill | 49 | 46 | 46 | 46 | 46 |
| Burner Insert Inside Diameter | 0.6 | 0.7 | 0.7 | 0.7 | 0.7 |
| Air Orifice Diameter | 3.25 | 1.844 | 1.844 | 1.844 | 2.25 |
| TCO1 High Limit Trip Temperature (Df/Hz) | 200/200 | 180/220 | 180/220 | 180/220 | 190/260 |
| FASCO Part Number | 7021-11054 | 7062-5033 | 7062-5033 | 7062-5033 | 7062-5033 |
| Combustion Blower Motor Number of Speeds | 1 | 2 | 2 | 2 | 2 |
| Combustion Blower Motor HP | 1/35 | 1/15 | 1/15 | 1/15 | 1/15 |
| Combustion Blower Motor FLA | 0.7 | 0.42 | 0.42 | 0.42 | 0.42 |
| Combustion Blower Motor (volts/ph/ hz) | 208-230/1/60 | 208-230/1/60 | 208-230/1/60 | 208-230/1/60 | 208-230/1/60 |
| Combustion Blower Motor RPM | 3000 | 3250 | 3250 | 3250 | 3250 |
| Rate per Primary Tube | 40 | 50 | 50 | 50 | 50 |
| Number Primary Tubes | 3 | 3 | 3 | 3 | 4 |
| Number Secondary Tubes | 3 | 4 | 4 | 4 | 5 |
| Air Baffle Required | No | No | No | No | No |
| Turbulator | 12 | 12 | 12 | 12 | 12 |
| Inlet Pipe Size (in.) | 1/2 | 3/4 | 3/4 | 3/4 | 3/4 |
| TCO2 High Limit Value (F) | 120 | 120 | 120 | 120 | 120 |

Notes:
Primary tubes are 35.8" long, T1 40 Aluminized Steel, 2.25" OD.
Secondary tubes are constructed of .042" minimum T1 40aluminized steel, 1.75" OD. They are 32.25" long.
All units will use a 240 flame rollout device as described in the report.
All units will use a 120 F fan limit as described in the report.
All units will use 12" long turbulators in the primary tubes.

# 6-10 Tons Gas Heat Specifications — High Heat

| Model Number | Y*C072A-H | YSC090A-H | YHC092A-H | Y*C102A-H | Y*C120A-H |
|---|---|---|---|---|---|
| Unit Size (Tons) | 6 | 7.5 | 7.5 | 8.5 | 10 |
| Cabinet Size | C | C | D | D | D |
| Input (BTUh) | 150000 | 200000 | 200000 | 200000 | 250000 |
| Output (BTUh) | 120000 | 160000 | 160000 | 160000 | 200000 |
| Minimum Input (BTUh) | 105000 | 140000 | 140000 | 140000 | 175000 |
| Temperature Rise Range | 25-55 | 35-65 | 35-65 | 35-65 | 35-65 |
| Maximum Outlet | 200 | 180 | 200 | 200 | 200 |
| Maximum External Static | 0.2 | 0.2 | 0.2 | 0.2 | 0.25 |
| NG Orifice Drill (0-2000 ft) | 3.3mm | 3.3mm | 3.3mm | 3.3mm | 3.3mm |
| Maximum Gas Supply Pressure (in.w.c.) | 14 | 14 | 14 | 14 | 14 |
| Minimum Gas Supply Pressure (in. w.c.) | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 |
| Manifold Pressure (Low/ High) (in. w.c.) | 1.8/ 3.5 | 1.8/ 3.5 | 1.8/ 3.5 | 1.8/ 3.5 | 1.8/ 3.5 |
| Maximum Input | 150000 | 200000 | 200000 | 200000 | 250000 |
| LP Orifice Drill | 46 | 46 | 46 | 46 | 46 |
| Burner Insert Inside Diameter | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| Air Orifice Diameter | 1.844 | 2.25 | 2.25 | 2.25 | 3.25 |
| TCO1 High Limit Trip Temperature (Df/Hz) | 180/210 | 200/200 | 180/220 | 190/260 | 190/260 |
| FASCO Part Number | 7062-5033 | 7062-5033 | 7062-5033 | 7062-5033 | 7062-5033 |
| Combustion Blower Motor Number of Speeds | 2 | 2 | 2 | 2 | 2 |
| Combustion Blower Motor HP | 1/15 | 1/15 | 1/15 | 1/15 | 1/15 |
| Combustion Blower Motor FLA | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 |
| Combustion Blower Motor (volts/ph/ hz) | 208-230/1/60 | 208-230/1/60 | 208-230/1/60 | 208-230/1/60 | 208-230/1/60 |
| Combustion Blower Motor RPM | 3250 | 3250 | 3250 | 3250 | 3250 |
| Rate per Primary Tube | 50 | 50 | 50 | 50 | 50 |
| Number Primary Tubes | 3 | 4 | 4 | 4 | 5 |
| Number Secondary Tubes | 4 | 5 | 5 | 5 | 6 |
| Air Baffle Required | No | YES | YES | YES | YES |
| Turbulator | 12 | 12 | 12 | 12 | 12 |
| Inlet Pipe Size (in.) | 3/4 | 3/4 | 3/4 | 3/4 | 3/4 |
| TCO2 High Limit Value (F) | 120 | 120 | 120 | 120 | 120 |

Notes:
Primary tubes are 35.8" long, T1 40 Aluminized Steel, 2.25" OD.
Secondary tubes are constructed of .042" minimum T1 40aluminized steel, 1.75" OD. They are 32.25" long.
All units will use a 240 flame rollout device as described in the report.
All units will use a 120 F fan limit as described in the report.
All units will use 12" long turbulators in the primary tubes.

# Heat Pump Demand Defrost

There are two schemes in common usage for heat pump outdoor coil defrosting: demand defrost and time-temperature defrost. Demand Defrost is more efficient because defrost cycles are initiated only when necessary, compared with initiation based on operating time below the threshold temperature. All 3-10 ton convertible packaged heat pumps use Demand Defrost.

Outdoor coil defrosting occurs only when operating in heating mode with outdoor ambient temperature below 52°F and the outdoor coil temperature below 35°F. The first defrost cycle after power-up is initiated based on operating time at the required conditions. Shortly after completion of the defrost cycle, the temperature difference between the outdoor coil and outdoor air is calculated and is used as an indicator of unit performance at dry coil conditions. Over time, as moisture and frost accumulate on the coil, the coil temperature will drop, increasing the temperature difference. When the temperature difference reaches double the dry coil temperature differential (deltaT), a defrost cycle is initiated. While defrosting, the reversing valve is in the cooling position, outdoor fans are off, and the compressors continue to operate. The defrost cycle is terminated when the coil temperature rises high enough to indicate that the frost has been eliminated.

Termination of the defrost cycle includes a "soft start" delay. At the end of each defrost cycle, the outdoor fan comes on 5 seconds before the reversing valve is de-energized. This reduces stress on the compressor and makes for a quieter defrost.

Demand defrost operation
Heating mode
Outdoor ambient <52°F
Outdoor coil <35

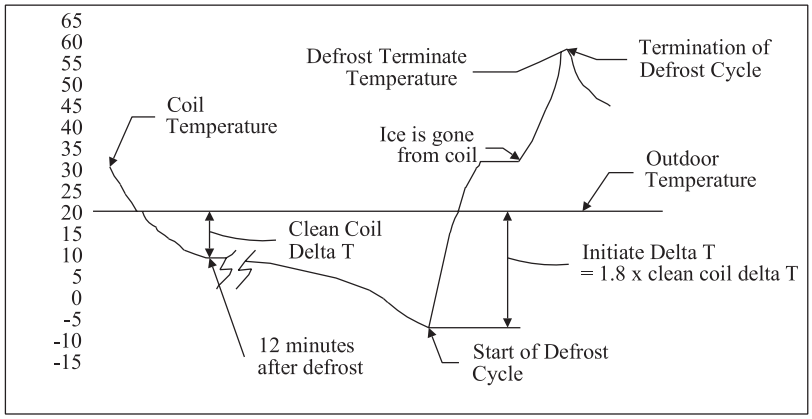
**Defrost Service Test**

When a Service Test Defrost Request is received, defrost mode is initiated immediately. The defrost cycle will remain active for a minimum of 1 minute, after which the normal termination will occur when the coil temperature exceeds the defrost termination temperature as defined below.

**Defrost Mode Operation**

Defrost Mode shall remain active until the Outdoor Coil Temperature (OCT) exceeds the Defrost Termination Temperature (DTT) or until ten (10) minutes have passed, whichever occurs first. If all Compressor Outputs turn Off during the defrost cycle, such as during a High Pressure Cutout or Low-Pressure Cutout event, Defrost Mode will terminate. When Defrost Mode has terminated, the function will track twelve (12) minutes to assure that a dry coil condition has been achieved. At the twelve-minute point, $D_T$ will be calculated using the current values of OAT and OCT (OAT is expected to be higher than OCT). This value is doubled to become the new Initiate Value. Figure 1 presents a graphical representation of a typical demand defrost cycle.

***Figure 1—Typical Demand Defrost Cycle***



# Heat Pump
# Demand Defrost

**Diagnostic Information**
Demand Defrost also tracks failures and operating problems as follows.
When any Defrost Fault is active, or if any sensor has failed, a 5-minute defrost cycle will be initiated after each 30 minutes of compressor heating operation.

***Table1 — Demand Defrost Fault Designation***

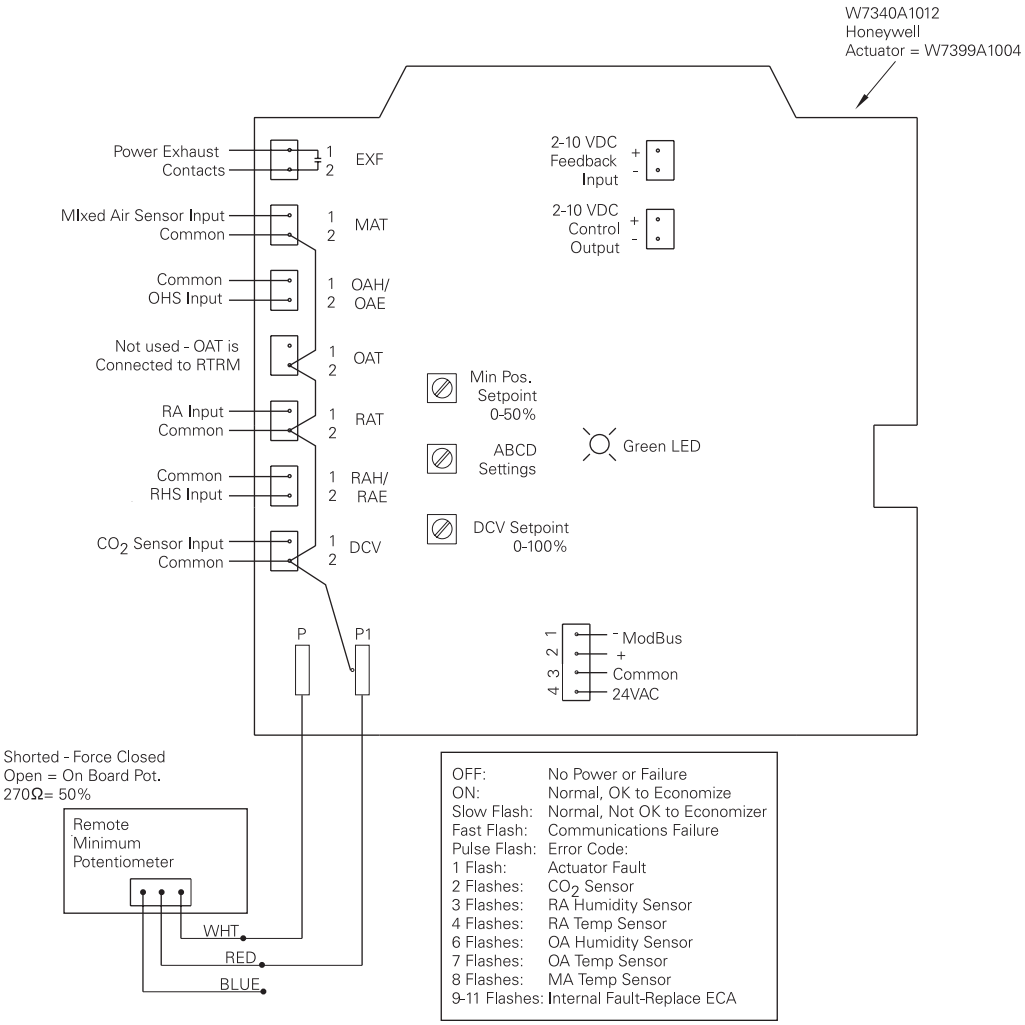
| Symptom | Diagnostic | Response |
|---|---|---|
| $\Delta_T$ is below Minimum Value 12 minutes after defrost is terminated | Low $\Delta_T$ | If> 2 hours, activate Defrost Fault<br>Reset timer if $\Delta_T$ returns within bounds. |
| Defrost Terminated on time requirement | Time Termination | If defrost is terminated on time requirement (vs. differential temperature).<br>After 10 consecutive Time Terminations, activate Defrost Fault. |
| $\Delta_T$ is above Maximum Value 12 minutes after defrost is terminated | High $\Delta_T$ | Initiate Defrost<br>After 16 consecutive High $\Delta_T$ Initiations activate Defrost Fault. |
| $\Delta_T$ does not change by 2 degrees in an hour's time starting 12 minutes after defrost is terminated and $\Delta_T$ is less than or equal to 4 degrees 12 minutes after defrost is terminated | Unchanging $\Delta_T$ | Initiate Defrost and activate Defrost Activate Defrost Fault. |

Notes:
Defrost Termination Temperature (DTT) = Outdoor Air Temperature (OAT) + 47°F
57°F <= DDT <= 72°F
$D_T$ = Outdoor Air Temperature (OAT) – Outdoor Coil Temperature (OCT)
Defrost Initiate Temperature ≅ 1.8 * ($D_T$| 12 Minutes After Defrost Mode is terminated)

# ReliaTel Economizer Module Layout

The economizer module plugs directly onto the actuator. It has a diagnostic LED, which under normal operation is either ON (OK to economize) or FLASHING (Not OK to economize). It communicates via MODBUS with the RTRM, and receives outside air temperature input from the RTRM.
Mixed air sensor (MAS), return air sensor (RAT), outdoor humidity sensor (OHS), and return humidity sensor (RHS) are all plugged directly into the ECA. The application section of this manual shows how to apply a $CO_2$ sensor.

A new stripped down version of the ECA Module was implemented in April, 2005 which only contains the MAT, input, min. pos. adjustment and the wire plug for power and ModBus communications. This module will only be applied on units that are supplied from the factory without any economizer options such as, Reference Enthalpy, Comparative Enthalpy or $C0_2$. Options installed in the field will require the "full-up" version in order to operate properly.



# ReliaTel Economizer Operation

**Customer Benefit**
An economizer consists of a fresh air damper, a return air damper, linkage to maintain an inverse relationship between the two, and an actuator to control the damper position. An economizer is used to provide two unit functions: ventilation and economizer cooling. In either case, the inverse relationship between the return and outdoor air dampers allows the unit to maintain the same approximate total airflow regardless of economizer position. A linkage adjustment is typically required in the field to adjust for differences in pressure drops due to different duct designs. Economizer cooling is provided to take advantage of cooler outdoor air to satisfy a cooling load in a conditioned space minimizing the need for mechanical cooling (with compressors). While economizer cooling, it is necessary to limit the damper position so that the mixed air temperature does not fall below 53°F (± 3°F) and cause excessively cool air from being discharged from the unit. When used with a zone sensor, an economizer setpoint that is below the cooling setpoint is used to allow sub-cooling essentially for free, further reducing the need for more expensive mechanical cooling. To maximize the use of an economizer, mechanical cooling is delayed from running until it has been determined that the economizer alone cannot satisfy the load.
Any time the supply fan is On and the building (unit) is occupied, the economizer damper will be maintained at or above minimum position. The economizer damper is held Closed when the supply fan is Off to prevent water from getting into the economizer section of the unit. Compressors will be delayed from operating until the economizer has opened to 100% for 5 minutes on all unit types other than Voyager III which will have a 3-minute delay.

**VAV Economizer Cooling Operation:**
A similar method of determining and adjusting the economizer setpoint as described in CV operation will be used in VAV Cooling operation with the additional VAV requirements below.

- Economizer Setpoint = SA Temp Control Point - 2°F.
- Economizer Cooling is only allowed when economizing is enabled and SA temp is greater than Economizer Setpoint - 1.5°F.
- If conditions allow enabling of economizer cooling after a compressor is active, the economizer damper is forced to 100% open until all compressors are deactivated or conditions change to disable economizing.
- If economizer cooling is active prior to mechanical cooing, compressor operation will be inhibited until the economizer damper reaches 100%. Once the economizer reaches 100%, mechanical cooling will be enabled without delay.
- During VAV Unoccupied operation economizer cooling will operate as it does in CV Unoccupied.

**Economizer Operation with zone sensor, programmable zone sensor or ICS**
When economizing is enabled and the unit is operation in the cooling mode with a zone sensor, the economizer damper is modulated between its minimum position and 100% to maintain the zone temperature at the economizer setpoint. When the unit is applied with a zone sensor, programmable sensor or ICS, the economizer setpoint is (ESP) is derived from the Cooling and Heating setpoints (CSP and HSP) so that ESP is the higher of 1) CSP – 1.5°F or 2) HSP + 1.5°F. When enabled, the economizer will modulate between minimum position and 100% to maintain a mixed air temperature of 53±3°F. If the mixed air temperature starts to fall below 53°F, the economizer starts closing; and at 50°F, the damper will be at minimum position.
If the economizer is not able to satisfy the cooling setpoint, 1st stage cooling will be energized. Should the cooling setpoint not be satisfied with 1st stage cooling, 2nd stage cooling will be energized. Most often, the economizer and 1st stage cooling will be adequate to satisfy the load. 1st stage cooling will not start until the economizer has been full open for five minutes and the zone temperature error has not being reduced quickly enough.

**Economizer Operation with Conventional Thermostat**
When the unit is operating from a conventional thermostat or other binary input, the economizer setpoint feature, relative to the cooling and heating setpoints, is lost. The economizer control is based strictly on a signal from the thermostat, but still maintains mixed air temperature control of 53°±3°F when in the economizer mode. The economizer enable and disable function is still determined by the outside air sensor through the RTRM.
If a single-stage thermostat is used, only the economizer (if enabled) or the compressor (if economizer is disabled) will operate on a call for cooling. A two-stage thermostat is required to achieve economizer operation and compressor operation at the same time.
With economizer enabled, a Y1 call for 1st stage cooling will be the economizer. The damper will modulate between minimum position and 100% to maintain mixed air temperature at 53°±3°. At 50°F the damper will be at minimum position. If the economizer is enabled, a Y2 call for 2nd stage cooling will start the first compressor if required.
If the economizer is disabled, 1st stage (Y1) will be the first compressor. If the unit has two compressors, a call for 2nd stage cooling (Y2) will start the second compressor.
When using a conventional thermostat, or other binary input, the ReliaTel controls will only allow two stages of cooling.

# ReliaTel Economizer Operation

**Barometric relief**
Units with economizers bring in outside air for ventilation and/or economizer cooling. Because the economizer contains a return air damper that operates inversely to the outdoor air damper, the outdoor air will tend to pressurize the conditioned space. This can cause exterior doors to open or audible noise from air escaping through various building openings.
Units without exhaust fans rely on barometric dampers to vent the pressure that builds up in the space due to outdoor airflow.

**Power exhaust**
Exhaust fans offer improved performance since they can be sized to overcome the pressure drops associated with the return duct that would otherwise add to the space pressure. This function allows the exhaust fan to operate when appropriate to maintain space pressure.
Units without RTOM: The power exhaust is on whenever the economizer damper is at 25% outside air or greater. This is not adjustable.

Units with RTOM: The power exhaust set point (point at which the power exhaust is turned on) is adjustable from 0% to 100% at the RTOM "exhaust setpoint" potentiometer.

Three different methods can be used to determine if outdoor air contains more cooling capacity than the return air and are described below. The different methods are suited for different applications and environments.

- Comparative Enthalpy — Outdoor Air Enthalpy is compared with Return Air Enthalpy. This method is best suited for high humidity climates and applications in which humidity can affect the cooling capacity of the outdoor air or return air.
- Reference Enthalpy — Outdoor Air Enthalpy is compared with a reference enthalpy point. This method is best suited for high humidity climates in which humidity can affect the cooling capacity of the outdoor air, but not necessarily the return air.
- Reference Dry Bulb— Outdoor Air Temperature is compared with a user set reference temperature. This method is best suited for low humidity climates and applications in which humidity does not strongly affect cooling capacity of the outdoor air or return air.

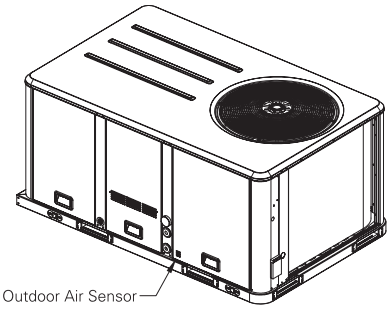
Dry bulb temperature and relative humidity data are used to determine enthalpy.
Economizer-based cooling is enabled only when outdoor air is determined to have more cooling capacity than the return air. The method used is according to the available data. When temperature and humidity data are available for the outdoor air and return air, the Comparative Enthalpy method is used. One of the other methods are used if data is invalid or unavailable. Ultimately, when there is insufficient data to use any of the three methods, economizer-based cooling is disabled.
When the Active Unit Mode is Cool, one of the enthalpy or temperature methods are used to determine if economizer-based cooling should be enabled or disabled.

**Thermostat note**
If the unit is applied with a thermostat, the algorithms use a fixed mixed air temperature setpoint of 55°F when the Y1 input is closed. If the unit is applied with a zone sensor, the algorithms use a dynamically calculated mixed air temperature setpoint, which is calculated by other algorithms, when cooling is requested.

The damper can be in three different states.

**Closed.** The damper is held at 0%.
**Minimum Position.** The damper is held at the Minimum Position as determined by the Minimum Position Potentiometer on the ECA or by an edited input from ICS. This position is between 0% and 50%. Note: When making minimum position adjustments, allow 30-45 seconds for actuator to respond.
**Modulating.** Algorithms control the damper to meet cooling demand. When modulating, the damper's range of motion is between Active Minimum Position and 100%.

**The following inputs are used:**
**Mixed Air Sensor (MAS)** measures the dry bulb temperature of the air leaving the evaporator coil while economizing. Return air, outdoor air and cooling caused by any compressor cooling make up the Mixed Air input. The MAS is plugged into the Economizer Actuator Module (ECA).




**Outdoor Air Sensor (OAS)** measures the ambient air surrounding the unit. It is located in the compressor section on the left side. Ventilation holes in the access panel of the unit allow air movement across the sensor. The OAS is plugged into the RTRM module.
**Outdoor Humidity Sensor (OHS)** measures the relative humidity of the outside air. It is located inside the economizer hood. The OHS is plugged into the ECA.
**Return Air Temperature Sensor (RAT)** measures the return air temperature. It is located on the return air damper of the economizer.
The RAT is plugged into the ECA.
Return Humidity Sensor (RHS) measures the relative humidity of the return air. It is located on the return air damper of the economizer. The RHS is plugged into the ECA.

# Economizer Damper Enthalpy Layout

*Figure 1—Economizer*

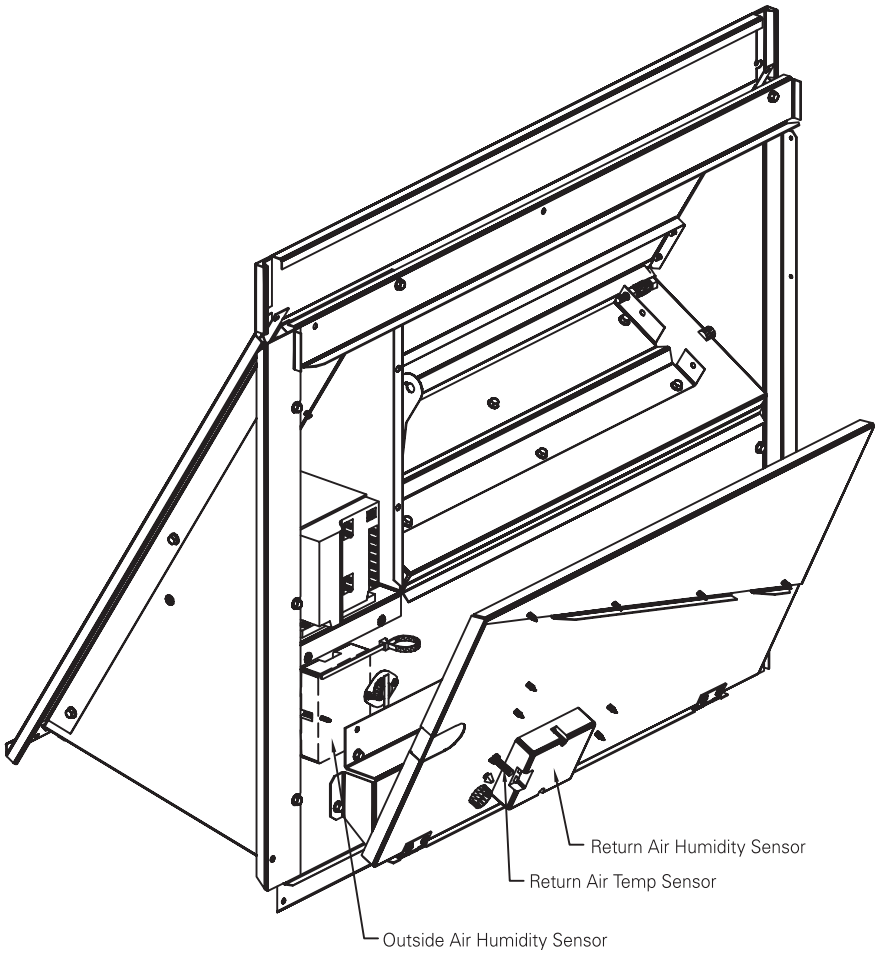



*Table 1 — Choice of Enthalpy Method*

| Method used to determine economizer effectiveness | Required Data |
|---|---|
| Comparative Enthalpy | MAS, OAT, OAH, RAT, RAH |
| Reference Enthalpy | MAS, OAT, OAH |
| Reference Dry Bulb | MAS, OAT |
| Unit will not economize | MAS or OAT data is invalid or unavailable |

# Economizer Operation
# Enthalpy Changeover

**Dry bulb/Reference Point Selections**
The Dry Bulb or Reference Enthalpy Point is user-selectable, according to the choices below. This selection is made on the ECA and is only functional on units with a reference or comparative enthalpy option.

***Table 2 — Dry Bulb/Reference Enthalpy Point Choices***

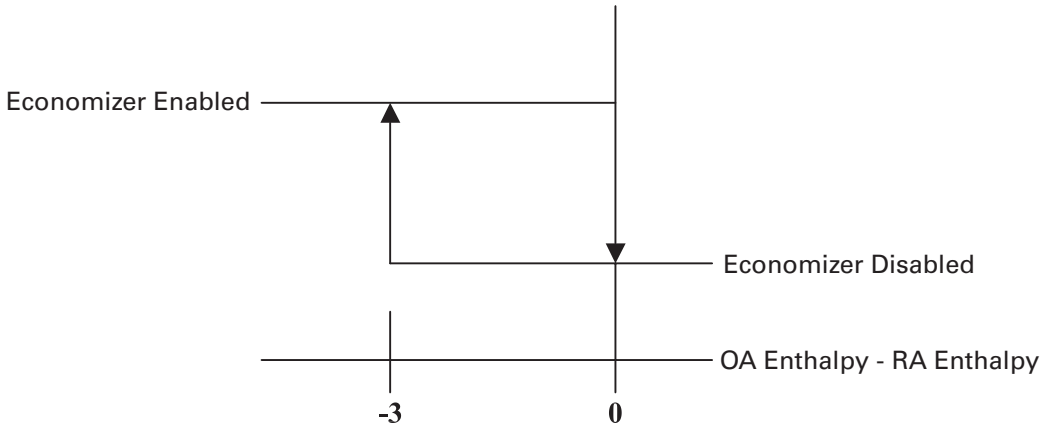
| Potentiometer Setting Point | Dry bulb changeover Point | Reference Enthalpy |
|---|---|---|
| A* | 73°F** | 27 BTU/lb. |
| B | 70°F | 25 BTU/lb. |
| C | 67°F | 23 BTU/lb. |
| D | 63°F | 22 BTU/lb. |

*factory setting
**dry bulb is fixed @73°F and is not adjustable

**Comparative Enthalpy Method**
OA Enthalpy is compared with RA Enthalpy.

- The Economizer is enabled when OA Enthalpy < [RA Enthalpy - 3.0 BTU/lb.].
- The Economizer is disabled when OA Enthalpy > RA Enthalpy.
- While [RA Enthalpy - 3.0 BTU/lb.] < OA Enthalpy < RA Enthalpy, the Economizer enable/disable status is not changed.

***Figure 2— Comparative Enthalpy Enable***



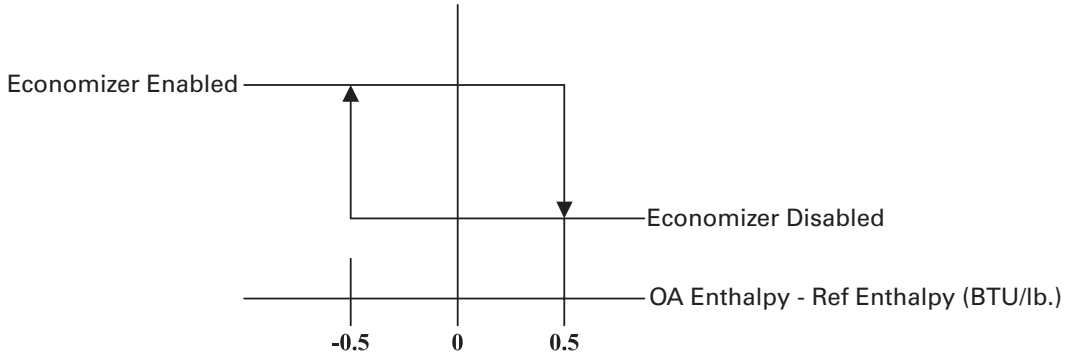

Comparative Enthalpy Hysteresis

# Economizer Operation
# Enthalpy Changeover

**Reference Enthalpy Method**
OA Enthalpy is compared with a reference enthalpy point.

- The Economizer is enabled when OA Enthalpy < [reference enthalpy point - 0.5 BTU/lb.].
- The Economizer is disabled when OA Enthalpy > [reference enthalpy point + 0.5 BTU/lb.].
- While [reference enthalpy point - 0.5 BTU/lb.] < OA Enthalpy < [reference enthalpy point + 0.5 BTU/lb.], the Economizer enable/disable status is not changed.

***Figure 3 — Reference Enthalpy Enable***

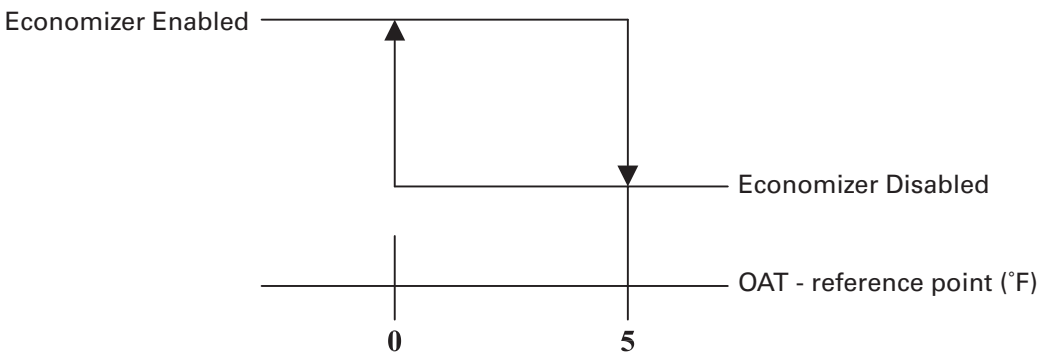



Reference Enthalpy Hysteresis

**Reference Dry Bulb Method**
OA Temperature is compared with a reference dry bulb point.

- The Economizer is enabled when OA Temp < reference dry bulb point.
- The Economizer is disabled when OA Temp > (reference dry bulb point + 5.0)°F.
- While reference dry bulb point < OA Temp < (reference dry bulb point + 5.0°F), the Economizer enable/disable status is not changed.

***Figure 4 — Dry Bulb Enthalpy Enable***




Dry Bulb Hysteresis

# ReliaTel Economizer Operation & Inputs

**Internal Calculations**
Air enthalpy is a value calculated from the air temperature and relative humidity using the relationship:
**Enthalpy= 0.24 x O.A.Temp(deg. F) + h(R.H.,OAT)**
Air enthalpy is calculated (Btu/Lb. dry air) using:
**H = 0.24 *T + W * Hv**
Where T= dry bulb temperature, deg. F
W= humidity ration, lb. water/lb. dry air
W = 0.622 * P/ (14.696 - P)
Hv= enthalpy of water at T, Btu/lb.
Hv= 1062.1 + 0.43 *T
Also,
P= partial pressure of water at T, psia
P= (0.421 - 0.01503 *T + 0.000202 *T**2) * RH

**ReliaTel Economizer Inputs**

**Terminals to read voltage:**

| | | |
|---|---|---|
| **Mixed Air Sensor** | ECA | MAS |
| **Return Air Sensor** | ECA | RAT |

***Note: These are Economizer inputs only. RTRM, RTOM inputs (Zone temp, Setpoints, OAS, DAS) are in the ReliaTel Temperature inputs section.***

Read DC voltage with the sensor attached. If voltage does not appear to be correct, read the resistance of the circuit, then the sensor itself, to see if a problem exists in the sensor or the wiring. With the sensor not attached there should be approximately 2.50 VDC at the terminals listed above.

**Service Tips:**
Terminal 1 in each of these circuits is common. All common terminals are grounded, therefore one volt meter lead can be attached to ground for voltage measurements.

| Temperature °F | Resistance (K ohms) | DCV Volts | Temperature °F | Resistance (K ohms) | DCV Volts\ |
|---|---|---|---|---|---|
| 40 | 26.105 | 1.853 | 61 | 14.899 | 1.551 |
| 41 | 25.393 | 1.839 | 62 | 14.521 | 1.536 |
| 42 | 24.703 | 1.826 | 63 | 14.154 | 1.520 |
| 43 | 24.033 | 1.812 | 64 | 13.797 | 1.505 |
| 44 | 23.385 | 1.799 | 65 | 13.451 | 1.490 |
| 45 | 22.756 | 1.785 | 66 | 13.114 | 1.475 |
| 46 | 22.146 | 1.771 | 67 | 12.787 | 1.460 |
| 47 | 21.554 | 1.757 | 68 | 12.469 | 1.444 |
| 48 | 20.980 | 1.743 | 69 | 12.160 | 1.429 |
| 49 | 20.424 | 1.728 | 70 | 11.860 | 1.413 |
| 50 | 19.884 | 1.714 | 71 | 11.568 | 1.398 |
| 51 | 19.360 | 1.699 | 72 | 11.284 | 1.383 |
| 52 | 18.852 | 1.685 | 73 | 11.008 | 1.367 |
| 53 | 18.359 | 1.670 | 74 | 10.740 | 1.352 |
| 54 | 17.880 | 1.656 | 75 | 10.479 | 1.337 |
| 55 | 17.415 | 1.641 | 76 | 10.225 | 1.321 |
| 56 | 16.964 | 1.626 | 77 | 9.978 | 1.306 |
| 57 | 16.527 | 1.611 | 78 | 9.738 | 1.291 |
| 58 | 16.102 | 1.596 | 79 | 9.505 | 1.276 |
| 59 | 15.689 | 1.581 | 80 | 9.278 | 1.261 |
| 60 | 15.288 | 1.566 | | | |

# ReliaTel Economizer Inputs

**To Test Humidity Sensors**

| | | |
|---|---|---|
| **Return Air Humidity Sensor** | ECA | RAH/RAE |
| **Outdoor Humidity Sensor** | ECA | OAH/OAE |

To test this circuit, place a DC milliamp meter in series with either of the leads to the humidity sensor. If the reading is 0ma, polarity may be reversed. Reverse + & - and retest. If the reading does not correspond to the table below, check the output voltage from the ECA with the sensor disconnected. It should be approximately 20VDC. If so, and all connections are intact, replace the sensor. If 20VDC is not present, yet the ECA green LED is on, the ECA module has failed.

| RH% | DCma | RH%D | Cma | RH% | DCma |
|---|---|---|---|---|---|
| 100% | 20.000 | 52.6 | 12.414 | 31.2 | 9.000 |
| 97.7 | 19.636 | 51.7 | 12.273 | 30.8 | 8.926 |
| 95.5 | 19.286 | 50.8 | 12.135 | 30.3 | 8.852 |
| 93.4 | 18.947 | 50.0 | 12.000 | 29.9 | 8.780 |
| 91.4 | 18.621 | 49.2 | 11.868 | 29.4 | 8.710 |
| 89.4 | 18.305 | 48.4 | 11.739 | 29.0 | 8.640 |
| 87.5 | 18.000 | 47.6 | 11.613 | 28.6 | 8.571 |
| 85.7 | 17.705 | 46.8 | 11.489 | 28.1 | 8.504 |
| 83.9 | 17.419 | 46.1 | 11.368 | 27.7 | 8.438 |
| 82.1 | 17.143 | 45.3 | 11.250 | 27.3 | 8.372 |
| 80.5 | 16.875 | 44.6 | 11.134 | 26.9 | 8.308 |
| 78.8 | 16.615 | 43.9 | 11.020 | 26.5 | 8.244 |
| 77.3 | 16.364 | 43.2 | 10.909 | 26.1 | 8.182 |
| 75.7 | 16.119 | 42.5 | 10.800 | 25.8 | 8.120 |
| 74.3 | 15.882 | 41.8 | 10.693 | 25.4 | 8.060 |
| 72.8 | 15.652 | 41.2 | 10.588 | 25.0 | 8.000 |
| 71.4 | 15.429 | 40.5 | 10.485 | 24.6 | 7.941 |
| 70.1 | 15.211 | 39.9 | 10.385 | 24.3 | 7.833 |
| 68.8 | 15.000 | 39.3 | 10.286 | 23.9 | 7.826 |
| 67.5 | 14.795 | 38.7 | 10.189 | 23.6 | 7.770 |
| 66.2 | 14.595 | 38.1 | 10.093 | 23.2 | 7.714 |
| 65.0 | 14.400 | 37.5 | 10.000 | 22.9 | 7.660 |
| 63.8 | 14.211 | 36.9 | 9.908 | 22.5 | 7.606 |
| 62.7 | 14.026 | 36.4 | 9.818 | 22.2 | 7.552 |
| 61.5 | 13.846 | 35.8 | 9.730 | 21.9 | 7.500 |
| 60.4 | 13.671 | 35.3 | 9.463 | 21.6 | 7.448 |
| 59.4 | 13.500 | 34.7 | 9.558 | 21.2 | 7.397 |
| 58.3 | 13.333 | 34.2 | 9.474 | 20.9 | 7.347 |
| 57.3 | 13.171 | 33.7 | 9.391 | 20.6 | 7.297 |
| 56.3 | 13.012 | 33.2 | 9.310 | 20.3 | 7.248 |
| 55.4 | 12.857 | 32.7 | 9.231 | 20.0 | 7.200 |
| 54.4 | 12.706 | 32.2 | 9.153 | | |
| 53.5 | 12.558 | 31.7 | 9.076 | | |

# ReliaTel Economizer Control Actuator (LED Fault Code Info.)

Actuator fault: An actuator fault will occur when the economizer position signal to the actuator is 25% different than the feedback signal from the actuator. Example: if the economizer is not attached to the motor, you would get an actuator fault only after the economizer would tell the motor to drive to at least 25% open.
Sensor faults: Sensor faults will occur if the sensors are disconnected during normal operation. However, during the 3 minute boot-up period, the ECA will default to the sensors that are connected. During the 3 minute period, the economizer will look to see which sensors are hooked up and determine which state it will be in. Example: if only the OAS and MAS is hooked up, it will be in Dry Bulb. If the OAS, OHS and MAS is hooked up, it will be in Reference.
If after the 3 minute "configuration" time has passed, if one of those sensors are disconnected, the economizer should fault. If you attach and disconnect sensors during the original 3 minutes, the economizer should not fault.

**Service Note:**
The actuator has an internal potentiometer that reports the actual damper position. Should the linkage become bound, the actuator may report an unexpected output to a BAS output (Tracer, Tracker, CCP).

The mixed air sensor (MAS) and outdoor air sensor input from the RTRM are minimum required sensors.
If the $CO_2$ sensor is not hooked up, the economizer will not look for it and will not fault.

The flash codes are prioritized. The higher the flash count, the more priority the fault has. If there is more than one fault, only the higher priority fault will flash.

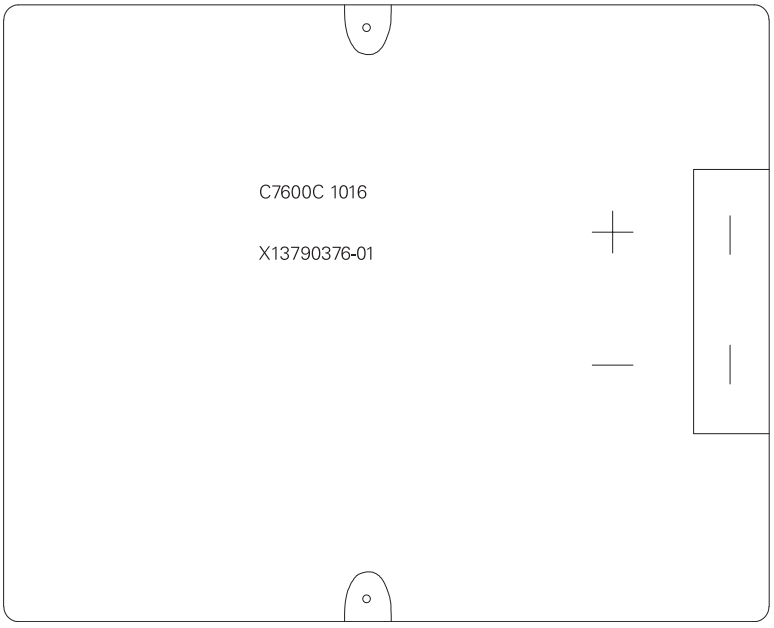
**The green system LED is located near the center of the ECA Module.**

**On: OK to economize**
**Slow flash: Not OK to economize**
**Fast flash: Not communicating with RTRM**
**OFF: No power or system failure**
***Error codes — ½ second on, ¼ second off***
**1 flash — Actuator fault**
**2 flash — CO2 sensor**
**3 flash — RA humidity sensor**
**4 flash — RA temp sensor**
**6 flash — OA humidity sensor**
**7 flash — OA temperature sensor**
**(On power up: No communication with RTRM)**
**8 flash — MA temp sensor**
**9-11 flash — Internal fault**

# ReliaTel
# Humidity Sensors

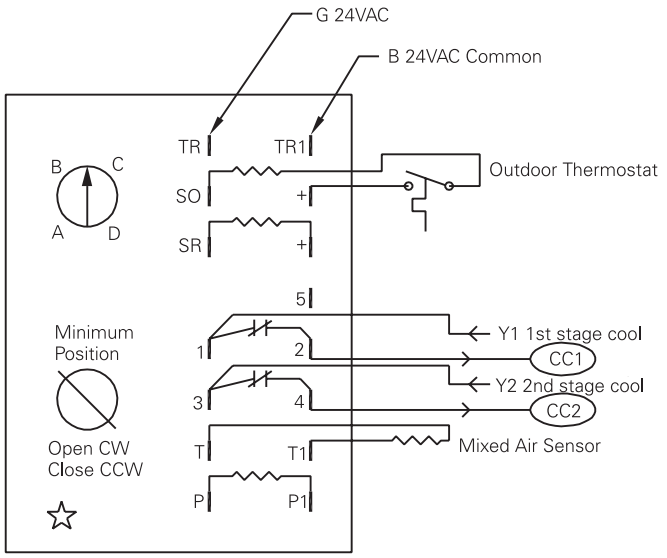
**Outdoor Humidity Sensor**
Field installed accessory, located below and to the left of economizer actuator motor. Used in reference (BAYENTH005A) and comparative (BAYENTH006A) enthalpy control. Operates from 10-90% RH, 32°F – 90°F.

**Return Humidity Sensor**
Field installed accessory, located inside economizer barometric relief hood. Used in comparative (BAYENTH006A) enthalpy control only. (Honeywell #C7600C).

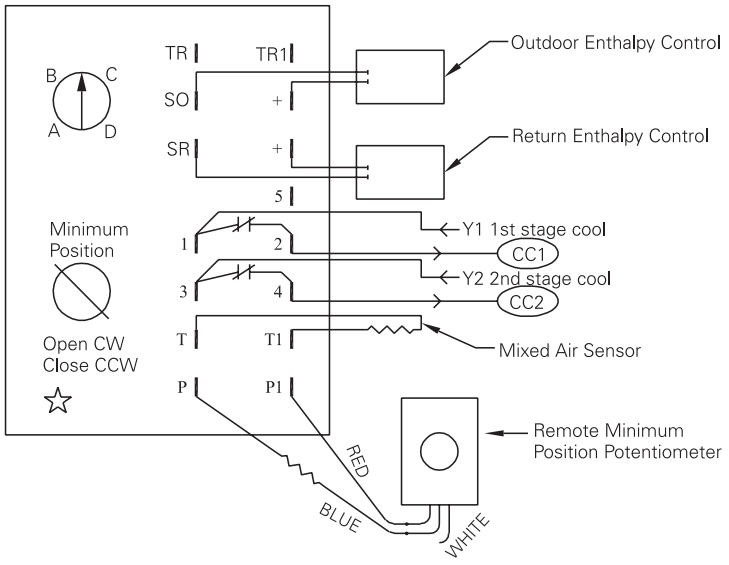



| **Component Description** | **Part Number** |
|---|---|
| Humidity Sensor (OHS, RHS) | SEN-01036 |

# Electromechanical Economizer Functions




***Economizer Actuator (ECA) connected to the unit***




***Economizer Actuator (ECA) connected to the unit***

# Electromechanical Economizer Testing

When the outdoor air thermostat is in the cold position (closed), the unit will attempt to economize if a fan (G) and cooling (Y1) call exists at the ECA module. This is readily apparent at the ECA, as the "OK to economize" LED will be on. During this time, the ECA is measuring the Mixed Air temperature via the Mixed Air Sensor (MAS).

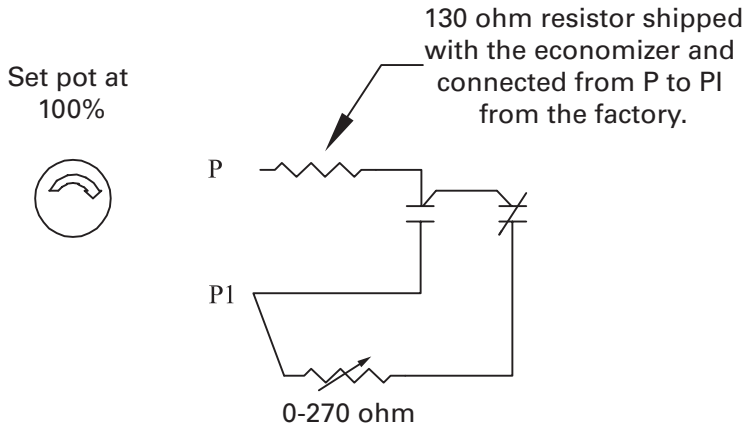
**Service Tips**
The MAS sensor is not energized unless the LED is on (G signal present, OK to economize), and the Y1 signal is present.
If the MAS is open, approximately 4.3 VDC will be seen.
Outdoor Air Thermostat opens at 70°F and closes at 60°F.
Read the voltage with the sensor connected, read the resistance with the sensor disconnected.

| Temp F | Temp C | R(K OHMS) | DC Volts |
|---|---|---|---|
| 33.8 | 1 | 9.576 | 3.910 |
| 35.6 | 2 | 9.092 | 3.882 |
| 37.4 | 3 | 8.636 | 3.894 |
| 39.2 | 4 | 8.204 | 3.863 |
| 41.0 | 5 | 7.796 | 3.829 |
| 42.8 | 6 | 7.412 | 3.790 |
| 44.6 | 7 | 7.048 | 3.749 |
| 46.4 | 8 | 6.705 | 3.713 |
| 48.2 | 9 | 6.380 | 3.674 |
| 50.0 | 10 | 6.073 | 3.634 |
| 51.8 | 11 | 5.782 | 3.590 |
| 53.6 | 12 | 5.507 | 3.550 |
| 55.4 | 13 | 5.247 | 3.507 |
| 57.2 | 14 | 5.000 | 3.420 |
| 59.0 | 15 | 4.767 | 3.373 |
| 60.8 | 16 | 4.545 | 3.328 |
| 62.6 | 17 | 4.335 | 3.283 |
| 64.4 | 18 | 4.136 | 3.239 |
| 66.2 | 19 | 3.948 | 3.180 |
| 68.0 | 20 | 3.769 | 3.157 |
| 69.8 | 21 | 3.599 | 3.118 |
| 71.6 | 22 | 3.437 | 3.080 |
| 73.4 | 23 | 3.284 | 3.034 |
| 75.2 | 24 | 3.138 | 3.007 |
| 77.0 | 25 | 3.000 | 2.971 |
| 78.8 | 26 | 2.869 | 2.932 |
| 80.6 | 27 | 2.744 | 2.896 |
| 82.4 | 28 | 2.625 | 2.860 |
| 84.2 | 29 | 2.512 | 2.824 |
| 86.0 | 30 | 2.404 | 2.787 |
| 87.8 | 31 | 2.301 | 2.750 |
| 89.6 | 32 | 2.204 | 2.714 |
| 91.4 | 33 | 2.111 | 2.676 |
| 93.2 | 34 | 2.023 | 2.639 |
| 95.0 | 35 | 1.938 | 2.600 |
| 96.8 | 36 | 1.858 | 2.561 |
| 98.6 | 37 | 1.781 | 2.526 |
| 100.4 | 38 | 1.708 | 2.484 |

# Electromechanical Economizer (3 Position Damper)

Full open (50%) economizer minimum position is accomplished by setting the ECA minimum position potentiometer to 100% and installing a set of contacts in series with the existing 130 ohm resistor to terminals P and P1 on the ECA.
Any intermediate (0 - 50%) economizer position is accomplished by installing a 0 - 270 ohm potentiometer in series with an additional set of contacts and the existing 130 ohm resistor to terminals P and P1 on the ECA. 0 ohms = 50% outside air and 270 ohms = 0% outside air.
Fully closed position is accomplished when the indoor fan is disabled.

***Note: Actual outside airflow is also dependent on return air static pressure***



# ReliaTel Control (Temporary Operation 3-25 tons)

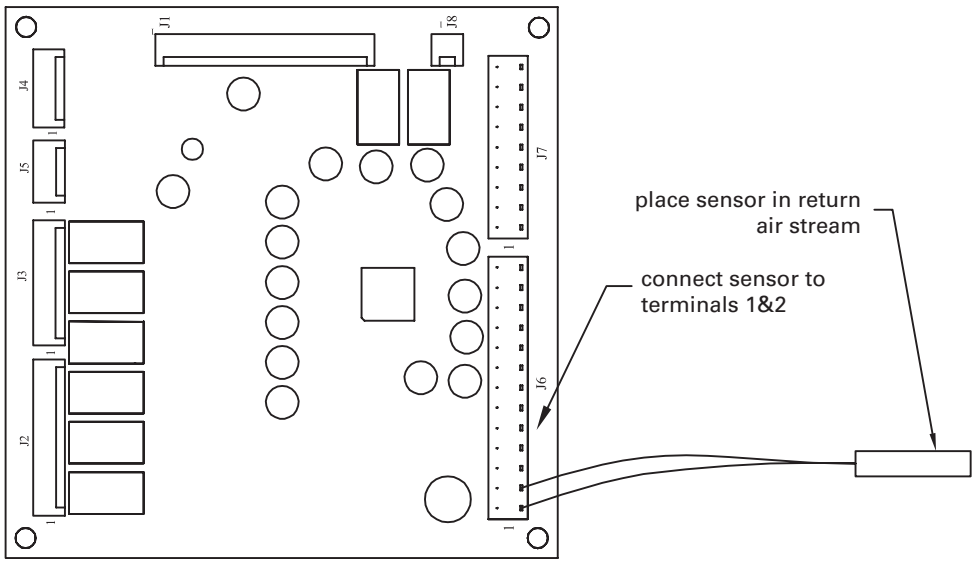
Temporary comfort can be provided without a Zone Sensor Module or thermostat in place by using the Outdoor Air Sensor or a spare Supply Air / Return Air Sensor. How to do it: remove the sensor from the unit, add enough thermostat wire to it so that it can be placed in the return air stream, then connect the sensor to J6-1 & J6-2. After the permanent Zone Sensor or thermostat is in place, the sensor must be removed from J6-1 & J6-2.

If the RTRM does not have a space temperature input (J6-1, J6-2), or have a conventional thermostat input (G,Y,W), the unit will not run (except in the test mode).

**Temporary Sensor (thermistor) attached to J6-1 and J6-2 only:**
Continuous fan
Auto changeover
74°F cooling, 71°F heating

***Note:***
***27½-50 ton units - the outdoor air sensor should not be used for this purpose.***

ReliaTel Refrigeration Module



# ReliaTel Supply Air Tempering Control

Supply air tempering maintains the supply air temperature above a lower limit during minimum ventilation periods when in heat mode. Supply air tempering is available when using a BAYSENS019*/ AYSTAT666* Programmable Zone Sensor, BAYSENS006-11/AYSTAT661-664 Mechanical Zone Sensor, or Trane ICS system. It is only active in the Heating mode.
The unit requires an RTOM (options module) and BAYTUBE discharge air sensing kit. Supply air tempering will not work with a conventional thermostat.

**How to enable Supply Air Tempering (CV only):**
Mechanical Zone Sensor BAYSENS006-11/AYSTAT661-664: remove the jumper from RTOM J3-1 and J3-2.
Programmable Zone Sensor BAYSENS019*/AYSTAT666*: change Option 4 in the options menu to 1=enabled. Or, remove the jumper from RTOM J3-1 and J3-2.
Trane ICS system: Enable through appropriate menu

***Note:***
***Supply air tempering is not available on 27½ to 50 ton VAV units.***

**Sequence of operation:**
When Supply Air Tempering is enabled, the supply fan is on, active mode is Heat or Emergency Heat, and with the unit not actively heating, stage 1 of heat is turned ON when the supply air temperature is 10°F below the Active Heating Setpoint. Stage 1 of heat is turned OFF when the supply air temperature is 10°F above the Active Heating Setpoint or the Mode is no longer Heat or Emergency Heat. Should the zone temperature exceed the Active Heating Setpoint by 1-2F, Supply Air Tempering will cease until another normal heating cycle resumes.
For heat pump units, the auxiliary heat is used for tempering.

# Discharge Air Sensing with TCI Comm3/4

Units connected to ICS systems have the ability to look at discharge air temperature. Units operating on COMM3/4 systems only have the ability to see one point for discharge air and that is through the Mixed Air sensor. This is reported back to the ICS display graphics as SAS (Supply Air Sensor). The discharge air sensor is often used to monitor true discharge air temperature out of the unit. It is also used to do supply air tempering with an ICS system or a BAYSENS019* programmable zone sensor.

Systems using LonTalk, and an LCI card have the ability to see both Mixed Air and Discharge Air temperature.

The following discussion is focused only with units utilizing COMM3/4 communications.

If an economizer is not installed, the discharge air sensor option is required to monitor discharge air temperature. The sensor must be used in conjunction with the RTOM options module. The discharge sensor will be located in the discharge opening of the unit and provides true discharge temperature out of the unit.

If a unit has an economizer, in order to monitor true discharge air temperature, the unit can use the Mixed Air sensor, but it will have to be relocated to the discharge of the unit. If the Mix Air sensor is relocated to the discharge of the unit, no further action is required. The sensor will report back true discharge temperature through the economizer module, and also still function as the Mixed Air sensor for the economizer operation. The Discharge Air sensor option is the recommended method because it uses an averaging tube to sense the air across the discharge opening. This sensor will have to be wired back to the Mixed Air Sensor (MAS) input on the economizer module and replaces the MAS sensor.

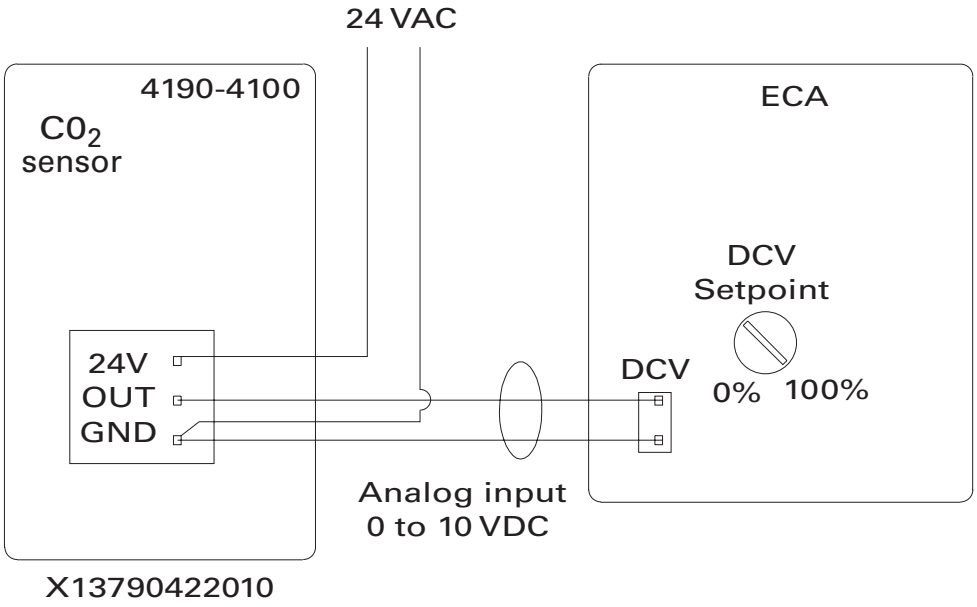
**Service Note:**
If there should be a sensor failure of either the Mixed Air sensor or the Discharge Air sensor, the diagnostic will be reported back as a Supply Air Sensor failure. It will require a visit to the jobsite to determine which sensor has failed.

**Note for 3-25 Ton Units:**
If the unit has an economizer and the Discharge Air sensor option is installed, then a 5.6K (1/4 watt) resistor must be installed on the OAT terminals of the economizer actuator module (ECA). This resistor will allow the economizer to continue operation from the Mixed Air sensor. The discharge air sensor will report true discharge temperature to the RTOM, and in turn, to the ICS panel via the TCI COMM3/4 communications. KIT08318 can be ordered for the 5.6K resistor.

# $CO_2$ Sensor Connections (ReliaTel units with Economizer)

**$CO_2$ Sensor Connections For ReliaTel Units With Economizer**
$CO_2$ setpoint adjustment

DCV setpoint potentiometer on economizer module can be adjusted as follows:
0% = 500ppm
50% = 1000ppm
100% - 1500ppm




The $CO_2$ sensor can be configured for 0-10vdc, 0-20mA or 4-20mA analog outputs. For use with the ReliaTel economizer, the sensor must be set for 0-10vdc. As the $CO^2$ level increases, the voltage output increases accordingly. The DCV potentiometer on the ReliaTel economizer module can be set to the desired point at which the economizer will start modulating. The adjustment range is to 100%; 0% = 500ppm, 50% = 1000ppm and 100% = 1500ppm.
When the DCV threshold is reached the economizer will start to modulate open to bring in more fresh air to reduce the $CO_2$ level. The damper will modulate open in small increments until the $CO_2$ level is satisfied or the damper reaches the full open position. Once the threshold is satisfied, the damper will return to normal economizer operation.

If the mixed air temperature drops to 40° F, the $CO_2$ sensor input is overriden and closes the damper to minimum position to prevent, hot water coils from freezing, or if gas heating, to prevent condensation in the heat exchanger. When the mixed air temperature rises to 43°F, $CO_2$ or economizer operation is once again restored. Since the damper can drive wide open, it is also recommended to install an evaporative defrost control to prevent the evaporator coil from freezing.

# ReliaTel Ventilation Override

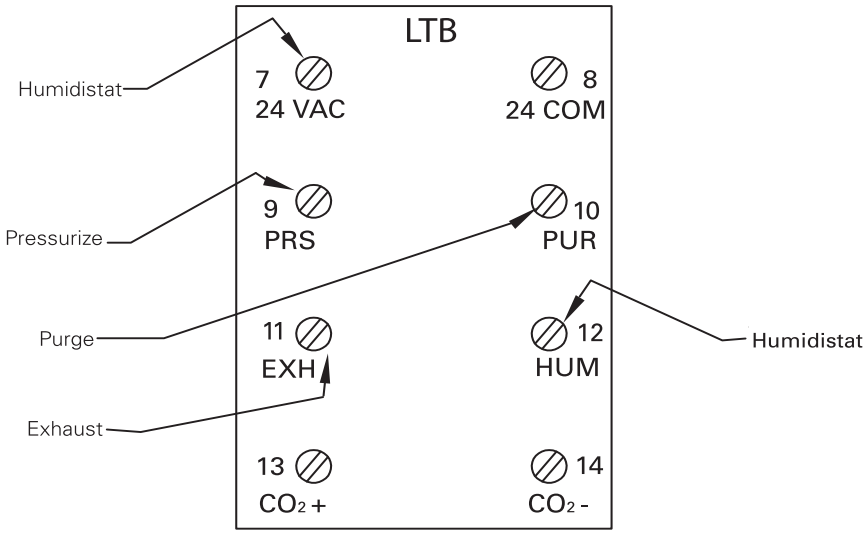
Three Ventilation modes are available with ReliaTel through use of an Options Module (RTOM) and economizer (ECA) with Power Exhaust. Following is a list of each mode and what happens during each.

| **Supply Fan forced:** | | **Compressors may run?** | **OK to heat (gas/elect.)?** | **Economizer position?** | **Power Exhaust?** |
|---|---|---|---|---|---|
| Pressurization | ON | No | No | 100% | Off |
| Purge | ON | No | No | 100% | On |
| Exhaust | OFF | No | No | 0% | On |

Connections to the unit to accomplish Ventilation Modes are shown below. All three inputs are shown for illustration; only one is typically used.

***Note: Although not associated with ventilation override, humidistat connections for dehumidification are also provided on this terminal block.***

Emergency shutdown from the RTRM will override any ventilation override mode.
Ventilation override inputs override smoke detector inputs through the RTOM. (3-25 tons only)



# Dehumidification with Hot Gas Reheat (3-25 Tons)

Factory installed hot gas reheat allows application of dehumidification. Initiation of reheat is performed by an input to the RTOM module from either a relative humidity sensor or a humidistat type device. These connections are made through the low voltage terminal strip located in the unit control panel. Actuation of the reheat is accomplished by energizing a valve that allows refrigerant hot gas to flow through the hot gas reheat coil.

Dehumidification is allowed only when the outside air temperature is above 40°F and below 100°F. Dehumidification is also not allowed if there is an active call for heating or cooling. If, during a dehumidification cycle, there is a call for heating or cooling, the dehumidification cycle is terminated. The economizer outside air damper is also driven to minimum position during dehumidification.

A humidity sensor that is capable of providing a 4 - 20 ma output can be used. The RH setpoint is established by adjusting the R41 potentiometer (labeled Dehumid SP) on the RTOM module. The range can be set from 40 to 60%. In the absence of a zone humidity sensor input, an on/off input from a zone humidistat is used to initiate or terminate the dehumidification cycle.

A relative humidity sensor takes priority over a humidistat. Dehumidification takes priority over a call for one stage cooling. Heating or 2 stage cooling takes priority over dehumidification.

## Sequence of Events

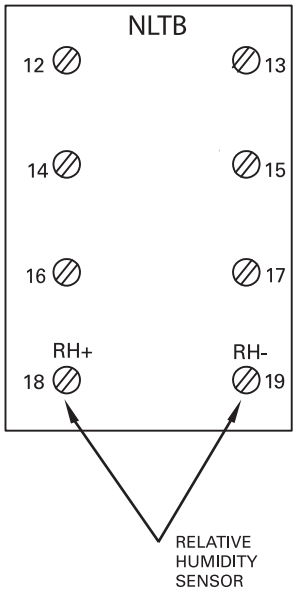
**Single compressor units**

On a call for dehumidification, the reheat valve is energized and the compressor is turned on. When the humidity control setpoint is satisfied, the valve is de-energized and the compressor is turned off. If there is a call for cooling from the space temperature controller, i.e. zone sensor or thermostat, while in reheat, the reheat valve is de-energized and the compressor continues to run. The three-minute compressor on and off times are still active during compressor operation.

**Dual Compressor units**

On a call for dehumidification, the reheat valve is energized and both compressors are turned on. When the humidity control setpoint is satisfied, the valve is de-energized and both compressors are turned off. If there is a call for 1st stage cooling while in the dehumidification mode, no action takes place. If there is a call for 2nd stage cooling, the reheat valve is de-energized, and the unit reverts to the cooling mode. If 2nd stage cooling is satisfied and there is still a call for dehumidification, the reheat valve will once again be energized. The three-minute compressor on and off times are still active during compressor operation.

Refer to appropriate unit wiring diagrams for control connections.




Verification of the RH setpoint can be determined by measuring the dc voltage at TB1 and TB2 on the RTOM.

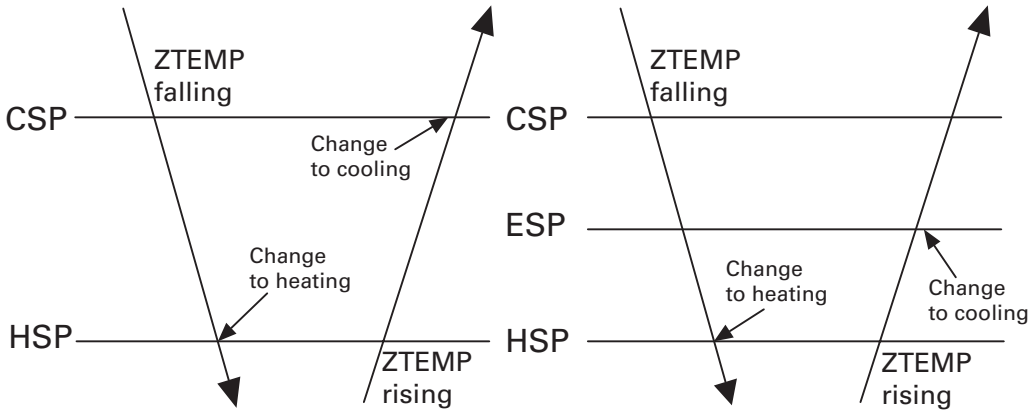
| Setpoint (%) | Voltage (vdc) | Setpoint (%) | Voltage (vdc) | Setpoint (%) | Voltage (vdc) | Setpoint (%) | Voltage (vdc) |
|---|---|---|---|---|---|---|---|
| 40 | 0.0 | 45 | 1.00 | 50 | 1.67 | 55 | 2.14 |
| 41 | .238 | 46 | 1.15 | 51 | 1.77 | 56 | 2.22 |
| 42 | .455 | 47 | 1.30 | 52 | 1.88 | 57 | 2.30 |
| 43 | .652 | 48 | 1.43 | 53 | 1.97 | 58 | 2.37 |
| 44 | .833 | 49 | 1.55 | 54 | 2.06 | 59 | 2.44 |
| | | | | | | 60 | 2.50 |

Calculation to convert mA to RH = (mA reading - 4) * 6.25
4mA = 0%
20mA = 100%
Example: (12mA - 4) * 6.25 = 50% RH
To measure the mA input current from the humidity sensor, disconnect sensor wire that is connected to terminal 18 of LTB. Connect amp meter in series with the wire and terminal 18 of the LTB.

# Heating/Cooling Changeover

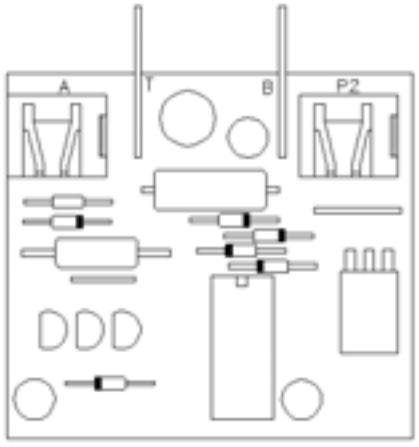
The change over from heating to cooling is accomplished in two different ways. The first drawing below illustrates change over in a system without an economizer, and the second drawing illustrates change over in a system with an economizer. Change over from cooling to heating is accomplished in the same manner for both economizer and non-economizer systems.

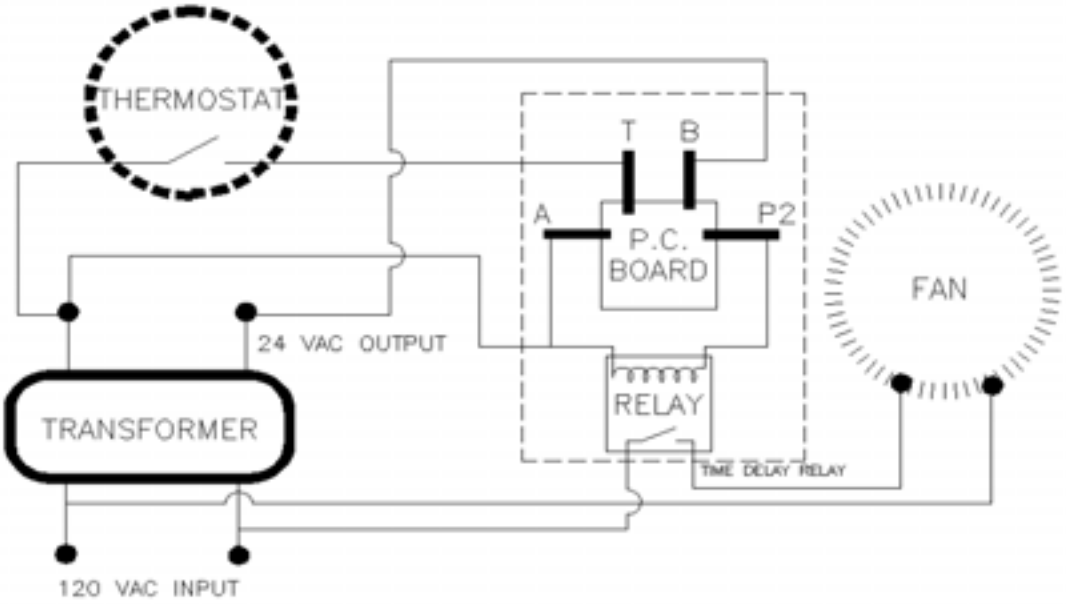
If the unit is in the cooling mode and the zone temperature is falling, the unit will change to the heating mode when the zone temperature is equal to or less than the heating set point. For systems without economizers, if the unit is in the heating mode, and the zone temperature is rising, the unit will change to the cooling mode when the zone temperature is equal to or greater than the cooling set point. For systems with economizers, if the unit is in the heating mode, and the zone temperature is rising, the unit will change to the cooling mode when the zone temperature is equal to or greater than the economizer set point.



# Electromechanical Time Delay Relay

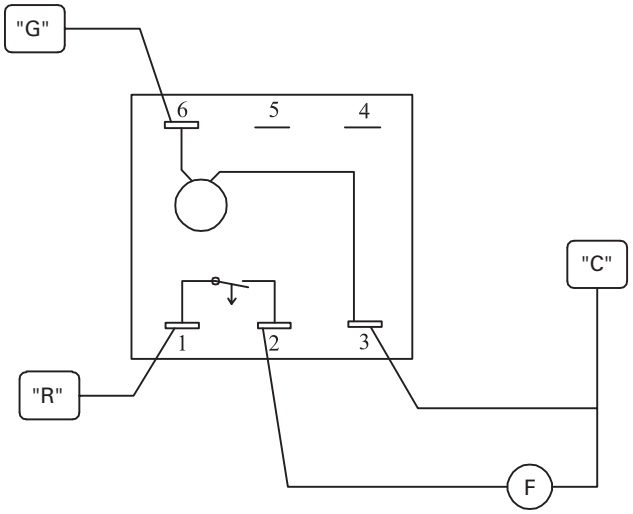
**Time Delay Relay**
This time delay circuit board attaches to the side of the relay. When energized, the fan starts immediately and when de-energized shuts off 80 seconds later. This delay is not adjustable.



# Electromechanical Time Delay Relay (Sequence of Operation)

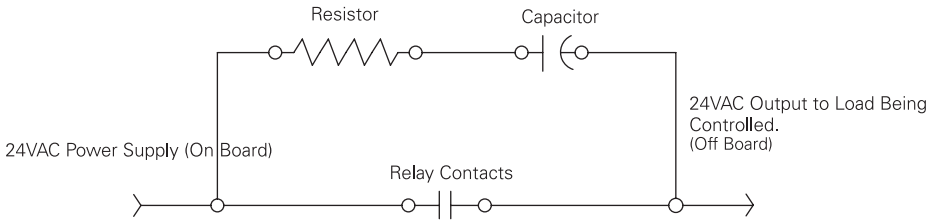
**Fan "Off" Delay Solid State Timer**
When "G" is energized, the N.O. contacts between 1 and 2 close immediately, energizing the fan relay (F), which in turn starts the indoor fan.
When "G" is de-energized, the contacts between 1 and 2 remain closed for 80 seconds, then open. This in turn de-energizes the F relay, which stops the indoor fan.



# Snubber Circuits

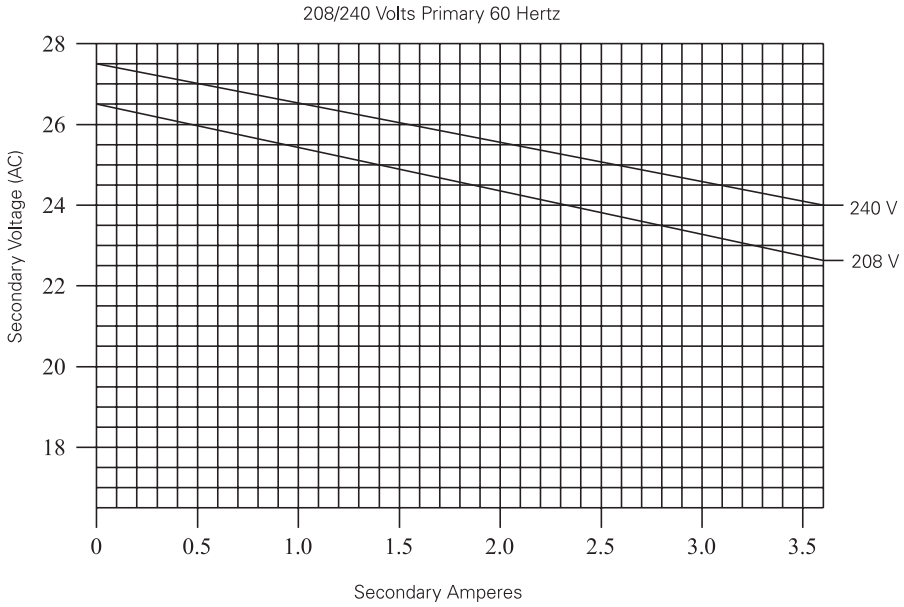
ReliaTel controls utilize relays to energize alternating current (AC) loads. Because of the characteristics of AC loads dealing with inrush current, snubber circuits are used.

The purpose of a snubber circuit is to act as a filter to help dampen the voltage peaks associated with the opening and closing of the relay contacts. The snubber circuit is a resistive/capacitive circuit, with a resistor and capacitor wired in series across the on-board relay contacts. Snubber circuits may cause confusion because 24 vac will be present if the output wire is disconnected from the load; such as a relay or contactor coil, and the contacts of the board relay are open. The voltage potential between the disconnected wire and ground will be 24 vac, but no current will be present. When the wire is placed back on the contactor coil, the 24 vac potential will disappear. To properly verify whether voltage is present to energize a relay and contactor, the circuit must be complete and in tact.



# Transformer Troubleshooting

The graph below shows how as current caused by loads on the transformer increases, voltage decreases. Once the voltage drops below the level that the contractor can pull in, usually about 16-18 volts, the current raises up to the point where the transformer burns out.The chart below is for illustration only.

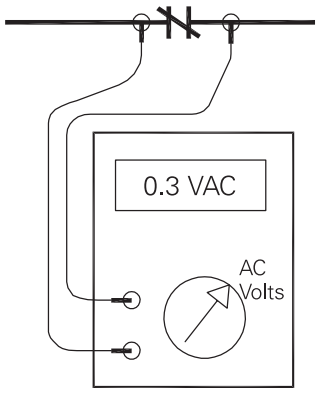



A transformer usually burns out due to a short circuit. When this occurs, the technician can usually find the source of the short. Sometime though, the cause of transformer failure is not so obvious. It can also fail when excessive voltage drops occur because of poor connections, thermostat wires too long, bad contacts on the smoke detector, etc. The excessive voltage drop results in low voltage to the load (contactor, relay) and then the transformer blows.

# Transformer Troubleshooting

**Here's what to look for:**
Transformer on the wrong voltage tap, i.e. 208 volts at the unit, transformer on the 230 volt tap.

Voltage drop across contacts (measure with a load on the circuit):




Voltage drop across contacts when load is applied should be less than ½ volt.

# High Pressure and Low Pressure Lockout Circuits

High Pressure Cutout (HPC) and Low Pressure Cutout (LPC) circuits are designed to shut compressor operation down when pressures are too low, such as loss of charge; or too high, such as would result from dirty condenser coils. The operational logic of these circuits is somewhat unique and requires explanation to fully understand how they operate.

**LPC Logic**
LPC logic was changed with version 3.1 of the RTRM. Timing was changed from two minutes to 10 seconds to enhance compressor reliability due to no-flow issues for theTXV option during compressor starts.

**Sequence of operation**
On a call for cooling, there is a ten second period where the LPC switch is ignored. If there is a low charge condition or low pressure condition due to extreme cold ambient conditions, the unit is allowed to run for ten seconds to build up pressure.

If the switch is closed after ten seconds, the compressor will continue to run. If the switch is open, the compressor will shut down immediately. After three minutes, if there is still an active call for cooling, the unit will once again start. If the switch is still open after the initial 10 seconds, the compressor will again shut down. The unit will try to start four times. If the switch is still open after the fourth try, the unit will shut down and be locked out, and will require a manual reset to start the unit again.
If the switch is closed and the compressor continues to run for three minutes, the counter is reset and the logic sequence starts over.
If the call for cooling goes away at any time during the routine, the counter is reset and the logic sequence starts over.

**HPC Logic**
High Pressure Cutout (HPC) is similar to the LPC in that the unit may be given up to four tries to operate. Like the LPC, the HPC provides reliability protection for compressors, but it is also used for safety protection due to the high operating pressures that the unit may see.
At no time should the HPC be removed or disabled in order to maintain unit operation.

**Sequence of operation**
On a call for cooling, if the HPC switch is closed, the compressor will be allowed to start. If at any time the HPC opens, the unit will shut down immediately. After a fifteen minute period, if there is still a call for cooling, the control logic will check to see if the switch has closed. If not, the unit is locked out and requires a manual reset to restart the unit.
After fifteen minutes, if the HPC is closed, and there is still a call for cooling, the unit will be allowed to restart. Once again, if the HPC opens, the unit will shut down and wait fifteen minutes to validate a restart. If the switch is closed, the unit will be allowed to restart.
If the HPC opens and closes four times during an active call for cooling, the unit will be shut down and locked out, and will require a manual reset.
If any time during the counter routine, the call for cooling goes away, the counter will reset and the logic sequence starts all over again.

# Novar Controls (Sequence of Operation)

Novar is a control system that is often interfaced with ReliaTel controls which allows others to take control of our equipment. The Novar system includes, but is not limited to, a control module EMT2024 or EMT3051, a relay panel and various sensors such as discharge and return. The Novar system connects to our unit in the same manner as a conventional thermostat. Other modifications are also made that allows the Novar system to take control of the economizer.

## Novar Controls Sequence of Operation

**General**
Novar Control units use a hybrid Reliatel-Novar control scheme. The Reliatel system is controlled using the RTRM thermostat inputs connected to a Novar Electronic Thermostat Controller that serves as a master unit controller and BAS network communication device. In addition to basic thermostat operation control, a Novar unit includes some additional relay connections that provide master control of economizer operation.

**Cooling with an Economizer**
On a Novar-controlled system the master controller initiates control requests to the RTRM through its Indoor Fan, Cool, and Heat command outputs and the RTRM thermostat inputs. The economizer control actuator **(ECA)** is wired to a **Damper** relay and a **Nightmode** Damper relay as described in the Economizer Set-up section. To enter an economizer-cooling only mode the master controller will energize its **Fan** (G) output activating the supply fan and close the contacts on the **Damper** relay allowing a valid signal from the mixed air sensor. The unit will then modulate the outdoor air damper open if the mixed air sensor reading is high compared to the mixed air setpoint of 53° F. If the Damper relay is not energized when the supply fan is on the ECA will maintain the outdoor air damper at default minimum position. When the Novar controller senses conditions that require additional cooling greater than that provided from economizing-only it will energize its **Cool 1** (Y1) output calling for compressor operation. If additional cooling is required above that provided by the first stage of compressors the second stage will be activated by energizing the **Cool 2** (Y2) output. Compressors will respond to these calls independent of the position or status of the economizer, but they will continue to adhere to minimum on, off, and inter-stage timing.

***Note: When compressors are activated and the indoor coil begins to cool down the temperature of the mixed air sensor may drop below the mixed air setpoint causing the ECA to close the outdoor air damper to minimum position.***

**Cooling without an Economizer**
The Novar controller uses its zone temperature input and setpoint input to determine when to initiate requests for compressors or heat. Calls for cooling are interpreted by the Reliatel controller as thermostat requests. When the zone temperature is sufficiently greater than the setpoint, the Novar will energize its **Cool 1** (Y1) output to turn compressors on. It will also close the contacts on its **Fan** (G) output to call for the Supply Fan to turn on. The first compressor will energize after its minimum 3-minute off time has expired. If additional cooling capacity is required above that provided by the first stage the second stage of compressors will be activated by energizing the **Cool 2** (Y2) output. Once the zone temperature falls below the setpoint sufficiently the compressor and fan outputs on the Novar controller will be deactivated and the RTRM will respond appropriately and deactivate its respective outputs. As with normal thermostat control the Supply Fan will remain on for a period of 60 seconds after the compressor output is de-energized for free cooling.

**Economizer Set-up**
The economizer function on a Novar-controlled unit is controlled more directly than in normal operation. The economizer is wired with additional inputs from the Novar controller to provide this control:

**– Manual Enthalpy Override**
The economizer control actuator (ECA) is configured for Novar operation by placing a 100KΩ resistor across the normally unused outdoor air temp input on the ECA. This signals the economizer to enter Manual Enthalpy Override which enables economizer cooling operation at all times regardless of outdoor or indoor conditions.

**– Damper Relay**
A relay output on the Novar controller is that signals a relay placed in-line with the mixed air temperature sensor. It is used to interrupt the mixed air sensor signal to the ECA indicating when to modulate for economizing or to go to minimum position. If an open is detected on the mixed air temperature input the ECA will hold the damper at minimum position.

**– Nightmode Damper Relay**
A relay on the Novar controller is connected across the remote minimum position potentiometer inputs (P and P1) on the ECA. When the relay contacts are closed for Nightmode operation the ECA uses a default damper minimum position of 0%. When they are not closed it uses the standard minimum position adjustment on the ECA as default.

**[Gas/Electric] Heating**
The Novar controller uses its zone temperature input and setpoint input to determine when to initiate requests for compressors or heat. Calls for heating are interpreted by the Reliatel controller as thermostat requests. When the zone temperature is sufficiently lower than the setpoint the Novar will energize its **Heat 1** (W1) output to turn the first stage of heat on. It will also close the contacts on its Fan (G) output to call for the Supply Fan to turn on. The first stage of [Gas/Electric] heat will energize. If additional heating capacity is required above that provided by the first stage the second stage of [Gas/Electric] will be activated by energizing the **Heat 2** (W2) output. Once the zone temperature rises above the setpoint sufficiently the heat and fan outputs on the Novar controller will be deactivated and the RTRM will respond appropriately and deactivate its respective outputs. On Gas Heat units the Supply Fan will remain on for a period of 90 seconds after heat is deactivated for free heating and heat exchanger cool down.

# Novar Controls (Sequence of Operation)

## Novar Controls Checkout/ Troubleshooting Procedure

**General**

The Novar Electronic Thermostat Module (ETM) includes an installation manual that describes the basic connections and checkout of the Novar controller. This manual should be consulted during installation, checkout, or troubleshooting. If problems are encountered with unit operation after consulting the Novar ETM installation manual, the following checkout procedures may help to determine and isolate the cause of the problem.

**Checkout Procedure:**

1. If the Novar controller is connected to the BAS network check for any failure messages related to the controller in question. Take appropriate actions if messages exist.
2. Verify proper power connection and that it is connected to a 24VAC source with at least a 10VA consumption rating.
3. Apply Power to the unit.
4. Verify all installed boards are energized by checking the status LED's on each. On the Novar board the Status LED will either be OFF if in Scheduled On mode and blink ON when network communications are exchanged, or be ON steady and blink OFF during communications if in Scheduled ON mode. The status lights on the main ReliaTel control modules will be on steady if the boards are powered up and properly communicating on the inter-module bus.
5. Check the 1-amp fuse on the Novar ETM (located next to the NightMode output relay) for integrity.
6. Verify all inputs are connected according to the ETM installation instructions.
7. Other than economizer connection verification all jumper locations and short connections refer to the ETM.
8. Apply a short across the jumper tabs on the Fan output relay on the ETM. Verify the supply fan energizes within a few seconds. Remove the short. The supply fan should turn off within a few seconds. If the supply fan does not energize verify proper connection of the Fan output relay to the RTRM Thermostat-G input and verify the Supply Fan Relay on the RTRM is properly connected.
9. To completely check economizer (if installed) operation the conditions at the Mixed Air Temperature Sensor must be at least 55° F or warmer. The Mixed Air Temp Sensor is located downstream of the indoor coil so this test should be performed in the absence of active compressor operation which would produce sub-cooled air across the Mixed Air Sensor preventing economizer opening. Mixed air sensor resistance should be less than 20K.
10. To verify proper economizer operation place a short across the jumper tabs on the Fan output relay and the NightMode output relay. Ensure that the 100K resistor is in place on the Outdoor Air Temp input on the economizer module. Verify the supply fan energizes and the outdoor air damper opens to the minimum position set by the on-board Economizer Module potentiometer. Once the damper reaches minimum position apply a short across the NightMode output relay. The damper should close completely. Disconnect the short and verify the damper opens back to minimum position.
11. If the outdoor air damper does not actuate as described above verify proper operation and connection of the economizer actuator as described in the Reliatel Controls installation guide. Also verify proper connection between the NightMode Damper relay and the P and P1 connections.
12. To continue the economizer operation check, place a short across the jumper tabs on the Damper output relay. If conditions are warm enough at the Mixed Air Sensor the economizer actuator should begin opening the damper toward fully open. The travel time is dependent on the temperature of the air flowing across the sensor. If the Mixed Air Sensor temperature falls below the 53° F economizer setpoint the damper will stop opening and begin to close back to minimum position.

# Novar Controls (Sequence of Operation)

13. If incoming air conditions are warmer than the setpoint and the damper is not opening check the damper relay connection in the Mixed Air Sensor circuit and verify the proper sensor and sensor wiring. Also measure the 100KΩ resistor and verify correctness and that it is connected to the proper input.
14. To check out compressor operation from the Novar ETM connect a short across the jumper tabs on the Cool 1 output relay. Verify that the 1st stage of compressors activates within 3 minutes. Each stage of compressors will be forced off for a minimum of 3 minutes at power up and after a period of operation. Be aware that the compressor will remain on for a minimum of 3 minutes even if the short is removed. To immediately discontinue compressor operation disconnect unit power. Verify that the unit is producing cool, conditioned air. Keep in mind that the outdoor air damper will close to minimum position when the discharge air cools below the economizer setpoint.
15. If compressors do not activate within 3 minutes of placing the short verify the Cool 1 relay output is properly connected to the Thermostat-Y1 input on the RTRM and that compressor circuit 1 is properly connected according to the Reliatel Installation guide. Verify the compressor(s) has properly connected line power and that all in-line safety limits and contactors are functioning correctly.
16. Follow the same procedure as above to check proper operation of the 2nd stage of compressors by placing a short across the Cool 2 output relay. Keep in mind that the Cool 1 and Cool 2 thermostat controls operate independently of each other and must adhere to a 3-minute delay between stage additions. If problems are encountered complete the checks above except verify proper connection between the Cool 2 output relay and the RTRM Thermostat-Y2 input.
17. After verifying proper operation of both refrigeration circuits remove all shorts. Compressors should deactivate immediately if they have been running for at least 3 minutes. The supply fan will remain on for 60 seconds, and the outdoor damper will close after the supply fan shuts off.
18. For heating checks (if installed) place a short across the jumper tabs on the Heat 1 output relay. If the unit is a gas heat unit the gas modules will begin the approximately 30 second cycle initiation. The supply fan will remain off until the gas heat has successfully initiated and operated for approximately 60 seconds. If the unit is an electric heat unit the 1st stage of electric heat will be energized and the supply fan will come on immediately. The unit should be discharging warm air.
19. If heat does not activate after placing the short, verify proper connection of the Heat 1 output relay to the RTRM Thermostat-W1 input. Verify proper Reliatel Module heater connections and function using the Reliatel Installation Guide.
20. To activate the second stage of heat (if applicable) place a short across the jumper tabs on the Heat 2 output relay. A similar process as described with the 1st stage of heat will take place. Verify, if possible, the 2nd stage of heat activates. If the 2nd stage of heat does not activate verify proper connection of the Heat 2 output relay to the RTRM Thermostat-W2 and verify proper Reliatel heat module/ output connections. Also verify line power connections to the heating units.
21. If heat operation is correct, disconnect all shorts from the jumper tabs on the relays. All heat will deactivate within a few seconds, supply fan will deactivate when electric heat deactivates or 90 seconds after gas heat deactivates.

# 27½ to 50 Ton CV and VAV (Overview)

**Overview**
As of April 19, 2004, all 27½ to 50 ton commercial rooftop units YCD, YCH, TED, TEH, TCD, TCH 330-600 are built using ReliaTel controls. The 10th digit of the model number is "M" and beyond. ReliaTel controls replace the now obsolete UCP controls.

**Constant Volume (CV)**
CV units operate much like 3-25 ton units with a few exceptions. These units may use a conventional thermostat or zone sensor. The units can be controlled using a LonTalk Communications Interface (LCI) or Tracer™ Summit. Every unit comes with an RTRM and RTOM. All other circuit boards are optional depending upon unit configuration. Troubleshooting the controls is comparable to 3-25 ton units.

**Variable Air Volume (VAV)**
VAV units use the same circuit boards as CV models, but operation and in some cases troubleshooting, are significantly different. The following section contains operating and troubleshooting information on VAV units. Every unit comes with an RTRM, RTOM, and RTAM. Additional information can be found in the Installation Operation and Maintenance (IOM) guide.

**VAV with ReliaTel versus VAV with UCP**
ReliaTel units do everything UCP units did and more. Here are some differences between UCP and ReliaTel units:
VAV Setpoint panel: ReliaTel has the same setpoints as UCP but they are mounted on (and integral to) the RTAM module. Also, every setpoint can be provided remotely by clipping the appropriate jumper and using the terminal strip on the RTAM
Exhaust Fan Setpoint panel: ReliaTel exhaust fan setpoint potentiometer is located on the RTOM module in the main control box.
Zone sensor and NSB inputs: With ReliaTel, these inputs are located on the RTRM module instead of LTB1 (UCP).

***VAV Note: The thermostat inputs on the RTRM are ignored. These inputs are for CV units only.***

Emergency stop: This input, called ESTOP, is located on LTB1-5 and LTB1-6 instead of LTB1-16 and LTB1-17 (UCP).

# 27½ to 50 Ton CV and VAV (Module Definitions)

The following modules are used in 27.5-50 ton Voyager units as of 4/19/04. Digit 10 of the model number is M or higher. ReliaTel modules communicate with each other on a ModBus link. Each module has a status LED indicating that the module is communicating with the link.

**RTRM - ReliaTel Refrigeration Module - (standard)**
This is the primary control module. It has built-in terminal strips for Zone Sensor, thermostat, and Night Setback connections as well as diagnostic outputs for service. In addition, the RTRM has the following inputs and outputs:
Compressor outputs
Outdoor fan relay outputs
Low Pressure (LPC) inputs
Outdoor Air Sensor (OAS) input
Supply Fan output
Electric Heat outputs (TE* only)
TEST mode input
Emergency Stop input

***Note: There is only one module used for 27.5 - 50 ton units regardless of configuration (VAV, CV). The unit is configured by wire harness inputs. See the wiring diagram for details.***

**RTOM - ReliaTel Options Module - (standard)**
This module has inputs for the following:
Ventilation Override (LTB4)
Frost Stat input
Clogged Filter Switch (optional)
Discharge Air Sensor (optional on CV**, standard on VAV)

**RTAM - ReliaTel Air Handler Module - (standard on VAV, optional on CV)**
This module contains the VAV setpoint potentiometers as well as the following inputs and outputs:
DIP switch inputs for Supply Air Reset, Daytime Warmup enable, and IGV/VFD configuration.
Supply pressure transducer input
Inlet Guide Vane (IGV) or Variable Frequency Drive (VFD) output.
Ventilation Heat Relay (VHR) output

**ECA - Economizer Actuator - (optional).**
If the unit has an economizer this module is present. It is screwed to the top of the economizer actuator motor in the economizer section of the unit. The ECA has the following inputs and outputs:
Mixed Air Sensor - this sensor is located in the supply air section of the unit.

Return Air Sensor (optional) - This sensor is used when the unit has Comparative Enthalpy.

Return Humidity Sensor (optional) - this sensor is used when the unit has Comparative Enthalpy.

Outdoor Humidity Sensor (optional) - this sensor is used when the unit has Reference Enthalpy or Comparative Enthalpy.

Exhaust Fan Relay output

$CO_2$ Sensor input (optional)

Remote minimum position potentiometer (optional)

**TCI - Trane Communication Interface - (optional)**
Input and output for communication to Tracer Summit (COMM4) or CCP (COMM4). Note: ReliaTel TCI does support communication from earlier versions of Tracker, Tracer 100 or ComfortTrac.

**LCI - LonTalk Communication Interface (optional)**
Input and output for LON communication with Tracer Summit, Tracker Version 10+, or 3rd party LonTalk building management systems.

**IGN - Ignition Control Module (YC* only)**
This module has the following inputs and outputs: TCO 1, TCO 2, TCO 3 input (limit switches)
Hot Surface Ignitor output / flame sensor input
Combustion blower motor output
Gas valve output

***Note: **Required with COMM3/4 ICS***

# 27½ to 50 Ton (Configuration Input)

The unit is hard wired with specific inputs as indicated below. These inputs cause the unit to respond with the appropriate outputs. Configuration inputs are only recognized at unit power-up.

Where "GND" is indicated below, the input is connected to chassis ground. Where "JUMPER" is indicated below, both connection points are shown.

| **Unit Type** | **RTOM J3-5** | **RTRM J1-3,J1-5** |
|---|---|---|
| V3 | GND | |
| V2, Precedent | Open | |
| Non Heat Pump | | Jumper |

| **Cond Fan Cycling** | **RTOM J3-4** |
|---|---|
| 27.5-30 Ton | GND |
| 35 Ton | Open |
| 40 Ton | GND |
| 50 Ton | Open |

| **SA Tempering** (CV Units Only) | **RTOM J3-1,J3-2** |
|---|---|
| Enabled | Open |
| Disabled | Jumper |

| **Electric Heat** | **RTRM J2-1,J2-2** |
|---|---|
| Heat | Open |
| No Heat | Jumper |

| **3 Compressor** | **RTRM J3-7** |
|---|---|
| 27.5-35 Ton | Open |
| 40-50 Ton | GND |

| **Lead/Lag** | **RTRM J3-8** |
|---|---|
| Disabled | GND |
| Enabled | Open |

# 27½ to 50 Ton VAV (Modes of Operation)

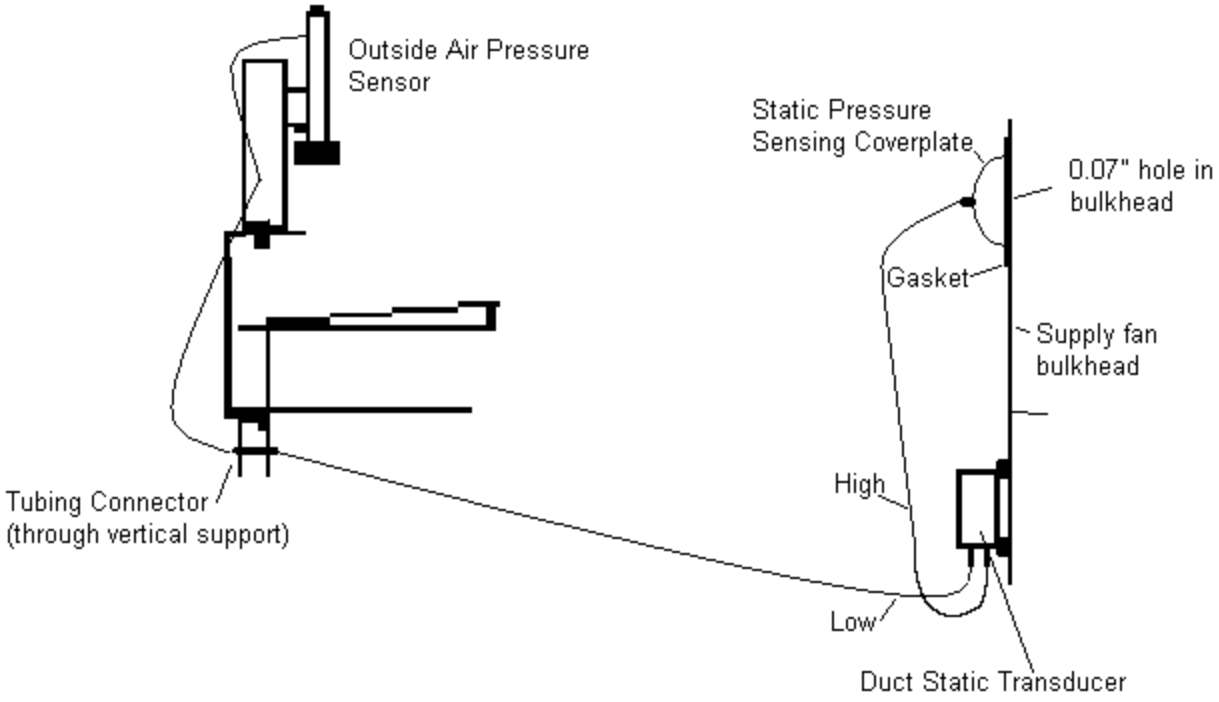
Unit functions are determined by the inputs on RTRM J6 as follows. The possible inputs are shown in the top (horizontal) row. The functions available are shown in the vertical columns below each input.

| | No Inputs on RTRM J6 | Jumper RTRM RTRM J6-2&4 | BAYSENS017B w/RTRM J6-2&4 Jumper | BAYSENS021B or BAYSENS017B w/7.68k resistor between RTRM J6-2&4 | BAYSENS020B or ICS™ system (Tracer Summit) |
|---|---|---|---|---|---|
| Occupied Cooling | No | Yes | Yes | Yes | Yes |
| Daytime Warmup (DWU) | No | No | Yes | Yes | Yes |
| Morning Warmup (MWU) | No | No | Yes | Yes | Yes |
| Indoor Blower (occupied mode) | Off | On | On | On | On |
| Indoor Blower (unoccupied mode) | N/A | Off | Auto | Auto | Auto |
| Unoccupied Cooling | N/A | No | No | No | Yes |
| Unoccupied Heating | N/A | No | Yes | Yes | Yes |
| Short Across RTRM J6-11&12 creates an unoccupied mode (Night setback) | No | No | Yes | Yes | N/A |

# 27½ to 50 Ton VAV (Airflow)

**Supply Duct Static Pressure Control**
The supply duct static pressure is measured by using a 0 to 5VDC transducer. The transducer is mounted on the supply fan bulkhead on the motor side of the supply fan section. The transducer is comparing the supply duct pressure (actually the pressure of the heat section of the unit) to outdoor air pressure. The high port of the transducer is connected to the static pressure sensing cover plate located on the supply fan bulkhead. The low port of the transducer is connected to a tubing connector on a vertical support of the unit and is field-connected to the Outside Air Pressure Sensor as pictured below. The transducer is wired to the RTAM and the decision to modulate the IGV or VFD is made at the RTRM.

*Figure VC-1*



# 27½ to 50 Ton VAV (RTAM Module)

Setpoints are provided by using the potentiometers on the RTAM, through remote potentiometers, or through ICS. The setpoint range is 0.3" WC to 2.5" WC. The deadband range is 0.2" WC to 1.0" WC.
The control band is the setpoint plus or minus ½ of the deadband.

For example:

Setpoint 1.5"

Deadband 0.4"

The IGV or VFD output will increase if the supply pressure goes below 1.3".

The IGV or VFD output will decrease if the supply pressure goes above 1.7"

The IGV or VFD output will not change if the supply pressure stays between 1.3" and 1.7".

DIP switch settings for this function are as follows:

RTAM SW1 switch 1 OFF for IGV, ON for VFD.

RTAM SW1 switch 2 OFF for VAV, ON for "VAV without IGV".

***Figure VC-2***

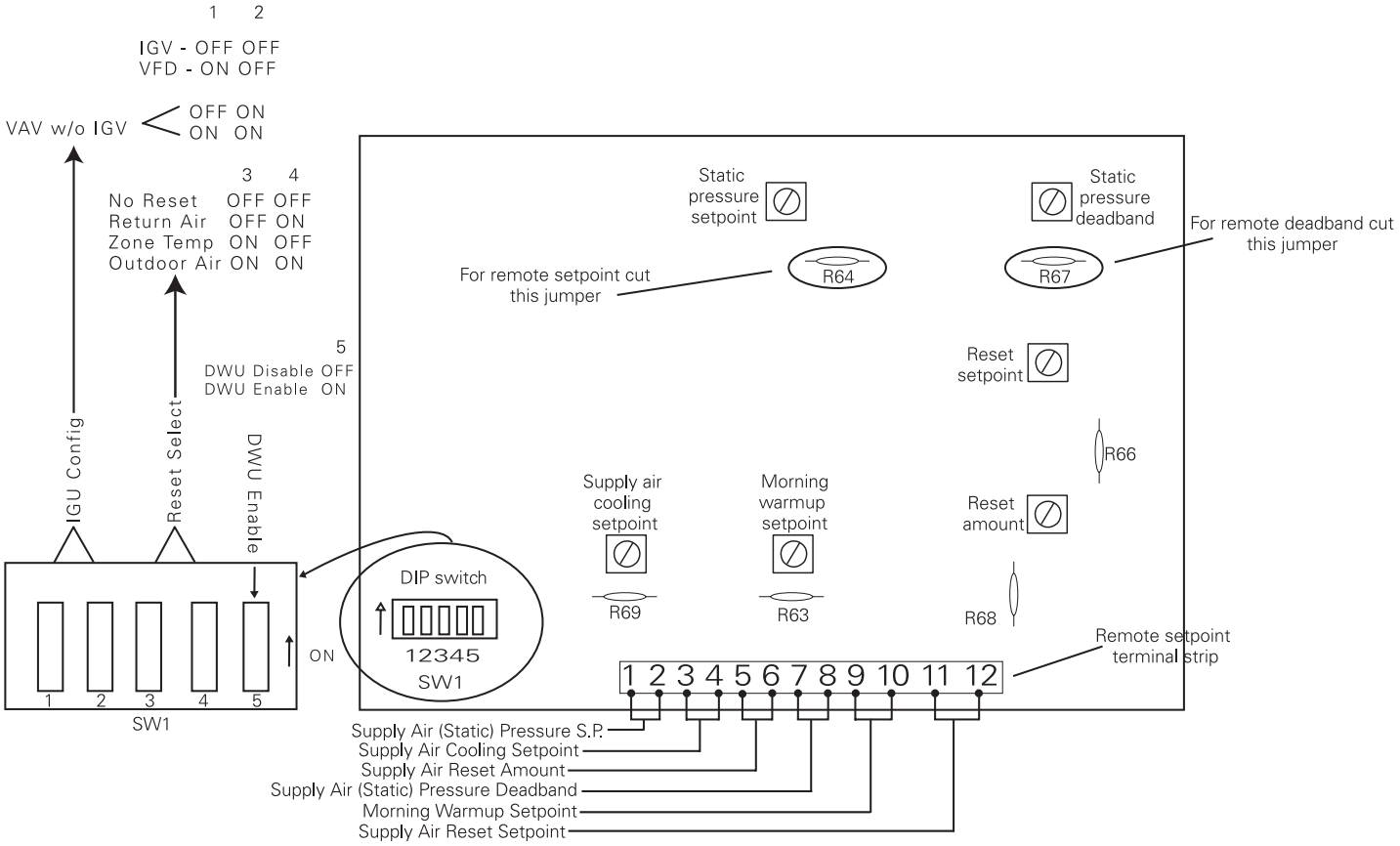
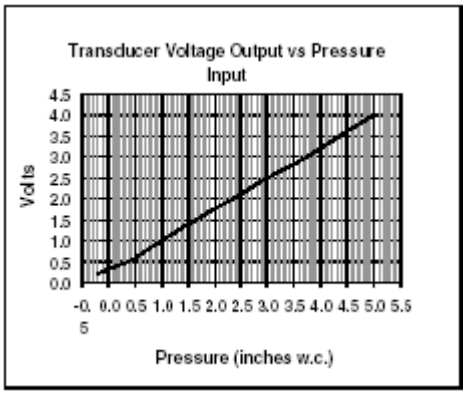


***Figure VC-3 Transducer Voltage Output vs. Pressure***




The transducer has a 0 to 5VDC range with a 0.25 to 2.125 VDC valid output range. The output is proportional. The chart illustrates the measured output voltage at typical supply duct pressures.
Airflow during unoccupied mode and heating:
When the unit transitions from occupied mode to unoccupied mode the VHR relay is energized. The VHR relay has a set of contacts on TB3 for the purpose of commanding the VAV boxes to drive open. The unit will only bring the fan on at 100% during the unoccupied mode. During Morning Warm-up and Daytime Warm-up modes the relay is energized and the fan runs at 100% airflow as well. If the unit has heat, the VAV boxes must be driven open. If the boxes are allowed to stay in control, the boxes may try to close instead of open when the warm air enters the room.

Additional notes:
1. When DIP SW1-1 is on, the output voltage range is approximately 0 to 10.5VDC.
2. When DIP SW1-1 is off, the output voltage range is approximately 2.5 to 8.5VDC.
3. IGV: When the supply fan is on and the output is 0%, the IGV are closed.
4. VFD: When the supply fan is on and the output is 0%, the VFD runs at 35hz.
5. If the supply static pressure goes below -0.2" (0.2VDC) the IGV / VFD output will stay at 0% and the diagnostic COOL FAIL + SERVICE FAIL will be present.
6. If the static pressure exceeds 3.8" WC the supply fan will stop and the diagnostic HEAT FAIL + COOL FAIL + SERVICE FAIL will be present.
7. During all heating modes; Daytime Warm-up, Morning Warm-up, and Unoccupied, the IGV or VFD output is always 100%.

**Troubleshooting tips**
If the transducer output voltages do not seem right, connect a 0-5" manometer in parallel with the transducer. This way you can see the same pressure the transducer is seeing. Many transducers get replaced in error when the real culprit is a loose tube or clogged fitting.
The polyethylene tubing in the transducer circuit does not readily go back to its original shape after use. Therefore, if a tube is removed from a fitting it should be cut back to a fresh end prior to reattaching.

Measure the transducer output voltage at RTAM terminal J1-3 to chassis ground. When the supply fan is off, the transducer output voltage should be approximately 0.25VDC. If the voltage output is high or low, unplug the transducer tubing to see if the voltage increases or decreases. If it does, a tube is probably clogged.
The input voltage to the transducer is measured between RTAM J1-4 and chassis ground. It should be 5VDC. If it is low, unplug the transducer and measure the voltage again. If OK now, the transducer or transducer wiring is shorted to common or ground.
The outdoor air pressure sensor must be mounted as shown in Fig. VC-1. If the sensor is mounted upside down the tubing can fill with water during heavy rains.
The static pressure sensing cover plate in the fan section of the unit is bolted to the fan bulkhead. The bulkhead has a very small (0.07") hole in the center area. The purpose of using such a small hole is to ensure that the transducer only sees the average supply air pressure. If the hole is enlarged, the transducer could respond erratically. If the hole is plugged, the transducer will not respond. If the gasket between the cover plate and bulkhead is leaking, the supply pressure will appear to be abnormally low since the cover plate is in the fan section.

**Application Notes**
Some applications call for relocating the supply air tube to 2/3 of the way down the duct. If this is done, be certain that there is no potential obstruction between the unit and the pickup point (such as fire dampers). A separate high duct static switch may need to be added.
The Outside Air Pressure Sensor should be located on top of the unit as shown in Figure VC-1. Some applications with extreme winds could require mounting the sensor in an area less affected by wind.

# 27½ to 50 Ton VAV (Outdoor Airflow Compensation)

**Outdoor Airflow Compensation (27½ - 50 Ton VAV only)**
When a VAV unit is modulating supply airflow, the pressure drop across the outdoor air damper changes. This usually means that the quantity of outside air will drop as the IGV closes or the VFD slows down. VAV units have a feature called Outside Air (OA) Flow Compensation to help maintain consistent OA flow regardless of supply airflow.

***Note: OA Flow Compensation mode is disabled if the unit has a CO2 sensor, min position input from ICS, or remote min position input at LTB3-1 and LTB3-2. It is also overridden during all Ventilation Override modes. Also, the minimum position can only be adjusted from 0 to 50% damper position regardless of OA Flow setpoints.***

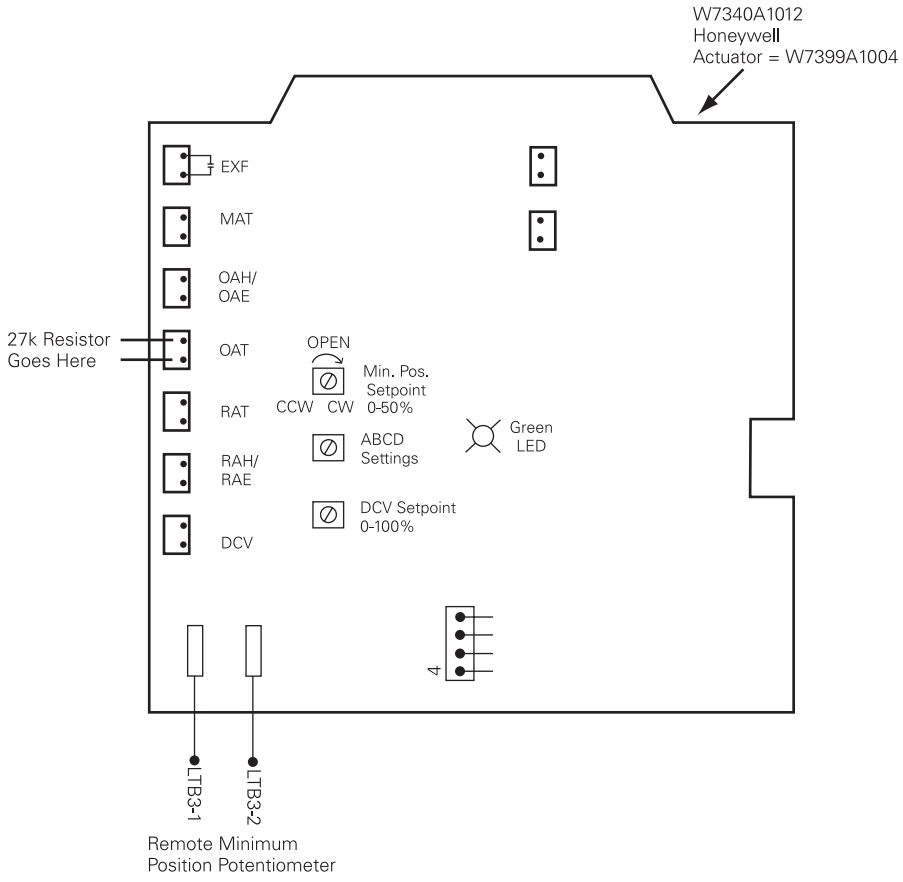
**Set up**
Once set up, the OA damper position will increase as the IGV closes or VFD slows down. The 27K resistor with plug in KIT#PLU00970 provides a signal to the unit to enable this function. The resistor must be plugged to the "OAT" input (this is an otherwise unused input) on the economizer module (ECA) and power reset to the unit.

**Operation**
The potentiometers MIN POS and DCV SETPOINT must now each be set in order to control the OA damper position.
The MIN POS setpoint determines the OA damper position (from 0 to 50%) when the IGV / VFD is at 100% regardless of DCV SETPOINT.
The DCV SETPOINT determines the percentage increase of the OA damper position when the IGV / VFD is at 0%. The percentage of OA damper increase between 0 and 100% IGV / VFD is linear.
To have no effect on the OA damper position when the IGV/VFD output is 0%, set the DCV SETPOINT to 0%.
To have the maximum effect on the OA damper position when the IGV/VFD output is 0%, set the DCV SETPOINT to 100%.
This chart shows the effect of DCV input vs. MIN POS when the IGV/VFD is at 0%.

***OA damper minimum position when IGV/VFD is closed / 0%***

| | MIN POS 0% (CCW) | MIN POS 25% | MIN POS 50% (CW) |
|---|---|---|---|
| DCVSP 0% | 0 (closed) | 25% | 50% |
| DCVSP 50% | 25% | 37.5% | 50% |
| DCVSP 100% | 50% | 50% | 50% |

***Figure VC-4***



# 27½ to 50 Ton VAV (BAYSENS021* VAV Remote Setpoints)

This chart lists setpoint /voltage/ resistance for the VAV Supply Air Cooling setpoint on the RTRM module. The chart can be used for troubleshooting units that have a remote setpoint at this input.
The typical remote setpoint input device is a BAYSENS021 zone sensor.
The connection points are RTRM J6-2 and RTRM J6-3.
If a remote setpoint is used, clip jumper R69 on the RTAM module. If the jumper is not clipped, the unit will ignore the RTRM setpoint.

***Note: A remote setpoint can also be applied to the RTAM Supply Air Cooling Setpoint input. However, the RTAM inputs use different temperature/ resistance inputs. See VAV Setpoint Inputs for input values.***

| Supply Air Cooling Setpoint (deg F) | Resistance (ohms) | DC Volts |
|---|---|---|
| 40 | 1084 | 2.6 |
| 41 | 1065 | 2.58 |
| 42 | 1045 | 2.56 |
| 43 | 1026 | 2.53 |
| 44 | 1006 | 2.51 |
| 45 | 987 | 2.48 |
| 46 | 967 | 2.46 |
| 47 | 948 | 2.43 |
| 48 | 928 | 2.41 |
| 49 | 909 | 238 |
| 50 | 889 | 2.35 |
| 51 | 870 | 2.33 |
| 52 | 850 | 2.3 |
| 53 | 831 | 2.27 |
| 54 | 812 | 2.24 |
| 55 | 792 | 2.21 |
| 56 | 773 | 2.18 |
| 57 | 753 | 2.15 |
| 58 | 734 | 2.12 |
| 59 | 714 | 2.08 |
| 60 | 695 | 2.05 |
| 61 | 675 | 2.02 |
| 62 | 656 | 1.98 |
| 63 | 636 | 1.94 |
| 64 | 617 | 1.91 |
| 65 | 597 | 1.87 |
| 66 | 578 | 1.83 |
| 67 | 558 | 1.79 |
| 68 | 539 | 1.75 |
| 69 | 519 | 1.71 |
| 70 | 500 | 1.67 |
| 71 | 481 | 1.62 |
| 72 | 461 | 1.58 |
| 73 | 442 | 1.53 |
| 74 | 422 | 1.48 |
| 75 | 403 | 1.44 |
| 76 | 383 | 1.39 |
| 77 | 364 | 1.33 |
| 78 | 344 | 1.28 |
| 79 | 325 | 1.23 |
| 80 | 305 | 1.17 |

# 27½ to 50 Ton VAV (VAV Setpoint Inputs)

This chart lists setpoint/voltage/resistance for VAV setpoints on the RTAM module in the control compartment. The chart can be used for troubleshooting the RTAM module or for applying a remote setpoint to the unit.

Each setpoint can be provided remotely by applying the appropriate resistance as shown in the table after cutting the resistor next to the setpoint knob. See drawing below.

Remote Setpoint inputs on RTAM J7:

J7-1, 2 Supply Air Pressure Setpoint

J7-3, 4 Supply Air Cooling Setpoint

J7-5, 6 Supply Air Reset Amount

J7-7, 8 Supply Air Pressure Deadband

J7-9, 10 Morning Warmup Setpoint

J7-11, 12 Supply Air Reset Setpoint

For remote setpoint cut this jumper:

Supply Air Pressure Setpoint R64

Supply Air Cooling Setpoint R69

Supply Air Reset Amount R68

Supply Air Pressure Deadband R67

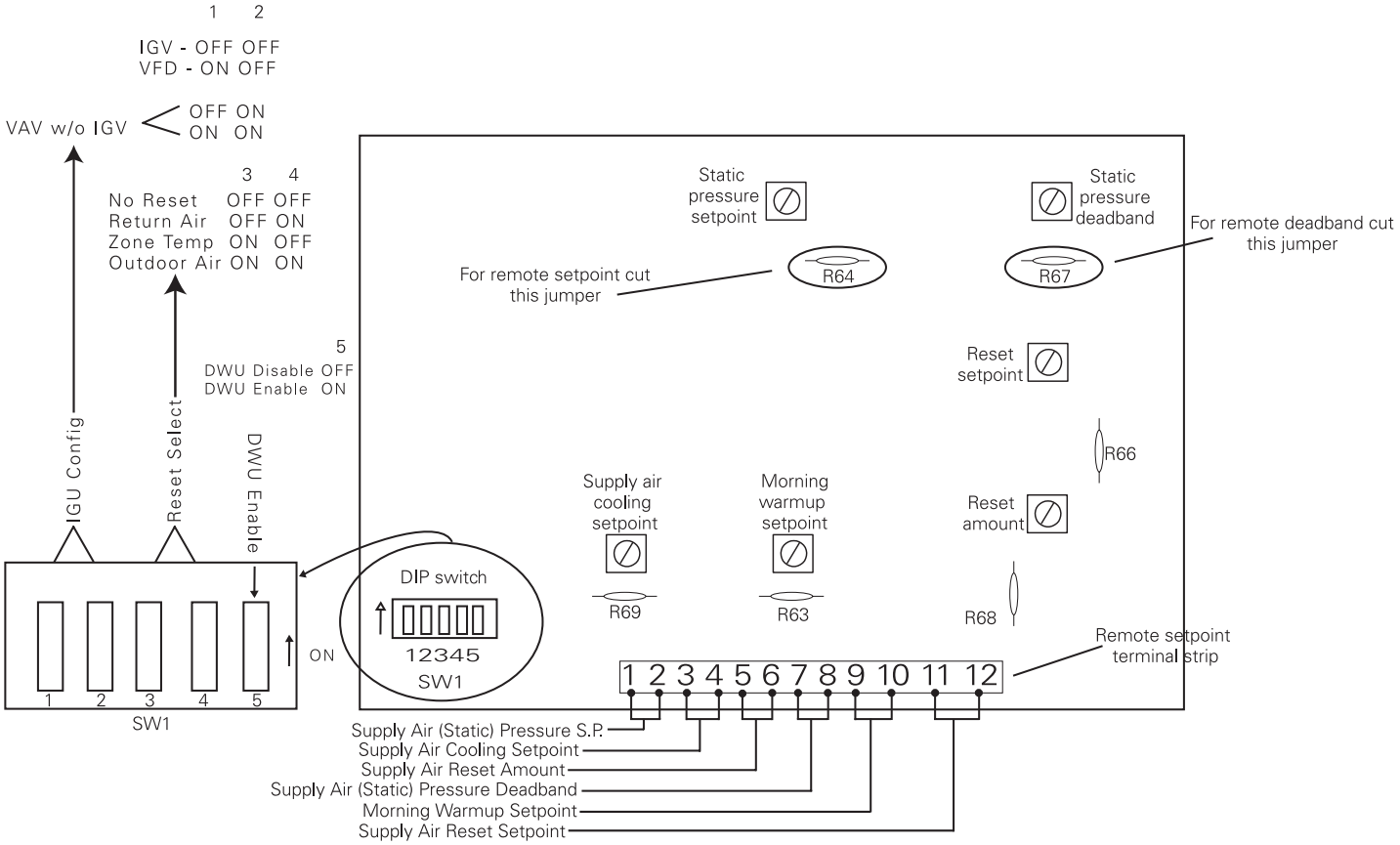
Morning Warmup Setpoint R63

Supply Air Reset Setpoint R66

Note: Remote SA Cooling Setpoint can be installed on RTAM J7-2, 3 (as shown) or on RTRM J6-2, 3. If the SA Cooling Setpoint is installed on RTRM J6-2, 3 or a BAYSENS021* is being used,

See VAV Supply Air Cooling remote setpoint - BAYSENS021*

***Figure VC-5***



# 27½ to 50 Ton VAV (VAV RTAM Setpoints)

| Resistance (Ohms) | DC Volts | Supply Air① Pressure Setpoint (see note) J7-1,2 "WC | Supply Air Cooling Setpoint J7-3,4 Deg F | Supply Air Reset Amount J7-5,6 Deg F | Supply Air② Pressure Deadband J7-7,8 "WC | Morning Warmup Setpoint J7-9,10 Deg F | Supply Air Reset Setpoint Outdoor J7-11,12 Deg F | Supply Air Reset Setpoint Zone or Return Air J7-11,12 Deg F |
|---|---|---|---|---|---|---|---|---|
| 0 | 0.00 | 0.00 | 40.00 | 0.00 | 0.00 | 50.00 | 0.00 | 50.00 |
| 10 | 0.05 | 0.02 | 40.27 | 0.13 | 0.01 | 50.27 | 0.67 | 50.27 |
| 20 | 0.10 | 0.05 | 40.81 | 0.40 | 0.02 | 50.81 | 20.02 | 50.81 |
| 30 | 0.15 | 0.08 | 41.29 | 0.65 | 0.03 | 51.29 | 3.23 | 51.29 |
| 40 | 0.19 | 0.11 | 41.23 | 0.91 | 0.05 | 51.23 | 4.57 | 51.83 |
| 50 | 0.24 | 0.14 | 42.31 | 1.16 | 0.06 | 52.31 | 5.78 | 52.31 |
| 60 | 0.28 | 0.17 | 42.79 | 1.40 | 0.07 | 52.79 | 6.99 | 52.79 |
| 70 | 0.33 | 0.20 | 43.28 | 1.64 | 0.08 | 53.28 | 8.19 | 53.28 |
| 80 | 0.37 | 0.24 | 43.76 | 1.88 | 0.09 | 53.76 | 9.40 | 53.76 |
| 90 | 0.41 | 0.27 | 44.24 | 2.12 | 0.11 | 54.24 | 10.61 | 54.24 |
| 100 | 0.45 | 0.30 | 44.73 | 2.36 | 0.12 | 54.73 | 11.82 | 54.73 |
| 110 | 0.50 | 0.32 | 45.16 | 2.58 | 0.13 | 55.16 | 12.89 | 55.16 |
| 120 | 0.54 | 0.35 | 45.59 | 2.79 | 0.14 | 55.59 | 13.97 | 55.59 |
| 130 | 0.58 | 0.38 | 46.02 | 3.01 | 0.15 | 56.02 | 15.04 | 56.02 |
| 140 | 0.61 | 0.40 | 46.45 | 3.22 | 0.16 | 56.45 | 16.12 | 56.45 |
| 150 | 0.65 | 0.43 | 46.88 | 3.44 | 0.17 | 56.88 | 17.19 | 56.88 |
| 160 | 0.69 | 0.46 | 47.31 | 3.65 | 0.18 | 57.31 | 18.26 | 57.31 |
| 170 | 0.73 | 0.48 | 47.68 | 3.84 | 0.19 | 57.68 | 19.20 | 57.68 |
| 180 | 0.76 | 0.51 | 48.11 | 4.06 | 0.20 | 58.11 | 20.28 | 58.11 |
| 190 | 0.80 | 0.53 | 48.49 | 4.24 | 0.21 | 58.49 | 21.22 | 58.49 |
| 200 | 0.83 | 0.55 | 48.86 | 4.43 | 0.22 | 58.86 | 22.16 | 58.86 |
| 210 | 0.87 | 0.58 | 49.24 | 4.62 | 0.23 | 59.24 | 23.10 | 59.24 |
| 220 | 0.90 | 0.60 | 49.62 | 4.81 | 0.24 | 59.62 | 24.04 | 59.62 |
| 230 | 0.93 | 0.62 | 49.99 | 5.00 | 0.25 | 59.99 | 24.98 | 59.99 |
| 240 | 0.97 | 0.65 | 50.37 | 5.18 | 0.26 | 60.37 | 25.92 | 60.37 |
| 250 | 1.00 | 0.67 | 50.69 | 5.34 | 0.27 | 60.69 | 26.72 | 60.69 |
| 260 | 1.03 | 0.70 | 51.26 | 5.63 | 0.28 | 61.26 | 28.14 | 61.26 |
| 270 | 1.06 | 0.73 | 51.74 | 5.87 | 0.29 | 61.74 | 29.35 | 61.74 |
| 280 | 1.09 | 0.77 | 52.30 | 6.15 | 0.31 | 62.30 | 30.76 | 62.30 |
| 290 | 1.12 | 0.80 | 52.79 | 6.39 | 0.32 | 62.79 | 31.97 | 62.79 |
| 300 | 1.15 | 0.83 | 53.27 | 6.63 | 0.33 | 63.27 | 33.17 | 63.27 |
| 310 | 1.18 | 0.86 | 53.75 | 6.88 | 0.34 | 63.75 | 34.38 | 63.75 |
| 320 | 1.21 | 0.89 | 54.24 | 7.12 | 0.36 | 64.24 | 35.59 | 64.24 |
| 330 | 1.24 | 0.92 | 54.72 | 7.36 | 0.37 | 64.72 | 36.80 | 64.72 |
| 340 | 1.27 | 0.95 | 55.12 | 7.56 | 0.38 | 65.12 | 37.81 | 65.12 |
| 350 | 1.30 | 0.98 | 55.61 | 7.80 | 0.39 | 65.61 | 39.01 | 65.61 |
| 360 | 1.32 | 1.01 | 56.09 | 8.04 | 0.40 | 66.09 | 40.22 | 66.09 |
| 370 | 1.35 | 1.03 | 56.49 | 8.25 | 0.41 | 66.49 | 41.23 | 66.49 |
| 380 | 1.38 | 1.06 | 56.89 | 8.45 | 0.42 | 66.89 | 42.24 | 66.89 |
| 390 | 1.40 | 1.09 | 57.38 | 8.69 | 0.43 | 67.38 | 43.45 | 67.38 |
| 400 | 1.43 | 1.11 | 57.78 | 8.89 | 0.44 | 67.78 | 44.45 | 67.78 |
| 410 | 1.45 | 1.14 | 58.18 | 9.09 | 0.45 | 68.18 | 45.46 | 68.18 |
| 420 | 1.48 | 1.16 | 58.59 | 9.29 | 0.46 | 68.59 | 46.47 | 68.59 |
| 430 | 1.50 | 1.19 | 58.99 | 9.49 | 0.47 | 68.99 | 47.47 | 68.99 |
| 440 | 1.53 | 1.21 | 59.39 | 9.70 | 0.48 | 69.39 | 48.48 | 69.39 |
| 450 | 1.55 | 1.24 | 59.80 | 9.90 | 0.49 | 69.80 | 49.49 | 69.80 |

① Supply Air Pressure Setpoint valid range is .3"-2.5".
② Supply Air Pressure Deadband valid range is .2"-1".

# 27½ to 50 Ton VAV (VAV RTAM Setpoints)

| Resistance (Ohms) | DC Volts | Supply Air① Pressure Setpoint (see note) J7-1,2 "WC | Supply Air Cooling Setpoint J7-3,4 Deg F | Supply Air Reset Amount J7-5,6 Deg F | Supply Air② Pressure Deadband J7-7,8 "WC | Morning Warmup Setpoint J7-9,10 Deg F | Supply Air Reset Setpoint Outdoor J7-11,12 Deg F | Supply Air Reset Setpoint Zone or Return Air J7-11,12 Deg F |
|---|---|---|---|---|---|---|---|---|
| 460 | 1.58 | 1.26 | 60.20 | 10.10 | 0.50 | 70.20 | 50.50 | 70.20 |
| 470 | 1.60 | 1.29 | 60.60 | 10.30 | 0.52 | 70.60 | 51.50 | 70.60 |
| 480 | 1.62 | 1.31 | 61.00 | 10.50 | 0.53 | 71.00 | 52.51 | 71.00 |
| 490 | 1.64 | 1.33 | 61.33 | 10.66 | 0.53 | 71.33 | 53.32 | 71.33 |
| 500 | 1.67 | 1.36 | 61.73 | 10.86 | 0.54 | 71.73 | 54.32 | 71.73 |
| 510 | 1.69 | 1.39 | 62.25 | 11.12 | 0.56 | 72.25 | 55.62 | 72.25 |
| 520 | 1.71 | 1.43 | 62.81 | 11.41 | 0.57 | 72.81 | 57.03 | 72.81 |
| 530 | 1.73 | 1.45 | 63.26 | 11.63 | 0.58 | 73.26 | 58.16 | 73.26 |
| 540 | 1.75 | 1.49 | 63.83 | 11.91 | 0.60 | 73.83 | 59.57 | 73.83 |
| 550 | 1.77 | 1.52 | 64.28 | 12.14 | 0.61 | 74.28 | 60.70 | 74.28 |
| 560 | 1.79 | 1.55 | 64.73 | 12.36 | 0.62 | 74.73 | 61.82 | 74.73 |
| 570 | 1.82 | 1.57 | 65.18 | 12.59 | 0.63 | 75.18 | 62.95 | 75.18 |
| 580 | 1.84 | 1.60 | 65.63 | 12.82 | 0.64 | 75.63 | 64.08 | 75.63 |
| 590 | 1.86 | 1.63 | 66.08 | 13.04 | 0.65 | 76.08 | 65.21 | 76.08 |
| 600 | 1.88 | 1.67 | 66.65 | 13.32 | 0.67 | 76.65 | 66.62 | 76.65 |
| 610 | 1.89 | 1.69 | 66.99 | 13.49 | 0.67 | 76.99 | 67.46 | 76.99 |
| 620 | 1.91 | 1.71 | 67.44 | 13.72 | 0.69 | 77.44 | 68.59 | 77.44 |
| 630 | 1.93 | 1.74 | 67.89 | 13.94 | 0.70 | 77.89 | 69.72 | 77.89 |
| 640 | 1.95 | 1.77 | 68.34 | 14.17 | 0.71 | 78.34 | 70.85 | 78.34 |
| 650 | 1.97 | 1.80 | 68.79 | 14.40 | 0.72 | 78.79 | 71.98 | 78.79 |
| 660 | 1.99 | 1.83 | 69.24 | 14.62 | 0.73 | 79.24 | 73.10 | 79.24 |
| 670 | 2.01 | 1.85 | 69.58 | 14.79 | 0.74 | 79.58 | 73.95 | 79.58 |
| 680 | 2.02 | 1.88 | 70.03 | 15.02 | 0.75 | 80.03 | 75.08 | 80.03 |
| 690 | 2.04 | 1.91 | 70.48 | 15.24 | 0.76 | 80.48 | 76.21 | 80.48 |
| 700 | 2.06 | 1.93 | 70.82 | 15.41 | 0.77 | 80.82 | 77.05 | 80.82 |
| 710 | 2.08 | 1.95 | 71.27 | 15.64 | 0.78 | 81.27 | 78.18 | 81.27 |
| 720 | 2.09 | 1.98 | 71.61 | 15.81 | 0.79 | 81.61 | 79.03 | 81.61 |
| 730 | 2.11 | 2.00 | 72.06 | 16.03 | 0.80 | 82.06 | 80.15 | 82.06 |
| 740 | 2.13 | 2.02 | 72.40 | 16.20 | 0.81 | 82.40 | 81.00 | 82.40 |
| 750 | 2.14 | 2.05 | 72.74 | 16.37 | 0.82 | 82.74 | 81.85 | 82.74 |
| 760 | 2.16 | 2.08 | 73.29 | 16.65 | 0.83 | 83.29 | 83.23 | 83.29 |
| 770 | 2.18 | 2.11 | 73.75 | 16.87 | 0.84 | 83.75 | 84.36 | 83.75 |
| 780 | 2.19 | 2.14 | 74.20 | 17.10 | 0.85 | 84.20 | 85.49 | 84.20 |
| 790 | 2.21 | 2.17 | 74.65 | 17.32 | 0.87 | 84.65 | 86.62 | 84.65 |
| 800 | 2.22 | 2.20 | 75.25 | 17.62 | 0.88 | 85.25 | 88.12 | 85.25 |
| 810 | 2.24 | 2.23 | 75.70 | 17.85 | 0.89 | 85.70 | 89.25 | 85.70 |
| 820 | 2.25 | 2.26 | 76.15 | 18.08 | 0.90 | 86.15 | 90.38 | 86.15 |
| 830 | 2.27 | 2.29 | 76.60 | 18.30 | 0.92 | 86.60 | 91.51 | 86.60 |
| 840 | 2.28 | 2.32 | 77.05 | 18.53 | 0.93 | 87.05 | 92.63 | 87.05 |
| 850 | 2.30 | 2.34 | 77.50 | 18.75 | 0.94 | 87.50 | 93.76 | 87.50 |
| 860 | 2.31 | 2.37 | 77.96 | 18.98 | 0.95 | 87.96 | 94.89 | 87.96 |
| 870 | 2.33 | 2.40 | 78.41 | 19.20 | 0.96 | 88.41 | 96.02 | 88.41 |
| 880 | 2.34 | 2.43 | 78.86 | 19.43 | 0.97 | 88.86 | 97.15 | 88.86 |
| 890 | 2.35 | 2.46 | 79.31 | 19.65 | 0.98 | 89.31 | 98.27 | 89.31 |

① Supply Air Pressure Setpoint valid range is .3"-2.5".
② Supply Air Pressure Deadband valid range is .2"-1".

# 27½ to 50 Ton VAV (VAV RTAM Setpoints)

| Resistance (Ohms) | DC Volts | Supply Air① Pressure Setpoint (see note) J7-1,2 "WC | Supply Air Cooling Setpoint J7-3,4 Deg F | Supply Air Reset Amount J7-5,6 Deg F | Supply Air② Pressure Deadband J7-7,8 "WC | Morning Warmup Setpoint J7-9,10 Deg F | Supply Air Reset Setpoint Outdoor J7-11,12 Deg F | Supply Air Reset Setpoint Zone or Return Air J7-11,12 Deg F |
|---|---|---|---|---|---|---|---|---|
| 900 | 2.37 | 2.49 | 79.76 | 19.88 | 0.99 | 89.76 | 99.40 | 89.76 |
| 910 | 2.38 | 2.50 | 80.00 | 20.00 | 1.00 | 90.00 | 100.00 | 90.00 |
| 920 | 2.40 | 2.50 | 80.00 | 20.00 | 1.00 | 90.00 | 100.00 | 90.00 |
| 930 | 2.41 | 2.50 | 80.00 | 20.00 | 1.00 | 90.00 | 100.00 | 90.00 |
| 940 | 2.42 | 2.50 | 80.00 | 20.00 | 1.00 | 90.00 | 100.00 | 90.00 |
| 950 | 2.44 | 2.50 | 80.00 | 20.00 | 1.00 | 90.00 | 100.00 | 90.00 |
| 960 | 2.45 | 2.50 | 80.00 | 20.00 | 1.00 | 90.00 | 100.00 | 90.00 |
| 970 | 2.46 | 2.50 | 80.00 | 20.00 | 1.00 | 90.00 | 100.00 | 90.00 |
| 980 | 2.47 | 2.50 | 80.00 | 20.00 | 1.00 | 90.00 | 100.00 | 90.00 |
| 990 | 2.49 | 2.50 | 80.00 | 20.00 | 1.00 | 90.00 | 100.00 | 90.00 |
| 1000 | 2.50 | 2.50 | 80.00 | 20.00 | 1.00 | 90.00 | 100.00 | 90.00 |

① Supply Air Pressure Setpoint valid range is .3"-2.5".
② Supply Air Pressure Deadband valid range is .2"-1".

# Software Change History

| | | | |
|---|---|---|---|
| ***RTRM*** | | | |
| V1.1 | 4/12/01 | X13650864010 | -Initial Release |
| V1.3 | 6/11/01 | X13650867010 | -Correct thermostat versus zone sensor detection. |
| V2.4 | 11/28/04 | X13650866010 | -Hardware change for power robbing thermostats and NSB status LCD's.<br>-Revise test mode logic for heating and cooling.<br>-Revise fan cycling when changing from economizer to mechanical cooling.<br>-Correct LPC2 diagnostic not to show on single circuit unit.<br>-Correct defrost not to run less than one minute if coil was thought to be clean. |
| V2.6 | 11/28/01 | X13650867020 | -Local ventilation fixed to work in remote.<br>-Fix all outdoor fans to run if outdoor sensor fails.<br>-Fix indoor fan on gas heat to run only if heat fires.<br>-Change Timed Override (TOV) bit for Tracer from two hours two minutes.<br>-If outdoor sensor fails, fix so that unit will still do default defrost.<br>-Set unit mode to auto with no sensor if unit transitions from remote to local. |
| V2.7 | 11/28/05 | X13650867020 | -Fix outdoor fan control in service test.<br>-Add ICS communication failure if comm. stops for 2 minutes.<br>-Fix stages of heat & cool to report correctly on ICS.<br>-Fix ICS Lead/Lag hardware to work if in remote control<br>-Correct algorithm Heat proportional gain to stop heat cycling.<br>-Fixed ICS cool and heat stage reporting.<br>-Fixed supply fan lockout to reset with ICS.<br>-Fixed supply fan lockout so zone sensor mode setting to off will reset.<br>-Fixed default defrost without call for heat. |
| V2.9 | 4/1/02 | X13650867020 | -Fix unit mode with remote.<br>-Fix defrost function to halt defrost if call for heat is removed or switched to cooling.<br>-Added stage 1 electric heat to defrost service test.<br>-Added 15 second delay before RTRM talks to TCI to prevent economizer false diagnostic.<br>-Fix software to ignore fault for MAS below 40 degrees with compressors on. |
| V2.10 | 8/13/02 | X13650867020 | -Fixed thermostat Y call on heat pump to keep SOV energized until three minute time has elapsed.<br>-Fixed false diagnostic reports on COMM5 without RTOM.<br>-Correct invalid economizer MAS from 65.4 to 53 F.<br>-Change hardware initialization to stop false diagnostics on Tracker 10. |
| V3.0 | 3/15/03 | X13650867030 | -Feature Enhancement: Add Dehumidification/Reheat Control.<br>-Bug fixes:<br>-Fix unit mode when going from off to auto.<br>-Fix supply fan to not wait 20 seconds at power-up if test mode is activated.<br>-Fix RTRM to ignore ICS compressor disable during service test mode.<br>-Fix ICS zone temp to work without local zone sensor. |

# Software Change History

| | | | |
|---|---|---|---|
| V3.1 | 8/25/03 | X13650867040 | -Fixed Cool 1 and Cool 2 in slave mode to allow economizing.<br>-Changed LPC startup bypass time from two minutes to ten seconds.<br>-Turn off electric heat if defrost terminates on HPC.<br>-Fix reheat with zone sensor, override reheat with cooling call.<br>-Ignore-40F MAT if compressor is running. |
| V4.0 | 1/13/04 | X13650867040 | -Feature Enhancement:<br>- Add Voyager III control functions.<br>-Added two flash diagnostic code and steady light.<br>-Bug fixes:<br>-Fix service test to lock out after power reset with resistance.<br>-Fix outdoor fan operation on one compressor unit during ServiceTest with dehumidfication/reset.<br>-Fix to disable Dehumidification if either compressor circuit becomes disabled.<br>-Fix Defrost Default A timing issues.<br>-Add 30 second delay before looking at Mixed Air and Return Air temperature. |
| V5.0 | 4/21/04 | X13650867050 | -Added dehumidification purge cycle.<br>-Fixed Fan Fail input to normally open input for Voyager III. |
| V5.1 | 1/1/05 | X13650867050 | -Fix compressor staging in test mode. |
| ***RTOM*** | | | |
| V1.0 | 4/6/01 | X13650868010 | -Initial production release. |
| V1.1 | 5/28/01 | X13650868010 | -Fix Supply Air Tempering enable input by inverting jumper configuration. |
| V1.4 | 11/12/01 | X13650868010 | -Fixed false diagnostics with COMM5. |
| V2.0 | 4/1/04 | X13650868020 | -Add Dehumidification support |
| ***ECA*** | | | |
| V1.05 | 4/12/01 | X13650878020 | -First production release. |
| V2.05 | 7/15/02 | X13650878020 | -Fixed 60 seconds communication loss. |
| V2.07 | 10/21/03 | X13650878060 | -Changed to Masked chip.<br>-Fixed comparative enthalpy. |
| V2.08 | 8/25/04 | X13650878080 | -Went back to OTP chip to resolve Masked chip problems. |
| V1.0 | 4/1/05 | X13651082010 | -First production of upgraded ECA/Actuator Assy. |
| V1.0 | 4/1/05 | X13651082020 | -First production ECA manual with ALL sensor inputs. |
| V1.0 | 4/1/05 | X13651081010 | -First production release of ECA module with dry bulb only input. |
| ***TCI*** | | | |
| V1.3 | 4/16/01 | X13650869010 | -First production release. |
| V1.23 | 12/31/01 | X13650869010 | -Fix a variety of false diagnostics. |
| V1.24 | 1/25/01 | X13650869010 | -Revised to allow true discharge air sensor to be reported through RTOM if unit doesn't have economizer option. |
| V3.1 | 3/10/04 | X13650869030 | -Add status LED support and VAV enhancements.<br>-Added code to fix VAV lockup. |
| ***LCI*** | | | |
| V1.02 | 4/16/01 | X13650870010 | -First production release. |
| V2.06 | | X13650870020 | -Fixed to allow stand-alone operation without communication link. |

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## Tables

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| Literature Order Number | RT-SVD03D-EN |
| File Number | PL-UN-RT-SVD03D-EN-09-05 |
| Supersedes | RT-SVD03C-EN 02-05 |
| Stocking Location | PI Louisville |