Voyager II-Modulating Gas

Voyager II-Modulating Gas addition for YCD_ product family. Only for YFD/YFH models (FIOPS ONLY)

Modulating Gas has been added to the 9th digit (heat option) in the product family as a "V" option. This new option will not be available with 50Hz (B or D) in the 8th digit or 380V (K in the 8th digit). It **requires** FIOPS Supply Air Sensing Tube and FIOPS Options module.
The field installed Supply Air Sensing Tube and FIOPS Supply Air Sensing Tube now has a default zero added due to disallowable rules and pricing rules. This could cause problems for any jobs that have been configured prior to the February update. They will have to add the zero in the field installed or FIOPS Supply Air Sensing Tube to handle "Not Found" pricing.
It is not allowed with field installed propane kit and FIOPS Novar.

Modulating gas units come standard with a 350 MBH Stainless Steel Heat Exchanger covered by a 10 year warranty. These units utilize a variable speed combustion blower motor that enables the motor to operate at the necessary speed required to provide the amount of heat needed to satisfy the current heating load of the building.

Modulating Gas Heat 5:1 Turndown Ratio (Optional): The set-up required for equipment ordered with modulating gas heat varies based on the control system utilized. Zone sensors, LonTalk, & Comm3/4 do not require additional set-up. 24 volt control systems (thermostats) require setting the desired leaving air temperature. The heat will modulate to maintain this temperature. Use the following procedure for set-up:

1. Locate the RTOM
2. Locate the "Discharge Air SP" or "OA CFM SP"
3. Adjust the variable resistor to match the desired leaving temperature.
The range is (50° F - 150° F). (Recommended setting is between 100°F and 120°F). Adjustments are clockwise to increase temperature and counterclockwise to decrease temperature.

In a modulating heat unit, when a call for heat is received, the burner will light at full fire (100%) for 1 minute before any turndown. After the burner is lit, the unit controls will monitor the discharge air temperature and modulate the input rate down to match the load. The automatic reset high limit (TCO1), located in the bottom right corner of the burner compartment, protects against abnormally high leaving air temperatures. The automatic reset fan fail limit (TCO2), located in the upper middle section of the indoor fan board, protects against abnormally high heat buildup which could occur because of extended cycling of the high limit (TCO1) or if the indoor fan motor (IDM) fails to operate. Should TCO2 open, the RTRM will energize the indoor fan relay (F) in an attempt to start the fan motor. The RTRM signals that a heat failure has occurred by flashing the “Heat” LED on the zone sensor. There is a Green LED located in the Ignition

Control Module. The Table below lists the diagnostics and the status of the LED during the various operating states.

Voyager ReliaTel

OFF: No power or failure
ON: Normal
Slow Flash: Normal, Heat Call
Fast Flash: Error Code
1 Flash: Communications Lockup
2 Flashes: System Lockout
3 Flashes: Not Used
4 Flashes: TCO-1 or TCO-2 Open
5 Flashes: Flame sensed without gas valve energized
6 Flashes: Not Used

Note: *At initial start-up modulating gas heat exchangers can produce a resonance that will subside after the break-in period.*

When using test mode, if you cycle the unit to what would have been stage one heating on a 2-stage unit, the unit will go through the normal lighting sequence and start on high fire and then turn down to 50% after a couple minutes. If you cycle the test mode into stage 2 heat, the unit will run at high fire.

Modulating gas Voyagers utilize a positive pressure gas valve, thus they require a pressure switch to ensure that the combustion blower motor is operating before the gas valve is allowed to operate on a call for ignition. V in the ninth digit of the model number indicates the need for the gas to be set at a positive pressure. The gas valve is not modulating and has yellow label with +.3" W.C. on it.
The positive gas pressure operating range is +0.10" - +0.35" W.C. on the modulating gas units. Modulating units use a metal fiber material in place of the Stainless Steel Burner Screen to ensure proper flame distribution at low fire. The pressure measurements should be taken at high fire.

"The Fasco motor control board is shown in Figure 1 below and can be used as a troubleshooting tool if the combustion blower motor is not operating when a heat call has been initiated on a modulating gas unit. If the board has shut down due to over current or over voltage faults, there will be a blinking red LED light in the center of the board. In this case, the board can be reset by turning off power to the unit for one minute. If there is no error code showing on the board, but the motor still does not operate, first check that the board is getting power. The same LED will have a continuous green light when the board is powered and functioning normally. Next, check connections of the three plugs on the board, the power connections, the analog input, and the flying leads connected to the blower motor. If the board is wired correctly, check the DC voltage on the analog input to the board. CAUTION: HIGH VOLTAGE IS PRESENT ON THE CFMB MODULE. This voltage can be measured from the contacts on the plug or from J5-1 and J5-2 on the RTOM board. This voltage controls the speed of the modulating blower motor and if it is zero, the blower will not run. At 2 Volts DC, the blower should

be at low fire and be turning around 950 rpm. At 10.5 Volts DC, the blower will be operating at high fire, around 4600 rpm.

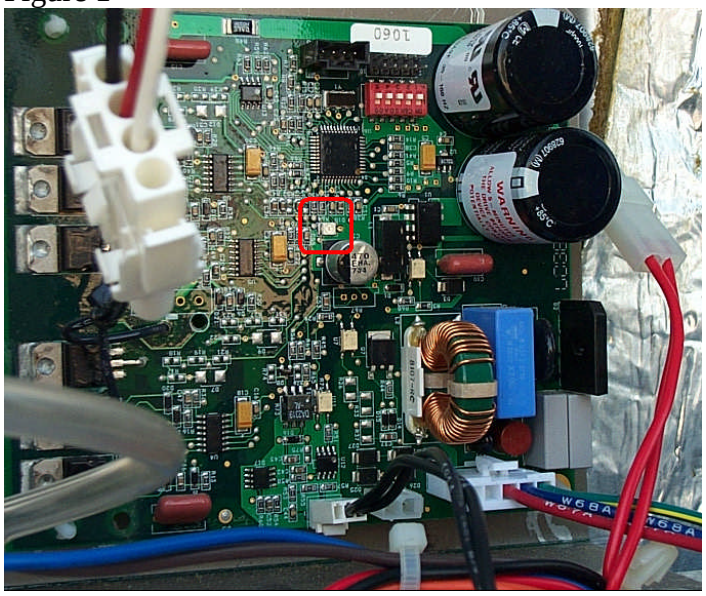
Modulating Heat Voltage Ranges		
		Approx. Rate (MBH)
DC Volts	Approx. RPM	350 heater/390 heater
2.0	950	70/80
3.5	1680	126/142
5.0	2410	182/204
6.5	3140	238/266
9.0	3870	294/328
10.5	4600	350/390

Note:

1. DC Voltage can be measured at the analog input of the CFMB Module or across pins J5-1 and J5-2 of the RTOM. CAUTION: HIGH VOLTAGE IS PRESENT ON THE CFMB MODULE.
2. Values can vary due to elevation, gas heating values and temperature in your area as well as gas valve adjustments. This table is for reference only.

The component outlined below in figure 1 is labeled D-18. It is the LED on the board.
Note: Dipswitches on board are not used for our applications.

Figure 1



Fault Indicator Output

The controller will indicate a fault condition by flashing the fault LED. The flashing pattern will be ¼ second on and ¼ second off for each count, if multiple faults are present it will dwell 2 seconds between each fault code, then dwell 5 seconds and repeat until the fault(s) are cleared. Listed below are the fault codes.

1 flash – Not Used
2 flashes – Under Voltage - Should have 208-230V from heat transformer. Range should be +/- 10%. Measure the voltage at the board and at the combustion fan motor.

3 flashes – Over Voltage - Should have 208-230V from heat transformer. Range should be +/- 10%. Measure the voltage at the board and at the combustion fan motor. Overvoltage limit of the board is approx. 270V.
4 flashes – Over Temperature - This board is not connected to any temp/safety switches in the unit, this fault should not be experienced.

5 flashes – Over Current

Thermostat Heating Operation with Modulating Heat

Units controlling modulating heat with conventional thermostat inputs will use the Discharge Air Set point from the RTOM to control the temperature of the unit's discharge air within +/- 2.0 degrees F. The discharge air will be used to satisfy the thermostat call from the space. The following sequence and limitations will be used to accomplish this:

1. **Call for 1st stage heat (W1) (0 – 80% Modulation)**
    a. Modulating Heat Control Output will be set at 100% for the gas ignition start sequence until flame is sensed plus 60 seconds.
    b. The modulating heat discharge air heating algorithm will control the heat capacity request using DISCHARGE AIR SP (DASP) vs. discharge air sensor and modulate between minimum fire and a maximum of 80% capacity.
    c. If the unit reaches 80% fire and **remains** there for 15 consecutive minutes without a call for 2nd stage heat (W2) it will switch to 100% capacity request until **all** heat calls are cleared (W1 and W2).
    d. If the DASP is satisfied and the output signal reduces to minimum fire, the gas heat will stay on at min fire until the thermostat heat call is cleared. This eliminates unnecessary cycling.
    e. If all calls for heat are ended the mod heat capacity request will go to 0Vdc and gas heat section will be turned off. The 15-minute inter-stage timer is reset.

2. **Transition: Call for 2nd stage heat (W1 + W2, W2) with no previous call or less than 15 minutes since the start of a heat cycle.**
    a. Initiate start sequence as above if no previous call.
    b. The modulating heat algorithm will control as above for W1 call for a minimum of 15 minutes inter-stage time regardless of additional heat calls.

3. **Transition: Call for 2nd stage heat (W1 + W2, W2) after 15-minute inter-stage time.**
    a. Goes to 100% Fire until call for 2nd stage heat call ends.
    b. If heat call returns to 1st stage call only - see Step 1b. (Algorithm will be active during 2nd stage call and the modulating signal will return to that value if the call drops back to 1st stage.)
    c. If all heat calls end, the mod heat output goes to 0Vdc and gas heat section is turned off. 15-minute inter-stage timer is reset.

General Thermostat Operation with Modulating Heat Failure Modes:

- If we lose our DISCHARGE AIR SP pot and the value coming in from the RTOM is invalid we will default to 100F and set a diagnostic on the ICS packet.
- If we lose our Supply Air Sensor revert to staged control with W1 calling 50% modulating heat capacity and W1+W2 (or W2) calling 100% capacity. A diagnostic will be set.
- If we get any type of gas heat failure, heat will be discontinued and a diagnostic set.
- If communications is lost with the RTOM the mod heat output will go to 0Vdc and heating will be discontinued by the RTRM.

The parts listed are the parts that are different from a standard heater.

Air Orifice Assy (includes Static Tap and Clip) -- X1527-0556-010
    Static Tap -- X0540-1833
    Clip -- X3219-0027-010
Positive Pressure Gas Valve -- X1520-0714-020
Burner Screen -- X0907-1074 (See pictures below for front and back views)
Combustion Air Proving Switch -- X1324-0405-050
Mod Blower Motor -- X3801-1011
Mod Control Board -- X1365-1489-010
Mod Heat Control Bracket -- 4385-6266-0100
Clear Tubing -- X2053-0063-030

Current Production, Gas Valve (GV) Mod heat, White-Rodgers Model 36D24-902B1, [same electrical and connection information as ones already in table]

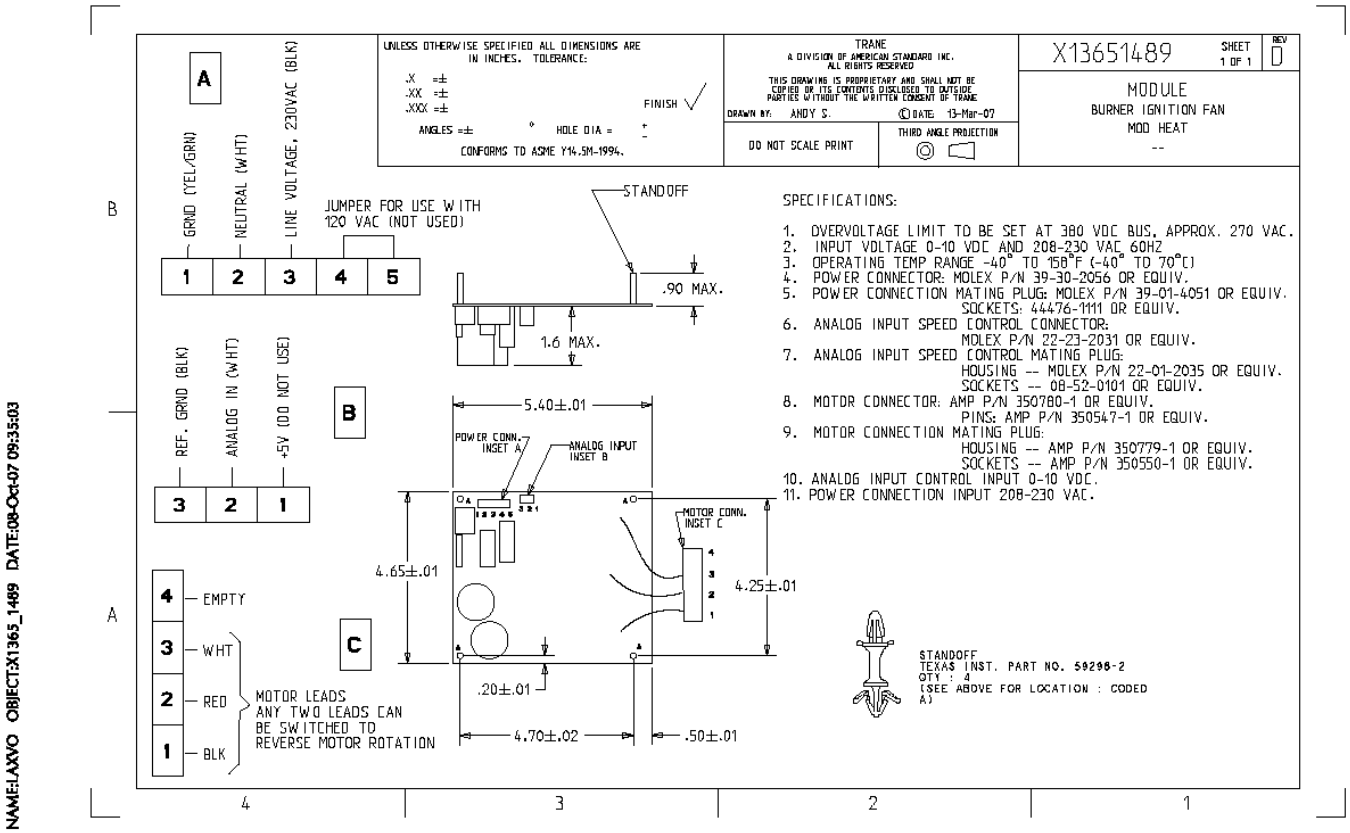
Current production, Combustion Blower Motor (CBM) 350 and 390 MBH Modulating, Fasco Industries Model 7043-0033 variable speed, 208-230 VAC, 950 - 4700 rpm

Combustion Fan Motor Board for the Modulating Gas Heat Burner
MOD01638-Module; Variable speed drive


350 MBH Heater Assembly w Note...


Burner Screen Front 02.jpg (82...


Burner Screen Back 01.jpg (831...



Voyager Modulating Gas Heat Notes

Unit will operate on high fire for 1 minute before any turndown.
2 Vdc = low fire
10 Vdc = full fire
CAUTION: HIGH VOLTAGE IS PRESENT ON THE CFMB MODULE

Gas valve is positive pressure and has yellow label +.3” W.C.

Gas valve is not Modulating

All Modulating Gas Heat is 350 MBH

RTOM OAC pot is set point to control to discharge sensor (50° F - 150° F)

The 0-10 VDC signal comes from J-5 on RTOM. J5-1 is routed directly to the Modulating Combustion Control Board via wire number 191A. Wire number 196A comes from J5-2 on the RTOM and goes through the power relays on the ignition board which serves to turn off the motor when the relays are open.

J3-3 to ground configures the mod heat option. If this is not present, the unit does not know it is a mod heat unit and will not run the algorithm to control the mod level or, more importantly, won't turn on the 0-10VDC output from the RTOM so the blower motor will never turn on meaning no heat.

Stainless Steel Heat Exchanger comes standard

Combustion fan increases to high speed for 20 seconds before shut down (post purge)

Combustion fan board 2-pin Modbus turned backward will cause only 0 – 5 VDC signal The plug in question is a three pin connector of which we only use two of the connections. Pins 2 and 3 should be getting the 0-10VDC signal with the reference voltage (-) being on pin 3 and the analog in (+) being on pin 2.

If these are reversed so that the reference is on 2 and the signal is on 3, the board will not turn the motor on. It's essentially seeing a -10VDC and doesn't know how to handle it so it doesn't do anything. This will not damage the board and will prevent the heat from running. The result is No Function. For this to occur, we have to get a wire harness in from TN that has been assembled wrong. If you all see this failure mode, we need to know about it so we can address it with the vendor.

If the plug itself is installed backwards, the failure mode will be much harder to diagnose and in reality the customer probably won't even see this as a failure mode. The plug is directional, so in theory this won't happen but it is possible. When this happens the reference voltage will be on pin 1 and the signal will still be on pin 2. The board still interprets this, but it doesn’t function correctly. The unit will function properly at high fire but will not turn down past about 60%. This severely limits the performance of the system, but it won't damage anything and the customer will still be getting heat. It will increase the amount of cycles the customer will see, but the thermostat will still turn the system off when it's satisfied so the conditioned space shouldn't get overheated. This will be difficult to catch in the field. The unit will not run at lower heating rates.

Wiring diagrams can be found on drive S:\PRODDEV\GASHEAT\Voyager Mod Gas Literature Update\Voyager2\Modulating Wiring Diagrams

23093806	Schematic; Electrical Diagram - Control YC 151-241
23093807	Schematic; Electrical Diagram - Control YC 150-301
23093808	Schematic; Power 208-230V YC 240, 241, 300 & 301
23093809	Schematic; Power 400-575V YC 200, 240, 241, 300 & 301
23093810	Schematic; Power 400-575V YC 151
23093811	Schematic; Power 208-230V YC 151
23093812	Schematic; Power 400-575V YC 150, 180, 181, 210 & 211
23093813	Schematic; Power 208-230V YC 150, 180, 181, 210 & 211
23093814	Diagram; Connection Electrical 208/230V YC 180, 181 & 210
23093815	Diagram; Connection Electrical 400-575V YC 180, 181 & 210
23093816	Diagram; Connection Electrical 208/230V YC 211
23093817	Diagram; Connection Electrical 400-575V YC 211
23093818	Diagram; Connection Electrical 208/230V YC 240, 241, 300 & 301
23093819	Diagram; Connection Electrical 400-575V YC 240, 241, 300 & 301
23093820	Diagram; Connection Electrical 208/230V YC 151
23093821	Diagram; Connection Electrical 400-575V YC 151
23093822	Diagram; Connection Electrical 400-575V YC 150
23093823	Diagram; Connection Electrical 208-230V YC 150
23093824	Diagram; Connection Electrical 400-575V YC 210E & 240E
23093825	Diagram; Connection Electrical 400-575V YC 151
23093826	Diagram; Connection Electrical 208/230V YC 151
23093827	Diagram; Connection Electrical 208-230V YC 181
23093828	Diagram; Connection Electrical 400-575V YC 181
23093829	Diagram; Connection Electrical 208-230V YC 241
23093830	Diagram; Connection Electrical 400-575V YC 241
23093831	Diagram; Connection Electrical 208-230V YC 210E & 240E

Finding: Supply air tempering does not work w/ Modulating Heat.

Action: Controls Team will correct 2qt09.

Phone Response: Product Support - "Modulating heat w/ supply air tempering will be available 2qt09. We offer both separately today." Tech Support - If you get a call from someone who is trying to get this feature to work but can not. Instruct them to change the RTRM board (after the new one is available).

Tech support

I've attached the proposed control schemes for supply air tempering. Also if you would like to comment or offer up alternatives please send them to me and Daniel Robertson.

The controls team wants to use the same scheme for all units. i.e. Relia-Tel w/ Mod Heat has the same cascading loop as Intellpak. So if you see references to Ipak don't ignore it because the same logic will be applied to Relia-Tel.

I'm going to copy in the Ipak think tank on this because we've had several discussions and I can never remember what the final direction was. This is my take on the situation. Feel free to comment. This concern is one of the Ipak II deferred CRs for phase 3 release I think.

We've had discussions already on Intellipak about how to better allow tempering with modulating gas heat in CV applications. As it stands today we will continue the supply air portion of heating control after the zone temp rises above the zone heating set point for up to 5 minutes. If the supply air drops below the discharge air temp heating set point that is calculated by the cascade loop control (the discharge air set point will equal zone heating set point if zone temp is higher than the zone heating set point) heat will activate and temper to the ZHSP but if the zone temp remains at or equal to the ZHSP a 5 minute timer will expire and the supply air control will be disabled until the zone temp drops below ZHSP again. If the zone temperature drops below the ZHSP before the 5 min timer expires it will reset the timer.

We've discussed just disabling the 5-min timer if SA Tempering is enabled and leaving it intact if not. If it is disabled the discharge air portion of the cascaded loop algorithm will run all the time we are in heat mode. As long as the Zone Temp is higher than the ZHSP the calculated discharge heat set point will equal the ZHSP and that's the temp we will be trying to maintain. This could cause a lot of cycling of heat since it won't be hard for the system to maintain 68 - 72 F (avg.) discharge air and heat will be shutting off and then restarting unless there is a lot of cool air coming in from outside. Cycles would be less on cooler days. We may have to include some minimum time between cycles.

A potentially better variation to the above solution would be to leave the 5-minute timer intact as is but if it expires and tempering is enabled we allow a low discharge air temp

(ZHSP - 10 F) to force the discharge air heating portion of the cascaded loop zone control to activate again and control to the normal calculate "Tset" set point which will be the ZHSP or very close to it. That would allow the heater to bring the supply air temp up to the zone heating set point and then continue heating to maintain that set point until it ever turns the heater off due to 0% capacity request then we would not allow it to turn on again until we dropped to the "low discharge air temp" set point. This option would eliminate high cycle rates I think and still temper effectively and control space over-heating since we'd be working between the ZHSP-10F and ZHSP for tempering control. There would be cases on cold days we could be running heat continuously and discharging just above or at ZHSP air for a long time, but I think cold days won't be a worry for overheating. On mild days we'll satisfy the discharge set point faster and shut off the heater and not restart it until ZHSP-10F.

Implementation timing to the field for this request is a call Bert and Co. will have to make. Coding would take less than a day and we'd have to do some re-verification (not a whole lot. Mostly focused on mod heat), submit articles, and update the build package for a new s/w part. 8.0 is coming and will include it but not till 2Q09 for the field at the earliest.