

SINGLE ZONE CONSTANT AIR VOLUME SEQUENCE (WATTMASTER CONTROLS)

Mode Enable Sensor Options

The temperature of this sensor will determine whether the unit is in heating, cooling or vent mode during Occupied operation. The following shall be provided:

- Space Air Temperature Sensor
- Return Air Temperature Sensor
- Outside Air Temperature Sensor (if in Exhaust Hood On Operation described in a later section)

Occupied Operation

There are several ways to initiate the Occupied Mode of operation for the VCM-X Controller:

- Internal week schedule
- Remote Forced Occupied contact closure
- Pushbutton Override button on a Space Sensor (Override length is user adjustable)
- Monitoring an external Orion scheduling device

Scheduling

- Has an internal clock that provides 7 day scheduling with 2 start/stops per day.
- Allows scheduling of up to 14 holiday periods per year.

HVAC Modes of Operation

There are 5 possible HVAC Modes of Operation:

- Cooling
- Heating
- Ventilation
- Dehumidification
- Off

Cooling Mode with Digital Scroll Compressor

- Cooling is enabled when the temperature at the Mode Enable Sensor rises one deadband above the Cooling Setpoint. Cooling is disabled when the Mode Enable temperature falls one deadband below the Cooling Setpoint. The setpoint and deadband are user adjustable.
- In the cooling mode, as the Supply Air Temperature (SAT) rises above the Active Supply Air Cooling Setpoint (see Supply Air Temperature Setpoint Reset section for explanation), the Digital Compressor will stage on and modulate to control to the Active Supply Air Cooling Setpoint.
- If additional cooling is required, fixed compressor stages can be staged on while the Digital Compressor continues to modulate.
- Mechanical cooling is disabled if the outdoor air temperature (OAT) falls 1° below the Cooling Lockout Setpoint and will remain disabled until the OAT rises 1° above the Cooling Lockout Setpoint. If the OAT disables mechanical cooling while it is currently operating, mechanical cooling will stage off as minimum run times and stage down delays are satisfied.
- If the economizer is enabled it will function as the first stage of cooling (see Economizer section).

Heating Mode

- Modulating SCR Electric heat shall be provided.
- Heating is enabled when the temperature at the Mode Enable Sensor falls one deadband below the Heating Setpoint. Heating is disabled when the Mode Enable temperature rises one deadband above the Heating Setpoint.
- In the Heating Mode, as the Supply Air Temperature falls below the Active Supply Air Heating Setpoint (see Supply Air Temperature Setpoint Reset section for explanation), the heating will begin to stage on or to modulate. Each stage must meet its Minimum Off Time (adj.) before it is allowed to energize and successive stages are subject to a Heating Stage Up Delay (adj.).
- Heating stages will continue to run until the supply air temperature rises above the Active Supply Air Temperature Setpoint plus the Heating Stage Control Window at which point the heating will begin to stage off. Each stage must meet its Minimum Run Time (adj.) before it is allowed to stage off and successive stages are subject to a Heating Stage Down Delay (adj.).
- Mechanical heating is disabled if the outdoor air temperature (OAT) rises 1° above the Heating Lockout Setpoint and will remain disabled until the OAT falls 1° below the Heating Lockout Setpoint. If the OAT disables mechanical heating while it is currently operating, mechanical heating will stage off as minimum run times and stage down delays are satisfied.
- The controller has dual heating capability (2 forms of heat). The following are the possible configurations for the 1st and 2nd forms of heat:
 - 1st – Modulating SCR Electric or Modulating HW heat & 2nd – MODGAS II (Allows fine tuning that ModGas alone cannot provide because of the 30% minimum turndown)
 - 1st – Modulating SCR Electric or Modulating HW heat & 2nd – Stages (Allows fine tuning)
 - 1st – MODGAS II & 2nd – Stages (For supplemental heat)
- During stage up of these dual heating options the 1st form of heat (modulating SCR Electric, Modulating HW heat or the ModGas) has to be at 100% before the 2nd form can be activated. During stage down, the 1st form of heat must be at 0% before the 2nd form can be de-activated.

Ventilation Mode

- This mode is only available in the Occupied Mode of operation on units configured for continuous supply fan operation and is generated anytime there is no demand for heating or cooling.

Dehumidification Mode with a Digital Scroll Compressor

- Dehumidification is enabled based on an Indoor Humidity Setpoint and requires a Space or Return Air Humidity Sensor.
- Dehumidification shall be selected as a priority mode to be active anytime the humidity is above the Indoor Humidity Setpoint.
- Once in dehumidification, the unit will maintain the Evaporator Coil Suction Temperature at the Coil Suction Temperature Setpoint by modulating the Digital Compressor.
- A coil suction pressure sensor shall be factory installed.
- Dehumidification Reheat is always controlled to the appropriate Active Supply Air Temperature Setpoint which will be dependent on whether you are in Heating Dehumidification, Cooling Dehumidification.
- Reheat shall be modulating.
- Heating may also be used to supplement hot gas reheat if necessary. In this case, SCR Electric shall be used.

Off Mode

- Occurs in the Unoccupied Mode when there is no heating, cooling or dehumidification demand.
- Supply fan is off and the outside air damper is closed.

Economizer Operation

- Enabled when Outdoor Air (OA) drybulb or wetbulb temperature falls below the Economizer Enable Setpoint by 1° and the outdoor temperature is at least 5° below the return air temperature (if a return air temperature sensor is being used).
- Economizer operation is disabled when the OA temperature rises 1° above the Economizer Enable Setpoint.
- Wetbulb operation requires an Outdoor Humidity Sensor.
- Economizer acts as 1st stage of cooling and controls to the Active Supply Air Cooling Setpoint. The economizer reaches 100% and the supply air temperature is still above setpoint, mechanical cooling is allowed to stage up while the economizer continues to modulate to the full operation.
- An Economizer Minimum Position can be programmed into the controller.
- Economizer Damper is closed during Unoccupied Mode, except when unoccupied mechanical cooling is using during reheat/cooling operation.

Space Sensor Operation

- Available as a Plain Sensor, Sensor with Override, Sensor with Setpoint Slide Adjust, and Sensor with Override and Setpoint Slide Adjust (this is the version that is factory supplied).
- A digital space sensor is also available with override and setpoint adjustment capability.
- Sensors with Setpoint Slide Adjust can be programmed to allow space setpoint adjustment of up to ± 10° F.
- The Slide Adjust can adjust the setpoint of whichever temperature sensor is configured as the controlling sensor, even if it is not the installed Space Sensor. If Space Temperature is the SAT/Reset Source, then the Slide Adjust will adjust the SAT/Reset Source setpoints simultaneously.
- During Unoccupied hours the Override Button can be used to force the unit back into the Occupied Mode (by pressing the button for less than 3 seconds) for a user-defined override duration of up to 8.0 hours. Pressing the button between 3 and 10 seconds cancels the override.

Supply Fan Operation

- Occupied Mode - Supply fan shall be configured to run continuously (default) or to cycle with heating, cooling or dehumidification.
- Unoccupied Mode - Supply fan will cycle on a call for heating, cooling or dehumidification.
- Anytime the Supply Fan is requested to start, a 1 minute minimum off timer must be satisfied. If the timer is satisfied the Supply Fan relay is activated while all other outputs are held off for a period of 1-2 minutes to purge stagnate air from the ductwork before heating or cooling occurs.
- In fan cycle mode or when going unoccupied the supply fan is held on for 2 minutes after the last stage of heating or cooling stages off.

Condenser Fan Control (Using a Condenser Head Pressure Module)

- The condenser fan is commanded on when the first compressor is enabled.
- Can monitor up to (4) head pressure transducers and control the condenser fan based on the highest of the (4) readings.
- In the Cooling Mode the speed of the condenser fan will be adjusted between 0% and 100% to maintain the desired Head Pressure Setpoint.
- In Heat Pump Heating Mode the condenser fan will operate at 100%.
- In units with (2) physically separate condenser sections, the highest reading of transducers 1 and 2 will control the fan output for the 1st section, while the highest reading of transducers 3 and 4 will control the fan of the 2nd condenser section.

Coil Suction Temperature Setpoint Reset

- During dehumidification the VCM-X will automatically reset the Coil Suction Temperature Setpoint within a ± 5° range based on the space or return air humidity sensor condition changing ± 5% from the humidity setpoint.

Building Pressure Control

This can be used to maintain a user adjustable Building Pressure Setpoint (requires a Building Pressure Sensor). Available controlling output options are:

- A relay output for On/Off operation
- A 0-10VDC modulating output

There are 2 possible methods of control:

- **Direct Acting**, meaning that on an increase in building static pressure, an on/off exhaust fan can be activated or a VFD exhaust fan can be ramped up.
- **Reverse Acting**, meaning that on a decrease in building static pressure, the outside air damper can be modulated open or a supply fan VFD can be ramped up. If the outside air damper in this manner, no economizer free cooling or IAQ operation will be available.

Duct Static Pressure Control for Filter Loading

- In order to maintain a constant CFM through the supply air ducts on a mixed air CAV Unit, the VCM-X shall utilize a duct static pressure sensor (used to monitor the discharge pressure) in conjunction with a supply fan VFD.
- If the filters are getting dirty, the VCM-X will ramp up the VFD to compensate for the decrease in airflow.
- Unit must be configured to use Duct Static Pressure VFD fan control.
- This feature cannot be used if this is a Zoning application with typical duct static pressure control.

Remote Forced Heating and Cooling

- These inputs (24 VAC wet contacts) allow another control system or a thermostat to force the unit into heating or cooling.
- To utilize these inputs, the heating and cooling setpoints in the VCM-X must be set to 0% and the modifiable sensor must be configured as Supply Air.
- Once in this force mode the unit will modulate or stage heating/cooling to maintain the setpoint heating or cooling leaving air setpoint until the force command is removed.

Remote Forced Dehumidification

- This input (24 VAC wet contact) allows another control system or a humidistat to force the unit into dehumidification.
- To utilize this feature the humidity setpoint in the VCM-X must be set to 100%.
- Once in this force mode the unit will stage compressors to maintain the suction temperature setpoint until the force command is removed.

Proof of Flow Interlock

- A Proof of Flow switch (by others) provides a 24 VAC wet contact closure when the supply fan is operating.
- If this contact opens while the fan is being run, all heating and cooling is disabled and a Fan Proving Alarm is generated.

Dirty Filter Status

- A differential pressure switch (by others) is used to provide a 24 VAC wet contact closure to indicate a dirty filter status. A Dirty Filter Alarm is then generated.

Emergency Shutdown

- A 24 VAC wet contact input is available to be used with a N.C. Smoke Detector, Firestat, or other shutdown condition (all by others).
- If this contact opens it will initiate shutdown of the VCM-X and will generate an alarm condition. This contact closure does not produce an instantaneous shutdown. For instantaneous shutdown the device initiating the open condition on this contact should also be wired to cut the 24 V common to the VCM-X relay outputs.

Temperature Protection

- Enabled when the Supply Air Temperature (SAT) rises above the High Cutoff Temperature (immediate) or drops below the Low Cutoff Temperature (for 10 minutes) both of which are user adjustable. This mode shuts off the unit (with a 3 minute fan off delay) until the mode is cancelled.
- This mode is cancelled when the SAT drops 5 degrees below the High Cutoff Temperature Setpoint or rises 5 degrees above the Low Temp Cutoff Temperature Setpoint, or when the unit stages back into Occupied Operation.

Outdoor Air Lockouts

- Mechanical cooling is disabled when the Outdoor Air Temperature is below the Cooling Lockout Setpoint.
- Mechanical heating is disabled when the Outdoor Air Temperature is above the Heating Lockout Setpoint.

- For Air to Air Heat Pumps the Cooling Lockout also applies to Compressor Heating, so it will usually be a lower setting than on Cooling units that are not Air to Air Heat Pumps.

Relay Outputs

There are up to 20 output relays that are configurable for the VCM-X controller (Relay #1 is reserved for the Supply Fan and is not configurable). The configuration options are as follows:

Cooling Stages, Reversing Valve for Heat Pump Operation, Heating Stages, Economizer (Outdoor Air Damper)*, Warm up Command for VAV Boxes, Occupied On/Off Hot Gas Reheat, Alarm*, Pre-heat* (Explained above), Override*, On/Off Exhaust Fan (see Bldg Pressure), Heat Wheel* (Described above)

Economizer (Outdoor Air Damper) Relay

- This relay will enable if any one of the following three conditions occurs:
 - The unit is configured for Economizer control and the Economizer moves 5% above its Economizer Minimum Setpoint position.

Occupied, Alarm, Override Relays

- Occupied Relay - enabled anytime the unit goes into the Occupied Mode
- Alarm Relay - enabled anytime a VCM-X alarm is active
- Override Relay - enabled anytime a space sensor pushbutton override is active

Alarm Detection and Reporting

- Continuously performs self diagnostics during normal operations to determine if any operating failures have occurred.
- Failures (alarms) shall be the Touch Screen System Manager.
- Diagnostic LEDs on the VCM-X controller generate "blink codes" for certain alarm conditions.

The following alarms shall be reported:

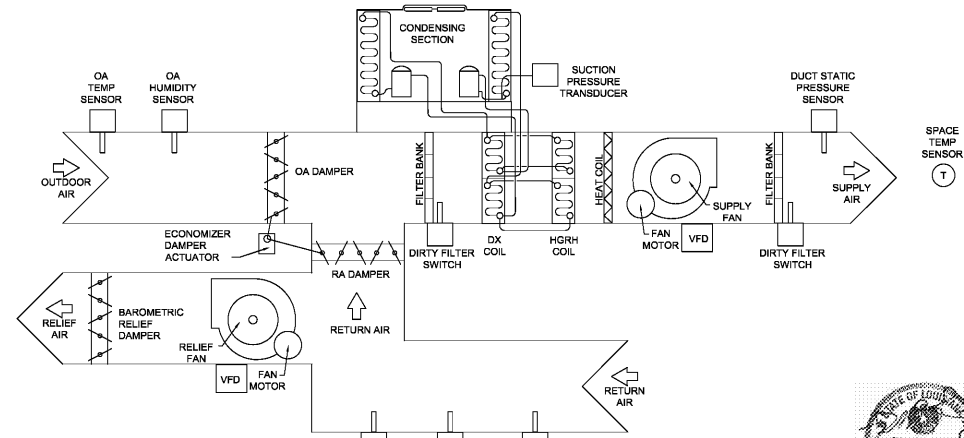
No Supply Sensor, Dirty Filter Alarm, Outdoor Air Temp Emergency Shutdown Alarm, Space Sensor Failure, Low Supply Air Alarm, Mechanical Cooling Failure, High Supply Air Alarm, Mechanical Heating Failure, Control Temp Alarm, Fan Proving Alarm, High Control Temp Alarm

Trend Logging

- Continuously maintains an internal Trending in memory on the controller which records a fixed set of values at a user-defined interval.
- Trend log positions (time intervals) are available on the controller.
- These positions are set and begins overwriting the oldest data.
- Values can be retrieved using the Prism graphical front-end software program.
- While system running continuously, values can be saved to the computer hard drive at regular intervals to keep from losing data.

The following alarm functions that can be logged:

Date, Outdoor Air Humidity, Time, Duct Static Pressure, Mode, Building Static Pressure, Return Air Temperature, Economizer Signal Percentage, Outdoor Air Temperature, Supply Fan VFD, Damper Signal Percentage, Supply Air Temperature, Exhaust Fan VFD/Exhaust Damper Signal, Percentage, Active Supply Air Setpoint, Modulating Heat Signal Percentage, Coil Suction Temperature, Modulating Cool Signal Percentage, Outdoor Air Dewpoint, On Board Relay Status, Space Temperature, Expansion Board Relay Status, Head Pressure, Condenser Fan Signal Percentage, Outdoor Air CFM, Supply Air CFM, ModGas Module Signal Percentage, Modulating Hot Gas Reheat Signal Percentage



Order Plans

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CONSTRUCTION REISSUE SET

Project No.	1607050	
Drawn:	DL	
Checked:	JR	
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M401
MECHANICAL CONTROLS

