

MicroTech™
Unit Ventilator Controller
Sequences of Operation

AAF-HermanNelson Classroom Unit Ventilator
Model AVS, AVV Floor Mounted
Model AHF, AHV Ceiling Mounted
Model AZS, AZQ Self Contained Air Cooled Units

Program UV4: DX Cooling with Steam or
Hot Water Heat

Table of Contents

Introduction ..... 2
General Information ..... 2
Software ID ..... 2
Setpoints ..... 2
DX Cooling with Wet Heat, Valve Control ..... 2
Description of Operation ..... 2
Definitions ..... 2
Occupied or Tenant Override Operating Mode ..... 2
Unoccupied Operating Mode ..... 3
Discharge Air Low Limit Control ..... 3
Safeties ..... 4
Sequence Charts ..... 4
DX Cooling with Wet Heat, Damper Control ..... 6
Description of Operation ..... 6
Definitions ..... 6
Heating End-of-Cycle Valve ..... 6
Occupied or Tenant Override Operating Mode ..... 6
Unoccupied Operating Mode ..... 7
Discharge Air Low Limit Control ..... 7
Safeties ..... 7
Sequence Charts ..... 8

# Introduction

This manual describes the sequences of operation for MicroTech controlled AAF-HermanNelson Unit Ventilators equipped with direct expansion (DX) cooling and either stream or hot water heating (“wet” heat). Unit Ventilators with this heating and cooling configuration could be AAF-HermanNelson models AZS, AZQ, AVS, AVV, or AHF

or AHV. Regardless of the AAF model type, the Unit Ventilator Controller (UVC) provided with these units uses program UV4\*\*\*.

For more information on the MicroTech Unit Ventilator Controller, refer to Bulletin No. IM613, “MicroTech Unit Ventilator Controller.”

## General Information

### Software ID

The Unit Ventilator Controller Software must be compatible with the Unit Ventilator heating and cooling configuration. The software is identified by a program code and “software model” number printed on a small label attached to the controller. Models AZS, AZQ, AVS, AVV, or AHF or AHV with DX cooling and wet heat use program UV4\*\*\*. The first wild card character defines the UVC communication type as follows: S = stand-alone. M = master/slave, and N = network code. The last two wild card characters denote the software version (numeric) and revision level (alphabetical) respectively. Program UV4\*\*\* comprises two software models: MDL07 and MDL08. MDL07 is for valve controlled heat, and MDL08 is for face-and-bypass damper controlled heat.

### Setpoints

Most UVC setpoints are either “hardware” or “software” adjustable. Hardware adjustable means there is an on-board potentiometer used for adjustment. Software adjustable means a PC equipped with Monitor software and proper cable connection is required to make an adjustment. Default software adjustable values are shown on the sequence charts. Hardware adjustable values shown on the charts are for example only. Several UVC setpoints are defined by offsets relative to other setpoints. Table 1 summarizes these setpoints and offsets.

Table 1. UVC Setpoints

Setpoint		Defined By	Label	Default Value
Description	Abbreviation			
Occupied cooling setpoint	OCS	Hardware setpoint	Room Setpoint	--
Ventilation cooling setpoint	VCS	Software offset (below OCS)	Vent Clg Offset	2°F
Occupied heating setpoint	OHS	Software offset (below OCS)	Occ RmT Spt Dfl	6°F
Unoccupied heating setpoint	UHS	Hardware offset (below OHS)	Unocc Offset	--
Unoccupied cooling setpoint	UCS	Hardware offset (above OCS)		
Compressorized cooling lockout	CCLO	Not adjustable	--	59°F
Ventilation cooling lockout	VCLO	Software setpoint	OAT Vent Clg Lkou	64°F
Heating EOC valve setpoint	HEOC	Not adjustable	OAT EOC Viv Lo	40°F
Ventilation cooling discharge air low limit	VCLL	Software setpoint	DAT Vent Clg Low	55°F
DX cooling discharge air low limit	DXLL	Software setpoint	DAT Vent Clg Low	50°F
Outdoor air lockout	OALO	Software setpoint	OALO Setpoint	35°F

## DX Cooling with Wet Heat, Valve Control

### Description of Operation

#### Definitions

##### Control Temperature

In order to maintain more stable room temperature control, the MicroTech Unit Ventilator Controller (UVC) uses the concept of a “Control Temperature.” During the occupied or tenant override operating modes, the Control Temperature is a weighted value equal to 19/20 room temperature and 1/20 discharge air temperature. During the unoccupied operating mode, the Control Temperature is set equal to the room temperature.

##### Setpoint Abbreviations

OCS	Occupied cooling setpoint
VCS	Ventilation cooling setpoint
OHS	Occupied heating setpoint
UHS	Unoccupied heating setpoint
UCS	Unoccupied cooling setpoint
VCLO	Ventilation cooling outdoor air lockout setpoint
CCLO	Compressorized cooling outdoor air lockout setpoint
VCLL	Ventilation cooling discharge air low limit setpoint
DXLL	DX cooling discharge air low limit setpoint
OALO	Outside air lockout setpoint

##### Software ID

Program: UV4\*\*\*

Software Model: MDL07

### Occupied or Tenant Override Operating Mode

The supply fan will run continually in the occupied or tenant override operating modes.

When the UVC is first energized it will perform a self-calibration procedure upon the OA damper and valve actuators. The calibration procedure will take approximately 5-minutes to perform during which time the supply fan will not operate.

The UVC provides a compressor minimum on time of 2-minutes and a minimum off time of 3-minutes.

An outdoor air lockout setpoint has been provided to force the OA damper closed when the OA temperature goes below the OALO setpoint (software adjustable). The OALO setpoint must not be set below the freeze point of the liquid being used within the building water loop. In order to lower the OALO setpoint below the default value glycol must be added to the building water loop in sufficient concentration to ensure freezing will not occur. However, the OALO setpoint can be lowered if steam heat is used.

If provided, the optional ventilation lockout feature can override UVC temperature control and keep the OA damper closed as required.

If provided, the optional exhaust fan output will energize when the OA damper opens and de-energize when the OA damper closes.

If provided, the optional auxiliary heat output will operate a normally open device. The auxiliary output will energize (close the device) when the Control Temperature is above the OHS. The auxiliary output will de-energize (open the device) when the Control Temperature is 3°F below the OHS.

The same UVC output is used for both the auxiliary heat output feature and the exhaust fan output feature. Therefore, both features cannot be used together.

### Morning Start

If the space is cool and heating is required, the unit will operate as described in "Heating Operation" below. The outdoor air (OA) damper will remain closed until the Control Temperature rises to within 3°F of the OHS setpoint. Then it will be opened to minimum position.

If the space is warm and cooling is required, the unit will operate as described in "Cooling Operation" below. If the outdoor air is not suitable for free cooling, the OA damper will remain closed until the Control Temperature falls to within 3°F of the OCS setpoint. Then it will be opened to minimum position.

### Cooling Operation

When the Control Temperature is greater than the OHS setpoint and less than the VCS setpoint, the OA damper will be held at its minimum position setpoint (hardware adjustable). As the Control temperature rises and cooling becomes necessary, the UVC will decide whether the outdoor air is suitable for free cooling by comparing the outdoor air temperature (dry bulb) to the VCLO setpoint.

If the OA temperature is less than or equal to the VCLO setpoint, the economizer will modulate as required to maintain the VCS setpoint (default = 2°F less than OCS). The Control Temperature will rise if the outdoor air is too warm to satisfy the cooling load. If the OA damper is more than 85% open, mechanical cooling will be energized when the Control Temperature rises to the OCS setpoint.

If the OA temperature is warmer than the VCLO setpoint, mechanical cooling will be energized when the Control Temperature rises to the OCS setpoint. The OA damper will be held to the minimum position setpoint, except when the OA temperature is warmer than the VCLO setpoint and the Control Temperature is 3°F or more above the OCS. In this unlikely situation, the OA damper will be closed.

Once the compressor is energized, the start-to-stop (minimum on) timer will override normal temperature control maintaining compressor operation for the minimum on time. The compressor will be de-energized when the Control Temperature falls below the OCS setpoint.

**Note:** Regardless of the economizer state, its operation is subject to discharge air low limit control.

**Note:** During normal (non-alarm) operation, the compressor will be disabled if any of the following conditions exist:

- OA temperature less than the CCLO setpoint
- Discharge air temperature less than the DXLL setpoint
- Stop-to-start (minimum off) timer has not expired
- Heating valve more than 15% open

### Heating Operation

When the Control Temperature is greater than the OHS setpoint and less than the VCS setpoint, the OA damper will be held at its minimum position setpoint. As the Control Temperature falls and heating becomes necessary, the heating valve (steam or hot water) will modulate as required to maintain the OHS setpoint.

The OA damper will maintain its minimum position when the Control Temperature is within 3°F of the OHS. If the Control Temperature falls to 3°F or more below the OHS, the OA damper will be closed.

## Unoccupied Operating Mode

The outdoor air damper will always be closed when the unit is in the unoccupied operating mode.

The indoor fan will remain off when the unit is in the unoccupied operating mode unless heating or cooling are required (see note below).

**Note:** During the unoccupied mode, if the fan remains off continually for 60-minutes, it will start and run for 5-minutes.

### Cooling Operation

The fan will be energized when the Control Temperature rises to the UCS setpoint. If the Control Temperature rises above the UCS setpoint, the compressor will be energized (see note below).

Once the compressor is energized, the start-to-stop (minimum on) timer will override normal temperature control maintaining compressor operation for the minimum on time. The compressor will be de-energized when the Control Temperature falls below the UCS setpoint.

The fan will also be de-energized when the Control Temperature falls below the UCS setpoint; however, it is interlocked so that it will not stop before the compressor stops.

**Note:** During normal (non-alarm) operation, the compressor will be disabled if any of the following conditions exists:

- OA temperature less than the CCLO setpoint
- Discharge air temperature less than the DXLL setpoint
- Stop-to-start (minimum off) timer has not expired
- Heating valve more than 15% open

### Heating Operation

If the Control Temperature falls below the UHS setpoint, the heating valve will be fully opened and the fan will be energized. The valve will modulate as required to prevent the discharge air temperature from exceeding the discharge air high limit setpoint.

When the Control Temperature rises to 2°F greater than the UHS setpoint, the valve will be closed and the fan will be de-energized.

**Note:** The UVC will modulate the heating valve to prevent the discharge air temperature from falling below the VCLL setpoint during the unoccupied mode when the fan is off.

## Discharge Air Low Limit Control

There are two discharge air low limit functions: the "DX cooling" low limit and the "vent cooling" low limit. The vent cooling low limit function prevents the discharge air (DA) temperature from falling below the VCLL setpoint whenever mechanical cooling is not necessary; when mechanical cooling is necessary, the vent cooling low limit function is disabled. The DX cooling low limit function prevents the DA temperature from falling below the lower DXLL setpoint whenever the compressor is on.

### Vent Cooling Low Limit (Mechanical Cooling Inactive)

If the DA temperature falls below the VCLL setpoint, the following sequence will occur:

1. **Occupied Mode Only:** The OA damper modulates toward (or remains at) minimum position
2. If the actual OA damper position is less than or equal to the minimum setpoint, the heating valve modulates open
3. If the OA temperature is less than or equal to the VCLO setpoint and the DA temperature remains below the VCLL setpoint until the actual valve position is more than 85% open (unlikely), the OA damper modulates toward fully closed

If the DA temperature rises to the VCLL setpoint at any time during this sequence, normal operation will resume.

### DX Low Limit (Mechanical Cooling Active)

If the DA temperature falls below the DXLL setpoint, the following will occur:

1. The compressor will be immediately de-energized

- The DXLL wait timer is set (default = 2 minutes). The vent cooling low limit function is disabled during the DXLL wait time period

If the DA temperature rises above the VCLL setpoint before the timer expires, normal operation will resume.

If the DA temperature remains below the VCLL setpoint until the timer expires, the vent cooling low limit function will be enabled (see above).

## Safeties

### High Pressure

A normally closed refrigerant high pressure switch is provided to detect refrigerant high pressure conditions. The high pressure switch cut out is 400 psig +/- 10 and the cut in is 300 psig +/- 20. When the UVC detects high pressure conditions the following will occur:

- The compressor will be immediately de-energized
- The "High Pressure" fault will be indicated by the UVC

When the alarm conditions are gone, the fault will automatically reset with the first 2-occurrences allowing operation to return to normal. If a third fault occurs within 1-week the fault must be manually reset by cycling power to the UVC after the alarm conditions are gone. Cycling power after the third fault resets this sequence.

### Low DX Coil Temperature

A normally closed low temperature switch is provided to detect low refrigerant temperature conditions within the indoor air coil. The low temperature switch cut in is 30°F +/- 4 and the cut out is 50°F +/- 6. When the UVC detects the possibility of low refrigerant temperatures for longer than 5 -seconds (fixed) the following will occur:

- The compressor will be immediately de-energized
- The "Low DX Coil Temperature" fault will be indicated by the UVC

When the alarm conditions are gone, the fault will automatically reset with the first 2-occurrences allowing operation to return to normal. If a third fault occurs within 1-week the fault must be manually reset by cycling power to the UVC after the alarm conditions are gone. Cycling power after the third fault resets this sequence.

### Low Water Coil Leaving Air Temperature

A normally closed low temperature switch is provided to detect low leaving air temperature conditions on the indoor air coil. The low temperature switch cut out is 38° F +/- 2 and the cut in is 45° F +/- 2. When the UVC detects the possibility of low leaving air temperatures for longer than 5-seconds (fixed) the following will occur:

- The compressor will be immediately de-energized
- The OA damper is closed

If the DA temperature is less than VCLL then the heating valve is positioned to a minimum of 100% open to the coil; if the DA temperature is equal to or greater than VCLL then the heating valve is positioned to a minimum of 25% open to the coil

The "Low Water Coil Temperature" fault will be indicated by the UVC.

### Brownout

If the UVC detects low line voltage conditions that persist for at least 10 seconds, the compressor will be immediately de-energized and the "Brownout" fault will be indicated. The brownout alarm setpoint is equivalent to approximately 85% of the nameplate voltage value.

The Brownout fault will automatically reset when the line voltage remains at or above 90% of the nameplate value for at least 5-minutes.

**Note:** The four brownout parameters above are PC adjustable, however, it is recommended that they not be changed.

## Sequence Charts

The following charts graphically summarize the expected sequences of operation for this Unit Ventilator configuration. The charts are all based upon factory default setpoints. The output states indicated on the charts will typically exist for a particular control temperature, however, exceptions will occur when other control features are active or when alarm conditions exist or when factory defaults are changed. Brief descriptions of the control feature

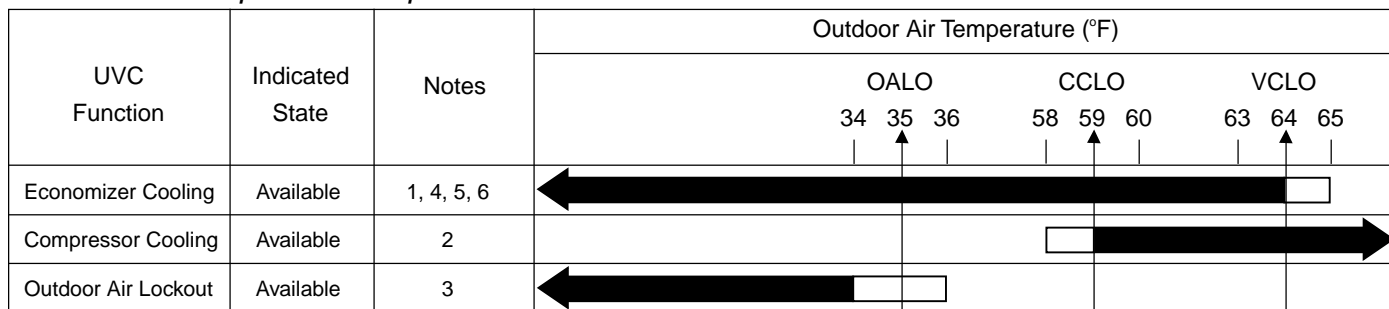
exceptions are noted on the charts. Refer to bulletin No. IM 613, "MicroTech Unit Ventilator Controller" for more information.

### Software ID

Program: UV4\*\*\*

Software Model: MDL07

## Outdoor Air Temperature Dependent Functions

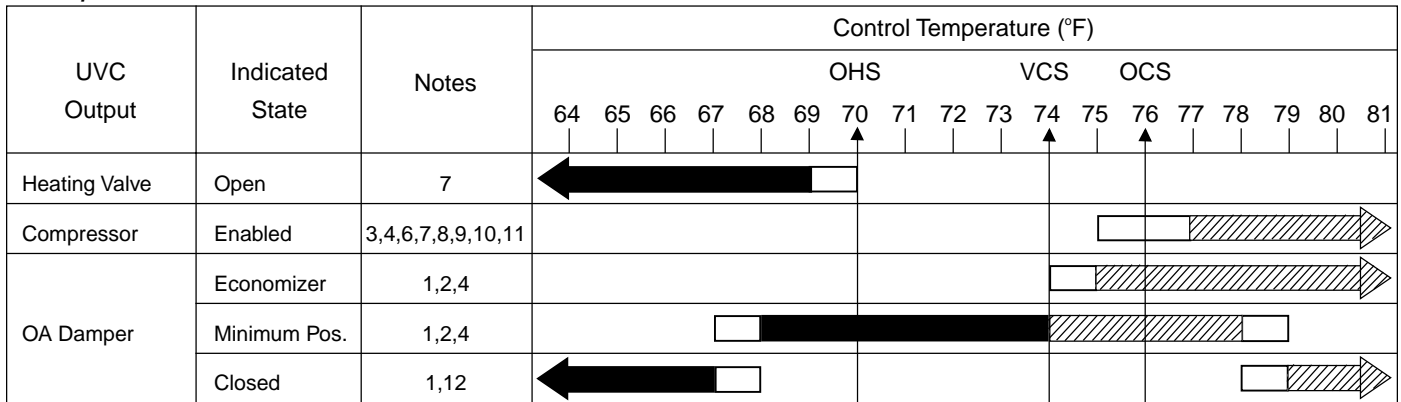


Indicated state (default setpoints)
  Indicated state dependent on differential (default setpoints)

### Outdoor Air Temperature Dependent Function Notes:

- Economizer cooling will be unavailable when OA is above VCLO
- Compressorized cooling lockout (CCLO) prevents compressorized cooling when the OA temperature is below CCLO
- OA lockout feature is enabled from the factory in UV Model 07, when enabled the OA damper will be forced closed if OA temperature is below OALO
- In very humid locations VCLO can be lowered to limit the economizer function
- Never lower VCLO below CCLO or a cooling deadband will be created
- In locations where humidity is of no concern, VCLO can be raised slightly to allow additional economizer cooling

## Occupied Mode

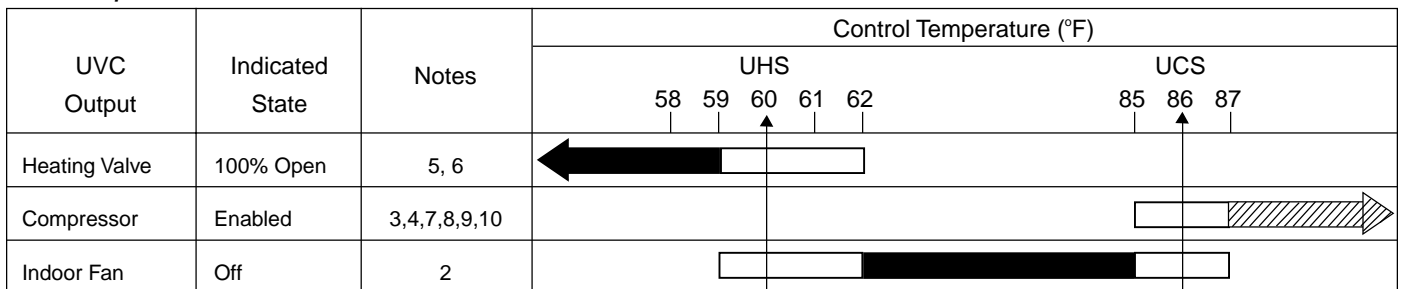


Indicated state (default setpoints)    
 Indicated state dependent on differential (default setpoints)    
 Indicated state dependent on OA temperature (default setpoints)

### Occupied Mode Notes:

1. The vent cooling discharge air low limit function can affect OA damper position
2. Economizer cooling will be unavailable when OA is above VCLO
3. Economizer cooling, when available, will work in conjunction with compressorized cooling dependent upon control temperature
4. In economizer mode, when cooling is required, the OA damper must be greater than 85% open before compressor cooling is enabled
5. Control temperature can affect OA damper operation
6. Compressorized cooling lockout (CCLO) prevents compressorized cooling when the OA temperature is below CCLO
7. Heating valve must be less than 15% open before compressor will start
8. Compressorized cooling can be affected by the DX cooling discharge air low limit function
9. Minimum on (2-minutes) and minimum off (3-minutes) timers can affect compressor operation
10. High pressure and low DX coil temperature can affect compressor operation
11. The brownout function can affect compressor operation
12. The outdoor air lockout option, if enabled, can affect OA damper position

## Unoccupied Mode



Indicated state (default setpoints)    
 Indicated state dependent on differential (default setpoints)    
 Indicated state dependent on OA temperature (default setpoints)

### Unoccupied Mode Notes:

1. The OA damper remains closed in unoccupied mode
2. The indoor fan will remain off in unoccupied mode when the compressor is off and the valve is closed
3. Compressorized cooling lockout (CCLO) prevents compressorized cooling when the OA temperature is below CCLO
4. Heating valve must be less than 15% open before compressor will start
5. Heating valve will be modulated to maintain the vent cooling discharge air low limit setpoint when the fan is off
6. Heating valve will modulate closed to maintain the discharge air high limit
7. Compressorized cooling can be affected by the DX cooling discharge air low limit function
8. Minimum on (2-minutes) and minimum off (3-minutes) timers can affect compressor operation
9. High pressure and low DX coil temperature can affect compressor operation
10. The brownout function can affect compressor and electric heat operation

# DX Cooling with Wet Heat, Damper Control

## Description of Operation

### Definitions

#### Control Temperature

In order to maintain more stable room temperature control, the MicroTech Unit Ventilator Controller (UVC) uses the concept of a "Control Temperature." During the occupied or tenant override operating modes, the Control Temperature is a weighted value equal to 19/20 room temperature and 1/20 discharge air temperature.

#### Setpoint Abbreviations

OCS	Occupied cooling setpoint
VCS	Ventilation cooling setpoint
OHS	Occupied heating setpoint
UHS	Unoccupied heating setpoint
UCS	Unoccupied cooling setpoint
VCLO	Ventilation cooling outdoor air lockout setpoint
CCLO	Compressorized cooling outdoor air lockout setpoint
HEOC	Heating end-of-cycle valve outdoor air setpoint
VCLL	Ventilation cooling discharge air low limit setpoint
DXLL	DX cooling discharge air low limit setpoint
OALO	Outdoor air lockout setpoint

#### Software ID

Program: UV4\*\*\*

Software Model: MDL08

### Heating End-of-Cycle Valve

A normally open, spring-return, two position "end-of-cycle" (EOC) valve is used to prevent overheating when the face-and-bypass damper is in the full bypass position. The following description of EOC valve operation is applicable to all operating modes.

If the outdoor air (OA) temperature is less than or equal to the HEOC setpoint, the EOC valve will always be open, regardless of the Control Temperature.

If the OA temperature is above the HEOC setpoint, the EOC valve will be opened when the Control Temperature falls to the heating setpoint (OHS or UHS). It will be closed when the Control Temperature rises 2°F or more above the heating setpoint.

### Occupied or Tenant Override Operating Mode

The supply fan will run continually in the occupied or tenant override operating modes.

When the UVC is first energized it will perform a self-calibration procedure upon the OA damper and the face and bypass damper actuators. The calibration procedure will take approximately 5-minutes to perform during which time the supply fan will not operate.

The UVC provides a compressor minimum on time of 2-minutes and a minimum off time of 3-minutes.

If enabled, an outdoor air lockout setpoint has been provided to force the OA damper to close when the OA temperature goes below the OALO setpoint (software adjustable). This feature is typically used only on valve control hydronic heat and or hydronic cool units. This feature is disabled by default in UV Model 08.

If provided, the optional ventilation lockout feature can override UVC Temperature Control and keep the OA damper closed as required.

If provided, the optional exhaust fan output will energize when the OA damper opens and de-energize when the OA damper closes.

If provided, the optional auxiliary heat output will operate a normally open device. The auxiliary output will energize (close the device) when the Control Temperature is above the OHS. The auxiliary output will de-energize (open the device) when the Control Temperature is 3°F below the OHS.

The same UVC output is used for both the auxiliary heat output feature and the exhaust fan output feature. Therefore, both features cannot be used together.

**Note:** When switching from unoccupied-to-occupied mode the OA damper will remain closed for the first 5-minutes of occupied operation.

#### Morning Start

If the space is cool and heating is required, the unit will operate as described in "Heating Operation" below. The OA damper will remain closed until the Control Temperature rises to within 3°F of the OHS setpoint. Then it will be opened to minimum position.

If the space is warm and cooling is required, the unit will operate as described in "Cooling Operation" below. If the outdoor air is not suitable for free cooling, the OA damper will remain closed until the Control Temperature falls to within 3°F of the OCS setpoint. Then it will be opened to minimum position.

#### Cooling Operation

If the OA temperature is at or above the CCLO setpoint, the face-and-bypass damper will be opened to the face position when the Control Temperature rises to 3°F or more above the OHS setpoint.

When the Control Temperature is greater than the OHS setpoint and less than the VCS setpoint, the OA damper will be held at its minimum position setpoint (hardware adjustable). As the Control Temperature rises and cooling becomes necessary, the UVC will decide whether the outdoor air is suitable for free cooling by comparing the outdoor air temperature (dry bulb) to the VCLO setpoint (default = 68°F).

If the OA temperature is less than or equal to the VCLO setpoint, the economizer will modulate as required to maintain the VCS setpoint (default = 2°F less than OCS). The Control Temperature will rise if the outdoor air is too warm to satisfy the cooling load. If the OA damper is more than 85% open, mechanical cooling will be energized when the Control Temperature rises above the OCS setpoint.

If the OA temperature is warmer than the VCLO setpoint, mechanical cooling will be energized when the Control Temperature rises above the OCS setpoint. The OA damper will be held to the minimum position setpoint, except when the OA temperature is warmer than the VCLO setpoint and the Control Temperature is 3°F or more above the OCS. In this unlikely situation, the OA damper will be closed.

Once the compressor is energized, the start-to-stop (minimum on) timer will override normal temperature control maintaining compressor operation for the minimum on time. The compressor will be de-energized when the Control Temperature falls below the OCS setpoint.

**Note:** Regardless of the economizer state, its operation is subject to discharge air low limit control.

**Note:** During normal (non-alarm) operation, the compressor will be disabled if any of the following conditions exist:

- OA temperature less than the CCLO setpoint
- Discharge air temperature less than the DXLL setpoint
- Stop-to-start (minimum off) timer has not expired

#### Heating Operation

When the Control Temperature is greater than the OHS setpoint and less than the VCS setpoint, the OA damper will be held at its minimum position setpoint. As the Control Temperature falls and heating becomes necessary, the face-and-bypass damper will modulate as required to maintain the OHS setpoint.

The OA damper will maintain its minimum position when the Control Temperature falls to 3°F or more below the OHS, the OA damper will be closed.

## Unoccupied Operating Mode

The outdoor air damper will always be closed when the unit is in the unoccupied operating mode.

The indoor fan will remain off when the unit is in the unoccupied operating mode unless heating or cooling are required (see note below).

**Note:** During the unoccupied mode, if the fan remains off continually for 60-minutes it will start and run for 5-minutes.

### Cooling Operation

If the OA temperature is at or above the CCLO setpoint, the face-and-bypass damper will be opened to the full face position when the Control Temperature rises to 3°F or more above the UHS setpoint.

The fan will be energized when the Control Temperature rises to the UCS setpoint. If the Control Temperature rises above the UCS setpoint, the compressor will be energized.

Once the compressor is energized, the start-to-stop (minimum on) timer will override normal temperature control maintaining compressor operation for the minimum on time. The compressor will be de-energized when the Control Temperature falls below the UCS setpoint.

The fan will also be de-energized when the Control Temperature falls below the UCS setpoint; however, it is interlocked so that it will not stop before the compressor stops.

**Note:** During normal (non-alarm) operation, the compressor will be disabled if any of the following conditions exist:

- OA temperature less than the CCLO setpoint
- Discharge air temperature less than the DXLL setpoint
- Stop-to-start (minimum off) timer has not expired

### Heating Operation

If the Control Temperature falls to the UHS setpoint, the face-and-bypass damper will be positioned to full face and the fan will be energized. The face-and-bypass damper will modulate as required to prevent the discharge air temperature from exceeding the discharge air high limit setpoint.

When the Control Temperature rises to 2°F greater than the UHS setpoint, the face-and-bypass damper will be positioned to full bypass and the fan will be de-energized.

**Note:** The UVC will modulate the face-and-bypass damper to prevent the discharge air temperature from falling below the VCLL setpoint during the unoccupied mode when the fan is off.

## Discharge Air Low Limit Control

There are two discharge air low limit functions: the “DX cooling”: low limit and the “vent cooling” low limit. The vent cooling low limit function prevents the discharge air (DA) temperature from falling below the VCLL setpoint whenever mechanical cooling is not necessary; when mechanical cooling is necessary, the vent cooling low limit function is disabled. The DX cooling low limit function prevents the DA temperature from falling below the lower DXLL setpoint whenever the compressor is on.

### Vent Cooling Low Limit (Mechanical Cooling Inactive)

If the DA temperature falls below the VCLL setpoint, the following sequence will occur:

1. **Occupied Mode Only:** The OA damper modulates toward (or remains at) minimum position
2. If the actual OA damper position is less than or equal to the minimum setpoint, the face-and-bypass damper modulates open to face
3. If the OA temperature is less than or equal to the VCLO setpoint (default = 68°F) and the DA temperature remains below the VCLL setpoint until the actual face-and-bypass damper position is more than 85% open to face (unlikely), the OA damper modulates toward fully closed

If the DA temperature rises to the VCLL setpoint at any time, during this sequence, normal operation will resume.

### DX Low Limit (Mechanical Cooling Active)

If the DA temperature falls below the DXLL setpoint, the following will occur.

1. The compressor will be immediately de-energized
2. The DXLL wait timer is set (default = 2 minutes). The vent cooling low limit function is disabled during the DXLL wait time period

If the DA temperature rises to the VCLL setpoint before the timer expires, normal operation will resume.

If the DA temperature remains below the VCLL setpoint until the timer expires, the vent cooling low limit function will be enabled (see above).

## Safeties

### High Pressure

A normally closed refrigerant high pressure switch is provided to detect refrigerant high pressure conditions. The high pressure switch cut out is 400 psig +/- 10 and the cut in is 300 psig +/- 20. When the UVC detects high pressure conditions the following will occur:

- The compressor will be immediately de-energized
  - The “High Pressure” fault will be indicated by the UVC
- When the alarm conditions are gone, the fault will automatically reset with the first 2-occurrences allowing operation to return to normal. If a third fault occurs within 1-week the fault must be manually reset by cycling power to the UVC after the alarm conditions are gone. Cycling power after the third fault resets this sequence.

### Low DX Coil Temperature

A normally closed low temperature switch is provided to detect low refrigerant temperature conditions within the indoor air coil. The low temperature switch cut in is 30°F +/- 4 and the cut out is 50°F +/- 6. When the UVC detects the possibility of low refrigerant temperatures for longer than 5-seconds (fixed), the following will occur:

- The compressor will be immediately de-energized
  - The “Low DX Coil Temperature” fault will be indicated by the UVC
- When the alarm conditions are gone, the fault will automatically reset with the first 2-occurrences allowing operation to return to normal. If a third fault occurs within 1-week the fault must be manually reset by cycling power to the UVC after the alarm conditions are gone. Cycling power after the third fault resets this sequence.

### Brownout

If the UVC detects low line voltage conditions that persist for at least 10 seconds, the compressor and all electric heat stages will be immediately de-energized and the “Brownout” fault will be indicated. The brownout alarm setpoint is equivalent to approximately 85% of the nameplate voltage value.

The Brownout fault will automatically reset when the line voltage remains at or above 90% of the nameplate value for at least 5 minutes.

**Note:** The four brownout parameters above are PC adjustable, however, it is recommended that they not be changed.

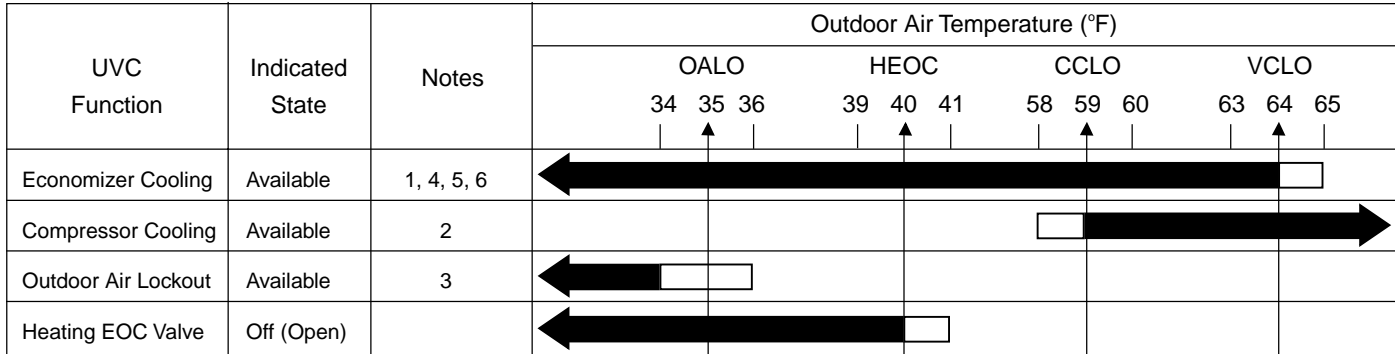
# Sequence Charts



The following charts graphically summarize the expected sequences of operation for this Unit Ventilator configuration. The charts are all based upon factory default setpoints. The output states indicated on the charts will typically exist for a particular control temperature, however, exceptions will occur when other control features are active or when alarm conditions exist or when factory defaults are changed. Brief descriptions of the control feature

exceptions are noted on the charts. Refer to bulletin No. IM 613, "MicroTech Unit Ventilator Controller" for more information.

**Software ID**  
 Program: UV4\*\*\*  
 Software Model: MDL07

## Outdoor Air Temperature Dependent Functions

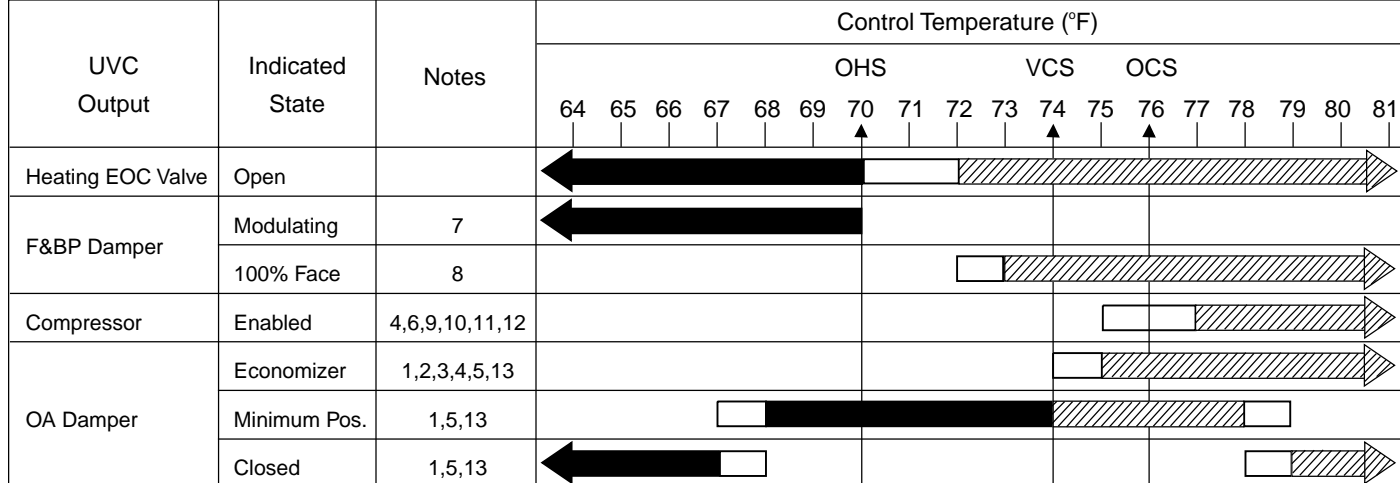





 Indicated state (default setpoints)
  Indicated state dependent on differential (default setpoints)

Outdoor Air Temperature Dependent Function Notes:

- Economizer cooling will be unavailable when OA is above VCLO
- Compressorized cooling lockout (CCLO) prevents compressorized cooling when the OA temperature is below CCLO
- OA lockout feature is enabled from the factory in UV Model 07, when enabled the OA damper will be forced closed if OA temperature is below OALO
- In very humid locations VCLO can be lowered to limit the economizer function
- Never lower VCLO below CCLO or a cooling deadband will be created
- In locations where humidity is of no concern, VCLO can be raised slightly to allow additional economizer cooling

## Occupied Mode

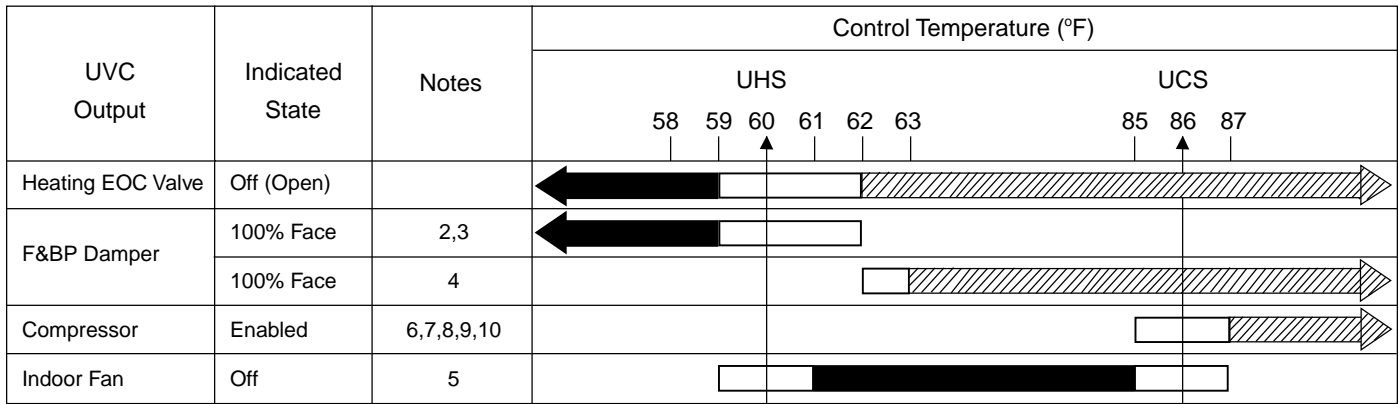


 Indicated state (default setpoints)
  Indicated state dependent on differential (default setpoints)
  Indicated state dependent on OA temperature (default setpoints)

Occupied Mode Notes:

- The vent cooling discharge air low limit function can affect OA damper position
- Economizer cooling will be unavailable when OA is above VCLO
- Economizer cooling, when available, will work in conjunction with compressorized cooling dependent upon control temperature
- In economizer mode, when cooling is required, the OA damper must be greater than 85% open before compressor cooling is enabled
- Control temperature can affect OA damper operation
- Compressorized cooling lockout (CCLO) prevents compressorized cooling when the OA temperature is below CCLO
- F&BP damper operation can also be enabled by the vent cooling discharge air low limit function
- F&BP damper will be driven to full face when the control temperature is 3°F more than the heating setpoint and OA temperature is 59°F or higher
- Compressorized cooling can be affected by the DX cooling discharge air low limit function
- Minimum on (2-minutes) and minimum off (3-minutes) timers can affect compressor operation
- High pressure and low DX coil temperature can affect compressor operation
- The brownout function can affect compressor operation
- The outdoor air lockout option, if enabled, can affect OA damper position

## Unoccupied Mode



Indicated state (default setpoints)

Indicated state dependent on differential (default setpoints)

Indicated state dependent on OA temperature (default setpoints)

### Unoccupied Mode Notes:

1. The OA damper remains closed in unoccupied mode
2. F&BP damper will modulate closed to face to maintain the discharge air high limit
3. F&BP damper will modulate open to face to maintain the vent cooling discharge air low limit when the fan is off
4. F&BP damper will be driven to full face when the control temperature is 3°F more than the heating setpoint and OA temperature is 59°F or higher
5. The indoor fan will remain off in unoccupied mode when the compressor is off and heating is not required
6. Compressorized cooling lockout (CCLO) prevents compressorized cooling when the OA temperature is below CCLO
7. Compressorized cooling can be affected by the DX cooling discharge air low limit function
8. Minimum on (2-minutes) and minimum off (3-minutes) timers can affect compressor operation
9. High pressure and low DX coil temperature can affect compressor operation
10. The brownout function can affect compressor operation

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