Operation Manual

OM 103-1

Group: **Unit Ventilator**

Part No.: **106101401**

Date: **July 1999**

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 UV3: DX Cooling with Electric Heat
DX Cooling Only
Electric Heat Only

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AAF Air Conditioning | HermanNelson

Introduction

This manual describes the sequences of operation for MicroTech controlled AAF-HermanNelson Unit Ventilators equipped with direct expansion (DX) cooling only, electric heating only, or DX cooling and electric heating. Unit Ventilators with these heating and cooling configurations could be AAF-HermanNelson models AZS, AZQ, AVS, AVV, AHF or AHV. (Model AZQ, AZS is the only model available in a DX cooling and electric heating configuration.) Regardless of the AAF-HermanNelson model type, the Unit Ventilator Controller (UVC) provided with these units uses program UV3***.

For more information on the MicroTech Unit Ventilator Controller, refer to Bulletin No. IM 613, "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, AHF or AHV with either DX cooling, electric heating, or both use program UV3***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 UV3*** comprises three software models: MDL04, MDL05, and MDL06. Each software model is for a different unit configuration. Refer to Table 1.

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 2 summarizes these setpoints and offsets.

Table 1. Program UV3 Unit Ventilator Configurations

Program	Software Model	AAF-HermanNelson Model			Configuration Description
		AZQ / AZS	AVS / AVV	AHF/ AHV	
UV3***	MDL04	•	•	•	DX Cooling and Electric Heat
	MDL05		•	•	DX Cooling Only
	MDL06		•	•	Electric Heat Only

Table 2. 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 Difl	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 Low	64°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 DX Clg Low	45°F
Outdoor air lockout	OALO	Software setpoint	OALO Setpoint	35°F

DX Cooling with Electric Heat

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." 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
VCLL Ventilation cooling discharge air low limit setpoint
DXLL DX cooling discharge air low limit setpoint
OALO Outside air lockout setpoint

Software ID

Program: UV3***
Software Model: MDL04

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 actuator. 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 Models 04, 05, and 06.

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 use 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 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 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.

If the Control Temperature falls below the OHS setpoint, the two or three (optional) stages of electric heat will be energized as required using a "stage-up" interstage delay timer (default = 30 seconds).

When the Control Temperature rises to the OHS setpoint, the electric heat stages will be de-energized using a "stage-down" interstage delay timer (default = 30 seconds).

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. During the unoccupied mode the indoor fan will also start and run if the DA temperature becomes greater than the room temperature plus 12°F and continue to run until the DA temperature is equal to or less than the room temperature plus 7°F.

Cooling Operation

The fan and compressor will be energized when the Control Temperature rises to the UCS setpoint (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 Operation

The fan will be energized when the Control Temperature falls below the UHS setpoint. If the Control Temperature falls below the UHS setpoint, the two or three (optional) stages of electric heat will be energized as required using a "stage-up" interstage delay timer (default = 30 seconds).

When the Control Temperature rises to 2°F above the UHS setpoint, the electric heat stages will be de-energized using a "stage-down" interstage delay timer (default = 30 seconds). If the Control Temperature is between the stage-up and stage-down points, no staging action will occur.

The fan will be de-energized when the Control Temperature rises above the UHS setpoint; however, it is interlocked so that it will not stop before all electric heat stages are 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. 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 electric heat will stage up as required to prevent the DA temperature from falling below the VCLL setpoint. The stage-up interstage delay timer (default = 30 seconds) must expire before each subsequent stage is energized
3. If the OA temperature is less than or equal to the VCLO setpoint (default = 68ºF) and the DA temperature remains below the VCLL setpoint after all electric heat stages have been energized (unlikely), the OA damper will be closed.

If the DA temperature rises to the VCLL setpoint at any time, the above sequence will be executed in reverse until normal operation resumes. (Electric heat stages will be de-energized using the stage-down interstage timer.)

Note: The vent cooling discharge air low limit function is disabled during the unoccupied mode.

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 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 out is 30ºF +/– 4 and the cut in is 50ºF +/– 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 (2 seconds w/electric heat), 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: UV3***
Software Model: MDL04

Outdoor Air Temperature Dependent Functions

UVC Function	Indicated State	Notes	Outdoor Air Temperature (°F)
			OALO 34 35 36 · CCLO 58 59 60 · VCLO 63 64 65
Economizer Cooling	Available	1,4,5,6	
Compressor Cooling	Available	2	
Outdoor Air Lockout	Available	3	

Outdoor Air Temperature Dependent Function Notes:

1. Economizer cooling will be unavailable when OA is above VCLO
2. Compressorized cooling lockout (CCLO) prevents compressorized cooling when the OA temperature is below CCLO
3. OA lockout feature is disabled from the factory in UV Model 04, when enabled the OA damper will be forced closed if OA temperature is below OALO
4. In very humid locations VCLO can be lowered to limit the economizer function
5. Never lower VCLO below CCLO or a cooling deadband will be created
6. In locations where humidity is of no concern, VCLO can be raised slightly to allow additional economizer cooling

Occupied Mode

UVC Output	Indicated State	Notes	Control Temperature (°F)
			OHS 64 65 66 67 68 69 70 · VCS 71 72 73 74 · OCS 75 76 77 78 79 80 81
Electric Heat	Staging	7,11,13	
Compressor	Enabled	4,6,8,9,11	
OA Damper	Economizer	1,2,3,5,12	
	Minimum Pos.	1,5,12	
	Closed	1,5	

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. Electric heat will be made available when the vent cooling discharge air low limit function is active
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 and electric heat operation
12. The outdoor air lockout option, if enabled, can affect OA damper position
13. When within the areas indicated above, electric heat will be staging up or will be on; outside the areas indicated, electric heat will be staging down or will be off

Unoccupied Mode

UVC Output	Indicated State	Notes	Control Temperature (°F)
			UHS: 58 59 60 61 62 — UCS: 85 86 87
Electric Heat	Staging	4,8	
Compressor	Enabled	3,5,6,7,8	
Indoor Fan	Off	2	

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 and all electric heater stages are off
3. Compressorized cooling lockout (CCLO) prevents compressorized cooling when the OA temperature is below CCLO
4. Electric heat will be made available when the vent cooling discharge air low limit function is active
5. Compressorized cooling can be affected by the DX cooling discharge air low limit function
6. Minimum on (2-minutes) and minimum off (3-minutes) timers can affect compressor operation
7. High pressure and low DX coil temperature can affect compressor operation
8. The brownout function can affect compressor and electric heat operation

DX Cooling Only

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." 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 (not used)
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 Outdoor air lockout setpoint

Software ID

Program: UV3***
Software Model: MDL05

Occupied or Tenant Override Operating Mode

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

When the U VC is first energized it will perform a self-calibration procedure upon the OA damper actuator. 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 Models 04, 05. and 06.

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 outdoor air (OA) damper will remain closed and room air will be recirculated 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 Operation

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

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. During the unoccupied mode the indoor fan will also start and run if the DA temperature becomes greater than the room temperature plus 12°F and continue to run until the DA temperature is equal to or less than the room temperature plus 7°F.

Cooling Operation

The fan and compressor will be energized when the Control Temperature rises to the UCS setpoint (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 differential between the compressor start and stop points is 1°F, fixed.)

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

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 OA damper will modulate toward fully closed. When the DA temperature rises to the VCLL setpoint, 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 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

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 out is 30°F +/– 4 and the cut in 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 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: UV3***
Software Model: MDL05

Outdoor Air Temperature Dependent Functions

UVC Function	Indicated State	Notes	Outdoor Air Temperature (°F)
			OALO 34 35 36 · CCLO 58 59 60 · VCLO 63 64 65
Economizer Cooling	Available	1,4,5,6	
Compressor Cooling	Available	2	
Outdoor Air Lockout	Available	3	

Outdoor Air Temperature Dependent Function Notes:

1. Economizer cooling will be unavailable when OA is above VCLO
2. Compressorized cooling lockout (CCLO) prevents compressorized cooling when the OA temperature is below CCLO
3. OA lockout feature is disabled from the factory in UV Model 05, when enabled the OA damper will be forced closed if OA temperature is below OALO
4. In very humid locations VCLO can be lowered to limit the economizer function
5. Never lower VCLO below CCLO or a cooling deadband will be created
6. In locations where humidity is of no concern, VCLO can be raised slightly to allow additional economizer cooling

Occupied Mode

UVC Output	Indicated State	Notes	Control Temperature (°F)
			OHS 70 · VCS 74 · OCS 76 · 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81
Compressor	Enabled	6,7,8,9,10	
OA Damper	Economizer	1,2,3,4,5,11	
	Minimum Pos.	1,5,11	
	Closed	1,5	

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. 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
11. The outdoor air lockout option, if enabled, can affect OA damper position

Unoccupied Mode

UVC Output	Indicated State	Notes	Control Temperature (°F)
			UCS 85 86 87
Compressor	Enabled	3,4,5,6,7	
Indoor Fan	Off	2	

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
3. Compressorized cooling lockout (CCLO) prevents compressorized cooling when the OA temperature is below CCLO
4. Compressorized cooling can be affected by the DX cooling discharge air low limit function
5. Minimum on (2-minutes) and minimum off (3-minutes) timers can affect compressor operation
6. High pressure and low DX coil temperature can affect compressor operation
7. The brownout function can affect compressor operation

Electric Heat Only

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." 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 (not used)
VCLL Ventilation cooling discharge air low limit setpoint
OALO Outdoor air lockout setpoint

Software ID

Program: UV3***
Software Model: MDL06

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 actuator. The calibration procedure will take approximately 5-minutes to perform during which time the supply fan will not operate.

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 Models 04, 05. and 06.

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 fan output feature. Therefore, both features cannot be use 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 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 economizer will modulate as required to maintain the VCS setpoint (default = 2°F less than OCS).

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

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.

If the Control Temperature falls below the OHS setpoint, the two or three (optional) stages of electric heat will be energized as required using a "stage-up" interstage delay timer (default = 30 seconds).

When the Control Temperature rises to the OHS setpoint, the electric heat stages will be de-energized using a "stage-down" interstage delay timer (default = 30 seconds).

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. During the unoccupied mode the indoor fan will also start and run if the DA temperature becomes greater than the room temperature plus 12°F and continue to run until the DA temperature is equal to or less than the room temperature plus 7°F.

Heating Operation

The fan will be energized when the Control Temperature falls below the UHS setpoint. If the Control Temperature falls below the UHS setpoint, the two or three (optional) stages of electric heat will be energized as required using a "stage-up" interstage delay timer (default = 30 seconds).

When the Control Temperature rises to 2°F above the UHS setpoint, the electric heat stages will be de-energized using a "stage-down" interstage delay timer (default = 30 seconds). If the Control Temperature is between the stage-up and stage-down points, no staging action will occur.

The fan will be de-energized when the Control Temperature rises above the UHS setpoint; however, it is interlocked so that it will not stop before all electric heat stages are off.

Discharge Air Low Limit Control

The "vent cooling" low limit function maintains the discharge air (DA) temperature at or above at or above the VCLL setpoint. If the DA temperature falls below the VCLL setpoint, the following sequence will occur.

1. 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 electric heat will stage up as required to prevent the DA temperature from falling below the VCLL setpoint. The stage-up interstage delay timer (default = 30 seconds) must expire before each subsequent stage is energized
3. If the DA temperature remains below the VCLL setpoint after all electric heat stages have been energized (unlikely), the OA damper will be closed

If the DA temperature rises to the VCLL setpoint at any time, the above sequence will be executed in reverse until normal operation resumes. (Electric heat stages will be de-energized using the stage-down interstage timer.)

Note: The vent cooling discharge air low limit function is disabled during the unoccupied mode.

Safeties

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

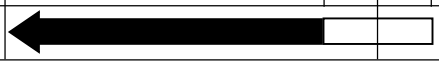
The following charts graphically summarize the expected sequences of operation for this Unit Ventilator configuration. The charts are all based upon factory default setpoints. The output states indicated on the charts will typically exist for a particular control temperature, however, exceptions will 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: UV3***

Software Model: MDL06

Outdoor Air Temperature Dependent Functions

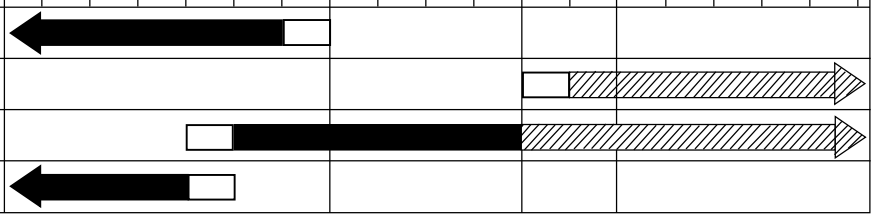
UVC Function	Indicated State	Notes	Outdoor Air Temperature (°F)
			OALO 34 35 36
Outdoor Air Lockout	Available	1	

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

Outdoor Air Temperature Dependent Function Notes:

1. OA lockout feature is disabled from the factory in UV Model 06, when enabled the OA damper will be forced closed if OA temperature is below OALO

Occupied Mode

UVC Output	Indicated State	Notes	Control Temperature (°F)
Electric Heat	Staging	3,5,6	
OA Damper	Economizer	1,5,11	
	Minimum Pos.	1,5,11	
	Closed	1,4	

Indicated state (default setpoints)

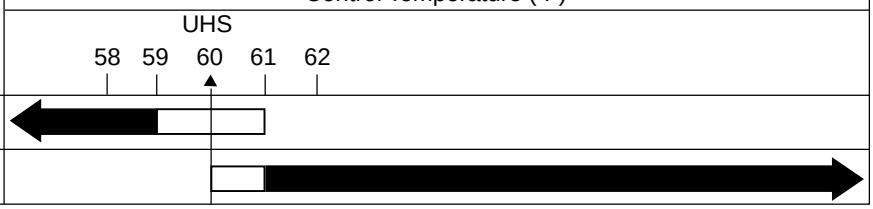
Indicated state dependent on differential (default setpoints)

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. Control temperature can affect OA damper operation
3. The brownout function can affect compressor and electric heat operation
4. The outdoor air lockout option, if enabled, can affect OA damper position
5. When within the areas indicated above, electric heat will be staging up or will be on; outside the areas indicated, electric heat will be staging down or will be off
6. Electric heat will be made available when the vent cooling discharge air low limit function is active
7. Economizer cooling will not be used if OA is greater than control temperature

Unoccupied Mode

UVC Output	Indicated State	Notes	Control Temperature (°F)
Electric Heat	Staging	3,4	
Indoor Fan	Off	1,3	

Indicated state (default setpoints)

Indicated state dependent on differential (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 all electric heater stages are off
3. The brownout function can affect compressor and electric heat operation
4. Electric heat will be made available when the vent cooling discharge air low limit function is active

AAF-HermanNelson Incorporated
4900 Technology Park Boulevard, Auburn, New York 13021-9030 USA (315) 253-2771