Operations Manual

OM 920-8

Group: **Applied Air Systems**
Part Number: **OM 920-8**
Date: **June 2023**

MicroTech® Unit Controller for Commercial Rooftop, Applied Rooftop and Self-Contained Systems

Models: DPS, MPS, RAH, RCS, RDS, RDT, RFS, RPS, SWP and SWT

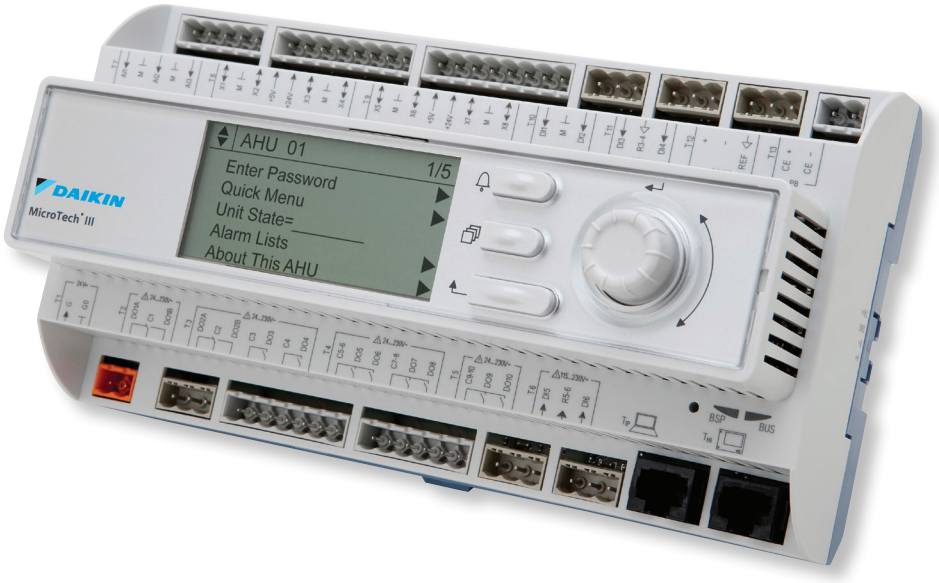


Table of Contents

Introduction

This manual provides information regarding the MicroTech control system. It specifically describes the operation and programmable options for units with constant air volume (CAV) control and variable air volume (VAV) control.

The MicroTech Unit Controller is a self contained device that is capable of complete, standalone operation. Information in the controller can be displayed and modified by using the keypad/display in the units main control panel. For installation and startup instructions and general information regarding a particular unit, refer to the applicable model-specific installation and maintenance manual.

For installation and startup instructions and general information regarding a particular rooftop unit, refer to the applicable model-specific installation and maintenance manual (Table 1).

Table 1: Installation and Maintenance Resources

Unit	Manual
Commercial Rooftop, Applied Rooftop and Self Contained Systems Unit Controller Protocol Information	ED 15112
MicroTech Unit Controller	IM 919
MicroTech Remote Unit Interface	IM 1005
RPS/RDT/RFS/RCS 015C-105C	IM 926
RPS/RDT/RFS/RCS 015D-140D	IM 893
SWP Self-Contained (012 to 130)	IM 1032
RoofPak RAH/RDS	IM 987
Maverick II Rooftop 62-75 ton	IM 991
Maverick II Rooftop 15-50 ton	IM 1058

Hazardous Information Messages

NOTICE

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with this instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user is required to correct the interference at his own expense. **Daikin Applied disclaims any liability resulting from any interference or for the correction thereof.**

⚠ WARNING

Electric shock hazard. Can cause personal injury or equipment damage. This equipment must be properly grounded. Connections and service to the MicroTech II control panel must be performed only by personnel that are knowledgeable in the operation of the equipment being controlled.

⚠ WARNING

Excessive moisture in the control panel can cause hazardous working conditions and improper equipment operation. When servicing this equipment during rainy weather, the electrical components in the main control panel must be protected from the rain.

⚠ CAUTION

Extreme temperature hazard. Can cause damage to system components. The MicroTech Unit Controller is designed to operate in ambient temperatures from -20°F to 125°F. It can be stored in ambient temperatures from -40°F to 140°F. It is designed to be stored and operated in relative humidity up to 95% (non-condensing).

⚠ CAUTION

Static sensitive components. A static discharge while handling electronic circuit boards can cause damage to the components. Discharge any static electrical charge by touching the bare metal inside the main control panel before performing any service work. Never unplug any cables, circuit board terminal blocks, relay modules, or power plugs while power is applied to the panel.

⚠ WARNING

Warning indicates potentially hazardous situations for PVC (Polyvinyl Chloride) and CPVC (Clorinated Polyvinyl Chloride) piping in chilled water systems. In the event the pipe is exposed to POE (Polyolester) oil used in the refrigerant system, the pipe can be chemically damaged and pipe failure can occur.

NOTICE

WARRANTY

MicroTech Unit Controllers with a blown internal fuse will not be covered by warranty. All MicroTech Unit Controllers are factory tested and their results are documented prior to shipping. This is to ensure that the MicroTech is functioning properly before it leaves the Daikin Applied factory.

In the text below, IM 919 clearly states that miswiring will damage the MicroTech Daikin Applied is not responsible for mishandling of our equipment in the field.

"The field needs to be careful not to ground their transformer for a field signal to chassis ground. They need to use the same ground as the controller to prevent a voltage potential above 3V. This voltage potential can damage the Microtech Unit Controller." – IM 919

Also, as indicated in Form No. 933-430285Y-00-A of Daikin Applied Americas Limited Product Warranty, it states that defects as a result of negligence, misuse etc. will not be covered by warranty.

"This warranty shall not apply to products or parts which (a) have been opened, disassembled, repaired, or altered by anyone other than Company or its authorized service representative; or (b) have been subjected to misuse, negligence, accidents, damage, or abnormal use or service; or (c) have been operated, installed, or startup has been provided in a manner contrary to Company's printed instructions, or (d) were manufactured or furnished by others and which are not an integral part of a product manufactured by Company; (e) have been exposed to contaminates, or corrosive agents, chemicals, or minerals, from the water supply source, or (f) have not been fully paid for by Owner." – Daikin Applied Americas Inc. Limited Product Warranty.

Getting Started

This manual contains information designed to assist the field technician with unit setup. The technician will need to be familiar with the following topics at a minimum to successfully set up unit operation.

- Keypad navigation/editing/passwords
- Control Mode
- Occ Mode
- DSP Setpoint
- BSP Setpoint
- Heat/Cool Changeover (Zone Setpoints)
- DAT Clg Setpoint
- DAT Htg Setpoint
- Clg Enable (OAT/EWT lockout)
- Htg Enable (OAT lockout)
- Econo Enable (Changeover temp/Enthalpy switch)
- Ventilation Limit/OA damper

Using the Keypad/Display

The keypad/display consists of a 5-line by 22 character display, three keys and a “push and roll” navigation wheel. There is an Alarm Button, Menu (Home) Button, and a Back Button. The wheel is used to navigate between lines on a screen (page) and to increase and decrease changeable values when editing. Pushing the wheel acts as an Enter Button.

The first line on each page includes the page title and the line number to which the cursor is currently “pointing”. The line numbers are X/Y to indicate line number X of a total of Y lines for that page. The left most position of the title line includes an “up” arrow to indicate there are pages “above” the currently displayed items, a “down” arrow to indicate there are pages “below” the currently displayed items or an “up/down” arrow to indicate there are pages “above and below” the currently displayed page.

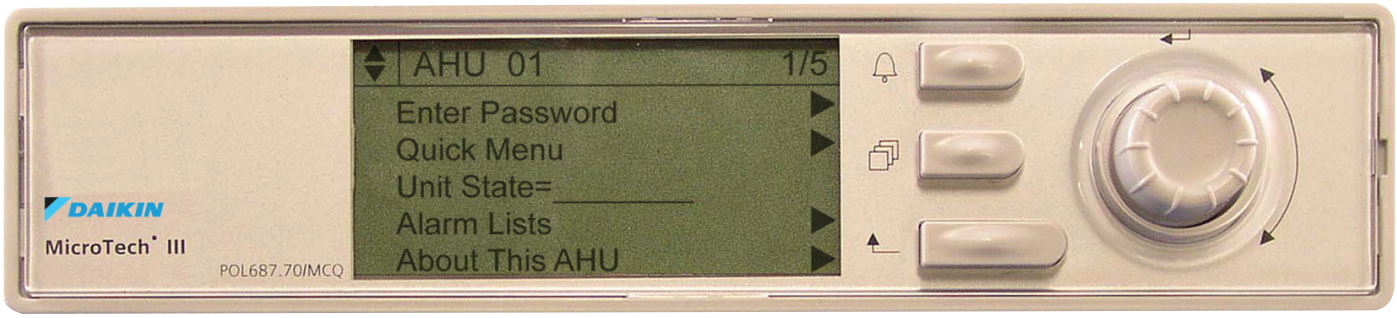
Each line on a page can contain status only information or include changeable data fields. When a line contains status only information and the cursor is on that line all but the value field of that line is highlighted meaning the text is white with a black box around it. When the line contains a changeable value and the cursor is at that line, the entire line is highlighted. Each line on a page may also be defined as a “jump” line, meaning pushing the navigation wheel will cause a “jump” to a new page. An arrow is displayed to the far right of the line to indicate it is a “jump” line and the entire line is highlighted when the cursor is on that line.

The keypad/display Information is organized into Menu groups; Main Menu, Quick Menu, View/Set Unit Menu, Commission Unit Menu, Manual Control Menu, Service Menu, Unit Configuration Menu and Alarm list Menus.

NOTE: Only menus and items that are applicable to the specific unit configuration are displayed.

The Main Menu allows the user to enter a password, access the Quick Menu pages, view the current unit state, access the Alarm List Menu as well as access to information about this unit. The Quick Menu provides access to status information indicating the current operating condition of the unit. The View/Set Unit Menus include basic menus and items required to setup the unit for general operation. These include such things are control mode, occupancy mode and heating and cooling setpoints. The Commission Unit Menus include more advanced items for “tuning” unit operation such as PI loop parameters and time delays. The Manual Control Menu allows service personnel to test unit specific operation manually. The Unit Configuration Menu allows the user to access to the unit specific configuration information. These generally do not needing changing or accessing unless there is a fundamental change to or a problem with the unit operation. The Alarm Lists Menu includes active alarm and alarm log information.

Figure 1: Keypad Controls



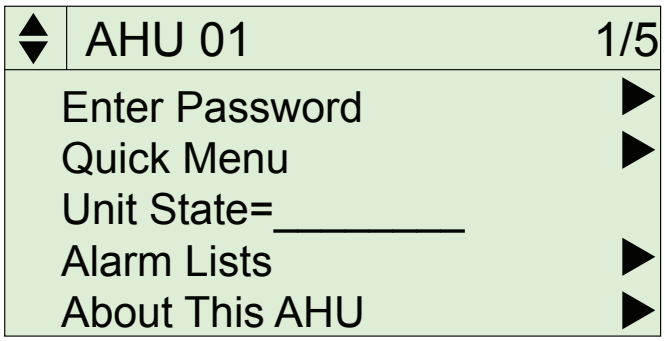
Passwords

Various menu functions are accessible or inaccessible, depending on the access level of the user, and the password they enter, if any. There are four access levels, including no password, Level 2, Level 4, and Level 6, with Level 2 having the highest level of access. Without entering a password, the user has access only to basic status menu items. Entering the Level 6 password (5321) allows access to the Alarm Lists Menu, Quick Menu, and the View/Set Unit Menus group. Entering the Level 4 password (2526) allows similar access as Level 6 with the addition of the Commission Unit Menu, Manual Control, and Service Menu groups. Entering the Level 2 password (6363) allows similar access as Level 4 with the addition of the Unit Configuration Menu.

NOTE: Alarms can be acknowledged without entering a password.

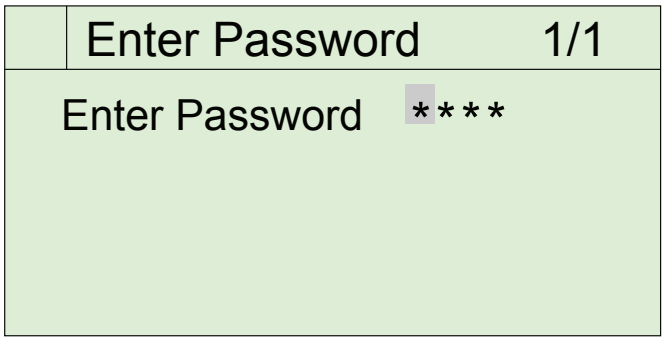
The main password page is displayed when the keypad/display is first accessed, the Home Key is pressed, the Back Key is pressed multiple times, or if the keypad/display has been idle longer than the Password Timeout (default 10 minutes). The main password page provides access to enter a password, access the Quick Menu, view the current Unit State, access the alarm lists or view information about the unit.

Figure 2: Password Main Page



The password field initially has a value **** where each * represents an adjustable field. These values can be changed by entering the Edit Mode described below.

Figure 3: Password Entry Page



Entering an invalid password has the same effect as continuing without entering a password. Once a valid password has been entered, the controller allows further changes and access without requiring the user to enter a password until either the password timer expires or a different password is entered. The default value for this password timer is 10 minutes. It is changeable from 3 to 30 minutes via the Timer Settings menu.

Navigation Mode

In the Navigation Mode, when a line on a page contains no editable fields all but the value field of that line is highlighted meaning the text is white with a black box around it. When the line contains an editable value field the entire line is inverted when the cursor is pointing to that line.

When the navigation wheel is turned clockwise, the cursor moves to the next line (down) on the page. When the wheel is turned counter-clockwise the cursor moves to the previous line (up) on the page. The faster the wheel is turned the faster the cursor moves.

When the Back Button is pressed the display reverts back to the previously displayed page. If the Back button is repeated pressed the display continues to revert one page back along the current navigation path until the “main menu” is reached.

When the Menu (Home) Button is pressed the display reverts to the “main page.”

When the Alarm Button is depressed, the Alarm Lists menu is displayed.

Edit Mode

The Editing Mode is entered by pressing the navigation wheel while the cursor is pointing to a line containing an editable field. Once in the edit mode pressing the wheel again causes the editable field to be highlighted. Turning the wheel clockwise while the editable field is highlighted causes the value to be increased. Turning the wheel counter-clockwise while the editable field is highlighted causes the value to be decreased. The faster the wheel is turned the faster the value is increased or decreased. Pressing the wheel again cause the new value to be saved and the keypad/display to leave the edit mode and return to the navigation mode.

Service Timers

A user may override timers for a period of up to 240 minutes by setting the Service Timer to a non-zero number. When the Service Timer is not zero, the times listed below are set to the Service Time (Default = 20 seconds) instead of the normal values. This allows the unit to be run through its operating states without having to wait for the normal time delays to expire. These times revert to the standard values when the Service Time count down to zero or is set to zero by the user.

The affected times are:

- Cooling Stage Time
- Heating Stage Time
- Start Initial Time
- Recirculation
- ZeroOATime

Rapid Start

The user may elect to initiate a rapid startup sequence at unit power up by setting the Rapid Start flag to Yes. When this flag is set to Yes, the Service Timer is set to 10 minutes whenever the power is reset to the controller.

Manual Control

A user may manually control outputs to check operation of components when Manual Control is set to ManCtrl. When Manual Control is set to ManCtrl, the unit is disabled and the unit is shut down in the normal manner if it is operating. Outputs listed in the Manual Control menu of the Keypad/Display section can then be controlled directly until Manual Control is set to Normal.

NOTE: Manual Control will be set to No automatically after 240 minutes so that a person could not put the unit into Manual Mode control and walk away from the unit and let it run at the manual settings.

When Manual Control is set to Yes, the Control Mode is set to Off so that the unit will not restart automatically.

When Manual Control is set to Normal all digital outputs in the Manual Control menu are set to Off and all the analog outputs are set to 0.0% so that all outputs are in the Off or minimum position when Manual Control is set to ManCtrl.

All alarms except those listed below are overridden during Manual Control.

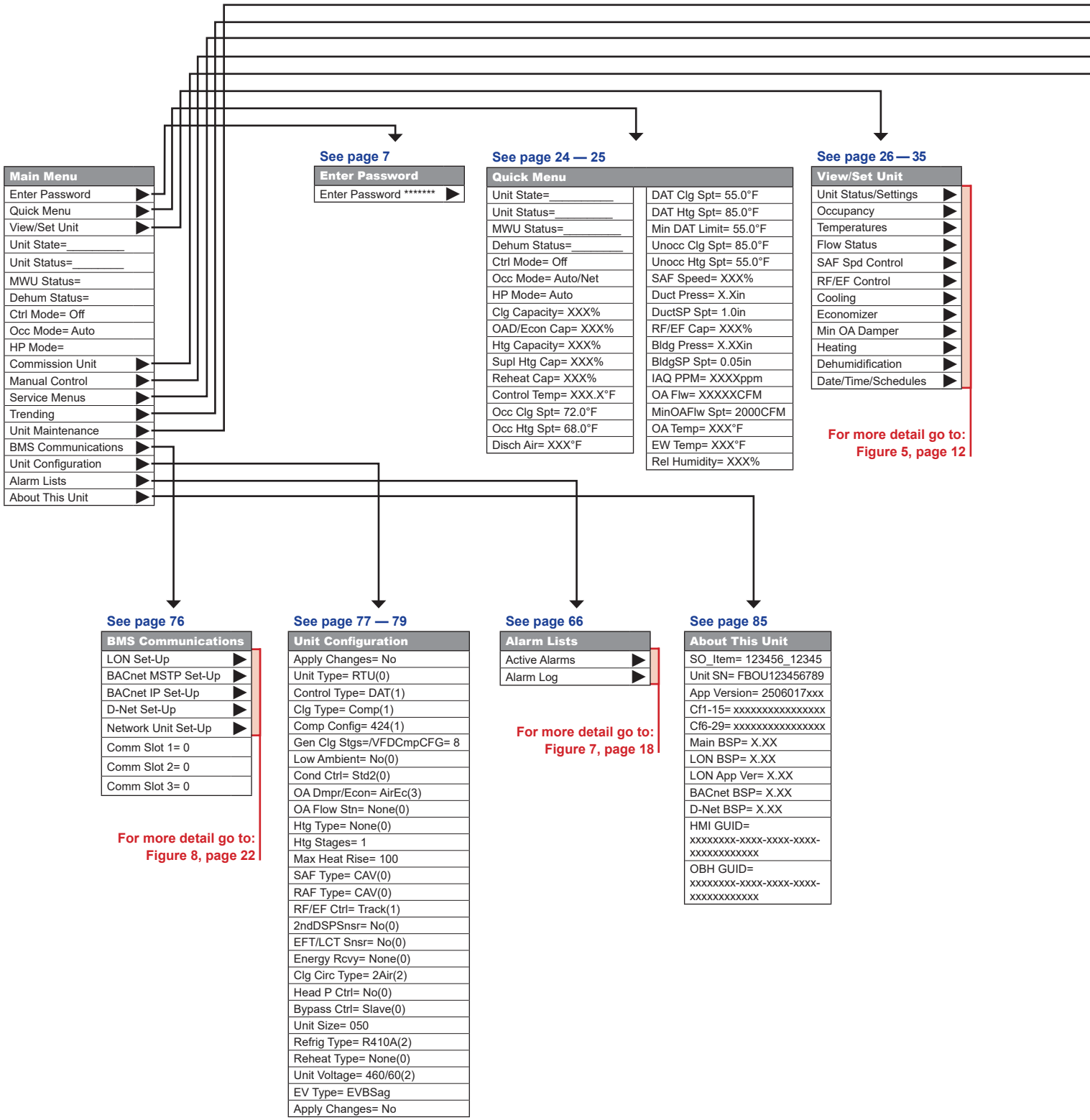
During manual control, the unit will respond in the normal manner to the following alarms.

- Emergency Stop Fault
- Duct High Limit
- High Return Temperature
- High Discharge Temperature
- Low Discharge Temperature
- High Pressure - Circuit # 1
- High Pressure - Circuit # 2
- Low Pressure - Circuit # 1
- Low Pressure - Circuit # 2

Keypad/Display Menu Structure

The following is a description of the MicroTech menu structure. These menus and items can all be displayed with the keypad/display. Menu items displayed will change based on the selected unit configuration.

Figure 4: Main Menu *– Keypad/Display Menu Structure*



See page 36 — 62

Commission Unit
Unit Set-Up ▶
Timer Settings ▶
SAF Set-Up ▶
RF/EF Set-Up ▶
Htg/Clg ChgOvr Set-Up ▶
Cooling Set-Up ▶
INV Cmp Set-Up ▶
Var Cmp Set-Up ▶
Econo Set-Up ▶
Min OA Set-Up ▶
Heating Set-Up ▶
OA Fan Set-Up ▶
Exp Valve Set-Up ▶
Defrost Set-Up ▶
Dehum Set-Up ▶
Energy Rec Set-Up ▶
Head Pressure Set-Up ▶
Evap Cond Set-Up ▶
D3 Set-Up ▶
Alarm Configuration ▶

For more detail go to:
Figure 6, page 14

See page 63 — 65

Manual Control	
Manual Ctrl= Normal	CFan Outpt 2= Off
Supply Fan= Off	CFan Outpt 3= Off
SAF Spd Cmd= 0%	BP/WR Valve= 0%
INV/OF Ena= Off	CW Valve= 0%
INV Cmp= Off	ExhFan Out 1= Off
INV Cmp Cmd= 0%	ExhFan Out 2= Off
Comp 3= Off	ECond VFD= Off
OA Fan= Off	ECFan Spd Cmd= 0%
OA Fan Cmd= 0%	EC Dm Valve= Close
4 Way Valve= Off	Sump Pump= Off
RcvSol Valve=Off	Sep Flsh Vlv= Off
BP Sol Valve= Off	SV1= Off
EVI Cmd= 0%	SV2= Off
EVO Cmd= 0%	Gas Htg On/Off= Off
RF/EF Fan= Off	Htg Valve= 0%
RF/EF Spd Cmd= 0%	SCR Out= 0%
OAD/Econo= 0%	F&BP Damper= 0%
OAD OpCl= Close	Htg Stg 1= Off
Var Cmp= Off	SCR Ena 1= Off
Var Cmp Cmd= 0%	Htg Stg 2= Off
VCmp Emg Stop= Nrml	SCR Ena 2= Off
Comp 1= Off	Htg Stg 3= Off
Comp 2= Off	Htg Stg 4= Off
Comp 3= Off	Htg Stg 5= Off
Comp 4= Off	Htg Stg 6= Off
Comp 5= Off	Reheat Valve= 0%
Comp 6= Off	RH Output= Off
Comp 7= Off	LSCRH Valve= Off
Comp 8= Off	HGBP Valve= Off
U1 Comp 1= Off	ERec Wheel= Off
U1 Comp 2= Off	ER Whl Cmd= 0%
U2 Comp 1= Off	ERBP Dmpr Cl= Off
U2 Comp 2= Off	ERBP Dmpr Op= Off
Cond Sol 1= Off	Cond Wtr Pump= Off
Cond Sol 2= Off	Alm Output= Off
CFan Outpt 1= Off	Fan Op Out= Off

See page 66 — 73

Service Menus
Timer Settings ▶
Operating Hours ▶
Save/Restore Settings ▶
Active Alarms ▶
Alarm Log ▶
Event Log ▶
Data Snapshots ▶
Alarm/Event Configuration ▶
Analog Input Status ▶
Universal I/O Status ▶
Digital Input Status ▶
Digital Output Status ▶
Network Input Status ▶
Modbus Status ▶
IP Set Up ▶
D3 Status ▶
Sensor Offsets ▶
HMI Set Up
Reset Counter= XXXX
LastResetInfo

For more detail go to:
Figure 7, page 18

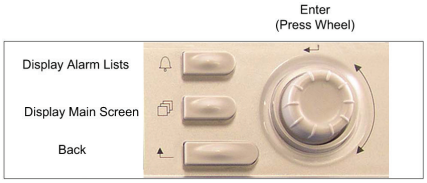
See page 80 — 84

Trending
Trending Ena= No
Apply Chgs= No
Sample Time= 300s
TrendOnOff= Off
AutoExpTime= 1440m
Export Data= No
Clear Trend= Done
Trend Full= Wrap
Default Trend= No
Points 1–5 ▶
Points 6–10 ▶
Points 11–15 ▶
Points 16–20 ▶
Points 21–25 ▶
Points 26–30 ▶

For more detail go to:
Figure 9, page 22

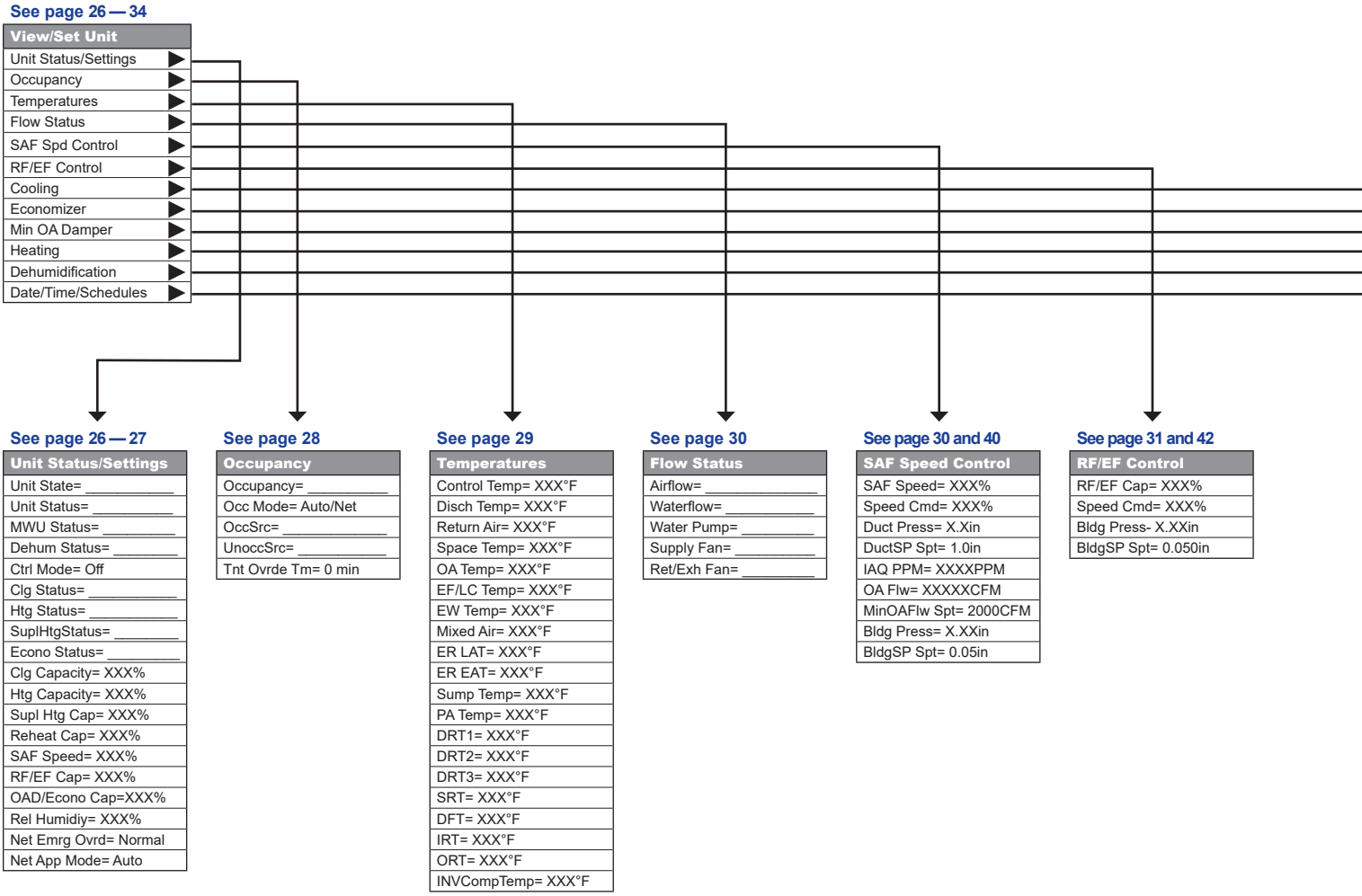
See page 74

Unit Maintenance
Operating Hours



This navigation map represents all possible AHU menus and menu items. Not all menus and items shown here will appear on the HMI display depending upon the specific unit configuration. Those that do not appear are not applicable to this unit.

***Figure 5: View/Set Unit** – Keypad/Display Menu Structure*



See page 31 and 45

Cooling
Occ Clg Spt= 72.0°F
Unocc Clg Spt= 85.0°F
DAT Clg Spt= 55.0°F

See page 31 and 47 — 49

Economizer
OAD/Econo Pos= XXX%
DAT Clg Spt= 55.0°F
Min OA Pos= XXX%
FreeClgStatus = _____
Occ Clg Spt= 72.0°F
Unocc Clg Spt= 85.0°F

See page 32 and 52

Min OA Damper
Min OA Pos= XXX%
Vent Limit= 20%
LoFlo V Lmt= 30%
DCV Limit= 10%
Min OA Src= _____

See page 32 and 50 — 54

Heating
Occ Htg Spt= 68.0°F
Unocc Htg Spt= 55.0°F
MWU Spt= 70.0°F
DAT Htg Spt= 85.0°F

See page 33 and 55 — 56

Dehumidification
Dehum Status= _____
Rel Humidity= XXX%
Dewpoint= XXX°F
Dehum Method= None
RH Setpoint= 50%
Dewpoint Spt= 50°F
Reheat Spt= XXX°F
Reheat Cap= XXX%

See page 34 and 100 — 101

Date/Time/Schedules
Time= hh:mm:ss
Date= MM/DD/YY
UTC Diff= -60min
DAILY SCHEDULE
Mon= HH:MM-HH:MM
Tue= HH:MM-HH:MM
Wed= HH:MM-HH:MM
Thu= HH:MM-HH:MM
Fri= HH:MM-HH:MM
Sat= HH:MM-HH:MM
Sun= HH:MM-HH:MM
Hol= HH:MM-HH:MM
HOLIDAY DATES
Hol 1=MMMDD/YY-MMMDD/YY
Hol 2=MMMDD/YY-MMMDD/YY
Hol 3=MMMDD/YY-MMMDD/YY
Hol 4=MMMDD/YY-MMMDD/YY
Hol 5=MMMDD/YY-MMMDD/YY
Hol 6=MMMDD/YY-MMMDD/YY
Hol 7=MMMDD/YY-MMMDD/YY
Hol 8=MMMDD/YY-MMMDD/YY
Hol 9=MMMDD/YY-MMMDD/YY
Hol 10=MMMDD/YY-MMMDD/YY
ONE EVENT SCHEDULE
Beg= MMMDD/YY@HH:MM
End= MMMDD/YY@HH:MM
OPTIMAL START
Enable= No
Htg Range= 0.4 °F/min
Htg OAT= 35 °F
Des Htg OAT= 0 °F
Clg Rate= 0.4 °F/min
Clg OAT= 85 °F
Des Clg OAT= 95 °F
DAYLIGHT SAVINGS
DLS Strt Mon= Mar
DLS Strt Wk= 2nd Week
DLS End Mon= Nov
DLS End Wk= 1st Week
DLS Enable= Auto
PURGE
Max Purge= 0min

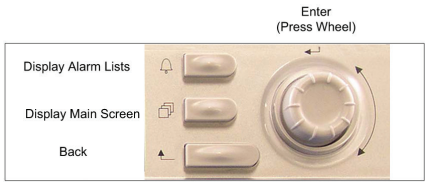


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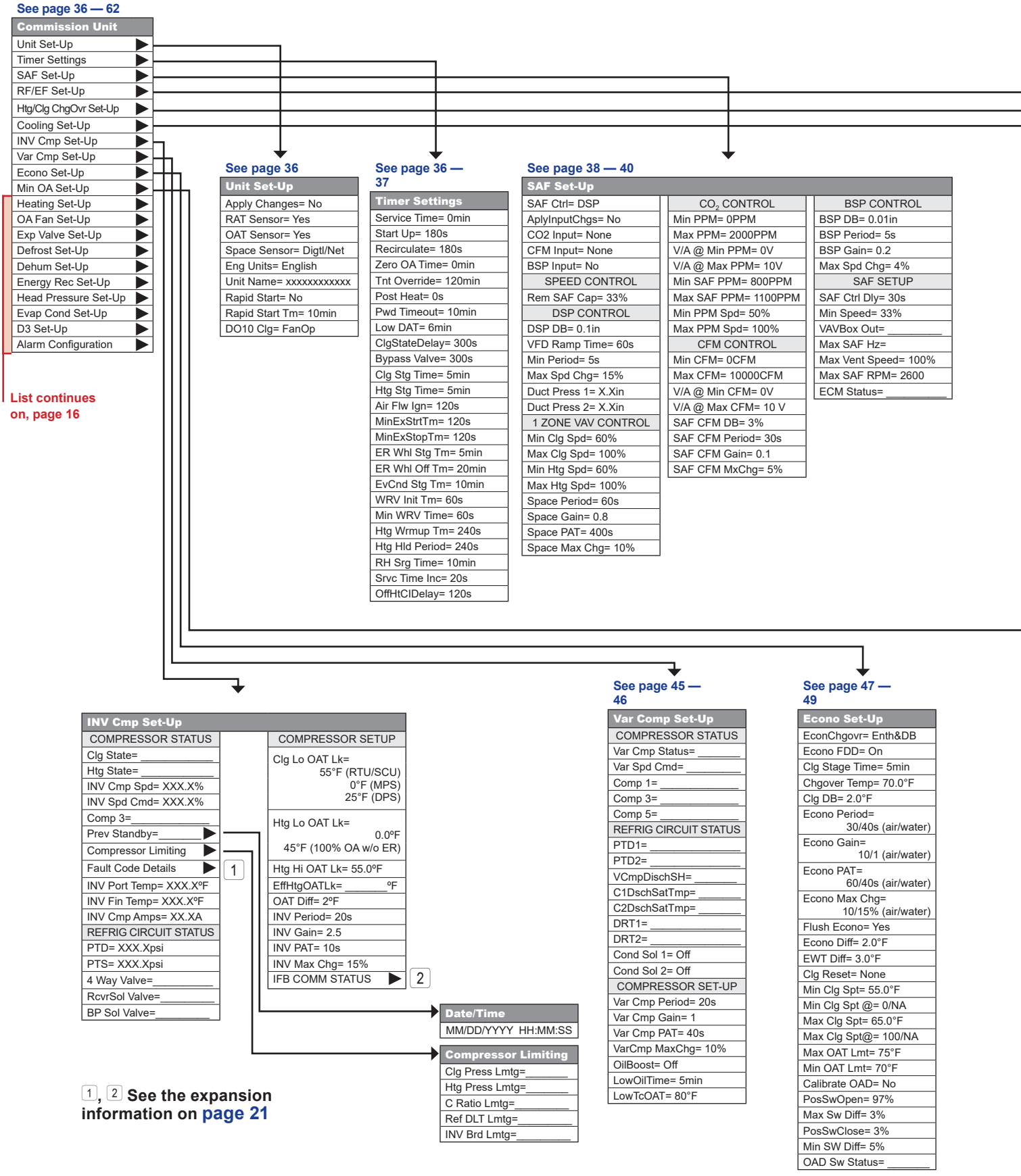
***Figure 6: Commission Unit** – Keypad/Display Menu Structure*



See page 31 and 41 — 42

RF/EF Set-Up	
RF/EF Ctrl= Tracking	MinExStrtTm= 120s
Rem RAF Cap= 5%	MinExStopTm= 120s
Rem ExhF Cap= 5%	MinExOAPos= 5%
BSP DB= 0.01in	MinExSAFCap= 10%
BSP Period= 5s	ExhOnOAPos= 40%
BSP Gain= 0.2s	ExhMxOAPos= 100%
Max Spd Chg= 4%	Exh Stg 1 On= 40%
Sup Fan Max= 100%	Exh Stg 1 Off= 30%
RF @ SF Max= 95%	Exh Stg 2 On= 55%
Sup Fan Min= 30%	Exh Stg 2 Off= 40%
RF @ SF Min= 25%	Exh Stg 3 On= 70%
Lo Fan Diff= 75%	Exh Stg 3 Off= 50%
Hi Fan Diff- 75%	Max RF/EF Hz= 60Hz
RFEF Ctrl Dly= 30s	Max Vent Spd= 100%
Min Speed= 5% (with Exhaust Fan) 33% (with Return Fan)	Max RFEF RPM= 2600
	ECM Status= _____

See page 43

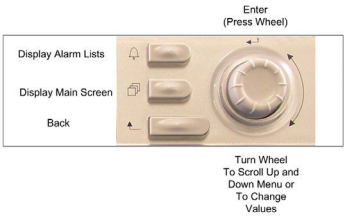
Htg/Clg ChgOvr Set-Up
Ctlr Temp Src= RAT
AplyTstatchg= No
Use Tstat Spt= No
Occ Clg DB= 2.0°F
Clg Period= 60s
Clg Gain= 0.1
Clg PAT= 600s
Max Clg Chg= 5.0°F
Occ Htg DB= 2.0°F
Htg Period= 60s
Htg Gain= 0.1
Htg PAT= 600s
Max Htg Chg= 5.0°F
CalDRemSpt@10°C= No
CalDRemSpt@50°F= No
CalDRemSpt@30°C= No
CalDRemSpt@86°F= No
DemandShed= Ena
ClgDmdShdInc= 4°F
HtgDmdShdInc= 4°F
ClgShedRate= 2.0°F/hr
HtgShedRate= 2.0°F/hr

See page 44

Cooling Set-Up
Clg Stage Time= 5min
RHTBleedDwn=
Clg DB= 2.0°F
Clg Period= 20s
Clg Gain= 1
Clg PAT= 40s
CW Max Chg= 15%
Clg Lo OAT Lk= 55ºF (RTU/SCU) 0°F (MPS) 25°F (DPS or RTU w/ VFD Cmps)
Clg OAT Diff= 2.0°F
Min EWT= 55°F
Clg Reset= None
Min Clg Spt= 55.0°F
Min Clg Spt @= 0/NA
Max Clg Spt= 65.0°F
Max Clg Spt@= 100/NA
Lead Circuit= #1
Staging Type= Std
CFanOut1 Spt= 55°F
CFanOut2 Spt= 65°F
CFanOut3 Spt= 75°F
Cond Fan Diff= 5°F
Unocc Diff= 3°F
DT Above Spt= _____
DT Below Spt= _____

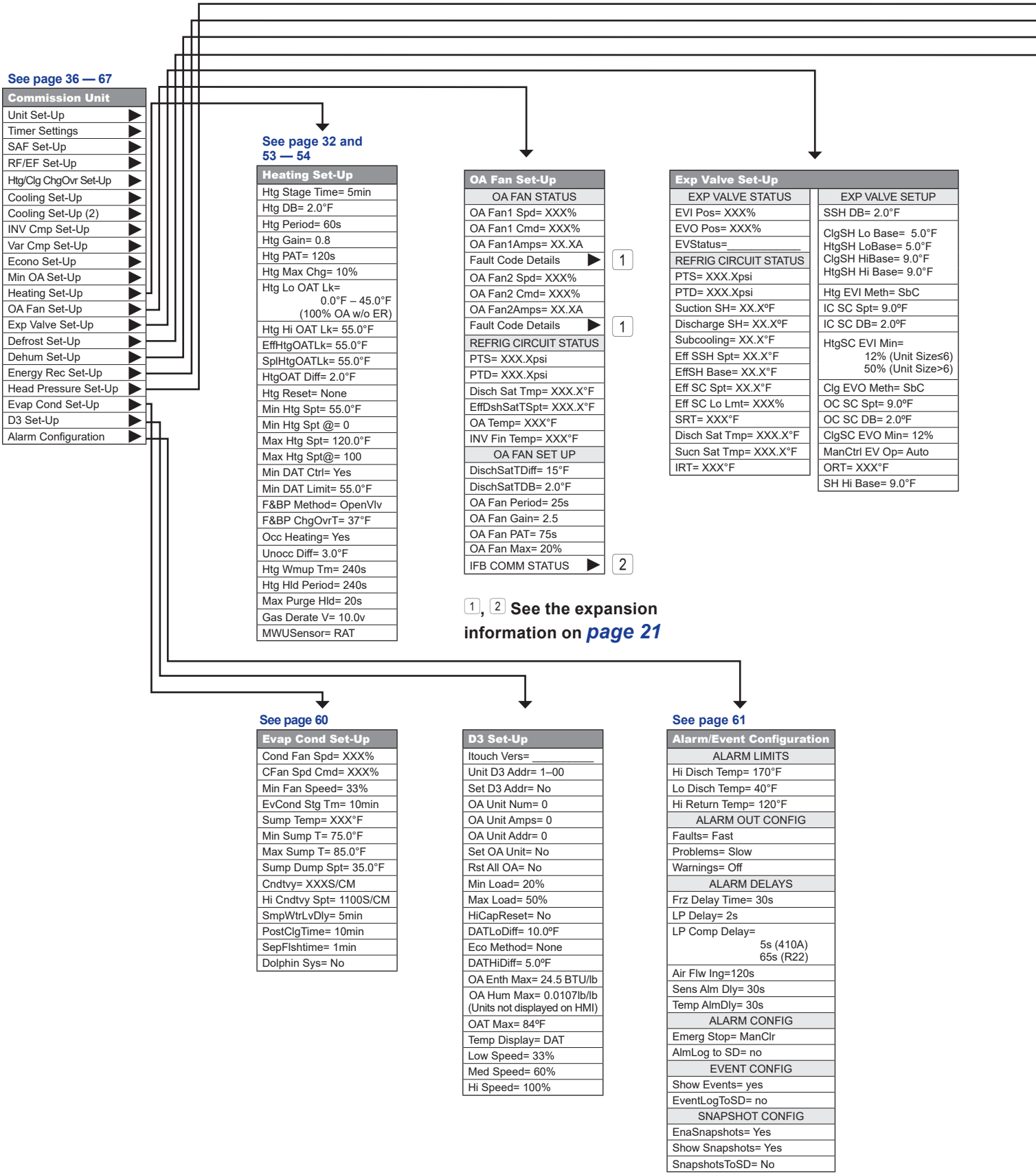
See page 32 and 50 — 52

Min OA Set-Up		
AplyMinOAChg= No (Uses MinOAT Type Instance Name)	CFM RESET	FAN SPEED RESET
Min OA Reset= None	OA Flow= XXXXXCFM	Min Fan Diff= 20%
BSPOAOvrd= No	MinOAFlwSpt= 2000CFM	Max Fan Diff= 50%
RstLmtSnsr= None	Field Stn Rst= No	Min Clg Spd= 40%
EXTERNAL RESET	Field Stn Cfg= VDC	Des Clg Spd= 100%
OA @ MinV/mA= 0%	Min CFM= 0 CFM	BSP RESET
OA @ MaxV/mA= 100%	Max CFM= 10000 CFM	MinRFEFTm= 120s
Min V/mA= 0.0/V	V/A @Min CFM= 0.0/V	BSP OvdST= 5s
Max V/mA= 10.0/V	V/A @Max CFM= 10.0/V	BSP OvdGain= 0.2
CO_2 RESET	OA CFM DB= 3%	BSP OvdMaxChg= 4%
IAQ Reset= Yes	OA CFM Period= 30s	DAMPER LIMITING
PPM@DCVLmt= 800PPM	OA CFM Gain= 0.1	RstTLmt= 32.0ºF
PPM@VntLmt= 1000PPM	OA CFM Max Chg= 5%	RstTSmplTm= 5s
IAQ PPM= XXXXPPM	Design Flow= Yes	RstTGain= 0.2
Min PPM= 0 PPM	Des Flo DB= 3%	RstPAT= 60s
Max PPM= 2000 PPM	DF Period= 30s	RstTMaxChg= 4%
V/A @Min PPM= 0.0/V	Des Flo Gain= 0.1	0–30% OA Max= 30%
V/A @Max PPM= 10.0/V	DF Max Chg= 5%	Min Inc Rate= 0.03
	RH Lvl Pos= _____	Max Inc Rate= 2.0
	LH Lvl Pos= _____	



This navigation map represents all possible AHU menus and menu items. Not all menus and items shown here will appear on the HMI display depending upon the specific unit configuration. Those that do not appear are not applicable to this unit.

Figure 6 continued: ***Commission Unit*** *– Keypad/Display Menu Structure*



Defrost Set-Up
Defrost State= _____
Manual DF= No
MinCmpOpTm= 10min
MinAccCmpTm= 40min
MaxFrostTm= 120min
Defrost Temp= XX°F
Tdef Adj= 0.0°F
CmpOpTm= XXXmin
AccCmpOpTm= XXXmin
LoFrstAccTm= XXXmin
HiFrstAccTm= XXXmin

See page 33 and 55 — 56

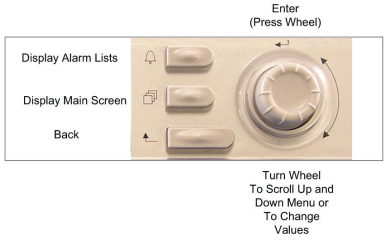
Dehum Set-Up
Dehum Method= None
RH DB= 6%
Dewpoint DB= 2°F
RH Period= 30s
RH Gain= 1
LSC Lo Gain= 0.2
RH PAT= 30s
RH Max Chg= 10%
RH Stg Time= 10min
Stg Rht DB= 5.0°F
Unoccupied Dehum= No
Sensor Loc= Return
Mn LCT= 45.0°F (RTU &MPS) 52.0°F (DPS)
Mx Lvg Coil T= 52.0°F
Rht Cmp Lmtg= Yes
Min Rheat Spt= 55.0°F
Max Rheat Spt= 65.0°F
RH Sens Type= VDC
RH Min Sig= 0.0V
RH Max Sig= 10.0V
Min Dehum Spd= 33%
Max Dehum Spd= 100%
Rht Min Pos= 10% (RPS) 15% (MPS) 5% (DPS/DPH)
RH Dec Rate= 1
RHOutMaxV= 8.5V (MPS & DPS) 10.0V RTU
BackupRHEna= No

See page 57 — 58

Energy Rec Set-Up
Energy Rcvy= Yes
ER Wheel= _____
Wheel Speed= XXX%
Whl Spd Cmd= XXX%
ER LAT= XXX°F
ER EAT= XXX°F
Min ExhT Diff= 2.0°F
Max ExhT Diff= 6.0°F
ER Whl Stg Tm= 5min
ER Whl Off Tm= 20min
Rel Humidity= XXX%
Min Whl Spd= 5%
Intersect Pt= XXX.X°F
Fst Mgnt Meth= Timed
OA Frst Temp= -5°F
Defrost Time= 5min
Defrost Period= 60min
Defrst On Tm= 1s
Defrst Off Tm= 24s
ER Whl Period= 30s
ER Whl Gain= 1.0
ER Whl PAT= 30s
ER Max Chg= 10%
LoERLATCmpLk= 45.0°F
Cap Limiting= Yes

See page 59

Head Pressure Set-Up
Wtr Reg Vlv= XXX%
Head P Circ 1= XXXPSI
Head P Circ 2= XXXPSI
Setpoint= 260PSI
Head Press DB= 10PSI
WRV Period= 10s
WRV Gain= 3.6
WRV PAT= 10s
WRV Max Chg=7%
WRV Init Tm= 60s
Min WRV Pos=10%
Min WRV Tmp= 58°F
Max WRV Tmp= 150°F
WRV Act Time= 60s
Min WRV Time= 60s



This navigation map represents all possible AHU menus and menu items. Not all menus and items shown here will appear on the HMI display depending upon the specific unit configuration. Those that do not appear are not applicable to this unit.

Figure 7: Service Menu *– Keypad/Display Menu Structure*

See page 66 — 73

Service Menus
Timer Settings ▶
Operating Hours ▶
Save/Restore Settings ▶
Active Alarms ▶
Alarm Log ▶
Event Log ▶
Data Snapshots ▶
Alarm/Event Configuration ▶
Analog Input Status ▶
Universal I/O Status ▶
Digital Input Status ▶
Digital Output Status ▶
Network Input Status ▶
Modbus Status ▶
IP Set Up ▶
D3 Status ▶
Sensor Offsets ▶
HMI Set Up
Reset Counter= XXXX
LastResetInfo

List continues on, page 20

See page 34 — 37

Timer Settings
Service Time= 0min
Start Up= 180s
Recirculate= 180s
Zero OA Time= 0min
Tnt Override= 120min
Post Heat= 0s
Pwd Timeout= 10min
Low DAT= 6min
ClgStateDelay= 300s
Clg Stg Time= 5min
Htg Stg Time= 5min
Air Flw Ign= 120s
MinExStrtTm= 120s
MinExStopTm= 120s
ER Whl Stg Tm= 5min
ER Whl Off Tm= 20min
Srvc Time Inc= 20s
OffHtClDelay= 120s

See page 74

Operating Hours
Supply Fan= XXXXXh
Ret/Exh Fan= XXXXXh
Exh Out1= XXXXXh
Exh Out2= XXXXXh
Mech Cool= _____
Var Comp= _____
Comp # 1= XXXXXh
Comp # 2= XXXXXh
Comp # 3= XXXXXh
Comp # 4= XXXXXh
Comp # 5= XXXXXh
Comp # 6= XXXXXh
Comp # 7= XXXXXh
Comp # 8= XXXXXh
Cmp Cooling= _____
INV Comp= _____
Comp 3= _____
Heating= XXXXXh
Cmp Heating= XXXXXh
Economizer= XXXXXh
Tnt Override= XXXXXh
Dehumid= XXXXXh
Reheat= _____
ER Wheel= XXXXXh

See page 66

Save/Restore Settings
Save Params= No
Rstr Params= No
Rstr Factory= No
SaveToCard= No
LoadFromCard= No
CreateTrace= No
Trace To SD= No

See page 66

Active Alarms
Alm Count: xx Clr Alms= No
+Alarm 1: Alarm Type ▶
+Alarm 2: Alarm Type ▶
•
•
•
+Alarm 10: Alarm Type ▶

3

This navigation map represents all possible AHU menus and menu items. Not all menus and items shown here will appear on the HMI display depending upon the specific unit configuration. Those that do not appear are not applicable to this unit.

See page 67

Alarm Log
Log Count: xx Clr Log= No ▶
+/-Alarm 1: Alarm Type ▶
+/-Alarm 2: Alarm Type ▶
•
•
•
+/-Alarm 10: Alarm Type ▶
•
•
•
+/-Alarm 50: Alarm Type ▶

4

See page 61

Alarm/Event Configuration
ALARM LIMITS
Hi Disch Temp= 170°F
Lo Disch Temp= 40°F
Hi Return Temp= 120°F
ALARM OUT CONFIG
Faults= Fast
Problems= Slow
Warnings= Off
ALARM DELAYS
Frz Delay Time= 30s
LP Delay= 2s
LP Comp Delay= 5s (410A) 65s (R22)
Air Flw Ing=120s
Sens Alm Dly= 30s
Temp AlmDly= 30s
ALARM CONFIG
Emerg Stop= ManClr
AlmLog to SD= No
EVENT CONFIG
Show Events= Yes
EventLog to SD= No
SNAPSHOT CONFIG
EnaShapshots= Yes
SHow Snapshots= Yes
Snapshots to SD= No

3, 4 See connection on *page 21*

See page 68

Analog Input Status
MCB AI1= XXXXXXXX
MCB AI2= XXXXXXXX
MCB AI3= XXXXXXXX

See page 69

Universal I/O Status	
MCB X1= XXXXXXXX	EMC X1= XXXXXXXX
MCB X2= XXXXXXXX	EMC X2= XXXXXXXX
MCB X3= XXXXXXXX	EMC X3= XXXXXXXX
MCB X4= XXXXXXXX	EMC X4= XXXXXXXX
MCB X5= XXXXXXXX	EMC X5= XXXXXXXX
MCB X6= XXXXXXXX	EMC X6= XXXXXXXX
MCB X7= XXXXXXXX	EMC X7= XXXXXXXX
MCB X8= XXXXXXXX	EMC X8= XXXXXXXX
EMA X1= XXXXXXXX	EMD X1= XXXXXXXX
EMA X2= XXXXXXXX	EMD X2= XXXXXXXX
EMA X3= XXXXXXXX	EMD X3= XXXXXXXX
EMA X4= XXXXXXXX	EMD X4= XXXXXXXX
EMA X5= XXXXXXXX	EMD X5= XXXXXXXX
EMA X6= XXXXXXXX	EMD X6= XXXXXXXX
EMA X7= XXXXXXXX	EMD X7= XXXXXXXX
EMA X8= XXXXXXXX	EMD X8= XXXXXXXX
EMB X1= XXXXXXXX	EME X1= XXXXXXXX
EMB X2= XXXXXXXX	EME X2= XXXXXXXX
EMB X3= XXXXXXXX	EME X3= XXXXXXXX
EMB X4= XXXXXXXX	EME X4= XXXXXXXX
EMB X5= XXXXXXXX	EME X5= XXXXXXXX
EMB X6= XXXXXXXX	EME X6= XXXXXXXX
EMB X7= XXXXXXXX	EME X7= XXXXXXXX
EMB X8= XXXXXXXX	EME X8= XXXXXXXX

See page 70

Digital Input Status
MCB DI1= _____
MCB DI2= _____
MCB DI3= _____
MCB DI4= _____
MCB DI5= _____
MCB DI6= _____
EMD DLA1= _____

See page 70

Digital Output Status	
MCB DO1= _____	EMC DO1= _____
MCB DO2= _____	EMC DO2= _____
MCB DO3= _____	EMC DO3= _____
MCB DO4= _____	EMC DO4= _____
MCB DO5= _____	EMC DO5= _____
MCB DO6= _____	EMC DO6= _____
MCB DO7= _____	EMD DO1= _____
MCB DO8= _____	EMD DO2= _____
MCB DO9= _____	EMD DO3= _____
MCB DO10= _____	EMD DO4= _____
EMA DO1= _____	EMD DO5= _____
EMA DO2= _____	EMD DO6= _____
EMA DO3= _____	EME DO1= _____
EMA DO4= _____	EME DO2= _____
EMA DO5= _____	EME DO3= _____
EMA DO6= _____	EME DO4= _____
EMB DO1= _____	EME DO5= _____
EMB DO2= _____	EME DO6= _____
EMB DO3= _____	
EMB DO4= _____	
EMB DO5= _____	
EMB DO6= _____	

Figure 7 continued: Service Menu – *Keypad/Display Menu Structure*

See page 66 — 73

Service Menus
Timer Settings ▶
Operating Hours ▶
Save/Restore Settings ▶
Active Alarms ▶
Alarm Log ▶
Event Log ▶
Data Snapshots ▶
Alarm/Event Configu-ration ▶
Analog Input Status ▶
Universal I/O Status ▶
Digital Input Status ▶
Digital Output Status ▶
Network Input Status ▶
Modbus Status ▶
IP Set Up ▶
D3 Status ▶
Sensor Offsets ▶
HMI Set Up ▶
Reset Counter= XXXX
LastResetInfo

See page 71

Network Input Status
Net OAT In= XXX.X°F
Net Space In= XXX.X°F
NetCurrState= _____
NetNextState= _____
NetTmToNxtSt= XXXXXmin
Net App Mode= _____
Net Cl Ena Sw= X.X
Net Cl Ena Vl= XXX%
Net Ht Ena Sw= X.X
Net Ht Ena Vl= XXX%
Net Ec Ena Sw= X.X
Net Ec Ena Vl= XXX%
Net SAF Cap= XXX%
Net RAF Cap= XXX%
Net ExhF Cap= XXX%
Net CFlw Sw= XXX%
Net Flw Val= XXX%
Net Space IAQ= XXXXPPM
Net Rel Humid= XXX%
Net DATClgSpt= XXX.X°F
Net DATHtgSpt= XXX.X°F
nviSetpoint= XXX.X°F
OccManCmd= _____
Net Min OA= XXX%
nvoEffSpt= XXX.X°F
nciOccClgSpt= XXX.X°F
nciOccHtgSpt= XXX.X°F
nciHVACType= _____

See page 72

Modbus Status
SF MB Status=_____
RF/EF MB Status=_____
ER MB Status=_____
OF MB Status= _____
IFB MB Status= _____
D3 MB Status=_____
SAFVFD Ex Flt= _____
RxFVFD Ex Flt= _____
ER VFD Ex Flt= _____
OF VFD Ex Flt= _____
MB Resistance= Yes
ECM Config= Done

See page 73

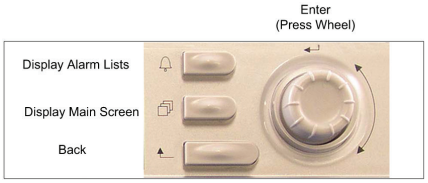
D3 Status
D3 Comm Sts= _____
D3 Addr Err= _____
D3 On/Off= _____
D3 Mode= _____
D3 Clg Spt= XXX.X°F
D3 Htg Spt= XXX.X°F
D3 Fan Spd= _____
D3 Min Load= XXX%
D3 Max Load= XXX%
D3 Eco Ena= _____
OA Enthalpy= XXXBTU/lb
OA Hum Ratio= g/kg
D3 SWVers= XXXXXXXXXX
OAAdd1–16= _____
OAAdd17–32= _____
OAAdd33–49= _____
OAAdd50–64= _____
SetOAAddr= XX
CurrOAAddr= XX
CurrOAAmps= XXXA
CurrOARLA= XXXA

See page 73

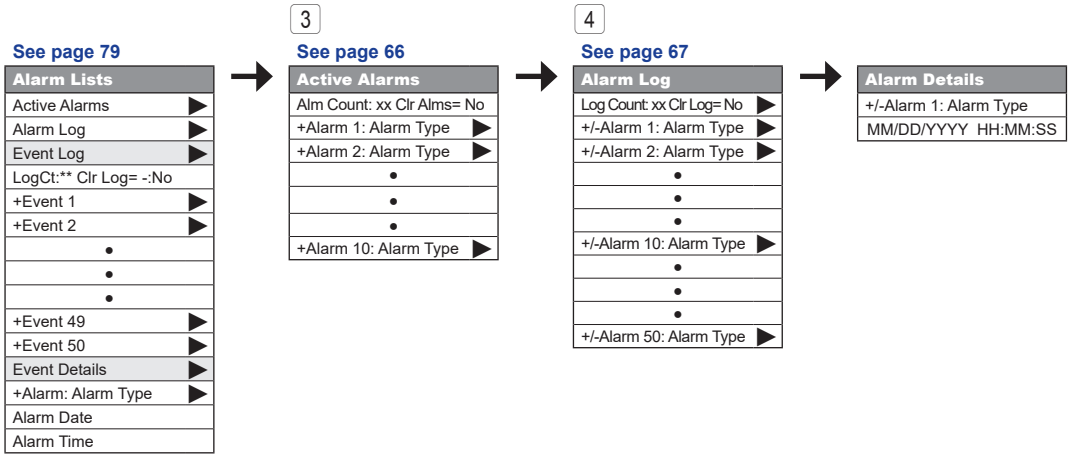
Sensor Offsets
Disch Air= 0.0°F
Return Air= 0.0°F
Space Temp= 0.0°F
OA Temp= 0.0°F
EF/LC Temp= 0.0°F
EW Temp= 0.0°F
Mixed Air= 0.0°F
MAT LON SCC= 0.0°F
ER LAT= 0.0°F
ER EAT= 0.0°F
Sump Temp= 0.0°F
DRT1= 0.0°F
DRT3= 0.0°F
SRT= 0.0°F
DFT= 0.0°F
IRT= 0.0°F
ORT= 0.0°F

See page 71

HMI Set-Up
Contrast = 0
BackLight = White
PBusPwrSply = on



This navigation map represents all possible AHU menus and menu items. Not all menus and items shown here will appear on the HMI display depending upon the specific unit configuration. Those that do not appear are not applicable to this unit.



Expansion Information

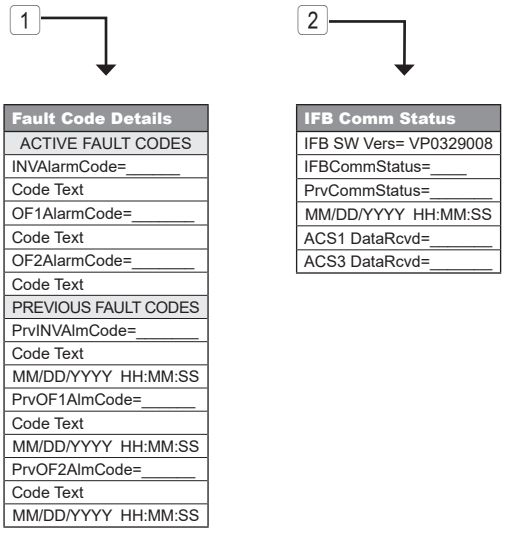


Figure 8: BMS Communications *– Keypad/Display Menu Structure*

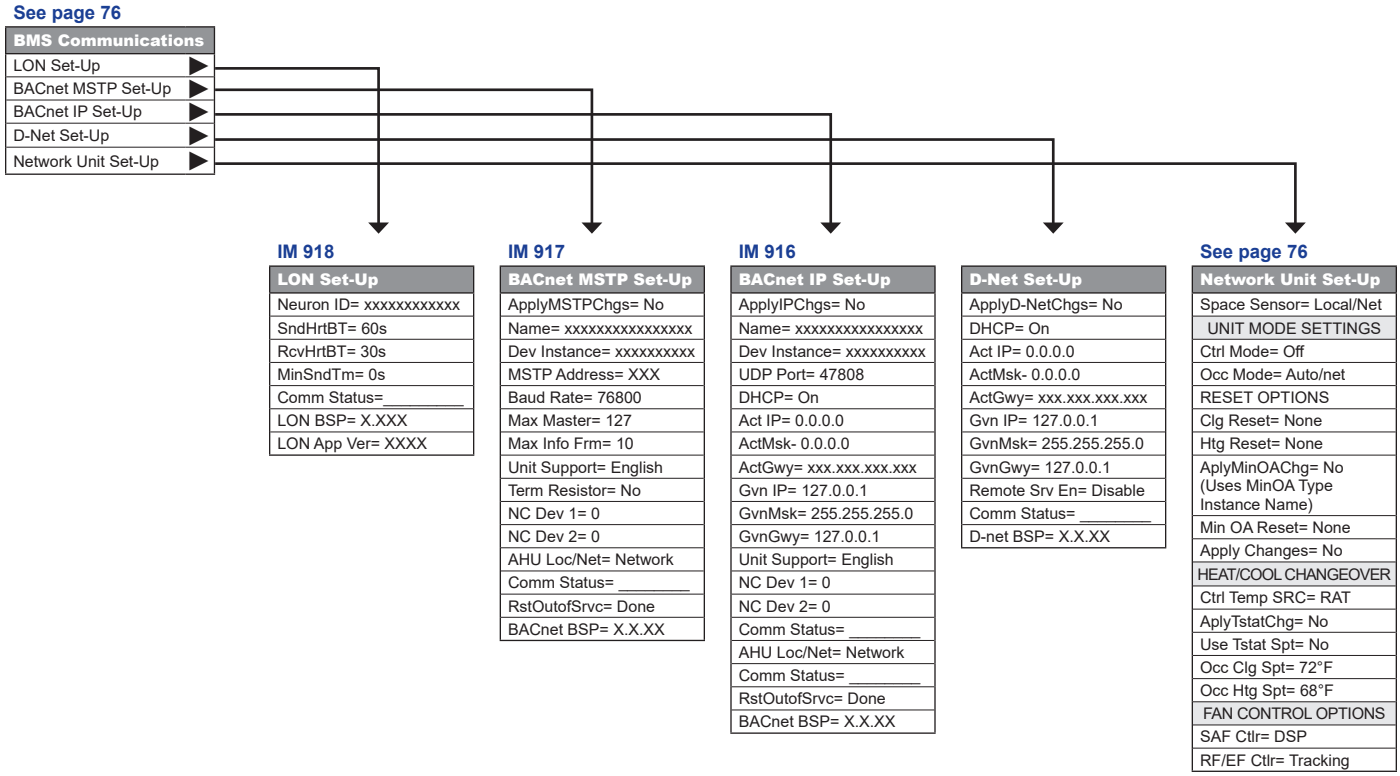
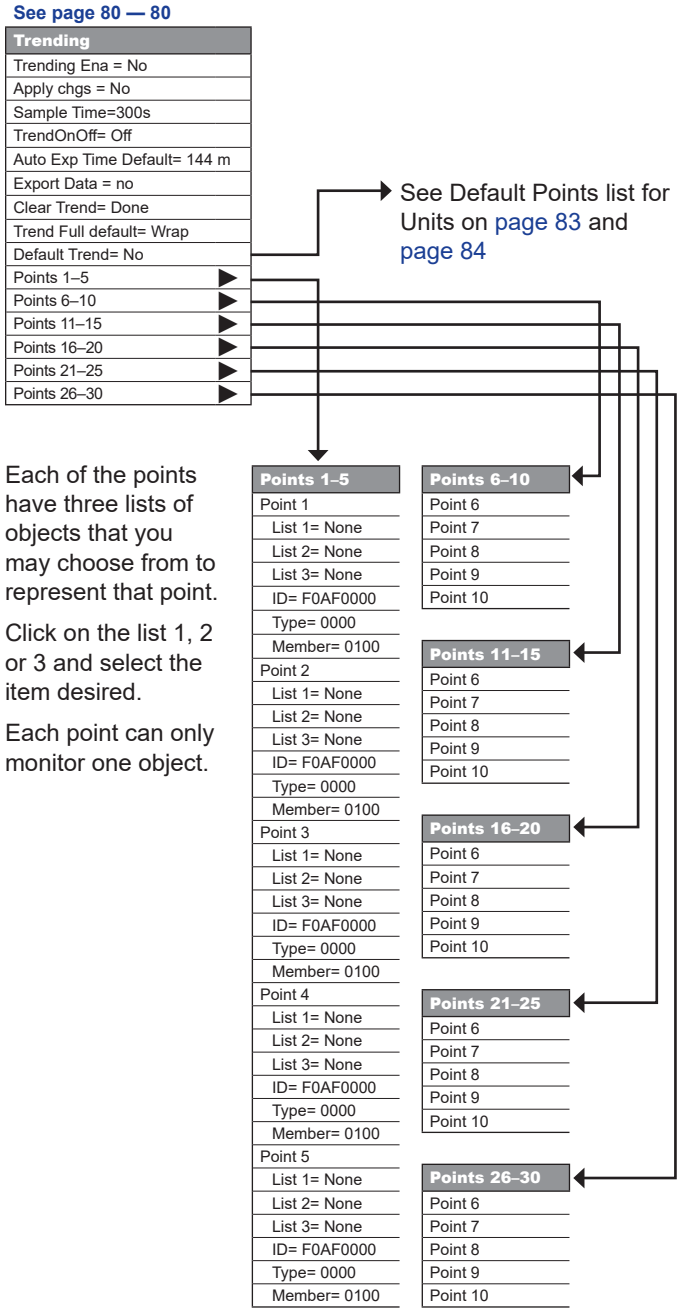


Figure 9:

Figure 10: Trending *– Keypad/Display Menu Structure*



Each of the points have three lists of objects that you may choose from to represent that point.

Click on the list 1, 2 or 3 and select the item desired.

Each point can only monitor one object.

After selecting the object to represent that point you must also enter the ID number. When the ID is selected the first four letters will highlight turn the radial knob to select the matching ID number from the list below, hit enter, the rest of the entries for the ID number are done individually until the object ID matches the one associated with the object in the list to the right matches. It is the same proceedure for the object type. The member number will always be 0100 when trending the present value.

Points list 1		
Enum Text	Object ID	Type
ACS1	0xF0AFC5F0	0x230B
ACS3	0xF0AF08FE	0x230B
ActEvnt	0xF0AFA993	0x230A
AFSts	0xF0AFB26D	0x2204
Alm	0xF0AFCF76	0x230A
BSP	0xF0AFC4BB	0x2203
Clg%	0xF0AFF4B5	0x230A
ClgSt	0xF0AF3991	0x230B
ClgSts	0xF0AFF6A6	0x230B
CO2	0xF0AF7F77	0x2203
CtlCrdT	0xF0AFE952	0x2203
CtrlT	0xF0AF3701	0x2203
DAClgSp	0xF0AF64FD	0x2300
DAHtgSp	0xF0AF6054	0x2300
DAT	0xF0AF538E	0x2203
DeHmSts	0xF0AF56EA	0x230B
Dewpt	0xF0AF532C	0x230A
DewptSp	0xF0AF75C1	0x2300
DFSt	0xF0AFBD68	0x230B
DFT	0xF0AFCA19	0x2203
DRT1	0xF0AFD8D7	0x2203
DRT3	0xF0AFF895	0x2203
DSH	0xF0AF33F2	0x230A
DSP	0xF0AF143C	0x230A
EcoSts	0xF0AFC1AB	0x230B
EFMBSts	0xF0AFAB24	0x230B
EfMnlNV	0xF0AF3D0A	0x230A
EfMxlNV	0xF0AFB58E	0x230A
EFT/LCT	0xF0AF356B	0x2203
EREAT	0xF0AF0DBB	0x2203
ERLAT	0xF0AFFD44	0x2203
ERWhl%	0xF0AF101D	0x2203
EVI%	0xF0AF3028	0x2203
EVICmd	0xF0AF2EAF	0x2206
EVO%	0xF0AF17B1	0x2203
EVOCmd	0xF0AF0936	0x2206

Points list 2		
Enum Text	Object ID	Type
HDRT1	0xF0AF4A6D	0x230A
HDRT3	0xF0AF6A2F	0x230A
Htg%	0xF0AFF01C	0x230A
HtgSt	0xF0AF4BE8	0x230B
HtgSts	0xF0AFD173	0x230B
HtSnkT	0xF0AFF487	0x2203
IFBCom	0xF0AF6D75	0x230B
INV%	0xF0AFDA3E	0x2203
INVAmps	0xF0AFA7E2	0x2203
INVCmd	0xF0AFEC72	0x2206
INVFC	0xF0AF3BDA	0x230A
INVFT	0xF0AF88A8	0x2203
INVTmp	0xF0AFE60D	0x2203
IRT	0xF0AFE8B8	0x2203
MinOA%	0xF0AFEEC9	0x230A
OAD%	0xF0AF6259	0x230A
OAFCmd	0xF0AF9E45	0x2206
OAFlw	0xF0AFF10A	0x230A
OAFlwSp	0xF0AF6B95	0x2300
OAT	0xF0AFA37F	0x2203
OcClgSp	0xF0AFF8A8	0x2300
OcHtgSp	0xF0AF8A33	0x2300
OcSrc	0xF0AFF838	0x230B
OF1FC	0xF0AFC9EB	0x230A
OF2FC	0xF0AFE4AF	0x230A
OF1Spd	0xF0AFB55B	0x2203
OF2Spd	0xF0AF2E87	0x2203
OilMng	0xF0AF2D66	0x2302
OilSts	0xF0AF1150	0x2204
ORT	0xF0AF6559	0x2203
PTD	0xF0AF229A	0x2203
PTS	0xF0AF404C	0x2203

Points list 3		
Enum Text	Object ID	Type
RAT	0xF0AFA24D	0x2203
ReHt%	0xF0AF00F8	0x230A
RemEF%	0xF0AF1969	0x2300
RemRF%	0xF0AF57A7	0x2300
RemSF%	0xF0AF211F	0x2300
RFEF%	0xF0AFAECF	0x2203
RH	0xF0AF1DDC	0x2203
RHSp	0xF0AFFA18	0x2300
RhtSp	0xF0AF335D	0x230A
SAF%	0xF0AF5BDF	0x2203
SbClg	0xF0AF842E	0x230A
SBEvnt	0xF0AFCB3E	0x230B
SFMBSts	0xF0AF2BDE	0x230B
SpaceT	0xF0AFF74A	0x2203
SpHtSts	0xF0AF7D21	0x230B
SRT	0xF0AFC35D	0x2203
SSH	0xF0AFB846	0x230A
SSHSpt	0xF0AF3144	0x230A
STD3	0xF0AF03CC	0x2207
SupHt%	0xF0AF1FEA	0x230A
Tc	0xF0AF19E9	0x230A
TcSpt	0xF0AF7FC1	0x230A
TDef	0xF0AF45E1	0x230A
Teg	0xF0AFDCFF	0x230A
Tp	0xF0AF3BBB	0x230A
UnOcSrc	0xF0AFF6B4	0x230B
UnitSt	0xF0AF9E60	0x230B
UntSts	0xF0AF4FF0	0x230B
VFDSts	0xF0AF64EC	0x230B

Menu Descriptions

Quick Menu

Items in the Quick Menu contain basic unit operating status and control set point parameters. The items shown in the Quick Menu are Read Only if a valid password has not been entered. The following are brief descriptions of the Quick Menu items. No password is required to view the Quick Menu.

Table 2: Quick Menu

Menu Display Name	Default Setting	Range	Password Level
Unit State=	—	Off Start Recirc FanOnly MinDAT Htg Econo Clg	None
Unit Status=	—	Enable OffMan OffMnCtl OffNet OffAlm OffFnRty	6
MWU Status=	—	Inactive Active	6
Dehum Status=	—	Active/Inactive	6
Ctrl Mode=	Off	Off HeatOnly CoolOnly FanOnly HeatCool Auto/Net	6
Occ Mode=	Auto/Net	Occ Unocc TntOvrd Auto/Net	6
Clg Capacity=	—	0–100%	None
OAD/Econo Cap=	—	0–100%	None
Htg Capacity=	—	0–100%	None
Reheat Capacity=	—	0–100%	None
Control Temp=	—	-50.0–200.0°F	None
Occ Clg Spt =	72.0°F	0.0–100.0°F	None
Occ Htg Spt =	68.0°F	0.0–100.0°F	None
Disch Air=	—	-50.0–250.0°F	None
DAT Clg Spt=	55.0°F	40.0–100.0°F	None
DAT Htg Spt=	85.0°F	40.0–140.0°F	None
Min DAT Limit=	55.0°F	0.0–70.0°F	None
SAF Capacity=	—	0–100%	None
DSP	—	0.2–4.0 in	None
DuctSP Spt=	1.0 in	0.2–4.0 in	None
RF/EF Capacity=	—	0–100%	None
BSP=	—	-0.25–0.25 in	None
BldgSP Spt=	0.050 in	-0.25–0.25 in	None
OA Temp=	—	-50.0–200.0°F	None
EW Temp=	—	-50.0–150.0°F	None
Rel Humidity=	—	0–100%	None

Unit State is a status only item which indicates the state of operation in which the unit is currently operating. The unit can be in any of the operating states shown.

Unit Status is a status only item which indicates the status of operation in which the unit is currently operating. The unit status can be any of the status values shown.

MWU Status is a status only item that indicates whether or not the unit is in the heating state due to MWU function.

Dehum Status is a status only item which indicates the status of operation of the dehumidifier. The dehumidifier can be active or inactive.

Ctrl Mode is an adjustable item which sets the operating mode of the unit. The unit can be in any of the modes shown.

Occ Mode is an adjustable item which sets the occupancy mode of the unit. The unit can be in occupied, unoccupied, tenant override, or auto modes.

Clg Capacity is a status only item which indicates the percentage of the unit maximum cooling capacity currently operating.

OAD/Econo Cap is a status only item which indicates the percentage that the outdoor damper or economizer valve is currently open.

Htg Capacity is a status only item which indicates the percentage of the unit maximum heating capacity currently operating.

Reheat Capacity is a status only item which indicates the percentage of the unit maximum reheat capacity currently operating.

Control Temp is a status only item which displays the current value of the “Control Temperature.” The “Control Temperature” is defined as the temperature input selected by the Control Temperature Source parameter. For example, if the Control Temperature Source parameter is set to “Return,” then the control temperature parameter reads the same value as the Return Air parameter.

Occ Clg Spt is a status only item which indicates the temperature in which the unit will go into the cooling mode of operation. Once a valid password has been entered this item becomes an adjustable item.

Occ Htg Spt is a status only item which indicates the temperature in which the unit will go into the heating mode of operation. Once a valid password has been entered this item becomes an adjustable item.

Disch Air is a status only item which displays the current temperature reading from the unit’s discharge air temperature sensor (DAT). This sensor is standard on all units.

DAT Clg Spt is a status only item which indicates the temperature that the DAT should be maintained at when it is in the cooling mode of operation. Once a valid password has been entered this item becomes an adjustable item.

DAT Htg Spt is a status only item which indicates the temperature that the DAT should be maintained at when in the heating mode of operation. Once a valid password has been entered this item becomes an adjustable item.

Min DAT Limit is a status only item which indicates the discharge air low limit temperature on CAV zone control units. Heating will be activated to maintain this setting when the discharge temperature falls below it during the Fan Only operating state. On VAV or CAV discharge control units, the minimum discharge temperature limit is the DAT Clg Spt. Once a valid password has been entered this item becomes an adjustable item.

SAF Capacity is a status only item which indicates the capacity of the supply air fan.

DSP is a status only item which displays the current duct static pressure reading.

DuctSP Spt= is a status only item which indicates the duct static pressure set point used for controlling the VFD for the supply air fan. The VFD is modulated to maintain the duct pressure at this value. Once a valid password has been entered this item becomes an adjustable item.

RF/EF Capacity is a status only item indicating the capacity of the return fan/exhaust air fans.

BSP is a status only item which displays the current building static pressure reading.

BldgSP Spt is a status only item which indicates the building static pressure set point used for controlling the return/exhaust fan VFD. The return/exhaust fan VFD is modulated to maintain the building static pressure sensor input to this value. Once a valid password has been entered this item becomes an adjustable item.

OA Temp is a status only item which displays the current temperature reading from the unit mounted outdoor air temperature sensor. This sensor is standard on all units.

EW Temp is a status only item that displays the current temperature reading from the unit mounted entering water temperature sensor. The sensor is standard on all water-cooled units.

Rel Humidity is a status only item that displays the current relative humidity reading from the optional humidity sensor.

View/Set Unit Menus

Unit Status Settings

The “Unit Status Settings” menu provides a summary of basic unit status and control items. This menu summarizes the current operating state of the unit, giving the operating state the unit is in, along with the current capacity level of that operating state.

Table 3: Unit Status/Settings

Item Display Name	Default Setting	Range	Password Level
Unit State=	—	Off Start Recirc FanOnly MinDAT Htg Econo Clg	6
Unit Status=	—	Enable OffMan OffMnCtl OffNet OffAlm OffFnRty	6
MWU Status=	—	Inactive Active	6
Dehum Status	—	Active/Inactive	6
Ctrl Mode=	Off	Off HeatOnly CoolOnly FanOnly HeatCool Auto	6
Clg Status=	—	Enabled None OffAmb OffAlarm OffNet OffMan	6
Htg Status=	—	Enabled None OffAmb OffAlarm OffNet OffMan	6
Econo Status=	—	Enabled None OffAmb OffAlarm OffNet OffMan OffDehum	6
Clg Capacity=	—	0–100%	6
Htg Capacity=	—	0–100%	6
Reheat Cap	—	0–100%	6
SAF Capacity=	—	0–100%	6
RF/EF Capacity=	—	0–100%	6
Rel Humidity=	—	0–100%	6
Net Emrg Ovrd=	Normal	Normal, Off	6
Net App Mode=	Auto	Off HeatOnly CoolOnly FanOnly Auto	6

Unit State is a status only item which indicates the state of operation in which the unit is currently operating. The unit can be in any of the operating states shown.

Unit Status is a status only item which indicates the status of operation in which the unit is currently operating. The unit status can be any of the status values shown.

MWU Status is a status only item that indicates whether or not the unit is in the heating state due to MWU function.

Dehum Status is a status only item which indicates the status of operation of the dehumidifier. The dehumidifier can be active or inactive.

Ctrl Mode is an adjustable item which sets the operating mode of the unit. The unit can be in any of the modes shown.

Clg Status is a status only item which indicates whether or not mechanical cooling is currently allowed. If cooling is disabled, the reason is indicated.

Htg Status is a status only item which indicates whether or not heating is currently allowed. If heating is disabled, the reason is indicated.

Econo Status is a status only item which indicates whether or not the economizer is currently enabled. If economizer is enabled, the reason is indicated.

Clg Capacity is a status only item which indicates the percentage of the unit maximum cooling capacity currently operating.

Htg Capacity is a status only item which indicates the percentage of the unit maximum heating capacity currently operating.

Reheat Capacity is a status only item which indicates the percentage of the unit maximum reheat capacity currently operating.

SAF Capacity is a status only item which indicates the capacity of the supply air fan.

RF/EF Capacity is a status only item indicating the capacity of the return fan/exhaust air fans.

Rel Humidity is a status only item that displays the current relative humidity reading from the optional humidity sensor.

Net Emrg Ovrd is an adjustable item which indicates if the unit was shut down in an emergency situation via a network command.

Net App Mode is a network adjustable item which indicates that the unit is set for network off, cooling only, heating only, fan only or auto heating/cooling operation via a network signal. This item has no affect on the unit operation unless the Ctrl Mode item is set to “Auto.”

Occupancy

Menus in the Occupancy menu contain status and control items that relate to unit occupied/unoccupied operation.

Table 4: Occupancy Menu

Item Display Name	Default Setting	Range	Password Level
Occupancy=		Occ Unocc TntOvrd	6
Occ Mode=	Auto/Net	Occ Unocc TntOvrd Auto/Net	6
OccSrc=	-	None NetSchd IntSchd OneEvnt RemoteSw OccManCmd OccMode TStatTO ManTO	6
UnoccSrc=	-	UnoccDehum UnoccClg UnoccHtg IntOptStrt NetOptStrt None	6
Tnt Ovrde Time=	0	0–300min	6

Occupancy is a status only item which indicates whether the unit is currently in an occupied, unoccupied, or tenant override mode of operation.

OccMode is an adjustable item which allows the unit to be set for manual occupied or unoccupied operation, automatic operation based on a time schedule input or manual tenant override operation.

OccSrc is a status only item which indicates the input source or function that is responsible for setting the Occupancy parameter to “Occ” or “TntOvrd.”

UnoccSrc is a status only item which indicates the input source or function that is responsible for running the unit while the Occupancy parameter to “Unocc.”

Tnt Ovrd Time is an adjustable item which indicates the amount of time remaining for unit operation since tenant override operation was activated.

Temperatures

Menus in the Temperatures menu contain unit temperature status information.

Table 5: Temperature Menu

Item Display Name	Default Setting	Range	Password Level
Control Temp=	—	-50.0–200.0°F	6
Disch Air=	—	-50.0–250.0°F	6
Return Air=	—	-20.0–200.0°F	6
Space Temp=	—	-0.0–150.0°F	6
OA Temp=	—	-50.0–200.0°F	6
EF/LC Temp=	—	-50.0–250.0°F	6
EW Temp=	—	-50.0–150.0°F	6
Mixed Air=	—	-50.0–250.0°F	6
ER LAT	—	-50.0–200.0°F	6
ER EAT	—	-50.0–200.0°F	6
Sump Temp	—	-50.0–150.0°F	6
PA Temp	—	-50.0–200.0°F	2
DRT2=	—	-50.0–392.0°F	6
DRT3=	—	-50.0–392.0°F	6
INVCompTemp=	—	-50.0–392.0°F	6

Control Temp is a status only item which indicates the current Control Temperature value.

Disch Air is a status only item which displays the current temperature reading from the unit's discharge air temperature sensor (DAT). This sensor is standard on all units.

Return Air is a status only item which displays the current temperature reading from the unit's return air temperature sensor (RAT).

Space Temp is a status only item which displays the current space (or zone) temperature reading from the optional unit space air temperature sensor input. If an optional space temperature sensor is not installed and space temperature value is not supplied by a network, the SpaceT Present= item in the Setup menu should be set to "No" to disable the alarm function associated with an open circuit at the space temperature sensor input.

OA Temp is a status only item which displays the current temperature reading from the unit mounted outdoor air temperature sensor.

EF/LC Temp is a status only item which displays the current entering fan/leaving coil temperature reading from the unit mounted temperature sensor. This sensor is available on RTU units with dehumidification capability. This sensor is also installed on RTU units equipped with either gas or electric heat and is used by the controller to calculate the heat rise across the heat exchanger by comparing it to the discharge air temperature input. The controller uses this information to protect the heat exchanger against overheating.

EW Temp is a status only item that displays the current temperature reading from the unit mounted entering water temperature sensor. The sensor is standard on all water-cooled units.

Mixed Air is a status only item that displays the current temperature reading from the unit mounted mixed air temperature sensor. The sensor is standard on all Self Contained units.

ER LAT is status only item which displays the current discharge air temperature leaving the optional energy recovery wheel.

ER Exh T is status only item which displays the current exhaust air temperature leaving the optional energy recovery wheel.

Sump Temp is a status only item that displays the current evaporative condenser sump temperature.

PA Temp is the value of the latest calculated PA Temperature.

DRT2 is a status only item which displays the current discharge refrigerant line temperature sensor reading for variable speed compressor on circuit #2.

DRT3 is a status only item which displays the current discharge refrigerant line temperature sensor reading for variable speed compressor on circuit #3.

INVCompTemp is a status item only which displays the current value of the inverter compressor body temperature sensor connected to the unit.

Flow Status

Table 6: Flow Status Menu

Item Display Name	Default Setting	Range	Password Level
Airflow=	—	NoFlow Flow	6
Waterflow=	—	NoFlow Flow	6
Water Pump=	—	Off On	6
Supply Fan=	—	Off On	6
RET/EXH Fan	—	Off On	6

Airflow is a status only item that indicates whether or not discharge airflow is detected. Airflow status is sensed by a binary input delivered to the controller by a differential pressure switch (PC7). On VAV units duct static pressure is also a factor in the indication of airflow.

Waterflow is a status only item that indicates whether or not water flow is detected on a water cooled unit. Water flow status is sensed by a binary input delivered to the controller by an optional water flow sensor (WF1) or from a network supplied water flow input.

Water pump is a status only item that indicates whether or not the Pump Start Output is active on a water cooled unit. The pump start output is available for field use to start a field supplied pump when water flow is required. For field wiring requirements for using this output refer to “Field Wiring” in the MicroTech Installation Manual (IM 919). The Pump Start Output is turned on whenever the economizer bypass valve is open, the unit is in the Econo or Cooling operating state, economizer flush mode is active or a Freeze fault or Freeze problem alarm is active or has been active within the past 10 minutes. Otherwise the Pump Start Output is off.

Supply Fan is a status only item which indicates whether or not the controller is commanding the unit supply fan on.

Ret/Exh Fan is a status only item which indicates whether or not the controller is commanding the unit RF/EF fan on.

SAF Speed Control

Table 7: Supply Fan Speed Menu

Item Display Name	Default Setting	Range	Password Level
SAF Speed=	—	0–100%	6
Speed Cmd=	—	0–100%	6
Duct Press=	—	0.0–5.0 in	6
DuctSP Spt=	1.0 in	0.2–4.0 in	6
IAQ PPM =			6
OA Flow =			6
Bldg Press =			6
BldgSP Spt			6

SAF Speed is a status only item that indicates the current supply fan speed.

Speed Cmd is a status only item that indicates the current supply fan VFD commanded speed.

Duct Press is a status only item which indicates the current pressure of the supply air ductwork. The duct pressure is measured at the location in which the duct static pressure tap was field installed. This device is not factory installed.

DuctSP SPT is an adjustable item which sets the duct static pressure set point used for controlling the VFD for the supply air fan. The VFD is modulated to maintain the duct pressure at this value.

IAQ PPM = is a status only item that indicates the current CO_2 level when the supply fan control method is set to CO_2.

Note: CO_2 option only available on 100% OA units that have the unit control type set to Zone or DAC.

OA Flow = is a status only item that indicates the current CFM value when the supply fan control method is set to CFM. **Note:** CFM option only available on 100% OA units that have the unit control type set to Zone or DAC.

Bldg Press = is a status only item which indicates the current building static pressure when the supply fan control method is set to BSP. **Note:** BSP option only available on 100% OA units that have the unit control type set to Zone or DAC.

BldgSP Spt is an adjustable item which sets the building static pressure set point used for controlling the VFD when the supply fan control method is set to BSP. **Note:** BSP option only available on 100% OA units that have the unit control type set to Zone or DAC.

RF/EF Control

Table 8: Return/Exhaust Fan Speed Menu

Item Display Name	Default Setting	Range	Password Level
RF/EF Speed=	-	0–100%	6
Speed Cmd=	-	0–100%	6
Bldg Press=	-	-0.25–0.25 in	6
BldgSP Spt=	0.050 in	-0.25–0.25 in	6

RF/EF Speed is a status only item that indicates the current return/exhaust fan VFD speed.

Speed Cmd is a status only item that indicates the current return/exhaust fan VFD commanded speed.

Bldg Press is a status only item which indicates the building static pressure at the building static pressure sensor location.

BldgSP Spt is an adjustable item which sets the building static pressure set point used for controlling the VFD for the return/exhaust air fan. The VFD is modulated to maintain the building pressure at this value.

Cooling

Table 9: Cooling Menu

Item Display Name	Default Setting	Range	Password Level
Occ Clg Spt =	72.0°F	0.0–100.0°F	6
Unocc Clg Spt=	85.0°F	40.0–100.0°F	6
DAT Clg Spt=	55.0°F	40.0–100.0°F	6

Occ Clg Spt an adjustable item which sets the temperature above which the unit will go into the cooling mode of operation.

Unocc Clg Spt is an adjustable item which sets the zone temperature above which the unit starts up and provides unoccupied cooling (night setup) during unoccupied periods.

NOTE: Setting this to its maximum value will disable unoccupied cooling.

DAT Clg Spt is an adjustable item used by the controller to set the DAT cooling setpoint. This value is adjustable only on DAC units when it is not being set by a reset schedule. It is not adjustable on CAV units.

Economizer

Table 10: Economizer Menu

Item Display Name	Default Setting	Range	Password Level
OAD/Econo Pos=	—	0–100%	6
DAT Clg Spt=	55.0°F	40.0–100.0°F	6
Min OA Pos=	—	0–100%	6
FreeClgStatus=	—	Unavail Avail	6
Occ Clg Spt =	72.0°F	0.0–100.0°F	6
Unocc Clg Spt=	85.0°F	40.0–100.0°F	6

OAD/Econo Pos is a status only item that is used to indicate percentage that the economizer dampers/waterside economizer valve is open.

DAT Clg Spt is an adjustable item used by the controller to set the DAT cooling setpoint. This value is adjustable only on DAC units when it is not being set by a reset schedule. It is not adjustable on CAV units.

Min OA Pos is a status only item which indicates the current minimum position of the outdoor air damper.

FreeClg Status is a status only item that indicates whether airside economizer free cooling is available or unavailable based on a definable ambient temperature range.

Occ Clg Spt an adjustable item which sets the temperature above which the unit will go into the cooling mode of operation.

Unocc Clg Spt is an adjustable item which sets the zone temperature above which the unit starts up and provides unoccupied cooling (night setup) during unoccupied periods.

NOTE: Setting this to its maximum value will disable unoccupied cooling.

Min OA Damper

Table 11: Min OA Damper Menu

Item Display Name	Default Setting	Range	Password Level
Min OA Pos=	-	0–100%	6
Vent Limit=	20%	0–100%	6
LoFlo V Lmt=	30%	0–100%	6
DCV Limit=	10%	0–100%	6
Min OA SCR=	—	VentLmt	4
		DesFlw	
		FldFlw	
		Network	
		Ext VDC	
		Ext mA	
		IAQ VDC	
		BSPOvrd	
		FanDiff	
		DCVLmt	
		ZeroOA	

Min OA Pos is a status only item which indicates the current minimum position of the outdoor damper. This value does not go above a value called the Ventilation Limit and does not go below a value called the Demand Control Ventilation Limit.

On CAV units the Ventilation Limit and the Demand Control Ventilation Limit are fixed values set equal to the Vent Limit= and DCV Limit= parameters. On VAV units the OA Damper Position increases from the Vent Limit= value to the LoFloVent Limit= value as the VFD speed goes from 100% down to the Min Clg Spd= value. The Demand Control Ventilation Limit in this VAV case is determined by the Ventilation Limit X DVC Limit=/Vent Limit=. When the Min OA Reset= parameter is set to “None” the Min OA Pos= value is set to the Ventilation Limit. If Min OA Reset= is set to Network, Ext VDC, Ext mA, IAQ VDC, or IAQ mA, the Min OA Pos= varies between the Ventilation Limit and the Demand Control Ventilation Limit as the reset signal varies from its maximum to minimum value.

Vent Limit is an adjustable item that sets the value of the Ventilation Limit on a CAV unit or when a VAV unit is at 100% discharge fan speed.

LoFlo Vent Limit is an adjustable item that sets the maximum value for the Ventilation Limit on a VAV unit. The ventilation limit is raised toward this value as the discharge fan speed decreases toward the Min Clg Spd value.

DCV Limit is an adjustable item that sets the value of the Demand Control Ventilation Limit on a CAV unit or when a VAV unit is at 100% discharge fan speed. This item is only used when the “Min OA Reset=” is set to something other than “None.”

Min OA Src = is a status only item that indicates the action that is winning for control of the OA damper position.

Heating Menu

The Heating menu provides a summary of the control parameters for units with heating. The unit’s heating mode of operation is controlled by the control temperature and the heating setpoint temperature. The unit goes into the heating mode of operation by analyzing the control temperature.

The control temperature can be return temperature, space temperature or outside air temperature. The unit goes into the heating mode of operation when the control temperature is below the heating setpoint by more than ½ the deadband.

Table 12: Heating Menu

Item Display Name	Default Setting	Range	Password Level
Occ Htg Spt =	68.0°F	0.0–100.0°F	6
Unocc Htg Spt=	55.0°F	40.0–100.0°F	6
MWU Spt=	70.0°F	40.0–100.0°F	6
DAT Htg Spt=	85.0°F	40.0–140.0°F	6

Occ Htg Spt is an adjustable item which sets the control temperature below which the unit will go into the heating mode of operation.

Unocc Htg Spt is an adjustable item which sets the zone temperature below which the unit starts up and provides unoccupied heating (night setback) during unoccupied periods.

MWU Spt is an adjustable item which sets the heating setpoint to be used during morning warm up on a discharge temperature control unit. CAV units use the Occ Htg Spt for morning warmup operation.

DAT Htg Spt is an adjustable parameter which sets the heating discharge set point.

Dehumidification

Table 13: Dehumidification Menu

Item Display Name	Default Setting	Range	Password Level
Dehum Status=	—	Disabled Enabled	6
Rel Humidity=	—	0–100%	6
Dewpoint=	—	-50–150°F	6
Dehum Method=	None Always	None Rel Hum DewPt	6
RH Setpoint=	50%	0–100%	6
Dewpoint Spt=	50°F	0–100°F	6
Reheat Spt=	—	40.0–100.0°F	6
Reheat Cap=	—	0–100%	6

Dehum Status is a status only item that indicates whether dehumidification is enabled or disabled.

Rel Humidity is a status only item that indicates the current relative humidity reading of the sensor.

DewPoint is a status only item that indicates the current dew point value that is calculated by the controller using the Rel Humidity= value and either the Space Temp= or Return Air= value, depending on the setting of the Humidity Sensor Location. This parameter can either be set to “Space” or “Return.”

Dehum Method is an adjustable item used to set the dehumidification method to either “RH” or “DewPt.” When this parameter is set to “RH,” dehumidification operation is controlled to maintain the Rel Humidity= value at the RH Setpoint=. When this parameter is set to “DewPt,” dehumidification operation is controlled to maintain the Dew Point value at the Dewpoint Spt=. When this parameter is set to “Always” dehumidification will be active as long as mechanical cooling is not disabled.

RH Setpoint is an adjustable item used to set the relative humidity value at which the relative humidity will be controlled to during dehumidification operation.

Dewpoint Spt is an adjustable item used to set the dewpoint value at which the dewpoint with will be controlled to during dehumidification operation.

Reheat Spt is a status only item which is used to indicate the DAT temperature to which the HGRH valve will be controlled in the Cooling and Fan Only operating states while dehumidification operation is active. The Reheat Spt= equals the DAT Cooling Setpoint for DAT controlled units and will vary in between the Min Reheat Spt= and Max Reheat Spt= for Zone Controlled units.

Reheat Cap is a status only item that indicates the current reheat capacity value.

Date/Time/Schedules

Time/Date

Table 14: Time/Date

Item Display Name	Default Setting	Range	Password Level
Time=		HH:MM:SS	6
Date=		MM/DD/YYYY	6
UTC Diff=			6

Time is an adjustable item that sets the current time.

Date is an adjustable item that sets the current date.

UTC Diff is an adjustable parameter that can be set to indicate how the local time where the unit is situated differs from the Coordinated Universal Time (UTC).

Daily Schedule Menu

The Daily Schedule sets the start and stop times for each of the days of the week. One start and one stop time can be set for each day.

Table 15: Daily Schedule Menu

Item Display Name	Default Setting	Range	Password Level
Mon=	HH:MM — HH:MM	00:00 — 23:59	6
Tue=	HH:MM — HH:MM	00:00 — 23:59	6
Wed=	HH:MM — HH:MM	00:00 — 23:59	6
Thu=	HH:MM — HH:MM	00:00 — 23:59	6
Fri=	HH:MM — HH:MM	00:00 — 23:59	6
Sat=	HH:MM — HH:MM	00:00 — 23:59	6
Sun=	HH:MM — HH:MM	00:00 — 23:59	6
Hol=	HH:MM — HH:MM	00:00 — 23:59	6

Holiday Schedule Menu

The Holiday Schedule is used to set the start and stop times for up to 10 different holidays.

Table 16: Holiday Schedule Menu

Item Display Name	Default Setting	Range	Password Level
Hol 1=	MMMDD/99–MMMDD/99	00/00/00–12/31/99	6
Hol 2=	MMMDD/99–MMMDD/99	00/00/00–12/31/99	6
Hol 3=	MMMDD/99–MMMDD/99	00/00/00–12/31/99	6
Hol 4=	MMMDD/99–MMMDD/99	00/00/00–12/31/99	6
Hol 5=	MMMDD/99–MMMDD/99	00/00/00–12/31/99	6
Hol 6=	MMMDD/99–MMMDD/99	00/00/00–12/31/99	6
Hol 7=	MMMDD/99–MMMDD/99	00/00/00–12/31/99	6
Hol 8=	MMMDD/99–MMMDD/99	00/00/00–12/31/99	6
Hol 9=	MMMDD/99–MMMDD/99	00/00/00–12/31/99	6
Hol 10=	MMMDD/99–MMMDD/99	00/00/00–12/31/99	6

One Event Schedule Menu

The One Event Schedule is used to set the start and stop times for one event.

Table 17: One Event Schedule Menu

Item Display Name	Default Setting	Range	Password Level
Beg=	MMMDD/99 @ HH:MM	00/00/00-12/31/99 @ 00:00 – 23:59	6
End=	MMMDD/99 @ HH:MM	00/00/00-12/31/99 @ 00:00 – 23:59	6

Optimal Start Menu

The Optimal Start menu is used to set up the unit so it starts at the most efficient time before building occupancy.

Table 18: Optimal Start Menu

Item Display Name	Default Setting	Range	Password Level
Enable=	No	No, Yes	6
Htg Rate=	0.4°F/min	0.0–1.0°F/min	2
Htg OAT=	35°F	-40–60°F	2
Des Htg OAT=	0°F	-40–60°F	2
Clg Rate=	0.4°F/min	0.0–1.0°F/min	2
Clg OAT=	85°F	-60–140°F	2
Des Clg OAT=	95°F	-60–140°F	2

Enable is an adjustable item that turns on the optimal start feature. Setting the value to yes will activate this function.

Htg Rate is an adjustable item used by the controller in determining the amount time before occupancy to start when the Optimal Start parameter is set to “ON.”

Htg OAT is an adjustable item used by the controller in determining the amount time before occupancy to start when the Optimal Start parameter is set to “ON.”

Design Htg OAT is an adjustable item that sets the outdoor air temperature at which the heating system could just hold the load. The rate of temperature rise would equal zero.

Clg Rate is an adjustable item that sets the rate of temperature drop in degrees per minute when the unit last started optimally in cooling.

Clg OAT is an adjustable item that sets the outdoor air temperature when the unit was last started optimally in cooling.

Design Clg OAT is an adjustable item that sets the outdoor air temperature at which the cooling system could just hold the load. Rate of temperature rise would equal zero.

Daylight Savings Menu

Table 19: Daylight Savings Menu

Item Display Name	Default Setting	Range	Password Level
DLS Strt Mon=	Mar	NA Jan-Dec	2
DLS Strt Wk=	2ndWeek	1stSun 2ndSun 3rdSun 4thSun 5thSun	2
DLS End Mon=	Nov	NA Jan-Dec	2
DLS End Week=	1stWeek	1stSun 2ndSun 3rdSun 4thSun 5thSun	2
DLS Enable=	Auto	Off/Auto	2

DLS Strt Mon is an adjustable item that sets the month for daylight savings time to begin.

DLS Strt Wk is an adjustable item that sets the week of the month for daylight savings time to begin.

DLS End Mon is an adjustable item that sets the month for daylight savings time to end.

DLS End Week is an adjustable item that sets the week of the month for daylight savings time to end.

DLS Enable is an adjustable item that sets whether or not daylight savings time is enabled.

Commission Unit

Unit Setup

Table 20: Unit Setup Menu

Item Display Name	Default Setting	Range	Password Level
Apply Changes=	No	No, Yes	4
RAT Sensor=	Yes	No, Yes	4
100% OA SCU	Yes	No, Yes	4
OAT Sensor=	Yes	No, Yes	4
Space Sensor	Digtl/Net	None Anlog/Net Digtl/Net	4
Eng Units=	English	English, SI	4
Unit Name=	—	—	4
Rapid Start=	No	No, Yes	2
Rapid Start Tm=	10 min	0–20 min	2
DO10 Cfg=	FanOp	FanOp VAVBox	2

Apply Changes is a flag that must be changed from no to yes, for the controller to recognize any changes made.

RAT Sensor is a status only item that indicates the current value of the RAT sensor.

100% OA SCU is an adjustable item used to select whether or not a self contained unit will be configured for 100% outside air operation. Flag must be changed from no to yes, in order for the controller to recognize any changes made.

OAT Sensor is a status only item that indicates the current value of the OAT sensor.

Space Sensor is an adjustable item to indicate if a space sensor is connected to the unit controller, or provided via a network signal.

Eng Units is an adjustable item to indicate if the unit is to display English or Metric units of measure.

Unit Name is an adjustable item that allows each controller to be given a unique name. This may be useful when multiple units are connected to a single remote HMI.

Rapid Start is an adjustable item that allows the user to select to initiate a rapid startup sequence at unit power up.

Rapid Start Tm is an adjustable item that allows the user to set the Rapid Start timing whenever the power is reset to the controller and the controller finishes its startup sequence.

DO10 Cfg is an adjustable item that redefines the functionality of the digital output (DO10) on the main control board. The output is either a supply fan operation indication or a VAV box signal depending on how this parameter is set.

Timer Settings Menu

Table 21: Timer Settings Menu

Item Display Name	Default Setting	Range	Password Level
Service Time	0min	0–240min	4
Start Up	180s	1800s	4
Recirculate	180s	3600s	4
Zero OA Time	0min	0–240min	4
Tnt Override	120min	0–300min	4
Post Heat	0s	0–180s	4
Pwd Timeout	10min	3–30min	4
Low DAT	6min	0–60min	4
ClgStateDelay	300s	0–600s	4
Clg Stg Time	5min	5–60min	4
Clg Stg Time (INV)	5min	2–60min	4
Htg Stg Time	5min	2–60min	4
Min Ex Strt Tm	120s	60–300s	4
Min Ex Stop Tm	120s	60–300s	4
ER Whl Stg Tm	5min	1–100min	4
ER Whl Off Tm	5min	1–100min	4
Air Flw Ign	120s	0–999S	2
Htg Wrmup Tm	240s	0–999s	2
Htg Hld Period	240s	0–999s	2
Srvc Time Inc	20s	0–300s	2
Off HtCl Delay	120s	0–999s	2

Service Time is an adjustable item that sets the amount of time the internal control timers can be temporarily sped up.

Startup is an adjustable item that sets the time in seconds that the unit will perform its startup operation.

Recirculate is an adjustable item that sets the time in seconds that the unit operates with only the fan, recirculating the building air upon unit start up.

Zero OA Time is an adjustable item that sets the time in minutes that the outdoor air damper stays at a zero position upon unit start up.

Tnt Override is an adjustable item that sets the amount of time that the unit will go into operation when the tenant override function is activated. Tenant override can be activated by the space sensor button, the network occupancy mode parameter or the keypad Occ Mode= parameter.

Post Heat is an adjustable item that sets the duration of the post heat function available on VAV units.

Pwd Timeout is an adjustable item that sets the amount of time in minutes that the controller will allow access to applicable menus without re-entering the necessary password. If the keypad display remains idle for this time period, the display will revert to the “main menu” requiring a re-enter of the password.

Low DAT is an adjustable item that sets the duration of a time period upon unit start up during which the Low Discharge Temperature fault is ignored. This may be particularly important in colder climates when a unit has been off for a significant time period during which the unit, including the discharge air temperature sensor, has become very cold. This time period allows the unit to run long enough to turn the unit heat on and warm the discharge sensor above the alarm limit, preventing nuisance unit alarm shutdown. This time period begins when the supply fan starts.

ClgStateDelay is an adjustable item that sets the amount of time between the fan only operating state and the mechanical cooling state. The unit will not enter the mechanical cooling state until this time has passed. This only applies on discharge control units following morning warm up heating operation.

Clg Stg Time is an adjustable item used to set a minimum time period between compressor stage changes.

Clg Stg Time (INV) is an adjustable item used to set a minimum time period between inverter controlled compressor stage changes

Htg Stg Time is an adjustable item used to set a minimum time period between heating stage changes.

MinExStrtTime is an adjustable item that sets the minimum exhaust fan on time (Default = 120 seconds).

MinExStopTime is an adjustable item that sets the minimum exhaust fan stop time (Default = 120 seconds).

ER Whl Stg Tm is an adjustable item used to set a minimum time period for operating at either the minimum or maximum speed before action is taken to change speed during the frost protect mode of operation.

ER Whl Off Tm is an adjustable item used to set the minimum amount of time the energy wheel will remain off after being turned off due to a frosting/condensation condition.

Air Flw Ign is an adjustable item that sets the amount of time the air proving switch is ignored after the supply fan is started.

Htg Wrmup Tm is an adjustable item which is used to set the amount of time the gas burner will remain at a low fire position on 100% OSA units (default 240 seconds).

Htg Hld Period is an adjustable item used to set the amount of time that the gas heating valve remains at its calculated value on units equipped with 100% OA (default 240 seconds). This is to allow the temperature to approach equilibrium with the modulating gas heating valve at a fixed position.

Srvc Time Inc is an adjustable item used to set the internal stage time delay when the Service Timer is not zero, the times listed below are set to the ServiceTime (Default = 20 seconds) instead of the normal values.

- Cooling Stage Time
- Heating Stage Time
- Start Initial Time
- Recirculation
- ZeroOATime

OffHtClDelay is an adjustable item that sets a delay in turning off the supply air fan when the unit is shut off while cooling or heating operation is active.

SAF Set-up

Table 22: Supply Fan Speed Menu

Item Display Name	Default Setting	Range	Password Level
SAF Ctrl=	DSP	DSP	4
		Spd/Net	
		1ZnVAV	
		BSP	
		CO2	
		CFM	
AplyInputChgs=	No	No	2
		Yes	
CO_2 Input=	None	None	2
		VDC	
		MA	
CFM Input=	None	None	2
		VDC	
		MA	
BSP Input=	No	No	2
		Yes	
SPEED CONTROL			
Rem SAF Cap=	33%	0–100%	4
DSP CONTROL			
DSP DB=	0.1in	0–0.5in	4
SAF Ramp Time=	60s	0–999s	4
Min Period=	5s	0–999s	4
Max Spd Chg=	15%	0–100%	4
DuctPress1=	—	0.0–5.0in	2
DuctPress2=	—	0.0–5.0in	2
1 ZONE VAV CONTROL			
Min Clg Spd=	40%	0–100%	4
Max Clg Spd=	100%	0–100%	4
Min Htg Spd=	40%	0–100%	4
Max Htg Spd=	100%	0–100%	4
Space Period=	60s	0–999s	4
Space Gain=	0.8	0.0–100.0s	4
Space PAT=	400s	0–999s	4
Space Max Chg=	10%	0–100%	4

Item Display Name	Default Setting	Range	Password Level
CO_2 CONTROL			
Min PPM=	0ppm	0–5000ppm	2
Max PPM=	2000ppm	0–5000ppm	2
V/A @ Min PPM=	0.0/V	0.0–20.0/V/mA	2
V/A @ Max PPM=	10.0/V	0.0–20.0/V/mA	2
Min SAF PPM=	800	0–5000ppm	4
Max SAF PPM=	1100	0–5000ppm	4
Min PPM Spd=	50	0–100%	4
Max PPM Spd=	100	0–100%	4
CFM CONTROL			
Min CFM=	0CFM	0–60000CFM	2
Max CFM=	10000CFM	0–60000CFM	2
V/A @Min CFM=	0.0/V	0.0–20.0/V/mA	2
V/A @Max CFM=	10.0/V	0.0–20.0/V/mA	2
SAF CFM DB=	3%	0–100%	4
SAFCFM Period=	30s	0–999s	4
SAF CFM Gain=	0.1	0.0–100.0	4
SAF CFM MxChg=	5%	0–100%	4
BSP CONTROL			
BSP DB=	0.01in	0.0–0.1in	4
BSP Period=	5s	0–999s	4
BSP Gain=	0.2	0.0–100.0s	4
Max Spd Chg=	4%	0–100%	4
SAF SETUP			
SAF Ctrl Dly=	30s	0–999s	4
Min Speed=	33%	0–100%	4
VAVBox Out=	—	Heat	2
		Cool	
MaxVentSpd=	100%	0–100%	2
Max SAF RPM=	2600	0–5000	2

SAF Ctrl is an adjustable parameter used to select how the supply fan is to be controlled. The supply fan can normally be controlled by duct pressure, space temperature (single zone VAV or 1ZnVAV) or by a percentage of supply air fan speed from 33% to 100%. On 100% OA unit applications the fan can be controlled to maintain building static pressure, space carbon dioxide level or and airflow based on a field supply airflow station. The speed option is typically used with a building automation system. When single zone VAV control is selected, the supply fan is controlled with a PI_Loop to maintain the Control Temperature input at the Occupied Cooling Set Point or Occupied Heating Set Point. When BSP is selected the supply fan is controlled with a PI_Loop to maintain the building static pressure at a building static pressure Set Point.

When CO_2 is selected the supply fan is controlled to maintain the CO_2 ppm between adjustable limits by varying the supply fan speed between an adjustable range. When CFM is selected the supply fan is controlled with a PI_Loop to maintain the measured CFM at a CFM set point.

AplyInputChgs is the Apply Input Changes flag must be changed from no to yes in order for the controller to recognize the changes. Setting the Apply Input Changes flag to YES will automatically reset the controller.

CO_2 Input is an adjustable item used to select the type of input for a field installed CO_2 sensor. If this is set to None the controller ignores any CO_2 sensor input. If CO_2 control and/or monitoring is desired this parameter is set to VDC or mA to match the input type of the field supplied CO_2 sensor input. This parameter applies only to 100% OA unit configurations.

CFM Input is an adjustable item used to select the type of input for a field installed airflow station. If this is set to None the controller ignores any field airflow station input. If CFM control and/or monitoring is desired this parameter is set to VDC or mA to match the input type of the field supplied airflow input. This parameter applies only to 100% OA unit configurations.

BSP Input is an adjustable item used to select whether on not a building static pressure sensor is connected to the unit controller. If this is set to No the controller ignores any building static pressure input. If BSP control of the supply fan is desired this parameter must be set to Yes. This parameter applies only to 100% OA unit configurations.

Remote SF Cap is an adjustable item for setting the supply fan speed by the keypad or by a network control signal.

DSP DB is an adjustable item which sets a dead band around the DuctSP Spt= parameter. No duct static pressure control action is taken when the current duct static pressure input is within this dead band.

SAF Ramp Time is an adjustable item that sets the amount of time it will take for the variable speed fan to drive from its minimum to maximum speed as well as its maximum to minimum speed. The SAF Ramp Time= value on the keypad must be changed whenever the ramp time of the variable speed fan is changed. The ramp up time must equal the ramp down time, and both must equal the SAF RampTime value to provide stable operation.

Min Period is an adjustable item that sets the duration of the sample time between speed changes. The sample time must be long enough to allow the static pressure to get very close to its steady state value before another calculation is made.

Max Spd Chg is an adjustable item that sets the maximum value for a speed increase or decrease. This speed change (either a positive or negative value) is added to the current fan speed whenever the duct static pressure is outside of the deadband, and the Min Period time has passed since the previous speed change.

DuctPress1 is a status only item that indicates the current value for the duct status pressure sensor.

DuctPress2 is a status only item that indicates the current value for the duct status pressure sensor If a second pressure sensor is used configuration spot 18 should indicate yes, the controller will use the lower reading of the two sensors installed.

Min Clg Spd is an adjustable item that sets the minimum supply fan speed used for cooling operation when 1ZnVAV is selected as the method of supply fan control.

Max Clg Spd is an adjustable item that sets the maximum supply fan speed used for cooling operation when 1ZnVAV is selected as the method of supply fan control.

Min Htg Spd is an adjustable item that sets the minimum supply fan speed used for heating operation when 1ZnVAV is selected as the method of supply fan control.

Max Htg Spd is an adjustable item that sets the maximum supply fan speed used for heating operation when 1ZnVAV is selected as the method of supply fan control.

Space Period is an adjustable item that sets the “sampling time” used in the PI control function to vary the supply fan speed when 1ZnVAV supply fan control is selected.

Space Gain is an adjustable item that sets the “gain” used in the PI control function to vary the supply fan speed when 1ZnVAV supply fan control is selected.

Space PAT is an adjustable item that sets the “project ahead time” used in the PI control function to vary the supply fan speed when 1ZnVAV supply fan control is selected.

Space Max Chg is an adjustable item that sets the maximum value of increase or decrease of the supply fan speed each period used in the PI control function to vary the supply fan speed when 1ZnVAV supply fan control is selected.

Min PPM is an adjustable item that sets the minimum PPM value of the field supplied CO_2 input signal.

Max PPM is an adjustable item that sets the maximum PPM value of the field supplied CO_2 input signal.

V/mA @ Min PPM is an adjustable item that sets the DC voltage or mA value at the minimum PPM value of the field supplied CO_2 input signal.

V/mA @ Max PPM is an adjustable item that sets the DC voltage or mA value at the maximum PPM value of the field supplied CO_2 input signal.

Min SAF PPM is an adjustable item that sets the PPM value at which the supply fan speed is controlled to minimum when CO_2 supply fan control is selected.

Max SAF PPM is an adjustable item that sets the PPM value at which the supply fan speed is controlled to maximum when CO_2 supply fan control is selected.

Min PPM Spd is an adjustable item that sets the supply fan speed when the CO_2 input signal is at minimum when CO_2 supply fan control is selected.

Max PPM Spd is an adjustable item that sets the supply fan speed when the CO_2 input signal is at maximum when CO_2 supply fan control is selected.

Min CFM is an adjustable item that sets the minimum CFM value of the field supplied airflow station input signal.

Max CFM is an adjustable item that sets the maximum CFM value of the field supplied airflow station input signal.

V/mA @ Min CFM is an adjustable item that sets the DC voltage or mA value at the minimum CFM value of the field supplied airflow station input signal.

V/mA @ Max CFM is an adjustable item that sets the DC voltage or mA value at the maximum CFM value of the field supplied airflow station input signal.

SAF CFM DB is an adjustable item that sets the “deadband” used in the PI control function to vary the supply fan speed when airflow (CFM) supply fan control is selected.

SAF CFM Period is an adjustable item that sets the “sample time” used in the PI control function to vary the supply fan speed when airflow (CFM) supply fan control is selected.

Space Gain is an adjustable item that sets the “gain” used in the PI control function to vary the supply fan speed when airflow (CFM) supply fan control is selected.

Space Max Chg is an adjustable item that sets the maximum value of increase or decrease of the supply fan speed each period used in the PI control function to vary the supply fan speed when airflow (CFM) supply fan control is selected.

BSP DB is an adjustable item that sets the “deadband” used in the PI control function to vary the supply fan speed when building static pressure (BSP) supply fan control is selected.

BSP Period is an adjustable item that sets the “sample time” used in the PI control function to vary the supply fan speed when building static pressure (BSP) supply fan control is selected.

BSP Gain is an adjustable item that sets the “gain” used in the PI control function to vary the supply fan speed when building static pressure (BSP) supply fan control is selected.

Max Spd Chg is an adjustable item that sets the maximum value of increase or decrease of the supply fan speed each period used in the PI control function to vary the supply fan speed when building static pressure (BSP) supply fan control is selected.

DSP Ctrl Dly is an adjustable item that sets the duration of time that the minimum speed signal is sent to the variable speed supply air fan after the supply fan is started via a digital output. Control reverts to either duct pressure or speed after the fan has been on for the DSPCtrlDelay (default 30 seconds).

Min Speed is an adjustable item which is used to set the minimum supply fan speed (default 33%).

VAVBox Out is a status only item that indicates the current value of the VAV output. The VAV output is only available to the field via network communications.

Max Vent Speed is an adjustable item that sets the supply fan speed when an external ventilation override input to the supply fan is present.

Max SAF RPM is an adjustable item that sets the maximum RPM value for the supply air fan. Note this is set based on the supply fan model size and the system specifications.

CFM monitoring and Airflow CFM Reset for 100%OA Applications

Airflow supply fan control is available on 100% OA units that have the Control Type set to Zone (0) or DAT (1). Airflow supply fan control is not available if the Control Type is set to 1ZnVAV (2).

If CFM Input= is set to None then no monitoring or supply fan control based on CFM is possible. All menu items related to CFM control and scaling are removed from the HMI in this case. If CFM Input= is set to VDC then the CFM input is available for control and/or monitoring purposes and the sensor scaling parameters are in terms of volts DC.

From the Main Menu select Commission Unit then SAF Set-Up, set the CFM Input setting to VDC and Apply Input Changes. To access OA flow readings from the main menu, scroll to Quick Menu and enter to view “OA Flow” in CFM and MinOAFlw Spt.

To access the CFM control settings: From the main menu scroll down to “Commission” unit then “SAF Set-up” Scroll down further under CFM control to view minimum and maximum CFM settings.

RF/EF Set-Up

Table 23: Return Fan/Exhaust Fan Set-up Menu

Item Display Name	Default Setting	Range	Password Level
RF/EF Ctrl=	Tracking	None	4
		Tracking	
		BldgP	
		Spd/Net	
		OA Damper	
Rem RAF Cap=	5%	0-100%	4
Rem ExhF Cap=	5%	0-100%	4
BSP DB=	0.01in	0.0-0.1in	4
BSP Period=	5s	0-999s	4
BSP Gain=	0.2	0.0-100.0s	4
Max Spd Chg=	4%	0-100%	4
Sup Fan Max=	100%	0-100%	4
RF @ SF Max	95%	0-100%	4
Sup Fan Min=	30%	0-100%	4
RF @ SF Min=	25%	0-100%	4
Lo Fan Diff=	75%	0-100%	4
Hi Fan Diff=	75%	0-100%	4
RFEF Ctrl Dly=	30s	0-999s	4
Min Speed=	5% With Exhaust Fan	0-100%	4
	33% With Return Fan		
MinExStrtTime=	120s	60-300s	4
MinExStopTime=	120s	60-300s	4
MinExhOAPos=	5%	0-100%	4
MinExhSAFCap=	10%	0-100%	4
ExhOnOAPos=	40%	0-100%	4
ExhMxOAPos=	100%	0-100%	4
Exh Stg 1 On=	40%	0-100%	4
Exh Stg 1 Off=	30%	0-100%	4
Exh Stg 2 On=	55%	0-100%	4
Exh Stg 2 Off=	40%	0-100%	4
Exh Stg 3 On=	70%	0-100%	4
Exh Stg 3 Off=	50%	0-100%	4
Max RF/EF Hz=	60Hz	0-100Hz	N/A
Max RF/EF Hz=	60Hz	0-100Hz	N/A
Max RF/EF Hz=	60Hz	0-100Hz	N/A
MaxVentSpd=	100%	0-100%	2
Max RFEF RPM=	2600	0-5000	2
ECM Status=	—	OK	2

RF/EF Ctrl is an adjustable parameter used to select how the return/exhaust fans are to be controlled. The exhaust fans can be controlled by the building pressure or by a percentage of return/exhaust air fan speed from 5% to 100%. The speed option is typically used with a building automation system.

Remote RAF Cap is an adjustable item for setting the return fan speed by the keypad or by a network control signal.

Remote ExhF Cap is an adjustable item for setting the exhaust fan speed by the keypad or by a network control signal.

BSP DB is an adjustable item which sets a dead band around the BldgSP Spt parameter. No building static pressure control action is taken when the current building static pressure input is within this dead band.

BSP Period is an adjustable item which sets the building static pressure return air or exhaust fan speed. Adjustable supply air fan building static pressure sample time. Adjustable from 5s to 0-999s if configuration for space 16 is 1,2,3,4,5,6,7,8,9 or A

BSP Gain is an adjustable item “Gain” in the “building static pressure control PI loop.

Max Spd Chg is an adjustable item that sets the maximum value for a exhaust speed increase or decrease. This speed change (either a positive or negative value) is added to the current fan speed whenever the building static pressure is outside of the deadband, and the BSP Period= time has passed since the previous speed change.

Sup Fan Max is an adjustable item used to set the supply fan maximum speed when the RF/EF control method is set to tracking.

RF @ SF Max is an adjustable setting used to set the return fan speed when the supply fan is operating at its maximum speed.

Sup Fan Min is an adjustable item used to set the supply fan minimum speed when the RF/EF control method is set to tracking

RF @ SF Min is an adjustable setting used to set the return fan speed when the supply fan is operating at its minimum speed.

Lo Fan Diff is an adjustable setting used to set the differential value between supply fan speed and return fan speed. The return fan will not modulate below the current supply fan speed minus the low fan differential.

Hi Fan Diff is an adjustable setting used to set the differential value between supply fan speed and return fan speed. The return fan will not modulate above the current supply fan speed plus the low fan differential.

RFEF Ctrl Delay is an adjustable item that sets the duration of time that the minimum speed signal is sent to the variable speed supply air fan after the return fan is started via a digital output. Control reverts to either building pressure or speed after the fan has been on for the BSPCtrlDelay (default 30 seconds).

Min Speed is an adjustable item the sets the minimum of the RF/EF fan

MinExStopTime is an adjustable item that sets the Minimum Exhaust Fan Stop Time (Default = 120 seconds). Once stopped, the exhaust fan must remain off for a minimum of this time before it can be re-started.

MinExhOAPos is an adjustable item that sets the Minimum Exhaust OA Position (default 5%). The outdoor air dampers must be open more that this value for prop exhaust fan operation.

MinExhSAFCap is an adjustable item that sets the Minimum Exhaust SAF capacity (default 10%). The supply air fan speed must be higher than this value for prop exhaust fan operation.

Exh On OA Pos is an adjustable item that turns on the exhaust fan when the OA damper position reaches this setting.

Exh Mx OA Pos is an adjustable item that sets the OA damper position at which the exhaust fan will be at is maximum speed.

Exh Stage 1,2,3 On is an adjustable setting that sets the damper positions at which point the staged exhaust fans are turned ON.

Exh stage 1,2,3 Off is an adjustable setting that sets the damper positions at which point the staged exhaust fans are turned OFF.

Max RF/EF Hz is an adjustable item that sets the maximum return/exhaust fan value. The maximum value settings must also be changed in the VFD’s to match this setting.

MaxVentSpd is an adjustable item that sets the exhaust fan speed when an external ventilation override input to the exhaust fan is present.

Max RFEF RPM is an adjustable item that sets the maximum RPM value for the exhaust air fan. **Note:** This is set based on the exhaust fan model size.

ECM Status is a status only item that indicates the current status of the return/exhaust fan motor

Heat/Cool Changeover Set-Up

Table 24: Heat/Cool Changeover Setup Menu

Item Display Name	Default Setting	Range	Password Level
Ctrl Temp Src=	RAT	RAT	4
		Space	
		MAT	
		OAT	
		None	
Use Tstat Spt=	No	No, Yes	4
Occ Clg DB=	2.0°F	0.0–10.0°F	4
Clg Period=	60s	0–999s	4
Clg Gain=	0.1	0.0–100.0	4
Clg PAT=	600s	0–999s	4
Max Clg Chg=	5.0°F	0.0–50.0°F	4
Occ Htg DB=	2.0°F	0.0–10.0°F	4
Htg Period=	60s	0–999s	4
Htg Gain=	0.1	0.0–100.0	4
Htg PAT=	600s	0–999s	4
Max Htg Chg=	5.0°F	0.0–50.0°F	4
AplyTstatChg=	No	No, Yes	4
CalRemSpt@10°C=	No	No, Yes	4
CalRemSpt@50°F=	No	No, Yes	4
CalRemSpt@30°C=	No	No, Yes	4
CalRemSpt@86°F=	No	No, Yes	4

Ctrl Temp Src is an adjustable item which selects the temperature sensor input to be used for the unit heating/cooling changeover or occupied cooling and heating capacity change decisions. For example, if the CtrlTemp Src parameter is set to “Return,” then the Control Temp parameter reads the same value as the Return Air parameter.

Use Tstat Spt is an adjustable item used to set whether or not to use the Tstat set point adjustment value for the Occ Clg Spt and Occ Htg Spt.

Occ Clg DB is an adjustable item which sets a dead band around the Occ Cooling Set Point parameter. For example, if the Occ Cooling Set Point parameter is set to 75ºF and the Clg Deadband parameter is set to 2ºF the dead band around the set point would be from 76.0ºF to 74.0ºF.

Clg Period is an adjustable item which sets the “sampling time” used in the PI control function to vary the DAT Clg Spt in zone control applications.

Clg Gain is an adjustable item which sets the “gain” used in the PI control function to vary the DAT Clg Spt in zone control applications.

Clg PAT is an adjustable item which sets the “project ahead time” used in the PI control function to vary the DAT Clg Spt in zone control applications.

Max Clg Change is an adjustable item that sets the maximum value for an increase or decrease of the DAT Clg Spt in zone control applications.

Occ Htg DB is an adjustable item which sets a dead band around the Occ Heating Set Point parameter. For example, if the Occ Heating Set Point parameter is set to 70ºF and the Htg Deadband parameter is set to 2ºF the dead band around the set point would be from 69.0ºF to 71.0ºF.

Htg Period is an adjustable item which sets the “sampling time” used in the PI control function to vary the DAT Htg Spt in zone control applications.

Htg Gain is an adjustable item which sets the “gain” used in the PI control function to vary the DAT Htg Spt in zone control applications.

Htg PAT is an adjustable item which sets the “project ahead time” used in the PI control function to vary the DAT Htg Spt in zone control applications.

Max Htg Chg is an adjustable item that sets the maximum value for an increase or decrease of the DAT Htg Spt in zone control applications.

AplyTstatChg is an adjustable item that resets the controller. This is required to affect changes to the Use TstatSpt parameter.

CalRemSpt@10°C is an adjustable item used to calibrate the digital space sensor minimum setpoint input when the engineering units set to SI.

CalRemSpt@50°F is an adjustable item used to calibrate the digital space sensor minimum setpoint input when the engineering units set to English.

CalRemSpt@30°C is an adjustable item used to calibrate the digital space sensor maximum setpoint input when the engineering units set to SI.

CalRemSpt@86°F is an adjustable item used to calibrate the digital space sensor maximum setpoint input when the engineering units set to English.

Cooling Set-Up

Table 25: Cooling Set-up Menu

Item Display Name	Default Setting	Range	Password Level
Clg Stage Time=	5min	5–60min	4
Clg DB=	2.0°F	1.0–10.0°F	4
Clg Lo OAT Lk=	55°F	0–100°F	4
OAT Diff=	2°F	0–10°F	4
Clg Reset=	None	None	6
		Ntwrk	
		Space	
		Return	
		OAT	
		ExtmA	
		ExtV	
		Airflow	
Min Clg Spt=	65.0°F	40.0–100.0°F	6
Min Clg Spt @=	0/NA	0–100/	6
		NA	
		°F	
		°C	
		mA	
		%	
Max Clg Spt=	65.0°F	40.0–100.0°F	6
Max Clg Spt @=	100/NA	0–100/	6
		NA	
		°F	
		°C	
		mA	
		%	
Unocc Diff=	3°F	0–10°F	2
DT Above Spt	DTA	0-250	2
DT Below Spt	DTB	0-250	2

Clg Stage Time is an adjustable item used to set a minimum time period between compressor stage changes.

Clg DB is an adjustable item which sets a dead band around the discharge cooling set point parameter. For example, if the discharge cooling set point parameter is set to 55ºF and the Clg Db parameter is set to 2ºF the dead band around the set point would be from 56.0ºF to 54.0ºF.

Clg Lo OAT Lk is an adjustable item which sets the low outdoor air temperature mechanical cooling lockout point. Mechanical cooling operation is disabled when the outdoor air temperature sensor input falls below this set point.

OATDiff is an adjustable item which sets a differential above the OAT Clg Lock parameter. Mechanical cooling operation is re-enabled when the outdoor air temperature sensor input rises above the OAT Clg Lock value by more than this differential.

Clg Reset is an adjustable item that is used to set the type of cooling reset to be used.

DTA & DTB: Current DTA and DTB values will be modified and displayed in real time. Degree time control of cooling stages will be based on the running totals of the degree time above setpoint and the degree time below setpoint. The difference between the actual discharge air temperature and the DAT Clg SPT will be added to either the DTA or DTB every ten seconds. This will cause the unit to operate longer at the cooling stage that produces the discharge air temperature that is closer to the setpoint which will result in an average discharge air temperature that is very close to the DATClgSpt.

NOTE this is applicable only if the unit is supplied with fixed speed compressors ONLY.

Min Clg Spt is an adjustable item which sets the minimum cooling discharge set point for use with a cooling discharge air temperature set point reset schedule.

Min Clg Spt @ is an adjustable item which sets the value of the sensor input, selected with the Cooling Reset parameter, at which the DAT cooling set point parameter is reset to the minimum DAT cooling set point value.

Max Clg Spt is an adjustable item which sets the maximum cooling discharge set point for use with a cooling discharge air temperature set point reset schedule.

Max Clg Spt @ is an adjustable item which sets the value of the sensor input, selected with the Cooling Reset parameter, at which the DAT cooling set point parameter is reset to the maximum DAT cooling set point value.

Unocc Diff is an adjustable item that sets the temperature differential for the unit operation below or above the unoccupied set points

Variable Compressor Set-Up

Table 26: Variable Compresor Setup Menu

Item Display Name	Default Setting	Range	Password Level
Compressor Status			
Var Cmp Status=	—	OFF	4
		ON	
Var Spd Cmd=	—	0–100%	4
Comp 1=	—	OFF	4
		ON	
Comp 3=	—	OFF	4
		ON	
Comp 5=	—	OFF	4
		ON	
Refrig Circuit Status			
PTD1=	—	0–5000kPa	4
PTD2=	—	0–5000kPa	4
VCmpDischSH=	—	-100.0–100.0°F	4
C1DschSatTmp=	—	-50.0–212.0°F	4
C2DschSatTmp=	—	-50.0–212.0°F	4
DRT1=	—	-50.0–392.0°F	6
DRT2=	—	-50.0–392.0°F	6
Cond Sol 1=	OFF	OFF	4
		ON	
Cond Sol 2=	OFF	OFF	4
		ON	
Compressor Setup			
Var Cmp Period=	20s	1–300s	4
Var Cmp Gain=	1	0.0–100.0	4
Var Cmp PAT=	40s	0–999s	4
VarCmp MaxChg=	10%	0–50%	4
OilBoost=	OFF	OFF	2
		ON	
LowOilTime=	10m	1–30m	2
OilBoostTime=	15m	1–15m	2
LowTcOAT=	80°F	50–122°F	2

Var Cmp Status is a status only item that indicates whether variable speed compressor on circuit # 2 is ON or OFF.

Var Spd Cmd is a status only item that indicates the current commanded speed of variable speed compressor on circuit # 2

Comp 1 is a status only item that indicates whether the fixed speed compressor# 1 is ON or OFF.

Comp 3 is a status only item that indicates whether the fixed speed compressor# 3 is ON or OFF.

Comp 5 is a status only item that indicates whether the fixed speed compressor# 5 is ON or OFF

PTD 1 is a status only item which displays the current value of the discharge line refrigerant pressure for circuit #1.

PTD 2 is a status only item which displays the current value of the discharge line refrigerant pressure for circuit #2.

VCmpDischSH is a status only item that indicates the current discharge superheat value for the variable compressor circuit based on discharge refrigerant temperature minus the discharge saturation temperature.

DRT 1 is a status only item which displays the current discharge refrigerant line temperature sensor reading for inverter compressor on circuit #1.

DRT 2 is a status only item which displays the current discharge refrigerant line temperature sensor reading for variable speed compressor on circuit #2.

C1DschSatTmp is a status only item which displays the current discharge pressure equivalent saturation temperature for circuit #1.

C2DschSatTmp is a status only item which displays the current discharge pressure equivalent saturation temperature for circuit #2.

Cond Sol 1 is a status only item that indicates whether the condenser coil splitter valve for circuit #1 is ON or OFF.

Cond Sol 2 is a status only item that indicates whether the condenser coil splitter valve for circuit #2 is ON or OFF.

VarCmp Period is an adjustable item that sets the sample period for the PI loop used to control the variable speed compressor capacity to maintain the effective discharge air temperature setpoint.

Var Cmp Gain is an adjustable item that sets the Gain for the PI loop used for the PI loop used to control the variable speed compressor capacity to maintain the effective discharge air temperature setpoint.

Var Cmp PAT is an adjustable item that sets the project ahead time for the PI loop used for the PI loop used to control the variable speed compressor capacity to maintain the effective discharge air temperature setpoint.

Var Cmp MaxChg is an adjustable item that sets the maximum change value for the PI loop used for the PI loop used to control the variable speed compressor capacity to maintain the effective discharge air temperature setpoint.

OilBoost is an item that indicates whether the I variable speed compressor oil boost sequence is On or Off and also allows the sequence to be manually initiated or terminated.

LowOilTime is an adjustable item that sets the amount of time a low oil level signal must be detected before the variable speed compressor low oil boost sequence is initiated.

OilBoostTime is an adjustable item that sets the amount of time the oil boost sequence remains active once initiated.

LowTcOAT is an adjustable item that sets the OAT solenoid valve setpoint used with condenser coil splitter valve control.

Copeland Digital Scroll Compressors

In some circumstances Daikin Applied units have incorporated Copeland Digital Scroll compressors. The compressors can provide variable capacity control by modulating it capacity from 10% to 100%.

When supplied the building control is to provide a 1-to-5-volt DC signal to control the capacity of the compressor. When the Digital Compressor Controller demand signal falls below 10% capacity (1.25vdc on decreasing demand) the Digital Compressor Controller will shut down the compressor and begin a two (2) minute anti-short cycle timer. When the Digital Compressor Controller signal rises above 10% capacity (1.44vdc on increasing demand) and the two (2) minute anti-short cycle timer has timed out, the Digital Compressor Controller will start the compressor again.

With a multi-staged unit, it is expected for the Digital compressor to start first and ramp all the way up to 5 Volt signal if more mechanical cooling is required to hold setpoint the second compressor (fixed speed) is started and the digital scroll is brought down to 1.44 volts. The Digital compressor will then continue to ramp up or down in capacity until set point is reached. Each time the staging reaches a point where a compressor will be started the digital compressor is reset to a voltage input of 1.44. When the compressors are staged off the fixed speed is dropped, and the digital is at 5 volts and gets a decreasing signal until the next compressor is dropped or the digital is shut down if it is the last compressor running.

NOTE: Circuit #2 Digital Scroll Compressor is always first on and last off.

NOTE: During normal occupied unit operation the BAS signal voltage @ TB5/681 Copeland

Digital Scroll Controller input C2 must always be above 0.5 volts.

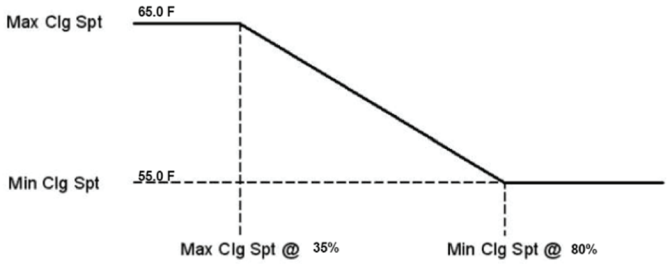
Figure 11 graphically shows the cooling reset operation. The normal DAT cooling set point is 55.0 F. The cooling reset scheme is set to airflow. The unit is to adjust the DAT from 55.0 F to 65.0 F. When the unit is at 35% of the design airflow the discharge temperature is to be 65.0 F. When the unit is at 80% of its airflow the DAT is to be 55.0F. This example would give the following inputs:

- Min Clg Spt= 55.0 F
- Min Clg Spt @= 80%
- Max Clg Spt= 65.0 F
- Max Clg Spt @= 35%

Based on the above, the unit will have a discharge air temperature set point of 55.0 F from 80% to 100% of the airflow.

Unocc Diff is an adjustable item that sets the unoccupied cooling differential.

Figure 11: Cooling Setpoint



Econo Set-Up

Table 27: Economizer Setup Menu

Item Display Name	Default Setting	Range	Password Level
EconChgovr=	Enth&DB	None	4
		OAT	
		OAT/RAT	
		Enth&OAT	
Econo FDD=	ON	OFF	2
		ON	
Clg Stg Time1=	5min	5–60min	4
Clg Stg Time2=	5min	2–60min	4
Chgover Temp=	70.0°F	0.0–100.0°F	4
Clg DB=	2.0°F	1.0–10.0°F	4
Econo Period=	30/40s (air/water)	0-999s	4
Econo Gain=	1-Oct (air/water)	0.0–100.0	4
Econo PAT=	60/40s (air/water)	0–999s	4
Econo Max Chg=	10/15% (air/water)	0–100%	4
Flush Econo=	Yes	No	4
		Yes	
Econo Diff=	2°F	0–10°F	4
EWT Diff=	3.0°F	0.0–10.0°F	4
Clg Reset=	None	None	4
		Network	
		Space	
		Return	
		OAT	
		ExtmA	
		ExtV	
		Airflow	
Min Clg Spt=	55.0°F	40.0–100.0°F	4
Min Clg Spt @=	0/NA	0–100/	4
		NA	
		°F	
		°C	
		mA	
		%	
Max Clg Spt=	65.0°F	40.0–100.0°F	4
Max Clg Spt @=	100/NA	0–100/	4
		NA	
		°F	
		°C	
		mA	
		%	

Max OAT Lmt=	75.0°F	50.0–100.0°F	2
Min OAT Lmt=	70.0°F	50.0–100.0°F	2
Calibrate OAD=	No	No	2
		Yes	
PosSwOpen=	97%	0–100%	2
Max Sw Diff=	3%	0–100%	2
PosSwClose=	3%	0–100%	2
Min Sw Diff=	5%	0–100%	2
OAD Sw Status=	—	Open	2
		Closed	

EconChangover is an adjustable item used to set how economizer operation will be enabled

Econo FDD is an adjustable item used to enable or disable the Economizer Fault Detection and Diagnostics function

Clg Stage Time 1 is an adjustable item used to set a minimum time period between compressor stage changes.

Clg Stage Time 2 is an adjustable item used to set a minimum time period between inverter compressor stage changes. config string #3 must equal 4.

Chgover Temp is an adjustable item which sets the OA dry bulb temperature at which the units changes over to the economizer operation.

Clg DB is an adjustable item which sets a dead band around the discharge cooling setpoint parameter. For example, if the discharge cooling setpoint parameter is set to 55ºF and the Clg DB parameter is set to 2ºF the dead band around the set point would be from 56.0ºF to 54.0ºF.

Econo Period is an adjustable item which sets the “sampling time” used in the PI control function of the economizer actuator.

Econo Gain is an adjustable item which sets the “Gain” used in the PI control function of the economizer actuator.

Econo PAT is an adjustable item which sets the “project ahead time” used in the PI control function of the economizer actuator.

Econo Max Chg is an adjustable item that sets the maximum value for an increase or decrease of the economizer actuator.

Flush Econo is an adjustable item used to enable the waterside economizer flush mode sequence.

Econo Diff is an adjustable item which sets a differential above the EconChgovrT parameter. Economizer operation is disabled when the OA Temp parameter indicates a value above the EconChgovrT= parameter by more than this differential.

EWT Diff is an adjustable item that sets a differential below the MAT at which waterside economizer operation is enabled based on entering water temperature.

Clg Reset is an status only item that is used to display the device that is in control of the economizer reset.

Min Clg Spt is an adjustable item which sets the minimum cooling discharge set point for use with a cooling discharge air temperature set point reset schedule.

Min Clg Spt @ is an adjustable item which sets the value of the sensor input, selected with the Cooling Reset parameter, at which the DAT cooling setpoint parameter is reset to the minimum DAT cooling setpoint value.

Max Clg Spt is an adjustable item which sets the maximum cooling discharge set point for use with a cooling discharge air temperature set point reset schedule.

Max Clg Spt @ is an adjustable item which sets the value of the sensor input, selected with the Cooling Reset parameter, at which the DAT cooling setpoint parameter is reset to the maximum DAT cooling setpoint value.

Max OAT Lmt is an adjustable item which sets the maximum outdoor air temperature for the applicable climate zone above which economizer should not be enabled.

Min OAT Lmt is an adjustable item which sets the minimum outdoor air temperature for the applicable climate zone below which economizer should be enabled. .

Calibrate OAD is an adjustable item used to initiate the calibration function that captures the command position at which the outdoor damper position end switches open and close at the closed and open ends of the damper modulation range.

PosSwOpen is an item that indicates the captured command position at which the outdoor damper position end switch closes at the open end of the damper modulation range. This parameter can also be manually adjusted.

Max Sw Diff is an item that indicates the captured switch differential at the open (maximum) end of the damper modulation. This parameter can also be manually adjusted.

PosSwClose is an item that indicates the captured command position at which the outdoor damper position end switch closes at the closed end of the damper modulation range. This parameter can also be manually adjusted.

Min SW Diff is an item that indicates the captured switch differential at the closed (minimum) end of the damper modulation. This parameter can also be manually adjusted.

OAD Sw Status is a status only item that indicates the current condition of the damper end switch position input (Open/Closed).

Min OA Set-Up

Table 28: Min OA Damper Menu

Item Display Name	Default Setting	Range	Password Level
Apply Changes	No	No, Yes	4
Min OA Reset=	None	None Network Ext VDC Ext mA IAQ VDC IAQ mA	4
BSP OA Ovrd	No	No/Yes	2
Rst Lmt Snsr	None	None DAT EFT MAT	2
OA @ MinV/mA=	0%	0–100%	4
OA @ MaxV/mA=	100%	0–100%	4
Min V/mA=	0.0/ V	0.0–20.0/ V mA	4
Max V/mA=	10.0/ V	0.0–20.0/ V mA	4
PPM @DCV Lmt=	800ppm	0–5000ppm	4
PPM @Vnt Lmt=	1000ppm	0-5000ppm	4
IAQ PPM=	-	0–5000ppm	4
Min PPM=	0ppm	0–5000ppm	4
Max PPM=	2000ppm	0–5000ppm	4
V/A @Min PPM=	0.0/ V	0.0–20.0/ V mA	4
V/A @Max PPM=	10.0/ V	0.0–20.0/	
V			
mA	4		
Min CFM	0CFM	0–60000CFM	4
Max CFM	10000CFM	0–60000CFM	4
V/A @ Min CFM	0.0/ V	0.0–20.0/ V mA	4
V/A @ Max CFM	10.0/ V	0.0–20.0/ V mA	4
Min Fan Diff=	20%	0–100%	4
Max Fan Diff=	50%	0–100%	4
Min Clg Spd=	40%	0–100%	4
Des Clg Spd	100%	0–100%	4
DesignFlow=	Yes	Yes, No	4
Field AO Stn	None	None VDC mA	4
OA Flow=	-	0–60000CFM	4
Min OA Flw Spt=	2000CFM	0–60000CFM	4
Des Flo DB=	3%	0–100%	4
DF Period=	30s	0–999s	4
Des Flo Gain=	0.1	0.0–100.0	4
DF Max Chg=	5%	0–100%	4
OA CFM DB	3%	0–100%	4
OA CFMPerod	30s	0–999s	4
OA CFM Gain	0.1	0.0–100.0	4
OA CFM Max Chg	5%	0–100%	4
LH Lvl Pos=	-	0.00–100.00%	4
RH Lvl Pos=	-	0.00–100.00%	4
MinRFEFTm=	120sec	0–3600sec	2
BSPOvdST=	5sec	0–999sec	2
BSPOvdGain=	0.2	0–999	2
BSPOvdMxChg=	4%	0–100%	2
ResetTLmt=	32.0°F	0–100°F	2
RstTSmplT=	5sec	0–999sec	2
RstTGain=	0.2	0–999	2
RstTPAT=	60sec	0-999sec	2
RstTMaxChg=	4%	0–100%	2
Min Inc Rate=	0.03	0.0–100.0	2
Max Inc Rate=	1.0	0.0–100.0	2
0-30% OA Max=	30%	0–100%	2

Apply Changes - the Apply Changes flag must be changed from no to yes in order for the controller to recognize the changes. Setting the Apply Changes flag to YES will automatically reset the controller.

Min OA Reset is an adjustable item that sets the type of minimum OA damper position reset to be used. When this is set to “None” the Min OA Pos= parameter is set to the Ventilation Limit. When this is set to “Network,” “Ext VDC,” “Ext mA,” “IAQ VDC,” or “IAQ mA” then the Min OA Pos= parameter varies from the Ventilation Limit down to the Demand Control Ventilation Limit as the reset signal goes from its maximum to minimum value.

NOTE: When the Min OA Reset type is set to Network and the Apply changes flag is set to yes, the value of the Vent Limit is automatically set to 100%, the value of the DCV limit is set to 0% and the LoFlo V Lmt is set to 0%.

BSP OA Ovrd is an adjustable item used to enable/disable the building static pressure override feature.

Rst Lmt Snsr is an adjustable item used to set the sensor to be used in conjunction with the OA reset limit function.

OA @ MinV/mA is an adjustable item used when Min OA Reset= is set to “Ext VDC” or “Ext mA” to define the Min OA Pos= is when the field signal is at minimum value.

NOTE: Min OA Pos= is limited above the Demand Control Ventilation Limit.

OA @ MaxV/mA is an adjustable item used when Min OA Reset= is set to “Ext VDC” or “Ext mA” to define the Min OA Pos= when the field signal is at the minimum value.

NOTE: Min OA Pos= is limited below the ventilation limit.

Min V/mA is an adjustable item used to set the minimum value of the field input signal.

Max V/mA is an adjustable item used to set the maximum value of the field input signal.

PPM @ DCV Limit is an adjustable item used when Min OA Reset= is set to “IAQ VDC” or “IAQ mA” to define at what PPM value the Min OA Pos= is to be at the Demand Control Ventilation Limit value.

PPM @ Vent Limit is an adjustable item used when Min OA Reset= is set to “IAQ VDC” or “IAQ mA” to define at what PPM value the Min OA Pos= is to be at the Ventilation Limit value.

IAQ PPM is a status only item which indicates the current reading from the CO_2 sensor.

Min PPM is an adjustable item that sets the minimum PPM value.

Max PPM is an adjustable item that sets the maximum PPM value.

V/mA @ Min PPM is an adjustable item that sets the minimum PPM value at the minimum DC voltage or mA value of the CO_2 sensor used when Min OA Reset= is set to “IAQ VDC” or “IAQ mA.”

V/mA @ Max PPM is an adjustable item that sets the maximum PPM value at the maximum DC voltage or mA value of the CO_2 sensor used when Min OA Reset= is set to “IAQ VDC” or “IAQ mA.”

Min CFM is an adjustable item that sets the minimum CFM value of the field supplied flow station.

Max CFM is an adjustable item that sets the maximum CFM value of the field supplied flow station.

V/A @ Min CFM is an adjustable item that sets the sensor input value at minimum CFM reading.

V/A @ Max CFM is an adjustable item that sets the sensor input value at maximum CFM reading.

Min Fan Diff is an adjustable item which sets a differential between the discharge and return fan capacities above which the minimum allowable Min OA Pos= begins to be reset upwards from the Demand Control Ventilation Limit toward the Ventilation Limit.

Max Fan Diff is an adjustable item which sets a differential between the discharge and return fan capacities at which the minimum allowable Min OA Pos= is fully reset up to the Ventilation Limit.

Min Clg Spd is an adjustable item that sets the discharge fan speed on a VAV unit at which the Ventilation Limit reaches the LoFloVent= value.

Des Clg Spd is an adjustable item used to adjust the design cooling speed setpoint.

Design Flow is an adjustable item used to turn the optional DesignFlow outdoor airflow measuring reset function on and off. This is one of several available methods of automatically resetting the Min OA Pos parameter.

Field OA Stn is an adjustable item used to turn the optional field supplied outdoor airflow measuring station function ON and OFF.

OA Flow is a status only item which indicates the current outdoor airflow based on an optional OA airflow sensor input used when the unit is equipped the DesignFlow OA control feature, or a field supplied OA measuring station.

Min OAFlw Spt is an adjustable item that is used to set the minimum design flow CFM's when the unit is equipped with the optional DesignFlow OA control feature, or a field supplied OA measuring station.

OA CFM DB is an adjustable item which sets the "deadband" used in the control function that modulates Min OA Pos parameter to maintain the OA Flow parameter at the MinOA Flow set point when a unit is equipped with the optional DesignFlow outdoor airflow measuring feature, or a field supplied OA measuring station.

OA CFMPeriod is an adjustable item which sets the "sampling time" used in the PI control function that modulates the Min OA Pos parameter to maintain the OA Flow parameter at the MinOA Flow set point when a unit is equipped with the optional DesignFlow outdoor airflow measuring feature, or a field supplied OA measuring station.

OA CFM Gain is an adjustable item which sets the "Gain" used in the PI control function that modulates the Min OA Pos parameter to maintain the OA Flow parameter at the MinOA Flow set point when a unit is equipped with the optional DesignFlow outdoor airflow measuring feature, or a field supplied OA measuring station.

OA CFM Max Chg is an adjustable item which sets the "maximum step" used in the control function that modulates the Min OA Pos parameter to maintain the OA Flow parameter at the MinOA Flow set point when a unit is equipped with the optional DesignFlow outdoor airflow measuring feature, or a field supplied OA measuring station.

LH Lvl Pos is a status item which is used to calibrate the left-hand side (unit opposite drive side) of the optional DesignFlow outdoor measuring apparatus. For details regarding calibration of the DesignFlow apparatus, refer to the applicable model-specific installation and maintenance manual.

RH Lvl Pos is a status item which is used to calibrate the right-hand side (unit drive side) of the optional DesignFlow outdoor measuring apparatus. For details regarding calibration of the DesignFlow apparatus, refer to the applicable model-specific installation and maintenance manual.

MinRFEFTm is an adjustable item used to set the time period for which the return/exhaust fan must operate at the minimum speed before the building static pressure override function is activated.

BSPOvdST an adjustable item which sets the "sampling time" used in the PI control function used for the building static pressure override feature.

BSPOvdGain is an adjustable item which sets the "Gain" used in the PI control function used for the building static pressure override feature.

BSPOvdMxChg is an adjustable item that sets the maximum value for an increase or decrease of the outside air damper position due to the building static pressure override feature.

ResetTLmt is an adjustable item which sets a temperature low limit which overrides functions that reset the outside air damper position if the temperature gets too cold.

RstTSmplT an adjustable item which sets the "sampling time" used in the PI control function used for the Reset Temperature Limit feature.

RstTGain is an adjustable item which sets the "Gain" used in the PI control function used for the Reset Temperature Limit feature.

RstTPAT is an adjustable item which sets the "project ahead time" used in the PI control function used for the Reset Temperature Limit feature.

RstTMaxChg is an adjustable item that sets the maximum change value PI loop used for the Reset Temperature Limit feature.

Min Inc Rate is an adjustable item used to set the minimum increase rate for the outside air damper "cold start" sequence.

Max Inc Rate is an adjustable item used to set the maximum increase rate for the outside air damper "cold start" sequence.

0-30% OA Max is an adjustable item used to set the maximum outside air damper position when the unit is configured for a 30% damper.

Heating Set-Up

The Heating menu provides a summary of the control parameters for units with heating. The unit's heating mode of operation is controlled by the control temperature and the heating setpoint temperature. The unit goes into the heating mode of operation by analyzing the control temperature.

The control temperature can be return temperature, space temperature or outside air temperature. The unit goes into the heating mode of operation when the control temperature is below the heating setpoint by more than ½ the deadband.

Table 29: Heating Set-Up Menu

Item Display Name	Default Setting	Range	Password Level
Htg Stage Time	5min	2–60min	4
Htg DB	2.0°F	1.0–10.0°F	4
Htg Period=	60s	0–999s	4
Htg Gain=	0.1	0.0–100.0	4
Htg PAT=	600s	0–999s	4
Htg Max Chg	10%	0–100%	4
Htg Hi OAT Lock	55°F	0–100°F	4
Htg Lo OAT Lock	0°F 45°F if 100% OA unit w/o ER	-20°F–50°F 45°F–50°F	4
OAT Diff	2°F	0–10°F	4
Htg Reset=	None	None Ntwrk Space Return OAT ExtmA ExtV	6
Min Htg Spt=	55.0°F	40.0–140.0°F	6
Min Htg Spt @	0/NA	0–100/ NA °F °C mA	6
Max Htg Spt=	55.0°F	40.0–140.0°F	6
Max Htg Spt @	100.0°F	0–100/ NA °F °C mA	6
Min DAT Ctrl=	Yes	Yes, No	6
Min Dat Limit	55.0°F	0.0–70.0°F	4
F&BP Method=	OpenVlv	OpenVlv ModVlv	4
F&BP ChgOvrT=	37°F	0–60°F	4
Occ Heating=	Yes	Yes, No	6
Unocc Diff=	3°F	0–10°F	2
Htg Warmup Tm=	240s	0–999s	2
Htg Hld Period=	240s	0–999s	2
Max Purge Hld=	20s	10–180s	2
Gas Derate V=	10.0V	0–10.0V	2
MWU Sensor	RAT	RAT Space None	2

Htg Stage Time is an adjustable item used to set a minimum time period between heating stage changes.

Htg DB is an adjustable item which sets a dead band around the discharge heating setpoint parameter. For example, if the discharge heating setpoint parameter is set to 100ºF and the Htg DB= parameter is set to 2ºF, the dead band around the set point would be from 101.0ºF to 99.0ºF.

Htg Period an adjustable item which sets the "sampling time" used in the PI control function that modulates the heating valve or face & bypass dampers.

Htg Gain is an adjustable item which sets the "Gain" used in the PI control function that modulates the heating valve or face & bypass dampers.

Htg PAT is an adjustable item which sets the "project ahead time" used in the PI control function that modulates the heating valve or face & bypass dampers.

Htg Max Chg is an adjustable item that sets the maximum value for an increase or decrease of the heating valve or face & bypass damper position.

Htg Hi OAT Lock is an adjustable item which sets the high outdoor air temperature heating lockout point. Heating operation is disabled when the outdoor air temperature sensor input rises above this set point.

Htg Lo OAT Lock is an adjustable item which sets the Low outdoor air temperature heating lockout point. Compressor Heating operation is disabled when the outdoor air temperature sensor input falls below this set point. (heat pump operation)

OAT Diff is an adjustable item which sets a differential below the OATHtg Lock parameter. Heating operation is re-enabled when the outdoor air temperature sensor input falls below the OATHtg Lock value by more than this differential.

Htg Reset is an adjustable item used to set the type of heating reset to be used.

Min Htg Spt is an adjustable item which sets the minimum heating discharge set point for use with a heating discharge air temperature set point reset schedule.

Min Htg Spt @ is an adjustable item which sets the value of the sensor input, selected with the heating reset parameter, at which the heating setpoint is reset to the Min Htg Spt value.

Max Htg Spt is an adjustable item which sets the maximum heating discharge set point for use with a heating discharge air temperature set point reset schedule.

Max Htg Spt @ is an adjustable item which sets the value of the sensor input, selected with the heating reset parameter, at which the heating setpoint is reset to the Max Htg Spt value.

Min DAT Ctrl is an adjustable item used on VAV or CAV discharge control units to activate or deactivate the low discharge temperature limit function available on units equipped with modulating or multistage heat.

Min DAT Limit is a status only item which indicates the discharge air low limit temperature on CAV zone control units. Heating will be activated to maintain this setting when the discharge temperature falls below it during the Fan Only operating state. On VAV or CAV discharge control units, the minimum discharge temperature limit is the DAT Clg Spt.

F&BP Method is an adjustable item used to set the face and bypass control method. When a unit equipped with steam or hot water and face and bypass damper, there are two methods available for controlling the heating arrangement. These are the "Open Valve" and "Modulating Valve" methods.

F&BP ChgOvrT is an adjustable item used to set the face and bypass changeover temperature.

Htg Warmup Tm is an adjustable item which is used to set the amount of time the gas burner will remain at a low fire position on 100% OSA units (default 240 seconds) during the special cold start sequence.

Htg Hld Period is an adjustable item used to set the amount of time that the gas heating valve remains at its calculated value on units equipped with 100% OA (default 240 seconds) during the special cold start sequence. This is to allow the temperature to approach equilibrium with the modulating gas heating valve at a fixed position.

Occ Heating is an adjustable item which enables and disables the "daytime" heating mode of operation. If the Occ Heating parameter is set to No, the unit will only go into heating during the initial morning warm-up cycle. If the Occ Heating parameter is set to Yes, the unit can go into the heating mode of operation any time during the day.

Unocc Diff is an adjustable item that sets the unoccupied heating differential.

Max Purge Hld is an adjustable item that sets the value of the maximum purge hold timer.

Gas Derate V is an adjustable item used to set the maximum analog output value for controlling the modulating gas valve actuator.

MWU Sensor is an adjustable item that sets the temperature sensor input to be used for morning warmup heating operation on discharge air control units. Setting this parameter to none disables morning warm up operation.

Dehum Set-Up

Table 30: Dehumidification Menu

Item Display Name	Default Setting	Range	Password Level
Dehum Method=	None	None	4
		Rel Hum	
		DewPt	
		Always	
RH DB=	6%	0–10%	4
Dewpoint DB=	2.0°F	2–10°F	4
RH Period=	30s	0–999s	4
RH Gain=	1	0.0–100.0	4
RH PAT=	30s	0–999s	4
RH Max Chg=	10%	0–100%	4
LSC Lo Gain=	0.2	0.0–100.0	2
RH Stg Time=	10min	0–60min	4
Stg Rht DB=	5°F	0–20°F	4
Unocc Dehuml=	No	No	4
		Yes	
Sensor Loc=	Return	Return	4
		OAT	
		Space	
Mn Lvg Coil T=	45.0°F RTU or MPS	40–100°F	4
	52.0°F DPS		
Mx Lvg Coil T=	52.0°F	40–100°F	4
Rht Cmp Lmtg=	Yes	No	2
		Yes	
Min Rheat Spt=	55.0°F	40.0–100.0°F	4
Max Rheat Spt =	65.0°F	40.0–100.0°F	4
RH Sens Type=	VDC	VDC mA	2
RH Min Sig=	0.0V	0.0–20.0	2
		V/mA	
RH Max Sig=	8.5V (MPS/DPS) 10.0V (RTU)	0.0–20.0	2
		V/mA	
Min Dehum Spd=	33%	0–100%	2
Max Dehum Spd=	100%	0–100%	2
Rht Min Pos=	10% (RPS)	0–100%	2
	15% MPS		
	5% (DPS, DPH)		
RH Dec Rate=	1	0–10.00%/s	2
Backup RH Enable=	No	No	2
		Yes	

Dehum Method is an adjustable item used to set the dehumidification method to either “RH” or “DewPt.” When this parameter is set to “RH,” dehumidification operation is controlled to maintain the Rel Humidity value at the Relative Humidity Set Point. When this parameter is set to “DewPt,” dehumidification operation is controlled to maintain the Dew Point= value at the Dew Point Set Point. When this parameter is set to “Always” dehumidification will be active as long as mechanical cooling is not disabled.

RH DB is an adjustable item that sets a dead band around the relative humidity set point. For example, if the RH Setpoint parameter is set to 50% and the RH Db parameter is set to 2% the dead band around the set point would be from 49% to 51%.

Dewpoint DB is an adjustable item that sets a dead band around the dew point set point. For example, if the DewPoint Spt parameter is set to 50ºF and the DewPntDb parameter is set to 2ºF the dead band around the set point would be from 49ºF to 51ºF.

RH Period is an adjustable item which sets the “sampling time” used in the PI control function for controlling the reheat valve.

RH Gain is an adjustable item which sets the “Gain” used in the PI control function for controlling the reheat valve.

RH PAT is an adjustable item which sets the “project ahead time” used in the PI control function for controlling the reheat valve.

RH Max Chg an adjustable item that sets the maximum value for an increase or decrease for controlling the reheat valve.

LSC Lo Gain - is an adjustable item which sets the “Gain” used in the PI control function for controlling the liquid subcooling reheat valve.

RH Stg Time is an adjustable item is an adjustable item which sets a stage time period for controlling reheat on units equipped with a single stage of hot gas reheat.

Stg Rht DB is an adjustable item which sets a dead band around the reheat setpoint parameter.

Unocc Dehum is an adjustable item to select whether dehumidification is allowed during off or unoccupied cycle times.

Sensor Loc is an adjustable item which is used to select the location of the humidity sensor. The location is selected by setting the Sensor Location value on the keypad to Return, Space, or OAT. The significance of the sensor location is that this determines which temperature sensor is use to calculate the Dewpoint. OAT can only be selected for units with DAT control.

Mn Lvg Coil T is an adjustable item which is used to set the minimum leaving coil temperature (Default = 45°F).

Mx Lvg Coil T is an adjustable item which is used to set the maximum leaving coil temperature (Default = 52°F).

Rht Cmp Lmtg is an adjustable item used to enable or disable the Compressorized Reheat Cooling Capacity Limiting Function.

Min Reheat Spt is an adjustable item which is used to set the minimum DAT during dehumidification.

Max Reheat Spt is an adjustable item which is used to set the maximum DAT during dehumidification.

RH Sen Type is an adjustable item used to define the field supplied humidity sensor input signal type.

RH Min Signal is an adjustable item used to define the minimum value of the field supplied humidity sensor current or voltage signal.

RH Max Signal is an adjustable item used to define the maximum value of the field supplied humidity sensor current or voltage signal.

Min Dehum Spd is an adjustable item used to set the minimum supply fan VFD speed during dehumidification.

Max Dehum Spd is an adjustable item used to set the maximum supply fan VFD speed during dehumidification.

Rht Min Pos is an adjustable item used to set the minimum position of the reheat valve when the PI loop is active.

RH Dec Rate is an adjustable item used to set the rate of decrease for the reheat valve, where the unit leaves the dehumidification operation.

Backup RH enable is an selectable item that will enable or disable supplement gas heat reheat. Re-heat must be active at 100% for 5 min to enable operation.

Energy Recovery Set-Up

The Energy Recovery Set-up menu contains parameters that relate to or are used to control the enthalpy wheel and exhaust fan when a unit is equipped with an optional energy recovery wheel system.

Table 31: Energy Recovery

Item Display Name	Default Setting	Range	Password Level
Energy Rvcy=	Yes	Yes, No	4
ER Wheel=	—	On, Off	4
Wheel Speed=	—	0–100%	4
Whl Spd Cmd=	—	0–100%	4
ER LAT=	—	-50.0–200.0°F	4
ER EAT=	—	–50.0–200.0°F	4
Min ExhT Diff=	2.0°F	1.0–20.0°F	4
Max ExhT Diff=	6.0°F	1.0–20.0°F	4
ER Whl Stg Tm=	5min	1–100min	4
ER Whl Off Tm=	20min	1–100min	4
Rel Humidity=	—	0–100%	4
Min Whl Spd	5%	0–100%	4
Intersect Pt=	—	-146.2.0–150.0°F	2
Fst Mgmt Meth=	Timed	Timed ExhAir	4
OA Fst Temp=	5°F	-40.0°F – 99.86°F	4
Defrost Time=	5min	0–60min	4
Defrst Period=	60min	0–1440min	4
Defrst On Tm=	1s	0–999s	2
Defrst Off Tm=	24s	0–999s	2
ER Whl Period=	30.0s	0–999.0s	2
ER Whl Gain=	1.0	0–100	2
ER Whl PAT=	30.0s	0–999.0s	2
ER Max Chg=	10%	0–100%	2
Capacity Limiting	Yes	Yes	2
		No	

Energy Rvcy is an adjustable item which turns the optional energy recovery system ON /OFF.

ER Wheel is a status only item used to indicate whether the energy recovery wheel is currently ON or OFF.

Wheel Speed is a status only item that indicates the energy wheel variable speed supply air fan speed.

Wheel Spd Cmd is a status only item that indicates the current energy wheel variable speed supply air fan commanded speed.

ER LAT is status only item which displays the current discharge air temperature leaving the optional energy recovery wheel.

ER EAT is status only item which displays the current exhaust air temperature leaving the optional energy recovery wheel.

Min Exh T Diff is an adjustable item that sets a differential below the calculated potential energy recovery exhaust air frosting point. When the ER Exh T falls below the calculated frosting point by more that this value, the energy wheel will be driven to its minimum speed, or turned OFF, to prevent frosting.

Max Exh T Diff is an adjustable item that sets a differential above the calculated potential energy recovery exhaust air frosting point. Once the wheel is driven to minimum speed, or turned off, to prevent frosting, it is driven back to maximum speed, or turned ON, only when ER Exh T rises back above the calculated frosting point by more that this value.

ER Whl Stg Tm is an adjustable item used to set a minimum time period for operating at either the minimum or maximum speed before action is taken to change speed during the frost protect mode of operation.

ER Whl Off Tm is an adjustable item used to set the minimum amount of time the energy wheel will remain off after being turned OFF due to a frosting/condensation condition.

Rel Humidity is a status only item that indicates the current relative humidity reading of the sensor.

Min Whl Spd is an adjustable item used to set the energy recovery minimum wheel speed.

Intersect Pt is a status only item used to indicate the current intersection point value from the psychometric chart where potential for wheel frosting exists.

Fst Mgmt Meth is an adjustable item used to select the frost protection method to be used on a constant speed energy wheel application.

OA Fst Temp is an adjustable item used to set the outside air frost temperature.

Defrost Time is an adjustable item used to set the duration of a defrost cycle.

Defrst Period is an adjustable item used to set how often a defrost cycle will be initiated.

Defrst On Tm is an adjustable item used to select how long the constant speed energy wheel is energized during defrost.

Defrst Off Tm is an adjustable item used to select how long the constant speed energy wheel is de-energized during defrost.

ER Whl Period an adjustable item which sets the “sampling time” used in the PI control function.

ER Whl Gain is an adjustable item which sets the “Gain” used in the PI control function.

ER Whl PAT is an adjustable item which sets the “project ahead time” used in the PI control function.

ER Max Chg is an adjustable item that sets the maximum value for an increase or decrease of the energy recovery wheel speed.

Capacity Limiting is an adjustable item used to turn ON and OFF the energy wheel capacity limiting function.

Head Pressure Set-Up

The Head Pressure Set-Up menu contains parameters that are used to maintain head pressure control.

Table 32: Head Pressure Setup Menu

Item Display Name	Default Setting	Range	Password Level
Wtr Reg Vlv=	—	0–100%	6
Head P Circ 1=	—	0–750psi	6
Head P Circ 2=	—	0–750psi	6
Setpoint=	260psi	230–340psi	6
Head Press DB=	10psi	0–50psi	4
WRV Period=	10s	0–999s	4
WRV Gain=	3.6	0.0–100.0	4
WRV PAT=	10s	0–999s	4
WRV Max Chg=	7%	0–100%	4
WRV Init Tm=	60s	0–3600s	2
Min WRV Pos=	10%	0–100%	2
Min WRV Tmp=	58°F	20–150°F	2
Max WRV Tmp=	105°F	20–150°F	2
WRV Act Time=	60s	0–300s	2
Min WRV Time=	60s	0–3600s	2

Wtr Reg Vlv is a status only item that indicates the current water regulating valve position.

Head P Circ 1 is a status only item that indicates the current refrigerant pressure for circuit 1.

Head P Circ 2 is a status only item that indicates the current refrigerant pressure for circuit 2.

Setpoint is an adjustable item that sets the refrigerant setpoint used for controlling the water regulating valve. The water-regulating valve is modulated to maintain the refrigerant pressure.

Head Press DB is an adjustable item that sets a deadband around the Head Pressure Setpoint parameter.

WRV Period is an adjustable item which sets the “sampling time” used in the PI control function of the water regulating valve.

WRV Gain is an adjustable item which sets the “Gain” used in the PI control function of the water regulating valve.

WRV PAT is an adjustable item which sets the “project ahead time” used in the PI control function of the water regulating valve.

WRV Max Chg is an adjustable item that sets the maximum value for an increase or decrease of the water regulating valve.

WRV Init Tm is an adjustable item that sets a minimum time period that the WRV remains at an initial startup position (InitPos) during the WRV start sequence..

Min WRV Pos is an adjustable item used which sets the minimum WRV position used in the WRV start sequence (default 10%).

Min WRV Tmp is an adjustable item which is used to set the edited temperature where WRV at a minimum position does not result in a high pressure condition.This is used in the WRV start sequence.

Max WRV Tmp is an adjustable item which is used to set the edited temperature where WRV at 100% does not result in a low pressure condition.This is used in the WRV start sequence.

WRV Act Time is an adjustable item which is used to set the time required for the WRV to be driven from 0 to 100%.

Min WRV Time is an adjustable item which sets the minimum WRV time (default 60 seconds) used in the WRV start sequence.

Evap Cond Set-Up

Table 33: Evap Condensing Menu

Item Display Name	Default Setting	Range	Password Level
Cond Fan Spd=	—	0–100%	4
CFan Spd Cmd=	—	0–100%	4
Min Fan Speed=	33%	0–100%	4
EvCond Stg Tm=	10min	0–100min	4
Sump Temp=	—	-50.0–150.0°F	4
Min Sump T=	75.0°F	0.0–100.0°F	4
Max Sump T=	85.0°F	0.0–100.0°F	4
Sump Dump Spt=	35.0°F	0.0–100.0°F	4
Cndtvy=	—	0–5000S/cm	4
Hi Cndtvy Spt=	1100 S/cm	0–5000S/cm	4
SmpWtrLvlDly=	5mim	0–60min	4
PostClgTime=	10min	0–60min	4
SepFlshTime=	1min	0–60min	4
Dolphin Sys=	No	No Yes	4

Cond Fan Speed is a status only item that displays the current VFD speed when the evaporative condenser option includes a VFD to control the first condenser fan on each circuit.

Cond Fan Spd Cmd is a status only item that indicates the current condenser fan VFD commanded speed.

Min Fan Speed is an adjustable item used to set the minimum speed for the VFD speed when the evaporative condenser option includes a VFD to control the first condenser fan on each circuit.

EvCond Stg Tm is an adjustable item used to set a minimum time period between condenser fan stage changes.

Sump Temp is a status only item that displays the current evaporative condenser sump temperature.

Min Sump T is an adjustable item used to set a minimum evaporative condenser sump temperature set point. This value is used to determine when condenser fans are turned off.

Max Sump T is an adjustable item used to set a maximum evaporative condenser sump temperature set point. This value is used to determine when condenser fans should be turned on.

Sump Dump Spt is an adjustable item used to set a minimum sump temperature. The sump is emptied to prevent freezing if the sump temperature drops below this set point.

Sump Pump Status is a status only item that displays the current evaporative condenser sump pump status.

Smp Pmp Delay adjustable item used to set the amount of time the sump pump fail alarm is delayed. If the Sump Pump status remains Off after the Sump Pump Output has been turned on for more than the Sump Pump Delay time, a Sump Pump fail alarm is initiated.

Conductivity is a status only item that displays the conductivity level of the water in the sump of an evaporative cooled condenser on rooftop units.

Hi Cndtvy Spt is an adjustable item that sets the alarm value setpoint used to generate a conductivity problem alarm

SmpWtrLvlDly is an adjustable item that sets the amount of time sump water level input is ignored once the unit enters the cooling state

PostClgTime is an adjustable item that sets the amount of time the sump pump output remains on after the unit leaves the cooling state.

SepFlshTime is an adjustable item that sets the amount of time the Purge Valve Binary Output is turned on to flush the solids out of the system separator.

Dolphin System is an adjustable parameter that indicates to the controller whether or not a Dolphin water treatment method is being used. When set to “yes” the controller assures the sump pump is run every three days to reduce scaling.

Alarm Configuration

Alarm Limits Menu

The Alarm Limits menu is used to set the limits of the discharge air temperature sensor and the return air temperature sensor.

Table 34: Alarm Limits Setup Menu

Item Display Name	Default Setting	Range	Password Level
Hi Disch Temp=	170°F	90–250°F	4
Lo Disch Temp=	40°F	-50–50°F	4
Hi Return Temp=	120°F	90–150°F	4

Hi Disch Alm is an adjustable item that sets the high temperature limit for the DAT sensor. When the discharge air temperature sensor reaches this set point the unit will go into the high discharge air alarm.

Lo Disch Alm is an adjustable item that sets the low temperature limit for the DAT sensor. When the discharge air temperature sensor reaches this set point the unit will go into the low discharge air alarm.

Hi Return Alm is an adjustable item that sets the high temperature limit for the return air temperature. When the RAT sensor reaches this set point the unit will go into the high return air temperature alarm.

Alarm Output Config Menu

Table 35: Alarm Out Configuration Setup Menu

Item Display Name	Default Setting	Range	Password Level
Faults=	Fast	ON	4
		OFF	
		Fast	
		Slow	
Problems=	Slow	ON	4
		OFF	
		Fast	
		Slow	
Warnings=	OFF	ON	4
		OFF	
		Fast	
		Slow	

The digital alarm output indicates the alarm group that contains the highest priority active alarm. This output is ON when no alarms are active. The options for the action of this output when an alarm in a group occurs are ON, Fast Blink, Slow Blink, or OFF. These can be edited via the keypad/display.

The default values for the three groups of alarms are:

- Warnings - OFF
- Problems - Slow Blink
- Faults - Fast Blink

A user could eliminate any signal of a particular group of alarms through this output by selecting ON for that alarm group in the keypad/display.

Alarm Delays Menu

The Alarm Delays Setup Menu can be accessed when a level 2 password has been entered. The default settings are the result of many years of testing and should not be changed.

Table 36: Alarm Delays Setup Menu

Item Display Name	Default Setting	Range	Password Level
Frz DelayTime=	30s	0–180s	2
LP Delay=	2s	0–10s	2
LP Comp Delay=	5s (410A) 65s (R22/407C)	0–300s	2
Aflw Ignr Tm=	120s	0–999s	2
Sens Alm Dly=	30s	0–300s	2
Temp Alm Dly=	30s	0–300s	2
Alarm Config			
Emerg Stop=	Man Clr	Man Clr Auto Clr	2

Frz DelayTime is an adjustable item used to set the freeze alarm delay time.

LP Delay is an adjustable item used to set the low pressure switch delay time.

LP Comp Delay is an adjustable item used to set the low pressure compressor delay time.

Aflw Ignr Tm is an adjustable item that sets the amount of time the air proving switch is ignored after the supply fan is started.

Sens Alm Dly is an adjustable item used to set the sensor alarm delay time.

Temp Alm Dly is an adjustable item used to set the temperature alarm delay time

Emerg Stop is an adjustable item used to set the emergency shutdown to either manual or automatic restart.

Manual Control

The manual control of operation is a function that is used for operating the unit during a service call only. The unit must not be operated in this mode for any extended period of time.

Table 37: Manual Control Menu

Item Display Name	Default Setting	Range	Password Level
Manual Ctrl=	Normal	Normal	4
		ManCtrl	
Supply Fan=	OFF	OFF	4
		ON	
SAF Spd Cmd=	0%	0–100%	4
RF/EF VFD=	OFF	OFF	4
		ON	
RF/EF Spd Cmd=	0%	0–100%	4
OAD/Econo=	0%	0–100%	4
OAD OpCl=	Close	Close	4
		Open	
Var Cmp=	OFF	OFF	4
		ON	
Var Cmp Cmd=	0%	0–100%	4
VCmp Emg Stop=	Nrml	Stop	4
		Normal	
Comp 1 =	OFF	OFF	4
		ON	
Comp 2 =	OFF	OFF	4
		ON	
Comp 3 =	OFF	OFF	4
		ON	
Comp 4 =	OFF	OFF	4
		ON	
Comp 5 =	OFF	OFF	4
		ON	
Comp 6 =	OFF	OFF	4
		ON	
Comp 7 =	OFF	OFF	4
		ON	
Comp 8 =	OFF	OFF	4
		ON	
U1 Comp 1=	OFF	OFF	4
		ON	
U1 Comp 2=	OFF	OFF	4
		ON	
U2 Comp 1=	OFF	OFF	4
		ON	
U2 Comp 2=	OFF	OFF	4
		ON	
Cond Sol 1=	OFF	OFF	4
		ON	
Cond Sol 2=	OFF	OFF	4
		ON	
Cfan Outpt 1=	OFF	OFF	4
		ON	
Cfan Outpt 2=	OFF	OFF	4
		ON	
Cfan Outpt 3=	OFF	OFF	4
		ON	
BP/WR Valve=	0%	0–100%	4
CW Valve=	0%	0–100%	4
ExhFan Out 1=	OFF	OFF	4
		ON	
ExhFan Out 2=	OFF	OFF	4
		ON	
ECond VFD=	OFF	OFF	4
		ON	
ECFan Spd Cmd=	0%	0–100%	4
EC Drn Valve=	Close	Close	4
		Open	
Sump Pump=	OFF	OFF	4
		ON	
Sep Flsh Vlv=	OFF	OFF	4
		ON	

Table 37 continued: Manual Control Menu

Item Display Name	Default Setting	Range	Password Level
SV1=	OFF	OFF ON	4
SV2=	OFF	OFF ON	4
GasHtg OnOff=	OFF	OFF ON	4
Htg Valve=	0%	0–100%	4
SCR Out=	0%	0–100%	4
F&BP Damper=	0%	0–100%	4
Htg Stg 1=	OFF	OFF ON	4
SCR Ena 1=	OFF	OFF ON	4
Htg Stg 2=	OFF	OFF ON	4
SCR Ena 2=	OFF	OFF ON	4
Htg Stg 3=	OFF	OFF ON	4
Htg Stg 4=	OFF	OFF ON	4
Htg Stg 5=	OFF	OFF ON	4
Htg Stg 6=	OFF	OFF ON	4
Reheat Valve=	0%	0–100%	4
RH Output=	OFF	OFF ON	4
LSCRH Valve=	0%	0–100%	4
HGBP Valve=	OFF	OFF ON	4
ERec Wheel=	OFF	OFF ON	4
ER Whl Cmd=	0%	0–100%	4
ERBP Dmpr Cl=	OFF	OFF ON	4
ERBP Dmpr Op=	OFF	OFF ON	4
Cond Wtr Pump=	OFF	OFF ON	4
Alm Output=	OFF	OFF ON	4
Fan Op Out=	OFF	OFF ON	4

Manual Ctrl is an adjustable item that puts the unit into manual control. Major components of the unit are turned on and off by this control. The units normal control sequences are overridden in this state with the exception of all the “fault” alarms and the cooling circuit high pressure and low pressure alarms.

Supply Fan is an adjustable item that turns on the supply fan.

RF/EF is an adjustable item that turns ON the return/exhaust fan.

SAF Spd Cmd is an adjustable item only on VAV units that sets the speed of the supply air fan.

RF/EF Spd Cmd is an adjustable item for units with VFD on the return/exhaust fans that sets the speed of the return/exhaust fan.

OAD/Econo is an adjustable item which is used to set the economizer damper position.

OAD OpCl is an adjustable item which is used to turn the OA damper output ON. This output is available only on self contained units.

Var Cmp is an adjustable item used in manual control to turn on the variable speed compressor

Var Cmp Cmd is an adjustable item used in manual control to sets the speed of the variable speed compressor

VCmp Emg Stop is an adjustable item used in manual control to test the variable speed compressor Emergency Stop function

Comp 1 OnOff is an adjustable item that turns on compressor #1.

Comp 2 OnOff is an adjustable item that turns on compressor #2.

Comp 3 OnOff is an adjustable item that turns on compressor #3.

Comp 4 OnOff is an adjustable item that turns on compressor #4.

Comp 5 OnOff is an adjustable item that turns on compressor #5.

Comp 6 OnOff is an adjustable item that turns on compressor #6.

Comp 7 OnOff is an adjustable item that turns on compressor #7.

Comp 8 OnOff is an adjustable item that turns on compressor #8.

U1 Comp 1 is an adjustable item the turns ON unloader 1 on compressor 1.

U1 Comp 2 is an adjustable item the turns ON unloader 1 on compressor 2.

U2 Comp 1 is an adjustable item the turns ON unloader 2 on compressor 1.

U2 Comp 2 is an adjustable item the turns ON unloader 2 on compressor 2.

CFan Outpt 1 is an adjustable item that turns ON the condenser fan output #1.

CFan Outpt 2 is an adjustable item that turns ON the condenser fan output #2.

Cond Sol 1 is an adjustable item used in manual control to turn ON/OFF the circuit 1 condenser coil splitter solenoid valve

Cond Sol 2 is an adjustable item used in manual control to turn ON/OFF the circuit 2 condenser coil splitter solenoid valve

CFan Outpt 3 is an adjustable item that turns ON the condenser fan output #3.

NOTE: Turning on any one of the compressors will automatically turn ON the first condenser fan on the circuit. Other condenser fans must be manually turned ON to control the head pressure of the unit. Refrigerant gauges must be connected to the unit for observation of the head pressure in the manual control mode of operation. Additional condenser fans must be turned ON to maintain the head pressure.

BP/WR Valve is an adjustable item used to manually drive the bypass/water regulating valve open and closed.

CW Valve is an adjustable item used to manually drive the chilled water valve open and closed.

Exh Fan Out 1 is an adjustable item that turns ON Exhaust fan output # 1.

Exh Fan Out 2 is an adjustable item that turns ON Exhaust fan output # 2.

ECond VFD is an adjustable item which is used to turn ON/OFF the evaporative cooling condenser fan VFD.

ECFan Spd Cmd is an adjustable item which is used to set the evaporative cooling condenser fan VFD speed position.

EC Drn Valve is an adjustable item which is used to open/close the evaporative cooling drain valve.

Sump Pump is an adjustable item which is used to turn on/off the evaporative cooling sump pump.

Sep Flsh Vlv is an adjustable item that turns on the Separator Flush Valve output.

SV1 is an adjustable output that turns on the circuit 1 liquid line solenoid valve.

SV2 is an adjustable output that turns on the circuit 2 liquid line solenoid valve.

GasHtgOnOff is an adjustable item used to manually turn the main gas valve output ON/OFF.

Htg Valve is an adjustable item used to manually drive the modulating heating valve open and closed.

SCR Out is an adjustable item used to manually drive the output signal to the SCR.

F&BP Damper is an adjustable item used to manually drive the F&BP damper open and closed.

Htg Stg 1 is an adjustable item that turns on the first stage of heat on units equipped with staged heating.

SCR Ena 1 is an adjustable item that enables the SCR heater.

Htg Stg 2 is an adjustable item that turns on the second stage of heat on units equipped with staged heating.

SCR Ena 1 is an adjustable item that enables the SCR heater.

Htg Stg 3 is an adjustable item that turns on the third stage of heat on units equipped with staged heating.

Htg Stg 4 is an adjustable item that turns on the fourth stage of heat on units equipped with staged heating.

Htg Stg 5 is an adjustable item that turns on the fifth stage of heat on units equipped with staged heating.

Htg Stg 6 is an adjustable item that turns on the sixth stage of heat on units equipped with staged heating.

Reheat Valve is an adjustable item used to manually drive the reheat valve open and closed.

RH Output is adjustable output that turns on the Reheat valve output.

LSCRH Valve is adjustable output that turns on the Liquid Subcooler Reheat Valve output

HGBP Valve is an adjustable item used to manually drive the HGBP Valve open and closed.

ERec Wheel is an adjustable item which is used to turn on/off the energy recovery wheel output.

ERec Whl Cmd is an adjustable item is an adjustable item which is used to set the energy recovery wheel VFD speed.

ERBP Dmpr Cl is an adjustable item which is used to close the energy recovery bypass damper.

ERBP Dmpr OP is an adjustable item which is used to open the energy recovery bypass damper.

Cond Wtr Pump is an adjustable item which is used to turn on/off the condenser water pump output.

Alm Output is an adjustable item which is used to turn on/off the alarm output.

FanOp is an adjustable item which is used to turn on/off the fan operation output.

NOTE: When Manual Control is set to ManCtrl, the Control Mode is set to OFF so that the unit will not restart automatically. When Manual Control is set to Normal all digital outputs in the Manual Control menu are set to OFF and all the analog outputs are set to 0.0% so that all outputs are in the OFF or minimum position when Manual Control is set to ManCtrl.

Service Menus

Timer Settings Menu

The Timer Settings Menu is also available from the Commission Unit Menu, and is described on page 36

Save/Restore Menu

The Save/Restore menu can be used to save or restore the user configured parameters as well as reset the controller back to the factory default parameters.

Table 38: Save/Restore Menu

Item Display Name	Default Setting	Range	Password Level
Save Params=	No	No/Yes	2
Rstr Params=	No	No/Yes	2
Rstr Factory=	No	No/Yes	2
SaveToCard=	No	No/Yes	2
LoadFromCard	No	No/Yes	2

Save Params is an adjustable item used to save the current parameters and configuration.

Rstr Params is an adjustable item used to restore the current parameters and configuration.

Rstr Factory is an adjustable item used to restore the factory parameters and configuration.

SaveToCard is an adjustable item used to save the current parameters and configuration to an SD card.

LoadFromCard is an adjustable item used to restore the current parameters and configuration from an SD card.

NOTE: The controller will automatically perform a reset when the value of Load From Card is changed from No to Yes and the enter button is pushed.

Active Alarms Menu

All active alarms as well as the date and time that they were detected are displayed on the Active Alarm menu. These alarms are displayed in order of group priority: Faults first, Problems second, and Warnings last. Within each group, alarms are displayed in the order that they were detected.

Table 39: Active Alarm Menu

Item Display Name	Default Setting	Range	Password Level
Active Alm Count=	—	0–10	None
ClrAlms=	No	No ClrFlts ClrPrblms ClrWrngs ClrAllAlms	None
+Alarm 1:Alarm Type	—		None
+Alarm 2:Alarm Type	—		None

Event Log Menu

The last fifty events (such as variable compressor unloading events, both detection and return to normal) as well as the date and times that they were detected are displayed on the Event Log menu. These events are displayed in the order that they were detected. The event that was detected most recently is displayed first. Multiple occurrences of the same event may appear.

Table 40: Possible Standby Events

Standby Event Enumeration	Enumeration Text	Description
0	None	No Active Standby Events
1	ClgLP	Cooling Low Pressure Unloading Control Standby
2	ClgHP	Cooling High Pressure Unloading Control Standby
3	HtgLP	Heating Low Pressure Unloading Control Standby
4	HtgHP	Heating High Pressure Unloading Control Standby
5	ClgLoDP	Cooling Low Differential Pressure Protection Control Standby
6	HtgLoDP	Heating Low Differential Pressure Protection Control Standby
7	INVDLT	Inverter Compressor High Discharge Line Temperature Unloading Control Standby
8	OfanFlt	Outdoor Fan Fault Standby
13	INVPrb	Inverter Compressor Problem Standby (mod bus)

ClgLP= is a standby event that will take place when the PTS < 9.957 PSI.

ClgHP= is a standby event that will take place when the PTD > 579 PSI. continuously for 10 minutes or PTD> 579 PSI and OAT < 45°F

HtgLP= is a standby event that will take place when the PTS < 9.67 PSI while in heating mode and not in defrost mode.

HtgHP= is a standby event that will take place when the PTD > 527.6 PSI.

ClgLoDP= is a standby event that will take place when the PTD-PTS <73.9 PSI continuously for stage time plus 40 seconds.

HtgLoDP= is a standby event that will take place when the PTD-PTS <73.9 PSI continuously for stage time plus 40 seconds, in the heating mode.

INVDLT= is a standby event that will take place when the HDRT1 > 250°F continuously for 3 minutes or HDRT1 > 275°F

OfanFlt= is a standby event that will take place when the controller receives a condenser fan fault from the VFD.

INVCmpT= is a standby event that will take place when the controller receives a high compressor body temperature reference.

Alarm Log Menu

The last fifty alarm events (alarm detection and return to normal) as well as the date and times that they were detected are displayed on the Alarm Log menu. These alarm events are displayed in the order that they were detected. The alarm event that was detected most recently is displayed first. Multiple occurrences of the same alarm may appear.

Table 41: Alarm Log Menu

Item Display Name	Default Setting	Range	Password Level
Log Alm Count=	—	0–50	None
ClrLog=	No	No Yes	None
+Alarm 1:Alarm Type	—		None
+Alarm 2:Alarm Type	—		None

Once an alarm is cleared there will be two entries in the Alarm Log. A (+) sign will be shown next to the entry added when the alarm became active and a (-) sign will be shown next to the entry added when the alarm has been cleared.

Alarm Configuration Menu

The Alarm Configuration menu is also available under the Commission Unit menu. Refer to page 61.

Table 42: Alarm Configuration Menu

Item Display Name	Default	Range	Password level
Alarm Config			
Emerg Stop=	Man clr	Man clr / Auto Clr	2
AlmLogToSD=	No	No / English / SI	2
Event Config			
Show Events=	Yes	No / yes	2
EventLogToSD=	No	No / English / SI	2
Snapshot Config			
Ena Snapshots=	Yes	No / yes	2
Show Snapshots	Yes	No / yes	2
Snapshots to SD	No	No / English / SI	2

Emergency stop= is an selectable item to allow the emergency stop to clear automatically upon resolution or require a manual clearing of the fault.

AlmLogToSD= is a selectable item that will enable the transfer of the alarm log to the controllers SD Card reader in English or SI units or not at all.

Show Events= is a selectable item to allow for masking the HMI display of events. Controller reset is required when “show events” is changed.

EventLogToSD= is a selectable item that will enable the transfer of the event log to the controllers SD Card reader in English or SI units or not at all.

Ena Snapshots= is a selectable item to enable or disable the recording of certain unit operating conditions at the moment of an alarm or event occurance.

Show Snapshots= is a selectable item to allow for masking the HMI display of snapshots. Controller reset is required when “show snapshots” is changed.

Snapshots to SD= is a selectable item that will enable the transfer of the snapshots to the controllers SD Card reader in English or SI units or not at all.

Analog Input Status Menu

The Analog Input Status Menu provides diagnostic information to qualified service personnel. The items listed in this menu will provide current status information of the unit’s analog inputs. The value shown is the input resistance shown in 1/10th of an ohm scale. Example: MCB-AI1 (DAT sensor) shows a value of 181380, the actual resistance would be 18,138 ohms. This would translate to a temperature of 53.5 ºF.

Table 43: Analog Input Status Menu

Item Display Name	Default Setting	Range	Password Level
MCB-AI1=	—	0–99999999	2
MCB AI2=	—	0–99999999	2
MCB AI3=	—	0–99999999	2

Universal I/O Status Menu

The Universal I/O Status Menu provides diagnostic information to qualified service personnel. The items listed in this menu will provide current status information of the Universal inputs and outputs. If the universal I/O is configured for resistance, the value will be displayed in 1/10th ohm scale. If the I/O is configured for mA, the value will be displayed in micro amps (1 mA = 1000 micro amps). If I/O is configured for voltage, the value is displayed in 1/1000th volt scale. Example: MCB-X7 (OA Damper analog output) shows a value of 3000, this would translate into 3 VDC.

Table 44: Universal I/O Status Menu

Item Display Name	Default Setting	Range	Password Level	Item Display Name	Default Setting	Range	Password Level
MCB X1=	—	0–9999999	2	EMC X1=	—	0–9999999	2
MCB X2=	—	0–9999999	2	EMC X2=	—	0–9999999	2
MCB X3=	—	0–9999999	2	EMC X3=	—	0–9999999	2
MCB X4=	—	0–9999999	2	EMC X4=	—	0–9999999	2
MCB X5=	—	0–9999999	2	EMC X5=	—	0–9999999	2
MCB X6=	—	0–9999999	2	EMC X6=	—	0–9999999	2
MCB X7=	—	0–9999999	2	EMC X7=	—	0–9999999	2
MCB X8=	—	0–9999999	2	EMC X8=	—	0–9999999	2
EMA X1=	—	0–9999999	2	EMD X1=	—	0–9999999	2
EMA X2=	—	0–9999999	2	EMD X2=	—	0–9999999	2
EMA X3=	—	0–9999999	2	EMD X3=	—	0–9999999	2
EMA X4=	—	0–9999999	2	EMD X4=	—	0–9999999	2
EMA X5=	—	0–9999999	2	EMD X5=	—	0–9999999	2
EMA X6=	—	0–9999999	2	EMD X6=	—	0–9999999	2
EMA X7=	—	0–9999999	2	EMD X7=	—	0–9999999	2
EMA X8=	—	0–9999999	2	EMD X8=	—	0–9999999	2
EMB X1=	—	0–9999999	2	EME X1=	—	0–9999999	2
EMB X2=	—	0–9999999	2	EME X2=	—	0–9999999	2
EMB X3=	—	0–9999999	2	EME X3=	—	0–9999999	2
EMB X4=	—	0–9999999	2	EME X4=	—	0–9999999	2
EMB X5=	—	0–9999999	2	EME X5=	—	0–9999999	2
EMB X6=	—	0–9999999	2	EME X6=	—	0–9999999	2
EMB X7=	—	0–9999999	2	EME X7=	—	0–9999999	2
EMB X8=	—	0–9999999	2	EME X8=	—	0–9999999	2

Digital Input Status Menu

The Digital Input Status Menu provides diagnostic information to qualified service personnel. The items listed in this menu will provide current status information of the controller's digital inputs.

Table 45: Digital Input Status Menu

Item Display Name	Default Setting	Range	Password Level
MCB DI1=	OFF	OFF/ON	2
MCB-DI2=	OFF	OFF/ON	2
MCB DI3=	OFF	OFF/ON	2
MCB DI4=	OFF	OFF/ON	2
MCB DI5=	OFF	OFF/ON	2
MCB DI6=	OFF	OFF/ON	2

Digital Output Status Menu

The Digital Output Status Menu provides diagnostic information to qualified service personnel. The items listed in this menu will provide current status information of the controller's digital outputs.

Table 46: Digital Output Status Menu

Item Display Name	Default Setting	Range	Password Level
MCB DO1=	OFF	OFF/ON	2
MCB DO2=	OFF	OFF/ON	2
MCB DO3=	OFF	OFF/ON	2
MCB DO4=	OFF	OFF/ON	2
MCB DO5=	OFF	OFF/ON	2
MCB DO6=	OFF	OFF/ON	2
MCB DO7=	OFF	OFF/ON	2
MCB DO8=	OFF	OFF/ON	2
MCB DO9=	OFF	OFF/ON	2
MCB DO10=	OFF	OFF/ON	2
EMA DO1=	OFF	OFF/ON	2
EMA DO2=	OFF	OFF/ON	2
EMA DO3=	OFF	OFF/ON	2
EMA DO4=	OFF	OFF/ON	2
EMA DO5=	OFF	OFF/ON	2
EMA DO6=	OFF	OFF/ON	2
EMB DO1=	OFF	OFF/ON	2
EMB DO2=	OFF	OFF/ON	2
EMB DO3=	OFF	OFF/ON	2
EMB DO4=	OFF	OFF/ON	2
EMB DO5=	OFF	OFF/ON	2
EMB DO6=	OFF	OFF/ON	2

Item Display Name	Default Setting	Range	Password Level
EMC DO1=	Off	Off/On	2
EMC DO2=	Off	Off/On	2
EMC DO3=	Off	Off/On	2
EMC DO4=	Off	Off/On	2
EMC DO5=	Off	Off/On	2
EMC DO6=	Off	Off/On	2
EMD DO1=	Off	Off/On	2
EMD DO2=	Off	Off/On	2
EMD DO3=	Off	Off/On	2
EMD DO4=	Off	Off/On	2
EMD DO5=	Off	Off/On	2
EMD DO6=	Off	Off/On	2
EME DO1=	Off	Off/On	2
EME DO2=	Off	Off/On	2
EME DO3=	Off	Off/On	2
EME DO4=	Off	Off/On	2
EME DO5=	Off	Off/On	2
EME DO6=	Off	Off/On	2

Network Input Status Menu

The Network Input Status Menu provides diagnostic information to qualified service personnel. The items listed in this menu will provide current status information of the controller's network inputs.

Table 47: Network Input Status Menu

Item Display Name	Default Setting	Range (No Network value in Bold)	Password Level
Net OAT In=	—	-50.0–200.0°F **(621.8°F)**	2
Net SpaceT In=	—	-0.0–150.0°F **(621.8°F)**	2
NetCurrState=	—	Occ	2
		Unocc	
		TntOvrd	
		Standby	
		Auto	
		(NULL)	
NetNextState=	—	Occ	2
		Unocc	
		TntOvrd	
		Standby	
		Auto	
		(NULL)	
NetTmToNxtSt=	—	0–65534min **(65535min)**	2
Net App Mode=	—	Off	2
		HeatOnly	
		CoolOnly	
		FanOnly	
		Auto	
		(Auto)	
Net Cl Ena Sw=	—	-1.0–1.0**(-1.0)**	2

Item Display Name	Default Setting	Range (No Network value in Bold)	Password Level
Net Cl Ena Vl=	—	0–255% **(255%)**	2
Net Ht Ena Sw=	—	-1.0–1.0 **(-1.0)**	2
Net Ht Ena Vl=	—	0–255% **(255%)**	2
Net Ec Ena Sw=	—	-1.0–1.0 **(-1.0)**	2
Net Ec Ena Vl=	—	0-255% **(255%)**	2
Net SAF Cap=	—	0–100% **(164%)**	2
Net ExhF Cap=	—	0–100% **(164%)**	2
Net Space IAQ=	—	0–5000ppm **(65535ppm)**	2
Net Rel Humid=	—	0-100% **(164%)**	2
Net DATClgSpt=	—	40.0–100.0°F	2
Net DATHtgSpt=	—	40.0–140.0°F	2
nviSetpoint=	—	0.0-100.0°F **(621.8°F)**	2
OccManCmd=	—	Occ	2
		Unocc	
		TntOvrd	
		Standby	
		Auto	
Net MinOA=	—	0–100%	2
nvoEffSpt=	—	0.0–100.0°F	2
nciOccClgSpt=	—	0.0–100.0°F	2
nciOccHtgSpt=	—	0.0–100.0°F	2
nciHVACType=	—	HVT_GEN	2

Modbus Status Menu

The Modbus Status Menu provides diagnostic information to qualified service personnel. The items listed provide the status of the Modbus communications with the various devices controlled by the internal Modbus network

Table 48: Modbus Status Menu

Item Display Name	Default Setting	Range	Password Level
SF MB Status=	—	Fault/OK	2
RFEF MB Status=	—	Fault/OK	2
ER MB Status=	—	Fault/OK	2
IFB MB Status=	—	Fault/OK	2
D3 MB Status=	—	Fault/OK	2
MB Resistance=	Yes	Yes/No	2
ECM Config=	Done	Set Add 1 Set Add 2 Set AICtl	2

SF MB Status is a status only item which indicates the status of the Modbus communications between the main controller and the supply fan motor.

RFEF MB Status is a status only item which indicates the status of the Modbus communications between the main controller and the return/exhaust fan motor.

ER MB Status is a status only s item which indicates the status of the Modbus communications between the main controller and the energy recover wheel variable speed supply air fan.

IFB MB Status is a status only item which indicates the status of the ModBus communication between the IFB board and the main controller.

D3 MB Status is a status only item which indicates the status of the ModBus communication between the D3 Gateway and the main controller.

MB resistance is status of the terminating resistors for the ModBus line

ECM Config is the area in which you are able to change addressing of any one of the ECB motors contained in the unit.

D3 Status Menu

The D3 Status menu is provided for viewing the status of an interface with the unit via a D3 gateway. Refer to IM 1133 – DIII-Net Communication Gateway for detailed information.

Table 49: D3 Status Menu

Item Display Name	Default Setting	Range	Password Level
D3 Comm Sts=	—	OK	2
		Error	
D3 Addr Err=	—	OK	2
		Error	
D3 On/Off=	—	On	2
		Off	
D3 Mode=	—	Auto	2
		Cooling	
		Heating	
		Fan	
D3 Clg Spt=	—	0–100ºF	2
D3 Htg Spt=	—	0–120ºF	2
D3 SAF Spd=	—	NA	2
		Low	
		Med	
		High	
D3 Min Load=	—	0–100%	2
D3 Max Load=	—	0–100%	2
D3 Eco Ena=	—	Enabled	2
		Disabled	
OA Enthalpy=	—	0–86 BTU/lb	2
OA Hum Ratio= g/kg	—	0–30 g/Kg	2
D3 SWVers=	—	XXXXXXXXXX	2
OAAdd1–16=	—	XXXXXXXX	2
OAAdd17–32=	—	XXXXXXXX	2
OAAdd33–49=	—	XXXXXXXX	2
OAAdd50–64=	—	XXXXXXXX	2
SetOAAddr=	0	0–64	2
CurrOAAddr=	—	0–64	2
CurrOAAmps=	—	0–200A	2
CurrOARLA=	—	0–200A	2

Sensor Offsets Menu

The Sensor Offsets Menu provides a means of calibrating the various temperature sensor inputs to the unit. Each sensor can be “biased” by as much as +/- 10.0°F.

The number of the sensors that appear are dependent on the configuration of the unit.

Table 50: Sensor Offset Menu

Item Display Name	Default Setting	Range	Password Level
Disch Air=	0.0°F	0.0–10.0°F	2
Return Air=	0.0°F	0.0–10.0°F	2
SpaceTemp=	0.0°F	0.0–10.0°F	2
OA Temp=	0.0°F	0.0–10.0°F	2
ER LAT=	0.0°F	0.0–10.0°F	2
ER EAT=	0.0°F	0.0–10.0°F	2
DRT1=	0.0°F	-10.0–10.0°C	2
DRT2=	0.0°F	-10.0–10.0°C	2

Sensor Offsets Menu

The HMI set up menu provides the means of defining the viewing of the information on the HMI being used, including contrast of the information displayed and the color of the back light. Note: Each HMI has it own individual contrast and backlight settings.

Item Display Name	Default Setting	Range	Password Level
Contrast	0	-40 - +40	2
BackLight	white	White / Blue	2
PBusPwrSply	On	On / Off	2

Unit Maintenance

Operating Hours

The Operating Hours menu gives a summary of the hours of operation for each of the supply fans, return/exhaust fans, compressors, heating and economizer operation.

Table 51: Operating Hours Menu

Item Display Name	Default Setting	Range	Password Level
Supply Fan=	—	0–50000H	6
Ret/Exh Fan=	—	0–50000H	6
Mech Cool=	—	0–50000H	6
Comp # 1=	—	0–50000H	6
Comp # 2=	—	0–50000H	6
Comp # 3=	—	0–50000H	6
Comp # 4=	—	0–50000H	6
Comp # 5=	—	0–50000H	6
Comp # 6=	—	0–50000H	6
Comp # 7=	—	0–50000H	6
Comp # 8=	—	0–50000H	6
Heating=	—	0–50000H	6
Economizer=	—	0–50000H	6
Tnt Override=	—	0–50000H	6
Dehumid=	—	0–50000H	6
ER Wheel=	—	0–50000H	6
Exh Out 1=	—	0–50000h	4
Exh Out 2=	—	0–50000h	4
Reheat=	—	0–50000h	4
Comp Cooling=	—	0–50000H	6
INV Comp=	—	0–50000H	6
Cmp Heating=	—	0–50000H	6
Var Comp=	—	0–50000H	6

Supply Fan is a status item which gives the number of hours the supply fan has operated.

Return/Exhaust Fan is a status item which gives the number of hours the return/exhaust fans have operated.

Mech Cool is a status item which gives the number of hours that mechanical cooling has operated.

Comp #1 is a status item which gives the number of hours that compressor #1 has operated.

Comp #2 is a status item which gives the number of hours that compressor #2 has operated.

Comp #3 is a status item which gives the number of hours that compressor #3 has operated.

Comp #4 is a status item which gives the number of hours that compressor #4 has operated.

Comp #5 is a status item which gives the number of hours that compressor #5 has operated.

Comp #6 is a status item which gives the number of hours that compressor #6 has operated.

Comp #7 is a status item which gives the number of hours that compressor #7 has operated.

Comp #8 is a status item which gives the number of hours that compressor #8 has operated.

Heating is a status item which gives the number of hours that the heating mode has operated.

Economizer is a status item which gives the number of hours that the economizer has operated.

Tnt Override is a status item which gives the number of hours that the unit has operated in the Tenant Override mode of operation.

Dehumid is a status item which gives the number of hours that the dehumidification has operated.

ER Wheel is a status item which gives the number of hours that the energy recovery wheel has operated.

Exh Out 1 is a status item which gives the number of hours the first stage exhaust fan has operated.

Exh Out 2 is a status item which gives the number of hours the second stage exhaust fan has operated.

Reheat is a status item which gives the number of hours the Reheat has operated.

Comp Cooling is a status item which gives the number of hours that a compressor has operated during cooling.

Inv Comp is a status item which gives the number of hours that a inverter compressor has operated during cooling.

Var Comp is a status item which gives the number of hours that a variable speed compressor has operated during cooling.

Cmp Heating is a status item which gives the number of hours that a compressor has operated during heating (heat pump).

BMS Communications Menu

LON/BACnetIP/BACnetMSTP Setup Menu

See the Installation & Maintenance Manuals for detailed instructions

- IM 916, IM 917, IM 918 manuals have been condensed into one manual for all protocols ED 15112

Network Unit Set-up Menu

The Network Unit Set-up menu provides one location for the Set-up of items that can be controlled via a network BMS system.

Table 52: Network Unit Set-up Menu

Item Display Name	Default Setting	Range	Password Level
Space Sensor=	Digtl/Net	None	2
		Anlog/Net	
		Digtl/Net	
Unit Mode Settings			
Ctrl Mode=	OFF	OFF	2
		Heat Only	
		Cool Only	
		Fan Only	
		Heat/Cool	
		Auto/Net	
Occ Mode=	Auto/Net	Occ	2
		Unocc	
		TntOvrd	
		Auto/Net	
Reset Options			
Clg Reset=	None	None	2
		Network	
		Space	
		Return	
		OAT	
		ExtmA	
		ExtV	
		Airflow	
Htg Reset=	None	None	2
		Network	
		Space	
		Return	
		OAT	
		ExtmA	
		ExtV	
		Airflow	
AplyMinOAChg=	No	No, Yes	2
Min OA Reset=	None	None	2
		Network	
		Ext VDC	
		Ext mA	
		IAQ VDC	
		IAQ mA	

Item Display Name	Default Setting	Range	Password Level
Heat/Cool Changeover			
Ctrl Temp Src=	RAT	RAT	2
		Space	
		MAT	
		OAT	
		None	
AplyTstatChg=	No	No	2
		Yes	
UseTstatSpt=	No	No	2
		Yes	
Oc c Clg Spt=	72.0°F	0.0–100.0°F	2
Occ Htg Spt=	68.0°F	0.0–100.0°F	2
Fan Control Options			
SAF Ctrl=	DSP	DSP	2
		Spd/Net	
		1ZnVAV	
		BPS	
		CO_2	
		CFM	
RFEF	BldgP	None	2
		Tracking	
		BldgP	
		Spd/Net	
		OA Damper	

Unit Configuration

Unit Configuration Setup Menu

After the main control board application software is loaded into the MCB, it must be “configured” for the specific control application. This consists of setting the value of 25 configuration variables within the MCB. These variables define things such as the type of cooling, number of compressors and cooling stages and the type of heat. If all of these items are not set appropriately for the specific unit, the unit will not function properly. The correct settings for these parameters are defined for a given unit by the unit “Software Configuration Code.”

The “Software Configuration Code” consists of a 29-character string of numbers and letters. The code can be found on the Unit Software Identification Label located on the back side of the control panel door.

Table 53 lists the configuration code variables including the position within the code, description of the parameter, and the applicable settings for each. The default values are shown in bold font. The unit is configured at the factory however may also be configured in the field by accessing the Unit Configuration Menu. Once changes have been made to the Unit Configuration Menu, the Apply Changes flag must be changed from no to yes in order for the controller to recognize the changes. Setting the Apply Changes flag to yes will automatically rest the controller.

Table 53: Unit Configuration Menu

Configuration Code Position	Description	Values (Default in Bold)	Special Condition	RTU	MPS	DPS	DPS_H	SCU
1	Unit Type	**0=Applied Rooftop (RTU)**		•	•	•	•	•
		1=Self-Contained (SCU)						
		2=Commercial Rooftop (MPS)						
		3=Rebel Cool Only (DPS)						
		4=Rebel Heat Pump (DPH)						
2	Control Type	0=Zone Control		•	•	•	•	•
		1=DAT Control						
		2=1ZoneVAV						
3	Cooling Type	0 = None		•	•	•	•	•
		1=Standard Compressorized Clg						
		2=Chilled Water						
		3=F&BP						
		4=Variable Comp Circuit 1						
		5=Variable Comp Circuit 2						
		6=NA						
		7=NA)						
		8=NA)						
		9=Digital Comp 1 Circuit						
		10=Digital Comp 2 Circuits						
4	Compressorized Cooling Configuration	0=None		•	•	•	•	•
		1=Generic Condenser						
		2=2Cmp/2Circ/3Stg						
		3=3Cmp/2Circ/4Stg						
		4=2Cmp/2Circ/2or6StgorVar (6 stg if 7=2,3,4or5)						
		5=3Cmp/3Circ/3Stg_NoWRV						
		6=3Cmp/3Circ/3Stg_WRV						
		7=4Cmp/2Circ/4StgorVar						
		8=4Cmp/4Circ/4Stg_NoWRV						
		9=4Cmp/4Circ/4Stg_WRV						
		A=6Cmp/2Circ/6StgorVar						
		B=6Cmp/6Circ/6Stg_NoWRV						
		C=6Cmp/6Circ/6Stg_WRV						
		D=3Cmp/2Circ/5StgorVar						
		E=4Cmp/2Circ/5or8Stg) (8 stg if 7=2,3,4or5)						
		F=8Cmp/4Circ/8Stg						
		G=8Cmp/8Circ/8Stg						
		H=6Cmp/3Circ/6Stg						
		I=Not Used						
		J=3 Cmp/3Circ/4Stg						
		K=Spare						
		L=1Var/1Circ						
		M=Var/1STD/1Circ						

Table 53 continued: Unit Configuration Menu

Configuration Code Position	Description	Values (Default in Bold)	Special Condition	RTU	MPS	DPS	DPS_H	SCU
5	Generic Condenser Stages/ VFD Comp Cfg	1 – 8 Stages **(default = 8)**/ 0=NA		•	• (if 4=4, 5or 6)	• (if 4=4, 5or 6)		
		1=Single						
		2=Tandom						
		3=Trio						
6	Low Ambient	**0 = No**	This position currently has no effect on unit operation.					
		1 = Yes						
7	Condenser Control	0=Std Method 1		•	•	•	•	
		1=Std Method 2						
		2=Evap ABB						
		3=Evap MD2						
		4=Evap MD3						
		5=Evap DF						
		6=Not Used						
		7=EBM						
		8=INV						
		9=INV w/MicroC OA Coil						
8	Damper Type	0=None	Values 1, 2, 5 & 7 only apply if Position 1 = 0 (RTU), 2 (MPS), 3 or 4 (DPS) Value 4 only applies if Position 1 = 1 (SCU)	•	•	•	•	•
		1=Single Position 30%						
		2=Single Position 100%						
		3=Economizer Airside						
		4=Economizer Waterside						
		5=100%OA_D3						
		6=AirEcon_D3						
		7=30%_DOAS						
		8=EconoAirsideFDD						
		9=D3EconFDD						
9	OA Flow Station	**0=None**		•	•	•	•	•
		1=DF_015-030 (800)						
		2=DF_036-042 (802)						
		3=DF_045-075 (047)						
		4=DF_080-135 (077)						
		5=Generic Flow Station						
		6=Generic Flow Station w/CO2						
		7=Ebtron MB						
10	Heating Type	**0=None**		•	•	•	•	•
		1=F&BP Control						
		2=Staged						
		3=Modulated Gas, 3-1						
		4=Modulated Gas 20-1						
		5=Steam or Hot Water						
		6=SCR Electric						
		7=MPSLoGas						
		8=MPSHiGas						
11	Max Heating Stages	1-8 Stages **(Default = 1)**		•	•	•	•	•
12, 13, 14	Max Heat Rise	Three Digits (Default = 100)		•	•	•	•	•
15	Supply Fan Type	**0=Constant Volume**		•	•	•	•	•
		1=VFD/ABB						
		2=VFD/DF						
		3=VFD/MD2						
		4=VFD/MD3						
		5=VFD/MD6						
		6=EBMVAV						
		7=EBMCAV						
16	Return Fan Type	**0=CAV**		•	•	•	•	
		1=RF_EF VFD/ABB						
		2=RF_EF VFD/DF						
		3=RF_EF VFD/MD2						
		4=RF_EF VFD/MD3						
		5=RF_EF VFD/MD6						
		6=PrpEx VFD/ABB						
		7=PrpEx VFD/DF						
		8=PrpEx VFD/MD2						
		9=PrpEx VFD/MD3						
		A=PrpEx VFD/MD6						
		B=None						
		C=1StageExh						
		D=2StageExh						
		E=3StageExh						
		F=EBMVAV						
		G=EBMCAV						

Table 53 continued: Unit Configuration Menu

Configuration Code Position	Description	Values (Default in Bold)	Special Condition	RTU	MPS	DPS	DPS_H	SCU
17	Return/Exhaust Fan Capacity Control Method	0=None		•	•	•	•	
		1=Tracking						
		2=Building Pressure						
		3=Speed						
		4=OADamper						
18	Second Duct Pressure Sensor	**0=No**		•				•
		1= Yes						
19	Entering Fan Temp Sensor	**0=No**		•	•	•	•	
		1=Yes						
20	Energy Recovery	**0=None**		•	•	•	•	
		1=ConstSpdWhl/NoRH						
		2=VarSpdWhl/Danfoss						
		3=VarSpdWhl/MD2						
		4=VarSpdWhl/MD3						
		5=VarSpdWhl/ABB						
		6=ConstSpdWhl/wRH						
21	Cooling Circuit Type	**0=Individual**	Values 0 and 1 are valid only when Position 1 = 1 (SCU)	•	•			•
		1=2,3 or 4 Circ. Water Condenser 2=2 Circ. Air Condenser						
22	Head Pressure Control	**0=No**	This position is valid only when Position 1 = 1 (SCU).					•
		1=Yes						
23	Bypass Valve Control	**0=Slave**	This position is valid only when Position 1 = 1 (SCU).					•
		1=Bypass						
24, 25, 26	Unit Size	Three digits **(default 050)**		•	•	•	•	•
27	Refrigerant Type	**0=R22**		•	•	•	•	•
		1=R407C						
		2=R410A						
28	Reheat Type	**0=None**		•	•	•	•	
		1=StgHG						
		2=ModHG						
		3=StdHtRht						
		4=ModLSC						
		5=ModHG&LSC						
29	Unit Voltage	0=208/60Hz		•	•	•	•	•
		1=230/60Hz						
		2=460/60Hz						
		3=575/60Hz						
		4=208/50Hz						
		5=230/50Hz						
		6=460/50Hz						
		7=575/50Hz						
30	EVType	0=None				•	•	
		1=EVB_Sag						
		2=EVB_DF						
		3=MTIII_Sag						
		4=MTIII_DF						
		5=MTIII_Sag_DF						
		6=MTIII_DF_Sag						

Alarm Lists Menu

The Alarm Lists Menu is also available from the Service Menu and is described on page 66.

Trending Menus

The Trending Menus allow for setting up and managing onboard trending of up to 30 data points within the controller. This data can then be exported to an SD card. The trending memory will begin over-writing the oldest existing data in the controller's memory when the allocated trending memory fills up. If an SD card is installed in the controllers SD card reader slot, an automatic export of the data will occur every night at midnight.

Table 54: Trending Menu

Item Display Name	Default Setting	Range	Password Level
Trending Ena=	No	No	2
		Yes	
Apply Chgs=	No	No	2
		Yes	
Sample Time=	300s	1–3600s	2
TrendOnOff=	Off	Off	2
		On	
AutoExpTime=	1440m	0–1440m	2
Export Data=	No	No	2
		Yes	
Clear Trend=	Done	Done	2
		ClrData	
		ClrCfg	
Trend Full=	Wrap	Stop	2
		Wrap	
Default Trend=	No	No	2
		Yes	

Trending Ena is an adjustable item which enables and disables the on board trending function.

Apply Changes is an adjustable item which must be set to make changes to trending point definitions and sampling rate take effect.

Sample Time is an adjustable item used to the sampling rate for trending data points.

TrendOnOff is an adjustable item which starts and stops the on board trending function.

Auto Exp Time is an adjustable item that determines when the trends are loaded onto the SD card. If left at the default 1440 trends data is exported to the SD card once a night at 11:59 PM. If set at something other than 1440 all accumulated trend data will be transfered to the SD card at that interval.

Export Data is an adjustable item which initiates a manual export of the current on board trend data to an SD card.

Clear Trend is an adjustable item used to either clear only the current trend data or the entire trend configuration.

Trend Full is a changeable item that determines when the trend data is full does it wrap the data or stop.

Default Trend data is a selectable item that will select a predetermined set of data to be trended 30 points for all units, if selected to Yes.

Selection of Trending Points

There are 97 individual points that can be monitored. Trending allows the user to select 30 points to record. The technician can chose between three ways to set up Trending.

1. Manual selection of the points desired to monitor.
2. Selection of the Default Trending list.
3. Selection of the Default list and modifying that list.

Manual Selection

Points 1 through 30 are divided into six groups of five points each.When entering a group the point will be listed and below that will be three lists, list 1, list 2, and list 3, to choose from. List one contains 36 items to choose from along with the Object ID andType. List 2 contains 32 items with Object ID's and type, and List 3 contains 29 items with Object ID's and type. Refer to Table 55 and Table 56 to see the charts of the three points lists.

Entering the trend points 1-5 for manual input the screen should like the example below.

Example

Points 1-5
Point 1
List 1= None
List 2= None
List 3= None
ID F0AF0000
Type 0000
Member 0100

Using the three points list grids on the next page work through the selection of the two points below. For point 1 select supply fan capacity and point 2 select discharge air temp. By finding the corresponding reference on one of the three points lists provided you also have the object ID and Type; Supply fan capacity (points list 3) SAF%, Discharge Air Temp (points list 1) DAT. The screens should look like:

Points 1-5
Point 1
List 1= None
List 2= None
List 3= SAF%
ID F0AF5BDF
Type 230B
Member 0100

Points 1-5
Point 2
List 1= DAT
List 2= None
List 3= None
ID F0AF538E
Type 2203
Member 0100

Table 55: Trending Points Lists for DPS Units

Trend Point List 1			
Enum Text	**Object Name**	**Object ID**	**Object Type**
ACS1	INV_IFInptStatus	0xF0AFC5F0	0x230B
ACS3	EV_IFInptStatus	0xF0AF08FE	0x230B
ActEvnt	ActiveEvents	0xF0AFA993	0x230A
AFSts	Airflow	0xF0AFB26D	0x2204
Alm	Alarm Enumeration	0xF0AFCF76	0x230A
BSP	Bldg Press	0xF0AFC4BB	0x2203
Clg%	ClgCapacity	0xF0AFF4B5	0x230A
ClgSt	Clg State	0xF0AF3991	0x230B
ClgSts	Clg Status	0xF0AFF6A6	0x230B
CO2	IAQ PPM	0xF0AF7F77	0x2203
CtlCrdT	CtrlCardTemp	0xF0AFE952	0x2203
CtrlT	ControlTemp	0xF0AF3701	0x2203
DAClgSp	DAT Clg Spt	0xF0AF64FD	0x2300
DAHtgSp	DAT Htg Spt	0xF0AF6054	0x2300
DAT	DAT	0xF0AF538E	0x2203
DeHmSts	Dehum Status	0xF0AF56EA	0x230B
Dewpt	Dewpoint	0xF0AF532C	0x230A
DewptSp	Dewpoint Spt	0xF0AF75C1	0x2300
DFSt	Defrost State	0xF0AFBD68	0x230B
DFT	DFT	0xF0AFCA19	0x2203
DRT1	DRT1	0xF0AFD8D7	0x2203
DRT3	DRT3	0xF0AFF895	0x2203
DSH	Discharge SH	0xF0AF33F2	0x230A
DSP	Duct Press	0xF0AF143C	0x230A
EcoSts	Econo Status	0xF0AFC1AB	0x230B
EFMBSts	RFEF MB Status	0xF0AFAB24	0x230B
EffMnINV	EffMinINVRps	0xF0AF3D0A	0x230A
EffMxINV	EffMaxINVRps	0xF0AFB58E	0x230A
EFT/LCT	EF/LC Temp	0xF0AF356B	0x2203
EREAT	ER EAT	0xF0AF0DBB	0x2203
ERLAT	ER LAT	0xF0AFFD44	0x2203
ERWhl%	Wheel Speed	0xF0AF101D	0x2203
EVI%	EVI Pos	0xF0AF3028	0x2203
EVICmd	EVICmd	0xF0AF2EAF	0x2206
EVO%	EVO Pos	0xF0AF17B1	0x2203
EVOCmd	EVOCmd	0xF0AF0936	0x2206

Trend Point List 2			
Enum Text	**Object Name**	**Object ID**	**Object Type**
HDRT1	HDRT1	0xF0AF4A6D	0x230A
HDRT3	HDRT3	0xF0AF6A2F	0x230A
Htg%	HtgCapacity	0xF0AFF01C	0x230A
HtgSt	Htg State	0xF0AF4BE8	0x230B
HtgSts	Htg Status	0xF0AFD173	0x230B
HtSnkT	HeatsinkTemp	0xF0AFF487	0x2203
IFBCom	ACSCommStatus	0xF0AF6D75	0x230B
INV%	INVSpd	0xF0AFDA3E	0x2203
INVAmps	INVSecAmps	0xF0AFA7E2	0x2203
INVCmd	INVCmd	0xF0AFEC72	0x2206
INVFC	INVAlarmDec	0xF0AF3BDA	0x230A
INVFT	INVFinTemp	0xF0AF88A8	0x2203
INVTmp	INVCompTemp	0xF0AFE60D	0x2203
IRT	IRTemp	0xF0AFE8B8	0x2203
MinOA%	Min OA Pos	0xF0AFEEC9	0x230A
OAD%	OAD_ EconCapOut	0xF0AF6259	0x230A
OAFCmd	OAFanCmd	0xF0AF9E45	0x2206
OAFlw	OA Flow	0xF0AFF10A	0x230A
OAFlwSp	MinOAFlw Spt	0xF0AF6B95	0x2300
OAT	OAT	0xF0AFA37F	0x2203
OcClgSp	Occ Clg Spt	0xF0AFF8A8	0x2300
OcHtgSp	Occ Htg Spt	0xF0AF8A33	0x2300
OcSrc	OccSrc	0xF0AFF838	0x230B
OF1FC	OF1AlarmDec	0xF0AFC9EB	0x230A
OF2FC	OF2AlarmDec	0xF0AFE4AF	0x230A
OF1Spd	OAFan1Spd	0xF0AFB55B	0x2203
OF2Spd	OAFan2Spd	0xF0AF2E87	0x2203
OilMng	OilManagement	0xF0AF2D66	0x2302
OilSts	VCmpOilStatus	0xF0AF1150	0x2204
ORT	ORTemp	0xF0AF6559	0x2203
PTD	PTD	0xF0AF229A	0x2203
PTS	PTS	0xF0AF404C	0x2203

Trend Point List 3			
Enum Text	**Object Name**	**Object ID**	**Object Type**
RAT	Return Air	0xF0AFA24D	0x2203
ReHt%	Reheat Cap	0xF0AF00F8	0x230A
RemEF%	Rem ExhF Cap	0xF0AF1969	0x2300
RemRF%	Rem RF Cap	0xF0AF57A7	0x2300
RemSF%	Rem SAF Cap	0xF0AF211F	0x2300
RFEF%	RF/EF Cap	0xF0AFAECF	0x2203
RH	Rel Humidity	0xF0AF1DDC	0x2203
RHSp	RH Setpoint	0xF0AFFA18	0x2300
RhtSp	Reheat Spt	0xF0AF335D	0x230A
SAF%	SFCapFbk	0xF0AF5BDF	0x2203
SbClg	Subcooling	0xF0AF842E	0x230A
SBEvnt	StandbyEvents	0xF0AFCB3E	0x230B
SFMBSts	SF MB Status	0xF0AF2BDE	0x230B
SpaceT	Space Temp	0xF0AFF74A	0x2203
SpHtSts	SuplHtgStatus	0xF0AF7D21	0x230B
SRT	SRT	0xF0AFC35D	0x2203
SSH	Superheat	0xF0AFB846	0x230A
SSHSpt	EffSHSpt	0xF0AF3144	0x230A
STD3	STD3	0xF0AF03CC	0x2207
SupHt%	Supl Htg Cap	0xF0AF1FEA	0x230A
Tc	Tc	0xF0AF19E9	0x230A
TcSpt	EffTcSpt	0xF0AF7FC1	0x230A
TDef	EffTDef	0xF0AF45E1	0x230A
Teg	Teg	0xF0AFDCFF	0x230A
Tp	INVPortTemp	0xF0AF3BBB	0x230A
UnOcSrc	UnoccSrc	0xF0AFF6B4	0x230B
UnitSt	UnitState	0xF0AF9E60	0x230B
UntSts	Unit Status	0xF0AF4FF0	0x230B
VFDSts	DFCompStatus	0xF0AF64EC	0x230B

Table 56: Trending Points Lists for MPS/RTU/SCU Units

Trend Point List 1			
Enum Text	**Object Name**	**Object ID**	**Object Type**
ActEvnt	ActiveEvents	0xF0AFA993	0x230A
AFSts	Airflow	0xF0AFB26D	0x2204
Alm	Alarm Enumeration	0xF0AFCF76	0x230A
BSP	Bldg Press	0xF0AFC4BB	0x2203
Clg%	ClgCapacity	0xF0AFF4B5	0x230A
ClgSts	Clg Status	0xF0AFF6A6	0x230B
CO2	IAQ PPM	0xF0AF7F77	0x2203
Comp1	Comp 1	0xF0AFAC75	0x2207
Comp2	Comp 2	0xF0AF9C16	0x2207
Comp3	Comp 3	0xF0AF8C37	0x2207
Comp4	Comp 4	0xF0AFFCD0	0x2207
Comp5	Comp 5	0xF0AFECF1	0x2207
Comp6	Comp 6	0xF0AFDC92	0x2207
Comp7	Comp 7	0xF0AFCCB3	0x2207
Comp8	Comp 8	0xF0AF3D5C	0x2207
CtrlT	ControlTemp	0xF0AF3701	0x2203
DAClgSp	DAT Clg Spt	0xF0AF64FD	0x2300
DAHtgSp	DAT Htg Spt	0xF0AF6054	0x2300
DAT	DAT	0xF0AF538E	0x2203
DeHmSts	Dehum Status	0xF0AF56EA	0x230B
Dewpt	Dewpoint	0xF0AF532C	0x230A
DewptSp	Dewpoint Spt	0xF0AF75C1	0x2300
DRT1	Comp1DRT	0xF0AF8C90	0x2203
DRT2	Comp2DRT	0xF0AF174C	0x2203
DSH	Discharge SH	0xF0AF3AF5	0x230A
DSP	Duct Press	0xF0AF143C	0x230A

Trend Point List 2			
Enum Text	**Object Name**	**Object ID**	**Object Type**
EcoSts	Econo Status	0xF0AFC1AB	0x230B
EFMBSts	RFEF MB Status	0xF0AFAB24	0x230B
EFT/LCT	EF/LC Temp	0xF0AF356B	0x2203
EREAT	ER EAT	0xF0AF0DBB	0x2203
ERLAT	ER LAT	0xF0AFFD44	0x2203
EWT	EW Temp	0xF0AFCD6B	0x2203
ERWhl%	Wheel Speed	0xF0AF101D	0x2203
HdPr1	Head P Circ 1	0xF0AFD3C4	0x2203
HdPr2	Head P Circ 2	0xF0AFE3A7	0x2203
Htg%	HtgCapacity	0xF0AFF01C	0x230A
HtgSts	Htg Status	0xF0AFD173	0x230B
MAT	Mixed Air	0xF0AFCD1F	0x2203
MinOA%	Min OA Pos	0xF0AFEEC9	0x230A
OAD%	OAD_EconCapOut	0xF0AF6259	0x230A
OAFlw	OA Flow	0xF0AFF10A	0x230A
OAFlwSp	MinOAFlw Spt	0xF0AF6B95	0x2300
OAT	OAT	0xF0AFA37F	0x2203
OcClgSp	Occ Clg Spt	0xF0AFF8A8	0x2300
OcHtgSp	Occ Htg Spt	0xF0AF8A33	0x2300
OcSrc	OccSrc	0xF0AFF838	0x230B
OilMng	OilManagement	0xF0AF2D66	0x2302
OilSts	VCmpOilStatus	0xF0AF1150	0x2204
PTD1	C1DischRefPressure	0xF0AF888A	0x2203
PTD2	C2DischRefPressure	0xF0AFB9AC	0x2203

Trend Point List 3			
Enum Text	**Object Name**	**Object ID**	**Object Type**
RAT	Return Air	0xF0AFA24D	0x2203
ReHt%	Reheat Cap	0xF0AF00F8	0x230A
RemEF%	Rem ExhF Cap	0xF0AF1969	0x2300
RemRF%	Rem RF Cap	0xF0AF57A7	0x2300
RemSF%	Rem SAF Cap	0xF0AF211F	0x2300
RFEF%	RF/EF Cap	0xF0AFAECF	0x2203
RH	Rel Humidity	0xF0AF1DDC	0x2203
RHSp	RH Setpoint	0xF0AFFA18	0x2300
RhtSp	Reheat Spt	0xF0AF335D	0x230A
SAF%	SFCapFbk	0xF0AF5BDF	0x2203
SBEvnt	StandbyEvents	0xF0AFCB3E	0x230B
SFMBSts	SF MB Status	0xF0AF2BDE	0x230B
SpaceT	Space Temp	0xF0AFF74A	0x2203
SumpT	Sump Temp	0xF0AF503D	0x2203
Tc1	Tc1	0xF0AF4C6A	0x230A
Tc2	Tc2	0xF0AF7C09	0x230A
UnOcSrc	UnoccSrc	0xF0AFF6B4	0x230B
UnitSt	UnitState	0xF0AF9E60	0x230B
UntSts	Unit Status	0xF0AF4FF0	0x230B
VCmp1%	Comp1Analog	0xF0AFEBE7	0x2206
VCmp2%	Comp2Analog	0xF0AF3365	0x2206
VCmpSts	Var Cmp Status	0xF0AFD3CE	0x230B
WFSts	Waterflow	0xF0AF2B89	0x2204

Table 57: Default Trend List for DPS Units

Trend number	Default Trend Set			
	Enum Text	Object Name	Object ID	Object Type
01	UnitSt	UnitState	0xF0AF9E60	0x230B
02	Clg%	ClgCapacity	0xF0AFF4B5	0x230A
03	Htg%	HtgCapacity	0xF0AFF01C	0x230A
04	SAF%	SFCapFbk	0xF0AF5BDF	0x2203
05	OAD%	OAD_EconCapOut	0xF0AF6259	0x230A
06	CtrlT	ControTemp	0xF0AF3701	0x2203
07	DAT	DAT	0xF0AF538E	0x2203
08	OAT	OAT	0xF0AFA37F	0x2203
09	ClgSt	Clg State	0xF0AF3991	0x230B
10	HtgSt	Htg State	0xF0AF4BE8	0x230B
11	INV%	HMIINVCmd	0xF0AF91E3	0x230A
12	INVCmd	INVCmd	0xF0AFEC72	0x2206
13	STDOut	STD3	0xF0AF03CC	0x2207
14	PTD	PTD	0xF0AF229A	0x2203
15	PTS	PTS	0xF0AF404C	0x2203
16	EVI%	EVI Pos	0xF0AF3028	0x2203
17	EVO%	EVO Pos	0xF0AF17B1	0x2203
18	OAFCmd	OAFanCmd	0xF0AF9E45	0x230A
19	OF1Spd	OAFan1Spd	0xF0AFB55B	0x2203
20	OF2Spd	OAFan2Spd	0xF0AFB55B	0x2308
21	Tc	Tc	0xF0AF19E9	0x230A
22	TcSpt	EffTcSpt	0xF0AF7FC1	0x230A
23	DSH	Discharge SH	0xF0AF33F2	0x230A
24	Teg	Teg	0xF0AFDCFF	0x230A
25	SSH	Superheat	0xF0AFB846	0x230A
26	SSHSpt	EffSHSpt	0xF0AF3144	0x230A
27	HDRT1	HDRT1	0xF0AF4A6D	0x230A
28	HDRT3	HDRT3	0xF0AF6A2F	0x230A
29	OilSts	VCmpOilStatus	0xF0AF1150	0x2203
30	OilMng	OilManagement	0xF0AF2D66	0x2302

Table 58: Default Trend List for MPS, RTU, and SCU Units

ao Trend number	Default Trend Set			
	Enum Text	Object Name	Object ID	Object Type
1	UnitSt	UnitState	0xF0AF9E60	0x230B
2	Clg%	ClgCapacity	0xF0AFF4B5	0x230A
3	Htg%	HtgCapacity	0xF0AFF01C	0x230A
4	SAF%	SFCapFbk	0xF0AF5BDF	0x2203
5	OAD%	OAD_EconCapOut	0xF0AF6259	0x230A
6	CtrlT	HtgCapacity	0xF0AF3701	0x2203
7	DAT	DAT	0xF0AF538E	0x2203
8	OAT	OAT	0xF0AFA37F	0x2203
9	DAClgSp	DAT Clg Spt	0xF0AF64FD	0x2300
10	DAHtgSp	DAT Htg Spt	0xF0AF6054	0x2300
11	OcClgSp	Occ Clg Spt	0xF0AFF8A8	0x2300
12	OcHtgSp	Occ Htg Spt	0xF0AF8A33	0x2300
13	MinOA%	Min OA Pos	0xF0AFEEC9	0x230A
14	UntSts	Unit Status	0xF0AF4FF0	0x230B
15	VCmp1%	Comp1Analog	0xF0AFEBE7	0x2206
16	VCmp2%	Comp2Analog	0xF0AF3365	0x2206
17	RH	Rel Humidity	0xF0AF1DDC	0x2203
18	ReHt%	Reheat Cap	0xF0AF00F8	0x230A
19	ClgSts	Clg Status	0xF0AFF6A6	0x230B
20	HtgSts	Htg Status	0xF0AFD173	0x230B
21	Comp1	Comp 1	0xF0AFAC75	0x2207
22	Comp2	Comp 2	0xF0AF9C16	0x2207
23	Comp3	Comp 3	0xF0AF8C37	0x2207
24	Comp4	Comp 4	0xF0AFFCD0	0x2207
25	Comp5	Comp 5	0xF0AFECF1	0x2207
26	Comp6	Comp 6	0xF0AFDC92	0x2207
27	DeHmSts	Dehum Status	0xF0AF56EA	0x230B
28	EFT/LCT	EF/LC Temp	0xF0AF356B	0x2203
29	OilMng	OilManagement	0xF0AF2D66	0x2302
30	OilSts	VCmpOilStatus	0xF0AF1150	0x2204

To modify the default trending list for any unit simply select yes for the Default trend. Then proceed to the point you wish to change and select “none” for the point listed then chose the list of the point desired, then select the the desired point . You must also enter the ID and type and Member number. Remember the member number is always 100 when trending the present value.

About this Unit

Table 59: About this Unit Menu

Menu Display Name	Item Display Name
About this Unit	SO_Item=
	Unit SN=
	App Version=
	Cf1-15=
	Cf16-29=
	Main BSP=
	LON BSP=
	LON App Ver=
	BACnet BSP=
	D-Net BSP=
	HMI GIUD=
	OBH GIUD=

SO_Item is an adjustable item which can be used to store the sales order number of the unit for reference purposes.

Unit SN is an adjustable item which can be used to store the serial number of the unit for reference purposes.

App Version is the version of application code loaded into the controller

Cf1-15 describe positions 1-15 of the unit configuration string

Cf16-30 describe positions 16-30 of the unit configuration string

Main BSP is the current version of firmware in the main controller

LON BSP is a status only item which indicates the current version of firmware in the LON communication module connected to the main controller.

LON App Ver is a status only item which indicates the current version of application code in the LON communication module connected to the main controller.

BACnet BSP is a status only item which indicates the current version of firmware in the BACnet communication module connected to the main controller.

D-Net BSP is a status only item which indicates the current version of firmware in the D-Net communication module connected to the main controller.

HMI GUID is the HMI software identifier number unique to each application code version

OBH GUID is the OBH software identifier number unique to each application code version

Alarms

Alarms provide the user with information about abnormal conditions that affect unit operation. The cause of the alarm should be investigated and eliminated before the unit or any disabled equipment in it is placed back into service.

Faults are conditions that are serious enough to shut down the unit. The alarm must be manually cleared to allow unit operation.

Problems are conditions that result in some limitation of unit operation, but the unit is allowed to continue to operate. Some of these alarms must be cleared manually, but others clear automatically.

Warnings inform the user of conditions that should be addressed, but do not limit operation in any way. The alarm condition needs to be fixed and the alarm must be manually cleared to cause this alarm to no longer be active.

All active alarms as well as the date and time that they were detected are displayed on the Active Alarm menu. These alarms are displayed in order of priority. Higher priority alarms are displayed first. The last fifty alarm “events” detected as well as the date and times that they were detected are displayed on the Alarm Log menu. An alarm “event” is either an alarm becoming active or being cleared. A “+” symbol precedes the active alarm event and a “-” symbol precedes the cleared alarm event. These alarms are displayed in the order that they were detected. The alarm that was detected most recently is displayed first. Multiple occurrences of the same alarm may appear.

Alarm Clearing

Active alarms can be cleared through the keypad/display or a BAS network. Alarms are automatically cleared when power is cycled. Alarms are cleared only if the conditions required to initiate the alarm do not exist. All alarms and groups of alarms can be cleared via the network or keypad by setting the ClearAlms variable to a non-zero value as indicated in the table below. Emergency Off Faults can be set to automatically clear once the condition that caused the alarm is corrected. This can be accomplished by navigating to Commission Unit/Alarm Configuration/Emerg Stop and changing the default ManClr value to AutoClr.

NOTE: The enumeration text is what shows up on the keypad/display not the number. The value of this variable automatically reverts to zero when the alarms are cleared. This variable may be set through the keypad in the Active Alarm menu. It may be set via LON using nviClearAlarms and via BACnet using the ClearAlarms object.

Table 60: Alarm Clearing

Value	Action
0	None
1	Clear All Faults
2	Clear All Problems
3	Clear All Warnings
4	Clear All Alarms

Warnings

Over Economizing

A warning alarm indicating the unit is economizing when it should not be will be generated whenever the outdoor air dampers are stuck open while operating in the Econo or Cooling operating state. The dampers are considered stuck open when either of the following abnormal situations occurs:

- The damper command value is less than the calibrated damper end switch closed value continuously for 180 seconds yet the outside air damper end switch input remains open.
- The damper end switch input does not change from closed to open with 30 seconds of the damper command value dropping (and remaining) below the calibrated damper end switch open value (less the calibrated maximum switch differential).

The over economizing warning will also be generated if the Econo Status is Enabled when the OAT is greater than the Max OAT Limit setting (default 75F). Exception: This case is ignored when the economizer enable decision is being controlled by a network input or when the economizer changeover method (EconChgovr) is set for OAT/RAT dry bulb comparison (OAT/RAT).

The alarm will automatically clear when the conditions causing the alarm are no longer present.

NOTE: The damper end switch open (PosSwOpen%), Minimum switch differential (MinSwDiff), damper end switch closed (PosSwClose%) and maximum switch differential (MaxSwDiff) values are determined during the OAD damper end switch calibration process.

Under Economizing

A warning alarm indicating the unit is not economizing when it should be will be generated whenever the outdoor air dampers are stuck closed while operating in the Econo or Cooling state. The dampers are considered stuck closed when either of the following abnormal situations occurs:

- The damper command value is greater than the calibrated damper end switch open value continuously for 180 seconds yet the outside air damper end switch input remains open.
- The damper end switch input does not change from closed to open with 30 seconds of the damper command value rising above the calibrated damper end switch closed value (plus the calibrated minimum switch differential)

The under economizing alarm will also be generated if the Econo Status is not Enabled when the OAT is less than the Min OAT Limit setting (default 70F). Exception: This case is ignored when the economizer enable decision is being controlled by a network input or when the economizer changeover method (EconChgovr) is set for OAT/RAT dry bulb comparison (OAT/RAT).

The under economizing alarm will also be generated when the OAT sensor is unreliable or the RAT sensor is unreliable while the OAT is below the Min OAT Limit setting (default 70F) and the economizer changeover method (EconChgovr) is set for OAT/RAT dry bulb comparison (OAT/RAT).

The alarm will automatically clear when the conditions causing the alarm are no longer present.

NOTE: The damper end switch open (PosSwOpen%), Minimum switch differential (MinSwDiff), damper end switch closed (PosSwClose%) and maximum switch differential (MaxSwDiff) values are determined during the OAD damper end switch calibration process.

Excess OA

A warning alarm indicating the unit is delivering excessive outdoor air will be generated whenever the outdoor air dampers are stuck open. The outdoor dampers are considered stuck open when either of the following abnormal situations occurs:

- The damper command value is less than the calibrated damper end switch closed value continuously for 180 seconds yet the outside air damper end switch input remains open.
- The damper end switch input does not change from closed to open with 30 seconds of the damper command value dropping (and remaining) below the calibrated damper end switch open value (less the calibrated maximum switch differential).

The excess outdoor air warning will also be generated while operating in the Econo or Cooling state when the Econo Status is Enabled and the OAT is greater than the Max OAT Limit setting (default 75F). Exception: This case is ignored when the economizer enable decision is being controlled by a network input or when the economizer changeover method (EconChgovr) is set for OAT/RAT dry bulb comparison (OAT/RAT).

The alarm will automatically clear when the conditions causing the alarm are no longer present.

NOTE: The damper end switch open (PosSwOpen%), Minimum switch differential (MinSwDiff), damper end switch closed (PosSwClose%) and maximum switch differential (MaxSwDiff) values are determined during the OAD damper end switch calibration process.

The alarm will automatically clear when the conditions causing the alarm are no longer valid.

The previous four warnings; Over Economizing, Under economizing, Excess OA and OAD stuck, for these warnings to become active EconFDD under Commission unit\Econo Set up menu has to be selected “ON”, This Economizer function FDD was to provide criteria requirements to meet California title 24 which requires fault detection and diagnostic requirements warning alarm indication of these conditions.

OAD Stuck

A warning alarm indicating the outdoor air dampers are stuck and not modulating will be generated whenever the damper are stuck open or stuck closed.

The dampers are considered stuck open when either of the following abnormal situations occurs:

- The damper command value is less than the calibrated damper end switch closed value continuously for 180 seconds yet the outside air damper end switch input remains open.
- The damper end switch input does not change from closed to open with 30 seconds of the damper command value dropping (and remaining) below the calibrated damper end switch open value (less the calibrated maximum switch differential).

The dampers are considered stuck closed when either of the following abnormal situations occurs:

- The damper command value is greater than the calibrated damper end switch open value continuously for 180 seconds yet the outside air damper end switch input remains open.
- The damper end switch input does not change from closed to open with 30 seconds of the damper command value rising above the calibrated damper end switch closed value (plus the calibrated minimum switch differential)

The damper stuck warning will also be generated when the damper end switch operation is unreliable. The ends switches are considered unreliable when the end switch input remains closed when the damper command value is between the calibrated end switch closed and open values (plus and minus the calibrated minimum and maximum switch differentials).

The alarm will automatically clear when the conditions causing the alarm are no longer present.

The previous four warnings, Over Economizing, Under economizing, Excess OA and OAD stuck, for these warnings to become active EconFDD under Commission unit\Econo Set up menu has to be selected “ON”, This Economizer function FDD was to provide criteria requirements to meet California title 24 which requires fault detection and diagnostic requirements warning alarm indication of these conditions.

Dirty Filter - (Dirty Filter: Warning)

If the pressure drop across the filter section in the unit exceeds the setting of the differential pressure switch the Dirty Filter warning occurs. When the Dirty Filter warning occurs, unit operation is not affected. The Dirty Filter warning must be manually cleared through the unit keypad or via a network signal.

Airflow Switch - (Airflow Sw: Warning)

If the unit has been in the Off operating state for at least thirty minutes and the PC7 airflow switch input to the main controller indicates airflow, the Airflow Switch warning occurs. This normally indicates a problem with the PC7 airflow switch. When the Airflow Switch warning occurs, unit operation is not affected. When the alarm condition is corrected, the Airflow Switch warning must be manually cleared through the unit keypad or via a network signal.

Conductivity - (Conductivity: Warning)

If the unit is equipped with a Dolphin system and the Conductivity value rises above the alarm setpoint value, the conductivity alarm occurs. When the alarm condition is corrected, the conductivity warning must be manually cleared through the unit keypad or via a network signal.

Return/Exh Fan Warning

When the unit is equipped with a Return/Exhaust fan VFD or ECM motor and a loss of Modbus communications for longer than 10 seconds a Return/Exhaust fan warning alarm occurs. The alarm is automatically clears when the condition causing the alarm is corrected.

Problems

Hi DL Temp: Problem

Normal compressor control is limited when a high discharge line temperature conditions occur. If the variable speed compressor is operating and the discharge line temperature is greater than 250F for 15 seconds a High Discharge Line Temperature Event is generated and the variable speed compressor capacity is reduced every 15 seconds until the discharge line temperature falls below 220F. If the discharge line temperature is above 250F continuously for 3 minutes the variable speed compressor is stopped and a High Discharge Line Temperature problem alarm is generated. The alarm must be manually cleared.

DRT2 Sensor: Problem

This alarm occurs when the DRT2 sensor input is shorted or open circuited for the Sensor Alarm Delay (default 30 seconds). It can also occur when the variable speed compressor is off and the input is above 329°F or the compressor has been off for 20 minutes and the input is below -4°F.

When this alarm is active compressor cooling operation is disabled.

The alarm must be manually cleared once corrective action is taken.

Variable Compressor: Problem

If the variable speed compressor is enabled (MCB-D03 is closed) and commanded to run for 30 seconds but the controller fails to receive the variable speed run verification input (EMC-X4 is open) the variable speed compressor enable output (MCB-D03) is cycled OFF for 5 seconds (a variable speed Compressor Emergency Stop Control Event is logged) and then back on. The variable speed compressor is then ramped to 45%. If this occurs 3 times in a 30 minute period the variable speed compressor is shut off and a variable speed Compressor Problem alarm is generated.

Low Discharge Pressure: Problem

Normal variable speed compressor control is limited when a low pressure condition occurs on the variable speed compressor circuit. If the variable speed compressor is operating and the discharge pressure (PTD) is less than 250 PSI a Low Pressure Unloading Control Event is generated and the variable speed compressor speed is increased every 30 seconds until either the discharge pressure rises above 250 PSI or remains lower than 250 PSI continuously for 15 minutes. If the discharge pressure is below 250 PSI continuously for 15 minutes the variable speed compressor is shut OFF and a Low Discharge Pressure Problem alarm is generated. The alarm must be manually cleared.

Low Discharge Superheat: Problem

Normal compressor control is limited when low superheat conditions occur. If the variable speed compressor is operating and the discharge superheat is less than 20F continuously for 10 minutes a Low Discharge Superheat Unloading Control Event is generated and the variable speed compressor speed is increased. The variable speed compressor speed is increased every 10 minutes as long as the discharge superheat remains less than 20F until the maximum allowed variable speed compressor speed (based on unit size) is reached. If the discharge superheat remains below 20F the variable speed compressor is shut off and a Low Superheat alarm is generated.

High Discharge Superheat: Problem

Normal compressor control is limited when high superheat conditions occur. If the variable speed compressor is operating and the discharge superheat is greater than 85°F continuously for 15 minutes a High Discharge Superheat Unloading Control Event is generated and the variable speed compressor speed is decreased. The variable speed compressor speed is decreased every 10 minutes as long as the discharge superheat remains greater than 85°F until the minimum allowed variable speed compressor speed (based on unit size) is reached. If the discharge superheat remains above 85°F the variable speed compressor is shut off and a High Superheat alarm is generated.

PTD1 Sensor: Problem

This alarm occurs when either the circuit 1 discharge line pressure inputs (PTD1) remains above 705 psi for 10 seconds or a compressor on circuit 2 has been operating for 60 seconds and the PTD1 value remains less than 155 psi. When this alarm is active compressor cooling operation is disabled.

The alarm must be manually cleared once corrective action is taken.

PTD2 Sensor: Problem

This alarm occurs when either the circuit 2 discharge line pressure inputs (PTD2) remains above 700 psi for 10 seconds or a compressor on circuit 2 has been operating for 60 seconds and the PTD2 value remains less than 155 psi. When this alarm is active compressor cooling operation is disabled.

The alarm must be manually cleared once corrective action is taken.

Variable Compressor Oil: Problem

If the variable speed compressor has been operating at the High Oil Boost value for the Oil Boost Timing period and the low oil input (EMC-X3) is still open the variable speed compressor is stopped and a Low Oil problem alarm is generated. The alarm is also generated if the oil boost sequence becomes active 12 times in a 24 hour operating period. This is for DPS and DPS H units.

High Pressure Circuit 2

Normal variable speed compressor control is limited when a high discharge pressure conditions occur on the variable speed compressor circuit. If the variable speed compressor is operating and the discharge pressure (PTD) is greater than 525 PSI, a High Pressure Unloading Control Event is generated and the VFD compressor is slowed every 10 seconds until either the discharge pressure falls to less than 525 PSI or remains higher than 575 PSI for 10 minutes. If the discharge pressure is above 575 PSI for 10 minutes the variable speed compressor is shut off and a High Pressure Problem alarm is generated. If the OAT is below 45F at the time the variable speed compressor is shut off immediately and a High Pressure Problem alarm is generated anytime the discharge pressure rises above 575 PSI. The alarm must be manually cleared.

High Pressure Circuit 1

Normal variable speed compressor control is limited when a high discharge pressure conditions occur on the variable speed compressor circuit. If the variable speed compressor is operating and the discharge pressure (PTD) is greater than 525 PSI, a High Pressure Unloading Control Event is generated and the variable speed compressor is slowed every 10 seconds until either the discharge pressure falls to less than 525 PSI or remains higher than 575 PSI for 10 minutes. If the discharge pressure is above 575 PSI for 10 minutes the variable speed compressor is shut off and a High Pressure Problem alarm is generated. If the OAT is below 45F at the time the variable speed compressor is shut off immediately and a High Pressure Problem alarm is generated anytime the discharge pressure rises above 575 PSI. The alarm must be manually cleared. (Not Yet Applicable – except normal fixed circuit high pressure switch alarm still applies

No Water Flow Problem - (Water Flw Sw: Problem) (Self Contained only)

When a unit is equipped with a water flow switch WFS, the No Water Flow problem occurs when lack of water flow is indicated by an open water flow switch or a network signal and all of the following conditions are true:

- Lack of water flow is indicated by an open water flow switch or a Network signal
- Either of the following is true:
- The Bypass Valve has been opened greater than 50% for more than the Bypass Valve Timer
- A water side economizer is installed and its position is greater than 50%
- Unit is not in the Off, Start or Recirc operating state

When the No Water Flow problem occurs, the unit continues to operate however cooling provided by compressors disabled. When all of the alarm condition are no longer present, the No Water Flow problem normally clears automatically and normal unit operation resumes. If the alarm occurs three times between 2:00 am of one day and 2:00 am of the next day, it becomes necessary to manually clear the alarm.

Water Regulating Valve Problem - (Water RegVlv: Problem) (Self Contained only)

When a unit is equipped with the head pressure control option, the Water Regulating Valve Problem occurs when the greater of the two refrigerant pressure readings drops below the head pressure setpoint by more than the deadband while at least one compressor is operating and the entering water temperature is less than 58°F. These conditions have to be true for more than 5 minutes for the alarm to become active. When the Water Regulating Valve problem occurs, the unit continues to operate but mechanical cooling is disabled. Mechanical cooling remains disabled until the Water Regulating Valve problem is manually cleared through the unit keypad or via a network signal.

Low Pressure - Circuit 1, 2, 3, 4, 5, 6 - (Lo Press 1, 2, 3, 4, 5, 6: Problem)

When a unit is equipped with individual cooling circuits, the Low Pressure Circuit 1 problem occurs when the compressor on circuit #1 has been running longer than the low pressure alarm delay (65 seconds factory default for R22 or 407C application, 5 seconds for 410A) and the low pressure switch LP1 remains open. The alarm also occurs any time afterward if the low pressure switch opens up while the compressor on the circuit is running. Note: The Low Pressure Circuit 2, 3, 4, 5, & 6 problems occur in the same manner for cooling circuits 2, 3, 4, 5, 6. Compressor #1 (2, 3, 4, 5 or 6) remains disabled for at least one cooling stage time period. After the cooling stage time period expires, the alarm automatically clears and the circuit is re-enabled. If the alarm occurs three times between 2:00 a.m. of one day and 2:00 a.m. of the next, the alarm does not automatically clear the third time but must be manually cleared through the unit keypad or via a network signal.

High Pressure - Circuit 1, 2, 3, 4, 5, 6 - (Hi Press 1, 2, 3, 4, 5, 6: Problem)

This alarm occurs on units equipped with compressorized cooling only. If the high pressure switch opens indicating a high refrigerant pressure situation, the High Pressure Circuit 1, 2, 3, 4, 5, 6 problems occurs.

When the High Pressure Circuit 1, 2, 3, 4, 5, 6 problem occurs, the unit continues to operate but the cooling circuit is disabled.

NOTE: The Circuit remains disabled until the high pressure switch closes and the High Pressure Circuit problem is manually cleared through the unit keypad or via a network signal.

Sump Water Level Problem

Problem alarm is generated if the unit has been in the Clg operation state for 5 minutes and the Sump Water Level Input is not present (Off). If this occurs, the Sump Pump output is turned off and mechanical cooling is disabled.

Entering Fan Temperature/Leaving Coil Temperature Sensor Problem (EFT/LCT Snsr: Problem)

This alarm occurs when the Entering Fan Temperature/Leaving Coil Temperature sensor is present and either shorted or open circuited for longer than the Sensor Alarm Delay (Default = 30 seconds). When this alarm occurs the unit continues to operate however dehumidification operation is disabled until the sensor becomes reliable. The maximum DAT limit function associated with gas or electric heat is also disabled until the sensor becomes reliable.

Return Air Temperature Sensor Problem - (RAT Sensor: Problem)

If the return air temperature sensor (RAT) is present and either shorted or open circuited for longer than the Sensor Alarm Delay (default is 30 seconds), the Return Air Sensor problem occurs. When the RAT Sensor problem occurs, the unit continues to operate with the following modifications:

- Cooling Reset and Heating Reset revert to none if they are set to Return
- Control temperature source reverts from return to space if a space temperature sensor is present and reliable

When the alarm condition is no longer present, the RAT Sensor problem automatically clears.

Space Temperature Sensor Problem - (Space Sensor: Problem)

If the Space Sensor Present setting is set to Yes, a valid Space Temperature value is not provided via a network signal and the local space sensor is shorted or open circuited longer than the Sensor Alarm Delay (default is 30 seconds), the Space Temperature Sensor problem occurs. When the Space Temperature Sensor problem occurs, the unit continues to operate with the following modifications:

- Cooling Reset and Heating Reset revert to none they are set to Space
- Control temperature source reverts from space to return if a return air sensor is present and reliable.

When the alarm condition is no longer present, the Space Temperature Sensor problem automatically clears.

OAT Temperature Sensor Problem -(OAT Sensor: Problem)

If the outside air temperature sensor (OAT) is present, a valid OAT value is not provided via the network and the local OAT sensor is either shorted or open circuited for longer than the Sensor Alarm Delay (default is 30 seconds), the Outside Air Sensor problem occurs. When the OAT Sensor problem occurs, the unit continues to operate with the following modifications:

- Heating is not locked out due to high OAT
- Cooling is not locked out due to low OAT
- Cooling Reset and Heating Reset revert to none if they are set to OAT
- Economizer is locked out due to high OAT

When the alarm condition is no longer present, the OAT Sensor problem automatically clears.

Entering Water Temperature Sensor Problem - (EWT Sensor: Problem)

If the entering water temperature sensor (EWT) is present and either shorted or open circuited for longer than the Sensor Alarm Delay (default is 30 seconds), the EWT Sensor problem occurs. When the EWT Sensor problem occurs, waterside economizer cooling is disabled. Mechanical cooling is not locked out based on EWT. When the alarm condition is no longer present, the EWT Sensor problem automatically clears.

Mixed Air Temperature Sensor Problem - (MAT Sensor: Problem)

If the Mixed Air Temperature (MAT) sensor is present and either shorted or open-circuited for longer than the sensor alarm delay (default is 30 seconds), the MAT sensor problem occurs. When the MAT sensor problem occurs, waterside economizer cooling is disabled. When the alarm condition is no longer present, the MAT sensor problem automatically clears.

Freeze Problem - (Freeze: Problem)

When a unit is equipped with a waterside economizer, chilled water, hot water, or steam coil, the Freeze problem occurs when the optional freezestat contacts open as a result of detecting an abnormally low water or steam coil temperature while the fans are off.

When the Freeze problem occurs, the controller opens the waterside economizer valve, chilled water and heating valves, and sets a 10-minute timer. If the unit is equipped with a waterside economizer, the pump output is also turned on. When the 10-minute timer expires, the controller checks the freezestat input again. If the freezestat contacts are closed the pump output is de-energized and the valves close. If the freezestat contacts are still open the pump output remains energized, the valves remain open, and the 10-minute timer resets. This continues while the unit remains off. Whenever the freezestat closes the Freeze problem automatically clears. This feature protects the coil(s) and allows the system to start normally when an occupied command is received.

Heat Fail Problem - (Heat Fail: Problem)

If an RPS unit is equipped with a Daikin Applied gas furnace and the burner flame safeguard (FSG) control enters the “safety lockout” state after a call for heat, a digital input is provided to EXP B-X4 on the controller. When this digital input is present the Heat Fail problem occurs. When the Heat Fail problem occurs, the unit continues to operate with the heating system disabled by the FSG. Heating remains disabled until the flame safeguard control is manually reset. The heat fail problem clears automatically when the FSG control is reset.

Faults

Airflow Fault - (Airflow: Fault)

If differential pressure switch PC7 fails to detect airflow for longer than the airflow timer (default = 120 seconds) and on VAV units the current duct static pressure indication is less than half the static pressure setpoint after the unit leaves the Startup operating state or any time afterward, while the unit is running, the Fan Fail fault occurs. When the Fan Fail fault occurs, the unit is shut down. It remains shut down until the Fan Fail fault is manually cleared through the unit keypad or via a network signal. On units equipped with a discharge fan VFD, the Fan Fail fault only occurs if the Fan Retry condition described above has first occurred twice within the previous twenty-four hour period. The conditions that cause the Fan Retry and the action taken are the same as for the Fan Fail fault with the difference being that the Fan Retry is automatically reset once the unit is shut off. This allows the unit to attempt to restart up to three times within a twenty-four hour period.

NOTE: There is no Fan Retry function or three retry function when a unit has a CAV supply fan.

If Modbus communication is lost between the MCB and the supply fan VFD the duct static pressure is not considered in the Fan Fail logic.

Low Discharge Air Temperature - (Lo Disch Temp: Fault)

If the unit is in an operating state and the discharge air temperature is less than the Low Discharge Temperature Limit (Default = 40°F) for longer than 35 seconds and the supply fan has been on for longer than the LowDAT temperature alarm delay (Default = 6 minutes), the Low Discharge Air Temperature fault occurs. When the Low Discharge Air Temperature fault occurs, the unit is shut down. It remains shut down until the Low Discharge Air Temperature fault is manually cleared through the unit keypad or via a network signal.

High Discharge Air Temperature - (Hi Disch Temp: Fault)

If the discharge air temperature is greater than the High Discharge Temperature Limit (Default = 170°F) and the supply fan has been on for longer than the Temperature Alarm Delay (Default = 35 seconds), the High Discharge Air Temperature fault occurs. When the High Discharge Air Temperature fault occurs, the unit is shut down. It remains shut down until the High Discharge Air Temperature fault is manually cleared through the unit keypad or via a network signal.

High Return Air Temperature - (Hi Return Tmp: Fault)

If the return air temperature is greater than the Return Air Temperature Limit (Default = 120°F) and the supply fan has been on for longer than the temperature alarm delay (Default = 35 seconds), the High Return Air Temperature fault occurs. When the High Return Air Temperature fault occurs, the unit is shut down. It remains shut down until the High Return Air Temperature fault is manually cleared through the unit keypad or via a network signal.

Duct High Limit Fault - (Duct Hi Limit: Fault)

If the unit is variable air volume, the contacts of the duct high pressure limit control (DHL) open, and the unit state is not Off or Startup, the Duct High Limit fault occurs. When the Duct High Limit fault occurs, the unit is shut down. The unit remains shut down until the Duct High Limit fault is manually cleared through the unit keypad or via a network signal.

Discharge Air Sensor Fault -(Disch Tmp: Fault)

If the discharge air temperature sensor (DAT) is open or short circuited for longer than the Sensor Alarm Delay (Default= 30 seconds), the Discharge Air Sensor fault occurs. When the Discharge Air Sensor fault occurs, the unit is shut down. It remains shut down until the Discharge Air Sensor fault is manually cleared through the unit keypad or via a networksignal.

Control Temperature Fault - (Control Temp: Fault)

If the temperature sensor (ZNT1, RAT, OAT, MAT) selected as the control temperature source is not reliable for longer than the Sensor Alarm Delay (Default= 30 seconds), a Control Temperature Fault occurs. When the Control Temperature Fault occurs, the unit is shut down. It remains shut down until the Control Temperature Fault is manually cleared through the unit keypad or via a network signal.

Emergency Stop Fault - (Emerg Stop: Fault)

An Emergency Stop Fault will occur if either of the following conditions is true:

- Emergency Stop Input in the Alarm (Open) condition
- The Net Emrg Ovrd input is set to Off via a network signal or the keypad/display

Freeze Fault - (Freeze: Fault)

When a unit is equipped with a waterside economizer, chilled water, hot water, or steam coil, the Freeze Fault occurs when the optional freezestat contacts open as a result of detecting an abnormally low water or steam coil temperature while the fans are running.

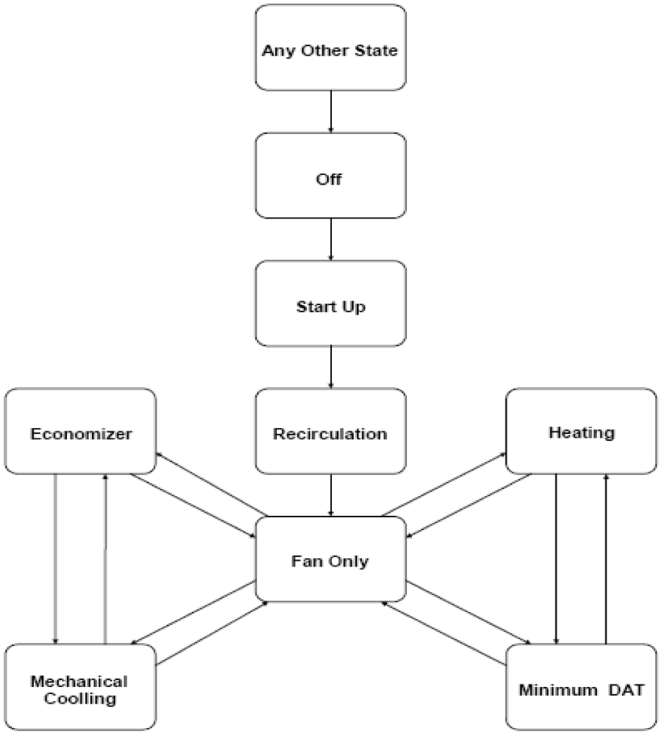
When the Freeze fault occurs, the controller shuts down the fans, opens the chilled water, economizer, and heating valves and set a 10-minute timer. If the unit is equipped with a waterside economizer, the pump output is also turned on. When the 10-minute timer expires, the controller checks the freezestat input again. If the freezestat contacts are closed the pump output is de-energized and the valves close. If the freezestat contacts are still open the pump output remains energized, the valves remain open, and the 10-minute timer resets. This continues until the fault is manually cleared through the keypad or via a network signal.

NOTE: Water valves remain open and Pump output remains on for 10 minutes after alarmconditions disappear.

Operator's Guide

The following "Operator's Guide" sections provide information regarding the day-to-day operation of the MicroTech Unit Controller. Topics covered are such common tasks as scheduling, displaying and clearing alarms, and setting the controller for manual operation.

Figure 11: State Diagram



The transition from any operating state to another is graphically represented in this figure. With a "start up" command from an OFF State the unit will always go into the "Start Up" state of operation for 3 minutes (adjustable). Next, it will transition into the "Recirculation" state of operation for another 3 minutes (adjustable) before finally going into the Fan Only state of operation. Then, based on sensor inputs it will go into any of the 4 remaining states of operation - heating, cooling, economizer, or minimum discharge air heating.

Determining Unit State

The unit will operate in one of eight operating states. The current state will be displayed by the Unit State parameter in the system summary menu.

In the OFF state, all heating, cooling, and fans are OFF. The alarm output indicates the type of alarm, if any, that is active.

In the start up state, the Fan Operation output is turned ON to allow shut OFF dampers to be opened before any the supply fan is turned ON. The outdoor air dampers remain closed.

The supply fan is turned ON when the unit enters the Recirculation state. The supply fan in VAV units is controlled as described in the "Supply Fan Capacity Control (VAV)" on page 145. The outdoor dampers remain closed.

A separate morning warm-up state is not provided, but an edited ZeroOATime is used to keep the outside air damper closed when the unit first starts. The Minimum OA Position is set to zero as long as the as the fan has been on for less than the ZeroOATime.

DAT Control units have a MWU setpoint available.

The Minimum OA Position is set to zero as long as the as the fan has been on for less than the ZeroOATime. This allows the Return Air type units to cool down the space with mechanical cooling or to warm up the space with the dampers closed. If the ZeroOATime is set correctly, the OA dampers will be open only during occupied periods. When Optimal Start is used Zero OA Time is set equal to the time to occupancy when the unit starts so that the OA dampers will open at occupancy time.

Neither heating nor cooling is provided when the unit is in the fan only state, with the exception of when dehumidification is active. The outdoor dampers are opened to the minimum position in this state when the fan on time exceeds the Zero OA Time.

In the other four states, temperature is controlled as describe in the appropriate sections of this document. These states are Minimum DAT, Heating, Economizer, and Cooling. The outdoor dampers are opened to at least the minimum position in these states when the fan on time exceeds the Zero OA Time.

OFF Operating State

In the Off operating state the fans are off, the outside air dampers are closed and any VFD's are driven to 0%. Cooling and heating are disabled. The unit is in the off state when it is not enabled, or when it is in the unoccupied mode with no call for unoccupied operation. refer to "Determining Unit Status" on page 95 for reasons the unit can be disabled.

Start Up Operating State

When a unit is commanded to start it will always enter the Startup operating state from the OFF operating state. The unit remains in the Startup operating state for an adjustable time period (default 180 seconds) before entering the Recirculating operating state.

During the Start up operating state the fans remain OFF, the outdoor air dampers are driven closed, and VFD's remain at 0%. Cooling and heating are disabled, except for 100% OA heating start sequences.

Recirculating Operating State

Units with return air always enter the Recirculating operating state after the completion of the Startup operating state. In the Recirculating operating state fans are started and operate while the outdoor air dampers remain closed. This allows temperature conditions throughout the unit and space to equalize before temperature control begins. Cooling and heating remain disabled. The unit remains in the Recirculating operating state until the Recirculate State Timer (default 180 seconds) expires.

NOTE: 100% outdoor air units do not transition through the Recirculating operating state.

Fan Only

The unit enters the Fan Only operating state after the recirculation timer expires. Units configured for 100% outside air operation will transition directly from the Start up operating state into the Fan Only operating state. Once entering the Fan Only state of operation the unit will then, based on sensor inputs transition into any of the 4 remaining states of operation - heating, cooling, economizer, or minimum discharge air heating.

Min DAT

If heating is enabled and there is no heating load (normally FanOnly operating state), the controller activates the units heating equipment as required to prevent the discharge air temperature from becoming too cool if the Min DAT Control Flag is set to yes via the Heating menu (Commission Unit/ Heating/MinDAT Ctrl). The unit enters the Min DAT operating state during occupied operation when neither cooling nor heating is required based on the heat/cool changeover function but the discharge temperature falls below a minimum discharge temperature limit. If the discharge air temperature falls below the this minimum discharge temperature limit by more than half the discharge heating deadband, the unit operating state changes from Fan Only to Min DAT. The unit transitions out of the Min DAT operating state once the discharge air temperature is above minimum discharge temperature limit and the heating capacity has been at its minimum position for the duration of the heating stage timer.

NOTE: On VAV or CAV discharge control units, the DAT cooling setpoint parameter in the Cooling menu acts as the minimum discharge temperature limit. On CAV zone control units the Min DAT Limit parameter in the Heating menu acts as the minimum discharge temperature limit.

Heating

The unit enters the Heating operating state when the control temperature falls below the Occupied or Unoccupied Heating Setpoint by more than ½ the occupied or unoccupied heating deadband. During the Heating operating state, the outdoor air dampers are either 100% open if the unit is a 100% outdoor air unit or controlled to the minimum outside air position. Cooling is disabled.

Economizer

If the unit is equipped with a 0-100% modulating economizer (waterside or airside) and the conditions are suitable for free cooling, the unit attempts to satisfy the cooling load by using either outdoor air or the waterside economizer before using mechanical cooling.

If the unit is configured for Zone Temperature Control the transition to economizer operation will occur if all the following are true:

- The control temperature rises above the occupied or unoccupied cooling setpoint by more that ½ the occupied or unoccupied cooling high deadband
- The discharge air temperature is greater than the Min DAT limit by more than ½ the DAT
- heating deadband. This will prevent more cold air from being brought in when the DAT is already cold
- The economizer operation is not disabled

If the unit is configured for Discharge Air Temperature Control the transition to Mechanical cooling will occur if all the following are true:

- The control temperature rises above the occupied or unoccupied cooling setpoint by more that ½ the occupied or unoccupied cooling deadband
- The discharge air temperature is greater than the DAT cooling setpoint
- The Ambient air temperature is below the Change Over Temperature set point, (Chgover temp) Default of 70° F Range: 0 to 100°F.
- If the system incorporates an enthalpy control the control does not sense the enthalpy of the outside air is too high.

Mechanical Cooling

The unit enters the mechanical cooling operating state when cooling is required and the economizer is disabled, not present, or already fully open.

If the unit is configured for Zone Temperature Control the transition to Mechanical cooling will occur if all the following are true:

- The control temperature rises above the occupied or unoccupied cooling setpoint by more that ½ the occupied or unoccupied cooling deadband
- The discharge air temperature is greater than the Min DAT limit by more than ½ the DAT heating deadband. This will prevent more cold air from being brought in when the DAT is already cold
- The economizer operation is disabled or not present
- Mechanical cooling is enabled

If the unit is configured for Discharge Air Temperature Control the transition to Mechanical cooling will occur if all the following are true:

- The control temperature rises above the occupied or unoccupied cooling setpoint by more that ½ the occupied or unoccupied cooling deadband
- The discharge air temperature is greater than the DAT cooling setpoint by more than ½ the DAT cooling deadband
- Post heat operation is complete
- Economizer operation is disabled
- Mechanical cooling is enabled

Determining Unit Status

Unit Status is a status only item which indicates whether or not the unit is enabled and if not why.

Enabled

Unit operation has not been disabled for any of the following reasons.

Off Manual

The unit operating state is OFF and the unit status is OffMan when the control mode is set to OFF via the keypad. The control mode can only be changed via the System menu on the keypad/display.

OffManCtrl

The unit operating state is OFF and the unit status is OffManCtl when the controller is set to manual control via the Manual Control menu.

Off Network

The unit operating state is OFF and the unit status is OffNet when the control mode is set to Auto via the System menu and the network Net App Mode is set to OFF.

Off Alarm

The unit operating state is OFF and the unit status is OffAlm when an active alarm of the "fault" type has the unit shutdown.

Off Fan Retry

The unit operating state is OFF and the unit status is OffFnRty when The fan retry conditions below indicate that the unit should be shutdown and restarted after airflow is lost.

- The supply fan is controlled by a VFD
- The airflow switch (PC7) is open AND the duct static pressure is less than ½ the duct static pressure setpoint
- There are no active faults that would shut down the unit

Determining Control Mode

The unit cooling and heating can be set up for automatic heat/cool, cool only, heat only, fan only, or network cool/heat operation by setting the Control Mode. The unit can also be manually disabled via the Control Mode. The following are descriptions of the six available Control Mode selections.

OFF

When the Control Mode is set to "OFF," the Unit Status is "Off Man" and the unit is completely disabled.

Heat Only

When the Control Mode is set to "Heat Only," heating operation is allowed to operate to maintain the heating set points. Cooling operation is disabled (Cooing Status is "Off Man").

Cool Only

When the Control Mode is set to "Cool Only," cooling operation is allowed to operate to maintain the cooling set points. Heating operation is disabled (Heating Status is "Off Man").

Fan Only

When the Control Mode is set to "Fan Only," the fans are allowed to operate but cooling and heating operation is disabled (Cooling Status and Heating Status are "Off Man").

Heat Cool

When the Control Mode is set to "Heat/Cool," both cooling and heating operation are allowed to operate as required to maintain the cooling and heating set points.

Auto

When the Control Mode is set to "Auto," the heat/cool, cool only, heat only, and fan only decision is determined by the network application mode parameter, which is set via a network signal as described below. The NetApp Mode parameter has no effect on unit operation unless the Control Mode is set to "Auto."

Determining Cooling Status

Clg Status is a status item which indicates whether or not mechanical cooling is currently allowed. If cooling is disabled, the reason is indicated.

The following are descriptions of cooling status states.

Enabled

Mechanical cooling is enabled if all the following are true:

- Cooling capability is provided
- Control mode is not set via the keypad to fan only or heat only
- Control mode is set via the keypad to auto and not disabled via a network command
- The outdoor air temperature (OAT) on air cooled units or the entering water temperature (EWT) on water cooled units is high enough for operation
- Compressor operation is not disabled by an alarm condition

None

Cooling capability is not provided.

Off Ambient

The outdoor air temperature (OAT) on air cooled units or the entering water temperature (EWT) on water cooled units is too low for operation.

The OAT becomes too low for operation when it drops below the OAT cooling lockout setting. OAT becomes high enough for operation when it rises above the OAT cooling lockout setting by more than 2°F (adjustable - OAT Diff). The EWT becomes too low for operation when it drops below the minimum EWT set point. EWT becomes high enough for operation when it rises above the minimum EWT set point by more than 2°F (adjustable - Econo Diff).

NOTE: The OAT cooling lockout cannot be set lower than 40°F when the unit is equipped with an evaporative condenser and should not be set lower than 50°F unless the unit is equipped with low ambient capability.

Off Alarm

Compressor operation is disabled by an alarm condition. This happens when either all circuits are disabled by either a high or low pressure alarm, when applicable the water flow switch alarm is active, when applicable sump pump fail alarm is active or applicable water regulating valve alarm is active.

Off Network

Control mode is set via the keypad to auto and cooling is disabled via a network command.

Off Manual

Control mode is set to Fan Only or Heat Only via the keypad display.

Determining Heat Status

Htg Status is a status item which indicates whether or not heating is currently allowed. If heating is disabled, the reason is indicated.

The following are descriptions of heating status states:

Enabled

Heating is enabled if all the following are true:

- Heating capability is provided
- Control mode is not set via the keypad to fan only or cool only
- Control mode is set via the keypad to auto and not disabled via a network command
- The outdoor air temperature (OAT) is low enough for operation

None

Heating capability is not provided.

Off Ambient

The OAT is too high for operation. The OAT becomes too high for operation when the OAT rises above the OAT heating lockout set point. OAT becomes low enough for operation when the OAT drops below the OAT heating lockout set point by more than the Heating Lockout Differential.

Off Network

Control mode is set via the keypad to auto and the unit is disabled via a network command.

Off Manual

Control mode is set to Fan Only or Cool Only via the keypad.

Determining Economizer Status

If the unit is equipped with a 0-100% modulating economizer (waterside or airside) and the conditions are suitable for free cooling, the unit attempts to satisfy the cooling load by using either outdoor air or the waterside economizer before using mechanical cooling.

The following are descriptions of Economizer Status states

Off Ambient

- Unit is an SCU configured for waterside economizer and the Entering Water Temperature (EWT) sensor is unreliable.
- Unit is an SCU configured for waterside economizer and the EWT exceeds (Mixed Air Temperature – EWT Differential). It is enabled if EWT drops below (Mixed Air Temperature – EWT Differential).
- Unit is configured for airside economizer and the outdoor air temperature (OAT) sensor is unreliable.
- Economizer Changeover is set to Enthalpy and OAT and the Enthalpy Input is in the High (Open) position.
- Economizer Changeover is set to Enthalpy and OAT and the OAT rises above the Economizer Changeover Temperature by a fixed 2°F differential. (OAT becomes low enough for operation when the OAT drops to or below the Economizer.
- Economizer Changeover is set to Enthalpy and OAT and the OAT rises above the Economizer Changeover Temperature by a fixed 2°F differential. (OAT becomes low enough for operation when the OAT drops to or below the Economizer Changeover Temperature).
- Economizer Changeover is set to OAT_RAT and the OAT rises above the RAT by a fixed 2°F differential. (OAT becomes low enough for operation when the OAT drops below the RAT a fixed 2°F differential).

Off Network

- A network signal is set to OFF

Off None

- Economizer Changeover is set to None
- Economizer capability is not provided
- Unit is not configured for an airside or waterside economizer

NOTE: Economizer is not disabled based on Control Mode or Application Mode.

Economizer operation is disabled via a network command.

Off Dehumidification

Economizer operation is disabled if dehumidification operation is enabled.

Determining Cooling Capacity

Clg Capacity is a status item which indicates the percentage of the unit maximum cooling capacity currently operating. When the unit is equipped with chilled water cooling, 0-100% is displayed as the cooling valve actuator strokes from the closed to open position. When the unit is equipped with compressorized cooling, the percentage value changes incrementally based on the number of operating cooling stages.

Determining Heating Capacity

Htg Capacity is a status item which indicates the percentage of the unit maximum heating capacity currently operating. When the unit is equipped with modulating heat, 0-100% is displayed as the heating valve actuator strokes from the closed to open position. When the unit is equipped with staged heat, the percentage value changes incrementally based on the number of operating heating stages.

Determining Supply Air Fan Capacity

SAF Speed is a status only item which indicates the supply air fan capacity. 0-100% of VFD maximum speed is indicated if the unit is equipped with a supply air fan VFD. 100% is indicated if the supply fan is constant volume and is running.

Determining RF/EF Capacity

RF/EF capacity is a status only item which indicates the current return or exhaust fan capacity. 0-100% of VFD maximum speed is indicated if the unit is equipped with a modulating return or exhaust fan VFD. 100% is indicated if the return/exhaust fan is constant volume and is running. When the unit is equipped with staged exhaust fans, the percentage value changes incrementally based on the number of operating exhaust fan stages.

Determining Outside Air Damper Position

OAD/Econo Cap is a status only item which indicates the current outdoor air damper or economizer valve position.

Determining Emergency Mode

Emergency Mode is an adjustable item which is normally used by a network system to shutdown the unit in an emergency situation.

Determining Application Mode

The unit heating and cooling can be set up for automatic heat/cool, heat only, cool only or fan only operation based on a network signal by setting the Control Mode parameter to "Auto." With the Control Mode parameters set to "Auto," the heat/cool, cool only, heat only, and fan only decision is determined by the Net App Mode. The Net App Mode is set by a network signal. The following sections describe the five available Net App Mode selections.

NOTE: The Net App Mode has no effect on the unit operation unless the Control Mode parameter is set to "Auto."

Off

When the Net App Mode is set to "OFF," the Unit Status is "Off Net" and the unit is completely disabled, including unoccupied heating (night set back) and unoccupied or unoccupied cooling (night set up) operation.

Heat Only

When the Net App Mode is set to "Heat Only," heating operation is allowed to operate as required to maintain the heating set points. Cooling operation is disabled (Cooling Status is "Off Net").

Cool Only

When the Net App Mode is set to "Cool Only," cooling operation is allowed to operate as required to maintain the cooling set points. Heating operation is disabled (Heating Status is "Off Net").

Fan Only

When the Net App Mode is set to "Fan Only," the fans are allowed to operate but cooling and heating operation is disabled (Cooling Status and Heating Status are "Off Net").

Auto

When the Net App Mode is set to "Auto" heating and cooling operation are allowed to operate as required to maintain the heating and cooling set points.

Determining Occupancy Status

Occupancy is a status item which indicates whether the unit is in an occupied, unoccupied or tenant override mode of operation.

The following are descriptions of the various "Occupancy" states.

Occ

The Occupancy parameter indicates "Occ" when the unit is in the occupied mode. In this mode, the unit starts and runs continuously, cooling and heating as required to maintain the occupied temperature set points. The unit is in the occupied mode if any of the following conditions are true:

- The Occ Mode entry on the keypad is set to occupied
- The Occ Mode entry on the keypad is set to Auto, and a manual network occupancy command is sent to the controller
- The Occ Mode entry on the keypad is set to Auto, a manual network occupancy command is set to Auto, and any of the following is true:
- The External Start/Stop switch is closed
- A network schedule signal is set to Occupied or Standby
- The internal schedule function is in the Occupied condition

Unocc

The Occupancy parameter indicates "Unocc" when the unit is in the unoccupied mode. In this mode, the unit remains off unless unoccupied operation becomes active. When unoccupied operation is active the unit operates normally except that Minimum OA Position is set to zero. See Unoccupied Operation, page 99 for information regarding when unoccupied operation is activated.

TntOvrd

The Occupancy parameter indicates "TntOvrd" when the unit is in the tenant override mode. In this mode, the unit starts and runs continuously, cooling and heating as required to maintain the occupied temperature.

Tenant override operation is initiated when the Tenant Override Timer is greater than zero. The Tenant Override Timer is set equal to the Local Tenant Override Time (Timer Settings menu) if the unit is enabled and any of the following is true:

- The Space Temperature sensor is present and its tenant override button is pressed for less than 10 seconds. Nothing happens if the button is pushed for more than 10 seconds but less than the time required to initiate a shorted sensor alarm (30 seconds). Subsequent presses on the button resets the Tenant Override Timer to the Local Tenant Override Time, i.e. the max time
- The Occ Mode entry on the keypad is set to Tenant Override. After the Tenant Override Timer is set, the Occ Mode entry on the keypad reverts to auto after a 2 second time delay
- The Occ Mode entry on the keypad is set to Auto or Unocc, and a manual network occupancy command is set to Bypass. After the Tenant Override Timer is set, the network occupancy command reverts to Auto Subsequent presses on the button, setting of the keypad occupancy entry to Tenant Override again, or setting of the network occupancy command to Bypass again resets the Tenant Override Timer to the Local Tenant Override Time.

The TOTime entry on the keypad can also be manually set to a non-zero value. In this case the value begins timing down from the edited value.

Tenant Override Operation may be terminated by manually setting the Tenant Override parameter on the keypad to zero or by disabling the unit.

Determining Occupancy Mode

Occ Mode is an adjustable item which sets the unit for manual occupied, unoccupied, tenant override or automatic operation.

Occ

When Occ Mode is set to "Occ," the unit is manually placed in the occupied mode of operation.

Unocc

When Occ Mode is set to "Unocc," the unit is manually placed in the unoccupied mode of operation.

TntOvrd

When Occ Mode is set to "TntOvrd," the unit is manually placed in the tenant override mode of operation.

NOTE: Once tenant override operation is activated the parameter automatically reverts back to "Auto."

Auto

When Occ Mode is set to "Auto" the automatically changes between occupied, unoccupied and tenant override operation.

Determining Occupancy Source

When the Occupancy parameter indicates Occ, the occupancy source is set to one of the following values to indicate the function responsible for placing the unit into the occupied mode of operation.

None The Occ Src= parameter indicates "None" when the Occupancy= parameter indicates "Unocc" or "Tnt Ovrd."

NetSchedule The Occ Src= parameter indicates "Net Schd" when the Occupancy= parameter indicates "Occ" due to a network schedule indicating an occupied period.

IntSchedule The Occ Src= parameter indicates "Int Sched" when the Occupancy= parameter indicates "Occ" due to the unit internal schedule.

OneEventSchedule The Occ Src= parameter indicates "Int Sched" when the Occupancy= parameter indicates "Occ" due to the unit one event schedule.

RemoteSwitch The Occ Src= parameter indicates "Remote Sw" when the Occupancy= parameter indicates "Occ" due to a field supplied external time clock or a tenant override switch signal in the form of a set of dry contacts is closed across terminals 101 and102 for MPS, RPS, and Rebel units 3 to 15 tons terminals. Larger Rebel units' 16 to 28 tons terminals 200 and 201, on the unit field terminal block TB2.

OccManCmd The Occ Src= parameter indicates "OccManCmd" when OccMode is set to Auto and the network manual occupancy command is set to Occupied.

OccMode The Occ Src= parameter indicates "Occ Mode" when the Occupancy= parameter indicates "Occ" due to the Occupancy Mode being manually set to "Occ."

TStatTO The Occ Src = parameter indicates "TStatTO" when the Occupancy= parameter indicates "TntOvrd" due to the tenant override button on the zone thermostat being pushed. The button must be held for at least 1 second but not more than 10 seconds.

ManTO The TntOvrd Src = parameter indicates "ManTO" when the Occupancy= parameter indicates "Occ" due to the being manually set via the keypad/display. When the Tenant Override Timer is set to a non-zero value, the unit starts and runs in the tenant override mode regardless of any scheduling features. The unit stops when the timer expires. The Tenant Override Timer can be set from 0-300 minutes.

Unoccupied Operation

During unoccupied operation the unit operates normally except that Min OA Pos is set to zero so that the damper is closed to the outdoor air.

Unoccupied Dehumidification

Dehumidification may be initiated in the unoccupied mode only if Unocc Dehum is set to yes on the keypad. When this is the case and the humidity goes high the unit transitions in the normal manner through Start up and Recirc to Fan Only and then into the Dehumidification Mode. In this case, the UnoccSrc= parameter indicates "Required".

Unoccupied Cooling (Night Setup)

Unoccupied operation is initiated if the space sensor is reliable, the space temperature is greater than the Unoccupied Cooling Setpoint, and the Unoccupied Cooling Setpoint is set lower than its maximum setting. In this case, the unoccupied source indicates "UnoccClg".

Unoccupied Heating (Night Setback)

Unoccupied operation is initiated if the space sensor is reliable, the space temperature is less than the Unoccupied Heating Setpoint, and the Unoccupied Heating Setpoint is set higher than its minimum setting. In this case, the Unoccupied Source indicates "UnoccHtg"

Internal Optimal Start

Unoccupied operation is enabled due to an internal optimal start schedule being activated. In this case, the Unoocupied Source indicates "IntOptStrt".

Network Optimal Start

Unoccupied operation is enabled due to a network optimal start schedule being activated. In this case, the Unoccupied Source indicates "NetOpStrt".

None

The Unoccupied Source is set to "None" when Unoccupied operation is inactive.

Scheduling

The Air Handling unit can be scheduled for operation by using the following three methods:

- Unit internal time scheduling functions
- External time clock function
- Network time scheduling function

Provided the unit is not locally or remotely disabled, the unit operates when any of these scheduling functions is calling for occupied operation. Conversely, the unit enters the unoccupied mode when all of these scheduling functions are calling for unoccupied operation. Therefore, any unused scheduling functions should be set for continuous unoccupied operation.

The next four sections: "Setting Controller Date and Time," "Internal Daily Scheduling," "Holiday Scheduling," and "One Event Scheduling" describe functions related to the internal unit scheduling functions. These are followed by a section describing the optimal start function which can be use with internal scheduling and network scheduling. This is followed by two sections that describe the external time scheduling and network time scheduling functions.

Setting Controller Date and Time

The controller uses the date and time to execute its internal scheduling functions. The current time and date will not be lost if the unit is turned off for up to forty-eight hours. The clock and date are settable from the keypad. The time of day can be set by entering the hour (00-23), minute (00-59), and second (00-59) into three fields of the Current Time. Note that the MicroTech Unit Controller uses "military" time. The current date can be set by entering the date (00-31), month (01- 12) and year (1999-2155) into the three fields of the Current Date.

Internal Daily Schedule

An internal Daily Schedule provides one start time and one stop time for each of the seven days of the week and for holidays. When the Occ Mode= parameter is set to "Auto/Net", and the unit is not disabled for other reasons, it starts and stops according to the controller internal schedule.

Holiday Scheduling

The operator may select the days when start and stop times for holidays are used by selecting a start date and an end date for up to ten periods during the year by using the holiday scheduling feature. Whenever a holiday period occurs, the controller uses the Holiday Schedule start and stop time for the period. For example, assume that Christmas Eve occurs on a Thursday. The building is shut down on both Christmas Eve and Christmas Day, but operates normally on the weekend. This holiday period would be scheduled by setting the Holiday Schedule to the default "no schedule" values "HH:MM- HH:MM" and setting the Holiday Period to "12/24/08 - 12/25/08."

One Event Scheduling

A One-Event Schedule is provided so that one operating period can be scheduled without affecting the regular internal schedule. A start date/time and an end date/time can be set.

The unit can be scheduled to operate during a specified period by using this feature. During the specified period defined by the One Event Beginning Date/Time and One Event Ending Date/Time parameters the unit starts up and runs continuously regardless of any other time scheduling functions. For example, assume that a space served by the unit is occupied for a special event on March 12, 2008 from 5:00 p.m. to 10:00 p.m. when the normal time scheduling has the unit shut off after 4:00 p.m. on that date. This event can be accounted for by setting the One Event Beginning Date/Time to "3/12/08 @ 17:00:00" and the One Event Ending Date/Time to "3/12/08 @ 22:00:00."

Optimal Start

When Optimal Start is active (Optimal Start = Yes), an early start time is determined before each scheduled start. The schedule must be based on an internal schedule or a signal via a connected network that indicates time to occupancy. The controller uses start history, outdoor air temperature and space temperature to determine when the unit should start. The unit may start up to four hours before the scheduled occupancy time. Optimal start based on heating operates when the space temperature is below the Occupied or Unoccupied Heating Spt by ½ the Zone Htg Deadband. Optimal start based on cooling operates when the space temperature is above the Occupied or Unoccupied Cooling Spt by ½ the Cooling Deadband. If space temperature is between the above two points, the unit starts at the occupancy time.

External Time Scheduling

An external time clock can be used to schedule unit operation. This is accomplished by a field supplied external time clock signal in the form of a set of dry contacts wired across terminals 101 and 102 on the unit field terminal block TB2. In this case, all internal daily schedules should be set to "HH:MM-HH:MM" (default setting).

Temperature Control Configurations

Temperature control is based on a Control Type that may be set to Zone, DAT, or Single Zone VAV.

When the Control Type is set to Zone temperature control, heating, compressors, and the economizer are controlled to maintain the temperature of the zone at a desired setpoint. This configuration is used on units equipped with constant volume supply fans. Compressors and heating stages are staged to maintain space or return temperature. The number of compressors is decreased when it is too cold and increased when it is too hot subject to stage timers. The number of heat stages is decreased when it is too hot and increased when it is too cold subject to stage timers.

When the Control Type is set to DAT, heating, compressors, and the economizer are controlled to maintain the discharge air temperature at a desired setpoint. This configuration is typically used on units equipped with variable air volume supply fans.

When the Control Type is set to (single zone VAV), heating, compressors and the economizer are controlled to maintain the discharge air temperature at the desired setpoint while the variable volume supply fan is modulated to maintain the temperature of the zone at the desired heating and cooling setpoints. In heating mode the supply fan capacity is increased as the zone temperature falls and decreased as the zone temperature rises.

Heat/Cool Changeover

In general, a unit configured for discharge air temperature control either operates to deliver the cooling discharge temperature set point using economizer and/or mechanical cooling or the heating discharge air temperature set point using the heating equipment. Cooling and heating never operate simultaneously. A unit configured for zone (or space comfort) control either operates to maintain the Occupied or Unoccupied Cooling Set Point using economizer and/or mechanical cooling or the Occupied or Unoccupied Heating Set Point using the heating equipment.

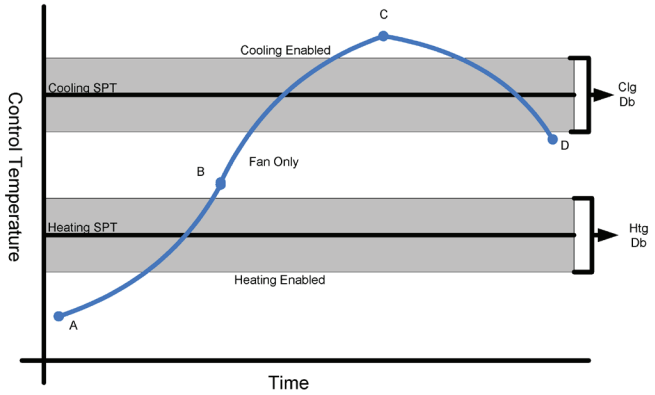
The occupied or unoccupied cooling/occupied or unoccupied heating setpoints can be set via the keypad/display or based on a signal from an optional space temperature sensor with set point adjustment capability. The following sections describe the unit heat/ cool changeover function.

Illustrative Heat/Cool Changeover Sequence

The following is an illustration of the heat/cool changeover function.

When the control temperature is below the occupied or unoccupied heating setpoint by more than ½ the deadband (point A), heating operation is enabled. Heating operation then remains enabled until the control temperature begins to rise and rises above the occupied or unoccupied heating setpoint by more than ½ the deadband (point B), at which point heating operation is disabled and the unit enters the fan only (or Min DAT) operating state. If the control temperature rises above the occupied or unoccupied cooling setpoint by more than ½ the deadband (point C) cooling operation is enabled. Cooling operation remains enabled until the control temperature begins to fall below the occupied or unoccupied cooling setpoint by more than ½ the deadband (point D), at which point the unit returns or fan only (or Min DAT) operating state.

Figure 12: Heat/Cool Changeover



Control Temperature

The "Control Temperature" is defined as the unit temperature input used to make the heat/cool changeover decision. This determines whether or not cooling or heating is enabled.

The user may select Space Temperature, Return Temperature, Outdoor Air Temperature or None for DAT units. Normally either the Return or Space Temperature is selected as the control temperature. Outdoor Air Temperature may be used as the control temperature for DAT units, but not for Zone Control units.

When the Control Temperature Source is set to None, the unit no longer "changes over" between heating and cooling in the normal manner. Instead it acts as if it is always in the "cooling" mode of operation controlling to the discharge air cooling set point. In this case the unit operating state will vary between Cooling, Fan Only and Min DAT (heating) in order to maintain the discharge air cooling set point. The unit will only enter the Heating operating state and control to the discharge heating set point for morning warm up purposes.

The Control Temperature Source automatically reverts from Return to Space if both of the following are true:

- The Return Air Sensor is not present and reliable
- A network or local Space Sensor is present and reliable

The Control Temperature Source automatically reverts from Space to Return if both of the following are true:

- The space sensor is not reliable (a valid space temperature value is not provided via the network and the space temperature sensor is either in alarm or not present)
- The return air sensor is reliable (present and not in alarm)

The Control Temperature Source automatically reverts from either Outdoor Air or Mixed Air to Return if the Control Type is Zone (Not DAT). If the return air temperature is not reliable, the control temperature may then revert to space as described above.

The Control Temperature Source automatically reverts from Mixed Air to Outdoor Air if Unit Type is not SCU.

A Control Temperature Fault that shuts down the unit is initiated if any of the following is true.

- The return air sensor is not present and reliable and Return Air is selected as the control temperature and a space sensor is not available.
- A network or local space sensor is not present and reliable and Space is selected as the control temperature and a return temperature sensor is not available.
- The OAT Sensor is not present and reliable and Outdoor Air is selected as the control temperature
- The mixed air temperature sensor is not present or reliable and Mixed Air is selected as the control temperature

Occupied Temperature Set Points

When the Use Tstat set point parameter is set to No, the Occupied Cooling Set Point and the Occupied Heating Set Point may be set through the keypad or via a network signal. In this case these set points are changed whenever the network or keypad value changes. When the Use Tstat set point parameter is set to Yes these set points can only be adjusted through the zone thermostat. Heating and cooling set points must not overlap. The Occupied Heating Set Point must be equal to or less than the Occupied Cooling Set Point. If a conflict occurs from values entered via the keypad or network, the Occupied Heating Set Point is automatically adjusted down to eliminate the conflict. When the Occupied Cooling Set point is changed by more than 0.5 degrees through the wall mounted sensor, the Occupied Heating Set Point is raised or lowered the same amount so that the difference between the Cooling and Heating set points does not change.

OA/EWT Lockout

Heating is disabled whenever the outdoor air temperature is greater than the Outdoor Air Ambient Heating Lockout Set Point. When the outdoor air temperature drops below the Outdoor Air Ambient Heating Lockout Set Point by more than the Heating Lockout Differential, heating operation is re-enabled. Cooling is disabled if outdoor air temperature or entering water temperature is too low for operation. The outdoor air temperature becomes too low for operation when it drops below the Outdoor Air Ambient Cooling Lockout Set Point. Outdoor air temperature becomes high enough for operation when it rises above the Outdoor Air Ambient Cooling Lockout Set Point by more than the Cooling Lockout Differential. The entering water temperature becomes too low for operation when it drops below the Minimum Entering Water Temperature Setpoint. Entering water temperature becomes high enough for operation when it rises above the Minimum Entering Water Temperature Setpoint by more the Cooling Lockout Differential.

Tenant Override

The tenant-override button provided with the optional zone temperature sensor packages is used to override unoccupied operation for a pre programmed time period. This time period is set with the Tenant Override Time Increment. This value can be adjusted from 0 to 300 minutes (default is 120 minutes). When an occupant presses and releases the tenant override button on the zone temperature sensor (ZNT1), the Tenant Override Timer is set equal to the Tenant Override Time Increment. (The button must be held for at least 1 second but not more than 10 seconds.) The unit then starts and runs in the tenant override mode which is the same as occupied mode except that it is temporary. The Tenant Override Timer begins timing out and the unit runs until the timer expires. If the tenant override button is pressed again while the unit is operating in tenant override mode, the Tenant Override Timer is reset to the Tenant Override Time Increment and the unit continues to operate. For example, assume that the Tenant Override Time Increment is 120 minutes. One press of the override button provides at least 120 minutes of unit operation. If the button is pressed again 60 minutes later, the Tenant Override Timer is reset to 120 minutes, and a total of 180 minutes of uninterrupted operation results.

NOTE: The same operation occurs if, instead of pressing the override button on a zone temperature sensor, the Occupancy Mode is set to "Tnt Ovrd." Once set to "Tnt Ovrd", the Occupancy Mode automatically reverts to the "Auto" setting once the Tnt Ovrd Timer is set to the Tnt Ovrd Time Increment. The same operation will also occur if the network occupancy manual command it set to bypass

Zero OA Time (Morning Warm-up)

A separate Morning Warm-up operating state is not provided, but an editable ZeroOATime is used to keep the Outside Air damper closed when the unit first starts. The Minimum OA Position is set to zero as long as the as the fan has been on for less than the ZeroOATime. This allows the Return Air type units to cool down the space with mechanical cooling or to warm up the space with the dampers closed. If the ZeroOATime is set correctly, the OA dampers will be open only during occupied periods. When Optimal Start is used ZeroOATime is set equal to the time to occupancy when the unit starts so that the OA dampers will open at occupancy time.

Post Heat Operation

After leaving the Recirc or Heating operating state and entering either the Fan Only or Min DAT operating state, the unit performs "post heat" operation if the Post Heat Timer is set to a non zero value. "Post heat" operation occurs within the Fan Only or MinDAT operating state. During "post heat" operation, the VAV Box Output remains open (heat) while the discharge fan capacity is forced to a minimum value (default 33% speed for VFD). By forcing the discharge fan capacity to a minimum value before the VAV Box Output closes (cool), "post heat" operation is designed to prevent duct over-pressurization by decreasing the duct pressure before the VAV boxes can close.

"Post heat" operation remains active until either the discharge fan capacity reaches the minimum value or until the Post Heat Timer expires, whichever occurs first. When "post heat" operation ends, normal duct static pressure or position control resumes.

NOTE: During "post heat" operation and for 120 seconds afterward, the proof of airflow input is ignored. This is to prevent nuisance Fan Fail fault alarms that may occur if the airflow switch opens during or following "post heat" operation. The unit cannot leave the Fan Only or Min DAT operating state while the airflow switch input is being ignored. The VAV output is only available to the field via network communications.

Dehumidification

In the dehumidification mode, mechanical cooling is used to cool air low enough to wring moisture out of it. Hot Gas Reheat or the standard unit heating equipment (Gas, SCR Electric or Steam/Hot water) is used to raise the temperature of this cooled air to a desirable value.

Dehumidification Initiation

An analog sensor is mounted in the return duct, the space, or outdoor to sense relative humidity. The location is selected by setting the Sensor Location value on the keypad to Return, Space, or OAT.

NOTE: This setting is used to dictate which temperature sensor is used to calculate the dewpoint. OAT can only be selected for units with DAT control. The relative humidity and a calculated dewpoint temperature are both displayed on the keypad. The calculated dewpoint temperature is based on the relative humidity and Return, Space, or OAT value depending on the location of the humidity sensor. Humidity control is disabled if cooling is disabled for any reason. Dehumidification operation is initiated when Humidity Control is set to either relative humidity or dewpoint and that value rises above the appropriate setpoint by more than half its deadband.

Dehumidification Termination

Dehumidification is terminated if the selected variable, Relative Humidity or Dew Point, drops below the appropriate humidity setpoint by more than half its deadband. Dehumidification is also terminated if cooling is disabled for any reason. Other ways that dehumidification may be terminated are if Dehum Method is set to "None" on the keypad, or if the unit goes to Off Net, Off Sw, Off Alm, or Off Man Ctrl.

When Dehumidification is terminated, all mechanical cooling is turned off except when the unit is in the Cooling state. Modulated cooling reverts to normal control when dehumidification is terminated in the Cooling state. For units with compressors, the number of cooling stages is reduced by one and control reverts to normal control when dehumidification is terminated in the Cooling state. Another compressor stage change could then occur after one Cooling Stage Time has elapsed

Dehumidification Mechanical Cooling Control

During dehumidification, control of mechanical cooling is based on the following two editable values of the Leaving Coil Temperature setpoint.

- Mx Lvg Coil T (Default = 52°F)
- Mn Lvg Coil T, 45°F (RTU/MPS); 52°F (DPS)

For compressorized units, the number of compressor stages increases when all of the following are true:

- The time since the last stage change exceeds the Clg Stage Time
- Leaving Coil Temperature is greater than the Mx Lvg Coil T
- The current cooling stage is less than the available number of stages

During the dehumidification mode, the number of compressor stages decreases when all of the following are true:

- The time since the last stage change exceeds the Clg Stage Time
- Leaving Coil Temperature is less than Mn Lvg Coil T Spt
- The current cooling stage is greater than zero

Units with modulated cooling are controlled by a PI Loop to maintain the temperature leaving the coil at the Mn Lvg Coil T. The normal DAT Cooling Deadband and PI Loop parameters are used in this PI Loop.

MPS HGBP Valve

When the Unit Type is MPS and the unit is equipped with modulating hot gas reheat control an HGBP valve output (MCB-DO6) is controlled to make sure hot gas is not flowing through both the hot gas bypass and hot gas reheat circuits simultaneously.

The HGBP Valve Output is ON (energized) whenever Unit State is Cooling and dehumidification operation is inactive. The HGBP Valve Output is OFF (de-energized) any other time.

Dehumidification Reheat Control

During dehumidification control either an analog or digital Hot Gas Reheat (HGRH) output or the standard modulating heating output is controlled to maintain the current Reheat Setpoint. If Reheat Type software configuration parameter is set to Staged Hot Gas, then a digital HGRH output is controlled to maintain the Reheat Setpoint. If the Reheat Type software configuration parameter is set to Modulating Hot Gas, then an analog HGRH output is controlled to maintain the Reheat Setpoint. If the Reheat Type software configuration parameter is set to Standard Heat, then the normal heating analog output is controlled to maintain the Reheat Setpoint.

- **Cooling/Fan Only:** In the Cooling and Fan Only states, a PI Loop is used to control the HGRH valve to maintain the Discharge Air Temperature at the Dehumidification Reheat Setpoint. The deadband for this loop is the same one used for other control of heating to maintain the DAT Heating setpoint.
- **Cooling:** In the Cooling state, the Dehumidification Reheat Setpoint equals the DAT Cooling Setpoint. For DAT units, this is the normal DAT setpoint resulting from any reset. For Zone Control units, this setpoint is the result of a PI Loop based on the control temperature as is done in the Economizer state or with modulated cooling in the Cooling state.
- **Fan Only:** In the Fan Only state, the Dehumidification Reheat Setpoint equals an editable MaxReheatSpt (Default = 65°F) when the control temperature drops to the Occupied or Unoccupied Heating Setpoint and equals an editable MinReheatSpt (Default = 55°F) when the control temperature rises to the Occupied or Unoccupied Cooling setpoint. The Dehumidification Reheat Setpoint varies linearly between these two points.

This means that no matter what the Control Temperature is, including OAT, the temperature leaving the unit is at a maximum just before the unit needs to go into heating and at a minimum just before the unit needs to go into cooling. This reduces opportunity for unit to go into heating or cooling during dehumidification.

Staged HGRH Control

In the Cooling and Fan Only states, a staged output is turned ON and OFF to control the HGRH valve to maintain the discharge air temperature at the Dehumidification Reheat Setpoint. The deadband for this setpoint is an adjustable. When the DAT is above the Dehumidification Reheat Setpoint by more than half the deadband, cooling capacity is greater than 0% and the Dehumidification Reheat Timer has expired, the reheat output is turned on. When the DAT is below the Dehumidification Reheat Setpoint by more than half the deadband and the Dehumidification Reheat Timer has expired, or if the cooling capacity is 0%, the reheat output is turned OFF.

Modulating HGRH Control

In the Cooling and Fan Only states, a PI Loop is used to control the HGRH valve to maintain the discharge air temperature at the Dehumidification Reheat Setpoint. The PI Loop is enabled when the unit is in the Cooling or Fan Only operating state and dehumidification becomes active.

NOTE: When configured for modulating hot gas reheat the reheat valve is stroked open and then closed every day at 2:00 AM as long as dehumidification is inactive and the unit is not in the Cooling operating state at the time.

Reheat Compressor Limiting Control

A special cooling capacity limiting function is used when a unit is configured for Hot Gas and/or Liquid subcooling control types of reheat. During dehumidification, if the unit cannot provide enough reheat to meet the discharge temperature setpoint this limiting function will act to reduce the cooling capacity of the circuit opposite the reheat circuit in an attempt to increase the leaving coil temperature and therefore the reheat temperature. An Event will also be logged.

Reheat compressor limiting is allowed during dehumidification operation if the following are true for longer than the cooling stage time:

- Reheat compressor limiting is set to Yes
- Reheat type equals ModHGRH, ModLSC or ModHG & LSC
- A fixed compressor in the circuit opposite the reheat circuit in ON
- The Reheat capacity equals 100%
- The DAT is less than the Reheat set point-1/2 DB

If all of the above items are true for longer than the cooling stage timer setting, the limiting function would reduce the cooling capacity of the circuit opposite the reheat circuit by one stage. This reduction in cooling capacity would continue until all compressors opposite the reheat circuit have been staged off as long as all of the above remained true.

The limiting function will remain active until the following are true for longer than the cooling stage time:

- Reheat capacity is less than or equal to the minimum reheat capacity
- The DAT is greater than the Reheat set point-1/2 DB
- All of the fixed stages have been staged back ON.

Energy Recovery

Energy recovery is provided by drawing outside air across half of an enthalpy wheel and drawing exhaust air across the other half. Latent and sensible heat is transferred from the hotter, moister exhaust air to the colder dryer outside air in winter. Latent and sensible heat is transferred from the hotter more moist outside air to the cooler dryer exhaust air in summer. Control consists of starting and stopping an exhaust fan, modulating the speed of the exhaust fan, starting and stopping the enthalpy wheel, and optionally controlling the speed of the enthalpy wheel. The outdoor dampers are controlled in the normal manner. The current statuses as well as editable parameters associated with energy recovery are located in the Energy Rec Setup menu.

Enthalpy Wheel

The enthalpy wheel is turned on when all of the following are true. The speed of the enthalpy wheel is set to the maximum speed for units with a VFD controlling the speed of the enthalpy wheel.

- The exhaust fan is ON
- The OA Dampers are at the minimum position
- The unit is not in the Economizer operating state
- The enthalpy wheel has not been turned OFF due to frost prevention (variable or constant speed wheels)
- The enthalpy wheel has not been turned OFF due to defrost control (constant speed wheels only)
- The wheel has not been turned OFF due to Variable Effectiveness Operation

The enthalpy wheel is turned OFF when any of the following is true

- The exhaust fan is OFF
- The OA Damper Position is driven above the Minimum OA Damper Position by more than 3%.
- Either of the frost prevention functions dictate that the wheel be OFF.
- The constant speed wheels defrost function dictates the wheel is to be OFF.

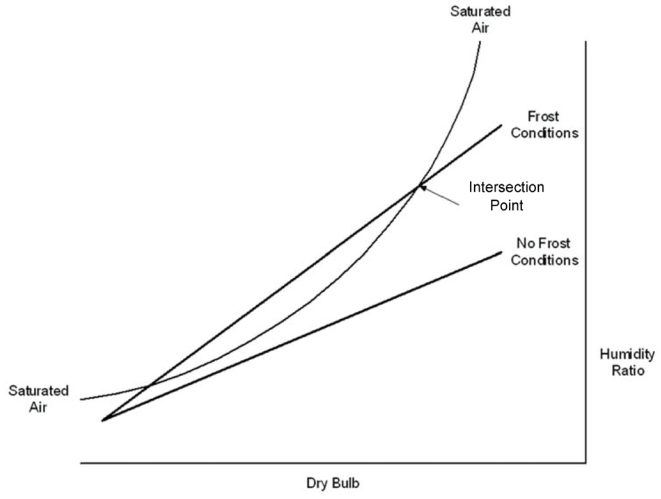
Enthalpy Wheel Frost Prevention

Two different frost protection methods are provided depending on whether or not the enthalpy wheel is controlled by a VFD. When there is a threat of frost or condensation on the enthalpy wheel, a variable speed wheel may be first slowed down and then stopped and a constant speed wheel may be stopped so that less enthalpy transfer occurs and frosting or condensation on the enthalpy wheel is avoided. In either case the frost control is based on an Intersection Point described as follows:

Condensation and frosting can occur on the enthalpy wheel when the exhaust air leaving the wheel is saturated. This condition will occur when two lines intersect on a psychometric chart, and it will not occur when these two lines do not intersect. One of these lines is the Humidity Ratio versus the dry bulb for saturated air. The other line is the Humidity Ratio versus the dry bulb temperature of the exhaust air leaving the enthalpy wheel. The two ends of this second straight line on a psychometric chart are the OAT at 95% RH and the return air temperature at the return air relative humidity. One line showing frosting conditions and another line showing no frost conditions are shown on the sketch of a psychometric chart shown.

A continuous calculation determines if and at what temperatures these two lines intersect. If they do intersect they intersect at two points. The higher of the two points is referred to as the "Intersection Point". When they do not intersect, the enthalpy wheel runs at full speed. When they do intersect, the variable speed enthalpy wheel may be slowed to its minimum speed as described above to maintain the dry bulb temperature of the exhaust air leaving the enthalpy wheel high enough to eliminate the Intersection Point and therefore the threat of frosting conditions. If slowing the wheel does not eliminate the Intersection Point after a stage time period, the wheel may be stopped. A constant speed wheel is stopped when an Intersection Point exists.

Figure 13: Exhaust Air Psychometric Chart



Constant Speed Wheel Frost Prevention Control

The enthalpy wheel is stopped when both of the following are true:

- The enthalpy wheel has been ON for longer than the edited Wheel Stage Time
- The exhaust air temperature leaving the enthalpy wheel is below the Intersection Point plus an edited minimum temperature difference.
- Defrost Method=ExhAir
- Enthalpy wheel is constant speed

The enthalpy wheel is turned back ON when the wheel has been OFF due to Frosting/Condensation for longer than an edited Minimum Off Time and the exhaust air temperature leaving the enthalpy wheel is above the Intersection Point plus an edited Maximum Temperature Difference.

Variable Speed Wheel Frost Prevention Control

The enthalpy wheel VFD speed is set to a minimum wheel speed (default 5%) value when all of the following are true:

- The enthalpy wheel has been operating at maximum speed for longer than the edited Wheel Stage Time
- The exhaust air temperature leaving the enthalpy wheel is below the Intersection Point plus an edited Minimum Temperature Difference.
- Enthalpy wheel is variable speed

To prevent Frosting/Condensation ON the enthalpy wheel, the enthalpy wheel is turned OFF when both of the following are true:

- The exhaust air temperature leaving the enthalpy wheel is below the Intersection Point plus an edited Minimum Temperature Difference.
- The wheel has been operating at the minimum wheel speed for longer than an edited Wheel Stage Time

The enthalpy wheel is turned ON at minimum speed when both of the following are true:

- The enthalpy wheel has been OFF due to Frosting/ Condensation for longer than an edited Minimum Off Time
- The exhaust air temperature leaving the enthalpy wheel is above the Intersection Point plus an edited Maximum Temperature Difference.

The Enthalpy Wheel speed will be increased to its maximum speed when both of the following are true:

- The exhaust air temperature leaving the enthalpy wheel is above the Intersection Point plus an edited Maximum Temperature Difference (MaxExhTDiff)
- The wheel has been operating at the minimum speed for longer than the edited Wheel Stage Time

Enthalpy Wheel Defrost Control (Constant Speed Wheels Only)

In lieu of the frost prevention method described above, a constant speed enthalpy wheel can be set for a simpler timed defrost method of frost management. With this method the enthalpy wheel is stopped periodically for a defrost time duration when the outdoor air temperature is below an outdoor frost temperature threshold setpoint.

Defrost operation becomes enabled when all of the following are true:

- Defrost Method = Timed
- Energy wheel is constant speed
- OAT is less than the OA frost temperature setpoint.
- Normal wheel operation has the enthalpy wheel ON

When defrost operation is enabled, the wheel is stopped for the Defrost Time (default 5 minutes) every Defrost Period (default 60 minutes).

When the wheel is stopped due to defrost operation the wheel must be slowly rotated so that both halves of the wheel are allowed to be defrosted by the relative warm exhaust air leaving the wheel. This is accomplished by alternately turning the wheel off for the editable Defrost Off Time (default 24 seconds) and on for the editable Defrost On time (default 1 second) during defrost operation.

Enthalpy Wheel Capacity Limiting

Enthalpy wheel capacity limiting control is a means to limit the capacity of an energy wheel during part load conditions. Normally wheels are sized for worst case winter/summer load and, therefore, at part load the wheel may be oversized. Capacity limiting control is allowed when the energy recovery wheel leaving air temperature (ERDAT) sensor is present and reliable and the outdoor air temperature (OAT) is colder than the returning air temperature.

Capacity limiting control is not allowed during dehumidification operation or when either the wheel frost prevention or defrost operation are active.

Capacity limiting operation differs depending on whether the energy recovery wheel is constant or variable speed.

Constant Speed Wheel

The conditions that cause the energy recovery wheel to turn due to capacity limiting are different depending on the unit operation state as follows:

Fan Only

When the unit is operating in the Fan Only state, the energy recovery wheel is stopped due to capacity limiting whenever the discharge air temperature (DAT) is above the MinDATLimit setpoint by more than ½ the discharge air heating deadband. The wheel is re-started when the DAT falls back to or below the MinDATLimit setpoint plus ½ the discharge air heating deadband.

Heating

When the unit is operating in the Heating state, the energy recovery wheel is stopped due to capacity limiting whenever all heating is OFF and the discharge air temperature (DAT) is above the discharge heating setpoint by more than ½ the discharge air heating deadband. The wheel is re-started when the DAT falls back to or below the discharge heating setpoint plus ½ the discharge air heating deadband.

Cooling

When the unit is operating in the Cooling state, the energy recovery wheel is stopped due to capacity limiting whenever the energy recovery wheel leaving air temperature (ER LAT) is above the discharge cooling setpoint by more than ½ the discharge air cooling deadband. The wheel is re-started when the ER LAT falls back to or below the discharge cooling setpoint plus ½ the discharge air cooling deadband.

Variable Speed Wheel

When the enthalpy wheel is variable speed and the Variable Effectiveness Control PI_Loop is active the ER LAT is controlled to the current effective discharge temperature setpoint.

Exhaust Fan

A variable speed exhaust fan controlled by a VFD is provided for all Economizer units with either constant volume or VAV supply fans and on 100% Outside Air units with VAV supply fans. Either a constant volume exhaust fan or a variable speed exhaust fan controlled by a VFD may be provided on 100% Outside Air units with constant volume supply fans.

The exhaust fan is turned ON when any of the following sets of conditions is true:

All four of the following are true:

- The Exhaust Fan is controlled by a VFD
- The OA Dampers are at least open to the Minimum OA Position
- The Minimum OA Position is greater than 0%
- The building static pressure is above the building static pressure setpoint by more than the deadband for longer than the Minimum Exhaust Fan Start Time (Default = 120 seconds)

All four of the following are true:

- The exhaust fan is controlled by a VFD
- The OA Dampers are at least open to the Minimum OA Position
- The Minimum OA Position is greater than 0%
- The exhaust fan capacity is commanded to a value above the minimum value (Default = 5%) by a BAS for longer than the Minimum Exhaust Fan Start Time (Default = 120 seconds)

Both of the following are true:

- The exhaust fan is constant volume
- The supply fan has been commanded on for at least 4 seconds

The exhaust fan is turned OFF when any of the following sets of conditions is true:

All three of the following are true:

- The exhaust fan is controlled by a VFD
- The building static pressure is below the building static pressure setpoint by more than the deadband
- The exhaust fan capacity is at or below its minimum value (Default = 5%) for longer than the Min Exhaust Fan Stop Time (Default = 120 seconds)

Both of the following are true:

- The exhaust fan is controlled by a VFD
- The exhaust fan capacity is commanded to less than or equal to its minimum value (Default = 5%) by the BAS for longer than the Minimum Exhaust Fan Stop Time (Default = 120 seconds)

The exhaust fan is OFF when the supply fan is OFF

Whenever a variable speed exhaust fan is ON, its capacity will be modulated using a VFD. The speed of the fan will be either (1) modulated to maintain the building static pressure at a desired value or (2) set at a fixed speed provided by a Building Automation System via a network.

Bypass Dampers (Not Applicable for 100% OA Units)

The bypass dampers are driven closed (Bypass Damper Closed output is energized) whenever the OA Damper position is less than or equal to the Minimum OA Position

The Bypass dampers are driven open (Bypass Damper Open output is energized) whenever the OA Damper Position exceeds the Minimum OA Damper Position by more that 3%

Outside Air Damper Control

Minimum Outside Air Damper Control

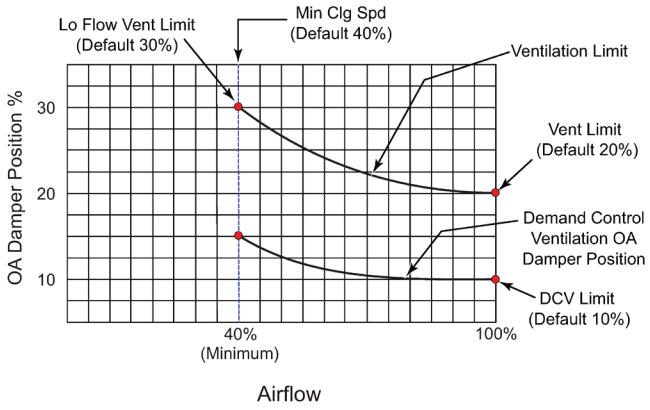
Control of the dampers in the Economizer state is described in the Economizer Control section. The outdoor air dampers are driven open in the cooling operating state if economizer operation is enabled and to the Minimum OA Position if economizer operation is disabled. For all other operating conditions, the outdoor air dampers are set to the Minimum OA Position. The Minimum OA Position is set to zero or closed position when the supply fan is off, the unit is in the Recirculation state, Occupancy is set to Unocc, or the fan has been on for less than the Zero OA Time.

As a result, the OA dampers are driven closed in night setback, night setup, morning warm-up, and morning cool down situations unless economizer operation is required. In all other conditions the Minimum OA Position is equal to or below a Ventilation Limit and equal to or above a Demand Control Ventilation limit. For CAV units, the Ventilation Limit equals the keypad editable Vent Limit and the Demand Control Ventilation Limit equals the keypad editable DCV Limit. For VAV units, the Ventilation Limit varies with VFD speed between the editable Vent Limit at 100% Supply Fan speed and the editable LoFlo Vent Limit at the Min Clg Spd, as shown in Figure 14. For VAV units, the Demand Control Ventilation Limit varies as the Ventilation Limit value changes so that the ratio between them remains constant. In the example shown in Figure 14 the Demand Control Ventilation Limit would always be 1/2 the Ventilation Limit since the DCV Limit= parameter (10%) is half of the Vent Limit= parameter (20%).

The editable parameters are to be determined when the airflow for the unit is balanced and are located in the Min OA Set-up menu.

NOTE: The MinClgSpd is prevented from being set equal to the Design Cooling Speed. The DCV Limit is prevented from being set greater than the Vent Limit. If the VentLimit or the LoFloVent Limit is set to 0, the Ventilation Limit is overridden to 0.

Figure 14: Damper Position versus Fan Speed Chart



Cold Start Operation

A special "cold start" sequence will slow the opening of the dampers when it is cold outdoors and the unit is equipped with either Hot water/Steam or F&BP heating. This is to try to prevent nuisance freezestat trips associated with dampers opening up rapidly to minimum position before the heat has a chance to ramp up. This "cold start" sequence is initiated if the following conditions are all true:

- OAT is below the current LoDATLimit
- The unit is equipped with an Airside Economizer
- The current Unit State is beyond the Recirc
- The current Minimum Outdoor Damper Position set point is greater than 0%

When the sequence is active the dampers will move more slowly the colder it is outdoors. The minimum and maximum ramp rates are adjustable via the keypad by navigating to the Commission Unit/Min OA Set-up menu. The effective ramp rate will vary from the minimum 40% 100% (Minimum) Airflow rate at OAT equal to -30°F to the maximum at OAT equal to 100°F. Once the damper position reaches a point 1% below the actual effective minimum position normal operation will begin. If the unit enters the Economizer operating state before the damper regulation begins, the regulation will begin from the current economizer position.

Minimum Outside Air Reset - None

If None is selected as the Min OA Reset Type, the Minimum OA Position is set equal to the Ventilation Limit. The Demand Control Ventilation Limit value is ignored when Min OA reset is set to None.

Minimum Outside Air Reset - Network Control

If Network is selected as the Min OA Reset Type and a valid value for the minimum position is provided via a network the Minimum OA Position is set equal to that value. The network is only allowed to write a value that is between the Ventilation Limit and the Demand Control Ventilation Limit current values. If Network is selected as the Min OA Reset Type and a valid value for the minimum position is not provided, the Min OA position is set equal to the Ventilation Limit.

Minimum Outside Air Reset - External Control

If ExtV is selected as the Min OA Reset Type, the Minimum OA Position is calculated based on an external 0-10 VDC signal. If ExtmA is selected as the Min OA Type, the Minimum OA Position is calculated based on an external 0-20 mA signal. This calculated Minimum OA Position varies linearly from zero % at the editable minimum external signal to the maximum value at the editable maximum external signal, but it is set no lower than the Demand Control Ventilation Limit and no higher than the Ventilation Limit.

Minimum Outside Air Reset -IAQ

If either IAQV or IAQ mA is selected as the Min OA Type, the Minimum OA Position is calculated based on a 0-10V or 0-20 mA CO_2 sensor input. The CO_2 level is expressed as Parts Per Million. The minimum and maximum sensor input values (0-10V or 0-20 mA) and the corresponding minimum and maximum PPM values are user defined. This calculated Minimum OA Position varies linearly from the Demand Control Ventilation Limit at the "PPM @ DCV Limit" to the Ventilation Limit at the "PPM @ VentLimit"". The "PPM @ DCV Limit" is not allow to be set equal to or greater than the "PPM @ VentLimit"

Examples of typical Min OA reset schedules

If IAQ VDC is selected as the Min OA Type, the Minimum OA Position is calculated based on a 0-10V CO_2 sensor input. The CO_2 level is expressed as PPM (Parts Per Million). The minimum and maximum sensor input values (0-10V) and the corresponding minimum and maximum PPM values are user changeable. This calculated Minimum OA Position varies linearly from the Demand Control Ventilation Limit at the value labeled "PPM @ DCV Limit" to the Ventilation Limit at the value labeled "PPM @ VentLimit". The "PPM @ DCV Limit" is not allow to be set equal to or greater than the "PPM @ VentLimit"

Example #1 Min OA reset type = IAQ VDC

If the requirement is to have the OA damper be at its minimum (Demand Control Ventilation Limit) when the CO_2 levels are less than 800 PPM and to be at its maximum (Ventilation Limit) when the CO_2 levels are greater than 1000 PPM, the controller would be set up as follow:

- Vent Limit = 100%
- Lo Flow Vent Limit = 100%
- DCV Limit = 0%
- Min OA reset type = IAQ VDC
- PPM@DCV Limit = 800
- PPM@Vent Limit = 1000
- IAQ PPM = Current PPM
- Min PPM = 0 (From CO_2 transducer)
- Max PPM = 2000 (From CO_2 transducer)
- V/A @ Min PPM = 0 VDC
- V/A @ Max PPM = 10 VDC

In this example the Minimum OA Position would vary linearly from 0% outside air at 800 PPM or less to 100% outside air at 1000 PPM or greater.

Examples of typical Min OA reset schedules

If EXT VDC is selected as the Min OA Type, the Minimum OA Position is calculated based on an external 0-10 VDC signal. This calculated Minimum OA Position varies linearly from zero % at the changeable minimum external signal to 100% at the changeable maximum external signal, but it is set no lower than the Demand Control Ventilation Limit and no higher than the Ventilation Limit.

Example #2 Min OA reset type = EXT VDC

If the requirement is to have the OA damper be at its minimum (Demand Control Ventilation Limit) when the field supplied signal is at its minimum (0 VDC) and to be at its maximum (Ventilation Limit) when the field supplied signal is at its maximum (10 VDC), the controller would be set up as follow:

- Vent Limit = 100%
- Lo Flow Vent Limit = 100%
- DCV Limit = 0%
- Min OA reset type = EXT VDC
- OA@MinV/mA = 0%
- OA@MaxV/mA = 100%
- Min V/mA = 0 VDC
- Max V/mA = 10 VDC

In this example the Minimum OA Position would vary linearly from 0% outside air at 0 VDC to 100% outside air at 10 VDC.

Reset Temperature Limit

The user has the option of setting a low temperature limit that will override all the outdoor air reset functions described in this section except the Return Fan Capacity Override function if the discharge air temperature or entering fan temperature gets too cold as a result of the reset. The user can choose the override sensor by setting the Reset Temperature Limit to None, DAT or EFT. When set to None the Reset Temperature Limit function is disabled. A Reset Temperature Limit PI_Loop will be used to reset the minimum outside air damper setpoint downward when the selected temperature input drops below the Reset Temperature Limit.

Minimum Position Control -Field Supplied Outdoor Airflow Station Input

When the OA Flow Station parameter in the Software Configuration Code is set to Field Station and the Field Station parameter on the keypad is set to VDC or mA, the Minimum OA Position value is adjusted based on the measured amount of outdoor air being brought into the unit from a field supplied airflow monitoring station. If the airflow is below the desired value, the Minimum OA Position is increased and if the airflow is above the desired value, Minimum OA Position is decreased.

The field airflow signal will be in the form of a 0-10V or 0-20 mA input. The minimum and maximum sensor input values (0-10V or 0-20 mA) and the corresponding minimum and maximum CFM values are user editable.

NOTE: The Minimum OA Position is reset up and down between the Ventilation Limit and the Demand Control Ventilation Limit by a PI_Loop function to maintain the field OA CFM value at an adjustable OA CFM Setpoint.

When the MinOAType is set to Ext or IAQ and the Field OA Station parameter is set to VDC or mA, the OA flow input is assigned to a specially added I/O expansion module (EXPE) position X1. When the MinOAType is not set to Ext or IAQ and the Field OA Station parameter is set to VDC or mA, the OA flow input is assigned to the main control board(MCB) position X1.

Minimum Position Control - Design Flow (RPS Airside Economizer Units Only)

When the OA Flow Station parameter in the Unit configuration menu is set to Design Flow and the Design Flow control flag is set to Yes, the minimum outside air damper position is controlled to maintain the minimum OA flow setpoint. Design Flow is only available when for RTU units with Airside Economizers.

When the DesignFlow control flag is set to Yes, the Minimum OA Position value is adjusted based on the measured amount of outdoor air being brought into the unit using a PI_Loop function. If the airflow is below the desired value, the Minimum OA Position is increased and if the airflow is above the desired value, Minimum OA Position is decreased.

If design flow is used settings for the min OA damper should be: Vent limit = 100%, Loflow V limit = 100%, and DCV limit = 0%

NOTE: The factory default for Min OA Reset is set to none however changes may be made by accessing the Min OA Set-Up menu. Once changes have been made to the Min OA Reset type, the Apply Changes flag must be changed from no to yes in order for the controller to recognize the changes. Setting the Apply Changes flag to YES will automatically reset the controller.

0-30%OA Units

A two position 0-30% OA actuator is controlled by a modulating analog output. This actuator is driven to its fully open position, nominally 30%, when the OA damper analog output is at its maximum value and it is driven closed when the OA damper analog output is at its minimum value. The desired minimum open position between 0% and 30% normally is set by an editable keypad menu item (Vent Limit). If a valid value is provided via the network, that position is used as the desired minimum open position instead of the keypad value.

The two position damper is driven to the closed position when the supply fan is OFF (OFF and Startup state), the unit is in the Recirculation state, unoccupied operation is active, or the fan has been on for less than the Zero OA Time. As a result the OA dampers are driven closed in night setback, night setup, morning warm-up, and morning cool down situations. The two position damper is driven to the desired minimum open position in all other conditions.

The Ventilation Limit equals the keypad editable Vent Limit and the Demand Control Ventilation Limit equals the keypad editable DCV Limit. The Vent Limit cannot be set higher than the 0-30%OAMax value. The DCV Limit cannot be set higher than the Vent Limit.

Return Fan Capacity Override (RTU Airside Economizer Units Only)

The minimum position determined by any method below may be overridden for a variable speed return fan when the return fan speed is below the supply fan speed by more than an adjustable value. In this situation, the outdoor air damper minimum position is reset up based on the schedule shown below if normal control of the minimum position would result in a lower value. The minimum position will be controlled in the normal manner if that results in a higher value than determined by the reset schedule.

Table 50: Outdoor Air Damper Minimum Position Reset Schedule

Discharge Fan Speed – Return Fan Speed	<= 20% Min Fan Differential	Between Min and Max Differential	>= 50% Max Fan Differential
Outdoor Air Damper Minimum Position	Demand Control Ventilation Limit	Linear Interpolation	Ventilation Limit

NOTE: If the supply fan is a constant volume fan, the Supply Fan Speed is assumed to be 100% when the discharge fan is on. If the Min Fan Differential is set equal to the Max Fan Differential, the return fan capacity override value reverts to the Ventilation Limit. This capability is not provided for exhaust fans.

Building Static Pressure Override (Airside Economizer Units Only)

The minimum position determined by any method described below may be overridden for a variable speed return fan or exhaust fan controlled by building static pressure when the return fan speed is at minimum or the exhaust fan has been stopped due to low building static pressure if the building pressure remains negative. If the user elects to use this function and the return fan has been at the minimum speed or the exhaust fan has been stopped for a minimum return/exhaust fan off time (default = 120 seconds) a PI_Loop will begin modulating the Min OA Pos setpoint upward to maintain the building static pressure at the building static pressure setpoint.

100% Outside Air Damper Control, Two Position

100% OA two position actuators are controlled by a digital output for SCU unit and by a modulating analog output for RTU units.

- Digital Output - The OA damper is driven fully open when the digital output is On and fully closed when the digital output is OFF
- Analog Output (100% OA Units) - The OA damper is driven to its 100% open position when the OA damper analog output is at its maximum value and it is driven closed when the OA damper analog output is at its minimum value

The OA damper is open during the Start Initial period, and it remains open during all operating states. The OA damper remains open after the fan is turned off until 30 seconds after the Airflow Switch digital input indicates loss of airflow. This keeps the outside air dampers open in case there is a failure or external override that keeps the fan running after it is turned OFF by controller logic. If the fan is turned ON by bypassing the controls that have it OFF, the Damper Output is NOT turned ON.

Airside Economizer

If a unit is equipped with a 0-100% modulating economizer, and the outdoor air is suitable for free cooling, the unit attempts to satisfy the cooling load by using outdoor air before using mechanical cooling. When the control temperature is above the Occupied or Unoccupied Cooling Set Point by more than half the Occupied or Unoccupied Cooling Dead Band and the discharge air temperature is above the Discharge Cooling Set Point by more than half the Discharge Cooling Dead Band, the controller enters the Econo state. When the unit is in the Econo operating state, the outdoor air dampers are modulated as required to maintain the Discharge Cooling Set Point.

Economizer to Cooling Operating State

The transition from the Econo to Cooling operating state occurs when the economizer is unable to satisfy the cooling load and mechanical cooling is available. This will occur when the commanded economizer position indicates more than 95% open and the discharge air temperature (DAT control units) or control temperature (Zone control units) is above the applicable Cooling Setpoint by more than half the applicable Cooling Deadband for longer than the Cooling Interstage Timer.

Waterside Economizer

If a unit is equipped with a 0-100% modulating waterside economizer, and the conditions are suitable for free cooling, the unit attempts to satisfy the cooling load by using waterside economizer before using mechanical cooling. When the control temperature is above the Cooling Enable Set Point by more than half the Cooling Enable Dead Band and the discharge air temperature is above the Discharge Cooling Set Point by more than half the Discharge Cooling Dead Band, the controller enters the Econo state. When the unit is in the Econo operating state, the economizer valve is modulated as required to maintain the Discharge Cooling Set Point.

Economizer FDD

The economizer fault detection and diagnostics function provides warning alarm indication of over economizing, under economizing, stuck dampers and excess outdoor air. This function is available when a fault detection type of OA damper is selected in the unit configuration menu. Once it is selected via the unit configuration menu it can be disabled/enabled via the Economizer set-up menu.

OAD End Switch Calibration

The outdoor air damper end switch input requires a calibration function that captures the command position at which the switches open and close at the closed and open ends of the damper modulation range. This function consists of a manually initiated sequence that strokes the dampers fully open and then fully closed and detects the changes of state of the switch input and records the points where changes occur. The sequence must be initiated while the Unit State is Off and starting with the end switch input in the closed position.

When the CalibrateOAD parameter is set from No to Yes the following sequence occurs:

Step 1: The damper command is increased 1% every 2 seconds until the OAD End Switch input opens.

Step 2: The damper command is then be decreased 1% every 2 seconds until the OAD End Switch input closes. At this point the current command % is captured.

Step 3: The damper command is increased 1% every 2 seconds until the OAD End Switch input opens. At this point the difference between the current command % and the damper end switch closed value is captured.

Step 4: The damper command is increased and held at 100% until the OAD End Switch input closes.

Step 5: The damper command is decreased 1% every 2 seconds until the OAD End Switch input opens.

Step 6: The damper command is increased 1% every 2 seconds until the OAD End Switch input closes. At this point the current command % is captured.

Step 7: The damper command is decreased 1% every 2 seconds until the OAD End Switch input opens. At this point the difference between the damper open end switch value and current command % value is captured.

Step 8: The damper command is decreased and held at 0% until the OAD End Switch input closes at which point the values captured in Step 2, Step 3, Step 6 and Step 7 are written to the damper end switch open (PosSwOpen%), Minimum switch differential (MinSwDiff), damper end switch closed (PosSwClose%) and maximum switch differential (MaxSwDiff) parameters respectively.

CalibrateOAD= parameter is then be set back to No and normal unit operation resumes.

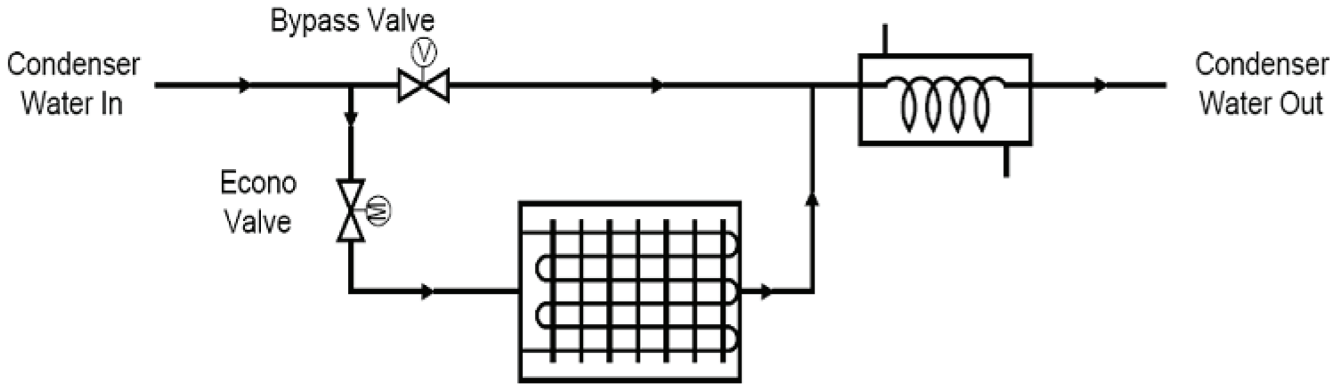
Bypass Valve Control

This section describes the operation of an analog output used to control a valve that allows water to bypass a waterside economizer and flow directly into a condenser.

When the bypass valve is closed, all water flows through the waterside economizer before it flows through the condenser.

When the Bypass Valve is open, all water that flows into the self-contained unit flows directly to the condenser without any water going through the waterside economizer. There are two different methods for controlling this valve; Slave Control and Bypass Control.

Figure 15: Bypass Control Diagram



Slave Control

The bypass valve is linked electrically to the economizer valve so that the bypass valve closes as the economizer opens. This provides a nearly constant flow of water through the unit regardless of the requirements of the economizer. When there is no cooling required, the bypass valve will be open and the waterside economizer valve is closed allowing water to flow through the condenser. This valve control option can be used in either a variable or constant pumping system.

Bypass Control

The bypass valve and waterside economizer valve are independently controlled. The bypass valve to the condenser is closed in all states except the Fan only, Mechanical cooling, and Economizer. The bypass valve is open when mechanical cooling is required and the water is not flowing through the waterside economizer. When the unit is OFF: Unoccupied, both the bypass valve and the waterside economizer valve are closed. No water is allowed to flow through the unit. This valve control option is typically used in variable pumping system or a constant pumping system with a bypass loop.

The two control schemes listed above are choices of how to control the water bypass valve. Both must have a configuration string place/spot 23 configured as one or the other (Slave/Bypass) and spot number one must be configured as a 1 (self contained / SCU).

Water Regulating Valve Control

In the Cooling state, the Water Regulating Valve stays at its last commanded position when the last compressor is turned OFF.

When all compressors are OFF and a compressor needs to be turned ON, the Water Regulating Valve must be driven open long enough to prevent the compressor from being locked out due to high pressure, but not so long that it is locked out due to low pressure. The WRV Start Sequence described below is used to make sure this is the case. This is required when transitioning to the Cooling state from the Fan Only or Economizer state.

In the Fan Only state, the Water Regulating Valve is normally closed. The WRV Start Sequence described below is initiated in the Fan Only state whenever all of the following are true:

- Cooling Status=Enabled or Off Ambient
- Airside Economizer operation is disabled or not installed
- Either of the following are true:
  - Both of the following are true:
    - Control Temperature Source is something other than None
    - Control Temperature > Occupied Cooling Setpoint + ½ the cooling dead band
  - Both of the following are true:
    - Control Temperature Source is set to None
    - DAT > DAT Cooling Setpoint + ½ the cooling dead band

In the Economizer state, the Water Regulating Valve is normally closed. The WRV Start Sequence described below is initiated in the Economizer state whenever either of the following is true:

All of the following are true:

- All of the following are true:
  - Cooling Status=Enabled or Off Ambient
  - Economizer Position is greater than 95.0% for more than the Cooling Stage Time AND
  - Discharge Air Temperature > DAT Cooling Setpoint + ½ the cooling dead band for more than the Cooling Stage Time
- Both of the following are true:
  - Cooling enabled AND
  - Economizer Disabled

WRV Start Sequence

The following Startup Sequence is followed when a stage up from stage zero is required and the Water Regulating Valve is closed.

The Water Regulating Valve is set to an minimum (Default = 10%)

The Entering Water Temperature (EWT) is measured after the WRV has been at its minimum position for a default of 60 seconds. An Initial WRV Position is then calculated based on the measured EWT. The Unit transitions to Cooling and the first compressor is started when the time to initial position has passed. The first compressor runs for an editable Initial Operation Time with the WRV at the calculated initial position. Control then reverts to normal PI control.

Special settings may warrant a change of timing sequence to the WRV. If conditions are showing symptoms of high head pressure start ups make the following changes to the default settings. These changes open the valve to 100 percent (full water flow) for the first 300 Seconds, and movement of the valve is changed from full stroke of 60 seconds to 10 seconds

Under headpressure set up/WRV init Tm change to 300, Min WRV Pos change to 100%, WRV Act time change to 10 sec.

Special Procedures for Units with WRV and More

- When the unit enters Cooling, a compressor on either circuit # 1 or # 2 must start first if one is enabled because the pressure sensors are on circuits # 1 and # 2.
- If both circuits # 1 and #2 are disabled due to High Pressure or Low Pressure alarms, the lead compressor is determined by the compressor circuit that contains the compressor with the fewest run hours.
- If both circuit # 1 and circuit # 2 are disabled, The WRV will be controlled based on the EWT and the calculated initial position.
- Control of the WRV reverts to normal PI control if either circuit # 1 or circuit # 2 is enabled and its compressor is turned ON.
- All compressors are disabled if EWT drops below the minimum WRV temperature value by more than the Outside air cooling lockout differential.
- Compressors are re-enabled if EWT rises above the minimum WRV temperature value.

Water Pump Control

The Pump output is in the on position if any of the following are true:

- The Bypass Valve output is being driven above 0%
- The Water Regulating Valve output is being driven above 0%
- A waterside economizer is installed and the unit is in the Economizer state
- The unit is the Cooling state
- The Unit is in the Start Initial state and Flush Mode is set to Yes
- The unit has a waterside economizer and a Freeze Fault or Freeze Problem is active
- The unit has a waterside economizer and 10 minutes have not yet passed after a Freeze Fault or Freeze Problem has disappeared

Cooling: Multistage

Entering the Cooling Operating State

The unit enters the Cooling operating state from the Fan Only operating state when the control temperature rises above the Occupied or Unoccupied Cooling Set Point by more than half the Cooling Dead Band and the discharge air temperature is above the discharge cooling setpoint by more than half the cooling Dead Band. The unit transitions from Cooling to Fan only when the control temperature falls below the Occupied or Unoccupied Cooling Set Point by more than half the Occupied or Unoccupied Cooling Dead Band. The unit will also transition from the Cooling to Fan only operating state if Cooling operation is disabled due to OA ambient lockout.

Staging -DAT Control

In the Cooling state, compressor stages are turned on and off to maintain an average Discharge Air Temperature near the Discharge Cooling Setpoint. When the load is such that cooling capacity is being staged up and down between two stages, this control sequence causes the unit to operate longer at the stage that produces the discharge air temperature that is closer to the setpoint over time which results in an average discharge air temperature that is very close to the Discharge Cooling Setpoint.

This setpoint may be fixed or reset as described in the Cooling DAT Reset section. External devices such as VAV boxes maintain the desired space conditions. The unit may be a Constant Volume unit, but it is normally a Variable Air Volume unit. If the Discharge Air Temperature is approaching the setpoint, the number of stages continues to increase or decrease until the actual temperature gets within half the deadband. Control of cooling stages is based on two values, the Degree Time Above and the Degree Time Below the Discharge Cooling Setpoint. The difference between the actual discharge air temperature and the Discharge Cooling Setpoint is added to one of the Degree Time values every ten seconds.

If the Discharge Air Temperature exceeds Discharge Cooling Setpoint, the difference is added to the Degree Time Above value. If the Discharge Air Temperature is below the Discharge Cooling Setpoint, the difference is added to the Degree Time Below value. These values are limited to a maximum value of 250 to prevent remaining too long in one stage because one value or the other became very large.

When the unit enters the Cooling state the first compressor is turned on immediately. When the unit is equipped with evaporative condensing, the sump pump must be turned on before any compressor is turned on. If there is a sump pump fail condition, cooling will stay in stage 0.

With DAT staging control, there are four possible staging transitions; Stage up after stage up, stage up after stage down, stage down after stage down, and stage down after stage up. These are described in the following paragraphs:

Stage Up After Stage Up:

If the time since the last stage change exceeds the cooling stage timer, the discharge air temperature is greater than the Discharge Cooling Setpoint by more than half the deadband, the last stage change was a stage up, and dehumidification is not active; cooling capacity is increased by one stage

Stage Up After Stage Down:

If the time since the last stage change exceeds the cooling stage timer, the discharge air temperature is greater than the Discharge Cooling Setpoint by more than half the deadband, the last stage change was a stage down, the Degree Time Above value is greater than or equal to the Degree Time Below value, and the dehumidification is not active; cooling capacity is increased one stage.

Stage Down After Stage Down:

If the time since the last stage change exceeds the cooling stage timer, the discharge air temperature is less than the Discharge Cooling Setpoint by more than half the deadband, the last stage change was a stage down, and dehumidification is not active; cooling capacity is decreased one stage.

Stage Down After Stage Up:

If the time since the last stage change exceeds the cooling stage timer, discharge air temperature is less than the Discharge Cooling Setpoint by more than half the deadband, the last stage change was a stage up, the Degree Time Below value is greater than or equal to the Degree Time Above value, and dehumidification is not active; cooling capacity is decreased one stage.

The Degree Time Below and Degree Time Above values change whenever a stage change occurs. If the previous stage change was a stage up and the number of stages increases again, both Degree Time Above and Degree Time Below are set to zero.

If the last stage change was a stage up and the stage decreases due to the Degree Time Below exceeding the Degree Time Above, the Degree Time Below is reduced by an amount equal to Degree Time Above and then the Degree Time Above is set to zero.

If the last stage change was a stage down and the stage increases due to the Degree Time Above exceeding the Degree Time Below, the Degree Time Above is reduced by an amount equal to Degree Time Below and then the Degree Time Below is set to zero.

Degree Time logic is not used when dehumidification is active. When dehumidification is active, cooling capacity is increased if the time since the last stage change exceeds the cooling stage timer and the Leaving Coil Temperature (LCT) is greater than the Maximum Leaving Coil Setpoint. When dehumidification is active, cooling capacity is decreased if the time since the last stage change exceeds the cooling stage timer amd the leaving coil temperature is less than the minimum leaving coil setpoint.

Average Discharge Control Method Illustration

"" on page 117 is an illustration of the "Degree Time" compressor staging control method and is meant to show a variety of staging possibilities not normal unit operation. shows nine points on a graph of the discharge air temperature changing with time. The Cooling Interstage Timer setting is 5 minutes.

Point 1 Assume that the controller has just staged up and that DTA and DTB are zero. As a result, the discharge air temperature drops and the Cooling Interstage Timer is reset.

Point 2 DTA (Area A) equals DTB (Area B). The discharge air temperature is below the Effective Discharge Cooling Set Point by more than half the Discharge Cooling Dead Band. However, since the Cooling Interstage Timer has not yet expired, no staging action occurs.

Point 3 The Cooling Interstage Timer has expired. DTB (Area B + Area C) is greater than DTA (Area A) and the discharge air temperature is below the Effective Discharge Cooling Set Point by more than half the Discharge Cooling Dead Band. Therefore, cooling is staged down. As a result, the discharge air temperature rises, the Cooling Interstage Timer is reset, and DTA is subtracted from both DTA and DTB. This zeros DTA and leaves DTB equal to Area C.

Point 4 The Cooling Interstage Timer has expired. The discharge air temperature is above the Effective Discharge Cooling Set Point by more than half the Discharge Cooling Dead Band. However, since DTA (Area E) is not yet equal to DTB (Area C + Area D), no staging action occurs and the discharge air temperature continues to rise.

Point 5 The Cooling Interstage Timer has expired. The discharge air temperature is above the Effective Discharge Cooling Set Point by more than half the Discharge Cooling Dead Band and DTA (Area E + Area F) is equal to DTB (Area C + Area D). Therefore, cooling is staged up. As a result, the discharge air temperature drops, the Cooling Interstage Timer is reset, and DTB is subtracted from both DTB and DTA. This zeros both DTA and DTB since they are equal. Note that the elapsed time since the last stage change in is 6.3 minutes.

Point 6 The Cooling Interstage Timer has expired. Because the cooling load is now increasing, the discharge air temperature does not fall below the Effective Discharge

Cooling Set Point by more than half the Discharge Cooling Dead Band. No staging action occurs for two reasons: (1) the discharge air temperature is within the Discharge Cooling

Dead Band and (2) DTB (Area H) is not yet equal to DTA (Area G). Even if the discharge air temperature falls below the Effective Discharge Cooling Set Point by more than half the Discharge Cooling Dead Band (as shown just after Point 6), a stage down does not occur because DTB remains less than DTA. The discharge air temperature starts rising again because the load is increasing.

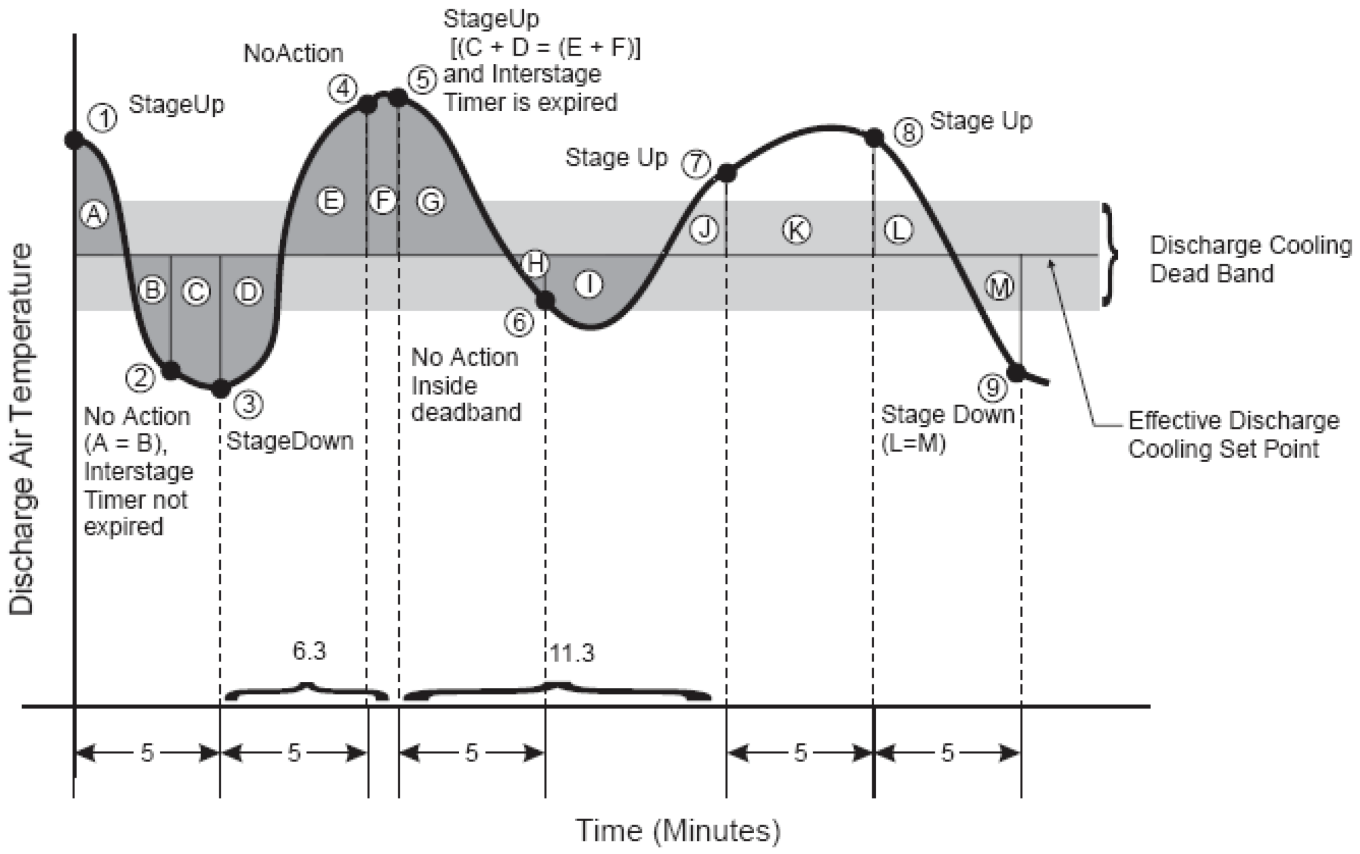
Point 7 The discharge air temperature is again above the Effective Discharge Cooling Set Point by more than half the Discharge Cooling Dead Band. Since the Cooling Interstage

Timer expired at Point 6, cooling is staged up. As a result, both DTA and DTB are zeroed and the Cooling Interstage Timer is reset. Note that DTA and DTB are both zeroed since two consecutive stage increase actions occurred. The discharge air temperature continues to rise, however, because the cooling load is still increasing. **Note:** that the elapsed time since the last stage change in this illustration is 11.0 minutes.

Point 8 The Cooling Interstage Timer has expired. Since the discharge air temperature is still above the Effective Discharge Cooling Set Point by more than half the Discharge Cooling Dead Band, another stage-up occurs. As a result, DTA (Area K) is again zeroed out (DTB remains zeroed) and the Cooling Interstage Timer is reset. The cooling load has leveled out, and the discharge air temperature drops.

Point 9 The Cooling Interstage Timer has expired at the same time that DTB (Area M) becomes equal to DTA (Area L). Therefore, cooling is staged down, the Cooling Interstage Timer is reset and DTA is subtracted from both DTA and DTB. This zeros both DTA and DTB since they are equal.

Figure 16: Average Discharge Control Method



Staging - Zone Control

In the Cooling state, compressor stages are turned ON and OFF to maintain the control temperature close to the Occupied or Unoccupied Cooling Setpoint. Use of the Projected Control Temperature reduces overshoot during cool down. See the Project Ahead section for a description of how the Project Ahead Temperature is calculated.

When the unit enters the Cooling state or dehumidification operation begins the unit goes directly to Cooling Stage # 1 so that the first compressor is turned on immediately.

During normal cooling operation the number of compressor stages increases when the time since the last stage change exceeds the Cooling stage timer, Projected Control Temperature is greater than the Occupied or Unoccupied Cooling Setpoint by more than half the deadband, the Control Temperature is greater than the Occupied or Unoccupied Cooling Setpoint by more than half the deadband, and the Discharge Air Temperature is greater than the minimum DAT cooling setpoint.

During normal cooling operation the number of compressor stages decreases when the time since the last stage change exceeds the cooling stage timer, the Projected Control Temperature is less than the Occupied or Unoccupied Cooling Setpoint by more than half the deadband, the Control Temperature is less than the Occupied or Unoccupied Cooling setpoint by more than half the deadband.

During normal cooling operation the compressor stages also decrease when the time since the last stage change exceeds the cooling stage timer, and the discharge air temperature is less than the minimum DAT Cooling setpoint.

When Dehumidification is active, compressor stages are controlled to maintain the leaving coil temperature between the minimum leaving coil setpoint and the maximum leaving coil DAT setpoint.

During dehumidification on operation, the number of compressor stages increases if the time since the last stage change exceeds the cooling stage timer and the leaving coil temperature is greater than the Maximum Leaving Coil Setpoint. During dehumidification operation, the number of compressor stages decreases if the time since the last stage change ecxeeds the cooling stage timer and the leaving coil temperature is less than the Minimum Leavaing Coil Setpoint.

Project Ahead

This section describes the Projected Control Temperature used to turn on and off stages of heating and cooling for Zone Control units. It is not used in DAT Control units.

In Zone Control cooling and heating operation, the Projected Control Temperature, reduces overshoot as the zone temperature approaches a setpoint after startup. It does this by causing stages to stop increasing before the actual control temperature reaches the setpoint. The rate of change of the control temperature is calculated once per minute by the controller and equals the change during the last sixty seconds. This rate of change is multiplied by the Effective Project Ahead Time and is added to the current control temperature. The rate of change may be negative or positive so the Projected Control Temperature may be higher or lower than the actual control temperature. This value, the Projected Control Temperature, is the temperature that would exist after the Project Ahead Time passes if the control temperature were to continue to change at the same rate for the Effective Project Ahead Time. The Effective Project Ahead Time is set equal to the Cooling Project Ahead Time when the unit is in the Cooling state. The Effective Project Ahead Time is set equal to the Heating Project Ahead Time when the unit is in the Heating state. It is set equal to zero under all other conditions causing the Projected Control Temperature to equal the actual control temperature

Cooling: Modulating

Modulating Cooling Control: Chilled Water

When the unit's cooling type is set to chilled water and is in the Cooling operating state, or in the dehumidification operating state the chilled water valve is modulated to maintain the discharge air temperature at the Discharge Cooling Set Point (or leaving coil temperature at the Minimum Leaving Coil Setpoint if dehumidification is active).

Modulating Cooling Control: Face & Bypass

When the unit's cooling type is set to Face & Bypass and is in the Cooling operating state, or in the dehumidification operating state, the chilled water valve is driven fully open and the face and bypass dampers are modulated to maintain the discharge air temperature at the Discharge Cooling Set Point (or leaving coil temperature at the Minimum Leaving Coil Setpoint if dehumidification is active).

Discharge Air Temperature Setpoint Reset - Cooling

The Cooling DAT Setpoint may be reset for units with DAT Cooling Control. The reset type may be set to one of the following:

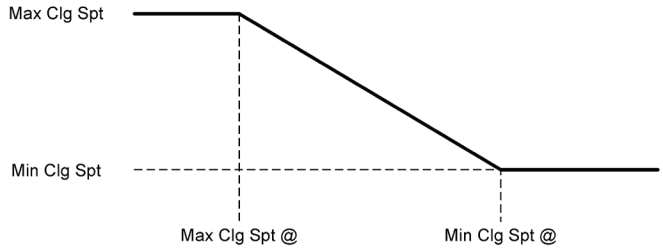
- **None:** Discharge Cooling Spt is user adjustable
- **Network:** Discharge Cooling Spt is equal to the Network DAT Clg Setpoint when it is valid
- **Space:** Discharge Cooling Spt is based on the Space Sensor
- **Return:** Discharge Cooling Spt is based on the Return Air Sensor
- **OAT:** Discharge Cooling Spt is based on the Outdoor Air Temperature
- **Ext mA:** Discharge Cooling Spt is determined by a 0-20 mA signal
- **Ext V:** Discharge Cooling Spt is determined by a 0-10 VDC signal
- **Airflow:** Discharge Cooling Spt is based on the airflow as indicated by the variable frequency drive speed

Reset reverts from Return to None when a Return Air Sensor opens or shorts. Reset reverts from Space to None when a Space Sensor opens or shorts. Reset reverts from OAT to None when an Outdoor Air Sensor opens or shorts.

When Space, Return, OAT, Airflow, Ext mA, or Ext V is selected, the Discharge Cooling Spt equals the Max Clg Spt when the selected value equals the Max Clg Spt @ value. Similarly, the Discharge Cooling Spt equals the Min Clg Spt when the selected value equals the Min Clg Spt @ value.

When Space, Return, OAT, or Airflow is selected, the reset schedule should be set so that the DAT Cooling setpoint decreases as the selected temperature increases as shown in the graph.

Figure 17: Cooling Setpoint



When Airflow is selected, the values "Min Clg Spt @" and "Max Clg Spt @" are entered as percentage values. When Ext mA is selected, the values "Min Clg Spt @" and "Max Clg Spt @" are entered as mA values. When Ext VDC is selected, the values "Min Clg Spt @" and "Max Clg Spt @" are entered as VDC values.

If Ext mA or Ext V is selected as the type of reset, the Min Clg Spt @ value may be set above the Max Clg Spt @ value to cause a decrease in the DAT setpoint as the external signal or the Min Clg Spt @ value may be set below the Max Clg Spt @ value to cause an increase in the DAT setpoint as the external signal increase.

The Min Clg Spt @ value can be set below the Max Clg Spt @ value for all types of reset, but it only makes sense for external reset.

When ever the Clg Reset Type or Engineering Units is changed, the Min Clg Spt @ and Max Clg Spt @ values revert to default values as follows:

- None: Min Clg Spt @=0NA, Max Clg Spt @=100NA
- Network: Min Clg Spt @=0NA, Max Clg Spt @=100NA
- Space, Return: Min Clg Spt @=73.0F, Max Clg Spt @=71.0F
- OAT: Min Clg Spt @=90.0F, Max Clg Spt @=70.0F
- ExtmA: Min Clg Spt @=4.0mA, Max Clg Spt @=20.0mA
- ExtVDC: Min Clg Spt @=0.0V, Max Clg Spt @=10.0V
- Airflow: Min Clg Spt @=33%, Max Clg Spt @=100%

Compressor Control for RoofPak

VFD Compressor Operation

When an RTU is equipped with the VFD compressor option there are two compressor circuits, one VFD controlled compressor in circuit #2 with up to 3 fixed speed compressors in circuit #1 depending on unit model. Circuit #2 (containing the VFD compressor) is always the "lead" circuit. The VFD compressor is controlled via a 0-10VDC analog output signal from the MicroTech Unit Controller that varies the VFD frequency between 25rps (0VDC) and 100rps (10VDC). The minimum and maximum rps (VDC) values actually used vary depending on unit size, whether or not a fixed speed compressor is running and whether or not a special oil return boost mode of operation is active. The following table shows the relationship between the minimums and maximums and unit size.

Table 51: VFD Compressor Size Range

RPS/RDT Unit Model	VFD Modulation Range					LoOilBoostrps/ LoOilBoostV	HiOilBoostrps/ HiOilBoostV
	VFDMinrps/ VFDMinV	VFD Max rps			VFD Comp Only VFDMaxrps/ VFDMaxV		
		VFD and Fixed Comp(s) On					
		1 Fixed On	2 Fixed On	3 Fixed On			
		VFD1Maxrps/ VFD1MaxV	VFD2Maxrps/ VFD2MaxV	VFD3Maxrps/ VFD3MaxV			
016	25 rps 0 Vdc	55 rps 4.0 V	NA		100 rps 10.0 V	70 rps 6.0 V	100 rps 10.0 V
021	25 rps 0 Vdc	70 rps 6.0 V	NA	NA	100 rps 10.0 V	70 rps 6.0 V	100 rps 10.0 V
026	25 rps 0 Vdc	85 rps 8.0 V	NA	NA	100 rps 10.0 V	70 rps 6.0 V	100 rps 10.0 V
031	25 rps 0 Vdc	70 rps 6.0 V	NA	NA	100 rps 10.0 V	70 rps 6.0 V	100 rps 10.0 V
042	25 rps 0 Vdc	100 rps 10.0 V	95 rps 9.33 V	NA	100 rps 10.0 V	70 rps 6.0 V	100 rps 10.0 V
045	25 rps 0 Vdc	75 rps 6.7 V	75 rps 6.7 V	NA	75 rps 6.7 V	70 rps 6.0 V	75 rps 6.7 V
051	25 rps 0 Vdc	85 rps 8.0 V	85 rps 8.0 V	NA	85 rps 8.0 V	70 rps 6.0 V	85 rps 8.0 V
063	25 rps 0 Vdc	95 rps 9.33 V	95 rps 9.33 V	NA	95 rps 9.33 V	70 rps 6.0 V	95 rps 9.33 V
074	25 rps 0 Vdc	70 rps 6.0 V	50 rps 3.3 V	100 rps 10.0 V	75 rps 6.7 V	70 rps 6.0 V	100 rps 10.0 V

The basic compressor control sequence is to first start the VFD compressor and modulate it with a PI control loop to maintain discharge temperature. When the VFD compressor is at its maximum speed and more capacity is required, the available fixed compressor with the fewest run hour total is started (any fixed compressors on the VFD circuit are started first) while the VFD compressor is reduced to minimum speed. When the VFD compressor is at its minimum speed and less capacity is required the fixed compressor with the highest run hour total is stopped (any fixed compressors on the circuit opposite the VFD circuit are stopped first) while the VFD compressor is increased to maximum speed.

VFD Compressor Start Sequence

On a call for VFD compressor operation the VFD Enable output (MCB DO3) is energized (on) and the 0-10VDC analog control signal is set to 3.33VDC (50rps) for 10 seconds. During this 10 second initial period the VFD compressor's internal logic ramps the compressor to 50rps (this aids in starting oil circulation). After 10 seconds the VFD compressor control signal begins modulating based on a PI loop to maintain the cooling discharge setpoint.

NOTE: In addition to enabling VFD compressor operation the VFD Enable output is used to energize a liquid line drop solenoid on the VFD circuit and to turn on auxiliary ventilation fans in the VFD compressor enclosure.

Compressor Stage Up Transition

When the VFD compressor has been operating at maximum capacity for the cooling stage time period (default 5 Minutes) and more capacity is required, the fixed compressor with the fewest run hours is started (any fixed speed compressors on the same circuit as the VFD compressor is started first). The VFD compressor is held at is minimum value for 30 seconds.

Compressor Stage Down Transition

When the VFD compressor has been operating at minimum capacity for the cooling stage time period and less capacity is needed, the fixed compressor with the highest run hour total is turned off (fixed speed compressors on the circuit opposite the VFD compressor are stopped first). The VFD compressor is held at its maximum value for 30 seconds

Dehumidification Transition During Cooling State

When dehumidification becomes active while the unit is in the Cooling operating state the VFD compressor is set to its maximum value and held there for 1 minute. In addition if the VFD compressor was operating above 75% when dehumidification became active, a fixed compressor with the fewest run hours is turned ON.

VFD Compressor Enable/Disable

If the VFD compressor becomes unavailable normal staging operation (based on run hours) occurs with the available fixed compressors.

VFD Emergency Stop Output

In normal operation the VFD Emergency Stop Output (EMC DO4) will be energized (ON). When any cooling related alarm that shuts off the VFD compressor is active the VFD Emergency Stop Output will be de-energized (OFF)

Oil Boost Sequence

The VFD compressor is equipped with an oil level sensor. If low oil level is detected the compressor speed must be increased for a time period to force oil in the system to be returned to the compressor. The low oil condition is communicated to the MicroTech Unit Controller via a digital input (EMC-X3) signal from the VFD compressor.

When the VFD compressor is ON and low oil level is detected (digital input EMC-X3 is open) for 10 consecutive minutes (default) or if oil boost is manually initiated (VFD compressor must be running for manual initiation of oil boost) the oil boost sequence is activated. The oil boost sequence is as follows:

- Upon entering into the oil boost operation the MicroTech Unit Controller logic captures the current VFD compressor capacity and fixed speed compressor status.
- If one or more fixed speed compressors are operating the fixed compressor with the highest run hour total is staged OFF.
- If the oil boost sequence is activated while the compressor capacity is less than 60 rps (46.7%) the VFD compressor capacity is increased to 60 rps (46.7%) and runs at that capacity for an Oil Boost Timing period (default 15 minutes).
- If the low oil input (EMC-X3) still open after the Oil Boost Timing period expires, the compressor capacity is increased to the High Oil Boost value.
- If the oil boost sequence is activated when the compressor capacity is equal to or greater than 60 rps (46.7%) the compressor capacity is increased to the High Oil Boost value.
- If the VFD compressor has been operating at the High Oil Boost value for the Oil Boost Timing period and the low oil input (EMC-X3) is still open the VFD compressor is stopped and a Low Oil problem alarm is generated. The alarm is also generated if the oil boost sequence becomes active 5 times in a 24 hour operating period.
- Once active the oil boost sequence remains active until the low oil input (EMC-X3) closes continuously for 3 minutes, until boost mode is manually stopped via the HMI, the Low Oil: Problem alarm is generated or the compressors are all stopped due to normal temperature control.
- When the oil boost sequence becomes active an event is entered in the Event Log, an event is also entered when the oil boost sequence becomes inactive and VFD compressor operation returns to normal.
- Once the low oil input (EMC-X3) closes continuously for 3 minutes, compressor capacity reverts to the condition captured when the oil boost mode became active.

NOTE: This only applies when the current oil boost cycle returns to inactive in the "normal" manner. It does not apply for example if the oil boost cycle returns to inactive due to the Low Oil: Problem alarm being generated.

The High Oil Boost Value varies with unit size.

VFD Compressor Protection Unloading Control

There are several unloading control functions that limit the speed of the VFD compressor to protect it from damage under abnormal operating conditions. The following functions are provided:

- High Pressure Unloading Control
- High Discharge Line Temperature Unloading Control
- Low Discharge Superheat Unloading Control
- High Discharge Superheat Unloading Control
- Condenser Coil Splitter Coil Unloading Control
- VFD Compressor Emergency Stop Control

High Pressure Unloading Control

Normal VFD compressor control is limited when a high discharge pressure conditions occur on the VFD compressor circuit. If the VFD compressor is operating and the discharge pressure (PTD) is greater than 525 PSI, a High Pressure Unloading Control Event is generated and the VFD compressor is slowed every 10 seconds until either the discharge pressure falls to less than 525 PSI or remains higher than 575 PSI for 10 minutes. If the discharge pressure is above 575 PSI for 10 minutes the VFD compressor is shut off and a High Pressure Problem alarm is generated. If the OAT is below 45F at the time the VFD compressor is shut OFF immediately and a High Pressure Problem alarm is generated anytime the discharge pressure rises above 575 PSI. The alarm must be manually cleared.

High Discharge Line Temperature Unloading Control

Normal compressor control is limited when a high discharge line temperature conditions occur. If the VFD compressor is operating and the discharge Line temperature is greater than 250°F for 15 seconds a High Discharge Line Temperature Event is generated and the VFD compressor capacity is reduced every 15 seconds until the discharge Line temperature falls below 220°F. If the discharge Line temperature is above 250°F continuously for 3 minutes the VFD compressor is stopped and a High Discharge Line Temperature problem alarm is generated. The alarm must be manually cleared.

Low Discharge Superheat Unloading Control

Normal compressor control is limited when low superheat conditions occur. If the VFD compressor is operating and the discharge superheat is less than 20F continuously for 10 minutes a Low Discharge Superheat Unloading Control Event is generated and the VFD compressor speed is increased. The VFD compressor speed is increased every 10 minutes as long as the discharge superheat remains less than 20°F until the maximum allowed VFD compressor speed (based on unit size) is reached. If the discharge superheat remains below 20°F the VFD compressor is shut OFF and a Low Superheat alarm is generated.

High Discharge Superheat Unloading Control

Normal compressor control is limited when high superheat conditions occur. If the VFD compressor is operating and the discharge superheat is greater than 85°F continuously for 10 minutes a High Discharge Superheat Unloading Control Event is generated and the VFD compressor speed is decreased. The VFD compressor speed is decreased every 10 minutes as long as the discharge superheat remains greater than 85°F until the minimum allowed VFD compressor speed (based on unit size) is reached. If the discharge superheat remains above 85°F the VFD compressor is shut OFF and a High Superheat alarm is generated.

VFD Compressor Emergency Stop Control

If the VFD compressor is enabled (MCB-D03 is closed) and commanded to run for 30 seconds but the controller fails to receive the VFD run verification input (EMC-X4 is open) the VFD compressor enable output (MCB-D03) is cycled OFF for 5 seconds (a VFD Compressor Emergency Stop Control Event is logged)and then back ON. The VFD compressor is then ramped to 45%. If this occurs 3 times in a 30 minute period the VFD compressor is shut off and a VFD Compressor Fault alarm is generated.

Condenser Coil Splitter Solenoid Valve Control

Condenser coil splitting is required on both circuits of a VFD compressor unit to maintain head pressure during low ambient/low modulating operation. This is accomplished with a solenoid valve on each circuit controlled by a normally open digital output (EMC DO1, EMC-DO2) from the MicroTech Unit Controller. The coil splitter solenoid valve is controlled based on the average discharge line pressure equivalent saturation temperature (Tc) determined from the corresponding discharge pressure (PTD) monitored via an analog input to the MicroTech Unit Controller as follows:

- The average Tc is determined using a sliding average of the previous 150 actual Tc values
- The splitter valve on a circuit is closed (energized) when that circuit is operating and the circuit's average Tc remains below 83.0°F continuously for 60 seconds and the OAT is less than or equal to 80.0°F.
- Once closed the solenoid valve is re-opened when the average Tc rises above 105.0°F continuously for 60 seconds, the OAT rises above 80°F or when all the compressors on the circuit are OFF.
- When the splitter coil output on the VFD compressor circuit is closed (EMC-DO2 is energized) normal VFD compressor control is limited. In this mode of operation the VFD Compressor Control PI Loop remains active but the VFD Compressor minimum allowed speed value is increased and Low Pressure Unloading Event is logged.

Network Load Shed Control

For Zone Control or Single Zone VAV units a network variable is provided to allow for overriding the current occupied cooling and occupied heating setpoints by an adjustable increment. The parameters for this function are located in the Heat/Cool Changeover Set-up menu.

Cooling Operation

When DemandShed = is set to Enabled and the Network variable parameter is set to Active, the current Occupied Cooling Setpoint value will be increased by the amount of the cooling shed increase value at an adjustable rate set by the cooling shed rate value. When load shedding becomes active in this manner an Auto Load Shed Event will be logged in the Event Log.

When either the DemandShed= is set to Disabled or the Network variable parameter is set to Inactive the Occupied Cooling Setpoint will revert to the value it had prior to the Network variable parameter being set to Active at an adjustable rate set by the cooling shed rate value. When load shedding becomes inactive in this manner a return to normal Auto Load Shed Event will be logged in the Event Log.

Heating Operation

When DemandShed= is set to Enabled and the Network variable parameter is set to Active the current Occupied Heating Setpoint value will be decreased by the heating shed increase value at an adjustable rate set by the heating shed rate value. When load shedding becomes active in this manner an Auto Load Shed Event will be logged in the Event Log.

When either the DemandShed= is set to Disabled or the Network variable parameter is set to Inactive the Occupied Heating Setpoint will revert to the value it had prior to the Network variable parameter being set to Active. When load shedding becomes inactive the Occupied Heating Setpoint will return to the original value at an adjustable rate set by the heating shed rate value. When load shedding becomes inactive in this manner a return to normal Auto Load Shed Event will be logged in the Event Log.

Compressor Control for Maverick II

VFD Compressor Operation

When a MPS is equipped with the VFD compressor option there are two refrigeration circuits, one VFD controlled compressor with up to 3 fixed speed compressors depending on unit model. The VFD compressor must always be the "lead" circuit or first one on and last one off.

VFD compressor modulation is controlled by an analog signal (0 – 10 Vdc) from the unit controller. Refer to Table 52. The minimum VFD compressor speed is 25 rps (1500 rpm) and the maximum VFD compressor speed is 100 rps (6000 rpm), but the minimum and maximum limits per unit may vary depending on operating conditions and unit model size.

The VFD compressor is a 4 pole motor design that operates off a frequency signal from the VFD between 50Hz and 200Hz.

At Start-up the VFD compressor will automatically ramp up to 50 rps for first 10 seconds for lubrication requirements.

Crankcase heating for VFD Compressor model VZH-088 is performed by the VFD via DC-holding current through the motor windings.

VFD compressor modulation is additionally monitored and adjusted in order to maintain operation within the approved compressor operating envelope.

If the VFD compressor were to become inoperative, any other compressors on the VFD circuit will be disabled. The unit can continue to operate on the remaining fixed speed compressors of the non-VFD circuit until the unit can be serviced.

When the VFD compressor is at its maximum speed and more capacity is required, a fixed speed compressor is started while the VFD compressor is reduced to minimum speed at which point it resumes modulating to maintain the discharge temperature. When the VFD compressor is at its minimum speed and less capacity is required, a fixed speed compressor is turned off while the VFD compressor is increased to maximum speed at which point it resumes modulating to maintain discharge temperature.

Figure 18: VFD Compressor Modulation Signal

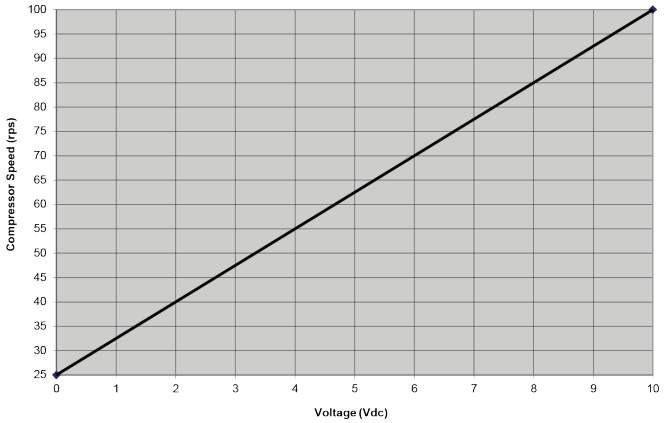


Table 52: VFD Compressor Modulation Ranges

MPS Unit Model	VFD Modulation Range					OilBoostrps/ OilBoostV*
	VFD Min rps/ VFD Min V	VFD Max rps				
		VFD and Fixed Comp(s) On			VFD Comp Only VFDMax rps/ VFDMaxV	
		1 Fixed On	2 Fixed On	3 Fixed On		
		VFD1Max rps/ VFD1MaxV	VFD2Max rps/ VFD2MaxV	VFD3Max rps/ VFD3MaxV		
026	39 rps / 0 Vdc	60 rps / 4.0 V	55 rps / 4.0 V	NA	70 rps / 6.0 V	70 rps / 4.0 V
030	39 rps / 0 Vdc	100 rps / 8.7 V	80 rps / 7.3 V	NA	100 rps / 10.0 V	100 rps / 7.3 V
035	39 rps / 0 Vdc	100 rps / 8.7 V	80 rps / 7.3 V	NA	100 rps / 10.0 V	100 rps / 7.3 V
040	39 rps / 0 Vdc	85 rps / 8.0 V	85 rps / 8.0 V	80 rps/ 7.3 V	100 rps / 10.0 V	100 rps / 7.3 V
050	39 rps / 0 Vdc	85 rps / 8.0 V	85 rps / 8.0 V	80 rps/ 7.3 V	100 rps / 10.0 V	100 rps / 7.3 V

* High and Low Oil Boost are explained on page 4

VFD Compressor Control

Control of the VFD compressor is accomplished with a digital output enable signal and a 0-10VDC analog modulating control signal.

General VFD Compressor Start Sequence

On a call for VFD compressor operation the 0-10VDC analog control signal will set to 0.00VDC (25 rps) for 65 seconds.

During the 65 second initial period the VFD compressor's internal logic will ramp the compressor to 50 rps for the first 10 seconds (this aids in starting oil circulation). The VFD compressor will then ramp down to the 25 rps commanded position for the remained of the 65 second start time.

NOTE: In addition to enabling VFD compressor operation the VFD enable output is used to energize the liquid line drop solenoid on the VFD circuit. (Only for Low Ambient Option)

Compressor Stage Up Transition

When the VFD compressor has been operating at maximum capacity for the cooling stage time period and there is a call for more cooling capacity the following transition sequence is followed when staging up.

During each fixed compressor stage UP sequence, the VFD compressor speed is reduced to its minimum, as a fixed speed compressor is turned on. Note that the VFD compressor speed range is extended for these staging points to assure smooth transition and to minimize capacity gaps. Typically, the VFD compressor is overdriven (higher speed than normal full load rating speed) before staging up a fixed compressor. The VFD is held at minimum speed for 30 seconds before normal modulation resumes.

Compressor Stage Down Transition

When the VFD compressor has been operating at minimum capacity for the cooling stage time period and there is a call for less capacity the following transition sequence is followed when staging down.

During each fixed speed compressor stage DOWN sequence, the VFD compressor speed is increased to maximum speed (which varies with unit size and number of operating fixed compressors) as a fixed speed compressor is turned off. Note that the VFD compressor speed range has been extended for these staging points to assure smooth transition and to minimize capacity gaps. Typically, the VFD compressor will be overdriven (higher speed than normal full load rating speed) when staging down a fixed compressor.

Dehumidification Transition During Cooling State

When dehumidification operation becomes active while the unit is in the Cooling operating state, The VFD compressor is ramped to its maximum capacity. If the VFD capacity at this point is already above 75% of its full modulation a fixed compressor is also turned on. The compressors are held at this capacity for 1 minute before normal modulation resumes, to maintain leaving coil temperature (LCT).

- VFD compressor will load up completely before starting any fixed speed compressors to achieve LCT of 45F (default) with the VFD compressor option. LCT may be set between 45F to 52F.
- If reheat signal is at 100% for 10 minutes and the unit is unable to raise the DAT to desired point, the controller will stage off 1 fixed compressor and modulate the VFD compressor speed to achieve the DAT set point.

Oil Balance/Boost Operational Sequence

When a low oil level is indicated in the VFD compressor sump, the unit switches to either an oil balance or oil boost state. The VFD compressor speed is increased during these modes to promote the return of refrigerant oil to the VFD compressor.

To avoid short cycling of the oil balance/boost sequence, no action is taken until a low oil indication has been present for 5 consecutive run minutes.

The unit determines whether to enter the oil balance or oil boost mode based on the running conditions when a low oil indication is experienced. The balance mode is only used when a VFD compressor is part of a tandem compressor set. The balance mode is usually entered first, and is utilized to move oil from the fixed speed compressor to the VFD compressor. If this mode fails to resolve the low oil indication issue, the unit will then go into the boost mode. The boost mode is utilized to return oil from the refrigerant system to the compressors. VFD compressors that are not part of a tandem compressor arrangement will skip the balance mode and only utilize the boost mode.

The balance mode will be entered if the VFD compressor is part of a tandem compressor arrangement and the fixed speed compressor is running, and there is a low oil indication. Upon entering the oil balance mode the fixed speed compressor is turned off and the VFD compressor speed is increased to the oil boost value shown in Table 20. The VFD compressor runs at this condition until the optical oil sensor verifies that oil is present for 3 continuous minutes. Unit Controller default is set for a 10 minute max balance.

If the oil balance mode fails to resolve the low oil condition, or the fixed speed compressor was not running when the low oil indication occurred, or the VFD compressor was not part of a tandemized compressor set, when the low oil indication occurred, the unit will enter boost mode

Upon entering oil boost mode, the VFD compressor speed is increased to the oil boost value shown in Table 20. If the VFD compressor is part of a tandem arrangement, the fixed speed compressor is started as well. The VFD compressor runs at this condition until the optical oil sensor verifies that oil is present for 3 continuous minutes. Unit Controller default is set for a 10 minute max boost.

During the oil balance/boost sequence the DAT temperature is overridden to allow the VFD compressor to continue operating until oil balance/boost sequence termination.

If one or more fixed speed compressors on the non VFD compressor circuit is operating, and the fixed speed compressor on the VFD compressor circuit was not already running when entering the oil boost mode, one fixed speed compressor on the non VFD compressor circuit will be turned off to minimize the disturbance to the DAT.

Oil balance/boost sequences and durations are logged in the unit controller.

If low oil indication does not clear, the VFD compressor will be shut down and oil level will be monitored for an additional 15 minutes. If low oil indication still does not clear within these 15 minutes, the VFD compressor will be locked out on alarm.

The low oil problem is also generated and the VFD compressor circuit is disabled if the oil boost sequence is initiated more than 4 times in a 24 hour period. If the oil balance/boost sequence successfully restores the VFD compressor oil level the fixed compressor stage is returned to its pre-oil balance/ boost condition and normal compressor sequencing and modulation resumes

VFD Compressor Protection Unloading Control

There are several modulating control functions that adjust the speed control range of the VFD compressor to protect it from damage under abnormal operating conditions. The following functions are provided by the unit controller

- High Pressure Unloading Control
- High Discharge Line Temperature Unloading Control
- High/Low Discharge Superheat Control
- Condenser Coil Splitter Valve Control (For Low Ambient Option)

High Pressure Unloading Control

The VFD compressor has an upper operating sat discharge pressure limit of 575 PSIG. If the discharge pressure exceeds 525 PSIG, the compressor speed is reduced 3 rps every 10 seconds until the discharge pressure is at or below 525 psig.

If the discharge pressure does not drop below 525 PSIG with the VFD compressor operating at minimum speed (30 rps), the compressor is locked out on alarm.

In addition, when the VFD compressor is operating above a sat discharge pressure of 525 PSIG, the VFD compressor maximum speed is limited to 90 rps and the minimum speed is limited to 30 rps.

A high side pressure transducer is standard on the VFD circuit allowing the discharge pressure of the refrigerant circuit to be viewed at the unit controller display.

If the unit controller needs to reduce the compressor speed in order to limit discharge pressure, the action is recorded in unit controller event log section.

High Discharge Line Temperature Unloading Control

A compressor discharge temperature sensor (Thermistor) is installed on the VFD compressor as standard. The temperature is used to measure discharge temperature and superheat levels at the VFD compressor discharge.

If the compressor discharge temp reaches 250F, the VFD compressor speed is reduced by 10 rps and monitored for 3 additional minutes. The unit controller will continue to reduce VFD compressor speed by 10-rps increments until the discharge temp drops below 250F. If the VFD compressor discharge temp reaches 250F a warning will be logged in the controller. If reduced compressor speed does not resolve the issue, the VFD compressor is shut down and allowed to cool for 30 minutes. The VFD compressor is then re-started and if the discharge temperature cannot be held under 250F, the VFD compressor is locked out. The root cause may be connected to a number of issues (low charge, blocked condenser coil, condenser fan failure, malfunctioning TEV, etc.) and service is needed.

The VFD compressor discharge Temp has an upper limit of 275F. The VFD compressor will be shut down if discharge temp reaches 275F.

NOTE: The fixed speed compressor circuit does not contain this feature.

Low/High Discharge Superheat

With the high side pressure transducer and discharge thermistor, the unit controller is capable of monitoring the variable speed compressor discharge superheat. This feature protects the VFD compressor against flood back, undercharged conditions, overcharged conditions, malfunctioning TEV, etc. Typical compressor superheat range is 20F to 75F. The discharge temperature of the VFD compressor can be viewed at the unit controller display.

Low Superheat

If the compressor discharge superheat falls below 20°F for 10 consecutive run minutes, the VFD compressor speed is increased by 10 rps increments up to a 60 rps operating speed. Superheat is monitored at each speed for 5 minutes and if superheat remains below 20°F, the VFD compressor speed is increased an additional 10 rps. When compressor discharge superheat level is at 20°F or above, the compressor speed is no longer increased. If speed correction resolves problem, the unit controller will have logged that a speed correction was needed for superheat in the event log. If increasing speed does not correct issue, the VFD compressor is locked out and an alarm is logged in the unit controller (Low Superheat).

High Superheat

If the VFD compressor discharge superheat rises to 85°F for 10 consecutive minutes, the VFD compressor speed is reduced by 10 rps increments down to a 40 rps operating speed. Superheat is monitored at each speed for 10 minutes and if superheat remains above 85°F, the VFD compressor speed is decreased an additional 10 rps. When compressor discharge superheat level is at 85°F or below, the compressor speed is no longer decreased. If speed correction resolves problem,

the unit controller will have logged that a speed correction was needed for superheat in the event log. If decreasing speed does not correct issue, the VFD compressor is locked out and an alarm is logged in the unit controller (High Discharge Superheat).

Manual Control (with VFD Compressor)

For service and troubleshooting the unit controller has capability to allow the VFD compressor to be operated manually.

The basic manual operations include the following:

- Start or Stop the VFD compressor
- Modulate VFD compressor from 0 – 100% speed
- Ability to energize condenser coil splitter solenoids (Only for low ambient option)
- Ability to initiate or terminate oil boost sequence

If an electrical issue with the VFD compressor is suspected, the winding resistance can be checked at the motor terminals.

Table 53: VFD Compressor Winding Resistance

Compressor Model	Voltage	Winding Resistance (Ohms)
VZH-088B-X	208-230V	0.03
VZH-088B-X	460V	0.10
VZH-088B-X	575V	0.10

Condenser Coil Splitter Solenoid Valve Control (MPS 040 and 050 Only)

Condenser coil splitting is avaialble only on VFD compressor circuit of a unit with low ambinet option. This feature assists in maintaining head pressure during low ambient/low modulating operation. A solenoid valve on each circuit is controlled by a digital output from the MicroTech Unit Controller.

The coil splitter solenoid valve is controlled based on the average discharge line pressure equivalent saturation temperature determined from the corresponding discharge pressure transducer monitored via an analog input to the MicroTech Unit Controller.

The splitter solenoid valve on each circuit is normally open (digital output de-energized). The splitter valve on a circuit is closed (energized) when that circuit's saturation temperature remains below 83.0°F (250 psig) continuously for 60 seconds and the OAT is less than or equal to 80.0°F. The solenoid valve is re-opened when the saturation temperature rises above 105.0°F (350 psig) continuously for 60 seconds and the OAT rises above 80°F or when all the compressors on the circuit are OFF.

If the average saturated discharge temp falls below 250 PSIG (83F) for 60 seconds and condenser coil splitter solenoid coil is energized (closed), the VFD compressor modulation rate is increased until an average saturated discharge temp of 250 PSIG (83F) is achieved. This operation will raise the lower modulation limit of the VFD compressor, but is needed to keep the VFD compressor inside its operating envelope and maintain head pressure for TEV control.

When the condenser coil splitter is energized (closed) and the VFD compressor discharge pressure is below 250 PSIG, the VFD compressor speed is increased by 5rps increments every 30 seconds until the discharge pressure exceeds 250 PSIG. When the VFD compressor reaches 250 PSIG, this speed becomes the new minimum speed of the VFD compressor. As the discharge pressure rises above 280 PSIG, the minimum allowable compressor speed is decreased in 2.5 rps increments every 30 seconds.

If the condenser coil splitter valve is closed and the VFD compressor discharge remains below 280 PSIG for 15 minutes the circuit is locked out and an alarm is logged in the unit controller.

If a speed correction was performed to increase the compressor discharge pressure, there will be a record of the action in the unit controller under the event log.

VFD Compressor Emergency Stop Control

If the VFD compressor enable output signal has been ON for 30 seconds and the controller fails to receive the VFD run verification input, VFD Compressor Emergency Stop Control is activated. When this function is active, VFD compressor enable output will be turned OFF for 5 seconds and then turned ON and ramp VFD compressor speed to 45%. If controller receives a VFD run verification input, a log event is set on VFD Emergency Stop Control. If controller fails to receive the VFD run verification input after 3 attempts in 30 minutes, the VFD compressor is locked out and the problem is logged.

Once active the VFD Compressor Emergency Stop Control function remains active until one of the conditions are met.

- VFD compressor enable output signal has been ON for 30 seconds and VFD compressor status Input is ON
- VFD compressor is OFF

If the controller fails to receive the VFD run verification input after the VFD compressor enable output signal has been ON for 30 seconds, the circuit is shut OFF on VFD Compressor Emergency Stop Control alarm.

Whenever this protection function becomes active a VFD Compressor Emergency Stop Control event is recorded in the Event Log with date and time stamp. Whenever this protection function returns to normal a VFD Compressor Emergency Stop Control return to normal event is recorded in the Event Log with date and time stamp.

Condenser Fan Operation for Variable Speed Compressor Low Ambient Option

(MPS 040 and 050 Only)

Daikin Applied's head pressure control operates by modulating the motor speed of one condenser fan on the VFD compressor refrigeration circuit in response to the condenser pressure. VFD compressor refrigerant circuit contains a solenoid valve that blocks refrigerant flow to half of the condenser coil, which effectively removes 50% of the condenser surface from the circuit for low load/low ambient conditions.

This option allows for mechanical cooling operation down to 0F (-18C). The VFD option senses refrigerant head pressure and varies the fan speed accordingly. When the pressure rises, the SpeedTrol increases the speed of the fan, when the pressure falls. SpeedTrol decreases the speed of the fan.

The VFD throttling range is 250 to 400 psig, fixed, with a corresponding fan speed range of 10Hz to 60Hz. The fan motor is a three-phase motor, identical to the unit voltage (208V to 575V) and is controlled by a variable frequency drive. The variable frequency drive receives a signal from a pressure transducer and varies the speed of the condenser fan accordingly.

The SpeedTrol arrangement for VFD compressors is also employing "Start-Stop control by Speed reference Level" in which the VFD will stop the condenser fan motor under certain conditions. If the head pressure were to fall below 250 PSIG with the condenser fan operating at minimum speed of 10Hz (possibly due to a low ambient or high wind condition) the VFD will shut down the condenser fan. The VFD will restart the condenser fan at 20 Hz if head pressure rises to a level above 250 PSIG. In addition to modulating fan speed, a refrigerant solenoid valve is included in circuit #1. Operation of the solenoid valve is based on head pressure. If the average condensing pressure falls below 250 PSIG (83F sat) for 60 seconds, the condenser solenoid valve closes, effectively removing 50% of the condensing surface. If the averaging condensing pressure rises above 350 PSIG (105F sat) for 60 seconds, the condenser solenoid valve is opened, activating the entire condenser surface. The solenoid valve is disabled above an outdoor ambient of 80F. The solenoid valve is in a normally open configuration.

Refer to Figure 19 for wiring schematics of SpeedTrol. Refer to Figure 20 and Figure 21 for SpeedTrol operating characteristics.

Figure 19: R-410A Speedtrol

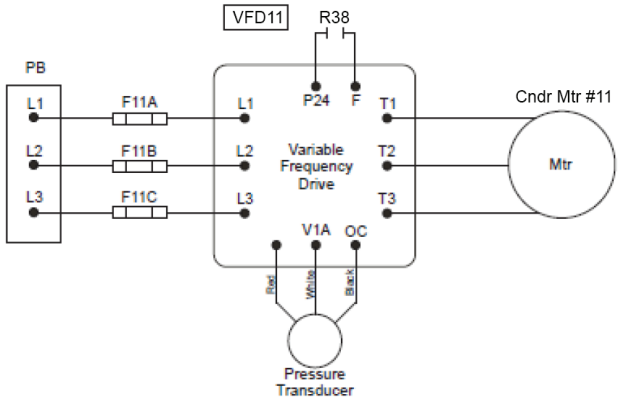


Figure 20: Speedtrol Operating Characteristics (for Variable Speed Inverter Compressor Units)

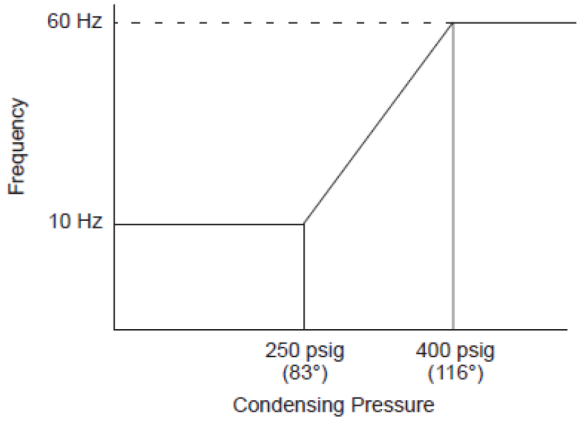
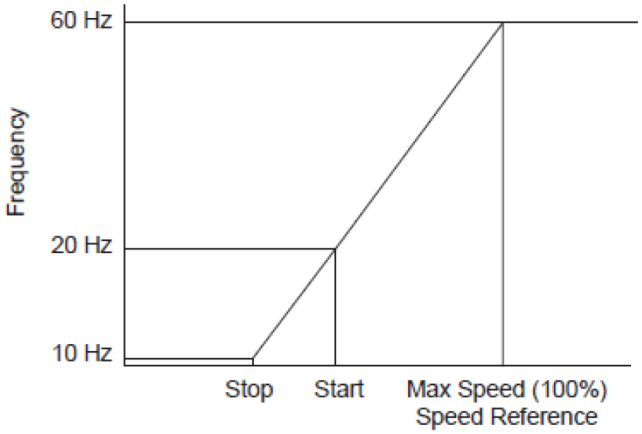


Figure 21: Speedtrol Operating Characteristics (for Variable Speed Inverter Compressor Units with Start-Stop Control)



Variable Frequency Drive for VFD Compressor

⚠ WARNING

Never bypass the compressor drive or directly connect the VFD compressor to the main power supply.

⚠ WARNING

The compressor drive is preset to run the compressor clockwise.

⚠ WARNING

Variable Speed Inverter Compressor

The VFD is factory-programmed and should not be modified in the field. Any modifications will void the warranty. Compressors are compatible with the manufacturer's VFD only.

The compressor drive used for this option is a special series (CDS 303) that is intended for use with an IPM compressor motor and cannot be replaced with any off the shelf VFD.

The compressor drive is mounted in the main control box.

The compressor drive and the LCP (local control panel) are preset with parameters from the factory and should not need to be changed in the field. The LCP is removable and is interchangeable with any of the compressor drives used by any of the VFD compressors. If the need arises to replace the compressor drive, the parameters can be downloaded from the LCP to the new compressor drive.

The compressor drive is preset to run the compressor clockwise and must be connected as shown in the unit schematic.

The compressor drive is preset for an open loop configuration with 0-10Vdc reference corresponding to 1500-6000 Rpm.

The compressor drive generates a soft start with an initial ramp of 2 seconds. In-rush current (or LRA) to the VFD compressor is typically not more than a few percent more than rated nominal Current.

Compressor Speed, modulation signal %, frequency signal, compressor amperage are all displayed in real time on the compressor drive screen. Alarms and descriptions will also be visible on the compressor drive screen.

Basic Operation of Compressor Drive:

Start= Connect terminals 12 & 18 for minimum of 5 secs, connect terminals 12 &27 and terminals 13 &37

Stop= Disconnect terminals 12 & 27

Emergency Stop= Disconnect terminals 13 & 37 are factory bridged.

Control/Modulation= 0 to 10Vdc signal to terminals 53 & 55

Run Verification= A contact closure from relay 02 (terminals 04 & 05) is provided when drive is running

Oil Injection= A contact closure from relay 01 (terminals 01 & 02) is provided when compressor speed is greater than 50 rps (3000 rpm) which energizes the oil solenoid coil.

The compressor drive contains protection for the compressor against short circuits at the compressor terminals, overload protection , phase loss and earth faults. The compressor drive is protected against short-circuits.

Table 54: Compressor Drive Model & Frame Size

Compressor Model	Drive Model	Frame Size	
		208-230V	460V
VZH-088B	CDS303-15kW	B4	B3
VZH-117B	CDS303-18kW	C3	B4
VZH-170B	CDS303-22kW	C3	B4

Refer to the VFD operational manual for more information.

Variable Speed Scroll Compressor

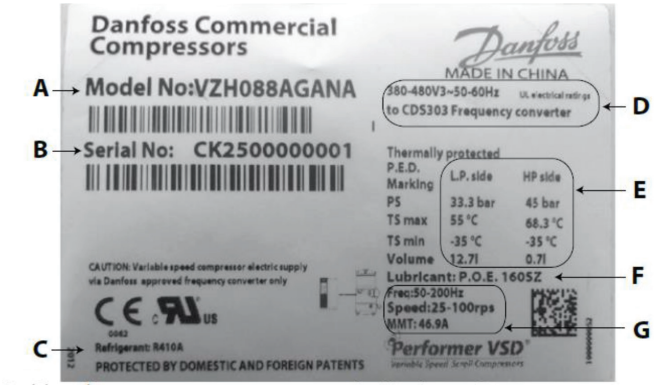
⚠ WARNING

The compressor must only be used for its designed purpose(s) and within its scope of application (refer to the Operating Limits). Consult the Application Guidelines. Under all circumstances, the EN378 (or other applicable local safety regulations) requirements must be fulfilled.

Daikin Applied units with variable speed inverter compressor are engineered with fixed speed compressor(s) in such a way that the unit delivers only the required energy to satisfy space conditions and provides you with exceptional energy savings. It improves comfort through precise temperature and humidity control. Variable speed compressor enhances energy efficiency and capable of providing unit capacity modulation down to 20% and reduces compressor cycling and wear on compressor.

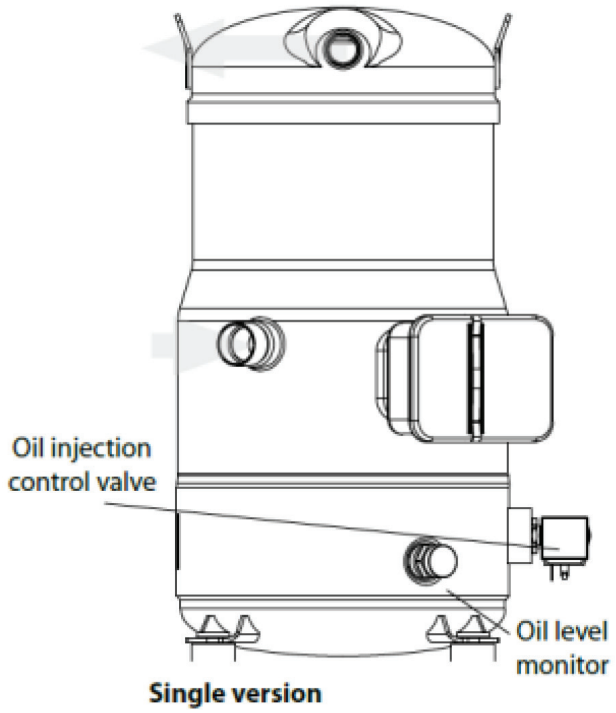
Daikin Applied rooftop units with variable speed Inverter compressors are provided with Internal Permanent Magnet (IPM) motors. Compressors are designed to vary capacity by modulating the speed of the scroll set. The speed ratio for the IPM motor compressor is 4:1 (25 rps to 100 rps). Condenser fans staging and an oil management/monitoring system are provided for reliable operation. The VFD compressor will always be on the "lead" circuit and will be the first one ON and last one OFF.

Figure 22: Compressor Nameplate Information



A.	Model number
B.	Serial number
C.	Refrigerant
D.	Supply voltage to CDS303 frequency converter
E.	Housing service pressure
F.	Factory charged lubrication
G.	Compressor frequency and MaxMust trip current

Figure 23: Compressor Components



Oil Injection Control

The VFD compressor contains an oil injection valve and solenoid (SV11) as standard. The oil injection valve provides lubrication to the scroll set under low speed/low refrigerant velocity situations. The oil injection valve is a normally closed valve. Below 50 rps (100 Hz) the valve is closed and directs oil to the scroll set suction port. Above 50 rps (100 Hz) the solenoid is bypassed and sends oil into sump. The oil injection valve/solenoid is mounted directly on the compressor and is controlled by the Compressor VFD (relay 1 output, terminals NO & Com). The coil voltage for the oil injection solenoid is 24 Vac.

The coil can be removed if required by carefully prying off the valve stem. The wiring connector is attached to the coil by a screw in the center of the housing. Refer to Figure 24 and Figure 25.

Figure 24: Assembly Components

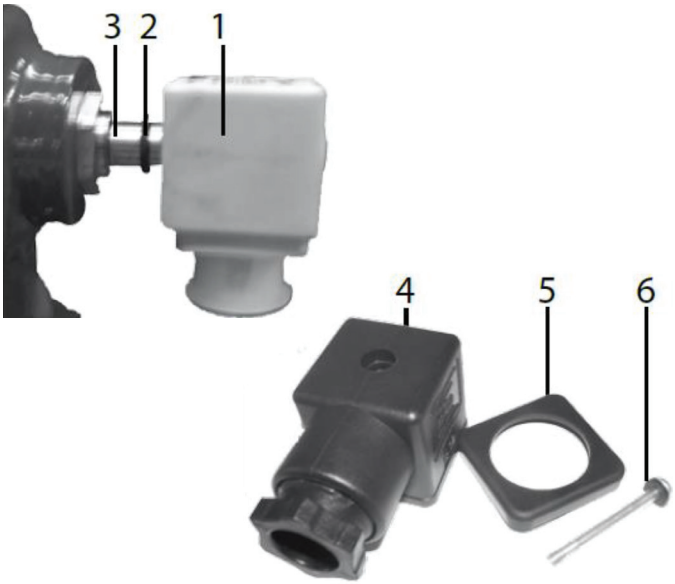
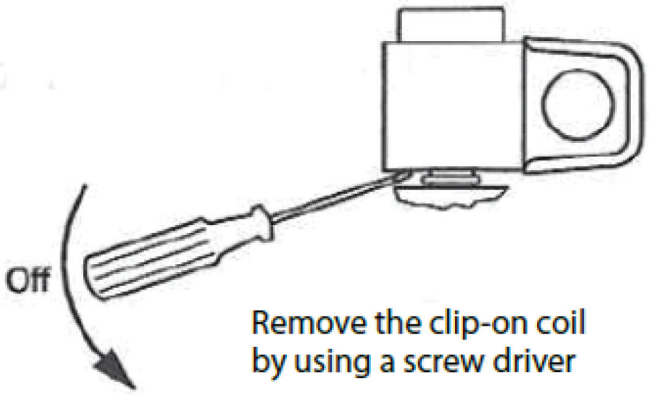


Figure 25: Oil Injection Control Dismanteling



Optical Oil Level Sensor

An optical oil sensor is used to monitor oil level in VFD compressor sump. The sensor is mounted directly to a fitting on the VFD compressor shell and can be removed without having to depressurize/reclaim the refrigeration system. Optical oil indication signal is sent to MicroTech Expansion Module 'C' (terminals X3 & M). Normal oil indication will provide a contact closure from relay R40. Relay R40 will de-energize during low oil indication, removing signal to terminal X3 and will start the unit in an oil boost sequence. Refer to Figure 26 and Figure 27.

NOTE: Testing of the optical oil sensor is not possible without the use of an optical oil sensor prism. Simply removing the sensor from the prism on the compressor will not have an effect on the switch. Need to test with an extra prism attached to the sensor and immerse in a glass or container of fluid. The sensor will not change state without the prism attached.

Figure 26: Sightglass for Optical Oil Sensor/Switch

Figure 27: Optical Oil Level Sensor/Switch

Electrical Connections and Wiring

Basic Connections

Depending on the frequency converter version, the physical position of individual connectors may differ. Always make sure that the compressor terminals, U, V and W are connected to the frequency converter terminals, 96, 97 and 98 respectively.

The compressor motor cable is shielded and the armoured part of the cable is connected to a ground on both cable ends; at the side of the compressor and at the side of the frequency converter.

Condenser Fan Control

RPS Units

There are up to four condenser fans per circuit. The first fan on each circuit is always turned on when any compressor on the circuit is turned on through auxiliary switches on the compressor contactors. The second two fans on each circuit (if applicable) are controlled by outputs from the Main Controller. These are controlled via Condenser Fan Output 1 and Condenser Fan Output 2. The last fan on each circuit (if applicable) is controlled by an external refrigerant pressure switch.

Condenser Fan Output 1 is turned ON when any compressor on is on and the OAT rises above the Condenser Fan A Set Point. Condenser Fan Output 1 is turned OFF when all compressors are OFF or the OAT drops below the Condenser Fan 1 Set Point by more than the Condenser Fan Differential (Default = 5°F). External relays allow operation of condenser fans associated with a specific circuit only when a compressor on that circuit is ON.

Condenser Fan Output 2 is turned ON when any compressor is ON and the OAT rises above the Condenser Fan B Set Point. Condenser Fan Output 2 is turned OFF when all compressors are OFF or the OAT drops below the Condenser Fan 2 Set Point by more than the Condenser Fan Differential (Default = 5°F). External relays allow operation of condenser fans associated with a specific circuit only when a compressor on that circuit is ON.

Condenser Fan Output 3 is turned ON when any compressor is ON and the OAT rises above the Condenser Fan 3 Set Point. Condenser Fan Output 3 is turned OFF when all compressors are OFF or the OAT drops below the Condenser Fan 3 Set Point by more than the Condenser Fan Differential (Default = 5°F). External relays allow operation of condenser fans associated with a specific circuit only when a compressor on that circuit is ON.

The Condenser Fan default setpoints vary by unit size according to the following tables:

Table 55: 410A Condenser Fan Setpoints

Unit Size	CondFanOutput1 (MCB-DO7)		CondFanOutput2 (MCB-DO8)		PC13/PC231	
	Setpoint	Differential	Setpoint	Differential	Setpoint	Differential
015	70	5	—	—	—	—
016	75	5	—	—	—	—
020	70	5	—	—	—	—
021	75	5	—	—	—	—
025	60	5	—	—	—	—
026	70	5	—	—	—	—
030	75	5	—	—	—	—
031	75	5	—	—	—	—
035	70	5	—	—	—	—
040	65	5	—	—	—	—
042	70	5	—	—	—	—
045	65	5	—	—	—	—
050	65	5	—	—	—	—
051	70	5	—	—	—	—
060	60	5	—	—	—	—
062	70	5	—	—	—	—
063	70	5	—	—	—	—
068	70	5	—	—	—	—
070	75	5	—	—	90	35
071	75	5	—	—	90	35
075	65	5	85	5	90	35
079	65	5	80	5	90	35
080	75	5	—	—	90	35
081	75	5	—	—	90	35
085	70	5	—	—	90	35
090	60	5	85	5	90	35
091	60	5	85	5	90	35
100	60	5	85	5	90	35
101	60	5	85	5	90	35
105	50	5	80	5	90	35
110	65	5	90	5	90	35
120	65	5	85	5	90	35
125	65	5	85	5	90	35
130	60	5	85	5	90	35
140	55	5	80	5	90	35

Table 56: R22 Condenser Fan Setpoints

Unit Size	CondFanOutput1 (MCB-DO7)		CondFanOutput2 (MCB-DO8)		CondFanOutput3 (MCB-DO6)	
	Setpoint	Differential	Setpoint	Differential	Setpoint	Differential
015	60	5	—	—	—	—
018	60	5	—	—	—	—
020	60	5	—	—	—	—
025	65	5	—	—	—	—
030	65	5	—	—	—	—
036	70	5	—	—	—	—
040	65	5	—	—	—	—
045	65	5	—	—	—	—
050	60	5	—	—	—	—
060	25	5	—	—	70	5
070	40	5	—	—	70	5
075	65	5	0	5	75	5
080	65	5	0	5	75	5
090	65	5	0	5	75	5
105	0	5	70	5	45	5

Table 57: R407C Condenser Fan Setpoints

Unit Size	CondFanOutput1 (MCB-DO7)		CondFanOutput2 (MCB-DO8)		CondFanOutput3 (MCB-DO6)	
	Setpoint	Differential	Setpoint	Differential	Setpoint	Differential
015	60	5	—	—	—	—
018	0	5	—	—	—	—
020	0	5	—	—	—	—
025	65	5	—	—	—	—
030	65	5	—	—	—	—
036	65	5	—	—	—	—
040	60	5	—	—	—	—
045	55	5	—	—	—	—
050	50	5	—	—	—	—
060	15	5	—	—	70	5
070	30	5	—	—	70	5
075	65	5	0	5	75	5
080	65	5	0	5	75	5
090	50	5	0	5	75	5
105	0	5	70	5	35	5

MPS Standard Condenser Fan Control

Standard Condenser Fan Control

Two, three or four condenser fans are provided. Two condenser fans are provided on 15, 17.5, 20 and 25 ton units. Three condenser fans are provided on 26, 30 and 35 ton units. Four condenser fans are provided on 40 and 50 ton units. The first condenser fan is always turned ON when any compressor is turned ON using compressor contactor auxiliary switches external to the controller.

When two condenser fans are provided, the second condenser fan (CondFanOutA) is turned ON when the OAT rises above the Condenser Fan 1 Set Point. This fan is turned OFF when the OAT drops below the setpoint by more than the Condenser Fan Differential (Default = 5°F).

When three condenser fans are provided, the second condenser fan is turned ON when the OAT rises above the Condenser Fan 1 Set Point and the third fan is turned ON when the OAT rises above the Condenser Fan 2 Set Point. These fans are turned OFF when the OAT drops below that corresponding setpoint by more than the Condenser Fan Differential (Default = 5°F).

When four condenser fans are provided, there are two different methods for control due to a redesign of the model 040 and 050.

When the "old" four condenser fan method is used (Condenser Control=Standard Method 1) is used, two outputs (Condenser Fan Output1 and Condenser Fan Output 2) on the controller are used to provide three additional stages as shown in Table 58. The second through fourth stages are turned on when the corresponding setpoint is exceeded by the OAT and turned OFF when the OAT drops below the corresponding setpoint by more than the Condenser Fan Differential (Default = 5°F).

Table 58: Fan Staging

Operating Fans (Stage)	Fan 1 (On with any compressor)	Fan 2 (Cond Fan Out A)	Fan 3 and 4 (Cond Fan Out B)	On Condition
1	On	Off	Off	Any Comp On
2	On	On	Off	Cond Fan 1 Spt
3	On	Off	On	Cond Fan 2 Spt
4	On	On	On	Cond Fan 3 Spt

When the "new" four condenser fan method is used (Condenser Control=Standard Method 2), the condenser fan control is circuit specific. The first fan on each circuit is turned ON using compressor contactor auxiliary switches. The second fan on each circuit is turned ON if a compressor in the circuit is ON and the OAT is above the corresponding condenser fan setpoint and is turned off when the OAT drops below the corresponding setpoint by more than the Condenser Fan Differential (Default = 5°F). Condense Fan 1 Setpoint corresponds to the second fan on Circuit 1 and Condenser Fan 2 Setpoint corresponds to the second fan on Circuit 2.

The default condenser fan setpoints vary by unit size as indicated in Table 59:

Table 59: CondenserFan Setpoints

Unit Size	Condenser Fan Setpoints		
	Cond Fan 1 Spt	Cond Fan 2 Spt	Cond Fan Spt
15	70°F/21.11°C	—	—
17	70°F/21.11°C	—	—
20	65°F/21.11°C	—	—
25	65°F/21.11°C	—	—
26	40°F/4.44°C	60°F/15.56°C	—
30	40°F/4.44°C	60°F/15.56°C	—
35	35°F/1.67°C	60°F/15.56°C	—
40 (Cond Ctrl=Std Method 1)	25°F/-3.89°C	45°F/7.22°C	60°F/15.56°C
50 (Cond Ctrl=Std Method 1)	35°F/1.67°C	45°F/7.22°C	55°F/12.78°C
40 (Cond Ctrl=Std Method 2)	70°F/21.11°C	70°F/21.11°C	N/A
50 (Cond Ctrl=Std Method 2)	70°F/21.11°C	70°F/21.11°C	N/A

Evaporative Condensing Control (RTU)

The evaporative condensing option for rooftop units uses the heat absorbed by evaporating water as well as air drawn across a bank of tubes with refrigerant flowing through them to condense hot refrigerant to a liquid. Water is pumped from a sump beneath the condenser tubes to nozzles above the coil that spray water onto the bank of tubes. The refrigerant in the tubes is cooled and condensed as some of this water is evaporated when it strikes the hot tubes and is carried away by condenser fans. Using this method, the refrigerant can be cooled to a lower temperature than is the case with a normal finned condenser that transfers heat directly to the air.

A unit equipped with evaporative condensers cannot operate in the cooling state with the outdoor air temperature below 40°F. If the OAT Compressor Lockout Temperature on units with evaporative condensing is lowered below 40°F, it will immediately be set back up to 40°F.

The first condenser fan on each circuit is turned on and off via ModBus communications with a single VFD. The speed of these two fans is controlled via ModBus communications with the VFD. These two fans always operate at the same speed.

The second and third condenser fans on each compressor circuit are turned ON and OFF using the two outputs on the Main Board that are used for standard condenser fans. Relays are driven by each of these outputs so that fans associated with a circuit that is not operating will not be turned ON.

Evaporative Condenser Compressor Staging Sequences

There are two cooling staging configurations available for evaporative condenser units. Both employ reciprocating compressors and so require pumpdown operation. When there is a first call for cooling on a circuit, the liquid line solenoid valve output is first energized and then as soon as the low pressure switch for that circuit closes the first compressor in the sequence is turned ON. If the low pressure switch fails to close within the low pressure compressor delay timer setting the low pressure alarm for that circuit is generated.

The circuit that has the fewer run hours is the lead circuit if Lead Circuit is set to Auto. The lead circuit is changed only when all compressors are off or at the maximum stages for the unit. If Lead Circuit is set to #1 then circuit #1 always leads if it is available. If Lead Circuit is set to #2 then circuit #2 always leads if it is available.

The Staging Type can be set to either Standard or Alternate.

Standard:

The two circuits are loaded up and unloaded as evenly as possible. When a stage up is required, the circuit operating at the lower stage is staged up. If both circuits are operating at the same stage, the lead circuit is staged up if it is not at its maximum stage.

When a stage down is required, the circuit operating at the higher stage is staged down if it is not at stage zero. If both circuits are operating at the same stage, the lag circuit is staged down if it is not at stage zero.

Alternate:

One circuit is loaded completely before the first compressor in the other circuit is turned ON, and one circuit is unloaded completely before the other circuit begins to be unloaded. When a stage up is required and the lead circuit is not at its maximum stage, the lead circuit is staged up.

When a stage up is required and the lead circuit is already at its maximum stage, the lag circuit is staged up. When a stage down is required and the Lag circuit is at a stage greater than zero, the lag circuit is staged down. When a stage down is required and the lag compressor is at stage zero, the lead compressor is staged down if it is not at stage zero.

A disabled circuit remains at stage zero. If the other circuit is enabled, it is staged up whenever a stage up is required, and down whenever a stage down is required. If a previously disabled circuit becomes enabled, the staging is re-aligned according to the staging tables upon the next call for stage increase or decrease.

NOTE: During this re-alignment, the cooling stage time guaranteed ON and OFF times must be observed as well as a minimum of 10 seconds between starting more than one compressor

When dehumidification is active staging reverts to Alternate regardless of the normal Staging Type setting. When dehumidification is not active staging is according to the Staging Type setting.

Table 60: Dehumidification Staging

Two Compressors and Six Stages (CompCfg=4 & Cond Ctrl=2 or 3)								
Stage	Circuit # 1				Circuit # 2			
	Comp # 1	Liq Line Valve # 1	Comp # 1 Unl # 2	Comp # 1 Unl # 1	Comp # 2	Liq Line Valve # 2	Comp # 2 Unl # 2	Comp # 2 Unl # 1
0	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
1	ON	ON	ON	ON	ON	ON	ON	ON
2	ON	ON	ON	OFF	ON	ON	ON	OFF
3	ON	ON	OFF	OFF	ON	ON	OFF	OFF
Four Compressors and Eight Stages (CompCfg=E & Cond Ctrl=2 or 3)								
Stage	Circuit # 1				Circuit # 2			
	Comp # 1	Liq Line Valve # 1	Comp # 1 Unl # 2	Comp # 1 Unl # 1	Comp # 2	Liq Line Valve # 2	Comp # 2 Unl # 2	Comp # 2 Unl # 1
0	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
1	ON	ON	OFF	ON	ON	ON	OFF	ON
2	ON	ON	OFF	OFF	ON	ON	OFF	OFF
3	ON	ON	ON*	ON	ON	ON	ON*	ON
4	ON	ON	ON	OFF	ON	ON	ON	OFF

* Note: A 20 second delay will be provided after unloading compressor #1 or #2 prior to starting Compressor #3 or Compressor #4.

Pumpdown

Pumpdown is accomplished by closing the liquid line solenoid valve on a circuit and operating a compressor on that circuit until the circuit low pressure switch opens. The compressor pumps most of the refrigerant into the condenser and then shuts OFF.

When pump down is required for a circuit, the liquid line solenoid valve for that circuit is closed (its output is OFF) and a compressor operates until the low pressure switch opens at which time the compressor is turned OFF. If the low pressure switch does not open in 180 seconds, pump down is terminated by turning OFF the compressor and its unloaders.

If a compressor in a circuit is operating, the circuit is pumped down when the last compressor is to shut OFF due to normal staging, or when the pump down switch for that circuit is placed in the Pumpdown (Open) position, or when the circuit or entire unit is shutdown due to any alarm other than the High Pressure Alarm. Of course, the conditions for completing pump down are met if the low pressure alarm shuts down the circuit so no pump down occurs as a result of this alarm.

Pumpdown is also initiated if no compressors are operating in a circuit, and the Pumpdown Switch is moved from the ON (Auto) position to the OFF (Pumpdown) position twice in less than 20 seconds, and the low pressure switch is closed. In this case the first compressor on the circuit is used to pump down the circuit.

If two compressors on one circuit are operating when pump down is required for that circuit, the lag compressor in that circuit is turned OFF immediately and the circuit is pumped down using the lead compressor.

If any unloaders on a reciprocating compressor are de-energized when that compressor is required for pump down, they are energized and the circuit is pumped down using one completely unloaded compressor.

NOTE: A reciprocating compressor is mechanically prevented from pumping down the circuit if the oil pressure switch is open.

Sump Pump Control

The Sump Pump Output is turned ON whenever the unit is in the Cooling state and the Sump Water Level Input is present (ON). The Sump Pump Output is turned ON before any compressor or condenser fan is turned ON. The Sump Pump Output remains ON for 10 minutes (adjustable) after unit leaves the Cooling operating state before turning OFF as long as the Sump Water Level Input is present (ON).

A Sump Water Level problem alarm is generated if the unit has been in the Cooling operation state for 5 minutes and the Sump Water Level Input is not present (OFF). If this occurs, the Sump Pump output is turned off and mechanical cooling is disabled.

To prevent problems related to Sump Water Level Switch fluctuations, there is a 5 second “to OFF” time on the switch.

If Dolphin= Yes, the sump pump is run every day to reduce scaling. The Sump Pump Output is turned ON for one hour if all of the following are true:

- Dolphin System= Yes
- Sump Pump Output has been off for more than 24 hours but less than 120 hours.
- The OAT is greater than 35°F.
- The Sump Drain Valve is closed.

Sump Drain Valve Control

When the sump temperature gets too cold, the sump needs to be emptied to prevent freezing. The Sump Drain Valve Output is used to control a sump drain valve. This output is turned ON if the sump temperature drops below the Sump Dump Setpoint, default = 35°F for more than 30 seconds.

This output is turned back OFF if the sump temperature rises above this setpoint by more than the Sump Dump Differential, 2°C (hardcoded), and the unit is in the Cooling state.

If Dolphin System= Yes and the pump does not run for five days, the sump needs to be emptied. This would occur when cooling is not required and the OAT remains below 35°F. Sump heaters are used to keep the sump temperature above 35°F when the OAT drops below that value so an additional means of turning on the Sump Drain Valve is required. In addition to the requirement that the Sump Drain Valve Output be turned ON to open the valve when the sump temperature drops below 35°F, the Sump Drain Valve Output is also turned ON if both of the following are true:

- Dolphin System= Yes
- The Sump Pump Output has been off for 120 hours or more.

Once on the Sump Drain Valve is turned back OFF as described above.

Separator Flush Valve Control

On units equipped with a Dolphin System the system Separator needs to be flushed of its collected solids every so often. An ON/OFF flush valve actuator is used to flush the separator. Every 8 hours the Purge Valve Binary Output is turned ON for the Separator Flush Time (default 1 minute).

Sump Temperature Control

Two configurations of evaporative condensing units are provided. One will have two condenser fan outputs per circuit (Unit Size<110), and one will have three condenser fan outputs per circuit (Unit Size≥110). The two lead condenser fans are controlled through a single VFD.

Whenever any compressor is turned ON, the lead condenser fan on both circuits is turned ON by the Microtech Unit Controller sending a signal to the VFD via Modbus. The lead condenser fans on both circuits are turned OFF when all compressors are OFF or they are turned OFF as described in paragraphs that follow when the sump temperature gets low.

Whenever any condenser fan is ON, a signal is sent to the VFD to control connected fans to a setpoint. The speed setpoint is calculated based on the sump temperature.

A single Condenser Fan Output A is controlled to turn ON the second condenser fan on both circuits. A single Condenser Fan Output B is controlled to turn ON the second condenser fan on both circuits. The second and third fans on the circuits are mechanically prevented from operating when no compressor on that circuit is operating. When compressors are operating on both circuits, the number of fans operating on the two circuits is the same.

The number of fans operating per circuit will increase if the time since the last change in the number of operating fans exceeds the Evap Condensing Stage Time and the sump temperature exceeds the Max Sump Temperature setpoint. This condenser fan stage increase may occur as soon as the temperature rises above the Maximum Sump Temperature. The temperature does not have to remain above the Maximum Sump Temperature for longer than the stage timer.

The number of fans operating per circuit will decrease if the time since the last change in the number of operating fans exceeds the Evap Condensing Stage Time, and the sump temperature drops below the Min Sump Temperature setting. This condenser fan stage decrease may occur as soon as the temperature drops below the Minimum Sump Temperature setting. The temperature does not have to remain below the Minimum Sump Temperature setting for longer than the stage timer.

After the two lead condenser fans are turned OFF via the VFD, they are turned back ON as soon as the sump temperature rises above the Maximum Sump Temperature setting. This transition from stage zero to stage one is the only transition that does not require the Stage Timer to expire.

All of the condenser fans need to be run periodically when evaporative condensing is used to prevent damage to the motors due to their high humidity environment. As indicated above, the condensing fans controlled by the VFD always run when evaporative operation is in effect so no special control of these fans is required. The fan motors controlled directly through the Condenser Fan A and Condenser Fan B outputs are turned ON and OFF based on time ON and time OFF. When a condenser fan output must be turned ON for normal operation, the output that has been OFF for the longest period of time is started. When a condenser fan must be turned OFF for normal operation, the output that has been on for the longest period of time is turned OFF.

Heating Control

Entering Heating Operating State

The unit enters the Heating operating state from the Fan Only operating state when the control temperature falls below the Occupied or Unoccupied Heating Set Point by more than half the Occupied or Unoccupied Heating Dead Band. The unit transitions from the Heating to Fan Only operating state when the control temperature rises above the Occupied or Unoccupied Heating Set Point by more than half the Occupied or Unoccupied Heating Dead Band. The unit will also transition from the Heating to Fan Only operating state if heating operation is disabled due to OA ambient lockout.

Morning Warmup Control

The unit does not enter a specific morning warmup operating state to accomplish the morning warmup function. Instead the unit enters the Heating operation state when morning warmup operation is required. The dampers are held at zero percent open for Zero OA Timer after the SAF starts. The Zero OA Timer should be set long enough to accomplish morning warmup with the dampers closed to minimize energy usage during the warmup period.

Zone Control Units

When a Zone Control Unit (Ctrl Typ=Zone) first starts in the morning it enters the Heating operating state if the Control Temperature is below the Occupied Heating Setpoint by more that ½ the heating dead band. In this case The Occupied Heating Setpoint is the "morning warmup setpoint".

DAT Control Units

For Discharge Temperature Control units (Ctrl Type=DAC) there are two additional morning warmup related adjustable parameters; MWU Heating Setpoint and MWU Sensor. When a Discharge Temperature Control unit first starts in the morning it enters the Heating operating state if the sensor selected by the MWU Sensor parameter (RAT or Space) is below the MWU Heating Setpoint by more that ½ the Heating dead band. The MWU Sensor can also be set to None. If the MWU Sensor is set to None the MWU Heating Setpoint has no effect and the unit only enters heating based on the Occupied Setpoint in the normal manner.

Heating: Staged Zone Control

When the unit first enters the Heating operating state the unit goes directly to Stage # 1.

The number of heating stages increases when the time since the last stage change exceeds the stage time, the Projected Control Temperature and the actual Control Temperature are less then the Occ Htg Spt (minus ½ the deadband), and the DAT is less than the Max DAT Htg Spt.

The number of heating stages decreases when the time since the last stage change exceeds the stage time, and the Projected Control Temperature and actual Contro Temperature are greater then the Occ Htg Spt (plus ½ the deadband).

The number of heating stages also decreases when the time since the last stage change exceeds the stage time, and the DAT is greater than the MaxDATHtgSpt.

Heating DAT Staging or MinDAT Staging

When the unit enters the Heating or Minimum DAT states and all heating is off, the unit goes directly to Heating Stage # 1 so that the first stage of heat is turned on immediately.

The number of heating stages increases when the time since the last stage change exceeds the stage time, and DAT is less than the effective DAT setpoint (DAT staging) or the Min DAT limit (MinDAT staging) by ½ the deadband. One exception to this is that if the current heating stage is zero, the heating stage can increase without regard to the stage timer.

The number of heating stages decreases when the time since the last stage change exceeds the stage time, and the DAT is greater than the effective DAT setpoint (DAT staging) or the MIN DAT limit (MinDAT staging) by ½ the deadband.

The unit enters the Min DAT operating state during occupied operation when neither cooling nor heating is required based on the unit heat/cool changeover function but the discharge air temperature falls below a minimum discharge temperature limit by more than ½ the deadband. The Min DAT operating state prevents cold discharge air temperatures during what would normally be the Fan Only operating state.

Modulating

Entering Heating Operating State

The unit enters the Heating operating state from the Fan Only operating state when the Control Temperature falls below the Occupied or Unoccupied Heating Set Point by more than half the Occupied or Unoccupied Heating Dead Band. The unit transitions from heating to Fan only when the Control Temperature rises above the Occupied or Unoccupied Heating Set Point by more than half the Occupied or Unoccupied Heating Dead Band. The unit will also transition from the Heating to Fan Only operating state if heating operation is disabled due to OA ambient lockout. When the unit is in the Heating operating state, heating capacity is modulated to maintain the discharge air temperature at the Discharge Heating Set Point.

There are several different modulating heating types available with this equipment. There are some differences in the control sequence depending on the heat type installed. The different types are described in the following sections.

Steam or Hot Water Heat: Face and Bypass Damper Control

When a unit is equipped with steam or hot water with face and bypass damper heating there are two different methods used for controlling the heating arrangement. These are the "Open Valve" and "Modulating Valve" methods and are described in the following sections.

Open Valve

When the unit enters the Heating operating state, the steam or hot water valve is driven fully open. The face and bypass dampers are then modulated to maintain the discharge air temperature at the discharge heating set point.

Modulating Valve

When the outdoor air temperature is below the F&BP changeover temperature, the Heating valve is driven to 100% open to protect the coil. The face and bypass dampers are then modulated to satisfy the heating load. When the outdoor air temperature rises above the F&B Changeover temperature by a differential of 2.0ºF, the face and bypass dampers are set at 100% open to the face of the coil and the Heating valve is modulated to satisfy the heating load. The default value for the changeover temperature is 37°F.

RTU Gas Heating

When a unit is equipped with modulating gas heating and is in the Heating operating state, the gas valve is modulated to maintain the discharge air temperature at the Discharge Heating Set Point. Differences in the control of modulating gas heat are described in the following sections. On units equipped with modulating gas heat, the Discharge Heating Set Point is limited according to a maximum heat exchanger temperature rise limit. This factory set limit varies depending on the unit burner model and can be found on the gas heat data plate attached to the unit. The controller does not allow the Discharge Heating Setpoint to be set above the current temperature entering the discharge fan (EFT) by more than this maximum heat exchanger temperature rise limit.

Min DAT

If heating is enabled and there is no heating load (normally Fan Only operating state), the controller activates the units heating equipment as required to prevent the discharge air temperature from becoming too cool if the Min DAT Control Flag (DAT units only) is set to yes via the Heating menu. The unit enters the Min DAT operating state during occupied operation when neither cooling nor heating is required based on the heat/cool changeover function but the discharge temperature falls below a minimum discharge temperature limit. If the discharge air temperature falls below the this minimum discharge temperature limit by more than half the discharge heating deadband, the unit operating state changes from Fan Only to Min DAT.

NOTE: On VAV or CAV discharge control units, the DAT cooling setpoint parameter in the Cooling menu acts as the minimum discharge temperature limit. On CAV zone control units the Min DAT Limit parameter in the Heating menu acts as the minimum discharge temperature limit.

Typical Sequence of Operation (20-1 gas burner)

When 120V power is furnished through the system ON/OFF switch (S1), through the burner ON/OFF switch (S3), and through the high limit control (FLC), terminal #6 on the flame safeguard (FSG) is powered on a call for heat. Whenever power is restored to the flame safeguard, the flame safeguard will go through a 10 second initiation period before the prepurge period will begin. The burner air control valve will be at minimum position during OFF cycles. Upon a call for heat or any other time that a prepurge cycle occurs, the air control valve will be repositioned to the maximum position for prepurge and then returned to the minimum position for low fire start.

Upon a call for heat, the controller will close digital output (EXPB-DO1) and energize the R20A relay. Once the normally open contacts of the R20A relay close 120V power is supplied to terminal # 6 on the FSG. The FSG then energizes its terminal #4, which powers the burner combustion air blower motor (BM) and starts the 90 second prepurge cycle. The controller will reposition the burner air valve to its maximum open position via analog output EXPBAO_X7 for prepurge.

When the burner air valve reaches the full open position switch (LS2) will 'make' and provide a digital input to the controller (EXPB-DI_X3). This digital input will initiate a 20 second timing period in the controller. At the completion of the timing period, the controller will begin to drive the burner air valve to its minimum (low fire) position.

When the valve reaches the minimum position switch LS1 will 'make' and provide a digital input to the controller (EXPB-DI_X2) indicating the controller's prepurge sequence is complete. As soon as the FSG prepurge time expires FSG terminal #8 will energize relay R22 which will turn ON a digital input to the controller (EXPB-DI-X1). As soon as this digital input is 'made' the controller will close digital output (EXPB-DO2) allowing the combination gas valve(s) (GV1) to be energized.

After completion of the FSG prepurge period there will be a 10 second trial for ignition during which terminal #8 (combination gas valve - GV1) and terminal #10 (ignition transformer - IT) will be energized. If flame is being detected through the flame rod (FD) at the completion of the 10 second trial for ignition period, terminal #10 (ignition transformer - IT) will be deenergized and terminal #9 (main gas valves - GV4 and GV5 depending on burner size) will be energized and the control system will be allowed to control the firing rate once the heating stage timer (default 5 minutes) has passed.

After the flame has lit and been proven and the heating stage time has passed, the controller will modulate (VM1) to the required firing rate via analog output EXPB-AO_X7. In the event the flame fails to ignite or the flame safeguard fails to detect its flame within 10 seconds, terminals #4, 8, 9, and 10 will be de-energized, thus de-energizing the burner. The FSG will then lockout and would require manual resetting. If the FSG lockout occurs, FSG terminal #3 will energize the R24 alarm input status relay which will 'make' a digital input to the controller (EXPB-DI_X4).

When this digital input is 'made' the controller will drive VM1 to the closed position, de-energize digital output EXPB-DO2 and the prepurge sequence will be disabled and reset. If the FSG terminal # 8 de-energizes R22 (EXPB-DI_X1) after having it turned ON and the FSG is not OFF on safety lockout, the prepurge sequence will start over. If an attempt is made to restart the burner by resetting the FSG or if an automatic restart is initiated after flame failure the earlier described prepurge cycle with the wide open air valve will be repeated. If the unit overheats, the high limit control (FLC) will cycle the burner, limiting furnace temperature to the limit control set point. The flame safeguard contains 'LEDS' (lower left corner) that will glow to indicate operation.

Typical Sequence of Operation (3-1 Gas)

When 120V power is furnished through the system ON/OFF switch (S1), through the burner ON/OFF switch (S3), and through the high limit control (FLC), terminal #6 on the flame safeguard (FSG) is powered on a call for heat. Whenever power is restored to the flame safeguard, the flame safeguard will go through a 10 second initiation period before the prepurge period will begin. The burner air control valve will be at minimum position during OFF cycles.

Upon a call for heat, the controller will close digital output (EXPB-DO1) and energize the R20A relay. Once the normally open contacts of the R20A relay close, 120V power is supplied to terminal # 6 on the FSG. The FSG then energizes its terminal #4, which powers the burner combustion air blower motor (BM) and starts the FSG prepurge cycle.

After completion of the FSG prepurge period there will be a 10 second trial for ignition during which terminal #8 (combination gas valve - GV1) and terminal #10 (ignition transformer - IT) will be energized. If flame is being detected through the flame rod (FD) at the completion of the 10 second trial for ignition period, terminal #10 (ignition transformer - IT) will be de-energized and terminal #9 (main gas valves - GV4 and GV5) will be energized and the control system will be allowed to control the firing rate once the heating stage timer (default 5 minutes) has passed.

After the flame has lit and been proven and the heating stage time has passed, the controller will modulate (VM1) to the required firing rate via analog output EXPBAO_X7. In the event the flame fails to ignite or the flame safeguard fails to detect its flame within 10 seconds, terminals #4, 8, 9, and 10 will be de-energized, thus de-energizing the burner. The FSG will then lockout and require manual resetting. If the FSG lockout occurs, FSG terminal #3 will energize the R24 alarm input status relay which will 'make' a digital input to the controller (EXPB-DI_X4). When this digital input is 'made' the controller will drive VM1 to the closed position. If the FSG terminal 8 de-energizes relay R22 (EXPBDI_X1) after having it turned ON and the FSG is not OFF on safety lockout the controller will drive VM1 to the closed position. If an attempt is made to reset the FSG or if an automatic restart is initiated after flame failure, the FSG prepurge cycle will be repeated. If the unit overheats, the high limit control (FLC) will cycle the burner, limiting furnace temperature to the limit control set point. The flame safeguard contains 'LEDS' (lower left corner) that will glow to indicate operation.

Special Start Sequence for 100% Outdoor Air Units with Gas Heat

A special start sequence is used for units 100% outdoor air units with gas heat. The special start sequence applies to both Zone Control and DAT Control units. If heat is required at unit startup, the furnace enters a special burner startup sequence as the unit enters its Startup operating state. Pre-firing the burner allows the gas heat pre-purge sequence to occur and the burner to fire and warm up so that tempered air is available immediately when the fans start.

Once a 100% Outdoor Air unit equipped with gas heat completes one of the start up sequences described below the gas heat operates the same for both return air units and 100% outdoor air units.

The sequence described in the following paragraphs is initiated for a 100% OA Zone Control unit any time during the Startup operating state when the Control Temperature is less than the Effective Occupied or Unoccupied Heating Setpoint† by ½ the Occupied or Unoccupied Heating Deadband or the OAT is less than the Min DAT Limit by the amount of the DAT Htg Deadband. The sequence described in the following paragraphs is initiated for 100% OA DAT Control units during the startup operating state when the Min DAT Ctrl parameter is set via the keypad and the OAT is less than the DATClgSpt by the amount of the DAT Htg Deadband.

The Effective Occupied or Unoccupied Heating Setpoint equals the Occupied or Unoccupied Heating Setpoint for Zone Control units. Otherwise it equals the Morning Warmup Heating Setpoint (DAT Control units). The special start up sequence is initiated during the Startup operating state. The fans will remain off. The main gas valve is energized so the burner starts during the Warmup Time (default = 240 seconds) and operates at low fire.

At the end of the Warmup Time, the modulating gas heating valve is set to a calculated position. This calculated position is based on the "Application Discharge Air Temperature Setpoint", the outdoor air temperature, and the Maximum Temperature Rise of the gas heat exchanger using the following formula:

Gas Heat Actuator Position = 100% x (Setpoint - Outdoor Air Temp) / Temp Rise

The Application Discharge Air Temperature Setpoint is the Occupied or Unoccupied Heating Setpoint if the control temperature initiated the special start sequence. If the OAT initiated the special start sequence, the setpoint is the Min DAT Limit for Zone Control units and the Eff DAT Clg Spt for DAT Control units. The Temp Rise is the Maximum Temperature Rise of the gas heat exchanger that is entered at the factory for the specific unit. After the modulating gas heating valve is set to the calculated position, there is a HeatUpDelay (default = 60 second) to allow the heat exchanger to heat up. After this delay, since the unit is 100% Outside Air, the unit immediately transitions from Startup to the Fan Only state. As soon as the unit enters the Fan Only state, the unit will immediately transition to either the Heating state or the MinDAT state.

The unit remains in either the Heating or Minimum DAT operating state for the duration of the Hold Period (Default = 240 seconds). The gas heating valve does not modulate from its calculated value to allow the temperature to approach equilibrium with modulating gas heating valve at a fixed position.

The unit reverts to normal modulation of the gas heating valve when the Hold Period has elapsed since the unit entered Heating or MinDAT.

Return Air Units

When the unit enters the Heating operating state, the controller first holds the gas valve at the minimum fire position (5% or 33% depending on the burner model) until the Heating Interstage Timer expires. Then, the controller modulates the gas valve to maintain the discharge air temperature at the Discharge Heating Set Point.

MPS Gas Heating

Sequence of Operation (Staged Control)

2-Stage Control

The following details the sequence of operation for the low heat option.

- Unit controller calls for heat
- Furnace DDC control module receives a call for heat
- High limit switch is checked for safe condition
- Proof of airflow switch is checked for combustion airflow
- 60 second prepurge cycle starts
- Spark ignitor is activated for 3 seconds
- Gas valve receives a command for stage 1 of heat
- Burner is ignited
- Unit controller calls for stage 2 of heat
- Furnace DDC controller receives a stage 2 heat command
- Gas valve receives a command for stage 2 of heat

4-Stage Control

For a unit with the optional high heat the above sequence is followed for the first two stages. For the remaining 2 stages the above procedure is repeated on the second furnace module.

Sequence of Operation (Modulating Burner)

5–1 Gas Burner

The following details the sequence of operation for the low heat option.

- Unit DDC controller calls for heat
- Furnace DDC control module receives a call for heat
- Furnace safety switches and DDC control are checked for safe conditions
- 45 second prepurge cycle starts. Proof of airflow switch is checked for combustion airflow
- Spark ignitor is activated
- Gas valve receives a signal to open fully
- Burner is ignited and runs for 20 seconds in high fire

NOTE: If call for heat is interrupted during this timing, the furnace will be locked in for the 20 seconds cycle.

- Gas valve and induction blower motor receives a signal to modulate burner output to match the unit discharge air temperature setting

10-1 Gas Burner

- Unit controller calls for heat.
- Top furnace DDC receives call for heat.
- Steps 3-9 from Low Heat Option are followed.
- If top furnace is unable to meet the unit controllers DAT heating setpoint then the furnace DDC calls for 3rd stage of heating
- Top furnace is reduced to low fire
- Bottom furnace receives a call for heat and sequences similar to steps 3-9 from Low Heat Option.
- Staged burner gas valve receives a signal to open 50%.
- Top furnace receives a signal to modulate the gas valve to meet the unit controllers DAT heating setpoint.
- If stage 3 and modulating furnace are unable to meet DAT heating setpoint then stage 4 heat initiates
- The bottom furnace stages up to high fire and the top furnace reduces to low fire
- Mod gas valve and inducer blower motor receive a signal to modulate to match the unit controllers DAT heating setpoint

Discharge Air Temperature Setpoint Reset - Heating

The Heating DAT Setpoint may be reset for units with DAT Heating Control. The Discharge Air Temperature Setpoint will never be set below the Minimum DAT Heating Setpoint or above the Maximum DAT heating Setpoint on the Heating Reset menu. The reset type may be set to one of the following:

- **None:** Discharge Heating Spt is user adjustable
- **Network:** Discharge Heating Spt is equal to the Network DAT Htg Setpoint when it is valid
- **Space:** Discharge Heating Spt is based on the Space Sensor
- **Return:** Discharge Heating Spt is based on the Return Air Sensor
- **OAT:** Discharge Heating Spt is based on the Outdoor Air Temperature
- **Ext mA**: Discharge Heating Spt is determined by a 0-20 or 4-20 mA signal
- **Ext V:** Discharge Heating Spt is determined by a 0-10 or 2 - 10 VDC signal

Reset reverts from Return to None when the return air sensor opens or shorts. Reset reverts from Space to None when the space sensor opens or shorts. Reset reverts from OAT to None when the outdoor air sensor opens or shorts.

When Space, Return, OAT, Ext mA, or Ext V is selected, the Discharge Heating Spt equals the Max Htg Spt when the selected value equals the Max Htg Spt @ value. Similarly, the Discharge Heating Spt equals the Min Htg Spt when the selected value equals the Min Htg Spt @ value.

When Space, Return, or OAT is selected, the reset schedule should be set so that the DAT Heating setpoint decreases as the selected temperature increases as shown in the graph.

When Ext mA is selected, the values “Min Htg Spt @” and “Max Htg Spt @” are entered as mA values. When Ext VDC is selected, the values “Min Htg Spt @” and “Max Htg Spt @” are entered as VDC values.

If Ext mA or Ext V is selected as the type of reset, the Min Htg Spt @ value may be set above the Max Htg Spt @ value to cause a decrease in the DAT setpoint as the external signal or the Min Htg Spt @ value may be set below the Max Htg Spt @ value to cause an increase in the DAT setpoint as the external signal increase.

Whenever the Clg Reset Type or Engineering Units is changed, the Min Clg Spt @ and Max Clg Spt @ values revert to default values as follows:

- **None:** Min Clg Spt @=0NA, Max Clg Spt @=100NA
- **Network:** Min Clg Spt @=0NA, Max Clg Spt @=100NA
- **Space, Return:** Min Clg Spt @=73.0F, Max Clg Spt @=71.0F
- **OAT:** Min Clg Spt @=90.0F, Max Clg Spt @=70.0F
- **ExtmA:** Min Clg Spt @=4.0mA, Max Clg Spt @=20.0mA
- **ExtVDC:** Min Clg Spt @=0.0V, Max Clg Spt @=10.0V

An example of discharge temperature reset based on outdoor air temperature is illustrated in Figure 28 (Cooling Reset Type Flag is set to "OAT" in this example). When the current outdoor air temperature is greater than or equal to the Minimum Cooling Set Point Reset Value (90°F in this example), the Discharge Cooling Set Point is set equal to the Minimum Discharge Cooling Set Point (55°F in this example). This is shown as Point C in Figure 28.

When the current outdoor air temperature is less than or equal to the Maximum Cooling Set Point Reset Value (70°F in this example), the Discharge Cooling Set Point is set equal to the Maximum Discharge Cooling Set Point (65°F in this example). This is shown as Point A in Figure 28.

When the current outdoor air temperature is between the Minimum Cooling Set Point Reset Value and the Maximum Cooling Set Point Reset Value, the Discharge Cooling Set Point varies linearly between the Minimum Discharge Cooling Set Point and Maximum Discharge Cooling Set Point. This is shown as Point B in Figure 28.

Whenever the Htg Reset Type or Engineering Units is changed, the Min Htg Spt @ and Max Htg Spt @ values revert to default values as follows:

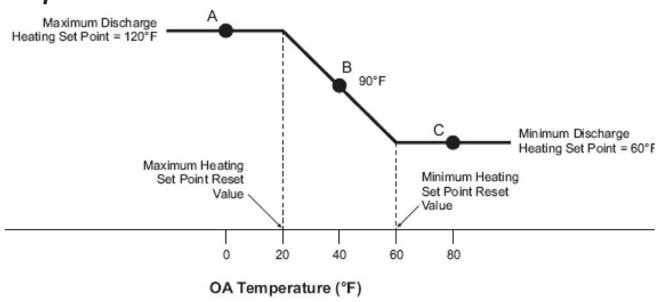
- **None:** Min Htg Spt @=0NA, Max Htg Spt @=100NA
- **Network:** Min Htg Spt @=0NA, Max Htg Spt @=100NA
- **Space, Return:** Min Htg Spt @=69.0°F, Max Htg Spt @=67.0°F
- **OAT:** Min Htg Spt @=60.0°F, Max Htg Spt @=20.0°F
- **ExtmA:** Min Htg Spt @=4.0mA, Max Htg Spt @=20.0mA
- **ExtVDC:** Min Htg Spt @=0.0V, Max Htg Spt @=10.0V

An example of discharge temperature reset based on outdoor air temperature is illustrated in Figure 28 (Heating Reset Type Flag is set to "OAT" in this example).When the current outdoor air temperature is greater than or equal to the Minimum heating Set Point Reset Value (60°F in this example), the Discharge Heating Set Point is set equal to the Minimum Discharge Heating Set Point (60°F in this example).This is shown as Point C in Figure 28.

When the current outdoor air temperature is less than or equal to the Maximum Heating Set Point Reset Value (20°F in this example), the Discharge Cooling Set Point is set equal to the Maximum Discharge Heating Set Point (120°F in this example). This is shown as Point A in Figure 28.

When the current outdoor air temperature is between the Minimum Heating Set Point Reset Value and the Maximum Heating Set Point Reset Value, the Discharge Heating Set Point varies linearly between the Minimum Discharge Heating Set Point and Maximum Discharge Heating Set Point. This is shown as Point B in Figure 28.

Figure 28: Discharge Temperature Reset Based on Temperature



Indoor Air Fan - ON/OFF Control

A supply fan is provided on every unit. That may be the only fan, but either a return fan or an exhaust fan, or fans, can be provided also. The start/stop signal and the speed signal for fans that are controlled by variable frequency drives are provided via an internal ModBus network. Constant volume supply and return fans are started and stopped through digital outputs.

Supply Fan

The supply fan is turned ON when the unit enters the Recirculation state. The supply fan is turned OFF when the unit transitions to the OFF state, but it stays on for a OffHtClDelayTime (Default- 120 seconds) if the unit is turned OFF while DX cooling or staged heating is active. The OffHtClDelayTime function is overridden when and Emergency Off or Duct High Limit fault is active.

Return Fan

A return fan driven by a variable frequency drive is started four seconds after the supply fan is started to reduce the amp draw peak on startup. A constant volume return fan is turned ON through the same output as the supply fan. An external Fan Delay Relay is used to provide a delay between startups if required.

Supply Fan Capacity Control (VAV)

The speed of a modulating supply fan is controlled by a 0-100% signal provided to the VFD via an internal Modbus network. Supply Fan Capacity Control for a modulating fan is controlled to either maintain the duct static pressure at a desired value or maintain a fixed speed based on a signal provided via a network.

The choice of control method, SF Cap Ctrl, may be set to Duct Pressure or Speed via the keypad. After the supply fan is started, a speed signal of 33% is sent to the variable frequency drive for the DSPCtrlDelay (Default=30 seconds). Control reverts to either duct pressure or speed after the fan has been on for the duration of the DSPCtrlDelay time. The VFD speed is not controlled below the minimum SAF speed setting (default 33%) while the fan is operating.

NOTE: Units supplied with Daikin Applied MD2, MD3, and MD6 drives will have a user editable maximum supply fan hertz setpoint (default 60 Hz) located in the SAF Set Up menu. This parameter can be changed when job site conditions require the speed of the drive to be above 60 Hz.

Duct Static Pressure Control

The supply air fan speed is controlled by a VFD. The control parameter for the fan speed is the duct static pressure setpoint. If the duct static pressure is below the duct static pressure setpoint by more than ½ the deadband, the fan speed will increase. Likewise if the duct static pressure is above the duct static pressure setpoint by more than ½ the deadband the fan speed will decrease. **Example** - if the duct static pressure setpoint is 1.2" and the deadband is 0.1",the duct static pressure must reach 1.14 before the fan will increase in speed. The Duct Static Pressure setpoint may be set through the keypad or via a network signal. The active setpoint is changed whenever either of these values changes so it equals whichever value was changed most recently.

Speed/Network

When speed control is selected, the fan operates at the larger of its minimum speed or a value provided via a connected network or the keypad/display.

Single Zone VAV Control (1ZnVAV)

When space temperature control is selected, the supply fan VFD is controlled with a PI_Loop to maintain the Control Temperature input at the Occupied or Unoccupied Cooling Setpoint or Occupied or Unoccupied Heating Setpoint. This control choice is designed for DAC control type and will be used in applications where the unit will act as a single VAV box to control space temperature. Cooling and heating discharge air temperature control and outside air damper control will function in the normal manner as with VAV units.

Cooling/Economizer

When the Unit State is Cooling or Econo the Single Zone VAV Control PI_Loop will be set for direct acting control to modulate the supply fan VFD to maintain the Control Temperature at the Occupied Cooling Setpoint. As the Control Temperature rises, the VFD speed will be increased and as the Control Temperature falls, the VFD speed will be decreased. An adjustable Minimum Cooling Speed and Maximum Cooling Speed value limits the range of modulation of the VFD.

Heating

When the Unit State is Heating the Single Zone VAV Control PI_Loop will be set to reverse acting control to modulate the supply fan VFD to maintain the Control Temperature at the Occupied Heating Setpoint. As the Control Temperature falls, the VFD speed will be increased and as the Control Temperature rises, the VFD speed will be decreased. An adjustable Minimum Heating Speed and Maximum Heating Speed value limits the range of modulation of the VFD

Fan Only/MinDat

When the Unit State is FanOnly or MinDat, the supply fan speed will be held fixed at the speed the VFD was operating upon entering the FanOnly or MinDat state. This will be either the Minimum Cooling Speed or the Minimum Heating Speed depending on the state the unit enters FanOnly/MinDat from

Building Static Pressure Control (BSP)

Building static pressure supply fan control is available on 100% OA units that have the Control Type set to Zone or DAC. Building static pressure supply fan control is not available if the Control Type set to 1ZnVAV (2). When BSP is selected as the SAF capacity control method, the supply fan VFD is controlled to maintain a building static pressure input at a building static pressure setpoint using a PI Loop.

A BSP Input parameter allows for selecting No or Yes for supply fan building static pressure control. If BSP Input is set to No then no monitoring or control based on BSP is possible. All menu items related to BSP control are removed from the HMI in this case. If BSP Input is set to Yes then the building static pressure input is available for control and monitoring purposes.

Carbon Dioxide Control (CO_2)

CO_2 supply fan control is available on 100% OA units that have the Control Type set to Zone or DAC.

CO_2 supply fan control is not available if the Control Type set to 1ZnVAV. When CO_2 is selected as the SAF capacity control method, the supply fan VFD is controlled based on a CO_2 input. The supply fan speed varies linearly between the Minimum PPM Speed and the Maximum PPM Speed value as the PPM input varies from the Minimum SAF PPM and the Maximum SAF PPM value. A CO_2 Input parameter allows for selecting None, VDC or mA as the type of input for the CO_2 sensor in this case.

If CO_2 Input is set to None then no monitoring or control based on CO_2 is possible. All menu items related to CO_2 control and scaling are removed from the HMI in this case. If CO_2 Input is set to VDC then the CO_2 input is available for control and/or monitoring purposes and the sensor scaling parameters are in terms of volts DC. If CO_2 Input is set to mA then the CO_2 input is available for control and/or monitoring purposes and the sensor scaling parameters are in terms of milliamps.

Airflow Control (CFM)

Airflow supply fan control is available on 100% OA units that have the Control Type set to Zone or DAC. Airflow supply fan control is not available if the Control Type set to 1ZnVAV. When CFM is selected as the SAF capacity control method, the supply fan VFD is controlled to maintain a CFM input at a Minimum Outside Air CFM Setpoint using a PI Loop.

A CFM Input parameter allows for selecting None, VDC or mA as the type of input for the CFM sensor in this case.

If CFM Input= is set to None then no monitoring or control based on CFM is possible. All menu items related to CFM control and scaling are removed from the HMI in this case. If CFM Input is set to VDC then the CFM input is available for control and/or monitoring purposes and the sensor scaling parameters are in terms of volts DC. If CFM Input is set to mA then the CFM input is available for control and/or monitoring purposes and the sensor scaling parameters are in terms of milliamps.

Modulating Return and Exhaust Fan Control (RTU, MPS)

Four different approaches may be used to maintain the building static pressure at acceptable levels. An analog signal is provided to the VFD to control return or exhaust fan to:

- Maintain the speed of a return fan based on supply fan speed (Fan Tracking)
- Maintain the building static pressure at a desired value
- Maintain a fixed speed based on a signal provided by a Building Automation System via a network.
- Vary the speed of an exhaust fan based on OA Damper position.

Any of the first three methods may be selected for a return fan. Building Static Pressure, Speed, or OA Damper may be selected for an exhaust fan.

When the unit is in the OFF or Startup state, the variable frequency drive for the return or exhaust is driven to 0%.

After the return or exhaust fan is started, a speed signal of 5% for exhaust fan or 33% for return fan is sent to the variable frequency drive for the BSPCtrlDelay (Default=30 seconds) and the VFD will increase its speed to 5% (or 33%). Control reverts to one of the methods below after the fan has been on for the BSPCtrlDelay. The VFD speed is not controlled below 5% (or 33%) while the fan is operating.

During non-OFF states when the outdoor air damper is closed, the speed of the return fan is set equal to the supply fan speed. Under these conditions, the return fan is set to 100% if the supply fan is a constant volume fan. To provide a "bumpless transfer" when the outdoor air damper opens the return fan will start to control building static pressure from its speed when the damper was closed. Exhaust fans do not use this feature.

NOTE: Units supplied with Daikin Applied MD2, MD3, and MD6 drives will have a user editable maximum return fan/exhaust fan hertz setpoint (default 60 Hz) located in the RF/EF Set Up menu. This parameter can be changed when job site conditions require the speed of the drive to be above 60 Hz.

Fan Tracking Control

For units with variable frequency drives, the return fan may be controlled such that the return fan speed tracks up and down with the supply fan speed. The user defines the position of the return fan with respect to the supply fan for minimum and maximum positions. When the supply fan is between the minimum and maximum positions, the fan varies proportionally between its minimum and maximum values. There are four adjustable parameters to define this relationship. They are:

Supply Fan (DF) Value Return Fan (RF) Value

1. Supply Fan Max
2. Return Fan @ Supply Fan Max
3. Supply Fan Min
4. Return Fan @ Supply Fan Min

To set the four parameters as described, the airflow and return vane positions are adjusted until maximum airflow and proper indoor conditions are met. The supply fan is controlled normally as the VAV boxes are adjusted to obtain maximum airflow. The return fan is adjusted using the Remote RF/EF setting on the keypad. The user then uses the key to set the Supply Fan Max values and Return Fan @ Supply Fan Max to the observed values. The process is repeated at minimum airflow to set Supply Fan Min and Return Fan @ Supply Fan Min values.

Low/High Fan Differential

When a return fan is running slower than the supply fan it is limited to a Lo Fan Diff value below the supply fan to prevent the supply fan from overloading the return VFD or ECM motor fan drive. When the return fan is running faster than the supply fan it is limited to a Hi Fan Diff value above the supply fan to prevent the return fan over pressurizing the return fan plenum.

Building Static Pressure Control

A PI control loop is used to modulate the variable frequency drive of the exhaust fans to maintain a measured building static pressure at a setpoint. The BSP Gain, Project Ahead Time, and Sample Time are editable via the keypad

The Building Static Pressure setpoint may be set through the keypad or via a network signal. The active setpoint is changed whenever either of these values changes so it equals whichever value was changed most recently.

Speed/Network Control

Single zone VAV control is available when the unit Control Type is Single Zone VAV (1ZnVAV). When single zone VAV control is selected as the SAF capacity control method, the supply fan VFD or ECM motor is controlled with a PI_Loop to maintain the Control Temperature input at the Occupied Cooling Setpoint or Occupied Heating Setpoint. This option is designed for discharge control applications where the unit will act as a single VAV box to control space temperature. OAT is not allowed as the Control Temperature when SAF capacity control method is set to 1ZnVAV. Cooling and heating discharge air temperature control and outside air damper control will function in the normal manner as with VAV units.

NOTE: Single zone VAV control of SAF is not available when the Control Temperature Source is set to None.

Exhaust Fan - Speed Control

The exhaust fan is turned ON when the OA Dampers are at least open to the Minimum Exhaust OA Position (default 5%), the SAF capacity is above the Minimum Exhaust SAF capacity (default 10%), and the Remote Exhaust Fan capacity is commanded to a value above the minimum value (Default = 5%) by a BAS for longer than the Minimum Exhaust Fan On Time (Default = 120 seconds).

The exhaust fan is turned OFF when the Supply Fan is turned OFF when the Remote Exhaust Fan capacity is commanded to less than or equal to its minimum value (Default = 5%) for longer than the MinExhStopTime (Default = 120 seconds).

Modulating Propeller Exhaust- OA Damper Control

When the unit is equipped with a modulating propeller exhaust fan arrangement and the Return/Exhaust Fan Capacity Control Method is set to OA Damper, the exhaust fan is turned on at an adjustable outdoor air damper position (default 40%), and is turned back off when the dampers are below this setting for more that the minimum exhaust stop time (Default = 120 seconds). When on the fan is modulated linearly between the minimum exhaust fan speed and 100% as the dampers vary between the Exhaust On OA Position and the Exhaust Maximum OA Position.

Exhaust Fan - Building Static Pressure Control

An exhaust fan, or fans, driven by a variable frequency drive is started based on building static pressure. A constant volume exhaust fan is turned ON through the same output as the supply fan. An external Fan Delay Relay is used to provide a delay between startups if required.

A VAV exhaust fan is turned ON when the OA Dampers are at least open to the Minimum Exhaust OA Position (default 5%), the SAF capacity is above the Minimum Exhaust SAF capacity (default 10%), and the building static pressure is above the building static pressure setpoint by more than the deadband for longer than the Minimum Exhaust Fan Start Time (Default = 120 seconds).

A VAV exhaust fan is turned OFF when the supply fan is turned off or when the building static pressure is below the building static pressure setpoint by more than the deadband, or the OA Dampers are open less than the Minimum Exhaust OA Position (default 5%), or the SAF capacity is below the Minimum Exhaust SAF capacity (default 10%), and the Exhaust Fan capacity is at or below its minimum value (Default = 5%) for longer than the Min Exhaust Fan Stop Time (Default = 120 seconds).

Exhaust Fan - Speed Control

When speed control is selected, the fan operates at the larger of its minimum speed or a value provided via a connected network or the keypad/display.

The exhaust fan is turned ON when the OA Dampers are at least open to the Minimum Exhaust OA Position (default 5%), the SAF capacity is above the Minimum Exhaust SAF capacity (default 10%), and the Remote Exhaust Fan capacity is commanded to a value above the minimum value (Default = 5%) by a BAS for longer than the Minimum Exhaust Start Time (Default = 120 seconds)

The exhaust fan is turned OFF when the supply fan is turned off when the Remote Exhaust Fan capacity is commanded to less than or equal to its minimum value (Default = 5%) for longer than the Minimum Exhaust Stop Time (Default = 120 seconds).

Staged Exhaust (MPS Units) Exhaust Fan - OA Damper Control

When the Return Fan Type is set to 1StgExh, 2StgExh or 3StgExh and the Return/Exhaust Fan Capacity Control Method is set to OA Damper, one, two or three exhaust fans are turned on and off based on the outdoor air damper position. Refer to Table 61 for the number of fans versus unit size.

Table 61: Fan Configuration

MPS Unit Size	Number of Fans
15	1
18	1
20	2
25	2
30	2
35	2
40	3
50	3

The default exhaust fan ON and OFF values are as follows:

Table 62: Fan Settings

Action	Default OA Setting	Adjustable Range
Exh Fan Stg 1 ON	40%	0–100%
Exh Fan Stg 1 OFF	30%	0–100%
Exh Fan Stg 2 ON	55%	0–100%
Exh Fan Stg 2 OFF	40%	0–100%
Exh Fan Stg 3 ON	70%	0–100%
Exh Fan Stg 3 OFF	50%	0–100%

Troubleshooting

Fan Failure Codes

HLL = Hall Sensor Error

First occurrence:

Power fluctuations may be responsible.

Corrective: Reset the failure; re-start the motor and observe it. If applicable, filter out the source of the disturbing voltage.

Repeated occurrence:

Question: Do other fans show the same failure?

Yes: Systematically search for voltage peaks.

No: It seems to be a hardware problem of the fan. Fan need to be replaced.

TFEI = Electronics Interior Overheated

First occurrence:

Too high ambient temperature may be responsible.

Question:
- Could ambient temperature have been too high?
- Is it possible to connect the fan to EC Control in order to display the temperature? If so, is the displayed temperature within the expected temperature range?

Corrective: If the displayed temperature is above 95°C (the electronics switches off at 105°C), double-check the ambient temperature in each operating mode.

Reset the failure; re-start the motor and observe it.

Repeated occurrence:

Question: Do other fans show the same failure?

Yes: Systematically search for the cause of excessive ambient temperature. Perhaps use a data logger or read out the electronics temperature via EC Control.

No: It seems to be a hardware problem of the fan. Fan need to be replaced.

TFM = Motor Overheated

First occurrence:

Excessive ambient temperature may be responsible.

Question:
- Could ambient temperature have been too high? Or is the motor overloaded?
- Is it possible to connect the fan to EC Control in order to display the motor temperature?
- Is the displayed temperature within the expected temperature range?

Corrective: If the displayed temperature is too high:
- Double-check the motor temperature in each operating mode.
- Check of the fan load: Measure the input power at max. load/ operating point and compare the measured value with nominal data on the label. Is there any discrepancy?
- Reset the failure; re-start the motor and observe it.

Repeated occurrence:

Question: Do other fans show the same failure?

Yes: systematically search for the cause of excessive ambient temperature. Perhaps use a data logger or read out the electronics temperature via EC Control.

No: It seems to be a hardware problem of the fan. Fan need to be replaced.

TFE = Power Mod Overheated

First occurrence:

Excessive ambient temperature may be responsible.

Question:
- Do other fans (temporarily) show the same failure within the arrangement? Could ambient temperature have been too high? Or is the motor overloaded?
- Is it possible to connect the fan to EC Control in order to display the temperature?
- Is the displayed temperature within the expected temperature range?

Corrective: If the displayed temperature is too high:
- Check the module temperature during operation in each operating mode (Tmodule <110°C; switching-off temperature 115°C)
- Check the fan load and supply voltage: Measure the input power at max. load/ operating point and compare the measured value with nominal data on the label. Is there any discrepancy?
- Reset the failure; re-start the motor and observe it.

Repeated occurrence:

Question: Do other fans show the same failure?

Yes: Systematic search for the reason of too high ambient temperature, overload, overvoltage or low voltage. Perhaps use a data logger.

No: It seems to be a hardware problem of the fan. Fan need to be replaced.

BLK = Locked Motor

First occurrence:

Question:
- Is it possible that the motor was locked by an obstruction or ice?
- Do other fans show the same behaviour?

Corrective: Remove the reason for blocking. Caused by ice: activate the shake-loose functionality (starting with ModBus 5) or increase the starting phase control factor.

Repeated occurrence:

Question: Does increasing the starting phase control factor improve the situation?

No: It seems to be a hardware problem of the fan. Fan need to be replaced.

SKF = Communication Error

First occurrence:

Power fluctuations may be responsible.

Corrective: Reset the failure; re-start the motor and observe it. If applicable, filter out the source of the disturbing signal.

Repeated occurrence:

Question: Do other fans show the same failure?

Yes: systematic search for peaks of disturbance voltage

No: It seems to be a hardware problem of the fan. Fan need to be replaced.

PHA = Phase failure

UzLow = DC-Link Undervoltage

UzHigh = DC-Link Overvoltage

UeHigh = Mains Overvoltage

UeLow = Mains Undervoltage

Question: Can the main voltage be measured at any spot; a data logger may be helpful.

No: Measure the voltage at the power supply input of the concerned fan.

Corrective:
- Reset the failure; re-start the motor and observe it.
- If applicable, filter out the source of disturbing signal.

Repeated occurrence:

Question:
- Do other fans show the same failure?
- How often does the failure occur?
- Get big electrical consumer loads switched at the same time when the failure occurs in the surrounding area?
- Are compressors or large asynchronous motors applied within the arrangement?

Yes: Systematic search for external disturbance voltage peaks; If applicable, usage of data logger for a longer period and analysis of the measured values.

- Are the voltage values within the specified range?

No: It seems to be a hardware problem of the fan. Fan need to be replaced.

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