Installation and Maintenance Manual

OM 1263-1

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MicroTech® III Unit Controller for Rebel® Refrigeration Only Controls

Model DPS

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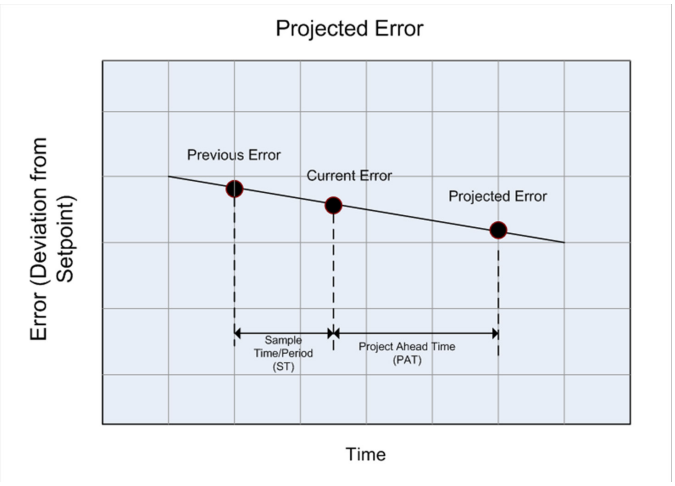
This manual provides information regarding the MicroTech® III control system. It specifically describes the operation and programmable options for units with refrigeration only controls (ROC).

The ROC MicroTech III Controller is a device that is not capable of complete, stand-alone operation. Information in the controller can be displayed and modified by using the keypad/display in the units main control panel. The ROC systems require a third-party controller for the Rebel unit to function.

Adjusting PI Control Parameters

The rooftop MicroTech III controller uses a “velocity” form of the traditional PI loop arranged such that the output is adjusted based on a “gain” parameter multiplied by the “projected” error. The projected error is determined based on the rate the error is changing as shown in Figure 1.

Figure 1: Projected Error Timeline



The change in output (Do) after each sample period (ST) is given by the following equation:

Do= Gain X Projected Error.

Although it is generally recommended that they are left at the factory settings there are four PI loop adjustment parameters available via the MicroTech III HMI. These are Gain, Period (ST), Project Ahead Time (PAT) and Max Change.

Generally speaking, the PAT should be set roughly equal to the “time constant” of the system being controlled and the Period (ST) one quarter to half the PAT. The Gain is then set to achieve control stability. If the system is unstable (hunting) the control is too fast and the Gain should be decreased to slow the control response. If the system takes excessively long to reach setpoint during transient conditions (sluggish) the Gain can be increased to speed the control response. The goal is an acceptable balance between these two conditions. When in doubt these parameters should be set to the factory settings.

Example of Adjusting the PI Loop

Put the unit into a cooling mode with a DAT set point that is relatively in reach considering the conditions of the outdoor air and the conditions of the temperature within the building. Watch the unit operate and mark the time when you see it operating at a steady state holding discharge temperature within the dead band. Then make an incremental change to the set point, lowering for (cooling PID), start a timer and again observe the temperature noting time when the system again is delivering a discharge temp within the dead band. Record the time it took to re-stabilize. 63% of this time is the system time constant and you should set the PAT to that value. Then you should set the Period to ¼ to ½ the PAT (this is not critical). From that point forward these values should be locked down and all you need to worry about is adjusting the Gain until the control is fast enough, but not too fast, that it is unstable. As an example: starting DAT temp is 60°F and it is stable, the DAT setpoint is changed to 55°F, it takes 5 minutes to reach 55°F and stabilize. Using that theory — 300 seconds, multiplied by 65% is 195 seconds, the PAT would be set to 195 seconds, Period would be set somewhere between 49 and 98 seconds.

Additional Instructions and Information

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

Table 1: Installation and Maintenance Resources

Unit	Manual
MicroTech III Remote Unit Interface	IM 1005
MicroTech III_Rooftop and Self-Contained Unit Controller Protocol Information	ED 15112
DPS 03 – 28	IM 1125

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 control panel must be performed only by personnel that are knowledgeable in the operation of the equipment being controlled.

⚠ CAUTION

Extreme temperature hazard. Can cause damage to system components.

The MicroTech III 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).

⚠ 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

Static sensitive components. A static discharge while handling electronic circuit boards can cause damage to the components.

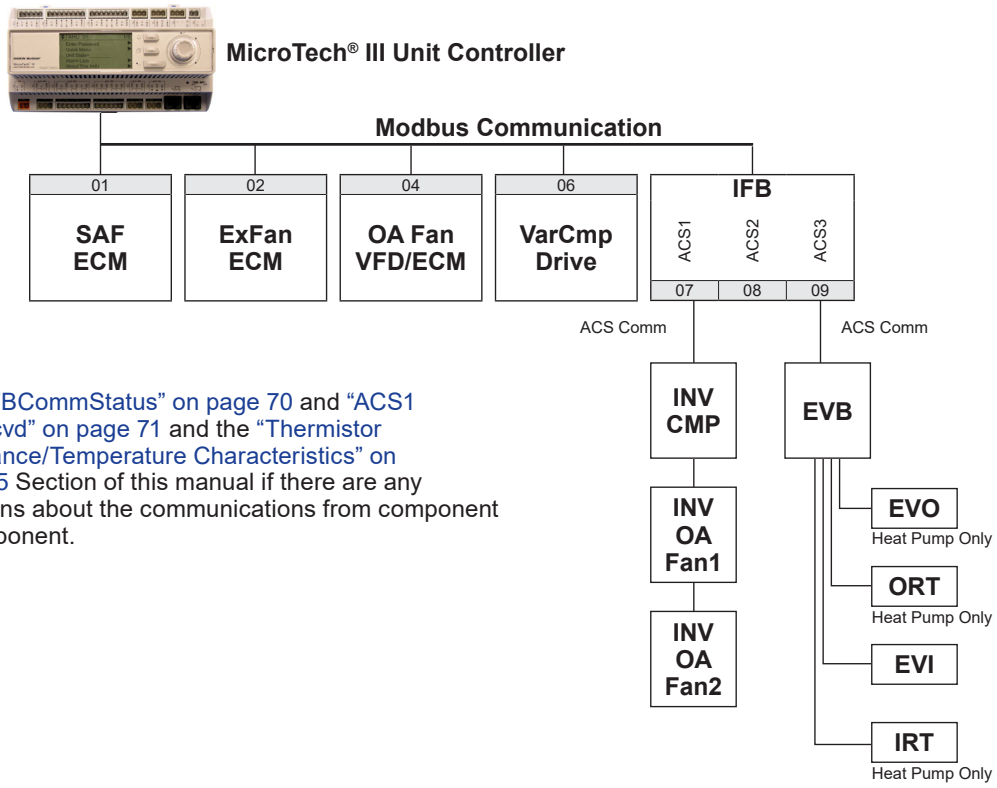
Discharge any static electrical charge by touching the bare metal inside the main control panel before performing any service work. Never unplug any cables, circuit board terminal blocks, relay modules, or power plugs while power is applied to the panel.

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
- Heat/Cool Changeover
- Compressor Capacity
- Supply Fan Capacity
- Exhaust Fan Capacity

Figure 2: Inter Component Communications Diagram



NOTE: See "IFBCommStatus" on page 70 and "ACS1 DataRcvd" on page 71 and the "Thermistor Resistance/Temperature Characteristics" on page 85 Section of this manual if there are any questions about the communications from component to component.

IFB Board

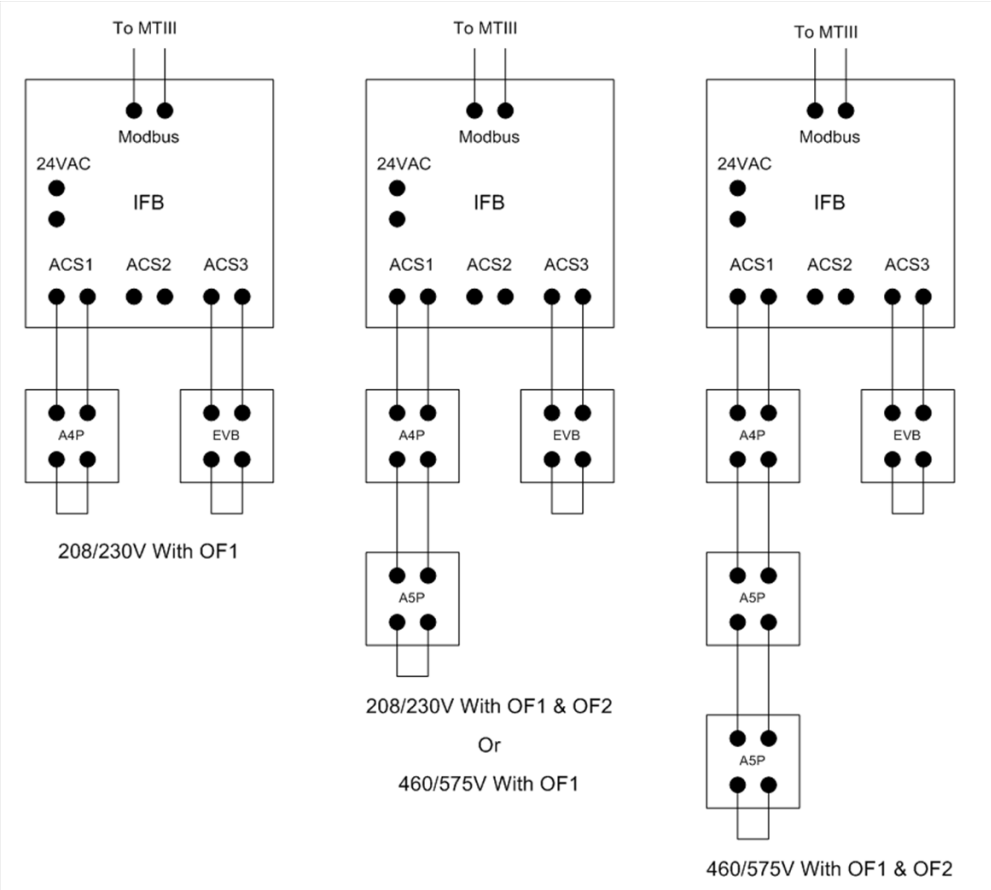
The IFB board is used to translate between the MicroTech III controller Modbus and the Daikin inverter compressor/outdoor fan boards' proprietary protocol.

There are three "ACS" communication current loop channels available on the IFB board; ACS1, ACS2 and ACS3. ACS1 is use for control of the inverter compressor (INV) and one or two outdoor fans (OF1 and OF2). ACS3 is use for control of the indoor expansion valve (EVI) and if the unit is a heat pump the outdoor expansion valve (EVO). ACS2 is not currently used.

INV, OF1 and OF2 are controlled by a combination of circuit boards designated A4P and A5P. These boards are interconnected forming the ACS1 communication loop. On 208/230V units the A4P board controls both INV and OF1. On 460/575V units the A4P board controls only INV and there is a separate A5P board that controls OF1. If a unit is equipped with an OF2 it is controlled by a separate A5P control board. Figure 3 shows the three possible board/loop arrangements that make up the ACS1 loop.

Expansion valves EVI and if applicable EVO are controlled by an expansion valve driver board EVB. The EVB board is connected to the IFB board forming the ACS3 communication loop. Figure 3 shows the ACS3 communication loop.

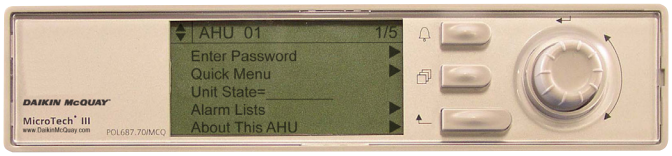
Figure 3: ACS Communication Current Loop Arrangements



For Troubleshooting Module-to-Module Communication, See page 70.

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.

Figure 4: Keypad Controls



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. 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.

MicroTech III Warranty Statement

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

In the text below, IM 919 clearly states that miswiring will damage the MicroTech III. Daikin 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 III 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.

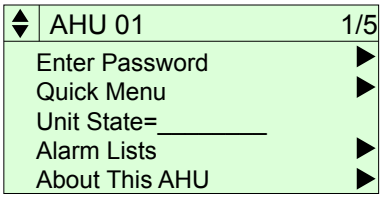
Passwords

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.

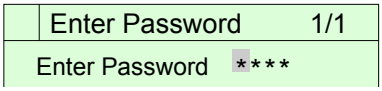
The main password page is displayed when the keypad/display is first accessed, the Home Key is pressed, the Back Key is pressed multiple times, or if the keypad/display has been idle longer than the Password Timeout (default 10 minutes). The main password page provides access to enter a password, access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

Figure 5: 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 6: 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

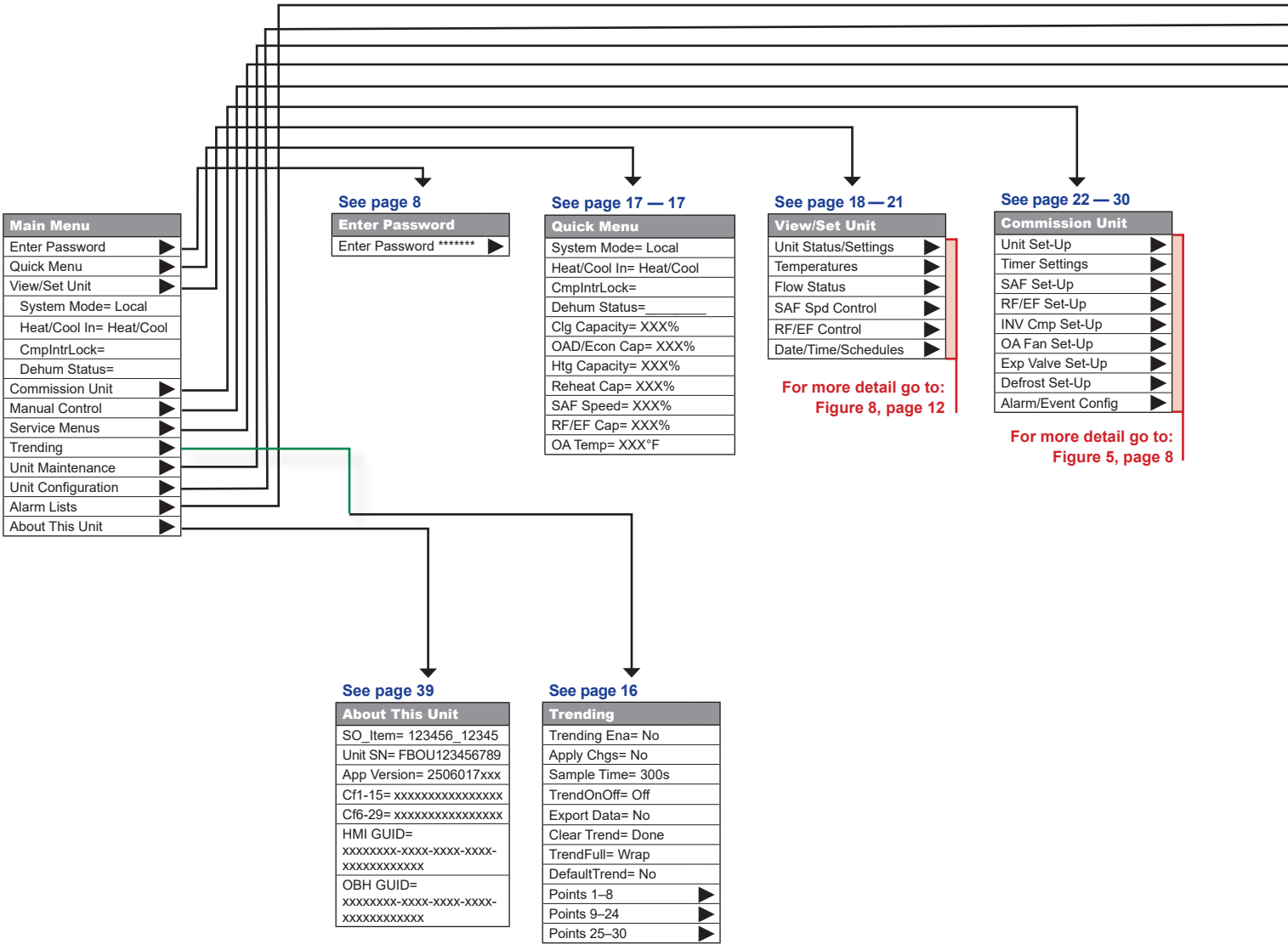
A user may override timers for a period of up to 240 minutes by setting the Service Timer to a non-zero number. When the Service Timer is not zero, the times listed below are set to the Service Time (Default = 20 seconds) instead of the normal values. This allows the unit to be run through its operating 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

The following is a description of the MicroTech III 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 7: Main Menu *– Keypad/Display Menu Structure*



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Manual Control
Manual Control= Normal
Supply Fan= Off
SAF Spd Cmd= 0%
INV/OF Ena= Off
INV Cmp= Off
INV Spd Cmd= 0%
Comp 3= Off
OA Fan= Off
OA Fan Cmd= 0%
4 Way Valve= Off
RcvSol Valve=Off
BP Sol Valve= Off
EVI Cmd= 0%
EVO Cmd= 0%
RF/EF Fan= Off
RF/EF Spd Cmd= 0%
OAD/Econo= 0%
Reheat Valve= 0%
RH Output= Off
Alm Output= Off

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Service Menus
Timer Settings ▶
Operating Hours ▶
Save/Restore Settings ▶
Active Alarms ▶
Alarm Log ▶
Event Log ▶
Data Snapshots ▶
Alarm/Event Config ▶
Analog Input Status ▶
Universal I/O Status ▶
Digital Input Status ▶
Digital Output Status ▶
Network Input Status ▶
Modbus Status ▶
IP Set-up ▶
Reset Counter= 0 ▶
LastResetInfo = - ▶

For more detail go to:
Figure 12, page 16

See page 32

Unit Maintenance
Operating Hours

See page 36

Unit Configuration
Apply Changes= No
Unit Type= DPS/DAH(3)
Control Type= RefOnly(3)
Clg Type= INV(4)
Comp Config= 1V1F1C(M)
Gen Clg Stgs= NA
Low Ambient= NA(0)
Cond Ctrl= INV(8)
OA Dmpr/Econ= AirEc(3)
OA Flow Stn= None(0)
Htg Type= None(0)
Htg Stages= 1
Max Heat Rise= 100
SAF Type= EBMVAV(F)
RAF Type= None(0)
RF/EF Ctrl= NA(0)
2ndDSPSnsr= NA(0)
EFT/LCT Snsr= NA(0)
Enrgy Rec= None(0)
Clg Circ Type= 1Air(2)
Head P Ctrl= NA(0)
Bypass Ctrl= NA(0)
Unit Size= 012
Refrig Type= R410A(2)
Reheat Type= None(0)
Unit Voltage= 460V/60Hz(2)
EV Type= EVBSag(1)
Apply Changes= No

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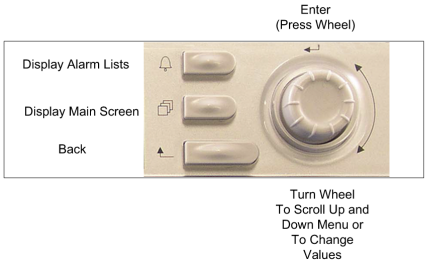
Alarm Lists
Active Alarms ▶
Alarm Log ▶

For more detail go to:
Figure 12, page 16



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 8: View/Set Unit** – Keypad/Display Menu Structure*

See page 18 — 21

View/Set Unit

- Unit Status/Settings ▶
- Temperatures ▶
- Flow Status ▶
- SAF Spd Control ▶
- RF/EF Control ▶
- Date/Time/Schedules ▶

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Unit Status/Settings
System Mode= Local
Heat/Cool In= Heat/Cool
CmpIntrLock= _____
CmpCapIn= _____
SAFSSIn= _____
SAFCapIn= _____
EAFSSIn= _____
EAFCapIn= _____
RhtVlvIn= _____
OADCapIn= _____
AlmResetIn=_____
Dehum Status= _____
Clg Status= _____
Htg Status= _____
SuplHtgStatus= _____
Econo Status= _____
Clg Capacity= XXX%
Htg Capacity= XXX%
Supl Htg Cap= XXX%
Reheat Cap= XXX%
SAF Speed= XXX%
RF/EF Cap= XXX%
OAD/Econo Cap=XXX%

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Temperatures
OA Temp= XXX°F
DRT1= XXX°F
DRT3= XXX°F
SRT= XXX°F
DFT= XXX°F
IRT= XXX°F
ORT= XXX°F
INVCompTemp= XXX°F

See page 20

Flow Status
Supply Fan= _____
Ret/Exh Fan= _____

See page 20

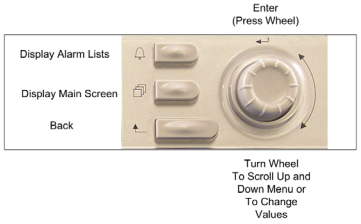
SAF Speed Control
SAF Speed= XXX%
Speed Cmd= XXX%

See page 20

RF/EF Control
RF/EF Cap= XXX%
RF/EF Spd Cmd= XXX%

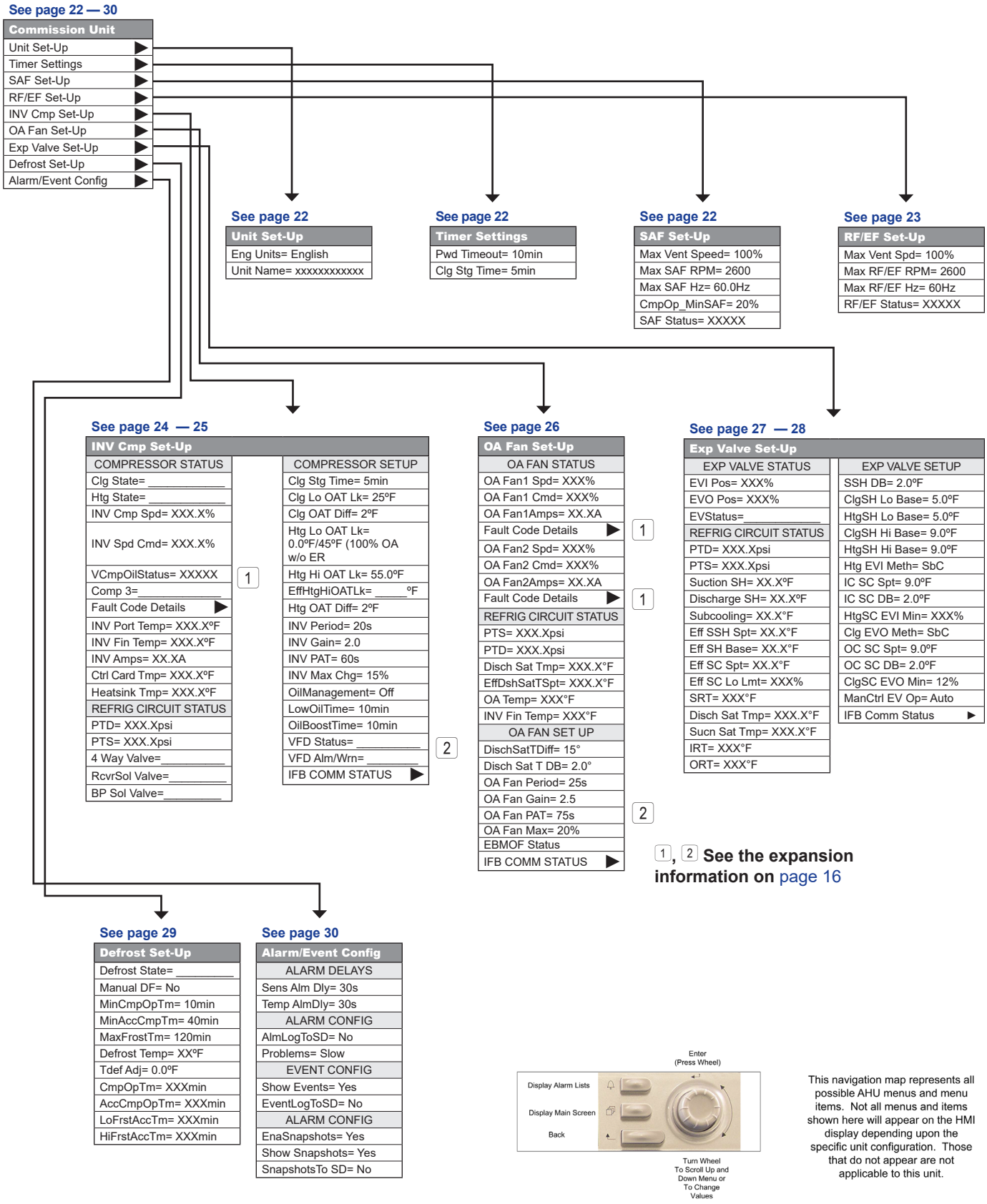
See page 21

Date/Time/Schedules
Time= hh:mm:ss
Date= MM/DD/YY
UTC Diff= -60min
DAYLIGHT SAVINGS
DLS Strt Mon= Mar
DLS Strt Wk= 2nd Week
DLS End Mon= Nov
DLS End Wk= 1st Week
DLS Enable= Auto



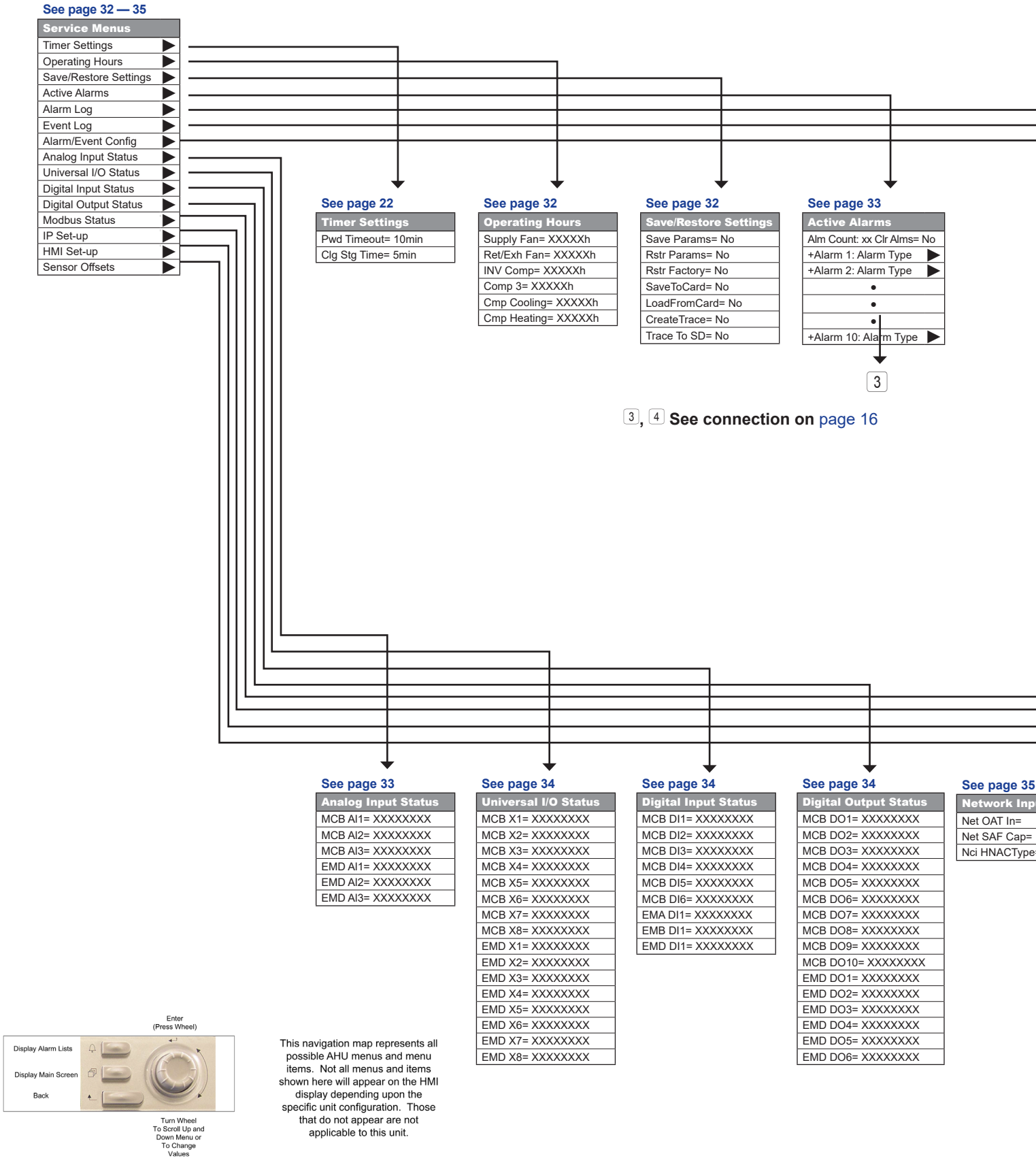
This navigation map represents all possible AHU menus and menu items. Not all menus and items shown here will appear on the HMI display depending upon the specific unit configuration. Those that do not appear are not applicable to this unit.

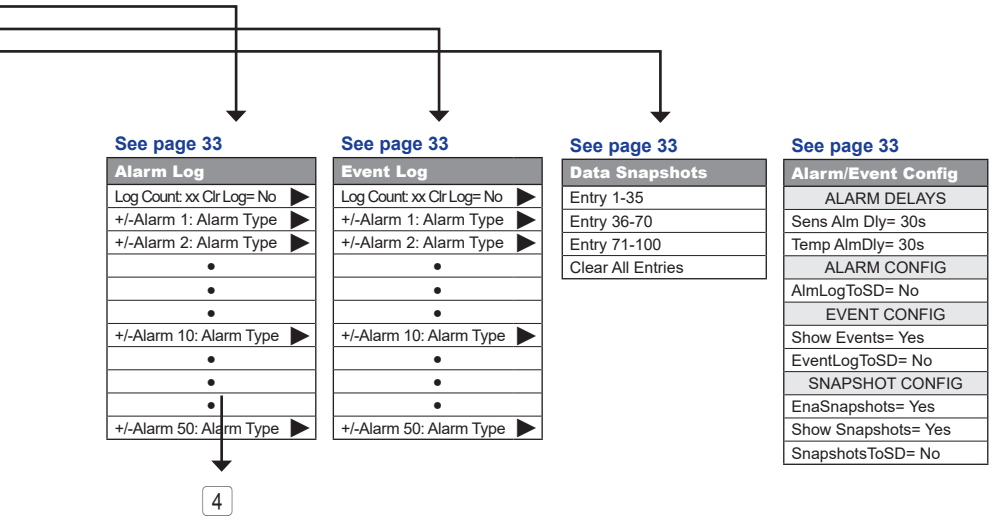
***Figure 9: Commission Unit** – Keypad/Display Menu Structure*



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 10: Service Menu *– Keypad/Display Menu Structure*





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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

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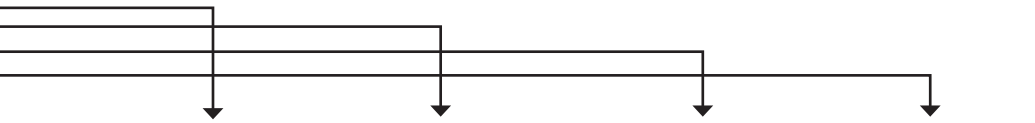
Event Log
Log Count: xx Clr Log= No ▶
+/-Alarm 1: Alarm Type ▶
+/-Alarm 2: Alarm Type ▶
•
•
•
+/-Alarm 10: Alarm Type ▶
•
•
•
+/-Alarm 50: Alarm Type ▶

See page 33

Data Snapshots
Entry 1-35
Entry 36-70
Entry 71-100
Clear All Entries

See page 33

Alarm/Event Config
ALARM DELAYS
Sens Alm Dly= 30s
Temp AlmDly= 30s
ALARM CONFIG
AlmLogToSD= No
EVENT CONFIG
Show Events= Yes
EventLogToSD= No
SNAPSHOT CONFIG
EnaSnapshots= Yes
Show Snapshots= Yes
SnapshotsToSD= No



ut Status
=

See page 35

Modbus Status
SF MB Status= XXXXXXX
RF/EF MB Status= XXXX
OF MB Status= XXXXXX
IFB MB Status= XXXXXX
VCmp MB Status= XXXX
MB Resistance= Yes
ECM Config= Done

See page 34

IP Set-Up
ApplyIPChgs= No
DHCP= On
Act Ip= XXX.XXX.XXX.XXX
ActMsk= XXX.XXX.XXX.XXX
ActGwy= XXX.XXX.XXX.XXX
Gvn IP= XXX.XXX.XXX.XXX
GvnMsk= XXX.XXX.XXX.XXX
GvnGwy= XXX.XXX.XXX.XXX

See page 39

HMI Set-Up
Contrast= 0
BackLight Clr= White
PBusPwrSply= On

See page 35

Sensor Offsets
OA Temp= 0.0ºF
DRT1= 0.0ºF
DRT3= 0.0ºF
SRT= 0.0ºF
DFT= 0.0ºF
IRT= 0.0ºF
ORT= 0.0ºF

Figure 11: Trending *– Keypad/Display Menu Structure*

See page 38

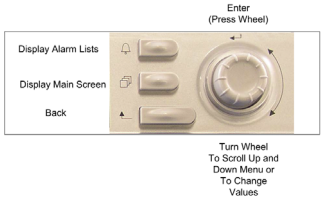
Trending
Trending Ena= No
Apply Chgs= No
Sample Time= 300s
TrendOnOff= Off
Export Data= No
Clear Trend= Done
TrendFull= Wrap
DefaultTrend= No
Points 1–8 ▶
Points 9–24 ▶
Points 25–30 ▶

The list of trending points shown to the right is the actual default trend list. The default listing is set by selecting "Default trend=No" changing the "No" to "Yes" the No will reappear but the trending points remain.

Points 1–8
Point 1= INV%
Point 2= STDOut
Point 3= SAF%
Point 4= EF%
Point 5= OAD%
Point 6= RH%
Point 7= H/C Out
Point 8= OAT

Points 9–24
Point 9= Clg St
Point 10= Htg St
Point 11= Cap%In
Point 12= INVCmd
Point 13= CmpInLk
Point 14= PTD
Point 15= PTS
Point 16= EVI%
Point 17= EVO%
Point 18= OAFCmd
Point 19= OF1Spd
Point 20= OF2Spd
Point 21= Tc
Point 22= TcSpt
Point 23= DSH
Point 24= Teg

Points 25–30
Point 25= SSH
Point 26= SSHSpt
Point 27= HDRT1
Point 28= HDRT3
Point 29= OilSts
Point 30= OilMng



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 12: Expansion Information *– Keypad/Display Menu Structure*

1 → See page 100

Fault Code Details
ACTIVE FAULT CODES
INVAlarmCode=_____
Code Text
OF1AlarmCode=_____
Code Text
OF2AlarmCode=_____
Code Text
PREVIOUS FAULT CODES
PrvINVAlmCode=_____
Code Text
MM/DD/YYYY HH:MM:SS
PrvOF1AlmCode=_____
Code Text
MM/DD/YYYY HH:MM:SS
PrvOF2AlmCode=_____
Code Text
MM/DD/YYYY HH:MM:SS

2 → See page 42

IFB Comm Status
IFB SW Vers= VP0329008
IFBCommStatus=____
PrvCommStatus=_____
MM/DD/YYYY HH:MM:SS
ACS1 DataRcvd=_____
ACS3 DataRcvd=_____

See page 33

Alarm Lists
Active Alarms ▶
Alarm Log ▶
Event Log ▶
LogCt:** Clr Log= -:No
+Event 1 ▶
+Event 2 ▶
•
•
•
+Event 49 ▶
+Event 50 ▶
Event Details ▶
+Alarm: Alarm Type ▶
Alarm Date
Alarm Time

3 → See page 33

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

4 → See page 33

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

Alarm Details
+/-Alarm 1: Alarm Type
MM/DD/YYYY HH:MM:SS

Items in the Quick Menu (see Table 2) 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
System Mode	Local	Local/Remote	6
Heat/Cool In	Heat/Cool	Heat/Cool	6
CmpIntrLock	—	Open/Closed	6
Dehum Status	—	Active/Inactive	6
Clg Capacity	—	0 – 100%	None
OAD/Econo Cap	—	0 – 100%	None
Htg Capacity	—	0 – 100%	None
Reheat Capacity	—	0 – 100%	None
SAF Speed	—	0 – 100%	None
RF/EF Cap	—	0 – 100%	None
OA Temp	—	-50.0 – 200.0°F	None

System Mode is an adjustable item that sets the status for the for the unit to run on local with field inputs are ignored or remote where operation is based on field inputs

Heat/Cool In is an adjustable item that only applicable on heatpump units to determine DX cooling or heatpump operation

CmpInterLock is an adjustable input safety that can be used to prevent compressor operation based on external system safeties

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

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.

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.

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.

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
System Mode=	Local	Local	6
		Remote	
Heat/Cool In=	Heat/Cool	Heat	6
		Cool	
CmpIntrLock=	—	Open	6
		Closed	
CmpCapIn=	—	0-100%	6
SAFSSIn=	—	Off	6
		On	
SAFCapIn=	—	0-100%	6
EAFSSIn=	—	Off	6
		On	
EAFCapIn=	—	0-100%	6
RhtVlvIn=	—	0-100%	6
OADCapIn=	—	0-100%	6
AlmResetIn=	—	Normal	6
		Clear	
Dehum Status=	—	Inactive	6
		Active	
Clg Status=	—	Enabled	6
		NA	
		OffAmb	
		OffAlarm	
		NA	
		NA	
Htg Status=	—	Enabled	6
		NAOffAmb	
		OffAlarm	
		NANA	
Clg Capacity=	—	0-100%	6
Htg Capacity=	—	0-100%	6
Reheat Cap=	—	0-100%	6
SAF Speed=	—	0-100%	6
RF/EF Cap=	—	0-100%	6
OAD/Econo Cap=	—	0-100%	6

System Mode is an adjustable item that sets the status for the for the unit to run on local with field inputs are ignored or remote where operation is based on field inputs

Heat/Cool In is an adjustable item that only applicable on heatpump units to determine DX cooling or heatpump operation

CmpInterLock is an adjustable input safety that can be used to prevent compressor operation based on external system safeties

CmpCapIn is the adjustable input for the amount of DX output desired

SAFSSIn is the adjustable input for the supply fan start/stop input

SAFCapIn is adjustable input for the supply fan capacity desired

EAFSSIn is the adjustable input for the exhaust fan start/stop input

EAFCapIn is the adjustable input for the exhaust fan capacity desired

RhtVlvIn is the adjustable input for the amount of hot gas reheat desired

OADCapIn is the adjustable input for the amount open desired of outdoor air damper

AlarmResetIn the adjustable point from the field that can reset applicable refrigeration alarms

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

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. If the unit is a heat pump, this applies to compressor heat.

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. If the unit is a heat pump, this applies to the compressor heat.

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.

OAD/EconoCap is a status item which indicates the percentage that the outdoor damper is currently open.

Temperature Menu

Menus in the Temperatures menu contain unit temperature status information.

Table 4: Temperature Menu

Item Display Name	Default Setting	Range	Password Level
OA Temp=	—	-50.0 – 200.0°F	6
DRT1=	—	-50.0 – 392.0°F	6
DRT3=	—	-50.0 – 392.0°F	6
SRT=	—	-50.0 – 200.0°F	6
DFT=	—	-50.0 – 200.0°F	6
IRT=	—	-50.0 – 150.0°F	6
ORT=	—	-50.0 – 150.0°F	6
INVCompTemp=	—	-50.0 – 392.0°F	2

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

DRT1 is a status only item which displays the current inverter compressor discharge refrigerant line temperature sensor reading.

DRT3 is a status only item which displays the current fixed compressor (Comp 3) discharge refrigerant line temperature sensor reading.

SRT is a status only item which displays the current suction refrigerant line temperature sensor reading.

DFT (Heat Pump only) is a status only item which displays the current defrost temperature sensor reading.

IRT (Heat Pump only) is a status only item which displays the current indoor refrigerant temperature sensor reading.

ORT (Heat Pump only) is a status only item which displays the current outdoor refrigerant temperature sensor reading.

INVCompTemp (15 ton unit size only) is a status only item which displays the current inverter compressor body temperature sensor reading.

Flow Status Menu

Table 5: Flow Status Menu

Item Display Name	Default Setting	Range	Password Level
Supply Fan=	—	Off	6
		On	
Ret/Exh Fan=	—	Off	6
		On	

Supply Fan is a status only item that indicates the current S/S state of the supply fan.

Ret/Exh Fan is a status only item that indicates the current S/S state of the exhaust or return fan.

RF/EF Control Menu

Table 6: Return/Exhaust Fan Speed Menu

Item Display Name	Default Setting	Range	Password Level
RF/EF Cap=	—	0 – 100%	6
RF/EF Spd Cmd=	—	0 – 100%	6

RF/EF Cap is a status only item which indicates the current exhaust fan capacity.

RF/EF Spd Cmd is an adjustable input to command the return/exhaust fan speed.

SAF Spd Control Menu

Table 7: Supply Fan Speed Menu

Item Display Name	Default Setting	Range	Password Level
SAF Speed=	—	0 – 100%	6
SAF Spd Cmd=	—	0 – 100%	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 commanded speed.

Time/Date Menu

Table 8: Time/Date

Item Display Name	Default Setting	Range	Password Level
Time=	—	0 – 23: 0 – 59: 0 – 59	6
Date=	—	1 – 12/0 – 31/1970 – 9999	6
UTC Diff=	-60	—	4
DLS Strt Mon=	Mar	NA	2
		Jan	
		Feb	
		Mar	
		Apr	
		May	
		Jun	
		Jul	
		Aug	
		Sep	
		Oct	
		Nov	
		Dec	
DLS Strt Wk=	2ndWeek	1stSun	2
		2ndSun	
		3rdSun	
		4thSun	
		5thSun	
DLS End Month=	Nov	NA	2
		Jan	
		Feb	
		Mar	
		Apr	
		May	
		Jun	
		Jul	
		Aug	
		Sep	
		Oct	
		Nov	
		Dec	
DLS End Week=	1stWeek	1stSun	2
		2ndSun	
		3rdSun	
		4thSun	
		5thSun	
DLS Enable=	Auto	Off/Auto	2

Time is an adjustable item that sets the current time.

Date is an adjustable item that sets the current date.

UTC Diff It 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).

DLS Strt Mon is the adjustable item to select the month that daylight savings locally begins

DLS Strt Wk is the adjustable item to select the week that daylight savings locally begins

DLS End Month is the adjustable item to select the month that daylight savings locally ends

DLS End Week is the adjustable item to select the week that daylight savings locally ends

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

Unit Setup

Table 9: Unit Setup Menu

Item Display Name	Default Setting	Range	Password Level
Eng Units=	English	English, SI	4
Unit Name=	—	—	4

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.

Timer Settings Menu

Table 10: Timer Settings Menu

Item Display Name	Default Setting	Range	Password Level
Pwd Timeout	10 min	3 – 30min	4
Clg Stg Time	5 min	5 – 60min	4
Off HtCl Delay	120s	0 – 999s	2

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.

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

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

(See page 22 for more information)

Table 11: Supply Fan Speed Menu

Item Display Name	Default Setting	Range	Password Level
MaxVentSpd=	100%	0 – 100%	N/A
Max SAF RPM=	2600	0 – 5000	2
Max SAF Hz=	60.0Hz	0 – 100Hz	2
CompOp_ MinSAF=	20%	10 – 100%	2
“SAF Status= (EBM Fan)*”	—	OK	2
		HLL	
		TFEI	
		TFM	
		TFE	
		BLK	
		SKF	
		PHA	
		UzLow	
		UzHigh	
		UeLow	
		UeHigh	
		NoComm	
“SAF Status= (ABB Drive)”	—	OK	2
		Fault	
		No Comm	

*See supply fan failure codes on page 98

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.

Max SAF Hz is an adjustable item to allow the maximum fan speed based on space design conditions

CompOp_MinSAF is an adjustable minimum speed for the fan to be running and allow for compressor operation

SAF Status is a status only item that the fan motor or VFD output on the status of the supply fan motor

RF/EF Set-Up

(See page 23 for more information)

Table 12: Return Fan/Exhaust Fan Set-up Menu

Item Display Name	Default Setting	Range	Password Level
MaxVentSpd=	100%	0 – 100%	N/A
Max RFEF RPM=	2600	0 – 5000	2
Max RF/EF Hz=	60.0Hz	0 – 100Hz	2
CompOp_ MinSAF=	20%	10 – 100%	2
"RF/EF Status= (EBM Fan)*"	—	OK	2
		HLL	
		TFEI	
		TFM	
		TFE	
		BLK	
		SKF	
		PHA	
		UzLow	
		UzHigh	
		UeLow	
		UeHigh	
		NoComm	

*See exhaust fan failure codes on page 98

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.

Max RF/EF Hz is an adjustable item to allow the maximum fan speed based on space design conditions

CompOp_MinSAF is an adjustable minimum speed for the fan to be running and allow for compressor operation

RF/EF Status is a status only item that the fan motor or VFD output on the status of the exhaust or return fan motor

Inverter Compressor Set-Up

(See page 51 — 56 for more information)

Table 13: Inverter Compressor Set Up Menu

Item Display Name	Default Setting	Range	Password Level
Compressor Status			
Clg State=	—	Off	4
		Start	
		Init	
		Normal	
		Pumpdn	
		Standby	
Htg State=	—	Off	4
		Start	
		Init	
		Normal	
		Pumpdn	
		Standby	
INV Cmp Spd=	—	0 – 100%	4
INV Spd Cmd=	—	0 – 100%	4
VCmpOilStatus=	—	Open	2
		Closed	
Comp 3=	—	Off	4
		On	
Fault Code Details			
INV Port Temp=	—	-50.0 – 200.0°F	2
INV Fin Temp=	—	-50.0 – 200.0°F	2
INV Amps=	—	0 – 50A	4
Ctrl Card Tmp=	—	-50.0 – 200.0°F	2
Heatsink Tmp=	—	-50.0 – 200.0°F	2
Refrig Circuit Status			
PTD=	—	0 – 5000kPa	4
PTS=	—	0 – 5000kPa	4
4 WayValve=	—	Cool	2
		Heat	
RcvrSol Valve=	—	Closed	2
		Open	
BP Sol Valve=	—	Closed	2
		Open	

Item Display Name	Default Setting	Range	Password Level
Compressor Setup			
Clg Stg Time=	5min	3 – 60min	4
Clg Lo OAT Lk=	55°F (RTU/SCU)	0 – 100°F	4
	0°F (MPS)		
	25°F (DPS)		
Clg OAT Diff=	2°F	0 – 10°F	4
Htg Lo OAT Lk=	0°F	-20 – 50°F	4
	45°F (100% OA w/o ER)		
Htg Hi OAT Lk=	55°F	0 – 100°F	4
EffHtgHiOATLk=	—	0 – 100°F	4
Htg OAT Diff=	2°F	0 – 10°F	4
INV Period=	20s	1 – 300s	4
INV Gain=	2	0.0 – 100.0	4
INV PAT=	60s	0 – 999s	4
INV Max Chg=	15%	0 – 50%	4
OilManagement=	Off	Off	2
		Balance	
		LoBoost	
		HiBoost	
		Boost	
LowOilTime=	10m	1 – 30m	2
OilBoostTime=	10m	1 – 15m	2
VFD Status=	—	OK	2
		OvrTActv	
		WrnActv	
		AlmNoTrp	
		AlmTrp	
		TripLck	
		NoComm	
VFD Alm/Wrn=	—	None	2
		A** – W**	
IFB Comm Status (10010)			

Clg State is a status only item which displays the current compressor operating state when the unit is in the Cooling operating state or when dehumidification operation is active. See page 55 for compressor cooling operating state details.

Htg State (Heat Pump only) is a status only item which displays the current compressor operating state when the unit is in the Heating or Min DAT operating state. See page 65 for compressor heating operation state details.

INV Cmp Spd is a status only item which displays the current inverter compressor speed in percent of the maximum.

INV Spd Cmd is a status only item that indicates the current commanded speed of the inverter compressor.

VCmpOilStatus is a status only item which displays if the unit is in oil boost mode or standard operation. Open indicates a low oil reading

Comp 3 is a status only item which displays the current on/off status of the fixe compressor.

INV Port Temp is a status only item which displays the current value of the calculated temperature (based on the current suction pressure reading) at the inverter compressors inlet port. This value is used in the inverter compressor discharge line higher temperature limiting protection function.

INV Fin Temp is a status only item which displays the current inverter compressor control board cooling fin temperature. This value is used in the inverter compressor fin temperature limiting protection function.

INV Amps is a status only item which displays the amps used by the inverter compressor (3-15Ts only). This can indicate a high amp unloading occurance.

Ctrl Card Tmp is a status only item which displays the drive temperature (16-28Ts only). This can indicate a high temp unloading occurance.

Heatsink Tmp is a status only item which displays the board heat temperature (16-28Ts only). This can indicate a high temp unloading occurance.

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

PTS is a status only item which displays the current value of the suction line refrigerant pressure.

4 Way Valve (Heat Pump only) is a status only item which displays the current Heat/Cool (Closed/Open) status of the heat pump four way reversing valve.

RcvrSol Valve (Heat Pump only) is a status only item which displays the current Open/Closed status of the heat pump receiver solenoid valve.

BP Sol Valve is a status only item which displays the current Open/Closed status of the refrigerant circuit bypass solenoid valve. This valve is normally closed but opens when needed to equalize the low and high side refrigerant pressures.

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

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.

Clg OAT Diff is a status only item which indicates if the unit is in the deadband for the low ambient cooling lockout and will indicate when the unit is no longer in that lockout condition.

Htg Lo OAT Lk is an adjustable item that sets a low outdoor ambient temperature value below which compressor heating is locked out.

Htg Hi OAT Lk is an adjustable item that sets a high outdoor ambient temperature value above which compressor heating is locked out.

EffHtgOATLk is a status only item that displays the current value that is being used for high outdoor ambient compressor heating lock out. Normally this value reads the same as the Htg Hi OAT Lk but can be lower due to the low differential pressure limiting function while the unit is operating in the Heating or MinDAT states.

Htg OAT Diff is a status only item which indicates if the unit is the deadband for the high ambient compressor heating lockout and will indicate when the unit is no longer in that lockout condition

INV Period is an adjustable item that sets the sample period for the PI loop used to control the compressor capacity to maintain the effective discharge air temperature set point.

INV Gain is an adjustable item that sets the Gain for the PI loop used for the PI loop used to control the compressor capacity to maintain the effective discharge air temperature set point.

INV PAT is an adjustable item that sets the project ahead time for the PI loop used for the PI loop used to control the compressor capacity to maintain the effective discharge air temperature set point.

INV Max Chg is an adjustable item that sets the maximum change value for the PI loop used for the PI loop used to control the compressor capacity to maintain the effective discharge air temperature set point.

OilManagement is a status only point that indicates if the unit (16–28 Ton only) is in a oil boost mode or not.

LowOilTime is an adjustable point to set the length of time, while in oil return mode, the unit will verify oil level as adequitely maintained.

OilBoostTime is an adjustable point to set the length of time, while in oil return mode, the unit will actively accellerate the compressor speed to return oil to the compressor.

VFD Status is a status only point from the inverter compressor VFD (16–28 Ton only) indicating the current state of the drive.

VFD Alm/Wrn is a status only point from the inverter compressor VFD (16–28 Ton only) indicating the drive fault codes.

Outdoor Air Fan Set-Up

Table 14: Outdoor Air Fan Set Up Menu

Item Display Name	Default Setting	Range	Password Level
OAFan Set-Up (347)			
OA Fan Status			
OA Fan1 Spd=	—	0 – 100%	4
OA Fan1 Cmd=	—	0 – 100%	4
OA Fan1Amps=	—	0 – 50A	4
Fault Code Details (10000)			
OA Fan2 Spd=	—	0 – 100%	4
OA Fan2 Cmd=	—	0 – 100%	4
OA Fan2Amps=	—	0 – 50A	4
Fault Code Details (10000)			
Refrig Circuit Status			
PTD=	—	0 – 5000kPa	4
PTS=	—	0 – 5000kPa	4
Disch Sat Tmp=	—	-50.0 – 212.0°F	4
EffDshSatTSpt=	—	-50.0 – 212.0°F	2
OA Temp=	—	-50.0 – 200.0°F	4
INV Fin Temp=	—	-50.0 – 200.0°F	2
OA Fan Setup			
DischSatTDiff=	15°F	10.0 – 20.0°F	2
Disch SatTDB=	2.0°F	2 – 10.0°F	2
OA Fan period=	25s	0 – 999s	4
OA Fan Gain=	2.5	0 – 100	4
OA Fan PAT=	75s	0 – 999s	4
OA Fan Max=	20%	0 – 100%	2
OF Status=	—	OK	2
		HLL	
		TFEI	
		TFM	
		TFE	
		BLK	
		SKF	
		PHA	
		UzLow	
		UzHigh	
		UeLow	
		UeHigh	
		NoComm	
IFB Comm Status (10010)			

OA Fan1 Spd is a status only item that displays the current speed of outdoor fan 1 in percent of maximum speed.

OA Fan1 Cmd= is is a status only item that indicates the current command speed of outdoor fan 1.

OA Fan1 Amps is a status only item which displays the current amperage being drawn by outdoor fan 1.

OA Fan2 Spd is a status only item that displays the current speed of outdoor fan 2 in percent of maximum speed.

OA Fan2 Cmd= is is a status only item that indicates the current command speed of outdoor fan 2.

OA Fan2 Amps is a status only item which displays the current amperage being drawn by outdoor fan 2.

PTD is a status only item which displays the current discharge refrigerant line pressure sensor reading.

PTS is a status only item which displays the current suction refrigerant line pressure sensor reading.

Disch Sat Tmp is a status only item which displays the current discharge pressure equivalent saturation temperature.

EffDshSatTSpt is a status only item which displays the effective discharge saturation temperature set point used to control the outdoor air fans in the cooling mode of operation.

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

INV Fin Temp is a status only item which displays the current inverter compressor control board cooling fin temperature. This value is used in the inverter compressor fin temperature limiting protection function.

DischSatTDiff is an adjustable item which sets a differential above the current outdoor air temperature reading which is used to establish the EffDshSatTSpt.

DischSatTDB is an adjustable item which sets a control deadband around the EffDshSatTSpt.

OA Fan Period is an adjustable item that sets the sample period for the PI loop used to control the outdoor fans in the cooling mode of operation to maintain the EffDshSatTSpt.

OA Fan Gain is an adjustable item that sets the Gain for the PI loop used for the PI loop used to control the outdoor fans in the cooling mode of operation to maintain the EffDshSatTSpt.

OA Fan PAT is an adjustable item that sets the project ahead time for the PI loop used for the PI loop used to control the outdoor fans in the cooling mode of operation to maintain the EffDshSatTSpt.

OF Status is a status only item that the fan motor on the status of the outdoor fan motor

Expansion Valve Set-Up

Table 15: Expansion Valve Set Up Menu

Item Display Name	Default Setting	Range	Password Level
Expansion Valve Status			
EVI Pos=	—	0–100%	4
EVO Pos=	—	0–100%	4
EV Status=	—	OK	4
		EVIErr	
		EVOErr	
		EVI&OErr	
		InitErr	
		MBErr	
Refrigerant Circuit Status			
PTS=	—	0–5000kPa	4
PTD=	—	0–5000kPa	4
Suction SH=	—	-100.0–100.0°F	4
Discharge SH=	—	-100.0–100.0°F	4
Subcooling=	—	-100.0–100.0°F	4
Eff SSH Spt=	—	3.0–22.0°F	2
EffSH Base=	—	0.0–18.0°F	2
Eff SC Spt=	—	0.0–18.0°F	2
Eff SC Lo Lmt=	—	0–100%	2
SRT=	—	-50.0–200.0°F	2
Disch Sat Tmp=	—	-50.0–212.0°F	2
Sucn Sat Tmp=	—	-50.0–212.0°F	2
IRT=	—	-50.0–200.0°F	2
ORT=	—	-50.0–200.0°F	2
Expansion Valve Set Up			
SSH DB=	2.0°F	2.0-5.0°F	2
ClgSH LoBase=	5.0°F	2-20°F	2
HtgSH LoBase=	5.0°F	2-20°F	2
ClgSH HiBase=	9.0°F	2-20°F	2
HtgSH HiBase=	9.0°F	2-20°F	2
Htg EVI Meth=	SbC	100% / SbC	2
IC SC Spt=	9.0°F	0.0-15°F	2
IC SC DB=	2.0°F	0.0-10°F	2
HtgSC EVI Min=	12% (unit size < 6) / 50% Unit size >6)	12-100%	2
Clg EVO Meth=	SbC	100% / SbC	2
OC SC Spt=	9.0°F	0.0-15°F	2
OC SC DB=	2.0°F	0.0-10°F	2
ClgSC EVO Min=	12%	12-100%	2
ManCtrl EV Op=	Auto	Auto / Man	2

EVO Pos (Heat Pump only) is a status only item which displays the current position of the outdoor expansion valve.

EVI Pos is a status only item which displays the current position of the indoor expansion valve.

EVI Status is a status only item which displays the current status of the connection between the IFB communication board and the expansion valve control board (EVB).

PTS is a status only item which displays the current suction refrigerant line pressure sensor reading.

PTD is a status only item which displays the current discharge refrigerant line pressure sensor reading.

Suction SH is a status only item which displays the current suction superheat value based on suction temperature minus saturated suction pressure.

Discharge SH= is a status only item that indicates the current discharge superheat value based on discharge refrigerant temperature minus the discharge saturation temperature.

Subcooling (Heat Pump only) is a status only item which displays the current discharge subcooling value.

Eff SSH Spt is a status only item which displays the effective suction superheat set point. This value varies depending on suction and discharge superheat conditions.

Eff SH Base is a status only item which displays the effective suction superheat base set point value. This value is normally set equal to the SH Hi Base value but can be lowered toward the SH Lo Base value during steady state supply fan and compressor operation.

Eff SC Spt (Heat Pump only) is a status only item which displays the effective subcooling set point. This value is normally set equal to the IC SC Spt (or OC SC Spt) value but can be raised toward 15°F during steady state supply fan and compressor operation.

Eff SC Lo Lmt (Heat Pump only) is a status only item which displays the effective subcooling expansion valve position low limit. This value is normally set to the 50% but can be lowered during steady state supply fan and compressor operation.

SRT is a status only item which displays the current suction refrigerant line temperature sensor reading. This value is used to calculate suction superheat.

Disch Sat Tmp is a status only item which displays the current discharge pressure equivalent saturation temperature.

Sucn Sat Tmp is a status only item which displays the current suction pressure equivalent saturation temperature.

IRT (Heat Pump only) is a status only item which displays the current indoor refrigerant temperature sensor reading.

ORT (Heat Pump only) is a status only item which displays the current outdoor refrigerant temperature sensor reading.

SSH DB is an adjustable item that sets deadband around the Eff SSH Spt for superheat control of either the indoor expansion valve (cooling operation) or outdoor expansion valve (EVO).

SSH Lo Base is an adjustable item that sets a low limit for the EffSH Base value. This parameter is for test purposes and should not generally be changed in the field.

Htg SH Lo Base is an adjustable item that sets a low limit for the EffSH Base value in heating mode. This parameter is for test purposes and should not generally be changed in the field.

SSH Hi Base is an adjustable item that sets a high limit for the EffSH Base value. This parameter is for test purposes and should not generally be changed in the field.

HtgSH Hi Base is an adjustable item that sets a high limit for the EffSH Base value in the heating mode. This parameter is for test purposes and should not generally be changed in the field.

Htg EVI Method (Heat Pump only) is an adjustable item that sets the method of control of the indoor expansion valve (EVI) during heating operation. If set to “STD” EVI is driven continuously to 100% open during heating operation. If set to subcooling “Sbc” then EVI is control to maintain the Eff SC Spt during heating operation.

IC SC Spt is an adjustable item that sets a base value for the Eff SC Spt during heating operation.

IC SC DB is an adjustable item that sets a deadband around the Eff SC Spt during heating operation.

HtgSC EVI Min= is an adjustable item which sets a minimum indoor expansion valve position for steady-state sub cooling reset control during heat pump heating operation.

Clg EVO Method (Heat Pump only) is an adjustable item that sets the method of control of the outdoor expansion valve (EVO) during cooling operation. If set to “STD” EVO is driven continuously to 100% open during cooling operation. If set to “Sbc” then EVO is control to maintain the Eff SC Spt during cooling operation.

OC SC Spt is an adjustable item that sets a base value for the Eff SC Spt during cooling operation.

OC SC DB is an adjustable item that sets a deadband around the Eff SC Spt during cooling operation.

ClgSC EVO Min= is an adjustable item which sets a minimum outdoor expansion valve position for steady-state sub cooling reset control during heat pump cooling operation.

ManCtrl EV Op is an adjustable item that sets the mode of expansion valve control during Manual Control operation. If set to “Auto” the expansion values are automatically controlled during Manual Control operation. If set to “Man” the expansion valves are manually controlled during Manual Control operation.

Expansion Valve Control (EVI or EVO, EVO supplied only on heat pumps)

The EVI valve is modulated use a PI Loop during cooling operation to maintain the effective suction superheat set point. On heat pump units EVI is either driven to the 100% open position or modulated to maintain the effective subcooling set point during heating operation.

The EVO valve is modulated use a PI Loop during heating operation to maintain the effective suction superheat set point. EVO is either driven to the 100% open position or modulated to maintain the effective subcooling set point during cooling operation.

Defrost Set-Up

(See page 67 for more information)

Table 16: Defrost Set Up Menu

Item Display Name	Default Setting	Range	Password Level
Defrost State=	—	Off	4
		Init	
		Exec	
		Term	
Manual DF=	No	No	4
		Yes	
MinCmpOpTm=	10min	0 – 60min	2
MinAccCmpTm=	40min	0 – 300min	2
MaxFrostTm=	120min	40 – 360min	2
Defrost Temp=	—	-64 – 64°F	2
Tdef Adj=	0°F	-4.0 – 4.0°F	2
CmpOpTm=	—	0 – 50000.0min	2
AccCmpOpTm=	—	0 – 50000.0min	2
LoFrstAccTm=	—	0 – 50000.0min	2
HiFrstAccTm=	—	0 – 50000.0min	2

Defrost State (Heat Pump only) is a status only item which displays the current state of defrost operation. The states are Off, Initialization, Execute and Terminate.

Manual DF (Heat Pump only) is an adjustable item that allows for manual initiation of defrost operation.

MinCmpOpTm (Heat Pump only) is an adjustable item that sets minimum time that compressor heating operation must active in the current run cycle before defrost operation can be initiated.

MinAccCmpTm (Heat Pump only) is an adjustable item that sets minimum accumulated compressor heating run time since the last defrost cycle before defrost operation can be initiated.

MaxFrostTm (Heat Pump only) is an adjustable item that defines the maximum time during periods of potential coil frosting that can accumulated without initiating a defrost cycle.

Defrost Temp (Heat Pump only) is a status only item which displays the effective temperature value the defrost temperature input must fall below before defrost operation is initiated base on temperature.

Tdef Adj (Heat Pump only) is an adjustable item that allows a manual bias adjustment to be used in the internal calculation of the Defrost Temp. Increasing this value would cause defrost to be initiated at a warmer defrost temperature value and vise versa.

CmpOpTime (Heat Pump only) is a status only item which displays the time that compressor heating operation has been active in the current run cycle.

AccCmpOpTm (Heat Pump only) is a status only item which displays the accumulated time of compressor heating operation since the last defrost cycle.

LoFrstAccTm (Heat Pump only) is a status only item which displays the accumulated time since the last defrost cycle of low frost potential.

HiFrstAccTm (Heat Pump only) is a status only item which displays the accumulated time since the last defrost cycle of high frost potential.

Alarm/Event Configuration Menu

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 17: Alarm Delays Setup Menu

Item Display Name	Default Setting	Range	Password Level
Alarm Delays			
Sens Alm Dly=	30s	0 – 300s	2
Temp Alm Dly=	30s	0 – 300s	2
Alarm Configuration			
AlmLogToSD=	No	No	2
		SI	
		English	
Event Config			
Show Events=	Yes	No	2
		Yes	
EventLogToSD=	No	No	2
		SI	
		English	
Snapshot Config			
EnaSnapshots=	Yes	No	2
		Yes	
Show Snapshots=	Yes	No	2
		Yes	
SnapshotsToSD=	No	No	2
		SI	
		English	

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

AlmLogToSD is a cselectable option to determine if alarms are to be stored on the local SD card.

Show Events is a location to see the events that have occurred on the unit

EventLogToSD is a selectable option to determin if events are to be stored on the local SD card.

EnaSnapshots are points and values determined to be captured for review at a later time.

Show Snapshots is a location to see the snapshots that have occurred on the unit

SnapshotsToSD is a selectable option to determine if snapshots are to be stored on the local SD card.

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 18: 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
INV/OF Ena=	Off	Off	4
		On	
INV Cmp=	Off	Off	4
		On	
INV Spd Cmd=	0%	0 – 100%	4
Comp 3=	Off	Off	4
		On	
OA Fan=	Off	Off	4
		On	
OA Fan Cmd=	0%	0 – 100%	4
4 Way Valve=	Off	Off	4
		On	
RcvrSol Valve=	Off	Off	4
		On	
BP Sol Valve=	Off	Off	4
		On	
EVI Cmd=	0%	0 – 100%	4
EVO Cmd=	0%	0 – 100%	4
RF/EF=	Off	Off	4
		On	
RF/EF Spd Cmd=	0%	0 – 100%	4
OAD/Econo=	0%	0 – 100%	4
Reheat Valve=	0%	0 – 100%	4
RH Output=	Off	Off	4
		On	
Alm Output=	Off	Off	4
		On	

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.

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

INV/OF Ena is an adjustable item used to turn the inverter compressor/outdoor fan enable output ON and OFF. Inverter compressor or outdoor fans cannot be manually controlled without first turning this output ON.

INV Comp is an adjustable item used to turn the inverter compressor ON and OFF. Note that the inverter compressor cannot be manually turned on unless the SAF Spd Cmd is first set to at least 33% and the INV/OF Ena output is turned ON.

INV Spd Cmd is an adjustable item that sets the speed of the inverter compressor. Note that the inverter compressor speed cannot be manually adjusted until the compressor operating state reaches Normal after the INV Comp output is turned ON.

Comp3 is an adjustable item used to turn the fixed speed compressor ON and OFF. Note that the fixed speed compressor cannot be manually turned on unless the SAF Spd Cmd is first set to at least 33%.

OA Fan is an adjustable item used to turn the outdoor fan(s) ON and OFF.

OA Fan Cmd is an adjustable item that sets the speed of the outdoor fan(s). Note that once the INV Comp or Comp3 output is turned ON the outdoor fan speed cannot be manually adjusted until the compressor operating state reaches Normal.

4 Way Valve (Heat Pump only) is an adjustable item used to change the 4 way reversing valve from the Cool to Heat position. Note that this setting determines whether the compressors operate in the cooling or heating mode when they are manually started.

RcvrSol Valve (Heat Pump only) is an adjustable item used to open and close the receiver solenoid valve.

BP Sol Valve is an adjustable item used to open and close the bypass solenoid valve.

EVI Cmd is an adjustable item used to set the position of the indoor expansion valve. Note that this can only be manually adjusted when the ManCtrl EV Op parameter is set to “Man”.

EVO Cmd (Heat Pump only) is an adjustable item used to set the position of the outdoor expansion valve. Note that this can only be manually adjusted when the ManCtrl EV Op parameter is set to “Man”.

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

RF/EF Spd Cmd is an adjustable item for units with variable speed supply air fan 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.

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

RHOutput a status point for if the unit is in reheat mode or not.

Alm Output is an adjustable item which is used to turn ON/OFF the alarm output.

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

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 19: Save/Restore Menu

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

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.

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 20: Operating Hours Menu

Item Display Name	Default Setting	Range	Password Level
Supply Fan=	—	0 – 50000H	4
Ret/Exh Fan=	—	0 – 50000H	4
Cmp Cooling=	—	0 – 50000H	4
INV Comp=	—	0 – 50000H	4
Comp 3=	—	0 – 50000H	4
Cmp Heating=	—	0 – 50000H	4

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.

Cmp Cooling is a status item which indicates the number of hours compressor cooling has operated.

INV Comp is a status item which indicates the number of hours the inverter compressor has operated.

Comp 3 is a status item which indicates the number of hours the fixed speed compressor has operated.

Cmp Heating is a status item which indicates the number of hours compressor heating has operated.

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 21: Active Alarm Menu

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

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 22: Alarm Log Menu

Item Display Name	Default Setting	Range	Password Level
Log Alm Count=	—	0-50	None
ClrLog=	No	No	None
		Yes	
+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 30.

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 23: Analog Input Status Menu

Item Display Name	Default Setting	Range	Password Level
MCB AI1=	—	0 – 9999999	2
MCB AI2=	—	0 – 9999999	2
MCB AI3=	—	0 – 9999999	2
EMD AI1=	—	0 – 9999999	2
EMD AI2=	—	0 – 9999999	2
EMD AI3=	—	0 – 9999999	2

Data Snapshots

Data Snapshots will provide a means of recording certain unit operating conditions at the moment of an alarm or event occurrence. The MicroTech III controller is capable of capturing up to 10 snapshots each containing up to 25 data points. All existing captured snapshots can be cleared with a ClrAllEntries=No/Yes parameter. The snapshot data can be exported to an SD card using an SnapshotsToSD= No/Yes parameter.

An HMI parameter Show Snapshots=No\Yes is provided to allow for masking HMI display of snapshots (default setting is No). Controller reset is required when Show Snapshots= is changed.

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 & 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 24: Universal I/O Status Menu

Item Display Name	Default Setting	Range	Password Level
MCB X1=	—	0 – 9999999	2
MCB X2=	—	0 – 9999999	2
MCB X3=	—	0 – 9999999	2
MCB X4=	—	0 – 9999999	2
MCB X5=	—	0 – 9999999	2
MCB X6=	—	0 – 9999999	2
MCB X7=	—	0 – 9999999	2
MCB X8=	—	0 – 9999999	2
EMD X1=	—	0 – 9999999	2
EMD X2=	—	0 – 9999999	2
EMD X3=	—	0 – 9999999	2
EMD X4=	—	0 – 9999999	2
EMD X5=	—	0 – 9999999	2
EMD X6=	—	0 – 9999999	2
EMD X7=	—	0 – 9999999	2
EMD 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 25: 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
EMB DI1=	Off	Off/On	2
EMB DI1=	Off	Off/On	2
EMD DI4=	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 26: 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
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

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 27: Modbus Status Menu

Item Display Name	Default Setting	Range	Password Level
SF MB Status=	—	Fault/OK	2
RFEF MB Status=	—	Fault/OK	2
OF MB Status=	—	Fault/OK	2
IFB MB Status=	—	Fault/OK	2
VCmp MB Status=	—	Fault/OK	2
MBResistance=	Yes	No/Yess	2
ECM Config=	Done	Done	2
		SetAdd1	
		SetAdd2	
		SetAdd4	
		SetAddCtl	

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.

OF MB Status is a status only point to indicate if the compressor is properly communicating with the controller via Modbus.

IFB MB Status ...

VCmp MB Status is a status only point to indicate if the compressor is properly communicating with the controller via Modbus.

MB Resistance is an adjustable item used turn the main controller's internal Modbus termination resistor.

ECM Config is an adjustable item used to set or change the internal Modbus address in the supply and exhaust fan motors

.

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.

Table 28: Sensor Offset Menu

Item Display Name	Default Setting	Range	Password Level
OA Temp=	0.0°F	0.0 – 10.0°F	2
DRT1=	0.0°F	0.0 – 10.0°F	2
DRT3=	0.0°F	0.0 – 10.0°F	2
SRT=	0.0°F	0.0 – 10.0°F	2
DFT=	0.0°F	0.0 – 10.0°F	2
IRT=	0.0°F	0.0 – 10.0°F	2
ORT=	0.0°F	0.0 – 10.0°F	2

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 29 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 reset the controller.

Table 29: Unit Configuration Menu

Configuration Code Position	Description	Values (Default in Bold)	“ROC Applicability”
1	Unit Type	3=Rebel Cool Only	•
		4=Rebel Heat Pump	
2	Control Type	0=Zone Control	NA
		1=DAT Control	NA
		2=1ZoneVAV	NA
		3=RefOnly	•
3	Cooling Type	0=None	NA
		4=Inverter Compressorized Clg	•
4	Compressorized Cooling Configuration	0=None	•
		1=Generic Condenser	NA
		L=1INV/1Circ	•
		M=1INV/1STD/1Circ	•
5	Generic Condenser Stages	1-8 Stages (Default 8)	NA
6	Low Ambient	0=None	NA
		1=Yes	
7	Condenser Control	7=EBM	•
		8=INV	
		9=INVMC	
8	Damper Type	0=None	•
		1=Single Position 30%	•
		2=Single Position 100%	•
		3=Economizer Airside	•
		5=100%OA_DOAS	NA
		6=AirEcon_DOAS	NA
		7=3-% DOAS	NA
9	OA Flow Station	0=None	•
		5=Generic Flow Station	•
		6=Generic Flow Station w/CO_2	NA
10	Heating Type	0=None	•
		1=F&BP Control	NA
		2=Staged	•
		5=Steam or Hot Water	•
		6=SCR Electric	•
		7=MOSLoGas	•
		8=MOSHiGas	•
11	Max Heating Stages	1-8 Stages (Default =1)	•
12,13,14	Max Heat Rise	Three Digits (Default = 100)	•
15	Supply Fan Type	6=EBMVAV	•
		7=EBMCAV	

Configuration Code Position	Description	Values (Default in Bold)	"ROC Applicability"
16	Return Fan Type	0=None	●
		6=EBMVAV	
		7=EBMCAV	
17	Return/Exhaust Fan Capacity Control Method	0=None	●
		1=Tracking	NA
		2=Building Pressure	NA
		3=Speed/Network	NA
		4=OADamper	NA
18	Second Duct Pressure Sensor	0=No	NA
		1=Yes	
19	Entering Fan Temp Sensor	0=No	NA
		1=Yes	
20	Energy Recovery	0=None	●
		1=ConstSpdWh/NoRH	●
		2=VarSpdWhl/Danfoss	●
		3=VarSpdWhl/MD2	NA
		4=VarSpdWhl/MD3	NA
		5=VarSpdWhl/ABB	●
		6=ConstSpdWhl/wRH	●
21	Cooling Circuit Type	0=Individual	NA
		1=2,3 or 4 Circ. Water Condenser	NA
		2=2 Circ Air Condesner	●
22	Head Pressure Control	0=No	●
		1=Yes	NA
23	Bypass Valve Control	0=Slave	●
		1=Bypass	NA
24,25,26	Unit Size	Three Digits (Default = 050)	●
27	Refrigerant Type	0=R22	NA
		1=R407C	NA
		2=R410A	●
28	Reheat Type	0=None	●
		2=ModHG	●
		3=StdHtRht	NA
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	Expansion Valve Type	0=None	●
		1=EVBSag	●
		4=MTIIIDF	●

NOTE: Items/selections with "NA" in the ROC Applicability column will not appear in the menu of the controller.

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 30: Trending Menu

Item Display Name	Default Setting	Range	Password Level
Trending Ena=	No	No/Yes	2
Apply Chgs=	No	No/Yes	2
Sample Time=	300s	1-3600s	2
TrendOnOff=	Off	Off/On	2
AutoExpTime=	1440m	0-1440m	2
Export Data=	No	No/Yes	2
Clear Trend=	Done	Done	2
		ClrData	2
		ClrCfg	2
TrendFull=	Wrap	Wrap/Stop	2
DefaultTrend=	No	No/Yes	2

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.

AutoExpTime is the length of time a trend is to be captured

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.

TrendFull is a writable input that allows the user to define once the trend is recorded to either stop recording or begin to overwright the beginning of the trend

DefaultTrend is a status to reset all trend reading back to the unit default settings or not.

Default

There are thirty default trend points for ROC. They will only not be recorded if manually programmed not to record.

Table 31: Default Trends Menu

Item Display Name	Default Setting	Range	Password Level
Point 1=	INV%	INV%	2
Point 2=	STDOut	STDOut	2
Point 3=	SAF%	SAF%	2
Point 4=	EF%	EF%	2
Point 5=	OAD%	OAD%	2
Point 6=	RH%	RH%	2
Point 7=	H/COut	H/COut	2
Point 8=	OAT	OAT	2
Point 9=	ClgSt	ClgSt	2
Point 10=	HtgSt	HtgSt	2
Point 11=	Cap%In	Cap%In	2
Point 12=	INVCmd	INVCmd	2
Point 13=	CmpInLk	CmpInLk	2
Point 14=	PTD	PTD	2
Point 15=	PTS	PTS	2
Point 16=	EVI%	EVI%	2
Point 17=	EVO%	EVO%	2
Point 18=	OAFCmd	OAFCmd	2
Point 19=	OF1Spd	OF1Spd	2
Point 20=	OF2Spd	OF2Spd	2
Point 21=	Tc	Tc	2
Point 22=	TcSpt	TcSpt	2
Point 23=	DSH	DSH	2
Point 24=	Teg	Teg	2
Point 25=	SSH	SSH	2
Point 26=	SSHSpt	SSHSpt	2
Point 27=	HDRT1	HDRT1	2
Point 28=	HDRT3	HDRT3	2
Point 29=	OilSts	OilSts	2
Point 30=	OilMng	OilMng	2

About this Unit

Table 32: 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

Cf16-29 describe positions 16-29 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.

Problems are conditions that result in the limitation of unit operation or shut down of the DX circuit. Some of these alarms must be cleared manually, but others clear automatically.

Refrigeration and compressor alarms are generally a combination problem and fault alarm. The unit will first unload to try and stay online, then turn off if unsuccessful.

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. 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.

Alarm List Menu – see page 33.

Table 33: Alarm Clearing

Value	Action
0	None
1	Clear All Faults
2	Clear All Problems
3	Clear All Warnings
4	Clear All Alarms

Problems

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:

- Compressor heating and cooling operations are locked out.
- 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.

Indoor Refrigerant Temperature Sensor Problem (Heat Pump only) – (IRT Sensor: Problem)

This alarm occurs when the IRT sensor input is outside the range of -4°F to 150°F continuously for the Sensor Alarm Delay (default 30 seconds). When this alarm is active compressor heating operation is disabled if HtgEVIMethod is set to “Sbc”. Otherwise not action is taken. The alarm must be manually cleared once corrective action is taken.

Outdoor Refrigerant Temperature Sensor Problem (Heat Pump only) – (ORT Sensor: Problem)

This alarm occurs when the ORT sensor input is outside the range of -4 to 150°F continuously for the Sensor Alarm Delay (default 30 seconds).

When this alarm is active compressor cooling operation is disabled if ClgEVOMethod is set to “Sbc”. Otherwise not action is taken.

The alarm must be manually cleared once corrective action is taken.

Fixed Speed Compressor Discharge Line Refrigerant Temperature Sensor Problem – (DRT3 Sensor: Problem)

This alarm occurs when the DRT3 sensor input is shorted or open circuited for the Sensor Alarm Delay (default 30 seconds). It can also occur when the fixed 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 the fixed speed compressor is disabled.

The alarm must be manually cleared once corrective action is taken.

Inverter Compressor Discharge Line Refrigerant Temperature Sensor Problem – (DRT1 Sensor: Problem)

This alarm occurs when the DRT1 sensor input is shorted or open circuited for the Sensor Alarm Delay (default 30 seconds). It can also occur when the inverter 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 and heating operation are disabled.

The alarm must be manually cleared once corrective action is taken.

Inverter Compressor Problem – (INV Comp: Problem)

This alarm occurs whenever the inverter compressor board generates an internal fault code. Refer to the troubleshooting section of this document for fault code details.

When this alarm is active compressor cooling and heating operation are disabled.

The alarm must be manually cleared once corrective action is taken.

Defrost Temperature Sensor Problem (Heat Pump only) – (DFT Sensor: Problem)

This alarm occurs when the DFT sensor input is shorted or open circuited for the Sensor Alarm Delay (default 30 seconds). It can also occur if the input is outside the range of -47°F to 194°F.

When this alarm is active compressor cooling and heating operation are disabled.

The alarm must be manually cleared once corrective action is taken.

Suction Line Refrigerant Temperature Sensor Problem – (SRT Sensor: Problem)

This alarm occurs when the SRT sensor input is shorted or open circuited for the Sensor Alarm Delay (default 30 seconds). It can also occur if the input is outside the range of -47°F to 194°F.

When this alarm is active compressor cooling and heating operation are disabled.

The alarm must be manually cleared once corrective action is taken.

High Inverter Compressor Discharge Line Temperature Problem – (Hi DL Temp: Problem)

This alarm occurs when the High Discharge Line Temperature Unloading function has forced compressor operation to the Standby state for a third time in a 100 minute period.

When this alarm is active compressor cooling and heating operation are disabled.

The alarm must be manually cleared once corrective action is taken.

Expansion Valve Problem – (Exp Valve: Problem)

This alarm occurs when the IFB communication board detects a faulty or disconnection between an expansion valve (EVI or EVO) and the expansion valve control board (EVB).

When this alarm is active compressor cooling and heating operation are disabled.

The alarm must be manually cleared once corrective action is taken.

NOTE: The EVB only detects a change in the EVI or EVO condition upon power up of the EVB.

Outdoor Fan Problem – (OA Fan: Problem)

On a single outdoor fan unit this alarm occurs when compressor operation is forced to the Standby state due to an outdoor fan internal fault for a third time in a 30 minute period.

On a two outdoor fan unit this alarm occurs when compressor operation is forced to the Standby state due an outdoor fan 2 internal fault for a third time in a 30 minute period. Note that outdoor fan 2 in this configuration provides critical cooling for the inverter/outdoor fan control boards.

When this alarm is active compressor cooling and heating operation are disabled.

The alarm must be manually cleared once corrective action is taken.

Low Refrigerant Charge Problem – (Lo Charge: Problem)

During compressor cooling operation this alarm occurs when the indoor expansion valve (EVI) is fully open (greater that 95%), the super heat is well above set point (greater than 20°F) and the lower of the two discharge line temperature inputs (DRT1 and DRT3) is hot (greater than 150°F) for more than 30 minutes continuously.

During compressor heating operation this alarm occurs when the outdoor expansion valve (EVO) is fully open (greater that 95%) and the super heat is well above set point (greater than 20°F) for more than 60 minutes continuously.

When this alarm is active compressor cooling and heating operation are disabled.

The alarm must be manually cleared once corrective action is taken.

Refrigerant Charge Loss Problem – (ChargeLoss: Problem)

This alarm occurs when both the suction and discharge line pressure inputs (PTS and PTD) remain below 10 psi continuously for 5 seconds.

When this alarm is active compressor cooling and heating operation are disabled.

The alarm must be manually cleared once corrective action is taken.

Suction Line Refrigerant Pressure Sensor Problem – (PTS Sensor: Problem)

This alarm occurs when the suction line pressure inputs (PTS) remains above 256 psi continuously for 12 minutes or below -15 psi continuously for 10 seconds.

When this alarm is active compressor cooling and heating operation are disabled.

The alarm must be manually cleared once corrective action is taken.

Discharge Line Refrigerant Pressure Sensor Problem – (PTD Sensor: Problem)

This alarm occurs when the suction line pressure inputs (PTD) remains above 611.6 psi or below 1.42 psi continuously for 10 seconds.

When this alarm is active compressor cooling and heating operation are disabled.

The alarm must be manually cleared once corrective action is taken.

Interface Board Communication Problem – (IFB Comm: Problem)

This alarm occurs when a communication problem is detected at any of the communication connections to the IFB board.

When this alarm is active compressor cooling and heating operation are generally disabled.

The alarm normally is cleared automatically when the communication problem is corrected. If the alarm occurs for a fifth time in a 24 hour period it must be manually cleared once corrective action is taken.

Low Refrigerant Pressure Differential Problem – (Lo Press Diff: Problem)

This alarm occurs when the Low Differential Pressure Unloading function has forced compressor operation to the Standby state for a third time in a 30 minute period.

When this alarm is active compressor cooling and heating operation are disabled.

The alarm must be manually cleared once corrective action is taken.

Low Refrigerant Pressure Problem – (Lo Press 1: Problem)

This alarm occurs when either the Cooling Low Pressure Unloading or the Heating Low Pressure unloading function has forced compressor operation to the Standby state for a third time in a 30 minute period.

When this alarm is active compressor cooling and heating operation are disabled.

The alarm must be manually cleared once corrective action is taken.

High Refrigerant Pressure Problem – (Hi Press 1: Problem)

This alarm occurs when either the Cooling High Pressure Unloading or the Heating High Pressure unloading function has forced compressor operation to the Standby state for a third time in a 30 minute period. This alarm also occurs if either of the mechanical high pressure switches (HP1 or HP3) open.

When this alarm is active compressor cooling and heating operation are disabled.

The alarm must be manually cleared once corrective action is taken

High Inverter Compressor Body Temperature – (HiINVCmpT: Problem)

If the inverter compressor body temperature rises above 245°F continuously for 5 seconds or 230°F for 10 minutes, the inverter compressor is shut down. After remaining in the standby for restart state for one cooling stage time period the compressor is allow to restart. If this occurs three times in a 100 minute time period, the High Inverter Compressor Body Temperature problem occurs. The cooling will then remain off until this alarm is manually cleared through the unit keypad or via a network signal.

Inverter Compressor Body Temperature Sensor Problem – (INVCmpTSnsr: Problem)

If the inverter compressor body temperature sensor becomes shorted or open circuited or out of range for longer than the Sensor Alarm Delay (Default= 30 seconds). When this alarm is active compressor cooling and heating operation are disabled. The alarm must be manually cleared once corrective action is taken.

Variable Compressor Oil Problem - (Var Comp Oil Problem)

This alarm occures when either the variable compressor has been operating at the max speed or for the oil boost time period and the low oil flag is still active or the maximum number of oil boost cycles within a 24hr period have occurred.

When this alarm is active compressor cooling and heating operation is disabled.

The alarm must be manually cleared once corrective action is taken.

4 Way Valve Problem - (4WayValve: Problem)

This alarm occures only on heat pump units when any of the following conditions are true. When compressor heating state is normal yet the DFT-Teg > 10°F for 15 minutes. When compressor cooling state is normal yet the DFT-Teg < or equal to 15°F for 15 mintues. When cooling or heating state is normal, defrost cycle is inactive, and 4 way valve flag is false for 15 minutes. Or when compressor state transisitons from alternate initialization to normal and 4 way valve flag is false.

When this alarm is active compressor cooling and heating operaiton is disabled.

The alarm must be manually cleared once corrective action is taken.

Protection Interlock Problem - (Protection Interlock Problem)

This alarm occures when the following are true for 90 seconds: system mode is remote, inverter compressor start/stop command is on, and compressor interlock is off.

When this alarm is active compressor cooling and heating operation is disabled.

The alarm must be manually cleared once corrective action is taken.

Compressor Protection Unloading Control

There are a number unloading control functions that limit the staging and speed control of the compressors to protect them from damage under abnormal operating conditions. The following unload functions are provided:

- Cooling High Pressure Unloading Control
- Cooling Low Pressure Unloading Control
- Heating High Pressure Unloading Control
- Heating High Protection Control [anticipating high pressure]
- Heating Low Pressure Unloading Control
- Inverter Compressor High Discharge Line Temperature Unloading Control
- Standard Compressor High Discharge Line Temperature Unloading Control
- Inverter Compressor High Current Unloading Control
- Inverter Compressor Request for Unloading Control
- Compression Ratio Unloading Control
- Inverter Compressor Board Temperature Unloading Control
- Low Differential Pressure Protection Control

Cooling High Pressure Unloading Control

Normal compressor operation is limited during cooling operation when high discharge pressure conditions occur. When the discharge pressure rises above 503 psi the inverter compressor is immediately reduced by three *steps** and then reduced a further *step* every 10 seconds in an attempt to keep the pressure from rising above 515 psi. If reducing the compressor capacity fails to keep the pressure below 515 psi the inverter compressor is reduced to minimum and any fixed speed compressor running is stopped. If the discharge pressure continues to rise above 527 psi, compressor operation is forced to the Standby state where it remains for a cooling stage time period before being allowed to restart. If the unit is forced to Standby in this manner 3 times in a 30 minute period, a high pressure alarm is generated requiring manual reset.

Once active this limiting function remains active until the discharge pressure falls back below 469 psi.

Cooling Low Pressure Unloading Control

Normal compressor operation is limited during cooling operation when low suction pressure conditions occur. When the suction pressure falls below 50 psi the inverter compressor capacity is held at its current valve and the bypass solenoid valve (SVB) is opened in an attempt to keep the pressure from falling below 36 psi. If the pressure continues to fall below 36 psi the inverter compressor is slowed to minimum speed and any fixed speed compressor running is stopped. If the pressure continues to fall below 10 psi, compressor operation is forced to the Standby state where it remains for a cooling stage time period before being allowed to restart. If the unit is forced to Standby in this manner 3 times in a 30 minute period, a low pressure alarm is generated requiring manual reset.

Once active this limiting function remains active until the suction pressure rises back above 57 psi.

Heating High Pressure Unloading Control

Normal compressor operation is limited during heating operation when high discharge pressure conditions occur. When the discharge pressure rises above 481 psi the inverter compressor capacity is immediately reduced by seven *steps* and then reduced a further *step* every 10 seconds in an attempt to keep the pressure from rising above 497 psi. If the pressure continues to rise above 497 psi the inverter compressor is slowed to minimum speed and any fixed speed compressor running is stopped. If the pressure continues to rise above 527 psi, compressor operation is forced to the Standby state where it remains for a heating stage time period before being allowed to restart. If the unit is forced to Standby in this manner 3 times in a 30 minute period, a high pressure alarm is generated requiring manual reset.

Once active this limiting function remains active until the discharge pressure falls back below 427 psi.

* See page 50 for more information about what is a compressor *“step”.*

Heating High Pressure Protection Control

Normal compressor operation is limited during heating operation when high discharge pressure or high inverter compressor discharge line temperature conditions occur while the inverter compressor is operating alone (fixed speed compressor off or not present) at low speed. This is an indication that too much liquid is backing up in the condenser causing hot high pressure conditions. When the DRT1 sensor input rises above 234°F or the discharge pressure rises above 455 psi while the inverter compressor is operating alone at low speed, the inverter compressor capacity is immediately reduced to minimum speed and the indoor expansion valve (EVI) is driven fully open. Note the bypass solenoid valve is also opened if DRT1 is above 234°F or if the pressure is above 469 psi.

Once active this limiting function remains active until the discharge pressure falls back below 427 psi, DRT1 is below 225°F and Heating High Pressure Unloading is inactive.

Heating Low Pressure Unloading Control

Normal compressor operation is limited during heating operation when low suction pressure conditions occur. When the suction pressure falls below 24 psi the inverter compressor is reduced by three *steps* then reduced a further *step* every 10 seconds in order to keep the pressure from falling below 19 psi. If reducing the compressor capacity fails to keep the pressure above 19 psi, the inverter compressor is reduced to minimum and any fixed speed compressor running is stopped. If the suction pressure continues to fall below 10 psi, compressor operation is forced to the Standby state where it remains for a heating stage time period before being allowed to restart. If the unit is forced to Standby in this manner 3 times in a 30 minute period, a low pressure alarm is generated requiring manual reset.

Once active this limiting function remains active until the suction pressure rises back above 33 psi.

Inverter Compressor High Discharge Line Temperature Unloading Control

Normal compressor operation is limited when high inverter compressor discharge line temperature (DRT1) conditions occur. When DRT1 rises above 239°F or a calculated suction port temperature (Tp) value rises above 275°F, the inverter compressor capacity is immediately reduced by one *step* and then reduced a further *step* every 30 seconds in an attempt to keep the temperatures from rising further. If DRT1 continues to rise above 266°F or above 248°F continuously for 90 seconds, the inverter compressor is reduced to minimum and any operating fixed speed compressor is stopped. If DRT1 continues to rise above 275°F or above 248°F continuously for 10 minutes or Tp rises above 302°F, compressor operation is forced to the Standby state where it remains for a stage time period before being allowed to restart. If the unit is forced to Standby in this manner 3 times in a 100 minute period, a high inverter discharge line temperature alarm is generated requiring manual reset.

Once active this limiting function remains active until DRT1 falls back below 212°F and Tp is below 230°F.

Fixed Speed Compressor High Discharge Line Temperature Unloading Control

Normal fixed speed compressor operation is limited when high discharge line temperature (DRT3) conditions occur. When DRT3 rises above 275°F or above 248°F continuously for 5 minutes or when a calculated inverter compressor suction port temperature (Tp) value rises above 293°F or above 266°F continuously for 10 minutes, the fixed is stopped.

Once active this limiting function remains active for 10 minutes.

Inverter Compressor High Current Unloading Control

Normal compressor operation is limited when high inverter compressor current conditions occur. When the internal inverter compressor amp draw exceeds 14.7A (460/575V unit) or 26.5A (208/230V unit) the inverter compressor capacity is immediately reduced by one *step* and then reduced a further *step* every 15 seconds in an attempt to keep the amps below these values.

Once active this limiting function remains active until the amps are above these values and the inverter capacity is back to the normal unlimited value.

Inverter Compressor Request for Unloading Control

Normal compressor operation is limited when inverter compressor control board provides a request to unload. This can occur for a number of internal compressor board built-in protection reasons (high amp draw for example). When the inverter unload request is active, the inverter compressor capacity is immediately reduced by one *step* and then reduced a further *step* every 15 seconds as long as the request remains active.

Once active this limiting function remains active until the request becomes inactive and the inverter capacity is back to the normal unlimited value.

High Compression Ratio Unloading Control

Normal compressor operation is limited when the ratio between the compression ratio between the discharge and suction pressure becomes too high. CmpRatio=(PTD + 14.7)/(PTS + 14.7). Note: in this equation PTD and PTS are in PSI. When the compression ratio exceeds 8.5 the inverter compressor is immediately reduced by three *steps* then reduced a further *step* every 10 seconds in an attempt to keep the compression ration from continuing to increase. If the compression ratio continues to rise above 8.9, the inverter compressor is reduced to minimum and any operating fixed speed compressor is stopped.

Once active this limiting function remains active until the compression ratio falls back below 8.0.

Inverter Compressor High Board Temperature Unloading Control

Normal compressor operation is limited when inverter compressor control board indicates an abnormally high board (fin) temperature value. This indicates the inverter compressor board is not receiving problem ventilation. When the inverter board temperature exceeds 183°F (460/575V unit) or 178°F (208/230V unit), the inverter compressor is immediately reduced by one *step* then reduced a further *step* every 15 seconds in an attempt to keep the board temperature from continuing to increase. The outdoor fan(s) are increased to maximum speed.

Once active this limiting function remains active until the inverter board temperature falls 5.4°F below the high limit.

Low Differential Pressure Protection Control

Normal compressor operation is overridden when the differential pressure between the high and low side of the refrigeration circuit (PTD-PTS) is abnormally low. This condition can inhibit proper oil return for lubricating the inverter compressor. When the differential pressure falls below 85 psi continuously for 40 seconds, the inverter compressor capacity is increased by one *step* then increased a further *step* every 40 seconds in an attempt to increase the differential pressure. If the inverter compressor is at maximum speed for 40 seconds and the differential pressure is still below 85 psi, compressor operation is forced to the Standby state where it remains for a stage time period before being allowed to restart. If the unit is forced to Standby in this manner 3 times in a 30 minute period, a low differential pressure alarm is generated requiring manual reset.

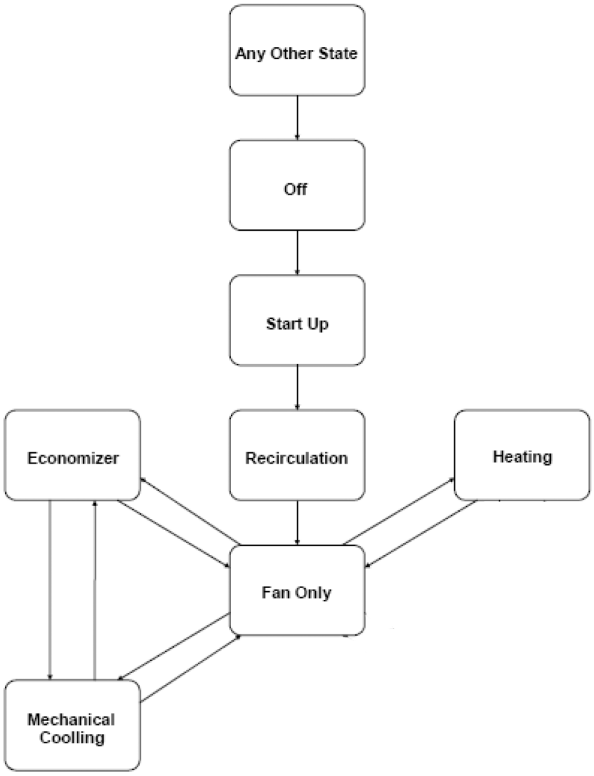
Once active this limiting function remains active until the differential pressure rises back above 171 psi.

To prevent excessive cycling of the compressor heating on an off during moderate heating load conditions, special *steps* are taken if this protection function causes the unit to cycle out of heating while it is active. If this occurs, the current effective compressor heating ambient lock out setting is reduced 10°F below the current outdoor air temperature which will lock out compressor heating operation. The effective compressor heating ambient lock out setting remains at this lower value until any of the following occur:

- 120 minutes elapses
- The effective minimum outdoor damper position changes by more that 10%.
- The effective discharge air heating set point changes by more than 5°F.
- The outdoor air temperature falls below this lower effective compressor heating ambient lock out setting.

The following "Operator's Guide" sections provide information regarding the day-to-day operation of the MicroTech III Unit Controller. Topics covered are such common tasks as scheduling, displaying and clearing alarms, and setting the controller for manual operation.

Figure 13: 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

(See page 58 for more information)

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 section, page 20. 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 set point 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 Optimum 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 variable speed supply air fan'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 57 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 variable speed supply air fan's remain at 0%. Cooling and heating are disabled, except for 100% OA heating start sequences.

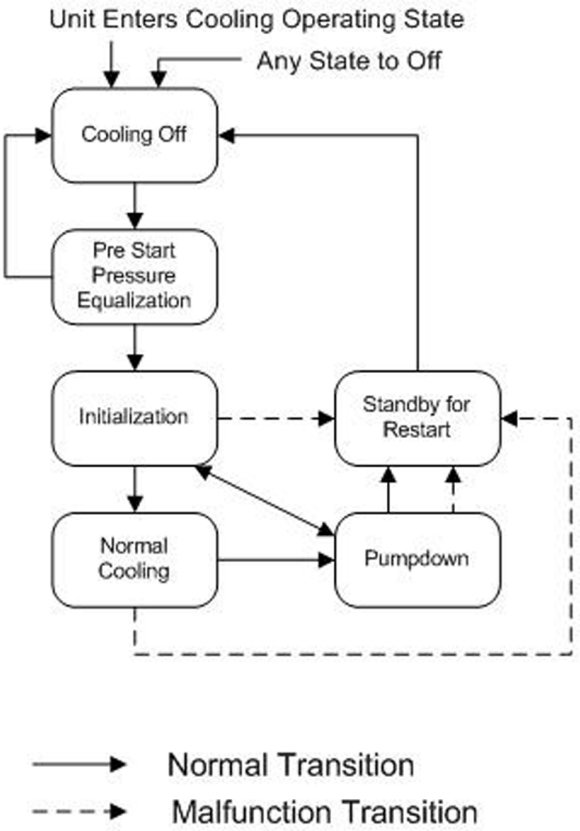
Heating

The unit enters the Heating operating state when the control calls for heat. This is for heat pumps only.

Mechanical Cooling

The unit enters the mechanical cooling operating state when cooling is called for by the third-party controller.

Figure 14: Cooling State Diagram



Off to Prestart Pressure Equalization

The Compressor Cooling State transitions from OFF to Prestart Pressure Equalization when the unit enters the Cooling operating state becomes active.

Prestart Pressure Equalization to Off

The Compressor Cooling State transitions from Prestart Pressure Equalization to OFF if there is no longer a call for cooling operation.

Prestart Pressure Equalization to Initialization

The Compressor Cooling State transitions from Prestart Pressure Equalization to initialization after thirty seconds.

Initialization to Normal

The Compressor Cooling State transitions from Initialization to Normal when the initialization sequence is complete. See Initialization state description in the Inverter Compressor Cooling State Descriptions section, page 51.

Initialization to Pumpdown

The Compressor Cooling State transitions from Initialization to Pumpdown if there is no longer a call for cooling operation.

Initialization to Standby for Restart

The Compressor Cooling State transitions from Initialization to Standby for Restart if one of the Compressor Protection functions force a transition to Standby for Restart, the inverter compressor or outdoor fan board requests a transition to Standby for Restart or if all compressor operation becomes disabled for any reason.

Normal to Pumpdown

The Compressor Cooling State transitions from Normal to Pumpdown if there is no longer a call for cooling operation.

Normal to Standby for Restart

The Compressor Cooling State transitions from Normal to Standby for Restart if one of the Compressor Protection functions force a transition to Standby for Restart, the inverter compressor or outdoor fan board requests a transition to Standby for Restart or if all compressor operation becomes disabled for any reason.

Pumpdown to Standby for Restart

The Compressor Cooling State transitions from Pumpdown to Standby for Restart if one of the Compressor Protection functions force a transition to Standby for Restart, the inverter compressor or outdoor fan board requests a transition to Standby for Restart or if all compressor operation becomes disabled for any reason.

Pumpdown to Initialization

The Compressor Cooling State transitions from Pumpdown to initialization if there is a call for cooling or dehumidification operation.

Standby for Restart to Off

The Compressor Cooling State transitions from Standby for Restart to OFF after the cooling stage timer expires.

Inverter Compressor Cooling Operation

Rebel units are always equipped with an inverter compressor. A fixed speed compressor is also provided on sizes 7.5–12, 25–28 tons.

The primary control devices related to inverter compressor operation are the following:

- Inverter and Fixed Speed Compressors (INV, Comp3)
- 1 or 2 Outdoor Fan(s)
- 4 Way Reversing Valve (4WV) – Heat Pump Units Only
- Refrigerant Receiver Solenoid Valve (SVR) – Heat Pump Units Only
- Refrigerant Discharge to Suction Bypass Solenoid Valve (SVB)
- Indoor Coil Expansion Valve (EVI)
- Outdoor Coil Expansion Valve (EVO) – Heat Pump Units Only

Control of these devices is described in the following sections.

Input Devices

PTS (suction refrigerant pressure) – MicroTech III AI

PTD (discharge refrigerant pressure) – MicroTech III AI

DRT1 (INV compressor discharge refrigerant line temperature) – MicroTech III AI

DRT3 (compressor discharge refrigerant line temperature) – MicroTech III AI

SRT (suction refrigerant temperature) – MicroTech III AI

DFT (defrost temperature) – MicroTech III AI

IRT (indoor refrigerant temperature) – IFB (heat pump)

ORT (outdoor refrigerant temperature) – IFB (heat pump)

Compressor Control

DPS units will utilize one of the following Compressor Cooling Configurations:

- Single inverter compressor (INV) on sizes 3–6 tons, 16–20 tons
- Single inverter compressor (INV) and a standard compressor on all other sizes

When compressor operation is active the combination of inverter and standard compressors is controlled to maintain the applicable cooling capacity input of the manual control.

The control of the inverter compressor is accomplished by sending the analog output of a PI_Loop via Modbus to the inverter compressor control board. As the PI_Loop output varies from 0-100% the speed of the inverter compressor increases from 0 to maximum. In the case where the unit is also equipped with standard (fixed) compressor, the fixed compressor is started and stopped via a digital output.

Upon an increasing call for cooling the inverter compressor is modulated to its maximum capacity before the fixed compressor is turned ON. When the load is such that the fixed compressor is required, the inverter compressor is slowed to its minimum speed before turning on the fixed compressor. The inverter compressor is then modulated to maintain the load.

Upon a decreasing call for cooling the inverter compressor is modulated to its minimum speed before the fixed compressor is turned OFF. Once the fixed compressor is turned off the inverter compressor is modulated maintain the load.

Compressor Control PI_Loop

When normal inverter compressor operation is active, the inverter compressor is controlled via a PI_Loop to maintain the remote of the manual point.

The compressor control PI_Loop is active when inverter operation is in either the Normal Cooling or, in the case of a heat pump configuration, the Normal Heating state. The PI_Loop is over-ridden when not in these states or when in these states and any of the Compressor Protection Unloading Control functions or Fixed Speed Compressor Step Transitions are active.

Compressor Output Control

Inverter Compressor (INV)

ON/OFF and speed commands are communicated to the inverter compressor control board via Modbus through the IFB Communication board.

Fixed Speed Compressor (Comp3)

A digital output is energized on the main control board controls the fixed speed compressor (Comp3).

Fixed Speed Compressor Step Transitions

Under normal compressor control, when the unit is equipped with a fixed speed compressor, special transition steps are taken when starting and stopping the fixed speed compressor. These steps are as follows:

Starting the Fixed Speed Compressor

Whenever the inverter compressor can not maintain sufficiently cold discharge air temperature at maximum speed, and timers are satisfied, the following fixed speed compressor stage up sequence occurs:

- Inverter Compressor speed is set to the minimum value. When the inverter compressor speed reaches the minimum value then the fixed speed compressor is turned ON.
- Inverter Compressor speed is held constant for 30 seconds
- Displayed compressor cooling/heating capacity is released to normal operation.

Stopping the Fixed Speed Compressor

Whenever the two compressors provide excessively cold discharge air temperature at minimum speed, and timers are satisfied, the following fixed speed compressor stage down sequence occurs:

- SVB bypass solenoid is opened
- Fixed speed compressor is turned OFF one second after SVB is opened
- SVB remains open for one second and then is turned OFF
- Inverter Compressor speed is set to maximum.
- When the inverter compressor speed reaches the maximum speed value, compressor cooling/heating control is released to normal operation.

Inverter Compressor Cooling State Descriptions

The Inverter Compressor Cooling State determines the operation of the following devices:

- Inverter Compressor
- Fixed Speed Compressor (if present)
- Outdoor Fan(s)
- 4 Way Reversing Valve (4WV) (Heat Pump only)
- Outdoor Expansion Valve (EVO) (Heat Pump only)
- Indoor Expansion Valve (EVI)
- Receiver Solenoid Valve (SVR) (Heat Pump only)
- Bypass Solenoid Valve (SVB)

Cooling Off

Compressor cooling operation begins in the Cooling Off state. All devices are OFF or closed. The state remains OFF until there is a call for cooling or dehumidification

Pre Start Pressure Equalization

In the Pre Start Pressure Equalization state the SVB valve is opened to divert hot gas leaving the compressor directly to the suction line to equalize the pressures in the system before beginning compressor operation. Operation remains in this state for 30 seconds [adjustable.] When in the Pre Start Pressure Equalization state, all devices are off or closed, except the Outdoor Fan and SVB. The Outdoor fan speed is set to 50%.

Initialization

In the Initialization state either the Standard Initialization or Alternate Initialization sequence is used in order to manage refrigerant and to assure a 4-way valve is switched. The Alternate Initialization sequence is used on inverter compressor units the first time the unit enters cooling after unit power up, the compressors had last operated in heating, or if it has been a long time since cooling has operated and it is cold outdoors.

Otherwise the Standard Initialization Sequence is normally used.

Table 34: Standard Initialization Sequence, 3–15 Tons

Device	Step 1	Step 2	Step 3	Step 4
Inverter Compressor & Comp3	"Inverter Compressor Speed = Minimum Comp3 = Off	"Inverter Compressor Speed = Smaller of Step 12 or Maximum Comp3 = Off	←	A
Inverter Compressor Only	Inverter Compressor Speed = Minimum	"If OAT ≥50°F or RAT ≥73°F, Inverter Compressor Speed = Smaller of Step 12 or Maximum If OAT <50°F or RAT <73°F, Inverter Compressor Speed = Minimum	←	A
Outdoor Fan	"Outdoor Fan = 0% if OAT < 68°F Outdoor Fan = 5% if OAT ≥ 68°F	B	←	←
4 Way Valve (Heat Pump)	OFF	←	←	←
Outdoor Coil Expansion Valve (EVO) (Heat Pump only)	EVO = 100%	←	←	←
SVR (Heat Pump only)	Closed	←	←	←
SVB	Normally Open	←	"Close if either of the following is true: 60 seconds elapses from the beginning of Step 1 Discharge superhead>9°F"	←
Indoor Coil Expansion Valve (EVI)	EVI = 0%	C	←	←
Time Duration	5 Seconds = 15 Ton size	5 Seconds	E = 15 Ton size	D
	10 Seconds ≠ 15 Ton size		5 Seconds ≠ 15 Ton size	

A. Inverter compressor speed is increased until the 4-way valve is seated (discharge minus suction pressure >57 psi) and as long as the suction pressure is above 43 psi. Comp 3 remains OFF

B. Outdoor fan capacity is controlled to maintain the discharge pressure between 256 psi and 313 psi. Outdoor fan capacity is set to 100% if discharge pressure is above 384 psi. Outdoor fan capacity runs at least at minimum capacity if inverter board (fin) temperature >167°F

C. The indoor expansion valve is controlled to keep the suction superheat between 3.6°F and 9.0°F.

D. Standard Initialization lasts a maximum 140 seconds. It is completed early anywhere between 20 seconds and 140 seconds if the saturated suction temperature is high (above 118°F), the suction pressure is low (below 79 psi) or once the 4-way valve is seated (differential pressure above 57 psi, suction pressure below 142 psi and suction or discharge superheat above 27°F).

Table 35: Standard Initialization Sequence, 16–28 Tons

Device	Step 1	Step 2	Step 3	Step 4
Inverter Compressor & Comp3	Inverter Compressor Speed = Minimum Comp3 = Off	Inverter Compressor Speed = Step 2 Comp3 = Off	Inverter Compressor Speed = Increasing 2 steps every 5 seconds if PTD-PTD < 26 PSI Comp3 = Off	Inverter Compressor Speed = Increasing 1 step every 20 seconds if there is no change of 4 Way Valve call Comp3 = Off
Inverter Compressor Only	Inverter Compressor Speed = Minimum	If OAT ≥50°F or RAT ≥73°F, Inverter Compressor Speed = Smaller of Step 12 or Maximum If OAT <50°F or RAT <73°F, Inverter Compressor Speed = Minimum	←	A
Outdoor Fan	Outdoor Fan = 0% if OAT < 68°F Outdoor Fan = 5% if OAT ≥ 68°F	B	←	←
4 Way Valve (Heat Pump)	OFF	←	←	←
Indoor Coil Expansion Valve (EVI)	C	←	←	←
Time Duration	5 Seconds	5 Seconds	E = 25/28 Ton size 5 Seconds ≠ 25/28 Ton size	D

A. Inverter compressor speed is increasing until the 4-way valve is seated (discharge minus suction pressure is >57 psi) and as long as the suction pressure is above 43 psi. Comp3 remains OFF

B. Outdoor fan capacity is controlled to maintain the discharge pressure between 256 psi and 313 psi. Outdoor fan capacity is set to 100% if discharge pressure is above 384 psi. Outdoor fan capacity runs at least at minimum capcity if heat sink temperature is > 167°F

C. The indoor expansion vavle is to keep the suction superheat between 7.2°F and 12.0 °F

D. The standard initialization lasts a max of 120 seconds. It is completed early anywhere between 20 and 120 seconds if the saturation suction temperature is high (above 118°F), the suction pressure is low (below 79 psi) or once the 4-way valve is seated (differential pressure above 57 psi, suction below 142 psi, suction superheat above 27°F, and discharge superheat above 34°F)

Table 36: Alternate Initialization Sequence, 3–15 Tons

Device	Step 1	Step 2	Step 3	Step 4
Inverter Compressor & Comp3	Inverter Compressor Speed = Minimum Comp3 = Off	Inverter Compressor Speed = Smaller of Step 12 or Maximum Comp3 = Off	←	A
Inverter Compressor Only	Inverter Compressor Speed = Minimum	If OAT ≥50°F or RAT ≥73°F, Inverter Compressor Speed = Smaller of Step 12 or Maximum If OAT <50°F or RAT <73°F, Inverter Compressor Speed = Minimum“	←	A
Outdoor Fan	Outdoor Fan = 0% if OAT < 68°F Outdoor Fan = 5% if OAT ≥ 68°F	B	←	←
4 Way Valve (Heat Pump)	OFF	←	←	←
Outdoor Coil Expansion Valve (EVO) (Heat Pump only)	EVO = 100%	←	←	←
SVR (Heat Pump only)	Closed	←	←	←
SVB	Normally Open Close if Discharge superheat >9°F	←	←	NA
Indoor Coil Expansion Valve (EVI)	EVI = 0%	C	←	←
Time Duration	5 Seconds	5 Seconds	E = 15 Ton size	F= 15 Ton size
			D ≠ 15 Ton size	NA

A. Inverter compressor speed is increased until the 4-way valve is seated (discharge minus suction pressure >57 psi) and as long as the suction pressure is above 43 psi. inverter compressor speed is also increased if the suction pressure remains above 71 psi. Comp 3 turns on if the inverter compressor speed is at maximum and these conditions are not met. Comp 3 is turned back OFF after 20 seconds if the suction pressure drops below 43 psi.

B. Outdoor fan capacity is controlled to maintain the discharge pressure between 171 psi and 221 psi. Outdoor fan capacity is set to 100% if discharge pressure is above 427 psi. Outdoor fan capacity runs at least at minimum capacity if inverter board (fin) temperature >167°F.

C. EVI is controlled to keep the suction superheat between 3.6°F and 14.4°F.

D. Alternate Initialization lasts a maximum 15 minutes. It is completed early anywhere between 10 seconds and 15 minutes if once the 4-way valve is seated (differential pressure above 57 psi and the discharge superheat above 9.0°F).

E. Step 3 ends when the compressor has reached 65% full speed, differential pressure is >26 psi for 3 seconds, the stage has been active for 3 minutes, or Comp3 is active

F. Step 4 (initializaiton) is complete when the stage has been active for 15 minutes, or 4 way valve has set and discharge superheat is above 9°F

Table 37: Alternate Initialization Sequence, 16–28 Tons

Device	Step 1	Step 2	Step 3	Step 4
Inverter Compressor & Comp3	Inverter Compressor Speed = Minimum Comp3 = Off	Inverter Compressor Speed = Step 2 Comp3 = Off	Inverter Compressor Speed = Increasing 1 step every 5 seconds if PTD-PTD < 26 PSI Comp3 = Off	A
Inverter Compressor Only	Inverter Compressor Speed = Minimum	If OAT ≥50°F or RAT ≥73°F, Inverter Compressor Speed = Smaller of Step 12 or Maximum If OAT <50°F or RAT <73°F, Inverter Compressor Speed = Minimum	A	N/A
Outdoor Fan	Outdoor Fan = 0% if OAT < 68°F Outdoor Fan = 5% if OAT ≥ 68°F	B	←	←
4 Way Valve (Heat Pump)	OFF	←	←	←
Indoor Coil Expansion Valve (EVI)	EVI = 0%	C	←	←
Time Duration	5 Seconds	5 Seconds	E = 25/28 Ton size D ≠ 15 Ton size	F

A. Inverter compressor speed is increasing until the 4-way valve is seated (discharge minus suction pressure is >57 psi) and as long as the suction pressure is above 43 psi. Inverter compressor speed is increased if the suction pressure remains above 71 psi. Comp3 turns ON if the inverter compressor speed is at maximum and these conditions are not met. Comp3 is turned back OFF afer 20 seconds if the suction pressure is below 43 psi

B. Outdoor fan capacity is controlled to maintain the discharge pressure between 171 psi and 221 psi. Outdoor fan capacity is set to 100% if discharge pressure is above 427 psi. Outdoor fan capacity runs at least at minimum capcity if heat sink temperature is >167°F

C. The indoor expansion valve is to keep the suction superheat between 7.2°F and 20°F

D. The standard initialization lasts a max of 15 minutes. It is completed early anywhere between 20 and 15 minutes if the 4-way valve is seated (differential pressure above 57 psi and discharge superheat above 34°F)

E. Step 3 ends when the compressor has reached 65% full speed, differential pressure is >26 psi for 3 seconds, the stage has been active for 3 minutes, or Comp3 is active

F. Step 4 (initializaiton) is complete when the stage has been active for 15 minutes, or 4-way valve has set and discharge superheat is above 34°F

Normal Cooling

In the Normal Cooling state the following are accomplished:

- Indoor coil expansion value is modulated to maintain the suction superheat at the suction superheat set point
- Outdoor coil expansion valve is controlled to maintain outdoor coil subcooling at the outdoor coil subcooling set point (heat pump)
- Outdoor fan(s) are modulated to maintain the discharge saturation temperature at the discharge saturation temperature set point

When in the Normal Cooling state the action of the cooling control devices is as follows:

Table 38: Normal Cooling State

Device	Action
Compressors	Inverter Compressor Speed Controlled with PI Loop to Maintain DAT Setpoint Comp 3: Turned On when inverter speed is at Maximum Comp 3: Turned Off when inverter speed is at Minimum
Outdoor Fan	Outdoor Fan Capacity Controlled With PI Loop to Maintain condensing temperature setpoint
4 Way Valve (Heat Pump)	OFF
Outdoor Coil Expansion Valve (EVO) (Heat Pump only)	A
SVR (Heat Pump only)	Closed
SVB	SVB is normally closed during the Normal Cooling state except in the following cases: SVB is opened for one second before and after Comp 3 is stopped. During Low Pressure Unloading Control SVB is opened if PTS< 21 psi. It is closed again when PTS> 43 psi.
Indoor Coil Expansion Valve (EVI)	EVI Controlled With PI Loop to Maintain Suction Superheat Setpoint
Time Duration	While in Normal Cooling state

A. The outdoor expansion valve position is either driven fully open (100%) or varied based on outdoor coil subcooling as follows:
   - When the outdoor expansion valve Method is set to 100%, the outdoor expansion valve is driven to the 100% open position.
   - When the outdoor expansion valve Method is set to subcooling, the outdoor expansion valve is controlled to maintain the outdoor coil subcooling temperature set point.

Normal Cooling Outdoor Fan (OA Fan PI_Loop) Control

One or two outdoor fans are controlled via Modbus connections to the Inverter Compressor Board via the IFB communication board.

The outdoor fan control PI_Loop is active only during the Normal Cooling and Cooling Pumpdown operating states and the loop maintains the discharge saturation temperature at the set point between a minimum value of 86°F and a maximum value of 131°F. EER values will be improved by allowing the lower set points when appropriate.

Normal Heating OA Fan Control

During the Normal Heating state the outdoor fan speed is first set at the maximum value and is then controlled as follows:

- If discharge pressure is low (below 107 psi) or the INV Board (fin) Temp is high [above 176°F (172°F for 208/230 volt units) continuously for 15 seconds] the outdoor fan speed is increased by 2%. No further changes are made for 15 seconds.
- If discharge pressure is high (above 162 psi) or the INV Board (fin) Temp is low [below 172°F (169°F for 208/230 volt units) continuously for 15 seconds] the outdoor fan speed is decreased by 2%. No further changes are made for 30 seconds.

Outdoor Fan Fault Protection

If a unit is equipped with only one outdoor fan and it is shut off on one of its internal faults, compressor operation enters the Standby for Restart state.

If a unit is equipped with two outdoor fans and either outdoor fan 2 or both outdoor fans shut off on one of their internal faults, compressor operation enters the Standby for Restart state. Note: In the case of two fans outdoor fan 2 provides critical cooling for the inverter compressor/outdoor fan control boards.

Once compressor operation finishes the Standby for Restart state and if there is a call for cooling, compressor operation is allowed to sequence to the Normal operating state in the normal manner. If this cycle is repeated three times in a thirty minute period an OA Fan: Problem alarm is generated, locking out compressor operation, requiring a manual reset.

Pumpdown

When compressor operation is no longer needed, the compressor enters the Pumpdown state before entering the Standby for Restart state from either the Initialization or Normal Cooling state.

The following describes the operation of the cooling control devices in the Pumpdown state:

Table 39: Pumpdown State

	Step 1	Step 2
Compressors	Inverter Compressor speed = maximum Comp3= OFF	Inverter Compressor speed = minimum Comp3= OFF
Outdoor fan	Normal control	←
4 way valve	Off	←
Outdoor Expansion Valve (EVO) (Heat Pump only)	Outdoor Expansion Valve position = 100%	Outdoor Expansion Valve position = 50%
SVR (Heat Pump only)	Closed	Open except Closed after 10 seconds if suction super heat < 41°F
SVB	Open	Closed
Indoor Expansion Valve (EVI)	Closed	Closed
Time Duration	A	B

A. The inverter compressor speed is at maximum with the outdoor expansion valve open, SVR closed, SVB open and the indoor expansion valve closed for a maximum of 5 minutes. Step 1 is normally finished before 5 minutes when the suction pressure drops below 72 psi. Step 1 is terminated if the inverter compressor discharge line temperature is above 230°F, the inverter compressor port temperature is above 257°F or the discharge pressure is above 427 psi.

B. The inverter compressor speed is at minimum, the outdoor expansion valve is open 50% open, SVR closed, SVB open and indoor expansion valve closed. Pumpdown is normally complete when the suction pressure drops below 36 psi. Pumpdown is terminated if the inverter compressor port temperature rises above 320°F

Standby for Restart

The Standby for Restart state guarantees at least one Clg Stg Time period elapses before re-entering the Intialization and Normal Cooling states. The following describes the Standby for Restart state sequence:

Table 40: Standby for Restart State

	Stage 1	Stage 2
Compressors	Inverter Compressor speed = 0% and Comp3 OFF	←
Outdoor Fan	Outdoor Fan position = 50% if OAT > 86°F when entering Standby for Restart state Outdoor Fan position = 0% if OAT ≤ 86°F when entering Standby for Restart state	←
4 way valve, outdoor expansion valve (EVO) (Heat Pump only) and SVB	Off or closed	Off or closed
SVR (HeatPump only)	Open if saturated discharge pressure > 427 psi when entering Standby for Restart state Closed otherwise	Closed
Indoor expansion valve (EVI)	Closed	Closed
Time Duration	5 seconds	Remainder of Clg Stg Time
	Clg Stg Time (default=5 minutes)	

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:

- 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 third-party signal
- The outdoor air temperature (OAT) 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) 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).

Off Alarm

Compressor operation is disabled by an alarm condition.

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 the primary source of heating in the unit is currently allowed. On heat pump units this is the compressor heating.

The following are descriptions of the heating status states:

Enabled

In the heat pump, compressor heating is enabled if all of the following are true:

- Control Mode is not set via the keypad to fan only or cool only
- Control Mode is set via the keypad to auto and heating is not disabled via a network command
- The outdoor air temperature (OAT) is warm enough (above 0°F default) and cool enough (below 55°F default) for compressor heating operation.

None

Unit is not a heat pump and heating capability is not provided

Off Ambient

In a heat pump, the OAT is too high or too low for compressor heating operation. OAT becomes too high for compressor heat operation when it rises above the high OAT heating lock out set point. The OAT becomes low enough for compressor heat operation when it drops below the high OAT heating lock out set point by more than the heating lockout differential. The The OAT becomes too low for compressor heat operation when it falls below the low OAT heating lock out set point. The OAT becomes high enough for compressor heat operation when it rises above the low OAT heating lock out set point by more than the heating lockout differential.

Off Network

Control Mode is set via the keypad to auto and heating is disabled via a network command.

Off Manual

Control Mode is set via the keypad to fan only or cool only..

Determining Cooling Capacity

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

Determining Heat Capacity

Htg Capacity is a status item which indicates the percentage of the unit maximum primary heating source that is currently operating. On heat pump units this is the compressor heating capacity.

Determining Supply Air Fan Capacity

SAF Speed is a status only item which indicates the supply air fan capacity. 0-100% of maximum speed is indicated if the unit is equipped with a variable volume supply air fan. 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 exhaust fan capacity. 0-100% of maximum speed is indicated if the unit is equipped with a variable volume exhaust fan. 100% is indicated if the exhaust fan is constant volume and is running.

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 System Mode

The system can be set up for local or remote modes.

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 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.

OAT Lockout

On heat pump units, compressor heating (primary heat) is disabled whenever the outdoor air temperature is below the Low Outdoor Air Ambient Heating Lockout set point or above the High Outdoor Air Ambient Heating Lockout set point. Whenever the outdoor air temperature rises above the Low Outdoor Air Ambient Heating Lockout set point or falls below the High Outdoor Air Ambient Heating Lockout set point by more than the Heating Lockout Differential, compressor heating operation is re-enabled.

Supplemental heating (secondary heat) is disabled whenever the outdoor air temperature is above the High Outdoor Air Ambient Supplemental Heating Lockout Set Point. Whenever the outdoor air temperature falls below the High Outdoor Air Ambient Supplemental Heating Lockout Set Point by more than the Heating Lockout Differential, supplemental heating operation is re-enabled.

Compressor cooling operation is disabled whenever the outdoor air temperature falls below the Low Outdoor Air Ambient Cooling Lockout Set Point. Whenever the outdoor air temperature rises above the Low Outdoor Air Ambient Cooling Lockout Set Point by more than the Cooling Lockout Differential, compressor cooling operation is re-enabled.

On non-heat pump units, heating is disabled whenever the outdoor air temperature is above the High Outdoor Air Ambient Heating Lockout Set Point. Whenever the outdoor air temperature falls below the High Outdoor Air Ambient Heating Lockout Set Point by more than the Heating Lockout Differential, heating operation is re-enabled.

Compressor cooling operation is disabled whenever the outdoor air temperature falls below the Low Outdoor Air Ambient Cooling Lockout Set Point. Whenever the outdoor air temperature rises above the Low Outdoor Air Ambient Cooling Lockout Set Point by more than the Cooling Lockout Differential, compressor cooling operation is re-enabled.

Heat Pump Control

A heat pump unit transitions between the Cooling and Heating operating states as described above. If compressor heating is available it is used first to provide the heating source during the Heating states. If compressor heating is unavailable (as during defrost operation for example) or inadequate to meet the heating requirements during these states, supplemental heating will be used to add to or in lieu of the compressor heating.

Heat Pump Cooling Operation

When the unit transitions from the Fan Only to Cooling operating state or if dehumidification operation becomes active while in the Fan Only state, compressor cooling operation begins. Refer to "Inverter Compressor Cooling State Descriptions" on page 51 for a detail description of the cooling compressor operating sequence.

Heat Pump Heating Operation

When the unit transitions from the Fan Only to Heating operating state, compressor heating operation begins. Refer to "Inverter Compressor Heating State Descriptions" on page 61 for a detail description of the heating compressor operating sequence.

Heat Pump Defrost Operation

Defrost operation is required when compressor operation is in the Normal Heating state when frost build up on the outdoor coil interferes with the normal heat transfer from the outdoor coil to the ambient air. Refer to "Defrost Operation – Heat Pump Units Only" on page 67 for a detailed description.

Supplemental Heating/Compressor Heating Transitions

Special action is required when the unit transitions from using compressor (heat pump) heating to supplemental heating and vise versa. Normal operation is for the compressor heating to turn ON first and ramp to full capacity before turning on any supplemental heating. Once the compressor heating is at full capacity, the supplemental heating will then ramp up and down as necessary to satisfy the load. There will however be instances when heating is required and compressor heating is unavailable in which case the supplemental heating must turn ON first. These include the following cases:

- Compressor heating operation is disabled
- Heat pump defrost operation is active
- Dehumidification is active
- Unit is 100% OA and the OAT is below the low limit set point of about 0° F [adjustable.] This is adjustable such that heat pump operation can be locked out at ambients where gas heat is more economical.

In the cases where compressor heating becomes available while the supplemental heating is operating it is desirable to shift as much of the load as possible to the compressor heating. This is accomplished with the following sequence which occurs whenever compressor heating enters the Normal Heating state or leaves defrost operation while supplemental heating is active:

- Inverter compressor speed is increased 5% every 15 seconds up to maximum speed.
- Fixed speed compressor is turned ON when the inverter compressor reaches maximum speed.

Supplemental heating is allowed to cycle OFF normally while the compressor heating is ramping up. When the supplemental heating has been OFF for one stage time period, normal modulating compressor control begins from the current capacity.

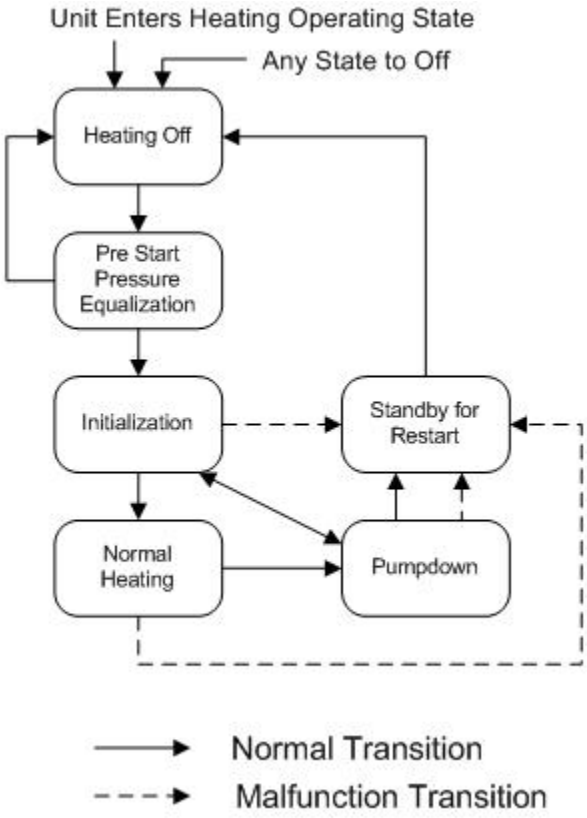
When compressor heating is operating while supplemental heating is inactive, the supplemental heating is held inactive until then compressor capacity has been operating at its maximum capacity and the fixed compressor is ON for one stage time period. At this point the supplemental heating is enabled to start cycling to meet the load.

Heat Pump Operating State

Compressor Heating Operation State Machine – Heat Pump Units Only

This section applies to heat pump units only. When a unit is configured for heat pump operation the primary source of heating is provided by operating the compressors in a heating mode of operation. When this primary heat is unavailable or at is maximum capacity and more heating is required, any available supplemental heating is controlled as described in that section. When this primary heating is enabled the compressor transitions through the heating states shown in the following state diagram. Control based on discharge air temperature (DAT) occurs in the Normal Heating state.

Figure 15: Heating State Diagram



Off to Prestart Pressure Equalization

The Compressor Heating State transitions from OFF to Prestart Pressure Equalization when the unit enters the MinDAT or Heating operating state.

Prestart Pressure Equalization to Off

The Compressor Heating State transitions from Prestart Pressure Equalization to OFF if there is no longer a call for MinDAT or Heating operation.

Prestart Pressure Equalization to Initialization

The Compressor Heating State transitions from Prestart Pressure Equalization to initialization after ninety seconds.

Initialization to Normal

The Compressor Heating State transitions from Initialization to Normal when the initialization sequence is complete. See Initialization state description in the "Inverter Compressor Heating State Descriptions" on page 61.

Initialization to Pumpdown

The Compressor Heating State transitions from Initialization to Pumpdown if there is no longer a call for MinDAT or Heating operation.

Initialization to Standby for Restart

The Compressor Heating State transitions from Initialization to Standby for Restart if one of the Compressor Protection functions force a transition to Standby for Restart, the inverter compressor or outdoor fan board requests a transition to Standby for Restart or if all compressor operation becomes disabled for any reason.

Normal to Pumpdown

The Compressor Heating State transitions from Normal to Pumpdown if there is no longer a call for MinDAT or Heating operation.

Normal to Standby for Restart

The Compressor Heating State transitions from Normal to Standby for Restart if one of the Compressor Protection functions force a transition to Standby for Restart, the inverter compressor or outdoor fan board requests a transition to Standby for Restart or if all compressor operation becomes disabled for any reason.

Pumpdown to Standby for Restart

The Compressor Heating State transitions from Pumpdown to Standby for Restart if one of the Compressor Protection functions force a transition to Standby for Restart, the inverter compressor or outdoor fan board requests a transition to Standby for Restart or if all compressor operation becomes disabled for any reason.

Pumpdown to Initialization

The Compressor Heating State transitions from Pumpdown to initialization if there is a call for cooling MinDAT or Heating operation.

Standby for Restart to Off

The Compressor Heating State transitions from Standby for Restart to OFF after the heating stage timer expires.

Inverter Compressor Heating State Descriptions

The Inverter Compressor Heating State determines the operation of the following devices:

- Inverter Compressor
- Fixed Speed Compressor (if present)
- Outdoor Fan(s)
- 4 Way Reversing Valve (4WV)
- Outdoor Expansion Valve (EVO)
- Indoor Expansion Valve (EVI)
- Receiver Solenoid Valve (SVR)
- Bypass Solenoid Valve (SVB)

Heating Off

Compressor heating operation begins in the OFF state. When in the OFF state, all devices are off or closed. The state remains here until there is a call for heating.

Pre Start Pressure Equalization

In the Pre Start Pressure Equalization state the SVB valve is opened to divert hot gas leaving the compressor directly to the suction line to equalize the pressures in the system before beginning compressor operation. The outdoor fan is set at 50% speed. Operation remains in this state for 90 seconds. When in the Pre Start Pressure Equalization state, all devices are OFF or closed except the outdoor fan(s) and SVB. The outdoor fan(s) speed is set to 50%.

Initialization

In the Initialization state either the Standard Initialization or Alternate Initialization sequence is used in order to manage refrigerant and assure the 4-way valve is switched. The Alternate Initialization sequence is used the first time the unit enters heating after unit power up, or when the compressors had last operated in cooling, or if it has been a long time since heating has operated and it is cold outdoors. Otherwise the Standard Initialization Sequence is used.

Table 41: Standard Initialization Sequence, 3–15 Tons

Device	Step 1	Step 2	Step 3	Step 4
Inverter Compressor & Comp3	Inverter Compressor Speed = Minimum Comp3 = Off	Inverter Compressor Speed = Smaller of Step 12 or Maximum Comp3 = Off	←	A
Inverter Compressor Only	Inverter Compressor Speed = Minimum	If OAT ≤59°F, Inverter Compressor Speed = Smaller of Step 12 or Maximum If OAT >59°F, Inverter Compressor Speed = Minimum	←	A
Outdoor Fan	Outdoor Fan = 100%	←	←	←
4 Way Valve (Heat Pump)	ON	←	←	←
Outdoor Coil Expansion Valve (EVO) (Heat Pump only)	EVO = 0%	←	←	←
SVR (Heat Pump only)	Closed	←	←	←
SVB	Size ≠ 15 tons: Normallly Open Close if either of the following is true: 60 seconds elapses from the beginning of Step 1 Discharge superheat > 18°F	←	Size = 15 Tons Normallly Open Close if either of the following is true: 60 seconds elapses from the beginning of Step 1 Discharge superheat > 18°F	←
Indoor Coil Expansion Valve (EVI)	EVI = 100%	C	←	←
Time Duration	10 Seconds	5 Seconds	D = 15 Ton size 5 Seconds ≠ 15 Ton size	C

A. Inverter compressor speed is increaded until the 4-way valve is seated (discharge minus suciton pressure >57 psi) and as long as the discharge pressure is less than 221 psi. Comp3 is always OFF.

B. Outdoor fan capacity is controlled to maintain the discharge pressure between 256 psi and 313 psi. Outdoor fan capacity is set to 100% if discharge pressure is above 384 psi. Outdoor fan capacity runs at least at minimum capacity if inverter board (fin) temperature >167°F.

C. The indoor expansion valve is controlled to keep the suction superheat between 3.6°F and 9.0°F.

D. Step 3 ends when either minimum Step 16 reached, differential pressure is greater than 26 psi for 3 seconds, or the stage has been active for 3 minutes.

See page 50 for more information about what is a compressor *“step”.*

Table 42: Standard Initialization Sequence, 16–28 Tons

Device	Step 1	Step 2	Step 3	Step 4
Inverter Compressor & Comp3	Inverter Compressor Speed = Minimum Comp3 = Off	Inverter Compressor Speed = Step 2 Comp3 = Off	Inverter Compressor Speed = Increasing 1 step every 5 seconds if PTD-PTD < 26 PSI Comp3 = Off	D
Inverter Compressor Only	Inverter Compressor Speed = Minimum	If OAT ≤59°F, Inverter Compressor Speed = Smaller of Step 12 or Maximum If OAT >59°F, Inverter Compressor Speed = Minimum	←	D
Outdoor Fan	Outdoor Fan = 100%	←	←	←
4-Way Valve (Heat Pump)	ON	←	←	←
Outdoor Coil Expansion Valve (EVO) (Heat Pump only)	EVO = 0%	A	←	←
Time Duration	10 Seconds	5 Seconds	C	B

A. The outdoor expansion valve is to keep the suction superheat between 3.6°F and 12°F.

B. Standard initialization lasts a maximum of 600 seconds. It is completed early anywhere between 10 and 600 seconds if discharge pressure is high (above 384 psi) or the 4-way valve has been seated for 60 seconds (differential pressure above 57 psi).

C. Step 3 ends when the minimum Step 16 is reached, differential pressure is greater than 26 psi for 3 seconds, or 3 minutes have elapsed since the start of step 3.

D. Inverter compressor speed is increaded until the 4-way valve is seated (discharge minus suciton pressure > 57 psi). Comp3 is always OFF.

See page 50 for more information about what is a compressor *“step”.*

Table 43: Alternate Initialization Sequence, 3–15 Tons

Device	Step 1	Step 2	Step 3	Step 4
Inverter Compressor & Comp3	Inverter Compressor Speed = Minimum Comp3 = Off	Inverter Compressor Speed = Smaller of Step 12 or Maximum Comp3 = Off	←	A
Inverter Compressor Only	Inverter Compressor Speed = Minimum	If OAT ≥50°F or RAT ≥73°F, Inverter Compressor Speed = Smaller of Step 12 or Maximum If OAT <50°F or RAT <73°F, Inverter Compressor Speed = Minimum“	←	A
Outdoor Fan	Outdoor Fan = 0% if OAT < 68°F Outdoor Fan = 5% if OAT ≥ 68°F	B	←	←
4 Way Valve (Heat Pump)	OFF	←	←	←
Outdoor Coil Expansion Valve (EVO) (Heat Pump only)	EVO = 100%	←	←	←
SVR (Heat Pump only)	Closed	←	←	←
SVB	Normally Open Close if Discharge superheat >9°F	←	←	NA
Indoor Coil Expansion Valve (EVI)	EVI = 0%	C	←	←
Time Duration	5 Seconds	5 Seconds	E = 15 Ton size	F= 15 Ton size
			D ≠ 15 Ton size	NA

A. Inverter compressor speed is increased until the 4-way valve is seated (discharge minus suction pressure >57 psi) and as long as the suction pressure is above 43 psi. inverter compressor speed is also increased if the suction pressure remains above 71 psi. Comp 3 turns on if the inverter compressor speed is at maximum and these conditions are not met. Comp 3 is turned back OFF after 20 seconds if the suction pressure drops below 43 psi.

B. Outdoor fan capacity is controlled to maintain the discharge pressure between 171 psi and 221 psi. Outdoor fan capacity is set to 100% if discharge pressure is above 427 psi. Outdoor fan capacity runs at least at minimum capacity if inverter board (fin) temperature >167°F.

C. EVI is controlled to keep the suction superheat between 3.6°F and 14.4°F.

D. Alternate Initialization lasts a maximum 15 minutes. It is completed early anywhere between 10 seconds and 15 minutes if once the 4-way valve is seated (differential pressure above 57 psi and the discharge superheat above 9.0°F).

E. Step 3 ends when the compressor has reached 65% full speed, differential pressure is >26 psi for 3 seconds, the stage has been active for 3 minutes, or Comp3 is active

F. Step 4 (initializaiton) is complete when the stage has been active for 15 minutes, or 4 way valve has set and discharge superheat is above 9°F

Table 44: Alternate Initialization Sequence, 16–28 Tons

Device	Step 1	Step 2	Step 3	Step 4
Inverter Compressor & Comp3	Inverter Compressor Speed = Minimum Comp3 = Off	Inverter Compressor Speed = Step 2 Comp3 = Off	Inverter Compressor Speed = Increasing 1 step every 5 seconds if PTD-PTD < 26 PSI Comp3 = Off	A
Inverter Compressor Only	Inverter Compressor Speed = Minimum	If OAT ≤59°F, Inverter Compressor Speed = Smaller of Step 12 or Maximum If OAT >59°F, Inverter Compressor Speed = Minimum	A	NA
Outdoor Fan	Outdoor Fan = 100%	←	←	←
4 Way Valve (Heat Pump)	ON	←	←	←
Outdoor Coil Expansion Valve (EVO) (Heat Pump only)	B	←	←	←
Time Duration	5 Seconds	5 Seconds	C	←

A. Inverter compressor speed is increased until the 4-way valve is seated (discharge minus suction pressure > 57 psi) and as long as discharge presure is below 221 psi. Inverter compressor speed is also increased if the discharge pressure remains below 171 psi. Comp3 turns on if the inverter compresor speed is at maximum and those conditions are not met. Comp3 turns back off after 20 seconds if the discharge pressure rised above 221 psi.

B. The outdoor expansion vavle is to keep the suction superheat between 3.6°F and 5.4 °F

C. Alternate initializaiton lasts a maximum 15 minutes. It is completed early anywhere between 10 seconds and 15 minutes if once the 4-way valve is seated (differential pressure above 57 psi) and superheat is above 18°F or discharge pressure is above 384 psi.

Normal Heat Pump Control

Normal Heating

In the Normal Heating state the following are accomplished:

- Compressor capacity (INV and Comp 3) is regulated to maintain the DAT at either the Discharge Air Temperature Heating Setpoint (Unit State=Heating) or the Minimum Discharge Air Temperature Spt (Unit State=MinDAT)
- Outdoor coil expansion value (EVO) is modulated to maintain the suction superheat at the suction superheat setpoint
- Indoor coil expansion valve (EVI) is controlled to maintain indoor coil subcooling at the indoor coil subcooling setpoint (heat pump)
- Outdoor fan(s) are set to maximum and then decreased if the suction pressure is high (above 162.2 psi) or increased back toward the maximum if the suction pressure is low (below 106.7 psi).

When in the Normal Heating state the action of the heating control devices is as follows:

Table 45: Normal Heating State

Device	Action
Compressors	Inverter Compressor Speed Controlled with PI Loop to maintain DAT Setpoint Comp 3: Turned On when Inverter Compressor at Maximum Comp 3: Turned Off when Inverter Compressor at Minimum
Outdoor Fan	A
4 Way Valve (HeatPump)	ON
Outdoor Coil Expansion Valve (EVO) (HeatPump)	EVO Controlled With PI Loop to maintain Suction Superheat Setpoint
SVR (HeatPump)	Closed
SVB	SVB is normally closed during the Normal Heating state except in the following cases: SVB is opened for one second before and after Comp 3 is stopped. During Low Pressure Unloading Control SVB is opened if PTS <147.1 kPa (21.34 psi). It is closed again when PTS>294.2 kPa (42.67 psi).
Indoor Coil Expansion Valve (EVI)	B
Time Duration	While in Normal Heating state

A. Outdoor fan(s) are set to maximum and then decreased if the suction pressure is high (above 162.2 psi) or increased back toward the maximum if the suction pressure is low (below 106.7 psi).

B. The indoor expansion valve is either driven fully open or varied based on indoor coil subcooling as follows:

   When the Htg EVI Method is set to 100%, the indoor expansion valve is driven to the 100% open position.

   When the Htg EVI Method is set to SbC, the indoor expansion valve is controlled to maintain the indoor coil subcooling at the indoor coil subcooling temperature setpoint.

Pumpdown

Compressor heating operation enters the Pumpdown state before entering the Standby for Restart state from either the Initialization or Normal Heating state.

The following describes the operation of the compressor heating control devices in the Pumpdown state:

Table 46: Pumpdown State

	Step 1
Compressors	Inverter Compressor Speed = Smaller of Step 12 or maximum Comp3=OFF
Outdoor Fan	Outdoor Fan speed = maximum
4 Way Valve (4WV)	ON
Outdoor Expansion Valve (EVO)	Outdoor Expansion Valve position = 0%
SVR	Closed
SVB	Open
Indoor Expansion Valve (EVI)	Indoor Expansion Valve Control position = 50%
Time Duration	See A below

A. Pumpdown is complete after 3 minutes or when the suction pressure drops below 34 psi. Pumpdown is terminated if either the discharge superheat rises above 230°F or if the Inverter Compressor port temperature rises above 284°F.

Standby for Restart

The Standby for Restart state guarantees at least one Htg Stg Time period elapses before re-entering the Intializaton and Normal Heating states. The following describes the Standby for Restart state sequence:

Table 47: Standby for Restart State

	Step 1	Step 2
Compressors	Inverter Compressor speed = 0% Comp3=OFF	←
Outdoor Fan	Outdoor Fan speed = 50% if OAT > 86°F when entering Standby for Restart state Outdoor Fan speed = 0% if OAT ≤ 86°F when entering Standby for Restart state	←
4 Way Valve (4WV)	ON	←
Outdoor Expansion Valve (EVO)	Outdoor Expansion Valve position = 0%	←
SVR	Closed	Closed
SVB	Closed	←
Indoor Expansion Valve (EVI)	Indoor Expansion Valve position = 0%	←
Time Duration	5 seconds	Remainder of Htg Stg Time
	Htg Stg Time (default = 5 minutes)	

Defrost Control

(See page 29 for more information)

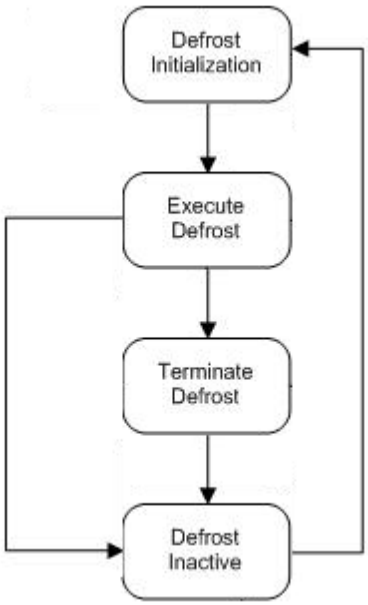
Defrost Operation – Heat Pump Units Only

This section applies to heat pump units only. Defrost operation is required when compressor operation is in the Normal Heating state when frost build up on the outdoor coil interferes with the normal heat transfer from the outdoor coil to the ambient air. When defrost operation is active, compressor operation remains in the Normal Heating state but the device control is overridden until the defrost operation is complete. While defrost operation is active, the auxiliary supplemental heat source in the unit is required to maintain comfort conditions.

Defrost Operation State

When outdoor coil defrosting is required defrost operation transitions through the defrost states shown in the following state diagram:

Figure 16: Defrost Operating States



Defrost Initiation (Heat Pump)

DPS heat pump units require a defrost cycle to remove frost build-up that can accumulate on the outdoor coil during certain heating operating conditions. The controller assumes there is a potential for frost build-up on the coil when the Defrost Temperature (DFT) is less than 14.0°F and the saturated suction temperature is below 32°F.

When a compressor is operating under these potential frosting conditions for at least the MinCmpOpTm= period (Default=10 minutes) and the accumulated compressor operation time since the last defrost cycle exceeds the MinAccCmpTm= value (Default=40 minutes), the controller can initiate a defrost cycle base on temperature, time or on a manual request as described in the following sections.

Temperature Defrost

A defrost cycle is initiated based on temperature when the Defrost Temperature (DFT) drops below a defrost temperature value (Tdef) and the saturated discharge temperature is below 109°F continuously for 3 minutes. The Tdef value is adjusted automatically between (+) 14°F and (-) 13.0°F based on outdoor air temperature. This value is not directly adjustable but can be “biased” by setting the Tdef Adj= parameter (Default=0°F) between -3.6°F and +3.6°F. Note: To improve performance the Tdef value is also automatically adjusted after each defrost cycle depending on the length of the cycle.

Timed Defrost

A defrost cycle is initiated based on time when the compressors have accumulated enough time operating in potential frosting conditions. The controller accumulates minutes of operation in low frost potential (LoFrstAccTm=) and high frost potential (HiFrstAccTm=) conditions. Whenever the HiFrstAccTm= time plus ½ the LoFrstAccTm= time exceed the MaxFrostTm= setting (Default=120minutes) a defrost cycle is initiated.

Manual Defrost

A defrost cycle is manually initiated when the Manual DF= parameter is set from No to Yes. Note: Once the defrost cycle begins the Manual DF= parameter automatically reverts to No.

Defrost Initialization

This state prepares the system for switching the 4-way valve to the cooling position

Execute Defrost

The 4-way valve is switched to the cooling position to defrost the coil. This state manages the refrigerant in the system and assures the 4-way valve is seated before defrosting the coil. Execute Defrost continues for 10 minutes or until the Defrost Temperature (DFT) exceeds 51.8ºF or the discharge pressure exceeds 426.7 psi.

Terminate Defrost

After the defrost operation is complete, the 4-way valve is switched to the heating position. Terminate Defrost manages the system refrigerant and assures the 4-way valve is seated before returning to normal heating compressor operation.

Defrost Inactive

When defrost operation is in the inactive state, action of the compressor devices is a dictated by the applicable heating or cooling compressor state.

4 Way Reversing Valve Control (4WV) – Heat Pump Units Only

4WV is energized (On) when the unit is in the MinDAT or Heating operating state. 4WVG is de-energized (OFF) when the unit is in the Cooling operating state.

NOTE: Once switched, the 4WV remains in the new position until the unit's state changes from Cooling to MinDAT or Heating or viceversa.

Receiver Solenoid Valve Control (SVR)

DPS heat pump units include a receiver solenoid valve that is used to direct the refrigerant to the receiver while switching the valve during the defrost cycle. The SVR valve is closed most of the time but is opened at certain points in the defrost cycle and in the Pumpdown and Standby for Restart compressor operating states.

Bypass Solenoid Valve Control (SVB)

DPS units include a bypass solenoid valve that opens when necessary to bypass refrigerant from the high to the low side of the inverter compressor to reduce the load on the compressor. The bypass solenoid is closed most of the time. Refer to the descriptions of the compressor operating states and protection control functions for details regarding when the bypass valve is opened.

Inverter Board Fault Codes

MicroTech III communicates with the fan and compressor inverter boards via Modbus. If the inverter boards detect an unsafe condition they issue the appropriate control commands and an error code can be read at the MicroTech III display as follows:

- Go to Main menu – Alarm lists – Active alarms – Alarm details - INV/OF Flt Code Details
- The error code is shown at “INVAlarmCode” and the error description is shown at “Code text” as shown in Figure 17.

Possible Inverter Compressor fault codes are listed in Table 71 below:

Table 71: Rebel Inverter Compressor Fault Codes

Fault Code	HMI Code Text	Extended Text
E5	Compressor Lock	Compressor Locked
L1	Current Sensor Alm	Current Sensor Alarm
L1	DC Cur Sensor Alm	DC Current Sensor Alarm
L1	EEPROM Setup Problem	EEPROM Setup Problem
L1	IGBT Problem	Insulated Gate Bipolar Transistor Problem
L1	JP Setup Problem	LP Setup Problem
L1	Momntry Ovrcurrent	Momentary Over Current
L4	Fin Temp Rise	Fin Temperature Rise
L5	Momntry Ovrcur (DC)	Momentary DC Over Current
L8	Elec Therm (Cur1)	Electrical Thermal (Current 1)
L8	Elec Therm (Cur2)	Electrical Thermal (Current 2)
L8	Elec Therm (Step)	Electrical Thermal (Out of Step)
L8	Elec Therm (Surge)	Electrical Thermal (Surge)
L8	Time Lag Ovr Current	Time Lag Over Current
L9	Stall Prevent (Strt)	Startup Prevention (Startup)
P1	Pwr Sup Imbalance	Power Supply Imbalance
P4	Fin Temp Sensor Alm	Fin Temperature Sensor Alarm
PJ	Model Setup Problem	Model Setup Problem
U2	Phase Pwr Loss	Phase Power Loss
U2	PN Short Circuit Alm	PN Electrical Short Circuit Alarm
U2	Pwr Sup Insufficient	Power Supply Insufficient

Possible outdoor fan fault codes are listed in Table 72 below.

Table 72: Rebel Outdoor Fan Fault Codes

Fault Code	HMI Code Text	Extended Text
E7	IPM Prot Active	IPM Protection Active
E7	Momntry Ovrcurrent	Momentary Over Current
E7	Motor Lock	Motor Locked
H7	Motor Alarm	Motor Alarm
L1	EEPROM Problem	EEPROM Problem
L1	EEPROM Setup Problem	EEPROM Setup Problem
L1	JP Setup Problem	JP Setup Problem
L4	Fin Temp Rise	Fin Temperature Rise
P4	Fin Temp Sensor Alm	Fin Temperature Sensor Alarm
PJ	Model Setup Problem	Model Setup Problem
U2	Pwr Sup Voltage Alm	Power Supply Voltage Alarm

Detailed description and diagnostic instructions are shown on the following pages.

Figure 17: Inverter Board Fault Codes

Fault Code Details
ACTIVE FAULT CODES
INVAlarmCode=_____
Code Text
OF1AlarmCode=_____
Code Text
OF2AlarmCode=_____
Code Text
PREVIOUS FAULT CODES
PrvINVAlmCode=_____
Code Text
MM/DD/YYYY HH:MM:SS
PrvOF1AlmCode=_____
Code Text
MM/DD/YYYY HH:MM:SS
PrvOF2AlmCode=_____
Code Text
MM/DD/YYYY HH:MM:SS

Troubleshooting Module-to-Module Communication

There are three status parameters on the HMI that are designed to aid in diagnosing communication problems related to the IFB board. These are IFBCommStatus=, ACS1 DataRcvd= and ACS3 DataRcvd= and are described below. Also refer to Figure 3 on page 6.

IFBCommStatus

The IFB communication status parameter indicates problems with the communication between the MicroTech III controller and the INV, OF1, OF2 and the EVB devices via the IFB board. There are 13 possible conditions indicated by this parameter. These are described as follows:

OK: All communications related to IFB Board is OK

OF2Err: Communication between the A5P board controlling OF2 and the ACS1 communication loop has been interrupted for 65 seconds after communication had initially been established. Since a break anywhere in the communication current loop will result in an ACS1Err (described below) this indicator generally suggests a defect in the A5P board.

OF1Err:
460/575V Unit—Communication between the A5P board controlling OF1 and the ACS1 communication loop has been interrupted for 65 seconds after communication had initially been established. Since a break anywhere in the communication current loop will result in an ACS1Err (described below) this indicator generally suggests a defect in the A5P board.

208/230V Unit—Communication between the A4P board controlling OF1 and the ACS1 communication loop has been interrupted for 65 seconds after communication had initially been established. Since a break anywhere in the communication current loop will result in an ACS1Err (described below) this indicator generally suggests a defect in the A4P board.

OF12Err:
460/575V Unit—Communication between both of the A5P boards controlling OF1 and OF2 and the ACS1 communication loop has been interrupted for 65 seconds after communication had initially been established. Since a break anywhere in the communication current loop will result in an ACS1Err (described below) this indicator generally suggests a defect in both the A5P boards.

208/230V Unit—Communication between the A4P board controlling OF1 and the A5P board controlling OF2 and the ACS1 communication loop has been interrupted for 65 seconds after communication had initially been established. Since a break anywhere in the communication current loop will result in an ACS1Err (described below) this indicator generally suggests a defect in both the A4P and A5P boards.

INVErr: Communication between the A4P board controlling inverter compressor (INV) and the ACS1 communication loop has been interrupted for 20 seconds after communication had initially been established. If this indicator remains active more than 120 seconds it generally suggests a defect in the A4P board.

NOTE: A break anywhere in the communication current loop will result in an ACS1Err (described below).

ACS3Err: The ACS3 communication loop between the IFB board ACS3 connector and the EVB board has been interrupted for 65 seconds after communication had initially been established. This generally indicates a physical break in the communication current loop wiring between the IFB board and the EVB board, lack of power to the EVB board or a defect in the EVB board.

ACS1Err: The ASC1 communication loop between the IFB board ASC1 connector and the A4P and A5P boards has been interrupted for 65 seconds after communication had initially been established. This indicator generally suggests a physical break or interruption somewhere in the communication current loop wiring or possibly lack of power to both A4P and A5P.

ACS13Err: The ASC1 and ACC3 communication loops between the IFB board ACS1 connector and the A4P and A5P boards and between the IFB board ACS3 connector and the EVB board have been interrupted for 65 seconds after communication had initially been established. This indicates that both of the conditions described above for ACS1Err and ACS3Err exist.

Init3Err: Proper communication was not established within 65 seconds of power up between the EVB board and the IFB board ACS3 connector. Refer also to ACS3 DataRcvd below.

Init1Err: Proper communication was not established within 65 seconds of power up between the A4P and A5P boards and the IFB board ACS1 connector. Refer also to ACS1 DataRcvd below.

Init13Err: Proper communication was not established within 65 seconds of power up between neither the EVB board and the IFB board ACS3 connector nor the A4P and A5P boards and the IFB board ACS1 connector. Refer also to ACS1 DataRcvd and ACS3 DataRcvd below.

IFBRst: 24 VAC power to the IFB was interrupted and then re-established causing a reset of the ACS1 and ACS3 communication loops.

MBErr: Communication between the MicroTech III controller and the IFB board has been interrupted for 30 seconds.

ACS1 DataRcvd

Upon power up the IFB board receives initial confirmation data from all the devices that are connected to the ACS1 channel. Problems with this confirmation are indicated with this parameter. There are 8 possible conditions indicated. These are described as follows:

ErrAll: IFB did not receive initial confirmation data from any of the devices on the ACS1 communication channel. This generally indicates a physical break in the ACS1 communication loop wiring between the IFB board and the A4P and A5P boards or lack of power to both the A4P and A5P boards.

F1F2Err: IFB did not receive initial confirmation data from the OF2 nor OF1 on the ACS1 communication channel. This generally indicates a defect in both the boards controlling OF1 (A4P or A5P) and OF2 (A5P).

INVF2Err: IFB did not receive initial confirmation data from the INV nor OF2 on the ACS1 communication channel. This generally indicates a defect in both the boards controlling INV (A4P) and OF2 (A5P).

F2Err: IFB did not receive initial confirmation data from the OF2 on the ACS1 communication channel. This generally indicates a defect in the board controlling OF2 (A5P).

INVF1Err: IFB did not receive initial confirmation data from the INV or OF1 on the ACS1 communication channel. This generally indicates a defect in both the boards controlling INV (A4P) and OF1 (A4P or A5P).

F1Err: IFB did not receive initial confirmation data from the OF1 on the ACS1 communication channel. This generally indicates a defect in the board controlling OF1 (A4P or A5P).

INVErr: IFB did not receive initial confirmation data from the INV on the ACS1 communication channel. This generally indicates a defect in the board controlling INV (A4P).

AllOK: All initial confirmation data has been received from all the devices on the ACS1 communication loop.

ACS3 DataRcvd

Upon power up the IFB board receives confirmation data from all the devices that are connected to the ACS3 channel. Problems with this confirmation are indicated with this parameter. There are 2 possible conditions indicated. These are described as follows:

Error: IFB did not receive initial confirmation data from the EVB board on the ACS3 communication channel. This generally indicates a physical break in the ACS3 communication loop wiring between the IFB board and the EVB board, lack of power to the EVB board or a defect in the EVB board.

OK: All initial confirmation data has been received from all the EVB board on the ACS3 communication channel.

Figure 18: Unit will not Start with Compressor Cooling

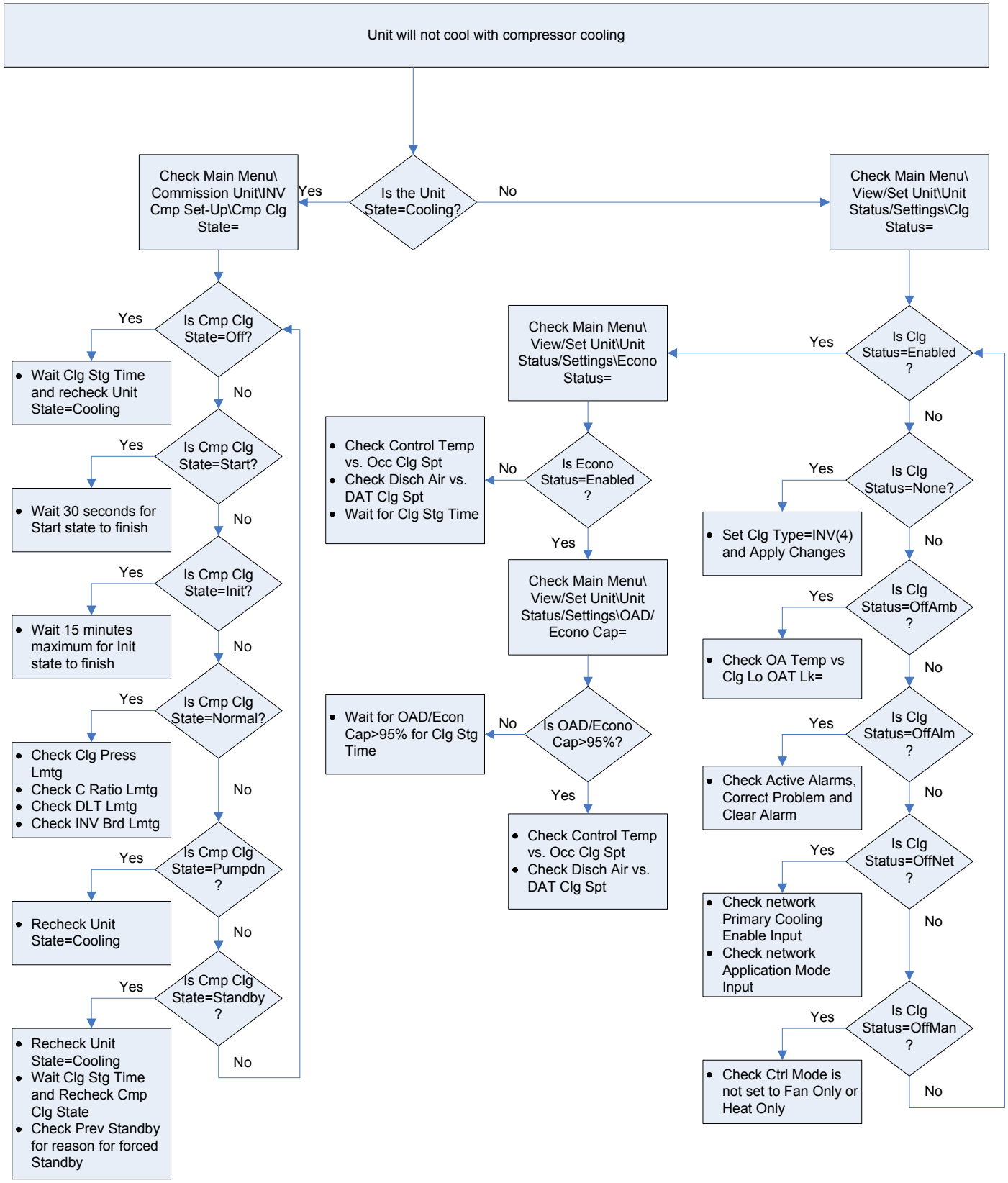
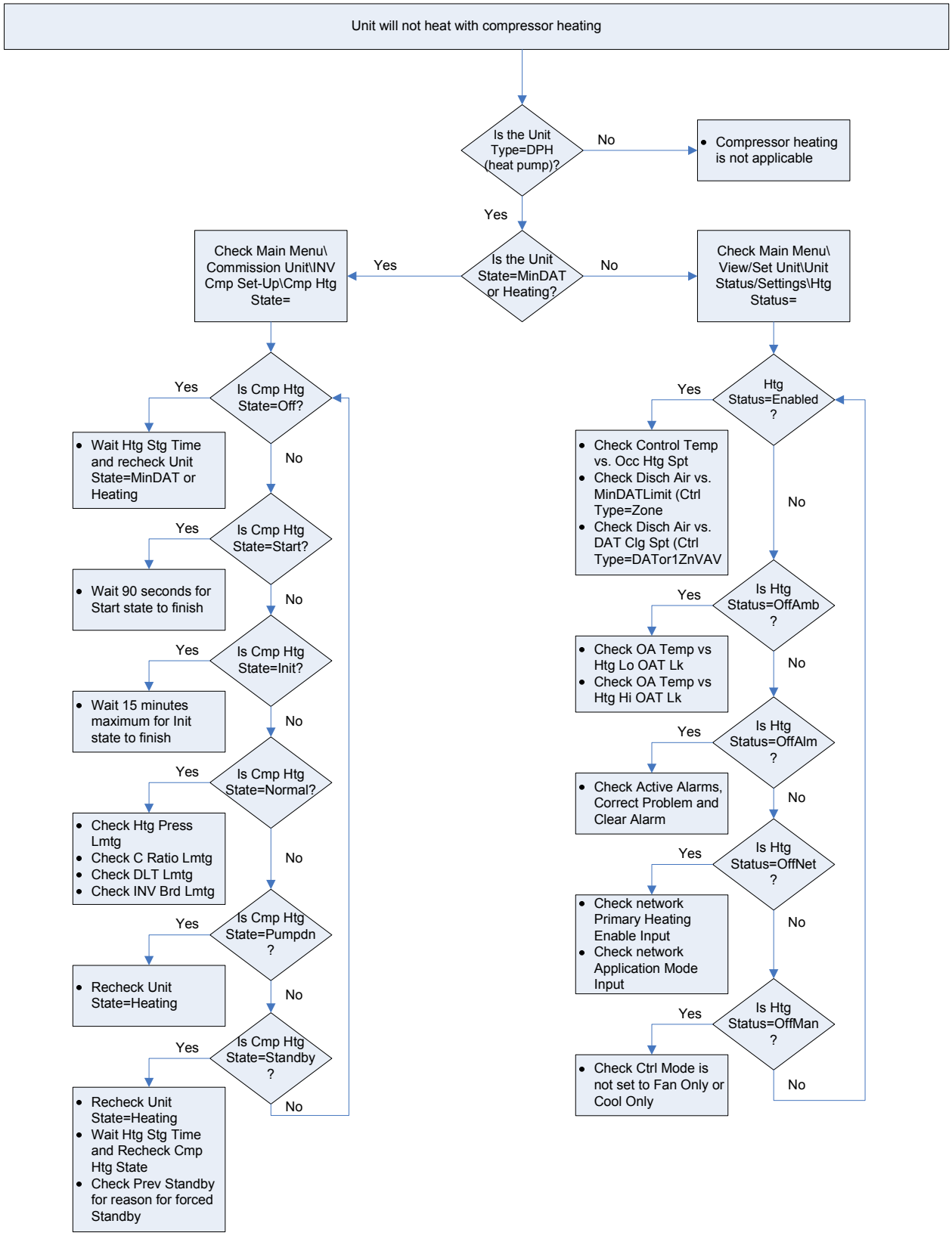


Figure 19: Unit will not Heat with Compressor Heating

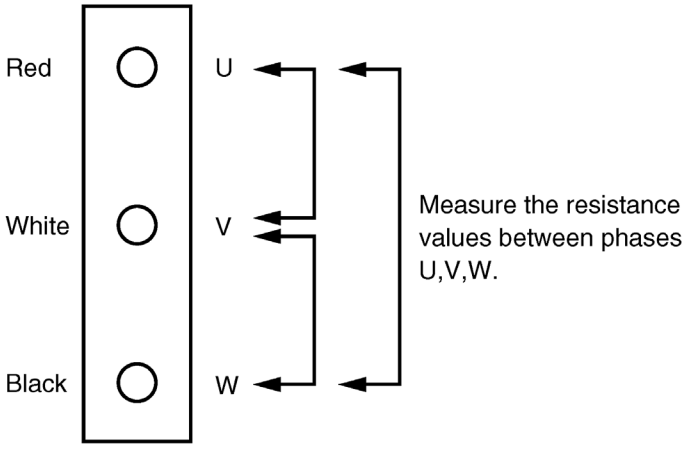


The Check 1, Check 2 and Check 3 procedures on page 74 and 75 are used to troubleshoot many error codes.

CHECK 1

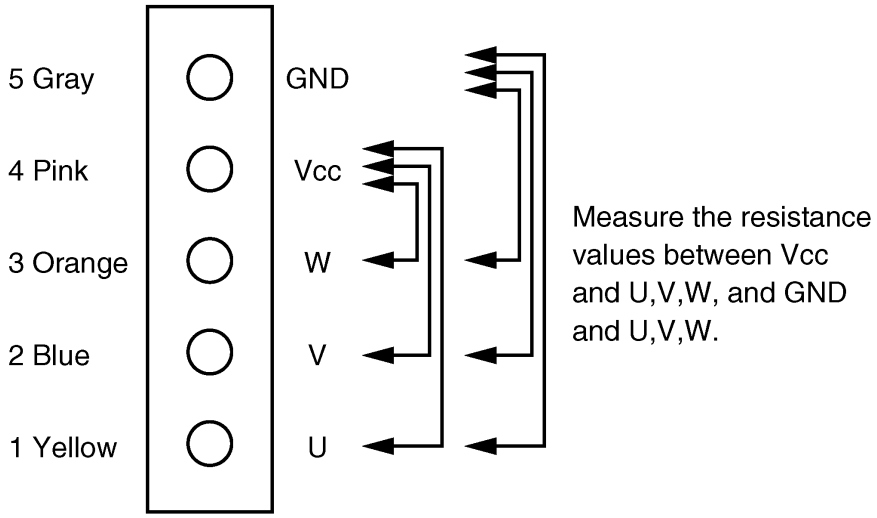
Check on connector of fan motor (Power supply cable)

1. Turn OFF the power supply.
   Measure the resistance between phases of U,V,W at the motor side connectors (three-core wire) to check that the values are balanced and there is no short circuiting, while connector or relay connector is disconnected.



CHECK 2

1. Turn OFF the power supply.
2. Measure the resistance between Vcc and each phase of U, V, W, and GND and each phase at the motor side connectors (five-core wire) to check that the values are balanced within the range of ± 20 %, while connector or relay connector is disconnected. Furthermore, to use a multiple meter for measurement, connect the probe of negative pole to Vcc and that of positive pole to GND.

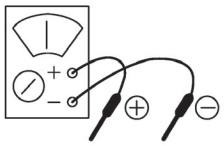


CHECK 3 – Power Resistor Check

Perform the following procedures prior to check.
(1) Power Off.
(2) Remove all the wiring connected to the PC board where power transistors are mounted on.

[Preparation]

· Tester



* Preparing a tester in the analog system is recommended. A tester in the digital system with diode check function will be usable.

[Point of Measurement and Judgment Criteria]

· Measure the resistance value using a tester at each point of measurement below, 10 minutes later after power OFF.

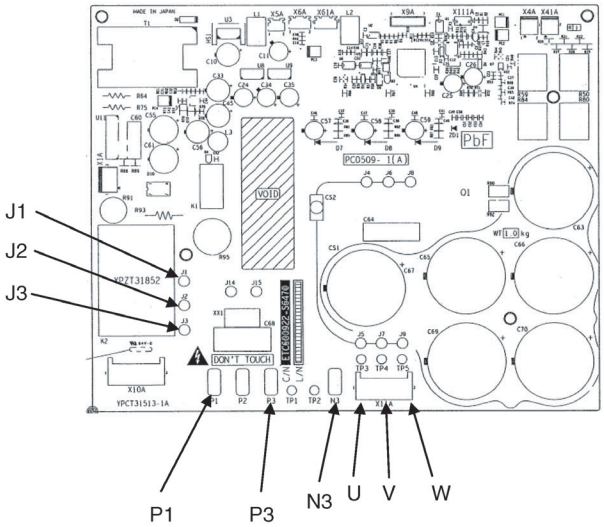
To use analog tester:
Measurement in the resistance value mode in the range of multiplying 1kΩ.

No.	Point of Measurement		Judgment Criteria	Remarks
	+	–		
1	P2	U	2 ~ 15kΩ	
2	P2	V		
3	P2	W		
4	U	P2	15kΩ and above (including ∞)	Due to condenser charge and so on, resistance measurement may require some time.
5	V	P2		
6	W	P2		
7	N3	U		
8	N3	V		
9	N3	W		
10	U	N3	2 ~ 15kΩ	
11	V	N3		
12	W	N3		

To use digital tester:
Measurement is executed in the diode check mode. (→|←)

No.	Point of Measurement		Judgment Criteria	Remarks
	+	–		
1	P2	U	1.2V and over	Due to condenser charge and so on, resistance measurement may require some time.
2	P2	V		
3	P2	W		
4	U	P2	0.3 ~ 0.7V	
5	V	P2		
6	W	P2		
7	N3	U		
8	N3	V		
9	N3	W		
10	U	N3	1.2V and over	Due to condenser charge and so on, resistance measurement may require some time.
11	V	N3		
12	W	N3		

[PC board and Circuit Diagram]

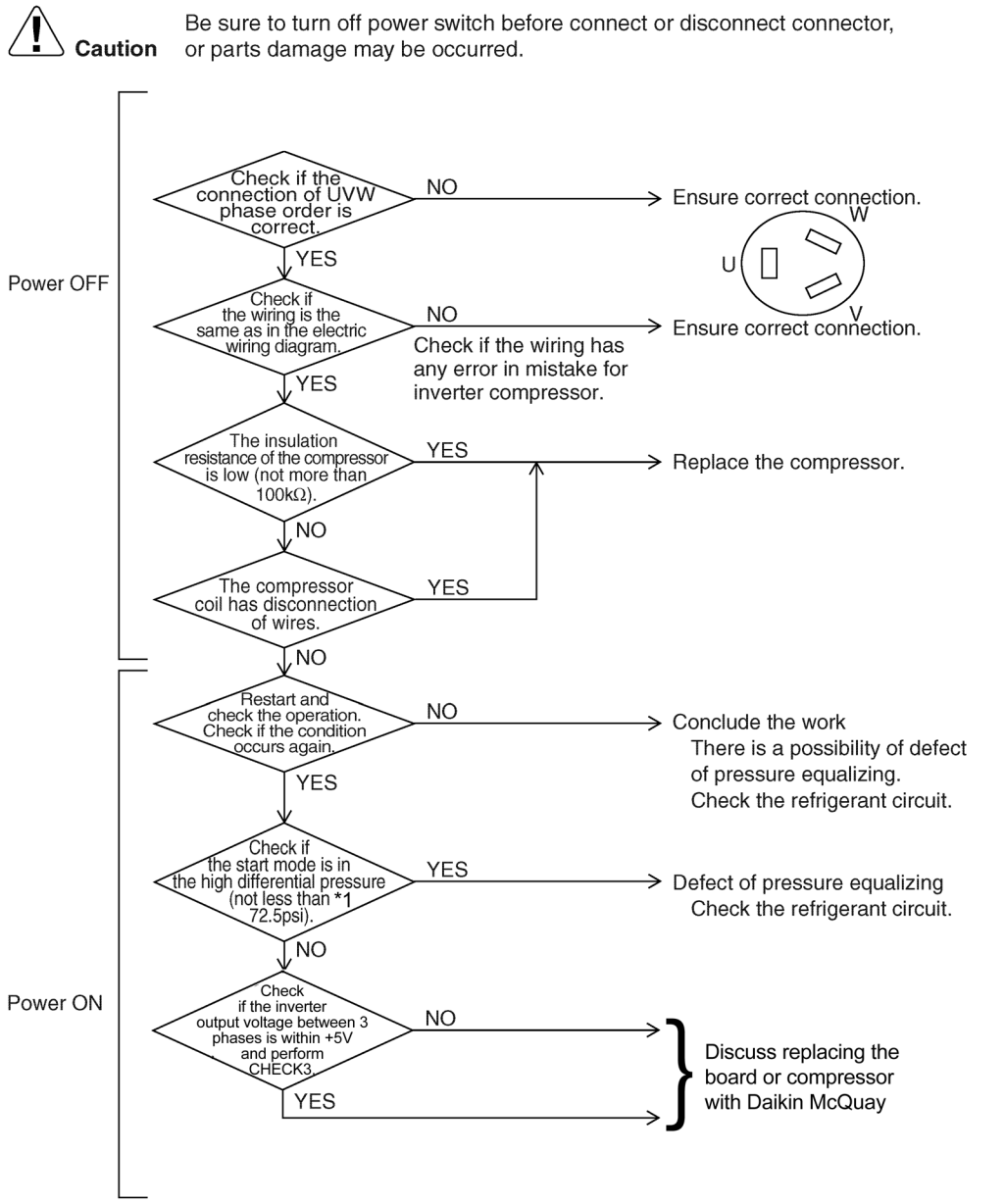


(V2895)

ERROR CODE: E5 – Inverter Compressor Motor Lock

Remote Controller Display	E5
Method of Malfunction Detection	Inverter PC board takes the position signal from UVW line connected between the inverter and compressor, and the malfunction is detected when any abnormality is observed in the phase-current waveform.
Malfunction Decision Condition	This malfunction will be output when the inverter compressor motor does not start up even in forced startup mode.
Supposed Causes	● Inverter compressor lock ● High differential pressure (72.5psi or more) ● Incorrect UVW wiring ● Faulty inverter PC board

Figure 20: E5 – Inverter Compressor Motor Lock

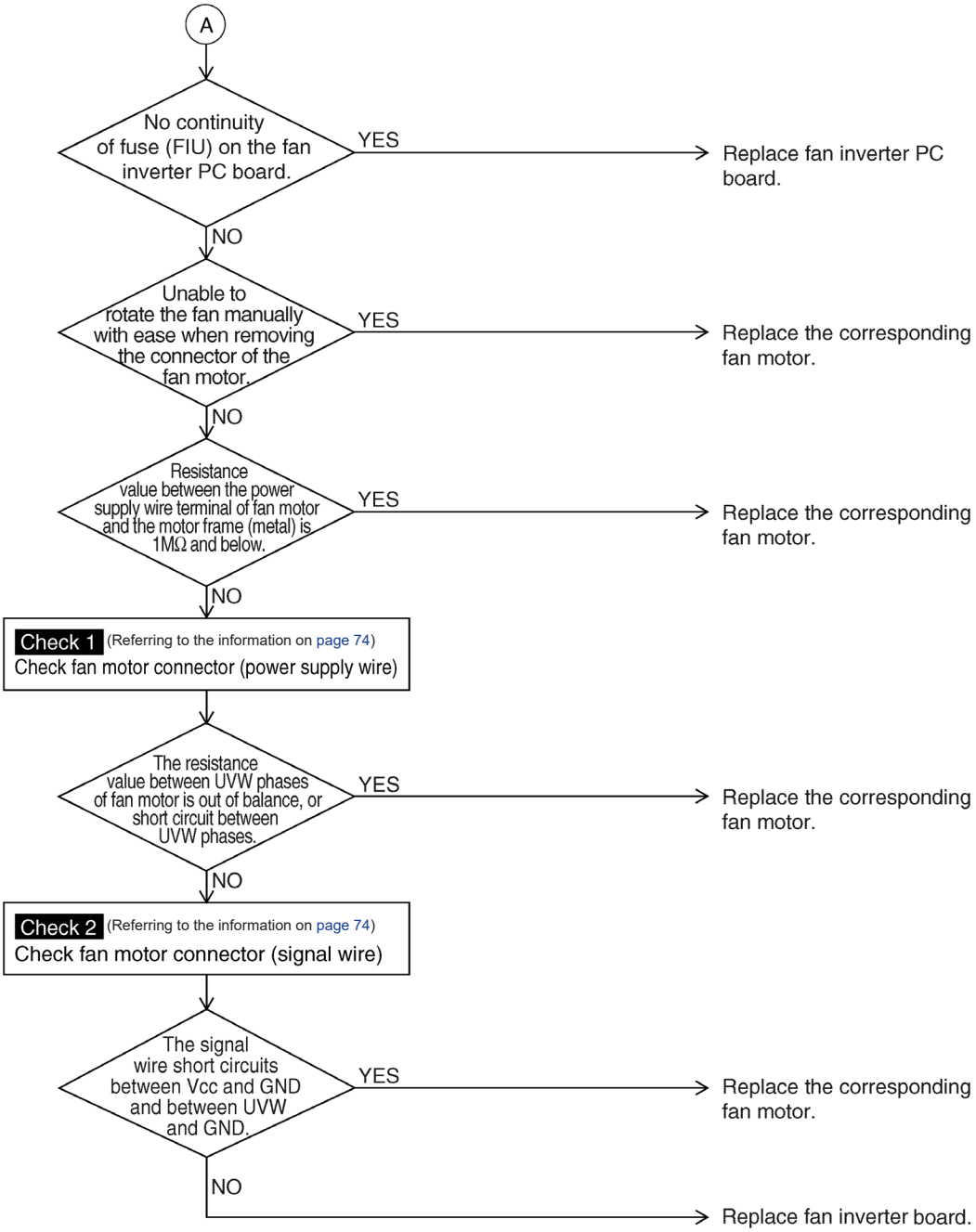


*1: Pressure difference between high pressure and low pressure before starting.
*2: The quality of power transistors/ diode modules can be judged by executing **Check 3** See page 75

ERROR CODE: E7 – Malfunction of Outdoor Unit Fan Motor

Remote Controller Display	E7
Method of Malfunction Detection	Detect a malfunction based on the current value in the INVERTER PC board (as for motor 2 current value in the fan PC board). Detect a malfunction for the fan motor circuit based on the number of rotation detected by hole IC during the fan motor operation.
Malfunction Decision Condition	● Overcurrent is detected for INVERTER PC board (A2P) or fan INVERTER PC board (A5P) (System down is caused by 4 times of detection.) ● In the condition of fan motor rotation, the number of rotation is below the fixed number for more than 6 seconds. (System down is caused by 4 times of detection.)
Supposed Causes	● Failure of fan motor ● Defect or connection error of the connectors/ harness between the fan motor and PC board ● The fan can not rotate due to any foreign substances entangled. ● Clear condition: Continue normal operation for 5 minutes

Figure 21: E7 – Malfunction of Outdoor Unit Fan Motor



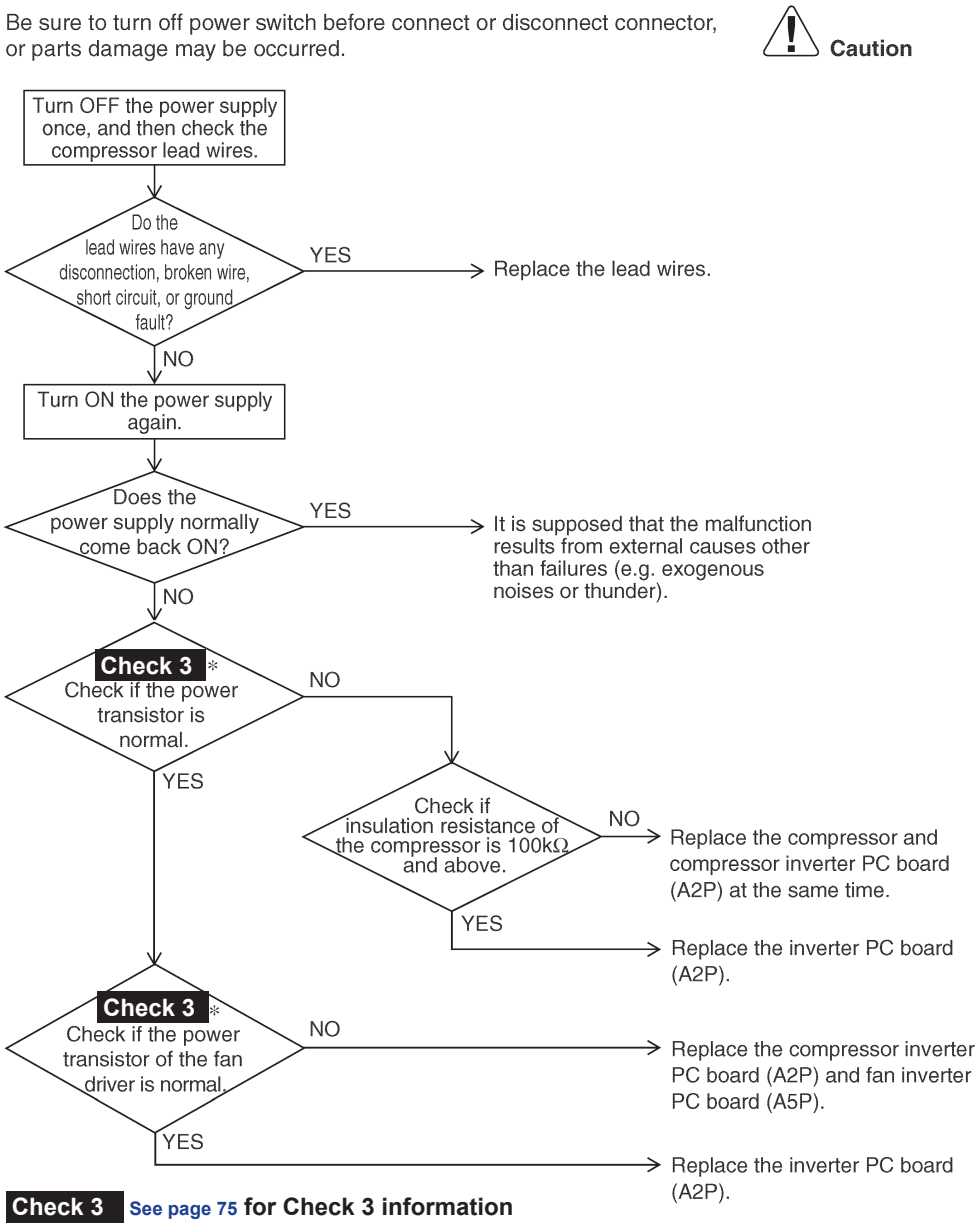
ERROR CODE: H7 – Abnormal Outdoor Fan Motor Signal

Remote Controller Display	H7
Method of Malfunction Detection	Detection of abnormal signal from fan motor.
Malfunction Decision Condition	In case of detection of abnormal signal at starting fan motor.
Supposed Causes	● Abnormal fan motor signal (circuit malfunction) ● Broken, short or disconnection connector of fan motor connection cable ● Fan Inverter PC board malfunction (A2P)
Perform	● Check 1 and Check 2 on page 74

ERROR CODE: L1 – Defective Inverter PC Board

Remote Controller Display	L1
Method of Malfunction Detection	Malfunction is detected based on the current value during waveform output before starting compressor. Malfunction is detected based on the value from current sensor during synchronous operation when starting the unit..
Malfunction Decision Condition	Overcurrent (OCP) flows during waveform output. Malfunction of current sensor during synchronous operation. IPM failure.
Supposed Causes	● Inverter PC board (A2P) – IPM failure – Current sensor failure – Drive circuit failure

Figure 22: L1 – Defective Inverter PC Board



ERROR CODE: L4 – Malfunction of Inverter Radiating Fin Temperature Rise

Remote Controller Display	L4
Method of Malfunction Detection	Fin temperature is detected by the thermistor of the radiation fin.
Malfunction Decision Condition	When the temperature of the inverter radiation fin increases above 188.6°F.
Supposed Causes	● Actuation of fin thermal (Actuates above 188.6°F) ● Defect of inverter PC board ● Defect of fin thermistor

Figure 23: L4 – Malfunction of Inverter Radiating Fin Temperature Rise

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.

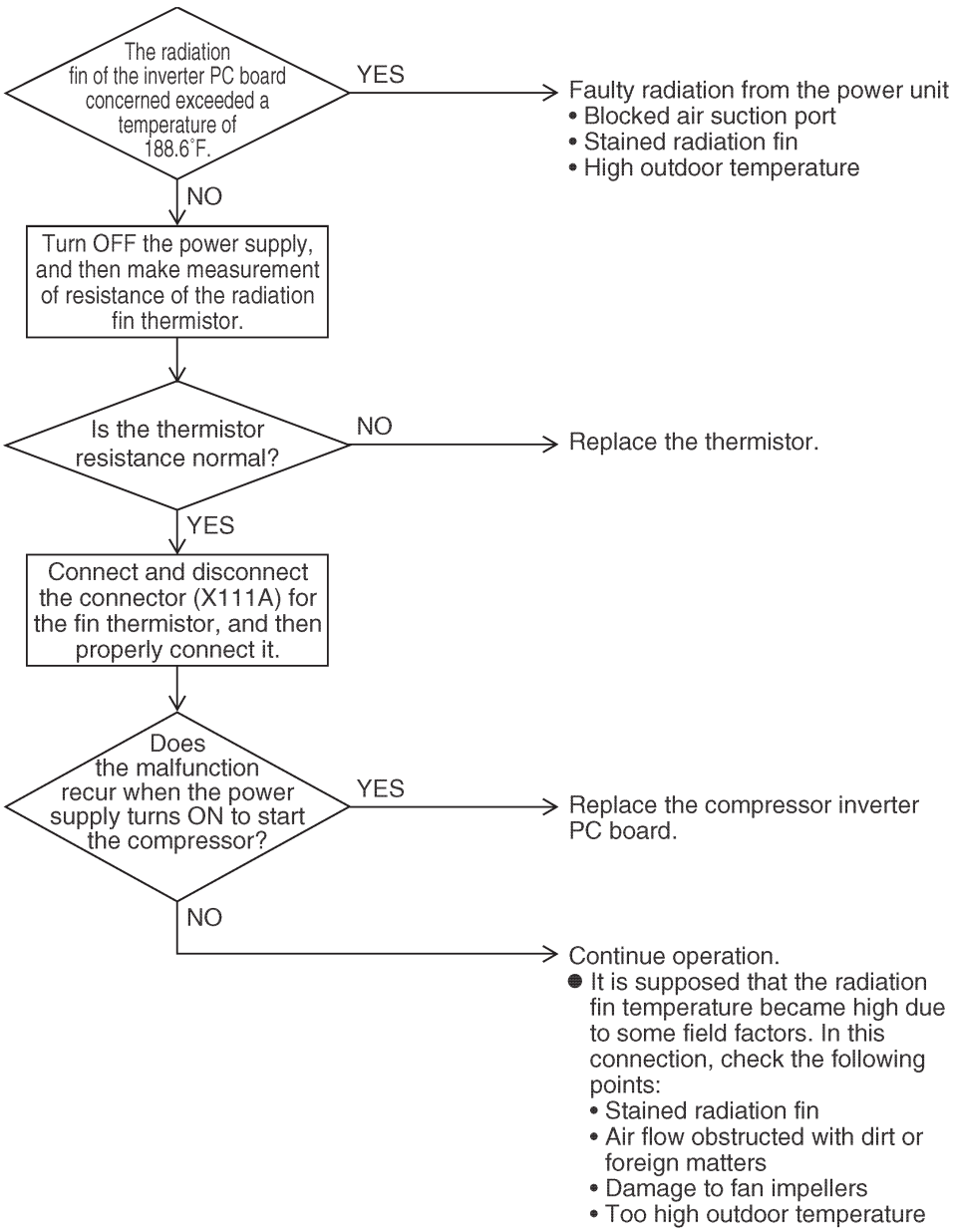
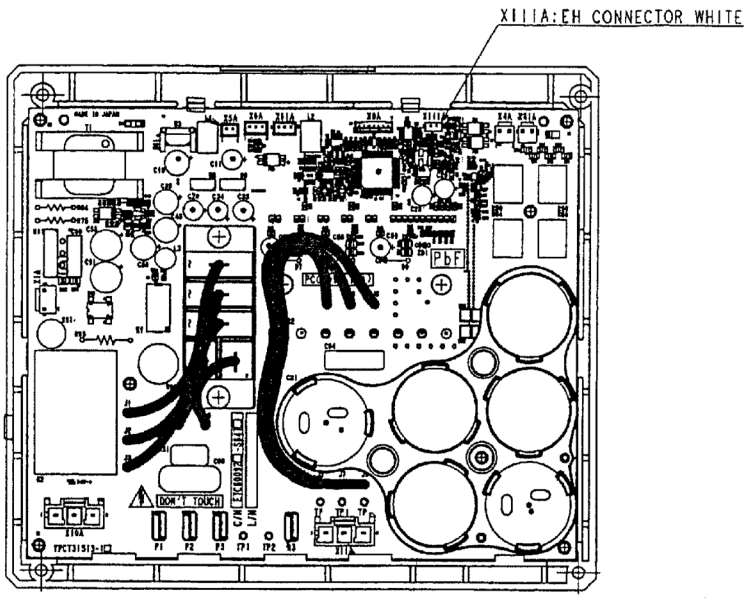


Figure 24: L4 – Malfunction of Inverter Radiating Fin Temperature Rise

Thermistor Resistance/Temperature Characteristics

Outdoor unit fin thermistor R1T

T°F	T°C	kΩ
14	-10	—
18	-8	—
21	-6	88.0
25	-4	79.1
28	-2	71.1
32	0	64.1
35	2	57.8
39	4	52.3
43	6	47.3
46	8	42.9
50	10	38.9
54	12	35.3
57	14	32.1
61	16	29.2
64	18	26.6
68	20	24.3
72	22	22.2
75	24	20.3
79	26	18.5
82	28	17.0
86	30	15.6
90	32	14.2
93	34	13.1
97	36	12.0
100	38	11.1
104	40	10.3
108	42	9.5
111	44	8.8
115	46	8.2
118	48	7.6
122	50	7.0
126	52	6.7
129	54	6.0
133	56	5.5
136	58	5.2
140	60	4.79
144	62	4.46
147	64	4.15
151	66	3.87
154	68	3.61
158	70	3.37
162	72	3.15
165	74	2.94
169	76	2.75
172	78	2.51
176	80	2.41
180	82	2.26
183	84	2.12
187	86	1.99
190	88	1.87
194	90	1.76
198	92	1.65
201	94	1.55
205	96	1.46
208	98	1.38



Inverter PC board for compressor

∗ Refer to “Thermistor Resistance / Temperature Characteristics” table

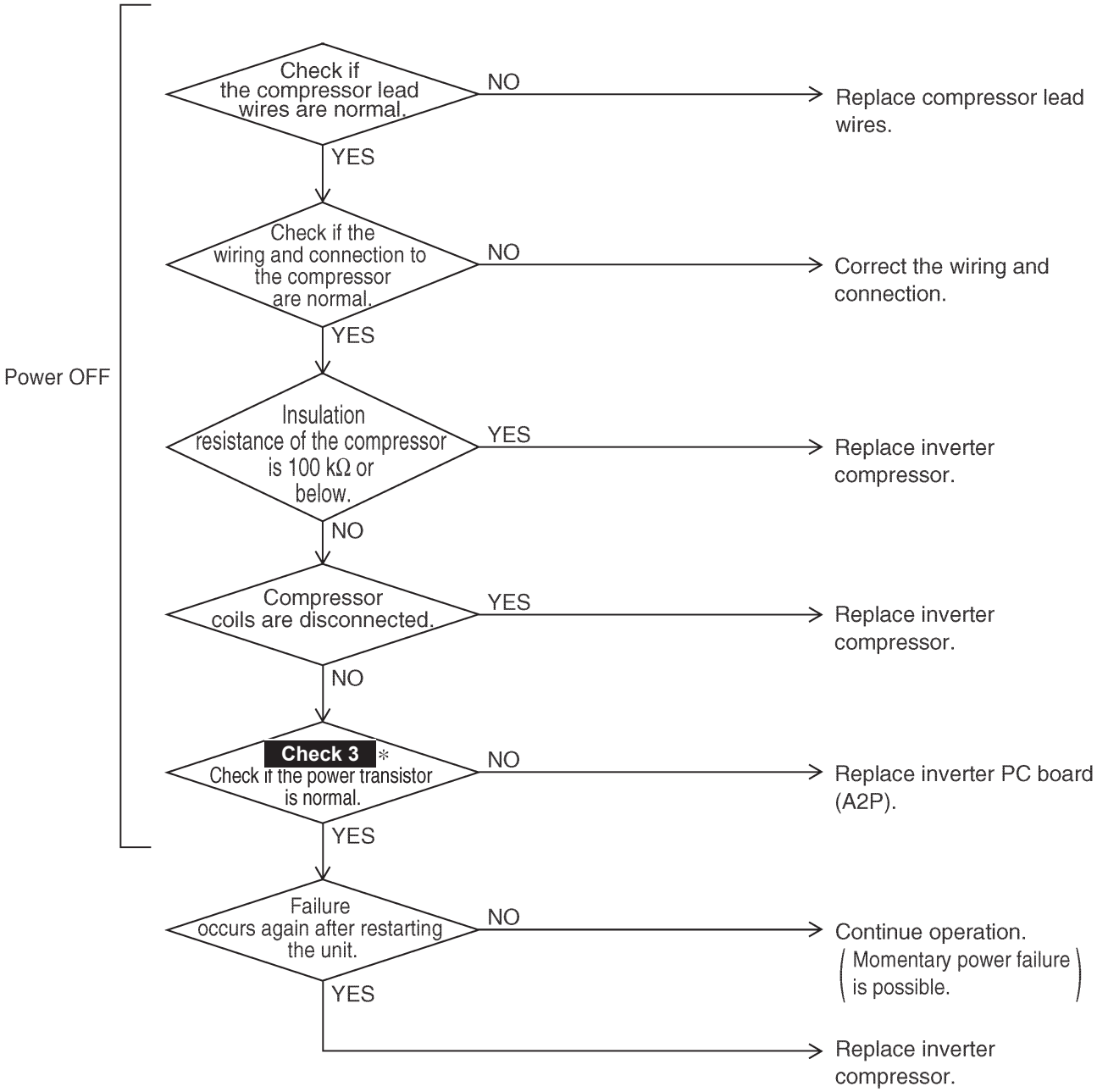
ERROR CODE: L5 – Momentary Overcurrent of Inverter Compressor

Remote Controller Display	L5
Method of Malfunction Detection	Malfunction is detected from current flowing in the power transistor.
Malfunction Decision Condition	When an excessive current flows in the power transistor. (Instantaneous overcurrent also causes activation.)
Supposed Causes	● Defect of compressor coil (disconnected, defective insulation) ● Compressor start-up malfunction (mechanical lock) ● Defect of inverter PC board

Figure 25: L5 – Momentary Overcurrent of Inverter Compressor

Compressor inspection

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



* **Check 3** See page 75

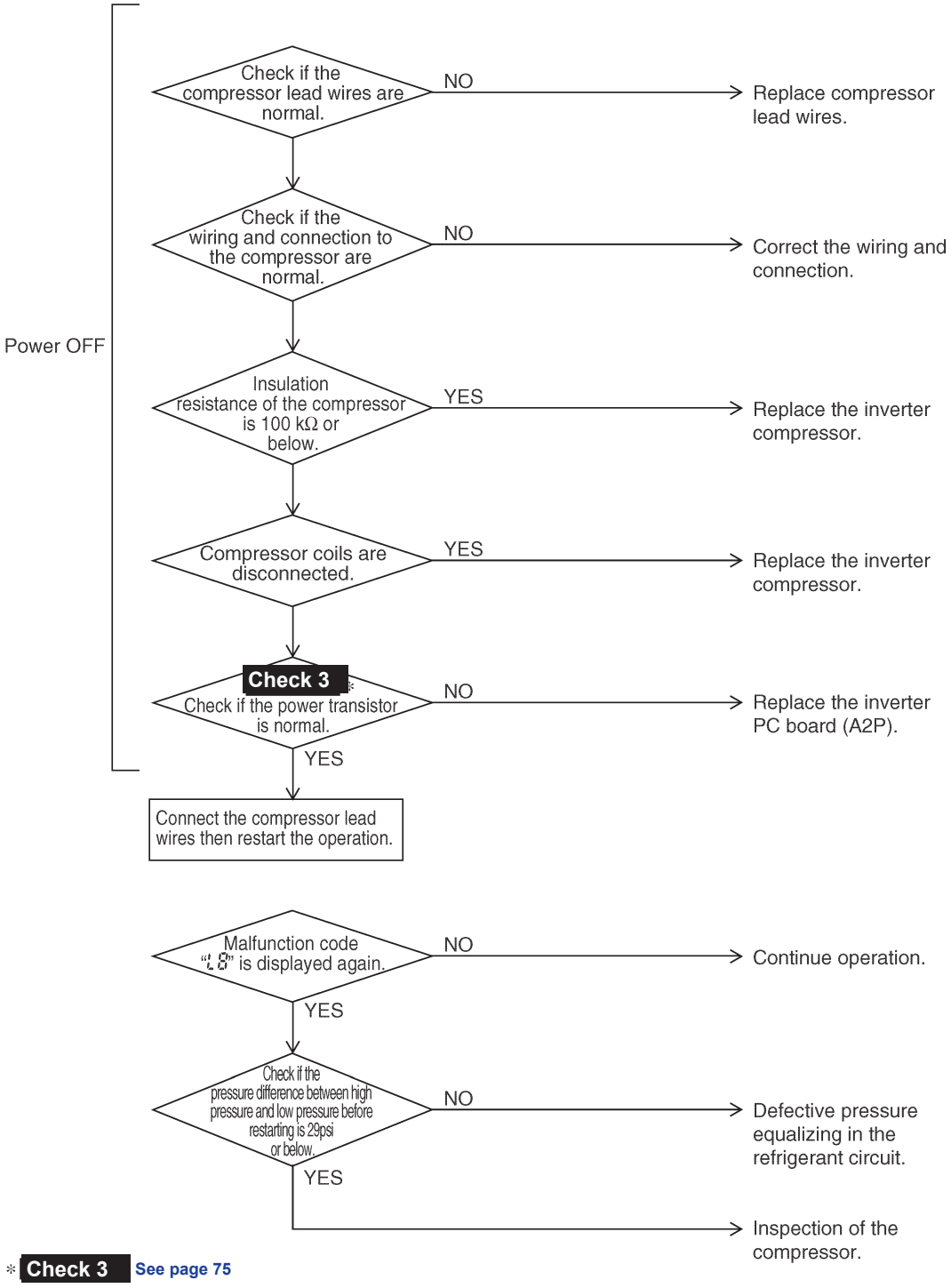
ERROR CODE: L8 – Momentary Overcurrent of Inverter Compressor

Remote Controller Display	L8
Method of Malfunction Detection	Malfunction is detected from current flowing in the power transistor.
Malfunction Decision Condition	When overload in the compressor is detected. (Inverter secondary current 16.1A) For 460V units (1) 19.0A and over continues for 5 seconds. (2) 16.1A and over continues for 260 seconds. For 230V units (1) A current of 33.5A or more continues for a period of consecutive 5 sec. (2) A current of 27.6A or more continues for a period of consecutive 260 sec.
Supposed Causes	● Compressor overload ● Compressor coil disconnected ● Defect of inverter PC board ● Faulty compressor

Figure 26: L8 – Momentary Overcurrent of Inverter Compressor

Output current check

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



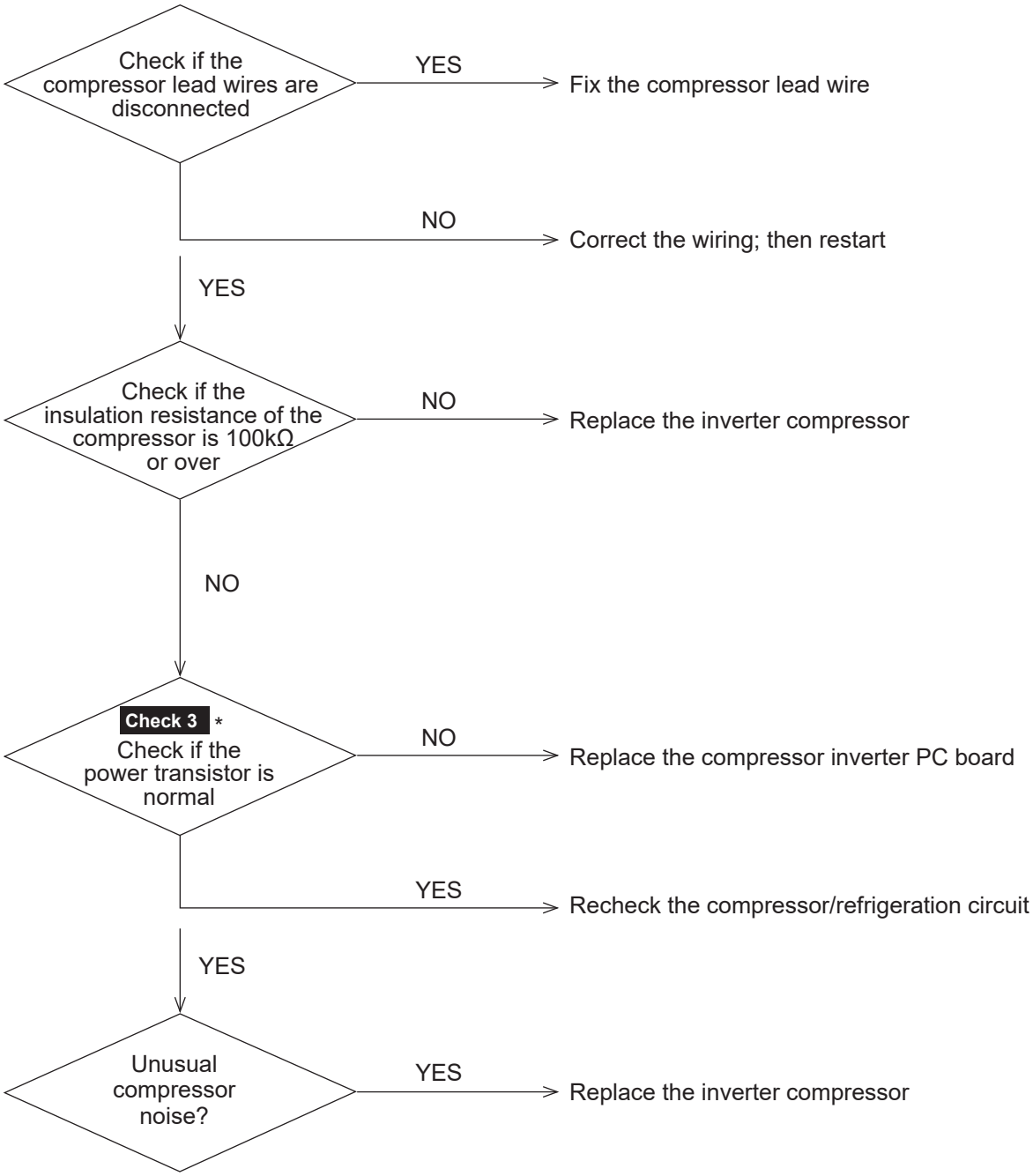
* **Check 3** See page 75

ERROR CODE: L9 – Inverter Compressor Starting Failure

Remote Controller Display	L9
Method of Malfunction Detection	Detect the failure based on the signal waveform of the compressor.
Malfunction Decision Condition	Starting the compressor does not complete.
Supposed Causes	● Defective compressor ● Wiring connection error to the compressor ● Large pressure difference before starting the compressor ● Defective inverter PC board

Figure 27: L9 – Inverter Compressor Starting Failure

Caution: Be sure to turn off power switch before connecting or disconnecting connectors to prevent parts damage.

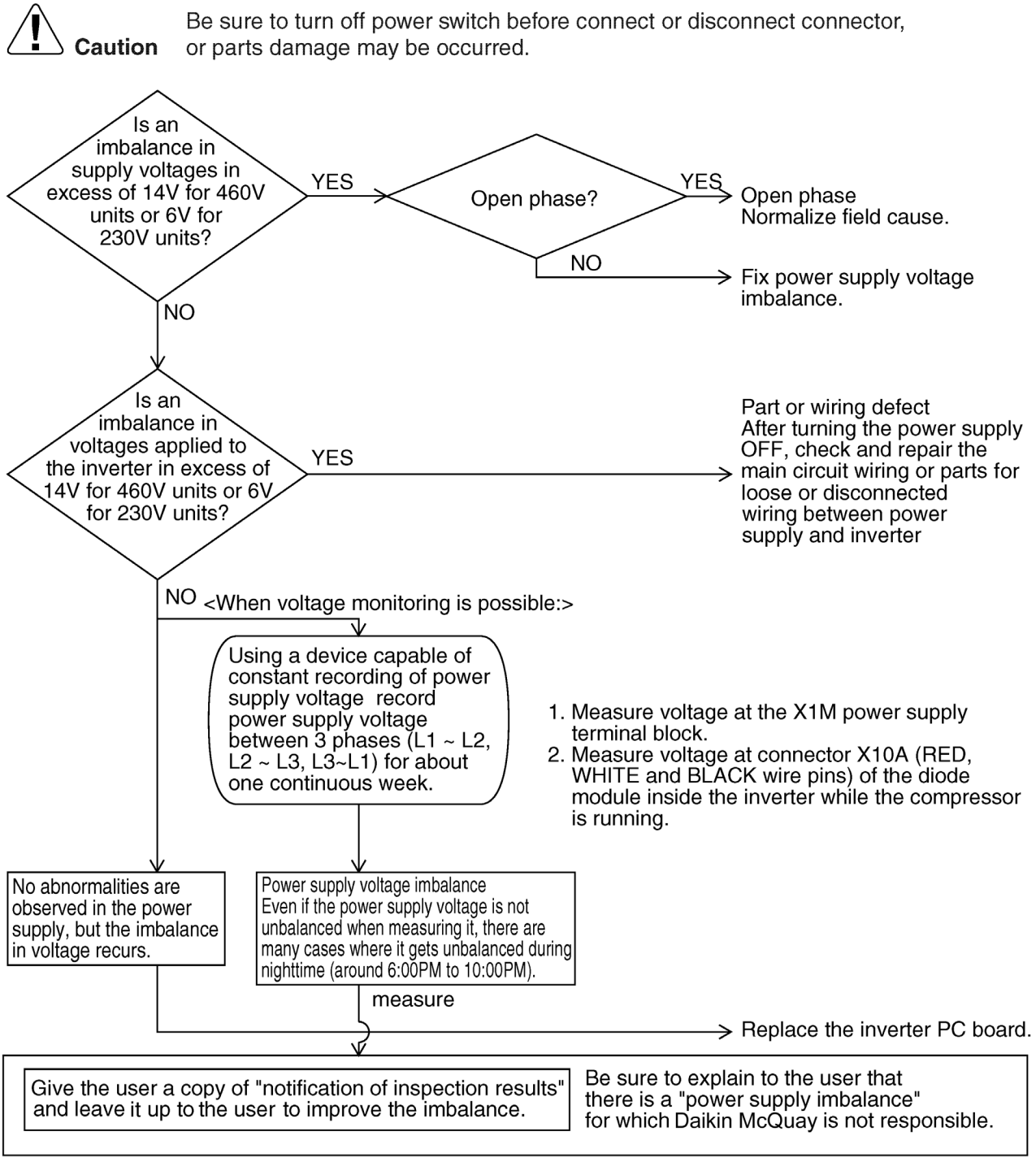


* Check 3 See page 75

ERROR CODE: P1 – Inverter Over-Ripple Protection

Remote Controller Display	P1
Method of Malfunction Detection	Imbalance in supply voltage is detected in PC board. Imbalance in the power supply voltage causes increased ripple of voltage of the main circuit capacitor in the inverter. Consequently, the increased ripple is detected.
Malfunction Decision Condition	"P1" will be displayed by pressing the inspection button. When the amplitude of the ripple exceeding a certain value is detected for consecutive 4 minutes.
Supposed Causes	● Open phase ● Voltage imbalance between phases ● Defect of main circuit capacitor ● Defect of inverter PC board ● Defect of K2 relay in inverter PC board ● Improper main circuit wiring

Figure 28: P1 – Inverter Over-Ripple Protection

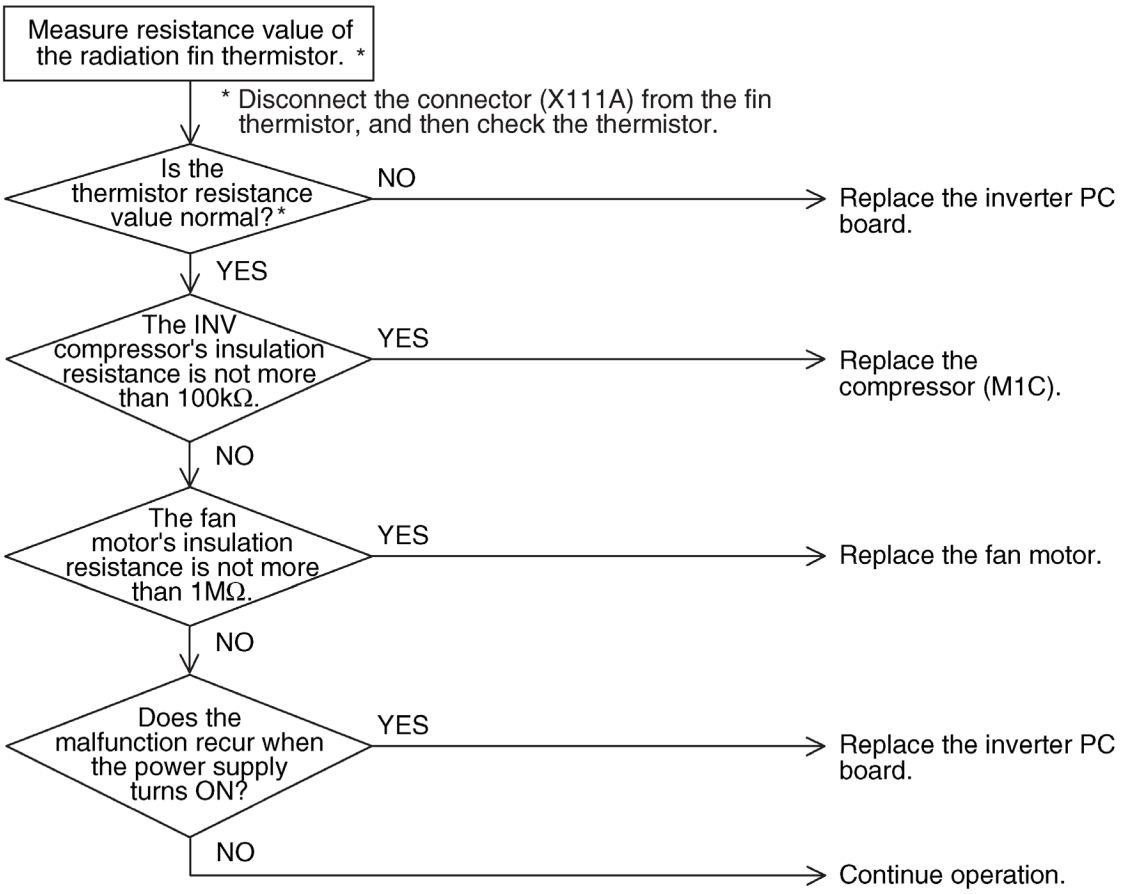


ERROR CODE: P4 – Malfunction of Inverter Radiating Fin Temperature Rise Sensor

Remote Controller Display	P4
Method of Malfunction Detection	Resistance of radiation fin thermistor is detected when the compressor is not operating. "P4" will be displayed by pressing the inspection button.
Supposed Causes	● Defect of radiator fin temperature sensor ● Defect of inverter PC board ● Faulty inverter compressor ● Faulty fan motor

Figure 29: P4 – Malfunction of Inverter Radiating Fin Temperature Rise Sensor

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



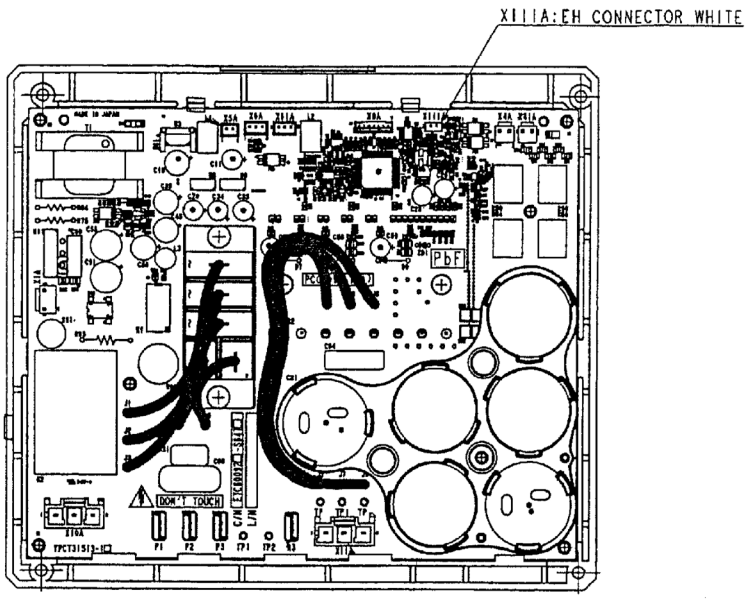
See Figure 30 on page 96

Figure 30: P4 – Malfunction of Inverter Radiating Fin Temperature Rise Sensor

Thermistor Resistance/Temperature Characteristics

Outdoor unit fin thermistor R1T

T°F	T°C	kΩ
14	-10	—
18	-8	—
21	-6	88.0
25	-4	79.1
28	-2	71.1
32	0	64.1
35	2	57.8
39	4	52.3
43	6	47.3
46	8	42.9
50	10	38.9
54	12	35.3
57	14	32.1
61	16	29.2
64	18	26.6
68	20	24.3
72	22	22.2
75	24	20.3
79	26	18.5
82	28	17.0
86	30	15.6
90	32	14.2
93	34	13.1
97	36	12.0
100	38	11.1
104	40	10.3
108	42	9.5
111	44	8.8
115	46	8.2
118	48	7.6
122	50	7.0
126	52	6.7
129	54	6.0
133	56	5.5
136	58	5.2
140	60	4.79
144	62	4.46
147	64	4.15
151	66	3.87
154	68	3.61
158	70	3.37
162	72	3.15
165	74	2.94
169	76	2.75
172	78	2.51
176	80	2.41
180	82	2.26
183	84	2.12
187	86	1.99
190	88	1.87
194	90	1.76
198	92	1.65
201	94	1.55
205	96	1.46
208	98	1.38



Inverter PC board for compressor

∗ Refer to “Thermistor Resistance / Temperature Characteristics” table

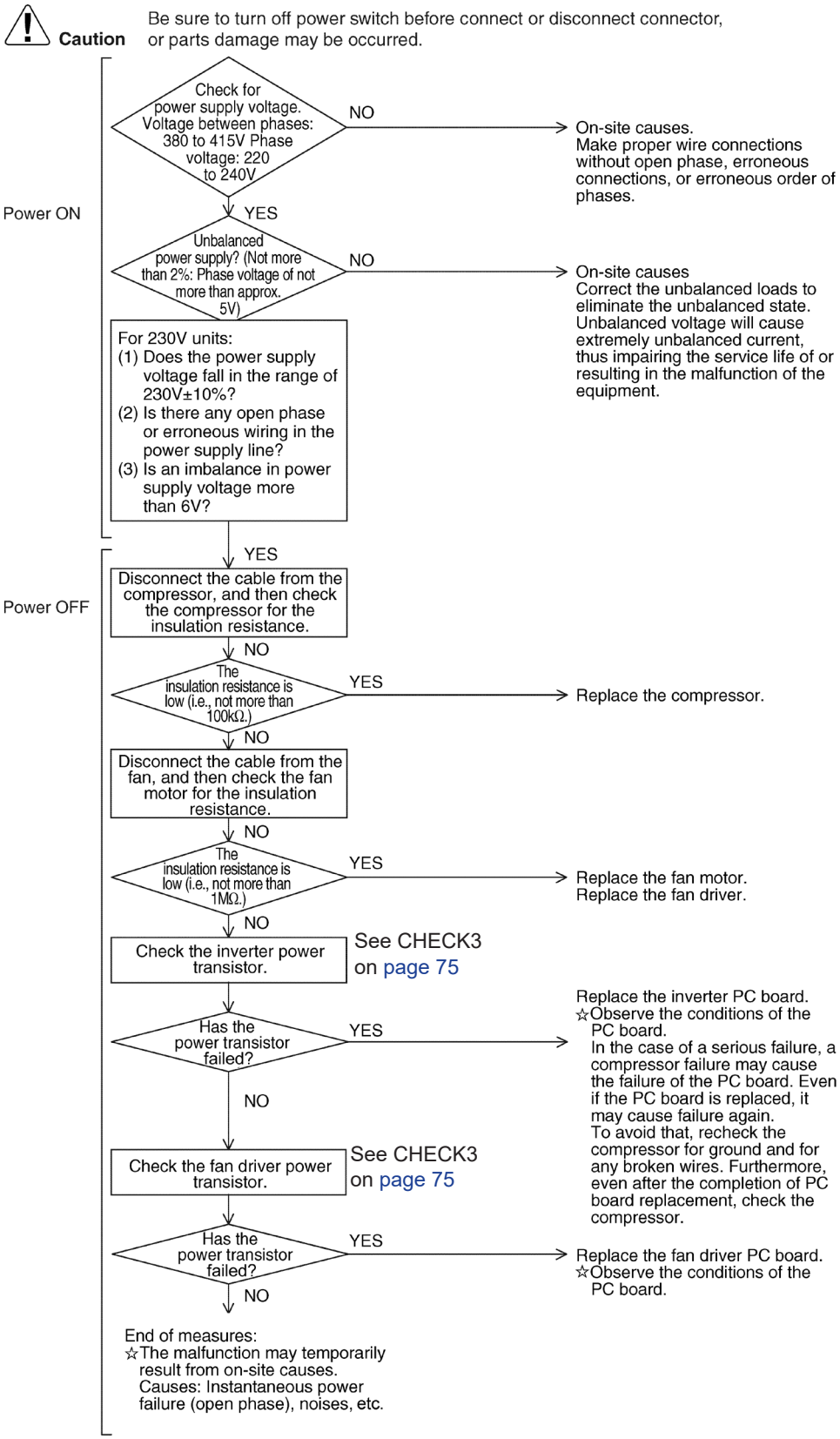
ERROR CODE: PJ – Faulty Field Setting after Replacing Main PC Board or Faulty Combination of PC Board

Remote Controller Display	PJ
Method of Malfunction Detection	This malfunction is detected according to communications with the inverter.
Malfunction Decision Condition	Make judgment according to communication data on whether or not the type of the inverter PC board is correct.
Supposed Causes	● Faulty (or no) field setting after replacing main PC board ● Mismatching of type of PC board
Recommended Action	● Contact the replacement parts supplier for resolution

ERROR CODE: U2 – Power Supply Insufficient or Instantaneous Failure

Remote Controller Display	U2
Method of Malfunction Detection	Detection of voltage of main circuit capacitor built in the inverter and power supply voltage.
Malfunction Decision Condition	When the voltage aforementioned is not less than 780V or not more than 320V, or when the current-limiting voltage does not reach 200V or more or exceeds 740V. For 230V units: When the voltage aforementioned is not more than 190V.
Supposed Causes	● Power supply insufficient ● Instantaneous power failure ● Open phase ● Defect of inverter PC board ● Defect of outdoor control PC board ● Main circuit wiring defect ● Faulty compressor ● Faulty fan motor ● Faulty connection of signal cable

Figure 31: U2 – Power Supply Insufficient or Instantaneous Failure



Supply 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.

Trending Selection Lists

Table 73: Primary Trending Select List

HMI Name	Select Abbreviation	Type	ID
Bldg Press=	BSP	2203	F0AFC4BB
Clg State=	ClgSt	230B	F0AF3991
Clg Status=	ClgSts	230B	F0AFF6A6
Clg Press Lmtg=	ClPLmtg	230B	F0AF3B4E
Cmp Ratio Lmtg=	CpRLmtg	230B	F0AF7BA2
DAT Clg Spt=	DAClgSp	2300	F0AF64FD
Dehum Status=	DeHmSts	230B	F0AF56EA
DFT=	DFT	2203	F0AFCA19
Ref DLT Lmtg=	DLLmtg	230B	F0AFB273
DRT1=	DRT1	2203	F0AFD8D7
DRT3=	DRT3	2203	F0AFF895
Duct Press=	DSP	230A	F0AF143C
Econo Status=	EcoSts	230B	F0AFC1AB
EF/LC Temp=	EFT/LCT	2203	F0AF356B
ER EAT=	EREAT	2203	F0AF0DBB
ER LAT=	ERLAT	2203	F0AFFD44
EVI Pos=	EVI%	2203	F0AF3028
EVO Pos=	EVO%	2203	F0AF17B1
EW Temp=	EWT	2203	F0AFCD6B
Htg Press Lmtg=	HtPLmtg	230B	F0AF3FE7
INV Brd Lmtg=	IBLmtg	230B	F0AFBAB2
INV Cmp Spd=	INV%	2203	F0AFDA3E
Mixed Air=	MAT	2203	F0AFCD1F
Min OA Pos=	MinOA%	230A	F0AFEEC9
Occ Clg Spt=	OcClgSp	2300	F0AFF8A8
OccSrc=	OcSrc	230B	F0AFF838
PTD=	PTD	2203	F0AF229A
PTS=	PTS	2203	F0AF404C
Return Air=	RAT	2203	F0AFA24D
Reheat Cap=	ReHt%	230A	F0AF00F8
RF/EF Cap=	RFEF%	2203	F0AFAECF
Subcooling=	SbClg	230A	F0AF842E
Space Temp=	SpaceT	2203	F0AFF74A
SRT=	SRT	2203	F0AFC35D
Superheat=	SSH	230A	F0AFB846
STD3=	STD3	2207	F0AF03CC
Sump Temp=	SumpT	2203	F0AF503D
UnoccSrc=	UnOcSrc	230B	F0AFF6B4
Unit Status =	UntSts	230B	F0AF4FF0

- Not all listed points may be available depending on the specific unit configuration

Table 74: Secondary Trending Select List

HMI Name	Select Abbreviation	Type	ID
Alarm Enumeration	Alm	230A	F0AFCF76
IAQ PPM=	CO_2	2203	F0AF7F77
Cmp Ratio Lmtg=	CpRLmtg	230B	F0AF7BA2
DAT Htg Spt=	DAHtgSp	2300	F0AF6054
Dewpoint=	Dewpt	230A	F0AF532C
Dewpoint Spt=	DewptSp	2300	F0AF75C1
Defrost State=	DFSt	230B	F0AFBD68
Ref DLT Lmtg=	DLLmtg	230B	F0AFB273
EF/LC Temp=	EFT/LCT	2203	F0AF356B
Wheel Speed=	ERWhl%	2203	F0AF101D
EVI Pos=	EVI%	2203	F0AF3028
EVO Pos=	EVO%	2203	F0AF17B1
EW Temp=	EWT	2203	F0AFCD6B
Head P Circ 1=	HdPr1	2203	F0AFD3C4
Head P Circ 2=	HdPr2	2203	F0AFE3A7
Htg State=	HtgSt	230B	F0AF4BE8
Htg Status=	HtgSts	230B	F0AFD173
Htg Press Lmtg=	HtPLmtg	230B	F0AF3FE7
INV Brd Lmtg=	IBLmtg	230B	F0AFBAB2
INV Cmp Spd=	INV%	2203	F0AFDA3E
Mixed Air=	MAT	2203	F0AFCD1F
OA Flow=	OAFlw	230A	F0AFF10A
MinOAFlw Spt=	OAFlwSp	2300	F0AF6B95
Occ Htg Spt=	OcHtgSp	2300	F0AF8A33
PTD=	PTD	2203	F0AF229A
PTS=	PTS	2203	F0AF404C
Return Air=	RAT	2203	F0AFA24D
Rem ExhF Cap=	RemEF%	2300	F0AF1969
Rem RAF Cap=	RemRF%	2300	F0AF57A7
Rem SAF Cap=	RemSF%	2300	F0AF211F
Rel Humidity=	RH	2203	F0AF1DDC
RH Setpoint=	RHSp	2300	F0AFFA18
Reheat Spt=	RhtSp	230A	F0AF335D
Subcooling=	SbClg	230A	F0AF842E
Space Temp=	SpaceT	2203	F0AFF74A
SuplHtgStatus=	SpHtSts	230B	F0AF7D21
Superheat=	SSH	230A	F0AFB846
Supl Htg Cap=	SupHt%	230A	F0AF1FEA
STD3=	STD3	2207	F0AF03CC

- Not all listed points may be available depending on the specific unit configuration.

Figure 32: DPS005A, 208V with Gas Heat and Exhaust Fan

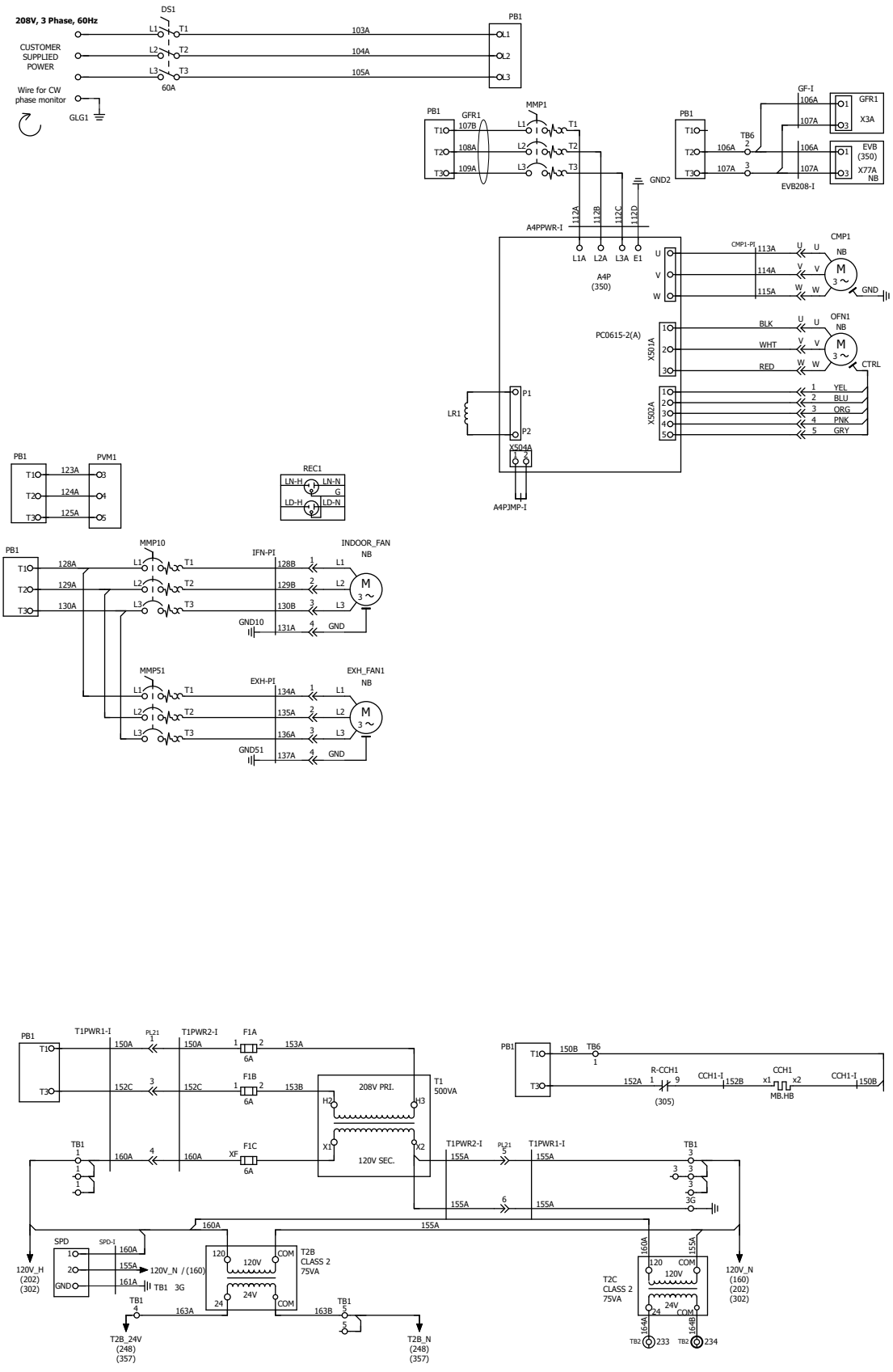


Figure 32 continued: DPS005A, 208V with Gas Heat and Exhaust Fan

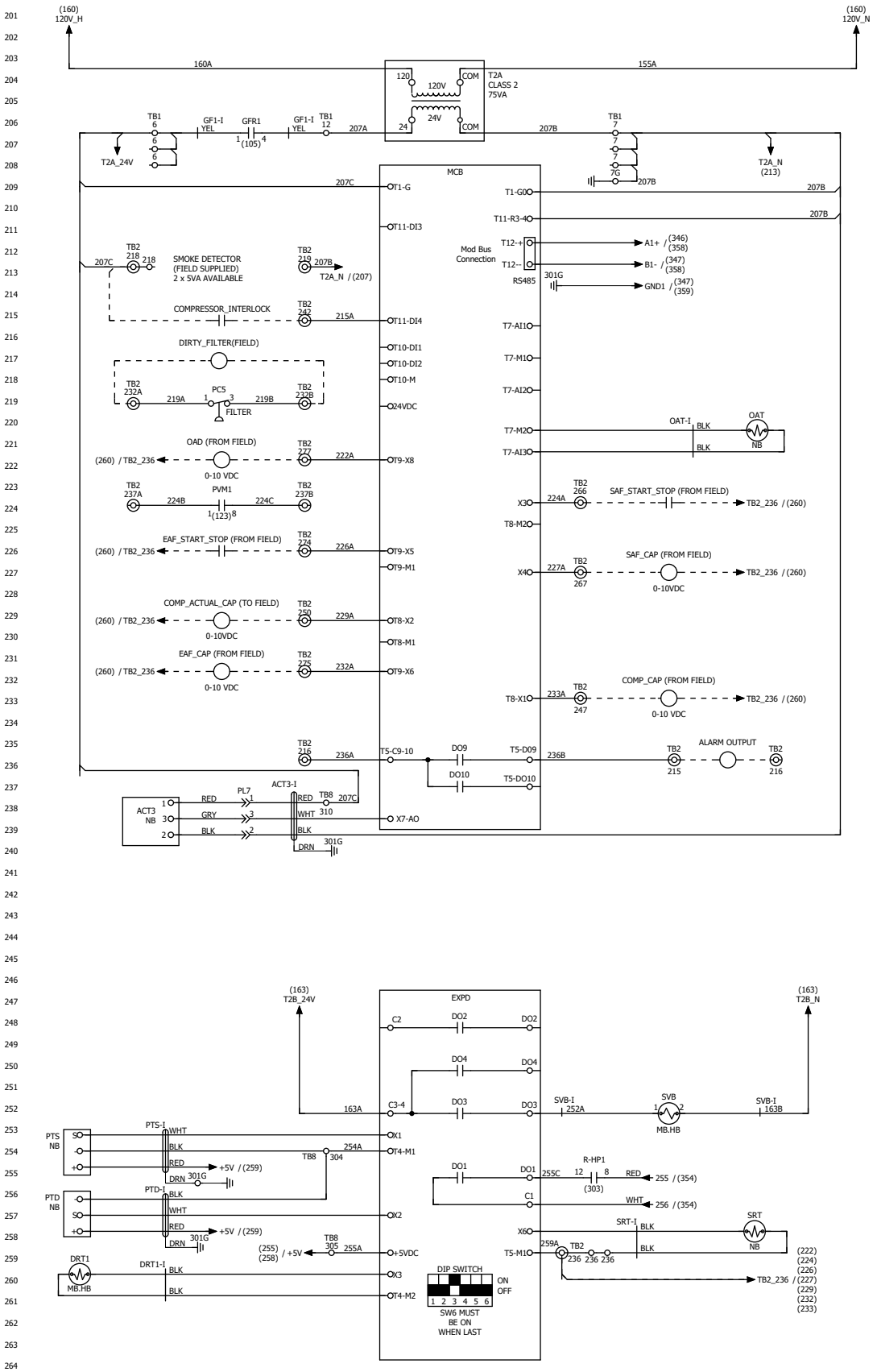


Figure 32 continued: DPS005A, 208V with Gas Heat and Exhaust Fan

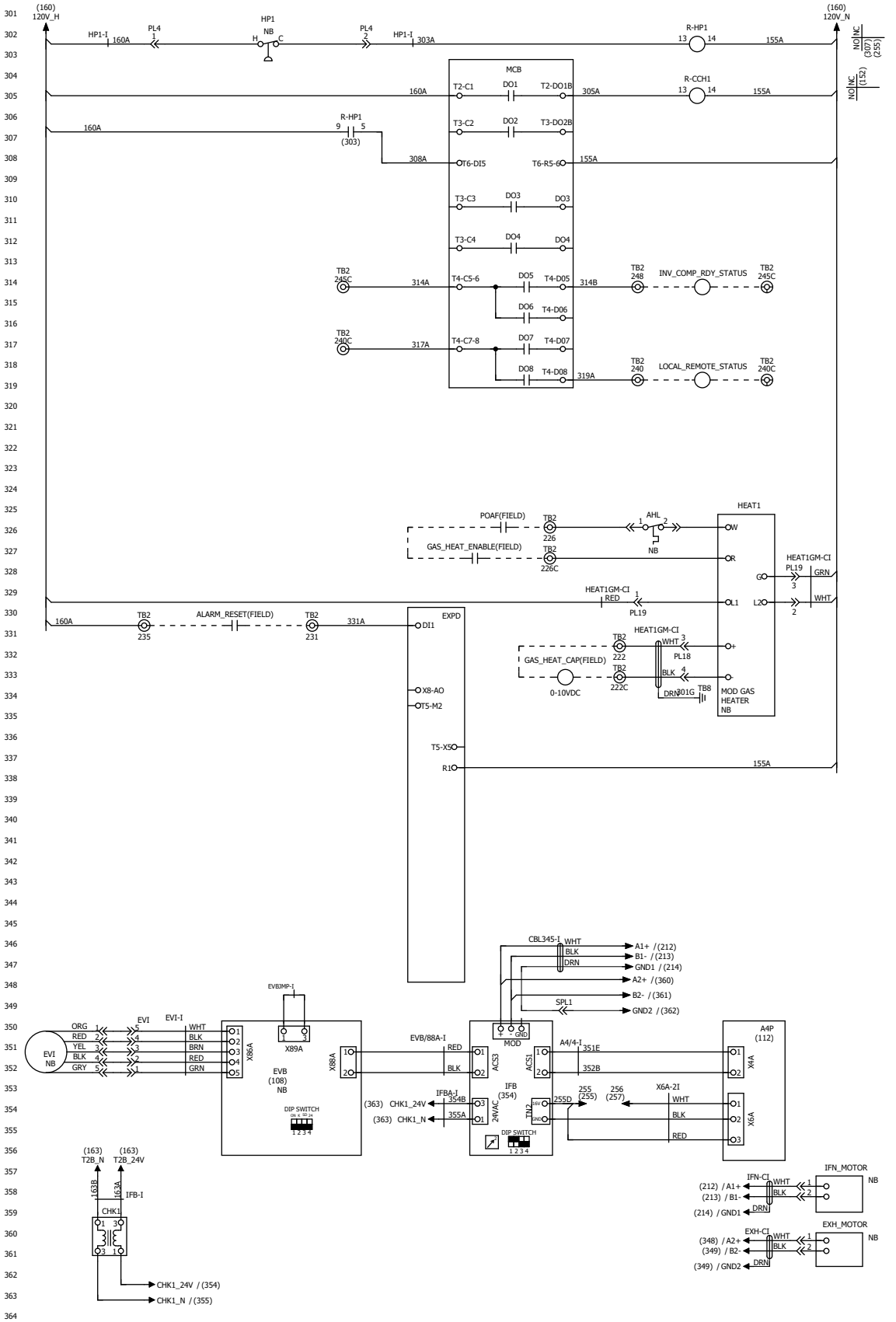
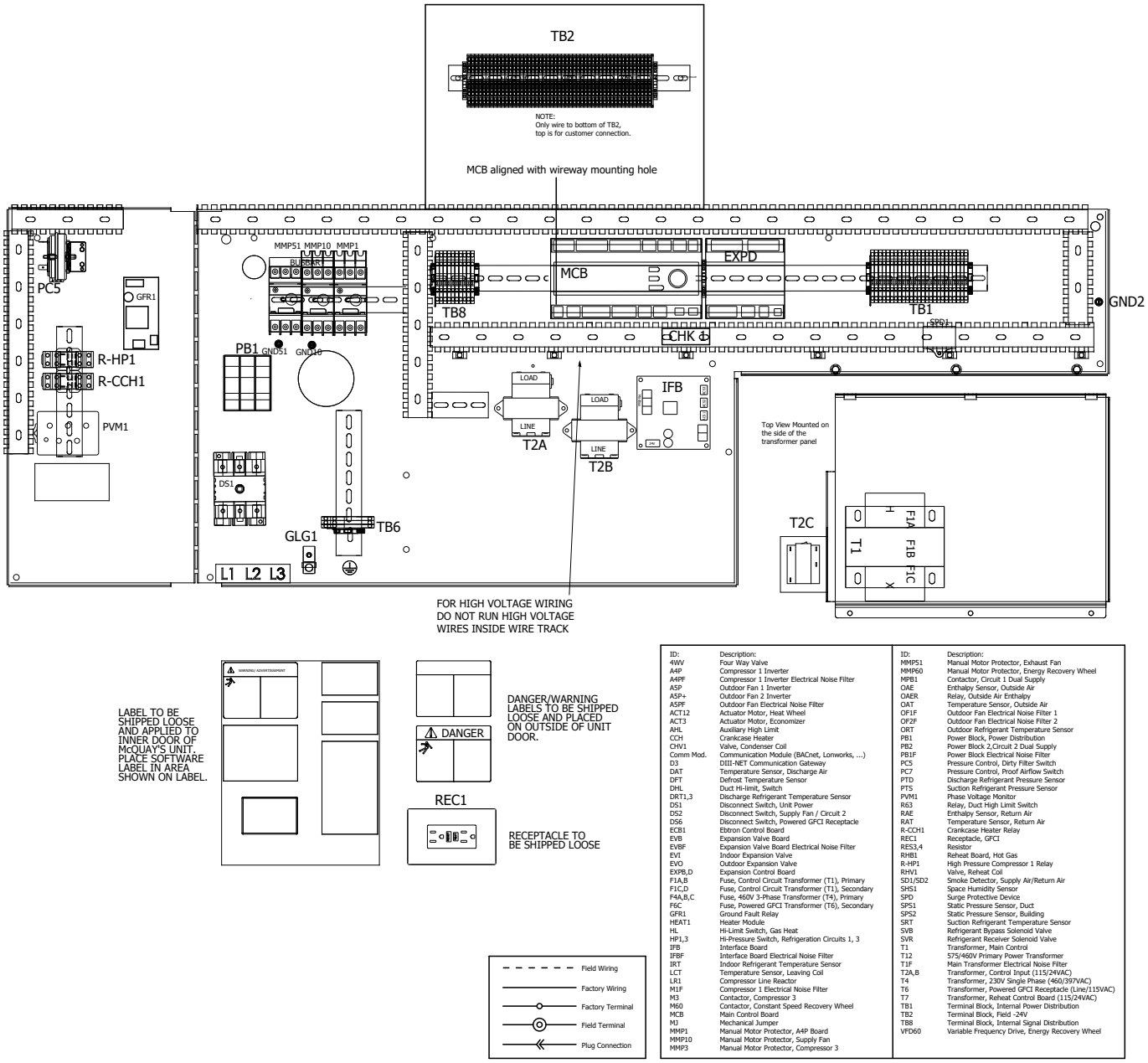


Figure 32 continued: DPS005A, 208V with Gas Heat and Exhaust Fan



ID:	Description:
4WV	Four Way Valve
A4P	Compressor 1 Inverter
A4PF	Compressor 1 Inverter Electrical Noise Filter
ASP	Outdoor Fan 1 Inverter
ASP+	Outdoor Fan 2 Inverter
ASPF	Outdoor Fan Electrical Noise Filter
ACT12	Actuator Motor, Heat Wheel
ACT3	Actuator Motor, Economizer
AHL	Auxiliary High Limit
CCH	Crankcase Heater
CHV1	Valve, Condenser Coil
Comm Mod.	Communication Module (BACnet, Lonworks, ...)
D3	DIII-NET Communication Gateway
DAT	Temperature Sensor, Discharge Air
DFT	Defrost Temperature Sensor
DHL	Duct Hi-limit, Switch
DRT1,3	Discharge Refrigerant Temperature Sensor
DS1	Disconnect Switch, Unit Power
DS2	Disconnect Switch, Supply Fan / Circuit 2
DS6	Disconnect Switch, Powered GFCI Receptacle
ECB1	Ebtron Control Board
EVB	Expansion Valve Board
EVBF	Expansion Valve Board Electrical Noise Filter
EVI	Indoor Expansion Valve
EVO	Outdoor Expansion Valve
EXPB,D	Expansion Control Board
F1A,B	Fuse, Control Circuit Transformer (T1), Primary
F1C,D	Fuse, Control Circuit Transformer (T1), Secondary
F4A,B,C	Fuse, 460V 3-Phase Transformer (T4), Primary
F6C	Fuse, Powered GFCI Transformer (T6), Secondary
GFR1	Ground Fault Relay
HEAT1	Heater Module
HL	Hi-Limit Switch, Gas Heat
HP1,3	Hi-Pressure Switch, Refrigeration Circuits 1, 3
IFB	Interface Board
IFBF	Interface Board Electrical Noise Filter
IRT	Indoor Refrigerant Temperature Sensor
LCT	Temperature Sensor, Leaving Coil
LR1	Compressor Line Reactor
M1F	Compressor 1 Electrical Noise Filter
M3	Contactor, Compressor 3
M60	Contactor, Constant Speed Recovery Wheel
MCB	Main Control Board
MJ	Mechanical Jumper
MMP1	Manual Motor Protector, A4P Board
MMP10	Manual Motor Protector, Supply Fan
MMP3	Manual Motor Protector, Compressor 3

ID:	Description:
MMP51	Manual Motor Protector, Exhaust Fan
MMP60	Manual Motor Protector, Energy Recovery Wheel
MPB1	Contactor, Circuit 1 Dual Supply
OAE	Enthalpy Sensor, Outside Air
OAER	Relay, Outside Air Enthalpy
OAT	Temperature Sensor, Outside Air
OF1F	Outdoor Fan Electrical Noise Filter 1
OF2F	Outdoor Fan Electrical Noise Filter 2
ORT	Outdoor Refrigerant Temperature Sensor
PB1	Power Block, Power Distribution
PB2	Power Block 2,Circuit 2 Dual Supply
PB1F	Power Block Electrical Noise Filter
PCS	Pressure Control, Dirty Filter Switch
PC7	Pressure Control, Proof Airflow Switch
PTD	Discharge Refrigerant Pressure Sensor
PTS	Suction Refrigerant Pressure Sensor
PVM1	Phase Voltage Monitor
R63	Relay, Duct High Limit Switch
RAE	Enthalpy Sensor, Return Air
RAT	Temperature Sensor, Return Air
R-CCH1	Crankcase Heater Relay
REC1	Receptacle, GFCI
RES3,4	Resistor
RHB1	Reheat Board, Hot Gas
R-HP1	High Pressure Compressor 1 Relay
RHV1	Valve, Reheat Coil
SD1/SD2	Smoke Detector, Supply Air/Return Air
SHS1	Space Humidity Sensor
SPD	Surge Protective Device
SPS1	Static Pressure Sensor, Duct
SPS2	Static Pressure Sensor, Building
SRT	Suction Refrigerant Temperature Sensor
SVB	Refrigerant Bypass Solenoid Valve
SVR	Refrigerant Receiver Solenoid Valve
T1	Transformer, Main Control
T12	575/460V Primary Power Transformer
T1F	Main Transformer Electrical Noise Filter
T2A,B	Transformer, Control Input (115/24VAC)
T4	Transformer, 230V Single Phase (460/397VAC)
T6	Transformer, Powered GFCI Receptacle (Line/115VAC)
T7	Transformer, Reheat Control Board (115/24VAC)
TB1	Terminal Block, Internal Power Distribution
TB2	Terminal Block, Field -24V
TB8	Terminal Block, Internal Signal Distribution
VFD60	Variable Frequency Drive, Energy Recovery Wheel

Figure 33: DPS020A, 208V with Hot Water Heat

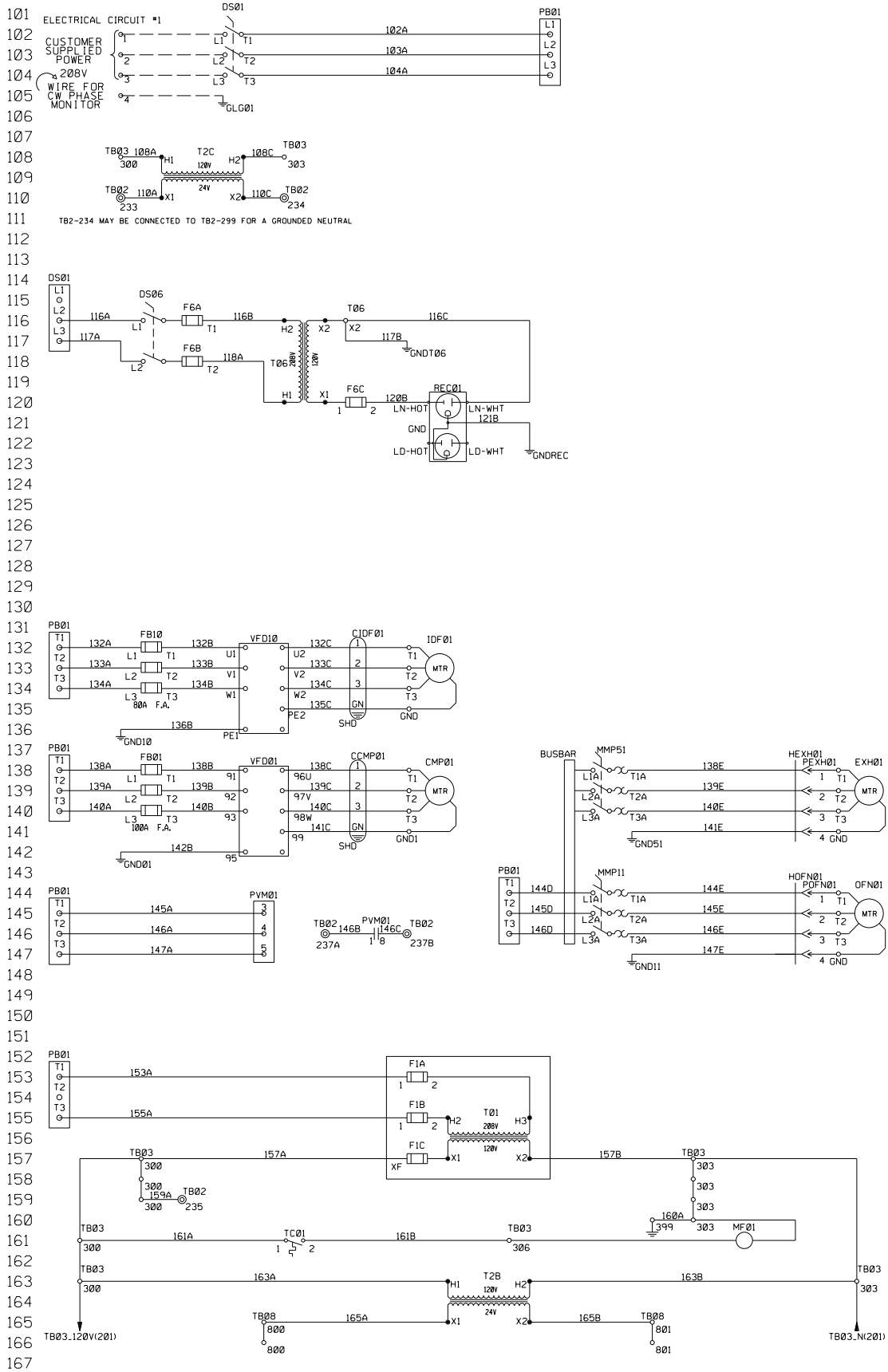


Figure 33 continued: DPS020A, 208V with Hot Water Heat

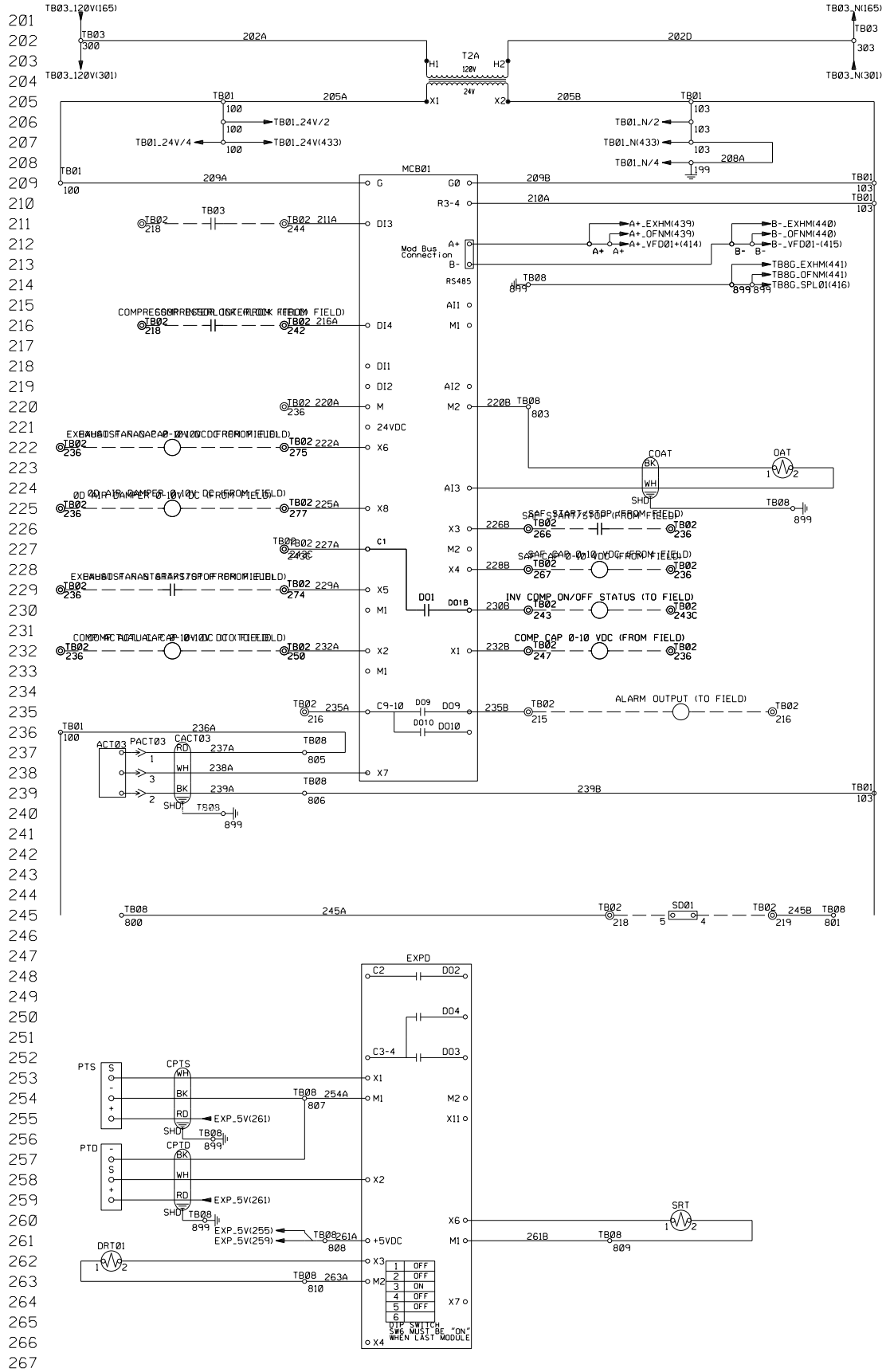


Figure 33 continued: DPS020A, 208V with Hot Water Heat

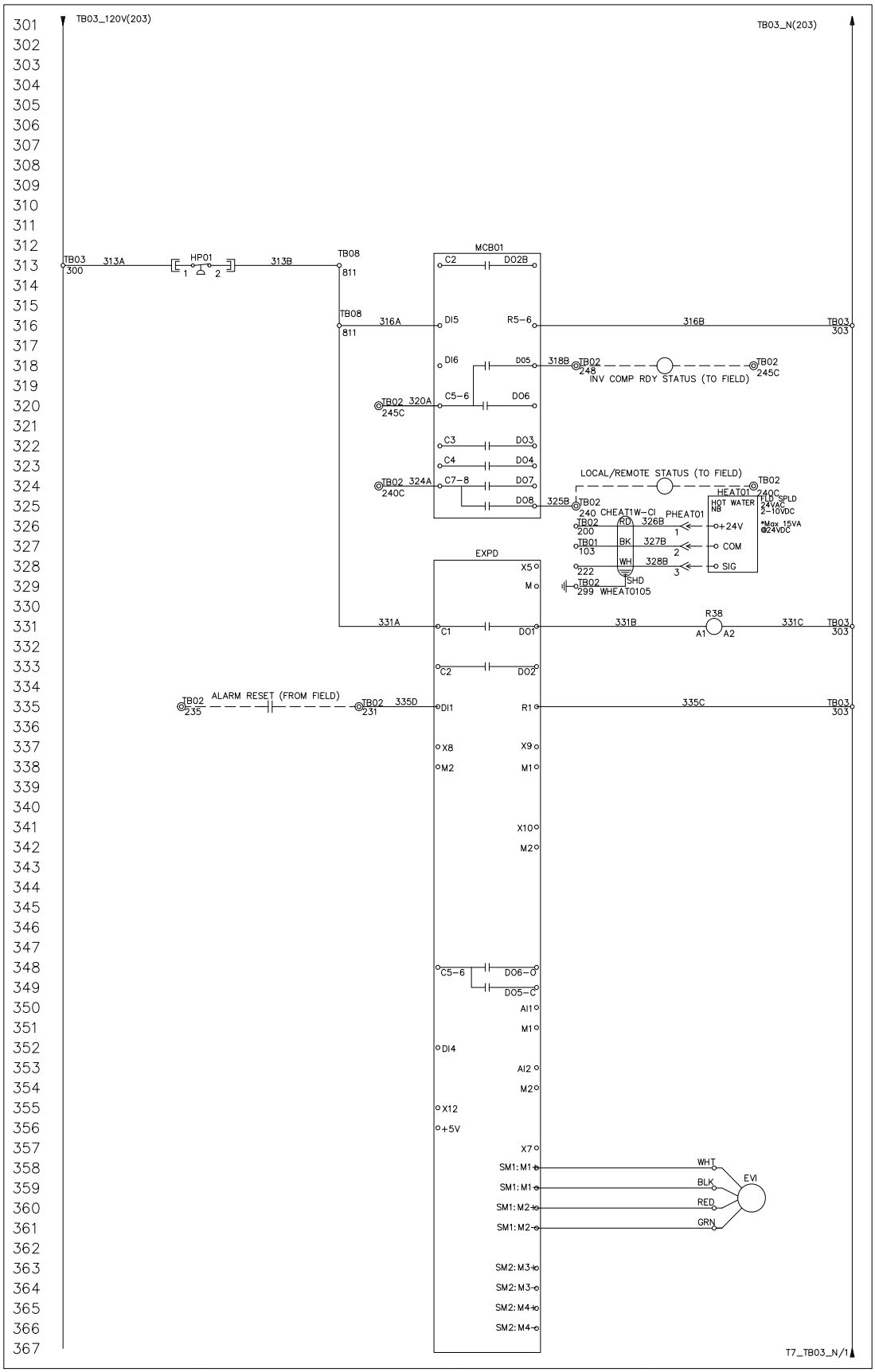
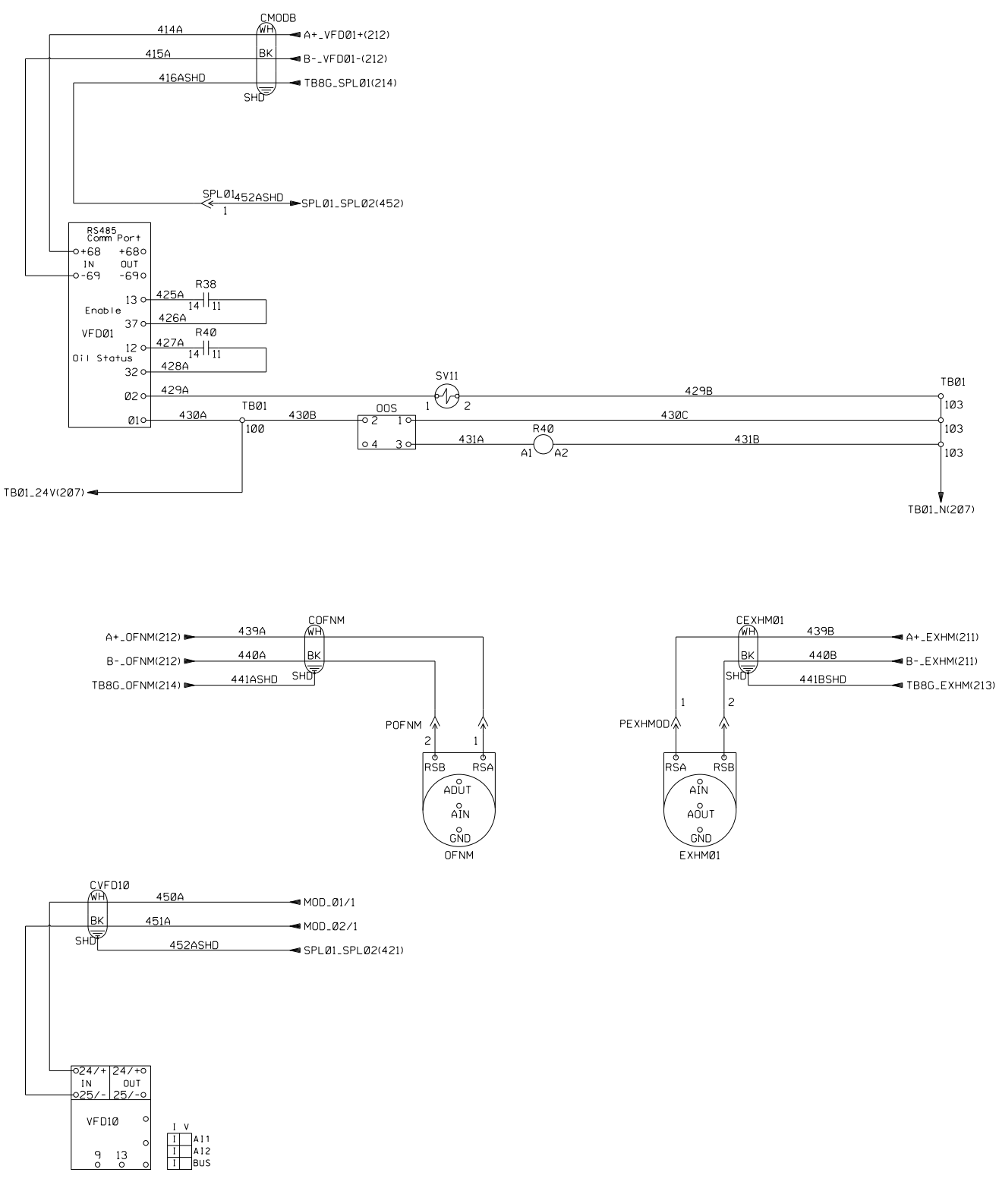


Figure 33 continued: DPS020A, 208V with Hot Water Heat



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