Application Guide

Symbio™ 700 Controller

with Odyssey Split Systems

⚠ SAFETY WARNING

Only qualified personnel should install and service the equipment. The installation, starting up, and servicing of heating, ventilating, and air-conditioning equipment can be hazardous and requires specific knowledge and training. Improperly installed, adjusted or altered equipment by an unqualified person could result in death or serious injury. When working on the equipment, observe all precautions in the literature and on the tags, stickers, and labels that are attached to the equipment.

June 2020

ACC-APG001A-EN

Introduction

Read this manual thoroughly before operating or servicing this unit.

Warnings, Cautions, and Notices

Safety advisories appear throughout this manual as required. Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

The three types of advisories are defined as follows:

⚠ WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTION	Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It could also be used to alert against unsafe practices.
NOTICE	Indicates a situation that could result in equipment or property-damage only accidents.

⚠ WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury.

All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state/national electrical codes.

⚠ WARNING

Personal Protective Equipment (PPE) Required!

Failure to wear proper PPE for the job being undertaken could result in death or serious injury.

Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, MUST follow precautions in this manual and on the tags, stickers, and labels, as well as the instructions below:

- **Before installing/servicing this unit, technicians MUST put on all PPE required for the work being undertaken (Examples; cut resistant gloves/sleeves, butyl gloves, safety glasses, hard hat/bump cap, fall protection, electrical PPE and arc flash clothing). ALWAYS refer to appropriate Safety Data Sheets (SDS) and OSHA guidelines for proper PPE.**
- **When working with or around hazardous chemicals, ALWAYS refer to the appropriate SDS and OSHA/GHS (Global Harmonized System of Classification and Labelling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection and handling instructions.**
- **If there is a risk of energized electrical contact, arc, or flash, technicians MUST put on all PPE in accordance with OSHA, NFPA 70E, or other country-specific requirements for arc flash protection, PRIOR to servicing the unit. NEVER PERFORM ANY SWITCHING, DISCONNECTING, OR VOLTAGE TESTING WITHOUT PROPER ELECTRICAL PPE AND ARC FLASH CLOTHING. ENSURE ELECTRICAL METERS AND EQUIPMENT ARE PROPERLY RATED FOR INTENDED VOLTAGE.**

⚠ WARNING

Follow EHS Policies!

Failure to follow instructions below could result in death or serious injury.

- **All Trane personnel must follow the company's Environmental, Health and Safety (EHS) policies when performing work such as hot work, electrical, fall protection, lockout/tagout, refrigerant handling, etc. Where local regulations are more stringent than these policies, those regulations supersede these policies.**
- **Non-Trane personnel should always follow local regulations.**

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Table of Contents

Introduction

The Symbio 700 installed on Odyssey split systems is a factory installed and programmed controller, providing digital control and protection of the equipment.

The Symbio 700 has two model options:

- **Standard Configuration** — provides standard troubleshooting via on-board user interface (UI) and access to the Symbio Service and Installation mobile app.
- **Advanced Configuration** — introduces additional troubleshooting tools and Building Automation System interface via BACnet® (ANSI/ASHRAE Standard 135-2016) or LonTalk™.

The Symbio 700 offers multiple equipment configuration options regardless of controller model. The Odyssey split system can be configured as the following system types:

- Conventional Thermostat Control (T-Stat)
- Space Temperature Control Constant Volume (CVZT)
- Space Temperature Control Single Zone Variable Air Volume (VVZT)

These configurations can be used with standard cooling or heat pump systems.

This guide provides information about the configuration, control capabilities and troubleshooting of the Odyssey system with Symbio 700 controller.

Additional Documentation

- Symbio Service and Installation Quick Start Guide - BAS-SVN043
- Symbio 700 User Guide - BAS-SVU054
- Symbio 700 BACnet Integration Guide - ACC-SVP001
- Symbio 700 LonTalk Integration Guide - ACC-SVP002
- Odyssey General Installation, Operation, and Maintenance Guide - SSA-SVX06
- Odyssey Cooling Installation, Operation, and Maintenance Guide -SS-SVX001
- Odyssey Heat Pump Installation, Operation, and Maintenance Guide - SSP-SVX001

Symbio 700 Overview

Field Connection

The Symbio 700 controller optimizes inputs and outputs (I/O) for multiple applications. For initial installation of an Odyssey with Symbio 700, the field landed inputs are outlined below.

Figure 1. Symbio 700 Field Connections

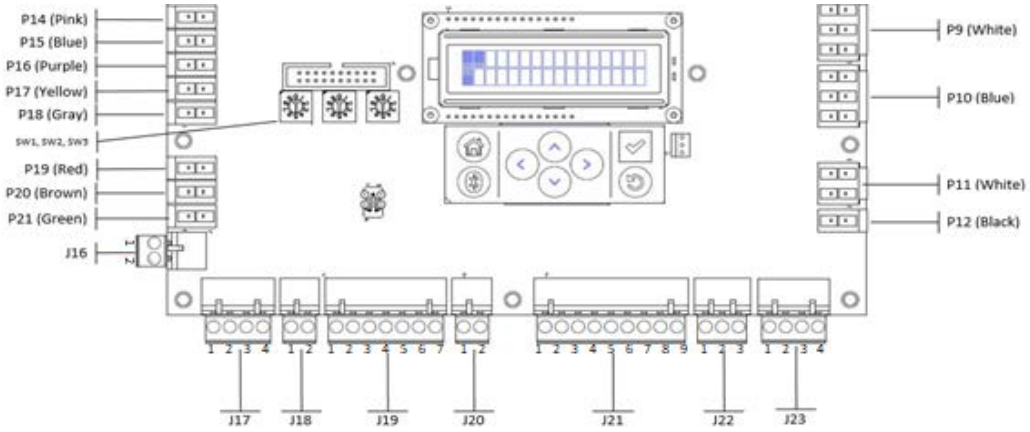


Table 1. Field Connections

Connector	Function	Pin #	Signal
J16	Demand Shed/Demand Limit Connection	1	24VAC
		2	Demand Shed/Demand Limit Input
J17	BACnet Communication Connections	1	BACnet +
		2	BACnet -
		3	BACnet +
		4	BACnet -
J18	Equipment Shutdown Input Connections	1	24VAC
		2	Equipment Shutdown Input
J19	Zone Sensor Connections	1	Zone Temperature
		2	GND
		3	Cool Setpoint
		4	Mode
		5	Heat Setpoint
		6	GND
		7	24VAC
J20	Occupancy Connections	1	24VAC
		2	Occupancy Switch

Table 1. Field Connections (continued)

Connector	Function	Pin #	Signal
J21	Thermostat Connections	1	24VAC
		2	Y1
		3	W1/O
		4	G
		5	W2
		6	Y2
		7	X2
		8	1.5K Ohms Pull-down
		9	GND
J22	CO_2	1	24Vdc Out
		2	CO_2 In
		3	Common
J23	Space Humidity	1	24Vdc Out
		2	Space Humidity
		3	Common

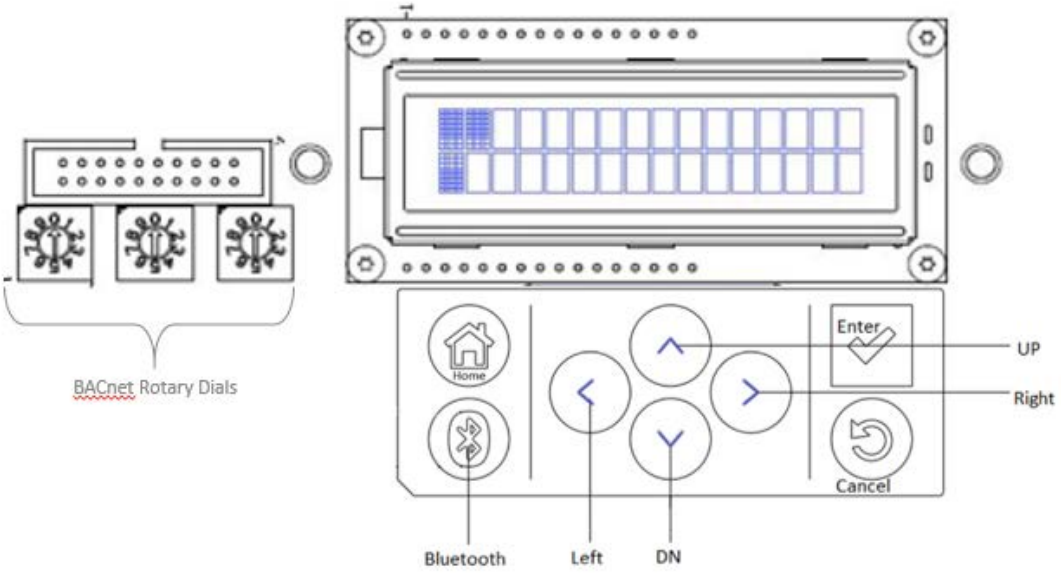
Unit Configuration

The Odyssey system can be configured via an onboard user interface or via the Symbio Service and Installation mobile app.

Onboard User Interface

The onboard user interface provides a 2 x 16 Backlit LCD display and navigational buttons. This allows the user to view status, configure, and troubleshoot the unit without additional tools.

Figure 2. Symbio 700 Onboard User Interface



The interface provides an intuitive menu structure: alarms, status, service, settings, and utilities. Configuration of the unit is accomplished under the utilities menu item. A complete list of functions is outlined in the Symbio 700 User Guide - BAS-SVU054.

To configure the unit, navigate to the utilities menu and press “Enter”. Once in the utilities menu the user has additional submenu options. This allows the user to navigate and configure the appropriate setting quickly and easily.

Mobile Application

The Trane Symbio™ Service and Installation mobile app is required to setup, edit, and confirm the communication protocol and associated settings.

The free download of Trane Symbio Service and Installation mobile app is available on the App Store® for iOS, and on Google Play® for Android™.

Figure 3. Trane Symbio™ Service and Installation mobile app

Bluetooth Pairing

Quick Connection Instructions

Follow these instructions to quickly connect the mobile app to the Symbio 700 controller:

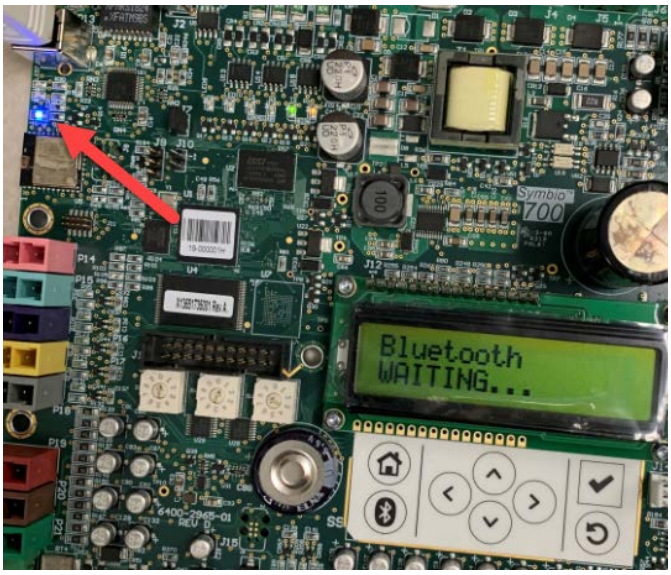
Step	Smart Device	Symbio 700
1	Turn on Bluetooth	
2		Press
3	Start the app; press **Skip**	
4	Select the controller	
5	Press **OK** or **Pair**	
6		Press

Connecting to the Symbio 700 controller

1. Enable **Bluetooth** on your smart device.
2. Press on Symbio 700 keyboard/display to turn on Bluetooth.
3. Confirm the status of Bluetooth communications.

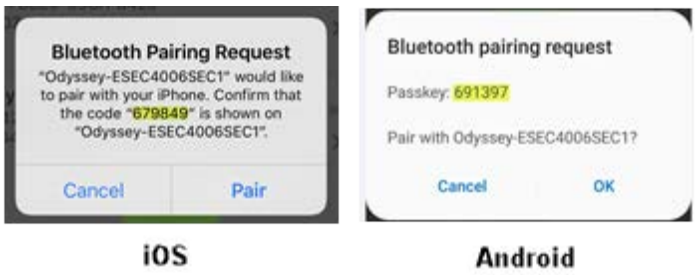
	Blue LED	Display	Description
Press for On/Off	Off	NOT CONNECTED	Bluetooth Off
	Blinking	WAITING...	Bluetooth On — Not Paired
	On Solid	CONNECTED	Bluetooth On — Connected/ Paired

Figure 4. Symbio 700 Bluetooth status



4. Start the mobile app on your smart device.
5. On the login screen, press **Skip** in the lower right-hand corner of the screen. Or Trane personnel can login using their Trane Connect username and password.
6. On the Unit List page, select the Symbio 700 controller that you want to pair with. If the controller is not listed, press the refresh arrow in the upper right-hand corner of the screen.
7. When prompted, pair the app to the Symbio 700 controller. A popup message displays a 6-digit random number. The same number is shown on the display of the Symbio 700 controller until the pairing is complete, allowing the user to confirm connection to the intended controller.

Figure 5. Bluetooth pairing



8. **Press ✔ on the Symbio 700 on-board keyboard/display to complete the connection.**

Important: *To keep the list of previously-connected devices manageable, the Bluetooth smart devices list is limited to 10 devices. When 10 or more Bluetooth devices are defined on the smart device, connection to the Symbio 700 controller is not allowed.*

- ***iOS devices*** *- delete any unused devices until there are less than 10 items.*
- ***Android devices*** *- the devices list is automatically limited to 10 items.*

The Symbio Installation and Service tool is required to view and configure the following:

- Building Automation System configuration (Advanced Controller Configuration)
  - BACnet over Zigbee® (Air-Fi™ Wireless)
  - BACnet IP (Internet Protocol)
  - BACnet MS/TP
  - LonTalk
- Historical Alarms
- Firmware Updates
- Backup & Restore

For more detailed information on the Symbio Service and Installation Mobile Application, refer to the Quick Start Guide for Symbio Service and Installation - BAS-SVN043.

Startup Sequence

Under normal conditions, the Symbio 700 will startup over approximately 60 seconds once power is applied to the system. During this process, the controller checks that a valid system configuration is present and proceeds to normal control operation. After startup, the system will begin to respond to operational requests.

Conventional Thermostat Sequence of Operation

When the Odyssey system is configured to operate with a conventional thermostat, the controller provides protection for the system (see General Support Sequence section) and continues to provide insight to operating conditions. A conventional thermostat can be applied with constant volume cooling only, heat pump, and single zone 2-speed fan configured systems. While not recommended, a conventional thermostat can be applied to single zone variable volume configured systems, but the system is limited to staged fan control instead of a fully variable sequence.

When under conventional thermostat control, the equipment responds directly to operating requests from the thermostat device. Each thermostat input corresponds to a specific unit function, as described in the following tables. Equipment protection functions and compressor minimum on/off timers remain in-control, even when under conventional thermostat control.

Table 2. Cooling only/electric heat systems

Inputs						Outputs				
X	**Y1**	**Y2**	**W1/O**	**W2**	**G**	**Supply Fan On/ Off Request**	**Supply Fan Speed Request**	**Compres-sor Cool Stage Request**	**Auxiliary Heat Stage Request**	**Heat Cool Mode Status**
NA	OPEN	OPEN	OPEN	OPEN	CLOSED	ON	Min	None	None	Fan Only
NA	OPEN	OPEN	CLOSED	OPEN	X	ON	Max	None	Stage 1	Heat
NA	OPEN	OPEN	X	CLOSED	X	ON	Max	None	Full Stage	Heat
NA	CLOSED	OPEN	OPEN	OPEN	X	ON	Min	Stage 1	None	Cool
NA	OPEN	CLOSED	OPEN	OPEN	X	ON	Min	Stage 1	None	Cool
NA	CLOSED	CLOSED	OPEN	OPEN	X	ON	Max	Full Stage	None	Cool
NA	X	X	X	X	X	OFF	0	None	None	OFF

X=ignored by controller

Table 3. Heat pump systems

Inputs						Outputs					
X	**Y1**	**Y2**	**W1/O**	**W2**	**G**	**Supply Fan On/ Off Request**	**Supply Fan Speed Request**	**Compres-sor Cool Stage Request**	**Compres-sor Heat Stage Request**	**Auxiliary Heat Stage Request**	**Heat Cool Mode Status**
CLOSED	OPEN	OPEN	OPEN	OPEN	X	ON	Max	None	None	Full Stage	Em Heat
OPEN	CLOSED	OPEN	OPEN	OPEN	X	ON	Max	None	Stage 1	None	Heat
OPEN	OPEN	CLOSED	OPEN	OPEN	X	ON	Max	None	Stage 1	None	Heat
OPEN	CLOSED	CLOSED	OPEN	OPEN	X	ON	Max	None	Full Stage	None	Heat
OPEN	CLOSED	OPEN	OPEN	CLOSED	X	ON	Max	None	Stage 1	Full Stage	Heat
OPEN	OPEN	CLOSED	OPEN	CLOSED	X	ON	Max	None	Stage 1	Full Stage	Heat
OPEN	CLOSED	CLOSED	OPEN	CLOSED	X	ON	Max	None	Full Stage	Full Stage	Heat
OPEN	X	X	OPEN	CLOSED	X	ON	Max	None	None	Full Stage	Heat
OPEN	OPEN	OPEN	CLOSED	OPEN	OPEN	OFF	0	None	None	None	Cool
OPEN	CLOSED	OPEN	CLOSED	OPEN	X	ON	Min	Stage 1	None	None	Cool
OPEN	OPEN	CLOSED	CLOSED	OPEN	X	ON	Min	Stage 1	None	None	Cool
OPEN	CLOSED	CLOSED	CLOSED	OPEN	X	ON	Max	Full Stage	None	None	Cool
OPEN	OPEN	OPEN	X	OPEN	CLOSED	ON	Min	None	None	None	Fan Only
X	X	X	X	X	X	OFF	0	None	None	None	OFF

X=ignored by controller

Space Temperature Control Sequence of Operation

Constant Volume and Multi-Speed Fan Configuration

Normal Operation

The Symbio 700 has a single-loop (space temperature only) control sequence. The sequence is PI-based (proportional, integral) and strives to maintain space temperature within 1F of the active cooling and heating setpoints.

- When Space Temperature Active > Space Temp Cooling Setpoint Status, the algorithm calculates a need for cooling capacity to be energized.
- When Space Temperature Active < Space Temp Heating Setpoint Status, the algorithm calculates a need for heating capacity to be energized.
- When Space Temp Heating Setpoint Status ≤ Space Temperature Active ≤ Space Temp Cooling Setpoint Status:
  - The algorithm calculates a reduction in need for any active cooling or heating capacity if ON.
  - If no cooling or heating capacity is active, cooling and heating capacity remains inactive.

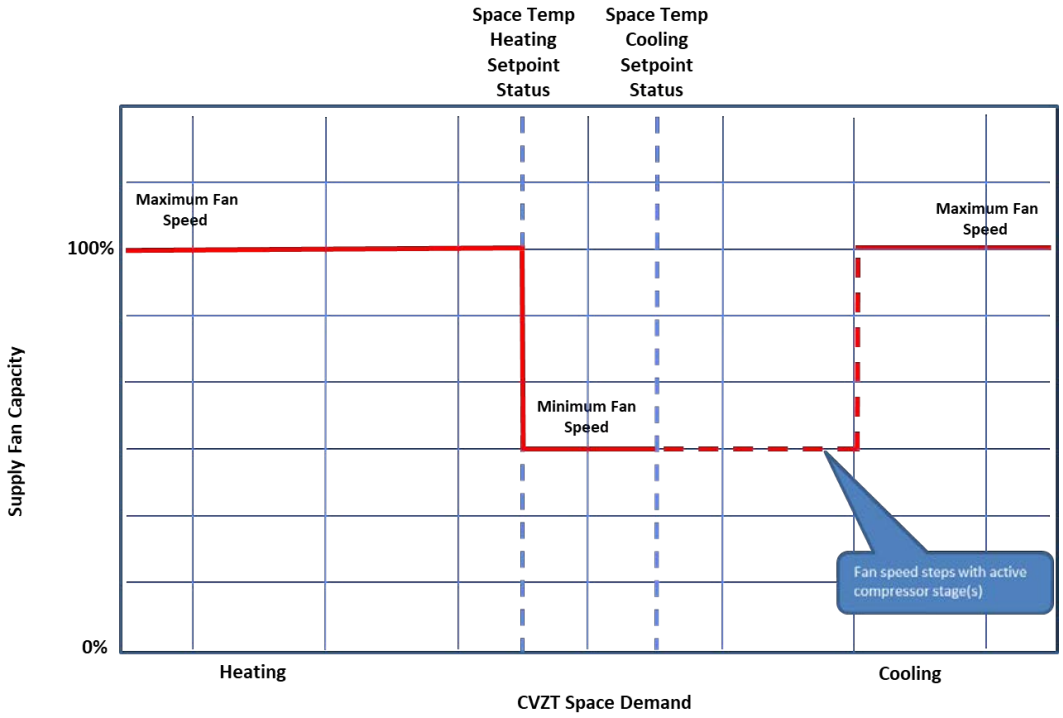
Supply Fan Control

The supply fan is controlled “ON” 5 seconds before heating or cooling capacity is energized. When heating or cooling capacity is de-energized, a supply fan off delay is applied based on active capacity. For single-speed supply fan configured systems, the supply fan is controlled “ON” during all cooling and heating sequences.

For multi-speed supply fan configured systems, the fan operates per the following:

- Low speed when the supply fan is ON without active capacity (unless ON due to an override function)
- Low speed when the unit is operating at its minimum cooling stage
- High speed when the unit is operating at its maximum cooling stage or while any heating stages are active.

Figure 6. Multi-speed fan sequence of operation



Single Zone Variable Air Volume

When configured for VVZT (also known as SZVAV) control, the sequence is only applicable when the following are true; otherwise, the CVZT sequence is leveraged:

- When Occupancy Status is Occupied and
- When Supply Fan Configuration Status is Continuous and
- When Discharge Air Temperature sensor is not in an Alarm state and
- The unit is operating under a cooling demand (VVZT heating is not applicable with staged heat for Odyssey)

The sequence is PI-based (proportional, integral) and strives to maintain space temperature within 1F of the Active Cooling and Heating setpoints.

When Space Temperature Active > Space Temp Cooling Setpoint status, the algorithm calculates a need for cooling capacity to be energized. A discharge air temperature setpoint calculates lower to determine proper compressor staging needs. The minimum value of this calculated setpoint for temperature control can be adjusted by the Discharge Air Temperature Minimum Cool Limit setpoint.

When Space Temperature Active < Space Temp Cooling Setpoint status, the algorithm calculates a reduction in need for cooling capacity to be energized. A discharge air temperature setpoint calculates higher to determine proper compressor staging needs. The maximum value of this calculated setpoint for temperature control can be adjusted by the Discharge Air Temperature Maximum Cool Limit setpoint.

Different from the CVZT sequence, compressors are staged to maintain the discharge air temperature at the Discharge Air Temperature Setpoint Active setpoint.

VVZT DAT Control Mode

With the Symbio 700 VVZT control sequence, the end user can choose to use the internally derived Discharge Air Temperature Setpoint Active or to override the value with their own.

If the VVZT DAT Control Mode – Active point is set to "Auto", the VVZT control algorithm will use the internally derived Discharge Air Temperature Setpoint Active, as described above, for all cooling capacity output control.

If the VVZT DAT Control Mode – Active point is set to "Manual", the VVZT control algorithm will use the Discharge Air Cooling Setpoint (Target) – Active as upper limit for the Discharge Air Temperature Setpoint calculation. Typically this is set to a low value (i.e 50-55F) to drive longer compressor runtimes. When this override is active, if the space temperature is 2° F below the Space Temp Cooling Setpoint Status value or 1° F above the Space Temp Heating Setpoint Status value, the controller will pause the override sequence until the space temperature recovers to above the Space Temp Cooling Setpoint status.

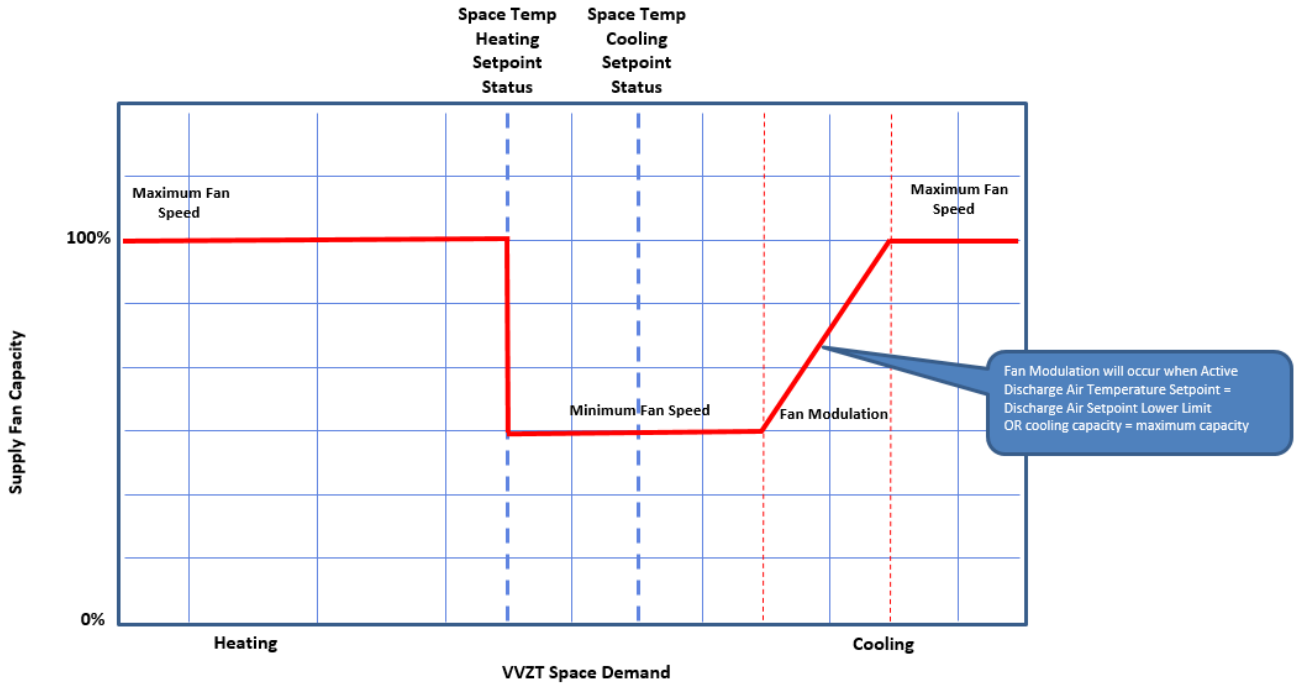
Supply Fan Control

For the VVZT control sequence to be active, the Supply Fan Configuration Status must be ON/Continuous.

The fan speed is continuously variable on VVZT systems. The fan remains at minimum speed (based on active compressor stages) until the space demand requires additional airflow.

All heating is accomplished with the CVZT control sequence, and the fan is controlled at maximum speed.

Figure 7. Supply fan sequence of operation



General Support Sequences

Fan Setpoints with VFD-driven Fan Types

When a system is equipped with a VFD, the minimum and maximum VFD parameters can be adjusted to tune the airflow to meet the application requirements.

In addition to this, the Symbio 700 supports setpoints that can adjust airflow as needed:

- Supply Fan Maximum Speed Setpoint
  - Range: 67-100%
  - Operation: This setpoint “trims” the maximum fan speed, based on the configured maximum VFD speed
  - Example: VFD Max = 60Hz
    - Supply Fan Maximum Speed Setpoint @ 75% yields a maximum of 45Hz VFD output.
    - Effective VFD Max (to be used in Supply Fan Minimum Speed Setpoint application) will be set to 45Hz
- Supply Fan Minimum Speed Setpoint
  - Range: 0-100%
  - Operation: 0-100% over minimum to effective maximum VFD configured fan speed
  - Example: VFD Min = 30Hz, Effective VFD Max = 60Hz
    - Supply Fan Minimum Speed Setpoint @ 50% yields 45Hz VFD output.
- Minimum and Maximum Speed Setpoints interact to ensure that the minimum defined fan speed at a given equipment operating condition is maintained.

Compressor Minimum Runtime

Under all normal running conditions, a 3–minute minimum ON and OFF timer is maintained for each compressor. Once a compressor is turned ON, it remains on for a minimum of 3 minutes. Once a compressor is turned OFF, it remains off for a minimum of 3 minutes. System overrides that require immediate shutdown of the equipment, test modes, and compressor diagnostics/ protection functions can override these 3–minute timers. However for normal temperature and thermostatic-based control, these minimum ON/OFF timers are maintained.

Refrigeration Circuit Management

There are two refrigeration configurations that the controller will use to determine proper response to refrigeration system faults:

- When the unit is configured with a **Manifold** refrigeration system, if any compressor protection device or function trips for a given compressor, all compressors associated with the circuit on which the protection device or functions trips will be commanded to OFF.
- When the unit is configured with an **Independent** refrigeration system, if any compressor protection device or function trips, for a given compressor, only the compressor associated with the protection device or function that tripped will be commanded to OFF.

Compressor Proof of Operation

For each compressor. a Compressor Proving binary input is used to monitor the state of an auxiliary switch that is used to indicate compressor motor contactor status. Under normal operation, detected operation indicates that all safety devices within the compressor safety circuit are in their normal state. The switch operates as OPEN when the compressor motor is OFF and CLOSED when the compressor motor is ON.

Refer to the Diagnostics section below for specific diagnostics that are generated based on the Compressor Proving signals.

Compressor Low Pressure Cutout Control

For each compressor/circuit, a normally CLOSED low pressure cutout input is monitored for equipment protection on the Symbio 700. When a low pressure event is active, the input becomes OPEN and diagnostics are generated as described below. Refer to the Diagnostics section below for specific diagnostics that are generated based on the circuit Low Pressure Cutout inputs.

Heat Pump Support Sequences

Heat Pump Switchover Valve

The Switchover Valve function is only applicable to Heat Pump units. Depending on the refrigeration system configuration for a unit, it may have one or two switchover valves. Additionally, some units with two switchover valves could control each valve independently while others will control in tandem.

In normal unit operation, the Unit Mode will determine the operation of the switchover valve. Unit Mode COOL will turn the switchover valve ON while Unit Mode HEAT will turn the switchover valve OFF.

If the unit is in active Heat Pump Heating (switchover valve is OFF) and then enters defrost, the switchover valve will be turned ON for the duration of defrost. When leaving active defrost, the switchover valve transition to OFF is delayed 5 seconds.

Demand Defrost Control

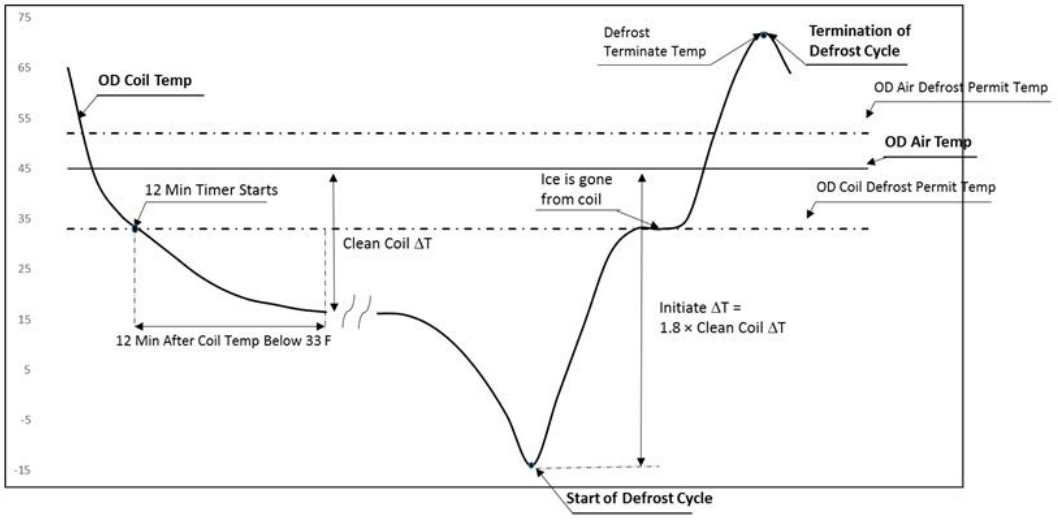
There are two schemes in common usage for heat pump outdoor coil defrosting: Demand Defrost and time temperature defrost. Demand Defrost is more efficient because defrost cycles are initiated only when necessary, compared with initiation based on operating time below the threshold temperature.

Outdoor coil defrosting occurs only when operating in heating mode with outdoor ambient temperature below 52° F and the outdoor coil temperature below 33° F. The first defrost cycle after power-up is initiated based on operating time at the required conditions. Shortly after completion of the defrost cycle, the temperature difference between the outdoor coil and outdoor air is calculated and is used as an indicator of unit performance at dry coil conditions.

Over time, as moisture and frost accumulate on the coil, the coil temperature will drop, increasing the temperature difference. When the temperature difference reaches 1.8 times the dry coil temperature differential (ΔT), a defrost cycle is initiated. While defrosting, the reversing valve is in the cooling position, outdoor fans are off, and the compressors continue to operate.

The defrost cycle is terminated when the coil temperature rises high enough to indicate that the frost has been eliminated. Termination of the defrost cycle includes a soft start delay. At the end of each defrost cycle, the outdoor fan comes on 5 seconds before the reversing valve is de-energized. This reduces stress on the compressor and makes for a quieter defrost.

Figure 8. Typical Demand Defrost cycle



During the defrost cycle, the Switchover Valve is turned ON, the Condenser Fan is turned OFF, and auxiliary heat is turned ON regardless of their prior operating status while maintaining

compressor operation. The defrost cycle is terminated based on the defrost termination temperature calculation using the outdoor temperature (ODT) +47°F. The defrost termination temperature (DTT) will be limited between 57° F and 72° F.

Evaporator Defrost Control

To prevent frost build-up on the indoor coil during low ambient conditions, compressor operation is monitored and controlled accordingly, relative to outdoor air temperature.

Evaporator Defrost Control can be initiated through two means, based on configuration.

- If configured for Evaporator Defrost Control Enabled:
  - When the unit is operating in a "Cool" mode with a valid Outdoor Air Temperature, the EDC function will keep track of the amount of time that at least one compressor in the unit is commanded ON and the Outdoor Air Temperature Active is less than the low ambient temperature defined in table 3. If the Accumulated Compressor On Time reaches 10 minutes, the EDC function will cause the Compressor Output(s) to de-energize for three minutes. The supply fan continues to operate during this three-minute interval at 100% capacity. After the three-minute EDC timer has expired, the EDC function is ended and compressors are allowed to operate as requested by the algorithm.
  - Low Ambient Temperature Sepoints:
    - Single Compressor Systems: 55° F
    - Multi-Compressor Systems: 40° F
- If configured for FroStat Installed:
  - A FroStat input can also be used to directly request the Evaporator Defrost Control function
  - When the unit is running in an effective "Cool" mode, the FroStat input will directly control the FroStat diagnostic. If the FroStat input CLOSES, the diagnostic will be annunciated.
  - When the unit is running in an effective "Heat" mode, and the Refrigeration System == Heat Pump, the FroStat diagnostic will be controlled "Inactive" until the following are true:
    - FroStat input is CLOSED
    - One or More Compressors have been active for Heat Pump Heating for more than 30 seconds.

    Once the above two conditions are met, the FroStat Diagnostic will become Active.
  - The FroStat diagnostic is an Auto-Reset diagnostic such that it will be reset when the FroStat input is OPEN in either effecting unit mode.
  - If the FroStat diagnostic becomes active, the Compressor Output(s) will de-energize until the FroStat diagnostic is cleared. The supply fan continues to operate during the FroStat diagnostic, so long as it is still requested by a heating or cooling function.

FroStat and Evaporator Defrost Control can both be configured on a unit, although in most cases, only one should be necessary.

Building Automation System Support Sequences

Occupancy Mode

During expected occupied periods, the system will control to the user selected cooling and heating setpoints.

- The unoccupied setpoint temperatures are often adjusted higher for cooling (setup) and lower for heating (setback) to reduce building operating cost.
- Regardless of how the (occupied) fan mode is set, the supply fan mode is forced to AUTO during unoccupied periods to reduce supply fan operating costs.

There are two mechanisms available to control when units should switch between occupied and unoccupied modes:

- Building controllers provide signals to the unit to request occupied or unoccupied operation. Time-of-day scheduling within building controllers typically determine when the switching should occur.
- Stand Alone Unoccupied control is initiated by a contact closure that causes the unit to begin unoccupied control. In this mode, the controller will use the Unoccupied Cooling and Heating setpoints to determine capacity control needs. Stand Alone Unoccupied control is only applicable when the unit is not being controlled by a conventional thermostat interface.

Timed Override

Exceptions to the time-of-day scheduling are required when unusual or difficult to schedule events cause a space to become occupied during a scheduled unoccupied period. The Timed Override function provides a mechanism for an occupant to signal the system that the space is actually occupied and override the time-of-day schedule to provide occupied control for some limited time period. It also provides a mechanism to return the system to unoccupied mode when the space is no longer occupied.

There are two methods of requesting or terminating timed override on a Symbio 700 control system:

- BAS
  - Timed Override Request value can be set to 3 discrete values:
    - **Idle [1]**— Controller will not override Unoccupied Mode.
    - **On [2]**— When the value is changed from Idle to On, the controller overrides Unoccupied Mode and the unit operates in Occupied Mode. The Occupied Bypass Timer and the Timed Override Timer is Active is set to 'Active'. The controller remains in Timed Override for the duration of the Occupied Bypass Time.
    - **Cancel [3]**— When value is changed from On to Cancel, the unit's unoccupied status is no longer overridden and the Occupied Bypass Timer will be set to 0.
- Zone Sensor Initiate/Terminate buttons – Some zone sensors have a Timed Override Initiate and Terminate buttons.

When Timed Override is initiated by any of the above methods, the controller starts a timer using the user selected Occupied Bypass Time to control the duration of the Timed Override event. The range for Occupied Bypass Time is 0-240 minutes with a default of 120 minutes.

When the unit is operating in Occupied Bypass mode, the Occupied Bypass Timer duration can be extended by initiating a Timed Override Request again. This extends the Occupied Bypass Timer duration by the value of the user selected Occupied Bypass Time.

When Timed Override is terminated by any of the above methods, the controller will exit Occupied Bypass and will again begin to use unoccupied control setpoints.

Supply Air Tempering

If the Supply Air Tempering function is configured and the Discharge Air Temperature local sensor is valid, the Space Temperature Control algorithm manages the Supply Air Tempering

function to prevent excessively cold discharge air from being supplied from the unit. The sequence for VVZT systems are consistent with CVZT systems, utilizing single-speed, and full airflow operation.

Supply Air Tempering is not applicable when a Conventional TStat is configured as the Space Controller.

The following requirements must be met to allow Supply Air Tempering on a Staged Heat unit:

- The supply fan is ON.
- The unit is in Occupied mode.
- The unit is in any heating mode, including Heat, Emergency Heat, Morning Warmup, Max Heat but is not actively heating OR
- The unit is in any cooling mode except night purge, but not actively cooling and cooling capacity has been OFF for 5 minutes.

If the discharge air temperature drops to the Discharge Air Temperature Minimum Cool Limit - Active and the Space Temperature is less than the Active Space Temp Cooling Setpoint Status – 0.5°F and if there are no stages of heat on, the Supply Air Tempering function will bring ON one stage of available staged auxiliary heat.

Note: *Heat Pump units will energize 1 stage of auxiliary Heat in order to meet the Supply Air Tempering request; compressor-based heating will not be used to satisfy Supply Air Tempering.*

Once Supply Air Tempering is active, the stage of heat will be turned OFF if the Discharge Air Temperature rises to 10°F ABOVE the Discharge Air Temperature Minimum Cool Limit - Active, or the Space Temperature rises to the Space Temp Cooling Setpoint Status. Additionally, if the Space Heat Control function determines that 1 or more stages of Heat are required to meet the Space Temp Heating Setpoint Status, Tempering will be discontinued and the unit will stage heating to meet the current space demand.

Unit Stop

The Unit Stop feature allows for immediate shutdown of all devices in the equipment when initiated. When a Unit Stop request is received, the following actions are taken:

- All equipment control binary outputs are de-energized
  - Indoor fan
  - Compressors
  - Condenser fans
  - Unloader solenoids
  - Heat stages
- All equipment control analog outputs are set to their minimum/off command values.
- All communicating devices, such as Supply fan VFD, are commanded to their Off state.
- All control algorithms are initialized to their normal startup values and held until the stop request is released.

The Unit Stop request can be initiated from the following sources:

- Unit Stop Command
- Equipment Shutdown Input
- Emergency Override BAS
- Phase Monitor

If a Unit Stop is initiated, the source of the Unit Stop can be determined by the Unit Stop Source Point and other status/diagnostic points.

Capacity Limit Control

There are three sources for capacity limitation provided by the Symbio700:

- BAS Lockout Function
- BAS Capacity Enable function
- Demand Limit Function

Depending on how the controller application is configured, different portions of the capacity limit control can be active at any time. Because of this, a priority scheme is built into the capacity limitation function.

If cooling is allowed from “Cooling Lockout BAS – Active” and if Demand Management is configured for Demand Limit, “Cooling Demand Limit Capacity Enable Setpoint – Active” or “Heating Demand Limit Capacity Enable Setpoint – Active” will be used to limit the unit capacity if it is active and “Cooling Capacity Enable – Active” is not limiting capacity. If “Cooling Capacity Enable – Active” is set to a value less than 100, “Cooling Capacity Enable – Active” has priority.

For capacity limiting values for user selected values, refer to the Appendix section of this document.

Remote Capacity Control

The Symbio 700 controls support the Remote Capacity Control function, which allows a user to directly control the unit capacity rather than allowing the internal algorithm to provide control.

The following features/functions can be requested directly via points, rather than relying on internal temperature or thermostat control sequences:

- Supply Fan Speed
- Cooling Capacity
- Heating Capacity

For Thermostat Controlled equipment, the Thermostat Inputs must be "OPEN" i.e. requesting "OFF" mode before the Cooling or Heating Capacity requests will be honored.

For Space Temperature controlled equipment, the Heat Cool Mode Request must be set to "Fan Only" before the Cooling or Heating Capacity requests will be honored.

For each entity, there is an "Enable" point to enable or disable the remote capacity control, and an analog value point to allow the user to request an analog capacity value. The analog value is translated to the appropriate value per function.

Supply Fan Speed Command overrides will be honored in all non-Heat or Off modes. When Supply Fan Speed Command is enabled, and the Supply Fan Speed Command value is 0%, the system will interpret as an "OFF" mode request, and all active capacity will be set to "Off"; fan, heating, and cooling.

All equipment safeties and limitations will be in-place while the Remote Capacity Control functions are being leveraged:

- Minimum fan speeds as defined per active capacity will be maintained
- Compressor Minimum ON/OFF times will be maintained
- All system diagnostics will be maintained.

Emergency and Ventilation Override

This feature has two options for initiating an override request, either through the optional (future) hardwired Ventilation Override terminals, or by initiating a request through the Emergency Override Command point, a priority scheme is required to ensure proper equipment operation.

Ventilation Override (Future)

When configured for the Ventilation Override option, applying 24 volts to one of the three Ventilation Override inputs manually activates Ventilation Override. Three inputs are provided to support Ventilation Override functionality:

- Pressurize mode
- Purge mode

- Exhaust mode

If more than one mode is requested at the same time, the Pressurize request will have priority followed by Purge, and then Exhaust. When Any Ventilation Override mode is active, all heating and cooling is turned off. For the case where the unit is required to turn Off via hardwired interface, the Equipment Shutdown input is used.

Emergency Override

All units with Symbio 700 support the remote Emergency Override Command functionality. Within this point, there are addition enumerations versus the hardware Ventilation Override interface:

- 1 = EMERG_NORMAL
- 2 = EMERG_PRESSURIZE
- 3 = EMERG_DEPRESSURIZE
- 4 = EMERG_PURGE
- 5 = EMERG_SHUTDOWN
- 6 = EMERG_FIRE

Pressurize, Depressurize, and Purge map to their respective Ventilation Override Modes directly. , Emerg_Shutdown and Emerg_Fire are unique to Emergency Override. Both of those are treated as a remote shutdown request for the equipment.

Equipment Operation

Emergency and Ventilation Override requests/actions will take priority over normal equipment timing events, such as compressor minimum ON/OFF/Inter-stage timers.

During an Emergency or Ventilation Override sequence, all temperature control algorithms are initialized to an inactive state until the Emergency or Ventilation Override request is cleared. For each override request, the unit will operate in a pre-determined state until override requests are cleared.

For detailed unit operation during Emergency or Ventilation Override, refer to the Appendix section of this document.

Service Test Mode

Service Test Mode can be used to initiate certain operating modes of the equipment. Refer to the following sections for more details associated with this feature.

Service Test Timeout

Service Test Timeout (Minute) is a user selected time value. Once Service Test Mode has been initiated, and this timer expires, the controls are forced to leave Service Test Mode and return to normal unit operation.

- **Minimum value**— 1 minute
- **Maximum value**— 120 minute
- **Default value**— 60 minutes

Timer Initiate: When any value for Service Test State Request is chosen other than Inactive, the controller sets the Service Test Timeout to the user selected value and the unit begins to operate as described in the tables below. It continues in operation until the Service Test Timeout Timer reaches 0 **OR** until the user chooses a different Service Test State Request.

Timer Terminate: if the Service Test Timeout timer has reached 0, the controls sets the Service Test Stage Request to Inactive and the unit returns to normal unit operation. If the Service Test Timeout Timer has not reached 0, the user can set the Service Test Stage Request to Inactive to exit the active Service Test State Request and return to normal unit operation.

Timer Reset: if the Service Test Timeout timer has not reached 0, the user can select the Service Test Stage Request to any value other than Inactive. The controller resets the Service Test Timeout Timer to the user selected value and the unit operates as describe in the tables below for the new request.

Leaving Service Test Mode

There are three ways to leave Service Test Mode:

- When the Service Test Timeout timer expires, the unit will leave Service Test Mode.
- Service Test State Request is set to “Inactive”.
- The controller goes through a power cycle or reset.

Constant Volume Supply Fan Service Test Mode

The tables below provide unit operation for each stage of service test depending on the unit configuration.

The tables describe the service test mode states and expected unit response. For all service test mode operation, “IN CONTROL” refers to Symbio 700 control algorithms controlling the unit. For instance, in all service test mode states, the Condenser Fan will be controlled as needed to ensure safe unit operation.

Table 4. Cooling Only

State #	Service Test State Request	Service Test Supply Fan On/Off Request	Service Test Compressor Cool Stage Request[1,2]	Service Test Auxiliary Heat Stage Request [3]	Service Test Condenser Fan Stage Request [4]	Heat Cool Mode Status
1	Inactive	IN CONTROL	IN CONTROL	IN CONTROL	IN CONTROL	IN CONTROL
2	Fan On	ON	0	0	IN CONTROL	TEST
3	Cool 1	ON	1	0	IN CONTROL	TEST
4	Cool 2	ON	2	0	IN CONTROL	TEST
5	Heat 1	ON	0	1	IN CONTROL	TEST
6	Heat 2	ON	0	2	IN CONTROL	TEST
7	Heat 3	ON	0	3	IN CONTROL	TEST

Table 4. Cooling Only (continued)

1	Inactive	IN CONTROL	IN CONTROL	IN CONTROL	IN CONTROL	IN CONTROL
8	Heat 4	ON	0	4	IN CONTROL	TEST
9	Defrost	OFF	0	0	IN CONTROL	TEST
10	Emergency Heat	ON	0	2	IN CONTROL	TEST

Notes:

1. Supply fan speed will operate the same as in normal cooling/heating operations. The minimum speeds can be found in the Appendix of this document.
2. Compressor cool stages are defined within the Appendix of this document.
3. Available auxiliary heat stages are defined within the Appendix of this document.
4. Condenser Fan stages are defined within the Appendix of this document.

Table 5. Heat Pump

State #	Service Test State Request	Service Test Supply Fan On/Off Request	Service Test Compressor Cool Stage Request [1]	Service Test Compressor Heat Stage Request [2]	Service Test Auxiliary Heat Stage Request [3]	Service Test Condenser Fan Stage Request [4]	Heat Cool Mode Status
1	Inactive	IN CONTROL	IN CONTROL	IN CONTROL	IN CONTROL	IN CONTROL	IN CONTROL
2	Fan On	ON	0	0	0	IN CONTROL	TEST
3	Cool 1	ON	1	0	0	IN CONTROL	TEST
4	Cool 2	ON	2	0	0	IN CONTROL	TEST
5	Heat 1	ON	0	1	0	IN CONTROL	TEST
6	Heat 2	ON	0	2	0	IN CONTROL	TEST
7	Heat 3	ON	0	3	1	IN CONTROL	TEST
8	Heat 4	ON	0	4	2	IN CONTROL	TEST
9	Defrost[7]	ON	0	2	1	IN CONTROL	TEST
10	Emergency Heat	ON	0	0	2	IN CONTROL	TEST

Notes:

1. Supply fan speed will operate the same as in normal cooling/heating operations. The minimum speeds can be found in the Appendix of this document.
2. Compressor cool stages are defined within the Appendix of this document.
3. Compressor heat stages are defined within the Appendix of this document.
4. Available auxiliary heat stages are defined within the Appendix of this document.
5. Condenser Fan stages are defined within the Appendix of this document.
6. During Defrost, the unit will run Defrost operation until defrost terminate point is reached. After active defrost is terminated, the unit will run in active Heat mode but will return to Defrost if it is determined to be needed by the controls.
7. Reversing Valve operation can be found in the Reversing Valve section of this document.

Multi-Speed Supply Fan Service Test Mode

Table 6. Cooling only

State #	Service Test State Request	Service Test Supply Fan On/Off Request	Service Test Supply Fan Speed Request [1]	Service Test Compressor Cool Stage Request [2]	Service Test Auxiliary Heat Stage Request [3]	Service Test Condenser Fan Stage Request [4]	Heat Cool Mode Status
1	Inactive	IN CONTROL	IN CONTROL	IN CONTROL	IN CONTROL	IN CONTROL	IN CONTROL
2	Fan On	ON	IN CONTROL	0	0	IN CONTROL	TEST
3	Cool 1	ON	IN CONTROL	1	0	IN CONTROL	TEST
4	Cool 2	ON	IN CONTROL	2	0	IN CONTROL	TEST
5	Heat 1	ON	IN CONTROL	0	1	IN CONTROL	TEST
6	Heat 2	ON	IN CONTROL	0	2	IN CONTROL	TEST
7	Heat 3	ON	IN CONTROL	0	3	IN CONTROL	TEST
8	Heat 4	ON	IN CONTROL	0	4	IN CONTROL	TEST
9	Defrost	OFF	IN CONTROL	0	0	IN CONTROL	TEST

Table 6. Cooling only (continued)

1	Inactive	IN CONTROL	IN CONTROL	IN CONTROL	IN CONTROL	IN CONTROL	IN CONTROL
10	Emergency Heat	ON	IN CONTROL	0	2	IN CONTROL	TEST

Notes:

1. Supply fan speed will operate the same as in normal cooling/heating operations. The minimum speeds can be found in the Appendix of this document.
2. Compressor cool stages are defined within the Appendix of this document.
3. Available auxiliary heat stages are defined within the Appendix of this document.
4. Condenser Fan stages are defined within the Appendix of this document.

Table 7. Heat pump

State #	Service Test State Request	Service Test Supply Fan On/Off Request	Service Test Supply Fan Speed Request [1]	Service Test Compressor Cool Stage Request [2]	Service Test Compressor Heat Stage Request [3]	Service Test Auxiliary Heat Stage Request [4]	Service Test Condenser Fan Stage Request [5]	Heat Cool Mode Status
1	Inactive	IN CONTROL	IN CONTROL	IN CONTROL	IN CONTROL	IN CONTROL	IN CONTROL	IN CONTROL
2	Fan On	ON	IN CONTROL	0	0	0	IN CONTROL	TEST
3	Cool 1	ON	IN CONTROL	1	0	0	IN CONTROL	TEST
4	Cool 2	ON	IN CONTROL	2	0	0	IN CONTROL	TEST
5	Heat 1	ON	IN CONTROL	0	1	0	IN CONTROL	TEST
6	Heat 2	ON	IN CONTROL	0	2	0	IN CONTROL	TEST
7	Heat 3	ON	IN CONTROL	0	2	1	IN CONTROL	TEST
8	Heat 4	ON	IN CONTROL	0	2	2	IN CONTROL	TEST
9	Defrost[7]	ON	IN CONTROL	2	0	1	IN CONTROL	TEST
10	Emergency Heat	ON	IN CONTROL	0	0	2	IN CONTROL	TEST

Notes:

1. Supply fan speed will operate the same as in normal cooling/heating operations. The minimum speeds can be found in the Appendix of this document.
2. Compressor cool stages are defined within the Appendix of this document.
3. Compressor heat stages are defined within the Appendix of this document.
4. Available auxiliary heat stages are defined within the Appendix of this document.
5. Condenser Fan stages are defined within the Appendix of this document.
6. During Defrost, the unit will run Defrost operation until defrost terminate point is reached. After active defrost is terminated, the unit will run in active Heat mode but will return to Defrost if it is determined to be needed by the controls.
7. Reversing Valve operation can be found in the Reversing Valve section of this document.

Variable Speed Supply Fan Service Test Mode

Table 8. Cooling only

State #	Service Test State Request	Service Test Supply Fan On/Off Request	Service Test Supply Fan Speed Request [1]	Service Test Compressor Cool Stage Request [2]	Service Test Auxiliary Heat Stage Request [3]	Service Test Condenser Fan Stage Request [4]	Heat Cool Mode Status
1	Inactive	IN CONTROL	IN CONTROL	IN CONTROL	IN CONTROL	IN CONTROL	IN CONTROL
2	Fan On	ON	IN CONTROL	0	0	IN CONTROL	TEST
3	Cool 1	ON	IN CONTROL	1	0	IN CONTROL	TEST
4	Cool 2	ON	IN CONTROL	2	0	IN CONTROL	TEST
5	Heat 1	ON	IN CONTROL	0	1	IN CONTROL	TEST
6	Heat 2	ON	IN CONTROL	0	2	IN CONTROL	TEST
7	Heat 3	ON	IN CONTROL	0	3	IN CONTROL	TEST
8	Heat 4	ON	IN CONTROL	0	4	IN CONTROL	TEST
9	Defrost	OFF	IN CONTROL	0	0	IN CONTROL	TEST

Table 8. Cooling only (continued)

1	Inactive	IN CONTROL	IN CONTROL	IN CONTROL	IN CONTROL	IN CONTROL	IN CONTROL
10	Emergency Heat	ON	IN CONTROL	0	2	IN CONTROL	TEST

Notes:

1. Supply fan speed will operate the same as in normal cooling/heating operations. The minimum speeds can be found in the Appendix of this document.
2. Compressor cool stages are defined within the Appendix of this document.
3. Available auxiliary heat stages are defined within the Appendix of this document.
4. Condenser Fan stages are defined within the Appendix of this document.

Table 9. Heat pump

State #	Service Test State Request	Service Test Supply Fan On/Off Request	Service Test Supply Fan Speed Request [1]	Service Test Compressor Cool Stage Request [2]	Service Test Compressor Heat Stage Request [3]	Service Test Auxiliary Heat Stage Request [4]	Service Test Condenser Fan Stage Request [5]	Heat Cool Mode Status
1	Inactive	IN CONTROL	IN CONTROL	IN CONTROL	IN CONTROL	IN CONTROL	IN CONTROL	IN CONTROL
2	Fan On	ON	IN CONTROL	0	0	0	IN CONTROL	TEST
3	Cool 1	ON	IN CONTROL	1	0	0	IN CONTROL	TEST
4	Cool 2	ON	IN CONTROL	2	0	0	IN CONTROL	TEST
5	Heat 1	ON	IN CONTROL	0	1	1	IN CONTROL	TEST
6	Heat 2	ON	IN CONTROL	0	2	2	IN CONTROL	TEST
7	Heat 3	ON	IN CONTROL	0	2	3	IN CONTROL	TEST
8	Heat 4	ON	IN CONTROL	0	2	4	IN CONTROL	TEST
9	Defrost	OFF	IN CONTROL	0	0	0	IN CONTROL	TEST
10	Emergency Heat	ON	IN CONTROL	0	0	2	IN CONTROL	TEST

Notes:

1. Supply fan speed will operate the same as in normal cooling/heating operations. The minimum speeds can be found in the Appendix of this document.
2. Compressor cool stages are defined within the Appendix of this document.
3. Compressor heat stages are defined within the Appendix of this document.
4. Available auxiliary heat stages are defined within the Appendix of this document.
5. Condenser Fan stages are defined within the Appendix of this document.
6. During Defrost, the unit will run Defrost operation until defrost terminate point is reached. After active defrost is terminated, the unit will run in active Heat mode but will return to Defrost if it is determined to be needed by the controls.
7. Reversing Valve operation can be found in the Reversing Valve section of this document.

Diagnostics

Device Tracker

Symbio 700 will keep statistical data of the unit for component starts and component run times (in hours) for the following unit components:

- Compressor 1
- Compressor 2
- Condenser Fan 1
- Condenser Fan 2
- Supply Fan
- Electric Heat Stage 1
- Electric Heat Stage 2
- Filter (Runtime only)

If the Filter Runtime hours exceed the value set by the user for the Filter Runtime Hours Setpoint, the Symbio 700 controller activates the Diagnostic: Maintenance Required point.

If for any reason it is required to reset the component statistical data, the Run Time Reset or Starts Reset points can be accessed through the Symbio Service and Installation mobile app.. If the reset points are set to Reset, the Component Run Time and Starts are reset to 0 and the associated reset points are set back to inactive. In the case of the Diagnostic: Maintenance Required point, it will also be reset to Inactive if Filter Timer Reset point is set.

Compressor Proving Diagnostics

There are three diagnostics that can be generated based on the compressor proving input.

Diagnostic: Compressor X Proving Trip

When a compressor output is commanded ON and it has been running for more than 5 seconds, if the associated proving input opens, the controls generate the Diagnostic: Comp X Proving Trip and the following will occur:

- Command the associated compressor output OFF immediately.
- Command any compressor output OFF that is on the same refrigeration circuit as the compressor which had the proving input trip.
- The Circuit is disabled for 15 minutes.

After the 15 minute compressor proving timeout has expired, if the unit is not under a "Diagnostic: Compressor 1 Proving Lockout" event

- The Diagnostic: Comp X Proving Trip diagnostic is reset
- If the cooling stage is still requested ON, the circuit is allowed to stage again

Diagnostic: Compressor X Proving Lockout

There are two cases that can cause a Diagnostic: Compressor X Proving Lockout:

- If a refrigeration circuit accumulates 4 consecutive Diagnostic: Comp X Proving Trips during the same compressor operating cycle, a Diagnostic: Compressor X Proving Lockout is generated.

  Note: *If the call for the compressor operation terminates, the counter is set to zero.*

- If a compressor's associated proving input does not CLOSE within 5 seconds of the compressor startup.

If a Diagnostic: Compressor X Proving Lockout is generated the following will occur:

- All compressors on the associated circuit are de-energized immediately and they are locked out until a Reset Diagnostic action is initiated.

- The “Diagnostic: Compressor X Proving Lockout” diagnostic point is activated and the alarm output is activated.

Diagnostic: Compressor X Contactor Failure

If a compressor proving input becomes Active for 5 continuous seconds when the associated compressor command output is Inactive, a Diagnostic: Compressor X Contactor Failure is generated and the following occurs:

- All compressors on the associated circuit are de-energized immediately and they are locked out until a Reset Diagnostic is initiated.

The “Compressor X Contactor Failure” diagnostic point is activated and the alarm output is activated.

Diagnostics – Low Pressure Cutout

The following operation is enforced based on the state of the circuit’s LPC input:

Prior to Compressor Startup:

- If a compressor output is Off and its circuit’s LPC input is open, compressor operation is not inhibited, and the **Diagnostic: Circuit X LPC Trip** point will not be annunciated.

After Compressor Startup:

An LPC Bypass Delay function delays the setting of a low pressure cutout after compressor startup on a circuit until a pre-determined amount of time passes in low ambient conditions. The length of the delay is determined based on ambient temperature:

- If the Outdoor Air Temperature Active is less than 40°F, the LPC Bypass Delay is set to 60 seconds
- If the Outdoor Air Temperature Active is between 40°F and 50°F, the LPC Bypass Delay is set to 30 seconds
- If the Outdoor Air Temperature Active is greater than 50°F, the LPC Bypass Delay is 0 seconds

There are two diagnostics that can be generated based on the Compressor Low Pressure Cutout input:

Diagnostic: Circuit X LPC Trip

- All Compressors Outputs on the effected circuit are commanded OFF
- The Diagnostic: Circuit X LPC Trip point is annunciated
- The circuit is disabled for 3 minutes
- The circuit’s LPC trip counter is incremented

After the 3 minute low pressure event timeout has expired, if the unit is not under a lockout event,

- The Diagnostic: Circuit X LPC Trip point is reset
- If the stage is still requested ON, the circuit is allowed to stage again
- If the Circuit runs for 3 minutes, its LPC Trip Count is reset to 0.

On Heat Pumps, if the Outdoor Air Temperature is less than 0° F or if the unit is in active defrost, the low pressure cutout input state is ignored.

Diagnostic: Circuit X LPC Lockout

If a circuit’s LPC trip counter accumulates 4 low pressure events without the circuit running for the 3 minute minimum on time (counter is not reset), a Diagnostic: Circuit X LPC Lockout” is generated.

Once a Diagnostic: Circuit X LPC Lockout has been generated, the following occurs:

- All compressors on the associated circuit are de-energized immediately and they are locked out until a Reset Diagnostic is initiated.
- The Diagnostic: Circuit X LPC Lockout point is activated and the alarm output is activated.

Diagnostics – Alarm Indicator Status

The Symbio 700 will support an Alarm Indicator Status point that if configured, drives the state of a relay output on the Customer Connection Module. This point is set to active when a failure occurs that functionally stops a critical component within the HVAC system.

For a list of all supported Symbio 700 Diagnostics and if it sets the Alarm Indicator, refer to the Appendix section of this document.

Reset Diagnostic

A Reset Diagnostic function is responsible for ensuring that the Reset Diagnostic point is set to the right value under normal application control. The below sections describes how the Reset Diagnostic point is set to Active and Inactive.

Power-Up Reset or Exception/Override Mode Transition

At power-up or after the unit leaves an Exception or Override mode, all diagnostics are cleared, and the application starts over.

Reset Diagnostic Point

Diagnostic Resets throughout the controller application are triggered by the state of the Reset Diagnostic Point. The Reset Diagnostic point is setup as a last-write-wins point type, so it can be controlled by the local UI on the Symbio 700 or can be communicated.

Heat Cool Mode Transition Reset

When the unit is controlled by a zone sensor, a transition from System Mode Switch Local = OFF to System Mode Switch Local ≠ OFF triggers a Reset Diagnostic request.

Reset Diagnostic Point – Active to Inactive Transition

When the diagnostic reset function detects the state of the Reset Diagnostic point is Active, after 5 seconds, the Diagnostic Reset function sets the Reset Diagnostic point to Inactive.

Troubleshooting

The Symbio 700 controller provides system shutdown, operational default operation, and communication error handling of the Odyssey unit. The list of fault conditions below will stop normal operation or change the operation of the unit to a default condition. Faults are indicated in the Active Alarm menu of the onboard user interface and the Symbio Service and Installation mobile app.

Unit Communication Fault

The maximum time for the inter-module communications (IMC) bus is 15 seconds. If 15 seconds passes with no valid communications received from any of the Options modules, the Symbio 700 takes the following actions:

Module	Symbio 700 Response	Response Type
Symbio 700 Onboard I/O	• Set Diagnostic: Unit Communications Failure • On-Board I/O Communication Status = Not Communicating • All unit functions will be shut down and I/O will go to their comm. loss state	Auto Reset
Customer Options Module	• Set Diagnostic: Unit Communications Failure • Customer Options Module Communication Status = Not Communicating • All unit functions that have dependencies on data from other modules will be discontinued – Ventilation Override functionality is discontinued – Alarm Indicator function is discontinued	Auto Reset
Indoor Options Module	• Set Diagnostic: Unit Communications Failure • Indoor Options Module Communication Status = Not Communicating • All unit functions that have dependencies on data from other modules will be discontinued – All Electric Heat operation is discontinued – Discharge Air Temperature dependent control discontinued (SZVAV)	Auto Reset

Sensor Fault

On Symbio 700, if a sensor value goes outside of its minimum or maximum range, the point goes into an Alarm State. If the point in the Alarm State, we consider the sensor failed and take the following actions:

Fault	Symbio 700 Response	Response Type
Space Temperature Active	• Annunciated in the Active Alarm list. • For specific unit operational response, see Space Temperature Control (CVZT/VVZT) section of this document.	Auto Reset
Discharge Air Temperature Local	• Annunciated in the Active Alarm list. • For specific unit operational response, see Space Temperature Control (CVZT/VVZT) section of this document.	Auto Reset
Outdoor Air Temperature Active	• Annunciated in the Active Alarm list. • Heat Pump Low Ambient functionality is disabled.	Auto Reset

Fault	Symbio 700 Response	Response Type
Coil Temperature Sensor 1	• Annunciated in the Active Alarm list. • If Outdoor Air Temperature < 52° F, Demand Defrost will be disabled and timed defrost will be used.	Auto Reset
Coil Temperature Sensor 2	• Annunciated in the Active Alarm list. • If Outdoor Air Temperature < 52°F, Demand Defrost will be disabled and timed defrost will be used.	Auto Reset
Space Humidity Sensor	Annunciated in the Active Alarm list.	Auto Reset
Space CO2 Sensor	Annunciated in the Active Alarm list.	Auto Reset

Compressor Fault

Symbio 700 supports compressor safety functionality to keep the compressors from operating in an undesirable condition. If a compressor safety failure occurs, the following actions occur:

Fault	Symbio 700 Response	Response Type
LPC Lockout	For specific operation associated with the LPC diagnostics, refer to the Compressor Protection section of this document.	Manual Reset
Proving Lockout	For specific operation associated with the proving diagnostics, refer to the Compressor Protection section of this document.	Manual Reset
Contactor Failure	For specific operation associated with the proving diagnostics, refer to the Compressor Protection section of this document.	Manual Reset

VFD Fault

The following failures are derived either through direct data monitoring from the Modbus device, or through a combination of Modbus data and additional failure criteria:

Fault	Fault Detection	Symbio 700 Response	Response Type
Diagnostic: Supply Fan Failure	If while the Supply Fan VFD is requested to run, the VFD Running Status from the drive is set to False for 40 continuous seconds, this failure will be detected	• Diagnostic: Supply Fan Failure will be set to Active • All unit functions will be shut down immediately	Manual Reset
Diagnostic: VFD Fault Supply Fan – 1	When Active	All unit functions will be shut down immediately	Auto Reset
Diagnostic: VFD Supply Fan Ground Fault – 1	When Active	All unit functions will be shut down immediately	Auto Reset
Diagnostic: VFD Supply Fan Motor Current Overload – 1	When Active	All unit functions will be shut down immediately	Auto Reset
Diagnostic: VFD Supply Fan Short Circuit – 1	When Active	All unit functions will be shut down immediately	Auto Reset
Supply Fan VFD Communication Status	If continual loss of communication between the controller and the VFD has occurred for a 30-second period, this failure will be detected.	• Supply Fan VFD Communication Status will be set to Not Communicating • All unit functions will be shut down	Manual Reset

Defrost Fault

The below list of diagnostics are associated with the Demand Defrost Function.

Fault	Fault Detection	Symbio 700 Response	Response Type
Diagnostic: Demand Defrost Disabled Diagnostic: Demand Defrost Disabled Ckt 1 Diagnostic: Demand Defrost Disabled Ckt 2	• Set **Diagnostic: Demand Defrost Disabled** with any Demand Defrost Fault on non-independent circuit heat pumps.- • Set **Diagnostic Demand Defrost Disable Ckt X** with any Demand Defrost Fault on any circuit for independent condenser systems.	• **Set Diagnostic: Demand Defrost Disabled** • For Independent Circuit Heat Pump units, set **Diagnostic Demand Defrost Disable Ckt X** (depending on the associated circuit) • Revert to Default Defrost operation. • See Demand Defrost Faults below	Manual Reset
Diagnostic: Demand Defrost Fault A Diagnostic: Demand Defrost Fault A Ckt 1 Diagnostic: Demand Defrost Fault A Ckt 2	ΔT is below minimum value 12 minutes after defrost is terminated.	• Initiate Defrost • If Low ΔT > 2 hours: – Set **Diagnostic: Demand Defrost Disabled** – Set **Diagnostic: Default Defrost Fault A** • For Independent Circuit Heat Pump units, set **Diagnostic: Demand Defrost Disable Ckt X** • Set **Diagnostic: Default Defrost Fault A CKt X** • Initiate Defrost Reset timer if ΔT returns within bounds	Manual Reset
Diagnostic: Demand Defrost Fault B Diagnostic: Demand Defrost Fault B Ckt 1 Diagnostic: Demand Defrost Fault B Ckt 2	Defrost terminated on time requirement	If defrost is terminated on time requirement (vs differential temp) • Set **Diagnostic: Default Defrost Fault B** • For Independent Circuit Heat Pump units, set Diagnostic: Default Defrost Fault B Ckt X • Increment Demand Defrost Fault B counter After counter = 10 Set Diagnostic: Demand Defrost Disabled or for Indepentent Circuit unit • For Independent Circuit Heat Pump units, set **Diagnostic: Demand Defrost Disable Ckt X**	Manual Reset
Diagnostic: Demand Defrost Fault C Diagnostic: Demand Defrost Fault C Ckt 1 Diagnostic: Demand Defrost Fault C Ckt 2	ΔT is above Maximum Value 12 minutes after defrost is terminated	• Set **Diagnostic: Default Defrost Fault C** or for Independent Circuit units, set **Diagnostic: Default Defrost Fault C Ckt X** • Initiate Defrost Increment Demand Defrost Fault C counter • After counter = 16 • Set **Diagnostic: Demand Defrost Disabled** or for Independent Circuit units • Set **Diagnostic: Demand Defrost Disable Ckt X**	Manual Reset

Fault	Fault Detection	Symbio 700 Response	Response Type
Diagnostic: Demand Defrost Fault D	ΔT does not change by 2°F in 1 hour, starting 12 minutes after defrost is terminated and ΔT is less than or equal to 6 but greater than Low ΔT degrees 12 minutes after defrost is terminated.	• Initiate Defrost • Set Diagnostic: Demand Defrost Disabled • Set Diagnostic: Default Defrost Fault D	Manual Reset

Appendix A

Supply Fan

Multi-Speed/VFD

Table 10. Multi-speed minimum supply fan speeds

Unit Operation	Supply Fan Speed
Off	0%
Fan Only	41.7%
Cooling Stage 1	41.7%
Cooling Stage 2	100%
Heat Pump Heating	100%
Electric/Auxiliary Heating	100%

Variable Speed/VFD

Table 11. Variable speed minimum supply fan speeds

Unit Operation	Supply Fan Speed
Off	0%
Fan Only	58%
Cooling Stage 1	58%
Cooling Stage 2	80%
Heat Pump Heating	100%
Electric/Auxiliary Heating	100%

Compressor Staging

Thermostat Staging

For equipment staging response to a conventional thermostat signals, refer to the Conventional Thermostat sequence of operation above.

Cooling Only (Electric Heat) – CVZT & VVZT

Table 12. Single compressor cooling staging

Unit Operation	Unit Response
Cooling Stage 1	Compressor 1 Output ON

Table 13. Dual compressor cooling staging (manifold or independent)

Unit Operation	Unit Response
Cooling Stage 1	Compressor 1 Output ON
Cooling Stage 2	Compressor 1 Output ON + Compressor 2 Output ON

Table 14. Dual unloading compressor cooling staging

Unit Operation	Unit Response
Cooling Stage 1	Compressor 1 Output ON + Compressor 2 Output ON
Cooling Stage 2	Compressor 1 Output ON +Compressor 1 Unloader Solenoid ON + Compressor 2 Output ON +Compressor 2 Unloader Solenoid ON

Heat Pump – CVZT & VVZT

Table 15. Single compressor cooling staging

Unit Operation	Unit Response
Cooling Stage 1	Compressor 1 Output ON

Table 16. Dual compressor cooling staging (manifold or independent)

Unit Operation	Unit Response
Cooling Stage 1	Comrpessor 1 Output ON
Cooling Stage 2	Compressor 1 Output ON + Compressor 2 Output ON

Condenser Fan Operation

Thermostat, CVZT, & VVZT

Table 17. Single condenser fan systems (cooling only and heat pump)

Unit Operation	Unit Response
Compressor 1 Output ON	Condenser Fan Output 1 ON
Compressor 2 Output ON	Condenser Fan Output 1 ON
Compressor 1 Output ON + Compressor 2 Output ON	Condenser Fan Output 1 ON

Note: *If Defrost is active on Heat Pump units, then Condenser Fan Output 1 OFF.*

Table 18. Dual condenser fan - shared airstream (cooling only)

Unit Operation	Unit Response
Compressor 1 Output ON	Condenser Fan Output 1 ON +Condenser Fan Output 2 ON
Compressor 2 Output ON	Condenser Fan Output 1 ON +Condenser Fan Output 2 ON
Compressor 1 Output ON + Compressor 2 Output ON	Condenser Fan Output 1 ON +Condenser Fan Output 2 ON

Table 19. Dual condenser fan - independent airstream (cooling only and heat pump)

Unit Operation	Unit Response
Compressor 1 Output ON	Condenser Fan Output 1 ON
Compressor 2 Output ON	Condenser Fan Output 2 ON
Compressor 1 Output ON + Compressor 2 Output ON	Condenser Fan Output 1 ON +Condenser Fan Output 2 ON

Notes:

- *If Defrost is active on Heat Pump refrigeration circuit 1, then unit response is Condenser Fan Output 1 OFF.*
- *If Defrost is active on Heat Pump refrigeration circuit 2, then unit response is Condenser Fan Output 2 OFF.*

Electric Heat

CVZT & VVZT

Table 20. Electric heat staging

Unit Operation	Unit Response
Electric Heat Stage 1	Electric Heat Stage 1 Output ON
Electric Heat Stage 2	Electric Heat Stage 1 and 2 Outputs ON

Diagnostics and Alarm Indicator Status

Table 21. Odyssey supported diagnostics and alarm relay functionality

Diagnostic/Alarm	Alarm Indicator
Diagnostic: Unit Communications Failure	Y
On-Board I/O Communication Status	Y
Customer Options Module Communication Status	Y
Indoor Options Module Communication Status	Y
Heat Options Module Communication Status	Y
Supply Fan VFD Communication Status	Y
Diagnostic: Demand Defrost Disabled	N
Diagnostic: Demand Defrost Disabled Ckt 1	N
Diagnostic: Demand Defrost Disabled Ckt 2	N
Diagnostic: Demand Defrost Fault A	N
Diagnostic: Demand Defrost Fault A Ckt 1	N
Diagnostic: Demand Defrost Fault A Ckt 2	N
Diagnostic: Demand Defrost Fault B	N
Diagnostic: Demand Defrost Fault B Ckt 1	N
Diagnostic: Demand Defrost Fault B Ckt 2	N
Diagnostic: Demand Defrost Fault C	N
Diagnostic: Demand Defrost Fault C Ckt 1	N
Diagnostic: Demand Defrost Fault C Ckt 2	N
Diagnostic: Demand Defrost Fault D	N
Diagnostic: VFD Fault Supply Fan - 1	Y
Diagnostic: VFD Supply Fan Ground Fault - 1	Y
Diagnostic: VFD Supply Fan Motor Current Overload - 1	Y
Diagnostic: VFD Supply Fan Short Circuit - 1	Y
Diagnostic: Circuit 1 LPC Lockout	Y

Table 21. Odyssey supported diagnostics and alarm relay functionality (continued)

Diagnostic/Alarm	Alarm Indicator
Diagnostic: Circuit 2 LPC Lockout	Y
Diagnostic: Compressor 1 Proving Lockout	Y
Diagnostic: Compressor 2 Proving Lockout	Y
Diagnostic: Compressor 1 Contactor Failure	Y
Diagnostic: Compressor 2 Contactor Failure	Y
Diagnostic: Circuit 1 LPC Trip	N
Diagnostic: Circuit 2 LPC Trip	N
Diagnostic: Comp 1 Proving Trip	N
Diagnostic: Comp 2 Proving Trip	N
Diagnostic: Maintenance Required	N
Coil Temperature Sensor 1	N
Coil Temperature Sensor 2	N
Coil Temperature Sensor 3	N
Discharge Air Temperature Local	N
Outdoor Air Temperature Active	N
Outdoor Air Humidity Active	N
Space CO2 Concentration Active	N
Space Humidity Active	N
Space Temperature Active	N

Emergency and Ventilation Override

Table 22. Emergency and ventilation override

Inputs	Outputs					
Emergency Override BAS	EOM Supply Fan On/ Off Request	EOM Supply Fan Speed Request	EOM Compres-sor Cool Stage Request	EOM Compres-sor Heat Stage Request	EOM Auxiliary Heat Stage Request	Heat Cool Mode Status
Point	State	%	Value	Value	Value	Point
2 = EMERG_ PRESSURIZE	ON	100	0	0	0	Fan Only
3 = EMERG_ DEPRESSURIZE	OFF	0	0	0	0	Fan Only
4 = EMERG_PURGE	ON	100	0	0	0	Fan Only
5 = EMERG_SHUTDOWN	OFF	0	0	0	0	OFF
6 = EMERG_FIRE	OFF	0	0	0	0	OFF
1 = EMERG_NORMAL	Auto	Auto	Auto	Auto	Auto	Auto

Internal and External Space Setpoint Adjustment

Zone sensors with an internal or external setpoint adjustment provide the controller with a local setpoint (50° F to 85° F or 10° C to 29.4° C). The internal setpoint adjustment is concealed under the zone sensor cover. To access the setpoint adjustment, remove the zone sensor cover. Some external setpoints (when present) are displayed on the digital display zone sensor front cover. When the local setpoint adjustment is used to determine the setpoints, all unit setpoints are calculated based on the local setpoint value, the configured setpoints, and the active mode of the controller. The controller determines the effective space setpoint based on the following:

- Local setpoint input (SET)
- The local setpoint calibration (configured)
- Whether or not the local setpoint adjustment can be used or not (configured)
- Communicated setpoint input
- Default setpoints (configured)
- Occupancy mode
- Heating or cooling mode (space demand)
- Space setpoint high and low limits (configured)

Heat mode:

- Occupied mode: Space Temperature Setpoint Active = Space Temperature Setpoint (arbitrated) - Occupied Offset
- Occupied standby mode: Space Temperature Setpoint Active = Space Temperature Setpoint (arbitrated) - Standby Offset
- Unoccupied mode: Space Temperature Setpoint Active = Unoccupied Heating Setpoint Cool mode

Cool mode:

- Occupied mode: Space Temperature Setpoint Active = Space Temperature Setpoint (arbitrated) + Occupied Offset
- Occupied standby mode: Space Temperature Setpoint Active = Space Temperature Setpoint (arbitrated) + Standby Offset
- Unoccupied mode: Space Temperature Setpoint Active = Unoccupied Cooling setpoint

When a building automation system or other controller communicates a setpoint to the controller, the controller ignores the local setpoint input and uses the communicated value. The exception is when the system is in unoccupied mode and the controller always uses the unoccupied setpoints. After the controller completes all setpoint calculations, the calculated occupied setpoint is validated against the following configured space setpoint limits:

- Heating setpoint high limit
- Heating setpoint low limit
- Cooling setpoint high limit
- Cooling setpoint low limit

These setpoint limits apply only to the occupied and occupied standby, heating, and cooling setpoints. They do not apply to the unoccupied heating and cooling setpoints. When the controller is in the unoccupied mode, it always uses the unoccupied heating and cooling setpoints. Unit configuration enables or disables the local setpoint. This parameter provides additional flexibility to allow you to apply communicated, local, or default setpoints without making physical changes to the unit. Similar to local setpoints, the effective setpoint value for a communicated setpoint is determined based on the stored default setpoints, configuration values, and the controller occupancy mode.

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