

Installation & Operation Manual



SKY-35

Controller for Multiple
Heat Sources



About this manual

Thank you for your purchase of the Sky-35 controller. Please keep this manual on site for reference.

- Chapters four through seven document the four tabs of the controller screen:
 - 4 🏠 *Home*
 - 5 ⚙️ *Setup*
 - 6 📊 *Status*
 - 7 ●●● *More.*
- Chapter 8 offers a survey of the best practices in system design.
- Chapter 9 provides concept drawings to aid in your application.



Caution: Handling the touchscreen

The touchscreen responds to a light finger touch on the screen. Use only a stylus or a clean finger to interact with the touchscreen. Using sharp or metallic objects will cause damage.



Caution: Controller's USB port

Be aware that the USB port is designed for software updates. It is not designed to power user devices that require and draw high amperage. Powering such devices via the USB port may result in a blank controller screen, and thus require a system reboot.

Accessories included

- Pump Relay Module
 - » for on/off control of three pumps
 - » includes 24 Volt power source for Sky-35
- Supply temperature sensor
- Return temperature sensor
- DHW temperature sensor
- Outdoor temperature sensor

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1.0 Specifications

Sky-35 Controller Specifications	
Rated Voltage / Frequency / Phase	24V / 60Hz / 1Ph
Total Load (less pumps)	10VA / 0.42 A
Weight	3.2 lb / 1.45 kg
Max Fuse Size	2 A
Minimum Ambient Temperature	32°F / 0°C
Maximum Ambient Temperature	131°F / 55°C
Height	11.375" / 288.5 mm
Width	10.125" / 256.7 mm
Depth	1.75" / 43.7 mm
Rated Impulse Voltage	330 V
Action Type	1
Pollution Degree	2

Table 1 Sky-35 controller Specifications

Pump Relay Module Accessory Specifications	
Rated Voltage / Frequency / Phase	120V / 60Hz / 1Ph
3 x Relays 120VAC / 4.4 A max each	12.0 A Total
Total Load (less pumps)	0.1 A
Weight	2.4 lb / 1.09 kg
Max Fuse Size	15 A
Minimum Ambient Temperature	32°F / 0°C
Maximum Ambient Temperature	131°F / 55°C
Height	6.125" / 156 mm
Width	10.125" / 257 mm
Depth	2.125" / 49 mm
Rated Impulse Voltage	2500 V
Action Type	1
Pollution Degree	2

Table 2 Pump Relay Module accessory Specifications

1.1 Certifications / ETL Listings

The Sky-35 Controller conforms to UL STD 60730-1, and is certified to CSA STD E60730-1

FCC Notice

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- » Reorient or relocate the receiving antenna.
- » Increase the separation between the equipment and receiver.
- » Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- » Consult the dealer or an experienced radio/TV technician for help.



Caution

The Sky-35 is designed for indoor installation only.

1.2 Sky-35 dimensions

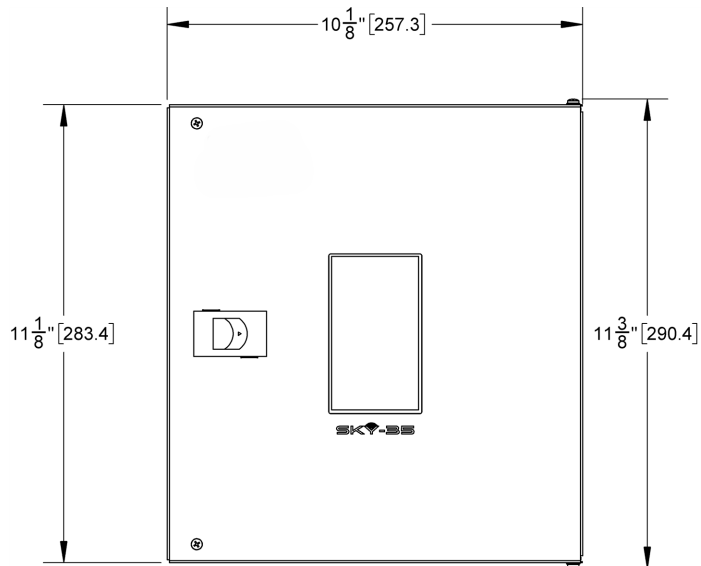


Figure 1 Front view- Sky-35 Controller

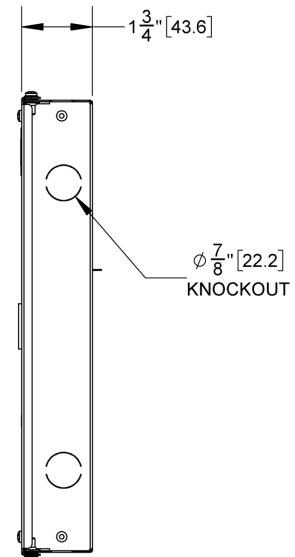


Figure 2 Side view- Sky-35 Controller

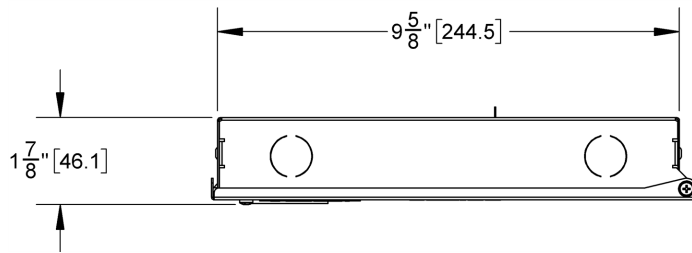


Figure 3 Top view- Sky-35 Controller

1.3 Relay Module dimensions

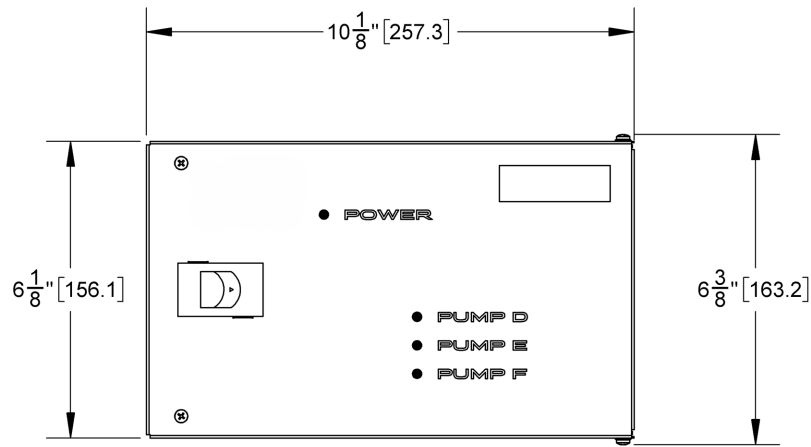


Figure 4 Front view - Pump Relay Module

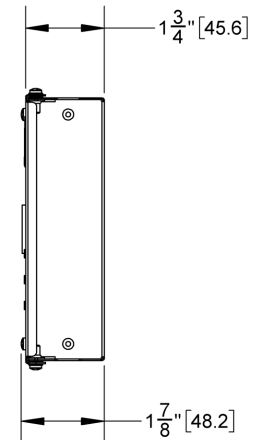


Figure 5 Side view-
Pump Relay Module

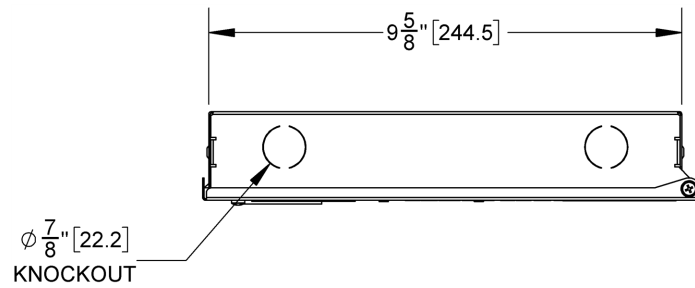


Figure 6 Top view - Pump Relay Module

1.4 Connection specifications

Sky-35 Connections	
Supply power wiring knock-out (1)	1/2"
Control wiring knock-outs (8)	1/2"
Ethernet port (1)	RJ45
USB port (1)	USB-A

Table 3 Sky-35 Connections

Clearances

When wall-mounting, leave adequate room for door swing, wiring connections and 6" (15cm) below for insertion of USB stick.

Pump Relay Module Connections	
Supply power wiring knock-out (1)	1/2"
Pump wiring knock-outs (7)	1/2"

Table 4 Pump Relay Module Connections

1.5 Warranty

The manufacturer offers a 2-year warranty on all parts against defects in materials or workmanship.

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2.0 Sky-35 Controller Overview

The controller provides easy and versatile management of multiple heating sources. The Sky-35 allows you to set up primary and backup heat sources so that they work together in a priority sequence.

2.1 Features of the controller

- Control staging of up to 16 heat pumps, four electric boilers and a gas boiler network
- Main loop monitoring and control
- Buffer tank monitoring with Summer or Winter Shutdown
- Always-on status display
- Easy-to-set Outdoor Reset control option
- Two-way communication with V10 boiler controllers and select Heat Pumps and Electric Boilers
- Dry contacts for control of third-party heat sources
- Easy Heat Source setup
- Supply, Return and Outdoor temperature sensors included
- Control for up to six ECM pumps
- On/off control for three conventional pumps with included Pump Relay Module
- Heat Pump Over-temp Protection
- Heat Pump Freeze Protection
- Flexible options for a wide spectrum of applications
- Easy expansion to six conventional pumps with purchase of additional Pump Relay Module

2.2 Controller's menu screens

The diagram below illustrates the controller's menu structure. Any of the four tabs can be selected at any time from the bottom of the touchscreen:

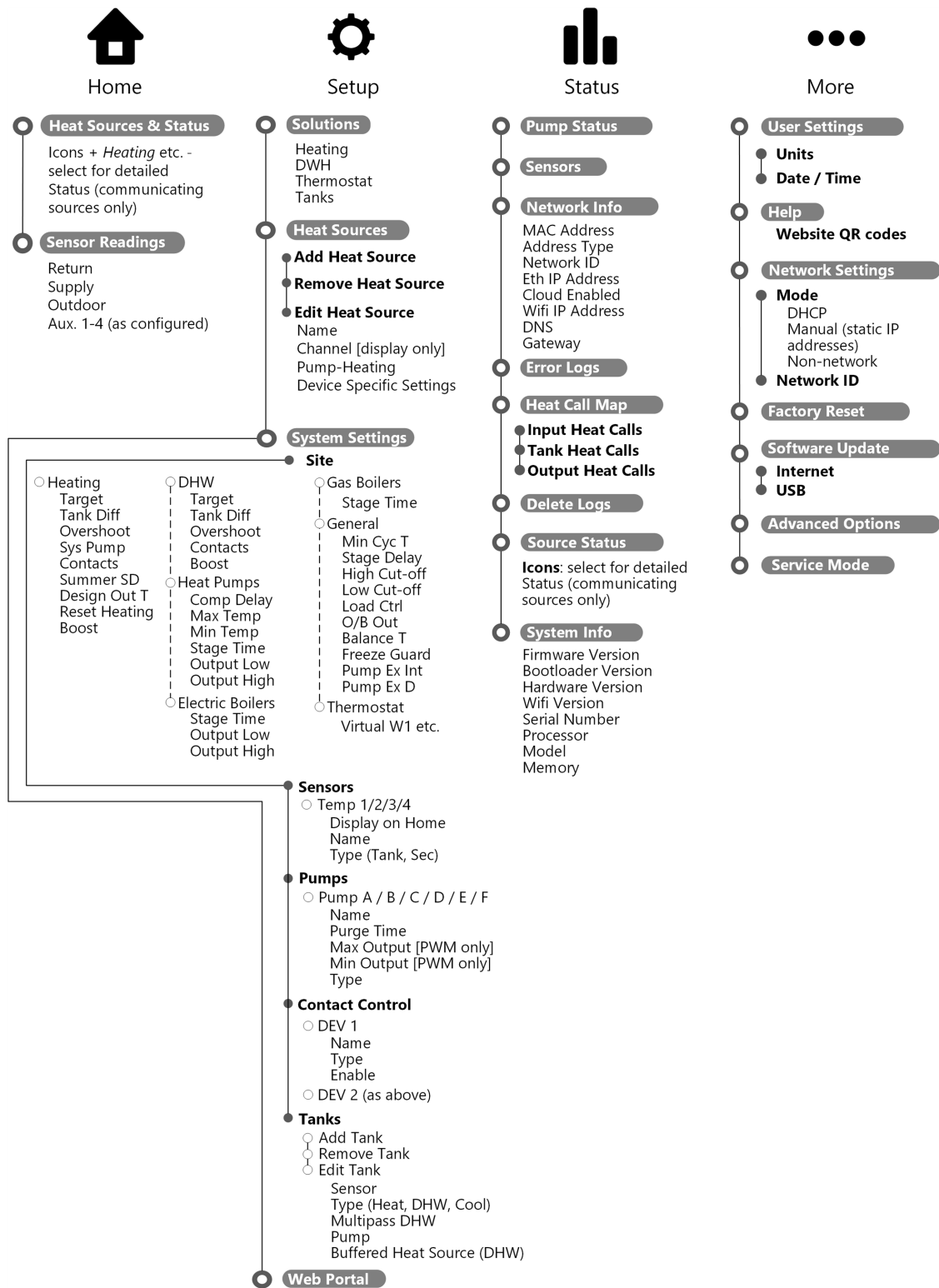


Figure 7 Map of the controller

2.3 Who is the manual for?

This manual is primarily written for heating professionals. Some of the content may be useful for building managers and homeowners.

2.4 Power-up sequence and operational states/cycles

When the Sky-35 is first energized, some settings will already be populated with default values: you will probably wish to change (and **Save**) certain settings. Generally, saved values take effect with the next heating call.

After a power interruption, the controller automatically resumes operation with all the previously stored values. During a power interruption a capacitor maintains the clock operation, but the capacitor charge is not required for retention of saved changes.

2.5 Getting to know the controller's interface

The controller's main screen displays four tabs:  Home,  Setup,  Status, and  More. These are covered in detail in the next four chapters.

At the bottom of all screens is a status bar; its colour has intuitive significance:

Status Bar Colour	Description
Green	Normal state - controller is operating within its limits.
Yellow	Warning error - When the controller detects an error.
Red	Alarm - Unresolved condition or error detected while a heat source is operating or preparing to operate.

Table 5 Status bar background colours

Errors are addressed in detail in the sections [The Status screen on page 45](#) and [Troubleshooting on page 81](#).

2.6 Multiple Heat Sources

For two or more heat sources a common control strategy is to designate one as primary and the other as a secondary heat source. The Sky-35 priority sequence (for the current software release) is:

1. Heat Pump (Heat Source 1)
2. Electric Boiler (Heat Source 2)
3. Gas Boiler (Heat Source 3)

The secondary heat source will turn on if

- the primary source run time reaches the *Stage Time* of the secondary heat source. See *Setup > System Settings > Site > (Heat Pump/ Electric Boiler/ Gas Boiler) > Stage Time*.
- there is a W2 call from the thermostat
- the outdoor temperature is below the *Balance Point*

Heat sources of identical type are added and dropped in a first on / first off pattern. The "first on" role is rotated among units for balanced run-times.

Sequence of operation – heating a buffer tank with two heat pumps

- If the outdoor temperature is above the temperature set as *Summer Shutdown*, Sky-35 displays *Standby-Summer* and does not heat.
- If the outdoor temperature is below *Summer Shutdown*, the buffer tank setpoint activates. This will be either a setpoint determined by Outdoor Reset or a fixed Setpoint.
- The Sky-35 will begin running one heat pump. Heat output will be proportional to the degrees below target temperature. Some heat pump models will progress through a first and second level staging.
- If after the interval set as *Staging Delay* the tank temperature is below setpoint, the Sky-35 will bring on the second heat pump.
- As the buffer tank temperature approaches its target, the heat pump(s) will reduce output.
- When the buffer tank reaches its target plus half the *Differential*, the Sky-35 will shut off the heat pump(s). (Note for DHW heating stops exactly when the target is reached.)



Note

For a DHW tank the differential applies only below the target: heating stops when the target is reached, and begins again when the tank falls below target by the differential.

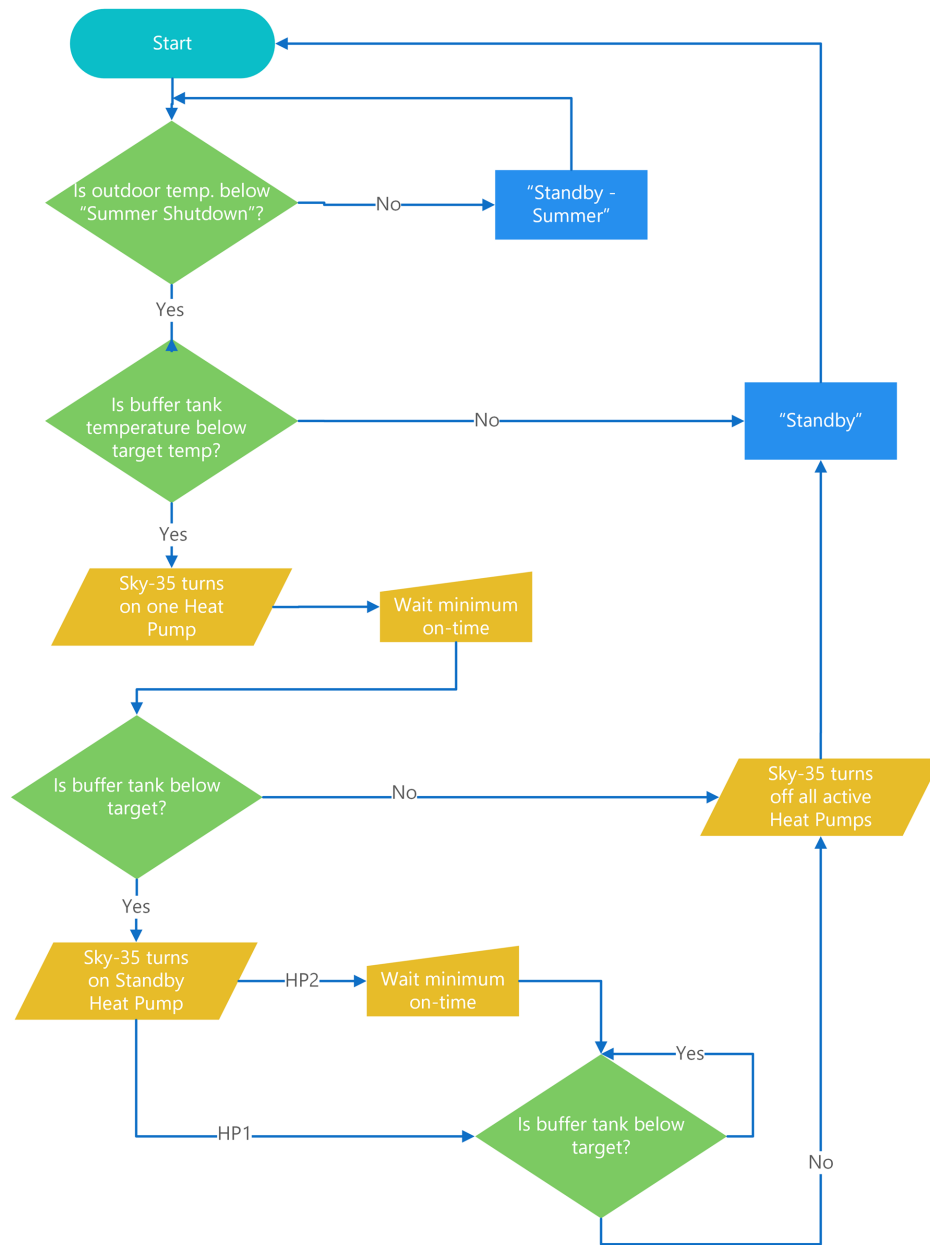


Figure 8 Sequence of operation: heating with two heat pumps

A similar sequence of operation can be seen in this example of a gas-fired combi boiler / water heater backup for space-heating:

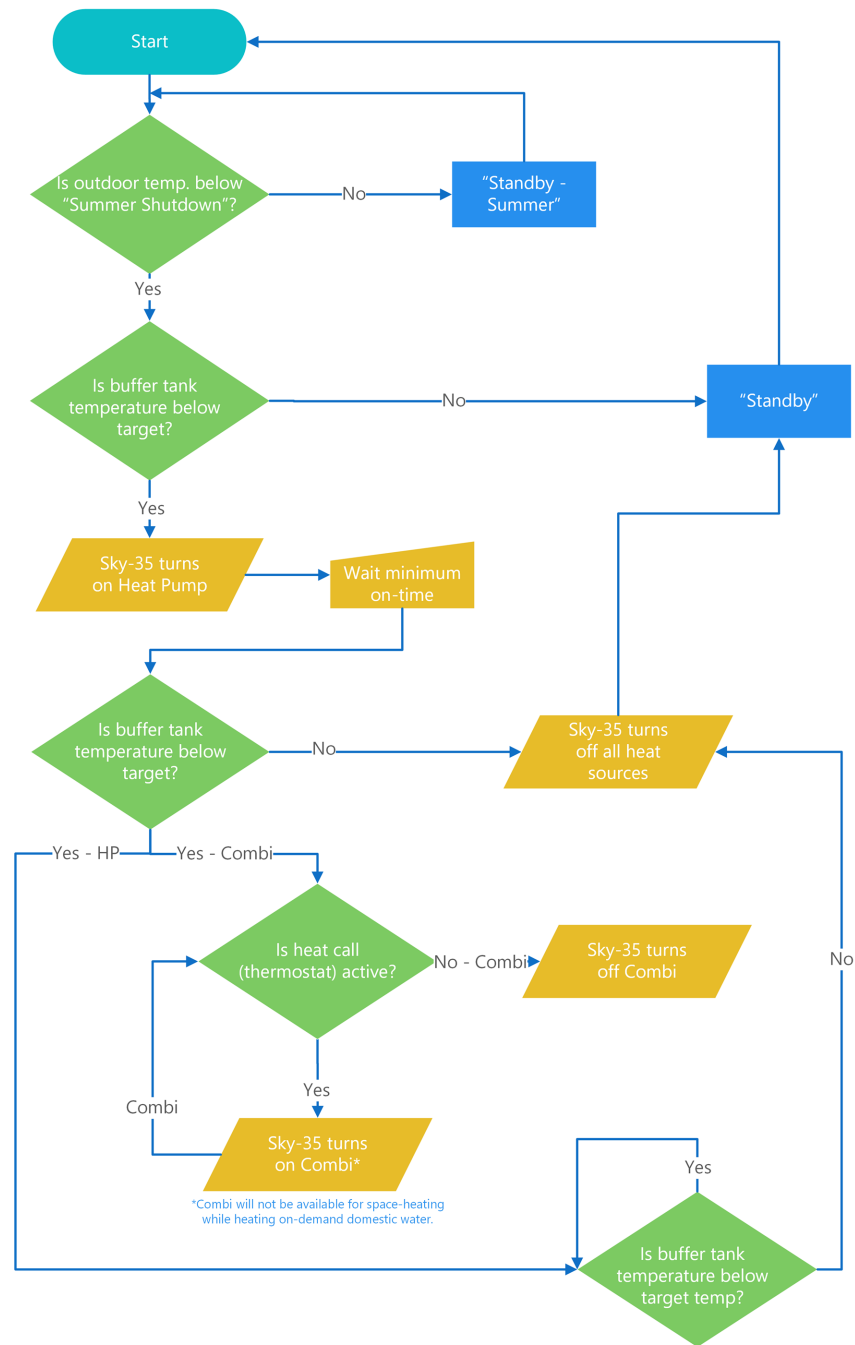


Figure 9 Sequence of operation: heating with heat pump and combi boiler / water heater

Sequence of operation – heating with heat pump with Combi boiler backup

The heat pump acts as the primary heat source. Heating is active while the outdoor temperature stays below the value *Summer Shutdown*, which is typically set around 66°F (19°C).

While heating is active the Sky-35 directs a heat source or sources to maintain the buffer tank temperature. The reset heating range (or simple tank setpoint) and buffer tank differential values are entered directly into the *Setup > Site Settings* menu. The tank differential must not be so great that at the end of the off-cycle the water is too cool to provide space-heating, but it must not be so small that the system short-cycles. The optimum value will depend on the heat output and the buffer tank volume: see the section [Buffer Tank on page 53](#) below.

The heat sources themselves need to be set to operate just slightly hotter than the buffer tank target, so that the buffer tank load may be satisfied and the heat sources go into Standby during periods of low demand. Where it can dictate target temperatures, the Sky-35 applies this lift automatically. For those heat sources requiring your configuration, we suggest the heat sources be set 2°F to 6°F (1°C to 3.3°C) above the buffer tank and distribution system.

When the buffer tank reaches target temperature and the heat sources turn off, some of the heating zones may still be active. Heat is transferred from the buffer tank to the building and eventually the tank temperature drops below the differential, and the Sky-35 will turn on the heat pump once again.

Rotation

When multiple heat pumps or electric boilers are configured, a 'Rotation' routine is applied automatically. The lead unit is alternated with each cycle.



Note on Thermostats with Buffer Tank

In Buffer Tank mode the backup heat source joins heating the buffer tank after the staging delay, while there's an active call from the thermostat. If the thermostat isn't calling the primary heat source brings the tank up to temperature without the backup. If there is no thermostat connection to the Sky-35, the backup heat source will activate only if the outside temperature is below the setting *Balance Point*, or the primary heat source is in error.

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3.0 Installation and Wiring

3.1 Location

Situate the controller in the heating equipment room approximately 1.5 m (5ft) from the ground, or at a height offering easy access. Before mounting, consider accessibility to heat sources and pumps which are to be wired to the controller. Leave adequate room for door swing, wiring connections and 4" (10 cm) below for insertion of USB stick.



Warning

The supply voltage wiring must be permanent, fixed type.



Warning

Wiring and testing must be performed by experienced and trained professionals.



Warning

The units were tested and certified for wired connections no longer than 32.8 feet (10 m) maximum. This does not apply to the supply voltage wiring.

This section includes the following topics:

- Layout
- Terminal functions and Ratings
- Connections to Pump Relay Module
- RS-485 and Ethernet connections
- Thermostats and Sensors
- Load pumps or valves
- Sensors
- Dry contacts for devices
- Wiring checklist



Note

Sensors connected to any sensor input contacts must be of the NTC Thermister type with a resistance of 10,000 ohms at 77°F (25°C) and $\beta = 3892$. We do not recommend using 3rd-party supplied sensors. Water temperature sensors and outdoor sensors can be supplied by your distributor.

3.2 Layout

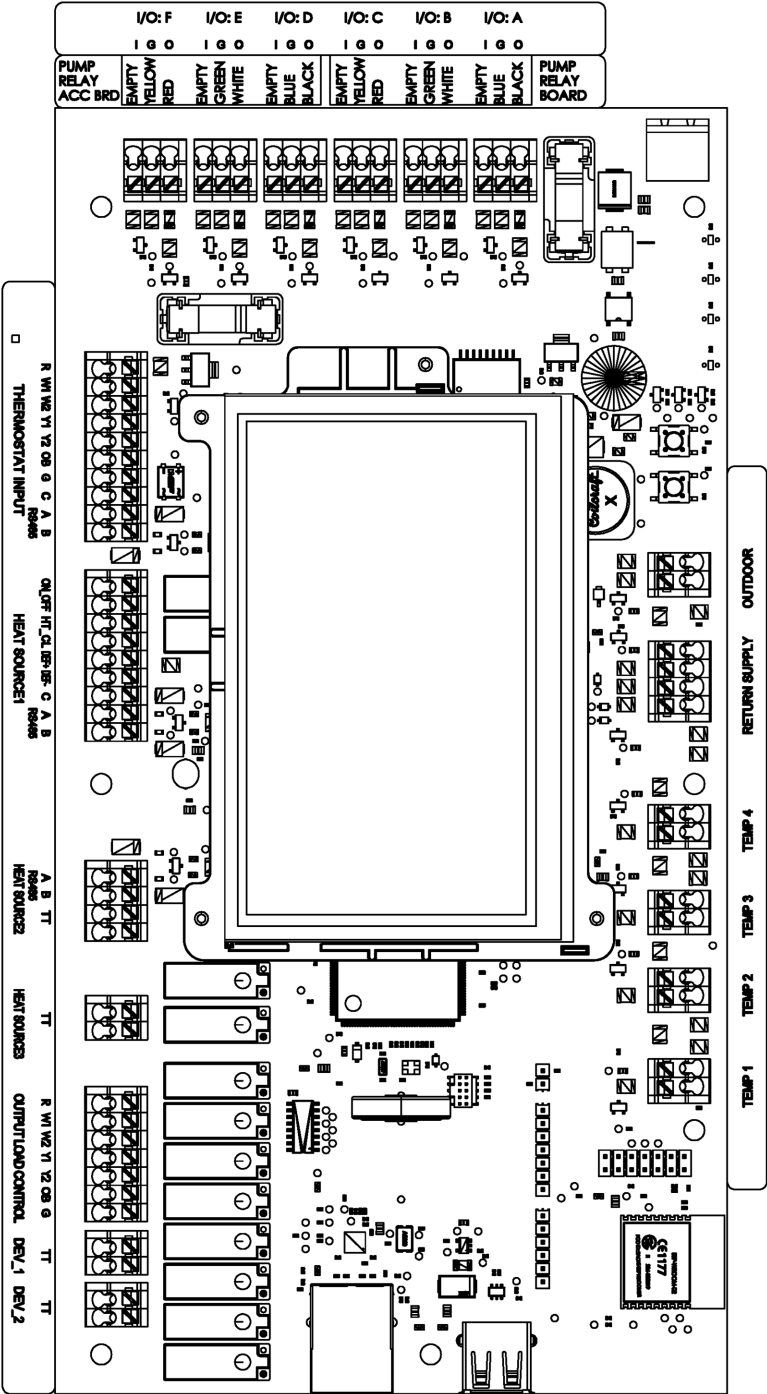


Figure 10 Sky-35 controller layout

3.3 Sky-35 Controller terminal functions and ratings

Block	Pin	Type	Description	Maximum Rating
AC IN		Input	24 VAC power to the Sky-35 controller from Pump Relay Module	24 VAC
I/O: PUMPS A-F	O	Output	EMC / PSC Circulator Control; 12V - PWM control signal relative to G terminal	150 mA; 400 mA total A-F
	I	Input	EMC / PSC Circulator Feedback; 5 to 24 V-PWM relative to G terminal	
	G	Output	With O terminal can connect to Pump Relay Module for standard PSC circulator control	
Thermostat Input Room thermostat connection	R	Output	24 VAC for wet contacts	24 VAC 100mA
	W1	Input	To trigger Heating	24 VAC
	W2	Input	To trigger Stage 2 Heating	24 VAC
	Y1	Input	<i>Not used</i>	24 VAC
	Y2	Input	<i>Not used</i>	24 VAC
	O/B	Input	To set mode as Heating	24 VAC
	G	Input	To trigger fan operation	24 VAC
	C	Input	Common	
	A		RS485 comms interface for compatible intelligent thermostats	DO NOT APPLY POWER
	B			
Heat Source 1 (HP) Heat Pump demand terminal block	ON_OFF (2)	Dry contacts	To initiate a call for heat pump operation (like TT)	24 VAC/DC
	HT_CL (2)	Dry contacts	For heat pump to select heatingmode (like TT)	24 VAC/DC
	DEF+ (2)	Input, isolated 24V	Defrost signal from heat pump	24 VAC/DC
	A		RS 485 comms interface for heat pumps	DO NOT APPLY POWER
	B			
Heat 2 (EB) Electric boiler demand terminal block	A		RS 485 comms interface for electric boilers	DO NOT APPLY POWER
	B			
	T (2)	Dry contacts	To initiate a call for electric boiler operation	24VAC/DC
Heat 3 (GB) Gas Boiler demand terminal block	T (2)	Dry contacts	To initiate a call for gas boiler operation	24VAC/DC

Block	Pin	Type	Description	Maximum Rating
Output Load Control Terminal block to control an air handler unit	R	Dry contacts	Common for other pins on terminal	24VAC/DC
	W1	Output	Stage 1 heating to Air Handler	*
	W2	Output	Stage 2 heating to Air Handler	*
	Y1	Output	<i>Not used</i>	*
	Y2	Output	<i>Not used</i>	*
	OB	Output	Reversing valve signal to Air Handler	*
	G	Output	Fan signal to Air Handler	*
DEV_1	T (2)	Dry contacts	Terminal block for auxiliary device 1 control	24VAC/DC
DEV_2	T (2)	Dry contacts	Terminal block for auxiliary device 2 control	24VAC/DC
TEMP_1	(2)	Input	Terminal block for auxiliary NTC 10KΩ thermistor as Temperature Sensor 1	DO NOT APPLY POWER
TEMP_2	(2)	Input	Terminal block for auxiliary NTC 10KΩ thermistor as Temperature Sensor 2	DO NOT APPLY POWER
TEMP_3	(2)	Input	Terminal block for auxiliary NTC 10KΩ thermistor as Temperature Sensor 3	DO NOT APPLY POWER
TEMP_4	(2)	Input	Terminal block for auxiliary NTC 10KΩ thermistor as Temperature Sensor 4	DO NOT APPLY POWER
RETURN	(2)	Input	Terminal block for supplied NTC 10KΩ thermistor as Return Temperature Sensor	DO NOT APPLY POWER
SUPPLY	(2)	Input	Terminal block for supplied NTC 10KΩ thermistor as Supply Temperature Sensor	DO NOT APPLY POWER
OUTDOOR	(2)	Input	Terminal block for supplied NTC 10KΩ thermistor as Outdoor Temperature Sensor	DO NOT APPLY POWER

*Output Load Control 24 VAC / VDC; 5.0 A; Resistive. 24 VAC @ 24 VA; 1.0 A; 3.6 A Inrush; Pilot

Table 6 Sky-35 Controller terminals and ratings



Warning

For all field wiring use copper conductors only.

3.4 Pump Relay Module terminal functions and ratings

Block	Pin	Type	Description	Maximum Rating
AC INPUT	L	Input	Line voltage supply to the Pump Relay Module	120 VAC; 60 Hz; 12.0 A
	N	Input	Neutral to the Pump Relay Module	
RELAY OUTPUTS	RL 1	Output	120 VAC for standard PSC I/O A control	1/6 HP @ 120 VAC*
	N1	Output	Neutral for standard PSC I/O A control	
	RL 2	Output	120 VAC for standard PSC I/O B control	1/6 HP @ 120 VAC*
	N2	Output	Neutral for standard PSC I/O B control	
	RL3	Output	120 VAC for standard PSC I/O C control	1/6 HP @ 120 VAC*
	N3	Output	Neutral for standard PSC I/O C control	
SKY-35 POWER	TOP	Output	24 VAC power supply for Sky-35 Controller	
	BOTTOM	Output		
RELAY CONTROL Pump control signal from Sky-35	PLUG (Blue)	Ground	GND to PWM signal from Sky-35 I/O A	
	PLUG (Black)	Input	12 VDC PWM signal from Sky-35 I/O A	
	PLUG (Green)	Ground	GND to PWM signal from Sky-35 I/O B	
	PLUG (White)	Input	12 VDC PWM signal from Sky-35 I/O B	
	PLUG (Yellow)	Ground	GND to PWM signal from Sky-35 I/O C	
	PLUG (Red)	Input	12 VDC PWM signal from Sky-35 I/O C	

* 4.4 A EACH; 12.0 A Total. Pilot duty 180 Va @ 120 VAC; 1.5 A. Min Pump conductor size 16 AWG

Table 7 Pump Relay Module terminals and ratings

3.5 Connections to Pump Relay Module

The Pump Relay Module supplies 24 V power for the Sky-35 through the cable provided (part #200-199), as shown. If used, the Module must be mounted within cable length, at most 11 inches (28 cm), from the controller.

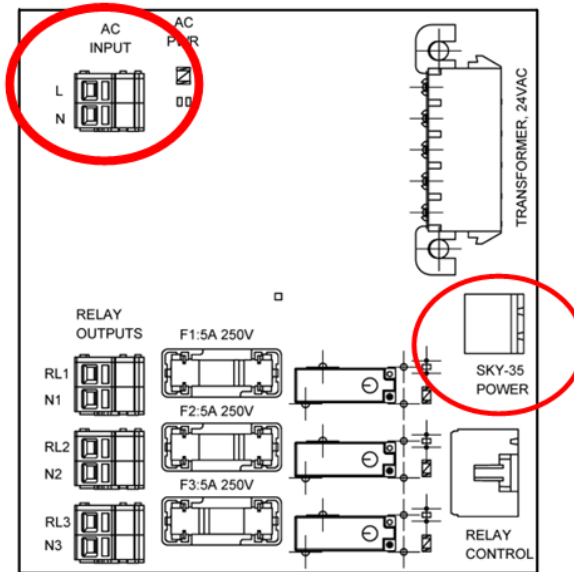


Figure 11 Pump relay board: System AC input and 24V output to Sky-35 highlighted

Particular wire restrainers may require using a small slot screwdriver to remove the power cable terminal plug, threading the wires through the restrainer, and reconnecting the plug. **Note wire polarity before removing the plug.**

Note the six Pump Relay wires for the terminals O (Red, White, Black) and G (Yellow, Green, Blue) for three pumps:

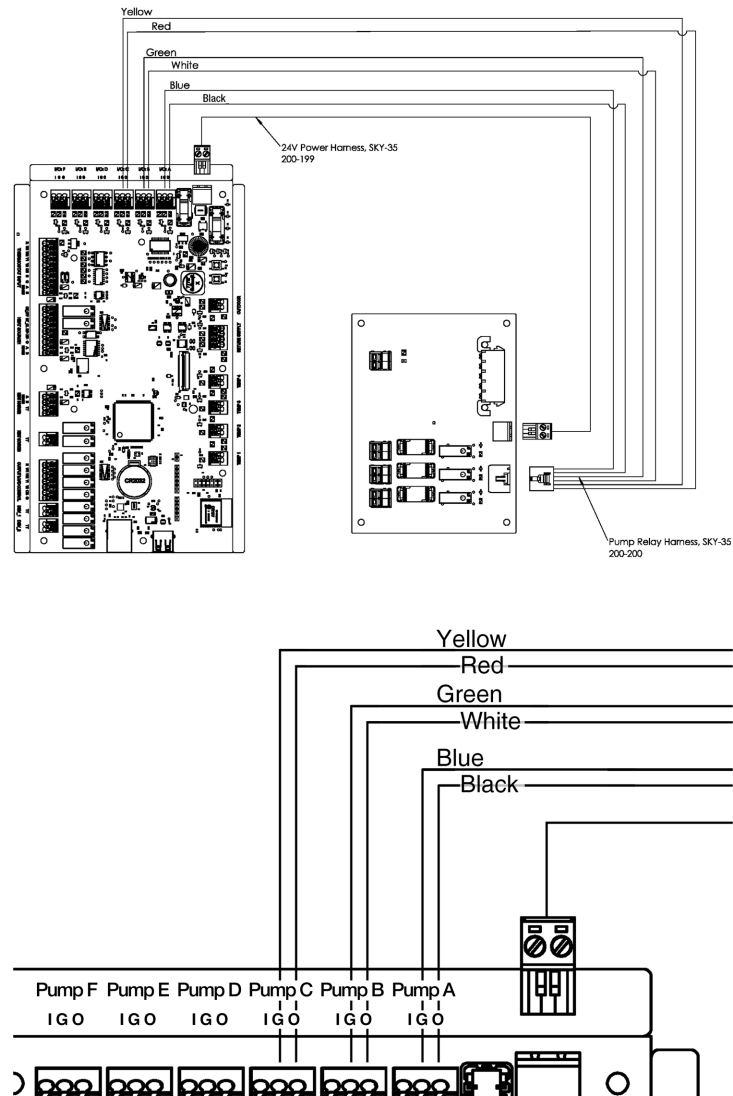


Figure 12 Sky-35 controller connections to Pump Relay Module (with detail)

3.6 RS-485 Connections

A Heat Pump connects to the Sky-35 through the RS-485 A/B connections on the Heat 1 (HP) terminal block.

For multiple heat pumps the RS-485 A/B connections must be daisy chained, with every A together, and every B together.

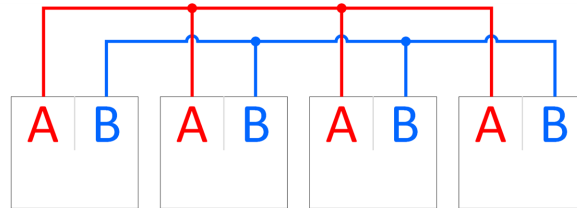


Figure 13 Daisy chain wiring



Note

To activate multiple RS-485 connections, power on only one unit at a time and complete the **Add Heat Source** routines before powering on the next unit.

3.6.1 Wiring and networking multiple electric boilers

An electric boiler connects to the Sky-35 through the RS-485 A/B connections on the Heat 2 (EB) terminal block.

To network multiple electric boilers:

1. With the power off, daisy-chain wire the RS-485 connections (as shown in [Figure 13](#) above).
2. Assign an order to the boilers; number them 1-4 if necessary.
3. On each boiler set the control board dipswitches as follows:
 - a. Boiler 1: 32 (code ACE)
 - b. Boiler 2: 33 (code ACF)
 - c. Boiler 3: 34 (code CDE)
 - d. Boiler 4: 35 (code ADF)
4. Power on the Sky-35 and navigate to **Setup > Add Heat Source**. To **Does your heat source support two-way communication with the Sky-35?** answer **Yes > EBX**.
5. Power on only Boiler 1. The Sky-35 will confirm the DIP switch settings. If these are correct, you do not need to re-power the boiler and you can select **Ready**.
6. Repeat the power-up and add process (step 5) for boiler(s) 2, 3 and 4 in sequence.

Leave the electric boiler with its default settings (Setpoint mode): the setpoint temperatures will be supplied by the Sky-35 via the RS-485 connections.

3.7 Ethernet Connections

The Sky-35 controller can be connected through an ethernet cable to the Internet for remote monitoring, or to a boiler's V10 Touchscreen controller. In V10 controller under *Network Settings* set "Sky-35 comm" to *Enabled*.



Note

When connecting a Sky-35 to a V10, change the *Network ID* on both devices to the same natural (**non-zero**) number.

When connecting to a V10 controller there are three options:

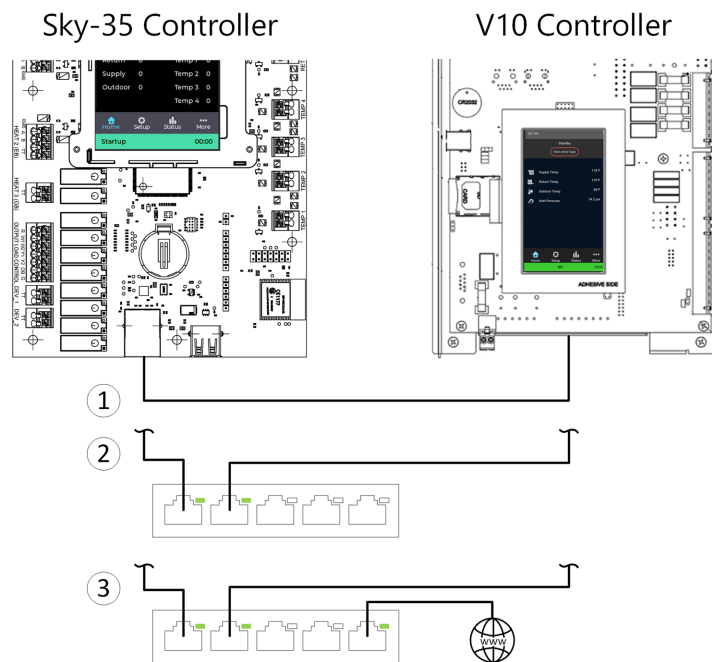


Figure 14 Sky-35 controller connections to V10 controller

- ① Ethernet cable: this needn't be a crossover cable. Select the Non-network mode for static IP addresses in the menu ●●● [More] > **Network Settings** > **Mode** > **Non-Network** See [Network Settings on page 51](#)

- ② Cables to an ethernet switch. Select the Non-network mode as above. Unmanaged switch recommended¹
- ③ Cables to an ethernet switch connected to the internet; units are automatically assigned IP addresses when using the *Add Heat Source* button in the Setup menu.

3.8 Thermostats

The controller is compatible with most common thermostats including simple single contact types (for example, a mercury switch). Common thermostats provide a simple contact closure.

- The Sky-35's **Thermostat Input R** terminal provides 24 volts AC to thermostat. This connects to the "R" terminal on the thermostat.



Note

Some thermostats, for example those with WiFi circuits, may require their own 24V power source.



Caution: power-stealing thermostats

The Sky-35 controller does not support power-stealing thermostats. Power stealing thermostats take their operating power from the thermostat line. If a t-stat has electronic display but does not use a C-wire or a battery, it is power-stealing.

¹ Alternatively, without a router you can allow a managed ethernet switch that includes a DHCP server to provide IP addresses to the controllers. **CAUTION FOR MANAGED SWITCHES:** if a router is to be introduced later, the DHCP server option on the switch must first be deactivated, because there can be only one DHCP server active on a network.

3.9 Sensors

The Sky-35 temperature sensor inputs are compatible with any 10K Ω NTC thermistor (also known as a 10K Type II NTC thermistor) with a beta value of 3895. Supply, Return and Outdoor temperature sensors are provided with the Sky-35. Kits for additional sensors such as the [P-9073](#) temperature sensor are available from your distributor.

The chart below gives the temperature/resistance relation:

Temp. °F/°C	Resist. Ω – Ohm	Temp. °F/°C	Resist. Ω – Ohm
0 / -18	85,362	100 / 38	5,828
5 / -15	72,918	105 / 41	5,210
10 / -12	62,465	110 / 43	4,665
15 / -9	53,658	115 / 46	4,184
20 / -7	42,218	120 / 49	3,760
25 / -4	39,913	125 / 52	3,383
30 / -1	34,558	130 / 54	3,050
35 / 2	29,996	135 / 57	2,754
40 / 4	26,099	140 / 60	2,490
45 / 7	22,763	145 / 63	2,255
50 / 10	19,900	150 / 66	2,045
55 / 13	17,436	155 / 68	1,857
60 / 16	15,311	160 / 71	1,689
65 / 18	13,474	165 / 74	1,538
70 / 21	11,883	170 / 77	1,403
75 / 24	10,501	175 / 79	1,281
80 / 27	9,299	180 / 82	1,172
85 / 29	8,250	185 / 85	1,073
90 / 32	7,334	190 / 88	983
95 / 35	6,532	195 / 91	903

Wire supplied thermistors (10K ohm type 2 sensor) to the following terminals:

- Supply
- Return
- Outdoor

Wire optional field-supplied thermister (10K ohm type 2 sensor) to TEMP 1/2/3/4 terminal:

- Buffer Tank Temperature
- DHW Temperature



Note

Always turn off electrical power to the Sky-35 before removing the circuit board cover.

3.10 Pumps



Note

Wiring for line terminals on the Relay Module should be Class 1, 12-14 AWG.

You can wire up to six variable speed pumps to the terminals "Output A/B/C/D/E/F." Variable speed pumps should be wired directly to the Sky-35 board (not to the accessory Relay Module). When a variable speed pump's wiring includes the "I" terminal, the Sky-35 displays an operating status on the *Status* screen.

Any pump being directly switched by the Sky-35 pump relay board must draw less than 4 amps.

3.11 DEV terminals

The terminals "DEV_1" or "DEV_2" are for a device control, for example to switch externally provided 24V to control a diverting valve. The terminals can be configured to activate during heating or DHW.

3.12 Wiring checklist

The following provides useful checks to confirm that wiring is successful.

Checklist for Wiring	Check
Ensure the appropriate loads are set to "Off" or to an appropriate load type.	☐
Ensure the pumps cycle on or off as expected.	☐
Check for poor connection or voltage problems from flickering screens or intermittent calls for heat.	☐
An Ethernet cable is installed if requiring Internet for connection to the V10 portal.	☐

4.0 The *Home* screen



Figure 15 *Home icon*

4.1 Controller Status

The Home screen displays the current operating status in the bottom banner, e.g. *Standby*, *Heating*, *Warning*, *Error*, *Service*, or (briefly) *Startup*, *Initialize*. The status *Standby-Summer* indicates that the Sky-35 will not respond to a call for heat because the current outdoor temperature is above the defined *Summer Shutdown* temperature. The bottom banner background colour indicates the system state (see [Status Bar Colour on page 15](#)).

The main panel reports the status of each heat source and the temperatures of the system sensors. (When you add an auxiliary temperature sensor you'll be asked whether you want it displayed on the Home screen.) You can see further data from a communicating Heat Source by touching its icon on the Home screen.

The top banner reads on the left *Sky-35* and, if the Web Portal has been enabled, on the right shows a cloud icon which by its colour indicates the Portal connectivity state.

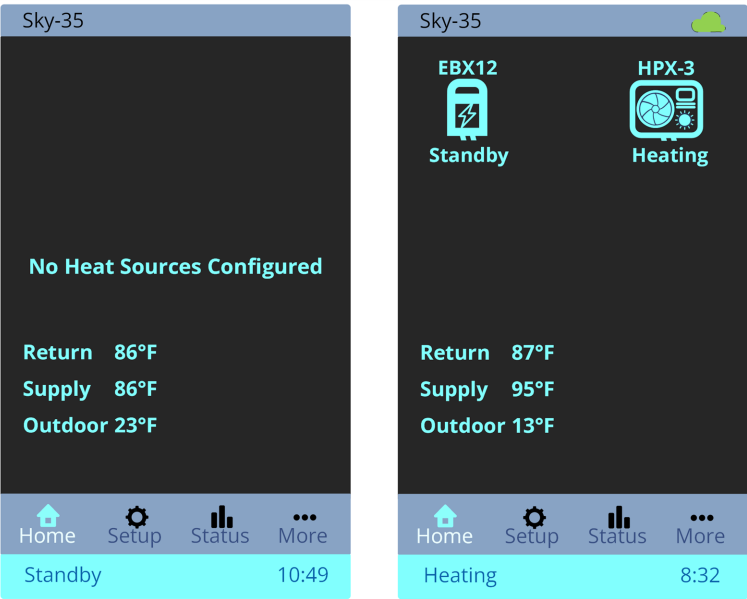


Figure 16 *Home screen on startup (L) and after configuration (R)*

Service status

Certain changes, such as adding or removing a heat source, or a software update, might produce erratic operation if performed in the midst of normal operation. To prevent this, the Sky-35 sometimes imposes a temporary pause to operation in order to apply changes safely. This is called *Service mode*, and it is announced as a yellow status along the bottom of the screen.

5.0 The *Setup* screen



Figure 17 *Setup icon*

The Setup tab is used for all of the basic setup of the controller. Changes to settings can be made at any time.

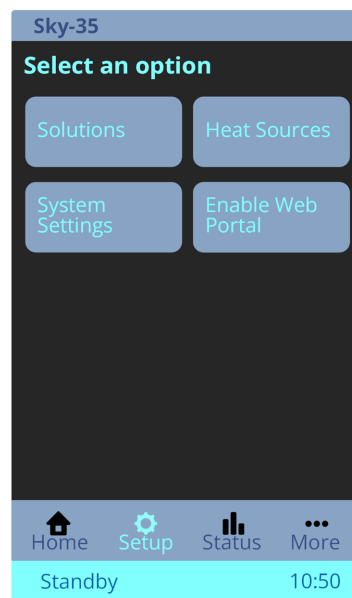


Figure 18 *Setup menu*



Initial Setup

Start initial setup with the Solutions button. After making changes there, the bottom banner (turned yellow) will suggest the next screen in this sequence:

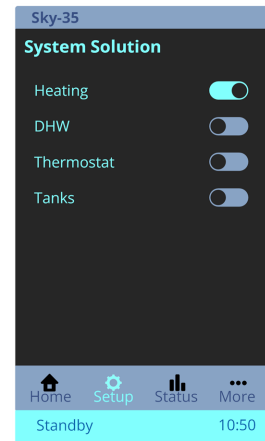
1. Solutions
2. System Settings > Sensors
3. System Settings > Tanks
4. System Settings > Pumps
5. Heat Sources

5.1 Solutions

Setup begins with going to *Solutions* and selecting from the *Heating*, *DHW*, *Thermostat* and *Tank* options. Toggle on any relevant slider buttons to activate modes for your system. If you can't find a heating or DHW menu, check here in *System Solutions* that the mode is selected.

Activate the *Thermostat* option whenever a thermostat will be wired to the Sky-35.

Figure 19 *Solutions menu*



5.2 System Settings > Site

5.2.1 Sensors

Here you can define temperature sensors you wish to add to the basic set of Supply, Return, Outdoor temperature sensors.

Name	Options and Ranges (Defaults in bold)	Notes
Name	[custom]	May have up to five characters (numbers, dash, and / or upper case letters)
Type	None / Tank / Reference	Defining a sensor as Reference associates it with thermostat calls.
Display on home	On / Off (slider)	Selects the sensor for continuous display on the Home screen.

5.2.2 Tanks

Installations using a Buffer Tank initiate a call from a drop in tank temperature, rather than initiating a call from a thermostat. This frees the heat production cycles to operate independently of thermostat cycles. In this case a Buffer Tank Sensor can replace thermostat connections to the Sky-35.



Thermostats with Buffer Tank

By default, in Buffer Tank mode the backup heat source(s) will join in heating the buffer tank when a call for heating appears at the thermostat terminals (after the staging delay). If the thermostat isn't calling, the primary heat source is left on its own to bring the tank up to temperature. If there is no thermostat connection to the Sky-35, the backup heat source will activate only if the outside temperature is below the setting *Balance Point* or the primary heat source is in error. For alternatives, see [Paths on page 38](#)

Before enabling Buffer Tank mode, you must assign an Aux Temperature Sensor as buffer tank sensor. The buffer tank sensor will be wired to one of the Sensor terminals, e.g. "TEMP 1." Define the buffer tank sensor by selecting "Buffer" for appropriate sensor terminal in the **Setup > System Settings > Sensor** menu.

Add Tank

Add Tank allows you to associate a sensor port with a tank, and define that tank as for *Heating* or *DHW*.

Edit Tank

Name	Options and Ranges (Defaults in bold)	Notes
Sensor Type	Heat, DHW	
Target	(DHW shown) Min: 49°C (120°F) Max: 66°C (150°F) Default : 49°C (120°F)	This buffer tank target plus the <i>Overshoot</i> becomes the Heat Source target.
Tank Diff	Min: 2°C (4°F) Max: 6°C (11°F) Default: 4°C (7°F)	Buffer tank: differential centered on Tank Target. DHW tank: differential is applied only below Target.
Always Active (<i>Thermostat</i> disabled)	On / Off	<i>On</i> : tank will heat up even when there is no thermostat input. <i>Off</i> : W1 acts as an enable for the tank.
Single-/Multi-pass DHW	Single-pass / Multi-pass	Defines device operation as single or multi-pass, as determined by the piping arrangement.
Path	W1 /W2/T1-4	(For buffer tanks only) User can specify what the buffer tank is serving.
Isolated Pump	Select terminal(s) (A to F)	Select this option when a pump must operate to heat the buffer tank without the pump being associated with a specific heating source.

Tank Differential: The Sky-35 manages a buffer tank temperature by activating a call for heat when the tank drops below the target temperature by half the *Differential*, and it ends the heating call when the tank exceeds target by half the *Differential*.

The tank differential must not be so great that at the end of the off-cycle the water is too cool to provide space-heating, but it must not be so small that the system short-cycles. The *Buffer Tank Differential* is critical to proper buffer tank sizing, and appears as the ΔT in the sizing calculation. See [Buffer tank sizing on page 53](#)

5.3 Heat Sources

Add Heat Source

While Adding or Removing heat sources the controller ignores calls for heat, and in the bottom banner displays *Service* mode.

Remove Heat Source

Remove existing heat sources here.

Edit Heat Source

Edit name, sensor (*Reference*) and pump association for existing Heat Sources here.

In this menu you will configure heat sources for your installation. In the menu **Add Heat Source** you will be asked **Does your heat source support two-way communication with Sky-35?** Answer **Yes** to establish communication to a Heat Pump, Electric Boiler or V10 Touchscreen gas-fired boiler. Answer **No** to configure any heat sources wired to TT contacts on terminals Heat Source 1 (Heat Pump), 2 (Electric Boiler) or 3 (Gas Boiler). The screen will confirm wiring connections.

For multiple electric boilers, see procedure [Wiring and networking multiple electric boilers on page 28](#)

Paths

Every system must have a buffer tank or a t-stat. When a system has both, the *Path* setting determines which sources respond to the thermostat and which to the buffer tank. By default the boiler is presumed to be backup to the heat pump.

- Default *Paths* for a heating system with a buffer tank:
 - » Heat pump→*Tank*.
 - » Boiler→*W1/W2* if t-stat is enabled, *Tank* if it's not.
- Default *Paths* for a heating system *without* a buffer tank:
 - » Heat pump→*W1/W2*.
 - » Boiler→*W1/W2*

For both defaults above a thermostat call on *W1/W2* runs the system pump.

When you select *Path W2*, but not *W1*, the heat source will respond only to second-stage thermostat calls.

V10 setup

If connecting to a boiler with a V10 board, before using **Add Heat Source**, see [The More screen on page 49](#). For any heat source with two-way communication, such as the V10, there is no need for local programming; the Sky-35 will provide the target temperatures. The V10 will give priority to its own locally-programmed loads (if any). The Sky-35 presumes that the V10 will run its boiler pump during a call for heat; future software releases will introduce further pump control options.

5.4 More System Settings

Most of your setup decisions will be recorded in the System Settings menu.

5.4.1 Site Settings

The following Site Settings table is also reproduced in [Appendices on page 85](#) with an additional column for your notations.

Heating

Name	Options and Ranges (Defaults in bold)	Notes
Target	Min: 25°C (77°F) Max: 85°C (185°F) Default: 43°C (109°F)	The target for supply water in response to a thermostat call.
Overshoot	Min: 1°C (2°F) Max: 8°C (14°F) Default: 5°C (9°F)	Overshoot is added to the target above to set the heat source's set point.
Reference	None / Supply / Return / [custom sensor]	During a thermostat heating call <i>Target</i> temperature applies to selected sensor.
Boost	Min: 10°C (50°F) Max: 60°C (140°F) Default: 27°C (81°F)	Below this temperature the source will heat aggressively.
Sys-Pump	0 - Off 1 - On	Associates one or more of six pumps with system (distribution) heating circulation
Contacts	0 - Disable 1 - Enable; Contacts close / Contacts open	Associates heating with DEV 1 and/or DEV 2 contact activation; set to open or to close.
Reset Heating	0 - Off 1 - On	If On, <i>Heating Target</i> is reset using outdoor temperature sensor.
Summer Shutdown T	Min: 10°C (50°F) Max: 45°C (113°F) Default: 45°C (113°F)	Requires outdoor sensor. Default setting of 45°C effectively disables Summer Shutdown.
Des Outdoor T	Min: -35°C (-31°F) Max: 15°C (59°F) Default: -10°C (14°F)	Expected winter cold, used for Reset Heating.

DHW

Name	Options and Ranges (Defaults in bold)	Notes
Target	Min: 49°C (120°F) Max: 63°C (145°F) Default: 49°C (120°F)	DHW delivery target
Overshoot	Min: 1°C (2°F) Max: 3°C (5°F) Default: 1°C (2°F)	For the heat source, the lift above the DHW tank target temperature
Boost	Min: 40°C (104°F) Max: 60°C (140°F) Default: 40°C (104°F)	Below this temperature the source will heat aggressively.
Contacts	0 - Disable 0 - Enable; Contacts close / Contacts open	Associate DHW with DEV 1 and/or DEV 2 contact action; set to open or to close.

Heat Pumps

Name	Options and Ranges (Defaults in bold)	Notes
Compressor Delay	Min: 0 Max: 10 Default: 5 minutes	Most HP and A/C units have a built-in compressor delay
Heat Pump Min T	Min: -30°C (-22°F) Max: 0°C (32°F) Default: -10°C (14°F)	Must be lower than Balance Point
Stage Time	Min: 5 Max: 240 Default: 20 minutes	Minimum interval between bringing on subsequent heat pumps
Max Temp	Min: 40°C (104°F) Max: 65°C (149°F) Default: 60°C (140°F)	

Electric Boilers

Name	Options and Ranges (Defaults in bold)	Notes
Stage Time	Min: 5 Max: 240 Default: 25 minutes	Minimum interval between bringing on subsequent electric boilers

Gas Boilers

Name	Options and Ranges (Defaults in bold)	Notes
Stage Time	Min: 5 Max: 240 Default: 45 minutes	Minimum interval between bringing on subsequent gas boilers

General

Name	Options and Ranges (Defaults in bold)	Notes
------	--	-------

Minimum Cycle Time	Min: 0 Max: 60 Default: 0	Minimum run time for a heating cycle
Stage Delay	Min: 0 Max: 10 Default: 0 minutes	Minimum interval between thermostat Stage1/Stage2 heating
Load Control Outputs	0 - Passthrough 1 - Controlled	Passthrough duplicates thermostat input
O/B Output	0 - Passthrough 2 - Active Heating	Passthrough duplicates thermostat input
Balance T	Min: -30°C (-22°F) Max: 15°C (59°F) Default: -4°C (25°F)	Used in backup for Heat Pump source. Requires Outdoor sensor.
Freeze Guard	0 - Off 1 - On	Calls for heat if the inlet water temperature drops below 41°F (5°C).
Pump Exercise Interval	Min: 0 Max: 96 Default: 48 hours	
Pump Exercise Duration	Min: 1 Max: 10 Default: 1 minute	
High Cutoff	Min: 30°C (86°F) Max: 90°C (x°F) Default: 63°C (145°F)	Heating is shut off if sensors read above this value. Targets are capped capped at this value.

Table 8 Site Settings



Temperature units

The Sky-35 can be programmed in °F or °C. You can change the controller units in the menu **••• More > User Settings > Units**

Thermostats

The Thermostat menu enables "Virtual" calls for W1, W2, Y1, Y2, G and / or OB. By toggling on a 'virtual' call there is no need to use a jumper for testing purposes or to establish a permanent call. Virtual calls are still subject to safety and seasonal shutdown limits.

Some notable settings, options and terms:

Heating Target: when the Buffer Tank mode is Enabled, this temperature will be the Buffer tank target temperature. The Sky-35 will augment the heat source target temperature by the *Overshoot* so that the Buffer target may be satisfied.

Load Control Outputs: The Passthrough / Controlled setting affects wiring (if any) only from the terminal marked "Output Load Control."

O/B Output: The O/B Output setting affects only wiring (if any) from the terminal marked "Output Load Control," connected to the heat pump's reversing valve.

- In *Passthrough*, the Sky-35 conveys the signal it receives from the thermostat.
- In *Active Heating*, during a heating call a 24V signal is sent from terminal O/B to the outdoor unit's reversing valve.

Balance Point: is the Outdoor Temperature below which, if there is any call for heat including a Buffer Tank below target, the Sky-35 will always bring on both a primary and a supplementary heat source.

Freeze Guard routine

To protect the system water from freezing, Sky-35 runs a Freeze Protection routine if the inlet water temperature drops below 41°F (5°C).

- If the inlet temperature drops below 41°F (5°C), the system pump turns on.
- If after 5 minutes the temperature has not risen, the Sky-35 brings on a heat source with a supply target temperature of 77°F (25°C).
- Heating for Freeze Protection continues until inlet temperature rises above 59°F (15°C).
- The Freeze Guard parameters are not user-adjustable.



Warning

- Even during the Freeze Guard routine a very cold boiler room could freeze a condensate trap, halting condensing boiler operation.
- In the absence of a thermostat signal, Freeze Guard cannot prevent freezing in a secondary circuit. Do not leave thermostats set Off when weather may turn freezing.

5.4.2 Pumps

Name	Options and Ranges (Defaults in bold)	Notes
Name	[custom]	May have up to five characters (numbers, dash, and / or upper case letters)
Purge Time	Min: 0 Max: 600 Default: 0 seconds	The number of seconds the pump should run after a call for heat has terminated
Output*	Min: 0% Max: 100% Default: ? See note.	Applies to PWM-controlled pumps only.
Type	Conventional / PWM	Conventional pumps are controlled through the accessory Pump Relay Module. PWM pumps are wired to receive a signal directly from Sky-35 controller I/O terminals A-F.



Note on Output setting

While some PWM pumps vary signal in proportion to speed, others decrease speed with an increase in PWM signal. Therefore, it is possible that you will set the *Max Speed* to a lower percentage than the *Min Speed* (e.g. *Max Speed* "0", *Min Speed* "100").

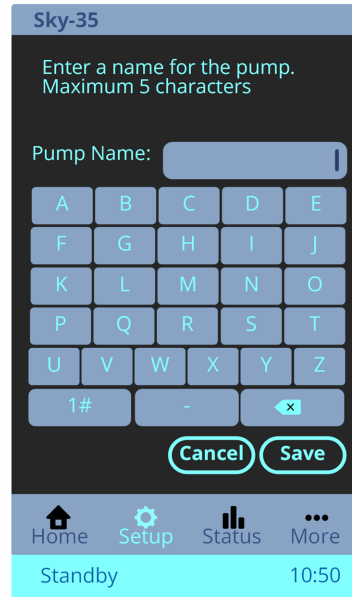


Figure 20 Pump naming keypad

To associate a pump with a heat source, see the *Heat Source* menu.

5.4.3 Contact Controls

Enable, name and associate DEV 1 and/or DEV 2 contacts for a diverting valve (or existing pump relay) during heating or DHW. The device contacts can be configured to activate by closing or by opening.

5.5 Web Portal

Here you can enable communication with a Web Portal. The Portal allows password-protected remote monitoring of the Sky-35.

Intentionally left empty

6.0 The *Status* screen



Figure 21 *Status icon*

The Status menu displays the following options that enable you to survey the system and confirm proper operation or identify problems:

- Sensors
- Network Information
- Error Logs
- Heat Call Map (incoming and outgoing calls)
- Clear Errors
- Source Status
- System Information

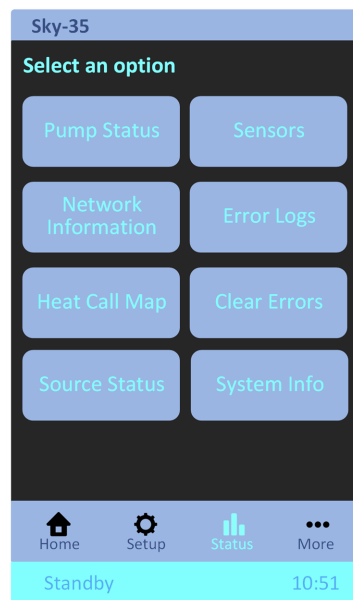


Figure 22 *Status menu*

6.1 Pump Status

A future feature for variable-output pumps.

6.2 Sensors

This screen displays readings from the Supply and Return temperature sensors, as well as Outdoor and Buffer Tank sensors if connected.

- » To customize a sensor name, go to ⚙️ **[Setup] > Aux. Temperature Sensors**
- » If a temperature sensor is not connected to the controller, the text 'NC' is displayed.

6.3 Network Information

The Network Information screen displays the information:

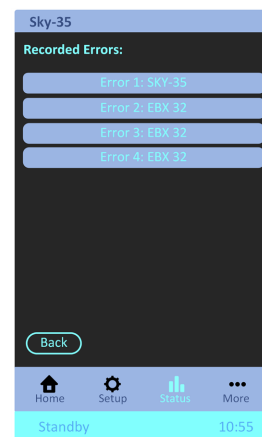
- Cloud Enabled
- Network ID
- Eth[ernet] IP Address
- Wifi IP Address
- MAC Address
- Network ID
- DNS
- Gateway

6.4 Error logs

Errors are triggered when a sensor detects that the controller is operating outside its limits. On the Error Logs screen you can choose an error to see more details. The Error Log page shows two kinds of errors: those relayed from communicating Heat Sources, and those specific to the Sky-35.

An error relayed from a heat source is tagged by the model, e.g. *Error 2: EBX 32* (see the example to the right). A suffix number (if present) is the MODbus address, which will be useful if there are multiple such models connected to the Sky-35. Heat source errors appear in the Sky-35 Error log but not in the bottom banner; while they're active they also appear as the heat source status.

The errors specific to the Sky-35, e.g. *Error 1: SKY-35*, would typically be triggered when the Sky-35 detects a temperature sensor, thermostat or



PWM pump fault. See [List of touchscreen controller error messages on page 81](#) for the full list of Sky-35 errors, and suggestions as to their possible causes.

The controller records all errors present at the time of an error event in a log. These logs date back to the original power-up, organized by date, time, classification, and type. For every error record, there is a "Details" button that provides the time of the error (displayed in Universal Time) and a plain language error message.

Status Bar Color	Description
Green	Normal state - system is operating within its limits.
Yellow	Warning error - When the controller detects an error.
Red	Alarm - Unresolved condition or error detected while the heat source is operating or preparing to operate.

Table 9 Status bar background colors

6.5 Heat Call Map

The Heat Call Map menu displays the current status of any calls:

- Incoming Heat Calls show with a check ✓ any energized terminals on the "Thermostat Input" (**W1 W2 Y1 Y2 G OB**)
- Tanks: a check ✓ indicates that a sensor-initiated call is active for a heating buffer or a DHW tank.
- Output heat calls to the terminal strip "Output Load Control" are shown with a check ✓ (**W1 W2 Y1 Y2 G OB**). Typically this terminal would be wired to an air handler.

6.6 Clear Errors

Use this button to delete the error history. Deleted error logs cannot be retrieved.

6.7 Source Status

The status of any connected heat source is displayed under its icon: **Standby**, **Heating**, **Circulating**, **Dev Error** (in the heat source), **Searching** (Sky-35 is looking for the device), **Init Error** (Sky-35 could not initially connect to the device), **Max Target** (a Site Settings limit has been reached), **High Outlet** (outlet is hotter than expected), **Delayed** (source is ready but waiting extra time before staging), **Comm Warn**, and **Comm Error**.

Select the icon of an communicating heat source in this menu (or on the home screen) to read its status information on the Sky-35. If the first line *State* reads *Com Err* the status information is not currently available and default values may be displayed.

6.8 System Information

This menu displays:

- Firmware Version
- Hardware Version
- WiFi Version
- Serial Number
- Processor
- Model
- Memory Usage

7.0 The *More* screen



Figure 23 *More icon*

When you select the More menu, you will be provided with configuration options.

- User Settings
- Help
- Network Settings
- Software Update
- Factory Reset
- Restart
- Advanced Options
- Service Mode



Figure 24 *More screen*

7.1 User Settings

This screen enables the user (installer, homeowner, site manager) to set or adjust:

- Date and Time
- Units

7.1.1 Changing and updating date and time

Date and time in a Sky-35 connected to the Internet

If the Sky-35 is connected to the Internet or to a computer (e.g., a server set up on an internal network that acts as the NTP time source), it will automatically set its internal clock. This is called **SNTP** mode; in it you can activate Daylight Savings Time or manually set the Time Zone.

1. Go to ●●● > **User Settings** > **Date & Time**.
2. To manually set the time zone, select **Time Zone** and choose the time zone.
3. To manually activate or deactivate Daylight Savings Time, adjust the slider **Participate in DST**.
4. Tap **Save**.

Changing the date and time in a Sky-35 not connected to the Internet

If the Sky-35 is not connected to the internet, you may need to manually set a date and time.

To set the date and time manually:

1. Go to ●●● > **User Settings** > **Date & Time**.
2. The Sky-35 should display as being in **Offline Mode**. Set the Date and Time using the number pad:
 - a. **Timezone**
 - b. **Participate in DST** [On / Off]. Enter the current time. Daylight Savings hour will be automatically added in the spring and removed in the fall.
 - c. **Day / Month / Year**
 - d. **Hour / Min**
3. Tap **Save**.

Changing default units of measurement displayed on the controller's screens

You can set the controller to display imperial or metric units of measurement.

Go to ●●● > **User Settings** > **Units** > Tap the desired unit(s) > **Save**.

7.2 Help

See the contact information for Technical Support on the back cover.

7.3 Network Settings



Note

When connecting a Sky-35 to a V-10, change the *Network ID* on both devices to the same natural (**non-zero**) number.

One purpose of the Network Settings page is to prepare a Sky-35 for connection to a V-10 boiler controller. In the menu *Mode*:

- **DHCP** The typical installation, where a Sky-35 connects to a V10 controller by using an active internet connection to assign IP addresses to the two devices.
- **Manual** Requires basic networking knowledge; used for situations where the network has been set up in a customized manner.
- **Non-network**: In the absence of an internet connection it is possible to connect a Sky-35 to a V10 controller using Non-network mode.
 - Select *Non-network*.
 - Then, on the V10 controller, go to ●●● **More** > **Network Settings** > **TCP/IP** and select *Non-network* mode.
 - You may now proceed to ⚙️ **Setup** > **Heat Source** > **Add Heat Source** > **Does your heat source support two-way communication with Sky35?** Select **No**.
 - To **What type of heat source are you connecting?** select *Heat Pump*, *Electric Heat Source*, or *Gas Heat Source*.
 - The Sky-35 will establish connection with the V10 controller using a special non-network routine. (This connection will be stable until it is replaced by DHCP addresses should internet access become available.)

7.4 Software Update

When you install firmware updates, the system checks if the Sky-35 has the latest firmware version. To view the firmware in a Sky-35, on the controller, go to 📊 **Status** > **System Info** and note the

Firmware Version.



Tip

Consider updating a Sky-35 with the latest firmware only if the new features are beneficial to the operation of the Sky-35.

Software update by Internet

- a. If the controller is not already in "Standby" activate **Service Mode** (in the **●●● More** menu).
- b. Select **●●● More > Software Update > Internet**
- c. The Sky-35 will search for updates: if an internet connection is available within a few seconds the prompt appears **Updates found: proceed?** Select **Start**. When the download is complete select the button **Begin**.
- d. The controller will then shut down, stay dark for up to 15 minutes, and restart. It is then again fully operational.

7.5 Factory Reset

This option restores all settings to the Factory Defaults. Note that this option will erase all field input including associations with heat sources.

7.6 Restart

Restarts the controller without altering any settings: this is recommended in troubleshooting connection issues.

7.7 Advanced Options

This menu is for factory engineering use only.

7.8 Service Mode

If you wish to pause system operation, for example to perform maintenance, settings adjustment or software update, toggle **Service Mode** to **On**.

8.0 Best practices

8.1 Temperature sensors

The supply and return temperature sensors furnished with the Sky-35 fit standard 3/8" [9.5mm] internal diameter immersion wells. For accuracy, ensure that the sensor is inserted to the well bottom, and that the well is set in flowing fluid.



Note

It is recommended that any temperature sensors be installed in a well with an application of heat-conductive paste.

The outdoor sensor should be installed on the North face of the house (i.e. not exposed to winter sunlight), away from any other sources of heat such as openable windows or exhaust venting.

8.2 Buffer Tank

Many hydronic designs for multiple heat sources are centered around the use of a buffer tank. Buffer tanks provide the advantages of:

- Simplifying hydraulic separation between multiple heat sources and multiple heat loads.
- Simplifying control strategies by providing a common reference point for heat sources and heat loads.
- Providing additional thermal mass to prevent heat source short-cycling, in particular for heat pumps but also beneficial for the longevity of gas-fired equipment.
- Providing thermal storage, capturing heat when it is abundant such as during lowered rate periods for electric use, or during midday when using solar thermal collectors.

8.3 Buffer tank sizing

Because repeated heat pump short-cycling can lead to premature compressor failure and other component damage, when using a heat pump it is important at the planning stage to consider whether a buffer tank will be needed to prevent short-cycling by looking at the minimum output during warm-weather conditions.

Good practice is to design for a standard compressor cycle time of ten minutes or longer. To calculate the buffer tank size required:

$$V = \frac{t(Q_{\text{heat source}} - q_{\text{load}})}{500(\Delta T)}$$

where:

- V= minimum volume of buffer tank (US gallons)
- t = desired minimum cycle time; we recommend, for a variable compressor, 8 (minutes)
- Q = heat source output rate, i.e. minimum warm-weather output (Btu/h)
- q = minimum guaranteed rate of heat extraction from tank: may be zero (Btu/h)
- ΔT = tank differential; we recommend 10 and advises this should not exceed 20 (°F)

Quick calculation for buffer tank sizing

The buffer tank volume in gallons can be quickly calculated by taking the minimum output in MBtu/h *in mild summer conditions* and multiplying by two. (This presumes the tank temperature can vary by 10°F.)

$$V = Q_{\text{heat source}} \times 2$$

where:

- V= minimum volume of buffer tank (US gallons)
- Q = minimum heat source output rate (MBtu/h)

Example: if the Heat Pump's minimum output is 20MBH (read from the lowest water temperature at 77°F), 20 X 2 = 40; thus the buffer tank's minimum size is 40 gallons.

8.4 Using concrete slab as buffer

When an application is using a minimally-zoned concrete slab, that slab's thermal mass may be able to act as a thermal buffer. To determine whether the slab can protect your equipment from short-cycling, use this variation of the buffer tank formula:

$$A = \frac{t(Q_{\text{heat source}} - q_{\text{load}})}{147(\Delta T)d}$$

- A = minimum area of **smallest** concrete slab zone (ft²)
- t = desired duration of heat source's on cycle; we recommend 8 (minutes)
- Q = heat source output rate, i.e. minimum output during warm weather (Btu/h)
- q = guaranteed rate of heat extraction from slab: may be zero (Btu/h)
- 147 = constant based on heat capacity of concrete and units used: (29.4 Btu/ft³/°F) (60 min/hr) (0.0833 ft/in)
- ΔT = slab differential; we recommend 2 (°F)
- d = depth of slab (inches)

Example: if the heat pump's minimum output is 20MBH (e.g. for a modulating heat pump, read from the lowest modulation chart and at the lowest supply water temperature at an outdoor temperature of 77°F), given a minimum on-time of 10 minutes, a slab temperature differential of 2°F and a slab depth of 5" the **smallest** zone should have an area of at least:

$$A = \frac{10(20,000 - 0)}{147(2)5} = 136 \text{ ft}^2$$



Caution: potential equipment damage

A concrete slab can act as a buffer only if that slab's **smallest** zone can prevent short-cycling; the above formula gives the minimum area of this smallest zone, not the total area of a zoned slab.



Note on constant used above

Part of the constant 147 is the heat capacity of concrete 29.4 Btu/ft³/°F, as derived from multiplying a concrete density of 140 lb/ft³ by a concrete specific heat of 0.21 Btu/lb/°F. These are valid figures for typical concretes, but if uncertain of the mixture used on your site consult with an engineer about these properties and revise constant accordingly.

8.5 Domestic hot water (DHW)

With a single heat source, the system gives priority to servicing a call for DHW before switching to other loads to service calls for heat (see [Best practices on page 53](#)).

Default settings for the DHW load are suitable for residential applications. It may be necessary to change these settings to satisfy commercial requirements.

For information on wiring DHW, see [Sensors on page 31](#).

DHW opt out

When there are multiple heat sources, one or more dedicated DHW sources can be programmed to "opt out" of the heating load, enabling the remaining heat sources to continue heating uninterrupted. For example, multiple DHW opt-out heat sources can respond to a high demand in buildings with multiple bathrooms. If opt-out heat sources are in the process of making DHW when the Sky-35 receives a setpoint or heating call, it will switch other heat sources to serve that load.

8.6 Reset heating

The heat lost by a building is proportional to the temperature difference between inside and outside. You can similarly scale the heat put into the building by using a Reset heating line. As the weather warms, reset heating preserves comfort by using cooler water, which is also particularly important for boosting heat pump efficiency.

The graphs below sample four *Outdoor Design Temperatures* to show how the target temperature tracks building heat loss over a heating season.

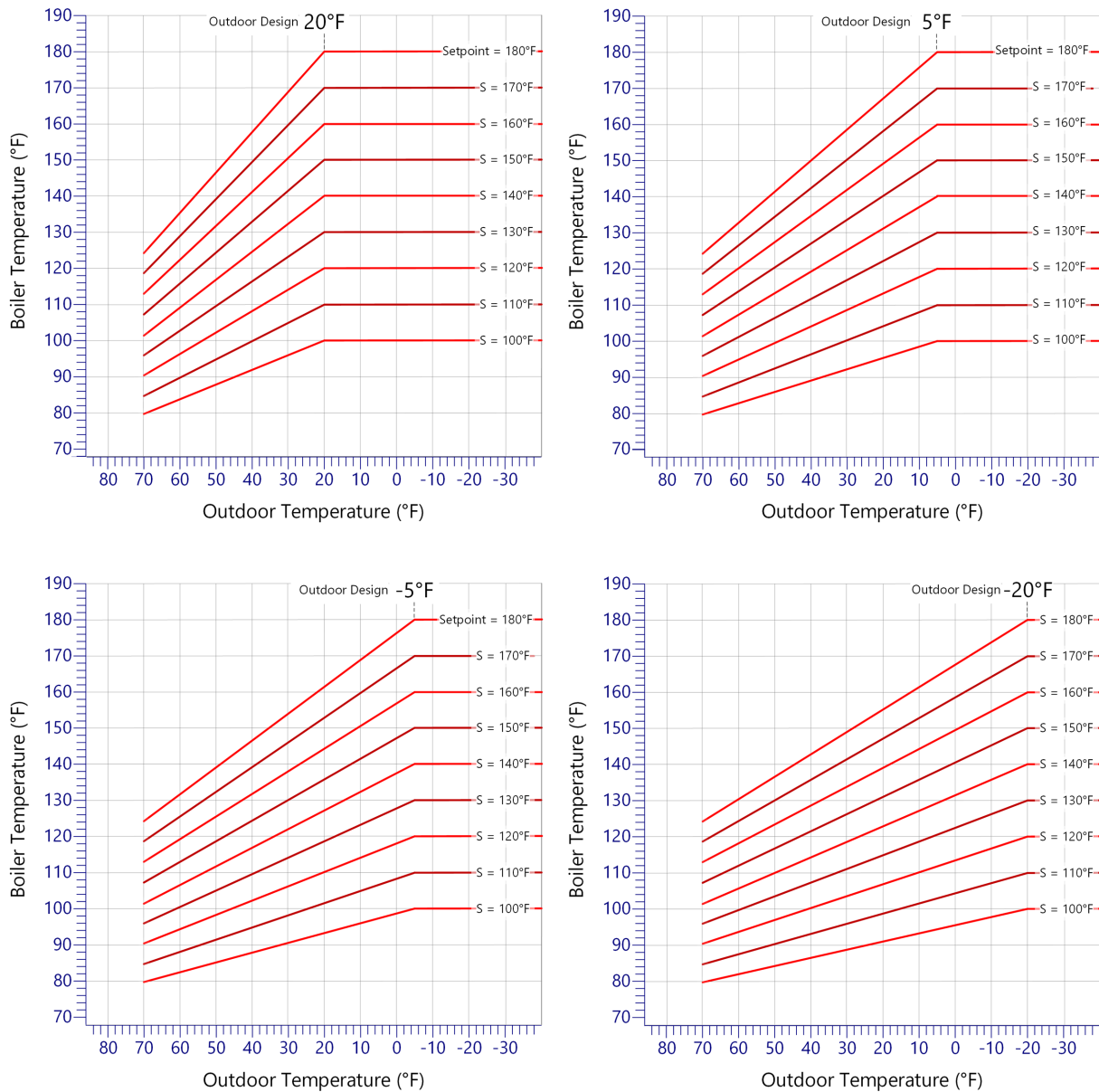


Figure 25 Outdoor reset lines for sample Outdoor Design Temperatures and Setpoints in Imperial units 100°F-180°F

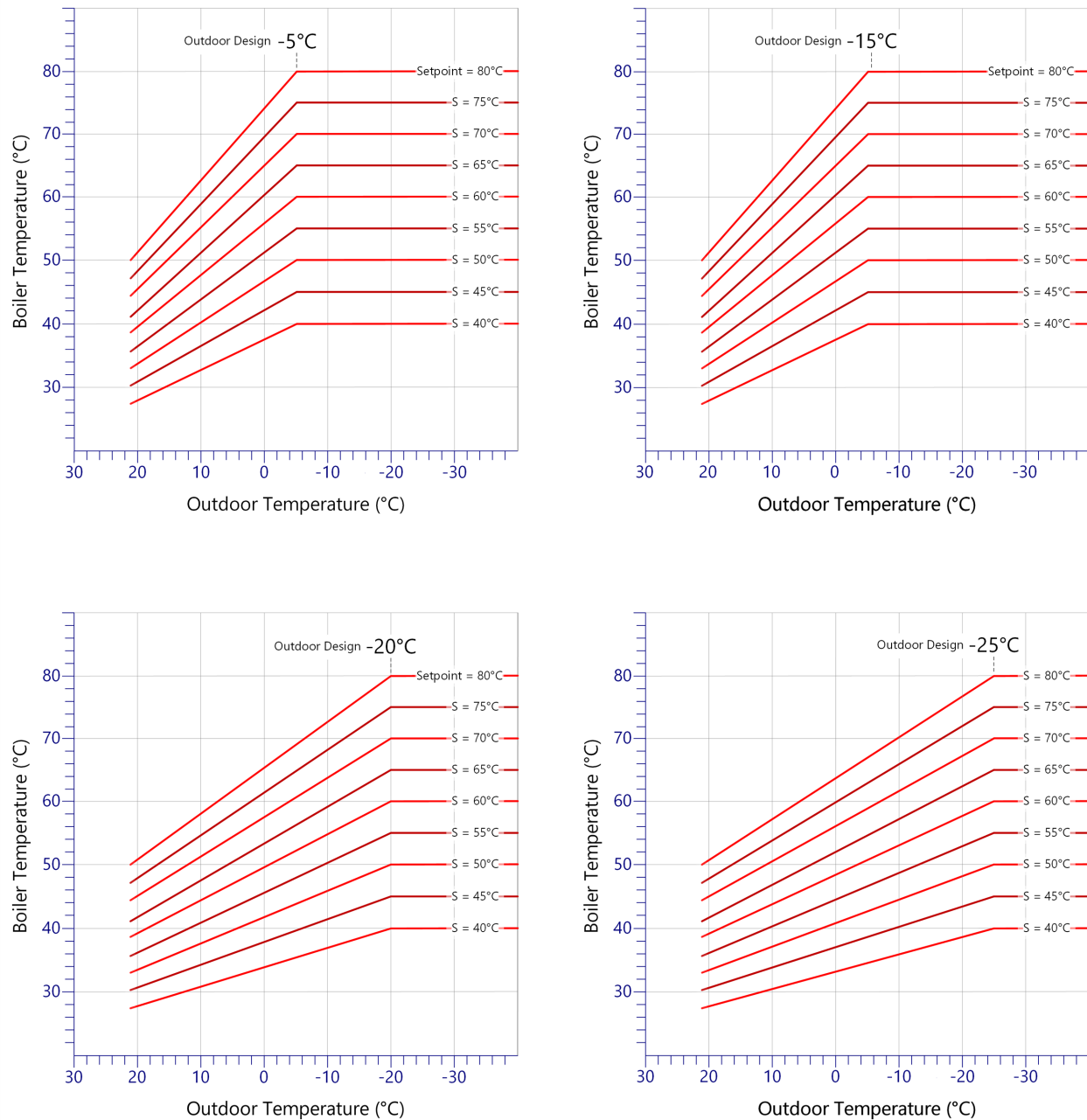


Figure 26 Outdoor reset lines for sample Outdoor Design Temperatures and Setpoints in Metric units 40°C-80°C

To set *Heat Type* to *Reset* you need just two variables: *Setpoint T* for the hottest water and *Outdoor Design T* for the local climate's winter temperature. Contact Tech Support if you are uncertain of your local *Design Outdoor Temperature*.

**Note**

Reset Heating mode requires the installation of an outdoor temperature sensor (supplied with the Sky-35).

Ensure that the outdoor sensor is appropriately located, typically on the north face of the building away from any heat source. If there is no signal from the outdoor sensor, the controller assigns a default 32°F / 0°C value.

8.7 Set Point

To program the set point, set:

- Heating Target – desired or fixed supply/outlet water temperature.
- Summer shutdown° - The cut-off outdoor temperature; above this Sky-35 ignores a call for heat. (Does not affect DHW.)

The heating target in *Site Settings > Heating* applies to a thermostat call, and that in *Tanks* to buffer tank operation. An adjustable *Overshoot* is added for the heat source setpoint.

8.8 Piping practices

Good practices include:

- sizing all pipe for the maximum heat transport at a velocity 2 to 4 ft/sec, at a realistic temperature drop
- insulating all heating pipe and fittings traveling through unconditioned space
- connecting automatic fill station, if used, to the point of no pressure change (expansion tank)
- situating circulator(s) inlet where there's a negligible pressure drop to the point of no pressure change (expansion tank)
- using primary / secondary piping (demonstrated in concept drawings) for stable flows through heat sources and heat emitters
- using fittings that simplify air removal, dirt removal, system flushing, and service of air vents / circulators / expansion tank

Intentionally left empty

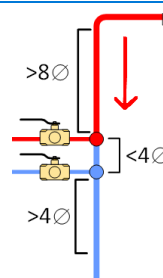
9.0 ooSystem concept drawings

This section illustrates piping recommendations for space heating and domestic hot water (DHW) loads. Most of these illustrations adopt piping strategies that allow different loads to operate without interference with each other.



Closely-spaced tees

This symbol  refers to closely-spaced tees, which are used to prevent pumps inducing flow where not intended. Closely-spaced tees are a maximum of four pipe diameters apart (center-to-center), with a minimum of eight pipe diameters of straight tubing upstream of first tee, and a minimum four pipe diameters of straight tubing downstream of second tee.



Required temperature sensors

Every application requires Supply and Return sensor connections.

Setting a target temperature

The following fields should be set for every heating application:

MENU	PROGRAMMING	NOTES
SYSTEM SETTINGS > SOLUTIONS	Heating / DHW / Thermostat / Tanks	Activate modes as required, e.g. toggle on <i>Thermostat</i> if one is wired to the Sky-35
SYSTEM SETTINGS > SITE > TANKS (if used--requires sensor)	Set <i>Heating Target</i> , e.g. 104°F (40°C)	Target for Buffer Tank
SYSTEM SETTINGS > SITE > HEATING	Set <i>Heating Target</i> , e.g. 104°F (40°C)	Target during thermostat call (if used)
	Set <i>Overshoot</i> , e.g. 9°F (5°C)	Added to target for the heat source set point
	Set <i>Reset Heating</i> , 0 - Off 1 - On	Requires Outdoor sensor; 0-Off if not used
	Set <i>Design Outdoor T</i> , e.g. - 10°C (14°F)	Local climate data
	Set <i>Summer Shutdown</i> Te.g. 70°F (21°C)	
[for heat pump systems] SYSTEM SETTINGS > SITE > HEAT PUMPS (Menu available after running <i>Add Heat Source</i>)	Set <i>Heat Pump Min T</i> e.g. - 22°F (-30°C)	Must be lower than Balance Point

9.1 Multiple heat pumps space-heating (without buffer tank)



Caution: potential equipment damage

This application requires that the load's **smallest** zone has sufficient thermal mass to prevent short-cycling.

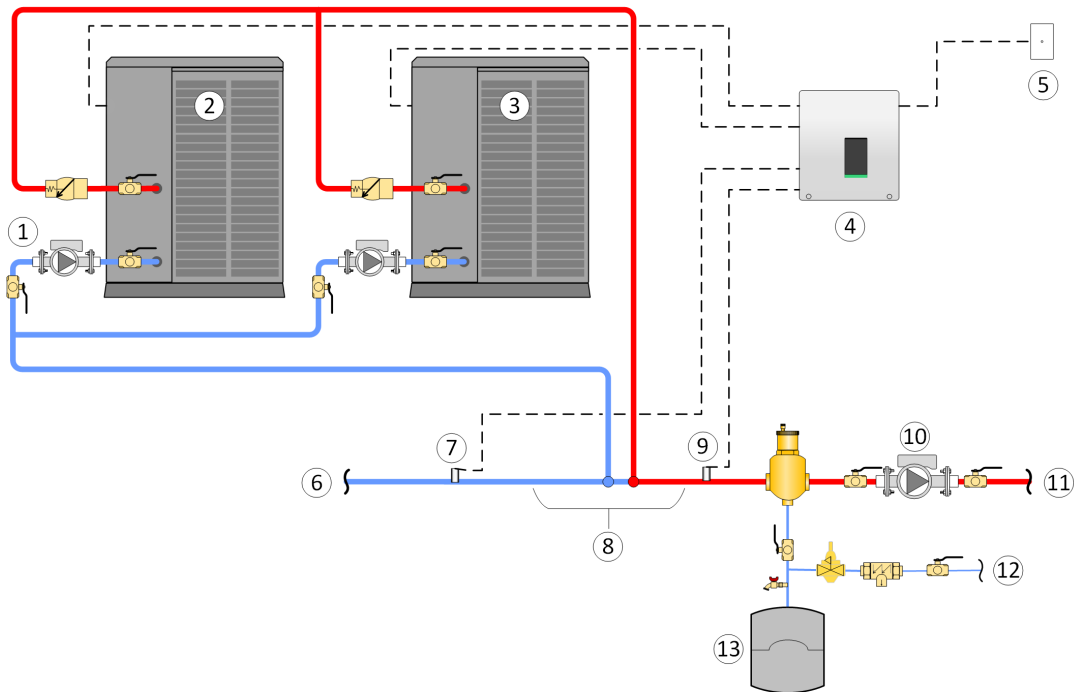
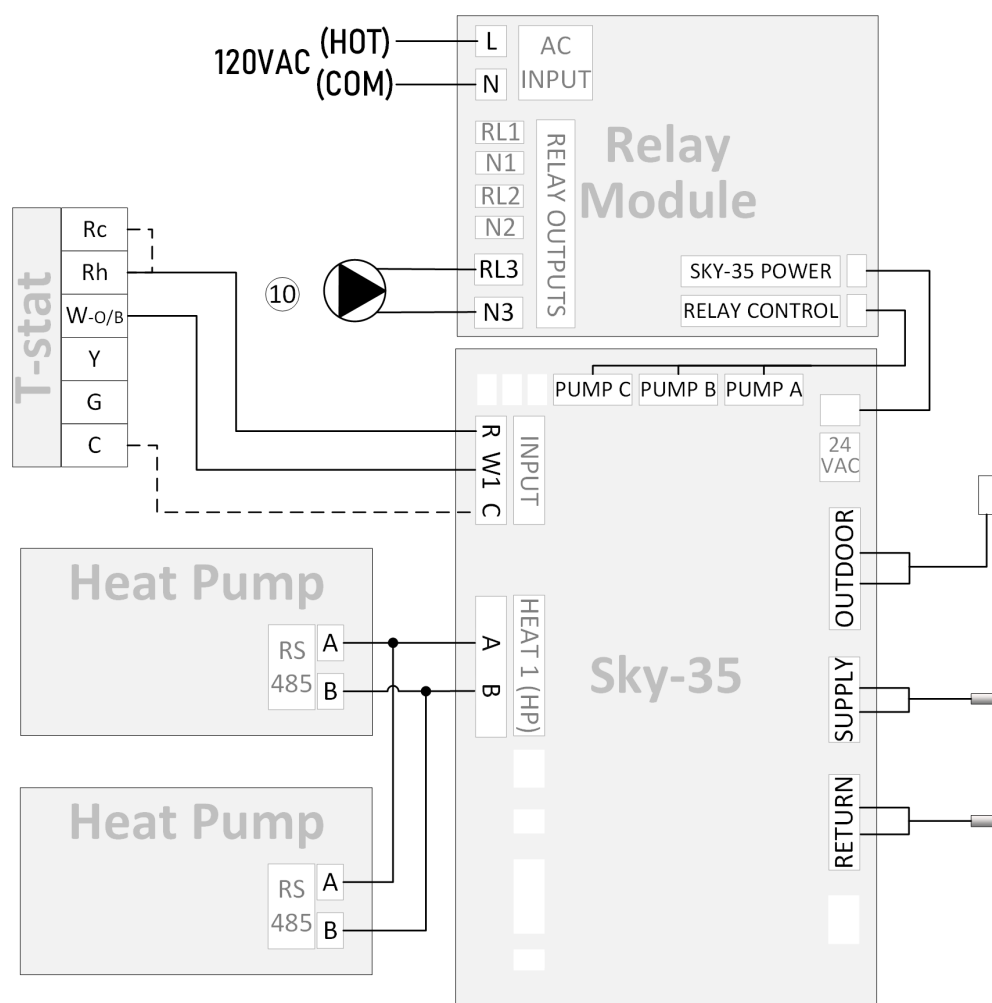


Figure 27 Concept drawing: Multiple heat pumps space-heating (without buffer tank)

①	Circulator controlled by heat pump (typ. of 2)	⑧	Tees: see Closely-spaced tees on page 61 .
②	Heat Pump 1	⑨	Supply sensor to Sky-35
③	Heat Pump 2	⑩	System Pump
④	Sky-35 controller	⑪	Supply piping to loads
⑤	Outdoor sensor	⑫	Fill water
⑥	Return from space-heating	⑬	Expansion tank
⑦	Return sensor to Sky-35		

Wiring



Programming (see also [Setting a target temperature on page 61](#))

MENU	PROGRAMMING	NOTES
SETUP > SOLUTIONS	Activate <i>Heat</i> , <i>Thermostat</i>	
SETUP > HEAT SOURCE > ADD > potable water Heat Pump? Torin?	Rename as "A"; Path = W1, W2	
Repeat ADD for second Heat Pump > Torin	Rename as "B"; Path = W1, W2	
SETUP > SYSTEM SETTINGS > SITE > HEAT	System Pump = C; Set <i>Target</i>	Pump ⑩ in drawings

9.2 Multiple heat pumps, multi-pass DHW (optional electric backup)

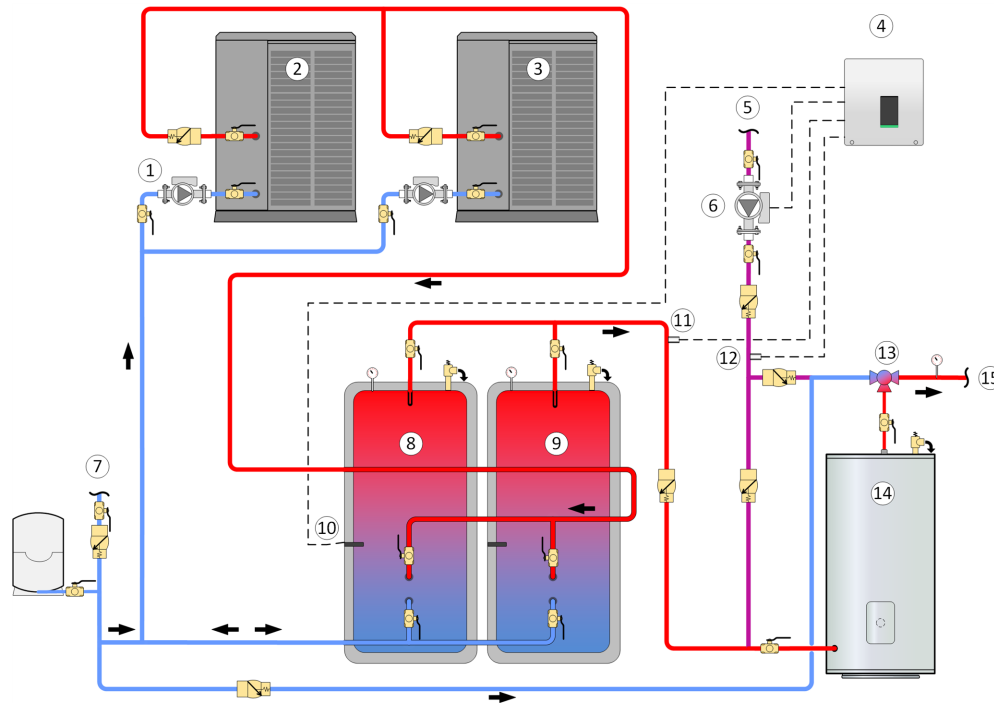
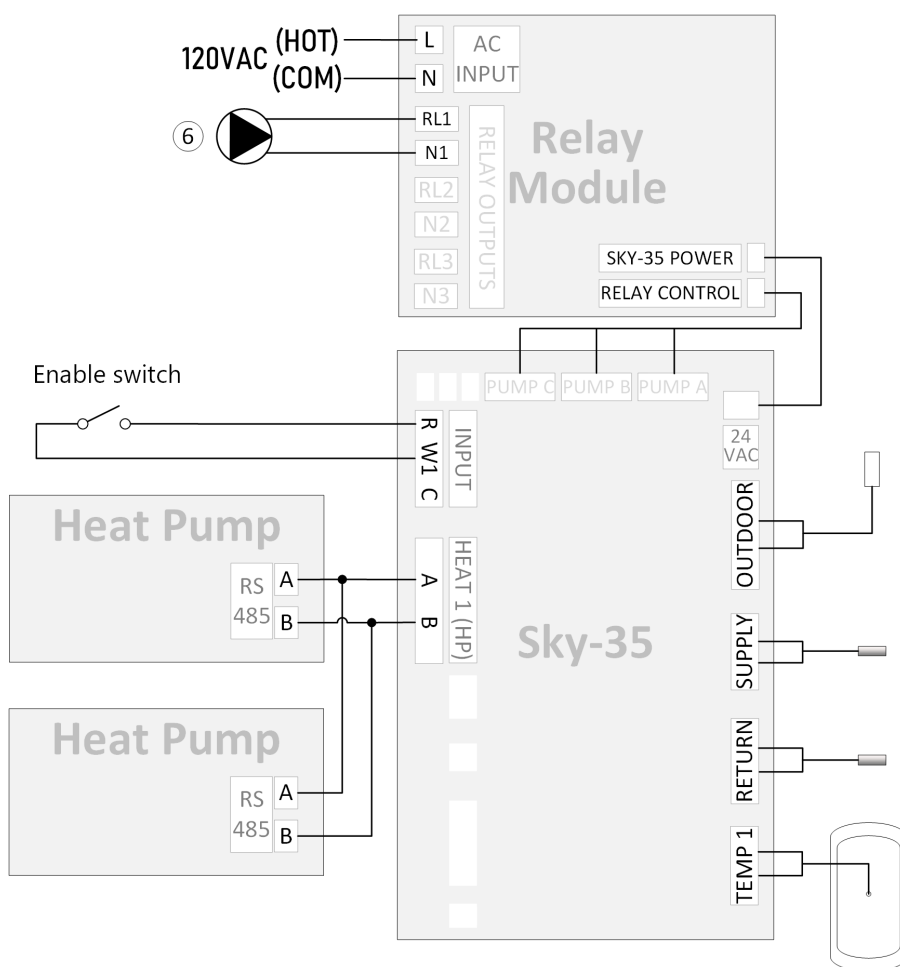


Figure 28 Concept drawing: Multiple heat pumps, multi-pass DHW (optional electric backup)

①	Circulator controlled by heat pump (typ. of 2)	⑨	Storage-2
②	Heat Pump 1	⑩	Tank sensor to Sky-35
③	Heat Pump 2	⑪	Supply sensor to Sky-35
④	Sky-35 controller with external enable/disable	⑫	Return sensor to Sky-35
⑤	DHW recirc return	⑬	Mixing valve (optional)
⑥	Recirc pump, controlled by Sky-35	⑭	Electric swing tank (optional)
⑦	Cold water	⑮	Hot water supply
⑧	Storage-1		

Wiring



Programming (see also [Setting a target temperature on page 61](#))

MENU	PROGRAMMING	NOTES
SETUP > SOLUTIONS	Activate <i>DHW, Tank</i>	
SETUP > SYSTEM SETTINGS > SENSORS	Temp 1: rename as <i>MULTI</i> , set to <i>Tank, Display on Home</i>	
SETUP > SYSTEM SETTINGS > TANKS > ADD	MULTI: <i>Type=DHW</i> , set <i>Target</i> , set <i>Diff</i> , set <i>Always Active</i> to <i>On</i> , <i>Multipass=1</i> ,	If <i>Always Active</i> is <i>Off</i> , tanks will heat only while W1 calls.
SETUP > HEAT SOURCE > ADD > potable water Heat Pump? Torin?	Path = MULTI	
Repeat ADD for second Torin	Path = MULTI	
SETUP > SYSTEM SETTINGS > SITE > DHW	Select <i>Recirc</i> pump as A	Pump ⑥ in drawings

9.3 Multiple heat pumps, single-pass DHW with gas backup

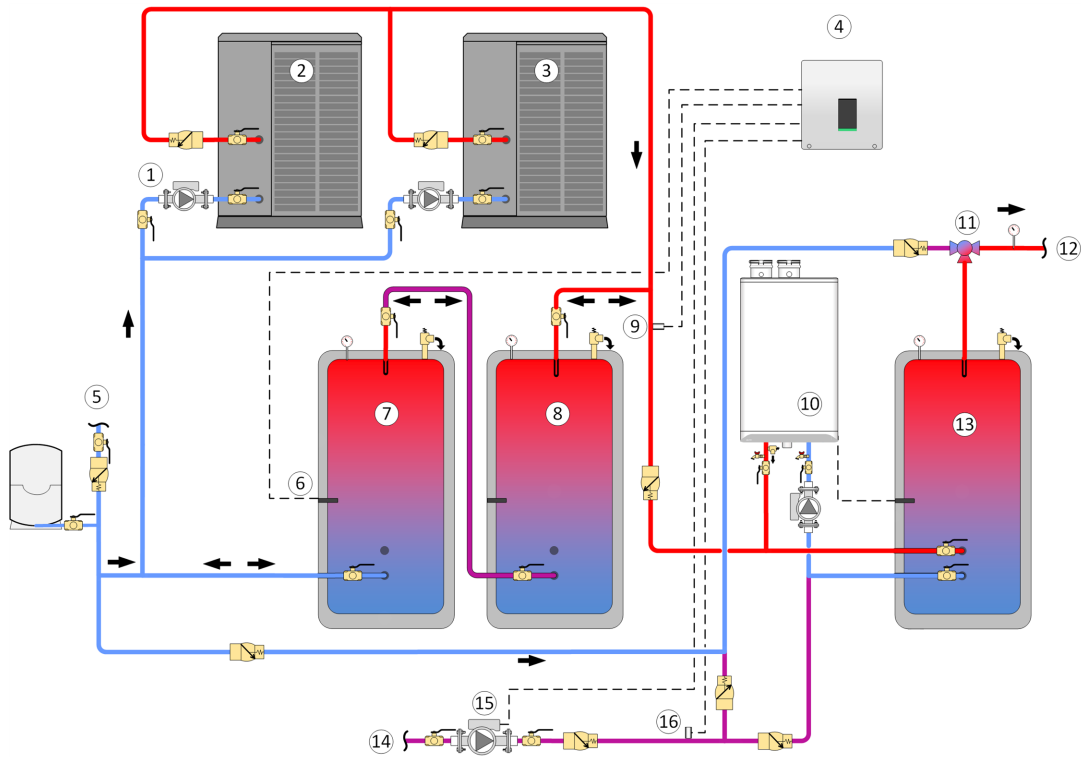
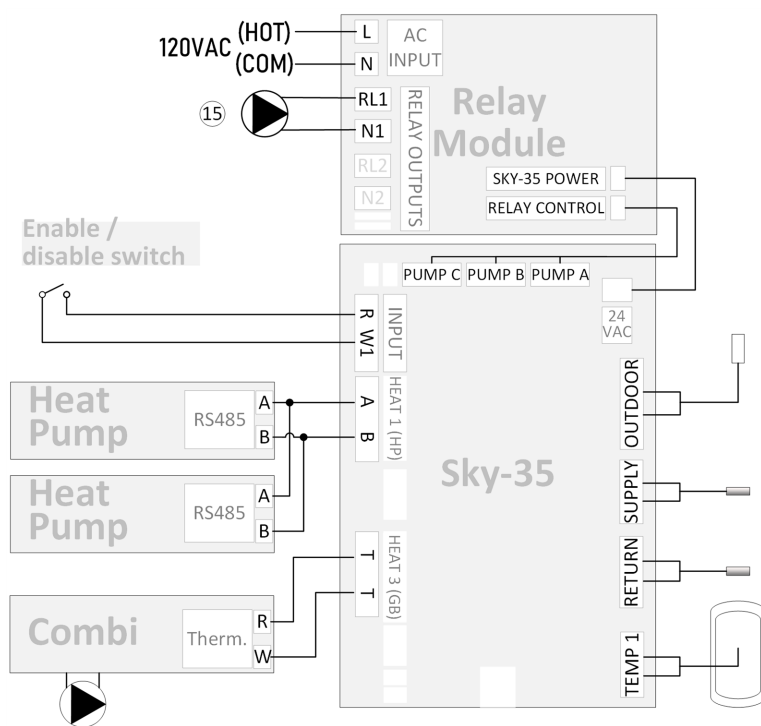


Figure 29 Concept drawing: Multiple heat pumps, single-pass DHW with gas backup

①	Circulator controlled by heat pump (typ. of 2)	⑨	Supply sensor to Sky-35
②	Potable water Heat Pump 1	⑩	Gas water heater and non-ferrous circulator
③	Potable water Heat Pump 2	⑪	Mixing valve (optional)
④	Sky-35 controller with external enable/disable	⑫	Hot water supply
⑤	Cold water	⑬	Swing tank
⑥	Tank sensor to Sky-35	⑭	DHW recirc return
⑦	Storage-1	⑮	Recirc pump, controlled by Sky-35
⑧	Storage-2	⑯	Return sensor to Sky-35

Wiring



Programming (see also [Setting a target temperature on page 61](#))

MENU	PROGRAMMING	NOTES
SETUP > SOLUTIONS	Activate <i>DHW, Tank</i>	
SETUP > SYSTEM SETTINGS > SENSORS	Temp 1: rename as <i>SINGL</i> , set to <i>Tank</i> , enable <i>Display</i>	
	Temp 2: rename as <i>SWING</i> , set as <i>Tank</i> , enable <i>Display</i>	
SETUP > SYSTEM SETTINGS > TANKS > ADD	<i>SINGL</i> : Type = <i>DHW</i> , set <i>Target</i> , set <i>Diff</i> , set <i>Always Active</i> to <i>On</i>	Multipass=0 If <i>Always Active</i> is <i>Off</i> , tanks heat only during <i>W1</i> call.
	<i>SWING</i> : Type=DHW, Multipass=1, set <i>Target</i> , set <i>Diff</i> , set <i>Always Active</i> to <i>On</i>	If <i>Always Active</i> is <i>Off</i> , tanks heat only during <i>W1</i> call.
SETUP > HEAT SOURCE > ADD > potable water Heat Pump? Torin?	Paths = <i>SINGL, SWING</i>	
Repeat ADD for second Torin	Paths = <i>SINGL, SWING</i>	
SETUP > HEAT SOURCE > ADD > GAS BOILER	Rename as <i>Backup</i> ; Path = <i>SWING</i>	
SETUP > SYSTEM SETTINGS > SITE > DHW	Select <i>Recirc</i> pump as <i>A</i>	Pump ⑮ in drawings

9.4 Multiple heat pumps, single-pass tanks with multi-pass heat pump swing tank

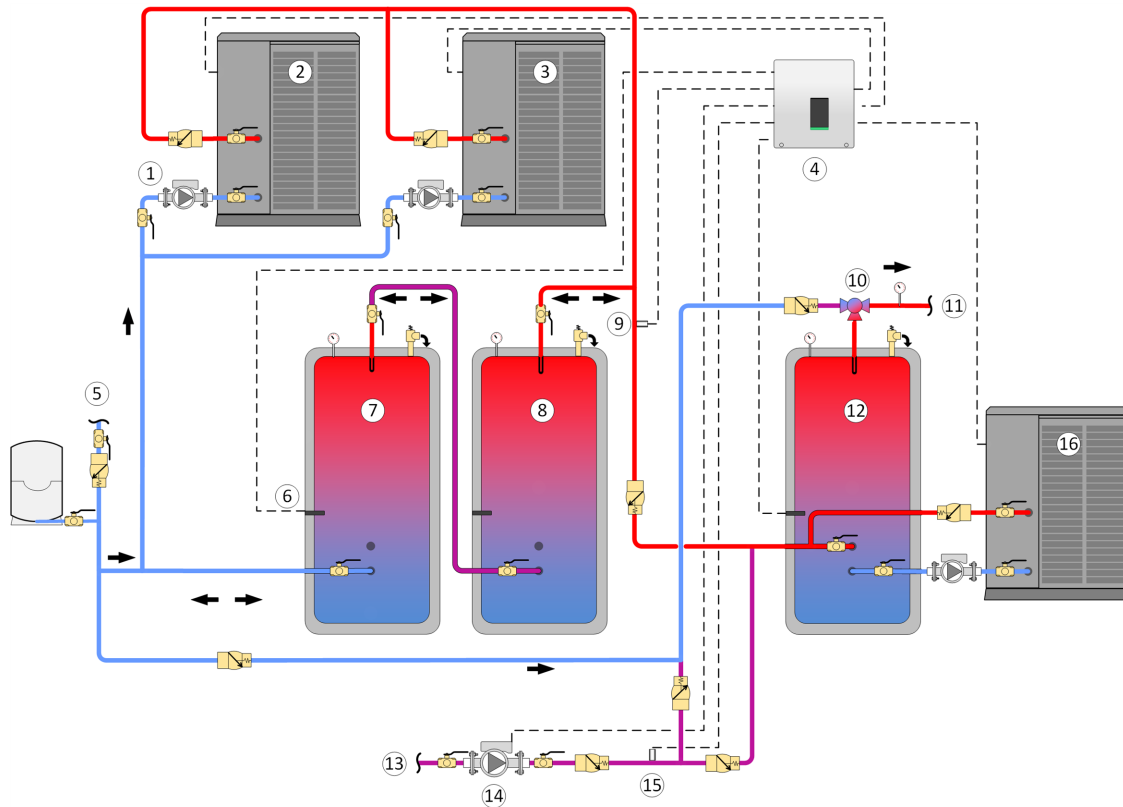
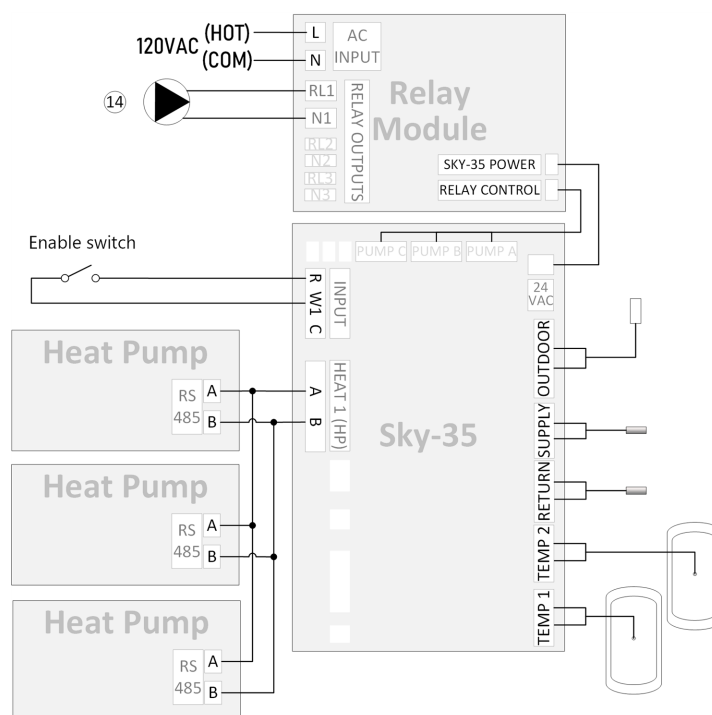


Figure 30 Concept drawing: Multiple heat pumps, single-pass tanks with multi-pass heat pump swing tank

①	Circulator controlled by heat pump (typ. of 3)	⑨	Supply sensor to Sky-35
②	Heat Pump 1	⑩	Mixing valve (optional)
③	Heat Pump 2	⑪	Hot water supply
④	Sky-35 controller with external enable/disable	⑫	Swing tank
⑤	Cold water	⑬	DHW recirc return
⑥	Tank sensor to Sky-35	⑭	Recirc pump, controlled by Sky-35
⑦	Storage-1	⑮	Return sensor to Sky-35
⑧	Storage-2		Multi-pass heat pump

Wiring



Programming (see also [Setting a target temperature on page 61](#))

MENU	PROGRAMMING	NOTES
SETUP > SOLUTIONS	Activate <i>DHW</i> and <i>Tank</i>	
SETUP > SYSTEM SETTINGS > SENSORS	TEMP 1: rename as <i>SINGL</i> , set Type as <i>Tank</i> , <i>Display on Home</i>	
	TEMP 2: rename as <i>SWING</i> , set Type as <i>Tank</i> , <i>Display on Home</i>	
SETUP > SYSTEM SETTINGS > TANKS > ADD	1 <i>SINGL</i> set Type as <i>DHW</i> , set <i>Target</i> and <i>Diff</i> , set <i>Always Active</i> to <i>On</i>	Multipass = 0 If <i>Always Active</i> is <i>Off</i> , tanks heat only during <i>W1</i> call.
	2 <i>SWING</i> Set Type as <i>DHW</i> , Multipass = 1, set <i>Target</i> and <i>Diff</i> , set <i>Always Active</i> to <i>On</i>	If <i>Always Active</i> is <i>Off</i> , tanks heat only during <i>W1</i> call.
SETUP > HEAT SOURCE > ADD > Torin?	Path = <i>SINGL</i> , <i>SWING</i>	
Repeat ADD for second Torin	Path = <i>SINGL</i> , <i>SWING</i>	
Repeat ADD for third Torin	Rename as " <i>AUX</i> "; Path = <i>SWING</i>	
SETUP>SYSTEM SETTINGS > SITE > DHW	Select <i>Recirc</i> pump as <i>A</i>	Pump ①④ in drawings

9.5 Heat pump with backup electric boiler

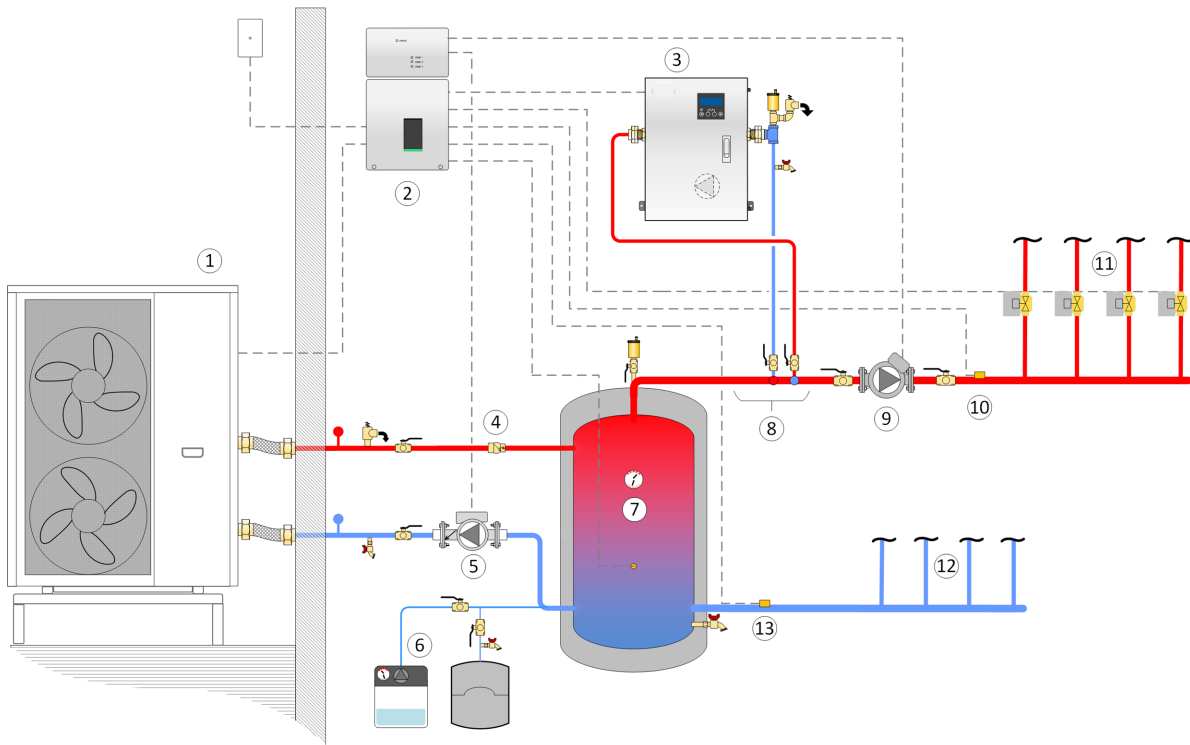
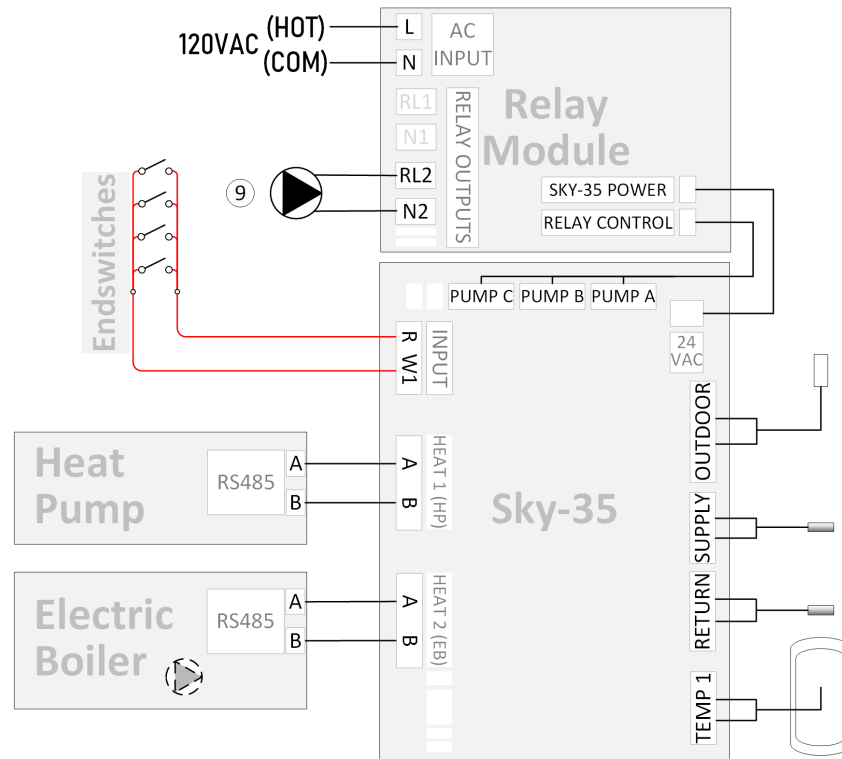


Figure 31 Concept drawing: heat pump with backup electric boiler

① Heat pump (outdoors)	⑧ Closely-spaced tees (see Closely-spaced tees on page 61)
② Sky-35 and Pump Relay Module	⑨ System (distribution) circulator
③ Electric boiler (pump built-in)	⑩ Supply sensor to Sky-35
④ Check valve	⑪ To heating zones
⑤ Heat pump circulator	⑫ From heating zones
⑥ Glycol fill tank and expansion tank connection	⑬ Return sensor to Sky-35
⑦ Buffer tank	

Even if the Sky-35 does not control the system pump, the zone valve endswitches shown (or thermostat) facilitate backup heat logic because the backup heat source should run only during an active call for heat.

Wiring



Programming (see also [Setting a target temperature on page 61](#))

SETUP > SYSTEM SETTINGS > SOLUTIONS		NOTES
Activate <i>Heating, Thermostat, Tanks</i>		
SETUP > SYSTEM SETTINGS > SENSORS		
Temp 1 or other	Set <i>Type</i> = <i>Tank</i> , rename, e.g. <i>BUFF</i>	
SETUP > SYSTEM SETTINGS > TANKS > ADD TANKS		
Select named sensor	Set tank <i>Type</i> = <i>Heating</i> . Set <i>Target</i> and <i>Diff</i> , set <i>Always Active</i> to <i>On</i>	
SETUP > HEAT SOURCES		
Add Heat Source	Follow prompts for Heat Pump	
	<i>Path</i> = <i>buff (T1)</i>	
	Follow prompts for Electric Boiler; <i>Path</i> = <i>W1, W2</i>	
SETUP > SYSTEM SETTINGS > SITE > HEAT PUMPS		
Minimum Cycle Time	E.g. 10 minutes	
Compressor Delay	E.g. 5 minutes	
SETUP > SYSTEM SETTINGS > SITE > HEATING		
Sys-Pump H	Select B ; rename e.g. <i>Systm</i>	Pump ⑨ in drawings

9.6 Heat pump with backup gas combi boiler / water heater

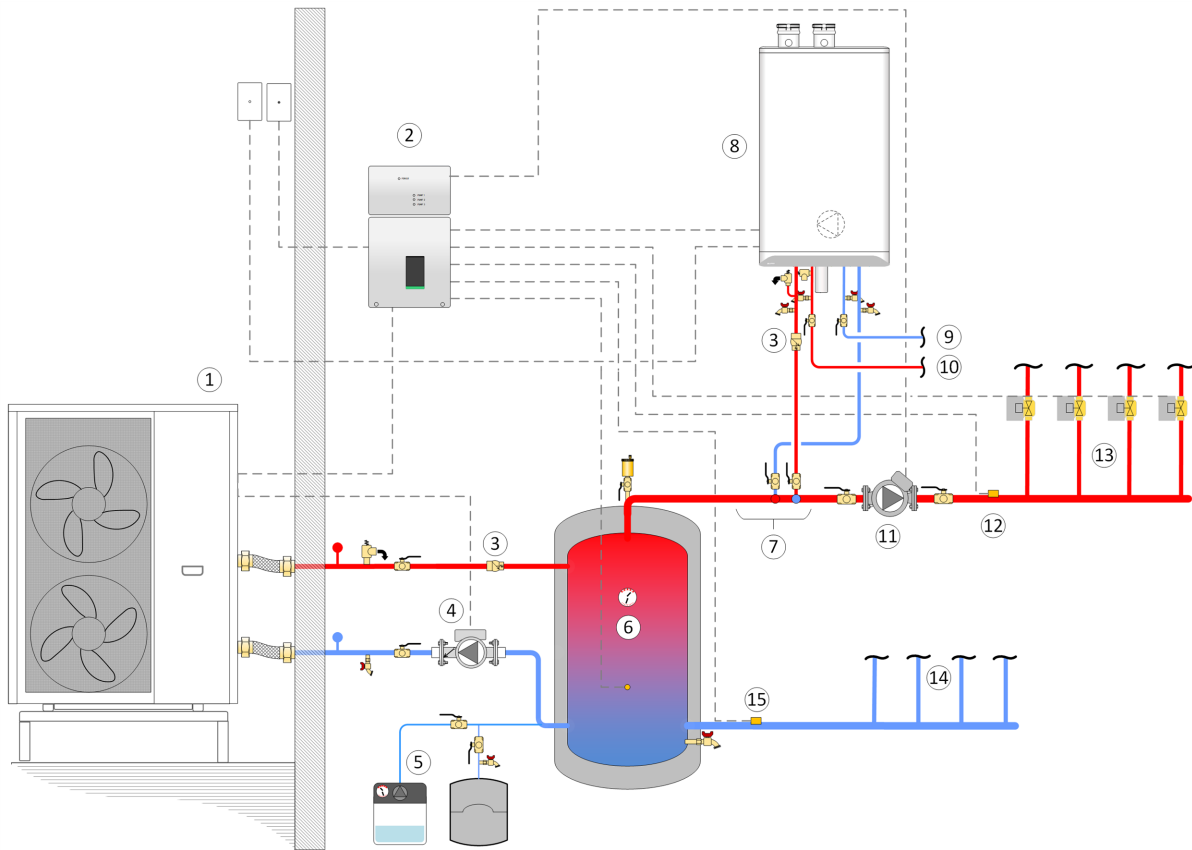
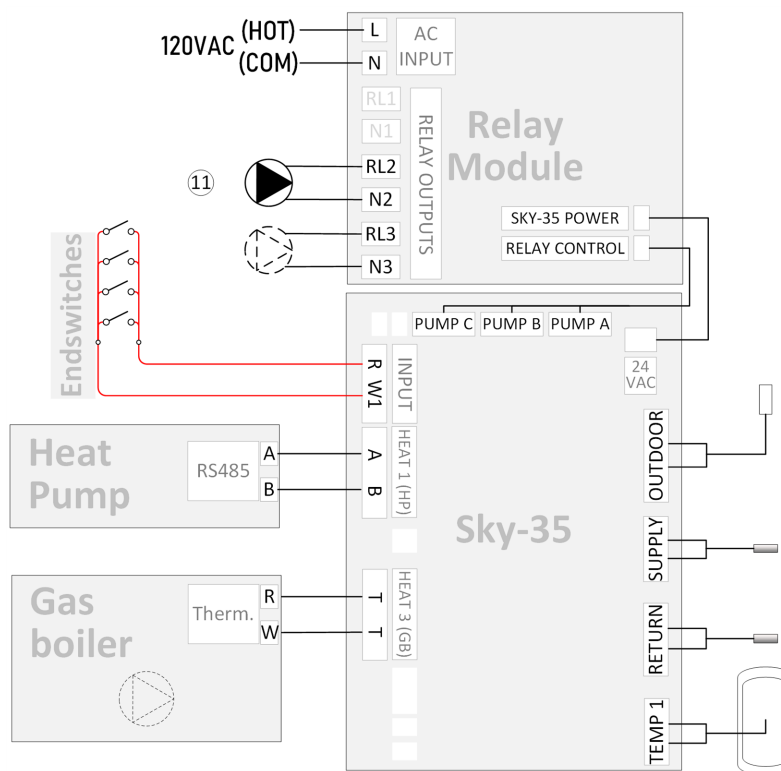


Figure 32 Concept drawing: Heat pump with backup gas combi boiler / water heater

①	HPX Heat pump (outdoors)	⑨	Domestic cold water
②	Sky-35 and Pump Relay Module	⑩	Domestic hot water (DHW)
④	Check valves	⑪	System (distribution) circulator
④	Heat pump circulator (controlled by heat pump)	⑫	Supply temp sensor to Sky-35
⑤	Glycol fill tank	⑬	To heating zones (zone valves)
⑥	Buffer tank	⑭	From heating zones
⑦	Closely-spaced tees	⑮	Return temp sensor to Sky-35
⑧	Gas combi boiler (with built-in circulator)		

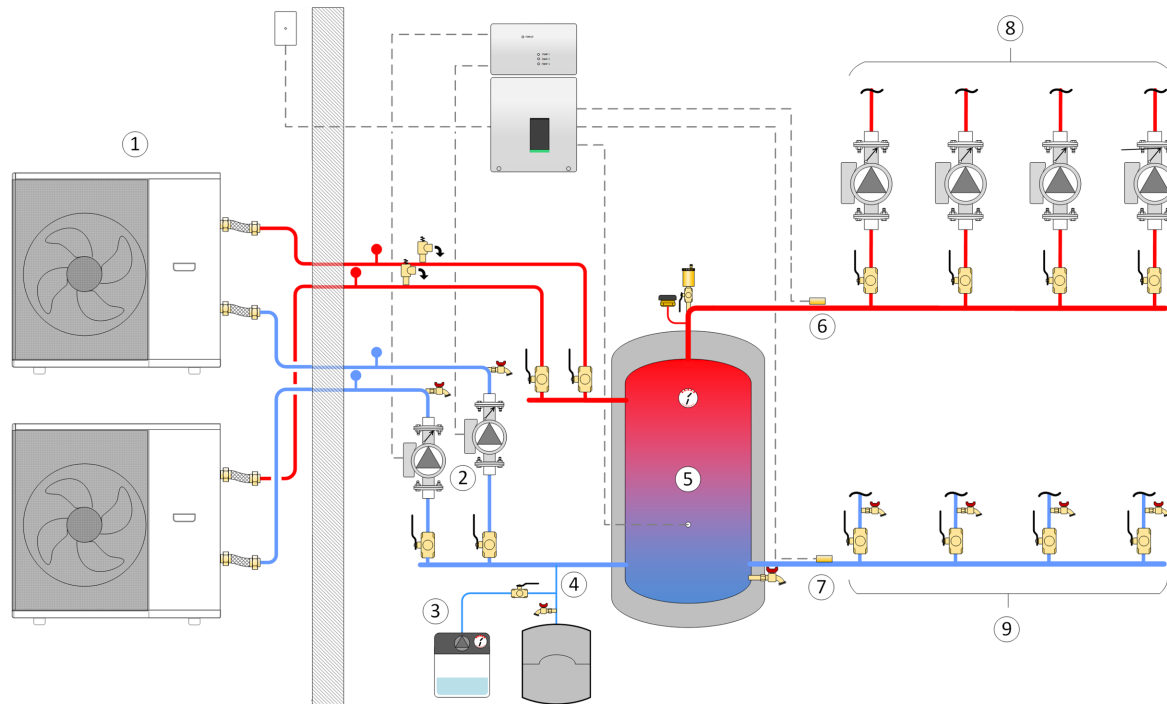
Wiring



Programming (see also [Setting a target temperature on page 61](#))

SYSTEM SETTINGS > SOLUTIONS		NOTES
Activate <i>Heating, Tanks, Thermostat</i>		
SYSTEM SETTINGS > SENSORS		
Temp 1 or other	Set <i>Type</i> = <i>Tank</i> . Rename, e.g. <i>buff</i>	
SYSTEM SETTINGS > TANKS > ADD TANKS		
Select named sensor	Define tank as <i>Heating</i> . Set <i>Target</i> and <i>Differential</i> . Set to <i>Always Active</i> .	
SETUP > HEAT SOURCES		
Add Heat Source	Follow prompts for Heat Pump. <i>Path</i> = <i>T1</i>	
	Follow prompts for gas boiler. <i>Path</i> = <i>W1, W2</i>	Set target temp approx. 5°F higher than buffer tank
SETUP > SYSTEM SETTINGS > SITE > HEAT PUMPS		
Minimum Cycle Time	E.g. 10 minutes	
Compressor Delay	E.g. 0 minutes	
SETUP > SYSTEM SETTINGS > SITE > HEATING		
Sys-Pump H	Select B ; rename e.g. <i>System</i>	Pump ⑪ in drawings

9.7 Multiple heat pumps space-heating with buffer tank

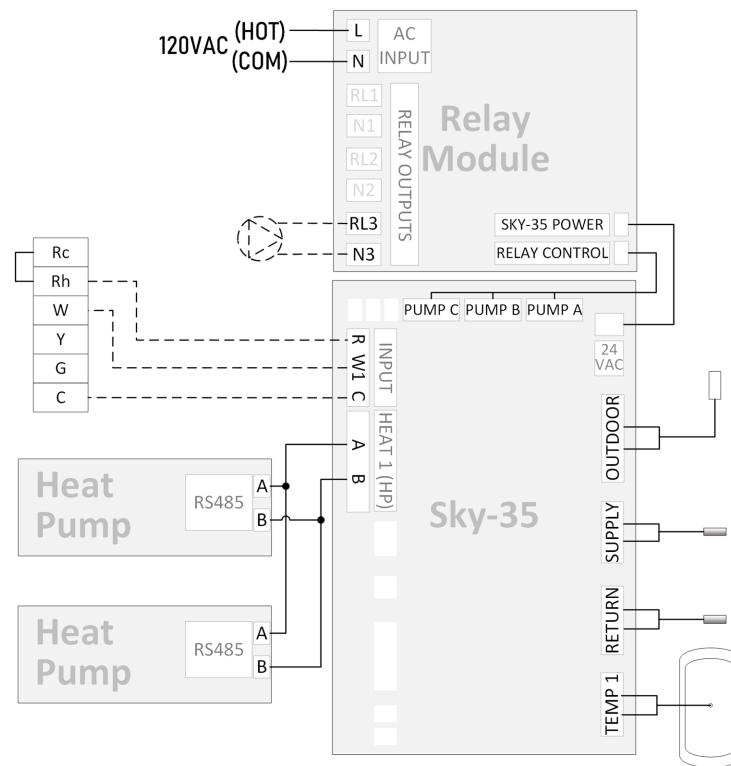


- | | |
|---|---------------------------|
| ① Heat Pumps | ⑥ Supply sensor to Sky-35 |
| ② Heat pump circulators controlled by heat pumps | ⑦ Return sensor to Sky-35 |
| ③ Glycol fill tank (shown), or fill station with isolation closed | ⑧ Supply piping to loads |
| ④ Recommended expansion tank connection point | ⑨ Returns from loads |
| ⑤ Buffer tank (with sensor reporting to Sky-35); use short fat headers. | |

Figure 33 Concept drawing: multiple heat pumps

Heat pumps alternate as lead with each cycle. Space-heating zone pump(s) can operate separately (as shown) controlled by zone / pump module, pressure-activated, or in constant circulation during heating season. Alternatively, a single load pump can be controlled by the Sky-35 if the thermostat is connected (see dotted "optional" lines in the wiring diagram).

Wiring



Programming (see also [Setting a target temperature on page 61](#))

MENU	PROGRAMMING	NOTES
SETUP > SOLUTIONS	Activate <i>Heat, Tank</i>	
SETUP > SYSTEM SETTINGS > SENSORS	Temp 1: rename as <i>BUFFR</i> , set to <i>Tank</i> , enable <i>Display</i>	
SETUP > SYSTEM SETTINGS > TANKS > ADD	<i>BUFFR</i> : Type= <i>Heat</i> , Set <i>Target</i> and <i>Diff.</i> Set to <i>Always Active</i> .	
SETUP > HEAT SOURCE > ADD > Heat Pump? Torin?	Rename as "A"; Path = <i>BUFFR (T1)</i> ; Pump heat = A	Pump(s) ② in drawing
Repeat ADD for second Torin	Rename as "B"; Path = <i>BUFFR (T1)</i> ; Pump heat = B	
SETUP > SYSTEM SETTINGS > SITE > HEATING	Sys Pump = C (option)	System pump (single - not shown with drawing)

Intentionally left empty

10.0 Start-up



Note

For a heat source to fire, it needs an "enabler" such as a zone valve end switch, thermostat, or a buffer tank temperature sensor.

When a Sky-35 controller is first energized, it runs through a power-up sequence that takes approximately one minute. During this time, the controller completes a self-diagnostic, and loads all previous settings. When power is restored after a power interruption, the Sky-35 automatically resumes operation with all the previously stored values.

10.1 Start-up checklist

Start-up Checklist	Check
Tested the pressure relief valve. For instructions, refer to the heat source's <i>Installation and Operating Instructions</i> manual.	☐
Check that all heat sources are configured and communicating with the controller.	☐
Review system settings.	☐
Check sensor temperatures for poor contact or mislabeling.	☐
Test run each pump to verify correct wiring.	☐
Tested the flow by observing the supply and return delta temperature.	☐

Intentionally left empty

11.0 Setup for Internet access

You can set up a Sky-35 controller for remote monitoring and editing through RayMote.

11.1 Connecting a Sky-35 controller to an IP network

The controller must be properly connected to an IP network to enable web browser capability. You can do this by using a router to connect the Sky-35's local area network to the internet. The connection for the Sky-35's controller to an IP network is through the Ethernet jack located on the underside of the controller (see [Installation and Wiring on page 21](#)). The controller supports standard 100 Base T data rates over typical CAT5 or CAT6 wiring.



Note

Remote access via the Internet typically requires that the router configured to forward port 80 to the Sky-35's local IP address.

When connecting to the Sky-35 within the local area network, the Sky-35's IP address will be the same as listed on the controller's Network Information screen.

Connecting to an IP address

There are three methods for connecting the Sky-35 to an IP network:

1. Install an Ethernet cable from the Sky-35 (RJ 45 Ethernet Jack) to the router.
2. Install an Ethernet cable from the Sky-35 into a network switch, which plugs into a router.
3. Install an Ethernet cable from the Sky-35 into a wireless access point device. The wireless access point device must be configured to operate in client mode (to enable the router to function as a wireless client).

Once an IP network connection is established, using one of the above methods, the router automatically requests the IP address, Net Mask, Net Mask, and the default gateway as part of the TCP/IP protocol configuration settings.



Warning

Ensure the Sky-35 controller is configured with a "local" network IP address, with access to the Internet through a properly configured and enabled firewall device. We do **not** approve connecting the Sky-35 controller directly to the Internet using a "public" IP address, or connecting without a secure firewall device.

On the controller's "Network Settings" screen (●●● > **Network Settings**), the TCP/IP group of parameters includes the basic settings required to connect to an IP network. By default DHCP is selected.

- When DHCP is activated the other four entries (IP address, the gateway, DNS server, and Net Mask) are not required, and their entry boxes are disabled.

- When assigning a Sky-35 with a fixed IP address, tap "Manual" and manually enter the Sky-35's IP Address, Net Mask, DNS Server address and Gateway address.

Set up access to RayMote

Now that you have set up the Sky-35's connection to an IP network, you can register this Sky-35 with the Raymote app to enable you to monitor operation.

- » Go to the  Setup tab and select *Enable Web Portal*. The option also appears when adding a communicating heat source.
- » Grant access by selecting *Yes*.

To complete the setup, you need to:

Register a Sky-35 with RayMote.

1. Go to  Status > Network Information and record the MAC address.
2. On your mobile device download the RayMote app
 - a. Sign up using a valid email address. Acknowledge the Terms & Conditions and *Continue*.
 - b. You'll receive a verification email which you must respond to within an hour. Use it to create a secure password.
3. Go back to the RayMote home page and *Log In*.
4. Click *Add New Device*.
 - a. Access the Sky-35 by entering the MAC address you recorded.

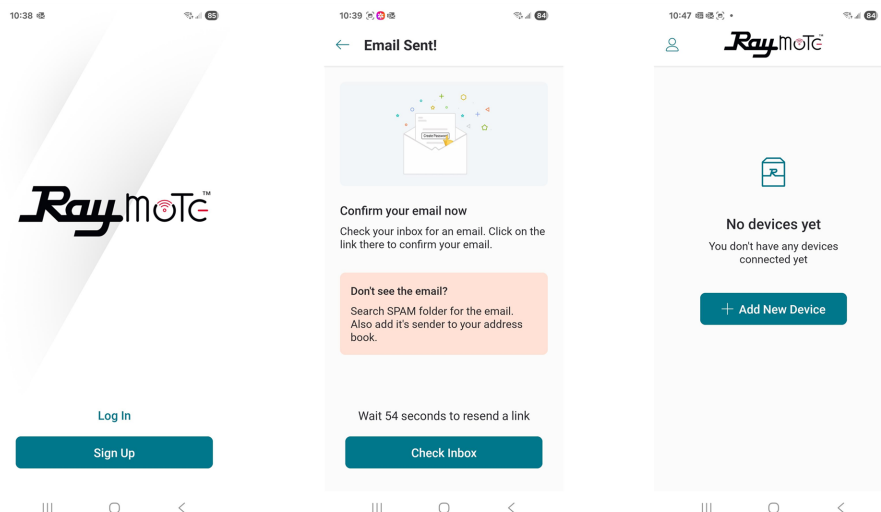


Figure 34 RayMote app

12.0 Troubleshooting

This section provides a list of controller error messages and possible way to resolve the errors. Errors clear automatically when the error circumstances are resolved. For information on the types of errors, see chart below. Note that disconnected wires or defective sensors may be the cause of the error. Always check connections and wiring first.



Warning

Do not attempt to repair the control module (circuit board). If the control module is defective, replace it immediately. Please contact technical support (see back cover) for assistance.

12.1 Viewing errors

If one or more errors are displaying on the status bar, you can view more details by going to the Error Logs screen.

1. Go to [Status]  > **Error Logs**.
2. Tap an error log, and then tap the **Details...** button. The Error log displays all the errors present at the time of the error event such as minor errors, major errors, and system faults.

Each error type is displayed as a dropdown that you can select to view the types of errors.



Tip

Once the errors have been resolved, it is not necessary to wait for the lockout period to end. See "Clearing Errors" below.

12.2 Clearing errors

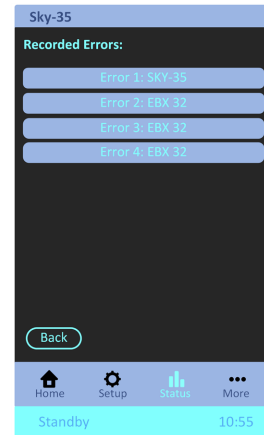
When you clear an error, the system clears any error states and forces the controller to reassess the boiler's error status and to determine if any error state is still present.

To clear the error(s), go to  > **Clear Errors** > **Yes**.

12.3 List of touchscreen controller error messages

The Error Log page lists two kinds of errors: those relayed from communicating Heat Sources and those specific to the Sky-35. An error relayed from a heat has is tagged by the model, e.g. *Error 2: EBX 32* (see the example to the right).

A suffix number (if present) is only the MODbus address, which will be useful if there are multiple such models connected to the Sky-35. In the table below, we've included a list of error messages that you may encounter on a controller as well as diagnostic steps to help you troubleshoot.



Error Text	Diagnosis & Recommended Troubleshooting
Delayed	Information only: compressor or other normal heating delay
Inlet Temp Sensor	Check Inlet temperature sensor
Outlet Temp Sensor	Check Outlet temperature sensor
Aux [#] Temp Sensor	Check Aux [# / assigned-name] temperature sensor
Outdoor Temp Sensor	Check Outdoor temperature sensor
Mode Fault	Sky-35 could not determine mode from given sources
MODbus [#] Fault <i>Shows up as a warning status for the affected heat source. MODbus faults are not recorded in the error log.</i>	MODbus # 1 / 2 / 3 is not indicative of terminal #
	Check MODbus wiring connections
Settings Fault	Check A/B polarity
	Error loading settings
	Power cycle
	Factory reset
	Software update
IP Network Fault	Contact Tech Support
	Check ethernet connection. Check presence of network switch
	Power cycle Sky-35 and/or network switch
RTOS Fault	Reset router (if used)
	Software fault or bad data from connected device.
	Reset to the system defaults
	Update firmware

Error Text	Diagnosis & Recommended Troubleshooting
WiFi/BT Module	Power Cycle
	Reset to the system defaults
	Update firmware
No Serial Number	Contact Tech Support
No Model Set	Possible faulty EEPROM: contact Tech Support
Delayed	Information only - compressor or other normal heating delay

**Tip**

If resetting the controller by applying a power cycle, keep power removed for a full minute for best results.

12.4 Deleting or clearing an error log

Deleting will delete all entries in an error log.

Go to  > **Error Logs** > Choose an error log (link) > **Delete all** > **Yes** to clear all entries in the error log.

Intentionally left empty

Appendix B: Board layouts for related products

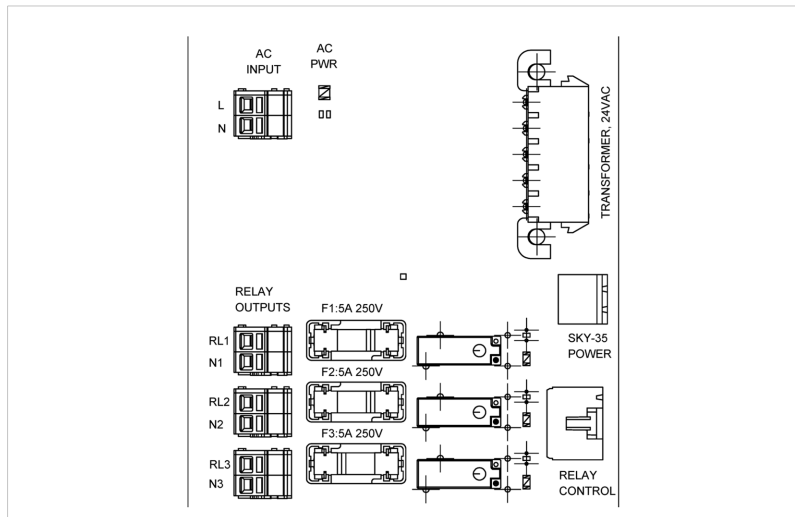


Figure 36 Relay Module layout

Appendix C: Installer log for Site Settings

Site Name: _____ Setup Date: _____ Revision Date: _____

Name	Options and Ranges (Defaults in bold)	Manufacturer's Notes	Installer's Notes
Target	Min: 25°C (77°F) Max: 85°C (185°F) Default: 43°C (109°F)	The target for supply water or for a buffer tank	
Overshoot	Min: 1°C (2°F) Max: 8°C (14°F) Default: 5°C (9°F)	For buffer tank applications, the heat source Target is the buffer tank Target plus this Overshoot.	
Reference	None / Supply / Return / [custom sensor]	During a thermostat heating call <i>Target</i> temperature applies to selected sensor.	
Boost	Min: 10°C (50°F) Max: 60°C (140°F) Default: 27°C (81°F)	Below this temperature the source will heat aggressively.	
Sys-Pump	0 - Off 1 - On	Associates one or more of six pumps with system (distribution) heating circulation	
Contacts	0 - Disable 1 - Enable; Contacts close / Contacts open	Associates heating with DEV 1 and/or DEV 2 contact activation; can be configured for contact closure or opening	
Reset Heating	0 - Off 1 - On	If On, <i>Heating Target</i> is reset using outdoor temperature sensor.	
Summer Shutdown T	Min: 10°C (50°F) Max: 45°C (113°F) Default: 45°C (113°F)	Requires outdoor sensor. Default setting of 45°C effectively disables Summer Shutdown.	
Des Outdoor T	Min: -35°C (-31°F) Max: 15°C (59°F) Default: -10°C (14°F)	Expected winter cold, used for Reset Heating.	

Figure 37 Installer site settings log - Heating

Name	Options and Ranges (Defaults in bold)	Manufacturer's Notes	Installer's Notes
Sensor Type	Heat, DHW		
Target	Min: 49°C (120°F) Max: 66°C (150°F) Default : 49°C (150°F)		
Tank Diff	Min: 2°C (4°F) Max: 6°C (11°F) Default: 4°C (7°F)	Differential centered on Tank Target	
Always Active	On / Off	<i>On:</i> tank will heat up even when there is no thermostat input. <i>Off:</i> if <i>Thermostat</i> is disabled, W1 acts as an enable for the tank.	
Multi-pass	On / Off	Sets applicable devices into single/ multi mode when they heat the tank.	
Path	W1/W2/ DHW	User can choose the tank that is being supported.	
Isolated Pump	Select terminal(s) (A to F)	Select this option when a pump must operate to heat the buffer tank without it being associated with a specific heating source.	

Figure 38 Installer site settings log - Tank

Name	Options and Ranges (Defaults in bold)	Manufacturer's Notes	Installer's Notes
Minimum Cycle Time	Min: 0 Max: 60 Default: 0	Minimum run time for a heating cycle	
Stage Delay	Min: 0 Max: 10 Default: 0 minutes	Minimum interval between thermostat Stage1/Stage2 heating	
Load Control Outputs	0 - Passthrough 1 - Controlled	Passthrough duplicates thermostat input	
O/B Output	0 - Passthrough 2 - Active Heating	Passthrough duplicates thermostat input	
Balance T	Min: -30°C (-22°F) Max: 15°C (59°F) Default: -4°C (25°F)	Used in backup for Heat Pump source. Requires Outdoor sensor.	

Freeze Guard	0 - Off 1 - On	Calls for heat if the inlet water temperature drops below 41°F (5°C).	
Pump Exercise Interval	Min: 0 Max: 96 Default: 48 hours		
Pump Exercise Duration	Min: 1 Max: 10 Default: 1 minute		
High Cutoff	Min: 30°C (86°F) Max: 90°C (x°F) Default: 63°C (145°F)	Heating is shut off if sensors read above this value. Targets are capped capped at this value.	

Figure 39 *Installer site settings log - General*

Appendix D: BACnet objects

A ProtoNode interface device is required to for BACnet communication to the Sky-35. Contact Tech Support if further documentation is needed.

OBJECT	Description	Units	R/W	MODbus REGISTER	BACnet Register
	Read Block 1				
INLET_T	Main Loop Return Temp	°C	R	4001	AI4001
OUTLET_T	Main Loop Supply Temp	°C	R	4002	AI4002
OTDOOR_T	Outdoor Temperature	°C	R	4003	AI4003
TS_1	Temperature Sensor 1	°C	R	4004	AI4004
TS_2	Temperature Sensor 2	°C	R	4005	AI4005
TS_3	Temperature Sensor 3	°C	R	4006	AI4006
TS_4	Temperature Sensor 4	°C	R	4007	AI4007
STAT_P_A	Pump A Output	%	R	4008	AV4008
STAT_P_B	Pump B Output	%	R	4009	AV4009
STAT_P_C	Pump C Output	%	R	4010	AV4010
STAT_P_D	Pump D Output	%	R	4011	AV4011
STAT_P_E	Pump E Output	%	R	4012	AV4012
STAT_P_F	Pump F Output	%	R	4013	AV4013
	Read Block 2				
HT_TARGET	Heat Mode Target	°C	R/W	4031	AV4031
HT_OVSHT	Heat Mode Overshoot	°C	R/W	4032	AV4032
SUMMER_T	Summer Shutdown	°C	R/W	4033	AV4033
DESOUT_T	Design Temperature	°C	R/W	4034	AV4034
BAL_T	Balance Temperature	°C	R/W	4035	AV4035
DH_OVSHT	DHW Overshoot	°C	R/W	4036	AV4036
	Read Block 3				
FRZGUARD	Freeze Guard		R/W	4051	BV4051
RST_HEAT	Reset Heating		R/W	4052	BV4052

The following variables are for each defined heat source. The ProtoNode configuration files, specifically the “prof1b.csv”, “prof1m.csv” and “prof1s.csv” files will need to be modified to match the number of heat source at a specific site. “xx” represents the unit number in system. Using

HSxx_IN as an example, if the unit # is 3, then MODbus register would be “301” and the BACnet Register would be “AI0301”.

OBJECT	Description	Units	R/W	MODbus REGISTER	BACnet Register
	Read Block 1				
HSxx__IN	Heat Source Inlet T	°C	R	xx01	AIxx01
HSxx_OUT	Heat Source Outlet T	°C	R	xx02	AIxx02
HSxx_TEMP_AMB	Heat Source Ambient T	°C	R	xx03	AIxx03
HSxx_TEMP_EVP	Heat Source EVP T	°C	R	xx04	AIxx04
HSxx_TEMP_SUCT	Heat Source SUCT T	°C	R	xx05	AIxx05
HSxx_TEMP_SST	Heat Source SST T	°C	R	xx06	AIxx06
HSxx_TEMP_SLT	Heat Source SLT T	°C	R	xx07	AIxx07
HSxx_VICTEMPI	Heat Source VIC IN T	°C	R	xx08	AIxx08
HSxx_VICTEMPO	Heat Source VIC OUT T	°C	R	xx09	AIxx09
HSxx_RESSUCG	Heat Source xx SUC Psig		R	xx10	AIxx10
	Read Block 2				
HSxx_PRESLIQG	Heat Source xx LIQ Psig		R	xx11	AIxx11
HSxx_WTR_PRES	Heat Source xx Water Psig		R	xx12	AIxx12
HSxx_TARGET	Heat Source xx Target	°C	R	xx13	AVxx13
HSxx_MODE	Heat Source xx Mode		R	xx14	AVxx14
HSxx_DELTA_SP	Heat Source xx Delta SP	°C	R	xx15	AVxx15
HSxx_UNITPUMP	Heat Source xx Unit Pump		R	xx16	AVxx16
HSxx_DEF_INFO	Heat Source xx Defrost		R	xx17	AVxx17
HSxx_ISCSPEED	Heat Source xx ICS Speed		R	xx18	AVxx18
HSxx_ACINPV	Heat Source xx Voltage		R	xx19	AVxx19
HSxx_INVSPEED	Heat Source xx Comp. Speed		R	xx20	AVxx20
	Read Block 3				
HSxx_ODFANRPM	Heat Source xx Fan RPM		R	xx21	BVxx21
HSxx_CLNUNITR	Heat Source xx Unit Clean		R	xx22	BVxx22

HSxx_CLNTRPTR	Heat Source xx Trap Clean		R	xx23	BVxx23
HSxx_ENABLE	Heat Source xx Enable		R/W	xx24	BVxx24

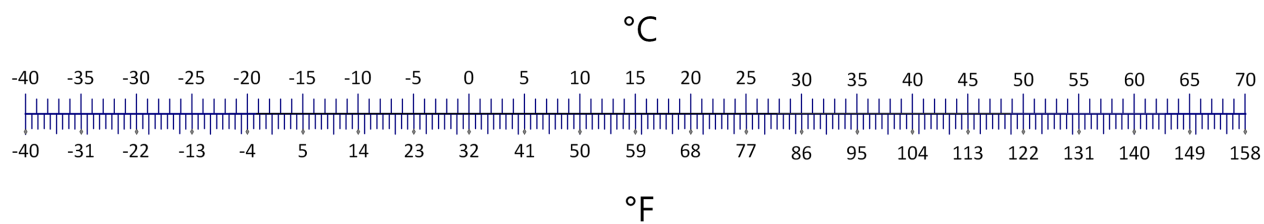
The ProtoNode configuration files, specifically the “prof1b.csv”, “prof1m.csv” and “prof1s.csv” files, will need to be modified to match the specific site's tank numbers: “xx” represents the unit number in system.

OBJECT	Description	Units	R/W	MODbus REGISTER	BACnet Register
TK_xx_TARGET	Tank xx Target	°C	R/W	xx51	AIxx51
TK_xx_DIFF	Tank xx Differential	°C	R/W	xx52	AIxx52
TK_xx_OVSHT	Tank xx Overshoot	°C	R/W	xx53	AIxx53
TK_xx_PASS	Tank xx Multi-pass	°C		xx54	AIxx54

Accessories

Sky-35 Controller Board Replacement	P-2000
Sky-35 Pump Relay Board Replacement	P-2001
Sky-35 Power Transformer	P-2002
Sky-35 Power Cable	P-2003
Sky-35 Pump Control Cable	P-2004
Supply / Return (Secondary Loop / DHW) Temperature Sensor	P-9073
Outdoor Temperature Sensor	P-9067

Temperature Conversions

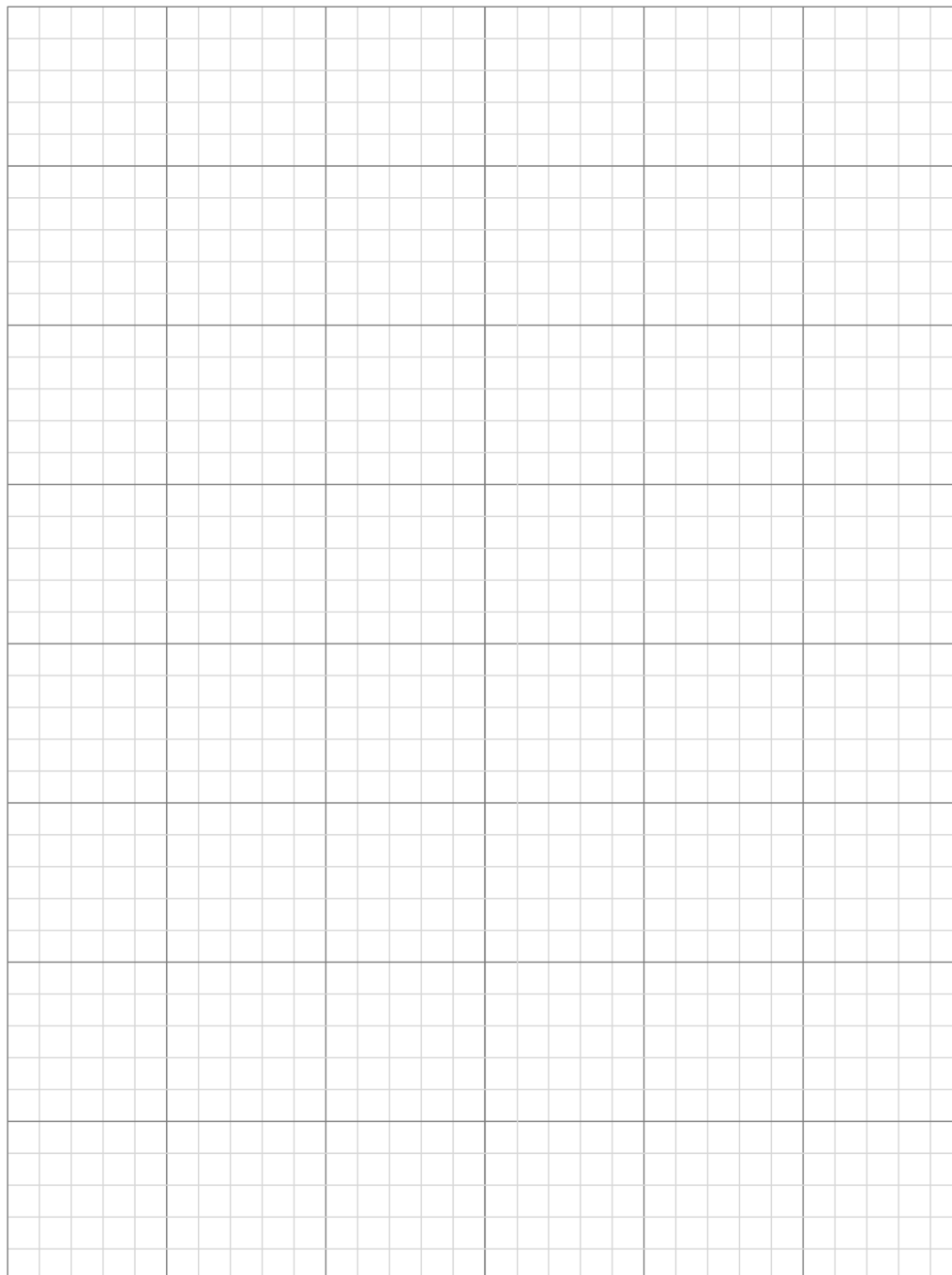


Temperature differences:

$$\Delta T^{\circ}\text{C} = 5/9 * (\Delta T^{\circ}\text{F})$$

$$\Delta T^{\circ}\text{F} = 9/5 * (\Delta T^{\circ}\text{C})$$

NOTES



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*Montgomery, AL.
(833) 212-9276*

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