



**Modular control system for
Buderus floor standing boilers with
indoor reset, outdoor reset, mixed zones,
and solar DHW capability**

Buderus

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1 Introduction

This manual addresses some of the many applications that are possible using Buderus outdoor reset controls. Applications depicted in the manual are presented with both hydraulical and electrical outlines. The drawings contained in this manual are intended to be used as an aid to system installers and designers and are conceptual in nature. Auxiliary equipment depicted in this manual does not necessarily represent any one particular manufacturer or specific model number. There are a wide variety of techniques, practices and piping arrangements possible with hydronic heating systems and it is the responsibility of the installing contractor to determine which of these is best suited for a specific application.

In an effort to simplify electrical drawings, they have been limited to zone controlling only (space heating and DHW). Other constants such as power input, boiler sensor and outdoor sensor wiring have also been eliminated. Information for wiring of burners can be found in section 9 of this manual. Further information can be found in the control service manual.

Although this manual covers many common applications for our equipment, the possibilities are virtually endless. Should you encounter an application that is not covered in this manual or have questions regarding any of its content, we encourage you to contact us here at Bosch Thermotechnology Corp.

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2 Terms

Outdoor Reset: Outdoor reset is a control method that takes outdoor air temperature into consideration when determining the system water temperature. Instead of a fixed high limit temperature (i.e. 180°F (82°C)), the high limit is reset to a temperature high enough to satisfy the heat loss at any given outdoor temperature.

In designing a heating system the first requirement is an accurate heat loss calculation. Several factors are used in determining heat loss; the volume of space being heated, type of materials being used in construction, insulation values and a design temperature. The design temperature represents the coldest day of the year. The heat loss calculation is then used to determine the output requirements for the boiler, baseboard, panel radiators, etc. In short the system is sized to heat the house on the coldest day of the year.

However, a building's heat loss is ever changing; and is largely dependent on outdoor temperature. As the outdoor temperature drops, the heat loss increases and as it rises the heat loss decreases. The fact is that approximately 98% of the heating season the boiler and radiators are oversized. With outdoor reset controlling you can more accurately match the output from the heating system to the current heat loss. For example, it may require 180°F (82°C) water temperature circulating through the system in order to have enough output to maintain a 70°F (21°C) indoor temperature on a 10°F (-12°C) day. Yet, at a 40°F (5°C) outdoor temperature it may only require 135°F (57°C) water temperature to satisfy the heat loss. By resetting the system water temperature, a lower average water temperature is used throughout the heating season and maximum temperature is used only on the coldest days of the year.

Among the many benefits to this type of controlling is optimum fuel economy. By only heating the water to the minimum temperature needed, fuel economy is maximized (as much as 30% in fuel savings!). Lower standby losses during "off" cycles (due to a lower boiler temperature) also reduce fuel consumption. In addition, the room comfort level is significantly increased by matching the heat output to the current heat loss. Less room temperature fluctuation is realized. System noise caused by expansion of piping is significantly reduced due to lower system water temperatures.

Constant circulation zone: A constant or continuous circulation zone is just what the term implies, water continuously circulates through a given zone when the heating system is in operation. The water temperature in this zone is modulated so that the heat output from the distribution units (i.e., fin-tube baseboard, panel radiators, radiant floors, etc.) matches the rate of heat loss for that zoned area. A constant circulation zone is typically the main heating zone. In multi-zone systems, the constant circulation zone must require the highest system water temperature. With this method of controlling, a room sensor is required in order to monitor room temperature. All secondary zones will have standard room thermostats to intermittently operate a zone valve or zone circulator.

The constant circulation zone will only be interrupted under the following conditions:

- Domestic hot water priority.
- Certain setback modes (See the control Service Manual for information on various setback modes).
- Condensate protection. If boiler water temperature falls below the condensate protection temperature while the burner is firing, the space heating circulator(s) will be shut off. Once the boiler temperature reaches a safe level, circulator operation will resume.
- When the outdoor temperature rises above the WWSD (warm weather shut down) setting.

WWSD: Warm weather shut down or summer-winter changeover, is the outdoor air temperature at which the space heating function of the system shuts down. With the Buderus control system this temperature is adjustable from 49°F to 87°F (9°C to 31°C). When the outdoor temperature rises above the WWSD set point, the system will only operate for domestic hot water production. (For detailed operation of the WWSD feature refer to the control Service Manual).

BFU Room sensor: The Buderus room sensor is similar to a thermostat although it will not turn a circulator on or off. The function of the room sensor is to continually monitor room temperature and relay this information back to the control system. This information is used to compensate for variations in room temperature due to internal heat gains (or losses) such as solar gain, fireplaces, wood stoves, appliances, lighting, people, open doors or windows, etc. The control compensates for these variations by adjusting the system water temperature (up or down) in order to maintain the desired room temperature. Buderus room sensors also allow the occupant to manually override programmed setback periods.

The control system allows you to limit the amount of compensation that the room sensor has over the selected heating curve. This setting is referred to as "ROOM COMP" and can be adjusted at the programming level of the control. This setting is only available when using a room sensor.

You may want to limit compensation if secondary zones are under radiated.

Example: The main heating zone (continuous circulation) zone is experiencing solar heat gain. The room sensor senses the rise in room temperature and lowers the system water temperature in order to keep the zone from over heating. In this scenario, the system water temperature could be lowered enough so that the output from a secondary zone was insufficient to satisfy that zone.

Only one Buderus room sensor can be used for high temperature space heating (a second room sensor can be added when using an FM241 module for motorized mixing of a lower water temperature).

Careful consideration must be given to placement of room sensors. Keep in mind that not all applications are suitable for using a constant circulation zone. Avoid using a room sensor in a small baseboard zone as overheating may occur during DHW

production. A standard room thermostat can be used in conjunction with the room sensor to give high limit protection.

Setback: Buderus reset controls allow the occupant to program setback periods in order to further reduce operating costs. Several modes of setback can be selected with the Buderus control. The two modes used for residential applications are "SETBACK" and "RMSETBACK". Unlike conventional setback thermostats that only reduce the zone temperature setting, the Buderus control system will operate the boiler at a reduced water temperature. For example, at a 30°F (-1°C) outdoor temperature the boiler water temperature may be 145°F (63°C), at that same 30°F (1°C) outdoor temperature during a setback period, the boiler water temperature may be reduced to 130°F (54°C).

This further reduction of water temperature will decrease the output from the radiators by lowering the room temperature in the living space. The extent to which the water temperature is reduced is dependent upon the desired room temperature reduction during setback periods. This value can be set in one of two ways:

- SETBACK mode - a "DAYTEMP" and a "NIGHTTEMP" would be entered on the Buderus control (this would be done when you are not using a BFU room sensor)
- RMSETBACK mode - when using a BFU room sensor, the room sensor allows you to select the amount of room temperature setback.

Allowance for pick-up time must be considered when coming out of a setback period. Systems that operate on outdoor reset will have a longer recovery time than systems that operate at maximum temperatures all the time. The two variables to consider are the amount of room temperature reduction and the length of the setback period. The use of a BFU room sensor can speed up the recovery time, however the amount of temperature boost is dependent upon the ROOMCOMP setting on the Buderus control (for details refer to the control Service Manual).

3 Control Programming

The following will allow access to the service side of the control:

1. Push and hold the turn page button "  " while inserting a pen or wire into the hole "  " on the display.
2. The word **AMERICAN** will be displayed.
3. Turn blue dial once to the right, **BLR TEMP** will be displayed. This is a main category.
4. Push and release return button to access sub menu. **FREEZE TEMP** will be displayed. If the outdoor temperature drops beneath the frost protection limit, the heating system pump (contacts 61/63) will be started. Factory default: 41°F (5°C).
5. Turn blue dial one more time and **BUILD RESP** will be displayed. The current setting will be **2**, change that to **1** by holding the "  " button and turning the blue dial until you get to the number **1** and release. This will let the boiler respond faster to outside air temp changes.
6. Turn the dial one more time and **PUMPLOGIC** will be displayed. The current setting is 104°F (40°C). This will not let the burners and the pump run at the same time below 104°F (40°C) to protect from condensation.
7. Turn the dial one more time and **MAXTEMP1** will be displayed. The current setting for this is 176°F (80°C). To change this to 194°F (90°C), hold down the "  " button and turn the blue dial until **194°F (90°C)** appears, then release. (this may not be necessary unless under radiated)
8. Now push the return button "  " once.
9. Now you are back to the main categories. Turn the blue dial once to the right and it will read **CIRCUIT1**.
10. Push and release the "  " button and **REF TEMP** will be displayed which represents the boiler water temperature at 14°F (-10°C). Default is 167°F (75°C). Refer to page 20 in the service manual for graphing **REF TEMP** changes.
11. Turn the blue dial one more time and **REMOTE1** will appear. The factory setting is off, and the only time you have to turn this on is if you are using a BFU room sensor. Use a BFU room sensor for constant circulation on one zone and power the pump off of 61 and 63.
- Once **REMOTE1** setting is turned „on“, the **ROOM COMP** parameter will be displayed. Use **ROOM COMP** to adjust the room influence on the heating curve.
12. Turn the blue dial one more time and **OASETBACK** will appear. Hold the "  " and turn the blue dial to **SETBACK**. On the **OASETBACK** mode, the pumps will turn off in the night setback mode if the temp outside is above the freezetemp. In the **SETBACK** mode the curve will drop back for fuel savings. If you have a room sensor

and want to do the temp set back by it, you will need to change it to **RMSETBACK**.

13. Turn the blue dial one more time and **OFFSET** will appear. The setting will be at **0°F (0°C)** and is okay with normal radiation, but if you have an air handler, you will need to raise the offset to **9°F (5°C)**. This will raise the beginning of the curve and supply enough temperature on milder days.
14. Push and release the return button "  " again.
15. Turn the blue dial one more time and **DHW PROD** will appear. The factory setting is **ON**. If no DHW tank is installed, hold down the "  " button and turn until it says **OFF** and release.
16. Turn the blue dial one more time and **RECIRPUMP** will appear. The setting is **2**, it can be changed to **OFF, 1,2,4,5,6,ON**. The pump will run 3 minute cycles depending on the number of cycles you choose per hour. If you do not have a recirc pump turn it to **OFF**.
17. Turn the blue dial one more time and **HTG CURVE1** will appear. Hold the "  " button and turn the blue dial. It will show you three points on the curve so you can see what the water temp will be at 3 different points, then release.
18. Turn the blue dial one more time and **RELAYS** will appear. This will allow you to test all the components that are wired to the 2107 control.
19. Push the "  " button and **BURNER** will appear. Hold the "  " button and turn the blue dial and the LCD will read **ON**, release and the burner will start. Hold the "  " button and turn the blue dial and the LCD will read **OFF**, release and the burner will turn OFF.
20. Test the Heating Pump (constant circulation pump), DHW Tank Pump, and DHW Recirc Pump the same way.
21. When you are done with the **RELAY** tests push the return button "  " .
22. Turn the blue dial one more time and **LCD-TEST** will appear. To test the LCD display, hold the "  " button and turn the blue dial, release and it should read **LCD-TEST**.
23. Turn the blue dial one more time and **RESET** should appear. To reset the control back to factory settings, hold the "  " button until all of the **8's** disappear and release. The first thing you will need to do is go back to the language and it will read **DEUTSCH**. Hold the "  " button and turn the blue dial until you read **AMERICAN** on the LCD. The control is now back to factory setting.

Now push the AUT button and you will be back in Automatic mode.



This product has been tested and is certified for both the US and Canadian markets and meets all applicable US and Canadian standards.

Notice:

To match the typical building, the following factory settings may need adjustment:

BLDG RESP: Change to 1 if typical 2x4 or 2x6 construction

MAX TEMP: Change to 185-190°F if high temperature baseboard is used

OASETBACK: Change to SETBACK if no room sensor is being used or

RMSETBACK: if a room sensor is present

Refer to page 10 for additional details.

4 Installation of the Logabracket

The Logabracket is designed to create strain relief for your line voltage and low voltage wiring for the 2107 Logamatic controls. The bracket is mainly designed for use with the G115, G125, GB125 and G124X boilers, but with minor modifications can be used on other boiler models as well.

G115, G125, GB125, G124X

Line the bracket up with holes, place the Logamatic in place over the holes and secure with screws provided. Four conduit connections are provided for line voltage wiring; a slotted opening is used to run low voltage sensor wiring.

G215

It is necessary to bend down the tabs on the rear jacket panel to prevent interference between bracket and jacket panel.

G234X, G334X

Simply cut off the tabs of the bracket and mount on the rear panel by drilling an additional hole for a second mounting screw.

GA124, GA244

These boilers do not require the bracket as strain relief connections are provided on the rear of the boiler.

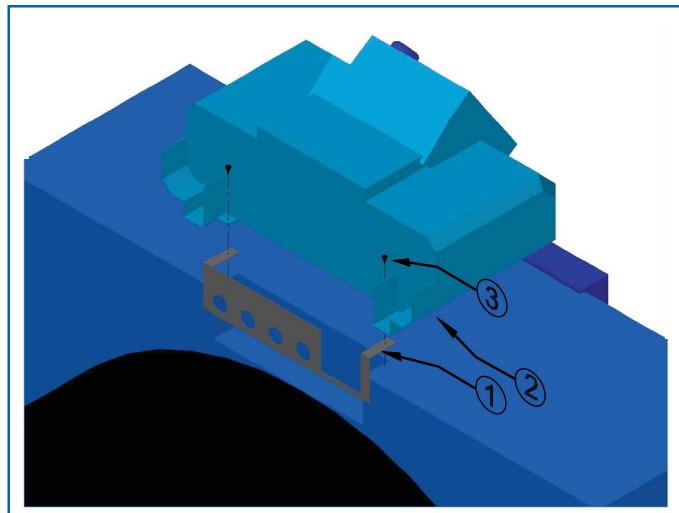


Figure 1 Logabracket installation

- 1 Logabracket
- 2 2107 Logamatic control
- 3 Screws

5 Setting parameters and display data for the Logamatic 2107



Press the 'Display' key and 'Install' key at the same time to call up the service level. Alternatively press (1....7), clock, and return arrow button simultaneously. See Chapter 3 for extended functions.

Display

AMERICAN	Language selection
BOILER	Boiler parameters
FREEZE TEMP	Freeze protection limit
BUILDING	Building response
2-STAGE1	Burner type ¹
MIN MOD ²	Minimum modulation output ²
TIME RUN ²	Minimum burner run time ²
PUMPLOGIC	Pump logic threshold
MAX TEMP	Maximum boiler switch-off temperature
CIRCUIT 01	Heating circuit 1 installation parameters (unmixed heating circuit)
PERIM HTG	Heating system
REF TEMP	Design temperature
REMOTE 1	Remote control ON/OFF
ROOM COMP	Room temperature compensation ³
OA SETBACK	Type of setback
OFFSET	Room temperature offset
CIRCUIT 02	Heating circuit 2 installation parameters (mixed heating circuit) ⁴
FLOOR HTG	Heating system
REF TEMP	Design temperature
DHW PR5	DHW priority ⁵
MAX TEMP	Maximum heating circuit temperature
REMOTE 2	Remote control ON/OFF
ROOM COMP	Room temperature compensation ³
OA SETBACK	Type of setback
OFFSET	Room temperature offset

Note: For footnotes, see next page

Display

SOLAR ⁷	
SLR FN ON	Solar function ON/OFF
MAX SL SR	Maximum storage tank temperature in solar mode
MIN SL SR	Minimum storage tank temperature in solar mode
DHW PROD	Domestic hot water ON/OFF
RECIRC PUMP ⁵	DHW circulation pump ⁵
HTG CURVE 1	Heating characteristic curve HK1
HTG CURVE 2 ⁴	Heating characteristic curve HK2 ⁴
RELAYS	Relay test
BURNER (St.1)	Burner relay stage 1
BURNER21, MOD2 ²	Burner relay ¹ stage 2, modulation output ²
HTG1 PUMP	Heating circuit pump (HZ1 unmixed)
HTG2 PUMP4	Heating circuit pump (HZ2 mixed) ⁴
MIX VALVE4	Mixer ⁴
DHW PUMP	Tank DHW pump
RECIR PUMP	DHW circulation pump
SLR PUMP ⁷	Solar pump ⁷
LCD TEST	LCD test
TIME	Time, accuracy
RESET	Reset
VERSION	Version number

¹ Only if the FM 242 module is installed and 2-stage burner is selected.

² Only if the FM 242 module is installed and modulating burner is selected.

³ Only if BFU remote control is installed.

⁴ Only if the FM 241 module is installed.

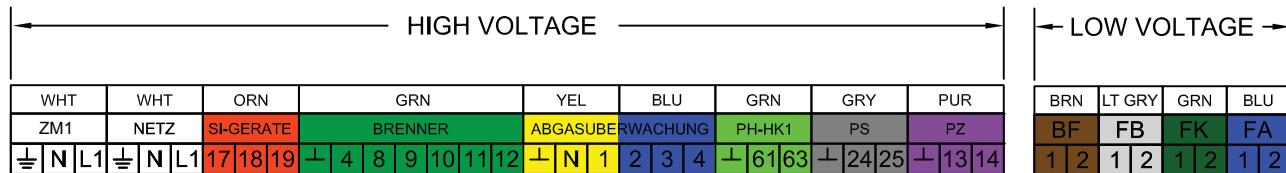
⁵ Only if DHW is installed.

⁶ Only if FM 241 module is installed and if heating circuit 2 is selected as an "FLOOR HTG" or "PERIM HTG" heating system.

⁷ Only if FM 244 module is installed.

6 Troubleshooting

6.1 "NO HEAT" call



"BRENNER" (burner) wiring block

- Terminal 4 – 120V Neutral
- Terminal 8 – 120V input clocks hours run meter (must be field wired)
- Terminal 9 – 120V input displays "BURNER ERR" message (must be field wired)
- Terminal 10 / 11 – "dry" contacts close to energize burner
- Terminal 12 – 120V power (drops out when manual reset limit is tripped)

Burner operation

The R2107 is not a cold start control. It does not reply on a call for heat from an end switch or thermostat to fire the boiler.

The boiler will maintain a range of water temperature based on outdoor temperature. The differential of this range is dynamic, meaning that it is not fixed, and will adjust based on outdoor temperature and current system load. The starting point of the differential is 27°F (15°C) and will adjust from there. The differential will generally be wider at milder outdoor temperatures and narrower at colder outdoor temperatures.

The differential is split above & below the current target temperature.

Example: Outdoor temperature at 32°F, based on heating curve the water temperature required is 140°F with a 26°F burner differential.

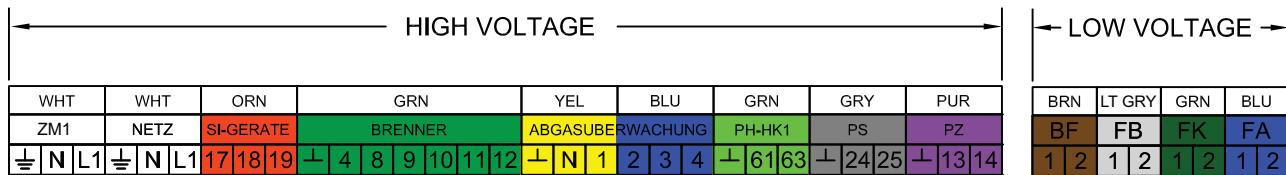
The differential (26°F) is split (13°F) above & (13°F) below the target temperature.

140°F target + 13°F = 153° high limit

140°F target - 13°F = 127° low limit

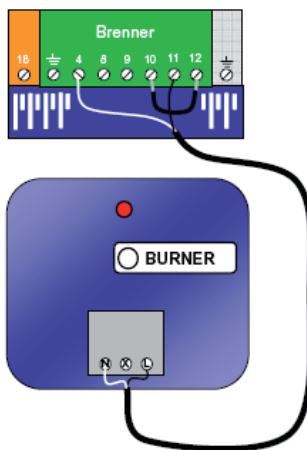
This 127°F to 153°F becomes the range of temperature that the boiler will maintain. As zones call and pull heat from the boiler, eventually the temperature in the boiler drops. Once the temperature in the boiler hits the low limit (127°F) the R2107 control closes a switch (dry contacts) between terminals 10 & 11 to fire the boiler (this is indicated by a flame symbol displayed on the LDC screen of the R2107). When the boiler temperature reaches the high limit (153°F), the contacts open and the boiler stops firing.

Once the outdoor temperature drops below the WWSD setting, the boiler begins to maintain temperature. Above WWSD the boiler will only fire on a call for DHW.

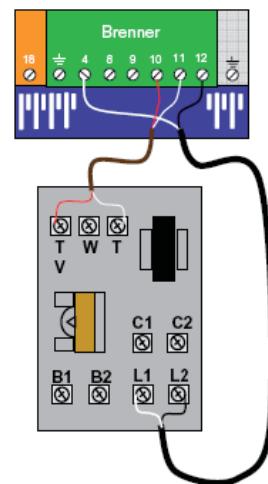


Oil burners – factory jumper between terminals 12 & 10, brings 120V from 12 to 10. When contacts close between terminals 10 & 11, 120V power is sent from terminal 11 to Hot on the burner (terminal 4 is the neutral).

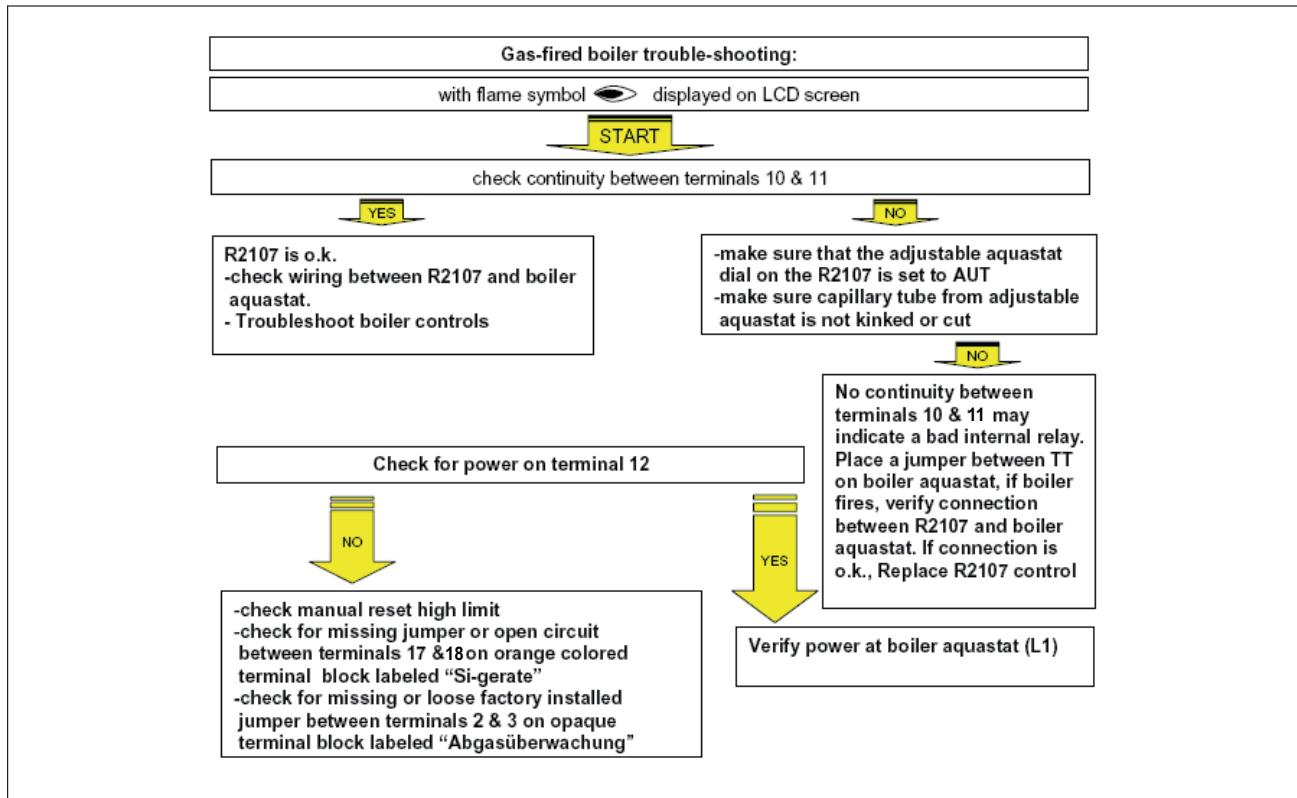
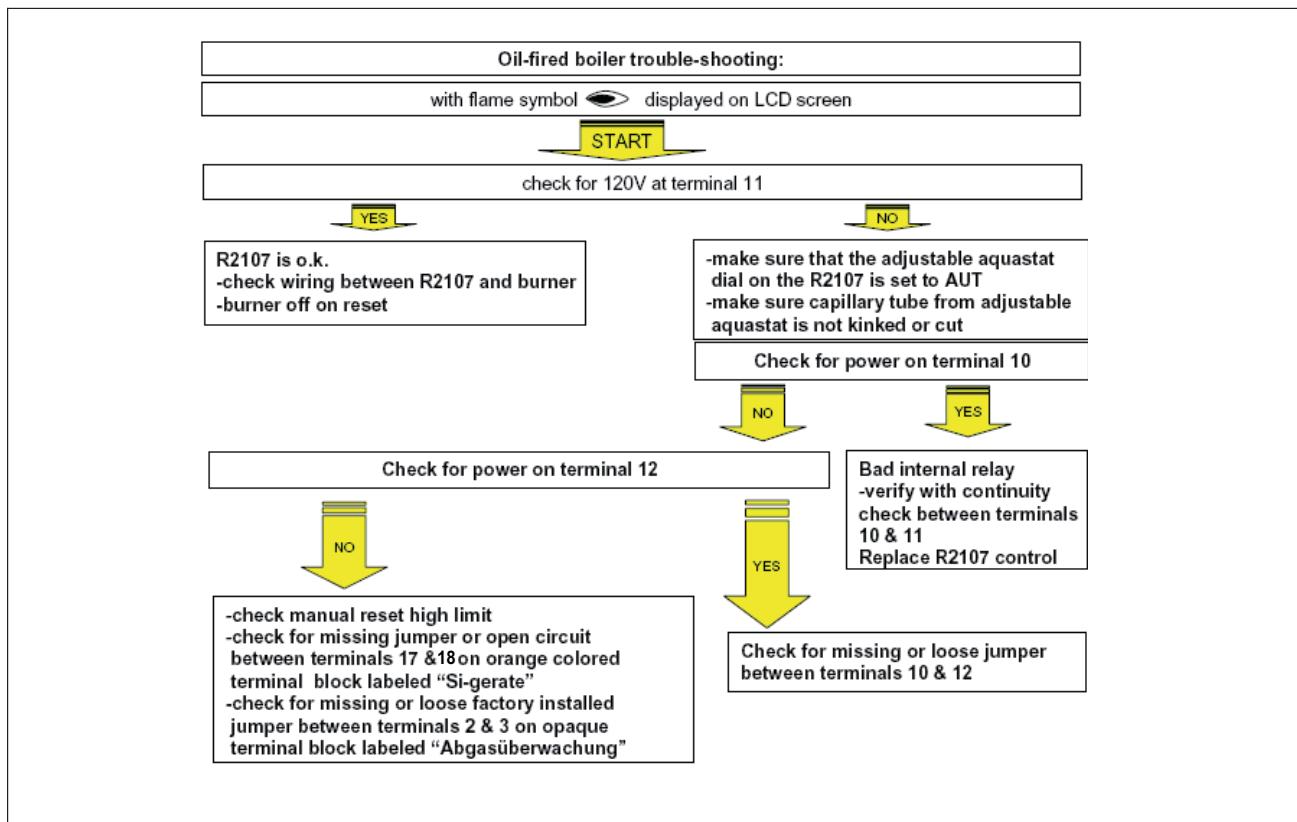
Gas burners – remove factory installed jumper between terminals 10 & 12. The contacts between terminals 10 & 11 are now “dry” (no voltage present) and switching to the burner is now low voltage between terminals 10 & 11 on the R2107 and TT (or RW) on the boiler aquastat.



3rd Party Oil Burner



Gas Burner



6.2 "INSUFFICIENT HEAT" call

A call for insufficient heat is generally a simple matter of adjusting the heating curve.

The water temperature required for any heating system is determined by any number of factors but the biggest influence we see is the amount of radiation in comparison to the actual heat loss. Buildings with less radiation in relation to their actual heat loss require higher water temperature than buildings that are overradiated. Every house is unique in terms of its heat requirements. Some of the many factors include, construction, exposure to sun, elevation, surroundings (trees, other structures, etc), furnishings, internal heat gain (computers, lights, people, appliances, etc) and the expectations and comfort level of the individual.

The heating curve on a R2107 can be adjusted in several ways:

REF TEMP – the reference temperature adjusts the slope of the heating curve. The REF temperature in the R2107 references a boiler water temperature at 14°F outdoor temperature. In general, if the homeowner complains that they can never get the house up to temperature, adjust the REF temperature up. A rule of thumb would be: for every 1°F you want to raise the room temperature, increase the REF temp by 2.5°F.

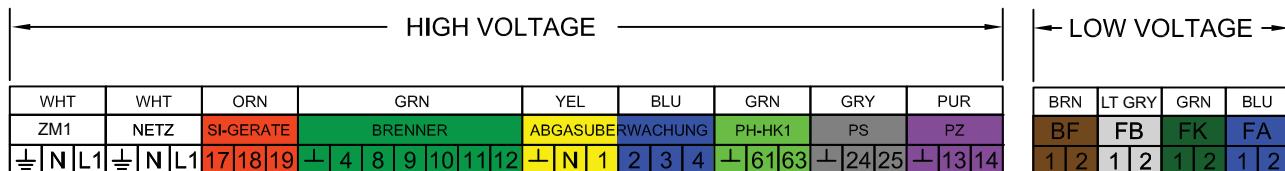
For example: Customer says they can't get the house above 65°F.
We need to increase the room temperature by 5°F
 $...5 \times 2.5 = 12.5$.

You would increase the REF temperature by 12 or 13°F. The default setting in the R2107 is 167°F REF temperature.

OFFSET – the OFFSET setting is used to raise the starting water temperature of the system. Another way to say this is, raising the OFFSET setting will give you higher water temperature at milder outdoor temperatures. Common applications for adjusting the OFFSET setting include, hydro-air, fan coils, unit heaters, etc. These types of heating units typically require some amount of minimum water temperature. Occasionally, you may have a call for insufficient heat but only in milder weather. Even with fin-tube radiation, cast-iron radiators or panel radiators. With this type of a call, you will want to increase the OFFSET setting.

USE THE QUICK REFERENCE GUIDE FOR INITIAL PROGRAMMING

6.3 "NO DHW" Call



A "DHW PROD ERR" message will appear on the LCD screen of the R2107 control with regard to domestic hot water production.

DHW ERR - when the tank temperature drops to the low limit (7°F below the set point), the R2107 goes into DHW priority mode.

The R2107 will learn through its own adaptive software intelligence the required temperature needed in the boiler to satisfy a call for domestic hot water. During DHW priority, it interrupts power to the space heating circuit {terminals 61 & 63} before the tank setpoint is reached and energizes the DHW pump circuit {terminals 24 (N) & 25 (H)} to purge the generated heat in the boiler into the indirect tank. The pump circuit symbol is displayed on the LCD screen during DHW operation.

The purpose of the R2107 intelligence is such that it is designed to operate the burner for the least amount of time to satisfy DHW and return the boiler back to its required heating temperature level.

In DHW priority, if the R2107 does not sense a rise in DHW temperature in 30 minutes, it will display a DHW PROD ERR message. The DHW PROD ERR will also be displayed if the tank is not satisfied within 2 hours.

At this point, the control will go back to space heating mode and lock out the DHW to avoid freezing the building. This message is general in nature and the R2107 control is essentially telling you, "I tried to make domestic hot water but nothing happened".

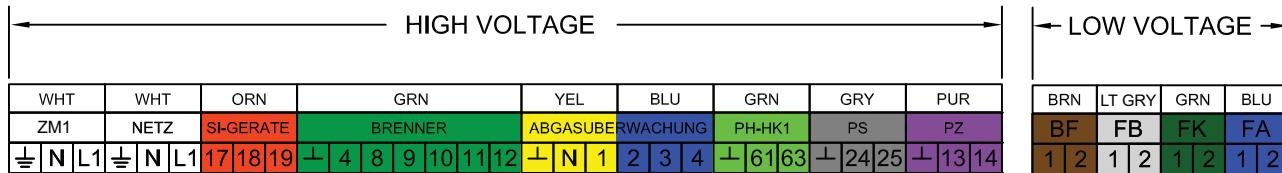
IN MOST CASES THE PROBLEM IS NOT WITH THE R2107 CONTROL. To rule out the R2107, turn power off to the R2107 to reset.

The R2107 will again try to make DHW. Check terminals 24 & 25 for 120V. If power is present and boiler fires the R2107 is o.k.

Check the following:

- 1 - bad circulator
- 2 - stuck flow check
- 3 - piping is air bound
- 4 - closed valve

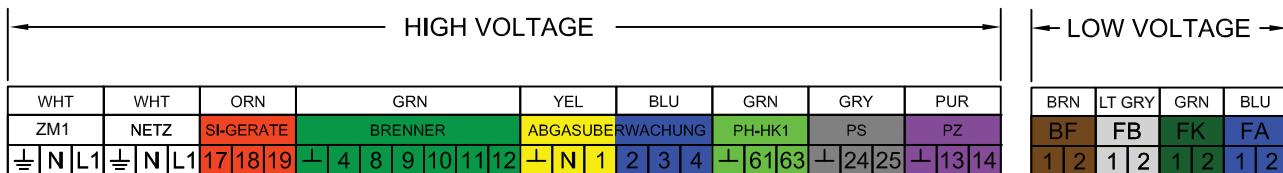
7 Description of wiring terminals



Line Voltage (120V) Connections:

White (ZM 1)	Constant 120V power: Used to supply line voltage power when using optional module FM241. The wiring harness on the FM241 module plugs into this block.
White (Netz)	Power input: Connect 120V power source to L and N using 10 amp in-line fuse provided.
Orange (SI)	Safety connections: Terminals 17 and 18: There is a factory-installed jumper between terminals 17 and 18. This jumper must stay in place unless a dry contact Low Water Cutoff, CO-detector or similar safety device is used. When using such a safety device, remove the jumper and connect the normally closed contacts to terminals 17 and 18. On 24V devices connect the dry contacts to 17 and 18. NOTE: cutting this circuit will disrupt power to the burner, but keep the control and heating system powered. Terminal 19: When the manual reset high-limit trips, terminal 19 puts out 120V for alarm signal (alarm provided by others).
Green (Brenner)	Burner connection: Terminal 4: Common neutral Terminal 8: Requires 120V input to operate the hours run meter Terminal 9: Requires 120V input to display burner error Terminal 10 and 11: Dry contact closure for burner firing Terminal 12: Constant 120V voltage. Power from manual reset high limit (See section 9 of this manual for application wiring diagrams for burner circuit)
Yellow/Blue (UE)	Flue gas testing: Used on GB125. Do not remove factory installed jumper between terminals 2 and 3.
Green (HK- I)	Space heating circuit # 1 : 120V power output on terminals 61 and 63 for space heating pump(s). Not to exceed 5 amp draw. If multiple space-heating pumps are used, refer to specific application wiring diagrams provided in this manual (section 8).
Grey (PS)	Domestic water circulator: 120V power output on terminals 24 and 25 for DHW production.
Purple (PZ)	Domestic water recirculation pump: 120V power output on terminals 13 and 14 for DHW recirculation.

Note: Power to terminals 61 and 63 are interrupted when the system is in domestic water production. Therefore, there will never be power on terminals 24/25 and 61/63 at the same time, while operating in automatic mode



Sensor Connections (Low Voltage):

Brown (BF)

BFU room sensor-circuit #1:

Connect BFU room sensor (circuit #1) using 18-2 AWG wire. Connections are polarity sensitive, terminal 1 must be wired to terminal 1 on room sensor, etc. Wiring can be run up to 500' from control.

Light Gray (FB)

Domestic tank sensor

The FB tank sensor and terminal plug are supplied with the control. For SU and ST series tanks the FB sensor is inserted into the immersion well in the tank. For L and LT series the sensor is surface mounted on the front of the tank using the bracket provided on the tank. Sensor wire can be extended if necessary, using 18 AWG wire.

Green (FK)

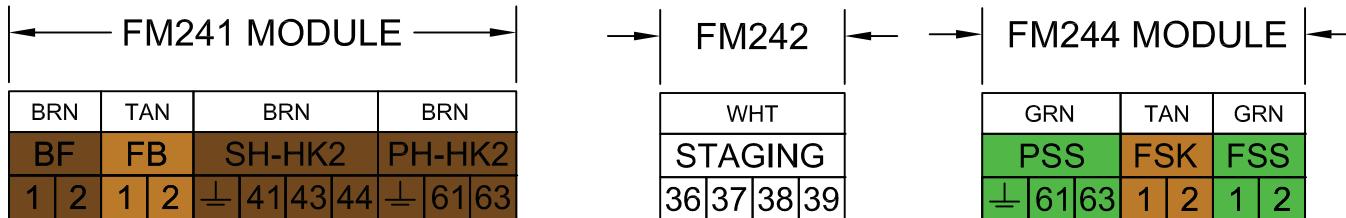
Boiler sensor:

The FK sensor comes pre-wired to the terminal block and bundled together with two capillaries. This sensor bundle is inserted into the chrome well provided. (refer to control Service Manual for well location for specific boiler model)

Blue (FA)

Outdoor sensor:

The outdoor sensor is a thermistor-type sensor protected by a UV resistant enclosure. The outdoor sensor should be installed on the North/Northeast side of the building, out of direct sunlight. Mount the sensor at a height where it cannot be tampered with or affected by snow accumulation. Run 18-2 AWG wire to the outdoor sensor up to 300' in length. Avoid running wire parallel to telephone or line voltage wires.



Optional modules:

FM241 Mixing module

Brown (SH/PH-HK2)

Mixing and Space heating circuit #2:

- Terminal 41 Power input for mixing motor
- Terminal 43 "OPEN" output to mixing motor
- Terminal 44 "CLOSE" output to mixing motor
- Terminals 61/63 Power output for circuit #2 pump(s) (2 amp max)
(refer to section 7 of this manual for detailed wiring information for FM241)

Brown (BF)

BFU room sensor-circuit #2

Connect BFU room sensor (circuit #2) using 18-2 AWG wire. Connections are polarity sensitive, terminal 1 must be wired to terminal 1 on room sensor, etc. Wiring can be run up to 500' from control.

Light Brown (FB)

Mixed circuit sensor:

The FB sensor and terminal plug are supplied with the FM241 module. The FB sensor is strapped onto circuit #2 piping, for sensing of the mixed water temperature mount to piping using the spiral spring and clip provided and cover with pipe insulation. The sensor leads can be extended if necessary, using 18-2 AWG wire.

Wiring Harness

Power Supply:

Connect the wiring harness attached to the FM241 module (brown, blue, and yellow/green wires) to wiring block ZM 1 on the control.

FM242 Staging Module

White

- Terminal 36 Not used.
- Terminal 37/39 Dry contact closure for firing of stage 2.
- Terminal 38 Output signal for modulating burners only.
(refer to section 9 of this manual for detailed wiring information for FM242)

FM244 Solar Card

PSS

Solar pump GND
 61 N
 63 L

FSK

Terminal 1/2 Collector sensor

FSS

Terminal 1/2 Tank bottom sensor

8 Application drawings

Description (page#)

Single temperature systems

- 8.1 Single Zone Space Heating with panel radiators (constant circulation)/Indirect DHW Heating ([page 22](#))
- 8.2 Single Zone Space Heating/Indirect DHW Heating ([page 24](#))
- 8.3 2-Zone Space Heating with BFU and 1 thermostat (with constant circulation zone)/Indirect DHW Heating ([page 26](#))
- 8.4 Multi-Zone Space Heating/Indirect DHW Heating ([page 28](#))
- 8.5 Multi-Zone Space Heating using Zone Valves (with constant circulation zone/Indirect DHW Heating ([page 30](#))
- 8.6 Multi-Zone Space Heating using Zone Valves/Indirect DHW Heating ([page 32](#))

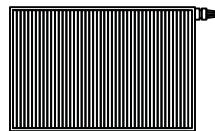
Multi-Temperature Systems

- 8.7 Multi-Zone High Temp Space/Radiant Floor Heating with FM241 module & Motorized Mixing Valve/Indirect DHW Heating ([page 34](#))
- 8.8 Multi-Zone Radiant Floor Heating with FM241 module and Motorized Mixing Valve/Indirect DHW Heating ([page 38](#))
- 8.9 Parallel Boiler Piping with FM242 Module / Indirect DHW Heating ([page 42](#))
- 8.10 Dual Boiler / Primary/Secondary Piping with FM242 Module / Indirect DHW Heating ([page 45](#))
- 8.11 Multi-Zone Space Heating/On-demand High Temp Heating/ Indirect DHW Heating ([page 48](#))

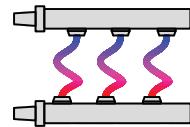
Boiler/Burner Wiring

In order to simplify electrical application drawings, boiler/burner wiring has been omitted from this section. Detailed wiring schematics for oil burners, G124X, G234X and G334X gas boilers are located in section 9.

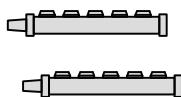
Mechanical/Electrical Symbols



PANEL
RADIATOR



LOW TEMP
RADIANT



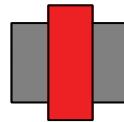
SUPPLY / RETURN
MANIFOLDS



HIGH TEMP
BASEBOARD



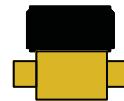
FAST FILL/
PRESSURE
REDUCING VALVE



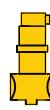
24VAC
TRANSFORMER



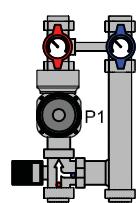
DRAIN VALVE



ZONE VALVE



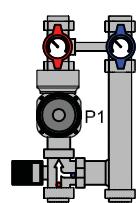
AIR SCOOP



BUDERUS
MIXING STATION
W/ THERMOSTATIC
3-WAY VALVE



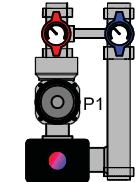
BACK FLOW
PREVENTER



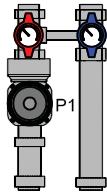
BUDERUS
MIXING STATION
W/ MOTORIZED
3-WAY VALVE



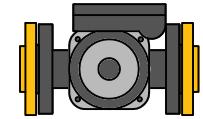
EXPANSION
TANK



GRUNDFOS
3 SPEED PUMP
WITH IFC



BUDERUS
PUMPING
STATION



120 VAC TO 24VAC
ISOLATION RELAY



HEAT
EXCHANGER

8.1 Single Zone Space Heating With Panel Radiators (Constant Circulation)/Indirect DHW Heating

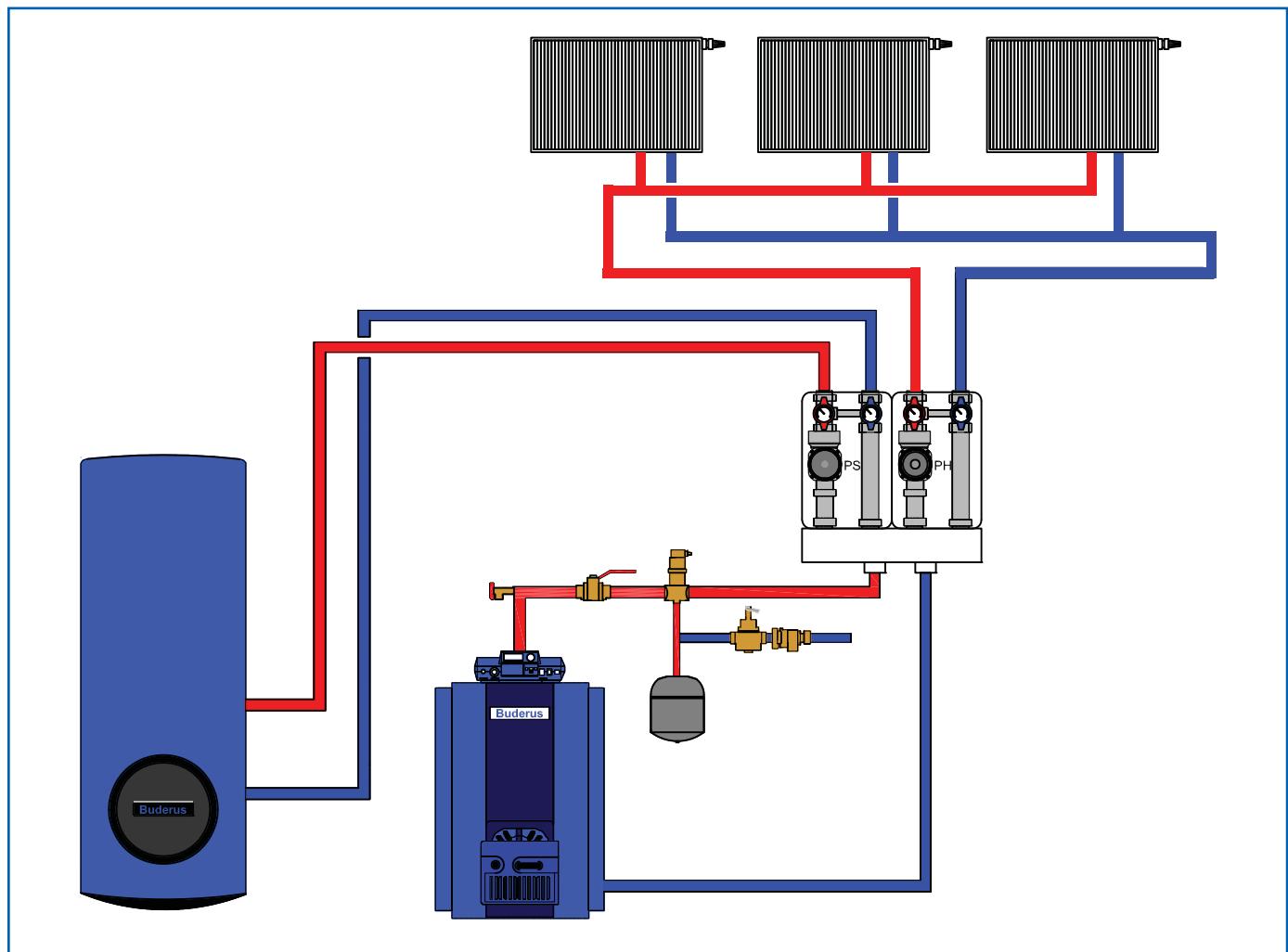


Figure 2 8.1 Mechanical diagram

Space Heating Operation:

- Boiler temperature is maintained based on the selected heating curve and inputs from both the outdoor sensor and indoor room sensor.
- During setback periods, the boiler temperature will be reduced based on the night setback setting on the room sensor.
- The space heating pump (PH) runs continuously with the following exceptions:
 - 1) DHW priority
 - 2) Condensate protection
 - 3) Outdoor temperature exceeds WWSD setpoint
 - 4) Initial part of setback period
- This application requires a room sensor for constant circulation.

DHW Heating Operation:

- The boiler temperature rises on a call for DHW for fast recovery.
- The control powers the domestic pump (PS) and the heating circuit (PH) is shut down.
- After the DHW recharging and intelligent purge cycle is completed, the PS pump will be shut down and PH circuit will be turned on.

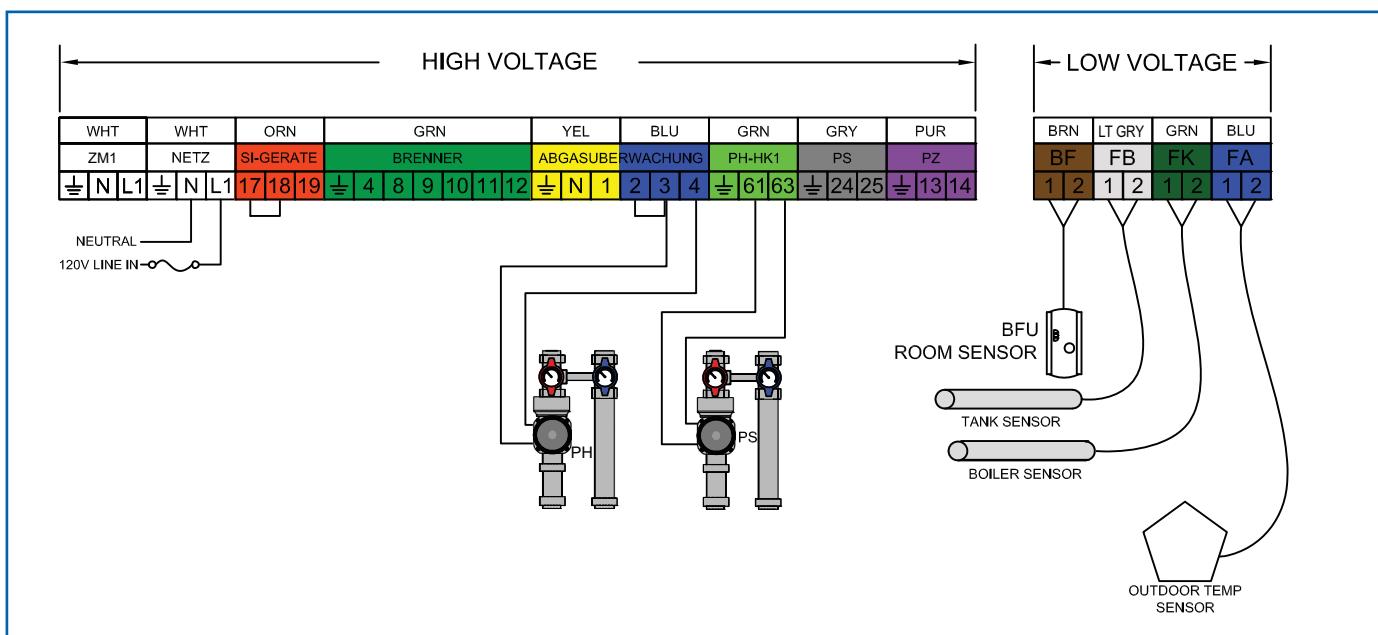


Figure 3 8.1 Electrical diagram

8.2 Single Zone Space Heating/Indirect DHW Heating

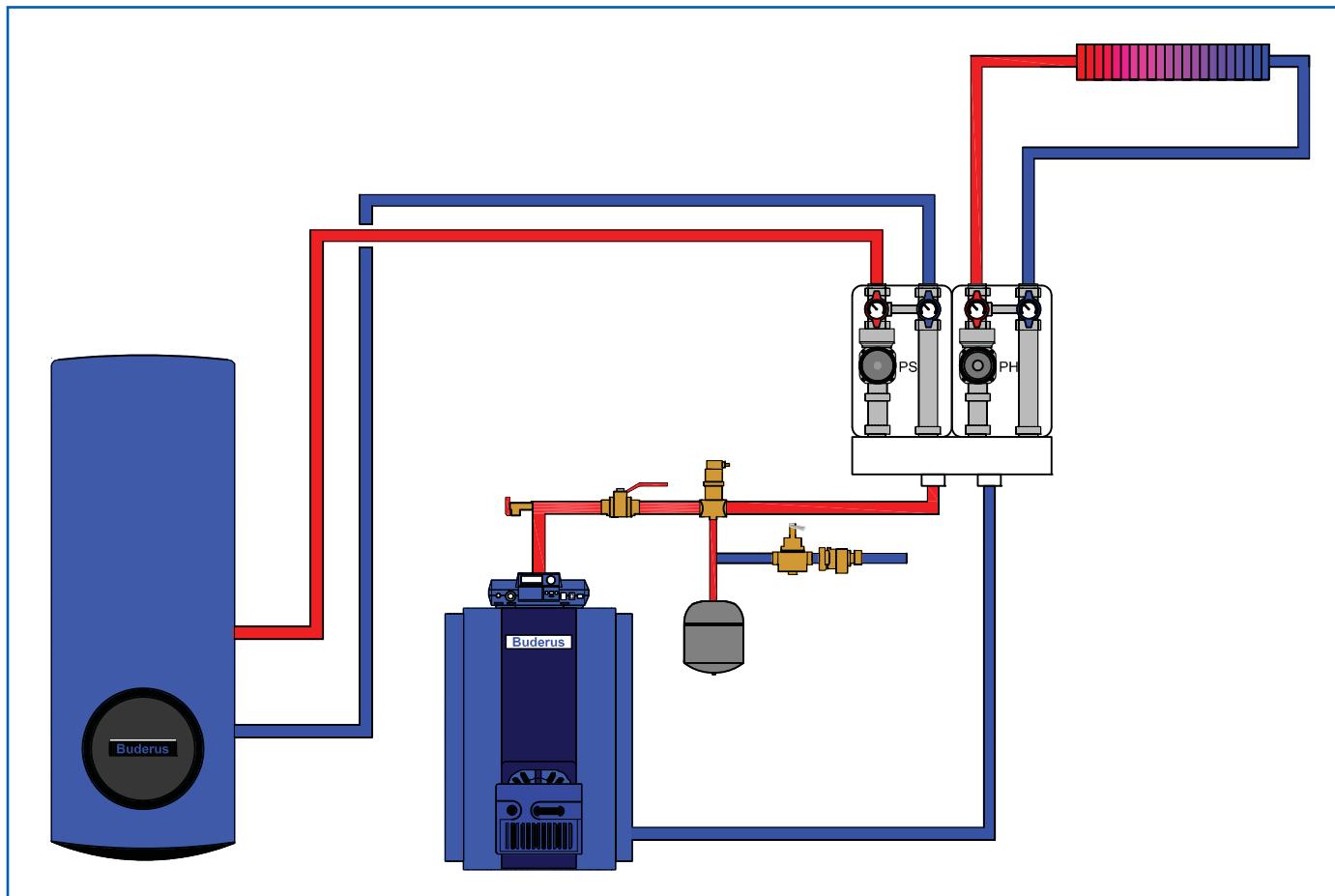


Figure 4 8.2 Mechanical diagram

Space Heating Operation:

- Boiler temperature is maintained based on the selected heating curve and input from the outdoor sensor.
- During setback periods, the boiler temperature will be reduced based on the DAY TEMP and NIGHT TEMP settings on the Logamatic control.
- The space-heating pump (PH) requires a switching relay to operate on a call for heat from a room thermostat.
- Power to the PH circuit is interrupted under the following conditions:
 - 1) DHW priority
 - 2) Condensate protection
 - 3) Outdoor temperature exceeds WWSD setpoint
- This application does not require a room sensor.

DHW Heating Operation:

- The boiler temperature rises on a call for DHW for fast recovery.
- The control powers the domestic pump (PS) and the heating circuit (PH) is shut down.
- After the DHW recharging and intelligent purge cycle is completed, the PS pump will be shut down and PH circuit will be turned on.

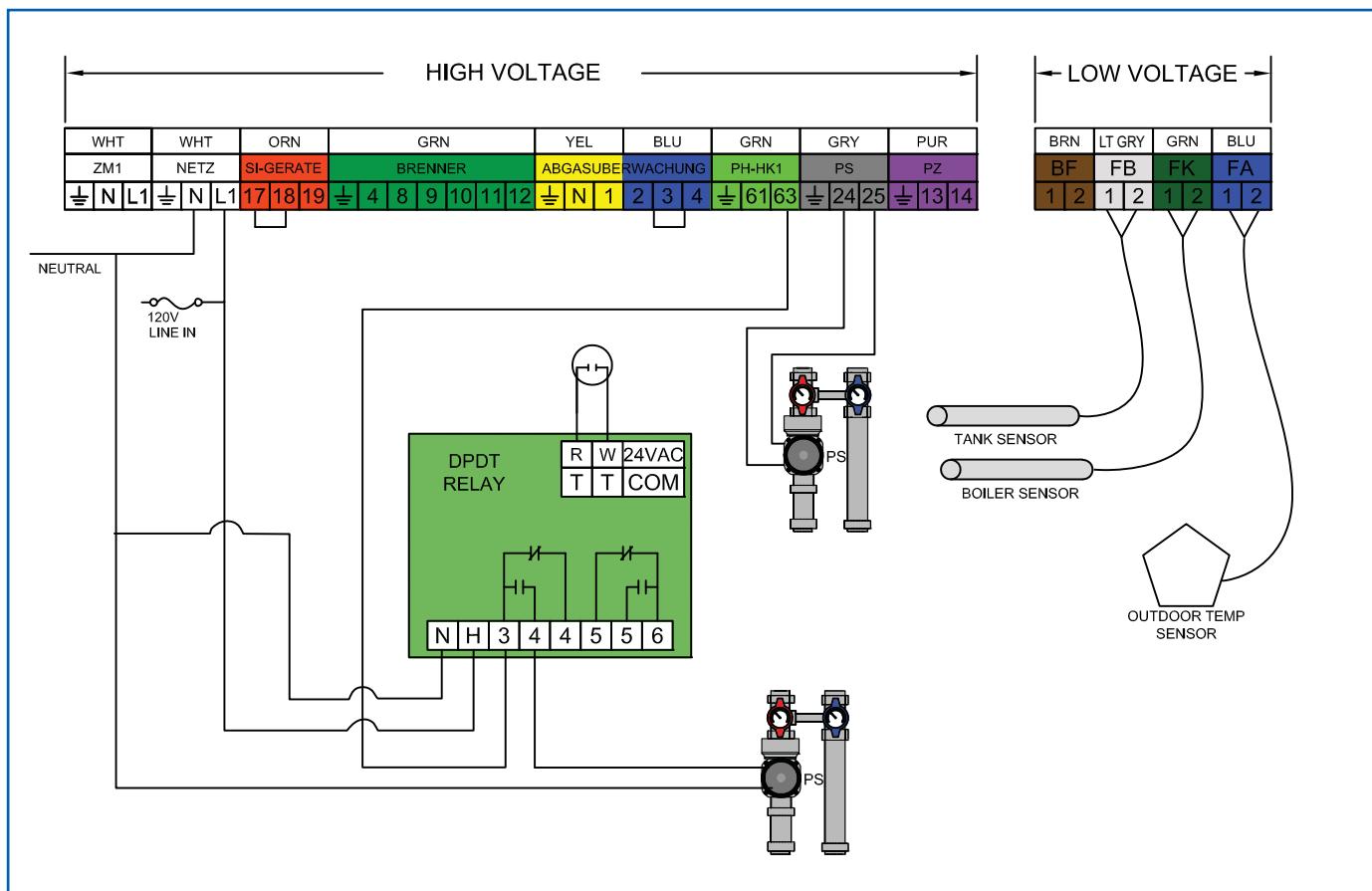


Figure 5 8.2 Electrical diagram

8.3 2-Zone Space Heating with BFU and 1 Thermostat (With Constant Circulation Zone)/Indirect DHW Heating

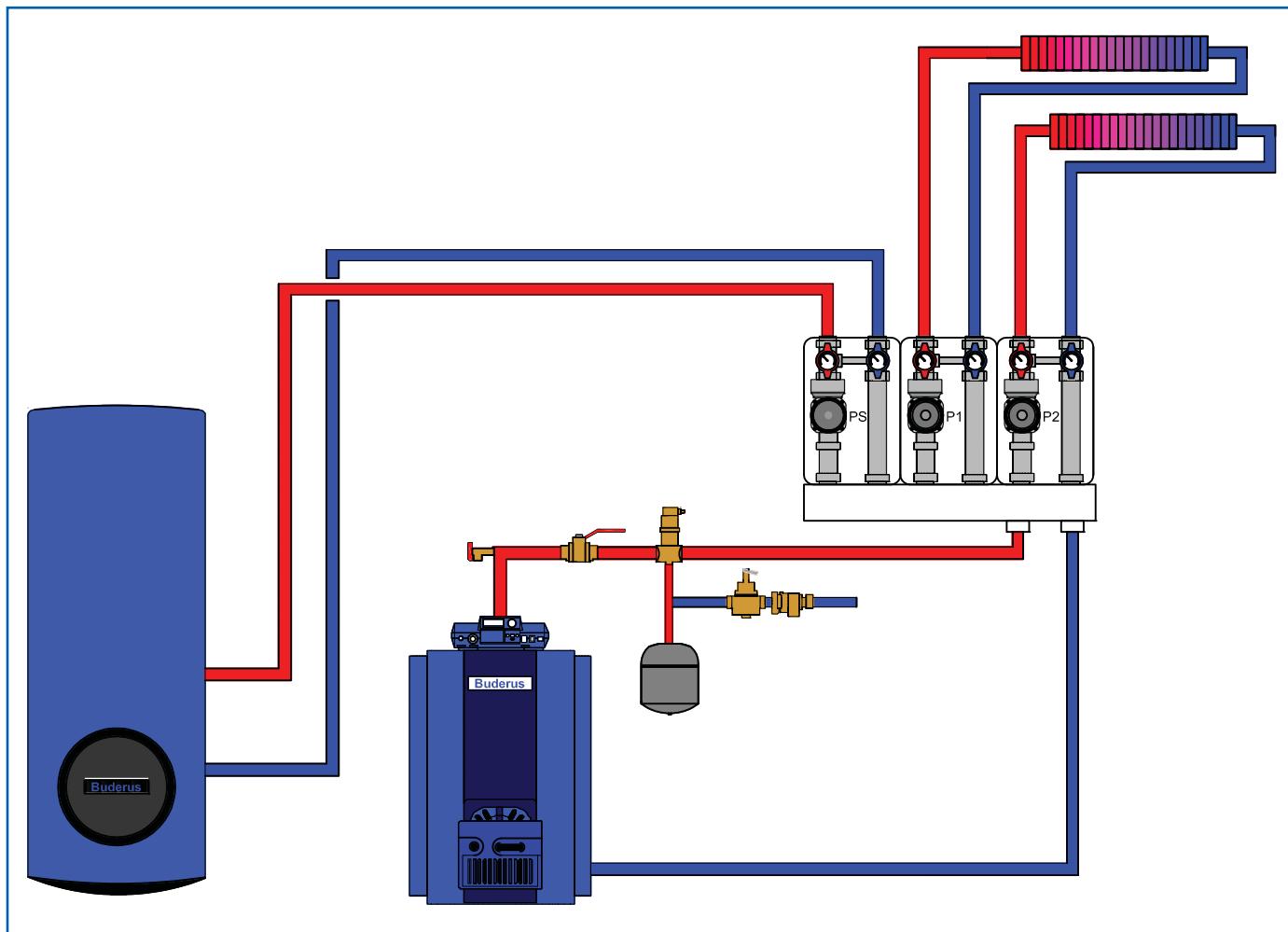


Figure 6 8.3 Mechanical diagram

Space Heating Operation:

- Boiler temperature is maintained based on the selected heating curve and inputs from both the outdoor sensor and indoor room sensor.
- During setback periods, the boiler temperature will be reduced based on the night setback setting on the room sensor.
- The constant circulation zone pump (P1) will be wired directly to the PH-HK1 circuit on the Logamatic control. Additional zone pumps require a multi-zone switching relay to operate on a call for heat from a room thermostat.
- Power to the PH-HK1 circuit is interrupted under the following conditions:

- 1) DHW priority
- 2) Condensate protection
- 3) Outdoor temperature exceeds WWSD setpoint
- 4) Initial part of setback period

- This application requires a room sensor for constant circulation.

DHW Heating Operation:

- The boiler temperature rises on a call for DHW for fast recovery.
- The control powers the domestic pump (PS) and the heating circuit (PH-HK1) is shut down.
- After the DHW recharging and intelligent purge cycle is completed, the PS pump will be shut down and PH-HK1 circuit will be turned on.

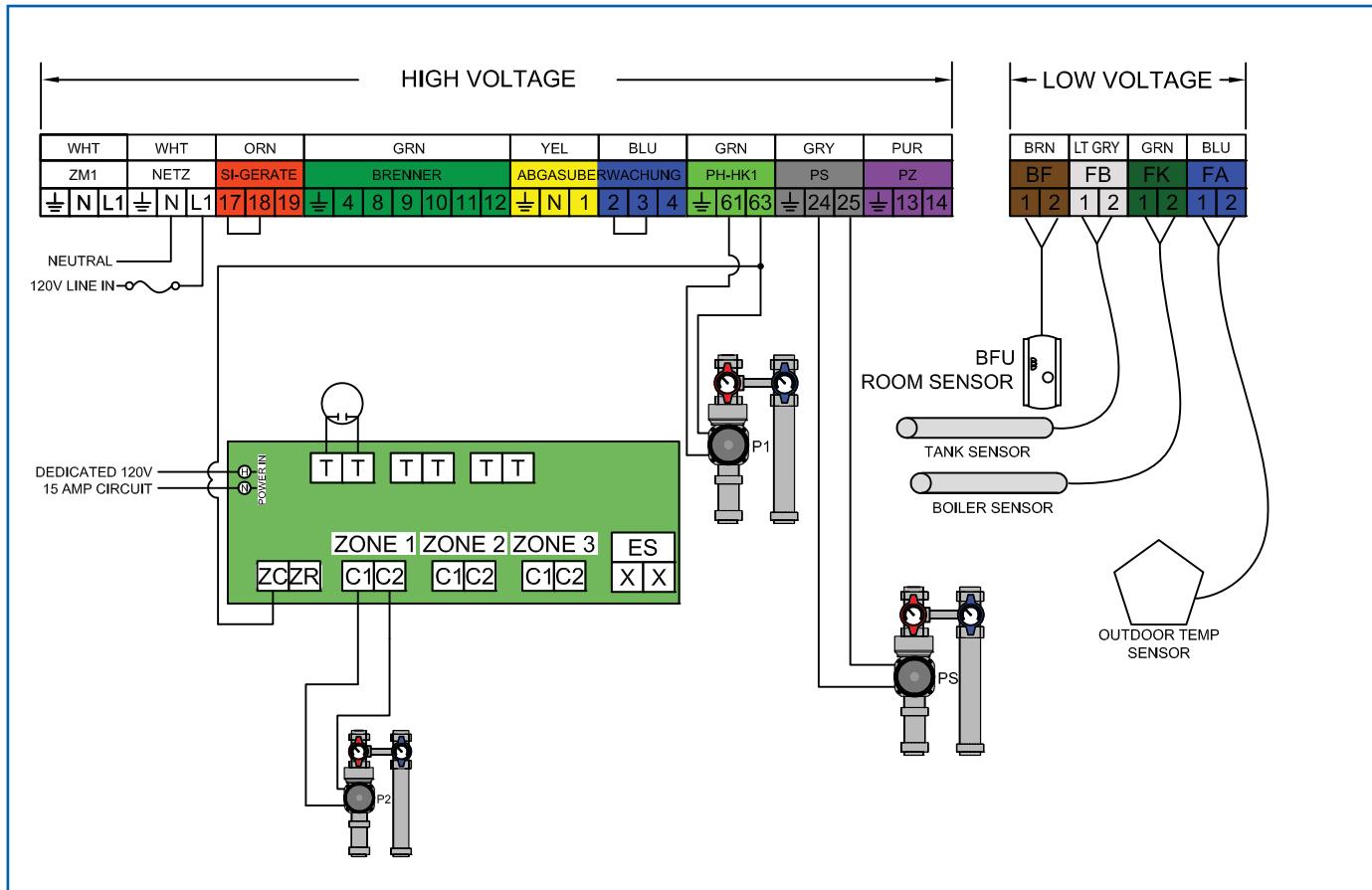


Figure 7 8.3 Electrical diagram

Space Heating Operation:

- Boiler temperature is maintained based on the selected heating curve (REF TEMP and OFFSET) and inputs from the outdoor sensor (FA), boiler sensor (FK) and room sensor (BF).
- This application requires a multi-zone pump relay (not supplied by Buderus). 120V output from terminal 63 (PH-HKI) will energize the relay. However, the PH-HK1 circuit is limited to a 5 amp maximum load. Therefore, multi-pump applications require an additional source of 120V power to the pump relay. Generally the #63 terminal is wired to the ZC terminal on the relay panel, however relay circuitry can vary. Refer to wiring diagrams provided in this manual for specific manufacturer and model of the relay being used. If the model being used is not listed, contact Buderus for assistance.
- The constant circulation pump (P1) shall run continuously (see following exceptions). All other zone pumps are energized on a call for heat from a room thermostat.
- Power to the pump relay and constant circulation pump shall be interrupted under the following conditions:

- 1) DHW priority
- 2) Condensate protection
- 3) Outdoor temperature exceeds WWSD setpoint
- 4) Initial part of setback period

- This application requires a room sensor for constant circulation.

- End switch (XI - X2) on multi-zone relay panel is not used.

DHW Heating Operation:

- The tank sensor (FB) monitors domestic water temperature.
- 120V output from terminals 24 & 25 (PS) powers the DHW pump.
- During a call for DHW production the domestic pump (PS) is turned on and the space-heating circuit (PH-HK1) is turned off.
- After the DHW recharging and intelligent purge cycle is completed, the PS pump will be shut down and PH-HK1 circuit will be turned on.

8.4 Multi - Zone Space Heating/Indirect DHW Heating

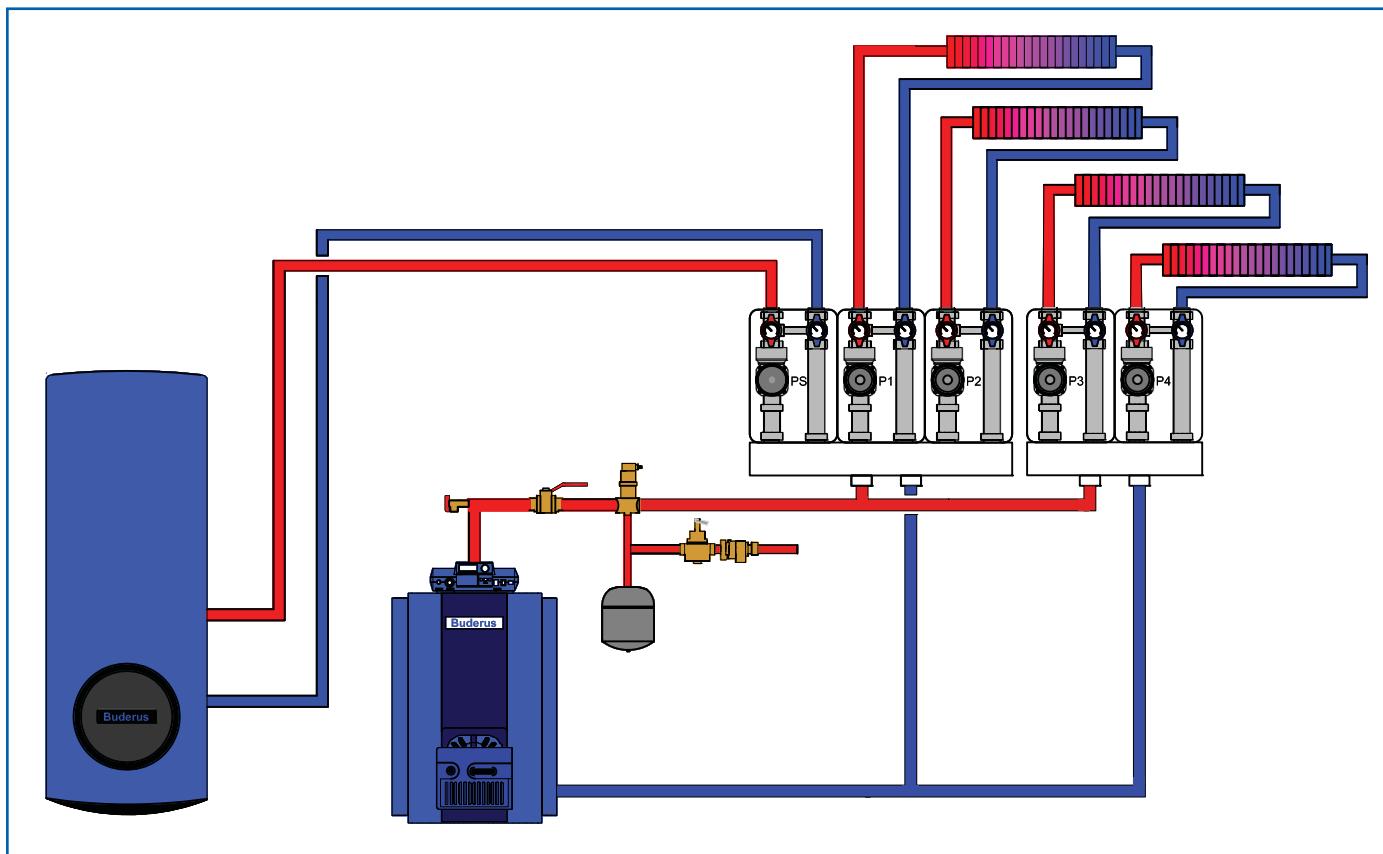


Figure 8 8.4 Mechanical diagram

Space Heating Operation:

- Boiler temperature is maintained based on the selected heating curve and input from the outdoor sensor.
- During setback periods, the boiler temperature will be reduced based on the DAY TEMP and NIGHTTEMP settings on the Logamatic control.
- Space heating pumps require a multi-zone switching relay to operate on a call for heat from a room thermostat.
- Power to the PH-HK1 circuit shall be interrupted under the following conditions:
 - 1) DHW priority
 - 2) Condensate protection
 - 3) Outdoor temperature exceeds WWSD setpoint
 - 4) This application does not require a room sensor.

DHW Heating Operation:

- The boiler temperature rises on a call for DHW for fast recovery.
- The control powers the domestic pump (PS) and the heating circuit (PH-HK1) is shut down .
- After the DHW recharging and intelligent purge cycle is completed, the PS pump will be shut down and PH-HK1 circuit will be turned on.

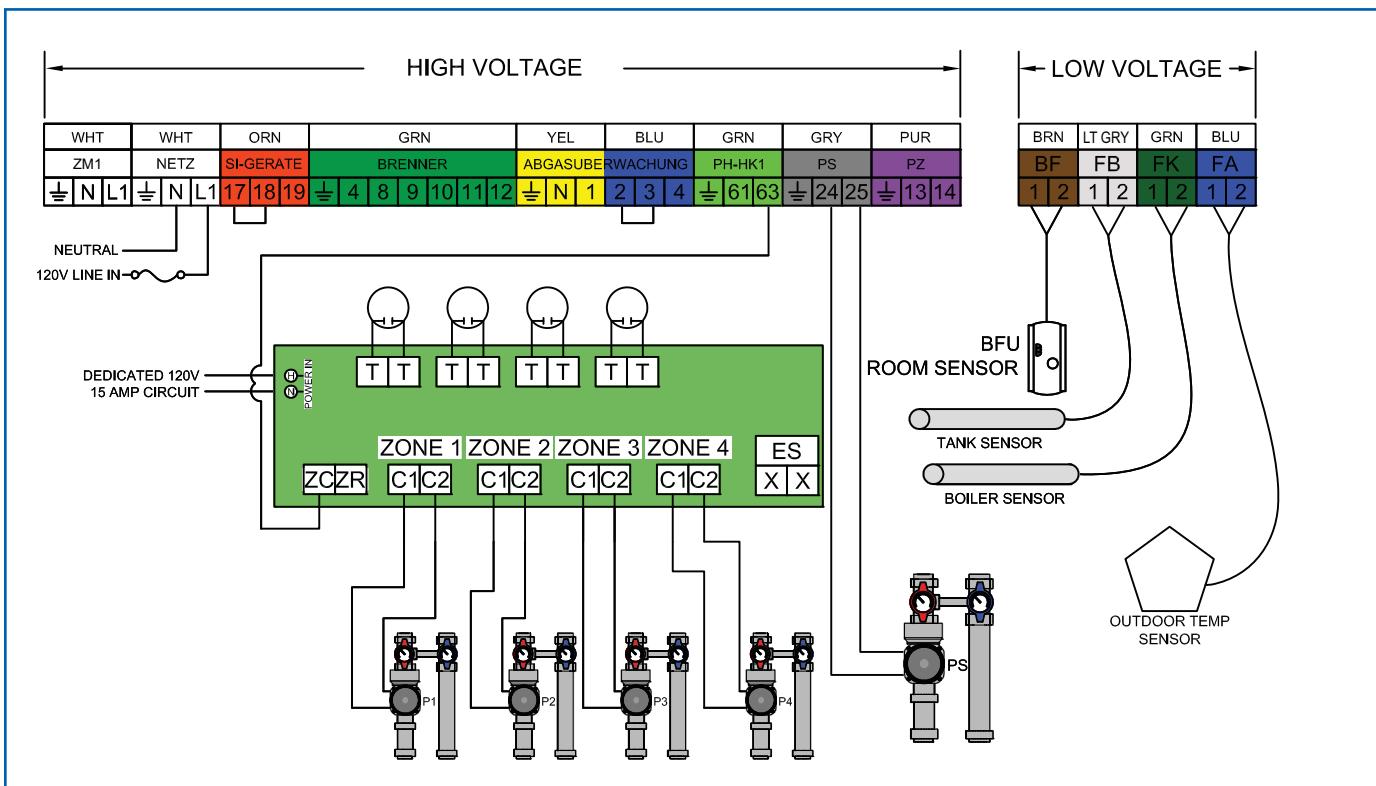


Figure 9 8.4 Electrical diagram

Space Heating Operation:

- Boiler temperature is maintained based on the selected heating curve (REF TEMP and OFFSET) and inputs from the outdoor sensor (FA) and boiler sensor (FK).
- This application requires a multi-zone pump relay (not supplied by Buderus).
- 120V output from terminal 63 (PH-HK1) will energize the relay. However, the PH-HK1 circuit is limited to a 5 amp maximum load. Therefore, multi-pump applications require an additional source of 120V power to the pump relay. Generally the #63 terminal is wired to the ZC terminal on the relay panel, however relay circuitry can vary. Refer to wiring diagrams provided in this manual for specific manufacturer and model of the relay being used. If the model being used is not listed, contact Buderus for assistance.
- Each zone pump is energized on a call for heat from its respective room thermostat. The end switch of the relay panel is not used.
- Power to the pump relay shall be interrupted under the following conditions:
 - DHW priority
 - Condensate protection
 - Outdoor temperature exceeds WWSD setpoint
- This application does not require a room sensor.

DHW Heating Operation:

- The tank sensor (FB) monitors domestic water temperature.
- 120V output from terminals 24 & 25 (PS) powers the DHW pump.
- During a call for DHW production the domestic pump (PS) is turned on and the space-heating circuit (PH-HK1) is turned off.
- After the DHW recharging and intelligent purge cycle is completed, the PS pump will be shut down and PH-HK1 circuit will be turned on.

8.5 Multi-Zone Space Heating Using Zone Valves (With Constant Circulation Zone) / Indirect DHW Heating

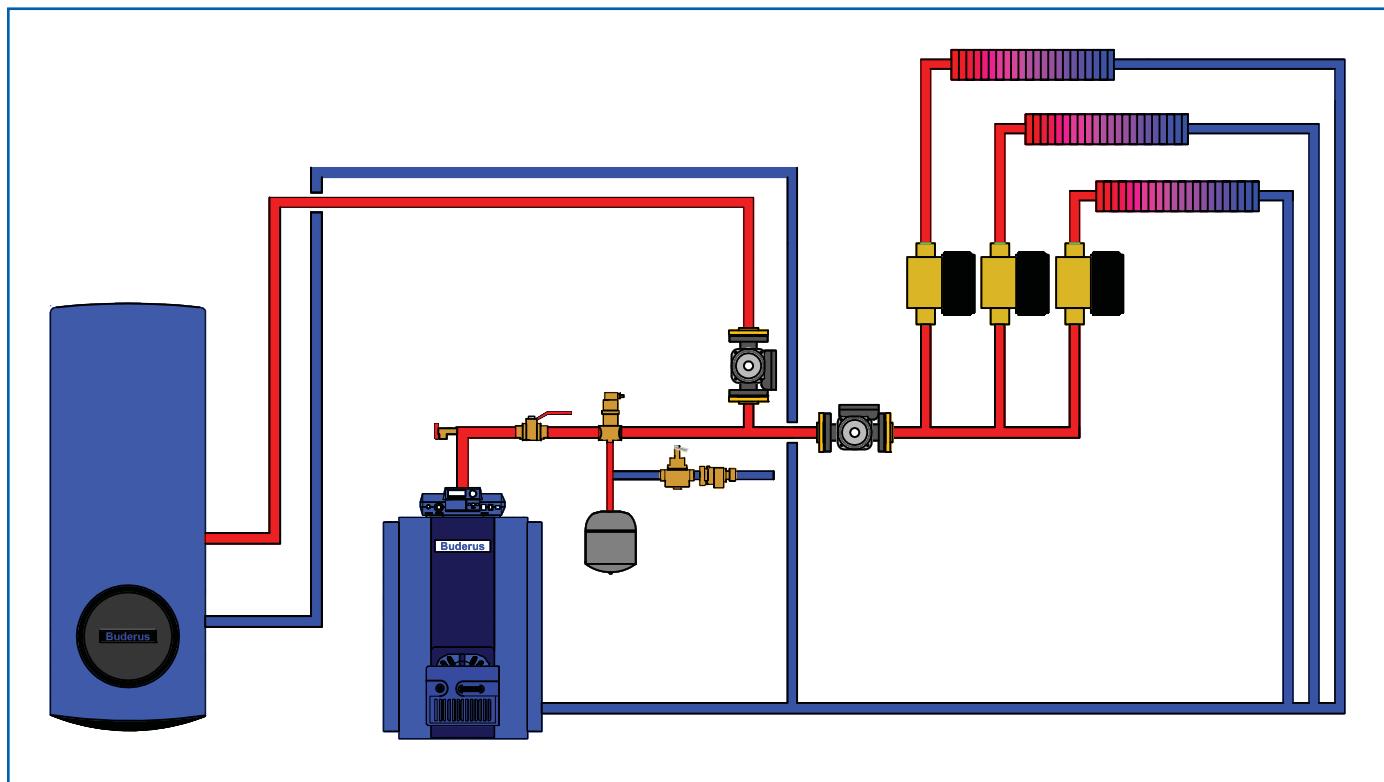


Figure 10 8.5 Mechanical diagram

Space Heating Operation:

- Boiler temperature is maintained based on the selected heating curve and inputs from the outdoor sensor and indoor room sensor.
- During setback periods, the boiler temperature will be reduced based on the night setback setting on the BFU room sensor.
- Constant circulation zone (Z1): Zone valve will be powered open when the PH-HK1 circuit is on.
- Additional zone valves will open on a call for heat from their respective room thermostats.
- The PH-HK1 circuit and space heating pump (PH) shall have continuous power with following exceptions:
 - 1) DHW priority
 - 2) Condensate protection
 - 3) Outdoor temperature exceeds WWSD setpoint
 - 4) Initial part of setback period
- This application requires a BFU room sensor.

DHW Heating Operation:

- The boiler temperature rises on a call for DHW for fast recovery.
- The control powers the domestic pump (PS) and the heating circuit (PH-HK1) is shut down.
- After the DHW recharging and intelligent purge cycle is completed, the PS pump will be shut down and PH-HK1 circuit will be turned on.

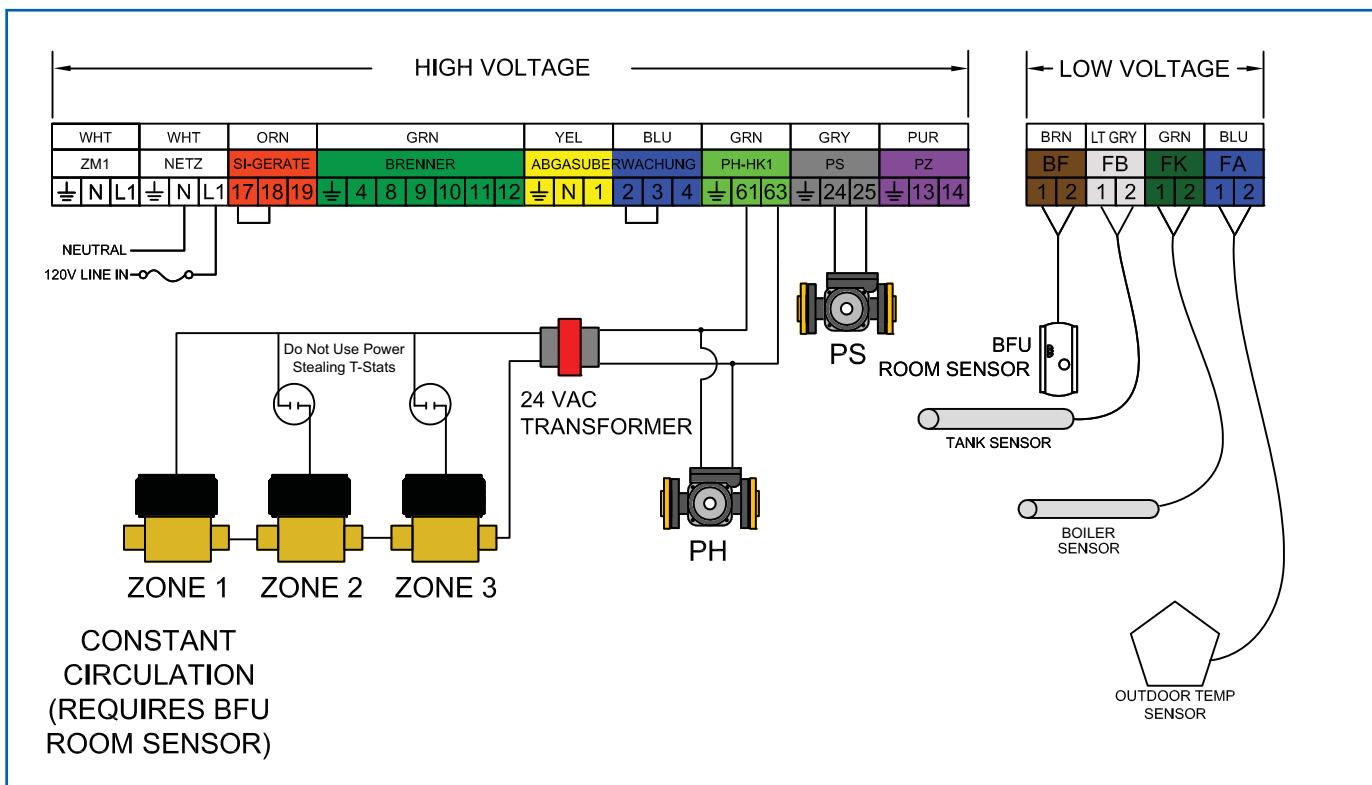


Figure 11 8.5 Electrical diagram

Space Heating Operation:

- Boiler temperature is maintained based on the selected heating curve (REF TEMP and OFFSET) and inputs from the outdoor sensor (FA), boiler sensor (FK) and room sensor (BFU).
- This application requires a 24V transformer to power zone valves (not supplied by Buderus). Transformer must be sized per manufacturer's instructions.
- 120V output from terminal 61 & 63 (PH-HK1) will provide power to both the space heating pump (PH) and the 24V transformer.
- The constant circulation zone valve (Z 1) will be powered directly from the transformer.
- Additional zone valves open on a call for heat from their respective thermostats. Zone valve end switches are not used.
- The PH-HK1 circuit and space heating pump (PH) shall have continuous power with the following exceptions:
 - DHW priority
 - Condensate protection
 - Outdoor temperature exceeds WWSD setpoint
 - Initial part of setback period
- This application requires a room sensor for constant circulation.

DHW Heating Operation:

- The tank sensor (FB) monitors domestic water temperature.
- 120V output from terminals 24 & 25 (PS) powers the DHW pump.
- During a call for DHW production the domestic pump (PS) is turned on and the space-heating circuit (PH-HK1) is turned off.
- After the DHW recharging and intelligent purge cycle is completed, the PS pump will be shut down and PH-HK1 circuit will be turned on.

8.6 Multi-Zone Space Heating Using Zone Valves/Indirect DHW Heating

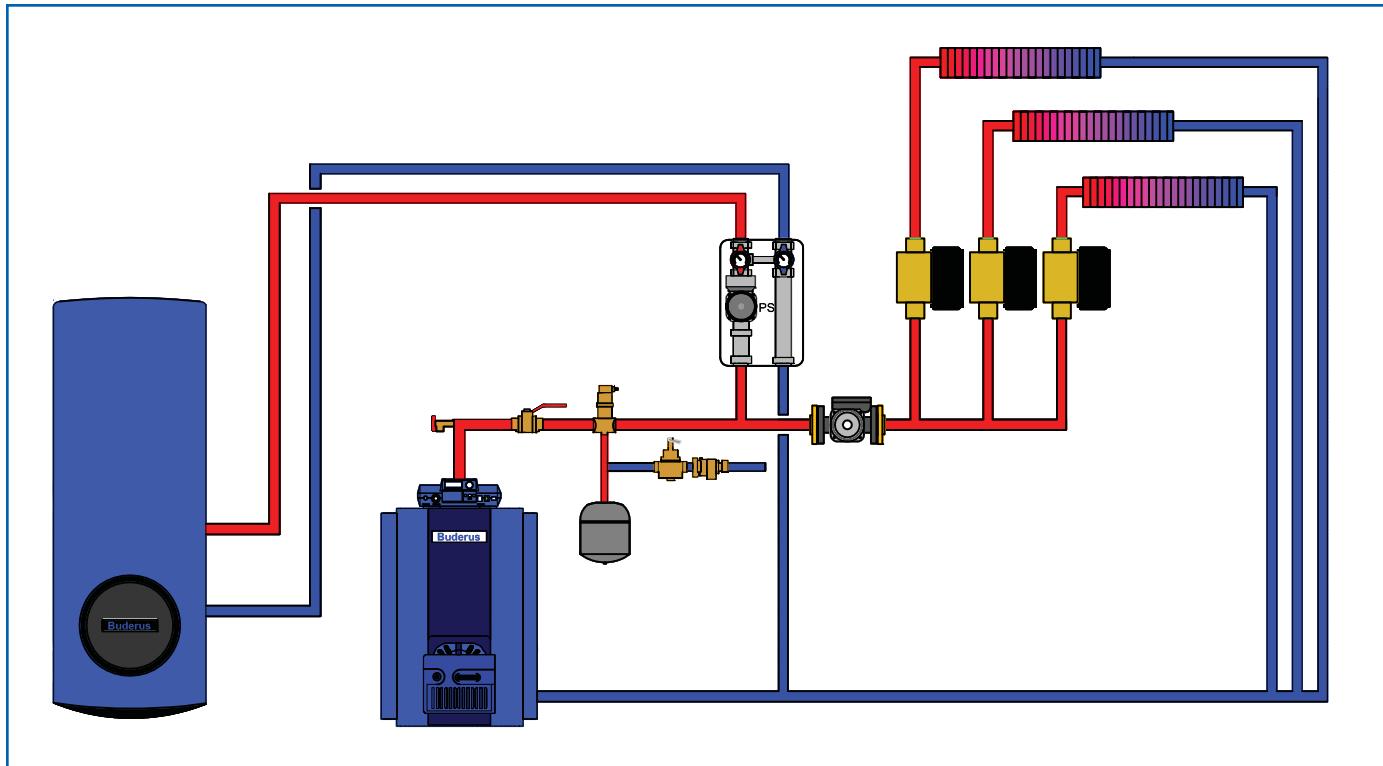


Figure 12 8.6 Mechanical diagram

Space Heating Operation:

- Boiler temperature is maintained based on the selected heating curve and input from the outdoor sensor.
- During setback periods, the boiler temperature will be reduced based on the DAY TEMP and NIGHT TEMP settings on the Logamatic control.
- All zones require a call for heat from their respective room thermostats to open zone valve and operate space-heating pump (PH).
- All zone valves will close when the PH-HK1 circuit is turned off.
- The PH-HK1 circuit shall have continuous power with the following exceptions:
 - 1) DHW priority
 - 2) Condensate protection
 - 3) Outdoor temperature exceeds WWSD setpoint
- This application does not require a BFU room sensor.

DHW Heating Operation:

- The boiler temperature rises on a call for DHW for fast recovery.
- The control powers the domestic pump (PS) and the heating circuit (PH-HK1) is shut down.
- After the DHW recharging and intelligent purge cycle is completed, the PS pump will be shut down and PH-HK1 circuit will be turned on.

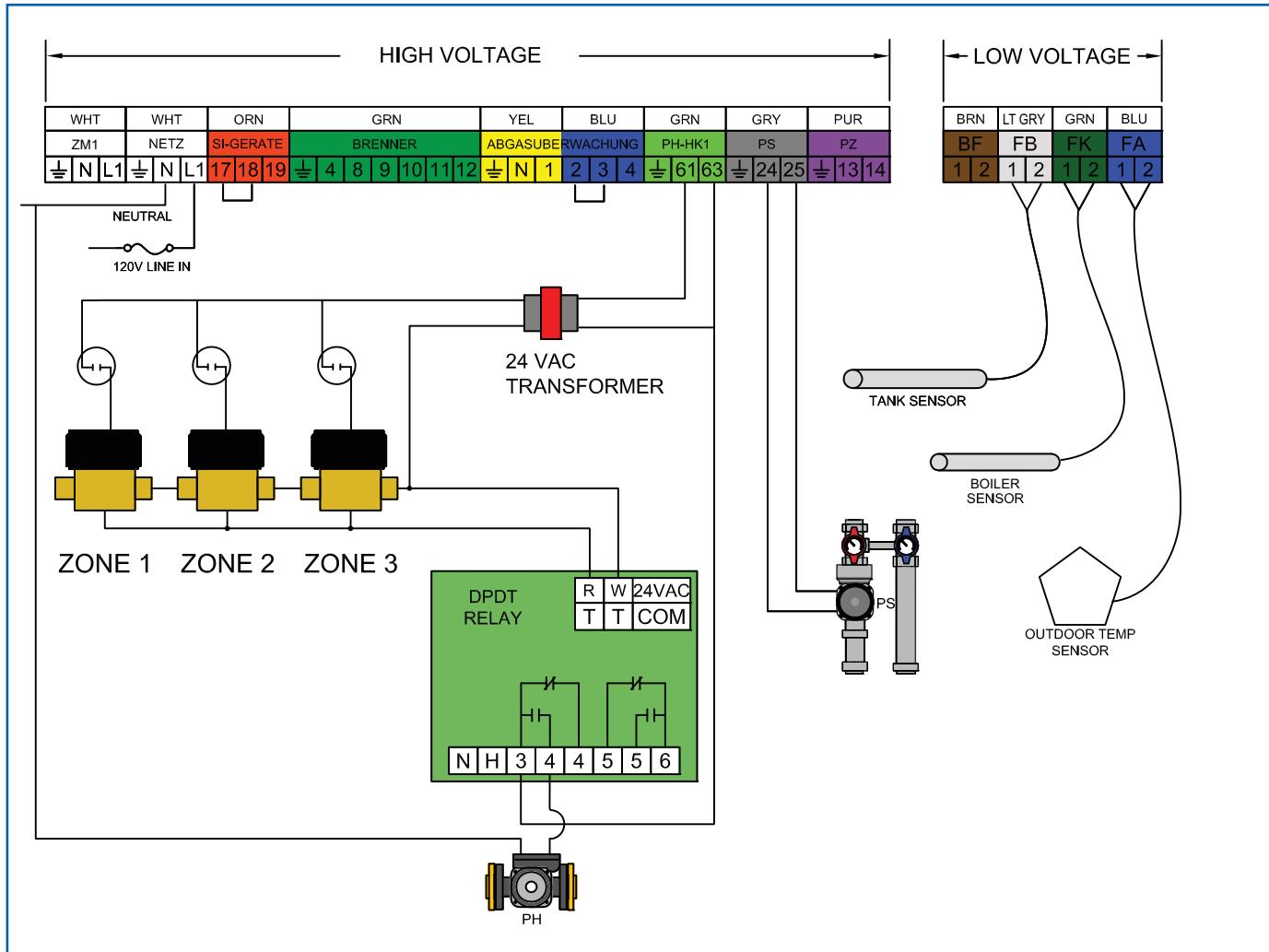


Figure 13 8.6 Electrical diagram

Space Heating Operation:

- Boiler temperature is maintained based on the selected heating curve (REF TEMP and OFFSET) and inputs from the outdoor sensor (FA) and boiler sensor (FK).
- This application requires a 24V transformer to power zone valves (not supplied by Buderus). Transformer must be sized per manufacturers instructions.
- This application requires a pump-switching relay (not supplied by Buderus).
- 120V output from terminal 61 & 63 (PH-HK1) will provide power to both the space heating pump relay and the 24V transformer.
- Zone valves will open on a call for heat from their respective room thermostats. Zone valve end switches will pull in pump relay to operate space-heating pump (PH).

- The PH-HK1 circuit shall have continuous power with the following exceptions:

- 1) DHW priority
- 2) Condensate protection
- 3) Outdoor temperature exceeds WWSD setpoint

- This application does not require a room sensor.

DHW Heating Operation:

- The tank sensor (FB) monitors domestic water temperature. 120V output from terminals 24 & 25 (PS) powers the DHW pump.
- During a call for DHW production the domestic pump (PS) is turned on and the space-heating circuit (PH-HK1) is turned off.
- After the DHW recharging and intelligent purge cycle is completed, the PS pump will be shut down and PH-HK1 circuit will be turned on.

8.7 Multi-Zone High Temp Space/Radiant Floor Heating with FM241 Module & Motorized Mixing Valve/Indirect DHW Heating

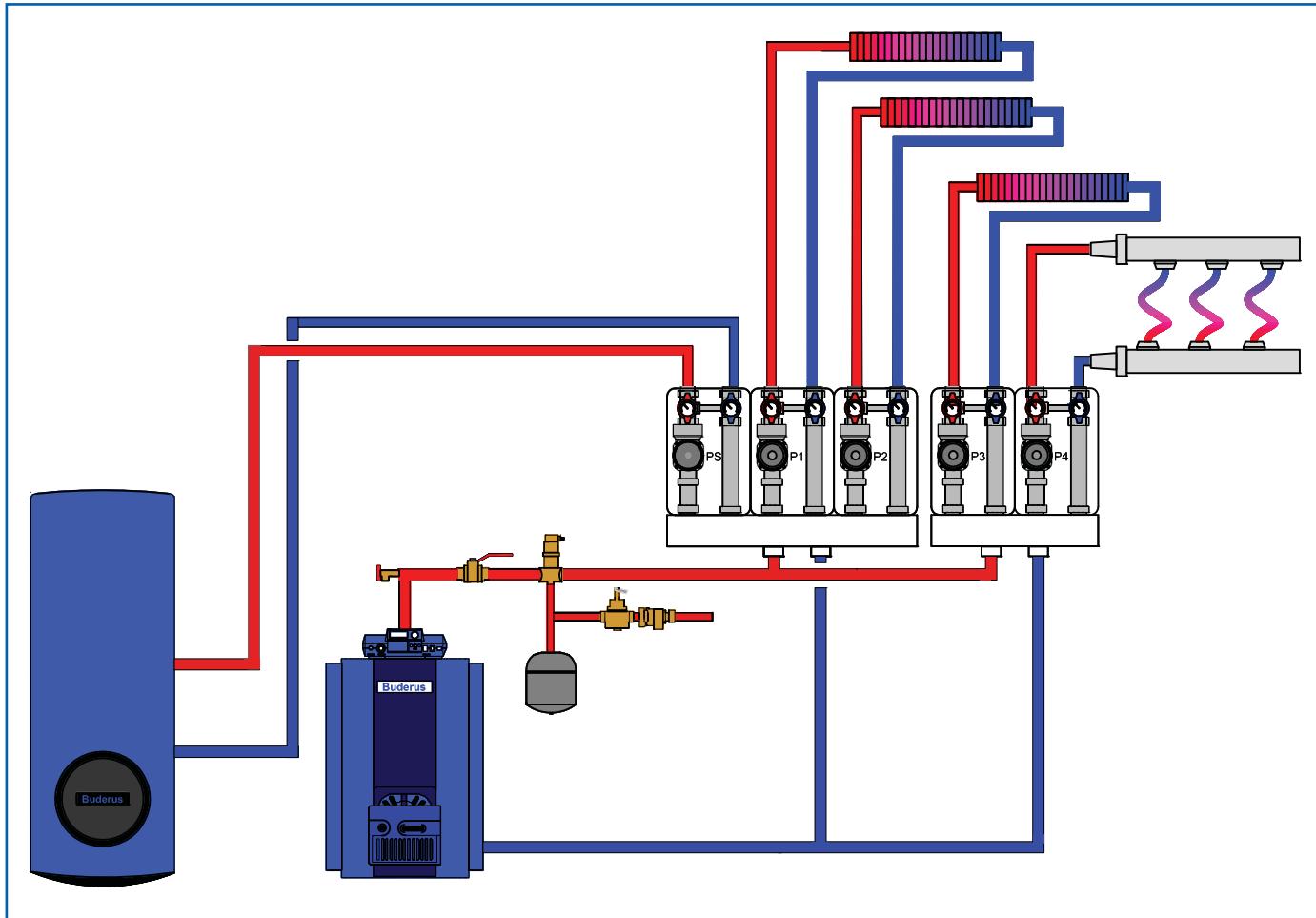


Figure 14 8.7 Mechanical diagram

Space Heating Operation:

HK1 circuit (high temperature)

- Boiler temperature is maintained based on the selected heating curve and input from the outdoor sensor.
- During setback periods, the boiler temperature will be reduced based on the DAY TEMP and NIGHT TEMP settings on the Logamatic control.
- Space heating pumps require a multi-zone switching relay to operate on a call for heat from a room thermostat.
- The PH-HK1 circuit shall be wired to the multi-zone pump relay to interrupt power to the space heating pumps under the following conditions:
 - 1) DHW priority
 - 2) Condensate protection
 - 3) Outdoor temperature exceeds WWSD setpoint

- This application does not require a room sensor for high temperature space heating.

HK2 circuit (mixed temperature)

- Mixed water temperature is maintained based on the selected heating curve and input from the outdoor sensor (FA), supply sensor (FV) and room sensor.
- During setback periods, the boiler temperature will be reduced based on the night setback setting on the room sensor.
- Power to the PH-HK2 circuit is turned off under the following conditions:
 - 1) Initial part of night setback period
 - 2) Condensate protection
 - 3) Outdoor temperature exceeds WWSD setpoint
- This application requires a room sensor for radiant floor heating.

DHW Heating Operation:

- The boiler temperature rises on call for DHW for fast recovery.
- The control powers the domestic pump (PS) and the heating circuit (PH-HK1) is shut down.
- The PH-HK2 pump will continue to operate during the DHW cycle. The mixing valve can be set to either continue normal operation or fully close to prioritize DHW production. (Refer to the Logamatic Service Manual for setting options)
- After the DHW recharging and intelligent purge cycle is completed, the PS pump will be shut down and PH-HK1 circuit will be turned on.

Note: 8.7 Electrical diagram on the following page

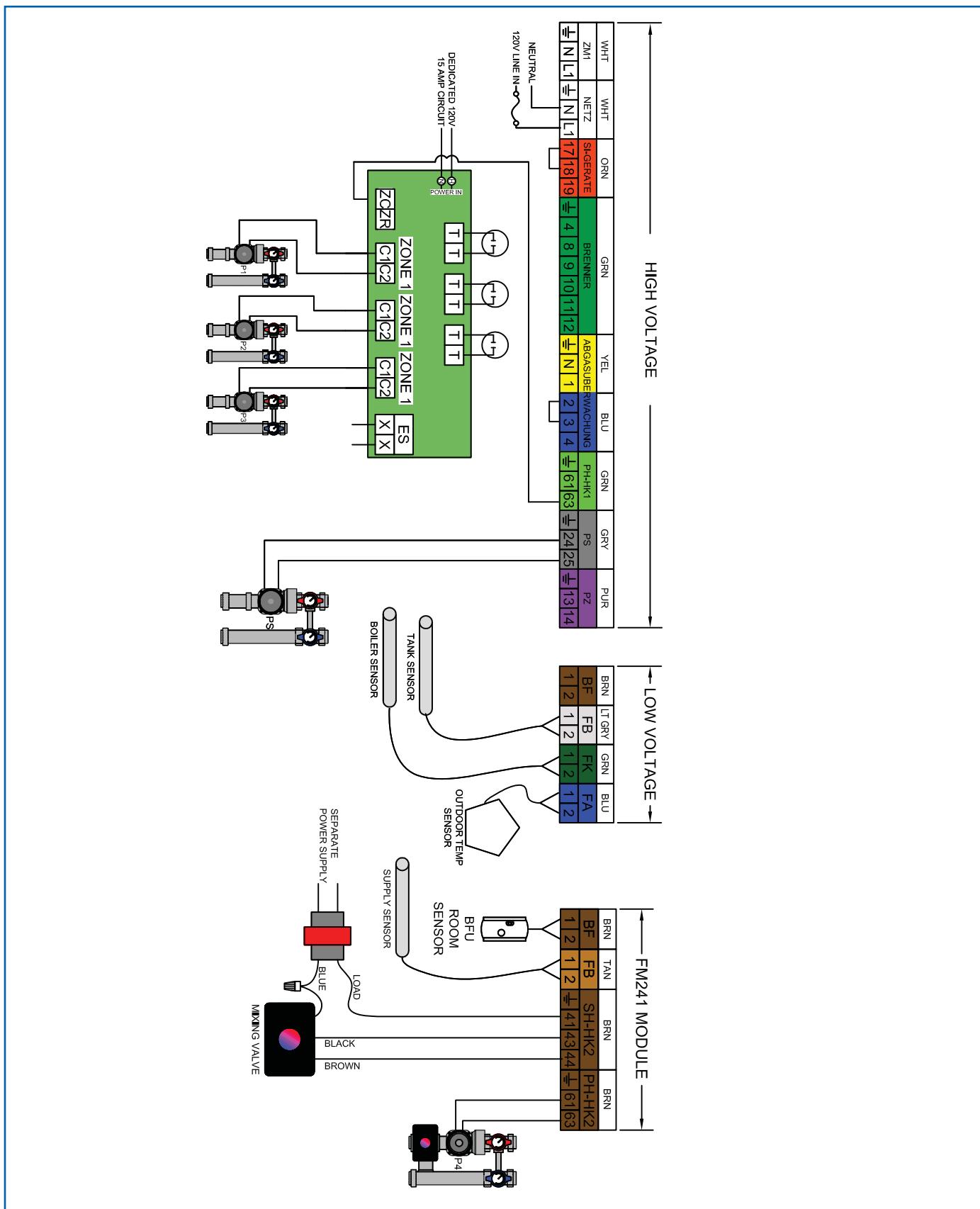


Figure 15 8.7 Electrical diagram

Space Heating Operation:

HK1 circuit (high temperature)

- Boiler temperature is maintained based on the selected heating curve (REF TEMP 1 and OFFSET 1) and inputs from the outdoor sensor (FA) and boiler sensor (FK).
- This application requires a multi-zone pump relay (not supplied by Buderus).
- 120V output from terminal 63 (PH-HK1) will energize the relay. However, the PH-HK1 circuit is limited to a 5 amp maximum load. Therefore, multi-pump applications require an additional source of 120V power to the pump relay. Generally the #63 terminal is wired to the ZC terminal on the relay panel, however relay circuitry can vary. Refer to wiring diagrams provided in this manual for specific manufacturer and model of the relay being used. If the model being used is not listed, contact Buderus for assistance.
- Each zone pump is energized on a call for heat from its respective room thermostat. The end switch of the relay panel is not used.
- Power to the pump relay shall be interrupted under the following conditions:
 - 1) DHW priority
 - 2) Condensate protection
 - 3) Outdoor temperature exceeds WWSD setpoint
- This application does not require a room sensor for high temperature space heating.

HK2 circuit (mixed temperature)

- Mixed water temperature is maintained based on the selected heating curve (REF TEMP 2 and OFFSET 2) and inputs from the outdoor sensor (FA), supply sensor (FV) and room sensor (BF).
- 120V output from terminal 61 & 63 (PH-HK2) provide power to pump P4. The PH-HK2 circuit is limited to a 2 amp maximum draw. It is important that the amp rating of the pump be verified to ensure that the circuit is not overloaded. Use an isolation relay if max amp rating is exceeded.
- This application requires a BFU room sensor for radiant floor heating.

DHW Heating Operation:

- The tank sensor (FB) monitors domestic water temperature.
- 120V output from terminals 24 & 25 (PS) powers the DHW pump.
- During a call for DHW production the domestic pump (PS) is turned on and the space-heating circuit (PH-HK1) is turned off.
- After the DHW recharging and intelligent purge cycle is completed, the PS pump will be shut down and PH-HK1 circuit will be turned on.
- During the DHW cycle the PH-HK2 circuit remains on. The mixing valve can be set to either continue normal operation or fully close to prioritize DHW production. (Refer to the Logamatic Service Manual for setting options)

8.8 Multi-Zone Radiant Floor Heating with FM241 Module and Motorized Mixing Valve/ Indirect DHW Heating

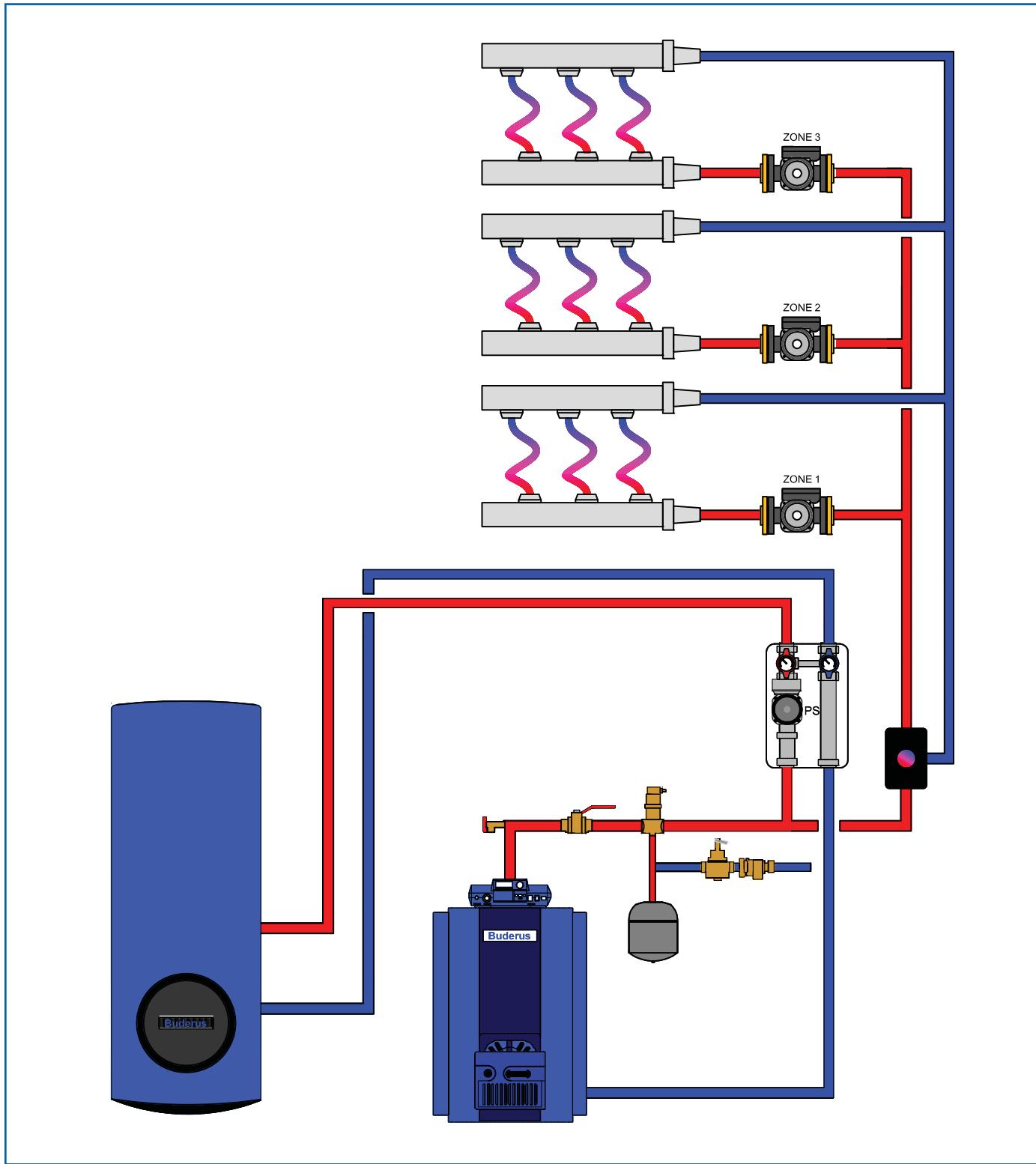


Figure 16 8.8 Mechanical diagram

Space Heating Operation:

Note: 8.8 Electrical diagram on the following page.

HK1 circuit (high temperature)

- System pump PH shall run continuously with the following exceptions:

- 1) Condensate protection
- 2) Outdoor temperature exceeds WWSD setpoint
- 3) DHW priority

- The system pump may also shut down during the initial part of night setback period if a BF room sensor is being used for high temperature space heating.

To simplify this application, it is being shown without high temperature space heating. Refer to previous application diagrams for high temp heating.

HK2 circuit (mixed temperature)

- Water temperature is modulated based on the selected heating curve and input from the outdoor (FA) and supply (FV) sensors.
- During setback periods, the water temperature can be reduced based on the DAY TEMP 2 and NIGHT TEMP 2 settings.
- Space heating pumps (P1,P2,P3) require a multi-zone pump relay to operate on a call for heat from room thermostats.
- The PH-HK2 circuit shall be wired to the multi-zone pump relay to interrupt power to the space heating pumps under the following conditions:
 - 1) Condensate protection
 - 2) Outdoor temperature exceeds WWSD setpoint
- This application does not require a room sensor for radiant floor heating.

DHW Heating Operation:

- The boiler temperature rises on a call for DHW for fast recovery.
- The control powers the domestic pump (PS) and the heating circuit (PH-HK1) is shut down.
- The PH-HK2 circuit will remain on during the DHW cycle. The mixing valve can be set to either continue normal operation or fully close to prioritize DHW production. (Refer to the Logamatic Service Manual for setting options)
- After the DHW recharging and intelligent purge cycle is completed, the PS pump will be shut down and PH-HK1 circuit will be turned on.

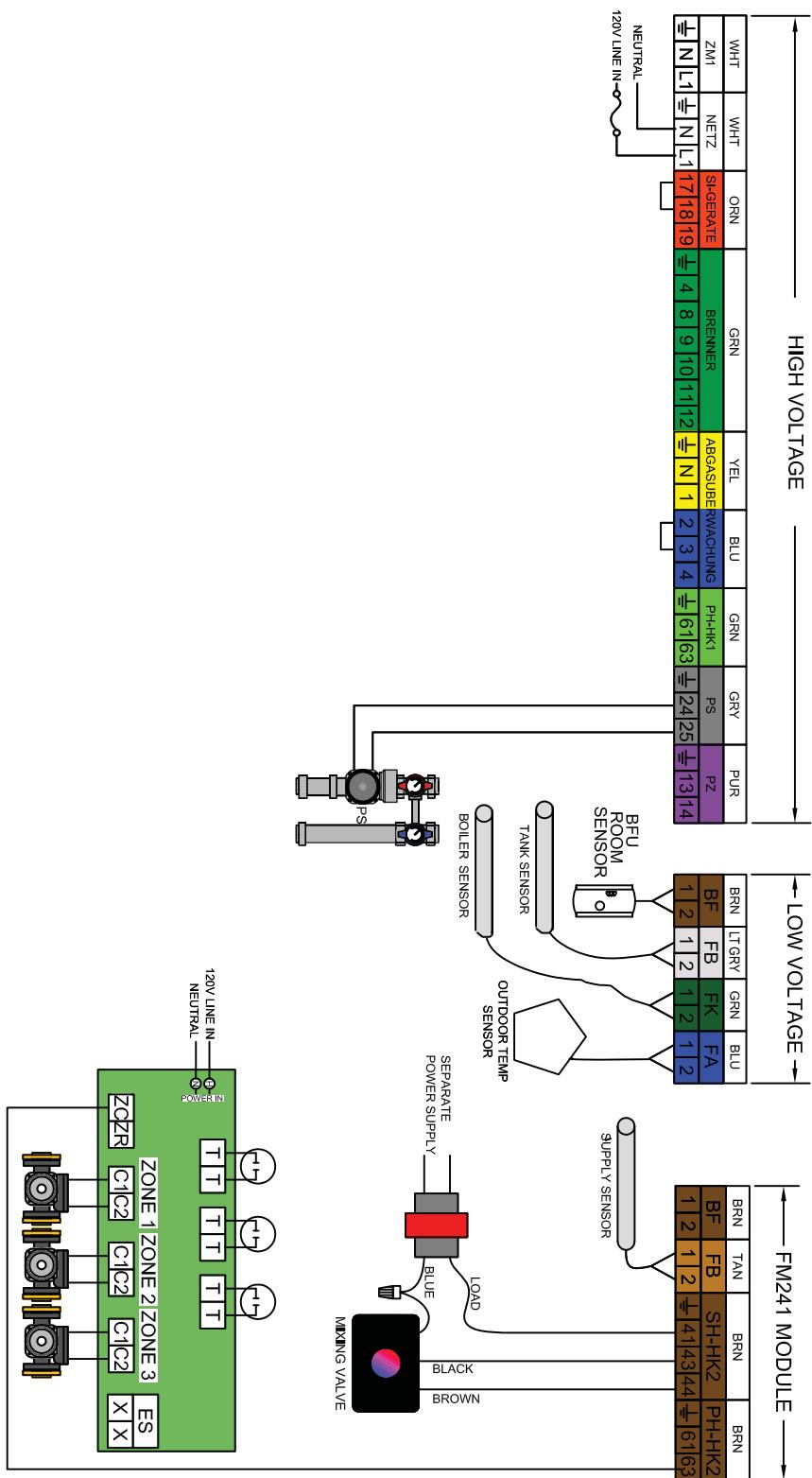


Figure 17 8.8 Electrical diagram

Space Heating Operation:

HK1 circuit (high temperature)

- 120V output from terminals 61 & 63 (PH-HK1) provide power to the system pump (PH).

HK2 circuit (mixed temperature)

- Mixed water temperature is maintained based on the selected heating curve (REF TEMP 2 and OFFSET 2) and inputs from the outdoor sensor (FA) and supply sensor (FV).

- This application requires a multi-zone pump relay (not supplied by Buderus).
 - 120V output from terminal 63 (PH-HK2) will energize the relay. However, the PH-HK2 circuit is limited to a 2 amp maximum load. Therefore, multi-pump applications require an additional source of 120V power to the pump relay. Generally the #63 terminal is wired to the ZC terminal on the relay panel, however relay circuitry can vary. Refer to wiring diagrams provided in this manual for specific manufacturer and model of the relay being used. If the model being used is not listed, contact Buderus for assistance.
 - Each zone pump is energized on a call for heat from its respective room thermostat. The end switch of the relay panel is not used.
 - Power to the pump relay shall be interrupted under the following conditions:
 - 1) Condensate protection
 - 2) Outdoor temperature exceeds WWSD setpoint
 - This application does not require a room sensor for radiant floor heating.

DHW Heating Operation:

- The tank sensor (FB) monitors domestic water temperature.
- 120V output from terminals 24 & 25 (PS) powers the DHW pump.
- During a call for DHW production the domestic pump (PS) is turned on and the space-heating circuit (PH-HK1) is turned off.
- After the DHW recharging and intelligent purge cycle is completed, the PS pump will be shut down and PH-HK1 circuit will be turned on.
- During the DHW cycle the PH-HK2 circuit remains on. The mixing valve can be set to either continue normal operation or fully close to prioritize DHW production. (Refer to the Logamatic Service Manual for setting options)

8.9 Parallel Boiler Piping with FM242 Module / Indirect DHW Heating

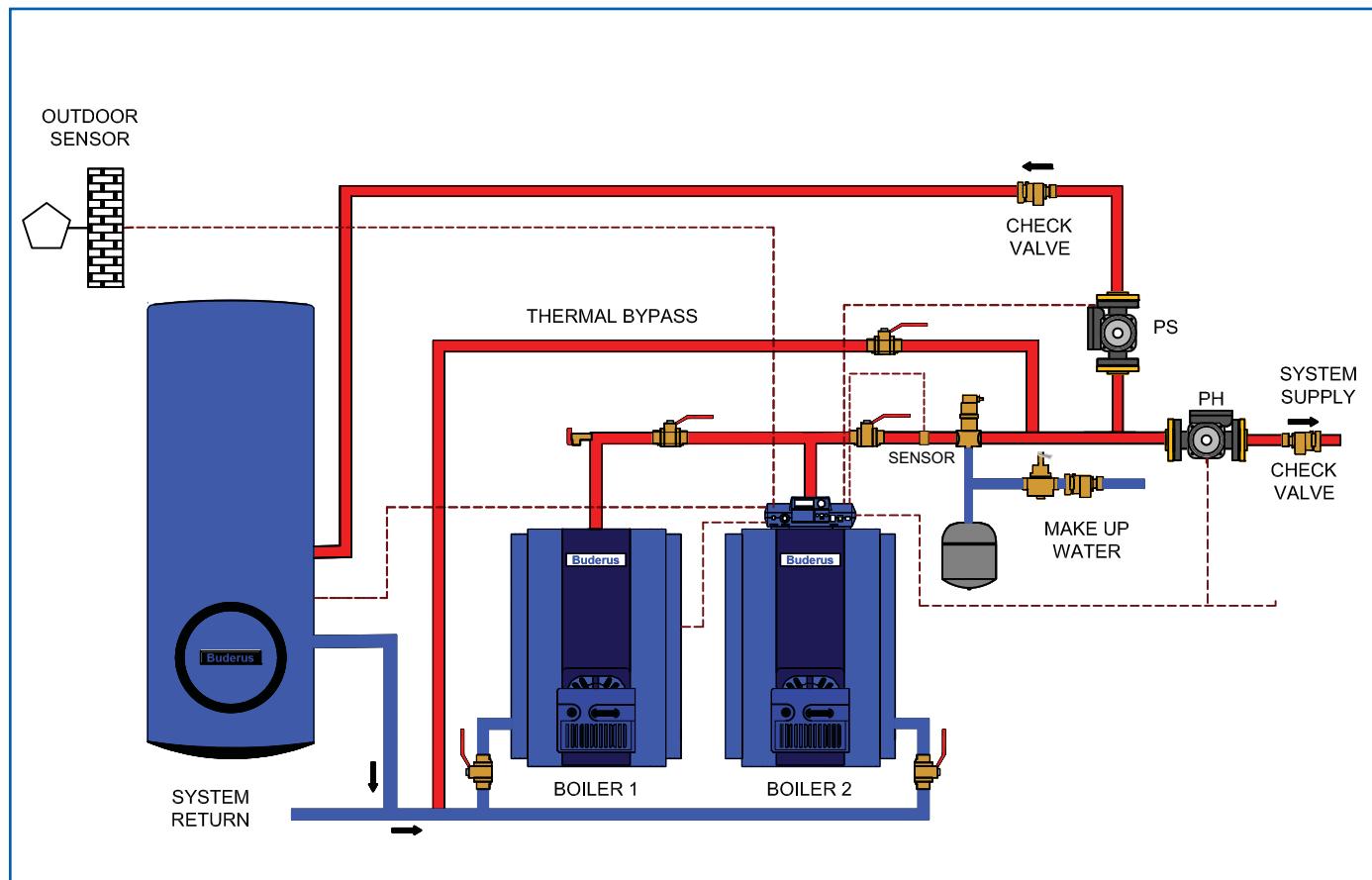


Figure 18 8.9 Mechanical diagram

Space Heating Operation:

- Boiler temperature is maintained based on the selected heating curve and input from the outdoor sensor.
- During setback periods, the boiler temperature will be reduced based on the DAY TEMP and NIGHT TEMP settings on the Logematic control.
- Power to the PH-HK1 circuit shall be interrupted under the following conditions:
 - 1) DHW priority
 - 2) Condensate protection
 - 3) Outdoor temperature exceeds WWSD setpoint

DHW Heating Operation:

- The boiler temperature rises on a call for DHW for fast recovery.
- The control powers the domestic pump (PS) and the heating circuit (PH-HK1) is shut down.
- After the DHW recharging and intelligent purge cycle is completed, the PS pump will be shut down and PH-HK1 circuit will be turned on.

Notes:

1. Boilers shall be piped in a reverse return arrangement to ensure equal flow through each boiler.
2. A small thermal bypass shall be installed immediately after the FK supply sensor in order to create flow past the sensor when the system pump (PH) is off.
3. 8.9 Electrical diagram is on the following page

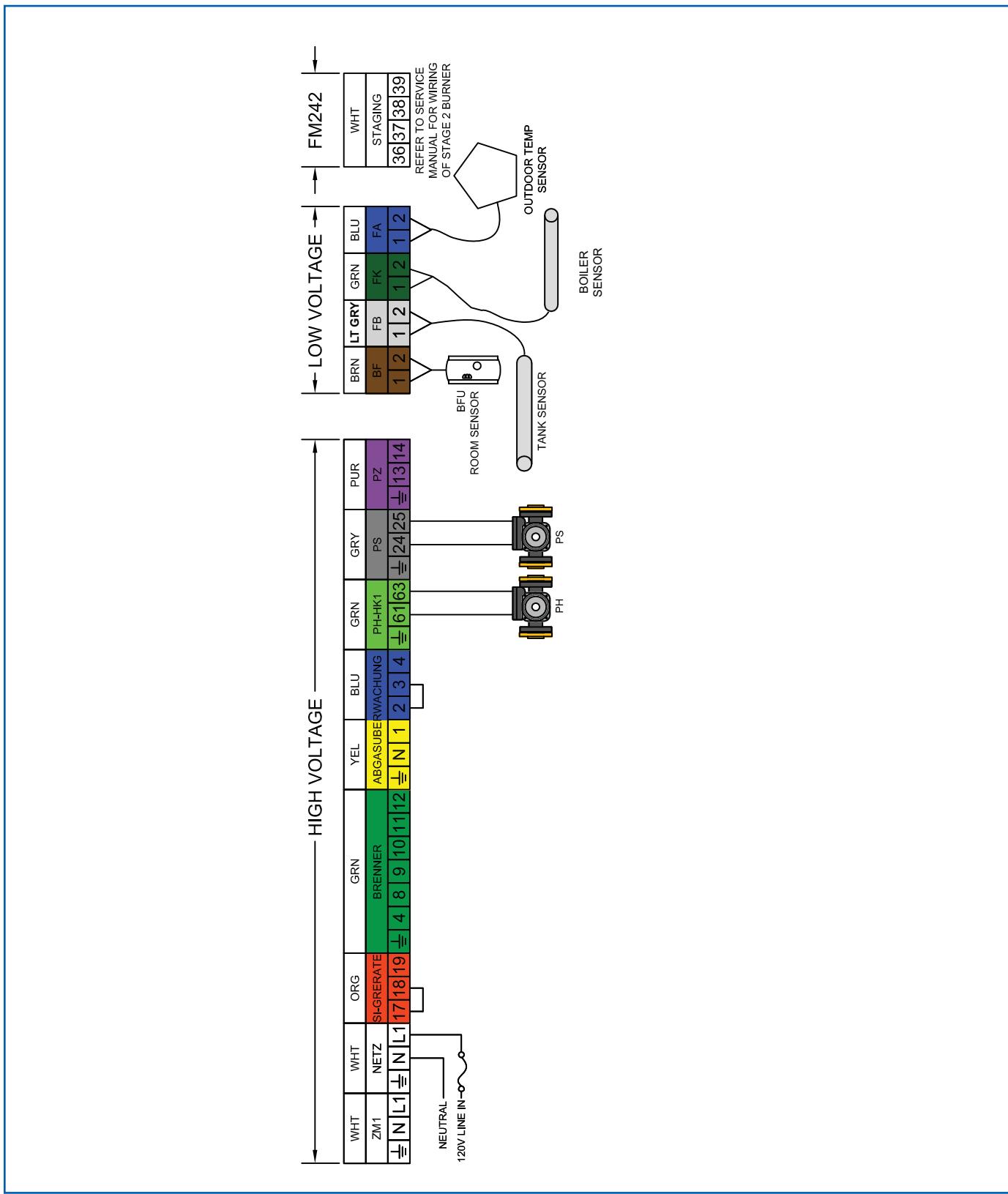


Figure 19 8.9 Electrical diagram

Space Heating Operation:

- System temperature is maintained based on the selected heating curve (REF TEMP and OFFSET) and inputs from the outdoor sensor (FA) and supply sensor (FK).
- This application requires optional staging module FM242.
- The control will stage either one or two boilers to maintain the desired set point. Refer to control Service Manual for wiring information for burners.
- 120V output from terminals 61 & 63 (PH-HK1) provides power to system pump (PH).
- Power to the PH-HK1 circuit shall be interrupted under the following conditions:
 - 1) DHW priority
 - 2) Condensate protection
 - 3) Outdoor temperature exceeds WWSD setpoint

DHW Heating Operation:

- The tank sensor (FB) monitors domestic water temperature.
- 120V output from terminals 24 & 25 (PS) powers the DHW pump.
- During a call for DHW production the domestic pump (PS) is turned on and the space-heating circuit (PH-HK1) is turned off.
- After the DHW recharging and intelligent purge cycle is completed, the PS pump will be shut down and PH-HK1 circuit will be turned on.

8.10 Dual Boiler / Primary/Secondary Piping with FM242 Module / Indirect DHW Heating

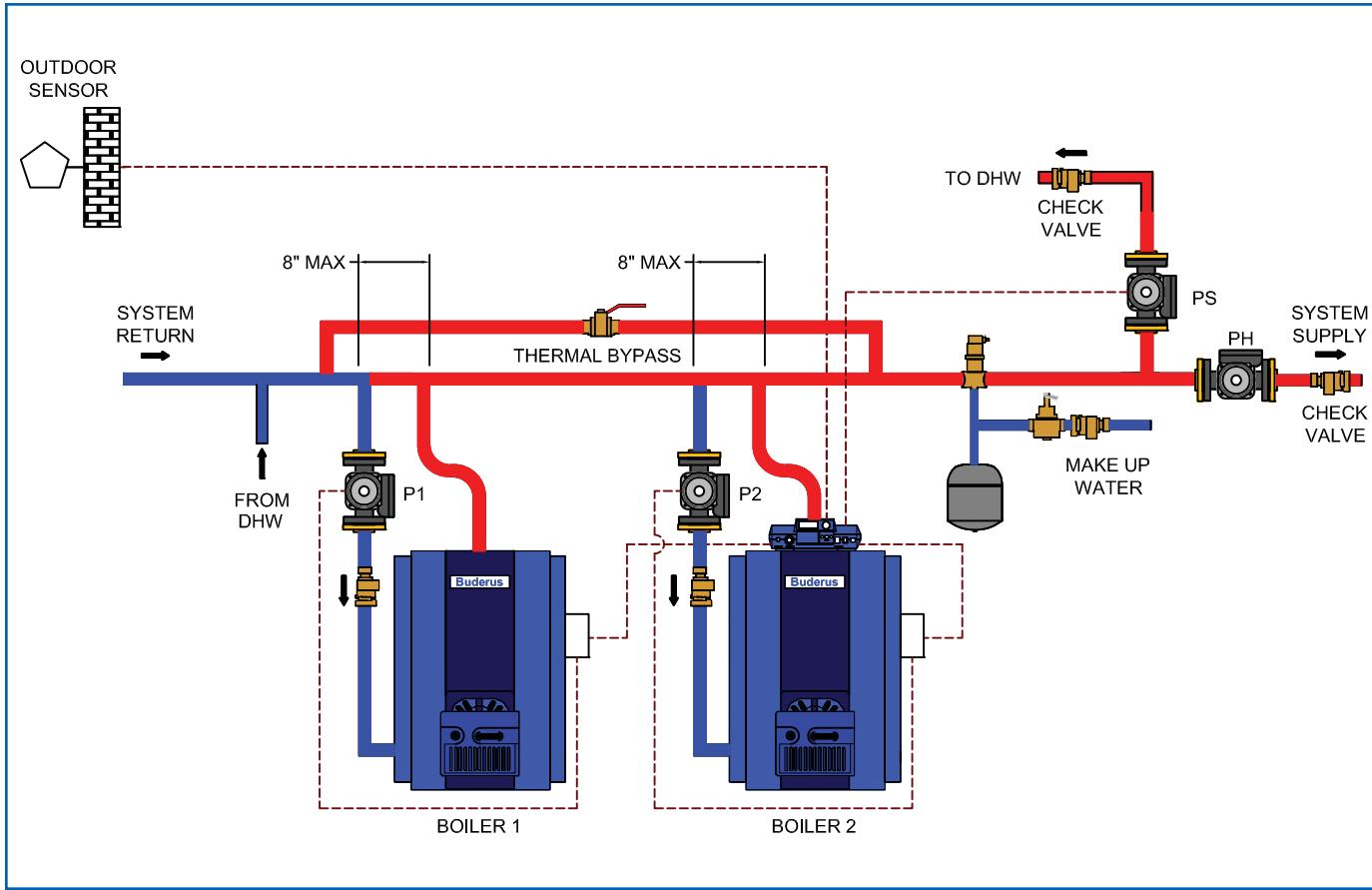


Figure 20 8.10 Mechanical diagram

Space Heating Operation:

- The primary loop temperature is maintained based on the selected heating curve and input from the outdoor sensor.
- During setback periods, the boiler temperature will be reduced based on the DAY TEMP and NIGHT TEMP settings on the Logamatic control.
- Boiler pumps (P1,P2) shall be wired to the Honeywell L8148 aquastat (L8148 (oil) or L7148 (gas)) and will operate on a demand signal from the Logamatic control.
- Power to the PH-HK1 circuit shall be interrupted under the following conditions:
 - 1) DHW priority
 - 2) Condensate protection
 - 3) Outdoor temperature exceeds WWSD setpoint

DHW Heating Operation:

- The boiler temperature rises on a call for DHW for fast recovery.
- The control powers the domestic pump (PS) and the heating circuit (PH-HK1) is shut down.
- After the DHW recharging and intelligent purge cycle is completed, the PS pump will be shut down and PH-HK1 circuit will be turned on.

Notes:

1. Boilers shall be piped in a primary/secondary arrangement with recommended spacing of 4 pipe diameters with a maximum of 8" between the supply and return to the primary loop.
2. A small thermal bypass shall be installed immediately after the FK supply sensor in order to create flow past the sensor when the system pump (PH) is off.
3. 8.10 Electrical diagram is on the following page

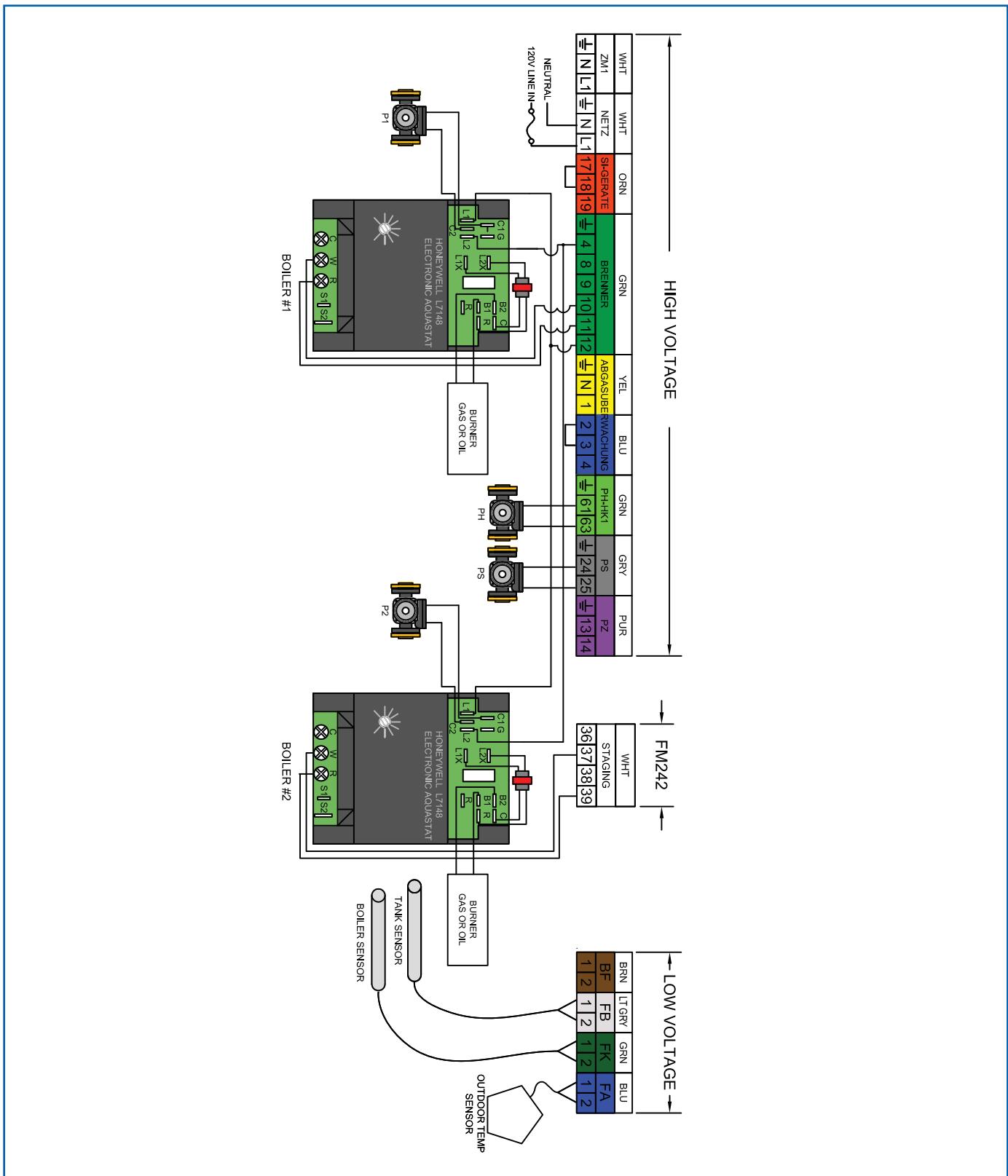


Figure 21 8.10 Electrical diagram

Space Heating Operation:

- Primary loop temperature is maintained based on the selected heating curve (REF TEMP and OFFSET) and inputs from the outdoor sensor (FA) and supply sensor (FK).
- This application requires optional staging module FM242.
- The control will stage either one or two boilers to maintain the desired set point. Refer to control Service Manual for wiring information for burners.
- This electrical diagram addresses only boilers using an operating aquastat/relay with a pump circuit (e.g. Honeywell L8148). Both boilers require a L8148 operating control (L8148 (oil) or L7148 (gas)). If this type of aquastat is not being used, please contact Buderus for assistance.
- Boiler pumps (P1,P2) shall be wired to the Honeywell L8148 aquastat (L8148 (oil) or L7148 (gas)) and will operate on a heat demand signal from the Logamatic control.
- 120V output from terminals 61 & 63 (PH-HK1) provides power to system pump (PH).
- Power to the PH-HK1 circuit shall be interrupted under the following conditions:
 - 1) DHW priority
 - 2) Condensate protection
 - 3) Outdoor temperature exceeds WWSD setpoint

DHW Heating Operation:

- The tank sensor (FB) monitors domestic water temperature.
- 120V output from terminals 24 & 25 (PS) powers the DHW pump.
- During a call for DHW production the domestic pump (PS) is turned on and the space-heating circuit (PH-HK1) is turned off.
- After the DHW recharging and intelligent purge cycle is completed, the PS pump will be shut down and PH-HK1 circuit will be turned on.

8.11 Multi-Zone Space Heating/On-demand High Temp Heating/Indirect DHW Heating

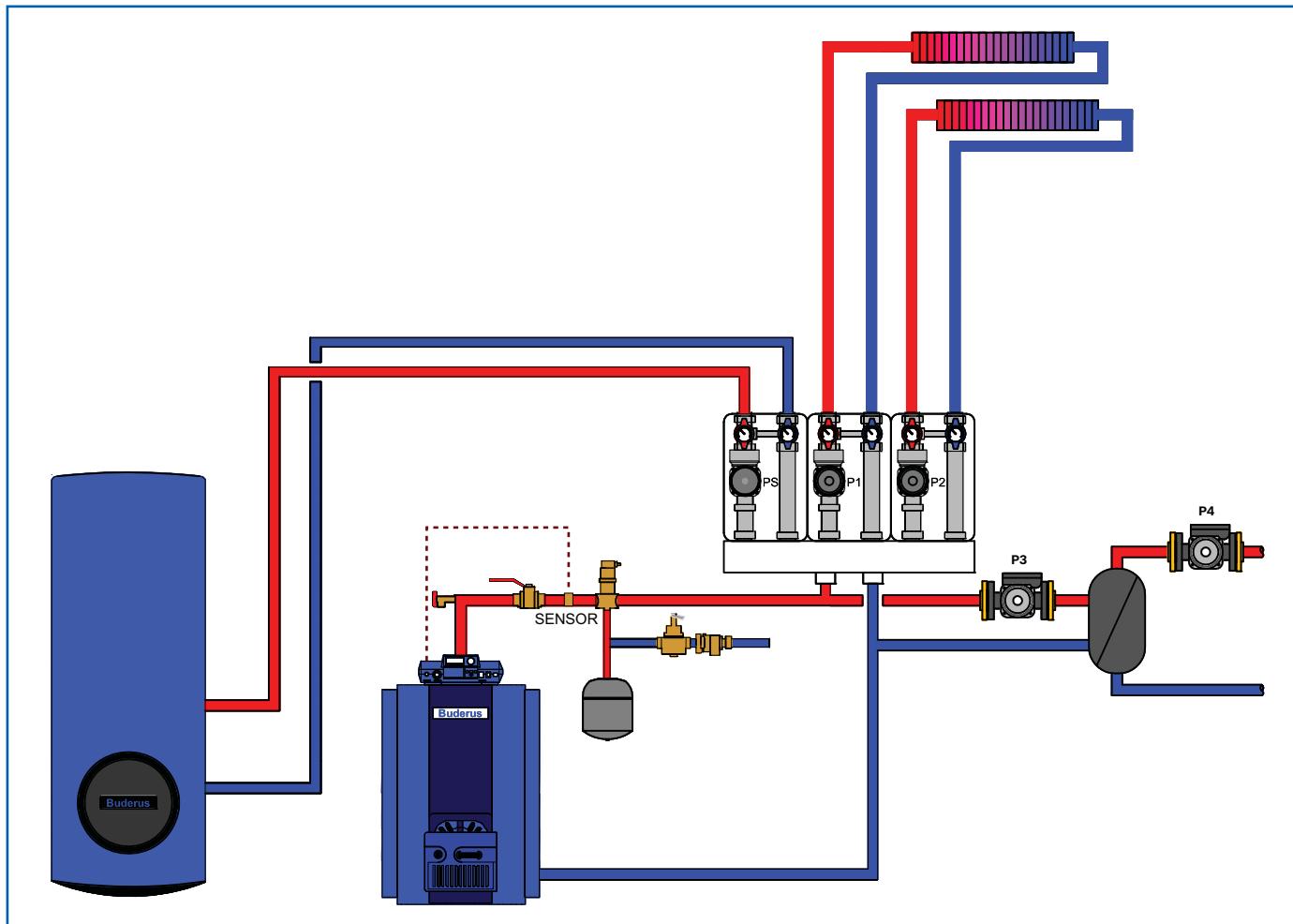


Figure 22 8.11 Mechanical diagram

Space Heating Operation:

- Boiler temperature is maintained based on the selected heating curve and input from the outdoor sensor.
- Boiler will run to high limit on call from on-demand heat zone.
- During setback periods, the boiler temperature will be reduced based on the DAY TEMP and NIGHT TEMP settings on the Logematic control.
- Space heating pumps require a multi-zone switching relay to operate on a call for heat from a room thermostat.
- On-demand zone requires a separate switching relay in order to fire the boiler on a call for heat.
- Power to the PH-HK1 circuit shall be interrupted under the following conditions:
 - 1) DHW priority
 - 2) Condensate protection
 - 3) Outdoor temperature exceeds WWSD setpoint

Note - As shown, the on-demand zone is interrupted during DHW priority, WWSD and condensate protection. For year round, 24-hour operation of the on-demand zones, disconnect the PH-HK1 connection from ZC on the pump relay. This will allow the on-demand zone to operate during DHW recharging cycles. Consideration to boiler sizing must be given.

DHW Heating Operation:

- The boiler temperature rises on a call for DHW for fast recovery.
- The control powers the domestic pump (PS) and the heating circuit (PH-HK1) is shut down.
- After the DHW recharging and intelligent purge cycle is completed, the PS pump will be shut down and PH-HK1 circuit will be turned on.

Note: 8.11 Electrical diagram on the following page.

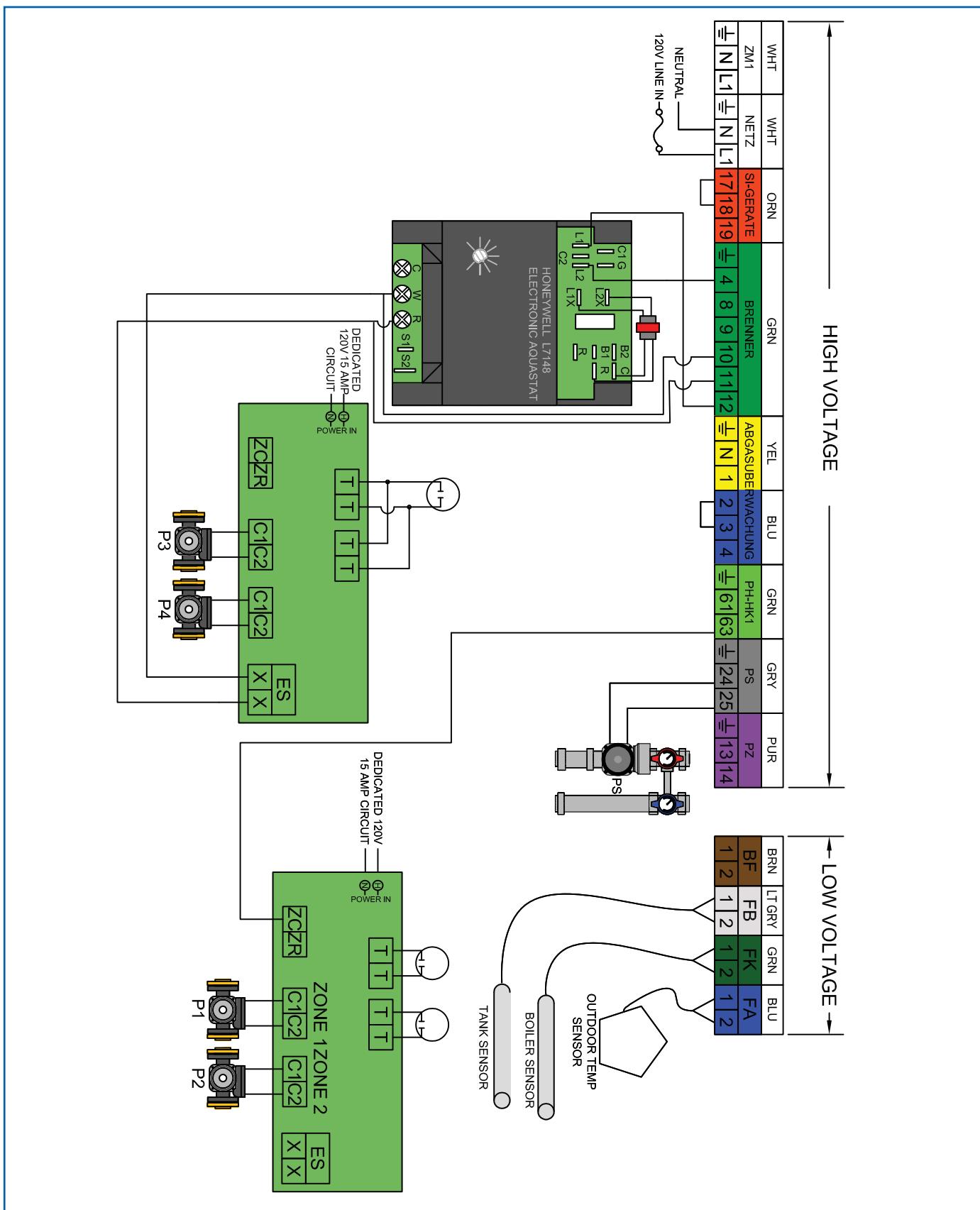


Figure 23 8.11 Electrical diagram

Space Heating Operation:

- Boiler temperature is maintained based on the selected heating curve (REF TEMP and OFFSET) and inputs from the outdoor sensor (FA) and boiler sensor (FK).
- Boiler will run to limit set on L8148 aquastat on a call for heat from on-demand zone(s).
- This application requires a multi-zone pump relay (not supplied by Buderus). The on-demand zone also requires a separate pump relay to fire the boiler on a call for heat. When using a heat exchanger as shown, pumps P3 and P4 must run simultaneously. The demand signal from the on-demand zone(s) (aquastat, thermostat or end switch) must be wired to turn both pumps on.
- 120V output from terminal 63 (PH-HK1) will energize pump relay #1. However, the PH-HK1 circuit is limited to a 5 amp maximum load. Therefore, multi-pump applications require an additional source of 120V power to the pump relay. Generally the #63 terminal is wired to the ZC terminal on the relay panel, however relay circuitry can vary. Refer to wiring diagrams provided in this manual for specific manufacturer and model of the relay being used. If the model being used is not listed, contact Buderus for assistance.
- Each zone pump is energized on a call for heat from its respective room thermostat. The end switch of relay panel #1 is not used for regular space heating zones. The end switch of the on-demand zone(s) relay (#2) is wired to T-T on the L8148 aquastat.
- Power to the pump relay #1 is interrupted under the following conditions:
 - 1) DHW priority
 - 2) Condensate protection
 - 3) Outdoor temperature exceeds WWSD setpoint
- For year round, 24-hour operation of the on-demand zone(s), do not connect the PH-HK1 to ZC on pump relay #2.
- In order to use a room sensor with this type of application, a standard room thermostat must also be used in the same zone in order to prevent overheating when the on-demand zone is calling.

DHW Heating Operation:

- The tank sensor (FB) monitors domestic water temperature.
- 120V output from terminals 24 & 25 (PS) powers the DHW pump.
- During a call for DHW production the domestic pump (PS) is turned on and the space-heating circuit (PH-HK1) is turned off.
- After the DHW recharging and intelligent purge cycle is completed, the PS pump will be shut down and PH-HK1 circuit will be turned on.

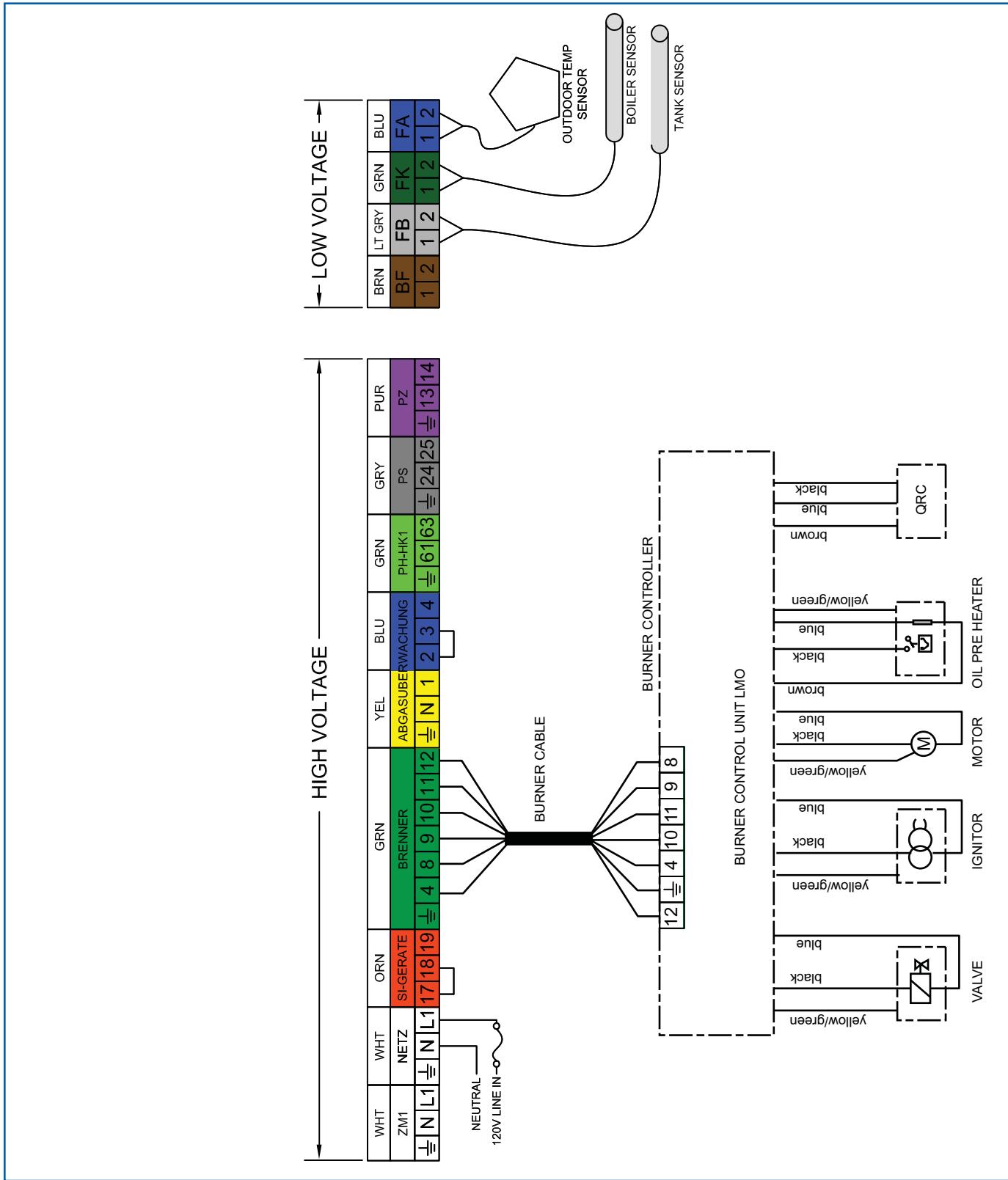
9 Burner/Boiler wiring

Description

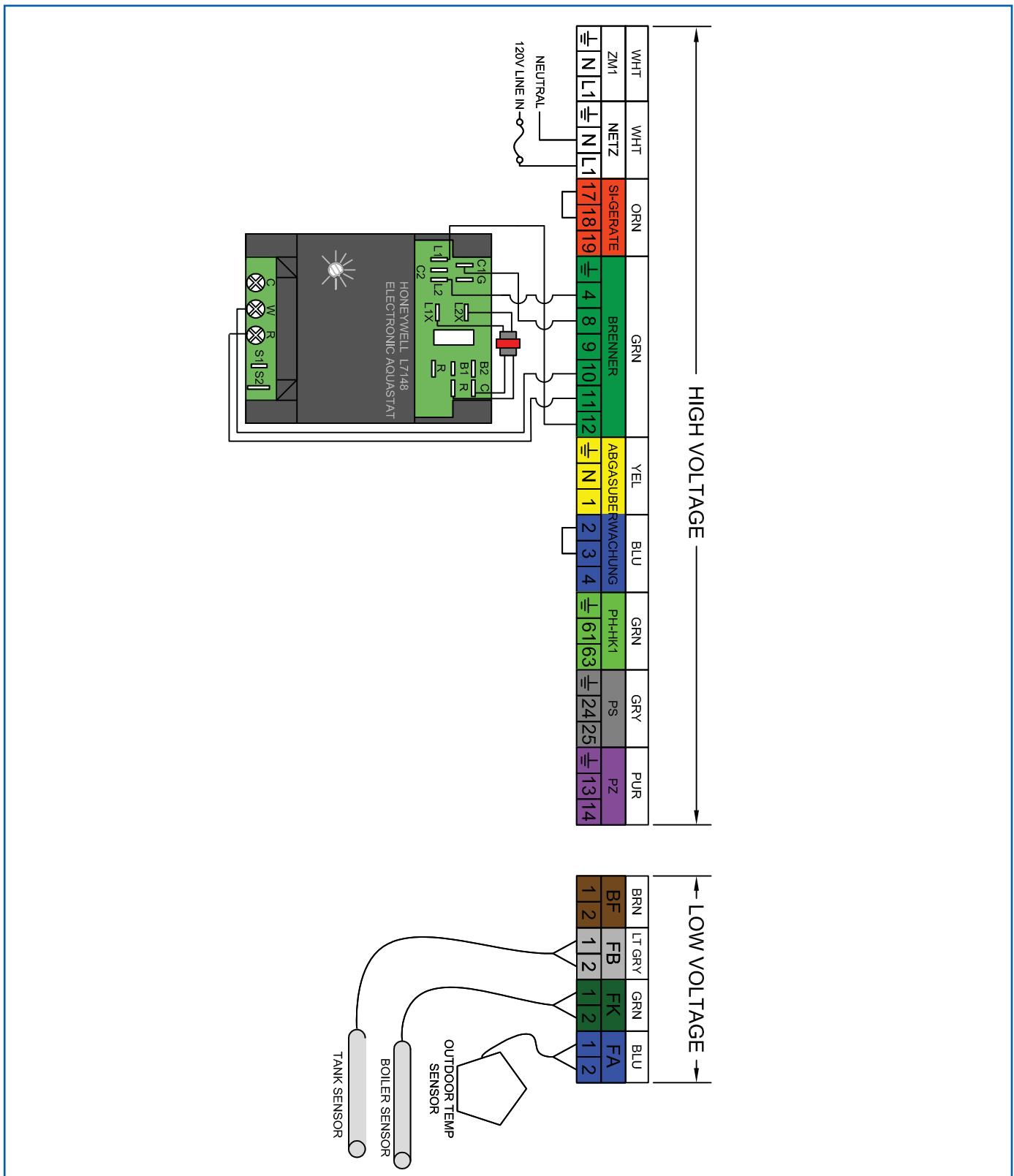
- 9.1** Burner Wiring Diagram for:
Buderus BE Burner ([page 53](#))
- 9.2** Burner wiring diagram for:
L7148 Aquastat Relay ([page 54](#))
- 9.3** Burner wiring diagram for:
G334X, G224E/73-128, Gas Boilers -Stage1 ([page 55](#))
- 9.4** Burner wiring diagram for:
Riello F40 with AL 1009 Control ([page 56](#))
- 9.5** Burner wiring diagram for:
Riello F40 Series F3, F5, F10 ([page 57](#))
- 9.6** Burner wiring diagram for:
Carlin EZ1 with 40200-02 Control ([page 58](#))
- 9.7** Burner wiring diagram for:
Carlin P10, 99 FRD - 60200-02 Control ([page 59](#))
- 9.8** Burner wiring diagram for:
Beckett Genisys 7505 ([page 60](#))
- 9.9** Burner wiring diagram for:
Beckett AFG, CF, SMG - R8148 Control ([page 61](#))
- 9.10** Burner wiring diagram for:
Isolation Relay for High Amp Burner ([page 62](#))
- 9.11** Burner wiring diagram for:
Taco ZVC Relay Used With Zone Valves ([page 63](#))

9.1 Burner wiring diagram for:

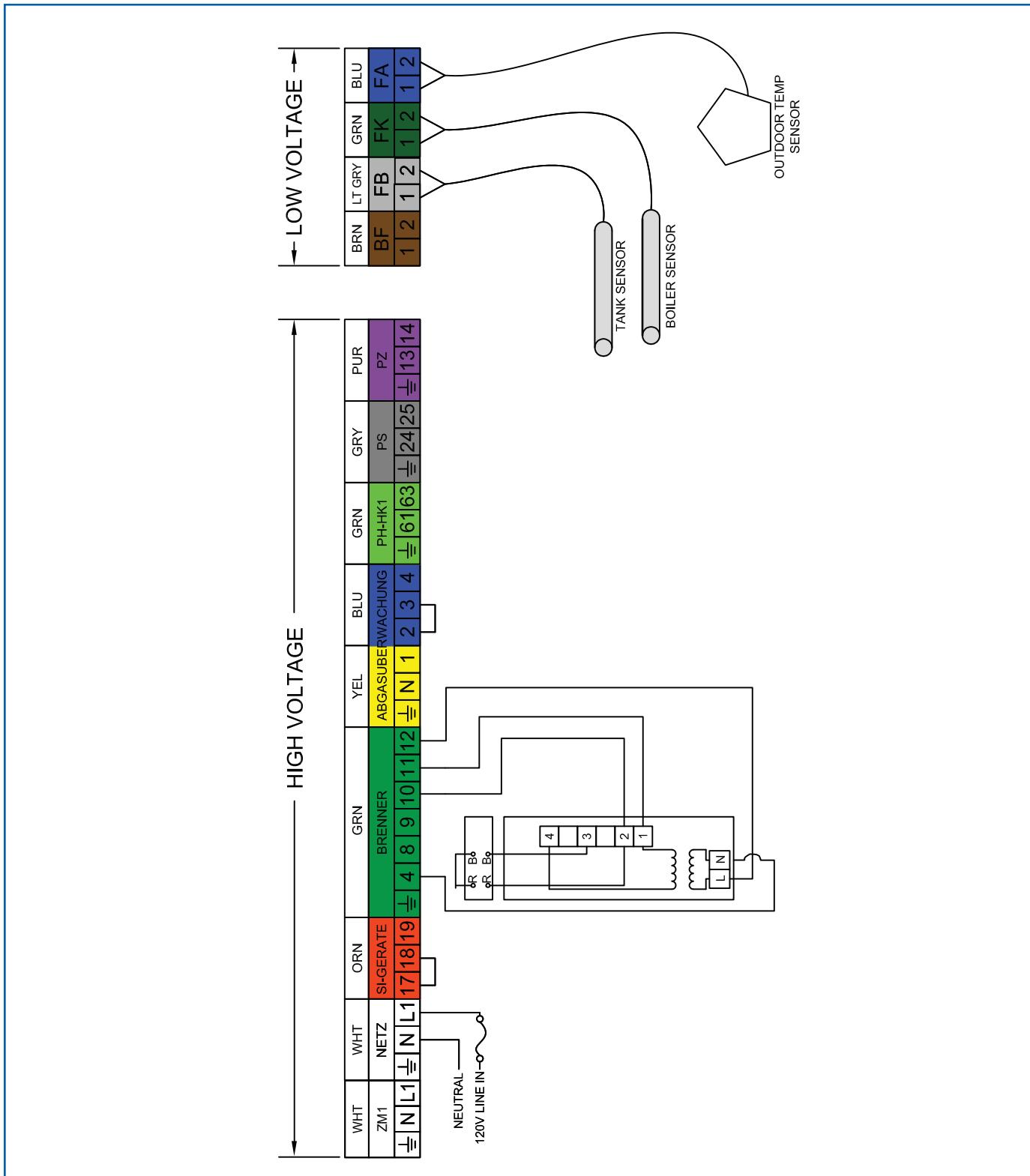
Buderus BE Burner



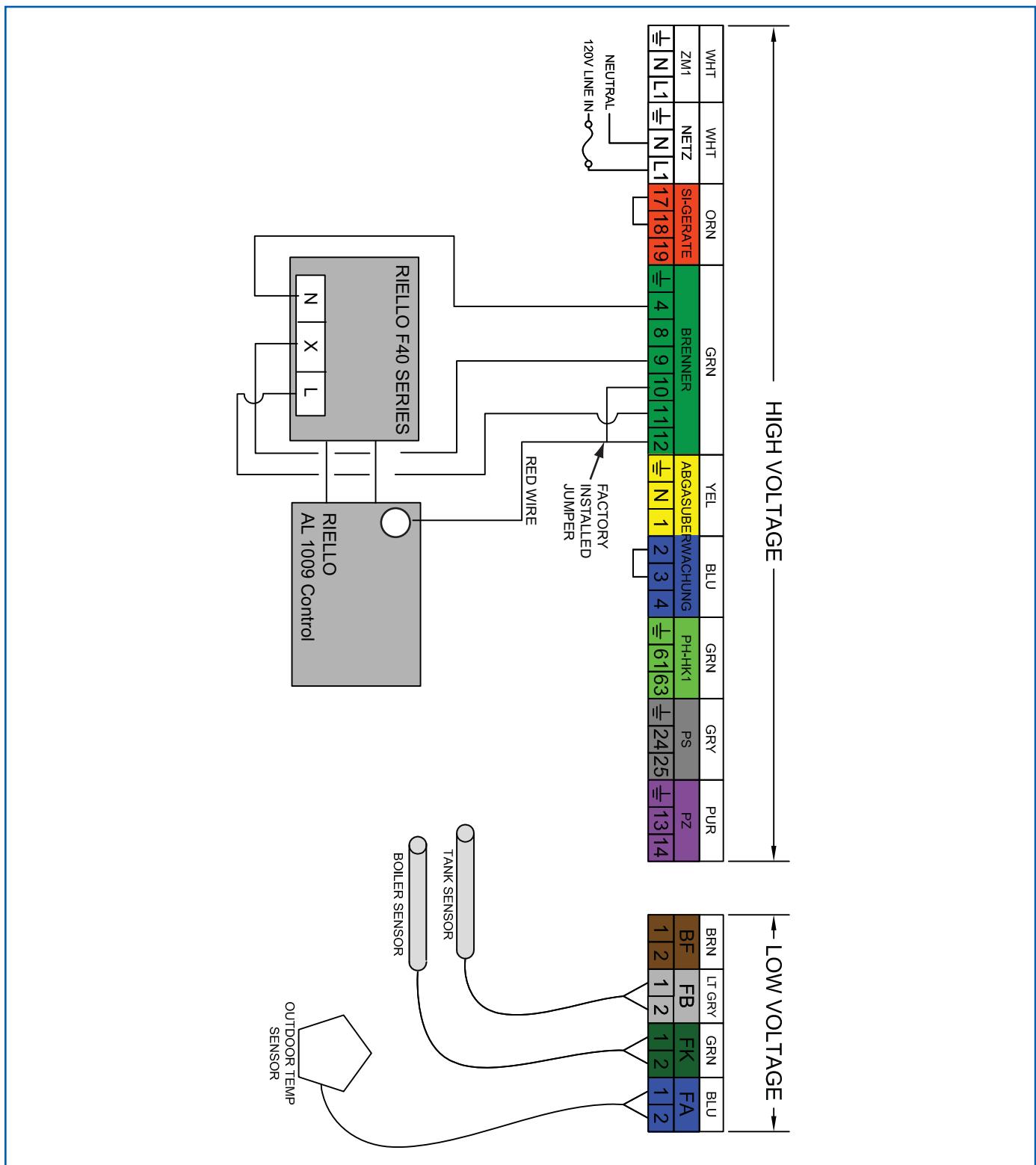
9.2 Burner wiring diagram for: L7148 Aquastat Relay



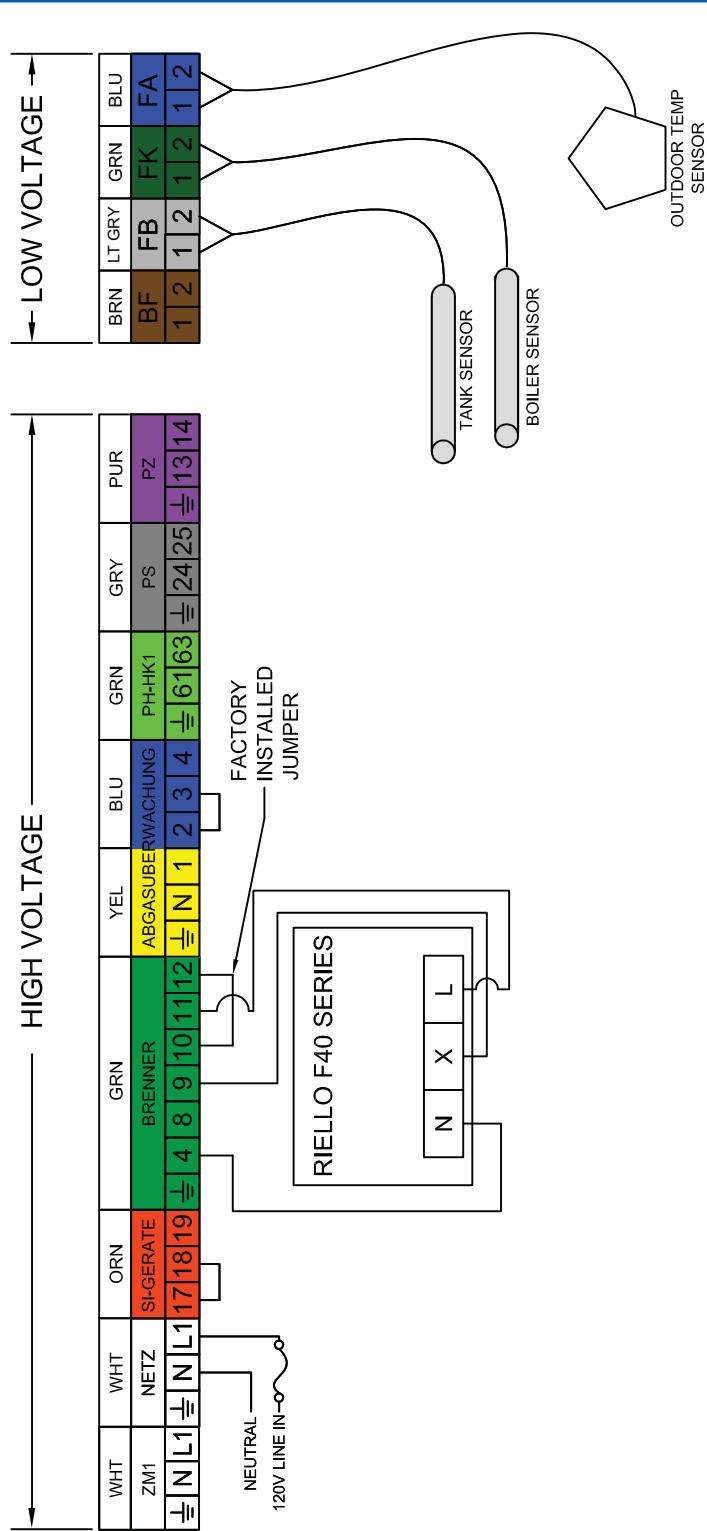
9.3 Burner wiring diagram for: G334X, G224E/73-128, Gas Boilers -Stage1



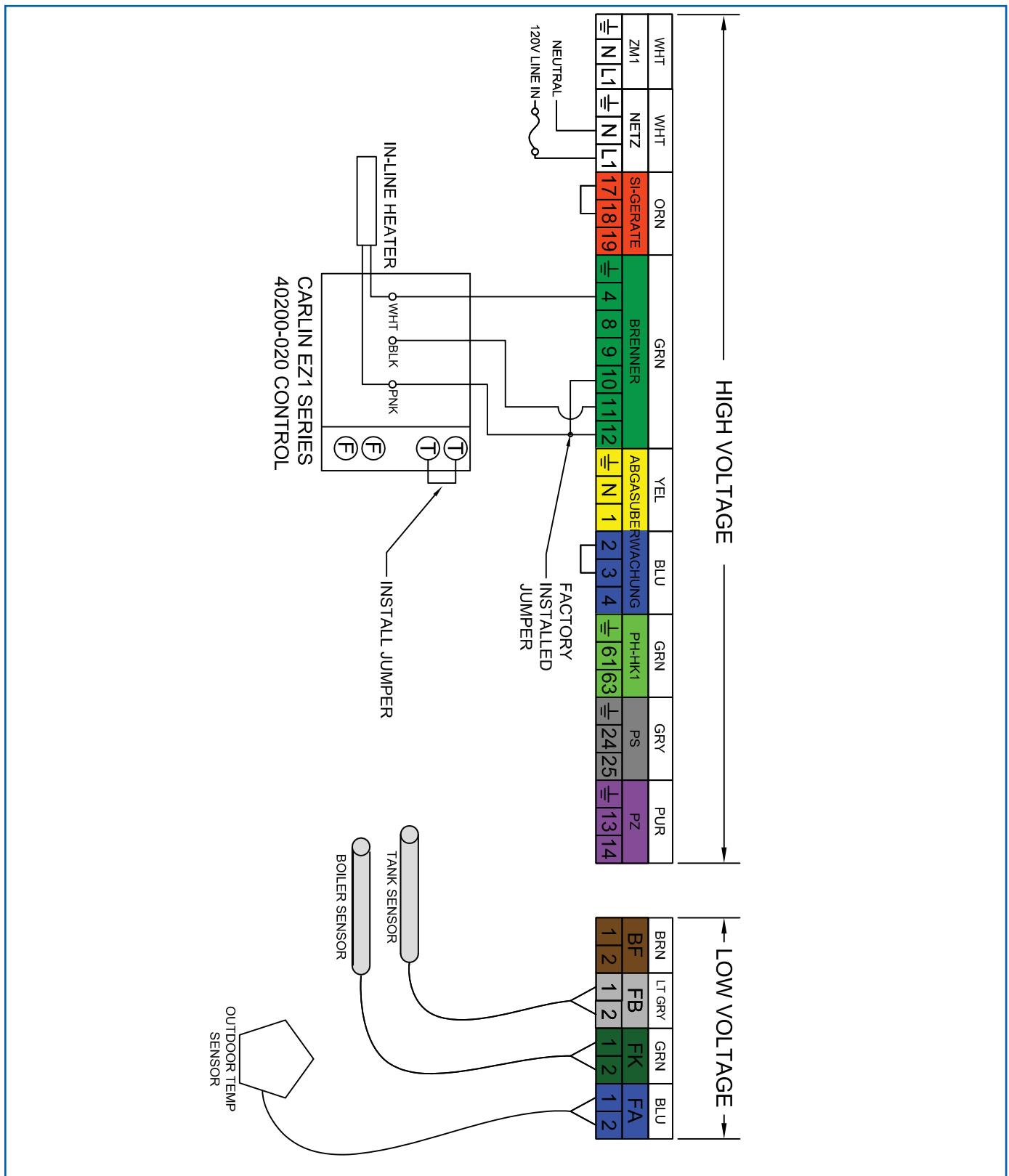
9.4 Burner wiring diagram for: Riello F40 with AL 1009 Control



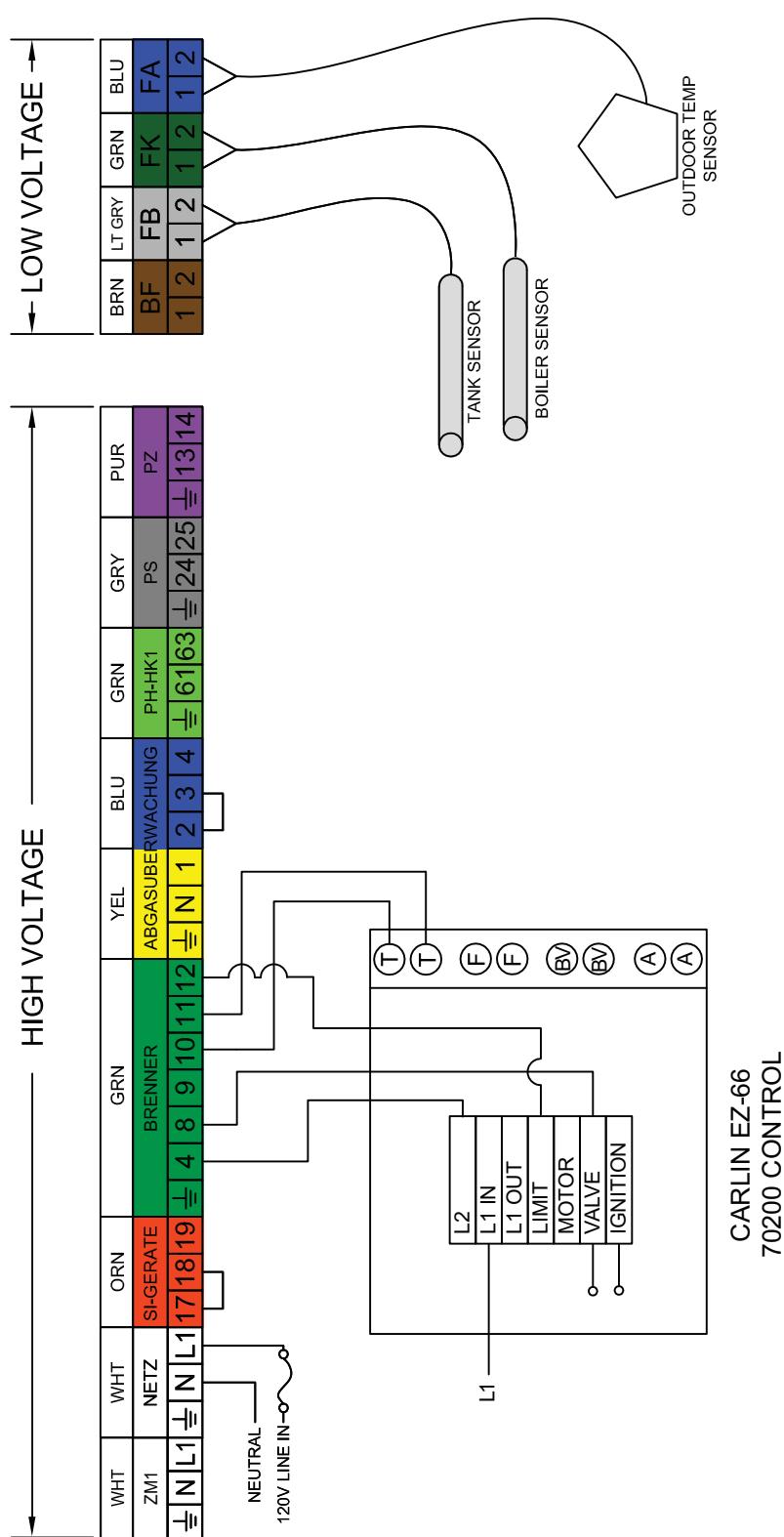
9.5 Burner wiring diagram for: Riello F40 Series F3, F5, F10



9.6 Burner wiring diagram for: Carlin EZ1 with 40200-02 Control

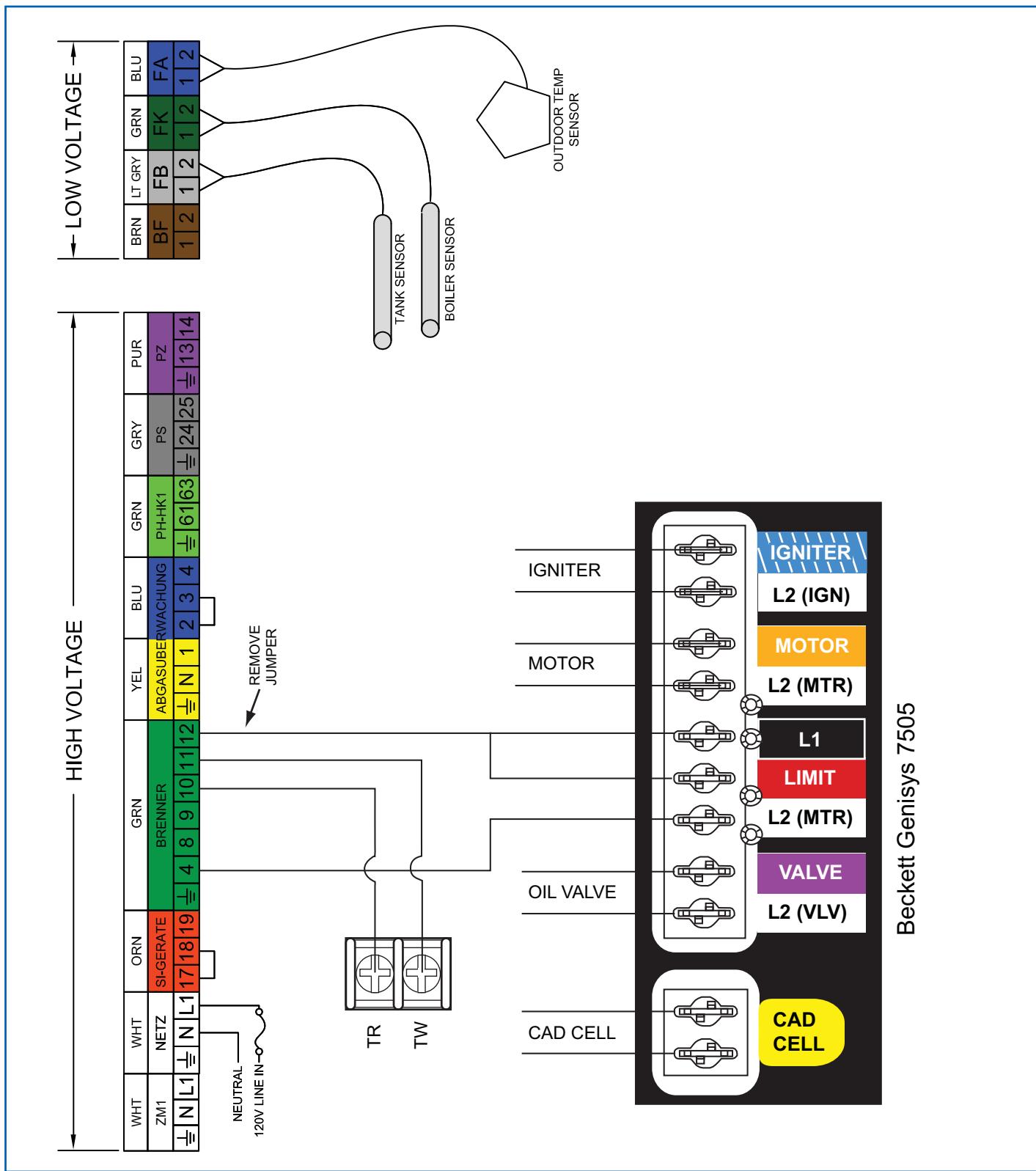


9.7 Burner wiring diagram for: Carlin EZ66 - 70200 Control

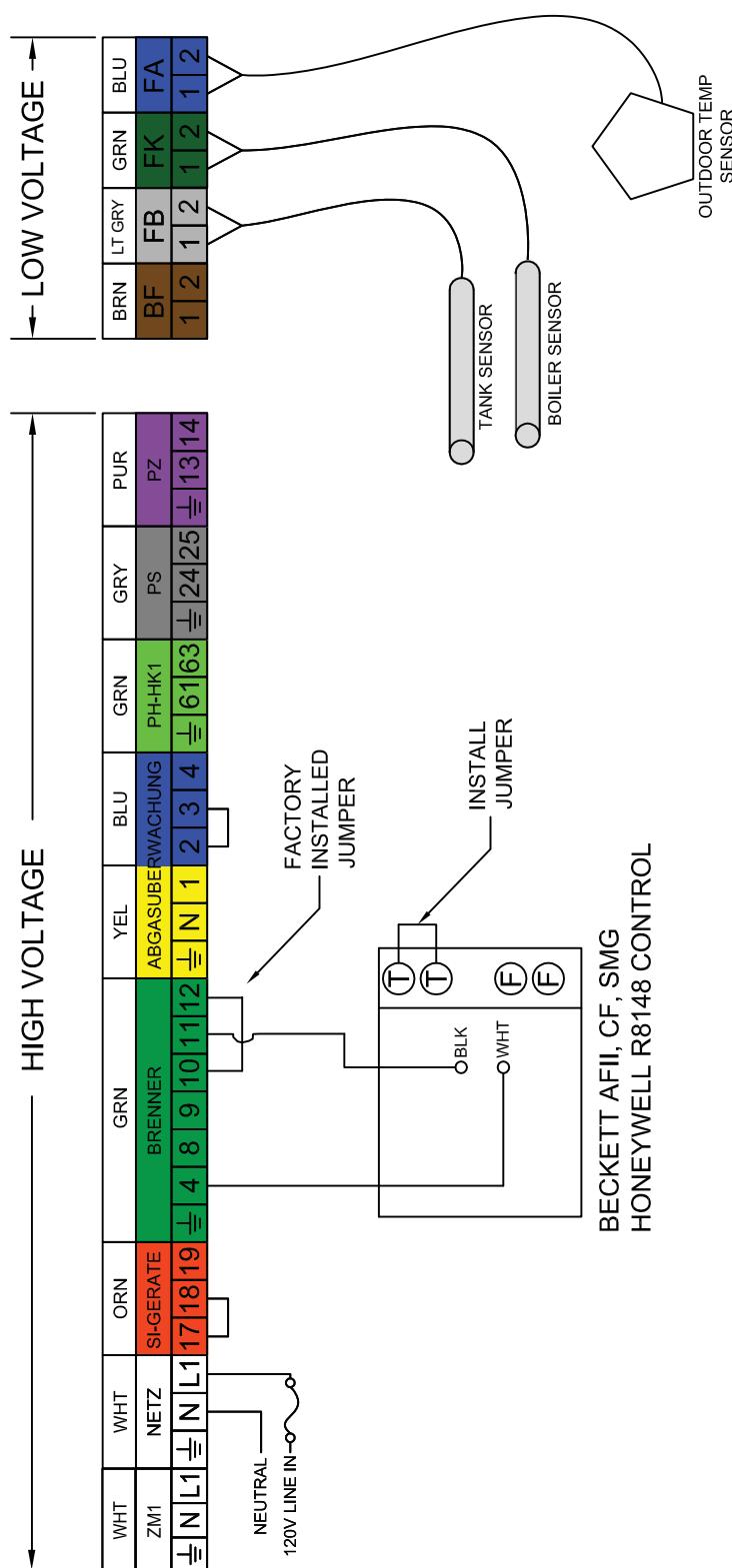


CARLIN EZ-66
70200 CONTROL

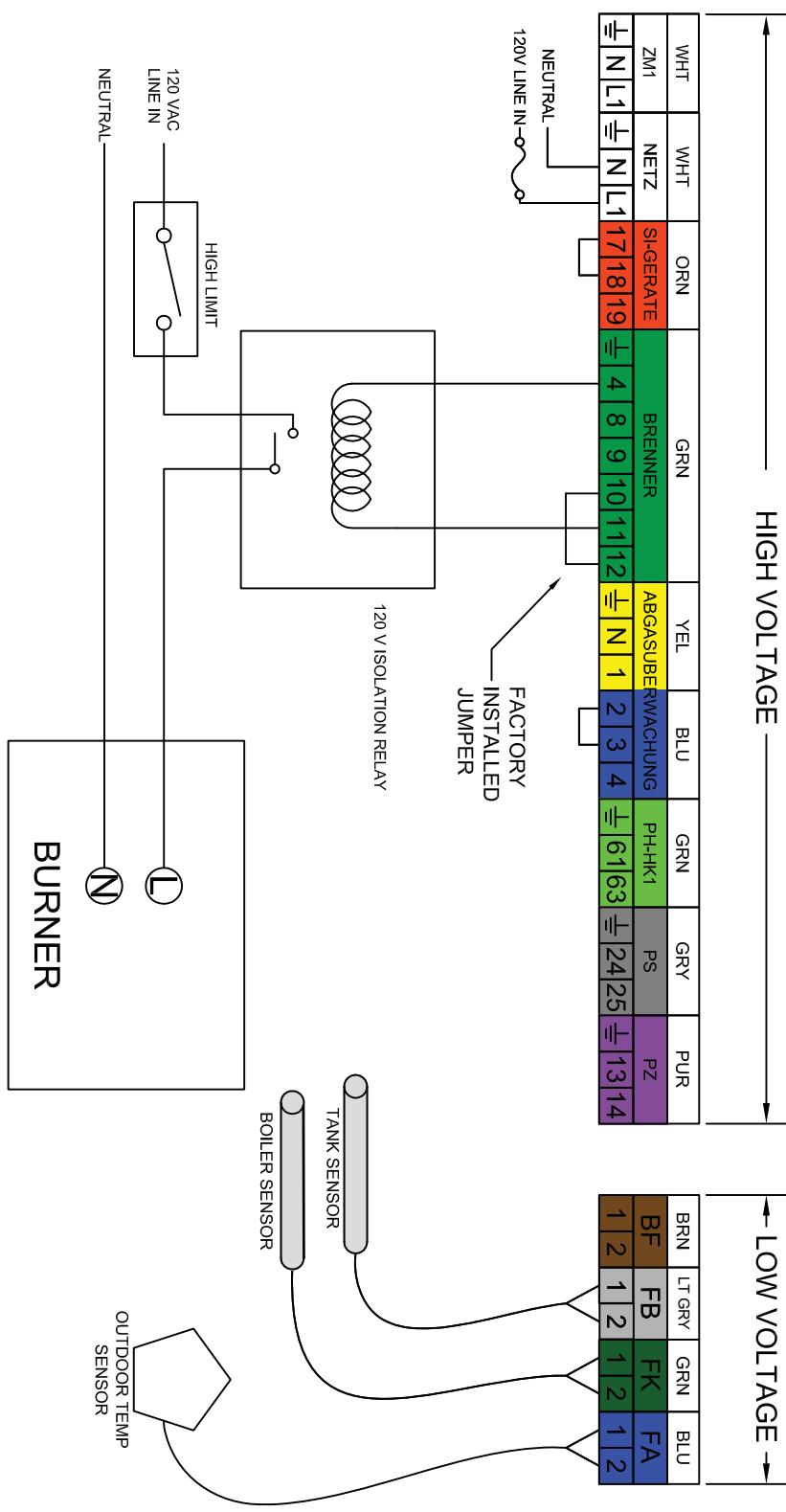
9.8 Burner wiring diagram for: Beckett Genisys 7505



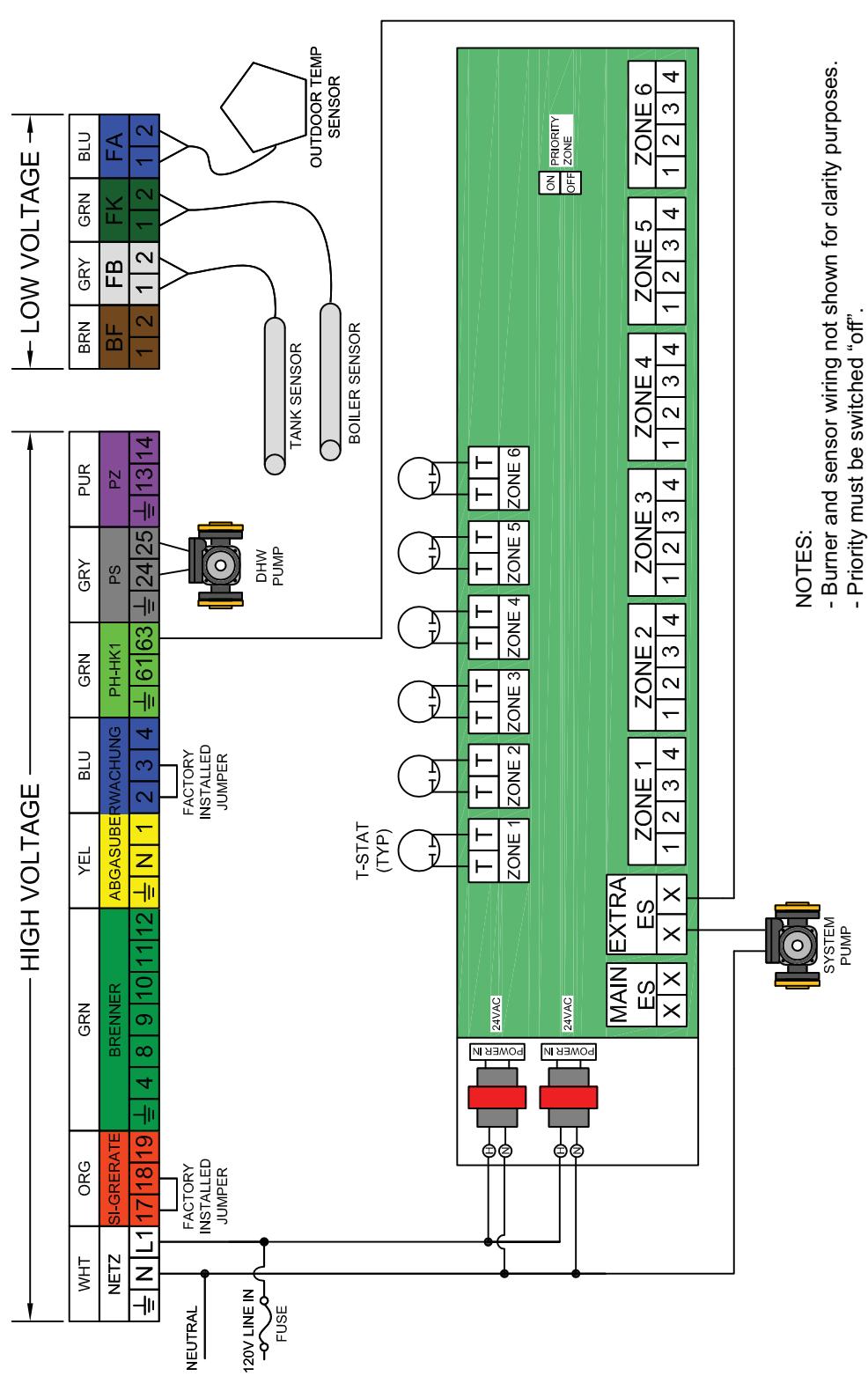
9.9 Burner wiring diagram for: Beckett AFG, CF, SMG - R8148 Control



9.10 Burner wiring diagram for: Isolation Relay for High Amp Burner



9.11 Burner wiring diagram for: Taco ZVC Relay Used With Zone Valves



NOTES:

- Burner and sensor wiring not shown for clarity purposes.
- Priority must be switched "off".

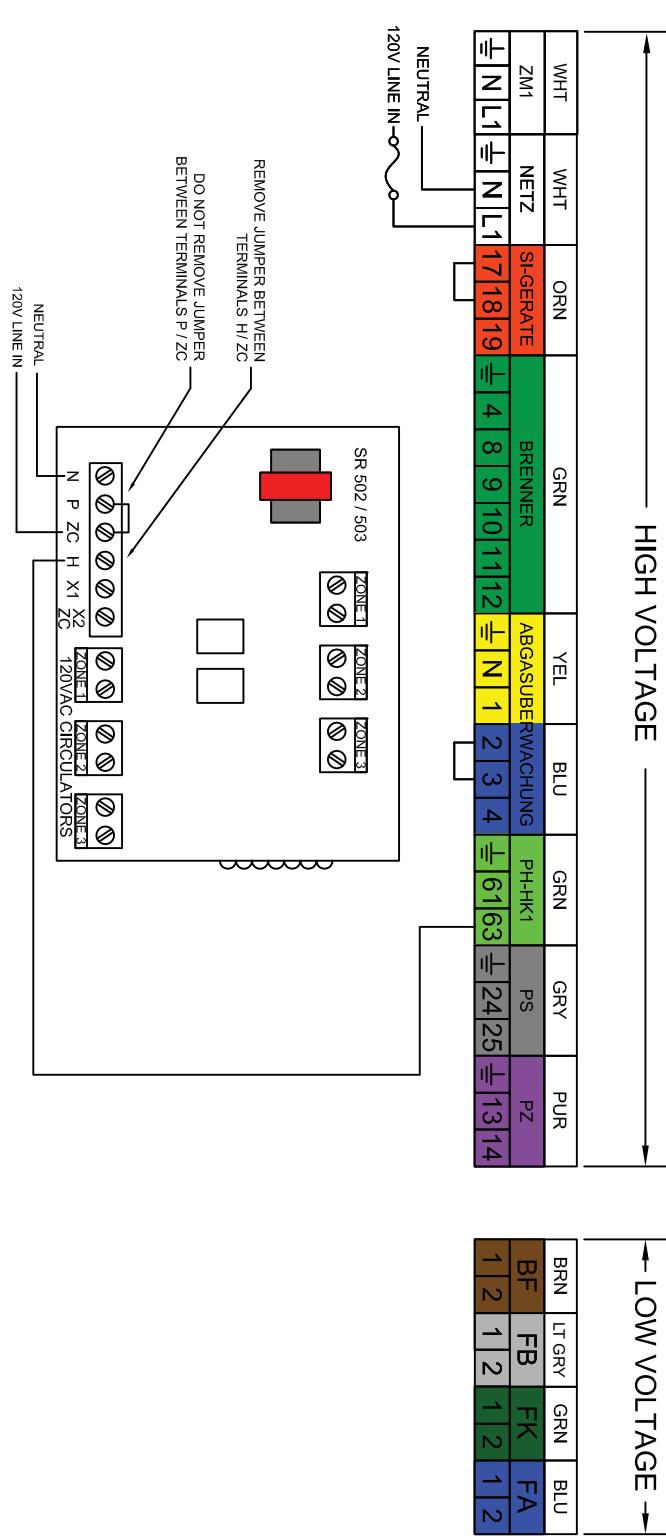
10 Multi-zone relay controls

Description

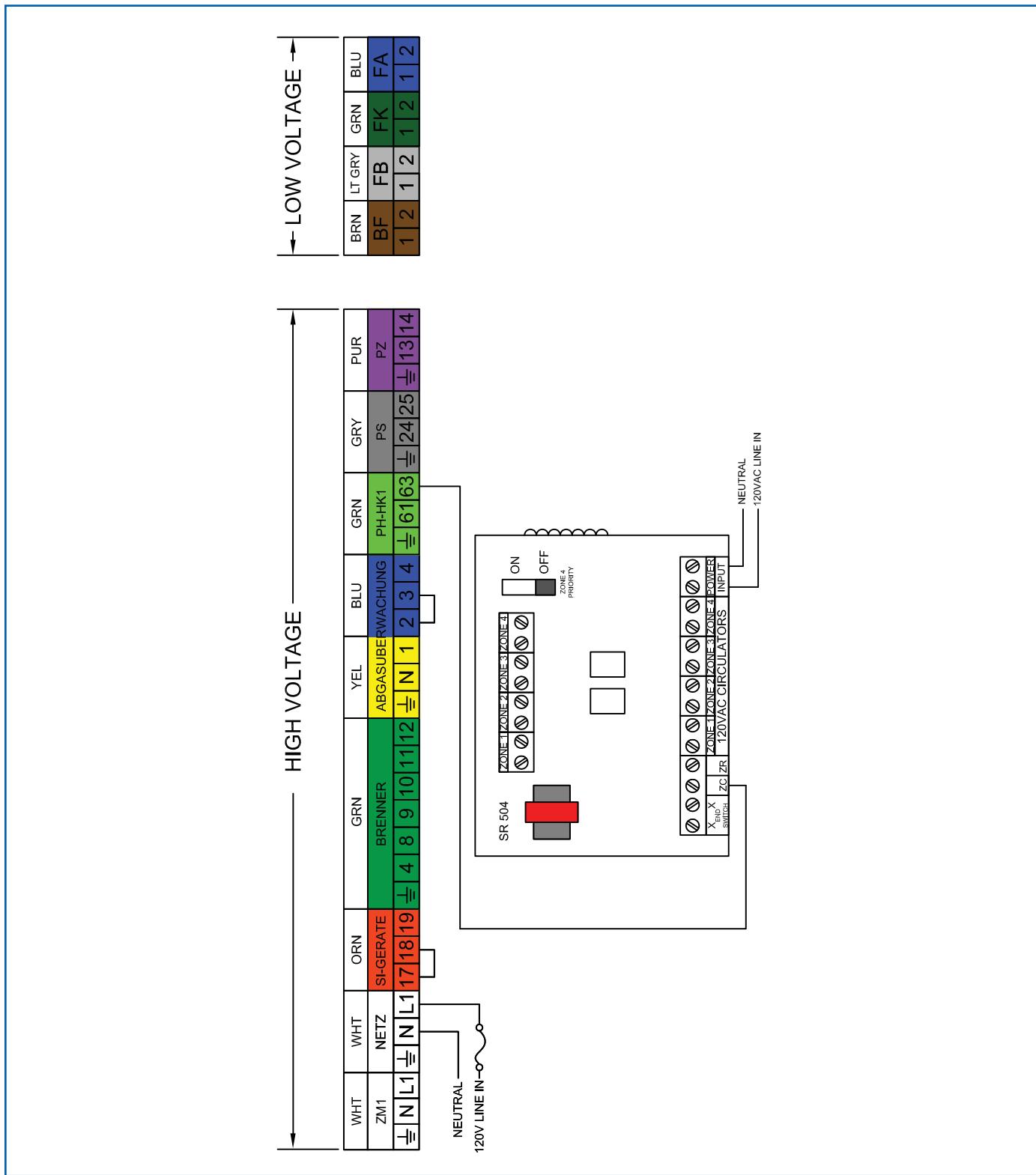
10.1 Multi-zone relay control wiring diagram for:
Taco models SR502, SR503 ([page 65](#))

10.2 Multi-zone relay control wiring diagram for:
Taco models SR504, SR506, SR503-EXP, SR504-EXP, SR506-EXP ([page 66](#))

10.1 Multi-zone relay control wiring diagram for: Taco models SR502, SR503



10.2 Multi-zone relay control wiring diagram for: Taco models SR504, SR506, SR503-EXP, SR504-EXP, SR506-EXP



11 Mixing

Description (page #)

11.1 Mixing Valves (*page 68*)

11.1.1 Mixing Valve Motor Wiring for:
24 volt wiring (*page 69*)

11.1 Mixing Valves

There are two types of mixing valves commonly used in hydronic heating systems, 3-port and 4-port. Both of these valves are used to mix return water from the system with water from the boiler. A motorized actuator is used to make adjustments to the valve positioning in order to maintain a given outlet temperature. This type of controlling provides very accurate control of water temperature to the system. It also allows the system water temperature to be reset based on changes in outdoor (and optionally indoor) temperature. Without the use of a motorized actuator, the outlet temperature of the valve is dependent on the flow rate and temperature of the incoming water. Using a manually set mixing valve without a motorized actuator can create wide swings in the outlet temperature.

3-port valve - Three port mixing valves allow system water to return directly to the heat source. Buderus generally recommends the use of 3 way mixing valves when using a Buderus boiler. Due to the flexibility and corrosion resistance of the Buderus boiler and the condensate protection feature of the Buderus control system, cooler return water temperature does not present a problem.

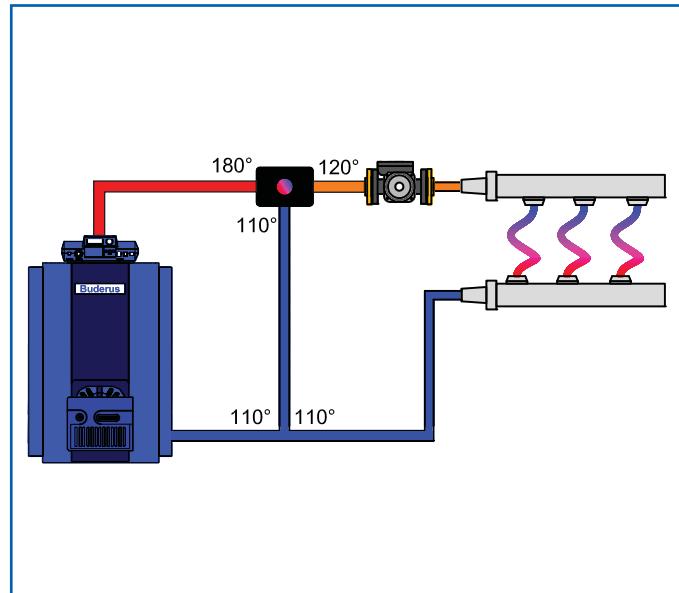
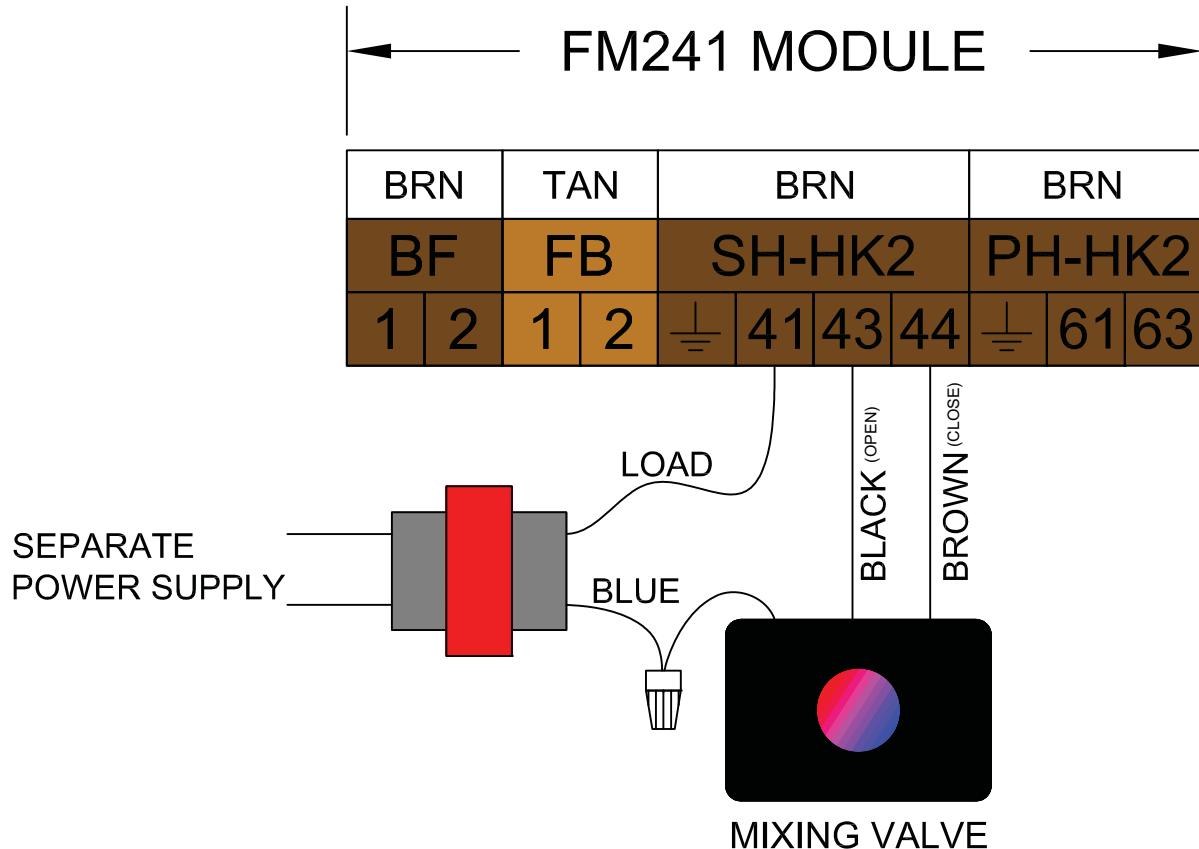


Figure 24 3 port valve

11.1.1 Mixing Valve Motor Wiring for: 24 volt wiring



12 Tables/Formulas

Flow Rate Calculations for Water		Table 1	
BTU/H	Temperature Drop		
	10	20	30
	GPM		
5,000	1	0.5	0.33
6,000	1.2	0.6	0.4
7,000	1.4	0.7	0.47
8,000	1.6	0.8	0.53
9,000	1.8	0.9	0.6
10,000	2	1	0.67
15,000	3	1.5	1
20,000	4	2	1.3
25,000	5	2.5	1.7
30,000	6	3	2
35,000	7	3.5	2.3
40,000	8	4	2.7
45,000	9	4.5	3
50,000	10	5	3.3
55,000	11	5.5	3.7
60,000	12	6	4
65,000	13	6.5	4.3
70,000	14	7	4.7
75,000	15	7.5	5
80,000	16	8	5.3
85,000	17	8.5	5.7
90,000	18	9	6
95,000	19	9.5	6.3
100,000	20	10	6.7
110,000	22	11	7.3
120,000	24	12	8
130,000	26	13	8.7
140,000	28	14	9.3
150,000	30	15	10
160,000	32	16	10.7
170,000	34	17	11.3
180,000	36	18	12
190,000	38	19	12.7

Flow Rate Calculations for Water		Table 2	
BTU/H	Temperature Drop		
	10	20	30
	GPM		
200,000	40	20	13.0
210,000	42	21	14
220,000	44	22	14.7
230,000	46	23	15.3
240,000	48	24	16
250,000	50	25	16.7
260,000	52	26	17.3
270,000	54	27	18
280,000	56	28	18.7
290,000	58	29	19.3
300,000	60	30	20
350,000	70	35	23.3
400,000	80	40	27.7
450,000	90	45	30
500,000	100	50	33.3

Mixing Valve Sizing			Table 3	
GPM (Radiant System)	ESBE 3-Way	ESBE 4-Way		
1 to 8	$\frac{3}{4}$ "	$\frac{3}{4}$ "		
9 to 14	1"	1"		
15 to 22	$1\frac{1}{4}$ "	$1\frac{1}{4}$ "		
23 to 40	$1\frac{1}{2}$ "	$1\frac{1}{2}$ "		
41 to 60	2"	2"		
61 to 125	$2\frac{1}{2}$ " *	$2\frac{1}{2}$ " *		
126 to 200	3" *	3" *		
* Requires VM83 motor and VL800 linkage				

Approx. Heat Output for Fin-Tube Baseboard Table 4

Average Water Temperature (°F)	BTU/Hr Per Lineal Ft @ 1GPM Flow Rate
90	65
100	106
110	156
120	209
130	262
135	290
140	320
150	380
160	450
170	510
180	580

Conversion Formulas

Table 6

Unit of Measure	Formula
Recovery time for an indirect water heater	$\frac{Q^*}{\text{Boiler Output (BTU/hr)}}$

* $Q(\text{Load}) = 8.31 \text{ (lbs/gal water)} \times \Delta T \times \text{Gallons}$

Table 6 Example:

53 gallon tank + 85,000 Btu/hr boiler

$8.31 \times 90 \text{ (degrees Rise)} \times 53 \text{ (gallons)} = 39,639 \text{ btu/hr}$

$39,639 / 85,000 \text{ (btu/hr)} = .466 \text{ (hour)}$

$.466 \text{ (hours)} \times 60 \text{ (minutes/hour)} = 28 \text{ (minutes)}$

Conversion Formulas

Table 5

Unit of Measure	Formula
GPM	$\frac{\text{BTU/hr}}{500 \times \Delta T \text{ (°F)}}$
BTU/hr	$500 \times \text{GPM} \times \Delta T \text{ (°F)}$
Pressure (PSI)	$\frac{\text{Head (ft)} \times 1 \text{ (Specific Gravity)}}{2.31}$
Head (feet)	$\frac{\text{Pressure(PSI)} \times 2.31}{1 \text{ (Specific Gravity)}}$
Fahrenheit	$(^{\circ}\text{C} \times 1.8) + 32$
BTU/hr	Kilowatts $\times 3,413$

Conversion Formulas

Table 7

Unit of Measure	Formula
Temperature drop through a series loop	$\frac{\text{New Supply Temp} - \text{Previous supply temp} - Q \text{ (Radiator)}}{500 \times \text{Loop GPM}}$

Table 7 Example:

Loop GPM = 2.5 $Q(\text{Radiant Output}) = 4,000 \text{ BTU}$

Starting Supply Temp = 180 degree

$180 - (4,000 / 500 \times 2.5) = 176.8^{\circ} \text{ (New supply temperature)}$

Heat Values

Table 8

Natural Gas	1 therm = 100,000 BTU
#2 Oil	1 gallon = 139,000 BTU
Propane	1 gallon = 91,800 BTU

Bosch Thermotechnology Corp.
65 Grove Street
Watertown, MA 02472
Tel.: 866-642-3198
Fax: 603-965-7581
www.boschheatingandcooling.com

Products manufactured by:
Bosch Thermotechnik GmbH
Sophienstrasse 30-32
D-35576 Wetzlar
www.buderus.de

Bosch Thermotechnology Corp. reserves the right to
make changes without notice due to continuing engineering
and technological advances.

BTC 463001101 C | 06/2018

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