

# System Operation

## Description of controls

ODR = Outdoor Reset Boiler Control - One Stage Boiler **SKU:256 Brand:** Tekmar

The ODR control is a device that measures the water temp in the Buffer Tanks and compares it with the outdoor temperature and determines whether to use the Gas Boiler or the water from the Buffer Tanks for central heating.

Mix Control = Mixing Control - Variable Speed **SKU:361 Brand:** Tekmar

The Mix Control varies the speed of the circulator bringing water in from the Buffer Tanks. It has a Separate ODR built in and operates the circulator at the appropriate speed to achieve the correct mixed water temp that the system requires at a given outdoor temperature.

Freeze Stat B = Single Stage ETC Temperature Control w/ Sensor, 120/240V Input (Includes 8' Cord) **SKU:ETC-111000-000 Brand:** Ranco

This Temp Controller is to prevent the Buffer Tanks from freezing. It will turn on the Gas Boiler, Freeze Circ B, Buffer Circ and the indoor gas boiler. That will bring hot water from the indoor boiler to warm up the tanks.

Freeze Stat A = Single Stage ETC Temperature Control w/ Sensor, 120/240V Input (Includes 8' Cord) **SKU:ETC-111000-000 Brand:** Ranco

This Temp Controller will measure the temps in the pipes outside of the Buffer Tank envelope and scavenge any residual heat from the tanks to keep the pipes from freezing. Freeze Stat A energizes the Wood Boiler Circ and Freez Circ A.

DHW Stat = Single Stage ETC Temperature Control w/ Sensor, 120/240V Input (Includes 8' Cord) **SKU:ETC-111000-000 Brand:** Ranco

This Temp Controller will measure the temperature of the water in the Buffer Tanks. On a call for DHW it will energize the indoor gas boiler, turn off the Buffer Circ if the water in the tanks is not a sufficient temp.

Taco Zone = Taco Priority Zoning Relay Module (existing)

This control receives signals from the thermostats and turns on the appropriate zone circ to provide heating for that zone. Any call from a thermostat will close the TT (dry contact end switch) terminals and send a call for heating to the system. Upon receiving a call to the priority TT terminals from DHW, it will turn off the zone circulators.

Indirect DHW = Aquastat (existing)

This aquastat maintains the temperature of the Indirect Water Heater. If the temp drops to low, it sends a signal to the system to provide high temperature water for DHW heating. That same signal will also energize the appropriate circulators and turn off any central heating calls. The central heating calls resume after the DHW is satisfied.

24 Volt Trans = Foot mounted 120/208/240 Vac Transformer w/ 9 in. Lead Wires (75VA) **SKU:AT175A1008 Brand:** Honeywell (native to control box)

This transformer provides 24 volts ac current for the low voltage controls.

Boiler = Indoor Gas Boiler

The Indoor Gas Boiler provides Central Heating and DHW when the Buffer Tanks cannot provide an adequate water supply temperature.

Buffer Circ = 0014 Cast Iron Circulator with Integral Flow Check, 1/8 HP **SKU:0014-F1-1IFC** **Brand:** Taco

This circulator brings water from the Buffer Tanks in to the system piping in the basement.

Freeze Circ B = Star S 21RFC, 3-Speed Cast Iron Star Series Circulator, 1/12 HP **SKU:4171560** **Brand:** Wilo

This circulator turns on when there is a call for freeze protection from Freeze Stat B. It provides flow between the closely spaced tees of both the boiler loop and buffer loop, allowing heated water from the indoor gas boiler to be transferred out to the buffer tanks.

DHW Circ = Existing

This circulator turns on to provide heating to the Indirect Water Heater

Freeze Circ A = Star S 21RFC, 3-Speed Cast Iron Star Series Circulator, 1/12 HP **SKU:4171560** **Brand:** Wilo

This circulator turns on in if there is a call from Freeze Stat A. It bypasses the Caleffi Mix valve and allows residual heat to be transferred from the buffer tanks to prevent the Wood Boiler piping from freezing.

Wood Boiler Circ = 0014 Cast Iron Circulator with Integral Flow Check, 1/8 HP **SKU:0014-F1-1IFC** **Brand:** Taco

This circulator provides flow between the Wood Boiler and the Buffer Tanks. It is controlled by the Wood Boiler with the exception of a call from Freeze Stat A

## Sequence of Operation

### Call for central heating

A thermostat will send a signal for heat to the Taco Zone Relay and energize the respective zone circulator. The TT end switch on the Taco Zone Relay will close sending a signal to the Relay Logic Box. The signal will be directed to the ODR control which will look at the outdoor temperature and compare it to the Buffer Tank temperature. If the Buffer Tank temperature is too low, the signal will be sent to the TT terminals on the indoor gas boiler and allow it to provide heating. The gas boiler will follow an internal ODR curve and also control its boiler circulator. In the event that the Buffer Tank temperature rises to meet the ODR demand, the signal to the TT terminals on the gas boiler will be disconnected and a signal will be sent to the Mix Control. The Mix Control will power the Buffer Circ to bring heat in from the buffer tanks. The Mix Control has an ODR curve built in. It will vary the speed of the Buffer Circ to achieve the target system water temperature as calculated by the ODR curve, in reference to outdoor ambient temperature.

### **Call for DHW**

If the Relay Logic Box receives a call for DHW from the Indirect Water Heater, it will disconnect the call for central heating from the Taco Zone Relay end switch. It will also send a signal to the Priority TT terminals on the Taco Zone Relay, which will turn off all the zone circulators. It energize the DHW circulator via Relay B. It will then send a signal to the DHW Stat on the Buffer Tanks. If the Buffer Tank temperature is 160°F or above, it will energize Relay A and turn the Buffer circulator to full speed. If the Buffer Tank temperature drops below 160°F, the Buffer circulator will turn off and a signal will be sent to the DHW TT terminals on the gas boiler to provide DHW heating.

### **Call from Freeze Stat A**

When this call becomes active, it means the water temperature in the Wood Boiler piping has dropped below 34°F. It will send a signal to Relay G and energize both the Wood Boiler circulator and Freeze Circ A. This will allow water to circulate through the Wood Boiler and pull any residual heat from the Buffer Tanks. Freeze Circ A is necessary to bypass the Caleffi Mix valve, which is in a bypass position at this temperature. This call will not affect indoor heating operations.

### **Call from Freeze Stat B**

When this call becomes active, it means the Buffer Tank temperature has dropped below 34°F. This will send a signal to the Relay Control Box and energize Relay L and Relay D. This will turn off all calls for central heating and DHW. It will then energize the Gas Boiler, the Buffer circulator (full speed) and Freeze Circ B. This will allow the Gas Boiler to be utilized to provide heated water to the Buffer Tanks and prevent them from freezing. Once the call goes away, the indoor system will resume normal operation.

## **Trouble shooting the Relay Logic Box**

The relays in the Relay Logic Control Box all have LED indicator lights to show whether a relay is engaged or not. The LED light will be on if the relay is engaged. The following will show which relays should be engaged, dependent on the system's current operation status. In order to test the control box, make sure that it only has one call at a time. This can easily be accomplished by turning off all thermostats and DHW stat and Freeze Stats. Then a jumper can be placed across the labeled terminals in the Relay Logic Control Box to simulate a call from the source of your choosing.

### **System off (no external demand)**

The relays should all be off. The electronic controls should all be powered.

### **Call for central heating**

#### **Sourcing from Buffer Tanks**

The following relays should be engaged.

Relay K

### **Sourcing from Gas Boiler**

The following relays should be engaged.

Relay K

Relay F

### **Call for DHW**

#### **Sourcing from Buffer Tanks**

The following relays should be engaged.

Relay H

Relay E

Relay B

Relay C

Relay A

#### **Sourcing from Gas Boiler**

The following relays should be engaged.

Relay H

Relay E

Relay B

### **Call from Freeze Stat A**

The following relays should be engaged.

Relay G

### **Call from Freeze Stat B**

The following relays should be engaged.

Relay L

Relay D

Relay I

Relay A

Relay J