

TRX and FTVN

Residential Condensing Gas Boiler

Cascade System Installation



Heat Exchanger Bears the ASME "H" Stamp

Included with TRX/FTVN Cascade Kit (p/n 87099):

Item #	Description	Quantity
1	BUS Connectors (p/n 87101)	8
2	SYS Connector (p/n 87102)	1
3	System Sensor (p/n 84010)	1
4	Instructions (p/n 87098)	1



87098 Revision Date 10.7.20

DANGER

This document is provided in addition to other documentation and does not replace the installation manual. This document must only be used by a qualified installer / service technician. Read all instructions in the installation manual before installing. Then, if installing a Cascade System, read these instructions. Only then proceed with installation. Perform steps in the given order. Failure to do so could result in substantial property damage, severe personal injury, or death.

WARNING

Improper installation, adjustment, alteration, service, or maintenance could void product warranty and cause property damage, severe personal injury, or death.

California Proposition 65 Warning: This product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

NOTICE

The manufacturer reserves the right to make product changes or updates without notice and will not be held liable for typographical errors in literature.

The surfaces of these products contacted by potable (consumable) water contain less than 0.25% lead by weight as required by the Safe Drinking Water Act, Section 1417.

Part 1 - Cascade Water Piping

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! WARNING

Failure to follow the piping instructions in the installation manual WILL VOID the warranty and may result in property damage, severe personal injury, or death.

Model	Number of Units Cascaded						
	2	3	4	5	6	7	8
TRX085	1.25"	1.5"	2"	2"	2"	2.5"	2.5"
TRX120 / 110C	1.25"	1.5"	2"	2"	2"	2.5"	2.5"
TRX150C	1.25"	1.5"	2"	2"	2"	2.5"	2.5"
TRX150	1.5"	2"	2"	2.5"	2.5"	3"	3"
TRX199 / 199C	1.5"	2"	2"	2.5"	2.5"	3"	3"

Model	Number of Units Cascaded						
	2	3	4	5	6	7	8
FTVN085	1.25"	1.5"	2"	2"	2.5"	2.5"	2.5"
FTVN110 / 110C	1.5"	2"	2"	2.5"	2.5"	2.5"	3"
FTVN150 / 150C	1.5"	2"	2"	2.5"	2.5"	3"	3"
FTVN199 / 199C	1.5"	2"	2"	2.5"	2.5"	3"	3"

Table 1 - Manifold Pipe Sizes in Inches – NOTE: The above pipe sizes are based on 20°F Delta and maximum water velocity between 5 - 6 ft/s

Piping Figure Notes:

NOTE: In piping applications utilizing a single zone, it is recommended that the installer use flow / check valves with weighted seats at or near the appliance to prevent gravity circulation.

NOTICE

Figures illustrate the basic plumbing concept of a cascade installation. Primary / Secondary is required to provide adequate flow for the secondary circuits.

CAUTION

A maximum of eight (8) models may be installed in a cascade system. Installing more than the maximum amount of boilers in a cascade system will result in system problems, property damage, and premature boiler failure. Such problems ARE NOT covered by product warranty.

On Boiler Only Heating Installation

Unless a boiler is connected to an Upstream IWH, cap the DHW fitting as indicated in the figures and disconnect the electrical connection of the 3-way valve motor while the boiler is operating in central heating mode. This will lock the valve motor in central heating mode and ensure freeze protection operates properly. Failure to disconnect the valve may disable boiler freeze protection and result in property damage.

In mixed temperature applications, a mixing valve is required for the protection of low temperature loops.

! WARNING

The piping will not support the weight of the circulators. Refer to the circulator manufacturer's instructions to properly support the circulator. Failure to comply with these instructions could result in property damage, severe personal injury, or death.

NOTES:

- These drawings are meant to show system piping concept only. Installer is responsible for all equipment and detailing required by local codes.
- Primary / Secondary Loop: All closely spaced tees shall be within 4 pipe diameters center to center spacing.
- A minimum of 6 pipe diameters of straight pipe shall be installed upstream and downstream of all closely spaced tees.
- The minimum individual boiler pipe size of DHW piping should be ¾" diameter and CH piping should be 1" in diameter.
- Circulators are shown with isolation flanges. The alternative is standard flanges with full port ball valves. Purge valves can be used with circulator flanges as an alternative.
- Piping shown is Primary/Secondary.
- Install a minimum of 12 diameters of straight pipe upstream of all circulators.
- Unit is equipped with built-in primary pump.** This pump is sized to ensure proper flow rate through the boiler heat exchanger and related piping provided the piping is done correctly.
- IWH Applications - a mixing valve is recommended if the DHW temperature is set above 119°F.

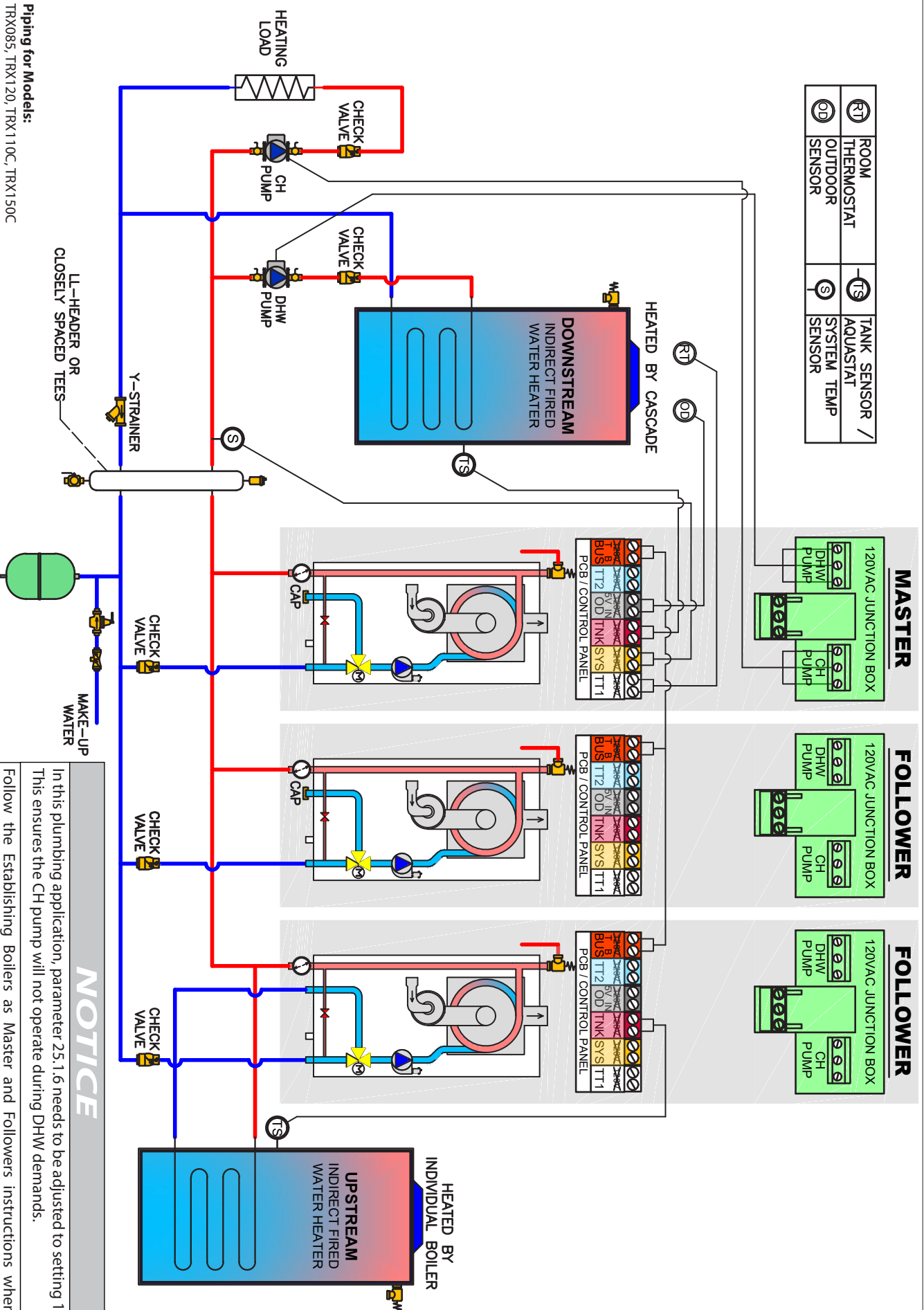


Figure 1 - Three (3) Cascaded Boilers with Upstream or Downstream Indirect Water Heater - Piping and Wiring for TRX085, TRX120, TRX110C, TRX150C Models ONLY

RT	ROOM THERMOSTAT	TS	TANK SENSOR / AQUASTAT
OD	OUTDOOR SENSOR	S	SYSTEM TEMP SENSOR

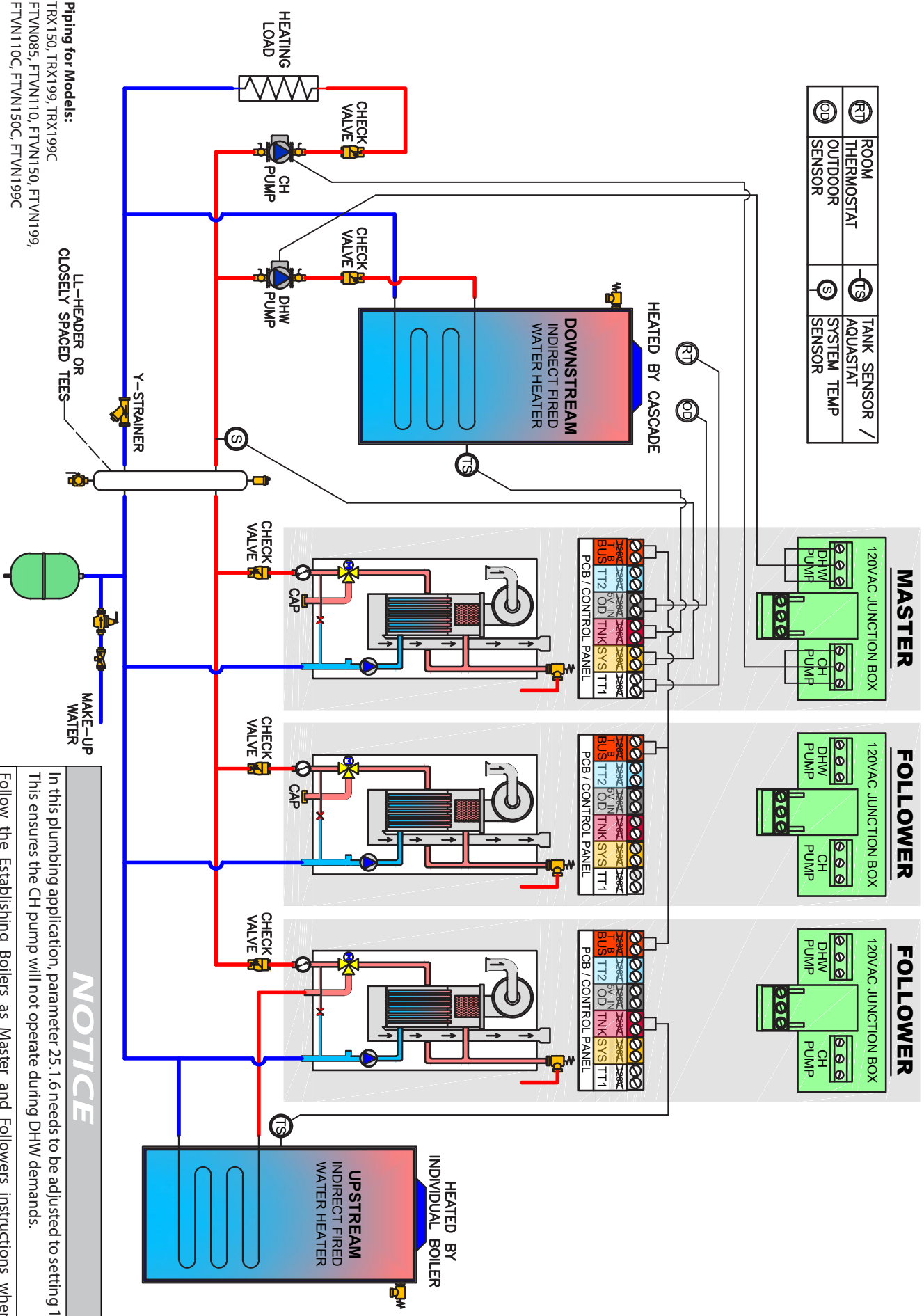


Figure 2 - Three (3) Cascaded Boilers with Upstream or Downstream Indirect Water Heater - Piping and Wiring for TRX150, TRX199, TRX199C, and all FTVN models ONLY

When setting up a cascade system, one boiler must be configured as a Master and the other boilers must be configured as Followers.

Establishing Boilers as Master and Followers:

NOTE: Disconnect the WiFi PCB on each Follower boiler prior to setting up the cascade system. Only the Master boiler should be connected to WiFi. See Figure 3.

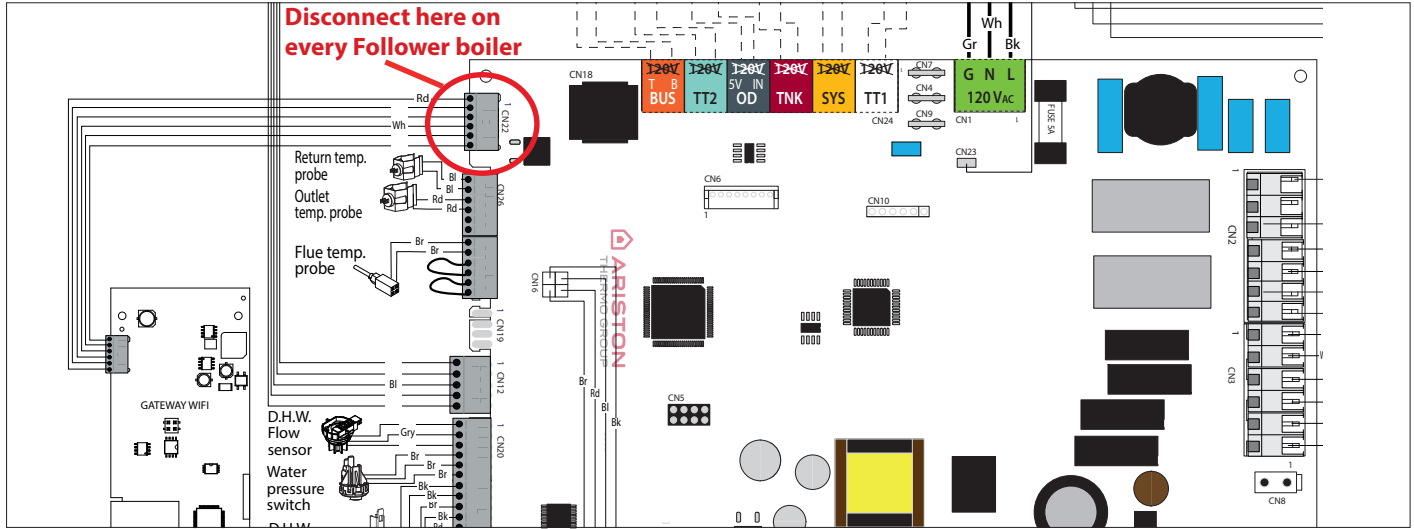


Figure 3 - Disconnect the WiFi PCB on each Follower Boiler

NOTE: Start with all boilers powered OFF and with no wires connected to each boiler's BUS connection.

- 1. Disconnect WiFi PCBs** - Permanently disconnect the WiFi PCB on each Follower boiler. Only the Master boiler can be connected to WiFi.
- 2. Establish the Cascade Master** - Connect power to the boiler chosen as the Master. Enter the Technical Menu and set parameter 0.4.6 = b-MAS. Connect the System Sensor at "SYS" of the Master boiler with the SYS connector. See Part 3 - Cascade Wiring. The System Sensor and SYS connector are included in this kit.
- 3. Establish Followers** - Connect power to the boiler chosen as Follower #1. Enter Technical Menu and set parameter 0.4.6 = b-FL1. Repeat for remaining Follower boilers, taking care to set a unique value for each Follower, e.g. "b-FL2" through b-FL7".
NOTE: Each Follower must have a unique address. Giving boilers the same address will result in a Configuration Conflict (CONFL) error code.
- 4. Establish Communication** - DISCONNECT POWER TO ALL BOILERS. Daisy-chain (connect in parallel) the BUS terminal of all boilers with the BUS connectors included in this kit. Take care to maintain the correct polarity of "B" and "T" terminals. Connect power to all boilers.

Program the Cascade System (Master Boiler):

The following parameters must be configured at the boiler configured as the Master (0.4.6 = b-MAS).

NOTE: Set parameter 0.4.6 prior to adjusting other settings using the Establishing Boilers as Master and Followers procedure. Menu level 25 is not accessible unless 0.4.6 is set to b-MAS.

Parameter	Description	Value	Default Setting
0.4.6	Cascade Boiler Address (Master boiler must be set to b-MAS)	UNDEF = undefined, b-SIN = single boiler, b-MAS = master boiler, b-FL1 = Follower #1 boiler, b-FL2 = Follower #2, b-FL3 = Follower #3, b-FL4 = Follower #4, b-FL5 = Follower #5, b-FL6 = Follower #6, b-FL7 = Follower #7	b-SIN
2.0.1	DHW Preheating	0 = Disabled, 1 = Enabled	1
	Enables / disables DHW Comfort Function on Combi models (not applicable to non-Combi models) - see par. 25.2.1. NOTE: When connected to a cascade system, DHW COMFORT Function is automatically turned on.		
2.2.8	Combi Models - DO NOT MODIFY	0 = Combi	0
	Non-Combi Models	1 = Storage with Tank Sensor	2
	Type of DHW control for Upstream IWH	2 = Storage with Aquastat	
	Applicable when an Upstream IWH is connected directly to the Master boiler. Not applicable for Combi models. NOTE: An Upstream IWH cannot be connected to a Master boiler when there is a Downstream / System IWH, i.e. when 25.2.2 = 1 or 2.		
2.10.3	Emergency Setpoint	68-179°F	113°F
	Sets Master boiler operating temperature when there is a malfunction of the BUS circuit. Can also be adjusted via the CH +/- buttons of the respective boiler, while operating in Emergency mode.		
4.2.0	Temperature Range of CH System (Zone 1 – TT1)	0 = Low Temp (68-122°F) 1 = High Temp (86-179°F)	1
	Establishes range of parameters 4.2.5 and 4.2.6. Refer to parameter 5.2.0 and 6.2.0 for CH Zone 2 and 3.		
4.2.5	Maximum CH Temperature Setting (Zone 1 – TT1)	68-122°F (when 4.2.0 = 0) 86-179°F (when 4.2.0 = 1)	120 (4.2.0 = 0) 179 (4.2.0 = 1)
	Sets the maximum allowable boiler operating temperature for CH Zone 1, limiting Automatic Temperature Control and manual adjustment from the User Menu. Refer to parameter 5.2.5 and 6.2.5 for CH Zone 2 and 3.		

Parameter	Description	Value	Default Setting
4.2.6	Minimum CH Temperature Setting (Zone 1 – TT1)	68-122°F (when 4.2.0 = 0) 86-179°F (when 4.2.0 = 1)	80 (4.2.0 = 0) 120 (4.2.0 = 1)
	Sets the minimum allowable boiler operating temperature for CH Zone 1, limiting Automatic Temperature Control and manual adjustment from the User Menu. Refer to parameter 5.2.6 and 6.2.6 for CH Zones 2 and 3.		
25.1.6	System CH Pump Activation Logic	0 = System CH pump runs for CH and DHW demands 1 = System CH pump only runs during CH demands	0
	For applications configured as illustrated in Figures 1 and 2, where the System CH pump must be off during DHW demands, configure 25.1.6 = 1.		
25.2.0	DHW Setpoint Temperature	97-140°F (Combi models) 104-140°F (Non-Combi models)	125
	Establishes DHW temperature for the entire cascade system, including Combi boilers and Upstream IWH connected to individual boilers. Not applicable to Downstream IWH when Master parameter 25.2.2 = 2, or to Upstream IWH connected to Follower when parameter 34-40.2.8 = 2, or Master when parameter 2.2.8 = 2 (and 25.2.2 = 0). Also settable by pressing the DHW +/- buttons from the home screen.		
25.2.2	System DHW Mode (Applicable to Downstream IWH)	0 = CH Only 1 = Storage with Tank Sensor 2 = Storage with Aquastat	0
	With 25.2.2 = 0, the Master boiler can be configured to heat an Upstream IWH connected only to the Master boiler. In this case, choose the DHW activation device (Tank Sensor or Aquastat) via parameter 2.2.8.		
25.2.6	System DHW Charging Priority	0 = Alternating 1 = Timed Concurrent / Alternating 2 = Concurrent	0
	0 = Alternating – DHW and CH will not operate simultaneously. Priority switches between DHW and CH at an interval defined by the CH/DHW Shifting Priority Time (parameter 25.0.8); first priority is DHW. If 25.0.8 = 0, then DHW has priority indefinitely. 1 = Timed Concurrent / Alternating – DHW and CH operate simultaneously for the period defined by the CH/DHW Shifting Priority Time (parameter 25.0.8). After the time elapses operation returns to Alternating until the end of the DHW request. 2 = Concurrent – DHW and CH can operate simultaneously indefinitely.		

Table 2 - Critical cascade parameters to be configured at the Master boiler. See E. Complete Cascade Technical Menu Parameters for a complete list of parameters.

Program the Cascade System (Followers):

The following parameters must be configured at the each Follower boiler (0.4.6 = b-FL1 - 7).

NOTE: Set parameter 0.4.6 prior to adjusting other settings using the Establishing Boilers as Master and Followers procedure. Each Follower must be set to a unique address, i.e., Follower #1 to b-FL1, Follower #2 to b-FL2, etc.

NOTE: Menu level 34 is applicable to Follower #1 (0.4.6 = b-FL1); menu levels 35 to 40 are applicable to Followers #2 to 7 respectively. For clarity, the follow table omits menu levels 35 through 40.

Parameter	Description	Value	Default Setting
0.4.6	Cascade Boiler Address (Follower boilers must be set to b-FL1, 2 - 7)	UNDEF = undefined, b-SIN = single boiler, b-MAS = master boiler, b-FL1 = Follower #1 boiler, b-FL2 = Follower #2, b-FL3 = Follower #3, b-FL4 = Follower #4, b-FL5 = Follower #5, b-FL6 = Follower #6, b-FL7 = Follower #7	b--SIN
34.0.1	DHW Preheating	0 = Disabled, 1 = Enabled	1
	Enables / Disables DHW Comfort Function on Combi models (not applicable to non-Combi models) see par. 25.2.1. NOTE: When connected to a cascade system, DHW Comfort Function is automatically turned on.		
34.2.8	Combi Models - DO NOT MODIFY	0 = Combi	0
	Non-Combi Models Type of DHW control for Upstream IWH	1 = Storage with Tank Sensor 2 = Storage with Aquastat	2
	Applicable when an Upstream IWH is connected directly to the individual Follower boiler. Not applicable for Combi models.		
34.10.3	Emergency Setpoint	68-179°F	113°F
	Sets Follower boiler operating temperature when communication with Master is lost. Can also be adjusted via the CH +/- buttons of the respective boiler, while operating in Emergency mode.		

Table 3 - Critical cascade parameters to be configured at each Follower boiler. See E. Complete Cascade Technical Menu Parameters for a complete list of parameters.

! WARNING

Install wiring and electrically ground boiler in accordance with the installation manual, the authority having jurisdiction or, in the absence of such an authority, follow the National Electrical Code, NFPA 70, and/or CSA C22.1 Electrical Code-Part 1 in Canada. Failure to follow all applicable local, state, and national regulations, mandates, and building supply codes for guidelines to install the electrical power supply could result in property damage, serious personal injury, or death.

ELECTRICAL SHOCK HAZARD – To ensure safety, turn off electrical power supply at service entrance panel before making any electrical connections to avoid possible electric shock hazard. Failure to do so could result in property damage, serious personal injury, or death.

Jumping out control circuits or components **WILL VOID** product warranty and can result in property damage, personal injury, or death.

It is of extreme importance that this unit be properly grounded. It is very important that the building system ground is inspected by a qualified electrician prior to making this connection. Electrical power must only be turned on when the boiler is completely filled with cold water. Failure to follow these instructions could result in component or product failure, serious injury, or death.

! CAUTION

Label all wires prior to disconnecting when servicing the boiler. Wiring errors can cause improper and dangerous operation. Failure to follow these instructions may result in property damage or personal injury.

CAUTION

NOTE: Some newer thermostat models may draw too much power from the boiler and will require an additional power supply to operate properly. Review the instructions provided with the thermostat to determine if an additional power supply is needed. Failure to do so could result in improper boiler and/or thermostat operation.

DO NOT CONNECT 120V TO ANY CONTROL WIRING CONNECTION! DOING SO WILL RESULT IN IMPROPER OPERATION AND POSSIBLE DAMAGE TO THE BOILER. SUCH DAMAGES ARE NOT COVERED BY PRODUCT WARRANTY!

NOTE: Figures 1 and 2 are provided as further references for wiring cascade systems.

1. Connecting Power (120V) for DHW and CH Circulators

NOTE: The CH and downstream IWH circulators **MUST BE CONNECTED** to the Master Boiler to ensure proper operation.

To connect power for the CH and DHW external pump at the boiler junction box:

1. Shut off the power supply at the boiler and at the circuit breaker.
2. Shut off the gas at the manual shutoff.
3. Remove the boiler front cover.
4. Disconnect the three clips and open the junction box
5. Insert the circulator power cable through the hole in the side panel; use an appropriate strain relief/conduit hub to secure the cable to the side panel.
6. Connect the cable on the connector CN5 (CH pump) and CN4 (DHW pump). See Electrical Wiring Diagram, Figure 4.

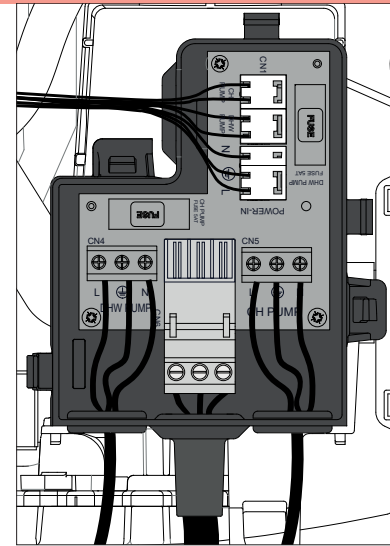


Figure 4 - 120V Connections for DHW and CH Circulators

7. Verify that the new cable is correctly positioned inside the control panel.
8. Reconnect the cover of the junction box.
9. Reinstall the boiler front cover
10. Restore gas to the boiler.
11. Restore power to the boiler.

2. Low Voltage Wiring Connections

To access the low voltage wiring connections:

1. Shut off the power supply at the boiler and at the circuit breaker.
2. Shut off the gas at the manual shutoff.
3. Remove the boiler front cover.
4. Remove the screw securing the control panel to the cross-member (not applicable for TRX085, 120, 110C, and 150C models).
5. Push in the tabs and pull the control panel housing forward.
6. Disconnect the two clips. See Figure 5.

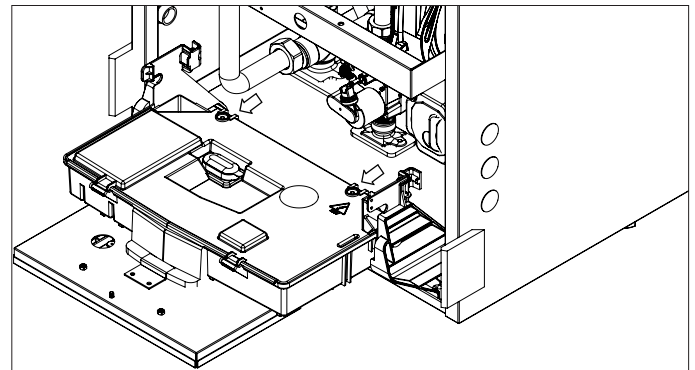


Figure 5 - Releasing the Two Clips

7. Open the control panel cover to have access to the main PCB. See Figure 6.

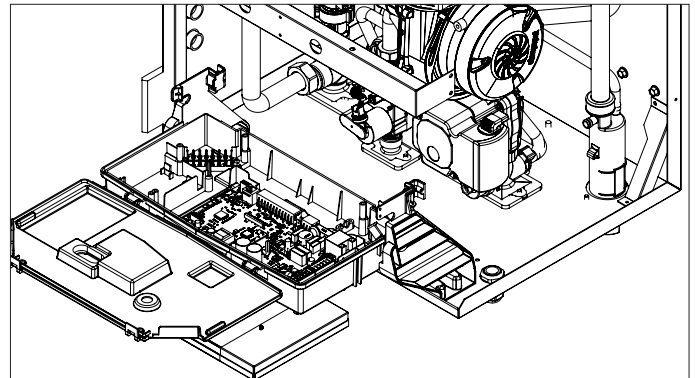


Figure 6 - Access to Low Voltage Wiring Connections

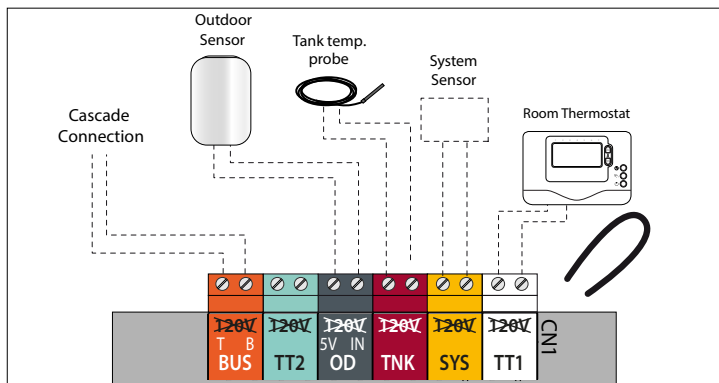


Figure 7 - Low Voltage Wiring Connections

3. Wiring a Cascade System

NOTE: Disconnect the WiFi PCB on each Follower boiler prior to setting up the cascade system. Only the Master boiler should be connected to WiFi.

NOTE: Use the Establishing Boilers as Masters and Followers procedure, outlined in Part 2, when connecting boilers together on the BUS.

Master Boiler Low Voltage Wiring	
BUS	BUS Network - Communication between cascaded boilers (up to 8) and/or NTI Room Sensors (up to 3) and/or one NTI Multifunctional Kit. Maintain correct polarity of "B" and "T" terminals. Use a minimum of 20 AWG cable, preferably twisted pair, up to a maximum of 164 feet.
TT2	Room Thermostat 2 - Dry contact input for System CH Zone 2 demands. Parameters 5.1.0 through 5.7.5 are applicable to Zone 2 demands. NOTE: Zone 1 (TT1) demands take priority over Zone 2 (TT2) demands.
OD	Outdoor Sensor - Connect to factory provided outdoor sensor to allow Automatic CH Temperature Control (or connect Master boiler to WiFi and use Internet Weather).
TNK	Tank Sensor or Aquastat - Connect to a tank sensor or Aquastat installed in a Downstream IWH heated by the entire cascade system and set via 25.2.2. Or, installed in an Upstream IWH connected to the Master boiler and set via 2.2.8. NOTE: The Master boiler cannot heat both a Downstream and an Upstream IWH. NOTE: If 25.2.2 = 1 or 2, the Master boiler considers the IWH to be Downstream and uses the entire cascade to service it - regardless of the setting of parameter 2.2.8.
SYS	System Sensor - Connect to a system sensor installed on the supply line of the secondary loop - DO NOT INSTALL IN PRIMARY LOOP. NOTICE: Failure to install a system sensor will cause the cascade system to operate in Emergency Mode.
TT1	Room Thermostat 1 - Dry contact input for System CH Zone 1 demands. Parameters 4.1.0 through 4.7.5 are applicable to Zone 1 demands. NOTE: Zone 1 demands (TT1) take priority over Zone 2 (TT2) demands.

NOTICE

Take care to route the BUS communication cables and other low voltage wiring away from line voltage cables to avoid electrical interference which can cause operation issues or damage the main PCB.

CAUTION

Ensure cascade wiring between boilers always runs from the BUS "T" connection to the next BUS "T" connection, and BUS "B" connection to the next BUS "B" connection. "T" to "T"; "B" to "B".

Failure to follow these instructions will result in improper system operation, wasted time, money, and possible property damage and personal injury. Such damages ARE NOT covered by product warranty.

Follower Boiler Low Voltage Wiring	
BUS	BUS Network - Communication between cascaded boilers (up to 8) and/or NTI Room Sensors (up to 3) or one NTI Multifunctional Kit. Maintain correct polarity of "B" and "T" terminals. Use a minimum of 20 AWG cable, preferably twisted pair, up to a maximum of 164 feet.
TT2	Auxiliary Limit Switch Input - Input does not function as a CH Zone 2 input, but functions as a limit switch input with parameter 34-40.2.3 = 0.
OD	Not Applicable - Input does not function on Follower boilers.
TNK	Tank Sensor or Aquastat - Connect to a tank sensor or Aquastat installed in an Upstream IWH connected to the respective Follower boiler. Set to Tank Sensor or Aquastat via parameter 34-40.2.8.
SYS	Not Applicable - Input does not function on Follower boilers.
TT1	Not Applicable - Input does not function on Follower boilers.

A. Master Boiler Homescreen Overview

When viewing the Cascade Master Homescreen, the following screens will appear on the display and alternate every three (3) seconds.

Master Homescreen 1 - Overall System Details

This screen signifies that this is a master boiler with two (2) followers: A three (3) boiler cascade system. The CASCADE text below further lets the user know that this is a cascade system. The system is currently meeting a CH Zone 1 demand. The bars to the left and right of the screen detail how close the DHW and CH temperatures are to the setpoint.

MAS Denotes Master Boiler Flame Detected with Power Level Denotes a Three (3) Boiler System

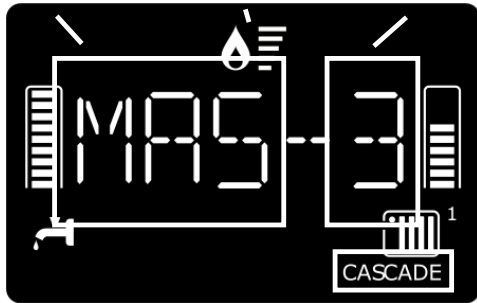


Figure 8 - Master Homescreen 1 - Overall System Detail

Master Homescreen 2 - System Temperature

This screen displays the current temperature read by the cascade System NTC Sensor. 138°F is displayed below.

SY Denotes System Sensor Current Temp Read by System Sensor

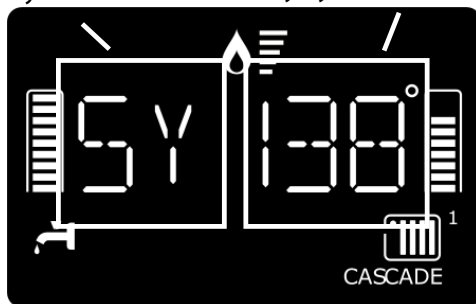


Figure 9 - Master Homescreen 2 - System Temperature

Master Homescreen 3 - Boiler Supply Temperature

This screen displays the current temperature read by the master boiler supply sensor. 150°F is displayed below.

bL Denotes Boiler Supply Sensor Current Temp Read by Boiler Supply Sensor

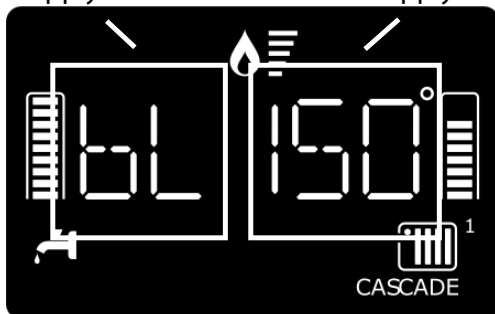


Figure 10 - Master Homescreen 3 - Boiler Supply Temperature

This screen displays if the master boiler is turned off with the ON/OFF button.



Figure 11 - Master Homescreen 3 - Boiler Off

NOTE: The screen will continue to rotate between the five (5) homescreens. The Supply Temperature screen will indicate "bLOFF".

Master Homescreen 4 - Cascade Master Operating Power Level

This screen displays the current operating power level percentage of the cascade master. A power level of 50% is displayed below.

PL Denotes Boiler Power Level Current Cascade Master Power Level Percentage

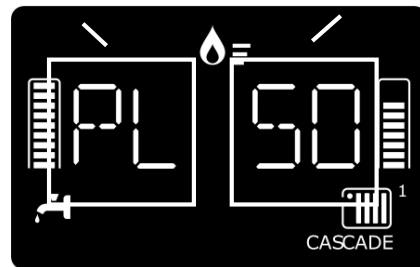


Figure 12 - Master Homescreen 4 - Cascade Master Power Level

Master Homescreen 5 - Current Indirect Water Heater Tank Temperature / Aquastat Status (of Downstream/System IWH)

This screen displays the current temperature read by a connected DHW NTC Tank Sensor. 120°F is displayed below.

TK Denotes DHW Tank Status Current Temperature Read by Sensor



Figure 13 - Master Homescreen 5 - Current Temperature Read by DHW Sensor

This screen displays if an aquastat is connected. ON will appear if there is a DHW demand; OFF if there is no demand.

TK Denotes DHW Tank Status Current Aquastat Status



Figure 14 - Master Homescreen 5 - Current Status of the DHW Aquastat

B. Follower Boiler Homescreen Overview

When viewing the display on a specific follower boiler the following homescreens will appear and alternate every three (3) seconds.

Follower Homescreen 1 - Boiler Details

This screen signifies that this is a follower boiler and its reference number is "2".

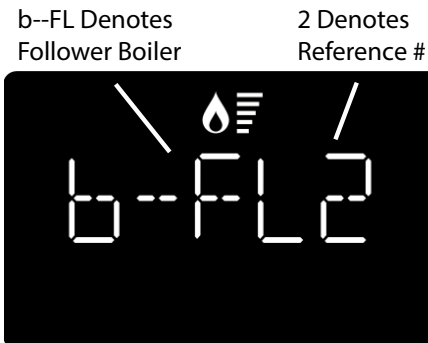


Figure 15 - Follower Homescreen 1 - Boiler Details

Follower Homescreen 2 - Boiler Supply Temperature

This screen displays the current temperature read by the follower boiler supply sensor. 140°F is displayed below.

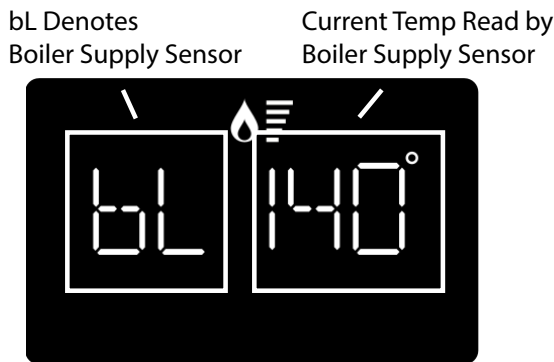


Figure 16 - Follower Homescreen 2 - Boiler Supply Temperature

This screen displays if the follower boiler is turned off with the ON/OFF button.



Figure 17 - Follower Homescreen 2 - Boiler Off

NOTE: The screen will continue to rotate between the five (5) homescreens. The Supply Temperature screen will indicate "bLOFF".

Follower Homescreen 3 - Boiler Operating Power Level

This screen displays the current operating power level percentage of the follower boiler. A power level of 40% is displayed below.

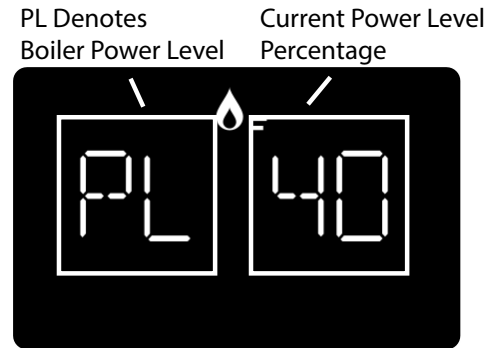


Figure 18 - Follower Homescreen 3 - Boiler Power Level

Follower Homescreen 4 - Indirect Water Heater Tank Temperature / Aquastat Status (of Upstream /Local IWH)

This screen is only displayed on the follower if it is connected to a DHW NTC Tank Sensor or Aquastat. This screen displays the current temperature read by a connected DHW NTC Tank Sensor. 120°F is displayed below.

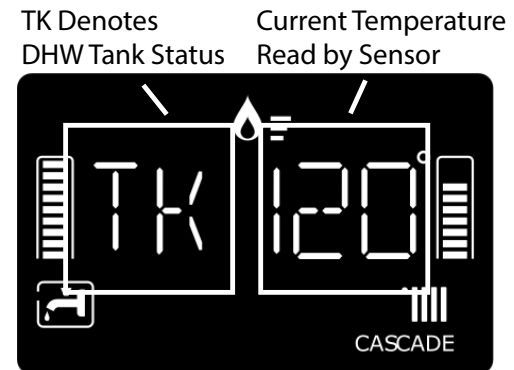


Figure 19 - Follower Homescreen 4 - Current Temperature Read by DHW Sensor

This screen displays if an aquastat is connected. ON will appear if there is a DHW demand; OFF if there is no demand.

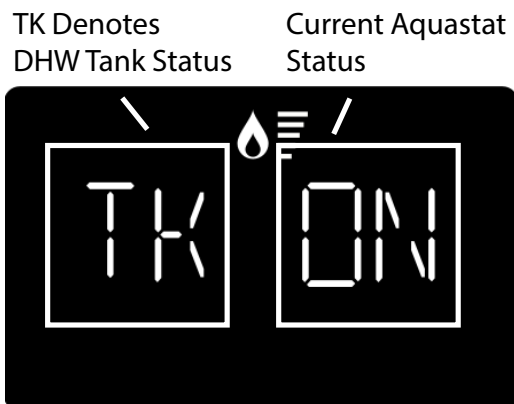


Figure 20 - Follower Homescreen 4 - Current Status of the DHW Aquastat

C. Technical Menu - Cascade Master Menu Structure

The technical menu levels and parameter selection options for boilers configured as Master and Followers are different than those configured as standalone boilers. The differences are as follows:

Master Boiler – Retains the technical menu levels available in a standalone boiler while adding menu level 25 for parameters specific to Cascade Management. **NOTE:** Some parameters normally accessed via menu levels 2 and 8 for a single boiler are now accessed via the Cascade Management menu – see below:

- Automatic Temperature Control moves from 2.2.4 to 25.1.0
- Outdoor Temperature Reading Correction: from 2.4.9 to 25.1.1
- CH Boost Interval: from 2.4.4 to 25.1.2

- DHW Setpoint Temperature: from 2.0.0 to 25.2.0
- DHW Comfort Function: from 2.5.0 to 25.2.1
- Anti-legionella Function: from 2.5.7 to 25.2.3
- CH Supply Setpoint (diagnostic – read only): from 8.3.0 to 25.3.0
- Outdoor Temperature (diagnostic – read only): from 8.3.5 to 25.3.2

Follower Boiler – Retains technical menu level 0 for setting the boiler address. Loses menu levels 4, 5, and 6 normally used for managing CH settings (Followers do not manage CH), and moves menu levels 2 and 8 to new menu level 34 (for Follower 1) [35-40 for Follower 2-7].

NOTE: The Master boiler also has access to the Follower menu of each Follower in the cascade system.

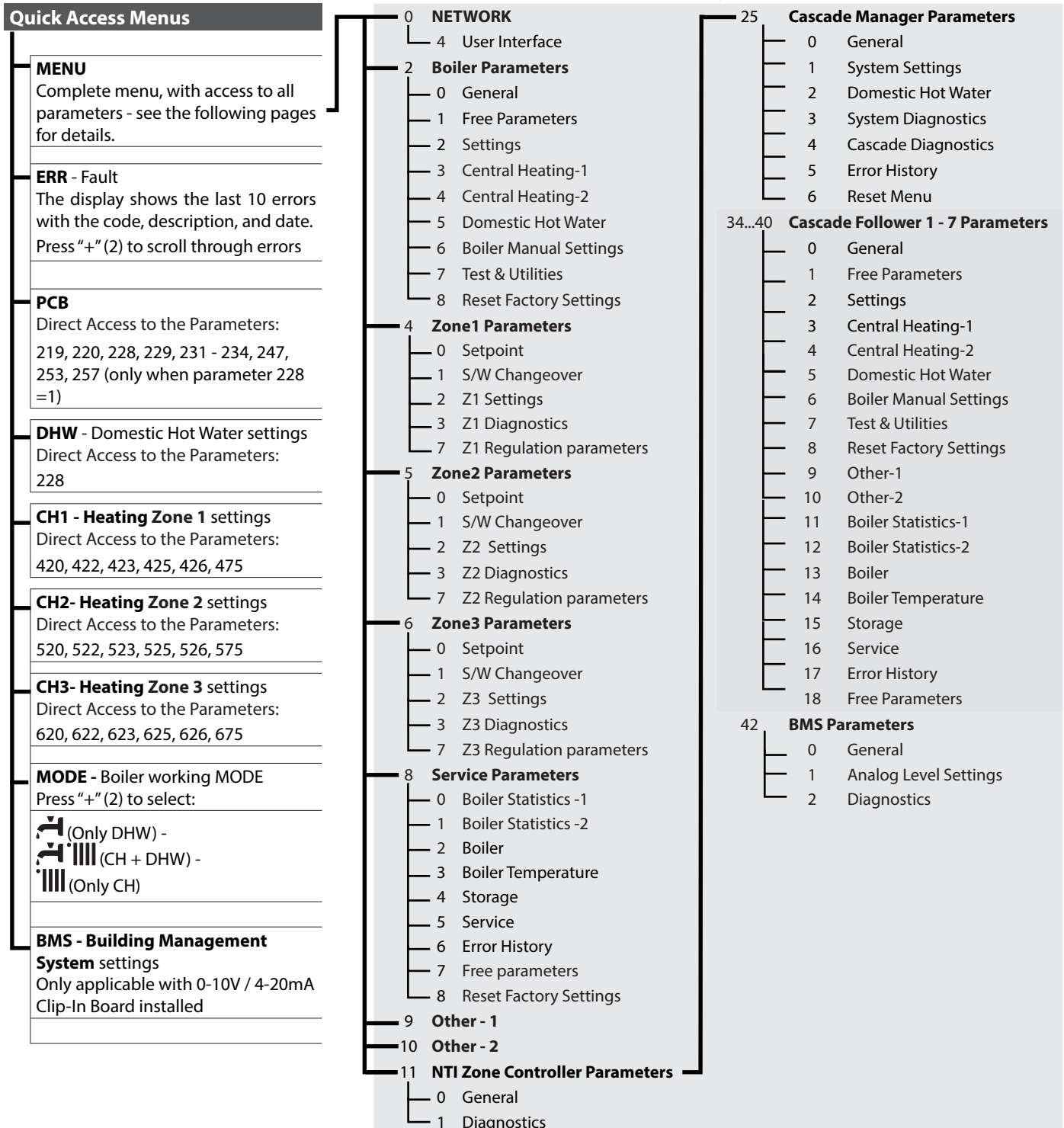


Figure 21 - Menu Structure

D. Technical Menu - Cascade Follower Menu Structure

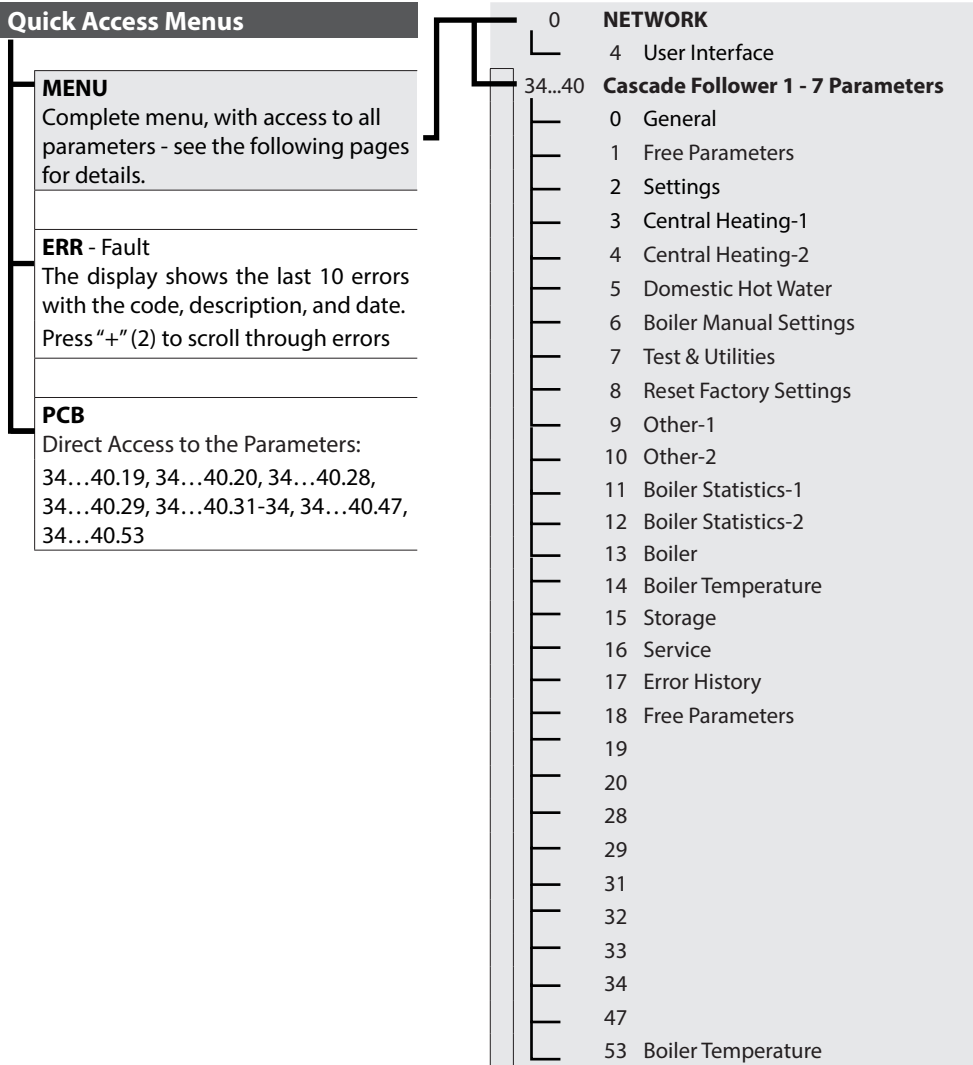


Figure 22 - Follower Menu Structure

E. Complete Cascade Technical Menu Parameters

Menu	Sub-Menu	Parameter	Description	Value	Default Setting
ACCESS the Complete Menu					
			1. Simultaneously press the "+" and "-"  buttons for 5 seconds. The display shows 222 . 2. Press the "+"  button to select 234 , the service code . 3. Press the OK button. The display shows the first "quick setting" PCB . 4. Press the "+"  button until the display shows MENU . 5. Press the OK button to access the complete menu.		
2	7	7	Burning Hours Harmonization		
			Sets the burner run hours statistics to equal the average of the other boilers in the cascade. Used when replacing the PCB on the Master boiler. Perform this function ONLY on the boiler where the PCB has just been replaced.		
25	CASCADE MANAGEMENT				
25	0	GENERAL			
25	0	0	Max CH Adjustable Power Percentage	0 - 100	100
			Maximum Total Cascade CH Power		
25	0	1	Max DHW Adjustable Power Percentage	0 - 100	100
			Maximum Total Cascade DHW Power		
25	0	2	Cascade Manager Turnover Logic	0 = Minimum Switches Off - On 1 = Maximum Power Division	0
25	0	3	Cascade Manager Turnover Hysteresis	0 - 20%	2
			Sets the difference in power level between switching on and switching off the next boiler. See 25.0.4 and 25.0.5.		
25	0	4	Cascade Manager Min Turnover Level	0 - par. 25.0.5 (%)	20
			Sets the power level threshold where the next boiler is switched off. Switches off if required power is < 25.0.4 - 25.0.3. To avoid short-cycling, ensure 25.0.4 is set to less than half of 25.0.5 setting. Applicable only when parameter 25.0.2 = 0.		
25	0	5	Cascade Manager Max Turnover Level	par. 25.0.4 - 100 (%)	70
			Sets the power level threshold where the next boiler is switched on. Switches on if required power is > 25.0.5. Switches off if required power is < 25.0.5 - 25.0.3. Off logic only applicable if parameter 25.0.2 = 1.		
25	0	7	CH On Differential Temperature	0 - 36°F	11
			Determines how much the System temperature can drop below target before turning the cascade back on.		
25	0	8	CH/DHW Shifting Priority Time	0 - 1440 minutes	45
			NOTE: See 25.2.6 - System DHW Charging Priority		
25	1	SYSTEM SETTINGS			
25	1	0	Automatic Temperature Control	0 = OFF, 1 = ON	1
			Normally managed via par. 2.2.4 for a standalone boiler.		
25	1	1	Outdoor Temperature Reading Correction	-5 - +5°F	0
			Normally managed via par. 2.4.9 for a standalone boiler.		
25	1	2	CH Boost Interval	0 - 60 (minutes)	16
			Sets the time delay between the automatic adjustments of the boiler target temperature in increments of +/- 7°F (normally managed via par 2.4.4 for a standalone boiler). Only applicable when the type of temperature control is set to Basic Temp. Control (Parameter 4.2.1 - 5.2.1 - 6.2.1 = 1)		
25	1	3	Plant Frost Protection	0 = OFF, 1 = ON	0
			CH system pump operates 10 minutes every 6 hours when outdoor temp = < 25°F; operates continuously when outdoor temp < 23°F.		
25	1	5	System Pump Overrun	0 - 15 minutes or OC (On Continuously)	5
25	1	6	System Pump Activation Logic	0 - 1	1
			0 = Always Active – System pump runs for CH and DHW demands 1 = Only CH – System pump only runs during CH demands		

Menu	Sub-Menu	Parameter	Description	Value	Default Setting
25	2	DOMESTIC HOT WATER - Applicable for Downstream / System IWH			
25	2	0	DHW Setpoint Temperature Combi Models	97 - 140°F	125
			DHW Setpoint Temperature Non-Combi Models	104 - 140°F	125
			Establishes DHW temperature for the entire cascade system, including Combi boilers and Upstream IWH connected to individual boilers. Not applicable to Downstream IWH when Master parameter 25.2.2 = 2, or to Upstream IWH connected to Follower when parameter 34-40.2.8 = 2, or Master when parameter 2.2.8 = 2 (and 25.2.2 = 0). Also settable by pressing the DHW +/- buttons from the home screen.		
25	2	1	DHW Comfort Function (only applicable to Combi Models)	2 = Always On	2
			Comfort function keeps the DHW heat exchanger of a Combi boiler warm when a DHW demand is not active, thereby reducing the amount of time needed to heat the hot water when a demand occurs. Function activates conditionally once per Comfort Anti-Cycling Time, par 2.5.1 on the Master boiler, par. 34-40.5.1 on Follower boilers. To deactivate DHW Comfort Function of a Master boiler set par 2.0.1 = 0. To deactivate DHW Comfort Function at a Follower boiler set par 34-40.0.1 = 0.		
25	2	2	System DHW Mode	0 = CH Only 1 = DHW Tank NTC 2 = DHW Tank Thermostat	0
25	2	3	Anti-Legionella Function	0 = Off 1 = On	0
25	2	6	System DHW Charging Priority	0 = Alternating 1 = Timed Concurrent / Alternating 2 = Concurrent	0
			0 = Alternating – DHW and CH will not operate simultaneously. Priority switches between DHW and CH at an interval defined by the CH/DHW Shifting Priority Time (parameter 25.0.8); first priority is DHW. If 25.0.8 = 0, then DHW has priority indefinitely. 1 = Timed Concurrent / Alternating – DHW and CH operate simultaneously for the period defined by the CH/DHW Shifting Priority Time (parameter 25.0.8). After the time elapses operation returns to Alternating until the end of the DHW request. 2 = Concurrent – DHW and CH can operate simultaneously indefinitely.		
25	2	7	DHW Modulation Setpoint	68 - 179°F	179
			System target temperature during a DHW demand. Not applicable for Combi models.		
25	2	8	DHW On Differential Temperature	0 - 36°F	0
			Determines how much the DHW storage tank temperature can drop below target before initiating a DHW demand. Only applicable when 25.2.2 = 1.		
25	3	SYSTEM DIAGNOSTICS - READ ONLY			
25	3	0	System CH Supply Setpoint	Actual calculated System CH Target temperature	
25	3	1	System Supply Temperature (in °F)	Actual temperature read by System sensor	
25	3	2	Outdoor Temperature (in °F)	Only with outdoor sensor connected	
25	3	3	DHW Storage Temperature (in °F)	Only with NTC tank sensor connected and 25.2.2 = 1	
25	3	5	System Pump Status	0 = OFF, 1 = ON	
25	3	6	DHW Pump Status	0 = OFF, 1 = ON	
25	4	CASCADE DIAGNOSTICS - READ ONLY			
25	4	0	Cascade Power Level (in %)		
25	4	1	Total Number of Cascaded Boilers		
25	4	2	Available Cascaded Boilers	Does not count operating or locked out boilers	
25	4	3	Active Cascaded Boilers	Boilers currently operating	

Menu	Sub-Menu	Parameter	Description	Value	Default Setting
25	4	4	Cascade Manager Status	1 = Stand-by, 2 = Meeting CH Demand, 5 = CH Temperature Reached, 8 = System Storage Loading, 9 = System Storage Loading Temp Reached, 20 = Pump Antifreeze, 21 = Burn Antifreeze, 27 = Plant Frost Protection with Burner Blocked, 28 = System Tank Frost Protection, 29 = System Antilegionella Function, 30 = Chimney, 31 = Air Purge, 51 = Lockout Volatile, 72 = External Control CH Serving, 74 = External Control DHW Serving, 75 = External Control CH Temp Reached, 77 = External Control DHW Temp Reached, 101 = Initialization	
25	5	ERROR HISTORY - READ ONLY			
25	5	0	Last 10 Errors	Displays the Last 10 Errors	
25	5	1	Reset Error List	OK = Yes, ESC = No	
25	6	RESET MENU			
25	6	0	Automatically resets all parameters to the factory defaults. WARNING: Always check PCB settings if restoring factory default settings on a replacement controller. Replacement controllers have generic settings that may not be specific to the boiler model.	Reset: OK = yes, ESC = no	
			Only applicable to parameters in menu levels 2 and 25 of the Master boiler.		
34 - 40	FOLLOWER BOILER 1 - 7				
34 - 40	0	GENERAL			
34 - 40	0	1	DHW Preheating	0 = Disabled, 1 = Enabled	1
			Enables/disables DHW Comfort Function on Combi models (not applicable to non-Combi models). See par 25.2.1.		
34 - 40	1	FREE PARAMETER			
34 - 40	1	9	DHW Flow Detection Device Type	0 = Flow Switch, 1 = Flow Meter	Varies
			Default: 0 for TRX085, 120, 110C, 150C Default: 1 for TRX150, 199, 199C, FTVN085, 110, 150, 199, 110C, 150C, 199C		
			Combi models use a flow meter. Not applicable for non-Combi models.		
34 - 40	2	SETTINGS			
34 - 40	2	0	Ignition Power %	0 - 100	
			Must be set in accordance with parameter 2.2.0 - see boiler Installation Manual.		
34 - 40	2	3	TT2 Input Configuration	0 = Auxiliary Limit Switch, 1 = Room thermostat zone 2	1
			NOTE: TT2 cannot work as a room thermostat input on a follower boiler.		
34 - 40	2	5	NOT USED		
34 - 40	2	8	Combi Models CANNOT BE MODIFIED	0 = Combi	0
			Non-Combi Models Type of DHW control for Indirect Hot Water Heater (Tank Sensor or Aquastat)	0 = NOT USED 1 = Storage with Tank Sensor 2 = Storage with Aquastat	2
34 - 40	2	9	Boiler Heating Capacity (MBH)	0 - 200	
			Only if the PCB is changed		
34 - 40	3	CENTRAL HEATING - 1			
34 - 40	3	1	NOT USED		
34 - 40	3	2	Absolute Max DHW power percentage CANNOT BE MODIFIED	0 - 100	
			Must be set in accordance with parameter 2.3.2 - see boiler Installation Manual.		
34 - 40	3	3	Absolute Min boiler power percentage CANNOT BE MODIFIED	0 - 100	
			Must be set in accordance with parameter 2.3.3 - see boiler Installation Manual.		

Menu	Sub-Menu	Parameter	Description	Value	Default Setting
34 - 40	3	4	Absolute Max CH percentage CANNOT BE MODIFIED	0 - 100	
			Must be set in accordance with parameter 2.3.4 - see boiler Installation Manual.		
34 - 40	3	5	NOT USED		
34 - 40	3	6	NOT USED		
34 - 40	3	7	Boiler Pump Post Circulation Time (After CH)	0 - 15 minutes or OC (On Continuously)	3
34 - 40	4	CENTRAL HEATING - 2			
34 - 40	4	3	CH Fan Post-Purge	0 = 2 minutes, 1 = 5 minutes	1
			Default: 0 for TRX085, 120, 150, 199, 110C, 150C, 199C Default: 1 for FTVN085, 110, 150, 199, 110C, 150C, 199C		
34 - 40	4	7	Pressure Detection Device	1 = Pressure Switch	1
34 - 40	5	DOMESTIC HOT WATER (Applicable for Upstream / Local [Individual Boiler] IWH) NOTE: Parameters 34 - 40.10.1 and 34 - 40.10.2 are also for Upstream / Local (Individual Boiler) IWH Management			
34 - 40	5	1	DHW Comfort Anti-cycling Time	0 - 120 (minutes)	60
34 - 40	5	2	DHW Start Delay	5 - 200 (0.5 to 20 seconds)	5
			Anti “water hammering”		
34 - 40	5	3	DHW Switch Off Logic	0 = anti-scale (stop at > 144°F) 1 = + 7 °F /setting	0
34 - 40	5	4	DHW Post Purge and Pump Cycle	0 = OFF, 1 = ON	1
			OFF = 30 second post-circulation and 2 minute post-ventilation (or 3 minute post-circulation and 5 minute post-ventilation if the boiler temperature requires it) ON = When setting is ON, time for post-circulation is 3 minutes, while the time for post-ventilation is 5 minutes.		
			Default: 0 for TRX085, 120, 150, 199, 110C, 150C, 199C Default: 1 for FTVN085, 110, 150, 199, 110C, 150C, 199C		
34 - 40	5	5	CH Start Delay Following DHW	0 - 30 (minutes)	0
			Setting is only applicable following a DHW demand from an Upstream IWH connected to the individual follower.		
34 - 40	6	BOILER MANUAL SETTINGS			
34 - 40	6	0	Manual mode activation	0 = OFF, 1 = ON	0
34 - 40	6	1	Boiler pump control	0 = OFF, 1 = ON	0
			Set Parameter 260=1		
34 - 40	6	2	Fan control	0 = OFF, 1 = ON	0
			Set Parameter 260=1		
34 - 40	6	3	3 way valve control	0 = DHW, 1 = Heating	0
			Set Parameter 260=1		
34 - 40	6	4	DHW Pump Control	0 = OFF, 1 = ON	0
34 - 40	7	TEST AND UTILITIES			
34 - 40	7	0	Test Mode	TEST+ = Max Heating power TEST+ = Max DHW power TEST+ = Minimum power.	
			TEST Mode can also be activated by pressing the Reset button for 10 seconds. Test Mode deactivates after 30 minutes or by pressing Reset .		
34 - 40	7	1	Air-purge cycle	0 = OFF, 1 = ON	
			See First Ignition section.		

Menu	Sub-Menu	Parameter	Description	Value	Default Setting
34 - 40	7	4	Floor drying cycle	0 = OFF 1 = Functional Heating 2 = Curing Heating 3 = Functional Heating + Curing Heating 4 = Curing Heating + Functional Heating 5 = Manual	0
34 - 40	7	5	Floor dry Supply setpoint temperature	77 - 140°F	131
34 - 40	7	7	Burning Hours Harmonization		
		Sets the burner run hours statistics to equal the average of the other boilers in the cascade. Used when replacing the PCB on a Follower boiler. Perform this function ONLY on the boiler where the PCB has just been replaced.			
34 - 40	8	RESET MENU			
34 - 40	8	0	Automatically resets all parameters to the factory defaults. WARNING: Always check PCB settings if restoring factory default settings on a replacement controller. Replacement controllers have generic settings that may not be specific to the boiler model.	Reset: OK = yes, ESC = no	
		Only applicable to parameters in menu level 34-40 of respective Follower boiler.			
34 - 40	10	OTHERS 2			
34 - 40	10	0	NOT USED		
34 - 40	10	1	DHW Modulation Setpoint	68 - 179°F	179
		Boiler target temperature during a DHW demand. Not applicable for Combi models.			
34 - 40	10	2	DHW On Differential Temperature	0 - 36°F	0
		Determines how much the DHW storage tank temperature can drop below target before initiating a DHW demand. Only applicable when 2.2.8 = 1.			
34 - 40	10	3	Emergency Setpoint	68 - 179°F	113
		Sets Follower boiler operating temperature when communication with the Master is lost, or when the System Sensor is disconnected. See Cascade Instruction Manual.			
34 - 40	10	4	NOT USED		
34 - 40	10	5	NOT USED		
34 - 40	10	6	NOT USED		
34 - 40	50	BOILER STATISTICS - 1 - READ ONLY			
34 - 40	50	0	3 way valve cycles No. (n x10)		
34 - 40	50	1	Boiler Pump On Hours (h x10)		
34 - 40	50	2	Boiler pump cycles No. (n x10)		
34 - 40	50	3	Boiler Power On Time (h x10)		
34 - 40	50	4	Fan On Hours (h x10)		
34 - 40	50	5	Number of fan cycles (n x10)		
34 - 40	50	6	CH number of flame detections (n x10)		
34 - 40	50	7	DHW number of flame detections (n x10)		
34 - 40	51	BOILER STATISTICS - 2 - READ ONLY			
34 - 40	51	0	CH Burner On Hours (h x10)		
34 - 40	51	1	DHW Burner On Hours (h x10)		
34 - 40	51	2	Number Of Flame Faults (n x10)		
34 - 40	51	3	Number Of Ignition Cycles (n x10)		
34 - 40	51	4	Average CH Cycle Length (min)		
34 - 40	51	6	Number of times the Priority Timer (2.10.4) has elapsed, switching priority from DHW to CH (or vice versa).		

Menu	Sub-Menu	Parameter	Description	Value	Default Setting
34 - 40	52	BOILER STATISTICS - 3 - READ ONLY			
34 - 40	52	1	Fan Status	0 = OFF, 1 = ON	
34 - 40	52	2	Fan Speed RPM		
34 - 40	52	3	Boiler Pump Status	0 = OFF, 1 or 2 = ON	
34 - 40	52	4	3 Way Valve Position	0 = DHW, 1 = Central Heating	
34 - 40	52	5	DHW Flow Rate (in US gpm)		
			Not applicable to Non-Combi models		
34 - 40	52	6	APS Status	0 = Open, 1 = Closed	
34 - 40	52	8	Gas Power (kW)		
34 - 40	53	BOILER TEMPERATURE - READ ONLY			
34 - 40	53	1	CH Supply Temperature (in °F)		
34 - 40	53	2	CH Return Temperature (in °F)		
34 - 40	53	3	DHW Outlet Temperature (in °F)		
			Not applicable to Non-Combi models		
34 - 40	53	4	Exhaust Flue Temperature (in °F)		
34 - 40	54	STORAGE - READ ONLY			
34 - 40	54	0	Displays current tank temperature (in °F)		
			Only with NTC tank sensor connected		
34 - 40	55	BOILER			
34 - 40	55	0	Months to next maintenance	0 - 60 (months)	12
			If enabled (8.5.1 = 1), a notification is made on the display (and via the Tele-diagnostic Service, if applicable), warning that it is time for maintenance		
34 - 40	55	1	Enable Maintenance Warning	0 = OFF, 1 = ON	0
34 - 40	55	2	Maintenance Warning Reset	Reset? OK= Yes, Esc = No	
			Resets Maintenance Advice and clears the Warning.		
34 - 40	55	4	SW Version - Display Interface		
34 - 40	55	5	SW Version - Main Controller		
34 - 40	55	7	Floor Drying Total Remaining Days	0 - 26 Days	
34 - 40	56	ERROR HISTORY - READ ONLY			
34 - 40	56	0	10 last errors	ERROR 0 - ERROR 9	
			This parameter displays the last 10 boiler errors, indicating the error code, day, month and year of occurrence. When the parameter is accessed, the errors are listed from ERROR 0 to ERROR 9.		
34 - 40	56	1	Error list reset - Clears Error History	Reset? OK = yes, ESC = no	
34 - 40	57	FREE PARAMETERS - READ ONLY			
34 - 40	57	2	NOT USED		
34 - 40	57	4	Boiler flow switch	0= OFF, 1= ON	
34 - 40	57	6	Safety flame sensor	0= OFF, 1= ON	
34 - 40	57	8	Boiler power level (%)	0 - 100 (0 = minimum power, 100 = maximum power)	
34 - 40	57	9	Boiler Flame Signal Measured by the Control	The flame signal must exceed 18 to initially detect the presence of flame. Flame loss is detected if the signal drops below 15.	

Table 4 - Complete Parameters List

Part 5 - Troubleshooting

The Cascade Master can display all faults generated by the cascade system, whether the boiler is the Master or a Follower.

Display	Description	Possible Remedies	Error Type
115	System Sensor Open Short Circuit	1. Connect System Sensor to Master boiler SYS terminal - see Wiring a Cascade System. 2. Check cable between System Sensor and Master boiler. 3. Ensure that the System Sensor is a 10k Ohm NTC. 4. Replace System Sensor. If problem persists replace the main control.	Warning (Auto Reset)
150	System Sensor Overheat	Press the Reset button to clear the Error Code. If Error happens again: 1. Check for the correct functioning and positioning of the supply and return temperature probes of each boiler. 2. Ensure that the System Sensor is a 10k Ohm NTC. 3. Check for the correct functioning and positioning of the System Sensor - check sensor resistance vs Sensor Temperature Resistance table in boiler Installation Manual. Replace System Sensor.	Warning (Auto Reset)
441	Follower Boiler Missing from BUS Connection	Press Reset to clear the Error Code. If Error happens again: Check the BUS wiring. Ensure it is intact and connected. Repair if necessary.	Warning (Manual Reset)
CONFL	Configuration Conflict	Each boiler connected to the BUS must have a unique address (parameter 0.4.6). No boiler can be configured as «b-SIN». 1. Press OK. Choose and correct the boiler address. Press OK again. 2. If above process does not work, access parameter 0.4.6 and set the correct boiler address - see Cascade Control Set-Up.	Blocking (Auto Reset)
NOAVL	Boiler Address Unconfigured	Boiler address is undefined (0.4.6 = UNDEF). 1. Press OK. Choose and correct the boiler address. Press OK again. 2. If above process does not work, access parameter 0.4.6 and set the correct boiler address - see Cascade Control Set-Up.	Blocking (Auto Reset)
EMERG	Emergency Mode	1. The Follower has been disconnected from the BUS or no longer sees the Master on the BUS - check the BUS connections. See Wiring a Cascade System. 2. The control has sensed a short circuit on the BUS connection. Disconnect the field wiring from the BUS connection and confirm wiring. 3. Verify that the BUS polarity («B» and «T» connections) is consistent on all devices connected to the BUS. 4. If problem persists replace the main control. NOTE: When in Emergency Mode the boiler operates in CH mode with a target boiler temperature = Emergency Setpoint (2.10.3 for Master boiler, 34-40.10.3 for Follower boilers).	Warning

Table 5 - Boiler Error Codes

Important

Contact a qualified service technician for assistance if a Lockout Error occurs frequently. For safety reasons, the boiler will permit a maximum of five (5) resets in 15 minutes (five [5] presses of the RESET button). A sixth (6th) attempt within this 15 minute period will lock out the boiler permanently. The boiler will only operate again after the electrical supply has been disconnected and reconnected.

Repeated Lockout Error conditions could indicate a serious error with the boiler or installation. Failure to contact a qualified service technician to troubleshoot the error could result in substantial property damage, serious personal injury, or death.

*Error is resettable remotely via NTI Tele-Diagnostic Service, NTI Remote Contractor.



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