



Ultra

Gas-fired
Water boiler
Series 1 & 2

REVISED 2010

Control Supplement & Service Guide

Boiler models: Ultra-80, -105, -155, -230 & -310

NOTICE

Series identification:

Read the boiler rating plate to determine the series number. The rating plate is located inside the boiler jacket, on the right rear interior panel.

NOTICE

Parameters settings:

Instructions in this supplement are based on factory default parameter settings.



- Wiring
- Operation
- Troubleshooting
- Service



Ultra
with **PhD** PRECISION
HYDRONIC
DATA technology



WARNING This document is a supplement to the Ultra Boiler Manual, and must only be used by a qualified heating installer/service technician. Read all instructions, including the Ultra Boiler Manual, before installing, starting or servicing the boiler. Perform all steps in the order given. Failure to comply could result in severe personal injury, death or substantial property damage.

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Please read before proceeding

⚠ WARNING **Installer**— Read all instructions, including this manual, Ultra Boiler Manual, and the Ultra Vent Supplement, before installing. Perform steps in the order given.

User — This document is for use only by a qualified heating installer/service technician.

User — Have this boiler serviced/inspected by a qualified service technician, at least annually. Refer to User's Information Manual for your reference.

Failure to comply with the above could result in severe personal injury, death or substantial property damage.

NOTICE When calling or writing about the boiler — Please have the boiler model number from the boiler rating label and the CP number from the boiler jacket. You may list the CP number in the space provided on the Installation and service certificate found in the Ultra Boiler Manual.

Consider piping and installation when determining boiler location.

⚠ WARNING When servicing boiler —

- To avoid electric shock, disconnect electrical supply before performing maintenance.
- To avoid severe burns, allow boiler to cool before performing maintenance.
- Failure to adhere to the guidelines on this page can result in severe personal injury, death or substantial property damage.

Commonwealth of Massachusetts

When the boiler is installed within the Commonwealth of Massachusetts:

- This product must be installed by a licensed plumber or gas fitter.
- If antifreeze is used, a reduced pressure back-flow preventer device shall be used.

⚠ WARNING High altitude installations

The boiler must be modified according to the procedure in the High altitude instructions. The minimum fanspeed and ignition fanspeed must be set on the Ultra Control module following the High altitude instructions (also included in this document, beginning on page 47).

Hazard definitions

The following defined terms are used throughout this manual to bring attention to the presence of hazards of various risk levels or to important information concerning the life of the product.

⚠ DANGER Indicates presence of hazards that will cause severe personal injury, death or substantial property damage.

⚠ WARNING Indicates presence of hazards that can cause severe personal injury, death or substantial property damage.

⚠ CAUTION Indicates presence of hazards that will or can cause minor personal injury or property damage.

NOTICE Indicates special instructions on installation, operation or maintenance that are important but not related to personal injury or property damage.

Field wiring

WARNING ELECTRICAL SHOCK HAZARD — For your 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 can cause severe personal injury or death.

NOTICE Wiring must be N.E.C. Class 1. If original wiring as supplied with boiler must be replaced, use only type 105°C wire or equivalent. Boiler must be electrically grounded as required by National Electrical Code ANSI/NFPA 70 – latest edition.

NOTICE Install field wiring before venting to allow easier access to terminal strips.

Installation must comply with:

1. National Electrical Code and any other national, state, provincial or local codes or regulations.
2. In Canada, CSA C22.1 Canadian Electrical Code Part 1, and any local codes.

Line voltage connections

1. Connect 120 VAC power wiring to line voltage terminal strip in left compartment of electrical entrance, as shown in Figure 2, page 5, item 1.
2. Provide and install a fused disconnect or service switch (15 amp. recommended) as required by the code. (See

Figure 2, page 5, item 2)

3. Boiler circulator is shipped loose. Wire Boiler circulator as shown for Figure 2, page 5, item 3.
4. When connecting a DHW circulator, connect wiring to line voltage terminal strip as shown for Figure 2, page 5, item 5.
5. Route all wires and conduits to the jacket openings specified in Figure 1.

Wiring a system circulator

1. To activate a system circulator when the Boiler circulator operates, add a circulator relay and wire as shown in Figure 2, page 5.
2. You must install a relay as shown. DO NOT wire in parallel with the Boiler circulator. See CAUTION in Figure 2, page 5.

Low voltage connections

1. Connect low voltage wiring to low voltage terminal strip (Figure 3, page 5, item 1) as shown in Figure 3 and the boiler wiring diagram.
2. Route all low voltage wires through grommets jacket opening to right of low voltage terminal strip, as shown in Figure 1.

Thermostat

1. Connect Figure 3, page 5, item 2, room thermostat or end switch (isolated contact only) between terminals 5 and 6.
2. Install thermostat on inside wall away from influences of drafts, hot or cold water pipes, lighting fixtures, television, sun rays, or fireplaces.
3. Thermostat anticipator (if applicable):
 - a. If connected directly to boiler, set for 0.1 amps.
 - b. If connected to relays or other devices, set to match total electrical power requirements of connected devices. See device manufacturers' specifications and thermostat instructions for details.

Outdoor temperature sensor

1. Connect outdoor temperature sensor (Figure 3, page 5, item 6) between terminals 1 and 2 to enable outdoor reset operation of the Ultra boiler. If fixed-temperature operation is required, do not install outdoor sensor.
2. Mount sensor on an exterior wall, if possible the North wall, shielded from direct sunlight or flow of heat or cooling from other sources.
3. If desired, install a summer/winter switch (Figure 3, page 5, item 7) across terminals 1 and 2. When the switch is closed, the boiler (space heating) circulator is disabled.
4. Route sensor wires through the hole at the right of the electrical entrance (see Figure 1).

DHW aquastat

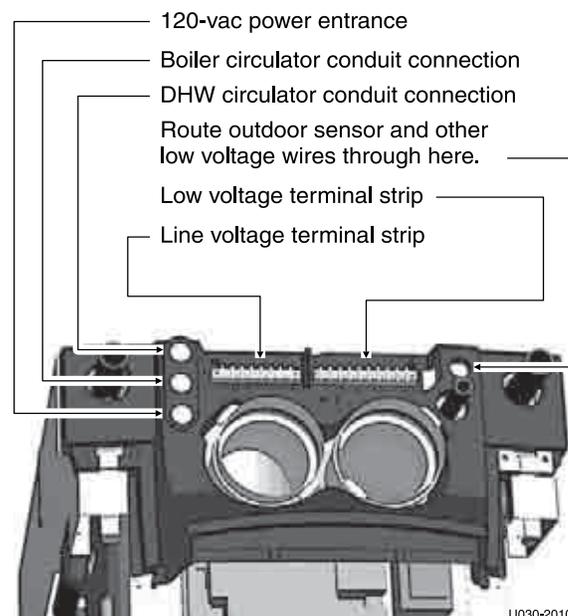
1. Connect storage indirect water heater (DHW) aquastat (Figure 3, page 5, item 3) between terminals 3 and 4.

Additional limits

1. Connect additional limit controls and interlocks between the terminals shown in Figure 3, page 5.
2. Controls connected between terminals 6 and 7 (see Figure 3, page 5, item 4) will cause a soft lockout (automatic reset). When limit(s) closes, boiler will resume normal operation.
3. Controls connected between terminals 6 and 8 (see Figure 3, page 5, item 5) will cause a hard lockout (manual reset). The boiler will only restart after the Ultra display panel RESET switch is pressed.

Figure 1 Routing field wiring

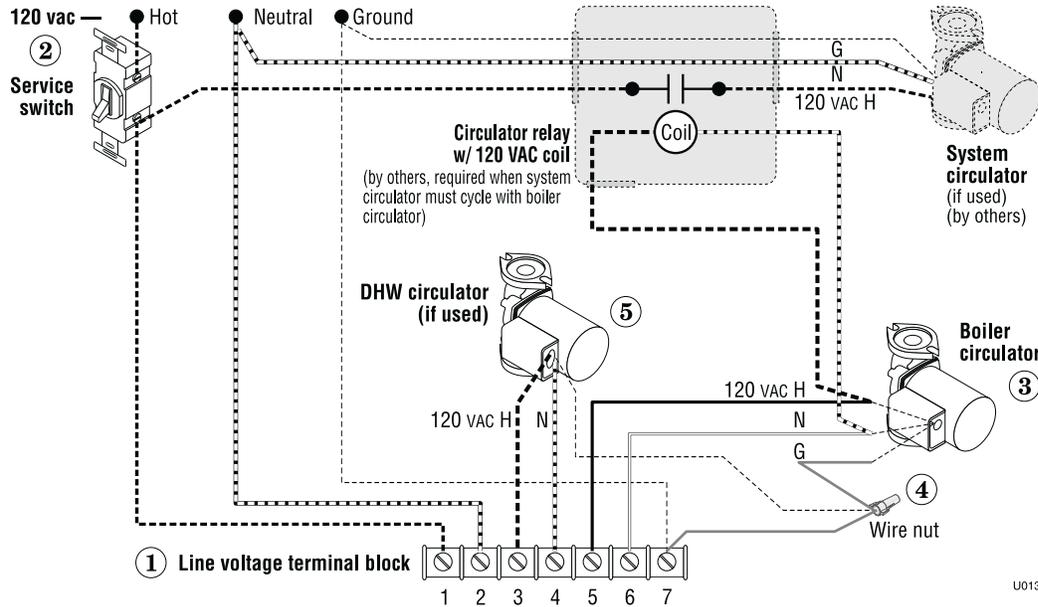
NOTICE Terminals are numbered from left to right when facing front of boiler.



U030-2010

Field wiring *(continued)*

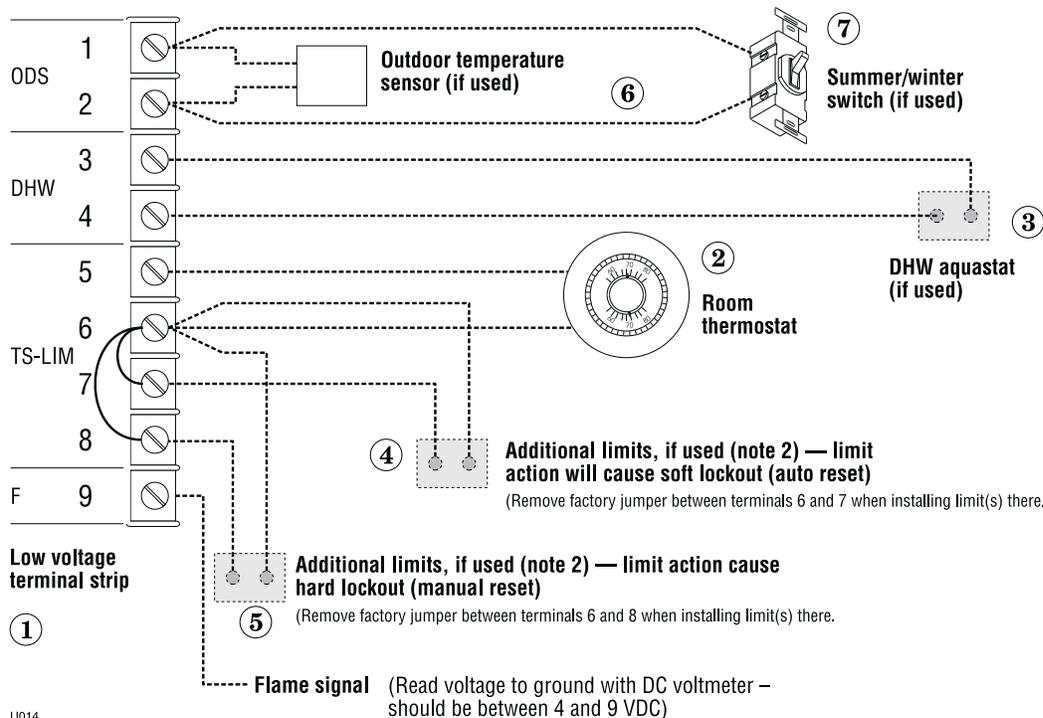
Figure 2 Line voltage field wiring connections (service switch provided by installer)



U013

CAUTION Do not connect another circulator directly to the same wires as the Boiler circulator or the DHW circulator. The control module will encounter fuse failures, causing the boiler to shut down. Use separate relay as shown when wiring a System circulator to operate with Boiler circulator. Connect all system circulator wires in external junction boxes (by others), not to boiler terminal block.

Figure 3 Low voltage field wiring connections



U014

Startup

Startup *(continued from Ultra Boiler Manual)*

1. Start the boiler only after completing all instructions in the Ultra Boiler Manual.
2. To start the boiler, follow the procedure given in Figure 4, page 8.
3. Once the boiler has started and is operating, continue the startup procedure by performing all of the following steps to set and verify operation of the Ultra controls.

NOTICE Instructions in this supplement are based on factory default parameter settings. To set parameters other than those in this section, see information beginning on page 41.

Set space heating operation

Verify space heating mode

1. Press the “Mode” button until the display shows “Para.” This is the parameter mode.
2. Press the “Step” button until the display first digit shows “3.”
3. The last digit must show “1.” If any other number displays, press the “+” or “-” button until “1” shows in the right-hand digit. Press the “Store” button to save this setting.
4. See Figure 12, page 18 for further information.

Set space heating target temperature

1. Press the Ultra control panel “Step” button until the display first digit shows “4.” The right 3 digits show the outlet water temperature setting.
2. Press the “+” or “-” button to change the setting to the desired outlet water temperature. (The factory default setting is 190°F.)
3. Press the “Store” button to save the setting.

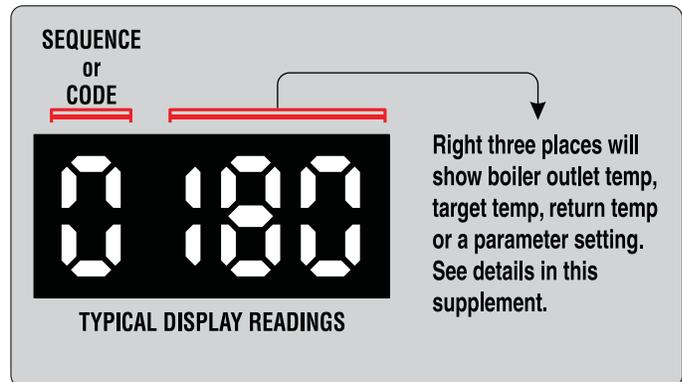
NOTICE Outdoor sensor installed — Setting is the target temperature for outdoor temperature at or below (factory setting) 32 °F. At higher outside temperatures, the Ultra PhD control module calculates the target temperature. (See pages 9 and 10 for detailed discussion of outdoor reset.)

When a summer/winter switch is used, closing the switch will disable the boiler (space heating) circulator during summer operation.

Outdoor sensor not installed — Setting is the target temperature at all times.

Check DHW operation setup

1. Go to step 2 if the control is in Parameter mode already. Press the “Mode” button until the display shows “Para” (parameter mode).



2. Press the “Step” button until the display first digit shows “2.”
3. The last digit must show “1.” If any other number displays, press the “+” or “-” button until “1” shows in the right-hand digit. Press the “Store” button to save this setting.
4. The Ultra PhD control module turns on the DHW circulator when the indirect water heater operating control closes. The control module shuts off the boiler circulator (stops space heating) during calls for DHW heating.

Set DHW target temperature

1. Press the Ultra control panel “Step” button until “1” shows as the display’s first digit. The right three digits show the DHW target temperature minus 50 degrees.
2. The DHW target temperature is the number in “Para” 1 plus 50 degrees. For example, for a target temperature of 190, the display must show 140 (190 = 50 + 140).
3. To change the target temperature, press the “+” or “-” button to increase or decrease the setting.
4. To save the setting, press the “Store” button. The display will flash to indicate the setting is saved.

Verify operation — space heating

NOTE: “[_ _ _ _]” in the following indicates the characters that should show on the Ultra display panel. “180” in the right 3 places means the display shows the measured boiler water temperature. The number shown will not necessarily be 180.

1. Turn down DHW aquastat on DHW tank (if used). If necessary, turn off power and remove one of the DHW aquastat wires to ensure boiler will not receive a DHW heat call.
2. Turn off power to boiler at service switch.
3. Wait a few seconds, then turn on power to boiler.
[AXXX] (self-check on power-up, for a few seconds)
[0XXX] (no call for heat)
4. Raise room thermostat to call for heat.
[5XXX] (blower/circulator on) The blower and boiler circulator energize and the control checks for air flow.
[1XXX] (prepurge) Blower speed will increase to ignition speed. The blower will run in prepurge for 10 seconds.

Startup *(continued)*

- [2XXX] (ignition) After prepurge, the control module opens the gas valve and starts ignition spark.
- If burner flame proves within 4.5 seconds, burner continues to fire. Burner will fire at startup rate — 50% of maximum input — for about 10 seconds to allow flame to stabilize.
 - If burner flame does not prove within 4.5 seconds, control module attempts ignition sequence again. Flame must prove within 5 attempts or control will lockout (display will show [E 02]).
 - Verify flame failure operation by closing boiler manual gas cock to prevent gas flow. Open manual gas valve after testing.
- [3XXX] (burner on, space heating) Once flame is proven and stable, the burner turns down to low fire for approximately 2 minutes.
- After this low fire period, the burner is allowed to modulate. Firing rate depends on actual outlet water temperature versus target temperature.
- Allow boiler to bring water temperature to target temperature.

[6XXX] (*target temperature reached*) The burner will shut down. The blower will run in postpurge (see below), then turn off. The boiler circulator continues to run as long as there is a call for heat.
 - Lower room thermostat to stop call for heat.

[1XXX] (*postpurge*) When the room thermostat is satisfied (call for heat ended), the burner turns off. The blower will continue for a 15-second postpurge, then turn off. (If another call for heat occurs, the boiler will remain off for one minute before starting again, and the display will show [6XXX].)

[0XXX] (*no call for heat*) Boiler is now in standby mode (waiting for heat call).
 - Repeat above steps several times to verify operation.
 - Return the room thermostat to normal setting.

Verify operation — DHW

- Reconnect DHW aquastat wiring to boiler if necessary.
- Turn off power to boiler at service switch.
- Wait a few seconds, then turn on power to boiler.

[AXXX] (*self-check* on power-up, for a few seconds)

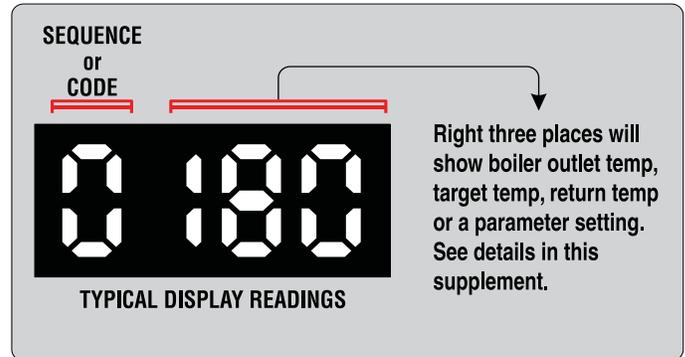
[0XXX] (*no call for heat*)
- Raise DHW aquastat above tank temperature, to call for heat.

[5XXX] (*blower/circulator on*) The blower and DHW circulator energize and the control checks for air flow.

[1XXX] (*prepurge*) Blower speed will increase to ignition speed. The blower will run in prepurge for 10 seconds.

[2XXX] (*ignition*) After prepurge, the control module opens the gas valve and starts ignition spark.

 - If burner flame proves within 4.5 seconds, burner continues to fire. Burner will fire at startup rate — 50% of maximum input — for about 10 seconds to allow flame to stabilize.
 - If burner flame does not prove within 4.5 seconds, control module attempts ignition sequence again. Flame must



- prove within 5 attempts or control will lockout (display will show [E 02]).
 - Verify flame failure operation by closing boiler manual gas valve to prevent gas flow. Open gas cock after testing.

[4XXX] (*burner on, DHW*) Once flame is proven and stable, the burner is allowed to modulate. Firing rate depends on actual outlet water temperature versus target temperature.
- Allow boiler to bring water temperature to target temperature.

[6XXX] (*target temperature reached*) The burner will shut down. The blower will run in postpurge (see below), then turn off. The DHW circulator continues to run as long as there is a call for DHW heating.
 - Lower DHW aquastat to stop call for heat.

[1XXX] (*postpurge*) When the room thermostat is satisfied (call for heat ended), the burner turns off. The blower will continue for a 15-second postpurge, then turn off. (If another DHW call for heat occurs, the boiler will begin the heating cycle immediately.)

[8XXX] (*DHW circulator run-on*) The DHW circulator continues to run for 30 seconds.

[0XXX] (*no call for heat*) Boiler is now in standby mode (waiting for heat call).
 - Repeat above steps several times to verify operation.
 - Return the DHW aquastat to normal setting.

Operating information

- To check operating conditions (actual and target temperatures, for example), see Figure 14, page 20 for an explanation of the Ultra control module Information mode.
- During normal operation (no shutdown or lockout), the right 3 display digits show actual boiler outlet water temperature.

Perform Check-out procedures

- Perform all steps of the Check-out/startup verification listed in the Ultra Boiler Manual.

Re-install boiler jacket front door

▲WARNING Re-install boiler jacket front door after servicing. The boiler front door must be securely fastened to the boiler to prevent boiler from drawing air from inside the boiler room. This is particularly important if the boiler is located in the same room as other appliances. Failure to keep the door securely fastened could result in severe personal injury or death.

Startup *(continued)*

Figure 4 Operating Instructions (Read page 7 and the Ultra Boiler Manual before proceeding.)

FOR YOUR SAFETY READ BEFORE OPERATING

⚠WARNING If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

- A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
- B. Before OPERATING, smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor. See below.
- C. Use only your hand to turn the gas control knob. Never use tools. If the knob will not turn by hand, don't try to repair it; call a qualified service technician. Force or attempted repair may result in a fire or explosion.
- D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control, which has been under water.

WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

OPERATING INSTRUCTIONS

1. Stop! Read the safety information above. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
2. Set room thermostat(s) to lowest setting. Verify external manual gas valve is open (valve handle parallel to gas piping).
3. Turn OFF POWER switch on the Ultra control panel.
4. Rotate two thumb screws at bottom of access door counterclockwise to release door.
5. Remove boiler access door.
6. Turn boiler manual gas valve knob counterclockwise to open gas supply.
7. Smell for gas in the boiler enclosure. If you smell gas, STOP! Follow "B" in the safety information above. If you don't smell gas, go to the next step.
8. Turn ON POWER switch on the Ultra control panel.
9. Set thermostat(s) to desired setting.
10. The Ultra control panel display left digit will show a sequence of numbers (0, 1, 2, etc.) that indicate boiler control sequence. Digit 3 or 4 indicates boiler is firing. Digit 0 means there is no call for heat (all room thermostats and domestic water heater satisfied).
11. If the appliance will not operate when there is a call for heat and piping is not hot, follow the instructions "To Turn Off Gas To Appliance" below and call your service technician or gas supplier.
12. Re-install jacket front panel. Make sure panel is seated firmly in place and all joints are visually sealed. Then tighten the two thumb screws at bottom of access door firmly.



TO TURN OFF GAS TO THE APPLIANCE

1. Set room thermostats to lowest setting.
2. Turn off all electric power to the boiler if service is to be performed. Turn OFF POWER switch on the Ultra control panel.
3. Close external manual gas cock (valve handle perpendicular to gas piping). Remove boiler access door. Turn boiler manual gas valve knob clockwise to close gas supply.
4. Re-install boiler access door.

Operating information

Ultra PhD Control Module

The Ultra boiler is controlled by a microprocessor electronic control — the Ultra PhD Control Module. The module senses outlet water temperature, return water temperature, flue temperature and outdoor temperature (when outdoor sensor is installed). It uses this information (plus input from external limit and operating controls) to regulate boiler on/off operation and can modulate boiler firing rate to more closely match output to demand.

Electrical specifications

Ultra boilers require 120 vAC/60 Hz power supply and are polarity sensitive.

Control module specifications

- | | |
|--------------------------------|-----------------|
| • Supply voltage | 120 vac / 60 hz |
| • Electrical demand | 10 va |
| • Prepurge timing | 10 seconds |
| • Postpurge timing | 15 seconds |
| • Min. off time, space heating | 1 minute |
| • Pump run on after space htg. | 10 seconds |
| • Min. off time, DHW | 0 seconds |
| • Pump run on after DHW | 30 seconds |
| • Line voltage fuse, F1 | 5 amp fast-blow |
| • Low voltage fuse, F3 | 4 amp slow-blow |

Boiler temperature regulation

Operating temperature (target)

The Ultra control module senses outlet water temperature and regulates boiler firing rate to achieve a target temperature, set by installer, by setting Parameter 4. Temperature can be set between 70°F and 190°F. See page 18 for procedure.

- Space heating with fixed temperature — Target temperature is fixed (equal to Parameter 4) when outdoor reset is not installed.
- Space heating with outdoor reset — Target temperature is calculated as described under “Outdoor reset operation” when outdoor sensor is connected. Exception: See explanation of “Supply temperature boost.”
- DHW heating — Target temperature is 50°F + Parameter 1. Do not change parameter 1 from the factory default setting of 140°F unless the application is specially engineered for other temperature.

High limit operation

If outlet water temperature exceeds target temperature plus OFF differential (or 190°F plus OFF differential, whichever is lower), high limit action occurs. The control module shuts the burner off.

DHW operation (if used)

The boiler is factory set to immediately change target outlet water temperature to 190°F on a call for heat from the DHW aquastat.

Additional Thermal Overrun Protection

High limit operation shuts down the burner when the outlet water temperature exceeds the target temperature. However, adverse conditions could cause the water temperature to rise too quickly, overshooting this temperature. The Ultra control module’s PhD technology provides advanced protection in the event of thermal overrun. Using its electronics, the Ultra control module provides two additional levels of overrun protection:

Level 1 Indication would occur if supply or return water temperature reached 203°F. The Ultra control module would display a soft lockout code (“b” followed by “18” if on the supply, or “19” if on the return). The module would not operate the burner again until the water temperature dropped 9°F below target temperature.

Level 2 Lockout would occur if supply or return water temperature reached 210°F. The Ultra module would enter hard lockout and display an error code (“E” followed by “18” if on the supply or “19” if on the return). NOTE: Hard lockout requires manually pressing the Ultra display panel reset button to restart operation. Service technician must troubleshoot the cause of the problem and correct it before placing the boiler back in operation.

Low water protection

1. The control module uses temperatures sensed at both supply and return areas of the heat exchanger. If the flow rate is too low (temperature difference too high) or either temperature is too high, the control module shuts the boiler down. This ensures boiler shutdown in the event of low water or low flow conditions.
2. Some codes and jurisdiction may accept these integral features of the control in lieu of requiring an additional limit control or low water cutoff. Consult local jurisdiction to determine.

Operating information *(continued)*

Outdoor reset operation, if used

Setpoint temperature with outdoor reset

All Ultra boilers are shipped with an outdoor temperature sensor. When this sensor is installed (low voltage terminal strip terminals 1 and 2), the control module regulates target outlet water temperature based on outside temperature.

CAUTION See detailed discussion of outdoor reset parameters beginning on page 44.

Set the temperature curve:

Suggested outdoor reset parameter settings

1. Parameter 4, $T1_{top}$ — Set to the required supply water temperature when outdoor temperature is at or below ODT (outdoor design temperature).
2. Parameter 5, $T1_{foot}$ — Set equal to the required room temperature for the building.
3. Parameter 6, $T4_{minimum}$ — Set to the ODT outdoor design temperature.
4. Parameter 7, $T4_{maximum}$ — Set to the balance point temperature for the building (typically 60 to 70°F).

Summer/winter switch option

Install a summer/winter switch, if desired, to disable the boiler (space heating) circulator during non-heating months. Connect switch across the outdoor sensor terminals. When switch closes, the boiler circulator is disabled and the boiler operates only on call for DHW heating.

Supply temperature boost

In outdoor reset operation (outdoor sensor connected), the Ultra control module automatically increases the target outlet water temperature if a call for heat exceeds 10 minutes. At each 10 minutes of a continuous call for heat, the control module increases the target temperature by 18°F. The module will continue increasing target temperature until it reaches the value set in parameter 4.

When the call for heat ends while target temperature is “boosted,” the target temperature drops about 2°F for each minute the thermostat is open.

Purpose of boost — If the target temperature happens to be too low, the control “boosts” the target temperature until the supply water meets the system’s needs.

DHW operation, if used

The *Ultra* PhD Control Module allows connection of a DHW aquastat to low voltage terminal strip terminals 3 and 4. When the DHW aquastat calls for heat, the module shuts down the boiler circulator, activates the DHW circulator and immediately sets target outlet water temperature to 190°F. This provides automatic priority heat allocation to the indirect water heater for maximum response and recovery. The DHW circulator continues for 30 seconds after the heating cycle to deliver the most possible heat.

A DHW demand is a priority event. The boiler will not respond to space heating until the DHW demand is satisfied.

Boiler circulator

Each Ultra boiler is shipped with a circulator. The circulator has sufficient head to handle boiler pressure drop plus reasonable pressure drop in the connecting piping. See Ultra Boiler Manual for piping and flow rate information. The control module internal relay contact is suitable for handling only the boiler circulator provided. Do not wire additional pumps in parallel with the boiler circulator. To operate a system circulator when the boiler circulator operates, see pages 4 and 5 for wiring required.

Freeze protection

DO NOT install the boiler in a room likely to freeze.

The following integral feature of the Ultra control module provides some protection for the boiler only — not for the system.

- The Ultra control module provides freeze-up protection as follows when the boiler water temperature drops below 45°F:
 - Below 45°F, the boiler circulator operates constantly.
 - Below 37°F, the boiler turns on at low fire.
 - Boiler and circulator turn off if boiler water temperature rises above 50°F.

CAUTION This feature of the Ultra control module does not eliminate the possibility of freezing. The installation must still use recognized design, installation and maintenance practice to prevent freeze potential for the boiler and system.

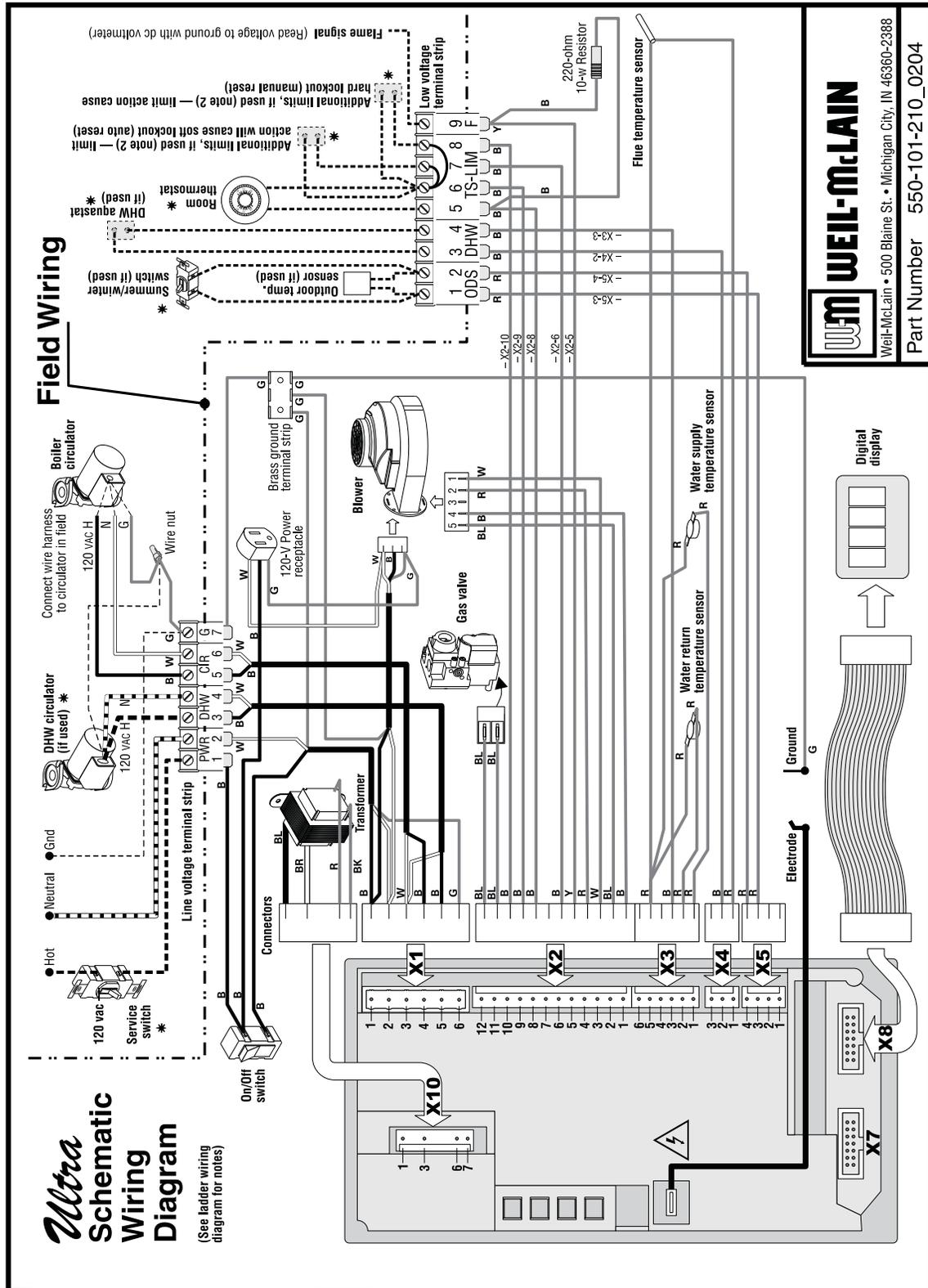
External controls (interlocks) *(if used)*

External limit controls wired between low voltage terminal strip terminals 6 and 7 will cause the boiler to shut down in soft lockout when they open. Remove the factory jumper between these terminals when using.

External limit control wired between low voltage terminal strip terminals 6 and 8 will cause the boiler to hard lockout (requiring manual reset of the electronic display RESET button). Remove the factory jumper between these terminals when using.

Operating information

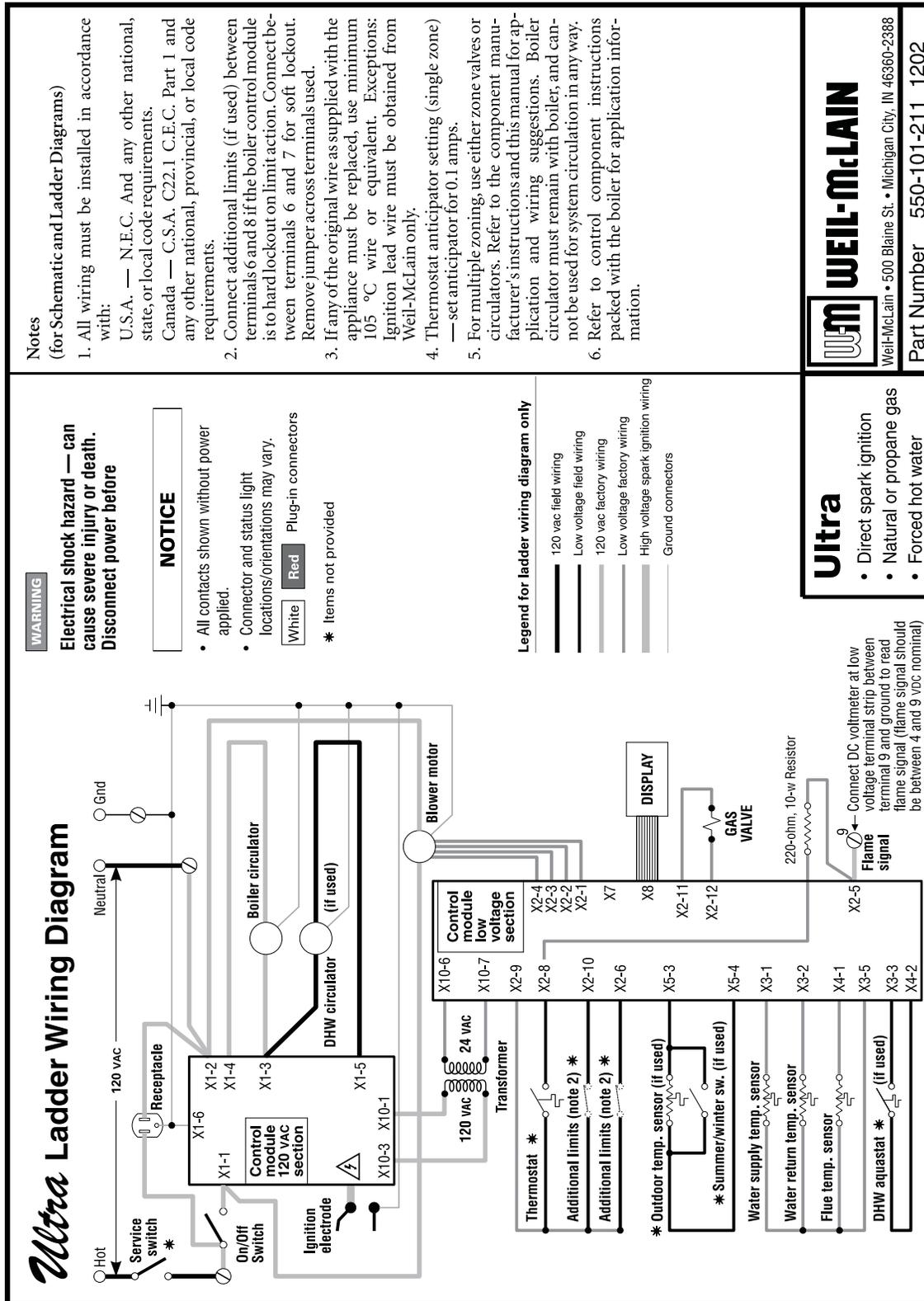
Figure 5 Schematic wiring diagram — Ultra-80 through Ultra-230



WEIL-McLAIN
Well-McLain • 500 Blaine St. • Michigan City, IN 46360-2388
Part Number 550-101-210_0204

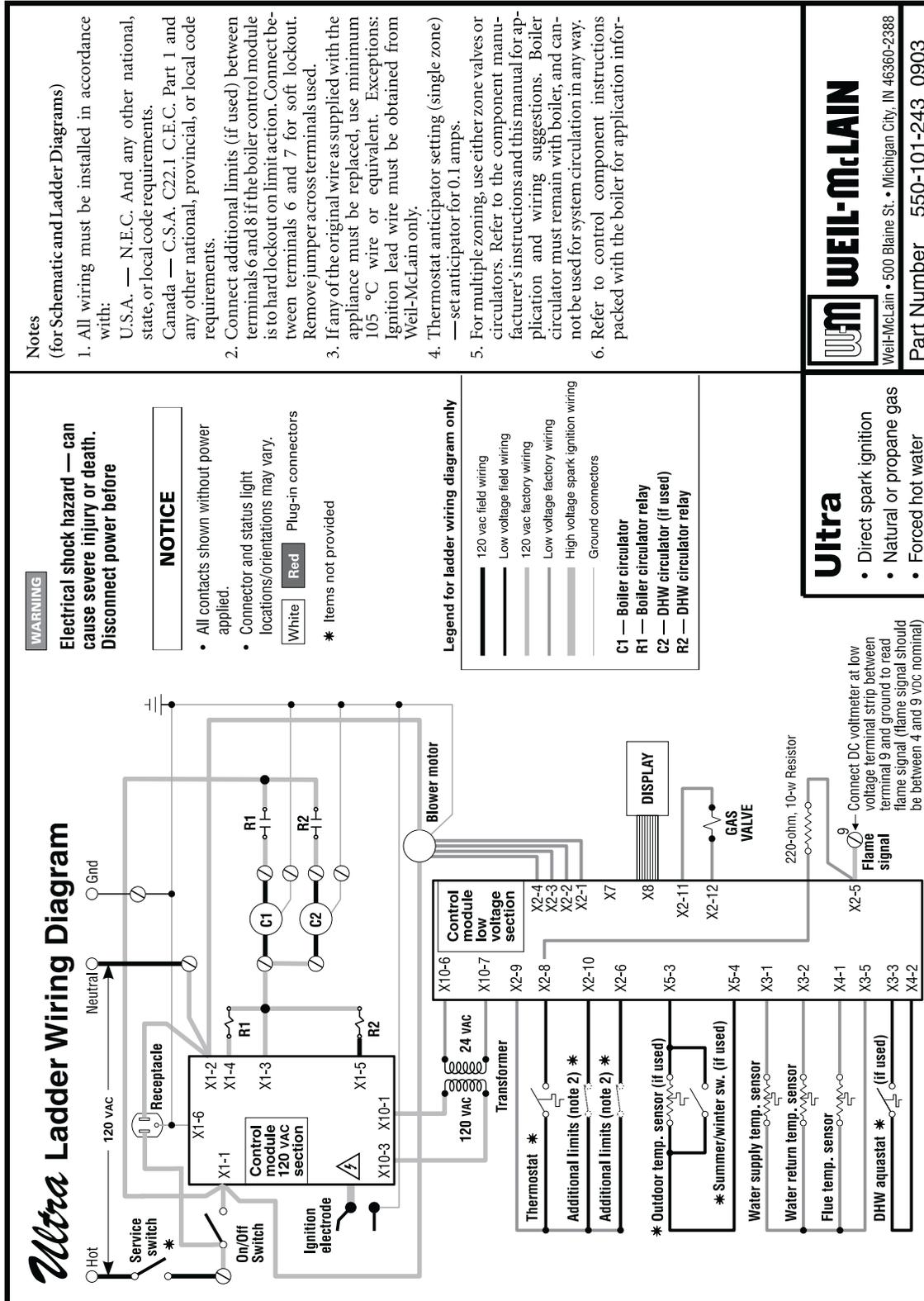
Operating information *(continued)*

Figure 6 Ladder wiring diagram — Ultra-80 through Ultra-230



Operating information *(continued)*

Figure 8 Ladder wiring diagram — Ultra-310



Operating information *(continued)*

Figure 9 Ultra display overview

WEIL-McLAIN *Ultra* PHD CONTROL MODULE QUICK-REFERENCE

Ultra digital display operation

NOTICE The data port is for use only when connecting a PC to the control, using the optional Advance Parameter Kit. Do not connect to this port for any other purpose.

Use digital display keys to set temperatures and operating conditions and monitor boiler operation.



↑ Mode button

Default:	Standby mode
Press 1 time:	Parameter mode
Press 2 times:	Information mode
Press 3 times:	Standby mode

Standby mode:	Normal operation / boiler status indication / soft lockout
Parameter mode:	Check or change space heating & DHW settings
Information mode:	Check operating temperatures and rates of change
Hard lockout mode:	Use error code to troubleshoot failures

Operating information *(continued)*

NOTICE Instructions in this supplement are based on factory default parameter settings.

Figure 10 Ultra display Standby mode — key functions & display

NOTICE Where two keys are shown pressed at the same time, you must **PRESS THE KEYS TOGETHER**. A slight delay in pressing one of the keys may cause a different result.

WEIL-MCLAIN *Ultra* PHD CONTROL MODULE QUICK-REFERENCE

Standby Mode *(Operating mode)*

Key functions & display

When boiler is powered on, the display will always show "A" followed by measured outlet water temperature during its self-test.



Press **RESET** to **restart boiler** after lockout or shutdown.

Display shows *Stby* briefly



SEQUENCE MEASURED OR TARGET OUTLET TEMPERATURE

TYPICAL DISPLAY READING:

	Press	Result	Display shows:
	Short	Outlet water target temp. (display shows "c" and outlet water target temperature**)	
	Long	Turn space heating OFF/ON (display shows "c" and outlet water target temp. or 0°F)	
	Short	Right 3 digits show boiler outlet temp setting for DHW operation minus 50°F — MUST NOT be above 140°F.	
	Long	Turn DHW OFF/ON [display shows "d" and DHW boiler outlet temp setting (- 50°F) or 0°F if DHW is deactivated]	
	Long	Set burner to high fire (display shows H and measured outlet water temperature)	
	Long	Set burner to low fire (display shows L and measured outlet water temperature)	
	Long	Deactivate forced hi/lo firing (display shows sequence and measured outlet water temp.)	
	Short	Change to next mode (Para)	

Press the key combinations above to obtain results shown

****** Outlet water "target temperature" means:
 Outdoor sensor not connected: Target is fixed setpoint temperature control attempts to maintain for boiler outlet water.
 Outdoor sensor connected: Target is temperature calculated by PhD control module, based on outside air temperature.

Operating information *(continued)*

NOTICE Instructions in this supplement are based on factory default parameter settings.

Figure 11 Ultra display Standby mode — boiler sequence display

WEIL-McLAIN *Ultra* PHD CONTROL MODULE QUICK-REFERENCE

Standby Mode *(Operating mode)*

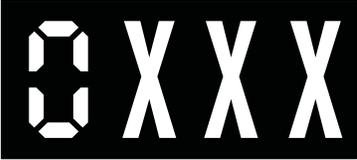
Boiler sequence display

After display shows "Stby" for a brief period, the first character shows boiler status, followed by boiler outlet water temperature. If the burner is being held off due to a soft lockout, the display alternates between showing **9** followed by boiler outlet water temperature and **b** followed by the two-digit codes below. Soft lockout means the boiler will start again automatically if the condition is corrected or timed out.

Press **RESET** button to restart boiler without waiting for timeouts below

First digit	Other digits	Boiler status	First digit	Code #	Boiler is in soft lockout when 9/b shows. Reason for boiler soft lockout is:
0	Actual (measured) outlet water temperature	Standby — no call for heat	9 alternating with b	_18	Outlet temperature too high (over 203°F) — Burner off until outlet water temp drops 9°F below target temperature
1		Pre-purge (10 seconds) or Post-purge (15 seconds)		_19	Return temperature too high (over 203°F) — Burner off until both outlet and return water temperatures drop 9°F below target temperature
2		Ignition		_24	Return temp higher than supply temp — Burner off waiting for correction
3		Burner on for space heating		_25	Outlet water temp rose too quickly — Burner off for 10 minute wait (burner recycles, increasing wait 1 minute each attempt, to max. of 15 minutes)
4		Burner on for DHW heating		_26	External limit open on limit wired in soft lockout (auto reset) circuit — Burner off for 150 seconds
5		Checking airflow before prepurge		_29	Blower signal not zero when it should be — Burner off until signal condition terminates
6 *		Burner off because temperature setting has been reached		_30	Temperature rise across boiler more than 58°F — Burner off for 150 second wait (plus 1 additional minute for each failed attempt, up to max. of 22 minutes each time)
7		Pump on after space heating cycle for run-on of 10 seconds		_35	Short circuit across flue temperature sensor terminals — Burner off until corrected
8		Pump on after DHW heating cycle for run-on of 30 seconds		_40	Open circuit across flue temperature sensor terminals — Burner off until corrected
H		Burner on, running in high fire mode (manually set for test)		_52	Flue temperature exceeded 216°F but did not exceed 225°F (hard lockout occurs above 225°F) — Burner off for 150 second wait
L	Burner on, running in low fire mode (manually set for test)	_65	Waiting for blower to start		

OUTLET TEMPERATURE
OR
SEQUENCE
(0-9, H or L) SOFT LOCKOUT CODE



* **First digit = 6** — If the control module loses flame signal during operation, the display will show 6, the same as the indication for heat demand satisfied. The boiler will start a new firing sequence (postpurge, followed by prepurge, etc.)

Part number 550-100-029/0810

17

Operating information *(continued)*

NOTICE Instructions in this supplement are based on factory default parameter settings.

Figure 12 Ultra display Parameter mode (also see reference table, Figure 13, page 19)

WEIL-McLAIN *Ultra* PHD CONTROL MODULE QUICK-REFERENCE

Parameter Mode *(Change settings)*

(Press **Mode** button 1 time from Standby mode)

Press **RESET** to restart boiler after lockout or shutdown.

Display shows **Para** until a key is pressed.

TYPICAL DISPLAY READING:

PARAMETER	CURRENT SETTING
Para	140

	Press	Result	Display shows:
		Short Step to next parameter <i>(continue tapping Step to change to 1, 2, 3 or 4)</i>	 DHW setting <small>(See details below)</small>
		Short Increase setting	 DHW setup <small>(See details below)</small>
		Hold FAST increase setting	 Space heating setup <small>(See details below)</small>
		Short Decrease setting	 Outlet temperature <small>(See details below)</small>
		Hold FAST decrease setting	 Outlet temperature <small>(See details below)</small>
		Short Store current setting *** <i>(tap this key after setting the parameter as desired)</i>	 Outlet temperature <small>(See details below)</small>
		Short Next mode (Info)	

1 DHW setting

Left digit shows **1**
Right three digits show 140.
WARNING DO NOT set above 140°F.
DHW operation could be hazardous due to high DHW tank temperature.

2 DHW setup

Left digit shows **2**
Right digit should show **1**
DO NOT change this setting. DHW performance could be unreliable or unsafe.

3 Space heating (SH) setup

Left digit shows **3**
Right digit should show **1**
DO NOT change this setting as it might affect boiler performance.

4 SH temperature

Left digit shows **4**
Right three digits show target outlet water temperature (outlet temperature at 32°F outside if outdoor sensor is installed). Adjust to desired setting with + and - keys.

*** After the Store button is pressed, the set value will flash twice to confirm the change. Change will take effect after you leave the Parameter mode.

Operating information (continued)

NOTICE Instructions in this supplement are based on factory default parameter settings.

Figure 13 Parameter reference table (also see Figure 12, page 18)

Parameter	Name	Range		Boiler display				Description
		Details	Boiler display	Display position				
				1st	2nd	3rd	4th	
1	T3-Set	Storage DHW: 68 to 142°F	68 to 142	1	SETTING			<ul style="list-style-type: none"> Boiler outlet water temperature setpoint in DHW mode is determined by adding parameter 1 to parameter 33 (parameter 33 = 50°). <p>WARNING DO NOT set higher than 140°F. A higher temperature setting could cause a hazardous condition due to excessive DHW temperature.</p>
2	DHW System	DHW OFF	0	2	— BLANK —	— BLANK —	VALUE	<ul style="list-style-type: none"> Parameter 2 determines whether DHW heating is activated. The boiler will not operate in DHW mode if parameter 2 is set to “0”. <p>WARNING Weil-McLain does not recommend setting this parameter VALUE to either “2” or “3” (continuous DHW pump). This could result in a hazardous condition — it would cause constant circulation between the boiler and the DHW heater.</p>
DHW ON		1						
DHW OFF + pump constant		2						
DHW ON + pump constant		3						
3	CH System	CH OFF	0	3	— BLANK —	— BLANK —	VALUE	<ul style="list-style-type: none"> Parameter 3 determines whether central heating is activated. The boiler will not operate in CH mode if parameter 3 is set to “0”. Select “1” to cycle the boiler circulator on central heating calls for heat. <p>WARNING Weil-McLain does not recommend setting this parameter VALUE to either “2” or “3” (continuous pump). This could result in a hazardous condition — it could supply water to other zones when heat demand is from a DHW tank.</p>
CH ON		1						
CH OFF + boiler pump constant		2						
CH ON + boiler pump constant		3						
4	T1 _{top} (Target temperature)	70 to 192°F	70 to 192	4	SETTING			<ul style="list-style-type: none"> Constant boiler temperature operation (outside sensor not connected) — T1_{top} is the target outlet water temperature at all times. Outdoor reset operation (outdoor sensor connected) — T1_{top} is the maximum target temperature for all outside temperatures.

Operating information *(continued)*

NOTICE Instructions in this supplement are based on factory default parameter settings.

Figure 14 Ultra display Information mode

WEIL-McLAIN *Ultra* PHD CONTROL MODULE QUICK-REFERENCE

Information Mode *(Check settings)*

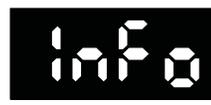
(Press **Mode** button 2 times from Standby mode)





Press **RESET** to restart boiler after lockout or shutdown.

Display shows **Info** until a key is pressed.



TYPICAL DISPLAY READING:

PARAMETER	CURRENT STATUS
1	190

DOT flashes in Info mode

MODE

STEP

STORE

+

-

Short Step to **next parameter**

 <p>Measured outlet water temperature (First digit shows 1 & dot flashes) (Others show measured outlet temp.)</p>	 <p>Return water temperature (First digit shows 2 & dot flashes) (Others show measured outlet temp.)</p>	 <p>This function not used (First digit shows 3 & dot flashes) (Others show -21)</p>
 <p>Outside temperature (First digit shows 4 & dot flashes) (Other digits show outside temperature) If display shows 4.230, the outdoor sensor has failed or sensor wires are shorted. If display shows 4.-22, the outdoor sensor is not connected, has an open circuit or has failed.</p>	 <p>Flue temperature (First digit shows 5 & dot flashes) (Others show measured flue temp.)</p>	 <p>Target outlet water temperature (First digit shows 6 & dot flashes) (Others show target outlet temp.) If display shows 6.-32, the blower has failed. See Figure 19, page 28 for hard lockout code 28 or 29.</p>
 <p>Outlet water temperature change (First digit shows 7 & dot flashes) (Right two show rate of change, °F/sec)</p>	 <p>Return water temperature change (First digit shows 8 & dot flashes) (Right two show rate of change, °F/sec)</p>	 <p>This function not used (First digit shows 9 & dot flashes) (Right digits show -32)</p>

NOTE Display will show **A-32** if **STEP** is pressed after 9 appears.

Operating information *(continued)*

NOTICE Instructions in this supplement are based on factory default parameter settings.

Figure 15 Ultra display Hard Lockout mode (see Figure 18, page 28 for further information)

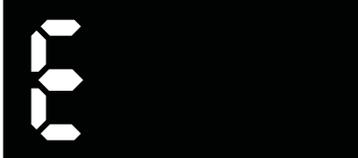
WEIL-McLAIN *Ultra* PHD CONTROL MODULE QUICK-REFERENCE

HARD LOCKOUT Mode

Boiler in hard lockout (requires manual RESET)

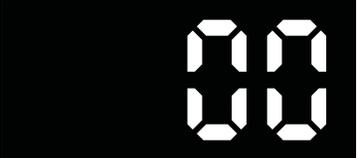
Display flashes First digit and Last two digits:

ERROR
"E"



Display flashes:
First digit (E) &
Last two digits (code)

LOCKOUT CODE
(xx) - See below



Code	Reason for hard lockout	Code	Reason for hard lockout
See Troubleshooting information for details			
00	Flame detected on start-up	18	Outlet water temperature was higher than 210°F
02	Ignition failed after 5 retries	19	Return water temperature was higher than 210°F
03	Internal control failure (see Troubleshooting)	25	Temperature rise too high (> 58°F)
04	Power lost after lockout (see Troubleshooting)	28	No signal from blower Check INFO #6
05	See Troubleshooting	29	Blower signal not zero when it should be Check INFO #6
06	See Troubleshooting	31	Outlet temperature sensor short circuit
07	See Troubleshooting	32	Return temperature sensor short circuit
11	See Troubleshooting	36	Outlet temperature sensor open circuit
12	External limit open (limit wired in hard lockout circuit)	37	Return temperature sensor open circuit
13	See Troubleshooting	44	Internal control failure
14	See Troubleshooting	52	Flue temperature was higher than 225°F
15	See Troubleshooting	60	Internal error reading parameters
16	See Troubleshooting	61	Air flow circuit failure
17	See Troubleshooting	65	Not enough blower driving force

Troubleshooting

VERIFY PROPER OPERATION AFTER SERVICING (see Ultra Boiler Manual for procedures)

Re-install BOILER JACKET FRONT DOOR AFTER SERVICING

WARNING Re-install boiler jacket front door after servicing. The boiler front door must be securely fastened to the boiler to prevent boiler from drawing air from inside the boiler room. This is particularly important if the boiler is located in the same room as other appliances. Failure to keep the door securely fastened could result in severe personal injury or death.

WARNING Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Always disconnect power to boiler before servicing. Failure to comply could result in severe personal injury, death or substantial property damage.

WARNING Never jumper (bypass) any device except for momentary testing as outlined in Troubleshooting tables. Severe personal injury, death or substantial property damage can result.

Before troubleshooting:

1. Have the following items:
 - a. Voltmeter that can check 120 VAC, 24 VAC and 12 VDC.
 - b. Continuity checker.
 - c. Contact thermometer.
2. Check for 120 VAC (minimum 102 VAC to maximum 132 VAC) to boiler.
3. Make sure thermostat is calling for heat and contacts (including appropriate zone controls) are closed. Check for 24 VAC between thermostat wire nuts and ground.
4. Make sure all external limit controls are either installed (and closed) or temporarily jumpered for testing.

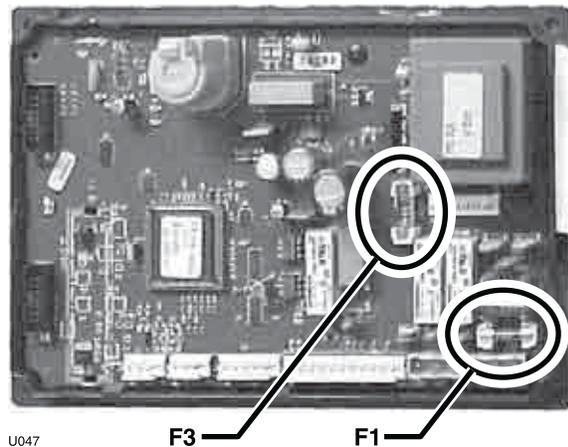
Check the following:

1. Wire connectors to control module are securely plugged in at module and originating control.
2. Gas pressures:
 - Maximum: 13" w.c. with no flow (lockup) or with boiler on
 - Minimum: 5" w.c. with gas flowing (verify during boiler startup with boiler at high fire)

Always check control module fuses

NOTICE ALWAYS check control module fuses before replacing control module or any major components (blower, etc.). If one of these fuses is blown, it can prevent control module or other components from operating.

1. Turn OFF power to boiler at external line switch.
2. Remove jacket top front panel (Ultra Boiler Manual, page 37, item 8).
3. Remove control module cover.
4. Inspect fuses F1 and F3 (located as shown below).



5. The boiler is shipped with two spare fuses attached to the control module cover.
6. If necessary, replace open fuse (F1 is 5-amp fast-blow; F3 is 4-amp slow-blow).

WARNING Do not jumper fuse or replace with any fuse except as specified. Failure to comply could result in severe personal injury, death or substantial property damage.

7. Install control module cover and jacket top front cover after fuse inspection.
8. Restore power to boiler at external line switch and verify boiler operation (per Ultra Boiler Manual procedures) after completing boiler service.

Troubleshooting *(continued)*

NOTICE Instructions in this supplement are based on factory default parameter settings.

Checking temperature sensors

1. The boiler temperature sensors (flue, outdoor, return water and supply water) are all resistance-type devices.
2. The table at right shows the correct value for the sensor at various temperatures.
3. Use the resistance values at 32°F, 60°F, 70°F and 212°F to measure the sensor resistance at known temperatures (ice point, room temperature and sea level boiling point). For ice point and boiling point, insert the sensor in water at that temperature. Use an ohmmeter to read resistance value.
4. To check whether the control module is correctly sensing temperature, you can use a resistance decade box. Connect the decade box temporarily in place of a sensor and use the control module **Information** mode (see page 19 for details) to read the temperature. The temperature should be close to the value corresponding to the input resistance.

Sensor resistance values					
Temp (°F)	Sensor ohms		Temp (°F)	Sensor ohms	
	Min	Max		Min	Max
32	34265	37871	130	3698	4088
40	27834	30764	140	3043	3364
50	21630	23907	150	2517	2782
60	16944	18727	160	2091	2311
70	13372	14780	170	1744	1928
80	10629	11747	180	1461	1615
90	8504	9399	190	1229	1359
100	6847	7568	200	1038	1147
110	5545	6129	210	880	972
120	4517	4992	212	851	941

REVIEW OF LAST LOCKOUT CODE MESSAGE

To access parameters, view RPM speed and the last Error Code:

1. The boiler must be in “STBY” mode.
2. Press and hold the STEP button.
3. While holding STEP, press and hold the MODE button.
4. Hold both buttons until CODE appears on the display. Release both buttons.
5. Press the STEP button and a number will appear as C-**.
6. Press the “+” or “-” buttons until the number changes to C-05.
7. Press STORE. The display should blink one time.
8. The control is now unlocked, ready to make parameter changes, view RPM speed and view the last error code.

To view the last lockout code:

Press MODE until ERROR appears on the display, with the following information:

1. The last lockout code (example: E-02 failed ignition; will not show E-04 code or soft lockout codes).
2. The sequence when lockout occurred (example: 03 call for heat)
 1 = prepurge; 2 = ignition; 3 = space heat on; 4 = DHW on; 5 = checking air flow
 H = high fire; L = low fire.
3. Supply temperature at the time of lockout.
4. The return temperature at the time of lockout.
5. Type of call (22 = call for heat; 230 = call for DHW).
6. Outdoor sensor status temperature if connected, -22 if not.

Troubleshooting *(continued)*

NOTICE Instructions in this supplement are based on factory default parameter settings.

Figure 16 Troubleshooting procedures

Boiler not firing and:	Check for:	Corrective actions:	
Display first digit shows a number from 1 to 8. Last digits show 2 or 3-digit number (boiler outlet water temperature).	This is normal operation.	1	Boiler is in normal operating mode. See page 16 for explanation and status.
Display first digit shows the number 6; other 2 or 3 digits show boiler water temperature	Boiler water temperature may have exceeded limit — the boiler will restart after the water temperature has dropped below limit setting (parameter 4) minus the differential.	1	If boiler water temperature is above parameter 4, the boiler shut down on limit. Follow the same corrective action suggestions given for Code 18 in Figure 17, page 26.
		1	If the boiler water temperature is NOT above parameter 4, the control may have lost flame signal. Flame signal (DC volts from low voltage terminal strip terminal 9 to ground) should be at least 4 VDC. Verify adequate gas flow — check incoming gas pressure. If acceptable, check gas line size, gas regulator or any possible cause of reduced pressure.
	The control module may have lost flame signal — if so, boiler should restart.	2	A lower flame signal may indicate a fouled ignitor or damaged ignitor insulation. Follow procedure in Ultra Boiler manual to check ignition electrode wiring and inspect and clean the ignition electrode. Replace the ignition electrode and wiring if necessary. If problem persists, obtain a maintenance kit for the boiler (page 33) and follow the maintenance procedure beginning on page 33 to remove and service the burner and components.
Display flashes 9, then b. Last two digits show code number.	Display is showing a lockout code.	1	See Figure 17, page 26 for brief explanation of soft lockout codes. See the following pages for additional troubleshooting information and diagnostics related to lockout conditions.
Control display is blank	Is 120 vac present at terminals 1 and 2 of line voltage terminal strip?	1	If not, check external line switch and fuse or breaker.
	Blower running on high, and F1 fuse blown?	1	Turn power off to boiler. Remove power wiring to circulator(s) at boiler terminal strip. Replace the F1 fuse. Then turn power on to boiler. If blower stops running and display works properly, replace defective circulator(s) and retry.
		2	If the blower continues to run after checking step 2, above, turn power off to the boiler. Inspect wiring and high voltage terminal strip for defects. Replace if necessary. Then retry.
		3	If the problem persists after above steps, replace the control module.
Display shows U124 or U125	Display stays on U124 or U125	1	Check transformer. If good: <ul style="list-style-type: none"> • Turn off power to the boiler. • Disconnect thermostat wires at boiler. • Replace F3 fuse. • Determine cause of fuse failure on 24-volt system. • Replace defective part and retry.
		2	If problems persists, check low voltage terminal strip and wire harness. Replace if necessary. Retry.
		3	If problem persists, replace control module.

Troubleshooting *(continued)*

NOTICE Instructions in this supplement are based on factory default parameter settings.

Figure 16 Troubleshooting procedures (continued)

Boiler not firing and:	Check for:	Corrective actions:		
Display first digit shows 0 and last digits show 2 or 3-digit number (boiler outlet water temperature).	Are room thermostat and DHW aquastat satisfied?	1	If yes, then boiler should be off — there is no call for heat. Turn up thermostat or aquastat. Boiler should start.	
	Is room thermostat or DHW aquastat calling for heat?	2	Check parameters 2 and 3. <ul style="list-style-type: none"> To change to Parameter mode, press the MODE button one time when in Standby mode. Parameter 2 must be ON for DHW operation — [2 01] on display. Parameter 3 must be ON for central heating operation — [3 01] on display. Refer to instructions in this guide to set parameters. 	
	Does display intermittently show 0 for outlet water temperature?	3	Check parameters 1 and 3. <ul style="list-style-type: none"> To change to Parameter mode, press the MODE button one time when in Standby mode. If parameter 1 shows 68: <ul style="list-style-type: none"> Press “+” until display returns to 140. Then press “Store.” Display will blink when setting is accepted and stored. If parameter 3 shows 00: <ul style="list-style-type: none"> Press “+” and display will return to “01” Then press “Store.” Display will blink when setting is accepted and stored. If problem persists, replace the control module.	
	Is blower running on low?	4	From Standby mode, press “Mode” twice and display will change to “Info” <ul style="list-style-type: none"> Press “Step” until display shows #6. If #6 value displays as 32, replace the blower assembly. 	
	Is room thermostat or DHW calling for heat, but boiler is not firing?		5	Check thermostat or aquastat: <ul style="list-style-type: none"> Turn off power to the boiler. Install a temporary jumper on low voltage terminal strip terminals 5 and 6 for central and terminals 3 and 4 for DHW. Retry. If boiler operates, check the thermostat or aquastat and connect wiring. Replace if necessary. Remove jumper and retry.
			6	Check boiler wiring: <ul style="list-style-type: none"> Turn off power to the boiler. Check wiring against wiring diagram. Verify all wiring is in good condition and securely fastened. Replace harness if necessary and retry.
			7	If boiler still does not fire, replace the control module.
Check information mode, #4 — does display show 4.230?		1	The outdoor sensor has failed or the wires are shorted. Replace the outdoor sensor if wiring is ok. Also, remove the outdoor sensor wires and check operation to ensure no other problem is occurring.	

Troubleshooting *(continued)*

NOTICE Instructions in this supplement are based on factory default parameter settings.

Figure 17 Troubleshooting procedures — when display shows soft lockout code

SOFT LOCKOUT <i>[Display flashes 9, then b in first position; last two digits on steady (code)]</i>		
Code	Reason for soft lockout	Corrective actions <i>(pressing RESET should restart boiler immediately)</i>
		⚠WARNING Electrical shock hazard. Turn off power to boiler when working with wiring or replacing any boiler component.
18	High limit operation — burner off until outlet water temp drops below 203 °F minus the ON differential	1 This should only happen when the heat demand is lower than the lowest firing rate of the boiler, such as operation of a single, small zone. Check system for:
		2 Verify boiler and system are full of water
		3 Make sure system does not have trapped air preventing proper flow
		4 Inspect and verify system piping and components (including pipe size and circulator capacity)
		5 Verify piping agrees with boiler manual recommendations.
		6 Verify proper circulator(s) operation
		7 Possible loose connector on boiler outlet sensor. Tighten connector
		8 Possible bad boiler supply outlet sensor
19	Return water temperature higher than 203 °F. — burner off until return water temp drops below 203 °F minus the ON differential	1 Verify proper direction of water flow through boiler
		2 Verify boiler and system are full of water
		3 Make sure system does not have trapped air preventing proper flow
		4 Inspect and verify system piping and components
		5 Verify piping agrees with boiler manual recommendations.
		6 Verify proper circulator(s) operation
		7 Possible loose connector on boiler outlet sensor. Tighten connector
		8 Possible bad boiler supply outlet sensor
24	Return temp higher than supply temp — Burner off waiting for supply temp to rise above return temp	1 Verify proper direction of water flow through boiler
		2 Verify boiler and system are full of water
		3 Make sure system does not have trapped air preventing proper flow
		4 Inspect and verify system piping and components
		5 Verify piping agrees with boiler manual recommendations.
		6 Verify proper circulator(s) operation
		7 Possible loose connector on boiler outlet sensor. Tighten connector
		8 Possible bad boiler supply outlet sensor

— Continued on next page —

Troubleshooting *(continued)*

NOTICE Instructions in this supplement are based on factory default parameter settings.

Figure 17 Troubleshooting procedures — when display shows soft lockout code (continued)

SOFT LOCKOUT <i>[Display flashes 9, then b in first position; last two digits on steady (code)]</i>			
25	Outlet water temp rose too quickly — burner off for 10 minute wait (burner recycles, increasing wait 1 minute each attempt, to a max of 15 minutes)	1	Possible hot water return from DHW tank.
		2	Make sure system does not have trapped air preventing proper flow.
		3	Inspect and verify system piping and components.
		4	Verify piping agrees with boiler manual recommendations.
		5	Verify proper circulator(s) operation.
		6	Possible loose connector on boiler outlet sensor. Tighten connector.
		7	Possible bad boiler supply outlet sensor.
26	External limit open on limit wired in soft lockout circuit (auto reset). Low voltage terminals 6 and 7. Burner off for 150 seconds	1	If no external limit connected to 6 & 7, verify green jumper wire making good electrical contact with screw terminals.
		2	If external limit connected, verify proper limit operation.
29	Blower signal not zero when it should be — Burner off until signal condition corrected	1	Change display to Information mode — if INFO #6 shows 6_32, the blower has failed.
		2	Possible strong wind blowing against vent turning blower wheel, correct venting.
		3	Defective blower.
		4	Defective control module.
30	Temperature rise across boiler more than 45°F. — Burner off for 150 second wait (plus 1 additional minute for each failed attempt, up to 20 times, then hard lockout occurs)	1	Flow problem through boiler — Temperature rise through boiler should be less than 35°F.
		2	Make sure system does not have trapped air preventing proper flow.
		3	Inspect and verify system piping and components (including pipe size and circulator capacity).
		4	Verify piping agrees with boiler manual recommendations.
		5	Verify proper circulator(s) operation.
		6	Possible loose connector on boiler supply/return sensor(s). Tighten connector.
		7	Possible bad supply/return sensor — replace sensor.
35	Short circuit across flue temperature sensor terminals — Burner off until corrected	1	Shorted wiring to flue sensor— correct the wiring.
		2	Defective flue sensor — replace sensor.
40	Open circuit across flue temperature sensor terminals — Burner off until corrected	1	Shorted wiring to flue sensor— correct the wiring.
		2	Defective flue sensor — replace sensor.
52	Flue Temperature exceeded 216 °F. but did not exceed 225 °F (hard lockout occurs above 225 °F — Burner off for 150 second wait	1	Verify flue temperature with thermometer. If actual temperature does not correlate with Information mode #5 replace flue sensor.
		2	Heat exchanger may need to be cleaned. Follow the boiler maintenance procedure given in this guide, page 33.
		3	Burner problem — verify gas pressure, burner firing rate and combustion per Ultra Boiler manual procedures — correct any problems. If combustion is not acceptable, see page 38 in this guide.
65	Waiting for blower to start	1	Change display to Information mode — if INFO #6 shows 6_32, the blower has failed.
		2	Verify blower wiring, 120 VAC on high voltage connector, if no 120VAC, inspect/replace wire harness, or control module.
		3	Defective blower.
		4	Defective control module.

Troubleshooting *(continued)*

NOTICE Instructions in this supplement are based on factory default parameter settings.

Figure 18 Troubleshooting procedures — when display shows hard lockout code

HARD LOCKOUT condition <i>[Display flashes first digit, "E" and last two digits (code)]</i>		
Code	Reason for soft lockout	Corrective actions <i>(pressing RESET should restart boiler immediately)</i>
		⚠WARNING Electrical shock hazard. Turn off power to boiler when working with wiring or replacing any boiler component.
00	Flame detected on startup	1 Igniter may be cracked. Moisture gets in crack and may cause E-00.
		2 Burner may be operating too hot due to incorrect combustion. Inspect flame during operation following the procedure in Ultra Boiler Manual. If flame is acceptable at both high and low fire, go to step 3, below. If flame is not acceptable: <ul style="list-style-type: none"> • For propane boilers, verify propane orifice is correct and properly installed. See Ultra Boiler Manual for procedure. Obtain and install propane orifice if necessary. • For correctly-orificed propane boiler or natural gas boiler, replace gas valve if burner glows excessively.
		3 Look into the burner inspection window after the boiler shuts down. If flame is still present, gas valve may be leaking. Replace gas valve. BEFORE replacing valve check gas line pressure coming to boiler. Pressure must not exceed 13 inches w.c. or valve damage could occur.
02	Ignition failed through 5 attempts: NO spark occurs:	1 Check ignition electrode cable, electrode connector, spade connection at MCBA and other connections. <ul style="list-style-type: none"> • Inspect ignition electrode cable and electrode for insulation damage. • Resistance of igniter wire should be 1000 ohms +/- 50 ohms. If resistance is more or less, replace igniter wire. • Check ground lead from ground terminal strip to heat exchanger access cover.
02	Ignition failed through 5 attempts: Spark occurs, but no flame:	1 Verify manual gas valve in boiler is open.
		2 [Models 80 or 105 only] — Verify plastic line from gas valve to air inlet elbow is connected to gas valve and elbow, and line is unobstructed, with no kinks
		3 Check incoming gas pressure per Ultra Boiler Manual. If gas pressure is too high, the gas valve regulator will lock up.
		4 Verify gas lines are free of obstruction.
		5 Purge gas lines of air if necessary.
		6 Verify flue gas vent and air supply piping are correctly installed, in good condition and there are no obstructions.
		7 Check voltage to gas valve. It should be approximately 19 to 21 vdc during ignition attempt.
		8 Check gas meter to verify gas flows when gas valve is activated.
		9 Remove and inspect/clean ignition electrode per Ultra Boiler Manual. Clean white oxides if necessary. Replace ignition electrode if in poor condition or cannot be cleaned.
		10 Ensure vent is clear. Restricted vent will not allow boiler to light.
— This section continued on next page —		

— Continued on next page —

Troubleshooting *(continued)*

NOTICE Instructions in this supplement are based on factory default parameter settings.

Figure 18 Troubleshooting procedures — when display shows hard lockout code (continued)

HARD LOCKOUT condition <i>[Display flashes first digit, "E" and last two digits (code)]</i>		
02	Ignition failed through 5 attempts: Spark occurs, but no flame:	— This section continued from previous page —
		11 Remove condensate drain and check drain fitting on bottom of heat exchanger and condensate trap for restriction. • If restricted, clean and let condensate water out. • Re-connect and fire boiler.
		12 Clean the heat exchanger — perform the boiler complete maintenance procedures beginning on page 33 of this guide.
		13 See Ultra Boiler manual or the instructions in this guide for procedure to disconnect gas valve from venturi. • Inspect venturi gas line to verify there are no obstructions. • Reinstall gas valve.
		14 Check for possible flue gas recirculation at vent/air terminations or inside boiler housing. Look for signs of moisture, corrosion in the venturi or water dripping from the burner.
		15 If gas valve is powered, gas flows when activated, and above have been verified, replace the gas valve and retry.
02	Ignition failed through 5 attempts: Flame occurs, but flame signal strength is low (less than 4 vdc between low voltage terminal strip terminal 9 and ground):	1 Inspect flame per procedure in Ultra Boiler manual, at low fire and high fire rates.
		2 Remove and inspect/clean ignition electrode per Ultra Boiler Manual. Clean white oxides if necessary. Replace ignition electrode if in poor condition or cannot be cleaned.
		3 Inspect and clean burner if necessary — perform the boiler complete maintenance procedures beginning on page 33 of this guide. • Replace burner if not in good condition.
		4 Check gas flow rate at gas meter with boiler at high fire (see Ultra Boiler manual for procedure to force boiler to high fire).
		5 If input is not within about 10% of boiler rating, replace gas valve. • Note that the length of the vent/air piping will affect boiler firing rate, with longer piping causing lower inputs.
		6 Check ground wire and connections from ground terminal strip to heat exchanger access cover and from ground terminal strip to X1-6 terminal on the wiring harness. • Use ground continuity meter to verify good ground path.
		7 Follow procedure in Ultra Boiler manual to inspect and clean ignition electrode. • Replace ignition electrode if necessary.
		8 If above does not correct problem, replace control module.
03	Ignition failure or gas valve electrical problem	1 If error occurs before boiler tries for ignition, problem may be gas valve connection or harness. Measure continuity of gas valve harness through outer 2 pins of connector.
		2 Measure resistance between outer two pins on gas valve — should be approximately 50 ohms. Resistance from each pin to ground must be infinity.
		3 If error occurs after 5 ignition retries, E-03 indicates same condition as E-02. Refer to E-02 troubleshooting.
		4 Replace control module.

— Continued on next page —

Troubleshooting *(continued)*

NOTICE

Instructions in this supplement are based on factory default parameter settings.

Figure 18 Troubleshooting procedures — when display shows hard lockout code (continued)

HARD LOCKOUT condition <i>[Display flashes first digit, "E" and last two digits (code)]</i>			
04	Voltage lost after lockout occurred or AC voltage fluctuations on incoming power	1	Control module will only restart with manual reset, even after power loss. <ul style="list-style-type: none"> Code 04 occurs if power is interrupted while another error is present or due to power input fluctuations.
		2	Incoming power fluctuations may cause MCBA module to go into E-04 hard error code. <ul style="list-style-type: none"> This can occur due to power failure, brown-out or poor electrical input from a back-up generator. To reduce shutdowns due to poor power conditions, install Weil-McLain part number 383-500-021, Time Delay Relay (3 minute incoming power time delay) to give incoming power time to stabilize before powering boiler.
		3	In severe cases of power fluctuations, Time Delay Relay may not solve E-04. <ul style="list-style-type: none"> If so, very good incoming power line filter or Uninterruptible Power Source (UPS) may correct.
05	Internal Control or Display error	1	Replace display and display ribbon cable.
		2	Replace control module.
06	Internal Control Failure	1	Reset control and retry. If problem persists, replace control module.
07	Gas valve relay error	1	Gas valve wiring may be shorted to ground. Check continuity to ground
		2	Defective gas valve. Measure resistance between outer two pins on gas valve — should be approximately 50 ohms. Resistance from each pin to ground must be infinity.
08	Internal Control Failure	1	Reset control and retry. If problem persists, replace control module.
09	Internal Control Failure	1	Reset control and retry. If problem persists, replace control module.
11	EEPROM Error	1	Ignition interference.
		2	Replace control module.
12	External limit open (between terminal 6 and 8)	1	Check low water cut-off, limit controls, etc. wired between terminals 6 and 8.
13	Usually indicates a sensor problem	1	Measure the resistance of each of the sensors — return, supply and flue. See page 23 for sensor resistance values. Replace sensor(s) if necessary.
14	Supply water sensor problem	1	Measure the resistance of each of the supply sensor. See page 23 for sensor resistance values. Replace sensor if necessary.
15	Internal control failure	1	Reset control and retry. If problem persists, replace control module.
16			
17			

— Continued on next page —

Troubleshooting *(continued)*

NOTICE Instructions in this supplement are based on factory default parameter settings.

Figure 18 Troubleshooting procedures — when display shows hard lockout code (continued)

HARD LOCKOUT condition <i>[Display flashes first digit, "E" and last two digits (code)]</i>			
18	Thermal overrun condition – Outlet water temperature above 210 °F.	1	This should only happen when the heat demand is lower than the lowest firing rate of the boiler, such as operation of a single, small zone. Check system for:
			Verify boiler and system are full of water.
			Make sure system does not have trapped air preventing proper flow.
			Inspect and verify system piping and components.
			Verify piping agrees with boiler manual recommendations.
			Verify proper circulator(s) operation.
			Possible loose connector on boiler outlet sensor. Tighten connector.
			Possible bad boiler supply outlet sensor.
	2	Use a contact thermometer to check outlet water temperature. <ul style="list-style-type: none"> • Compare to temperature shown with display in Info mode ("1" in the display's first digit — see Figure 14, page 20). • Replace return temperature sensor if results are not close. • Replace control module if sensor replacement doesn't solve problem. 	
19	Thermal overrun condition – Return water temperature above 210 °F.	1	Verify boiler and system are full of water
			Make sure system does not have trapped air preventing proper flow
			Inspect and verify system piping and components
			Verify piping agrees with boiler manual recommendations.
			Verify proper circulator(s) operation and direction
			Possible loose connector on boiler outlet sensor. Tighten connector
	Possible bad boiler return boiler inlet sensor		
25	Temperature rise > 58°F	1	Check flow. Check pipe size and circulator capacity. Follow suggestions for hard lockout code 18.
28	Blower not running	1	Change display to Information mode — if INFO #6 shows 6._32, the blower has failed.
		2	Verify 120 volts at blower connection — If no 120 VAC, inspect wiring. Replace control module if wiring is correct and in good condition.
		3	If 120VAC is present, remove low voltage wiring harness. If blower does not run, replace the blower. If blower runs, replace the control module.
29	Blower signal not zero when it should be	1	Change display to Information mode — if INFO #6 shows 6._32, the blower has failed.
		2	This might happen if the vent is facing a very windy side of the building. If the blower is turning because of the wind when a call for heat initiates on the Ultra, an E-29 might occur. Move the vent to a less windy location
		3	Check the wiring. Replace blower.
		4	Replace control module.

— Continued on next page —

Troubleshooting *(continued)*

NOTICE Instructions in this supplement are based on factory default parameter settings.

Figure 18 Troubleshooting procedures — when display shows hard lockout code (continued)

HARD LOCKOUT condition <i>[Display flashes first digit, "E" and last two digits (code)]</i>			
30	Temperature rise across boiler over 58 °F, and occurred 20 times.	1	Flow problem through boiler — Temperature rise through boiler should be less than 35 °F.
		2	Make sure system does not have trapped air preventing proper flow.
		3	Inspect and verify system piping and components.
		4	Verify piping agrees with boiler manual recommendations.
		5	Verify proper circulator(s) operation.
		6	Possible loose connector on boiler supply/return sensor(s). Tighten connector.
		7	Possible bad supply/return sensor.
31	Outlet water temperature sensor short circuit.	1	Inspect outlet water temperature sensor and wiring. Replace sensor if wiring correct and in good condition. Replace low voltage wiring harness if problem persists. Replace control module if harness replacement doesn't resolve.
32	Return water temperature sensor short circuit.	1	Inspect return water temperature sensor and wiring. Replace sensor if wiring correct and in good condition. Replace low voltage wiring harness if problem persists. Replace control module if harness replacement doesn't resolve.
36	Outlet water temperature sensor open circuit.	1	Inspect outlet water temperature sensor and wiring. <ul style="list-style-type: none"> • Replace sensor if wiring correct and in good condition. • Replace low voltage wiring harness if problem persists. • Replace control module if harness replacement doesn't resolve.
37	Return water temperature sensor open circuit.	1	Inspect return water temperature sensor and wiring. <ul style="list-style-type: none"> • Replace sensor if wiring correct and in good condition. • Replace low voltage wiring harness if problem persists. • Replace control module if harness replacement doesn't resolve.
44	Internal control failure	1	Reset control and retry. If problem persists, replace control module.
52	Flue temperature exceeded 225 °F.	1	Verify flue temperature with thermometer. <ul style="list-style-type: none"> • If actual temperature does not correlate with Information mode #5, replace flue sensor
		2	Heat exchanger may need to be cleaned — perform the boiler complete maintenance procedures beginning on page 33 of this guide.
		3	Burner problem — verify gas pressure, burner firing rate, combustion. Correct problems. If combustion is still unacceptable, follow the procedures beginning on page 38 of this guide.
60	Internal control failure	1	Reset control and retry. If problem persists, replace control module.
61	Internal control failure	1	Reset control and retry. If problem persists, replace control module.
65	Blower signal too low (not enough driving force)	1	Inspect wiring and connections. <ul style="list-style-type: none"> • If wiring is correct, replace blower assembly. • If blower assembly replacement is unsuccessful, replace control module.

Boiler maintenance procedure

VERIFY PROPER OPERATION AFTER SERVICING (see Ultra Boiler Manual for procedures)

⚠️WARNING Removing and reinstalling components can change boiler behavior. After any maintenance procedure, you must prove the boiler is operating correctly. To do so, follow the complete procedure for boiler and system start-up, beginning on page 31 of the Ultra Boiler manual. Failure to comply could result in severe personal injury, death or substantial property damage.

OBTAIN REQUIRED MAINTENANCE KIT BEFORE PROCEEDING!

⚠️WARNING Removing heat exchanger and burner components may damage gaskets or components. You must have the following Weil-McLain Maintenance kit available to correctly perform the required maintenance procedures. Failure to complete could result in severe personal injury, death or substantial property damage.

For **Ultra-80** or **Ultra-105** — part number **383-500-605** (includes igniter, igniter gasket, cover plate gasket, cover plate insulation, burner gasket, venturi gasket, Sentinel inhibitor test kit)

For **Ultra-155, -230** or **-310** — part number **383-500-620** (includes igniter, igniter gasket, cover plate gasket, cover plate insulation, burner gasket, venturi gasket, Sentinel inhibitor test kit)

In addition, for **ALL boilers**, obtain exchanger cleaning too, Weil-McLain part number **591-706-200**.

DISCONNECT POWER BEFORE PROCEEDING

⚠️WARNING **Electrical shock hazard** — Disconnect all electrical power to the boiler before attempting maintenance procedures. Failure to complete could result in severe personal injury, death or substantial property damage.

Re-install jacket front door

⚠️WARNING Re-install boiler jacket front door after servicing. The boiler front door must be securely fastened to the boiler to prevent boiler from drawing air from inside the boiler room. This is particularly important if the boiler is located in the same room as other appliances. Failure to keep the door securely fastened could result in severe personal injury or death.

Clean and treat boiler water

Obtain Sentinel X100 inhibitor and Sentinel inhibitor test kit from Weil-McLain.

After filling the system as directed in these instructions, use a caulking gun to inject the X100 inhibitor into the system, following the instructions on the tube. Allow time for the water to circulate and mix. Then check the inhibitor level. Add additional inhibitor if necessary.

Test the pH of a sample of system water at least annually. The pH of the water mixture must be between 7.0 and 8.5. (Or use the Sentinel inhibitor test kit to check concentration.) If pH is outside this range (or inhibitor test kit indicates low level), the inhibitor level may not be sufficient to prevent corrosion. Add X100 inhibitor if the need is indicated.

If antifreeze is used, use only antifreeze listed by Weil-McLain as suitable for use with Ultra Gas Boilers. Follow all guidelines provided. A list of approved antifreeze products is available at www.Weil-McLain.com.

Figure 19 Tools and test equipment required for maintenance procedure, troubleshooting and combustion verification

Tools needed for troubleshooting	Purpose
25mm Torx screwdriver	change gas valve or to add orifice from natural to propane
7 mm Nut driver	burner screws
10mm & 11mm nut drivers	Front cover plate of heat exchanger
4 mm Allen wrench (long-handled) and/or 8mm open-end wrench	Remove blower assembly from heat exchanger
Digital multi-meter	Read AC and DC voltage, read ohms
Gas manometer	Measure gas pressure
Combustion analyzer (Digital preferred)	Measure CO ₂ , CO and O ₂
Contact thermometer	For checking surface temperatures of heat exchanger and pipes

Boiler maintenance procedure *(continued)*

Perform ALL of the (14) procedures listed in the following, in the ORDER SHOWN.
(You must have the correct maintenance kit to proceed. See page 33 for details.)

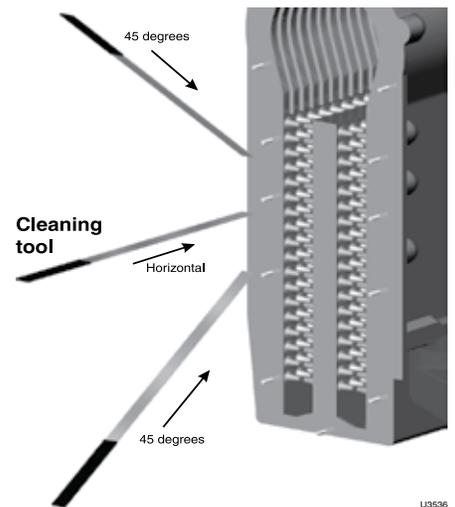
Order	Procedure	Description
1	Shut down the boiler.	<ul style="list-style-type: none"> Follow “To Turn Off Gas to Appliance” instructions under Lighting instructions on boiler label and in Ultra Boiler manual. Make sure to close the external manual gas cock to prevent gas flow to the boiler. Do not drain boiler unless it will be exposed to freezing temperatures. If using freeze prevention fluid in system, do not drain. Allow time for boiler to cool to room temperature if it has been firing. Remove jacket front door by removing two knurled head screws at lower front. Lift door away from boiler to remove.
2	Clean or replace the igniter.	<ul style="list-style-type: none"> Remove the igniter from the cover plate. Use steel wool or equivalent to clean any white oxides on the igniter rod. Make sure the igniter electrodes are parallel to one another. If the igniter is damaged or cannot be cleaned satisfactorily, discard it.
3	Remove combustion chamber cover plate, gas valve / venturi and blower	<p>⚠WARNING The boiler contains ceramic fiber materials. Use care when handling these materials per instructions on page 29 of the Ultra Boiler manual. Failure to comply could result in severe personal injury.</p> <p>Ultra-80 or Ultra-105:</p> <ul style="list-style-type: none"> Remove (4) Phillips-head screws securing gas valve inlet adapter to gas valve. This will disconnect the gas valve from the gas line. Remove the air silencer by separating it from the air adapter on the blower inlet. Disconnect the gas valve plug, blower power supply plug and blower control connector. Release the exchanger cover plate by removing the nuts securing it to the exchanger. Pull the entire blower/venturi/gas valve/cover plate assembly out of the boiler. (See Ultra Boiler manual page 39 for component identification and locations.) <p>Ultra-155, -230 or -310:</p> <ul style="list-style-type: none"> Disconnect wiring: <ul style="list-style-type: none"> gas valve electrical plug two electrical Molex plugs from the blower assembly ignition cable ground wire. Disconnect the flexible gas line at its flare fitting. Remove the air silencer by lifting the plastic clamp off of the gas line and then gently sliding the air silencer down and off the valve. Remove hex head nuts (use box end wrench, 10 mm for series 1 boilers or 11 mm for series 2 boilers) from heat exchanger cover plate and remove burner cover plate from heat exchanger. Pull the entire blower/venturi/gas valve/cover plate assembly out of the boiler. Remove three M4 hex head screws (7mm box end wrench) and burner clips securing burner to cover plate. Remove cover plate.
4	Clean the venturi.	<ul style="list-style-type: none"> Separate the venturi from the combustion chamber cover plate on Ultra-80 or Ultra-105. Separate the venturi from the blower on Ultra-155, -230 or -310. Hold the gas valve/venturi assembly so the venturi is vertical. Use a soft brush, such as a toothbrush, to clean the interior of the venturi. DO NOT use a wire brush. Make sure to clean slots. Avoid getting any debris in the gas valve orifice while cleaning the venturi. Re-attach the venturi to the cover plate (Ultra-80 or -105) or to the blower (Ultra-155, -230 or -310). Set combustion chamber cover plate assembly aside in a safe place while cleaning the heat exchanger.

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Boiler maintenance procedure *(continued)*

Perform ALL of the (14) procedures listed in the following, in the ORDER SHOWN.
(You must have the correct maintenance kit to proceed. See page 33 for details.)

Order	Procedure	Description
5	Clean the burner.	<ul style="list-style-type: none"> • See Figure 20, page 37 for burner access and assembly. • Remove the burner retaining hardware and remove burner from cover plate. • Brush the exterior of the burner with a nylon-bristle brush (DO NOT use a wire brush). • Use a vacuum cleaner or compressed air to clean the interior of the burner. When using compressed air, wear protective eye gear. Compressed air should only be used when cleaning the burner outdoors.
6	Replace combustion chamber cover plate insulation and gaskets.	<ul style="list-style-type: none"> • Reassemble the burner to the cover plate (see Figure 20, page 37). • Replace cover plate insulation and gaskets on cover plate. • Set aside until the heat exchanger has been cleaned as described below.
7	Clean the heat exchanger heating surface.	<ul style="list-style-type: none"> • Use a vacuum cleaner to remove any accumulation on the heating surfaces. Do not use any solvent. • If the vacuum cleaner is unable to clean completely, wash the heating surfaces with clean, warm water. • If further cleaning is necessary, use the Heat exchanger cleaning tool (see illustration at right) or a piece of 20-gauge or lighter sheet metal $\frac{3}{4}$" wide by about 18 inches long to loosen deposits. • Slide the cleaning tool between the pins as shown, from three directions. Continue until all sediment on pins is removed. • After using the cleaning tool as shown, spray water downward from above the pins to flush remaining sediment. • Remove sediment from the bottom of the heat exchanger. • Then disconnect the condensate line at the bottom of the heat exchanger. • Loosen the hose clamps at both ends of the condensate line. • Remove the line and place a pan under the trap connection. • Spray water into the bottom of the heat exchanger to flush remaining sediment to the condensate outlet. • Spray water through the condensate line to clean it thoroughly. • Remove pan and re-install the condensate line. • NOTE: Series 1, Ultra-155 or Ultra-230 only — Examine plug seals. If there is evidence of weeping, replace all plugs using Weil-McLain plug kit, part number 383-500-345.
8	Remove, clean and re-install condensate trap.	<ul style="list-style-type: none"> • If not already removed in the previous step, disconnect the condensate line at the bottom of the heat exchanger. • Spray water through the condensate line to clean it thoroughly. • Fill with fresh water and re-install condensate line.



— Continued on next page —

Boiler maintenance procedure *(continued)*

Perform ALL of the (14) procedures listed in the following, in the ORDER SHOWN.
(You must have the correct maintenance kit to proceed. See page 33 for details.)

Order	Procedure	Description
9	Re-install the combustion chamber cover plate assembly and igniter. ⚠ WARNING You must have the maintenance kit specified on page 33.	<ul style="list-style-type: none"> Inspect the heat exchanger cover plate insulation. Replace if insulation is damaged. Read the ceramic fiber WARNING on page 93 of the Ultra Boiler manual before handling or disposing of ceramic fiber materials. ⚠ WARNING When re-installing the heat exchanger cover plate, you must gradually tighten the cover plate nuts. Follow the tightening sequence shown in Figure 21, page 37, making two or three passes with a torque wrench. The final torque MUST NOT exceed 50 inch-pounds, +/- 10 inch-pounds. Ultra-80 or Ultra-105: <ul style="list-style-type: none"> Reinstall the blower/venturi/gas valve/cover plate assembly. Follow the tightening sequence shown in Figure 21, page 37, making two or three passes with a torque wrench to install the nuts. Reconnect wiring: • gas valve plug • blower power supply plug • blower control connector • ignition cable • ground wire. ⚠ DANGER If the valve adapter block is removed, carefully inspect the O-ring that should still be in the gas valve inlet adapter block. The O-ring must be in good condition and must be installed when gas valve is reconnected. Failure to comply will cause a gas leak, resulting in severe personal injury or death. <ul style="list-style-type: none"> Reconnect the flexible gas line. Reinstall the air silencer by pressing onto the air inlet adapter. Perform a soap suds leak test on all interior gas piping after starting the boiler. Ultra-155, -230 or -310: <ul style="list-style-type: none"> Place cover plate gasket in groove of heat exchanger cover plate. Re-install cover plate. Follow the tightening sequence shown in Figure 21, page 37, making two or three passes with a torque wrench to install the nuts Reinstall air silencer by sliding on gas valve venturi and securing clamp to gas line. Reconnect wiring: • gas valve electrical plug • two electrical Molex plugs from the blower assembly • ignition cable • ground wire. Perform a soap suds leak test on all interior gas piping after starting the boiler.
10	Re-install the igniter and check ignition ground wiring.	<ul style="list-style-type: none"> After the cover plate is re-installed on the heat exchanger, install the igniter. If the existing igniter was successfully cleaned, you can re-install it. If not, or to reduce the possibility of problems, install the new igniter included in the Maintenance kit. Attach igniter, making sure the gasket is in good condition and correctly positioned. Reconnect green ground wire. Check ground wire, ignition wire and connections.
11	Check all boiler wiring.	<ul style="list-style-type: none"> Inspect all boiler wiring, making sure all wires are in good condition and securely attached.
12	Check flue vent and air piping system.	<ul style="list-style-type: none"> Visually inspect entire flue gas venting system and air piping for blockage, deterioration or leakage. Repair any joint that shows signs of leakage in accordance with the vent manufacturers instructions. Where combustion air is ducted to boiler, verify that air inlet piping is connected and properly sealed. Verify that all combustion and ventilation air openings are to the boiler room and/or building are open and unobstructed. Check operation and wiring of automatic combustion air dampers, if used. Verify that boiler discharge and air intake is clean and free of obstructions.
13	Restart boiler and run combustion tests.	<ul style="list-style-type: none"> Follow the Ultra Boiler manual Start-up procedures. Start the boiler and perform combustion tests as specified in the Ultra Boiler manual.
14	If combustion results are unacceptable, follow the procedure beginning on page 38.	<ul style="list-style-type: none"> Ultra boilers do not typically require field adjustment of the gas valve. However, it may be necessary to verify and possibly adjust the combustion settings. When combustion results obtained using the Ultra Boiler manual procedures, see page 38 for procedure to adjust for proper combustion. ⚠ WARNING The adjustment specified in the procedure of page 38 must only be performed by a qualified service technician, using combustion test instruments. Failure to comply could result in severe personal injury, death or substantial property damage.

Boiler maintenance procedure *(continued)*

Figure 20 Burner access and assembly (you must use the Maintenance Kit listed on page 33)

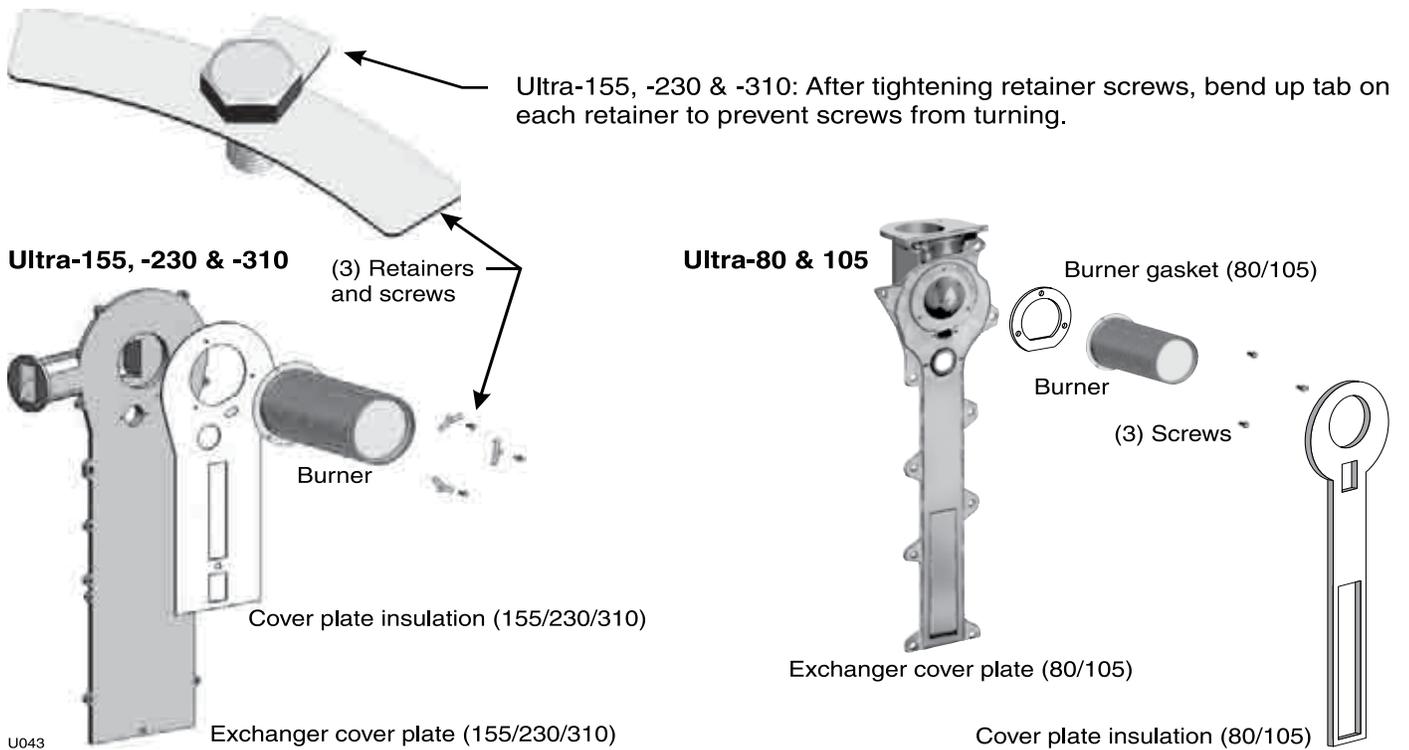
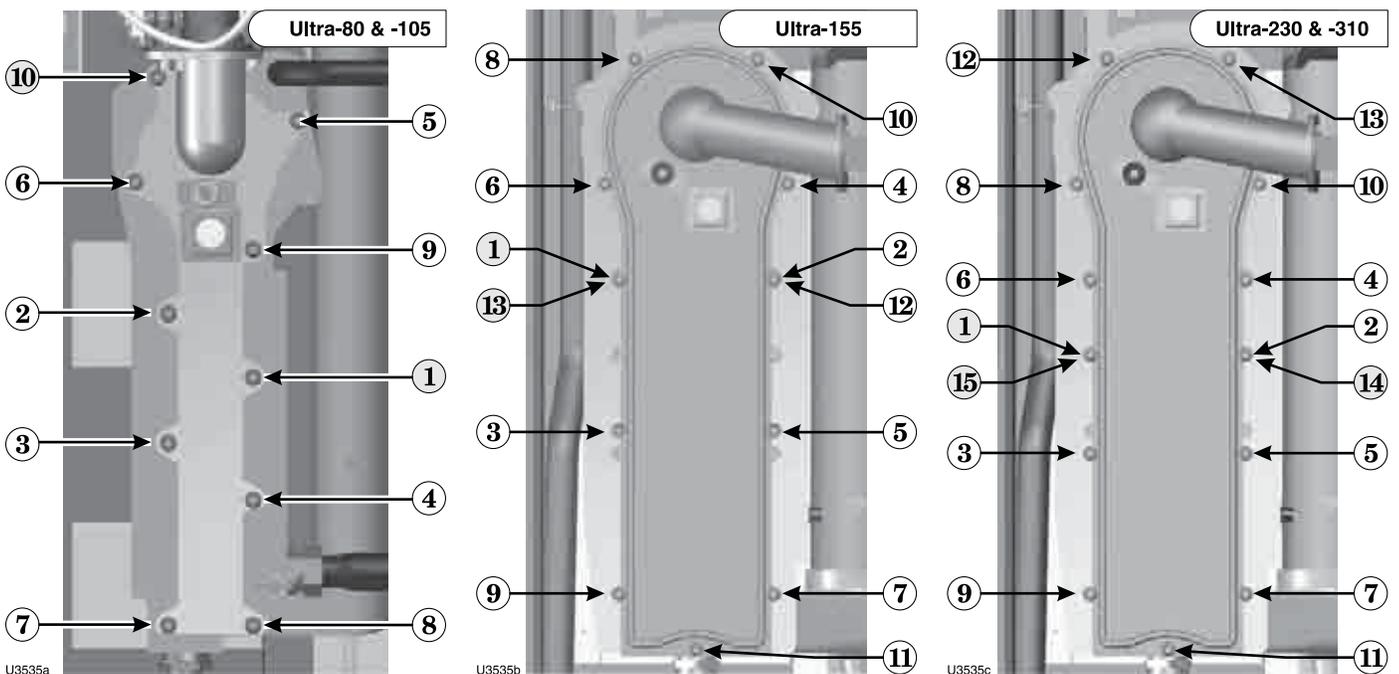


Figure 21 Gradually tighten the nuts, repeating the sequence shown below until the torque reaches 50 inch-pounds (+/- 10 inch-pounds)



Combustion testing and adjustment

DO NOT PROCEED WITHOUT COMBUSTION TEST EQUIPMENT

WARNING The combustion testing and adjustment procedures on this and the following pages are intended only for a qualified technician, using combustion test equipment. Failure to use combustion test equipment to verify adjustments could result in severe personal injury, death or substantial property damage.

□ When is adjustment required?

Ultra boilers do not typically require field adjustment. However, it may be necessary to verify and possibly adjust the combustion settings of the boiler. A calibrated combustion analyzer is necessary to measure the Ultra's combustion settings and adjust, if necessary. The information below is to assist in this adjustment for the Ultra boiler.

A boiler that is out of adjustment may have some or all of the following symptoms: difficulty igniting, poor stability at low fire, combustion noise, and/or above normal carbon monoxide readings. If any of these symptoms are present the boiler needs to be thoroughly inspected to rule out any possible causes due to components other than the gas valve venturi assembly, such as connections

or venting configuration. Follow the Troubleshooting procedures in this guide to check for possible causes before proceeding with combustion adjustment.

If all the other items are ruled out the following instructions may be used to adjust the venturi in the field.

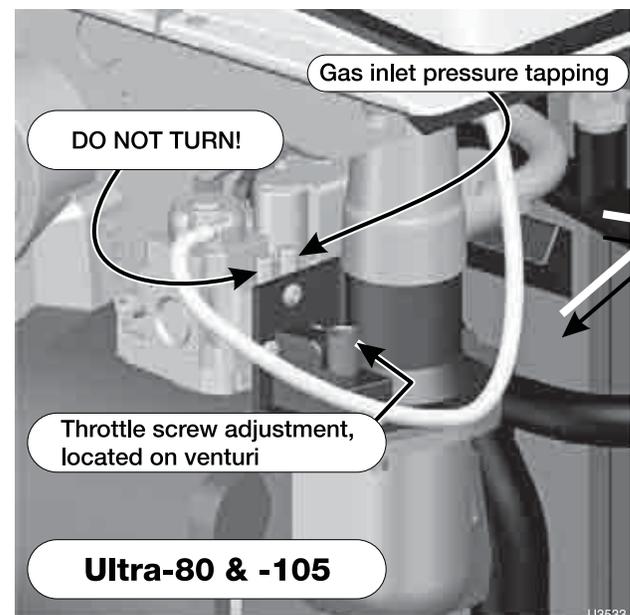
The venturi is the device attached to the gas valve that controls the mixture of gas and air entering the blower. The throttle screw is the only adjustment on the venturi. This adjustment changes the size of the passage which gas flows into the venturi. This adjustment will be referred to as the throttle adjustment. This is the only adjustment that is made to adjust air-fuel ratio. Follow the instructions in the following pages if adjustment is required.

□ Check flame & combustion with instruments

1. Initiate a call for heat on one of the heat demand inputs.
2. Press and hold both the Ultra control panel "Mode" and "+" buttons simultaneously until "H" appears.
3. The "H" in the first digit of the display means the boiler will operate at high fire when the blower speed reaches maximum.
4. Look at the flame through the flame inspection window. The high fire flame should be blue and should be stable. The burner surface should be covered with orange dots.
5. Remove the flue temperature sensor from the flue pipe and insert a combustion test probe., using a calibrated combustion test instrument.
6. Test for CO₂ (or O₂) and for CO. The CO₂ values must be within 1.0% of the values listed in Figure 24, page 40.
 - a. If results are acceptable, proceed to step 7.
 - b. IF NOT, follow the instructions under "Throttle screw adjustment procedure", page 40, to set the throttle screw position. See WARNING below.

WARNING If combustion at either high or low fire is outside the range given in Figure 24, page 40, follow the procedure given on page 40 for adjusting the throttle screw on the venturi. If throttle screw adjustment does not correct the problem, then shut down the boiler and contact your local Weil-McLain representative. Throttle screw adjustment must be done only by a qualified technician, using calibrated test instruments. Failure to comply could result in severe personal injury, death or substantial property damage.

Figure 22 Models 80 & 105 — Throttle screw location (ONLY for use by a qualified technician, using calibrated combustion test instruments)



— See next page for Ultra-155, -230 or -310 —

Combustion testing and adjustment *(continued)*

7. Measure natural gas input:
 - a. Operate boiler 10 minutes.
 - b. Turn off other appliances.
 - c. At natural gas meter, measure time (in seconds) required to use one cubic foot of gas.
 - d. Calculate gas input:

$$\frac{3600 \times 1000}{\text{number of seconds from step c}} = \text{Btuh}$$

- e. Btuh calculated should approximate input rating on boiler rating label.
8. Press and hold the Ultra control panel “Mode” and “-” buttons simultaneously until the display shows “L”.
9. The “L” in the first digit means the boiler will operate at low fire when the blower speed reaches minimum.
10. Look at the flame through the flame inspection window. The low fire flame should be stable and evenly distributed over burner surface with a uniform orange color.
11. Test for CO₂ (or O₂) and for CO. The CO₂ values must be within 1.0% of the values listed in Figure 24, page 40.
 - a. If results are acceptable, proceed to step .
 - b. IF NOT, follow the instructions under “Throttle screw adjustment procedure”, page 40, to set the throttle screw position. See WARNING below.

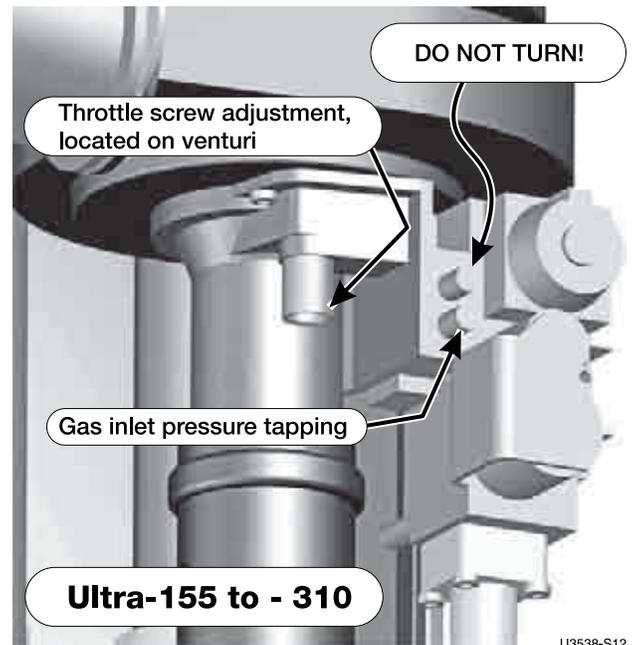
▲WARNING If combustion at either high or low fire is outside the range given in Figure 24, page 40, follow the procedure given on page 40 for adjusting the throttle screw on the venturi. If throttle screw adjustment does not correct the problem, then shut down the boiler and contact your local Weil-McLain representative. Throttle screw adjustment must be done only by a qualified technician, using calibrated test instruments. Failure to comply could result in severe personal injury, death or substantial property damage.

12. If combustion test results at high fire and low fire are correct, press and hold the “+” and “-” buttons to return boiler to automatic firing.
13. Re-install the flue gas temperature sensor. When inserting the sensor, remove the rubber grommet from the probe. Insert the rubber grommet into the flue pipe, then insert the probe into the rubber grommet.

▲WARNING You must re-install the flue gas temperature sensor to prevent flue gas spillage into the boiler enclosure. Failure to comply could result in severe personal injury, death or substantial property damage.

▲WARNING Re-install boiler jacket front door after servicing. The boiler front door must be securely fastened to the boiler to prevent boiler from drawing air from inside the boiler room. This is particularly important if the boiler is located in the same room as other appliances. Failure to keep the door securely fastened could result in severe personal injury or death.

Figure 23 Models 155, 230 & 310 — Throttle screw location (ONLY for use by a qualified technician, using calibrated combustion test instruments)



— See previous page for Ultra-80 or -105 —

Combustion testing and adjustment *(continued)*

Throttle screw adjustment procedure

See Figure 22, page 38, or Figure 23, page 39, for location of the throttle screw.

⚠ WARNING DO NOT attempt to adjust the throttle screw unless by a qualified technician, and with the use of calibrated combustion test instruments. Adjust the throttle screw only as needed to meet the combustion values given in Figure 24.

1. This procedure is only necessary when specified elsewhere in this manual or when combustion tests indicate the need, as explained under “**□ Check flame & combustion with instruments**, page 38.”
2. Initiate a call for heat on one of the heat demand inputs.
3. Combustion readings must be taken at both high fire and low fire.

⚠ WARNING DO NOT attempt an adjustment of the throttle screw at low fire. Just check the combustion values.

4. Press and hold both the Ultra control panel “Mode” and “+” buttons simultaneously until “H” appears.
5. The “H” in the first digit of the display means the boiler will operate at high fire when the blower speed reaches maximum.
6. After the boiler has had time to stabilize, take a CO₂ reading.
 - a. If the CO₂ is HIGH, turn the throttle screw CLOCKWISE to lower the input. Allow the boiler to stabilize and take another reading. Continue until the desired CO₂ value is achieved.
 - b. If the CO₂ is LOW, turn the throttle screw COUNTERCLOCKWISE to increase the input. Allow the boiler to stabilize and take another reading. Continue until the desired CO₂ value is achieved.
7. Press and hold the Ultra control panel “Mode” and “-” buttons simultaneously until the display shows “L”.
8. The “L” in the first digit means the boiler will operate at low fire when the blower speed reaches minimum.
9. Check the combustion readings.
 - a. If results are acceptable at low fire, verify high fire readings again. Then press and hold the “+” and “-” buttons to return boiler to automatic firing.
 - b. If results are not acceptable, shut down the boiler. Contact your Weil-McLain representative immediately.

⚠ WARNING If throttle screw adjustment does not correct the problem, then shut down the boiler and contact your local Weil-McLain representative.

⚠ WARNING You must re-install the flue gas temperature sensor to prevent flue gas spillage into the boiler enclosure. Failure to comply could result in severe personal injury, death or substantial property damage.

Figure 24 Acceptable CO₂ / O₂ and CO values: CO₂ / O₂ values must be within 1.0% of the values listed below —

Boiler	Fuel	High fire		Low fire	
		%CO ₂	%O ₂	%CO ₂	%O ₂
Ultra-80	NG	8.6	5.8	7.8	7.2
	LP	9.6	6.4	8.6	7.8
Ultra-105	NG	9.0	5.0	8.4	6.2
	LP	10.1	5.5	9.2	7.0
Ultra-155	NG	9.0	5.0	8.0	6.8
	LP	10.0	5.6	8.5	8.0
Ultra-230	NG	9.0	5.0	8.0	6.8
	LP	10.0	5.6	9.0	7.2
Ultra-310	NG	9.0	5.0	8.0	6.8
	LP	10.0	5.6	9.0	7.2

NOTICE: CO values should measure less than 60 PPM.

The values above are with the boiler front door removed. Values will typically increase about 0.2% once the door is reinstalled.

The values above are for altitudes up to 5,500 feet. For higher altitudes, CO₂ may be slightly lower and CO slightly higher.

⚠ WARNING Re-install boiler jacket front door after servicing. The boiler front door must be securely fastened to the boiler to prevent boiler from drawing air from inside the boiler room. This is particularly important if the boiler is located in the same room as other appliances. Failure to keep the door securely fastened could result in severe personal injury or death.

□ Adjust and test boiler controls

1. Follow instructions in the Ultra Boiler manual to set and verify operation of the boiler controls.

Overview of Ultra Control Module parameters

Ultra Control Module parameters

NOTICE See information beginning on page 44 for detailed information on all Ultra control module parameters.

Parameter descriptions

1. This section includes explanations of the adjustable parameters (beginning on page 44).

WARNING Revise module parameters **ONLY** if you fully understand the purpose and result of the changes. Tampering with control settings can result in unreliable operation, with possible severe personal injury, death or substantial property damage.

2. You will find additional information on parameters and control operation in the Ultra Control Supplement.

Default parameter settings

1. Figure 26, page 43 lists the factory default settings for all Ultra models, for standard altitudes (up to 5,500 feet) and high altitude (over 5,500 feet).
2. When in doubt, always restore parameters to the default settings listed in Figure 26, page 43.

When to change parameters

1. Factory default settings will work for most applications. There are situations for which changes are desirable or even mandatory:
 - altitudes over 5500 feet.
 - multiple boiler applications using the AM4 module.
2. Default boiler settings are satisfactory for most high-mass systems (radiant slab, cast iron radiators, most finned-tube radiation).

Typical parameter changes

Outdoor reset applications

1. Outdoor reset operation can sometimes be improved by adjusting parameters 4, 5, 6 and 7. Parameters 9, 10 and 11 might also be modified.
2. See page 44 for discussion of outdoor reset.

High altitude installations

1. Minimum fan speed (parameter 17) and ignition fan speed (parameter 9) **MUST** be changed for operation at altitudes over 5,500 feet.
2. See the High Altitude Kit instructions for details. Change these parameters following the High Altitude instructions. If revising the parameters, use **ONLY** the values given in Figure 26, page 43.
3. Also see page 47 for further discussion of fan speed parameters.

Fan-coil systems

1. Systems using fan coil units respond to heat input rapidly, and may require larger differential settings for best performance.
2. See page 49 for discussion of control differential and how to adjust.

High-mass systems

1. High-mass systems, such as in-slab radiant and cast iron radiator systems, respond slowly to heat input. The factory default settings will work well for most of these applications.

DO NOT Change the following:

WARNING Failure to comply with the following could cause equipment performance problems, resulting in potential severe personal injury, death or substantial property damage.

Parameter 2

- DO NOT set for continuous DHW pump.

Parameters 13 & 15

- DO NOT set higher than values in Table 1.

Parameters 17 & 19

- DO NOT set lower than the values in Table 1.

Parameters 24, 25, 26 & 27

- DO NOT change from default settings.

Parameter 32

- DO NOT change from value of 0.

Parameter 33

- Leave setting at 50°F for storage tank DHW applications.

Parameter 34 – first digit

- DO NOT change from value of 0.

Parameter 34 – second digit

- Set only at 0 (2nd CH circuit off) unless using an AM-4. With AM-4, set second digit to 4 (0 - 10 V analog on AM-4: capacity).

Parameter 35 – both digits

- DO NOT change either digit from default setting.

Parameters 37, 39, 40 & 41

- DO NOT CHANGE — For future use only.

Parameter 42 – first digit

- DO NOT change from default value.

How to set parameters

Using the boiler display

With the six buttons on the front of the boiler and the proper code the boiler can be both monitored and modified using the digital display (Figure 25).

Perform the following steps with the boiler powered and in a standby condition.

1. On the boiler display in [STBY] mode
 2. Press and hold the **STEP** button. While holding the “Step” button press and hold the **MODE** button. Hold both buttons together for several seconds until “Code” is displayed. Release buttons. “Code” stays on the display.
 3. NOTE: If [CODE] is not displayed after several seconds release the buttons and press the **MODE** button several times to return to [STBY]. Repeat step two again.
 4. Press the **STEP** button once.
 5. Adjust the number displayed to [C - 05] by using the **+** and **-** buttons.
 6. Press the “Store” button.
- NOTICE** The Ultra control module will automatically exit code mode after 10 minutes of no activity.
7. Press the mode button several times until [PARA] is displayed.
 8. Press the **STEP** button several times until [P-XX] is displayed. The XX represents the parameter that will be changed. The parameter’s value will then be displayed.
 9. Use the **+** or **-** buttons to adjust to the desired value.
 10. Press the **STORE** button. Steps 8 through 10 can now be repeated for additional parameter changes. Or continue to step 11 to exit.
 11. Press the **MODE** button until [STBY] is displayed to exit.

Figure 25 Ultra boiler digital display



	<u>Code not entered</u>	<u>Code entered</u>
Default:	Standby mode	Standby mode
Press 1 time:	Parameter mode	Parameter mode
Press 2 times:	Information mode	Information mode
Press 3 times:	Standby mode	Connection mode
Press 4 times:	Fan mode
Press 5 times:	Error mode
Press 6 times:	Standby mode

WARNING

Revise module parameters ONLY if you fully understand the purpose and result of the changes. Tampering with control settings can result in unreliable operation, with possible severe personal injury, death or substantial property damage.

WARNING

This document must only be used by a qualified heating installer/service technician. Read all instructions, including this Addendum, the Ultra Boiler Control Supplement and the Boiler Manual before installing. Perform steps in the order given. Failure to comply could result in severe personal injury, death or substantial property damage.

NOTICE

After making changes to parameters, record the changes made on the last page of this supplement, and leave a copy with the boiler for future reference.

NOTICE

Installation must comply with local requirements and with the National Fuel Gas Code, ANSI Z223.1 for U.S. installations or CSA B149.1 or B149.2 for Canadian installations.

Ultra GAS-FIRED WATER BOILER SERIES 1 & 2 — Control supplement & Service guide

NOTICE See Figure 25, page 42 for procedure to access Parameter settings.

Figure 26 Default parameter settings — **DO NOT** change any parameter unless the application requires special settings

Par. No.	Parameter description		Ultra-80 thru -230		Ultra-310 ONLY	
			Standard (to 5500 feet)	High altitude	Standard (to 5500 feet)	High altitude
1	T3set DHW		140	140	140	140
2	DHW System		1	1	1	1
3	CH System		1	1	1	1
4	T1 Top CH-mode		190	190	190	190
5	T1 Foot CH-mode		70	70	70	70
6	T4 minimum		32	32	32	32
7	T4 maximum		70	70	70	70
8	T4 frost protection		-22	-22	-22	-22
9	T4 correction		0	0	0	0
10	T blocking		70	70	70	70
11	Booster time		10	10	10	10
12	T parallel shift		0	0	0	0
13	Maximum fanspeed CH	Display shows value in 100's Example: 52 = 5200 rpm	52(00)	52(00)	58(00)	58(00)
15	Maximum fanspeed DHW		52(00)	52(00)	58(00)	58(00)
17	Minimum fanspeed		13(00)	20(00)	14(00)	20(00)
19	Ignition fanspeed		27(00)	35(00)	23(00)	32(00)
20	CH postpump time		0	0	0	0
21	DHW postpump time		03	03	03	03
22	CH modulation hysteresis on		8	8	8	8
23	CH modulation hysteresis off		4	4	4	4
24	DHW modulation hysteresis on		8	8	8	8
25	DHW modulation hysteresis off		4	4	4	4
26	DHW detection hysteresis on		8	8	8	8
27	DHW detection hysteresis off		8	8	8	8
28	CH blocking time		06	06	06	06
29	DHW blocking time		0	0	0	0
30	DHW -> CH blocking time		0	0	0	0
31	Modulate back difference T1 - T2		44	44	44	44
32	RMCI Address		0	0	0	0
33	Tplus: Setvalue additional for DHW		50	50	50	50
34	2nd CH-circuit (1st digit)		00	00	00	00
34	CH type (2nd digit)					
35	DHW 3wayvalve or pump (1st digit)		13	13	13	13
35	DHW-type (2nd digit)					
36	Manual fanspeed		-1	-1	-1	-1
37	PWM-pump level (1st digit)		41	41	41	41
37	PWM-pump level (2nd digit)					
38	Tset hold boiler warm		32	32	32	32
39	Ttop for 2nd CH circuit		94	94	94	94
40	Tfoot for 2nd CH circuit		50	50	50	50
41	Thysterese for 2nd CH circuit		36	36	36	36
42	Pump settings for CH and DHW		21	21	21	21
42	Minimum Off Cycle					

NOTICE See Figure 25, page 42 for procedure to access Parameter settings.

Parameter explanations

NOTICE Fixed-temperature operation (outdoor temperature sensor not installed) — To operate with constant outlet temperature, set parameter 4 to the required supply water temperature for the system.

Outdoor reset operation

1. The closer the heating unit output matches the heat loss, the less the swing in indoor temperature. Outdoor reset adjusts the supply water temperature so the heat output from the heating units matches the heat loss as the outdoor temperature changes. The colder the outdoor temperature, the warmer the water temperature, and vice versa.
2. The control module temperature parameters are named T1xxx for boiler water temperatures and T4xxx for outside temperatures.
3. Parameters 4 through 7 determine the water temperature reset curve, as shown in Figure 27, page 45.
4. **Parameter 6 — ODT** is the Outdoor Design Temperature for the building location, used to calculate design heat loss.
 - Set parameter 6 ($T_{4\text{minimum}}$) equal to the ODT.
5. **Parameter 4** — At the ODT, the boiler outlet water temperature must be at the **design water temperature** to provide required output from the heating units.
 - Set parameter 4 ($T_{1\text{top}}$) equal to the design water temperature.
6. **Parameter 7 — Balance point temperature** is the outside temperature at which building heat loss **equals** building heat gain from solar and internal sources; that is, no space heating is required at this outside temperature.
 - Set parameter 7 ($T_{4\text{maximum}}$) equal to the balance point temperature, typically 60 to 70°F.
7. **Parameter 5** — When outside temperature is at or above the balance point temperature, the boiler outlet water temperature should equal room temperature — this would result in zero heat output by the heating units.
 - Set parameter 5 ($T_{1\text{foot}}$) equal to the design room temperature, typically 68 to 70°F.
8. **Parameter 11** — Automatic temperature boost timing
 - Automatic temperature boost compensates for required pick-up times and variations in heating load requirements. It automatically increases setpoint temperature when a call for heat exceeds a preset time (parameter 11).
 - See page 46 for further discussion.

NOTICE Set parameters 4 to 7 as needed for the desired reset curve. Make sure to set parameters 4 and 6 so the outlet water temperature is at design water temperature when outside temperature drops to the ODT (outdoor design temperature) or lower.

9. Boiler setpoint temperature ($T_{1\text{set}}$)
 - The control module regulates the boiler outlet water to the temperature required by the reset curve.
 - For outside temperature at or below the ODT — parameter 6 ($T_{4\text{minimum}}$), the setpoint temperature equals parameter 4 ($T_{1\text{top}}$).
 - For outside temperature at or above the balance point temperature — parameter 7 ($T_{4\text{maximum}}$), the setpoint temperature equals parameter 8 ($T_{1\text{foot}}$).
 - For outside temperatures between parameter 6 and parameter 7, the setpoint temperature is on the reset curve sloped line, between $T_{1\text{foot}}$ and $T_{1\text{top}}$.
 - See Figure 27, page 45 and Figure 28, page 45 for examples.
 - If a call for heat exceeds the time set in parameter 11, the setpoint temperature will automatically be boosted (increased) above the reset curve value as explained on page 46.
 - The boiler may not operate as low as $T_{1\text{foot}}$, because parameter 10 (T_{blocking}), sets a minimum operating outlet water temperature. If the calculated setpoint, $T_{1\text{set}}$, is less than T_{blocking} , the boiler shuts off. See parameter 10 explanation below.

Parameter 9 ($T_{4\text{ correction}}$)

1. Location of the outdoor sensor may sometimes cause the sensor to incorrectly detect outside temperature.
2. You can set parameter 9 to correct for this difference (up to 9°F more or less) if you believe boiler response needs to be improved. Set a negative number to reduce the outdoor temperature reading, a positive number to increase the reading.

Parameter 10 (T_{blocking})

1. Use this parameter to set a minimum operating boiler outlet water setpoint temperature.
2. When calculated setpoint temperature, T_{set} , is at or below T_{blocking} the boiler shuts down (after operating a postpump cycle).
3. To deactivate this parameter, set the value to 32.

Suggested outdoor reset parameter settings

1. Parameter 4, $T_{1\text{top}}$ — Set to the required supply water temperature when outdoor temperature is at or below ODT (outdoor design temperature).
2. Parameter 5, $T_{1\text{foot}}$ — Set equal to the required room temperature for the building.
3. Parameter 6, $T_{4\text{minimum}}$ — Set to the ODT outdoor design temperature.
4. Parameter 7, $T_{4\text{maximum}}$ — Set to the balance point temperature for the building (typically 60 to 70°F).

NOTICE See Figure 25, page 42 for procedure to access Parameter settings.

Parameter explanations *(continued)*

Figure 27 Outdoor reset curve and control module parameters

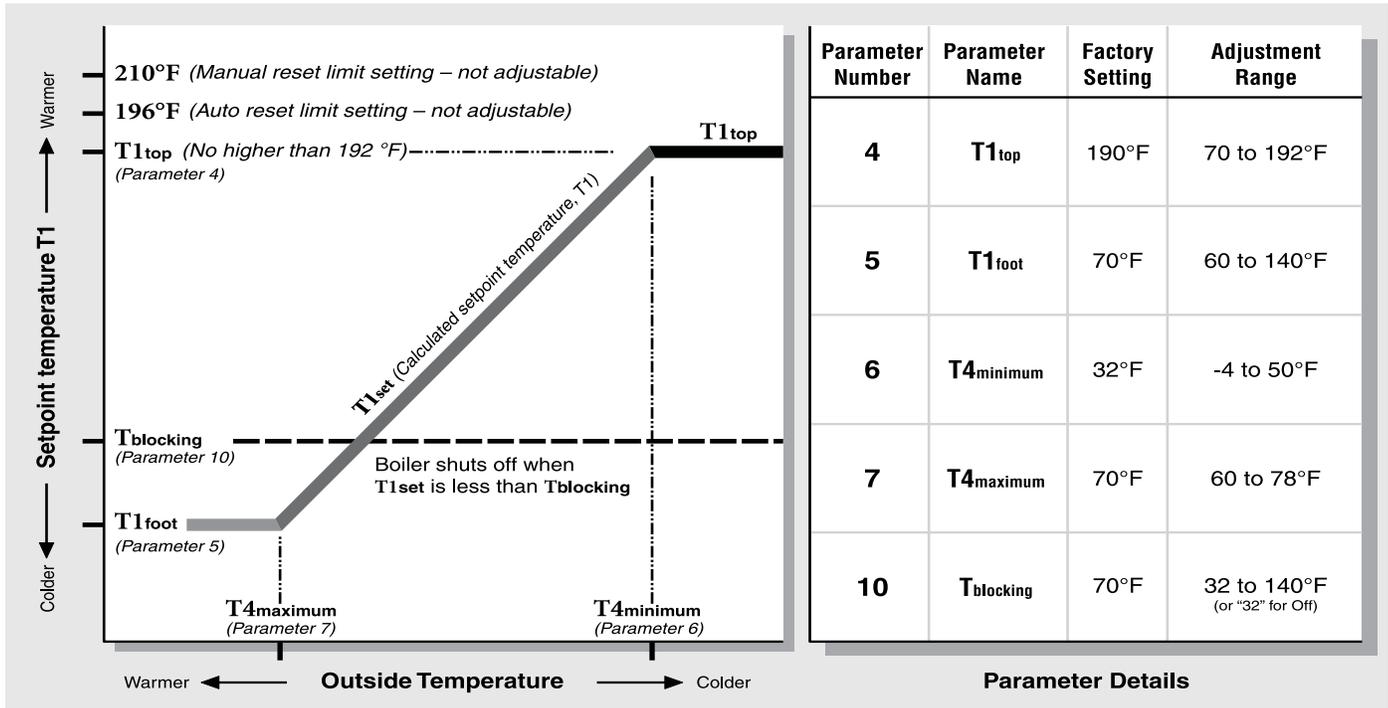
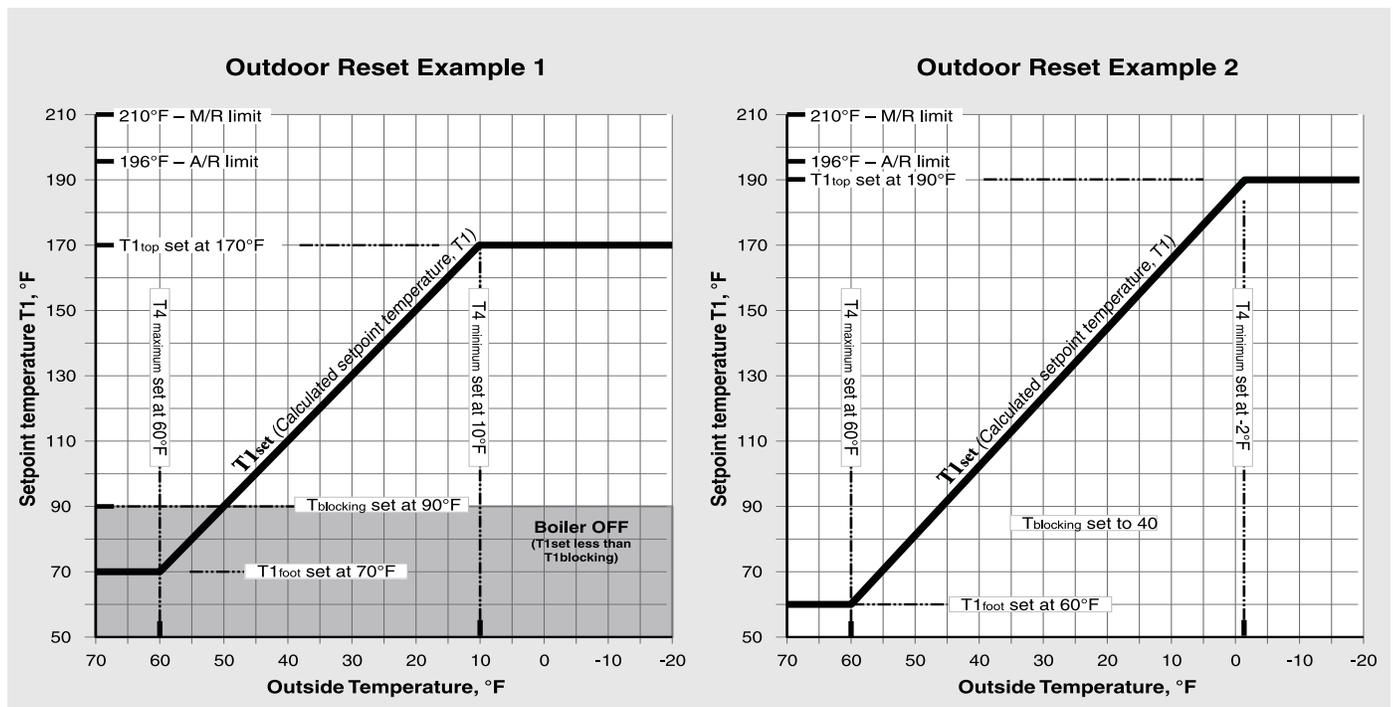


Figure 28 Typical reset curves



NOTICE See Figure 25, page 42 for procedure to access Parameter settings.

Parameter explanations *(continued)*

Automatic temperature boost

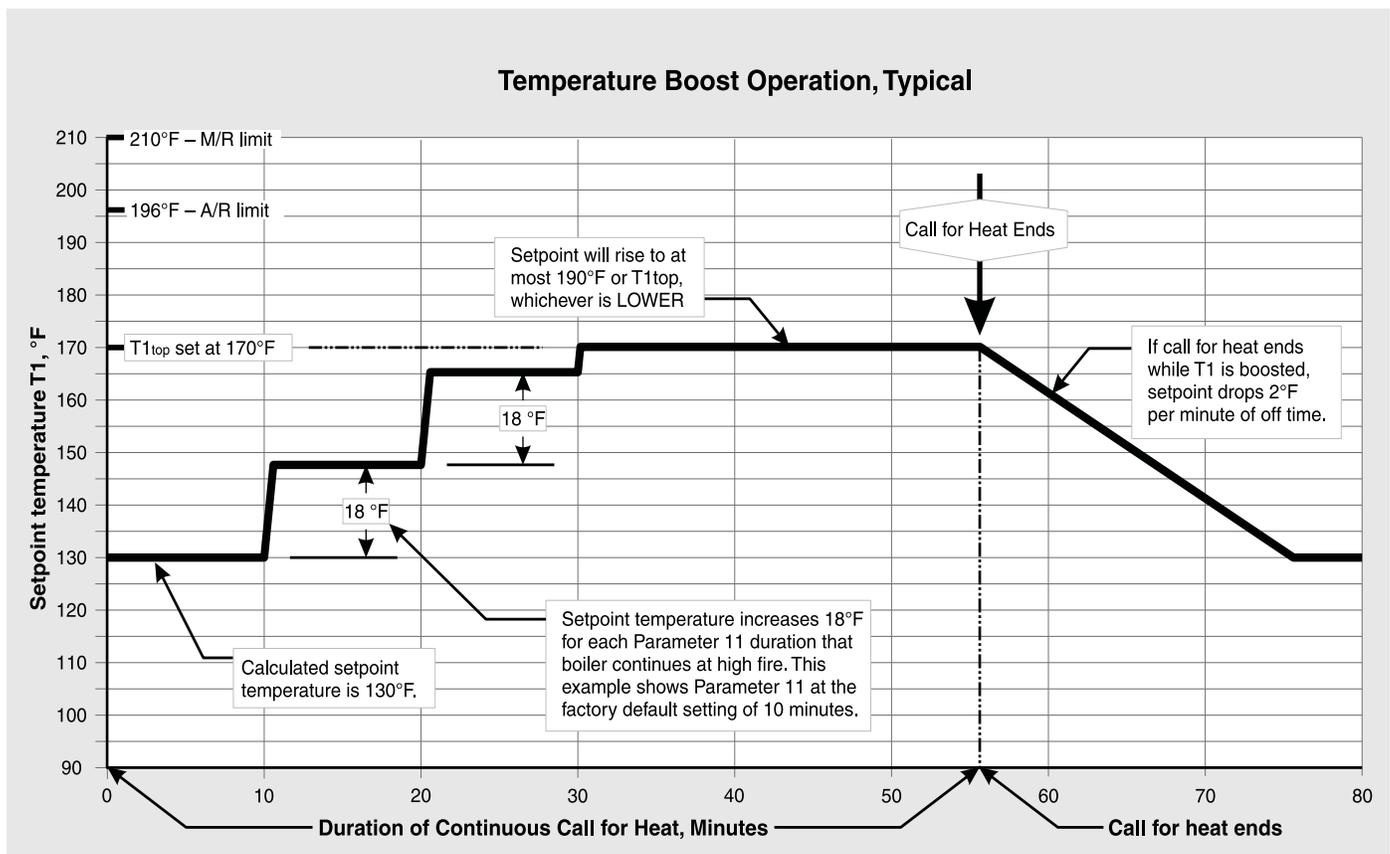
1. If the target temperature happens to be too low for the heating units to supply sufficient heat within ten minutes (default setting), the control “boosts” the target temperature until the supply water meets the system’s needs. See Figure 29, page 46.
2. Even if the reset parameters are optimized for the application, use of setback thermostats or the need for occasional cold start operation will require faster recovery than provided by the normal calculated supply water temperature because the curve assumes steady-state operation.
3. Boost will not call for supply water temperature setpoint greater than the value of parameter 4 (T_{1top}). There is no concern that temperature boost would supply water too hot for low-temperature systems, such as slab-type radiant heating. On hybrid systems, with finned tube radiation and radiant slab, provide additional low temperature protection for the radiant portion of the system, because parameter 4 (T_{1top}) is likely to be set higher than on a radiant-only system.

NOTICE Many slab-type radiant systems won’t require boost. This function can be disabled with a parameter setting of “0.”

Boost operation

1. In outdoor reset operation (outdoor sensor connected), the Ultra control module automatically increases the target outlet water temperature if a call for heat exceeds a time equal to parameter 11 (factory default of 10 minutes for most Ultra boilers).
2. At each interval of parameter 11 of a continuous call for heat, the control module increases the target temperature by 18°F.
3. The control module will continue increasing target temperature until it reaches the value set in parameter 4 (T_{1top}).
4. When the call for heat ends while target temperature is “boosted,” the target temperature drops about 2°F for each minute the thermostat is open.
5. Range = 1 to 30 minutes.
6. Factory default setting = 10 minutes.
7. Deactivate automatic temperature boost by setting to “0.”

Figure 29 Parameter 11 — Automatic supply temperature boost operation — In the example below, the boiler is operating in outdoor reset mode, with a calculated setpoint temperature of 130°F. The call for heat has lasted for more than 10 minutes (value of parameter 11), and supply temperature boost has occurred.



NOTICE

See Figure 25, page 42 for procedure to access Parameter settings.

Parameter explanations *(continued)*

Maximum fan speed

1. **Parameters 13 and 15** can be set to limit the maximum boiler firing rate. Boiler firing rate is proportional to the fan speed, so reducing the maximum fan speed reduces maximum input.
2. Reducing maximum fan speed will be helpful for systems on which the boiler is oversized for either space heating or DHW, or both.
3. The maximum fan speed can be set separately for space heating and DHW using parameters 13 and 15.

Parameter 13 — Space heating max fan speed

1. Acceptable range:
 - Ultra-80 to 230: 1300 to 5200 rpm (13 to 52 on boiler display).
 - Ultra-310: 1400 to 5800 rpm (14 to 58 on boiler display).
 - Boiler display shows fan speed in 100's of rpm. A value of 48 would mean a speed of 100 x 48, or 4800 rpm.
2. Factory default — see Figure 26, page 43.
3. If the boiler is oversized for space heating, you can reduce the maximum fan speed during space heating operation, parameter 13, to limit the maximum boiler input.

Parameter 15 — DHW max fan speed

1. Acceptable range:
 - Ultra-80 to 230: 1300 to 5200 rpm (13 to 52 on boiler display).
 - Ultra-310: 1400 to 5800 rpm (14 to 58 on boiler display).
 - Boiler display shows fan speed in 100's of rpm. A value of 48 would mean a speed of 100 x 48, or 4800 rpm.
2. Factory default — see Figure 26, page 43.
3. If the boiler is oversized for domestic water heating, you can reduce the maximum fan speed during DHW operation, parameter 15, to limit the maximum boiler input.

WARNING

The fan speed **must not be set ABOVE** the value listed in Figure 30, page 48. This would increase boiler firing rate beyond the acceptable limit, resulting in potential for severe personal injury, death or substantial property damage.

WARNING

The fan speed **must not be set BELOW** the value listed in Figure 30, page 48. This could result in potential for severe personal injury, death or substantial property damage.

WARNING

HIGH ALTITUDE installations (above 5,500 feet) — The **MINIMUM** fan speed (parameter 17) and **IGNITION** fan speed (parameter 19) must be set to the values listed in Figure 31, page 49. Failure to comply could result in severe personal injury, death or substantial property damage.

Minimum fan speed — parameter 17

1. **Parameter 17** sets the minimum fan speed. Boiler firing rate is proportional to fan speed, so increasing the minimum fan speed increases the minimum firing rate (low fire).
2. Parameter 17 sets the minimum fan speed for both DHW and space heating modes.

NOTICE See Figure 25, page 42 for procedure to access Parameter settings.

Parameter explanations *(continued)*

Figure 30 Firing rates and corresponding blower speeds (low fire, ignition, and high fire) —
Low fire and Ignition speeds MUST be adjusted for high altitude applications (above 5,500 feet).
DO NOT set Low fire speed lower than the values listed below.

ULTRA Model →		80	105	155	230	310
		RPM	RPM	RPM	RPM	RPM
Low fire Parameter 17	Minimum fanspeed (up to 5,500 feet) (Factory default setting)	1,300	1,300	1,300	1,300	1,400
	Minimum fanspeed @ High altitude (over 5,500 feet)	2,000	2,000	2,000	2,000	2,000
Ignition Parameter 19	Ignition fanspeed (up to 5,500 feet) (Factory default setting)	2,700	2,700	2,700	2,700	2,300
	Ignition fanspeed @ High altitude (over 5,500 feet)	3,500	3,500	3,500	3,500	3,200
High fire <i>(adjust if desired to match maximum system load — High fire % rate = Max heat load / Boiler output)</i>	Maximum fanspeed CH (parameter 13) (Factory default setting) Applies to all altitudes	5,200	5,200	5,200	5,200	5,800
	Maximum fanspeed DHW (parameter 14) (Factory default setting) Applies to all altitudes	5,200	5,200	5,200	5,200	5,800

- Acceptable range (altitude up to 5,500 feet only):
 - Ultra-80 to 230: **1300 to 5200 rpm** (13 to 52 on boiler display).
 - Ultra-310: **1400 to 5800 rpm** (14 to 58 on boiler display).
 - Boiler display shows fan speed in 100's of rpm. A value of 48 would mean a speed of 100 x 48, or 4800 rpm.
- Parameter 17 must be increased for **high altitude** applications. See Figure 30, page 48 for required values.
- Factory default — see Figure 30.

Ignition fan speed — parameter 19

- Parameter 19** sets the fan speed during ignition. Boiler firing rate is proportional to fan speed, so increasing the minimum fan speed increases the minimum firing rate (low fire).

WARNING

The ignition fan speed **must not be set BELOW** the value in Figure 30). This would reduce boiler firing rate below the acceptable limit during ignition, resulting in potential for severe personal injury, death or substantial property damage.

- Parameter 19 should **only be changed** as required for **high altitude** applications.
- Acceptable range (up to 5,500 feet ONLY):
 - Ultra-80 to 230: **1300 to 5200 rpm** (13 to 52 on boiler display).
 - Ultra-310: **1400 to 5800 rpm** (14 to 58 on boiler display).
 - Boiler display shows fan speed in 100's of rpm. A value of 27 would mean a speed of 100 x 27, or 2700 rpm.
- Factory default — see Figure 30.

NOTICE See Figure 25, page 42 for procedure to access Parameter settings.

Parameter explanations *(continued)*

Differential (hysteresis) settings

WARNING DO NOT change the differentials (hysteresis) for DHW operation (parameters 24, 25, 26 and 27). Always use only the factory default settings for these parameters.

Space heating differentials (parameters 22 and 23)

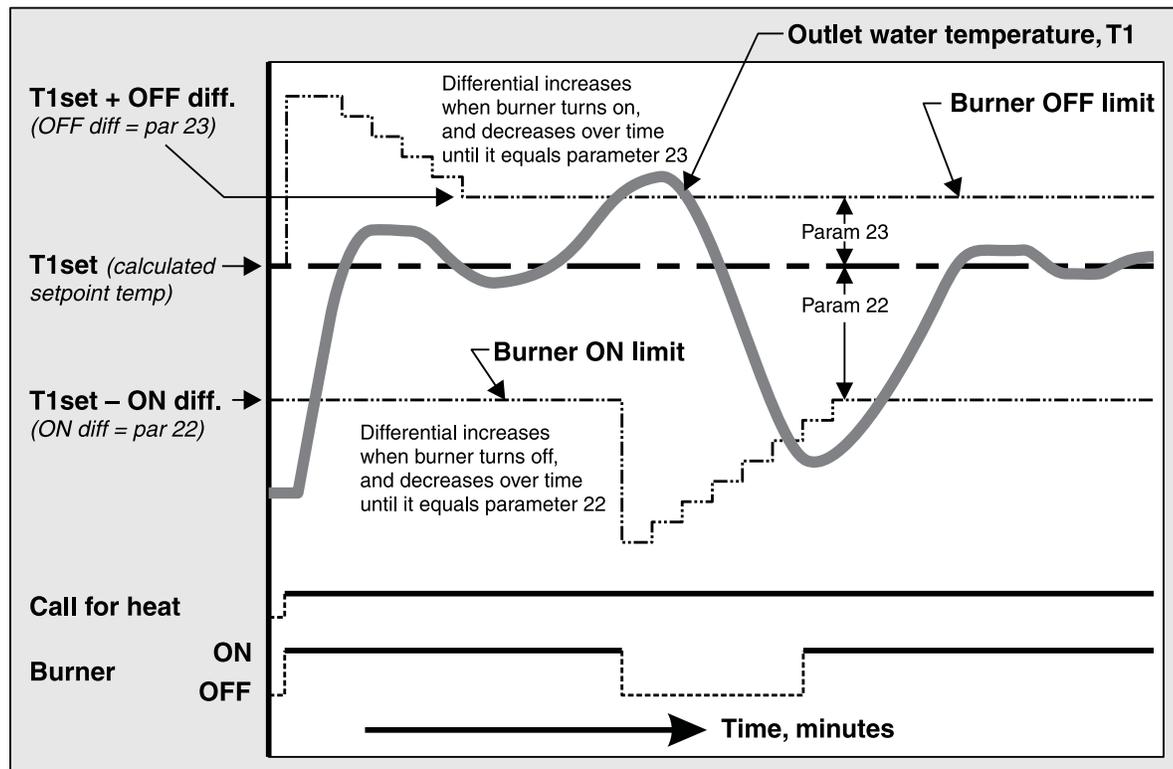
1. The term, “differential,” is also referred to as “hysteresis.”
2. Parameter 22 is the “ON” differential. The water temperature must be at least parameter 22 less than the calculated setpoint temperature for the boiler to turn on.
3. Parameter 23 is the “OFF” differential. When the boiler is firing, the water temperature must rise at least parameter 23 above the calculated setpoint temperature for the boiler to turn off.

4. See Figure 31 for an explanation of the “ON” and “OFF” differentials of the Ultra control module. Note that the differentials are greater when a heat call starts or stops, as shown. The differentials decrease with time until they equal parameters 22 and 23.

Setting “OFF” differential (parameter 23)

1. The factory DEFAULT setting for parameter 23 is 4°F. This works well for most applications.
2. For low-mass systems (fan coil), performance can be improved by increasing parameter 23. This compensates for the quicker system temperature response of low-mass systems. Typical settings for fan coil systems are parameter 23 set at 16°F, with parameter 4 set at 180°F, to allow adequate time for the boiler to modulate.
3. When setting parameter 23, make sure that parameter 23 plus parameter 4 is not over 203°F to avoid possible nuisance lockouts.

Figure 31 Space heating on and off differentials (hysteresis) — Parameters 22 and 23



NOTICE See Figure 25, page 42 for procedure to access Parameter settings.

Parameter reference table

Para.	Name	Range	Boiler display				Description								
			Display position:												
			1st	2nd	3rd	4th									
1	T3set	68 to 142 104 to 150	1	Setting			<ul style="list-style-type: none"> T3 is the DHW temperature detected by an immersion sensor. DO NOT CHANGE this parameter from factory setting of 140°F. (Boiler outlet water temperature setpoint in DHW mode is determined by adding parameter 1 to parameter 33.) If applied for instantaneous DHW operation (not recommended), set parameter 35 for the correct configuration. 								
2	DHW System	0 1 2 3	2	Blank ...	Blank ...	Value	<ul style="list-style-type: none"> Parameter 2 determines whether DHW heating is activated. The boiler will not operate in DHW mode if parameter 2 is set to “0”. <p>⚠ WARNING Weil-McLain does not recommend setting this parameter VALUE to either “2” or “3” (continuous DHW pump). This could result in a hazardous condition — it would cause constant circulation between the boiler and the DHW heater.</p>								
3	CH System	0 1 2 3	3	Blank ...	Blank ...	Value	<ul style="list-style-type: none"> Parameter 3 determines whether central heating is activated. The boiler will not operate in CH mode if parameter 3 is set to “0”. Select “1” to cycle the boiler circulator on central heating calls for heat. <p>⚠ WARNING Weil-McLain does not recommend setting this parameter VALUE to either “2” or “3” (continuous pump). This could result in a hazardous condition — it could supply water to other zones when heat demand is from a DHW tank.</p>								
4	T1_{top} <i>(see page 44)</i>	70 to 192	4	Setting			<ul style="list-style-type: none"> Constant boiler temperature operation (outside sensor not connected): T1_{top} is the target outlet water temperature at all times. Outdoor reset (outside sensor connected): T1_{top} is the maximum target temperature for all outside temperatures — occurs for outdoor temp at or below parameter 6, T4_{minimum}. 								
5	T1_{foot} <i>(see page 44)</i>	60 to 140	<p><i>Initial reading:</i></p> <table border="1"> <tr> <td>P</td> <td>.</td> <td>0</td> <td>5</td> </tr> </table> <p><i>After 2 to 3 seconds:</i></p> <table border="1"> <tr> <td>Blank</td> <td colspan="3">Setting</td> </tr> </table>				P	.	0	5	Blank	Setting			<ul style="list-style-type: none"> Parameter 5, T1_{foot}, applies only in outdoor reset operation. T1_{foot} is the minimum target temperature for all outside temperatures — occurs for outdoor temp above parameter 7, T4_{maximum}.
P	.	0	5												
Blank	Setting														
6	T4_{minimum} <i>(see page 44)</i>	-4 to 50	<p><i>Initial reading:</i></p> <table border="1"> <tr> <td>P</td> <td>.</td> <td>0</td> <td>6</td> </tr> </table> <p><i>After 2 to 3 seconds:</i></p> <table border="1"> <tr> <td>Blank</td> <td>Blank</td> <td colspan="2">Setting</td> </tr> </table>				P	.	0	6	Blank	Blank	Setting		<ul style="list-style-type: none"> Parameter 6, T4_{minimum}, applies only in outdoor reset operation. T4_{minimum} is the outside temperature at which the target outlet water temperature is at maximum.
P	.	0	6												
Blank	Blank	Setting													

NOTICE See Figure 25, page 42 for procedure to access Parameter settings.

Parameter reference table *(continued)*

Para.	Name	Range	Boiler display				Description
			Display position:				
			1st	2nd	3rd	4th	
7	T4 maximum <i>(see page 44)</i>	60 to 78	<i>Initial reading:</i>				<ul style="list-style-type: none"> Parameter 7, T4 maximum, applies only in outdoor reset operation. T4 maximum is the outside temperature at which the target outlet water temperature is at minimum.
			P	.	0	7	
			<i>After 2 to 3 seconds:</i>				
			Blank	Blank	Setting		
8	T4 frost protection	-22 to 50	<i>Initial reading:</i>				<ul style="list-style-type: none"> When outside temperature drops to this number, the boiler circulator will run constantly.
			P	.	0	8	
			<i>After 2 to 3 seconds:</i>				
			Blank	Setting			
9	T4 correction <i>(see page 44)</i>	- 8 to 10	<i>Initial reading:</i>				<ul style="list-style-type: none"> Use this parameter to modify the outside temperature reading if needed to correct for outside sensor location.
			P	.	0	9	
			<i>After 2 to 3 seconds:</i>				
			Blank	Blank	Setting		
10	T blocking <i>(see page 44)</i>	32 (off) 34 – 140	<i>Initial reading:</i>				<ul style="list-style-type: none"> When the target outlet water temperature is less than this setting, the boiler shuts off.
			P	.	1	0	
			<i>After 2 to 3 seconds:</i>				
			Blank	Setting			
11	Booster time <i>(see page 46)</i>	0 to 30	<i>Initial reading:</i>				<ul style="list-style-type: none"> If a call for heat causes the boiler to remain at high fire for a time equal to parameter 11, the control module increases outlet water temperature setpoint by 18°F. For each additional parameter 11 time the heat call continues, the setpoint is increased another 18°F (never exceeding Parameter 4 + Parameter 23 [hysteresis off]). To deactivate booster operation, set this parameter to 0.
			P	.	1	1	
			<i>After 2 to 3 seconds:</i>				
			Blank	Blank	Setting		
12	T parallel shift	0 to 144	<i>Initial reading:</i>				<ul style="list-style-type: none"> The value of parameter 12 reduces the calculated setpoint temperature by the amount set when the call for heat is from outdoor temperature. Weil-McLain recommends not changing this parameter from its factory default of 0 (no parallel shift).
			P	.	1	2	
			<i>After 2 to 3 seconds:</i>				
			Blank	Setting			
13	Maximum fan speed CH <i>(see page 47)</i>	13 to 52 <small>(100's of rpm)</small>	<i>Initial reading:</i>				<ul style="list-style-type: none"> Use this parameter to change the maximum boiler input for central heating (CH) — NEVER above default value. [Increasing fan speed increases boiler input; decreasing fan speed decreases input.] When in central heating mode, the boiler fan speed will not exceed this setting. NEVER set below low fire setting or above the maximum value shown at left.
			P	.	1	3	
		14 to 58 <small>(100's of rpm)</small>	<i>After 2 to 3 seconds:</i>				
		Blank	Setting				
15	Maximum fan speed DHW <i>(see page 47)</i>	13 to 52 <small>(100's of rpm)</small>	<i>Initial reading:</i>				<ul style="list-style-type: none"> Use this parameter to change the maximum boiler input for domestic water heating (DHW) — NEVER above default value. Boiler fan speed will not exceed this setting in DHW mode. Increasing fan speed increases boiler input; decreasing fan speed decreases input. NEVER set below low fire setting or above the maximum value shown at left.
			P	.	1	5	
		14 to 58 <small>(100's of rpm)</small>	<i>After 2 to 3 seconds:</i>				
		Blank	Blank	Setting			

NOTICE See Figure 25, page 42 for procedure to access Parameter settings.

Parameter reference table *(continued)*

Para.	Name	Range	Boiler display				Description
			Display position:				
			1st	2nd	3rd	4th	
17	Minimum fan speed DHW <i>(see page 47)</i>	13 to 52 <small>(100's of rpm)</small>	<i>Initial reading:</i>				<ul style="list-style-type: none"> Use this parameter to increase the minimum input of the boiler. Parameter 17 must be increased when the boiler is used at high altitude, per the high altitude instructions. High-altitude control modules are factory-set for the correct value.) Increasing fan speed increases boiler input; decreasing fan speed decreases input. NEVER set below minimum value shown at left.
		14 to 58 <small>(100's of rpm)</small>	P	.	1	7	
			<i>After 2 to 3 seconds:</i>				
			Blank	Blank	Setting		
19	Ignition fan speed <i>(see page 48)</i>	13 to 52 <small>(100's of rpm)</small>	<i>Initial reading:</i>				<ul style="list-style-type: none"> Use this parameter to increase the minimum input of the boiler during ignition. (Parameter 19 must be increased when the boiler is used at high altitude, per the high altitude instructions. High-altitude control modules are factory-set with the correct value.) Increasing fan speed increases boiler input; decreasing fan speed decreases input. SET ONLY at recommended (default) values (Figure 26, page 43).
		14 to 58 <small>(100's of rpm)</small>	P	.	1	9	
			<i>After 2 to 3 seconds:</i>				
			Blank	Blank	Setting		
20	Postpump time CH	0 to 99	<i>Initial reading:</i>				<ul style="list-style-type: none"> Parameter 20 is the length of time the boiler circulator continues to operate after completing a central heating cycle.
			P	.	2	0	
			<i>After 2 to 3 seconds:</i>				
			Blank	Blank	Setting		
21	Postpump time DHW	0 to 30 <small>(times 10.2 seconds)</small>	<i>Initial reading:</i>				<ul style="list-style-type: none"> Parameter 21 is the length of time the boiler circulator continues to operate after completing a DHW cycle.
			P	.	2	1	
			<i>After 2 to 3 seconds:</i>				
			Blank	Blank	Setting		
22	CH modulation differential ON <i>(see page 49)</i>	0 to 36	<i>Initial reading:</i>				<ul style="list-style-type: none"> Differential may also be referred to as “hysteresis.” This is the temperature the boiler water must drop below setpoint temperature to turn the boiler on.
			P	.	2	2	
			<i>After 2 to 3 seconds:</i>				
			Blank	Blank	Setting		

NOTICE See Figure 25, page 42 for procedure to access Parameter settings.

Parameter reference table *(continued)*

Para.	Name	Range	Boiler display				Description
			Display position:				
			1st	2nd	3rd	4th	
23	CH modulation differential OFF <i>(see page 49)</i>	0 to 18	<i>Initial reading:</i>				<ul style="list-style-type: none"> Differential may also be referred to as “hysteresis.” This is the temperature the boiler water must rise above setpoint temperature to turn the boiler off. As outlet temperature increases, the control module reduces boiler input. If temperature continues to rise with boiler at minimum input, the boiler will shut down when the temperature reaches setpoint temperature plus parameter 23.
			P	.	2	3	
			<i>After 2 to 3 seconds:</i>				
			Blank	Blank	Setting		
24	DHW modulation differential ON <i>(see page 49)</i>	-2 to 54	<i>Initial reading:</i>				<ul style="list-style-type: none"> Notice: Differential may also be referred to as “hysteresis.” This is the temperature the boiler water must drop below setpoint temperature to turn the boiler on. (Boiler outlet water setpoint temperature is 195°F during DHW mode.)
			P	.	2	4	
			<i>After 2 to 3 seconds:</i>				
			Blank	Blank	Setting		
25	DHW modulation differential OFF <i>(see page 49)</i>	-6 to 54	<i>Initial reading:</i>				<ul style="list-style-type: none"> Notice: Differential may also be referred to as “hysteresis.” This is the temperature the boiler water must rise above setpoint temperature to turn the boiler off. (As outlet temperature increases, the control module reduces boiler input. If temperature continues to rise with boiler at minimum input, the boiler will shut down when the temperature reaches setpoint temperature plus parameter 23.)
			P	.	2	5	
			<i>After 2 to 3 seconds:</i>				
			Blank	Blank	Setting		
26	DHW detection differential ON	-6 to 54	<i>Initial reading:</i>				<ul style="list-style-type: none"> Notice: Differential may also be referred to as “hysteresis.” This parameter has no effect unless a DHW sensor is used — not recommended (use an aquastat instead). This is the temperature the DHW water must drop below DHW setpoint temperature to turn the boiler on.
			P	.	2	6	
			<i>After 2 to 3 seconds:</i>				
			Blank	Blank	Setting		
27	DHW detection differential OFF	-6 to 54	<i>Initial reading:</i>				<ul style="list-style-type: none"> Notice: Differential may also be referred to as “hysteresis.” This parameter has no effect unless a DHW sensor is used — not recommended (use an aquastat instead). This is the temperature the DHW water must rise above DHW setpoint temperature to turn the boiler off.
			P	.	2	7	
			<i>After 2 to 3 seconds:</i>				
			Blank	Blank	Setting		
28	Blocking time CH	0 to 30 (times 10.2 seconds)	<i>Initial reading:</i>				<ul style="list-style-type: none"> Parameter 28 is the minimum time between consecutive central heating cycles. After a call for heat is satisfied, the boiler will remain off for at least the blocking time before starting another cycle.
			P	.	2	8	
			<i>After 2 to 3 seconds:</i>				
			Blank	Blank	Setting		

NOTICE See Figure 25, page 42 for procedure to access Parameter settings.

Parameter reference table *(continued)*

Para.	Name	Range	Boiler display				Description
			Display position:				
			1st	2nd	3rd	4th	
29	Blocking time DHW	0 to 30 (times 10.2 seconds)	<i>Initial reading:</i>				<ul style="list-style-type: none"> Parameter 29 is the minimum time between consecutive DHW heating cycles. After a DHW call for heat is satisfied, the boiler will remain off for at least the blocking time before starting another DHW cycle.
			P	.	2	9	
			<i>After 2 to 3 seconds:</i>				
			Blank	Blank	Setting		
30	Blocking time DHW to CH	0 to 30 (times 10.2 seconds)	<i>Initial reading:</i>				<ul style="list-style-type: none"> Parameter 30 is the minimum wait time after a DHW call before the boiler will start on a call for central heating. If a DHW call is satisfied and a central heating call starts, the boiler will shut down and wait the blocking time before starting.
			P	.	3	0	
			<i>After 2 to 3 seconds:</i>				
			Blank	Blank	Setting		
31	T1-T2 difference for modulating back	9 to 72	<i>Initial reading:</i>				<ul style="list-style-type: none"> If the difference between boiler outlet water temperature (T1) and return temperature (T2) is larger than parameter 31, the boiler is forced to low fire. DO NOT set higher than factory default shown in Figure 26, page 43.
			P	.	3	1	
			<i>After 2 to 3 seconds:</i>				
			Blank	Blank	Setting		
32	RMCI address	-1 (RMCI off) 0 to 7 (address)	<i>Initial reading:</i>				<ul style="list-style-type: none"> DO NOT CHANGE this parameter. It is intended for use with an RMCI 1400 interface device, currently not available.
			P	.	3	2	
			<i>After 2 to 3 seconds:</i>				
			Blank	Blank	Setting		
33	Tplus (Setvalue addition for DHW)	0 to 54	<i>Initial reading:</i>				<ul style="list-style-type: none"> Parameter 33 sets the target boiler outlet water temperature in DHW mode. Add parameter 33 to parameter 1 to determine the target temperature. Factory default is 140°F for parameter 1 and 50°F for parameter 33, for a total of 190°F as the DHW boiler outlet water temperature.
			P	.	3	3	
			<i>After 2 to 3 seconds:</i>				
			Blank	Setting			

NOTICE See Figure 25, page 42 for procedure to access Parameter settings.

Parameter reference table *(continued)*

Para.	Name	Range	Boiler display				Description
			Display position:				
			1st	2nd	3rd	4th	
34 1st digit	2nd CH circuit	0 to 8	<i>Initial reading:</i>				<p>First digit (2nd CH circuit):</p> <ul style="list-style-type: none"> • DO NOT CHANGE parameter 34 first digit. Second central heating circuit operation is not currently supported. • 0 (2nd CH circuit off) — No second CH circuit operation (LEAVE AS IS) • 1 (2nd CH circuit as slave) • 2 (2nd CH circuit as master) • 3 (2nd CH circuit as slave, Tset also by potmeter) — 2nd heating circuit as slave, with setpoint temperature determined by potentiometer • 4 (2nd CH circuit as master, Tset also by potmeter) — 2nd heating circuit as master, with setpoint temperature determined by potentiometer • 5 (2nd CH circuit as slave, active during HW) — 2nd heating circuit as slave, during DHW • 6 (2nd CH circuit as slave, active during HW) — 2nd heating circuit as master, during DHW • 7 (2nd CH circuit as slave, Tset also by potmeter, active during HW) — 2nd heating circuit as slave, during DHW, with setpoint temperature determined by potentiometer • 8 (2nd CH circuit as master, Tset also by potmeter, active during HW) — 2nd heating circuit as slave, during DHW, with setpoint temperature determined by potentiometer
			P	.	3	4	
34 2nd digit	CH type	0 to 6	<i>After 2 to 3 seconds:</i>				<p>Second digit (CH type):</p> <ul style="list-style-type: none"> • 0 (room thermostat) — Central heating operation controlled by room thermostat • 1 (outside temperature) — DO NOT SELECT — Central heating operation controlled by outside sensor (not currently supported) • 2 (0 - 10 V analog on MCBA: capacity) — DO NOT SELECT — Central heating boiler input controlled with 0 – 10 vdc input to control module (not currently supported) • 3 (0 - 10 V analog on MCBA: temperature) — DO NOT SELECT — Central heating boiler outlet temperature controlled with 0 – 10 vdc input to control module (not currently supported) • 4 (0 - 10 V analog on AM-4: capacity) — Select this value when using AM4 module to interface with multiple boiler controller. See AM4 instructions. • 5 (0 - 10 V analog on AM-4: temperature) — DO NOT SELECT — Central heating boiler outlet temperature controlled with 0 – 10 vdc input to AM-4 module, but controls temperature setpoint. See AM4 instructions. • 6 (+/- control) — DO NOT SELECT — Central heating mode controlled with +/- input to control module (not currently supported)
			Blank	Blank	Digit 1	Digit 2	

NOTICE See Figure 25, page 42 for procedure to access Parameter settings.

Parameter reference table *(continued)*

Para.	Name	Range	Boiler display				Description
			Display position:				
			1st	2nd	3rd	4th	
35 1st digit	3-Way valve	0 to 2	<i>Initial reading:</i>				First digit (3-way valve): <ul style="list-style-type: none"> Ultra control module readout: Initial reading: P . 35 (indicates parameter 35) After 2 to 3 seconds, changes to parameter setting: Positions 1, 2 = blank Position 3 = Parameter 35 first digit (3-way valve or pump) Position 4 = Parameter 35 second digit (DHW type) DO NOT CHANGE parameter 35 first digit. 3-way valve operation is not currently supported. 0 (3-way valve normally open) — Switch to DHW from CH with normally open 3-way valve 1 (hot water pump) — Use DHW circulator in DHW mode 2 (3-way valve normally closed) — Switch to DHW from CH with normally closed 3-way valve
			P	.	3	5	
35 2nd digit	CH type	0 to 9	<i>After 2 to 3 seconds:</i>				Second digit (CH type): <ul style="list-style-type: none"> 0 (instant water heater with NTC3) — DO NOT SELECT — Instantaneous water heater with sensor (not currently supported) 1 (instant water heater without NTC3) — DO NOT SELECT — Instantaneous water heater without sensor (not currently supported) 2 (storage tank with NTC3) — DO NOT SELECT — Storage tank with sensor (not currently supported) 3 (storage tank without NTC3) — DO NOT CHANGE — Storage tank with aquastat 4 (instant water heater with NTC3 + anti condensing) — DO NOT SELECT — Instantaneous water heater with sensor; anticondensate mode (not currently supported) 5 (instant water heater without NTC3 + anti condensing) — DO NOT SELECT — Instantaneous water heater without sensor; anticondensate mode (not currently supported) 6 (storage tank with NTC3 + anti condensing) — DO NOT SELECT — Storage tank with sensor; anticondensate mode (not currently supported) 7 (storage tank without NTC3 + anti condensing) — DO NOT SELECT — Storage tank with aquastat; anticondensate mode (not currently supported) 8 (plate heater exchanger) — DO NOT SELECT — Plate heat exchanger (not currently supported) 9 (external heat request) — DO NOT SELECT — External heat request, from RMCI (not currently supported)
			Blank	Blank	Digit 1	Digit 2	
36	Manual fanspeed	-1 (auto) 0 to 100 (%)	<i>Initial reading:</i>				<ul style="list-style-type: none"> Use this parameter, if desired, to manually set the boiler at a fixed input. The manual operation will only continue for 15 minutes. The control module then returns to automatic operation.
			P	.	3	6	
			<i>After 2 to 3 seconds:</i>				
			Blank	Blank	Setting		

NOTICE See Figure 25, page 42 for procedure to access Parameter settings.

Parameter reference table *(continued)*

Para.	Name	Range	Boiler display				Description
			Display position:				
			1st	2nd	3rd	4th	
37 1st digit	PWM-level CH-pump	1 to 4	<i>Initial reading:</i>				<ul style="list-style-type: none"> This function is not currently supported.
			P	.	3	7	
1 to 4		<i>After 2 to 3 seconds:</i>					
		Blank	Blank	Digit 1	Digit 2		
37 2nd digit							
38	T hold	32 (feature off)	<i>Initial reading:</i>				<ul style="list-style-type: none"> Parameter 38 sets a minimum standby temperature for the boiler. If boiler outlet or return water temperature is sensed at less than T_{hold}, the boiler fires (without pump operating) to bring temperature up to T_{hold}.
		32 to 176	P	.	3	8	
			<i>After 2 to 3 seconds:</i>				
		Blank	Blank	Setting			
39	T6 top 2nd CH circuit	50 to 176	<i>Initial reading:</i>				<ul style="list-style-type: none"> This function is not currently supported. Sets maximum target boiler temperature during call for heat from 2nd CH circuit (same function as T1_{top} for first CH circuit).
			P	.	3	9	
			<i>After 2 to 3 seconds:</i>				
		Blank	Blank	Setting			
40	T6 foot 2nd CH circuit	50 to 94	<i>Initial reading:</i>				<ul style="list-style-type: none"> This function is not currently supported. Sets minimum target boiler temperature during call for heat from 2nd CH circuit (same function as T1_{foot} for first CH circuit).
			P	.	4	0	
			<i>After 2 to 3 seconds:</i>				
		Blank	Blank	Setting			
41	T6 differential 2nd CH circuit	2 to 54	<i>Initial reading:</i>				<ul style="list-style-type: none"> This function is not currently supported. T6_{differential} is the differential (hysteresis) for call for heat from 2nd CH circuit when 2nd CH circuit is master. Boiler starts when outlet temperature drops T6_{differential} below target outlet temperature.
			P	.	4	1	
			<i>After 2 to 3 seconds:</i>				
		Blank	Blank	Setting			

NOTICE See Figure 25, page 42 for procedure to access Parameter settings.

Parameter reference table *(continued)*

Para.	Name	Range	Boiler display				Description
			Display position:				
			1st	2nd	3rd	4th	
42 1st digit	Special pump CH / DHW	0 to 3	<i>Initial reading:</i>				First digit (Special pump CH/DHW): <ul style="list-style-type: none"> • 0 — <i>NOT RECOMMENDED</i> Normal circulator operation for both CH and DHW. • 1 — <i>NOT RECOMMENDED</i> Boiler circulator off on CH call for heat. Normal circulator operation on DHW. • 2 — RECOMMENDED SETTING Boiler circulator normal operation. DHW circulator 5-second delay before starting. • 3 — <i>NOT RECOMMENDED</i> Boiler circulator off on CH call for heat. DHW circulator 5-second delay before starting.
			P	.	4	2	
42 2nd digit	Low/Off cycle	0 or 1	<i>After 2 to 3 seconds:</i>				Second digit (Low/off cycle): <ul style="list-style-type: none"> • If boiler continues firing at low fire for 3 minutes or longer, the boiler will begin cycling like an on/off boiler, firing only at low fire, for cycle times of 10 minutes. • The boiler will return to normal (modulating) operation if the burner is either off or on for at least 9 minutes.
			Blank	Blank	Digit 1	Digit 2	

