

SFC/SFB Controller



Visitez également notre site web www.ibcboiler.com/TIPortal pour y obtenir ce manuel en français.

 WARNING

If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury, or loss of life.

SAFETY CONSIDERATIONS

Installation, start-up and servicing of IBC boilers must be done with due care and attention, and should only be performed by competent, qualified, licensed and trained heating technicians. Failure to read and comply with all instructions and applicable National and local codes may result in hazardous conditions that could result in property damage and injury to occupants which in extreme cases might result in death.

HAZARDS & PRECAUTIONS

 DANGER

Points out an immediately hazardous situation which must be avoided in order to prevent serious injury or death.

 WARNING

Points out a potentially hazardous situation which must be avoided to prevent serious injury or death.

 CAUTION

Points out a potentially hazardous situation which must be avoided to prevent possible moderate injury and/or property damage

 NOTE

Points out installation, maintenance and operation details that will result in enhanced efficiency, longevity and proper operation of your boiler.

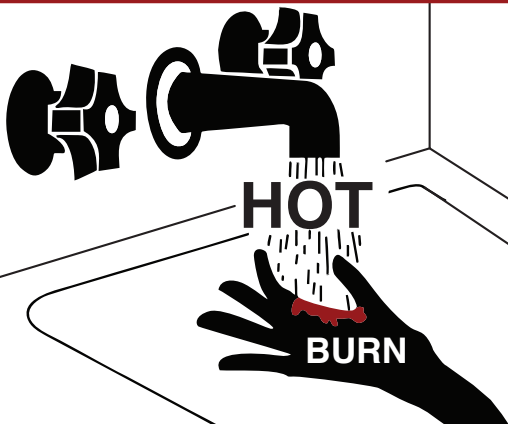
 BEST PRACTICES

Points out recommendations for better installation.

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DANGER



- **Water temperature over 125°F (52°C) can cause severe burns instantly or death from scalds.**
- **Children, disabled, and elderly are at highest risk of being scalded.**
- **See instruction manual before setting temperature at boiler.**
- **Feel water before bathing or showering.**
- **Temperature limiting valves are available, see manual.**

WATER HEATER INSTALLATION GUIDELINES

WARNING

- This boiler must be installed in accordance with local codes, if any; if not follow the National Fuel Gas Code, ANSI Z223.1/NFPA 54, or the Natural Gas and Propane Installation Code, CAN/CSA B149.1, as applicable.
- Failure to correctly install and operate this appliance can result in severe personal injury or death.
- The water heater shall have a pressure relief valve installed within 6" [152mm] of the DHW HOT outlet connection.
Refer to the Boiler User's Manual before operating relief valve.
- The water heater requires a pressure relief valve identified with the ASME V or HV symbol and set to relieve at or below 150psi of domestic water pressure and a minimum relieving capacity of 199,000 Btu/hr with 3/4" NPT threads. For safe operation of the water heater, the relief valve must not be removed from its designated point of installation or plugged.
- For complete information refer to installation manual.
- Read and follow warnings and instructions.

CAUTION

- Hotter water increases the risk of scald injury. Before changing the temperature setting, see instruction manual.

ADJUSTABLE TEMPERATURE SETTING

- Touch the panel above the White Dot twice, then touch the Tap . Adjust the water temperature with the Plus + and Minus – then touch the Return button  to save the changes.

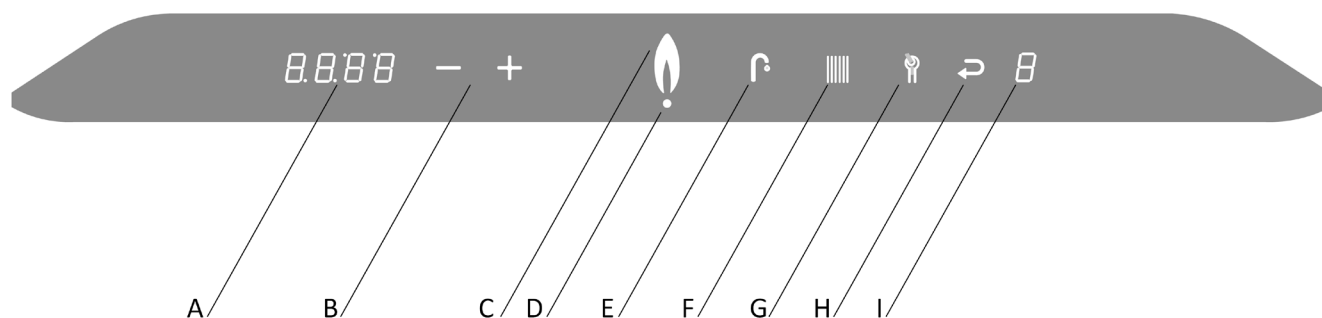
BOILER CONTROL OPERATION

NOTE

Use only fingers when operating the boiler control.

The boiler's control functions as an interactive touch-sensitive panel with buttons that light up, showing indicators such as numbers, icons, or letters. Some of these lit indicators signify boiler operational status. Other indicators enable you to program the boiler.

INTERFACE INDICATORS/BUTTONS



ICON		FUNCTION
A	Numerical Display	Main Display
B	Plus & Minus	Temperature Adjustment
C	Flame	Burner ON Indicator
D	Dot	Power ON Indicator
E	Tap	Domestic Hot Water Indicator
F	Radiator	Space Heating Indicator
G	Wrench	Service / Reset
H	Return Arrow	Enter / Save
I	Numerical Display	Service Display

Table 1: Controller Indicators and Touch Pad

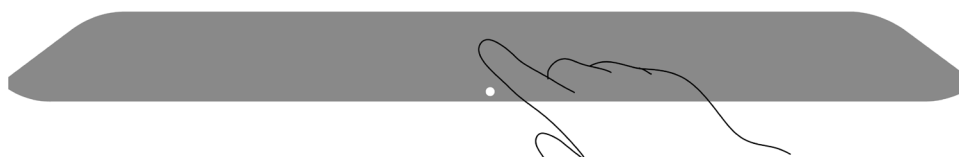
MAIN MENU

Main menu is a top-level menu, through which you can access other (sub) menus. These menus can be accessed by touching a button or a combination of buttons on the touchscreen panel. The sub menus include the:

- Space Heating menu
Use to adjust the target temperature for space heating.
- Domestic Hot Water (DHW) menu
Use to adjust the DHW temperature and check the DHW flow.
- Information menu
Use to view sensor readings and other operating conditions.
- Service menu
Use to view service information access the Installer menu to change parameters. In this menu, you can view service information and regulate the firing rate for the commissioning setup of the gas valve.

ACCESSING THE MAIN MENU

To access the Main menu, press the area above the Dot.



If buttons remain untouched in the Main menu (show below) for a minute, the previous display is returned.



In the Main Menu the controller displays:

- The Dot.
- The Faucet button. Touch to access the DHW menu.
- The Radiator button. Touch to access the Space Heating menu.
- The Wrench button. Touch to access the Service menu.
- The time, if the clock is activated.

OPERATIONAL MODES

Below are various operational modes:



The unit is switched off. The unit is connected to power but has been turned off.

In this mode, the display view shows:

- The Dot.
- The pressure in the boiler loop on the left display.
- A line in the right display.



The unit is switched on and is ready for a heat demand. The unit is turned on and is ready to respond to a request for domestic hot water or space heating. In this mode, the display view shows the Dot.



The unit is in operation and is supplying domestic hot water. The unit is running on a domestic hot water call. In this mode, the display view shows the:

- Dot.
- Flame. The burner is switched on.
- Faucet symbol.



The unit is in operation and is supplying space heating water. The unit is running on a space heating call. In this mode, the display view shows the:

- Dot.
- Flame to indicate that the burner is switched on.
- Radiator symbol.

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USAGE

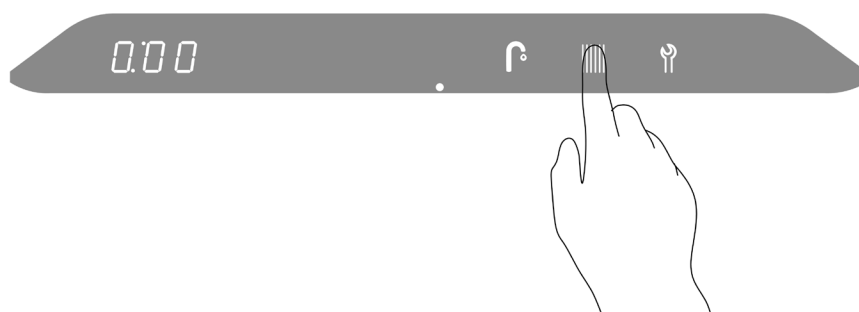
This section describes how to:

- Adjust the space heating water temperature
- Adjust the DHW water temperature
- Adjust the DHW modes
- Access the Service menu to test the unit firing rate
- Access the Information menu to obtain information on displayed codes

ADJUSTING THE SPACE HEATING WATER TEMPERATURE

To adjust the water temperature in the space heating:

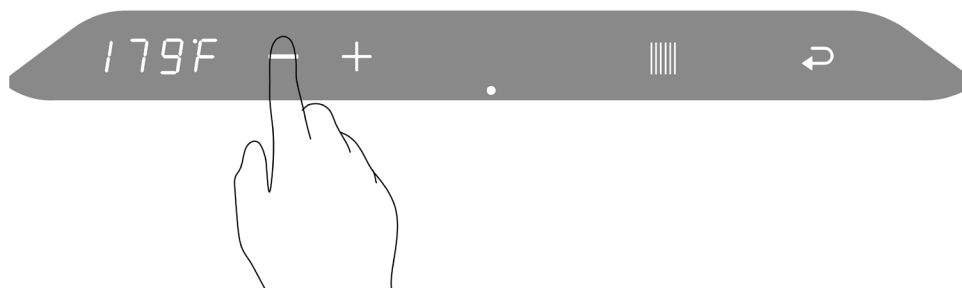
1. From the Main menu, touch the Space Heating  button.



The current target temperature is displayed on the left side. Note that the Faucet and Wrench are no longer displayed.



2. To change the target temperature or space heating, tap the Plus or Minus buttons.



3. To save the changes, touch the Return  button.

NOTE

The boiler is equipped with a Frost Protection feature. This feature will operate the boiler pump and the burner to help protect the boiler from freezing. If the boiler is in a hard lock-out condition the burner will not operate, however the boiler heater pump will operate. IBC is not responsible for damages to the boiler, and/or related components, nor property damages that may result from freezing conditions.



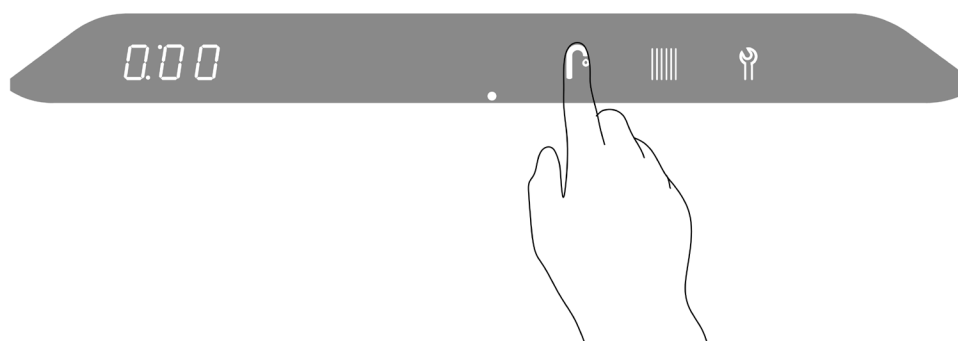
“P” to the right of the panel indicates that the changes have been saved.

To exit without saving the changes, touch the On/Off area above the Dot.

ADJUSTING THE DHW TEMPERATURE

To adjust the DHW temperature:

1. From the Main menu, touch the Faucet button.



The DHW menu is displayed. In this menu, the DHW target temperature appears on the main display.



2. To change the DHW target temperature, touch the Plus or Minus buttons.



3. To save the changes, touch the Return button. To exit without saving the changes, touch the On/Off button.



“P” to the right of the screen indicates that the changes have been saved.

To exit without saving the changes, touch the On/Off area above the Dot.

CHECKING THE DHW FLOW

You can check the DHW flow detected by the water heater (read in US gallons per minute or in liters per minute). See ACCESSING THE INFORMATION MENU on pages 1-10 to 1-11.

ADJUSTING THE DHW MODES

Note: These modes apply only to the SFC series of boilers.

When in standby, the unit has three DHW modes related to the heat exchanger temperature:

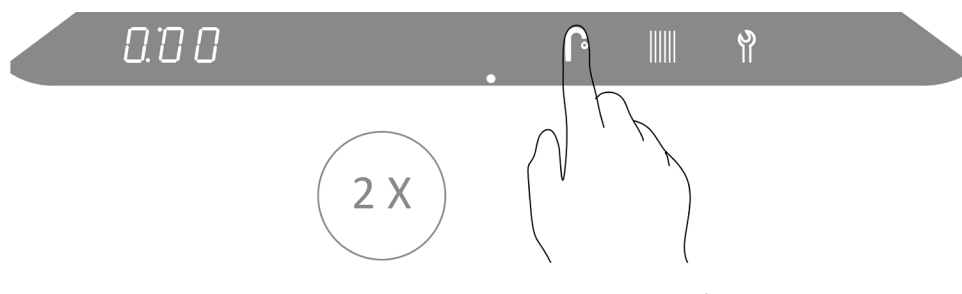
Standard Mode (OFF): The unit will respond to a call for DHW as a priority over the space heating demand. When the DHW demand is satisfied the unit will return to the space heating load if the load is still calling. The water heater’s heat exchanger will not maintain its DHW temperature between demands for hot water.

Comfort Mode (ON): The water heater’s heat exchanger is maintained at the DHW temperature.

ECO Comfort Mode (ECO): This mode operates like the Comfort Mode but has the added advantage of learning when the DHW is used. During low-use periods, the heat exchanger is allowed to cool.

To switch between the three modes:

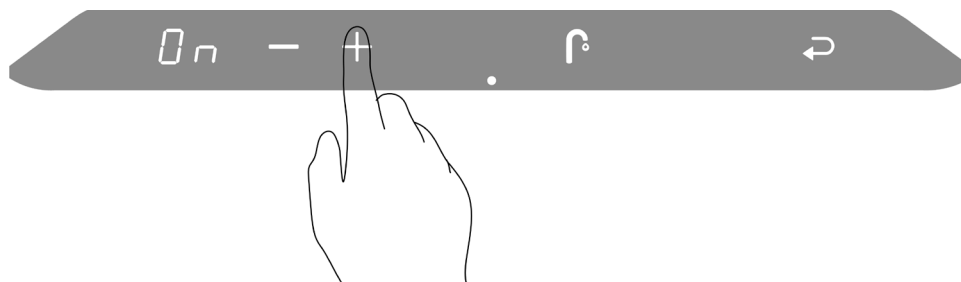
1. From the Main Menu, touch the Faucet button twice.



The DHW mode is displayed on the left side of the panel.



2. To change the DHW mode, scroll through the modes using the Plus or Minus buttons.



3. To save the changes, touch the Return button. To exit without saving the changes, touch the area above the Dot (or power indicator).



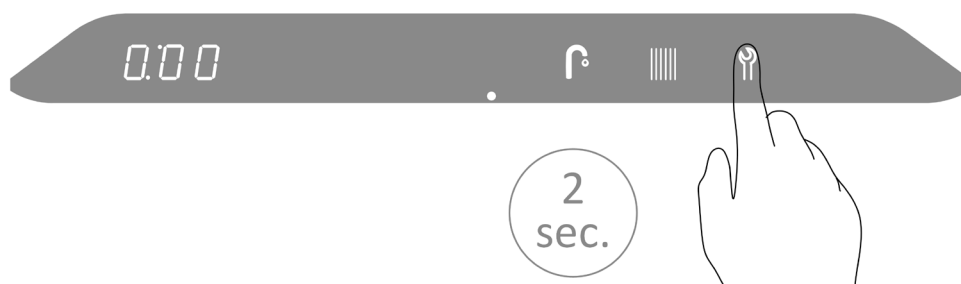
“P” to the right of the screen indicates that the changes have been saved.

To exit without saving the changes, touch the area above the Dot.

ACCESSING THE SERVICE MENU

The Service Menu provides service information and control over the unit firing rate, used in the commissioning setup of the gas valve.

To access the Service Menu, from the Main Menu press and hold the Wrench for two seconds.



The Service menu is displayed below.



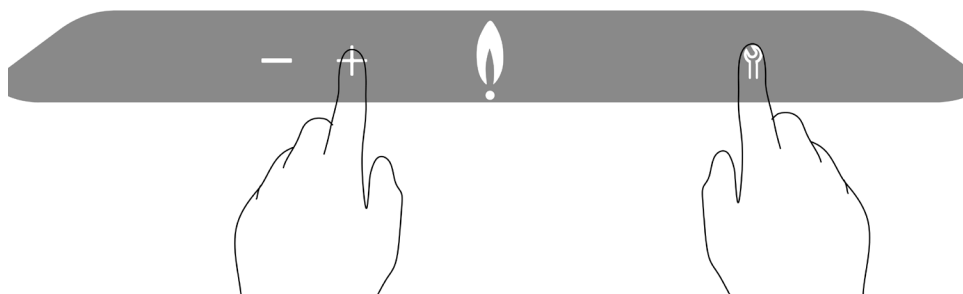
TESTING THE UNIT FIRING RATE

From the Service menu, you can test the unit's high-fire and low-fire operation.

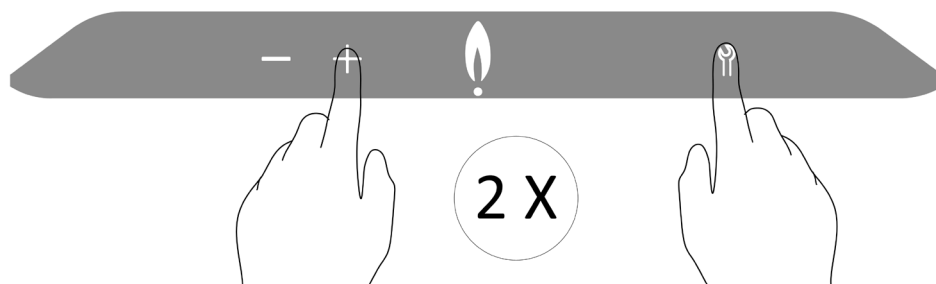
Program 'L': Burner on with minimum DHW capacity. With DHW running, press Wrench and Minus at the same time. A L will display on the right.



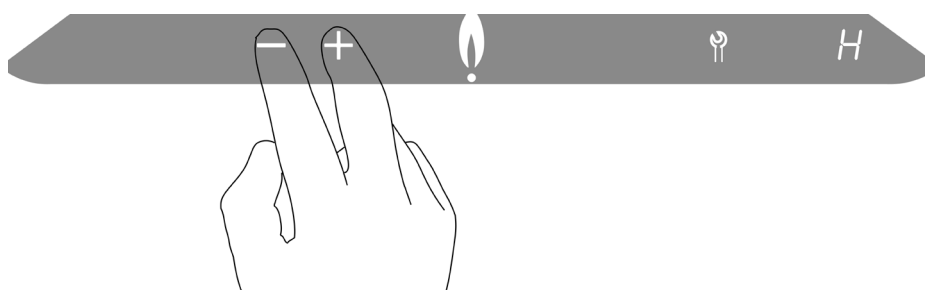
Program 'h': Burner on with maximum Space Heating setting. With a call for heat, press Wrench and Plus at the same time. An h will display on the right.



Program 'H': Burner on maximum capacity. With a call for heat, press Wrench and Plus simultaneously twice. An H will display on the right.



To switch off test program press the Plus and Minus at the same time.

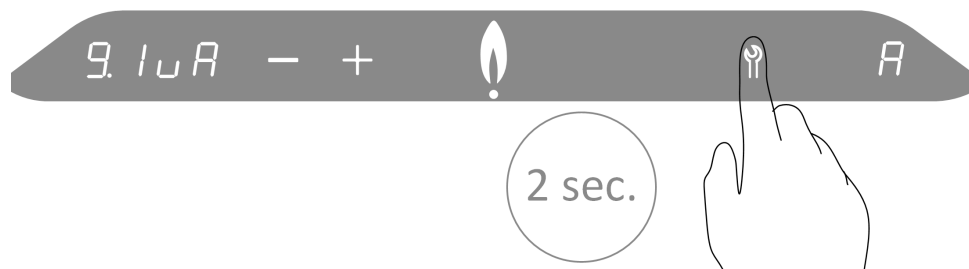


ACCESSING THE INFORMATION MENU

The Information menu provides sensor readings as well as other operating conditions in the form of codes.

To access the Information menu:

1. Touch the area above the Dot twice to access the Main menu.
You'll need to access the Information menu via the Service menu.
2. To access the Service menu, touch and hold the Wrench button for two seconds.



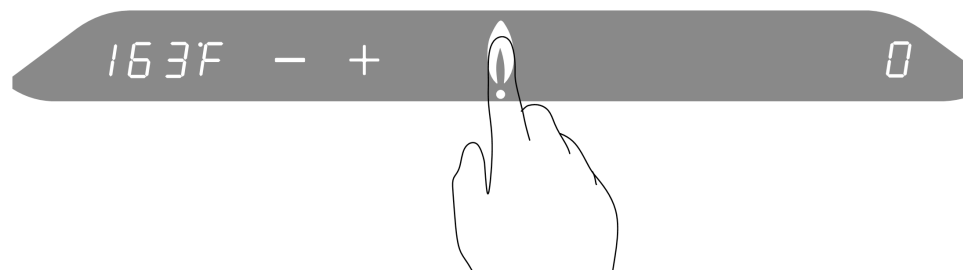
The Minus, Plus, Wrench and Enter indicators are displayed.

3. Again, touch and hold the Wrench button for two seconds.

You are now in the Information menu. Note that the Enter button has disappeared indicating that you are in read-only mode and therefore cannot enter values.

In the Information menu, the code “A” appears to indicate the flame current in DC μA (see table 2 for a list of codes and corresponding description).

4. To scroll through the list of codes, use the Minus or Plus button.
5. To switch out of the Information menu (and to return to the Service menu), press the Flame button or area above the Dot.



See below for a description of the codes:

CODE	DISPLAY	EXAMPLE
A	flame current in μ A	9.80A
b	DHW flow in L/min or Gallon/min	0.98
C	boiler system pressure	18.8P
F	estimated power input in kW or MBH	11.6
P	actual pump speed in %	42
E	last lock-out code	F031
=	main processor software 	1.60
=	DSP software	1.20
0	Temp. S0 (Heat Exchanger)	134°F
1	Temp. S1 (Boiler Supply)	118°F
2	Temp. S2 (Boiler Return)	87°F
3	Temp. S3 (Hot Water)	125°F
4	Temp. S4 (Cold Water In)	50°F
5	Temp. S5 (Flue)	142°F
6	Temp. S6 (Outdoor)	17°F
7	Temp. S7 (DHW tank)	124°F

Table 2: Information menu

ACCESSING PARAMETER MENUS TO CHANGE CONTROLLER PARAMETERS

The Parameter Menus allow users to change controller parameters set out in tables 3 and 4.

The most commonly used parameters will be available in the installer parameter menu, through the installer's code 015. For more advanced users, an advanced parameter menu is available through the code 020.

The parameter menu code is shown on the left numerical display after the letter C. The parameters are also shown on the left numerical display, after the letter P.

⚠ WARNING

Do not apply power to any connection point on the controllers terminal strips. A hazardous situation could occur resulting in possible serious injury or death.

ACCESSING THE INSTALLER PARAMETER MENU

To access the Installer Menu:

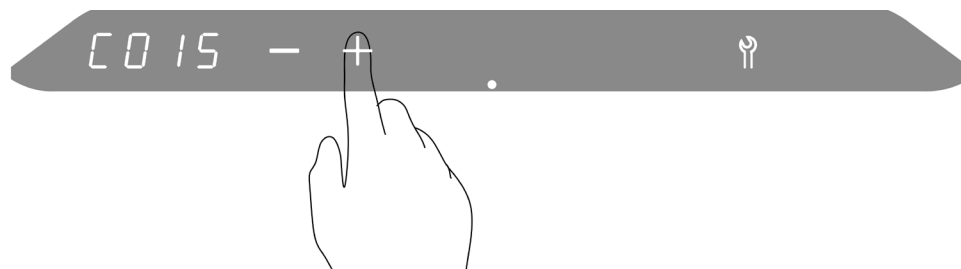
1. Press the Enter button and Wrench button at the same time.



The code numbers are displayed in the left numerical display.



2. Touch the Plus button repeatedly to enter code "015".



3. Touch the Wrench again to open the parameter for editing. You can use the Plus or Minus buttons to choose a different parameter.



Multiple changes can be made and all will be saved when the Return is pressed. "P" to the right of the screen indicates that the changes have been saved. To exit without saving the changes, touch the On/Off area above the Dot.

INSTALLER PARAMETERS - ACCESS CODE C015

PARAMETER	DESCRIPTION	DEFAULT	RANGE / OPTIONS
P001	System Type	SFC = 0 SFT = 2 SFB = 3	0 = Space heating + DHW direct 1 = Space heating + External indirectly heated tank 2 = DHW direct only 3 = Space heating only 4 = Combi + External indirectly heated tank. Tank differential 9°F / 5°C.
P010	Maximum Space Heating Output (%)	100%	25% - 100%
P013	<i>Maximum indirect tank output (%)</i>	100%	25% - 100%
P030	<i>Space Heating Pump Setting</i>	0	0 = Post-purge time active 1 = Continuous (DHW comfort function off) 2 = Not applicable for North American use 3 = Pump is active when terminal 4-5 on connector X4 is closed.
P031	Space Heating Pump Maximum Capacity (%)	100%	15%-100% (but cannot be below parameter P032)
P032	Space Heating Pump Minimum Capacity (%)	50%	15%-100% (but cannot be above parameter P031)
P033	Space Heating Pump Post-Purge (minutes)	1 minute	0-15 minutes
P034	Space Heating Pump post-purge after DHW tank operation (minutes)	1 minute	0-15 minutes
P035	Step Modulation	1	0 = Off 1 = On: After Space Heating starts, fan speed will gradually ramp up from the min. value
P036	Space Heating Anti-cycle (minutes)	2 minutes	0-15 minutes
P050	Space Heating Supply Temperature / Design Supply Temperature	176°F / 80°C	50°F to 176°F / 10°C to 80°C
P051	<i>Minimum supply temperature for reset heating curve</i>	100°F / 38°C	50°F to 194°F / 10°C to 90°C
P052	Design Outdoor Temperature	16°F / -9°C	-22°F to 50°F / -30° to 10°C
P053	Summer Shutdown Temperature	70°F / 21°C	50°F to 87°F / 10°C to 30°C

PARAMETER	DESCRIPTION	DEFAULT	RANGE / OPTIONS
P056	Minimum supply temperature when using an Open Therm modulating thermostat	100°F 38°C	50°F to 140°F 10°C to 60°C
	Minimum supply temperature when using an on/off thermostat and “smart outdoor function” active		
P059	Maximum User set temperature of Space Heating	194°F / 90°C	50°F to 194°F / 10°C to 90°C
P061**	Smart Outdoor reset - Slope for increase and decrease supply setpoint	3	°C/100 seconds. 0 = function inactive
P070	Maximum DHW capacity (%)	100%	20%-100%
P074	Number of ECO days	3 days	0 to 10 days Number of past days the predictive heat-exchanger heat-up algorithm averages over
P075	Supply Temperature for external indirect tank	176° F / 80°C	140°F to 194°F / 60°C to 90°C
P077	Response time delay for space heating after DHW operation (minutes)	0 minutes	0 to 15 minutes
P081	Setting of three-way valve or electric shutoff valve	0	0 = powered during Space Heating demand 1 = powered during DHW demand and no demand 2 = powered during Space Heating demand and no demand 3 = powered during DHW demand
P089	External tank set temperature unit	140°F / 60°C	50°F to 149°F / 10°C to 65°C
P255	Restore parameter to default	0	Set option to 9 to restore all parameters to factory default.

Table 3: Installer parameter codes

** Smart outdoor reset function

When using a non-modulating room thermostat (on/off), if no outdoor reset sensor is connected to the boiler it is possible to simulate weather-dependent heating by activating “smart outdoor reset”.

When “smart outdoor reset” is activated, the setpoint for the supply temperature is starting at a minimum value (P056), and during heating increases to the maximum value set by the user.

When the demand for space heating is satisfied, the setpoint for the supply temperature is lowered in the same way until it reaches the minimum value.

The slope for this modulation can be set with parameter P061. Note that the value is °C per 100 seconds (*).

(*) Important: The lower the setting the more stable the heating process. However, it will take longer for rooms to heat up.

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ACCESSING THE ADVANCED PARAMETER MENU

To access the Advanced Parameter Menu:

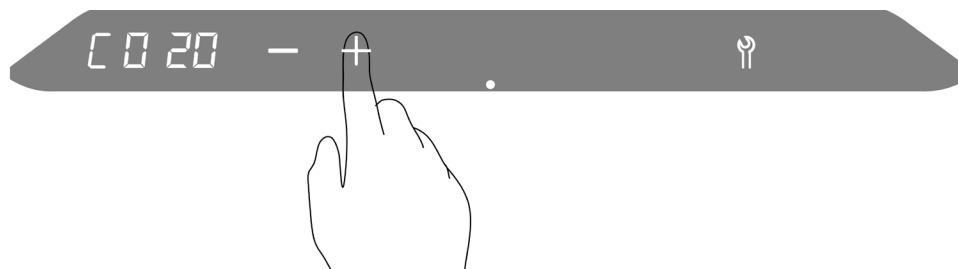
1. Press the Enter button and Wrench button at the same time.



The code numbers are displayed in the left numerical display.



2. Touch the Plus button repeatedly to enter code "020".



3. Touch the Wrench again to open the parameter for editing. You can use the Plus or Minus buttons to choose a different parameter.



Multiple changes can be made and all will be saved when the Return is pressed.

"P" to the right of the screen indicates that the changes have been saved.

To exit without saving the changes, touch the On/Off area above the Dot.

ADVANCED PARAMETERS - ACCESS CODE C020

PARAMETER	DESCRIPTION	DEFAULT	RANGE / OPTIONS
P001	System Type	SFC = 0 SFT = 2 SFB = 3	0 = Space heating + DHW direct 1 = Space heating + External indirectly heated tank 2 = DHW direct only 3 = Space heating only 4 = Combi + External indirectly heated tank. Tank differential 9°F / 5°C.
P002	Display type	2	0 = Simple (Flame only) 1 = Basic (Flame and function) 2 = Complete (Flame, function, and current temperature setting)
P003	Units	1	0 = Metric (°C, L/S, Bar) 1 = Imperial (°F, gpm, PSI)
P009	Maximum output adjustment (%)	0%	-5% to 5%
P010	Maximum Space Heating Output (%)	100%	25% - 100%
P011	<i>Minimum Space Heating Output (%)</i>	16%	Cannot be higher than the maximum space heating output (P010)
P012	Starting fan speed for space heating (%)	70%	40% to 100%
P013	<i>Maximum indirect tank output (%)</i>	100%	25% - 100%
P030	<i>Space Heating Pump Setting</i>	0	0 = Post-purge time active 1 = Continuous (DHW comfort function off) 2 = Not applicable for North American use 3 = Pump is active when terminal 4-5 on connector X4 is closed.
P031	Space Heating Pump Maximum Capacity (%)	100%	15%-100% (but cannot be below parameter P032)
P032	Space Heating Pump Minimum Capacity (%)	50%	15%-100% (but cannot be above parameter P031)
P033	Space Heating Pump Post-Purge (minutes)	1 minute	0-15 minutes

PARAMETER	DESCRIPTION	DEFAULT	RANGE / OPTIONS
P034	Space Heating Pump post-purge after DHW tank operation (minutes)	1 minute	0-15 minutes
P035	Step Modulation	1	0 = Off 1 = On: After Space Heating starts, fan speed will gradually ramp up from the min. value
P036	Space Heating Anti-cycle (minutes)	2 minutes	0-15 minutes
P037	Space heating demand response delay time (minutes)	0 minutes	0-15 minutes
P050	Space Heating Supply Temperature / Design Supply Temperature	176°F / 80°C	50°F to 176°F / 10°C to 80°C
P051	<i>Minimum supply temperature for reset heating curve</i>	100°F / 38°C	50°F to 194°F / 10°C to 90°C
P052	Design Outdoor Temperature	16°F / -9°C	-22°F to 50°F / -30° to 10°C
P053	Summer Shutdown Temperature	70°F / 21°C	50°F to 87°F / 10°C to 30°C
P056	Minimum supply temperature when using an Open Therm modulating thermostat	100°F 38°C	50°F to 140°F 10°C to 60°C
	Minimum supply temperature when using an on/off thermostat and “smart outdoor function” active		

PARAMETER	DESCRIPTION	DEFAULT	RANGE / OPTIONS
P057	Response to an Open Therm modulating thermostat	1	0 = Ignore Open Therm demand if setpoint < value P056 (minimum supply temperature) When the setpoint for the supply temperature sent by the Open Therm room thermostat is lower than the value of parameter P056 (minimum supply temperature), the boiler will ignore this demand. 1 = Restrict Open Therm setting if setpoint < value P056 (minimum supply temperature) When the setpoint for the supply temperature sent by the Open Therm room thermostat is lower than the value of parameter P056 (minimum supply temperature) the boiler will respond to the demand for heat with the setpoint of P056. 2 = On / Off No modulation is allowed by the Open Therm room thermostat. The boiler will consider the room thermostat to be an On / Off type. The setpoint for the supply temperature is the value set by the user in the display (P050, space heating supply temperature/ design supply temperature). 3 = Low Load (Load Control) If supported by the room thermostat, the boiler will go into low load when the heating demand is below the minimum output. LC is shown on the display. The boiler will function on min. capacity for a longer time. The setpoint for the supply temperature will be ignored.
P059	Maximum User set temperature of Space Heating	194°F/ 90°C	50°F to 194°F / 10°C to 90°C
P060	Maximum Space Heating Temperature (low temperature zone)	104°F/ 40°C	50°F to 194°F / 10°C to 90°C
P061**	Smart Outdoor reset - Slope for increase and decrease supply setpoint	3	°C/100 seconds. 0 = function inactive
P070	Maximum DHW capacity (%)	100%	20% to 100%
P071	Minimum DHW output (%)	18%	13% to 50%
P072	DHW ignition fan speed (%)	70%	40% to 100%

PARAMETER	DESCRIPTION	DEFAULT	RANGE / OPTIONS
P073	DHW ECO / Comfort Mode temperature	32°F / 0°C	34°F / 1°C to 149°F / 65°C 0 = ECO / Comfort Mode will be the same as the user defined DHW temperature
P074	Number of ECO days	3 days	0 to 10 days Number of past days the predictive heat-exchanger heat-up algorithm averages over
P075	Supply Temperature for external indirect tank	176° F / 80°C	140°F to 194°F / 60°C to 90°C
P076	DHW Mode	0	0 = Standard Mode (on-demand) 1 = ECO Comfort Mode (adapts to DHW usage pattern) 2 = Comfort Mode (maintains DHW temperature)
P077	Response time delay for space heating after DHW operation (minutes)	0 minutes	0 to 15 minutes
P081	Setting of three-way valve or electric shutoff valve	0	0 = powered during Space Heating demand 1 = powered during DHW demand and no demand 2 = powered during Space Heating demand and no demand 3 = powered during DHW demand
P086	Temperature reduced during ECO Comfort mode low DHW demand periods	63°F / 17°C	32°F to 140°F / 0°C to 60°C
P089	External tank set temperature unit	140°F / 60°C	50°F to 149°F / 10°C to 65°C
P090	Function of Relay Re1, contact 3 on X4	0	0= External valve (Functionality depends on P081 setting) 1= Low temperature / high temperature function active when heating demand is on a low temperature zone 2= Active during all heating demands 3= External heat source 4= Active during space heating demand for an external space heating pump 5= Active during DHW demand (solo) for an external DHW 6= Active during DHW demand (combi) for an external DHW

PARAMETER	DESCRIPTION	DEFAULT	RANGE / OPTIONS
P091	Function of Relay Re2, contact 3 on X3	5	0= Three-way valve (active during space heating) 1= Low temperature/ high temperature function active when heating demand is on a low temperature zone 2= Active during all heating demands 3= External heat source 4= Active during space heating demand for an external space heating pump 5= Active during DHW demand (solo) for an external DHW 6= Active during DHW demand (combi) for an external DHW
P097	Alarm relay	0	0= No alarm function 1= Relay is activated when boiler is powered and not in lockout. Terminal X11 (X11.1= NC, X11.2= NO, X11.3=Com)
P100	Functionality of X13 terminals 3 and 4	0	0= Outdoor sensor 1= Low temperature zone safety sensor (Low temperature/high temperature) 2= Not applicable for North America 3= 10kΩ tank sensor, Aquastat (normally closed)
P101	Functionality of X13 terminals 4 and 5	0	0= 10kΩ tank sensor, Aquastat (normally opened) 1= Low temperature zone safety sensor (Low temperature/high temperature) 2= Not applicable for North America
P104	0-10V DC external control input	0	0= Off 1= 0-10V DC firing rate control 2= 0-10V DC temperature control
P255	Restore parameter to default	0	Set option to 9 to restore all parameters to factory default.

Table 4: Advanced parameter codes

**** Smart outdoor reset function**

When using a non-modulating room thermostat (on/off), if no outdoor reset sensor is connected to the boiler it is possible to simulate weather-dependent heating by activating “smart outdoor reset”.

When “smart outdoor reset” is activated, the setpoint for the supply temperature is starting at a minimum value (P056), and during heating increases to the maximum value set by the user.

When the demand for space heating is satisfied, the setpoint for the supply temperature is lowered in the same way until it reaches the minimum value.

The slope for this modulation can be set with parameter P061. Note that the value is °C per 100 seconds (*).

(*) Important: The lower the setting the more stable the heating process. However, it will take longer for rooms to heat up.

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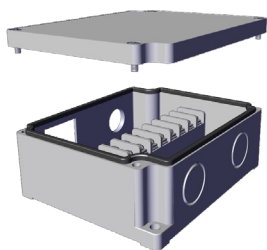


Figure 1: Junction box

REMOVING & WIRING THE CONTROLLER

The unit ships with an optional field-wiring junction box. This box provides wiring connections for a space-heating pump, a DHW pump, and an outlet for unit power. A certified harness from the wiring box connects to the movable controller tray.

You do not require a junction box if: 1. the unit's integral pump provides adequate flow through the space-heating heat emitters *and* 2. there is no DHW tank.

REMOVING THE CONTROLLER

The figure below shows you how to pull out the controller.

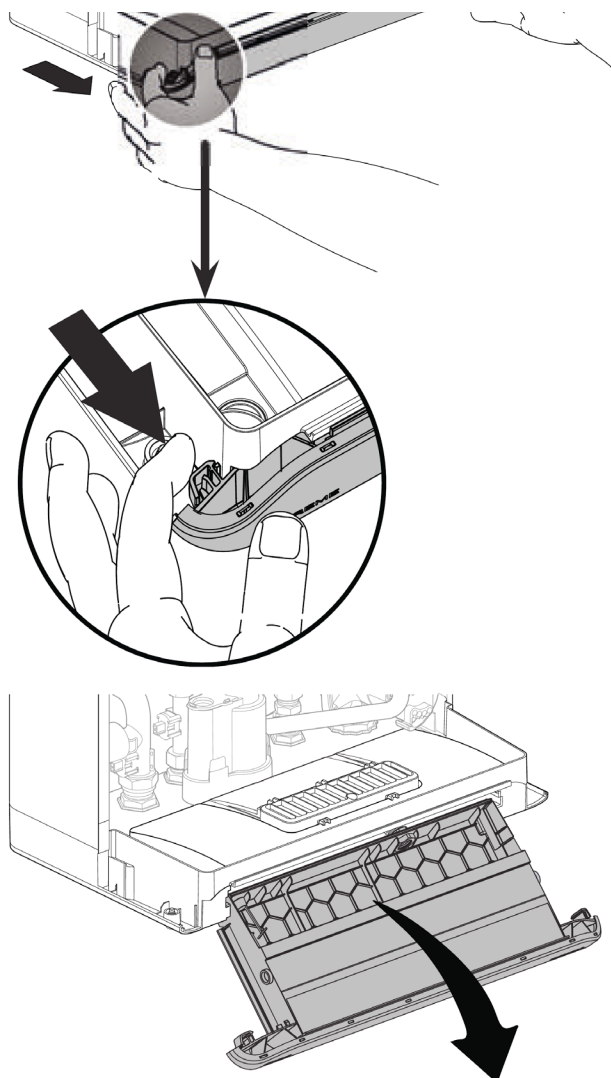


Figure 2: Pulling out the controller tray

WIRING THE CONTROLLER

Electrical wiring to the unit (including grounding) must conform to local electrical codes and/or National Electrical Code, ANSI/NFPA No. 70 – latest edition, or The Canadian Electrical Code, C22.1 - Part 1.

If using an external electrical source, the unit, when installed, must be electrically bonded to ground in accordance with the requirements of the authority having jurisdiction or, in the absence of such requirements, with the *National Electrical Code, ANSI/NFPA 70, and/or the Canadian Electrical Code Part I, CSA C22.1, Electrical Code.*

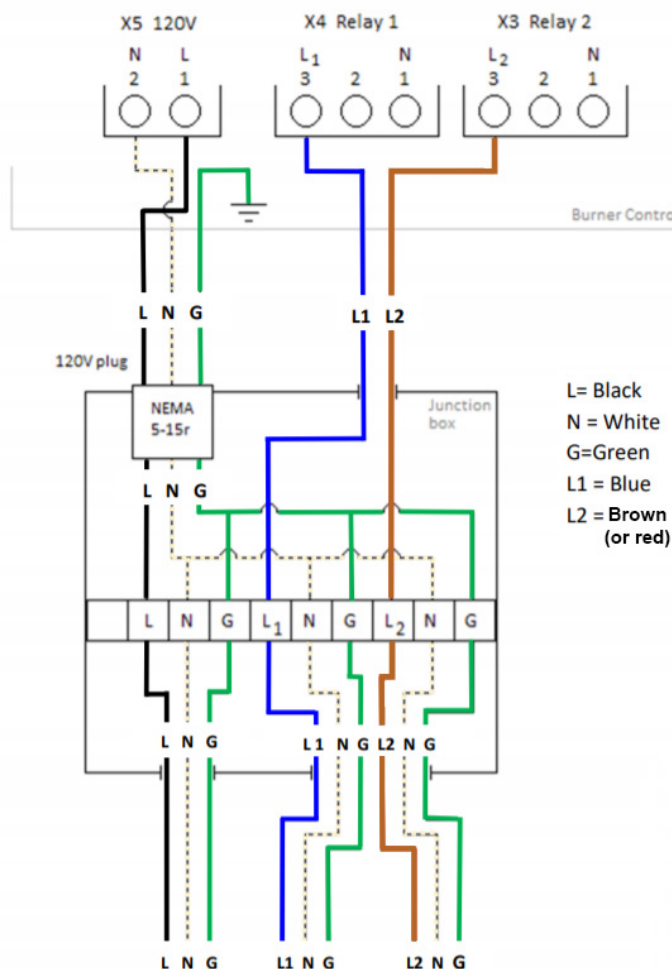


Figure 3: Junction box schematic

120VAC LINE VOLTAGE HOOK-UP

Connect the unit to the grid power, using the supplied appliance plug in a separate, fused circuit and on/off switch within sight of the unit.

The unit is equipped with 3 x 1/2" electrical knock-outs for control wiring located behind the power supply terminal strip.

The SF series units include a factory installed and pre-wired pump. The pump may not be able to supply adequate flow for the heat emitter circuits. A system heating pump switched through a separate relay or control box may be needed.

SEQUENCE OF OPERATION

The boiler operates in a similar way for both a space heating and a domestic hot water call for heat. When the boiler is powered up the controller enters a self-diagnostic mode, and displays “2” in the Service Display.

The Sequence of Operation is as follows:

1. The boiler receives a call for heat from closing terminals X13.1 and X13.2 (24 volts section). The boiler can also receive a call from Domestic Hot Water heating from the internal flow sensor, or from a 10KΩ sensor or aquastat (X13.4 and X13.5 in 24V terminal).
2. The boiler does a safety check and energizes the fan for a pre-purge (*Service Display* = 3).
3. Once the 5-second pre-purge is complete, the boiler enters a 5-second trial for ignition (*Service Display* = 4). If the boiler fails to ignite, the boiler will complete a 5-second inter-purge then another 5-second trial for ignition. This is repeated 4 times before a hard lock-out occurs. The Return button must be pressed to reset the controller and to allow for another attempt.
4. Once the burner is lit and flame has been proven the boiler operates as it is programmed (*Service Display* =  for Space Heating or  for Domestic Hot Water).
5. If the boiler reaches its target temperature and there is still a call for heat or hot water the Burner will turn off (integral pump runs unless call is on-demand dhw). (*Service Display* = 1)
6. After the call for heat is satisfied, the boiler pump will operate for an adjustable amount of time (*Service Display* = 0).
7. If the burner is on to maintain the heat exchanger temperature for DHW Comfort mode or for Freeze Protection mode (*Service Display* = 7).
8. If the burner is on to maintain the heat exchanger temperature for DHW Comfort mode or for Freeze Protection mode (*Service Display* = 7).

MAIN DISPLAY	LIT DISPLAY	DESCRIPTION
[pressure] P	-	The boiler is OFF. Press the space above the Dot to turn on the boiler.
(blank)	(blank)	No Call for Heat - Standby
XXX	0	Boiler pump running – pump post purge
XXX	1	Boiler water temperature reached target – boiler pump is energized, call for heat still present
XXX	2	Self-test – When power is applied to the boiler the controller enters a self diagnostic mode for 5 seconds
XXX	3	Fan Pre-purge , Inter-purge and Post-purge
XXX	4	Trial for Ignition and Flame Proving
XXX	 + 	Heating – Space Heating
XXX	 + 	Heating – DHW
XXX	7	Burner on for Comfort mode or Freeze Protection mode

Table 5: Operating Display and Service Display Codes.

Sensors

The resistance of the temperature sensors varies inversely with temperature. To test, measure the temperature of the sensed environment and compare with the value derived from the measurement of the resistance (obtained by connecting a good quality test meter capable of measuring up to 5,000 K Ω (5,000,000 Ω) at the controller end of the sensor lead).

To obtain a resistance reading, remove power to the unit. For the supply water and return water temperature sensors, remove the wire leads by disconnecting their respective Molex connectors. Place multi-meter probes into the sensor's male Molex connector socket. Do not apply voltage to the sensor as damage may result.

12K Ω temperature sensors are supplied with the unit. See Table 7 for resistance values.

SENSOR	TYPE	PURPOSE	LOCATION
S0	NTC 12K Ω	Heat Exchanger Temperature	Upper Left of Heat Exchanger
S1	NTC 12K Ω	Heating Supply Temperature	Heating Supply Pipe
S3	NTC 12K Ω	Domestic Hot Water	DHW Supply Pipe
S7	NTC 10K Ω	Hot Water Tank	External Water Heater
S6	NTC 12K Ω	Outdoor Sensor	Outdoors (North side)
S5	NTC 12K Ω	Flue Gas Temperature	Top of rear Flue passage
		Water Pressure	Heating Supply Pipe

Table 6: Temperature and Pressure Sensors

TEMPERATURE	RESISTANCE	TEMPERATURE	RESISTANCE	TEMPERATURE	RESISTANCE
F / C	Ω - ohm	F / C	Ω - ohm	F / C	Ω - ohm
5F / -15C	76,020	77F / 25C	12,000	149F / 65C	2,752
14F / -10C	58,880	86F / 30C	9,805	158F / 70C	2,337
23F / -5C	45,950	95F / 35C	8,055	167F / 75C	1,994
32F / 0C	36,130	104F / 40C	6,653	176F / 80C	1,707
41F / 5C	28,600	113F / 45C	5,522	185F / 85C	1,467
50F / 10C	22,800	122F / 50C	4,609	194F / 90C	1,266
59F / 15C	18,300	131F / 55C	3,863	203F / 95C	1,096
68F / 20C	14,770	140F / 60C	3,253	212F / 100C	952

Table 7: Temperature Sensor Resistance Values – 12K Ω sensors.

TROUBLESHOOTING

WARNING CODES

During operation the controller can detect unusual situations and can take action to avoid damage to the heat exchanger or other unsafe operations. During these situations, the controller limits the temperature and power output of the burner, or temporarily disables operation entirely.

These warnings are shown flashing and visible on the main display, and display only when an unusual reading is currently detected.

FAULT CODE	DESCRIPTION	POSSIBLE CAUSE / SOLUTION
F000	Problem with heat exchanger temperature sensor S0	- Heat exchanger temperature sensor S0 is out of range (temperature is below 20°F / -7°C) - Check for open wire connections from the control board to the S0 sensor. - Replace heat exchanger temperature sensor S0. - Replace the control board.
F001	Temperature is too high during central heating demand.	- Air is trapped in the heat exchanger. Bleed the central heating system - SFC / SFB 99 and 125: Open the radiator key vent. SFC 199: purge the heat exchanger. - Pump does not run. Replace the pump. - Check the wiring of heating supply temperature sensor S1 for open or short. - Check for the correct resistance of heating supply temperature sensor S1. - Check whether heating supply temperature sensor S1 is installed correctly. - Replace the heating supply temperature sensor S1.
F002	Temperature too high during DHW demand.	- Check the wiring of domestic hot water sensor S3 for open or short. - Check the correct resistance of domestic hot water sensor S3. - Check whether domestic hot water sensor S3 is installed correctly. - Check for the correct operation of domestic hot water sensor S3. - Replace the domestic hot water sensor S3.
F003	Flue gas temperature is too high.	- Check the heat exchanger for contamination. - Clean the heat exchanger. - Check whether the vent temperature sensor S5 is installed correctly. - Check the wiring of vent temperature sensor S5 for open or short. - Check the correct resistance of vent temperature sensor S5. - Verify the appliance's combustion and if the appliance has over-fired - Replace the vent temperature sensor S5.

FAULT CODE	DESCRIPTION	POSSIBLE CAUSE / SOLUTION
F004	No flame during start-up.	• Check for partially blocked vent or drain. Clean the vent or drain if blocked. • Verify the operation of the backflow flapper in the fan outlet. • Gas valve is closed. • Gas inlet pressure lower than 4" w.c. or sometimes disappears. • Gas valve or ignition module is not receiving electricity. • The ignitor gap is too tight (no spark). • Poor internal grounding. • No voltage is applied to the gas valve coil (24VDC) • Open the gas shut-off valve. • Check the ignitor gap • Replace the ignitor • Replace the gas valve. • Replace the ignition module • Replace the control board.
F005	Flame disappears during operation.	• Condensate drain is blocked. • Check for improper venting (termination protection from wind load). • Gas inlet pressure lower than 4" or sometimes disappears. • Check adjustment of gas valve. • Check the air supply duct and flue for possible recirculation or blockage of flue gases. • Poor internal grounding. Check the grounding spring connection.
F006	Flame detected out of sequence	• Replace the gas valve. • Replace the control board. • Replace the ignition module
F007	No or insufficient flame current.	• Check the ignitor. • Check the wiring of the ignitor for open or short. • Replace the ignition module.
F008	Incorrect fan speed	• Check the fan cable. • Check and/or replace the fan. • Replace the control board.
F009	Internal fault in the control board	• Replace the control board.
F010, F011	Sensor fault S0 (heat exchanger temperature sensor)	• There are two sensors contained in one shell. Both sensors are 12kΩ sensors and must be within 10% of each other. • For error F011: Average temperature between sensors is out of range (over 280°F / 138°C) / resistance is under 46 Ω. • Check whether the heat exchanger sensor S0 is installed correctly. • Check the wiring of heat exchanger sensor S0 for open or short. • Check for the correct resistance for the heat exchanger temperature sensor S0. • Check for the correct operation of heat exchanger sensor S0. • Replace the heat exchanger sensor S0.
F012	Sensor fault S5 (flue gas sensor)	• Check the wiring of flue gas sensor S5 for open or short. • Check for the correct resistance for the flue gas sensor S5. • Check whether the flue gas sensor S5 is connected correctly. • Check for the correct operation of flue gas sensor S5. • Replace the flue gas sensor S5.

FAULT CODE	DESCRIPTION	POSSIBLE CAUSE / SOLUTION
F013	Sensor fault S4 (DHW inlet sensor)	• Check the wiring of DHW inlet sensor S4 for open or short. • Check for the correct resistance for the DHW inlet sensor S4. • Check whether the DHW inlet sensor S4 is connected correctly. • Check for the correct operation of DHW inlet sensor S4. • Replace the DHW inlet sensor S4.
F014	Mounting fault sensor S0.	• Heat exchanger sensor S0 is not mounted correctly. Mount the sensor correctly. • Burner is short cycling. Check the appliance software version. • Adjust on demand hot water target temperature above 135°F / 57°C • Replace the heat exchanger S0 sensor. • Replace control board with a new board with updated software.
F016	Mounting fault S3	• Domestic hot water sensor S3 is not mounted correctly. Mount the sensor correctly. • Check for partially blocked vent or drain. Clean the vent or drain if blocked.
F017	Incorrect bypass valve	• Check the bypass valve for proper voltage/resistance values. • Replace the bypass valve.
F018	Flue and/or air supply duct is blocked.	• Check the flue and the air supply duct. • Clean the flue and/or the air supply duct. • Verify the operation of the backflow flapper in the fan outlet.
F019	Boiler Memory Module (BMM) fault.	• Check BMM wiring for breakage/shutdown. • Replace the BMM.
F021	Safety related parameter changed	• Factory reset needed
F026	Outdoor sensor S6 defect	• Check for low resistance across the outdoor sensor S6, X13 terminals 3 and 4.
F027	Short circuit of outdoor sensor S6.	• Check the wiring of the outdoor sensor S6 for open or short. • Replace the outdoor sensor S6.
F028	Reset error.	• Check the reset button for unintentional operation (e.g. cleaning of the control board). • Replace the control board.
F029	Gas valve fault.	• Check the gas valve for leakage. • Replace the control board.
F030	Sensor fault S3 (DHW sensor)	• Check whether the domestic hot water sensor S3 is installed correctly. • Check the wiring of the domestic hot water sensor S3 for open or short. • Check for the correct resistance of domestic hot water sensor S3. • Replace the domestic hot water sensor S3.
F031	Sensor fault S1 (heating supply temperature sensor)	• Check whether the heating supply temperature sensor S1 is installed correctly. • Check the wiring of the heating supply temperature sensor S1 for open or short. • Check for the correct resistance of heating supply temperature sensor S1. • Replace the heating supply temperature sensor S1.
≡	Water pressure sensor fault	• Check the wiring of the water pressure sensor for open or short. • Replace the water pressure sensor.

Table 8: Fault codes

NOTIFICATION CODES

During operation the controller can also detect unusual situations and display a notification, usually without significant interruption of the normal operation of the appliance.

These warnings are shown flashing and visible on the main display, and display only when an unusual reading is currently detected. Once the error has been resolved, the operation will be restored

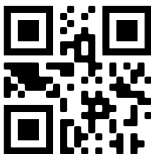
Note that these notifications only appear on controllers installed with software versions after 1.80. The software version of the controller will appear upon the controller's initial start up.

NOTIFICATION CODE	DESCRIPTION	POSSIBLE CAUSE / SOLUTION
n000	No outstanding notifications	No action needed.
n020	Low pressure error	Boiler pressure is too low.
n030	DHW temperature sensor S3 error	- DHW temperature sensor S3 is defective or not connected. DHW usage will be blocked. - Check whether the domestic hot water sensor S3 is installed correctly. - Check the wiring of the domestic hot water sensor S3 for open or short. - Check for the correct resistance of domestic hot water sensor S3. - Replace the domestic hot water sensor S3.
n120	Maintenance warning	Based on gas usage, the appliance has gone through excessive use. Maintenance is advised.
n121	Maintenance required	Based on gas usage, the appliance has gone through excessive use. Maintenance is needed. DHW use has been limited.
n122	Maintenance: DHW blocked	Based on gas usage, the appliance has gone through excessive use. Maintenance must be performed. DHW use has been blocked.
n150	Heat exchanger limit temperature	Output has been reduced because heat exchanger temperature is too high.
n151	Flue limit temperature notice	Output has been reduced because flue gas temperature is too high.
n152	Flue limit temperature notice (extra)	Output has been reduced because flue gas temperature is too high.
n200	Heat exchanger temperature is too high	Possible poor heat transfer. Clean gas and/or water side as necessary.
n201	Temperature difference between sensors S0 and S1 exceeds 63°F/35°C	Possible poor heat transfer. Pump will cycle off and on to attempt to untrap air.
n202	Flue gas temperature is too high	Flue gas temperature is too high. Burner has been turned off.
n245	Backflow protection	Backflow of flue gases detected. The fan will run on low speed.

Table 9: Notification codes

Revision History

R0 JUNE 2019	Initial release
R1 NOVEMBER 2019	Minor changes
R2 MARCH 2020	Changes to parameters including new feature: Smart Outdoor reset function (parameter P061)
R3 MARCH 2021	Changes to parameters and fault codes. Addition of resistance values for temperature sensors and notification codes, and an additional section for advanced parameters. New junction box image.

**IBC Technologies Inc.**

8015 North Fraser Way
Burnaby, BC
Canada V5J 5M8

Toll Free: 1.844.432.8422

Tel: 604.877.0277

Fax: 604.877.0295

www.ibcboiler.com

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IBC Technologies USA Inc.

1702 Taylors Lane
Cinnaminson, NJ 08077
USA

Tel: 856.887.0544

Fax: 856.735.5584

www.usa.ibcboiler.com