

4 Digit 6039 Multifuel Stove Control
Technician Reference Firmware Revision 0.15

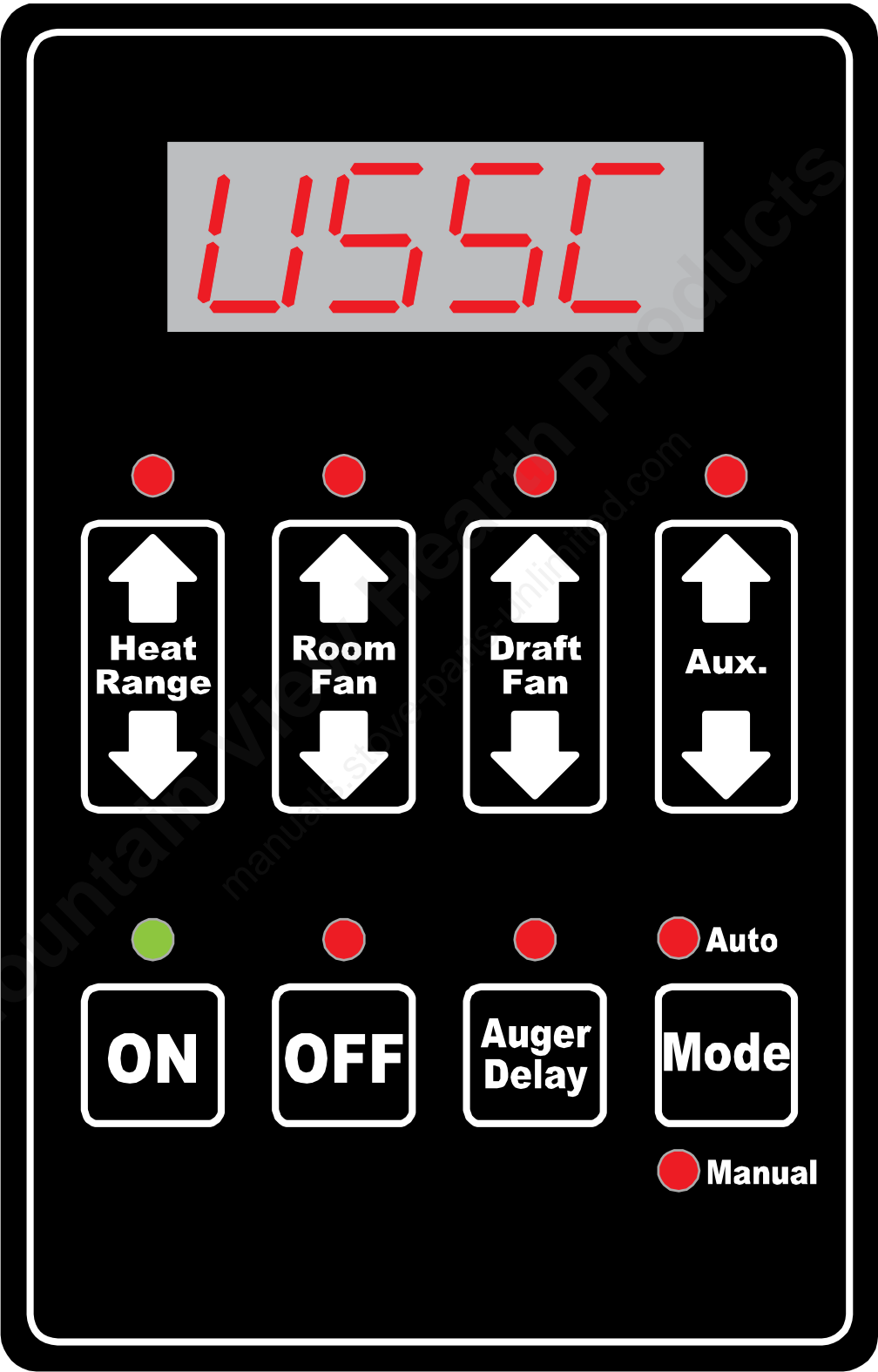


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1. Overview including diagram

The Mega 6039 Multifuel Stove Control automates the process of burning select fuels to produce heat. The control allows you to precisely control the amount of fuel dispensed into the burn chamber, the amount of air used to burn the fuel, and the amount of warm air circulating in the room. Figure 1 shows a diagram of the Stove Control.

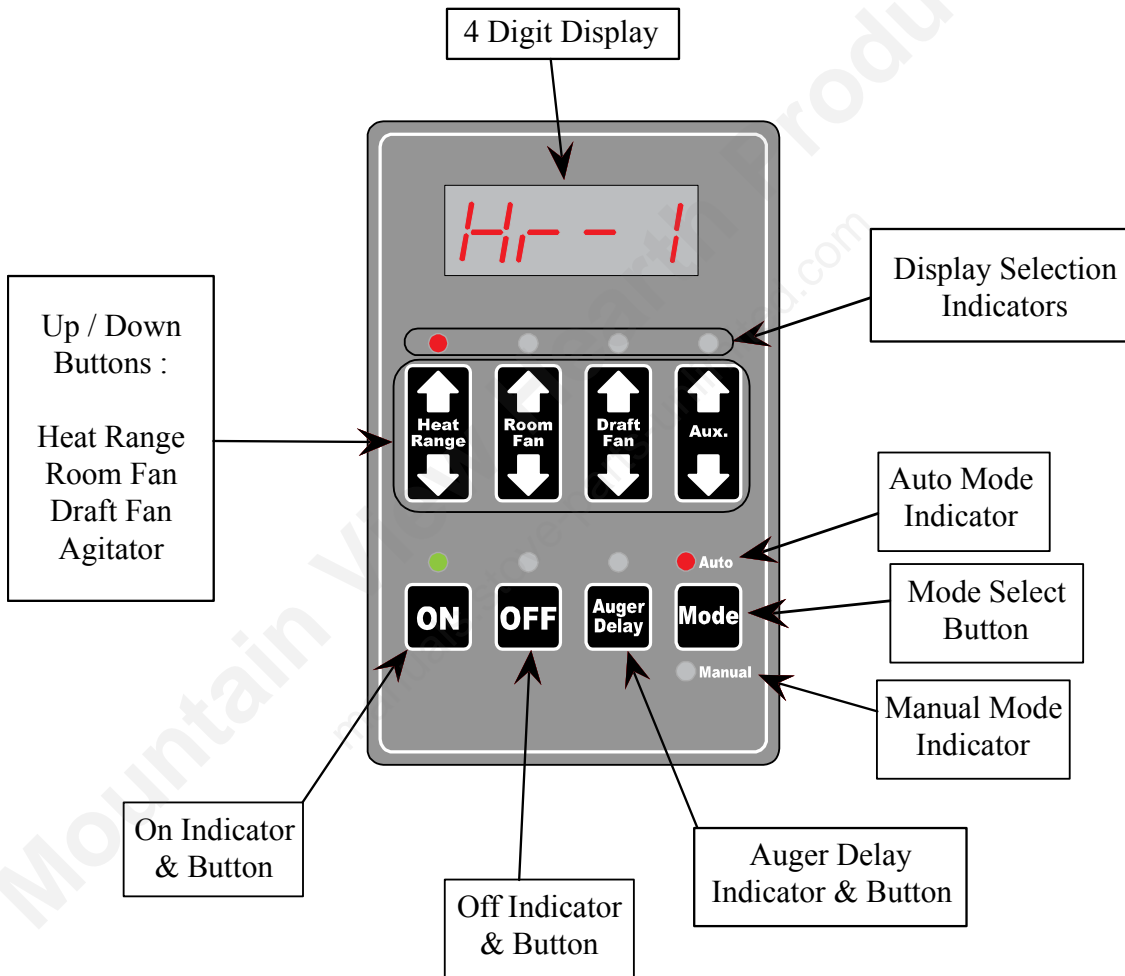


Figure 1 : Stove Control Display Panel Components

2. Basics of combustion

The amount of heat produced by the stove is proportional to the rate of fuel that is burned, and this rate is controlled by the heat range setting. In order to maintain combustion of the fuel at the desired rate, the air provided to the burn chamber by the exhaust or combustion fan must be maintained precisely. Too little air will result in a flame that is non-energetic or "lazy". If the fuel continues to flow with too little air for long enough, the burn pot will fill with too much fuel and the fire will go out. Too much air will result in a flame that is over-active. The flame in this situation is typically very blue at the bottom and resembles a blow torch. If this situation continues, the fuel in the burn pot will be consumed and the fire will go out. Matching the amount of air required for combustion to the fuel rate is the primary objective in effectively burning fuels of various types and qualities in your Multifuel Stove. The stove has been calibrated in the factory to burn the most typical fuels efficiently, but ultimately, if this doesn't provide the optimum flame for your fuel of choice, the air to fuel ratio can be easily adjusted to almost any fuel type and quality to burn effectively by following the procedures detailed in the remainder of this manual.

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3. Before starting the stove for the first time

Make sure to test the functionality of your new stove's outputs before starting your first fire. After following the procedures for setting up the stove do the following :

1. Plug in the stove and verify that the display shows "USSC" followed by the version number which should correspond to the version number of this document.
2. Make sure that the hopper and burn pot are empty.
3. Check to make sure there are no foreign materials in the burn chamber or in the ash pan.
4. Make sure that the front door and hopper lid are closed.
5. Press the ON button.
6. Verify that the ON LED comes on (blinking) and the display shows Hr-1. In addition, the Heat Range indicator should be lit and the Auto Mode Indicator should be lit. If any other LEDs are on or flashing, consult the section on "Display Indicators" for possible reasons.
7. You should hear the exhaust motor come on immediately and all other systems should remain off.
8. After 3 minutes, the auger and agitator should begin turning for short periods of time.
9. The room fan will not turn on until the stove has reached 110 degrees F.
10. Press the OFF button and verify that the auger motor turns for a few seconds and all lights on the control turn off.
11. Fill the hopper with fuel.
12. You're now ready to start your Multifuel stove.

4. Lighting the stove

1. Make sure the stove is off and the burn pot is initially empty.
2. Place a small handful of wood or fire starting pellets in the burn pot.
3. Squirt a small amount of fire starter gel on top of the pellets in the burn pot.
4. Light the fire starter and wait for approximately 1 minute for the fire to start actively burning.
5. Press the ON button and use the Heat Range Buttons to select a heat range of 2 ("Hr-2"). Pull the damper out approximately 1.5 inches for this heat setting.
6. If you wish to control the combustion air manually, press the mode button to light the MANUAL LED and adjust the damper to obtain the proper air to fuel ratio. If you wish to use the automatic damper setting, make sure the mode button is set for Auto Mode and the damper is pulled out.
7. Three minutes after turning the stove on, the auger will begin to feed fuel into the burn pot. If the fuel is not consumed quickly enough on startup, you may need to delay the fuel feed by pressing the Auger Delay Button. This will cause the auger and agitator to stop for 1 minute. If the fuel is being consumed too quickly as the stove starts, you may need to provide more fuel by pressing and holding the ON button to force the auger to turn.
8. Once the fuel starts to burn aggressively, the stove has been successfully started and you can follow the procedures below to fine tune the operation to your desired setting.

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5. Adjusting the heat range

Increasing the heat range causes more fuel to be consumed and increases the heat output of the stove. Use the Heat Range Up or Down buttons to change the amount of fuel to be burned from level 1 to level 9. If you are burning shelled corn with a moisture content of approximately 11% in your Multifuel stove, a heat setting of 1 delivers 2 pounds of corn per hour, and a heat setting of 9 provides 6 pounds of corn per hour. The heat setting 9 fuel rate can be modified to 6.5 pounds per hour maximum. By default, the settings for the room fan, the draft fan, and the agitator are automatic meaning that they will be set by the control depending on the value of the heat range. The damper should be pulled out approximately 1.5 inches for heat ranges 1 through 4, and pulled out all the way for heat ranges 5 through 9 when the stove is in the automatic mode. If you wish to adjust the fuel to air ratio or increase the room fan output or change the frequency of the agitator movement, you can fine tune these settings as described in the following sections.

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6. Adjusting the draft fan or combustion air mixture (flame quality)

Adjusting the manual damper is the most direct means of changing the quality of the flame in the burn chamber. One way to tell if your fuel to air mixture ratio is set correctly is to watch the level of fuel in the burn pot. If it increases over time, increase the amount of air. If instead, it decreases over time, decrease the amount of air. There are three methods of adjusting the air flow for the stove.

Method 1 : Changing the draft fan speed for low and high directly.

The draft fan speed can be adjusted for a fan setting of 1 and a fan setting of 8. By default, a fan setting of 9 always produces the maximum voltage for the fan. From the factory, the low air value is 219 of 500, and the high air value is 270 of 500. A proportional distribution is made from the low end to the high end across all heat settings. To adjust fan output levels for fan setting 1 and fan setting 9 from the defaults of 219 and 270, press the DRAFT FAN DOWN and AUX DOWN buttons to adjust the minimum output level (fan setting 1) or use the DRAFT FAN UP and AUX UP buttons to adjust the high level (fan setting 9). Once the value for the fan setting is displayed, use the AUX UP and AUX DOWN buttons to raise or lower the setting, and press ON to save the changes and exit or OFF to exit without saving any changes. Small adjustments to these values can make large variations to the output air so don't change them by much before confirming whether too much of a change is being made.

Method 2 : Changing the draft fan setting with the damper fully pulled out.

When you press either the DRAFT FAN UP button or the DRAFT FAN DOWN, the Draft Fan Indicator is lit and the Heat Range Indicator goes out. The display will show "Df-A" for automatic, or "Df-1" to "Df-9" for manual settings. If you do not press another button for 5 seconds, the display will revert back to the Heat Range Setting mode. While the Draft Fan Indicator is lit, the DRAFT FAN UP and DRAFT FAN DOWN buttons can be used to adjust the draft fan output. To produce more air, try increasing the draft fan setting to a value of 1 greater than the heat range setting. For example, if you are running at a heat range setting of 2, and the fire needs more air, try a draft fan setting of 3 first, then go higher if needed. While you can quickly change the draft fan settings, it may take several minutes for the effect of changing the value to show up in the quality of the flame so be sure to wait until the flame seems to stabilize for at least ten minutes before deciding whether the change you have made is appropriate. To reduce the air, try decreasing the draft fan setting to a value of 1 less than the heat range setting. For example, if you are operating at a heat range setting of 2 and the fire needs less air, try a draft fan setting of 1. If you reach the draft fan limit of 1 or 9 in attempting to create the correct ratio, it may be necessary to try a different heat range setting to allow more adjustment of the heat range. When the draft fan setting is anything other than "DF-A" the Auto Indicator will flash if the control is in the Automatic mode. To return to an automatic setting for the draft fan, increase the value until "Df-A" is displayed. This will cause the draft fan to be set to the same value as the heat range as you change the heat range. If the setting for the draft fan is not automatic, any

adjustment made to the heat range setting will have to be made proportionally to the draft fan setting. For example, if you have achieved a proper air to fuel mixture with a heat range setting of 5 and a draft fan setting of 6, and you decide to change the heat range to a setting of 7 (increased by 2), you will also need to modify the draft fan setting to 8 (also increased by 2). This mixture ratio can vary depending on the fuel type and quality.

Method 3 : Manual control through the use of the Damper

If you wish to control the air flow by use of the damper only, the system can be put into manual mode by pressing the MODE button. In the Manual mode, the Manual Mode Indicator will be lit and the Automatic Mode Indicator will be off. In the Manual mode, the fan is operated at its highest setting, and the air can be tailored to suit your needs by moving the damper in or out.

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7. Adjusting the room fan level (room heat output rate)

Changing the amount of air delivered by the room fan does not affect the combustion properties of the stove. However, the room fan must operate at a level greater than or equal to the heat range setting to ensure that heat is not allowed to build up in the exchanger located over the burn pot. For this reason, the room fan setting cannot be made lower than the heat range setting. By default, the room fan operates in the automatic mode where the setting is made to match the heat range. To increase the amount of air circulated through the room, use the ROOM FAN UP Button. When you press either the ROOM FAN UP button or the ROOM FAN DOWN button, the Room Fan Indicator is lit and the Heat Range Indicator goes out. The display will show "Rf-A" for automatic, or "Rf-1" through "Rf-9" for manual settings. If you do not press another button for 5 seconds, the display will revert back to the Heat Range Setting mode. While the Room Fan Indicator is lit, the ROOM FAN UP and ROOM FAN DOWN buttons can be used to adjust the Room Fan output. In general, increasing the Room Fan level increases the efficiency of the stove, but at low heat range settings and high room fan levels, the output temperature may be reduced below your comfort level. Reducing the room fan level will usually increase the output temperature at the front of the stove. As with the Draft Fan, to return to an automatic setting for the Room Fan, increase the Room Fan level until "Rf-A" is displayed. This will cause the room fan to be set to the same value as the heat range setting. If the heat range setting is increased above the Room Fan setting, the room fan will be adjusted to match the heat range automatically.

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8. Adjusting the Auxiliary Output (Agitator)

Occasionally, it may be beneficial to modify the agitator output frequency. If for example, you are trying to burn corn with a high moisture content, reducing the frequency of agitator rotation may help allow the wet corn to dry on top of the coal bed before mixing it with the primary heat source. If on the other hand the fuel burns well but seems to clump together too much because the agitator is not moving enough, increasing the frequency of the agitator rotation may help reduce clumping in the fuel. By default, the agitator operates in the automatic mode where the setting is made to match the heat range setting. To change the frequency of agitator rotation, use the AUX UP or AUX DOWN buttons. When you press either the AUX UP or AUX DOWN button, the Aux Indicator is lit and the other setting indicators go out. The display will show "AU-A" for automatic or "AU-0" - "AU-9" for manual settings. If you do not press another button for 5 seconds, the display will revert to the Heat Range Setting mode. While the Aux Indicator is lit, the AUX UP and AUX DOWN buttons can be used to adjust how frequently the agitator rotates. A setting of 0 will stop the agitator completely. As with the Draft Fan and Room Fan settings, to return to an automatic setting for the agitator rotation frequency, increase the Aux level until "AU-A" is displayed. This will cause the agitator rotation frequency to be set to the same value as the heat range setting. When the Aux setting is manual ("AU-0" through "AU-9"), the Auto Indicator will flash unless the mode is set to Manual.

9. Auger Delay, Auger Bump, and Agitator Bump

Pressing the Auger Delay button causes the Auger and Agitator to stop moving for 1 minute. This can be cancelled by pressing the ON button. Pressing and holding the On button causes the Auger to be turned on continuously. These functions can be helpful when making adjustments to the stove burn settings to maintain a fire while changing values or in recovering from delays in operation such as adding fuel to the hopper. When the stove is off and cool, the AUX UP and AUX DOWN buttons can be used to rotate the agitator to make it easier to remove the burn pot for cleaning.

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10. Combustion Chamber Pressure Switch

The combustion chamber pressure is monitored by a pressure switch located inside the stove. If the door is opened during normal operation or a strong negative pressure is created in the room or a strong wind is blown into the flue, the stove will increase the Draft Fan to full power to reduce the emission of smoke in the room. While this occurs, the Draft Fan Indicator will blink indicating that the combustion chamber has lost pressure, and the Auger and Agitator will stop turning.

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11. Turning the stove off

Pressing the OFF button will cause the stove to enter a shutdown mode. If the stove has reached operating temperature, the OFF Indicator will blink until the shutdown procedure succeeds in lowering the stove temperature. The Room Fan will stay on to cool the stove, and the Exhaust Fan will stay on to remove smoke and heat from the combustion chamber. The Agitator will stop. The Auger will bump the fuel out of the auger every few seconds to prevent the fuel in the auger from burning. Once the temperature of the burn chamber falls below about 100 degrees F and the pressure switch detects that the door is closed, the fans will stop and the Auger will run for a few seconds to purge the auger system of any burned fuel. At this point, the OFF Indicator will go out and the stove will turn completely off. If during burning, the stove has reached at least 120 degrees F, the shutdown procedure will also include a 15 minute shutdown timer that will keep the stove in the shutdown state for at least 15 minutes regardless of whether it is cool or pressure is detected. The 15 minute timer can be turned off by pressing the off button during shutdown. This will cause the system to exit shutdown and return to the "OFF" mode as soon as the door is closed and the stove is cool.

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12. Error Codes

During normal operation, the stove is constantly monitored for problems. In the event of an error condition, the stove is stopped and an error code is displayed as follows :

Err1 - The high limit temperature sensor was tripped.

- Inadequate ventilation,
- Room fan failure,
- Exhaust blockage,
- Electrical Open in over temperature switch or wiring

Err2 - Stove ran out of fuel in normal operation.

- Hopper empty
- Auger output failure or jam
- Flame or Fuel quality caused fire to go out
- Electrical Open in low temperature switch or wiring

Err3 - The stove was unable to reach the 110 deg.F. within the startup time

- Flame or Fuel quality caused the fire to burn too slowly or go out
- Auger output failure or jam
- Hopper empty on startup
- Electrical Open in low temperature switch or wiring

Err4 - The power failed while the stove was hot, and when power was restored, the fire was out.

- Power loss
- Electrical Open in low temperature switch or wiring

Err5 - The Auger output fuse has blown.

- Auger motor jammed or bad

Err6 - The Agitator output fuse has blown.

- Agitator motor jammed or bad

Err7 - The Exhaust blower output fuse has blown.

- Exhaust Fan motor jammed or bad

Err8 - The Room fan blower output fuse has blown.

- Room Fan motor jammed or bad

Err9 - Zero Cross Input failed

- AC Supply frequency out of range
- Zero Cross Optocoupler Failure

13. Display Indicators

Several situations or events are indicated in normal operation by blinking display indicators or segments in the display :

Flashing On Indicator : This means that the stove is in the “Start Up” state waiting for either a 3 minute timeout to begin burning or for the stove to reach the warm temperature whichever comes first.

Flashing Off Indicator : This indicates that the stove is in the “Shutdown” state waiting for the OFF button, or for a 15 minute period after the stove was turned off, or for the stove to cool down, or for the door to be closed.

Flashing dash in Heat Range Display : This indicates that the stove is in the normal run mode and is ramping from the current heat range setting to the target heat range setting. Once the ramp is complete, the dash will stop flashing. For ramping from heat range 1 to 9, the default time is 12 minutes (with a 90 second ramp time).

Flashing Automatic Mode Indicator : This indicates that the stove is in normal operation and is running in the automatic mode. However, either the Draft Fan or Auxiliary setting is manually configured.

Flashing Draft Fan Setting Indicator : This indicates that the stove is in normal operation and that the vacuum sensor detects a loss of pressure either because the door is open or because there is a negative pressure in the room with respect to the exhaust.

14. USSC Factory Test

The USSC Factory Test is used at the factory where the stoves are assembled to test the functionality of the control and the stove before the unit is shipped. To perform this test, press and hold the OFF and AUGER DELAY buttons simultaneously for 3 seconds. To advance through the test, press any key unless otherwise noted in the test step.

1. Exhaust Fan Output Test - Exhaust Fan is turned on full then reduced to a level just above the typical minimum pressure switch setting. The ON LED indicates whether the pressure sensor is detected. During this test, the display shows "Out1".
2. Room Fan Output Test - The Room Fan is turned on full. During this test, the display shows "Out2".
3. Agitator Output Test - The Agitator is turned on full. During this test, the display shows "Out3".
4. Auger Output Test - The Auger is turned on full. The ON LED will light when the over temperature snap disc is in the cool state. During this test, the display shows "Out4".
5. Low Limit Switch Test - If the stove is warm (above 110 deg. F), the ON LED will turn off, but if the stove is cool, the ON LED will turn on. During this test, the display shows "in 1"
6. Thermostat Test - If the thermostat input is closed, the ON LED will light, otherwise if the thermostat input is open, it will turn off. During this test, the display will show "in 2"
7. Temperature Test - If equipped with an RTD temp sensor, the measured temperature will be displayed in degrees F.
8. AC Frequency Test - Displays the measured AC Frequency in hertz.

15. Factory Defaults

To return the control to its original factory default settings, press and hold the AUX UP and AUX DOWN buttons together for three seconds.

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