

Welcome –**Instruction Manual**

You have chosen to improve your household comfort and increase the efficiency of your heating dollars.

The Corn-trol Digital™ system has been specifically developed to improve the performance and convenience of your Corn/Pellet Furnace. A new type of digital thermostat and solid-state control module make this possible. Like Cruise Control for a car, the Corn-trol Digital™ for CORN smoothly changes fuel feed and combustion air to maintain desired temperature and efficiency of your furnace.

An investment of a small amount of time to review this manual will ensure proper performance of your Corn-Trol Digital™ system.

Introduction

This manual contains operating instructions for the Corn-trol Digital™ for Corn and Model TS2C Thermostat. This system has been designed specifically for use with LMF Manufacturing Model 620-9 or AH 170 Biomass Furnaces. Only appliances tested and approved to ANSI/UL 391, "Solid-Fuel and Combination-Fuel Central and Supplementary Furnaces." Please verify that your appliance is approved.

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Corn-trol Digital Feature Overview

The Corn-trol Digital System is a complete control system designed for auger fed corn furnaces burning corn or wood pellet fuel. The furnace-mounted Control Module and the wall-mounted Corn-trol Thermostat work together to supervise all furnace operations and maintain room temperature to $\pm 1^{\circ}\text{F}$ (typical) of the desired setting.

Configureable for 100 BTU/hr or 170 BTU/hr and fuel, either corn or wood pellets, the Corn-trol regulates the air and fuel for optimal burn.

With turndown as low as 5%, (5,000 BTU/hr) or less, the Corn-trol allows burning in warmer weather without overheating.

The Control Module controls the corn feed rate (auger motors), combustion blower fan, and optionally a power-vent fan.

The Control Module has a lighted power On/Off switch for load control. The TS2C Thermostat is always on.

The Thermostat may be located up to 100 ft. from the Control Module. Proper temperature control only requires that the heat generated by the stove is readily communicated to the thermostat.

Fuel feed is continuously adjusted to maintain room temperature as set on the Corn-trol thermostat.

Two temperature setbacks automatically change the temperature at prescribed times set by the user on a 24 hour time cycle.

A room high temperature limit supplements primary safety devices to shut off the furnace if the room temperature is too hot.

Manual Ignition mode to assist in initial fire start.

A One-touch Feed mode assists in starting a fire by continuously stoking Corn for 10 minutes at a 100% rate.

All settings, except for time of day clock, are maintained during power loss without batteries.

Power loss ride-through allows the thermostat to continue furnace operation if power is restored within 2 hours.

Test Mode sequences all motors and blowers to assist in installation and troubleshooting.

The Corn-trol Digital TS2C Thermostat features an LCD display, one LED indicator, and 3 pushbuttons for indication and control of all settings.

Safety Information

Please read and pay careful attention before proceeding!

ATTENTION - Please follow all manufacturers instructions that came with your furnace. The Corn-Trol Digital is designed to complement and enhance the safe operation of your appliance. Specifically, the Corn-Trol Digital control system has been designed for use with appliances tested to ANSI/UL 391, Solid-fuel Furnaces.

Use of the Corn-trol Digital™ on appliances not permanently marked with one of the above designations voids all warranties and may be unsafe. Contact us or your stove manufacturer if you are not sure that your stove/furnace is built in compliance with these safety standards.

WARNING: IMPORTANT INFORMATION CONCERNING POWER VENTS - Only appliances approved for use with a power vent are to use provisions provided for this purpose. It is required that electrical power to a mechanical venting system (power vent) be sourced from the Corn-trol Digital control module. The On/Off switch on the control module must control the power vent. A fume spillage switch must be included to remove power to the combustion air and fuel feed when tripped. A barometric damper is required for proper operation.

WARNING - The Corn-trol Digital™ is capable of regulating a Corn fire smaller than required to maintain proper chimney draft. Follow all manufacturers recommendations for minimum draft pressures and temperature. The use of mechanical means such as a draft inducer fan may be required to ensure proper draft at low fire. Installation of a carbon monoxide detector (not-included) is highly recommended.

Please Keep reading... Additional Safety Information:

THIS PRODUCT HAS A GROUNDING TYPE PLUG AND REQUIRES A GROUNDING TYPE OUTLET. IF THE PLUG DOES NOT FIT, CONTACT A QUALIFIED ELECTRICIAN. DO NOT MODIFY THE PLUG IN ANY WAY.

TO REDUCE THE RISK OF ELECTRIC SHOCK, DO NOT CONNECT TO A CIRCUIT AT MORE THAN 150 VOLTS TO GROUND.

FOR INDOOR USE ONLY.

RISK OF ELECTRICAL SHOCK: THE CONTROL MODULE AND THERMOSTAT HAS NO SERVICEABLE PARTS INSIDE. SEE WARRANTY FOR SERVICE.

WARNING: BYPASS OF MECHANICAL VENT SPILLAGE SWITCH (FUME SWITCH) OR BONNET TEMPERATURE LIMIT, IF INSTALLED IS DANGEROUS. OPERATION MAY CAUSE SERIOUS INJURY OR DEATH, DUE TO CO POISONING OR FIRE.

For Service or Repair

Contact your dealer, or our company.

Automation Correct LLC

405 Parrish Lane Syracuse, NY 13205

Phone: (315) 299-3589

Email: support@automationcorrect.com

Web: www.automationcorrect.com

Corn-trol Digital™ Limited Warranty

THREE-YEAR WARRANTY – Automation Correct LLC (us) warrants this product to be free from defects in material and workmanship. If a defect is found within three years from the date of original installation of the product (whether or not actual use begins on that date) Automation Correct LLC will provide a new or remanufactured part, at our sole option, to replace any defective part, without charge for the part itself.

This warranty does not include labor or other costs incurred for diagnosing, repairing, removing, installing, shipping, servicing or handling of either defective parts or replacement parts.

Warranty Conditions:

1. Warranties only apply to products in their original installation location.
2. Installation, use, care, and maintenance must be normal and in accordance with the instructions contained in the Operation Manual, Installation Manual and Automation Correct LLC's Service Information.
3. Defective parts must be returned to us or an authorized dealer for credit.
4. All work performed during normal business hours.
5. This warranty applies only to residential use.

LIMITATIONS OF WARRANTIES – All implied warranties (including implied warranties of merchantability and fitness for a particular purpose) are hereby limited in duration to the period for which the LIMITED WARRANTY is given and applies. Some states do not allow limitations on how long an implied warranty lasts, so the above may not apply to you. The expressed warranties made in this warranty are exclusive and may not be altered, enlarged, or changed by any distributor, dealer, or other person whatsoever.

Automation Correct LLC will not be responsible for:

1. Damage or repairs as a consequence of faulty installation, misapplication, abuse, improper servicing, unauthorized alteration or improper operation.
2. Failure to operate due to voltage conditions, blown fuses, open circuit breakers or other conditions beyond the control of Automation Correct LLC.
3. Parts not supplied or designated by us, or damages resulting from their use.
4. Automation Correct LLC products installed outside the 50 US states or Canada.
5. Cost of heating fuel of any kind whatsoever including electricity.
6. Any special indirect or consequential property or commercial damage of any nature whatsoever. Some states do not allow the exclusion of incidental or consequential damages, so the above limitation may not apply to you.

This warranty gives you specific legal rights, and you also may have other rights, which vary from state to state.

Combustion Air Intake Opening

For furnaces without the LMF pellet kit:

Remove restrictor plate completely.

For furnaces with the LMF air kit:

Restrict the air intake as shown.

Further adjustment of the air intake should not be required..



Locating the Thermostat

The room temperature sensor is located in the Thermostat. For proper operation, the sensor must be exposed to the heat produced by the stove. The preferred mounting locations include: An inside wall, away from the direct air stream of the convection blower, and away from radiant heat produced by the stove. The Thermostat does not have to be within the same room as the stove if air readily circulates to the location of the Thermostat.

Connect Thermostat to Control Module

Connect the Thermostat cable to the THERMOSTAT connector on the Control Module and the Connector on the rear of the TS2 Thermostat. Push connectors in until you hear it click.

50 ft. Thermostat Cord



The provided 50 ft. cord may be extended up to 100 ft. with an eight pin, RJ45 to RJ45 coupler and/or standard computer network cable. The cable must be a 'through' type, not a crossover type. Note: The Corn-trol thermostat and Power Module cannot be connected to computer networks through this cable.

Power On/Off Switch




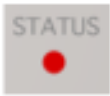
Power to the Corn-trol system is controlled by the On/Off switch on the Control Module. When illuminated the control is on. Power to the thermostat is always on when the control module is plugged in and has power.

Operating Controls of the Thermostat

Purpose of the Buttons and Lights



Corn-trol Digital™ Model TS2 Thermostat

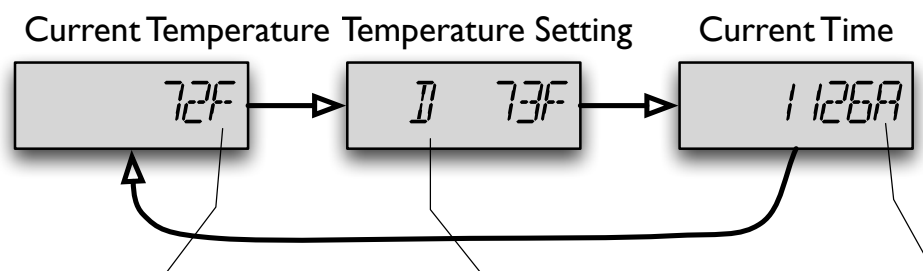
	<p>MENU button - Each press will display next OPERATION menu setting. Pressing and holding will enable access to SETUP and EXTENDED menu options.</p>
	<p>DOWN button - Each press will decrease a setting. Press and hold to decrease fast. Also used to enable a selected setting.</p>
	<p>UP button - Each press will increase a setting. Press and hold to increase fast. Also used to enable a selected setting.</p>
	<p>STATUS Light - When On indicates a startup, manual setting, or over temperature condition.</p>

Quick Usage Guide

**"Everything is installed and setup.
Tell me how to work the thing!"**

In regular operation the display shows the current temperature, the temperature setting and current time. This is called the Round-robin Display.

Round-robin Display



In regular operation the display shows the current temperature, the temperature setting and current time. This is called the Round-robin Display.

"F" for Fahrenheit
"C" for Celsius

"D" for Daytime Temperature setting.
"N" for Nighttime Temperature setting.
"O" for Override Temperature setting.

"A" for AM
"P" for PM

I want to...

Return to the Round-robin Display: (I might be lost)	Momentarily press the MENU button two or more times until the Round-robin Display is shown.
Change the temperature setting for awhile:	Press the UP button to increase or press the DOWN button to decrease the temperature setting.
Set the time of day clock:	Press and hold the MENU button until the display shows SETUP, then release. Display will show "S1200P" or the current incorrect time. Press the UP/DOWN buttons as needed to set the correct time.
Switch from Corn to Pellets: (I have the LMF Pellet Kit installed)	Press and hold the MENU button until the display shows SETUP, then release. press the MENU button until the display show FUEL. Press UP/DOWN button to select "C" (corn) or "P" (pellet).
Start the furnace:	Make sure all draft controls are working. Clean pot, place a few cups of pellets or corn in pot. Build a good wood or charcoal fire. Use IGNITE mode on page 13.
Stop the stove:	Turn the Power Switch to OFF.
Maintain SAFE operation of my solid-fuel appliance:	Are all combustibles a safe distance from the appliance? Got working smoke alarm(s)? Got working carbon monoxide detector(s)? Proper draft? Regular appliance maintenance?

Power-up Sequence

Upon first power to the thermostat, the display will momentarily show the firmware version number, the thermostat type, and a manufacture type. The thermostat will then enter and wait for the time of day clock to be set, with the status light blinking. If the thermostat has been running normally and the power is interrupted, the display will sequence as above, but will skip the clock setting step and proceed directly to control of the appliance.

MENU Button Operation *Overview of the MENU System*

The MENU button is used to access all settings of the thermostat. Three areas are accessible depending on the manner that the MENU button is pressed. The MENU may be momentarily pressed, or pressed and held for 2 seconds, or pressed and held for 5 seconds.

Starting from the Round-robin display 

OPERATION Menu Access

Momentary press MENU button.

Display changes to:

FR+ 22

Momentary press MENU button

FEED RATE Indication
WEEKDAY Setbacks
WEEKEND Setback
See page 9

SETUP and EXTENDED Menu Access

Press and hold MENU button for 2 seconds. OR Press and hold MENU button for 5 seconds.

Display changes to:

SETUP

Momentary press MENU button

SETUP Menu Operations
See page 11

Display changes to:

FEED

Momentary press MENU button

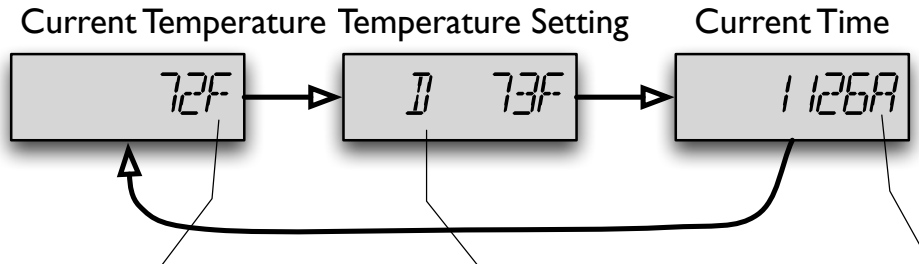
EXTENDED Menu Operations
See page 13

In the documentation that follows, it is assumed that the Round-robin display is the 'Action' step starting point.

Round Robin Temperature/Time Display

While in regular operation, the thermostat cycles between the Current Temperature, the Temperature Setting, the Current Time and Day of the Week. The Round-robin display occurs automatically if the Thermostat is left alone for 30 seconds. (No button presses)

Round-robin Display



In regular operation the display shows the current temperature, the temperature setting and current time. This is called the Round-robin Display.

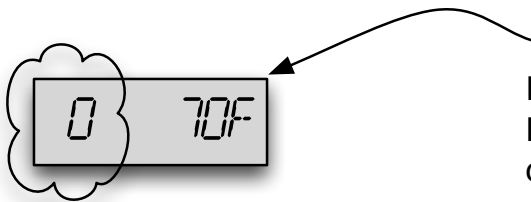
"F" for Fahrenheit
"C" for Celsius

"D" for Daytime Temperature setting.
"N" for Nighttime Temperature setting.
"O" for Override Temperature setting.

"A" for AM
"P" for PM

For the remainder of the manual, it is presumed that the ACTION starts from the Round-robin Display.

Override Temperature Setting (Temporarily)



ACTION

Press UP or DOWN button.
Display shows "O" and current temperature setting.

NOTE

The new temperature setting remains in effect until the time for the next programmed daytime or nighttime setback setting.

It can take an hour or more for the room temperature to move from one setting to another.

Firing Rate Indicator

How much fuel is being fed?

DISPLAY



ACTION

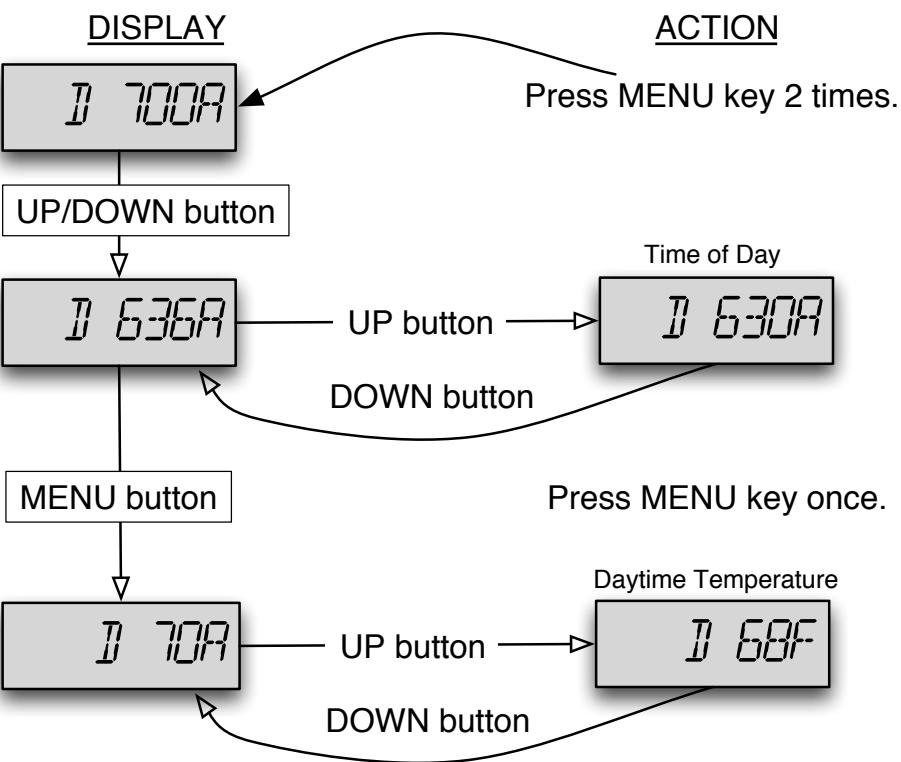
Press MENU key 1 time.

NOTE

Displays the fuel feed rate in percent. (0-99%).

If the display shows a plus sign (+), this indicates that the auger motor is currently feeding fuel.

Day Temperature Setting (Daytime Setback)



NOTE

First set the time of day for the temperature setback. This is the time when the Daytime Temperature setting will occur.

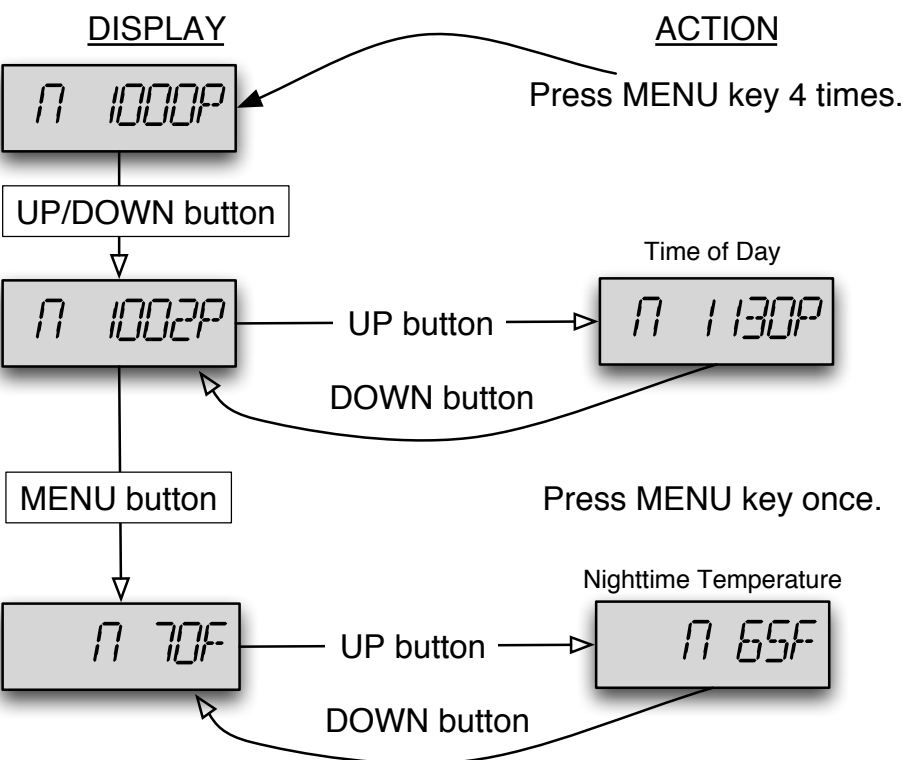
Press UP/DOWN buttons to set the time of day. Press and hold UP/DOWN to increase/decrease setting rapidly. When finished press MENU button.

Now set the setback temperature.

In this example, at 6:30 AM the thermostat will set the temperature to 68°F.

It can take an hour or more for the room temperature move to from one setting to another.

Night Temperature Setting (Nighttime Setback)



NOTE

First set the time of day for the temperature setback. This is the time when the Nighttime Temperature setting will occur.

Press UP/DOWN buttons to set the time of day. Press and hold UP/DOWN to increase/decrease setting rapidly. When finished press MENU button.

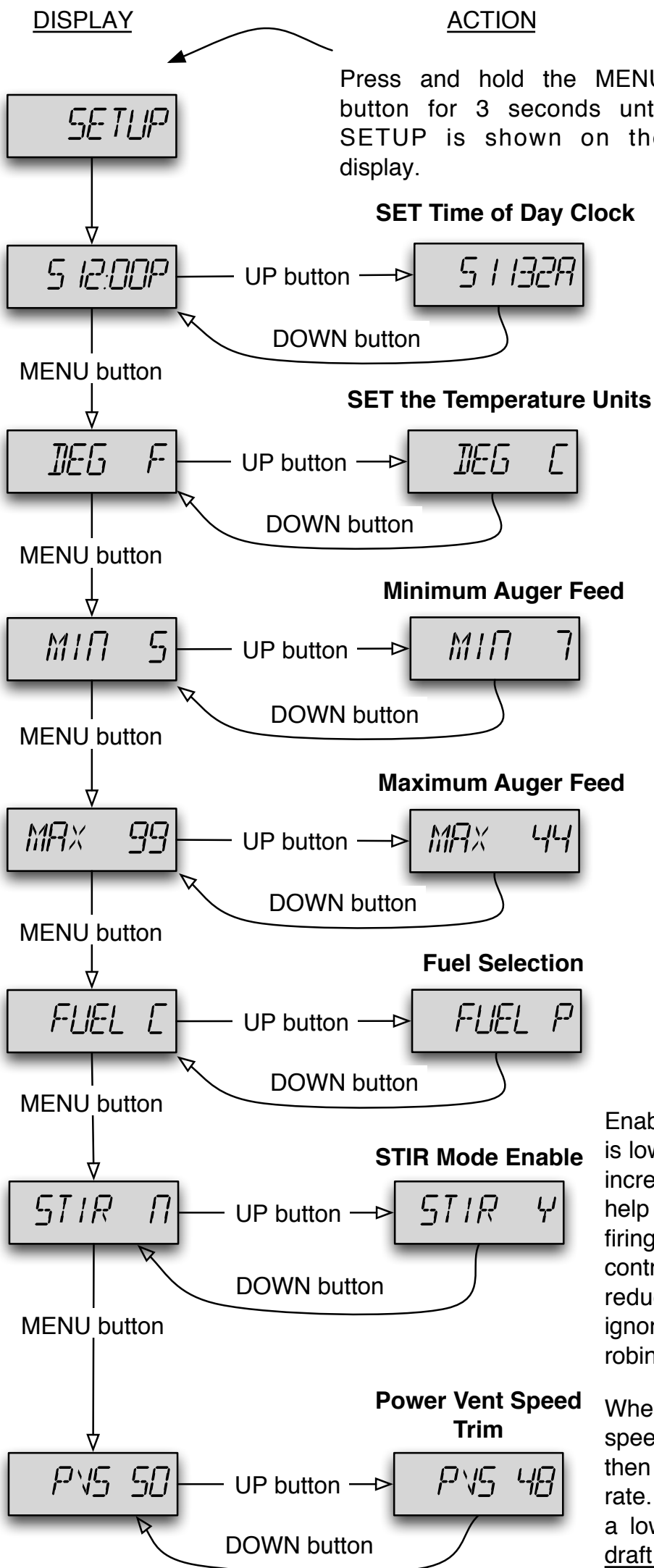
Now set the setback temperature.

In this example, at 11:30 PM the thermostat will set the temperature to 65°F.

It can take an hour or more for the room temperature to move from one setting to another.

SETUP Menu Operation

The SETUP menu is for initial setup. Once done, these settings need not be adjusted. Except for the time of day clock, the settings are maintained in the thermostat.



The word "SETUP" is displayed for only 1 second and then the display shows the Time of Day setting.

Display shows "S" for SET. After extended power loss, the time of day setting may be adjusted without entry into SETUP menu.

Press UP button for Deg. C or the DOWN button for Deg. F temperature units.

MIN feed value cannot be increased beyond the MAX feed value. Too low a value can allow the fire to go out. This setting does not automatically return to the Round-robin display.

MAX feed value cannot be decreased below the MIN feed value. This setting does not automatically return to the Round-robin display.

If the LMF Pellet kit is installed, use this to select the fuel being burned. "P" for wood pellets, "C" for corn. Without LMF Pellet kit always leave in "C" corn.

Enables anti-clinker mode. If the firing rate [FR] is low for an extended period then the control will increase the firing rate for a period of time to help clear the clinker (LOW anti-clinker). If the firing rate [FR] is high for an extended period, the control will decrease the firing rate for a period to reduce sticking in the pot. The thermostat ignores temperature during STIR. The round-robin will indicate if anti-clinker is active.

When PVS = 50, the Power Vent will track the speed of the Combustion Blower. If PVS > 50, then the power vent speed will track at a higher rate. When PVS < 50 the power vent will track at a lower rate. Note: A fume switch and proper draft pressure is required in every power vent installation.

MIN/MAX Adjustment

The Corn-trol Thermostat uses the values set by MIN and MAX as limits to determine the minimum and maximum fire size allowed in the pot. The factory settings for your stove should be the starting point for any adjustment. The need for large adjustment from the factory default settings may indicate mechanical problems with the stove that will not be solved by MIN/MAX adjustment.

While displaying MIN or MAX, the Corn-trol Digital runs the auger at the MIN or MAX value and NOT according to desired room temperature. When finished making a MIN or MAX adjustment, press the MENU button to return to the Round-robin display which resumes normal thermostatic control.

To adjust the Minimum feed rate go to MIN and observe the fire. Allow the fire to "settle into" its minimum firing rate. Adjust MIN to the desired fire size. Allow enough time between adjustments for fire to settle in to a new value. MIN values typically range between 2 and 10, If MIN is set too low, the fire can go out.

To adjust the Maximum feed rate go to MAX and observe the fire. Allow the fire to "settle into" its maximum firing rate. Adjust MAX to the desired fire size. Allow enough time between adjustments for fire to settle in to a new value. MAX values typically range between 85 and 99.

WARNING - The Corn-trol Digital™ is capable of regulating a Corn fire smaller than required to maintain proper chimney draft. Follow all manufacturers recommendations for minimum draft pressures and temperature. The use of mechanical means such as a draft inducer fan may be required to ensure proper draft at low fire. Installation of a carbon monoxide detector (not-included) is highly recommended.

NOTE: By adjusting the MAX downward the maximum BTUs of the furnace is effectively reduced. This may be of benefit to limit temperature overshoot during setpoint changes, especially on well insulated dwellings. By observing the firing rate [FR] when the actual temperature is settled at the temperature setting, you can ensure enough BTU "headroom" for the coldest day. For example, if the desired and actual temperature is say 70 degrees, and the firing rate is 80%, then one has 20% more BTUs available at the current outside temperature.

SETUP Menu - Factory Settings

This table contains the TS2 thermostat settings as shipped from the factory and typical settings for various stove models. Our website may have addition information on settings and retrofit to your unit.

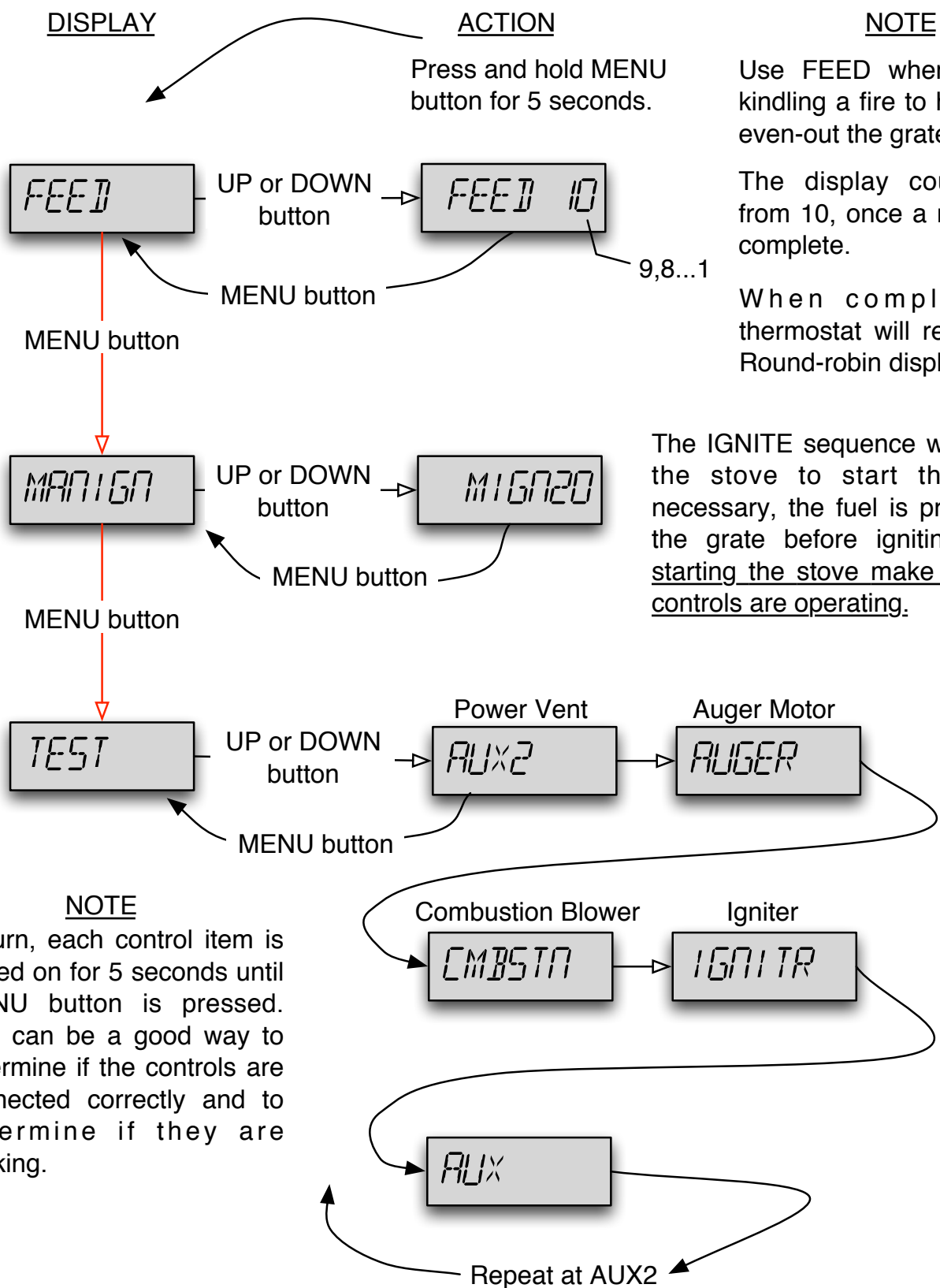
Setting	Display	Factory Value
Clock	S	12:00P
Temperature Units	DEG	F
Minimum Feed Rate	MIN	5
Maximum Feed Rate	MAX	99
Fuel	Fuel	C
Stir	STIR	N

ADVANCED Menu - Settings

From the factory, the TS2C thermostat is configured for a 3 RPM Bin Auger motor and a BTU setting of 100K. For all configurations their is no restrictor tube.

Contact us or see separate instructions for ADVANCED MENU SETTINGS.

Extended Menu Operations



NOTE
 In turn, each control item is turned on for 5 seconds until MENU button is pressed. This can be a good way to determine if the controls are connected correctly and to determine if they are working.

Room Over-Temperature Cutout

DISPLAY

ACTION

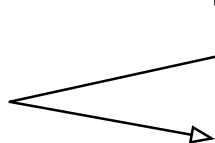
NOTE

HI TEMP



The STATUS indicator light blinks every second.

CAUTION: Before proceeding, investigate the cause of the over-temperature condition.



Press the MENU button to Reset.

The temperature sensor in the thermostat has detected a room temperature above 97°F/36°C and has disabled all the controlled motors.

The HI TEMP display may indicate a problem with your stove, chimney, or Corn-trol Digital System.

The thermostat will not allow the MENU button to reset the thermostat until the room temperature is less than 96°F/35.5°C

Maintenance and Troubleshooting

The Corn-trol Digital System is only the command and control piece of a properly operating stove. If the Control Module power light is ON, and the Thermostat is displaying normally, the easiest way to determine the source of an electrical or mechanical problem is to go to TEST mode and observe for proper operation of the controlled item.

Problem	Possible Cause(s)	Possible Solution(s)
Power Light on Control Module is not ON	1) No power to Control Module. 2) Fuse blown in Control Module.	Check power. Turn Power switch ON. Replace fuse. Bad Motor or bad wiring. Bad Control Module.
Thermostat has no display.	1) No power to Control Module. 2) Cable not snapped in. 3) Bad cable.	Check power. Snap in both ends of cable. Replace cable. Bad Thermostat. Bad Control Module.
Fire goes out now, but was working before.	1) Auger mechanism jamming or dragging. 2) Hopper clogged or empty. 3) Auger motor defective. 4) Combustion blower defective.	Go to TEST mode and verify that the Stoker motor and Combustion blower are working. Troubleshoot mechanicals. Verify fuel quality and sizing. Bad control cable. Bad Thermostat Bad Control Module.

Corn-trol Digital Specifications

Note: Automation Correct LLC is constantly working to improve our products.
For this reason, all specifications are subject to change without notice.
Not all versions include all control options.

Control Module (CM2-X/PB1/CM1): FOR INDOOR USE ONLY

Electrical: Design Specification: UL-873

Input Power	120VAC 60Hz, 1200W
Fuse	10A 125V Fast, (IR10kA/125V), BK/GMA-10A or Equivalent.
Output Power	
Stoker	1A Continuous, 2A MAX
Convection Blower	4 A Continuous, 8A MAX
Igniter	3A Continuous, 8A MAX
Combustion Blower	1.5A Continuous, 2A MAX
Power Vent	4 A Continuous, 8A MAX

**All motors loads must be shaded-pole or PSC type.
Combined Output Power - 1200W MAX**

Mechanical:

Dimensions	PB1/CM1: 6 1/2"L x 9"W x 2 1/2"H 16.5 cm L x 22.9 cm W x 6.35 cm H CM2: 6 1/4" L x 5 1/8"W x 2 1/8" H 15.7 cm L x 10.3 cm x 5.2 cm
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Construction	16 GA galvanized steel
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Environmental:

Operating Temperature	113°F/45°C MAX
Storage Temperature	40°F to 120°F
Weight	PB1/CM1: Approx. 3.5lbs/1.59Kg

Thermostat (TS2): FOR INDOOR USE ONLY

Temperature:

Displayed Precision	1°F/1°C
Accuracy	±2°F/±1.8°C @ 68°F/20°C

Electrical:

Input Power	8VAC, 2.5VA CLASS 2
Connection to Power Module	RJ45 - 8PIN, 100 ft. Maximum (Standard Ethernet Straight Cable)

Mechanical:

Dimensions	5.367" L x 2 5/8"W x 1.260 "H (13.63 cm L x 6.68 cm W x 3.2 cm) (With mounting bracket)
Construction	ABS Plastic, UL94V-0

Environmental:

Operating Temperature	97°F/35°C (Limited by software)
Storage Temperature	40°F to 120°F
Weight	Less than 1 lb./0.45Kg

Igniter Power Supply FOR INDOOR USE ONLY

Electrical: Design Specification: UL-873

Input Power (Thermally Protected)	120VAC 60Hz, 240W
Fuse	3A 125V Fast, (IR10kA/125V), BK/GMA-3A or Equivalent.
Output Power	6VAC

Designed for use with the Corn-trol Digital System and igniter elements only.



www.automationcorrect.com

Automation Correct LLC designs and manufactures technology products for home and industry. Combining over 75 years of practical experience, the Engineers and Technicians of Automation Correct LLC are dedicated to supporting our customers with innovative products.

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