KILNS BUILT TO LAST
1.1..1.1 L&L Kiln Mfg. Inc. ♦ 505 Sharptown Rd.♦ Swedesboro, NJ 08085
Phone: 856.294.0077 ♦ Fax: 856.294.0070 ♦ Email: sales@hotkilns.com ♦ Web: hotkilns.com

DYNATROL REFERENCE INSTRUCTIONS

With the 700 Series Processor

Congratulations! You have just purchased one of the new DynaTrol automatic temperature controls with "Dynamic Zone Control". This is an easy to use control which should give you many years of service.

Suggestions? Firing Tips? Corrections? Please phone, fax or email us with your suggestions, firing tips, unique uses, applications, or corrections. The DynaTrol is a truly great control. However, we want to keep improving both the control and the instructions. Please help us and our other customers.

What Control this manual applies to: This manual is for all DynaTrols with the 700 Series processor. These are used in most kilns manufactured after Jan 1, 2005.

Note: One easy way to tell whether you have a 700 level control is to look at the display. Each of the four characters on the display have 14 segments in the character, allowing a for a more legible display. The older controls had 7 lighted segments in each character.

When L&L started using the 700 Processors: The 700 processor is used on L&L Kilns made after Jan 1, 2006 (The serial number will have an "06" in it – for instance 012806A).

TYPE CONVENTIONS USED IN THIS MANUAL

BUTTON = This type font equals a button that you hit on the face of the control
DISPLAY = This type font equals what the display shows

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1.0 CONTROL PRECAUTIONS

- The controller is used to control temperature, it is not a safety device.
- Do not operate the controller in temperatures above 125°F or below 32°F (NOTE: The board components are rated for 50°C below zero so the control (and kiln) can be stored outside in a covered area).
- Never leave your kiln unattended at the end of a firing. (The Delay feature gives you control over this).
- The controller contains electronic components which are sensitive to static electricity. Before handling the controller dissipate any static charge you may have by touching metal or a screw on the controller panel, the electrical box, the kiln lid, or some other grounded object. Pack in anti-static treated material or paper. Do not pack in plastic bag or untreated material.
- Be sure that the kiln has been set up properly. For EASY-FIRE kilns see the specific EASY-FIRE Assembly Instructions. For Davinci and Jupiter kilns: the kiln sections are numbered with a small sticker on the end of each section's powercord. The top section on any L&L kiln is section #1. The #2 section is always the section directly under the #1 section on any sectional L&L kiln. On three section kilns section #3 is the bottom section. On kilns with more than three sections, sections are numbered 1 through 4 or 1 through 5, top to bottom. Likewise, the top thermocouple is labled #1 and should be in the top section of the kiln. The #2 thermocouple is the bottom thermocouple in a two section kiln. The #2 thermocouple is the middle thermocouple on three or more section kilns. The #3 thermocouple is always in the bottom section of the kiln. It is imperative that your kiln is set up like this. Be sure to double-check this even if you set up the kiln yourself.
- When hooking up the thermocouple wires to the thermocouples on the kiln be sure to follow these color codes:

THERMOCOUPLE WIRE COLOR CODING

In the USA and non-European countries with Type K Thermocouples: The RED wire goes to the NEGATIVE side of the thermocouple connection block and the YELLOW wire goes to the POSITIVE side of the thermocouple connection block. The external sheathing of the extension wire is YELLOW.

In the USA and non-European countries with Type S Platinum Thermocouples: The RED wire goes to the NEGATIVE side of the thermocouple connection block and the BLACK wire goes to the POSITIVE side of the thermocouple connection block. The external sheathing of the extension wire is GREEN.

In European Countries with Type K Thermocouples: The WHITE wire goes to the NEGATIVE side of the thermocouple connection block and the GREEN wire goes to the POSITIVE side of the thermocouple connection block. The external sheathing of the extension wire is GREEN.

In European Countries with Type S Platinum Thermocouples: The WHITE wire goes to the NEGATIVE side of the thermocouple connection block and the ORANGE wire goes to the POSITIVE side of the thermocouple connection block. The external sheathing of the extension wire is ORANGE.

NOTE: On the 700 control the control can be switched between Type K and Type S. This requires a software configuration as well as a jumper change. See more about this is section 4.4.12.

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- Always check the position of the thermocouple probe on the inside of the kiln before starting a firing. The current temperature displayed on the controller is measured at the end of the thermocouple. NOTE: If the thermocouple tip (where the temperature is measured) is back inside the brick insulation of the kiln (even a little bit) it will make the control think that the kiln is not as hot as it really is. That could lead to an overfiring!
- Always review the current program before firing to ensure the correct profile is programmed.
- We recommend having your kiln shut off by a manual fused disconnect switch located near the kiln. That way you can turn off all electricity to the kiln when you are not using it. This would prevent any sort of accidental turning on of the kiln by an electrical surge.
- Follow the other precautions listed in your Kiln Instructionsand in the Troubleshooting Guide.

NOTE: SETTING UP THE SECTIONS WITH A JUPITER OR DAVINCI KILN
Be sure to set up the sections, thermocouples and plugs in the proper way or the kiln will not work properly.

2.0 DYNATROL SPECIFICATIONS

Thermocouple Input: Type K or Type S (software/jumper switchable)
Accuracy: +/- 10°F
Cold Junction Compensation: Electronic
Power Input: 24 Volt Center Tap Transformer / 50 Hz or 60 Hz
Outputs 1 & 3: 150mA at 12 VDC, one 12 volt relay with 80 ohm coil per output
Output 2: 600mA at 12 VDC, one to three 12 volt relays with 80 ohm coil per output
Output 4: 150mA at 12 VDC, one optional 12 VDC relay with 80 ohm coil per output
Output 5: 150mA at 12 VDC, one optional 12 VDC relay with 80 ohm coil per output
Operating Temperature Range: 0°F to 125°F, 0°C to 52°C (See the notes in the Frequently Asked Questions Section concerning "What Ambient Temperature Conditions do I need for control?")
High Side Switching: High side switching which allows the relay's return wire to be connected to ground (if the return wire shorts to ground it will have no effect.
Safety Transistor: A safety transistor powers the other output transistors giving multiple ways to turn off the output and increase safety.
Capacitor-Couple Output: The microprocessor is connected to the output transistor through a capacitor so that the output turns off if the microprocessor latches up.

3.0 OVERVIEW: HOW THE DYNATROL WORKS

When electrical power is connected to the Dynatrol, the display will be lit , and WAIT will be displayed for about 5 seconds then, IdLE, TC2, and the current temperature will be cycling over and over in the display. This cycling IdLE message means that the Dynatrol is on, ready to be programmed, but the kiln is not running yet. The current temperature is measured at the tip of the three thermocouples (TC1, TC2, TC3). If the thermocouple wires are connected to the thermocouples and if the tips of the thermocouples are inserted inside the kiln, the current temperature displayed is the temperature inside the kiln. The default thermocouple reading is TC2. In other words unless you specifically ask the control to show you the temperature at TC1 or TC3 then it will only show you the temperature at TC2. This is done by simply pressing the #1 button to see the temperature at TC1, or the #3 button to see the temperature at TC3.

When the **START/STOP** button is pressed after either a EASY-FIRE (also sometimes called "Cone-Fire) or a VARY-FIRE profile has been selected, the Dynatrol starts to increase the temperature in the kiln towards the first set temperature at the programmed rate of rise. The kiln

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will be cycling (clicking) on and off to accomplish the exact rate of temperature rise. When the displayed temperature reaches the first set temperature in the first segment, the first hold phase can begin. If there is a hold time programmed in this segment, the Dynatrol will hold at the first set temperature for the programmed amount of hold time until the ending of the first segment of the firing. The second segment ramp stage then begins with the temperature increasing toward the second set temperature at the second ramp rate. Once it reaches the second set temperature it will hold there if there is a hold time programmed for the second segment (if there is no hold time then it simply goes on to the next segment). The control keeps going through this sequence until the end of the firing profile.

With the VARY-FIRE mode you may program six different programs with up to eight segments in each program. VARY-FIRE programs can be changed to whatever you need them to be. Each segment in a given program has a ramp rate (set in degrees Fahrenheit or Centigrade, heating or cooling, per hour), a set point temperature or cone number (the temperature that ramp rate will heat or cool to) and an optional hold time at that temperature for up to 99 hours and 99 minutes. In the " EASY-FIRE" mode, the number of segments and the firing profile are preset according to the EASY-FIRE Temperature Profiles shown in the Appendix section. The ramp portion of a segment need not always be increasing in temperature. You can program a decrease in temperature at a specific rate also. EASY-FIRE programs can have preheat segments and cooling segments added to them, or they can stand alone.

WHEN YOU HAVE LESS THAN THREE THERMOCOUPLES

If your kiln has only two thermocouples you will not be able to find TC3 as there is no third thermocouple. The Dynatrol comes pre-programmed from the factory for your kiln's particular specifications.

If your kiln only has one thermocouple many of the features in the Dynatrol are not used. Rather than seeing IdLE and a TC1, TC2, or TC3, you will only see IdLE and a temperature flashing on and off. Likewise any menu choice which controls relationships between the different "zones" in the kiln will either not even appear in the menu or if in the menu or will not affect the Dynatrol's operation using only one thermocouple.

4.0 PROGRAMMING

4.1 EASY-FIRE

The EASY-FIRE mode allows you to fire to a CONE NUMBER at one of four different speeds and then hold at that final temperature if you desire. EASY-FIRE also allows you to add a preheat time to the beginning of the program, and/or, a slower cooling time or a more complex program to the end of it. These are the four preset EASY-FIRE programs that have been designed to do most typical ceramic firing cycles. They are **Slow Bisque** (very slow; approximately 13+ hours heating time only), **Fast Bisque** (slow; approximately 10+ hours heating time only), **Slow Glaze** (medium; approximately 6-1/2+ hours heating time only) and **Fast Glaze** (fast; approximately 3+ hours heating time only). These preset programs have specific ramps and speeds built into them. You can enter any cone number up to cone 10. *(see note below) as the hottest set point. This allows for some degree of customization while still keeping the programming simple and easy.

The EASY-FIRE mode uses the Orton Foundation's patented method to achieve the correct heat work making these programs ideal for firing ceramics. The advantage of using the EASY-FIRE method is that a very complicated firing profile may be chosen with just a few key strokes (see Appendix F for these firing profiles). These program's final temperature set points are based on a

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108°F temperature rise per hour for a large Orton self-supporting cone (rather than the small Orton cones or regular large Orton cones). Your real rate of climb may be different in the end; depending on a lot of different variables. **Expect to see a lower final temp if the kiln goes slower, or a higher one if it climbs faster.**

TIP *** NOTE:** Some L&L Kilns are not designed to go to cone 10 or 2350°F. Consult your kiln's control panel label for the maximum operating temperature.

4.1.1 To use EASY-FIRE**:**

Make sure IdLE, TC2, and the temperature are flashing.
Press one of the four easy firing profile buttons: **SLOW BISQUE** or **FAST BISQUE** or **SLOW GLAZE** or **FAST GLAZE**.
Press **ENTER.** You will see S-bC, F-bC, S-GL or F-GL
Type the cone number you want to fire to (for instance **05**).
If you type a wrong number here, press **000** until all zeros appear in the display, press **ENTER,** then type the correct cone number.
Press **ENTER.**
Type the hold time or leave at 0.00. Numbers to the left of the decimal are hours, to the right are minutes. (Note that adding hold time will add heat-work to ceramics and thus increase the cone that you are firing to. The EASY-FIRE programs will NOT compensate for this)
Press **ENTER,** IdLE, tC2 and the current temperature will be flashing in the display.
Press **START/STOP** to begin firing.

4.1.1.1 Use the Preheat Option:

TIP **NOTE: PREHEAT OPTION.** With any of the EASY-FIRE programs, a preheat stage is available. During the preheat stage the temperature is automatically increased at a rate of 60°F per hour until 200°F is reached; the 200F° temperature is then held for the programmed amount of time. Preheat is automatically set to zero at the end of each firing, so if a preheat stage is wanted, it must be reprogrammed for each EASY-FIRE firing.

To preheat the kiln for a specific amount of time you must first program an EASY-FIRE program. Once this is done you can add the preheat option to it:
Press **PREHEAT** and see HLd, 0.00 cycling over and over.
Press the number keys to enter the amount of Preheat time desired. Numbers to the LEFT of the decimal in the display are hours, i.e. 3 hours of preheat time would look like 03.00 or like 3.00. Numbers to the RIGHT of the decimal in the display are minutes, i.e. 75 minutes of preheat time would look like 00.75 or like 0.75.
Press **ENTER** and see CPL meaning that programming the preheat option is complete.

More Information about Preheat -see Section 4.1.4.1

4.1.1.2 Use the Delay Option:

TIP **NOTE: DELAY OPTION** With any EASY-FIRE or VARY-FIRE program an optional Delay for the start time of the program is available. **This feature makes it easy for you to be present at the end of a firing.** Appendix F has the estimated times that the EASY-FIRE Programs take for

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selected cone numbers. By using this appendix, and adding however many hours you need, up to 99 hours and 99 minutes, to the delay timer you can ensure your presence at the end of the firing.

To program a delay time you need not have programmed any firing profile yet. When the display cycles IdLE, tC2, current temperature over and over:

Press **Delay** and see dELA, 0.00 cycling over and over.
Press the number keys to enter the amount of delay time desired. Numbers to the RIGHT of the decimal in the display are minutes, i.e. 75 minutes of delay time would look like 00.75 or 0.75 or .75. Numbers to the Left of the decimal in the display are hours, i.e. 14 hours 30 minutes of delay time would look like 14.30.
Press **ENTER** and see IdLE/ TC 2, - that's it.

Now once you program any EASY-FIRE or VARY-FIRE program this delay will appear in the display like a timer counting down when you press **START/STOP** to begin firing. The firing will begin once the timer reaches zero. It will remain set as is until you change it.

More Information about Delay - see Section 4.1.4.2

4.1.1.3 Controlled Cooldown:

NOTE: DOWN-RAMP or EXTENDED FIRING OPTION. With any EASY-FIRE program an optional controlled cooling or extended firing can be added. This allows you to control the cooling rate of your firing if you want to, or add as many as seven more segments to the program for crystalline firing (or other slow cooling effects). The DynaTrol comes pre-programmed with a slow cooling program you can add to a cone 6 program. The pre-programmed cooldown is located under **USER 6** in the VARY-FIRE programs. **USER 6** is the only program that can be added to an EASY-FIRE program

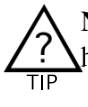
The pre-programmed cone 6 cooldown can be reprogrammed with a different program. Once this happens the cone 6 cooldown program will no longer be available until you re-enter it or until the control's defaults are reset.

To Add The Program That Is In User 6 to an EASY-FIRE Program:

When the display cycles IdLE, TC2, current temperature over and over:
First enter a complete **EASY-FIRE** program.
Once it says IdLE, TC2 again, press **Other** again and again until it shows 16-S, then press ENTER
Press **1** until it says **ON**, press **ENTER** and see **IdLE, TC 2,** current temperature over and over:

Setting the **16-S** setting to **ON** will attach whatever is in **USER 6** to the last EASY-FIRE program you programmed. Setting the **16-S** to **OFF** will unattach **USER 6** from your EASY-FIRE program.To change this program see the VARY-FIRE section a little further on in this section of the kiln manual.

More Information about Down-ramping and Adding Segments - see Section 4.1.4.4



NOTE: If you make a mistake while programming (like entering the wrong hold time) and you have already pressed **ENTER,** You must complete the programming as if you made no mistake, to

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get back to IdLE, TC2, and the current temp again. Then you must re-enter the entire program over again, making sure that you do it properly this time.

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4.1.2 EASY-FIRE Example 1

Slow Bisque Firing Profile to Cone 04, **Pre-heat of 1 hour, 2 minute Hold** - Use the following steps for a bisque firing to cone 04, a 2 minute temperature hold at the peak temperature, and a preheat stage with 1 hour hold time. THIS IS JUST AN EXAMPLE…You can change the firing profile, cone number, hold time, or preheat time to fit your specific needs.

To begin programming the display must be reading IdLE, TC2, and the current temperature.

Press	Display	Comment
Slow Bisque	S-bC	If you press the wrong button, before pressing **ENTER**, simply press the correct button.
ENTER	Alternately flashing: CONE & #	The Slow Bisque profile is now selected. The word CONE and the last entered cone number will alternately flash on the display. Now enter the cone number - **04**.
04	Alternately flashing: CONE & 04	The word CONE and the entered cone number will alternately flash on the display. If you type a wrong number, press **000**, then type the correct number.
ENTER	Alternately flashing: HOLd & 0.00	The cone number has been accepted. Now enter the 10 minute hold time.
0002	**00.02**	Numbers to left of decimal point are hours, to the right of decimal point are minutes. If you type a wrong number, press **0000**, then type the correct number.
ENTER	IdLE TC 2 flashes, then the current temperature	The 2 minute hold time is accepted. IdLE indicates the firing profile has been completed.
Preheat	Alternating flashing: HLd & 0.00	Preheat has been selected and the hold time is to be entered now.
100	**1.00**	Numbers to left of decimal point are hours, to the right of decimal point are minutes. NOTE: For a 1 hour hold time you could also enter **60** for 60 minutes; the display would show .60. If you type a wrong number, press **0000**, then type the correct number.
ENTER	IDLE TC 2 flashes, then current temperature	Accepts a hold time of 1 hour, then IdLE indicates the preheat stage has been completed.
START STOP	-ON-	After -On- is displayed for several seconds, the heating elements of the kiln will cycle on and the current temperature in the kiln will be displayed. If a time is displayed instead of the current temperature, then a delay start is in effect. If you do not want to delay the start. Press **START/STOP** button, then **DELAY,** then **0000,** then **ENTER**. When the current temperature and IdLE are again flashing in the display, press **START/STOP** to re-start the program.

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4.1.3 EASY-FIRE Example 2

Fast Glaze Firing Profile to Cone 06, 10 minute Hold, Delay start of 2 hours. Use the following steps for a glaze firing to cone 06, a 10-minute temperature hold at the peak temperature, and a 2-hour delay before the start of the firing. THIS IS JUST AN EXAMPLE. You may change the firing profile, cone number, hold time, delay time, or even add a preheat to this program to fit your special needs.

Press	Display	Comment
Fast Glaze	F-GL	If you press the wrong button, before pressing **ENTER,** simply press the correct button.
ENTER	Alternately flashing: CONE & #	Fast Glaze is selected. The word CONE and the last entered cone number will alternately flash on the display.
06	Alternately flashing: CONE & 06	The word CONE and the entered cone number will alternately flash on the display. If you type a wrong number, press **0000**, then type the correct number.
ENTER	Alternately flashing: HOLd & 0.00	The cone number has been accepted and the hold time is entered now.
10	**00.10**	The Hold time is displayed. Numbers to left of decimal point are hours, to the right of decimal point are minutes. If you type a wrong number, press zero 4 times, then type the correct number.
ENTER	IDLE TC 2 flashes, then the current temperature	Accepts a hold time of 10 minutes and then IdLE indicates the firing profile has been completed.
Delay	Alternately flashing: dELA & 0.00 (or the last programmed delay time)	Either 0.00 or the last programmed delay time will flash alternately with dELA.
200	**02.00**	Numbers to left of decimal point are hours, to the right of decimal point are minutes. If you type a wrong number, press zero 4 times, then type the correct number.
ENTER	IdLE TC 2 flashes, then current temperature	The 2 hour delay time is accepted. IdLE indicates the job is completed.
START/ STOP	-On- then 2.00	Starts the countdown of the delay time toward zero, at which time the kiln will start to heat. The display will show the amount of time left until the firing is to start.

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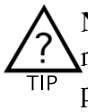
4.1.4 EASY-FIRE OPTIONS SECTION

4.1.4.1 Delay Button

This button's function is used to delay the start of a firing.



NOTE: There is a separate button specifically for this function. If you program a delay start it will remain on and set for all programs (both VARY-FIRE and EASY-FIRE until you take it off by programming it to 0.00. This means you can program the delay time before or after you enter (or recall) the program that you want to fire.

Example: Program a one hour delay to the start of a firing. You can change the one hour delay to as much as 99 hours and 99 minutes of delay time.

Remember: IdLE, TC2, and the current temperature must be cycling on the display before beginning to program.

Press	Display	Comment
Delay	Alternately flashing: dELA and 0.00	The controller is ready to accept the delay time of 1 hour.
100	1.00	Displays the selected time. Numbers to left of decimal point are hours, to the right of decimal point are minutes. If you type a wrong number, press **0000**, then type the correct number.
ENTER	IdLE TC 2 flashes then the current temperature	IdLE indicates the 1 hour delay has been accepted. The current temperature then flashes in the display.

4.1.4.2 Preheat Button

- Preheat can be used with the EASY-FIRE mode only. When Preheat is in use, the temperature ramps up at 60°F/hour to 200°F and then holds at 200°F for the amount of time programmed. If you start at a room temperature of 70°F, then it will take about 1-1/2 hours to reach 200°F at which time the hold segment in the Preheat will start. Preheat is automatically set to zero during EASY-FIRE programming and at the end of each firing, so if a preheat stage is wanted, it must be reprogrammed for each cone firing. **Preheat Example:** Set a preheat time of 3 hours.

Remember: You must choose and program an EASY-FIRE profile first, before you set the preheat time.

IdLE, TC2 and the temperature must be flashing to start the programming.

Press	Display	Comment
Preheat	Alternately flashing: HLd and 0.00	If you see IdLE when you press Preheat then it means that you have a VARY-FIRE program entered. You can not use preheat with a VARY-FIRE program.
ENTER	Alternately flashing: HLd & 0.00	Preheat has been selected; enter the time you want to hold the temperature at 200°F (in this example 3 hours)
300	3.00	Displays the selected time of 2 hours. Numbers to left of decimal point are hours, to the right of decimal point are minutes. If you type a wrong number, press **0000**, then type the correct number.
ENTER	IdLE TC 2 flashes then the current temperature	IdLE, TC2, and the current temperature then cycles in the display.

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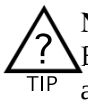
4.1.4.3 Alarm Button

This button's function enables you to program an audible temperature alarm. (Note: it is not very loud)



NOTE: If the alarm is desired, it must be set with the Alarm Button for each firing when an EASY-FIRE program is chosen. When a VARY-FIRE program is chosen the Dynatrol will automatically use the alarm setting that can be programmed with that VARY-FIRE program (It is done within the VARY-FIRE program). Once the Alarm Button is pressed, if no alarm setting is entered within 10 seconds, the display will return to IdLE, TC2 and the current temperature.

The alarm may be set before or *during* a firing. When the alarm temperature is reached, a beeper will sound. Turn off the sound by pressing **ENTER**. This is very useful for alerting you to specific critical temperatures in a program - for instance just before the kiln is going to reach maturing temperatures or when to close the peepholes during natural venting.

Example: Before or during a firing, set the alarm temperature to go off at 600°F.

Press	Display	Comment
Alarm	Alternately flashing: ALRM and #	The word ALRM and the last entered alarm temperature will alternately flash on the display. The controller is ready to accept the alarm temperature. If no alarm is entered within 10 seconds, the display will return to IdLE TC 2 and the current temperature.
600	600	Displays the selected temperature of 600°F. If you type a wrong number, press **0000**, then type the correct number.
ENTER	IdLE TC 2 flashes then the current temperature	The IdLE, TC2, and the current temperature then cycles in the display.

4.1.4.4 Downramping, or Controlled Cooling with EASY-FIRE

If your kiln is cooling too rapidly for good glaze results, or if the cooling is so rapid that cracking occurs on certain large pieces, it is recommended to cool under power. This is accomplished using the following instructions. A kiln with a light load or a large firing chamber will cool more quickly than a kiln with a heavy, dense load or a small firing chamber assuming the same thickness of the insulation. So you may want to test your kiln to see how quickly it cools at high temperatures and at low temperatures to see what type of cooling segment(s) you need.

The EASY-FIRE to VARY-FIRE feature allows you to fire an EASY-FIRE program and then automatically start a VARY-FIRE program at the end of the EASY-FIRE program.

4.1.4.5 Step-By-Step: How To Control The Cooling

1) First you enter the cooling segment. (NOTE: If your kiln is brand new this cooling segment is already entered in your DynaTrol. If you are not sure that it is in there, it will not hurt anything to re-enter it. Start by pressing the **ENTER PROG** button in the VARY-FIRE Section

2) Press **6** and then press **ENTER** to program **USER 6**.

3) Program **USER 6** with the desired cool down program. 150 degrees F per hour down to 1400 F is a good cooling program. Once we finish these steps, **USER 6** will start when your EASY-FIRE

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program reaches complete (CPLT). If you do not know how to program a VARY-FIRE program, see Section 4.2.

NOTE: Segment 1 of **USER 6** is utilized by the controller and cannot be used for the program. Therefore the number of segments you input for the program will need to be one greater than the number of segments that are really being used for the cooling. Once you begin programming **USER 6**; when the display asks for RA1 press **ENTER**, **ENTER**, **ENTER** and begin the cool-down part of the program with segment 2.

4) Press the desired EASY-FIRE program button (i.e. **Slow Bisque, Fast Bisque, Slow Glaze or Fast Glaze**).

5) Enter desired EASY-FIRE program. This will program the EASY-FIRE portion for the program. Do this just as you would for any EASY-FIRE program.

6) To tell it to join the cooling program to the EASY-FIRE program enter in the following: Press the **Other** button until 16-S appears in the display. Press **ENTER**.

7) Press the **1** key until the desired condition is displayed. On will allow EASY-FIRE program to flow into VARY-FIRE **USER 6** program and OFF will disable this option.

8) Press the **ENTER** button. Programming is now complete. If 16-segment is On then the controller will complete the EASY-FIRE program and, upon finishing it, will run the VARY-FIRE **USER 6** program.

NOTE: 16-S will appear in in the Program Review when you press the **Review Prog** button. Once the **USER 6** is programmed with the controlled cooling segment you do not need to enter it every time. In place of steps 1-3; do the following: 1) Press **Recall Prog**. 2) Press #6. 3) Press **ENTER**. Then follow with steps 4-8 above.

4.1.6 EASY-FIRE Example 3 with a controlled cooldown

Slow Glaze Firing Profile to Cone 6, 5 minute Hold, Controlled Cooldown.

Press	Display	Comment
Enter Prog	Alternately flashing: USER & 6	This allows you to chose which program number to program. You FIRST have to program the cooldown program BEFORE you program the EASY-FIRE program. Otherwise the control thinks you are going to use VARY-FIRE program #6 as your main program.
6	6	You are going to program VARY-FIRE program No 6
ENTER	Alternately flashing: SEGS & 2 (or some other number 2-8)	This is the number of segments you will need. In most cases you will want 2 segments. The first segment IS NOT USED and it doesn't matter what it says.
2	2	This tells the control you will be programming two segments
ENTER	Alternately flashing: RA 1 & 0500 (or some other number)	This is the ramp of segment 1. It doesn't matter what the value is because it will be ignored.
ENTER	Alternately flashing: oF 1 & 0200 (or some other number)	This is the temperature set point of segment 1. It doesn't matter what the value is because it will be ignored.

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ENTER	Alternately flashing: HLd1 & 0200 (or some other number)	This is hold value of segment 1. It doesn't matter what the value is because it will be ignored.
ENTER	Alternately flashing: RA 2 & 0000 (or some other number)	This is asking you what ramp value to put in for segment 2. This will be our cooldown rate in degrees F (unless you are operating in deg C)
150	150	This means we will cool at a rate of 150 deg per hour.
ENTER	Alternately flashing: oF 2 & 0000 (or some other number)	This is asking you what temperature value to put in for segment 2. This will be our cooldown setpoint, i.e. the target temperature to cool down to. After we reach this temperature the kiln will stop firing and it will cool down without any power.
1400	1400	We will have a controlled cooldown to 1400 Deg F
ENTER	Alternately flashing: HLd2 & 0000	This is asking you for a hold time.
0000	00.00	Hold of zero
ENTER	Alternately flashing: ALRM & 9999	This is asking you for an alarm temperature. 9999 keeps it turned off.
ENTER	IdLE	The cooling segment is complete. Now we must enter the heating part of the program
Slow Glaze	S-GL	If you press the wrong button, before pressing **ENTER,** simply press the correct button.
ENTER	Alternately flashing: CONE & #	Fast Glaze is selected. The word CONE and the last entered cone number will alternately flash on the display.
6	Alternately flashing: CONE & 6	The word CONE and the entered cone number will alternately flash on the display. If you type a wrong number, press **0000, press ENTER**, then type the correct cone number.
ENTER	Alternately flashing: HOLd & 0.00	The cone number has been accepted and the hold time is entered now.
05	**.05**	The Hold time is displayed. Numbers to left of decimal point are hours, to the right of decimal point are minutes. If you type a wrong number, press zero 4 times, then type the correct number.
ENTER	IdLE flashes, then the current temperature, etc	Accepts a hold time of 5 minutes and then IdLE indicates the heating part of the program is complete
Other, Other, Other, Other	16-S	This means "16 segment". This is how we add the two programs to each other.
ENTER	OFF	The 16 segment feature is turned off as the default setting.
1	On	Pressing 1 turns the 16 segment feature on. You can toggle between OFF and On by pressing **1** again.
ENTER	IdLE	You have now activated the 16 segment hfeature which will start VARY-FIRE Program No 6 when the EASY-FIRE program finishes
START/ STOP	-On-	Starts the program..
Review Prog		You will see 16-S at the end of the displays that scroll. This tells you that VARY-FIRE Program #6 will start when your EASY-FIRE program ends.

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4.2 VARY-FIRE

The VARY-FIRE mode allows you to program exactly how you want the kiln to fire. It provides a very broad range of programming possibilities designed to allow for the many different ways these kilns can be used. The Dynatrol allows you to permanently store 6 separate programs with up to 8 ramp/hold segments in each program. There is one cooling or heating ramp, a temperature setpoint, and an optional hold time at that setpoint, per segment. These programs are stored in a non-volatile memory bank, which means that they will stay in memory even when all power is turned off. The Dynatrol allows you to hold at a low temperature for a long time (i.e. you can have an automatic drying period similar to the Preheat option in the EASY-FIRE mode). Then it can automatically ramp up to your final temperature, switching to different heating or cooling rates along the way. You can ramp slowly through critical periods or soak at any temperature within, or at the end of a firing, for more consistent maturing of work. Your program can include a controlled cool down to avoid heat shock. Many of these options are permanently programmed into the EASY-FIRE programs to maximize their ability to properly fire your ceramics. However, with the VARY-FIRE programs you have complete control over nearly every aspect of the firing so you can adjust the kiln performance to your exact needs. **This can allow the kiln to be used for non-ceramic applications such as glass slumping, annealing, enameling, growing crystals, jewelry, heat treating, testing, and other industrial uses.**

In the VARY-FIRE mode your saved programs are called USER1, USER2,... USER6. These are the names that will define your programs and make them easy to recall in order to use them to fire the kiln.

These six programs slots; USER1, USER2,... USER6 etc come with generic programs already in place. These programs can be replaced with your own custom programs, and at any time in the future the original programs can be recalled. If they are recalled however, they will replace any of your custom programs that you have saved under USER1, USER2,... USER6.

The six pre-set programs in the VARY-FIRE's custom program slots are as follows:

USER1 is a glass slumping program

USER2 is a glass tack fuse program

USER3 is a glass full fuse program

USER4 is a glass bead annealing program

USER5 is a lost-wax burnout program

USER6 is a slow cooling cycle that can be added to a CONE 6 firing (or can be altered to add to any firing) but only when the 16-S option is selected

NOTE: See the Appendix I section in this manual for exactly what each of these programs will do.

VARY-FIRE programs in general are best thought of in the terms of a chart. For example: a three segment program with a maximum set point temperature of 1575°F, a one hour hold time, and a controlled cooldown. In segment 1, ramp rates are at first only 100°F per hour until the entire kiln's temperature reaches 200°F. Then, with no hold time in segment 1, the control automatically switches to segment 2, which will allow the kiln to rise at 500°F per hour until its maximum setpoint at 1575°F. Then it will hold for one hour at 1575°F. Then, in segment 3, it will cool from 1575°F to 1000°F at 143°F per our. Once the kiln temperature cools to 1000°F the firing is complete and the kiln heaters will turn off.

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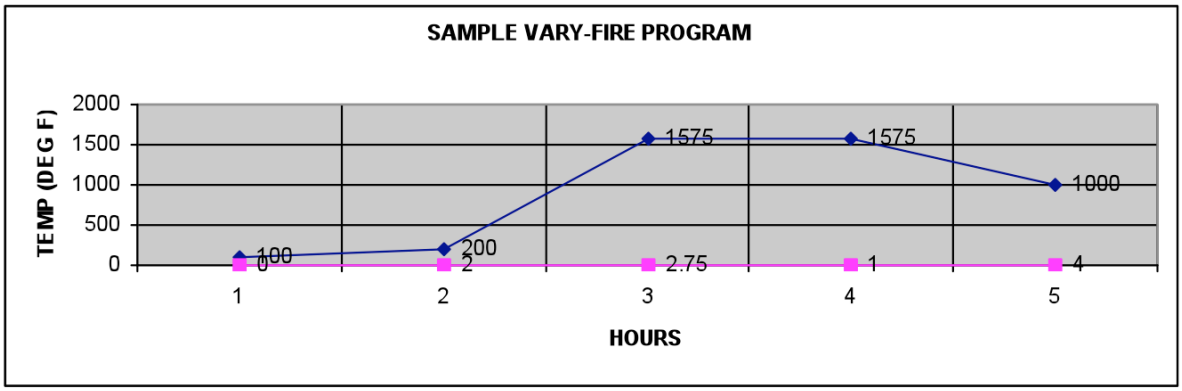
Segment	Rate °F/hour	Temperature	Hold
1	100°F/Hour	200°F	0
2	500°F/hour	1575°F	1 hour (01.00)
3	143°F/hour	1000°F	0



NOTE: The Appendix section has a blank form for writing your firing programs. Photo-copy this form as needed.

4.2.1 VARY-FIRE Example

The following steps are used to enter a program under USER1 for the firing profile in the above example.

TIP **NOTE:** You can change the program's name (the USER number), change the number of segments, and change the ramping rates, segment setpoints and hold times within each of the segments. You can even add a DELAY time to ensure that you will be around for the end of the firing, all to fit the program to your own specific needs.

Press	Display	Comment
Enter Prog	Alternately flashing: USER & #	The display alternates between USER and the last selected firing profile number.
1	1	Selects user (USER) profile number 1. Only choose USER 1 if you wish to program over the program that is already there.
ENTER	Alternately flashing: SEGS & No.	The displays flashes between SEGS and the number of segments which were previously selected for this profile.
3	3	This is the number of segments needed for our example profile.
ENTER	Alternately flashing: RA 1 & No.	The display flashes between RA1 and the heating rate per hour of the previously selected for this profile.
100	100	Displays the selected rate/hour.
ENTER	Alternately flashing: °F 1 & No.	The display flashes between °F1 & the temperature which was previously selected for this profile.
200	**200**	Displays the selected temperature

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ENTER	Alternately flashing: HLd1 & No.	The display flashes between HLd1 & the hours and minutes which were previously selected for this profile.
0	. 0	No hold time.
ENTER	Alternately flashing: RA 2 & No.	The display flashes between RA2 & the heating rate previously selected for this profile.
500	500	Displays the selected rate/hour.
ENTER	Alternately flashing: °F 2 & No.	The display flashes between °F2 & the temperature which was previously selected for this profile
1575	1575	Displays the selected temperature.
ENTER	Alternately flashing: HLd2 & No.	The displays flashes between HLd2 & the previously selected hold time.
0100	1.00	One Hour hold time at 1575°F. (Normally with pottery you would rarely hold at the top temp/cone. Holding here adds heat work… an hour hold can make it 2-3 cones hotter. Type "0" for no Hold))
ENTER	Alternately flashing: RA 3 & No.	The display flashes between rA3 & the heating rate previously selected for this profile.
143	143	Displays the selected rate/hour.
ENTER	Alternately flashing: °F 3 & No.	The display flashes between °F3 & the temperature which was previously selected for this profile
1000	1000	Displays the selected temperature.
ENTER	Alternately flashing: HLd3 & No.	The displays flashes between HLd3 & the previously selected hold time.
0	. 0	No hold time.
ENTER	Alternately flashing: ALRM & No.	The display alternates between ALRM & the previously used alarm setting.
9999	9999	Enters the temperature at which the alarm will sound. The alarm will be turned off with a setting of 9999.
ENTER	CPL flashes then IdLE and the current temperature	CPL flashes indicating the program has been completed. IdLE then the current temperature flashes in the display.

NOTE: **Preheating (Candling) with VARY-FIRE**

There is no actual **Preheat** option in the VARY-FIRE mode. You must include another segment in your program in order to "Preheat". To preheat in the VARY-FIRE mode you would make your first segment as follows:

rA1 **60**

°F1 **200 -**

HLD1 (time you wish to preheat for)

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4.2.2 Downramping, or Controlled Cooling with VARY-FIRE

To have the kiln cool at a prescribed rate, slower than it's natural rate, within a program or at the end of a firing, first consider the following. A kiln with a light load or a large firing chamber will cool more quickly than a kiln with a heavy, dense load or a small firing chamber assuming the same thickness of the insulation. So you may want to test your kiln to see how quickly it cools at high temperatures and at low temperatures to see what type of cooling segment(s) you need.

When using just VARY-FIRE programming, treat a cooling segment the same as a heating segment when programming the Dynatrol. While programming, you must initially add an extra segment. Then, when you input the RA number in this segment (ramp or rate of rise or fall in °F or °C per hour), this number will be the number of degrees per hour that you want the kiln to COOL. Next in that segment, when you input the °F (or °C) number (the segment's set point), this number will be the temperature *to which* the kiln will cool to, at the rate you have just programmed. You can then program a hold (if you need one here) at this temperature. The program can then end (this was your last segment) or it can continue on cooling or go back to heating in the next segment.

All that the Dynatrol knows, is that to be a cooling segment, the set point must be *LOWER* than the previous segment's set point. It will treat the ramp rate the same for either heating or cooling, just moving the temperature along at the prescribed rate. (See the previous example for the VARY-FIRE).

NOTE: When programming a firing with a controlled cooling, be sure to put at least one heating segment before the cooling segment as the kiln cannot cool first. It must heat first before cooling.

4.2.3 Using VARY-FIRE to fire to a CONE number

You can write a VARY-FIRE Program, and rather than have to set a *temperature* as the hottest point, you can set a *Cone Number* as the hottest point. This is very useful when you want your glazes fired to say "cone 6". The VARY-FIRE program will actually adjust the final temperature in the segment where you programmed a cone number as the set point. All subsequent set points in later segments must be lower in temp than the Cone segment.

In order to do this; while you are programming the VARY-FIRE program and you come to the point where you would normally enter the hottest *temperature*, press **Other** instead of entering a top temperature. Now enter in the appropriate cone number, then press **ENTER** and continue on with that segment's hold time and any later cooling segments etc…

If you change your mind, pressing **Other** before you enter a cone number will take you back to where you can input a temperature rather than a cone number for that segment.

Example: (Same program as the earlier example, just going to a cone number instead of 1575)

Press	Display	Comment
Enter Prog	Alternately flashing: USER & #	The display alternates between USER and the last selected firing profile number.
1	1	Selects user (USER) profile number 1. Only choose USER 1 if you wish to program over the program that is already there.
ENTER	Alternately flashing: SEGS & No.	The displays flashes between SEGS and the number of segments which were previously selected for this profile.
3	3	This is the number of segments needed for our example profile.

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ENTER	Alternately flashing: RA 1 & No.	The display flashes between RA1 and the heating rate per hour of the previously selected for this profile.
100	100	Displays the selected rate/hour.
ENTER	Alternately flashing: °F 1 & No.	The display flashes between °F1 & the temperature which was previously selected for this profile.
200	**200**	Displays the selected temperature
ENTER	Alternately flashing: HLd1 & No.	The display flashes between HLd1 & the hours and minutes which were previously selected for this profile.
0	. 0	No hold time.
ENTER	Alternately flashing: RA 2 & No.	The display flashes between RA2 & the heating rate previously selected for this profile.
500	500	Displays the selected rate/hour.
ENTER	Alternately flashing: °F 2 & No.	The display flashes between °F2 & the temperature which was previously selected for this profile
Other	CONE & No.	This is where we are entering a cone number for the max temp rather than a temperature
012	012	Cone 012 is roughly equal to heating to 1575F at 108degrees F per hour. We are choosing to enter a cone number here because we really want to hit cone 012… not whatever 012 would look like at 1575.
ENTER	Alternately flashing: HLd2 & No.	The displays flashes between HLd2 & the previously selected hold time. Done with the cone part- back to the regular VARY-FIRE program
0100	1.00	One Hour hold time at 1575°F (Normally with pottery you would rarely hold at the top temp/cone. Holding here adds heat work… an hour hold can make it 2-3 cones hotter. Type "0" for no hold)
ENTER	Alternately flashing: RA 3 & No.	The display flashes between rA3 & the heating rate previously selected for this profile.
143	143	Displays the selected rate/hour.
ENTER	Alternately flashing: °F 3 & No.	The display flashes between °F3 & the temperature which was previously selected for this profile
1000	1000	Displays the selected temperature.
ENTER	Alternately flashing: HLd3 & No.	The displays flashes between HLd2 & the previously selected hold time.
0	. 0	No hold time.
ENTER	Alternately flashing: ALRM & No.	The display alternates between ALRM & the previously used alarm setting.
9999	9999	Enters the temperature at which the alarm will sound. The alarm will be turned off with a setting of 9999.
ENTER	CPL flashes then IdLE and the current temperature	CPL flashes indicating the program has been completed. IdLE then the current temperature flashes in the display.

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4.2.4 Adding Two VARY-FIRE Programs Together

TIP

The USER 6 program can be added to any EASY-FIRE or to VARY-FIRE program USER 5. USER 6 comes pre-programmed as a slow cooldown from a Cone 6 firing. It can be adapted to be a slow cooldown from a different cone number or temperature, or with a few adjustments it can be it's own program, or it can be the second half of a sophisticated crystalline glaze program.

To add whatever is programmed in USER 6 to whatever you program in USER 5 you must check and be sure USER 5 is programmed the way you want it. Then be sure USER 6 is programmed the way you want it. Think of the first segment of USER 6 following right after the end of USER 5. Then turn on the **16-S** feature- located under the **Other** key so the control knows to join those two programs together and run first USER 5, then immediately follow it with USER 6

TIP

4.2.5 The UNDO/GO-BACK Button

The **Review Prog** (Review Program) button acts as the Go-Back button during VARY-FIRE Programming only. If you are programming a segment of a VARY-FIRE program, you can go backwards to change something if you need to by pressing **Review Prog**. Once you reach the ALRM, 9999 part of the programming you can no longer go backwards. Likewise, while you are programming your USER # or number of segments you cannot go backwards either.

If you cannot go back, just continue on and finish programming like nothing was wrong. Then when you get back to IdLE, go back in and program it correctly.

You cannot go backwards in the EASY-FIRE programming at all. Just finish programming as if no mistake was made, then once you are back to IdLE, re-program it correctly.

4.2.6 The RECALL PROG (RECALL PROGRAM) Button

This button is used to call up one of your six previously programmed USER firing profiles in order to use that program to fire the kiln.

Example: To recall USER profile #4, do the following. First enter your program into User Profile #4, then:

Press	Display	Comment
Recall Prog	Alternately flashing: USER & 1	The controller is ready to accept the desired user number.
4	4	Indicates the user program selected.
ENTER	IdLE flashes then the current temperature	IdLE appears indicating the program has been selected. The current temperature then flashes in the display.

4.2.7 The SKIP-STEP Feature

The Skip Step function is performed using the **Review Seg** (Review Segment) button. The Skip Step feature is only available in a VARY-FIRE firing profile. It is used when enough heat work has been done at the current segment and you want to immediately go the next segment. To skip to the next segment, press **Review Seg**, then within 2 seconds, press **ENTER**, and **ENTER** a second time. If you press **View Seg** and do not press **ENTER** within 2 seconds, the current segment (e. g., rA1) will continue to be displayed. Simply wait until the temperature is again displayed and press **Review Seg**, then **ENTER** within 2 seconds, and **ENTER** again. If you press **Review**

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Seg, then **ENTER,** then decide not to skip to the next ramp stage, simply do not press any key; after about 10 seconds the display will return to the current temperature.

If you are currently in the ramping part of the segment and you skip step you will jump over any hold time in that segment and go directly to the ramp in the next segment. If you are currently in the hold part of a segment and you skip a step you will just go to the ramp in the next segment.

4.2.8 Full Power Ramp

A full power ramp will be enabled if a ramp rate of 9999 degrees per hour is programmed. At the start of a full power up ramp the elements will continuously be on until the soak temperature is reached. At temperatures 50 degrees less than the programmed soak temperature the elements will begin to cycle to minimize overshoot. A full power ramp is the quickest way to reach a specified temperature.

4.3 VIEW/ REVIEW AND SPECIAL OPTIONS

4.3.1 Review Prog (Review Program)

This feature is useful to be sure that the program that you have just selected to fire the kiln, either one of the preprogrammed EASY-FIRE programs or one of your six USER programs, is the one that you think it is.

Example - If you have selected a Slow Bisque "EASY-FIRE" profile to cone 04 with a 20 minute hold, the following will be displayed, each for about 1/2 second when **Review Prog** is pressed:

Display	Comment
S-bC	Slow Bisque firing profile
PRHT	Indicates the next value will be the preheat hold time
0.00	No preheat hold time is selected
CONE	Next value will be the selected cone number
04	Selected cone number
°F	next number will be the cone temperature
1926	Dynatrol's temperature for cone 04
CNOS	Indicates the next value will be the amount of offset applied to that cone number
0	There is no offset- Offset is degrees +/- you can add to a cone's temp equivalent
HOLd	Next number will be the hold or soak time at the end of the firing
0.20	20 minutes hold selected
dELA	next number will be the delay time before the start of firing
0.00	No delay, firing will start when **START/STOP** is pressed
ALRM	Next number will be the high alarm limit setting
9999	This is as high as the alarm can be set and assures the alarm will be off
ERCd	Next message will indicate if the error codes are ON or OFF
ON	Error codes are ON
FIRE	Next number is the number of times the kiln has been fired
25	Kiln has been fired 25 times (yours may say a different number here)
IdLE	End of firing profile- it goes back to IdLE

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4.3.2 Review Seg (Review Segment)

Pressing the **Review Seg** key during a firing will display several different pieces of information about the status of the firing.

Once pressed, this is what the DynaTrol is displaying:
First: The Current Segment
Next: The Rate of Rise (in degrees Fahrenheit per hour)
Next: The Traveling Temperature Set Point
Last: The actual physical temperature of the DynaTrol's circuit board.

Examples:

If you press Review Seg, and the FIRST message that is displayed is…	**It Means:**
STOP	No firing is in progress, the controller is currently idling (IdLE, tC2, temp.)
rA 4	Kiln firing, ramp stage in segment 4, 500 degrees per hour rate of rise
rA 3	Kiln firing, ramp stage in segment 3, 50 degrees per hour rate of rise
HLd2	Kiln firing, hold stage in segment 2
HLd6	Kiln firing, hold stage in segment 6
If you press Review Seg, the SECOND message that is displayed is…	**It Means:**
The Rate of Rise: in the form of a temperature number in whatever temperature scale you are using. i.e. ROR, 500	The rate of rise number is displayed as degrees per hour. The actual number is preceded by the acronym "ROR", meaning Rate Of Rise. The number that is displayed next after ROR is the rate the kiln is climbing in degrees per hour.
If you press Review Seg, the THIRD message that is displayed is…	**It Means:**
The Travelling Set Point: in the form of a temperature number in whatever temperature scale you are using. i.e. SETP, 200	This number is constantly changing based on how you have programmed the kiln. The Dynatrol looks at the entire program you have entered and then plots the course of the Travelling Set Point. Once the firing has started and the elements are heating, the thermocouples are registering the temperature in the kiln. These temperatures are constantly compared to the Travelling Set Point and their relationship is what determines whether or not the elements stay on or are turned off in each zone of the kiln.
If you press Review Seg, the FOURTH message that is displayed is…	**It Means:**
The ambient temperature of the Dynatrol's electronics in the control panel. i.e. bd T, 100	This temperature can tell you if you are operating the kiln in a detrimental and possibly unsafe environment. The recommended maximum ambient temperature is 125°F. If your temperature reads hotter than that you could damage the Dynatrol over time. Something else to consider is the fire hazard issue (see the general kiln instructions for precautions on this)

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4.3.3 The 'Other' Button

The Other button contains a menu which contains many of the different user-programmable settings. As you press Other again and again the menu will scroll by. You can press **Review Seg** to go backwards in the menu. NOTE: You can not access the **Other** menus while the control is firing a program.

The Other Menus:

- Reset feature RSET
- Cone Lookup Table CONE
- Controller ID Id
- 16 step program 16-S (only comes up if you have VARY-FIRE Program #5 in active memory or if you have an EASY-FIRE program in active memeory)
- Cone temperature offsets CNOS
- Temperature scales °F or °C CHG°
- Error codes ON or OFF ERCd
- Thermocouple offset TCOS
- Board temperature bd T

TO EXIT this menu without changing anything, cycle through by pressing Other until CONE appears, then press ENTER twice.

4.3.3.1 Reset

RSET - Choosing this function will re-assign the default value (ON) to the Error codes only. Press **Other** until RSEt is displayed. Then press **ENTER**. IdLE will be displayed indicating that the Error Checking to ON. It is also the screen where you can enter the "hidden other menu".

4.3.3.2 Cone Lookup Table

CONE- **This option allows you to type in a cone number and see what the Dynatrol's programmed temperature is for that cone number at a temperature climb of 108°F per hour.** This function is provided as a handy reference table to use while you are programming. There is a more complete cone table in "Logs, Cones, Tips" section of the Owners Manual. Remember, however, that there is no absolute equivalent between cones and temperature.

Cone Table Example:

Press	Display	Comment
Other **Other**	CONE	The word CONE will appear on the display
ENTER	Alternately flashing: CONE & a cone number. This example: CONE, 07	The word CONE and a cone number will alternately flash on the display.
04	04	This is the cone we are looking up in this example

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ENTER	1945	The cone temperature is displayed for 2 seconds then IdLE is displayed followed by the flashing current temperature

4.3.3.3 Identification

Id - **Used by KISS (Kiln Interface Software System) to identify the kiln when hooked to a personal computer.** This software is available from L&L. Normally this is set to 1. If you are not using the control in a KISS environment it doesn't matter what it says.

4.3.3.4 Sixteen Segment Program

16-S - **This option allows VARY-FIRE profile #5 or any EASY-FIRE program to be combined with USER 6 to make one profile with up to 16 segments.** It shows up in the **Other** menu only when VARY-FIRE #5 Profile or any EASY-FIRE program has been programmed . To use it, first, program VARY-FIRE Profile #5 or an EASY-FIRE program. Then program VARY-FIRE Profile #6. Note that the beginning segment of Profile #6 should be entered as if it was to start directly after the ending segment of the EASY-FIRE program or of VARY-FIRE profile #5.

To take advantage of this feature do the following:

Press	Display	Comment
		First, program VARY-FIRE Profile #6 Then VARY-FIRE Profile #5. Then…
RECALL PROGRAM	USER, 1	This is asking which program to recall, you can press 5.
5	5	USER profile number 5 containing at least the first half of your program has been chosen, press **ENTER**.
ENTER	IdLE	The program USER 5 has been recalled
Other (4x)	16-S	Press **Other** until the 16-S appears. Press **ENTER** to accept the option.
ENTER	OFF	This option is currently off. Use any number key to toggle between ON and OFF
1	ON	This turns on the 16 segment programming – linking program #5 and program #6, press **ENTER**.
ENTER	IdLE	This activates and confirms the programming
START		The controller will fire VARY-FIRE Profile #5 until complete and then will fire VARY-FIRE Profile #6 until complete

TIP **NOTE:** If you just want USER5 to fire without automatically being followed by whatever is programmed in USER6 double-check that this option is set to OFF. It will show up in the Program Review. If you have activated the 16-S feature and you press **Review Prog** it will only show you the first half of the program; USER 5 or the EASY-FIRE program. It will not show you the contents of USER 6 in the Review Program. It will show you "16-S" as it scrolls through the Review Program. This is your clue that whatever is in USER 6 is going to follow your current program.

4.3.3.5 Cone Offset

CNOS **(Cone Offset) - Used to fine tune what the Dynatrol thinks the final cone temperature should be in EASY-FIRE programs.** The final cone temperature can be raised or lowered a maximum of 99°F (or 55°C). When entering the offset temperature the following code is used: the left two digits designate whether to raise (00) or lower (90) the cone temperature, that is, "00"

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means plus (+) and "90" means minus (-). The right two digits are the number of degrees the cone temperature will be raised or lowered. This offset will remain programmed only for the specific cone number until you reprogram the cone offset differently

Examples:

Number	Meaning
0020	Raise the final cone temperature by 20°F
0040	Raise the final cone temperature by 40°F
0015	Raise the final cone temperature by 15°F
9030	Lower the final cone temperature by 30°F
9005	Lower the final cone temperature by 5°F
9045	Lower the final cone temperature by 45°F

NOTE: This option does not affect the VARY-FIRE (Ramp-Hold) mode but it will show up on the menu.

NOTE ABOUT PREPROGRAMMED CONE OFFSETS: The Cone Offsets come preprogramed. From cone 022 to cone 017 the cone offsets are set at 9020. All other cones are preset at 0000. (Note on Blue DynaTrols made before Oct 1 2004 the cone offset was 9030 for cones 022 to 017 and 9020 for other cones. The offsets were changed when we switched to a more responsive thermocouple protection tube). You can always change this. The **RESET** option in **Other** menu will *NOT* reset these settings. This is part of the compensation necessary for the mullite thermocouple protection tubes.

Cone Offset Example: Adjust cone 07 to shut off the kiln at 20°F below Orton's prescribed cone temperature.

Press	Display	Comment
Other **Other**	CNOS	If CNOS does not show on the display, press the **Other** key until CNOS displays.
ENTER	Alternately flashing: CONE & #	Cone Offset has been selected; the word CONE and the last entered cone number will alternately flash on the display. Now enter the cone number which you want to adjust (in this example cone 07)
07	Alternately flashing: CONE & 07	The word CONE and the entered cone number (07) will alternately flash on the display. If you type a wrong number, press zero 3 times, press ENTER, then type the correct number.
ENTER	Alternately flashing: °FOS & 0	°FOS and the previous offset setting alternately flash. Enter the new offset temperature using the rules above, in this example, 9020"
9020	9020	The selected offset temperature is displayed. If you type a wrong number, press zero 4 times, then type the correct number.
ENTER	IdLE flashes then the current temperature	IdLE appears indicating the offset temperature adjustment has been accepted. The current temperature then flashes in the display.

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4.3.3.6 Change from Deg F to Deg C

CHG° - **Used to select degrees Fahrenheit (°F) or degrees Celsius (°C).**

Example: Change from °F to °C.

Press	Display	Comment
Other Other	CHG°	If CHG° does not show on the display, press the **Other** key until CHG° displays.
ENTER	°F	Indicates that the Fahrenheit (°F) scale is being used. You can toggle back and forth between °F and °C by pressing the **1** key.
1	°C .	Displays °C . **The decimal point in the lower right corner means that the Celsius (centigrade) scale has been selected**.
ENTER	IdLE flashes then the current temperature	IdLE appears indicating the temperature scale has been changed. The current temperature in °**C** then flashes in the display. There will be a decimal point in the lower right-hand corner of the display.

4.3.3.7 Error Codes (On/Off)

ERCd - **Used to turn ON or turn OFF the error codes.** When you receive your Dynatrol the error codes are turned on. In most cases, you will want the error codes on. They can be turned off if you are doing special firings, such as jewelry or glass firing where the kiln is opened while hot. Turning the error codes off turns off the dynamic zone control feature that keeps the temperature in the kiln even top to bottom. It eliminates nuisance shut downs but side also eliminates built in fail-safe measures that help prevent mistakes.

Example: **Turn the error codes off.**

Press	Display	Comment
Other Other	ERCd	If ERCd does not show on the display, press the **Other** key until ERCd displays.
ENTER	ON	Indicates that the error codes are turned on. You can toggle back and forth between on and off by pressing the **1** key.
1	OFF	Displays OFF indicating the error codes will be turned off.
ENTER	IdLE flashes indicating that the error codes have been turned off.	IdLE appears indicating that programming is complete. IdLE, tC2, and the current temperature then cycle in the display.

4.3.3.8 Thermocouple Offsets

TCOS - This is used to raise or lower the temperature indicated by any of the thermocouples. The maximum offset is 99°F (or 54°C). A positive offset is entered with 00 preceding the amount of offset and a negative offset is preceded with 90. This is similar to what is done for entering cone offsets. When TCOS is displayed, press **ENTER** and TC1 will be displayed. Press **ENTER** and the current offset for the top thermocouple will be displayed. Press **ENTER** when the correct offset for the top thermocouples is displayed and then TC2 will be displayed. Repeat the process for TC2 and TC3 only inputting the offset on the thermocouples that need it. **Raising the indicated temperature LOWERS the actual temperature in the kiln and therefore the amount of heat work. Lowering the indicated temperature RAISES the actual temperature in the kiln and therefore the amount of heat work.**

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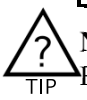
Thermocouple Offset Example

Entering this sequence of steps will make the TOP zone of the kiln fire cooler by 15°F than the rest of the kiln. To do this, the offset is performed on the top (#1) thermocouple only, however the rest of the thermocouples must be programmed as well. The other one or two thermocouples (depending on model of kiln) would be programmed for a zero offset.

Reminder: IdLE, TC2, and the current temperature must be cycling before you begin programming

Press	Display	Comment
Other Other	TCOS	Represents thermocouple offset, press **ENTER**
ENTER	TC1	Represents thermocouple #1. The top of the kiln contains TC1 so this is the thermocouple that we want to offset. Press **ENTER**.
ENTER	°FOS 18	The Dynatrol is asking how many degrees you wish to add to or take from that thermocouple's displayed reading. NOTE: If this number reads something other than **0000**, you already have an offset programmed here. Note that the control comes with 18 degrees already preprogrammed in as a thermocouple offset to help compensate for the ceramic protection tube. Press **ENTER** if you wish to keep this offset, OR press **0000** and then press **ENTER** to have no offset on that thermocouple OR in this example we would press **33**
33	33	You have now programmed the top thermocouple to read 65°F hotter, therefore making the top of the kiln 65°F cooler, provided of course, that you program no offsets for thermocouples 2 or 3. Press **ENTER**
ENTER	tC2	Press **ENTER**, you must now enter offsets for thermocouples 2 and 3. In this example we are keeping these offsets set for zero.
ENTER	°FOS 0050	Keep at **0050**. If this number reads something other than **0050**, you already have an changed the default offset programmed here. Press **ENTER** if you wish to keep this offset.
ENTER	tC3	Press **ENTER**
ENTER	°FOS 0050	Keep at **0050**. If this number reads something other than **0050**, you already have an changed the default offset programmed here. Press **ENTER** if you wish to keep this offset.
ENTER	CPL or StOP	Thermocouple offset programming is complete.



NOTE: The thermocouple offset will affect the final temperature in that zone only for all EASY-FIRE and VARY-FIRE profiles. It will remain programmed until you reprogram it.

NOTE: The Thermocouple Offset comes already programmed into the control at 0018 (+ 18 Deg F) when it leaves the factory. Note the the room temperature will show 18 Deg F higher than it actually is. The RESET option in Other will NOT reset these settings. IF YOU DO NOT USE THE THERMOCOUPLE PROTECTION TUBES THEN YOU NEED TO CHANGE THERMOCOUPLE OFFSET TO 0000. (Note that on DynaTrols sent out before Oct 1, 2004 the thermocouple offset was set for 0050)

4.3.3.9 Board Temperature

bd t - You may press **ENTER** here to see what the ambient temperature of the Dynatrol's electronics are. This temperature can also be seen while the kiln is firing by pressing **Review Seg** three times. (125°F is an acceptable ambient operating temperature)

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4.4 HIDDEN "Other" MENU & Programming the Powered Bottom

This menu contains the programmable settings for the rest of the features in the Dynatrol. To find this menu, first IdLE, tC2, and the current temperature must be cycling in the display.

Press **Other** once to see RSET displayed
Press **4, 4, 3**, and see NOTC (this is the first option in the hidden "Other" menu)
To exit the menu press **ENTER** twice when you see PCt. You will then see CPL, and then IdLE, tC2, and the current temperature cycling in the display again.

WARNING: 'OPTION A'(OPA), 'OPTION B'(OPB) DO NOT PRESS **ENTER** HERE. These options are currently programmed to operate with different equiptment than our powered bottoms and are therefore not recommended as options for controlling them. If you accidentally press **ENTER** on OPAor OPB you must then re-enter the hidden **Other, 4, 4, 3** menu and press **Other, Other, Other** (a total of three times to scroll to OPC). If you have a powered bottom then press ENTER while you see OPC. If you do NOT HAVE a powered bottom you must press **ENTER** on PCT, set it for all zeros, and press **ENTER** again.

When you press **Other, 4, 4, 3** The "Hidden Other Menu" is displayed as follows:

4.4.1 NOTC: Number of Thermocouples

NOTC is used to change the number of zones in your kiln (essentially, the number of thermocouples used).

To run the kiln using only one thermocouple: When you see notC press **ENTER**, then **1,** then **ENTER**. If you choose to do this you must use only thermocouple number 2 in the kiln and we recommend putting it in the middle zone's thermocouple hole. All the zones of the kiln will turn on and off simultaneously when you program the Dynatrol to use only one thermocouple.

If you wish to run the kiln using only two thermocouples: When you see notC press **ENTER**, then **2,** then **ENTER.** If you choose to do this you must have thermocouple #1 in the top zone of the kiln and thermocouple #2 in the middle zone or in the bottom zone. When you program the Dynatrol to run using only two thermocouples the bottom zone and the middle zone go on and off simultaneously.

To run the kiln using three thermocouples: When you see notC press **ENTER**, then **3**, then **ENTER**. If you choose to do this thermocouple #1 must be in the top zone, thermocouple #2 in the middle, and #3 in the bottom. All three zones will operate independently, tied to their respective thermocouples.

NOTE: Kilns with only one thermocouple can be *programmed* to run with two or three thermocouples but because they physically only have one thermocouple the FAIL message will be displayed referring to the non-exhistant thermocouple. You must then re-program for just one thermocouple. Likewise, two section L&L kilns come with only two thermocouples. If you physically add a section to a two section kiln, you be able to add a third thermocouple. But if you program a two section kiln for three thermocouples you will receive the FAIL message referencing the non-exhistant thermocouple. You must then re-program for two thermocouples.

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4.4.2 OP A: Option A
DO NOT USE

4.4.3 OP B: Option B
DO NOT USE

4.4.4 OP C: Option C
When you press **ENTER** here all you will see is CPL (meaning 'Complete'). Now when you program in VARY-FIRE mode however, you will see an extra prompt in each segment called FAN1, FAN2,...FAN8. This will appear right before you see the rA1, rA2,...rA8 prompt. FAN, in this application, is referring to the powered bottom. You can set the powered bottom to be either ON or OFF in each segment of programming in a VARY-FIRE program only. Toggle between ON and OFF using a number key.

4.4.5 PCT: Percent
When you press **ENTER** here you can either exit the menu by pressing **ENTER** again (you are essentially setting the percent to remainas is without changing it by doing this). Or else you can program this setting to turn your powered bottom on *a percent of the time that the bottom zone in the kiln is on*. To set this percent from 0% to 150% press the percent you want. i.e. Entering 100 here would turn the powered bottom on whenever the bottom zone came on. Entering 50 here would turn the powered bottom on for about eight seconds, then off for about eight seconds if the bottom zone of the kiln was on all the time. 150 is the maximum you can enter. This pretty much ensures the power bottom is on all the time. The bottom zone would have to be on less than about 66% of the time to have the power bottom cycle if **PCT** was set to 150.

NOTE: Setting the PCt setting to 0000 will turn off all powered bottom options.

4.4.6 PId: PID Setting
This setting is not part of the powered bottom settings, It is always "on". Pressing **ENTER** here allows you to set another percent setting that can help a slow, heavily loaded kiln fire faster. This setting comes pre-programmed at the factory for 65%. Basically you are determining how much help the middle zone of the kiln gives the bottom zone of the kiln when the bottom zone is lagging behind during heating. This function automatically activates to your pre-programmed setting when the bottom zone is on 100% of the time. Without this feature, heat from the bottom zone will rise up and help to heat the other zones so generally the bottom of the kiln is on more than the other zones to compensate for this. Sometimes the slow bottom zone will slow the whole kiln down. With this feature, the middle zone of the kiln will come on the programmed percent of the time that the TOP zone comes on, if the bottom zone is on all the time. What was found during tests was that if the bottom was on 100% of the time, the top zone was generally on 90% of the time, but the middle zone was on only about 40% of the time. By programming a higher percent you can greatly speed up your firings. (you will have to experiment, try the factory setting 65% then try maybe 85% and compare your results).

4.4.7 dIAG: Diagnostics
This is handy to use when your kiln is first delivered and set up to make sure it was done properly. It can also be useful in seeing if an element has burned out. Press **ENTER** when you see dIAG

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and open the lid of your kiln. When you are ready, press Enter again and each zone of the kiln will turn on for 10 seconds starting with zone #1, the top zone. If you have a powered bottom it will be on last; when it says OUT4. **CAREFUL it can get hot and there is LIVE electricity – DO NOT TOUCH THE ELEMENTS!** This will tell you if all the power circuits are hooked up right and working; , or if kiln sections are plugged in to the wrong receptacles on the control panel(jupiter kilns only). If this is the case the zones will not turn on in the proper 1, 2, 3, order.

4.4.8 ShTO: Shut-Off Averaging

This option is used to shut off the automatic feature in the Dynatrol that holds the hottest part of the kiln at each segment's set point until the average of the three (or two) thermocouples reaches that set point. Pressing **1** here allows you to toggle between ON and Off. ON meaning that as soon as the hottest zone gets to the segment's set point the entire kiln switches to either the "hold time" or the next segment. OFF meaning that the Dynatrol will not let the hottest zone's temperature rise until the average temperature of the three zones reaches that segment's set point. Then the kiln can begin the "hold time" or the next segment. You may want to turn this setting to ON if you fire with the "Lag" set for say 15 and the "Autolag" OFF. ON can also help to speed up a slow firing as well.

4.4.9 ALR4: Alarm For…

This feature is activated by pressing **ENTER** when ALR4 is displayed. It energizes output #4 on the DynaTrol electronics board when the Alarm goes off. Since the alarm is a temperature alarm; can be set to go off at a specific temp, output 4 can be connected (for example) to a relay that governs the power for an auto-dialer to call your cell phone so you know it is time to come check the kiln. Or it could be connected to a really loud buzzer or light for the kiln room door. Contact the factory if you want to learn more.

NOTE: On kilns with powered bottoms DO NOT CHOOSE THIS OPTION. Your Powered Bottom is connected to output #4 and is best controlled by the 'PCT' option in the Hidden Other Menu. If this option is chosen, *and* you have a powered bottom, *and* you set the alarm, when the alarm goes off the powered bottom will come on- even if the program is off. The bottom of your kiln could get a bit hot if this happens. Just another reason why it is good to never leave a firing un-attended.

4.4.10 CYCL: Cycle Time

The cycle time is the length of time between an element turning on two consecutive times. Using a short cycle time may improve temperature control, while using a long cycle time may improve relay life. Cycle time can be programmed anywhere from 10 to 60 seconds. The default setting from the factory is 14 seconds

4.4.11 MAX: Maximum Temperature Setting

Maximum Temperature Setting controls how hot the kiln can be programmed to fire. It can be set as high as 2400°F, although on any L&L the max temp in the warranty literature is "2350°F or Cone 10". This is already set in the factory.

4.4.12 TYPE: Type of Thermocouple

The type of thermocouple can be either Type K or Type S. You must have the appropriate thermocouples and lead wire to switch from one to the other; either Type K thermocouples and wire or Type S. In addition you must switch the software setting from "K-TH" to "S-TH", or vise versa. Pressing any number key toggles you back and forth from K-TH to S-TH. For precaution, a

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small jumper must be moved on the circuit board when going from K to S. This jumper is located approximately in the center of the board under the marking "R97". If the jumper is on only one of the prongs the control is set for Type K. If the jumper is on both of the two prongs the control is set for Type S. This precaution keeps you from accidentally having it set for K with S thermocouples or vise-versa. (A severe overfiring can occure if you have the control programmed for a Type S thermocouple and you are using a type K thermocouple). If there is a mismatch between the jumper setting and the software setting you will get an error code: **ERR9**.

4.4.13 2KEY: Two- Key Start

Two-Key Start is a safety feature that makes you press **ENTER** after pressing **START/STOP** to begin a program. It keeps you from turning the kiln on by accident. If Two-Key Start is activated, when you press **START/STOP** you will see "----". Pressing **ENTER** now starts the program. By defailt we do not have this feature turned on.

4.4.14 E-bd: Error Board Temperature

This allows you to set how hot the room can be that the kiln is in before the DynaTrol shuts the elements off. A temp sensor right on the electronic board inside the control box senses temperature and can be used to trigger a power-off to the elements if the kiln room gets too hot. 250°F is the max. Remember it is a whole lot hotter that close to the kiln than it is in the rest of the room. Default seting is 200°F (93°C)

4.4.15 REST: Restore Default USER Programs

The DynaTrol comes preloaded with 6 special programs in the VARY-FIRE USER memory slots. VARY-FIRE has 6 memory slots for you to create and store your own custom programs. When it comes to you from the factory however, it already contains programs that as you create your own, you will program over.You may decide to keep these original programs or program over them with your own programs.

If you ever want to get all of the original programs back again, you can go to REST in the Hidden Other Menu and press **ENTER**. If you do this however, any custom programs you made up and saved in the VARY-FIRE USER memory slots will be unretrievable. If you want to just get some of the original programs but not others, you will have to manually enter them in. VARY-FIRE TEMPERATURE PROFILES section in the Appendixes contains the actual segment-by-segment program for each of the preset programs.

4.4.16 ERTF: Stores the Temp, Hours Past, and Rate of Rise when an Error Code occurs.

This feature stores the temp, number of hours that have passed in the program, and the rate of rise of the kiln when an error code occurs. If you come in to your kiln and see E- 1 for example, it has shut off because it cannot climb faster than the slowest allowable temp:12 degrees per hour. You can press **ENTER** and then go to ERTF in the Hidden Other Menu, press **ENTER** there and see, the temperature at which the error code happened, then the number of hours and minutes that have passed since the program began, then the actual rate of rise in degrees F/ hour (or degrres C/ hour if yours is set for Celcius) when the error code occurred. This is a great diagnostic tool.

4.4.17 COOL: Cone-Fire Cooling Segment

This feature allows the user to toggle **ON** or **OFF** a cooling segment for any EASY-FIRE Program. **OFF** means that the EASY-FIRE Program will fire to it's maximum temperature, then shut off and

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cool naturally. **ON** means that once the max temp is reached the cooling segment will kick in. If **ON** is set, when a EASY-FIRE Program is chosen, like **Slow Bisque**, the control will prompt you to enter the cool down segment you want after you are done programming the EASY-FIRE Program.

With this feature turned on, the prompt while you are programming an EASY-FIRE program will be RA 8. When you see this enter a ramp rate. Then you will see °F 8 (or °C 8). Enter a final set point temperature that you want the controlled cooldown to stop at. Then you will see HLd8 for a hold time (typically not used). An example of a good cool-down segment would be: **Rate: 150 degF/hr, to: 1200F, hold: 0.**

4.4.18 VOLT: Voltage Measurement

This feature allows the line voltage to be tested by the DynaTrol safely, where the kiln is set up. This will help diagnose firing problems where the kiln cannot reach temperature. When you see VOLT in the Hidden Other Menu, press **ENTER** and the display will flash NOLd; meaning that the next number displayed will be the "No Load Voltage". Press **ENTER** again and FLLd will flash meaning the next number to appear will be the "Full Load Voltage". The kiln's heating elements will be turned on for about 4 seconds while the full load voltage is displayed. After that, it will return to IdLE

To display voltage using the kiln controller a calibration must be done. Before calibration make sure the relays and elements are connected.

1. Press **Other** key one time. The message RSET will be displayed.
2. Type in key sequence **4, 4, 3**
3. NOTC will be displayed. Press **Other** until VOLT is displayed.
4. Press **ENTER** key. NOLD for no load will be displayed for two seconds. After NOLD, a number will be displayed until either **ENTER** is pressed or the **443** calibration code is entered. This number is the no load voltage. However, until after calibration this number is meaningless.
5. Type in key sequence **4, 4, 3**.
6. CAL1 will be displayed. Measure the line voltage and enter this number now using the keypad. This number will be used to calculate no load voltage
7. Press **ENTER** key.
8. CAL2 will be displayed. Measure the line voltage and enter this number now using the keypad. This number will be used to calculate full load voltage.
9. Press **ENTER** key.
10. The voltage calibration routine is now complete. The controller will return to idle.

4.4.19 DTCT: Amperage Measurement Setting

This feature can only be used if your DynaTrol came with the optional current sensor. If equipped and properly installed, this sensor allows the DynaTrol to read the amperage of the kiln in real time. This setting here only controls the maximum amount that the current sensor will measure. It is set in the factory for the proper amount and should not have to be changed. The amperage reading requires a current sensor that clips around one of the power cord's hot wires. The default range for the calibrated sensor is 50A. For larger kilns the controller can be adjusted for a higher range sensor.

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Installing the optional current sensor:
The current sensor has two wires that need to be connected to the circuit board. One wire is black. One wire is white. On the top left corner of the circuit board is a terminal with inputs marked black and white.

1. Insert the white wire in the terminal that has been marked white.
2. Insert the black wire in the terminal that has been marked black.
3. Use a screwdriver to tighten the two screws on the terminals so that the wires will not come lose.
4. The circuit sensor clips around one of the power cord's hot wires.

The control is now able to measure the amperage draw using the controller's diagnostic routines.

4.4.20 Amperage Measurement

Amperage measurement can only be done if your kiln is equipped with a current sensor. If there is no sensor (or no amperage), your amp readings will be 0 when you run try this feature.

To run this feature first enter the "Hidden Other Menu", then scroll through it until you come to dIAG. Press **ENTER** and see it say OUTS. Press "**1**", see it say AMPS. Press **ENTER** and see it say AMP1 -meaning the next number displayed will be the amps of Zone 1. Then AMP2 will be displayed- meaning the next number to appear will be the amps of Zone 2, and so on for Zone 3 if you have three zones.

APPENDIX A

OVERVIEW OF FEATURES

A.1 Dynamic Zone Control

The DYNATROL features Dynamic Zone Control. It measures temperatures in the bottom, middle and top of the kiln and automatically adjusts the heat output of three separate heating zones even as the kiln is heating up and during the final approach to maturing temperatures. Kiln temperatures are automatically evened out to within 1/2 cone or better top to bottom! There is no manual intervention with input switches to even out temperatures. There are separate thermocouples (heat sensors) and contactors (power controls) for each of the three zones. Dynamic Zone Control suspends firing on one or more zones if the other zones are lagging behind the faster zone(s)..TC1 (as displayed on the kiln) is the Top Zone, TC2 is the Middle Zone, TC3 is the Bottom Zone. **NOTE: It is absolutely necessary to match the proper section with the proper control box outlet and proper thermocouple** (Thermocouples, cords and receptacles are all marked for identification. If these are mismatched the kiln will not operate properly and you will get the Ed display showing that one of the zones is way off set point.

A.2 Programmable Number of Zones

The latest version of the DynaTrol allows you to program the number of zones. Typically there are three zones in a kiln. However, on our two section kilns the control will come programmed to operate as a two zone control. On GS1714 kilns we have the control programmed to be a single zone control. If you change the number of sections in a kiln (for instance, if you take one section off a three section kiln) you can reprogram the control to suit your needs. Another benefit of this new feature is that you can program the control to be a single zone control and avoid the complications of three zone control (i.e. LAG issues). When the control is programmed to be a single zone control outputs 1, 2 and 3 all work together. When programmed as a two zone control outputs 2 and 3 work together and output 1 is separate.

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A.3 Four Easy Preset Programs

There are four preset " EASY-FIRE" programs that have been designed to do most typical ceramic firing cycles. They are **Fast Bisque, Slow Bisque**, **Fast Glaze** and **Slow Glaze**. These preset programs have specific ramps and speeds built into them (see Appendix A for details of what these ramps are). You can enter any cone number up to cone 10* as a final temperature, a hold time, a delay time and even a time as options. This allows a great deal of customization while still keeping the programming simple and easy. We recommend you start with these programs until you get some experience with the control and your kiln.

The EASY-FIRE mode uses Orton's patented method to achieve correct heat work so it is ideal for firing ceramics. The advantage of using the EASY-FIRE method is that a very complicated firing profile may be chosen with just a few key strokes. The EASY-FIRE method helps protect against over and under firing by carefully tracking and controlling the temperature at the end of the firing as the cone temperature is approached. The program is based on a 108°F temperature rise for a large self supporting cone (rather than the small Orton cones or regular large cones).

***Note:** Some L&L Kilns are not designed to go to cone 10. Consult your kiln's label for the maximum operating temperature.

A.4 Six User Defined Programs

If your needs are more sophisticated or involved there is a separate VARY-FIRE programmer mode. This allows you to have 6 separate, repeatable, storable programs with up to 8 segments. There is one cooling or heating ramp, a temperature setpoint and an optional hold time per segment. The programs are stored in non-volatile memory which means that they will stay in memory even when all power is turned off. The DYNATROL allows you to soak at a low temperature for a long time (i.e. you can have an automatic drying period) and then automatically ramp up to your high fire at different rates. You can ramp slowly through critical periods or soak at end point temperatures for more consistent maturing of work. It also allows a controlled cool down to avoid heat shock. Of course many of these valuable uses are available in the preset EASY-FIRE programs. However, with the VARY-FIRE programs you have complete control over ramp times and rates and so you can adjust the kiln performance to your exact needs. It also allows the control to be used for non-ceramic applications such as glass, enameling, heat treating and other industrial uses.

Note: VARY-FIRE programs fire the kiln to your specifically programmed temperature. EASY-FIRE programs will fire the kiln to your specifically programmed cone number.

A.5 Linkable Programs

You can link VARY-FIRE Program #5 and #6 to get a 16 segment program. You can also use this system to link VARY-FIRE Program #6 to the end of an EASY-FIRE Program.

A.6 Delay Start

You can delay the start of the program by up to 99 hours, 99 minutes. This allows you to plan end of firing conveniently. This is also very useful for saving energy costs by firing kiln with night electric rates. If you want the kiln to mature at 2:00 PM the next day and you know your program will take 12 hours and you are starting your program at 4:00 PM today you would program in an 8 hour delay. NOTE: The delay start remains on or set for all programs (both VARY-FIRE and EASY-FIRE) until you turn it off.

A.7 Preheat (Candling)

You can "candle" the kiln for up to 99 hours, 99 minutes to dry ware thoroughly. "Candling" is a specific hold at 200°F which boils off the water in the clay slowly so that your work does not explode as the water expands rapidly to steam. This is highly recommended to do for most ceramics. We recommend overnight or for at least several hours depending on how dry your work

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it. NOTE: This is available as an optional step in the EASY-FIRE mode only. You can do the same thing with an added first segment in the VARY-FIRE mode.

A.8 Soak

The control will soak at Final Set Point for up to 99 hours, 99 minutes, and can be programmed to hold a temperature as long as 66 days before needing to be reset. This is a very useful feature and one of the great advantages of an automatic control. Most ceramics achieve their characteristics not so much by what temperature they reach but by how much "heat-work" is put into them. A long soak at a lower cone can often develop the bisque or glaze better. In addition a soak period almost always will improve the uniformity of the firing throughout the kiln. A soak period gives the entire load of ware time to absorb the radiant heat that is projected from the elements. If you simply rise to a certain temperature and then shut the kiln off (as is typical of a manual kiln sitter operation) then the center or the bottom of the kiln may not have had a chance to absorb as much heat as the ware around the perimeter. You may have experienced the fact that an older kiln with slow firing elements may in fact have given you better results. This is because the entire kiln has had a chance to even itself out as it approached final cone. We suggest experimenting with this feature. Try a soak of 10 to 20 minutes. The Dynatrol will automatically adjust the final temperature to compensate for the programmed Hold Time in the EASY-FIRE mode only. Be warned that element life is lessened by the amount of time the elements spend up at at a higher temperature.

A.9 Audible Temperature Alarm

There is an easily settable audible temperature alarm. This can alert you at any point in program. For instance the control can alert you that the kiln is close to maturity so you can watch it reach final set point. You can use it to alert you when to close the lid if you are manually venting the kiln. You can disable this alarm by programming in 9999. Press **ENTER** to turn off alarm when it is sounding. You can tie this into a relay output to ring an external alarm. (See section 4.4.9).

A.10 Program Review

Press this button to see the entire program before or while running it. It will scroll through the programmed steps. We suggest hitting **Review Prog** at the beginning of your firing to see if the control is set up to do what you want it to. If the control shows error codes "OFF" when they should be "On" or no "Hold" where one should be, you must first stop the program that is running in order to change anything. Most settings cannot be changed while running a program.

A.11 Segment Review

Press **Review Seg** once while you are firing to see which segment's ramp or hold you are currently in, what the current set point is, and what the actual temperature of the Dynatrol's electronics are.

A.12 Skip Segment

In the VARY-FIRE mode you can skip a segment to advance to a higher segment and speed the program along.

A.13 Set Point Indication

If you press **Review Seg** twice while the kiln is firing, the control will show you what your current set point is during the program as it is changing. This is useful to confirm that the temperatures of the thermocouples are where they are supposed to be.

A.14 Change of Program During Firing

When firing you can alter the program anytime. You must press **START/STOP**, then reprogram, then press "Start". The Dynatrol will automatically take the current temperature into consideration and start back up at that point in the program. If you attempt to do this right at the end of a firing, the amount of time it takes to reprogram is not accounted for by the Dynatrol. If more than a few minutes go by, the temperature displayed may not accurately represent the amount of heat work taking place in the kiln. Another reason to fire with witness cones.

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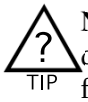
A.15 Cone Offset

This is one tool you have to help you match the control to your real firing experience. It is important to fire the kiln with witness cones to find out what is really happening inside the kiln. Using these you can fine tune the overall performance of the kiln to match what is really happening to your ware. The cone offset is just one of the ways you have of making this adjustment. Keep in mind however that your firing speed and soak time will also have an effect on how the witness cones and ware perform. When you are making an adjustment try changing one variable at a time. For instance if you are firing to Cone 05 and your witness cones don't mature you could do a number of things. One is to use the cone offset to raise what the Dynatrol thinks is the temperature of cone 05 in an EASY-FIRE program. Another thing you could do is put in a soak/hold time at the end of the program in a VARY-FIRE program. Another thing would be to slow the kiln down towards the end of its firing cycle with a slower, longer final segment in a VARY-FIRE program. Try one thing at a time to find out what works best for you. The cone table that the Dynatrol uses are based on a 108°F temperature rise for a large self-supporting cone (not the small Orton cones or the regular large cones).

A.16 Thermocouple Offset

This allows you to individually change what the Dynatrol thinks the thermocouples are reading. Use this to adjust for thermocouple drift or kiln uniformity adjustments. It allows you to influence how the kiln "sees" the temperature in the kiln. For instance, if the center zone is consistently firing higher (as measured by witness cones) then you would change that thermocouple to read higher. This would trick the control into thinking that the center zone was hotter and it would keep the temperatures down. The difference between Cone Offset and Thermocouple Offset is that Cone Offset works in EASY-FIRE programs only and changes a specific cone's temperature for the whole kiln. Thermocouple Offset will affect temperatures in both VARY-FIRE programs and in EASY-FIRE programs. Basically it changes just that particular thermocouple's reading up or down to even out temperatures in an unevenly heating kiln no matter what cone number or temperature you are firing to.



NOTE: Thermocouples drift in their accuracy over time. The hotter you fire the quicker this will occur. This is another reason why it is important to check each firing (or at least every 5 or 10 firings) with witness cones. This is particularly important if you are firing at high temperatures like cone 6 or cone 10.

A.17 Last Temperature Reached Indication

When an EASY-FIRE program is complete it will tell you what the last temperature reached was. You press **Review Prog** at the end of the cycle to see this temperature. This is useful for logging and comparing to what happened with your ware. Compare this temperature to witness cones and make adjustments in your firing cycle or cone offsets to adjust the performance of the kiln.

A.18 Cone/Temperature Equivalent Look Up Table

Convert cone numbers to temperatures in degrees. The look up table is based on a ramp rate of 108°F. This table is provided as a handy reference table to use while you are programming. There is a more complete table in the Appendix J.

A.19 Dust Sealed Keypad

The keypad is dust tight so you don't need to worry if you have dirty hands that might get dust into the electronics.

A.20 Easy to Follow Graphic Design

It is graphically designed to be user friendly. EASY-FIRE, VARY-FIRE, OPTIONS and VIEW functions are grouped separately. The numeric keypad makes entering parameters like temperatures and cone numbers easy.

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A.21 Error Checking Can Be Turned Off

There are various error codes in the control. These can be important diagnostic tools. They can also be somewhat confusing and alarming if you don't understand then. One of the most common ones is E 1 which will stop the program if the kiln's temperature is rising too slowly. ErrP flashing or PF indicates a power outage to the control. E d indicates that one zone is 100°F off set point. All these and more are explained in greater detail in Appendix G.

A.22 Reset Defaults Function

This function (available under "Options, Other" - see Section 4.3.3) resets most settings back to factory defaults. It does not affect the thermocouple or cone offsets. Turns Error Checking On.

A.23 Reads Control Board Temperature

This is a diagnostic tool. The control should not be operated when it is above 125°F (52°C) or below 32°F (0°C). This should not normally be a problem with the way L&L mounts these controls away from the heat. However, if you do get a reading that is higher than this temperature (for instance if you are operating in a particularly hot room) we recommend that you direct some cooling air at the control. This board temperature is displayed as follows: When you press the View Segment Button while firing, first the current segment is displayed, then the set point temperature and then the Dynatrol's board temperature. Ambient temperatures that are out of the suggested range can lead to either control failure or control inaccuracy.

A.24 Automatic Restart after Brief Power Interruption with Flashing Alert

This is the ErrP indication. If the power outage was brief the program will continue to fire and the ErrP message will flash with the temperature indication. By hitting the "1" button you can clear this alarm message. See Appendix G for all error code explanations

A.25 PID Tuning Control

PID stands for Proportional - Integral - Derivative. It is a sophisticated calculus algorithm that minimizes temperature overshoot. The control is able to anticipate the temperature set point and start to cut back power before it reaches actual setpoint. In standard On/Off control the power does not turn off until the actual set point is reached. Because of the inertia of the kiln this could result in temperature overshoot without the PID control. The values for the PID are hard programmed into the control and can not be changed. They are optimized for ceramics. If you are using the control for another application and you find that the control gives you some overshoot try a step in your VARY-FIRE program that is a very slow ramp for the last few degrees of the program. For instance if you wanted to get to 1800°F without overshoot, have the program go to 1775°F and then take 15 minutes to ramp to 1800°F. NOTE: As of April 2000 a second set of PID settings was added for temperatures below 500°F. This improved overshoot in the lower temperature range.

A.26 Thermocouple Burnout Protection

The kiln will shut down automatically if all thermocouples burn out. The kiln continues to fire if only one or two thermocouples burn out. This protects your firing in the event of failed thermocouples. Of course, if all three thermocouples fail then the control stops firing.

A.27 Digital Indication of Temperature in either Degrees F or C

You can switch between temperature readings in degrees Fahrenheit or degrees Centigrade.

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A.28 See All the Zone Temperatures

You can scroll through all three thermocouple readings by pressing **1** to see TC1 (top zone), **2** to see TC2 (middle zone) and **3** to see TC3 (bottom zone). The default view is of TC2. You must specifically hit **1** or **3** to see the top and bottom zone temperatures. The reading will stay on the thermocouple that you last pressed.

A.29 See Which Zones are Firing

Press Number Key **8** while the kiln is firing. This toggles the LED display to show you which zones are firing. See the section under **DESCRIPTION OF KEY FUNCTIONS AND DISPLAY,** Appendix C for details. This is a great diagnostic tool to allow you to see which zones are firing. For instance if one zone is firing constantly and the other zones are not then you know that the constantly firing zone is the slow zone.

A.30 See the current rate of rise in degrees per hour:

Press Number Key **5.** See the section under **DESCRIPTION OF KEY FUNCTIONS AND DISPLAY,** Appendix C for details

A.31 See the elapsed time since the firing began

Press Number Key **0.** See the section under **DESCRIPTION OF KEY FUNCTIONS AND DISPLAY,** Appendix C for details

A.32 Cold Junction Compensation

The control automatically compensates for varying ambient temperatures. It can operate in ambient temperatures of 32°F to 125°F (0°C to 50°C). The **Review Seg** button lets you see ambient board temperature (press **Review Seg** three times). This is an electronic compensation.

A.33 Matches Pyrometric Cone Performance in EASY-FIRE Mode

This feature is licensed from Orton. (Patent #4,461,616 and 4,730,101). This feature is not controlled by the user. Basically it adjusts how the firing takes place towards the end so that the control approximates how cones work. The control sees how fast the kiln is rising and adjusts the final end point temperature higher or lower to achieve the proper amount of “heat-work”. For instance, to mature your ware at the same cone number, a the kiln rising at 100°F per hour will require a lower set point temperature than a kiln rising at 200°F per hour. This feature is only used in the EASY-FIRE mode. Note: The control emulates the self supporting cones. (see Appendix J, Pyrometric Cones)

A.35 Computer Interface System

The new DynaTrol is capable of being hooked up to a computer using special KISS Software. See separate instructions for details on this feature. Up to 10 separate kilns can be hooked up to one computer. This is available from L&L.

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A.36 PID algorithm

The PID algorithm (in industrial, mathematical terms this is the proportional, integral, and derivative functions of the control) is how the controller decides what percentage of the kiln's total power is required to keep the temperature at the desired set point. The DynaTrol 700 board has a cycle time of 14 seconds (as the default setting) and will turn the relays on for a calculated number seconds to give the correct percent of power needed to keep the temperature near the traveling set point. For example, if the controller calculates that 25% of the power is required, the relays will be on for 3.5 seconds and off for 10.5 seconds.

Each part of the P (Proportional band), I (Integral) and D (Derivitive) are calculated separately and added together to determine the correct percentage (control value) of power required. The proportional part of the control value is based on how far the temperature is away from the desired set point. It is the difference between the set point and the current temperature (also called the error) multiplied by the proportional gain.

The integral part of the control value is based on how long the temperature is taking to get to the set point. It is calculated by multiplying the error by the integral gain and summing this value over time. The integral value compensates for any long term error not taken care of by the proportional part.

The derivative part of the control value is based on how fast the temperature is moving towards or away from the set point. If the temperature is moving quickly towards the set point the derivative portion reduces the control value to prevent overshoot. If the temperature is moving away from the set point then the derivative portion increases the control value to get the temperature to start moving back towards the set point.

The constants for calculating the control value are fixed within the controller and can not be changed by the user. They do vary throughout the firing depending on the current temperature in the kiln. To prevent over and undershoot, the controller also has "approach control" to smooth the transition from a fast ramp to a hold.

A.37 Automatic Lag Function

With a zone control kiln there is always a trade off between speed and tightness of control . The series 700 automatic control LAG feature uses the programmed ramp rate to automatically set its "LAG" temperature setting to balance these two opposing needs. Sometimes the temperature of one or more kiln's sections "lags" behind one or more of the other sections. This is because the traveling set point of the control (based on the programmed ramp rate) is faster than one or more of those sections' can rise and have the temperature in the sections stay even. To effectively deal with this the 700 DynaTrol will automatically slow the ramp rate when a section of the kiln lags. The amount of "lagging" that is allowed before the firing rate will slow is determined by the ramp rate. Fast ramp rates (greater than 500 °F/hour) will allow the greatest temperature difference between sections. Slow ramp rates (below 70 °F/hour) will have the smallest temperature difference between sections. Therefore, when the controller is programmed to go fast it will sacrifice evenness to obtain speed. Likewise, when the controller is programmed to go slow, the controller will maintain tighter control. The controller will try to balance speed and tight control when a medium speed is programmed.

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Here is the actual algorythm for those of you who are interested in knowing what is taking place (note that this is all transparent to the user and is included in here to let you know how this works):

1. **If the programmed rate of rise is between 1˚F/hour and 70˚F/hour and -**

    1. all thermocouple readings are less than 3 degrees behind the traveling set point, the traveling set point moves at the programmed rate.
    2. the lowest thermocouple reading is between 3 and 6 °F behind, the traveling set point moves at 75% of the programmed rate.
    3. the lowest thermocouple reading is between 6 and 9 °F behind, the traveling set point moves at 50% of the programmed rate.
    4. the lowest thermocouple reading is between 9 and 12 °F behind, the traveling set point moves at 25% of the programmed rate.
    5. the lowest thermocouple reading is more than 12 °F behind, the traveling set point moves at 1 degree F per hour.

2. **If the rate of rise is between 71˚F/hour and 500˚F/hour and -**

    1. all thermocouple readings are less than 7 degrees behind the traveling set point, the traveling set point moves at the programmed rate.
    2. the lowest thermocouple reading is between 7 and 14 °F behind, the traveling set point moves at 75% of the programmed rate.
    3. the lowest thermocouple reading is between 14 and 21 °F behind, the traveling set point moves at 50% of the programmed rate.
    4. the lowest thermocouple reading is between 21 and 28 °F behind, the traveling set point moves at 25% of the programmed rate.
    5. the lowest thermocouple reading is more than 28 °F behind, the traveling set point moves at 1 degree F per hour.

3. **If the rate of rise is greater than 500˚F/hour and -**

    1. all thermocouple readings are less than 10 degrees behind the traveling set point, the traveling set point moves at the programmed rate.
    2. the lowest thermocouple reading is between 10 and 20 °F behind, the traveling set point moves at 75% of the programmed rate.
    3. the lowest thermocouple reading is between 20 and 30 °F behind, the traveling set point moves at 50% of the programmed rate.
    4. the lowest thermocouple reading is between 40 and 50 °F behind, the traveling set point moves at 25% of the programmed rate.
    5. the lowest thermocouple reading is more than 50 °F behind, the traveling set point moves at 1 degree F per hour.

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APPENDIX B

DESCRIPTION OF KEY FUNCTIONS AND DISPLAY

The front panel of the controller has seven distinct parts:

- **START/STOP** Key
- **LED** Display
- **VARY-FIRE PROGRAMMER** Section
- **REVIEW AND SPECIAL OPTIONS** Section
- **NUMBER KEYS** Section
- **EASY-FIRE** Section

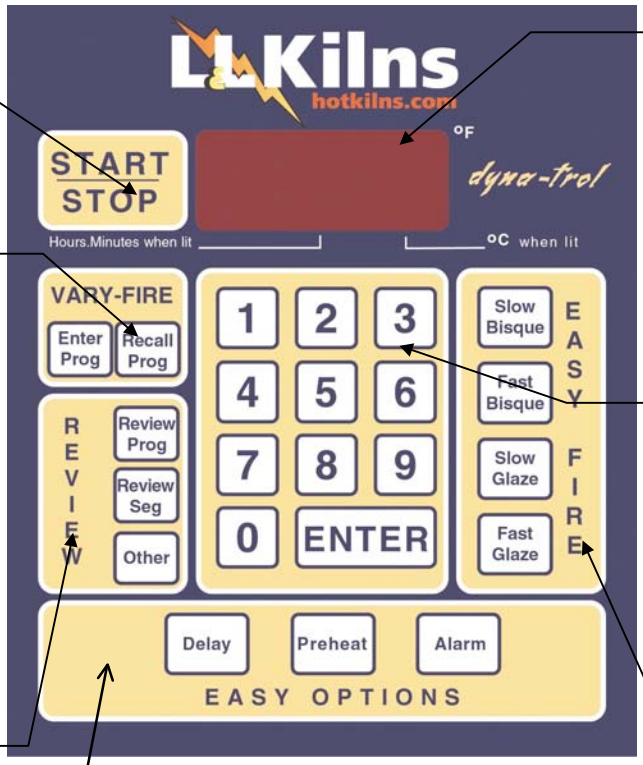
EASY OPTIONS Section

START/STOP button for starting and stopping firings.

"Vary Fire" Programmer for setting and saving your own firing profiles.

REVIEW section to review the selected program, view the current segment, view the board temperature, view the program set point, or skip to the next firing segment.

OPTIONS button to look up cone temperatures, set the cone offset to adjust cone tem-peratures, set thermocouple offsets, set LAG, AUTOLAG On/Off, Identify Control, Turn On/Off 16 seg-ment program capability, Reset default values, or change the temperature scale (°F/°C).



LED DISPLAY - four digit display showing times and temp-eratures. Indicate Deg F or C

Number keys section for entering temperatures and times. Change which thermo-couple you are reading. Turn On/Off ability to see which zones are firing. Reprogram the number of zones of control.

EASY FIRE section for choosing one of four preset Easy Fire profiles.

EASY OPTIONS section for setting Delay Time, PreHeat Time, and Alarm Temperature.

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B.1 START/STOP Key

Starts the firing or, if there is a firing in progress, stops the firing.

NOTE: This key has no function during programming.

B.2 VARY-FIRE PROGRAMMING Section

Program your own firing profiles and recall them for use.

Enter Prog - This button allows you to initiate programming. Up to 6 profiles (programs) may be programmed and saved.

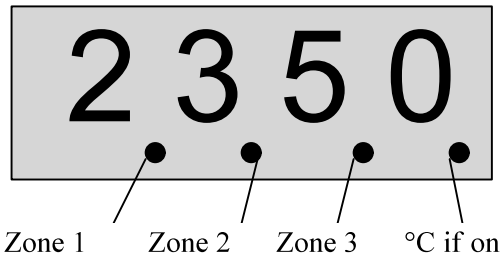
Recall Prog - Allows one step recall of one of the programmed profiles (programs).

B. 3 LED DISPLAY- Displays temperatures, times, and messages.

The LED (Light Emitting Diode) has room for four digits or letters in the display.

When the decimal point is displayed between the middle 2 digits, a time is being displayed.

If there is a decimal to the right of the last digit, the temperature is being displayed in degrees Celsius (Centigrade). By pressing #8 on the numerical Keypad while you are firing a profile you can turn on and off the ability to see which zones are firing. The little LED lights under the numerals in the display act as indicators of the zones firing. There are three of these little indicators and all three will blink on and off even if your kiln only has two or one heating zone



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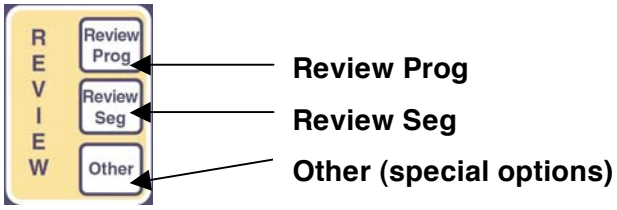
B.4 REVIEW & SPECIAL OPTIONS

Cone Offset, Thermocouple Offset, Identify Control for KISS software, Set 16 Segment Program, View Cone Table, and change between °F and °C.



Review Program - The information displayed when Review Program is pressed varies depending on whether you are using EASY-FIRE or VARY-FIRE. When Review Program is pressed, each of the steps in the current firing profile is displayed one after another.

When a firing is complete, Review Program is used to see the final temperature reached during the firing.

Review Segment - It is used to view the current firing segment or to skip from the current segment to the next segment. When Review Segment is pressed during a firing the current stage of the firing is displayed. If it is pressed in between firings, STOP will flash and then the current temperature will be displayed. When you press **REVIEW SEG** twice you will see the program set point temperature. When you press it three times you will see the control board temperature.

Other - There are several "**Other**" options

- Reset feature RSET
- Cone Lookup Table CONE
- Controller ID Id
- 16 step program 16-S (only comes up if you have VARY-FIRE Program #5 in active memory or if you have an EASY-FIRE program in active memeory)
- Cone temperature offsets CNOS
- Temperature scales °F or °C CHG°
- Error codes ON or OFF ERCd
- Thermocouple offset TCOS
- Board temperature bd T

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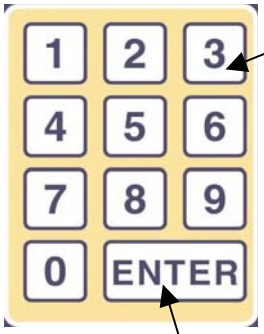
B.5 NUMBER KEYS Section

Contains the ENTER key and the number keys.



Numeric keys - Used for entering times, temperatures and other numbers. The number "1" is also used to acknowledge the ErrP error signal when you first turn the kiln on. Press "**1**", "**2**" or "**3**" while firing to change which thermocouple reading you see in the LED display.

-Press **5** while firing and see the current rate of climbing in degrees per hour. This is useful to look at near the end of the program so you can look on a cone chart to accurately see what temperature your kiln will shut off.

-Pressing the **7** key will run the amperage diagnostic routine displaying the amperage rating for each section of the kiln. If the kiln is not equipped with the optional current sensor all amperage readings will be zero.

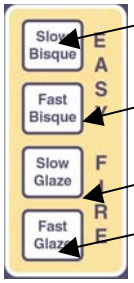
-Press **8** while firing to turn On/Off the ability to see which zones are firing by the LED display dots. Dot on the left is the top zone, dot in the center is the center zone, and the dot on the right is the bottom zone. Don't forget that the dot on the very far right is only on if you are running in Celcius temp scale.

-Press **0** while firing to see how much time has elapsed since the program began

Enter Key – Used to enter or acknowledge numbers and programs

B.6 EASY-FIRE Section

Choose the EASY-FIRE mode you want to use.



Slow Bisque - Used for setting a slow bisque firing profile.
** ~13 hours to fire to cone 04.**

Fast Bisque - Used for setting a fast bisque firing profile.
** ~10 hours to fire to cone 04.**

Slow Glaze - Used for setting a slow glaze firing profile.
** ~7 hours to fire to cone 04.**

Fast Glaze - Used for setting a fast glaze firing profile.
** ~4 hours to fire to cone 04.**

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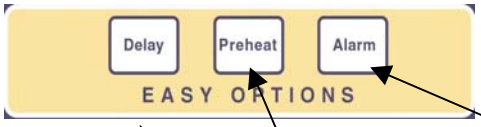
B.7 EASY-OPTIONS Section

Choose the EASY options (Delay Time, Preheat Time, Alarm)



Alarm – Used to sound an audible alarm at a temperature that you specify. Pressing the **Alarm** key while firing will allow the reprogramming of the alarm to either a low or high temperature alarm.

Preheat – Used to put in a preheat time at 200F to allow the ceramic work to dry out completely.

Delay – Used to delay firing until you want the program to start

APPENDIX C

TERMS AND ABBREVIATIONS

Celsius - a temperature scale in which 0° is the freezing point and 100° the boiling point of water. Also called centigrade.

centigrade - a temperature scale in which 0° is the freezing point and 100° the boiling point of water. Also called Celsius.

cone - a pyramid shaped ceramic composite which bends and melts in the kiln to indicate the amount of heat work which has taken place in the kiln.

default – (or default settings) These are the settings that the Dynatrol comes programmed with from the factory. Using the Reset feature will return the Dynatrol to it's default settings.

final set point – in an all heating program with no cooling segments this would be the maximum temperature the kiln was programmed to reach. If there are programmed cooling or holding segments then the last segment's programmed set point is the final set point.

profile - A series of segments which define how the kiln temperature is to proceed through the firing. This is sometimes referred to as a program.

ramp-hold - A firing profile in which the temperature is programmed to increase to a specific temperature, hold for a period of time then repeat this sequence until a final temperature is reached.

segment - One unit of programming. Each segment on this control has a ramp (Deg per hour), a final set point temperature and a hold time.

set point – the target temperature within a programmed segment.

T/C or **t/c** - Abbreviation for thermocouple.

thermocouple (abbreviated **T/C** or **t/c**) - Temperature measurement sensor made of two dissimilar metals which are joined at one end; the end where they are joined is the temperature measuring end. The RED wire is always the negative lead in a thermocouple.

witness cone - a ceramic cone which bends to indicate the heat work which has been done.

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APPENDIX D

DISPLAY MESSAGES (in alphabetical order)

ALRM - **Alarm**. When ALRM flashes in the display, an alarm temperature between 0° and 9999° may be entered. When the alarm is set to 9999°, it is turned off.

bd T - **Board Temperature**. Indicates the temperature of the Dynatrol's electronics (see Control Precautions).

°C1, °C1, °C1, through °C 8, Degrees Celsius temperature. In the VARY-FIRE Mode with the Celsius temperature scale selected, the controller is waiting for an end temperature to be entered for the segment. The numbers stand for the segment which is being programmed.

CHG° - **Change degrees -** When CHG° is displayed, press **ENTER** to select the temperature scale you would like to use, either Fahrenheit (°F) or Celsius (°C). The **1** key will toggle between °F and °C. When the scale you want to use is displayed, press **ENTER**.

CNOS - **Cone offset**. Press **ENTER** to adjust an individual cone shut off temperature plus or minus 50°F.

CONE - **Cone number**. When **CONE** is displayed, a cone number between 022 and 10 must be entered. This will be found in the Cone Table or the " EASY-FIRE" Mode.

°COS - **Degrees Centigrade offset** – seen when a Cone Offset or a Thermocouple offset is being programmed.

CPL - **Complete**. Indicates programming or some programming function is complete.

CPLT - **Complete**. Indicates a firing has been completed.

Decimal Point displayed in lower right-hand corner of display The temperature is displayed in degrees Celsius (°C).

Decimal Point displayed in center of display between 10's and 100's. A time in hours and minutes is being displayed.

dELA - **Delay**. Indicates the time in hours and minutes before the start of firing.

DIAG - **Diagnostics**. Located in the Hidden "Other" Menu. Pressing **ENTER** here turns zone 1's elements on for a few seconds followed by zone 2's elements, then zone 3's elements. A powered bottom will stay on during all three zone's test. If the kiln is improperly put together it will become apparent now.

ERCd. **Error Codes**. When ErCd is displayed, press enter to turn the Error Code function on or off. This function is located by pressing **Other** in the OPTIONS Section.

E A **Error**. Indicates a software error has occurred. The error codes are listed in **APPENDIX.**

E E. Software Error. Indicates a software error has occurred. Contact L&L Service. The error codes are listed in **APPENDIX.**

E 0, E 1, E 2 through E 8 means **Error**. An error has occurred; the error codes are listed in **APPENDIX.**

ErrP (flashing)- **Power Outage Error**. This is displayed during a firing if power to the kiln has been interrupted for less than a couple minutes, depending how far along in the firing you are. The error codes are listed in **APPENDIX.**

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°F1, °F2, °F3 through °F8 In the VARY-FIRE Mode with the Fahrenheit temperature scale selected, the controller is waiting for an end temperature to be entered for the segment. The numbers stand for the segment which is being programmed.

°FOS - **Degrees Fahrenheit Offset** – seen when a Cone Offset or a Thermocouple offset is being programmed.

FAIL - **Thermocouple Failure**. The thermocouple is not connected to the controller or there may be a break in one of the thermocouple lead wires. If the thermocouple wire is broken, it must be replaced. When connecting the thermocouple, SEE THE COLOR CODING INFORMATION in Section 1.0 (Control Cautions).

FAN1, FAN2, FAN3, through FAN8. This message will appear during programming in the VARY-FIRE mode only after OP C (option C in the hidden "other" menu) has been chosen. "FAN" refers to your powered bottom (if you have one), and the number is the number of the segment you are currently programming. The powered bottom (FAN) can be programmed to be ON or OFF in each segment of the VARY-FIRE program.

F-bC **Fast Bisque**, One of the EASY-FIRE programs

F-GL **Fast Glaze**, One of the EASY-FIRE programs

HOLd or HLd - **Hold**. Indicates the holding time in hours and minutes at the end of a " EASY-FIRE" program. OR it may mean that you have just chosen the Preheat option and now the Dynatrol is asking how much hold time in the preheat setting you want to have.

HLd1, HLd2, HLd3 through HLd8 In the VARY-FIRE Mode the controller is waiting for a soak or hold time in hours and minutes to be entered for the segment. The numbers stand for the segment which is being programmed.

Id – **Identification.** Allows you to identify a particular control for use with KISS computer software.

IdLE **and Temperature – Flashing** The kiln is <u>off,</u> and the current temperature in the kiln is displayed. The Dynatrol is programmed to run using only one thermocouple.

IdLE, TC2**, and the current temperature flashing**- The kiln is <u>off,</u> and the current temperature in the kiln at thermocouple #2 is displayed. The Dynatrol is programmed to run using either two or three thermocouples.

NOTC **- Number of thermocouples.** Located in the Hidden "Other" Menu. Pressing **ENTER** here allows you to choose how many thermocouples (essentially how many zones) are in the kiln.

OFF. Press **ENTER** when displayed to turn the Error Codes, the Autolag, a Powered Bottom, or the "shut off" feature Off. Pressing the **1** key toggles between On and OFF.

ON (no dashes). Press **ENTER** when displayed to turn the function you are programming on. Pressing the **1** key toggles between On and OFF.

-On- (displayed with dashes). Displayed for about 10 to 15 seconds when the **START/STOP** button is pressed to begin a firing. The heating elements of the kiln will not begin heating until -On- disappears and the current kiln temperature is displayed. NOTE: Pressing any key besides **START/STOP** while -On- is displayed, will stop the firing. Pressing **START/STOP** after –ON- goes away will stop the firing.

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OPA. **Option A**. DO NOT PRESS ENTER HERE. This option is not used with L&L's kiln systems.

OPB. **Option B**. DO NOT PRESS ENTER HERE. This option is not used with L&L's kiln systems.

OPC. **Option C**. Located in the Hidden "Other" Menu. Allows you to turn the powered bottom on or off in each segment of the VARY-FIRE mode.

PCT. **Percent**. Located in the Hidden "Other" Menu. You can set how often your powered bottom comes on based on a percent of when the bottom zone comes on.

PF. **Power Failure**. PF indicates the power to the kiln has been interrupted for a long enough time to effect the current firing. The kiln has shut down and the firing must be restarted.

PId. Located in the Hidden "Other" Menu. Pressing **ENTER** when you see this allows you to program a setting to help a heavily or unevenly loaded kiln fire faster.

RA1, RA2, RA3 through rA8 In the VARY-FIRE Mode the controller is waiting for an ramp temperature rise per hour to be entered for the segment. The numbers stand for the segment which is being programmed. The temperature is in °F/hr or °C/hr whichever has been selected. If °C has been selected, there will be a decimal point in the lower right-hand corner of the display.

RSET **Reset**. Press **Other** until rSEt is displayed. Then press **ENTER**. IDLE will be displayed indicating that the the Error Checking is ON. This is the Default settings.

16-S. **Sixteen step program option.** VARY-FIRE profile #5 must have been chosen, and now the Dynatrol must be told whether to automatically fire VARY-FIRE profile #6 immediately after the ending of #5 (16-S set to ON) or not (16-S set to OFF).

SAFT. **Saftey option.** DO NOT PRESS ENTER HERE. This option is not used with L&L's kiln systems

S-bC **Slow Bisque**. One of the EASY-FIRE programs

S-GL **Slow Glaze**, One of the EASY-FIRE programs

SEG. **Segment**. When SEG is displayed, the number of desired segments for a VARY-FIRE program should be entered.

SHTO. Located In the Hidden "Other" Menu. Set to either ON or OFF. Lets you choose between firing styles where:ON means that as soon as the hottest zone gets to the segment's set point the entire kiln switches to either the "hold time" or the next segment. OFF means that the Dynatrol will not let the hottest zone's temperature rise until the average temperature of the three zones reaches that segment's set point. Then the kiln can begin the "hold time" or the next segment.

STOP - **Stop**. Indicates firing has been stopped. Also may be displayed when the controller is first turned on. Also used like CPL with some functions.

USER. When USEr is displayed, one of the 6 user programs may be selected or programmed.

SSTP. **Skip Step**. Press **Review Seg, ENTER, ENTER** to skip to the next ramp segment in a VARY-FIRE program. Skip Step is not available with a EASY-FIRE program.

TCOS **Thermocouple offsets**. This is used to raise or lower the temperature indicated by any of the thermocouples. The maximum offset is 50°F. A positive offset is entered with 00 preceding the amount of offset and a negative offset is preceded with 90. This is the same as is done for entering

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cone offsets. When TCOS is displayed, press **ENTER** and TC1 will be displayed. Press enter and the current offset for the top thermocouple will be displayed. Press **ENTER** when the correct offset for the top thermocouples is displayed and then TC2 will be displayed. Repeat the process for TC2 and TC3.

Temperature - Continuously displayed The kiln is on (in either a VARY-FIRE or a EASY-FIRE program), and the current temperature in the kiln is displayed. The Dynatrol is programmed to run using only one thermocouple.

TC2 **and the current temperature flashing**- The kiln is on (in either a VARY-FIRE or a " EASY-FIRE" program), and the current temperature in the kiln at thermocouple #2 is displayed. The Dynatrol is programmed to run using either two or three thermocouples.

Time - Decreasing A delay start is in effect for a VARY-FIRE or a EASY-FIRE program. The time remaining before the kiln starts to heat is displayed.

Time - Temperature alternately flashing. The kiln is in either a hold phase of a VARY-FIRE segment or a hold phase at the end of an EASY-FIRE Profile. The numbers displayed are the remaining time and the current kiln temperature.

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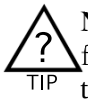
APPENDIX E

EASY-FIRE TEMPERATURE PROFILES

These charts tell what the EASY-FIRE programs do to your kiln when you choose one of them. These charts will also be good reference points for writing your own programs in the VARY-FIRE mode. These charts are for cones 07 through 04 and cones 5, 6, 7, and 10. Other cone numbers will work as well in your own programs.



NOTE: No delays, preheats. or final soaks are shown. When these programs are fired the actual final temperatures will vary as the Dynatrol adjusts itself based on how quickly it is climbing to that final temperature. This would not be the case for VARY-FIRE programs that you develop and input yourself. Also note that all these programs end on segment 7 rather than start on segment 1. This is due to the way the Orton feature works in the EASY-FIRE mode and is not relevant to your own programming in the VARY-FIRE mode. (Segment #7 in the EASY-FIRE mode is a special segment that incorporates the Orton software and so it must be the last segment of every " EASY-FIRE" profile). Start your VARY-FIRE profiles on segment 1.

NOTE: All the programs shown are written to accommodate the fastest possible empty kilns. THE NUMBERS DO NOT REPRESENT TYPICAL KILN FIRING TIMES WITH A LOAD. Your kiln can take considerably longer (as much as 4 times) to fire than the times shown here.

CONE 07

Slow Bisque Firing Profile for cone			**07**	**1787°F**		**Slow Glaze** Firing Profile			
Segment	Rate°F /hr	Temperature °F	Hold	Time in Hours	Segment	Rate°F /hr	Temperature °F	Hold	Time Hours
3	80	250		2.25	5	150	250		1.20
4	200	1000		3.75	6	400	1537		3.22
5	100	1100		1	7	120	1787*		2.08
6	180	1537		2.43					
7	80	1787*	0	3.13				0	
			Total	12.55				Total	6.50
	Fast Bisque Firing Profile					**Fast Glaze** Firing Profile			
Segment	Rate°F /hr	Temperature °F	Hold	Time in Hours	Segment	Rate°F /hr	Temperature °F	Hold	Time Hours
3	120	250		1.50	6	570	1537		2.57
4	300	1000		2.50	7	200	1787*		1.25
5	150	1100		0.67					
6	180	1537		2.43					
7	108	1787*	0	2.31				0	
			Total	9.41				Total	3.82

*This final set point temperature is based on the specific rate of rise programmed for the last segment. If the rate of rise changes (for instance if the kiln goes slower than the programmed rate of rise because of a heavy load or aging elements) then the final set point temperature will be recalculated by the control. This maintains the "heat-work". The faster the rate of rise in the final segment, the higher the set-point temperature needs to be to get the same "heat-work". Inversely, the slower the rate of rise the lower the set-point temperature needs to be.

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CONE 06

Slow Bisque Firing Profile for cone			**06**	**1819°F**		**Slow Glaze** Firing Profile			
Segment	Rate°F /hr	Temperature °F	Hold	Time in Hours	Segment	Rate°F /hr	Temperature °F	Hold	Time Hours
3	80	250		2.25	5	150	250		1.20
4	200	1000		3.75	6	400	1569		3.30
5	100	1100		1	7	120	1819*		2.08
6	180	1569		2.61					
7	80	1819*	0	3.13				0	
			Total	12.73				Total	6.58
	Fast Bisque Firing Profile					**Fast Glaze** Firing Profile			
Segment	Rate°F /hr	Temperature °F	Hold	Time in Hours	Segment	Rate°F /hr	Temperature °F	Hold	Time Hours
3	120	250		1.50	6	570	1569		2.63
4	300	1000		2.50	7	200	1819*		1.25
5	150	1100		0.67					
6	180	1569		2.61					
7	108	1819*	0	2.31				0	
			Total	9.59				Total	3.88

CONE 05

Slow Bisque Firing Profile for cone			**05**	**1891°F**		**Slow Glaze** Firing Profile			
Segment	Rate°F /hr	Temperature °F	Hold	Time in Hours	Segment	Rate°F /hr	Temperature °F	Hold	Time Hours
3	80	250		2.25	5	150	250		1.20
4	200	1000		3.75	6	400	1641		3.48
5	100	1100		1	7	120	1891*		2.08
6	180	1641		3.01					
7	80	1891*	0	3.13				0	
			Total	13.13				Total	6.76
	Fast Bisque Firing Profile					**Fast Glaze** Firing Profile			
Segment	Rate°F /hr	Temperature °F	Hold	Time in Hours	Segment	Rate°F /hr	Temperature °F	Hold	Time Hours
3	120	250		1.50	6	570	1641		2.75
4	300	1000		2.50	7	200	1891*		1.25
5	150	1100		0.67					
6	180	1641		3.01					
7	108	1891*	0	3.13				0	
			Total	10.81				Total	4

*This final set point temperature is based on the specific rate of rise programmed for the last segment. If the rate of rise changes (for instance if the kiln goes slower than the programmed rate of rise because of a heavy load or aging elements) then the final set point temperature will be recalculated by the control. This maintains the “heat-work”. The faster the rate of rise in the final segment, the higher the set-point temperature needs to be to get the same “heat-work”. Inversely, the slower the rate of rise the lower the set-point temperature needs to be.

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CONE 04

Slow Bisque Firing Profile for cone			**04**	**1926°F**		**Slow Glaze** Firing Profile			
Segment	Rate°F /hr	Temperature °F	Hold	Time in Hours	Segment	Rate°F /hr	Temperature °F	Hold	Time Hours
3	80	250		2	5	150	250		1
4	200	1000		4	6	400	1676		4
5	100	1100		1	7	120	1926*		2
6	180	1676		3					
7	80	1926*	0	3				0	
			Total	13				Total	7
	Fast Bisque Firing Profile					**Fast Glaze** Firing Profile			
Segment	Rate°F /hr	Temperature °F	Hold	Time in Hours	Segment	Rate°F /hr	Temperature °F	Hold	Time Hours
3	120	250		2	6	570	1676		3
4	300	1000		3	7	200	1926*		1
5	150	1100		1					
6	180	1676		3					
7	108	1926*	0	2				0	
			Total	11				Total	4

CONE 5

Slow Bisque Firing Profile for cone			**5**	**2165°F**		**Slow Glaze** Firing Profile			
Segment	Rate°F /hr	Temperature °F	Hold	Time in Hours	Segment	Rate°F /hr	Temperature °F	Hold	Time Hours
3	80	250		2.25	5	150	250		1.20
4	200	1000		3.75	6	400	1915		4.16
5	100	1100		1	7	120	2165*		2.08
6	180	1915		4.43					
7	80	2165*	0	3.13				0	
			Total	14.66				Total	7.44
	Fast Bisque Firing Profile					**Fast Glaze** Firing Profile			
Segment	Rate°F /hr	Temperature °F	Hold	Time in Hours	Segment	Rate°F /hr	Temperature °F	Hold	Time Hours
3	120	250		1.50	6	570	1915		3.24
4	300	1000		2.50	7	200	2165*		1.25
5	150	1100		0.67					
6	180	1915		4.53					
7	108	2165*	0	2.31				0	
			Total	11.51				Total	4.49

*This final set point temperature is based on the specific rate of rise programmed for the last segment. If the rate of rise changes (for instance if the kiln goes slower than the programmed rate of rise because of a heavy load or aging elements) then the final set point temperature will be recalculated by the control. This maintains the “heat-work”. The faster the rate of rise in the final segment, the higher the set-point temperature needs to be to get the same “heat-work”. Inversely, the slower the rate of rise the lower the set-point temperature needs to be.

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CONE 6

Slow Bisque Firing Profile for cone			**6**	**2199°F**		**Slow Glaze** Firing Profile			
Segment	Rate°F /hr	Temperature °F	Hold	Time in Hours	Segment	Rate°F /hr	Temperature °F	Hold	Time Hours
3	80	250		2.25	5	150	250		1.20
4	200	1000		3.75	6	400	1949		4.25
5	100	1100		1	7	120	2199*		2.08
6	180	1949		4.72					
7	80	2199*	0	3.13				0	
			Total	14.85				Total	7.53
	Fast Bisque Firing Profile					**Fast Glaze** Firing Profile			
Segment	Rate°F /hr	Temperature °F	Hold	Time in Hours	Segment	Rate°F /hr	Temperature °F	Hold	Time Hours
3	120	250		1.50	6	570	1949		3.30
4	300	1000		2.50	7	200	2199*		1.25
5	150	1100		0.67					
6	180	1949		4.72					
7	108	2199*	0	2.31				0	
			Total	11.70				Total	4.55

CONE 7

Slow Bisque Firing Profile for cone			**7**	**2228°F**		**Slow Glaze** Firing Profile			
Segment	Rate°F /hr	Temperature °F	Hold	Time in Hours	Segment	Rate°F /hr	Temperature °F	Hold	Time Hours
3	80	250		2.25	5	150	250		1.20
4	200	1000		3.75	6	400	1978		4.32
5	100	1100		1	7	120	2228*		2.08
6	180	1978		4.88					
7	80	2228*	0	3.13				0	
			Total	15				Total	7.60
	Fast Bisque Firing Profile					**Fast Glaze** Firing Profile			
Segment	Rate°F /hr	Temperature °F	Hold	Time in Hours	Segment	Rate°F /hr	Temperature °F	Hold	Time Hours
3	120	250		1.50	6	570	1978		3.35
4	300	1000		2.50	7	200	2228*		1.25
5	150	1100		0.67					
6	180	1978		4.88					
7	108	2228*	0	2.31				0	
			Total	11.86				Total	4.60

*This final set point temperature is based on the specific rate of rise programmed for the last segment. If the rate of rise changes (for instance if the kiln goes slower than the programmed rate of rise because of a heavy load or aging elements) then the final set point temperature will be recalculated by the control. This maintains the “heat-work”. The faster the rate of rise in the final segment, the higher the set-point temperature needs to be to get the same “heat-work”. Inversely, the slower the rate of rise the lower the set-point temperature needs to be.

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CONE 10

Slow Bisque Firing Profile for cone			**10**	**2345°F**		**Slow Glaze** Firing Profile			
Segment	Rate°F /hr	Temperature °F	Hold	Time in Hours	Segment	Rate°F /hr	Temperature °F	Hold	Time Hours
3	80	250		2	5	150	250		1
4	200	1000		4	6	400	2095		5
5	100	1100		1	7	120	2345*		2
6	180	2095		6					
7	80	2345*	0	3				0	
			Total	16				Total	8
	Fast Bisque Firing Profile					**Fast Glaze** Firing Profile			
Segment	Rate°F /hr	Temperature °F	Hold	Time in Hours	Segment	Rate°F /hr	Temperature °F	Hold	Time Hours
3	120	250		2	6	570	2095		4
4	300	1000		3	7	200	2345*		1
5	150	1100		1					
6	180	2095		6					
7	108	2345*	0	2				0	
			Total	13				Total	5

*This final set point temperature is based on the specific rate of rise programmed for the last segment. If the rate of rise changes (for instance if the kiln goes slower than the programmed rate of rise because of a heavy load or aging elements) then the final set point temperature will be recalculated by the control. This maintains the “heat-work”. The faster the rate of rise in the final segment, the higher the set-point temperature needs to be to get the same “heat-work”. Inversely, the slower the rate of rise the lower the set-point temperature needs to be.

APPENDIX G

ERROR CODES

Error Code	**Description**	**Quick View** NOTE: “>” means greater than, “<” means less than
E 0 RPCN	Software Error. Recheck the selected program, and reprogram if necessary. You may have to contact the L&L for new software.	
E 1	The temperature is increasing less than 12 degrees per hour during a ramp segment, where the temperature is programmed to increase. This slow rate must persist for 22.5 minutes before the error is displayed. This can be caused by low power to the kiln, aged elements, etc. See the kiln Troubleshooting Guide to check for all the things that could cause slow heat up. It is one of the most common error codes. Try running the kiln with the error codes turned off. Note that Err1 is only a possibility during a ramp.	Ramp segment Temp. increase < 12°F/hr Persists > 22.5 min.
E 2	During a hold segment the temperature rises to greater than 50 degrees above the hold temperature which was set. The temperature must stay 50 degrees above this set temperature for 18 seconds before the error is displayed.	Hold segment 50°F above set temp. Persists > 18 sec.

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E 3	During a hold segment the temperature is more than 50 degrees below the hold temperature which was set. The temperature must stay 50 degrees below this set temperature for 18 seconds before the error is displayed.	Hold segment 50°F below set temp. Persists > 18 sec.
E 4	The temperature is more than 50 degrees above the set-point during a ramp segment where the temperature is programmed to decrease. The temperature must stay 50 degrees above this set temperature for 18 seconds before the error is displayed.	Decreasing Ramp segment 50°F above last hold temp. Persists > 18 sec.
E 5	The temperature is more than 50 degrees below the local setpoint temperature during a ramp segment where the temperature is programmed to decrease. The temperature must stay 50 degrees below this set temperature for 18 seconds before the error is displayed.	Decreasing Ramp segment 50°F below local setpoint temp. Persists > 18 sec.
E 6	A Negative temperature is displayed. This generally indicates the thermocouple is connected incorrectly. To correct this situation, ensure the red and yellow wires are connected correctly to the controller and at all junctions. You can identify the red lead on an unmarked thermocouple with a magnet because a magnet will be attracted to the red lead.	(-) displayed
E 7	The temperature is more than 50 degrees above the local setpoint temperature during a ramp segment where the temperature is programmed to increase. The temperature must stay 50 degrees above this set temperature for 18 seconds before the error is displayed.	Increasing Ramp segment 50°F above local setpoint temp. Persists > 18 sec.
E 8	When using the EASY-FIRE Mode, the temperature is decreasing during the last ramp segment. This could indicate that (if provided on your kiln) that a kiln sitter has turned the kiln off or that the lid was up or the peepholes open or some other physical thing is causing the kiln to decrease in temperature.	Cone fire mode only Temp. decreasing during last ramp segment
E 9	There is amismatch between the thermocouple type selected in the software and the jumper for the thermocouple type. See section 4.4.12 to correct. (Also see section 1.0 about thermocouple extension wire).	
E 22	E-22 appears if one of the thermocouple's connection wires is reversed- i.e. the red wire is where the yellow wire is, and the yellow wire is where the red wire is. When the wires are reversed on a thermocouple circuit the temperature it reads actually falls rather than rises as the thermocouple is heated. Eventually this leads to it's reading a negative number and this trips the error code. E-22 is the same as E--6. To fix it first look for which thermocouple reading is falling while the kiln is heating up. Press 1,2,3 while it is running to see the different thermocouple temperatures. 1 is always the top, 3 is the bottom. 2 is the bottom on a two section kiln. Then unplug the kiln and open the control cover and follow the wires for whichever thermocouple was falling. Look for where the wire's colors are reversed; at each connection it is red to red, and yellow to yellow. If all looks well, the thermocouple itself is probably flipped in the ceramic thermocouple connection block. Remove that thermocouple's mounting screws and washers. Loosen the two center screws on the thermocouple connection block. Pull the block off, turn the two heavy wires of the thermocouple itself over and slide the connection block back on. Retighten the two center screws and remount. Test it to see if that fixed it.	
PF	Continuous PF in display. Indicates a long term power outage. The kiln has been shut down. Press **1** to clear the display.	

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ERRP	ErrP and the current temperature are alternately flashing. To clear the display, press the **1** key. If a firing was in progress, the kiln will continue to fire even though this message is flashing. This error can also happen as a result of RF noise that resets the microprocessor. If this is suspected, the control panel should be returned to L&L for testing and possible modification.	
E d	This is "Error Difference." Errd indicates that a difference of more than a 100 degrees has been detected between any of the thermocouples and the set point. When Errd is displayed the firing will be terminated. Errd will not be detected if the error codes (ErCd) have been turned off. The reason for having Errd is to insure against a case where, for instance, the top (tC1) and bottom (tC3) thermocouples have been inadvertently switched. In such a case the top thermocouple (tC1), while placed in the bottom section, could be calling for heat and the heat will be delivered to the bottom of the kiln causing a grossly uneven firing. The first thing to test, if you have this error code, is that the thermocouples are placed in the proper sections. To do this take each thermocouple out (while the kiln is cold) and heat it with a match while pressing the 1, 2, or 3 button on the control to read the appropriate thermocouple. Top should be #1, Middle should be #2 and Bottom should be #3. Another potential cause of this error code could be the sections stacked in the wrong order, or plugged into the control's receptacles in the wrong order. If not this, a bad element in one of the sections. Check to see if the elements are firing. Check resistance on the elements (see the troubleshooting guide or the general kiln instructions or contact L&L for information on this). Another possibility is a bad contactor or bad receptacle or loose wire. Using a digital multi-meter that allows you to test voltage in an outlet and resistance in a circuit (available from any good electronics or hardware store) you, your electrician, or your local kiln distributor can see whether a circuit is actually delivering power to the receptacles on the control box, and exactly what the resistance of your elements are.	
E E	A hardware error has been detected by the controller software. The controller must be returned for service.	Hardware error

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APPENDIX G

HOW THREE ZONE CONTROL IS USED ON A TWO, FOUR AND FIVE SECTION KILN AND WITH A POWERED BOTTOM

On kilns with four heating sections the center two heating sections are tied together as one center zone. On kilns with five heating sections the center three heating sections are tied together as one center zone. Each section still has its own separate contactor, but the center zone control output controls one contactor on a three section kiln, two contactors on a four section kiln and three contactors on a five section kiln. We suggest placing the center zone thermocouple (TC2) in either of the two middle sections on a four section kiln and in the center section on a five section kiln. You can of course experiment to achieve optimal results.

Kilns with two zones typically use inputs (thermocouples) and outputs (receptacles) 1 and 2 even though we usually have a third unused circuit on the control. If you add a section you may want to enable the three zone control (see the section on programming) and possibly add a thermocouple. On kilns with powered bottoms the powered bottom is controlled off the bottom zone control output. This would be the case of a kiln with three or more sections. In the case of a two section kiln with a powered bottom the powered bottom is controlled off the center zone control (TC2). This acts as a two zone kiln.

APPENDIX H

FREQUENTLY ASKED QUESTIONS

H.1 During programming of a firing, I typed a wrong number. How do I correct this?

Before pressing **ENTER,** enter zero until all zeros are displayed, then enter the correct number. If you have already pressed **ENTER,** you must continue to enter the rest of the program as you would have, then you must start over again to program properly, fixing your mistake this time around..

H.2 How do I clear the ERRP/ PF from the display?

Press the **"1"** key. After several seconds the current temperature will be displayed. The amount of time the last firing took or STOP may be displayed before the current temperature. If the ERRP/ PF message is flashing with the alternate display being the temperature then it means that the kiln is still firing after a brief power interruption.

H.3 I am getting the E d message. What is wrong?

More than likely the kiln was set up improperly. NOTE: It is absolutely necessary to match the proper ring with the proper control box outlet and proper thermocouple. If these are mismatched the kiln will not operate properly and you will get the E d display showing that one of the zones is way off set point. Thermocouples, cords and receptacles are all marked for identification. The top zone ring, outlet and thermocouple are all marked #1. In three ring kilns the middle zone is #2 and the bottom is #3. In four ring kilns the middle zone is #2 and #3; the bottom is #4. In five ring kilns the middle is #2, #3 and #4 and the bottom is #5. You can easily test to make sure the thermocouples are properly located by putting a match to one at a time and checking the temperature rise on the control for that thermocouple.

H.4 I am getting the E 1 message. What is wrong?

This is the most common error message. It means the kiln is rising in temperature too slowly and can be caused by a variety of things. In older kilns it is probably a result of elements being aged or one or more elements not firing for some reason. The first thing to check is element resistance and continuity. See our troubleshooting guide for details. If this happens in a newer kiln it is still a good idea to check the elements. One problem we have found is that the thermocouple lead wire was

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pinched and was creating a short circuit (meaning that the controls was reading whatever temperature was at the pinched point and so, as far as the control was concerned, the kiln wasn't heating up. The way to test for such a condition is first of all to observe that the control is showing a temperature that is greatly different than what you can tell is in the kiln. The other better way is to disconnect the thermocouple and see if the display says FAIL. If it does then it means there is no short circuit in the thermocouple circuit. This could also happen with a burned thermocouple connection wire (say if the yellow wire touched the kiln case and the wire insulation burned off). Note that Err1 is only a possibility during a ramp. A common problem is that one of the sections is lagging. Try to find out which section is lagging. If it is the bottom (fairly typical) you could try a 2" layer of calcium silicate under the kiln bottom (this is very inexpensive insulation that is quite hard and non-compressible) or even another brick bottom. If you are using a vent try turning it off towards the high end of the firing cycle. (NOTE: This is OK to do on an L&L Vent-Torr but with some bottom mounted vents you are not supposed to do this or you will burn up the motor). Make sure your peepholes are closed at high fire.. Make sure kiln is loaded evenly, more in the bottom of the kiln than the top will make it fire very slowly also. One last thing to consider is the voltage available to the kiln when it is on and running. Get an electrician to check this at the kiln and be sure it comes pretty close to the kiln's label. Low voltage can cause slow heat ups and voltage lower than 208VAC can also cause problems with the microprocessor in the Dynatrol as well.

H.5 My kiln takes longer to fire than I think it should.
See suggestions above in E 1 troubleshooting.

H.6 My program takes longer to complete than I expected. What is happening?
The controller actually accomplishes the temperature rise by establishing what's called a traveling set point. The traveling set point is set by the controller at the initial kiln temperature, and it is increased (or decreased) at a rate equal to the ramp rate you have chosen. Anytime the kiln temperature is below this traveling set point the heating elements of the kiln are turned on. If the temperature is above the traveling set point the heating elements are turned off. When both the traveling set point and the average of the measured temperatures reach the first soak temperature, the hold phase begins or the next ramp rate begins. (That is called a guaranteed soak). It means that a program might take longer than the theoretical time you have programmed into it.

H.7 My kiln seems to be much hotter than the thermocouples indicate. Or the kiln seems to be going to slow (by the readings on the controller).
This could be serious. Check to see that the thermocouples are inserted at least 1 to 1-1/2" into the kiln. If the tips of the thermocouples are buried in the kiln wall insulation they will obviously read at a lower temperature than the inside of the kiln. **THIS COULD LEAD TO AN OVERFIRING OF THE KILN!** Another possibility is that there is a short circuit in the thermocouple lead wire. See the above Err1 question to check the thermocouple circuit.

H.8 Is there a guaranteed soak?
Yes. This means that if the kiln does not reach temperature in the time you assign in a ramp it will not start the hold portion of that segment until the kiln reaches the set point temperature. This also means that the actual time to fire may take longer than you have programmed into the kiln (if it takes longer to get to a particular temperature than you think it ought to take).

H.9 I turned on the controller and FAIL is displayed. What does this mean?
One or more of the thermocouples are not connected to the controller. When connecting the thermocouple, connect the negative wire (on Type K in non-European kilns this is RED) to the connector with the negative (minus) sign under it. Connect the positive wire (on Type K non-European kilns this isYELLOW) to the connector with the positive (plus) sign under it. (See Section 1.0 for information on Type S and European kilns). Also there may be a break in one of the thermocouple lead wires, if so, the thermocouple lead wire must be replaced. Make sure all

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thermocouple connections are very secure and tight and that there is a direct touching of the thermocouple lead wire with the actual wire inside the thermocouple. (See I.21)

H.10 I keep burning out thermocouples. What is wrong?

Thermocouples, like elements are a consumable item. They will burn out over time. If you are firing to high temperatures (Cone 5 and above) you should consider either an 8 gauge thermocouple with a ceramic protection tube or Type S thermocouples. A reduction atmosphere (the lack of enough oxygen in the kiln to thoroughly burn off all impurities) attacks elements and thermocouples. Speedy firings especially as the kiln climbs to 1100°F, will not give enough time to burn out these impurities. This is made worse if there is no ventilation to the kiln. An open peephole or three may be enough, or a downdraft venting system like L&L's Vent Sure system may be what you need for a good, clean, oxidizing atmosphere.

H.11 How can I find out the final temperature which was reached during a cone firing?

At the end of an EASY-FIRE firing, the current kiln temperature and CPLT will be alternately flashing in the display. Press **ENTER** or **START/STOP**. Then press **Review Program**, the final temperature will display. This final temperature will be retained until the next firing or until the controller is reprogrammed. In a VARY-FIRE program the Dynatrol will fire to the temperature programmed.

H.12 My kiln underfires, turns off before the DynaTrol reaches its set point .

If you have a Dawson Kiln Sitter as a back up safety device be sure that the cone in it is at least two to three cones higher than your final set point temperature. Remember that, when using the DynaTrol control, the optional kiln sitter is only safety back up controls. You do not want it to actually actuate. If you have a Dawson Kiln Sitter/Timer, be sure the time is set higher than the expected length of your program. See above answer about the kiln sitter safetey control. Also you may need to calibrate; to adjust the cone settings with the cone offset. Note that it is common for thermocouples to "drift" in their readings. As this happens the cone offset or the thermocouple offset can compensate for this. Sometimes fire with witness cones so you can compare what the control did to the actual performance of cones.

H.13 Why use a soak time or make the kiln go slow?

Most ceramics achieves its characteristics not so much by what temperature it reaches but by how much "heat-work" is put into it. A long soak at a lower cone can often develop the bisque or glaze better. In addition a soak period almost always will improve the uniformity of the firing throughout the kiln. A soak period gives the entire load of ware time to absorb the radiant heat that is projected from the elements. If you simply rise to a certain temperature and then shut the kiln off (as is typical of a manual kiln sitter operation) then the center of the kiln may not have had a chance to absorb as much heat as the ware around the perimeter. The same would be true for a thick piece of pottery if it was just heated to a temperature and then cooled. The middle of the piece would never get to the same temperature as the outside of the piece, and in extreme situations, if it was heated very quickly, could cause the piece to explode. You may have experienced the fact that an older kiln, with slow firing elements may in fact have given you better results. This is because the entire kiln has had a chance to even itself out as it approached final cone. A slow heat up will result in "cleaner" bisque. It will give the kiln time to burn out impurities like sulfur and carbon out of the clay. These impurities can cause pitting and other problems when you subsequently glaze the ware if they have not been given sufficient time to burn off during the bisque.

H.14 Can you change a program segment while running a program?

No. You must first Stop the program by hitting **START/STOP**. Then change the program. Then re-start the program. The control will automatically start from where you were previously. For instance if the kiln temperature is at 1200°F and this is segment No 2 it will restart from that point in the program. You can advance to the next segment (in a VARY-FIRE Program). See the directions in under Skip Step in the View Section.

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H.15 When the control flashes TC2 alternating with a temperature does it read that until you toggle to a different thermocouple?

The control is continually reading the temperatures in all three zones. However it only displays one temperature at a time. It does not scroll automatically. To manually scroll to the different thermocouples hit either 1, 2 or 3. The default display is thermocouple #2.

H.16 Is there a lead zone?

No. Each zone is controlled independently with a separate input (each thermocouple), and a separate output (the signal from the Dynatrol to one of the contactors to send or not to send power to the elements. The output of the zones can be quite different. For instance the top zone (#1) may be calling for 75% output while the middle zone (#2) is calling for 35% output while the bottom zone (#3) is calling for 90% output. This percentage is the percent of time that a zone is on, out of the total time elapsed. This is a time proportioning control.

H.17 Is this a time proportioning control?

Yes. The control determines what the percent of output (0-100%) is required to properly heat the kiln. It then converts this into amount of time or and time off that the contactor should be firing. This is different than current proportioning which would send a proportional current to adjust an continually adjustable SCR power control for instance.

H.18 What happens when I turn off the Error Codes?

It is O.K. to do this. However, you will not get certain operator protections which might prevent you from getting a poorly fired kiln. They can be turned off if you are doing special firings, such as jewelry or glass firing where the kiln is left open. This will also turn off the Dynamic Zone Control, and the E d function when the Error Codes are turned off. This turns off most error functions so that kiln is not affected by these built in checks. It eliminates nuisance shut downs but side steps built in “fool proofing”. The only Error codes that this does not turn off are E 6, FAIL, and ErrP/ PF in both the EASY-FIRE and VARY-FIRE modes. In addition E 1 (indicating slow temperature rise) and E 8 (temperature falling) is not turned off in the last segment of an “ EASY-FIRE” program. This is because the built in calculations would make no sense if the kiln were firing too slowly.

H.19 What happens when a thermocouple fails?

If the top (TC1) thermocouple fails then the top (TC1) and middle (TC2) work together from the TC2 thermocouple. If the bottom (TC3) fails then the bottom (TC3) and middle (TC2) work together from the TC2 thermocouple. If the middle (TC2) fails then the top (TC1) and middle (TC2) work together from the TC1 thermocouple.

I.20 One or more of the thermocouples reads FAIL. What is wrong?

One or more of the thermocouple circuits has failed. Chances are this is a bad thermocouple. Even if the thermocouple looks OK there might be a microscopic crack that could fail intermittently. A simple test to see if the problem is in the thermocouple itself or in the thermocouple wire is to do the following: Disconnect the thermocouple from the yellow lead/extension wire that attaches at the cold end of the thermocouple. Touch together the red and yellow leads coming out of the yellow lead/extension wire (note: this is very low milli-voltage and is not dangerous). This will complete the thermocouple circuit and eliminate the actual thermocouple from consideration. Now press the #1 button, If the FAIL message goes away then you know it is a bad thermocouple. If the FAIL message does not go away then the next thing to check is make sure that the thermocouple is properly attached to the connection board on the control. If this looks OK then the yellow extension wire should be replaced or the Dynatrol might have a problem. (See I.9)

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H.21 What is PID and can the PID settings be changed?
PID stands for “Proportional, Integral, Derivative” This is a mathematical calculus function built into the control that proportions the amount of power going to the output device (contactor) as the kiln approaches set point temperature. It is used to prevent overshoot which you would get if the control did not turn off until it reached the set point. The values are fixed and based on average kiln conditions. Because most kiln conditions are fairly similar and the ramps are very slow by most industrial standards not much flexibility needs to be built into the PID constants. There is no “adaptive tuning.” The values for the PID are hard programmed into the control and can not be changed. They are optimized for ceramics. If you are using the control for another application and you find that the control gives you some overshoot try a step in your program that is a very slow ramp for the last few degrees of the program. For instance if you wanted to get to 1800°F without overshoot have the program go to 1775°F and then take 15 minutes to ramp to 1800°F .

NOTE: Do not confuse the PID talked about here with the “PID” setting in the Hidden Other Menu.

H.22 Is there any way to know what the set point actually is?
Yes. Press Review Segment twice while the kiln is firing and the set point will appear.

H.23 What happens if there is a power outage?
If the power outage lasts for less than ½ hour the control should pick up where it left off unless the kiln temperature has dropped more than 250°F or, if it is within 100°F of the end of the firing then only a 100°F drop off is allowed. If the program automatically aborts based on the above logic then it must be manually restarted. If you restart the program, the control will find out where the temperature is and will start from there. If you get a power outage you will see an ErrP or PF error code. This must be reset by hitting any button on the key pad.

H.24 The display is jumpy. What about Thermocouple noise?
The negative lead of the thermocouples are automatically grounded to the safety ground. This typically is able to remove thermocouple noise from the system. Thermocouple noise is typically caused by stray electrical currents induced into the low voltage thermocouple circuits by the kiln elements. It shows up as “jumpy” temperature readings on the control. A little of this is OK but if the readings are very jumpy it can confuse the control. If you see this sort of “jumpiness” check all ground connections involved for tightness and continuity. If the ground is OK and the thermocouples are in the factory provided holes, in your kiln about one and one half inches, then contact L&L or a certified repairman for assistance. NOTE: thermocouples in homemade holes that may be positioned too close to the elements, could receive more of the inductive current generated by the elements, therefore receive more noise (NOTE: In extreme cases L&L can retrofit your control box with a noise suppresser and even wire the box so that the control voltage is feed through a separate 120 volt cord).

H.25 Do thermocouples need to be grounded or ungrounded?
They must be ungrounded thermocouples. Grounded thermocouples will cause problems with this control. The negative leads of the thermocouples are connected to the kiln ground. (See above). Be sure there is only one ground to your kiln. This is normally through the plug or main power connection all the way to the “earth ground”. The control is grounded and RF noise generated in the thermocouples (from the elements and other sources) is drawn into the sheath ground and into the negative lead of the thermocouple and then ultimately out to earth ground.

H.26 Can I overide the end of a firing to gain temperature?
Lets say you just fired a load and you can see through your peephole (looking at a witness cone) that your load did not fire to full maturity. Restart the program with a higher cone value and then manually shut off kiln when the witness cone starts to mature. Use the cone offset feature next time to eliminate this problem before it happens again.

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H.27 I hear the contactors clicking on and off when the kiln is at a low temperature and even though my set point is way above the temperature readings. Why?
The control only allows power for about 1/3 of the time when the kiln temperature is below 500°F. This is because kilns are generally overpowered for these low temperatures and the control would constantly be overshooting any lower temperature set points without this feature.

H.28 What does it mean when the display flashes?
The Dynatrol is trying to give more information than can fit on just one displayed message. Either the message cycles over and over again, like IdLE, TC2, current temperature, or the messages continue to flash by quickly, as in the case of what happens when you press the Review Program button.

H.29 What does CPL mean?
"**CPL**" means that programming an option or a sequence of steps has been completed.

H.30 How do you turn off the audible alarm?
The alarm is an audible signal. You can turn it off (after it turns on) by pressing **ENTER**. Set it for **9999** to disable it.

H.31 How do I get information about my firing?
When the program has completed it will flash CPLT and the time it took to get to temperature. After pressing **STOP** you can press **REVIEW PROGRAM** to get more information about the firing. The display will scroll through the following: the Cone you set it at, the actual temperature that the kiln achieved, what speed you had it set for, and hold time etc. This only works in the EASY-FIRE mode. In the VARY-FIRE mode, if you press **REVIEW PROGRAM** you see what you programmed only. This information will be retained in memory until the control is reprogrammed.

H.32 What ambient temperature conditions do I need for the control?
Do not operate the controller in temperatures above 125°F or below 0°F or 0°C. Actually a little hotter or colder will still be within tolerance of the components. The real component rating is near 160°F . If you are using the Celsius temperature scale 0°C is the lowest operating temperature possible as the Dynatrol thinks a negative temperature displayed is because of a thermocouple installed backwards, not because it could be cold outside. and . (NOTE: The board components are rated for 50°C below zero so the control (and kiln) can be stored outside in a covered area).

H.33 The kiln did not begin soaking when it should have.
The fact that the kiln did not start to soak when its seems like it should could be due to the fact that an average of all the process variables (TC readings) and the traveling set point have to reach set point temperature before the hold begins. Or the dynatrol has computed a higher temp (than you expected it to) to equate to the cone # fired to and the rate of climb… Once it gets to where it determines the cone is , it will begin the hold.

H. 34 The thermocouples seem to be off according to the cones.
If you had an ErrP or PF message while firing, and the kiln temperature went down briefly, the cones may have misrepresented actual temperature for the following reason: If the temperature decreases in the kiln temporarily after the cone begins to form a glass (starts to mature even though it may not be visible) the decrease in temperature could "freeze" the cone and prevent it from operating properly. Cone temperatures also vary according to how quickly the kiln climbs in temperature. Thermocouples do age, sometimes rapidly, and may not read like they used to. Try a cone offset to raise or lower the entire kiln's final temperature for the cone you have programmed. Or try a thermocouple offset if it is just one or two zones that are consistently hotter or cooler than they should be.

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H.35 How do I ramp down?

You must use the VARY-FIRE Mode. The control will change the path of the firing profile in the direction of the next segment's set point. In other words if the current segment has a set point of 500°F and the following segment has a set point of 1000°F then the control will ramp the set point in the "up" direction. Conversely if the current segment has a set point of 1000°F and the next segment has a setpoint of 500°F then the control will ramp the set point in the "down" direction. See the specific instructions in the Programming section under VARY-FIRE.

H.36 Does the control work on 50 HZ?

Yes. The control will work on either 50 Hz or 60 Hz. The electrical cycle does not affect any timing circuits in the control.

H.37 TEMPERATURE READINGS VS CONES

Automatic controls are great tools. *They are not complete tools, however.* They base what they do on electrical signals generated by the thermocouples that get interpreted by the electronic control as specific temperatures. There are four inherent problems with this. First, the thermocouples are only measuring temperature at the very tip of the thermocouple. Typically this is placed an inch or two in from the inside surface of the kiln. The thermocouple is usually not measuring the temperature in the middle of the kiln. Second, there is an inherent error in the thermocouple of a few degrees either way. Third, thermocouples drift in their accuracy over time. Fourth, and perhaps most important, thermocouples only measure temperature. For ceramics you are really interested in "heat-work" or the amount of heat that is absorbed by your ware over time. It is like baking a cake. Absolute temperature is only one factor in the successful baking. For all these reasons we highly recommend the use of witness cones in every firing. These will tell you what really happened in the kiln. We suggest using a set of three witness cones in each zone for the kiln. At the absolute minimum use one witness cone per firing to check basic performance of the kiln and control. Then using this accurate information you can use the many features of the DynaTrol to conform the performance of the control to your exact needs. You may want to try firing the kiln with all the preset programs with witness cones to see just how the type of program affects the cones you will be using. Keep good records and get to know your kiln, the Dynatrol and how the combination of these two things with the kind of ware that you fire all work together. **There is no substitute for experimentation and personal individualized documentation.**

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APPENDIX I

VARY-FIRE DEFAULT PROGRAM'S TEMPERATURE PROFILES

USER 1: Medium Speed Glass Slumping ProfileSegment	Rate	degF	Hold
1	500	250	00:12
2	500	500	00:12
3	500	750	00:12
4	600	1100	00:05
5	600	1220	00:05
6	9999	1000	01:00
7	90	970	01:00
8	120	750	00:01

USER 2: Medium Speed Glass Tack Fuse Profile

Segment	Rate	degF	Hold
1	500	250	00:12
2	500	500	00:12
3	500	750	00:12
4	600	1250	00:20
5	600	1350	00:10
6	9999	1000	01:00
7	90	970	01:00
8	120	750	00:01

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USER 3: Medium Speed Full Fuse Profile

Segment	Rate	degF	Hold
1	500	250	00:12
2	500	500	00:12
3	500	750	00:12
4	600	1250	00:20
5	600	1480	00:15
6	9999	1000	01:00
7	90	970	01:00
8	120	750	00:01

USER 4: Glass Bead Annealing Profile

Segment	Rate	degF	Hold
1	9999	960	08:00
2	9999	960	00:40

USER 5: Lost Wax Burnout Profile

Segment	Rate	degF	Hold
1	9999	300	01:00
2	100	350	00:30
3	350	1350	01:30
4	300	900	99:99

USER 6: Slow Cooling Cycle for Cone 6 Glazes

Segment	Rate	degF	Hold
1	9999	2232	00:00
2	9999	1900	00:00
3	150	1500	00:00

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APPENDIX J
FIRING PROGRAM BLANK

Firing Program Number: _____

Segment	Rate	Temperature	Hold
1			
2			
3			
4			
5			
6			
7			
8			

Firing Program Number: _____

Segment	Rate	Temperature	Hold
1			
2			
3			
4			
5			
6			
7			
8			

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Firing Program Number: _____

Segment	Rate	Temperature	Hold
1			
2			
3			
4			
5			
6			
7			
8			

Firing Program Number: _____

Segment	Rate	Temperature	Hold
1			
2			
3			
4			
5			
6			
7			
8			

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