Programming
Turn Power on, press A/M key (may be labeled R/S)
Upper display (red) will read C01
Use ^ and V keys to set C01(Step 01 temperature) from chart below
Press Set key
Display will now read t01
Use ^ and V keys to set t01(time to reach Step 02 temperature) from chart below
Press Set key
Display will read C02
Continue programing all temperatures and times

Skutt Slow ^04 – all temps in Celsius - 17.25 hours

Step	C (temperature)	t (time in minutes)	Ramp C/Hr
1	21	222	27
2	121	206	121
3	538	151	66
4	704	156	82
5	918	300	27
6	1053	-121 (turn off)	0

Skutt Medium ^04 – all temps in Celsius - 8.9 hrs

Step	C (temperature)	t (time in minutes)	Ramp C/Hr
7	21	64	93
8	121	122	204
9	538	60	82
10	621	121	149
11	923	171	49
12	1063	-121 (turn off)	0

L&L Slow ^06 – all temps in Celsius – 7.9 hrs

Step	C (temperature)	t (time in minutes)	Ramp C/Hr
13	21	90	66
14	121	215	204
15	854	170	49
16	993	-121 (turn off)	0

Key points for programming
C01 with be the ambient (room) temperature. In these examples set at 21C (70F)
t will be the ramp time in minutes to the next step
t for the last step of a program will be -121 which turns the kiln off.
You can add a hold to a step if desired. For example, to add a 5 minute hold to the end of the
L&L Slow ^06 program, Step 16 would be changed to C16=993 t16=05 and Step 17 added
C17=993 t17= -121

Just please consider that this controller's programmed based on the given time, which means if you program it to reach to 500C in 10 minutes, but your kiln doesn't have the power to heat up to 500C in 10 minutes, after 10 minutes the controller will go to the next step (before reaching to the desired temperature). That being said, you need to know the power of your kiln or consider some more time to make sure that you'll reach to the temperature that you need.

Operation
Plug the kiln controller into a power outlet, plug the kiln into the controller
If you have a Kiln Setter – place an appropriate Orton pyrometric bar in the kiln setter, set the timer for more than the anticipated program cycle, set the kiln on high.
Turn the kiln controller on
Press the Set button twice quickly to display the step number
Use the ^ and V keys to select the desired step and press Set to select
In the examples above Step 1 would start the Skutt Slow ^04 program, Step 7 would start the Skutt Medium ^04 program, Step 13 would start the L&L Slow ^06 program
Upper (red) display reads kiln temp in Celsius

Press Set key to display current step
Press Set key twice – red is programmed time for that step. Green is run time for that step
Press and hold V key to hold a step (with kiln on). Press and hold V key to resume the step
Press and hold ^ to stop a program

This is a supplementary manual for the Ramp/Soak controller. It is only for operating the programmable steps (ramp and soak steps) functions. The main manual for the Ramp/Soak is the same as the advanced temperature controller. It covers all the regular set up and operation instructions. The Ramp and Soak series programmable controllers with the ramp/soak option are designed for applications where it is desirable to have the set point automatically adjust itself over time.

1. **Features**
   50 steps of program control for ramping and soaking process.High flexibility in program and operation. It has programmable/maneuverable commands such as jump (for loops), run, hold and stop.The program can even be modified while it is running.The program can also control the two relays that are used for alarms. This feature can be used to notify the operator of the stage of the operation, or to signal other equipment. The safety start and ready function may allows the program to run more efficiently. 6 power-off/power-on event handling (see 3.10) modes can be selected. This can prevent the program control from being adversely affected by unexpected power interruptions.

2. **Terms and Functions**
   Program StEP: The value of the program StEP can range from 1 to 50. The current StEP is the program StEP being executed.
   StEP temperature, CXX: The StEP temperature is the set temperature at the beginning of the step XX (where XX can be any value from 01 to 50).
   StEP time, tXX: The StEP time is the ramping time from the current step temperature to the next step temperature. The unit is in minutes and the available value range is from 1 to 9999.
   Running time: The running time is the time that the current StEP has been running. When the running time reaches the StEP time,the program will jump to the next StEP automatically.
   Jump: The program can jump to any other steps in the range of 1 to 30 automatically as you programmed in the program StEP. It can also be used to perform cycle control. If StEP number is modified, the program will also jump. Furthermore if the program StEP reaches and finishes the 50th StEP, the program will jump back to the first StEP and run automatically.
   Run: When the program is in the "running"status, the timer counts down, and the set point value changes according to the preset ramp curve.
   Hold: When the program is in the "hold"status, the temperature is still controlled, but the timer is paused so the current set point remains.
   Stop: When the stop operation is activated, the program, timer, and output control will stop, and the running time and event output switch will reset. If the "run" operation is activated while the instrument is in the "stop"status, the program will start-up and run from the StEP 1.
   Power interrupt: It means the power has turned off or an unexpected power failure has occurred during running status. 6 handling modes are available to the user. **Event output:** Event output can be programmed in to the controller. It can trigger two alarm relays to make external equipment operate with interlock.

Safety start: If the difference between the PV and SV is larger than the deviation alarm setting at the beginning of a step (or when powered up), the controller will adjust the PV until the alarm is turned off before the timer starts. See 3.10 for example. Page 3/5 3.

3. **Programming**
   3.1 Program Setup Press the R/S key to bring the instrument into the program setup mode; the instrument will display the temperature set point of the current StEP (indicated by "C" in the upper display followed by the StEP number). Use theA/M key to choose which digit to edit (indicated by the flashing decimal point). After adjusting the temperature set point (−1999 to +9999), press theSET key once again, and the current StEP's ramping time will be displayed ("t" in the upper display). In each program StEP, the temperature and the time is displayed in turn. Hold down the A/M key and press V to go back to the previous parameter. Hold A/M and press SET to exit program setup mode. Modifying program steps while a program is running is permitted. See section 4 for a programming example. Note: the above operation is inhibited if the program setup function is locked(refer to 3.11 for the introduction of the LocK parameter).
   3.2 Program Ramp To program a ramp, you need to set the start temperature CXX, the end temperature CXX+1, and the time duration tXX. For example, at step 3, if you want the controller to take 60 minutes to ramp up from 200 to 300 degrees, set C03=200, C04=300, t03=60. Note: Unless the deviation alarms are set to a narrow range, the ramping time decides when the program is going to the next step. Once the ramping time is finished the current step, the controller will execute the next step regardless if the temperature reaches the target temperature. Therefore, the ramp speed should be always lower than the maximum speed that the oven can offer at the full power. In other words, the ramping time should be longer than the minimum time needed for oven to jump from C03 to C04 at full power. If the ramping time is shorter than that, the time programmed for the next step will not be fulfilled. When program a temperature ramps down, you need to consider the speed of natural cooling (or forced air cooling) for the same reason. If the maximum speed of the system is unknown or varies with environmental conditions, users should use the "safety start" function to ensure that the temperature and time during ramping and soaking are kept within a reasonable range required by the process. This is done by setting the deviation alarm close to the SV. At the beginning of a step, the timer will not start until PV is larger than SV-dLAL+dF and smaller than SV+dHAL-dF. e. g. Set dHAL=30, dLAL=20, dF=5 and SV=100. At the beginning of the step, if the temperature is below 85 (SV-dLAL+dF=85) degrees, or above 125 (SV+dHAL-dF=125)degrees,the controller will stop the timer to wait until the temperature is above than 85 degrees or below than 125 degrees before continuing. Please note that the dF value should be smaller than both dHAL and dLAL, Otherwise the controller will not start the next steps.
   3.3 Program Soak The soak can be considered as a special case of ramping. It is a ramp with a zero degree slope. To program a soak, you need to set the start and the end temperature to be the same (CXX=CXX+1), e.g. At step 3, if you want the controller to soak the parts at 200 degrees for 60 minutes, set C03=C04=300, t03=60. Note: The StEP time is not how long the controller will stay at the set temperature for the current step. It is how long the controller will take from the current step temperature set point to the next step temperature set point. These two concepts are very different.

3.4 Program Hold When the program reaches a StEP where the StEP time is set to zero, or when a jumping StEP transitions to another jumping StEP, the program will be set to "hold" status.You can also manually activate hold status by pressing the V key for about 2 seconds until "HoLd" appears in the lower display window.

3.5 Program Stop When the program reaches a StEP where the StEP time is set to -121, the controller will stop running. The StEP number is reset to 1, the event output is cleared,and the control output is turned off.You can also manually execute the stop operation by pressing and holding the key for roughly 2 seconds until the lower display window displays "StoP".

3.6 Run Program In order to continue the program when the controller is in "hold" mode (or restart it from "stop"mode) lower window displays "run".When a program is running,

3.7 StEP Time/Command Parameter When tXX is between 1 and 9999 (min), it is used to set the ramp and soak time. When it is set to zero or a negative number, it is used for executing other commands. tXX=0 The instrument is put in hold mode on StEP number XX until manually released by the operator. tXX=-1 to -240 represents an operation command such as run, hold, stop,jump and event output. The number is calculated according to the equation tXX = -(A*30+B). "B"is the number (ranging from 1 to 30) of the next step for the program to jump to and "A" is the event that is triggered: A=0 no effect (for jump function only) A=1 switch on AL2 A=2 switch on AL1 A=3 switch on AL1 and AL2 A=4 Stop the instrument(B must be set to 1 when A=4) A=5 switch off AL2 A=6 switch off AL2 A=7 switch off AL1 and AL2 Examples: ● Jump from StEP4 to StEP5 and switch on AL2. Time setup is: t04=-(1x30+5)=-35 ● Jump from StEP6 to StEP1 and switch off AL2. Time setup is: t06=-(5x30+1)=-151 ● Stop program at StEP8 Time setup is: t08=-(4x30+1)=-121 The controller does not let a jump command jump to itself(for example: t06=-6) because the Hold status would never be released.

3.8 Displaying and modifying the running StEP number of the program Sometimes it is convenient to jump directly to a particular StEP and execute from there. If the program is still in the middle of the 4th StEP, and you wish to finish it in advance and execute the 5th StEP -the StEP modification feature will meet your need. The Ramp and Ramp series controller can start the program from any one of its 30 steps.Press the SET key(briefly)to display the StEP number. Press the Λ, V keys to change it. The StEP number increases or decreases automatically as the program executes. If the StEP number is manually changed, the running time will be cleared to 0 and the program will begin with the new StEP. If the StEP number is not changed, pressing the SET key will not affect the operation of the program. Displaying and modifying the running StEP number (StEP) of the program

3.9 Multiple Curves The flexible programming format of the Ramp & Soak controller can be used to store and recall multiple programmed curves. If a temperature curve doesn't require all 50 steps, the unused steps can be used to store another program. Several different curves can be stored and executed individually, as long as there are not more than 50 steps total (including necessary controls steps). For example, when a process curve only needs nine program steps, it is possibleto store three such process curves in the instrument. Simply change the StEP number to initiate a different curve. Suppose 8 steps represent three groups of process parameters. They are separately arranged on StEP2-StEP9,StEP10-StEP17, StEP18-StEP25. The step time of step 1 can be set as follows to choose the desired program: T01=-2 Execute the program of curve 1 (StEP2-StEP9) T01=-10 Execute the program of curve 2 (StEP10-StEP17) T01=-18 Execute the program of

curve 3 (StEP18-StEP25) You can also choose the curves by manually setting the value of StEP before the program starts. For example, if curve 2 is needed in the current process, then set the value of StEP to 10.

3.10 Control Mode Parameter run

The function of the run parameter is defined differently in the ramp and Soak controller than it is for the controller without the ramp/soak option. Its operation is determined according to the equation run = AX_1+BX_8 Where "A" is used to select one of 4 power outage/startup event handing modes, and "B" is used to select Safety Start and PV preparation function Power Outage/Startup Modes: A=0: When the instrument is turned on, the program will simultaneously jump to 29th program segment and clear event output status. This mode is suitable for applications in which power failure is not allowed at any time. The user may do error handling in segment 29, such as switching on the event output to trigger an alarm. A=1: If there is no deviation alarm at power up, the program will continue running from the original break point and the event output state remains. Otherwise, the program will jump to the 29th segment and clear event output status. A=2: After power is turned on, it will continue the program from the original break point, and the event output state will remain. This mode is suitable for the applications in which power failure does not affect production (default setting). A=3: After power is turned on, controller goes to Stop status A=4: After power is turned on, controller goes to Hold status, the controllers will goes to Stop status if the controller at Stop mode before power failure. Safety Start and PV Preparation functions: B=0, without and PV preparation function, Program is executed as planned. This mode guarantees constant running time of the program, but it can't guarantee the integrity of the whole curve. B=1, with the function of Safety Start and without the function PV preparation B=2, with the function of PV preparation and without the function of Safety Start B=3, with the function of Safety Start and PV preparation About and PV Preparation Safety Start Function At the first step of program, when the ambient temperature is differ from the C01(Set point of first step), the controller will automatically adjust the running time to make the expected set point the same as the current PV. For example, in a system where the program configured from 25C to 625C within 600 minutes at the first step, but after the power on in the system, the process value is already at 100C which is higher than the original setpoint 25C for first step, in this case, the controller will automatically adjust the running time to 75 minutes and run the program. Please noted that Safety Start function only applicable for 1st step of a program PV Preparation Function In a system where the ambient temperature is differ from the Set point of executed steps, the controller will adjust the PV to SV and maintain the integrity of the program. For example, in a heating step from 100C to 600C, the system suffers power off when temperature at 125C. and when power comes back , the PV of the system is actually at 105C, the controller will automatically adjust the process value to 125C where the power failed point and without increase the running time of the system. after process value reaches 125C, the program goes on as planned before. Safety Start Safety Start

3.11 Privilege for parameter set LocK

For ramp & soak controllers with ramp/soak option, the LocK has slightly different functions. The table 1 shows the privilege of each lock code.

Lock Value	EPI-8 Adjustment	Program Adjustment	Step Selection while running
0	Yes	Yes	Yes
1	Yes	No	Yes
2	Yes	No	No
3 and up	No	No	No
808 (default)	Yes	Yes	Yes

4. Programming Example

Programs in the Ramp & Soak controller have a uniform format of temperature-time-temperature. The temperature set point of the current step will linearly change to the set point of the next step over the time interval of the two steps. The first temperature set point should always be the ambient temperature at which the process starts to ramp up. DO NOT set the first temperature set point to the target temperature (see example 1 below) if you are not using the safety-start function. The time units are in minutes. Negative values of the time interval represent program commands. 4.1 Example 1 The following example holds the oven at 800 °C for 2 hours. In this example, it is assumed that the heater is able to heat the oven from 25 °C to 800 °C within 30 minutes. If the heater does not have this ability, the soak section can begin when the oven is below 800 °C after the 30 minutes ramping time is up. Please note that the value of C is the beginning temperature of the step. e.g. C01 is always the temperature at the beginning of the step 1. Usually C01 should be the ambient temperature, and t01 is the time from step1 to step2. StEP1: C01=25, t01=30 Start linear temperature heating up from 25 °C to 800 °C, over a time period of 30 minutes (25.8 °C /minute). StEP2: C02=800, t02=120 Maintain 800 °C for 120 minutes. StEP3: C03=800, t03=-121 Stop the program and let the oven cool down.The equation used to get the command number is -(30 * Command# + Next Step) =-(30*4+1)=-121. The temperature control block is shown below
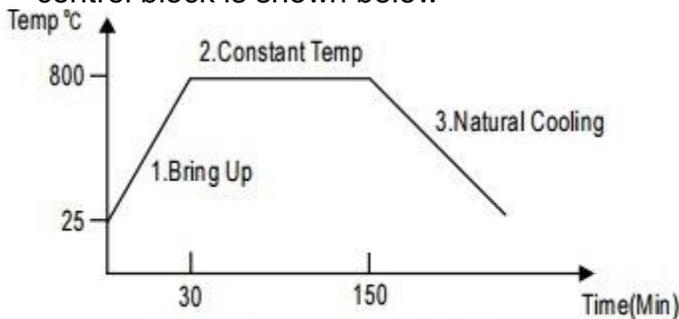

Figure 1. Holding oven at 800°C for 2 hours

4.2 Example 2

The following example includes 6 steps: linear temperature heating, maintaining a constant temperature, linear temperature cooling, jump cycling, 0 ready, hold and event output. In the following example, it is assumed that the deviation high alarm dHAL=dLAL= 5 C and dF=0.

StEP1: C01=100, t01=30 Start linear temperature heating up from 100 to 400 , over a time period of 30 minutes (10 /minute). 0 StEP2: C02=400, t02=60 Maintain 400 C for 60 minutes. 0 0 StEP3: C03=400, t03=120 Reduce the temperature at a rate of |C04-C03|/ t03 = 2 C /minute for 120 minutes. This will bring it down to 160 C. StEP4: C04=160, t04=-65 Alarm 1 is triggered, and the program jumps to StEP5: The command number for turning alarm 1 on is "2" The equation used to get the command number is-(30*Command#+Next Step)=-(30*2+5)=-65 StEP5: C05=160, t05=0 A time value of zero puts the program in a Hold state. A run operation executed by the user is needed for the program to continue to StEP6. StEP6: C06=100, t06=-181 Alarm 1 is switched off (unless it is also being triggered by an alarm condition outside the program), and the program jumps to StEP1 to start from the beginning. The command for switching Alarm 1 off is "6",so t06=-(30*6+1)=-181 0 StEP1: C01=100, t01=30 Since the temperature is still at 160 C, the program will pause until the controller can bring the temperature within the alarm 0 range of the new set point. Since the deviation high alarm is set to 5 C, the program will resume (from the beginning) as soon as the temperature 0 drops below SV+dHAL-dF=105 C. The temperature control block is shown below

Figure 2. Ramp/Soak Example 2
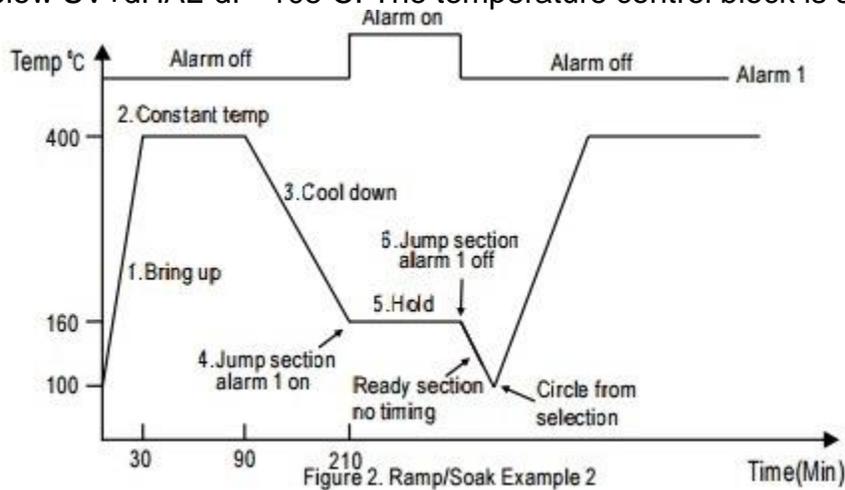
5. **Quick list of the New Key Functions for the Ramp/Soak Model**
The following list contains a brief description of each key function for when the controller is in basic operation mode.
1) Mode Key(SET) When pressed momentarily,PV display shows the current step that the program is processing. When pressed again, the PV display shows the set time length of the current step. The SV display shows how long the current step has run in minutes. Press again to have the display return to the basic display mode.The PV shows the process temperature and SV can either show the set temperature or the status of the controller(Stopped,Running,or on Hold).Pressing and holding the mode key for two seconds will put the controller into parameter setting mode, just like the controllers without the ramp/soak option.
2) Auto/Manual function key(A/M) Press this key to have the controller enter step setting mode in order to set the time, temperature and action of each step.
3) Decrement key V. Press and hold this key for two seconds to start the processing. Press and hold again to hold the processing.
4) Increment key ^ : Press and hold this key for two seconds to stop the processing of the program.

Table 2. Summary of New Key Function

To start/hold the processing	Press V for 2 seconds
To stop the processing	Press ^ for 2 seconds
Check current step	Press SET briefly
Check run time of current step	Press SET briefly twice
Go to Step X	Press SET briefly, then use V or ^ to go to step
To program the steps	Press A/M key to enter programming mode, then SET ket to go to the next step

7. Frequently Asked Questions
7.1What is the difference between "Hold" and "Stop"?
Hold does not stop heating,It holds the temperature at the current setting,(or at oPL,see 3.10 for details), "Stop" will stop heating. Frequently asked questions If you Hold the program (V key) and start Run (V key) again, it will start from the step that was put into hold.However,if you Stop the program( )and start Run(key)again,it will start from step1. key V V

7.2 How do I run this controller as a regular controller without the ramp/soak function?
Here are two methods. 1)Program a very long step. If you didn't use up all the steps for programming,you can use one of the unused steps for that. For example,assuming step 10 and 11 are unused, set C10=100,C11=10 and t10=9999,This sets Step 10 to control the temperature at 100 degrees for 9999 minutes.To begin the program, start Run(V key),press SET once to display StEP,use to go to StEP 10. Press SET twice.The controller will run just like regular controller with PV displayed on top and SV in the bottom.You don't have to do this every time the controller powers up(assuming the A-M parameter has not changed from default).It will remain running StEP 10 until 9999 minutes (7 days) runs out,or until you reset it for another application. > 2) Put the program on hold mode. This can be done either by manually pressing the Hold button at the desired temperature, or by programming a hold step (by setting tXX=0).

7.3 I just want to run the oven at 800 degrees for 120 minutes. When I set C01=800, t01=120, the controller SV first displays 800, then it starts dropping with time. Did I do something wrong?
This is the most common mistake first time users make. Since this is a ramp controller, not a step controller, the time t01 (or tXX) is not the time that controller will stay at C01 (or CXX), it is the ramping time that controller will take from temperature C01 to C02. To hold the temperature constant for 120 minutes, you need to set two steps at the same temperature, or a 0 degree ramp (C02=C03=800 in this case). Then, set the ramping time for 120 minutes. Please see example 1.