

# CASCADE™

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# TEK



Vacuum Ovens – TVO-2-VCs TVO-5-VCs  
Profile Programming Manual

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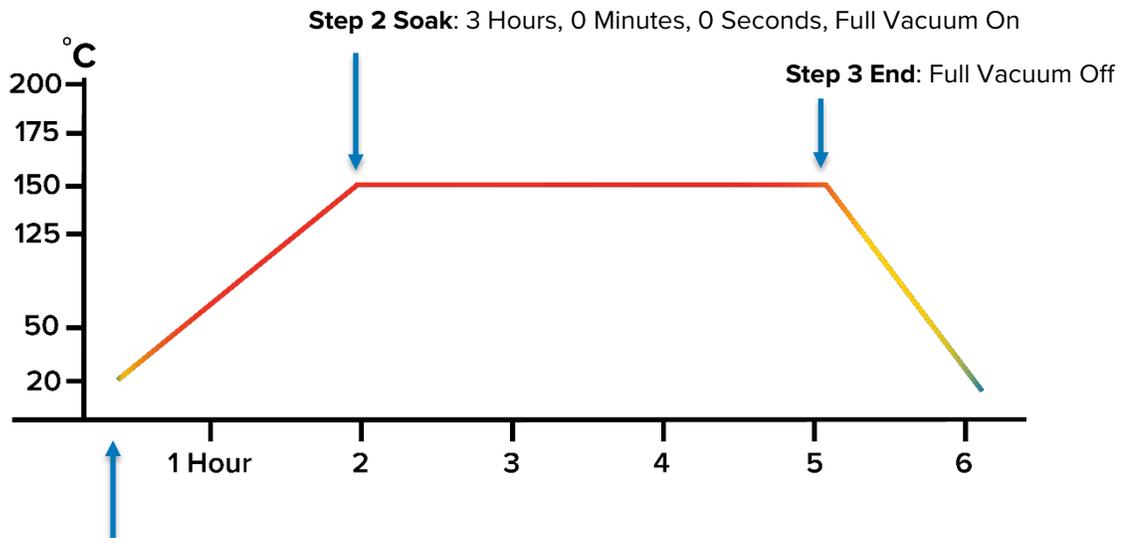


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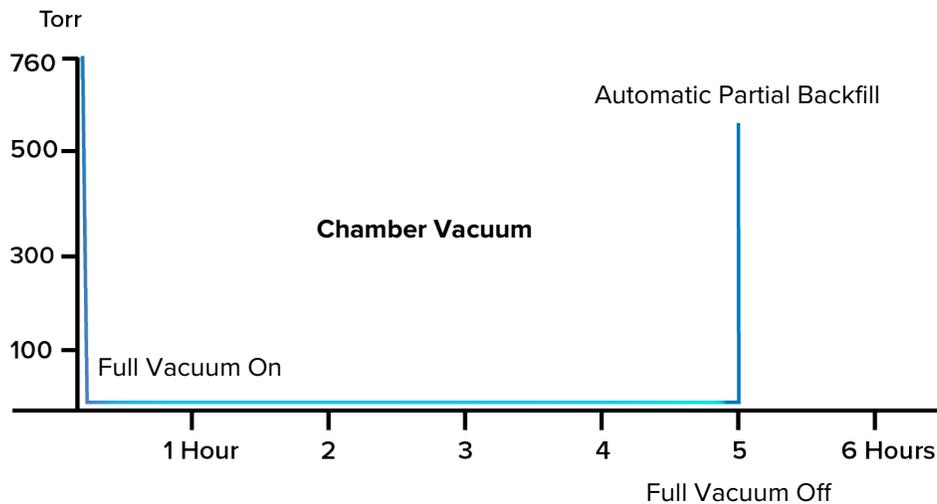
# PROFILE EXPLANATION

A profile is a recipe programmed in software form. This allows the oven to run the recipe as an automated baking and vacuum process.

**Example:** Instant Change and Soak Profile



**Step 1 Instant Change:** Parameters include Temperature Setpoint 150°C, Hour 2, Minutes 0, Seconds 0, Full Vacuum On





# DISPLAY PROFILE ELEMENTS

## Profile Status Icons



## Controller Homepage – Profile Active

**Temperature**

- Process 1 Value
- Target Setpoint
- Current Setpoint
- Profile Status Indicator

**Vacuum**

- Process 2 Value
- Target Setpoint
- Current Setpoint

## Process Values and Setpoints

**PV:** Process Values. These are the oven chamber temperature and the vacuum system pressure as measured by the oven.

- The vacuum Process Value on the controller display does not always match pressure shown on the main vacuum gauge. These are outputs from two different gauge types that measure with greater precision at different pressure levels.

**TSP:** Target Setpoints. The target temperature and the vacuum pressure for the current profile step.

**CSP:** Current Setpoints. The setpoints being used now. During some step types, the Target and Current Setpoints differ significantly. A Ramp Time step gradually adjusts the Current Setpoints as the oven seeks to achieve the Target Setpoints at the end of the step duration.

## Touch Button Ribbon

### Home

Returns the display to the Homepage.



### Menu

Accesses the login menu.



### Return

Returns the display to the previous page or menu.



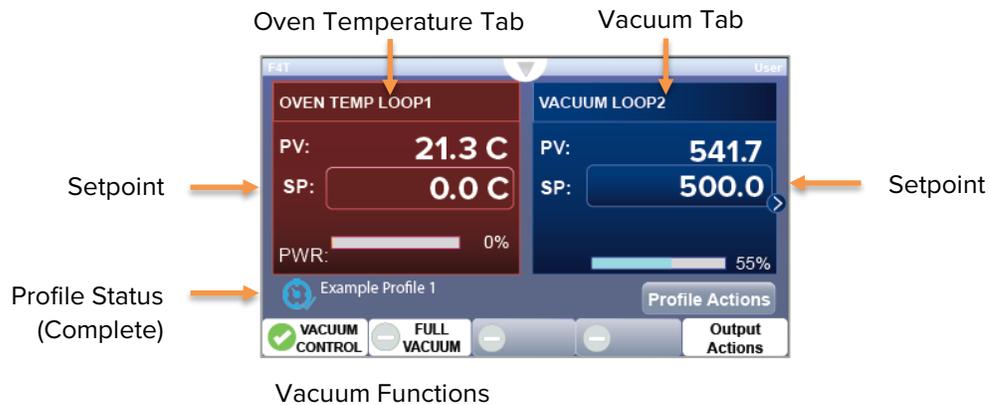
### Help

This button has no assigned functions.



# DISPLAY PROFILE ELEMENTS

## Oven Homepage After a Profile Ends



## Setpoints after a Profile

The oven temperature and the vacuum setpoint can all be independently set to revert to pre-profile conditions or hold at the settings of the final profile step. Pre-profile conditions are the homepage settings at the time of profile launch.

## Vacuum Functions

The oven continues running the Vacuum Function settings specified in the End Step after the profile ends.

## Example

In the illustrated example above, the oven was programmed to resume using the Homepage, pre-profile setpoints. Since the Homepage temperature setpoint was set to 0 (zero) at the time the profile was launched, the oven ceases heating after the profile ends. It will not resume heating while the Homepage setpoint is below room temperature. The setpoint may be adjusted at any time after the profile has ended.

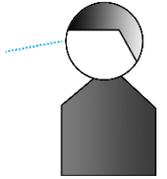
The oven was pumping down to 500 torr using the Homepage settings when the profile was launched. After the profile ends, the chamber will resume pumping down to 500 torr using the Vacuum Control On setting from the last step of the profile. After achieving 500 torr, the chamber holds this vacuum pressure indefinitely until the oven operator turns off the Vacuum Control function and presses and holds the manual Backfill button.

# PROGRAMMING CONSIDERATIONS

**You must log on to the oven to program a profile using the oven controls.** See page 11.

## Evacuation: Oven Operator Presence Required

The operator must be present and monitor the oven **while it is pumping down**. This verifies the oven chamber is sealed and not leaking, helping to ensure oven safety. To this end, turning on the vacuum pump is never an automated feature, even in ovens that come with a built-in pump.



## Profile Capabilities

- The oven controller holds 40 profiles.
- Each profile has 50 available steps:
  - Users may choose to use only a limited set of steps in a profile.
  - Choosing an End step for a step type terminates the profile.
- Maximum time for steps with time parameters:
  - 999 Hours, 59 Minutes, 59 Seconds

## Quickly pump down the chamber to at least 500 torr to seal the oven chamber door

- The first profile step should pump down the chamber to a minimum of 500 torr within 10 seconds.
- A Ramp Time or Ramp Rate step using Vacuum Control will gradually pump down the chamber over the course of the step duration. This may not be sufficient to obtain a seal when pumping from room atmospheric pressure.

## Backfilling during a profile

- The oven will not backfill when either of the Vacuum Functions is On.
- Backfilling during a profile requires a dedicated step during which both Vacuum Functions are turned Off. By default, the oven backfills to between 600 to 700 torr, but a Wait For step can be used to interrupt the backfill at a lower range.
  - Interrupted backfills typically overshoot the target vacuum setpoint. This should be planned for.

# PROGRAMMING CONSIDERATIONS



**The oven cannot heat faster than its stated heating specifications even when programmed to do so in a profile.**

**The oven cannot pump down faster than the evacuation rate of the attached vacuum pump.**

**The oven chamber walls can take days to cool down when the chamber is evacuated.**

- The oven effectively functions like a vacuum-insulated beverage container with excellent heat retention when evacuated.
- Oven chamber cooling rates are affected by the ambient room conditions.

## *PROFILE CHARACTERISTICS*

### **Profile Capabilities**

- The oven controller holds 40 profiles
- Each profile has 50 available steps
  - Users may choose to use only a limited set of steps in a profile.
  - Choosing an End step for a step type terminates the profile.
- Maximum time for steps with time parameters:
  - 999 Hours, 59 Minutes, 59 Seconds

**Profiles are highly customizable.** Read the profile parameters and step type explanations starting on **page 43** and **page 47**.

# PROGRAMMING CONSIDERATIONS

**The Instant Change step type can be used as a short or instant transition point.**

Instant Change steps are normally used to perform temperature ramps, soaks, and vacuum pump downs in a single step. However, an Instant Change step can also be set to a 1 – 10 second duration in order to facilitate transitions such as:

- Quickly pumping down the chamber to 500 torr to fully seal the oven door before beginning a gradual Ramp Time pump down to a lower pressure.
- Ending or pausing heating by setting the temperature below the current setpoint but leaving the oven under vacuum between a Soak step and a Ramp Time step or between two Soak steps.
- Starting a partial backfill that will end when the backfill exceeds a pressure specified in an immediately following Wait For step.

**A Wait For step with conditions that cannot be achieved by the oven will run the oven indefinitely at the best achievable temperature and vacuum levels.**

## ***RETURN TO PREVIOUS SCREEN***

If you find yourself on the wrong screen while programming, tap the Return icon at the bottom of the screen to return to the previous menu page.



## ***POWER, MEMORY, OUTAGES***

Heating profile steps remain stored in the controller memory when the oven is turned off or if it experiences a power outage. In the event of a power interruption while running a profile, the oven restarts if the Power switch is in the ON position, but it will not automatically resume the profile.

**The operator must re-launch an interrupted profile.**



You must be logged in on the oven controller to create or edit profiles. Profiles can be launched, paused, or terminated without logging in.

## LOGGING IN

### 1. Access the Main Menu



- Tap the Menu Icon

### 2. Login



- Tap the Login Icon

### 3. Enter the Controller password



- Type **ctek**
- Tap the Enter button

You may now return to the Homepage



- Tap the Home Icon

## Changing the Password

The oven password may be changed using Watlow Composer™ software. However, Cascade TEK **cannot recover a lost password.**

## LOGGING OUT

### 1. Access the Main Menu

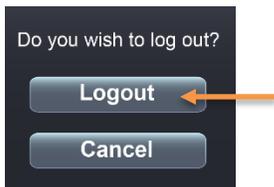


- Tap the Menu Icon

### 2. Logout



- Tap the Logout Icon
- Confirm logout



### You may now return to the Homepage



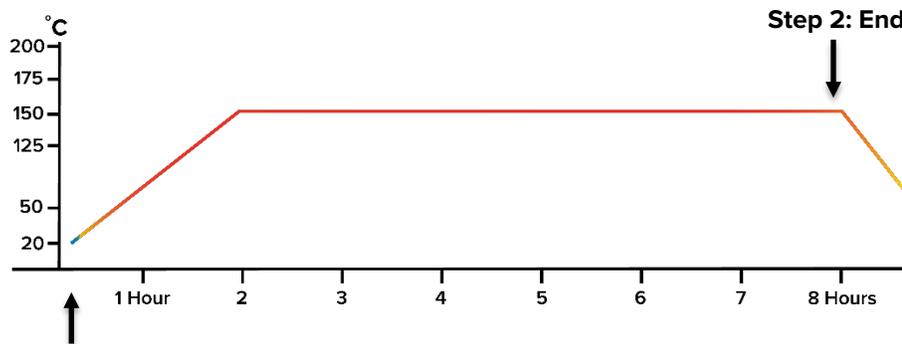
- Tap the Home Icon

End of procedure

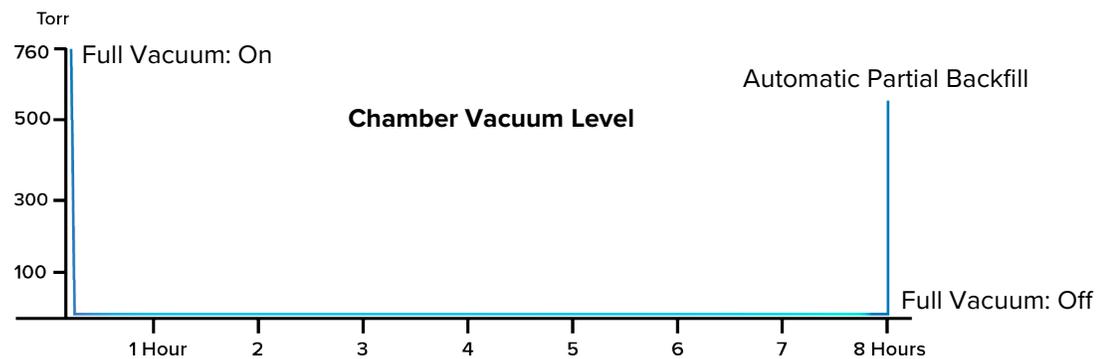
# EXAMPLE PROFILE 1

## INSTANT CHANGE EXAMPLE

This 2-step profile uses an Instant Change Step to rapidly pump down the oven chamber to the best vacuum level achievable. It will heat the oven chamber and then hold it at a constant temperature over 8 hours. An End step then terminates the profile, auto backfills the chamber to between 500 and 600 torr, and restores control of the homepage parameters to the oven operator.



**Step 1: Instant Change 150°C, 8 Hours, Full Vacuum On**



### Profile Outline

#### Step 1: Instant Change

- Target Setpoint Loop 1: 150°C
- Hours: 8
- Full Vacuum: On

#### Step 2: End

- End Action Loop 1: User
- Full Vacuum: Off

#### Oven Conditions when the profile is launched:

- Target Setpoint Loop 1: 0°C
- Vacuum Functions: Off

**Note:** See pages 43 and 47 for detailed descriptions of the parameters and step types.

# EXAMPLE PROFILE 1

## Programming Instructions

Reminder: You must be logged in to create or edit a profile.

### Profile Creation

#### 1. Create a new profile.



- Tap the Profile Actions button on the Homepage.
- Tap the Create Profile option in the Profile Actions menu.

#### 2. Create a profile name.

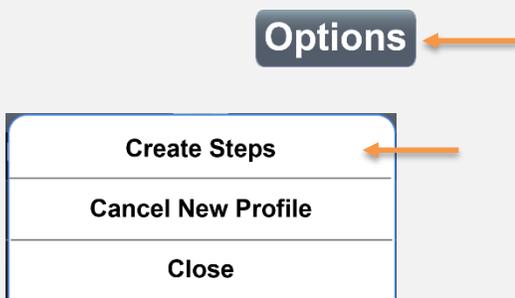


- Enter an easy-to-remember descriptive profile name in the Name field.

**Guaranteed Soak Deviations:** Do not alter these parameter settings.

### Profile Step 1

#### 3. Create the first step in the profile.



- Tap Options in the upper right corner.
- Tap the Create Steps option.

Continued Next Page

# EXAMPLE PROFILE 1

## 4. Open the Step Type menu.



- Tap the Step Type button.

By default, the Step Type button is set to “Soak” in the first step of a new profile.

## 5. Change the step type to Instant Change.



- Tap the Instant Change option.

## 6. Set the Step 1 parameters, part 1.



- Tap the Target Setpoint Loop 1 field, then enter a temperature value of 150°C.
- Tap the Hours field and enter a value of 8.

## 7. Set the Step 1 parameters, part 2, and exit the step.



- Scroll down the menu.
- Tap the Full Vacuum button and change to On.
- Tap Done.

Continued Next Page

# EXAMPLE PROFILE 1

## Profile Step 2

### 8. Add Step 2 to the profile.



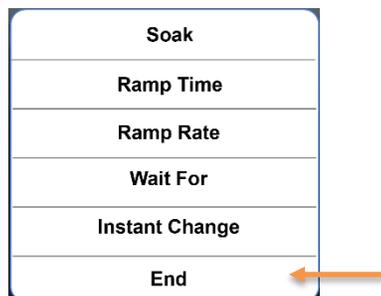
- Tap Add Step.

### 9. Open the Step Type menu.



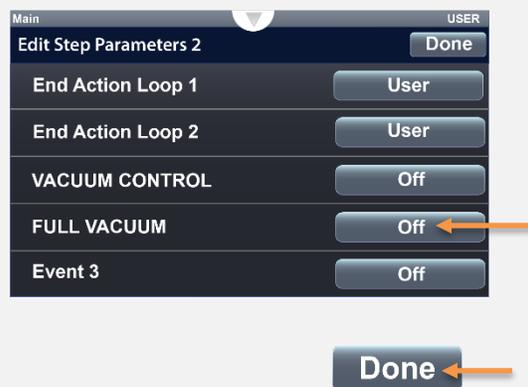
- Tap the Step 2 button, presently labeled Instant Change.

### 10. Select the End step type.



- Tap the End option.

### 11. Edit the Step 2 parameters and exit the step.



- Tap Full Vacuum and change to Off.
- Tap Done to exit the menu.

**Reminder:** The End Action Loop User settings return the oven to its pre-profile temperature and vacuum setpoints.

**Reminder:** With both vacuum functions set to Off, the oven automatically backfills to between 500 and 600 torr when the profile ends.

Continued Next Page

# EXAMPLE PROFILE 1

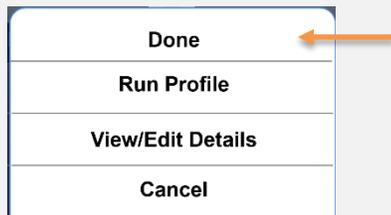
## End the Programming Process

### 12. Open the Options menu.



- Tap the Options button in the upper right corner.

### 13. Exit the programming process.



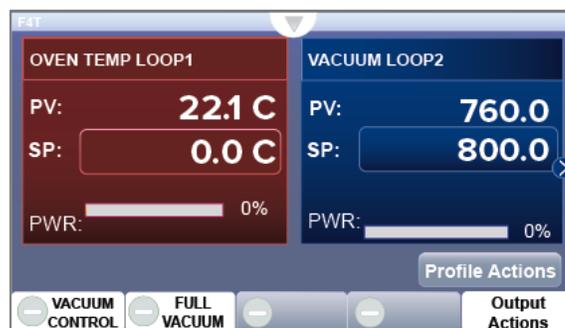
- Tap Done.

A finished profile can be edited or deleted as needed.

You may now return to the Homepage.



## Homepage



End of procedure



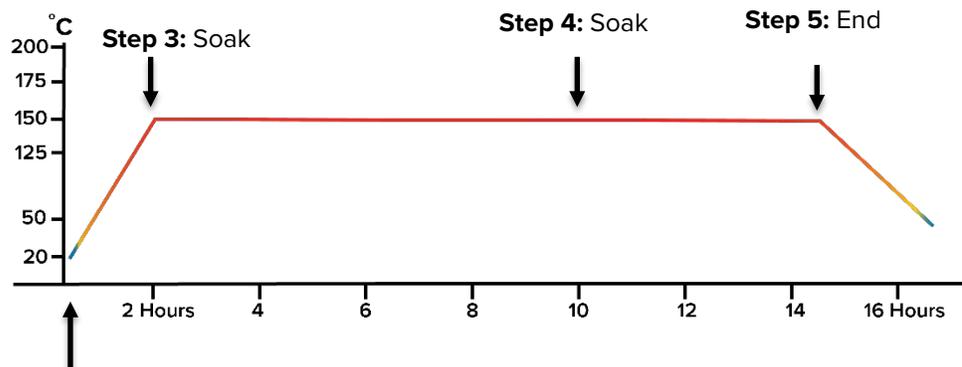
# EXAMPLE PROFILE 2

## RAMP AND SOAK EXAMPLE

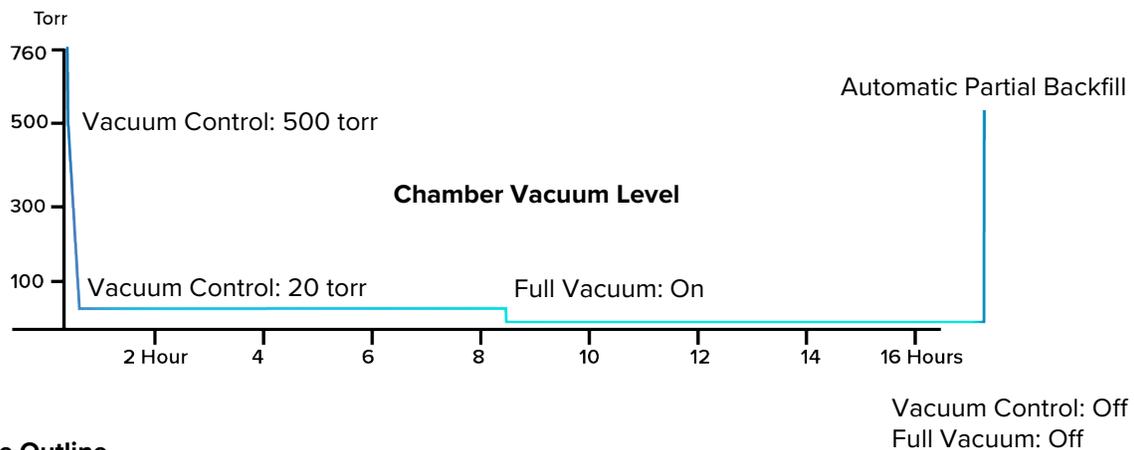
This profile ramps up to and temperature soaks at two different vacuum levels for 13 hours, then Upon completion, the oven chamber auto backfills to between 500 and 600 torr.

### Oven Conditions when the profile is launched:

- Homepage Oven Temperature (Loop1) Setpoint set to zero (0).
- Homepage Vacuum Functions both set to Off.



Steps 1 and 2: Instant Change and Ramp Time



### Profile Outline

#### Step 1: Instant Change

- Target Setpoint Loop 1: 150°C
- Seconds: 10
- Target Setpoint Loop 2: 500 torr
- Vacuum Control: On

**Note:** See pages 43 and 47 for detailed descriptions of the parameters and step types.

# EXAMPLE PROFILE 2

## Step 2: Ramp Time

This step heats to the temperature setpoint while gradually pumping down to the profile's second vacuum setpoint.

- Target Setpoint Loop 1: 150°C
- Hours: 2
- Vacuum Control: On
- Target Setpoint Loop 2: 20 torr

## Step 3: Soak

Step 3 is a constant temperature soak at 150°C, 20 torr.

- Hours: 8
- Vacuum Control: On
- Reminder: Soak steps use the temperature and vacuum setpoints of the previous step.

## Step 4: Soak

This step switches from Vacuum Control to Full Vacuum.

- Hours: 5
- Full Vacuum: On
  - Reminder: Full Vacuum overrides Vacuum Control and its setpoint.

## Step 5: End

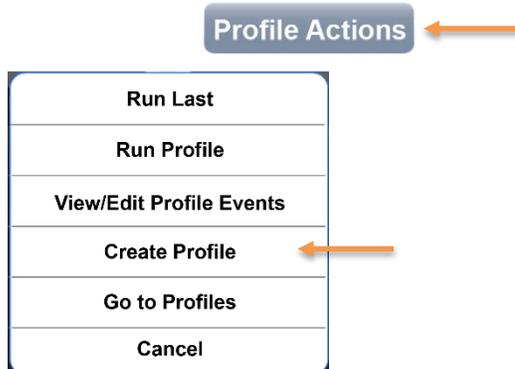
- End Action Loop 1: User
- Full Vacuum and Vacuum Control: Off
  - The oven automatically backfills to between 500 and 600 torr

# EXAMPLE PROFILE 2

## Profile Programming Instructions

### Profile Creation

#### 1. Create a new profile.



- Tap the Profile Actions button on the homepage.
- Tap the Create Profile option in the Profile Actions menu.

#### 2. Create a profile name.

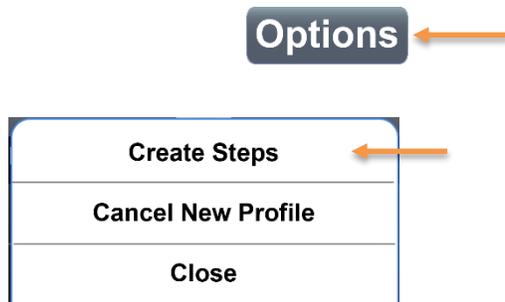


- Tap the Name field.
- Enter an easy-to-remember descriptive name in the Name field.

**Guaranteed Soak Deviations:** Do not alter these parameter settings.

### Profile Step 1

#### 3. Create Step 1.



- Tap the Options button in the upper right corner.
- Tap the Create Steps option.

Continued Next Page

# EXAMPLE PROFILE 2

## 4. Open the Step Type menu



- Tap the Step Type button.

The first Step Type button in the profile shows “Soak” by default.

## 5. Change the step type to Instant Change.



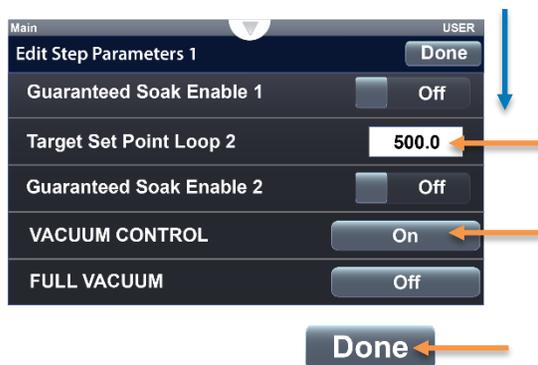
- Tap the Instant Change option.

## 6. Set the Step 1 parameters, part 1.



- Tap the Target Setpoint Loop 1 field and then enter a temperature of 150°C.
- Tap the Seconds field and enter a time of 10.

## 7. Set the Step 1 parameters, part 2, and exit the step.



- Scroll down.
- Enter 500 torr for the Target Setpoint Loop 2.
- Tap the Vacuum Control button to change to On.
- Tap Done.

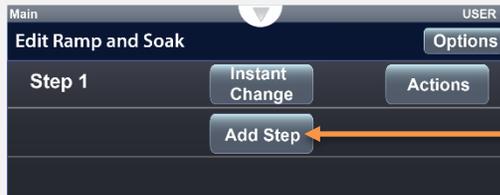
**Reminder:** Step 1 is the 10-second pump down previously discussed that helps ensure the oven chamber door fully seals.

Continued Next Page

# EXAMPLE PROFILE 2

## Profile Step 2

### 8. Add Step 2.



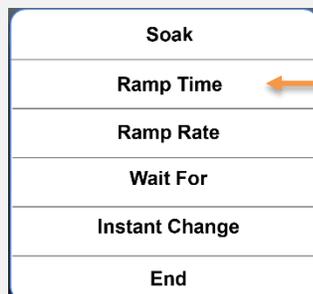
- Tap Add Step.

### 9. Open the Step Type menu.



- Tap the Step 2 button, presently labeled Instant Change.

### 10. Change the step type to Ramp Time.



- Tap the Ramp Time option.

### 11. Edit the Step 2 parameters, part 1.



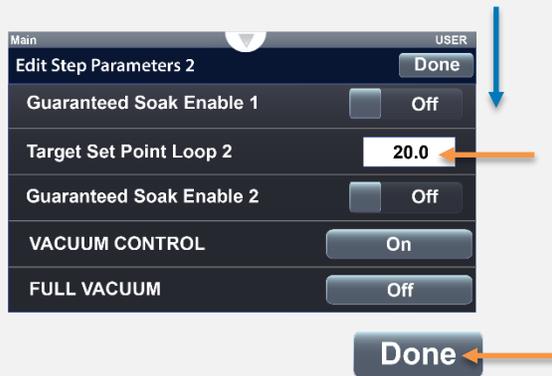
- Leave Target Setpoint Loop 1 set to 150°C.
- Enter 2 in the Hours field.
- Change Seconds to 0 (zero).

**Reminder:** A new step retains applicable parameters setting from the step preceding it.

Continued Next Page

# EXAMPLE PROFILE 2

## 12. Edit Step 2 parameters, part 2, and exit the step.

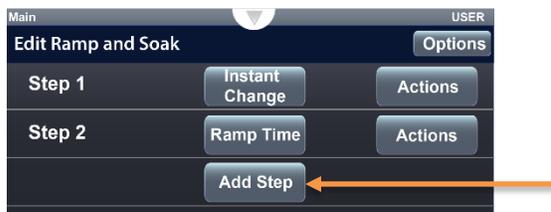


- Scroll down.
- Change the Target Setpoint Loop 2 value from 500 to 20 torr.
- Verify that Vacuum Control is set to On.
- Tap Done.

Reminder: Vacuum Function settings should retain from the preceding step.

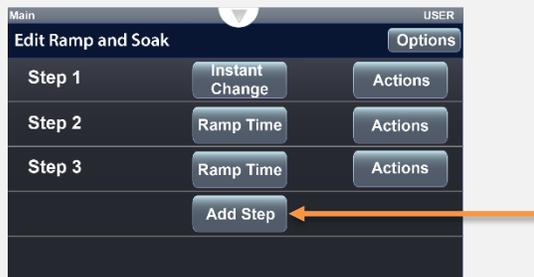
## Profile Step 3

## 13. Add Step 3.



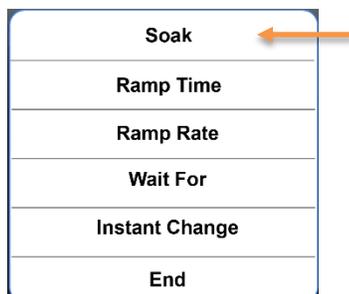
- Tap Add Step.

## 14. Open the Step Type menu.



- Tap the Step 3 Step Type button presently labeled Ramp Time.

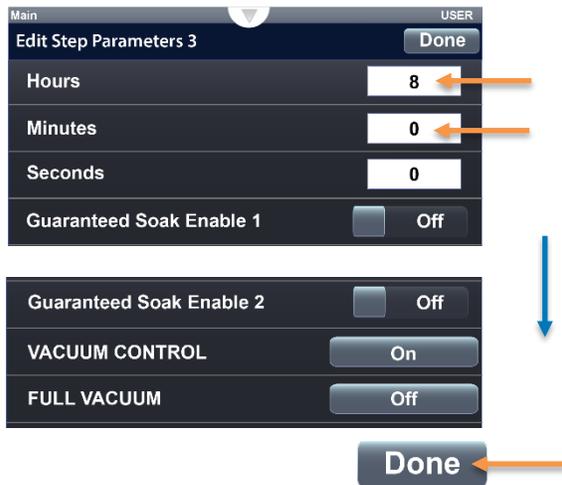
## 15. Change the step type to Soak.



- Tap the Soak option.

# EXAMPLE PROFILE 2

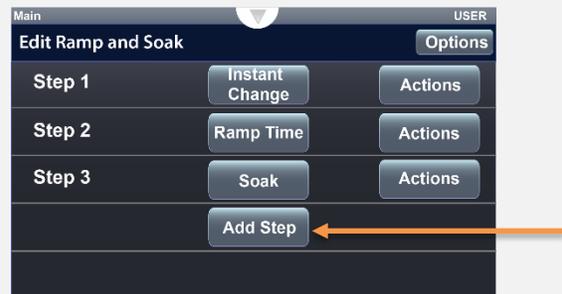
## 16. Edit the Step 3 parameters and exit the step.



- Tap the Hours field and then enter a value of 8.
- Change Minutes to 0 (zero).
- Scroll down and verify that Vacuum Control is set to On.
- Tap Done.

## Profile Step 4

## 17. Add Step 4.



- Tap Add Step.

## 18. Open the Step 4 Actions Menu.



- Tap the Actions button for Step 4.

## 19. Open the Edit Step Parameters menu.

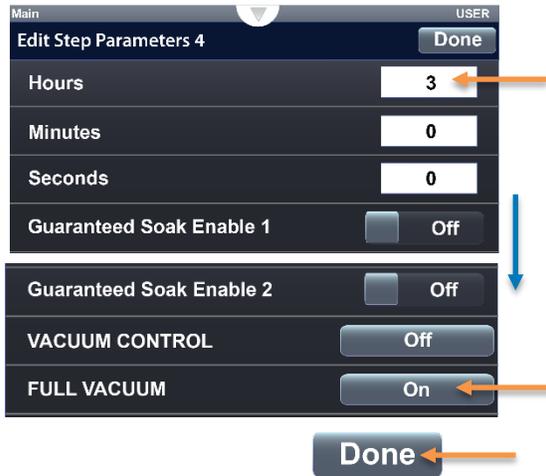


- Tap the Edit Step Parameters option.

Continued on next page

# EXAMPLE PROFILE 2

## 20. Edit the Step 4 Parameters and exit the step.



- Change the Hours parameter to 3.
- Scroll Down.
- Tap Full Vacuum and change to On.
- Tap Done to exit.

**Reminder:** Full Vacuum overrides Vacuum Control.

## Profile Step 5

## 21. Add Step 5.



- Scroll down.
- Tap the Add Step button.

## 22. Open the Step Type menu.



- Scroll down.
- Tap the Step Type button for Step 5, presently labeled Soak.

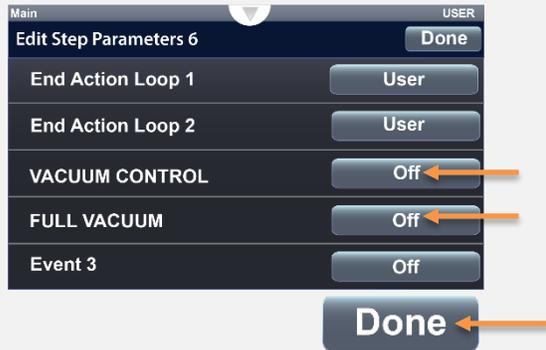
## 23. Change Step 5 to End.



- Tap the End option.

# EXAMPLE PROFILE 2

## 24. Edit the Step 5 parameters and exit the step.



- Tap Full Vacuum and change to Off.
- Tap Vacuum Control and change to Off.
- Tap Done to exit the menu.

**Reminder:** The End Action Loop User settings return the oven to its pre-profile temperature and vacuum setpoints.

- **Reminder:** With both vacuum functions set to Off, the oven automatically backfills to between 500 and 600 torr when the profile ends.

## End the Programming Process

## 25. Open the Options menu.



- Tap Options.

## 26. Exit the programming process.



- Tap Done.

A finished profile can be edited or deleted as needed.



You may now return to the Homepage.

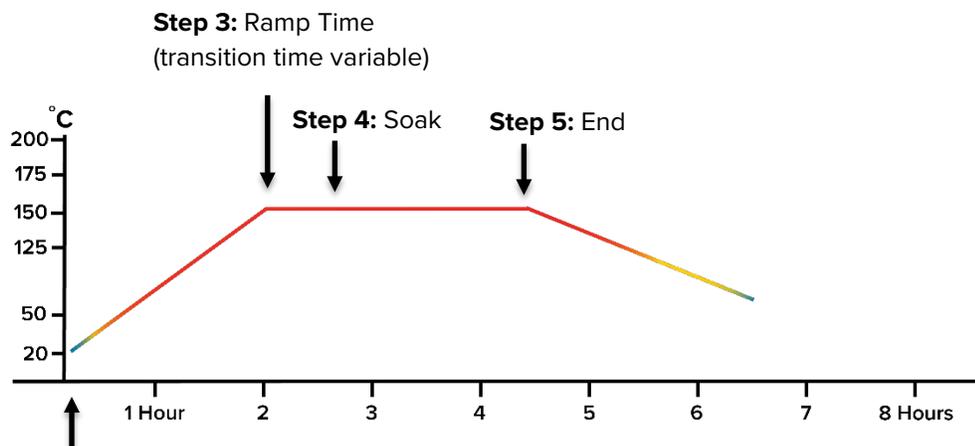
End of procedure



# EXAMPLE PROFILE 3

## WAIT FOR EXAMPLE

This profile uses an Instant Change step followed by a Wait For step to heat until the oven has nearly achieved the target temperature setpoint. It then advances to a Ramp Time step to pump the oven down to 20 torr over a 20-minute period, followed by a 2 hour Soak. The start of the constant temperature and slow pump down step is not determined by a timer countdown but rather initiated by obtaining a target temperature.



### Steps 1 and 2: Instant Change and Wait For

#### Oven Conditions when the profile is launched:

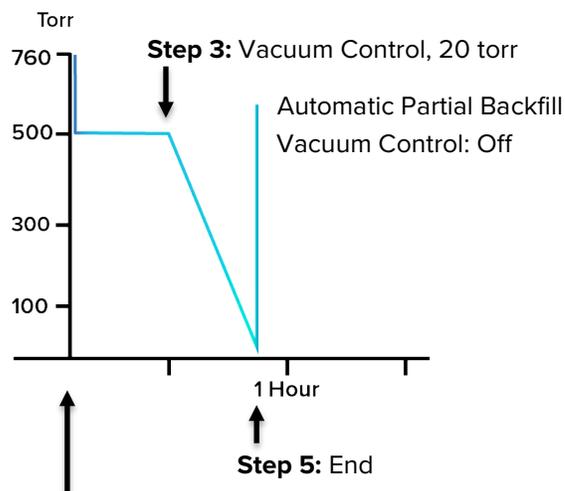
- Homepage Oven Temperature Loop1 Setpoint set to zero (0).
- Vacuum Functions set to Off

#### Profile Outline

##### Step 1: Instant Change

This step sets the temperature condition the oven must achieve in order to satisfy the Wait For requirements in the next step.

- Target Setpoint Loop 1: 150°C
- Seconds: 1
- Target Setpoint Loop 2: 500 torr
- Vacuum Control: On



### Steps 1 and 2: Vacuum Control, 500 torr

**Note:** See pages 43 and 47 for detailed descriptions of the parameters and step types.

# EXAMPLE PROFILE 3

## Step 2: Wait For

Step 2 sets the condition requirements for the profile to advance to Step 3. This makes the transition from Step 2 to 3 dependent on the actual oven chamber temperature rather than an elapsed time.

- Wait For Process 1 Condition: Above
- Wait For Process 1 Value: 148°C
  - A setting of 148°C helps ensure this step does not run indefinitely in the event that temperature instability, outgassing in the chamber, or other issues prevent the oven from achieving 150°C.
  - **Reminder:** Wait For steps use the temperature setpoint of the preceding step.
- Vacuum Control: On
  - **Note:** When first created, this step should retain its Vacuum Function settings from the preceding step.
  - **Reminder:** A Wait For step automatically retains the vacuum setpoint of the preceding step.

## Step 3: Ramp Time

Step 3 is a constant temperature soak at 150°C while gradually pumping down to 20 torr.

- Target Setpoint Loop 1: 150°C
- Minutes: 20
- Target Setpoint Loop 2: 20 torr

## Step 4: Soak

Step 4 is a constant temperature soak at 150°C, 20 torr.

- Hours: 2
- Vacuum Control: On
- **Reminder:** Soak steps use the temperature and vacuum setpoints of the previous step.

## Step 5: End

Step 5 terminates the profile and returns the oven its pre-profile operating states.

- Vacuum Control: Off
  - The oven automatically backfills to between 500 and 600 torr

# EXAMPLE PROFILE 3

## Profile Programming Instructions

### Profile Creation

#### 1. Create a New Profile.



- Tap the Profile Actions button on the Homepage.
- Tap Create Profile on the Profile Actions menu.

#### 2. Create a profile name.

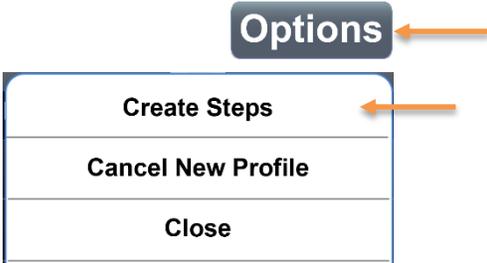


- Tap the Name field.
- Enter an easy-to-remember descriptive name in the Name field.

**Guaranteed Soak Deviations:** Do not alter these parameter settings.

### Profile Step 1

#### 3. Create the first step in the profile.



- Tap Options in the upper right corner.
- Tap Create Steps.

Continued on next page

# EXAMPLE PROFILE 3

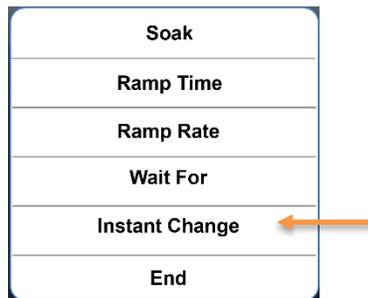
## 4. Open the Step Type menu.



- Tap the Step Type button.

The first Step Type button in the profile shows “Soak” by default.

## 5. Change the step type to Instant Change.



- Tap the Instant Change option.

## 6. Set the Step 1 parameters, part 1.



- Tap the Target Setpoint Loop 1 field and then enter a temperature of 150°C.
- Tap the Seconds field and enter a value of 1.

## 7. Set the Step 1 parameters, part 2, and exit the step.



- Scroll down.
- Enter 500 for the Target Setpoint Loop 2.
- Tap the Vacuum Control button and change to On.
- Tap Done.

Continued on next page

# EXAMPLE PROFILE 3

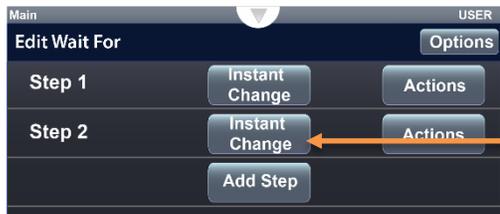
## Profile Step 2

### 8. Add Step 2.



- Tap Add Step.

### 9. Open the Step Type menu.



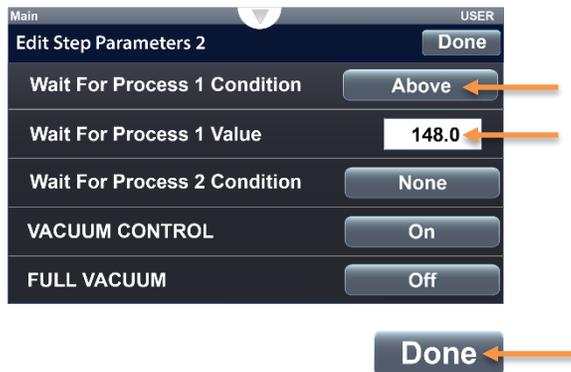
- Tap the Step 2 Step Type button, presently labeled Instant Change.

### 10. Change the step type to Wait For.



- Tap Wait For.

### 11. Edit and verify the Step 2 parameters, and exit the step.

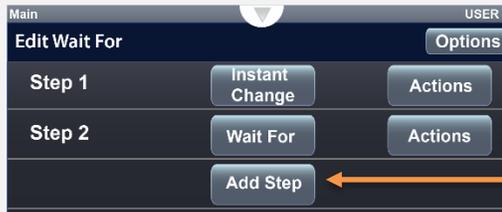


- Tap the Wait For Process 1 Condition button and change it from None to Above.
- Tap and enter 148°C in the Wait For Process 1 Value field.
- Verify that Vacuum Control is set to On.
- Tap Done.

# EXAMPLE PROFILE 3

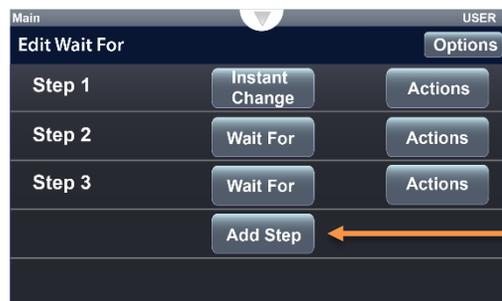
## Profile Step 3

### 12. Add Step 3.



- Tap Add Step.

### 13. Open the Step Type menu.



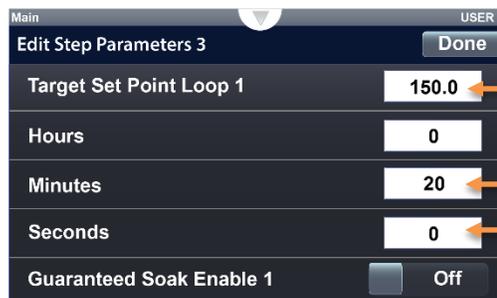
- Tap the Step 3 Step Type button, presently labeled Wait For.

### 14. Change the step type to Ramp Time.



- Tap Ramp Time.

### 15. Edit the Step 3 Parameters, part 1.

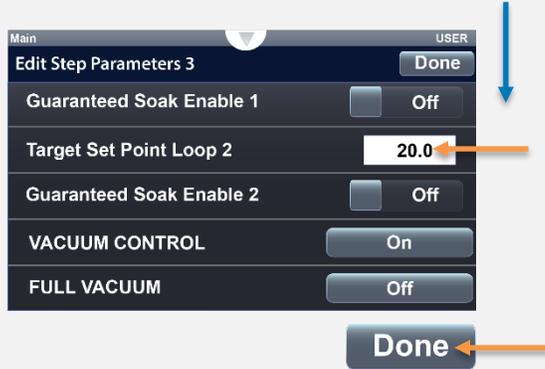


- Enter 150°C in the Target Setpoint Loop 1 field.
- Enter 20 in the Minutes field.
- Change Seconds to 0 (zero).

Continued on next page

# EXAMPLE PROFILE 3

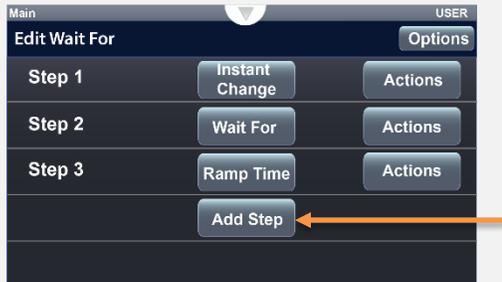
## 16. Edit Step 3 parameters, part 2, and exit the step.



- Scroll down.
- Enter 20 torr in the Target Setpoint Loop 2 field.
- Verify Vacuum Control is set to On.
- Tap Done.

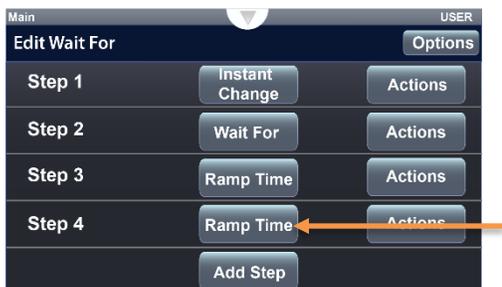
## Profile Step 4

## 17. Add Step 4.



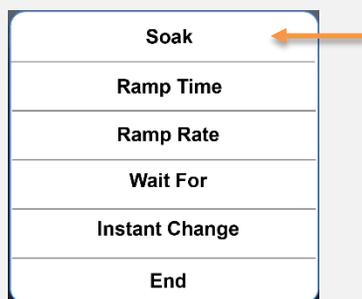
- Tap Add Step.

## 18. Open the Step Type menu.



- Tap the Step 4 Step Type button, presently labeled Ramp Time.

## 19. Change the step type to Soak.

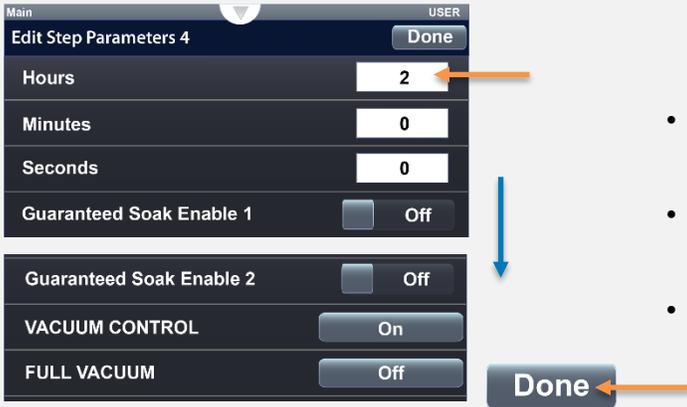


- Tap Soak.

Continued on next page

# EXAMPLE PROFILE 3

## 20. Edit Step 4 parameters and exit the step.



- Tap the Hours field and then enter a value of 2.
- Scroll down and verify that Vacuum Control is set to On.
- Tap Done.

## Profile Step 5

## 21. Add Step 5.



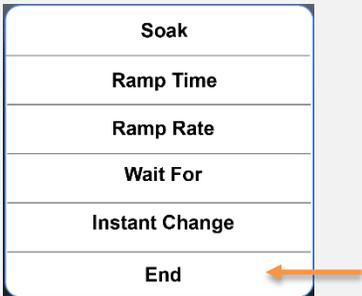
- Tap Add Step.

## 22. Open the Step Type menu.



- Tap the Step 5 Step Type button, presently labeled Soak.

## 23. Change the step type to End.

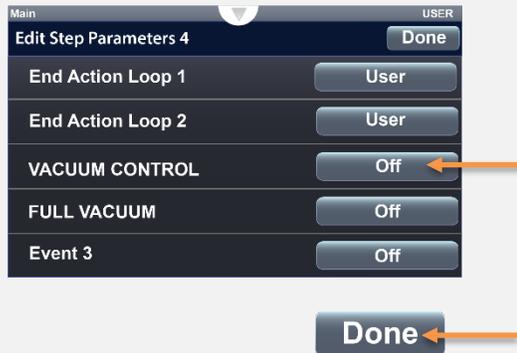


- Tap End.

Continued on next page

# EXAMPLE PROFILE 3

24. Edit the Step 5 Parameter settings and then exit the step.



- Tap Vacuum Control and change to Off.
- Tap Done to exit the menu.

**Reminder:** The End Action Loop User settings return the oven to its pre-profile temperature and vacuum setpoints.

**Reminder:** With both vacuum functions set to Off, the oven automatically backfills to between 500 and 600 torr when the profile ends.

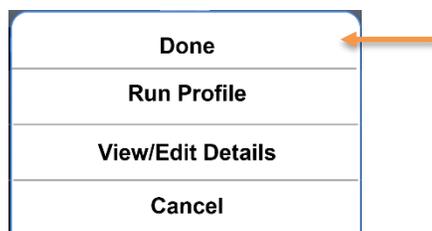
## End the Programming Process

25. Open the Options menu.



- Tap Options.

26. Exit the programming process.



- Tap Done.

You may now return to the Homepage.



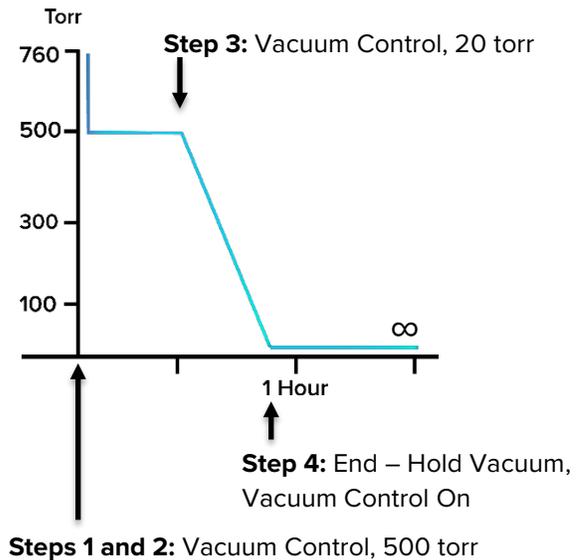
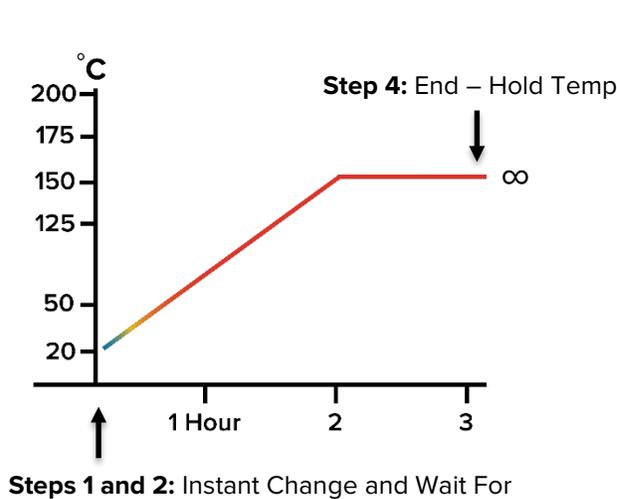
End of procedure



# EXAMPLE PROFILE 4

## HOLD END STATE EXAMPLE

This profile is a variant of Example Profile 3. It runs the same Instant Change, Wait For, and Ramp Time steps with the same step parameter settings. However, the End step Action Loop parameters are now both set to Hold rather than User, and Vacuum Control is left set to On. With these new settings, the oven maintains the 150°C target setpoint and keeps the chamber at 20 torr after the profile ends. The oven will hold these conditions indefinitely until the operator changes the temperature setpoint on the Homepage and turns off the Vacuum Control function.



### Oven Conditions after the profile ends:

- These are now set by the End step rather than defaulting to the pre-profile Homepage settings.

### Profile Changes

#### Step 5: End

Terminates the profile and sets the post-profile operating states.

- End Action Loop 1: **Set to Hold**
  - The End step will retain the 150°C target setpoint from Step 3.
- End Action Loop 2: **Set to Hold**
  - The End step will retain the 20 torr target setpoint from Step 3.
- Vacuum Control: On





# PROFILE OPERATIONS

## LAUNCHING PROFILES

Profiles can be launched from the Profile Actions button on the Homepage.

**1. Turn on the vacuum pump connected to the oven.**

**2. On the Homepage, tap the Profile Actions button.**



**Profile Actions**

**Menu Options**

<b>Run Last</b>
<b>Run Profile</b>
<b>Go to Profiles</b>
<b>Cancel</b>

**Run Last** immediately launches the profile that was last run.

**Run Profile** brings up the Profiles menu. The operator can then choose which profile to launch.

## OVERRIDING PROFILE STEP VACUUM SETTINGS

The Vacuum Control and Full Vacuum functions can be turned On or Off on the Homepage while a profile is running. This temporarily changes the profile vacuum settings for the current profile step. When the profile reaches the next programmed step, the Vacuum Functions will revert to the settings of that profile step.



# PROFILE OPERATIONS

## *PAUSING, RESUMING, OR TERMINATING A RUNNING PROFILE*

Tap the Profile Actions button to pause or abort a running profile.

Profile Running



Tap



Profile Actions

Pause
Terminate
Cancel



Pausing a profile stops the profile timer. The oven will continue to heat and any active Vacuum Function will continue to operate.

To end the pause, tap the Profile Actions button and tap the **Resume** option.



Terminate immediately ends the profile, advancing it to the End step.

# PARAMETERS

The programmable parameters define the actions the oven takes during a profile step.

## *TARGET SETPOINTS*

Most steps have both a temperature and a vacuum setpoint. Those that do not, such as Soak and Wait For, use the target setpoints of the immediately preceding step. In the case of a soak step following another soak step, the second soak will use the same setpoints as the first.

### Target Setpoint Loop 1 (Temperature)

The target temperature setpoint for the profile step.

### Target Setpoint Loop 2 (Vacuum Level)

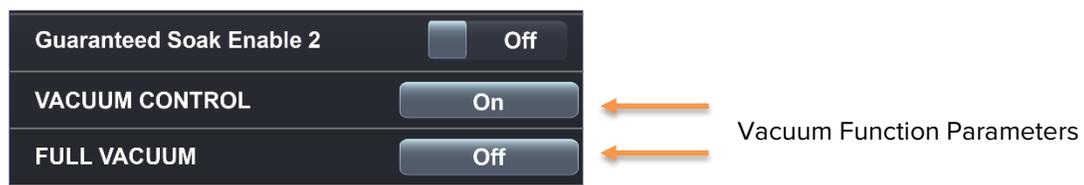
This is the target vacuum setpoint for the Vacuum Control function. A vacuum Loop 2 setpoint value only needs to be entered if Vacuum Control will be set to On in the step.

## *TIME PARAMETERS*

Fixed duration steps have hours, minutes, and seconds parameters.

## *VACUUM FUNCTION PARAMETERS*

Each profile step has two Vacuum Function event parameters: **Vacuum Control** and **Full Vacuum**. One of the two functions must be set to On during each profile step in which the oven chamber is required to pump down or maintain a vacuum.



Continued on next page

# PARAMETERS

Vacuum function parameters continued

## **Vacuum Control**

The Vacuum Control function parameter pumps down to and then maintains the chamber at a target vacuum setpoint between 720 and 1 torr. It does so for the duration of each step in which the function is set to On. The setpoint is programmed by entering a torr value for the Target Setpoint Loop 2 parameter of the step.

**The Vacuum Control function cannot backfill the chamber** to meet a higher setpoint. Partial backfilling from a lower vacuum level must be accomplished during a step in which both Vacuum Functions are set to Off.

## **Full Vacuum**

Full Vacuum opens the vacuum valve to its maximum open position during each step this parameter is set to On. This pumps down the chamber and then maintains a vacuum level at the maximum capability of the pump.

**Both Functions On:** If both functions are set to On in the same step, Full Vacuum overrides Vacuum Control.

**Automatic Backfilling:** The oven chamber vacuum valve closes when an active profile reaches a step in which both the vacuum functions are set to Off. The oven will then automatically open the backfill port, backfilling the chamber to 600 – 700 torr.

## ***GUARANTEED SOAK ENABLE***

These parameters are not supported in this oven. Leave both set to Off.

## ***EVENT PARAMETERS***

An Event is an oven function that activates if the Event is set to On for a profile step. Event parameters labeled with the default “Event” name do not have functions mapped to them in this oven and will not affect a profile.

Vacuum Control and Full Vacuum are Events with mapped functions and affect oven operations as described previously.

## *END ACTION LOOP*

The End step type has two unique parameters.

### 1. End Action Loop 1

- Temperature

### 2. End Action Loop 2

- Vacuum (torr)

These parameters can each be safely set to either:

- User
- Hold

**User** returns the oven to using the pre-profile Homepage temperature and vacuum setpoints. These setpoints can then be changed by the oven operator.

**Hold** changes the Homepage setpoints to those of the profile step preceding the End step. This can be used to “hold” the oven at the last temperature and / or vacuum setpoint of the profile after the profile ends. The setpoints can then be changed by the oven operator.

**Contact Cascade TEK** before creating a profile using the **Off** setting. Off locks out different function sets in the controller, including the Homepage temperature setpoint and can be difficult to unlock.



# STEP TYPES

Soak
Ramp Time
Ramp Rate
Wait For

Instant Change
Jump
End

## Step Types

Each profile step is defined by the parameters it contains.

**Basic** step types use parameters with user-programmed time durations. This requires accurate knowledge of what the oven chamber temperature or vacuum will be when the profile step is launched. The programmer must also make sure their programmed heating or vacuum change rates are within the capability of the oven to achieve.

**Advanced**, variable duration step types offer greater automation, creating process responsiveness to initial conditions and end-states and will only run within the capability range of the oven. However, runtime lengths can vary.

Basic and advanced step types can be used together in the same profile.

## Basic Step Types (Fixed durations)

### *INSTANT CHANGE*

Instant Change sets a run time. It can also set a target temperature setpoint (Loop1) as well as a vacuum setpoint (Loop2). This is the simplest step type and is often used to perform a heat up, vacuum pump down, and temperature soak in a single step. Instant Change can be also used as a short-duration or even a 1-second transition step to initiate phase changeovers in a profile. These include changing from Vacuum Control to Full Vacuum during a multi-step heat soak phase or turning off heating prior to a cooldown under vacuum. See page 7.

Important Parameters: Hours, Minutes, Seconds.

Advantages: Simplicity, Fixed duration.

Disadvantage: Fixed duration regardless of initial conditions or end states unless followed by a conditional Wait For step.

### *RAMP TIME*

A Ramp Time step sets a fixed duration and a target setpoint or setpoints to achieve by the end of that duration. When the Ramp Time step starts during a profile, the oven calculates rates of change needed to achieve target setpoints by the end of the duration. Each rate of change is based on the current state of the oven chamber as measured by the oven.

For example: Target Setpoint Loop 1, 100°C; programmed duration 90 minutes; chamber temperature at the step beginning, 50°C.

- $(100^{\circ}\text{C} - 50^{\circ}\text{C}) \div 90 \text{ minutes} = +0.55^{\circ}\text{C}$

An observer watching the oven would then see the oven increasing the Current Setpoint for temperature by 0.55°C each minute until 90 minutes is reached.

# STEP TYPES

## Ramp Time continued

A Ramp Time step has only one duration, with hours, minutes, and seconds parameters. Target setpoints may be set for either temperature (Target Loop 1) or vacuum (Target Loop 2) or for both. In vacuum ovens, Ramp Time steps are normally used to create controlled cool down rates and / or controlled pump down rates with Vacuum Control enabled.

Note that setting Full Vacuum to On during a Ramp Rate step effectively overrides any vacuum target setpoint.

**Example 2:** Target Setpoint Loop 2, 200 torr; duration 90 minutes; Vacuum Control, On; Full Vacuum, Off; oven chamber at the start of the step, 500 torr.

- $(500 \text{ torr} - 200 \text{ torr}) \div 90 \text{ minutes} = -3.3 \text{ torr per minute.}$

An observer watching the oven during this step would see the oven decreasing the Current Setpoint for vacuum by 3.3 torr each minute until 90 minutes is reached. The Vacuum Control function would adjust the vacuum valve position to achieve this rate.

**Reminder:** Gradually pumping down from room atmosphere pressure over a long period may result in the chamber failing to seal.

**Reminder:** The Vacuum Control function on its own only allows the oven to achieve and maintain a vacuum target setpoint. Controlled pump down rates are achieved by using Vacuum Control during either a Ramp Time or Ramp Rate step.

Important Parameters: Hours, Minutes, Seconds, Target Setpoint Loops.

Advantages: Simplicity, fixed duration. Slows heating, cooling, and Vacuum Control pump down rates.

Disadvantages: Fixed duration regardless of end temperature or vacuum level unless followed by a Wait For step. The profile programmer must estimate or plan out the oven chamber conditions at the start of the Ramp Time step and verify the oven or vacuum pump can achieve the target setpoints.

### *Instant Change Step versus Ramp Time Step*

**Instant Change:** When reached, an Instant Change step immediately changes both Current Setpoints to match the Target Setpoints. The oven then heats or cools to a temperature setpoint at its best rate and may reach the setpoint before the step ends. Likewise, if Vacuum Control is On, the oven will adjust the vacuum valve to evacuate to the Loop 2 target setpoint at its best rate.

**Ramp Time:** This step gradually adjusts its current temperature and vacuum setpoints so that the oven should reach the target setpoints when the step ends.

# STEP TYPES

## ***SOAK***

A Soak step sets a fixed time for running the oven at a constant temperature and vacuum level. A Soak step uses the temperature and vacuum setpoints of the step preceding it.

Important Parameters: Hours, Minutes, Seconds.

Advantage: Fixed time.

Disadvantage: By itself, this step does not guarantee the chamber has reached the temperature setpoint when starting the soak. Either the profile must be structured by the programmer to ensure the oven chamber achieves or is near to achieving the target temperature before starting the Soak or the Soak step must be preceded by a Wait For step.

## ***END***

This step type terminates an active profile. End steps come with two unique parameters:

- End Action Loop 1 (Temperature)
- End Action Loop 2 (Vacuum)

The default setting for these parameters is **User**, which restores the oven to running at the pre-profile setpoints on the Homepage.

The **Hold** setting changes the Homepage setpoints to match the target setpoints of the step preceding the End step. In other words, the oven indefinitely “holds” the profile’s last target setpoints. For example, if the step prior to the End step has a target Loop 1 setpoint of 50°C, the Homepage temperature setpoint will change to 50°C when the profile ends if Action Loop 1 is set to Hold.

Both the User and Hold settings restore control of the Homepage setpoints to the oven operator. The setpoints may be adjusted anytime after the profile ends.

Please see page 45 for a description of the **Off** End Action Loop parameter settings. The oven manufacturer **recommends against using Off**.

### **Vacuum Event Parameters**

The End step has both Full Vacuum and Vacuum Control events. If both are set to Off, the oven partly backfills, if it has not already done so as part of a previous step. If Vacuum Control is set to On, the oven will run using the Vacuum Control function when the profile ends. If Full Vacuum is set to On, the oven runs using the Full Vacuum function post-profile. Either function may then be turned on or off by the oven operator.

# STEP TYPES

## *Advanced Step Types*

### **WAIT FOR**

This step type uses the temperature and vacuum target setpoints from the previous steps. It does not, however, have time parameters. Instead, the programmer sets conditional statement parameters that govern when the profile advances to the step following the Wait For. Conditions can be set for a temperature or a vacuum level or for both.

The Wait For step will not end until **all** set conditions are met.

The Wait For step has 4 unique parameters.

#### **Wait For Temperature Parameters**

- Wait For Process 1 Condition: Set to “Above” or “Below” or “None”
- Wait For Process 1 Value: Set to a value of degrees Celsius

#### **Wait For Vacuum Parameters**

- Wait For Process 2 Condition: Set to “Above” or “Below” or “None”
- Wait For Process 2 Value: Set to a pressure value between 760 and 1 torr

Example: **Wait For Process Condition 1, Above** and **Wait For Process Value 1, 149.9°C** prevents the profile from advancing to the step following the Wait For until the oven achieves 150°C.

The programmer must keep in mind the temperature stability of the oven model when setting a conditional temperature requirement. A TVO-5 oven has a temperature stability of  $\pm 0.25^\circ\text{C}$  at  $150^\circ\text{C}$ , so the programmer should set the Wait For Process Value 1 at  $148^\circ\text{C}$  when attempting to reach  $150^\circ\text{C}$ . Otherwise, **the oven may run indefinitely** around  $149.0^\circ\text{C}$  if outgassing in the chamber, normal temperature instability, or other issues prevent the oven from exceeding  $149.9^\circ\text{C}$ . Note that after  $148^\circ\text{C}$  is achieved, a Soak step following the Wait For will continue heating to the target temperature originally programmed in the step preceding the Wait For.

Important Parameters: The Wait For Conditions and Values.

Advantages: Can be used to help ensure the profile operates within the oven heating and cooling rates and the pump down rate of your vacuum pump. Can be used to ensure the required conditions of your recipe are met before the profile advances to the next step. Can also be used to set up limited backfilling when following a step in which both Vacuum Functions are set to Off.

Disadvantages: Adds variability to the length of the profile. The programmer must account for uncertainty in actual heat and vacuum operations to prevent the oven from running indefinitely in the Wait For step.

# STEP TYPES

## ***RAMP RATE***

The programmer enters a Target Setpoint and a rate of change. When the Ramp Rate step is reached during a profile, the oven begins changing the Current Setpoint at the specified rate until the Target Setpoint is reached. Ramp rates may be set for either temperature or vacuum or for both. If ramp rates are set for both, the step runs until both target temperature and vacuum setpoints have been achieved.

### **Temperature Parameters**

- Target Setpoint Loop 1 (temperature °C)
- Rate – given in degrees per minute.

### **Vacuum Parameters**

- Target Setpoint Loop 2 (vacuum in torr)
- Rate – given in torr per minute, vacuuming down.

**Note:** To leave either the chamber temperature or vacuum unchanged during a Ramp Rate Step, leave its Target Setpoint Loop parameter set to the setpoint of the previous step. Leave the rate of change for the Loop set to 0 (zero).

**Reminder:** The Vacuum Control function on its own only allows the oven to achieve and maintain a vacuum target setpoint. Controlled pump down rates are achieved by using Vacuum Control during either a Ramp Time or Ramp Rate step.

## ***JUMP***

Jump steps can be used to create loops in a heating profile.

The Jump step unique parameters are:

- Jump Step
  - Selects the step to loop back to.
- Jump Count
  - The number of times the profile will loop back to the previous step.

Looping back repeats the targeted Jump Step and all of the other steps leading up to Jump until the Jump Count is completed.

**Caution:** The programmer must anticipate the cascading heat and vacuum pressure consequences of a loop.

**End of the programming manual**



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