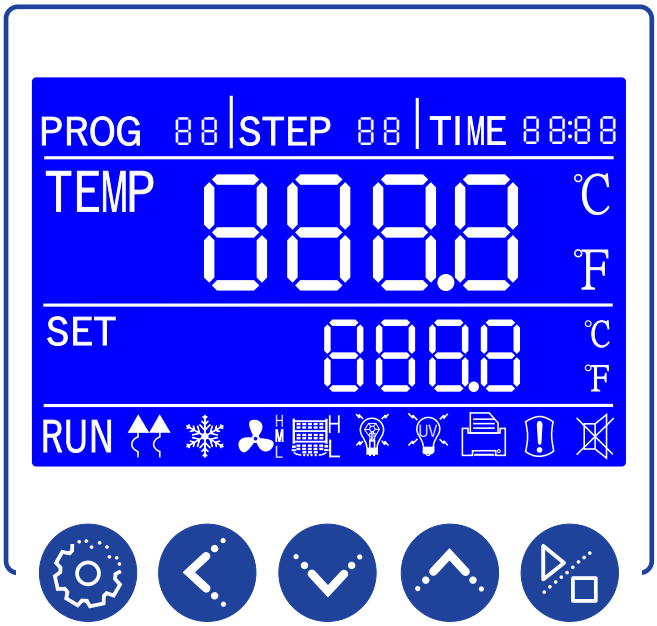
LCD CONTROLLER

L Series



Controller used on the following product

- BOF/BON Drying Ovens
- BIT/BIF Heating Incubators
- BIC Cooling Incubators
- BOV Vacuum Ovens
- BWB Water Bath

PROGRAMMING GUIDE

User Edition

1.0 INTRODUCTION

This programming guide provides the user of the following BEING laboratory instruments the ability to change the backlit LCD controller's internal parameters to allow the instrument to work more effectively and efficiently for your operation, process, or experiment.

BIF-16, -35, -55, -120, -200, -400
Mechanical Convention Incubators

BIT-16, -35, -55, -120, -200
Natural Convention Incubators

BIC-60, -120, -250
Cooling incubators

BOF-30, -50, -120, -200, -400
Mechanical Convention Drying Ovens

BON-30, -50, -115, -200
Natural Convention Drying Ovens

BOV-20, -50, -90
Vacuum Ovens

BWB-05, -12, -22
General Purpose Water Bath

2.0 TABLE OF CONTENTS

Safety Message

Be sure that you are completely familiar with the safe operation of each BEING series. This unit may be connected to other machinery, such as a vacuum pump. Improper use can cause serious or fatal injury.

Installation and repair procedures require specialized skills with laboratory equipment and electricity. Any person that installs or repairs this unit must have these specialized skills to ensure that this unit is safe to operate. Contact BEING Instrument, Inc. or their local authorized distributor for repairs or any questions you may have about this unit's safe installation and operation.

The precaution statements are general guidelines for the safe use and operation of these instruments. It is not practical to list all unsafe conditions. Therefore, if you use a procedure that is not recommended in this programming guide, you must determine if it is safe for the operator and all personnel in the proximity to the instrument. If there is any question of the safety of a procedure, please contact BEING Instrument before starting or stopping the instrument.

This equipment contains high voltages. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the startup procedure or troubleshoot this unit.

- Documentation must be available to anyone that operates this equipment at all times.
- Keep non-qualified personnel at a safe distance from this unit.
- Only qualified personnel familiar with the safe installation, operation, and maintenance of this unit should attempt start-up or operating procedures.
- Always stop the instrument before making or removing any connections.

Symbols used in this Programming Guide

The following signal word panels, safety symbols, and non-safety symbols are used to alert you to potential personal injury hazards or information of importance. Obey all safety messages that follow these symbols to avoid possible personal injury or death.

- **Signal word panels**
  Signal word panels are a method for calling attention to a safety messages or property damage messages and designate a degree or level of hazard seriousness. It consists of three elements: a safety alert symbol, a signal word and a contrasting rectangular background. The following signal word anels are in accordance with ANSI Z535.4-2111 (R2017) and ISO 3864 standards.

Indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.

- **Safety symbols**
  Safety symbols are graphic representations—of a hazard, a hazardous situation, a precaution to avoid a hazard, a result of not avoiding a hazard, or any combination of these messages—intended to convey a message without the use of words. The following safety symbols are used in this quick start guide.

Mandatory

General alert. Mandatory action.

Wear protective gloves.

Warning

Safety Alert Symbol. General caution.

Hot Surface

Prohibition

Do not touch fluid.

Controller Element Overview

PROG Area: Displays the program working or setting group. Controller is capable of programming and storing up to 8 programs.

STEP Area: Displays the number of the step within a program. There are 9 steps available for each program.

TIME Area: Displays the running time or parameter value.

TEMP Area: Displays the measured (actual) temperature within the unit's chamber. Also, displays the ambient room temperature when requested.

SET Area: Displays the temperature setpoint.

RUN: Illuminates when the unit's program is working. Turns off when program is stopped.

HEAT: Arrows illuminate and blinks when the unit's heater is on. Turns off when heating elements are off.

COOLING: Snowflake illuminates and blinks when the unit's cooling is on. Turns off when cooling system is off. Series BIC only.

FAN: Fan blades illuminate and blinks when the unit's circulation fan is on. H (high), M (medium), and L (low) indicate the fan speed. Turns off when fan is off. Series BIF, BIC, and BOF only.

Water Level: Indicates high and low water bath levels.

Visible Alarm: Illuminates when the program has completed, has been stopped by user, or when an over temperature condition occurs. Additionally, when the visible alarm illuminates an audible alarm will start.

Audible Alarm Disabled: Illuminates when the user presses any key or when the unit's power is turned off.

Keys

SETTING: Starts the programming of the temperature and run time. Accepts the temperature and run time values.

SHIFT: For changing the parameter value being set and viewing ambient temperature.

DECREASE: Used for setting parameter value, modification of various values, or start/stop auto-tuning.

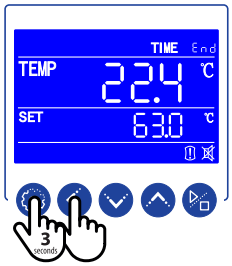
INCREASE: Used for setting parameter value, or press and hold for more than 2 seconds to view the remaining program time.

RUN/STOP: Press for 2 seconds to run or stop the controller.

Changing Temperature Unit of Measurement

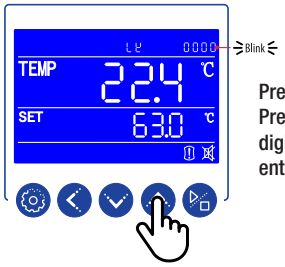
Units are shipped with the temperature measurement set to Celsius (°C). Parameter **CF=0000.**

STEP 1: Enter Level 3 of controller internal parameters

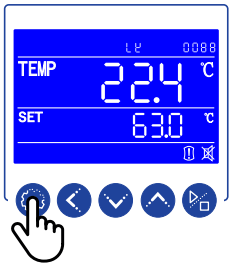


Press the SETTING and SHIFT keys for 3 seconds to enter the controller's internal parameter settings. Time area will change and first digit will blink.

STEP 2: Enter Level 3 code LK=0088



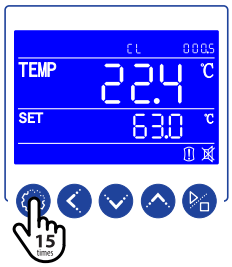
Press the INCREASE key to enter the first code digit. Press the SHIFT key to move to the second code digit. Digit will blink. Press the INCREASE key to enter the second code digit.



Press the SETTING key to enter the Level 3 controller parameters.

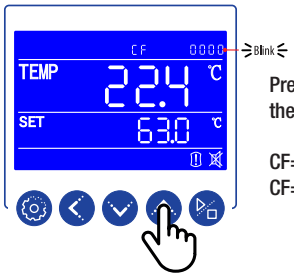
First available parameter will appear.

STEP 3: Scroll to parameter CF



Press the SETTING key 15 times to scroll through parameters until the parameter CF appears.

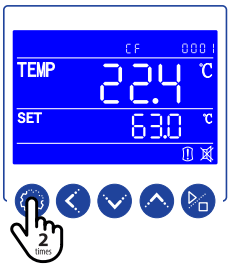
STEP 4: Change parameter CF



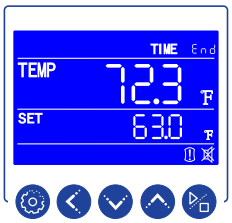
Press the INCREASE or DECREASE key to change the first digit.

CF=0000 Celsius (°C)
CF=0001 Fahrenheit (°F)

STEP 5: Set parameter and return to standard state



Press the SETTING key 2 times to set parameter CF and return to standard state.

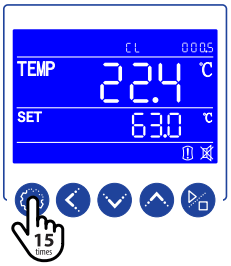


Upon changing the temperature unit of measurement, the present value (PV) temperature will change its value.

Temperature setpoint must be changed manually.

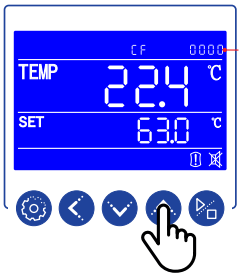
STEP 6: Repeat Steps 1 and 2

STEP 7: Scroll to parameter Ht



Press the SETTING key 11 times to scroll through parameters until the parameter CF appears.

STEP 8: Change parameter Ht



Press the INCREASE or DECREASE key to change the first digit. Press the SHIFT key to move to the second or third digit. Press the INCREASE or DECREASE key to change setting.

Ht=0300 Celsius (°C)
Ht=0572 Fahrenheit (°F)

STEP 9: Set parameter and return to standard state

Press the SETTING key 6 times to set parameter Ht and return to standard state.

Calibration After Unit of Measurement Change

Check the instrument's chamber temperature after changing the unit of measurement to ensure the controller is measuring it accurately.

Tools Needed:

A remote-monitoring thermocouple thermometer with a NIST-traceable calibration certificate.

Compare the thermometer's and probe's temperature ratings against the series operating range to ensure compatibility.

Series BOV: A ribbon lead thermocouple is required so as not to damage the door seal. Additionally, the lead's and probe's materials must be rated for temperatures up to ambient + 200°C (ambient + 392°F).

Series BIF, BIT, BOF, and BON

STEP 1: Place test materials in chamber, set program, and press run for 3 seconds.

STEP 2: Insert thermometer probe into test hole.

Upon reaching the set temperature, insert thermometer probe into the test hole.

Thermometer probe's outer diameter must be less than 5mm.

STEP 3: Run test again at a second set temperature (SV2) at least 10°C (18°F) greater than the first.

Make sure thermometer is stable. Then record the set temperature (SV1 & SV2), present measured value (PV1 & PV2), and thermometer reading (TV1 & TV2).

STEP 4: Compare thermometer readings to set and present temperatures. If SV1≠PV1≠TV1 or SV2≠PV2≠TV2, move to STEP 5.

Series BIC

STEP 1: Place test materials in chamber, set program, and press run for 3 seconds.

STEP 2: Open test hole / accessory port and insert thermometer probe into test hole.

Upon reaching the set temperature and opening the test hole, insert thermometer probe into the test hole.

The test hole / accessory port is Ø25mm and located on the right side of the incubator.

STEP 3: Run test again at a second set temperature (SV2) at least 10°C (18°F) greater than the first.

Make sure thermometer is stable. Then record the set temperature (SV1 & SV2), present measured value (PV1 & PV2), and thermometer reading (TV1 & TV2).

STEP 4: Compare thermometer readings to set and present temperatures. If SV1≠PV1≠TV1 or SV2≠PV2≠TV2, move to STEP 5.

Series BOV

STEP 1: Place test materials in chamber. Place temperature probe in the center of the chamber. Close and lock door. Set program and press run for 3 seconds.

STEP 2: Run test again at a second set temperature (SV2) at least 10°C (18°F) greater than the first.

Make sure thermometer is stable. Then record the set temperature (SV1 & SV2), present measured value (PV1 & PV2), and thermometer reading (TV1 & TV2).

STEP 3: Compare thermometer readings to set and present temperatures. If SV1≠PV1≠TV1 or SV2≠PV2≠TV2, move to STEP 4.

Series BWB

STEP 1: Fill chamber. Place test materials in chamber. Close chamber cover. Set program and press run for 3 seconds.

STEP 2: Upon reaching set temperature, oven chamber cover. Insert the thermometer probe into the center of bath.

STEP 3: Run test again at a second set temperature (SV2) at least 10°C (18°F) greater than the first.

Make sure thermometer is stable. Then record the set temperature (SV1 & SV2), present measured value (PV1 & PV2), and thermometer reading (TV1 & TV2).

STEP 4: Compare thermometer readings to set and present temperatures. If SV1≠PV1≠TV1 or SV2≠PV2≠TV2, move to STEP 5.

The Math

STEP 4/5: Perform the following calculations to determine Pb and PK.

For example:

SV1= 37°C TV1 = 36°C
SV2= 50°C TV2 = 48°C

Full Scale Adjustment (Slope)

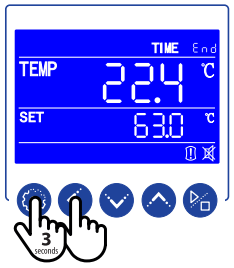
PK = {[(TV2-TV1) ÷ (SV2-SV1)] - 1} x 4000
PK = {[(48-36) ÷ (50-37)] - 1} x 4000
PK = -308

Zero Adjustment (Intercept)

Pb = TV2 - {[PK ÷ (4000 ÷ SV2)] + SV2}
Pb = 48 - {[-308 ÷ (4000 ÷ 50)] + 50}
Pb = 1.9

Programming Correction

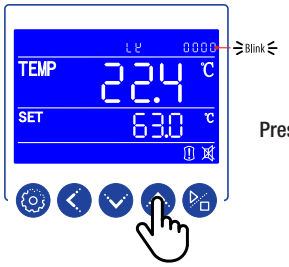
STEP 5/6: Enter Level 2 of controller internal parameters



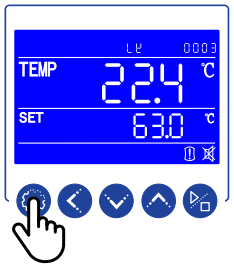
Press the SETTING and SHIFT keys for 3 seconds to enter the controller's internal parameter settings.

Time area will change and first digit will blink.

STEP 6/7: Enter Level 2 code. LK=0003



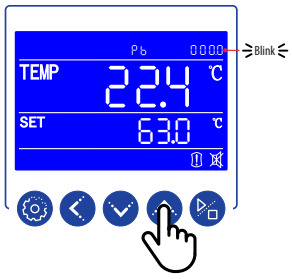
Press the INCREASE key to enter the code digit.



Press the SETTING key to enter the Level 2 controller parameters.

The tM parameter will appear. Press the SETTING key 3 times to scroll through parameters until the parameter Pb appears.

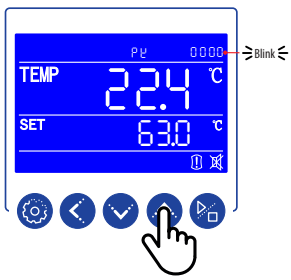
STEP 7/8: Change parameter Pb



Press the INCREASE or DECREASE key to change the first digit. Press the SHIFT key to move to the second digit. Digit will blink. Press the INCREASE key to enter the second digit. Continue until parameter is set.

Press the SETTING key 1 time to move to the PK parameter.

STEP 8/9: Change parameter PK



Press the INCREASE key to change the first digit. Press the SHIFT key to move to the second digit. Digit will blink. Press the INCREASE key to enter the second digit. Continue until parameter is set.

Press the DECREASE key immediately if you want a negative parameter value.

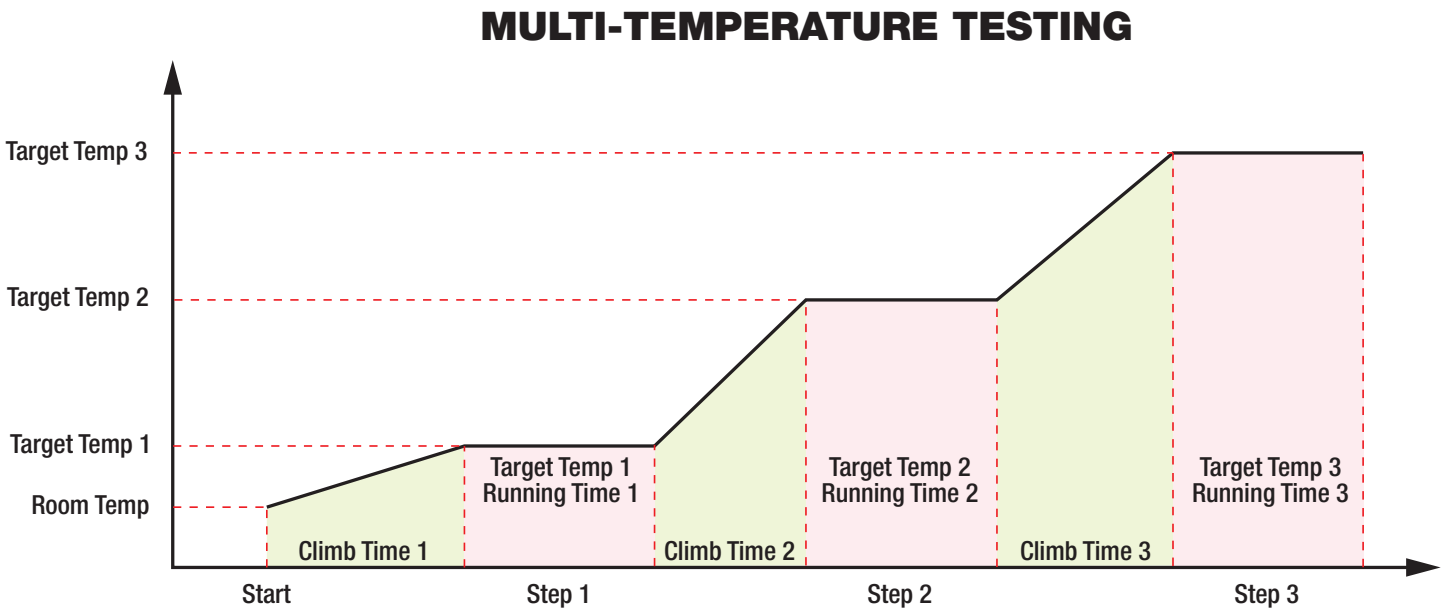
Press the SETTING key 2 times to set parameter PK and return to standard state.

What is a Multi-step Programs

Numerous applications — like materials testing, quality assurance, environmental simulation, and many more — in many industries require precise, multi-temperature (heating or cooling) testing.

BEING's L Series controller allows the user to easily program up to 8 multi-step (multi-temperature) programs with up to 8 steps (temperature and run time) per program. Each program can be cycled from 1 to 99 times.

The following chart shows a 3-step program, where for example, Step 1 is 25°C for 60 minutes, Step 2 is 99°C for 45 minutes, and Step 4 is 199°C for 99 minutes.



Legend

Target temp: The temperature you want it to run as planned. *(Input / set temperature)*
Climb time: The time it takes to reach your target temperature setting. *The temperature rise rate will be controlled automatically based on the controller's settings. The step's run time will not start counting down until the chamber reaches ±0.5 °C / °F of the set temperature.*
Running time: The time you want the chamber to run at the set temperature. *The controller automatically launches the next step when time runs out unless it is the last step in the program then the unit shuts down and the audible and visual alarm goes off.*

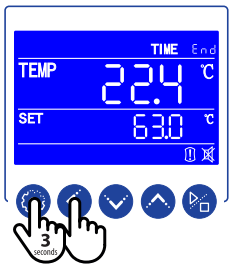
Programs

PROG O - Fixed Value and Time
PROG 1 - Multi-step, Step 1 to Step 8
PROG 2 - Multi-step, Step 1 to Step 8
PROG 3 - Multi-step, Step 1 to Step 8
PROG 4 - Multi-step, Step 1 to Step 8
PROG 5 - Multi-step, Step 1 to Step 8
PROG 6 - Multi-step, Step 1 to Step 8
PROG 7 - Multi-step, Step 1 to Step 8
PROG 8 - Multi-step, Step 1 to Step 8

Turning On/Off Multi-step Programs

Units are shipped with the controller set to fixed value (single-step) programs. Parameter Mo=0000.

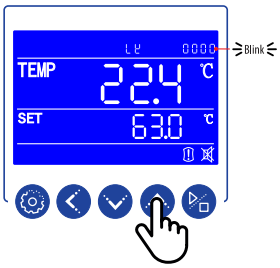
STEP 1: Enter Level 4 of controller internal parameters



Press the SETTING and SHIFT keys for 3 seconds to enter the controller's internal parameter settings.

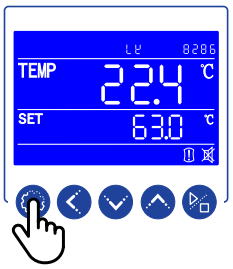
Time area will change and first digit will blink.

STEP 2: Enter Level 4 code. LK=8286



Press the INCREASE key to enter the first code digit. Press the SHIFT key to move to the second code digit. Digit will blink. Press the INCREASE key to enter the second code digit.

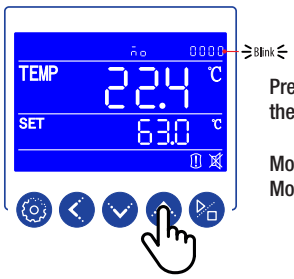
Follow the same procedure for the third and fourth code digits.



Press the SETTING key to enter the Level 4 controller parameters.

The Mo parameter will appear.

STEP 3: Change parameter Mo

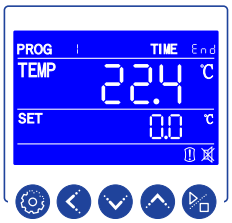


Press the INCREASE or DECREASE key to change the first digit.

Mo=0000 Fixed value (Single-step) program
Mo=0001 Multi-step programs

STEP 4: Set parameter and return to standard state

Press the SETTING key 1 time to set parameter Mo and return to standard state.



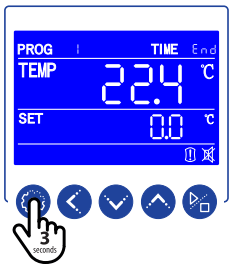
Upon changing to multi-step progams, the controller screen will change to PROG 1.

Upon initializing the unit for the first time, user needs to set the temperature and time for each step in a program.

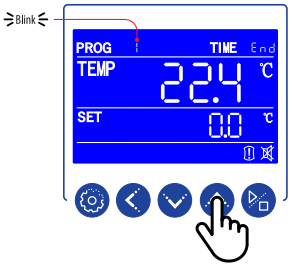
Programming Multi-step Programs

Units are shipped with the controller initially set to PROG 1 when multi-step programs are turned on. If multi-step programs are turned off and later turned on, the last program run or selected will be displayed.

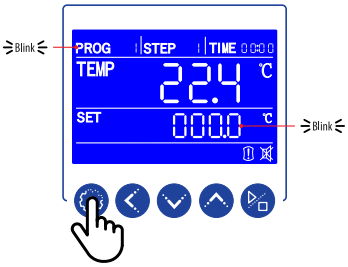
STEP 1: Select program number to set up



Press the SETTING key for 3 seconds. The “PROG 1” will initially blink. Then the number will blink.



Press the INCREASE key to select the program number to program.

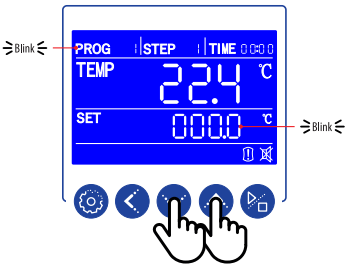


Pressing the SETTING key starts the programming process.

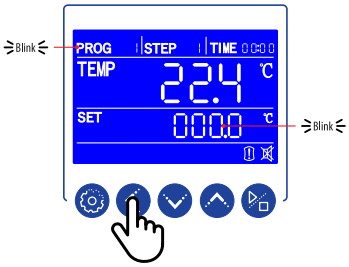
STEP 1 will appear. “End” in TIME area will change to run time digits. PROG and the tenths temperature value blinks.

Units are shipped with all steps in each program set to zero temperature and zero run time.

STEP 2: Set the STEP temperature



Press the INCREASE or DECREASE key to enter the tenths temperature value.



Press the SHIFT key to move to the next parameter digits. Each move will cause parameter to blink.

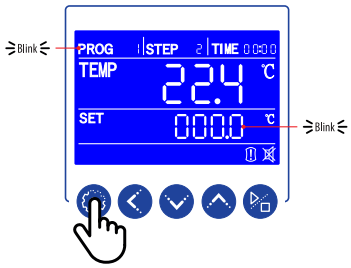
Use INCREASE or DECREASE key to set each temperature value.

Press the SETTING key to accept temperature setpoint. The first TIME digit will blink.

STEP 3: Set the STEP run time

Use INCREASE or DECREASE key to set each minute and hour value.

Press the SHIFT key to move to the next parameter digits.



Press the SETTING key to accept the run time.

The next program step will appear. The tens temperature value will blink.

STEP 4: Repeat Steps 2 and 3 for each program step

Leave step temperature and run time at zero for each step not needed for the program.

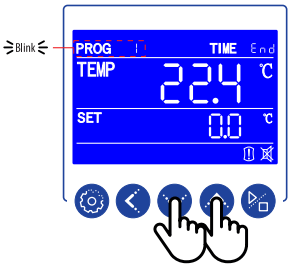
Upon setting all of the steps, the controller will return to multi-step program standard state.

Selecting Multi-step Program to Run

STEP 1: Press SETTING key

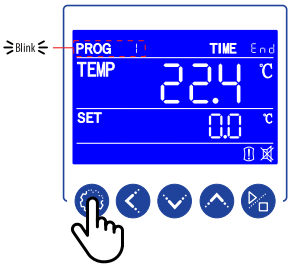
Press the SETTING key one (1) time. The “PROG” area will blink.

STEP 2: Select program number



Press the INCREASE or DECREASE to select program number.

Units are shipped with the controller initially set to PROG 1 when multi-step programs are turned on. If multi-step programs are turned off and later turned on, the last program run or selected will be displayed.



Press the SETTING key to confirm the program to be run.

STEP 3: Press RUN key

Pressing the RUN key for 2 seconds starts the program. STEP area, RUN, HEAT, and run time illuminate.

Setting up Program Cycling

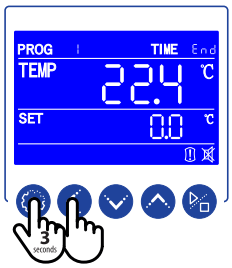
This function is for multi-step programs only.

Units are shipped with program cycling set to 1.
Parameter **Cy=0001**.

STEP 1: Ensure the multi-step program function is turned on. *See "Turning On/Off Multi-step Programs" instructions on page 09.*

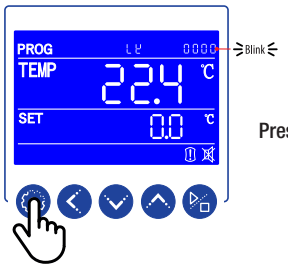
STEP 2: Select program (1 - 8) to run multiple cycles. *See "Selecting Multi-step Program to Run" instructions on page 11.*

STEP 3: Enter Level 1 of controller internal parameters



Press the SETTING and SHIFT keys for 3 seconds to enter the controller's internal parameter settings. Time area will change and first digit will blink.

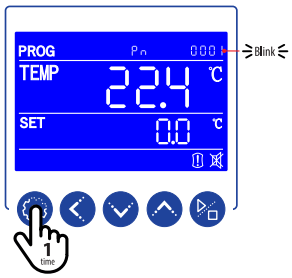
STEP 2: Press SETTING key



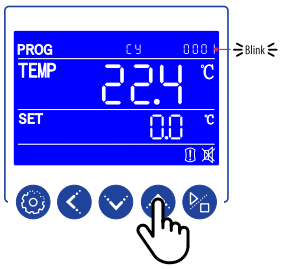
Press the SETTING key to enter Level 1 parameters.

When entering the controller's internal parameters, Level 1, LK =0000, will always come up first.

STEP 3: Scroll to parameter Cy



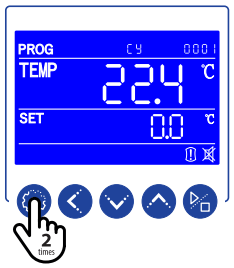
Press the SETTING key 1 time to scroll through parameters until the parameter Cy appears.



Press the INCREASE key to enter the first cycle value. Press the SHIFT key to move to the second cycle digit. Digit will blink. Press the INCREASE key to enter the second cycle value.

Parameter **Cy=0001 to 0099.**

STEP 4: Set parameter and return to multi-step program standard state.



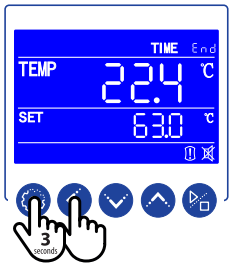
Press the SETTING key 2 times to set parameter Cy and return to multi-step program standard state.

Setting up RUN Delay

BEING's L Series controller allows the user to delay the start of a program for up to 99 hours and 59 minutes. Once the delay times out, the program will start operation.

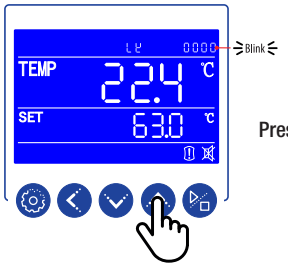
Fixed Value (Single-step) Programs

STEP 1: Enter Level 1 of controller internal parameters



Press the SETTING and SHIFT keys for 3 seconds to enter the controller's internal parameter settings. Time area will change and first digit will blink.

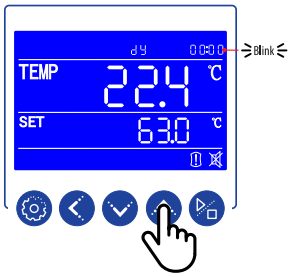
STEP 2: Press SETTING key



Press the SETTING key to enter Level 1 parameters.

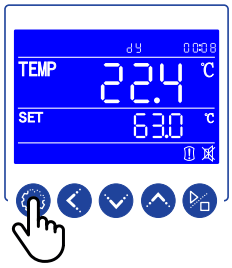
When entering the controller's internal parameters, Level 1, LK =0000, will always come up first.

STEP 4: Set parameter and return to multi-step program standard state.



Press the INCREASE key to enter the first time value. Press the SHIFT key to move to the second time digit. Digit will blink. Press the INCREASE key to enter the second time value.

Parameter **dy=00:00 to 99:59.**



Press the SETTING key 1 time to set parameter dy and return to fixed value program standard state.

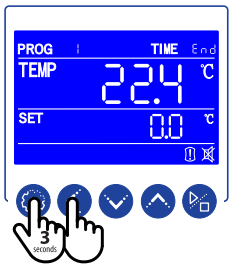
Setting up RUN Delay

Multi-step Programs

STEP 1: Ensure the multi-step program function is turned on. *See "Turning On/Off Multi-step Programs" instructions on page 09.*

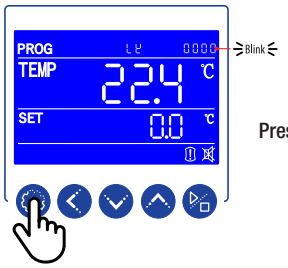
STEP 2: Select program (1 - 8) to run multiple cycles. *See "Selecting Multi-step Program to Run" instructions on page 11.*

STEP 3: Enter Level 1 of controller internal parameters



Press the SETTING and SHIFT keys for 3 seconds to enter the controller's internal parameter settings. Time area will change and first digit will blink.

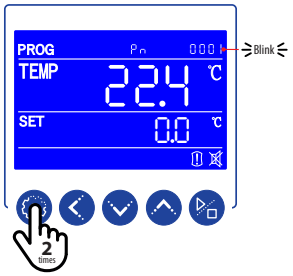
STEP 2: Press SETTING key



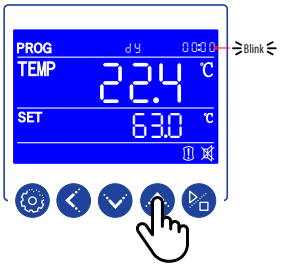
Press the SETTING key to enter Level 1 parameters.

When entering the controller's internal parameters, Level 1, LK =0000, will always come up first.

STEP 3: Scroll to parameter dy

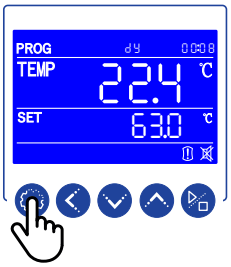


Press the SETTING key 2 times to scroll through parameters until the parameter dy appears.



Press the INCREASE key to enter the first time value. Press the SHIFT key to move to the second cycle digit. Digit will blink. Press the INCREASE key to enter the second time value.

STEP 4: Set parameter and return to multi-step program standard state.

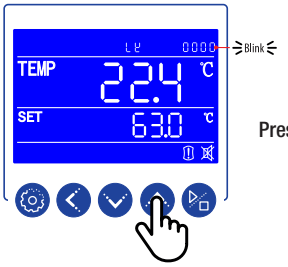


Press the SETTING key 1 time to set parameter dy and return to multi-step program standard state.

Changing Power-up Mode

Units are shipped with power-up mode set to 2. The controller starts running from the last power-off.
Parameter **Po=0002**.

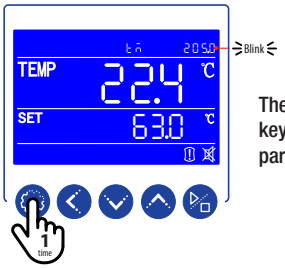
STEP 1: Enter Level 2 code. LK=0003



Press the INCREASE key to enter the code digit.

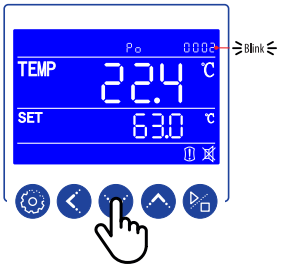
Press the SETTING key to enter the Level 2 controller parameters.

STEP 2: Scroll to parameter Po



The tM parameter will appear. Press the SETTING key 1 time to scroll through parameters until the parameter Po appears.

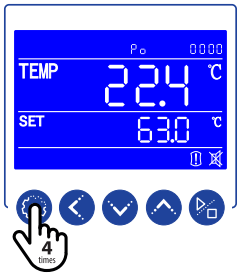
STEP 3: Change parameter Po



Press the DECREASE key to change the first digit.

Po=0000 The controller is in a stopped state after power-on, and user must start the operation pressing START/STOP button for 2 seconds.
Po=0001 The controller automatically the step operation after power-on.
Po=0002 The controller starts running from the last power-off.

STEP 4: Set parameter and return to standard state.

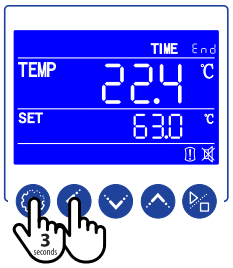


Press the SETTING key 4 times to set parameter Po and return to standard state.

Internal Parameter Settings Overview

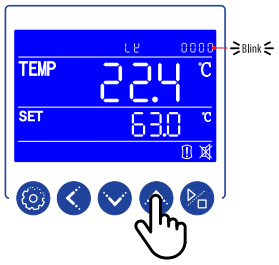
Changing parameter value process

STEP 1



Press and hold SETTING and shift keys for 3 seconds to view the controller's internal parameters.

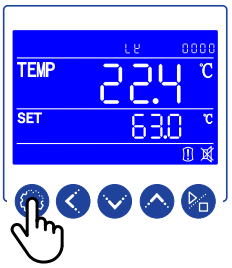
STEP 2



Press increase key to change first digit value. Value will blink as it is being set.

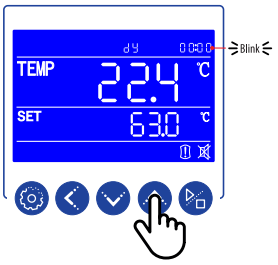
Press the shift key to move to the next parameter digits. Each move will cause digit to blink.

STEP 3



Press SETTING key once entering required code for the parameter level you want to change.

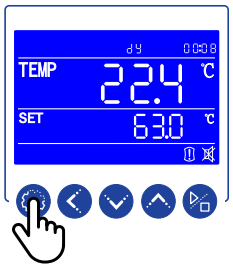
STEP 4



First available function parameter within level will appear. Press increase key to change first digit value. Value will blink as it is being set.

Press the shift key to move to the next parameter digits. Each move will cause digit to blink.

STEP 5



Press SETTING key once entering parameter value.

Next parameter will appear or controller will return to standard state.

Level 1

LK [LK] = 0000

PROMPT		FUNCTION NAME	FUNCTION RANGE	EXPLANATION	INITIAL VALUE
Pn	Pn	Working Group	0 – 8	For multi-step program control only, set up a working group for instrument operation. When **Pn** is set to 0, group 0 is fixed value (single-step) control.	
Cy	CY	No. of Cycles	0 – 99	Controls number of times a multi-step program runs. **When Cy is 0**, the instrument has been running between the work groups. **When Cy IS NOT 0**, the instrument will automatically stop after cycling **Cy** times in the work group. The value will automatically return to 1 after shutdown.	0001
dy	dY	Run Delay	00:00 – 99:59 (hh:mm)	00:00 - No delay. Other values - Start of a program will be delayed **dy** time after pressing the RUN key.	00:00

Level 2

LK [LK] = 0003

PROMPT		FUNCTION NAME	FUNCTION RANGE	EXPLANATION	INITIAL VALUE
tM	tM	Maximum Allowable Temperature Setting	Set within the measuring range	Stop heating and alarm when the maximum temperature is exceeded	200.0
Po	Po	Power-up Mode	0 – 2	**Po=0000:** Controller is in a stopped state after power-on. User must start the operation by pressing the RUN/STOP button for 3 seconds. **Po=0001:** Controller automatically starts the step operation after power-on. **Po=0002:** Controller starts running from the last power-off.	0002
AL	AL	Alarm Setting	0 – Full Range	Alarm illuminates with audible output (and HOLD function) when the temperature exceeds the Setpoint+**AL** value.	003.0
Pb	Pb	Zero Adjustment (Intercept)	-100.0 – 100.0	When the zero error of the meter is large and the full-scale error is small, adjust this value. Generally, PT100 rarely adjusts this value.	000.0
PK	PK	Full Scale Adjustment (Slope)	-1000 – 1000	When the zero error of the meter is small and the full-scale error is large, adjust the value. **PK**=4000 x (mercury thermometer value-display value)/display value, generally PT100 first adjust this value.	0000
PA	PA	Ambient Temperature Correction	-80 – 80	When there is an error between the actual ambient temperature and the controller display ambient temperature, adjust the value	000.0

Level 4

LK [LK] = 8286

PROMPT	FUNCTION NAME	FUNCTION RANGE	EXPLANATION	INITIAL VALUE
Mo Mo	Program Type Selection	0 – 1	**Mo=0000**: Fixed Value (Single-step Program) **Mo=0001**: Multi-step Program	0000

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