

LCD CONTROLLER

L Series



Controller used on the following product series.

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

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

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

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

BOV-20, -50, -90
Vacuum Ovens

BIC-60, -120, -250
Cooling incubators

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

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

2.0 TABLE OF CONTENTS

Safety messages	03
Controller elements overview	04
Changing temperature unit of measurement.....	05
Calibration after unit of measurement change	06-07
What is a multi-step program	08-09
Turn on/off multi-step programs	10
Programming multi-step programs	11
Selecting multi-step program to run	12
Setting up program cycling	13
Setting up RUN delay — fixed value (single-step) programs	14
Setting up RUN delay — multi-step programs	14
Changing power-up mode	15
Internal parameters overview	16-17

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 startup 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 panels 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.

Prohibition



Do not touch fluid.

Warning



Safety Alert Symbol. General caution.



Hot Surface



Controller Element Overview



PROG Area: Displays the program working or setting group. Controller is capable of programming and storing up to 7 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 blink when the unit's heater is on. Turns off when heating elements are 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.

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 blink 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.

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 temperature measurement set to Celsius (°C).
Parameter CF=0000.

STEP 1: Enter Level 3 of controller internal parameters.



Press and hold 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 4: Change parameter CF.



Press the increase or decrease key to change the first digit.

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

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.

STEP 5: Set parameter and return to standard state.



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



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

First available parameter will appear.



Upon changing the temperature unit of measurement, the actual temperature will change its value.

STEP 3: Scroll to parameter CF.



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



Temperature setpoint must be changed manually.

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 8mm.



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 value (PV1 & PV2), and thermometer reading (TV1 & TV2).

STEP 4: Compare thermometer readings to set and present temperatures. If $SV1 \neq PV1 \neq TV1$ or $SV2 \neq PV2 \neq TV2$, 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.



 The test hole is Ø25mm and located on the right side of the oven.



STEP 3: Insert thermometer probe into test hole.



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

STEP 4: 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 value (PV1 & PV2), and thermometer reading (TV1 & TV2).

STEP 5: Compare thermometer readings to set and present temperatures. If $SV1 \neq PV1 \neq TV1$ or $SV2 \neq PV2 \neq TV2$, move to STEP 6.

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 value (PV1 & PV2), and thermometer reading (TV1 & TV2).

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

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, open 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 value (PV1 & PV2), and thermometer reading (TV1 & TV2).

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

STEP 4/5/6: Perform the following calculations to determine Pb and PK.

Full Scale Adjustment (Slope)

$$PK = \{[(TV2-TV1)/(SV2-SV1)]-1\} \times 4000$$

Zero Adjustment (Intercept)

$$Pb = TV2 - \{[PK/(4000/SV2)]\} + SV2$$

What is a Multi-step Program

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 4: Set parameter and return to standard state



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

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.



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



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

The Mo parameter will appear.



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

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

Programming Multi-step Programs

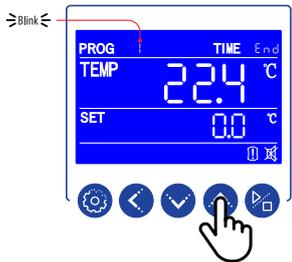


Units are shipped with the controller initially set to PROG 1 when multi-step programs are turned on. If multi-step programs are turned off and later turned on, the last program run or selected will be displayed.

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.



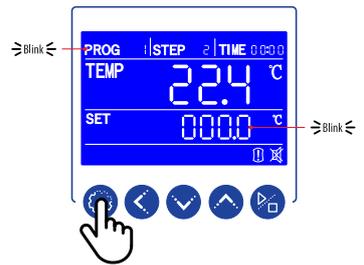
Press the SETTING key to accept temperature setpoint. The first TIME digit will blink.

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.



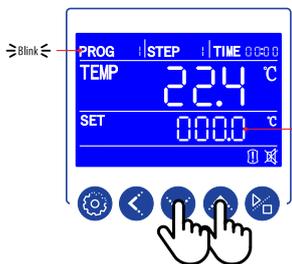
Press the SETTING key to accept the run time.

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



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.

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.

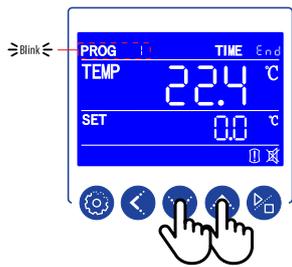
Selecting Multi-step Program to Run

STEP 1: Press SETTING key



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

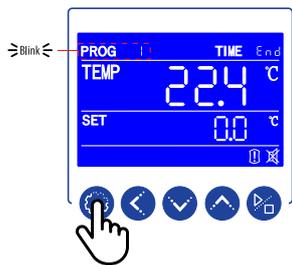
STEP 2: Select program number



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 06.

STEP 2: Select program (1 - 8) to run multiple cycles.
See "Selecting Multi-step Program to Run" instructions on page 08.

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 code 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.

Fixed Value (Single-step) Programs

Multi-step Programs

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 3

LK [LL] = 0088

PROMPT	FUNCTION NAME	FUNCTION RANGE	EXPLANATION	INITIAL VALUE
CL CL	Cooling Control Set Up	-5.0 – 60.0	When the compressor is started and stopped for cooling, when the temperature exceeds the CL value and the compressor cooling control delay is met, the cooling light is on, the cooling contact is turned on, and the compressor is started.	000.5
Ct CL	Cooling Control Delay	0 – 300 seconds	The delay time required to start the compressor twice, Ct=0 cancels the compressor function.	0001
LA LR	Lower Limit Absolute Value Alarm	Full Range	Alarm illuminates with audible output when the measured temperature is lower than this value.	010.0
P P	Proportional Band	2.0 – 300.0	Proportional effect adjustment, the greater the P , the smaller the proportional effect, the lower the system gain.	015.0
I I	Integral Time	2 – 3600 seconds	Integral action time constant, the greater the I , the weaker the integral action.	0300
d d	Derivative Time	0 – 3600 seconds	Derivative action time constant, the greater the d , the stronger the derivative action.	0300
Hp HP	Overshoot Suppression	0 – 100%	Controller has stronger ability to suppress temperature overshoot when the value of Ar is smaller.	0100
SL SL	Segmentation Point	0.0 – 300.0	Sectional setting temperature of section PID.	050.0
Lr LR	Overshoot Suppression 1	0 – 100	Lr overshoot suppression effect when set temperature is less than or equal to SL .	0020
t T	Heating Cycle	1 – 100 seconds	Relay output <20s, SSR and thyristor switch <3s.	0003
Lt LT	Temperature Lower Limit Setting	-80.0 – 320.0	Set the lower limit of measurement temperature.	000.0
Ht HT	Temperature Upper Limit Setting	-80.0 – 320.0	Set the upper limit of measurement temperature.	300.0
md MD	Circulation Fan Selection	0 – 1	md=0000 : Automatic circulation fan md=0001 : Manual circulation fan	0000
Fn FN	Fan Speed Conversion Value	0 – 300.0	<ul style="list-style-type: none"> When the measured temperature is greater than the set temperature +Fn or when the measured temperature is less than the set temperature -Fn, the high-speed fan starts. When the measured temperature is higher than the set temperature -Fn and the measured temperature is lower than the set temperature +Fn, the low-speed fan start. This parameter is only valid when the circulating fan parameter md is selected as 0. Fn=0, no fan output; Fn=300.0, first gear fan output. 	002.0
dr DR	Gating Options	0 – 2	dr=0000 : No gating dr=0001 : Close the door dr=0002 : Open the door	0001
CF CF	Unit of Temperature Measurement	0 – 1	CF=0000 : Celsius CF=0001 : Fahrenheit	0000
co CO	Cooling Options	0 – 2	co=0000 : RUN/Stop type co=0001 : Balanced type, related to ambient temperature co=0002 : Balanced type, related to CL	0001

Level 4

LK [LL] = 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



