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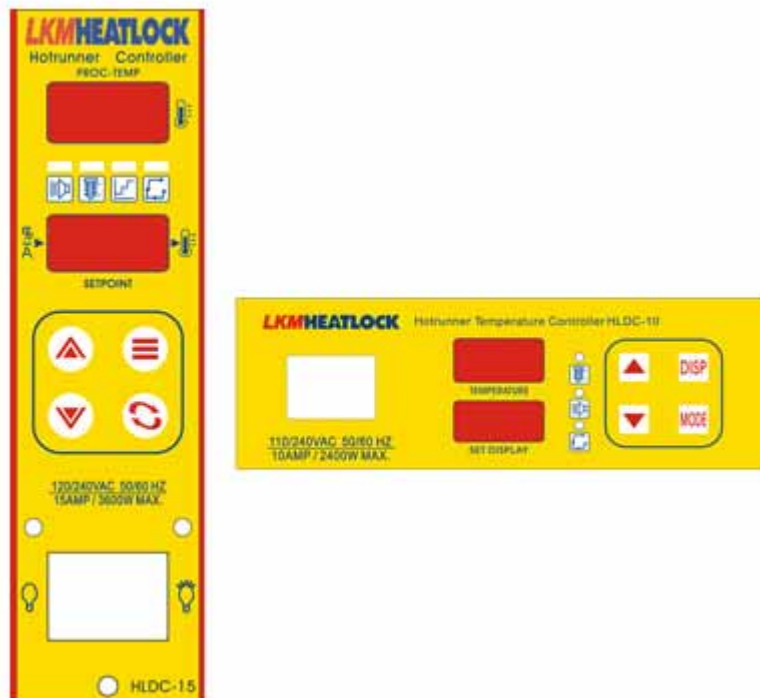
## MICROPROCESSOR-BASED TEMPERATURE CONTROLLER

DUAL DIGITAL DISPLAY INDICATING  
DUAL TYPE THERMOCOUPLE SENSOR

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# LKMHEATLOCK

## HLDC-15 & HLDC-10 USER MANUAL



## HOT RUNNER TEMPERATURE CONTROLLER

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**LKMHEATLOCK CO. LTD**

**HEAD OFFICE ADDRESS:**  
2/F., Cheung Kong Electronic  
Building 4 Hing Yip Steet,  
Kwun Tong, HongKong

**ADRESS IN CHINA:**  
Qiao Li Lnd.Area, Chang Ping,  
DongGuan Guangdong, China

**TEL:(852)2341 2321**

**FAX:(852)2343 0990**

**E-MAIL :lkmheatlock@lkm.com.hk**

**TEL:(86)0769-333 0020**

**FAX:(86)0769-393 9020**

## CAUTION



Never insert or remove a controller from a mainframe with the AC power on. Hazardous potentials exist on components inside the mainframe and controller. Always disconnect AC power to the mainframe when servicing ! Because these temperature controls or associated equipment may not always fail safe, an approved temperature and/or pressure safety control should be used for safe operation.

## GENERAL DESCRIPTION

The Series zone temperature controller is a PID-controlled instrument specifically designed for runnerless (hot runner) plastic injection molding applications. The controller is self-adjusting and capable of maintaining a very high degree of temperature accuracy over a wide range of operating conditions. Simplified controls and the use of status indicators allow the operator to make adjustments easily. The status display also provides visual indication of normal or abnormal operating conditions existing in both the controller and/or load.

## INSTALLATION

Set jumper configuration to desired operation (see jumper table). To install the controller in a mainframe, release the locking device on the lower edge of the unit by pulling the plunger gently away from the panel. Align the upper and lower edges of the controller printed circuit board with the respective card guides on the mainframe and slide the unit all the way into the mainframe until the rear connector is completely engaged. Lock the controller into the frame by depressing the plunger on the locking device.

## Safety Warning

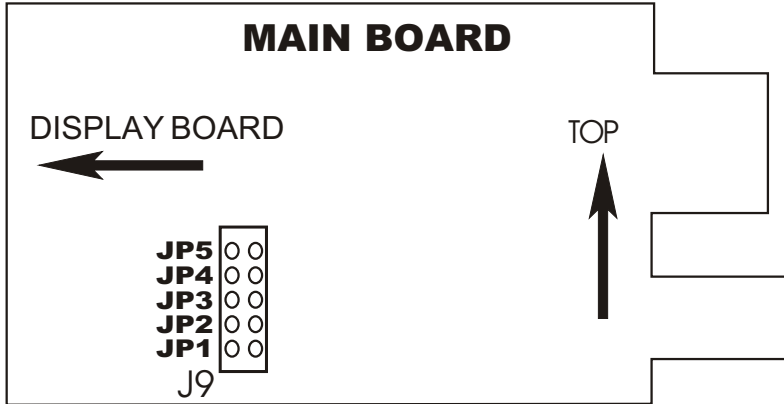
In addition to presenting a potential fire hazard , high voltage and high temperature can damage equipment and cause severe injury or death.

When installing or using this instrument, follow all instructions carefully and use approved safety controls (high limit, etc.). Only suitably trained personnel should perform electrical wiring of connections.

Do not locate this instrument electrical where it may be subjected to excessive shock, vibration, dirt, moisture, oil, or other liquids.

Safe operating temperature range is 32 to 131° F (0 to 55°C).

# JUMPER SELECTIONS



## WHEN INSTALLED

### CLOSE

JP1 SOFT START ALWAYS  
JP2 "K" THERMOCOUPLE  
JP3 DEGREES CELSIUS  
JP4 NOT USED  
JP5 NOT USED

### OPEN

AUTO SOFT START  
"J" THERMOCOUPLE  
DEGREES FAHRENHEIT  
NOT USED  
NOT USED

## STANDARD FACTORY DEFAULTS

SETPOINT	392°F (200°C)
AUTOTUNE	DIS
PROPORTIONAL BAND	13
RATE	7
DEVIATION ALARMS	+/- 33°F (20°C)

# INTRODUCTION

Thank you for choosing this Control. Congratulation on your purchase. Used properly, this precision instrument will provide you with many years of trouble-free and productive service.

The Series zone controllers offer many advanced features designed to increase productivity and ensure fast, accurate and repeatable mold temperature control.

- > Compatible with all G units and all existing Hot Runner Controls for easy retrofit/replacement. **\*\* (G Is Registered Trademark Of The DME CO. )**
- > Simultaneous display of both process/setpoint temperature and process temperature/percent power output or Heater current.
- > Autotuning independently adjusts zone control characteristics.
- > Built-in diagnostics alert operator to fault conditions.
- > AdjCompStep circuitry provides for safe heater warm-up through gradual phase-angle fired voltage control (Soft Start).

# PRODUCT DESCRIPTION

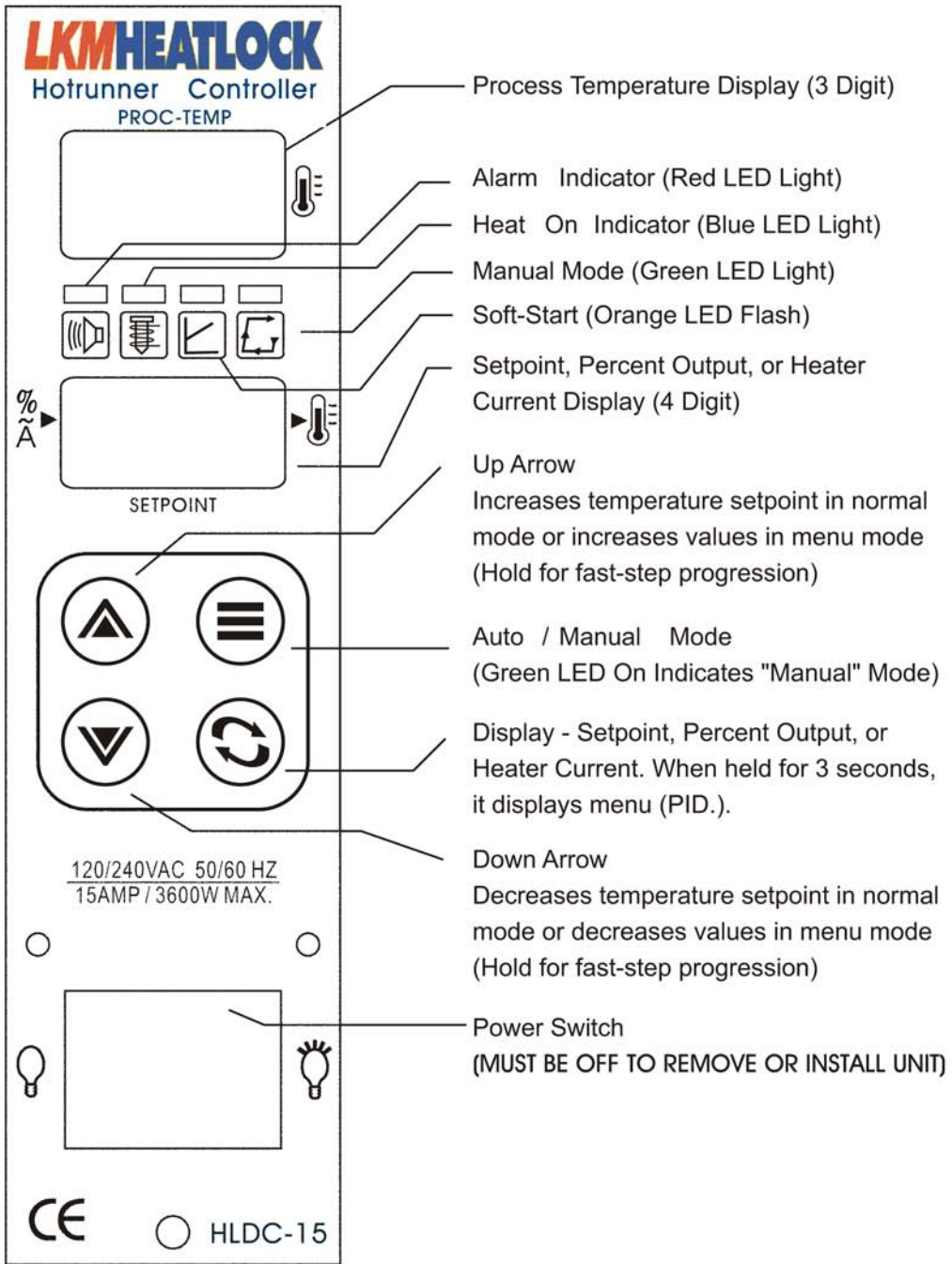
The Zone is a microcontroller-based "Hot-Runner" family control module that provides temperature control and operator interface function. It controls one temperature zone by sensing a J or K thermocouple (see jumper table).

The Zone operator input is via a 4-button keypad. The controller has two displays comprised of seven-segment LED's. The upper display is a three character display and the lower display is a four character display. Additionally the unit has 3 discrete LED indicators to indicate system status.

The Controller consists of two electronics boards (Microcontroller and Display), a triac /heat-sink assembly, and a front-panel assembly. It is physically and electrically compatible with the existing other brands mainframe system.

The Zone is intended for use in an industrial environment by both technical and nontechnical personnel. With this in mind, the Controller hardware and software are designed for straightforward use with a high level of fault tolerance.

# Panel Descriptions



# ENTERING AND CHANGING PARAMETER VALUES

The Parameter menu contains two items. Enter the menu by holding down the DISPLAY key for three seconds. Exit the menu by holding down the DISPLAY key for three seconds.

- (1) PID. Parameter Menu.
- (2) Par. Parameter Menu.

-->To select next item in menu use the DISPLAY key.

The PID menu contains three items.

- 1). Pb Proportional Band
- 2). rAte Tacking integral
- 3). A.tun Autotune Operation (On/OFF)

-->To adjust parameters use the up or down keys.

-->To select next item in menu use the MODE key.

## PROPORTIONAL BANDWIDTH

This item is accessible within the Menu. This PID control parameter is adjustable from 0.1 to 999 °F / 537 °C

## RATE

This item is accessible within the Menu. This PID control parameter is adjustable from 0.0 to 999.

## AUTOTUNE

On ENABLE: Tunes every time power is applied.

OFF DISABLE: Uses currently stored PID values.

The Par. menu contains two items.

- 1). LPb.t Loop Break Time

This item is accessible within the Menu. This parameter is adjustable OFF or from 10 to 999 seconds.

- 2). HT.SU Heater Save Temperature

This item is accessible within the Menu. This parameter is adjustable OFF or from 1 to 999 °F / 537 °C heater limited temperature.

# Modes of Operation

## Manual Mode

To switch to Manual Mode from Auto Mode, press the Mode key until the "Manual" LED illuminates. This mode allows the operator to adjust the Manual Output Percentage (0 to 100%) by pressing the UP/DOWN arrow keys.

There are two different parameters that can be viewed on the lower display while in MANUAL mode. Pressing the DISPLAY key will toggle between them.

1. Manual Control Output percent: display followed by "P" (modifiable by user)
2. Measured Heater Current (display followed by "A")

## AUTO MODE

To select Auto Mode, press the MODE key until the manual LED turns off. This mode allows the operator to adjust the Setpoint temperature value by pressing the UP/DOWN arrow keys.

There are three different parameters that can be viewed on the lower display while in Auto Mode. Pressing the DISPLAY key will toggle between them.

- 1). Setpoint value (modifiable by user)
- 2). Output Percent (display followed by "P")
- 3). Measured Heater Current (display followed by "A")

# **FUNCTIONS**

The controller provides the following functions:

## **SENSOR SAMPLING**

A "J" or "K" (OPTIONAL) thermocouple is sampled using a 16-bit dual-slope integrating A/D converter. Input voltages corresponding to temperatures from 32 to 999 °F (0 to 537 °C) are processed with a resolution of 1 °F (°C)

## **CLOSED-LOOP CONTROL**

A PID control algorithm is used to adjust the amount of power delivered to the load. The Proportional Band and Derivative parameters are individually and directly adjustable. The Integral parameter tracks the Derivative parameter by a fixed ratio.

## **OPEN-LOOP CONTROL**

In open-loop (MANUAL CONTROL MODE), the operator is able to set the output percentage.

## **ADJCOMPSTEP (HEATER BAKE-OUT)**

Graduated phase-angle activation of the TRIAC is provided for drying heaters on startup.

## **LOOP-BREAK PROTECTION**

Software will monitor the response of the system to changes in the output for the purpose of detecting a control loop break. Display will read ("Er.01").

## **TEMPERATURE INDICATION**

Actual process temperature is indicated on the Process Display (upper display). Units (°F or °C) for this display are determined by a jumper (see page 2.) and displayed on the lower display.

## **HEAT ON INDICATION**

A single Blue LED is lit whenever the output is on. For additional output state information, the operator will also be given the ability to directly monitor the heater output percentage from the front panel's lower display. (see page 4.)

## **CURRENT MONITORING**

The Controller is capable of monitoring and displaying the average current being delivered to the load. The display is in 0.1 ampere increments.



## **FUNCTIONS (CONTINUED)**

### **MANUAL CONTROL MODE**

AUTO/MANUAL has easy accessibility from the front panel. Pressing the "MODE" Key until the LED adjacent to "MANUAL" legend is illuminated will cause manual control to begin. Manual Control is also activated at zero percent when input error conditions arise and under these circumstances is activated automatically regardless of the "MODE" key Enable state. The initial control percent, established when manual control is activated, is dependent upon the cause of activation. When entered normally because of operator actions, a bumpless transfer is attempted. Pressing the "MODE" Key again (when in manual mode) returns the control to automatic mode.

### **AdjCompStep/BAKE OUT/SOFT START**

Gradually applying power to the heaters extends the life of the heaters and the mold. Phase angle firing is used to implement the AdjCompStep feature. The AdjCompStep will last for 5 minutes or until the temperature reaches 221 °F. AdjCompStep is a self-terminating feature but the operator may also terminate it by pressing the MODE key.

### **AUTOTUNE**

The tune operation will follow AdjCompStep. The tuner looks for stability in the process temperature before it proceeds. If system stability cannot be achieved within a fixed time period then the tune process will terminate. The operator has the ability to terminate Autotuner execution by pressing the MODE key while the Autotuner is active. During autotuning, the display alternately flashes "A.tu." and the process value.

### **NORMAL CONTROL MODE (AUTO)**

The control algorithm used for Normal control MODE is PID. The rate and proportional band parameters appear in the menu system. The reset parameter is always set to a value equal to five times the rate. The Controller has a fixed cycle time of 100 ms (10Hz).

### **BUMPLESS TRANSFER**

The Controller employs an intelligent bumpless transfer. When the process is within five degrees of setpoint, the controller periodically records the output percent necessary to maintain setpoint. When an operator initiated transition to Manual Control occurs, the recorded output percentage is used.

# FUNCTIONS (CONTINUED)

## CURRENT MONITOR/ OUTPUT FAILURE DETECTION

The Current Monitor processor continually monitors heater current readings to insure that they correlate with output activity.

If the output device signal (HEAT) is off and a current flow is detected then the processor will post a triac short error, the Lower Display will toggle flash "Er.02" error message, the Alarm LED will light, all other indicators are set off, and all control processing will terminate.

If the output device is on but no current flow is detected then the processor will post a bad heater error, the Lower Display will toggle flash "Er.03" error message, the Alarm LED will light, all other indicators are set off, and all control processing will terminate.

If either of these error conditions is detected, the OPTIONAL Power Interrupt Relay provided by the hardware will open to interrupt power between the TRIAC and the heater.

There is no automatic recovery from either of these problems. Once detected and posted, power to the unit must be cycled for control processing to resume.

## SENSOR ERROR DETECTION

When a sensor error is detected, the upper display will toggle between "TC" and the cause of the thermocouple error: "r.tc." if the thermocouple is reversed, "o.tc." if the thermocouple is open. The alarm LED will light, and the output will turn off.

## NORMAL OPERATING MODE

The following summarizes key functionality within Normal Operating MODE:



Pressed briefly, this key indexes to the next available lower display item. Pressed for an extended time (three seconds), menu system entry will occur.

### UPARROW

This key will increment the current value of the item presented is one that can be incremented. A setpoint value is an example of a lower display item which can be incremented. The measured Heater Current value is an example of a lower display item which cannot be incremented.

# FUNCTIONS (CONTINUED)

**DOWN ARROW** This key will decrement the current value of the item presented on the lower display when the item presented is one that can be decremented.



This key will terminate AUTOTUNE or Soft Start or will change the AUTO/MANUAL mode selection.

## NORMAL OPERATING MODE DISPLAY FUNCTIONS

In the absence of any special circumstances or error conditions, the upper display (3-character display) of the Controller is dedicated to the presentation of the Process Value when the unit is in Normal Operating MODE. The Process Value is displayed in accordance with the temperature scale established by the "Units" jumper.

In the absence of any error conditions, the lower display (4 character display) of the Controller is used to present a variety of items. The operator can index through the available items with brief presses of the DISPLAY key.

## AUTOTUNE ACTIVE INDICATOR

Whenever the Autotune Process is active, the upper display will toggle between Autotune (A.tu.) and Process Value.

The Autotune process can terminate itself for two reasons. Self-termination occurs because the process has either completed or an error has been detected. When the process has completed, the Autotune Active Indicator (A.tu.) is removed and the display reverts to a steady display of the process Value. When the process self-terminates due to an error condition the Autotune Active Indicator will toggle with a mnemonic, indicating the specific error condition that has occurred.

The Autotune process can also be terminated by pressing the MODE key while the Autotune process is active. The unit will go directly to Normal Control Mode, the Autotune Active Indicator (A.tu.) is removed and the display reverts to a steady display of the Process Value.

# Specifications

Operating Temperature	32 to 131°F (0 to 55 °C)
Shipping Temperature	-40 to 158°F (-40 to 70 °C)
Humidity	10 to 95% Non-Condensing
Sensor Type (Jumper Selectable)	J or K Thermocouple
Sensor Range	32 to 999°F (0 to 537 °C)
Sampling Rate	10 Hz (100 ms)
Noise Rejection	Common Mode > 100 dB Series Mode > 70 dB
Temperature Accuracy	+/- 0.3% of span.
Repeatability	+/- 0.1% of span.
Displays	7-Segment LEDs; 3-digit upper (Red) and 4-digit lower (Red)
Upper Display Height	14.2 mm/ 0.4"
Lower Display Height	9.15 mm/ 0.36"
Output Status Indication	Blue LED
Alarm Status Indication	Red LED
Manual Mode Indicator	Green LED
Soft-Start Mode Indicator	ORG LED
Control Output Device Type optional 30 A	Triac, 15 A at 120/240 Vac
Operator Activation/Interface	4 Momentary Switches, 16A Power Switch
Power Requirements	115 to 240 V 50/60 Hz Nominal

All specifications are subject to change without notice.

## ERROR CODE DSIPLAY

ERROR CODE		DESCRIPTION
Er.01		Loop Break Down
Er.02	(Display Flash)	Output Short
o.tc.	(Display Flash)	Open Thermocouple
r.tc.	(Display Flash)	Reverse Thermocouple
Er.03	(Display Flash)	Open Heater

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Manual End