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Call Toll-Free: 800-782-6776
For Technical Assistance Outside the U.S.,
Call: 610-828-2490

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The Temperature Control Company

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ATHENA®
The Temperature Control Company

SERIES
RMB

HOT RUNNER CONTROLLER

Instruction Manual

Introduction

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

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

- Compatible with all previous G[1] and G+ units and all existing Hot Runner Controls for easy retrofit/replacement.
- 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.
- CompuStep® circuitry provides for safe heater warm-up through gradual phase angle-fired voltage control (Soft Start).

While most technical questions concerning the operation of the Series RMB controllers can be answered by referring to this manual, you may contact your Athena representative for additional support, or Athena Customer Service directly, at 800-782-6776 (outside the U.S. call 610-828-2490).

Precautions

After unpacking, inspect the instrument for any physical damage that may have occurred in shipping. Save all packing materials and report any damage to the carrier immediately.

CE

NOTES ON CE EMC COMPLIANCE

This unit is compliant with the following standards when properly installed into a grounded metal housing: (EMC testing was conducted with a load of 1Amp and setpoint of 400°F.)

EMC Directive (89/336/EEC)
EN 50081-1 (1992 edition)
EN 50082-1 (1992 edition)
Low Voltage Directive (73/23/EEC)
EN 61010-1 (1992 edition, Amendments 1, 2, 3, 4 and 11)

WARNING

This is a Class A product. In a domestic enviroment this product may cause radio interference in which case the user may be required to take adequate measures.

[1] G is a registered trademark of the DME Corporation.

USE OF THIS EQUIPMENT IN A MANNER NOT SPECIFIED BY THE MANUFACTURER MAY IMPAIR PROTECTION PROVIDED BY THE EQUIPMENT!

UNIT	OUTPUT RATING (AMPS / VOLTS)	FUSE RATING (AMPS)	TYPE
RMB	15 / 265	15	Fast-Acting 'F'

CLEANING INSTRUCTIONS

1) Remove power from the unit prior to any cleaning operation.
2) Use a cotton cloth to gently and sparingly apply isopropyl alcohol only. Do not use cleaners or other solvents as they may damage the unit.
3) Allow the unit to dry completely prior to reapplying power.

Caution (refer to accompanying documents)

Caution, risk of electrical shock!

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 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).

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.

Table of Contents

General Description

The Series RMB 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.

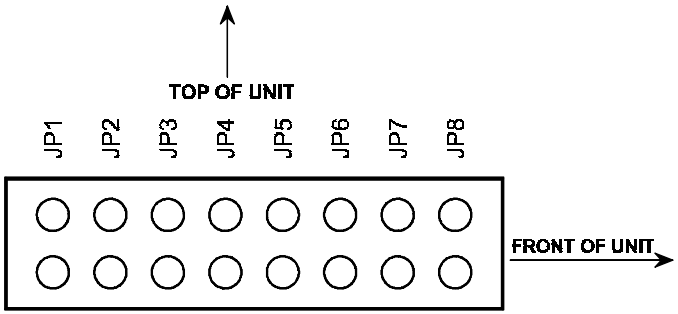
The RMB is a microcontroller-based “Hot-Runner” family control module that provides temperature control and operator interface functions. It controls one temperature zone by sensing a J or K thermocouple (see jumper table). The RMB’s operator input is via a 4-button keypad. The controller has two displays consisting of seven-segment LEDs. The upper display is a three-character display and the lower display is a four-character display. Additionally, the unit has three discrete LED indicators to indicate system status.

The RMB 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 Athena mainframe system.

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. NOTE: For CE units use appropriate tool to remove locking screw. 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.

Jumper Selections



	WHEN INSTALLED	OPEN
JP1	SOFT START ALWAYS	AUTO SOFT START
JP2	"K" THERMOCOUPLE	"J" THERMOCOUPLE
JP3	DEGREES CELCIUS	DEGREES FAHRENHEIT
JP4	FACTORY USE ONLY	NO FUNCTION
JP5	DEFAULT LOAD	NO FUNCTION
JP6	NOT USED	NOT USED
JP7	NOT USED	NOT USED
JP8	NOT USED	NOT USED

Factory Default Settings

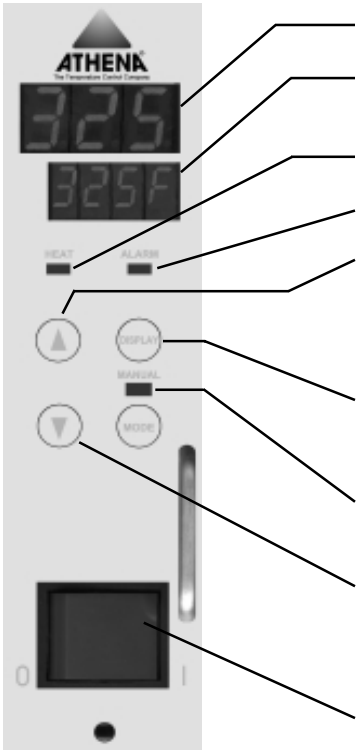
MENU

SETPOINT	100 °F (37.8 °C)
AUTOTUNE	ONCE
PROPORTIONAL BAND	24
RATE	7
DEVIATION ALARMS	+/- 30 °F (+/- 17°C)

JUMPERS

JP1	SOFT START
JP2	SENSOR
JP3	CENTIGRADE / FAHRENHEIT

Entering and Changing Parameter Values



Process Temperature Display (3 Digit)

Setpoint, Percent Output, or Heater Current Display (4 Digit)

Heat On Indicator (Orange)

Alarm Indicator (Orange)

Up Arrow
Increases temperature setpoint in normal mode or increases values in menu mode (Hold for fast-step progression)

Display - Setpoint, Percent Output, or Heater Current. When held for 3 seconds , it displays menu (PID).

Auto / Manual Mode (Green)
(LED On Indicates "Manual")

Down Arrow
Decreases temperature setpoint in normal mode or decreases values in menu mode (Hold for fast-step progression)

Power
(MUST BE OFF TO REMOVE OR INSTALL UNIT)

The PID menu contains three items. Enter the menu by holding down the DISPLAY KEY for three seconds and pressing the MODE KEY to index through the parameters. Exit the menu by holding down the DISPLAY KEY for three seconds.

Pb	Proportional Band
rAte	Derivative w/tracking integral
At.OP	Autotune Operation (enable/once/disable)

- To adjust parameters use the up or down keys.
- To select next item in menu use the MODE key.

Parameter Descriptions

PROPORTIONAL BANDWIDTH

Proportional Band is the amount of deviation of the controlled variable required to move through the full range (expressed in % of span or degrees of temperature). It is an expression of Gain (the wider the band, the lower the gain.) This item is accessible within the Menu. This PID control parameter is adjustable from 0.1 to 999 °F/537 °C.

RATE

Rate is a control function that produces a corrective signal proportional to the rate at which the controlled variable is changing. Rate action produces a faster corrective action than proportional action alone. Also referred to as Derivative action, Rate is useful in eliminating overshoot and undershoot. This item is accessible within the Menu. This PID control parameter is adjustable from 0.0 to 999.

RESET

Reset is a control function that produces a corrective signal proportional to the length of time and magnitude the controlled variable has been away from the setpoint. Reset action accommodates load changes, and is also known as Integral action. This item is not accessible within the Menu as the Reset parameter tracks the Rate parameter by a fixed ratio.

AUTOTUNE

When "At.OP" appears on the display, it will toggle with one of the following. Press the UP/DOWN keys to change setting.

EnA	ENABLE: Tunes every time power is applied.
oncE	ONCE: Tunes the first time power is applied, then reverts to disable.
dIS	DISABLE: Uses currently stored PID values.

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 (modifiable by user) (display followed by "P")

2) Measured Heater Current (display followed by "A")

Auto Mode

To switch to Auto Mode from Manual 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

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 (rate) parameters are individually and directly adjustable. The Integral (reset) 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.

COMPUSTEP® (HEATER BAKE-OUT)

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

OUTPUT FAILURE OVERRIDE (OPTIONAL)

An optional relay on the RMB is used by the microcontroller to interrupt current to the load in the event of triac shorting or error condition.

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. When this error occurs the display will read "LPbr".

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 6) and displayed on the lower display after the setpoint temperature.

HEAT ON INDICATION

A single orange LED is lit whenever the output is on. For additional output state information, the operator may select to monitor Heater Output Percentage from the front panel's lower display. See page 8.

CURRENT MONITORING

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

Functions (cont'd)

COMPUSTEP® / 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 CompuStep feature. The CompuStep will last for 5 minutes or until the temperature reaches 200 °F.

CompuStep is a self-terminating feature but the operator may also terminate it by pressing the MODE key.

AUTOTUNE

The Athena® autotune process executes according to the value established for the autotune parameter in the PID menu (default is to operate "ONCE").

The tune operation will follow CompuStep. 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 "tun" and the process value.

AUTO CONTROL MODE

The default (auto) 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 RMB has a fixed cycle time of 100 ms (10 Hz).

Functions (cont'd)

MANUAL CONTROL MODE

Switching between Auto and Manual mode is easily accomplished by pressing the MODE key to toggle between both states. In Manual mode, the LED indicator labeled "Manual" is illuminated. In Auto mode, it is not. 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.

BUMPLESS TRANSFER

The RMB 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. This is adjustable 0 - 100%.

GROUND FAULT DETECTION OPTION (standard on domestic units)

If a ground fault is detected during power up and if the unit is below 200 °F (93.3 ° C) during any operating mode the RMB makes up to three attempts to use CompuStep® to resolve the problem.

If the ground fault signal is still asserted when the unit is above 200 °F (93.3 ° C), a steady "gFi" will appear in the lower display, and the Alarm LED will illuminate. All other indicators will be off and all control processing will terminate. Power to the unit must be reset to resume control.

Functions (cont'd)

PRESET DEVIATION ALARMS

The RMB provides two deviation alarms, preset to 30 °F or 17 °C above and below setpoint value. If the process temperature falls below the setpoint minus the low deviation alarm value, or if the process temperature rises above the setpoint plus the high deviation alarm value, the controller enters the alarm state. The Alarm LED will illuminate. A port line is enabled on the communications connector strip that can be used to activate the audible alarm on Athena's ACM or ASM communications module (or similar module like the mainframe endplate module) if one is included in the system. When a deviation alarm condition occurs, this port is activated.

CURRENT MONITOR / OUTPUT FAILURE DETECTION

The Current Monitor processor continually monitors heater current readings to ensure 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 between "Out" and "SHrt," and the Alarm LED will illuminate. All other indicators will be 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 between "bAd" and "Htr," and the Alarm LED will illuminate. All other indicators will be off, and all control processing will terminate.

If either of these error conditions is detected, and the Power Interrupt option is installed, a relay will open to shut off power between the triac and heater.

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

SENSOR ERROR DETECTION

When a sensor error is detected, the upper display will alternately flash between "TC" and the cause of the thermocouple error. "rEv" occurs if the thermocouple is reversed, and "oPn" occurs if the thermocouple is open. The alarm LED will illuminate, and the output will be disabled. When "rEv" or "oPn" occur, the unit goes into Manual Mode 0%.

Functions (cont'd)

NORMAL OPERATING MODE DISPLAY FUNCTIONS

In the absence of any special circumstances or error conditions, the upper display (3-character display) of the RMB 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 RMB 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 INDICATION

Whenever the Autotune Process is active, the upper display will alternately flash between Autotune (tUn) and Process Value.

The Autotune process will terminate when completed, or when an error has been detected. When autotuning is completed, the flashing Autotune Active display (tUn) will revert to a steady display of the process value. When the process self-terminates due to an error condition, the Autotune Active display will flash alternately with an error code, indicating the specific error condition that has occurred. (see page 16).

The Autotune process can also be terminated by pressing the Mode key while the Autotune process is active. The unit will revert to auto control mode, and the flashing Autotune Active display will be replaced with a steady readout of the process value.

Display and Error Codes

DISPLAY CODE	DESCRIPTION
Pb	Proportional Band
RAte	Derivative w/tracking integral
At.OP	Autotune Operation (enable/once/disable)
EnA	Enable
oncE	Once
dIS	Disable
tUn	Autotuning

ERROR CODE	DESCRIPTION
Err.L	Input too low
Err.h	Input too high
gFi	Ground Fault
LPbr	Loop Break
SHrt Out (display alternates)	Output Short
tC OPn (display alternates)	Open Thermocouple
tC rEv (display alternates)	Reverse Thermocouple
Htr bAd (display alternates)	Open Heater

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 (orange) and 4-digit lower (green)
Upper Display Height	14.2mm / 0.56”
Lower Display Height	9.15mm / 0.36”
Output Status Indication	Orange LED
Alarm Status Indication	Orange LED
Manual Mode Indicator	Green LED
Control Output Device Type	Triac, 15 A at 120/240 Vac optional 30 A
Operator Activation/Interface	4 Momentary Switches, 16 A Power Switch
Power Requirements	115 to 240 V 50/60 Hz Nominal CE Compliant

All specifications are subject to change without notice.

Two-Year Limited Warranty

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Repairs and Spare Parts

It is recommended that units requiring service be returned to an authorized service center. Before a controller is returned for service, please consult the service center nearest you. In many cases, the problem can be cleared up over the telephone. When the unit needs to be returned, the service center will ask for a detailed explanation of problems encountered and a Purchase Order to cover any charge. This information should also be put in the box with the unit. This should expedite return of the unit to you.

SPARE PARTS

A spare parts list can be supplied upon request if the complete model number is supplied.

DISCLAIMER

This document is based on information available at the time of its publication. While efforts have been made to render accuracy to its content, the information contained herein does not purport to cover all details or variations in the hardware, nor to provide for every possible contingency in connection with the installation and maintenance. Features may be described herein which are not present in all hardware. Athena Controls assumes no obligation of notice to holders of this document with respect to changes subsequently made.

Part Number: 900M046U00 Revision "A"