Athena® Series RMC Hot Runner Controller Configuration and Operation Manual

Precautions

Warning

Use of this equipment in a manner not specified by the manufacturer may impair protection provided by the equipment.

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.

Hazardous potentials exist on components inside the mainframe and controller. Always disconnect AC power to the mainframe when servicing the controllers or the mainframe.

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.

The controller power switch must be in the "OFF" position before you put a controller into an energized mainframe, or remove a controller from an energized mainframe. If the mainframe supports the SafeChange™ feature, enable SafeChange on the controller to reduce the possibility of damage to the controller when installing a controller or removing a controller from the mainframe. Controllers are shipped with the SafeChange feature disabled. To determine whether the mainframe supports SafeChange and to enable SafeChange, follow the instructions in Section 3.

Turn off power to the controller before cleaning the exterior of the controller.

Failure to observe these precautions can result in exposure to a potentially lethal shock hazard.

Changing DIP switch and jumper settings, and all wiring should be done by an experienced technician. The controller and wiring should be installed in accordance with national and local electrical codes. To avoid serious personal injury and damage to equipment, follow all warnings and cautions provided in the manual supplied with the mainframe.

Caution

If a controller shows signs of having been damaged during shipping, do not power up or install the controller. Save all packing materials and report any damage to the carrier immediately.

When the controller is powered up, the output may be activated. Consider the effects on your process before powering up the controller.

We recommend placing the controller in standby mode until you have configured the controller for your application. By default, the output is off in standby mode. However, the standby output is configurable; see Section 6.

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

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

Specified operating ambient temperature is 32 to 131 °F (0 to 55 °C).

Table of Contents

1. Introduction

1.1 About this Manual

1.1.1 What It Contains

This manual contains all the information needed to configure and operate the Series RMC Hot Runner controllers.

This manual contains:

- an overview of the controllers' capabilities in this section
- a description of the user interface and instructions for using the display and keypad; see Section 2
- information about setting the DIP switches that affect the controllers' functionality; see Section 3
- general information about configuration parameters; see Section 4
- detailed information about every configuration parameter used by the controllers; see Sections 5 through 10
- tuning instructions (for automatic and manual tuning); see Section 11
- instructions for restricting access to controller functions; see Section 12
- error messages and codes displayed on the front panel of the controllers; see Section 13
- instructions for cleaning the front panel of the controller and replacing the fuses; see Section 14
- frequently asked questions; see Section 15
- instructions for restoring the factory default values for configuration parameters; see Section 16

Instructions for wiring[1], installing, and troubleshooting the controllers are in the Athena *Hot Runner Temperature Control Systems Mainframe Installation Manual.*

Guidelines for using a MODBUS host to communicate with the Series RMC controllers are in *Using the MODBUS Protocol with Athena Series RMC Hot Runner Controllers*. That manual also contains the MODBUS register address for all values stored in the controllers' databases.

[1] Input and power wiring instructions are included in the mainframe installation manual. Communication wiring between mainframes, and between a mainframe and the host, must conform to the EIA-RS-485 standard.

1.1.2 What to Read

This manual contains a comprehensive discussion of all the controller functions. Some of the information may not apply to your situation.

If you are a process operator, read Sections 1, 2, and 13. If the controller does not behave as you expect, read Section 15.

If you are a process engineer responsible for configuring the controller, look at Sections 1 through 12, reading anything that applies to your application.

If you are a programmer responsible for programming a MODBUS host to communicate with the controllers, read Section 1 and those portions of Sections 4 through 12 that apply to your application.

1.2 Features and Benefits of RMC Controllers

1.2.1 PID Control with Autotuning

In normal (automatic) mode each Series RMC controller uses a single TRIAC output to implement Proportional-Integral-Derivative (PID) control. The Series RMC Hot Runner controllers also support a manual mode that overrides automatic control. In manual mode you control the output by entering a fixed output percentage value.[2] Transfer from PID to manual is "bumpless" when the process value is within 9 °F (5 °C) of the setpoint.

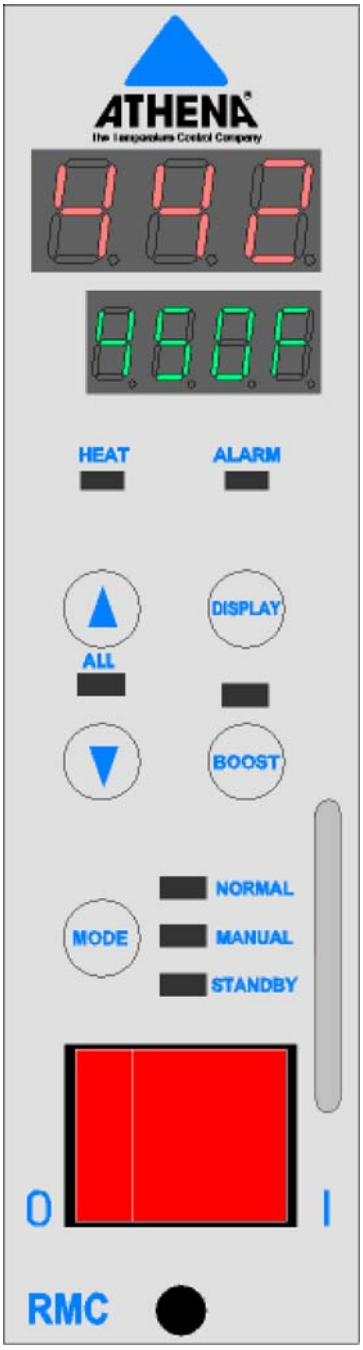
Using PID control, the controller modulates output power by adjusting the output power percentage within a configurable proportional band. Power is proportionally reduced as the process temperature gets closer to the setpoint temperature.

The configurable derivative action affects the output based on the rate of change of the process value.

The integral action affects the output based on the duration of the process value's variation from the setpoint. In the Series RMC Hot Runner controllers, the integral (reset) action is always equal to five times the configured derivative (rate) action.

An Autotune function is standard on every Series RMC controller. This feature for easy tuning of the proportional and derivative components of the control algorithm can be initiated every time the controller is powered up, once when the controller is set up (and again by changing a parameter value), or never. Instructions for tuning the controller automatically and manually are in Section 11.

[2] Use of a fixed output percentage is also possible under other circumstances. Configuration parameters let you specify a fixed output to be used as a failsafe action, a different fixed output percentage to be used in standby mode, and another fixed output percentage to be used during the boost function described in 1.2.4.



RMC Front Panel

1.2.2 Convenient User Interface

The Series RMC controllers are equipped with a bright two-line LED display that is easy to read over wide viewing angles. During operation in normal (auto) mode the process value is displayed on the top line, and setpoint is displayed on the lower line. Pressing the **DISPLAY** key displays the output (in percent) on the lower line. Pressing **DISPLAY** again displays the heater current (in amps) on the lower line. Descriptions of all the control displays are in 2.3.4.

The RMC keypad consists of five keys.

MODE – Use this key to change the control mode, terminate the boost before the configured boost duration time has expired, terminate the soft start before its natural completion, and terminate an Autotune operation before completion.

During configuration, use the **MODE** key as an "enter" key to write values to the controller's database and to step through items within a configuration menu. This key can be disabled using the ACC (access) menu's c_bUt (control mode key enable) parameter.

DISPLAY – Use brief presses of the **DISPLAY** key to step through the possible lower line operator displays.

Press and hold the **DISPLAY** key to access the configuration menu system; within the menu system use this key to move from menu to menu.

▲ **up** and ▼ **down** – Press one of these keys to increase or decrease a numeric value, or to scroll up or down through lists of configuration choices. If the controller is configured for local communication, then press the ▲ and ▼ keys simultaneously to make the controller the ALL master (green ALL LED lit). Pressing the two keys simultaneously again will cancel the ALL mastership.[3] See 1.2.6.2 for information about local communication and ALL mastership.

BOOST – Used to activate the boost function described in 1.2.4. This key can be disabled using the ACC (access) menu's b_bUt (boost key enable) parameter.

Instructions for using these keys to operate the controller are in Section 2. You can prevent the operator from using the keypad to change the controller mode, setpoint, etc. if necessary at your site. To limit the operator's use of the keypad, configure the ACC (access) menu's AcL (access level) parameter as described in 12.4.[4]

The front panel of the Series RMC controllers includes LEDs that are used for alarm annunciation, as well as to signal which controller functions are active. See 2.4 for more information about these LEDs.

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[3] If a controller is configured to support no communication (SCI (serial communication interface) menu Pro (protocol) parameter set to nonE) or MODBUS (SCI menu Pro parameter set to bUS, the default), then when you press the ▲ and ▼ key simultaneously, nothing will happen.

[4] The ACC (Access) menu is displayed only when SW2-switch 7 is ON as described in 12.3.

1.2.3 CompuStep® Soft Start for Heater Bake Out

All Series RMC Hot Runner controllers support the CompuStep soft start feature, which allows slow dissipation of moisture in heaters, by gradually applying power to the heaters. Using this feature helps extend the life of the heaters and the molds. When a soft start is executed, phase angle firing starts at 5% output power and steps up the output 5% every 30 seconds.

- The soft start when the controller is in normal (automatic) mode lasts five minutes or until the process temperature reaches 200 °F (93 °C).
- The soft start when the controller is in manual mode continues until the output is 50% or until the output is less than 5% of the last output percentage stored in non-volatile memory (EEPROM) before the controller was powered down.[5]

The green NORMAL LED flashes during soft start in normal (auto) mode. The operator can stop the soft start by pressing the **MODE** key.

By default (SW2-switch 1 ON), a soft start will be executed:

- every time the controller starts and the process value is less than 200 °F (93 °C), and
- every time the controller is returned to normal (automatic) operation and the PV is less than 200°F (93 °C).

However, you can change a switch setting as described in 3.8 to cause the controller to execute a soft start only in response to detection of a ground fault interruption. If a ground fault is detected, the controller will perform the soft start up to three times if necessary. If the ground fault is still detected after the soft start has been executed three times, the controller will signal a hard ground fault; see 1.2.5.7. More information about the start up sequence of events is in 1.6.

1.2.4 Programmable Boost Function

Every Series RMC Hot Runner controller supports a boost function. This function allows you to configure a special setpoint (closed loop boost) or a special fixed output percentage (open loop boost) to be used when the operator presses the **BOOST** key. While the special boost setpoint or boost fixed output percentage is being used, the green LED above the **BOOST** key will be lit. During closed loop boost, the boost setpoint is included in the display cycle for the lower line. During open loop boost, the configured boost fixed output percentage is included in the lower line display cycle (see 2.3.4).

The boost function will remain active (and the BOOST LED on) until:

- the configured boost duration time has expired, or
- the operator presses the **BOOST** key again before the expiration of the boost duration.

[5] While the controller is in manual mode, the processor periodically compares the output percentage in use with the manual mode output percentage stored on the EEPROM. If the output has been changed since the last time the output was stored, the new output percentage is written to the EEPROM.

This boost function can be started simultaneously on all controllers in a usage group if the operator presses the **BOOST** key on a local communication ALL master (see 1.2.6.2). The boost duration on the various controllers in a usage group can be configured to expire normally at different times. However, if the operator terminates the boost before the expiration of the boost duration on the ALL master, the boost will be stopped on all the other controllers in that usage group, too.

See Section 5 for instructions on configuring the bSt (boost) menu parameters. If the boost function is not appropriate for your application, see 12.6 for instructions for disabling the **BOOST** key.

1.2.5 Process Protection Features

1.2.5.1 Deviation Alarms

Each Series RMC Hot Runner controller supports two configurable deviation alarms. The alarm setpoints are configured using the ALr (alarm) menu.[6] If the process value falls below the setpoint minus the deviation low setpoint, or if the process value exceeds the setpoint plus the deviation high setpoint, the red ALARM LED on the front panel of the controller will light.

The alarm status indicator will remain lit as long as the process value is below or above the deviation setpoints. If the controller is networked with a MODBUS host, the alarm status is available for the host to read as described in *Using the MODBUS Protocol with Athena Series RMC Hot Runner Controllers*.

1.2.5.2 Automatic Shutoff if Process Temperature Exceeds Programmable Safety High

You can use the SUP (supervisor) menu's Ht_S (high-temperature safety) parameter to specify a high-temperature safety value to be applied to the process. If the process value exceeds this value:

- controller processing and output activity is halted, and
- the ALARM LED is lit, and
- the message H_SF alternating with Err will be displayed on the lower line.

Once the high-temperature safety value has been exceeded by the PV, the controller will not resume processing and output activity until you cycle power to the controller. Instructions for configuring the high-temperature value are in 10.3.

[6] The ALr menu also contains a parameter that can be used to disable the alarm function, and a parameter used to specify an optional alarm inhibit time. See Section 8 for details.

1.2.5.3 Loop Break Detection

You can use the RMC SUP (supervisor) menu's LPb_t (loop break time) parameter to specify a time period within which the input value should change at least 1% of supported sensor span (9.67 °F or 5.37 °C) if the sensor is working properly and the input wiring is intact. If the input value does not change within the specified time period while the controller is operating in normal (automatic) mode or in closed loop standby mode (or while a closed loop boost is in progress), and a "bad heater" error has not been detected (see 1.2.5.6), then:

- the controller output will be turned off, and
- the ALARM LED will be lit (all other LEDs turned off), and
- the message LPbr will be displayed on the lower line.

The controller will remain in this alarm and output off state until you cycle the power to the controller.

1.2.5.4 Failsafe Operation if a Sensor Error is Detected

You can use the RMC SUP (supervisor) menu's FS_A (failsafe action) parameter to specify what should happen to the output if the controller detects a reversed or open sensor. Your choices are:

- output off, or
- use a calculated output value based on output values that have typically successfully maintained the current setpoint for your process in the past, or
- use a special configurable failsafe fixed output percentage.

If the controller detects an open or reversed sensor:

- the controller output goes to the configured failsafe state, and
- the ALARM LED will be lit (all other LEDs turned off), and
- the upper display will alternate tC and rEU (reversed sensor), or tC and oPn (open sensor).

The controller will remain in this alarm and failsafe state until the operator cycles the power to the controller.

1.2.5.5 Heater Current Monitoring

The present current output to the heater, expressed to the closest tenth of an amp, is always displayable in the lower line. The operator cycles through the available lower line display items using the **DISPLAY** key.

1.2.5.6 Output Interruption Relay

An RMC controller constantly checks heater current readings to ensure that they correlate with output activity.

- If the output device is off and a current flow greater than 0.1 amp is detected, then the controller will post a “TRIAC short” error.
- If the output device is on, but no controller current output flow is detected, then the processor will post a “bad heater” error.[7]

If either of these error conditions is detected:

- the output failure interruption relay will break the connection between the controller’s TRIAC output and the heater, and
- controller processing will cease, and
- the red ALARM LED will be lit (all other LEDs turned off), and
- an alarm message will be displayed on the lower line:
- if a short was detected, OUt will alternate with SHrt
- if a heater problem is detected, bAd will alternate with HEr

The controller will remain in this halted state until you cycle power to the controller.

If the controller is the ALL master for local communication at the time that the output failure is detected, the mastership will be cancelled automatically. (See 1.2.6.2 for more information about local communication and ALL mastership.)

1.2.5.7 Ground Fault Detection Circuit

An RMC controller is capable of detecting ground faults in the controller output. When a ground fault is detected, the controller will attempt to perform a normal soft start. As usual in the case of a soft start, if the process value is less than or equal to 200 °F (93 °C), the standard CompuStep soft start described in 1.2.3 will be executed. The controller will perform the soft start up to three times if necessary. If the ground fault is detected again after the soft start has been executed three times, the controller will signal a “hard” ground fault.

If the process value is greater than 200 °F (93 °C) when the ground fault is detected, the controller will immediately consider this a “hard” ground fault. The controller will:

- interrupt the signal to its own output, in effect “turning off” the output (even if the controller output was already at the configured failsafe output state), and
- an error message GFI will be displayed on the lower line, and
- the red ALARM LED will also be lit (all other LEDs will be turned off).

Following the interrupt in response to a “hard” ground fault, the controller’s output will remain off until you cycle power to the controller.

[7] Other conditions must also be met; see 13.6 for details.

If the controller is the ALL master for local communication at the time that the ground fault is detected, the mastership will be cancelled automatically. (See 1.2.6.2 for more information about local communication and ALL mastership.)

1.2.6 RS-485 for MODBUS or Local Communications

Every Series RMC Hot Runner controller supports RS-485 serial communications. If you choose to use this communication capability, you have two choices: MODBUS or local communication. The protocol is selected using the SCI (serial communication interface) menu's Pro (protocol) parameter.

1.2.6.1 MODBUS Communication

You can network the controllers to a MODBUS host. This host can read and write to every configuration parameter in a RMC controller's database. The host can also read every status value available in the database, including which LEDs are lit.[8] Guidelines for using a MODBUS host to communicate with the controllers are in *Using the MODBUS Protocol with Athena Series RMC Hot Runner Controllers*.

1.2.6.2 Local Communication with ALL Mastership

If you select local communication, then you use the SCI (serial communication interface) menu's U_USE (usage group) parameter to assign each RMC controller within a single mainframe to one of three usage groups. The front panel of any controller in a usage group can be used to activate the boost, change the mode, change the setpoint, or change the manual mode output in every controller in the usage group.

This is accomplished by making any one of the controllers in the usage group the ALL master temporarily by pressing ▲ and ▼ simultaneously. The ALL master's green ALL LED will light. While this LED is lit, you can use the ALL master to activate the boost, change the mode, change the setpoint, or change the manual mode output in other RMC controllers. An ALL master can communicate with all the other RMC controllers in the same usage group as the master, if the controllers are in mainframes that are linked via an RS-485 network with the ALL master's mainframe.[9]

If you do not press another key within 5 seconds of pressing ▲ and ▼ simultaneously (or during any 5 second interval while the ALL LED is lit), ALL mastership will be cancelled automatically. You can cancel ALL mastership manually before 5 seconds have passed by pressing ▲ and ▼ again simultaneously.

If the ALL master experiences a problem, such as a ground fault error or a short in the TRIAC output, ALL mastership is automatically cancelled.

1.2.7 Ease of Configuration

A few basic features are set up using DIP switches, as described in Section 3. For example, if you plan to use a K thermocouple for input, instead of the default J thermocouple, you set a DIP switch (SW2-switch 2) to ON.

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[8] Peer-to-peer communications are not supported by the MODBUS protocol.

[9] Series RMB controllers can be installed in the same mainframe with Series RMC controllers. However, the RMB controllers do not support communication. Therefore, changes to RMB controllers cannot be implemented using an RMC ALL master.

All other configuration parameters can be configured using the front panel display and keypad or a MODBUS host.

When parameters are configured using the controller's front panel, the parameters are displayed grouped (on the basis of function) in menus. Parameters that do not apply to your control strategy will not be displayed. For example, if you choose to disable the alarm function, then none of the other alarm-related parameters are displayed (until you enable alarms again).

Instructions for using a controller's front panel to view and change configuration parameters are in Section 2. An overview of all available configuration parameters is in 4.4. Descriptions of all the parameters and the valid values for each are in Sections 5 through 12.

1.3 Modes of Operation

1.3.1 Control Modes

The Series RMC Hot Runner controllers support several modes of operation for control, as well as a special mode used to tune the unit automatically for PID control.

The table below summarizes the control modes and their effects on the controller output.

Use the **MODE** key to step through these modes in the sequence in which they are listed in the table. The LEDs to the right of the **MODE** key signal the controller's present mode. The operational display for each mode is in 2.3.4.

Control Mode	Description
normal (closed loop)	When the controller is in normal mode (closed loop control), the output is based on the controller's calculations of the output action needed to achieve or maintain the currently active setpoint, in accordance with the configured control strategy. In closed loop control, the controller is dependent on the input received.
manual (open loop)	When the controller is in manual mode (open loop control) the output percentage used is not influenced by the input value. In manual the output percentage can be changed by the operator using the front panel of the controller (see 2.8.2) except under special circumstances (see 2.8.3). Transfer from normal (auto) to manual is bumpless (if the PV is within 9 °F (5 °C) of the SV).
standby	When the controller is in standby mode, the behavior of the output depends on how the StB (standby) menu parameters have been configured. • If the standby type is configured as closed loop, the configured standby setpoint will be used. • If the standby type is open loop, the configured standby fixed output percentage will be used.

A special automatic control mode is provided for automatic tuning of the controller (that is, automatically determining the proportional and derivative values to be used by the PID control algorithm)[10]. When Autotune is active, the output is under the control of the Autotune algorithm, and is dependent on the input received. By default, the Autotune operation is executed once. If the Autotune is successful, then Autotune is disabled. The operator can terminate the Autotune operation prematurely by pressing the **MODE** key. This does not disable the Autotune feature. If Autotune operation is set to "once", then the controller will attempt to perform the Autotune operation again the next time it is powered up.

Autotune can also be disabled entirely or enabled for every power up. To configure the Autotune operation, use the PId menu's At_OP (Autotune operation) parameter. See 11.3.4 for details.

[10] In the Series RMC controllers the integral value is automatically set to five times the derivative (rate) value.

1.3.2 Configuration

In addition to the operating displays associated with the control modes described in 1.3.1 above, the Series RMC Hot Runner controllers can display configuration parameters. The parameters are grouped by purpose and organized in menus.

Instructions for viewing and changing configuration parameter values are in 2.10.

An overview of all available configuration parameters is in 4.4. Descriptions of all the parameters and the valid values for each are in Sections 5 through 12.

Attention

Before accessing the menu system (or changing a parameter value using a remote host), we recommend putting the controller in standby mode as described in 2.7 (or in the manual supplied with the host software). By default, the output is off in standby mode. However, the controller's behavior in standby mode is configurable; see Section 6.

1.4 Security

1.4.1 You Can Control Which Keys and Functions Are Enabled

You can configure the Series RMC Hot Runner controllers to limit the functions that operators can access or the values they can change using the keypad. This access control is configured using the using the ACC (access) menu described in Section 12.

The ACC menu contains an AcLU (access level) parameter, which affects some of the functions available to the operator (see 1.4.2 and 12.4). For example, the access level can be set to allow operators to change only the setpoint for normal (auto) mode (closed loop control) or the output percentage used in manual mode (open loop control).

The ACC menu also contains the c_bUt (control mode key enable) parameter and the b_bUt (boost key enable) parameter that are used to enable and disable the **MODE** and **BOOST** keys.

The ACC menu can be accessed only when SW2-switch 7 is set to ON (see 12.3).

1.4.2 Access Levels Available

A controller can be set to any of the access levels in the table below. The sequence of levels in the table is from most restrictive to least restrictive. New RMC controllers are shipped with the access level set to ConF (configuration).

Displayed AcLU Value	Access Level	Description
Loc	keypad lockout	**Highest security level; no access.** While the access level is "keypad lockout", no controller values can be changed, not even the setpoint. Pressing the **MODE** and **BOOST** keys will have no effect, even if the **MODE** and **BOOST** keys have been enabled using the ACC menu c_bUt and b_bUt parameters.
SP	setpoint only	**Setpoint or manual output can be adjusted; no access to menus.** When the access level is "setpoint only", the keypad can be used to change the setpoint or the manual mode output percentage. Whether the operator will be able to change the controller from normal (automatic closed loop control) to manual (open loop control) mode (or vice versa) depends on whether the **MODE** key is enabled using the ACC menu c_bUt parameter. Availability of the boost function depends on whether the **BOOST** key is enabled using the ACC menu b_bUt parameter.
ConF	configuration	**Setpoint and manual output can be adjusted. Access to all available menus is permitted.** When the access level is "configuration", the keypad can be used to change the setpoint, change the output percentage in manual mode, and to view and change all configuration parameter values in accessible menus. Not all menus are accessible all the time. If SW2-switch 7 is ON, all menus are accessible. If SW2-switch7 is OFF (factory setting), the ACC (access) menu is not accessible. See Section 3 for the location of the option switches.

1.5 Switch Setting and Configuration Sequence Matters

1.5.1 Input and Unit of Measure Switches

The DIP switches in a Series RMC Hot Runner controller are set at the factory for J thermocouple as the input type. The unit of measure set at the factory depends on the shipping destination: controllers shipped to destinations in North America are set to use degrees Fahrenheit; controllers shipped to destinations outside North America are set to use degrees Celsius. If you plan to use a K thermocouple for input, and/or if you plan to display the process value and enter the setpoint using the temperature scale that is not the default for your location, you must change these switch settings.

Read the safety warnings in Section 3 before changing switch settings.

- When SW2-switch 2 is OFF (the factory setting) the controller expects input from a J thermocouple. When SW2-switch 2 is ON, the controller is set up to use input from a K thermocouple.
- The unit of measure used by the controller for internal operations, as well as for external communications, is set by means of SW2-switch 3. When SW2-switch 3 is OFF the controller uses Fahrenheit. When SW2-switch 3 is ON the controller uses Celsius.

  When you change the units of measure switch setting, the controller recalculates any temperature values that have already been specified. For example, if you want the setpoint to be 100 °C and the controller is set to use °F, then you must change the units from the default °F to °C before you write the setpoint of 100 to the controller. If you change the units after you write the setpoint of 100 to the controller, the controller will convert the 100 °F setpoint to 37.8 °C. In this case, you would have to reconfigure the setpoint to 100 °C to implement the control needed by your process.

In addition to the input type and the unit of measure, other functions are set up using DIP switches as described in Section 3. You can save time by making all planned changes to switch settings before you power up the controller the first time.

1.5.2 Menu and Parameter Sequence

Once you have set the DIP switches, the next step is to power up the controller and put it in standby mode by repeatedly pressing the **MODE** key until the STANDBY LED lights.[11] Next configure the setpoint range using the I nP (input) menu's SP_LL (setpoint low limit) and SP_HL (setpoint high limit) parameters. This range will affect the values you can enter as the boost setpoint and the standby mode setpoint. You can skip configuring the setpoint range first if you are satisfied to use the default range 32 to 999 °F (0 to 537 °C), or if you plan to use open loop control[12] during the boost and in standby mode.

[11] The number of times you must press the **MODE** key to enter STANDBY mode depends on whether the controller is configured to do a soft start, do Autotune, and other factors. See 1.6 for details of what happens when you power up the controller.

[12] When open loop control is used, a configurable fixed output percentage is used. The controller ignores the input value during open loop control. No setpoint applies to open loop control.

Once you have configured the setpoint range using the input menu, we recommend that you configure the parameters in the sequence in which they are presented in Sections 5 through 12. With the exception of the ACC (access) menu and PId (PID control) menu, this is the same sequence in which the parameters are displayed.

Although the tuning parameters in the PId menu are configured last, they are displayed first for your convenience. You may need to access the tuning parameters during normal operation. However, once the controller is configured, you may never need to use any of the parameters in the other menus again.

Within a menu, the parameters should be configured in order, because the value you select for a parameter early in a menu sometimes determines the other parameters that are displayed in that menu. For example, if you use the bSt (boost) menu's first parameter tYPE (type) to specify that during the boost closed loop control will be used, then the menu includes the b_SP (boost setpoint) parameter. However, if you use the tYPE parameter to specify open loop control during boost mode, then the menu will include the b_Pct (boost fixed output percentage) parameter.

1.6 What Happens When You Power Up the Controller

When an RMC controller is powered up, it lights all segments of the display briefly, then displays its firmware level.[13]

The sequence of controller actions that follow and the state of the controller output depend on:

- **SW2-switch 1 setting** – If SW2-switch 1 is ON (the default), the controller does a CompuStep soft start if the process value is less than or equal to 200 °F (93 °C) and the controller is set up to start in normal (auto) mode. If SW2-switch 1 is OFF, the controller does not do a soft start at power up.

- **SW2-switch 6 setting** – If SW2-switch 6 is OFF (the default), the controller starts up in normal (auto) mode. If SW2-switch 6 is ON, the controller starts up in the mode it was in when it was powered down.

  - ***if SW2-switch 6 is ON,* the last mode used** – The last mode used is stored in non-volatile memory. The controller behaves differently if the controller was last in normal (auto) mode than it does if the controller was last in manual mode. (In manual mode, if the last output percentage used was less than 5%, the controller's behavior is also influenced.)

- **PId (PID control) menu's At_OP (Autotune operation) parameter value** – If At_OP is set to onCE (once) or EnA (always enabled), and the controller is starting in normal (auto) mode, Autotune will be attempted.

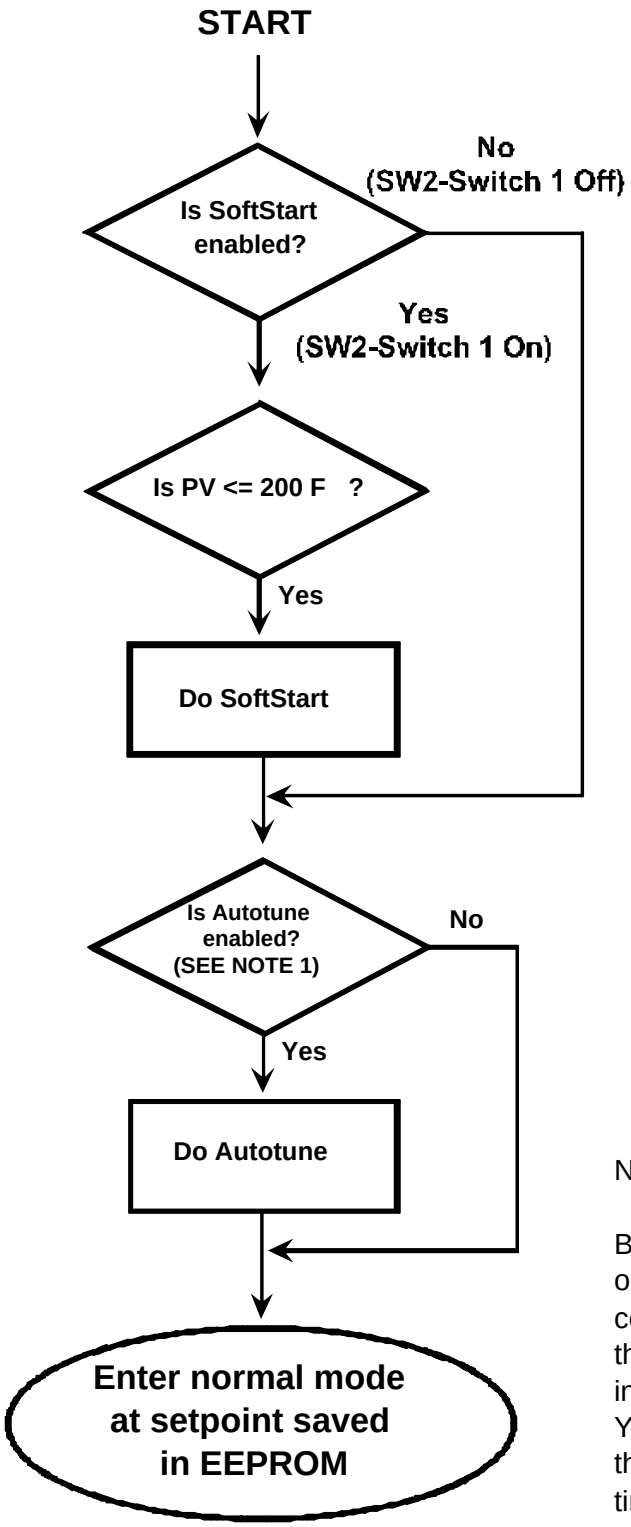
The interactions between all these factors are diagramed on the following two pages.

- The first diagram shows what happens if SW2-switch 6 is OFF (the default), so that the controller starts in normal (auto) mode.

- The second diagram shows what happens SW2-switch 6 is ON, so that the controller starts in the last mode that was used before shutdown.

You can terminate soft start and Autotune by pressing the **MODE** key.

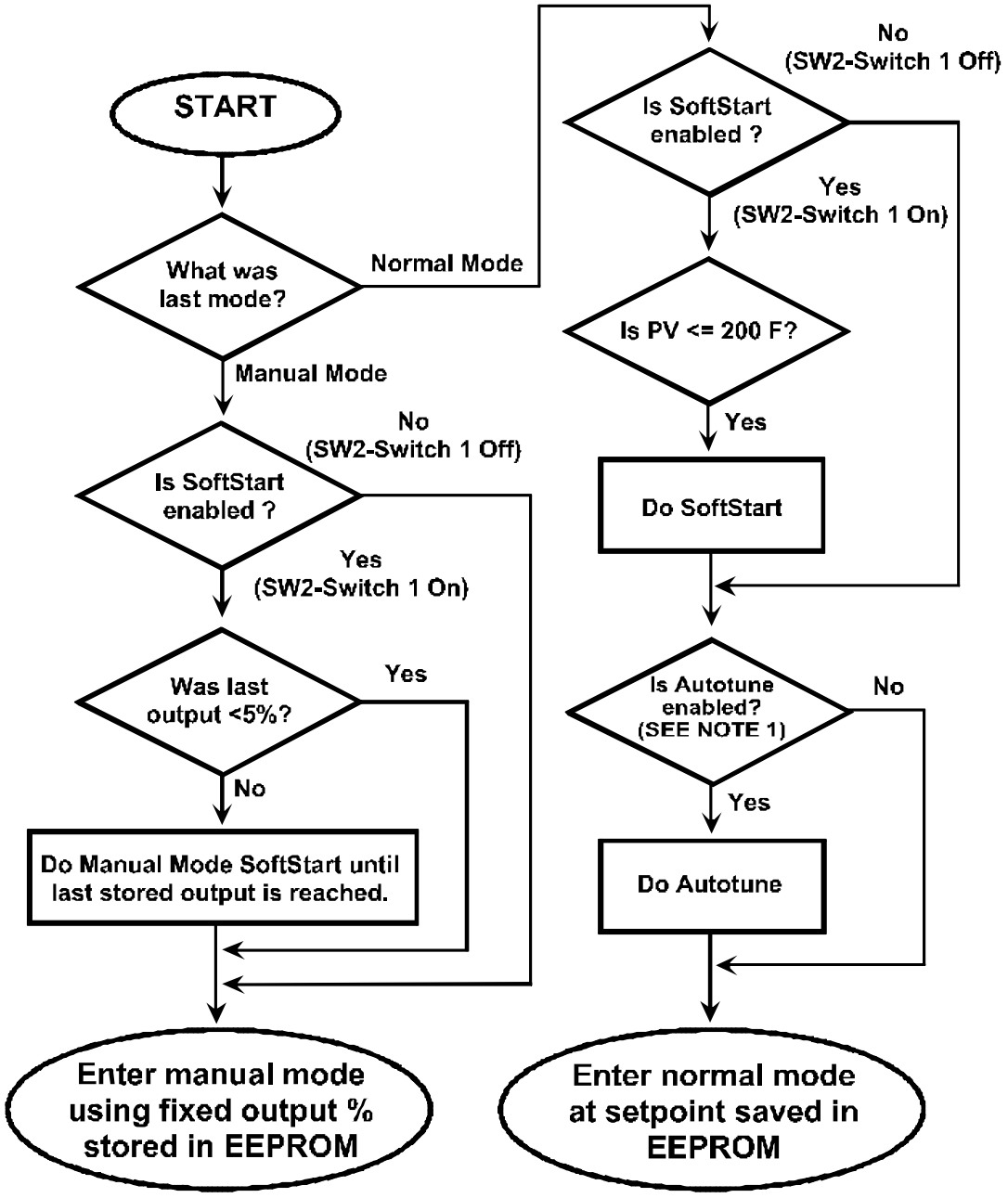
[13] It is a good idea to make a note of the firmware version number. If you phone for technical support, you will be asked for this version information, as well as for the complete model number of the controller in question.



Note 1)

By default, Autotune is enabled once. When the controller has completed Autotuning successfully, the Autotune operation parameter in the PID menu is set to disabled . You can use the PID menu to specify that Autotuning is initiated every time the controller starts up, or never.

Automatic Startup Sequence If SW2-Switch 6 Is OFF (Default) – Controller Starts in Normal (Auto) Mode



Note 1) By default, Autotune is enabled once. When the controller has completed Autotuning successfully, the Autotune operation parameter in the PID menu is set to disabled. You can use the PID menu to specify that Autotuning is initiated every time the controller starts up, or never.

Automatic Startup Sequence If SW2-Switch 6 Is ON – Controller Starts in the Last Mode Used Before Shutdown

1.7 Configuration and Startup Activities

The following table summarizes the configuration and startup tasks to be accomplished once the controllers are installed and wired as described in the manual supplied with the mainframe. As described in 1.5, configuration sequence does matter, because there are interdependencies among parameters. We recommend configuring the controllers in the sequence shown below.

Step	Action	Where Described
1	Check to see if the mainframe supports the SafeChange feature. If so, enable the SafeChange feature on the controller by changing a jumper setting.	3.2 and 3.3
2	If you plan to use a K thermocouple as the sensor or plan to display the process value and setpoint using the temperature scale that is not the default for your location (Fahrenheit for controllers shipped to destinations in North America; Celsius for controllers shipped to destinations outside North America), you must change two DIP switches from their factory settings before using the menus to configure the controller. Other switch settings that affect how the controller behaves under certain circumstances can be changed now or later.	3.6 and 3.7
3	Power up the controller.	1.6
4	Put the controller in standby mode.	2.7
5	*If you want to use a setpoint range other than the default 32 to 999* °F *(0 to 537* °C*) and plan to use closed loop control during the boost or while in standby mode*, configure the setpoint range using the input menu now.	7.3
6	*If you plan to use boost mode*, specify the type of control to be used during the boost, and enable the boost function. Specify the setpoint to be used for closed loop boost or the output percentage to be used for open loop boost.	5
6	*Unless the default (open loop control with 0% output) is appropriate for standby mode at your site*, configure the parameters that determine how the controller implements standby mode.	6
7	Use the input menu to specify any bias that should be applied to the input, and define the setpoint low limit and setpoint high limit values (if you have not configured the range already in Step 4).	7
8	*If you plan to use the deviation alarms,* configure the parameters in the alarm menu.	8
9	*If you plan to use local or MODBUS communications,* configure the communication parameters.[14]	9
10	Specify the loop break time and the high-temperature safety value, and configure the output for failsafe operation.	10
11	Adjust the setpoint.	2.5
12	Tune the controller.	11
13	*If you want to restrict operators from accessing the configuration menu or from using the **BOOST** or **MODE** keys*, power down the controller, change the switch setting that will allow you to display the access menu, so that you can limit operator access to controller functions. (After restricting access, you should change the switch setting again, so no one can "un-do" your restrictions.)	12
14	Put the controller in normal (automatic) mode.	2.7

[14] If the controller will be configured using MODBUS, the communication option parameters can be configured first, permitting you to configure the other parameters using a personal computer. Details of the communication setup appropriate for MODBUS is described in *Using the MODBUS Protocol with Athena Series RMC Hot Runner Controllers*.

1.8 Specifications

1.8.1 Operating Limits

Ambient Temperature 32 °F to 131 °F (0 °C to 55 °C)

Relative Humidity Tolerance 10 to 95 % Non-Condensing

Shipping Temperature –40 °F to 158 °F (–40 °C to 70 °C)

Power Requirements 115 to 240 Vac 50 or 60 Hz nominal CE compliant

1.8.2 Performance

Accuracy ± 0.3 % of span

Setpoint Resolution 1 degree Fahrenheit

Repeatability ± 0.1 % of span

Temperature Stability ± 0.5 % of full scale over the ambient range of 32 °F to 131 °F (0 °C to 55 °C)

Thermocouple Cold-End Tracking automatic, better than 0.02 °F per °F (0.01 °C per °C)

Noise Rejection Common Mode > 100 dB, Series Mode > 70 dB

Process Sampling Rate 10 Hz

1.8.3 Control Characteristics

Autotune automatic or operator initiated.

Manual mode control operator initiated.

Failsafe action is configurable.

1.8.4 Front Panel Display and Indicators

Information about the user interface (including an illustration of the controller front panel) is in Section 2 of this manual.

Temperature Display Three digits composed of orange seven-segment LED characters; a decimal point can be displayed.

Setpoint Display Four digits composed of green seven-segment LED characters; a decimal point can be displayed.

Output Status Indicator orange LED labeled “HEAT”

Alarm Status Indicator red LED labeled “ALARM”

Boost Function Indicator green unlabeled LED above the **BOOST** key

ALL Master Indicator green LED labeled “ALL”

Standby Mode Indicator green LED labeled “STANDBY”

Normal (Automatic) Mode Indicator green LED labeled “NORMAL”

Manual Mode Indicator green LED labeled “MANUAL”

1.8.5 Connections and Mounting

The Series RMC controllers are designed for installation in an Athena Hot Runner mainframe; removal of an RMC controller from the mainframe requires removal of a locking pin (standard controllers) or locking screw (CE-compliant controllers).

1.8.6 Inputs

thermocouple J or K

supported sensor range 32 to 999 °F (0 to 537 °C)

1.8.7 Output

TRIAC, 15 amps at 120/240 Vac, driven by optically isolated interface circuit. Protected with a pair of 15 amp field-replaceable fuses. Instructions for replacing the fuses are in 14.3. Replacement fuses must be Type F fast-acting 250 Vac fuses rated at 15 amps. Suitable fuses are Littlefuse Inc. p/n 314015 and Athena p/n 210B001U01

An 15 amp (120/240 Vac) relay interrupts power to the heater if the controller detects shorting of the TRIAC output or other system failures.

A ground fault detection circuit is also standard.

1.8.8 Communications

RS 485 standard for local communication among controllers assigned to the same usage group within a single mainframe (or among mainframes linked by an RS-485 network), or between a MODBUS host and every controller on the network; 9600 baud maximum

2. User Interface

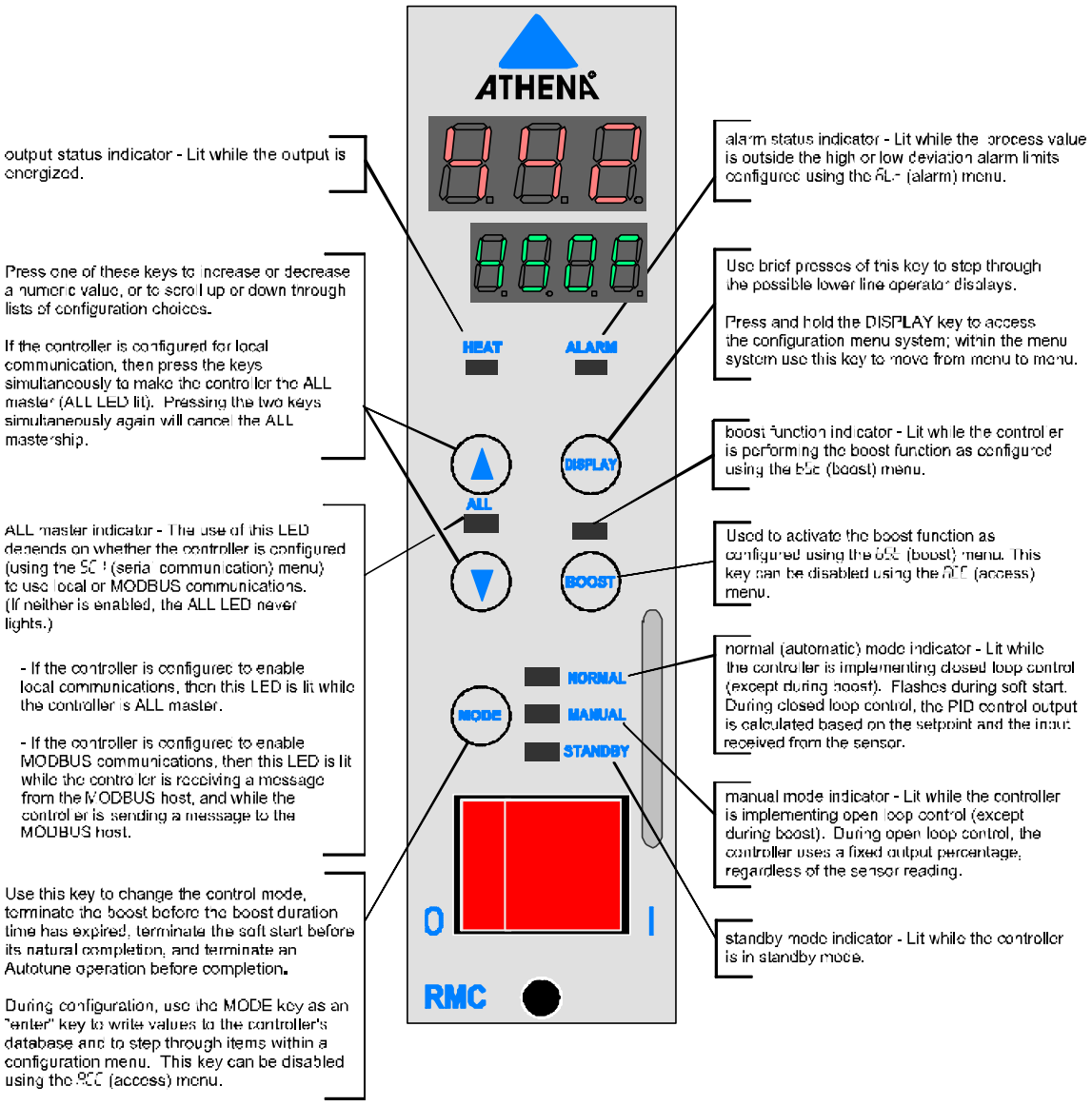
2.1 Overview

The Series RMC controllers are equipped with a bright two-line LED display that is easy to read over wide viewing angles. During operation in normal (auto) mode the process value is displayed on the top line, and setpoint is displayed on the lower line. Pressing the **DISPLAY** key displays the output (in percent) on the lower line. Pressing **DISPLAY** again displays the heater current (in amps) on the lower line. Descriptions of all the control displays are in 2.3.4.

The RMC keypad consists of five keys: **DISPLAY**, **BOOST**, **MODE**, ▲ and ▼. The functions of these keys are described in 2.2 Instructions for using these keys to operate the controller are in 2.5 through the end of this section. You can prevent the operator from using the keypad to change the controller mode, setpoint, etc. if necessary at your site. The keypad is disabled when the ACC (access) menu's AcL (access level) parameter is set to Loc (lockout) as described in 12.4.[15] The instructions in this section assume that the controller's access level is not set to lockout.

The front panel of the Series RMC controllers also includes LEDs that are used for alarm annunciation, as well as to signal which controller functions are active. See 2.4 for more information about these LEDs.

[15] The ACC (Access) menu is displayed only when SW2-switch 7 is ON as described in 12.3.



RMC Front Panel

2.2 Key Functions

2.2.1 MODE Key

During operation use the **MODE** key to change the control mode, terminate the boost before the boost duration time has expired, terminate the soft start before its natural completion, and terminate an Autotune operation before completion.

During configuration, use the **MODE** key as an "enter" key to write values to the controller's database and to step through items within a configuration menu.

This key can be disabled using the ACC (access) menu's c_bUt (control mode key) parameter (see 12.5).

2.2.2 DISPLAY Key

When the controller is in a control mode), use brief presses of the **DISPLAY** key to step through the possible lower line operator displays available (see the table in 2.3.4).

To access the configuration menu system, press and hold the **DISPLAY** key (approximately three seconds) to access the configuration menu system. If the first configuration menu is not displayed, the access level of the controller prohibits configuration from the front panel (see 12.2 and 12.4).

Within the menu system, use this key to move from menu to menu.

2.2.3 Up and Down Arrow Keys

Pressing and releasing the ▲ or ▼ key increases or decreases the numerical value on the operator display or configuration display one unit. Pressing and holding one of these keys changes the value more rapidly.

When a string of characters representing a configuration parameter choice or a mode choice is on display, pressing ▲ or ▼ displays the previous or next choice on the list.

If the controller is configured for local communication, then press ▲ and ▼ simultaneously to make the controller the ALL master (green ALL LED lit). Pressing the two keys simultaneously again will disable the ALL mastership.[16] See 1.2.6.2 for more information about ALL mastership.

2.2.4 BOOST Key

Use the **BOOST** key to activate the boost function described in 1.2.4.

This key can be disabled using the ACC (access) menu's b_bUt (boost key) parameter (see 12.6).

[16] If a controller is configured to use MODBUS (the default), or communication is disabled using the serial communication interface menu, then when you press ▲ and ▼ simultaneously, nothing will happen.

2.3 Display

2.3.1 Introduction

What is displayed on the front panel of the controller depends on the mode of operation (see 1.3), and whether the controller detects any problems with the input or with its own operation.

2.3.2 Unit of Measure Displayed

The unit of measure (Fahrenheit or Celsius) is set using SW2-switch 3 as described in 3.7. This unit of measure is used by the controller for internal operations, for external communications, and for the process value and setpoint display.

2.3.3 Cycling Through Available Displayed Values

Unless the configuration menus have been accessed or the controller has detected an error, the top line of the display will always show the process value. At any time the operator can press the **DISPLAY** key repeatedly to cycle through the other values available for display on the lower line. The available values always include the output (in percent) and the heater current (in 0.1 amp increments).

2.3.4 Control Displays

The control displays (when no problems are detected) are summarized in the table below. The error messages that can be displayed when the controller detects a problem with the input, the output, or its own operation are explained in Section 13.

Information about the controller's behavior, and error codes displayed if the controller detects a problem during Autotune are in Section 11.

The configuration displays are discussed in 2.3.5.

Circumstance	What's Displayed Top Line Lower Line	Example Top Line Lower Line
normal mode (closed loop control) NORMAL LED is lit.	process value	407
	display cycle includes: setpoint and unit of measure	450F
	and	*and*
	output (in percent)	100P
	and	*and*
	measured heater current (in amps)	15.0A
manual mode (open loop control) MANUAL LED is lit.	process value	407
	display cycle includes: output percent value	90P
	and	*and*
	measured heater current (in amps)	13.5A
standby mode STANDBY LED is lit.	process value	407
	display cycle includes: output percent value	90P
	and	*and*
	measured heater current (in amps)	13.5A
	If standby type is configured as closed loop, then the display cycle also includes: configured standby setpoint and unit of measure	450F
boost function active BOOST LED is lit.	process value	407
	display cycle includes: output percent value	90P
	and	*and*
	measured heater current (in amps)	13.5A
	If boost type is configured as closed loop, then the display cycle also includes: configured boost setpoint and unit of measure	450F
Autotune active	process value alternating with tUn	tUn

Circumstance	What's Displayed	Example
	Top Line	Top Line
	Lower Line	Lower Line
	setpoint value	450F

2.3.5 Display During Configuration

2.3.5.1 Introduction

When the **DISPLAY** key has been used to display a menu, you can configure the controller.

It is recommended that you put the controller in standby mode as described in 2.7 before going into configuration to change parameter values. By default, the output is off in standby mode. You can configure the controller to use your choice of standby setpoint or standby fixed output percentage while the controller is in standby. If you do not put the controller in standby mode, normal controller output action will continue during configuration. The effects on your process may be undesireable.

During configuration the top line of the display contains a menu name. The second line of the display contains a parameter name, alternating with the current value. For example, when the input menu bias parameter is accessed the display will show the default value of the bias parameter:

InP	alternating	InP
bIAS	with	0

2.3.5.2 Menus Available

To access the menus containing the configuration parameters, press the **DISPLAY** key until a text string is displayed on the top line of the display (approximately 3 seconds). The following table lists all the menus available.

You can see configuration menus only when the access level for the controller is set to CONF as described in 1.4 and 12.4. You can change the access level only when SW2-switch 7 is ON as described in 12.3. The RMC controllers are shipped with SW2-switch 7 OFF.

To see all the parameters in all the menus, go to Section 4 or the section of this manual referenced in the following table.

Displayed Abbreviation	Menu Name	Described In
PId	PID control	Section 11
bSt	boost	Section 5
Stb	standby	Section 6
InP	input	Section 7
ALr	alarm	Section 8
SCI	serial communication interface	Section 9
SUP	supervisor	Section 10
ACC	access (See Note 1 below.)	Section 12

Note 1: The access menu is displayed in the menu cycle only when SW2-switch 7 is ON; see 12.3. The RMC controllers are shipped with SW2-switch 7 OFF.

2.4 LEDs

The front panel of every Series RMC controller includes seven status LEDs, which are described in the table below. The status of each of these LEDs can be read by a MODBUS host as described in *Using the MODBUS Protocol with Athena Series RMC Hot Runner Controllers*.

LED Label	Color	Function
HEAT	orange	**output status indicator** – Lit while the output is energized.
ALARM	red	**alarm status indicator** – Lit while the process value is outside the high or low deviation alarm limits configured using the alarm menu as described in Section 8.
BOOST (See Note 1 below.)	green	**boost function indicator** – Lit while the controller is performing the boost operation described in 1.2.4. (See Section 5 for boost configuration.)
ALL	green	**ALL master indicator** – The use of this LED depends on whether the controller is configured (using the serial communications interface menu) to use local or MODBUS communications. (If neither is enabled, the ALL LED never lights.) • *If the controller is configured to enable local communications*, then this LED is lit while the controller is ALL master. As long as this LED is lit (while local communications are enabled), you can use the ALL master to activate the boost, change the mode, change the setpoint, or change the manual mode output in all the other controllers in the same usage group within mainframes linked via an RS-485 network with the ALL master's mainframe (see 1.2.6.2). • *If the controller is configured to enable MODBUS communications*, then this LED is lit while the controller is receiving a message from the MODBUS host, and while the controller is sending a message to the MODBUS host.
STANDBY	green	**standby mode indicator** – Lit while the controller is in standby mode.
NORMAL	green	**normal (automatic) mode indicator** – Lit while the controller is implementing closed loop control (except during boost). During closed loop control, the PID control output is calculated based on the setpoint and the input received from the sensor. This LED flashes (instead of being lit steadily) during a soft start in normal mode.
MANUAL	green	**manual mode indicator** – Lit while the controller is implementing open loop control (except during boost). During open loop control, the controller uses a fixed output percentage, regardless of the sensor reading.

Note 1: The BOOST LED is not labeled. It is directly above the **BOOST** key.

2.5 Displaying and Changing the Setpoint

The setpoint can be changed only when the controller is in normal (automatic) mode (NORMAL LED lit) and a CompuStep soft start is not in progress.

To display the setpoint, if the setpoint is not on display in the lower line while the controller is in normal mode, press the **DISPLAY** key until the setpoint and unit of measure are displayed.

To change the setpoint, use the ▲ and ▼ keys to change the displayed setpoint value.

The setpoint values that can be entered using the controller's front panel are limited by the setpoint range configured using the InP (input) menu's SP_LL and SP_HL parameters (see 7.3).

If the controller is using a configured boost (closed loop) setpoint or a standby mode (closed loop) setpoint, then that setpoint can be changed only in configuration.

2.6 Using the Boost Function

Unless the **BOOST** key has been disabled (see 12.6), the boost function described in 1.2.4 can be used any time that the controller is in normal mode, and is not Autotuning or displaying an error message.

To start the boost function, press the **BOOST** key. The LED above the **BOOST** key will light, and remain lit until the configured boost duration has expired or you stop the boost function.

To stop the boost function before the configured boost duration time has expired, press the **BOOST** key or the **MODE** key. The boost will be terminated and the LED above the **BOOST** key will go off.

2.7 Changing the Controller Mode

Unless the **MODE** key has been disabled (see 12.5), you can put the controller in normal (auto) mode for closed loop control, manual mode for open loop control, or standby mode.[17]

To change the controller's mode, press the **MODE** key until the LED corresponding to the desired mode is lit.

Pressing the **MODE** key while a soft start or Autotune operation is active will stop the operation. If the controller is going through the sequence of startup actions diagrammed in 1.6, the processing will move on to the next action in the startup sequence.

[17] Whether the controller performs closed loop control using the configured standby setpoint or performs open loop control using the configured standby fixed output percentage depends on the configuration of the StB (standby) menu parameters; see Section 6.

2.8 Displaying and Changing the Output in Manual Mode

2.8.1 Displaying the Output Percentage in Use

If you switch the controller from normal (automatic) mode to manual mode using the **MODE** key, then the fixed output used when the switchover occurs depends on whether the process value was within 9 °F (5 °C) of the setpoint when the operator switched to manual.

- If the process value is within 9 °F (5 °C) of the setpoint, bumpless transfer will occur. That means that the fixed output percentage will be set to a calculated value that typically maintained this setpoint in the past in normal mode. The operator can change the output as described below.

- If the process value is not within 9 °F (5 °C) of the setpoint when the switchover occurs, the fixed output percentage will be set to 0% until the operator changes it as described below.

To display the output percentage being used when the controller is in manual mode, if the output percentage is not on display in the lower line while the controller is in manual mode, press the **DISPLAY** key until the output percentage is displayed.

2.8.2 Changing the Output Percentage

To change the manual mode output percentage, use the ▲ and ▼ keys to change the displayed output percentage value.

2.8.3 Special Cases When a Fixed Output is Used

If using a fixed output percentage is the configured failsafe action, that special failsafe fixed output percentage can be changed as described above. However, the change will not affect the value stored for the SUP (supervisor) menu's FS_P (failsafe output percentage). The FS_P parameter's value can be changed only in configuration (that is, using the supervisor menu).

If the controller is using a fixed output percentage because open loop boost is active, or because the controller is in open loop standby mode, the output percentage used is the configured boost fixed output percentage or standby fixed output percentage. You cannot change the output percentage as described in 2.8.2. The boost output percentage and the standby output percentage can be changed only in configuration mode (that is, using the boost or standby menu).

2.9 Using Local Communication

If a controller is configured for local communication (see 9.2) and the controller has been assigned to a usage group (see 9.4.4), then you can use that controller as an ALL master. When a controller is ALL master, you can use it to activate the boost, change the mode, change the setpoint, or change the manual mode output in other RMC controllers. An ALL master can communicate with RMC controllers in the same usage group as the master, if the controllers are in the ALL master's mainframe, or in mainframes that are linked via an RS-485 network with the ALL master's mainframe.

To make a controller ALL master, press ▲ and ▼ simultaneously.[18] The ALL master's green ALL LED will light. While this LED is lit, the controller is ALL master.[19] You can use its front panel to make changes to the operation of every controller in its usage group (within its mainframe or among mainframes linked by an RS-485 network).

To make a change to all the controllers in the ALL master's usage group in networked mainframes, use the keypad of the ALL master as you ordinarily would.

- Mode changes and the activation of the boost are transmitted immediately to all the other controllers in the ALL master's group.
- Setpoint and output changes are transmitted to the other controllers when you have completed changing the value on the ALL master.

If you do not press another key within 5 seconds of pressing ▲ and ▼ simultaneously (or during a 5 second interval while the ALL LED is lit), ALL mastership will be cancelled automatically. To cancel ALL mastership manually, press ▲ and ▼ simultaneously while the ALL master's green ALL LED is lit.

If the ALL master experiences a problem, such as a ground fault error or a short in the TRIAC output, ALL mastership is automatically cancelled.

Caution

Each controller can be assigned to only one usage group. However, up to three usage groups can co-exist in a single mainframe (or networked mainframes). Enable ALL mastership on only one controller at a time in a mainframe (or networked mainframes). If more than one ALL master is active at the same time, network collisions can occur. The results will be unpredictable and may be undesirable.

[18] If a controller is configured to use no communication or MODBUS communication (the default), then pressing ▲ and ▼ simultaneously has no effect.

[19] Series RMB controllers can be installed in the same mainframe with Series RMC controllers. However, the RMB controllers do not support communications. Therefore, changes to RMB controllers cannot be implemented using an RMC ALL master.

2.10 Working in Configuration Mode

2.10.1 Entering and Exiting Configuration Mode

We recommend that you put the controller into standby mode as described in 2.7 before entering the menu system.

To enter configuration mode, assuming the access level of the controller is set to configuration (see 12.4), press and hold the **DISPLAY** key to access the configuration menu system.

To exit configuration mode, press and hold the **DISPLAY** key until the process value is displayed. (If you do not press any keys for 5 minutes while in configuration mode, you will be timed out automatically.)

2.10.2 Procedure for Viewing and Changing a Configuration Parameter Value

To view a parameter's current value:

1. Access configuration mode by pressing and holding the **DISPLAY** key until PId is displayed on the top line (approximately 3 seconds). PId is abbreviated name of the first menu, PID control.[20]
2. Press the **DISPLAY** key repeatedly to step through the available menus.
3. Once the name of the menu of interest is on the top line of the display, press the **MODE** key once (briefly) to display the first parameter in the menu. The abbreviated name of the parameter will be on the lower line, alternating with the current value for the parameter stored in the controller's database.
4. To step through the parameters in the displayed menu, press the **MODE** key repeatedly.
5. When the parameter of interest is on display, stop pressing the **MODE** key. The abbreviated parameter name will alternate with the value or choice currently stored in the controller's database.
6. To change the current choice or numeric value, use the ▲ and ▼ keys.
7. When the desired choice or numeric value is on display, press the **MODE** key once. The displayed choice or value will be written to the controller's database. The next parameter in the menu (or the first parameter if you were at the end of the menu) will be displayed.

[20] The controllers are shipped from the factory with SW2-switch 7 OFF. Therefore, the ACC (access) menu is not included in the display cycle. If you set SW2-switch 7 to ON, the ACC menu will be displayed before the PId menu; see Section 12 for details.

At this point you can:

- change the value of the newly displayed parameter using the ▲ and ▼ keys, or
- if you like the current value of the parameter on display, you can press the **MODE** key to leave the displayed value unchanged and go on through the parameters in the menu, or
- go to the next menu by pressing the **DISPLAY** key once, then use the **MODE** key to step through the parameters in that menu, or
- display menus later in the cycle by pressing the **DISPLAY** key repeatedly, or
- exit configuration by pressing and holding the **DISPLAY** key until the normal operating display returns to view.

If you do not press any key, eventually you will be timed out of the menu system. The controller will revert to the operational display that was in view before you entered the menu system. The value that was on display when you were timed out of configuration will be saved to the controller's database automatically.

2.10.3 Configuration Example

Suppose that once the controller is in operation you want to adjust the standby setpoint and the high-temperature safety value.

1. Press the **MODE** key repeatedly until the STANDBY LED lights.[21]
2. Press and hold the **DISPLAY** key (approximately three seconds) until PId is displayed on the top line, and Pb alternating with the proportional band value on the lower line.
3. Press the **DISPLAY** key once; bSt (boost) will be displayed on the top line.
4. Press the **DISPLAY** key again; Stb (standby) will be displayed on the top line.
5. Press the **MODE** key until the S_SP (standby setpoint) parameter is on the lower line, alternating with the current standby setpoint value.
6. Use the ▲ and ▼ keys to change the value.
7. To write this new setting to the controller's database, press the **MODE** key once. The new setting will be saved and tYP (standby type) will be displayed on the lower line. (The standby setpoint is the last parameter in the standby menu when closed loop standby is configured, so the controller goes to the top of the menu and shows you the first display parameter, standby type.)

[21] When you power up the controller, it may begin a CompuStep soft start, followed by an Autotune operation (see 1.6). In this case, the first time you press the **MODE** key the soft start will be stopped. The second time you press the **MODE** key the Autotune operation will be stopped. Subsequent presses of the **MODE** key will affect the controller mode, as you can see by watching the NORMAL, MANUAL, and STANDBY LEDs.

8. To move to the next menu, press the **DISPLAY** key once. The top line will display InP (input).

9. Press the **DISPLAY** key repeatedly to move through the menus.

10. When SUP (supervisor) is on the top line, press the **MODE** key to step through the parameters in the supervisor menu.

11. The second parameter in the supervisor menu is Ht_S (high-temperature safety value). The lower line display will alternate Ht_S and the current high-temperature limit value.

12. Use the ▲ and ▼ keys to change the value.

13. To write this new setting to the controller's database, press the **MODE** key once. The new setting will be saved and the name of the next parameter in the supervisor menu FS_A (failsafe value) will be displayed on the top line.

14. The two configuration changes you wanted to make have been accomplished, so you can press and hold the **DISPLAY** key until the process value is again displayed on the top line.

If you do not press and hold the **DISPLAY** key, after approximately 5 minutes the controller will automatically go back to the normal operating display, with the process value on the top line, and setpoint or other value is displayed on the lower line (see 2.3.4).

If you do not press the **DISPLAY** key after you change a parameter value, but before you are timed out, the change will be saved to the controller's database automatically.

3. Enabling SafeChange and Setting the Switches

Warning

Use of this equipment in a manner not specified by the manufacturer may impair protection provided by the equipment.

Hazardous potentials exist on components inside the mainframe and controller. Always disconnect AC power to the mainframe when servicing the controllers or the mainframe.

The controller power switch must be in the "OFF" position before you put a controller into an energized mainframe, or remove a controller from an energized mainframe. If the mainframe supports the SafeChange™ feature, enable SafeChange on the controller to reduce the possibility of damage to the controller when installing a controller or removing a controller from the mainframe. Controllers are shipped with the SafeChange feature disabled. To determine whether the mainframe supports SafeChange and to enable SafeChange, follow the instructions in this section.

Failure to observe these precautions can result in exposure to a potentially lethal shock hazard.

Changing DIP switch and jumper settings, and all wiring should be done by an experienced technician and be installed in accordance with national and local electrical codes. To avoid serious personal injury and damage to equipment, follow all warnings and cautions provided in the manual supplied with the mainframe.

3.1 Introduction

Controllers are shipped with SafeChange disabled, because the controller will not work if the SafeChange feature is enabled, but the mainframe does not support SafeChange. You can enable SafeChange quickly and easily using a jumper as described in this section.

Some basic set up choices are made using DIP switches as described in this section. The switches in a Series RMC Hot Runner controller are set at the factory for J thermocouple as the input type. The factory setting for unit of measure depends on the shipping destination; see 3.5.

If you plan to use a K thermocouple for input and/or if you plan to display the process value and enter the setpoint in the temperature scale that is not the default for your location, you must change these switch settings. When you change the unit of measure (temperature scale) the controller recalculates any temperature values that have already been specified (such as the setpoint range limits). Therefore, we recommend changing the unit of measure before doing configuration.

Other switch settings that affect how the controller behaves under certain circumstances can be changed before or after configuration.

3.2 Checking Mainframe for SafeChange Capability

Do not enable SafeChange on a controller unless the mainframe supports this feature.

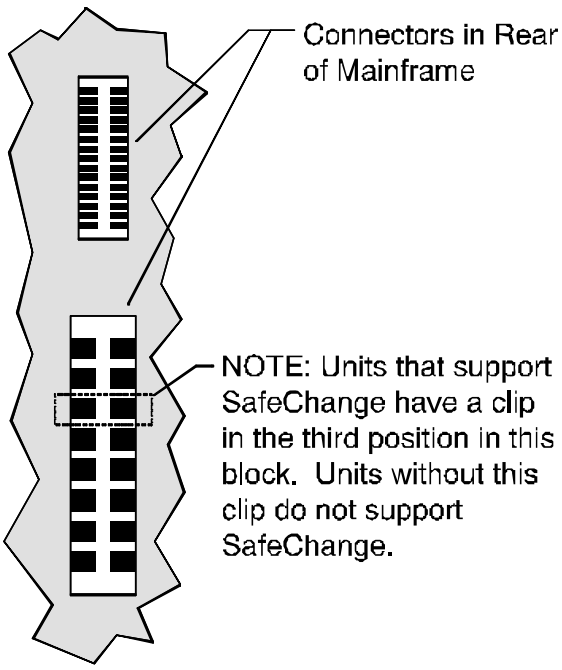
To check the mainframe for SafeChange capability:

1. Turn off power to the mainframe.
2. Remove a blanking panel or a controller that is OFF, so you can look into the mainframe.
3. Look at the lower connector block on the backplane.

   - If a metal clip is in the third position in the connector block, then the mainframe supports SafeChange (see below). You should enable SafeChange on the controller before installing it in the mainframe to reduce the possibility of damage to the controller.

     Use of the SafeChange feature does not eliminate the need for careful installation and removal of controllers.

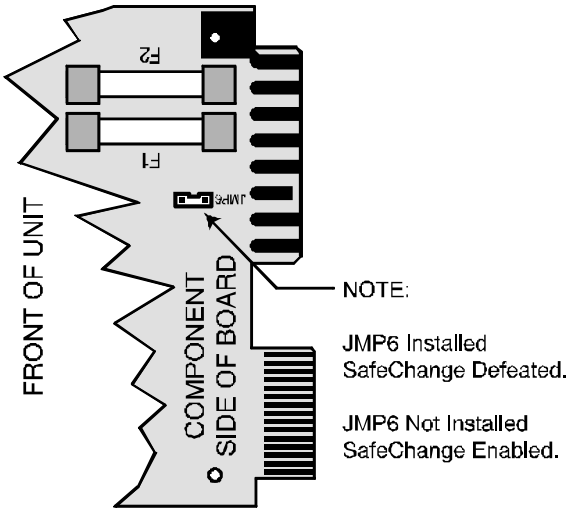
   - If the third position in the connector block does not contain a metal clip, then the mainframe does not support SafeChange.



Location of Clip in Mainframe to Support SafeChange

3.3 Enabling the SafeChange Feature

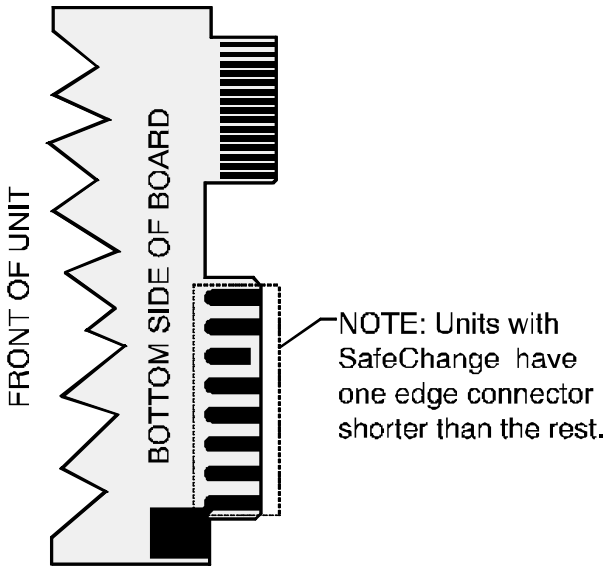
Controllers are shipped with SafeChange disabled, because the controller will not work if the SafeChange feature is enabled, but the mainframe does not support SafeChange. You can enable SafeChange quickly and easily.



Location of SafeChange Jumper JP6

To enable the SafeChange feature on a controller, remove the jumper block from JP6.

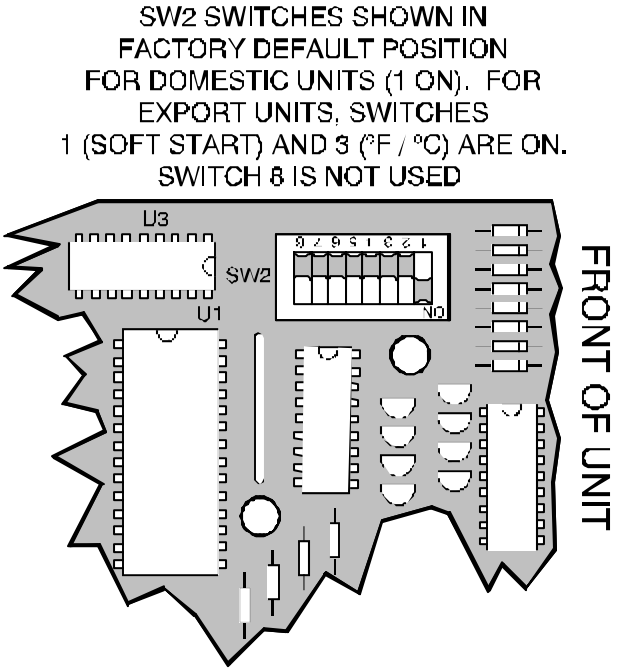
If you don't see JP6, the controller in hand may pre-date the SafeChange feature. In addition to JP6 in the location shown above, controllers that support SafeChange also have one edge connector shorter than the others. If all the edge connectors are the same length, the controller does not support the SafeChange feature.



SafeChange Edge Connector

3.4 Location of DIP Switches

The location of the bank of setup DIP switches (SW2) is shown below.



Location of DIP Switches

3.5 Factory Switch Settings

Every Series RMC Hot Runner controller is shipped from the factory with the switches set as shown in the table below. The ON position is toward the center of the board.

SW2 Switch	Associated Function	If OFF	If ON	Factory Setting
1	soft start	soft start only when ground fault has been detected	soft start every time controller is powered up	ON
2	input type	J thermocouple	K thermocouple	OFF
3	unit of measure	degrees Fahrenheit	degrees Celsius	depends on shipping destination: OFF for North America ON for all others
4	production test	normal operation	production test; factory use only; do not close unless told to do so by a member of our Technical Support team	OFF
5	load default parameters	normal operation	load default parameter values (except for communication parameters) next time controller is powered up	OFF
6	start mode	start in normal (automatic) mode	start in last mode used	OFF
7	expanded menu	no access to menu used to configure the access level	access to all menus, including the access menu	OFF
8	*reserved for future use*			

Information about the functions of SW2-switches 1, 2, 3, 6, and 7 is in this section.

Instructions for using SW2-switch 5 to load parameter defaults are in Section 16.

Information about using SW2-switch 7 to enable display of the menu used to specify the access level is in Section 12.

3.6 Specifying the Input Type

The setting of SW2-switch 2 must match the type of sensor used.

- If SW2-switch 2 is OFF (the factory setting), the controller is set to receive input from a J thermocouple.
- If SW2-switch 2 is ON, the controller is set to receive input from a K thermocouple.

3.7 Selecting Unit of Measure

The unit of measure (temperature scale) used by the controller for internal operations, for the controller display, and for external communications, is set by means of SW2-switch 3.

- If SW2-switch 3 is OFF (the factory setting for units shipped to destinations in North America), the controller uses degrees Fahrenheit.
- If SW2-switch 3 is ON (the factory setting for units shipped to destinations outside North America), the controller uses degrees Celsius.

When you change the units of measure switch setting, the controller recalculates any temperature values that have already been specified, such as the setpoint, setpoint limits, and high temperature safety value.

For example, if you want the setpoint high limit to be 400 °C, but the controller is set to use °F, then you must change the units from °F to °C before you write the setpoint high limit of 400 to the controller. If you change the units after you write the setpoint high limit of 400 to the controller, the controller will convert the 400 °F setpoint high limit to 222 °C when you power up the controller after changing the switch. In this case, you would have to reconfigure the setpoint high limit to 400 °C to implement the control needed by your process.

3.8 Enabling Soft Start

The Series RMC Hot Runner controllers support the CompuStep soft start feature, which allows slow dissipation of moisture in heaters, by gradually applying power to the heaters.

SW2-switch 1 determines when a soft start will be executed.

- If SW2-switch 1 is ON (the factory setting), a soft start will be executed every time the controller is powered up or upon every return to normal (automatic) mode, assuming that the process temperature is below 200 °F (93 °C).
- If SW2-switch 1 is OFF, a soft start will be executed only when a controller detects a ground fault (see 1.2.5.7).

You can change the setting of SW2-switch 1 after the controller has been configured without adversely affecting the configuration.

3.9 Selecting the Mode to Be Used at Power Up

The mode (automatic or manual) used by the controller when it is powered up depends on the setting of SW2-switcch 6.

- If SW2-switch 6 is OFF (the factory setting), the controller will start in normal (automatic) mode. The controller's behavior at start up in normal mode is also affected by the SW2-switch 1 setting and the PId (PID control) menu's At_OP (Autotune operation) parameter setting (see 1.6 and 11.3.4).
- If SW2-switch 6 is ON, the controller will always start in the last mode used before power was removed.
    - If the controller was in normal (automatic) mode, the controller will be in normal when it is powered up. The controller's behavior at start up in normal mode is also affected by the SW2-switch 1 setting and the PId (PID control) menu's At_OP (Autotune operation) parameter setting (see 1.6 and 11.3.4). With or without soft start and Autotune, the setpoint stored on the EEPROM will be used.
    - If the controller was in manual mode, the controller will be in manual when it is powered up. Depending on the SW2-switch 1 setting, a manual mode soft start may be used. The fixed output percentage used (at the conclusion of the soft start, if any) will be the last one stored on the EEPROM by the controller.[22] (A new controller will use 0%.)

[22] If SW2-switch 6 is ON and the controller is in manual mode, then every 10 seconds the output percent value being used will be compared to the most recent manual mode output stored on the EEPROM. If the values do not match, the currently used output value will be written to the EEPROM.

4. General Information About Configuration Parameters

4.1 Information in This Section

This section contains general information about the configuration parameters used by the Series RMC controllers. Sections 5 through 12 contain information about functional groups of parameters. Each section describes the parameters in a single configuration menu.

4.2 How to Use Sections 5 through 12

You do not have to read all of Sections 5 through 12. You can skip any sections marked "optional" that do not apply to your application. You can also skip some parts of some of the required sections. The path you take as you read will be determined by your control strategy.

For example, in Section 5 everyone needs to know about the information in 5.1 and 5.2, so there are no stop signs to interrupt your reading. However, when you get to the end of 5.2 you will see:

What's next after you have specified the boost control type?

If you chose closed loop control, go to 5.3.
If you chose open loop control go to 5.4.

This means that you should look at either 5.3 or 5.4, but you do not have to read both. If a parameter (in this case, boost duration) applies to both closed loop and open loop boost, it is included in both 5.3 and 5.4.

4.3 Information Provided About Each Parameter

4.3.1 Summary

Each menu consists of a functional group of parameters. For each parameter the following information is provided:

- **parameter name**
- **abbreviated name as displayed**
- **when displayed** – This paragraph indicates whether the parameter applies to all control strategies ("always") or only under certain circumstances (which are identified).
- **choices** or **range** – If you must make a selection from a list, all the choices are listed in the sequence in which they appear if you scroll through the list using the ▼ key. If you must specify a numerical value, then the range of valid values is defined.
- **factory default value** – The default value is shown for each configuration parameter. The configuration parameter values can be returned to their default values using the procedure in Section 16.
- **description** – The purpose of the parameter and any special information you need to know to use this parameter is provided.
- **effect on other parameters** – For some parameters, additional information is included. If applicable, this paragraph tells how the value selected for a parameter affects other parameters.

4.4 Menu and Parameter Display Sequence

The menus and parameters are displayed in the sequence shown in the following table. When a new controller is powered up, the menu sequence starts with the PId (PID control) menu, because the ACC (access) menu is displayed only when SW2-switch 7 is ON. Controllers are shipped with SW2-switch 7 OFF.

Within the menus, the parameters are displayed in the sequence shown in the following table. However, not all parameters apply to every application.

If a parameter does not apply to a particular control strategy, then that parameter will not be displayed. For example, if you specify that the communication protocol is "local", then only parameters that apply to local communication are displayed in the **SCI** menu.

Displayed Abbreviation (menu name)	Parameters	Access Enabled (see Note 1 below)	Described In
ACC (access)	Ac_LU c_bUt b_bUt	Only when SW2-switch 7 is ON.	Section 12
PId (PID control)	Pb rAtE At_OP	Whenever the access level is set to ConF (configuration).	Section 1
bSt (boost)	tYPE dUr b_SP (closed loop boost) b_Pct (open loop boost)	Whenever the access level is set to ConF (configuration).	Section 5
Stb (standby)	tYPE S_SP (closed loop standby) S_Pct (open loop standby)	Whenever the access level is set to ConF (configuration).	Section 6
InP (input)	bIAS SP_LL SP_HL	Whenever the access level is set to ConF (configuration).	Section 7
ALr (alarm)	AL_OP dE_H dE_L InH	Whenever the access level is set to ConF (configuration).	Section 8
SCI (serial communication interface)	Pro S_Id (MODBUS only) bAUd dAt_F nnod (MODBUS only) U_USE (local only)	Whenever the access level is set to ConF (configuration).	Section 9
SUP (supervisor)	LPb_t Ht_S FS_A FS_P (if failsafe action is to use a failsafe fixed output percent) HI_t (read-only value; can be reset) LO_t (read-only value; can be reset)	Whenever the access level is set to ConF (configuration).	Section 10

Note 1: The access level is configured using the ACC menu's AcLU parameter. The access menu is displayed only when SW2-switch 7 is ON. Controllers are shipped with SW2-switch 7 OFF.

4.5 Using Factory Defaults

Sections 5 through 12 include the factory default value for every parameter. If you want to use the default for a particular parameter, you do not have to take any action. You do not have to access the parameter at all. For example, if you are content to use the default values for all the parameters in the InP (input) menu, then when you have completed configuration of the StB (standby) menu, you can press the **DISPLAY** key to step to the InP menu, then immediately press **DISPLAY** again to move on to the SCI (serial communications interface) menu.

5. Boost Parameters – Required If Boost Feature Will Be Used

5.1 Introduction

Although the PId (PID control) menu is the first displayed, do not configure it now.

Once you have set the switches, the next step is to power up the controller, and put it in standby by pressing the **MODE** key repeatedly until the STANDBY LED lights. Next, configure the setpoint range using the InP (input) menu's SP_LL (setpoint low limit) and SP_HL (setpoint high limit) parameters as described in 7.3. This range will affect the values you can enter as the boost setpoint described in this section, and the standby mode setpoint described in 6.3. You can skip configuring the setpoint range if you are satisfied to use the default range 32 to 999 °F (0 to 537 °C), or if you plan to use open loop control during the boost and in standby mode.

If you want the operator to be able to use the boost function described in 1.2.4, next use the bSt (boost) menu to specify the type of control that will be used during the boost.

Your choices for the type of control used during the boost are:

- open loop (the default), in which the input from the sensor has no effect on the output used; in this mode a configurable boost fixed output percentage is used
- closed loop, in which the input from the sensor will be used by the controller to calculate the output based on the configured boost setpoint

You also must specify the length of time the boost will last.

Depending on the type of control you select for the boost, you then configure the boost fixed output or the boost setpoint.

If you do not want the boost function to be available to the operator, you must disable the **BOOST** button as described in 12.6.

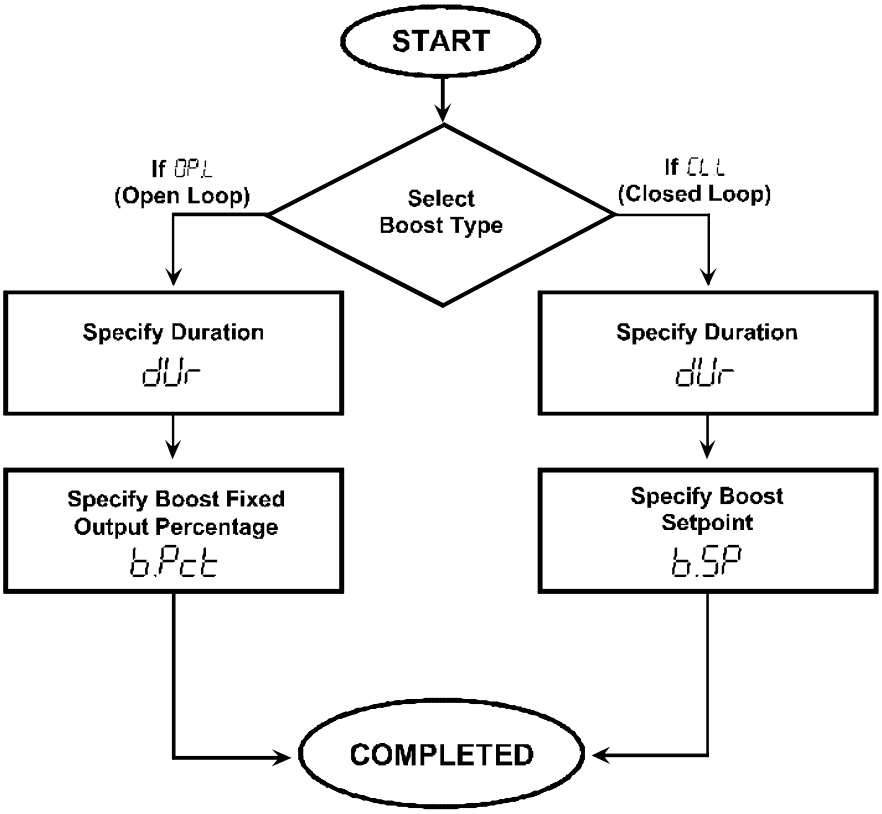
The bST (boost) menu is displayed whenever configuration is enabled using the ACC (access) menu. New RMC controllers are shipped from the factory with configuration enabled.

The boost parameters are shown in the table below. Descriptions of the individual parameters are later in the subsection.

Item	Parameter Name	When Displayed
tYPE	Boost Control Type	always
dUr	Boost Duration	always
b_SP	Boost Setpoint	if boost type is closed loop

b_Pct	Boost Fixed Output Percentage	if boost type is open loop

The process of configuring the boost parameters is diagramed below.



5.2 Specifying Whether Open or Closed Loop Control Will Be Used During the Boost

5.2.1 Parameter Used

Parameter Name: **Boost Control Type**

Name as Displayed: tYPE

When Displayed: always

Choices:
- OP_L open loop
- CL_L closed loop

Default: open loop

Description: The type of control used during the boost. With open loop control the input from the sensor has no effect on the output used; the output will be the boost fixed output percentage. With closed loop control the input from the sensor will be used by the controller to calculate the output based on the configured boost setpoint.

Effect on Other Parameters: Determines whether you can configure a fixed output percentage or a setpoint for the boost function.

5.2.2 Procedure for Viewing the Currently Selected Boost Type

To view the boost type currently set for the controller:

1. Press the **MODE** key until the controller is in standby mode (STANDBY LED lit).

2. Access the configuration menus by pressing the **DISPLAY** key until PId is displayed on the top line (approximately 3 seconds). This is the abbreviated name of the first menu, PID control.

3. Press the **DISPLAY** key once; bSt, the name of the boost menu is displayed on the top line.

4. Press the **MODE** key briefly. The lower line displays tYPE alternating with the currently configured choice for this parameter. For example, in an out-of-the box controller, tYPE will alternate with the display of OP_L (open loop).

5.2.3 Procedure for Changing the Boost Type Selection

To change the boost type selection:

1. Press ▲ or ▼ to cycle through the two boost type choices until the boost type you want is displayed on the lower line.

2. Press the **MODE** key once to write the configuration change to the controller's EEPROM and display the next parameter (dUr) in the boost menu.

What's next after you have specified the boost control type?

If you chose closed loop control, go to 5.3.
If you chose open loop control go to 5.4.

5.3 Configuring Boost Parameters When Closed Loop Control Is Used

5.3.1 Selecting the Duration of the Boost Period

Parameter Name: **Boost Duration**

Name as Displayed: dUr

When Displayed: always

Choices: off
15 seconds
30 seconds
45 seconds
60 seconds
75 seconds
90 seconds
105 seconds
120 seconds

Default: off

Description: The duration of the boost in seconds.

5.3.2 Specifying the Boost Setpoint

Parameter Name: **Boost Setpoint**

Name as Displayed: b_SP

When Displayed: if the boost control type is closed loop

Range: SP_LL to SP_HL (setpoint low limit to setpoint high limit from input menu) (See Note 1 below.)

Default: 100 °F
38 °C (See Note 2 below.)

Description: The setpoint used for the duration of the boost.

Note 1: If the setpoint range is changed after the boost setpoint has been configured, and the boost setpoint is not within the new setpoint range, then the boost setpoint value will automatically be set to match the new setpoint low limit.

Note 2: The unit of measure used depends on whether SW2-switch 3 is OFF (degrees Fahrenheit) or ON (degrees Celsius).

If you are using closed loop control during the boost, you have finished configuration of boost parameters. The remainder of this chapter does not apply to your application.

Go to Section 6 – Standby Parameters.

5.4 Configuring Boost Parameters When Open Loop Control Is Used

5.4.1 Selecting the Duration of the Boost Period

Parameter Name: **Boost Duration**

Name as Displayed: dUr

When Displayed: always

Range: off
15 seconds
30 seconds
45 seconds
60 seconds
75 seconds
90 seconds
105 seconds
120 seconds

Default: off

Description: The duration of the boost in seconds.

5.4.2 Specifying the Boost Fixed Output Percentage

Parameter Name: **Boost Fixed Output Percentage**

Name as Displayed: b_Pct

When Displayed: if the boost control type is open loop

Range: 0 to 100 percent

Default: 0 %

Description: The fixed output percentage used for the duration of the boost.

6. Standby Parameters – Recommended

6.1 Introduction

The **Stb** (standby) menu is used to customize the behavior of the controller while the operator has placed it in standby mode, assuming the **MODE** key has not been disabled using the **ACC** (access) menu (see 12.5).

Your choices for the type of control used while the controller is in standby mode are:

- open loop (the default), in which the input from the sensor has no effect on the output used; in this mode a configurable standby fixed output percentage is used
- closed loop, in which the input from the sensor will be used by the controller to calculate the output based on the configured standby setpoint

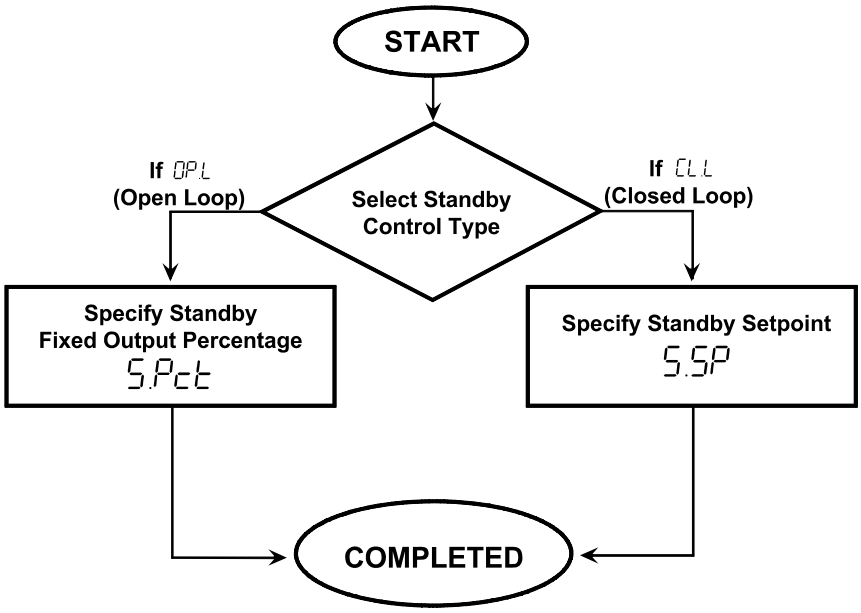
Depending on the type of control you select for standby mode, you then configure the standby fixed output or the standby setpoint.

The **Stb** (standby) menu is displayed whenever configuration is enabled using the **ACC** (access) menu. New RMC controllers are shipped from the factory with configuration enabled.

The standby parameters are shown in the table below. Descriptions of the individual parameters are later in the subsection.

Item	Parameter Name	When Displayed
tYPE	Standby Control Type	always
S_SP	Standby Setpoint	if standby type is closed loop
S_Pct	Standby Fixed Output Percentage	if standby type is open loop

The process of configuring the standby parameters is shown below.



6.2 Specifying Whether Open or Closed Loop Control Will Be Used While in Standby Mode

Parameter Name: **Standby Control Type**

Name as Displayed: tYPE

When Displayed: always

Choices: OP_L open loop
CL_L closed loop

Default: open loop

Description: The type of control used while the controller is in standby mode. With open loop control the input from the sensor has no effect on the output used; the output will be the standby fixed output percentage. With closed loop control the input from the sensor will be used by the controller to calculate the output based on the configured standby setpoint.

Effect on Other Parameters: Determines whether you can configure a fixed output percentage or a setpoint for standby.

Which standby parameters apply to your application?

If you chose closed loop control, 6.3.
If you chose open loop control, go to 6.4.

6.3 Specifying the Closed Loop Standby Setpoint

Parameter Name: **Standby Setpoint**

Name as Displayed: S_SP

When Displayed: if the standby control type is closed loop

Range: SP_LL to SP_HL (setpoint low limit to setpoint high limit from input menu) (See Note 1 below.)

Default: 100 °F
38 °C (See Note 2 below.)

Description: The setpoint used while the controller is in standby mode.

Note 1: If the setpoint range is changed after the standby setpoint has been configured, and the standby setpoint is not within the new setpoint range, then the standby setpoint value will automatically be set to match the new setpoint low limit.

Note 2: The unit of measure used depends on whether SW2-switch 3 is OFF (degrees Fahrenheit) or ON (degrees Celsius).

If you are using closed loop control in standby, you have finished configuration of standby parameters. The remainder of this chapter does not apply to your application.

Go to Section 7 – Input Parameters.

6.4 Specifying the Open Loop Standby Fixed Output Percentage

Parameter Name: **Standby Fixed Output Percentage**

Name as Displayed: S_Pct

When Displayed: if the standby control type is open loop

Range: 0 to 100 percent

Default: 0 %

Description: The fixed output percentage while the controller is in standby mode.

7.Input Parameters – Required

7.1 Introduction

Every Series RMC controller is shipped with SW2-switch 2 OFF. That means that the controller is ready to accept input from a J thermocouple. If you plan to use a K thermocouple to provide the input to the controller, set SW2 switch 2 to ON.

Read the safety warnings in Section 3 before changing switch settings.

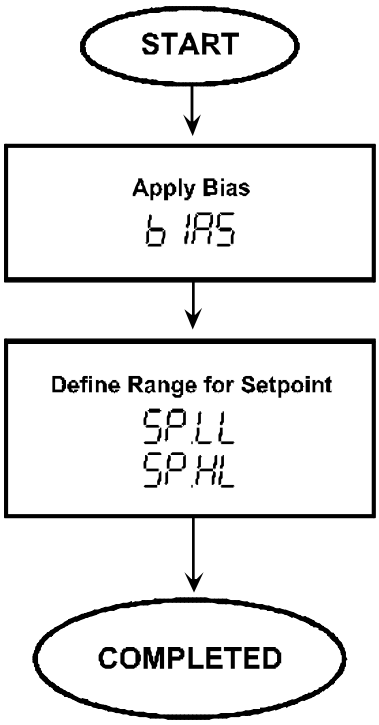
The I nP (input) menu is used to specify the bias (if any) to be applied to the input, and to specify the setpoint range.

The input menu is displayed whenever configuration is enabled using the ACC (access) menu. New RMC controllers are shipped from the factory with configuration enabled.

The input parameters are shown in the table below. Descriptions of the individual parameters are later in the subsection.

Item	Parameter Name	When Displayed
bI AS	Input Bias	always
SP_LL	Setpoint Low Limit	always
SP_HL	Setpoint High Limit	always

The process of configuring the input parameters is shown below.



7.2 Applying a Bias to the Temperature Input

Parameter Name: **Input Bias**

Name as Displayed: bIAS

When Displayed: always

Range: –100 to 100 °F
–56 to 56 °C (See Note 1 below.)

Default: 0

Description: Applying bias allows you to compensate for any difference (plus or minus) between sensor reading and the location to be measured. The displayed process variable and setpoint will be offset by the value entered here.

Effect on Other Parameters: No effect on other configuration parameters. However, the bias will be applied to the displayed PV and the active setpoint.

Note 1: The unit of measure used depends on whether SW2-switch 3 is OFF (degrees Fahrenheit) or ON (degrees Celsius).

7.3 Specifying the Setpoint Range

Configure the setpoint range, that is, the range of setpoint values the operator can enter using the front panel. The range specified here also limits the values that can be configured for the boost setpoint and standby setpoint.

The Setpoint Low Limit and the Setpoint High Limit must not be set to the same value.

Parameter Name: **Setpoint Low Limit**

Name as Displayed: SP_LL

When Displayed: always

Range: 32 to 999 °F
0 to 537 °C (See Note 1 below.)

Default: 32 °F
0 °C

Description: This is the lowest value that can be entered by the operator as a setpoint (before bias is applied). This is also the lowest value that can be configured as the boost setpoint (see 5.3.2) and the standby setpoint (see 6.3).

Parameter Name: **Setpoint High Limit**

Name as Displayed: SP_HL

When Displayed: always

Range 32 to 999 °F
0 to 537 °C (See Note 1 below.)

Default: 999 °F
537 °C

Description: This is the highest value that can be entered by the operator as a setpoint (before bias is applied). This is also the highest value that can be configured as the boost setpoint (see 5.3.2) and the standby setpoint (see 6.3).

Note 1: The unit of measure used depends on whether SW2-switch 3 is OFF (degrees Fahrenheit) or ON (degrees Celsius).

8. Alarm Parameters – Optional

8.1 Introduction

Each Series RMC Hot Runner controller supports two deviation alarms, each with its own configurable alarm setpoint. If the process value falls below the setpoint minus the deviation low setpoint, or if the process value exceeds the setpoint plus the deviation high setpoint, the red ALARM LED on the front panel of the controller will light. The alarm status indicator will remain lit as long as the process value is below or above the deviation setpoints.

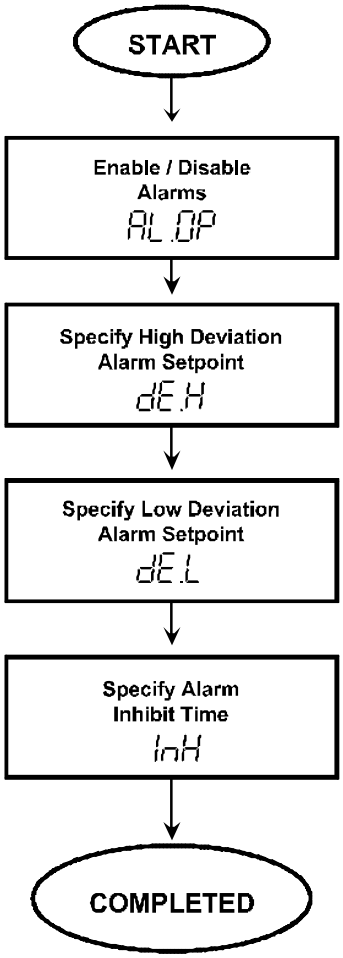
Alarm configuration is done using the ALr (alarm) menu.

The alarm menu is displayed whenever configuration is enabled using the ACC (access) menu. New RMC controllers are shipped from the factory with configuration enabled.

The alarm parameters are shown in the table below. Descriptions of the individual parameters are later in the subsection.

Item	Parameter Name	When Displayed
AL_OP	Alarm Operation	always
dE_H	High Deviation Alarm Setpoint	always
dE_L	Low Deviation Alarm Setpoint	always
InH	Alarm Inhibit	always

The process of alarm configuration is shown below.



8.2 Enabling the Alarm Feature

Parameter Name: **Alarm Operation**

Name as Displayed: AL_OP

When Displayed: always

Choices:
- dIS disabled
- EnA enabled

Default: enabled

Description: Determines whether the controller will use the alarm function.

Effect on Other Parameters: If alarm operation is disabled, the other parameters in the alarm menu will not be displayed.

If you disabled the alarm function, the remainder of this chapter does not apply to your application (although you can continue to configure alarm values for future use).

Go to Section 9 – Communication Parameters.

8.3 Specifying the Deviation Alarm High and Low Setpoints

Parameter Name: **High Deviation Alarm Setpoint**

Name as Displayed: dE_H

When Displayed: always

Range: 1 to 967 °F
1 to 537 °C (See Note 1 below.)

Default: 30 °F
17 °C

Description: Number of degrees the process value must exceed the setpoint to trigger the alarm state.

Parameter Name: **Low Deviation Alarm Setpoint**

Name as Displayed: dE_L

When Displayed: always

Range: 1 to 967 °F
1 to 537 °C (See Note 1 below.)

Default: 30 °F
17°C

Description: Determines whether the controller will use the alarm function.

Effect on Other Parameters: Number of degrees the process value must fall below the setpoint to trigger the alarm state.

Note 1: The unit of measure used depends on whether SW2-switch 3 is OFF (degrees Fahrenheit) or ON (degrees Celsius).

8.4 Inhibiting the Alarm – Optional

If you specify an alarm inhibit time, the controller will not signal an alarm state following power up until the alarm inhibit time has elapsed. This is particularly useful for preventing activation of low alarms during startup (before the process has had time to reach operating temperature).

Parameter Name: Alarm Inhibit

Name as Displayed: I nH

When Displayed: always

Range: 0 to 999 seconds

Default: 0 (off)

Description: Used to specify the number of seconds the controller should wait after power up before signaling an alarm condition.

9. Communications Parameters – Recommended

9.1 Introduction

Every Series RMC Hot Runner controller supports RS-485 serial communications. If you choose to use this communication capability, you have two choices: MODBUS or local communication.

- **MODBUS communication using a MODBUS master** – You can network the controllers to a MODBUS host. This host can read and write to every configuration parameter in a RMC controller's database. The host can also read every status value available in the database, including which LEDs are lit.[23] Guidelines for using a MODBUS host to communicate with the Series RMC Hot Runner controllers are in *Using the MODBUS Protocol with Athena Series RMC Hot Runner Controllers*.

- **local communication using an ALL master** – You can assign each RMC controller to one of three usage groups. The front panel of any controller in a usage group can be used to activate the boost, change the mode, change the setpoint, or change the manual mode output in all other RMC controllers in the same usage group (within the same mainframe or in mainframes that are linked via an RS-485 network).

  This is accomplished by making any one of the controllers in the usage group the ALL master temporarily by pressing ▲ and ▼ simultaneously. The ALL master's green ALL LED will light, and remain lit while the controller is ALL master. (If you do not press another key within 5 seconds of pressing ▲ and ▼ simultaneously (or during a 5 seconds interval while the ALL LED it lit), ALL mastership is cancelled automatically; see 2.9.)

The SCI (serial communications interface) menu is used to specify the type of communication to be used (if any), and to configure the parameters associated with the type of communication you specify.

The serial communication menu is displayed whenever configuration is enabled using the ACC (access) menu. New RMC controllers are shipped from the factory with configuration enabled.

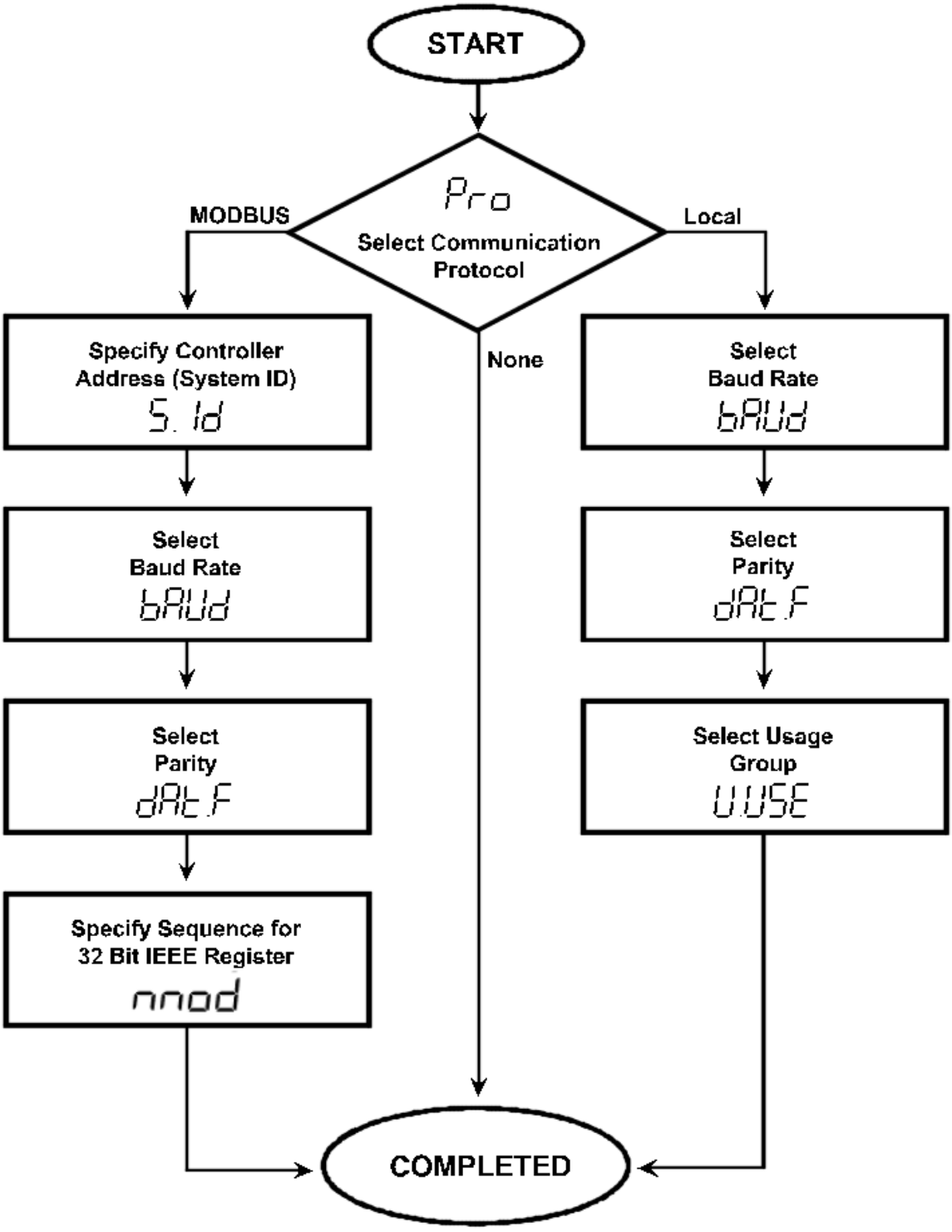
<u>If you use SW2-switch 5 as described in Section 16 to return configuration parameter values to the defaults, the communication parameter values will not be changed</u>.

[23] Peer-to-peer communications are not supported by the MODBUS protocol.

The communication parameters are shown in the table below. Descriptions of the individual parameters are later in the subsection.

Item	Parameter Name	When Displayed
Pro	Communication Protocol	always
S_Id	System ID (controller address)	if MODBUS protocol is selected
bAUd	Baud Rate	if MODBUS or local communication is selected
dAt_F	Data Format (Parity)	if MODBUS or local communication is selected
nnod	IEEE Register Ordering	if MODBUS protocol is selected
U_USE	Usage Grouping	if local communication is selected

The process of configuring the controller for serial communications is shown below.



9.2 Specifying the Communications Protocol to Be Used

Parameter Name: **Communication Protocol**

Name as Displayed: Pro

When Displayed: always

Choices:

nonE	no communication enabled
bUS	MODBUS protocol
LocL	local communication

Default: MODBUS

Description: The type of serial communication that will be used by the controller.

Effect on Other Parameters: Determines which other communication parameters are displayed for configuration.

Which communication parameters apply to your application?

If you chose no communication, go to Section 10.
If you chose MODBUS protocol, go to 9.3.
If you chose local communication, go to 9.4.

9.3 Configuring Communication Parameters for MODBUS Protocol

9.3.1 Introduction

The items that appear on the SCI (serial communications interface) menu in controllers that are configured to use MODBUS protocol are different from the SCI menu items displayed if the controller is configured to use local communications. The MODBUS communication parameters presented briefly below are described in more detail in *Using the MODBUS Protocol with Athena Series RMC Hot Runner Controllers.* We recommend that you consult that manual before setting up your MODBUS network and configuring these communication parameters.

9.3.2 Assigning a Unique Controller Address When MODBUS is Used

Parameter Name: **System ID (Controller Address)**

Name as Displayed: S_Id

When Displayed: if MODBUS protocol is selected

Range: 1 to 247

Default: 1

Description: Used to assign a unique address to each controller on the MODBUS network.

9.3.3 Selecting the Baud Rate Applicable to MODBUS Communications

Parameter Name: **Baud Rate**

Name as Displayed: bAUd

When Displayed: whenever communications are enabled

Choices: 4800
9600

Default: 9600

Description: Used to select the baud rate.

9.3.4 Selecting the Parity When MODBUS is Used

Parameter Name: **Parity**

Name as Displayed: dAt_F

When Displayed: whenever communications are enabled

Choices:
- nonE none
- Odd odd
- EUEn even

(See Note 1 below)

Default: none

Description: Used to select the type of parity to be used, if any.

Note 1: Regardless of the parity selected, a Series RMC controller that is configured to use MODBUS protocol always uses 1 start bit, 8 data bits, and 1 stop bit.

9.3.5 Selecting the Sequence for 32-bit IEEE Registers When MODBUS Is Used

Parameter Name: **IEEE Register Ordering**

Name as Displayed: nnod

When Displayed: if MODBUS protocol is selected

Choices:
- YES MODBUS standard ordering: low register before high
- no non-standard ordering: high register before low

Default: yes

Description: Used to choose whether the two registers that make up a single 32-bit IEEE floating point value are transmitted in standard MODBUS sequence (low before high), or not in standard sequence (high before low)

If you are configuring MODBUS serial communications, you have finished configuring the communication parameters. The remainder of this section does not apply to your application

Go to Section 10.

9.4 Configuring Communication Parameters for Local Communications

9.4.1 Introduction

The items that appear on the SCI (serial communications interface) menu in controllers that are configured to use local communications are different from the SCI menu items displayed if the controller is configured to use MODBUS communications.

9.4.2 Selecting the Baud Rate Applicable to Local Communications

Parameter Name: **Baud Rate**

Name as Displayed: bAUd

When Displayed: whenever communications are enabled

Choices: 4800
9600

Default: 9600

Description: Used to select the baud rate.

9.4.3 Selecting the Parity for Local Communications

Parameter Name: **Parity**

Name as Displayed: dAt_F

When Displayed: whenever communications are enabled

Choices: nonE none
Odd odd
EUEn even

(See Note 1 below)

Default: none

Description: Used to select the type of parity to be used, if any.

Note 1: Regardless of the parity selected, a Series RMC controller that is configured to support local communications always uses 1 start bit, 8 data bits, and 1 stop bit.

9.4.4 Specifying the Usage Group

Parameter Name: **Usage Grouping**

Name as Displayed: U_USE

When Displayed: if local communication is selected

Choices:
- tIP tip
- FoLd manifold
- Othr other (See Note 1 below)

Default: other

Description: Used to select the usage group to which the controller will belong.

Note 1: If you want all the controllers in all the networked mainframes to receive the same communications from the ALL master, then assign all the controllers to Oth (other) group.

10. Supervisor Parameters – Recommended

10.1 Introduction

You can use the SUP (supervisor) menu to specify several safety-related parameters.

If you specify a loop break time, the controller will turn off the output if the input value does not change 1% of supported sensor span (9 °F or 5 °C) in response to output action within the configured time. Controller activity will not resume until the operator cycles the power to the controller; see 1.2.5.3 and 10.2.

You can specify a high-temperature safety value. If the process value exceeds this value, controller processing and output activity is halted. Once the high-temperature safety value has been exceeded by the PV, the controller will not resume processing and output activity until the operator cycles power to the controller; see 1.2.5.2 and 10.3.

You can also select the output action to be taken if the controller detects a problem with the sensor (reversed or open sensor); see 1.2.5.4 and 10.4. One of the failsafe action choices is using a fixed output percentage, which is also configurable using this menu; see 10.5.

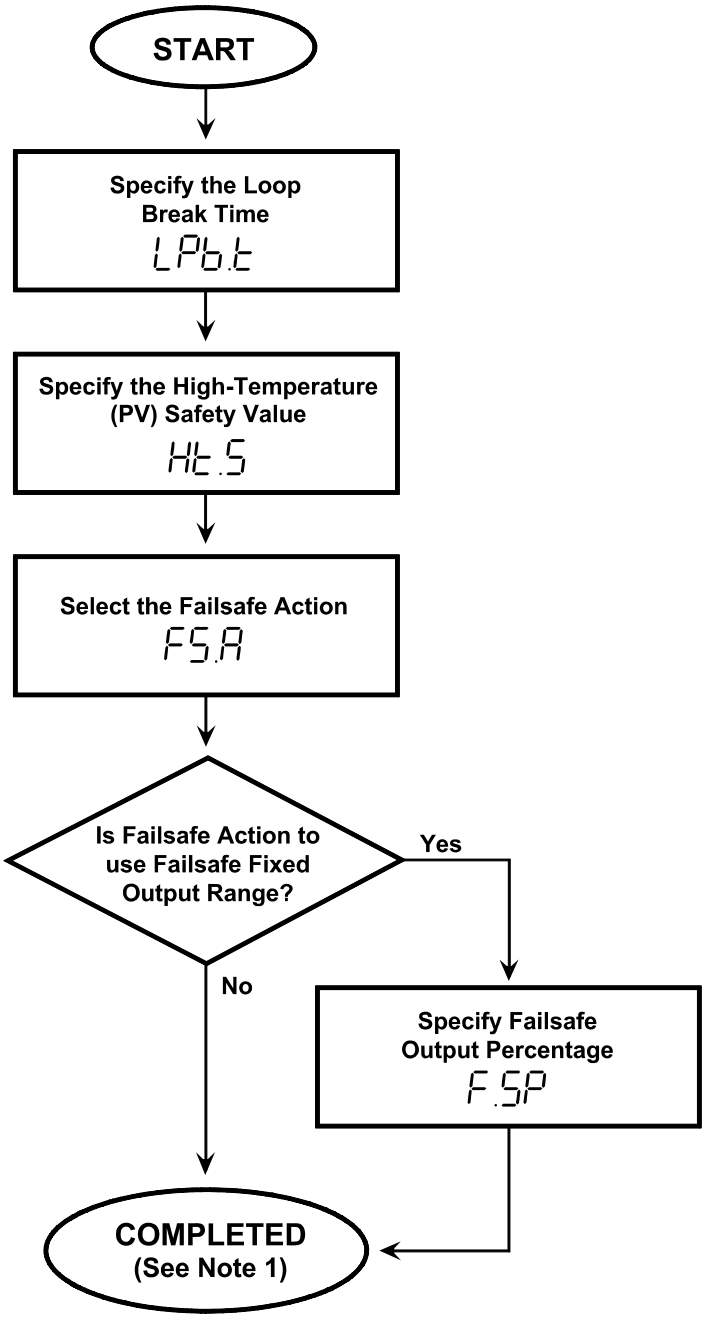
You can also use this menu to see the highest and lowest process value received by the controller since it was powered up (or the last time the values were reset); see 10.6.

The SUP (supervisor) menu is displayed whenever configuration is enabled using the ACC (access) menu. New RMC controllers are shipped from the factory with configuration enabled.

The configuration parameters (and stored viewable values) in the SUP menu are listed in the table below. Detailed descriptions are in the following pages.

Item	Parameter Name	When Displayed
LPb_t	Loop Break Time	always
Ht_S	High-Temperature Safety Value	always
FS_A	Failsafe Action	always
FS_P	Failsafe Fixed Output Percentage	if failsafe action selected is failsafe fixed output percentage
HI_t	Highest Temperature (PV) Reading	always
LO_t	Lowest Temperature (PV) Reading	always

The sequence of configuring the supervisor parameters is shown below:



NOTE 1: The SUP (supervisor) menu also contains two read-only values: H.t [highest temperature (PV) reading] and L.0.t [lowest temperature (PV) reading].

10.2 Defining the Loop Break Time

The loop break time parameter is used to specify the length of the time period during which the input should change 1% of supported sensor span (9.67 °F or 5.37 °C) in response to output action if the sensor is working correctly, and the input wiring is intact. If a loop break is detected, the controller output will be turned off. (See 1.2.5.3 and 13.4 for more information about loop break detection.) This time period is also used when the controller tests for a "bad heater" error; see 13.6.

Parameter Name: **Loop Break Time**

Name as Displayed: LPb_t

When Displayed: always

Range: 9 = off
10 to 999 seconds

Default: 999 seconds

Description: Used to specify the time period during which the input should change 1% of supported sensor span (9.67 °F or 5.37 °C) in response to output action if the sensor is working correctly and the input wiring is intact; see 13.4. This time period also is used when the controller tests for a "bad heater" error; see 13.6.

10.3 Specifying the Safety High Temperature That Will Trigger Halt of Controller Activity

The high-temperature safety value parameter is used to specify the process value that will trigger a halt of controller processing and output activity.

In this case the output will not go to the failsafe state. Instead, the output will be set to off. The controller processing and output activity will remain off until the operator cycles the power to the controller.

Parameter Name: **High-Temperature Safety Value**

Name as Displayed: Ht_S

When Displayed: always

Range: whole number within the range
33 to 999 °F
1 to 537 °C
or OFF
(See Note 1 below.)

Default: off

Description: Used to specify the high temperature (PV) that will trigger a halt of controller processing and output activity.

Note 1: The unit of measure used depends on whether SW2-switch 3 is OFF (degrees Fahrenheit) or ON (degrees Celsius).

10.4 Specifying Failsafe Action: What Should Happen to Output If Sensor Is Bad

The failsafe action is used when the controller detects a problem with the input: open sensor or reversed sensor. You cannot rely on the controller taking this action if the controller's internal circuitry fails.

Parameter Name: **Failsafe Action**

Name as Displayed: FS_A

When Displayed: always

Choices: OFF = output off

AUE = use a calculated output value based on output values that have typically successfully maintained the current setpoint for your process in the past

FS_P = use fixed output percentage specified with Failsafe Fixed Output Percentage parameter (see 10.5)

Default: off

Description: Used to select the output action to be used when the controller detects a problem with the input from the sensor.

At the conclusion of an unsuccessful Autotune operation, the controller also goes to the configured failsafe state automatically.

10.5 Specifying the Failsafe Fixed Output Percentage

If the failsafe action is configured to use the failsafe fixed output percentage, use this parameter to specify that percentage. Once the controller has gone to the failsafe state, the operator will be able to change the output percentage in use at that time. However, the changes will not affect the value stored for the failsafe fixed output percentage parameter. The next time the controller goes to the failsafe state, the percentage configured here will again be used as the initial failsafe output percentage.

Parameter Name: **Failsafe Fixed Output Percentage**

Name as Displayed: FS_P

When Displayed: if failsafe action is set to use the failsafe fixed output percentage

Range: 0 to 100%

Default: 0

Description: Used to specify the fixed output percentage the controller will use if it detects a problem with the input while the failsafe action is set to use the failsafe fixed output percentage.

10.6 Viewing the Highest and Lowest Process Value Received Since Last Reset

The highest and lowest process values received from the input sensor. These are read-only values. The displayed values are the highest and lowest process values stored in RAM since the controller was most recently powered up, or the values were reset.

Every 30 minutes the controller compares the value in RAM with the value in non-volatile memory (on the EEPROM). If a higher or lower reading has been received in the last 30 minutes, the new highest or lowest value is written to the EEPROM.[24]

To reset one of these values (in RAM) to its default, press the ▲ or ▼ key while the value is on display.

Parameter Name: **Highest Temperature (PV) Reading** and **Lowest Temperature (PV) Reading**

Name as Displayed: HI _t and LO_t

When Displayed: always

Range: 32 to 999 °F
0 to 537 °C
(See Note 1 below.)

Default: *for high:* 32 °F (0 °C)
for low: 999 °F (537 °C)

Description: Used to view read-only highest and lowest sensor readings received by the controller since last power up or reset.

Note 1: The unit of measure used depends on whether SW2-switch 3 is OFF (degrees Fahrenheit) or ON (degrees Celsius).

[24] The values stored on the EEPROM cannot be viewed using the controller's front panel. However, they can be read (and reset) by a MODBUS host.

11. Tuning the Controller for PID Control – Required

11.1 Introduction

The Series RMC Hot Runner controllers use Proportional-Integral-Derivative (PID) control to modulate the output power by adjusting the output power percentage within a proportional band. Power is proportionally reduced as the process temperature gets closer to the setpoint temperature. The integral action affects the output based on the duration of the process value's variation from the setpoint, and the derivative action affects the output based on the rate of change of the process value.

The proportional band and derivative action (rate) are automatically adjusted by the Autotune operation. The integral (reset) action used by an RMC controller is always equal to five times the configured derivative (rate) action.

If your process experiences extremely long lag time, Autotuning may be unsuccessful. If this is the case, an error message will be displayed to alert you to that fact (see 11.5). If Autotuning is not possible, you can tune the controller manually as described in 11.6. The PId menu allows you to view and change the proportional band and derivative (rate) action manually if necessary.

Unless display of the ACC (access) menu has been enabled by setting SW2-switch 7 to ON, the PId menu is usually displayed first when configuration is enabled. New RMC controllers are shipped from the factory with configuration enabled and with display of the ACC menu disabled.

11.2 Configuration Sequence and Autotune

By default, every Series RMC controller is configured to execute the Autotune operation the first time it is powered up, then to disable the Autotune feature after a successful Autotune has been completed. When the Autotune feature is disabled, the PId (PID control) menu At_OP (Autotune operation) parameter is set to dIS (disabled). If the Autotune is not successfully completed, either because the operator interrupts it by pressing the **MODE** key or because an Autotune error condition is detected, the Autotune feature will not be disabled automatically.

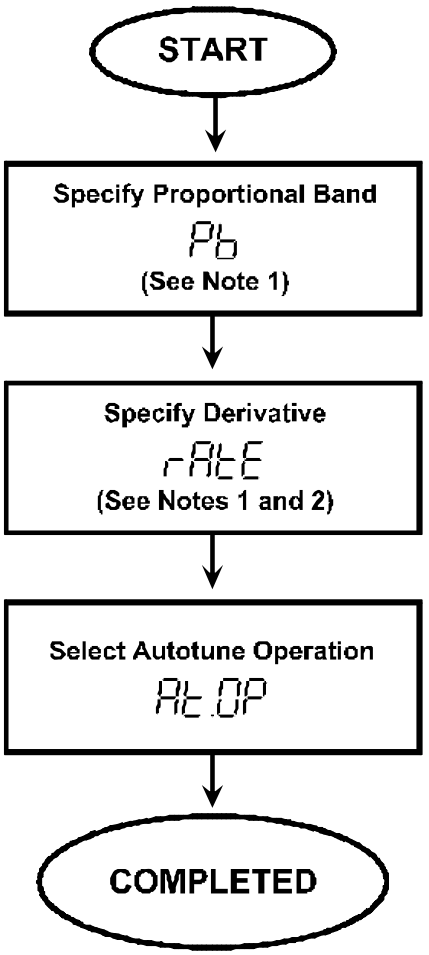
The controller must be configured before it is tuned. When you first power up the controller, it will attempt to do through the normal startup procedure described in 1.6. Press the **MODE** key until the controller is in standby mode and configure the controller. Once all the parameters described in Sections 5 through 10 have been configured, perform Autotune as described in 11.4.

11.3 PID Control Parameters

11.3.1 Summary

The parameters in the PId menu are summarized in the table below.

Item	Parameter Name	When Displayed
Pb	Proportional Band	always
rAtE	Derivative (Rate) Action	always
At_OP	Autotune Operation	always



Note 1) If you plan to use Autotune, you do not need to configure this parameter.

Note 2) The integral (reset) action used is always set to five times the configured derivative (rate) action.

11.3.2 Specifying the Proportional Band for Manual Tuning of PID Control

Do not change the value of this parameter if you plan to rely on Autotuning.

Parameter Name: **Proportional Band**

Name as Displayed: Pb

When Displayed: always

Range: 0.1 to 999 °F
0.1 to 537 °C (See Note 1 below.)

Default: 24 °F
13 °C

Description: Used to specify the width of the band below the setpoint within which the controller will modulate the output as the process value approaches the setpoint.

Note 1: The unit of measure used depends on whether SW2-switch 3 is OFF (degrees Fahrenheit) or ON (degrees Celsius).

11.3.3 Specifying the Derivative (Rate) Action for Manual Tuning of PID Control

Do not change the value of this parameter if you plan to rely on Autotuning.

Parameter Name: **Derivative (Rate) Action**

Name as Displayed: rAtE

When Displayed: always

Range: 0.0 to 999 seconds

Default: 7 seconds

Description: Used to specify the time period used by the derivative component of the control algorithm when analyzing load changes.

Effect on Other Parameters: The integral term for PID control is not configurable in the Series RMC Hot Runner controllers; the integral (reset) action is always equal to five times the configured derivative (rate) action.

11.3.4 Choosing If and When the Autotune Operation Will Be Performed

Parameter Name: **Autotune Configuration**

Name as Displayed: At_OP

When Displayed: always

Choices:

dIS	Autotune disabled
oncE	Autotune once at next power up, then disable Autotune only if the Autotune was successful.
EnA	Autotune enabled every time controller is powered up (See Notes 1 and 2 below.)

Default: once

Description: Used to choose if and when the Autotune operation will occur.

Note 1: If the Autotune is not successfully completed, either because the operator interrupts it by pressing the **MODE** key or because an Autotune error condition is detected, the Autotune feature will not be disabled automatically.

Note 2: Regardless of the At_OP setting, the Autotune operation will not be invoked automatically if SW2-switch 6 is ON to cause the controller to start in the last mode active, and the controller was in manual mode when powered down. See 1.6 for a fuller explanation of the factors that affect the controller's operation following power up.

11.4 Autotuning

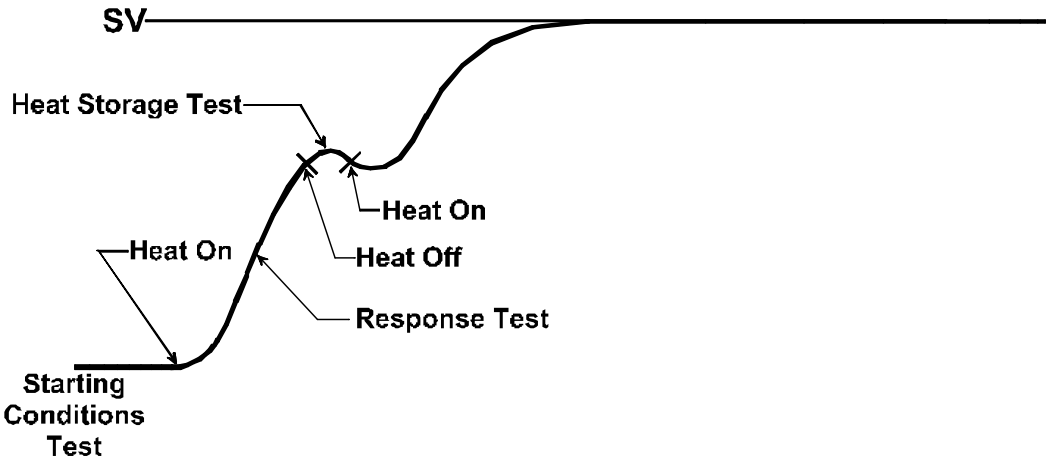
11.4.1 Introduction

By default, every Series RMC controller is configured to execute the Autotune operation the first time it is powered up, then to disable the Autotune feature after a successful Autotune has been completed. When the Autotune feature is disabled, the PId (PID control) menu AtuP (Autotune operation) parameter is set to dIS (disabled). If the Autotune is not successfully completed, the Autotune feature will not be disabled automatically.

The Autotune operation overwrites any existing proportional band and derivative (rate) parameter values that were previously configured.

All RMC controllers in a single process should be Autotuned simultaneously, so that interactions between zones during tuning parallel the interactions expected while the controllers are in use.

Typical Autotune PV Profile



11.4.2 Procedure for Autotuning

To Autotune:

1. After configuring any parameters described in Sections 5 through 10 that apply to your application, exit configuration by pressing and holding the **DISPLAY** key until the PV is displayed on the top line of the display in place of the menu name.

2. Use the ▲ and ▼ keys to enter a setpoint that is representative of the setpoint you expect to use when the controller is in normal operation.

3. Cycle the power to the controller.

4. At this point the controller may execute a CompuStep soft start (NORMAL LED flashing). (See 1.6 for an explanation of the factors that affect whether a soft start occurs when you power up the controller.)

   - If you want to terminate the soft start, press the **MODE** key once.
   - If you want the soft start to continue to its normal conclusion (recommended), do not press any keys.

5. When the Autotune operation begins, the process value on the top line of the display will alternate with **tUn**. Unless you want to terminate the Autotune by pressing the **MODE** key, do not press any keys during the Autotune operation. The lower line will continue to display the setpoint your entered in Step 2.

6. When the controller has completed Autotuning successfully, the flashing **tUn** will disappear. The display will revert to the normal mode operating display, with the process value on the top line and the setpoint on the lower line. The controller will save the tuning parameter values in the proportional band and rate parameters. (The new tuning values can be viewed in the **PId** menu.)

   If the Autotune was unsuccessful, the top line will display **Er** plus a one-digit error code (alternating with **tUn**). Refer to 11.5 for the Autotune error codes. If the controller detects an Autotune error condition, the controller will go to the configured failsafe state automatically. (The effect on the output depends on how you configured the **FS_A** (failsafe action) parameter in the **SUP** (supervisor) menu; see 10.4.)

7. To clear the error display and put the controller in standby mode, press the **MODE** key once. (The effect on the output depends on the configuration selections you made with the **Stb** (standby) menu.)

8. Fix the problem and try tuning again. (If **Er9** was displayed, your process is not responsive enough for the Autotune algorithm to work successfully. Tune the controller manually as described in 11.6).

9. Once Autotune has been completed successfully, and the PV and SV are on display, the controller is controlling the process in normal (auto) mode.

Once Autotune is complete, we recommend changing the security access level to the most restrictive level suitable for your application. See Section 12 for details.

11.5 Autotune Error Codes

If an Autotune error occurs, the top line of the display will alternately show tUn and an error code (which will be displayed until you press the **MODE** key). If the Autotune operation is terminated by the controller because of an error condition, the controller is placed in the failsafe state configured using the SUP (supervisor) menu. The Autotune error codes are in the table below.

Error Code	Description
Er3	Setpoint is higher than the process value. Look at the setpoint. If it is realistic for your process, then check the thermocouple leads; maybe they are reversed.
Er5	There is not enough difference between initial PV and the setpoint. For Autotune to work, the difference must be at least 9 °F (5 °C).
Er8	The startup curve (change in PV) was not acceptable to the Autotune algorithm. This could be caused by a process upset that occurred during tuning. Try Autotuning again when the process is stable. If the error recurs, your process is not suitable for Autotuning. Use manual tuning as described in 11.6.
Er9	The Autotuning timed out, because the process was unresponsive (or extremely slow). Your process is not suitable for Autotuning. Use manual tuning as described in 11.6.

11.6 Manual Tuning (Zeigler-Nichols PID Method)

11.6.1 Introduction

This tuning method may be used if the spread between initial process temperature and process operating temperature is small, or if the process is too slow for Autotuning. Manual tuning requires that the PV be tracked over time. (Graph the displayed PV against time manually.)

The procedure below is used to do manual tuning using the front panel of an RMC controller. You can also use a MODBUS master to change the mode, and to view and change tuning parameter values for the controller.

These instructions assume that:

- SW2-switch 6 is OFF (the factory setting) so that the controller starts in normal (automatic) mode, and
- SW2-switch 1 is OFF (***not*** the factory setting), so that the controller will not do a soft start when powered up.

After you have finished manual tuning, you can set SW2-switch 6 and/or SW2-switch 1 to ON if appropriate for your site.

Read the safety warnings in Section 3 before changing switch settings.

11.6.2 Procedure

To perform manual tuning:

1. After configuring any parameters described in Sections 5 through 10 that apply to your application, exit configuration by pressing and holding the **DISPLAY** key until the PV is displayed on the top line of the display in place of a menu name.
2. Immediately use the ▲ and ▼ keys to enter a setpoint that is representative of the setpoint you expect to use when the controller is in normal operation.
3. Press and hold the **DISPLAY** key until the PId (PID control) menu's name is displayed on the top line. The lower line will display Pb (proportional band), alternating with the default value 24F (13C).
4. Press the **MODE** key to accept the default value (for now) and display rAtE (rate) alternating with its default value 1 (seconds).
5. Use the ▲ and ▼ keys to change the rAtE value to 0.0.
6. Press the **MODE** key to write the change to the controller's database. The lower line will display At_OP (Autotune operation), alternating with onCE (once), the factory setting. Use the ▲ and ▼ keys to change the At_OP value to dIS (disabled).

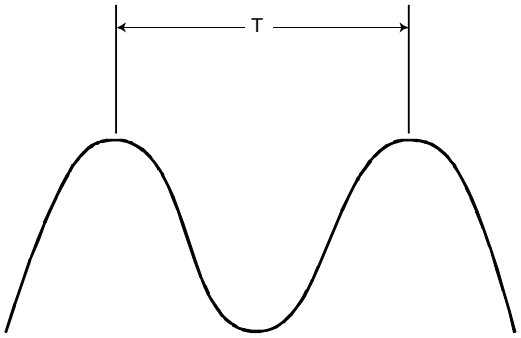
7. Exit configuration by pressing and holding the **DISPLAY** key until the PV is displayed on the top line in place of a menu name.

8. Plot a graph of the displayed PV against time or record time period between temperature peaks. (Be patient. It may be several minutes before you see oscillation in the PV for a manifold zone.)

9. If the temperature (PV) will not oscillate, then decrease the proportional band value by repeatedly halving the value until a small, sustained temperature oscillation is observed.

   Alternatively, if the temperature (PV) oscillates severely, double the proportional band value repeatedly until a small, sustained temperature oscillation is observed.

10. Measure the period in seconds of one cycle of oscillation ("T" on the diagram below).



11. Divide the period of oscillation (T) by 8. The resulting number (quotient) is the correct rAtE (derivative) time in seconds.

12. Display the PId menu and enter the value obtained in Step 11 as the rAtE. The integral time will be set automatically to 5 times the rate. (You cannot view the integral term value.)

13. <u>If the process is stable, manual tuning is completed</u>. However, if slight oscillation is observed, multiply the proportional band value used in Step 10 (to obtain T in Step 11) by 1.66 and enter the product as the new proportional band value to complete the tuning procedure.

Once tuning has been completed, we recommend changing the security access level to the most restrictive level suitable for your application. See Section 12 for details.

12. Restricting Access to Controller Functions – Recommended

12.1 Introduction

You can configure the Series RMC Hot Runner controllers to limit the functions that operators can access or the values they can change using the keypad. This access control is configured using the ACC (access) menu.

The ACC menu contains an AcLU (access level) parameter, which affects some of the functions available to the operator (see 12.4). For example, the access level can be set to allow operators to change only the setpoint or the manual mode (closed loop control) output percentage.

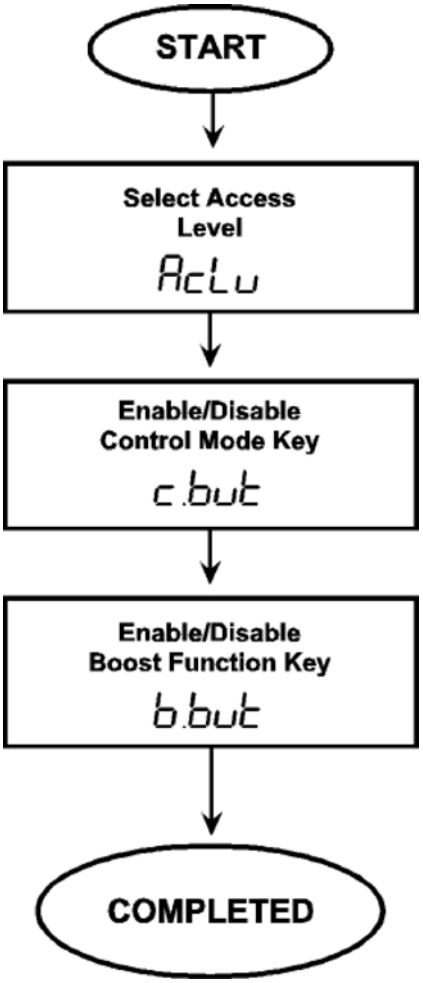
The ACC menu also contains a c_bUt (mode key enable) parameter and a b_bUt (boost key enable) parameter that are used to enable or disable the **MODE** and **BOOST** keys (see 12.5 and 12.6).

The ACC (access) menu is displayed only when SW2-switch 7 is ON (see 12.3). The controllers are shipped from the factory with SW2-switch 7 OFF.

After you have configured the controller for your application, set the access level to the most restrictive level appropriate for your site, then set SW2-switch 7 to OFF.

Read the safety warnings in Section 3 before changing switch settings.

The diagram below shows the sequence of ACC menu parameters.



12.2 Access Levels Available

A controller can be set to any of the access levels in the table below. The sequence of levels in the table is from most restrictive to least restrictive. New RMC controllers are shipped from the factory with the access level set to **CONF** (configuration).

Displayed AcLU Value	Access Level	Description
Loc	keypad lockout	**Highest security level; no access.** While the access level is "keypad lockout", no controller values can be changed, not even the setpoint. Pressing the **MODE** and **BOOST** keys will have no effect, even if the **MODE** and **BOOST** keys have been enabled using the **ACC** menu **c_bUt** and **b_bUt** parameters.
SP	setpoint only	**Setpoint or manual output can be adjusted; no access to menus.** When the access level is "setpoint only", the keypad can be used to change the setpoint or the manual mode output percentage. Whether the operator will be able to change the controller from normal (automatic closed loop control) to manual (open loop control) mode (or vice versa) depends on whether the **MODE** key is enabled using the **ACC** menu **c_bUt** parameter. Availability of the boost function depends on whether the **BOOST** key is enabled using the **ACC** menu **b_bUt** parameter.
CONF	configuration	**Setpoint and manual output can be adjusted. Access to all available menus is permitted.** When the access level is "configuration", the keypad can be used to change the setpoint, change the output percentage in manual mode, and to view and change all configuration parameter values in accessible menus. Not all menus are accessible all the time. If SW2-switch 7 is ON, all menus are accessible, including **ACC** (access). If SW2-switch 7 is OFF (factory setting), the **ACC** access menu is not accessible. See Section 3 for the location of the option switches.

12.3 Setting Switch to Permit Display of Access Menu

The ACC (access) menu is displayed in the menu cycle only when SW2-switch 7 is ON. The RMC controllers are shipped with SW2-switch 7 OFF.

After you have configured the controller for your application, set the access level to the most restrictive level appropriate for your site, then set SW2-switch 7 to OFF.

Read the safety warnings in Section 3 before changing switch settings.

12.4 Using the Access Menu to Control Menu Access

When SW2-switch 7 is ON, the ACC (access menu) is included at the beginning of the sequence of menus. Its first parameter is used to choose the access level that will limit or permit access to the controller's database via the front panel and through local communication from an ALL master.

The access level configured here will place no limitations on access to the controller's database using a MODBUS master.

Parameter Name: **Access Level**

Name as Displayed: ACC

When Displayed: when SW2-switch 7 is ON

Choices:
- Loc keypad lockout
- SP setpoint only
- conF configuration

These access levels are explained in 12.2.

Default: configuration

Description: The access level that will apply to changes made using the controller's front panel or an ALL master.

Effect on Other Parameters: When this is set to keypad lockout or setpoint only, no access to the configuration menus will be permitted while SW2-switch 7 is ON.

12.5 Using the Access Menu to Enable the MODE Key

If you do not want the operator to use the front panel of this controller or an ALL master to change the mode of this controller, use this parameter to disable the **MODE** key.

Even though the **MODE** key is disabled, a MODBUS master will be permitted to change the mode of the controller.

Parameter Name: **Control Mode Key Enable**

Name as Displayed: c_bUt

When Displayed: when SW2-switch 7 is ON

Choices:
- EnA enabled
- diS disabled.

Default: enabled

Description: This parameter is used to enable/disable the front panel **MODE** key.

12.6 Using the Access Menu to Enable the Boost Key

If you do not want the operator to use the front panel of this controller or an ALL master to start the boost function on this controller, use this parameter to disable the **BOOST** key.

Even though the **BOOST** key is disabled, a MODBUS master will be permitted to activate the boost function.

Parameter Name: **Boost Key Enable**

Name as Displayed: b_bUt

When Displayed: when SW2-switch 7 is ON

Choices:
- EnA enabled
- d iS disabled.

Default: enabled

Description: This parameter is used to enable/disable the front panel **BOOST** key.

13. Error Messages and Codes

13.1 Introduction

As described in Section 2, usually the controller displays the process variable on the top line and the setpoint on the lower line of the display. You can see other values on the lower line by pressing the **DISPLAY** key. However, when the controller detects a problem with the process (other than a deviation alarm) or with its own operation, messages and codes are displayed to alert you to conditions that require your immediate attention.

13.2 Problem with Process Temperature

You can use the SUP (supervisor) menu's HI_S (high-temperature safety) parameter to specify a high-temperature safety value to be applied to the process. If the process value exceeds this value:

- controller processing and output activity is halted, and
- the ALARM LED is lit, and
- the message H_SF alternating with Err will be displayed on the lower line.

Once the high-temperature safety value has been exceeded by the PV, the controller will not resume processing and output activity until you cycle power to the controller. Instructions for configuring the high-temperature safety value are in 10.3.

13.3 Ground Fault in Controller Output Wiring

The RMC controller is capable of detecting ground faults in the controller output wiring. When a ground fault is detected, the controller will attempt to perform a normal soft start. As usual in the case of a soft start, if the process value is less than or equal to 200 °F (93 °C), the standard CompuStep soft start described in 1.2.2 will be executed. In this special case, the soft start will be executed up to three times. If the ground fault is still detected, the controller will consider this a "hard" ground fault. The effect on the controller will be the same as when the PV is greater than 200 °F (93 °C) when the ground fault is detected as described below.

If the process value is greater than 200 °F (93 °C) when the ground fault is detected, the controller will consider this a "hard" ground fault. The controller will:

- interrupt the signal to its own output, in effect "turning off" the output (even if the controller output was already at the configured failsafe output state), and
- an error message GFI will be displayed on the lower line, and
- the red ALARM LED will also be lit (all other LEDs will be turned off).

Following the interrupt in response to a "hard" ground fault, the controller's output will remain off until you cycle power to the controller.

If the controller is the ALL master for local communication at the time that the ground fault is detected, the mastership will be cancelled automatically. (See 1.2.6.2 for more information about local communication and ALL mastership.)

13.4 Loop Break in Sensor Wiring

You can use the RMC SUP (supervisor) menu's LPb_t (loop break time) parameter to specify a time period within which the input value should increase at least 1% of supported sensor span (9.67 °F or 5.37 °C) if the sensor is working properly and the input wiring is intact. If the input value does not change within the specified time period while the controller is operating in normal (automatic) mode or in closed loop standby mode (or while a closed loop boost is in progress), and a "bad heater" error has not been detected (see 13.6), then:

- the controller output will be turned off, and
- the ALARM LED will be lit (all other LEDs turned off), and
- the message LPbr will be displayed on the lower line.

The controller will remain in this alarm and output off state until you cycle power to the controller.

13.5 Failsafe Operation if a Sensor Error is Detected

You can use the RMC SUP (supervisor) menu's FS_A (failsafe action) parameter to specify what should happen to the output if the controller detects a reversed or open sensor.[25] Your choices are:

- output off, or
- use a calculated output value based on output values that have typically successfully maintained the current setpoint for your process in the past, or
- use a special configurable failsafe fixed output percentage.

If the controller detects an open or reversed sensor:

- the controller output goes to the configured failsafe state, and
- the ALARM LED will be lit (all other LEDs turned off), and
- the upper display will alternate tC and rEU (reversed sensor), or tC and oPn (open sensor).

The controller will remain in this alarm and failsafe state until the condition clears or you cycle power to the controller.

[25] When an Autotune error condition is detected, the controller goes to the failsafe state automatically. In this case, an Autotune error message will be displayed; see 11.5.

13.6 Heater Current Monitoring

The present current output to the heater, expressed to the closest tenth of an amp, is always displayable in the lower line. Cycle through the available lower line display items using the **DISPLAY** key. The controller constantly checks heater current readings to ensure that they correlate with output activity.

- If the output is off and a current flow greater than 0.1 amp is detected, then the controller will post a “TRIAC short” error.
- If the output is on, but no controller current output flow is detected, then the processor will post a “bad heater” error. (This condition is checked only if loop break detection is enabled, the PV has not changed 1% of supported sensor span during the configured loop break time period while the controller is in normal (auto) mode, and the PV is not within the proportional band.[26])

If either of these error conditions is detected:

- the output failure interruption relay will break the connection between the controller’s TRIAC output and the heater, and
- controller processing will cease, and
- the red ALARM LED will be lit (all other LEDs turned off), and
- an alarm message will be displayed on the lower line:
  - if a short was detected, OUt will alternate with SHrt
  - if a heater problem is detected, bAd will alternate with Htr

The controller will remain in this halted state until you cycle power to the controller.

If the controller is the ALL master for local communication at the time that the output failure is detected, the mastership will be cancelled automatically. (See 1.2.6.2 for more information about local communication and ALL mastership.)

[26] If the input has not changed 1% during the loop break period, but the current output flow is OK, then the loop break error will be displayed; see 13.4.

13.7 Problem with Controller

13.7.1 Introduction

If the controller detects a problem with its own operation, it displays Err on the top line instead of the process value and displays an error code on the lower line instead of the setpoint. For example, if the controller detects a checksum error, the display will show:

Err
0 100

13.7.2 Controller Error Codes

The table below lists the error messages and codes that the RMC controllers display in place of the setpoint value when a self-diagnostic test has failed.

All errors of this type will shut down controller activity (except for display of error message). Output will go off. A host computer cannot communicate with a controller that is displaying one of these messages.

Display	Error Condition	Operator Action
Ht_rd alternating with Err (See Note 1)	Heater conversion error *There is a problem getting a reading from the analog to digital converter.*	Cycle power to clear the message. *Note the error code and call for service.*
0 100	PROM checksum error *This message is usually displayed only at startup, before any outputs are calculated.*	Cycle power to clear the message. *Note the error code and call for service.*
0 101	RAM error *This message is usually displayed only at startup, before any outputs are calculated.*	Cycle power to clear the message. *Note the error code and call for service.*
0202	Default parameter values were loaded automatically, because the controller found corrupted values stored on the EEPROM. (This message is not displayed when you use the procedure in 16.2 to set the default values intentionally.) *This message is usually displayed only at startup, before any outputs are calculated.*	Cycle power to clear the message. Re-configure all configuration parameter values.
0249	Calibration value corrupted.	Cycle power to clear the message. *Note the error code and call for service.*

Display	Error Condition	Operator Action
0303	EEPROM write failure *This message is usually displayed when a configuration value is written.*	Cycle power to clear the message. Try the write operation again. If the message recurs and persists, the EEPROM may be worn out. Call for service. (See Note 2 below.)
2436	Line frequency determination error. *The controller was unable to determine whether the line frequency was 50 Hz or 60 Hz.*	Cycle power to clear the message. Check the line frequency. If it is OK, but the message recurs and persists, call for service.
3923 through 3543	interrupt-related problem *While one of these messages is on display, the controller output is off*.	Cycle the power to the controller. If the message recurs and persists, call for service.

Note1: In this case, the PV is displayed on the top line.

Note 2: A host computer can wear out the EEPROM by writing to it too many times. Do not write the setpoint to the EEPROM when you are writing a temporary setpoint to the controller, such as when you are ramping to a final setpoint under the direction of a MODBUS master.

13.8 Error Display Priority and Summary

If more than one error occurs simultaneously, only the highest priority error will be displayed. The following table shows the priority of the RMC error codes and messages.

Displayed Code or Message	Description	Output State	Where to Find More Information
Highest Priority – No communication with MODBUS host possible			
Err 0 100 or *other 4-digit code*	controller has detected a problem with its own operation	off	13.7
High Priority – Communication with MODBUS host still possible. PV is displayed on top line, unless an input error (medium priority) occurs simultaneously. In that case, the top line is blank; no valid PV is available. If two high priority error states are detected, the one ranked highest will be displayed on the lower line (see numbers below).			
1) GFI	hard ground fault detected	off	13.3
2) bAd Htr	heater problem detected	off (output failure relay will interrupt output)	13.6
3) OUt SHrt	output is off, but current flow is detected	off (output failure relay will interrupt output)	13.6
4) H_SF Err	configured high temperature safety value has been exceeded	off	13.2
5) LPbr	PV has not increased at least 1% of supported sensor span in the configured loop break time	off	13.4
6) Ht_rd Err	heater conversion error	off	13.7
Medium Priority – Communication with MODBUS host still possible. SV is displayed on lower line. These conditions cannot occur simultaneously.			
tC oPn	thermocouple open	goes to configured failsafe state	13.5
tC rEU	thermocouple leads reversed	goes to configured failsafe state	13.5
Low Priority – Communication with MODBUS host still possible. SV is displayed on lower line. Only one Autotune error will be displayed.			
tUn Er3	initial SV is less than PV	goes to configured failsafe state	11.5
tUn Er5	not enough difference between initial SV and PV	goes to configured failsafe state	11.5
tUn Er8	change in PV not acceptable to Autotune algorithm; possible process upset during tuning	goes to configured failsafe state	11.5
tUn Er9	Autotune timed out; process unresponsive or very slow	goes to configured failsafe state	11.5

14. Maintenance

14.1 Introduction

This section contains instructions for cleaning the front panel of the controller and instructions for replacing the fuses.

Except for fuses, the controller contains no user-serviceable parts.

14.2 Cleaning the Front Panel

Warning

Do not attempt to clean any part of a controller other than the front panel.

If you want to clean the front panel of a single controller, use the power switch on the front of the controller to turn it off, then remove the controller from the mainframe.

If you want to clean the front panel of several controllers, turn off power to the mainframe before cleaning the controllers while they are installed in the mainframe.

While cleaning a controller's front panel, do not allow alcohol to enter the switch.

Allow controllers and mainframes to dry thoroughly before restoring power. Do not use a heater or compressed air to dry the units.

Failure to observe these precautions can result in exposure to a potentially lethal shock hazard.

The controller power switch must be in the "OFF" position before you put a controller into an energized mainframe, or remove a controller from an energized mainframe. Failure to observe these precautions can result in damage to the connectors and printed circuit boards.

To clean an RMC controller:

1. Read the safety warnings on the previous page before you start cleaning a controller.

2. To clean the front panel of a single controller, put the controller power switch in the "OFF" position, and then remove the controller from the energized mainframe by removing the locking pin or locking screw, and pulling on the handle on the front of the controller.

   Alternatively, if you plan to clean the front panel of several controllers, put the power switch of every controller in the mainframe in the "OFF" position, and then turn off power to the entire mainframe. After the mainframe has been de-energized, you can clean the controllers while they are in the mainframe.

3. Use a cotton cloth to gently and sparingly apply isopropyl alcohol to the front panel of the controller. Do not use cleaning solutions or other solvents. Use of anything other than isopropyl alcohol can result in damage to the controller.

   Do not allow alcohol to enter the power switch on the controller's front panel.

4. Allow the controller to air-dry thoroughly. Do not use a heater or compressed air to dry the unit.

5. Inspect all surfaces to make sure that they are completely dry.

6. When the controller is completely dry, re-install it and return it to service.

14.3 Replacing the Fuses

Each RMC controller contains two fuses, located on the main printed circuit board.

To replace the fuses in an RMC controller:

1. Make sure that you have appropriate replacement fuses. The fuses used in an RMC controller are Type F fast-acting 250 Vac fuses rated at 15 amps. Suitable fuses are Littlefuse Inc. p/n 314015 and Athena p/n 210B001U01.

2. Put the power switch of the controller in the "OFF" position.

3. Remove the locking pin or locking screw.

4. Use the handle on the front of the controller to pull it out of the mainframe.

5. Replace the fuses.

6. Re-install the controller and return it to service.

15. Frequently Asked Questions

15.1 Introduction

You can reach our technical support team by phoning 1-800-782-6776 (from the United States) or 610-828-2490 (from anywhere in the world).

Before you call, please look at this section to see if your question is covered here. If you do call for technical assistance, be ready to supply the following information:

- complete model number of controller
- symptoms of the problem
- unusual events, if any, that preceded the problem
- remedies you have already tried

15.2 How do I change from a J to a K thermocouple (or vice versa)?

Every Series RMC controller is shipped ready to accept input from a J thermocouple. If you plan to use a K thermocouple for input, you must set SW2-switch 2 to ON as described in Section 3. **Read the safety warnings in Section 3 before changing switch settings.**

After you have set SW2-switch 2 to ON, configure the controller and tune it.

If you later decide to use the controller with a J thermocouple, you must set SW2-switch 2 to OFF, change any configuration settings affected by your new control strategy, and tune the controller again.

15.3 Do I have to calibrate a new controller?

No

15.4 Why doesn't the PV displayed match the value on a thermometer in the process?

Unless the thermometer and the sensor providing input to the controller are very close to one another, their readings will not match in some applications, because of temperature variations within the process. However, if you want the controller to maintain the setpoint value at the location of the thermometer, instead of at the location of the sensor, use the I nP (input) menu's bI AS (bias) parameter. Applying bias allows you to compensate for any difference between sensor reading and the location to be measured. The process variable and setpoint will be offset by the value entered for the bias parameter (see 7.2).

For example, suppose you want the process to be 150 °F. However, the sensor providing input to the controller is so close to the heater that it reads 50 degrees higher than the process at the location of interest to you. Enter -50 as the bias value. Enter the setpoint of 150. The setpoint 150 will be displayed. However, the controller will use a setpoint of 200. The process value displayed will also be offset, so that when the reading at the sensor location next to the heater is 206 °F, the controller shows 156, the temperature at the location of interest in the process.

15.5 Why can't I make changes to the other controllers in the mainframe using an ALL master?

In order for other RMC controllers to receive instructions from the ALL master, the other controllers must all be configured for local communication and must be assigned to the same usage group as the ALL master. The controllers must also be in the same mainframe as the ALL master, or in mainframes that are linked via an RS-485 network with the ALL master's mainframe.

Check the SCI (serial communication interface) menu's Pro (protocol) parameter setting in all the non-responsive controllers. Their protocol may still be set to the default bUS (MODBUS). Change the setting to LocL (local) when appropriate. Also, make sure that the controllers with which you are trying to communicate are all assigned to the same usage group using the U_USE parameter in the SCI menu.

If the configuration parameters have been set correctly and local communications are still not successful, check the communication wiring.

15.6 Why doesn't the controller communicate with the host computer?

When a controller has been communicating successfully with a MODBUS master, then stops communicating, the cause is most likely damage to the network wiring. However, before going to search for the fault, take a quick look at the communication settings on the SCI (serial communication interface) menu. Make sure that the controller address configured using the S_Id (system ID) parameter has not been changed, and that the other communication settings match those used by the host. (See Section 9 in this manual and *Using the MODBUS Protocol with Athena Series RMC Hot Runner Controllers*.)

15.7 Why does the controller start up in manual mode sometimes?

If SW2 switch 6 is OFF, which is the factory default, then the controller always starts up in normal (auto) mode. However, if SW2-switch 6 has been set to ON, then the controller starts up in the last mode used before the controller was powered down. See 3.9 for more information.

15.8 I turned on the power; why doesn't the controller light up?

If SafeChange is enabled on the controller, but the mainframe does not support SafeChange, the controller will not work. Instructions for checking to see if a mainframe supports SafeChange are in 3.2.

16. Resetting All Parameters to the Default Values

16.1 Introduction

Using this function returns all configuration parameter values to their defaults except the communication parameters described in Section 9.

The calibration of the controller will not be affected.

Read the safety warnings in Section 3 before changing switch settings.

16.2 Procedure

16.2.1 Loading Defaults

To reset all configuration parameters (except communication parameters) to their default values:

1. Put the power switch on the front of the controller in the “OFF” position.
2. Remove the locking pin or locking screw.
3. Use the handle on the front of the controller to pull it out of the mainframe.
4. Set SW2-switch 5 to ON to enable loading the defaults at power up. The location of the switch is shown in 3.1.
5. Return the controller to the mainframe.
6. Insert the locking pin or locking screw.
7. Power up the controller. The display will briefly show dFL on the top line and LOAd on the bottom line while the configuration parameter values are returned to their defaults. When all the defaults have been written to the controller’s database, the display will show dFL over donE.
8. Put the power switch on the front of the controller in the “OFF” position.
9. Remove the locking pin or locking screw.
10. Use the handle on the front of the controller to pull it out of the mainframe.
11. Set SW2-switch 5 to OFF to disable loading of the defaults at power up.

12. If the configuration defaults shown in Sections 5 through 11 are not appropriate for your application and the ACC (access) menu's AcL (access level) parameter is currently set to Loc (lockout) or SP (Setpoint), also set SW2-switch 7 to ON to enable you to use the access menu to change the access level to ConF (configuration).
13. Return the controller to the mainframe.
14. Insert the locking pin or screw.

16.2.2 Returning Controller to Service

To customize the configuration and return the controller to service:

1. Turn on power to the controller.
2. If you want to change configuration parameter values, press the **MODE** key repeatedly until the STANDBY LED lights.
3. Configure the controller (see 2.10).
4. Tune the controller (see Section 11).
5. Change the access level to "lockout" or "setpoint" (see 12.4).
6. Put the power switch on the front of the controller in the "OFF" position.
7. Remove the locking pin or locking screw.
8. Use the handle on the front of the controller to pull it out of the mainframe.
9. Set SW2-switch 7 to OFF to disable display of the ACC (access) menu.
10. Return the controller to the mainframe.
11. Insert the locking pin or locking screw.
12. Power up the controller.

The controller is ready for use.

17. Index

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