



**PLASTIC PROCESS
EQUIPMENT, INC.**
TEMPERATURE CONTROLS
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PPE® **Series RMX** Hot Runner Controller Operation Manual



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MODBUS[®] is a registered trademark of AEG Schneider Automation, Inc.

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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.

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.

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.

Changing 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.

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 environments 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).

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1. INTRODUCTION

1.1 ABOUT THIS MANUAL

This manual contains the information needed to operate the RMX Hot Runner controller. Any configurations should be self-evident from the simplified menu driven GUI, but this manual also contains further explanations on configurations of the RMX.

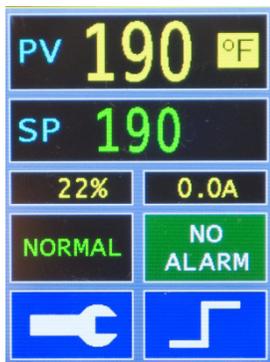
1.2 ABOUT THE CONTROL

Each RMX controller has one output, which is used for PID (proportional-integral- derivative) control. When PID control is used, you can take advantage of the controllers' Autotune feature for easy tuning of the proportional, integral, and derivative components of the control algorithm.

The controller can operate in NORMAL (auto) mode, in which the controller calculates the output based on the setpoint (closed loop control). The controller can also be operated in MANUAL mode, in which you set the output percentage (open loop control). Transfer from PID to manual / open loop control is "bumpless" when the process value is within 9 °F (5 °C) of the setpoint.

1.3 TOUCHSCREEN DISPLAY

Each RMX controller features a 2 ½ inch high definition touchscreen LCD display that features a menu driven operation system and provides for the most simple and intuitive operation.



Homescreen Display.- Actual Size

2. DISPLAY

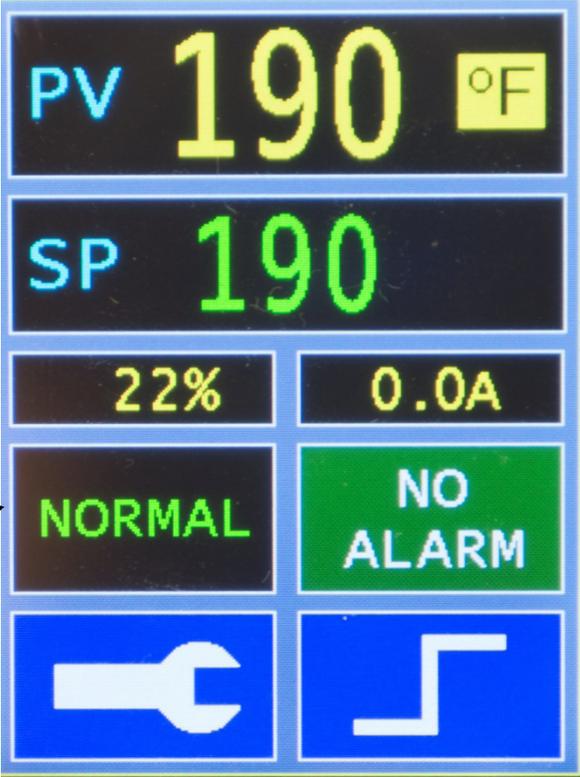
2.1 INTRODUCTION

What is displayed on the screen of the controller depends on the mode of operation and whether the controller detects any problems with the input or with its own operation.

2.2 ACCESSING CONFIGURATION AND MODES SUB-SCREENS

The display is a touchscreen display, so 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, you can press the tools/config (🔧) window to cycle through the other values available for display.

2.2.1. CONTROLLER HOMESCREEN DISPLAY



The screenshot shows a touchscreen display with the following elements:

- PV 190 °F**: Process Value and measured value.
- SP 190**: Set Point value.
- 22%**: Percentage heat output.
- 0.0A**: Current draw.
- NORMAL**: Control Mode.
- NO ALARM**: Alarm status.
- 🔧**: Tools/Config icon.
- 📈**: Boost function icon.

Annotations:

- PV** is the *Process Value* and the measured value is displayed here.
- SP** is the *Set Point* value; to change the set point, touch this window and a new screen will be displayed.
- This window is a display only window, showing the percentage heat output.
- The window is a display only window, showing the current draw.
- This window will show any alarms. If no alarm is present, the window background will be green; if an alarm is present, the window background will be red and a clear indication of the alarm type will be displayed.
- This is the **TOOLS/CONFIG** window – touching this window will give access to all submenus.
- This window will activate the **BOOST** function; if the BOOST has not been configured, the BOOST step icon will be greyed out.

3. WHAT HAPPENS WHEN YOU POWER UP THE CONTROLLER

3.1 INTRODUCTION

All Series RMX 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 / open loop control 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. While the controller is in manual / open loop control mode, the processor periodically compares the output percentage in use with the manual / open loop control 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.

The **NORMAL** status is displayed during soft start in normal mode. You can stop the soft start by pressing the CONTROL MODE window, selecting NORMAL mode, then **OK**. By default 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).
- if a ground fault interruption is detected by the controller's software algorithm (as opposed to on-board GFI hardware detection), the controller will execute a soft start

3.2 POWER UP SEQUENCE

The sequence of controller actions and the state of the controller output following power up depend on configuration choices made when the controller was set up.

Unless the Supervisor Menu parameter is set to disable soft start, the controller does a CompuStep soft start if in NORMAL (auto) mode and the process value is less than or equal to 200 °F (93 °C) (or if in MANUAL mode and the last output used in manual / open loop control mode was greater than or equal to 5%).

4. MODES OF OPERATION AND CONTROLLER DISPLAYS

4.1 CONTROL MODES

The Series RMX 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 Control Mode window will display the current status.

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

Control Mode	Description
NORMAL (closed loop)	<p>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. The Control Mode window will display NORMAL.</p> <p>If the controller is in CompuStep soft start and closed loop control, the Control Mode window will display :</p> <p>NORMAL SOFT ST</p> <p>If the controller is in Autotune mode, the window will display:</p> <p>NORMAL TUNE</p>
MANUAL (open loop)	<p>When the controller is in manual mode (open loop control) the output percentage used is not influenced by the input value. In manual / open loop control mode you can change the output percentage using the front panel of the controller except under special circumstances. Transfer from NORMAL (auto) to MANUAL is bumpless (if the PV is within 9 °F (5 °C) of the SV). The Control Mode window will display MANUAL.</p> <p>If the controller is in CompuStep soft start and manual / open loop control, the Control Mode window will display:</p> <p>MANUAL SOFT ST</p>
STANDBY	<p>When the controller is in standby mode, the behavior of the output depends on how the standby menu parameters have been configured.</p> <ul style="list-style-type: none"> • If the standby type is configured as closed loop, the configured standby temperature setpoint will be used. • If the standby type is open loop, the configured percentage output setpoint will be used. • If STBY comes from a hardware signal, then HARDWAR STANDBY will be displayed
BOOST	<p>If the Boost mode is selected, then the controller will operate as set-up in the Boost configuration. If the boost configuration has not been set up, Boost mode cannot be entered.</p> <p>When the controller is in Boost mode, the behavior of the output depends on how the boost menu parameters have been configured.</p> <ul style="list-style-type: none"> • If the Boost type is configured as closed loop, the configured Boost temperature setpoint will be used. The Control Mode window will display: <p>NORMAL BOOST</p> • If the Boost type is open loop, the configured Boost percentage output setpoint will be used. The Control Mode window will display: <p>MANUAL BOOST</p>
IDLE	<p>When the controller is in Idle mode, the control is inactive, the output is off (0%), and alarms are inactive.</p>
FAIL SAFE	<p>If the controller detects an open thermocouple, the controller will enter the Failsafe mode and the output will be truned off (0%)</p>



A special automatic control mode is provided for automatic tuning of the controller where the proportional and derivative values to be used by the PID control algorithm are automatically determined; the integral value is automatically set to five times the derivative (rate) value as the default.

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. You can terminate the Autotune operation prematurely by changing the current mode, such as NORMAL.

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.

4.2 CONFIGURATION

In addition to the operating displays associated with the control modes described above, an RMX controller can display configuration parameters. The parameters are grouped by purpose and organized in menus.

Attention

Before accessing the menu system (or changing a parameter value using a remote host), we recommend putting the controller in standby mode. By default, the output is off in standby mode. However, the controller’s behavior in standby mode is configurable.

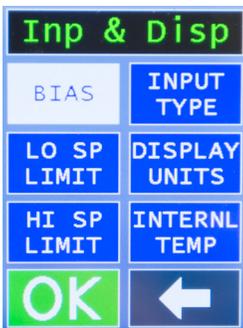
Its important to note here that some of the configuration items can be readily accessed from the menu system. At this point we will mention the different configuration options and describe their functions but they will covered in greater detail in the relevant section.

When you press the tools/config (🔑) window, the following Config Type window appears. The options that can be configured here are as follows:



- INPUT & DISPLAY
- BOOST
- PID
- STANDBY
- ALARM
- COMM

These submenus are further expanded as follows:



INPUT AND DISPLAY options allow you to determine:

- BIAS - allows you to add a constant offset value to the process value
- LO SP LIMIT - allows you to specify the lowest temperature setpoint
- HI SP LIMIT - allows you to specify the highest temperature setpoints at which the controller operates
- INPUT TYPE - allows you to specify whether a type J or type K thermocouple is being used
- DISPLAY UNITS - allows you to specify whether the controller reports in °C or °F
- INTERNAL TEMP - this is an information display of the temperature inside the module



BOOST options allow you to determine:

- TYPE - allows you to specify the type of control during the Boost, namely closed or open loop.
- TIME - allows you to specify the time, in seconds, for Boost to run
- TEMP SP - allows you to specify the temperature the Boost function, when Boost type is set to closed loop, must reach before ending the Boost routine
- PCT OUT SP - allows you to specify percentage of output power used to get the zone to the Boost setpoint when the Boost type is set to open loop.



PID options allow you to determine:

- PROP BAND - allows you to set the proportional heating rate, set in
- DERIV - allows you to specify the derivative rate, i.e. the rate of change of the process value, set in
- AUTO TUNE - allows you to specify whether the Autotune function is disabled, enabled, a one try only operation, or is performed once. The Autotune function automatically determines the best proportional, derivative and integral rates for the process.
- STARTUP MODE - allows you to specify the start-up mode for the controller. Options here are Auto, Standby, Manual, Idle, and Last Active.



STANDBY options allow you to determine:

- TYPE - allows you to specify whether the controller operates in either closed loop or open loop control when in Standby mode.
- TEMP SP - allows you to specify the lowest temperature
- PCT OUT SP - allows you to specify the standby percentage of power for open loop.



ALARM options allow you to determine:

- INHIBIT SECONDS - this allows you to set the time, in seconds, that a condition must persist for an alarm to become active
- HI DEV SP - allows you to specify the number of degrees above the setpoint to trigger an alarm
- LO DEV SP - allows you to specify the number of degrees below the setpoint to trigger an alarm
- CURRENT LIMIT - allows you to specify current limit at which an alarm is triggered.



COMM options allow you to determine:

- PROTOCOL - this allows you to set MODBUS communications, or local to access Master/Slave functionality
- SYSTEM ID - this is the ID for the MODBUS protocol
- BAUD RATE - allows you to select the speed of communication
- MOD FLOAT - allows you to specify which floating point method should be used
- USAGE GROUP - allows you to group controllers into either manifold, tip or other groups in local protocol for Master/slave functionality.
- MASTER MODE - designates, in local protocol, whether this unit is a master controller over a group or not.

4.3 CHANGING THE MODE

To change the controller's mode, press the Control Mode window. The SELECT MODE screen appears allowing you to choose between NORMAL, STANDBY, MANUAL, BOOST and IDLE modes.

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

5. NORMAL MODE SETPOINT AND MANUAL MODE OUTPUT PERCENTAGE

5.1 INTRODUCTION

Every Series RMX controller can operate in normal (auto) mode, in which the controller calculates the output based on the setpoint. The NORMAL status is displayed while the controller is in normal mode of auto / closed loop control.

The controller can also be operated in manual / open loop control mode (MANUAL status displayed), in which you set the output percentage for open loop control. Transfer from PID to manual / open loop control is “bumpless” when the process value is within 9 °F (5 °C) of the setpoint.

5.2 WHERE SETPOINTS COME FROM

The value of the PV and the setpoint currently being used (“active setpoint”) are always displayed when an RMX controller is operating in normal (automatic) mode.

The setpoint used (and displayed) is not always the one you enter using the front panel.

- If the controller is configured to use closed loop boost, then when you push the BOOST  virtual button, the boost temperature setpoint will be used.
- If the controller is configured to use open loop boost, then when you push the BOOST  virtual button, the boost percentage output setpoint will be used.
- If the controller is configured to use closed loop control standby, then when STANDBY mode is entered, the standby temperature setpoint will be used.
- If the controller is configured to use open loop control standby, then when STANDBY mode is entered, the standby percentage output setpoint will be used.
- If the controller is configured to use MODBUS communication, the setpoint can be written to the controller by a MODBUS host.
- If the controller is configured to use local communications with Master /slave functionality and the SP is changed on the master.

5.3 WHAT DETERMINES WHICH IS THE ACTIVE SETPOINT

The active setpoint is the setpoint value currently being used for control. This is also the setpoint currently being displayed. As described above, this setpoint can come from one of several sources. The logic flow that determines which setpoint value is used is shown below.



If controller is in failsafe mode due to an open thermocouple,

Then the setpoint is the failsafe fixed output percentage configured in the supervisor menu.

Else If boost is active and the boost control type is closed loop,

Then the active setpoint equals the boost temperature setpoint.

Else If boost is active and the boost control type is open loop,

Then the active setpoint equals the boost percentage output setpoint.

Else If standby mode is active and the standby control type is closed loop,

Then the active setpoint equals the standby temperature setpoint.

Else If standby mode is active and the standby control type is open loop,

Then the active setpoint equals the standby percentage output setpoint.

Else active setpoint equals the setpoint entered using the controller front panel or written by a MODBUS host or master

5.4 DISPLAYING AND CHANGING THE SETPOINT

When in a closed loop mode, the home screen will display the active temperature setpoint in the Setpoint window. If in an open loop mode, the home screen will display the active fixed output percentage setpoint in the Setpoint window followed by a [%] .



To change the setpoint, press the SP window and then use the  and  keys to change the displayed setpoint value. Once the desired setpoint is shown, press the  button.

The setpoint values that can be entered using the controller's front panel are limited by the configured setpoint range (high and low setpoint limits).

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

Operation Note - with screens where the  and  windows are seen, pressing the  window saves the information and goes up a menu level. Hold  down for 1.5 seconds saves and goes up to the home screen. Pressing  exits the menu without saving and goes up one level; similarly, hold  down for 1.5 seconds returns to the home screen.

5.5 CONTROLLER DETERMINATION OF OUTPUT IN MANUAL MODE

IF YOU SWITCH THE CONTROLLER FROM NORMAL (AUTOMATIC) MODE TO MANUAL MODE, 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 YOU 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. You 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 you change it using the  and  keys.

5.5.1. CHANGING THE OUTPUT PERCENTAGE

To change the manual / open loop control mode output percentage, press the output percentage display window and the Output Percentage screen will be shown. To adjust the percentage output, use the  and  keys.

5.5.2. SPECIAL CASES WHEN A FIXED OUTPUT IS USED

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

6. BOOST FUNCTION

6.1 INTRODUCTION

Every Series RMX Hot Runner controller supports a boost function. During configuration the process engineer specified a boost setpoint (closed loop boost) or a boost fixed output percentage (open loop boost) to be used when you press the BOOST key .



When in a closed loop boost mode, the CONTROL MODE window will display:
NORMAL
BOOST

When in an open loop boost mode, the CONTROL MODE window will display:
MANUAL
BOOST

6.2 USING THE BOOST FUNCTION

If the boost function has been configured as operational (BOOST time not set to OFF), the BOOST key  can be used any time that the controller is in NORMAL mode or MANUAL mode, and is not Autotuning or displaying a serious alarm condition.

Note that when boost is not configured as operational, the BOOST key  will appear as greyed out on the home screen.

To start the boost function, press the BOOST key . The boost function will remain active until:

- the configured boost duration time has expired, or
- you change the control mode to another control mode, or
- A serious alarm condition such as open thermocouple is encountered

If the configured boost type is closed loop, the active setpoint will become the boost temperature setpoint while boost remains active. If the configured boost type is open loop, the active setpoint will become the boost percentage output setpoint while boost remains active.

This boost function can be started simultaneously on all controllers in a usage group if you press the BOOST  key on a local communication ALL master. The boost duration on the various controllers in a usage group can be configured to expire normally at different times. However, if you terminate 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.

6.3 CONFIGURING THE BOOST FUNCTION



TO ACCESS THE BOOST CONFIGURATION MENUS, PRESS THE TOOLS/CONFIGURATION  WINDOW AND SELECT THE BOOST WINDOW.

Once BOOST configuration type is selected, you will be given a selection of TYPE, TIME, TEMP SP, and PCT OUT SP. Choosing TYPE, by pressing the TYPE window, will prompt the following screen:

Select either CLOSED LOOP or OPEN LOOP control for the type of boost. CLOSED LOOP means that the temperature is monitored and controlled with full PID control, whereas OPEN LOOP means the output percentage power is set and maintained with no temperature measurement feedback.

Alternatively, if you select TIME from the BOOST configuration menu, the following screen appears:



Selecting BOOST TIME allows you to set the period of time you want the Boost function to run. Incrementally increase the setting to the desired run time for the boost by pressing the  and  keys until the desired boost time is displayed. Once the desired time is displayed, press the  button

If you select TEMP SP from the Boost configuration menu, the following screen appears:



Selecting the BOOST TEMPERATURE SETPOINT (TEMP SP) allows you to set the temperature that the Boost function must attain before ending the Boost routine. Incrementally increase the setting to the desired temperature set point for the boost by pressing the  and  keys until the desired boost temperature is displayed. Once the desired time is displayed, press the  button

If you select PCT OUT SP from the Boost configuration menu, the following screen appears:



This screen allows you to set the PERCENT POWER (BOOST PCT) of the output that can be used to get the zone at the setpoint. Incrementally increase the setting to the desired temperature set point for the boost by pressing the  and  keys until the desired boost temperature is displayed. Once the desired time is displayed, press the  button

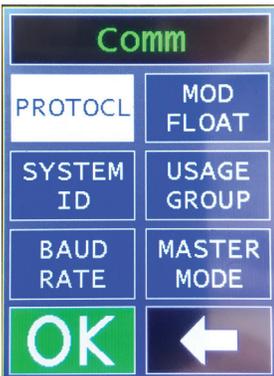
7. COMMUNICATION

7.1 INTRODUCTION

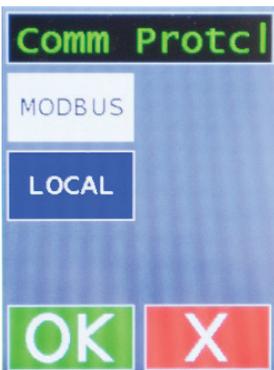


Every Series RMX Hot Runner controller supports RS-485 serial communications using MODBUS protocol. To access the communications set-up, press the tools/configuration icon  on the home screen and the CONFIG TYPE screen will be shown - press the COMM window followed by .

7.2 MODBUS COMMUNICATION



The RMX controllers can be networked to a MODBUS host. You can use this host to read and write to every configuration parameter in a RMX controller's database; the host can also be used to read every status value available in the database. To access this set-up, press PROTOCL followed by .



The COMM PROTCL window will appear, where you can select MODBUS followed by .

This will then take you back to the COMM screen where you should press  which will take you back to the CONFIG TYPE screen.

The default communication parameter is a Baud Rate of 9,600 and the System ID is automatically identified from the controller's location in the mainframe.



To change the baud rate of a controller, press the tools/configuration icon  on the home screen and the CONFIG TYPE screen will be shown - press the COMM window followed by .

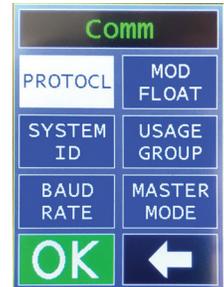
From here select the BAUD RATE window and you will be given the choice of 38,400; 19,200; 9,600; or 4,800. Once you have made your selection press  followed by repeated presses of  which will take you back to the Home screen.

7.3 LOCAL COMMUNICATION WITH ALL MASTERSHIP

If local communication was selected during configuration, then each controller was assigned to a usage group. These groups can be TIP, MANIFLD or OTHER. The display panel of any controller that has been made a MASTER in a usage group can be used to activate the boost, change the mode, change the setpoint, or change the manual / open loop control mode output in every controller in the usage group.

To make a controller a master, ensure the communications is set to Local by pressing the Tools / Configuration icon on the home screen, selecting COMM followed by LOCAL on the Comm Protcl window. Next, select USAGE GROUP from the COMM screen and select either TIP, MANIFLD or OTHER groups. Press the **OK** and the screen reverts back to COMM screen. Next select MASTER MODE and press **OK** and the subsequent screen select ENABLE, followed by **OK** then press **←** and the screen will return to the home screen. At this point the selected controller is set as the master for the selected group and is identified as such by the caption of MTIP, MMAN or MOTH (master for tip group, master for manifold group or master of other group) shown under the SP display in the setpoint window.

Of course, the master function relies on the fact that the master controller talks to at least one slave controller. To set a controller to slave mode, ensure the communications is set to Local by pressing the Tools / Configuration icon on the home screen, selecting COMM followed by LOCAL on the Comm Protcl window. Next, select USAGE GROUP from the COMM screen and select either TIP, MANIFLD or OTHER groups. Press the **OK** and the screen reverts back to COMM screen, then press **←** and the screen will return to the home screen. If you have selected a master for a group and this controller is also in that same group, then it will, by default, be set as a slave in the group and is identified as such by the caption of STIP, SMAN or SOTH (slave in tip group, slave in manifold group or slave in other group) shown under the SP display in the setpoint window..



8. ALARMS

8.1 HOW YOU ARE ALERTED TO ALARM CONDITIONS

Each Series RMX Hot Runner controller supports two configurable deviation alarms. 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 ALARM STATUS window will display the alarm condition. Additionally, the alarm conditions shown below are supported. When no alarm is present, the ALARM STATUS window has a green background and displays "NO ALARM", however, when an alarm condition is present, the ALARM STATUS window has a red background and displays text as shown for the condition.

The ALARM STATUS window will remain red with the alarm text for as long as the condition exists. If an alarm is present, the hardware output signal for alarm is energized. The unit recognizes process problems (such as loop break, reversed and open sensors, and process temperature exceeding configured safety limit) and problems with its own operation. If the controller has more than one alarm condition, the code for the highest priority alarm is displayed; these priorities are as follows:

PRIORITY	DISPLAY	CONDITION	CONTROLLER RESPONSE	HOW ALARM IS CLEARED
1	OVER TEMP	internal over-temperature	controller output off	turn off controller; make sure fan and vents are not blocked; wait for controller to cool; turn on controller; if error recurs, contact technical support
2	HARDWAR SHUTDOWN	problem with controller's internal operation	controller output off	cycle power to controller; if error recurs, contact technical support
3	UNKNOWN ALARM	problem with controller's internal operation	controller output off	cycle power to controller; if error recurs, contact technical support
4	CURRENT ERROR	problem with controller's internal operation	controller output off	cycle power to controller; if error recurs, contact technical support
5	TC REVERSE	reversed thermocouple detected	controller goes to configured failsafe state	Put the controller in Idle Mode and then after problem is fixed, put controller in Normal (closed loop) or Manual (open loop) mode
6	HIGH SAFETY	high-temperature safety limit exceeded (configured in Superv. Config menu; default is feature disabled)	controller output off if feature is enabled	Put the controller in Idle Mode and then after problem is fixed, put controller in Normal (closed loop) or Manual (open loop) mode
7	HARD GFI	Controller hardware detected a ground fault typically when over 200°F	controller output off	Put the controller in Idle Mode and then after problem is fixed, put controller in Normal (closed loop) or Manual (open loop) mode
8	TC OPEN	open thermocouple detected	controller goes to configured failsafe state (configured in Superv. Config menu)	Put the controller in Idle Mode and then after problem is fixed, put controller in Normal (closed loop) or Manual (open loop) mode
9	LOOP BREAK	loop break detected	controller output off	Put the controller in Idle Mode and then after problem is fixed, put controller in Normal (closed loop) or Manual (open loop) mode
10	SOFT GFI	Controller has detected a ground fault usually under 200°F, caused by moisture in the mold.	controller output off	This alarm will usually clear itself as the ontroller goes through a soft start to bake out moisture. If the condition persists, change the mode to clear the alarm.

11	HI TEMP	high deviation alarm	controller output off	clears automatically when alarm condition clears
12	LO TEMP	low deviation alarm	controller output on	clears automatically when alarm condition clears
13	SHORTED TRIAC	Controller software detected an output short	controller output off	Put the controller in Idle Mode and then after problem is fixed, put controller in Normal (closed loop) or Manual (open loop) mode
14	LO CURRENT	low output current	No action	Clears automatically when alarm condition clears
15	HI CURRENT	high current output	controller current off	Put the controller in Idle Mode and then after problem is fixed, put controller in Normal (closed loop) or Manual (open loop) mode
16	TUN ERR DELTA	autotuning error	controller output off	The initial process value and the setpoint are not far enough apart. For Autotune to work, the difference must be at least 9 °F (5 °C).
17	TUN ERR REVERSE	autotuning error	controller output off	Setpoint is lower than the process value. Look at the setpoint. If it is realistic for your process, then check the thermocouple leads; maybe they are reversed.
18	TUN ERR TIMEOUT	autotuning error	controller output off	The Autotuning timed out, because the process was unresponsive (or extremely slow to respond). Your process is not suitable for Autotuning. Tune the controller manually.
19	TUN ERR PROCESS	Autotuning error	controller output off	The startup curve (change in PV) was not acceptable to the Autotune algorithm. This problem 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.
20	TUN ERR GENERAL	Autotuning error	controller output off	The Autotune operation failed for a reason other than those listed above. Try Autotuning again when the process is stable.

8.2 AUTOMATIC SHUTOFF IF PROCESS TEMPERATURE EXCEEDS PROGRAMMABLE SAFETY HIGH

If the process engineer used the supervisor menu to specify a high-temperature safety value to be applied to the process, then when the process value exceeds this value:

- controller processing and output activity is halted, and
- the ALARM STATUS window displays - HIGH SAFETY.

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.

9. TUNING THE CONTROLLER FOR PID CONTROL

9.1 INTRODUCTION

The Series RMX 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 RMX 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. If Autotuning is not possible, you can tune the controller manually.

9.2 CONFIGURATION SEQUENCE AND AUTOTUNE

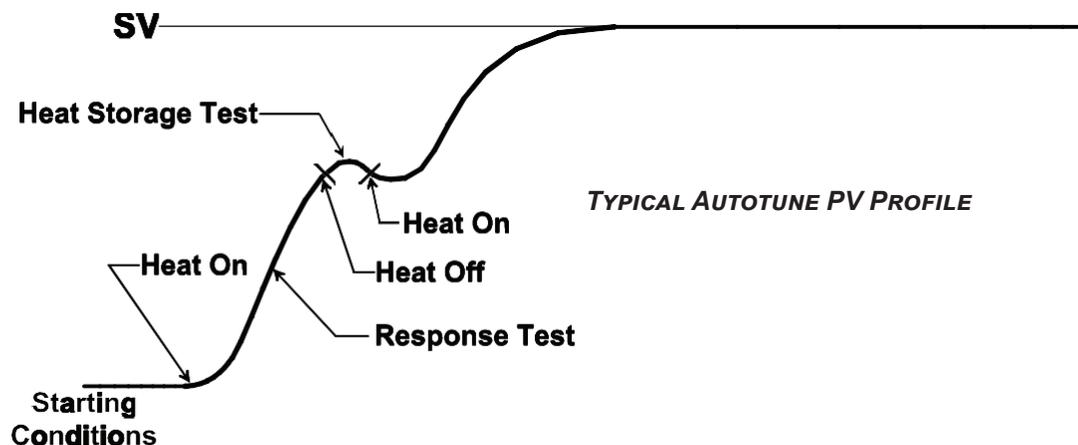
By default, every Series RMX controller is configured to execute the Autotune operation the first time it is powered up; once a successful Autotune is completed, the configuration sequence will then disable the Autotune feature. When the Autotune feature is disabled, the PID control menu Autotune operation parameter is set to disabled. If the Autotune is not successfully completed, either because the procedure was interrupted changing the control mode or because an Autotune error condition is detected, the Autotune feature will not be disabled automatically.

9.3 AUTOTUNING

9.3.1. INTRODUCTION

The controller must be configured before Autotune is used. The Autotune operation overwrites any existing proportional band and derivative (rate) parameter values that were previously configured, but it must have a valid temperature setpoint to be tuned.

All RMX 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.



9.3.2. PROCEDURE FOR AUTOTUNING

The procedure below is used to start Autotune using the front panel of the controller. You can also use a MODBUS master to change the mode, view and change parameter values, and to start Autotuning.

To Autotune:

- To change the setpoint, press the SP window and then use the  and  keys to change the displayed setpoint value. Once the desired setpoint is shown, press the  button.
- Cycle the power to the controller.
- At this point the controller may execute a CompuStep soft start and NORMAL SOFT ST is displayed in Control Mode window.
 - 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.
- When the Autotune operation begins, the Control Mode window will display NORMAL TUNE. Unless you want to terminate the Autotune by changing MODE to, say, NORMAL, do not press any keys during the Autotune operation. The SETPOINT window will continue to display the setpoint you entered.
- When the controller has completed Autotuning successfully, the Control Mode window will change to display NORMAL. 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 configuration sub-menu.)
- If the Autotune was unsuccessful, the ALARM window will be red and display the appropriate alarm. Please refer to the ALARM section in this manual for the corrective action to clear the alarm.
- To clear the error display use the CONTROL MODE window to change the control operation to IDLE or STANDBY.
- Apply the corrective action and try tuning again; its possible that your process is not responsive enough for the Autotune algorithm to work successfully - a TUNE ERR PROCESS alarm message can be an indication of that. if you cannot Autotune, tune the controller manually.
- Once Autotune has been completed successfully, the controller is controlling the process in normal (auto) mode.



10. ERROR MESSAGES AND CODES

10.1 INTRODUCTION

Whenever 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. These are displayed in the ALARM window on the home display.

10.2 PROBLEM WITH PROCESS TEMPERATURE

During configuration, the supervisor menu can be used 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 window will be red and display HIGH SAFETY

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.

10.3 GROUND FAULT IN CONTROLLER OUTPUT WIRING

The RMX controller is capable of detecting ground faults in the controller output wiring. When a ground fault is detected by the controller's software algorithm, the controller will attempt to perform a normal soft start ("soft" ground fault only). 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 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.

When a "soft" ground fault is detected the ALARM window will be red and display "SOFT GFI". When there is a "hard" ground fault, the ALARM window will be red and display "HARD GFI". 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 and 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).

"Hard" ground faults can also be detected by the controllers built-in circuitry to detect ground faults. Following the interrupt in response to a "hard" ground fault, the controller's output will remain off until you cycle power to the controller.

10.4 LOOP BREAK IN SENSOR WIRING

During configuration the supervisor menu can be used to specify a loop break time, that is, the 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), then:

- the controller output will be turned off, and
- the ALARM window will be red and display LOOP BREAK.

The controller will remain in this alarm and output off state until change the control mode to IDLE or STANDBY.

10.5 FAILSAFE OPERATION IF A SENSOR ERROR IS DETECTED

During configuration the supervisor menu can be used to specify a failsafe action, that is, what should happen to the output if the controller detects a reversed or open sensor.

The possible failsafe actions are:

- None (disabled), or
- 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 window will be red and display either “TC OPEN” or “TC REVERSE”, and
- the upper CONTROL MODE window will display “FAIL SAFE”.

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

10.6 HEATER CURRENT MONITORING

The present current output to the heater, expressed to the closest tenth of an amp, is always displayed in the CURRENT window on the home screen. (NOTE: Current below 10 amps is expressed to nearest tenth (e.g. 3.4A). Current great than or equal to 10 amps is expressed to nearest whole number (e.g. 12A)). 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 “SHORTED TRIAC” error.
- If the output is on, but no controller current output flow is detected, then the processor will post a “LO CURRENT” 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.)

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 ALARM window will be red and display either “SHORTED TRIAC” or “LO CURRENT”.

The controller will remain in this halted state until you cycle power to the controller or change the CONTROL MODE to IDLE.

If a current limit alarm is set in the ALARM configuration sub-menu and the measured current exceeds the limit, then:

- 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 ALARM window will be red and display “HI CURRENT”.

The controller will remain in this halted state until you cycle power to the controller or change the CONTROL MODE to IDLE.

10.7 PROBLEM WITH CONTROLLER

10.7.1. INTRODUCTION

If the controller detects a problem with its own operation, an error display screen will be shown. The error display screen will have information to assist PPE in assisting you with the problem. Should this occur, it's important to write down all the information displayed so you can use that when contacting PPE technical support.

10.7.2. CONTROLLER ERROR CODES

Controller error codes cannot all be listed here so it is important that if the error displays continue, you contact PPE and let us know the error code and all the other information on the error display.

Some errors are minor and will not shut down control activity or the output. Others are more serious and will shut off control activity and the output.

In some situations, you can resume using the controller without power cycling. In those cases, the error display will have a “RESUME” touch window. When a re-boot is required, the error display will have a “RESTART” touch window.

Note: A host computer communicating with the MODBUS protocol can wear out the controller's internal 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. This can cause a serious error (Error Code 202).

11. MAINTENANCE

11.1 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.

11.2 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 RMX controller:

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

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.

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.

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

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

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

11.3 REPLACING THE FUSES

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

To replace the fuses in an RMX controller:

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

12. SUPERVISOR MENUS

Entering the Supervisor section allows the operator to determine Failsafe Actions, Resetting PIDs, set Output Percent High Limit, enable / disable Soft Start, and several other operational parameters. To get into Supervisor mode, press the config  button and then press on the area of screen that indicates the title Config Type and hold for three (3) seconds; the screen will then enter Supervisor mode and you can scroll through the differeny parameter settings using the  and  arrows; press  to select the parameter; when finished, press the back arrow  to return. The Supervisor adjustable parameters, and their function, are as follows:

FAILSAFE ACTION - this determines how the controller reacts when it enters a failure state like an open thermocouple. Options are Off, Auto Average or Fixed %.

- Off means that the failsafe action turns off the output to the controller;
- Auto Average means that the average output value that typically maintained the setpoint will be calculated and applied;
- Fixed % means that the percentage power output specified in the Failsafe Percent menu will be applied.

HI SAFETY - this menu item allows the user to specify a temperature value that will cause a shutdown of output activity. If the Process Value exceeds the specified value, control processing and output activity is terminated. Should this condition occur, it will be considered a fatal error and power to the unit must be cycled before control processing will resume.

LOOP BREAK TIME - this menu item allows the user to specify a time in seconds in which the Process Value must move towards the setpoint, if below it before a loop break error is asserted. The Process Value must move one percent of the span within the Loop Break Time. The loop break time can be set to "off" by decrementing all the way to zero (i.e. 0=off)

OUTPUT % HI LIMIT - this menu item allows the user to specify an output percent value to use if the failsafe mode is activated and Percent output is the Failsafe action specified.

HI READING - this menu item allows the user to see the highest measured temperature recorded. This value can be reset to the current Process Value (PV) by pressing the RESET window.



LO READING - this menu item allows the user to see the lowest measured temperature recorded. This value can be reset to the current Process Value (PV) by pressing the RESET window.



FAILSAFE FOP - (Fixed Output Percentage) this menu item allows the user to specify an output percentage to use if the failsafe mode is activated and the percent output is the specified failsafe action.



SOFT START ENABLE - RMX Hot Runner controllers support the CompuStep soft start feature, allowing slow dissipation of moisture in heaters, by gradually applying power to the heaters and extending the life of heaters and molds. Unless this Supervisor Menu parameter is set to DISABLE, the controller does a CompuStep soft start if in Normal (auto) mode and the process value is less than or equal to 200 °F (93 °C) (or if in Manual / open loop control mode and the last output used in Manual mode was greater than or equal to 5%).



RESET PID - pressing the OK window here will reset all the PID parameters back to the factory settings.



Caution! Make sure you really want to reset all the PID parameters back to the factory settings before you press OK

LOAD DEFAULTS - pressing the OK window here will reset all the configurable parameters back to the factory settings.



Caution! Make sure you really want to reset all the configuration parameters back to the factory settings before you press OK

MASTER PERSISTENT - the master / slave functionality is used to allow you to use one controller to change the set point on a number of controllers within the same group. This functionality will remain active for 30 seconds once initiated, after which the master slave functionality is turned off. If you wish for this functionality to remain active until you de-activate it, this Master Persistent switch must be turned on.



