Honeywell

ZM7999
ControLinks™
Software Configuration Tool

Software License Advisory

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INTRODUCTION

The ZM7999 ControLinks™ Software Configuration Tool reduces burner/boiler setup time by letting you create a burner/boiler modulation curve (profile) for the burner/boiler that allows for safe and efficient operation at all points along the modulation curve. The software uses a wizard-like process to assist you through the commissioning process. It also lets you save curves in standard PC files so that you can commission similar systems rapidly and safely. Once the burner/boiler is commissioned, real-time monitoring of the system can be done via the monitoring tool.

The software can be used on systems with one or two fuels and on systems with or without flue gas re-circulation (FGR).

The information in this user guide is also available on-line, see "Getting Help," below.

REQUIREMENTS

The minimum system requirements for using the ZM7999 ControLinks™ Software Configuration Tool are as follows:

    a. PC or laptop with a Pentium© processor running Windows© 95, Windows 98, Windows ME or Windows 2000.
    b. 16 MB of RAM.
    c. 1G hard drive with 100 MB of free memory.
    d. RS232 Serial Port (DB9).

Before commissioning a burner/boiler with the ZM7999, you will also need the following equipment:

    a. A calibrated stack gas analyzer.
    b. An RS232 to RS485 converter.
    • QM4520A1008
    • 32005354-001 Self-Powered.

SAFETY FEATURES

This software incorporates many features that are designed to guide you safely through the commissioning process. Safety, however, is your responsibility.

This software should only be used by experienced and/or licensed burner/boiler operators and mechanics.

Read all documentation carefully and respond appropriately to all error messages.

Be aware that as you command the software to open and close actuators, the software is designed to prevent you from opening or closing them too rapidly. When any of the system actuators is below 20% of its full open position, the R7999 effectively limits any actuator from traveling more than three degrees without moving the other actuators in the system. When all the actuators are over 30% of their full open position, the limit increases to 10 degrees.

⚠ WARNING

Explosion Hazard.
Improper configuration can cause fuel buildup and explosion.
Operators of this software may move fuel and/or air actuators to positions that can create Hazardous burner conditions. Improper user operation may result in PROPERTY LOSS, PHYSICAL INJURY or DEATH.

The ZM7999 ControLinks™ Software Commissioning Tool is to be used only by experienced and/or licensed burner/boiler operators and mechanics.

GETTING HELP

In addition to referring to this manual, you can get on-line help when using the software by pressing the HELP button on any of the screens. You can then use the table of contents of the help system to open topics or use the search function to find information.

INSTALLING THE HARDWARE

Use the following ControLinks™ instructions to install the system hardware:

    — 65-0238 R7999A,B ControLinks™ Controller.
    — 65-0239 ML7999A ControLinks™ Actuator.
    — 65-0240 Q7999A Wiring Subbase.

INSTALLING THE SOFTWARE

To install the software, follow the directions provided in the CD-ROM booklet. If those instructions are not available proceed as follows:

1. Start Windows™.
2. Insert the CD-ROM in your CD-ROM drive.
3. Press the Windows *Start* button.
4. Enter D:setup (assuming your CD-ROM drive is your D: drive), and press *OK*.
5. Follow the installation directions as they are displayed. An on-line help file will be installed along with the configuration software. A printed copy of this User Guide (form number 65-0242) can be ordered from Honeywell, Inc. by calling 1- 800 – 468 –1502
6. When updating or removing ZM7999 software, perform an uninstall of the old software.

Once installed, the ZM7999 software can be used to configure and monitor the R7999A, B ControLinks™ Controller.

BEFORE YOU BEGIN

Before you begin to commission a system:

1. Read this guide to understand how the program operates.
2. Review the "Commissioning Process" and "Creating an Air/Fuel Ratio Profile - Example" sections so that you have a clear understanding of the commissioning process.

STARTING THE PROGRAM

To start the program, proceed as follows:

Double-click the "FuelAir ZM7999" icon on your desktop.

OR

1. Press the Windows *Start* button.
2. Select "*Fuel Air Wizard ZM7999*."
3. Select "*FuelAir ZM7999*."

THE COMMISSIONING PROCESS

Commissioning a burner using the ZM7999 ControLinks™ Software Configuration Tool requires the following general steps:

1. Connecting the R7999 to the communications port of your PC, and logging onto the software with a password. This prevents unauthorized users from modifying the modulation curve.
2. Specifying the base configuration: one or two fuels, with or without FGR.
3. Selecting system parameters such as Low Fire Hold.
4. Specifying the characteristics of the actuators and setting the valve/damper end points for those actuators.
5. Creating a modulation curve (profile) for each fuel and verifying it from maximum to minimum modulation. (While you are commissioning the system, you must monitor the burner operation with appropriate safety instrumentation to verify the modulation curve.)

Refer to "Creating an Air/Fuel Ratio Curve - Example" for a detailed example of how a system should be commissioned.

Commissioning Overview

The following table provides a step-by-step overview of how a system is commissioned. A detailed example of how to commission a system is described in "Creating an Air/Fuel Ratio Curve—Example".

The Notes column in the table provide references to detailed information when completing the more complex operations.

Table 1. Commissioning Overview.

Step	Action	Notes
1	On the Intro screen, press Commission.	
2	On the Connect to Fuel/Air Controller screen, perform the following steps:	
2.a.	Enter your password.	The ZM7999 requires you to enter your own password. The factory default password is "password."
2.b.	Select or verify the communications port to which the R7999 is connected.	
2.c.	Press Next button.	
3	On the Select Base Configuration screen, perform the following steps:	
3.a.	Select the base configuration.	The choices are: • Unconfigured: selecting this option takes the device back to a factory state. • Single Fuel • Single Fuel with FGR • Dual Fuel • Dual Fuel with FGR
3.b.	Select an actuator to configure: Air, Fuel 1, Fuel 2, or FGR.	There may not be a button for each actuator.
4	On the Set Actuator Endpoints screen, perform the following steps:	
4.a.	Select the Direction of Closed Travel: Clockwise or Counterclockwise.	
4.b.	Select the Actuator's Valve or Damper Type: Fixed Stops or Continuous Rotation.	

Table 1. Commissioning Overview.

Step	Action	Notes
4.c.	Enter the KEY (serial number) of the Actuator.	Manually move the actuator to a midspan position to allow the ID unlocking algorithm to function properly. Please ensure all eight digits are entered correctly. You may confirm that an actuator has been successfully brought on-line by noting its flash rate has changed from a rapid flash to a slow flash, i.e. one blink a second.
4.d.	Press Set Configuration.	
4.e.	Press Auto Seek Open or Auto Seek Close.	Press here for information on which to select first.
4.f.	If necessary, press Open or Close to adjust the actuator position.	
4.g.	Press Lock Position.	
4.h.	Repeat steps 4.e. through 4.g. to set the Open/Close position of the other actuators in your system.	
4.i.	Press Next.	
5	On the Create Fuel Ratio Curve screen, press the Fuel 1 or Fuel 2 button.	If you selected "Single Fuel" in the base configuration (step 3.a.), only one Fuel button appears.
6	On the Create Profile screen, perform the following steps:	
6.a.	Switch the external burner demand switch (power LCI terminal 13) and then hit the "start lightoff sequence" button.	
6.b.	Press Open and/or Close for Fuel and Air and the FGR (if present and configured to follow purge) to move the cursor to the Air Purge point of the burner.	See System Parameters. The R7999 will automatically move the Air actuator to a 62% open position.
6.c.	Press Air Purge.	A "P" will be displayed on the profile. The R7999 will energize its HFP output (terminal 10) which, in turn, allows the burner control to start the purge time.
6.d.	Press the Open and Close buttons for Fuel and Air and the FGR (if present) to move the cursor to the Light Off point of the burner.	The damper will automatically move to a 25% open position, while the fuel actuator will remain at the closed position plus 1 degree. When used with Honeywell burner controls, the user has 240 seconds to perform this action, otherwise the burner control will lock out.
6.e.	Press Light Off.	An "L" will be displayed on the profile, and the R7999 will energize the LFP output (terminal 8), which will allow the burner control to light off the system. The burner should light. Press here for troubleshooting information.
6.f.	Press Open and Close for Fuel Air and the FGR (if present) to move the cursor to the Minimum Modulation point for the burner.	Press here for information on using the flat line Wizard for the FGR.
6.g.	Press Min Modulation.	An "m" will be displayed on the profile. NOTE: The min modulation point may be higher or lower than the Light Off point.
6.h.	Press Open and Close for Fuel Air and the FGR (if present) to move the cursor to the next desired fuel air mixture point.	The R7999 enforces slope limitations of 1 to 8 and 8 to 1 (in degrees) with the exception of Flat Line or Negative FGR capability. The cursor changes from a cursor to a diamond when you have moved out of the range of allowable slopes. You are not allowed to enter points when a diamond shape is present. With controller release 1.4 or greater, the FGR actuator may have negative slopes (maximally negative slope of 1 to 5) anywhere within the modulation band.

Table 1. Commissioning Overview.

Step	Action	Notes
6.i.	Press Intermediate. Or press Maximum Modulation. With Rev. 1.4 controllers or greater, the user may alternatively place a maximum modulation point in place of an intermediate as long as a span of at least 17 degrees exist between the minimum and maximum modulation points.	A dot will be displayed on the profile and a line will connect the minimum modulation point and the first intermediate point. Entering a new Maximum Modulation point causes an pre-existing Maximum Modulation point to change to an intermediate point. This technique of entering each new intermediate point as the new "temporary" Maximum Modulation point has an advantage, which is apparent under light boiler load conditions. the user will be able to use the "Move Along Curve" commands during the next light off sequence and hence will be able to more quickly reach the firing rate point where the system was at prior to going out because of low demand. For gas systems of which the gas pressure has not been adjusted to match the burner-rated btu capability, the use should use the maximum Modulation replacement technique to rough in a curve until maximal airflow is obtained. The gas flow may then be adjusted to set the maximum firing rate. The user may then delete all points and immediately re-enter another maximum modulation point.
6.j.	Repeat steps 6.h. and 6.i. until you have created at least six intermediate points along the profile.	
6.k.	Press Open and Close for Fuel Air and the FGR (if present) to move the cursor to the Maximum Modulation point for the burner.	For gas systems of which the gas pressure has not been adjusted to match the burner-rated btu capability, the use should use the maximum Modulation replacement technique to rough in a curve until maximal airflow is obtained. The gas flow may then be adjusted to set the maximum firing rate. The user may then delete all points and immediately re-enter another maximum modulation point. This may save the user some time by not having to successively delete invalid intermediate points due to the gas pressure change.
6.l.	Press Max Modulation.	An "M" will be displayed on the profile and a line will connect it to the previous intermediate points. The R7999 requires re-verification of any verified curve segments after setting the maximum modulation point.
6.m.	Press Move to Next Lower/Next Higher position until the cursor reaches the next lower point on the profile. Alternatively the user may add intermediate points as the effective firing rate is lowered. Jump back to 6 h if the temporary intermediate points were deleted in 6 k.	The line segment turns color , red to blue, to indicate the curve has been walked (verified). NOTE: The ZM7999 requires you to enter at least three points (inclusive of the min and max modulation points) in order to use the "Move Along the Curve" buttons.
6.n.	Repeat step 6.m. until you have moved along the curve from top to bottom.	The profile is now complete and operational. The R7999 requires reverification of any line segment after the maximum modulation point has been altered.
6.o.	If you wish to save the profile you have just created to your PC or disc, press Save Profile.	The user must insure that the purge point is within the minimum and maximum modulation points before finishing the profile. The purge point can be moved while the burner is firing by simply using the Move Along the Curve commands and pressing the PURGE button at the desired level or at the purge point definition period during the next start up sequence.
7	When you are through with the profile, press Finish.	The Monitor screen appears. You have successfully commissioned the R7999.

PROGRAM OPERATION

Because the ZM7999 ControLinks™ Software Configuration Tool operates like a wizard, you cannot open screens randomly. You must step through them one at a time, and provide the information necessary for one before you can move on to another. The screen descriptions are provided below so that you can understand the purpose of each and view the selections, parameters, and information that is available or required on each.

Screen Descriptions

The ZM7999 ControLinks™ Software Configuration Tool screens include the following:

    a. Honeywell Fuel/Air Ratio Controller Commissioner ZM7999, referred to as the "Intro" screen.
    b. Connect to Fuel/Air Controller.
    c. Select Base Configuration.
    d. Set *XXXX* Actuator Endpoints, where *XXXX* is either Air or Fuel or FGR (Serial Number).
    e. Create Fuel/Air Ratio Curve.
    f. Create/Modify Curve for Fuel *X*, where *X* is either 1 or 2.
    g. Monitor (This screen is not part of the commissioning process, but allows you to monitor a system after it has been commissioned.)

Intro Screen

The Intro screen (Fig. 1) is used to select one of the following actions:

- Commission the system.
- Monitor the system.

You can perform the following actions from this screen:

    1. Begin to commission a new system.
    2. Modify the commissioning of an existing system.
    3. Monitor the status of a commissioned system.
    4. Verify the version number of the ZM7999 software.
        a. **Commission** Press to start commissioning a new system or modify/review the commissioning settings of an existing system.
        b. **Monitor** Press to monitor the status of a commissioned system.
        c. **Help** Press to display the help system.
        d. **Exit** Press to exit the program.

Connect to Fuel/Air Controller Screen

The Connect to Fuel/Air Controller screen (Fig. 2) is used to:

- Protect the system from unauthorized users.
- Connect the R7999 to the software. Refer to the R7999A,B ControLinks™ Controller specification sheet (Form No. 65-0238).

You can perform the following actions from this screen:

    1. Enter your password to access the commissioning function of the program.
    2. Select the PC communications port the R7999 is connected to.
    3. Change the password.

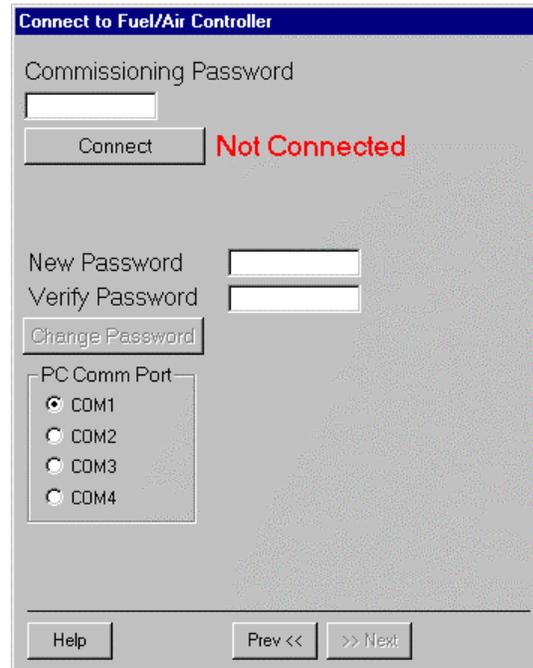**Fig. 1. Intro Screen.**

Fig. 2. Fuel/Air Controller Screen.

NOTE: The password has to have a minimum of four and a maximum of 15 characters.

    a. **Commissioning Password** Before you can connect to the system, you must enter a valid password here. See Fig. 3 and 4.

NOTE: The first time you use the system, enter the password 'password' and then press *Connect*. A message will display that you must change the default password. Change the password, as described in "How to Change the System Password." Enter your new password and press *change password*.

   b. **Connect** Press after you have entered a valid password and selected the PC Comm Port. (Fig. 5) See "How to Connect to the PC Comm Port."

   c. **New Password** Enter your new password in this field. See "How to Change the System Password."

   d. **Change Password** Press to change your password.

   e. **PC Comm Port** Select the communications port that the R7999 is connected to. See "How to Connect the R7999" in the specification sheet (Fig. 5).

   f. **Help** Press to display the help system.

   g. **Exit** Press to exit the program. Valid changes will be saved.

   h. **Prev** Press to return to the previous screen.

   i. **Next** Press to move to the next screen, *Select Base Configuration.* You cannot move to this screen until you have properly connected to the R7999.
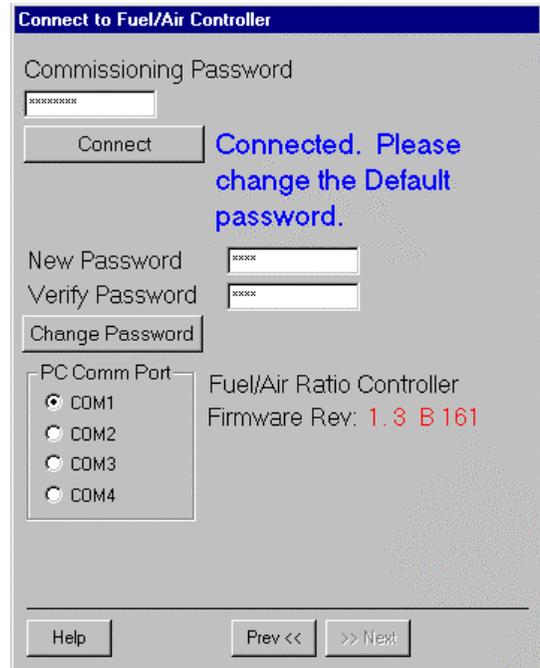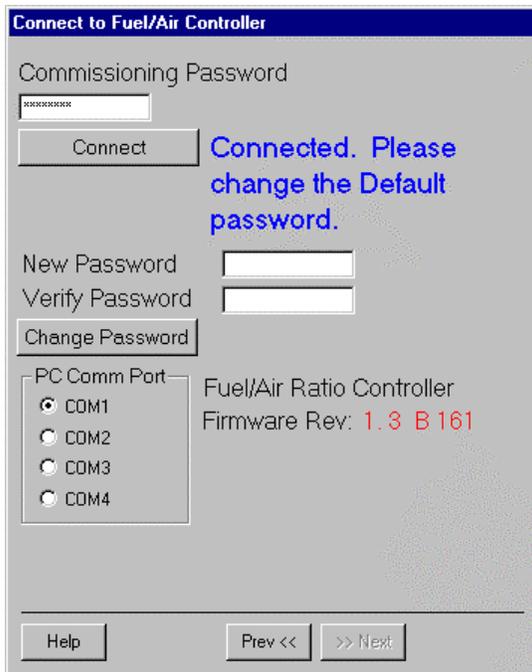

Fig. 3. Connected.
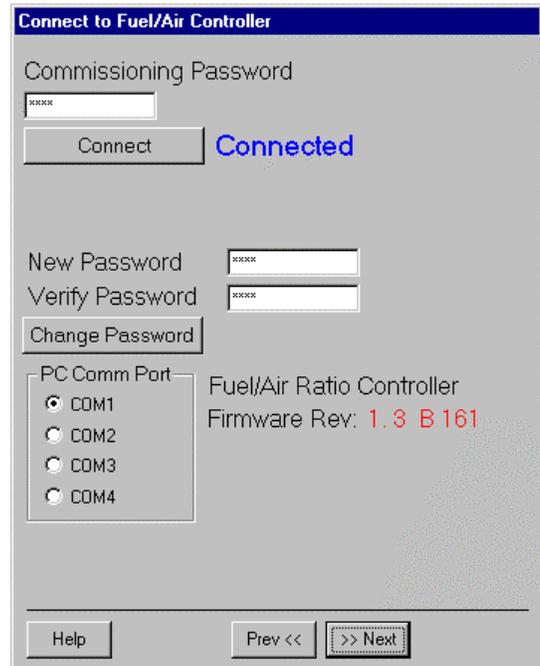

Fig. 4. Changing the password.

Fig. 5. Connected.

Select Base Configuration Screen

The Select Base Configuration screen (Fig. 6) is used to:

• Identify the configuration of the system you want to commission, for example, dual fuel system with a FGR or a single fuel system, etc.
• Begin configuration of the actuators.
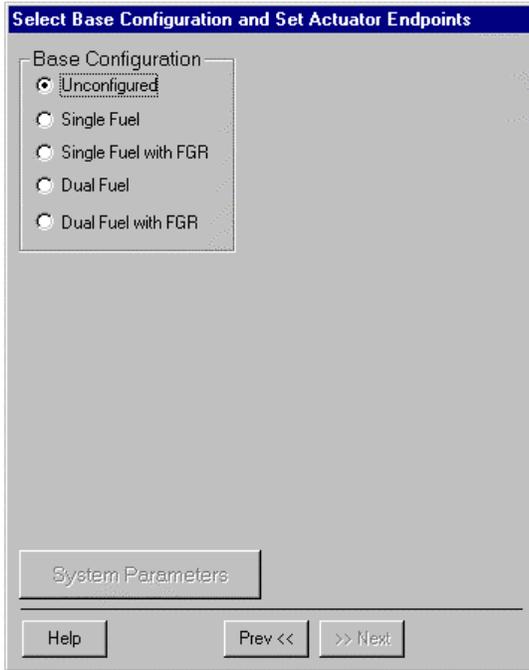• Allow the user to set System Parameters.

Fig. 6. Select Base Configuration.

You must perform the following actions from this screen:

1. Select base configuration for the system.
2. Select and configure all actuators within the base configuration.
3. Go to the System Parameters screens to set system parameters or view the default system parameters.

NOTE: Depending on the number of actuators physically connected to the R7999, some of the selections on this screen may be grayed out. For example, if you have a single fuel system and only two actuators, you can only select "*Unconfigured*" or "*Single Fuel*."

   a. **Base Configuration**
     (1) **Unconfigured** —This is the initial (default) option. You can select this option to erase the current configuration and reset to factory configuration.
     (2) **Single Fuel**—Select if you want to configure only one fuel actuator and one air actuator.
     (3) **Single Fuel with FGR**—Select if you want to configure a fuel actuator, an air actuator, and an FGR actuator.
     (4) **Dual Fuel**—Select if you want to configure two fuel actuators and one air actuator.
     (5) **Dual Fuel with FGR**—Select if you want to configure two fuel actuators, one air actuator, and an FGR actuator.

   b. **Air**
     Fuel1
     Fuel 2
     FGR
     (1) Press a button to configure the actuator. (If you selected 'Single Fuel' or 'Single Fuel with FGR' in the Base Configuration, the Fuel 2 button is not displayed. If you selected 'Single Fuel' or 'Dual Fuel' in the Base Configuration, the *FGR* button is not displayed.) When you press a button, the *Set Actuator Endpoints* screen is displayed. When the actuator has been configured, the word "Configured" is displayed next to the appropriate button. See Fig. 7.
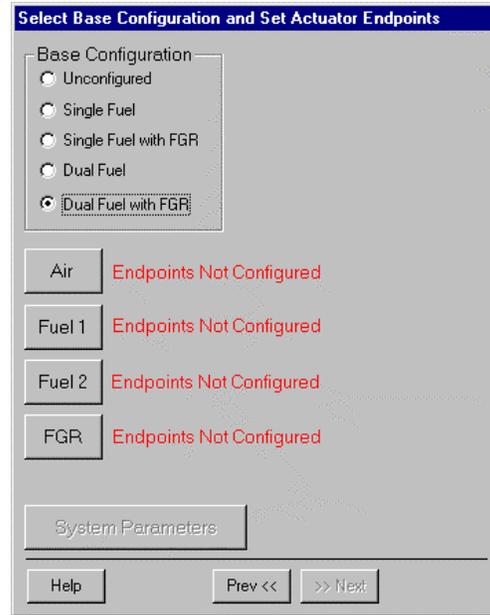

Fig. 7. Base Configuration for Dual Fuel with FGR.

Set Air/Fuel Actuator Endpoints Screen (Fig. 8)

The Set Air/Fuel Actuator Endpoints screens (there is one screen for each actuator) are used to:

• Identify the configuration of each actuator in the system. This prevents actuator and/or controller replacement without recommissioning the system and verifying safe operation.
• Set the maximum open and closed positions for each actuator.
• You can perform the following actions from these screens:
• Enter the actuator configuration information including: direction of travel, actuator type, and KEY (serial number).
• Set the maximum open and closed position for each actuator.

⚠ CAUTION

Operating condition hazard.
Wrong actuator information can cause an unsafe operating condition.
Use caution when selecting this setting. If you enter the wrong direction of travel, you may create an unsafe condition later in the commissioning process.

1. Actuator Configuration:
   a. Direction of Closed Travel—Select the direction that the actuator travels to close, either *Clockwise* or *Counterclockwise*. See Fig. 9.
   b. Actuator Type—Select the type of actuator, either *Fixed Stops* or *Continuous* rotation.
   c. Serial Number—Enter the serial number of the actuator you are configuring. The serial number can be found on the ML7999 actuator body in two places under the label "KEY." The "key" is made up of eight numbers, the first four numbers represent the date code of manufacture for the actuator. When you attempt to set the configuration, the software writes the serial number to the actuator to verify your entry. If you enter the wrong number, you will receive an error message.
   d. If you change an actuator in a commissioned system, you cannot run the system until you have entered the new KEY (serial number) of the actuator, set the maximum open and closed positions and re-verify the existing curve (or set and verify a new curve) for the system.
2. Set Configuration (Fig. 10):
   e. Press this button after you have selected the direction of closed travel, actuator type, and entered the KEY (serial number). The software verifies the serial number and stores the configuration information. If the serial number you entered and the device serial number do not match, you will receive an error message
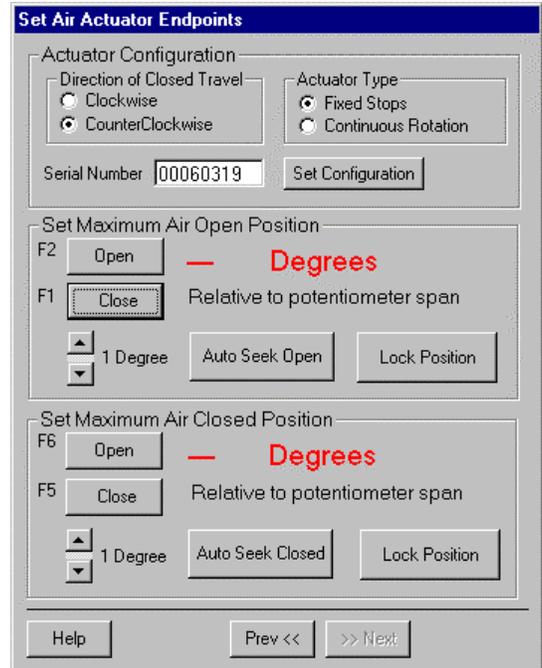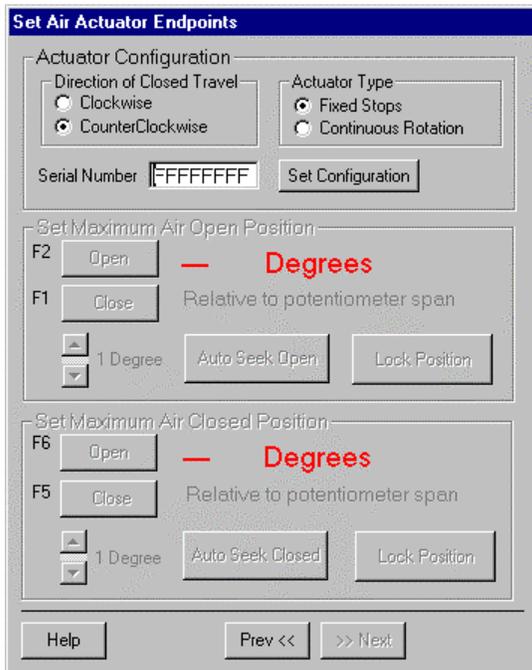

Fig. 9. Set Direction of Travel.

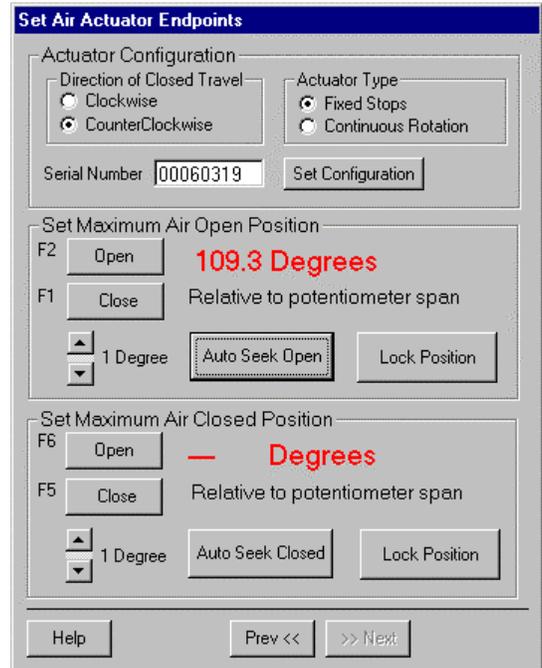**Fig. 8. Set Air Actuator Endpoint.**

Fig. 10. Set Configuration.

NOTE: You must resend the KEY (serial number) any time you revise the closed direction setting or change the type of end-stop selection.

3. Set Maximum Closed Position/Set Maximum Open Position (Fig. 11 and 12):
   • Press one of these buttons to manually open or close the actuator the number of degrees indicated in the slide bar (from 1 to 10). You can also use the function keys indicated next to the buttons (F1, F2, F5 or F6) to perform the same actions. Each time you press the *Open* or *Close* key, the R7999 receives a command to execute the move command, the interface is essentially locked out until the command has been completed.
4. Auto Seek Open/Closed:
   • Press one of these buttons to let the software automatically locate the maximum open or maximum closed position of the actuator. The actuators are moving in a limited torque mode. Therefore the time required to move from one end of travel to the other is extended by approximately a factor of three. You can speed up this activity by opening the actuator cover and pressing the CW or CCW buttons.
5. It is not recommended that you let the actuators hit the damper or valve system endpoints when using the actuator CW or CCW buttons.

Fig. 11. Set Maximum Air Open Position.

Fig. 12. Set Maximum Air Closed Position.

6. Lock/Unlock Position:
   • After you have set the maximum open or closed positions for the actuator, 'lock' the settings by pressing the *Lock Position* button. Once you press the *Lock Position* button, the degrees position will change from red to blue and the button redisplays as *Unlock Position*. To change the position settings once the *Lock Position* button has been pressed, you must press the *Unlock Position* button.
   a. **Help** Press this button to display the help system.
   b. **Exit** Press this button to exit the program. Valid changes will be saved.
   c. **Prev** Press this button to return to the previous *Select Base Configuration* screen without completing this screen.
   d. **Next** Press this button to move to the *Select Base Configuration* screen. You cannot move to the next screen until you have completed the actions required on this screen. See Fig. 13 and 14.
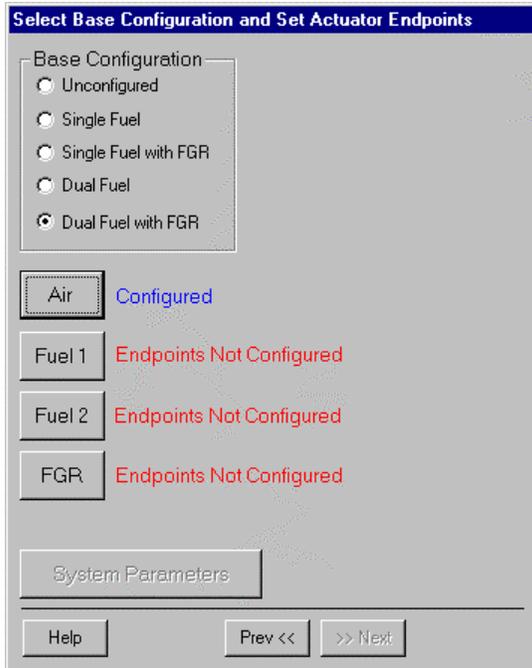
Fig. 13. Air Configured.
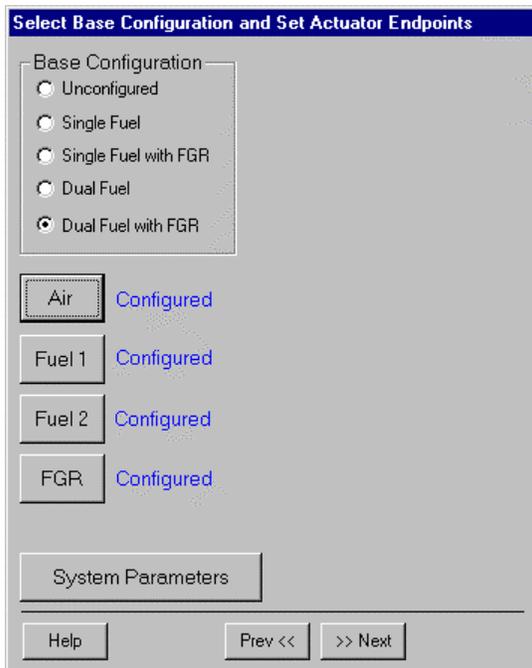
Fig. 14. Base Configuration Set; Actuators Configured; System Parameters Screens Selectable.

System Parameters Screen

SYSTEM PARAMETERS

1. Press to set system parameters. System parameters let you choose advanced features that use the auxiliary 4-20mA input such as: low fire hold and/or FGR holds, configure actuator positions during standby, configure the position of the non-selected fuel actuator, configure action of the FGR actuator during purge, adjust the postpurge timing parameter, and select a maximum firing rate limit via the manual potentiometer input.
2. See "System Parameters Screen" below.
3. Setting these parameters is optional. If you do not set system parameters, the default values will be used. See "Default System Parameters" for the default value/setting for each parameter.

NOTE: The selection of Xma (auxiliary mA) operation system parameters result in a common attribute between the operation of both fuel selections. For example, selecting low fire hold will apply to both fuels.

a. **Help** Press to display the help system.
b. **Exit** Press to exit the program. Valid changes will be be saved.
c. Prev Press to return to the Connect to Fuel/Air
d. **Prev** Press to return to the *Connect to Fuel/Air Controller Controller* screen.
e. **Next** Press to move to the next screen, *Create Fuel Ratio Curve.*

NOTE: You cannot move to Create Fuel Ratio Curve screen until all of the actuators have been configured.

NOTE: You do not have to set any of these system parameters. Default values/positions are defined. If you want to review system parameter settings or add/modify them. Press *System Parameters* on the *Select Base Configuration* screen.

If you make changes to the system parameters, they are not saved until you press *Finish* on the second system parameters screen.

System parameters you can set include:

• Stack or boiler water temperature sensor operating parameters.
• Controller timing (postpurge time).
• Auto/manual maximum firing rate option via the manual potentiometer input.
• Program standby positions and nonselected fuel position.
• FGR behavior during purge.
• XmA Operation (Auxiliary mA input).
Select an operation from the dropdown list:

1. Disabled means the input is ignored.
2. Low Fire Hold—Selecting this option field enables an algorithm that protects the boiler from thermal shock. Upon successful progression to modulation, the R7999 holds the burner at the light off point until the auxiliary temperature input exceeds the programmed threshold. The Low Fire Hold function re-enables once the tempeature input falls below the threshold minus the differential.
Use of this function requires an auxiliary linearized

temperature transducer. You must match the programmed high and low temperature range points to that of the transducer; all other values are determined in a linear interpolated manner ranging from 4.0 mA to 20.0 mA. the maximum temperature range is -40°F to 1400°F respectively. The minimum span is 100°F.

3. FGR Hold—Selecting this option field enables an algorithm that holds the FGR damper closed until the stack temperature has reached a programmed threshold. After successful progression to modulation, the R7999 holds the FGR closed until the auxiliary temperature input exceeds the programmed threshold. The FGR function re-enables once the temperature input falls below the threshold minus the differential. use of this function requires an auxiliary linearized temperature transducer. You must match the programmed high and low temperature range points to that of the transducer; all other values are determined in a linear interpolated manner ranging from 4.0 mA to 20.0 mA. The maximum temperature range is -40°F to 1400°F respectively. the minimum span is 100°F.

4. FGR and Low Fire Hold—Selecting this option enforces both of the above actions.
   a. **Max (20 mA)—**This field lets you set the maximum sensing range of the transducer. The maximum value must be between -40°F and 1400°F.
   b. **Min (4 mA)—**This field lets you set the minimum sensing range of the transducer. The minimum must be less than the maximum by at least 100°F.
   c. **Threshold—**This field lets you set the threshold temperature at which you want the low fire hold or FGR hold or Low Fire and FGR hold to be released. The threshold temperature must be less than the maximum.
   d. **Differential**—This field lets you set the differential temperature at which the system will revert to a hold condition. The threshold must be set lower than the threshold but greater than the minimum.

5. **Controller timing**
   a. **Postpurge Timeout**—Use the dropdown list to select how long the system should wait at the postpurge position once the postpurge state has been detected. It is important that the postpurge timeout time be at least as long as the burner control time, especially when the air damper is configured to close while in standby.

6. Auto/Manual Switch
   a. Select either Normal or Maximum Firing Rate Limit.
   b. When the Maximum Firing Rate Limit is selected, the R7999 (when in auto mode) reads the value of the manual potentiometer input and does not allow modulation beyond its interpreted value. The manual potentiometer input equates 0 to 500 ohms as a 4 mA firing rate input and 4500 ohm or greater as a 20 mA input; all other values are determined by linear interpolation. The behavior during manual switch setting is not affected, i.e., the firing rate input is derived directly from the potentiometer value and the controller mA input is ignored.

7. **Program Standby Position**—Lets you set the position of the actuators when the controller is in the standby position. For each actuator, select *Closed*, *Lightoff* or *Open*. If you select *Open*, you must enter a value in the appropriate field to indicate how wide the actuator should be opened (percentage of maximum open value).

8. **Program Non Selected Fuel Position**—Lets you set the position of the fuel actuator of the fuel that is not currently being used. Select *Closed*, *Lightoff* or *Open*. If you select *Open*, you must enter a value in the appropriate field to indicate how wide the actuator should be opened (percentage of maximum open value).

9. FGR Behavior During Purge—Lets you set the position of the FGR actuator during the purge cycle. The options are *Remain Closed* or *Follow FGR Curve to Purge Position*.

Default System Parameters

The default values/settings for each system parameter are shown in Table 2. See also Fig. 15 and 16.

Table 2. Default Values/Settings for System Parameters

Parameter	Default
Xma Operation	
Operation	Disabled
Max (20 mA)	NA
Min (4 mA)	NA
Threshold	NA
Differential	NA
Controller Timing	
Postpurge time	30 seconds
Automanual Switch	
Automanual Switch	Normal Mode
Program Standby Position	
Fuel Selection 1	
Fuel	Closed
Air	Closed
FGR	Closed
Fuel Selection 2	
Fuel	Closed
Air	Closed
FGR	Closed
Program Non-Selected Fuel Position	
Fuel Selection 1	
Fuel Selection 2	Closed
Fuel Selection 2	
Fuel Selection 1	Closed
FGR Behavior During Purge	
FGR Behavior During Purge	Remains Closed.
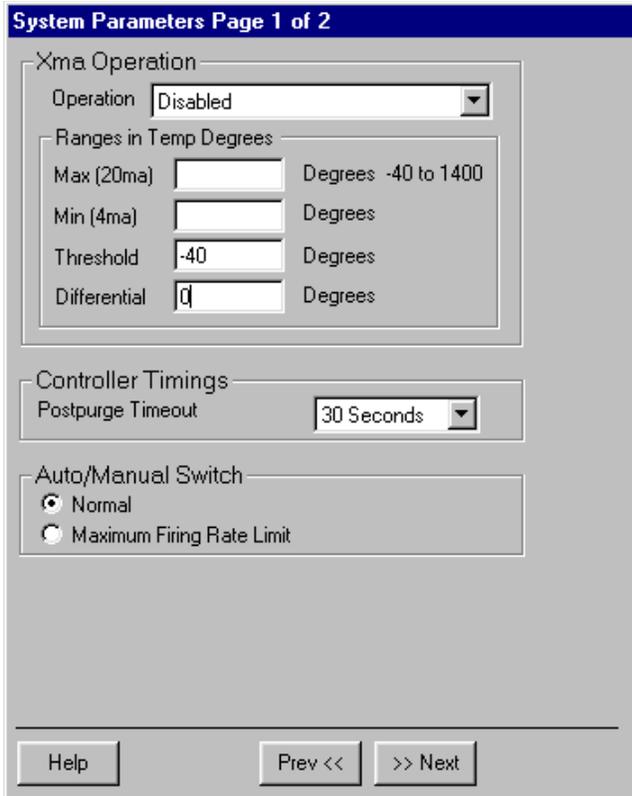
Fig. 15. System parameters Screen 1.
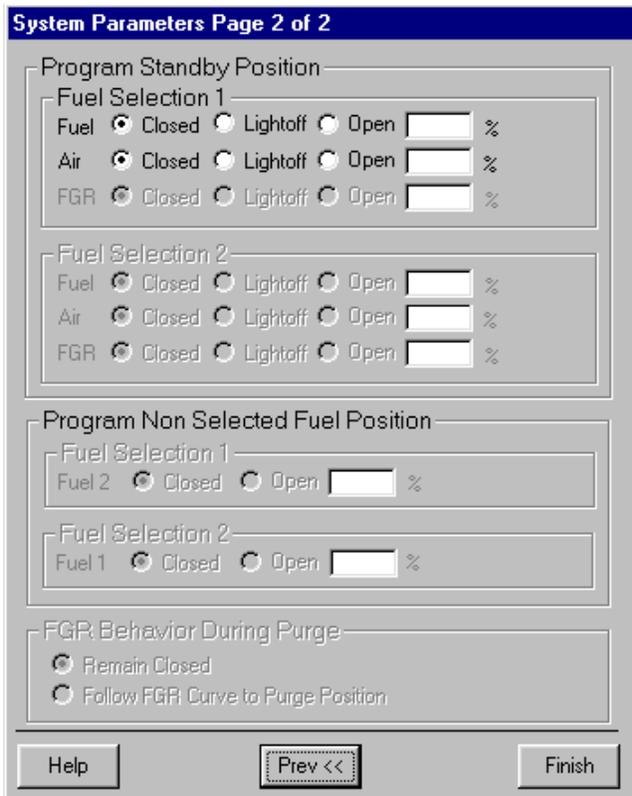
Fig. 16. System parameters Screen 2.

Create Fuel Ratio Curve Screen

The Create Fuel Ratio screens are used to:

- Select which fuel is to be configured. (If your base configuration has only one fuel, the Fuel 1 button is all that is available.)
- Identify whether fuel/air ratio curves are configured.

You can perform the following actions from these screens (see Fig. 17):
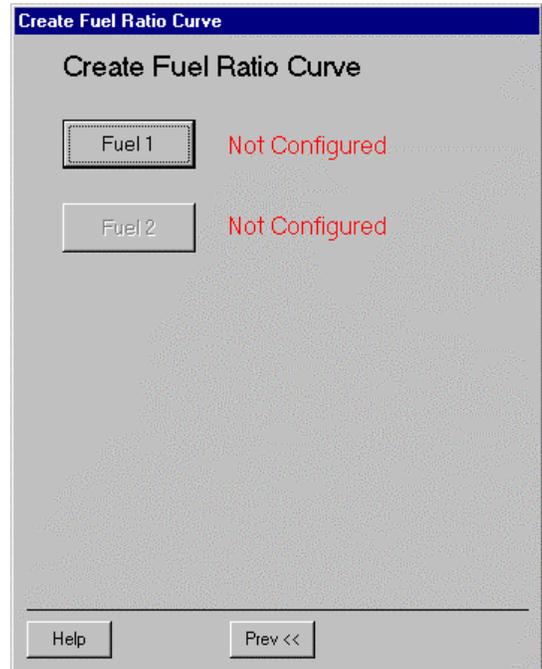
Fig. 17. Create Fuel Ratio Curve.

- Select which Fuel/Air curves to configure: Fuel 1 or Fuel 2. (If your base configuration has only one fuel, the Fuel 1 button is the only one available.)
  1. **Fuel 1/Fuel 2**: Press the appropriate button to indicate the fuel for which you want to create a fuel ratio curve. If you have only one fuel, only a *Fuel 1* button is displayed. ('Configured' means a curve already exists, 'Not Configured' means the profile must be created, changed, or validated.)
  2. **Help:** Press this button to display the help system.
  3. **Exit:** Press this button to exit the program. Valid changes will be saved.
  4. **Prev:** Press this button to return to the previous *Select Base Configuration* screen.
  5. **Next:** This button is not available on this screen. Press the *Fuel 1* or *Fuel 2* button to proceed to the *Create Profile* screen.

Create/Modify Profile Curve for Fuel Screen

The Create/Modify Profile Curve for Fuel 1 or Fuel 2 screens (Fig. 18) are used to:

- Create modulation curves for the burner.
- Identify whether fuel/air ratio curves are configured.

You can perform the following actions from this screen:

- Enter points on the graph to indicate the Air Purge position, Light Off position, Maximum and Minimum modulation positions, and intermediate positions for the actuators for the specified fuel (Fuel 1 or Fuel 2). See Fig. 19.
- Create a curve that provides safe and efficient operation of the burner from minimum to maximum modulation.
- Verify the profile that was created.
- Load a file from your PC that contains a curve (profile) to use as a starting point for constructing a profile for this burner.
- Save the profile you created to a file on your PC or disc for reference or future use. Fig. 20 through 31 illustrate creating the profile curve.
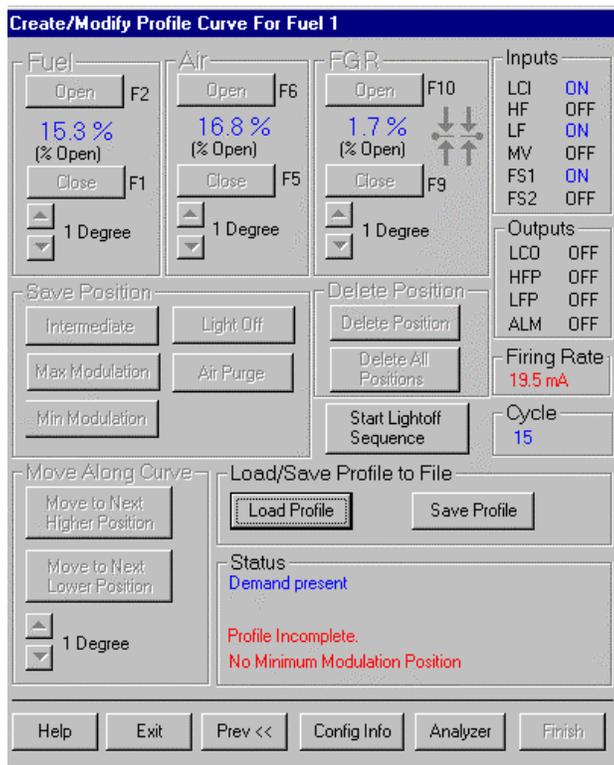
Fig. 18. Create/Modify Profile Curves.
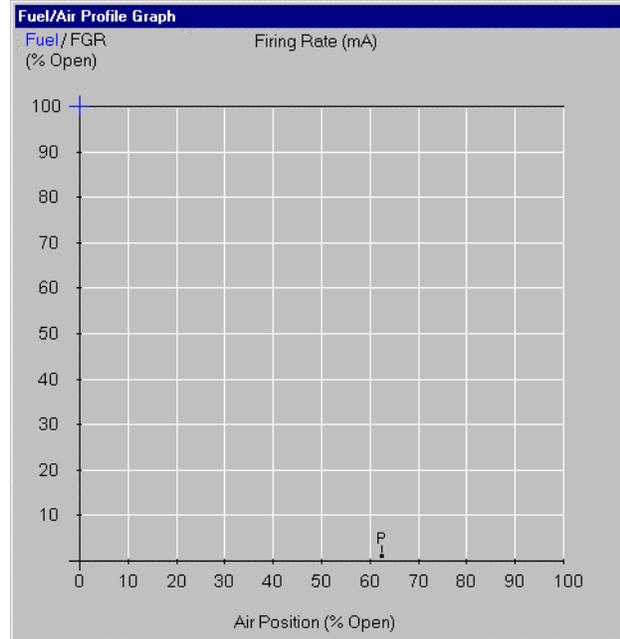
Fig. 19. Fuel/Air Profile Graph.

1. Fuel/Air/FGR:
   - Open/Close—Press one of these buttons to manually open or close the actuator the number of degrees indicated in the slide bar (from 0.1 to 10). You can also use the function keys indicated next to the buttons (*F1, F2, F5, F6, F9* or *F10*) to perform the same actions. When you are positioning actuators, while any actuators are below 20%, you can only move the actuator 1 degree at time. This is a safety constraint.
2. Outputs/Inputs:
   - The R7999 outputs and inputs are displayed on the screen and their current state is noted. See "Outputs and Inputs" for a description.
3. Firing Rate:
   - This window displays the current value of input firing rate (from the pressure or temperature controller). Once the minimum and maximum modulation positions are entered, the window also provides a visual indication if over-firing (the current load demand) of the system occurs during the commissioning process. When the color of the 'mA value' is blue, it indicates an under firing condition exists. When the color of the 'mA value' is red, it indicates your commanded firing rate exceeds the present input demand needs (over-firing).
4. Save Position:
   - After positioning the actuator(s), press the appropriate button to save the point on the graph.
   a. Intermediate—Press to save positions on the curve that are between the max and min modulation points. A point is displayed on the graph each time

you press this button. You need at least 6 intermediate points between the max and min modulation points on a curve for a valid profile.

b. Light Off—Press to save the light off position on the graph. An 'L' is displayed on the graph to indicate the lightoff point. Only one light off point is allowed per curve.

c. Max Modulation—Press to save the maximum modulation position on the graph. An 'M' is displayed on the graph to indicate the maximum modulation point. Only one maximum modulation point is allowed per curve.

d. Min Modulation—Press to save the minimum modulation position on the graph. An 'm' is displayed in the graph to indicate the minimum modulation point. Only one minimum modulation point is allowed per curve.

e. Air Purge—Press to save the air purge position on the graph. A 'P' is displayed on the graph to indicate the air purge point. Only one air purge point is allowed per curve.

5. Delete Positions:
    a. Delete Position—Press to delete a point on the curve. To delete the point, you must position the cursor on the point.
    b. Delete All Positions—Press to delete ALL positions on the curve, including the light off, air purge, max and min modulation points. Use this button ONLY when you want to start creating the curve from the beginning.

6. Start Lightoff Sequence:
    • Stop Modulation:
    • This button serves a dual purpose. Press this button after you have positioned the actuators (as shown by the cursor) to the light off position. Pressing this button activates the burner controller lightoff sequence. If the lightoff sequence is successful, this button then displays *Stop Modulation*. If the lightoff sequence fails, the *Status* window indicates the problem.
    • If you want to stop the system at any time during the commissioning process, use the *Stop Modulation* button.

7. Move Along Curve:
   Move to Next Higher Position—

   Move to Next Lower Position—

    • Press these buttons to move the cursor along the curve to a previously set position. Use these buttons to reposition the cursor or to 'walk the curve' and verify system operation. As the curve is verified, the color of the curve changes.

NOTE: The ZM7999 requires you to enter at least 3 points (inclusive of the min and max modulation points) to use the "Move Along the Curve" buttons.

8. Load/Save Profile to File:
    • Load Profile—Press this button to load an existing profile curve (from a file saved on your PC or disc). When you press the button, a *File Search* window opens and you can navigate to the directory and filename of the file you want to load. Press *Okay* to load the profile in the file. The profile will be displayed in red. You must 'walk the curve' to verify system operation with the curve.
    • Save Profile—Press this button to save the curve you have created to a file on your PC or disc. When you press the button, a File search window opens and you can navigate to the directory you want to save the file in (Fig. 20). Use a descriptive filename for the file. The extension (.prf) is automatically added when you press *Save* to save the profile.
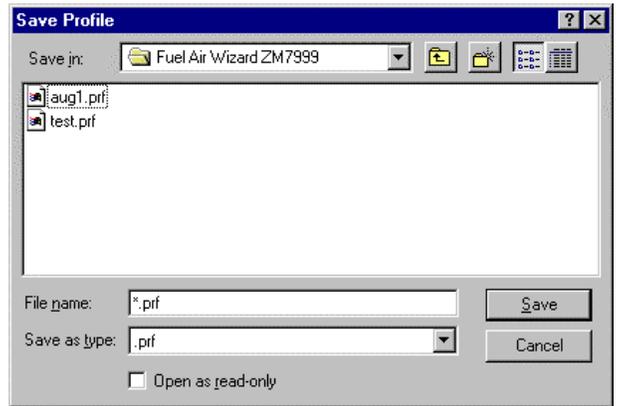
Fig. 20. Save Profile Screen.

9. Configuration Information:
    • Config Info—Press this button to view the system configuration information.
    • Save to file—Press this button (.txt).
    • Save —Press this button to save the system configuration you have created to a file on your PC or disc. When you press the button, a File search window opens and you can navigate to the directory you want to save the file in. Use a descriptive filename for the file. The extension (.prf) is automatically added when you press *Save* to save the system configuration.

NOTE: The curve is saved in the R7999 as you create it. Saving the profile to a file is only necessary to provide a backup copy of the profile or to use it as a base for creating a curve for a similar system in another location.
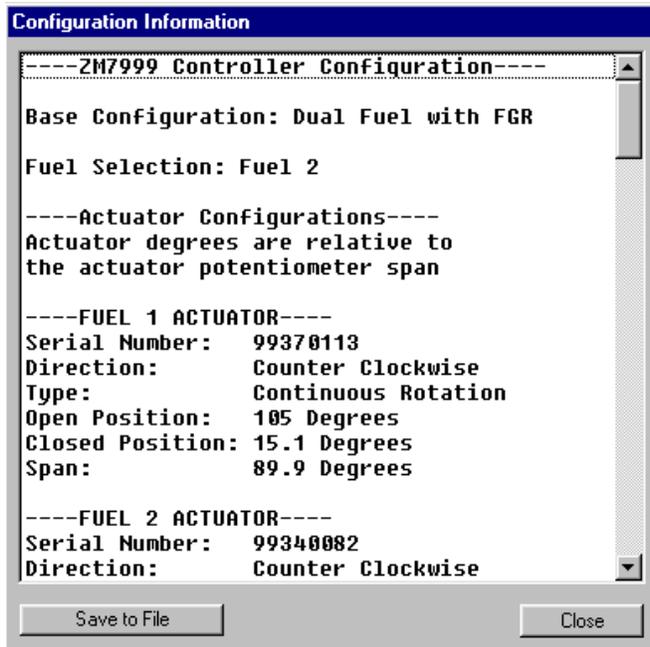
Fig. 21. Configuration Information.
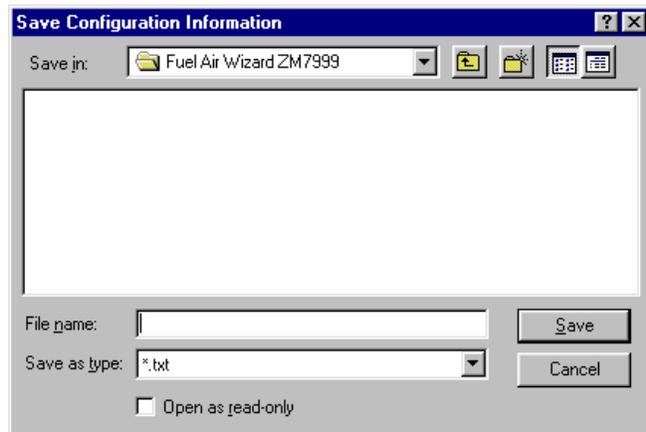
Fig. 22. Save Configuration Information.

10. Status:
    • This window displays status and error information as you create the profile. It cannot be edited.
11. Help:
    • Press to display the help system.
12. Exit:
    • Press to exit the program. Valid changes will be saved.
13. Prev:
    • Press to return to the *Create Fuel Ratio Curve* screen.
14. Next:
    • This button is not available on this screen. It is grayed out.
15. Finish:

• Press to save the profile you have created. The *Finish* button is grayed out until you complete the profile. After you press this button, the *Monitor* screen is displayed. You can exit the program from there.
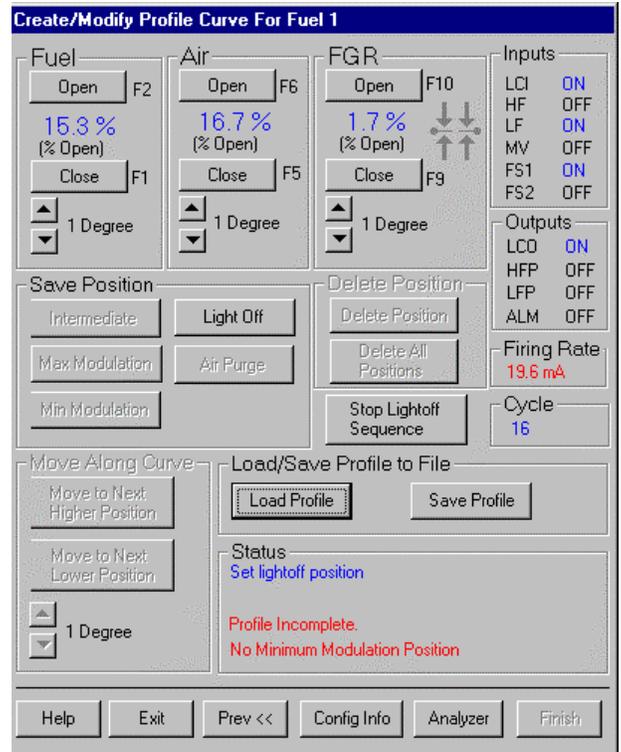
Fig. 23. Setting Lightoff point.
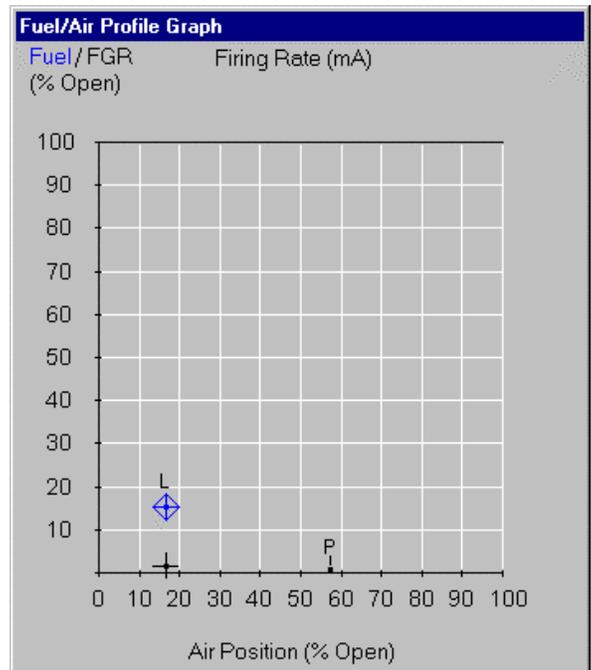
Fig. 24. Establishing Lightoff Point for the Curve.
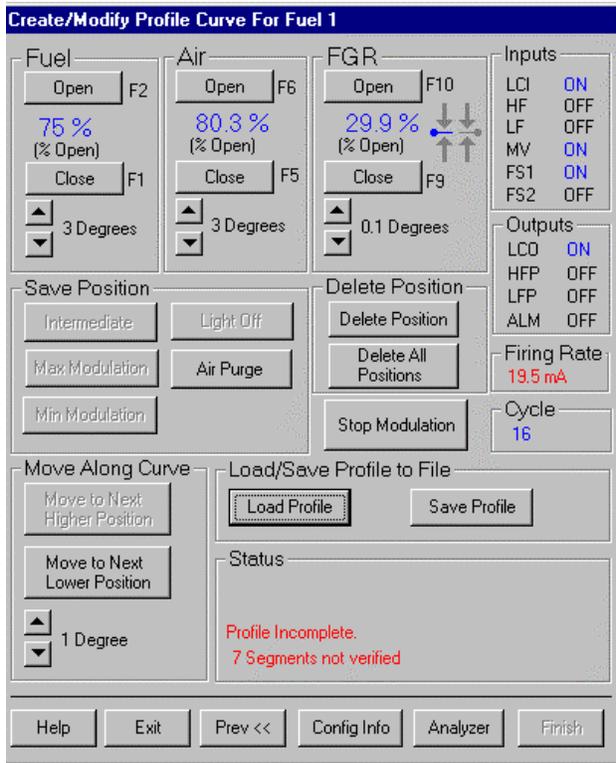
Fig. 25. Setting Maximum Modulation Point.
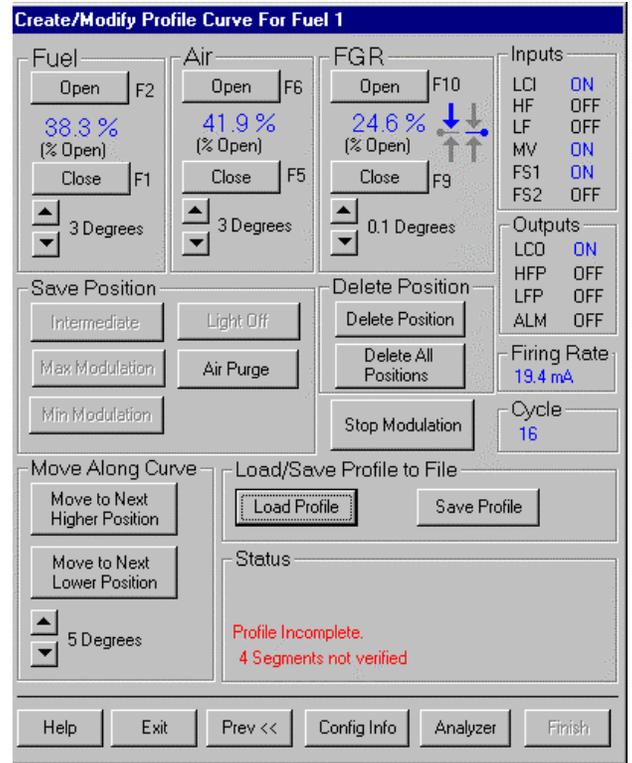
Fig. 27. Verifying an Intermediate Point.
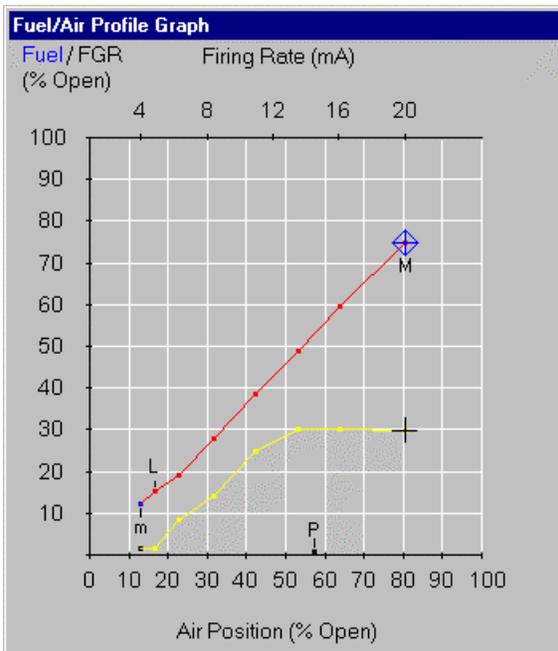
Fig. 26. Establishing Maximum Modulation Point for the Curve.
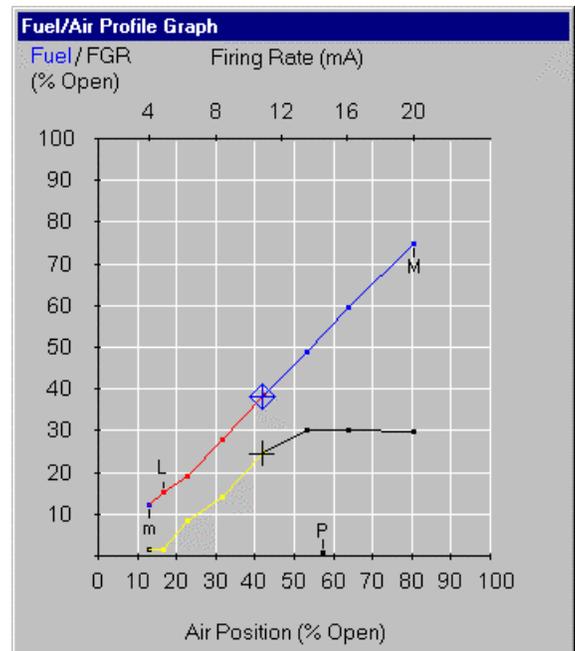
Fig. 28. Verifying an Intermediate Point on the Curve.
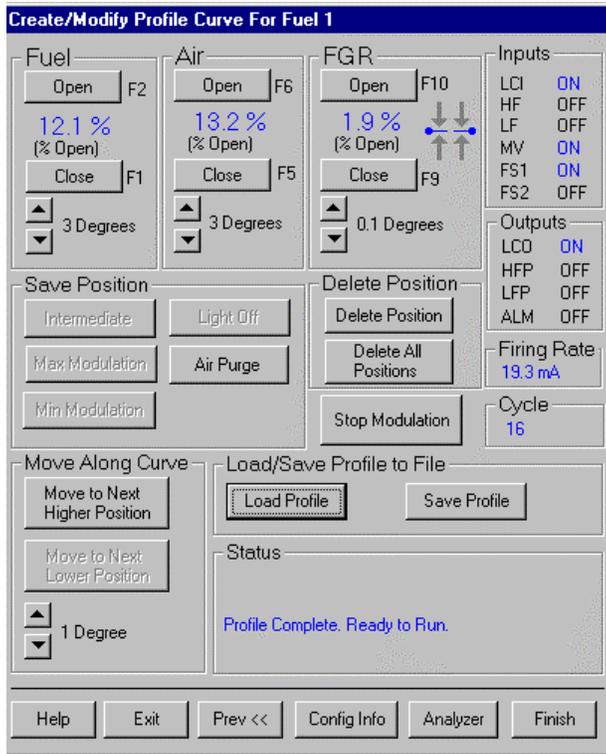
Fig. 29. Verifying the Minimum Modulation Point.

**Fig. 30. Verifying the Minimum Modulation
Point on the Curve**

**Fig. 31. Fuel 1 Configured;
Fuel 2 Not Configured.**

Monitor Screen

The Monitor screen (Fig. 32) is used to:

- Monitor the burner controlled by an R7999.
- Review alarms that were generated during run cycles.

You can perform the following action from this screen:

- View various parameters of the system including: the current positions of the Air, Fuel and FGR actuators; the status of the system, on/modulating/lockout/alarm etc.; historical list of alarms.

1. Fuel Selection:
   - Identifies which fuel is currently in use, Fuel 1 or Fuel 2.
2. Fuel:
   - Displays the current position of the fuel actuator.
3. Air:
   - Displays the current position of the air actuator.
4. FGR:
   - Displays the current position of the FGR actuator (if present).
5. Firing Rate:
   - Displays the current firing rate position (in milliamps).
6. Aux Temperature Input:
   - Displays the actual interpreted temperature reading from the auxiliary input. If the function is disabled, the value indicates "disabled".
7. Status:
   - Indicates system status, for example, manual modulation, air purge, lightoff sequence, etc.
8. Cycle:
   - Indicates the current cycle of the system, with one being the first call-for-heat cycle since the system was commissioned.
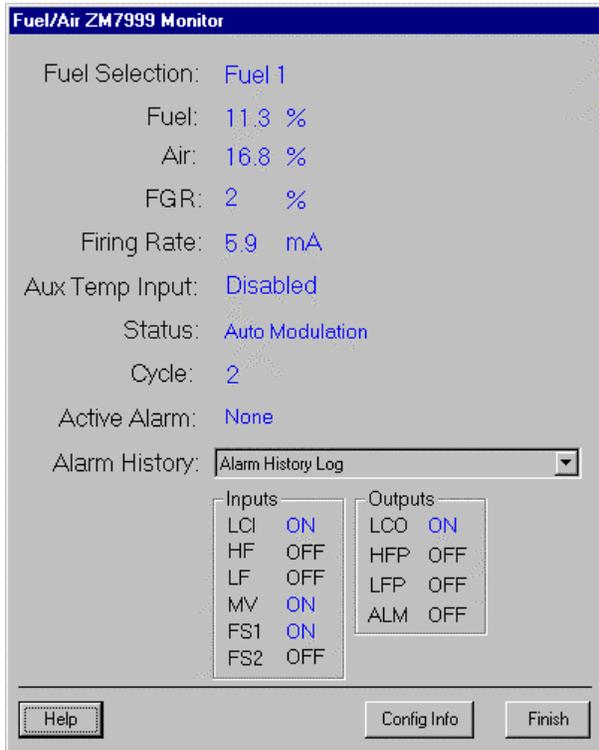
Fig. 32. Monitor Screen.

9. Active Alarm:
   • Indicates if the system is in an Alarm state.
10. Alarm History:
    • Displays all alarms that have been generated. The dropdown box displays the cycle the alarm occurred in and the alarm type.
11. Inputs/Outputs:
    • All Outputs and Inputs are displayed and their current state is noted. See Outputs and Inputs for a description.
12. Help:
    • Press this button to display the help system.
13. Finish:
    • Press this button after you are through monitoring the system to return to the *Intro* screen.

SETTING THE FIRING RATE HYSTERESIS AND ACTUATOR DEADBAND

The Firing Rate Hysteresis feature is available for all R7999 controller (ControLinks™) software builds except 176. The Actuator Deadband feature is not available for ControLinks™ software builds 178 and lower and will be disabled.

Firing Rate Hysteresis

The Firing Rate Hysteresis value controls the amount of hysteresis for the 4 to 20 mA firing rate (CmA) input signal. Adjusting the Firing Rate Hysteresis value determines when the R7999 will react to a firing rate change in the opposite

direction. The ControLinks™ only reacts to a firing rate change in the opposite direction when it has increased or decreased more than the user-selected Hysteresis value. However, the ControLinks™ always follows the firing rate signal as it changes in the same direction. For example: When a hysteresis value of 0.5 mA has been selected and the firing rate dropped from 12 mA to 10 mA, the ControLinks™ will not begin to follow an increased firing rate until it increases to a value of 10.5 mA or higher. All firing rate values between 10 mA and 10.5 mA are interpreted as a value of 10 mA. The configured actuators will remain at their corresponding 10 mA firing rate position until the firing rate has increased higher than 10.5 mA. Increasing the hysteresis value may reduce the amount of actuator dither and hunting and premature wear-out due to noisy environment or an intelligent firing rate controller continuously attempting to satisfy a very precise setpoint.

Actuator Deadband

The Actuator Deadband setting controls how closely the actuators will follow the profile curve configured in a ControLinks™ and defines the allowable tolerance for achieving each commanded position. The ControLinks™ will normally drive the actuators to within 0.1 degree (default value) of the programmed curve. Applications that do not require 0.1 degree of accuracy can benefit from increasing the Actuator Deadband value which will reduce the amount of actuator dither/hunting and premature wear-out due to a noisy environment. Downloading the new Actuator Deadband and Hysteresis values will cause the controller to reset and the new values will be written into nonvolatile memory. Note: Setting the Actuator Deadband to a value other than 0.1 degree will disable 0.1 degree positioning commands when commissioning the curve. To maintain accuracy during commissioning it is recommended to change the actuator deadband to 0.1 degrees then back to the previous setting when finished.

Procedure:

See Fig. 33 to 36.

1. Save the profile curve and Config Info if not already saved.
2. On the Home page, click the "Modify Factory Default Values" button.
3. Read the Warning screen then click the "OK" button.
4. Reset the ControLinks.
5. Click the "Connect" button and wait for the ControLinks to connect with ZM7999.
6. Select the "Modify Factory Default Values" button.
7. Wait for the current values to be read from the ControLinks.
8. Note that the current values are displayed on the left half of the screen and the new values to be downloaded are displayed on the right half of the screen.
9. Use the drop down combo boxes to select the desired Firing Rate Hysteresis and Actuator Deadband values.
10. Click the "Download New Hysteresis and Deadband Values" button.
11. Verify that the download was successful. (See figure 4 for an example).
12. Click the "Exit Program" button to reset the ControLinks™ and exit ZM7999.
13. The ControLinks™ will start operating using the new values.

Fig. 33. ZM7999 Home Page.

Fig. 34. Warning.
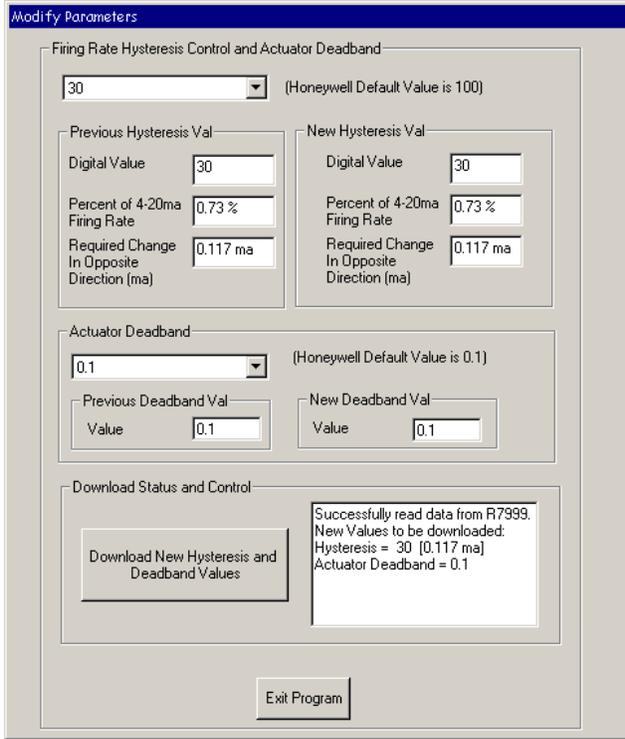
Fig. 35. Firing Rate Hysteresis and Actuator Deadband.
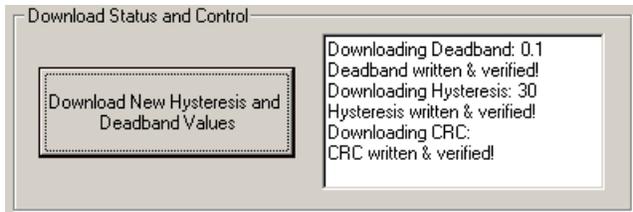
Fig. 36. Successful download.

NOTE: If the ControLinks™ stops responding after writing the new values and is in Factory Test mode (all LED's are on), attempt to re-write the values using the procedure above. If Commissioning or Monitoring are attempted and a message asking if you want to reset the ControLinks™ to the Factory Default Values appears, (Fig. 37), select "No" then attempt to re-write the values using the procedure above. If this does not cause the ControLinks™ to operate properly then it is necessary to completely re-commission the ControLinks™. Select "Yes" to the "Reset to Factory Default Values?" message. All factory default values will be loaded and all old data will be cleared. Commission the actuators then load your saved profile curve.

Fig. 37. Factory Test Mode.

Comm Ports:

Some computers do not have comm ports or the comm ports are being used by other devices, so a USB to Comm Port adapter needs to be installed. Follow the manufacturer instructions, then write down the Comm Port number it was installed as. It should get installed in the first available comm port but may not be if several attempts were made to install a USB to Comm Port adapter. To find out which comm port the adapter is, use the Device Manager, which is a Windows Hardware utility typically located in the Control Panel - System Properties - Hardware tab - Ports. The Comm Port number may be changed manually in the Advanced Properties of the Comm Port.

Fig. 38. PC Comm Port Selection.

OPERATING PROCEDURES

This section describes procedures for the various operations you will have to perform when using the ZM7999 ControoLinks™ Software Configuration Tool to commission a burner.

The ZM7999 works like a wizard. As you progress through the screens, use this section to answer specific questions as to how to perform required actions.

The process of commissioning a system is described in detail in "Creating an Air/Fuel Ratio Profile - Example."

How to Change the System Password

To change the system password, proceed as follows:

1. Enter the current password in the *Commissioning Password* field. (The factory default password is "password".)
2. Press *Connect*. The system must be connected in order to change the password.
3. Enter a new password in the *New Password* field.

NOTE: Your new password requires a minimum of four (4) characters and a maximum of 15 characters.

4. Press *Change Password*.
5. Return to the *Commissioning Password* field and enter your new password to proceed.

NOTE: The password is not case sensitive. Make sure you write down your new password before you press *Change Password*. Once you have pressed this button you cannot enter the system without the password.

How to Connect to the PC Comm Port

To connect to the PC communications port, proceed as follows:

1. Refer to your PC manual to determine the location of your communications ports.
2. Connect the RS232 to RS485 conversion cable from the R7999 to the appropriate communications port of your PC.
3. Enter your password in the *Commissioning Password* field. (The factory default password is "password.")
4. Press the appropriate radio button (*COM 1, COM2*, etc.) on the *Connect to Fuel/Air Controller* screen.
5. Press *Connect*. If you selected the correct communications port and the R7999 is properly connected, you will see the word "Connected" displayed next to the *Connect* button.

If you get an error while connecting, refer to Troubleshooting.

How To Set the Actuator Maximum Open/Closed Positions

To set the maximum open and closed positions for the actuator, proceed as follows:

1. Look at the open and closed positions displayed on the screen. (If no number is displayed, press *Open* or *Close* so that a number is displayed.)
Typically the position of one maximum is closer to its end point than the other. For example, the open position reading might be "85.3 Degrees" and the closed position reading might be "40.2 Degrees". Since the actuator will be fully open at approximately 100 degrees, it will take less time to move it to its maximum open position than its maximum closed position. You will note that the readings are initially in percentage of potentiometer travel.

NOTE: The system must exhibit at least 15 degrees of travel from open to closed.

2. Press *Auto Seek Open* or *Auto Seek Closed* based on your observation in Step 1. The controller automatically opens (or closes) the actuator to its maximum open (or closed) value.
3. When the actuator has been driven to is maximum position, visually verify its position and use the *Open* or *Close* buttons to manually adjust the maximum position if necessary. Press the *Lock Position* button for the endpoint once the appropriate position has been achieved and verified.
4. Repeat Steps 2 and 3 for the other maximum position.
5. When the maximum open and closed values are set where you want them and you have pressed *Lock Position* buttons for both positions, the *Next* button will be available.
6. Press the *Next* button. This will return you to the *Select Base Configuration* screen to configure another actuator. After all actuators are configured, press the *Next* button again to display the *Create Fuel Ratio Curve* screen.

How to Verify the Profile -- Walking the Curve

'Walking the Curve' means to verify the profile you have just completed. You can 'walk' a partial curve, however, you must have successfully entered minimum and maximum modulation points and one additional point, such as light off or an intermediate point. If you modify a point on a profile you must 'walk' the section of the curve connecting the new point to points that have already been verified (walked).

To walk the curve:

1. Position the cursor at one end of the profile that needs to be verified.
2. Press either the *Move to Next Higher Position* button or the *Move to Next Lower Position* button.

As you reach a new point, the line changes color (red to blue). To verify the transition lines between points (or points themselves), you should allow sufficient time for the combustion system to stabilize before accepting the fuel/air and FGR ratios.

After each point move, carefully monitor the oxygen sensor for unsafe conditions or inefficient combustion. Make adjustments to the curve shape or add points as necessary. When you have completely walked the curve, the entire profile is one color and the *Finish* button is operational.

How to Delete a Position on the Profile

Points on the curve can be deleted individually. For example if you want a new fuel/FGR mixture at a predefined air point, simply position the actuators near the point of interest (until the *Delete Point* button is highlighted), and pressing *Delete Point*. Pressing this button removes all data relative to the point of interest. If you want to add a new point between two existing points (and it is not on the existing curve), move the cursor to the appropriate stop and add the new point by pressing the *Intermediate* button.

If you decide the entire curve you created is not usable, press *Delete All Positions* button. This will clear the display and let you start over.

How to Load an Existing Profile

If you are responsible for commissioning a number of burner systems with similar characteristics, you may want to create and save one profile and then load it when you commission another system. (Or you may want to save the current profile so that you have a copy of it in case an actuator or another part of the system needs to be changed out. You may still have to modify points, and you WILL have to walk the curve to verify operation, but it will save you time.)

To load an existing profile from your PC:

1. Press *Load Profile* on the Create Profile screen.
2. Navigate to the directory where you saved the profile.
3. Highlight the file and press the *OK* button on the *File Open* window.

The curve will be displayed on the graph in the color that indicates it must be verified.

CREATING AN AIR/FUEL RATIO PROFILE - EXAMPLE

The steps required to commission a burner depends on the complexity of the system. A single fuel system without an FGR will require fewer steps than a system with an FGR or a dual fuel system with an FGR.

So that you understand the basic steps required to commission a system, you should review the following example *before* you attempt to commission a live system.

During commissioning, you must monitor the combustion process with an oxygen meter to verify save operation as you commission the system.

Flat Line FGR Wizard

The Flat Line FGR Wizard is supported only with version 1.3 or greater of R7999 ControLinks™ controllers.

The Create/Modify Profile screen includes a Flat Line Wizard to help you set points for the FGR that are precisely flat line with respect to an existing point to the right or left of the current position.

As you position the cursor on the profile , the discrete segments of the Wizard are highlighted to indicate what condition exists and inform you of the steps required to create an FGR actuator flat line segment. Refer to the following description and examples. See Fig. 33 and Table 3.

WHEN HIGHLIGHTED, INDICATES THE **FGR** ACTUATOR IS **ABOVE** A **FLAT LINE** CONDITION WITH RESPECT TO THE NEAREST POINT TO THE LEFT OF CURRENT **FGR** POSITION.

WHEN HIGHLIGHTED, INDICATES THE **FGR** ACTUATOR IS **AT** A **FLAT LINE** CONDITION WITH RESPECT TO THE NEAREST POINT TO THE LEFT OF CURRENT **FGR** POSITION.

WHEN HIGHLIGHTED, INDICATES THE **FGR** ACTUATOR IS **BELOW** A **FLAT LINE** CONDITION WITH RESPECT TO THE NEAREST POINT TO THE LEFT OF CURRENT **FGR** POSITION.

WHEN HIGHLIGHTED, INDICATES THE **FGR** ACTUATOR IS **ABOVE** A **FLAT LINE** CONDITION WITH RESPECT TO THE NEAREST POINT TO THE RIGHT OF CURRENT **FGR** POSITION.

WHEN HIGHLIGHTED, INDICATES THE **FGR** ACTUATOR IS **AT** A **FLAT LINE** CONDITION WITH RESPECT TO THE NEAREST POINT TO THE RIGHT OF CURRENT **FGR** POSITION.

WHEN HIGHLIGHTED, INDICATES THE **FGR** ACTUATOR IS **BELOW** A **FLAT LINE** CONDITION WITH RESPECT TO THE NEAREST POINT TO THE RIGHT OF CURRENT **FGR** POSITION. M17928

Fig. 39. FGR Flat Line Wizard symbols and meanings.

Table 3. Examples of Flat Line Wizard displays .

Symbol	Meaning
M17929	The FGR actuator is above Flat Line with respect to the nearest point to the left. You would need to close the FGR actuator to reach the Flat Line condition shown next. No programmed point exists to the right. .
M17930	The FGR actuator is at a Flat Line position with respect to the nearest programmed point to the left. No programmed exist to the right.
M17931	The FGR actuator is below Flat Line with respect to the nearest programmed point to the left and above Flat Line with respect to the nearest programmed point to the right. You would need to close the FGR actuator to achieve Flat Line with respect to the left point and open the FGR actuator to achieve Flat Line with respect to the nearest programmed point to the right.
M17932	The FGR actuator is at Flat line position with respect to the nearest programmed point to the left and to the nearest programmed point to the right. No further adjustment, open or closed, is necessary to enter a Flat Line point with respect to the closest programmed points to the left and right of the current position.
M17933	The FGR actuator is above Flat Line with respect to the nearest programmed point to the left and above Flat Line with respect to the nearest point to the right. You would need to close the FGR actuator to achieve Flat Line with respect to the right point and/or close the FGR actuator to achieve Flat Line with respect to the nearest programmed point to the left.
M17934	The FGR actuator is above Flat Line with respect to the nearest point to the right. You would need to close the FGR actuator to react the Flat Line condition. No programmed point exists to the left.
M17935	The FGR actuator is below Flat Line with respect to the nearest point to the right. You would need to open the FGR actuator to reach the Flat Line condition. No programmed point exists to the left.
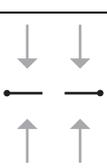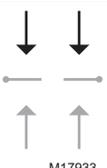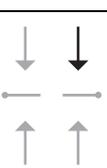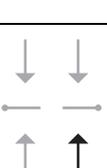
A7999 Portable Combustion Analyzer

The Honeywell A7999 Portable Combustion Analyzer can be used with the R7999 ControlLinks™ System. During the commission process, the A7999 can be used to monitor the burner combustion parameters. By using the 32004354-001 Port Expander, the A7999 combustion parameters can be displayed during the commissioning process as the fuel air

curve is being built. To access the A7999 parameters, click on the Analyzer button and a screen will open (Combustion Analyzer Information). The screen is similar to the screen that is displayed on the analyzer. This screen is only active during the commissioning process.

Table 4. A7999 Combustion Analyzer Information Screen Description.

Screen Display	Definition
O2 Concentration	% Oxygen reading multiplied by a factor of ten.
CO2 Concentration	% Carbon Dioxide reading multiplied by a factor of ten.
Air Temperature	Room/Primary-Air temperature.
(--------)	Rotating bar indicates A7999 is active and sampling. Static bar indicates A7999 is inactive and not sampling.
CO Concentration	PPM carbon monoxide reading referenced to O2.
NO Concentration	PPM Nitric Oxide reading that is referenced to O2.
Stack Temperature	Stack temperature.

The following screens will be displayed during the commissioning process:

Warming Up Hold (Fig. 34): The A7999 is going through self-diagnostic startup, which takes 60 seconds. This is a normal screen.

Fig. 40. Warming up hold.

Warming Up Hold (Fig. 35): The A7999 is in a hold mode and waiting for data to be transmitted. This is a normal screen.

Fig. 41. Hold.

Run (Fig. 36): The A7999 is processing data. In the lower lefthand corner is a rotating bar. This means that the A7999 is active.
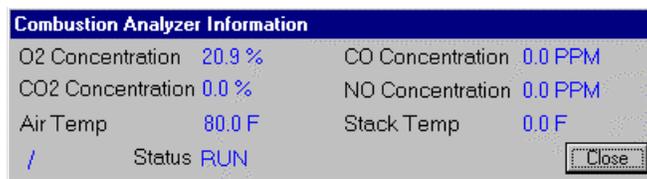
Fig. 42. Run.

Off-Line (Fig. 37): The A7999 is not communicating with the ZM7999 Configuration Tool. Check for proper wiring connections.
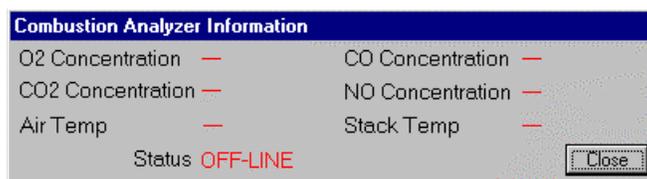
Fig. 43. Off-Line.

Low-Battery (Fig. 38): The A7999 is indicating the battery power is low. Replace the batteries.

Fig. 44. Low Battery.

TROUBLESHOOTING

Burner Control Locks Out Due to Loss of Air Flow Switch.

- The R7999 ControLinks™ Controller has a preset of 25% air position/0% fuel for the initial lightoff point. Depending on the air damper topology, this may not provide enough airflow to maintain the air flow switch and cause the burner control to lock out. The R7999 is still functional at this time even though the burner control is locked out. Therefore, before resetting the burner control and restarting the light off process, you should first set a new temporary light off point to a higher airflow value to prevent the air flow switch from dropping out. The next time through the sequence, the new higher light off point may allow the air flow switch to be maintained or you will have to repeat the process, i.e., move the light off point air value to a more open value such that the new point can maintain the air flow switch.

Purge Setting Beyond Maximum Modulation Point.

- A finished profile requires the purge position to be lower than the maximum modulation. If you encounter a condition where you are required to place the maximum modulation point below the current purge setting, you must first move the purge point to a lower position. The purge position can be moved at any time by reselecting the *Air Purge* button in the *Save Position* command window.

Cannot Establish Communications.

- Beyond the difficulties associated with communications polarity wiring errors, RS232 to RS485 converter problems, and lack of power to the devices (RS232 converter or R7999), there are several subtle system errors that preclude communications. All of the errors are indicated by the green LED and red Lockout LED being continuously "on." Fuel select problems after power up are indicated with all LED's being "on" continuously.

a. If no fuel select inputs are on, or both fuel selects are made, you cannot establish communications with the controller. The corrective action is to select one of the fuels or remove one of the fuel select inputs.

b. R7999 is in a locked out state. The corrective action is to first reset the control. If that does not work, you must remove the fault.

c. If the Fuel Air Commissioning Tool was aborted due to a PC operating system fault or ZM operating system fault, the ZM7999 software may have been improperly shut down and the program may still be running even though there is no indication on the screen. Press "CTRL-ALT-DEL". This brings up the Task Manager. Select "End Task" for any occurrence of the Fuel Air Commissioning Tool before you start another session of Fuel Air Commissioning Tool.

d. If the communications port settings are at the low setting, you can experience connect/disconnection problems. To check the communications port settings, the following steps get you to the proper screen(s). Double click on My Computer. Double click on Control Panel. Double click on System. Click on Device Manager. Double click on Ports (COM & LPT1). Double click on comm port (could be COM 1-4). Double click on port settings. Click on advanced settings. This screen displays the Receive Buffer and Transmit Buffer settings. Move the slide bars up to the high settings. Click OK to verify the new settings.

Unable to Land on a Predefined Point

- Under unique actuator loading conditions, it may be difficult to land on an existing programmed point. This can occur while using the "Move Along the Curve" command. it can also occur when you are completing the curve verification process on extremely flat or steep line segments as you reach the end of the curve. If you ar experiencing problems, back up from the problem point at least 5 degrees, then move back to the point using a 3-degree, 1-degree or 0.1-degree movement. This should allow you to complete your curve verification or land on a problem point for deletion.

Password no Longer Valid

- Bringing a system to an unconfigured state utilizing the ZM7999 tool wipes out your custom password and returns the system password to "password". Enter a new password.

Fault Code Retrieval

The R7999 incorporates two methods to retrieve fault information.

- Press and hold the reset button. The fault code is indicated by the blinks and flashes of the LED. All codes are two digits. The 10's digit is indicated by a series of slow blinks while the 1's digit is indicated by a series of short flashes after the slow 10's digit. For example, 64 is made up of six slow blinks followed by four fast flashes. The cadence is repeated as long as the user holds the reset button. The device will not reset by the action of the reset switch once it enters the flash mode. To reset the R7999, push and release the reset button within one second.
- Read the code directly from the Monitor screen of the ZM7999.

Click here for a list of <u>Fault Codes and Actions</u>.

Click here for <u>LED Status Panel Blink Patterns</u>.

R7999 OUTPUTS AND INPUTS

The current state of the R7999 outputs and inputs are displayed on both the Create/Modify Profile Curve screen and the Monitor screen for convenience and diagnostics purposes. The inputs and outputs are defined as follows:.

Table 5. Outputs.

Abbreviation	Description	Meaning when ON
LCO	Limit Control Output	Limits are satisfied and demand exits. The R7999 is operational and able to move all actuators.
HFP	High Fire Proved	The R7999 has moved the actuators to the Purge position.

Table 5. Outputs. (Continued)

Abbreviation	Description	Meaning when ON
LFP	Low Fire Proved	The R7999 has moved the actuators to the Light Off position.
FS1	Fuel Select Channel 1	Fuel 1 is selected.
FS2	Fuel Select Channel 2	Fuel 2 is selected.
ALM	Alarm	The system is in an alarm state.

Table 6. Inputs.

Abbreviation	Description	Meaning when ON
LCI	Limit Control Input	Limits are satisfied and demand is present.
HF	High Fire Input	R7999 is being commanded to drive actuators to the Purge position.
LF	Low Fire Input	R7999 is being commanded to drive actuators to the Light Off position
MV	Main Valve Input	The main valve input is active. Normally only active during "Run," and transitional with LF during light off.

R7999 FAULT CODES AND CORRECTIVE ACTIONS

The R7999 incorporates two methods to retrieve fault information:

• Press and hold the reset button. The fault code is indicated by the blinks of the LED. All codes are two digits. The 10's digit is indicated by a series of slow blinks while the 1's digit is indicated by a series of short blinks following the slow ten's digit. For example, 64 is made up of six slow blinks followed by four fast blinks. The cadence is repeated as long as you hold the reset button. The device will not reset by the action of the reset switch once it enters the flash mode. To reset the R7999, push and release the reset button within one second.
• Read the code directly from theMonitor screen of the ZM7999..

Table 7. Fault Codes and Corrective Actions.

Fault/ Blink Code	Description	Corrective Action
11	Device is operating properly.	
13	MV input energized at an improper time.	Reset control. Check Burner Control Interface wiring and correct error. This error causes the device to remain in initiate state at power up.
14	HF and LF are energized at the same time.	Reset control. Check Burner Control Interface wiring and correct error. This error causes the device to remain in initiate state at power up.
15	Transition to the requested Burner Control input state is not allowed from the current state. E.g., Standby to Modulate is not allowed.	Check wiring to burner control and/or burner control operation. NOTE: Moving a RM78XX Run/Test switch to Test will Induce this fault during commissioning mode.
21	Internal Error - Time base.	Reset Control[a].
22	Internal Error - KEY decode .	Reset Control[a].
23	Internal Error - Rdlow.	Reset Control[a].
24	Internal Error - Time storage.	Reset Control[a].
25	Internal Error – Limited move.	Reset Control[a,c].
26	Internal Error – Targeted move.	Reset Control[a,c].
27	Internal Error- LVD.	Reset Control[a].
28	Internal Error- ISR check.	Reset Control[a].
31	Internal Fault- A2D Range.	Reset Control[a].
32	Internal Fault – A2D Matching.	Reset Control[a].
33	Internal Fault - LCO Drive.	Reset Control[b].

Table 7. Fault Codes and Corrective Actions. (Continued)

Fault/ Blink Code	Description	Corrective Action
34	Internal Fault – LCO/I Feedback.	1.) Reset Control[b]. Check actuator wiring. See Channel LED for actuator. 2.) Terminal 14 has voltage present from an external source, correct wiring problem. 3.) [d].
35	Internal Fault – Commanded State.	Reset Control[a].
36	Fuel Selection Problem.	Check wiring through fuel select switch, at least one fuel must be selected at any given time (not zero, not two).
37	Fault HFP or LFP output.	Verify correct wiring to burner control. Specifically check wiring at LFP and HFP.
38	Internal Fault – memory curve.	Reset control[a].
39	Internal Fault – AC sampling .	Reset control[b].
41	Feedback potentiometer Interface circuit fault - Air.	Verify correct wiring of Potentiometer[a].
42	Feedback potentiometer Interface circuit fault – Fuel 1.	Verify correct wiring of Potentiometer[a].
43	Feedback potentiometer Interface circuit fault – Fuel 2.	Verify correct wiring of Potentiometer[a].
44	Feedback potentiometer Interface circuit fault – FGR.	Verify correct wiring of Potentiometer[a].
45	Feedback potentiometer wiper resistance problem, Air.	Check for loose potentiometer wiring[a,c].
46	Feedback potentiometer wiper resistance problem, Fuel 1.	Check for loose potentiometer wiring[a,c].
47	Feedback potentiometer wiper resistance problem, Fuel 2.	Check for loose potentiometer wiring[a,c].
48	Feedback potentiometer wiper resistance problem, FGR.	Check for loose potentiometer wiring[a,c].
49	Feedback potentiometer total resistance problem, Air.	Check for loose potentiometer wiring[a,c].
51	Feedback potentiometer total resistance problem, Fuel 1.	Check for loose potentiometer wiring[a,c].
52	Feedback potentiometer total resistance problem, Fuel 2.	Check for loose potentiometer wiring[a,c].
53	Feedback potentiometer total resistance problem, FGR.	Check for loose potentiometer wiring[a,c].
54	Internal memory function problem, Air.	Repeat actuator ID On-line process.
55	Internal memory function problem, Fuel 1.	Repeat actuator ID on-line process.
56	Internal memory function problem, Fuel 2.	Repeat actuator ID on-line process.
57	Internal memory function problem, FGR.	Repeat actuator ID on-line process.
58	Stuck Reset button.	Turn off remote reset switch. Check operation of controller button.
61	Actuators not reaching light off point.	Check for actuator wiring problems or stuck valves/dampers. Place controller in standby and use actuator manual keys to verify actuator travel.
65	Internal Memory fault.	Reset control[a].
66	Internal Initialization Error.	Reset control[a]. Check the wiring and range capability for both the CmA+- input and XmA+- input (if configured).
67	Fuel Actuator off curve (selected fuel type).	Check for stuck fuel actuator and/or proper shielding on actuator interface.

Table 7. Fault Codes and Corrective Actions. (Continued)

Fault/ Blink Code	Description	Corrective Action
68	FGR Actuator off curve.	Check for stuck FGR actuator and/or proper shielding on actuator interface.
69	Air Actuator off curve.	Check for stuck Air actuator and/or proper shielding on actuator interface.
71	Verifies that the Air actuator accepted the off-line, on-line, move counterclockwise and move clockwise commands. Furthermore, all potentiometer tests must successfully passed to bring an actuator online.	Check wiring of actuator, verify correct ID is being used. Use Actuator LED to verify that the actuator that is being brought "online". A fast flash in the actuator equates to "off line" state while a 1 second flash equates to an "online" state.
72	Verifies that the Fuel 1 actuator accepted the off-line, on-line, move counterclockwise and move clockwise commands. Furthermore, all potentiometer tests must successfully passed to bring an actuator online.	Check wiring of actuator, verify correct ID is being used. Use Actuator LED to verify that the actuator that is being brought "online". A fast flash in the actuator equates to "off line" state while a 1 second flash equates to an "online" state.
73	Verifies that the Fuel 2 actuator accepted the, off-line, on-line, move counterclockwise and move clockwise commands. Furthermore, all potentiometer tests must successfully passed to bring an actuator online.	Check wiring of actuator, verify correct ID is being used. Use Actuator LED to verify that the actuator that is being brought "online". A fast flash in the actuator equates to "off line" state while a 1 second flash equates to an "online" state.
74	Verifies that the FGR actuator accepted the off-line, online, move counterclockwise and move clockwise commands. Furthermore, all potentiometer tests must successfully passed to bring an actuator online.	Check wiring of actuator, verify correct ID is being used. Use Actuator LED to verify that the actuator that is being brought "online". A fast flash in the actuator equates to "off line" state while a 1 second flash equates to an "online" state.
75	Internal memory fault.	Reset Control[a].
76	Internal check sum error.	Reset Control[a]
82	Actuator secondary fault.	Check Actuator wiring. See Channel LED for Actuator.
83	Air actuator non-responsive.	Check actuator wiring and stuck damper/valve[c].
84	Fuel 1 actuator non-responsive.	Check actuator wiring and stuck damper/valve[c].
85	Fuel 2 actuator non-responsive.	Check actuator wiring and stuck damper/valve[c].
86	FGR actuator non-responsive.	Check actuator wiring and stuck damper/valve[c].
87	Internal math error.	Reset Control[a].

Table 7. Fault Codes and Corrective Actions. (Continued)

Fault/ Blink Code	Description	Corrective Action
91	The 4 to 20 mA firing rate input is below 3 mA, Out of Range—Low. (Actuators return to or remain at the minimum modulation point with the alarm on; the control remains operational only to the extent that Minimum Modulation firing operation is allowed.) Not supported on Version 1.2 controllers.	Check CmA+- input (Terminals 39 and 40) for proper operation polarity and range. The input must be within 3.0 mA to 21.0 mA. The voltage at this terminal must be within 0.7 to 5.0 Vdc, respectively. Conditional Alarm—Alarm output is energized; controller continues to run.[e]
92	The manual potentiometer rate input is higher than an allowable range, i.e., Out of Range—High. (The actuators move to the maximum modulation point with alarm on, control will remain operable, yet when MANUAL MODE is selected, maximum modulation and alarm output shall occur.) Auto mode operation is **not** affected. Not supported on Version 1.2 controllers.	The manual potentiometer is out of range high. Make sure a 5000 ohm (±10%) potentiometer is being used and wiring to it is correct. Shielded cable is recommended. Conditional Alarm—Alarm output is energized; controller continues to run.[e]
93	The auxiliary 4 to 20 mA input must be below 3. mA when configured for use. (The actuators return or remain at the minimum modulation point with alarm on, the control will remain operable only to the extent that Minimum Modulation firing operation is allowed. Not supported on Version 1.2 controllers.	Check XmA+- input (Terminals 37 and 38) for proper operation polarity and range. The input must be within 3.0 mA to 21.0 mA. The voltage at this terminal must be within 0.7 to 5.0 Vdc, respectively. Conditional Alarm—Alarm output is energized; controller continues to run.[e]
94	After LCO is set by the R7999, the Burner Control must provide a Lightoff or Purge request within 20 seconds. (Controller remains in a processing demand condition indefinitely, waiting for valid inputs on the LF, MV and HF inputs; the alarm sounds after the 20-second period expires.) Not supported on Version 1.2 controllers.	Check burner control interface wiring and burner control operation (Terminals 10, 11, 12). The R7999 is waiting for a command via these terminals. Conditional Alarm—Alarm output is energized; controller continues to run.[e]

[a] It is possible that a random external electrical noise event has caused a fault checking algorithm to be detected. Resetting the control will allow recalculation of the fault and, provided it is not a hard failure, the device will continue to operate. If the condition will not clear, the control must be replaced.

[b] Check AC waveform, severe noise on AC lines can corrupt the sampling of AC signals.

[c] Verify actuator total resistance and wiper measurements, check the ability of the actuator to travel full stroke using the Manual override buttons within the actuator. Verify input power to the actuator. If actuator is not functioning, replace the actuator.

[d] Verify a short does not exist at terminal 14. The control will need replacement if a sustained fault code 34 exists after the noted items 1 and 2 have been performed. Fuse line voltage power to control system with type SC15 fuse or fuse Limit input (terminal 13) with type SC5 fuse.

[e] Conditional Alarm. Causes the alarm output to be energized. The system may still be operating but requires attention in order to modulate or to proceed with the light off sequence. The actuators would be positioned at light off point, minimum modulation point or maximum modulation point, dependent on what the particular fault is and when the fault is introduced relative to the R7999 operating state.

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