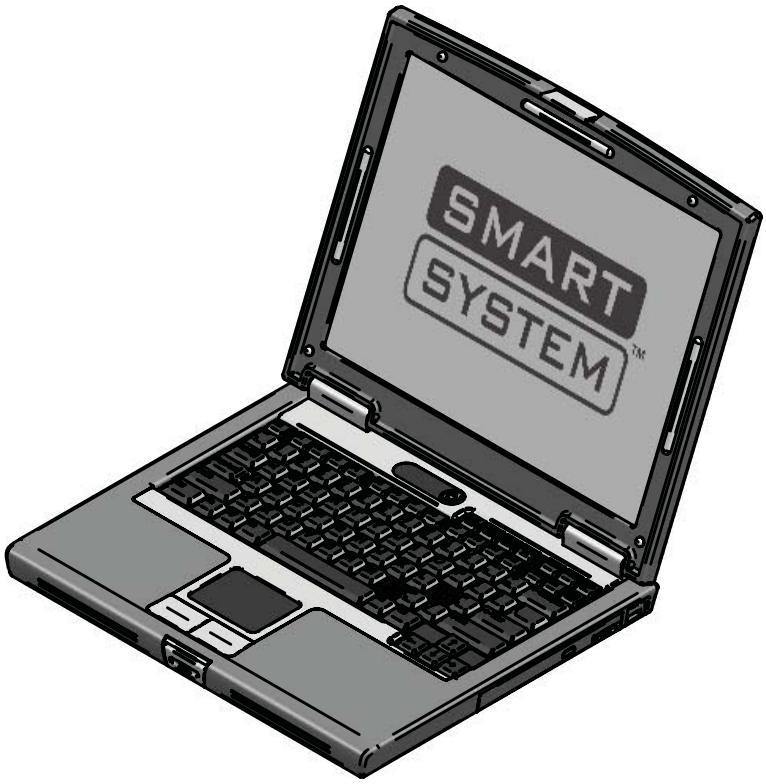
SMART SYSTEM™

PC PROGRAM INSTRUCTIONS

Models: Power-Fin, Knight, Knight XL, Knight Wall Mount and Armor



⚠ WARNING This manual must only be used by a qualified heating installer / service technician. Read all instructions, including this manual, the Installation and Operation Manuals, and the Service Manuals, before installing. Perform steps in the order given. Failure to comply could result in severe personal injury, death, or substantial property damage.

Save this manual for future reference.

Lochinvar®
High Efficiency Water Heaters, Boilers and Pool Heaters

Contents

1 Installation

Program installation

To begin installation of the program, please insert your Smart System CD into the CD drive. If you have Autostart enabled, the Smart System software screen will load. If not, navigate to your CD drive and double-click on **index.html**. Once the screen opens, select the program you wish to install. Follow the prompts then restart your computer.

If you wish to have the PC program icon on your desktop, click on **START**, and then **Programs**. Right click on **SMART SYSTEM PC**. Place the cursor over **Send to** >, and then click on **Desktop**. The icon will appear on the Desktop Screen.

USB installation

Your PC will communicate with the SMART SYSTEM control through the USB cable adapter combo included with your kit. Once connected to your PC, the adapter will install automatically provided the appropriate driver is present on your system. If the driver is not present, you will need to install one from the Smart System CD. To begin installation of the driver:

1. Disconnect the USB cable from the PC, and insert your Smart System CD, as above. This time, you will need to select **USB drivers**; this will begin the driver installation program. If you are prompted by Internet Explorer with "File Download – Security Warning…" please click **"Run"** and continue. If you receive an "Internet Explorer – Security Warning", please select **"Run"**.

2. The next message box confirms you are installing the USB drivers for the Lochinvar Smart System software; select **"Setup"**. You should receive confirmation that the drivers have been installed.

3. You are now ready to connect your USB adapter to your laptop. Once connected, you should see **"New Hardware Found"**, and depending on your version of windows, you may or may not be prompted to install software. If you are prompted, just select the defaults and allow the system to finalize installation of your new hardware. The installation file, *USB drivers.exe*, and the drivers, *USB drivers.zip*, can be found on the CD under the folder entitled **"Software"** if needed.

Program setup

The PC will assign a ComPort to your new adapter. You will need to know the ComPort number it uses in order to tell the Smart System PC program which one to communicate with:

1. Click on **Start**, then **Control Panel**, then on the **System** icon (use the Classic View), then on the **Hardware** tab, and then on the **Device Manager** button. You will see a list of the hardware on your PC.

2. Double click on **"Ports (COM&LPT)"**. You will see an entry called **"USB Serial Port (COM4)"**. The ComPort number may be different on your computer but the device description will be the same. The Smart System PC program can communicate through Comports 1 – 4 on the Power-fin models and Comports 1 – 8 on all of the other models. If the Comport assigned by your computer is a value larger than what's available in the Smart System PC program, you will need to manually reassign the ComPort on your computer.

3. Go back to the **"Ports (COM&LPT)"** area referenced above and take note of any unused ComPort between COM1 to COM4 on the Power-fin models and between COM1 to COM8 on all of the other models. Double click on the **"USB Serial Port"**.

4. Click on the **"Port Settings"** tab, then on the **"Advanced"** button. Select an unused Comport number (preferably COM1) in the range of COM1 to COM4 on the Power-fin models and between COM1 to COM8 on all of the other models. Click on **OK**. Click **OK** on the previous window and then close all of the other windows.

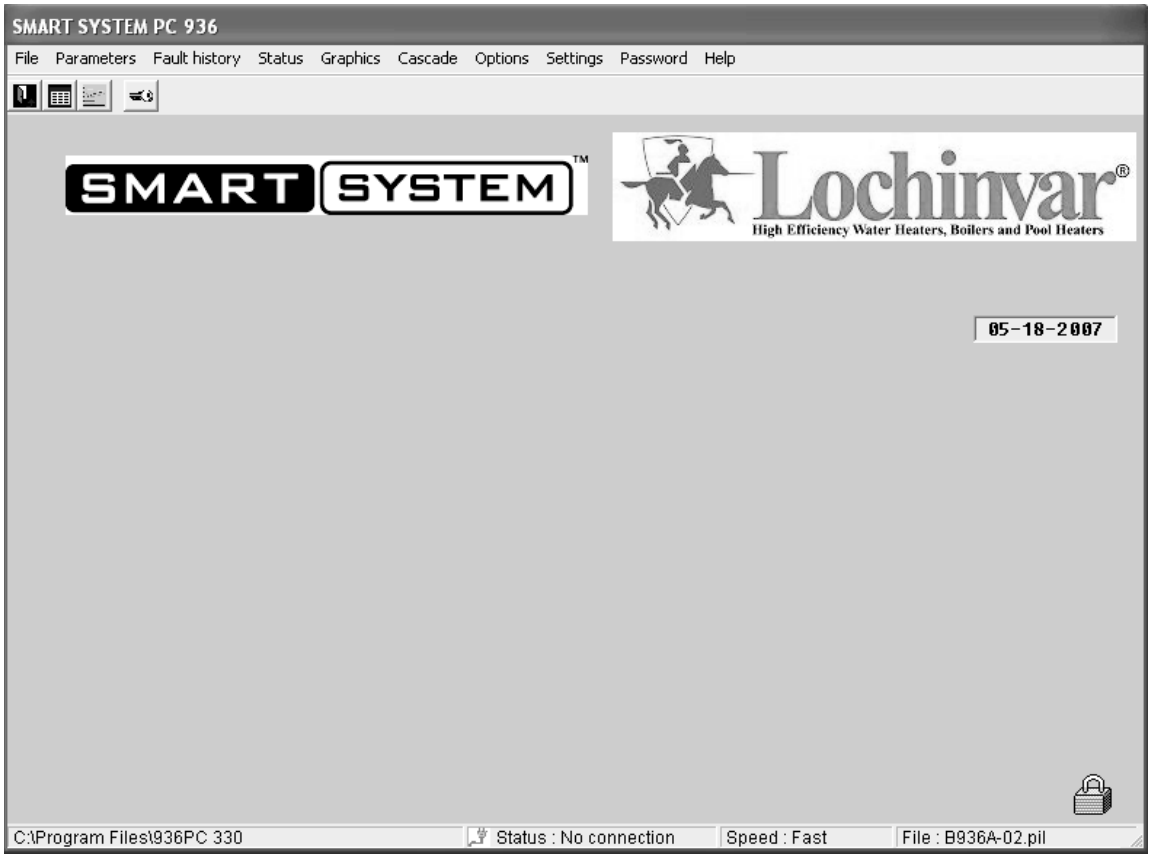
5. Restart your PC to make sure the new ComPort number is active. When you attach the USB cable to the PC, the PC should recognize the cable. The first time you start up the Smart System PC program, click on the **"Settings"** tab at the top of the screen, then click on **"Comport"**. Select the ComPort number assigned to the USB cable above.

The program displays temperatures in °F. If you wish to display temperatures in °C, click on the **Settings** tab along the top of the Main Screen window, and move the cursor over **Temperature** > in the pull-down menu. A new menu will appear, click on **Celsius**.

⚠ CAUTION DO NOT connect a phone line to the phone jack on the front display.

1 Installation

Figure 1-1_Main Screen



Starting the program

To start the program, double click on the icon (if you put it on your desktop), or click on **START**, then **Programs**, then **SMART SYSTEM PC**. See FIG. 1-1 on page 4.

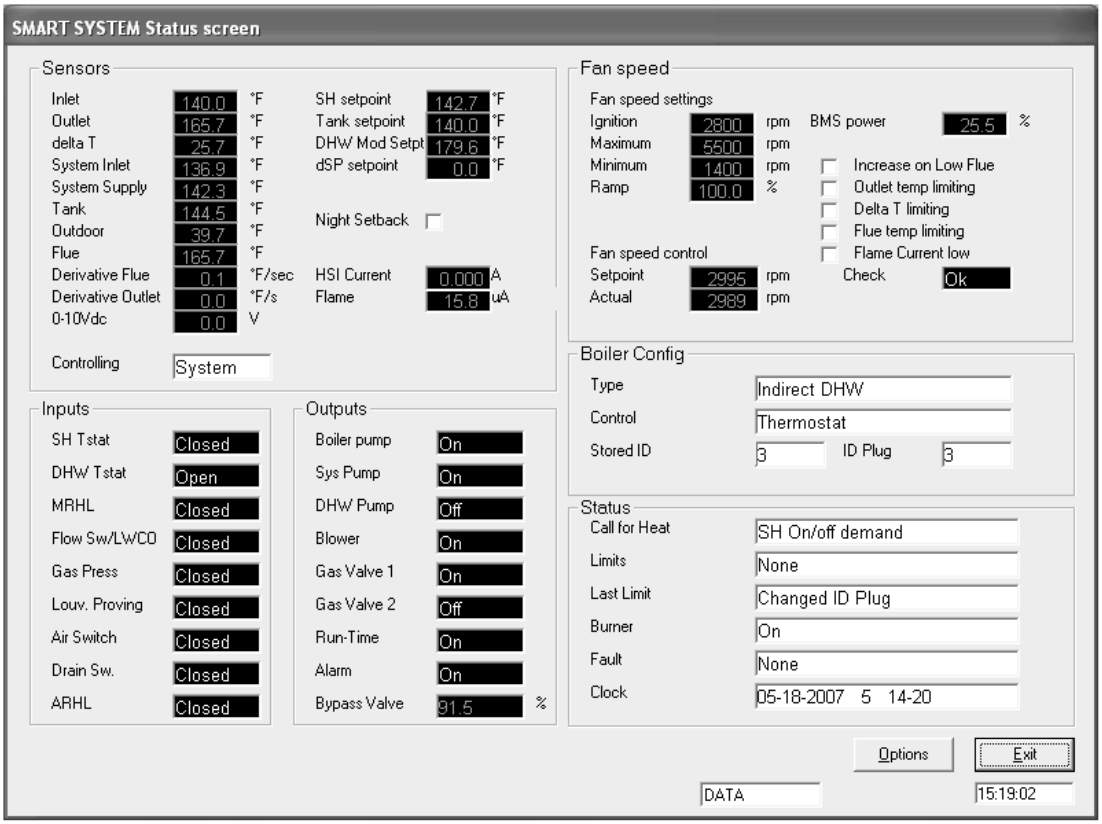
There are two access levels for this program. The user access level allows only certain settings to be changed. The installer access level allows more settings to be changed. The program defaults to the user level when started. You will notice that a lock symbol appears in the lower right-hand corner of the window. To move to the installer level, a password must be entered. This password is located on a label on the CD-ROM case. You may enter the password by clicking on the "key" button in the upper left-hand corner of the window. A window opens in which you can type in the password (see FIG. 1-2). Note that the password is case sensitive and is in all CAPS. Click on the **Ok** button, or press the **Enter** key. You will notice that the lock symbol at the lower right-hand corner of the window has changed into a key symbol.

There are some fields along the bottom of the window (FIG. 1-1): The left field shows the location of the program. The next field shows the status of the communication between the PC and the SMART SYSTEM. This will say "No connection" when the program is started. As soon as the program sends or receives data from the SMART SYSTEM, this field will show "Connected". The right field shows the filename of the parameter file in the program's memory (see the following parameters).

Figure 1-2_Password Window

2 SMART SYSTEM Status screen

Figure 2-1_SMART SYSTEM Status Screen



To monitor and record the operation of the heater, click on the **Status** tab along the top of the Main Screen window (FIG. 1-1, page 4). The SMART SYSTEM Status Screen will appear (see FIG. 2-1 above). The screen is divided into several sections.

The Sensors section displays the current temperatures seen by the Inlet, Outlet, System Inlet, System Outlet, Tank, Outdoor, and Flue sensors. It also shows the delta T across the heat exchanger and the voltage being applied to the 0-10Vdc input (FIG. 2-1). The controlling sensor is shown below the items mentioned above. The default controlling sensor is the Outlet sensor. If a System Supply sensor is connected, the control will automatically use it as the controlling sensor.

The SMART SYSTEM can be programmed to use the Inlet sensor if desired. When so programmed, the Outlet sensor will be displayed for the first 3 minutes after the burner lights, and then the Inlet sensor will be displayed. **Power-fin Models Only:** If a System Return sensor is connected, the control will use it as the controlling sensor, and display its reading instead.

Below the temperature readings are Derivative Flue and Derivative Outlet. These show how quickly these temperatures are changing. The control will take certain actions based on these values. For instance, if the outlet temperature rises too quickly, the control will force the heater to run at low fire.

To the right of the sensor temperature readings are the various setpoints. The SH setpoint is the setpoint the SMART SYSTEM uses during a space heating call for heat. Note that this setpoint will depend upon the outdoor temperature if the outdoor air sensor is connected. When the 0-10Vdc input is used, this setpoint will vary with the input voltage if it is used to control the setpoint. The tank setpoint is the setpoint used when a Tank sensor is connected. The DHW Mod Setpt is the outlet temperature setpoint used when heating an indirect DHW tank. The dSP setpoint is used when the inlet sensor is programmed as the controlling sensor. Below these is a check box indicating if Night Setback is active or not. Finally, the HSI Current and Flame Current are shown.

Below the Sensors section is the Inputs section (FIG. 2-1). This section displays the status of the Enable (Room Thermostat) Input, DHW Thermostat, Manual Reset High Limit, Flow Switch/Low Water Cutoff (optional), Gas Pressure Switch (optional), Louver Proving Switch (optional), Air Pressure Switch, Blocked Drain Switch, and Auto Reset High Limit Switch.

Next to the Inputs section is the Outputs section (FIG. 2-1). This section shows the status of the Boiler (secondary) pump, System (primary) Pump, DHW Pump, Blower, Gas Valve (1), Run-time Contacts, and Alarm Contacts.

2 SMART SYSTEM Status screen

Power-fin Models Only: If a 3-way bypass valve is installed, the display will indicate how much of the flow is not bypassed. The Gas Valve 2 output is not used. At the top right of the window is the Fan Speed status information (FIG. 2-1). Included in the Fan Speed status are Min., Max., and Ignition fan speeds. If Ramp Delay is activated, the Ramp Delay limit is shown. The target and actual fan speeds are displayed, and if the actual speed is within acceptable limits. If the SMART SYSTEM is programmed to be controlled by a Building Management System (BMS), and programmed to have the BMS control the power from the boiler, then the percent of max. power is displayed. Finally, should select temperatures or the flame current approach certain limits, the SMART SYSTEM will force the fan speed up or down accordingly to prevent exceeding those limits. When this happens, the box next to the corresponding sensor is checked.

Below the Fan Speed status is the Boiler Configuration. This indicates the application to which the SMART SYSTEM is programmed to be used (water heater or boiler with indirect DHW), and the source of control (thermostat, BMS, or cascade depending on the model). The ID plug information is used in production to verify the correct programming of the control on Power-fin models.

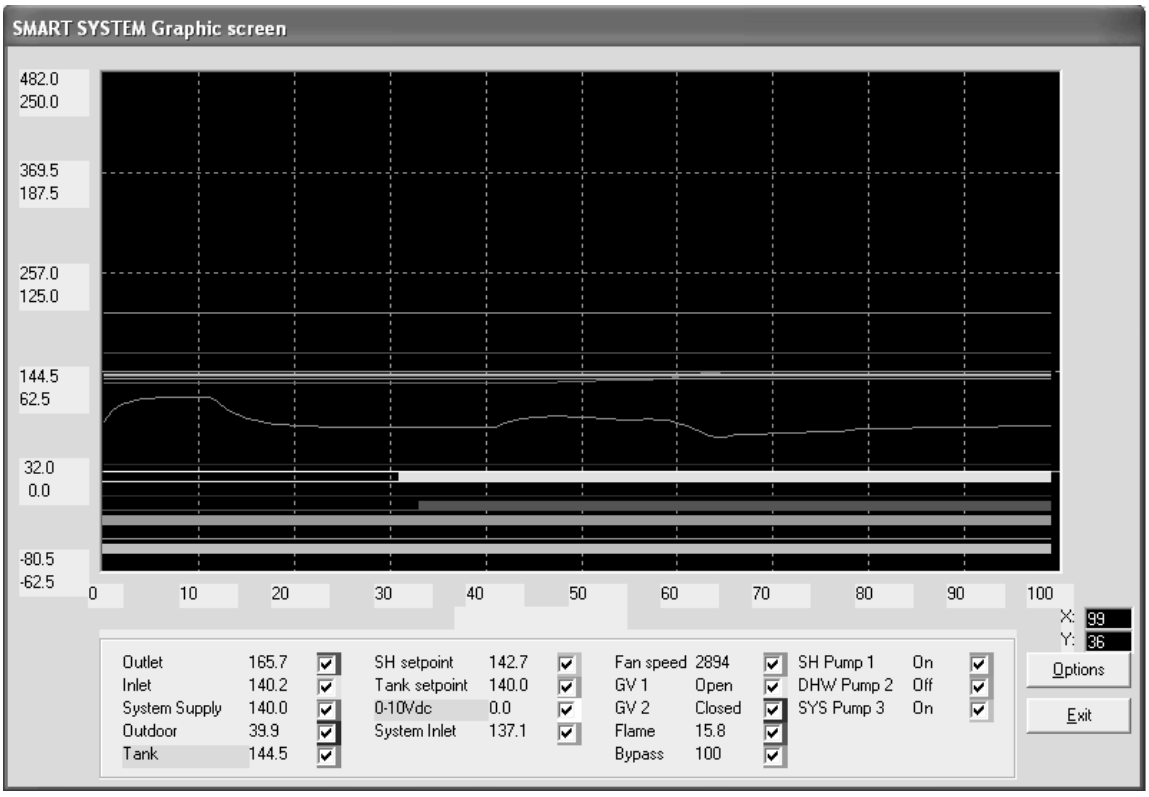
Finally, the General status of the boiler is shown. Included in the General status is the active call for heat (if any), the active limits (if any), the last active limit, the burner status, the last fault, and the date and time as stored in the SMART SYSTEM.

While in the SMART SYSTEM Status Screen, you can generate a log file of the readings as the heater operates. Click on the **Options** button at the bottom right-hand corner of the screen (FIG. 2-1). Press the **LogFile** button and define a log file name and the directory you want it to be located in. Click **OK**. When you want to start logging data, click the **Log** button. The **Log** button will turn green to indicate that it is logging. You will also notice the filename at the top of the window, and will see the size increase as data is logged to the file. To stop logging, click on the **Options** button, then click on the **Log** button again. The **Log** button will turn back to gray to indicate that logging has stopped. If you desire to log data over an extended period of time, you may want to select a longer Log every time so the log file doesn't grow too large.

You can also produce a bitmap of the window. Click on the **Options** button, then the **Bitmap** button. A bitmap of the window will be saved into the ENCONFLS directory below the directory in which the SMART SYSTEM program resides.

3 SMART SYSTEM Graphics screen

Figure 3-1_SMART SYSTEM Graphics Screen



The SMART SYSTEM Graphics Screen allows you to observe the changes in various readings while the heater operates (see FIG. 3-1). By default, the Outlet Temperature, Inlet Temperature, System Supply Temperature (if connected), Outdoor Temperature (if connected), Tank Sensor Temperature (if connected), Space Heating setpoint, Tank setpoint, 0-10Vdc input voltage, System Inlet Temperature (if connected), fan speed, and 3-way Bypass Valve are plotted.

Power-fin Models Only: In addition, the status of the Gas Valve Output, Flame Current, and Pump Outputs are indicated by horizontal lines. When these readings are off, the line is thin; when on, the line is wide. Any of these readings can be removed from the graph by deselecting them at the bottom of the window. The current values of these readings are also displayed at the bottom of the window as depicted in FIG. 3-1.

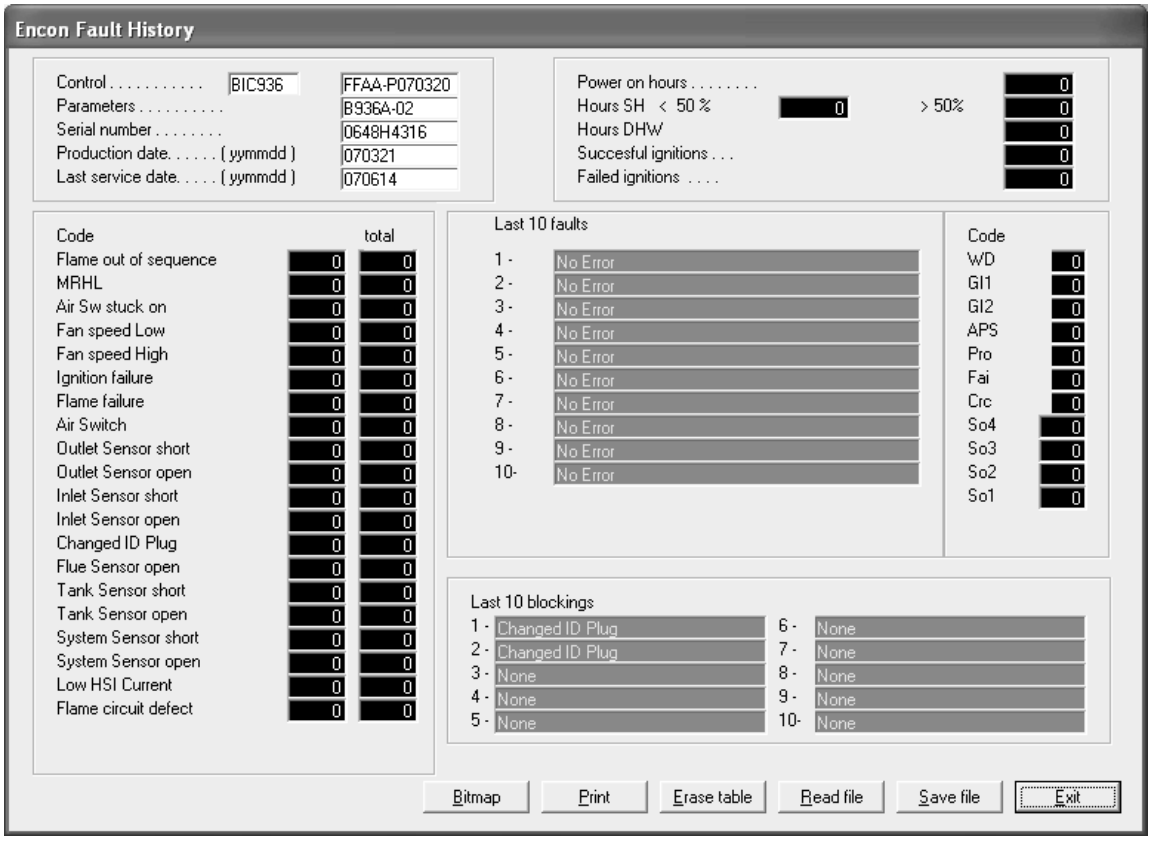
The time scale and vertical (Y) scale can be changed by clicking on the **Options** button to get the Options window, and then the **Up** or **Down** buttons for the desired scale. Note that the vertical scale has two numbers for each division. The top number represents °F, and the bottom number represents °C. Press the **Ok** button to close the Options window. The background color of the Graphics Screen can be changed by pressing the **Display** button on the Options window.

As with the SMART SYSTEM Status Screen, a log file can be generated to record the performance of the appliance. Click on the **Options** button to open the Options window. Click on the **LogFile** button to create a file name and define the folder in which to put it. Once a Log File is defined, click on the **Log** button to start logging the readings. The **Log** button will turn green to indicate that the program is logging, and the log file size will appear at the top of the Graphics Screen window. Note that the file size will increase as more readings are logged. Click on the **Log** button again to stop logging of the readings. The **Log** button will turn gray again to indicate that logging has stopped.

A bitmap can also be generated of the SMART SYSTEM Graphics Screen. Click on the **Options** button, and then the **Bitmap** button. A bitmap of the window will be saved into the C:/program files/SMART SYSTEM PC/enconfls directory.

4 SMART SYSTEM Fault history screen

Figure 4-1_Fault History Screen



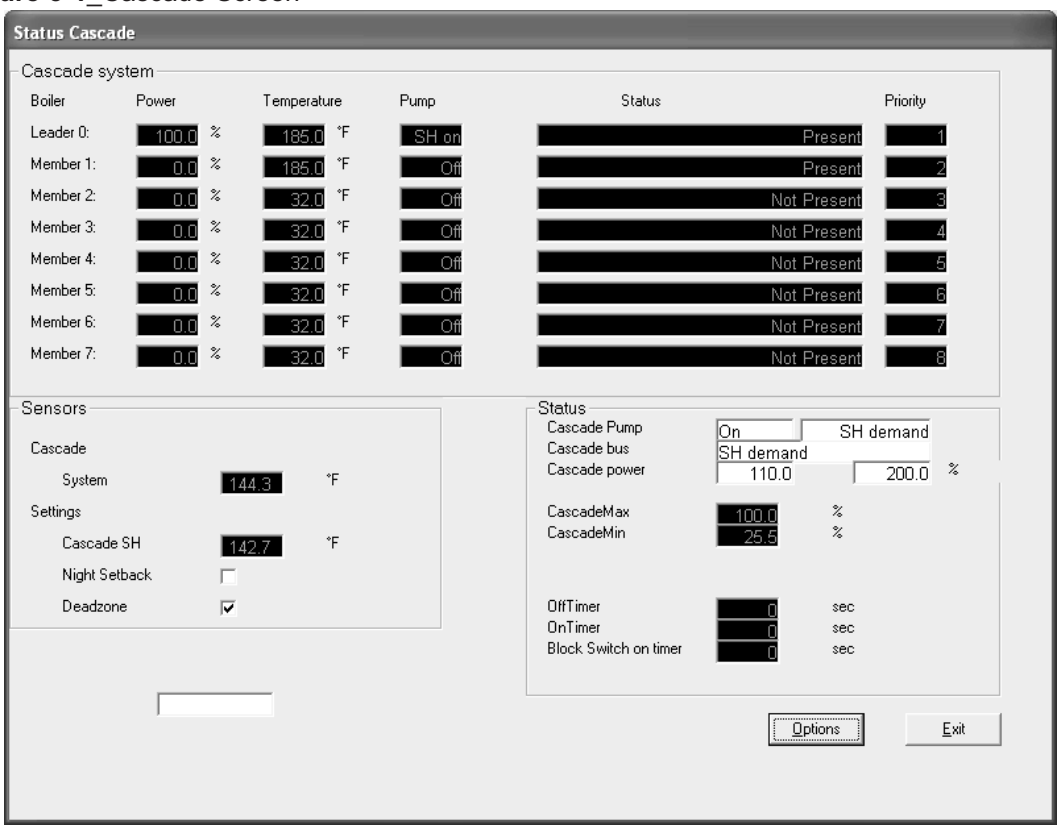
The Fault History Screen provides historical data about the operation of the SMART SYSTEM. Click on the **Fault history** button along the top of the Main Screen window (FIG. 1-1), and then click on **Read from Control** in the pull-down menu. After uploading data from the SMART SYSTEM, a window will appear with the status of numerous counters and lists of the most recent events (see FIG. 4-1 above). Included are details of the control board serial number, software version, default parameters, production date, and last service date. The number of times various faults have occurred is also shown. The last 10 faults are listed, as well as the last 10 blockings (a blocking is an event that causes the burner to shut off). In addition, the number of hours the control has operated in various states is shown, as well as the number of successful and failed ignition attempts. Finally, a count of internal checks is shown.

The total number of occurrences of certain faults are also stored in the control and shown on the left side of the screen. The column on the right shows the total occurrences since the control was built. The column on the left shows the total occurrences since the table was reset. Press the **Erase table** button at the bottom of the window to clear the totals in the column on the left. This will also clear the Last 10 faults and the Last 10 blockings.

Some of this information may be needed by a service technician to diagnose a problem, so provision is made to create a file in which to save this data. Click on **Save file**, and define a file name and the folder in which to save it. A bitmap can also be saved by clicking on the **Bitmap** button at the bottom of the Fault History Screen (FIG. 4-1). The bitmap file will be saved to the folder ENCONFLS located below the file in which the SMART SYSTEM program resides.

5 SMART SYSTEM Cascade screen

Figure 5-1_Cascade Screen



The Cascade Screen provides the status of the cascade system. The PC must be connected to the Leader (address 0) appliance. Click on the **Cascade** button along the top of the Main Screen window (FIG. 1-1).

The Cascade System area shows the power demand and setpoint, the boiler pump status, the boiler status, and the priority of each heater in the cascade. If a tank sensor (water heaters) or system supply sensor (boilers) is connected to the Leader heater, the cascade control will send a fixed setpoint of 215°F (102°C) (Power-fin boiler only); 185°F (85°C) (Knight boilers only) or a setpoint equal to the tank setpoint +27°F (15°C) (water heaters) and a power (% modulation) command to all the heaters as required to maintain the controlled temperature at the setpoint. On water heaters, if a tank sensor is not connected the Leader will control the cascade based on its inlet sensor. On boilers, if a system supply sensor is not connected (NOT recommended), the Leader will send the space heating setpoint to all of the boilers in the cascade and each boiler will fire as required to hold their outlet sensors to this setpoint.

The Priority column indicates the order in which the heaters will fire to meet the load. This order changes every hour during the first day of operation, and every 24 hours thereafter.

The Sensors area displays the system supply or tank sensor temperature, and space heating or tank setpoint (see FIG. 5-1).

Beneath this area is a check box indicating if Night Setback is active. Beneath that is a check box indicating if the Dead zone is active.

The Dead zone is active whenever the actual temperature is near the setpoint and the target modulation rate for the last boiler to fire is below its minimum firing rate. In this zone, the calculated total firing rate is held steady. Once the actual temperature goes too far above or below the setpoint, the total firing rate is adjusted accordingly.

The Status area displays several important parameters. The Cascade Pump gives the status of the system pump output, and the type of heat demand (Space Heating or DHW). The Cascade power shows the power target for the cascade, and the total power available. This target power may not be the same as the total power shown in the Cascade System area, due to the various time delays described below. The Cascade Max and Cascade Min values show the maximum and minimum fan speed percentages available in all of the heaters. The Off Timer and On Timer are used to force each boiler to have a minimum off and on time, to prevent short cycling. The Block Switch on the timer is started whenever a heater is commanded to start, and the next heater is prevented from starting until this timer times out. This allows time for the system supply or tank sensor to read the temperature change resulting from firing the last heater, before starting the next heater.

By clicking on the **Options** button, a log file can be defined, and logging can be started and stopped in the same way as with the Status and Graphics Screens previously described. A bitmap of the current screen can also be saved if desired.

6 Power-fin Parameters

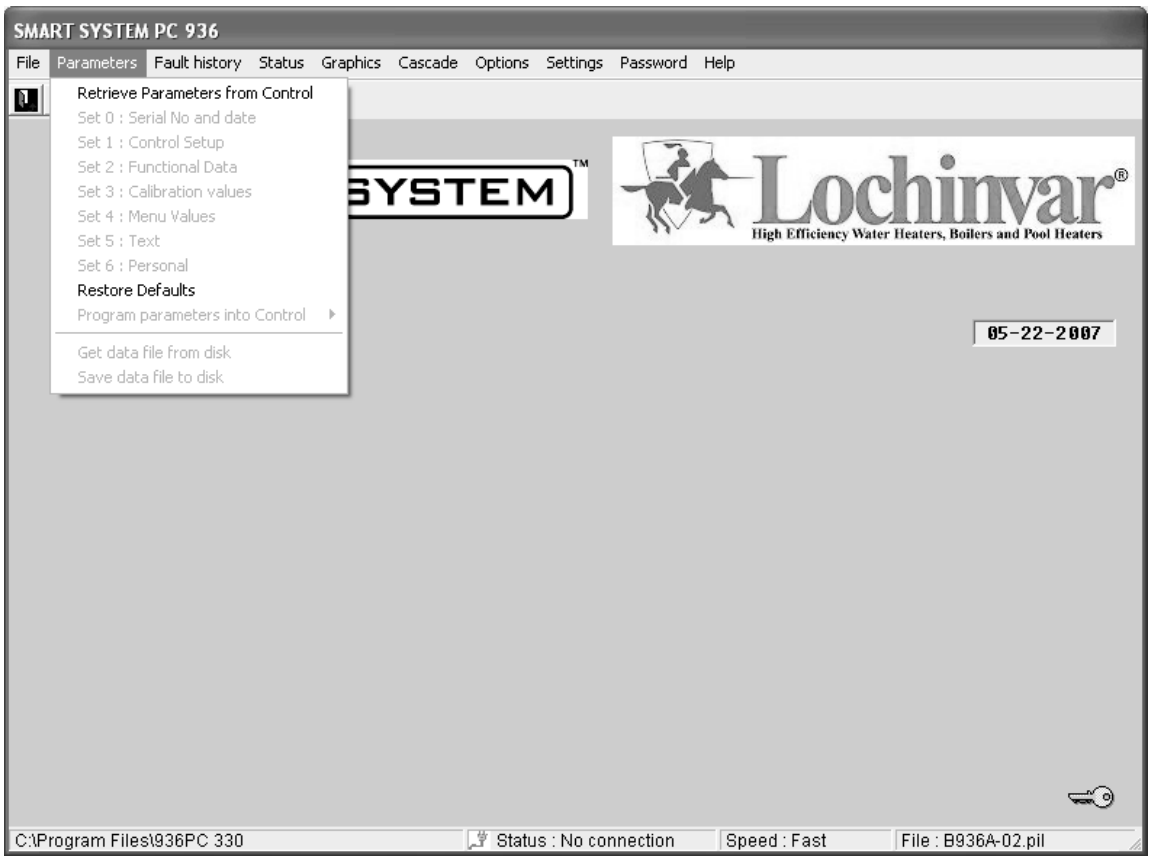
Parameter information screens

By accessing the Parameter Information Screens, the installer can view all of the SMART SYSTEM parameters. The installer can also change certain specific parameters to fine tune the operation of the heater to the installation.

To access the parameter list, click on the **Parameters** button along the top of the Main Screen window (FIG. 6-1). Next click on **Retrieve Parameters from Controller** in the pull down menu (see FIG. 6-1). This will upload the current parameters in the SMART SYSTEM to the PC.

On the Parameters pull down menu, click on the **Program Parameters into Control** button. This will bring up another pull down menu. If a parameter was changed in just one set, select the set from the menu and click on it. If changes were made in multiple sets, select the **Store Parameter Set 0-6** from the menu and click on it. This will program the new parameters into the SMART SYSTEM.

Figure 6-1_Parameters Pull-Down Menu Screen



Adjustable parameters are located in:

Set 2: Functional Data

Set 4: Menu Values

While many parameters are viewable in each set, only select parameters are adjustable. To make an adjustment to a parameter, select the parameter to be changed from the appropriate set. Click on the box next to the parameter and type in the value for the parameter.

Once an adjustment has been made to a parameter, it must be programmed into the SMART SYSTEM.

While the programming is taking place, the SMART SYSTEM will go into a lockout mode. It requires the **Enter/Reset** button on the display to be pressed after the programming has been completed before the appliance will be allowed to operate.

6 Power-fin Parameters *(continued)*

Changeable parameters

The following is a brief discussion of the changeable parameters, their default settings, the range of adjustment, and their location. The title for the parameters may differ slightly between the PC and the heater display. To prevent confusion, the heater display version will be listed in parenthesis.

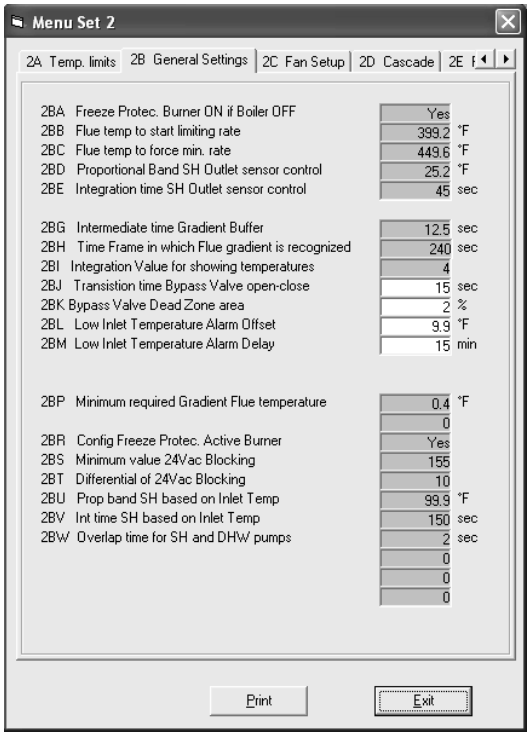
Set 2: Functional Data

Set 2 is accessed by clicking on **Parameters** at the top of the Main Screen window, then clicking on **Set 2: Functional Data** on the pull-down menu (FIG. 6-1, page 10).

3-Way bypass valve

In order to prevent condensation of the flue products on the heat exchanger, a 3-way bypass valve may be installed and connected to the low voltage connection board on the rear of the heater. This SMART SYSTEM control will automatically adjust this valve to maintain a minimum inlet temperature of 140°F (60°C). If the inlet temperature remains below 140°F (60°C) for 15 minutes after the appliance has fired, an "IN TEMP LOW" message will appear on the heater display and the alarm contacts will close. Parameters **2BJ** through **2BM** determine part of the operation of this condensing protection feature. To access these, click on the tab marked **2B General Settings** (FIG. 6-2).

Figure 6-2_Parameter Set 2B



Transition time bypass valve open-close

This parameter is set to the total time needed by the valve to move from the fully open to fully bypassed positions. This can be changed by accessing parameter **2BJ**. This time is adjustable from 0 to 51 seconds. The default value is 15 seconds.

Bypass valve dead zone area

This parameter is used to prevent the 3-way bypass valve from adjusting too frequently. The target position must change by the amount programmed before the valve position is changed. This can be changed by accessing parameter **2BK**. This is adjustable from 0 to 100 percent. The default value is 2 percent.

Low inlet temperature alarm offset

This parameter determines how far below 140°F (60°C) the actual inlet temperature must remain before the display shows "IN TEMP LOW" and the alarm contacts close. This can be adjusted by accessing parameter **2BL**. This is adjustable from 0 to 36°F (0 to 20°C). The default value is 10°F (5.5°C).

Low inlet temperature alarm delay

This parameter determines how long the inlet temperature must remain below 140°F (60°C) - parameter 2BL before the display shows "IN TEMP LOW" and the alarm contacts close. It can be adjusted by accessing parameter **2BM**. It is adjustable from 0 to 42.5 minutes. The default value is 15 minutes.

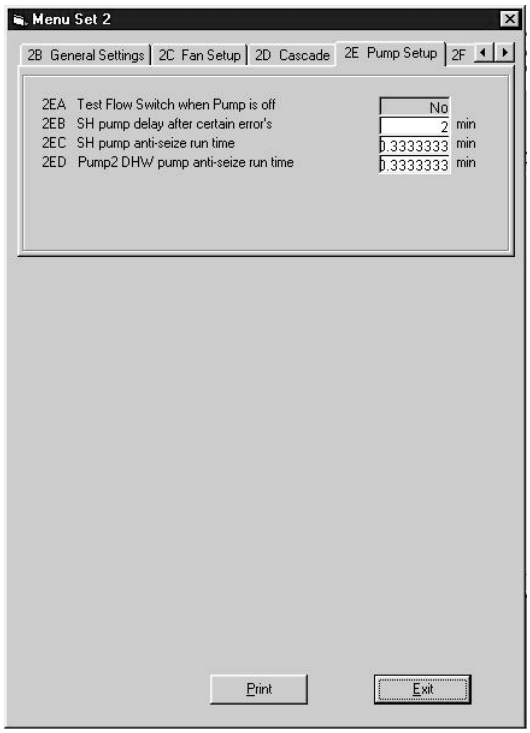
For additional bypass valve parameter adjustments, see also parameters **4B**.

NOTICE **CONTINUOUS OPERATION AT AN INLET TEMPERATURE BELOW 140°F (60°C) CAN RESULT IN NON-WARRANTABLE DAMAGE TO THE HEAT EXCHANGER.**

Special pump delay functions

The parameters for special pump delay functions are accessed by clicking on the tab labeled **2E Pump Setup** (see FIG. 6-3).

Figure 6-3_Parameter Set 2E



6 Power-fin Parameters

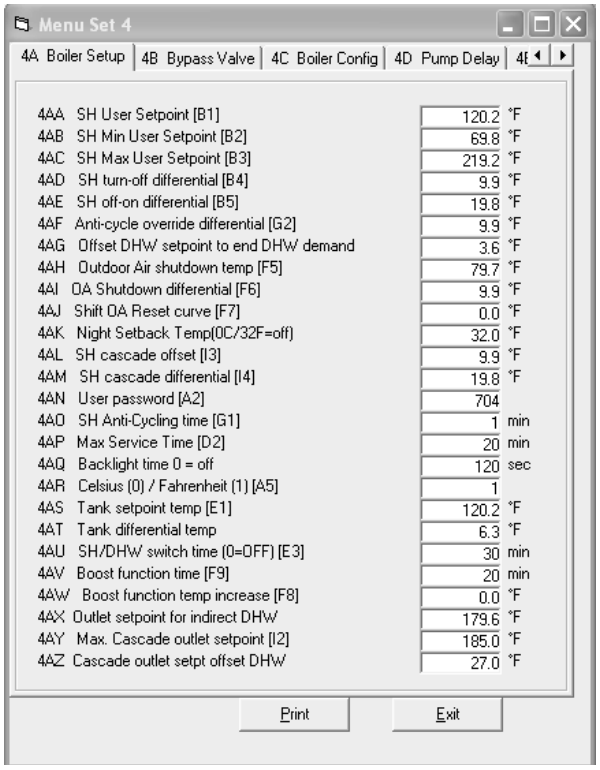
Parameter **2EB** sets the pump delay time for the boiler pump after an over-temperature condition. This time is adjustable from 0 to 40 minutes. The default time is 2 minutes.

If the boiler pump or DHW pump have not been active in a 24 hour period, the SMART SYSTEM will activate the appropriate pump for a programmed time to prevent seizing. The boiler pump time can be changed by accessing parameter **2EC**. This time is adjustable from 0 to 40 minutes. The default time is 20 seconds. The DHW pump time can be changed by accessing parameter **2ED**. This time is adjustable from 0 to 40 minutes. The default time is 20 seconds.

Set 4: Menu values

Set 4 contains parameters that can be accessed from the heater display. The parameters in this set control the basic operation of the heater. To access these parameters, click on **Parameters** at the top of the Main Screen window (FIG. 6-1, page 10), then click on **Set 4: Menu Values** on the pull-down menu.

Figure 6-4_Parameter Set 4A



SH User setpoint (SH setpoint)

The SH User Setpoint sets the water temperature setpoint for fixed operation or the maximum temperature setpoint when the outdoor air sensor is used. This parameter can be changed by accessing parameter **4AA**. The temperature range of this parameter is 50°F (10°C) to 260°F (127°C). The default value is 120°F (82°C).

SH Min user setpoint (Minimum SH Setpoint)

The SH Minimum User Setpoint sets the minimum water temperature setpoint that can be used for space heating operation. The user or installer will not be able to program the control with a lower SH setpoint. This parameter can be changed by accessing parameter **4AB**. The temperature range of this parameter is 32°F (0°C) to 248°F (120°C). The default value is 70°F (21°C).

SH Max user setpoint (Maximum SH setpoint)

The SH Maximum User Setpoint sets the maximum water temperature setpoint that can be used for space heating. The user or installer will not be able to program the control with a higher SH setpoint. This parameter can be changed by accessing parameter **4AC**. The temperature range of this parameter is 32°F (0°C) to 260°F (127°C). The default value is 220°F (104°C).

SH turn-off differential (Offset SH)

The SH Turn-off Differential sets how many degrees above setpoint the temperature has to go before the boiler will shut off. This parameter can be changed by accessing parameter **4AD**. The temperature range of this parameter is 0°F (0°C) to 54°F (30°C). The default value is 10°F (5.5°C).

SH off-on differential (Differential SH)

The SH Off-On Differential sets how many degrees below the turn-off temperature the temperature has to go before the boiler will turn on. This parameter can be changed by accessing parameter **4AE**. The temperature range of this parameter is 0°F (0°C) to 54°F (30°C). The default value is 20°F (11°C).

Drop of inlet temp before ending anti-cycling (Return Temperature Differential for Ending Anti-Cycling)

The control will bypass the Anti-Cycling time if the inlet water temperature drops too much. The control will use the inlet water temperature when it shuts off as the starting point. If the temperature drops this amount below the starting point, the control will abort anti-cycling and allow the boiler to fire. This parameter can be changed by accessing parameter **4AF**. The temperature range of this parameter is 0°F (0°C) to 54°F (30°C). The default value is 10°F (5.5°C).

6 Power-fin Parameters *(continued)*

Offset DHW setpoint to end DHW demand

This parameter determines how far above the setpoint the tank sensor (or inlet sensor if a tank thermostat is used) temperature must go in order for the tank call for heat to end. This setting can be changed by accessing parameter **4AG**. The temperature range of this parameter is 0°F (0°C) to 54°F (30°C). The default value is 4°F (2°C). See also parameter 4AS and 4AT.

Outdoor air shutdown temp (Outdoor Air Shutdown)

When the outdoor air temperature rises above this point, the control will inhibit all SH demands (DHW demands will still be active). This parameter can be changed by accessing parameter **4AH**. The temperature range of this parameter is 32°F (0°C) to 122°F (50°C). The default value is 80°F (26.5°C).

OA shutdown differential (Outdoor Air Shutdown Differential)

This is the number of degrees below parameter **4AH** the outdoor air temperature must go before the boiler will respond to an SH demand again. This parameter can be changed by accessing parameter **4AI**. The temperature range of this parameter is 0°F (0°C) to 90°F (50°C). The default value is 10°F (5.5°C).

Shift OA reset curve (Shift Outdoor Air Reset)

The Shift Heat Curve shifts the actual setpoint above or below the calculated setpoint by the number of degrees in this parameter. This parameter can be changed by accessing parameter **4AJ**. The temperature range of this parameter is -27°F (-15°C) to 27°F (15°C). The default value is 0°F (0°C). This feature will be active if this parameter is set to anything other than 0°F (0°C).

Night setback temperature

Once the internal clock has been set correctly, the night setback feature can be used to program a lower water temperature setpoint (space heating on boilers, tank on water heaters) during a certain part of each day of the week. This parameter can be changed by accessing parameter **4AK**. The temperature range for this parameter is 32°F (0°C) to 140°F (60°C). With a setting of 32°F (0°C) the feature is turned off. The default value is 32°F (0°C).

SH cascade offset

When programmed for cascade operation, the Leader boiler will use this value to determine how far above the setpoint the controlled temperature must rise in order to end the space heating call for heat. This setting can be changed by accessing parameter **4AL**. The temperature range of this parameter is 0°F (0°C) to 72°F (40°C). The default value is 10°F (5.5°C).

SH cascade differential

When programmed for cascade operation, the Leader boiler will use this value to determine how far below the turn-off temperature (Setpoint + Offset) the controlled temperature must drop in order to start the space heating call for heat. This setting can be changed by accessing parameter **4AM**. The temperature range of this parameter is 0°F (0°C) to 72°F (40°C). The default value is 20°F (11°C).

User password (User Code)

This code allows the user to access and change a limited number of control parameters via the display. To change the code, parameter **4AN** must be accessed. The default code is 0704 (July 4th).

SH anti-cycling time (Anti-Cycling Time)

Once the SH setpoint has been met, a set amount of time must elapse before the control will fire the boiler again. This helps prevent short cycling of the boiler. The control will inhibit firing and "Anti-cycling" will be shown on the display, until either this time has elapsed or the water temperature drops below parameter **4AF**. This parameter can be changed by accessing parameter **4AO**. The time range for this parameter is 0 minutes to 40 minutes. The default value is 1 minute.

Max service time (Service Mode Delay)

By pressing the **Pin** button on the front of the display for 5 seconds, the control will be placed in service mode. This will override all other heat demands. The service mode allows the installer to set the unit to a fixed firing rate for the purpose of combustion analysis. The delay sets the length of time the heater will stay in the service mode if neither the **Up** or **Down** keys have been pressed before going back to its original state. This parameter can be changed by accessing parameter **4AP**. The time range of this parameter is 0 to 40 minutes. The default value is 20 minutes.

Backlight time

This parameter sets the amount of time the backlight will stay on after a button has been pressed on the display. This parameter can be changed by accessing parameter **4AQ**. The time range of this parameter is 0 to 255 seconds. A setting of 0 will turn the backlight feature off and a setting of 255 will leave the backlight on continuously (not recommended). The default time is 60 seconds.

Celsius/Fahrenheit (Unit °C or °F)

The control can be configured to display temperatures in either °C or °F. This parameter can be changed by accessing parameter **4AR**. For °C set the parameter to 0. For °F set the parameter to 1. The default is °F.

6 Power-fin Parameters

Tank setpoint temp

This setting is applied to either the tank sensor (when connected) or the inlet sensor (water heaters only). On boilers, it is used to start and stop the DHW call for heat. On water heaters, it is also used as the target temperature for modulation. This setting can be changed by accessing parameter **4AS**. The temperature range is 60°F (15.5°C) to 190°F (87.5°C). The default setting 120°F (49°C).

Tank differential temp

This parameter determines how far below the tank setpoint the tank sensor temperature (or inlet sensor temperature on water heaters when a tank sensor is not connected) must go to start a DHW call for heat. This setting can be adjusted by accessing parameter **4AT**. The temperature range is 0°F (0°C) to 180°F (100°C). The default value is 6°F (3.5°C).

Time to switch between DHW and SH (SH/DHW Switching Time)

This feature sets the length of time the control will stay in DHW mode when a SH call has been received. After this time period has expired the control will revert to SH mode. If a DHW call is still active the timer will reset. After the time period has expired the control will revert to DHW mode. This will continue back and forth until one of the demands has been satisfied. This parameter can be changed by accessing parameter **4AU**. The time range of this parameter is 10 minutes to 240 minutes. The default value is 30 minutes.

Boost function time (Boost Time)

This function will only work if the outdoor air sensor is connected. The Boost Function Time sets the amount of time that must elapse during an SH demand before the water temperature setpoint will be increased. This parameter can be changed by accessing parameter **4AV**. The time range for this parameter is 1 minute to 60 minutes. The default value is 20 minutes.

Boost function temp increase (Boost Temperature)

This function will only work if the outdoor air sensor is connected. If a SH demand lasts longer than the programmed time setting in parameter **4AV**, and there have been no DHW demands, the control will increase the water temperature setpoint by the amount in this parameter. If the SH demand continues through another time period, the setpoint will be increased again. This will continue until either the SH demand ends, a maximum of 20 increases has occurred, or the maximum user setpoint has been reached. Once the SH demand has been satisfied the setpoint will revert back to its calculated setting. The boost temperature can be changed by accessing parameter **4AW**. The temperature range of this parameter is 0°F (0°C) to 45°F (25°C). The default value is 0°F (0°C). This feature will be active if this parameter is set to anything other than 0°F (0°C).

Outlet setpoint temp for direct DHW (DHW Boiler Setpoint)

When a DHW call for heat from an indirect DHW tank becomes active, the control will control the firing rate of the boiler in order to maintain the outlet water temperature at this setpoint. This parameter can be changed by accessing parameter **4AX**. The temperature range of this parameter is 32°F (0°C) to 261°F (127°C). The default value is 180°F (82°C).

Max cascade outlet setpoint (Max Cascade Setpoint)

This setting provides a target outlet temperature for all the boilers in a cascade. Each boiler's internal temperature control program will attempt to drive its outlet temperature to this setting. The Leader boiler may limit the modulation of any boiler in the cascade in order to maintain the space heating setpoint. Thus, this setting may be used as a limit on the outlet temperature of all the boilers (including the Leader boiler). This parameter can be adjusted by accessing parameter **4AY**. The temperature range for this setting is 32°F (0°C) to 261°F (127°C). The default value is 215°F (102°C).

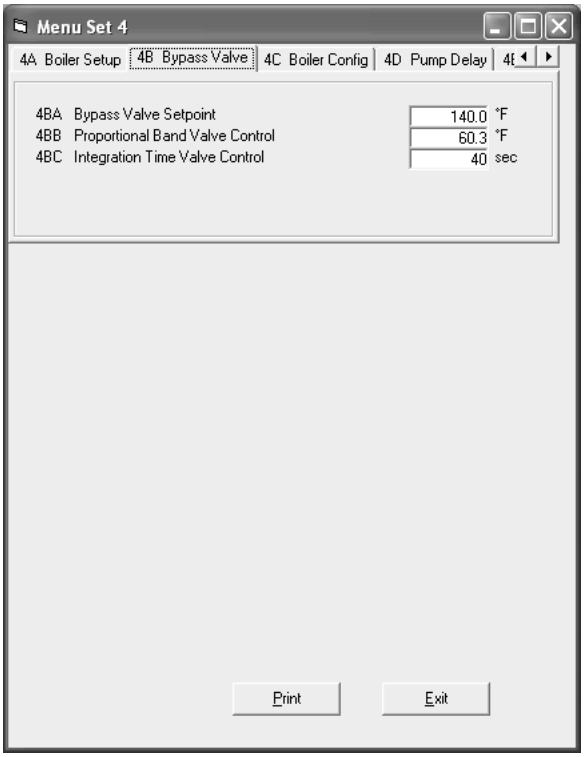
Cascade outlet setpoint offset DHW

When water heaters are connected in a cascade the value of this parameter will be added to the tank setpoint and sent to all of the water heaters as the setpoint to use for their internal temperature control program. Each water heater will attempt to drive its inlet temperature to this setting. The Leader water heater may limit the modulation of any water heater in the cascade in order to maintain the tank setpoint. Thus, this value can be used to limit the temperature at the bottom of the tank or wherever the water heater draws its water from. This setting can be adjusted by accessing parameter **4AZ**. The temperature range of this offset is 0°F (0°C) to 36°F (20°C). The default value is 27°F (15°C).

6 Power-fin Parameters *(continued)*

On the tabs at the top of the window, click on the tab labeled **4B Bypass Valve** to set additional parameters for the condensing protection feature, see FIG. 6-5. See also parameters **2A** discussed previously.

Figure 6-5_Parameter Set 4B



Bypass valve setpoint

This parameter sets the target minimum temperature for the condensing protection feature. This can be adjusted by accessing parameter **4BA**. The temperature range of this parameter is 32°F (0°C) to 261°F (127°C). The default value is 140°F (60°C).

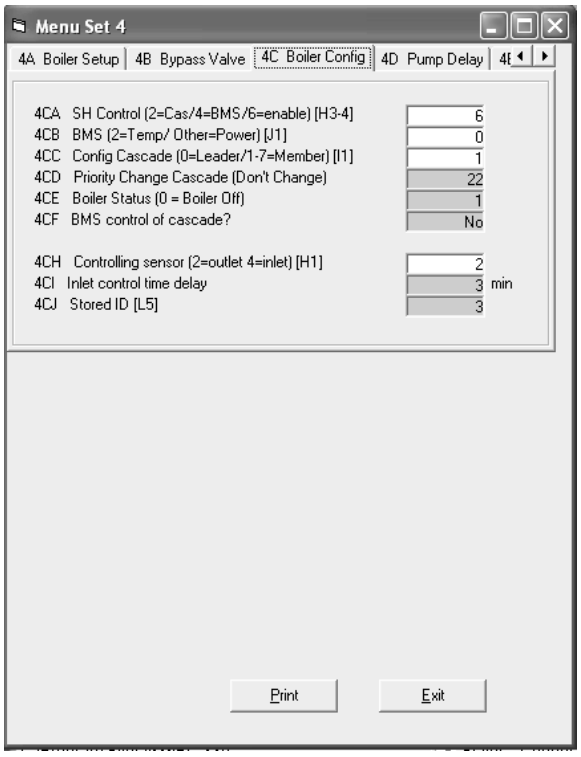
NOTICE **CONTINUOUS OPERATION AT AN INLET TEMPERATURE BELOW 140°F (60°C) CAN RESULT IN NON-WARRANTABLE DAMAGE TO THE HEAT EXCHANGER.**

Proportional band valve control/integration time valve control

These parameters determine the responsiveness of the 3-way bypass valve to the inlet temperature. These parameters should be adjusted only when the 3-way bypass valve is reacting too slowly to temperature changes or is continuously adjusting when the return temperature is not changing very much. Parameter **4BB** determines how quickly the valve responds to a change in the inlet temperature. The lower the value of this parameter the quicker it will respond. Parameter **4BC** determines how quickly the valve will adjust to bring the inlet temperature to the desired setpoint (**4BA**). The lower the value of this parameter the faster it will adjust the position of the 3-way valve. The default values are 60°F (33.5°C) and 40 seconds respectively.

On the tabs at the top of the window, click on the tab labeled **4C Boiler Config** to set the parameters that enable Building Management System (BMS) operation and determines the controlling sensor, see FIG. 6-6.

Figure 6-6_Parameter Set 4C



Config SH control (SH Control)

The Config SH Control parameter selects the method used to control the modulation of the heater. This parameter can be changed by accessing parameter **4CA**. The allowable values are 2 for cascade control, 4 for 0-10Vdc Building Management System (BMS) control, or 6 for operation based on user setpoint and the temperature of the selected controlling sensor. If BMS control of a cascade is desired, set this parameter to 2 and set BMS control (**H3**) to "active" using the menu on the operator interface of the heater. If either 2 or 4 are selected, additional parameters may need to be adjusted.

BMS

If BMS has been selected in parameter **4CA** or through the operator interface panel on the heater, the control must know how to use the 0-10Vdc signal. This can be either temperature based or power based. This parameter can be changed by accessing parameter **4CB**. The allowable values for this parameter are "0" for power or "2" for temperature. The default value is 0. Parameters **4GA** through **4GK** may need to be adjusted.

6 Power-fin Parameters

Config cascade

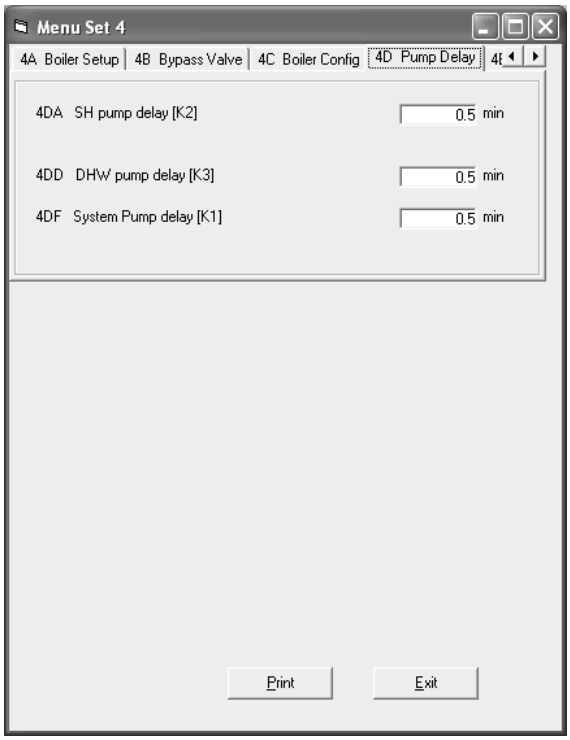
When a heater is programmed for cascade control, the address of each heater must be set to a different value. The Leader heater will always be programmed with address 0. All other heaters (and stand-alone heaters) must be given an address from 1 to 7. The address can be adjusted by accessing parameter **4CC**. The adjustment range is 0 to 7. The default value is 1.

Controlling sensor

This parameter selects which sensor the control will use to regulate the boiler firing rate. This parameter is adjustable by accessing parameter **4CH**. The selections are "2" for outlet sensor, which will regulate the firing rate based on the outlet water temperature from the boiler, or "4" for inlet sensor which will regulate the firing rate based on the inlet water temperature to the boiler. If the outlet sensor is selected, and the optional system supply sensor has been connected, the control will regulate the firing rate based on system supply sensor temperature. If the inlet sensor is selected and the optional system return sensor is connected, the control will regulate the firing rate based on the system return sensor. The default sensor is the outlet sensor.

On the tabs at the top of the window, click on the tab labeled **4D Pump Delay** to set the delay time for the boiler, system, and DHW pumps (see FIG. 6-7).

Figure 6-7_Parameter Set 4D



SH pump delay after SH demand (Pump Delay SH Pump)

This feature sets the length of time the boiler pump will run after a SH demand has been satisfied. This parameter is adjustable by accessing parameter **4DA**. The time range for this parameter is 0 minutes to 40 minutes. The default time is 30 seconds.

DHW pump delay (Pump Delay DHW Pump)

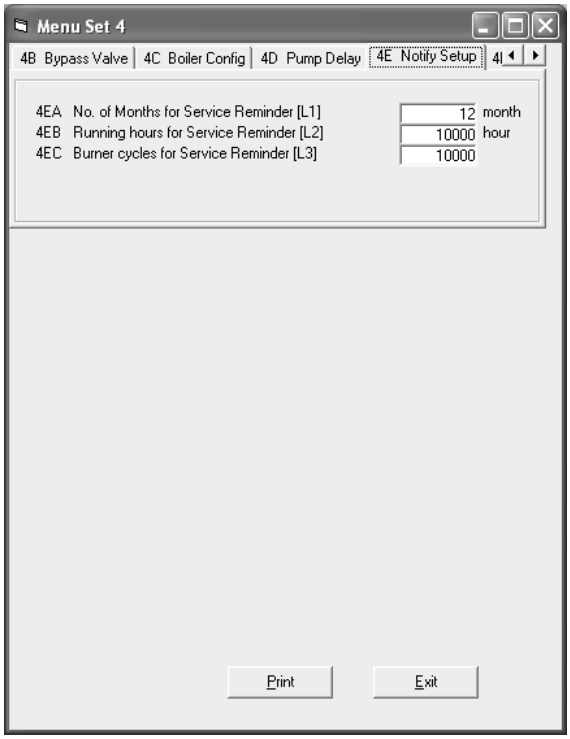
This feature sets the length of time the DHW pump (if connected) will run after a DHW demand has been satisfied. This parameter is adjustable by accessing parameter **4DB**. The time range for this parameter is 0 minutes to 40 minutes. The default time is 30 seconds.

System pump delay (Pump Delay System Pump)

This feature sets the length of time the system pump (if connected) will run after a SH demand has been satisfied. This parameter is adjustable by accessing parameter **4DC**. The time range for this parameter is 0 minutes to 40 minutes. The default time is 30 seconds.

To set the parameters for Service Notification, click on the tab labeled **4E Notify Setup** (see FIG. 6-8).

Figure 6-8_Parameter Set 4E



6 Power-fin Parameters *(continued)*

No. of months for service reminder (Service Notification in Months)

When the heater control determines that a scheduled service is due based on days of installation, the heater display will alternate the standard heater display text with the message SERVICE DUE every 5 seconds. This parameter is adjustable by accessing parameter **4EA**. The time range for this parameter is 0 months to 36 months. The default time is 12 months.

Running hours for service reminder (Service Notification Running Hours)

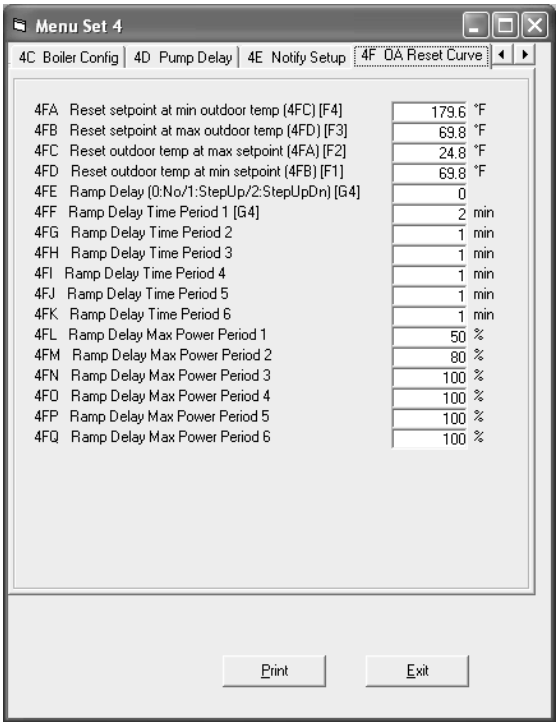
When the heater control determines that a scheduled service is due based on the hours of actual operation, the heater display will alternate the standard heater display text with the message SERVICE DUE every 5 seconds. This parameter is adjustable by accessing parameter **4EB**. The time range for this parameter is 0 hours to 100,000 hours. The default time is 10,000 hours.

Burner cycles for service reminder (Service Notification Boiler Cycles)

When the heater control determines that a scheduled service is due based on the number of heater cycles, the heater display will alternate the standard heater display text with the message SERVICE DUE every 5 seconds. This parameter is adjustable by accessing parameter **4EC**. The range for this parameter is 0 cycles to 100,000 cycles. The default is 10,000 cycles.

To adjust the Outdoor Air Reset curve and the Ramp Delay, click on the tab labeled **4F OA Reset Curve** (see FIG. 6-9).

Figure 6-9_Parameter Set 4F



OA reset water temp at min outdoor temp (4FC) (Maximum SH Setpoint)

When the outdoor air temperature drops to its minimum setting (**4FC**), the water temperature setpoint will be at this value. However, if the SH user setpoint (**4AA**) is lower, it will override this setting (see FIG. 6-10). This parameter can be changed by accessing parameter **4FA**. The temperature range of this parameter is 32°F (0°C) to 248°F (120°C). The default value is 180°F (82°C).

OA reset water temp at max outdoor temp (4FD) (Minimum SH Setpoint)

When the outdoor air temperature rises to or above its maximum setting (**4FD**), the water temperature setpoint will be at this value. This parameter can be changed by accessing parameter **4FB**. The temperature range of this parameter is 32°F (0°C) to 248°F (120°C). The default value is 70°F (21°C).

OA reset outdoor temp at max water temp (4FA) (Minimum Air Temperature)

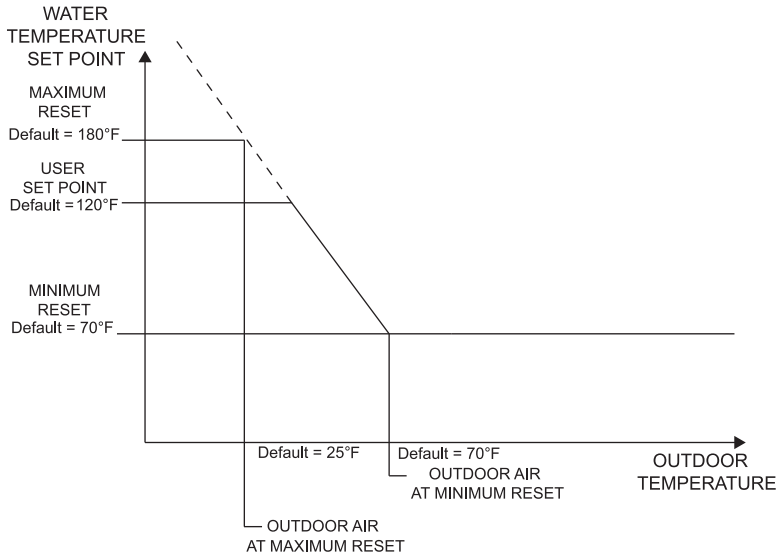
When the outdoor air temperature drops to this point, the water temperature setpoint will be at its maximum setting (if not overridden by the SH user setpoint). This parameter can be changed by accessing parameter **4FC**. The temperature range of this parameter is -22°F (-30°C) to 86°F (30°C). The default value is 25°F (-4°C).

OA reset outdoor temp at min water temp (4FB) (Maximum Air Temperature)

When the outdoor air temperature rises to or above this point, the water temperature will be at its minimum setpoint. This parameter can be changed by accessing parameter **4FD**. The temperature range of this parameter is -22°F (-30°C) to 86°F (30°C). The default value is 70°F (21°C).

6 Power-fin Parameters

Figure 6-10_Outdoor Air Reset Curve



When active, the ramp delay limits the boiler firing rate when a space heating cycle has started. There are six (6) limiting steps used to limit temperature overshoot and short cycles (see FIG. 6-11). This feature can be turned on or off depending on the installation. The default condition for this feature is disabled. It should only be needed when the flow through the heat exchanger is very low or the flow in the primary loop can be less than the flow in the secondary loop. The time for each of the six (6) ramp delays as well as the power level for each of the six (6) ramp delays are adjustable. This process can also work in reverse when the boiler shuts off. By setting this parameter to "step up/down", the timer for step 6 will start when the burner shuts off. Once the timer for step 6 expires, it will start the timer for step 5. Once this timer expires, it will start the timer for step 4, and so on. If the burner turns back on before the timer for step 2 has expired, the control will use the max firing rate of the current step, instead of the max firing rate of step 1. This way, the heater can start up at a higher rate when the off time is short.

Ramp delay

This parameter configures the ramp delay feature from off to on. This parameter can be changed by accessing parameter **4FE**.

The control range of this parameter is 0 = Off, 1 = Ramp Up Only, and 2 = Ramp Up and Ramp Down. The default is 0.

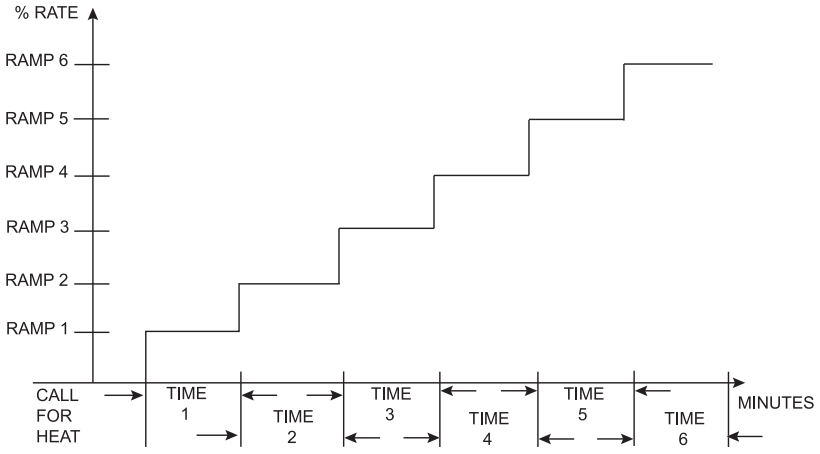
Ramp delay time period x

Parameters **4FF** through **4FK** determine the time of each step during ramp delay, starting with step 1 through step 6 respectively. The time range for each ramp delay is adjustable from 1 minute to 40 minutes with the total of all six (6) ramp delays not to exceed 109 minutes. The default time for ramp 1 is 2 minutes. The default time for the rest of the ramps is 1 minute.

Ramp delay max power period x

The power range for each ramp delay is adjustable from 0 to 100. The defaults for each ramp delay is ramp delay 1 = 50%, ramp delay 2 = 80%, ramp delay 3 = 100%, ramp delay 4 = 100%, ramp delay 5 = 100%, ramp delay 6 = 100%. The locations for these parameters are **4FL** through **4FQ**. Note that the power limit for step 6 will apply throughout the remainder of the call for heat.

Figure 6-11_Ramp Delay

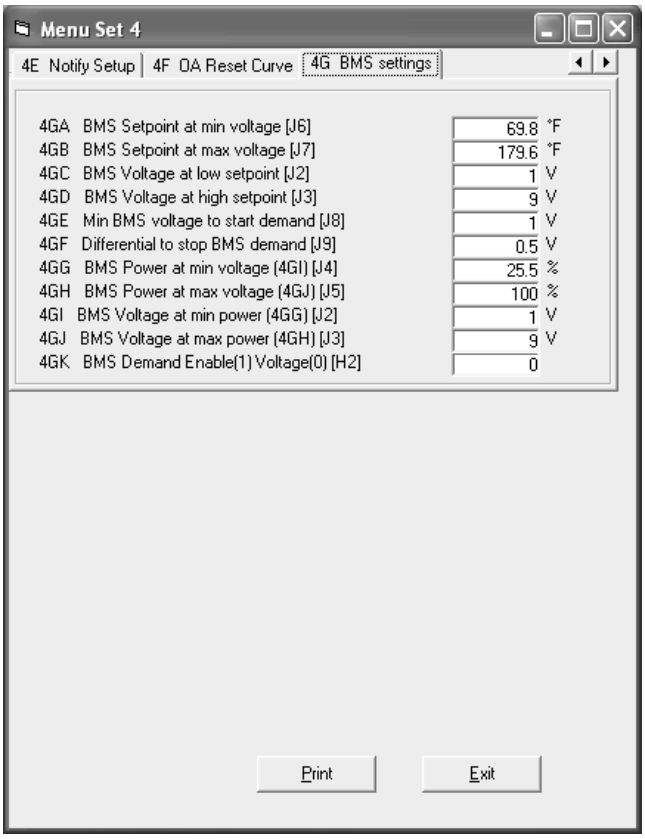


6 Power-fin Parameters *(continued)*

Building Management System control

To adjust the Building Management System control parameters, click on the tab marked **4G BMS settings**, see FIG. 6-12.

Figure 6-12_BMS Settings



BMS setpoint at min voltage (4GC)

If parameter **4CB** is set to 2, the control must know the minimum setpoint temperature to use. This can be changed by accessing parameter **4GA**. The temperature range for this parameter is 32°F (0°C) to 248°F (120°C). The default value is 70°F (21°C).

BMS setpoint at max voltage (4GD)

If parameter **4CB** is set to 2, the control must know the maximum setpoint temperature to use. This can be changed by accessing parameter **4GB**. The temperature range for this parameter is 32°F (0°C) to 248°F (120°C). The default value is 180°F (82°C).

BMS voltage at low setpoint (4GA)

If parameter **4CB** is set to 2, the control must know the voltage corresponding to the minimum setpoint. This can be adjusted by accessing parameter **4GC**. The voltage range for this parameter is 0Vdc to 10Vdc. The default value is 2Vdc.

BMS voltage at high setpoint (4GB)

If parameter **4CB** is set to 2, the control must know the voltage corresponding to the maximum setpoint. This can be adjusted by accessing parameter **4GD**. The voltage range for this parameter is 0Vdc to 10Vdc. The default value is 10Vdc.

Min BMS voltage to start demand

If parameter **4GK** is set to 1, the heat demand will be generated by the voltage present on the 0 - 10Vdc input. Parameter **4GE** determines the voltage at which the SMART SYSTEM control initiates a head demand. The range for this parameter is 0Vdc to 10Vdc. The default value is 2Vdc.

Differential to stop BMS demand

If parameter **4GK** is set to 1, the heat demand will be generated by the voltage present on the 0 - 10Vdc input. Parameter **4GF** determines how far below the starting voltage (parameter **4GE**) the voltage must drop before the heat demand ends. The range for this parameter is 0Vdc to 10Vdc. The default value is 1Vdc.

BMS power at min voltage (4GI)

If parameter **4CB** is set to 0, the control must know what minimum power level to use. This can be changed by accessing parameter **4GG**. The range for this parameter is 20% to 100%. The default value is 20%.

BMS power at max voltage (4GJ)

If parameter **4CB** is set to 0, the control must know the maximum power level to use. This can be changed by accessing parameter **4GH**. The range for this parameter is 20% to 100%. The default value is 100%.

BMS voltage at min power (4GG)

If parameter **4CB** is set to 0, the control must know the voltage corresponding to the minimum power. This can be changed by accessing parameter **4GI**. The range for this parameter is 0Vdc to 10Vdc. The default value is 2Vdc.

BMS voltage at max power (4GH)

If parameter **4CB** is set to 0, the control must know the voltage corresponding to the maximum power. This can be changed by accessing parameter **4GJ**. The range for this parameter is 0Vdc to 10Vdc. The default value is 10Vdc.

BMS demand enable [1] voltage [0]

If parameter **4CA** is set to 4 (BMS control), the heat demand can be activated by either the voltage on the 0 - 10Vdc input, or by closing the enable contacts (boiler) or tank thermostat contacts (water heater). To choose the voltage input, set parameter **4GK** to 0. To choose the enable / tank thermostat input, set parameter **4GK** to 1. The default value is 0.

7 Knight, Knight XL, Knight Wall Mount, and Armor Parameters

Parameter information screens

By accessing the Parameter Information Screens, the installer can view all of the SMART SYSTEM parameters. The installer can also change certain specific parameters to fine tune the operation of the boiler to the installation.

To access the parameter list, click on the **Parameters** button along the top of the Main Screen window (FIG. 7-1). Next click on **Retrieve Parameters from Controller** in the pull down menu (see FIG. 7-1). This will upload the current parameters in the SMART SYSTEM to the PC.

Adjustable parameters are located in:

Set 1: System Setup

Set 2: Functional Data

Set 4: Menu Values

While many parameters are viewable in each set, only select parameters are adjustable. To make an adjustment to a parameter, select the parameter to be changed from the appropriate set. Click on the box next to the parameter and type in the value for the parameter.

Once an adjustment has been made to a parameter, it must be programmed into the SMART SYSTEM. On the Parameter pull down menu, click on the **Program Parameters into Control** button. This will bring up another pull down menu. If a parameter was changed in just one set, select the set from the menu and click on it. If changes were made in multiple sets, select the **Store Parameter Set 0-4** from the menu and click on it. This will program the new parameters into the SMART SYSTEM. If the parameters are based on a parameter set from a different model, they may not be compatible with this model. In that case, the program will display a message to let you know. You may compare parameter **1AR** in the SMART SYSTEM control, and in the new parameter file, to determine if they are compatible.

While the programming is taking place, the SMART SYSTEM will go into a lockout mode. It will require that the **Enter/Reset** button on the display be pressed after the programming has been completed before the unit will be allowed to operate.

Figure 7-1_Parameters Pull-Down Menu Screen

7 Knight, Knight XL, Knight Wall Mount, and Armor Parameters *(continued)*

Changeable parameters

The following is a brief discussion of the changeable parameters, their default settings, the range of adjustment, and their location. The title for the parameters may differ slightly from the PC to the boiler display. To prevent confusion, the boiler display version will be listed in parenthesis.

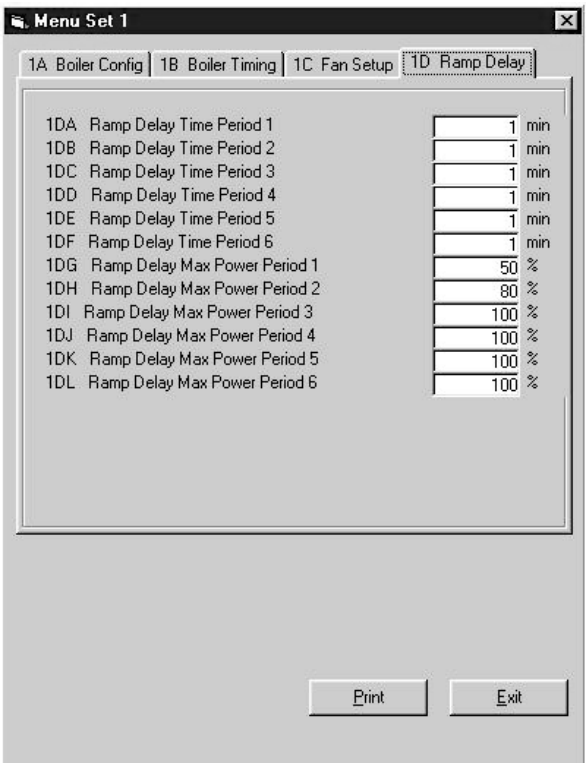
Set 1: System setup

Set 1 is accessed by clicking on **Parameters** at the top of the Main Screen window (FIG. 7-1), then on Set 1: Control Setup on the pull-down menu.

Ramp delay settings

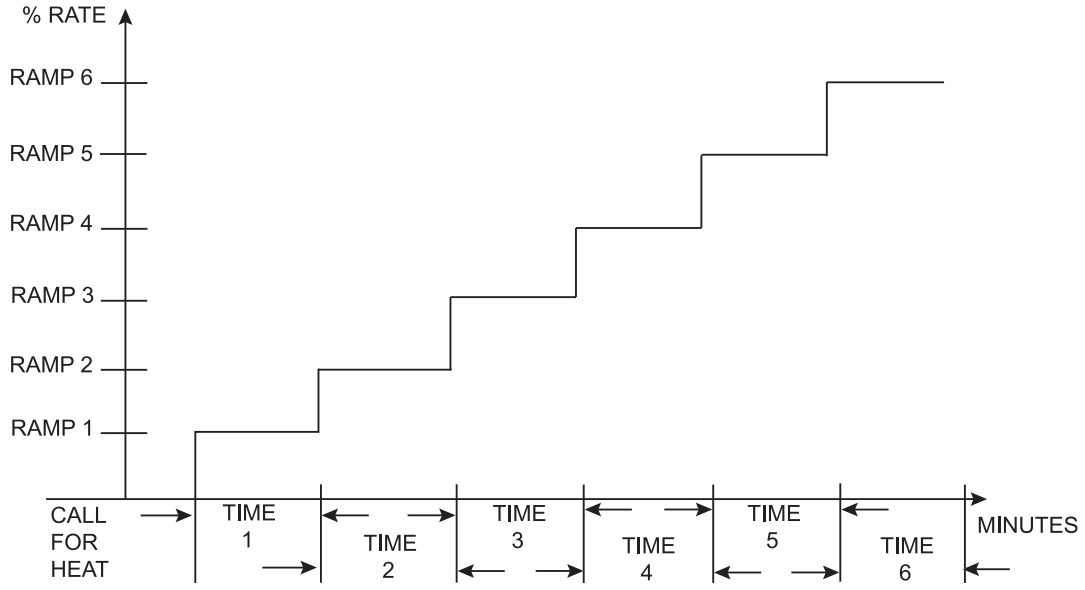
When active, the ramp delay limits the boiler firing rate when a SH cycle has started. There are 6 limiting steps used to limit temperature overshoot and short cycles (see FIG. 7-2). This feature can be turned on or off depending on the installation. The default condition for this feature is disabled. It should only be needed when the flow through the heat exchanger is very low, or the flow in the primary loop can be less than the flow in the secondary loop. The time for each of the 6 ramp delays as well as the power level for each of the 6 ramp delays are adjustable. The time range for each ramp delay is adjustable from 1 minute to 40 minutes with the total of all 6 ramp delays not to exceed 109 minutes. The default time for each ramp delay is 1 minute. This process can also work in reverse when the boiler shuts off. After shutting off, the max firing rate will be limited to the ramp 6 limit for the period 6 time delay, then to the ramp 5 limit for the period 5 time delay, and so forth. This step down feature overrides the step up feature until the ramp up limit becomes higher than the ramp down limit. To access the Ramp Delay settings, click on the tab labeled 1D Ramp Delay (see FIG. 7-2).

Figure 7-2_Parameter Set 1D



The power range for each ramp delay is adjustable from 0 to 100. The defaults for each ramp delay is ramp delay 1= 50%, ramp delay 2=80%, ramp delay 3=100%, ramp delay 4=100%, ramp delay 5=100%, ramp delay 6=100% (FIG. 7-3). The locations for these parameters are 1DG through 1DL. See parameter 4FE (page 27 of this manual) to enable or disable the ramp delay feature.

Figure 7-3_Ramp Delay Interval



7 Knight, Knight XL, Knight Wall Mount, and Armor Parameters

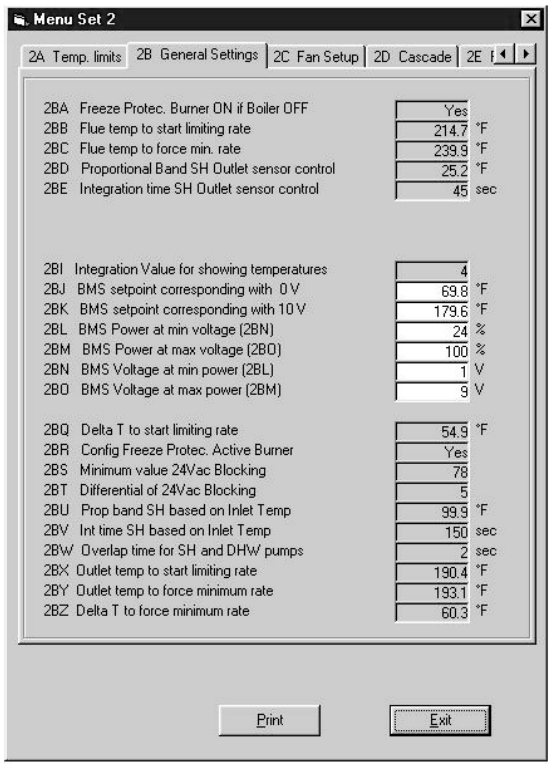
Set 2: Functional Data

Set 2 is accessed by clicking on **Parameters** at the top of the Main Screen window, then clicking on **Set 2: Functional Data** on the pull-down menu (FIG. 7-1, page 20).

Building Management System (BMS) control

Parameters **2BJ** through **2BO** sets the configuration for the control when a 0-10Vdc BMS has been connected to the unit and has been selected in parameter **4CA** as the control input. If BMS has been selected as the control input, then parameter **4CB** selects how the control responds to the 0-10Vdc signal. This can be based on either temperature or power level. Parameters **2BJ** and **2BK** will set the temperature range if temperature has been selected. Parameters **2BL** through **2BO** will set the power levels if power control has been selected. To access the BMS parameters, click on the tab labeled **2B General Settings** (see FIG. 7-4 below).

Figure 7-4_Parameter Set 2B



BMS setpoint corresponding with 0V

If temperature has been selected, the control must identify the minimum temperature 0V relates to. This can be changed by accessing parameter **2BJ**. The temperature range for this parameter is 32°F-190°F. The default value is 70°F.

BMS setpoint corresponding with 10V

If temperature has been selected, the control must identify the maximum temperature 10Vdc relates to. This can be changed by accessing parameter **2BK**. The temperature range for this parameter is 32°F-190°F. The default value is 180°F.

BMS power at min voltage (2BN)

If power has been selected, the control must identify the minimum power level to be used. This can be changed by accessing parameter **2BL**. The range for this parameter is 20% to 100%. The default value is 20%.

BMS power at max voltage (2BO)

If power has been selected, the control must identify the maximum power level to be used. This can be changed by accessing parameter **2BM**. The range for this parameter is 20% to 100%. The default value is 100%.

BMS voltage at min power (2BL)

If power has been selected, the control must identify the lowest voltage signal to be used. The control will relate this signal to what the minimum power level will be. This can be changed by accessing parameter **2BN**. The range for this parameter is 0 to 10. The default value is 1.

BMS voltage at max power (2BM)

If power has been selected, the control must identify the highest voltage signal that will be used. The control will relate this signal to what the maximum power level will be. This can be changed by accessing parameter **2BO**. The range for this parameter is 0 to 10. The default value is 9.

Special pump delay functions

The parameters for special pump delay functions are accessed by clicking on the tab labeled **2E Pump Setup** (see FIG. 7-5, page 23).

7 Knight, Knight XL, Knight Wall Mount, and Armor Parameters *(continued)*

Figure 7-5_Parameter Set 2E

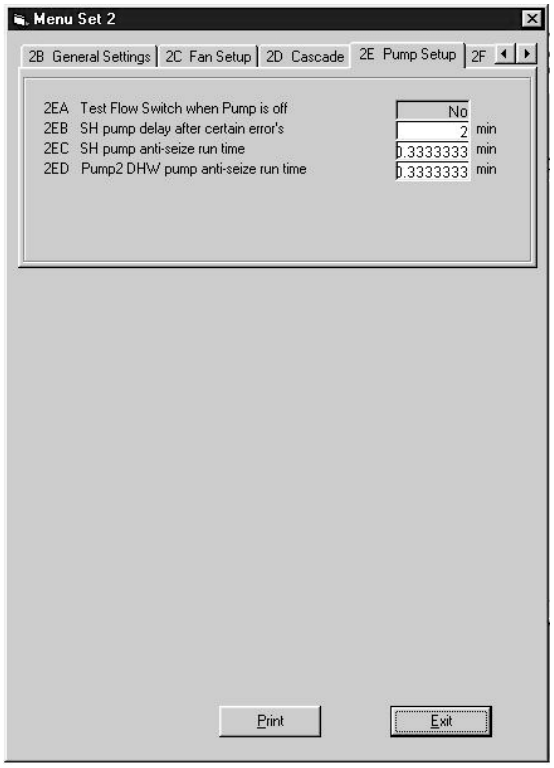
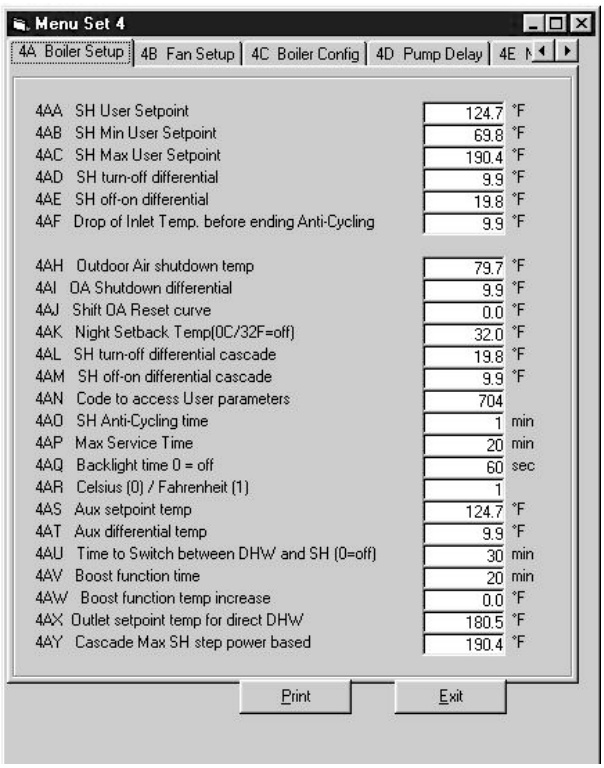


Figure 7-6_Parameter Set 4A



Parameter **2EB** sets the pump delay time for the boiler pump after an over-temperature condition. This time is adjustable from 0 minutes to 40 minutes. The default time is 2 minutes.

To prevent jamming, if the boiler pump or DHW pump have not been active in a 24 hour period, the SMART SYSTEM will activate the appropriate pump for a programmed time. The boiler pump time can be changed by accessing parameter **2EC**. This time is adjustable from 0 minutes to 40 minutes. The default time is 20 seconds. The DHW pump time can be changed by accessing parameter **2ED**. This time is adjustable from 0 minutes to 40 minutes. The default time is 20 seconds.

Set 4: Menu values

Set 4 contains parameters that can be accessed from the boiler display. The parameters in this set control the basic operation of the boiler. To access these parameters, click on **Parameters** at the top of the Main Screen window (FIG. 7-1, page 20), then click on **Set 4: Menu Values** on the pull-down menu (FIG. 7-6).

Space Heating (SH) user setpoint (SH setpoint)

The SH User Setpoint sets the water temperature setpoint for fixed operation or the maximum temperature setpoint when the outdoor air sensor is used. This parameter can be changed by accessing parameter **4AA**. The temperature range of this parameter is 50°F to 190°F. The default value is 125°F.

SH min user setpoint (minimum SH setpoint)

The SH Minimum User Setpoint sets the minimum water temperature setpoint that can be used for space heating operation. The user or installer will not be able to program the control with a lower SH setpoint. This parameter can be changed by accessing parameter **4AB**. The temperature range of this parameter is 0°F to 190°F. The default value is 70°F.

SH max user setpoint (maximum SH setpoint)

The SH Maximum User Setpoint sets the maximum water temperature setpoint that can be used for space heating. The user or installer will not be able to program the control with a higher SH setpoint. This parameter can be changed by accessing parameter **4AC**. The temperature range of this parameter is 0°F to 190°F. The default value is 190°F.

7 Knight, Knight XL, Knight Wall Mount, and Armor Parameters

SH turn-off differential (Offset SH)

The SH Turn-off Differential sets how many degrees above setpoint the temperature has to go before the boiler will shut off. This parameter can be changed by accessing parameter **4AD**. The temperature range of this parameter is 0°F to 86°F. The default value is 10°F.

SH off-on differential (Differential SH)

The SH Off-on Differential sets how many degrees below the turn-off temperature the temperature has to go before the boiler will turn on. This parameter can be changed by accessing parameter **4AE**. The temperature range of this parameter is 0°F to 86°F. The default value is 20°F.

Drop of inlet temp before ending anti-cycling (Return Temperature Differential for Ending Anti-cycling)

The control will bypass the anti-cycling time if the inlet water temperature drops too much. The control will use the inlet water temperature when it shuts off as the starting point. If the temperature drops this amount below the starting temperature, the control will abort anti-cycling and allow the boiler to fire. This parameter can be changed by accessing parameter **4AF**. The temperature range of this parameter is 0°F to 86°F. The default value is 10°F.

Outdoor air shutdown temp (Outdoor Air Shutdown)

When the outdoor air temperature rises above this point, the control will inhibit all SH demands (DHW demands will still be active). This parameter can be changed by accessing parameter **4AH**. The temperature range of this parameter is 0°F to 120°F. The default value is 80°F.

OA shutdown differential (Outdoor Air Shutdown Differential)

This is the number of degrees below parameter **4AH** the outdoor air temperature must go before the boiler will again respond to an SH demand. This parameter can be changed by accessing parameter **4AI**. The temperature range of this parameter is 0°F to 90°F. The default value is 10°F.

Shift OA reset curve (Shift Air Reset)

The Shift Heat Curve shifts the actual setpoint above or below the calculated setpoint by the number of degrees in this parameter. This parameter can be changed by accessing parameter **4AJ**. The temperature range of this parameter is -27°F to 27°F. The default value is 0°F. This feature will be active if this parameter is set to anything other than 0°F.

Night setback temperature

Once the internal clock has been set correctly, the night setback feature can be used to program a lower water temperature setpoint for space heating. This parameter can be changed by accessing parameter **4AK**. The temperature range for this parameter is 32°F to 140°F. With a setting of 32°F the feature is turned off. The default value will be 32°F.

Code to access user parameters (User Code)

This code allows the user to access and change a limited number of control parameters via the display. To change the code, parameter **4AN** must be accessed. The default code is 0704 (July 4th).

SH anti-cycling time (Anti-Cycling Time)

Once a SH demand has been satisfied, a set amount of time must elapse before the control will respond to a new SH demand. This helps prevent short cycling of the boiler. The control will inhibit the new heat demand and "Anti-cycling" will be shown on the display, until either this time has elapsed or the water temperature drops below parameter **4AF**. This parameter can be changed by accessing parameter **4AO**. The time range for this parameter is 0 minutes to 40 minutes. The default value is 1 minute.

Max service time (Service Mode Delay)

By pressing the pin button on the front of the display for 5 seconds, the control will be placed in service mode. This will override all other heat demands. The service mode allows the installer to set the unit to a fixed firing rate for the purpose of combustion analysis. The delay sets the length of time the boiler will stay in the service mode if no keys have been pressed before going back to its original state. This parameter can be changed by accessing parameter **4AP**. The time range of this parameter is 0 minutes to 40 minutes. The default value is 20 minutes.

Backlight time

This feature sets the amount of time the backlight will stay on after a button has been pressed on the display. This parameter can be changed by accessing parameter **4AQ**. The time range of this parameter is 0 seconds to 255 seconds. A setting of 0 will turn the backlight feature off and a setting of 255 will leave the backlight on continuously. The default time is 60 seconds.

7 Knight, Knight XL, Knight Wall Mount, and Armor Parameters *(continued)*

Celsius/Fahrenheit (Unit °C or °F)

The control can be configured to display temperatures in either °C or °F. This parameter can be changed by accessing parameter **4AR**. For °C set the parameter to 0. For °F set the parameter to 1. The default is °F.

Time to switch between DHW and SH (SH/DHW Switching Time)

This feature sets the length of time the control will stay in DHW mode when a SH call has been received. After this time period has expired the control will revert to SH mode. If a DHW call is still active the timer will reset. After the time period has expired the control will revert to DHW mode. This will continue back and forth until one of the demands has been satisfied. This parameter can be changed by accessing parameter **4AU**. The time range of this parameter is 10 minutes to 240 minutes. The default value is 30 minutes.

Boost function time (Boost Time)

This function will only work if the outdoor air sensor is connected. The Boost Function Time sets the amount of time that must elapse during an SH demand before the water temperature setpoint will be increased. This parameter can be changed by accessing parameter **4AV**. The time range for this parameter is 1 minute to 60 minutes. The default value is 20 minutes.

Boost function temp increase (Boost Temperature)

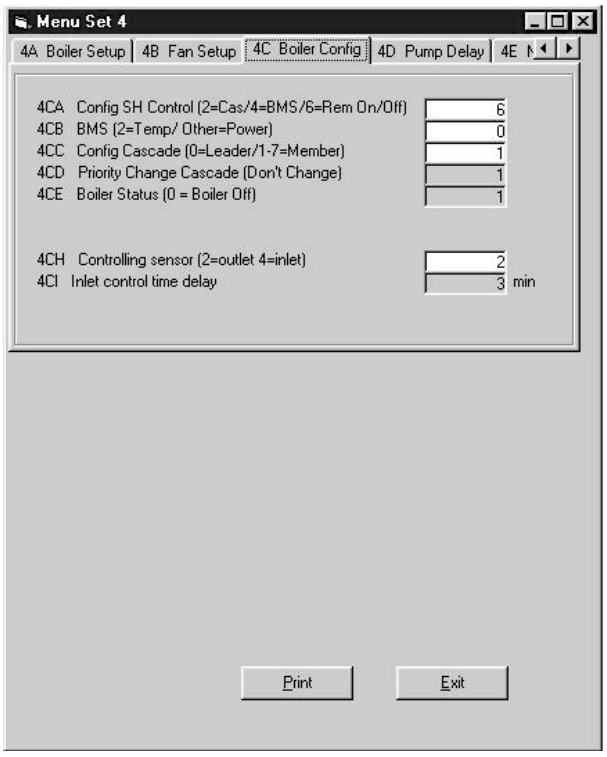
This function will only work if the outdoor air sensor is connected. If a SH demand lasts longer than the programmed time setting in parameter **4AV**, and there have been no DHW demands, the control will increase the water temperature setpoint by the amount in this parameter. If the SH demand continues through another time period, the setpoint will be increased again. This will continue until either the SH demand ends, a maximum of 20 increases has occurred, or the maximum user setpoint has been reached. Once the SH demand has been satisfied the setpoint will revert back to its calculated setting. The boost temperature can be changed by accessing parameter **4AW**. The temperature range of this parameter is 0°F to 45°F. The default value is 0°F. This feature will be active if this parameter is set to anything other than 0°F.

Outlet setpoint temp for direct DHW (DHW Boiler Setpoint)

When a DHW call for heat becomes active, the control will control the firing rate of the boiler in order to maintain the outlet water temperature at this setpoint. This parameter can be changed by accessing parameter **4AX**. The temperature range of this parameter is 50°F to 190°F. The default value is 180°F.

On the tabs at the top of the window (FIG. 7-7), click on the tab labeled **4C Boiler Config** to set the parameters that enable BMS operation and determine the controlling sensor (see FIG. 7-7 below).

Figure 7-7_Parameter Set 4C



Config SH control (SH Control)

The Config SH Control parameter selects the method used to control the modulation of the boiler. This parameter can be changed by accessing parameter **4CA**. The allowable values are 2 for cascade control, 4 for 0-10Vdc BMS control, or 6 for operation based on user setpoint and the temperature of the selected controlling sensor. If 2 is selected for cascade control, additional parameters will have to be adjusted. If 4 is selected for 0-10Vdc BMS control, additional parameters may need to be adjusted.

BMS

If BMS has been selected in parameter **4CA**, the control must know how to use the 0-10Vdc signal. This can be either temperature based or power based. This parameter can be changed by accessing parameter **4CB**. The allowable values for this parameter are "0" for power or "2" for temperature. The default value is 0. Parameters **2BJ** through **2BO** may need to be adjusted.

Cascade

If Cascade has been selected in parameter **4CA**, each boiler in the cascade must be given a unique address. This address can

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be changed by accessing parameter **4CC**. The Leader boiler (to which the thermostat/zone control, system sensor, and system pump (if controlled by the boiler) are connected) must be set to address 0. All the Member boilers must be given an address from 1 to 7. The range of this parameter is 0 to 7. The default value is 1.

Cascade Max SH step power based (SH setpoint)

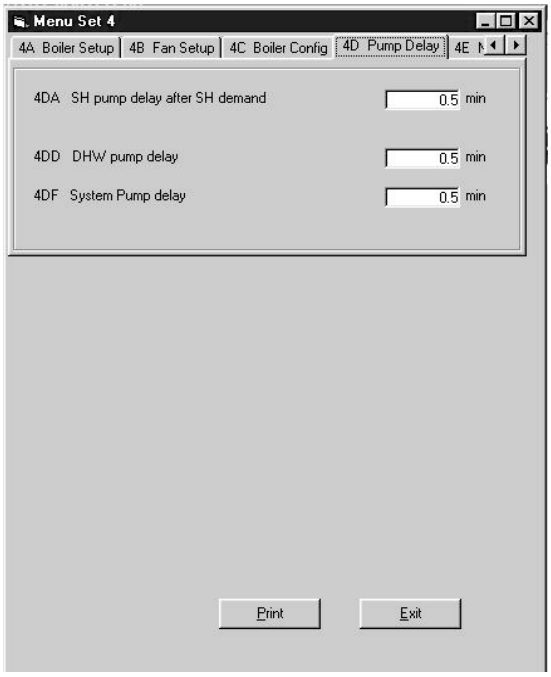
When the control is programmed as a Cascade Leader (address 0), the cascade control will modulate the boilers in order to maintain the system sensor temperature at this setpoint. This parameter can be changed by accessing parameter **4AY**. The temperature range of this parameter is 32°F to 212°F. The default value is 125°F.

Controlling sensor

This parameter selects which sensor the control will use to regulate the boiler firing rate. This parameter is adjustable by accessing parameter **4CH**. The selections are "2" for outlet sensor, which will regulate the firing rate based on the outlet water temperature from the boiler, or "4" for inlet sensor which will regulate the firing rate based on the inlet water temperature to the boiler. If the outlet sensor is selected, and the optional system sensor has been connected, the control will regulate the firing rate based on system sensor temperature. The default sensor is the outlet sensor. The inlet sensor may not be used if the control configuration is set to cascade.

On the tabs at the top of the window, click on the tab labeled **4D Pump Delay** to set the delay time for the boiler, system, and DHW pumps (see FIG. 7-8 below).

Figure 7-8_Parameter Set 4D



SH pump delay after SH demand (Pump Delay SH Pump)

This feature sets the length of time the boiler pump will run after a SH demand has been satisfied. This parameter is adjustable by accessing parameter **4DA**. The time range for this parameter is 0 minutes to 40 minutes. The default time is 30 seconds.

DHW pump delay (Pump Delay DHW Pump)

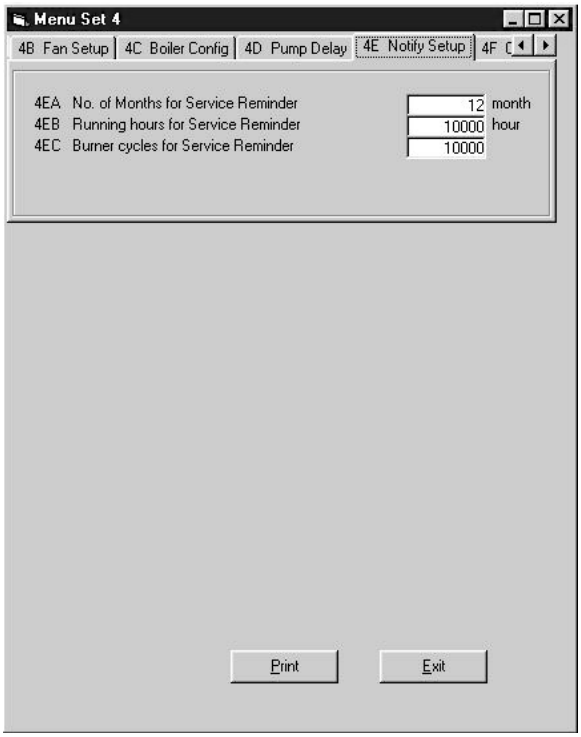
This feature sets the length of time that the DHW pump (if connected) will run after a DHW demand has been satisfied. This parameter is adjustable by accessing parameter **4DB**. The time range for this parameter is 0 minutes to 40 minutes. The default time is 30 seconds.

System pump delay (Pump Delay System Pump)

This feature sets the length of time the system pump (if connected) will run after a SH demand has been satisfied. This parameter is adjustable by accessing parameter **4DC**. The time range for this parameter is 0 minutes to 40 minutes. The default time is 30 seconds.

To set the parameters for Service Notification, click on the tab labeled **4E Notify Setup** (see FIG. 7-9 below).

Figure 7-9_Parameter Set 4E



7 Knight, Knight XL, Knight Wall Mount, and Armor Parameters *(continued)*

No. of months for service reminder (Service Notification in Months)

When the boiler control determines that a scheduled service is due based on days of installation, the boiler display will alternate the standard boiler display text with the message SERVICE DUE every 5 seconds. This parameter is adjustable by accessing parameter **4EA**. The time range for this parameter is 0 months to 36 months. The default time is 12 months.

Running hours for service reminder (Service Notification Running Hours)

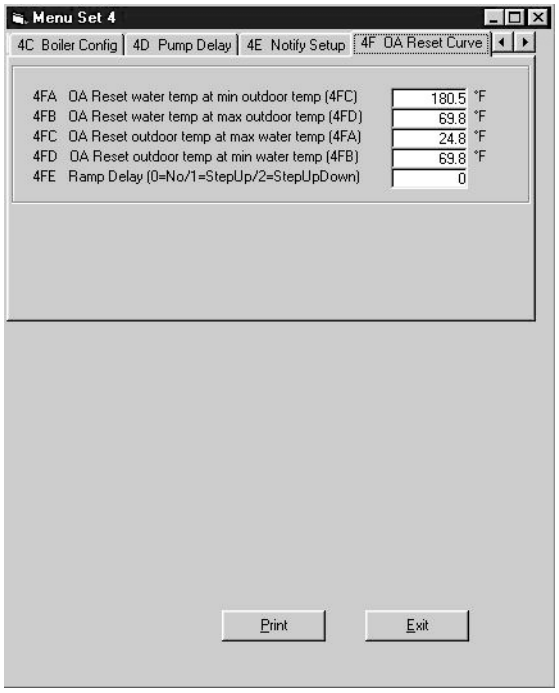
When the boiler control determines that a scheduled service is due based on the hours of actual operation, the boiler display will alternate the standard boiler display text with the message SERVICE DUE every 5 seconds. This parameter is adjustable by accessing parameter **4EB**. The time range for this parameter is 0 hours to 100,000 hours. The default time is 10,000 hours.

Burner cycles for service reminder (Service Notification Boiler Cycles)

When the boiler control determines that a scheduled service is due based on the number of boiler cycles, the boiler display will alternate the standard boiler display text with the message SERVICE DUE every 5 seconds. This parameter is adjustable by accessing parameter **4EC**. The range for this parameter is 0 cycles to 100,000 cycles. The default is 10,000 cycles.

To adjust the Outdoor Air Reset curve, click on the tab labeled **4F OA Reset Curve** (see FIG. 7-10 below).

Figure 7-10_Parameter Set 4F



OA reset water temp at min outdoor temp (4FC) (Maximum SH Setpoint)

When the outdoor air temperature drops to or below its minimum setting (**4FC**), the water temperature setpoint will be at this value. However, if the SH user setpoint (**4AA**) is lower, it will override this setting. This parameter can be changed by accessing parameter **4FA**. The temperature range of this parameter is 0°F to 190°F. The default value is 180°F (FIG. 7-11).

OA reset water temp at max outdoor temp (4FD) (Minimum SH Setpoint)

When the outdoor air temperature rises to or above its maximum setting (**4FD**), the water temperature setpoint will be at this value. This parameter can be changed by accessing parameter **4FB**. The temperature range of this parameter is 0°F to 190°F. The default value is 70°F (FIG. 7-11).

OA reset outdoor temp at max water temp (4FA) (Minimum Air Temperature)

When the outdoor air temperature drops to or below this point, the water temperature setpoint will be at its maximum setting (if not overridden by the SH user setpoint). This parameter can be changed by accessing parameter **4FC**. The temperature range of this parameter is -30°F to 90°F. The default value is 25°F (FIG. 7-11).

OA reset outdoor temp at min water temp (4FB) (Maximum Air Temperature)

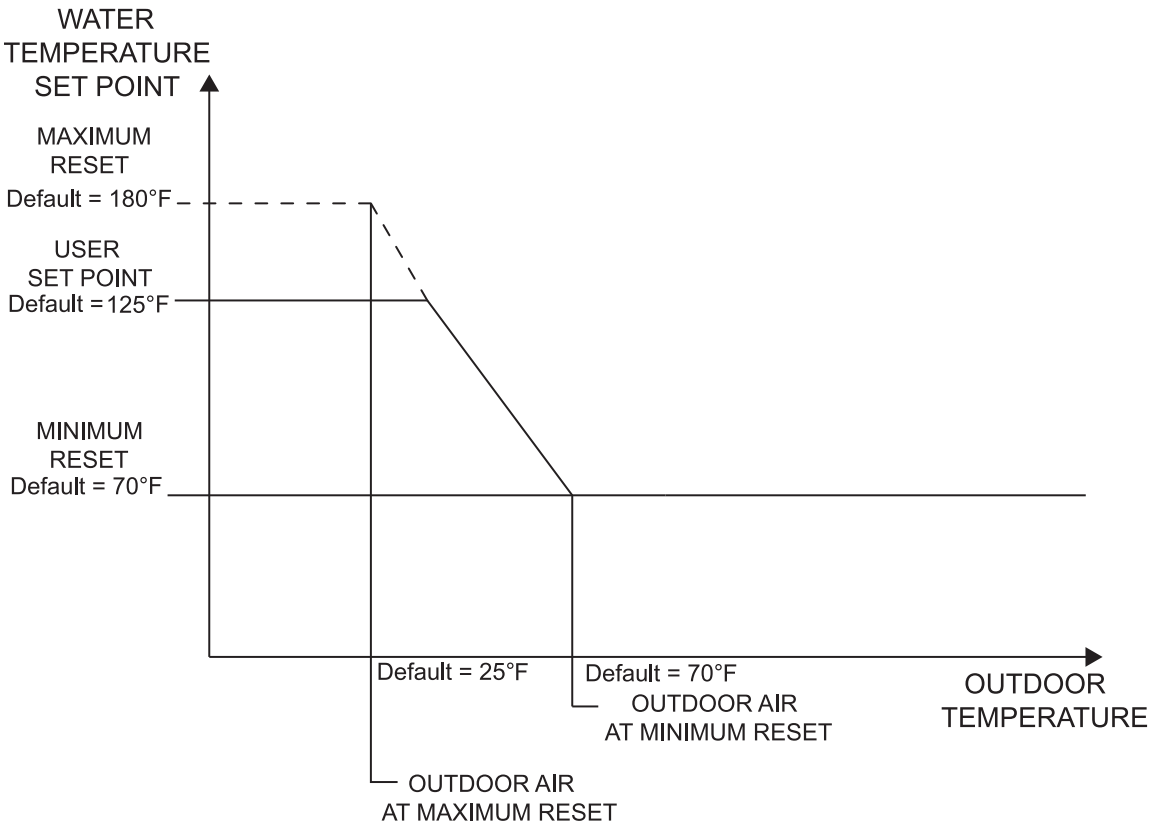
When the outdoor air temperature rises to or above this point, the water temperature will be at its minimum setpoint. This parameter can be changed by accessing parameter **4FD**. The temperature range of this parameter is -30°F to 90°F. The default value is 70°F (FIG. 7-11).

Ramp delay

This parameter configures the ramp delay feature from off to on. This parameter can be changed by accessing parameter **4FE** (FIG. 7-10). The control range of this parameter is 0 = Off, 1 = Ramp Up Only, and 2 = Ramp Up and Ramp Down. The default is 0.

7 Knight, Knight XL, Knight Wall Mount, and Armor Parameters

Figure 7-11_Outdoor Air Reset Curve



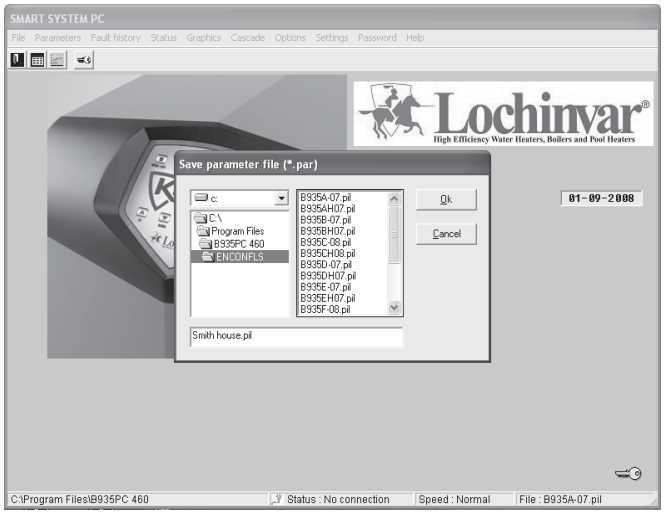
7 Knight, Knight XL, Knight Wall Mount, and Armor Parameters *(continued)*

Storing parameters on your PC

Once you have customized the parameters for a particular heater, you can store the new settings on your PC. This will allow you to restore these settings should you have to replace the SMART SYSTEM control, or allow you to load these settings into another heater at a later date.

The settings are stored as a data file. To save a file, click on **Parameters** at the top of the screen, then on **Save data file to disk** on the bottom of the pull-down menu (see FIG. 7-1 on page 20). A new window will appear (FIG. 7-12). On the top left side it shows the drive on which it will save the file. Below that is the directory it will use. These may be changed to any drive and folder you wish (for instance, a USB flash drive). At the right side is a list of the default data files. At the bottom is a field for entering the file name you wish to use. Note that the extension for this file is **.pil**. Make sure that you DO NOT overwrite the extension when entering the file name. **You MUST NOT use any of the default file names shown in the field on the right side of the window. This could overwrite that default file!** If you are updating a file, and want to overwrite the old one, you may scroll down to that file name and click on it, instead of having to type it into the field at the bottom of the window. Click on the **OK** button to save the file. A message will appear confirming that the file was saved. Note that the new file name appears in the lower right-hand corner of the SMART SYSTEM PC program window.

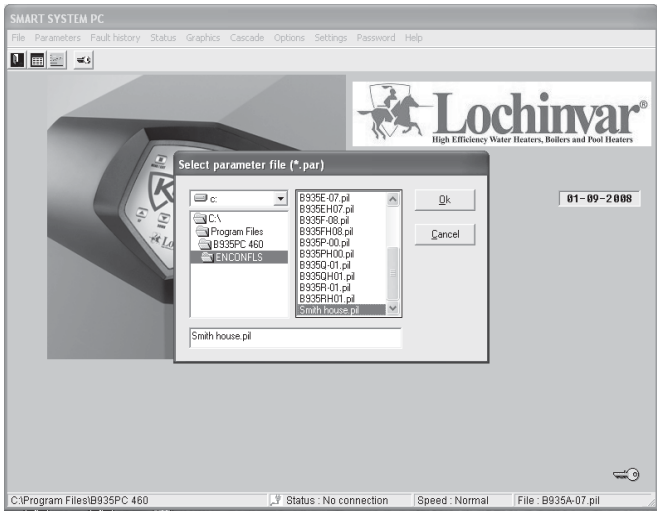
Figure 7-12_Save Parameter File Window



Loading stored parameters from the PC

To retrieve a set of parameters that had been stored previously, click on **Parameters** at the top of the screen, then on **Get data file from disk** (see FIG. 7-1 on page 20). A new window will appear (FIG. 7-13). On the left top corner, select the drive on which the data file is stored, followed by the correct folder. The list of data files in that folder will be shown on the right. Click on the data file you wish to obtain. That file name will appear in the field at the bottom of the window. Click on the **OK** button. Note that this file name appears in the lower right-hand corner of the SMART SYSTEM PC window.

Figure 7-13_Get Parameter File Window



8 Notes

8 Notes

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