



MODEL KN-SERIES PROGRAMMABLE CONTROL

PROGRAMMING EXAMPLES

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TABLE 1

Example #	1	2
Number of Boilers	1	2+
SYS/DHW Sensor	NO	YES
OUTDOOR Sensor	YES	YES
RETURN Sensor	NO	NO
SUPPLY Sensor	YES	YES
Combustion Air Damper	YES	NO
Circulator Pump	YES	YES
Outdoor Reset	YES	NO
Night Setback	YES	NO
Password	YES	NO
HEAT NET	NO	YES

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KN Series Boiler Initialization

Before we can setup a KN series boiler we need to establish a known starting point. This starting point consists of loading default values and checking for the latest firmware release of the control code. While the factory ships a fully functional boiler, enhancements and features may have been added to the KN series boiler's firmware (control program). The release version is "V2.1" and should be at least this version. Released versions are numerically sequential.

When you first turn the boiler on you should here at least (2) beeps. The control's version number and a timer will then be displayed. The initialization timer allows the Low Water Cutoff to reset.

Once the timer finishes, the KN series boiler will enter the status screen. STANDBY will be displayed in the upper left if there is no call for heat (T1, T2, T3, T4, AA, and Heat Demand **must not** have a closed contact across their respective inputs, and no 4-20ma or 0-10vdc signal present). During this procedure we must not have a call for heat present.

STANDBY	LOCAL SET
	140°F

Now, Press the BACK key and hold it for (5) seconds. This will allow us to leave the status screen and enter the setup menus.

▶ SETUP
ADVANCED SETUP
VIEW LOG

With the pointer pointing to SETUP, press the SELECT key. This will take us to the basic setup menu.

▶ KN SERIES V2.1
BOILERS
SETPOINTS
OUTDOOR AIR RESET

The top line indicates the current firmware (program) revision of the KN boiler's control.

If the Version number (in this case V2.1) does not match the current version released by the factory, the newer firmware file should be acquired and downloaded into the KN series boiler before continuing with setup.

To do this, Press the BACK key to return to the main setup menu screen.

▶ SETUP
ADVANCED SETUP
VIEW LOG

Using the DOWN arrow key, move the pointer until it is pointing to ADVANCED SETUP.

SETUP
▶ ADVANCED SETUP
VIEW LOG

Press the SELECT key to enter the advanced menus.

▶ DISTRIBUTED CTRL
MODULAR BOILER SET
MODULATION PID
FIRING MODE

Using the DOWN arrow key, scroll down until the menu item SYSTEM is displayed.

PASSWORD
COMMUNICATIONS
LOAD DEFAULTS
▶ SYSTEM

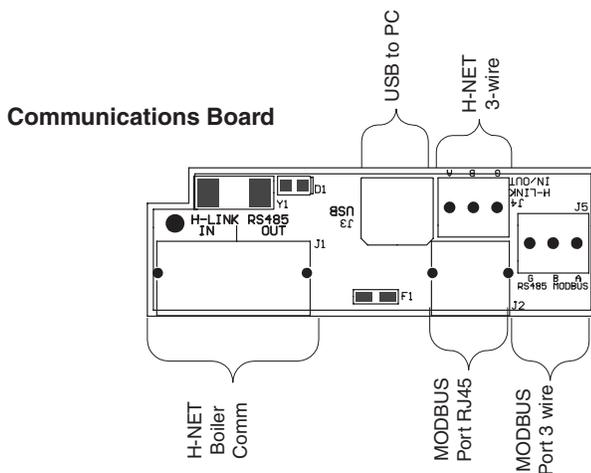
FIRMWARE UPDATE

Before we go any further, you must have a personal computer or notebook computer with a USB port or a Serial to USB adapter. This computer must have the “KN Series Firmware Update” program installed. **Do Not continue** if this program is not installed, since the current running firmware program will be erased. A loader program will be run in its place and will wait for the “KN Series Boiler Firmware Update” program to connect. The Installation program will look like the following:



NOTE: Before beginning the update process, record all setup information. After the Firmware load has completed successfully. You may need to enter setup to verify or restore your settings. The factory ignition settings will remain unchanged.

If the program and the USB driver have been installed on the PC/Notebook, plug one end of the USB cable into the PC/Notebook and the other end into the communications board. The USB Connector is on top of the communications board.

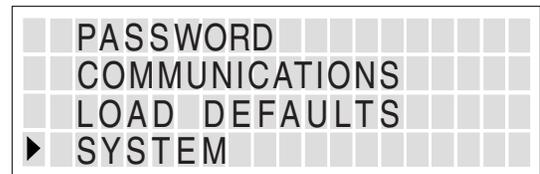


It is important that the cable be plugged in the PC/ Notebook and Communications board first before launching the “KN Series Boiler Firmware Update” program. When the program is launched, it will auto detect the KN series boiler and default to its comport. The program will load and will display the firmware program file to load. So, now it is OK to launch the “KN Series Firmware Update” program if you have the correct file.

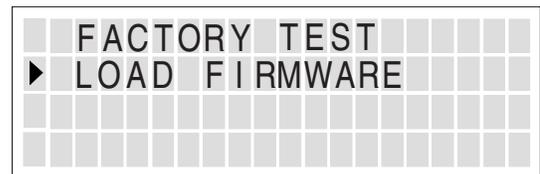


Ensure that this is the correct file. If not, you can use the box with the “...” in it to select the directory/file.

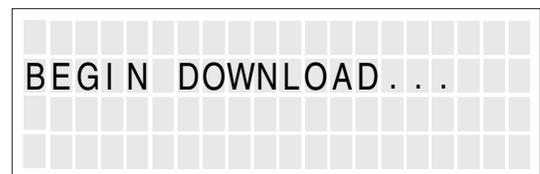
The KN series boiler should still be displaying:



Press the SELECT key on the KN series Boiler to access the LOAD FIRMWARE menu. Then using the DOWN arrow key, place the pointer next to LOAD FIRMWARE. Press the SELECT key.



Use the DOWN arrow key to select “YES” and press SELECT key. When “ARE YOU SURE?” is displayed, use the DOWN arrow key to select “YES” and press the SELECT key.

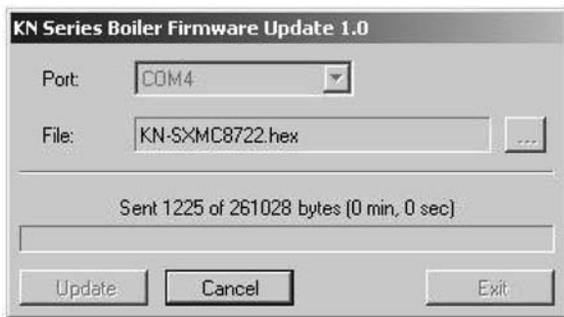


At this point the KN series boiler remains in the download state. A program must be downloaded in order for the KN series boiler to function again.

Now, return to the “KN Series Boiler Firmware Update” program on the PC/Notebook and using the mouse pointer, press the Update button.



The “KN Series Boiler Firmware Update” program will now ask to turn the KN series boiler OFF and then turn the KN series boiler back ON.



Once the power cycling (power switch OFF then ON) has been done the PC/Notebook will begin downloading the program into the KN series boiler. If for any reason the downloading is interrupted or fails, Power cycle the KN series boiler and then the “KN Series Boiler Firmware Update” program will need to be run and the Update button pressed again. The KN series control will appear to be unresponsive after power cycling, but will still be waiting for the program from the PC/Notebook to download.

If the update program starts sending, but then stops or just can't load. Remove the shorting jumpers if set for termination from J3 and J6. Then attempt the update again. Remember to replace the shorting jumpers once the download completes.

Once the download has completed, the “KN Series Boiler Firmware Update” program will indicate it has a completed. The KN series boiler will then reboot.



After the initialization, the status screen will be displayed:

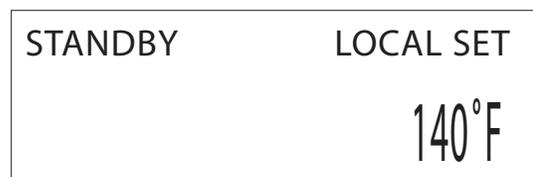


Check that the boiler performs a normal power up and the status screen is displayed. If the firmware did not load correctly the display will remain blank indicating that the control is waiting for a good load. The firmware will need to be reloaded until a normal power up is observed.

LOADING DEFAULTS

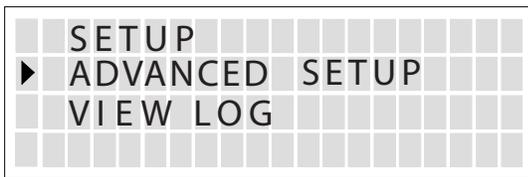
1. The factory ships the KN series boiler with a default setup, but to ensure that the default values have not been changed you should load these defaults.
2. If a new firmware program was loaded, you may wish to load the factory defaults as good measure.
3. The loading of factory defaults will require you to record any custom settings you have made and re-enter them after you have loaded the factory defaults or performed a firmware load.

Power-up the KN series boiler. You should here at least (2) beeps. The control's version number and a timer will then be displayed. After the timer expires you will enter the status screen.

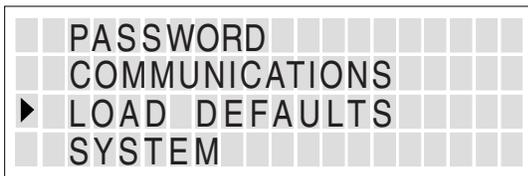


Now, Press the BACK key and hold it for (5) seconds. This will allow us to leave the status screen and enter the setup menus.

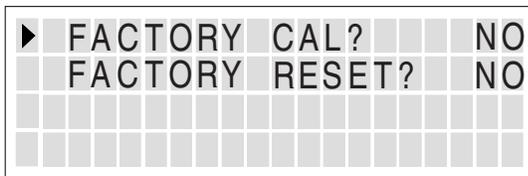
Press the DOWN key to select the ADVANCED menu option and then press the SELECT key.



Using the DOWN arrow key, scroll down until the pointer is pointing at LOAD DEFAULTS.

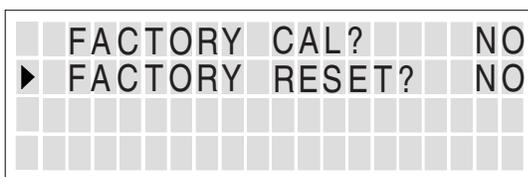


Press the SELECT key. The menu displayed will have two options. The FACTORY CAL will load all of the calibration values for ignition, such as: pilot ignition blower speed, the blower's minimum run speed (Min Output), and the maximum blower speed (Max Output).

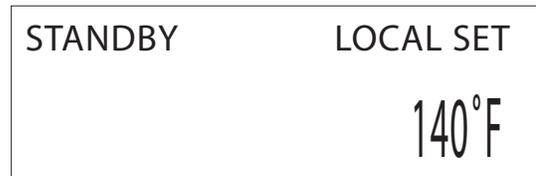


Press the SELECT key. Next, using the DOWN arrow key, select YES, and press the SELECT key. Now you will be asked if you are sure. Use the DOWN arrow key to select YES and press the SELECT key. The factory calibration values for ignition are now loaded.

Now, move the pointer using the arrow key to FACTORY RESET and press the SELECT key. Answer YES to both questions the same way you did in FACTORY CAL.



After a few seconds the KN Boiler will reset and you will notice the initialization screen and then the status screen displayed.



At this point you can begin programming the KN series boiler. There are programming examples in the rest of the manual that you may use as a guideline.

QUICK START INSTALLATION (HEAT NET)

If you have verified that the current version of the firmware is valid for your requirements and that the default settings are OK you may continue.

First, identify which boiler is to be used as the MASTER. On a single boiler system the single boiler may be set up as a MASTER or as a MEMBER.

1. Attach the header sensor (determines MASTER). Attach the Outside Air sensor to MASTER if used.
2. Place the REMOTE/LOCAL switches on all boilers to the REMOTE position.
3. Jumper any unused 24VAC interlocks and attach any additional interlocks (such as a flow switch).
4. Connect the ALARM and CIRC relay contacts if used.
5. Terminate the Heat Net communications bus by jumpering J21 and J23 on the MASTER and the last MEMBER boiler.
6. Power up each boiler with the other boilers remaining OFF and enter the LOAD DEFAULTS menu from ADVANCED SETUP.
StatusScreen>ADVANCED SETUP>LOAD DEFAULTS
Select the FACTORY RESET and answer "YES" and "YES" again. This will load all default values and reboot the boiler.
7. Enter the DISTRIBUTED CTRL menu from ADVANCED SETUP.
StatusScreen>ADVANCED SETUP>DISTRIBUTED CTRL
Assign a unique LOCAL ADDRESS to each of the member boilers starting with address (2) for the first MEMBER.

8. Calibrate each boiler by following the calibration instructions in the KN Instruction and Operating Manual. Use the CAL/NORM switch on the board. This will also require placing the REMOTE/LOCAL switch to LOCAL to fire the boiler.

9. Plug in the Heat Net cable starting with the MASTER (Yellow LED blinking) to the communications board J1 OUT. Then plug in the communications cable to each MEMBER, IN and then OUT of J1. The MASTER and the last MEMBER will have only (1) cable connected to the communications board at J1.

10. HEAT DEMAND:

- a. If a building management system needs to enable and disable the system, connect a dry set of contacts to the HEAT DEMAND input on J12A of the MASTER boiler. This will parallel the REMOTE/LOCAL switch wires already on J12A. Closing the contacts enables the system.
- b. Place the REMOTE/LOCAL switch on the MASTER boiler to the LOCAL position. This will enable and start the system.

11. Verify operation of the system by observing the yellow LEDs on the communications boards J1. All boilers should be blinking at about twice a second. If they are not, check the termination, communications cables, and the LOCAL ADDRESS values. If the MASTER's communication cable is unplugged all MEMBER boilers' yellow LEDs will stop blinking. If blinking is observed on the MEMBER boilers, one or more boilers are sensing a header sensor and configuring themselves as a MASTER. Only one MASTER is allowed in a system. Remove the other header sensor(s) if this is the case.

You can observe the MEMBER boilers as they are detected by going to the BOILERS menu.

StatusScreen>SETUP>BOILERS

The number of boilers can not be changed manually, but are auto-detected over the Heat Net communications bus.

12. Finalize custom settings.

- a. Adjust the setpoint to the desired temperature.
- b. Enable the outdoor reset if used and verify/adjust the reset values.
StatusScreen>SETUP>OUTDOOR AIR RESET
- c. Adjust MOD MAX-LAST FIRE value (default = 70%)
StatusScreen>ADVANCED SETUP>MODULAR BOILER SET.
- d. Verify OP LIM: *StatusScreen>SETUP>SETPOINTS.*
- e. Verify auxiliary functions: *StatusScreen>SETUP>AUX FUNTIONS*
- f. Set the clock on the MASTER: *StatusScreen>SETUP>SYSTEM CLOCK.*

The MASTER will synchronize and load the time on the MEMBERS.

EXAMPLE #1: Single (Member) Boiler & Menu Walkthrough

BASIC SETUP MENU

This example will give you an idea of the different features available. Applying these features to a single boiler application will allow us to expand to multiple boilers. A walkthrough of all the setup menus will be done only in this example.

It is assumed that you have loaded the latest firmware or are comfortable with the version that is currently loaded in the KN series boiler. The default values have been loaded so that our example displays will match what you are being presented on your display.

Lets begin by powering up the KN series boiler.

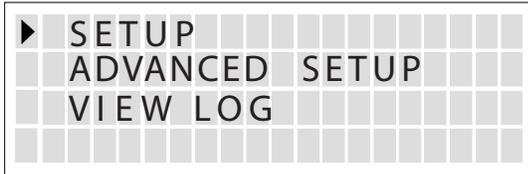
When you first turn the boiler on you should here at least (2) beeps. The control's version number and a timer will then be displayed. The initialization timer allows the Low Water Cutoff to reset.

Once the timer finishes, the KN series boiler will enter the status screen. STANDBY will be displayed in the upper left if there is no call for heat (T1, T2, T3, T4, AA, and Heat Demand **must not** have a closed contact across their respective inputs, and no 4-20 ma or 0-10vdc signal present). Also ensure that the any communications cabling is disconnected. During this procedure we must not have a call for heat present and the upper left corner must display STANDBY. Many of the setup values can only be changed when there is no call for heat.



The status screen is the normal display that will be presented during operation and consists of multiple screens. But for now we'll concentrate on how the KN series boiler works using the setup menus. The status screen menus will be reviewed later when we're ready to run.

Now, Press the BACK key and hold it for (5) seconds. This will allow us to leave the status screen and enter the **SETUP MENU**.



The basic SETUP menu is what you will use most often. The ADVANCED SETUP menu will be accessed mainly during an installation startup or a firmware program update. The VIEW LOG is primarily used for troubleshooting. So, let's continue.

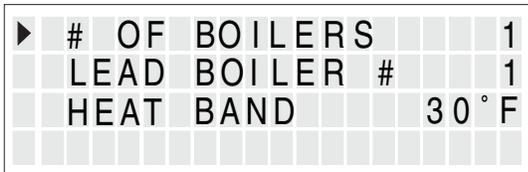
With the pointer pointing to SETUP, press the SELECT key. This will take us to the basic setup menu.



The top line indicates the current firmware (program) revision of the KN boiler's control.

If the Version number (in this case V2.1) does not match the current Version released by the factory, the newer firmware file should be acquired and downloaded into the KN series boiler before continuing. See section "KN Series Boiler Initialization" of this manual.

Using the DOWN arrow key, position the pointer next to BOILERS and press the SELECT key.



The boilers screen is displayed. The # OF BOILERS and the LEAD BOILER can't be changed since there is no SYS/DHW sensor connected. Without this sensor, the boiler is treated as a member boiler and can only maintain its supply temperature, unless an external input attempts to control it.

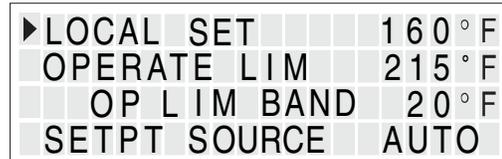
The HEAT BAND is the temperature around the setpoint/2. This can be considered the differential temperature. In this example of 30° F, when we are 15° F below the setpoint the KN series boiler will start. When we're 15° F above the setpoint the boiler will turn off. While in the heat band the KN series boiler will maintain setpoint adjusting the modulation accordingly.

To change the HEAT BAND temperature, press the SELECT key. The pointer will move to the temperature. Press the DOWN or UP arrow keys to change the entry. Pressing SELECT saves the entry, the BACK key aborts and restores the old entry. **This method is used for changing all values.**

Press the BACK key to return to the setup menu.



Press the DOWN arrow key to point to SETPOINTS. Then press the SELECT key.



This screen shows us the setpoint at which the boiler will maintain the temperature of the supply water out of the boiler. In the example shown, it is 160° F. It may also be changed/adjusted in the status screen. The status screen displays the current setpoint that is adjusted for setbacks or for the OA RESET. So, it may be confusing to set the setpoint in the status screen. The setpoint sometimes appear to be moving. In this location it is stable. This will be explained a little better during the status screen walkthrough.

The second line is the operating limit. Its purpose is to perform as an aquastat to our supply water temperature. While running locally (Heat Demand input closed), the HEAT BAND acts as our aquastat for our supply water when it crosses the upper bound (setpoint + HEAT BAND/2) and shuts off the boiler. If the boiler is unable to shut off due to too long of a STOP DELAY setting, the OPERATING LIMIT will shut the boiler off before it hits the HIGH LIMIT. When the KN series boiler is controlled by an external input (T1-T4, AA, or the 4-20ma/0-10vdc) or used in a primary/secondary loop, the operating limit is used exclusively to monitor supply water temperature.

The boiler must drop at least 10° F below the OPERATING LIMIT before starting again. If the OPERATING LIMIT BAND is used, the bottom of the operating limit band will be used to restart the boiler. This can be up to 50° F. So the restart range, after the boiler trips on the operating limit is: 10-50° F.

The OP LIM BAND is the operating limit band. With an **external** input, it's purpose in the example, is to limit the output of the boiler 2°F below the operating limit of 215°F. So, if the AA terminal is closed (instructs the boiler to run at high fire 100% output), and the supply water temperature is 195° F and rising, the boilers output will drop to 95%. As we approach the operating limit every degree increase will lower the output by 5% until the boiler shuts off. This helps prevent the boiler from short cycling when using external inputs. The equation for this is:

$$\frac{(\text{OPERATING LIMIT} - (\text{OPERATING LIMIT} - \text{OP LIM BAND}))}{\text{OP LIM BAND}} = \% \text{ output of input called for}$$
(1=100%, .25 = 25%).

The last line on this screen is the setpoint source. When it is set to AUTO, the master will automatically control the setpoint using the fixed SETPOINT setting, dynamically adjust the setpoint based on the outside air temperature, or can interpret commands sent over the MODBUS port to change the setpoint.

If the SETPOINT SOURCE is set to 4-20ma (**SETPT SOURCE 4-20ma**), The setpoint is controlled externally using a 4-20ma signal that is mapped to a setpoint range.

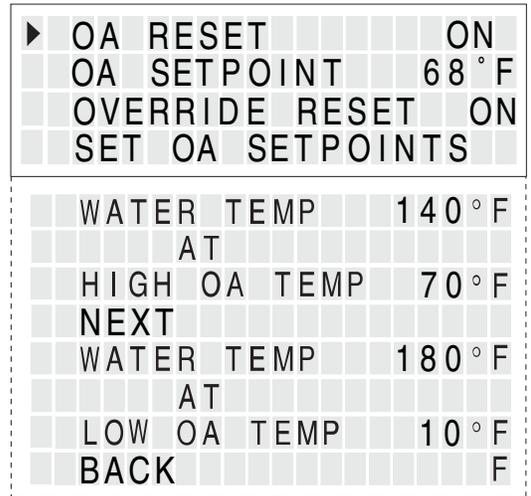
Firmware Version 2.1 added the 4-20ma setpoint control functionality. This function translates a 4-20ma control signal to a setpoint mapped from 60°F to 220°F. The minimum current accepted is 5ma and translates to 60°F. To get the approximate setpoint (within a few %), divide the 4-20ma current sent by .09.
Example: 10ma / .09 = 110°F. **The REMOTE ENABLE input must also be closed in order for this feature to work.**

NOTE: If the HEAT DEMAND input is closed, the H-Net system will use the SYSTEM/LOCAL SET to control the boiler(s) if the 4-20ma signal is below 5ma. Once the current exceeds 5ma, the 4-20ma current is mapped to the new setpoint. (This method may be thought of as a backup in the event the 4-20ma signal is lost.) Also, if the HEAT DEMAND input is not used, the 4-20ma signal can be used to start the H-NET system once the current exceeds 5ma and is mapped to the new setpoint.

Press the BACK key to return to the SETUP menu.



Move the DOWN arrow key to point to OUTDOOR AIR RESET. Press the SELECT key.



This brings up the outdoor reset menu. The outdoor reset sensor is required for this function to work.

There are two parts to the outdoor reset. The first part is the OA RESET, which if ON, as in the example, will act as a warm weather shutdown (Winter/Summer). It is used with the OA SETPOINT to determine the temperature at which the boiler automatically turns itself OFF. In the example, since the OA RESET is ON, the KN series boiler will shut off when the outside air temperature is equal to or rises above 68°F. The OA SETPT temperature in the status screen will display the last setpoint before the shutdown. Before the boiler can cycle ON again the Outside temperature has to fall 2° F below the OA SETPT value (hysteresis).

The second part of the outdoor reset menu if OA RESET is ON, consists of a proportional outside air temperature to boiler supply water temperature slope. The four temperature points to calculate the slope can be entered by selecting the SET OA SETPOINTS.

In the example, when the high outside air temperature is 70°F the boiler water supply temperature setpoint will be 140°F. Well, 70°F is above the outdoor reset value of 68°F. How, could the boiler supply water temperature get to 140°F if the boiler is OFF. Even though the outside air temperature is above the outdoor reset value, the water temperature will follow a line that is constantly calculated from the four OA setpoint values. In the example, the setpoint would never get to 140°F, but is used to calculate the slope for outside temperatures below the OA SETPT.

The following equation shows that the difference in outside air temperature points divided by the difference in water temperature points yields a 1.5°F water temperature change for every degree of outside air temperature change.

$$(70-10) / (180-140) = 1.5^{\circ}\text{F}$$

So, at 68°F outside air temperature, the water temperature setpoint would be 143°F, +/- 1°F.

The last menu item is the OVERRIDE RESET. When the OVERRIDE RESET is ON, the KN series control will monitor for a switch closure across the OA OVR terminal on J12A. If the input is closed, the outdoor reset slope is overridden and the setpoint becomes the LOCAL setpoint. In our example: 160 F. When this input is open, the OA reset setpoint is calculated. When the OA RESET is enabled and the outside air temperature is equal to or above the OA SETPOINT and the OA OVR is closed, the KN series boiler will turn ON and run at the LOCAL setpoint.

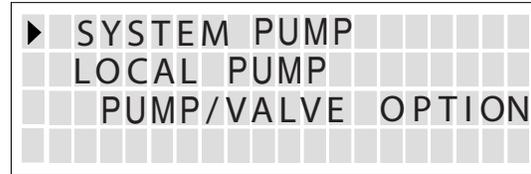
Next, press the BACK key to return to the setup menu. Press the DOWN arrow key until the PUMP OPTIONS menu is displayed. Press the SELECT key to enter the pump options screen.



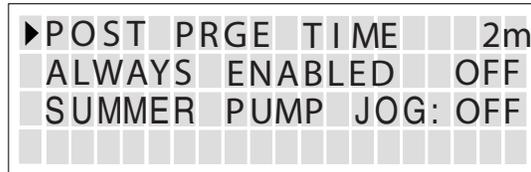
Version 2.1 incorporates the control of a system pump (common system supply pump). A system pump prove dry contact must be placed across the SPARE 3 interlock input. This is the very first interlock, so the H-Net boiler system will not work if this input is open. The on-board relay contacts must be isolated and must only be used to control a motor contactor.

If the system pump is not to be controlled by the H-Net system, but a building management system or other manufacturer's control, place a jumper across the SPARE 3 input.

Now, lets go over the system pump setup. Press the SELECT key to enter the System Pump menu.



The Options for the SYSTEM PUMP are now displayed.



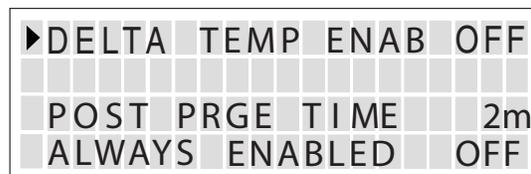
The POST PRGE TIME is always enabled, but can be set to any time from 1 to 60 minutes. The default time, as in this example is 2 minutes. This time is used to keep the pump on after the system has shut down (the call-for-heat is removed).

The next item in the menu is the ALWAYS ENABLED. The ALWAYS ENABLED option, if set to ON, will keep the pump on regardless of the DELTA TEMP and POST PRG TIME. However, the pump turns off if outdoor reset is enabled and the outside air temperature is above the OA SETPOINT (summer mode).

The last item, SUMMER PUMP JOG is used to cycle the pump once a week when in the summer shutdown mode (outdoor reset is enabled and the outside air temperature is above the OA SETPOINT). It is used to prevent the pump from seizing during long periods of inactivity. It can be set to any day of the week and will run the pump starting at 12:00 am and continue for (1) post purge time cycle. In this example: for 2 minutes if not set to OFF.

Press the BACK key to return to the Pumps menu.

Press the SELECT key to enter the LOCAL PUMP options screen.



This screen defines how our circulator pump is to perform. The first item "DELTA TEMP ENAB" requires the use of a return temperature sensor. It is used to keep the pump running until the temperature across the boiler has fallen to the temperature designated by DELTA TEMP. The POST PRGE TIME would also need to expire before the pump turns OFF.

```

▶ DELTA TEMP ENAB ON
  DELTA TEMP      10°
  POST PRGE TIME   2m
  ALWAYS ENABLED  OFF
  
```

The POST PRGE TIME is always enabled, but can be set to any time from 1 to 60 minutes. The default time, as in this example is 2 minutes.

The ALWAYS ENABLED option, if set to ON, will keep the pump on regardless of the DELTA TEMP and POST PRG TIME. However, the pump turns off if outdoor reset is enabled and the outside air temperature is above the OA SETPOINT.

Press the BACK key to return to the PUMPS menu.

```

▶ SYSTEM PUMP
  LOCAL PUMP
  PUMP/VALVE OPTION
  
```

Using the DOWN arrow key, select the PUMP/VALVE OPTION. Press the Select key.

```

▶ MASTER PUMP/VALVE
  REMAINS ON: OFF
  
```

This is a special feature/option of the LOCAL pump/valve. If the local pump control is used to control a pump or valve in a primary/secondary loop, a deadhead flow condition may occur when all the pump/valve(s) are off. If this option is set to ON, the master boiler will keep its LOCAL pump/valve relay closed when no boilers are firing (the master also accounts for boilers that are in the LOCAL override mode). Flow will then occur through the master boiler when all boilers are OFF.

Press the BACK key to return to the setup menu. Use the DOWN arrow key to point to NIGHT SETBACK.

```

PUMP OPTIONS
▶ NIGHT SETBACK
  OPTIONS
  LOG/RUNTIME
  
```

Press the SELECT key to enter the NIGHT SETBACK menu.

```

▶ SETBACK ENTRY      1
  ENTRY IS           OFF
  SETBACK            20° F
  SETBACK TIME
  
```

This menu allows us to set up to four setbacks. The SETBACK ENTRY defines 1 of 4 entries. This entry can be changed by positioning the pointer adjacent to SETBACK ENTRY and pressing the SELECT key. The arrow keys can then be used to change the Entry #. Press the SELECT key again to work with this entry. To enable the entry, position the pointer to ENTRY IS and press the SELECT key. Use the DOWN arrow key to set the value to ON and press the SELECT key. Position the pointer so that it points to SETBACK and press the SELECT key. Adjust the temperature using the arrow keys and press SELECT to save the value (press BACK to abort the change). Now, position the pointer so that it points to the SETBACK TIME and press the SELECT key. You will be taken to the SETBACK TIME menu.

```

▶ START DAY          MON
  TIME              12:00 AM
  END DAY           MON
  TIME              12:00 AM
  
```

Here you can enter the START DAY of the week that you would like the example setback of 20° F to begin. In this case Monday is the start day. Enter the time you would like to begin the setback. The setback actually begins ramping down 30 minutes before the time set in order to arrive at the 20° F setback at the entered time. It also begins ramping up 30 minutes before the end time

Now, enter the END DAY and the end TIME that you want to return back to the LOCAL setpoint. The setback will actually end 30 minutes prior to this set time in order to ensure that we are at the LOCAL setpoint when this time arrives.

If you have a combustion air damper, you can assign it here. The Master boiler controls a system damper and Member boilers control their own respective dampers. Once a call for heat is detected, the combustion damper relay will energize and wait for the dampers proof switch to make before starting boilers. When the call for heat is removed, the damper will remain open for 30 seconds before closing. This allows for post purge cycles to complete.

If the damper fails to open on the Master, all Member boiler(s) in the system won't start, including the Master. The fault may be cleared and a retry done by clearing the call for heat.

If a member boiler's damper fails to open, only the Member boiler won't start. The fault can only be cleared by power cycling the member boiler.

NOTE: If a member boiler is placed in the LOCAL mode, the system damper will need to be opened manually if the master boiler is powered off or not connected via H-Net.

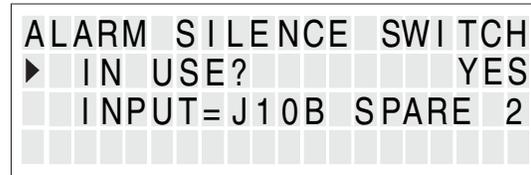
Use the arrow keys to point to "IN USE?" and press the SELECT key. The pointer will now point to NO. Press the DOWN arrow key until "YES" is displayed. Press the SELECT key to save. You have now enabled support for the combustion air damper. Upon a call-for-heat, Relay K5's (BOILER3 /DAMPER) relay contact will close. The KN series boiler will then wait up to the proof time for the damper to open. A proof switch is required to make before ignition can continue. The proof switch is connected on input **SPARE 1** located on J10B. In the event the proof switch does not make, a fault message indicating this will be displayed.

Press the DOWN arrow key until the pointer is beside the PROOF TIME. Press the SELECT key to position the pointer adjacent to the time. Use the arrow keys to adjust the time required for the combustion air damper to open and the proof switch to make. Press the SELECT key to save your setting. Press the BACK key to return to the auxiliary functions menu.

Move the pointer so it points to ALARM SILENCE using the DOWN arrow key.

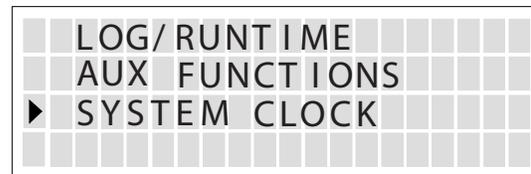


Press the SELECT key to enter the ALARM SILENCE menu.

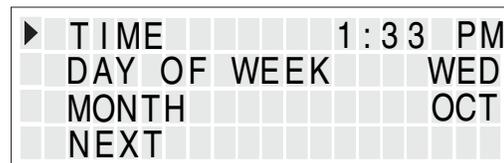


The ALARM SILENCE SWITCH menu configures the alarm located on the KN series boiler. The default is to use the input located on J10B with a momentary switch. When an interlock is tripped or an alarm is set, the alarm relay closes and the audible alarm chirps every second. Pressing the momentary switch connected to J10B will silence the alarm, but the alarm relay will remain closed and the display will indicate the alarm condition with a time stamp. This menu allows the disabling of the use of this switch.

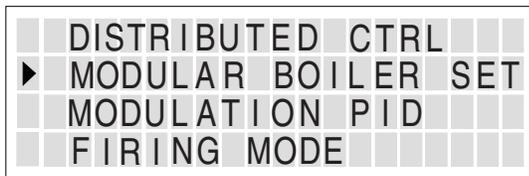
Press the DOWN arrow key to position the pointer next to the SYSTEM CLOCK.



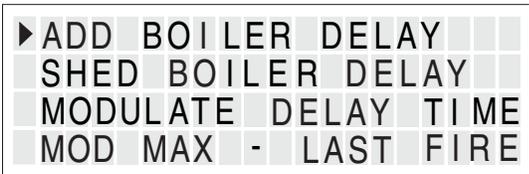
Press the SELECT key to enter the set clock menu. The setting of the clock is not required for operation of the boiler (except the night setbacks), but provides an accurate time for logging events and time stamping faults. Once all of the time entries have been set, they will still need to be saved in the NEXT menu.



Press the BACK key to return to the advance menu. Position the pointer so that it is adjacent to the MODULAR BOILER SET.



Press the SELECT key to enter the modular boiler settings menu.



The first menu item (master only) determines how much time is required before firing the next boiler. Boilers are fired when the system water temperature is below the heat band (setpoint - heat band/2). The first boiler always fires immediately, and before the next boiler can fire the ADD BOILER DELAY time needs to expire. This prevents the water temperature overshooting when staging boilers. The ADD BOILER DELAY should be set to prevent too many boilers firing and then shutting off quickly (short cycling). APPLIES: MASTER

The menu item is the SHED BOILER DELAY. The SHED BOILER DELAY should be set so that the safety limits do not trip (too long of a time), and all boilers do not turn off too quickly when the top of the heat band is tripped (setpoint + heat band/2). Ideally, once a boiler turns off, the water temperature should have sufficient time to settle back into the heat band and maintain setpoint with the remaining boilers firing. APPLIES: MASTER

Our next menu item is the MODULATE DELAY TIME. When a boiler first fires and proves flame it goes to its minimum fire position. It holds there until the modulate delay time has expired. After this time has been met, a boiler will then accept commands to fire at the command rate. APPLIES: MASTER OR MEMBER

The next menu item is the MOD MAX - LAST FIRE. The master uses this when firing (total boilers - 1). If we are not firing the last boiler in the system, the maximum fire rate of the boilers is limited to STOP MOD MAX %. Once all the boilers are firing, this STOP MOD MAX % clamp is released and all the boilers can fire at the maximum fire rate of 100%. APPLIES: MASTER

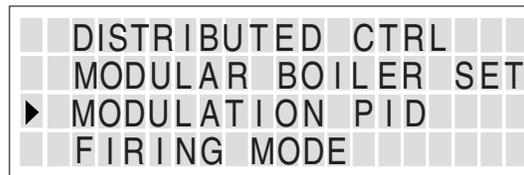
There are more menu items on this screen, so press the DOWN arrow key to view the next menu item.



The STOP BAND OFFSET allows us to change the EARLY STOP DEGREES variable. This variable allows the boiler to stop early before it reaches the (setpoint + heat band/2) when the water temperature is moving fast enough to overshoot the top of the band significantly. The default value should be sufficient for most applications. APPLIES: MASTER OR MEMBER

The last menu item is the BOILER START TIME. This time is used to start a boiler early when the water temperature is falling and the control predicts that it will fall out of the heat band. The default value is the standard time to start a boiler (pre-purge and ignition). If long MODULATE DELAY TIMES are used, this may need to be adjusted. APPLIES: MASTER OR MEMBER

Press the BACK key to return to the advance menu. Use the DOWN arrow key to point to MODULATION PID.

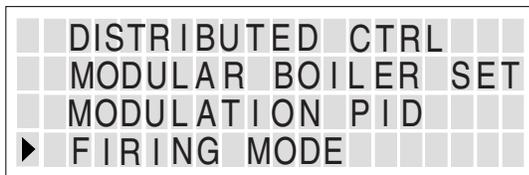


Press the SELECT key to enter the menu.

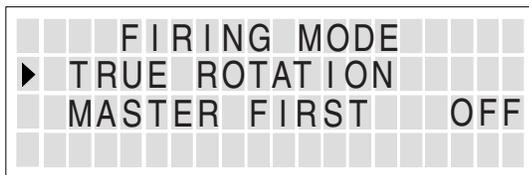


The KN series boiler uses a modified PID algorithm to maintain the water setpoint. The values here may be adjusted **with care** to achieve tight control of the water temperature with changes in load. We recommend that if adjustments are necessary, the Integral value be used primarily and then Derivative value. The default values should be sufficient for most application using the KN series boilers. Remember, you can always load the default values.

Press the BACK key to return to the advanced menu. Position the pointer to firing mode.

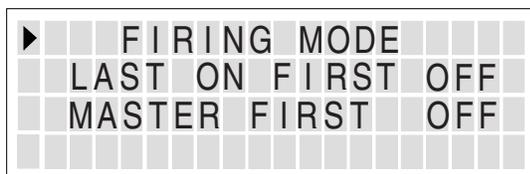


Press the SELECT key to enter the firing mode selection.



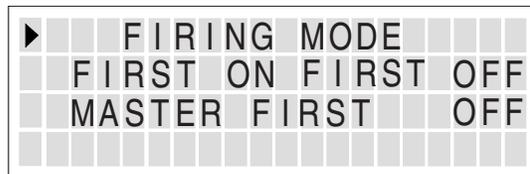
The firing mode allows for different methods of firing multiple boilers by the MASTER to equalize runtime. The default method is TRUE ROTATION. In this method, rotation of the boilers is done strictly on time. Each boiler maintains its own runtime based on the time the main valve is open. The Master boiler reads this runtime value from each boiler via H-Net, and fires the boiler with the least runtime. When the boilers need to turn off, the Master finds the boiler with the most runtime and turns it off first. This method eliminates the need for a lead boiler, since all boilers should have roughly the same runtime.

If using a common flue for your boiler system you would also need to turn the **MASTER FIRST** menu item to ON. The Master boiler would then be connected closest to the vent so as to establish a draft. Once the Master fires, the TRUE ROTATION method will be used fire/stop the remaining boilers. So in this way, the Master acts a bit like a lead boiler.

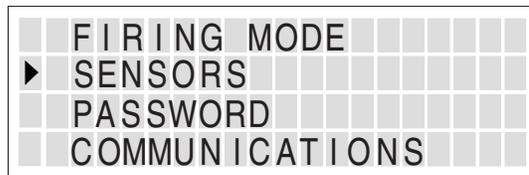


The next method is LAST ON FIRST OFF (LOFO). This firing method can also be used as the firing method for common flue boiler systems. The Master would always be the first boiler to fire and the last one to shut off. The Master boiler would then be connected the closest to the vent so as to establish a draft.

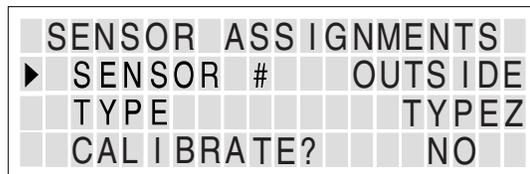
The next mode is FIRST ON FIRST OFF (FOFO). This method provides rotation of boilers and a more equalized runtime but is not good for common vent systems.



Press the BACK key to return to the advanced menu. Position the Pointer until it is adjacent to SENSORS.



Press the SELECT key to enter the sensors menu.



The purpose of the sensor menu is to allow us to view the different sensors and calibrate the sensor inputs. With the pointer pointing at the SENSOR #, you can use the arrow keys to cycle through the different sensors. Once a sensor is identified, press the SELECT key. The pointer will then point to TYPE. You can then cycle through the different types of sensors. The default and current temperature sensor used by all KN series boilers is a 10k TYPEZ thermistor. For provisions using alternate types, contact the factory. Sensors 5 and 6 are reserved sensor inputs and are typically used for dry contact switch/relay closure detection. The type will be displayed as ON/OFF when using this type sensor. Sensors 5 and 6 are also reserved for future sensing applications.

The sensor inputs should not need calibration, but if they do you will need to connect the supplied 10k precision resistor to the input in need of calibration. Press SELECT when the TYPE indicates TYPEZ and then use the arrow keys to change to CALIBRATE? YES. Press the SELECT key.

```

PLACE A PRECISION
1K OR 10K RESISTOR
ON CHANNEL #  --
▶TRIM OHMS =  ---
  
```

The KN series control will then measure the precision resistor and establish a calibration trim resistance of TRIM OHMS. The TRIM OHMS value should not exceed +/- 200. If it does, the precision resistor may not be connected or there is a problem with this input. If you are satisfied with the value calculated, press the SELECT key to save it or the BACK key to discard it and check the input.

If you save the value, you will get the screen:

```

TRIM VALUE SET!
  
```

After a few seconds you will return to the sensors menu. This may be done for each sensor, one at a time.

```

SENSOR ASSIGNMENTS
▶ SENSOR #    OUTSIDE
TYPE          TYPEZ
CALIBRATE?   NO
  
```

Press the BACK key to return to the advanced menu. Position the pointer to the PASSWORD menu item.

```

▶ PASSWORD
COMMUNICATIONS
LOAD DEFAULTS
SYSTEM
  
```

Press the SELECT key to enter the password menu.

```

CHANGE PASSWORD
▶ OLD:  - - - - -
NEW:   - - - - -
  
```

Use the arrow keys to change each character where the '?' is present. Press the SELECT key to enter that character. Continue entering characters this way until the complete password has been entered. If you wish to cancel out at anytime you can press the BACK key. Once you have completed the password entry, you can now change the password. Enter the new password using the same method. Remember the default password is "AAAAAA" and can be reset to this if you hold the BACK key down while powering up the KN series boiler. The password feature can be enabled in the OPTIONS menu.

Press the BACK key to exit the password menu. Press the DOWN arrow key and skip the COMMUNICATIONS menu. This is a menu that will be used in the future. It will need a firmware upgrade when it is ready.

The last two menus, LOAD DEFAULTS and SYSTEM are explained in earlier in this manual. See section 1.0 "KN Series Boiler Initialization".

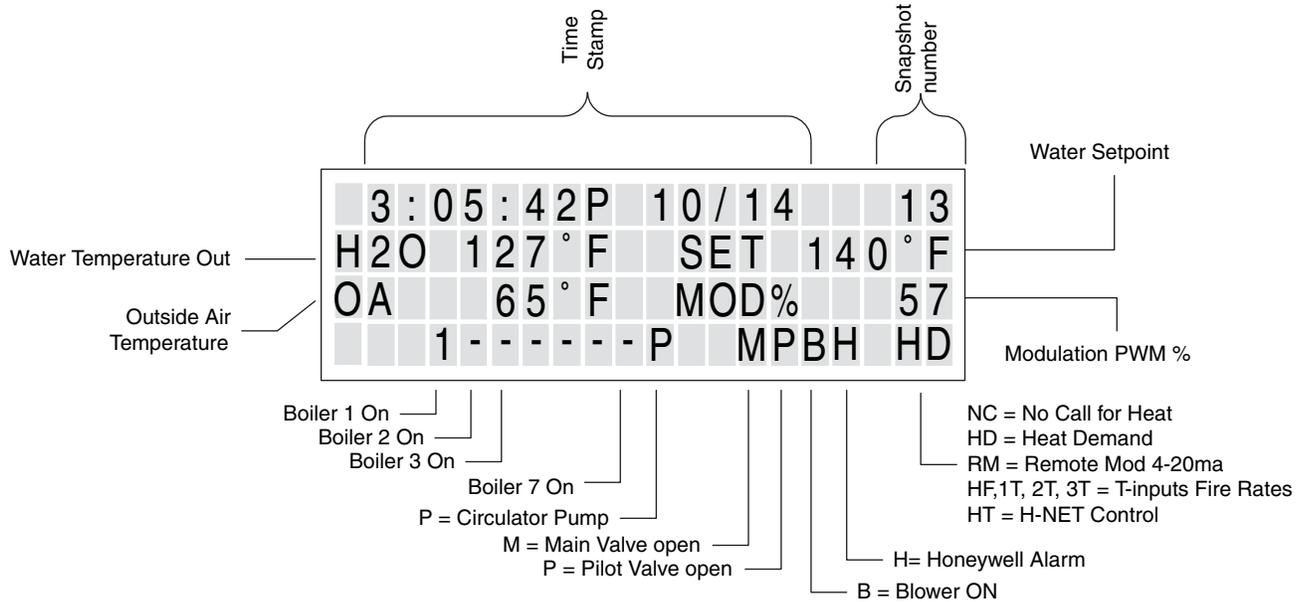
VIEW LOG SCREEN

The VIEW LOG menu is located in the main menu. It is used to access the information stored in the log.

```

SETUP
ADVANCED SETUP
▶ VIEW LOG
  
```

Press the SELECT key to enter the log.



The log stores major events that have occurred during the operation of the KN series boiler. These events include:

1. Faults
2. Boilers starting and stopping
4. Pump activity
5. Valve activity (main and pilot)
6. Input (Type of call for heat)

With these events, other information is recorded. This information includes:

1. Time of event (Timestamp)
2. The # of the event in the log
3. The supply water temperature
4. The setpoint
5. The outside air temperature
6. The actual PWM % of modulation
7. All of the boilers that are firing (Master)

Observe the snapshot #. This is a log entry of which there are 1,000. As soon as you enter the view log screen, it displays the last log entry the KN series boiler recorded. To view previous entries, press the DOWN arrow key. If you pressed the UP arrow key instead, you would have been taken to the very first entry. The log entries form a continuous ring of entries. You can verify this by observing the time stamp as you cycle through the entries.

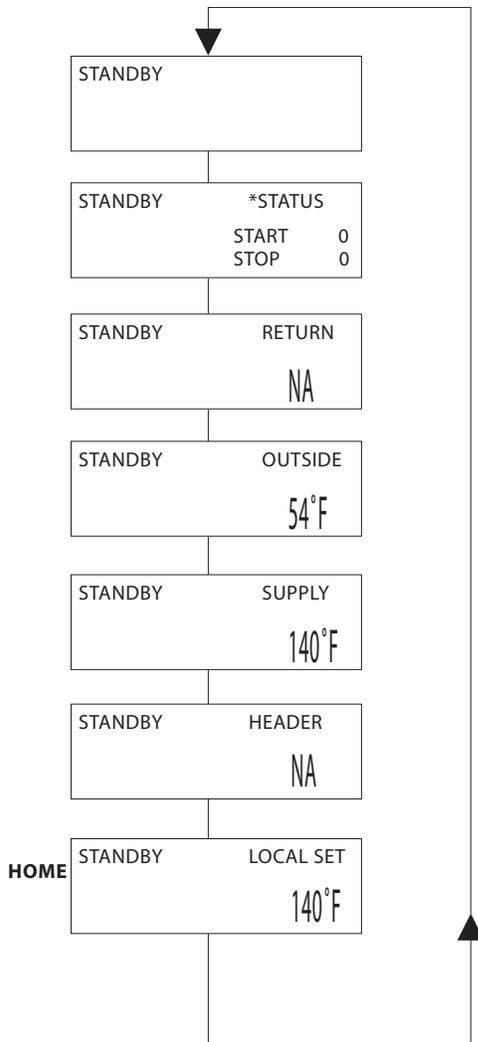
Once the log is full of the 1,000 entries, pressing the UP arrow key will show the oldest entry and no longer take you to the first entry. The log cannot be cleared and is a continuous record of 1000 entries. So don't wait too long for a service call, since older entries will be overwritten. To exit the log, press the BACK key.

STATUS SCREEN

If you are anywhere in the setup menus you can get to the status screen by pressing and releasing the BACK button until the status screen appears. If you are not there, or cannot get there, follow the first few paragraphs of 1.1 BASIC SETUP MENU.



The status screen is actually a menu that is displayed while running or in standby. It is the first screen displayed after the power-up and initialization. It provides all the system runtime status, faults, and calibration settings. You can navigate the status screen by simply pressing on the arrow keys. These keys will allow us to cycle through each screen.



With no call for heat, the menu's upper left corner will display STANDBY. The HOME screen is the setpoint screen. In this example, there is no SYS/DHW (HEADER) sensor, so the upper right corner of the setpoint screen will display LOCAL SET. LOCAL SET indicates that we are running off of the local setpoint and using the supply sensor to maintain temperature. To change the LOCAL SET setpoint, press and hold the SELECT key for a second. It will begin blinking. Use the arrow keys to move the setpoint up or down. If you are satisfied with the setpoint you selected, press the SELECT key. If you want to keep the old value, press the BACK key.

By pressing on the UP arrow key, we can view the HEADER screen. The header temperature is not available because of the lack of the sensor and will display NA (Not Available) where the temperature is normally displayed.

Pressing the UP key again takes us to the SUPPLY sensor temperature. Again, this is the sensor tied to the LOCAL SETPOINT, so the temperature displayed here should match, be very close, or approach the setpoint when the boiler is running.

Pressing the UP key again displays the OUTSIDE air temperature. In this example, the outdoor air sensor is connected and reports that the temperature outside is 54°F.

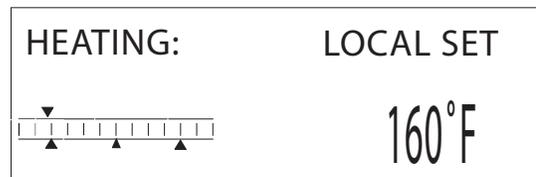
Pressing the UP key again displays the RETURN water temperature screen. Since we are not using the RETURN sensor, NA is displayed.

Pressing the UP key again displays the add boiler and stop boiler timers. Since we are not configured as a master boiler in this example, these values do not matter. If we were configured as a master, these timers would be counting down until 0 is reached. A boiler would then start or stop depending on the heat band end points.

Pressing UP again displays a blank screen with no information.

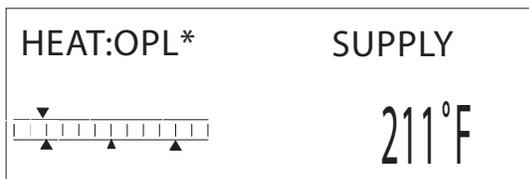
Pressing UP again returns us to the HOME setpoint display screen.

Now, let's fire the KN series boiler. First, we need to give it a heat demand. This can be done by placing the LOCAL/REMOTE switch on the inside of the control box to the LOCAL position. The LOCAL position acts as a local override. This switch allows the boiler to override a 4-20ma, 0-10 v, or H-Net control. It will maintain a supply temperature setpoint.

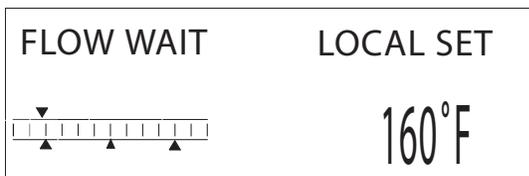


The left side of the display will now change to display the running status. The upper left corner will display HEATING, indicating that there is a call for heat. If any interlocks trip, the message FAULT will appear, and a time-stamped fault message will be displayed. This fault will need to be cleared before continuing.

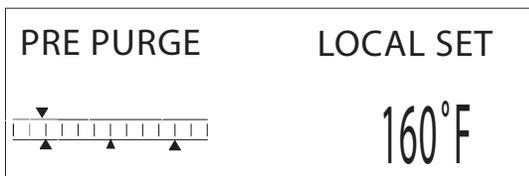
If the KN series boiler detects that its supply sensor has exceeded its OPERATING LIM setting or the OPERATOR input on J11B, this will be indicated by OPL*.



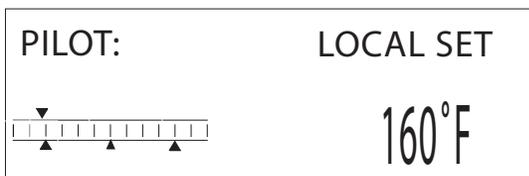
If a flow switch is connected, FLOW WAIT will be displayed until water flow has been proved.



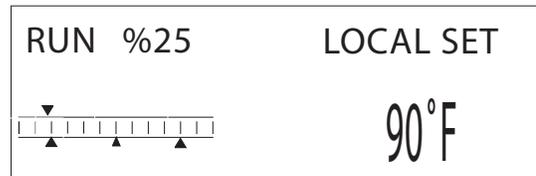
If a combustion air damper is used, then the status screen will display HEATING again. Once the prove switch for the damper makes, all interlocks should now be made and a call to the ignition control is sent if we are below the heat band. If the message HEATING: is still displayed, the water temperature is in or above the heat band and the boiler will not fire until it drops below the band. To continue this example we will need to wait for the water temperature to fall. If we are below the heat band the status display will indicate to PRE PURGE after receiving the blower signal from the ignition control.



After approximately 10 seconds the ignition control will set the PILOT signal. This will cause the Blower speed to drop to the ignition speed. Pilot will be displayed at this point and the ignition control will now enable the spark ignition.



If the ignition control at this point, detects a flame signal, it will activate the main valve signal. This will be indicated in the status screen by the example: RUN %25.



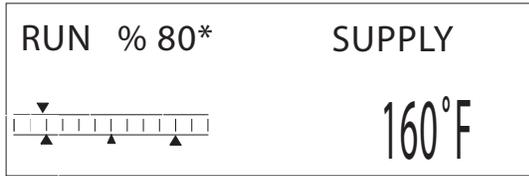
The main valve is now open and the KN series boiler is now firing at the MIN setting. The modulation signal sent to the blower will be held here for 3 seconds + the modulation delay time. Once this hold time has been met, the PID control will modulate the boiler to change the water temperature until it can maintain the setpoint temperature.

You can watch the progress of the control as the water temperature targets the setpoint. The **SCALE** in the bottom left is used as an indicator of temperature and setpoint relative to the heat band. There are (3) pointers that point up in the bottom of the scale. The center pointer is the setpoint and the (2) outer ones are the limits of the heat band. The top pointer, which points down, is the water temperature.

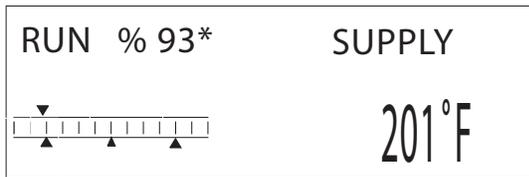
In the example, the local setpoint is 160° F. It represents the center pointer pointing up. If you count the gradations from the center pointer to the right pointer you will notice (4) lines. Each line always represents 5° F. This means that there is 20° F to the top of the heat band (180° F), and 20° F to the bottom of the heat band (140° F). Our heat band then is defined as 40° F (Heat band/2). Remember that when the water temperature is below the heat band pointer (to the left of pointer) boiler(s) will fire and modulation will increase. While we are between the heat band pointers we won't fire stop any boilers and will maintain setpoint (center pointer) with just the modulation control of the blower. When we are above the heat band (to the right of pointer) we will turn off the boiler(s).

Using this scale gives an understanding of how the system is reacting to your setup variables such as the heat band setting. Too small of a heat band and the boiler(s) will tend to short cycle due to changes in load. Too big of a heat band and the system will appear sluggish trying to hit setpoint with changes in load.

If a multi-boiler system is used, the master boiler uses the MOD MAX clamp to hold all boilers to this % until the last boiler has fired. An '**' next to the % modulation value is displayed if the MOD MAX clamp is active.

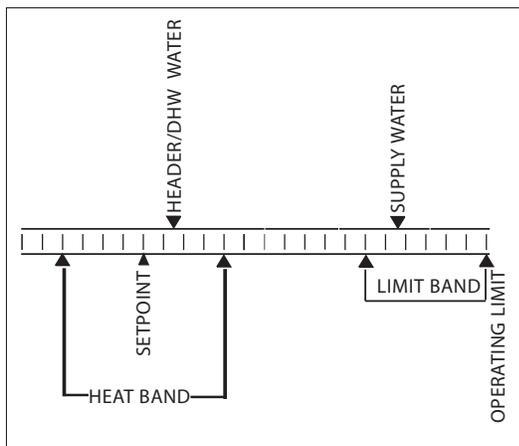


If the supply setpoint is in the OPERATING LIMIT BAND, the input is limited and an '**' will also appear adjacent to the RUN %.



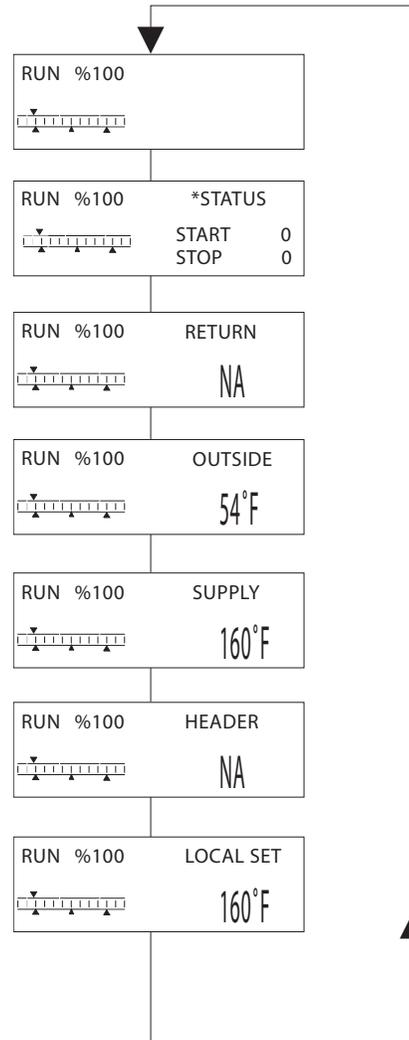
This is a limit that helps prevent the boiler from short cycling when the SYSTEM/DHW sensor temperature has not met setpoint, and the boiler's supply temperature is nearing the OPERATING LIMIT (primary/secondary loop). It is also used with an external input or when running stand-alone to limit the supply water temperature.

The operating limit band hangs "OP LIM BAND" degrees below the operating limit. If the supply temperature of the boiler is in this band below the operating limit, the input call for heat will be limited by a % of how close it is to the operating limit. If the operating band input limit feature is not needed, you can set the OPERATING LIMIT BAND = 1. This will shut the boiler off when the operating limit is reached.

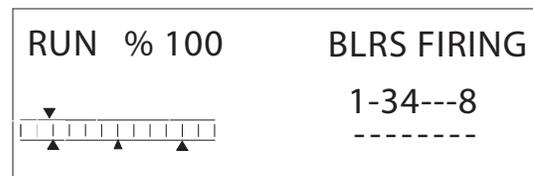


Temperature Scale

The advanced menu settings under MODULAR BOILER SET and MODULATION PID can be used to tune the system. Remember, you can always load the DEFAULT settings in the advance menu to a known state.



The master boiler will replace the blank screen with one that lets you know the boilers that it is firing.



If one of the boilers that is displayed is blinking, a fault has occurred on that boiler. This is only displayed when the H-Net is used. You would need to go to that boiler to determine the fault.

The boiler firing # is the same as the boiler's LOCAL ADDRESS except for the master. The master boiler is always displayed as boiler 1, but the LOCAL ADDRESS as set in the ADVANCED menu, DISTRIBUTED CTRL will always read 255. The Member boilers will all have their LOCAL ADDRESS values match the boiler firing. So, when setting up your boiler network, you way want to set the address on each boiler to match a pattern that is displayed on the screen.

If you have upgraded the firmware or this is a new installation, there will be address contentions with member boilers. The default value for the LOCAL ADDRESS on each boiler = 2. You cannot have the same address on each member boiler. They will all need a unique address. Also, there can only be one master boiler. Do not connect more than one SYSTEM/DHW sensor in a boiler network.

STATUS SCREEN FAULT DISPLAY

There are numerous interlock switches and software limits that are detected. Each of these, when tripped will produce a display message, an audible beeping, and an alarm relay closure. The fault is displayed first, then after a second, the time the fault occurred is displayed. This cycle will keep occurring until the fault is cleared. These faults are:

HIGH LIMIT: When the high limit aquastat trips the following message is displayed:

FAULT HIGH LIMIT	SYSTEM SET 160°F
---------------------	-------------------------

FAULT 10/27 9:16	SYSTEM SET 160°F
---------------------	-------------------------

The high limit interlock breaks power to the ignition control (shutting it off) and effectively removes any chance of the gas valve receiving power. The KN series control will remain powered to display the fault, latch the alarm relay/audible beeper, and to access the log. The interlock is located on J5, HIGH LIMIT.

INTERLOCK SPARE 3: This is a reserved interlock input that is normally jumpered at the factory, but can have a remote interlock connected as a field install. The interlock is located on J11A, SPARE 3.

FAULT INTERLOCK SPARE 3	SYSTEM SET 160°F
----------------------------	-------------------------

LOW WATER CUTOFF: If there is a low water condition reported by the low water cutoff switch this fault is displayed. Check that there is water flow and water in the boiler. There is a reset switch located on the LWCO box. The interlock connection is located on J11A, LWCO.

FAULT LOW WATER CUTOFF	SYSTEM SET 160°F
---------------------------	-------------------------

VAR FREQ DRIVE: The variable frequency drive, which controls the blower, reports this fault in the event of over current or other conditions that would cause it to shut down. If this is the case, check the fault indicators on the VFD. The interlock is located on J11A, VFD.

FAULT VAR FREQ DRIVE	SYSTEM SET 160°F
-------------------------	-------------------------

GAS PRESSURE: The gas pressure switches (high pressure and low pressure) are connected in series, so if either trip, a fault will be reported here. A reset switch is located on the gas pressure switches. The interlock is located on J11A, GAS PR.

FAULT GAS PRESSURE	SYSTEM SET 160°F
-----------------------	-------------------------

INTERLOCK SPARE 4: This is also a spare interlock (similar to INTERLOCK SPARE 3) for future expansion or use as a field interlock. The interlock is located on J11B, SPARE 4.

FAULT INTERLOCK SPARE 4	SYSTEM SET 160°F
----------------------------	---------------------

FLOW SWITCH ERROR: Once the KN series boiler receives a call for heat, it closes the circulator pump relay. It then waits 10 seconds to prove flow. If there is no flow, the flow switch alarm will be set. Every 10 seconds the circulator pump relay will cycle ON for 10 seconds and then OFF for 10 seconds to try and establish flow. The interlock connection is located on J11B, WTR FLW.

FAULT WATER FLOW SWITCH	SYSTEM SET 160°F
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UV AIR SWITCH: The UV air switch is a pressure sensor that senses air passing by the UV scanner. Its purpose is to minimize condensation on the UV lens assembly. If the air source fails, this fault will occur. It will not shut down the system, but will need attention. This fault is latched when there is a call for heat and will be displayed after the call for heat goes away. The boiler needs to be running and the air source functional to clear the fault. A power cycle will also do it. The interlock connection is located on J11B, AIR PR UV SENSOR.

FAULT UV AIR SWITCH	SYSTEM SET 160°F
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IGNITION CTRL ALARM: The ignition control alarm is displayed if the ignition control detects a fault. This could be a flame failure, air proving switch, or other fault associated with the ignition control. When this fault occurs, you will need to refer to the ignition control for the reason.

FAULT IGNITION CTRL ALARM	SYSTEM SET 160°F
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IRI ALARM: The IRI alarm is the alarm from the gas valve. If this alarm is set check the gas valve.

FAULT IRI ALARM	SYSTEM SET 160°F
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COMBUST AIR DAMPER: If the combustion air damper has been selected for use (MASTER BOILER, AUX FUNCTIONS), and the proof switch does not make, this fault will be displayed.

When the combustion air damper is used, the master's BOILER3/DAMPER relay contacts at J13 are closed. These should be wired to the combustion air damper or preferably an isolation relay. The prove switch on the combustion air damper must be wired to J10B, SPARE 1.

FAULT COMBUSTION AIR DAMPER	SYSTEM SET 160°F
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When the master boiler receives a call for heat and needs to start a boiler, the BOILER3/DAMPER relay closes. At the same time, the boiler is started, fires, and continues to fire. If the combustion air damper does not prove within the proof time specified in the combustion air damper menu, the boiler will shut down and display the fault. The fault on the Master boiler can be cleared by removing the call for heat on the master boiler and fixing the combustion air damper problem. A combustion damper fault on a Member boiler can only be cleared by power cycling.

The Master boiler controls a system damper and Member boilers control their own respective dampers. Once a call for heat is detected, the combustion damper relay will energize and wait for the dampers proof switch to make before starting boilers. When the call for heat is removed, the damper will remain open for 30 seconds before closing. This allows for post purge cycles to complete.

OPEN () SENSOR: If the open sensor fault is displayed, the sensor in the position reported was originally detected, but has since opened. The boiler will shut down on any OPEN sensor.



SHORTED () SENSOR: If the shorted sensor fault is displayed, the sensor in the position reported was originally detected, but has since shorted. The boiler will shut down on any SHORTED sensor.

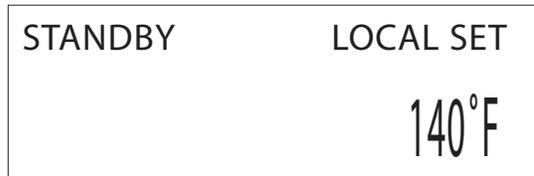


CALIBRATION

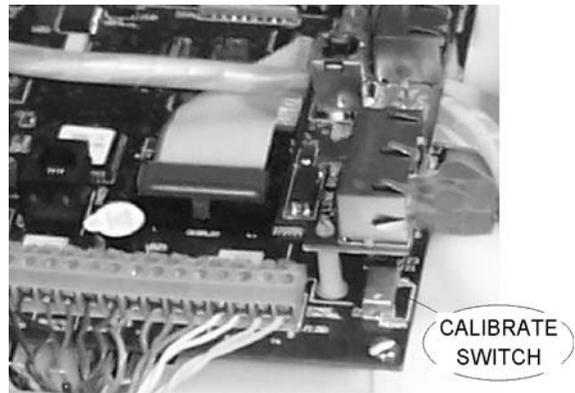
The Calibration of the KN series boiler with digital communication is different than earlier models of KN series boilers. The difference is the way the Min, Max and Pilot are adjusted. The earlier models required the use of a screwdriver and adjustment of potentiometer. This version allows changing the Min, Max, and Pilot using the display and keypad.

You will need to reference “KN SERIES GAS BOILER INSTALLATION AND OPERATION INTRUCTIONS” manual. In the operating instructions section, the method for setup has changed.

To enter the calibration mode, you must first ensure that there are no calls for heat. Place the power switch on the boiler to the ON position. The status screen will display standby.



Next, open the front door and locate the main control board. Now, locate the calibration switch. It is located under the communications board in the corner of the main control board. It's a slide type switch, so slide it toward the middle of the board.

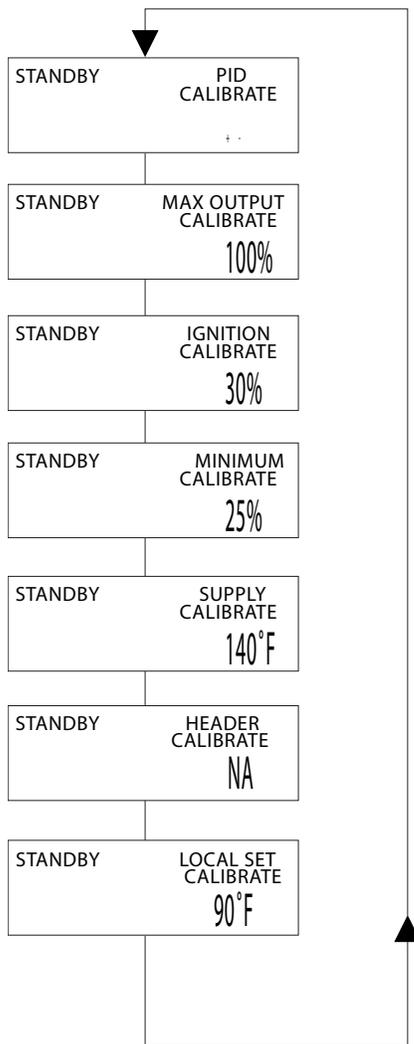


The KN series boiler is now in calibrate mode.



If the status screen does not display CALIBRATE below the setpoint "LOCAL SET" or "SYSTEM SET", check the calibrate switch.

Now that we are in calibrate, a different set of menus is displayed in the status screen. Notice the addition of the MINIMUM, IGNITION, and MAX OUTPUT screens.



These (3) screens will be used to setup the minimum fire rate (blower speed), the ignition (blower speed), and the maximum output (blower speed).

To change the MINIMUM fire rate, press and hold the SELECT key for a second. It will begin blinking. Use the arrow keys to move the MINIMUM rate up or down. If you are satisfied with the MINIMUM rate you selected, press the SELECT key for a second. If you want to keep the old value, press the BACK key for a second.

The above method can be used to change the ignition rate and the Maximum fire rate of the boiler.

In order to make the adjustments to the boiler while it is running, the boiler needs a call for heat at low fire. To fire the boiler at **low fire**, insure that there is no other call for heat. Connect a toggle switch across the **T1 input (J12B)** on the main control board. When the switch is closed the boiler will fire normally and proceed to low fire. Now, when you select and adjust the MINIMUM, , or MAX OUTPUT settings, the boiler will track the changes while the adjustments are made. Any other call for heat at this time will cause the boiler to stop.

NOTE: While in calibration mode and when a setting is blinking, you are allowed five (5) minutes without a key press to save your settings. After the five (5) minutes has elapsed, the old value will be restored and the setting will stop blinking.

Remember to remove your low fire call for heat and place the CAL switch on the main control board to the NORM position when the calibration is completed.

EXAMPLE # 2: Two or More Boilers

THE MASTER BOILER

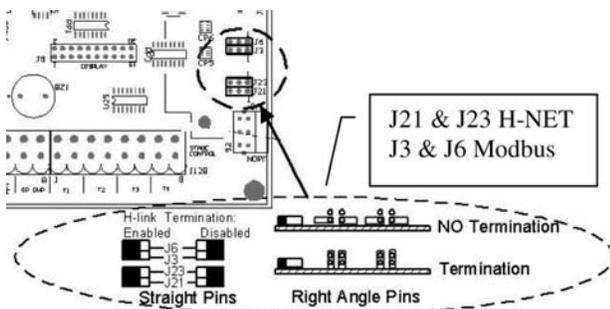
In multiple boiler configurations, one boiler and only one boiler is required to be the master. A master boiler's purpose is to acquire the common (header) temperature, monitor the outside air temperature, and designate which member boilers to fire. So the first thing we need to do is set up the master boiler. As a reference, refer to: MODEL KN-SERIES CONTROL INSTALLATION & OPERATION MANUAL.

To make a boiler the master, connect a water temperature sensor to the SYS/DHW input located on the control board at J10A. When the KN series boiler is powered ON, it will recognize this boiler as the master.

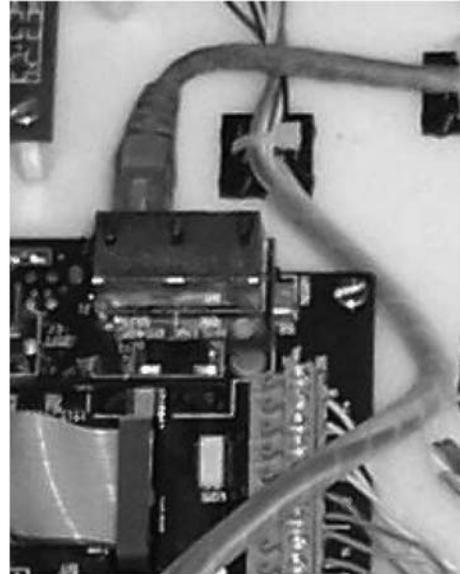
Ensure an outdoor reset sensor is also connected to J10A for this example. Also ensure that the supply water sensor is connected.

If a pump needs to be controlled, connect the pump contacts of the KN-series boiler to a pump contactor.

Now, the master boiler needs to have its communications port terminators selected. Locate J3,J6 for the H-Net and J21,J23 for the MODBUS on the main control board. The jumper shunts need to be set as illustrated for termination. Termination needs to be set on the master and on the last member boiler to have a clean communications signal.

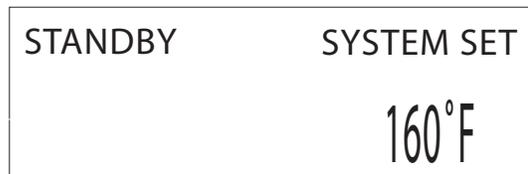


Connect an RJ45 jack and cable on the master to the top plug (OUT) on the dual communications connector. You may also use the terminal blocks which are marked A,B,G if you wish to run a shield wire without RJ45 connectors to J4.



Now, turn the master boiler on by placing the power switch to the ON position. When you first turn the boiler on you should here at least (2) beeps. The control's version number and a timer will then be displayed.

Once the timer finishes, the KN series boiler will enter the status screen. STANDBY will be displayed in the upper left if there is no call for heat (T1, T2, T3, T4, AA, and Heat Demand must not have a closed contact across their respective inputs, and no 4-20ma or 0-10vdc signal present). We are not ready to start our boiler yet.



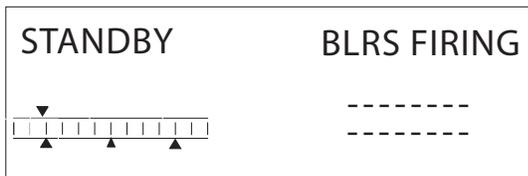
SYSTEM SET should now be displayed indicating that it will be using a system setpoint. This will also appear on a member when an H-Net call to fire the member boiler is received, otherwise the LOCAL SET will be displayed on the member.

If the master is functioning properly, the yellow LEDs on the communications board dual jack will blink. The blinking indicates that the master is looking for member boilers to communicate with.

If you have a **FAULT** message displayed, you need to clear the faults until the STANDBY message is displayed. **You may silence the alarm by shorting across J10B SPARE 2.** You can visit section 2.5 to determine your fault message and resolution.

For this example we will use the factory defaults for controlling the system water temperature. You may change the system setpoint by pressing and holding the SELECT key. Then adjust the setpoint using the UP and DOWN arrow keys. Press the SELSECT key to save your changes.

Next, use the DOWN arrow key to move to the BLRS FIRING screen.



We now need to go to our member boilers and connect them to the H-Net network.

THE MEMBER BOILER(S)

The member boiler's function is as a stand-alone boiler. It fires based on an external modulation command issued by the master boiler. It works the same as a boiler with an external 4-20ma signal controlling it's firing rate. The difference is that the 4 20ma signal is an analog current, and the H-Net is a digital signal.

First, let's set the H-Net termination on our last member boiler the same way we terminated the master. If there are only (2) boilers, including the master, then both boilers will require termination.

Next, plug the other end of the H-Net cable into the RJ45 IN port on the Communications board. You may also use the terminal blocks which are marked A,B,G if you wish to run a shield wire without RJ45 connectors to J4 on the communications board.

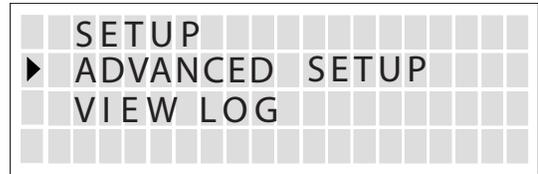
If you will be connecting more than (1) member boiler, remember to connect another RJ45 cable to the OUT port on the H-Net communications board or double up on the terminal block J4. Also, the termination jumpers are only connected on the last KN series member boiler.

Next, ensure that the supply sensor is connected to J10A, WTR OUT, SUPPLY.

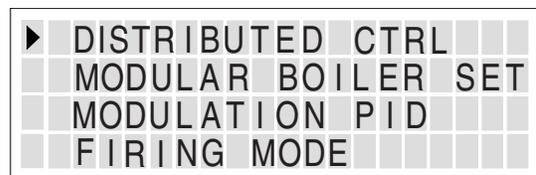
Again we are going to use the system defaults on our member boiler. Ensure you have the **LOCAL/REMOTE** switch inside the control box set to **REMOTE** and no other external inputs connected (T1-T4, AA, 4-20ma or 0-10vdc).

Place the power switch on the KN series boiler to the ON position and wait for the initialization sequence to finish and enter the status screen.

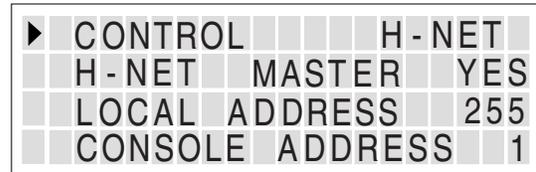
Now, we have to let the master know where this boiler is located. We have to set the LOCAL ADDRESS. From the status screen press and hold the BACK key for 5 seconds or until the setup screen appears.



Move the pointer to the ADVANCED SETUP menu and press the SELECT key.



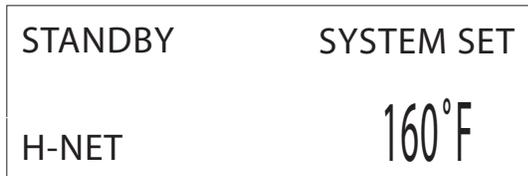
The pointer should be pointing to DISTRIBUTED CTRL. Press the SELECT key.



Now position the pointer next to LOCAL ADDRESS and press the SELECT key. You can now use the arrow keys to change the address. The address is the boiler #, except for the master which has a LOCAL ADDRESS of 255 and is boiler #1. **Each member must have a unique address.** Leave this first member boiler at address #2. So repeat this procedure for each of the members while incrementing the address by 1 on each boiler(so the next member = 3, then 4, etc..). If a new firmware program is loaded, these addresses will need to be re-entered. Once you have selected the address you want, press the SELECT key and the value will be saved. If you press the BACK key the old address will be retained.

Press the BACK key until you return to the status screen.

After approximately 30 seconds or less the master should detect the member. The H-NET connection will be indicated in the lower left of the member's display.



If the RJ45 connectors (or terminal blocks) are connected properly (also the termination jumpers) the H-Net connection should be solid. If the connection is intermittent (H-NET disappears and comes back) or does not connect, look at the yellow LED on the Communication board's H-Net dual connector. It should be blinking at approximately 1 to 2 times per second. If it appears ON all the time and flashing quickly, the termination is not correct. Either no termination has been set, or more than (2) terminations, or not at the master and last member. If it does not blink at all, the connection is open and you will need to check your cables.

If you have a **FAULT** message displayed, you need to clear the faults until the STANDBY message is displayed. **You may silence the alarm by shorting across J10B SPARE 2.** You can review section 2.5 to determine your fault message and resolution.

Continue section 3.1 until all member boilers have been connected.

Now, the member should be waiting for a command to start, but it needs this from the master. So, we need to go back to our master.

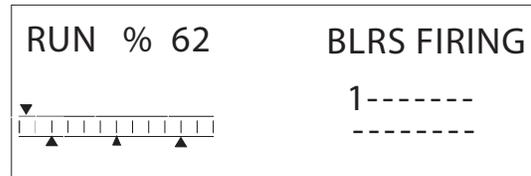
STARTING THE SYSTEM

If the master and members have all been connected, we can give a call for heat. Ensure all safeties are in place and the system checks out.

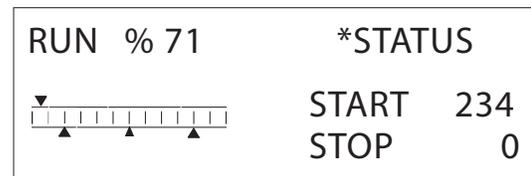
Place the **LOCAL/REMOTE** switch located inside the master boiler to **LOCAL**. Though it is marked LOCAL, it is the main system call for heat. The members each have a LOCAL/REMOTE switch that they can use to start them selves and control their supply water temperature locally. A thermostat or other remote switch may be tied in parallel with the LOCAL/REMOTE switch, which is wired to the J12A HEAT DEMAND input.

Again, if you have a **FAULT** message displayed, you need to clear the faults until the STANDBY message is displayed. **You may silence the alarm by shorting across J10B SPARE 2.** You can visit section 2.5 to determine your fault message and resolution.

Since we are doing a cold start, the master should fire first, since it is boiler #1. Use the arrow keys, DOWN and UP to cycle between the different screens.



After the ADD BOILER DELAY expires the next boiler will fire. You can watch the ADD BOILER DELAY "START" time count down in the timer status screen. Once the START time reaches 0 the next boiler will start if we are below the HEAT BAND. The "STOP" boiler delay is also viewed here.



The next boiler started will be indicated by a '2' appearing in the boilers firing screen. If this does not happen, the water temperature may have entered the HEAT BAND and does not need to fire more boilers.

You can watch the temperature band graph as the top pointer (System water temperature) moves towards the lower heat band pointer and towards the target setpoint. The modulation value will adjust itself to hit the setpoint. There will be some overshoot of the setpoint initially, but this will ring out. If the overshoot is significant, you may want to adjust the PID INTEGRAL value a little. If too many boilers have fired and you have gone way beyond setpoint after the boilers have shut off, you may want to adjust the ADD BOILER DELAY TIME or the STOP BOILER DELAY time. A MODULATE DELAY TIME can also be used to hold the boiler at low fire for this time until the modulation value is used. These settings are in the ADVANCED SETUP. See Section 2.2.

If you view the member boiler with it running, you will see the modulation % in the upper left of the display also mimic the master boilers modulation.

NOTE: The AA terminal is the HIGH FIRE override. When closed on a member boiler the H-Net won't be able to control the member and the member will fire at HIGH FIRE. If the AA terminal is closed on the master, the H-Net network shuts down and ONLY the master boiler fires at HIGH FIRE. All members go to standby. If using a diverting valve for a tank, it is recommended that you use a member boiler with the member AA terminal. In this way the H-Net and the heating loop will still be under control.

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