AMB-4

MODULAR BOILER CONTROL

Instruction Manual and Specification

For Technical Help Please Call 1-800-325-5479

6/1/03

ARGO Industries

Berlin, Connecticut

AMB-4 Modular Boiler with Remote Communication Capability
Instruction Manual and Specification

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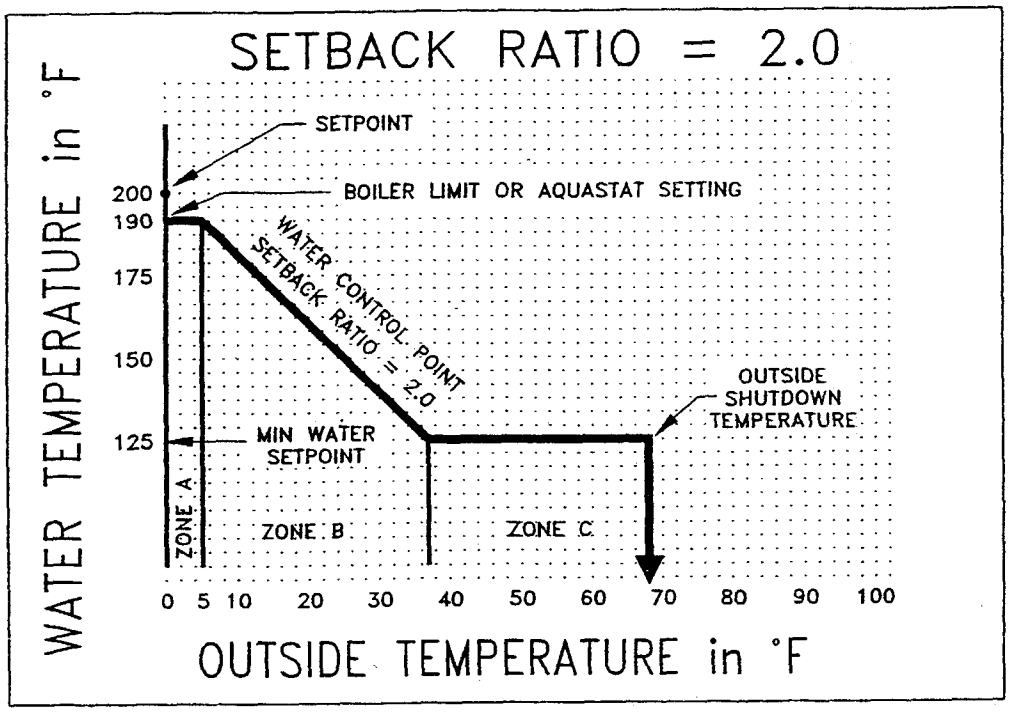


FIGURE 5

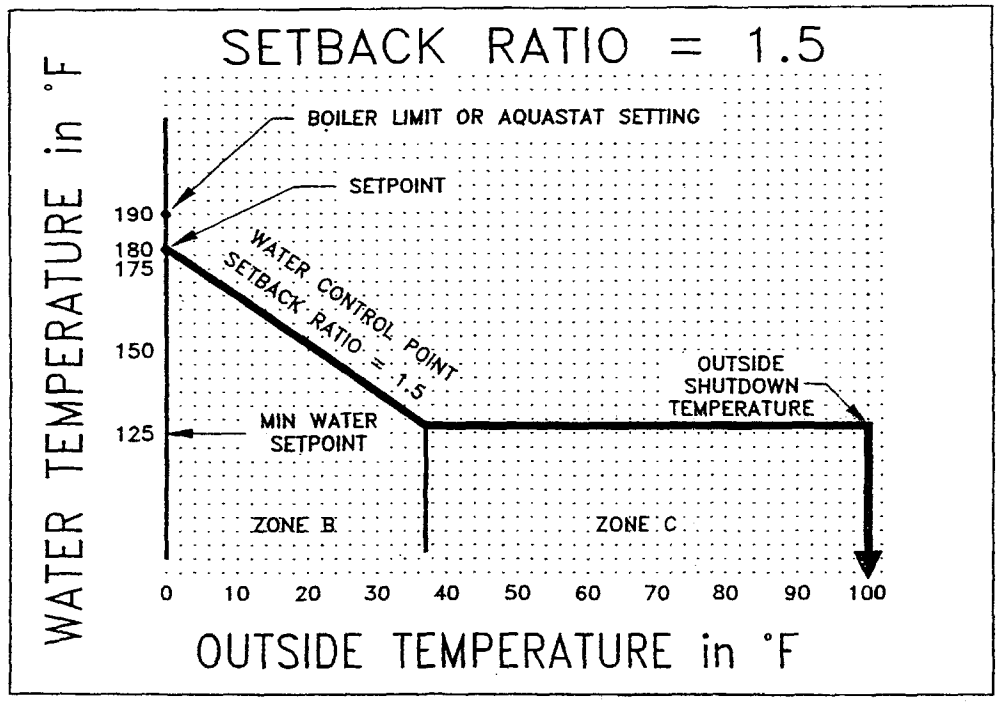


FIGURE 6

THE SETPOINT IS LESS THAN BOILER LIMIT OR AQUASTAT SETTING AND THE OUTSIDE SHUTDOWN TEMPERATURE IS GREATER THAN 69 DEGREES

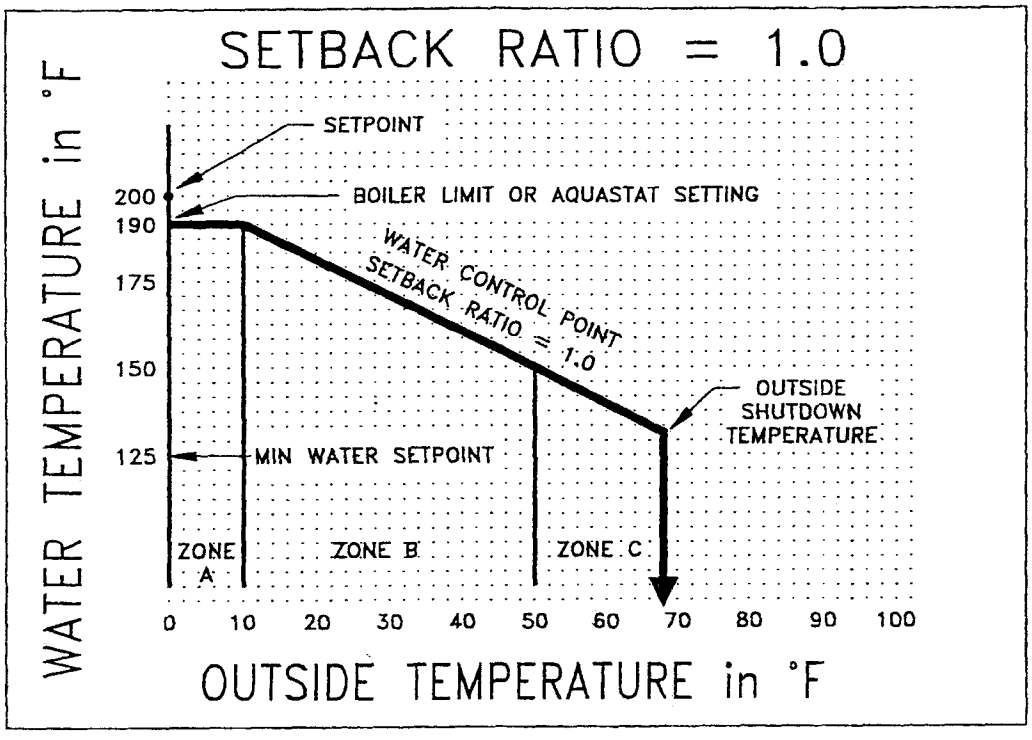


FIGURE 3

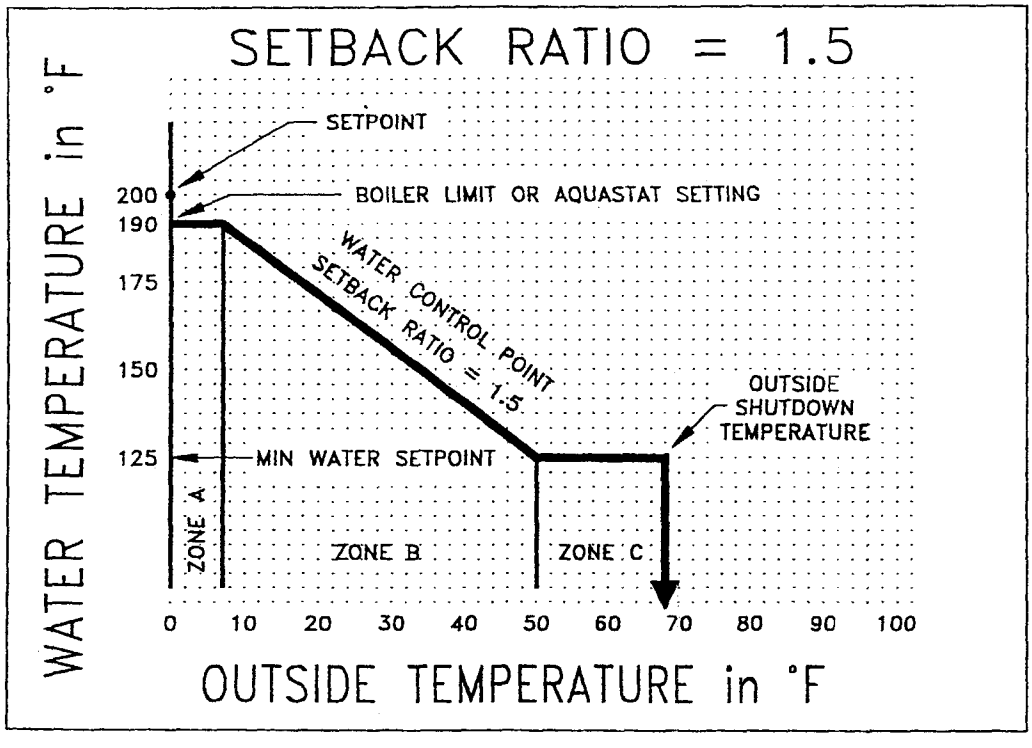
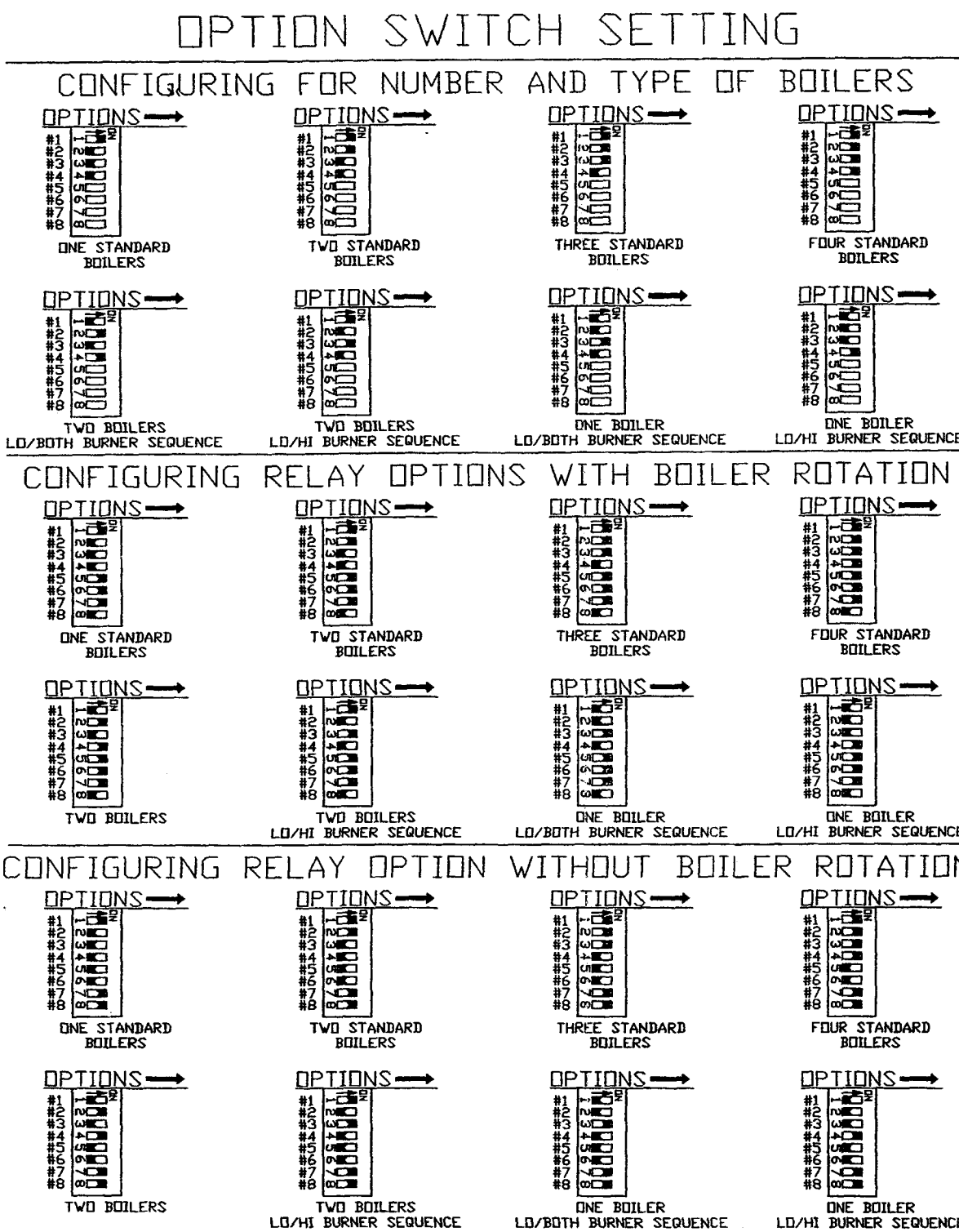
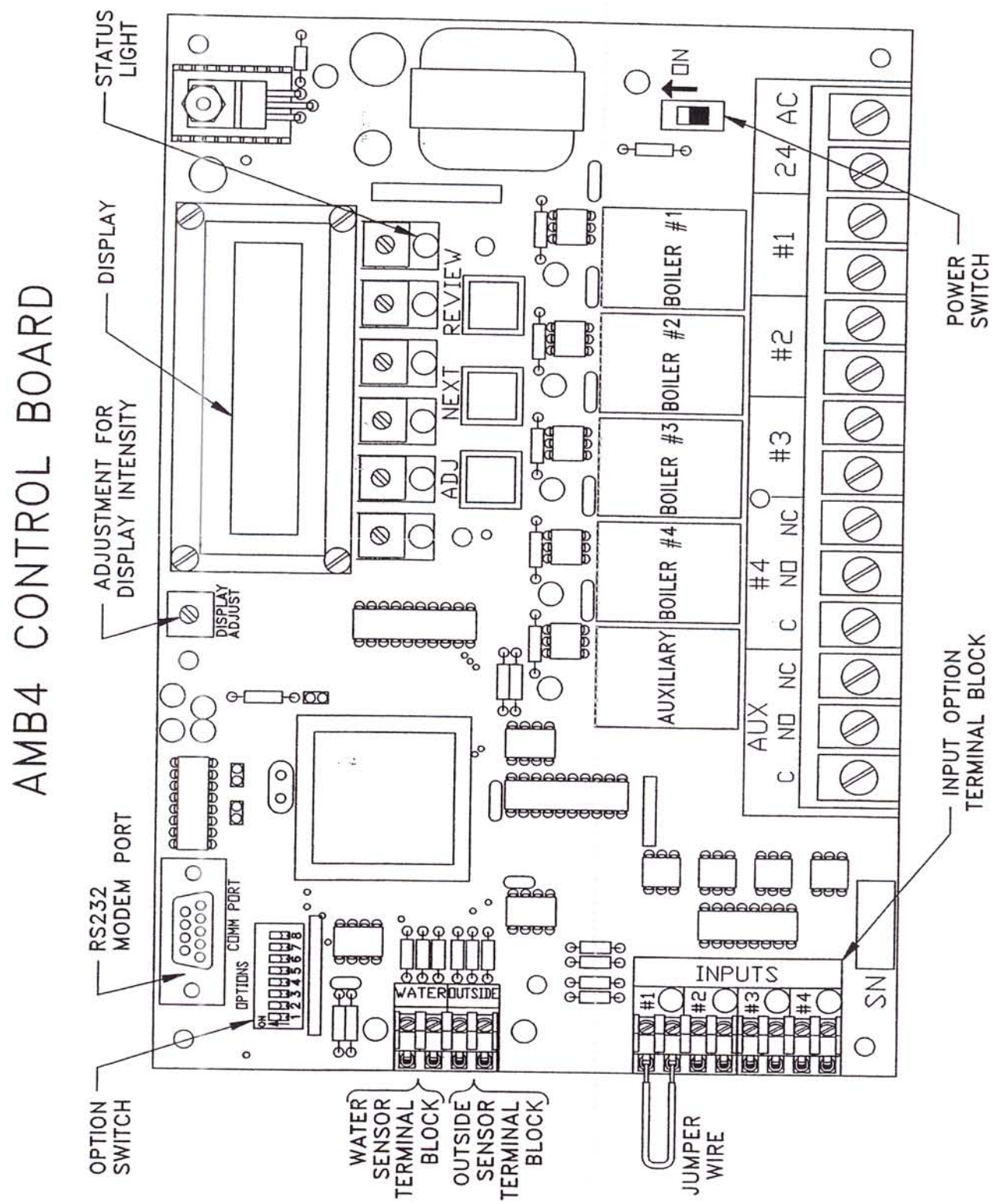


FIGURE 4

Option Switch Display



AMB-4 Board Diagram



10.1 Continuous Flow Systems .

In a continuous flow system, the water flows continuously through a main loop. Heating water is fed to individual zones by auxiliary pumps or zone valves. The flow rate is generally determined by the actual number of active zones. It will vary from a low rate determined by the main loop to a maximum rate when all zones are calling for heat.

Input #1 is generally a flow switch in the main loop to detect a pump failure.

In this system the boilers operate to maintain a constant supply water temperature. For example, if the heating load remains constant at 60% of total capacity, the AMB-4 will keep two of four boilers (50%) on constantly while turning the third boiler on and off to make up the 10%, while the forth boiler rarely comes on.. If the system varies between "all boilers on" to "all boilers off", the response time may be too low.

10.2 Demand Systems

In a Demand System the pumps or circulators and boilers are shut down when the system is satisfied (no zones are calling for heat).

Input #1 is generally the system "TT" signal. It is active if any zone calls for heat and is off when the system is satisfied.

In this system, the supply water may cool to a temperature lower than the AMB-4 control point before starting up again. When the system calls for heat the AMB-4 will bring on one boiler at a time based on the RESPONSE TIME setting, until either the Control Point temperature is reached or the system is satisfied. If the system is satisfied before the Control Point is reached, all boilers are turned off and the supply water will again be allowed to cool.

10.3 Gas Boilers

Gas boilers have a built in Delay to purge the boiler before turning it on as a safety precaution. The Response Time setting should be made longer to allow the boiler to come on and heat the supply water. In other words the Response Time should be greater than the purge Delay.

10.4 Piping Considerations

There are two (2) basic ways to pipe a multiple boiler system.

Boilers can be connected in "series" in which all the supply water flows out of the first boiler to the input of the next. One main pump or circulator is used. Each boiler simply adds an increment of heat to the flow. Water flow rate is limited by the boiler size. Chances of water running on its internal safety limit aquastat are minimal.

Boilers can be connected in parallel. The supply water is divided and the flow through a boiler is a fraction of the total. Individual pumps and check valves pump return water to a boiler and output the water to the supply. In some cases the water simply divides based on the piping without auxiliary pumps.

System water flow is greater than that achievable with a series connected system. Since only a fraction of the water is being heated and re-mixed with the supply, an individual boiler may run on its high limit aquastat before the next boiler comes on or the system is satisfied.

9.1 Hardware Check

The AMB-4 has a simple self check which you can perform by turning off the Power Switch, then holding down both the ADJ and REVIEW push buttons while you turn it on again. Keep the buttons pushed until the display says "HARDWARE CHECK". This can be done with the Boiler off to keep them from operating.

The AMB-4 does the following:

HARDWARE CHECK is displayed. System water flow is greater than that achievable with a series connected system.

- Relay 1 is turned on then off.
- Relay 2 is turned on then off
- Relay 3 is turned on then off.
- Relay 4 is turned on then off
- AUX Relay is turned on then off.
- END OF RELAY TEST is displayed
- A series of "1" and "0" are displayed.

Starting from the left, the first eight (8) digits are the Option Switch (mounted on PCB) settings . Check the settings and correct if necessary. If it fails to respond, the switch may have failed.

The last four (4) digits are the Inputs. A "1" indicates that the input command is present. Check that the display responds to input changes.

Turn the power off then back on to return the AMB-4 to the Run Mode. Failure to do this will keep the AMB-4 in the Hardware Check Mode forever.

9.2 If the Hardware is OK

If the hardware is functional check the settings (see Sect. 7, Review and Adjust Modes). the problem may be the result of other changes or failures.

Are the temperature sensors still accurate?
Are the readings reasonably accurate but fluctuate significantly? Observe each .
Is the water flow restricted?
Have the temperature sensors been moved?
Has the heating load changed?

If your system does not have a Modem, call us at 860-829-2710 and ask for AMB-4 Technical Service. AMB-4.

If your system includes a Telephone Modem, connect the modem to your telephone line. Call us at 860-829-2710 and ask for AMB-4 Technical Service.

10.0 Applications

Systems can be divided into two (2) broad categories; Continuous Flow and Demand

- The middle LED flashes every second when the AMB-4 is operating normally on the settings which were entered via the communication port.

- The Lead Boiler is rotated every 24 hours (approximately) if Option Switch #5 (Rotation) is ON. The Lead boiler is the boiler with the least amount of running time.

- If Option Switch #6 (Priority) is ON, the water temperature Control Point is set to the SET POINT when Input #3 is ON. In other words, the SET BK RATIO is temporarily set to 0.0 as long as Input #3 is ON.

- The AMB-4 will exit the ADJUST mode and return to the RUN mode five minutes after the last push-button. This prevents accidentally leaving the control in ADJUST.

8.2 Additional Rules When System Has Three (3) Boilers

- Boiler #4 Relay operates when the Outdoor temperature exceeds the SHUTDWN TEMP value.

8.3 Additional Rules When System Has Two (2) Boilers

- Boiler #3 Relay operates when either Boiler #1 or Boiler #2 is turned on. This relay can be used for a circulator pump for example.

- Boiler #4 Relay operates when the Outdoor temperature exceeds the SHUTDWN TEMP value.

8.4 Auxiliary Relay Operation When Outdoor Shutdown Option is selected

- The AUX relay operates when the Outdoor temperature exceeds the SHUTDWN TEMP value by two (2) degrees. The AUX relay turns off when temperature is two (2) degree less than the SHUTDWN TEMP value.

- In this mode, the AUX relay operation is not effected by any Input status.

8.5 Auxiliary Relay Operation When Priority Option Is Selected

- The AUX relay operates when Priority is active, that is, Input #3 (Priority) is on.

- The AUX relay operation takes place whether or not the water temperature is raised to a maximum or not changed in response to Input #3.

8.6 Auxiliary Relay Operation When REQ-ACK Option Is Selected

- The AUX relay operates whenever a Boiler is to be turned on. The AMB-4 first REQuests permission to turn on the boiler by energizing the AUX relay. The request is Acknowledged by an signal at Input #4.

9.0 Before You Call For Assistance or Trouble Shooting Hints

Before you call there are several things you can do to provide enough information.

If the AMB-4 is operating in the Local Mode, the led below each adjustment pot will be turned on and off as the items are sequenced. If the AMB-4 is operating in the Program mode, LEDs are not turned on and the values displayed are the programmed values which can only be changed from a computer.

SET POINT.....Maximum water temperature **
SET BK RATIO.....Setback ratio **
TEMP DIFF.....Temperature differential **
RESPONSE TM.....Response time **
SHUTDWN TEMP.....Outside shutdown temperature setting **
MIN WTR TEMP.....Minimum water temperature setting **
& TYPE OF BLRS.....Number and type of boilers
ROTATION.....Lead boiler rotation either on or off selected by switch #5
PRIORITY.....Priority response either on or off selected by switch #6
OPTION #.....Auxiliary relay option selected by switch #7 and #8
DAY/NIGHT.....Status of Input #2, twenty (2) degree reduction of Setpoint is on or off

** Only these values can be edited over the Communication Port **

8. Summary of Operating Rules

Descriptions in color, such as TEMP DIFF, refer to values which are programmed by the user. The current values used for operation can be read by the user on the single line LCD display. Below is a list of definitions of items of items in red.

SET POINT: desired water temperature
SET BK RATIO: this value is multiplied by the outdoor temperature and is subtracted from the set point. This result is the temperature of the water is controlled to.
TEMP DIFF: this value is the difference from the control point which is required to turn on a boiler.
RESPONSE TM: response time. After the response time period, the control will decide whether to turn on or off a boiler.
SHUTDWN TEMP: the outdoor temperature at which the controller will turn off all boilers.
MIN WTR TEMP: the controller will not let the water temperature go below this value.

8.1 Basic Rules For All Systems; Four (4) Three (3) or Two Boilers

- A boiler is turned on or a boiler is turned off for each TEMP DIFF change in water temperature.
- A boiler is turned on or a boiler is turned off every RESPONSE TM period unless otherwise noted.
- All boilers are immediately turned off if Input #1 is not present. Input #1 is the control on/off input.
- All boilers are turned off if the Outdoor temperature exceeds the programmed SHUTDWN TEMP value except when Priority Input is on (Input #3 is present) and the Priority option is selected.
- The water temperature Control Point is reduced by 20 degrees when Input #2 is ON. Input #2 is the Day/Night input.
- The water temperature Control Point is never less than the MIN WTR TEMP or greater than the SET POINT.
- The LED on the far right flashes every second when the AMB-4 is operating normally on the local settings.

BLR 2 T .....99999.9 HR
BLR 3 T .....99999.9 HR
BLR 4 T .....99999.9 HR

DEGREE DAYS .....Degree days since last reset

INPUT #1: (CONTROL ON/OFF): ON or OFF
DAY/NIGHT: DAY or NIGHT
INPUT #3: (PRIORITY INPUT SWITCH): ON or OFF
INPUT #4: (REQUEST/ACKNOWLEDGE): ON or OFF

The following parameters can be cleared to zero. To reset the reading, hold down the ADJ push button until the screen reads UPDATE.

BLR 1 ON..... 0 HR
BLR 2 ON..... 0 HR
BLR 3 ON..... 0 HR
BLR 1 ON..... 0 HR
BLR 2 T..... 0 HR
BLR 3 T..... 0 HR
BLR 4 T..... 0 HR
DEGREE DAYS

A degree day is the daily average of the outdoor temperature below 68 degrees. Temperatures above 68 degrees are ignored. Each day this added up to DEGREE DAYS. This can be reset at the start of the heating season or periodically.

The AMB-4 will maintain the existing outputs until the Review Mode is ended. The review is not timed. It will sequence items as you continue to press the NEXT push button. You can end the review at any point by pressing REVIEW again. To prevent damage, the Review Mode will end 2.0 minutes after the last NEXT push button is pressed.

7.2 Adjust Mode

The Adjust mode is used to review and adjust the AMB-4. Press the ADJ button at any time to enter the Adjust Mode.

The display indicates the current operating mode:

- MODE: PROGRAM..... The AMB-4 uses the parameters entered via the Communications Port by computer over a modem or directly.

- MODE: LOCAL .....The AMB-4 uses the values set by the on board pots.

Press the ADJ push-button to toggle the Mode from Local to Program. To select the operating mode, press the NEXT push button with the display reading the desired mode of operation.

Note: The AMB-4 will not return to the Run mode until the NEXT button has been pressed. If not, the AMB-4 will exit after five (5) minutes.

This adjustment does not change the water temperature at which boilers are turned on or off. It simply adds a time requirement. The RESPONSE TM is the time period or delay which must elapse before a boiler is turned ON or OFF. In warmer weather this adjustment is the shortest time a boiler will remain on.

In general, this adjustment should reflect the expected heating and cooling times of the actual system. If it takes ninety (90) seconds for all the boilers to heat the supply water one (1) degree, a "first try" setting of 90 seconds might be reasonable. A low value will bring on the boilers before they have had time to heat the water resulting in short cycling and large temperature overshoots. High values may result is slow response particularly in very cold weather.

6.0 Display Messages

During normal operation of the AMB-4 several messages are displayed. Some are status measures. Some are error messages. All messages are listed below for your reference.

START UP TIME
RUN MODE.....The AMB-4 begins its normal control functions
ADJUST MODE.....The AMB-4 halts normal operation to allow user adjustments
CHK WATER SENSOR.....Flashing message that water sensor is less than 32 or greater than 250 degrees
CHK OUTSIDE SNSR.....Flashing message that outside sensor is greater than 150 degrees
OUTSIDE SHUTDOWN.....Flashing message that boilers have been turned off
PRIORITY ON.....Flashing message that AMB-4 is responding to a Priority Command at Input #3.
INP #1 OFF.....AMB-4 is responding to a loss of a signal at Input #1. Flow has stopped in a continuous flow system or the system has been satisfied in a demand system.
REQ ON -> WAIT ACK.....Flashing message that AMB-4 is ready to turn on a boiler and is waiting for a signal at Input #4
INVALID SET UP.....Switches #1 through #4 is not a valid or recognized
PROGRAM: LOCAL.....AMB-4 will operate using the adjustments on the ADJ pots on the PCB.
PROGRAM: REMOTE.....AMB-4 will operate using the values entered via the Communication Port
SCANNING.....AMB-4 is reading the control values
MODEM.....External Modem is being initialized to answer a call on the sixth ring .

7.0 Adjust and Review and Adjust Modes

7.1 Review Mode

The Review mode is used to display parameters that can not be adjusted. During normal operation, press the REVIEW button then press the NEXT button to display these parameters.

OUTDOOR.....Outside temperature sensor reading
WATER.....Water temperature sensor reading
CNTRL PT.....The calculated control point temperature
NUMBER OF BLRS.....The number of boilers that are now turned on.
LEAD BOILER.....The present Lead Boiler. Lead Boiler is boiler with lowest running time
TIME TILL THE NEXT LEAD ROTATION

BLR 1 ON.....9999 HR .....Running time since being reset
BLR 2 ON.....9999.9 HR
BLR 3 ON.....9999.9 HR
BLR 4 ON.....9999.9 HR
BLR 1 T .....99999.9 HR .....Total running time.

- Determine the outside temperature above which the supply water will be 140, for example 50 degrees.
- The RESET RATIO can be calculate as (200 - 140) divided by (50) equals 1.2

4.6 Water Temperature Limited by the Boiler Aquastat

If the AMB-4 Setpoint temperature is higher than the internal High Limit of the Boilers, your system will operate on these Limit settings rather the Setback . For example, the Setpoint is 200 degrees with a Setback ratio of 1.0 and a Boiler Upper Limit of 180 degrees. The supply water will be limited by the Boiler to 180 degrees until the outside temperature reaches (200 - 180) divided by (1.0) equal to 20 degrees F. Although this operation is acceptable and may be desirable, the AMB-4 Control Point is normally less than the Upper Limit setting of the boilers.

5.0 Fine Tuning The System Response

It must be pointed out that it may not be possible to find settings which will optimize the system performance over the wide range of heating zones size, outside temperatures, high winds, rain, etc.

There are only two (2) adjustments require to tune the response of the system.
- DIFF TEMP.....Is the Differential Temperature.
- RESPONSE TM .....Response Time of the control.

5.1 Differential Temperature Adjustment

Assume that the first or Lead Boiler has just been turned on because the supply water temperature has dropped below the Control Point. How many degrees should we allow the supply water temperature to drop before we turn on Boiler No 2? The answer is the differential temperature or DIFF TEMP setting .

The AMB-4 turns boilers On and Off depending on this setting. To illustrate the control, let Setpoint be 180 degrees with a Differential of 4.0 degrees

Supply Water Temperature Drop .....Rise

182.....1st Boiler Off
180.....1st Boiler On
178.....2nd Boiler Off
176.....2nd Boiler On
174.....3rd Boiler Off
172.....3rd Boiler On
170.....4th Boiler Off
168.....4th Boiler On

This adjustment essentially sets the control precision of the system. If a tight control of water temperature is required, set the DIFF TEMP low. A higher setting reduces "short cycling" of boilers in response to small fluctuations in supply or return water temperature.

5.2 Response Time Adjustment

If time was not a factor, the AMB-4 would turn boilers On and Off only on the basis of the Water Temperature readings. The response of the system would depend on the time to heat or cool the water and the change in outdoor temperature. The AMB-4 provides a Response Time adjustment to allow you to prevent short cycling by slowing down the system response to fluctuations.

4.2 Water Temperature Control

Generally, the water temperature is measured on the supply side of the hydronic system. Water measurement can also be made on the return water side.

The AMB-4 continually calculates the target or control point temperature which can be read as CONTRL PT on the Display.

It multiplies the Outdoor Temperature by the Reset Ratio, then subtracts this from the SETPOINT temperature.

The Control Point = (Setpoint) minus (Outdoor Temperature times Setback Ratio)

This value is then compared to the Minimum Water Temperature

If the Control Point is greater than the Minimum Water Temperature, the calculated Control Point is used. If less, the Minimum Water Temperature is used.

4.3 Outside Temperature Shutdown

SHUTDOWN TEMP is the outside temperature which sets the changeover of the AMB-4 control. When the outside temperature exceeds the displayed value, all boilers will be turned off. When the outside temperature drops to two (2) degrees below this level, the boilers are turned on again. The two (2) degree differential is a fixed value and is not adjustable.

The Display flashes "OUTSIDE SHUTDOWN" when this condition exists.

4.4 Minimum Water Temperature

At warmer outside temperatures, the reset water temperature may be lower than that recommended by the Boiler or Baseboard manufacturer. Set this value to the recommended level or to the minimum temperature which results in an efficient system in warmer weather.

If you do not wish to establish a minimum water temperature, set this to 50 degrees.

After installing the sensors and wiring the boilers , we suggest that you adjust these values:
See Figures 1 & 2 on Page 2.

SETPOINT ..... 180 degrees
SETBACK RATIO..... 0.0.
Boiler Aquastats.....greater than 180 degrees

4.5 Setback or Reset Ratio Temperature

A heating system operates efficiently when the supply water temperature is just high enough to supply the total heat loss. This requires that the water temperature be lowered as the outside temperature becomes warmer. Calculating this SET BK RATIO is a simple matter.

- Establish the desired water temperature at an outdoor temperature of zero degrees Fahrenheit, for example 200 degrees.
- Establish the minimum water temperature, for example 140 degrees.

Auxiliary Relay Operates When Priority Is Active.

Switch #7.....ON
Switch #8.....OFF

In this Mode the AMB-4 will turn on the AUX relay when the Input #3 is ON. This is true for either status of Priority Switch #6. Option Mode sets the action of the AUX relay while Switch #6 sets the water temperature that determines OPTION MODE , which determines the control water temperature not the . .

Auxiliary Relay Operates on Outdoor Temperature Rise Above Shutdown Temperature

Switch #7.....OFF
Switch #8.....ON

In this Mode the AUX relay is energized when ever the outdoor temperature exceeds the SHUTDWN TEMP by one (1) degree and is then de-energized when the outdoor temperature drops one (1) degree below.

Auxiliary Relay Operates Whenever A Boiler Is To Be Turned On (REQ-ACK Mode)

Switch #7.....ON
Switch #8.....ON

In this Mode, the AUX relay is energized when the AMB-4 is ready to turn ON a boiler. The AMB-4 then waits for an acknowledgment at Input #4. All boilers are turned OFF if Input #4 is removed.

4.0 Setting The Desired Supply Water Temperature

This section covers the relationship between the system supply water temperature and the outside temperature. As the outside temperature drops, the heat loss increases and the supply water temperature should increase proportionally. The desirable water temperatures depend of the actual system and environment. The heat loss on a very windy day is greater than a calm day. Heat loss with southern exposure is less than northern exposure. The system must therefore be set for average conditions. Start with your first estimates or calculations. Evaluate the system in coldest weather and adjust the Setpoint if necessary. Evaluate the system in moderately cold weather and adjust the Setback Ratio or the Minimum Water Temperature if necessary.

4.1 Programmed Settings or Adjustments

Four (4) user adjustable or setable values are provided to control the desired water temperature.

- SETPOINT.....Maximum Water Temperature. It is the target water temperature when the outdoor temperature is zero degrees or less.
- SET BK RATIO.....The Setback Ratio. For every degree increase in outdoor temperature the water temperature will decrease by the SET BK RATIO in degrees.
- MIN WTR TEMP.....The Minimum Water Temperature. This establishes the minimum water temperature under all possible SETPOINT or SET BK RATIO settings
- SHUTDWN TEMP.....The Shutdown Temperature. It is the outdoor temperature at which the AMB-4 will turn off all boilers.

Switch Settings	#1	#2	#3	#4	
Standard Boilers					
One Boiler	ON	OFF	OFF	OFF	
Two Boilers	ON	ON	OFF	OFF	
Three Boilers	ON	ON	ON	OFF	
Four Boilers	ON	ON	ON	ON	.....is applications
Dual Boilers with Low then High					
One Dual Boiler	OFF	OFF	OFF	ON	
Two Dual Boilers	ON	OFF	ON	OFF	
Dual Boiler with Low then Both					
One Dual Boiler	OFF	OFF	ON	OFF	
Two Dual Boilers	OFF	ON	ON	OFF	

3.2 Lead Boiler Rotation

The Lead Boiler is the first boiler turned on and the last boiler turned off during a heating cycle. Boiler life can be extended by periodically rotating the lead boiler. The AMB-4 can be directed to rotate the lead boiler every twenty four (24) hours by means of Option Switch #5.

Option Switch #5.....ON.....Lead Boiler Rotates every 24 hours
OFF.....Boiler #1 is always the Lead Boiler

The lead boiler is always the boiler with the least running time.

3.3 Priority

The AMB-4 can be directed to ignore the outdoor temperature setback or reset ratio as long as Input #3 is ON. The Setback Ratio is temporarily made equal to 0.0 and the Control Point temperature becomes the SETPOINT or maximum temperature. This feature can be used to heat domestic hot water using the maximum supply water and returning to the Reset or Setback temperature when it is satisfied.

Option Switch #6.....ON.....Input #3 directs the AMB-4 maximize the water temperature
.....OFF.....AMB-4 does not respond to Input #3, water is always reset.

A "PRIORITY ON" message is flashed when active. The normal response time (TEMP DIFF) is cut in half during this time. In other words, Boilers are turned on twice as fast as normal. **See Section 5.0 Fine Tuning Your System for details.**

3.4 Operating Options

There are three (3) operating optional modes as mentioned in the General Description. All options involve the operation of the Auxiliary Relay. Selecting one of the options directs the AMB-4 to operate the AUX relay in a specific way. It does not change any other functions unless specified below. Option Modes are selected by Switch #7 and #8.

Auxiliary Relay Does Not When Operate

Switch #7.....OFF
Switch #8.....OFF

Press ADJ push button. Display will read ADJUST MODE for 1 second, then display MODE: PROGRAM. Press the ADJ push-button again. This action will toggle the display from PROGRAM to LOCAL. Pressing the ADJ push button will toggle it back to LOCAL. Leave it in the LOCAL position. This instructs the AMB-4 to operate on the printed circuit board pot settings.

Press the NEXT push button to bring up the following items. Adjust the pots located above the lit LED to verify the adjustment range.

	Initial Setting	Adjustment Range
SETPOINT	200	50 to 249 degrees
SET BK RATIO	1.5	0.2 to 5.2
TEMP DIFF	4.0	1 to 10 degrees
RESPONSE TM	120 S	2 to 500 seconds
SHUTDWN TEMP	69	50 to 149 degrees
MIN WTR TEMP	125	50 to 149 degrees

NOTE: The factory settings <u>are not</u> the recommended settings for your application. Read Section 5.0 Fine Tuning Your System for application information.

Press the NEXT push button to bring up the Setup or Option Switch settings. This is a good time to set up the AMB-4 for your application. Before you press the NEXT push-button, enter the proper setting for each of the operations. As you change the switch settings for numbers 1 through 8 the AMB-4 will display the selected status. After you have entered the proper switch settings for each, press NEXT to go on to the next option. The factory settings are:

	Switch Number	Initial Setting
# BLRS TYPE	#1 through #4	4 BLRS STD
ROTATION	#5	OFF
PRIORITY	#6	OFF
OPTION #	#7 and #8	0

For information regarding each of the above, see Section 3.0: Setting Up Your AMB-4

Press the ADJ push button to exit the ADJustment mode. The Display will read RUN MODE for 1 second before changing to display the selected item, e.g. WATER.....70.

3.0 Setting Up the AMB-4 for Your System

Because the AMB-4 is designed to control a range of multiple boiler systems, it must be set up for your specific application. The set up procedure directs the AMB-4 to perform in a specific way to meet your requirements. First, the AMB-4 must be told about the system and then told how it is to operate.

Press the ADJ at any time to enter the Adjust Mode. Press the NEXT push-button to advance to the selected item. Press ADJ button to exit the Adjust Mode.

3.1 Number and Type of Boilers

The number of Boilers is set by the first four (4) switches of the Option switch located in the upper left of the printed circuit board. Three types of Boilers can be selected. Set Option Switch as follows:

1.3 Relay Outputs

- A normally open isolated relay contact is provided for each of the four (4) boilers. Contact rating is 10 amps at 240 vac. Outputs are labeled #1 through #4 . Relays are turned on in ascending order starting with the Lead Boiler.

- A fifth relay is labeled as the Auxiliary Relay. The AUX relay has both a normally open and a normally closed contact. This relays operates in one of three (3) ways depending on the operating mode selected (see Section 1.4).

- When the system has less than four Boilers the **unused boiler relays** have specific functions. Relay #4 operates on Outdoor temperature shutdown. Relay #3 operates whenever any Boiler is on.

1.4 Auxiliary Relay Options

Notice that these Options refer only to the operation of the Auxiliary or AUX Relay. Three (3) options are available; only one (1) of the three (3) can be selected. See Section 3.4 Operating Options for details.

- In **Priority** mode, the AUX Relay is energized whenever Input #3 is active.

- In **Temperature Shutdown** mode the AUX Relay is energized as long as the Outside temperature exceeds the programmed limit. If DIP Switch #6 is On, an active Priority Input #3 will temporarily ignore the Shutdown and turn on Boilers as required (to make hot water, for example).

- In **REQ/ACK** mode, the AUX Relay is energized whenever a Boiler is to be turned On and the control will not turn a boiler On without a signal at Input #4. Any time input #4 is Off, all Boilers will be turned Off.

2.0 What To Do After Opening The Box

The AMB-4 and the enclosed temperature sensors are tested at the factory prior to shipment. The LOCAL (PCB mounted adjustment pots) have been set to specified values to allow you to quickly determine if it was damaged in shipment.

Connect 24 vac to the designated terminals. Connect both temperature sensors to their designated terminals. The sensors are not polarized so that a wire can connected to either terminal. Turn On the Power Switch.

The green LED will come on. After a 5 second initialization period, the green Status LED located at the right end will flash every second. This is the basic timing clock of the AMB-4. This flashing light assures you that the AMB-4 is operating normally. Each second it scans the LOCAL or PROGRAMMED settings, reads the temperatures and input commands, and energizes relays as necessary.

The Display will read WATER .....70 (Assuming that is the room temperature).

Press the NEXT push button and read OUTSIDE ....70.

If either sensor fails to read properly check the connections and then contact Technical Assistance.

Press Next again to display CNTRL PT..... 200 Continuing to press NEXT will allow you to scroll through these three readings.

1. General Description

The AMB-4 Modular Boiler Control is designed to control a multiple boiler system with two, three, or four boilers feeding a single supply line. It can be applied to a wide range of applications by selecting various operating options for an auxiliary relay.

1.1 Inputs

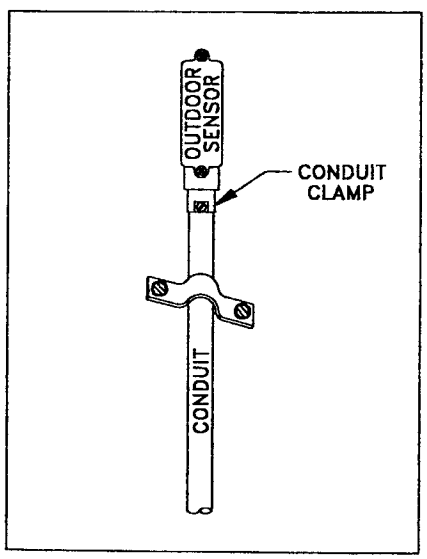
- Input #1 is the main control command signal. A dry contact closure across the terminals will turn on the green LED indicating an active input command. All boilers are turned off if this signal is not present. In continuous flow systems it is generally a safety signal indicating that the Main Pump is operating properly.

- Input #2 is the DAY/NIGHT command. A dry contact closure across the terminals will turn on the green LED indicating an active input command. The water temperature setpoint is reduced by twenty (20) degrees as long as this command is present.

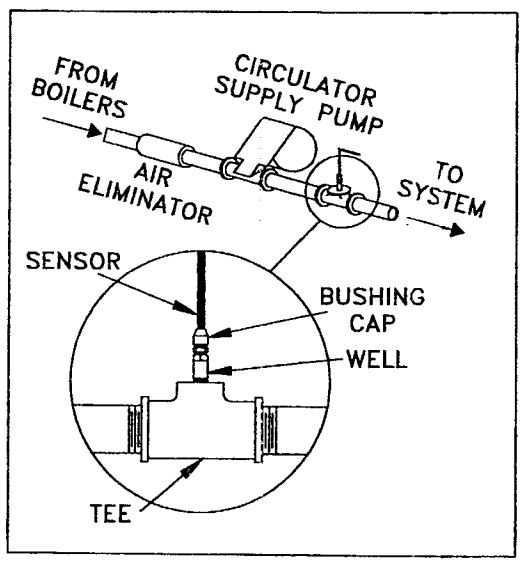
- Input #3 is the PRIORITY command. A dry contact closure across the terminals will turn on the green LED indicating an active input command. If priority operation has been selected by DIP Switch #6 On, the SETBACK is temporarily made equal to 0.0 and the water temperature is controlled to the Setpoint or its maximum setting.

- Input #4 is the Acknowledge signal. A dry contact closure across the terminals will turn on the green LED indicating an active input signal. If the REQ-ACK option mode has been selected (see Section 1.4), the AMB-4 will wait for this signal before turning on any boilers.

1.2 Temperature Sensors



OUTDOOR SENSOR INSTALLATION
FIGURE 1



INSIDE SENSOR INSTALLATION
FIGURE 2

Two (2) RTD temperature Sensors are provided with 6 inches of cable. Sensors are two wire type which can be connected in either polarity. Sensors are electrically identical and can be used in either the water well or in the outdoor mount.