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B6000™

BOILER MANAGEMENT SYSTEM

SYSTEM CONTROL

BOILER MONITOR

Installation and Operating Manual

Raypak®
A Rheem® Company

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Before operating this product, please read these instructions completely.

B6000 BOILER MANAGEMENT SYSTEM (BMS)

Contents

Equipment	Quantity
B6000 System Control	1
B6000 Boiler Monitor, Installed on Boiler(s)	As Ordered
Outdoor Temperature Sensor Assy. (064140)	1
Water Temperature Sensor Assy. (064139)	1
Optional Equipment	As Ordered

Check packaging for damage or missing components.

IMPORTANT NOTICE: These instructions are intended for the use by qualified personnel only, specifically trained and experienced in the installation of this type of equipment and related system components. Installation and service personnel may be required by some states to be licensed. If your state is such, be sure your contractor bears the appropriate license. Only qualified persons shall attempt to repair this equipment. Repair must be according to these instructions.

WARNING: Improper installation, adjustment, alteration, service or maintenance may damage the equipment, create a hazard resulting in asphyxiation, explosion, fire, electric shock, personal injury or property damage and will void the warranty.

CAUTION: *MORE THAN ONE (1) SUPPLY SOURCE. THIS CONTROL HAS THE POTENTIAL TO BE CONNECTED TO MORE THAN ONE (1) ELECTRICAL SUPPLY SOURCE. TO REDUCE THE RISK OF ELECTRIC SHOCK, DISCONNECT ALL CONNECTIONS BEFORE SERVICING.*

CAUTION: *RISK OF ELECTRIC SHOCK. MORE THAN ONE (1) DISCONNECT SWITCH MAY BE REQUIRED TO DE-ENERGIZE THE EQUIPMENT BEFORE SERVICING.*

PLEASE REGISTER

Before proceeding any further, please take a moment to complete the enclosed user registration form and mail to Raypak, Inc., 2151 Eastman Avenue, Oxnard, CA 93030.

TABLE OF CONTENTS

Thank you for selecting the Raypak B6000 Boiler Management System (BMS). It is our sincere hope that you will enjoy its power, ease of use and energy saving features.

GETTING STARTED

To learn about the B6000 BMS, simply install it and start using it. The following steps will outline the things you will need for installation and to prepare it for use.

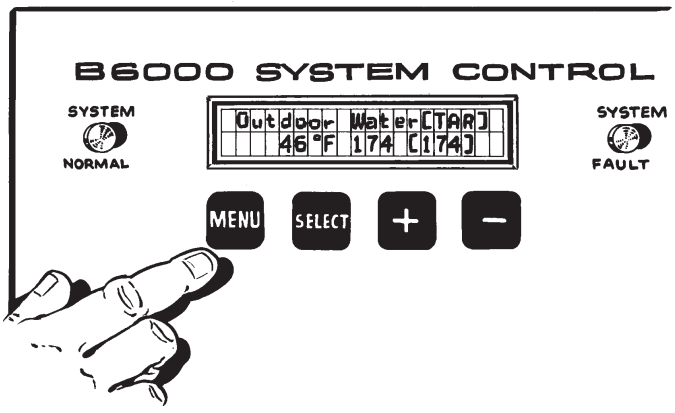
FOREWORD

The B6000 Boiler Management System is comprised of a Boiler Monitor for each boiler, one System Control for each system, an Outdoor Air Temperature Sensor and a Water Temperature Sensor. The system is a microprocessor-based energy management hot water control system that controls single or multiple boiler installations used for hydronic heating and/or domestic hot water supply.

The B6000 BMS is designed to provide the ultimate in personal comfort, efficiency and operation. The system requires minimal attention after initial setup. The system control to boiler can be separated by up to 2000 feet. It is capable of being monitored from a remote location, with an optional modem package and a Personal Computer (PC) equipped with a modem. The Raypak Boiler Management System minimizes boiler operator attendance and increases system reliability and cost effectiveness.

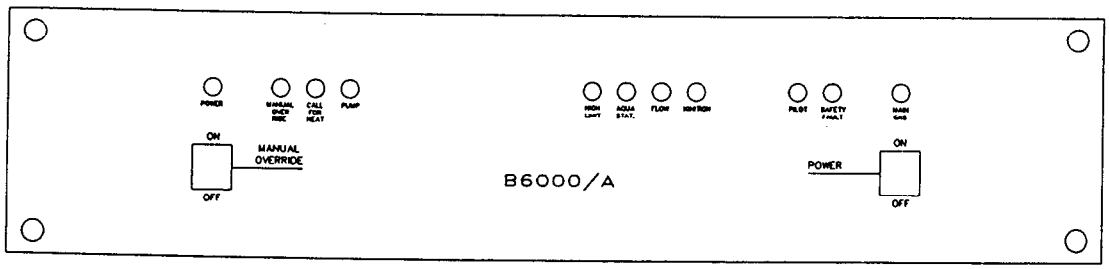
The **System Control** Module has

- A screen that displays the different operating characteristics of the system.
- A green light, to the left of the screen, that indicates normal system operating conditions.
- A red light, to the right of the screen, that flashes when a fault occurs.
- An alarm buzzer with a silencing switch. If the buzzer is silenced the red light will continue to flash until the diagnosed fault is corrected.
- Buttons which are used to monitor and program the selectable system features.
- On board relays designed to control primary system pumps, combustion vent louvers and/or other boiler accessories.



Each Boiler Monitor Module contains

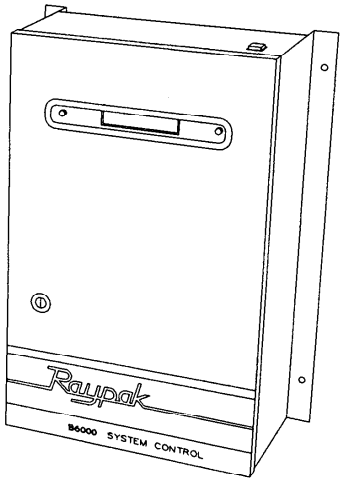
- The boiler on-off power switch.
- The boiler manual override switch, which allows the boiler to operate independently in the event of a system control failure.
- Standard indicator lights:
  "Power On" - green, indicates the boiler is powered.
  "Manual Override" - red, indicates boiler is in manual override mode.
  "Call for Heat" - amber, indicates there is a call for heat.
  "Pump" - green, indicates pump circuit is energized.
  "High Limit" - red, indicates boiler is off on high limit.
  "Aqua Stat" or "Thermostat" - red, indicates boiler is off on operating control (may not appear on all models).
  "Flow" - red, indicates boiler fault - no flow.
  "Ignition" - red, indicates ignition failure.
  "Pilot" - yellow or amber, indicates pilot is lit.
  "Safety Fault" - red, indicates fault in safety valve or safety circuit.
  "Main Gas" - green, indicates modulating valve is energized.
- Boiler identification dip switch.

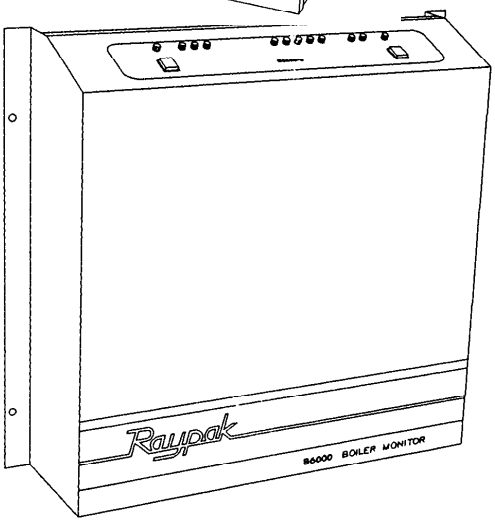


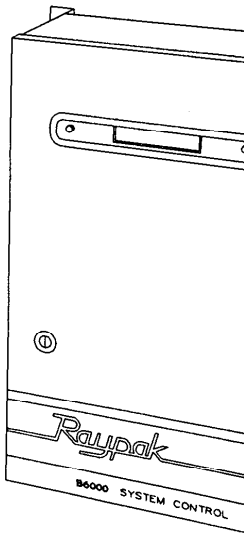
B6000/A Illustrated

INSTALLATION AND MOUNTING

The System Control module should be mounted on a permanent base not subject to vibrations, moisture or dust. It should be mounted with the display screen at a convenient height for reading and for access to the alarm silence button located on the top of the cabinet.







Dimensions & Weight
Boiler Monitor
18-3/4" W
5-1/2" D
17-1/2" L
21-1/4 lbs.

MECHANICAL INSTALLATION

Install the **B6000 System Control Module** boiler(s). The B6000 System Control Modul facing downward. Conduit holes are provi Additional or larger conduit fittings that may the module.

Mount the B6000 System Control with 3/8" or 1/4" hardware in four (4) places.

A minimum of six (6) inches clearance on all sides is required and a minimum of eighteen (18) inches clearance from the front is required for service access. The hinged side of the box is to the right and the clearance (minimum 3" from bolt hole on the right side) should be sufficient to open the cover.

A sub-panel containing the disconnect switches and surge suppressors is required at or near the equipment location(s).
For accessibility remove the lower interior panel, by removing the four (4) access screws.

INSTALL CONDUIT AS APPROPRIATE.

NOTE: Shielded cable, Belden #8132 or #9842 or equivalent, must be used to connect the sensors to the System Control Module.

DIMENSIONS AND WEIGHT

System Control Module	19 1/2 lbs	Boiler Monitor Module	21 1/4 lbs
15 3/16 L		17 1/2 L	
12 1/2 W		18 3/4 W	
4 3/4 D		5 1/2 D	

ELECTRICAL CHARACTERISTICS

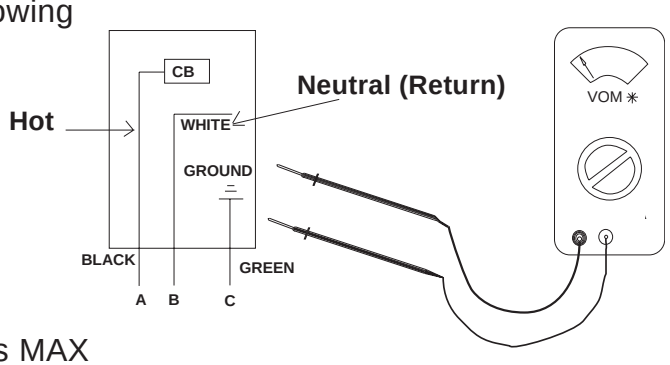
Control Module - 120 VAC, 0.5A; 60 Hz
Boiler Monitor Module - 120 VAC, 2.0A; 60 Hz

ELECTRICAL INSTALLATION

115 VAC FEEDER CIRCUITS
Install surge protection device(s) sized appropriately for your installation.
Install separate disconnect means for each load. Pull in appropriately sized wire for equipment as defined by NEC and/or local code. All primary wiring will be 125% of minimum rating.
It is strongly recommended that the System Control Module and the Boiler Control Module be supplied from the same source power.

CHECK YOUR POWER SOURCE

Using a volt-ohm meter, check the following voltages at the circuit breaker



AC = 108 Volts AC Minimum, 132 Volts MAX
Hot to Ground
AB = 108 Volts AC Minimum, 132 Volts MAX
Hot to Neutral
BC = Must be less than 1.0 Volts AC
Neutral to Ground

AIR TEMPERATURE SENSOR

- **INSTALLATION**

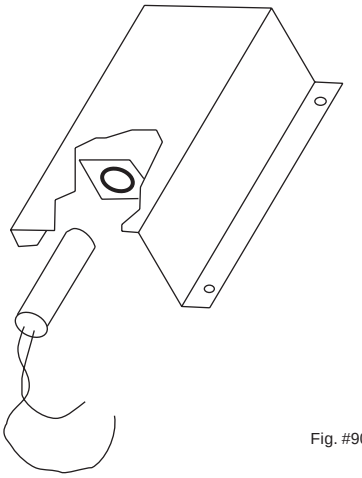


Fig. #9040

TYPICAL AIR TEMPERATURE SENSOR

Air Temperature Sensor Installation Notes:

- Locate on coldest side of building, usually (North or West) side.
- Install the sensor in a shaded area, out of direct sunlight.
- Locate no higher than 2/3 way up side of building or between 2nd and 3rd floor if building is more than 3 stories tall.
- Shielded cable length not to exceed 4000 feet.
- Do not locate under an overhang, near wall corners, near drafts from stacks, air moving devices, windows, doors, or balconies.
- Assure cable length does not exceed 4000 ft. Use larger gauge (Belden #9842) cable if run is in excess of 100 ft.
- Install in conduit with no other wiring.
- Observe proper wire colors. Sensor is polarity sensitive.

WATER TEMPERATURE SENSOR

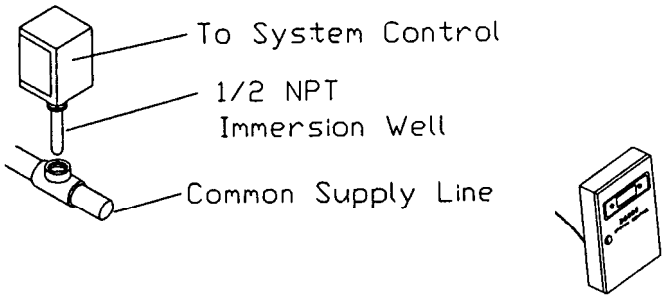
- **INSTALLATION**
  The water sensor should be installed in the system supply.

Supply

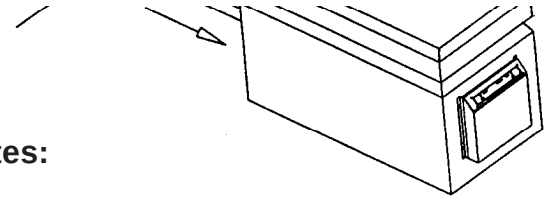
Return

Multiple Boilers

Single Boiler



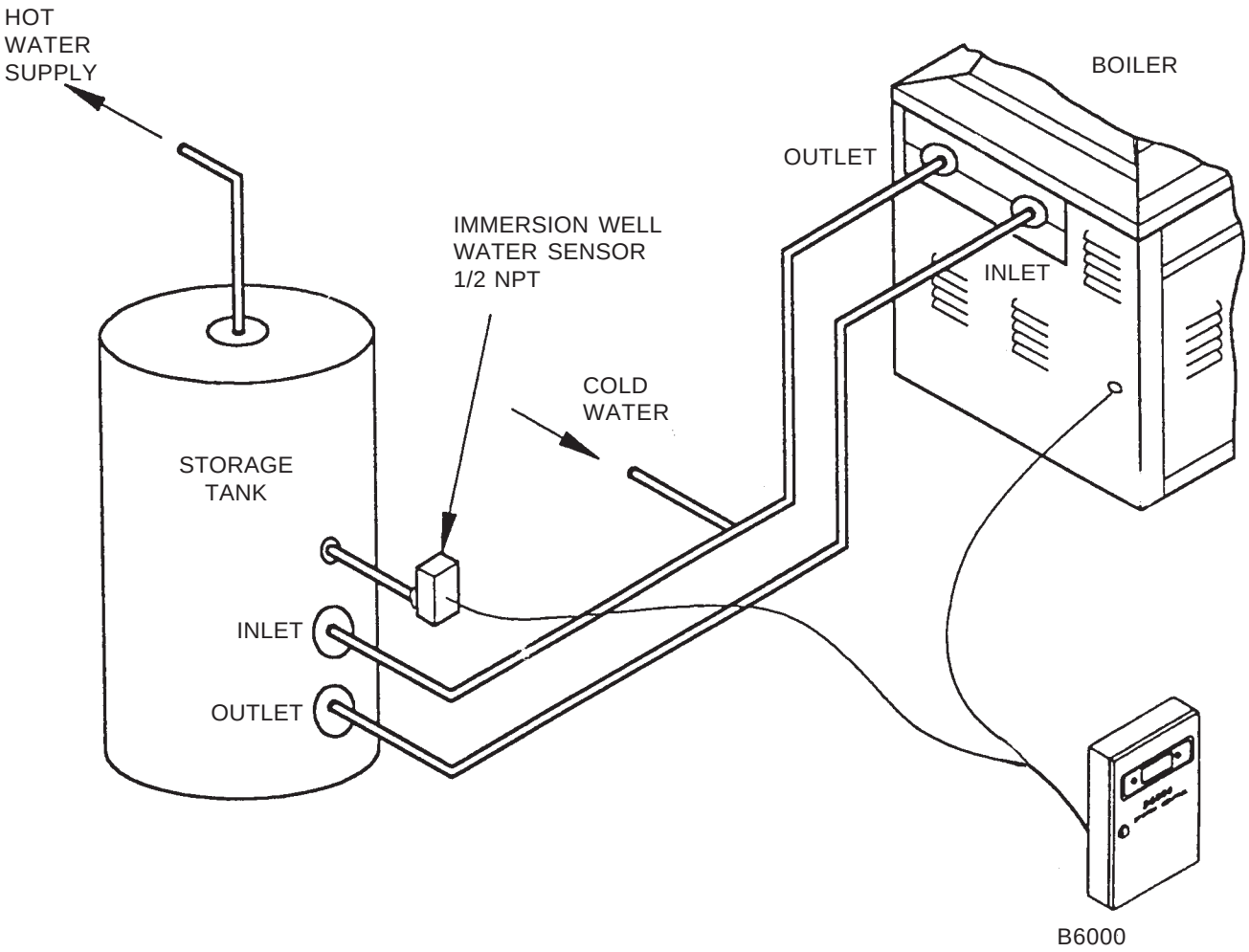
TYPICAL WATER SENSOR



Water Temperature Sensor Installation Notes:

- Locate sensor in system piping within a minimum of three (3) feet or prior to the first take off connection, on the downstream side of the System Supply Loop.
- Assure cable length does not exceed 4000 ft. Use larger gauge (Belden #9842) wire if run is in excess of 100 ft.
- Install in conduit with no other wiring.
- Observe proper wire colors. Sensor is ploarity sensitive.

WATER TEMPERATURE SENSOR INSTALLATION (Domestic Hot Water Supply)



SIMPLIFIED DIAGRAM OF TYPICAL PIPING
(PIPING LAYOUT MAY VARY PER SPECIFIC APPLICATION)

AIR TEMPERATURE SENSOR MUST BE INSTALLED ACROSS AIR TEMPERATURE SENSOR CONTACTS. THE SENSOR IS NOT ACTIVATED AND CAN BE LEFT STORED IN B6000 ENCLOSURE.

IMPORTANT

Configuration Note:

If your System Control Module is supplied with a single Field Wiring Teminal Strip use "Alternate" wiring. (See page 36-38)

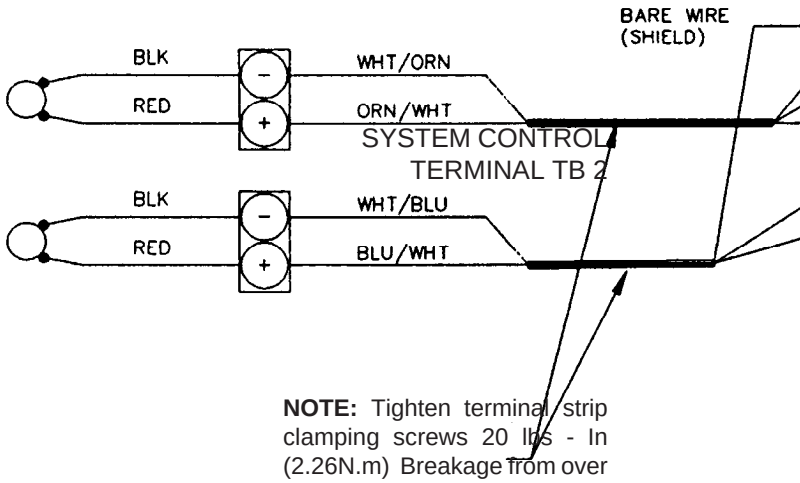
WIRING - AIR AND WATER SENSORS

TO THE SYSTEM CONTROL MODULE

WATER SENSOR

OUTDOOR SENSOR

BELDEN #8132
OR BELDEN #9842



NOTE: Tighten terminal strip clamping screws 20 lbs - In (2.26N.m) Breakage from over torquing is not covered under warranty.

Use copper conductors only.

For supply connections use wires sized on the basis of 60°C Ampacity and rated Min. 90°C (194°F).

COMMUNICATION (RS 485) WIRING

System Control

Boiler Monitor

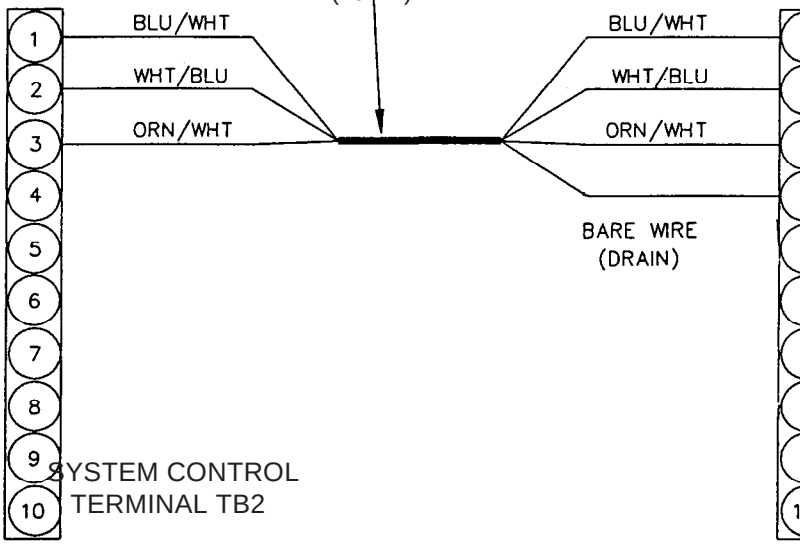
- Use **Belden #9842 Cable Or Equivalent (See Note).** Polarity must be observed. Make use of wire color coding to ensure proper polarity.
- The shielding foil wrapper - bare wire (drain) - MUST be grounded. **Grounding is done at the System Control Module** only. DO NOT ground at Boiler Monitor.
- Note: Equivalent shielded cable must be suitable for RS 485 communication applications; must have 100-140 ohm impedance; and less than 30 picofarad per foot capacitance.
- Install in conduit with no other wiring.

BELDEN #9842

NOTE: Tighten terminal strip clamping screws 20 lbs - In (2.26N.m) Breakage from over torquing is not covered under warranty.

Use copper conductors only.

For supply connections use wires sized on the basis of 60°C Ampacity and rated Min. 90°C (194°F).

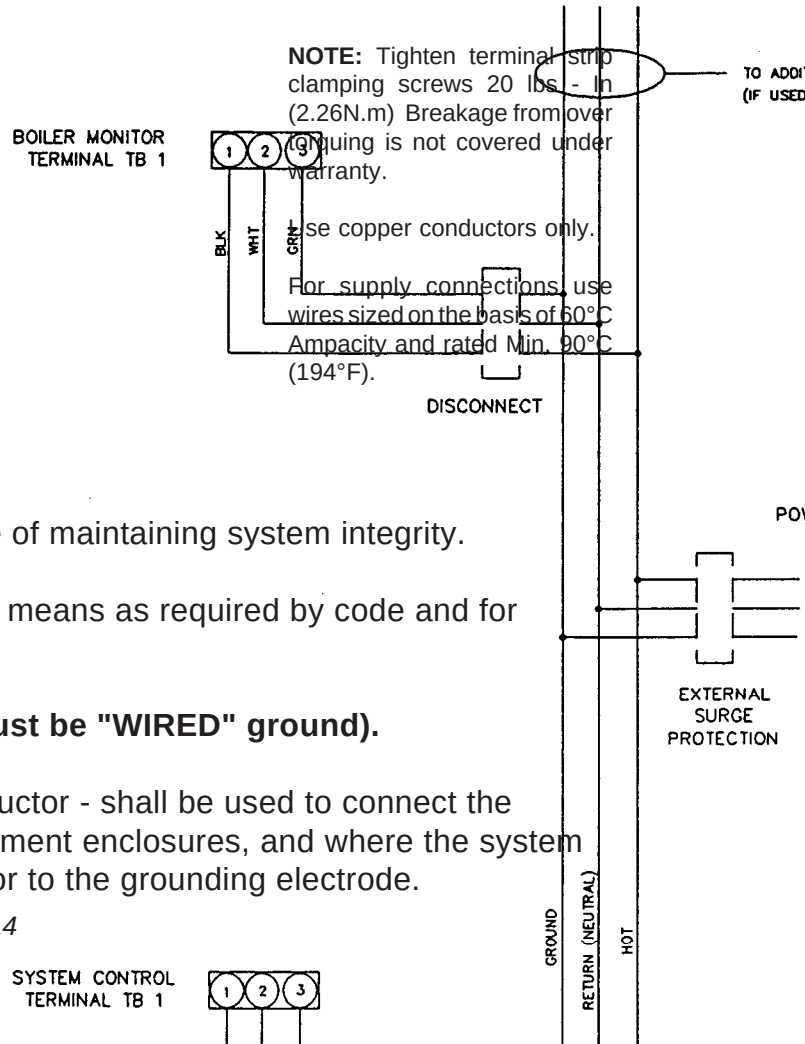


BOILER MONITOR
TERMINAL TB 3

SYSTEM CONTROL
TERMINAL TB2

RS 485 Communications Cable Schematic

WIRING: Power Source to System Control and Boiler Modules.



Dia. #9

- Observe proper Polarity.
- Observe proper wire colors.
- Provide external surge suppressor capable of maintaining system integrity.
- Provide overload protection and disconnect means as required by code and for equipment serviceability.
- Conduit can not be used as the ground. **(Must be "WIRED" ground).**
- **Very Important:** Grounding electrode conductor - shall be used to connect the equipment grounding conductors, the equipment enclosures, and where the system is grounded, the grounded service conductor to the grounding electrode.

POWER TEST

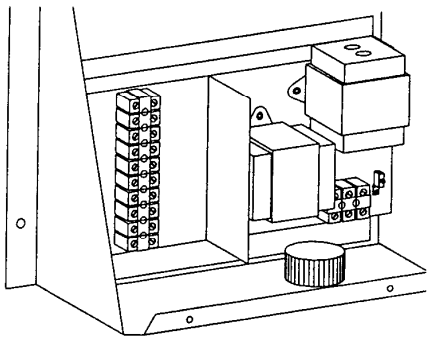
CHECK POWER

Utilizing a Volt-Ohm-Meter (VOM) monitor the following on the "System Control Module" and "Boiler Monitor(s)" for proper voltage levels.

POWER TEST TABLE

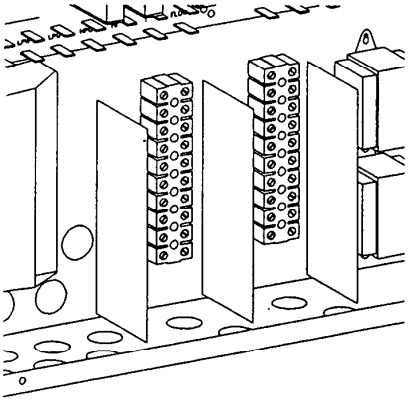
Module	Test Points	Indication
System Control	TB1-1- TB1-2	108 VAC to 132 VAC
System Control	TB1-1- TB1-3	108 VAC to 132 VAC
System Control	TB1-2- TB1-3	LESS THAN 1 VAC
System Control	TB1-1 - ⏚	108 VAC to 132 VAC
System Control	TB1-2 - ⏚	LESS THAN 1 VAC
System Control	TB1-3 - ⏚	LESS THAN 0.5 VAC

Module	Test Points	Indication
Boiler Monitor	TB1-1- TB1-2	108 VAC to 132 VAC
Boiler Monitor		C to 132 VAC
Boiler Monitor		HAN 1 VAC
Boiler Monitor		C to 132 VAC
Boiler Monitor		HAN 1 VAC
Boiler Monitor		HAN 0.5 VAC

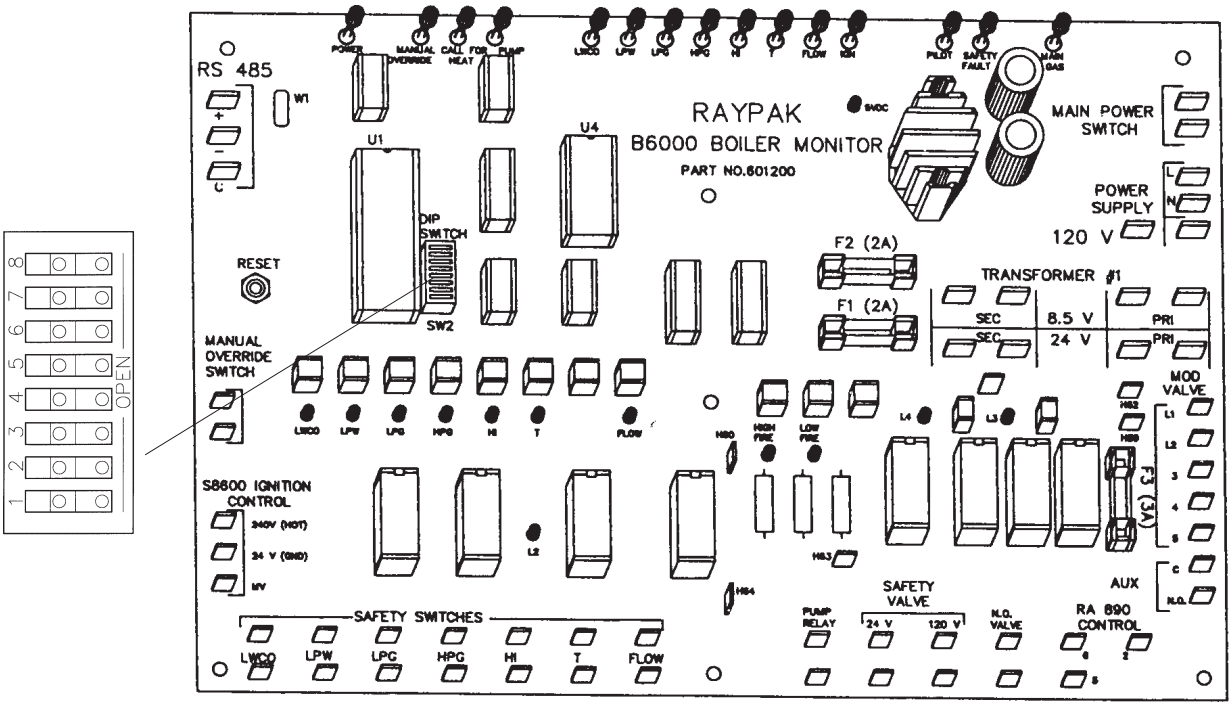


FROM: BOILER

Boiler Monitor	on
TB1 - 1	HAN 0.5 VAC
TB1 - 2	HAN 0.5 VAC
TB1 - 3	HAN 0.5 VAC
TB1 - 2	HAN 0.5 VAC

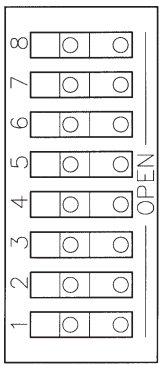


IMPORTANT: The Boiler Monitor control board has a series of dip switches which identify the boiler(s) (SW2). It is required that the switches be set as shown in the switch position table shown below.



BOILER MONITOR CARD PICTORIAL

BOILER MONITOR SELECT SWITCH



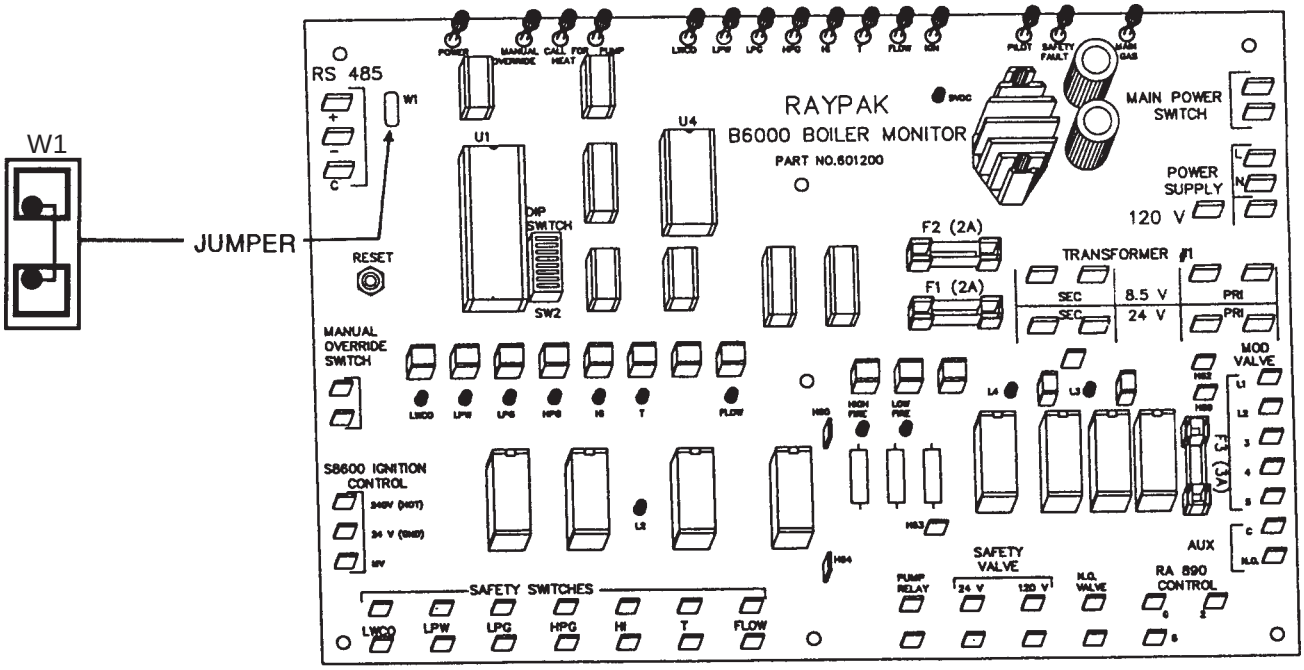
SWITCH POSITION

SWITCH	BOILER NUMBER 1	2	3	4	5	6	7	8
8	O	O	O	O	O	O	O	O
7	O	O	O	O	O	O	O	O
6	O	O	O	O	O	O	O	O
5	O	O	O	O	O	O	O	O
4	O	O	O	O	O	O	O	O
3	O	O	O	O	X	X	X	X
2	O	O	X	X	O	O	X	X
1	O	X	O	X	O	X	O	X

SWITCH O = Open X = Closed

BOILER MONITOR COMMUNICATIONS JUMPER W1

- Located in the upper left hand corner of the "LAST" Boiler Monitor board.
- NOTE: The jumper indicates to the System Controller logic that the "Last" wired boiler has been communicated with over the RS485 BUSS Link.
- Definition: The "LAST" wired boiler is physically wired with the greatest wire length from the "System Control" or is the last wired boiler for a single or multiple boiler installation.
- On a single boiler make sure the W1 Jumper has been installed.



BOILER MONITOR CARD PICTORIAL

On boiler systems the jumper (W1) MUST BE installed on the "**Last**" wired boiler. This is located on the Boiler Monitor board in the upper left hand corner, adjacent to the RS485 terminals.

On Multiple boiler systems the W1 jumper must be removed from all Boiler Monitor boards except on the "Last" wired boiler.

For normal boiler operation the dip switch settings can be utilized to define any of the boilers as #1 thru # (maximum), independent of the "Last" wired boiler position.

OPTIONAL BOILER MONITOR

- Wiring
- Contact Authorized Raypak representative for other wiring options

NOTE: Tighten terminal strip clamping screws 20 lbs - In (2.26N.m) Breakage from over torquing is not covered under warranty.

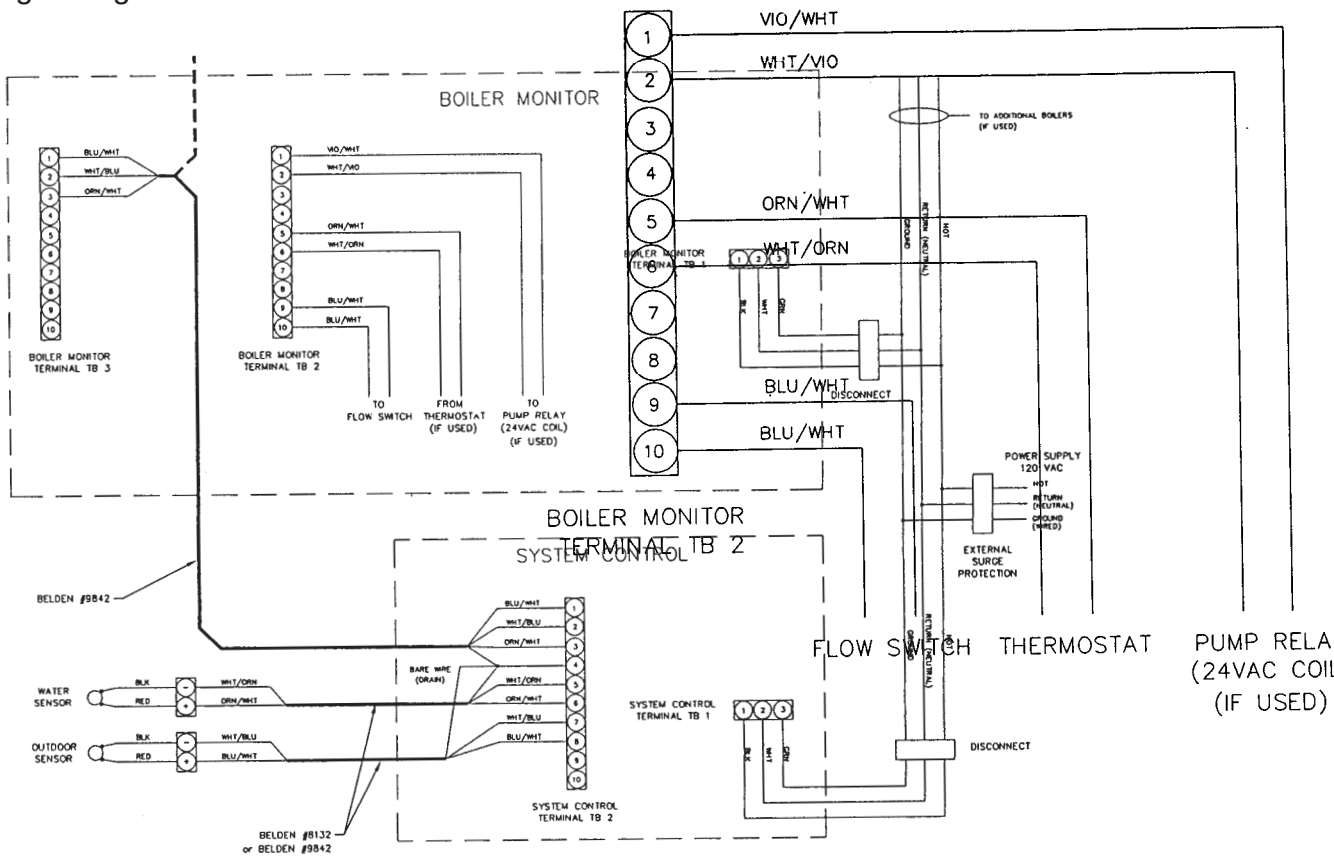
Use copper conductors only.

For supply connections use wires sized on the basis of 60°C Ampacity and rated Min. 90°C (194°F).

Dia. #2

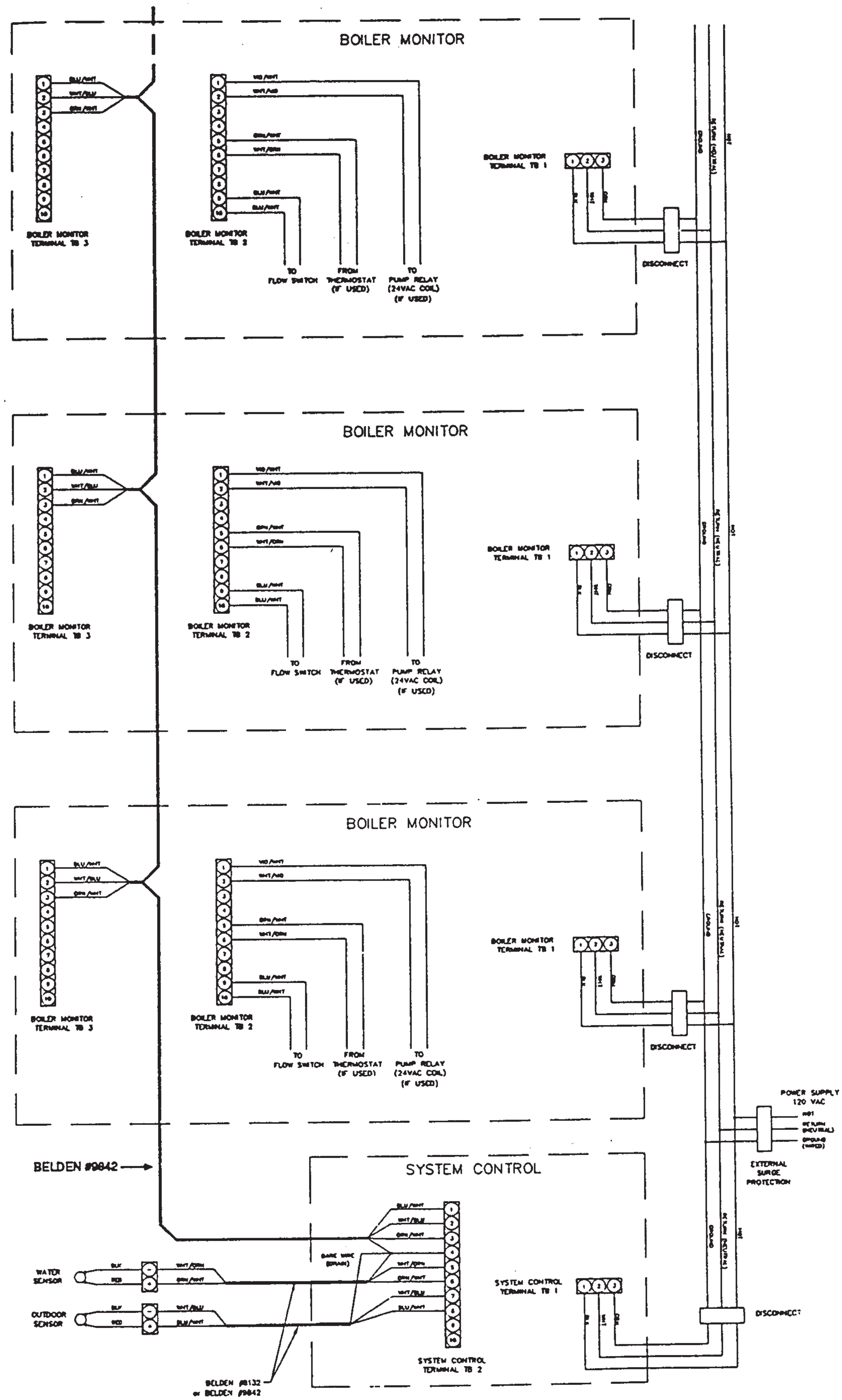
Field Wiring - Single Boiler

Dia. #7



Field Wiring - Multiple Boilers

Dia. #7



INSTALLATION VERIFICATION PROCEDURE

REGISTER
Before proceeding any further, please verify that the user registration form has been completed and mailed (reference: Registration Card).

MECHANICAL INSTALLATION
Verify installation has been completed (reference: Mechanical Installation).

AIR TEMPERATURE SENSOR
Verify installation parameters have been met (reference: Air Temperature Sensor).

WATER TEMPERATURE SENSOR
Verify installation parameters have been met (reference: Water Temperature Sensor).

Verify System Control/Boiler Monitor power wiring connections.

Verify Torque Requirements.

Verify Air Temperature Sensor wiring, must be Belden #8132, #9842 or equivalent.

Verify Water Temperature Sensor wiring, must be Belden #8132, #9842 or equivalent.

Verify Power Test has been completed successfully.

Verify RS485 Communications Cable, must be Belden #9842 or equivalent.

Verify Boiler Monitor Select Switch (SW2) settings.

Verify Installation/Removal of Boiler Monitor Communications Jumper(s) [W1].

Verify Optional Boiler Monitor Control Wiring.

MODEM (Optional)

Perform and/or verify modem installation and hook-up per Raypak Add/On Options P/N 240596 and B6000 BMS Optional Modem Software Documentation P/N 240595.

SYSTEM CONTROL/DISPLAY FAMILIARIZATION

The System is set up by using the selector buttons and the displays on the System Control module.

There are ten or more displays. Each display provides information regarding the system operating parameters and system component status. Some displays provide information only, such as current outdoor temperature, system temperature, etc..

Selectable data is identified by flashing characters.

The selector buttons are:

"MENU" - which when pressed will change displays.
"SELECT" - moves the cursor - flashing character - to the next selection in a display.
"+" - moves a value to a higher reading (e.g. Display shows flashing boiler #1. Pushing "+" will change display to boiler #2).
"–" - moves a value to a lower position (e.g. Display shows flashing boiler #2. Pushing "–" will change display to boiler #1).

EDITING B6000 DISPLAYS LOCATION

The B6000 BMS has a forty (40) character screen that displays status and memory contents.

Selectable Parameters on the B6000 Monitor Screen are as follows:

Selectable Parameters	**Range**	**Value**
Change to Fahrenheit (F) or Celsius (C).		Default (After Initialization)
Maximum Water Temp	70 - 235	Degrees.....180
Set	40 - 220	Degrees.....100
Day Temperature	40 - 220	Degrees.....100
Nite	40 - 220	Degrees..... 90
Ratio	None - 20:1	Numeric.....1.0:1
° Rise	1 - 99	Degrees..... 20
Step	1s,2s, 5 - 100	Percentile..... 20
O/C (Outdoor Cutoff)	35 - 199	Degrees..... 65
O/Cdb (O/C dead band)	1 - 9	Degrees..... 4
CBand (Control Band)	1 - 9	Degrees..... 3
Lead	1 - 8	Numeric..... 1
Change Hours	0 - 225	Numeric.....100
Pump Delay *	0 - 20	Minutes..... 3
Ign Time*	15 - 100	Seconds..... 30

*Indicates multiple entries

When the B6000 BMS is equipped with a night setback feature, [WHEN INITIALIZED], NITE SETBACK defaults to OFF.

NOTE: Nite setback feature must be set at the B6000 BMS Control Panel to "ON". This results in display change that shows NITE rather than DAY. The BMS can change "SETBACK TIMES" up to six selections for each of the seven days.

WARNING WARNING WARNING WARNING WARNING WARNING

When the initialize control selection is set to "Y" and "SELECT" button is pushed, the B6000 BMS resets all of the SELECTABLE PARAMETERS on this screen to DEFAULT values. Nite Setback (NSB), Lead Lag is set to "OFF" (If option installed).

POWER-UP

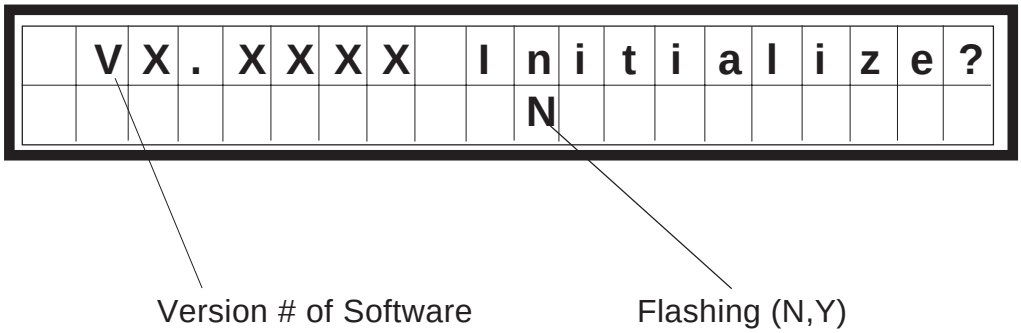
Boiler Monitor

a. Energize by pushing Power Switch to "ON" position. The following indicator lights will be lit: - Power On

The following indicator lights will be lit if the boiler is performing the valve calibration cycle.

- Call for Heat
- Pump
- Pilot

b. Boiler will start provided there are no "faults" after the System Control module has been energized.



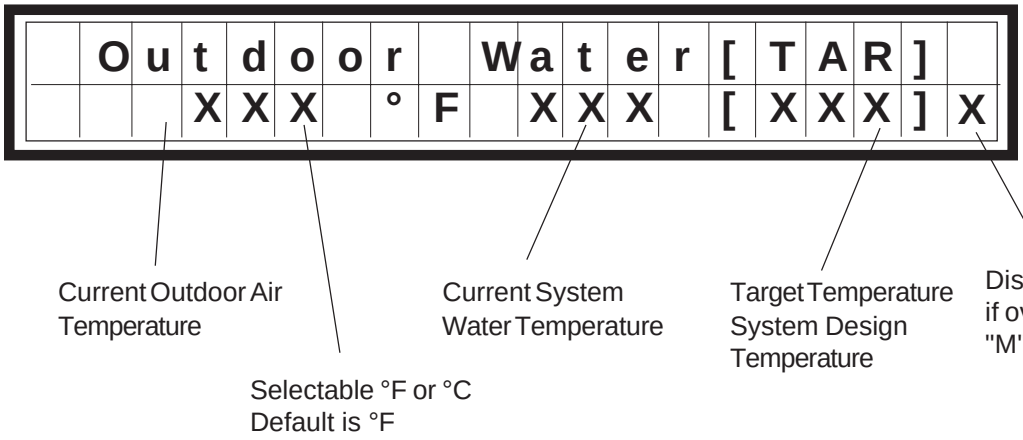
System Control Module

a. Energize the system control module.
   - The screen should show the System Temperature (Display #1)
b. Press the "MENU" button until the screen shows the Initialize screen .
c. Press "+" or "–" button to change the cursor to "Y".
d. Press "Select" button.
   - This will initialize the control memory to the default values.

DISPLAYS

System Temperatures * Indicates selectable item

Program the System Control Module to meet the design conditions of the installation. Return to System Temperature Display by pressing the "MENU" button until screen appears as below.



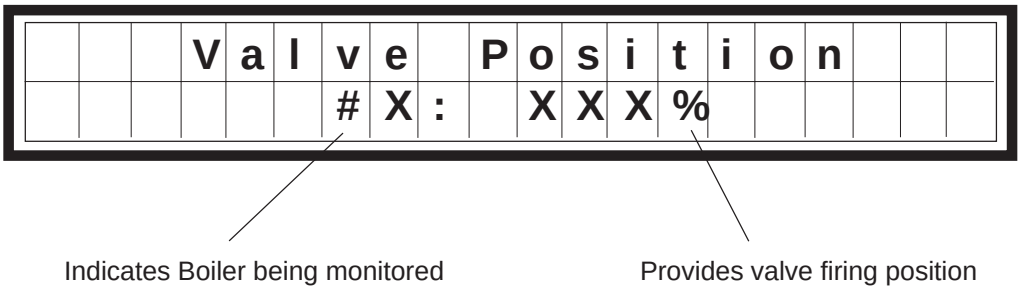
INFORMATION ONLY

This is the first screen displayed when system is energized. After system is set up this display should be used. °F or °C is selectable by pressing "+" or "–".

Provides:
- Outdoor temperature – actual
- System Water temperature – actual
- Target Temperature, which is the desired system temperature.

Press MENU button

Boiler Valve Firing Rates



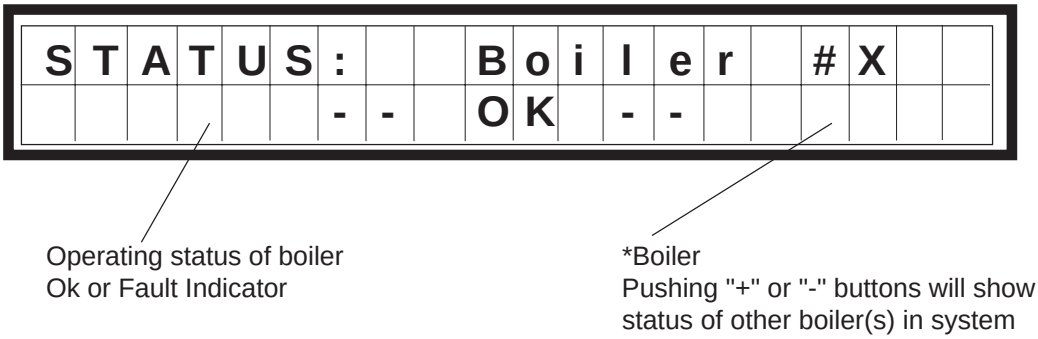
On multiple boiler installations press "+" or "–" to view position of other boiler firing rates.

INFORMATION ONLY

- Provides firing valve position for each boiler.
- Multiple boilers - press SELECT button to determine status of each boiler.

Press MENU button

Boiler Status



READOUT

Readout	
OK - boiler operation	normal

FAULT indications: MAX TEMP - Target exceeds Max Temp -Not a fault-
THERMOSTAT - Operating aquastat - Not a fault -
LWCO - low water cutoff - when supplied
LO PRES WTR - Low pressure water - when supplied
LO PRES GAS - Low pressure gas - when supplied
HIGH PRES GAS -High pressure gas
HIGH LIMIT -
FLOW SWITCH - Flow switch
NO PILOT -
MANUAL OVERRIDE - Boiler in emergency or manual operation

- When a fault is indicated, the red light, to the right of the display, flashes and the alarm buzzer sounds. The light continues to flash after alarm is silenced and until the fault is corrected.
- When fault is corrected display will read "OK"
- Should communication between the system control module and the boiler monitor module(s) be disrupted, the display will show "BOILER NOT ON-LINE".
- To display status of other boilers press the (+) or (–) buttons on multiple boiler installations.

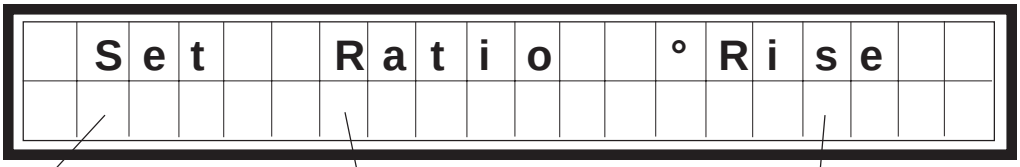
System Control Display	GREEN Power On	RED Manual Over-ride	AMBER Call for Heat	GREEN Pump On ☆	RED Low Water Cutoff
OK System operating normally	x		x	x	
LWCO Low water in boiler	x		x	x	x
LOW PRES WATER Water Pressure too low	x		x	x	
LO PRESS GAS Gas pressure below setting	x		x	x	
HIGH PRESS GAS Gas pressure on manifold too high	x		x	x	
HIGH LIMIT Boiler temp excess high limit	x		x	x	
THERMOSTAT OFF Boiler off on aquastat	x		x	x	
FLOW SWITCH Flow through boiler insufficient	x		x	x	
NO PILOT Pilot light failed to start	x		x	x	
BOILER NOT ON-LINE Communication lost	x		x	x	

x = Light On

☆ PUMP light used only when Economaster programmed.

If a boiler should lose communication with the System Controller, BOILER NOT ONLI

Primary Control Parameters



*System water temperature desired at outdoor temperature of 70°.
Range 40 - 200
Default value 100°.

*RESET RATIO
Ratio of outdoor temperature to water system temperature.
Range: 0.0:1 to 20: and "None" for constant water temperature
for constant water temperature (TAR T - Set Point). Default value is 1.0:1.

* Rise is the temperature rise in system when all boilers are at full rate. (ÐT of system) Range 1 -99
Default value is 20°F

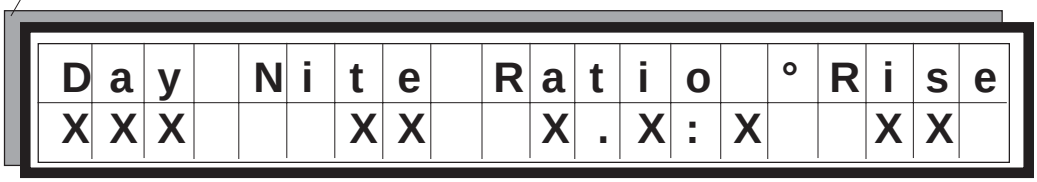
NOTE"S"
This "shadow box" indicates the display for "Lead Lag, Nite Setaback" feature.

LEAD LAG, NIGHT SET BACK

* System water temperature desired at outdoor temperature of 70°.
Default value 100° (Day).
Default value 90°F (Nite).

LEAD LAG, NIGHT SET BACK

Primary Control Parameters



Day Value is used as the set point when setback is OFF; Nite value, when setback is ON.

– Sets up boiler and system,

SET – Sets desired water temperature @ 70°F - minimum design
Range 40 -220 (Day), 40 - 220 (Night)
Default value is 100° (Day); 90°F (Nite)
To increase PUSH [+] button to required temperature - suggested setting is 110°F.

PUSH SELECT

RATIO – Sets the desired change in system water temperature increases as the outdoor temperature decreases. The reset ratio is expressed as follows:

2:1 for every 2 degree change in outdoor temperature the sytem temperature will change 1 degree.

e.g: Set = 135°F

Ratio	Temperature °F Outdoor	System
2:1	**60**	**140**
	40	**150**
	20	**160**

Suggested Guidelines

RADIATION	Typical		Reset Ratio Setpoint at Design Temp:			
	Temp@ Design Cond	Temp@ 70°F	40°F	20°F	0°F	-20°F
Standing	190	105	0.3:1	0.6:1	0.8:1	1.1:1
Convection or Baseboard	200	105	0.3:1	0.5:1	0.7:1	0.9:1
Fan Coil - Heating	190	105	0.3:1	0.6:1	0.8:1	1.1:1
Fan Coil - Heat & Cool	140	105	0.9:1	1.4:1	2.0:1	2.6:1
Radiant Floor	120	105	2.0:1	3.3:1	4.7:1	6.0:1
Radiant Ceiling	120	105	2.0:1	3.3:1	4.7:1	6.0:1

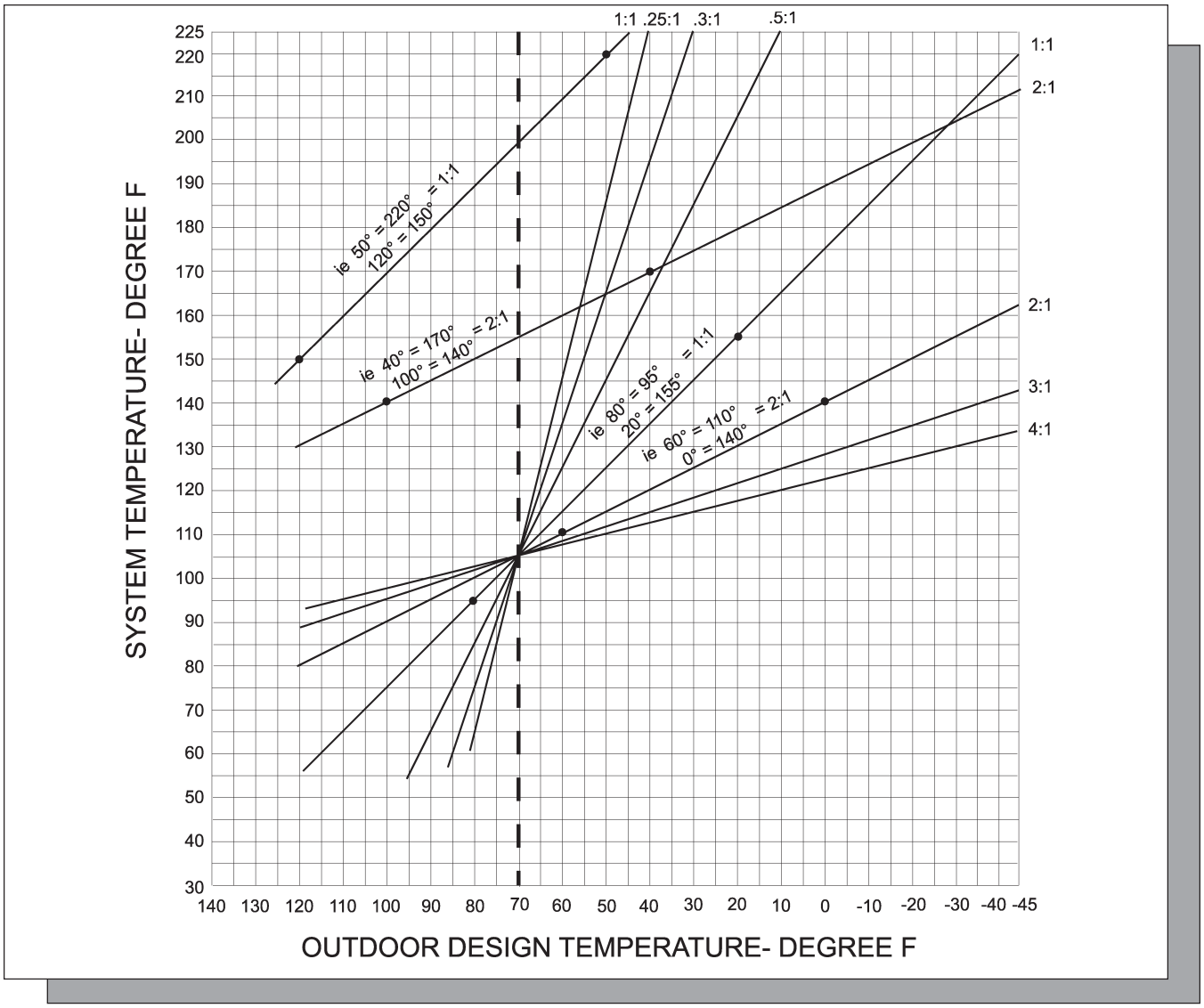
SUGGESTED GUIDELINES

The selection of the correct ratio is dependent on the initial temperature and the desired system water temperature setpoint and the design temperature conditions.

The reset ratio and setpoint must be selected so that the controller will raise the system water temperature from the initial setpoint – suggested 110°F – to the maximum temperature required when the outdoor temperature drops from 70°F to the design temperature.

PUSH SELECT

Design temperature rise of the system related to the boiler. Default value 20°F.



Secondary Control Parameters

Step	O/C	O/Cdb	C band
XX%	XXX	X	X
		°F	

*Step
Increment of firing valve opening.
Range 1s, 2s 5-100
Default value 20%.

*O/C
Maximum outdoor temperature that heat is desired, set at 70°,
Range 35° to 199°.
Default value is 65.

*O/Cdb,
Outdoor cutoff deadband is the number of degrees below O/C where O/C reset occurs.
Range 1-9
Default value is 4°F.

*C Band is a range of temperature above and below the target temperature.
Range 1-9
Default value is 3°F.

*STEP
Enter desired valve firing increments. Recommended setting is between 5% and 20% for Modulating Boiler.

Or

Enter 1S If Gas Valve is an On-Off or Single Stage

Or

Enter 2S If Gas Valve is 2 Stage Firing

Or

Enter 20% If the control boilers include modulating and 2 stage or single stage boilers under control of a single system control module.

*O/C
Enter desired outdoor cutoff temperature, usually 70°F, depending on geographical location.
When outdoor temperature exceeds desired setting, target temperature will show "O/C".
Note: Boiler will restart when outdoor temperature drops below O/CF Tep - O/C db.

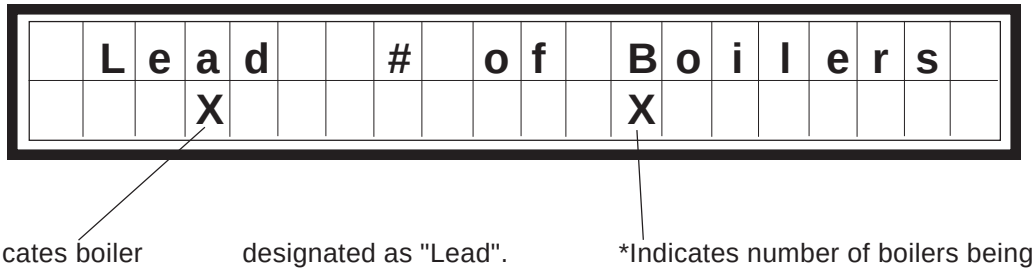
*O/Cdb
Enter desired outdoor cutoff dead band, which is the number of degrees below O/C where O/C resets, usually 1F.

*C Band
Enter desired Control Band, determines when boiler will fire below target temperature and shut off above target temperature, usually 1°F.

NOTE: The above settings are recommended at initial installation. For maximum performance and system efficiency these settings should be modified, as required, to meet such parameters as system capacity, location and usage.

NOTE: Contact factory for recommended settings if this is a special application ie. Heat pump applications.

Lead Boiler Select

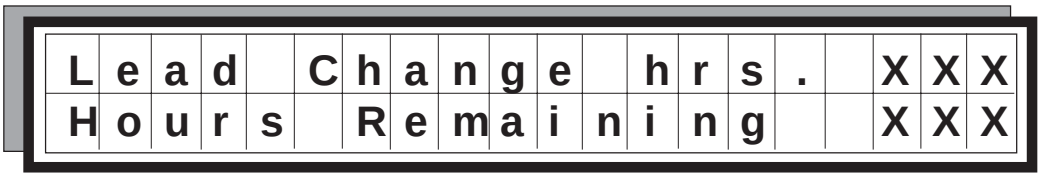


Used when there are multiple boilers. Set number (#) of boilers to match actual installation. Readout lists lead boiler. To change lead boiler PRESS [+] or [–] button until desired boiler is displayed. In the event of a fault in the designated lead boiler the next boiler, numerically, becomes the lead boiler.

Boiler being monitored is displayed. If multiple boilers, push [+] or [–] to select the desired boiler.

LEAD LAG, NIGHT SET BACK

Automatic Lead Lag



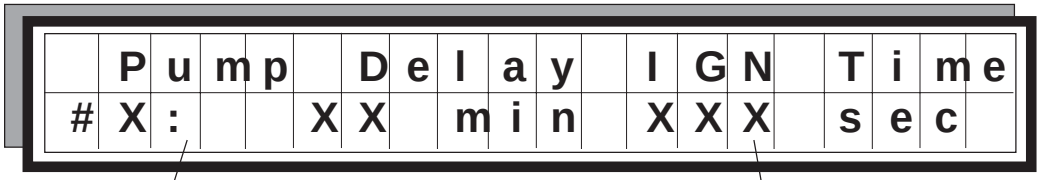
*Lead Change Hours
Designated lead boiler will change when remaining hours reaches 0.
Range 0-225 hrs. Default value is 100 hrs.
If set at 0 hours lead will not change.
Hours remaining will automatically total.

Enter the desired number of hours of lead boiler operation before change. Hours remaining is automatically calculated. Designated lead boiler will change as soon as remaining hours run out. Set at 0 hours and lead will not change.

STANDARD
BOILER PARAMETERS

LEAD LAG, NIGHT SET BACK

Boiler Parameters



*Pump delay selectable from 0 to 20 minutes. Range 0-20. Default value 3 mins.

*Ignition time sets the duration to monitor Ignition prior to lock out. Range 15-100. Default value 30 secs.

PUSH SELECT
PUMP DELAY
Enter time desired for boiler pump operation, if one is installed and wired to boiler monitor. If there is no pump or a continuous running pump, ignore.

PUSH SELECT

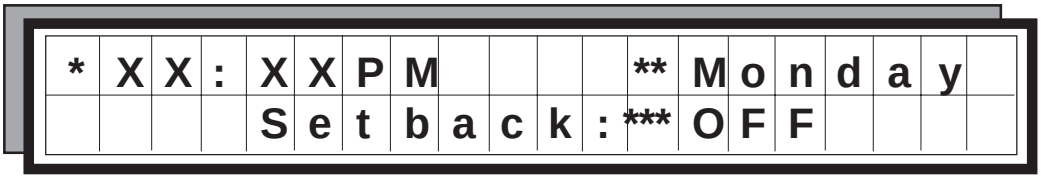
IGN TIME
Display shows time of monitoring the ignition prior to main flame. Default timing is 30 seconds.
Note: On multiple boilers, a time must be entered for each boiler.

Night Setback
"OFF" indicates the system is in the Normal or design operating mode. "ON" indicated the system is operating in a programmed night setback mode.

NOTE"S"
This "shadow box" indicates the display for "Lead Lag, Nite Setaback" feature.

LEAD LAG, NIGHT SET BACK

Automatic Lead Lag



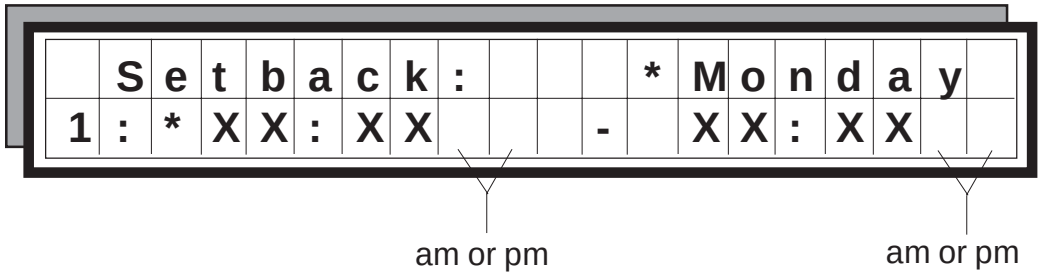
*Set Time of day
** Day of Week
*** On or Off

This screen shows the time and day of the week. Default values: Monday for the day, and "OFF" for Setback.

Enter the current time.
PUSH SELECT Until day flashes.
Enter day of the week.
Setback status can be manually changed from "OFF" to "ON", or vice versa, provided the setback times have been cleared, otherwise the timer will override the manually selected status of setback. Push [+] or [–] to setback mode to "on" or "off".

LEAD LAG, NIGHT SET BACK

Setback Times



This screen shows the Setback "ON" and "OFF" times for each day. There are six (6) "ON" and six (6) "OFF" times per day, as indicated by the number on the left.

Set Back Example:

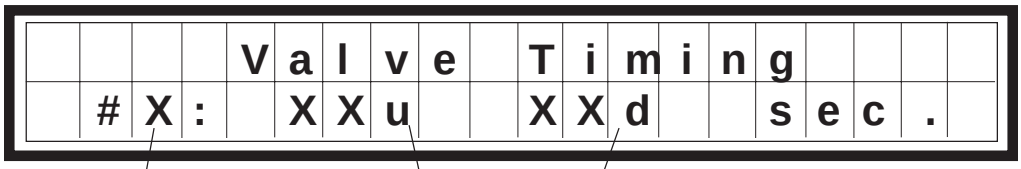
Period	SETBACK "ON"	SETBACK "OFF"	DAY
1	xx:xx	05:00 am	Monday
2	10:00 pm	xx:xx	Monday
1	xx:xx	05:00 am	Tuesday
2	10:00 pm	xx:xx	Tuesday
1	xx:xx	05:00 am	Wednesday
2	10:00 pm	xx:xx	Wednesday
1	xx:xx	05:00 am	Thursday
2	10:00 pm	xx:xx	Thursday
1	xx:xx	05:00 am	Friday
2	10:00 pm	xx:xx	Friday
1	xx:xx	xx:xx	Saturday
2	xx:xx	xx:xx	Saturday
1	xx:xx	xx:xx	Sunday
2	xx:xx	xx:xx	Sunday

The above example will set back temp weekends and 10:00 pm to 5:00 am weekdays. Each day can have up to six (6) separate setbacks.

When no time is entered (indicated by xx:xx) the setback time in effect from the previous time period will continue on to the next period, which means, when the night setback is "ON" the system water temperature for nighttime use will be maintained until the next "OFF" entry is reached.

Boiler Valve Timing

Boiler Valve Timing
Information only



u= UP
d = DOWN

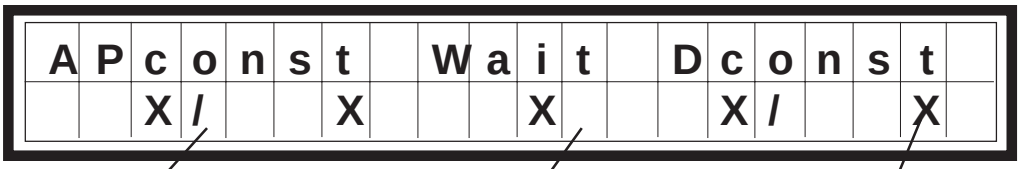
Boiler Number

Displays in seconds real time opening and closing of modulating gas valve from closed (0%) to full open (100%)

This display shows the time (secs) required for the gas valve to open and close. If "u" display is from 12 to 26 and "d" is less than "u" and between 4 and 18 the gas valve requires no adjustment. This timing is not operator changeable on the screen display.

Proportional Integral Derivative Operator Manual Action (PIDOMA)

A.Proportional Integral Derivative
Operator Manual Action



*Pconst is the proportional ratio which causes the boiler to step up or down, faster or slower (overshoot or undershoot) and finally end up offset from desired temperature. Default is 1/3.

*Wait is the time controller waits until it acts on a temperature change. Default value is 5 seconds.

*Dconst is the derivative ratio which tells the system how first to react to differing changes in water temperature. Default is 3/1.

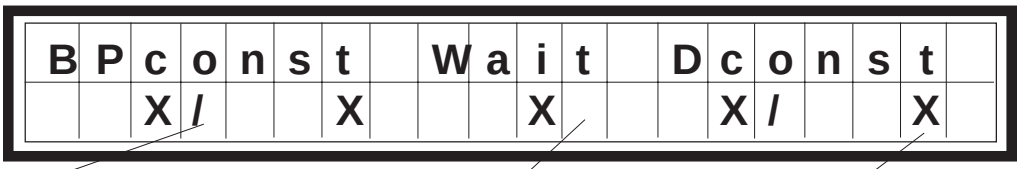
*Pconst
Proportional ratio which causes the boiler to step up or down, faster or slower.

*WAIT
Wait as time controller hesitates before acting on a temperature change.

*Dconst
Derivative ratio speeds or slows boiler response compensating for overshoot and undershoot.

Proportional Integral Derivative Operator Manual Action (PIDOMA)

B.Proportional Integral Derivative
Operator Manual Action



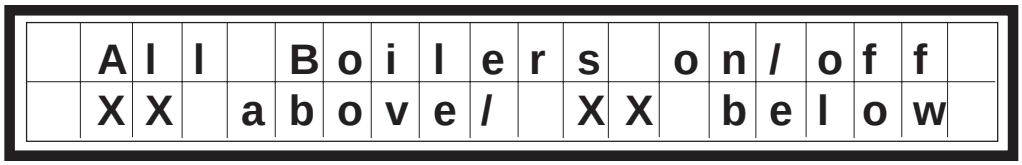
*Pconst is the proportional ratio which causes the boiler to step up or down, faster or slower (overshoot or undershoot) and finally end up offset from desired temperature. Default is 1/3.

*Wait is the time controller waits until it acts on a temperature change. Default value is 5 seconds.

*Dconst is the derivative ratio which tells the system how first to react to differing changes in water temperature. Default is 3/1.

*Pconst
Proportional ratio which causes the boiler to step up or down, faster or slower.
*WAIT
Wait as time controller hesitates before acting on a temperature change.
*Dconst
Derivative ratio speeds or slows boiler response compensating for overshoot and undershoot.

ALL BOILERS ON/OFF

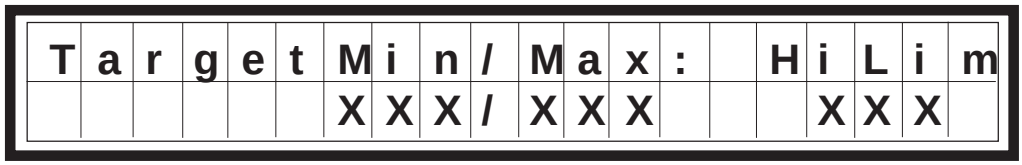


Range 1 to 99. Default valve 20° F.

This Display Indicates:

The temperature above or below target at which the control will turn off or on all the boilers.

TARGET MIN/MAX AND HI LIM



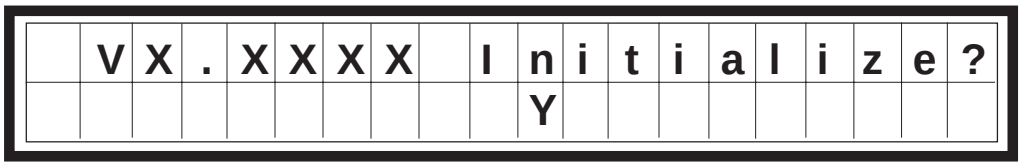
Min Default 105, range 0 to 220°F
Max Default 180, range 0 to 220°F
Hi Lim Default 200, range 0 to 220°F

Hi Lim shows the maximum obtainable water temperature.
Hi Lim can not be lower than the target XXX/ Max.
Note: All of the values interact and are depedent upon each other.

tandard
Initialize

LEAD LAG, NIGHT SET BACK

Initialize



Y - Yes
N - No

Version # of software.

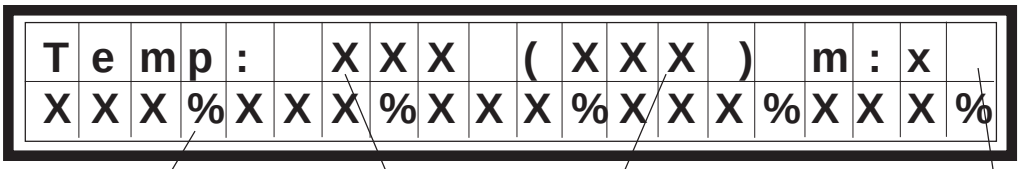
* This will initialize all previous selectable values to default values. Should not be used unless operator wants to reprogram new values. Should be used at Start-up to clear the control memory.

This should be by-passed, if controls have been initialized as the first step.

Standard
Utility Service

LEAD LAG, NIGHT SET BACK

Utility Service



Displays controller operating mode, changes continously from 1 to 5.

Displays Firing Rate of each Boiler

Displays System Target Temperature

Displays Actual System Temperature

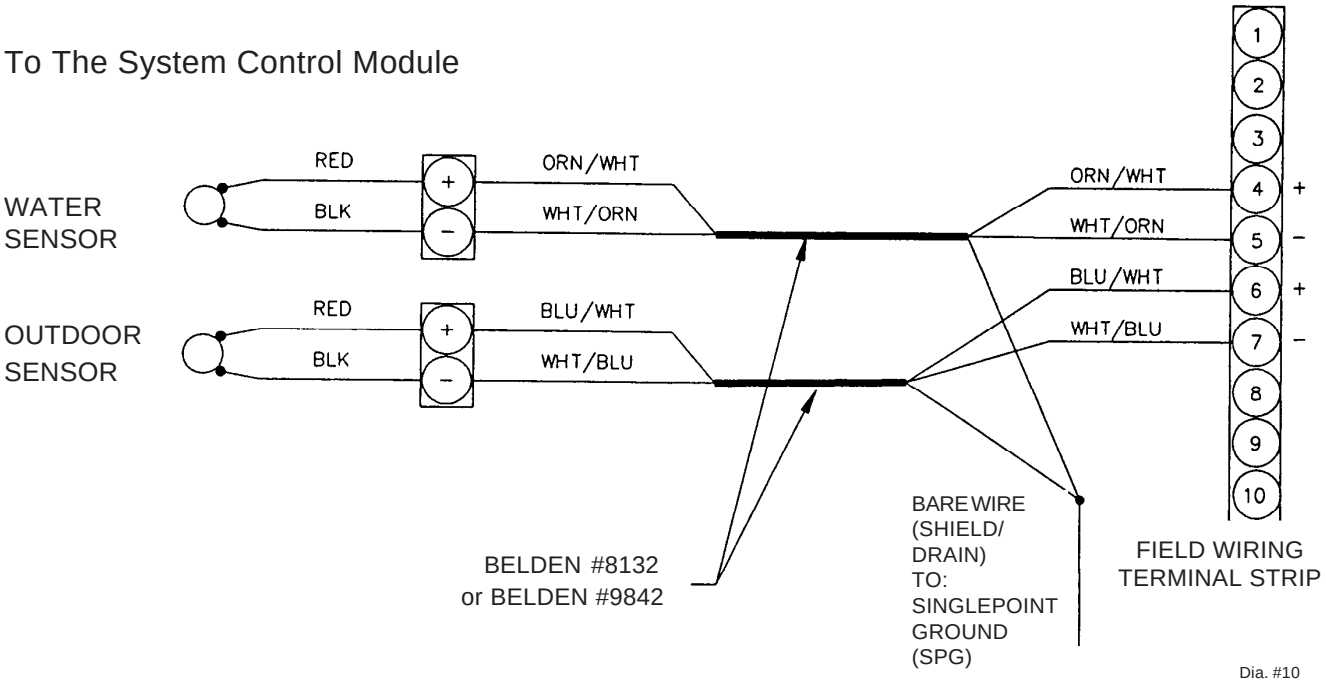
Information Only.
Displays the system operating conditions and the firing rate of each boiler up to total of (5).

IMPORTANT

START "ALTERNATE" If your system module(s) are supplied with a single Field Wiring Terminal Strip use this method for wiring.

WIRING - AIR AND WATER SENSORS

To The System Control Module



Dia. #10

AIR/WATER TEMPERATURE SENSOR SCHEMATIC

"ALTERNATE" Continued

COMMUNICATION (RS 485) WIRING

From: System Control Module

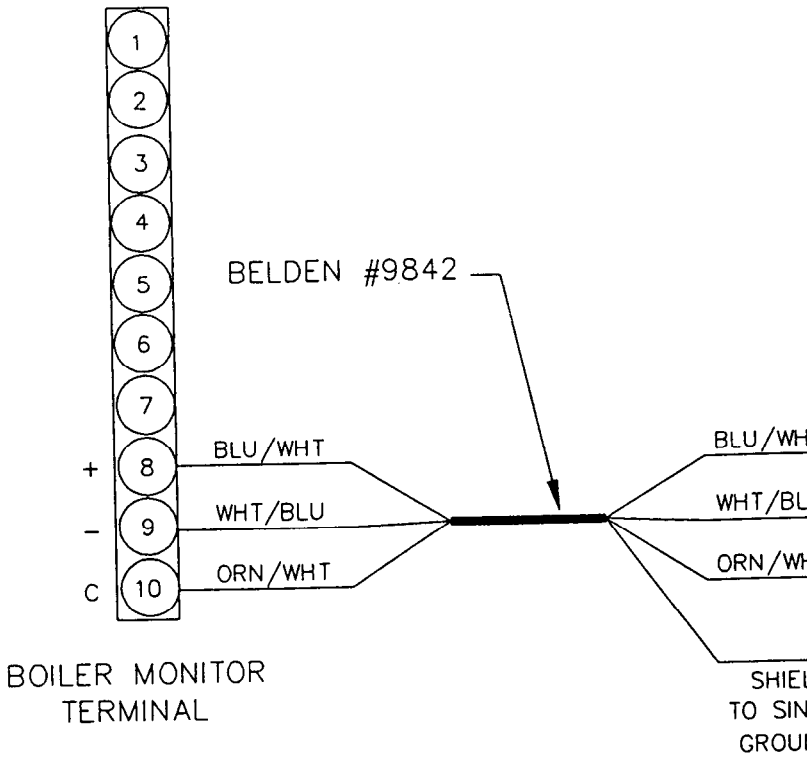
To: Boiler Module

- Shielded communications cable - Belden #9842 must be used.
  Polarity must be observed. Make use of wire color coding to ensure polarity.

- The shielding [foil wrapper - bare wire (drain)] MUST be grounded.
  Grounding is done at the (System Control) only. **DO NOT** ground at boiler monitor.

- Note: Equivalent shielded cable must be suitable for RS 485 communication applications; must have 100-140 ohm impedance; and less than 30 picofarad per foot capacitance.

- Install in conduit with no other wiring.



RS 485 Communica

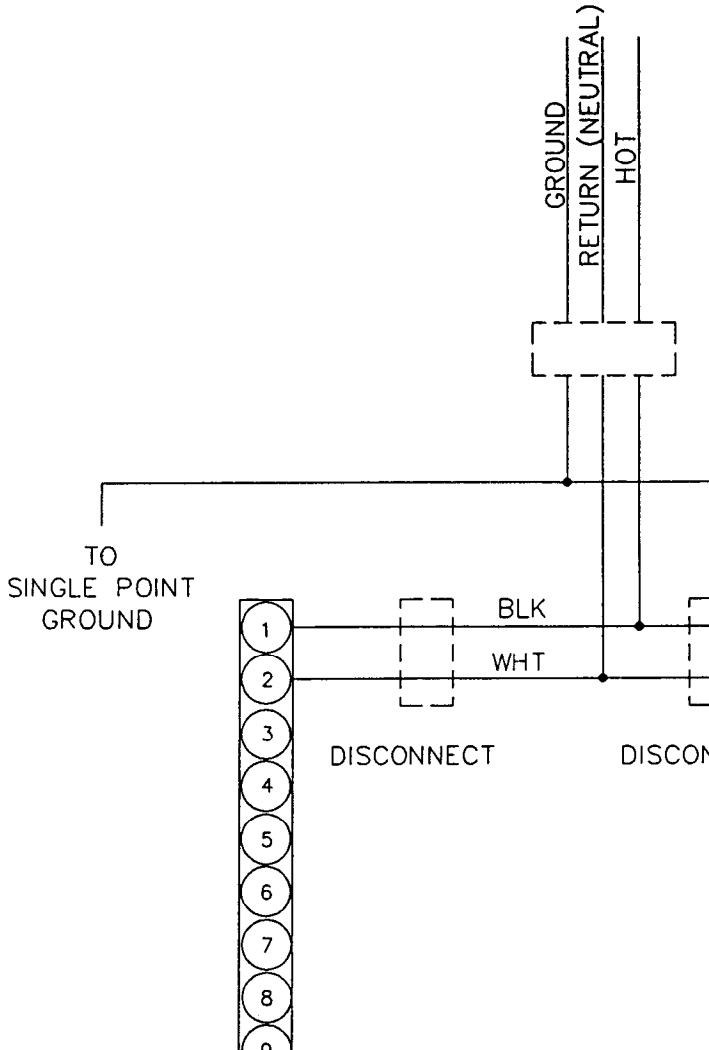
SY

RS 485 Communications Cable Schematic

WIRING: Power Source to Control and Boiler Modules

- Observe Polarity very important.
- Observe wire colors
- Provide external surge suppressor capable of maintaining system integrity.
- Provide overload protection and disconnect means as required by code and for equipment serviceability.
- Conduit can NOT be used as ground.

* Must be "WIRED" Ground.



POWER TEST

CHECK POWER

Utilizing a Volt-Ohm-Meter (VOM) monitor the following on the "System Control" and "Boiler Monitor(s)" for proper voltage levels. Check at the Terminal Block (TB).

POWER TEST TABLE

SYSTEM CONTROL From:	To:	INDICATION	BOILER MONITOR(S) From:	To:	INDICATION
TB pin 1	TB pin 2	108 VAC to 132 VAC	TB pin 1	TB pin 2	108 VAC to 132 VAC
TB pin 1	SPG	108 VAC to 132 VAC	TB pin 1	SPG	108 VAC to 132 VAC
TB pin 2	SPG	less than 1 VAC	TB pin 2	SPG	less than 1 VAC

BOILER MONITOR(S) From:	SYSTEM CONTROL To:	INDICATION
TB pin 1	TB pin 1	Less than 0.5 VAC
TB pin 2	TB pin 2	Less than 0.5 VAC
SPG	SPG	Less than 0.5 VAC
TB pin 2	SPG	Less than 0.5 VAC

END – – – – – – – –

Return to: "Boiler Monitor Select Switch"
(See page 20.)

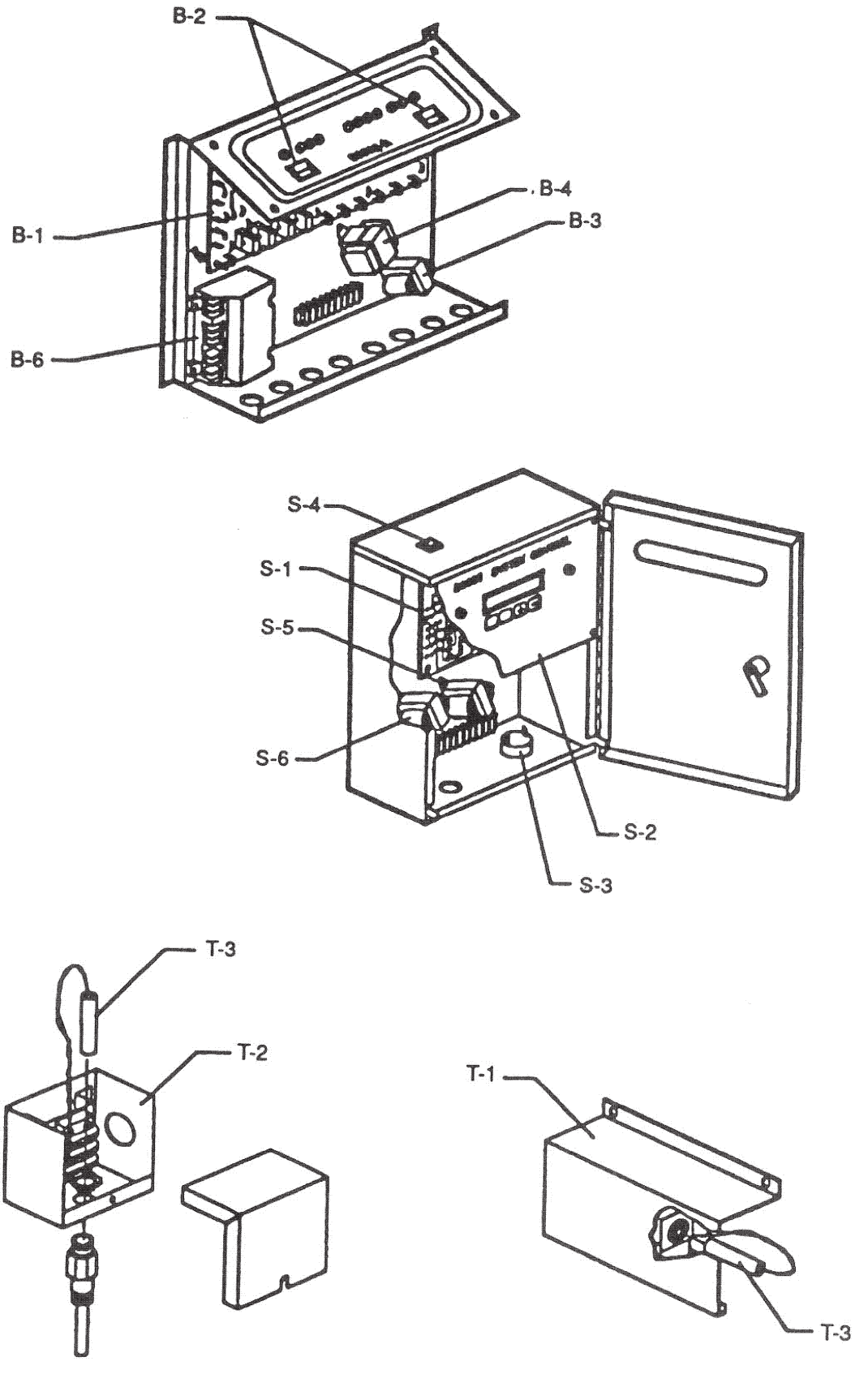


Fig. # 9458

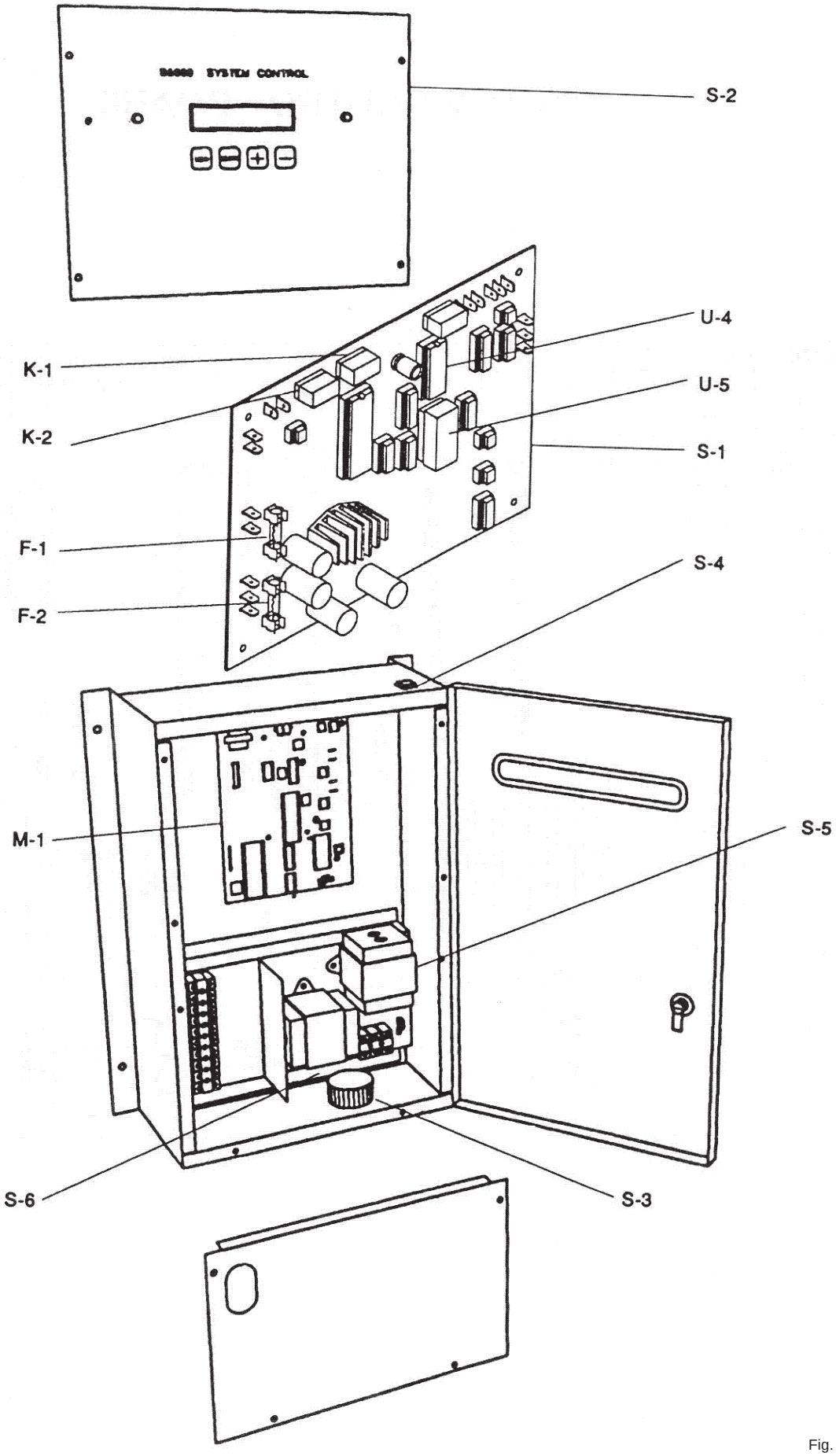


Fig. # 9459

SYSTEM CONTROL BOARD

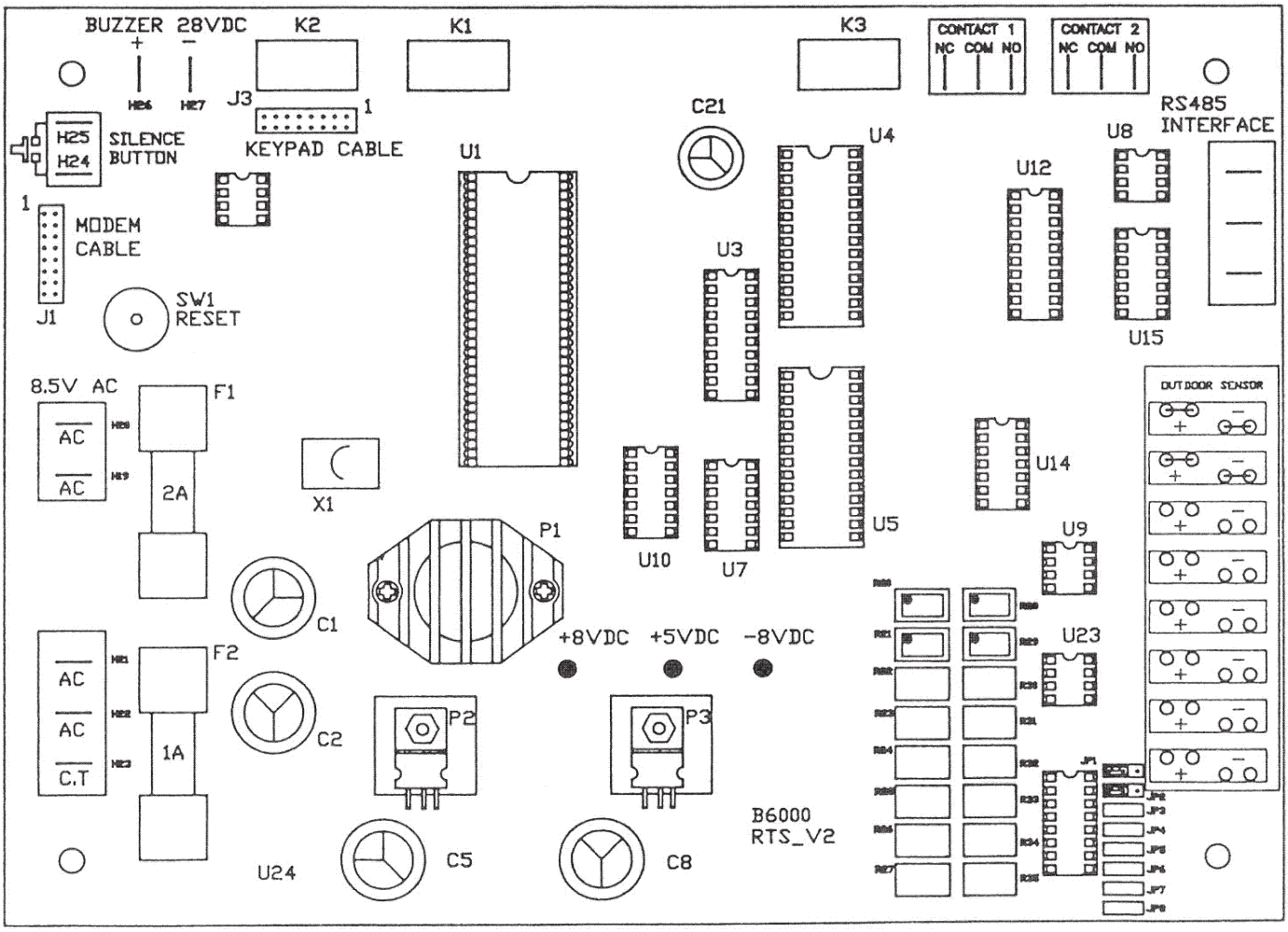


Fig. # 9460

Replacement Parts List

CALL OUT	B6000 SYSTEM	PART NO.
	System Control Box	
S-1	Control PC Board w/Display	004797F
	Control PC Board w/Display, Night Setback (NSB)	004796F
	Control PC Board w/Display, NSB + Modem + No MIN	005495F
S-2	Display Selector Panel	004798F
S-3	Alarm Buzzer (Piezo electric horn)	005640F
S-4	Alarm Reset Switch	650751
S-5	Transformer, 120/24/12 VAC C.T	064922
S-6	Transformer, 120/8.5 VAC C.T.	064921
K-1,K-3	Relay, 5 VDC, DPDT	005961F
K-2	Relay, 24 VDC DPDT	005962F
F-1	Fuse, 250V, 2A	650896F
F-2	Fuse, 250V, 1A	650522F

Part Number	Nomenclature	Checksum	Description
601190	CP 8.0 _ _ _	943E	System Cont'l Std.
601191	CP8.0 N _ _	942 E	System Cont'l W/N.S.B.
601193	M 8	6F1 D	Modem
601194	BV8.0	736 A	Monitor
601204	CP8.0 _ M _	942 D	System Control w/modem
601205	CP8.0 NM _	941 D	System Control w/NSB & Modem
601244	CP8.0 _ _ n	9353	System Control Low Temp
601245	CP8.0 N _ n	9343	System Control W/NSB & Low Temp
601246	CP8.0 _ Mn	9342	System Control W/Modem & Low Temp
601247	CP8.0 NMn	9332	System Control W/NSB, Modem & Low Temp
601509	CP8.3 _ _ _	1 C 9 E	System Control Std/Max Temp, Sensor Fault
601510	CP8.3 N _ _	1 C 8 E	System Control W/NSB/Max Temp, Sensor Fault
601511	CP8.3 NM _	1 C 7 D	System Control W/NSB & Modem/ Max Temp, Sensor Fault
601512	CP8.3 NMn	1 B B A	System Control W/NSB, Modem & Low Temp/ Max Temp, Sensor Fault
601512A	CP9.0	969D	CP8.3 + Special Features
New	CP10.0_ _ _	90FI	
Part	CP10.0N _ _	90EI	
#	CP10.0NMn	900D	

U-5	Chip, RAM - with Lithium Battery	601192

Replacement Parts List

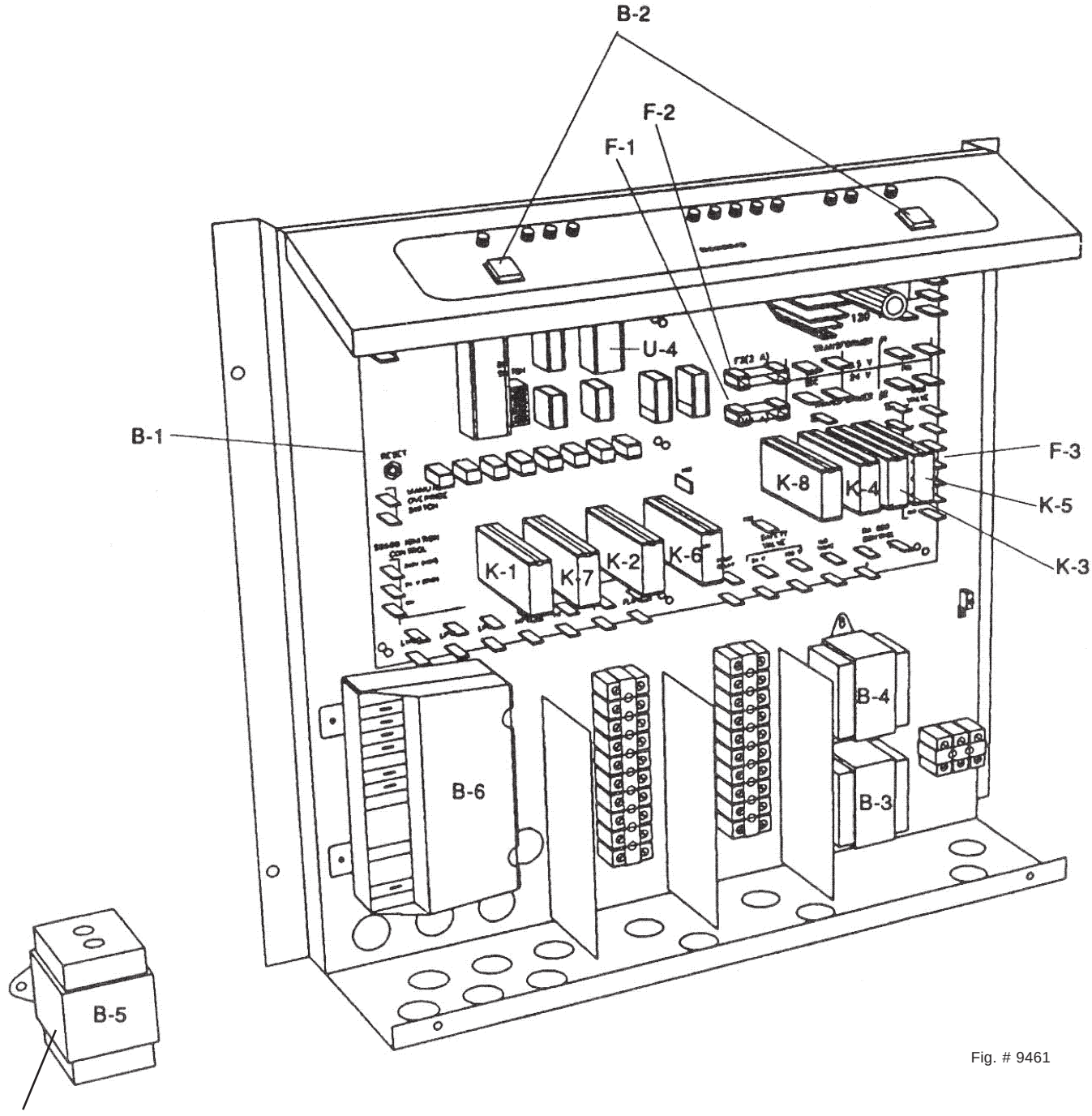


Fig. # 9461

Located in place of ignition control on C2 boilers only.

BOILER MONITOR CONTROL BOX

Replacement Parts List

CALL OUT	B 6000 SYSTEM	PART NO.
	Boiler Monitor Control Box	
B-1	Control PC Board	004795F
B-2	Power/Manual or Override Switch	650745
B-3	Transformer, 120/8.5 VAC C.T.	064921
B-4	Transformer, 120/24 VAC C.T.	650495
B-5	Transformer, 120/24 VAC (C2 Units only)	650495
B-6	Ignition Control with Lockout	004818B
F1 & F2	Fuse, AGC 2, 250V, 2A	650896F
F3	Fuse, AGC3, 250V, 3A	650523
K-1, K-2, K-3, K-4	Relay, 5 VDC, SPDT	650846F
K-7, K-8	Relay, 24 VAC, DPDT	650849F
K-6	Relay, 120 VAC, SPDT	650848F
K-5	Relay, 24 VAC, SPDT	650847F
K-1, K-2, K-3, K-4, K-5, K-6	Relay, Socket SPDT	650851F
K-7, K-8	Relay, Socket DPDT	650850F
U4	EPROM BVx.x	601194

B6000 BOILER MANAGEMENT SYSTEM START-UP DATA

SYSTEM SETTINGS ENTERED ON DATE:_____

Temperature Scale <u>°F or °C</u>

Standard

Set _____ Deg.	Ratio _____ : 1	Rise _____ Deg.
System Water Temp. @ Oc	Reset Ratio-Outdoor:	System Design Temp. Diff.
Default Value 100°F (38°C)	Default Value: 1.0:1	Default Value: 20°F (7°C)

<u>Select Set Optional</u>

Day _____ Deg.	Nite_____ Deg.	Ratio _____:1	Rise _____ Deg.
System Temps @ Oc		Reset Ratio	System Design Temp. Rise
Default Value	Default Value:	Default Value:	Default Value:
100°F (38°C)	90°F (32°C)	1 .0:1	20°F (7°C)

<u>Universal</u>

Step _____ %	O/C_____Deg.	O/Cdb _____Deg.	C Band _____ Deg.
Valve Opening	Outdorr Cutoff	Outdoor Cutoff	Control Band
Default Value:	Default Value:	Deadband	Default Value:
5%	65 degs.	Default Value: 4 Deg	3 Deg.

Lead	_____	# of Boilers	_____
Indicates Lead Boiler		Number of Boilers in system.	

<u>Select Set Optional</u>

Lead Change hrs. _____

Lead boiler will change after selected no. of hours.

<u>Universal</u>

Pump Delay _____ Min.	Ign Time _____ Sec.
Delay off pump timing.	Ignition lockout timing.
Default Value: 3 min.	Default value: 15 seconds.

<u>Select Set Option</u>

_____	_____	_____	_____
Time of Day	AM or PM	Day of Week	Set-back- Off or On
		Default Value: Monday	Default Value: Off

Period Set-Back	1 On	Off	2 On	Off	3 On	Off	4 On	Off	5 On	Off	6 On	Off
Monday	___	___	___	___	___	___	___	___	___	___	___	___
Tuesday	___	___	___	___	___	___	___	___	___	___	___	___
Wednesday	___	___	___	___	___	___	___	___	___	___	___	___
Thursday	___	___	___	___	___	___	___	___	___	___	___	___
Friday	___	___	___	___	___	___	___	___	___	___	___	___
Saturday	___	___	___	___	___	___	___	___	___	___	___	___
Sunday	___	___	___	___	___	___	___	___	___	___	___	___

<u>Proportional Integral Derivative</u>

_____	_____	_____
Pconst	Wait (Integral)	Derivative

V_____ <u>Version # of Software</u>

Troubleshooting Guide

The procedures outlined below assume that the initial installation / turn on / power up procedures have been completed and that the B6000 was operational. This guide is a basic instruction to determine if an authorized Raypak representative should be contacted.

If you follow the instructions in this manual and have difficulty operating the B6000, locate the **SYMPTOM** in the left column below. Check the corresponding **POSSIBLE CAUSE** and **CORRECTIVE ACTION** Column to locate and remedy the problem.

Symptom	Possible Cause	Corrective Action
No Display.	No Primary power.	Check power connections to units. Check surge protection devices. Check disconnects, check grounds. Check power switches.
* Nite set-back time display no longer correct.	Time display accidentally Re-Programmed.	Initialize system. Program Nite set-back feature.
* Nite set-back not working properly.	Nite set-back turned off. Clock times not set.	Initialize system.
* Time display does not maintain proper time.	System ground not adequate. Line noise. Internal battery weak. Prolonged power outage.	Initialize system and / or contact authorized Raypak Representative for further instructions.
System not working automatically.	Boiler monitor has Manual Mode selected	Select Automatic mode on Boiler Monitor.
Display shows incorrect number of boilers.	Inadequate grounds. Line noise Power outages.	Check primary power - check wired ground. Rework as necessary. Initialize system.
Scrambled control display.	Power outages.	Initialize system.
Boiler does not function properly after power outage.	Internal battery weak. Line noise. System ground not adequate.	Initialize system.
Boiler "Not on Line" displayed.	Primary power at boiler not connected.	Initialize system.
Outdoor and water temp. readings Incorrect (-35°F).	Inadequate ground Line noise. Power outage.	Initialize system.
Displayed parameters do not make sense.	Power outage.	Initialize system.
System Faults indicators do not make sense.	Power outage.	Initialize system.

* With Nite Set-Back option only.

Trouble Shooting Guide-Continued

Symptom	Possible Cause	Corrective Action
Boiler # x "Not on Line" Displayed	Boiler not powered.	Check primary power. Correct as necessary. Check communication cable, check (surge) ground Remove / Replace (R/R) as necessary. Initialize system.
Outdoor Temp. Sensor readings are high.	Outdoor sensor not mounted correctly.	Refer to installation manual mounting instructions. Possible relocation for sensor.
Sensor reading 220°F.	Sensor wiring shorted	Check sensor wiring for damage. R/R as necessary. Initialize system.
Sensor reading - 35°F.	Sensor wiring open.	R/R as necessary Initialize system.
Low water cut-off alarm.	Excessive circuit loading of pump contacts by user supplied system pump. Low water level in boiler	Check power. Check pump contactor / relay R/R as necessary. Replace F1 fusing. Check main water supply
Power lamp off on Boiler Monitor.	Fuse F1 blown. Excessive circuit loading of pump contacts by user supplied system pump. Circuit breaker tripped.	Replace F1 fusing. Remove Relay-K1 to isolate circuit loading. R/R as necessary. Reset circuit breaker.
Pump not running.	Excessive circuit loading of pump contacts by user supplied system pump. Pump going off on thermal over-load circuit breaker tripped	Replace F1 fusing. Check pump. Reset circuit breaker
Off at flow switch.	Paddle damaged or missing. Pump off on thermal overload.	Check paddle on flow switch. Check pump, contact or relay. Replace F1 fusing.
Off on High Limit.	Low limit settings. Intermittent power or pump failure.	Check and correct settings. Meter amperage on pump. R/R as needed.

LIMITED WARRANTY
B6000, Y-Series, E-4 & Accessories

SCOPE OF WARRANTY :

Raypak, Inc. ("Raypak") warrants to the original owner the Control System to be free from defects in materials and workmanship under normal use and service for the applicable warranty period. In accordance with the terms of this Limited Warranty, RAYPAK will furnish a replacement or repair, at our option, any defective part which fails in normal use and service during the applicable warranty period. The replacement or repair will be warranted for only the unexpired portion of the original Warranty Period.

APPLICABLE WARRANTY PERIOD

The effective date of warranty coverage is the date of original installation, of the Control System, by a qualified electrician or by a RAYPAK authorized service technician. The Applicable Warranty Period is one (1) year from the effective date.

WARRANTY EXCLUSIONS

This Limited Warranty does not apply:

1. if the control system is not properly installed by a qualified technician in accordance with manufacture's installation instructions, applicable codes, ordinances and good trade practices,
2. to damage or malfunctions resulting from failure to properly install, operate or maintain the system in accordance with the manufacture's instructions;
3. if the rating plate(s) or serial number(s) are altered, defaced or removed;
4. if the System is modified in any way or used with any non-factory authorized accessories or components;
5. to damage or failure from abuse, accident, act of nature, fire, flood, freezing or the like;
6. to accessories, rubber or plastic parts, light bulbs or glass parts;
7. if the System is moved from its original installation site; or if the original owner no longer owns the site or the System.

LABOR AND SHIPPING COSTS

This Limited Warranty does not cover labor costs for service, removal or reinstallation of any part nor shipping charges to or from RAYPAK'S designated repair center or to or from the installation site. All such costs are your responsibility.

HOW TO MAKE A WARRANTY CLAIM

To make a warranty claim, promptly ship (postage prepaid) or carry the defective part to a designated RAYPAK Service Dealer or Service Station in the United States, supplying proof of purchase and date of installation and the model and serial numbers. If you cannot locate a dealer, contact RAYPAK'S Service Department at the address/telephone listed below. Raypak reserves the right at all times to inspect the claimed defect and verify warranty coverage at its factory.

EXCLUSIVE WARRANTY - LIMITATION OF LIABILITY

This is the only warranty given by RAYPAK. No one is authorized to make any other warranties on Raypak's behalf. **ANY IMPLIED WARRANTIES, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, SHALL NOT EXTEND BEYOND THE APPLICABLE WARRANTY PERIOD SPECIFIED ABOVE. RAYPAK'S SOLE LIABILITY WITH RESPECT TO ANY DEFECT SHALL BE AS SET FORTH IN THIS LIMITED WARRANTY. ANY CLAIMS FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES (INCLUDING DAMAGE FROM WATER LEAKAGE) ARE EXCLUDED.** Some states do not allow limitations on how long an implied warranty lasts, or for the exclusion of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

THIS LIMITED WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE.

We suggest you immediately complete the information below and retain this Limited Warranty Certificate in case warranty service is needed.

RAYPAK, INC. SERVICE DEPARTMENT
2151 Eastman Avenue, Oxnard, California 93030
Telephone: (805) 278-5300 FAX (805) 278-5468

The following information must be provided when you write or call:

_____ _____
Original Owner Daytime Telephone Number

_____
Complete Mailing Address

_____ _____
City State Zip Code Installation Site

_____ _____
Model Number Contractor/Installer

_____ _____
Date of Installation Serial Number

www.raypak.com

Design and specifications subject to change without notice.

This symbol on the nameplate means the product is listed by Underwriters Laboratories, Inc. ®

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