OPERATION & WIRING GUIDES FOR
MODULEX E8 CONTROLLER & BOILER COMMUNICATIONS MODULE (BCM)

AERCO

Modulex

Unical ®

Gas Fired
Boiler Systems

Modular, Condensing, Hot Water Boilers
Models: 303, 454, 606, 757, 909, 1060

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1. INTRODUCTION

The information in this manual provides a guide to the operation of the Modulex Boiler using the E8 Controller and the Boiler Communications Module (BCM) mounted on the front of the unit. Sections 2 through 6 and Appendix A provide descriptions and procedures for the E8 Controller. Section 7 and Appendix B provide similar information for the BCM.

It is imperative that the initial startup procedures be performed by factory trained personnel. Operation by untrained personnel, prior to the initial startup, will void the equipment warranty. In addition, the following CAUTIONS and WARNINGS must be observed at all times:

⚠ CAUTION ⚠	All initial installation procedures must be completed prior to attempting to start the unit.
⚠ WARNING ⚠	THIS SYSTEM UTILIZES 120 VAC POWER. IT MUST NOT BE SERVICED BY PERSONNEL WHO ARE NOT FACTORY CERTIFIED SERVICE TECHNICIANS.
⚠ WARNING ⚠	DO NOT ATTEMPT TO DRY-FIRE THE BOILER. STARTING THE UNIT WITHOUT A FULL WATER LEVEL CAN SERIOUSLY DAMAGE THE UNIT AND MAY RESULT IN PERSONAL INJURY OR PROERTY DAMAGE. THIS SITUATION WILL ALSO VOID ANY EQUIPMENT WARRANTY.

2. E8 CONTROLLER DESCRIPTION

The E8 Controller is housed in a compact enclosure measuring 5.7" (145 mm) x 3.9" (100 mm). The Controller is mounted on the front of the Modulex Boiler and contains all of the controls, indicators and displays necessary to adjust, operate and troubleshoot the Modulex Boiler.

The front of the Controller (Figure 2-1) contains a hinged cover which, when closed, reveals a multi-function LCD display and a Rotary Knob. When the Controller cover is opened, it provides access to additional controls and indicators used for installation setup, operation and troubleshooting tests for the Modulex Boiler. These items are illustrated and described in Figure 2-2 and the Table 2-1.

Figure 2-3 illustrates and describes the type of information provided on the LCD display.
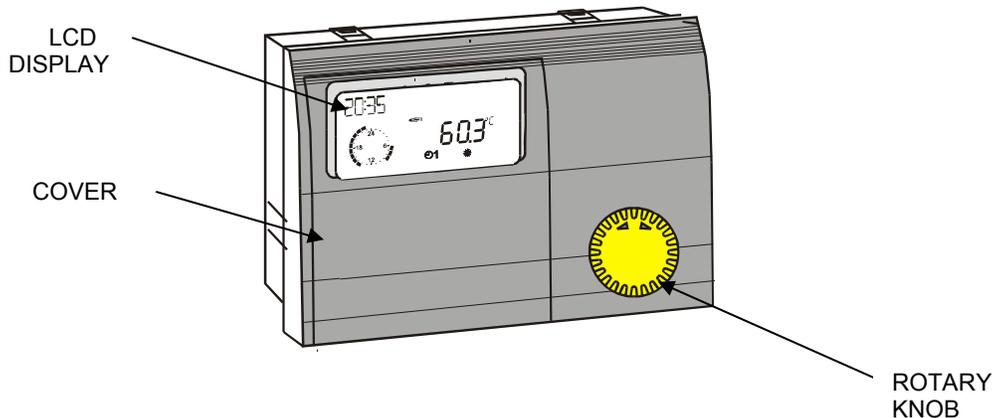
Figure 2-1. E8 Controller With Cover Closed

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MODULEX CONTROLLER OPERATION
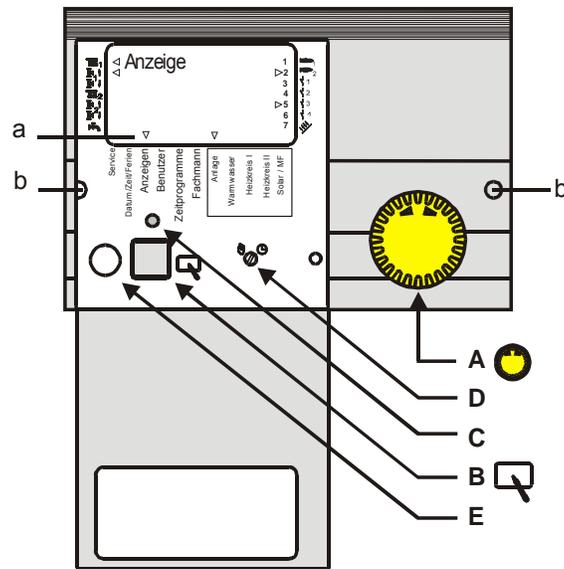
Figure 2-2. E8 Controller With Hinged Panel Open

Table 2-1. Operating Controls & Indicators

ITEM	FUNCTION
a	LCD display indicating current level
b	Access holes to unlock controller mounting socket. Insert narrow screwdriver deep into holes and lift up the controller
A	Rotary Knob. Used to search for value/level or adjust value setting.
B	Program Key. Used to: • Select a value level • Select a value level to change • Save a new value level
C	Change LED. When lit, it indicates that the value in the display can be changed using Rotary Knob (A)
D	Manual/Automatic Switch is a 2-position (10/2 o'clock) screwdriver adjustable switch. Normally, this switch is set to the Automatic (2 o'clock) position to allow program control of the boiler. When set to the Manual (10 o'clock) position, a flashing "EMERG – MODE" message is displayed. Heating Circuit 1 (HC1) pump and the first burner stage are switched on. Pumps for Heating Circuit 2 (HC2) and Domestic Hot Water (DHW) will also be switched on if sensors are installed and enabled. The pump(s) will turn off when the flow temperature reaches the value set for MAX T-FLOW (in EXPERT/HEAT CIRCUIT 1 menu). The first burner stage will cut off when the boiler temperature reaches the value set for MAX T-MODUL (in EXPERT/INSTALLATION menu).
E	PC connection for optical adapter.

Figure 2-3 and Table 2-2 illustrate and describe the type of information provided on the LCD display.
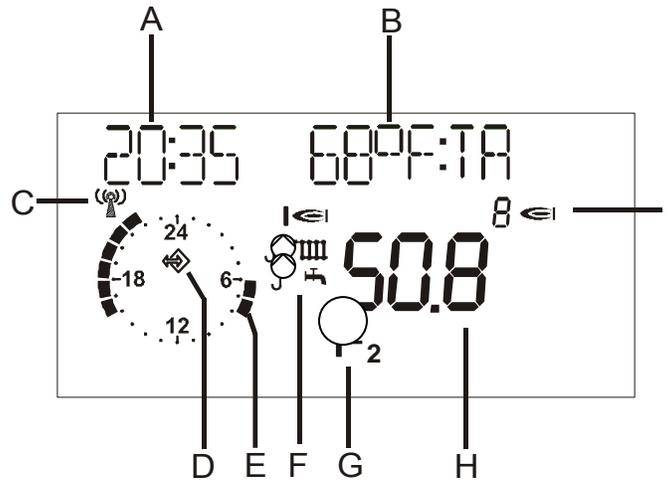
Figure 2-3. LCD Normal Mode Display

Table 2-2. LCD Normal Display Mode Functions

ITEM	DISPLAY FUNCTION
A	Current time (24 hour format)
B	Freely selectable display (refer to "DISPLAY SEL" parameter in the USER menu)
C	DCF reception OK (only if receiver is connected via eBUS)
D	Bus icon (if this icon does not appear, check data line to connected CAN controllers => check eBUS via DISPLAY level)
E	Display of the active heating program for the first heating circuit (here: 6:00 to 08:00 a.m. and 4:00 to 10:00 p.m.)
F	Status display: Shows symbols for internal burner 1 relay ON; heating mode; hot water preparation
G	Heating Mode display symbol. See paragraph 2.1. The display symbols apply to all internal heating circuits for which a separate heating mode has been selected
H	Display of current temperature of HS 1 or header temperature when cascading.
I	Display of numbers of active heat generators (only applies when cascading)

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2.1 HEATING MODE SETUP PROCEDURES

Heating modes are selected using the Rotary Knob on the Controller. The available heating modes are indicated by symbols at the bottom of the display. Mode changes take effect when the setting is not changed for 5 seconds. The symbols for the available heating modes are shown below.

Operation in normal mode
(Display cover closed)
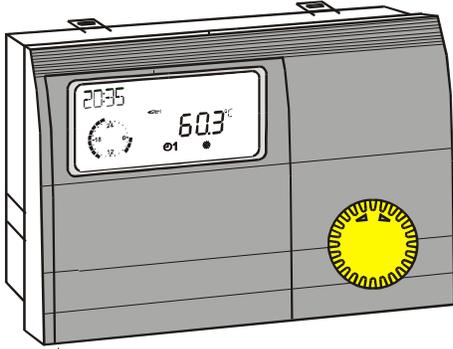
HEATING MODES

Heating mode selection

Turn the knob to select the heating mode required. The heating mode is indicated by a symbol at the bottom of the display. It takes effect when the setting is not changed for 5 seconds.
The following heating modes are available:

Standby / OFF
(Heat OFF and hot water (HW) preparation OFF,
only frost protection mode)

Automatic mode 1
(Heat according to timer program 1; HW according to HW program)

Automatic mode 2
(Heat according to timer program 2; HW according to HW program)

Summer mode
(Heating OFF, HW according to HW program)

Day mode
(24 Hr heating with comfort temperature 1; HW according to HW program)

Night mode
(24 Hr heating with reduced temperature; HW according to program)

Service mode
(Automatic reset after 15 minutes. Boiler regulated at max boiler temperature)

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3.   CONTROLLER MENUS

The Controller includes an extensive set of software menus which are divided into the following Main Menu areas:

- DISPLAY Menu

- USER Menu

- TIME PROGRAM Menu

- EXPERT Menu

- EXPERT HS Menu (Not Applicable for Modulex)

- GENERAL Menu

Each of these Main Menus includes a group of Sub-Menus as shown in the listing below. Access to the Menus and Sub-Menus shown in this Table is accomplished by opening the hinged display panel cover and turning the Rotary Knob on the front panel. Clockwise rotation of the knob sequences through the menus in the "Top-Down" order. Counterclockwise rotation sequences through the menus in the "Bottom-Up" order.

MAIN MENUS	SUB-MENUS
DISPLAY	INSTALLATION
	HOT WATER
	HEAT CIRCUIT I
	HEAT CIRCUIT II
	SOLAR/MF
USER	INSTALLATION
	HOT WATER
	HEAT CIRCUIT I
	HEAT CIRCUIT II
	SOLAR/MF
TIME PROGRAMS	CIRCL TIME
	HOTW-PROG
	HTG-PROG 1
	HTG-PROG 2
EXPERT	INSTALLATION
	HOT WATER
	HEAT CIRCUIT I
	HEAT CIRCUIT II
	SOLAR/MF
EXPERT HS	INSTALLATION
GENERAL	SERVICE
	DATE/TIME
	HOLIDAY
	CLOCK CHANGE

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The basic procedures for navigating through the Main Menus, Sub-Menus and functions are described in paragraph 3.1 The items and functions included in each Main Menu and Sub-Menu are briefly described in paragraphs 3.2 through 3.7.

3.1 BASIC MENU PROCESSING PROCEDURE

In order to change or view displayed settings, the display cover must first be opened. When opened, the Controller automatically takes you to the display and indicator area.

The basic menu processing procedure is accomplished using the Rotary Knob and the Program Key shown in Figure 2-2. Following initial startup and one-time entry of the required INSTALLATION menu items (see paragraph 3.8), perform the following steps to access, view and/or change menu items:

NOTE

The following menu processing steps assume that all required (one-time) INSTALLATION menu items have already been entered. It should be noted that whenever the unit is powered down and then powered up again, the INSTALLATION menu will reappear. When this occurs, the INSTALLATION menu items DO NOT need to be reentered. Normally, after entry of the required initial INSTALLATION menu entries, turning the Rotary Knob clockwise will automatically advance the Controller to the DISPLAY menu group. All items in this group are "Read Only" and cannot be changed.

1. When the ON/OFF switch on the front of the boiler is turned ON and the swing-down hinged panel is opened, INSTALLATION will be displayed. This is the initial INSTALLATION menu and it is assumed that all entries have already been made.

2. Turn the Rotary Knob clockwise until the display advances to the DISPLAY menu. The dial on the clock face will rotate one revolution counterclockwise and then go off. The display will then show INSTALLATION, which is the first sub-menu in the DISPLAY menu group

3. To view functions included in the INSTALLATION sub-menu, press the Program Key (Item B in Figure 2-2). If desired, turn the Rotary Knob to scroll through the functions in the INSTALLATION sub-menu. As previously mentioned, these display functions are read-only and cannot be changed. Once you reach the end of the sub-menu, RETURN will appear in the display.

4. To exit this sub-menu and advance to the next sub-menu in the DISPLAY menu, press the Program Key. INSTALLATION will again be displayed. Turn the Rotary Knob clockwise until the next sub-menu is displayed.

5. Repeat steps 2, 3 and 4 to view the remaining main menus and their associated sub-menus. The remaining main menus are: USER, TIME PROGRAM, EXPERT, EXPERT HS (Not Applicable to Modulex), and GENERAL.

NOTE

Except for the items included in the DISPLAY Menu and sub-menus, all other Menu groups and sub-menus contain Read-Write items which can be viewed or, changed. Also, turning the Rotary Knob counterclockwise, instead of clockwise will scroll through menu items in reverse order.

6. When in the USER, TIME PROGRAM, EXPERT, or GENERAL Main Menu, virtually all sub-menu items can be changed if the desired value or condition is not displayed.

7. Turn the Rotary Knob clockwise to display the next menu item in the group.

8. To change the value of a displayed sub-menu function, press the Program Key. The Change LED (item C in Figure 2-2) will light indicating that the displayed sub-menu function can now be changed. Turn the Rotary Knob clockwise (increase) or counterclockwise (decrease) to change displayed value of the sub-menu function.

9. To store the displayed value in the Controller memory, press the Program Key. The LED will go off.

10. Continue this process to view and/or change sub-menu function values in the various groups.

IMPORTANT

Paragraphs 3.2 through 3.7 which follow include flow-chart illustrations and tabular listings of all Menu and Sub-Menu functions. However, descriptions, entry ranges and default values are provided for only the commonly used functions which are referenced in Section 4, titled Operating Mode Set-Up & Programming Instructions. These commonly used functions are shown in ***Bold Italics*** in the illustrations and tables which follow.

Refer to Appendix A for additional information on functions marked "Not Applicable" in the illustrations and tables provided in paragraphs 3.2 through 3.7.

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3.2 DISPLAY MENU

The DISPLAY Menu contains an Installation, Hot Water, Heating (HTG) Circuit 1 & 2 and a Solar M/F Sub-Menu as shown in Figure 3-1. Tabular listings for these items are provided in Table 3-1.

```
┌─────────────────────────┐
│        DISPLAY          │
└─────────────────────────┘
            │
            ▼
┌─────────────────────────┐
│      INSTALLATION       │
│  T-OUTSIDE              │
│  T-EXT DES             │
│  T-COLL DES            │
│  T-COLLECTOR           │
│  T-BOIL                │
│  T-SOLID FUEL          │
│  T-RETURN 1            │
│  T-RETURN 2            │
│  T-BUFFER T            │
│  T-BUFFER M            │
│  T-BUFFER L            │
│  T-STORAGE 3           │
│  MODGRAD               │
│  RETURN                │
└─────────────────────────┘
            │
            ▼
┌─────────────────────────┐
│       HOT WATER         │
│  T-DHW RATED           │
│  T-DHW                 │
│  T-DHW L               │
│  RETURN                │
└─────────────────────────┘
            │
            ▼
┌─────────────────────────┐
│      HTG CIRCUIT 1      │
│  T-ROOM DES A          │
│  T-ROOM                │
│  HUMIDITY              │
│  T-FLOW RATED          │
│  T-FLOW                │
│  N-OPT-TIME            │
│  RETURN                │
└─────────────────────────┘
            │
            ▼
┌─────────────────────────┐
│      HTG CIRCUIT 2      │
│  T-ROOM DES A          │
│  T-ROOM                │
│  HUMIDITY              │
│  T-FLOW RATED          │
│  T-FLOW                │
│  N-OPT-TIME            │
│  RETURN                │
└─────────────────────────┘
            │
            ▼
┌─────────────────────────┐
│       SOLAR M/F         │
│  T-MF1                 │
│  T-MF2                 │
│  T-MF3                 │
│  T-MF4                 │
│  T-COLLECTOR           │
│  T-DHW                 │
│  T-DHW L               │
│  RETURN                │
└─────────────────────────┘
```

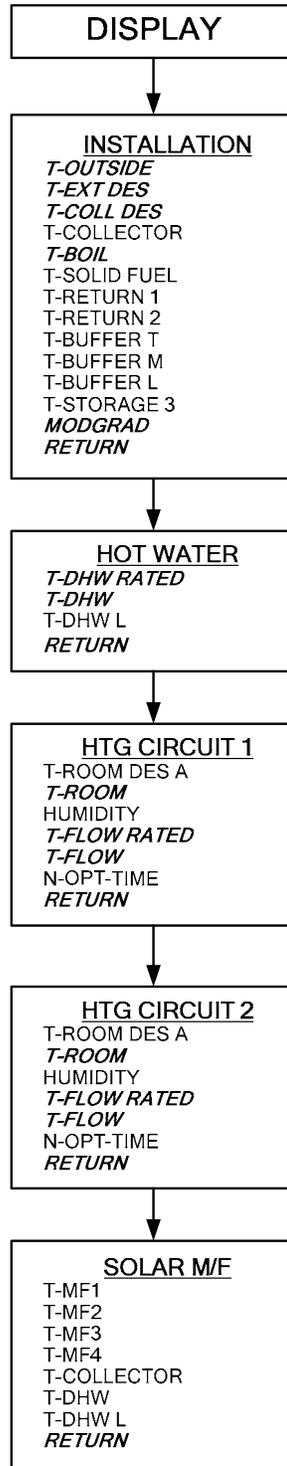**Figure 3-1. DISPLAY Menu Flow Chart**

NOTE

All DISPLAY Menu & Sub-Menu functions are READ ONLY and cannot
be changed. Temperature readings shown are in °F.

Table 3-1. DISPLAY Menu Listing

FUNCTION	DESCRIPTION	REMARKS
INSTALLATION Sub-Menu		
T-OUTSIDE	Outside air temperature	Displayed only if outside air sensor is installed.
T-EXT DES	Boiler Set Point setting in 0 to 10 volt input mode	A 0 to 10 volt external input signal can be used to change the Boiler set point.
T-COLL DES	Boiler Set Point temperature in Indoor/Outdoor Reset and Constant Set Point modes.	
T-COLLECTOR	Header Set Point temperature (cascade)	
T-BOIL	Press Program Key to display temperature and ON/OFF status of individual Heat Modules (HS) which range from 2 (MLX-303) to 7 (MLX-1060). Turn Rotary Knob to sequence between Heat Modules.	The Burner symbol (⇒) is displayed when the respective Heat Module is ON.
T-SOLID FUEL	Not Applicable	
T-RETURN 1	Not Applicable	
T-RETURN 2	Not Applicable	
T-BUFFER T	Not Applicable	
T-BUFFER M	Not Applicable	
T-BUFFER L	Not Applicable	
T-STORAGE 3	Not Applicable	
MODGRAD	Press Program Key to display Modulation % for individual Heat Modules (HS). Turn Rotary Knob to sequence between Heat Modules.	
RETURN	Press Program Key to exit INSTALLATION Sub-Menu.	
HOT WATER Sub-Menu		
T-DHW RATED	DHW set point temperature	Based on heating program and operating mode. Actual DHW set point as set in the USER/HOT WATER menu.
T-DHW	Actual hot water temperature	Only if tank sensor is installed
T-DHW L	Not Applicable	
T-CIRCL	Not Applicable	
RETURN	Press Program Key to exit the HOT WATER Sub-Menu.	

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Table 3-1. DISPLAY Menu Listing - Continued

FUNCTION	DESCRIPTION	REMARKS
HTG CIRCUIT 1 Sub-Menu		
T-ROOM DES A	Not Applicable	
T-ROOM	Current room air temperature.	Only if indoor sensor is connected
HUMIDITY	Room humidity (%).	Only if humidity sensor is installed and parameters set for heating circuit.
T-DHW RATED	Hot water set point temperature	Appears only if heating circuit is programmed as hot water circuit
T-DHW	Current hot water temperature	Same as above
T-FLOW RATED	Current flow set point temperature	
FLOW	Current flow temperature	
N-OPT-TIME	Not Applicable	Not applicable
RETURN	Press Program Key to exit HTG CIRCUIT 1 Sub-Menu.	
HTG CIRCUIT 2 Sub-Menu		
	Functions for HTG (Heating) Circuit 2 are identical to HTG Circuit 1 Functions above.	
SOLAR M/F Sub-Menu		
T-MF1	Not Applicable	Currently not used
T-MF2	Not Applicable	Currently not used
T-MF3	Not Applicable	Currently not used
T-MF4	Not Applicable	Currently not used
T-COLLECTOR 1	Not Applicable	Currently not used
T-DHW	Not Applicable	Currently not used
T-DHW L	Not Applicable	Currently not used
RETURN	Press Program Key to exit SOLAR M/F Sub-Menu.	

3.3 USER MENU

The USER Menu (Figure 3-2) contains the same Sub-Menus as the DISPLAY Menu. However, the USER Menu items are not "Read Only" and therefore can be changed if the desired values are not displayed. The Sub-Menu functions in the USER Menu also differ from those contained in the DISPLAY Menu. Tabular listings for the USER Menu items are provided in Table 3-2.
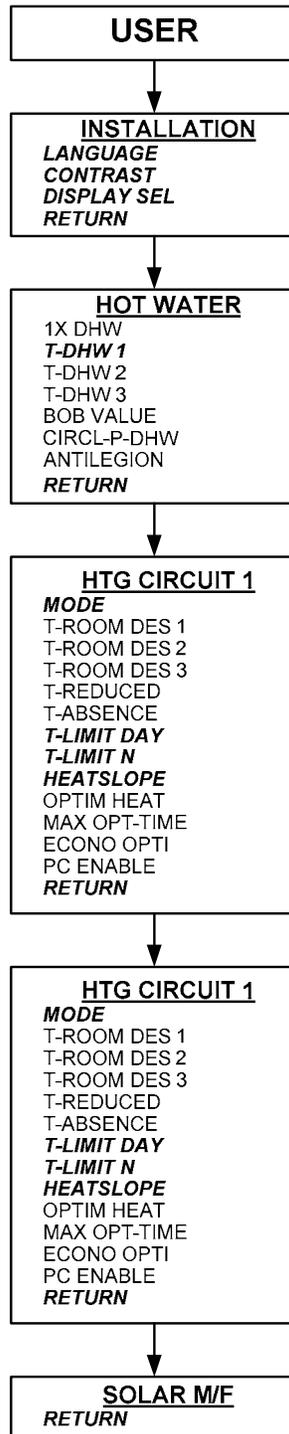
```
┌──────────────────────────┐
│          USER            │
└──────────────────────────┘
             │
             ▼
┌──────────────────────────┐
│      INSTALLATION         │
│ LANGUAGE                  │
│ CONTRAST                  │
│ DISPLAY SEL               │
│ RETURN                    │
└──────────────────────────┘
             │
             ▼
┌──────────────────────────┐
│       HOT WATER           │
│ 1X DHW                    │
│ T-DHW 1                   │
│ T-DHW 2                   │
│ T-DHW 3                   │
│ BOB VALUE                 │
│ CIRCL-P-DHW               │
│ ANTILEGION                │
│ RETURN                    │
└──────────────────────────┘
             │
             ▼
┌──────────────────────────┐
│      HTG CIRCUIT 1        │
│ MODE                      │
│ T-ROOM DES 1              │
│ T-ROOM DES 2              │
│ T-ROOM DES 3              │
│ T-REDUCED                 │
│ T-ABSENCE                 │
│ T-LIMIT DAY               │
│ T-LIMIT N                 │
│ HEATSLOPE                 │
│ OPTIM HEAT                │
│ MAX OPT-TIME              │
│ ECONO OPTI                │
│ PC ENABLE                 │
│ RETURN                    │
└──────────────────────────┘
             │
             ▼
┌──────────────────────────┐
│      HTG CIRCUIT 1        │
│ MODE                      │
│ T-ROOM DES 1              │
│ T-ROOM DES 2              │
│ T-ROOM DES 3              │
│ T-REDUCED                 │
│ T-ABSENCE                 │
│ T-LIMIT DAY               │
│ T-LIMIT N                 │
│ HEATSLOPE                 │
│ OPTIM HEAT                │
│ MAX OPT-TIME              │
│ ECONO OPTI                │
│ PC ENABLE                 │
│ RETURN                    │
└──────────────────────────┘
             │
             ▼
┌──────────────────────────┐
│        SOLAR M/F          │
│ RETURN                    │
└──────────────────────────┘
```

Figure 3-2. USER Menu Flow Chart

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Table 3-2. USER Menu Listing

FUNCTION	DESCRIPTION	ENTRY RANGE	DEFAULT
INSTALLATION Sub-Menu			
LANGUAGE	Selects display language.	12 different languages are available.	ENGLISH
CONTRAST	Adjusts display contrast	-20 to 20	00
DISPLAY SEL	Sets the day of the week or the sensor temperature (°F) to appear in the display when the swing-down panel is closed. Day: SUN – SAT T-OUTSIDE: Outside Temperature FLOW TEMP (1/2): Flow Temp. For Heating Circuit 1 or 2 supply water temperature. (Only if sensor is installed) T-DHW: Domestic Hot Water Temp T-BOILER; Boiler Outlet Temp. T-ROOM (1 / 2): Room Temp, Heating Circuit 1 or 2 (ONLY if Remote Control is connected)	See DESCRIPTION Column	- - - -
RETURN	Press Program Key to exit INSTALLATION Sub-Menu.		
HOT WATER Sub-Menu			
1X DHW	Not Applicable		
T-DHW 1	Hot Water set point	50°F - 158°F	140°F
T-DHW 2	Not Applicable		
T-DHW 3	Not Applicable		
BOB-VALUE	Not Applicable		
CIRCL-P-DHW	Not Applicable		
RETURN	Press Program Key exit HOT WATER Sub-Menu.		

Table 3-2. USER Menu Listing - Continued

FUNCTION	DESCRIPTION	ENTRY RANGE	DEFAULT
HTG CIRCUIT 1 Sub-Menu			
MODE	Displays Timer Mode for Boiler	- - - -, Standby, Auto 1, Auto 2, Day, Night	- - - -
T-ROOM DES 1	Not Applicable		
T-ROOM DES 2	Not Applicable		
T-ROOM DES 3	Not Applicable		
T-REDUCED	Not Applicable		
T-ABSENCE	Not Applicable		
T-LIMIT DAY	Applies during day-time heating periods	- - - -, -23.0°F–104.0°F	66.0°F
T-LIMIT N	Applies during reduced night-time periods.	- - - -, -23.0°F–104.0°F	50.0°F
HEATSLOPE	Indicate number of degrees that the flow temperature changes if the outside temperature increases or decreases by 1°F.	0.00 – 3.00	1.20
OPTIM HEAT	Not Applicable		
MAX OPT-TIME	Not Applicable		
ECONO OPTI	Not Applicable		
PC-ENABLE	Not Applicable		
RETURN	Press Program Key to exit HTG CIRCUIT 1 (or 2) sub-menu.		
HTG CIRCUIT 2 Sub-Menu			
	Functions for HTG Circuit 2 are identical to HTG Circuit 1 Functions listed above.		
SOLAR M / F Sub-Menu (No Functions Currently In This Sub-Menu)			
RETURN	Pressing the Program Key with SOLAR M/F displayed will change display to RETURN. Press Program Key again to redisplay SOLAR M/F. Turning the Rotary Knob clockwise will advance thd display to the TIME PROGRAM Menu.		

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3.4 TIME PROGRAM MENU

Day and Time-related functions can be set using the TIME PROGRAM Menu and its associated Sub-Menus. However, at the present time, none of the Sub-Menus and functions in the TIME PROGRAM Menu are being utilized. This menu is shown in Figure 3-3. Refer to Appendix A for additional information on the Menu and Sub-Menu functions shown in Figure 3-3.
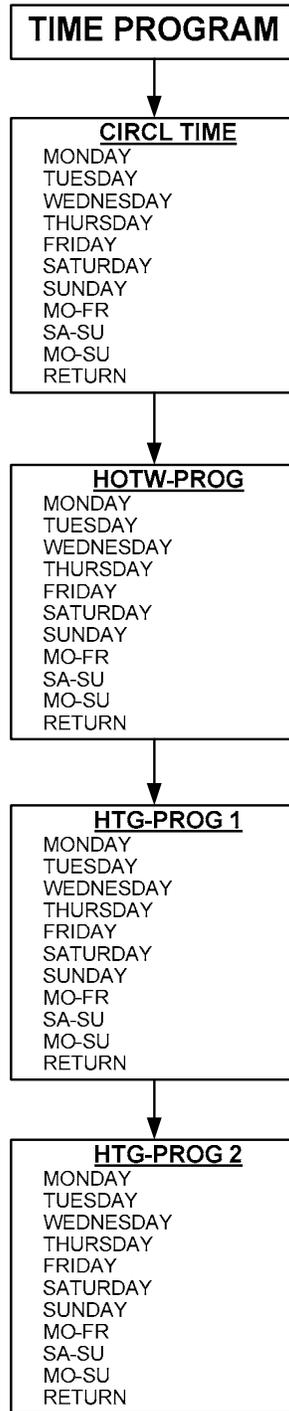

Figure 3-3. TIME PROGRAM Menu Flow Chart

3.5 EXPERT MENU

The EXPERT Menu contains the following Sub-Menus: INSTALLATION, HOT WATER, HEAT CIRCUIT 1, HEAT CIRCUIT 2 and SOLAR M/F as shown in Figure 3-4. As this Figure shows, the EXPERT Menu includes an extensive list of Sub-Menu functions, particularly in the INSTALLATION Sub-Menu. Tabular listings for the EXPERT Menu and Sub-Menu items are provided in Table 3-3.

Whenever "CODE NO." is displayed, it indicates that the valid password must be entered. This is accomplished by entering code 0000 (4 zeros) by pressing the Program Key 4 times.

```
                    ┌──────────────────────┐
                    │        EXPERT        │
                    └──────────────────────┘
                               │
                               ▼
                    ┌──────────────────────┐
                    │     INSTALLATION     │
                    │  CODE-NO             │
                    │  BUS ID HS           │
                    │  BUS ID 1            │
                    │  BUS ID 2            │
                    │  AF SUPPLY           │
                    │  BUS TERM            │
                    │  EBUS SUPPLY         │
                    │  TIME MASTER         │
                    │  MAX T COLL          │
                    │  MIN T COLL          │
                    │  MAX T-HS2           │
                    │  MIN T-HS2           │
                    │  V-CURVE             │
                    │  CURVE 11-U1         │
                    │  CURVE 11-U2         │
                    │  CURVE 11-T1         │
                    │  CURVE 11-T2         │
                    │  CURVE 11-UA         │
                    │  HYSTERESIS          │
                    │  FOUND MODULS        │
                    │  CAP/MODULE          │
                    │  NEW CONFIG          │
                    │  MIN MOD CASC        │
                    │  HW-BOILER           │
                    │  CONTR DEVIAT        │
                    │  DES OUTPUT          │
                    │  BLOCK TIME          │
                    │  MAX T-MODUL         │
                    │  DYN UPWARD          │
                    │  DYN DOWNWARD        │
                    │  RESET TIME          │
                    │  MODULAT MAX         │
                    │  MODULAT MIN         │
                    │  MIN MOD HS          │
                    │  SEQUENCE 1          │
                    │  SEQUENCE 2          │
                    │  SEQU CHANGE         │
                    │  SEQ SW TIME         │
                    │  LOCK TIME           │
                    │  HYST BURNER 2       │
                    │  HS COOL FUNC        │
                    │  T-HS COOL           │
                    │  HEATSOURCE 1        │
                    │  HS1 BUS             │
                    │  HEATSOURCE 2        │
                    │  STORAGE HS 2        │
                    │  BUFFER              │
                    │  RETURN              │
                    └──────────────────────┘
                               │
                               ▼
                    CONTINUED ON SHEET 2
```

Figure 3-4. EXPERT Menu Flow Chart (Sheet 1 of 2)

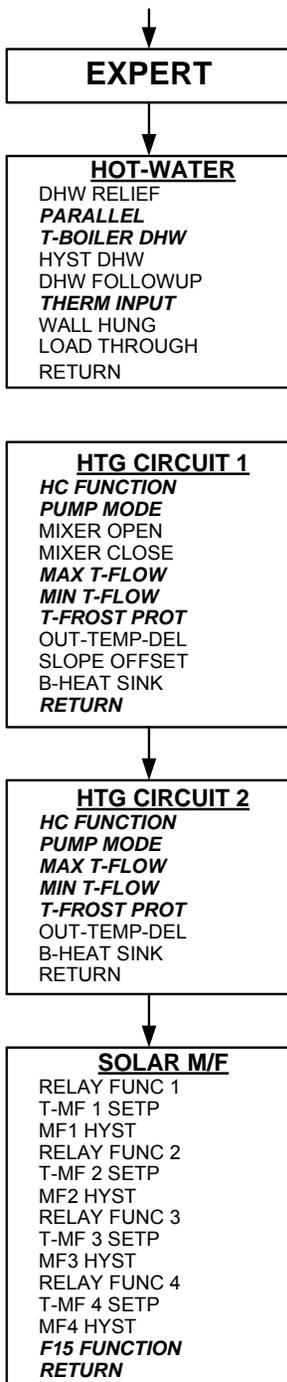15

MODULEX CONTROLLER OPERATION

CONTINUED FROM SHEET 1

┌─────────────────────────┐
│   **EXPERT**   │
└─────────────────────────┘

┌─────────────────────────┐
│   **HOT-WATER**   │
│ DHW RELIEF   │
│ *PARALLEL*   │
│ *T-BOILER DHW*   │
│ HYST DHW   │
│ DHW FOLLOWUP   │
│ *THERM INPUT*   │
│ WALL HUNG   │
│ LOAD THROUGH   │
│ RETURN   │
└─────────────────────────┘

┌─────────────────────────┐
│   **HTG CIRCUIT 1**   │
│ *HC FUNCTION*   │
│ *PUMP MODE*   │
│ MIXER OPEN   │
│ MIXER CLOSE   │
│ *MAX T-FLOW*   │
│ *MIN T-FLOW*   │
│ *T-FROST PROT*   │
│ OUT-TEMP-DEL   │
│ SLOPE OFFSET   │
│ B-HEAT SINK   │
│ *RETURN*   │
└─────────────────────────┘

┌─────────────────────────┐
│   **HTG CIRCUIT 2**   │
│ *HC FUNCTION*   │
│ *PUMP MODE*   │
│ *MAX T-FLOW*   │
│ *MIN T-FLOW*   │
│ *T-FROST PROT*   │
│ OUT-TEMP-DEL   │
│ B-HEAT SINK   │
│ RETURN   │
└─────────────────────────┘

┌─────────────────────────┐
│   **SOLAR M/F**   │
│ RELAY FUNC 1   │
│ T-MF 1 SETP   │
│ MF1 HYST   │
│ RELAY FUNC 2   │
│ T-MF 2 SETP   │
│ MF2 HYST   │
│ RELAY FUNC 3   │
│ T-MF 3 SETP   │
│ MF3 HYST   │
│ RELAY FUNC 4   │
│ T-MF 4 SETP   │
│ MF4 HYST   │
│ *F15 FUNCTION*   │
│ *RETURN*   │
└─────────────────────────┘

Figure 3-4. EXPERT Menu Flow Chart (Sheet 2 of 2)

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NOTE

Whenever "CODE NO." is displayed, it indicates that the valid password must be entered. This is accomplished by entering code 0000 (4 zeros) by pressing the Program Key 4 times.

Table 3-3. EXPERT Menu Listing

FUNCTION	DESCRIPTION	ENTRY RANGE	DEFAULT
INSTALLATION Sub-Menu			
CODE-NO	Permits entry of valid Code No.(0000)	0000 - 9999	0000
BUS ID HS	BUS ID HS **MUST** be set to - - - - to operate the boiler	01 - 08	- - - - DO NOT CHANGE
BUS ID 1	The heating circuits are sequentially numbered starting with „01", heating circuit numbers must not be assigned twice	(00), 01 – 15	01
BUS ID 2	The heating circuits are sequentially numbered starting with „01", heating circuit numbers must not be assigned twice	(00), 01 – 15	- - - -
AF SUPPLY	Outdoor sensor power supply	00, 01 (OFF/ON)	01 (ON)
BUS TERM	Bus terminating resistor (Must be set to 01)	00, 01 (OFF/ON)	01 (ON)
EBUS SUPPLY	Switches the Ebus supply ON/OFF	00, 01 (OFF/ON)	01 (ON)
TIME MASTER	Not Applicable		
MAX T-COLL	Sets the maximum allowable header set point temperature.	86.0°F – 230.0°F	185.0°F
MIN T-COLL	Sets the minimum allowable header set point temperature.	50.0°F – 176.0°F	50.0°F
MAX T-HS2	Not Applicable		
MIN T-HS2	Not Applicable		
V-CURVE	0 to 10 Volt input Voltage curves. Choose from preset curves (see para. 3.5.1) or customize a curve.	00 – 11	11
CURVE 11-U1	Low voltage setting	0.00V – 10.00V	0.000
CURVE 11-U2	High voltage setting	0.00V – 10.00V	10.00
CURVE 11-T1	Minimum set point temperature	32.0°F – 248.0°F	59.0°F
CURVE 11-T2	Maximum set point temperature	32.0°F – 248.0°F	185.0°F
CURVE 11-UA	Stop/Start voltage level. Going below/above this setting will stop/start the Boiler.	0.00V – 10.00V	1.00

MODULEX CONTROLLER OPERATION

Table 3-3. EXPERT Menu Listing – Continued

FUNCTION	DESCRIPTION	ENTRY RANGE	DEFAULT
INSTALLATION Sub-Menu – Continued			
HYSTERESIS	Not Applicable	–	
FOUND MODULS	Displays the number of heat modules available for service.	Display	
CAP/MODULE	Displays the maximum Kw output of each heat module.	00 – 1000 Kw	40 Kw
NEW CONFIG	Not Applicable		
MIN MOD CASC	Not Applicable	01 – 08	01
HW-BOILER	Not Applicable	00 – 08	00
CONTR DEVIAT	Control Deviation indicates the temperature difference between the Boiler set point and the actual water temperature.	Display	°F
DES OUPUT	Required system output [in %]	0 – 100%	00
SWITCH TIME	Not Applicable	(N/A)—	(N/A)
BLOCK TIME	Not Applicable	(N/A)	(N/A)
MAX T-MODUL	Maximum temperature of Heat Module	122.0°F to 230.0°F	194.0°F
DYN UPWARD	Not Applicable	(N/A)	(N/A)
DYN DOWNWARD	Not Applicable	(N/A)	(N/A)
RESET TIME	Not Applicable	5 – 500	50
MODULAT MAX	Start Level. If this modulation percentage is exceeded, the next heat module is connected after the delay time elapses.	50% - 100%	30%
MODULAT MIN	Stop Level. If value drops below this modulation percentage, the last heat generator (module) of the current sequence is switched off	10% - 60%	35%
MIN MOD HS	Not Applicable	0% - 60%	35%
MOD LEVEL HW	Not Applicable		
SEQUENCE 1	Boiler sequence 1	12345678	
SEQUENCE 2	Boiler sequence 2	87654321	

Table 3-3. EXPERT Menu Listing – Continued
–

FUNCTION	DESCRIPTION	ENTRY RANGE	DEFAULT
INSTALLATION Sub-Menu – Continued			
SEQU CHANGE	Sequence change mode	01 – 06	06
SEQ SW TIME	Time to sequence change (hours)	10 – 800	200
LOCK TIME	Not Applicable	00 min – 30 min	00
HYST BURNER2	Not Applicable	–	
HS COOL-FCT	Not Applicable		
T-HS COOL	Not Applicable		
HEATSOURCE 1	Identification of Boiler Type being used: 00 = No Boiler 01 = Single-Stage, switching 02 = Single-Stage, modulating 03 = 2-Stage, switching 04 = 2 individual, switching 05 = Multi-Stage, switching 06 = Multi-Stage, modulating (cascade via BUS)	See DESCRIPTION–	06 (Multi-Stage Modulating)
HS 1 BUS	Communication connection between Controller and Heat Source	00 – 04	02
HEATSOURCE 2	Not Applicable	N/A–	N/A
STORAGE HS2	Not Applicable	N/A–	N/A
BUFFER	Not Applicable	N/A	N/A
SCREED	Not Applicable	N/A	N/A
SCREED PROGR	Not Applicable	N/A	N/A
RETURN	Press Program Key to exit INSTALLATION Sub-Menu.		
HOT WATER Sub-Menu			
DHW RELIEF	Not Applicable	N/A	N/A
PARALLEL	Parallel pump operation. 00 = Hot Water Priority 01 = Hot Water Partial Priority 02 = Pump Parallel Running	00, 01, 02	01
T-BOILER DHW	Boiler temperature increase during Hot Water operation. Boiler Temp = (DHW Temp Setting) + (T-BOILER DHW)	32°F – 194°F	97°F
HYST DHW	Hot Water Hysteresis	48°F – 129°F	48°F
DHW FOLLOWUP	Pump Run-Down Time	00 min. – 30 min.	00 min.
THERM INPUT	Storage Tank With Sensor = 00 Storage Tank With Thermostat = 01	00, 01	00
WALL HUNG	Not Applicable		
LOAD THROUGH	Not Applicable		
RETURN	Press Program Key to exit HOT WATER Sub-Menu.		

MODULEX CONTROLLER OPERATION

Table 3-3. EXPERT Menu Listing – Continued

FUNCTION	DESCRIPTION	ENTRY RANGE	DEFAULT
HEAT CIRCUIT 1 & 2 Sub-Menus			
	The Sub-Menu Functions for HEAT CIRCUIT 1 & HEAT CIRCUIT 2 are identical, except for the MIXER OPEN & MIXER CLOSE Functions which apply only to HEAT CIRCUIT 1. The Function values in this Sub-Menu level will change, depending on the Heat Circuit Function (HC FUNCTION) selected.		
HC FUNCTION	Heat Circuit Function defines type of circuit: 00 = Standard Heat Circuit 01 = Control to fixed flow temperature 02 = Swimming pool control (HC 2 ONLY) 03 = Hot Water Circuit 04 = Return flow temp. Increase via mixing valve.	00 – 04	00 (Standard Heat Circuit)
PUMP MODE	Circulation pump mode control for ON/OFF switching of pumps. 00 = Standard pump control 01 = Pump switching per heating limits 02 = Pump switching per heating program 03 = Continuous pump operation	00 – 03	00
MIXER OPEN	Not Applicable		
MIXER CLOSE	Not Applicable		
MAX T-FLOW	Maximum allowable water temperature setting for the heating circuit.	68°F – 230°F	176°F
MIN T-FLOW	Minimum allowable water temperature setting for the heat circuit.	50°F – 230°F	50°F
T-FROST PROT	Specifies the minimum allowable outside air temperature setting for the Frost Protection Mode. If temperature drops below this value, the system switches to the Frost Protect Mode and the pumps are switched ON. (This Function should be set to 0°F in the INSTALLATION Mode)	-5°F – 41°F	32°F
OUT-TEMP-DEL	Not Applicable	N/A	N/A
SLOPE OFFSET	Not Applicable	N/A	N/A
B-HEAT SINK	Not Applicable	N/A	N/A
RETURN	Press Program Key to exit HEAT CIRCUIT 1 (or 2) Sub-Menu.		

Table 3-3. EXPERT Menu Listing – Continued

–

FUNCTION	DESCRIPTION	ENTRY RANGE	DEFAULT
SOLAR M/F Sub-Menu			
MF (1-4) FUNCTION	Not Applicable	–	
MF (1-4) SET TEMP	Not Applicable		
MF (1-4) HYST (1-4)	Not Applicable		
F15 FUNCTION	F15 Function 00 = Room Sensor for Heating Circuit 2 01 = 0 – 10V iInput 02 = Light sensor	00 -02	00
RETURN	Press Program Key to exit SOLAR M/F Sub-Menu.		

3.5.1 Available V-Curve Preset Voltage Curves for 0 – 10 Volt Input

The following listing shows the available preset V-Curve settings for operation in the 0 to 10 Volt Mode:

CURVE NO.	U1	U2	T1	T2	UA
0	2.0 V	10.0 V	32°F	194°F	2.0 V
1	2.5 V	0.3 V	100°F	176°F	5.0 V
2	2.5 V	0.3 V	100°F	167°F	5.0 V
3	2.5 V	0.3 V	100°F	113°F	5.0 V
4	4.0 V	0.1 V	68°F	185°F	5.0 V
5	4.0 V	0.1 V	68°F	167°F	5.0 V
6	4.0 V	0.1 V	68°F	131°F	5.0 V
7	4.0 V	0.1 V	68°F	189°F	5.0 V
8	4.0 V	0.1 V	68°F	189°F	5.0 V
9	4.0 V	0.1 V	68°F	163°F	5.0 V
10	4.0 V	0.1 V	68°F	127°F	5.0 V
11	4.0 V	0.1 V	68°F	194°F	5.0 V

3.6 EXPERT HS AREA

(NOT APPLICABLE TO MODULEX BOILERS)

MODULEX CONTROLLER OPERATION

3.7 GENERAL AREA

The GENERAL Menu Area contains a DATE/TIME Menu and a SERVICE Menu.

3.7.1 DATE / TIME MENU

This Sub-Menu is used to set the time, date, holiday (vacation) schedule and, where necessary, enter clock change settings (daylight savings time, etc). The DATE/TIME menu functions are illustrated and described in Figure 3-5 and Table 3-4 respectively.
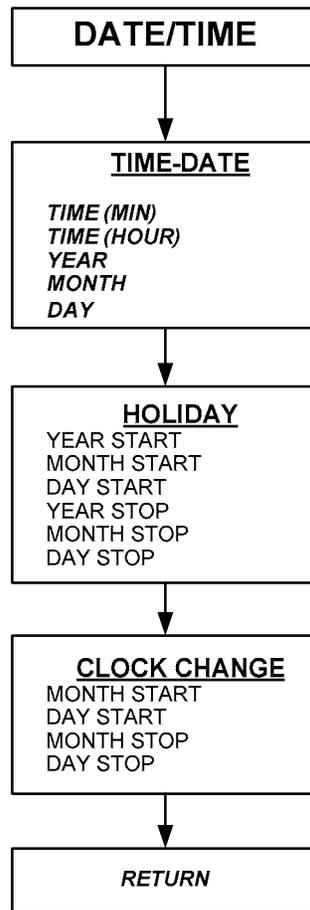
Figure 3-5. DATE/TIME Menu Flow Chart

NOTE

All items in the following DATE/TIME Menu must be entered in sequence. Press the Program Key to step through the menu functions. Use the Rotary Knob to adjust/change entries. Press the Program Key to store entries and sequence to the next function.

Table 3-4. DATE / TIME Menu Listing

FUNCTION	DESCRIPTION	ENTRY RANGE
TIME – DATE Sub-Menu		
	This Sub-Menu is used to set the time, date, holiday schedule and, where necessary, enter clock change settings (daylight savings time, etc).	
TIME	Set current time (min., hours)	00:00 – 24:00
YEAR	Set current year	XXXX
MONTH	Set current month	01 – 12
DAY	Set currrent day	01 – 31
HOLIDAY Sub-Menu		
	This Sub-Menu sets the start and end dates for Holiday (Vacation) periods where no heat or hot water is required.	
YEAR	Set current holiday start year	XXXX
MONTH START	Set current holiday start month	01 – 12
DAY START	Set current holiday start day	01 – 31
YEAR STOP	Set current holiday end year	XXXX
MONTH STOP	Set current holiday end month	01 – 12
DAY STOP	Set current holiday end day	01 – 31
CLOCK CHANGE Sub-Menu		
	This Sub-Menu is used in areas where seasonal time changes are required for "Daylight Savings", etc.	
MONTH START	Set clock change start month	01 -12
DAY START	Set clock change start day	01 – 31
MONTH END	Set clock change end month	01 – 12
DAY END	Set clock change end day	01 – 31
RETURN	When CLOCK CHANGE reappears, press Program Key.	

MODULEX CONTROLLER OPERATION

3.7.2 SERVICE MENU

The SERVICE Menu contains all the test and diagnostic functions/values required for Customer Service Engineers to troubleshoot the equipment in a timely manner. The SERVICE Menu items are illustrated and described in Figure 3-6 and Table 3-5 respectively.

Some of the Functions in this Sub-Menu require a valid Code No. (password) to be entered, prior to accessing/changing Function values. When prompted by a "CODE NO." display, enter 0000 (4 zeros) by pressing the Program Key four times. This will allow function access.

```
┌─────────────────────────┐
│        SERVICE          │
└─────────────────────────┘
            │
            ▼
┌─────────────────────────┐
│       RELAY TEST        │
│                         │
│  CODE NO                │
│  01 - 11                │
└─────────────────────────┘
            │
            ▼
┌─────────────────────────┐
│      SENSOR TEST        │
│    F1                   │
│    F2                   │
│    F3                   │
│    F5                   │
│    F6                   │
│    F8                   │
│    F9                   │
│    F11                  │
│    F12                  │
│    F13                  │
│    F14                  │
└─────────────────────────┘
            │
            ▼
┌─────────────────────────┐
│     SW NO 259-04        │
└─────────────────────────┘
            │
            ▼
┌─────────────────────────┐
│  BURNER TIME            │
│  BURNER START           │
│  LIMITER TEST           │
│  SERVICE                │
│  RESET USER             │
│  RESET EXPERT           │
│  RESET PRG              │
│  RETURN                 │
│  RETURN                 │
└─────────────────────────┘


┌─────────────────────────┐
│     CASCADE MANU        │
│  BOILER 01 – 00%        │
│  BOILER 02 – 00%        │
│  BOILER 03 – 00%        │
│  BOILER 04 – 00%        │
│  BOILER 05 – 00%        │
│  BOILER 06 – 00%        │
│  BOILER 07 – 00%        │
│  BOILER 08 – 00%        │
│  BOILER INT – 00%       │
│  RETURN                 │
└─────────────────────────┘
```
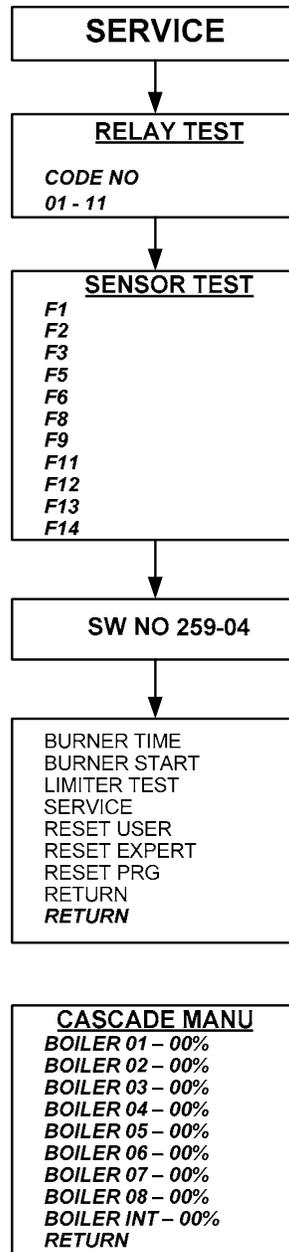
Figure 3-6. SERVICE Menu Flow Chart

Table 3-5. SERVICE Menu Listing

FUNCTION	DESCRIPTION	REMARKS
RELAY TEST Sub-Menu		
RELAY NO.	This Sub-Menu is used to check the status of the relays contained in the Controlller. These relays are numbered 00 through 11 and are defined as shown below. CODE NO. Entry is required to access these relays.	
00	No relay	
01	A1: Pump, Heating Circuit 1	
02	A2: Pump, Heating Circuit 2	
03	A3: Hot Water Charging Pump	
04	A4: Mixer OPEN, Heating Circuit 2	
05	A5: Mixer CLOSED, Heating Circuit 2	
06	A6: HS 1 ON	
07	A7: HS2 ON [2-stage:HS 1+2 (after 10s) ON]	
08	A8: Mixer OPEN Heating Circuit 1 / Multifunction 1	
09	A9: Mixer CLOSED Heating Circuit 1 / Multifunction 2	
10	A10: Multifunction 3	
11	A11: Collector Pump / Multifunction 4	
SENSOR TEST Sub-Menu		
SENSOR	This Sub-Menu is used to check and display the temperature readings of the sensors connected to the Controller.	
F1	Buffer storage temperature Lower	
F2	Buffer storage temperature middle or room temperature heating circuit 1	
F3	Upper buffer storage temperature	
F5	Flow temperature, heating circuit 2	
F5	Flow temperature, heating circuit 2	
F6	Upper hot water temperature	
F8	Heat generator /header temperature	
F9	Outside temperature	

Table 3-5. SERVICE Menu Listing – Continued–

FUNCTION	DESCRIPTION	REMARKS
SENSOR TEST Sub-Menu		
F11	Flow temperature heating circuit 1 or temperature multifunction 1	
F12	Hot water temperature lower or temperature multifunction 2	
F13	Solid fuel boiler temperature or collector 2 or temperature multifunction 3	
F14	Collector 1 temperature or temperature multifunction 4	
F15; Light; 0-10V I	Room temperature heating circuit 2 or measured value of the light sensor or voltage value 0-10V input	
OTHER ENTRIES		
	Additional items and functions in the SERVICE Sub-Menu include the following:	
SW NO XXX-XX	Specifies the Software Version and Index number currently installed in the Controller	
CASCADE MANU (1-8)	Starting different burner stages of the cascade See GF-115/GF-115-H, Section 6, para. 6.5 for additional startup instructions using these sub-menu functions.	
BURNER TIME (1-8)	Program Key – Burner time for all stages	
BURNER START (1-8)	Program Key – Burner start for all stages	
LIMITER TEST (1-8)	Safety temperature limiter test with heat generator temperature display Start with Program Key (hold down)!	
SERVICE	Input of date or operating hours for service messages	
WARNING: NEVER ATTEMPT TO USE THE FOLLOWING RESET FUNCTIONS.		
RESET USER 00	DO NOT USE	
RESET EXPERT 00	DO NOT USE	
RESET T-PRG 00	DO NOT USE	
RETURN	Exit level using Program Key	

—

3.8 MODULEX CONTROLLER INITIAL STARTUP

Initial startup of the Modulex Controller requires a number of one-time entries to be made in the INSTALLATION Menu Flow Chart and Menu Listing shown in Figure 3-7 and Table 3-6 respectively. Table 3-7. Proceed as follows:

1. Set the POWER rocker switch, located to the right of the Controller, to the ON (1) position.

2. Open the panel cover on the Controller. The LCD display will read INSTALLATION. All values in this level must be entered, in sequence, without interruption. The initial entries required include: Language, Time and Date as shown in the INSTALLATION Table which follows.

3. The first function that appears is Language. By default, the display should show ENGLISH. If ENGLISH is not displayed, turn the Rotary Knob until ENGLISH appears.

4. Press the Program Key to store setting.

5. Next, TIME will be displayed. Enter the current time (minutes, hours) using the Rotary Knob. Press the Program key to store each value.

6. The next items displayed are the YEAR, MONTH and DAY. Enter each item using the Rotary Knob and press the Program Key as previously described to store the entry.

7. Following entry of all Language, Time and Date entries, continue entering the remaining items shown in Figure 3-7 and Table 3-6 until all required items have been entered. Use the Program Key and Rotary Knob to select, adjust and store all entries as previously described.

8. Continue step 7 until RETURN appears in the display, indicating that you are at the end of the INSTALLATION menu.

9. Press the Program Key to exit the INSTALLATION menu.

NOTE

All items in the following INSTALLATION Menu must be entered in sequence. Press the Program Key to step through the menu functions. Use the Rotary Knob to adjust/change entries. Press the Program Key to store entries and sequence to the next menu item.

MODULEX CONTROLLER OPERATION

```
┌─────────────────────────────┐
│      INSTALLATION            │
│                             │
│   LANGUAGE                  │
│   TIME                      │
│   YEAR                      │
│   MONTH                     │
│   DAY                       │
│   CONF DEVICE               │
│   HEATSOURCE 1              │
│   HS1 BUS                   │
│   HEATSOURCE 2              │
│   STORAGE HS2               │
│   BUFFER                    │
│   HC FUNCTION 1             │
│   HC FUNCTION 2             │
│   CAP MODULE                │
│   RELAY FUNC 1              │
│   T-MF1 SETP                │
│   MF1 HYST                  │
│   RELAY FUNC 2              │
│   T-MF2 SETP                │
│   MF2 HYST                  │
│   RELAY FUNC 3              │
│   T-MF3 SETP                │
│   MF3 HYST                  │
│   RELAY FUNC 4              │
│   T-MF4 SETP                │
│   MF4 HYST                  │
│   BUS ID 1                  │
│   BUS ID 2                  │
│   5K SENSOR                 │
│   RETURN                    │
└─────────────────────────────┘
```
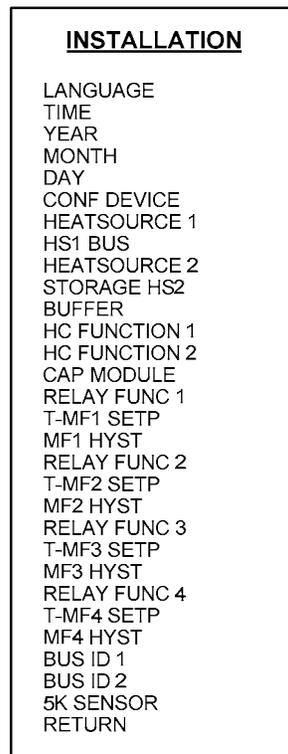
Figure 3-7. INSTALLATION Menu Flow Chart

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Table 3-6. INSTALLATION Menu Listing

FUNCTION	DESCRIPTION	ENTRY RANGE	DEFAULT
INSTALLATION Sub-Menu			
LANGUAGE	Set Language		ENGLISH
TIME	Set current time (min., hrs)	00:00 – 24:00	
YEAR	Set current year	XXXX (4 digits)	
MONTH	Set current month	00-12	
DAY	Set current day of month	00-31	
CONF DEVICE	Confirm Device	- - - -, 01 – 06	- - - -
HEATSOURCE 1	Heat Source 1	00 – 06	06
HS1 BUS	Heat Source 1 Bus	00 – 04	02
HEATSOURCE 2	Heat Source 2	00 – 05	00
STORAGE HS2	Storage Heat Source 2	00 – 03	00
BUFFER	Buffer	00, 01, 02	00
HC FUNCTION 1	Heating Circuit Function 1	00, 01, 03	00
HC FUNCTION 2	Heating Circuit Function 2	00 – 04	00
CAP/MODULE	See paragraph 3.8.1 for additional instructions for the CAP/MODULE function.	00 – 1000 Kw	40 Kw
RELAY FUNC 1	Relay Function 1 (See paragraph 3.8.2 for listing of available relay functions)	00 – 26	00
T-MF1 SETP	Temperature – Multifunction Relay 1 Setpoint	86°F – 194°F	86°F
MF1 HYST	Multifunction Relay 1 Hysteresis	4°F – 18°F	9°F
RELAY FUNC 2	Relay Function 2 (See paragraph 3.8.2)	00 – 26	00
T-MF2 SETP	Temperature – Multifunction Relay 2 Setpoint	86°F – 194°F	86°F
MF2 HYST	Multifunction Relay 2 Hysteresis	4°Ra – 18°Ra	9°F
RELAY FUNC 3	Relay Function 3	00 – 26	01
T-MF3 SETP	Temperature – Multifunction Relay 3 Setpoint	86°F – 194°F	86°F
MF3 HYST	Multifunction Relay 3 Hysteresis	4°F – 18°F	9°F
RELAY FUNC 4	Relay Function 4	00 – 26	02
T-MF4 SETP	Temperature – Multifunction Relay 4 Setpoint	86°F – 194°F	86°F
MF4 HYST	Multifunction Relay 4 Hysteresis	4°F – 18°F	9°F
BUS ID 1	Bus Identification No. 1	00 – 15	01
BUS ID 2	Bus Identification 2	00 – 15	02
5K SENSOR	5,000 Ohm Sensor	00=5K, 01=1K	00 = 5 K

MODULEX CONTROLLER OPERATION

3.8.1   Additional Instructions for CAP/MODULE Function

When the Program Key is pressed with CAP/MODULE displayed, the display may show "SCAN", indicating that the Controller is searching for related MODULE (BOILER) functions. Once the scan is complete, proceed as follows:

1. Press the Program Key. The display will show CODE NO., requesting the valid code to be entered.

2. Enter code 0000 (4 zeros) by pressing the Program Key four times. The red LED will remain lit while the four code digits are entered.

3. Press the Program Key

4. The display will show BOILER 1 (meaning Heat Module 1), along with kilowatt (Kw) setting for the first Module. The default setting for each Boiler Module is 40 Kw.

5. If the desired Kw setting is not displayed, press the Program Key and change the setting using the Rotary Knob. Once the desired setting is displayed, press the Program Key to store the value.

6. Continue scrolling through each BOILER (Heat Module) and observe the Kw setting for each one. Change as needed by repeating step 5.

7. Once all BOILER MODULES have been set, RETURN will be displayed.

8. Press the Program Key to continue with the next menu function (RELAY FUNC 1) in the INSTALLATION Menu Table.

3.8.2   Available Settings for Relay Functions 1 – 4 (RELAY FUNC 1 thru 4)

Table 3-7 lists the available Function selections for Multi-Function (MF) Relays 1 thru 4:

Table 3-7. Available Relay Functions

FUNCTION	DESCRIPTION
00	No MF Relay Function
01	Header Pump
02	Circulation (Time)
03	Booster Pump
05	Pump HS1
06	Pump HS2
20	Temperature-Controlled Circulation Pump
21	Pulsed Circulation Pump
22	Solid Fuel Boiler Integration (Not Applicable)
23	Solar Integration
24	Return Flow Temperature Increase HS1
25	Return Flow Temperature Increase HS2
26	Return Flow Temperature Increase Via Buffer Storage

4. OPERATING MODE SET-UP & PROGRAMMING INSTRUCTIONS

The following paragraphs provide the detailed set-up and programming procedures necessary to configure the Modulex Boiler for service operation.

NOTE

When performing the following operating mode set-up procedures, refer to Section 2 of this document for illustrations and descriptions of the Controller operating controls and displays. Refer to Section 5 for Controller wiring connections.

4.1 INDOOR/OUTDOOR RESET MODE

This mode is used to adjust the boiler set point based on the outdoor air temperature and a programmed heating curve. The heating curve can be customized using functions provided in the USER menu. The outdoor air sensor provided with the Modulex boiler must be installed to enable this mode of operation. The following paragraphs provide the procedures necessary to wire and configure the controller for operation in the Indoor/Outdoor Reset mode.

4.1.1 Wiring Connections

The outdoor air sensor provided with the boiler should be mounted on the outer North or North-East side of the building away from windows, doors and vents. Never mount the outdoor air sensor in a location where it is exposed to direct sunlight.

Wire the sensor using shielded 2-conductor, 18 AWG wire (Belden #8760, or equiv.). Connect the outdoor air sensor wire leads to terminals 9 (F9) and 10 (GND) of Connector 1 on the rear of the Controller. There is no polarity to observe when connecting the wire leads. Refer to the wiring diagrams in Section 5 for the locations of sensor connections. This sensor must be connected prior to configuring the Controller in the following paragraph.

IMPORTANT

The outdoor air sensor MUST be connected as described above, prior to configuring the Controller for Indoor/Outdoor Reset Mode operation.

4.1.2 Configuring the Controller for Indoor/Outdoor Reset Operation

The Indoor/Outdoor Reset Mode is configured using the USER menu. Proceed as follows:

1. Set the **ON/OFF** switch on the front of the Modulex boiler to the **ON** position.

2. Open the swing-down hinged panel of the Controller.

3. Turn the Rotary Knob clockwise to the USER menu. The first item (sub-menu) displayed will be INSTALLATION.

4. Continue scrolling clockwise through the USER menu until the HTG CIRCUIT 1 sub-menu is displayed.

5. With HTG CIRCUIT 1 displayed, press the Program key to enter the sub-menu.

6. Using the Rotary Knob, scroll to HEATSLOPE sub-menu item. The display will show "HEATSLOPE" and the current value stored in memory (0.00 to 3.00).

7. If the desired value for HEATSLOPE is not displayed, press the Program Key. The red LED will light.

8. Refer to the Heat Slope Diagram shown in Figure 4-1 to determine the required value for the HEATSLOPE function based on the boiler installation design set point. The value to be entered must be between 0 and 3.00.
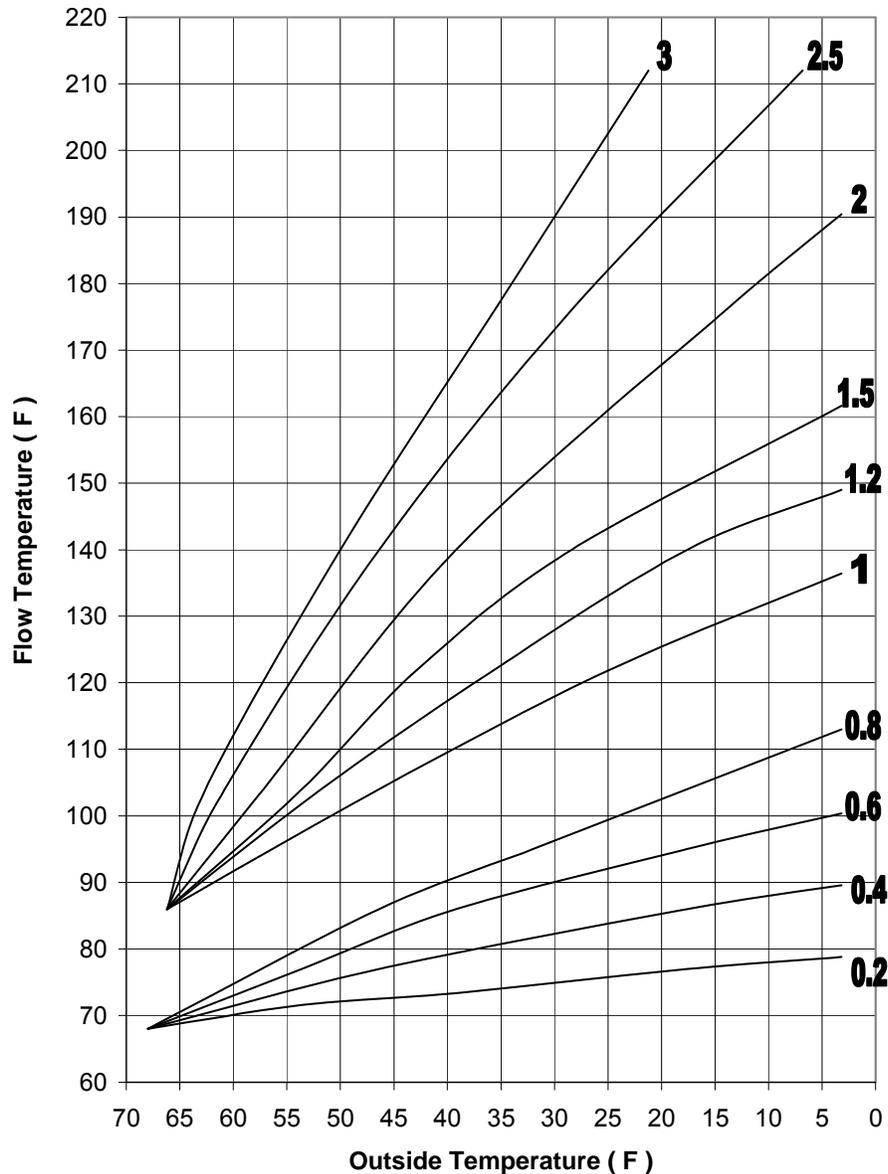
Figure 4-1. Heat Slope Diagram

9. Turn the Rotary Knob until the desired HEATSLOPE value is displayed.

10. Press the Program Key to store the HEATSLOPE value.

11. Continue scrolling through the HTG CIRCUIT 1 sub-menu until RETURN is displayed. Press the Program Key to exit the HTG CIRCUIT 1 sub-menu.

12. This completes the required Indoor/Outdoor Reset Mode set-up instructions.

4.1.3 Viewing Boiler Set Point

The set point temperature is viewed in the DISPLAY menu as follows:

1. Turn the Rotary Knob to the DISPLAY menu. The first sub-menu displayed will be INSTALLATION.

2. Press the Program Key to enter the INSTALLATION sub-menu.

3. Turn the Rotary Knob clockwise until T-COLL DES is displayed along with corresponding temperature reading. This T-COLL DES reading equals the boiler set point.

4.2   CONSTANT SET POINT MODE

The Constant Set Point Mode is used when a fixed header temperature is desired.

4.2.1 Wiring Connections

There are NO wiring connections required for this mode.

4.2.2 Configuring the Controller for Constant Set Point Mode

The Constant Set Point Mode is enabled using functions contained in the EXPERT menu and USER menu. Proceed as follows:

1. Set the **ON/OFF** switch on the front of the Modulex boiler to the **ON** position.

2. Open the swing-down hinged panel of the Controller.

3. Turn the Rotary Knob clockwise to the EXPERT menu. The first item (sub-menu) displayed will be INSTALLATION.

4. Continue turning the Rotary Knob clockwise until HEAT CIRCUIT 1 is displayed.

5. Press the Program Key to enter the HEAT CIRCUIT 1 sub-menu.

6. Scroll to HC FUNCTION. The currently stored setting (00 or 01) will be displayed. Normally, 00 will be displayed since this is the Factory Default. However, for the Constant Set Point Mode, the HC FUNCTION setting must be changed to 01. If the HC FUNCTION is currently set to 00, proceed to step 7. However, if it is set to 01, skip to step 11.

7. If the HC FUNCTION is set to 00, press the Program Key. CODE NO. will be displayed requesting the valid code to be entered.

8. Enter code 0000 (4 zeros) by pressing the Program Key four times. The red LED will remain lit while the four code digits are entered.

9. With HC FUNCTION again displayed, press the Program Key. The red LED will light. Turn the Rotary Knob to change the HC FUNCTION to 01.

10. Press the Program Key to store the 01 setting for the HC FUNCTION. The red LED will go off. RESET will be momentarily displayed, followed by a display of the current Controller software version (e.g. SW 259-04). Following RESET, the Controller display will then switch to the initial INSTALLATION menu.

11. Next, scroll to the USER menu using the Rotary Knob and access the HTG CIRCUIT 1 sub-menu. Press the Program Key to enter the sub-menu.

12. Using the Rotary Knob, scroll to T – FLOW DAY. The currently stored value for T – FLOW DAY will be displayed. This represents the current Constant Set Point temperature in °F.

13. If the desired Constant Set Point is not displayed, press the Program Key and turn the Rotary Knob to select the desired Constant Set Point. Press the Program Key again to store the Set Point.

14. This completes the required set-up instructions for the Constant Set Point mode.

4.2.3 Viewing Constant Set Point Value.

The set point is view in the DISPLAY menu as follows:

1. Turn the Rotary Knob to the DISPLAY menu. The first sub-menu displayed will be INSTALLATION.

2. Press the Program Key to enter the INSTALLATION sub-menu.

3. Turn the Rotary Knob clockwise until T-COLL DES is displayed along with corresponding temperature reading. This T-COLL DES reading equals the boiler set point in °F.

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4.3 0 TO 10 VOLT REMOTE SET POINT MODE

This mode allows the boiler set point to be controlled by an external control signal. The following paragraphs provide the procedures necessary to wire, configure and set the required functions necessary to operate in the 0 to 10 volt remote set point mode.

4.3.1 Remote Signal Source Wiring Connections

When setting up to operate in the 0 to 10 volt remote setpoint mode, the remote signal source must be wired to terminals 1 (F-15) and 2 (GND) of connector number 3 (III) on the rear of the Controller. See Section 5 for illustrations and pinouts of the connectors located on the rear of the Controller.

4.3.2 Configuring the Controller

Configure the Controller as follows:

1. Set the **ON/OFF** switch on the front of the Modulex boiler to the **ON** position.

2. Open the swing-down hinged panel of the Controller.

3. Turn the Rotary Knob clockwise to the EXPERT menu. The first item (sub-menu) displayed will be INSTALLATION (the sub-menu items will scroll in the following sequence: INSTALLATION, HOT WATER, HEAT CIRCUIT 1, HEAT CIRCUIT 2, SOLAR / MF). Continue scrolling (clockwise) through the EXPERT menu until SOLAR / MF is displayed.

NOTE

If you scroll past the SOLAR / MF item, the EXPERT HS menu will be displayed. If this occurs, <u>slowly</u> turn the Rotary Knob counterclockwise until SOLAR / MF is again displayed.

4. With SOLAR / MF displayed, press the Program Key to enter the SOLAR / MF sub-menu.

5. Scroll through the SOLAR / MF sub-menu by turning the Rotary Knob clockwise until the F-15 Function is displayed along with it's presently stored value (default is 00).

6. Press the Program Key to change the F-15 Function. The display will show CODE NO., requesting the valid code to be entered.

7. Enter code 0000 (4 zeros) by pressing the Program Key four times. The red LED will remain lit while the four code digits are entered.

8. With F-15 Function again displayed and the red LED lit, turn the Rotary Knob to change the F-15 Function to 01.

9. Press the Program Key to store the 01 setting for the F15 Function. The red LED will go off.

10. Continue scrolling through the sub-menu until RETURN is displayed.

11. Press the Program Key to exit the SOLAR / MF sub-menu.

12. With SOLAR / MF displayed, turn the Rotary Knob <u>counterclockwise</u> until the INSTALLATION sub-menu item is displayed. Turning the Rotary Knob counterclockwise will help minimize scrolling and display the sub-menu items in reverse order (i.e.:SOLAR / MF, HEAT CIRCUIT 2, HEAT CIRCUIT 1, HOT WATER, INSTALLATION).

13. With INSTALLATION displayed, proceed directly to paragraph 4.3.3.

4.3.3   Setting the Voltage and Set Point Limits

The following steps are used to set the voltage limits corresponding to the minimum and maximum allowable set point limits. Proceed as follows:

NOTE

Ensure that steps 1 through 13 in paragraph 4.3.2 were completed prior to performing the following steps.

Also, when scrolling through sub-menus and functions, enter the required Code 0000 only when prompted to do so. Normally, Code 0000 only needs to be entered once, unless you exit and then re-enter the EXPERT menu.

1. –Press the Program Key to enter the EXPERT menu – INSTALLATION sub-menu. The display will show CODE NO. requesting the valid code to be entered.

2. Enter code 0000 (4 zeros) by pressing the Program Key four times. The red LED will remain lit while the four code digits are entered. A dashed line will appear in the display following code entry.

3. Next, turn the Rotary Knob clockwise until CURVE 11-U1 is displayed.

4. Press the Program Key. The red LED will light.

5. Enter the desired low voltage limit for U1 by turning the Rotary Knob. The voltage will increment in 0.10 volt increments.

6. With the desired low voltage limit displayed, press the Program Key to set the U1 voltage. The red LED will go off.

7. Turn the Rotary Knob clockwise and scroll to CURVE 11-U2.

8. Press the Program Key. The red LED will light.

9. Enter the desired high voltage limit for U2 by turning the Rotary Knob.

10. With the desired high voltage limit displayed, press the Program Key to set the U2 voltage. The red LED will go off.

NOTE

The previous steps set the U1 and U2 voltages which will be used to scale the minimum and maximum set point levels. The following steps set the minimum (T1) and maximum (T2) set point temperatures which correspond to the U1 and U2 voltage levels, respectively.

11. Turn the Rotary Knob clockwise and scroll to CURVE 11-T1. This will be the minimum set point temperature.

12. Press the Program Key. The red LED will light.

13. Enter the desired low set point temperature limit for T1 by turning the Rotary Knob. The selected T1 value will correspond to U1.

14. With the desired low set point temperature limit displayed, press the Program Key to set the T1 temperature (low set point limit). The red LED will go off.

15. Finally, turn the Rotary Knob clockwise and scroll to CURVE 11-T2. This will be the maximum set point temperature.

16. Press the Program Key. The red LED will light.

17. Enter the desired high set point temperature limit for T2 by turning the Rotary Knob. The selected T2 value will correspond to U2.

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18. With the desired high set point temperature limit displayed, press the Program Key to set the T2 temperature (high set point limit). The red LED will go off.

19. This completes the required steps for setting the low and high limits corresponding to the set point voltage and temperature functions. Proceed immediately to paragraph 4.3.4 to set the CURVE 11-UA voltage.

4.3.4 Setting the Curve 11-UA Voltage

UA is a voltage level that will turn off the boiler. Therefore, the UA voltage level must be set <u>below</u> the limit set for the U1 voltage. For example; if U1 is set for 1 Volt, UA should be set to 0.9 Volt (or lower). After setting the low and high set point limits as described in paragraph 4.3.3, set the UA voltage as follows:

1. Turn the Rotary Knob clockwise and scroll to CURVE 11-UA.

2. Press the Program Key. The red LED will light.

3. Using the Rotary Knob, adjust the UA voltage to <u>below</u> the voltage set for U1.

4. With UA set to the desired value, press the Program Key to store the setting. The red LED will go off.

5. This completes all of the required entries for operation in the 0 to 10 Volt Remote Set Point Mode.

6. To exit the EXPERT menu – INSTALLATION sub-menu, continue scrolling using the Rotary Knob until RETURN is displayed.

7. Press the Program Key to return to exit the INSTALLATION sub-menu.

8. To view the remote set point temperature, proceed to paragraph 4.3.5.

NOTE

When viewing the set point temperature using the steps in paragraph 4.3.5, you will note that the when the voltage source is equal to 0.9 Volt, the set point temperature will drop to 41°F (9°C), thereby shutting down the boiler.

Example: U1 = 1 Volt and the set point = 80°F
U2 = 8 Volts and the set point = 180°F
UA should be set to 0.9 Volt

4.3.5 Viewing the Set Point

The set point is displayed as follows:

1. Turn the Rotary Knob to the DISPLAY menu – INSTALLATION sub-menu.

2. Press the Program Key to enter the INSTALLATION sub-menu.

   Using the Rotary Knob, scroll to T-EXT DES to view the set point temperature.

4.4 DHW OPERATION USING A TANK SENSOR

With the Controller hinged panel closed, turn the Rotary Knob until the Faucet symbol (🚰) appears in the lower part of the display window. When there is a demand for domestic hot water (DHW), a second Faucet symbol will be displayed. This second Faucet symbol indicates that the boiler is currently in the DHW mode and is raising the temperature of the domestic water to the DHW set point. Once the DHW demand has been satisfied, the boiler will switch back to the space heating mode. The second Faucet symbol will change to a heating circuit symbol, indicating that the boiler is back in the space heating mode.

The following procedures describe the wiring connection and Controller configuration setting needed to provide domestic hot water (DHW) using a tank sensor installed in a thermowell.

4.4.1 Sensor Wiring Connections

To monitor the DHW temperature, connect the tank sensor wire leads to Connector 1, Terminals 6 (F6) and 7 (GND) on the rear of the Controller. After the sensor is connected, turn the ON/OFF switch to the OFF position, then back to the ON position. This is necessary to ensure that the Controller recognizes the added sensor.

IMPORTANT

The tank sensor MUST be connected as described above, prior to configuring the Controller for DHW operation. If the sensor is not connected, many of the required sub-menu functions will not be displayed.

4.4.2 Configuring the Controller for DHW With a Tank Sensor

Both the EXPERT and USER Menus will be used to configure the Controller for DHW production. In addition, the DISPLAY Menu will be used to display the set point. Proceed as follows:

1. Set the **ON/OFF** switch on the front of the Modulex boiler to the **ON** position.

2. With the hinged cover of the Controller closed, turn the Rotary Knob until the Faucet symbol (🚰) appears in the lower part of the of the display window.

3. Open the swing-down hinged panel of the Controller.

4. Turn the Rotary Knob clockwise to the EXPERT menu – HOT WATER sub-menu.

5. With HOT WATER displayed, press the Program Key to enter the HOT WATER sub-menu.

6. Scroll through the HOT WATER sub-menu by turning the Rotary Knob clockwise until the THERM INPUT function is displayed along with the currently stored setting (00 or 01). If 00 is displayed, the Controller is already set for Sensor operation. If this is the case, skip to step 11.

7. If the THERM INPUT is currently set to 01 (Aquastat), press the Program Key to change the THERM INPUT. The display will show "CODE NO.", requesting the valid code to be entered.

8. Enter code 0000 (4 zeros) by pressing the Program Key four times. The red LED will remain lit while the four code digits are entered.

9. With THERM INPUT again displayed and the red LED lit, turn the Rotary Knob to change the function to 00 for Sensor operation.

10. Press the Program Key to store the 00 setting for THERM INPUT. The red LED will go off.

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4.4.3   Setting the DHW Set Point

The set point temperature is set in the USER menu as follows:

1.   Using the Rotary Knob scroll to the USER menu. The first item (sub-menu) displayed will be INSTALLATION.

2.   Continue scrolling clockwise until the HOT WATER sub-menu is displayed.

3.   Press the Program key to enter the HOT WATER sub-menu.

4.   Scroll to the T-DHW 1 function. T-DHW 1 will be displayed along with the current DHW set point temperature.

5.   If the desired DHW set point is not displayed, press the Program Key. The red LED will light.

6.   Using the Rotary Knob, enter the desired set point temperature.

7.   With the desired DHW set point displayed, press the Program Key to store the displayed value. The red LED will go off.

8.   Next, continue scrolling until RETURN is displayed. Press the Program Key to exit the sub-menu.

NOTE

It typically requires a higher temperature boiler water to heat the domestic hot water (DHW) to its set point. This can be accomplished using the T BOILER DHW function in the EXPERT menu – HOT WATER sub-menu. The degree value entered for this function will be added to the DHW set point temperature set in the USER menu – HOT WATER sub-menu (para. 4.2.3).

9.   Scroll clockwise to the EXPERT menu, HOT WATER sub-menu.

10. Press the Program Key and scroll to the T BOILER DHW function in the HOT WATER sub-menu. The currently stored value for this function will be displayed in °F.

11. If the desired temperature is not displayed, press the Program Key to change the degree value that will be added to the DHW set point. The red LED will light.

12. Adjust the T BOILER DHW temperature to the desired value using the Rotary Knob.

13. Press the Program Key to store the temperature setting. The red LED will go off.

14. Continue scrolling through the HOT WATER sub-menu until RETURN is displayed. Press the Program Key to exit the sub-menu.

4.4.4 Displaying Temperatures Associated With DHW

Functions in the DISPLAY menu are used to display the actual DHW temperature measured by the tank sensor. The swing-down hinged panel must be open to access and display these functions.

4.4.4.1 Viewing DHW Set Point and Actual DHW Temperature

The DHW set point and the actual DHW temperature measured by the tank sensor are displayed as follows:

1. Turn the Rotary Knob to the DISPLAY menu. The first sub-menu displayed will be INSTALLATION.

2. Continue turning the Rotary Knob clockwise until the HOT WATER sub-menu is displayed.

3. Press the Program Key to enter the HOT WATER sub-menu.

4. Turn Rotary Knob to display T-DHW RATED. The temperature value shown is the DHW set point temperature.

5. Next, scroll to T-DHW. The temperature value shown is the actual DHW temperature measured by the tank sensor.

6. Continue scrolling until RETURN is displayed. Press the Program Key to exit the HOT WATER sub-menu.

4.4.4.2 Viewing DHW Set Point With T-BOILER DHW Function

To view the DHW set point with the T-BOILER DHW setting already added to it, proceed as follows:

1. Turn the Rotary Knob to the DISPLAY menu. The first sub-menu displayed will be INSTALLATION.

2. Press the Program Key to enter the INSTALLATION sub-menu.

3. Turn the Rotary Knob clockwise until T-COLL DES is displayed along with corresponding temperature reading. This T-COLL DES reading equals the DHW set point plus the value of the T-BOILER DHW function. Therefore:

T-COLL DES = (T-DHW RATED) + (T-BOILER DHW)

4.5 DHW OPERATION USING AN AQUASTAT

Operation, wiring connections and Controller configuration settings for DHW heating using an aquastat are virtually identical to the procedures previously described in paragraph 4.4 for the tank sensor. Therefore, the following paragraphs describe only the differences between these two types of applications.

4.5.1 Sensor Wiring Connections

To monitor the DHW temperature, connect the aquastat wire leads to Connector KF/SPF, Terminals 6 (F6) and 7 (GND). After the sensor is connected, turn the ON/OFF switch to the OFF position, then back to the ON position. This is necessary to ensure that the Controller recognizes the added sensor.

IMPORTANT

The aquastat MUST be connected as described above, prior to configuring the Controller for DHW operation. Also, the aquastat must be closed (shorted) for the Controller to display the required sub-menu functions.

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4.5.2 Configuring the Controller for DHW With an Aquastat

The procedures for configuring the Controller for DHW with an Aquastat are virtually identical to those specified in paragraph 4.4.2. The only difference is that the THERM INPUT in the EXPERT menu – HOT WATER sub-menu must be set to 01 (Aquastat) instead of 00 (Sensor).

4.5.3 Setting the DHW Set Point

Same as paragraph 4.4.3.

4.5.4 Displaying Temperatures Associated With DHW

Same as paragraphs 4.4.4 through 4.4.4.2

4.6 BOILER & PUMP ENABLE/DISABLE

The Enable/Disable feature found between terminals 3 and 4 of connector "I" can be used to start/stop the boiler only in Indoor/Outdoor Reset and Constant Set Point modes of operation. The Enable/Disable does not start/stop the boiler in 0 to 10 Volt Remote Set Point mode. To start/stop the boiler in 0 to 10 Volt Remote Set Point mode, see paragraph 4.3.4.

To use the Enable/Disable feature, wire a dry set of contacts between terminals 3 and 4 of Connector "I" and then set the boiler to Standby mode (⏻). To set the boiler to Standby mode, close the swing-down front panel door of the E8 and turn the wheel counterclockwise until the Standby symbol (⏻) is displayed. With terminals 3 and 4 closed, the Standby symbol, and others in the display, will be blinking. This indicates that the boiler is enabled. When the connection is broken between terminals 3 and 4, the Standby symbol, and others in the display, will stop blinking indicating that the boiler is disabled.

The Enable/Disable feature not only start/stops the boiler but also start/stops the pumps.

5. CONNECTION DIAGRAMS
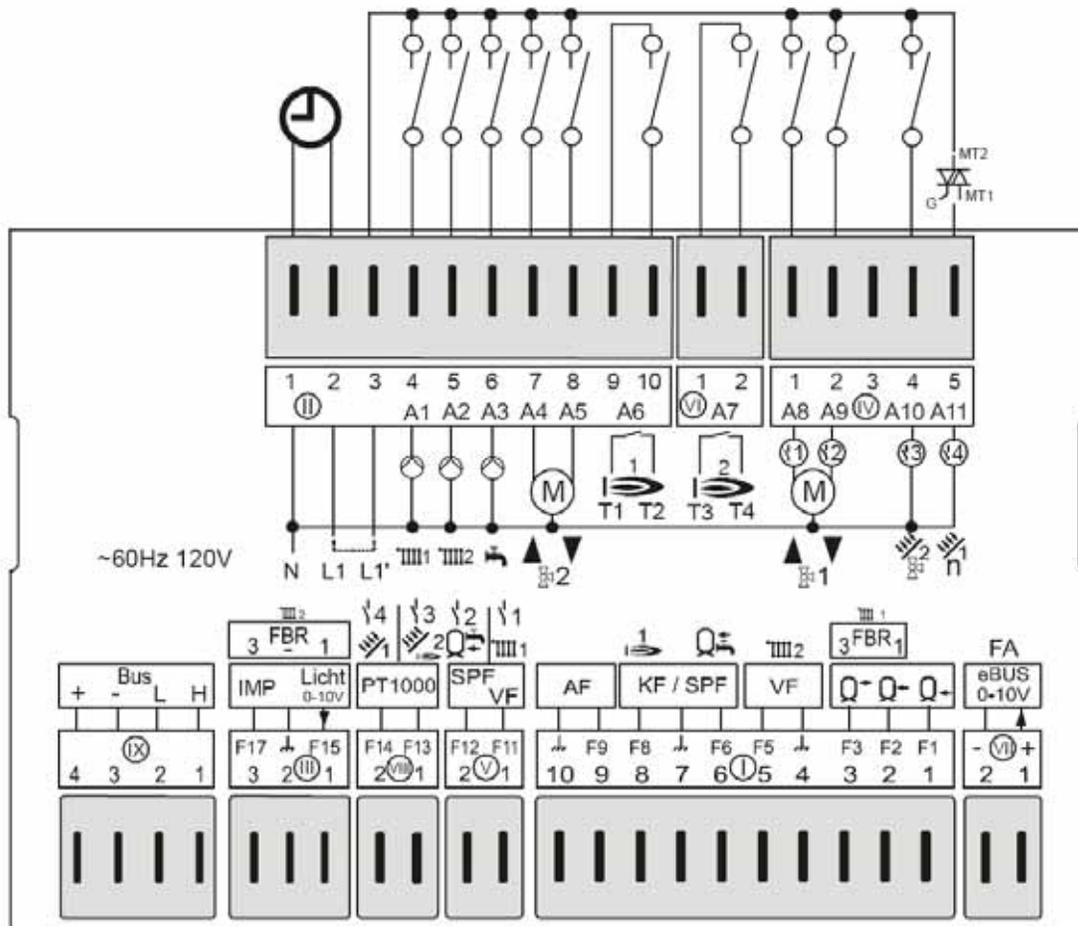
120V~; Relay switching capacity 2(2)A, 250V~

Terminal assignment

Sensors

VII (1+2):   Ebus (FA) or 0-10V output
I   (1,2,3+M): F1/F2/F3 = buffer storage tank low/middle/top
I   (2+3+M): FBR2 (FBR1) for heating circuit 1
I   (2+M):   F2 = Room sensor for heating circuit 1
I   (4+5):   F5 = Flow sensor heating circuit 2
I   (6+7):   F6 = Storage tank sensor
I   (7+8):   F8 = Boiler sensor/header sensor
I   (9+10):   F9 = Outdoor sensor
V   (1+M):   F11 = Flow sensor heating circuit 1/Multifunction relay sensor 1
V   (2+M):   F12 = Hot-water tank low/Multifunction relay sensor 2
VIII (1+M):   F13 = PT1000 => HS2/collector 2/Multifunction relay sensor 3
VIII (2+M):   F14 = PT1000 => Collector 1/Multifunction relay sensor 4
III (1-3):   FBR2 (FBR1) for heating circuit 2
III (1+2):   F15 = 0-10V input/light sensor/Room sensor for heating circuit 2
III (2+3):   F17 = Pulse counter for output measurement
IX (1+2):   Data line CAN bus
IX (3+4):   Power supply CAN bus

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Mains

II	(1):	Neutral conductor, mains
II	(2):	Power supply, unit
II	(3):	Power supply, relay
II	(4):	A1 = Secondary Pump, heating circuit 1
II	(5):	A2 = Secondary Pump, heating circuit 2
II	(6):	A3 = Cylinder charging pump
II	(7):	A4 = Mixer motor heating circuit 2 on
II	(8):	A5 = Mixer motor heating circuit 2 to
II	(9+10):	A6 = Burner stage 1/HS 1
VI	(1+2):	A7 = Burner stage 2/HS 2/Solid fuel
IV	(1):	A8 = Mixer motor heating circuit 1 on/Multifunction relay ⌄ 1
IV	(2):	A9 = Mixer motor heating circuit 1 to/Multifunction relay ⌄ 2
IV	(3):	A10 = Primary Pump, Collector pump 2/Switching valve to solar tank 2/Multifunction relay ⌄ 3
IV	(4):	A11 = Collector pump 1 (speed controlled) multifunction relay ⌄ 4

Power terminal assignments

Plug 2 [II]

N: Neutral conductor, mains
L1: Power supply, unit
L1´: Power supply to relay
▥ 1: heating circuit pump HC 1
▥ 2: heating circuit pump HC 2
⊟: Storage tank charging pump
⊠: Mixer open, heating circuit 2
⊠: Mixer closed, heating circuit 2
⊳: Burner stage 1
⊳: Burner stage 1

Plug 6 [VI]

⊳: Burner stage 2/HS2
⊳: Burner stage 2/HS2
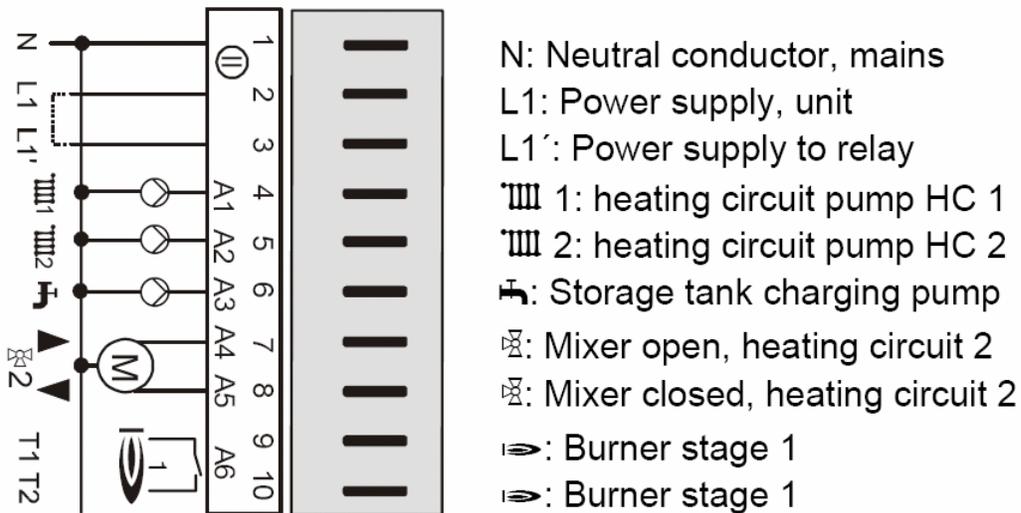
Plug 4 [IV]

IMPORTANT

THE PRIMARY PUMP (COLLECTOR PUMP 2) <u>MUST</u> BE WIRED TO RELAY A10.
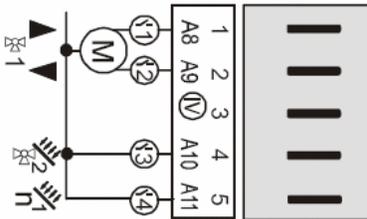
⊠: Mixer heating circuit 1 open / Multifunction relay ↓1
⊠: Mixer heating circuit 1 close / Multifunction relay ↓2

Collector pump 2/Switching valve / Multifunction relay ↓3
Collector pump 1(rpm)/Multifunction relay ↓4

Sensor terminal assignments

Connector 7 [VII]
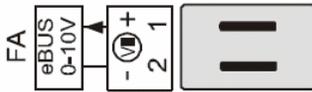
Pin 1: eBUS (FA) or 0-10V output
Pin 2: (Ground BUS / 0-10V)

Connector 1 [I]
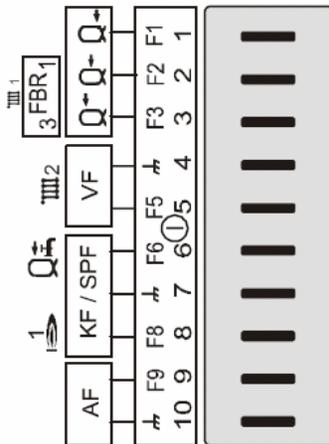
Pin 1: Buffer storage tank low sensor
Pin 2: Buf. stor. tank middle sensor / FBR heat. circ. 1 (room sensor)
Pin 3: Buf. stor. tank top, sensor / FBR heating circuit 1 (set value)

Pin 4: Flow sensor, heating circuit 2 (ground)
Pin 5: Flow sensor, heating circuit 2

Pin 6: Waste water sensor
Pin 7: Waste water and boiler sensor (ground)
Pin 8: Boiler sensor

Pin 9: Outdoor sensor
Pin 10: Outdoor sensor (ground)

Connector 5 [V]

Pin 1: Flow sensor heating circuit 1 / sensor multifunction 1
Pin 2: Service water low sensor / sensor multifunction 2

Connector 8 [VIII] => **PT 1000 sensor**
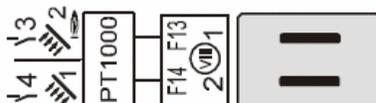
Pin 1: Sensor HS2 / Solar 2 / Multifunction relay 3
Pin 2: Sensor Solar 1 / Sensor multifunction relay 4

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Connector 3 [III]
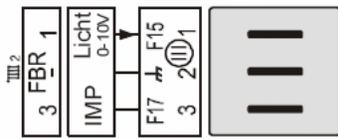
Pin 1: FBR heating circuit 2 (room sensor) / 0-10V IN / Light
Pin 2: FBR heating circuit 2 (ground)
Pin 3: FBR heating circuit 2 (set value) / Pulse counter for output measurement

Connector 9 [IX]
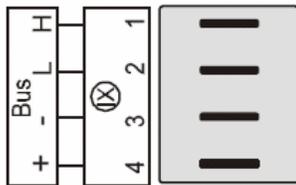
CAN Bus Pin 1 = H (Data)
CAN Bus Pin 2 = L (Data)
CAN Bus Pin 3 = - (ground, Gnd)
CAN Bus Pin 4 = + (12V supply)

6. E8 CONTROLLER FAILURE CODES

The Failure Codes that may appear in the Controller display during operation of the Modulex Boiler are described in paragraph 6.1. In addition, paragraph 6.2 provides the procedure to be followed to clear a displayed failure code after the cause of the failure has been corrected.

6.1 FAILURE CODES AND DESCRIPTIONS

Failure codes are divided into four basic categories: PCB Element Failures, System Manager Failures, Communication Errors and Internal Errors. These codes are listed and described in Table 6-1.

Table 6-1. E8 Controller Failure Codes

FAILURE CODE	FAILURE DESCRIPTION
Failure – PCB Element	
E 1	High limit thermostat
E 2	Supplier low gas pressure
E 4	Flame absence during ignition time
E 5	Flame absence during operation time
E 6	High temperature of element (> 203°F)
E 8	Low water pressure (only with SensorLogic)
E 10	Local PCB failure
E 11	Flame presence before ignition cycle
E 12	Local flow sensor failure
E 13	Auxiliary sensor failure (DHW)
E 14	Global return sensor failure
E 15	Difference between global return sensor and local flow sensor > di 86°F (rp +10)
E 16	Low temperature: risk of freeze
E 20	Flame present after burner switching off
E 22	Air pressure switch does not commute within 30 sec. in the ignition cycle
E 23	Air pressure switch always active
E 24	Fan out of control: doesn't achieve correct speed within 30 sec. of ignition cycle start
E 26	Fan out of control: do not stop within 30 sec. from the stop of the burner
E 27	Air pressure switch detect a technical fault during the ignition time
E 30	Parameters setting alteration
E 32	Electrical supplier < 108 Vac
E 40	Low system flow rate (only with SensorLogic)
E 41	Presence of air in the pump (only with SensorLogic)
E 42	Pump blocked (only with SensorLogic)
E 43	Pump wire failure (only with SensorLogic)
Failure – System Manager – Sensor Defective (break/short circuit)	
E 69	E8: F5 – flow sensor HC2
E 70	E8: F11 – flow sensor HC1
E 71	E8: F1 – buffer storage tank low sensor
E 72	E8: F3 – buffer storage tank top sensor
E 75	E8: F9 – outdoor sensor
E 76	E8: F6 – storage tank sensor
E 78	E8: F8 – boiler sensor
E 80	E8: F2 – room sensor HC1
E 83	E8: F15 – room sensor HC2
E 135	F12: HW Storage Tank Low Sensor, Multi-Function 2
E 136	F13: (PT1000): HS2, Collector 2, Multi-Function 3
E 137	F14: (PT1000): Collector 1, Multi-Function 4
E 138	F15 – room temperature HC2

MODULEX CONTROLLER OPERATION

Table 6-1. E8 Controller Failure Codes – Continued

FAILURE CODE	FAILURE DESCRIPTION
Communication Error	
E 90	E8: Address 0 and 1 on BUS. IDs BUS 0 and 1 may not bee used simultaneously
E 91	E8: BUS ID used. The set BUS ID is already in use by another device
E 99	E8: Internal failure
E 200	Communication Error HS1
E 201	Communication Error HS1
E 202	Communication Error HS1
E 203	Communication Error HS1
E 204	Communication Error HS1
E 205	Communication Error HS1
E 206	Communication Error HS1
E 207	Communication Error HS1
Internal Error	
E 81	E8: EEPROM error. The invalid value has been replaced with default value (Check parameter values)

6.2 PROCESSING & CLEARING FAILURE CODES

When a failure occurs, the appropriate failure code will be displayed along with a "Flashing Triangle". To process and clear the failure, proceed as follows:

NOTE

If the cause of the failure has not been corrected, the displayed Failure Code will reappear after performing the following steps.

1. Open the hinged cover on the Controller (see Figure 2-2).

2. Press the Program Key. The red LED will light. Also the display will show the failure code and the number of the suspect module.

3. Correct the cause of the failure.

4. Press the Program Key again. The red LED will go off and the Failure Code will clear.

5. If more than one failure (or more than 1 failed module) exists, repeat the above steps until all failure codes are cleared.

6. Close the hinged cover on the Controller.

7. Monitor the display to ensure no other Failure Codes appear.

8. Resume normal operation after all failures have been cleared.

7. BOILER COMMUNICATIONS MODULE (BCM)

When installed and enabled, the BCM enhances the range of control functions offered by the Modulex Boilers. These additional control functions include the following:

- BCM provides a fault relay which energizes when any fault condition occurs in the Modulex Boiler.
- BCM serves as a Back-up Controller in the event that the primary E8 Controller fails.
- BCM can be selected as the Primary Controller instead of the E8.
- BCM can function as a "Slave" to a "Master" Energy Management System (EMS), Building Automation System (BAS) or AERCO's Boiler Management System II (BMS II) on a Modbus Network.

Paragraphs 7.1 through 7.7 which follow provide detailed descriptions of the BCM and each of the additional control functions listed above.

7.1 BOILER COMMUNICATIONS MODULE (BCM) DESCRIPTION

The BCM shown in Figure 7-1 is housed in a compact enclosure measuring 4.13" (105 mm) x 3.50" (89 mm). The BCM is installed on the front of the Modulex Boiler, behind the removable front panel.
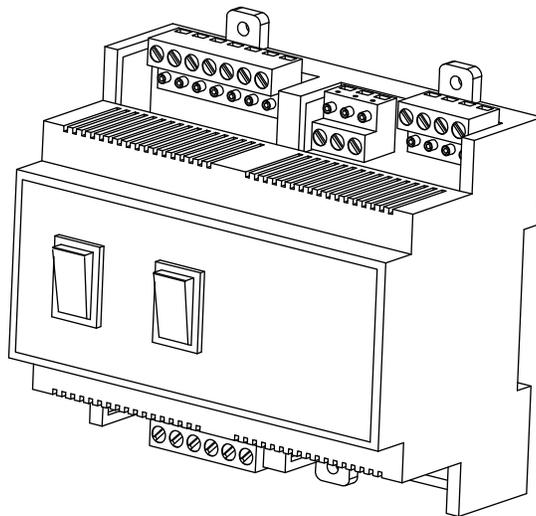
Figure 7-1. Boiler Communications Module (BCM)

Input/Output (I/O) connections to the BCM are made via four connectors mounted on the Printed Circuit Board (PCB) of the BCM. Two Control Switches are mounted on the clear plastic cover on the front of the BCM. Three LED Status Indicators are mounted directly on the BCM PCB and can be viewed through the clear plastic cover. In addition, the PCB contains an on-board, screwdriver-adjustable address switch. The control and indicator functions are illustrated and described in Figure 7-2.

If the Modulex Boiler was shipped with the BCM factory-installed, a third Control Switch is mounted above the BCM. This switch is used to enable/disable the e-Bus connection between the E8 and BCM Controllers. Refer to paragraph 7.4.3 for details.

MODULEX CONTROLLER OPERATION

FRONT VIEW
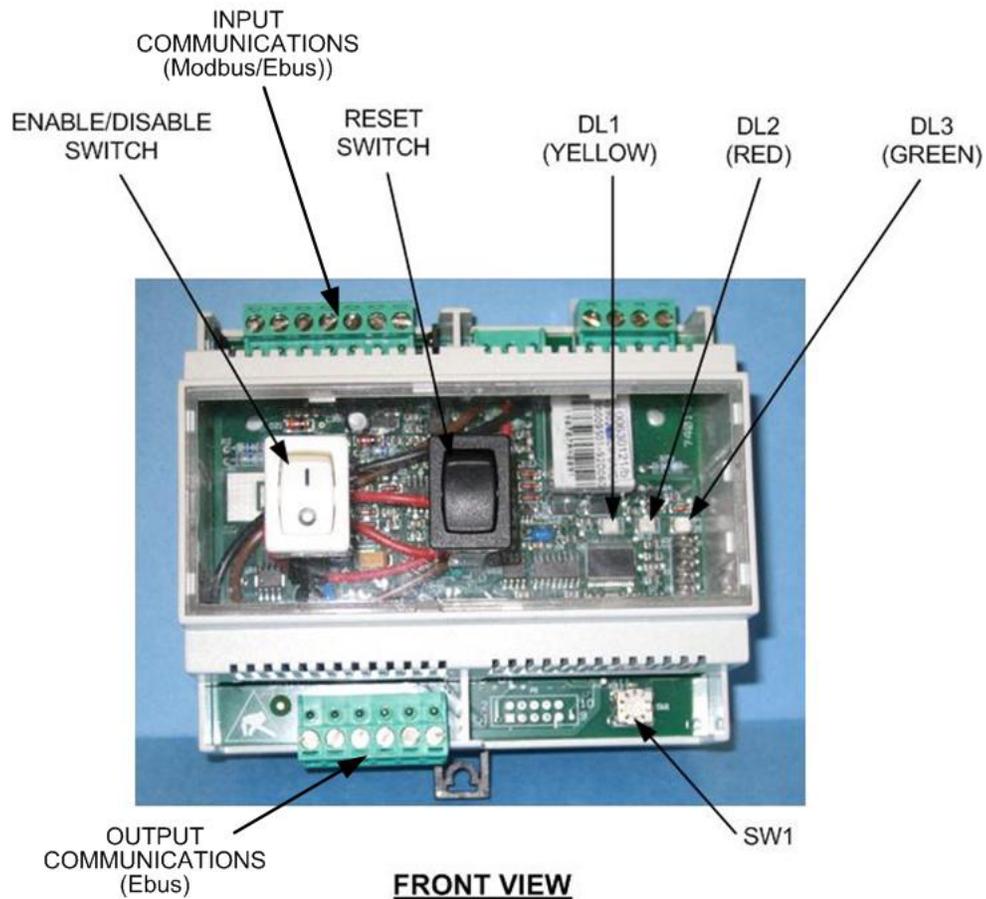
CONTROL/INDICATOR	FUNCTION
ENABLE/DISABLE SWITCH (I/0)	Two-position rocker switch enables the BCM to act as a Back-Up Controller when placed in the ON (I) position.
RESET SWITCH	Momentary two-position rocker switch resets (clears) fault relay and LED when activated.
DL1 (Yellow) LED	Communication Status Indicator functions as follows: DL1 STATUS DESCRIPTION OFF No devices detected by either communication interface BLINKING Only one communication device detected at one communication interface (input or output) ON Both communication interfaces (input & output) are active
DL2 (Red) LED	Alarm Status LED lights when a fault is detected by the BCM. Activating the Reset Switch will clear the faults
DL3 (Green) LED	Pump Status Indicator lights when Pump is running.
SW1	Screwdriver-adjustable rotary switch labeled 0 – 9. This switch is used to set the corresponding address of the Modulex Boiler on the input Modbus or Ebus Network.

Figure 7-2. BCM Controls and Indicators

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7.2 BCM FAULT RELAY

The BCM Fault Relay is activated (energized) when a fault condition occurs in the Modulex Boiler. When activated, the Fault Relay provides contact closure across pins 3 and 4 of connector Y4 on the BCM board. In addition, the red LED on the BCM board will light continuously.

7.2.1 BCM Fault Relay Wiring

If desired, pins 3 and 4 of connector Y4 (Figure 7-3) can be wired to an external source to provide a remote alarm indication when the BCM Fault Relay is activated.

7.2.2 Clearing Faults

A fault can be cleared by pressing and releasing the black Reset Switch on the front cover of the BCM. However, if the cause of the fault has not been corrected, the Fault Relay will again be activated.
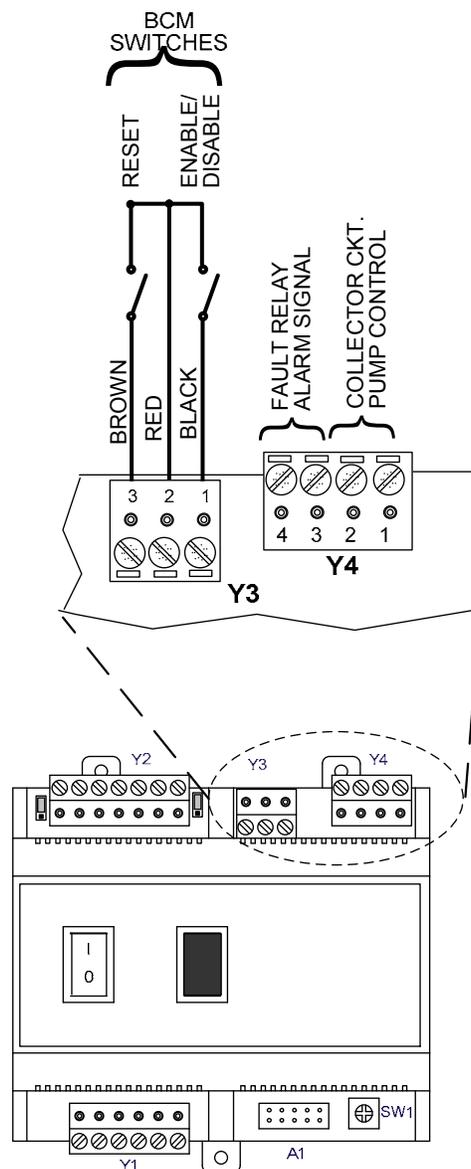
Figure 7-3. BCM Fault Relay & Reset Switch Wiring

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MODULEX CONTROLLER OPERATION

7.3 BCM CONFIGURED AS BACK-UP CONTROLLER

When the BCM is configured as the Back-Up Controller for the E8, it will assume control of the Modulex Boiler if the E8 fails. In the event of an E8 Controller failure, the BCM will operate the Modulex Boiler in the Constant Setpoint Mode (default setpoint = 180°F [82°C]). The primary Boiler Pump must also be wired to the BCM so it will run when the BCM assumes control in the Back-Up Mode.

If a setpoint temperature lower than 180°F is desired, the setpoint can be changed prior to boiler start-up. Refer to paragraph 7.3.1 for details.

7.3.1 BCM Back-Up Controller Wiring

The Primary Boiler Pump must be wired to BCM Connector Y4 as shown in Figure 7-4. Also, if a Constant Setpoint temperature lower than the default setting of 180°F (82°C) is desired in the event of an E8 failure, the appropriate resistor must be connected across terminals 6 and 7 of BCM Connector Y2 as shown in Figure 7-5.
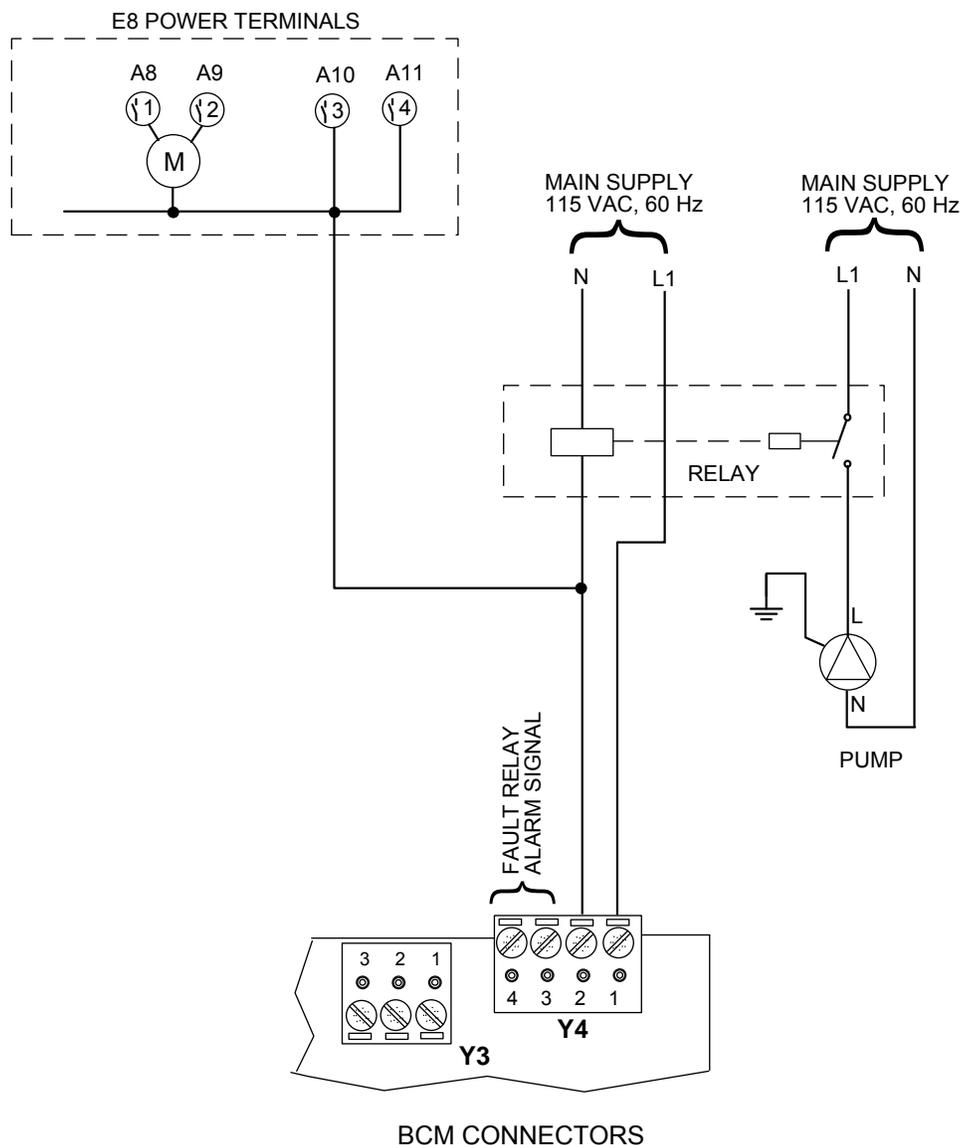
Figure 7-4. BCM Back-Up Controller Wiring

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RESISTOR	SETPOINT
OPEN	180°F
100K OHMS	160°F
47K OHMS	140°F
22K OHMS	120°F
10K OHMS	100°F
SHORT	80°F
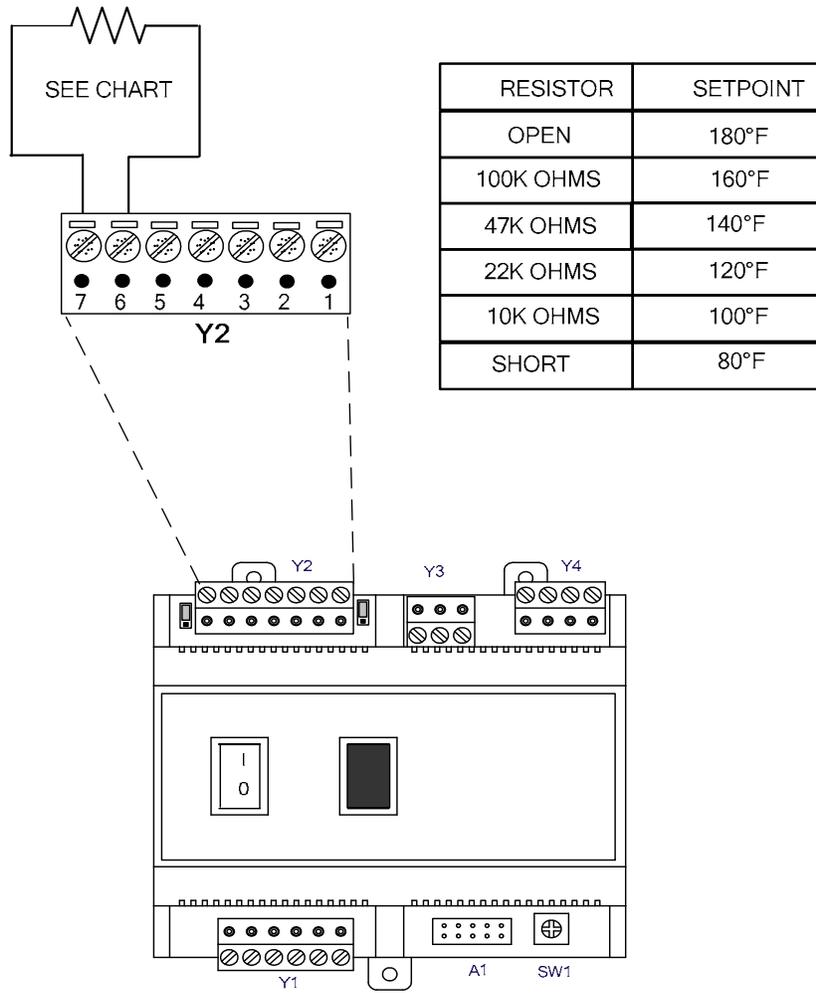
Figure 7-5. Installing Resistor to Change Default Setpoint

MODULEX CONTROLLER OPERATION

7.4 BCM CONFIGURED AS PRIMARY CONTROLLER UTILIZING MODBUS

The BCM can be configured as the Primary Controller, instead of the E8, when it is connected to a Modbus Network. However, the E8 must be disconnected from the e-Bus connection on the BCM Board (see para. 7.4.3). All Modbus Networks are implemented utilizing a "Master – Slave" scenario where only one device, the "Master", can initiate a communication sequence. However, BCMs can only function as "Slave" devices on a Modbus Network. Therefore, the BCM must be interfaced to an external controlling "Master". The "Master" can be AERCO's Boiler Management System II (BMS II) or an Energy Management System (EMS)/Building Automation System (BAS) developed by other manufacturers.

The following subordinate paragraphs provide descriptions of Modbus Network operation and required wiring connections between the BCM "Slaves and the controlling "Master" (EMS, BAS).

Detailed information on the Modbus Function Codes, Input/Holding Register Assignments and other Modbus requirements supported by the BCM are provided in Appendix B of this document.

7.4.1 Operating Scenario

Each Modulex Boiler must be equipped with its own BCM to allow Modbus Network monitoring and control. The Master can control the Networked Modulex Boilers utilizing either Remote Setpoint or Modulation Level (Direct Drive) signaling.

In the event that the external control signal from the Master BMS II, EMS or BAS is lost, the BCM will assume control of the Modulex Boilers if enabled. When this occurs, the BCM will maintain the boiler at a constant setpoint based on the resistor installed between terminals 6 and 7 of connector Y2 (see Figure 7-5). In addition, the BCM Fault Relay will be activated and the red Fault LED (DL2) will light.

7.4.2 Physical Modbus RS485 Wiring

Modbus RS485 devices should be wired in a "Daisy-Chain" configuration similar to the example shown Figure 7-6. DO NOT wire the units in a "Star" configuration where all devices are connected to a central point (node).
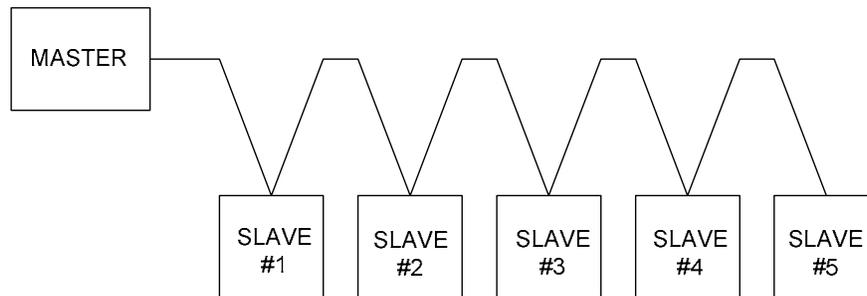
Figure 7-6. Typical Daisy-Chain Modbus/RS485 Network

The physical wiring connections for a Modbus Network should be made using shielded twisted-pair wire, from 18 to 24 AWG. Examples of suitable wire are: Belden # 9841, #8761, #3105A, or equivalent.

Modbus wiring connections are made at terminals 1 and 2 of BCM connector Y2 as shown in Figure 7-7.
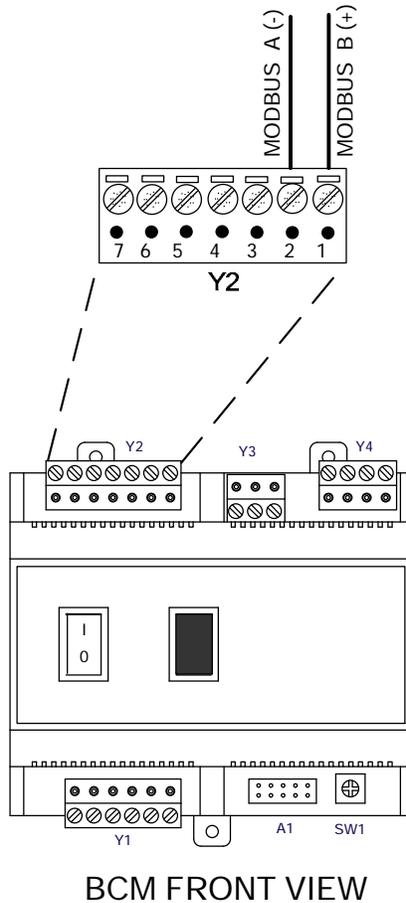
Figure 7-7. BCM Modbus (RS485) Connections

7.4.3 Disconnecting E8 from e-Bus on BCM Board.

If the BCM was retrofitted in the field utilizing Technical Service Bulletin 2007-07, refer to this bulletin and disconnect CBL 24 from Connector VII on the E8 Controller. However, if the Modulex Boiler was shipped with the BCM factory-installed, it will contain a 3-position switch mounted above the BCM (Figure 7-8). Refer to the switch matrix in Table 7-1 for descriptions of how the factory-installed 3-position switch functions with respect to the 2-position ON/OFF switch on the BCM.

MODULEX CONTROLLER OPERATION

Table 7-1. 3-Position BCM Switch Functions

BCM 2 Postion ON/OFF Switch	BCM 3 Position Switch (Equivalent Terminal in Modulex Wiring Diagram)		
	I (1b) (See NOTE 1 Below)	O (0) (See NOTE 2 Below)	II (1a) (See NOTE 3 Below)
O (OFF)	DO NOT USE	The BCM is the Gateway for Modbus and external control. The E8 does not control the boiler and the BCM **will not** take over the boiler if the Modbus signal fails.	The E8 is the primary controller and the BCM will allow monitoring through Modbus but **will not** take over boiler if the E8 fails.
I (ON)	DO NOT USE	The BCM is the Gateway for Modbus and external control. The E8 does not control the boiler and the BCM **will** take over the boiler if the Modbus signal fails.	The E8 is the primary controller and the BCM will allow monitoring but the BCM **will** take over running the boiler if the E8 fails

NOTES:

1. <u>DO NOT</u> set the 3-Position Switch to Position **I**.

2. Set the 3-Position Switch to Position **O** ONLY when controlling Boilers from an external Controller via Modbus Communication.

3. Position **II** is the <u>Default</u> position for the 3-Position Switch. Ensure it is set to this position when it arrives from the Factory
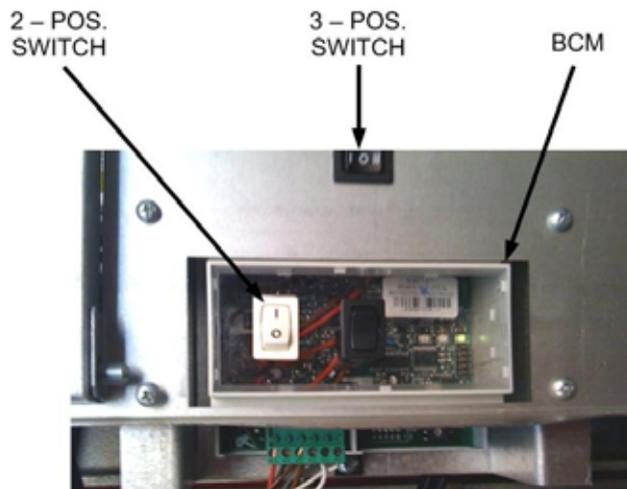
Figure 7-8. Location of 2-Position and 3-Position Switches

7.4.4 AERCO BMS II Master to BCM Slave Wiring Connections.

The AERCO BMS II contains a RS232 port for connection to an EMS/BAS or personal computer. In addition, the BMS II contains a RS485 port for connection to the BCM's Modbus input.

7.4.5 EMS or BAS Master to BCM Slave Wiring Connections

When a third-party EMS or BAS Master is used, the Modbus Network connections will depend on the available communication port(s) on the EMS/BAS. Many EMS/BAS Models contain only a RS232 (DB9) port, while others contain either a 2-Wire or 4-Wire RS485 port. In addition, some EMS/BAS models contain both a RS232 and a RS485 port. If the EMS or BAS is equipped with only a RS232 port, a RS232-to-RS485 converter will be required (such as a B&B Electronics, Model 485SD9TD or AERCO Part No. 124943).

7.5   RS485 LOOP TERMINATION RESISTORS AND BIAS

A terminating resistor (120 ohms) on each end of the RS485 loop is designed to match the electrical impedance characteristic of the twisted-pair loop and prevent echoes or cross-talk from corrupting data on the line.   Short or medium length Modbus/RS485 loops (less than 1000 feet) can usually operate satisfactorily without the terminating resistor.   However, longer loop runs (over 1000 feet), may require terminating resistors.

Bias may be necessary on the RS485 loop to minimize noise on the circuit. Loop bias is accomplished by activating pull-up/pull-down resistors on the last Boiler Communications Module (BCM) in the chain.

AERCO recommends that both terminating resistors and bias be implemented on the RS485 circuit as described in paragraphs 7.5.1 and 7.5.2 which follow.

7.5.1 Master AERCO BMS II or EMS/BAS Terminating Resistor and Bias

All AERCO BMS II units are equipped with a built-in terminating resistor. Therefore, when the BMS II is the controlling Master, no terminating resistor needs to be added. In addition, the BMS II contains two Bias DIP switches which must be activated when the BMS II is the controlling Master. Refer to BMS II Manual GF-124,paragraph 2.6 and Figure 2-6 for additional information on these switches.

When a third-party EMS or BAS is used as the controlling Master, consult the manufacturer's Technical Manual for termination resistor recommendations. If the EMS/BAS being used does not provide a bias and one is needed, pull-down bias can be implemented by installing a 1K ohm resistor (not provided) across terminals 2 and 4 on BCM connector Y2 (Figure 7-9).

7.5.2 BCM Controller Terminating Resistor and Bias

BCMs can function only as Slave devices on a Modbus Network. Since the Slaves are connected in a "Daisy-Chain" configuration, the terminating resistor must be enabled only in the last BCM Controller in the chain. Enabling the terminating resistor is accomplished by positioning jumper JP1 as shown in Figure 7-9 only on the BCM Board contained in the last BCM Controller.

As mentioned in paragraph 7.5.1, when the controlling Master is an EMS or BAS, pull-down bias may be implemented by connecting a 1K ohm resistor as shown in Figure 7-9. DO NOT install this bias resistor if the controlling Master is an AERCO BMS II. Bias will be provided by the BMS II DIP switches. The last unit in the chain must be energized (even if disabled) to enable bias.

MODULEX CONTROLLER OPERATION
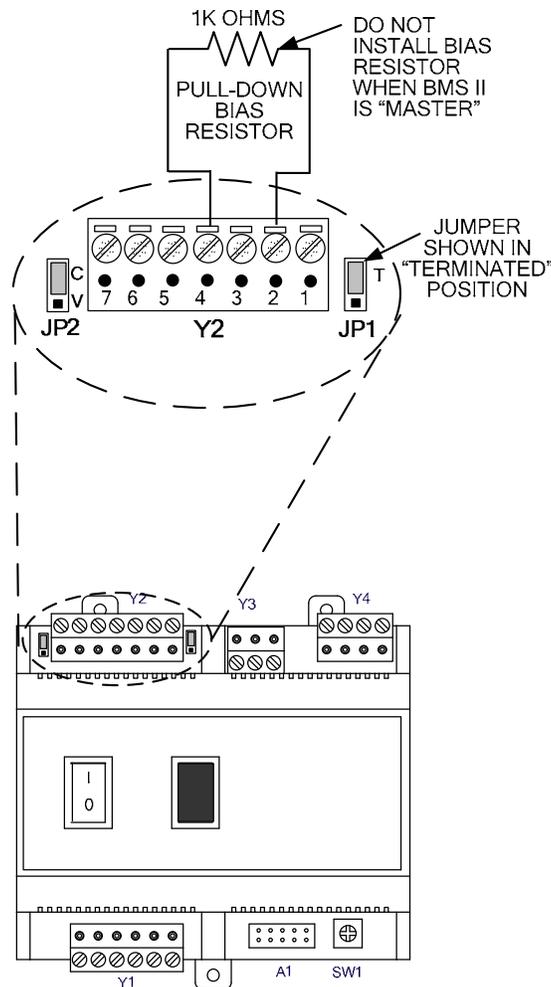
BCM FRONT VIEW

Figure 7-9. BCM Loop Termination and Bias

7.6   MODBUS NETWORK WIRING DIAGRAM

A "Sample" Modbus Network wiring diagram for an AERCO BMS II Master controlling BCM Slaves is shown in Figure 7-10. Activate the terminating resistor in the last BCM on the daisy-chain loop. DO NOT install the 1K bias resistor. Instead, activate the two bias DIP switches in the BMS II. Refer to GF-124, Figure 2-6 for the location of these switches.

Figure 7-11 shows a Sample Modbus Network wiring diagram for a Master EMS/BAS controlling BCM Controller Slaves. This Figure shows an EMS or BAS Master equipped with a RS485 port. If the EMS or BAS contains a 4-Wire RS485 port, refer to Detail "A" for wiring details. If the controlling Master EMS/BAS contains only a RS232 port, a RS232-to-RS485 converter will be required to interface with connector Y2 at each BCM Controller. It should be noted that this diagram is only intended as a guide and does not include all possible scenarios. Refer to the EMS/BAS manufacturer's manual prior to attempting any network wiring connections.

CAUTION

It is imperative that polarity be maintained between all Modbus Network connections. The Network will not operate if the proper polarity is not maintained. Also, twisted-pair wiring shields should only be terminated at the controlling Master for the Modbus Network.
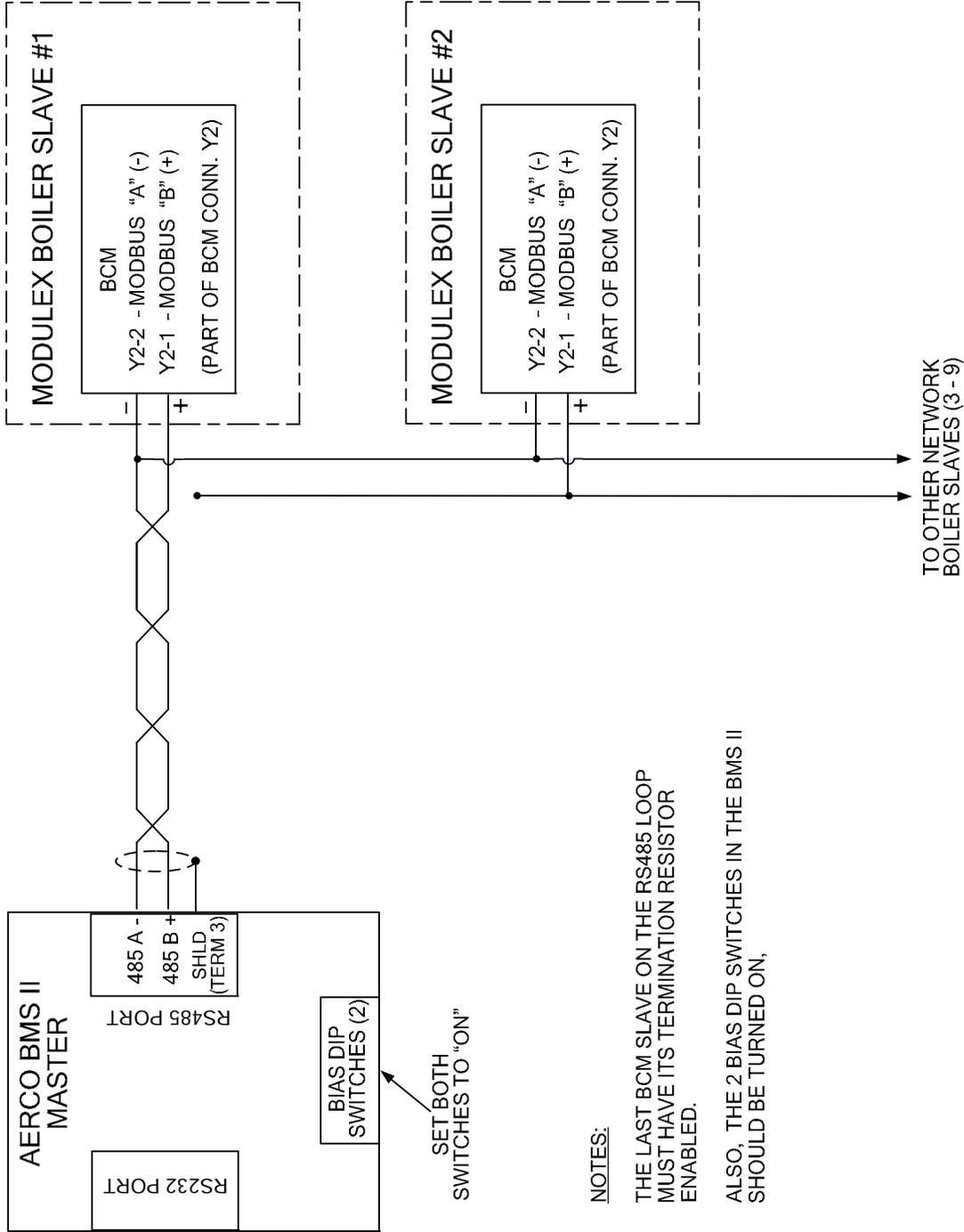
Figure 7-10. AERCO BMS II Master Controlling Modulex Boiler Slaves

MODULEX CONTROLLER OPERATION

NOTES:

1. IF EMS MASTER CONTAINS A 4-WIRE RS485 PORT, TIE THE TWO POSITIVE (+) AND NEGATIVE (-) LEADS TOGETHER AS SHOWN IN DETAIL "A".

2. IF EMS MASTER CONTAINS ONLY A RS232 PORT, A RS232-TO-RS485 CONVERTER WILL BE REQUIRED.

3. THE LAST BCM SLAVE ON THE RS485 LOOP MUST HAVE ITS TERMINATION RESISTOR ENABLED. ALSO, A 1K OHM BIAS RESISTOR MAY BE REQUIRED. CHECK WITH THE EMS MANUFACTURER.
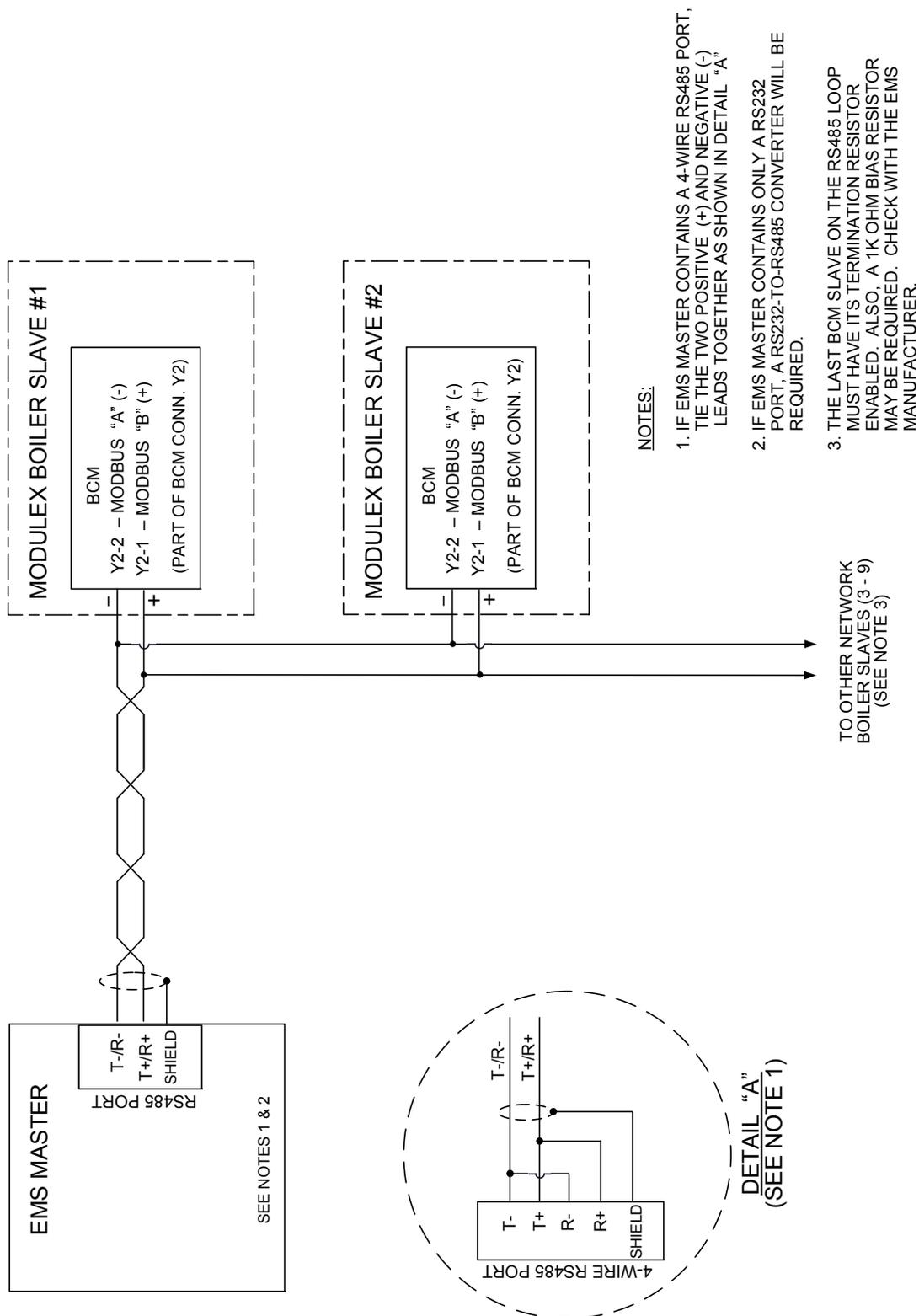
Figure 7-11. EMS/BAS Master Controlling Modulex Boiler Slaves

7.7 MODBUS SOFTWARE SET-UP

The following paragraphs provide the information and procedures necessary to configure the Boiler Communications Modules (BCMs) to operate on a Modbus Network.

NOTE

The following paragraphs assume that between 1 and 9 Modulex Boilers are being controlled on the Modbus Network.

7.7.1 BCM Set-Up for Modbus Operation

The BCM Controller can be set up for the following types of Modbus operating modes:

- Monitoring and Configuration Only
- Modbus Direct Drive Control and Monitoring
- Modbus Remote Setpoint Control and Monitoring

In order for the BCM Controller to be recognized by the Modbus Master, a valid address must be set at each BCM on the Modbus Network. Address selection on each BCM is accomplished by setting rotary DIP switch SW1. This switch is located in the lower right portion of each BCM as shown in Figure 7-12.

As Figure 7-12 shows, SW1 is a 10-position switch labeled 0 – 9. SW1 is set to the desired position using a small flat-tip screwdriver. Figure 7-12 shows SW1 set to address 0 (zero) which disables the BCM on the Modbus Network. Only Modbus addresses 1 through 9 will be recognized by the Modbus Master. SW1 must be set to a different position for each Modulex Boiler being controlled on the Modbus Network.

Once the desired address has been set on each BCM, the Modulex Boiler is configured for Modbus Network control by the controlling Master EMS/BAS or AERCO BMS II. In order for the BCM to act as the Back-Up Controller if the Modbus Master signal is lost, the ENABLE/DISABLE switch must be set to ENABLE (1).

See Appendix B and GF-124 for Modbus points for the BCM and BMS II.
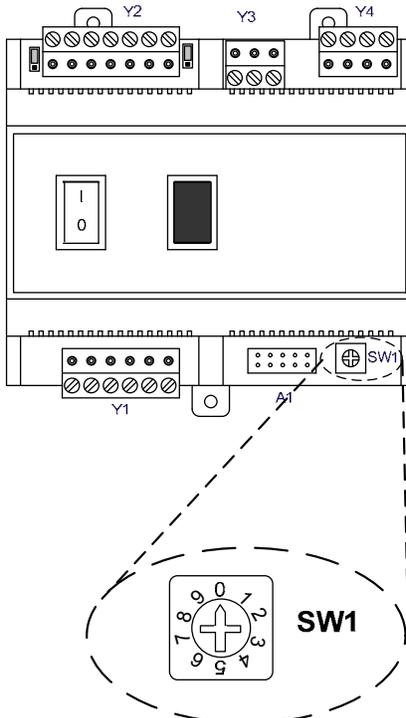
Figure 7-12. Location of BCM Address Selection Switch SW1

MODULEX CONTROLLER OPERATION

7.7.2 Monitoring and Configuration Only

For monitoring and configuration only, set the 3-position switch to position II when the E8 is controlling the boiler. The boiler operation can be monitored via the Modbus terminals.

7.7.3 Modbus Direrct Drive Control and Monitoring

The BCM's modulation output can be directly driven by writing to its Direct Drive register (Standard Holding Register or Control Register #1). It will ramp up the boiler based on the settings in the Standard Holding Register or Setting Register 3000 to 3015. The default maximum setpoint temperature limit is 180°F as shown in register 3015. This value should not be increased, if possible. The default timeout interval is 30 seconds as shown in register 3011. To prevent communication dropouts, write the direct drive modulation value at least 3 times within the communication timeout interval.

7.7.4 Modbus Remote Setpoint Control and Monitoring

To send a setpoint temperature to the BCM and have it control the boiler based on its internal settings, 3 registers need to be adjusted:

1. the desired setpoint should be written to the Requested Setpoint (Address 1004)in the Standard holding Registers or Control Registers. This value should be written at least 3 times within the Communication Timeout time (Address 3011).

2. The Heat Request Command (Control Register Address 1021) should be set to 0xEE (238) to request heat.

3. If the modulation level should be allowed to go above 50%, adjust the Maximum Modulation Level setting (Address 1017).

NOTE

If power is lost, all Control Register settings return to their default values.
Be sure to read them regularly and refresh if necessary. The changes to
the Settings Registers are stored during power-down.

7.7.5 EMS or BAS Set-Up As Master to BCM Controller Slaves

Refer to the set-up instructions in the manufacturer's equipment manual for the Energy Management System (EMS) or Building Automation System (BAS) being used as the controlling Master.

7.8 MULTIPLE MODULEX BOILER HEATING MODE – UTILIZING A BMS II

Multiple Modulex boiler plants are the ultimate energy conversion for building space heating. By modulating input at extremely high combustion efficiency, there is no wasted energy from overshoot. A multiple Modulex boiler plant offers inherent standby protection and ease of installation along with longevity.

In a multiple boiler plant of over two boilers, the use of an AERCO Boiler Management System II (BMS II) Model 5R5-384 is recommended for maximum efficiency and flexibility of operator control. The BMS II has the capability of controlling up to 32 boilers as well as auxiliary equipment. The BMS II system has an Internal Plant Start adjustment that can be set from 32°F to 100°F outdoor air temperature. When the boiler plant is activated, the system pump should be started simultaneously. This can be controlled from outside the BMS II, but boilers that fire with no flow will trip out on internal high temperature limit controls.

The following example briefly explains the operational sequence for a boiler plant consisting of multiple Modulex Boilers controlled by a BMS II:

Sequence of Operation (Example: Four-Modulex boiler installation)

When there is a need for heat, the BMS II will send a fire rate signal to the first boiler to begin firing. The Boiler Communications Module (BCM) of the first boiler will turn on one of its modules. When the BMS II fire rate signal to this boiler reaches a value twice that of the start level percentage (programmed by the user into the BMS II), the BMS II will call on the second boiler to begin firing one module, and the BMS II will then split the fire rate signal between the two boilers and send each a signal equal to the start level percentage. When the combined BMS II fire rate signal to the two boilers reaches a value three times that of the start level percentage, the BMS II will call on the third boiler to begin firing one module, and the BMS II will then split the fire rate signal between the three boilers and send each a signal equal to the start level percentage. As the demand increases, in a similar method as above, the BMS II will call on the BCM of the fourth boiler to turn on one module. At this point, the BMS II will modulate the fire rate signal to the boilers in a parallel manner, while the BCM of each boiler sequences the individual modules.

Boiler inputs will modulate down and come off line in response to the BMS II in a reverse manner. Whether the BMS II is set in a Constant Temperature or Modulating Temperature mode, it will use the modulating ability to prevent header temperature fluctuation and maximize efficiency. As well, the BMS II can stage auxiliary equipment such as combustion air dampers and fans. *Refer to BMS II Operations and Maintenance Manual GF-124 and Product Spec BMS-II for details.*

APPENDIX A

E8 CONTROLLER MENU LISTINGS

APPENDIX A

A-1. DISPLAY AREA

The DISPLAY area contains an Installation, Hot Water, Heating (HTG) Circuit 1 & 2 and a Solar Heating Sub-Menu. The sub-menu functions associated with each of these items are listed below:

NOTE

All DISPLAY area menus are READ ONLY and cannot be changed. Temperature readings are in °F.

DISPLAY MENU TABLE

FUNCTION	DESCRIPTION	REMARKS
INSTALLATION Sub-Menu		
T-OUTSIDE	Outside air temperature	Only if outside air sensor is installed.
T-EXT DES	External Set Point value specification (0-10V) Boiler Set Point setting in 0 to 10 volt input mode	A 0 to 10 volt external input signal can be used to preset a Set Point value for the control system.
T-COLL DES	Heat Source (HS) / Header Set Point value (cascade). Boiler Set Point temperature in Indoor/Outdoor Reset and Constant Set Point modes.	
T-COLLECTOR	HS / Header Set Point temperature (cascade)	
T-BOIL	Press Program Key to display temperature and ON/OFF status of individual Heat Modules (HS) which range from 2 (MLX-303) to 7 (MLX-1060). Turn Rotary Knob to sequence between Heat Modules.	
T-SOLID FUEL	For HS2 = Solid fuel boiler (A7)	Not Applicable
T-RETURN 1	Return flow temperature of HS 1	
T-RETURN 2	Return flow temperature of HS 2	
T-BUFFER T	Buffer storage tank temperature – top	Only if buffer storage installed
T-BUFFER M	Buffer storage tank temperature - mid charging zone HS	Only if buffer storage installed
T-BUFFER L	Buffer storage tank - low	Only if buffer storage installed
T-STORAGE 3	Temperature of storage tank 3 (e.g. solar pool-heating)	
MODGRAD	Modulation degree of HS (BUS)	
RETURN	Press Program Key to exit INSTALLATION Sub-Menu.	

DISPLAY MENU TABLE – Continued

FUNCTION	DESCRIPTION	REMARKS
HOT WATER Sub-Menu		
T-DHW RATED	DHW set point temperature	Based on heating program and operating mode. Actual DHW set point as set in the USER/HOT WATER menu.
T-DHW	Actual hot water temperature	Only if tank sensor is installed
T-DHW L	Temperature of HW tank in the lower section (inflow)	Not applicable
T-CIRCL	Return flow temperature of recirculation	Not applicable
RETURN	Press Program Key to exit the HOT WATER Sub-Menu.	
HTG CIRCUIT 1 Sub-Menu		
T-ROOM DES A	Programmed room temperature setting specified in currently selected heating program and operating (timer) mode	
T-ROOM	Current room air temperature.	Only if indoor sensor is connected
HUMIDITY	Room humidity (%).	Only if humidity sensor is installed and parameters set for heating circuit.
T-DHW RATED	Hot water set point temperature	Appear only if heating circuit is programmed as hot water circuit
T-DHW	Current hot water temperature	Same as above
T-FLOW RATED	Current flow set point temperature	
FLOW	Current flow temperature	
N-OPT-TIME	Previous time required to heat up with heat-up optimization activated	Not applicable
RETURN	Press Program Key to exit HTG CIRCUIT 1 Sub-Menu.	
HTG CIRCUIT 2 Sub-Menu		
	Functions for HTG (Heating) Circuit 2 are identical to HTG Circuit 1 Functions above.	

APPENDIX A

DISPLAY MENU TABLE – Continued

FUNCTION	DESCRIPTION	REMARKS
SOLAR M/F Sub-Menu		
T-MF1	Temperature Multi-Function Sensor 1 (=F11)	Currently not used
T-MF2	Temperature Multi-Function Sensor 2 (=F12)	Currently not used
T-MF3	Temperature Multi-Function Sensor 3 (=F13)	Currently not used
T-MF4	Temperature Multi-Function Sensor 4 (=F14)	Currently not used
T-COLLECTOR 1	Temperature Collector 1 (set point temperature)	Currently not used
T-DHW	Upper hot water temperature	Currently not used
T-DHW L	Hot water temperature in-feed	Currently not used
RETURN	Press Program Key to exit SOLAR M/F Sub-Menu.	

A-2. USER AREA

The USER area contains exactly the same main areas as the DISPLAY area. However, the USER area items are not "Read Only" and therefore can be changed if the desired values are not displayed.

USER MENU TABLE

FUNCTION	DESCRIPTION	ENTRY RANGE	DEFAULT
INSTALLATION Sub-Menu			
LANGUAGE	Selects display language.	12 different languages are available.	ENGLISH
CONTRAST	Adjusts display contrast	-20 to 20	00
DISPLAY SEL	Sets the day of the week or the sensor temperature (°F) to appear in the display when the swing-down panel is closed. Day: SUN – SAT T-OUTSIDE: Outside Temperature FLOW TEMP (1/2): Flow Temp. For Heating Circuit 1 or 2 supply water temperature. (Only if sensor is installed) T-DHW: Domestic Hot Water Temp T-BOILER; Heat Generator Temp. T-ROOM (1 / 2): Room Temp, Heating Circuit 1 or 2 (ONLY if Remote Control is connected)	See DESCRIPTION Column	- - - -
RETURN	Press Program Key to exit INSTALLATION Sub-Menu.		
HOT WATER Sub-Menu			
1X DHW	Enables storage tank for heating	00, 01 (OFF/ON)	00 = OFF
T-DHW 1, 2 or 3	Hot Water set point for enable time 1, 2, or 3	50°F – 158°F	140°F
BOB-VALUE	Currently Not Applicable	(N/A)	(N/A)
CIRCL-P-DHW	Circulation Pump for Domestic Hot Water	00, 01 (OFF/ON)	00 = OFF
RETURN	Press Program Key exit HOT WATER Sub-Menu.		

APPENDIX A

USER MENU TABLE – Continued

FUNCTION	DESCRIPTION	ENTRY RANGE	DEFAULT
HTG CIRCUIT 1 Sub-Menu			
MODE	Displays Timer Mode for Boiler	- - - -, Standby, Auto 1, Auto 2, Day, Night	- - - -
T-ROOM DES 1	Room temperature setting for first enable tiime.	41.0°F – 104.0°F	68.0° F
T-ROOM DES 2	Room temperature setting for second enable tiime.	41.0°F – 104.0°F	68.0° F
T-ROOM DES 3	Room temperature setting for third enable tiime.	41.0°F – 104.0°F	68.0° F
T-REDUCED	Reduced night-time room temperature setting.	41.0°F – 104.0°F	50.0° F
T-ABSENCE	Required room temperatures during holidays (vacations).	41.0°F – 104.0°F	59.0° F
T-LIMIT DAY	Applies during day-time heating periods	- - - -, -23.0°F–104.0°F	66.0°F
T-LIMIT N	Applies during reduced night-time periods.	- - - -, -23.0°F–104.0°F	50.0°F
HEATSLOPE	Indicate number of degrees that that the flow temperature changes if the outside temperature increases or decreases by 1°F.	0.00 – 3.00	1.20
OPTIM HEAT	Heating optimization	00, 01, 02	00
MAX OPT-TIME	Only active if OPTIM HEAT is set to 01 or 02.	0:00 – 3:00 [h]	2:00 [h]
ECONO OPTI	Reduction optimization	0:00 – 2:00 [h]	0:00 [h]
PC-ENABLE	Code Number for enabling access to heating circuit data from a Personal Computer.	0000 – 9999	0000
RETURN	Press Program Key to exit HTG CIRCUIT 1 (or 2) sub-menu.		
HTG CIRCUIT 2 Sub-Menu			
	Functions for HTG Circuit 2 are identical to HTG Circuit 1 Functions listed above.		
SOLAR M / F Sub-Menu (No Functions Currently In This Sub-Menu)			
RETURN	Pressing the Program Key with SOLAR M/F displayed will change display to RETURN. Press Program Key again to redisplay SOLAR M/F. Turning the Rotary Knob clockwise will advance thd display to the TIME PROGRAM Menu.		N/A

A-3. TIME PROGRAM AREA

All time-related functions can be set using the Time Program Menu and its associated Sub-Menus. The Sub-Menus and Functions in this area contain programs which set the ON and OFF times for the following devices using a 24-Hour clock format:

- Circulation (CIRCL) Pump
- Hot Water (HOTW) Charging Pump
- Heating (HTG) Circuits 1 & 2

The time programs for each device can be set for a single day, weekdays (Monday – Friday). Weekends (Saturday, Sunday) or for an entire week (Monday – Sunday). The available options are listed in the following Table.

TIME PROGRAM MENU TABLE

FUNCTION	DESCRIPTION	ENTRY RANGE	DEFAULT
CIRCL TIME Sub-Menu			
	The CIRCL (Circulation) Time Sub-Menu is used to set the ON-OFF times for Circulation Pump. Press the Program Key to enter this Sub-Menu and view or change ON-OFF times. The times can be set individually for each day of the week or they can be set in groups as listed in the options which follows:		
MONDAY	View or change the pump ON – OFF times for Monday. Press the Program Key to view current settings. Turn Rotary Knob to change displayed ON or OFF time if required. Press Program Key to store displayed ON or OFF time and sequence the display to the next function.	All ON and OFF times can be set in 15 minute increments from 00:00 – 24:00	ON: 5:00h OFF: 21:00h
TUESDAY	Same as previous except for Tuesday.	See prev.	See prev.
WEDNESDAY	Same as previous for Wednesday	See prev.	See prev.
THURSDAY	Same as previous for Thursday	See prev.	See prev.
FRIDAY	Same as previous for Friday	See prev.	See prev.
SATURDAY	Same as previous for Saturday	See prev.	See prev.
SUNDAY	Same as previous for Sunday	See prev.	See prev.
MO – FRI	Same as above for Monday – Friday	See prev.	See prev.
SA – SU	Same as previous for Saturday and Sunday	See prev.	ON: 6:00h OFF: 22:00h
MO – SU	Same as previous for Monday – Sunday	See prev.	ON: 6:00h OFF: 22:00h
RETURN	Press Program Key to exit CIRCL sub-menu		

APPENDIX A

TIME PROGRAM MENU TABLE – Continued

FUNCTION	DESCRIPTION	ENTRY RANGE	DEFAULT
HOTW – PROG Sub-Menu			
	The HOTW – PROG (Hot Water Program) Sub-Menu is used to set the ON-OFF times for the Hot Water Charging Pump. The procedures for viewing/changing ON-OFF times are identical to those previously described for the CIRCL TIME Sub-Menu, except they apply to the Hot Water Charging Pump. The days/day groups are also identical to the those shown in the CIRCL TIME Sub-Menu.		
MONDAY	View or change the pump ON – OFF times for Monday. Press the Program Key to view current settings. Turn Rotary Knob to change displayed ON or OFF time if required. Press Program Key to store displayed ON or OFF time and sequence the display to the next function.	All ON and OFF times can be set in 15 minute increments from 00:00 – 24:00	ON: 5:00h OFF: 21:00h
TUESDAY	Same as previous except for Tuesday.	See prev.	See prev.
WEDNESDAY	Same as previous for Wednesday	See prev.	See prev.
THURSDAY	Same as previous for Thursday	See prev.	See prev.
FRIDAY	Same as previous for Friday	See prev.	See prev.
SATURDAY	Same as previous for Saturday	See prev.	See prev.
SUNDAY	Same as previous for Sunday	See prev.	See prev.
MO – FRI	Same as above for Monday – Friday	See prev.	See prev.
SA – SU	Same as previous for Saturday and Sunday	See prev.	ON: 6:00h OFF: 22:00h
MO – SU	Same as previous for Monday – Sunday	See prev.	ON: 6:00h OFF: 22:00h
RETURN	Press Program Key to exit HOTW – PROG sub-menu.		

TIME PROGRAM MENU TABLE – Continued

FUNCTION	DESCRIPTION	ENTRY RANGE	DEFAULT
HTG – PROG 1 Sub-Menu			
	The HTG-PROG 1 (Heating Program 1) Sub-Menu is used to set the ON-OFF times for Heating Circuit 1 The procedures for viewing/changing ON-OFF times are identical to those previously described for the CIRCL TIME Sub-Menu, except they apply to the HTG PROGRAM 1. The days/day groups are also identical to the those shown in the CIRCL TIME Sub-Menu. The associated ON / OFF times are as shown In the **DEFAULT** column		
MONDAY	View or change the pump ON – OFF times for Monday. Press the Program Key to view current settings. Turn Rotary Knob to change displayed ON or OFF time if required. Press Program Key to store displayed ON or OFF time and sequence the display to the next function.	All ON and OFF times can be set in 15 minute increments from 00:00 – 24:00	ON: 6:00h OFF: 22:00h
TUESDAY	Same as previous except for Tuesday.	See prev.	See prev.
WEDNESDAY	Same as previous for Wednesday	See prev.	See prev.
THURSDAY	Same as previous for Thursday	See prev.	See prev.
FRIDAY	Same as previous for Friday	See prev.	See prev.
SATURDAY	Same as previous for Saturday	See prev.	See prev.
SUNDAY	Same as previous for Sunday	See prev.	See prev.
MO – FRI	Same as above for Monday – Friday	See prev.	See prev.
SA – SU	Same as previous for Saturday and Sunday	See prev.	See prev.
MO – SU	Same as previous for Monday – Sunday	See prev.	See prev.
RETURN	Press Program Key to exit HTG – PROG 1 sub-menu.		
HTG – PROG 2 Sub-Menu			
	Sub-Menu Functions, processing procedures, ranges and defaults are same as HTG PROG 1 above.		
RETURN	Press Program Key to exit HTG – PROG 2 sub-menu.		

APPENDIX A

A-4. EXPERT AREA

The EXPERT Menu area includes the same Sub-Menu areas as the USER Menu described in paragraph 3.5. However, in order to change any settings, the valid Code No. (password) must be entered.

Whenever "CODE NO." is displayed, it indicates that the valid password must be entered. This is accomplished by entering code 0000 (4 zeros) by pressing the Program Key 4 times.

As the following Table shows, the EXPERT Menu contains a large number of Functions, particularly in the INSTALLATION Sub-Menu.

EXPERT MENU TABLE

FUNCTION	DESCRIPTION	ENTRY RANGE	DEFAULT
INSTALLATION Sub-Menu			
CODE-NO	Permits entry of valid Code No.(0000)	0000 – 9999	0000
BUS ID HS	BUS ID HS **MUST** be set to - - - - (Default)	01 - 08	- - - -
BUS ID 1	The heating circuits are sequentially numbered starting with "01", heating circuit numbers must not be assigned twice	(00), 01 - 15	01
BUS ID 2	The heating circuits are sequentially numbered starting with "01", heating circuit numbers must not be assigned twice	(00), 01 - 15	- - - -
AF SUPPLY	Outdoor sensor power supply	00, 01 (OFF/ON)	01 (ON)
BUS TERM	Bus terminating resistor (Must be set to 01)	00, 01 (OFF/ON)	01 (ON)
EBUS SUPPLY	Switches the eBUS supply ON/OFF	00, 01 (OFF/ON)	01 (ON)
TIME MASTER	When set to 00, it indicates there is no time master. When set to 01 the Controller is the time master. <u>LEAVE SET TO 00</u>.	00, 01	00 (N/A)
MAX T-COLL	Sets the maximum allowable header set point temperature.	86.0°F – 230.0°F	185.0°F
MIN T-COLL	Sets the minimum allowable header set point temperature.	50.0°F – 176.0°F	50.0°F
MAX T-HS2	Sets the maximum allowable HS2 (Heat Source 2) set point temperature (Not Applicable)	86.0°F – 230.0°F (N/A)	185.0°F (N/A)
MIN T-HS2	Sets the minimum allowable HS2 set point temperature.	50.0°F – 176.0°F	104.0°F
V-CURVE	0 to 10 Volt input Voltage curves. Choose from preset curves (see para. 3.5.1) or customize a curve.	00 - 11	11
CURVE 11-U1	Low voltage setting	0.00V – 10.00V	0.000
CURVE 11-U2	High voltage setting	0.00V – 10.00V	10.00
CURVE 11-T1	Low temperature level setting (Min. set point temperature)	32.0°F – 248.0°F	59.0°F
CURVE 11-T2	High temperature level setting (Max. set point temperature)	32.0°F – 248.0°F	185.0°F
CURVE 11-UO	Stop/Start voltage level. Going below/above this setting will stop/start the Boiler.	0.00V – 10.00V	1.00

EXPERT MENU TABLE - Continued

FUNCTION	DESCRIPTION	ENTRY RANGE	DEFAULT
INSTALLATION Sub-Menu - Continued			
HYSTERESIS	Dynamic Switching hysteresis stage 1. (Not Applicable)	5K - 20K (N/A)	5.0K (N/A)
FOUND MODULS	Display of heat generators automatically reported via BUS with BUS ID. Displays the number of heat modules available for service.	display	
CAP/MODULE	After restarting, the Controller, searches the bus systems for available new heat modules and the maximum kW output of each heat module.	00 - 1000 kW	40 kW
NEW CONFIG	If the BUS configuration was modified, the automatic search for generators on the BUS may be activated here. (Currently Not Applicable)	00, 01 (OFF/ON) (N/A)	00 (N/A)
MIN MOD CASC	Specifies the number of heat modules started simultaineously.	01 - 08	01
HW-BOILER	Number of stages for HW operation	00 - 08	00
CONTR DEVIAT	Control Deviation indicates the temperature difference between the header set point and the actual temperature.	display	F
DES OUPUT	Required system output [in %]	0 - 100%	00
SWITCH TIME	Internal control value: only for switching cascade	(-99) - 0 - (99)	Display (N/A)
BLOCK TIME	Not Applicable	(N/A)	(N/A)
MAX T-MODUL	Maximum temperature of Heat Module	122.0°F – 230.0°F	194.0°F
DYN UPWARD	Dynamic heat generator connection (Not Applicable)	(N/A)	(N/A)
DYN DOWNWARD	Dynamic heat generator deactivation (Not Applicable)	(N/A)	(N/A)
RESET TIME	Resetting time for Controller (seconds)	5 - 500	50
MODULAT MAX	Start Level. If this modulation percentage is exceeded, the next heat generator (module) is connected after the delay time specified by the SEQ SW TIME (see below) elapses.	50% - 100%	30%
MODULAT MIN	Stop Level. If value drops below this modulation percentage, the last heat generator (module) of the current sequence is switched off	10% - 60%	35%
MIN MOD HS	Connection of the next heat generator	0% - 60%	35%
MOD LEVEL HW	Entry of the set modulation percentage for the heat generators in hot water operation (Currently Not Applicable)	40% - 100% (N/A)	80% (N/A)
SEQUENCE 1	Boiler sequence 1	12345678	
SEQUENCE 2	Boiler sequence 2	87654321	

APPENDIX A

EXPERT MENU TABLE - Continued

FUNCTION	DESCRIPTION	ENTRY RANGE	DEFAULT
INSTALLATION Sub-Menu - Continued			
SEQU CHANGE	Sequence change mode	01 - 06	06
SEQ SW TIME	Time to sequence change (seconds)	10 - 800	200
LOCK TIME	Min. delay time after switching ON or with switching HS	00 min - 30 min	00
HYST BURNER2	Solid fuel integration: hysteresiys for the charging pump	2K - 20K	2.0
HS COOL-FCT			
T-HS COOL			
HEATSOURCE 1	Identification of Boiler Type being used: 00 = No Boiler 01 = Single-Stage, switching 02 = Single-Stage, modulating 03 = 2-Stage, switching 04 = 2 individual, switching 05 = Multi-Stage, switching 06 = Multi-Stage, modulating (cascade via BUS)		06 (Multi-Stage Modulating)
HS 1 BUS	Connections for HS 1	00 - 04	02
HEATSOURCE 2	Secondary heat generator type	00 - 05	00
STORAGE HS2	Not Applicable	00 - 03	00
BUFFER	Not Applicable	00, 01, 02	00
SCREED	Not Applicable	N/A	N/A
SCREED PROGR	Not Applicable	N/A	N/A
RETURN	Press Program Key to exit INSTALLATION Sub-Menu.		
HOT WATER Sub-Menu			
DHW RELIEF	Charge pump blocking.	00 = OFF 01 = ON	01 (ON)
PARALLEL	Parallel pump operation. 00 = Hot Water Priority 01 = Hot Water Partial Priority 02 = Pump Parallel Running	00, 01, 02	01
T-BOILER DHW	Boiler temperature increase during Hot Water operation. Boiler Temp = (DHW Temp Setting) + (T-BOILER DHW)	32°F – 194°F	97°F
HYST DHW	Hot Water Hysteresis	48°F – 129°F	48°F
DHW FOLLOWUP	Pump Run-Down Time	00 min. – 30 min.	00 min.
THERM INPUT	Storage Tank With Thermostat	00 = OFF 01 = ON	00 (OFF)
WALL HUNG	For Modulating Heat Source (HS)	00 = OFF 01 = ON	00 (OFF)
LOAD THROUGH		00 = OFF 01 = ON	00 (OFF)

EXPERT PROGRAM MENU TABLE -Continued

FUNCTION	DESCRIPTION	ENTRY RANGE	DEFAULT
HEAT CIRCUIT 1 & 2 Sub-Menus			
	The Sub-Menu Functions for HEAT CIRCUIT 1 & HEAT CIRCUIT 2 are identical. The Function values in this Sub-Menu level will change, depending on the Heat Circuit Function (HC FUNCTION) selected.		
HC FUNCTION	Heat Circuit Function defines type of circuit: 00 = Standard Heat Circuit 01 = Control to fixed flow temperature 02 = Swimming pool control (HC 2 ONLY) 03 = Hot Water Circuit 04 = Return flow temp. increase via mixing valve.	00 – 04	00 (Standard Heat Circuit)
PUMP MODE	Circulation pump mode control for ON/OFF switching of pumps. 00 = Standard pump control 01 = Pump switching per heating limits 02 = Pump switching per heating program 03 = Continuous pump operation	00 - 03	00
MIXER OPEN (NOT for HW circuit)	Specifies speed setting at which mixer motor opens when there is a control temperature difference.Entering small temperature difference values may cause the mixing valve to oscillate	5°F -25°F	18°F
MIXER CLOSE (NOT for HW circuit)	Specifies speed setting at which mixing valve closes when there is a control temperature difference. Entering small temperature difference values may cause the mixing valve to oscillate	5°F -25°F	12°F
MAX T-FLOW	Maximum allowable water temperature setting for the heating circuit.	68°F – 230°F	176°F
MIN T-FLOW	Minimum allowable water temperature setting for the heat circuit.	50°F – 230°F	50°F
FROST PROT	Specifies the minimum allowable outside air temperature setting for the Frost Protection Mode. If temperature drops below this value, the system switches to the Frost Protect Mode and the pumps are switched ON.	-5°F – 41°F	32°F
OUT-TEMP-DEL	Outside Temperature Delay. Specifies the elapsed time before a decrease in the outside temperature will affect the indoor room temperature. The time entered must be consistent with the type of building construction (i.e., thick well-insulated walls can use a long time delay. For light, poorly insulated structures, set time to 0 hours)	0:00 – 24:00	0:0 (N/A)
SLOPE OFFSET	Heating slope distance.	32°F – 194°F	48°F (N/A)

APPENDIX A

FUNCTION	DESCRIPTION	ENTRY RANGE	DEFAULT
HEAT CIRCUIT 1 & 2 Sub-Menus - Continued			
B-HEAT SINK	Circuit Enable	00 = OFF 01 = ON	01 (ON)
RETURN	Press Program Key to exit HEAT CIRCUIT 1 (or 2) Sub-Menu.		
SOLAR M/F Sub-Menu			
MF (1-4) FUNCTION	Multi-Function (MF) Relay Functions. 00 = No Function 01 = Header Pump 02 = Circulation (Time) 03 = Booster Pump 05 = Pump HS1 06 = Pump HS2 20 = Temp-Controlled Circulation Pump 21 = Pulsed Circulation Pump 22 = Solid Fuel Boiler Integration 23 = Solar Integration 24 = Return Flow Temperature Increase HS1 25 = Return Flow Temperature Increase HS2 26 = Return Flow Temperature Increase HS Via Buffer Storage	00, 01, 02, 03, 05, 06 & 20-26	00 (No Function)
MF (1-4) SET TEMP	Multi-Function Relay Set Point Temperature indicates switching temperature for relay	86F – 194F	86°F
MF (1-4) HYST (1-4)	Multi-Function Relay Hysteresis	39°F – 64°F	48°F
F15 FUNCTION	F15 Function 00 = Room Sensor for Heating Circuit 2 01 = 0 – 10V iInput 02 = Light sensor	00 -02	00
RETURN	Press Program Key to exit SOLAR M/F Sub-Menu.		

A-5 GENERAL AREA

The GENERAL Area contains a DATE/TIME Menu area and a SERVICE Menu area.

A-5.1 DATE / TIME Sub-Menu

This Sub-Menu is used to set the time, date, holiday schedule and, where necessary, enter clock change settings (daylight savings time, etc).

NOTE

All items in the following DATE/TIME Menu must be entered in sequence. Press the Program Key to step through the menu functions. Use the Rotary Knob to adjust/change entries. Press the Program Key to store entries and sequence to the next function.

• **DATE / TIME MENU TABLE**

FUNCTION	DESCRIPTION	ENTRY RANGE
TIME - DATE Sub-Menu		
	This Sub-Menu is used to set the time, date, holiday schedule and, where necessary, enter clock change settings (daylight savings time, etc).	
TIME	Set current time (min., hours)	00:00 – 24:00
YEAR	Set current year	XXXX
MONTH	Set current month	01 - 12
DAY	Set currrent day	01 - 31
HOLIDAY Sub-Menu		
	This Sub-Menu sets the start and end dates for Holiday (Vacation) periods where no heat or hot water is required.	
YEAR	Set current holiday start year	XXXX
MONTH START	Set current holiday start month	01 - 12
DAY START	Set current holiday start day	01 – 31
YEAR STOP	Set current holiday end year	XXXX
MONTH STOP	Set current holiday end month	01 – 12
DAY STOP	Set current holiday end day	01 - 31
CLOCK CHANGE Sub-Menu		
	This Sub-Menu is used in areas where seasonal time changes are required for "Daylight Savings", etc.	
MONTH START	Set clock change start month	01 -12
DAY START	Set clock change start day	01 – 31
MONTH END	Set clock change end month	01 – 12
DAY END	Set clock change end day	01 – 31
RETURN	When CLOCK CHANGE reappears, press Program Key.	

APPENDIX A

A-5.2 SERVICE Sub-Menu

The SERVICE Menu contains all the test and diagnostic functions/values required for Customer Service Engineers to troubleshoot the equipment in a timely manner.

Some of the Functions in this Sub-Menu require a valid Code No. (password) to be entered, prior to accessing/changing Function values. When prompted by a "CODE NO." display, enter 0000 (4 zeros) by pressing the Program Key four times. This will allow function access.

SERVICE MENU TABLE

FUNCTION	DESCRIPTION	REMARKS
RELAY TEST Sub-Menu		
RELAY NO.	This Sub-Menu is used to check the status of the relays contained in the Controlller. These relays are numbered 00 through 11 and are defined as shown below. CODE NO. Entry is required to access these relays.	
00	No relay	
01	A1: Pump, Heating Circuit 1	
02	A2: Pump, Heating Circuit 2	
03	A3: Hot Water Charging Pump	
04	A4: Mixer OPEN, Heating Circuit 2	
05	A5: Mixer CLOSED, Heating Circuit 2	
06	A6: HS 1 ON	
07	A7: HS2 ON [2-stage:HS 1+2 (after 10s) ON]	
08	A8: Mixer OPEN Heating Circuit 1 / Multifunction 1	
09	A9: Mixer CLOSED Heating Circuit 1 / Multifunction 2	
10	A10: Multifunction 3	
11	A11: Collector Pump / Multifunction 4	
SENSOR TEST Sub-Menu		
SENSOR	This Sub-Menu is used to check and display the temperature readings of the sensors connected to the Controller.	
F1	Buffer storage temperature Lower	
F2	Buffer storage temperature middle or room temperature heating circuit 1	
F3	Upper buffer storage temperature	
F5	Flow temperature, heating circuit 2	
F5	Flow temperature, heating circuit 2	
F6	Upper hot water temperature	
F8	Heat generator /header temperature	
F9	Outside temperature	

SERVICE MENU TABLE - Continued

FUNCTION	DESCRIPTION	REMARKS
SENSOR TEST Sub-Menu		
F11	Flow temperature heating circuit 1 or temperature multifunction 1	
F12	Hot water temperature lower or temperature multifunction 2	
F13	Solid fuel boiler temperature or collector 2 or temperature multifunction 3	
F14	Collector 1 temperature or temperature multifunction 4	
F15; Light; 0-10V I	Room temperature heating circuit 2 or measured value of the light sensor or voltage value 0-10V input	
OTHER ENTRIES		
	Additional items and functions in the SERVICE Sub-Menu include the following:	
SW NO XXX-XX	Specifies the Software Version and Index number currently installed in the Controller	
CASCADE MANU (1-8)	Starting different burner stages of the cascade See GF-115/GF-115-H, Section 6, para. 6.5 for additional startup instructions using these sub-menu functions.	
BURNER TIME (1-8)	Program Key - Burner time for all stages	
BURNER START (1-8)	Program Key - Burner start for all stages	
LIMITER TEST (1-8)	Safety temperature limiter test with heat generator temperature display Start with Program Key (hold down)!	
SERVICE	Input of date or operating hours for service messages	
WARNING: NEVER ATTEMPT TO USE THE FOLLOWING RESET FUNCTIONS.		
RESET USER 00	DO NOT USE	
RESET EXPERT 00	DO NOT USE	
RESET T-PRG 00	DO NOT USE	
RETURN	Exit level using Program Key	

APPENDIX A

GENERAL AREA MENUS - Continued

OTHER ENTRIES	
(General -> Service level)	
Select value using Rotary Knob => value is displayed	
SOFTWARE NO XXX-XX	Software number with index (Example: 259-04)
CASCADE MANU (1-8; only with code no.)	Starting different burner stages of the cascade See GF-115/GF-115-H, Section 6, para. 6.5 for additional startup instructions using these sub-menu functions.
BURNER TIME (1-8)	Program Key - Burner time for all stages
BURNER START (1-8)	Program Key - Burner start for all stages
LIMITER TEST (1-8)	Safety temperature limiter test with heat generator temperature display Start with Program Key (hold down)!
SERVICE (only with code no.)	Input of date or operating hours for service messages
WARNING: <u>NEVER</u> ATTEMPT TO USE THE FOLLOWING RESET FUNCTIONS.	
RESET USER 00	DO NOT USE
RESET EXPERT 00 (only with code no.)	DO NOT USE
RESET T-PRG 00	DO NOT USE
RETURN	Exit level using Program Key

APPENDIX B

BOILER COMMUNICATIONS MODULE (BCM)

APPENDIX B

B-1 BCM MODBUS COMMUNICATION & SUPPORT REQUIREMENTS

The Modbus communication support requirements incorporated in the BCM are as follows:

B-1.1 Function Codes

The BCM supports the Modbus Function Codes SHOWN IN Table B-1.

Table B-1. Supported Modbus Function Codes

FUNCTION CODE	DESCRIPTION
03	Read up to 8 contiguous Holding Registers
04	Read up to 8 contiguous Address Registers
06	Write a single 16 bit Register

B-1.2 Modbus Support Requirements

The Modbus Network must conform to the support requirements listed in Table B-2.

Table B-2. Modbus Support Requirements

CHARACTERISTIC	DESCRRIPTION
Communication Medium BMS II or EMS Master to BCM Slave	RS485 2-Wire Differential Bus With Shield
RS485 Allowable Cable Length	4000 Feet Maximum
Address Support From Master EMS	1 to 9 via Address Select Switch (SW1). (Addresses from 10 to 127 can be implemented via software)
Transmission Mode Support	RTU (Remote Terminal Unit)
Timing Specifications: Baud Rate: Data Framing: Message Framing: Character Framing: Heartbeat Timeout:	 Fixed at 9600 8 data bits, no parity, 1 stop bit Silent period of at least 3.5 character times Before first character and After last character No more than 1.5 character times of silence between received and transmitted characters. Adjustable (0 or 1 – 240 seconds)

B-2. BCM CONTROLLER STANDARD HOLDING REGISTER ASSIGNMENTS

B-2.1 BCM Controller Standard Input Register Assignments

The BCM Controller has only two Read Only Input Register addresses as shown in Table B-3.

Table B-3. BCM Controller Standard Input Register Address Mapping

Modbus Data Address	Menu Item	Units and Range
0	Status & Error Code	enum (2,8,10,18,23,32,42,38) 2 = Standby 8 = High temperature switch open 10 = Low gas pressure switch open 18 = Air flow switch open during ignition 23 = Flame loss during run 32 = Residual flame 42 = Outlet temperature sensor fault 38 = Other conditions not listed above
1	Unit Status	enum (1, 3, 5) 1 = Standby (ready to run but not fired) 3 = Remote (fired) 5 = Fault (failure detected)

B-2.2 BCM Controller Standard Holding Register Assignments

The BCM Controller Holding Registers contain functions that are Read Only, Write Only or both Read & Write. The address assignments for these functions are listed in Table B-4 and are grouped into the following major categories: Control Registers, Operating Data Registers, System Data Settings and Test Registers. Functions within each group are not necessarily in hex address order.

The Read Only, Write Only or Read/Write status for each function in Table B-4 is shown in the Default/Comments column.

APPENDIX B

Table B-4. BCM Standard Holding Register Address Mapping

Modbus Data Address	Menu Item	Units and Range	Default/(Comments)
CONTROL REGISTERS			
1	Direct Drive Requested Modulation Level	% (0 to 100)	(Read/Write) A value other than 0 requests Run mode and supersedes the value set for Max Modulation Level (address 0x03F9)
1017	Maximum Modulation Level	% (0 to 100) (Value x 2)	(Read/Write) 100° (50%)
1004	Requested Setpoint	32°F – 212°F (0°C – 100°C) (Value x 10)	(Read/Write) 180°F
1001	System Command	enum (0xAA)	(Read/Write) 0xAA: Restart Slave identification procedure
1021	Heat Request Command	enum (0x01, 0x33, 0x44, 0x55, 0xBB, 0xCC, 0xEE) <table><tr><td>0x01:</td><td>No action</td></tr><tr><td>0x33:</td><td>Space Heating mode enabled</td></tr><tr><td>0x44:</td><td>Space Heating & DHW modes enabled</td></tr><tr><td>0x55:</td><td>DHW mode enabled</td></tr><tr><td>0xBB:</td><td>Space Heating requested & DHW enabled</td></tr><tr><td>0xCC:</td><td>Check request</td></tr><tr><td>0xEE:</td><td>Space Heating request</td></tr></table> If enum is none of the above, Standby is selected.	(Read/Write) 0x01
1022	Requested DHW Setpoint	32°F – 212°F (0°C – 100°C) (Value x 10)	(Read/Write)
1023	Pump Control	enum (0, 1, 2) 0 = No action 1 = Switch OFF 2 = Switch ON	(Read/Write)
1030	Error/Reset	enum (0x5A)	(Read/Write)

Table B-4. BCM Standard Holding Register Address Mapping – Cont.

Modbus Data Address	Menu Item	Units and Range	Default/(Comments)
CONTROL REGISTERS - Cont.			
1041	Check Mode, Inserted burner control	Flags (0 – 0xFF) Bit 0: BMM #0 to Bit 7: BMM #7	(Read/Write) Bit 0 (BMM #0) is automatically set at Check Mode start
OPERATING DATA REGISTERS			
0	Error Code	0 – 0xFFFF LSB: Error Code MSB: Identification code of fault device: 0: BMM #0 to 7: BMM #7 255: BCM	(Read/Write)
1000	Cascade Control Status	enum (0, 1, 2, 4) 0: Stop 1: Slave identification procedure 2: Normal operation 4: Monitor mode	(Read/Write)
1002	Flow Sensor Temperature	14°F to 212°F (-10°C to 100°C) (Value x 10)	(Read/Write)
1003	Return Flow Temperature	32°F to 212°F (0°C to 100°C) (Value x 10)	(Read/Write)
1005	External Sensor Temperature	-31°F/-22°F to 86°F (-35°C/-30°C to 30°C) (Value x 10)	(Read/Write) -31°F (-35°C) if not connected
1008	Global Actual Modulation Level	0 – 100%	(Read/Write)
1016	Target Setpoint	32°F to 212°F (0°C to 100°C) (Value x 10)	(Read/Write)
1020	Operating Mode	enum (0, 1, 2, 3, 6) 0: Standby 1: Space Heating 2: DHW 3: Check 6: Test	(Read/Write)
1100	Linked BMM	Flags (0 -255) Bit 0: BMM #0 to Bit 7: BMM #7	(Read/Write)

APPENDIX B

Modbus Data Address	Menu Item	Units and Range	Default/(Comments)
OPERATING DATA REGISTERS –Cont.			
1101	Inserted BMM	Flags (0 -255) Bit 0: BMM #0 to Bit 7: BMM #7	(Read/Write)
1102	BMM in Check Mode	Flags (0 -255) Bit 0: BMM #0 to Bit 7: BMM #7	(Read/Write)
1103	BMM Flame Status	Flags (0 – 255) Bit 0: BMM #0 to Bit 7: BMM #7	(Read/Write)
1104	BMM Alarm Status	Flags (0 – 255) Bit 0: BMM #0 to Bit 7: BMM #7	(Read/Write)
1108	BMM Maximum Modulation Level	0 – 100% (Value x 10)	(Read/Write)
1109	Pump Modulation Output	0 – 10V	(Read/Write)
1200	Monitor Only	0 – 100%	(Read Only) Global modulation level from Cascade Manager
2n00	BMM #n Error Code (n = 0 – 7)	0 – 0xFFFF	(Read Only)
2n02	BMM #n Outlet Temperature (n = 0 – 7)	14°F to 212°F (-10°C to 100°C) (Value x 10)	(Read Only)
2n08	BMM #n Actual Modulation Level (n = 0 – 7)	0 – 100%	(Read Only)
2n10	BMM #0 Capacity (n = 0 – 7)	0 – 255 kW	(Read Only)
2n11	BMM #n Configuration (n = 0 – 7)	Flag (0, 1) 0: Space Heating Only 1: Space Heating and DHW	(Read Only)
2n20	BMM #n Operating Flags (n = 0 – 7)	Flags (0-255) Bit 3: Flame detected Bit 4: Check mode Bit 6: Pump status Bit 7: Alarm	(Read Only)

Table B-4. BCM Standard Holding Register Address Mapping – Cont.

Modbus Data Address	Menu Item	Units and Range	Default/(Comments)
SYSTEM DATA			
1550	Firmware Code & Firmware Revision	0x3400 – 0x34FF High byte: Firmware Code Low byte: Firmware Revision	(Read Only)
1011	Boiler Global Capacity	0 – FFFF kW	(Read Only)
12	Boiler Mode = Direct Drive	2	(Read Only)
13	Remote Signal = Network	3	(Read Only)
SETTINGS			
19	Modbus Address	1 - 127	(Read/Write)
3000	Burner OFF Hysteresis	9°F to 36°F (5°C to 20°C) (Value x 10)	(Read/Write) 9°F
3001	Minimum Inserted Burner	1 - 8	(Read/Write) 1
3002	Temp. Control: Slope Limit	2°F to 54°F/minute (1°C to 30°C/minute)	(Read/Write) 9°F
3003	Temp. Control: Proportional Band	0°F to 90°F (0°C to 50°C)	(Read/Write) 45°F
3004	Temp. Control: Integral Gain	0 - 50	(Read/Write) 12
3005	Temp. Control: Derivative Gain	0 - 50	(Read/Write) 12
3006	Pump Over-run Time	1 – 10 minutes	(Read/Write) 5 minutes
3007	Pump Modulation Output @ Minimum Burner Level	0 – 10V (Value x 10)	(Read/Write) 3V
3008	Pump Modulation Output @ Maximum Burner Level	0 – 10V (Value x 10)	(Read/Write) 10V
3009	Burner Minimum Modulation Level	0 – 100%	(Read/Write) 35%

APPENDIX B

Table B-4. BCM Standard Holding Register Address Mapping – Cont.

Modbus Data Address	Menu Item	Units and Range	Default/Comments
SETTINGS – Cont.			
3010	Water Δ Temp. Protection	0°F/2°F – 90°F (0°C/1°C-50°C)	(Read/Write) 36°F
3011	Communication Timeout Time	0/10 – 240 sec. (in 10 sec. intervals) 0 = Disable	(Read/Write) 30 sec.
3012	Temperature Limits	0/1; 0 =°C, 1 = °F	1 = °F
3013	Analog Input Function	0/1; 0 = Setpoint Adjust, 1 = Outdoor Temp Sensor	(Read/Write) 0
3014	(Not Used)		
3015	Maximum Target Temperature	113°F to 185°F (45°C to 85°C	(Read/Write) 180°F
TEST REGISTERS			
1040	Test Mode Control	enum (0xA5/0x5A) 0xA5: Test mode release 0x5A: Test mode request	(Write Only) This command is only executed in Standby mode. The other Write messages are executed only in Test mode.
3100	Digital Inputs Status [0, 1]	Flags (0 - 0x1F80) bit 0: eBUS RX bit 1: eBUS-1 RX bit 2: eBUS -1 detect (true, false) bit 7: Room Stat (open, close) bit 8: 0, not used bit 9: RESET by Low Voltage Detector bit 10: RESET by clock monitor bit 11: RESET by Watchdog timer bit 12: RESET (open, close) bit 13: SW1-1 bit 14: SW1-2 bit 15: SW1-4	(Read Only)

Table B-4. BCM Standard Holding Register Address Mapping – Cont.

Modbus Data Address	Menu Item	Units and Range	Default/(Comments)
TEST REGISTER – Cont.			
3101	Digital Outputs Status [0, 1]	Flags (0 - 0x0F) bit 0: Burner [OFF, ON] bit 1: Pump [OFF, ON] bit 2: Not used Bit 3; Alarm [OFF, ON] bit 4: DL1 [OFF, ON] bit 5: eBUS TX bit 6: eBUS-1 TX bit 7: eBUS Supply [OFF, ON]	(Read Only)
3102	Digital Output Control in Test Mode [0, 1]	Flags (0 - 0x0F) bit 0: Not used bit 1: Pump [OFF, ON] bit 2: MPump-PWM [100%, 0%] bit 3; Alarm [OFF, ON] bit 4: DL1 [OFF, ON] bit 5: eBUS TX bit 6: eBUS-1 TX bit 7: eBUS Supply [OFF, ON]	(Read/Write)

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