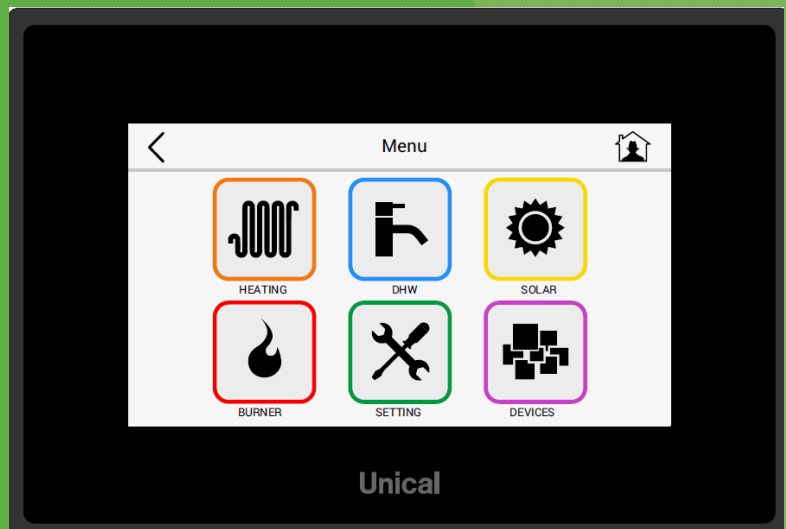# Installation, Operation & Maintenance Manual

Modulex EXT Ufly Controller & BCM

For Modulex EXT Natural Gas Modulating and
Condensing Hot Water Boilers

Applies to Modulex models:

- EXT 450 2S
- EXT 600 2S
- EXT 800 2S
- EXT 1100 2S
- EXT 1500 2S
- EXT 2300 2S
- EXT 2600 2S
- EXT 3000 2S

Table of Contents

CHAPTER 1: INTRODUCTION

The information in this manual provides a guide to the operation of the Modulex Boiler using the Ufly Controller and the Boiler Communications Module (BCM) mounted on the front of the unit.

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, CAUTIONS and WARNINGS in this manual must be observed at all times.

CAUTION!
It is of utmost importance to observe all **CAUTIONS** and **WARNINGS** presented in this manual to avoid injury, death, and damage to the equipment. Failure to properly heed safety warnings and cautions may result in the voiding of applicable warranties.

CHAPTER 2: UFLY CONTROLLER & BCM MODULES

MODULEX boilers contain advanced and reliable electronic controls, the Ufly Controller and the BCM (Boiler Communications Module), which provide comprehensive programming and monitoring of the MODULEX boiler and its functions. Features and functions of the Ufly Controller and BCM are described in this chapter.

2.1 Ufly Controller

A standard component included in MODULEX units, the Ufly Controller is responsible for the staging and modulation of individual thermal heating modules and also monitors supply and return water temperatures and domestic hot water zones.

The Ufly Controller is mounted on the front of the MODULEX Boiler and contains all of the controls, indicators and displays to adjust, operate and troubleshoot the MODULEX Boiler.

2.1.1 Ufly Controller Features and Functions

The Ufly features the following functions for MODULEX boilers:

- Shares the heating load among as many of the boiler's thermal heating modules as possible, maximizing the overall operating efficiency of the boiler.

- Provides access to all testing/programming parameters of each individual heating module: operation test, operation time, boiler freeze protection and pump's anti seize program.

- Drives lead-lag burner operation based on operating hours. The boiler module with the least burner operating hours is the first to start and the burner with the most operating hours is the first to stop.

- Supports DHW (Domestic Hot Water) production using a dedicated sensor to control a dedicated pump or 3-way diverting valve for storage tank temperature control.

- Supports a manual operation service mode to control individual modules during troubleshooting or combustion calibration procedures.

- Drives diagnostics such as relay and sensor testing.

- Supports Modbus integration with AERCO Control System (ACS) or Building Automation Systems. AERCO also offers a Communication Gateway to support BACnet, Lonworks and N2 system integration.

2.1.2 Reading the Icons on Home Page

Buttons and symbol (outline + filled color area) shown only in Home page	Buttons and symbol (outline + empty color area)
Service present and in operation at that time	Service present but not in operation at that time

Buttons and symbol (outline in dark grey no filled area)	Buttons and symbol (outline in ligh grey no filled area)
Service disabled or off but installed	Service not installed

Heating: Access space heating parameters including setpoint, outdoor reset and building reference temperature.

Domestic Hot Water: Access domestic hot water parameters including setpoint, timed programming, and legionella protection function

Solar: This menu is currently not available.

Burner: Access calibration, manual operation, and troubleshooting settings. This menu is password protected and is only for authorized AERCO technicians.

Setup: Access general setup parameters including time and date, display settings, language, and units of measure.

Devices: Access BCM parameters for functions including 0-10V operation and domestic hot water operation.

2.1.3 Display Modes
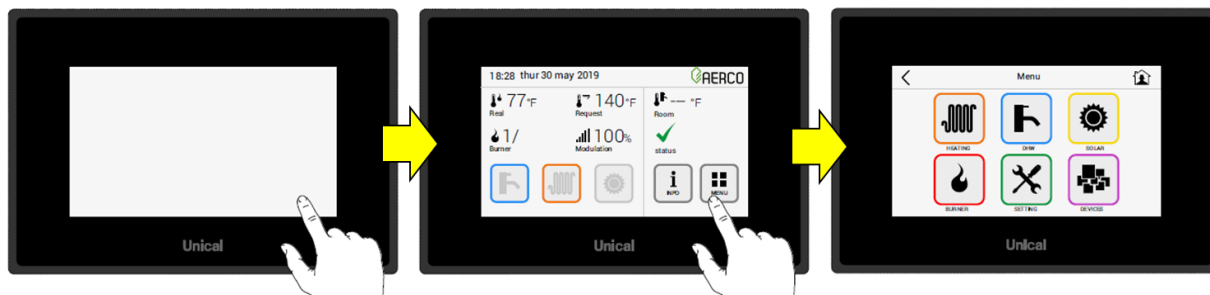
6	Display Mode
	Screen Off

7	Display Mode
	Home Screen

8	Display Mode
	Menu Screen
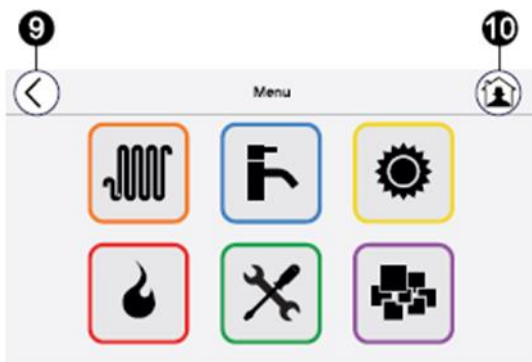
9	<	One page back
10	🏠	Return always to Home page
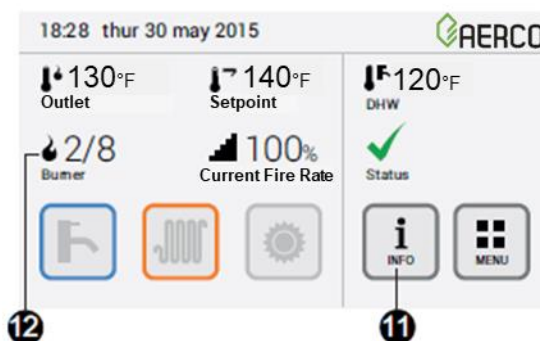
11	INFO: allows user to set parameters on right side of home screen such as Inlet Temp, DHW Outlet, Individual Module temperature, etc.
12	Shows the number of burners that are firing.

NOTE: Menu icons do <u>not</u> indicate operating status.

2.2 Boiler Communication Module (Bcm)

The MODULEX BCM supports full interoperability to BAS (Building Automation Systems) via Modbus protocol to enable remote communications and control. It also provides a remote alarm contact to notify customers of faults within any of the thermal modules. Finally, in the event the boiler's master controller stops working, the BCM also takes over operation of the boiler. Additional control functions include the following:

- A fault relay which energizes when any fault condition occurs.
- BCM serves as a Back-up Controller if the primary Ufly Controller fails.
- BCM provides a 0-10V output for controlling a VFD primary pump.
- BCM can function as a "Client" to a "Manager" Energy Management System (EMS), Building Automation System (BAS) or AERCO Control System (ACS) on a Modbus Network.
- BCM can start/stop the primary pump; BCM can also control a variable speed primary pump via 0-10V analog signal.

The BCM is installed on the front of the Modulex Boiler, behind the lift-up front panel. Additional information for the BCM can be found in Chapters 6, 7, and 8.
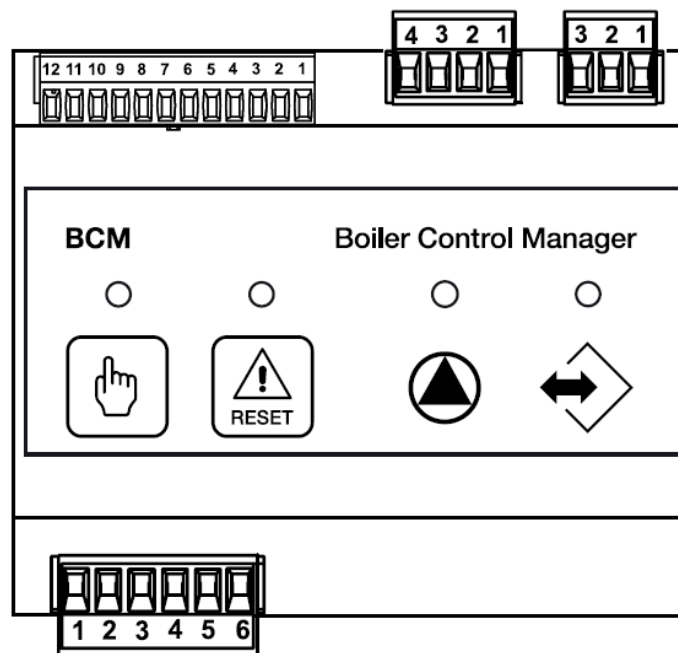
Figure 2-1: Boiler Communications Module (BCM)

CHAPTER 3: OPERATION, MENU & PARAMETERS

This chapter introduces the Ufly controller basic menu contents needed to set up the MODULEX EXT boiler. For more detailed information concerning the Ufly controller menus, operating modes and functions, refer to Section 4.
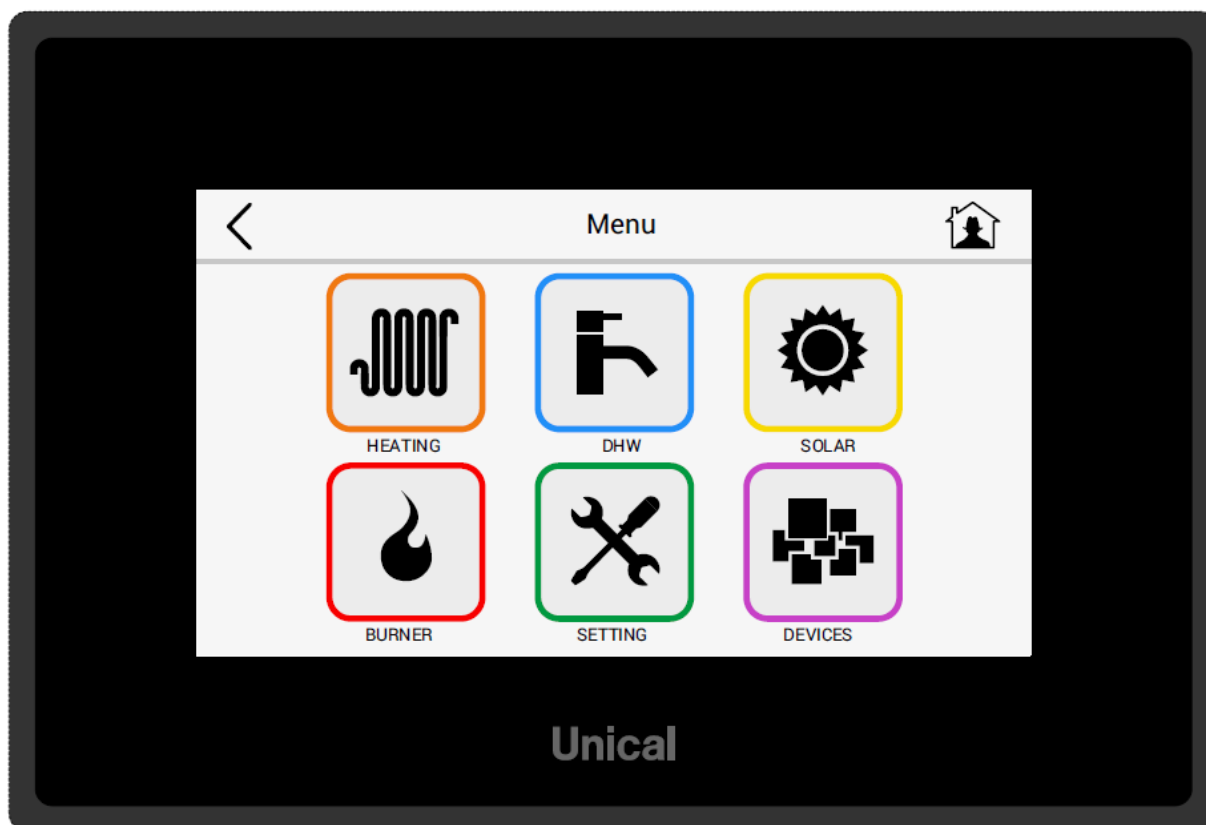
Figure 3-1: Modulex Ufly Controller Main Menu

3.1 Setup Menu

The Setup Menu allows the user to setup time and date, program Building Reference temperatures and domestic hot water setpoint, change display and language settings, and change the password for the Devices.

3.1.1 Setting Time and Date
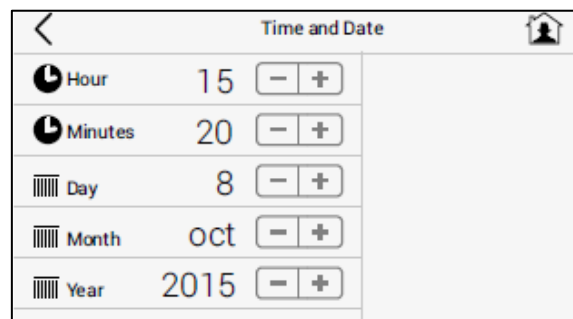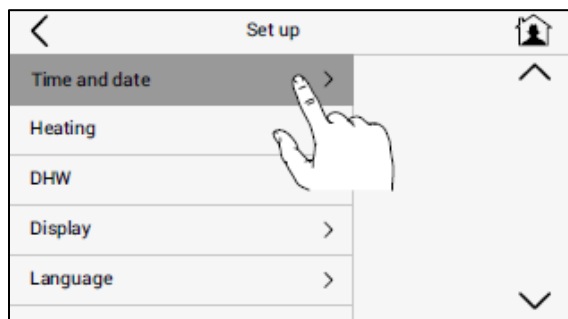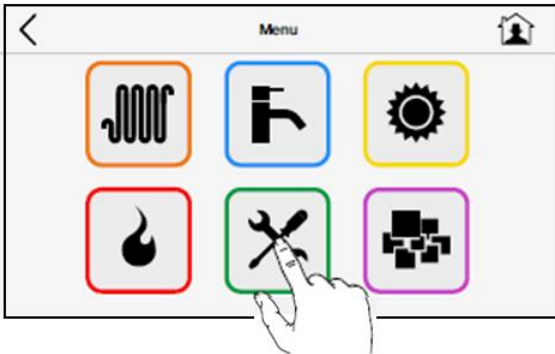
3.1.2 Setting Comfort and Eco Building Reference Temperatures

The Comfort and Eco Building Reference Temperatures for the Outdoor Reset Mode are programmed in the Setup Menu. For details on Outdoor Reset Mode and Building Reference Temperature, see Section 4.1.
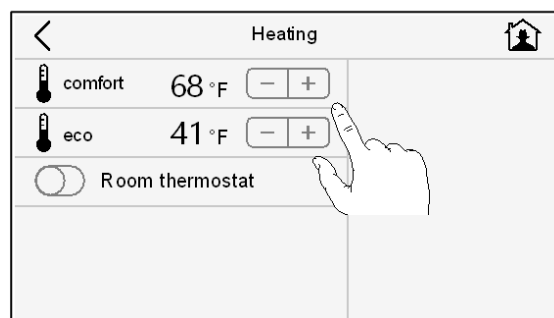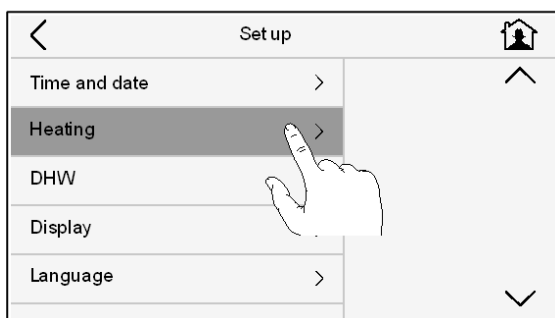
3.1.3 Setting Comfort and Eco Domestic Hot Water Setpoints

The Comfort and Eco Domestic Hot Water Setpoints are programmed in the Setup Menu. For details on Domestic Hot Water Operation, see Section 4.4.
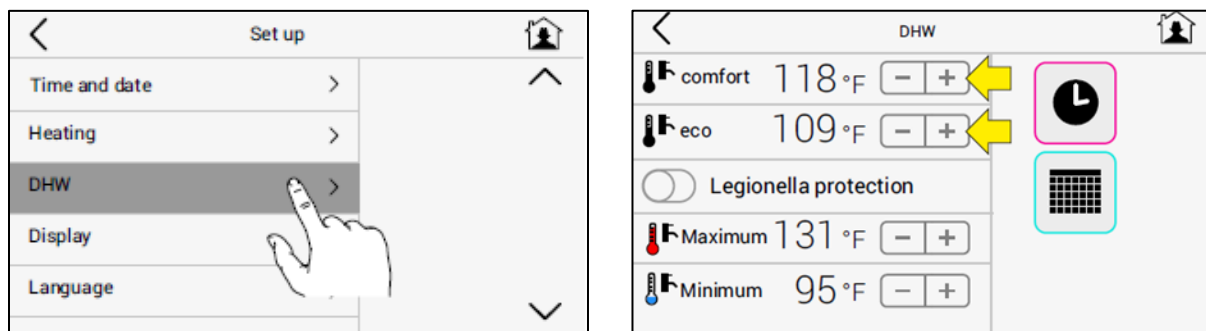
The Ufly screen automatically turns off after 20 seconds (default) of inactivity. If the "Always on" is toggled on like in the image below, the screen will remain on all the time.

NOTE: Do not change the value of the Modbus address. This is an internal function of the boiler. For Modbus setup when communicating to AERCO ACS or BAS/EMS, see Section 6.8.

3.1.4 Display Settings
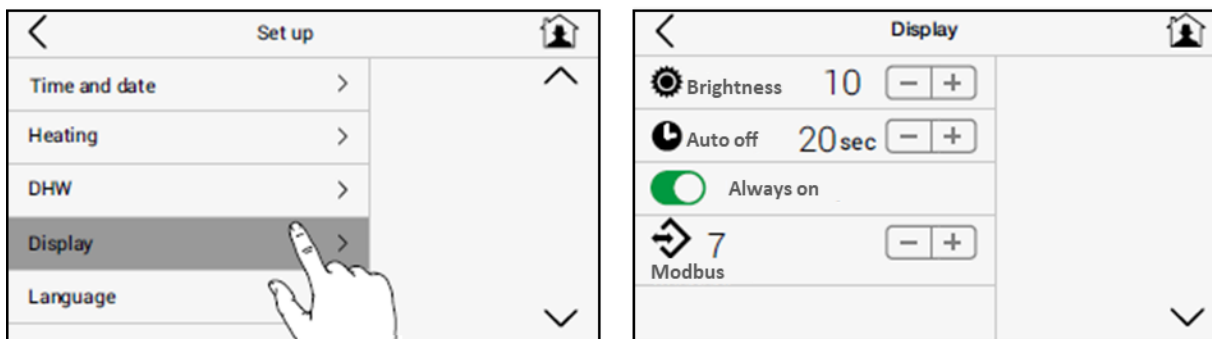
3.1.5 Language and Unit Settings

3.1.6 Password

For security and protection of the boiler, the default password is only available to Authorized AERCO Service technicians.

To Change the password:

1. Enter the current password and click OK

2. Delete the current password using the backspace button.

3. Enter new password and click OK.
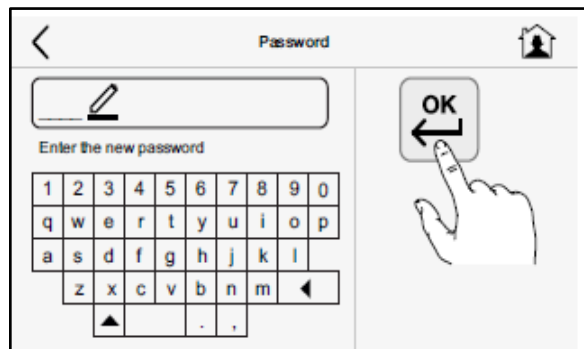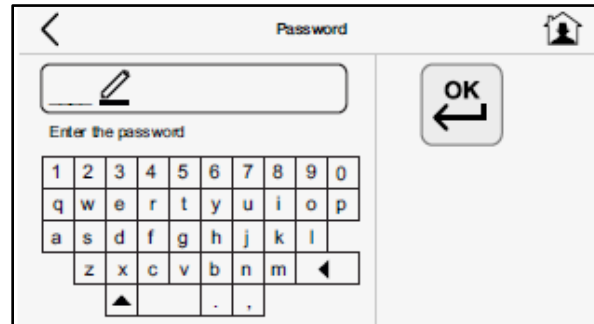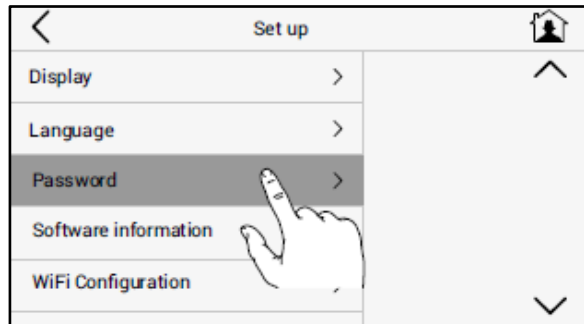
3.2 Heating Menu

The Heating Menu provides access to Space Heating parameters including Outdoor Reset and Constant Setpoint Mode. For Space Heating programming details, see sections 4.1 and 4.2.
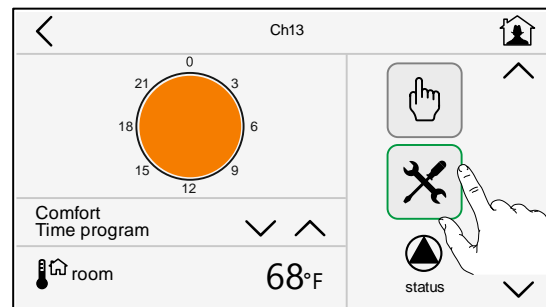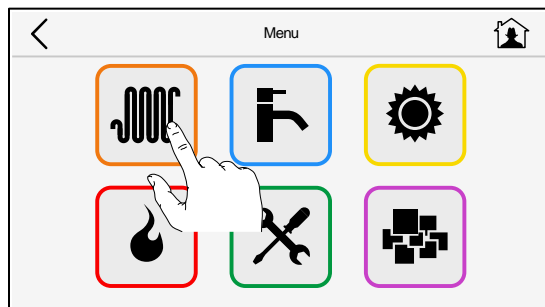
Outdoor Reset Parameter and Space Heating Setpoint are accessed via the **Settings** button.
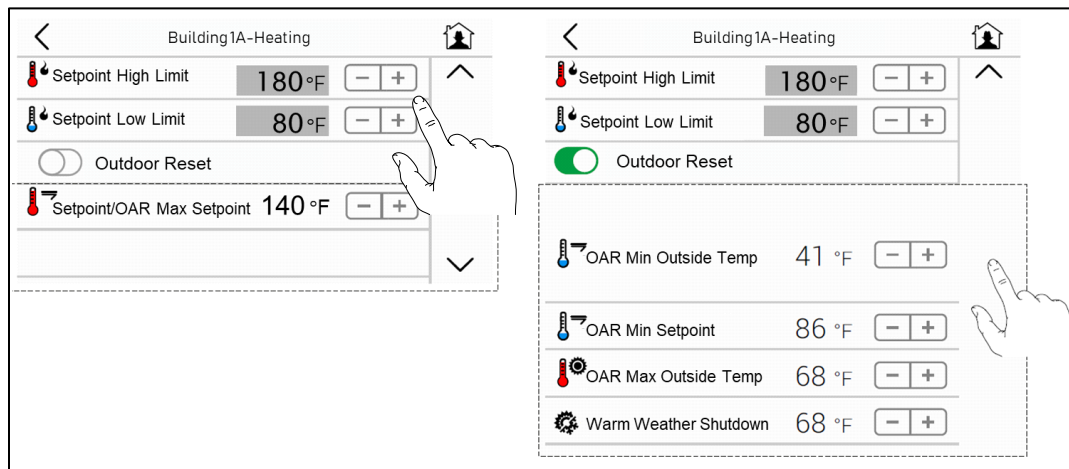
Building Reference Temperatures for Outdoor Reset Mode are accessed via the Heating Menu.
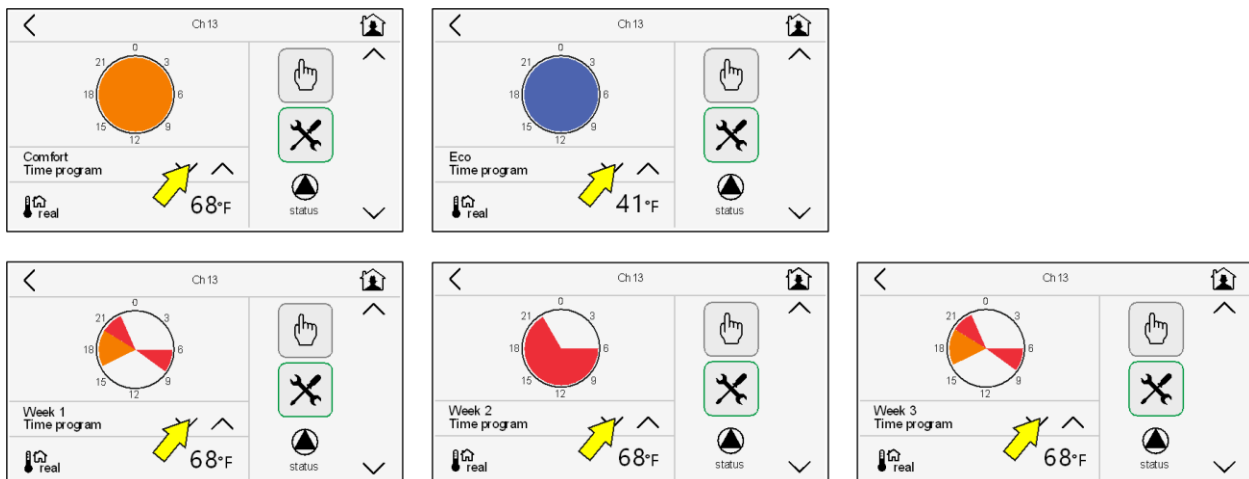
3.3 Domestic Hot Water Menu

The Domestic Hot Water Menu provides access to parameters to provide domestic hot water (DHW) using a tank sensor. For DHW programming details, see section 4.4.
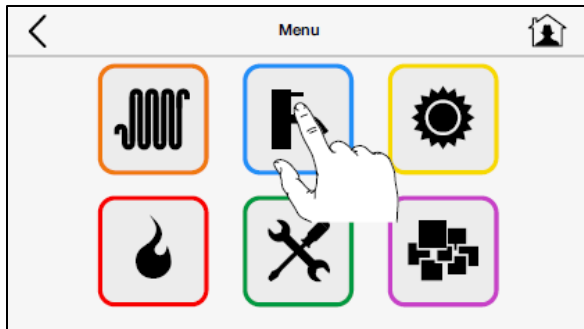
The Comfort and Eco DHW Setpoints can be accessed by clicking the settings button.
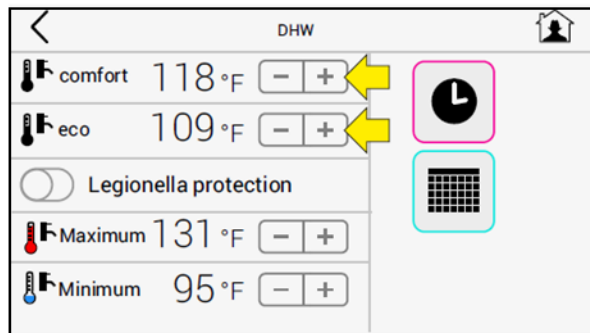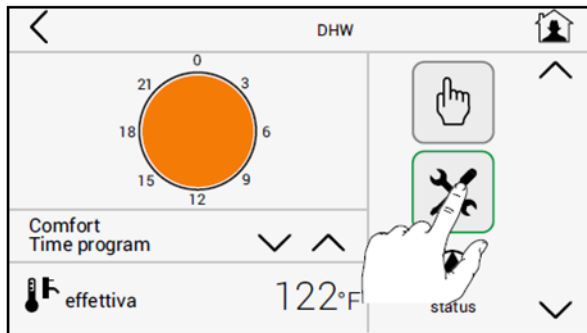
The DHW Setpoint to use can be selected in the Domestic Hot Water Menu
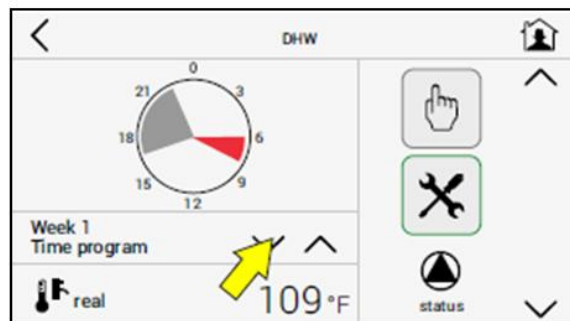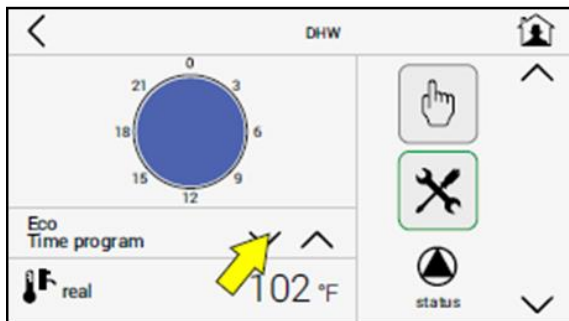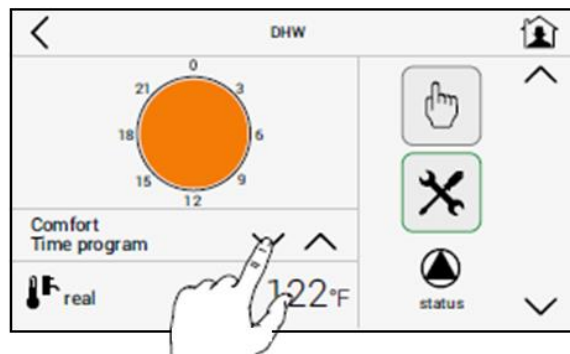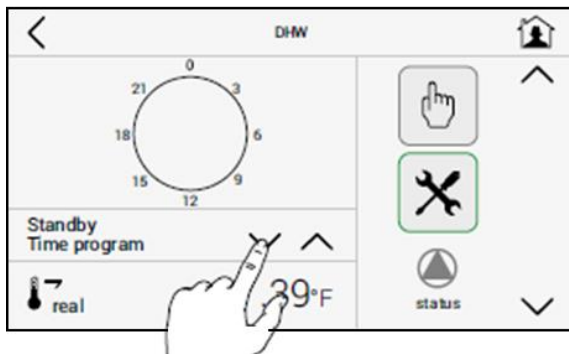
3.4 Devices Menu

The Devices Menu allows access to BMM (Burner Management Module) parameters, BCM parameters for functions including 0-10V operation and domestic hot water operation, and error

history. These parameters are for use by Authorized AERCO service technicians only. Password is required to access this Menu.
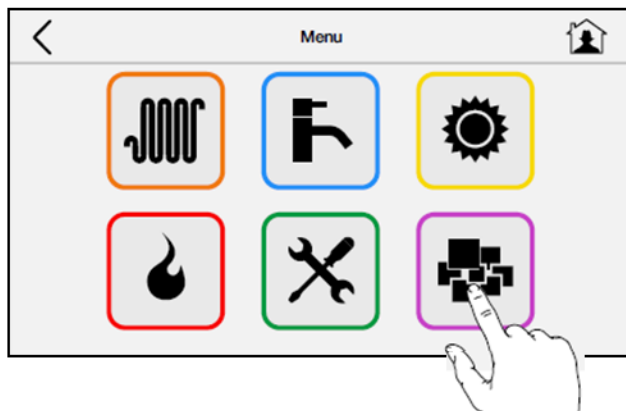
Access the BCM Menu via the **hcm** button. **See Appendix A for a list of BCM Parameters.**
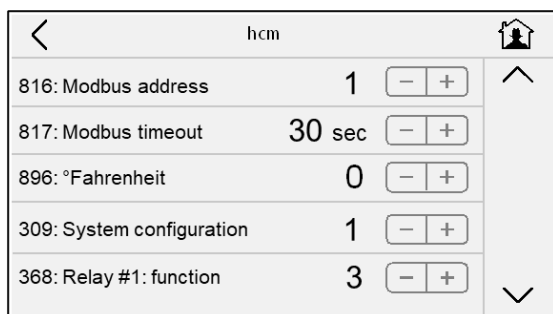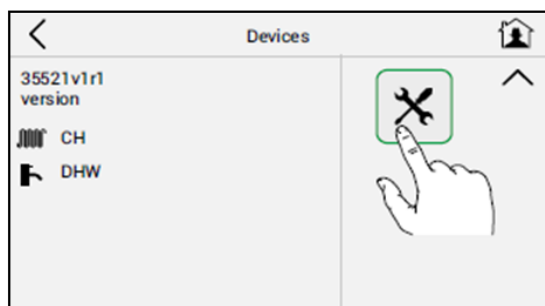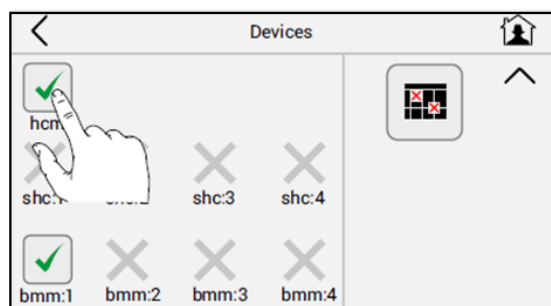
Access the BMM Menu vis the **bmm** buttons. **See Appendix B for a list of BMM Parameters.**

bmm: 1		
487: Fan: integral gain	9	− +
489: Fan: PWM @ Min	8 %	− +
337: Modulation slope	2.0 %	− +
526: Fan: maximum speed	90 Hz	− +
319: Maximum modulation	100.0 %	− +
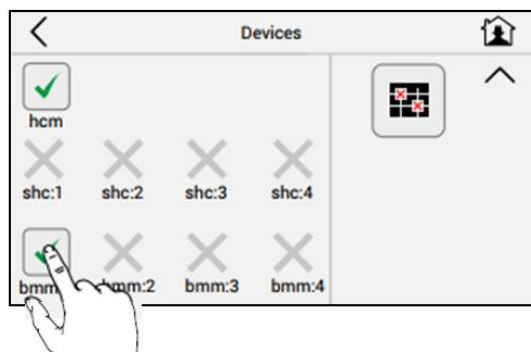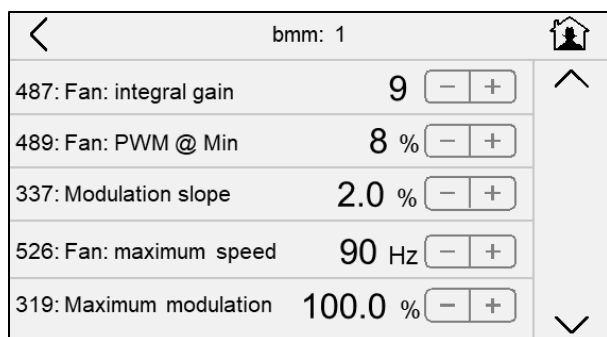
Access and clear error history.

Devices		Devices	
✓ hcm		hcm: 10.48 Thu 17 Feb 2022 4: Ignition Failure	CLEAR
✗ shc:1 ✗ shc:2 ✗ shc:3 ✗ shc:4		hcm: 10.55 Thu 17 Feb 2022 4: Ignition Failure	
✓ bmm:1 ✗ bmm:2 ✗ bmm:3 ✗ bmm:4		hcm: 11.15 Thu 17 Feb 2022 4: Ignition Failure	
		hcm: 17.18 Thu 17 Feb 2022 4: Ignition Failure	
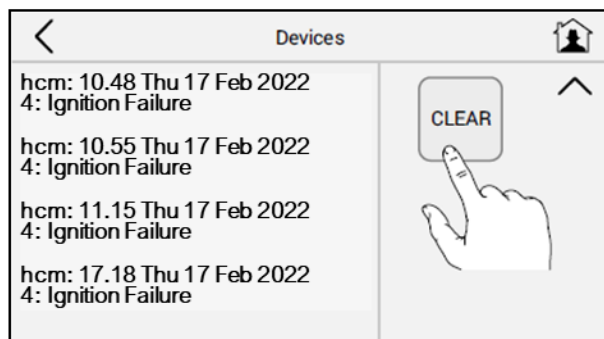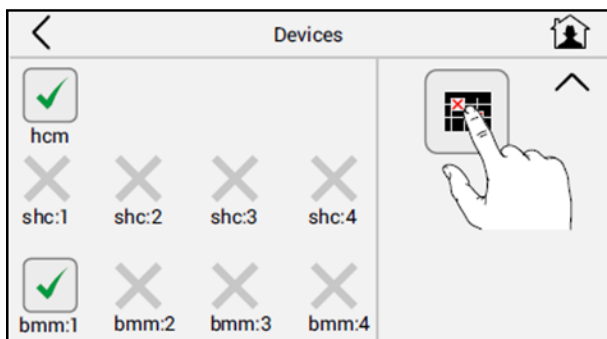
3.5 Burner Menu

The Burner Menu allows access to calibration, manual operation, and troubleshooting settings. This menu is password protected and is only for authorized AERCO technicians.
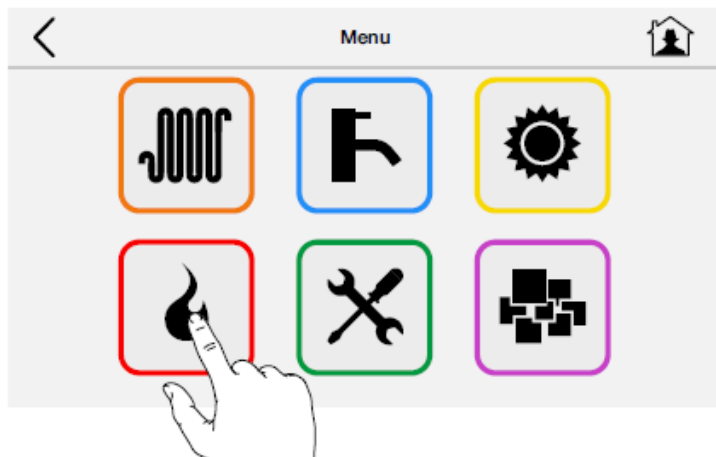
3.5.1 Service Mode/Manual Firing Rate Function

1. Click on the Service Mode 🖌 icon.
2. Enter the password.
3. Click on the Service Mode Icon again. This will show an Activate Button.
4. Note that at this point, the screen shown is for the whole boiler.
5. Toggling the Activate button allows user to operate the boiler with a manual firing rate
6. Click on the Request +/- buttons to set the boiler manual firing rate desired.
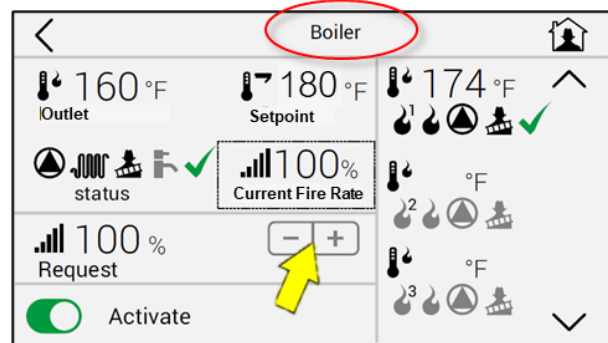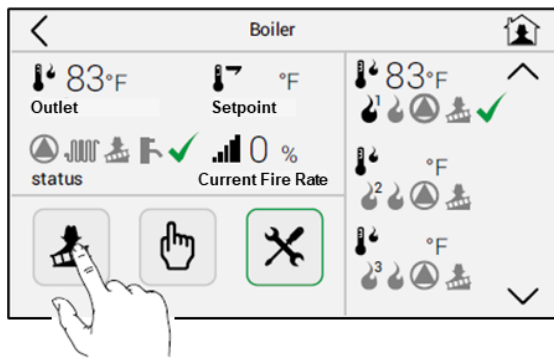
7. If desired, user can select which burner(s) to run during manual firing rate function.

   a. Select one of the available burners 🔥.
   b. Note that the next screen shown is for the selected Burner.
   c. Toggling the Activate button enables the selected burner to run during manual firing rate.
   d. The Current Fire Rate of activated burners will equal the manual firing rate set in the Boiler Screen.

8. To disable the Sweeper/Manual Firing Rate Function, press the Home button 🏠.
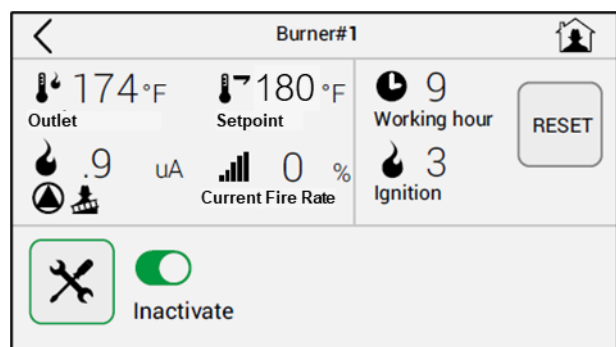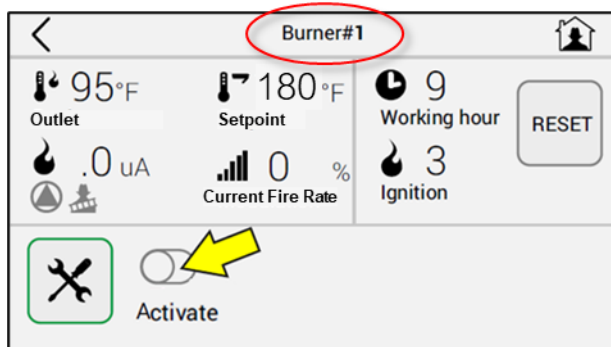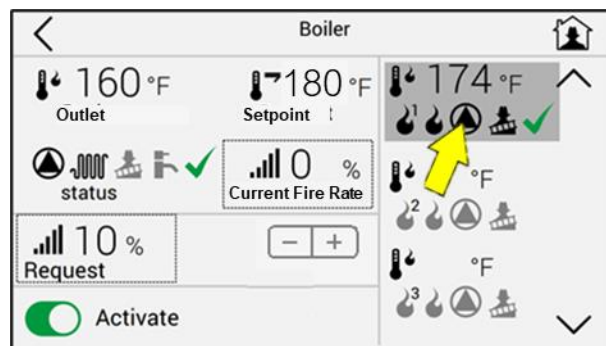
3.5.2 Manual Setpoint Function

1. Click on the Manual Setpoint button 🖐 icon. This will show an Activate Button.
2. Toggling the Activate button allows the boiler to be operated via manual setpoint. Setpoints in Heating or DHW Mode are ignored when Manual Setpoint is activated.
3. Click on the Request +/- buttons to set the manual setpoint desired.
4. To disable the Manual Setpoint Function, select the Home button 🏠.
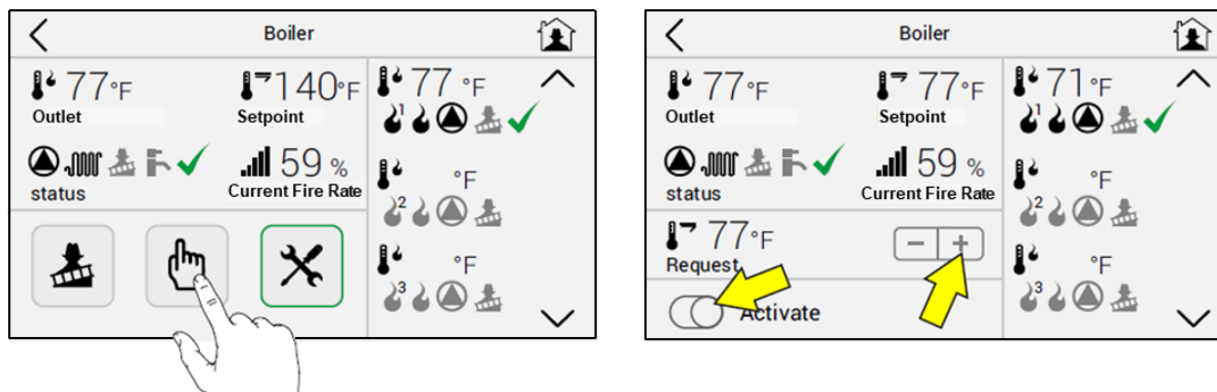
3.5.3 Reset Burner Working Hours and Ignition Count

Select one of the available burners
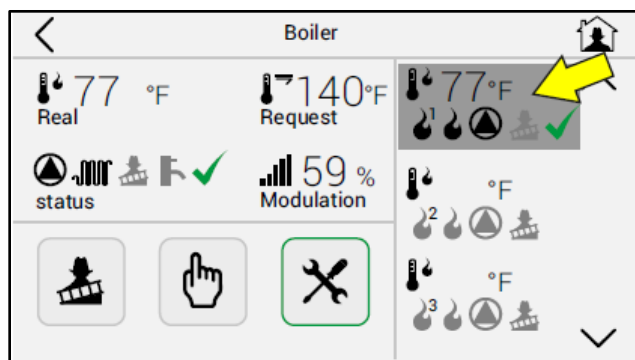
Click the Reset button. Password will be required to proceed.
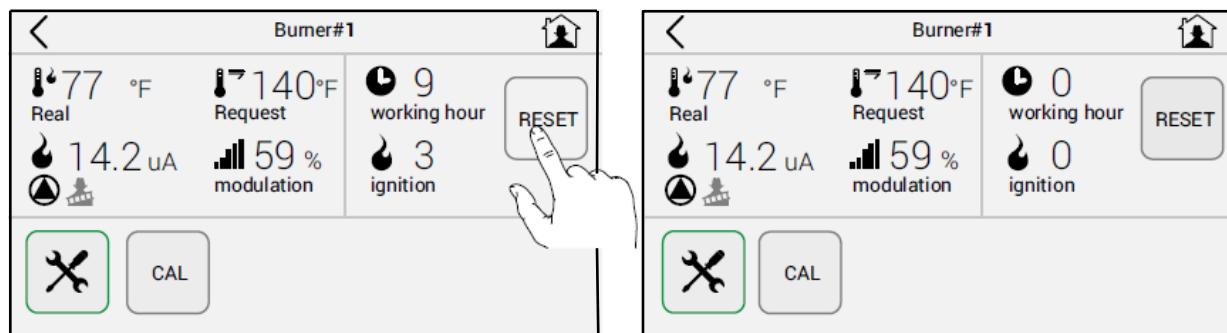
CHAPTER 4: UFLY SETUP AND PROGRAMMING

The following sections 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 Chapter 3 of this document for illustrations and descriptions of the Controller operating controls and displays. Refer to Chapter 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. The supply heating curve can be customized using the Outdoor Reset parameter in the Heating Menu . The outdoor air sensor provided with the Modulex boiler must be installed to enable this mode of operation. The following sections 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.

There is no polarity to observe when connecting the wire leads.

Connect outdoor air sensor (PN 95000926) to Input/Output box, connector Y2, terminals 6 & 7.
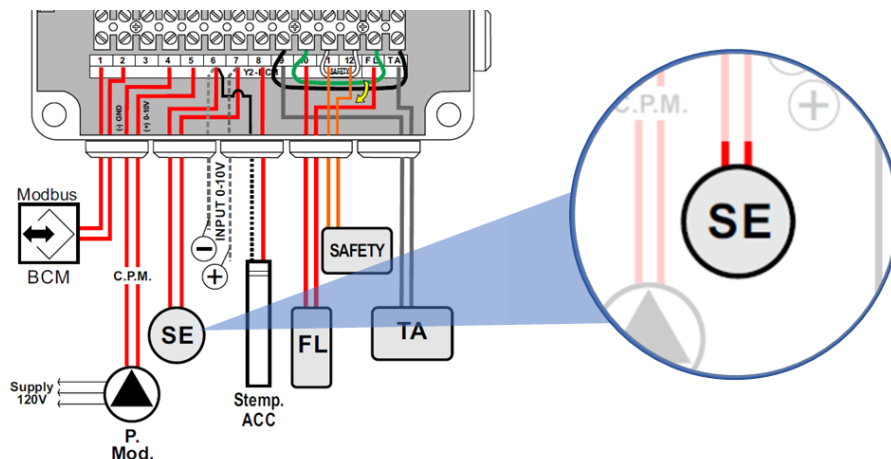
> **NOTE:** The same set of terminals are used for outdoor air sensor and 0-10V remote setpoint input. The functions of these terminals are set through Parameter 799 in the Device Management Menu. For outdoor air sensor, Parameter 799 = 1 (default value). For 0-10V remote setpoint input, Parameter 799 = 2 – see Section 4.3 for details.

4.1.2 Indoor/Outdoor Reset Operation Configuration

The Indoor/Outdoor Reset Mode is configured in the Heating Menu as follows:

IMPORTANT!
The outdoor air sensor MUST be connected as described in Section 4.1.1 above, prior to configuring the Controller for Indoor/Outdoor Reset Mode operation.

1. Access the Heating menu from the Home Screen or from Main Menu.
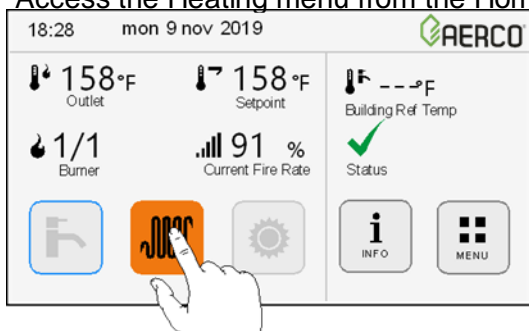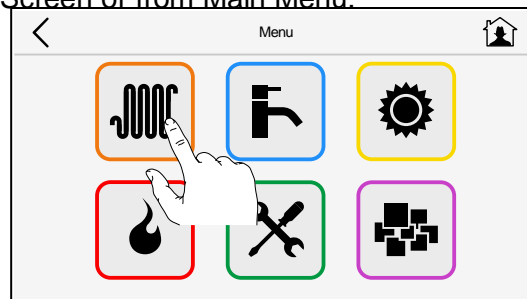
Home Screen   **Main Menu**

2. If there is more than one heating circuit in the system, select the one to be setup for outdoor reset.
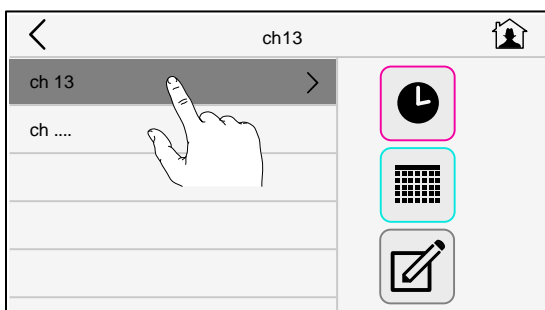
3. Click the settings icon.
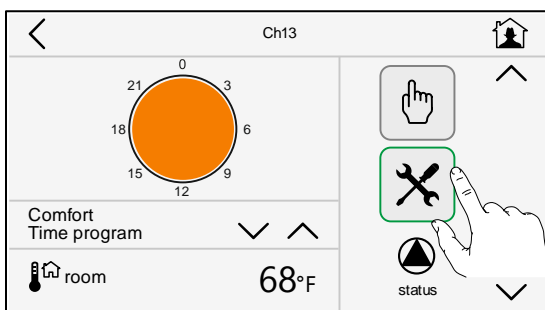
4. Toggle ON "Outdoor Reset"

5. The parameters that will be used to create a temperature curve to vary the unit's setpoint based on the Outside Air Temperature will become accessible.

   a. **Setpoint/OAR Max Setpoint:** the maximum allowable outlet water (setpoint) temperature.

      b. **OAR Min Outside Temp:** when outside temperature is at or below this number, the unit setpoint will be the OAR Max Setpoint.

      c. **OAR Min Setpoint:** the minimum outlet water (setpoint) temperature.

      d. **OAR Max Outside Temp:** the maximum Outside Temperature that the system will operate in. For example: if set to 68°F, the boiler will operate between 68°F outside temperature and OAR Min Out setting.

6. Set **Warm Weather Shutdown** parameter to the threshold outside temperature above which the unit shuts down. For example, if set to 70°F, when the outside temperature goes above 70°F, the unit goes into standby. The unit will then restart when temperature falls below 70°F.

7. **Setpoint High Limit** (upper limit of setpoint) and **Setpoint Low Limit** (lower limit of setpoint) can also be set on this screen.
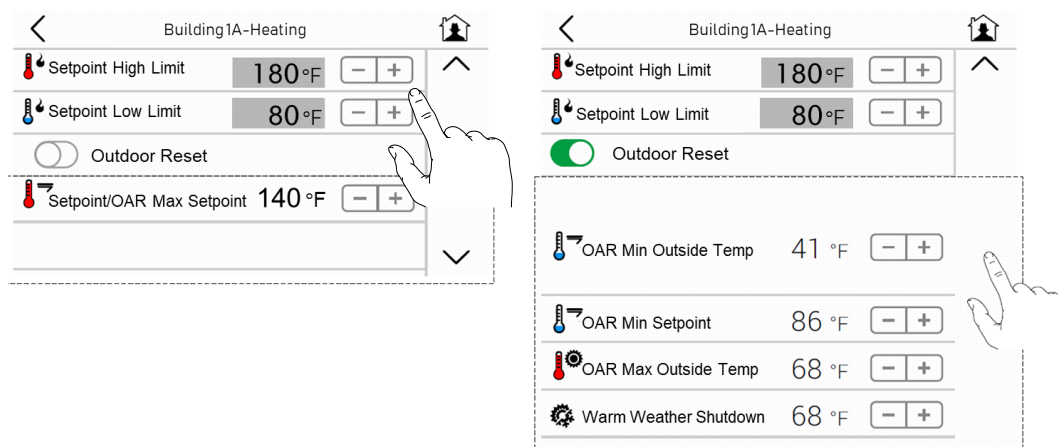
In addition to the Outdoor reset parameters, in Outdoor Reset Mode the unit's setpoint is also influenced by the Building Ref Temp. For example, the graph below shows the setpoint curves at 66°F, 68°F and 70°F Building Ref Temps for the following Outdoor Reset Schedule: OAR Max Setpoint = 160°F, OAR Min Outside Temp = 20°F, OAR Min Setpoint = 100°F and OAR Max Outside Temp = 68°F.
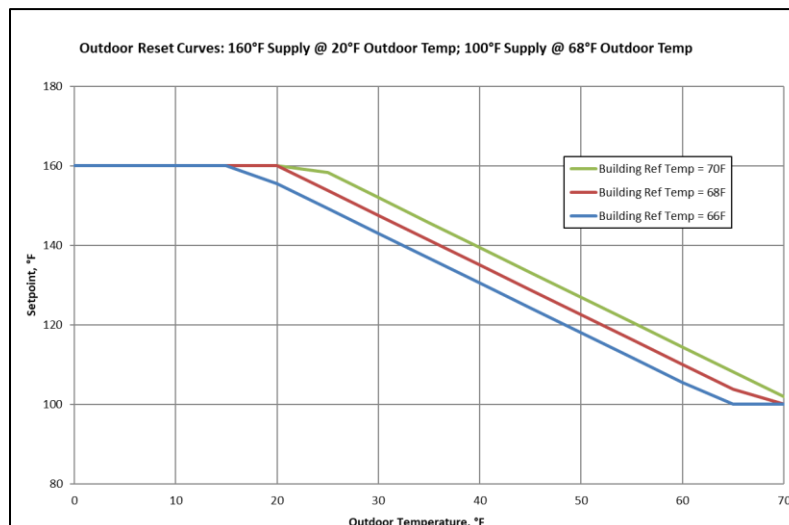
The **Building Ref Temp.** can be programmed using three different methods:
1. **Comfort:** Choose this to set a Building Ref Temp that will be used 24/7.

2. **Eco:** Choose this to set a Building Ref Temp that will be used 24/7. Use this to set a lower Building Ref Temp, resulting to lower setpoint.

3. **Weekly Schedule** (3 schedules available): Choose this to setup Building Ref Temp on a 24-hr clock schedule.

Comfort and **Eco** Building Ref Temp can be set from the Main Menu > Setup > Heating.
- Set Comfort Building Ref Temp to desired setting.
- Set Eco Building Ref Temp to desired setting.
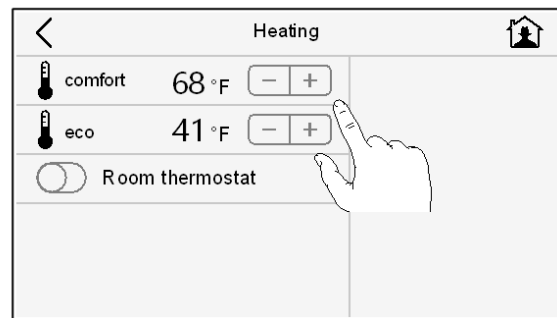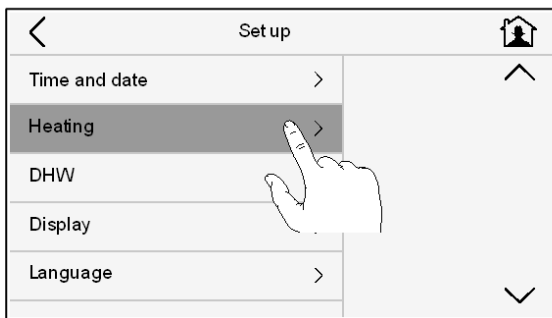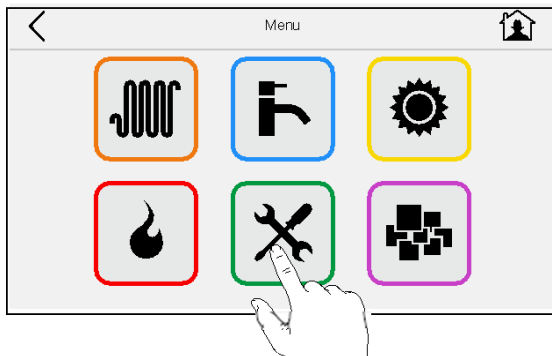
NOTE: Do <u>not</u> toggle ON **Room thermostat**. For boiler enable/disable feature, see section 4.5.

Weekly Scheduled Building Ref Temp: The user can create 3 weekly Building Ref Temp schedules. Each day can be selected from 5 types and programmed with up to 3 time slots."

Creating Types of Day:
1. Access the Heating menu from the Home Screen <u>or</u> from Main Menu.
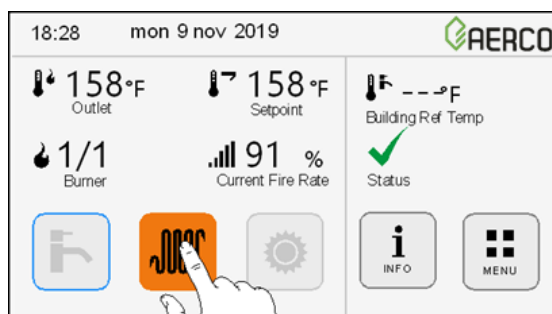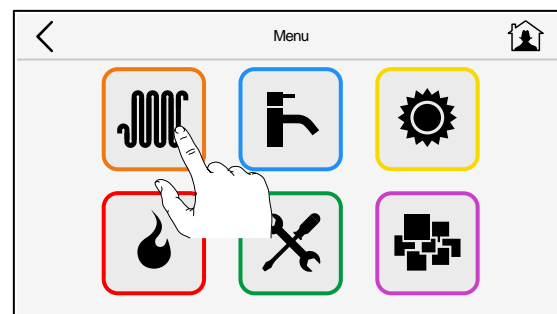
Home Screen   **Main Menu**

2. Rename type of Day as desired (e.g., School Day, School Closed, etc.).
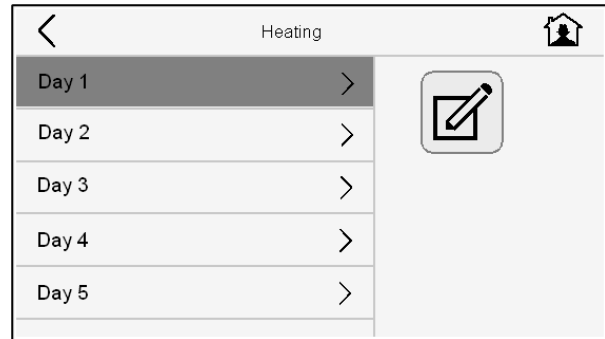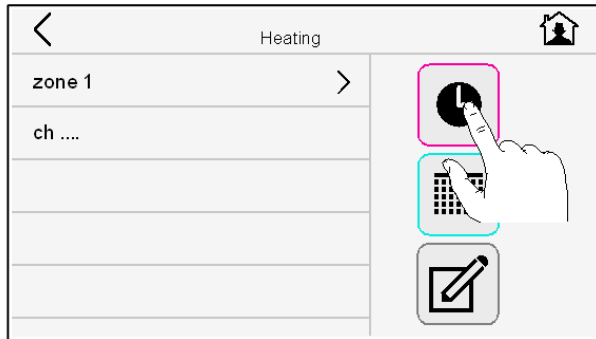
3. Set time slots for each day type. Time slots are programmed in a 24-hr clock.
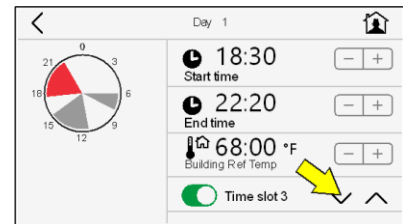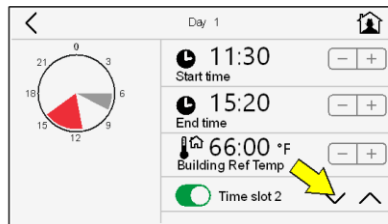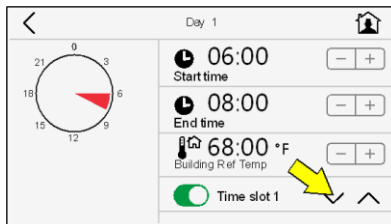
Creating Weekly Building Ref Temp schedules:

1. Rename week type as desired (e.g., School Week, Spring Break Week, etc.).
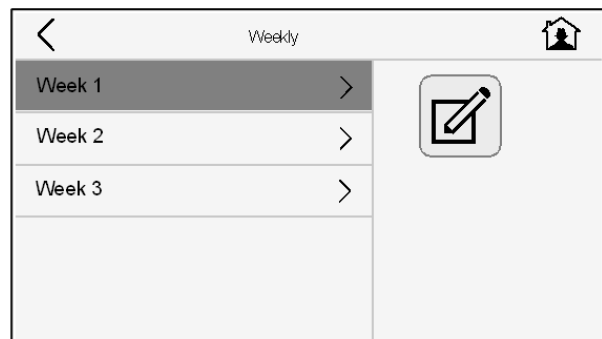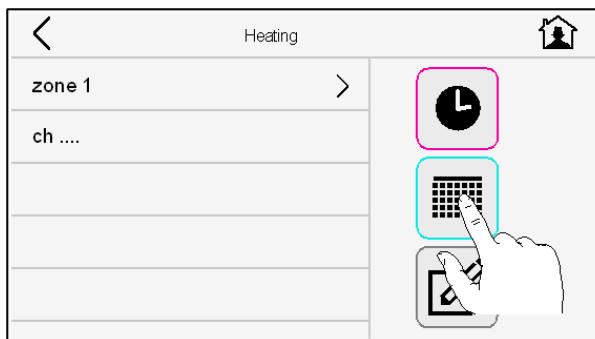
- Mon-Fri can be combined to have a common type of Day if desired.
- Sat/Sun can be combined to have a common type of Day if desired.
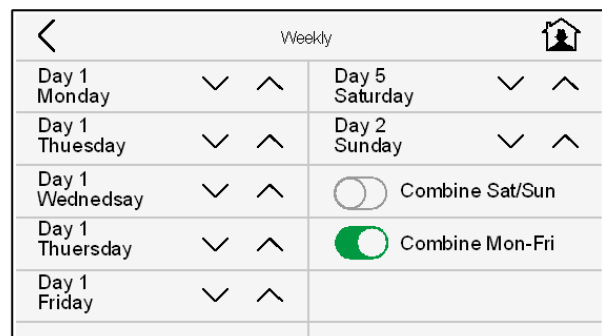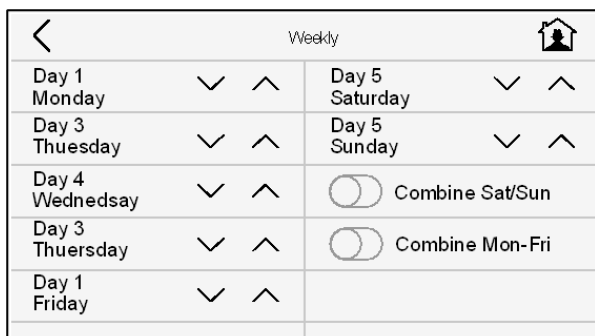
Choosing the Building Ref Temp to use in Outdoor Reset Mode:
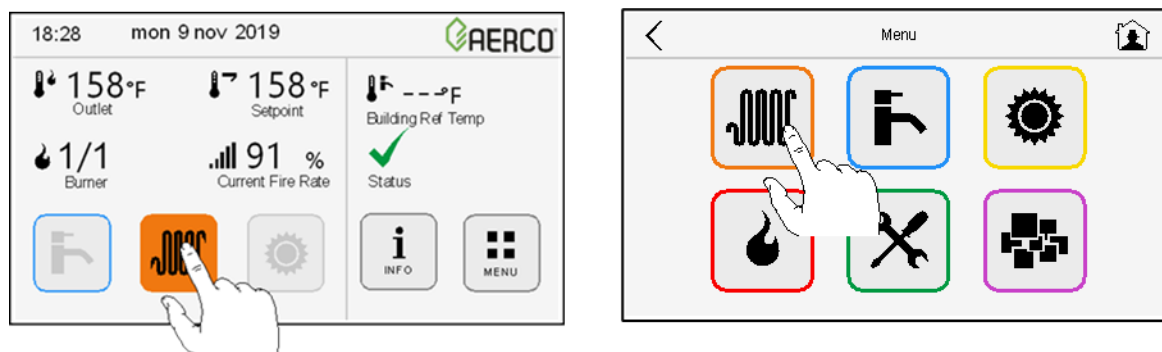
1. Access the Heating menu from the Home Screen <u>or</u> from Main Menu.

2. If there is more than one heating circuit in the system, select the one to be setup for outdoor reset.
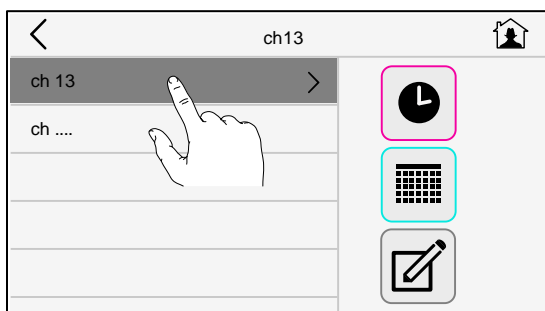
3. Select Comfort, Eco, Week 1, Week 2 or Week 3 Building Ref Temp.
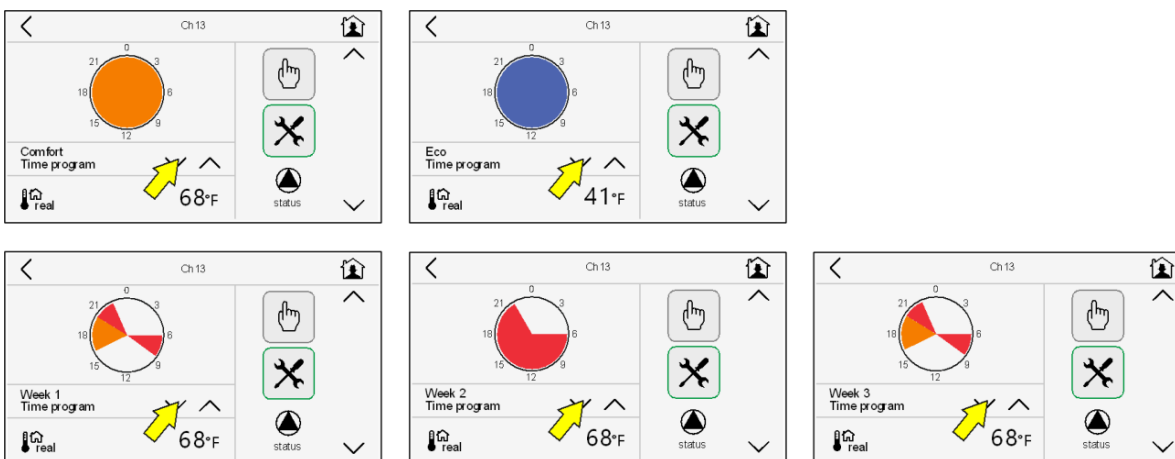
4.

For weekly Building Ref Temp, details of the program can be viewed as follows:
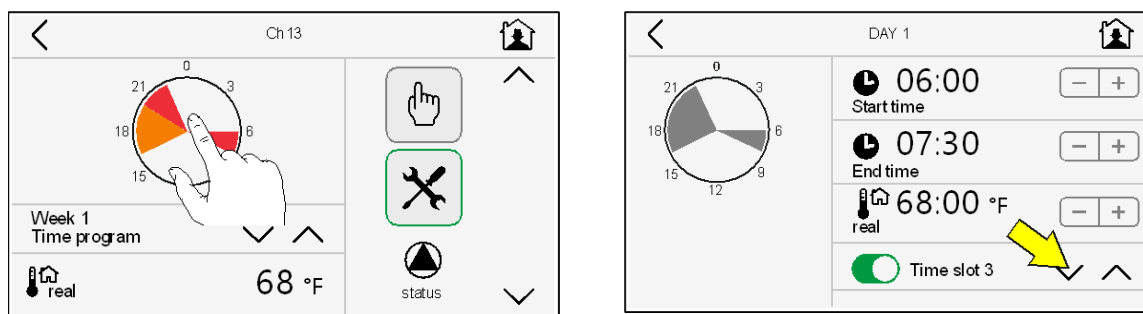
NOTE: During periods between the programmed slots (represented by the un-shaded sections of the pie), the Eco Building Ref Temp is used.

4.1.3 Viewing the Boiler Setpoint

The setpoint temperature setting is viewed in the Heating Menu.

1. Access the **heating** menu from the Home Screen or from Main Menu.
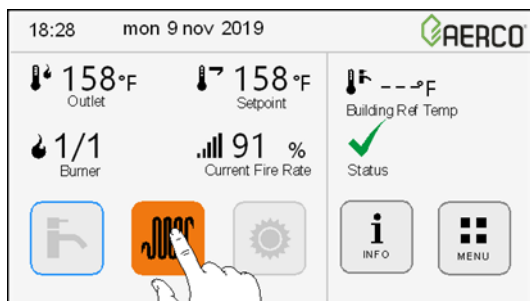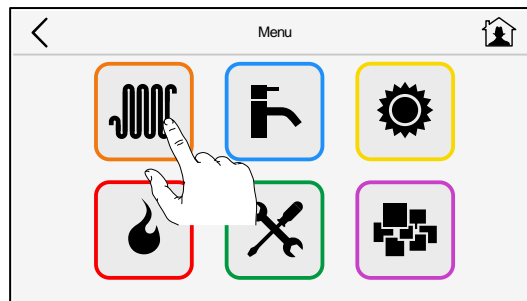
Home Screen   **Main Menu**

If there is more than one heating circuit in the system:

4.2 Constant Set Point Mode

When a fixed header temperature is desired, configure the Constant Set Point Mode as shown below. Follow these instructions to configure the controller for operation in the Indoor/Outdoor Reset mode.

1. Access the **heating** menu from the Home Screen or from Main Menu.

Home Screen   **Main Menu**

2. If there is more than one heating circuit in the system, select the one to be setup for constant setpoint.
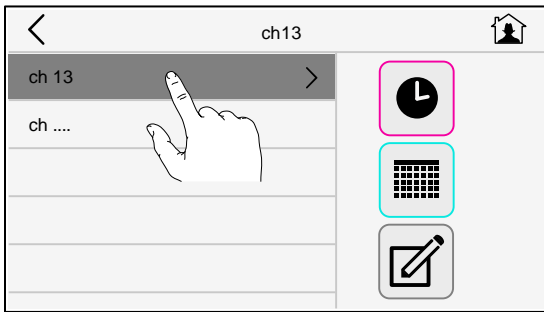
3. Click the **settings** icon.
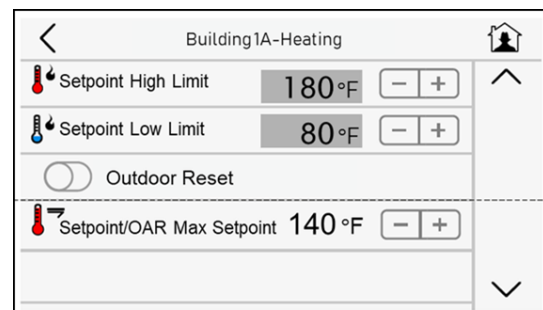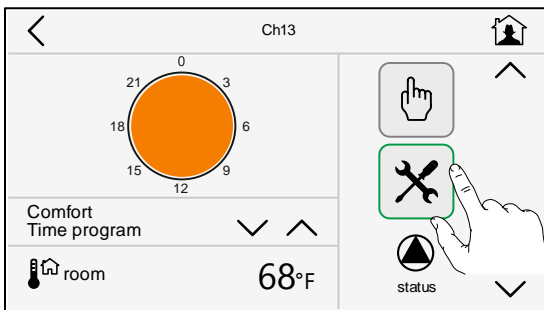
- Set the **Setpoint/OAR Max Setpoint** to desired temperature

- **Setpoint High Limit** (upper limit of setpoint) and **Setpoint Low Limit** (lower limit of setpoint) can also be set on this screen

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 sections 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 Wiring Connections

Connect the 0-10V remote setpoint input to the Input/Output box, connector Y2, terminals 6 (GND) and 7 (Analog input).
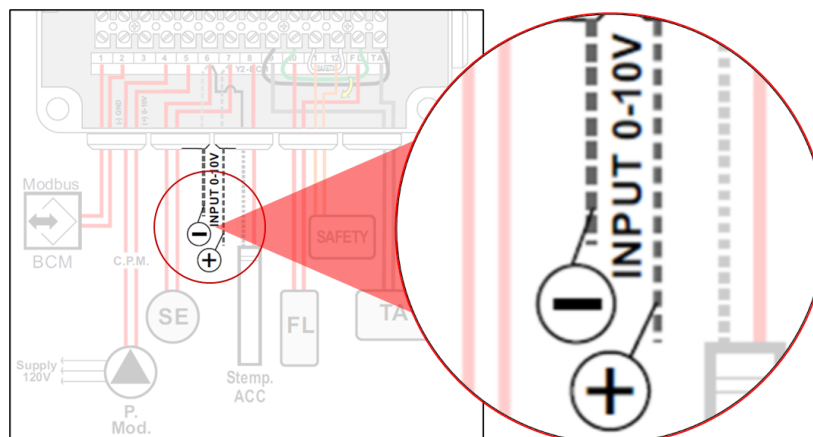
4.3.2 0-to-10-Volt Remote Setpoint Mode Operation Configuration

The 0-to-10-volt Remote Setpoint Mode is configured as follows:

1. Access **Device Management** from Main Menu; select **hcm** > **Parameter Settings**
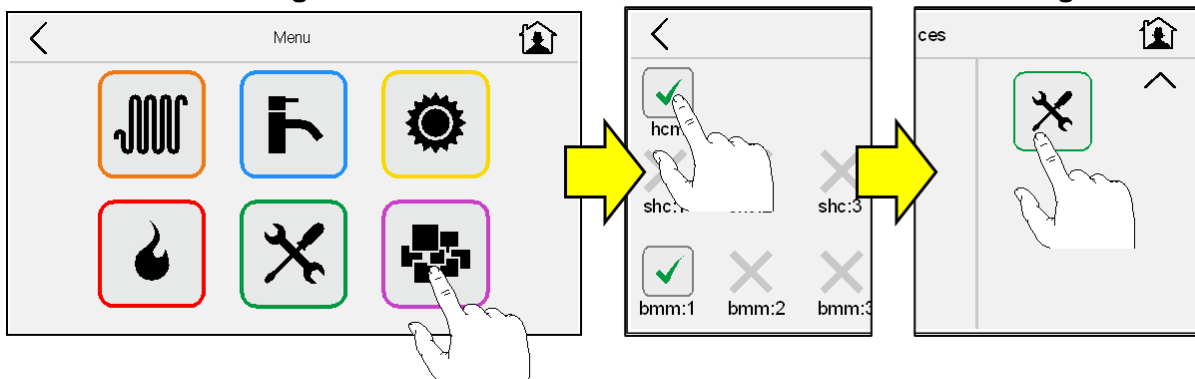
2. Scroll to Parameter 799. Set Parameter 799 = 2.
    *   Parameter 799 defines the functionality of terminals 6/7 of connector Y2 on the Input/Output box.
    *   When set to "2", the terminals will accept a 0-10V Remote setpoint input.
    *   When set to "1" (Default value), the terminals will accept an outdoor air sensor – see Chapter 4.1.

3. Scroll to Parameters 31 and 39 and set values.
    *   The remote setpoint value for 10V is set using Parameter 39.
    *   The remote setpoint value for voltage input between 0V and 10V is linearly distributed between 32°F and the value set for Parameter 39.
    *   The heat request is maintained until the remote setpoint falls 3.6°F below the value set for Parameter 31, at which point the unit will go to Standby.
    *   The heat request resumed when voltage input reaches value set for Parameter 31.

    Example:
    Set Parameter 39 = 140°F
    Set Parameter 31 = 90°F

10V signal will call for 140°F setpoint.

9V signal will call for 129°F setpoint.

7.5V signal will call for 113°F setpoint.

Unit will go to Standby when voltage signal drops to 5.04V (86.4°F remote setpoint).

Unit will resume operation when voltage signal reaches 5.37V (90°F).

4.4 Domestic Hot Water Operation Using A Tank Sensor

The following procedures describe the wiring connection and Ufly Controller configuration 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 the Input/Output box, connector Y2, terminals 6 and 8. 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.
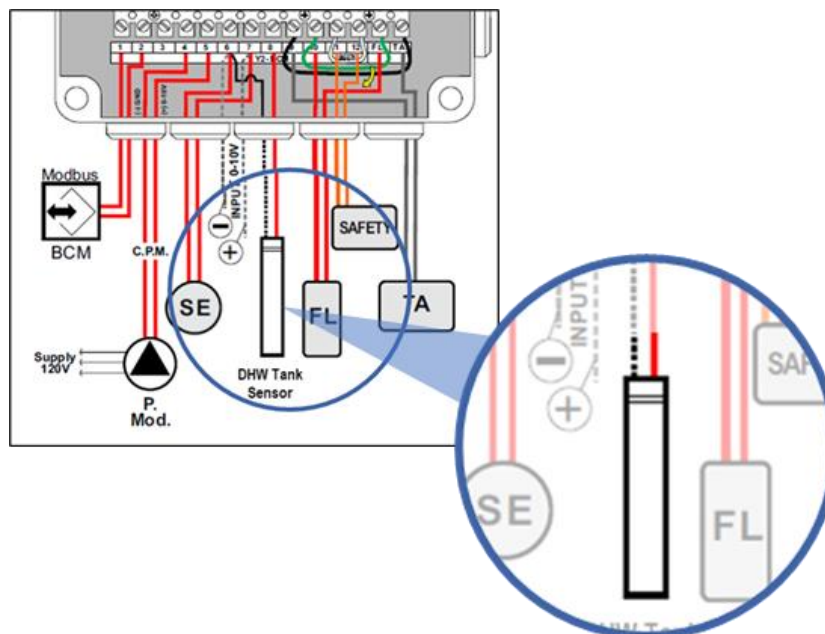
4.4.2 Configuring the Controller for DHW With a Tank Sensor
The DHW production is configured in the DHW Menu as follows:

IMPORTANT!
The tank sensor MUST be connected (Section 6.4.1), prior to configuring the Controller for DHW operation. If the sensor is not connected, many required functions will not display.

Access the DHW menu:
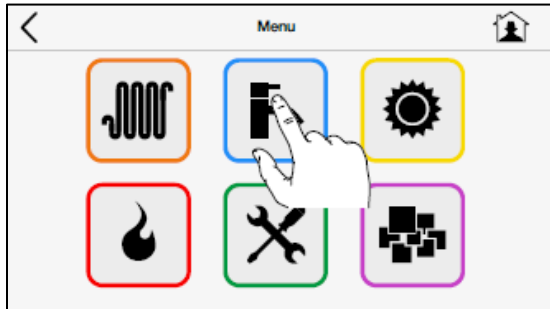
DHW Setpoint can be programmed using three different methods:
1. **Comfort:** Choose this to set a DHW Setpoint that will be used 24/7.

2. **Eco:** Choose this to set a DHW Setpoint that will be used 24/7. Use this to set a lower DHW Setpoint

3. **Weekly Schedule** (3 schedules available): Choose this to setup DHW Setpoint on a 24-hr clock schedule.

Comfort and **Eco** DHW Setpoints can be set by tapping the settings icon:
- Set **Comfort** DHW Setpoint to desired setting.
- Set **Eco** DHW Setpoint to desired setting.
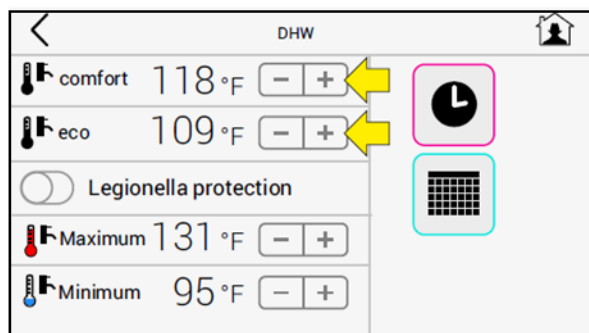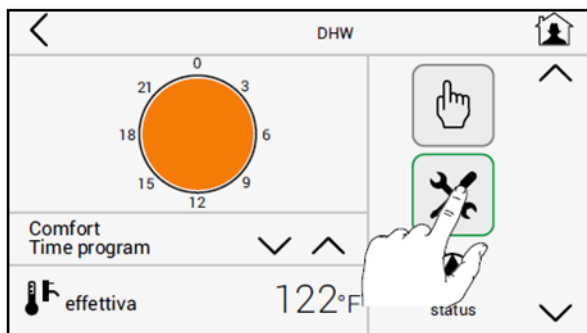
Weekly Scheduled DHW Setpoint: The user can create 3 weekly DHW Setpoint schedules to choose from. Each day of the week can be selected from 3 choices of type of day and each type of day can be programmed with up to 3 time slots."

Creating Types of Day:

1. Rename type of Day as desired (e.g., School Day, School Closed, etc.).
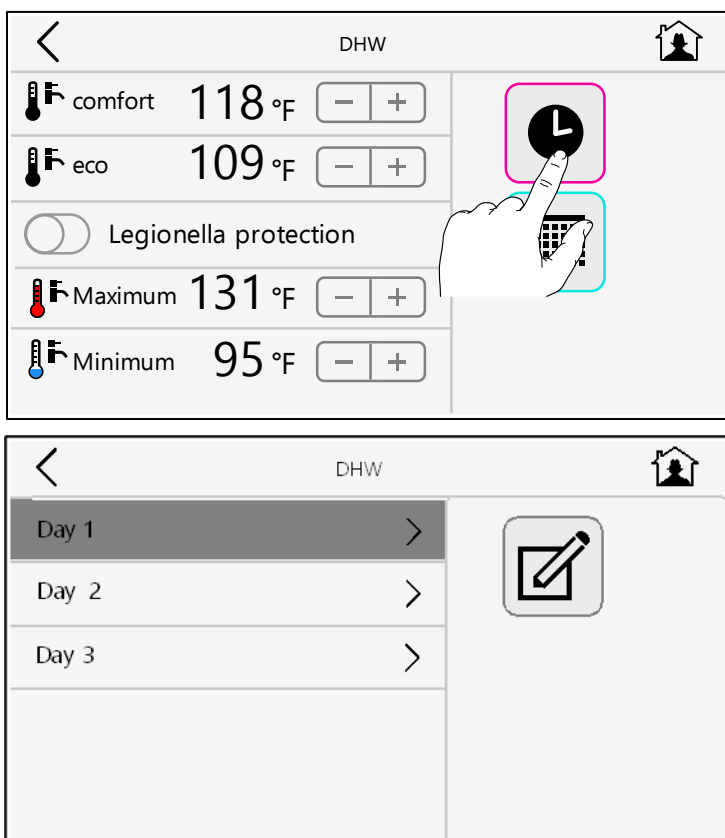
2. Set time slots for each day type. Time slots are programmed in a 24-hr clock.
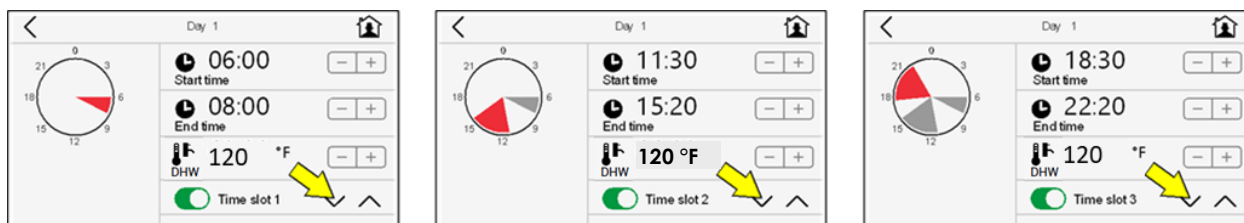
Creating Weekly DHW Setpoint schedules:

1. Rename week type as desired (e.g., School Week, Spring Break Week, etc.).
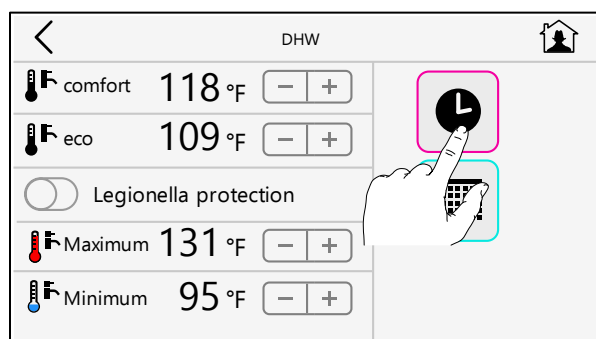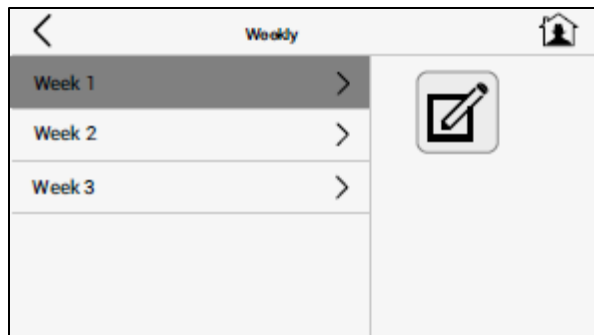
- Mon-Fri can be combined to have a common type of Day if desired.
- Sat/Sun can be combined to have a common type of Day if desired.
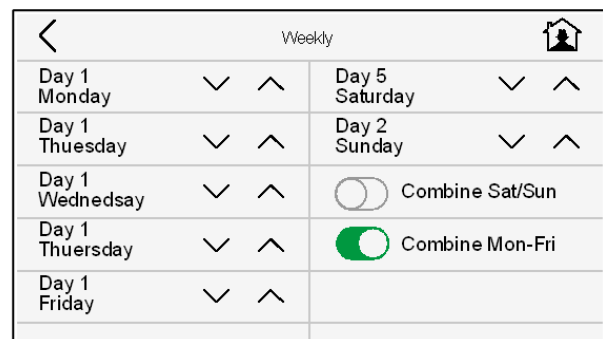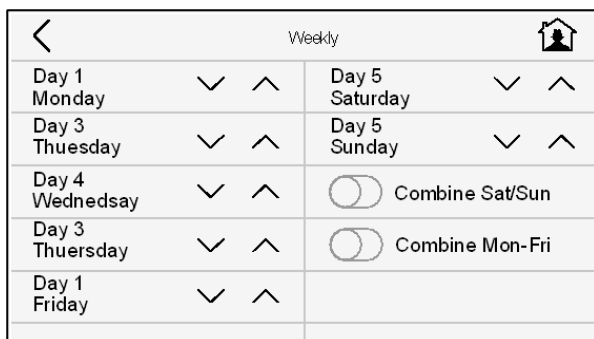
Choosing the DHW Setpoint to use:

1. Select Comfort, Eco, Week 1 , Week 2 or Week 3 DHW Setpoint.
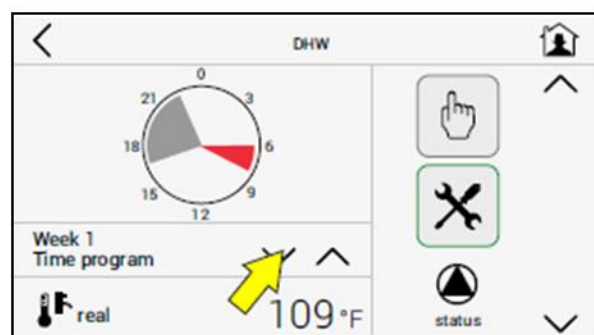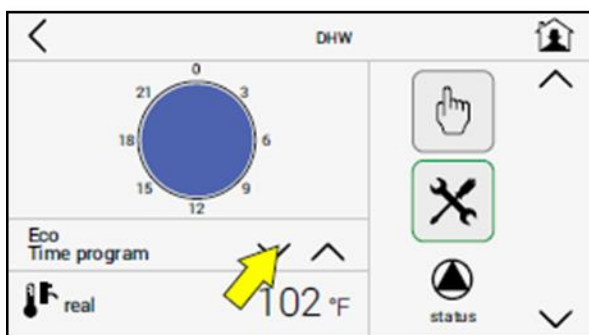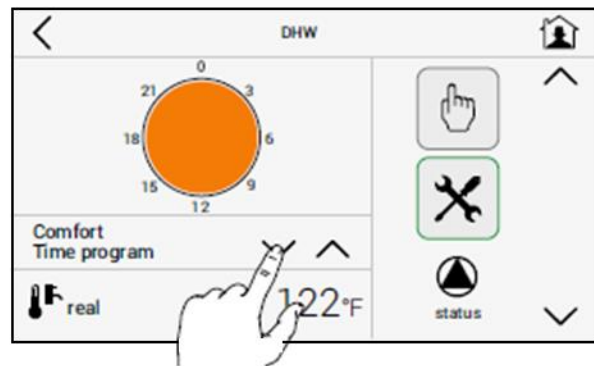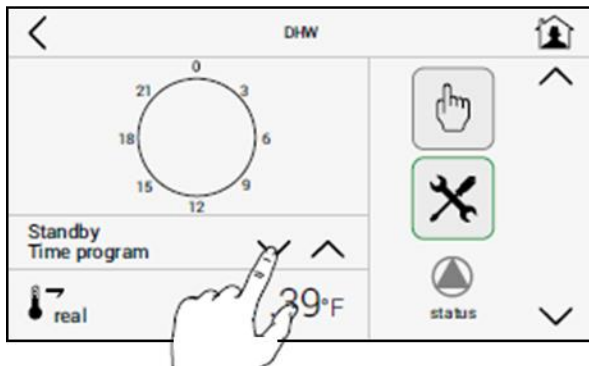
2. For weekly DHW Setpoint, details of the program can be viewed as follows:
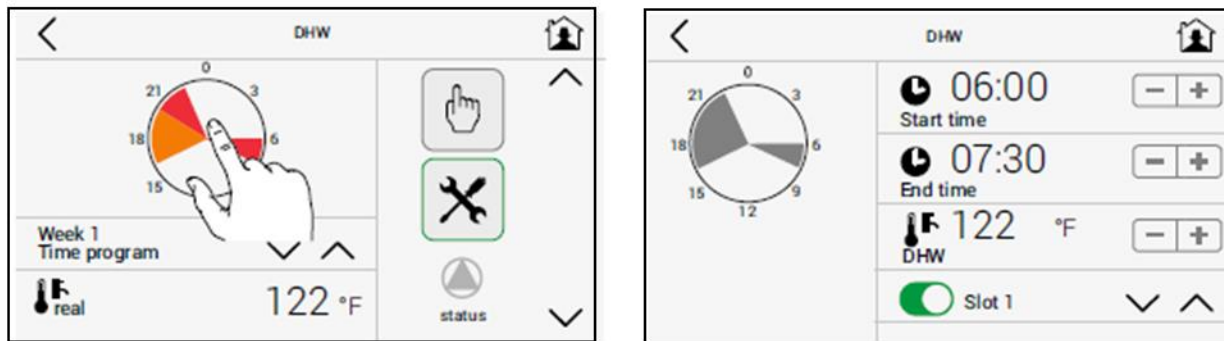
NOTE: During periods between the programmed slots (represented by the un-shaded sections of the pie), the Eco DHW Setpoint is used.

Viewing the DHW Setpoint:
The setpoint temperature setting is viewed in the Heating Menu.
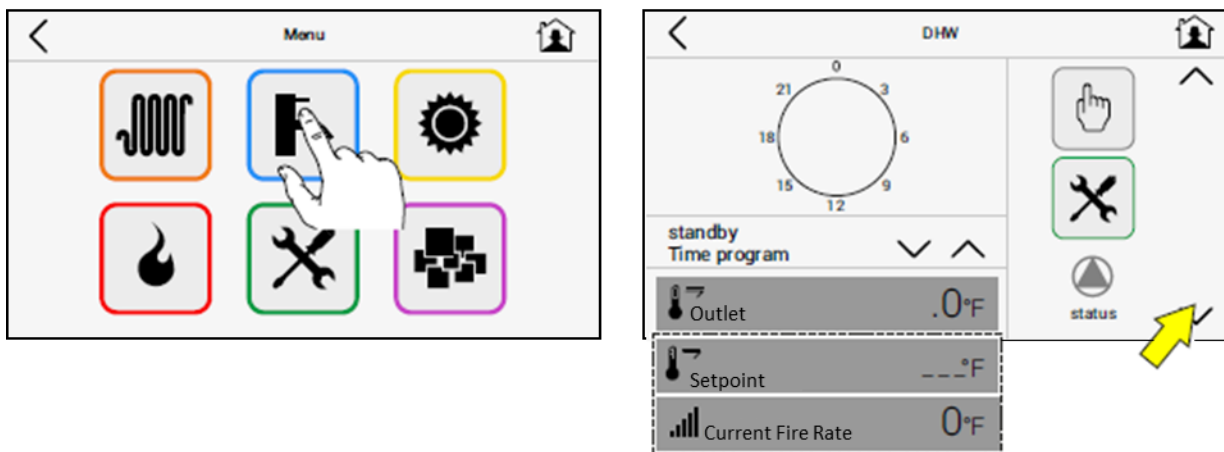
4.5 Boiler & Pump Enable/Disable

The boiler and pump can be enable/disabled via terminals TA and 9 terminal block Y2 in the Input/Output box. The function of terminals Y2 TA/9 is configured as follows:

1. Remove jumper from terminals 9 and TA.
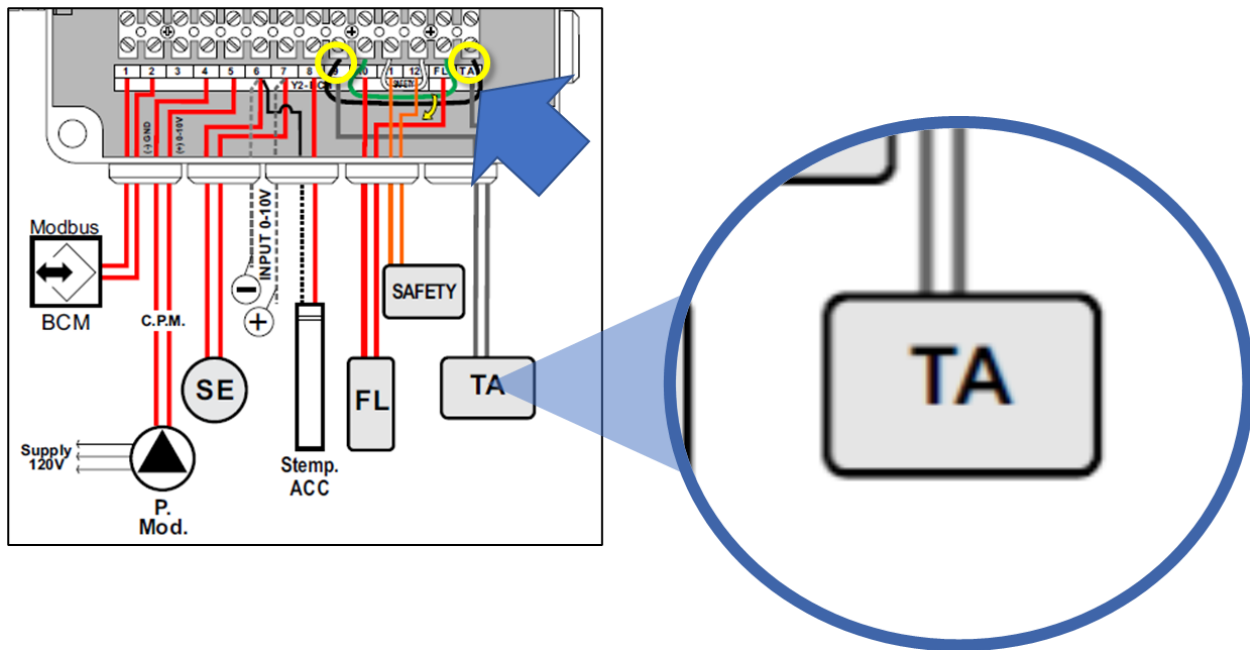
2. Access **Device Management** from Main Menu; select **hcm** > **Parameter Settings**
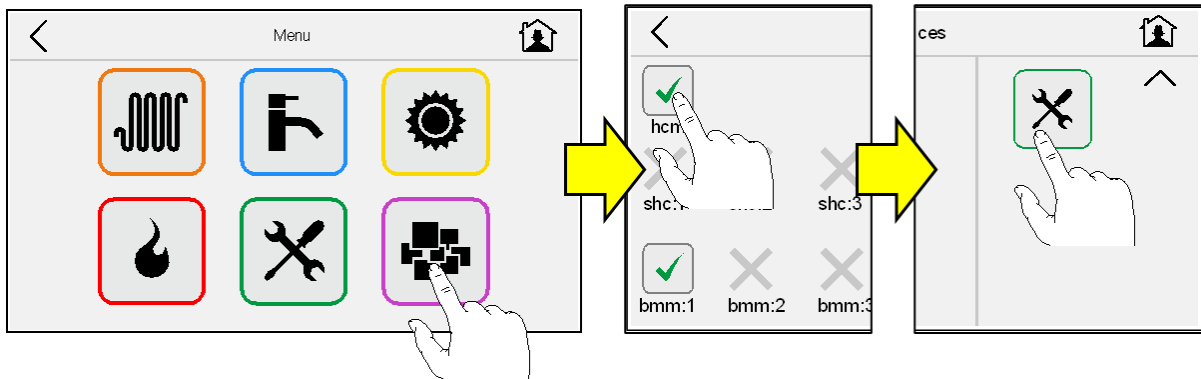
3. Set Parameter 376. This defines the functionality of terminals TA/9 of connector Y2:
    *   Parameter 376 is set = 0. This setting enables/disables the secondary loop pump.
        - When Y2 TA/9 is opened, the secondary loop pump is disabled. The boiler loop pump and the domestic boiler water pump will run when needed to satisfy domestic hot water demand.
        - When Y2 TA/9 is closed, the secondary loop pump is enabled.
    *   Parameter 376 is set = 1. This setting enables/disables the entire system.
        - When Y2 TA/9 is opened, the Modulex boiler, boiler loop pump, secondary loop pump and domestic boiler water pump are all disabled.

– When Y2 TA/9 is closed, the Modulex boiler, boiler loop pump, secondary loop pump and domestic boiler water pump are all enabled.

NOTE: Terminals Y2 TA/9 can be used for enable/disable functionality described above **OR** for automatic activation of BCM as a backup controller, <u>not</u> both. See Chapter 6.3 for setting of Parameter 376 for automatic activation of BCM as a backup controller.

---

hcm		
799: 0/10V input	2	− +
376: Input#1: function	0	− +
322: Pump: overrun	5 min	− +
341: Pump: minimum control	3.0 Volt	− +
313: Pump: maximum control	10.0 Volt	− +

CHAPTER 5: INPUT/OUTPUT BOX, BCM TERMINAL ASSIGNMENTS
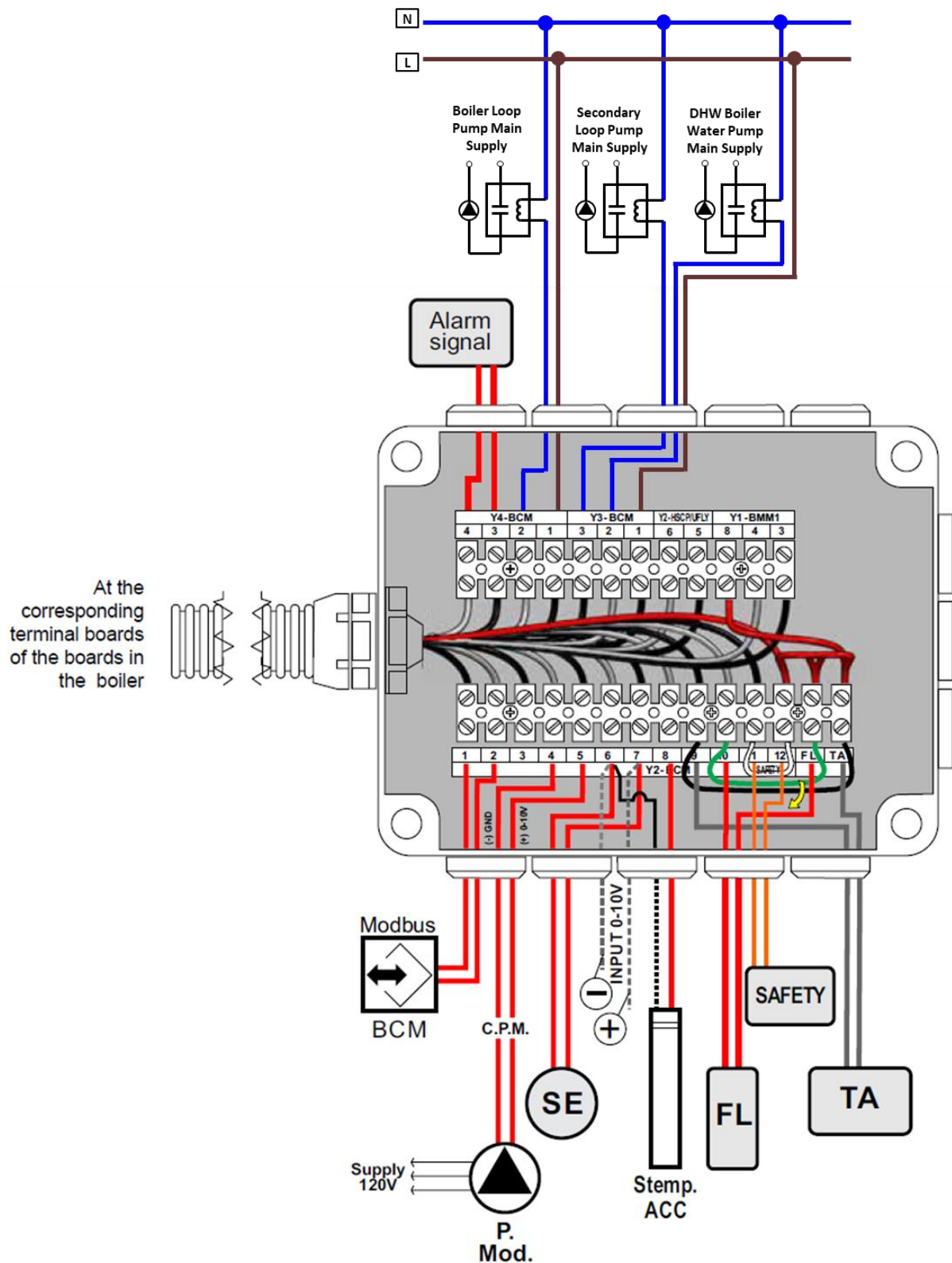
Figure 5-1: Input/Output Box, BCM Terminals

5.1 Terminal Assignments

Connections for:	Y2 BCM	
Modbus BCM A B	2 1	Remote boiler control A (-) Data connection B (+) Data connection
P. mod	4 - 5	Modulating heating pump
SE	6 - 7	External sensor
- / +	6 - 7	0 / 10 V signal contact
Stemp ACC (*)	6 - 8	Storage Tank Temperature Sensor
FL	FL - 10	Flow switch (remove jumper)
INAIL	11-12	Safety devices (remove jumper)
TA	TA - 9	Room thermostat / Clock remove jumper

	Y4 - BCM	
Alarm signal (**)	3 - 4	Alarm / signal contact (NO potential-free contact)
P. Coll.	1 - 2	Manifold pump (primary loop)
	Y3 - BCM	
P. CH	1 - 3	Heating circuit pump
P. Car DHW	1 - 2	Storage Tank loading Pump
	Y2 - UFLY	
Modbus Ufly A B	5 6	Remote Temperature Control A (5) Data connection B (6) Data connection
	Y1 BMM1	
SHC (***)	8 - 4 - 3	Optional multifunction module (to be inserted in the box cover)

CHAPTER 6: BOILER COMMUNICATIONS MODULE (BCM)

The BCM (Boiler Communication Module) is an electronic module in MODULEX boilers, which supports full interoperability to BAS (Building Automation Systems) via Modbus protocol to make remote communications and control possible. In addition, it provides customers with a remote alarm contact to notify customers of faults detected within any of the boiler's multiple thermal modules. Finally, in the event the boiler's master controller stops working, the BCM also takes over operations of the boiler.

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 when any fault condition occurs in the Modulex Boiler.

- BCM serves as a Back-up Controller if the primary Ufly Controller fails.

- BCM provides a 0-10V output for controlling a VFD primary pump.

- BCM can function as a "Client" to a "Manager" Energy Management System (EMS), Building Automation System (BAS) or AERCO Control System (ACS) on a Modbus Network.

The following describes the BCM and each additional control function listed above.

6.1 BCM Description

The BCM is installed on the front of the Modulex Boiler, behind the lift-up front panel.
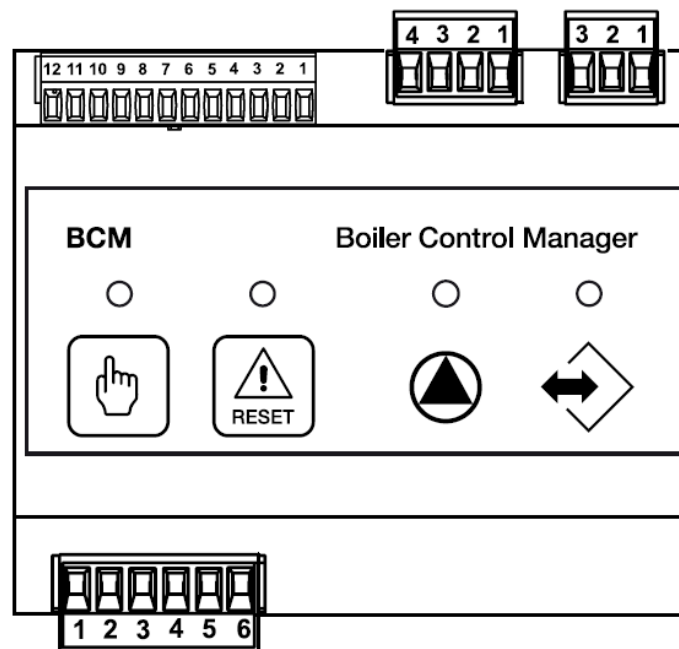
Figure 6-1: Boiler Communications Module (BCM)
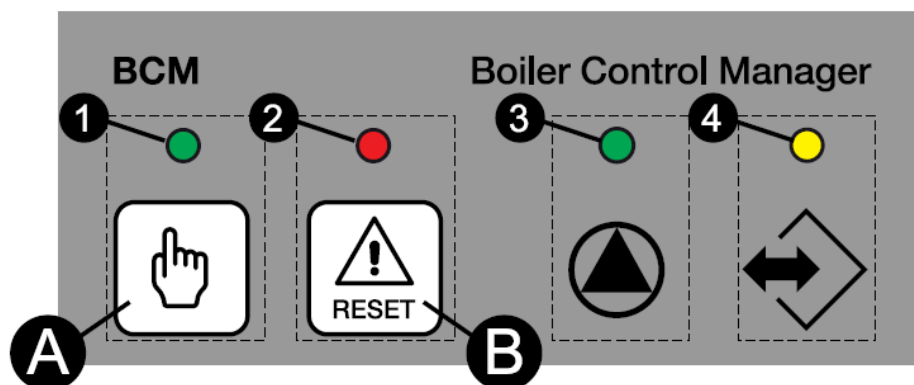
KEY		
No.		**Description**
A		MANUAL request button (See section 7.3.2 for details)
1	**GREEN**	LED
	OFF	MANUAL request NOT active
	ON	MANUAL request active
B		RELEASE button
2	**RED**	LED
	ON	FAULT detected
	FLASH.	ANTIFREEZE protection activation
	OFF	Normal operation
3	**GREEN**	LED
	ON	CH heating operation or antifreeze protection active
	FLASH.	DHW request operation
	OFF	Standby
4	**YELLOW**	LED
	ON	BCM communication with local and BCM remote controls (cascade)
	FLASH.	BCM communication with local HSCP or SHC controls
	OFF	No communication with controls (manual A request)

Figure 6-2: BCM Key and LEDs Legend

6.2 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 in the Input/Output box. In addition, the red LED on the BCM board will light continuously.

6.2.1 BCM Fault Relay Wiring

If desired, pins 3 and 4 of connector Y4 (Figure 6-4) can be wired to an external source to provide a remote alarm indication when the BCM Fault Relay is activated.

6.2.2 Clearing Faults

A fault can be cleared by pressing and releasing the black Reset Button on the front cover of the BCM (see Figure 6-2) or tapping on the reset icon on the Ufly Controller However, if the cause of the fault has not been corrected, the Fault Relay will again be activated.
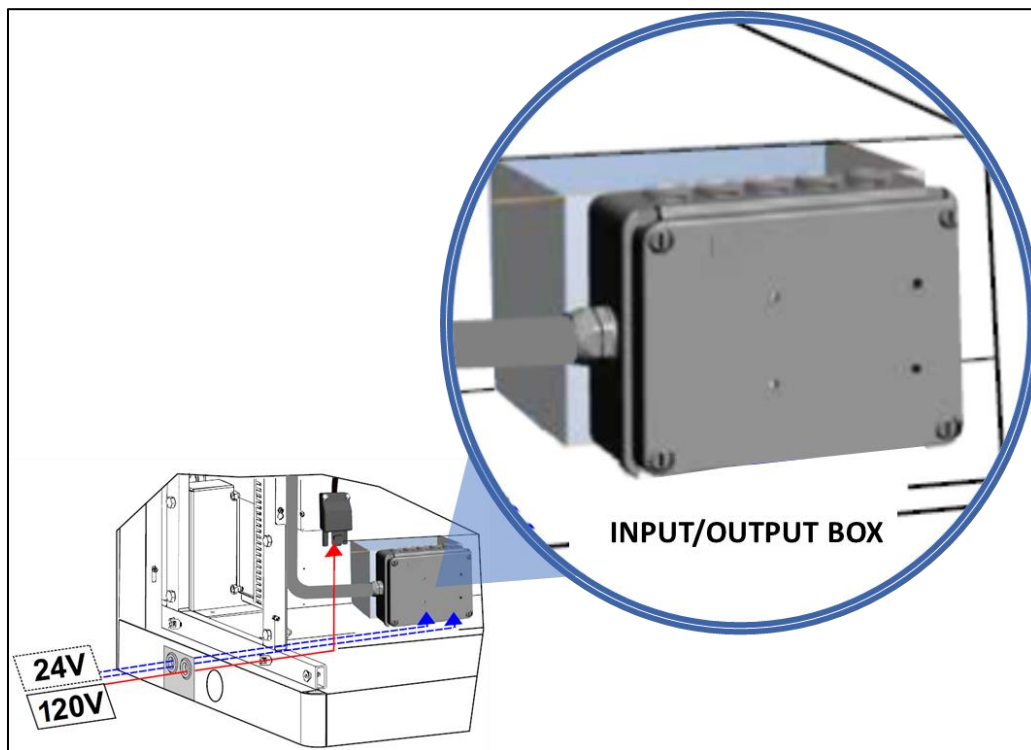
Figure 6-3: Input/Output box location
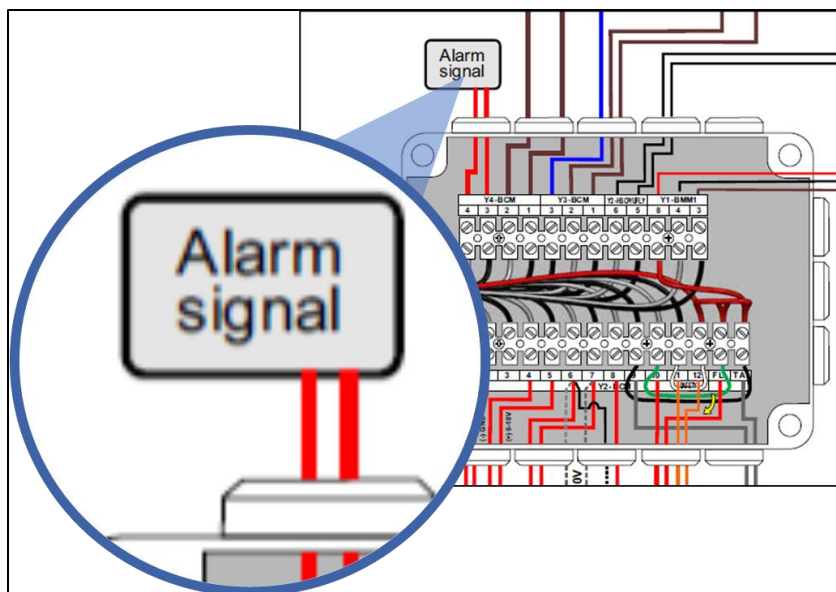
Figure 6-4: Alarm Signal location
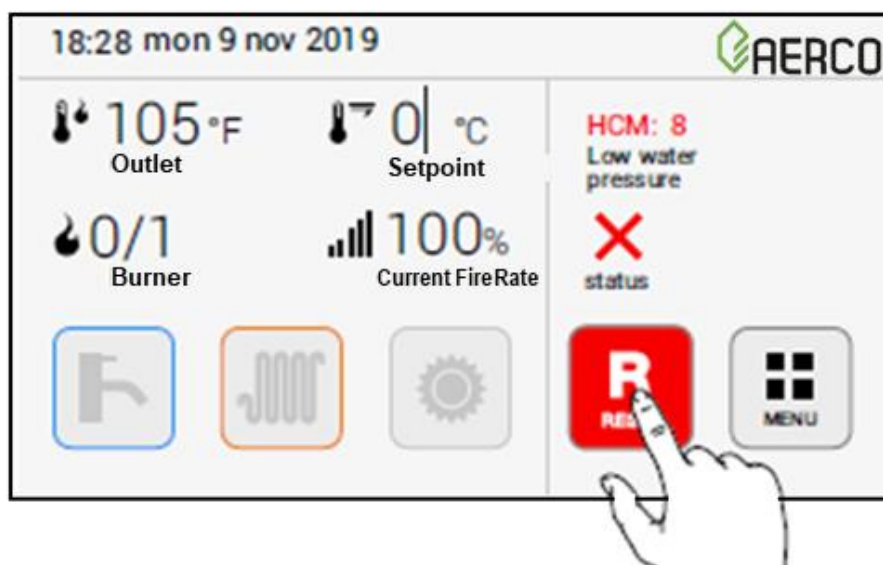
Figure 6-5: BCM Fault Relay & Reset Switch Wiring

6.3 BCM: Backup Controller Function

6.3.1 Backup Controller Setpoint

The BCM is a backup controller and will assume control of the Modulex Boiler if the Ufly Controller fails. In the event of a Ufly Controller failure, the BCM will operate the Modulex Boiler with a setpoint equal to the value assigned for Parameter 39 (Maximum Setpoint) in the BCM. **Do not change the value of Parameter 39 as it also represents the maximum setpoint for the boiler during normal operation.**

If a different setpoint is desired for controller back-up operation, a resistor can be installed in terminals 6 and 7 of connector Y2 in the Input/Output box and Parameter 799 must be set = 0.

NOTE: A resistor can be installed on terminals Y2 6/7, and Parameter 799 can be changed to zero <u>only if</u> the normal operating mode is either Constant Setpoint or via Modbus (AERCO ACS, BAS/EMS). A resistor cannot be installed on terminals Y2 6/7 if the normal operating mode is Outdoor Reset or Analog Remote Setpoint because they are used for the outdoor air sensor or analog input. (Do not change Parameter 799 to zero as it is used to define the function of the same terminals for Outdoor Reset or Analog Remote Setpoint).

SETPOINT RESISTOR VALUES	
RESISTOR	SETPOINT
OPEN	180°F
100K OHMS	160°F
47K OHMS	140°F
22K OHMS	120°F
10K OHMS	100°F
SHORT	80°F
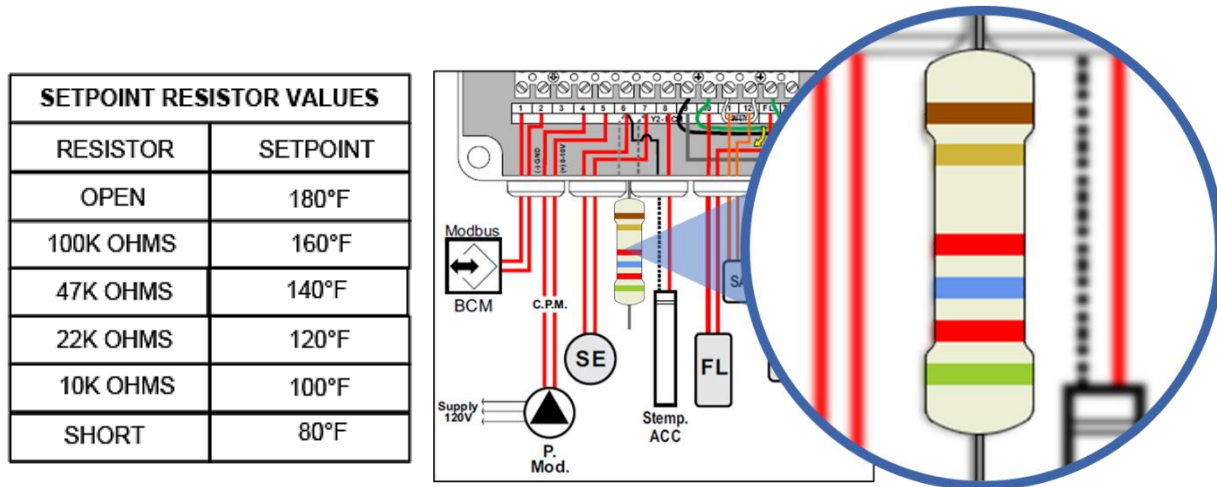
Figure 6-6: Installing Resistor to Change Default Setpoint

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6.3.2 Operating the BCM as a Backup Controller

When the Ufly Controller fails or the external control signal from the Master ACS, EMS, or BAS is lost, the yellow LED on the BCM will blink.
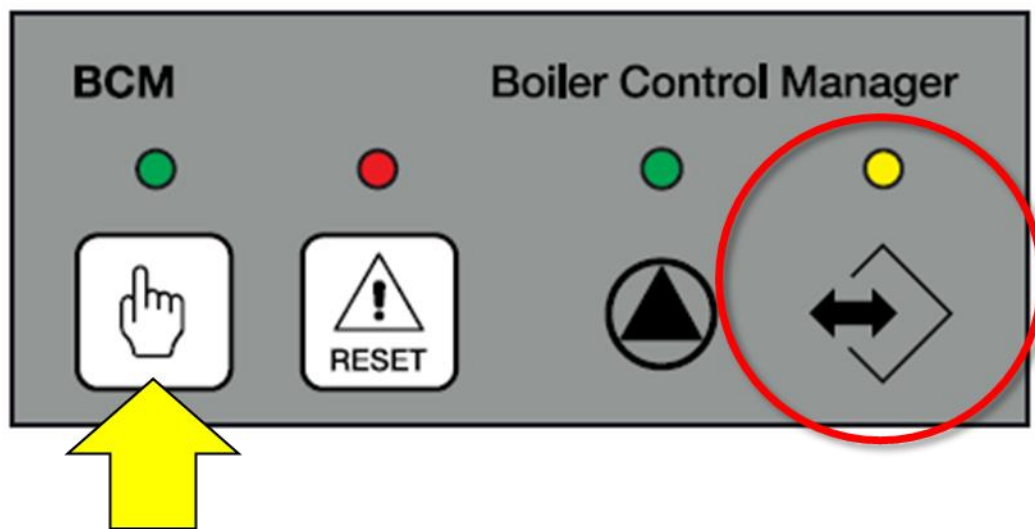
Figure 6-7: Boiler Control Manager Screen

To operate the BCM as a backup controller, press the MANUAL button on the BCM controller.

The BCM can also be operated as a backup controller automatically in lieu of pressing the MANUAL button. This is particularly useful if the normal mode of operation is via Modbus so that if the Modbus signal is lost, the BCM will automatically act as a backup controller. To accomplish this, a jumper must be installed on terminals TA and 9 terminal block Y2 in the Input/Output box and Parameter 376 must be set to 3.
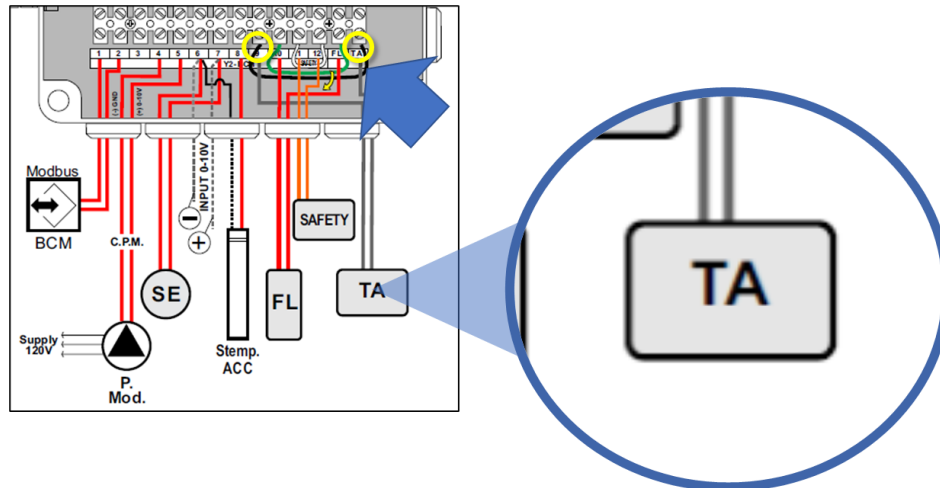
The function of terminals Y2 TA/9 is configured as follows:

1. Access **Device Management** from Main Menu; select **hcm** > **Parameter Settings**
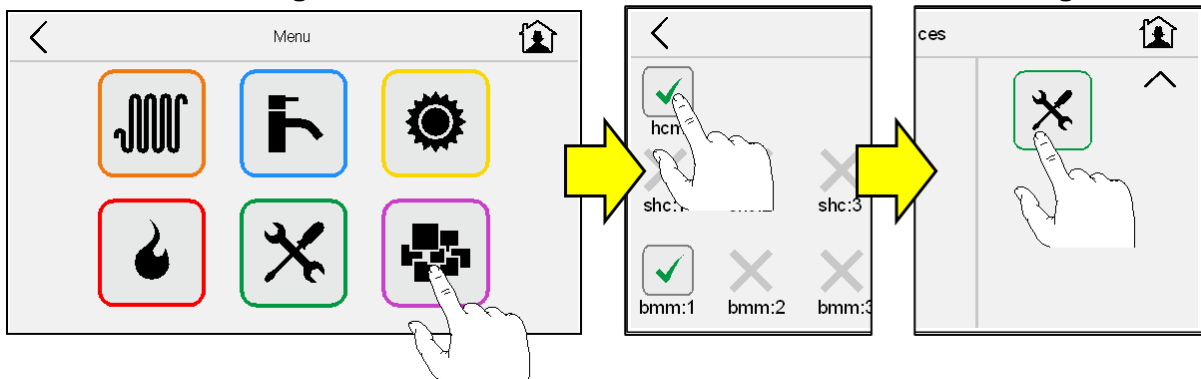
2. Scroll to Parameter 376. This parameter defines the functionality of terminals Y2 TA/9. Set Parameter 376 = 3 to automatically activate the BCM as a backup controller.

hcm		
799: 0/10V input	2	− +
376: Input#1: function	3	− +
322: Pump: overrun	5 min	− +
341: Pump: minimum control	3.0 Volt	− +
313: Pump: maximum control	10.0 Volt	− +

NOTE: Terminals Y2 TA/9 can be used for automatic activation of BCM as a backup controller described above <u>OR</u> for enable/disable functionality <u>not</u> both. See Section 4.5 for setting of Parameter 376 for enable/disable functionality.

6.4 BCM Control Of Variable Speed Primary Pump

The BCM has a 0-10 V output that can be used to control a Variable Speed primary pump. There is no connection on the Modulex controller for pump mains power. Pump mains power must be supplied externally, as directed by pump manufacturer's instructions.

6.4.1 Pump Control Wiring

The 0-10 V signal wire must be wired to terminals 4 and 5 of terminal block Y2 in the Input/Output box. See Figure 6-8. The positive wire connects to terminal 5 and the negative to terminal 4.
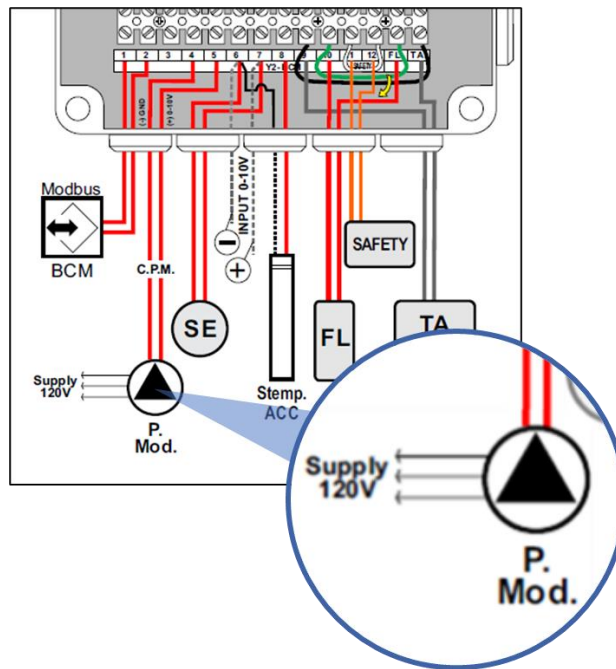
Figure 6-8: Pump Wiring - 0-10V Analog Control

6.4.3 Pump Control Operation

The voltage control signal to the pump is configured as follows:

1. Access **Device Management** from Main Menu; select **hcm** > **Parameter Settings**
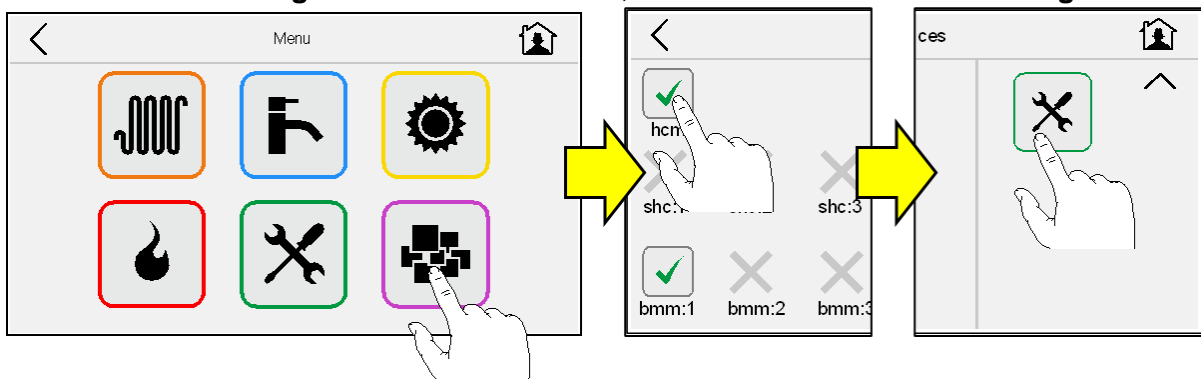
2. Voltage control signal configuration
   - Scroll to Parameter 341 and set it to the output voltage at lowest firing rate of boiler. Default is 3V. See Figure 6-10 for lowest firing rate of each Modulex boiler.
   - Set Parameter 313 to the output voltage at 100% boiling firing rate. Default is 10V.
   - For example, MLX EXT 1100 2S: If Parameter 341 is set to 2V and Parameter 313 is set to 10V, the variable speed pump control will send 0VDC at 5% boiler firing rate, and 10VDC at 100% boiler firing rate, varying linearly between the two voltages.

NOTE: Consult pump manufacturer for control signal specifications and set Parameter 341 accordingly to ensure it is high enough to enable the pump.

hcm		
799: 0/10V input	2	− +
376: Input#1: function	0	− +
322: Pump: overrun	5 min	− +
341: Pump: minimum control	2 Volt	− +
313: Pump: maximum control	10.0 Volt	− +

Figure 6-9

Model	Minimum Firing Rate
MLX EXT 450 2S	10.0%
MLX EXT 600 2S	8.0%
MLX EXT 800 2S	6.0%
MLX EXT 1100 2S	5.0%
MLX EXT 1500 2S	6.0%
MLX EXT 2300 2S	4.0%
MLX EXT 2600 2S	4.0%
MLX EXT 3000 2S	3.0%

Figure 6-10

3. Scroll to Parameter 322 and set it to desired time. Parameter 322 controls the amount of time, in minutes, that the pump will continue to run after the unit is shut down.

6.5 Control Via Modbus (Through BCM)

All Modbus Networks are implemented utilizing a "Manager-Client" scenario where only one device, the "Manager", can initiate a communication sequence. However, BCMs can only function as "Client" devices on a Modbus Network. Therefore, the BCM must be interfaced to an external controlling "Manager". The "Manager" can be the AERCO Control System (ACS), or an Energy Management System (EMS)/Building Automation System (BAS) developed by other manufacturers.

The following sections provide describe Modbus Network operation and required wiring connections between the BCM "Clients" and the controlling "Manager" (EMS, BAS).

6.5.1 Operating Scenario

An EMS or BAS Master can control the Networked Modulex Boilers utilizing Remote Setpoint. An AERCO ACS Master can control the networked Modulex boilers utilizing a Modbus signal.

If the external control signal from the Master ACS, 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 (See section 6.3) In addition, the BCM Fault Relay will be activated and the red Fault LED (DL2) will light.

6.5.2 Physical Modbus RS485 Wiring

Modbus RS485 devices should be wired in a "Daisy-Chain" configuration similar to the example shown below. DO NOT wire the units in a "Star" configuration where all devices are connected to a central point (node).
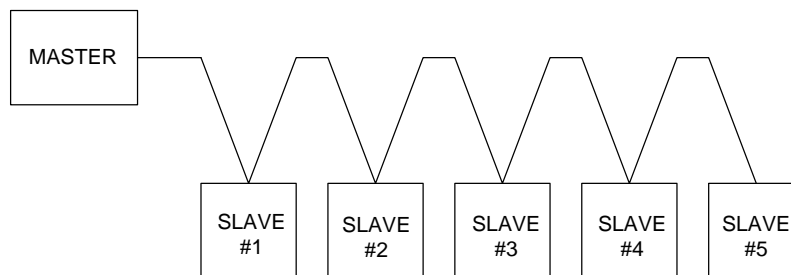
Figure 6-11: Typical Daisy-Chain Modbus/RS485 Network

The physical wiring connections for a Modbus Network should be made using shielded twisted-pair wire, from 18 to 24 AWG (e.g. Belden # 9841, #8761, #3105A, or equivalent).

Modbus wiring connections are made at terminals 1 and 2 of BCM connector Y2 in the Input/Output box as shown in Figure 6-12.

Modbus B (+): Terminal Y2-1
Modbus A (-): Terminal Y2-2
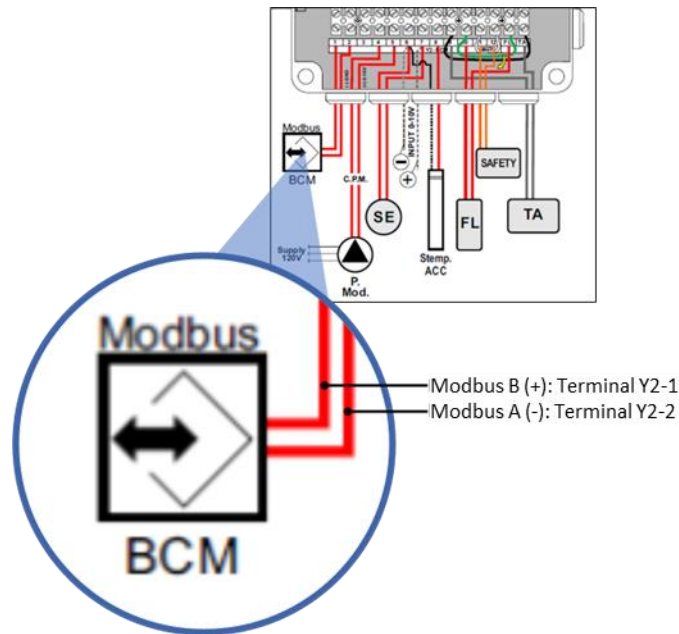
Figure 6-12: BCM Modbus (RS485) Connections

6.5.3 AERCO BMS II/ACS Master to BCM Slave Wiring Connections.

The AERCO BMS II/ACS contains a RS232 port to connect to an EMS/BAS or personal computer, plus a RS485 port for connection to the BCM's Modbus input. See section 6.7 for details.

6.5.4 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). See section 6.7 for details.

6.6 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. AERCO recommends that both terminating resistors and bias be implemented on the RS485 circuit as described below.

6.6.1 Master BMS II/ACS or EMS/BAS Terminating Resistor and Bias

All AERCO ACS units are equipped with a built-in terminating resistor. Therefore, when the ACS is the controlling Master, no terminating resistor needs to be added. In addition, ACS contains two Bias DIP switches which must be activated when the ACS is the controlling Master. See ACS Manual GF-131, Section 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.

6.6.2 BCM Controller Terminating Resistor

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 JP2 as shown in Figure 6-13 only on the BCM Board contained in the last BCM Controller.
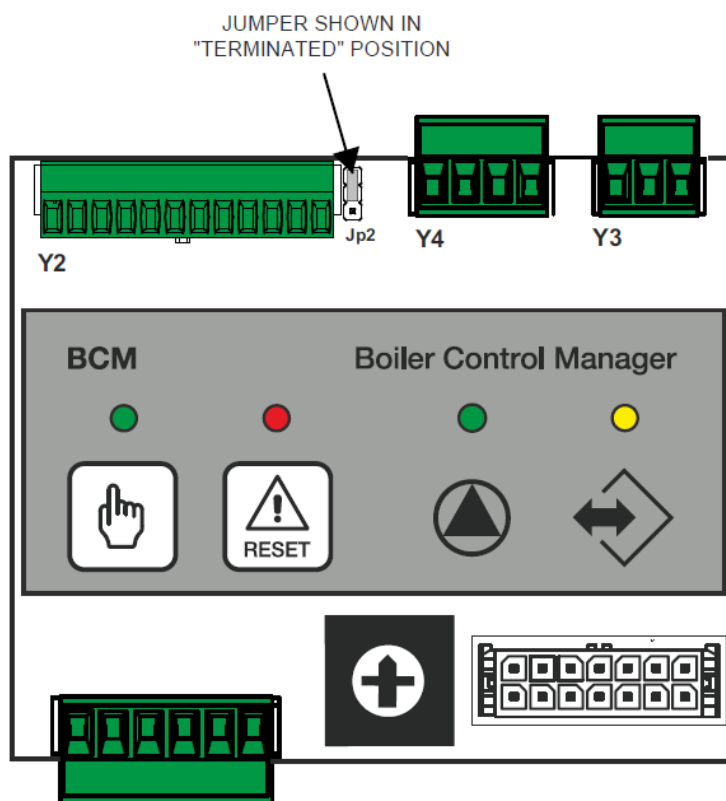
Figure 6-13: BCM Loop Termination and Bias

6.7 Modbus Network Wiring Diagram

A "Sample" Modbus Network wiring diagram for an AERCO ACS Master controlling BCM Slaves is shown in Figure 6-14. Activate the terminating resistor in the <u>last</u> BCM on the daisy-chain loop. DO NOT install the 1K bias resistor. Instead, activate the two bias DIP switches in the ACS. Refer to GF-124 for the location of these switches.

C A U T I O N !
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.
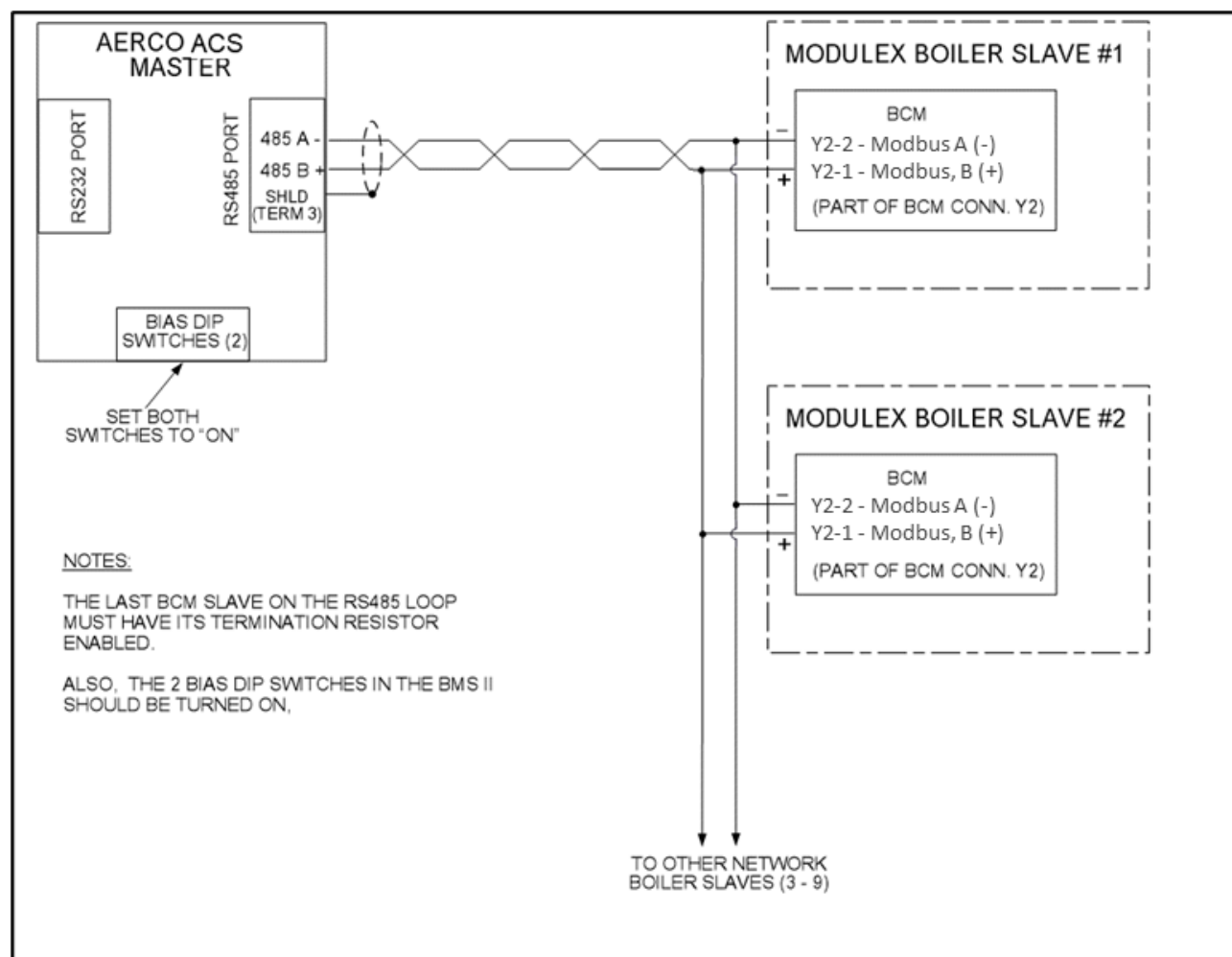
Figure 6-14: AERCO BMS II Master Controlling Modulex Boiler Slaves

Figure 6-15 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.
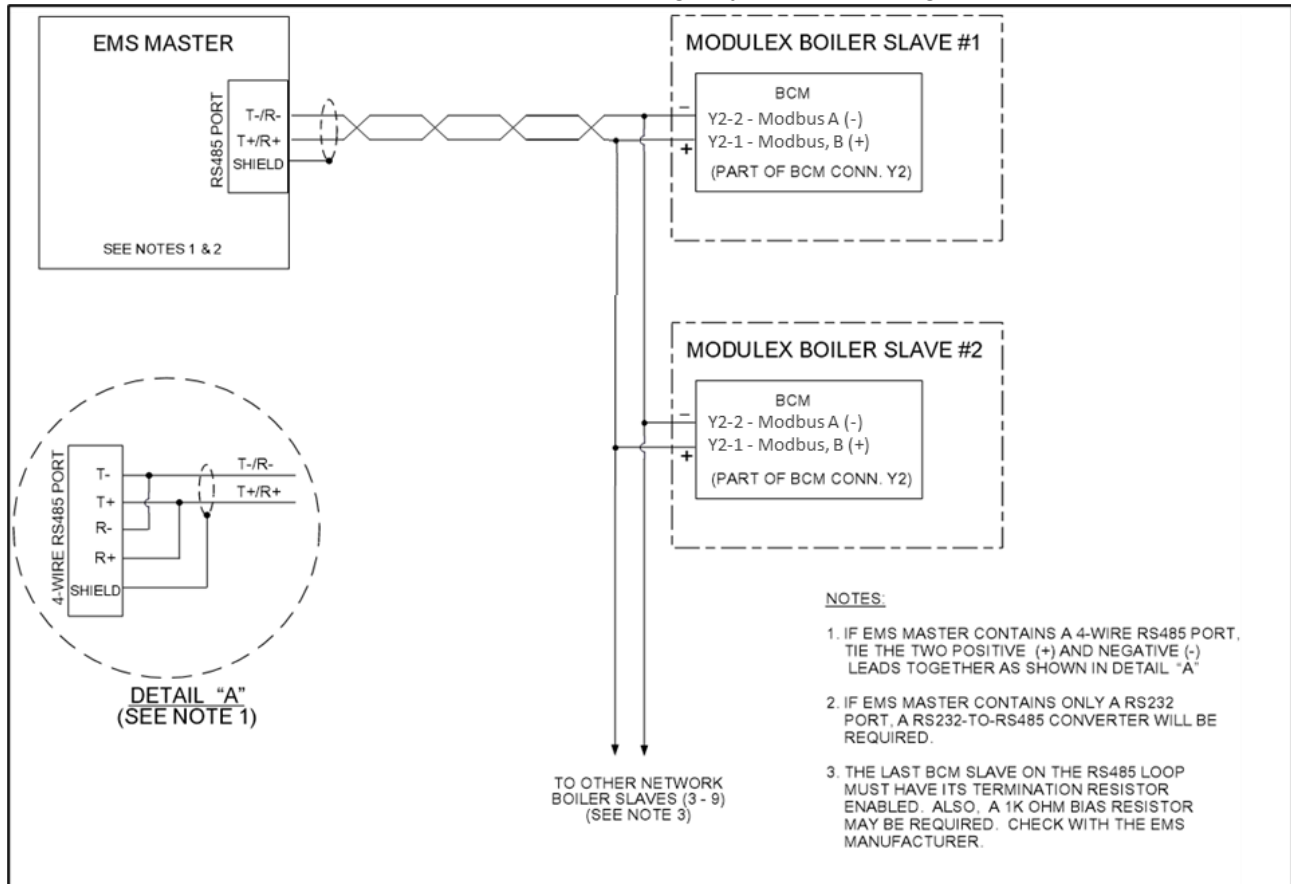
Figure 6-15: EMS/BAS Master Controlling Modulex Boiler Slaves

6.8 Modbus Software Set-Up

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

6.8.1 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
- AERCO ACS Modbus Control and Monitoring
- Modbus Remote Setpoint Control and Monitoring

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 is set using Parameter 816 on the BCM. Only Modbus addresses 1 or greater will be recognized by the Modbus Master. A different address must be set to for each Modulex Boiler being controlled on the Modbus Network.

1. Access **Device Management** from Main Menu; select **hcm** > **Parameter Settings**
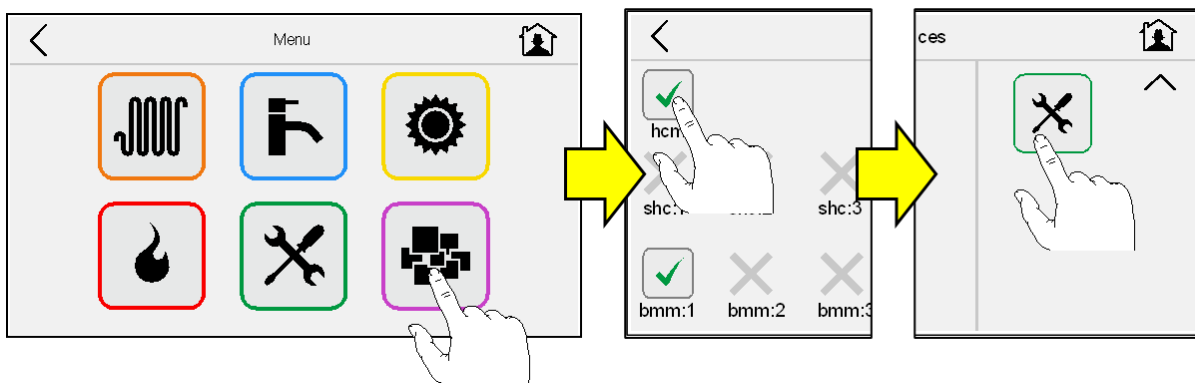
2. Scroll to Parameter 803 and set its value to 16. This allows Control via Modbus such as via AERCO ACS or BAS/EMS.

3. Scroll to Parameter 816 and set the Modbus address for this BCM.

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 ACS. For the BCM to automatically act as the Back-Up Controller if the Modbus Master signal is lost, Parameter 376 of the BCM must be set to 3 and a jumper must be installed on terminals TA/9 of connector Y2 (see section 6.3.2 for details)

See Chapter 8 and GF-124 Chapter 2 for Modbus points for the BCM and ACS.

6.8.2 AERCO ACS Modbus Control and Monitoring

The BCM's modulation output can be controlled by writing to its requested modulation level 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.

6.8.3 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, 2 registers need to be programmed:

- 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.

- Write 100 to Address 1. This address sets the maximum firing rate that the boiler can go to as needed to satisfy the Requested Setpoint entered in above Address 1004.

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

6.8.4 EMS or BAS Set-Up as Master to BCM Controller Slaves

Refer to 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.

6.9 Multiple Modulex Boiler Heating Mode – Using Acs

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 boiler plant with two or more boilers, the use of an AERCO Control System (ACS) is recommended for maximum efficiency and flexibility of operator control. The ACS has the capability of controlling up to 32 boilers as well as auxiliary equipment. The ACS 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 ACS, 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 ACS.

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

When there is a need for heat, ACS 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 ACS fire rate signal to this boiler reaches a value twice that of the start level percentage (programmed by the user into the ACS), the ACS will call on the second boiler to begin firing one module, and the ACS 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 ACS fire rate signal to the two boilers reaches a value three times that of the start level percentage, the ACS will call on the third boiler to begin firing one module, and the ACS 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 ACS will call on the BCM of the fourth boiler to turn on one module. At this point, the ACS 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 ACS in a reverse manner. Whether the ACS is set in a Constant Temperature or Outdoor Reset mode, it will use the modulating ability to prevent header temperature fluctuation and maximize efficiency. As well, the ACS can stage auxiliary equipment such as combustion air dampers and fans. Refer to ACS Manual GF-131, and Product Spec ACS for details.

CHAPTER 7: BCM MODBUS AND ADDRESS ASSIGNMENTS

7.1 BCM Modbus Comm. & Support Requirements

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

7.1.1 Function Codes

The BCM supports the Modbus Function Codes shown below.

TABLE 7-1: 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

7.1.2 Modbus Support Requirements

The Modbus Network must conform to the support requirements listed below.

TABLE 7-2: Modbus Support Requirements	
CHARACTERISTIC	**DESCRIPTION**
Communication Medium BMS II/ACS 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 <u>Before</u> first character and <u>After</u> last character No more than 1.5 character times of silence between received and transmitted characters. Adjustable (0 or 1 – 240 seconds)

7.2 BCM Controller Standard Holding Register Assignments

7.2.1 BCM Controller Standard Input Register Assignments

The BCM Controller has only two Read Only Input Register addresses as shown below.

TABLE 7-3: BCM Controller Standard Input Register Address Mapping		
Modbus Data Address	**Menu Item**	**Units and Range**
0	Error Code	0 – 0xFFFF <table><tr><td>LSB:</td><td>Error Code</td></tr><tr><td>MSB:</td><td>Identification code of fault device: 0: BMM #0 to 7: BMM #7 255: BCM</td></tr></table>
1	Unit Status	enum (1, 3, 5) 1 = Standby (ready to run but not fired) 3 = Remote (fired) 5 = Fault (failure detected)
2	Flow Sensor Temp	14° to 248° F (-10° to 120° C) (Valve X10)
3	Return Flow Temp	32° to 248° F (0° to 120° C) (Valve X10)

7.2.2 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 below and are grouped into the following 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 8-4 is shown in the Default/Comments column.

Table 7-4: BCM Standard Holding Register Address Mapping			
Modbus Data Address	**Menu Item**	**Units and Range**	**Default/(Comments)**
CONTROL REGISTERS			
1	AERCO BMS II/ACS 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
1021	Heat Request Command	enum (0x01, 0x33, 0x44, 0x55, 0xBB, 0xCC, 0xEE) 0x01: No action 0x55: DHW mode enabled 0xBB: Space Heating requested & DHW enabled 0xCC: Check request 0xEE: Space Heating request If enum is none of the above, Standby is selected.	(Read/Write) 0x01
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)
1031	Run Counters Clear	enum (0x5A)	(Read/Write)
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			

Table 7-4: BCM Standard Holding Register Address Mapping			
Modbus Data Address	**Menu Item**	**Units and Range**	**Default/(Comments)**
0	Error Code	0 – 0xFFFF LSB: Error Code MSB: Identification code of fault device: 0: BMM #0 to 7: BMM #7 255: BCM	(Read Only)
10	Run Hours	0-50000	----
11	Run Counts	0-50000	----
1000	Cascade Control Status	enum (0, 1, 2, 4) 0: Stop 1: Slave identification procedure 2: Normal operation 4: Monitor mode	(Read Only)
1002	Flow Sensor Temperature	14°F to 248°F (-10°C to 120°C) (Value x 10)	(Read Only)
1003	Return Flow Temperature	32°F to 248°F (0°C to 120°C) (Value x 10)	(Read Only)
1005	External Sensor Temperature	-31°F/-22°F to 122°F (-35°C/-30°C to 50°C) (Value x 10)	(Read Only) -31°F (-35°C) if not connected
1006	0-10V control input voltage	0-10V (Value x 10)	(Read Only)
1008	Global Actual Modulation Level	0 – 100%	(Read Only)
1110	Number of inserted burners	0-8	(Read Only)
1111	Number of ignited burners	0-8	(Read Only)
1016	Actual Target Setpoint	32°F to 212°F (0°C to 100°C) (Value x 10) Should increase up to "Target Setpoint" temp as boiler heats up	(Read Only)
1018	Target Setpoint	32°F to 212°F (0°C to 100°C) (Value x 10)	(Read Only)

Table 7-4: BCM Standard Holding Register Address Mapping			
Modbus Data Address	**Menu Item**	**Units and Range**	**Default/(Comments)**
1400	CH actual target temperature	32°F-212°F (0°C-100°C) (Value x 10)	(Read Only)
1407	DHW actual target temperature	32°F-212°F (0°C-100°C) (Value x 10)	(Read Only)
1408	DHW actual temperature	14°F-212°F (-10°C-100°C) (Value x 10)	(Read Only)
1020	Operating Mode	enum (0, 1, 2, 3, 6) 0: Standby 1: Space Heating 2: DHW 3: Check 4: CH frost protection 6: Test	(Read Only)
1100	Linked BMM	Flags (0 -255) Bit 0: BMM #0 to Bit 7: BMM #7	(Read Only)
1101	Inserted BMM	Flags (0 -255) Bit 0: BMM #0 to Bit 7: BMM #7	(Read Only)
1102	BMM in Check Mode	Flags (0 -255) Bit 0: BMM #0 to Bit 7: BMM #7	(Read Only)
1103	BMM Flame Status	Flags (0 – 255) Bit 0: BMM #0 to Bit 7: BMM #7	(Read Only)
1104	BMM Alarm Status	Flags (0 – 255) Bit 0: BMM #0 to Bit 7: BMM #7	(Read Only)
1108	BMM Maximum Modulation Level	0 – 100%	(Read Only)
1109	Pump Modulation Output	0 – 10V (Value x 10)	(Read Only)

Table 7-4: BCM Standard Holding Register Address Mapping			
Modbus Data Address	**Menu Item**	**Units and Range**	**Default/(Comments)**
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 0: CH Pump direction Bit 1: DHW Pump direction Bit 2: CHECK mode Bit 3: Flame detected Bit 4: Heat request Bit 5: Warning Bit 6: Pump status Bit 7: Alarm	(Read Only)
SYSTEM DATA			
1550	Firmware Code & Firmware Revision	0x2100 – 0x21FF High byte: Firmware Code Low byte: Firmware Revision	(Read Only)
1011	Boiler Global Capacity	0 – FFFF kW	(Read Only)
12	Boiler Mode = AERCO BMS II/ACS	2	(Read Only)
13	Remote Signal = Network	3	(Read Only)
SETTINGS			

Table 7-4: BCM Standard Holding Register Address Mapping			
Modbus Data Address	Menu Item	Units and Range	Default/(Comments)
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) 0
3006	Pump Over-run Time	1 – 10 minutes	(Read/Write) 3 min.
3018	Burner insertion delay time	30-900 sec. (in 10 sec. intervals)	(Read/Write) 120 sec.
3019	Burner insertion delay time	30-900 sec. (in 10 sec. intervals)	(Read/Write) 120 sec.
3020	Pump relay function code	0/1: 0 = Main pump control 1 = Boiler status	(Read/Write) 0
3021	Alarm relay function code	0/1: 0 = Active only if the failure prevents the insertion of the requested number of burners. 1 = Activated by each failure of the boiler.	(Read/Write) 1
3022	Digital input function	0/1/2/3: 0: CH service enable 1: Heat generator enable 2: DO NOT USE 3: Manual request	(Read/Write) 0
3023	Manual request	0/1: 0 = Manual request not active 1 = Manual request active	(Read/Write) 0

Table 7-4: BCM Standard Holding Register Address Mapping			
Modbus Data Address	**Menu Item**	**Units and Range**	**Default/(Comments)**
3016	CH maximum modulation level	0-100%	(Read/Write) 100%
9101	CH maximum target temperature.	68°F to 212°F (20°C to 100°C)	(Read/Write) 185°F
9102	CH: enable the parallel operation CH/DHW	0/1: 0 = Parallel Operation is disabled. 1 = Parallel operation is enabled.	(Read/Write) 0
9200	DHW minimum target temperature	77°F to 113°F (25°C to 45°C)	(Read/Write) 95°F
9201	DHW maximum target temperature	122°F to 149°F (50°C to 65°C)	(Read/Write) 149°F
9202	DHW request: tank to target temperature differential.	-36°F to 36°F (-20°C to 20°C)	(Read/Write) 7°F
9203	DHW request: tank to target temperature hysteresis.	2°F to 36°F (1°C to 20°C)	(Read/Write) 14°F
9204	DHW: tank temperature regulation gain	0-15	(Read/Write) 0
9206	DHW: Boiler request maximum temperature	122°F to 212°F (50°C to 100°C)	(Read/Write) 167°F
9211	DHW Pump Off Delay	5 - 600 sec	(Read/Write) 60 sec.
9212	Maximum modulation level that enables the CH and DHW parallel operation	0-100%	(Read/Write) 0%
9213	Maximum regulation error that disables the CH and DHW parallel operation	0-54°F	(Read/Write) 9°F

Table 7-4: BCM Standard Holding Register Address Mapping			
Modbus Data Address	**Menu Item**	**Units and Range**	**Default/(Comments)**
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%
3010	Water Δ Temp. Protection	0°F/2°F – 90°F (0°C/1°C-50°C) 0 = Disabled	(Read/Write) 36°F
3011	Communication Timeout Time	0/10 – 240 sec. (in 10 sec. intervals) 0 = Disable	(Read/Write) 30 sec.
3012	Temperature Units	0/1; 0 =°C, 1 = °F	1 = °F
3013	Analog Input Function	0/1; 0 = Setpoint Adjust, 1 = Outdoor Temp Sensor 2 = 0-10V setpoint control 3 = DO NOT USE	(Read/Write) 1
3014	Minimum Target Temperature	68°F to 104°F (20°C to 40°C)	(Read/Write) 86°F
3015	Maximum Target Temperature	113°F to 212°F (45°C to 100°C	(Read/Write) 185°F
3050	Application Code	0/1	0 = Burners Array 1 = Standalone Burners

Table 7-4: BCM Standard Holding Register Address Mapping			
Modbus Data Address	**Menu Item**	**Units and Range**	**Default/(Comments)**
3051	Services Enable	0-255	16 = Control via Modbus (e.g., AERCO ACS, Remote Setpoint from BAS/EMS) 17 = Heating only 18 = Antifreeze only 19 = Heating + Antifreeze 24 = DHW only 25 = Heating + DHW 26 = DHW + Antifreeze 27 = Heating + DHW + Antifreeze
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.
1109	Pump Modulation Output	0-10V (Value x 10)	(Read/Write)

Table 7-4: BCM Standard Holding Register Address Mapping			
Modbus Data Address	**Menu Item**	**Units and Range**	**Default/(Comments)**
3100	Digital inputs status [0, 1]	Flags (0 - 0xFFFF) bit 0: Input1 bit 1: Input2 bit 2: Input3 bit 3: Input4 bit 4: Input5 bit 5: Input6 bit 6: Input7 bit 7: Input8 bit 8: Key1 bit 9: Key2 bit 10: SW1-1 bit 11: SW1-2 bit 12: SW1-4 bit 13: eBUS RX bit 14: eBUS-1 RX bit 15: not used	(Read Only)
3101	Digital outputs status [0, 1]	Flags (0 - 0xFF) bit 0: Relay1 [OFF, ON] bit 1: Relay2 [OFF, ON] bit 2: Relay3 [OFF, ON] bit 3: Relay4 [OFF, ON] bit 4: DL1 [OFF, ON] bit 5: DL2 [OFF, ON] bit 6: DL3 [OFF, ON] bit 7: DL4 [OFF, ON]	(Read Only)
3102	Digital outputs control in TEST mode [0, 1]	Flags (0 - 0xFFFF) bit 0: Relay1 [OFF, ON] bit 1: Relay2 [OFF, ON] bit 2: Relay3 [OFF, ON] bit 3: Relay4 [OFF, ON] bit 4: DL1 [OFF, ON] bit 5: DL2 [OFF, ON] bit 6: DL3 [OFF, ON] bit 7: DL4 [OFF, ON] bit 8: Vout [0%, 100%] bit 9-12: not used bit 13: eBUS TX bit 14: eBUS-1 TX bit 15: eBUS supply [OFF, ON]	(Read/Write)

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CHAPTER 8: TROUBLESHOOTING

8.1 Ufly Controller Error Codes

Fault codes are displayed in the right-hand section of the Ufly Controller display (see Figure 8-1). There are codes for the following two different devices:

- **BCM (Boiler Control Module):** These fault codes are shown in Table 8.1.1.

- **BMM (Burner Management Module):** These fault codes are shown in Table 8.1.2.
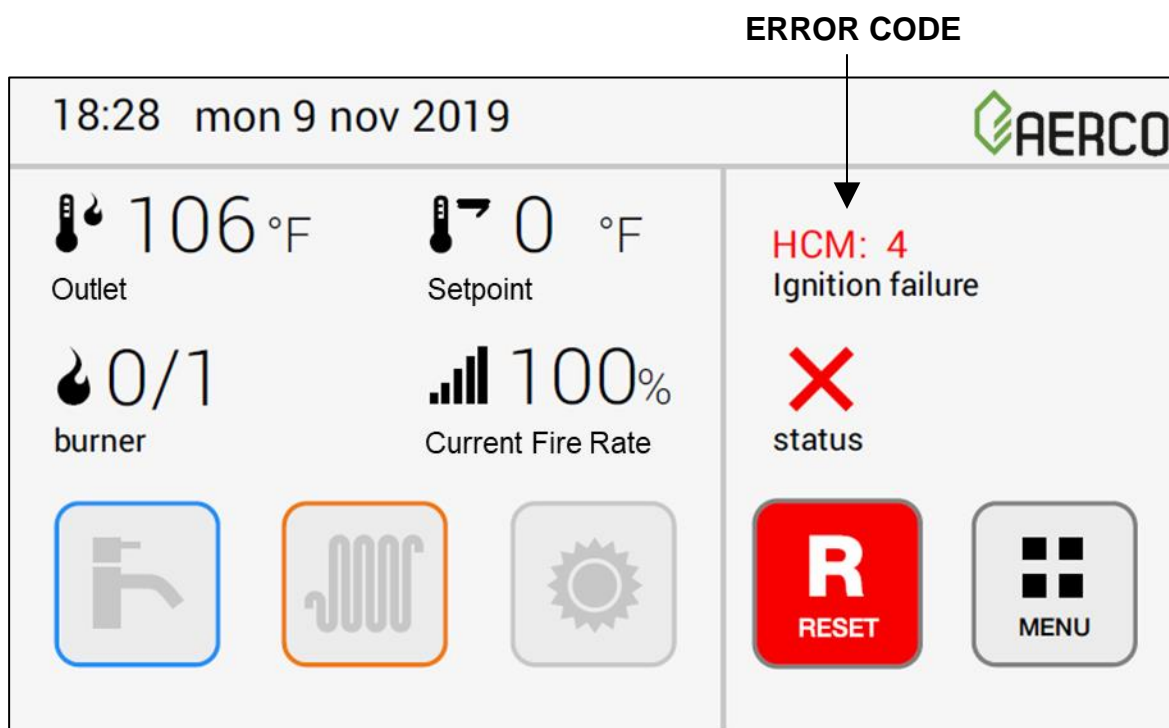
Figure 8-1: Ufly Error Code Location

8.1.1 BCM (Boiler Communications Module) Fault Codes

The table below lists the fault codes and troubleshooting tips associated with the BCM.

FAULT CODE	DESCRIPTION	EFFECT	CORRECTION	RESET
HCM: 2 **Low gas pressure**	Gas Pressure Switch - NOT APPLICABLE.			
HCM: 8 **Low water pression**	Water Deficiency - NOT APPLICABLE.			
HCM: 9 **Outer temperature sensor**	Outdoor sensor Enabled but not connected	Outdoor Reset not available.		AUTOMATIC - Outdoor Reset will be available once outdoor sensor is connected.
HCM: 13 **DHW Temperature sensor**	DOMESTIC HOT WATER sensor fault	DHW service not active	Check DHW sensor and its resistance using the resistance/Temp table); check the sensor connections.	AUTOMATIC
HCM: 14 **CH return sensor**	Global return sensor failure	All burners turned OFF.	Check return sensor or wiring.	AUTOMATIC
HCM: 17 **Global frozen**	Boiler pipe is frozen. Flow sensor temp. is 36°F or less.	Ignition is inhibited. Pump runs for 5 min at max speed.	Carefully defrost boiler.	AUTOMATIC - when Flow sensor is greater than 41°F.
HCM: 18 **Global differential temperature**	Maximum Δ-temperature protection. Fault is detected if [Global FlowSensor – Return Sensor] > [Param 483 + 50°F]. Note: Referred parameter is BCM Param. 483	All burners turned OFF and Pump ON at maximum speed.	Check circulation, check installation	AUTOMATIC - Fault is cleared when [Global FlowSensor – Return Sensor] < Param 483. Note: Referred parameter is BCM Param. 483
HCM: 19 **Global overheating**	High outlet temperature. Flow sensor temperature > 203°F.	All burners turned OFF and pump ON at maximum speed.	Check Flow Sensor or system pump.	AUTOMATIC - when Flow sensor < 176°F.
HCM: 28 **Chimney closed**	Flue/Chimney Obstruction	Ignition is inhibited.	Check flue/chimney	MANUAL
HCM: 29 **Condense level**	Water inside the combustion chamber.	Ignition is inhibited.	Check for water in the exhaust manifold	AUTOMATIC
HCM: 30 **Service parameters**	Settings corrupted.	Ignition is inhibited.	Contact factory.	MANUAL - push reset switch

FAULT CODE	DESCRIPTION	EFFECT	CORRECTION	RESET
HCM: 31 **System Configuration**	System configuration scanned during power up does not match stored configuration. May be a result of a BCM or BMM board being recently configured or replaced.	Burners turned OFF.	Cycle power to Ufly. On power up, go to the Devices Menu and wait for "OK" to appear and tap it ("OK" may take up to 2 minutes to appear).	MANUAL
HCM: 37 **Parameters memory**	BCM: Internal fault		Contact factory.	MANUAL
HCM: 38 **Factory parameters**	Settings corrupted by electromagnetic interference.	Ignition is inhibited.	Contact factory.	MANUAL - push reset switch
HCM: 39 **User parameters**	Settings corrupted by electromagnetic interference.	None	Contact factory.	AUTO
HCM: 40 **Low water flowrate**	Low system flow rate. Water flow is not detected by sensor connected to BCM terminal Y2/FL-TA 20 seconds after the Pump activation.	Burners turned OFF.	Check water flow or check switch.	AUTOMATIC
HCM: 47 **Communication**	Communication error on the bus line.	Burners turned OFF.	Check the ebus communication connection and wiring from UFly to BCM.	MANUAL
	Burner(s) disabled and/or incorrect First Burner Priority	Burners turned OFF.	Check the following BCM (hcm) parameters are set to their default values. 647: Set to 0 648: Set to 0	MANUAL
HCM: 56 **Heat control lack**	BCM: No remote control detected		It is possible to activate burner ignition from the BCM manual request button	
HCM: 57 **Burners lack**	BCM: No BMM detected	Burners turned OFF.	Check electrical connections BMM and e-BUS	AUTOMATIC
HCM: 58 **Global temperature sensor**	BCM: Sensor global flow detected.	Burners turned OFF.	Check the flow sensor connection. Replace the sensor.	AUTOMATIC
HCM: 73 **Flow sensor**	Water deficiency pressure switch - NOT APPLICABLE			

FAULT CODE	DESCRIPTION	EFFECT	CORRECTION	RESET
HCM: 93 **Security block**	AUXILIARY SAFETY INTERVENTION	Stop burner and stop pump	check the jumper or safety devices wired to connector Y2, terminals 11/2.	MANUAL

8.1.2 BMM (Burner Management Module) Fault Codes

The table below lists the fault codes and troubleshooting tips associated with the BMM.

CODE	DESCRIPTION	EFFECT	CORRECTION	RESET
BMM: 1 Overheat thermostat	High Limit (STB) Thermostat activated.	All burners turned OFF and pump ON at maximum speed.	Check flow sensor thermal connection to boiler.	MANUAL - push reset switch when temperature goes below limit.
BMM: 4 Ignition failure	No flame detected at burner start.	Burner control lockout.	Check flame rod or combustion.	MANUAL - push reset switch or cycle power.
BMM: 5 Flame lost	Flame loss during run.	Ignition retry.	Check combustion and wiring.	MANUAL - push reset switch or cycle power.
BMM: 6 Overheating	High outlet temperature. Flow sensor temperature > 203°F.	All burners turned OFF and pump ON at maximum speed.	Check flow sensor or system pump	AUTOMATIC - when Flow sensor < 176°F.
BMM: 7 Aux temperature sensor	The BMM is not reading the local flow sensor	Burners turned OFF.	Check sensor connection and wiring.	MANUAL
BMM: 10 Internal failure	Internal failure.	Ignition is inhibited.	Contact factory for new BMM.	MANUAL - cycle the power.
BMM: 11 Unexpected flame	Flame signal detected before ignition.	Ignition is inhibited.	Disconnect flame rod wire from BMM. If problem goes away, change flame rod and/or wire. If problem does not go away, change BMM.	MANUAL - push reset switch or cycle power.
BMM: 12 CH flow sensor	Flow sensor fault.	All burners turned OFF.	Check flow sensor and its resistance using the resistance/Temp table); check the sensor connections.	AUTOMATIC
BMM: 14 CH return sensor	Return sensor fault. - NOT APPLICABLE			
BMM: 15 Differential temperature	Maximum Δ-temperature protection. Fault is detected if Local FlowSensor – Return Sensor] > [Param 483 + 50°F]. Note: Referred parameter is BMM Param. 483	All burners turned OFF and Pump ON at maximum speed.	I Check the system installation.	AUTOMATIC - Fault is cleared when [Local FlowSensor – Return Sensor] < Param 483. Note: Referred parameter is BMM Param. 483
BMM: 16 Frozen	Boiler pipe is frozen. Flow sensor temperature is 36°F or less.	Ignition is inhibited. Pump runs for 5 min at max speed.	Carefully defrost boiler.	AUTOMATIC - when flow sensor is greater than 41°F.

CODE	DESCRIPTION	EFFECT	CORRECTION	RESET
BMM: 22 Lack air for ignition	Air pressure switch does not close within 30 sec. in the ignition cycle	Ignition retry after 60 second delay and failure remains until a successful burner operation.	If fan is stopped, check supply voltage and fan wiring. If OK, try another fan. If still not working, change the BMM. If fan is not stopped, check the exhaust gas outlet for blockage. If OK, check the air pressure switch wiring. If still not working, try another air pressure switch. If still not working, change the BMM.	AUTOMATIC/MANUAL
BMM: 23 Unexpected air flux	Air pressure switch always active	Ignition is inhibited.	Disconnect the air proving switch. If problem goes away, install a new switch. If not, check the wiring. If wiring is OK, change BMM.	AUTOMATIC
BMM: 24 Low fan speed	Modulating fan speed failure: failed to reach the correct speed within 30 seconds from starting of burner ignition cycle.	Ignition retry after 60 second delay and failure remains until we have a successful burner operation.	Check fan wiring.	AUTOMATIC/MANUAL
BMM: 26 High fan speed	Modulating fan speed failure: failed to stop within 30 seconds from end of operation	Ignition is inhibited.	Check fan wiring.	AUTOMATIC
BMM: 27 Lack of air	Air pressure switch fault during the ignition time	Restart pre-purge timer. The failure remains until we have a successful burner operation.	Check fan and wiring. Check air proving switch and wiring.	AUTOMATIC
BMM: 30 Service parameters	Alteration of the operating parameters caused by EMC disturbances.	Ignition is inhibited. Pump runs for 5 min at max speed.	Re-program the settings. Contact factory.	MANUAL - cycle the power or send reset message.
BMM: 32 Low supply tension	Mains supply voltage < 108 VAC.	Wait for proper line voltage (>102 VAC).	Check input voltage. Try another BMM.	AUTOMATIC

APPENDIX A: BCM PARAMETERS

This section provides the list of the parameters in the BCM. See Section 3.4 for instructions on how to navigate to the BCM parameters.

PARAMETER	DESCRIPTION	ENTRY RANGE	DEFAULT
803	Enabled services 16 = Control via Modbus* 17 = Heating only 18 = Antifreeze only 19 = Heating + Antifreeze 24 = DHW only 25 = Heating + DHW 26 = DHW + Antifreeze 27 = Heating + DHW + Antifreeze * - Control via Modbus examples: AERCO ACS, Remote Setpoint from BAS/EMS*	See Description	19
483	Maximum Differential Temperature (Water ΔT protection)	0°F/2°F – 90°F (0°C/1°C-50°C) *0 = Disabled; Units may be expressed in R or K*	MLX EXT 450 2S -1100 2S: 45°F (25°C) MLX EXT 1500 2S -3000 2S: 54°F (30°C)
34	Burner Hysteresis	9°F to 36°F (5°C to 20°C) *Units may be expressed in R or K*	9°F (5°C)
31	CH#1: Minimum Setpoint	68°F to 221°F (20°C to 105°C)	86°F
39	CH#1: Maximum Setpoint	68°F to 221°F (20°C to 105°C)	185°F
799	Analogue input function 0/10 V: 0 = Backup Controller (BCM) target temperature 1 = External temperature sensor 2 = 0-10 V Remote Setpoint *3 = DO NOT USE* *See Sections 4.1.1, 4.3.2 and 6.3.1*	See Description	1
376	Programmable Input #1 function 0 = CH Service Enable/Disable 1 = System Enable/Disable *2 = DO NOT USE* 3 = Backup Controller (BCM) Remote activation *See Sections 4.5 and 6.3.2*	See Description	0
322	Pump Off Delay	1 - 10 min	3 min

PARAMETER	DESCRIPTION	ENTRY RANGE	DEFAULT
341	Pump: minimum control (Minimum output pump modulation) *See Section 6.4.3*	0-10V	3V
313	Pump: maximum control (Maximum output pump modulation) *See Section 6.4.3*	0-10V	10V
792	CH Maximum modulation	0-100%	100%
611	CH Parallel: maximum error *This is the maximum boiler outlet error that disables the CH and DHW parallel operation. Parallel operation of space heating/DHW is deactivated (space heating secondary pump stops) when boiler outlet temperature falls below Boost Temperature Setpoint (Param. 660) by the amount of Parameter 611.*	0°F to 54°F (0°C to 30°C) *Units may be expressed in R or K*	9°F (5°C)
612	CH Parallel: modulation maximum *This is the maximum firing rate that enables the CH and DHW parallel operation; during parallel operation, space heating secondary pump is allowed to run while DHW demand is present; 0 = No parallel Operation*	0-100%	0%
650	DHW: Minimum Setpoint *DHW setpoint must be set higher than the value of Parameter 650.*	77°F to 113°F (25°C to 45°C)	95°F (35°C)
385	DHW: Maximum Setpoint	122°F to 149°F (50°C to 65°C)	149°F (65C)
360	DHW: tank adjustment (tank temperature regulation gain) *Leave this Parameter set = 0 for a constant boost temperature (Param. 660) when DHW is present*	0-15	0
656	DHW request: tank to target temperature differential • *DHW demand is present when DHW outlet/tank temperature falls below the DHW setpoint by the amount of Parameter 656.* • *DHW demand is satisfied when DHW outlet/tank reaches a temperature above the DHW setpoint by the amount [Param. 657 minus Param. 656]*	-36°F to 36°F (-20°C to 20°C) *Units may be expressed in R or K*	7°F (4C)
657	DHW: Requested Temp. Hysteresis • *DHW demand is satisfied when DHW outlet/tank reaches a temperature above the DHW setpoint by the amount [Param. 657 minus Param. 656]*	2°F to 36°F (1°C to 20°C) *Units may be expressed in R or K*	14°F (8C)
310	DHW Pump Off Delay	5 - 600 sec	60 sec
660	DHW: Maximum Boiler Temperature *This is the boost temperature. When DHW demand is present, the value of Parameter 660 will be the boiler setpoint.*	122°F to 212°F (50°C to 100°C)	167°F (75C)
48	CH#1: setpoint (CH maximum target temperature)	68°F to 221°F (20°C to 105°C)	185°F (85C)

PARAMETER	DESCRIPTION	ENTRY RANGE	DEFAULT
64	CH#1: parallel DHW (Heating/DHW Parallel Operation) 0 = DHW demand is priority, Parallel Operation is disabled. 1 = Parallel operation of space heating and DHW is allowed provided the Boost Temperature setpoint (Param. 660) is satisfied and the Current Fire Rate is less than a predefined limit (Parameter 612).	See Description	0
649	Burner: Minimum Setpoint	68°F to Param. 39 (20°C to Param. 39)	68°F (20°C)
346	Minimum modulation: Part of the algorithm that determines when burners are turned on/off. NOTE: This is **not** the minimum firing rate of the boiler.	0-100%	MLX EXT 450 2S -1100 2S: 31% MLX EXT 1500 2S -3000 2S: 28%
800	Burners: minimum inserted	1-8	1
616	Cascade: insert lock time (Burner insertion delay time)	30 - 900 sec	120 sec
613	Cascade: remove lock time (Burner removal delay time)	30 - 900 sec	MLX EXT 450 2S -1100 2S: 120 sec MLX EXT 1500 2S -3000 2S: 60 sec
674	Generator: automatic restart (How often boiler changes operating burners to balance wear and tear).	1-10 hr	2 H
647	Disable Burners Map - **NOT APPLICABLE.** Note: Leave at default value of 0		0
648	First Burner Priority - **NOT APPLICABLE.** Note: Leave at default value of 0		0
336	Temperature control: slope limit	2°F to 54°F/min (1°C to 30°C/min)	9°F/min (5°C/min)
353	Temperature control: proportional band	0°F to 90°F (0°C to 50°C) *Units may be expressed in R or K*	45°F (25C)
354	Temperature control: integral gain	0-50	12
478	Temperature control: derivative gain	0-50	0
816	Modbus Address	1-127	1
817	Modbus Communication Timeout	0 - 240 sec	30 sec
896	Temperature unit 0: °C 1: °F	See Description	1
309	System configuration (Application Code) 0 = Burner cascade (BMM) *1 = DO NOT USE*	See Description	0

PARAMETER	DESCRIPTION	ENTRY RANGE	DEFAULT
368	Programmable Relay #1 (BCM Y4-1/2) Function (BCM connector Y4, terminals 1 and 2) 0 = Primary Pump (boiler loop) control 1 = Boiler status contact (closes when at least one burner is on, opens when all the burners are off)	See Description	0
369	Programmable Relay#2 (Alarm Relay) Function (BCM connector Y4, terminals 3 and 4) 0 = Contact closes if a failure prevents the insertion of the requested number of burner(s) 1 = Contact closes with each failure of the boiler	See Description	1
771	Water Pressure Sensor **- NOT APPLICABLE.** Note: Leave at default value of 0		0
768	Min Gas Pressure Sensor **- NOT APPLICABLE.** Note: Leave at default value of 0		0
793	Chimney Obstruction Sensor **- NOT APPLICABLE.** Note: Leave at default value of 2		2
622	Minimum Flow Sensor Note: Leave at default of 1 - this will register a global fault when the flow sensor connected to BCM terminals Y2 FL/10 trips. 1 = Enabled Flow Sensor / Global Fault 3 = Enabled Flow Sensor / Local Fault 5 = Enabled Flow Sensor / Global Fault and check Flow Switch fault 7 = Enabled Flow Sensor / Local Fault and check Flow Switch fault	1-7	1
607	CH Manual Request **- NOT APPLICABLE.** Note: Leave at default value of 0		0

APPENDIX B: BMM PARAMETERS

This section provides the list of the parameters in the BMM boards. See Section 3.4 for instructions on how to navigate to the BMM parameters.

PARAMETER	DESCRIPTION	ENTRY RANGE	DEFAULT
803	Enabled services - **NOT APPLICABLE.** Note: Leave at default value of 1		1
48	CH#1: setpoint (CH maximum target temperature)	68°F to 185°F (20°C to 85°C)	176°F (80C)
784	Local BUS address Note: DO NOT CHANGE the value as this is automatically assigned on the bus chain		Automatically assigned
816	Modbus Address	1-127	1
817	Modbus Communication Timeout	0 - 240 sec	30 sec
896	Temperature unit 0: °C 1: °F	See Description	0
799	Analogue input function 0/10 V - **NOT APPLICABLE.** Note: Leave at default value of 0		0
376	Programmable Input #1 function - **NOT APPLICABLE.** Note: Leave at default value of 0		0
322	Pump Off Delay - **NOT APPLICABLE.** Note: Leave at default value of 3 min.		3 min
341	Pump: minimum control - **NOT APPLICABLE.** Note: Leave at default value of 30%		30%
313	Pump: maximum control - **NOT APPLICABLE.** Note: Leave at default value of 100%		100%
31	CH#1: Minimum Setpoint	68°F to 104°F (20°C to 40°C)	86°F
39	CH#1: Maximum Setpoint	113°F to 212°F (45°C to 100°C)	203°F
792	CH Maximum modulation	0-100%	100%
619	Ignition Modulation	32-82%	MLX EXT 450 2S -1100 2S: 55% MLX EXT 1500 2S -3000 2S: 50%
645	Flame stabilization time - **NOT APPLICABLE.** Note: Leave at default value of 0 sec		0 sec
783	Burner: recycling - **NOT APPLICABLE.** Note: Leave at default value of 0		0
646	Burner: soft shutdown - **NOT APPLICABLE.** Note: Leave at default value of 0		0

PARAMETER	DESCRIPTION	ENTRY RANGE	DEFAULT
527	Fan: pulse/revolution Note: Leave at the default value of 2	0/1-4	2
486	Fan regulation: proportional band	0-50	MLX EXT 450 2S -1100 2S: 10 MLX EXT 1500 2S -3000 2S: 30
487	Fan regulation: integral gain	0-50	9
489	Fan: PWM min.	5-15%	8%
337	Modulation Gradient	1-100%	2%
526	Fan: Maximum Speed	50-120Hz	MLX EXT 450 2S -1100 2S: 90Hz MLX EXT 1500 2S -3000 2S: 91Hz
319	Maximum Modulation	1-100%	100%
346	Minimum modulation (Burner Minimum modulation level)	1-100%	MLX EXT 450 2S -1100 2S: 34% MLX EXT 1500 2S -3000 2S: 31%
314	Standby modulation	0-100%	MLX EXT 450 2S -1100 2S: 31% MLX EXT 1500 2S -3000 2S: 33%
620	Postpurge: fan speed	0-100%	MLX EXT 450 2S -1100 2S: 31% MLX EXT 1500 2S -3000 2S: 33%
617	Ignition: minimum modulation	0-100%	32%
618	Ignition: maximum modulation	0-100%	82%
353	Temperature control: proportional band	0°F to 90°F (0°C to 50°C) *Units may be expressed in R or K*	45°F (25C)
354	Temperature control: integral gain	0-50	12
478	Temperature control: derivative gain	0-50	0
34	Burner Hysteresis	9°F to 36°F (5°C to 20°C) *Units may be expressed in R or K*	9°F (5°C)
336	Temperature control: slope limit	0°F to 54°F/min (0°C to 30°C/min)	18°F/min (10°C/min)
483	Maximum Differential Temperature (Water ΔT protection)	0°F/2°F – 90°F (0°C/1°C-50°C) *0 = Disabled;* *Units may be expressed in R or K*	54°F (30°C)

PARAMETER	DESCRIPTION	ENTRY RANGE	DEFAULT
380	Programmable Sensor #1 function - **NOT APPLICABLE.** Note: Leave at default value of 1		1
777	APS check **- NOT APPLICABLE.** Note: Leave at default value of 0		0
623	Temperature sensors 0: 10K @ 25°C, B=3977 1: 10K @ 25°C, B=3435 Note: Leave at default value of 0	0/1	0
626	Temperature sensor type 0: 10K @ 25°C, B=3977 1: 10K @ 25°C, B=3435 2: PT1000 3: minimum water flow switch Note: Leave at default value of 0	0/1/2/3	0
805	Supply voltage	100-240V	115V
2590	Burner Capacity	10-1000kW	MLX EXT 450 2S -1100 2S: 50kW MLX EXT 1500 2S -3000 2S: 112kW