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# Installation, Operation, and Maintenance Manual

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## CEMLINE CORPORATION®

### CEM-TROL® II Solid State Control Module and Electronic Control Valves



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Ver. 2.4

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## Disclaimers

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This Installation, Operation, and Maintenance Manual is intended to be as complete and up to date as possible. It covers the installation, operation, and maintenance procedures for CEMLINE CORPORATION's CEM-TROL®II control module and electronic control valves. CEMLINE® reserves the right to update this manual and other product information concerning installation, operation, and/or maintenance, at any time and without obligation to notify product owners of such changes.

CEMLINE is not responsible for inaccuracies in specifications, procedures and/or the content of other product literature, supplied by the manufacturers of components used in CEMLINE CEM-TROL II control module. CEMLINE strives to use only the highest quality components; however, CEMLINE has no direct control over their manufacture, or their consistent quality.

CEMLINE is not responsible for injury to personnel or product damage due to the improper installation, operation, and/or maintenance of CEMLINE Electronic Controls. All installation, operation, and maintenance procedures should only be performed by trained/certified personnel. All personnel performing these procedures should completely and carefully read and understand all supplied materials before attempting the procedures. All personnel should pay strict attention to all Notes, Cautions, and Warnings that appear within the procedures detailed in this manual.

CEMLINE welcomes user input as to suggestions for product or manual improvement.

### Contact Information

For information concerning warranties, or for questions pertaining to the installation, operation or maintenance of CEMLINE products, contact:

CEMLINE CORPORATION  
P.O. Box 55  
Cheswick, PA 15024

USA Phone: (724) 274-5430  
USA Fax: (724) 274-5448  
www.cemline.com

To order replacement parts, contact CEMLINE CORPORATION at the address listed above, or call toll free:

USA/Canada/Caribbean Phone: (800) 245-6268

***Note: Please include the model and serial number of the unit for which the parts are being ordered. If ordering by phone, please have this information readily available.***

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## General Notes and Warnings

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### Notes

- ❖ This manual is intended to cover installation, operation, and maintenance procedures for CEMLINE CORPORATION CEM-TROL II control module and electronic control valves.  
  
If questions are not answered by this manual, or if specific installation, operation, and/or - maintenance procedures are not clearly understood, contact CEMLINE CORPORATION for clarification before proceeding.
- ❖ All installation, operation, and maintenance procedures should be performed only by experienced, trained and certified personnel. Personnel should be trained in and familiar with correct piping and electrical procedures and methods, and should be experienced in working with hot/boiler water systems and steam systems.
- ❖ CEMLINE CORPORATION CEM-TROL II control module and other electronic controls are designed for indoor use only, unless otherwise required by design specifications.
- ❖ If the unit is damaged during installation, operation, or maintenance, complete the following steps:
  1. Turn off and lock out the electric power supply to the unit in an approved manner.
  2. Turn off all incoming steam/hot water valves.
  3. Contact in-house maintenance personnel or CEMLINE CORPORATION for instructions.

### Warnings

As with any piece of equipment that utilizes hot/boiler water or steam and electricity, **the potential exists for severe personal injury** if proper installation, operation, and maintenance procedures are not followed. Listed on the following pages are specific warnings pertaining to CEMLINE Electronic Controls. **All warnings should be carefully read and understood.** All precautions contained in the warnings should be carefully followed to reduce the chance of injury.

**Note: Throughout this manual, warnings will be denoted by the symbol ▼ .**

All documentation for each major component has been included with the unit. It is strongly recommended that each document be reviewed before attempting any installation, operation, or maintenance procedures.

The documentation for each major component may also contain warnings and cautions identified by the manufacturer of each component. These warnings and cautions may be specific for the particular component, and therefore not covered in this general Installation, Operation, and Maintenance Manual. They should also be carefully reviewed before attempting installation, operation, or maintenance procedures.

- ▼ The combination of electricity and water can pose a **very dangerous situation**. Assure that all power has been **shut off/disconnected and locked out** in an appropriate manner, before attempting any installation or maintenance procedures.
- ▼ Areas of potential danger:
  1. all electric power leads and connections;
  2. all hot/boiler water lines, steam lines, joints, valves, and relief valves; and
  3. all joints at valve, gauges, etc.
- ▼ Before attempting any installation, operation, or maintenance procedures pertaining to the unit.
  1. Assure that the electric power supply has been turned off and locked out in an approved manner;
- ▼ Hot/boiler water and steam present a situation that can be very dangerous due to the fact it is under pressure and at very high temperatures. To avoid possible injury or death, use common sense and follow all accepted and recommended procedures when performing installation, operation, and maintenance procedures.

### **Connecting the Electric Power Source**

- ▼ All installation procedures involving electric power connection should only be performed by trained, certified electricians.
- ▼ Hot/boiler water and steam present a situation that can be very dangerous because of the high temperatures and pressures. Use common sense and follow all accepted and recommended procedures when performing installation, operation, and maintenance procedures to avoid possible injury or death.
- ▼ The combination of electricity and water can pose a very dangerous situation. Assure that all power has been shut off/disconnected and locked out in an approved manner, before attempting any installation or maintenance procedures.

The CEMLINE Packaged Water Heaters have been wired during assembly. Connecting the electric power supply to the unit consists of connecting the correct voltage, phase, and amperage power leads to the terminal strip or circuit breaker. The exact voltage, phase, and amperage requirements for the unit can be determined from the rating plate affixed to the jacket of the unit, or from the Submittal Sheet and Wiring Diagrams supplied with the unit.

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## The Controller - Overview

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Cemline CEM-TROL II control module is a solid state controller designed to control temperatures and limit(s) on Cemline Packaged Water Heaters.

The CEM-TROL II is supplied with a LCD touch screen display. LED pilot lights are supplied to indicate On-Off, primary high limit temperature, and secondary high limit temperature. The CEM-TROL II control module allows the owner to set the operating temperature, primary high temperature limit and the secondary temperature high limit on the display screen. The CEM-TROL II control module has over temperature alarm lights and an alarm horn with built in alarm silence relay. The CEM-TROL II control module is supplied with dry contact closure outputs to indicate to building automation system (BAS): power on, primary high temperature, secondary high temperature, and any alarm. The CEM-TROL II control module allows the BAS to turn the Cemline Packaged Water Heater on or off through a remote relay. The control module allows the BAS to remotely monitor the operating temperature and remotely set the operating temperature. The control module is supplied with an on-off switch and is mounted in a NEMA 4 enclosure.

**Built in remote start stop:** This feature allows the Packaged Water Heater to be started or stopped from a remote location. Typically this would be accomplished from the Building Automation System (BAS). Terminal block P7 terminals 3 – 4 on the board is where the BAS on-off is wired.

**Built in On-Off Switch:** Allows for local on-off and is convenient for service in the unlikely event service is required. This switch is mounted in the side of the panel.

**Built in Alarm Horn:** The alarm horn will sound and LED will light red on primary high temperature limit and/or secondary high temperature limit. If either high temperature limits are exceeded the alarm horn will also sound and the alarm light(s) will light red. The CEM-TROL II also features an alarm silence relay which will silence the alarm but not the fault light when the generator is being serviced. When the fault is cleared both the alarm and fault light(s) will automatically reset.

**Built in PID controller:** The PID control in the CEM-TROL II allows the user to easily select the operating temperature set point of the water heater. The controller reads the temperature of the heated water from a temperature sensor in the water heater. Based upon the water temperature, the controller then sends a 0 –10 VDC output signal to the control valve to open or close the valve accordingly. In order to use this functionality of the CEM-TROL II must be wired to either a pneumatic control valve with an I-P transducer or an electronic control valve. This feature is not functional when using a pilot operated valve with a self-contained temperature pilot.

The CEM-TROL II is designed with the P-I-D control logic.

P is proportional. The proportional is used to handle the present. Proportional is a constant used to send a signal to the output. Proportional control with a set point of 140 °F and a proportional band of 10 would have a 100% (10 VDC) output at 130 deg F, 50% (5 VDC) output at 135 °F and 10% (1 VDC) output at 139 °F.



I is integral. The integral measures error over a short period of time to develop a constant used to send a signal to the output. The integral is then added to the proportional to eliminate error.

D is derivative. The derivative is often referred to as rate. Derivative is used to respond to a change in the system. The larger the derivative the more rapidly the controller can respond to changes within the system.

Built in operating temperature readouts: The CEM-TROL II features an easy to read LCD touch screen readout of the water temperature in the water heater.

Built in primary high temperature cut off and alarm: In the event of high temperature, the CEM-TROL II will close the source steam, boiler water, or HTHW supply valve and sound an alarm.

Built in secondary high temperature limit and alarm: In the event of secondary high temperature set point is exceeded the CEM-TROL II will open an optionally supplied domestic water solenoid valve to relieve the vessel of overheated water and sound an alarm.

Built in remote temperature set point: The BAS can remotely set the operating temperature of the water heater. This requires the use of a pneumatic control valve with an I-P transducer or an electronic control valve. This feature is not functional when using a pilot operated valve with a self-contained temperature pilot.

Built in LED/LCD display of functions and alarms: The CEM-TROL II is designed for the user to tell at a glance how the system is operating. The built in LED displays make troubleshooting simple.

<b>Function</b>	<b>LED Indicator 1</b>	<b>LED Indicator 2</b>
Power ON	Green = Power On	Blank = No power
Primary High Limit	Green = Temperature below primary high limit set point.	Red = Primary high limit set point has been exceeded.
Secondary High Limit	Green = Temperature below secondary high limit set point.	Red = Secondary high limit set point has been exceeded.

CEM-TROL II units will display the below alarm status on the LCD screen if the temperature sensor(s) are not attached or are defective. In order to determine the version of the CEM-TROL please refer to the 'Software Version' section on page 33 of this manual

<b>LCD Display</b>	<b>Description</b>
Sensor Loss 1	The primary sensor wired to terminal block P11 - terminals 1 & 2 is not connected and needs to be connected or the sensor is faulty or defective and needs to be replaced.
Sensor Loss 2	The secondary sensor wired to terminal block P11 - terminals 3 & 4 is not connected and needs to be connected or the sensor is faulty or defective and needs to be replaced.

Built in contacts to notify BAS (Building Automation System) of functions and alarms: This control allows for simple and reliable interface from a remote location. The BAS can also start and stop the packaged water heater. BAS can remotely read the temperature in the packaged water heater via a 4 – 20 mA signal whereby 4 mA= 0 °F and 20 mA = 212°F. BAS can remotely set the temperature of the packaged water heater between 50 and 160 °F using a 4 – 20 mA signal whereby 4 mA= 32 °F and 20 mA = 250 °F.

Power ON
Primary High Limit
Secondary High Limit
Alarm
Operating temperature (via a 4-20 mA signal) (4 mA = 32 °F; 20 mA = 250 °F)

The Cem-trol II is supplied with a 24 VAC contact to turn On/Off a Remote Pump. The remote pump is typically used to pump boiler water through the heat exchanger of the water heater. The Cem-trol II offers two remote pump options. The first option is valve based. The controller energizes the 24 VAC terminal block P-4 terminals 3-4 when the control valve is open and de-energizes the 24 VAC when the valve is closed. The control valve is open when the VDC output to the control valve is between 1 – 10 VDC. The second option is temperature based. The controller energizes the 24VAC output for pump until the temperature set point is achieved. The 24 VAC (pump) is de-energized until the temperature drops below the pump differential temperature setting. The 24 VAC output will energize and de-energize over and over again to maintain temperature of the water heater. Settings are available for minimum pump on and off times to prevent pump from short cycling.

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## Contractor Wiring

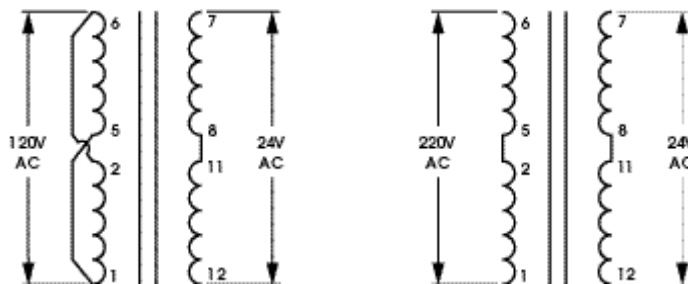
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**All Power Connections should be performed by a trained, certified electrician. Be sure the factory supplied on-off switch is in the OFF position before connecting to building power.**

**Field wiring:** Installer must run feed wires to terminals on panel mounted on-off disconnect switch and green ground wire to ground lug. *Units are normally wired for 120 volt single phase input.*

**Warning: Before drilling hole in panel for conduit connection of power carefully open door and verify that nothing in panel will be interfered with. BE CAREFUL not to get any drill shavings or metal slug on board or transformer or disconnect switch.**

Panel is normally factory shipped for 120 Volt/ 1 phase/60/50 Hz. If so desired 220/1/50 or 60 Hz power can be used. To convert to 220 volt input it is necessary to reconfigure the 24 volt output transformer. Below is the wiring diagram for 120 volt and 220 volt input.



▼ **CAUTION: Before attempting to rewire the transformer be sure power coming to the unit is turned off and locked out in an approved manor.**

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## Ratings

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Input: selectable 120/220 VAC – 50/60 Hz @ 120 Vac min 90 volt max 130 volt

Output Contacts: 1 amp at 24 Vac

Building Automation outputs: Dry contacts, NO .5 amp maximum, non-inductive

Display: LED display with resolution of

.3 % of scale

Available temperature set range:

50 – 160 °F

Operating ambient temperature:

Min 32 Deg F max 140 deg F

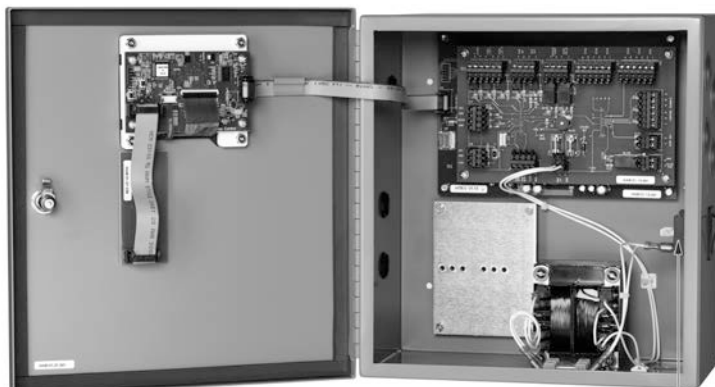
Operating Humidity:

5% to 95% relative humidity (RH)

non condensing

Alarm approximately 103 db.

NEMA 4 enclosure



The Cemline CEM-TROL II is a self-contained board and cannot be field repaired. For a replacement board contact Cemline Corporation at the address shown on page one of this manual.

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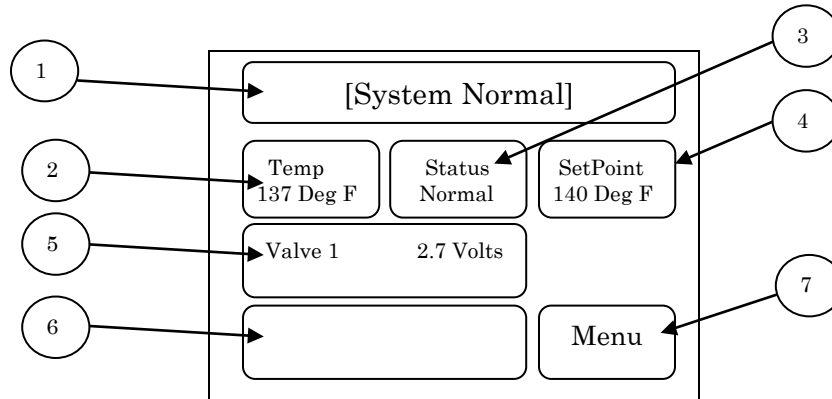
## Controller Screens

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### Controller Home Screen:

The controller is supplied with an LCD touch screen. The MENU button in the lower right hand corner of the screen is touched in order to go to the main menu screen to set the controller.

In the event an alarm horn is going off touch the screen to silence the alarm horn.



1. Top Banner: [System Normal] will indicate if the system is normal. If there is an alarm this area will indicate the type of alarm. Top Banner will also indicate if using a Remote Set Point or if the unit is Disabled Remotely.
2. Temperature: This is the temperature of the water in water heater. Temperature is indicated in degrees Fahrenheit.
3. Status: This will indicate if the status of the unit is in Normal or in Alarm state.
4. Set Point: This displays the set point of the unit in degrees Fahrenheit.
5. Valve: This will indicate if one or two valves are being used with the controller. This will indicated the voltage between 0 – 10 VDC being supplied to the control valve(s).
6. Blank/Rate/Temperature: Normally this banner is blank. This banner will indicate rate limit if rate limit is active. When the banner is pressed it will indicate the temperature of sensors 1 through 6.
7. Menu: This is the button that will allow the user to set the controller.

After 90 seconds in any screen "Home" screen will be displayed

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# Setting the Controller

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## Setting the Controller

The controller is supplied with an LCD touch screen display. The screen will display virtual buttons or selection choices on the screen that are pushed or selected to set the device. The function and settings are read on the LCD display. The sequence to access and change any screen is as follows:

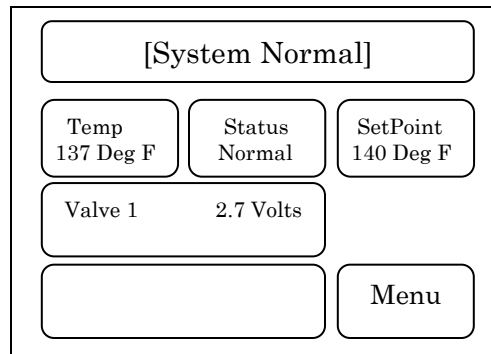
1. Press “MENU” button to go to the Main Menu screen.
2. In the Main Menu Screen select a setting by pressing the wording of the setting that will highlight the setting on the screen.
3. Press the SELECT button to go to the setting adjustment screen for the highlighted setting.
4. For settings requiring numeric values press the + / - keys to cycle through the values in an increasing or decreasing fashion until the desired setting is displayed on the screen.
5. For settings with specific options press the NEXT / PREV keys to cycle through the options until the desired option is highlighted on the screen.
6. Press the ACCEPT or SELECT key to store last screen setting into memory and return the controller to the Main Menu screen.

## Instructions for Setting Each Screen:

### Home Screen

This is the screen which should be displayed during normal operation:

Home



**TOP BANNER:** [System Normal] will indicate if the system is normal. If there is an alarm this area will indicate the type of alarm. Top Banner will indicate if using a Remote Set Point or if the unit is Disabled Remotely.

**Status** can be either NORMAL or ALARM. The mode will read normal in normal operation and alarm if any alarm condition occurs. If an alarm condition is cleared the mode will switch back to normal reading.

**Temp (Degrees Fahrenheit):** This is the temperature of the heated water.

**Menu:** This button is pushed by the user to adjust settings of the controller.

**Valve:** This will indicate if one or two valves are being used with the controller. The valve display area will indicate the voltage between 0 – 10 VDC which is being supplied to the control valve. Below are examples of the valve screen with one valve or two valve options.

**One Valve**



**Two Valves**

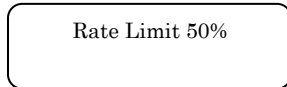


**Blank/Rate/Temperature:** Normally this banner will be blank. This banner will indicate rate limit if rate limit is active. When the banner is pressed it will indicate the temperature of sensors 1 through 6.

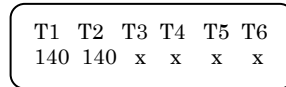
**Blank**



**Rate Limit Active**



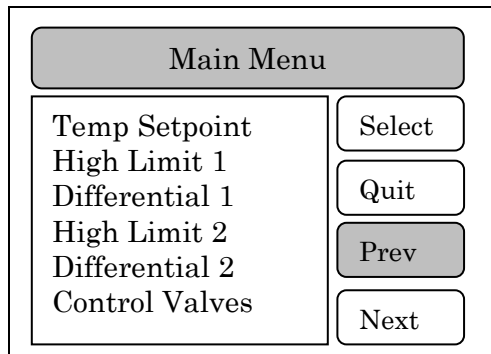
**Activated by pressing banner**



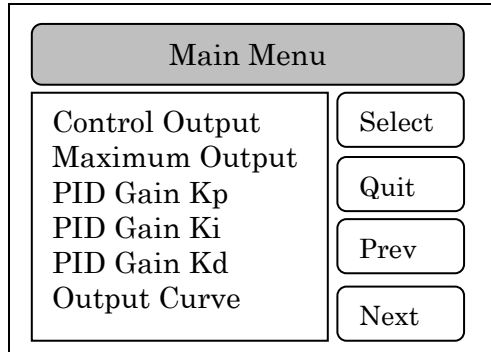
**Main Menu Screen**

When the user pushes the Menu button the Main Menu screen will be displayed. The Main Menu screen(s) shows a list of options that can be selected. There are six (6) options displayed at a time on the screen. There are a total of 27 menu options. In order to cycle forward through the list of available options the user must push the NEXT button. In order to cycle backward through the list of available options the user must push the PREV button. There is a two-step process for selecting an option, the user must first highlight the option by touching it on the screen and then push the SELECT button.

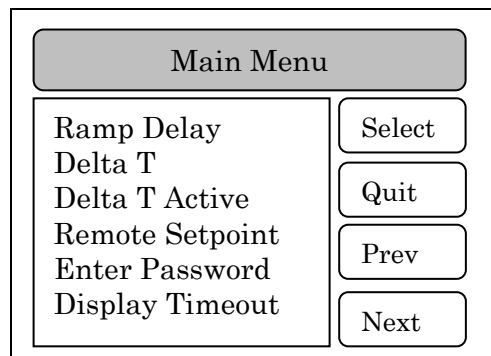
**Main Menu Screen Options 1 - 6:**



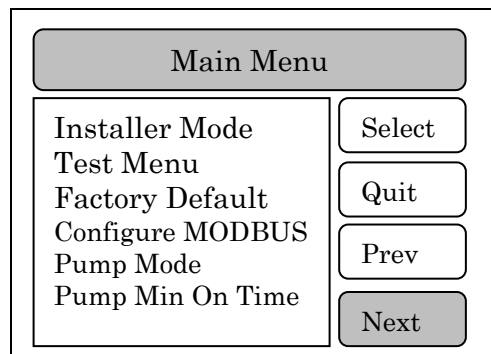
**Main Menu Screen Options 7- 12:**



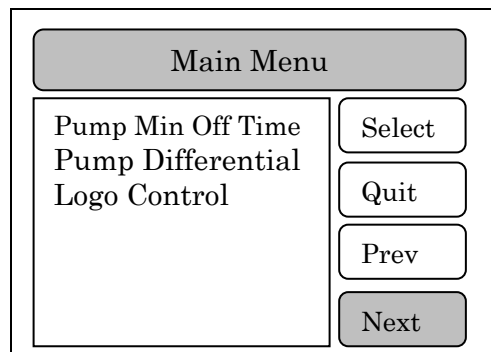
**Main Menu Screen Options 13 - 18:**



**Main Menu Screen Options 19 - 23:**



**Main Menu Screen Options 24 - 27:**

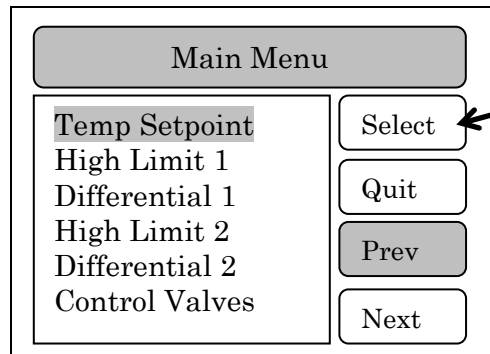


## Set Point Degree F.

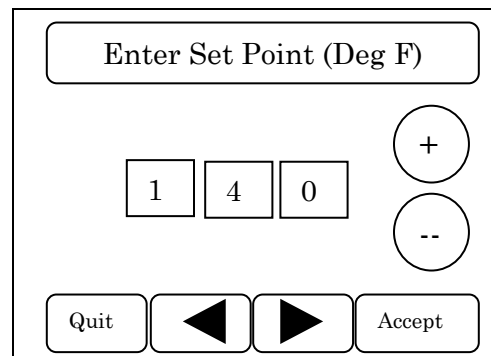
This is the operating temperature set point of the water heater. If the water heater was supplied with either an electronic control valve or a pneumatic control valve with an I-P transducer the temperature set point of the water heater will be selected using the CEM-TROL II. This feature is not functional when using a pilot operated valve with self-contained temperature pilot.

*To set the Operating Temperature Set Point:*

1. Highlight Temp Set Point on the Main Menu Screen and press the SELECT Button:



2. The following screen will appear:



3. Press “+” key to change temperature setting in an increasing direction or press “-” key to change the temperature setting in a decreasing direction until the desired operating temperature appears on the screen. The set point temperature is adjustable between 32 - 160 °F in 1 °F increments. The default value of the operating temperature set point is 140 °F. *If the temperature output desired is above 160 °F, please contact the factory for special instructions.*
4. Press ACCEPT key to place setting in memory and to return to Main Menu screen.



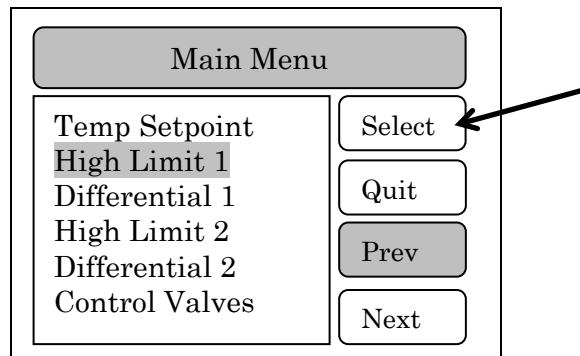
## Primary High Limit Temperature or Cut Out

This is the primary high limit temperature which is typically set 10 to 20 °F higher than the desired operating temperature. When the primary high limit temperature or cut out temperature is reached the controller will cause the main control valve to close.

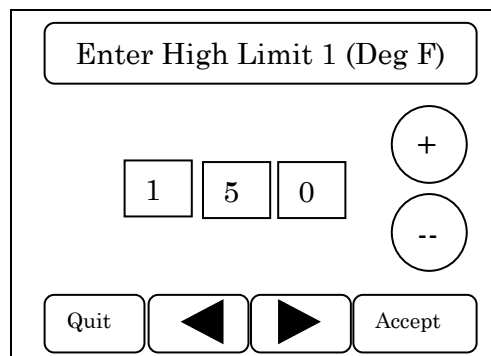
- ▼ **CAUTION:** When using a pilot operated control valve with a self-contained temperature pilot the operating temperature of the water heater will be set by the self-contained temperature pilot and not the CEM-TROL II. See the Cemline Water Heater I O & M manual and the self-contained temperature pilot I O & M manual for setting the operating temperature.
- ▼ **CAUTION:** When using the self-contained temperature pilot **DO NOT** set the operating temperature greater than the primary or secondary high limit settings. This will cause improper operation of the unit, with the potential for **DANGER** by causing alarms and dump valves to go off.

*To set the High Limit 1 Temperature Cut Out:*

1. Highlight High Limit 1 on the Main Menu Screen and press the SELECT Button.



2. The following screen will appear:



3. Press the + / - keys to scroll through the temperature settings until the desired temperature setting appears on the screen. The range of the primary high limit temperature set point is between 5 °F greater than the operating temperature set point

and 220 °F in 1 °F increments. The default value of the primary high limit temperature is 150 °F.

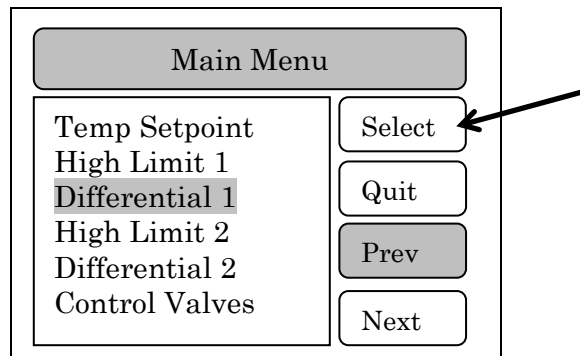
4. Press ACCEPT key to place the setting in memory and return to the Main Menu screen.

## Primary High Limit Temperature Reset Differential

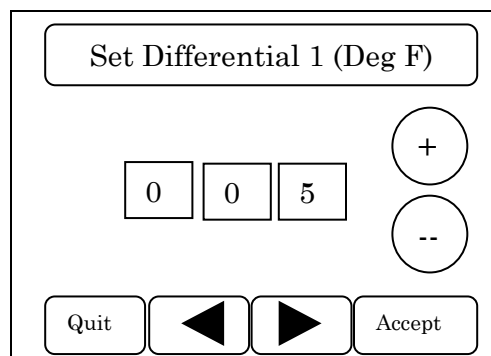
This is the temperature differential from the primary high limit set point at which the primary high temperature limit will reset. Normally it is set at 5 °F but can be set between 1 to 20 °F in 1 °F increments.

*To set the Primary High Limit Temperature Differential:*

1. Highlight Differential 1 on the Main Menu Screen and press the SELECT button.



The following screen will appear:



2. Press the + / - key(s) to scroll through the temperature settings until the desired temperature differential is displayed. The range is 1-20 °F in 1 °F increments.
3. Press the ACCEPT key to place setting in memory and return to the Main Menu screen.

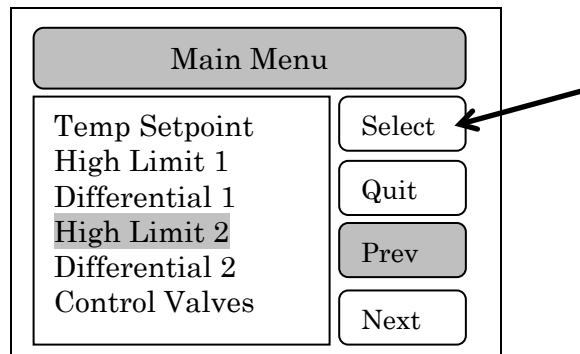
## Secondary High Temperature Limit

This is the secondary high limit temperature is typically set 20-30 °F higher than the desired operating temperature. When the secondary high limit temperature is reached a solenoid opens to dump overheated water to drain. *Be sure to pipe the outlet from this solenoid to drain.*

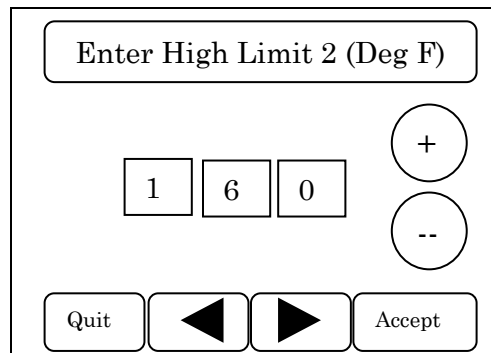
- ▼ **CAUTION: When using the self-contained temperature pilot DO NOT set the operating temperature greater than the primary or secondary high limit settings. This will cause improper operation of the unit, with the potential for DANGER by causing alarms and dump valves to go off.**

To set the High Limit 2 Temperature Cut Out:

1. Highlight High Limit 2 on the Main Menu Screen and press the SELECT Button.



2. The following screen will appear:



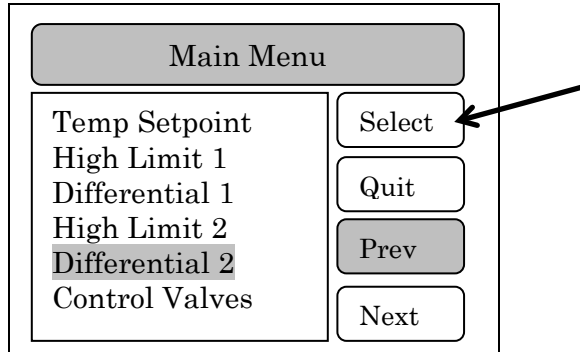
3. Press the + / - keys to scroll through the temperature settings until the desired temperature setting appears on the screen. The range of the secondary limit temperature set point is between 2 °F greater than the primary high limit temperature set point and 230 °F in 1 °F increments. The default value of the primary high limit temperature is 160 °F.
4. Press ACCEPT key to place the setting in memory and return to the Main Menu screen.

## Secondary High Limit Temperature Reset Differential

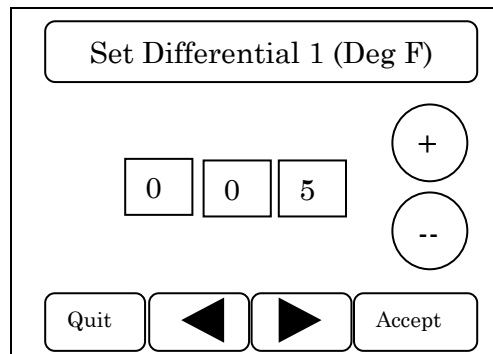
This is the temperature differential from the secondary high limit set point at which the secondary high limit temperature will reset. Normally it is set at 5 °F but can be set from 1 to 20 °F in 1 °F increments.

*To set the Secondary High Limit Temperature Differential:*

1. Highlight Differential 2 on the Main Menu Screen and press the SELECT button.



The following screen will appear:



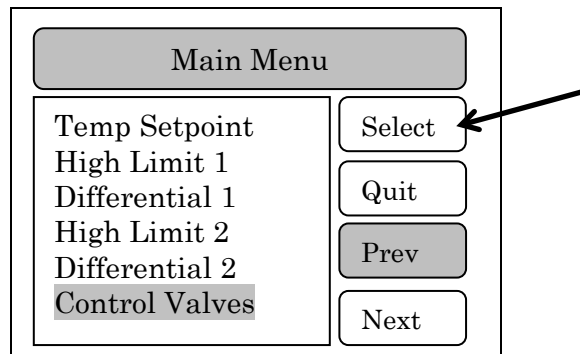
2. Press the + / - key(s) to scroll through the temperature settings until the desired temperature differential is displayed. The range is 1-20 °F in 1 °F increments.
3. Press the ACCEPT key to place setting in memory and return to the Main Menu screen.

## Control Valves

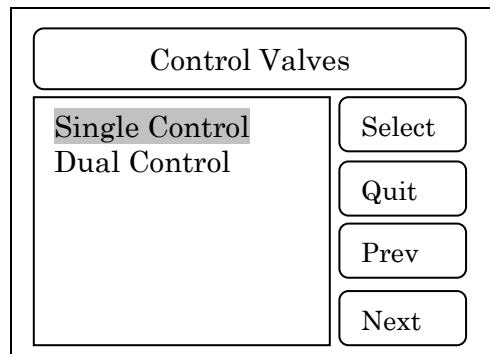
If desired the control module can be used to control two control valves set up in a 1/3 – 2/3 piping configuration.

To set the Control Valve Option:

1. Highlight Control Valves on the Main Menu screen and press the SELECT button.



2. The following screen will appear:



3. Highlight the desired Control Valve option. The control valve choices are “Single Control” when one control valve is being utilized or “Dual Control” when two control valves are being utilized.
4. Press SELECT key to place setting in memory and return to Main Menu screen.

## Control Output

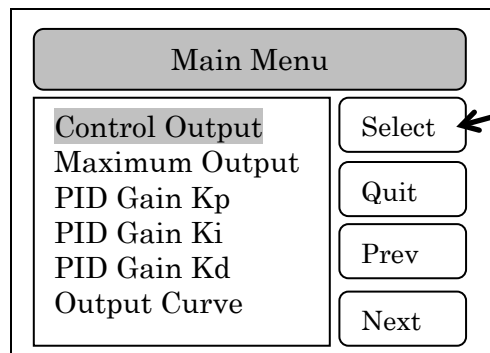
The CEM-TROL II has four output settings options. The output setting options are 0 – 10, 2 – 10, AIR VALVE or PILOT VALVE. The 0-10 setting will output a 0 -10 VDC control output signal to the control valve, the 2 –10 setting will output a 2 - 10 VDC control output signal to the control valve, and the AIR VALVE setting will output a 1.5 – 7.5 VDC control output signal to an electronic- to- pneumatic transducer. The electronic-to-pneumatic transducer converts the input voltage (1.5 to 7.5 VDC) to an output 3-15 psig air signal to the air operated control valve. The PILOT VALVE uses an externally mounted temperature pilot for modulating the control valve. When in PILOT VALVE mode the PID control / functionality of the CEM-TROL II is disabled.

- ▼ **CAUTION: DO NOT set the “Control Output” to 2 – 10 VDC or AIR VALVE setting for a control valve that operates on a 0 – 10 VDC control signal. This will prevent the control valve from closing as the CEM-TROL II will output a MINIMUM of 2 or 1.5 VDC. This will cause improper operation of the unit, with the potential for DANGER by causing alarms and dump valves to go off.**
- ▼ **THE VALVES DESCRIBED IN THIS MANUAL ON PAGES 56 - 62 REQUIRE A 0 –10 VDC CONTROL SIGNAL. THESE VALVES ARE MANUFACTURED BY SIEMENS BUILDING CONTROLS.**
- ▼ **VALVE PRO REV ACTUATORS AND WARREN CONTROLS ILEA ACTUATORS ACTUATOR REQUIRES 0 - 10 VDC CONTROL SIGNAL.**
- ▼ **WARREN CONTROLS AMURACT ACTUATOR REQUIRES 2 - 10 VDC CONTROL SIGNAL.**
- ▼ **AIR OPERATED CONTROL VALVES USE THE AIR VALVE SETTING. THE ELECTRONIC-TO-PNEUMATIC TRANSDUCER REQUIRES 1.5 – 7.5 VDC INPUT CONTROL SIGNAL TO PRODUCE A 3 – 15 PSIG OUTPUT AIR SIGNAL TO THE CONTROL VALVE.**
- ▼ **CAUTION: DO NOT set the “Control Output” to 0 – 10 VDC or AIR VALVE setting for a control valve that operates on a 2 – 10 VDC control signal. This will cause improper operation of the unit, with the potential for DANGER by causing alarms and dump valves to go off.**

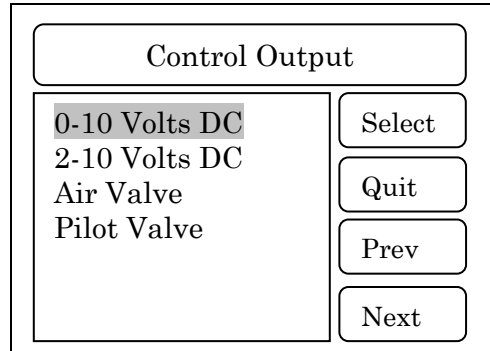
It is extremely important that the control signal of the control valve supplied and the “Control Output” listed in the CEM-TROL II be the same. The water heater is factory shipped with the “Control Output” properly set for the supplied control valve’s actuator.

*To set the Control Output:*

1. Press NEXT key one (1) time until Control Output is displayed on the Main Menu.
2. Highlight Control Output on the Main Menu screen and press the SELECT button.



- The following screen will appear:



- Verify that the Control Output listed on the screen and control valve's required control signal supplied on the steam generator are the same. IF AND ONLY IF the control valve's required signal is different than the "Control Output's" screen setting should the screen setting be changed. Highlight the desired Control Output option. The Control Output choices are "0 – 10 VDC" when the control valve requires a 0 – 10 VDC control signal, "2 – 10 VDC" when the control valve requires a 2 – 10 VDC control signal, "AIR VALVE" when using an air operated control valve, or "PILOT VALVE" when using a pilot operated control valve.
- Press the SELECT key to place the setting in memory and return to the Main Menu screen.

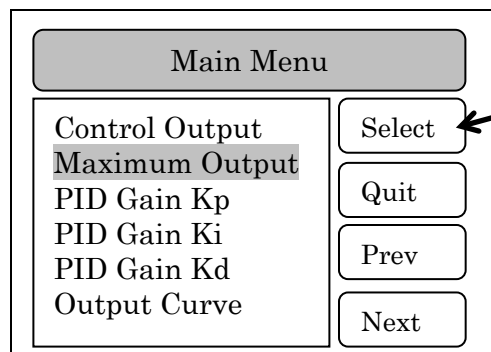
## Maximum Output

The CEM-TROL II can be adjusted to limit the maximum output voltage being sent to the control valve. The maximum output setting can be set as 10, 9, 8, 7, 6, or 5 VDC. The maximum output setting is used to limit the maximum stroke of the control valve. The maximum output adjustment is only available when the "Control Signal" is set to 0 – 10 VDC or 2 – 10 VDC.

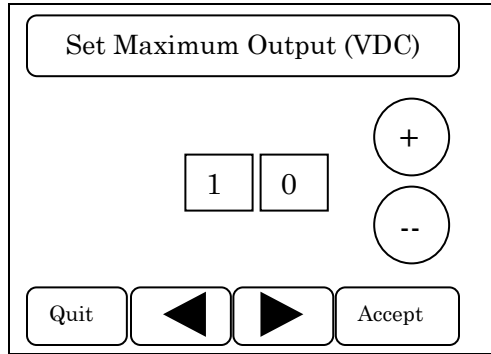
The water heater is factory shipped with the "Maximum Output" set for 10.

*To set the Maximum Output:*

- Press NEXT key one (1) time until Maximum Output is displayed on the Main Menu:
- Highlight Maximum Output on the Main Menu screen and press the SELECT Button.



- The following screen will appear:

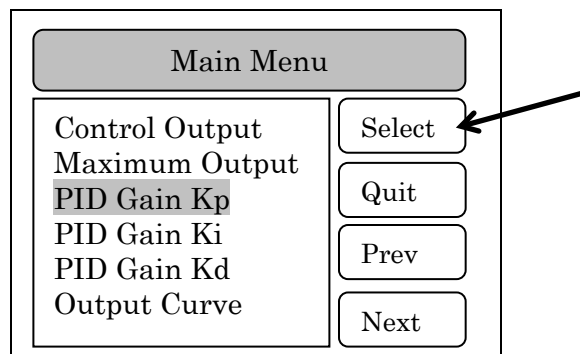


- Press “+” key to change control output setting in an increasing direction or press “-” key to change the control output setting in a decreasing direction until the desired maximum control output appears on the screen. The range is 10 - 5.
- Press ACCEPT key to place the setting in memory and return to the Main Menu screen.

### Setting PID Gain Kp (Proportional)

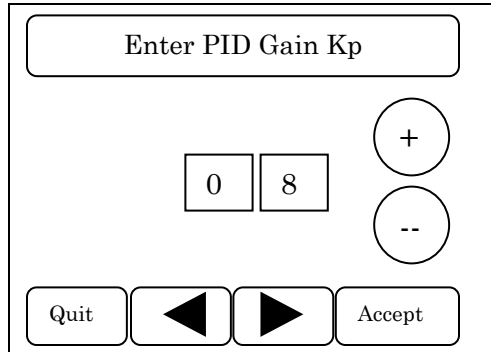
The operating controls are factory preset for optimal control of the water heater. The Kp (Proportional) is used to handle the present. Kp (proportional) is a constant used to send a signal to the output. The proportional control with a set point of 140 °F and a proportional band of 10 would have a 100% output at 130 °F, 50% output at 135 °F and 10% output at 139 °F. The default value of the Kp (proportional) is 8 (°F). The Kp (Proportional) setting of the controller can be determined and if necessary changed as follows:

- Press NEXT key one (1) times until PID Gain Kp is displayed on the Main Menu.
- Highlight PID Gain Kp on the Main Menu screen and press the SELECT button.





3. The following screen will appear:



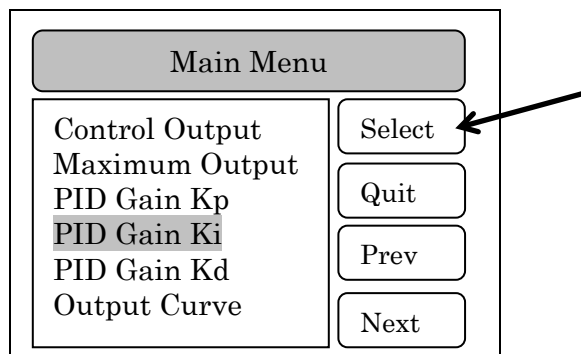
4. Press "+" key to change the Gain Kp setting in an increasing direction or press "--" key to change the Gain Kp setting in a decreasing direction until the desired PID Gain Kp appears on the screen. The range is 0 - 30 (°F).
5. Press ACCEPT key to place the setting in memory and return to the Main Menu screen.

### Setting PID Gain Ki (Integral)

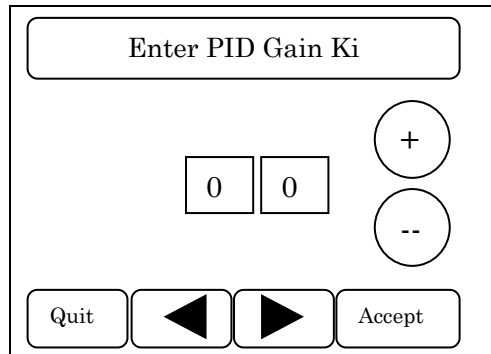
The operating controls are factory preset for optimal control of the water heater. The Ki (Integral) measures error over a short period of time to a constant used to send a signal to the output. The default value of the Ki (integral) is 2. The Ki (integral) setting of the controller can be determined and if necessary changed as follows:

*To set the PID gain Ki:*

1. Press NEXT key one (1) times until PID Gain Ki is displayed on the Main Menu.
2. Highlight PID Gain Ki on the Main Menu screen and press the SELECT button.



3. The following screen will appear:



4. Press “+” key to change Gain Ki setting in an increasing direction or press “-” key to change the Gain Ki setting in a decreasing direction until the desired setting appears on the screen. The range is 0 - 30.

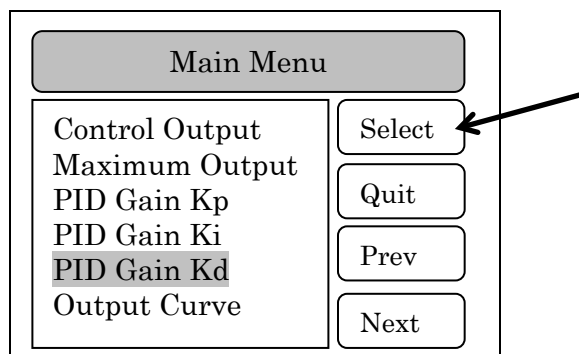
5. Press ACCEPT key to place the setting in memory and return to the Main Menu screen.

### Setting PID Gain Kd (Derivative)

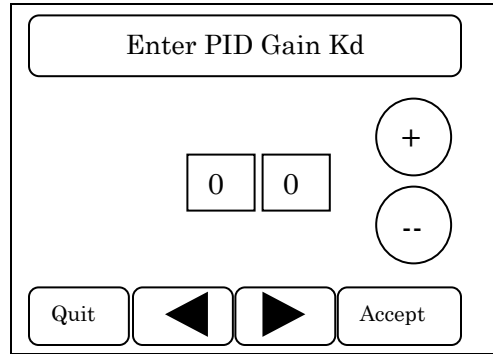
The operating controls are factory preset for optimal control of the water heater. The Kd (derivative) measures error over a short period of time to a constant used to send a signal to the output. The default value of the Kd (derivative) is 10. The Kd (derivative) setting of the controller can be determined and if necessary changed as follows:

*To set the PID gain Kd:*

1. Press NEXT key one (1) times until PID Gain Kd is displayed on the Main Menu.
2. Highlight PID Gain Ki on the Main Menu screen and press the SELECT button.



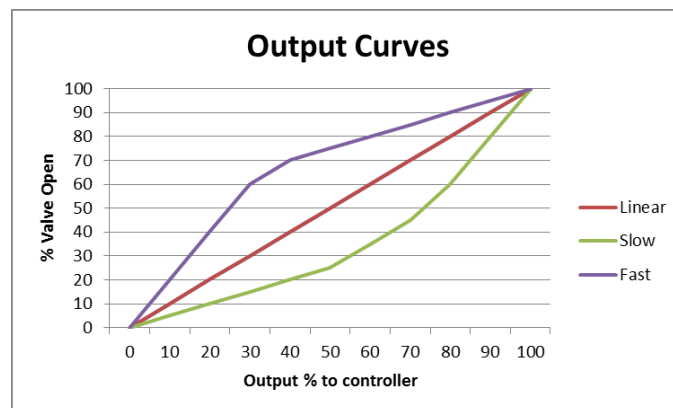
3. The following screen will appear:



4. Press "+" key to change Gain Kd setting in an increasing direction or press "-" key to change the Gain Kd setting in a decreasing direction until the desired setting appears on the screen. The range is 0 - 60.
5. Press ACCEPT key to place the setting in memory and return to the Main Menu screen.

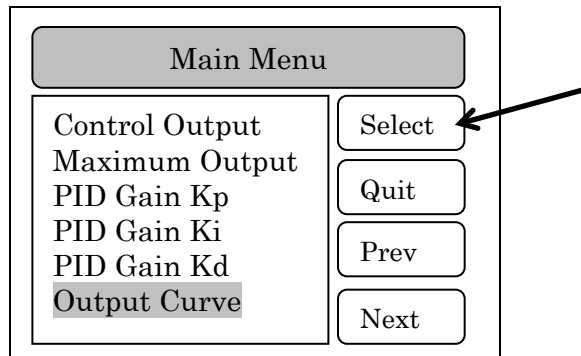
## Setting Output Curve

The output curve setting will vary the characteristic of the voltage output to the control valve. The characteristic is the relationship between voltage output and percent valve open. The voltage characteristic can be a Linear, Slow, or Fast output. See the chart below showing a graphical representation of the Output Curves. The linear output setting will supply output voltage in a linear fashion. The slow output setting will track below the linear characteristic opening the valve slower than the linear output. The fast output setting will open the valve quicker than the linear characteristic. The Cem-trol II will be factory preset with a linear output curve. The Output Curve setting of the controller can be determined and if necessary changed as follows:

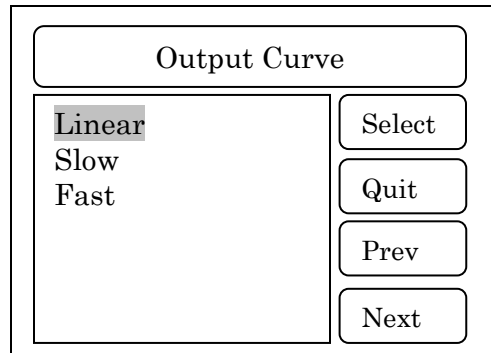


*To set the Output Curve:*

1. Press NEXT key one (1) times until Output Curve is displayed on the Main Menu.
2. Highlight Output Curve on the Main Menu screen and press the SELECT button.



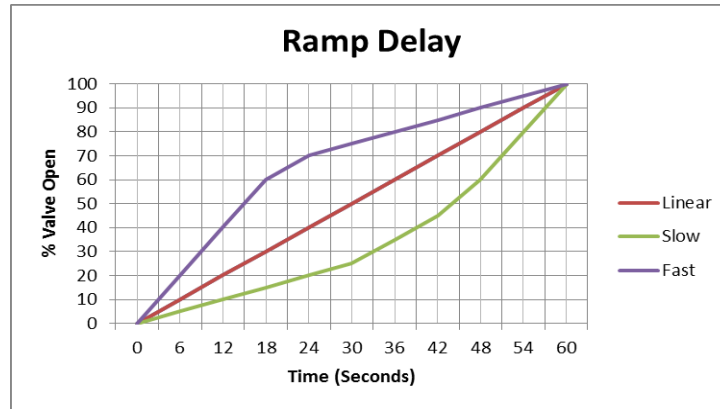
3. The following screen will appear:



4. Highlight the desired Output Curve option. The Output Curve choices are “Linear”, “Slow”, and “Fast”. The default setting is Linear.
5. Press SELECT key to place the setting in memory and return to the Main Menu screen.

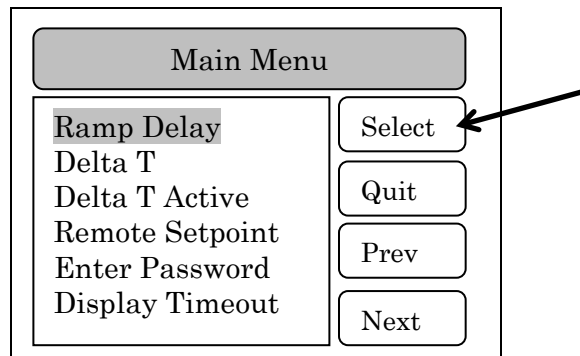
## Setting Ramp Delay

The Ramp Delay is a time setting that slows the opening of the control valve. The ramp delay prevents the control valve from opening fully until the time setting has been reached. The valve open percentage can be seen below in a chart where the Ramp Delay is set at 60 seconds. The voltage to the valve can be less than the curve maximum during the ramp process, but never above the curve. When this function is enabled every time the valve closes the Ramp Delay will be in effect when there is a demand for the valve to re-open. This function when used in conjunction with the Output Curve functionality. The display screen will indicate the Ramp Delay maximum output percentage on the bottom banner. The range is 0 – 300 seconds. The ramp delay setting of the controller can be determined and if necessary changed as follows:

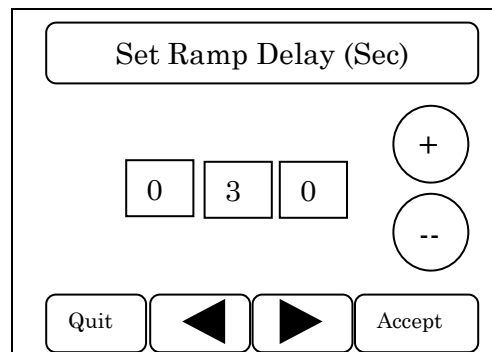


To set the Ramp Delay:

1. Press NEXT key two (2) times until Ramp Delay is displayed on the Main Menu.
2. Highlight Ramp Delay on the Main Menu screen and press the SELECT button.



3. The following screen will appear:



4. Press "+" key to change Ramp Delay setting in an increasing direction or press "-" key to change the Ramp Delay setting in a decreasing direction until the desired setting appears on the screen. The range is 0 - 300 seconds. If the setting is 0 the Ramp Delay functionality is disabled.

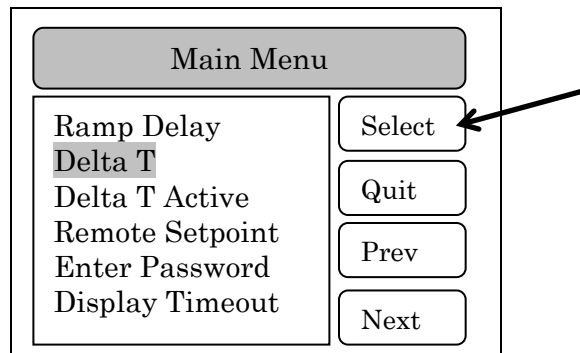
5. Press ACCEPT key to place the setting in memory and return to the Main Menu screen.

## Setting Delta T

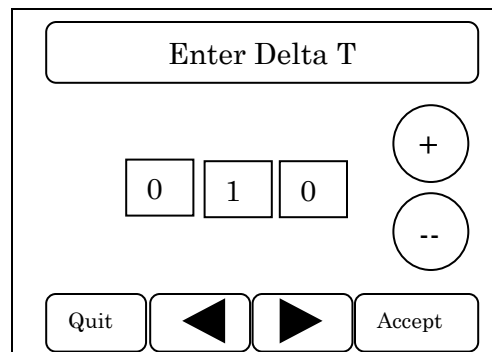
The Delta T function adds feedforward control to the water heater by comparing the outlet and inlet water temperatures. As water flows through the unit the Delta T setting compares the outlet water temperature and the mixed water inlet temperature. The inlet water temperature is a mixture between the cold water inlet and a small amount of outlet hot water by means of an intra heater pump. As these values become closer it indicates a reduction of total flow through the water heater. The user can adjust how many degrees difference between the outlet water temperature and mixed inlet water temperature where the gain is automatically adjusted by the controller. The setting adjusts the degree difference required between the outlet water temperature and the inlet mixed water temperature for the controller to automatically start adjusting the gain. This functionality is not available in all Celine Water Heaters. It requires the use of a third temperature sensor. The heaters that can potentially utilize this functionality are SEH, SSH, PBH, and PFH. Please contact the factory to see if your unit is supplied with this functionality. The range is 0 – 15 degrees. The Delta T setting of the controller can be determined and if necessary changed as follows:

*To set the Delta T:*

1. Press NEXT key two (2) times until Delta T is displayed on the Main Menu.
2. Highlight Delta T on the Main Menu screen and press the SELECT button.



3. The following screen will appear:



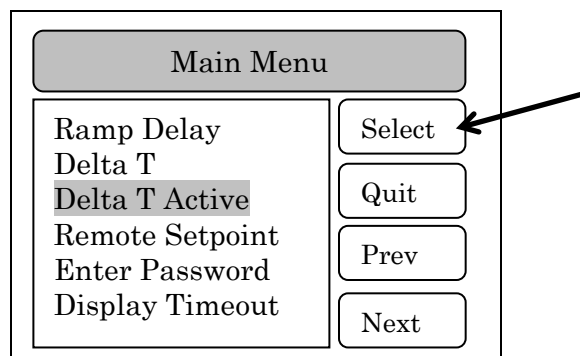
4. Press “+” key to change Delta T setting in an increasing direction or press “-” key to change the Delta T setting in a decreasing direction until the desired setting appears on the screen. The range is 0 - 15 degrees F. If the Delta T setting is 0 the functionality will be disabled.
5. Press ACCEPT key to place the setting in memory and return to the Main Menu screen.

## Setting Delta T Active

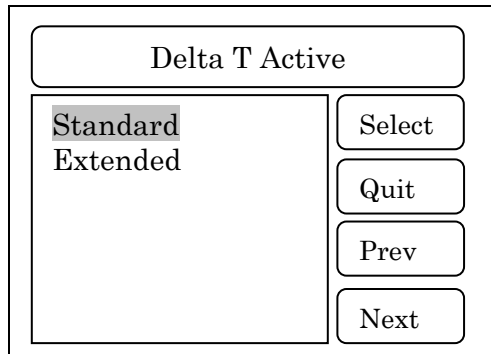
Delta T Active setting works in conjunction with the Delta setting. The Delta T setting compares the outlet water temperature and the mixed inlet water temperature to adjust the gain. The Delta T Active compares the set point temperature to the outlet water temperature in order to turn on the Delta T functionality. For example if a water heater is being initially started up the outlet water temperature and the mixed water temperature will be equal at 50 °F. Since these temperatures are equal and the Delta T setting is 5 °F the gain will be adjusted to 0 and the valve will be closed even though the set point is at 140°F. Therefore, the Delta T Active setting has been added to compare the set point temperature and the outlet water temperature. If these temperatures are within the setting range of the Delta T Active the Delta T will be functioning. There are two setting choices for the Delta T Active: Standard or Extended. The Standard setting activates the Delta T when the outlet water temperature is within 5 °F of set point or the Extended setting activates the Delta T when the outlet water temperature is within 10 °F of set point. The Delta T Active setting of the controller can be determined and if necessary changed as follows:

*To set the Delta T Active:*

1. Press NEXT key two (2) times until Delta T Active is displayed on the Main Menu.
2. Highlight Delta T Active on the Main Menu screen and press the SELECT button.



3. The following screen will appear:



4. Highlight the desired Delta T Active option. The Delta T Active choices are “Standard” will activate the Delta T setting when the outlet water temperature is within 5 °F of set point or the “Extended” will activate the Delta T setting when outlet water temperature is within 10 °F of set point.
5. Press ACCEPT key to place the setting in memory and return to the Main Menu screen.

## Remote Set Point

The CEM-TROL II can operate with a remote temperature set point. The remote temperature set point allows the Building Automation System (BAS) to supply a constant 4 – 20 mA signal to the controller.

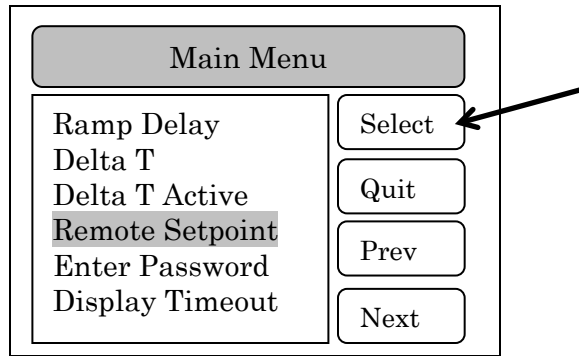
- ▼ **CAUTION: When using the remote set point DO NOT set the operating temperature greater than the primary or secondary high limit settings. This will cause improper operation of the unit, with the potential for DANGER by causing alarms and dump valves to go off.**
- ▼ **CAUTION: Once the Remote Control is Enabled the local setting is no longer used unless the Remote Control has been Disabled.**

The remote temperature set point of the temperature of the packaged water heater can be set between 32 and 160 °F using a 4 – 20 mA signal whereby 4 mA= 32 °F and 20 mA = 250 °F.

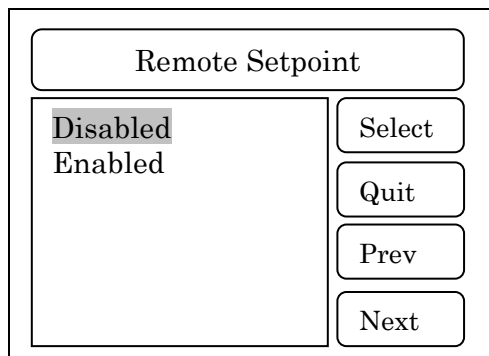
*To set the Remote Set Point:*

1. Press NEXT key two (2) times until Remote Set point is displayed on the Main Menu.
2. Highlight Remote Set point on the Main Menu screen and press the SELECT button.





3. The following screen will appear:



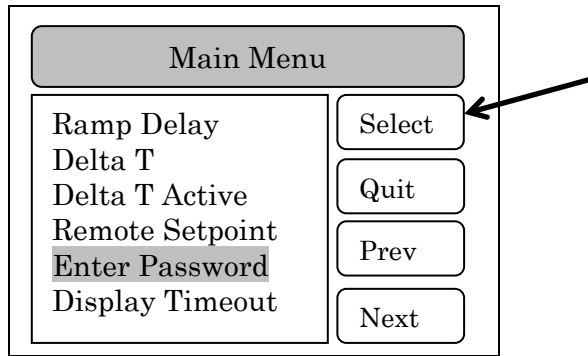
4. Highlight the desired Remote Set point option. The Remote Control choices are “Disabled” when the CEM-TROL II local pressure setting (Set point PSI) is being utilized or “ Enabled” when a remote pressure set point via a 4-20 mA input signal is being utilized.
5. Press SELECT key to place the setting in memory and return to the Main Menu screen.

## Enter Password

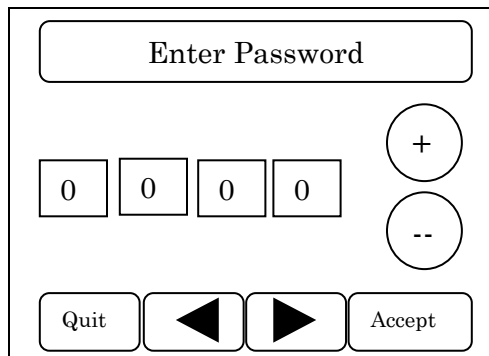
The CEM-TROL II is supplied with a password protection that is required to be entered in order to change some settings.

*To enter the Password:*

1. Press NEXT key two (2) times until Enter Password is displayed on the Main Menu.
2. Highlight Enter Password on the Main Menu screen and press the SELECT button.



3. The following screen will appear:



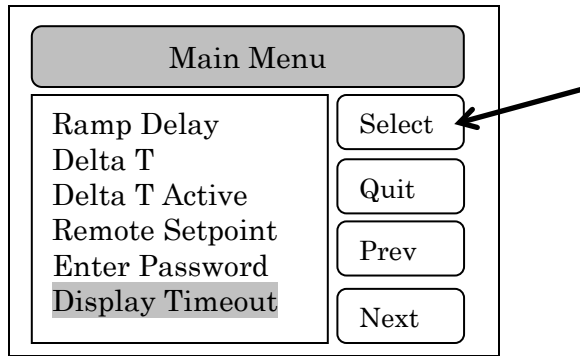
4. There are four values that need to be entered. Touch the screen in the box on the value that is to be altered. Press “+” key to change password setting in an increasing direction or press “-” key to change the password setting in a decreasing direction until the desired setting appears on the screen. Do this for all four values to until the passcode is properly selected. You will need to contact your local Cemline representative or the factory at 1-800-245-6268 for the passcode.
5. Once the proper passcode is displayed, press the SELECT key to place the setting in memory and return to Main Menu screen

## Display Timeout

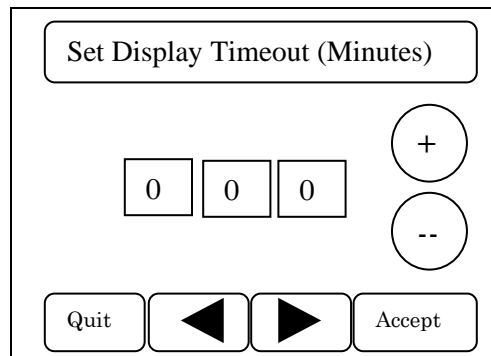
The display on the CEM-TROL II can be set to turn off in a screen saver/power save mode. This mode is similar to that of a screen saver on a computer. If an alarm occurs while the display is off the display will turn back on.

*To set the Display Timeout:*

1. Press NEXT key two (2) times until Display Timeout is displayed on the Main Menu.
2. Highlight Display Timeout on the Main Menu screen and press the SELECT button.



3. The following screen will appear:



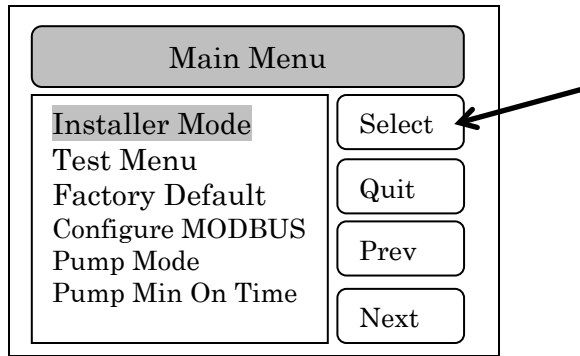
4. Press “+” key to change Display Timeout setting in an increasing direction or press “-” key to change the Display Timeout setting in a decreasing direction until the desired setting appears on the screen. The range is 0-300 minutes.
5. Press ACCEPT key to place the setting in memory and return to the Main Menu screen.

## Installer Mode

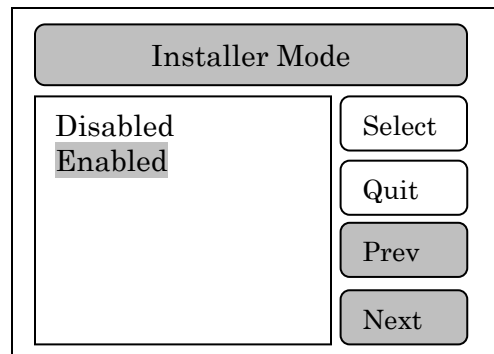
The installer mode if enabled will remove the display of some of the items in the main menu. These items will not be accessible while the installer mode is enabled.

*To set the Installer Mode:*

1. Press NEXT key three (3) times until Installer Mode is displayed on the Main Menu.
2. Highlight Display Timeout on the Main Menu screen and press the SELECT button.



3. The following screen will appear:



4. Highlight the desired Installer Mode. The Installer Mode choices are “Disabled” when all of the menu items will be displayed or “Enabled” when some of the menu items will not be displayed in the main menu. When the Installer Mode is “Disabled” the Main Menu options 7 -12 are hidden. While in the “Disabled” Mode the user will not see the options for Control Valves, Control Output, Maximum Output, PID Gain Kp, PID Gain Ki, and PID Gain Kd, Output Curve, Ramp Delay, Delta T, and Delta T Active.

**When Installer Mode is Disabled Main Menu Screen Options 6- 15 (below) will not be displayed:**

**Control Valves,  
Control Output,  
Maximum Output,  
PID Gain Kp,  
PID Gain Ki  
PID Gain Kd,  
Ramp Delay,  
Delta T,  
Delta T Active**

5. Press SELECT key to place the setting in memory and return to the Main Menu screen.

## Test Menu Options

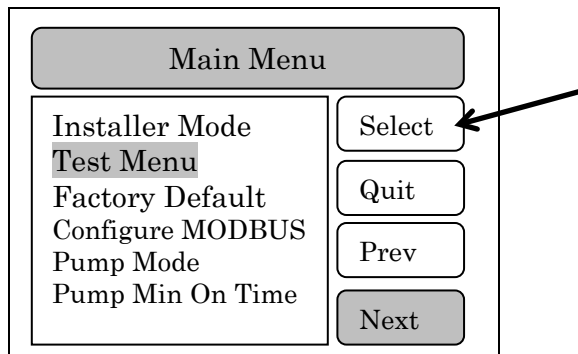
There are two (3) submenu items in the Test Menu option. They are Software Version, Extended Temp, and Output Test. To access any of these three items the user must go to the Test Menu screen first. Extended Temp is a factory setting that is not intended to be changed in the field.

## Software Version

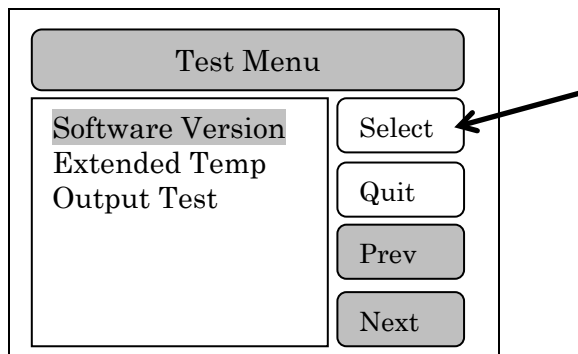
This screen lists the version of the controller. When contacting the factory about the controller be sure to mention the version.

*To view the Software Version:*

1. Press NEXT key three (3) times until Test Menu is displayed on the Main Menu.
2. Highlight Test Menu on the Main Menu screen and press the SELECT button.



3. The Test Menu screen will appear:
4. Highlight Software Version on the Test Menu screen and press the SELECT button.



5. The following screen will appear:

```
>System Information
>CemHeat2 V1.08
>UpTime 54:10:39
```

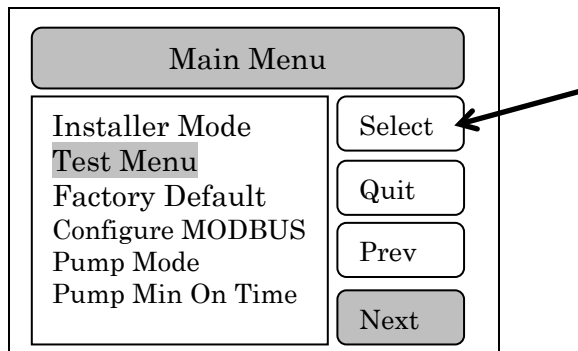
6. After 5 seconds the controller will automatically return to the Main Menu screen.

## Output Test

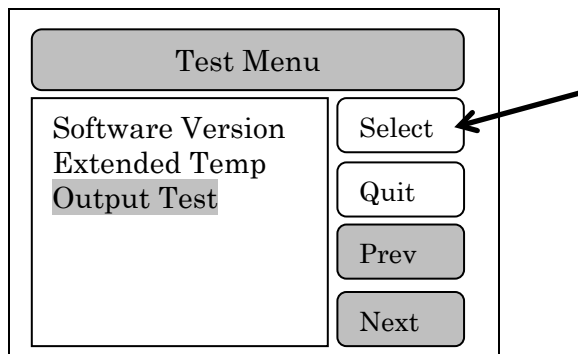
The Output Test is used for factory testing and is not field useable.

*To view the Output Test:*

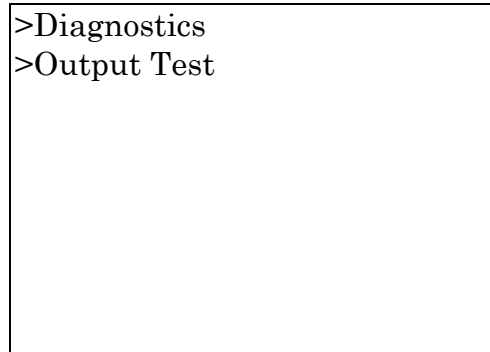
1. Press NEXT key three (3) times until Test Menu is displayed on the Main Menu.
2. Highlight Test Menu on the Main Menu screen and press the SELECT button.



3. The Test Menu screen will appear:
4. Highlight Output Test on the Test Menu screen and press the SELECT button.



5. The following screen will appear:



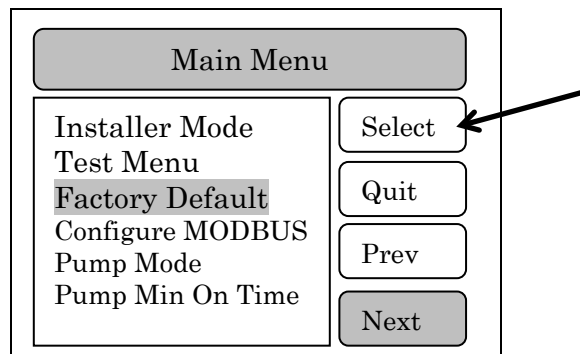
6. After 5 seconds the controller will automatically return to the Main Menu screen.

## Factory Default

The Factory Default is used for factory testing and is not field useable. To go to “home” screen press Alarm Silence.

*To view the Factory Default:*

1. Press NEXT key three (3) times until Factory Default is displayed on the Main Menu.
2. Highlight Factory Default on the Main Menu screen and press the SELECT button.



3. Press SELECT key to place the setting in memory and return to the Main Menu screen.

## Configure MODBUS

The CEM-TROL II is supplied with MODBUS communication via a RS485 connection. Some of the MODBUS communication settings can be configured with in the Cem-trol II. The user can adjust the MAC Address and the Baud Rate. The communication is fixed to 8 Data Bits, No Parity, and 1 Stop Bits.

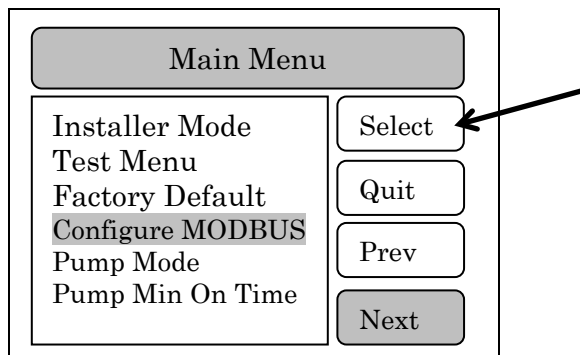
The Unit Number is the MAC Address or Address. This address is a unique identification within the MODBUS network. The address can be configured and the range of the address is 1 to 247. This identification number must be provided by the MODBUS network administrator.

The Baud Rate determines the speed of communication. The Baud Rate is adjustable with options of 9600, 19200, and 38400. The Baud Rate of the Cem-trol II must use the same Baud Rate as the Building Management System (BMS).

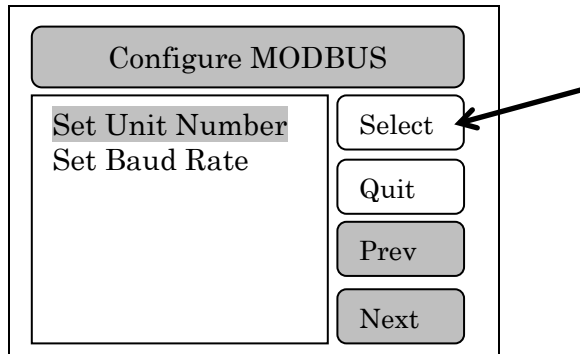
## MODBUS Address

*To Configure MODBUS Address:*

1. Press NEXT key three (3) times until Configure MODBUS is displayed on the Main Menu.
2. Highlight Configure MODBUS on the Main Menu screen and press the SELECT button.

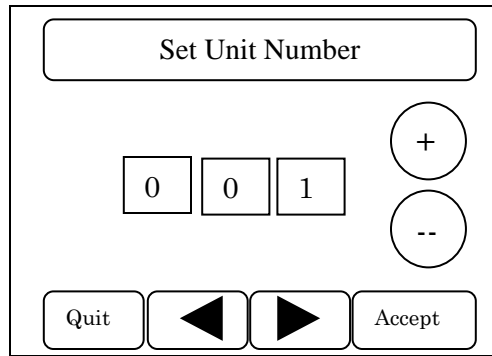


3. The Configure MODBUS screen will appear:
4. Highlight Software Version on the Test Menu screen and press the SELECT button.



5. The following screen will appear:



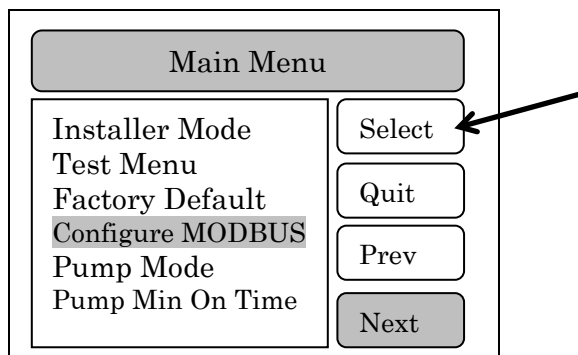


6. Press the + / - keys to scroll through the various address settings until the desired number of address appears on the screen. The address range is 1-247 in 1 unit increments.
7. Press ACCEPT key to place setting in memory and to return to Main Menu.

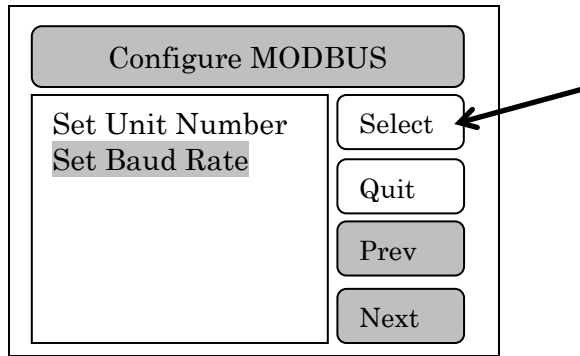
## MODBUS Baud Rate

*To Configure MODBUS Baud Rate:*

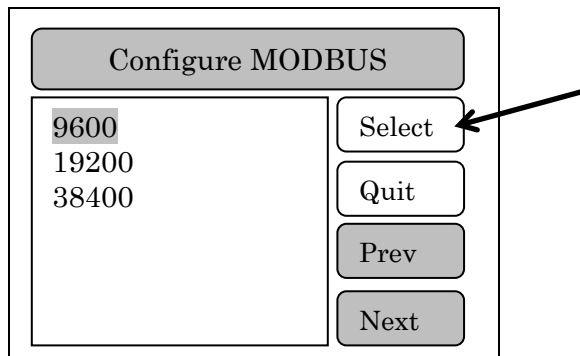
1. Press NEXT key three (3) times until Configure MODBUS is displayed on the Main Menu.
2. Highlight Configure MODBUS on the Main Menu screen and press the SELECT button.



3. The Configure MODBUS screen will appear:
4. Highlight Software Version on the Test Menu screen and press the SELECT button.



5. The following screen will appear:



6. The Baud Rate choices are “9600”, “19200”, or “38400”. The Cem-trol II control and the BMS must use the same Baud Rate.
7. Press SELECT key to place the setting in memory and return to the Main Menu screen.

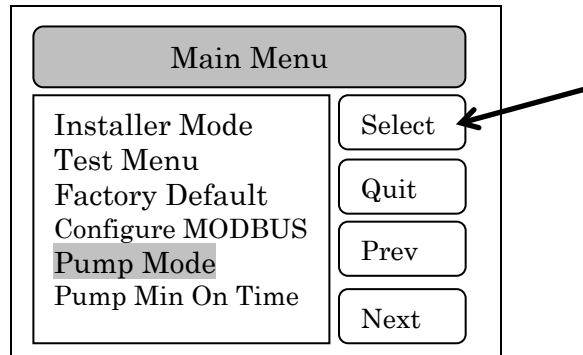
## Setting Pump Mode

The Cem-trol II is supplied with a 24 VAC contact to turn On/Off a Remote Boiler Water Pump. The remote pump is typically used to pump boiler water through the heat exchanger of the water heater. The Cem-trol II offers two remote pump options. The first option is valve based. The controller energizes the 24 VAC terminal block P-4 terminals 3-4 when the control valve is open and de-energizes the 24 VAC when the valve is closed. The control valve is open when the VDC output to the control valve is between 1 – 10 VDC. The second option is temperature based. The controller energizes the 24VAC output for pump until the temperature set point is achieved. The 24 VAC (pump) is de-energized until the temperature drops below the pump differential temperature setting. The 24 VAC output will energize and de-energize over and over again to maintain temperature of the water heater. Settings are available for minimum pump on and off times to prevent pump from short cycling.

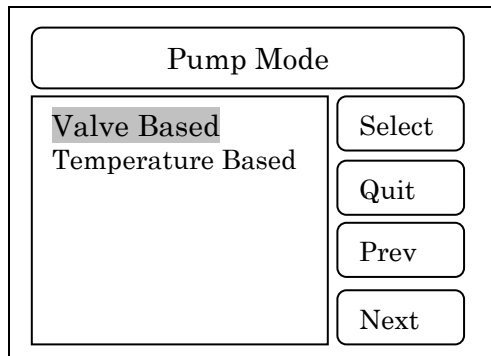
*To set the Pump Mode:*

1. Press NEXT key three (3) times until Pump Mode is displayed on the Main Menu.

2. Highlight Pump Mode on the Main Menu screen and press the SELECT button.



3. The following screen will appear:



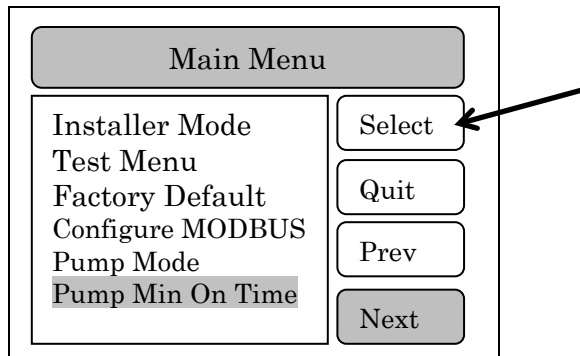
4. Highlight the desired Pump Mode option. The Pump Mode choices are “Valve Based” setting will supply 24 VAC when the control valve is open or the “Temperature Based” setting will activate the 24 VAC until the set point is reached, the 24 VAC be re-energized when the temperature drops below a temperature differential and/or a minimum on/off time.
5. Press ACCEPT key to place the setting in memory and return to the Main Menu screen.

## Pump Minimum On Time

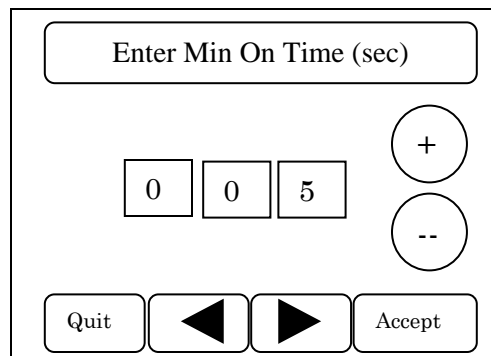
The CEM-TROL II can be set to provide a minimum pump run time to prevent the boiler water pump from short cycling. The 24 VAC contact will remain energized for a minimum amount of time from 5 – 300 seconds.

*To set the Pump Minimum On Time:*

1. Press NEXT key three (3) times until Pump Min On Time is displayed on the Main Menu.
2. Highlight Pump Min On Time on the Main Menu screen and press the SELECT button.



3. The following screen will appear:



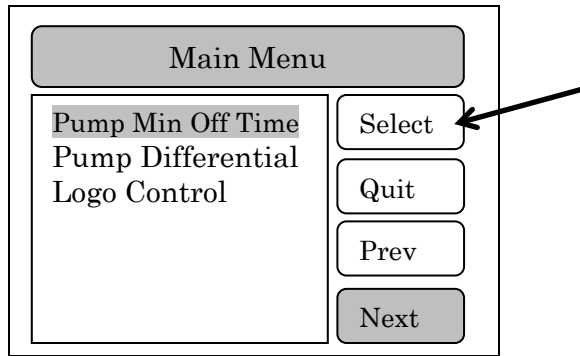
4. Press “+” key to change Pump Min On Time setting in an increasing direction or press “-” key to change the Pump Min On Time setting in a decreasing direction until the desired setting appears on the screen. The range is 5 - 300 seconds.
5. Press ACCEPT key to place the setting in memory and return to the Main Menu screen.

## Pump Minimum Off Time

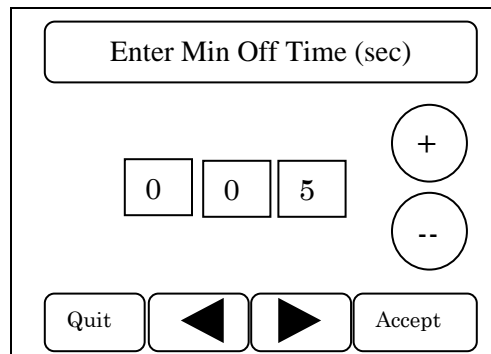
The CEM-TROL II can be set to provide a minimum pump off time to prevent the boiler water pump from short cycling. The 24 VAC contact will remain de-energized for a minimum amount of time from 5 – 300 seconds.

*To set the Pump Minimum Off Time:*

1. Press NEXT key four (4) times until Pump Min Off Time is displayed on the Main Menu.
2. Highlight Pump Min Off Time on the Main Menu screen and press the SELECT button.



3. The following screen will appear:



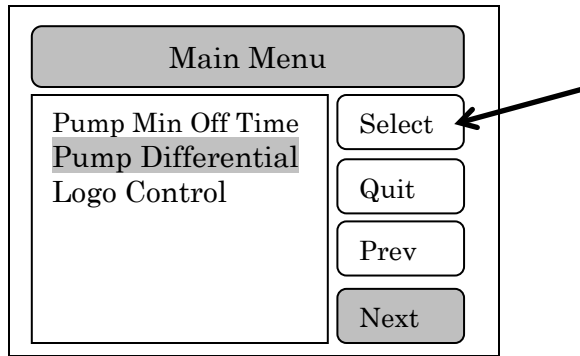
4. Press “+” key to change Pump Min Off Time setting in an increasing direction or press “-” key to change the Pump Min Off Time setting in a decreasing direction until the desired setting appears on the screen. The range is 5-300 seconds.
5. Press ACCEPT key to place the setting in memory and return to the Main Menu screen.

## Pump Differential

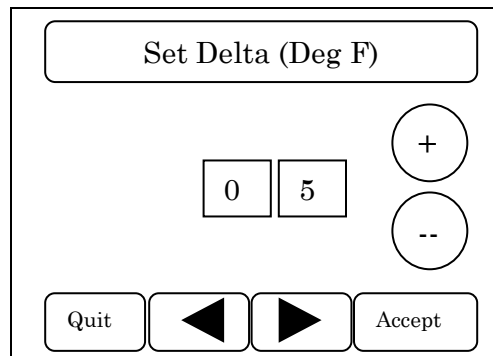
This is the temperature differential from the set point at which the 24 VAC for the remote pump will be energized. Normally it is set at 5 °F but can be set between 1 to 20 °F in 1 °F increments.

*To set the Pump Differential:*

1. Press NEXT key four (4) times until Pump Differential is displayed on the Main Menu.
2. Highlight Pump Differential on the Main Menu Screen and press the SELECT button.



The following screen will appear:



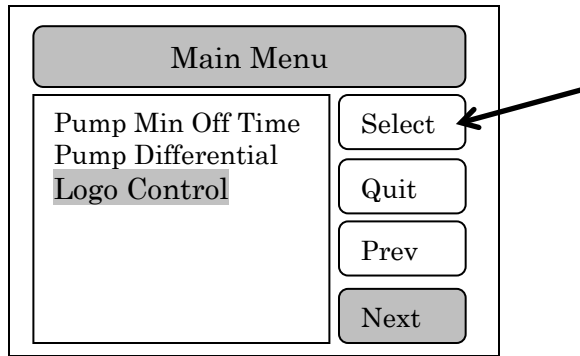
3. Press the + / - key(s) to scroll through the temperature settings until the desired temperature differential is displayed. The range is 1-20 °F in 1 °F increments.
4. Press the ACCEPT key to place setting in memory and return to the Main Menu screen.

## Logo Control

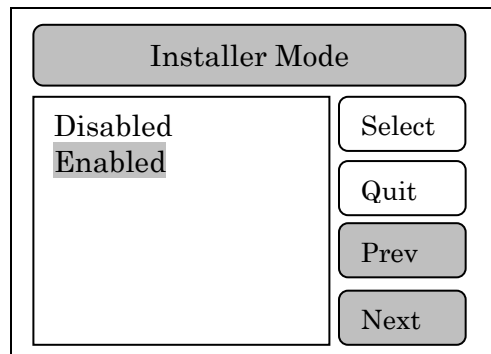
This screen allows the user to turn off the logo on the display when the unit is turned on.

*To set the Logo Control:*

1. Press NEXT key four (4) times until Logo Control is displayed on the Main Menu.
2. Highlight Logo Control on the Main Menu screen and press the SELECT button.



- The following screen will appear:



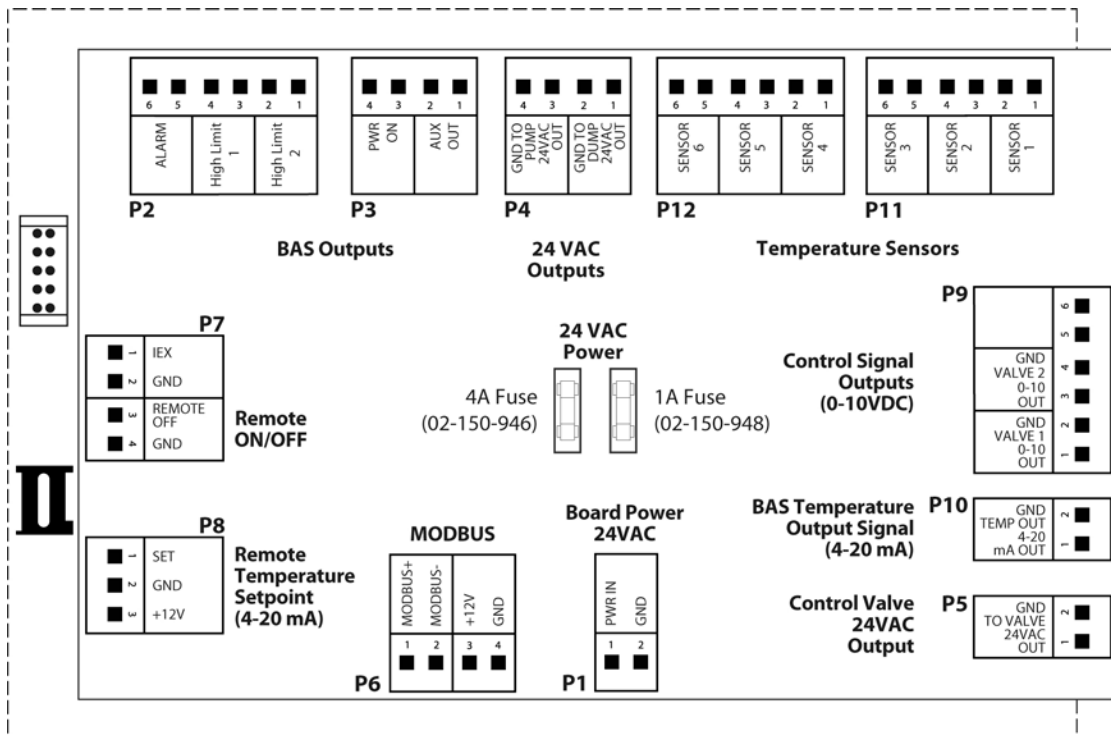
- Press “Next” key to change Logo Control setting in an increasing direction or press “Prev” key to change the Logo Control in a decreasing direction until the desired Logo Control is highlighted on the screen. The “Logo Control” choices are “Disabled” when the CEM-TROL II will not display the Cemline logo on start-up of the controller or “Enabled” when the Cemline Logo will appear on startup of the controller.
- The below screen is the logo that will be displayed on when the CEM-TROL II is turned on.



- Press SELECT key to place the setting in memory and return to the Main Menu screen.

**Note: After 90 seconds in any screen “home” screen will be displayed**

# Terminal Board Layout





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## Building Automation System (BAS) Interface

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The CEM-TROL has built in contacts to interface with the building automation system (BAS).

### Remote On-Off:

Terminal block P-7 is a four pole block. To wire for remote on-off install a switch or relay contacts connecting terminals 3 and 4.

### Built in contacts to notify BAS of functions and alarms:

This control allows for simple and reliable interface with the BAS via dry contact to enable the BAS to monitor the following functions from a remote location:

Power ON
Primary high limit
Secondary high limit
Alarm

Refer to the “Terminal Board Layout” page of this manual for the key to and location of terminal connections to the BAS. Note that all of the function relays supply a normally open (NO) dry contact output. The ratings of the dry contacts are 1 amp at 24 VAC or .5 amp at 120 VAC.

▼ **CAUTION: Do not connect any voltage above 120 volts across the BAS contacts on terminal block.**

Contact closure as follows:

Power ON	COM - NO contact made when power is on to the board.
Primary high limit	COM - NO contact made when primary high limit temperature set point is exceeded.
Secondary high limit	COM - NO contact made when secondary high limit temperature set point is exceeded.
Alarm	COM - NO contact made when any alarm occurs

### Remote Temperature Read-Out (via a 4-20 mA signal):

Terminal block P-10 (terminals 1-2) will output a 4-20 mA signal. This signal will be scaled as 4 mA = 0 °F and 20 mA = 212 °F.

▼ **CAUTION: Terminal block P-10 terminals 1-2 are connected to an isolated chassis ground. This may interfere with the BAS system. BAS engineering should determine if BAS needs isolation for this signal.**

▼ **CAUTION: No AC voltage should be applied to terminals P-10.**

### **Remote Temperature Set Point (via a 4-20 mA signal):**

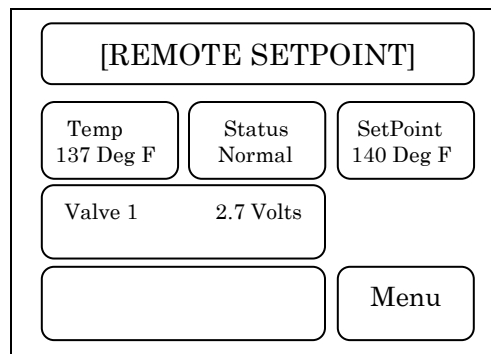
Terminal block P-8 (terminals 1-2) will input a 4-20 mA signal to remotely set the operating temperature of the packaged water heater.

**NOTE: In order to use the remote set point the Remote Control must be enabled see page 17 to read how to enable the remote temperature set point.**

▼ **CAUTION: When using the remote set point DO NOT set the operating temperature above the primary or secondary high limits. This will cause improper operation of the unit, with the potential to cause alarms and dump valves to go off.**

The remote temperature set point of the temperature of the packaged water heater can be set between 32 and 160 °F using a 4 – 20 mA signal whereby 4 mA = 32 °F and 20 mA = 160 °F.

When the remote set point is enabled the main screen will be as shown below. REMOTE SETPOINT will be cycle on the top banner with [System Normal] indicating the remote set point has been enabled.



**NOTE: If no mA signal is applied to the remote set point the EXT temperature will default to 32 °F.**

▼ **CAUTION: Terminal block P-8 is connected to an isolated chassis ground. This may interfere with the BAS system. BAS engineering should determine if BAS needs isolation for this signal.**

▼ **CAUTION: No AC voltage should be applied to terminals P-8.**

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## MODBUS COMMUNICATION

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The Cem-trol II is supplied with MODBUS RTU communication via a RS485 connection. Some of the MODBUS communication settings can be configured within the Cem-trol II. The user can adjust the MAC Address and the Baud Rate. The communication is fixed to 8 Data Bits, No Parity, and 1 Stop Bits.

The Unit Number is the MAC Address or Address. This address is a unique identification within the MODBUS network. The address can be configured and the range of the address is 1 to 247. This identification number must be provided by the MODBUS network administrator. See page 35 of this manual for instructions on configuring the Unit Number.

The Baud Rate determines the speed of communication. The Baud Rate is adjustable with options of 9600, 19200, and 38400. The Baud Rate of the Cem-trol II must use the same Baud Rate as the Building Management System (BMS). See page 35 of this manual for instructions on configuring the Baud Rate.

The MODBUS should be wired using 18 AWG Twisted-Pair cable. The cable length should not exceed 3500 feet. A longer cable length may require a lower Baud Rate. Terminal Block P-6 Contacts 1 through 3 are the MODBUS RTU connections. Contact 1 is positive (+), Contact 2 is negative (-), and Contact 4 is Ground. Please verify that the (+) and (-) polarity is correct. The Ground RS485 terminal P6 contact 3 must be connected to the BMS RS485 Ground.

The Cem-trol II MODBUS Variable List can be found on page 48 of this manual. The conditions that are being supplied are outputs only no inputs. Therefore, in order to remotely set the temperature a 4 – 20 mA signal is required. Please see page 28 of this manual for instructions on remote temperature setting.

## Cem-trol II MODBUS Variable List

(Version 1.16 & above)

Register	Condition	Value
400101	Any Alarm	1 = Alarm / 0 = No Alarm
400102	Alarms	0 = No Alarm
		1 = Any Alarm
		3 = High Limit 1 Alarm
		7 = High Limit 2 Alarm
		17 = Sensor Loss 1
		19 = High Limit 1 + Sensor Loss 1
		23 = High Limit 1 + High Limit 2 + Sensor Loss 1
		39 = Sensor Loss 2; or High Limit 1 + High Limit 2 + Sensor Loss 2;
		55 = Sensor Loss 1 & 2; or High Limit 1 + High Limit 2 + Sensor Loss 1 & 2;
400103	High Limit 1	1 = High Limit 1 Alarm / 0 = No High Limit 1 Alarm
400104	High Limit 2	1 = High Limit 2 Alarm / 0 = No High Limit 2 Alarm
400105	Boiler Water Pump	1 = Boiler Water Pump On / 0 = Boiler Water Pump Off
400106	Sensor Loss 1	1 = Temperature Sensor 1 Loss / 0 = No Temperature Sensor 1 Loss
400107	Sensor Loss 2	1 = Temperature Sensor 2 Loss / 0 = No Temperature Sensor 2 Loss
400108	Power Status / Remotely Disabled	1 = Power On / 3 = Disabled Remotely
400109	Temperature Sensor 1 Value	Value is Temperature 1 Reading (°F)
400110	Temperature Sensor 2 Value	Value is Temperature 2 Reading (°F)
400111	Temperature Sensor 3 Value	Value is Temperature 3 Reading (°F)
400112	Temperature Sensor 4 Value	Value is Temperature 4 Reading (°F)
400113	Temperature Sensor 5 Value	Value is Temperature 5 Reading (°F)
400114	Temperature Sensor 6 Value	Value is Temperature 6 Reading (°F)
400115	Voltage Out to Control Valve 1	Value is Voltage out to Valve 1 (VDC)
400116	Voltage Out to Control Valve 2	Value is Voltage out to Valve 2 (VDC)
400117	Setpoint Value	Value is Setpoint Value (°F)

## Remote Pump 24 VAC Contact

The Cem-trol II is supplied with 24 VAC contact to turn On/Off a Remote Pump. The remote pump is typically used to pump boiler water through the heat exchanger of the water heater. The boiler water pump can be set up into two settings. The first setting energizes the 24 VAC terminal block P-4 terminals 3-4 when the control valve is open. The control valve is open when the VDC output to the control valve is between 1 – 10 VDC. The second setting energizes the 24VAC output for the pump until set point is achieved. The pump will then turn back on after the temperature drops below a temperature differential and/or a minimum On/Off time for the pump has been met. See pages 38 - 42 of this manual for the Remote Pump set up instructions.

Remote Pump On/Off (Valve Based - Standard)	24 VAC output for pump when control valve is open (i.e., between 1 to 10 VDC output to the control valve)
Remote Pump On/Off (Temperature Based - Differential)	24 VAC output for pump until temperature setpoint is achieved. 24 VAC (pump) turns off until the temperature drops below the differential temperature and the 24 VAC (pump) is turned on until the temperature setpoint is attained. Settings are available for minimum pump on and off times to prevent pump from short cycling.

## Testing the Temperature Sensor

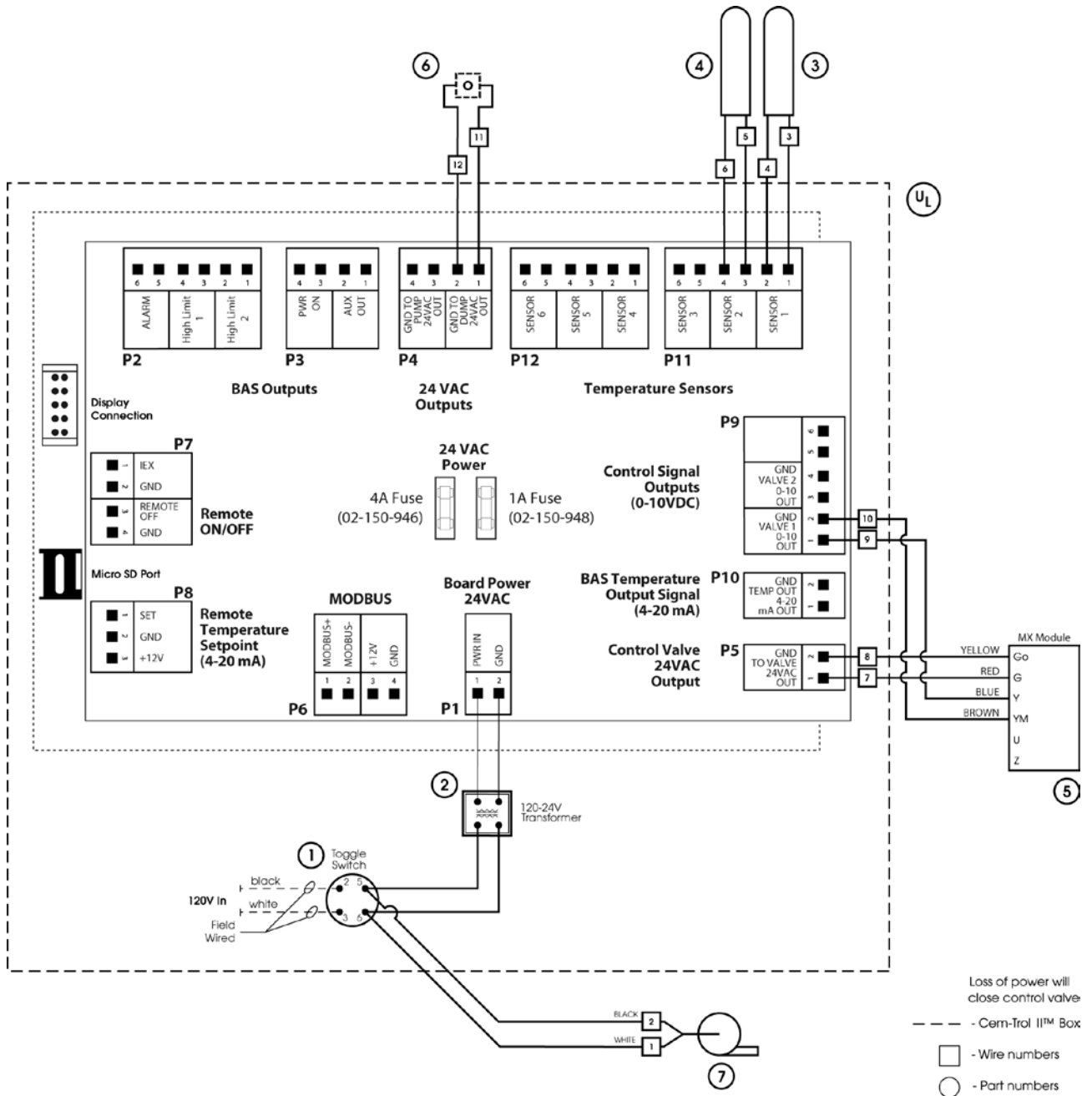
The temperature sensors used are a 1000 ohm Platinum PT 1000 sensing element. To test the temperature sensor:

1. Turn the power off to the unit.
2. Remove the temperature sensor connection  
Plug from the controller.
3. Measure the resistance between terminal block P-2 terminals 1 and 2 for one probe, and terminal block P-2 terminals 3 and 4 for the second probe.
4. Compare the resistance read and the corresponding temperature of the water heater to the chart shown on the right to verify accuracy of the temperature sensor.
5. Replace the temperature sensor connection plug.
6. Turn power back on.

Degree Fahrenheit	Resistance In OHMS
40	1017
50	1039
60	1060
70	1082
80	1104
90	1125
100	1147
110	1168
120	1190
130	1211
140	1232
150	1254
160	1275
170	1296
180	1317

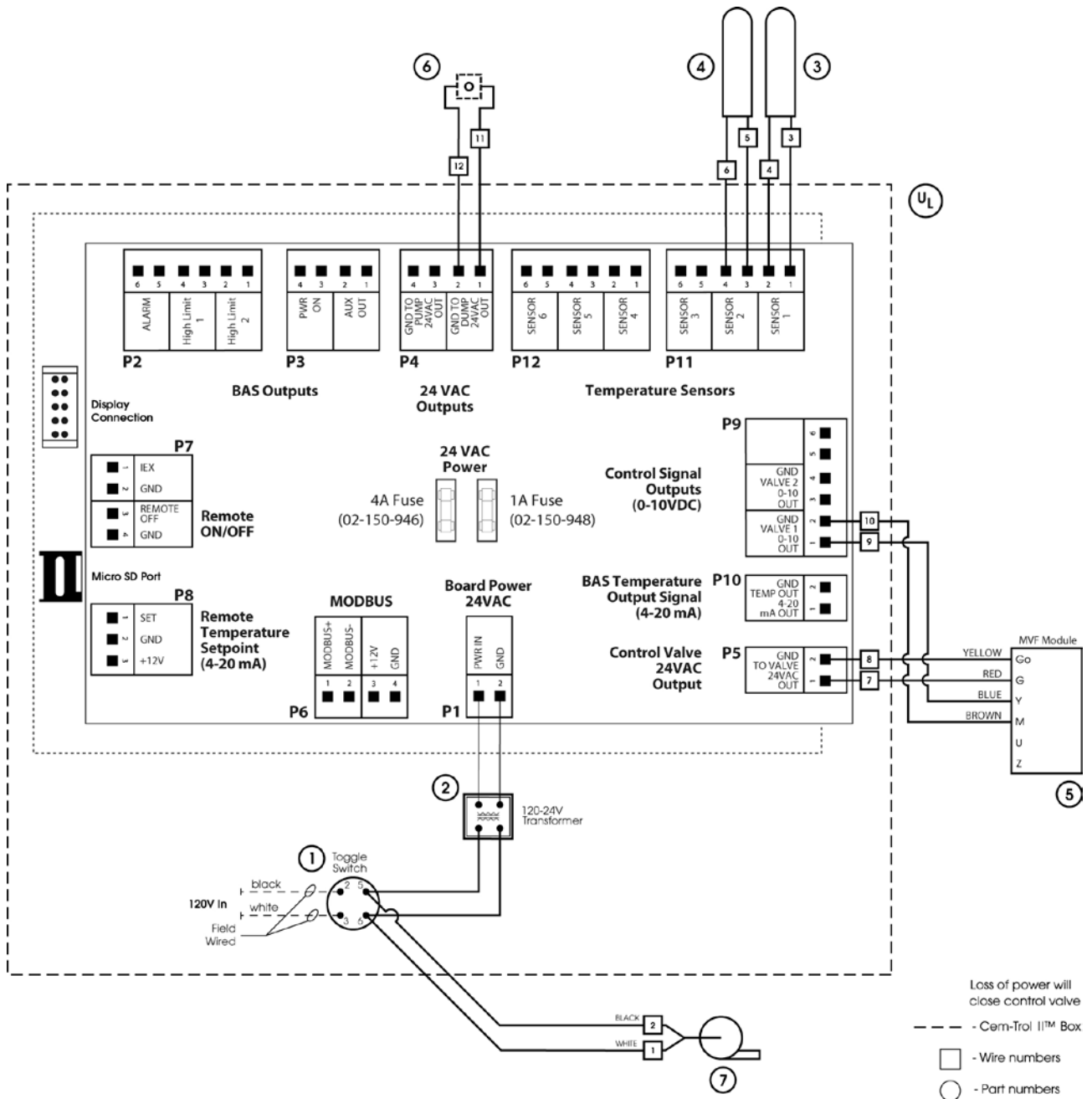
LCD Display	Description
Sensor Loss 1	The primary sensor wired to terminal block P11 - terminals 1 & 2 is not connected and needs to be connected or the sensor is faulty or defective and needs to be replaced.
Sensor Loss 2	The secondary sensor wired to terminal block P11 - terminals 3 & 4 is not connected and needs to be connected or the sensor is faulty or defective and needs to be replaced.

# Wiring Diagram – MXG and MXF Valves



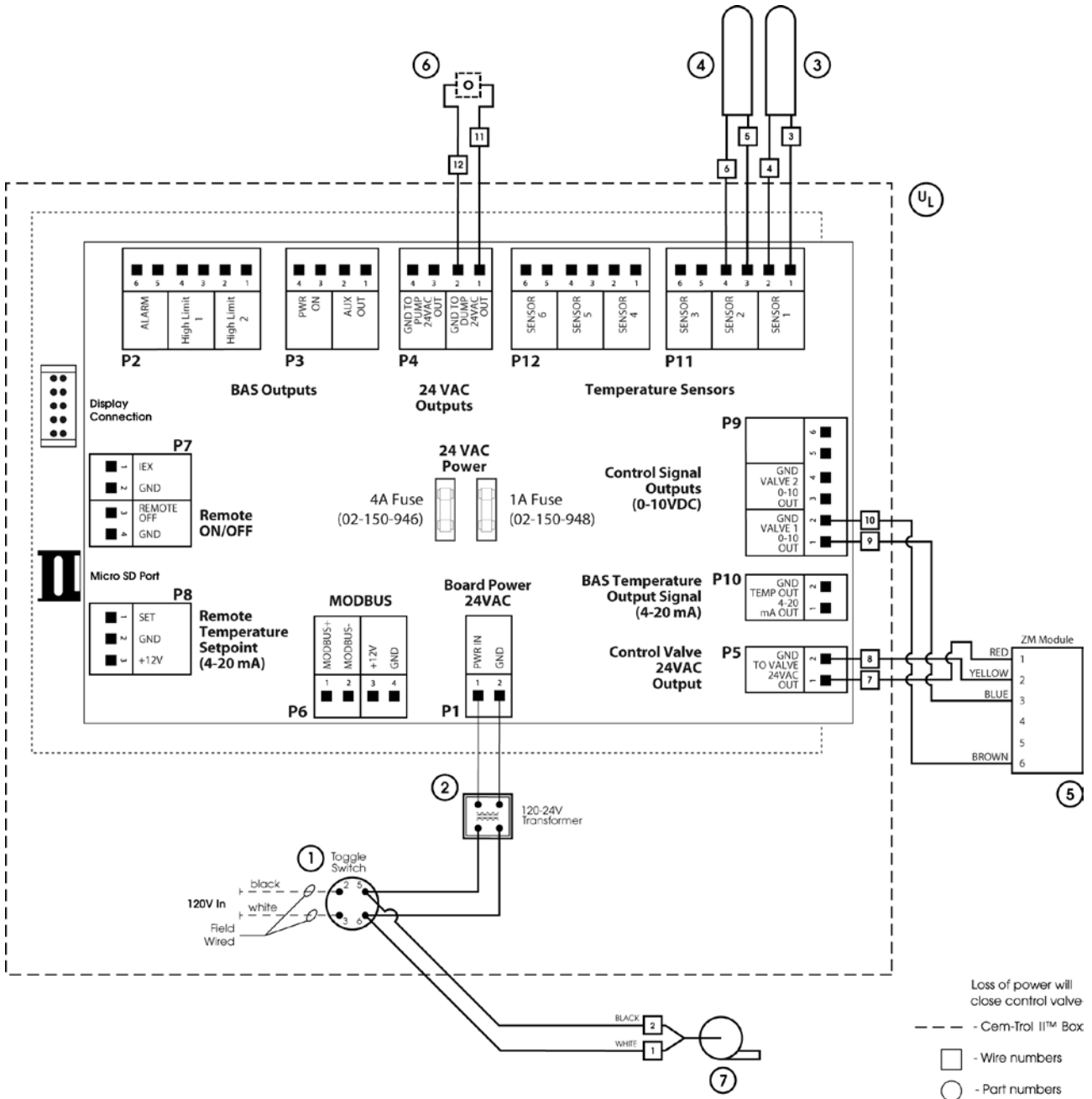
NO.	Description
1	ON/OFF Switch
2	Transformer 120-24V
3	Operating Temperature Sensor
4	High Limit Temperature Sensor
5	Valve Module
6	Optional Dump Water Solenoid Valve (DSS)
7	Intratank Circulator 120V AC

# Wiring Diagram – MVF Valves



NO.	Description
1	ON/OFF Switch
2	Transformer 120-24V
3	Operating Temperature Sensor
4	High Limit Temperature Sensor
5	Valve Module
6	Optional Dump Water Solenoid Valve (DSSS)
7	Intracrank Circulator 120V AC

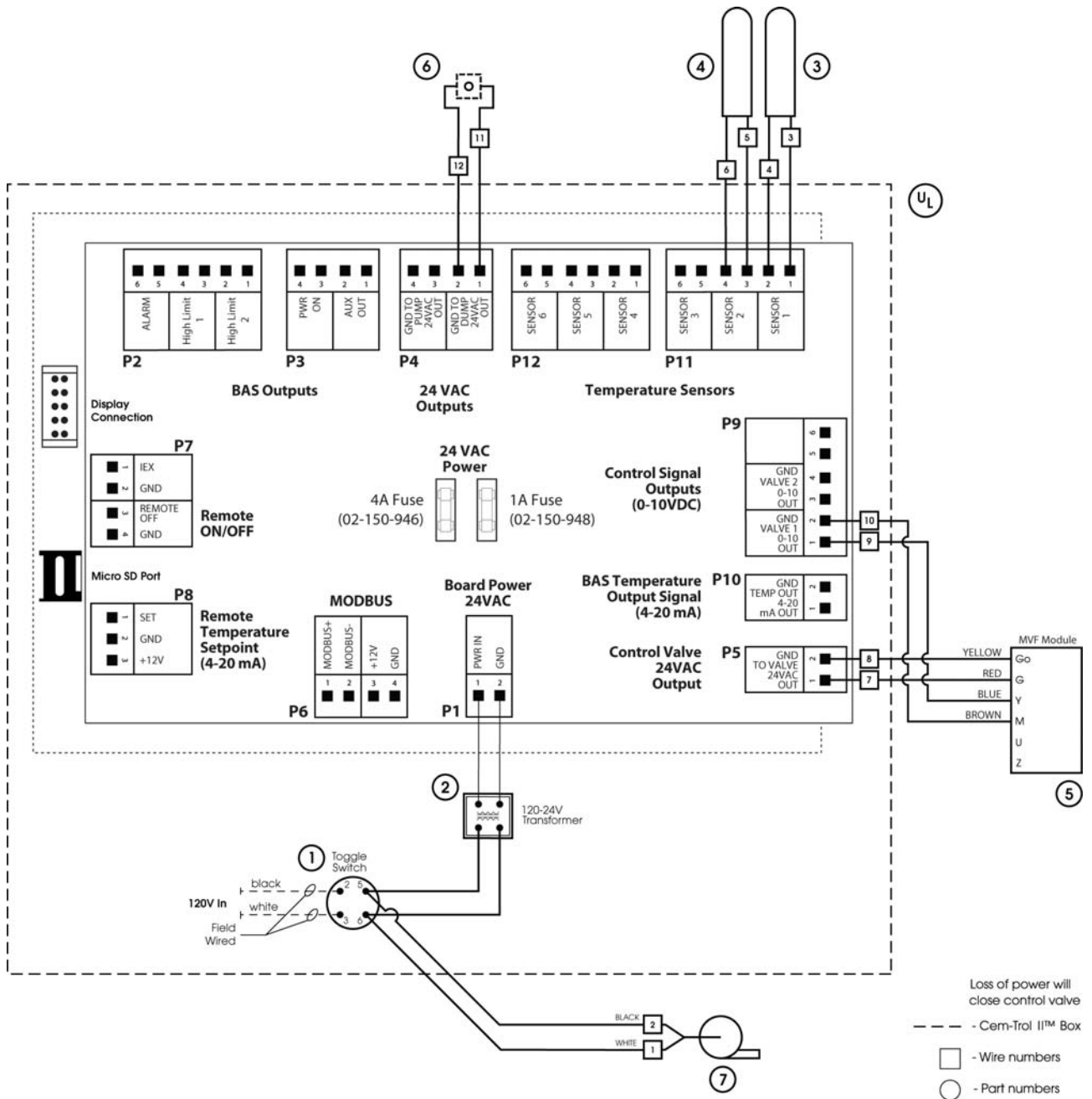
# Wiring Diagram – M2H and M3P Valves



NO.	Description
1	ON/OFF Switch
2	Transformer 120-24V
3	Operating Temperature Sensor
4	High Limit Temperature Sensor
5	Valve Module
6	Optional Dump Water Solenoid Valve (DSSS)
7	Intracrank Circulator 120V AC

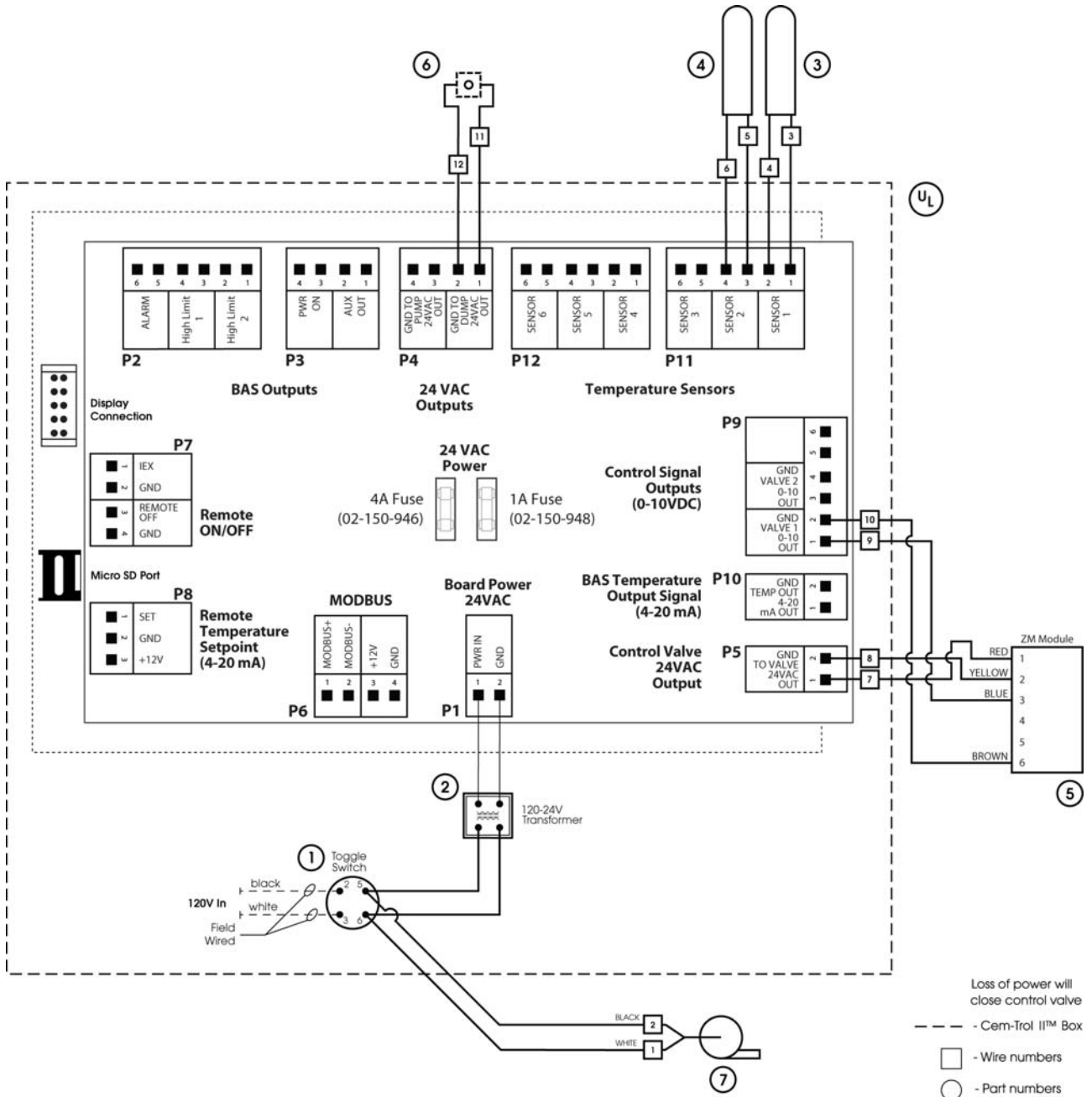


# Wiring Diagram – MVF Valves



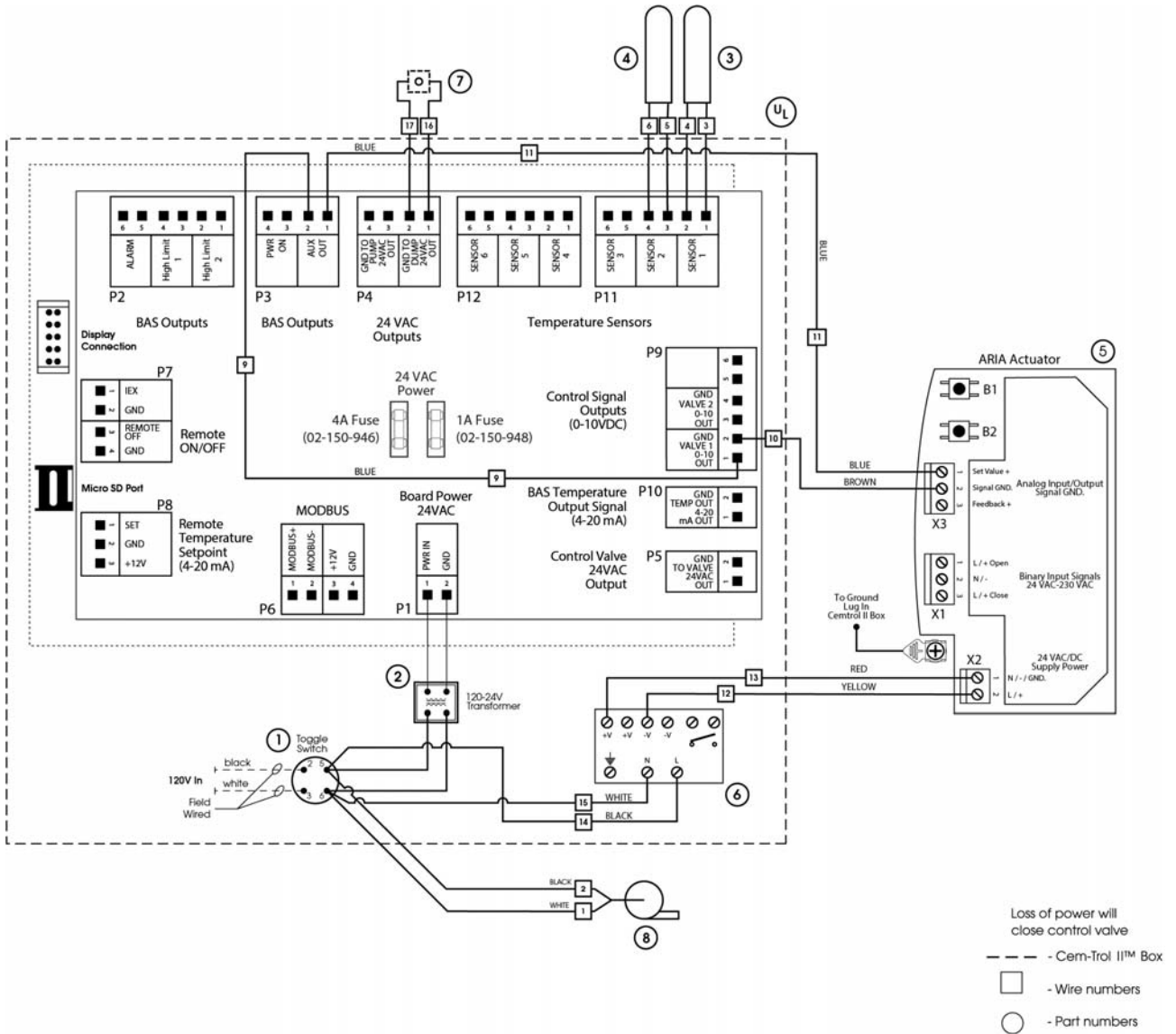
NO.	Description
1	ON/OFF Switch
2	Transformer 120-24V
3	Operating Temperature Sensor
4	High Limit Temperature Sensor
5	Valve Module
6	Optional Dump Water Solenoid Valve (DSSS)
7	Intrastank Circulator 120V AC

# Wiring Diagram – M2H and M3P Valves



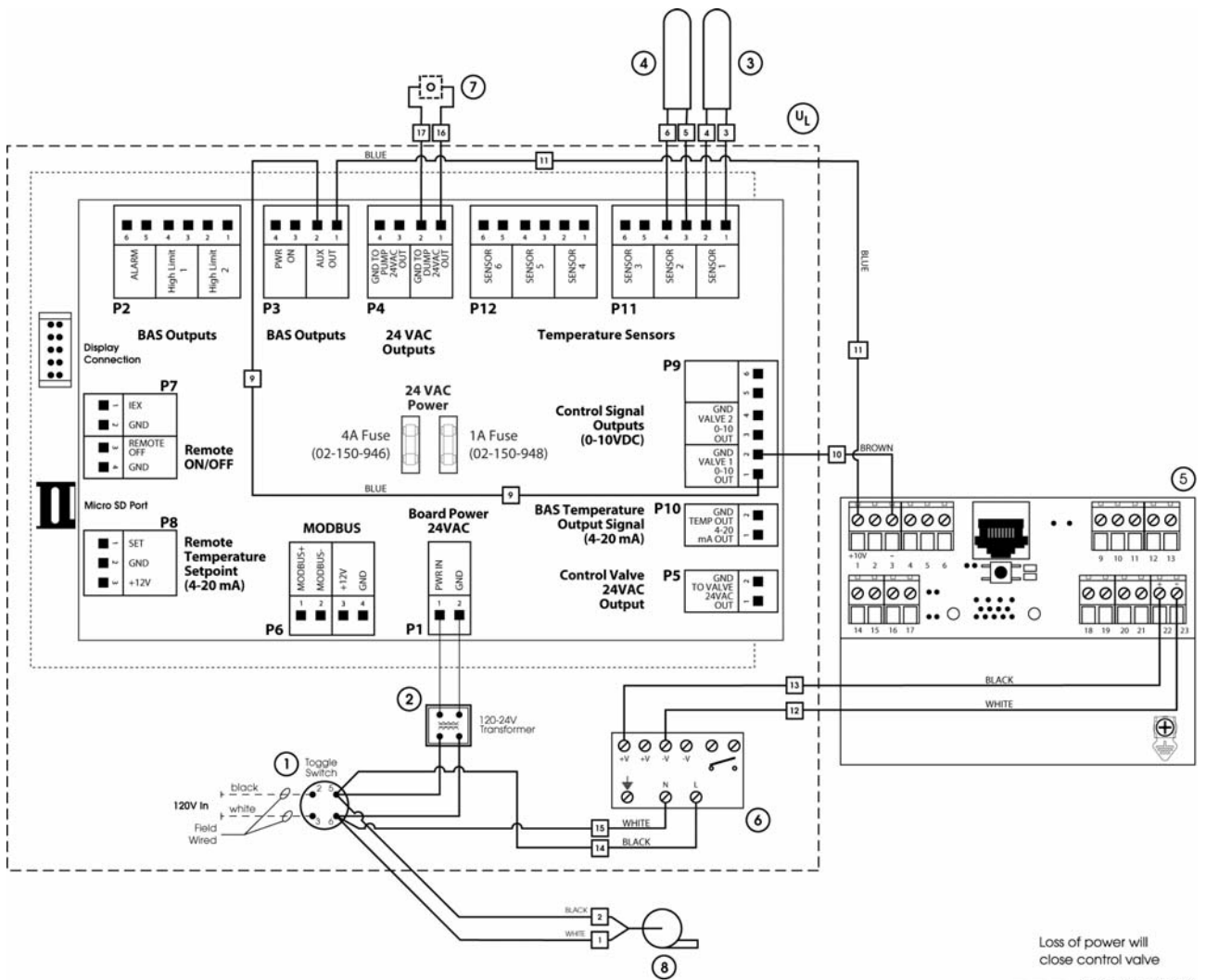
NO.	Description
1	ON/OFF Switch
2	Transformer 120-24V
3	Operating Temperature Sensor
4	High Limit Temperature Sensor
5	Valve Module
6	Optional Dump Water Solenoid Valve (DSSS)
7	Intracrank Circulator 120V AC

# Wiring Diagram – Warren Controls ARIA



NO.	Description
1	ON/OFF Switch
2	Transformer 120-24V
3	Operating Temperature Sensor
4	High Limit Temperature Sensor
5	Valve Module
6	DC Power Supply 120V AC - 24V DC
7	Optional Dump Water Solenoid Valve (DSSS)
8	Intratrunk Circulator 120V AC

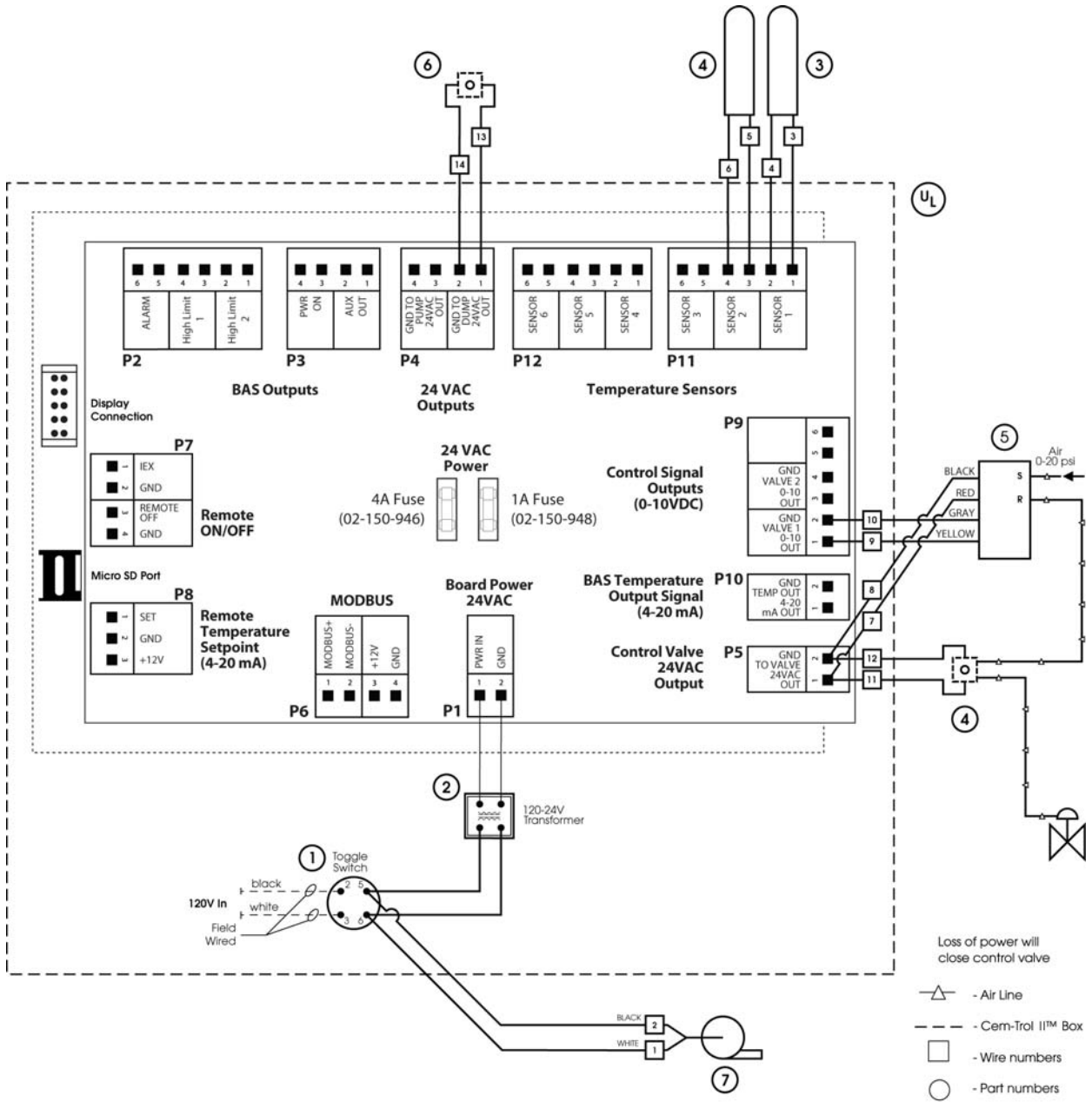
# Wiring Diagram – Warren Controls ILEA / Valve Pro



- Loss of power will close control valve
- - - - Cern-Trol II™ Box
- - Wire numbers
- - Part numbers

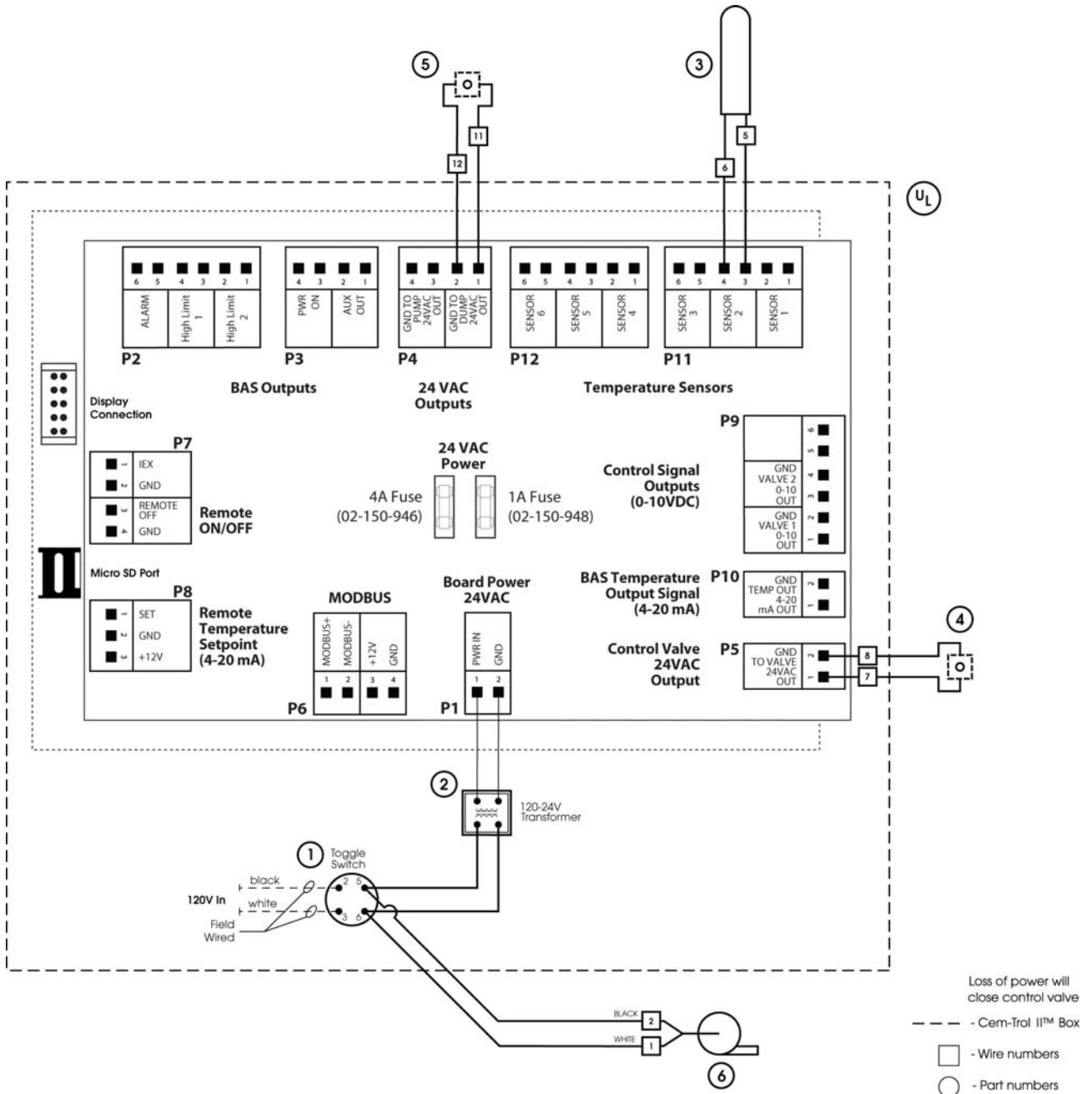
NO.	Description
1	ON/OFF Switch
2	Transformer 120-24V
3	Operating Temperature Sensor
4	High Limit Temperature Sensor
5	Valve Module
6	DC Power Supply 120V AC - 24V DC
7	Optional Dump Water Solenoid Valve (DSSS)
8	Intratank Circulator 120V AC

# Wiring Diagram – Pneumatic Operated Control Valves with I-P Transducer



NO.	Description
1	ON/OFF Switch
2	Transformer 120-24V
3	Operating Temperature Sensor
4	High Limit Temperature Sensor
5	I-P Transducer
6	Optional Dump Water Solenoid Valve (SSSS)
7	Optional Dump Water Solenoid Valve (DSSS)
8	Intratank Circulator 120V AC

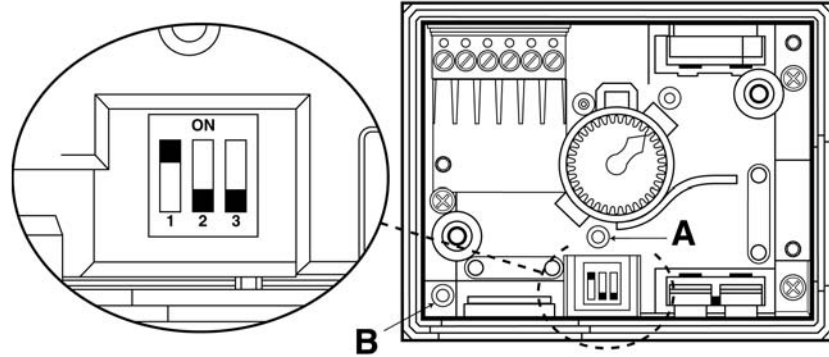
# Wiring Diagram – Self-Contained Temperature Pilot Operated Control Valves



NO.	Description
1	ON/OFF Switch
2	Transformer 120-24V
3	High Limit Temperature Sensor
4	Pilot Steam Solenoid Valve (SSSS)
5	Optional Dump Water Solenoid Valve (DSSS)
6	Intrastank Circulator 120V AC

## MXG and MXF Valve Information

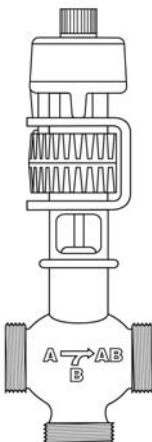
The MXG and MXF valves can be configured for linear and equal percentage operation. Factory setting is equal percentage.



Switch	OFF	ON
1	Characteristic Linear	Equal percentage *
2	Control signal — must be in the OFF position	
3	Volts or mA — must be in the OFF position	

### Valve Calibration

The MXG and MXF valves are factory-calibrated at 0% and 100% stroke. When commissioning the valves, however, (especially under extreme conditions of use) there may still be some leakage via control path A → AB (below, and marked on the valve). In this case, the valve can be recalibrated simply and quickly as follows. Remove the screws from the top of the electrical housing on the control valve and remove the cover. Using a pointed implement (2mm diameter) to operate the button in the opening [A] in the terminal housing. While recalibration is in progress, the LED [B] in the electronics module will flash green for approximately 10 seconds. The valve will be briefly closed and fully opened.



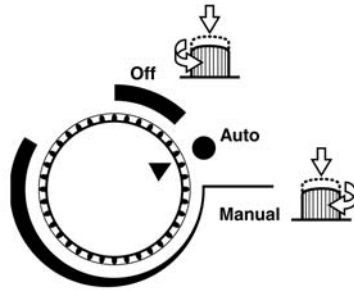
The two-color LED display [B] indicating operating status can be viewed by opening the cover of the electronics module.

<b>LED green</b>	On continuously	Automatic mode: 'Auto' (normal, no faults)
	Flashing	<ul style="list-style-type: none"> <li>– Mechanically set to 'Manual'</li> <li>– Mechanically set to 'Off'</li> <li>– Currently in 'Calibration' mode</li> </ul>
<b>LED red</b>	On continuously	<ul style="list-style-type: none"> <li>– General fault</li> <li>– General calibration error</li> <li>– Micro controller fault</li> </ul>
	Flashing	– Faulty AC 24 V supply (e.g. too low)
	<b>LED</b>	Off

As a general rule, the LED can assume only the states shown above (continuously red or green, flashing red or green, or off).

## Warning

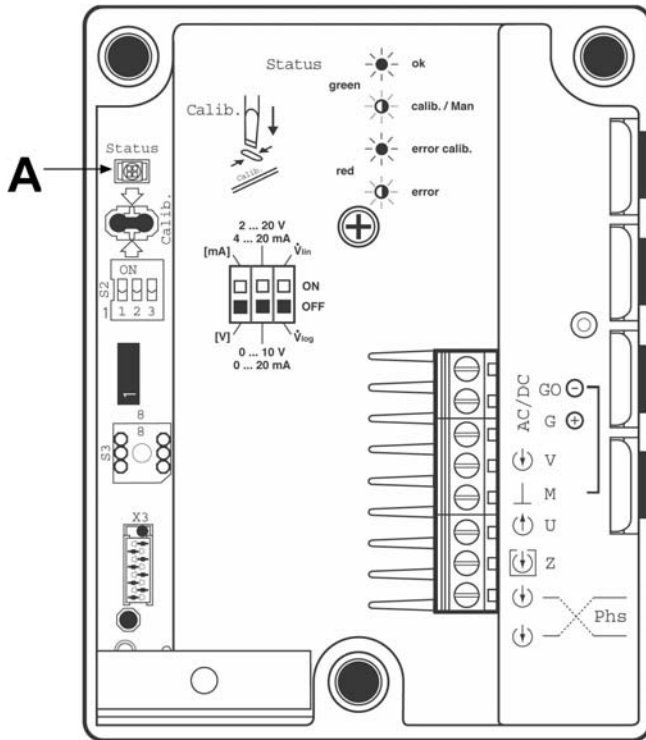
The control valve has a hand wheel knob on the top of the valve (see diagram below). This control knob must be placed into the automatic position (AUTO). The AUTO position allows automatic control of the valve to occur. By placing the hand wheel in the OFF position the valve will not close. **Do not place the wheel in the manual position.** By placing the wheel in the manual position prevents the control program to function correctly and is dangerous to the operation of the unit. **The hand wheel knob must be in the auto position.**





## MVF Valve Information

The MVF valve can be configured for linear and equal percentage operation. Factory setting is equal percentage.

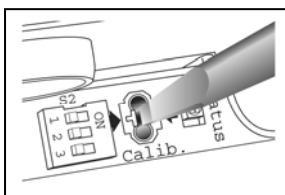


Switch	OFF	ON
1	Volts or mA	— must be in the OFF position
2	Correcting span	— must be in the OFF position
3	Characteristic	Equal percentage * Linear

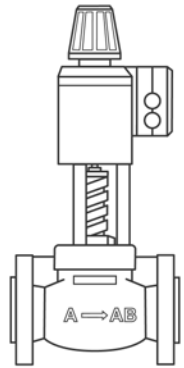
### Valve Calibration

The MVF valves are factory-calibrated at 0% and 100% stroke. When commissioning the valves, however, (especially under extreme conditions of use) there may still be some leakage via control path A → AB and the valve's electronics must be recalibrated. To recalibrate, the hand wheel must be set into the automatic position (AUTO).

Remove the screws from the top of the electrical housing on the control valve and remove the cover. The printed circuit board has a slot for calibration (see diagram below). Calibrate by bridging the contacts located behind the slot on the printed circuit board, using a screwdriver. The valve will then travel across the full stroke to store the end positions. While recalibration is in progress, the LED [A] in the electronics module will flash green for approximately 10 seconds. The valve will be briefly closed and fully opened. The valve will then go to the position which corresponds to the position signal. If the LED continues to flash after 10 seconds there was an error in operation during the calibration process or there is another fault.

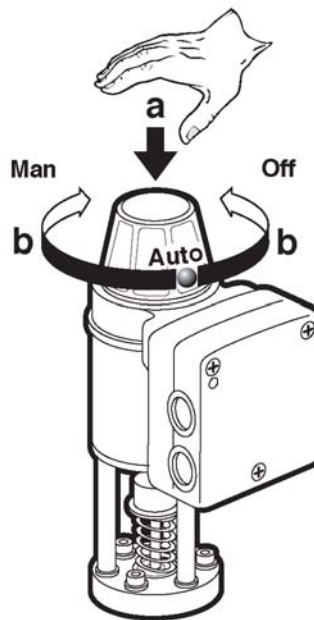


The two-color LED display [A] indicating operating status can be viewed by opening the cover of the electronics module.

 <p style="text-align: center;"><b>MVF</b></p>		<b>Indication</b>	<b>Operating State, Function</b>	<b>Remarks, Troubleshooting</b>
	Green	Lit	Control mode	Normal operation; everything OK.
		Flashing	Calibration In manual control	Wait until calibration is finished (green or red LED will be lit) Hand wheel in Man or Off position
	Red	Lit	Calibration error Internal error	Recalibrate (bridge contacts behind the calibration slot) Replace electronics module
		Flashing	Main fault DC Supply - / +	Check electric main network (outside the frequency or voltage range); VDC supply +/- connection polarity
	Both	Dark	No power supply Electronics faulty	Check electric main network, check wiring Replace electronics module

## Warning

The control valve has a hand wheel knob on the top of the valve (see diagram below). This control knob must be placed into the automatic position (AUTO). The AUTO position allows automatic control of the valve to occur. By placing the hand wheel in the OFF position the valve will not close. **Do not place the wheel in the manual position.** By placing the wheel in the manual position prevents the control program to function correctly and is dangerous to the operation of the unit. **The hand wheel knob must be in the auto position.**



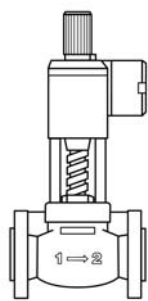
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## M3P and M2H Valve Information

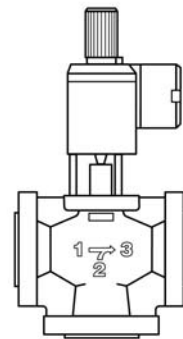
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### Valve Calibration

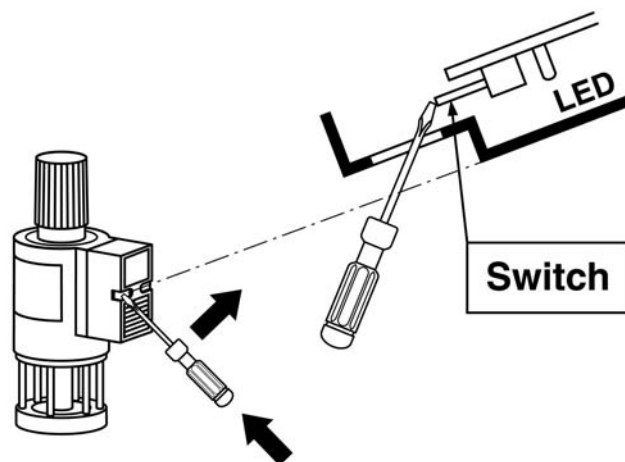
The M3P and M2H valves are factory-calibrated at 0% and 100% stroke. When commissioning the valves, however, (especially under extreme conditions of use) there may still be some leakage via control path 1 → 2 for the M2H and 1 → 3 for the M3P (*see below*, and marked on the valve) with a 0% stroke control signal (DC 0V, DC 4 mA or DC 2 V). In this case, the valve can be recalibrated simply and quickly as follows. Remove the left screw of the electronic module also known as the ZM module. Use a pointed implement (2mm diameter) or a screwdriver No. 0 or 1 to push in the switch in the electronics module (*see below*). While recalibration is in progress, the LED in the electronics module will flash green for approximately 10 seconds. The valve will be briefly closed and fully opened, full stroke is maintained for 1 to 3 seconds and the valve closes again. The valve will then go to the position which corresponds to the position signal. If the LED continues to flash after 10 seconds there was an error in operation during the calibration process or there is another fault.



**M2H**



**M3P**



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## General Valve Information

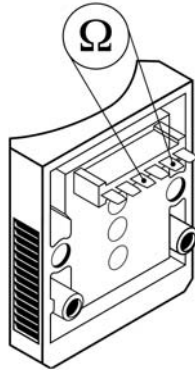
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The valve is factory assembled and does not require repacking or other periodic service.

### Testing

1. Turn the power off to the unit.
2. Remove the control module from the valve by loosening the two mounting screws.
3. Measure the resistance between the two terminals indicated on the drawing on page 62. Also see chart on page 62 for resistance for valve coil. Look on valve for the model number that corresponds with the chart.
4. Check one of above terminals to ground. The resistance should be infinite.
5. Measure the voltage at 24 volt transformer between points 7 and 12 as seen on the wiring diagram from page 7.
6. Reconnect the control module.
7. Reconnect the power to the CEM-TROL.

## Magnetic Coil Resistance Information



1) Magnetic Coil Resistance (Kl. 7+8)

Valve Model	Actuator Coil
	Resistance (Ω)
M2H15F	21
M2H20FY	21
M2H25FY	21
M2H32FY	15.3
M2H40FY	10
M2H50FY	10
M3P80FY	5.187
M3P100FY	3.34

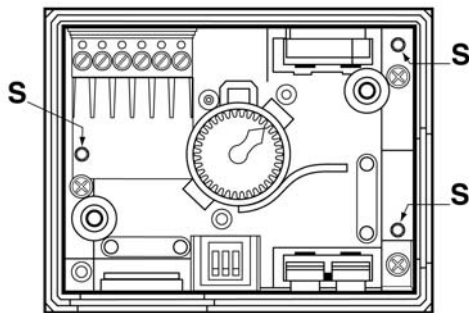


Diagram A

1. Remove the screws from the top of the electrical housing on the control valve and remove the cover.
2. Using a 3 mm Allen wrench remove the 3 Allen head screws (S) which hold the electronic module to the control valve housing (see diagram A).
3. Measure the magnetic coil resistance across the two exposed terminals (see diagram B) and compare the resistance to the chart below.
4. Carefully re-install the electronic control module and cover.

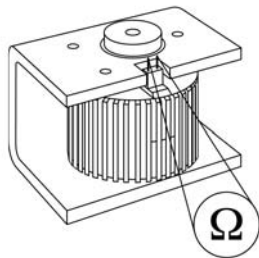


Diagram B

Valve Model	Actuator Coil
	Resistance (Ω)
MXF461.15	9.2
MXF461.65	4.87
MXG461.25	9.2
MXG461.32	9.2
MXG461.40	5.55
MXG461.50	5.55
MXG461.15	9.2

Magnetic Coil Resistance  
(Stem stroke length cannot be measured)

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## **Warren Controls (ARIA & ILEA) / Valve Pro Valve Information**

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- ▼ For Complete information on the Warren Controls ARIA & ILEA Actuators see the Warren Installation, Operation, & Maintenance Manual supplied with the unit. The IOM manual is supplied with the unit, otherwise the manual can be found online at [www.warrencontrols.com](http://www.warrencontrols.com).
- ▼ For complete information on the Valve Pro Valve and Actuator see the Valve Pro Installation, Operation, & Maintenance Manual supplied with the unit. The IOM manual is supplied with the unit, otherwise the manual can be found online at [www.valvepro.biz](http://www.valvepro.biz).



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