

EATON LMR Plus Electric Fire Pump Controllers



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1. INTRODUCTION

1.1 Safety

This technical document is intended to cover most aspects associated with the installation, application, operation, and maintenance of the LMR Plus Fire Pump Controller. It is provided as a guide for authorized and qualified personnel only in the selection and application of the LMR Plus Controller. If further information is required by the purchaser regarding particular installation, application, or maintenance activity, please contact an authorized EATON sales agent or the installing contractor.

1.2 Warranty

No warranties, expressed or implied, including warranties of fitness for a particular purpose of merchantability, or warranties arising from course of dealing or usage of trade, are made regarding the information, recommendations and descriptions contained herein. In no event will EATON be responsible to the purchaser or user in contract, in tort (including negligence), strict liability or otherwise for any special, indirect, incidental or consequential damage or loss whatsoever, including but not limited to damage or loss of use of equipment, plant or power system, cost of capital, loss of power, additional expenses in the use of existing power facilities, or claims against the purchaser of user by its customers resulting from the use of the information and descriptions contained herein.

1.3 Safety Precautions

All safety codes, safety standards, and/or regulations must be strictly observed in the installation, operation, and maintenance of this device.



CAUTION

COMPLETELY READ AND UNDERSTAND THE MATERIAL PRESENTED IN THIS DOCUMENT BEFORE ATTEMPTING INSTALLATION, OPERATION, OR APPLICATION OF THE EQUIPMENT. IN ADDITION, ONLY QUALIFIED PERSONS SHOULD BE PERMITTED TO PERFORM ANY WORK ASSOCIATED WITH THIS EQUIPMENT. ANY WIRING INSTRUCTIONS PRESENTED IN THIS DOCUMENT MUST BE FOLLOWED PRECISELY. FAILURE TO DO SO COULD CAUSE PERMANENT EQUIPMENT DAMAGE.

1.4 Product Overview

The LMR Plus Controller is a comprehensive, multi-function microprocessor based Fire Pump Controller.

Designed to meet the needs of markets worldwide, the LMR Plus controller is certified by the following authorities: Underwrites Laboratories (UL), Underwriters Laboratories of Canada (ULC), Factory Mutual (FM), Canadian Standards Association (CSA), New York Department of Buildings (NYSB) Ce, and meets the requirements for U.S.B. / C.B.C Seismic approvals.

Starting types of the LMR Plus Fire Pump Controller include the following: FD30-Across the Line, FD40-Part Winding, FD50-Primary Resistor, FD60-Autotransformer, FD70-Wye-Delta (Star-Delta) Open Transition, FD80-Wye-Delta (Star-Delta) Closed Transition, FD90-Soft Start, and FDM30-Medium Voltage Across the Line. All products, except the FDM30, can be offered as an Additive (Foam) system and/or with an Automatic Power Transfer Switch.

2. INSTALLATION AND ELECTRICAL CONNECTIONS

2.1 Mounting

Carefully unpack the controller and inspect thoroughly.

The controller should be located as close as is practical to the motor it controls and shall be within sight of the electric motor, preferably ten feet or less.

The LMR Plus controller is designed for either wall or floor mounting. Note that the controller is not free standing and must be mounted with feet or bolted securely to a wall. For dimensional and weight data please refer to the respective data sheets for the various types of Fire Pump Controllers.

2.2 Pressure Switch Connections

NOTICE

WATER LINES TO THE PRESSURE SWITCH MUST BE FREE FROM DIRT AND CONTAMINATION

The LMR Plus is equipped with a pressure sensor. The controller is provided with a 1/2" NPT female system pressure connection located on the bottom, external side of the enclosure. The connection should be installed as per NFPA, pamphlet no. 20.

The actual pressure is displayed on the top left hand side of the LCD display. Precise start and stop pressure set points can be programmed in the controller. Refer to Section 5 for programming instructions.

The maximum operating pressure of the pressure sensor and internal plumbing components is listed on the controller nameplate.

2.3 Electrical Connections

NOTICE

ALL CONDUIT CONNECTIONS TO THE CONTROLLER ARE RECOMMENDED TO BE INSTALLED ON THE BOTTOM OF THE CONTROLLER. REFER TO THE ASSOCIATED DIMENSIONAL DRAWING FOR REFERENCE. DRILLING OR INSTALLING CONDUIT ABOVE THE MICROPROCESSOR BOARDS MAY VOID WARRANTY.

All electrical connections should meet national and local electrical codes and standards.

The controller should be located or so protected that it will not be damaged by water escaping from pumps or pump connections. Current carrying parts of controllers shall be a minimum of 12 inches (305mm) above the floor.

Prior to starting, verify all data on the nameplate such as: catalog number, AC line voltage, horsepower, and frequency.

Inspect all electrical connections, components, and wiring for any visible damage. Correct as necessary. Ensure that all electrical connections are tightened before energizing.

Refer to the wiring schematic affixed to the enclosure door for all wiring information pertaining to the incoming AC power supply and motor wiring.

Install necessary conduit using proper methods and tools.

Incoming AC line voltage is clearly marked L1, L2, L3, and ground, located at the top of the enclosure.

2.3.1 Wire Sizes

For control wiring, use #14 AWG wire for all electrical connections.

For power wiring sizes refer to Appendix K.

2.3.2 Electrical Checkout Instructions

To ensure the pump does not start upon energizing the controller, the interlock circuit is enabled with the installation of a jumper between terminals 39 and 49. Energize the controller to determine the status of the controller. If it is determined that the controller will not start the motor, this jumper can be removed.

The LMR Plus controller is designed to be phase sensitive. L1, L2 & L3 should be connected to A, B & C respectively. Energize the controller by closing the isolation switch (MIS) and circuit breaker (CB). If the phases are connected incorrectly, the 'Phase Reversal' LED on the alarm display will be lit. To correct this condition, refer to Appendix F to correct the phase reversal setting. Re-energize the controller.

With the controller energized, operate the 'Start' pushbutton immediately followed by the 'Stop' button to check the rotation of the motor. If the rotation is incorrect disconnect power and reverse connection of the load terminals of the motor contactor T1, T2 & T3.

Note: On models Primary Resistor (FD40), Wye Delta (Star-Delta) Open (FD70) and Wye Delta (Star-Delta) Closed (FD80) models, the connection must be changed on both contactors.

Adjust the pressure set points detailed in Appendix D.

With the controller isolated and the 'Start Pressure' and 'Stop Pressure' values programmed, energize the controller. If the system water pressure is lower than the start pressure, the pump will start. If the controller is set

up for fully automatic operation, the pump will stop when the pressure is above the stop point and the running period timer (RPT) has completed its timed interval. If the controller is setup for semi-automatic operation (programmed for manual stop mode), the stop pushbutton must be operated to stop the pump. Note that the system pressure must be equal to or greater than the programmed stop pressure value, otherwise the pump will stop only when the pushbutton is pushed.

The circuit breaker setting is factory set and should not be adjusted.

The running period timer (RPT) must be set for a minimum of ten (10) minutes. Refer to Appendix E for programming of the RPT.

If the sequential start timer (SST) is required refer to Appendix E. If not required set the SST to disabled. If required, the lead pump SST should be set to disabled and the lag SST to five (5) to ten (10) seconds. If there are more than two pumps in the system, allow a ten (10) second delay between pumps.

The acceleration timer (AT) is used for reduced voltage controllers only. The AT is factory set based on the starting method of the controller. If it is found that more time is required to allow the pump to come up to speed, the timer may be adjusted to suit. Refer to Appendix E for programming of the AT.

If the Undervoltage/Overvoltage alarms are present, check the programmed values by referring to Appendix F. If the values are programmed to their maximum and the alarms continue to occur, check the main voltage supply to ensure that the power available is dependable as per NFPA, Pamphlet 20 standards.

3. HARDWARE DESCRIPTION

3.1 General

The purpose of this section is to familiarize the reader with the LMR Plus Controller hardware, its nomenclature, and to list the unit's specifications.

3.2 Front Operator Panel

The front operator panel, depending on the installation, is normally accessible from the outside of the door. The front panel provides a means to:

- Alert the user to specific conditions
- Program the controller
- Set and monitor the operating parameters

The LMR Plus Controller front panel serves two primary functions: output and input. The output function consists of:

- A four-line, 40 character LCD display module
- Twenty LED outputs: Power On, Pump Running, Local Start, Remote Start, Deluge Valve, Emergency Start, Interlock On, Low Pressure, Phase Reversal,

Phase Failure, Fail to Start, Undervoltage, Overvoltage, Low Room Temperature, Locked Rotor Trip, Low Suction Pressure, Auto Shutdown Enabled, Source 2 Disconnected and two (2) user defined LEDs.

There are nine input functions accessible via the pushbuttons:

- Silence Alarm
- Motor Test
- Data | Print
- Lamp Test
- Reset | Save/Exit
- Up
- Down
- Ack. Alarm
- Menu

A four-line, 40-character alphanumeric LCD Display module is used to display all LMR Plus monitored parameters, set points, and messages in easy to read formats. The display has a green high contrast background that allows clear visibility of any information displayed. The display is continuously lit for clear visibility under poorly lit or no light conditions.

Seven different displays can be presented via the LCD display:

- Status Display
- Set Points Display
- Statistics Display
- Diagnostics Display
- Configuration Menu
- Data/Print Menu
- Message History Display

The "Home" screen display will show the voltages and currents on all three phases, system frequency, system pressure, and the current date and time. The fourth line of the display will also indicate the time remaining on any active timers, alarms without an associated LED, and custom messages.

3.2.1 The LEDs

- **Power On** - This green LED will be illuminated when there is power present in the controller and the microprocessor board is powered up.
- **Pump Running** - This green LED will be illuminated once the amperage draw in the controller exceeds 20% of the programmed motor full load amps.
- **Local Start** - This green LED will be illuminated when the pump is running after the start pushbutton on the flange has been depressed.
- **Remote Start** - This green LED will be illuminated when the pump is running after receiving a start signal on the remote start input.
- **Deluge Valve** - This green LED will be illuminated when the pump is running after receiving a start signal from special starting equipment. This is a

normally closed contact that is required to be opened to start.

- **Emergency Start** - This green LED will be illuminated when the pump is running after the emergency start handle has been depressed and the micro-switch has been activated.
- **Interlock On** - This green LED will flash when the interlock input is received, signaling that another controller or device has locked out the controller.
- **Low Pressure** - This green LED will flash when the system pressure has dropped below the programmed low-pressure set point. If the pump is running due to a low-pressure condition, this LED will be fully illuminated.
- **Auto Shutdown Enabled** - This Green LED will be illuminated when the Auto Shutdown function is enabled.
- **Phase Reversal** - This red LED will be illuminated when the controller senses that the input voltage lines are reversed and there is a risk of operating the pump in the reverse direction.
- **Phase Failure** - This red LED will be illuminated when at least one of the three phases coming into the controller is missing or the voltage is abnormally low.
- **Fail To Start** - This red LED will be illuminated if the amperage draw has not reached 20% of the motor full load amps after the programmed fail to start timer has timed out.
- **Undervoltage** - This red LED will illuminate when the system voltage is below the programmed undervoltage alarm.
- **Overvoltage** - This red LED will illuminate when the system voltage is above the programmed overvoltage alarm.
- **Low Room Temperature** - This red LED will illuminate when the low room temperature signal has been received. A thermostat can be supplied as option R4.
- **Locked Rotor Trip** - This red LED will illuminate when the controller has tripped in a locked rotor condition.
- **Low Suction Pressure/Low Foam Level** - This red LED will illuminate when the low suction pressure signal has been received. A low suction pressure switch can be added to the controller as option P7.
- **Source 2 Disconnected** - This red LED will illuminate if the main disconnect switch on a transfer switch controller is turned off while the controller is energized.

3.2.2 Pushbuttons

■ **Silence Alarm** - When an alarm condition exists, the alarm buzzer will sound. If the Silence Alarm button is pressed, the alarm buzzer will turn off. If a subsequent alarm condition occurs after the silence button is pressed, the buzzer will re-sound. Pressing the Silence Alarm button again, will silence the buzzer.

■ **Motor Test** - Pressing the 'Motor Test' button will simulate an automatic start on the controller due to a low pressure condition.

If the Drain Valve menu item is enabled, the controller will energize the drain valve and wait for the panel to be started. If, after one minute, the system does not detect a sufficient pressure drop to start the controller, the drain valve will de-energize and the panel will alarm. The LCD Display will indicate Motor Test Failure.

If the drain valve is disabled, the system will simulate a pressure drop and start immediately.

All automatic features of the controller such as Run Period Timer and Automatic Shutdown will operate as normal when the Motor Test button is pressed and a low pressure condition is detected.

■ **Data | Print** - The data, print button allows the user to enter a multi-task menu where they can initiate the download of the message history, system diagnostics, system statistics, configuration file to an external USB drive, upload custom messages, and an additional language. If the optional printer (X1) is included with the controller, the user will be able to initiate a print cycle through this menu list.

■ **Lamp Test** - The lamp test button allows the user to test all of the LED's on the operator panel. Pressing and holding this button will illuminate each LED on the operator panel in successive steps.

■ **Reset | Save/Exit** - The reset/save/exit button serves two functions. Pressing the reset button will reset any alarms that are present on the controller at that time. If the alarm condition still exists it will alarm again. When the user is in the programming mode, pressing the save/exit button will save all of the user adjusted values and make the recent changes active.

■ **↑** - The up arrow is used to navigate the main display as well as the menu systems.

■ **↓** - The down arrow is used to navigate the main display as well as the menu systems.

■ **↵ | Ack.** - The enter and acknowledge button serves two functions. When navigating the main display, the enter button will allow the user to enter/exit the message history, statistics, and diagnostics. When in the menu system, the enter button will

allow the user to change the programmed set points, and navigate to the next menu item.

■ **Menu** - Pressing the menu will allow the user access to the programming mode of the controller. When in the programming mode, the menu button will serve as a back button to return to the previous menu heading.

3.3 Display Board Access Area

The display board is housed in a protective case that is mounted on the inside of the controller door. Access to communication ports and terminals is possible when the controller door is open.

Note: To allow for uniform identification, the frame of reference when discussing the access area is with the panel door open and the user facing the back of the LMR Plus controller.

The USB port and I/O board power cable are located on the bottom of the chassis. Optional RS232 and RS485 ports are available.

The display contrast adjustments can be made via the open potentiometer dial in the back of the chassis.

3.4 Power I/O Board

The Power I/O board is used for all connections pertaining to the operation of the controller. From the remote inputs, starting conditions, and the alarm relay outputs.

Refer to the schematic diagram mounted on the inside of the controller door for all connection points specific to the controller.

3.5 Main Isolating Switch/Circuit Interrupter

The main isolating switch (MIS) is intended for isolating an electric circuit from its source of power. It has no interrupting rating and must be externally operable.

The circuit interrupter (CB) is used to disconnect a running pump motor, if necessary. The CB also provides short circuit protection for the controller and the pump motor and operates in conjunction with the Locked Rotor Protector (LRP). In case of a short circuit the CB will trip instantaneously. In the case of seizure of the pump or motor while starting or running the LRP will trip the CB, via a shunt trip, within twenty (20) seconds, as per NFPA 20 standards.

When necessary, a current limiter attachment may be mounted on the bottom of the CB to increase the interrupting capacity.

If one or more of the current limiter fuses blows, the cause must be repaired immediately and new current limiters installed when repairs are complete.

The isolating switch and circuit interrupter are interlocked so that the enclosure door cannot be opened with the handle in the On position, except by qualified electrical personnel. This is accomplished by the use of

a defeater screw located on the side of the operator handle.

Note: The isolation switch is not required on Limited Service controllers. A circuit breaker with a thermal magnetic trip setting between 150 and 250 percent will be used.

3.6 Contactor(s)

The contactor(s) (M, in full voltage and soft start controllers; 1M and 2M, in part winding; M and A, in primary resistor; R, S and Y, in autotransformer; 1M, 2M, 1S and 2S, in wye-delta) connect the pump motor to the supply, under control of the pressure switch, start pushbutton, or emergency handle.

The contactor coil(s) are connected to the supply voltage of the controller. If a replacement coil is ever required, the correct voltage must be ordered.

3.7 External Pushbuttons

Start

The start pushbutton is used to initiate a local manual start of the pump motor.

Stop

The stop pushbutton will initiate the stopping sequence of the fire pump motor. Pressing the stop button will put the controller back into the automatic mode. If a starting condition exists, the pump motor will start again once the stop button is released.

4. OPERATION

4.1 General

This section specifically describes the operation and functional use of the LMR Plus controller. The practical use of and operation within each category will be discussed. In this section, it is assumed that prior sections of this manual were reviewed and that the operator has a basic understanding of the hardware.

4.2 Automatic Start / Stop

The LMR Plus controller will automatically start and stop the fire pump motor as dictated by the features supplied and their programmed set-point values. A summary of the controller intelligence and supervisory circuits that constantly monitor the condition of the system pressure, inputs, and system alarm points is provided.

4.2.1 Manual Start Sequence

Manual start is defined as a local start, remote start, or emergency start. Whenever the motor is running via a manual start, the motor needs to be manually stopped via the stop pushbutton located on the enclosure flange.

4.2.2 Automatic Start Sequence

Automatic start is defined as a low-pressure condition, deluge valve start or a pump start. Whenever the motor is running via an automatic start, the motor can

automatically stop once all starting conditions have returned to normal and the RPT has finished its timing cycle. If the controller is programmed for manual stop, the motor needs to be manually stopped via the local stop pushbutton located on the enclosure flange.

4.3 Control Inputs

The LMR Plus has six (6) pre-defined input control signals and nine (9) programmable inputs.



SEVERE DAMAGE COULD BE CAUSED TO THE MICROPROCESSOR BOARDS IF A VOLTAGE IS APPLIED TO THESE INPUTS. THEY ARE INTERNALLY POWERED.

4.3.1 Control Input Descriptions

The Control Input state definitions are as follows.

Connected - When the input is shorted by an external contact or connection.

Disconnected - When the input is NOT shorted by an external contact or connection.

The Control Input operations are defined as follows.

Note: Terminal 49 is common to all of the inputs outlined below.

Remote Start (Terminal 34)

When this input is in the "Connected" state, the LMR Plus controller will initiate a manual start sequence. This input is typically wired to a remote pushbutton to allow for remote manual starting of the controller.

Deluge Valve (Terminal 35)

When this input is in the "Disconnected" state, the LMR Plus controller will initiate an automatic start sequence. This input is typically wired to remote water control equipment that starts the controller before the pressure transducer does. As this input requires a normally closed contact to open to initiate the start, a jumper is factory installed. The jumper must be removed in order to utilize this optional input.

Pump Start (Terminal 36)

When this input is in the "Connected" state, the LMR Plus controller will initiate an automatic start sequence. This input is typically wired to a separate pressure switch when the use of a pressure transducer is not desired.

Note: When the controller is programmed for foam operation, the pump start input be a normally closed input that will open to initiate a start.

Low Suction/Low Foam Level (Terminal 37)

When this input is in the "Connected" state, the LMR Plus controller will signal a visual indication on the main display board for Low Suction. If the controller is

programmed for Low Suction Shutdown it will initiate the shutdown sequence. Refer to Section 5 to program Low Suction Shutdown. When the controller is setup for a foam system, all references to Low Suction Shutdown will be changed to Low Foam Level.

Low Room Temperature (Terminal 38)

When this input is in the "Connected" state, the LMR Plus controller will signal a visual indication on the main display board for Low Room Temperature. The Common Alarm relay will also de-energize for remote monitoring of this alarm.

Interlock On (Terminal 39)

When this input is in the "Connected" state, the LMR Plus controller will not permit a start of the motor except for Emergency Start. This input is typically used in backup style systems. For example, the Engine Running contacts from the backup Diesel Engine Controller are wired into this input. When the Diesel Engine is running, it will lock out the LMR Plus panel and prevent it from starting.

Inputs (Terminals 40 to 48)

These are programmable inputs and will function based on how they are programmed. Refer to Appendix G(a) for programming details.

4.4 Output Relays

The primary control outputs of the LMR Plus controller are dry relay contacts. These relays are comprised of two separate "Form C" outputs for Phase Failure, Phase Reversal, Common Alarm, Pump Run, and Future #1. The alarm relays are UL/CSA rated at 8A 250Vac / 30Vdc.

Each relay has a green LED on the I/O board to indicate the relay status. If the LED is "On" the relay is energized and "Off" the relay is de-energized.

4.4.1 Relay Functions

Startup

This is the Motor Start relay. It will energize the Run contactor(s), which initiate the motor start.

Acceleration

This relay is used on reduced voltage starting controllers only. It will energize after the programmed acceleration time delay. It will then switch the motor over to full voltage.

Phase Failure

This relay is used for remote monitoring of a phase failure alarm condition. In order to ensure dependable operation of this relay it is energized under normal conditions and will de-energize during alarm. This relay can also be used to signal the loss of main power in the fire pump controller.

Phase Reversal

This relay is used for remote monitoring of a phase reversal condition. The phase reversal alarm is factory set in an ABC configuration.

Common Alarm

This relay is used to signal any alarm that the LMR Plus controller is alarming on. This relay is energized under normal conditions and will de-energize during alarm.

Pump Run

This relay is used for remote monitoring when the pump is running. When the amperage draw sensed by the LMR Plus controller exceeds 20% of the motor full load amps, the relay will energize.

Future #1

This relay can be programmed for a number of alarm or status conditions. Refer to Appendix G(b) for programming details.

5. PROGRAMMING

5.1 Introduction

The LMR Plus controller is fully programmable from the device's faceplate. Users can program set points as well as other parameters. The time, date, and set points can only be changed from the menu system.

The menu system is broken down to eight (8) menu groupings. They include, Language, Regional Settings, Pressure Settings, Timer Values, Alarm Set-points, Custom Input/Output, System Configuration Menu, and Main Menu Password.

5.2 Navigation

In order to enter the menu system, press the Menu button on the LMR Plus faceplate. If the main menu password has been enabled, the user will be required to enter the password at this time.

Once in the menu system, the Up and Down arrow keys will provide navigation between each menu item. The display will show the previous, current, and next menu items. The current menu item is located on the middle of the four line display.

All LMR Plus controller programmable features and associated set-point possibilities are presented in Table 1.

The following set points are programmable in the LMR Plus controller.

Table 1 Programmable Features and Set points

Description	Factory Default	Range
Main Program - (Appendix A)		
Language (Appendix B)	English	English/French/Spanish
Regional Settings - Appendix C		
Change Date	Current Date	Unlimited
Change Time	Current Time (MST)	24 Hours
Pressure Settings - Appendix D		
Pressure Sensor	Enabled	Enabled/Disabled
Drain Valve	Enabled	Enabled/Disabled
Pressure Start Point	100 PSI	0-500 PSI
Pressure Stop Point	110 PSI	0-500 PSI
Low Pressure Alarm Point	105 PSI	0-500 PSI
High Pressure Alarm Point	300 PSI	0-500PSI
Auto Shutdown	Automatic	Enabled/Disabled
Proof Pressure Switch	Disabled	Enabled/Disabled (Foam Only)
Low Suction Shutdown (Foam Level)	Disabled	Disabled/Enabled
Pressure Deviation	10 PSI	1-50 PSI
Hourly Pressure Recording	Disabled	Enabled/Disabled
Timer Values - Appendix E		
Run Period Timer	10 Minutes	0-45 Minutes
RPT Start Mode	Pump Run	Pump Run/Pressure Stop Point
Acceleration Timer	2 Seconds	0-10 Seconds
Weekly Test Timer	Disabled	7 Days/24 Hours (0-60 Minutes)
Fail To Start	20 Seconds	0-60 Seconds
Fail To Stop	3 Seconds	0-60 Seconds
Sequential Start Timer	Disabled	Disabled / 1-300 Seconds
Alarm Set Points - Appendix F		
Phase Rotation	ABC	ABC/CBA
Phase Failure Setup	80%	+20-80%
Overvoltage	+10%	+5-30% / Disabled
Undervoltage	-10%	-5-30% / Disabled
Over Frequency	+5%	+3-10% / Disabled
Under Frequency	-5%	-3-10% / Disabled
Audible Common Alarm	Disabled	Enabled/Disabled
Custom Input/Output - Appendix G		
Custom Inputs #1-9	Undefined	Refer to Appendix G(a)
Custom Outputs #1-9	Undefined	Refer to Appendix G(b)
Custom Lights #1-2	Undefined	Refer to Appendix G(c)
Main Menu Password (Appendix H)	Disabled	Enabled/Disabled - Any number of four (4) button combinations from keypad

Following is a description of each programmable set point.

Please Enter Password - If the password is enabled, the user will be prompted to enter the password at this time. If there are no buttons pressed for five (5) seconds, the controller will switch back to the automatic mode.

Language - Three (3) languages are offered as standard. They are English, French, or Spanish. A fourth language can be added utilizing the USB port. Consult Eaton for available languages. Refer to Appendix B for programming.

Regional Settings - Refer to Appendix C. Following are the descriptions of each menu item:

- **Change Date** - Factory set, however, this parameter allows the user to set the current date.
- **Change Time** - Factory set to Mountain Standard Time (MST). This menu item allows the user to adjust the time to the local time. The clock is of the 24-hour type.

Pressure Settings - Refer to Appendix D. Following are the descriptions of each menu item:

- **Pressure Sensor** - Some applications do not require a pressure sensor to sense the system pressure in order to start the pump motor when required. In order to accomplish this, the pressure sensor can be disabled through this menu item. Once disabled, the pressure start point, pressure stop point, low pressure alarm, and high pressure alarm set-points will be removed from the menu system. Refer to 4.3 for the Pump Start input to use instead of the pressure sensor.
- **Pressure Start Point** - The value programmed determines at which pressure the controller will initiate a start sequence.
- **Pressure Stop Point** - The value programmed determines the pressure the system must reach before the controller will automatically stop the fire pump motor, via the running period timer. If the system pressure does not exceed the programmed Pressure Stop Point, the fire pump motor will continue to run. (Auto shutdown only)
- **Low Pressure Alarm** - A low pressure alarm point can be selected that will be recorded in the controller's history.
- **High Pressure Alarm** - A high pressure alarm point can be selected that will be recorded in the controller's history.
- **Auto Shutdown** - The auto shutdown mode is user selectable. If the auto shutdown mode is disabled, the pump motor must be stopped via the local stop pushbutton, whether or not the motor started via an automatic start. If the auto shutdown mode is enabled, the controller will stop the pump motor automatically after all starting causes have been returned to normal and the running period timer has timed out.
- **Proof Pressure Switch** - An external pressure switch will activate input # 1, terminal 40. This menu item will only be active when the controller is programmed for a Foam Pump Controller.
- **Low Suction Shutdown/Foam Level** - The controller can be programmed to shutdown when a low suction condition is present. If this is desired, the user will select Enabled. There will also be a shutdown delay timer built in (Range: 0-30 Seconds, Default: 10 Seconds) along with the selection of either a Manual or Automatic reset. If Manual Reset is selected, the Ack./Alarm button on the faceplate must be activated to reset the alarm. If an Automatic Reset (default reset mode) is selected, a delay timer (Range: 0-30 Seconds, Default: 10 Seconds) must be set. The controller will then verify if the input is still active, every time the timer times out. If the input is still active the timer will reset and count down

again. Once the input has been removed, the timer will start timing. Once the timer has finished timing, out the controller will return to the automatic run mode. When the shutdown delay timer is timing, the time left on the timer will be displayed on the fourth line of the display. When the controller is shutdown on Low Suction, the display will read Low Suction Shutdown. The display will also show the automatic reset time delay when timing. Low Suction Shutdown will not work on Local Starts, Remote Starts, or Emergency Starts.



ATTENTION

NFPA 20, SECTION 2-9.9, SPECIFICALLY PROHIBITS THE INSTALLATION OF ANY DEVICE IN THE SUCTION PIPING THAT WILL RESTRICT STARTING OR STOPPING OF THE FIRE PUMP. EATON CORPORATION ASSUMES NO LIABILITY WHEN THIS FUNCTION IS USED.

- **Pressure Deviation** - A pressure setting may be selected, such that any change in pressure greater than this setting, will record the pressure fluctuation in the alarm memory.
- **Hourly Pressure Recording** - The controller can be set so that it will take a pressure reading every hour on the hour. If this feature is not required it can be turned off by selecting Disabled.

Timer Values - Refer to Figure #6. Following are the descriptions of each menu item:

- **Run Period Timer (RPT)** - The run period timer is used to automatically stop the controller after a programmed time. It can be programmed to operate based on either of two separate conditions, the stop pressure point or when the pump has started to run. If the RPT is programmed to start at the Stop Pressure, the timer will start timing once the system pressure has reached the programmed Stop Pressure Point. If the RPT is programmed to start timing once the pump is running then the timer will start timing once the pump has reached a running condition. If Automatic Shutdown is enabled, the RPT will not be active. It will not start on Remote, Local, and Emergency Starts. While it is timing the amount of time left on the timer will be displayed on the fourth line of the display.
- **RPT Start Mode** - The point at which the run period timer starts timing is programmable. If it is programmed to start timing after the pump has started, the RPT will start timing once 20% of the motor FLA has been reached. If it is programmed to start timing once the Stop Pressure Point has been reached, the RPT will start timing when the system pressure has risen above the programmed Pressure Stop Point.

- **Acceleration Timer (AT)** - The acceleration timer can be programmed to allow the controller to run in a reduced voltage state for a period of time. This timer will start timing once a start signal has been received and the startup relay has energized.
- **Weekly Test Timer** - A Weekly Timer can be programmed that will automatically start and run the fire pump motor. The Weekly Timer is set by adjusting the day, hour, and minute of the desired weekly run time, the length of time that this test shall be performed, and a Test Interval (TI) (Range 1-52 Weeks) that will run the test every TI weeks. While the weekly test timer is timing, the remaining time will be displayed on the fourth line of the display.
- **Fail To Start Timer (FTS)** - The controller will verify that the motor has reached an amperage rating greater than 20% of the programmed motor full load amps when the pump is running. If the amperage has not reached 20% of the motor FLA after the Fail To Start timer has timed out the Fail to Start alarm will be generated.
- **Fail To Stop Timer** - The controller will verify that the amperage draw from the motor has dropped below 20% of the programmed motor full load amps when there is a call to stop. If the amperage has not dropped below 20% of the motor FLA, after the Fail To Stop timer has timed out, the Fail to Stop alarm will be generated.
- **Sequential Start Timer (SST)** - The SST can be set to delay the starting of the pump when a low-pressure condition exists. If, during the timing of the sequential timer, the pressure rises above the pressure start point, the timer will stop timing and the starting sequence will discontinue. When the SST is timing, the time left will be displayed on the fourth line of the display. The SST will not work on Remote starts, Local starts and Emergency starts.

Alarm Set Points - Following are the descriptions for each menu item:

- **Phase Rotation** - The user will be able to change the Phase Rotation that the program will base the Phase Reversal alarm on.
- **Overvoltage (OV)** - An Overvoltage setting is built into the controller. If the system voltage is above this percentage setting, an alarm will be activated. There is a one (1) second delay before alarming on Overvoltage. Once the condition no longer exists, the alarm will automatically clear.
- **Undervoltage (UV)** - An Undervoltage setting is built into the controller. If the system voltage is below this percentage setting, an alarm will be activated. There is a one (1) second delay before alarming on Undervoltage. Once the condition no longer exists, the alarm will automatically clear.

- **Over Frequency (OF)** - An Over Frequency setting is built into the controller. If the system frequency is above this percentage setting, an alarm will be activated. Once the condition no longer exists the alarm will automatically clear. There is a three (3) second delay before alarming on Over Frequency.
- **Under Frequency (UF)** - An Under Frequency setting is built into the controller. If the system frequency is below this percentage setting, an alarm will be activated. Once the condition no longer exists the alarm will automatically clear. There is a three (3) second delay before alarming on Under Frequency.

Custom Input/Output - Refer to Appendix G. Following are the descriptions of each menu item:

Custom Inputs - The optional inputs have the ability to be programmed for predetermined values or custom values. The Custom Input Menu will display each input, what it is programmed for and if there are any associated optional relays and / or lights linked to the input. Refer to Table 2 Generic Custom Input Labels for the generic values the optional inputs can be programmed for. When this input is received a message will be stored in memory using the programmed label.

Table 2 Generic Custom Input Labels

Input
Custom Input #1
Relief Valve Discharge
Low Oil Pressure
Proof Pressure Switch
Emergency Switch Open
Jockey Pump Run
Secondary Pump Run
Low Reservoir
High Reservoir
Pump Room Door Open
Supervisory Power Fail
Generator Disconnected

- **Label** - If the input label is set to Custom Input, this menu item will become active and allow the user to enter the desired input name in. The label will be limited to 20 characters in length and will include all standard ASCII characters.
- **Energize Common Alarm** - If required, the common alarm relay (3CR) can be programmed to change states when this input is received. Default value is Disabled.
- **Link to Relay** - All inputs can be linked to an output relay. If the relay has been linked to another input or is programmed for another alarm, the program will show that the output is programmed for another alarm and ask if the relay should be reassigned. Default value is Disabled.

- **Link to Light** - All inputs can be linked to one of the future LED's. If the LED is already linked to another input or is programmed for another alarm, the program will show that the LED is programmed for another alarm and ask if the LED should be reassigned. Default value is Disabled.
- **Latched Until Reset** - The alarm signal can be programmed to latch in an on state until the ACK/ALARM or RESET buttons are pressed. In this case if there are any associated relays or LED's linked to the input, they will stay active until the ACK/ALARM or RESET buttons are pressed. Default value is No.
- **Normal Input State** - All inputs can be programmed as normally open or normally closed. Default value is Open.
- **Timer** - A timer can be programmed to delay the time before the alarm becomes active. Default value is 0 seconds. Range is 0-500 seconds. The timer will reset if the input is removed before the time has timed out.

Custom Outputs - The optional output relays, as well as the Future #1, relay can be programmed to operate based on generic values. The Custom Output Menu will display each output, what it is programmed for and if there are any associated future inputs and / or lights linked to the output. Please refer to Table 3 for the generic values the optional outputs can be programmed for. Following is a description of the menu items in the Custom Outputs menu.

Table 3 Generic Outputs

Alarm
Low Pressure
High Pressure
Overvoltage
Undervoltage
Low Suction
Interlock On
Fail To Start
Pump Running
Motor Overload
Weekly Test Timing
Call to Start
Over Frequency
Under Frequency
Local Start
Remote Start
Deluge Start
Emergency Start
Low Pressure Start
Pump Start
RPT Timing
Sequential Start Timing
Transducer Failure
Backup Battery Low
Low Room Temp

Alarm
Load Shed
Fail to Stop

- **Load Shed** - When an output is programmed for Load Shed and there is any call to start, except remote start, local start and emergency start, the program will scan the Transfer Switch Emergency Input, terminal 58. If this input is active, the program will energize the assigned output relay and delay the start of the motor until after an adjustable timer period has elapsed. The Load Shed Timer will become active once the Load Shed function is enabled. If the emergency input is not active, the pump will start normally. The load shed relay will return to its normal state once the timer has finished timing.
- **Load Shed Timer** - This timer will delay the starting of the motor for a programmed set time as outlined in the previous item. While timing, the remaining time will be displayed on the fourth line of the display.
- **Latched Until Reset** - Output relays can be set as latching relays. Pressing the ACK/ALARM or RESET buttons will unlatch them. Default value is No.
- **Fail Safe** - Output relays can be programmed to energize under normal conditions (fail safe) or de-energize under normal conditions. Default value is No.
- **Timer** - Each output relay can be programmed as a time delay relay. Either as an On delay or as an Off delay. If it is set for On Delay (default) the relay will delay for the programmed time prior to activating the relay. If it is set for Off Delay the relay will activate the relay instantly and then de-activate it after the programmed time.

Custom Lights - The two (2) optional LED's can be programmed for alarms that do not have an associated LED or one of the custom inputs. In this section of the program, the LED's can be programmed for one of the values listed in Table 4. As a default the LED's will be programmed for Undefined.

Table 4 Custom Lights

Alarm
High Pressure
Motor Overload
Weekly Test Timing
Over Frequency
Under Frequency
RPT Timing
Sequential Start Timing
Transducer Failure
Pump Start
Battery Backup Low
Fail to Stop

6. HISTORY, DIAGNOSTICS AND STATISTICS

The LMR Plus controller will record a number of items in its memory to assist with troubleshooting of the system and/or the fire pump controller.

These include system history, system statistics, and controller diagnostics.

6.1 System History

The LMR Plus controller will record up to 10,000 alarm/status messages in its memory that can be viewed on the main display, saved to a USB storage device, or viewed on the optional embedded webpage.

In order to view the messages on the display press the up or down arrow buttons from the main screen until the display shows "Display Message History". Press the Ack. Alarm button to view the message history. The display will now show three messages at a time. Pressing the up or down arrow buttons will allow navigation showing the most recent message to the oldest message. Refer to Appendix L for common messages and their meaning.

Refer to Section 7 to save the message history to a USB storage device or to view the message history on the optional embedded webpage.

6.2 Statistics

The LMR Plus controller will record a number of statistical points for a quick review of how the system has been operating. The statistics can be viewed on the main display, saved to a USB storage device, or viewed on the optional embedded webpage.

In order to view the statistics on the display press the up or down arrow buttons from the main screen until the display shows "Controller Statistics". Press the Ack. Alarm button to view the statistics. The display will show the statistics that the controller has recorded. Refer to Table 5 for the statistics included with the controller.

Refer to Section 7 to save the controller statistics to a USB storage device or to view the message history on the optional embedded webpage.

Table 5 Controller Statistics

Statistic	Range
Powered Time	000000.0-999999.9
Motor Run Time	00000.0-99999.9
Number of Calls to Start	00000-99999
Number of Starts	00000-99999
Last Motor Start	Date & Time
Last Motor Run Time	0000.0-9999.9
Last Low Pressure Start	Date & Time
Minimum System Voltage	Unlimited
Maximum System Voltage	Unlimited
Minimum System Frequency	Unlimited
Maximum System Frequency	Unlimited
Minimum System Pressure	Unlimited
Maximum System Pressure	Unlimited

Statistic	Range
Last System Startup	Date & Time
Last Phase Failure	Date & Time
Last Phase Reversal	Date & Time
Last Locked Rotor Trip	Date & Time
Maximum Run Current	Unlimited
Last Locked Rotor Current	Unlimited

6.3 Controller Diagnostics

The LMR Plus controller has a number of diagnostic points that can be used to help in troubleshooting issues with the controller. The diagnostics can be viewed on the main display, saved to a USB storage device, or viewed on the optional embedded webpage.

In order to view the diagnostics on the display press the up or down arrow buttons from the main screen until the display shows "Controller Diagnostics". Press the Ack. Alarm button to view the diagnostics. The display will show the diagnostics. In order to navigate the diagnostics use the up or down arrow buttons.

Note: The diagnostic information shall be provided to personnel trained in the meaning of the values shown.

Diagnostic values that are recorded are the current data and time, the microprocessor's firmware version, Eaton's shop order number, customer shop order number, voltage readings, current transformer readings, pressure sensor readings, input status, and output status.

Refer to Section 7 to save the controller diagnostics to a USB storage device or to view the message history on the optional embedded webpage.

7. COMMUNICATION

The LMR Plus controller is available with a number of communication protocols that can be used for the collection of information that the controller has seen.

A USB port is included standard. Optional communications ports are available for Ethernet, Modbus and a Printer.

7.1 USB

The USB port is used to download the message history, controller statistics, controller diagnostics, and status to a USB storage device. The USB port can also be used to upload custom messages, additional languages, and update the microprocessor firmware.

The USB memory device must meet the following requirements:

- Maximum memory size: 2GB
- USB 1.0 or 2.0
- Formatted with Fat 16 protocol.

Information Download

- In order to download the history, diagnostics, statistics, and status, install a USB storage device into the USB port on the display board. With the power on, press the Data | Print button. The first selection is "Save to USB". Press the Ack. Alarm button and the controller will save the information to the USB storage device.
- There will be five (5) files saved to the disk drive. Refer to Table 6 for the file nomenclature.

Table 6 File Nomenclature

File	Nomenclature	Description
ARC00000.csv	ARC=Archive 00000=Serial number	Message history
STC00000.txt	STC=Statistics 00000=Serial number	Controller statistics
DIA00000.txt	DIA=Diagnostics 00000=Serial number	Controller diagnostics
STA00000.txt	STA=Statistics 00000=Serial number	Controller status
CON00000.txt	CON=Configuration 00000=Serial number	Controller configuration

- The .csv file is a comma separated values file that can be opened using standard spreadsheet, word processor, or database programs. The .txt files can be opened using standard text viewers.

Custom Message Upload

- The LMR Plus controller has the ability to store and use up to ten (10) custom messages that can appear based on a specific date, time, alarm or status condition.
- Refer to Appendix J to upload and enable the custom messages.
- Refer to Section 8 for the creation of the custom message file.

Firmware Update

- Contact the factory or an authorized trained representative for assistance.

Language Upload

- Contact the factory or an authorized trained representative for assistance.

7.2 Embedded Webpage *

The controller has a built-in webpage that can be used to view the main display of the controller and its current status.

* COM Option must be ordered for this function.

Contact the factory or an authorized trained representative for assistance in accessing the webpage.

7.3 RS485 Serial Port *

An optional RS485 serial port can be provided for communication to various external software programs including Modbus.

*COM Option must be ordered for this function.

7.4 RS232 Serial Port *

This optional port is used with the optional printer (X1) to initiate a print cycle.

*COM Option must be ordered for this function.

8. CUSTOM MESSAGES

In order to upload custom messages to the controller a file needs to be created. This section outlines the file format and trigger points required to use the custom messages.

All that is required to create the custom message file is a standard spreadsheet program. Specific software is not required.

Ten (10) custom messages can be saved in the file and uploaded to the controller for use. Each message will be entered in the first ten (10) rows of the spreadsheet. Do not use the top row as a heading row.

There are five (5) trigger points that can be used. They include specific date and time range, number of pump start events, number of hours run, specific alarms, or common alarm.

Figure 1 shows examples of the custom messages and how the file needs to be laid out. Following is a description of each column and the data required to be entered in the column.

Figure 1 Custom Message Examples

	A	B	C	D	E
1	Message #1	1	MMDDYYHHMM	MMDDYYHHMM	
2	Message #2	2	XXXXX		
3	Message #3	3	XXXXX		
4	Message #4	4	XX		
5	Message #5	5			
6					
7					
8					
9					
10					

Column A contains the message that will scroll along the fourth line of the display. The message can be up to one hundred (100) characters in length.

Column B contains the message type reference number. Refer to Table 7 for the message types.

Table 7 Custom Message Types

Number	Description
1	Specific date and time range
2	Number of pump start events
3	Number of hours run
4	Specific alarms
5	Common Alarms

Column C and D are used to determine when the custom message will appear. Refer to the following for specific notes regarding each tripper point.

Date and Time Range (1)

Column C is used for the date and time that the message will start and column D is used for the date and time that the message will stop.

The date and time format is as follows:

MMDDYYHHMM = Month Day Year Hour Minute

If any value entered between 1 and 9 needs to be lead by a 0. For example, January 1, 2007, 8:15AM needs to be entered as 0101070815.

Note: All cells need to be formatted as text.

Number of Pump Start Events (2)

Column C is used to enter the number of pump starts before the message will appear.

The format is as follows:

XXXXX = Number of Pump Start Events

For example to have the message appear after 25 pump start events it will be entered as 00025.

Note: All cells need to be formatted as text.

Number of Hours Run (3)

Column C is used to enter the number of hours the pump has run before the message will appear.

The format is as follows:

XXXXX = Number of Hours Run

For example, to have the message appear after 125 hours of running the trigger point will be entered as 00125.

Note: All cells need to be formatted as text.

For detailed instructions, refer to Technical Services Brochure - FPCTB-RH012 - Rev A.

Specific Alarms (4)

Column C is used to enter the alarm event number. Refer to Table 8 for the alarm events and their corresponding number.

Table 8 Specific Alarm Events

Number	Event
01	Overvoltage (Phase A, B, or C)
02	Undervoltage (Phase A, B, or C)
03	Phase Failure (Phase A, B, or C)
04	Phase Reversal
05	Low Suction
06	Relief Valve Open
07	Fail to Stop
08	Fail to Start
09	Locked Rotor Trip

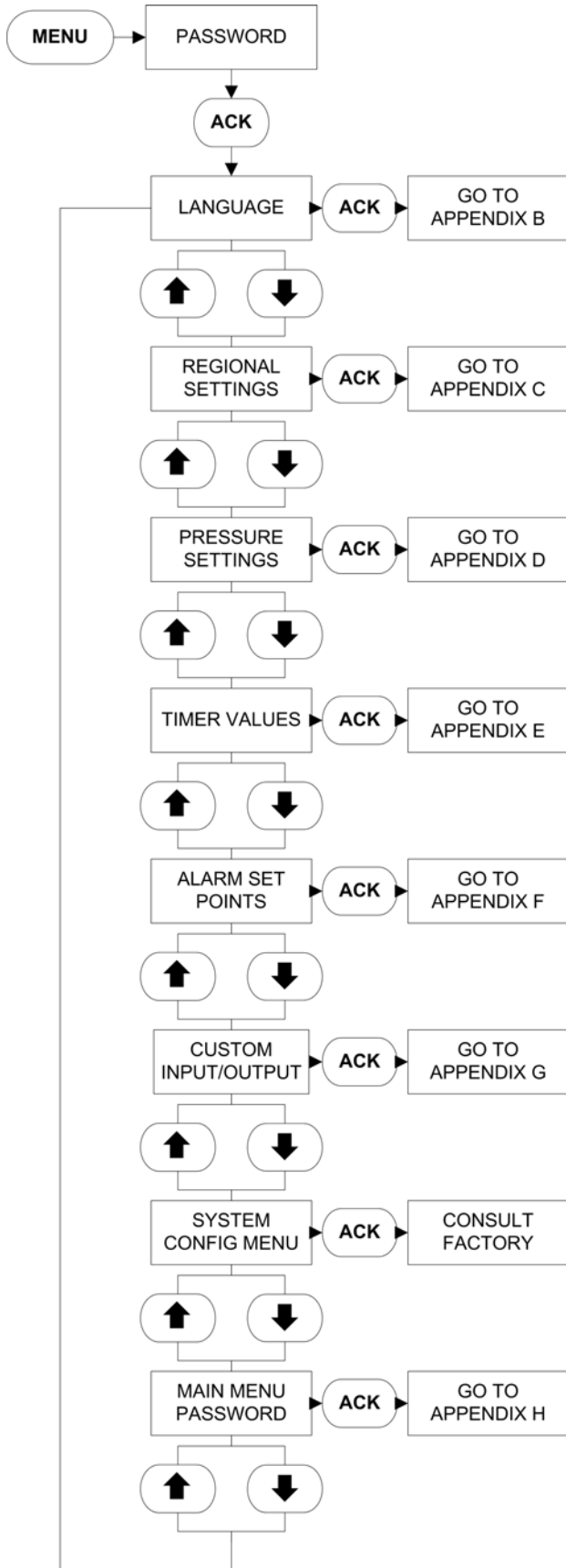
Number	Event
10	Deluge Valve Off
11	Low Foam Level
12	Low Pressure
13	Low Room Temperature
14	Over Frequency
15	Under Frequency
16	Transducer Failure

Note: All cells needs to be formatted as text.

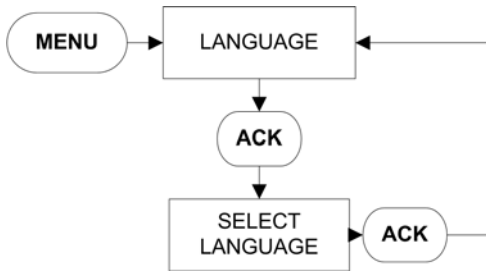
Common Alarm (5)

No other points are required to be entered into the spreadsheet, as this message will appear anytime there is an alarm.

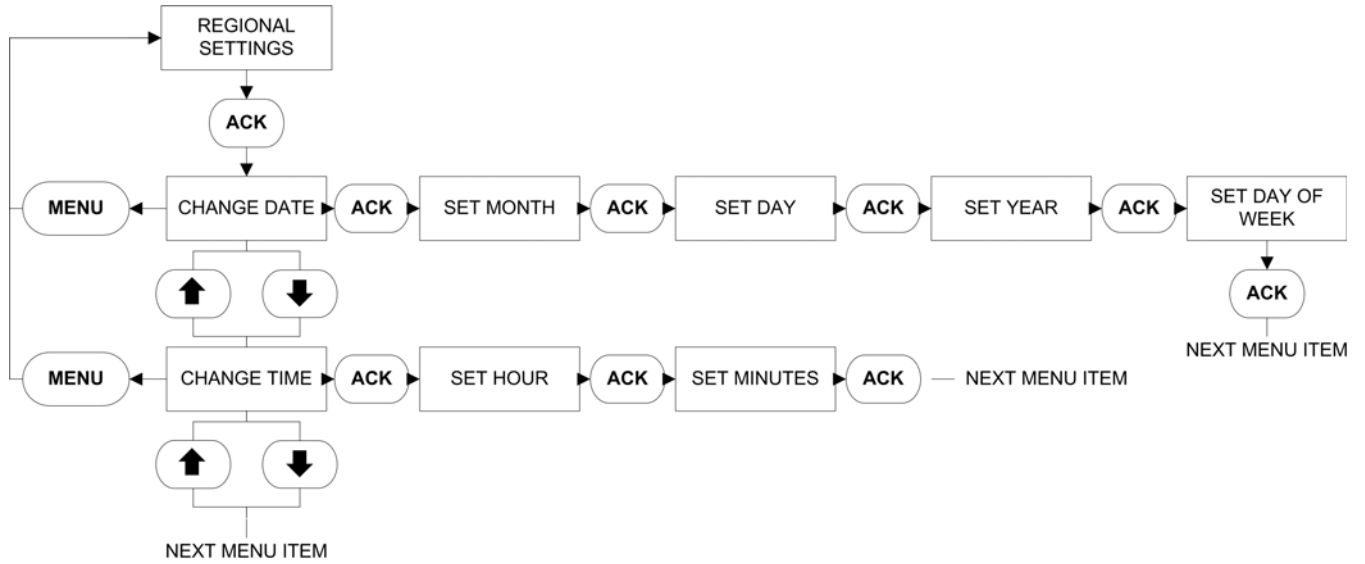
APPENDIX A: MAIN MENU TREE



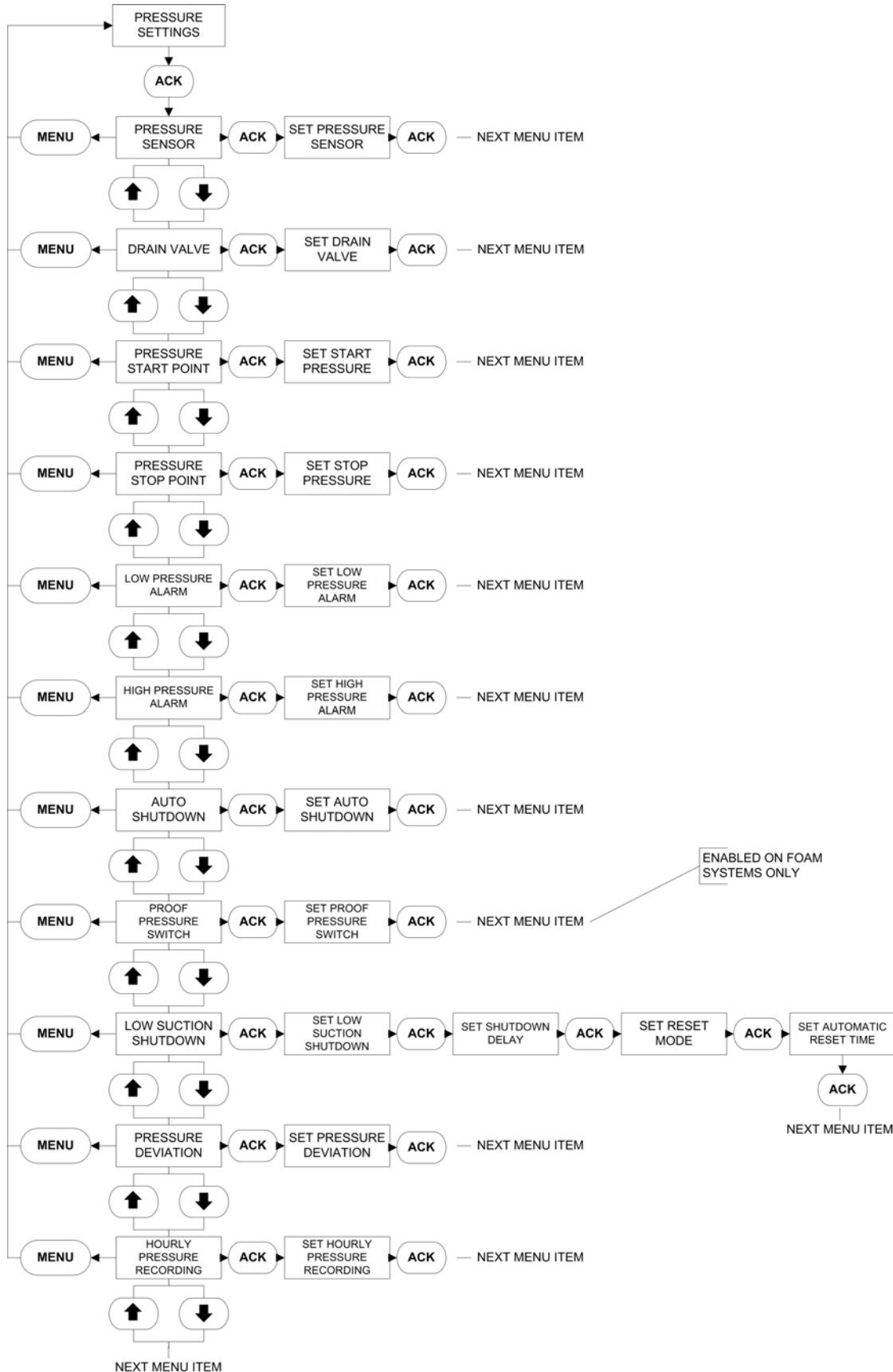
APPENDIX B: LANGUAGE MENU TREE



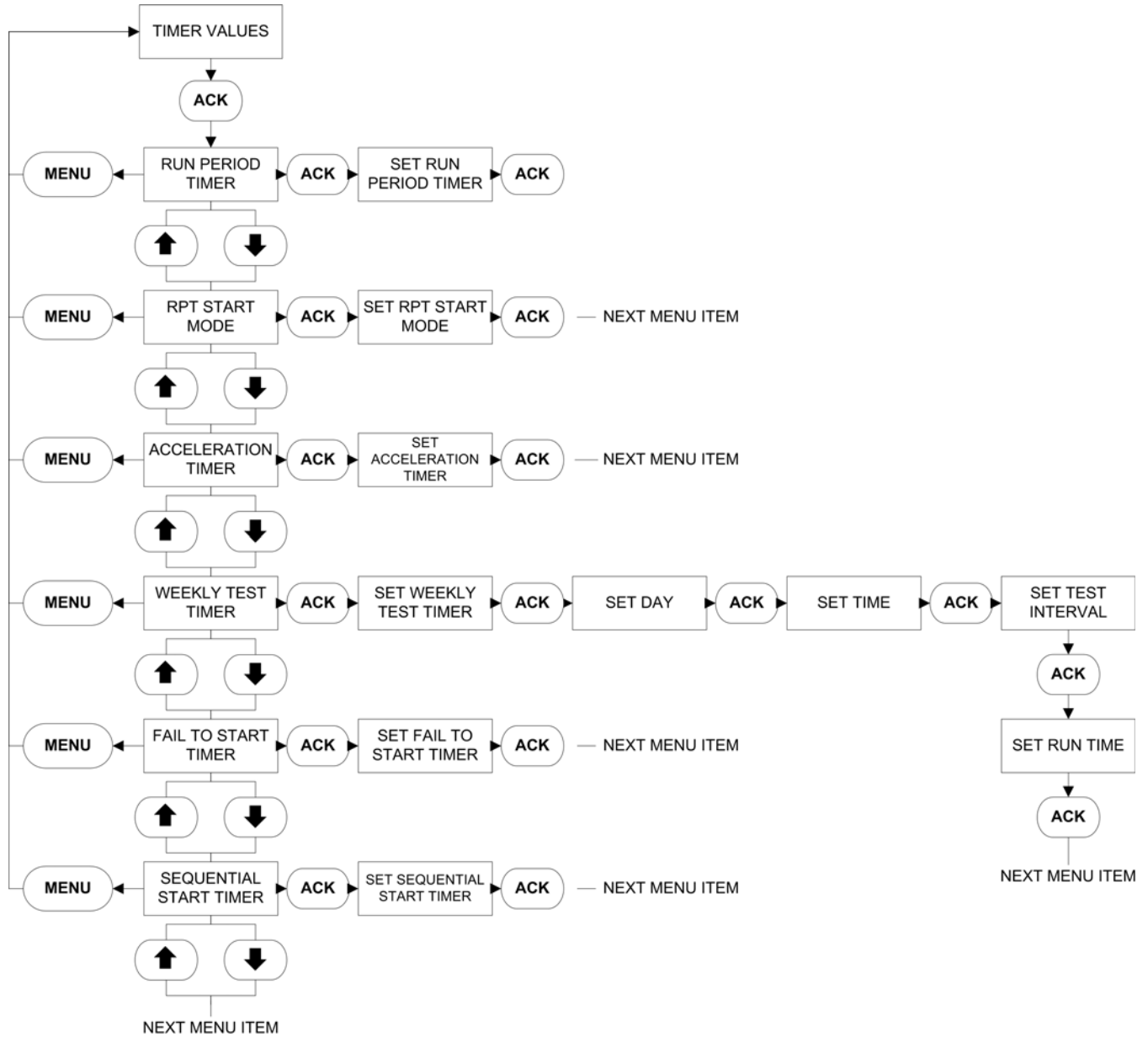
APPENDIX C: REGIONAL SETTINGS MENU TREE



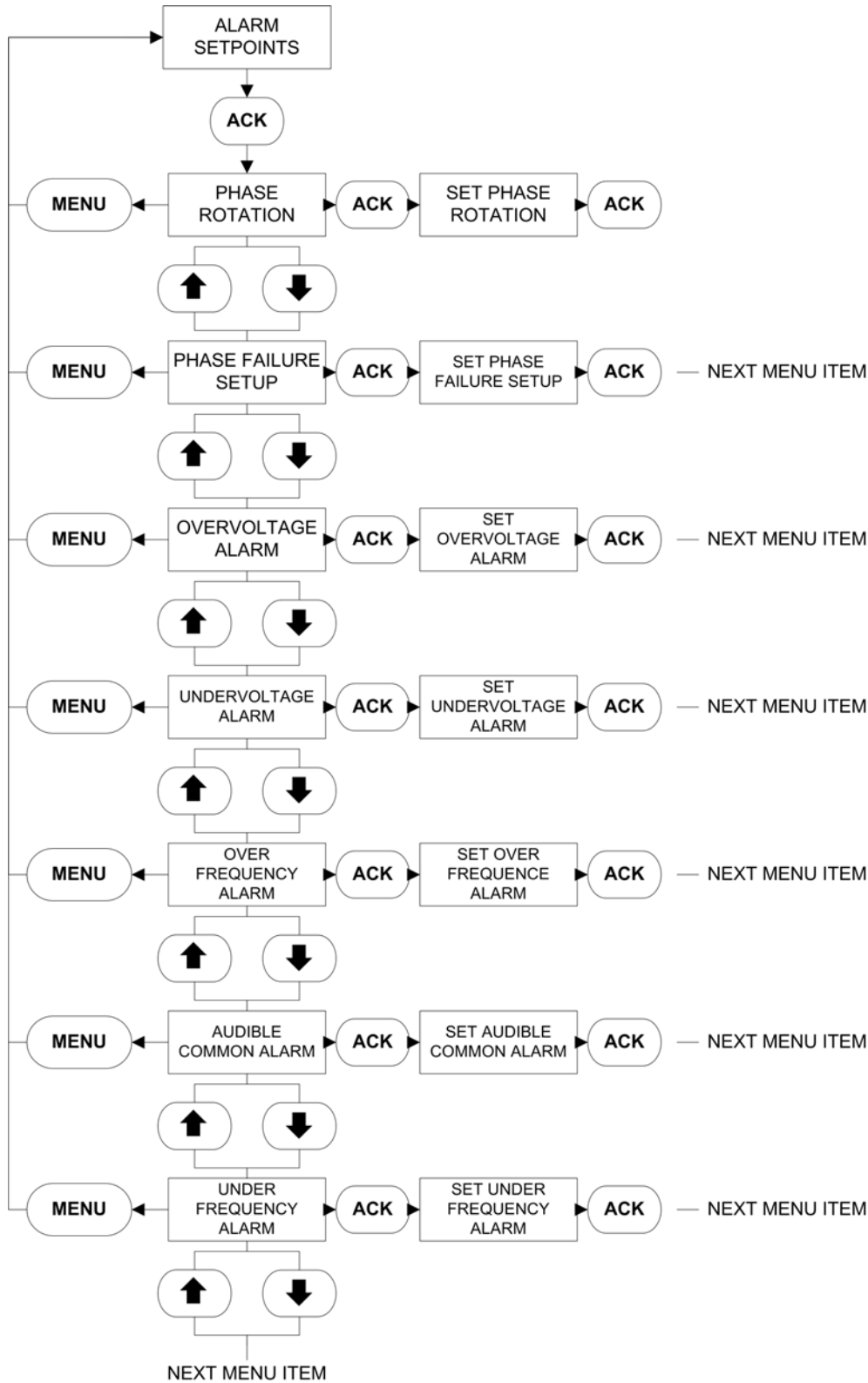
APPENDIX D: PRESSURE SETTINGS MENU TREE



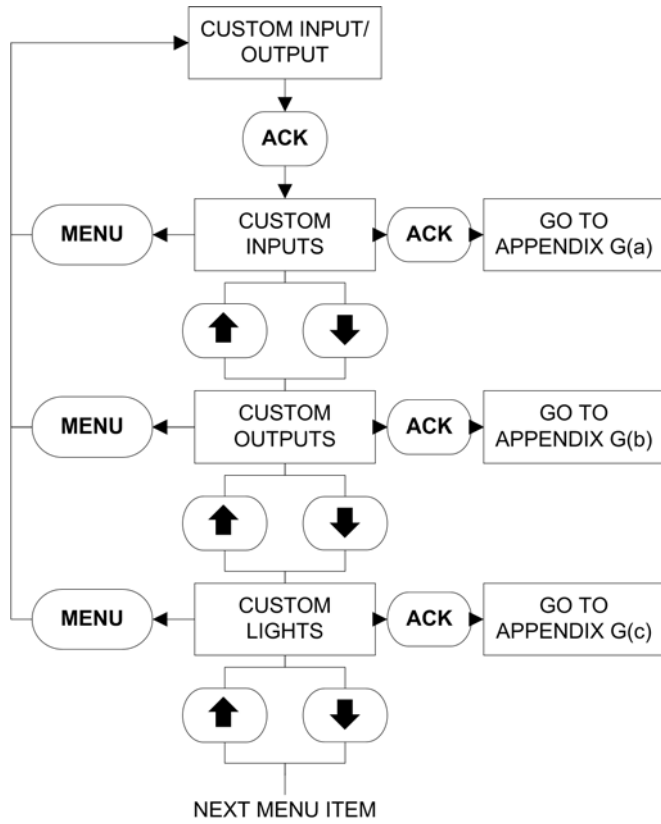
APPENDIX E: TIMER VALUES MENU TREE



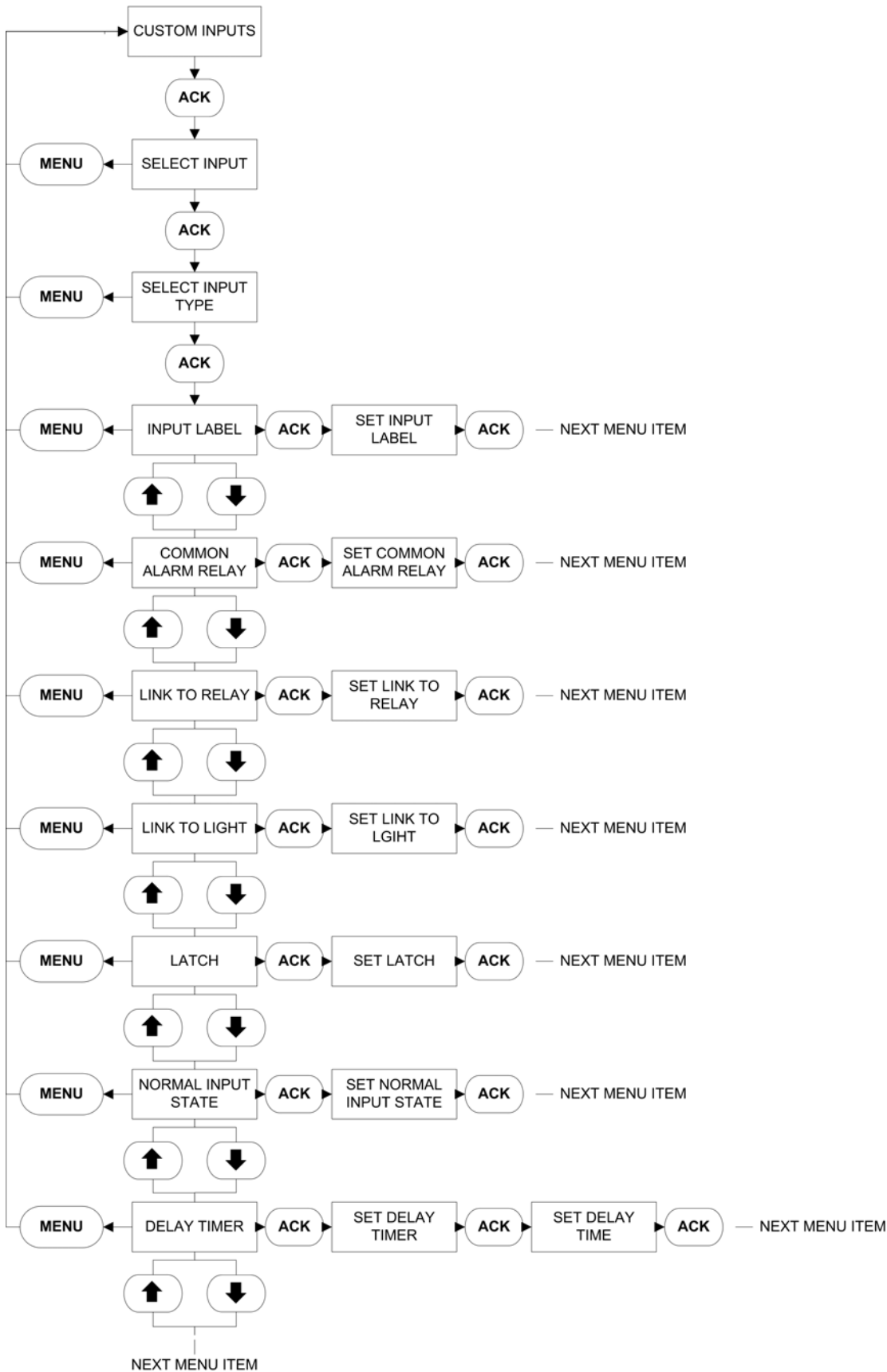
APPENDIX F: ALARM SETPOINTS MENU TREE



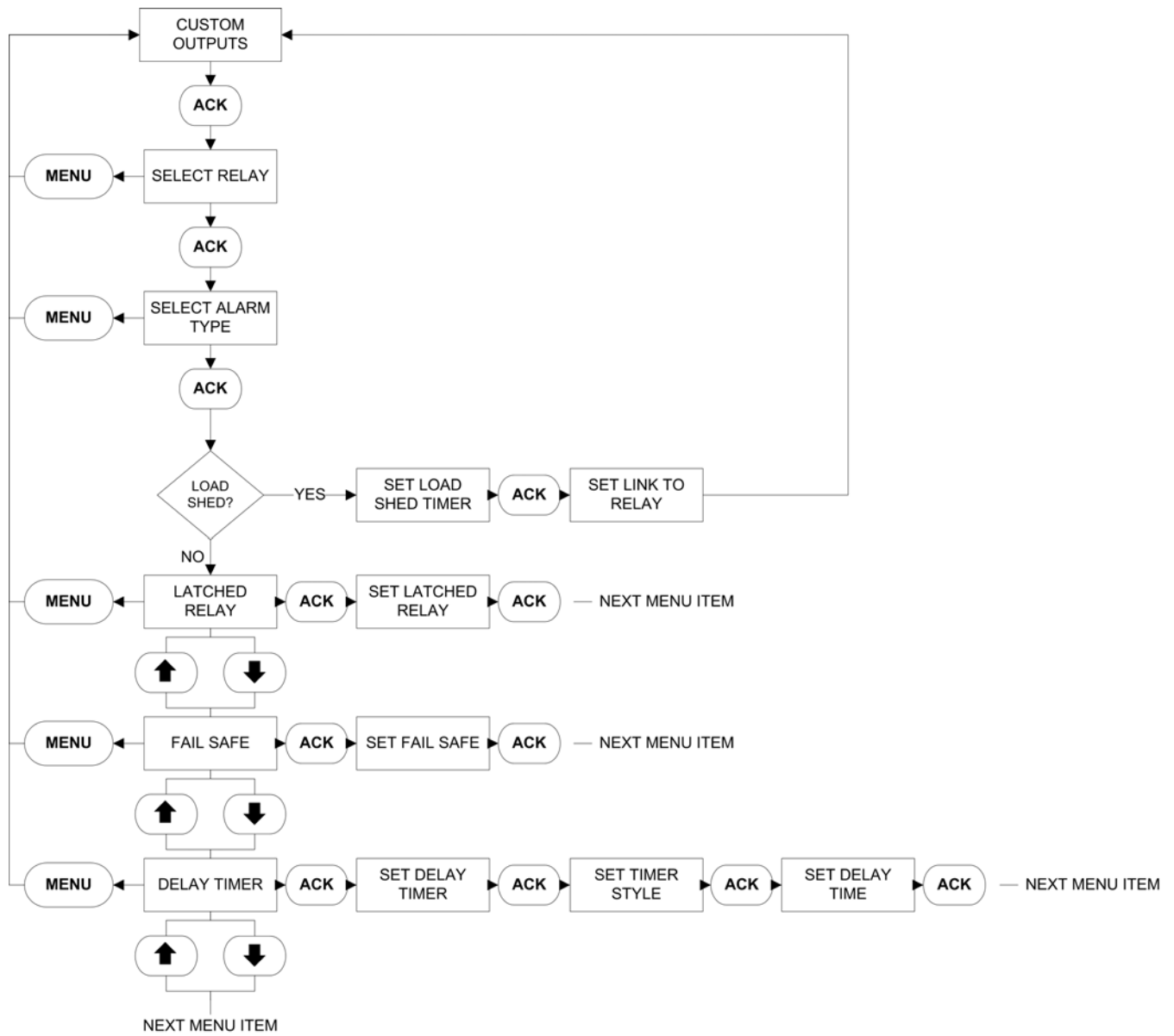
APPENDIX G: CUSTOMER INPUT/OUTPUT MENU TREE



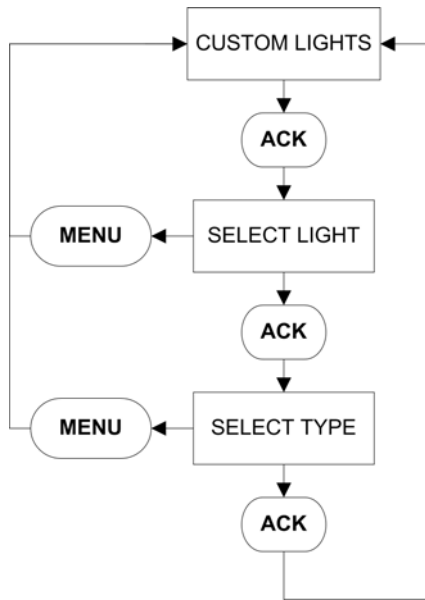
APPENDIX G(A): CUSTOM INPUTS MENU TREE



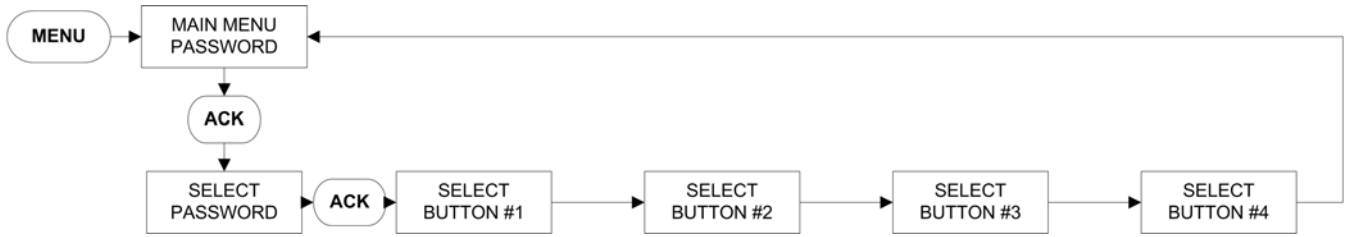
APPENDIX G(B): CUSTOM OUTPUTS MENU TREE



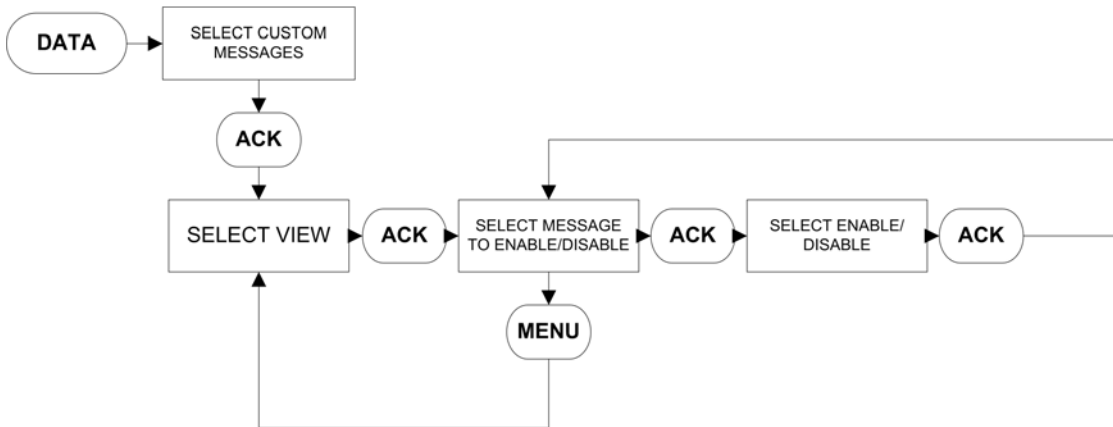
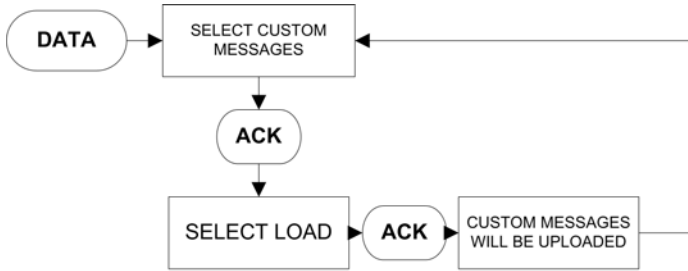
APPENDIX G(C): CUSTOM LIGHTS MENU TREE



APPENDIX H: MAIN MENU PASSWORD MENU TREE



APPENDIX J: CUSTOM MESSAGE LOAD & ACTIVATION



APPENDIX K: POWER WIRE CABLE REFERENCE

	Line Terminals on Main Isolation Switch (Incoming Cables)						
	Line Voltage					Qty. & Cable Sizes	Service Entrance GND. LUG Qty. & Cable Sizes
	200-208V	220-240V	*380-415V	440-480V	550-600V		
Max HP	25	30	40	60	75	(1)#14-1/0 Per Ø (CU/AL)	(1)#14-2/0 (CU/AL)
	40	50	75	100	100	(1)#4-4/0 Per Ø (CU)	(1)#4-350MCM (CU/AL)
	75	75	150	200	200	(1)#3-350MCM Per Ø (CU/AL)	(1)#4-350MCM (CU/AL)
	100	125	200	250	300	(2)3/0-250MCM Per Ø (CU/AL)	(2)1/0-750MCM (CU/AL)
	150	200	300	400	400	(2)250-350MCM Per Ø (CU/AL)	(2)1/0-750MCM (CU/AL)
	200	-	350	450	550	(2)#1-500MCM PER Ø (CU/AL)	(2)1/0-750MCM (CU/AL)
	250	300	500	600	700	(3)3/0-400MCM PER Ø (CU/AL)	(2)1/0-750MCM (CU/AL)

* Coils available: 380V-50Hz, 380V-60Hz, 415V-50Hz, 415V-60Hz

	Service Entrance Ground Lug					
	Line Voltage					Qty. & Cable Sizes
	200-208V	220-240V	380-415V	440-480V	550-600V	
Max HP	25	30	40	60	75	(1)#14-2/0 (CU/AL)
	40	50	75	100	100	(1)#14-2/0 (CU/AL)
	75	75	150	200	200	(1)#4-350MCM (CU/AL)
	100	125	200	250	300	(2)#4-350MCM (CU/AL)
	150	200	350	400	400	(2)#2-600MCM (CU/AL)

*For proper cable size, refer to the National Electrical Code NFPA-70

APPENDIX L: ALARM/STATUS MESSAGES

Message	Description
ATS IN EMERGENCY	The automatic transfer switch is in the emergency position
ATS IN NORMAL	The automatic transfer switch is in the normal position
DELUGE VALVE START	The controller started the motor after it received a deluge valve start signal
EMERGENCY START	The emergency start handle was pressed in and the motor started
FAIL TO START	There was a call to start the motor, however, the amperage draw did not reach 20% of the programmed motor full load amps
FAIL TO STOP	If the amperage draw has not dropped below 20% of the programmed motor full load amps two (2) seconds after a stop command, this alarm will be triggered
FREQUENCY OK	The system frequency has come back into normal operating levels and the alarm has been cleared
GENERATOR DISCONNECT	The isolation switch on the automatic power transfer switch is in the open position
HIGH PRESSURE	The system pressure is above the programmed high pressure alarm set point
INTERLOCK OFF	The interlock signal has been removed
INTERLOCK ON	The interlock signal has been received
INTERLOCK SHUTDOWN	The pump has been shutdown due to an interlock signal
JOCKEY RUNNING	The jockey pump running signal has been received
JOCKEY STOPPED	The jockey pump running signal has been removed
LOAD SHED CLOSED	The load shed timer has started timing and the load shed output has closed
LOCAL START	The start pushbutton on the enclosure flange was pressed initiating a start sequence
LOCAL STOP	The stop pushbutton on the enclosure flange was pressed initiating a stop sequence
LOCKED ROTOR TRIP	The controller has tripped on the built in locked rotor over current protection
LOW FOAM SHUTDOWN	The controller has shutdown after receiving a low foam level signal
LOW PRESSURE	The system pressure has dropped below the programmed pressure start point
LOW PRESSURE ALARM	The system pressure has dropped below the programmed low pressure alarm point
LOW PRESSURE OK	The system pressure has risen above the programmed pressure stop point
LOW PRESSURE START	The pump has started running because of a low pressure condition
LOW ROOM TEMPERATURE	The controller has received a low room temperature signal
LOW SUCTION	The controller has received a low suction signal
LOW SUCTION SHUTDOWN	The controller has shutdown because of low suction
MENU ENTERED	The menu system was entered by a user
MOTOR OVERLOAD	The amperage draw has exceeded 125% of the programmed motor full load amps
OV PHASE AB	The voltage measured between phase A and B has exceeded the programmed overvoltage alarm set point
OV PHASE BC	The voltage measured between phase B and C has exceeded the programmed overvoltage alarm set point
OV PHASE CA	The voltage measured between phase C and A has exceeded the programmed overvoltage alarm set point
OVER FREQ	The system frequency has exceeded the programmed over frequency set point
PHASE A FAILURE	The controller has detected a phase failure on phase A
PHASE A OK	The phase failure alarm detected on phase A has been cleared
PHASE B FAILURE	The controller has detected a phase failure on phase B
PHASE B OK	The phase failure alarm detected on phase B has been cleared
PHASE C FAILURE	The controller has detected a phase failure on phase C
PHASE C OK	The phase failure alarm detected on phase C has been cleared
PHASE REVERSAL	The controller has detected a phase reversal on the system voltage
PHASE REVERSAL OK	The phase reversal alarm has been cleared
PRESSURE = 000	System pressure readings the controller has recorded
PUMP RUNNING	The amperage draw on the motor has reached at least 20% of the programmed motor full load amps
PUMP START	The pump has started via a pump start signal
PUMP START OFF	The pump start signal has been removed

Message	Description
PUMP STOPPED	The pump has stopped after a stop sequence has been initiated
REMOTE START	The pump has started via a remote start signal
ROOM TEMPERATURE OK	The low room temperature alarm has cleared
RPT TIMED OUT	The running period timer has finished its timing cycle
SEQ START DELAY	A start sequence has been started, however, it is delayed due to the programmed sequential start timer
SST STOPPED	The sequential start timer has stopped timing
SYSTEM STARTUP	Power has been reapplied to the system and a successful system boot has been completed
TRANSDUCER FAILURE	The controller has detected that the transducer has failed
TRANSDUCER OK	The controller has detected that the transducer is in good working condition
UV PHASE AB	The voltage measured between phases A and B has dropped below the programmed undervoltage set point
UV PHASE BC	The voltage measured between phases B and C has dropped below the programmed undervoltage set point
UV PHASE CA	The voltage measured between phases C and A has dropped below the programmed undervoltage set point
WEEKLY TEST DONE	The weekly test has been completed
WEEKLY TEST START	The pump has started on a weekly test
WEEKLY TEST STOP	The pump has stopped after a weekly test cycle

NOTES:

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