

## **TECHNICAL DATA**

### **MicroProcessor Regulated Water Supply System MPR-78PC**

#### **Features**

- **Requires Only a Single 24VAC Power Source**
- **All Solid State (no moving parts)**
- **State-of-the-art Digital Electronics**
- **Manufactured using SMT (Surface Mount Technology) Components**
- **Automatic Freeze Protection with Optional Plug-in Board**
- **Programmable ON Time to Compensate for Varying Flow Rates**
- **Completely Automatic Operation**
- **User Friendly Design**

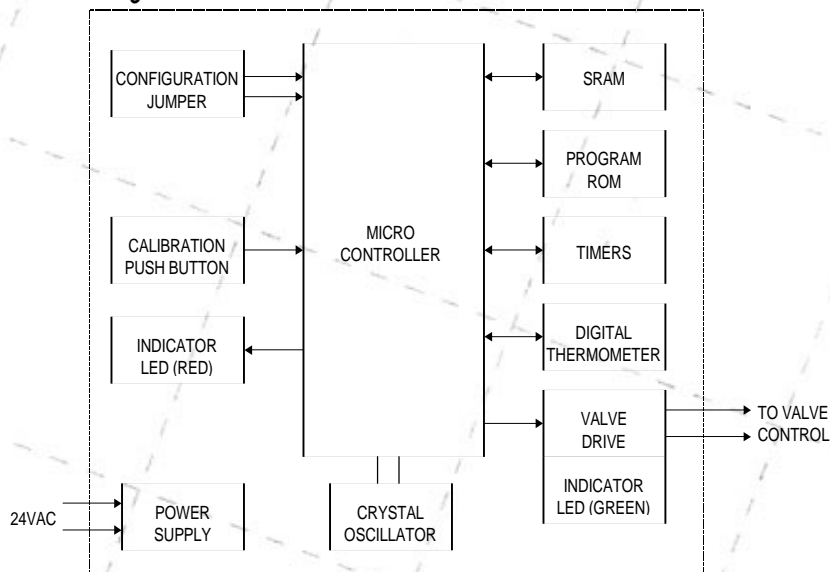
#### **Description**

The Energy Saver Microprocessor Regulator Water Supply System model MPR-78PC is a powerful CMOS microcomputer requiring only a single 24VAC power source. It is designed measure the ambient air temperature and use this information to open and close a 24VAC electrically controlled valve using a predetermined time schedule. This valve then delivers water to the evaporative media in the most efficient manner. A crystal oscillator provides a high frequency clock for the microprocessor as well as a high-resolution time base for accurately controlling the on and off times of the valve drive electronics. A digital thermometer provides 0.5° C (0.9° F) resolution for accurate temperature measurements.

The MPR-78PC will also auto-detect the presence of an optional plug-in board, which adds the capability to automatically protect the system plumbing from damage caused by unexpected freezing temperatures.

The Energy Saver Microprocessor Regulator Water Supply System model MPR-78PC provides a highly reliable digital solution to substantially increase the life span of the evaporative media.

## Block Diagram



## Specifications

POWER SUPPLY INPUT	24VAC - 60 Hz @ 40VA
VALVE CONTROL OUTPUT	24VAC - 60 Hz @ 10VA

## AUTO-FREEZE OPTION

SUPPLY VALVE CONTROL OUTPUT	24VAC - 60 Hz @ 10VA
DRAIN VALVE CONTROL OUTPUT	24VAC - 60 Hz @ 10VA

## USER CONTROLS AND INDICATORS

Configuration jumper for default time schedule selection.

Momentary push button for calibration control.

Red LED (Light Emitting Diode) indicates the status of the system.

Green LED glows when valve is open.

## Functional Description

The MPR-78PC provides a simple yet powerful architectural to meet the system application requirements.

The power supply uses the 24VAC input signal to create 5VDC to power the micro controller and the other low voltage digital components.

The program ROM (Read-Only Memory) is programmed at the factory to provide interrupts to the micro controller at a specific elapsed time or at regular time intervals and uses the current and average temperatures to control the timing of the valve control. It also interacts with the user for testing and calibration and continually displays status information.

At the heart of the software is a real-time multi-tasking operating system. The operating system is tightly coupled with the application program to provide efficient use of the available memory space and to provide complete turn-key operation with no user intervention required. However, the user can easily interrupt the normal operation of the system to perform testing and calibration functions.

The application program is a state machine. That is, the program runs in a continuous loop and the behavior while inside the loop changes according to the current state of the system. This type of program provides very robust code because every operating state of the system can be clearly defined and the executive code processes events according to the rules of that state. Certain events can cause state transitions. These events can be timed events, button pressed events, or temperature related events.

### **Configuration**

Jumper header J2 selects the appropriate timing table for one of three different unit sizes.

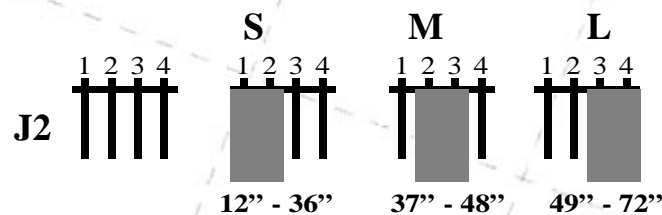
See the *Timing Tables* section for the actual time schedules for each configuration.

Installing the suitcase jumper across pins 1 and 2 selects the small (12" to 36") size.

Installing the suitcase jumper across pins 2 and 3 selects the medium (37" to 48") size.

Installing the suitcase jumper across pins 3 and 4 selects the large (49" to 72") size.

The jumper position may be moved at any time but should only be changed in a power-off state. The position of the jumper is read by the system software only once during system initialisation which occurs immediately after power is applied. Moving the jumper while power is on will have no effect on system operation.



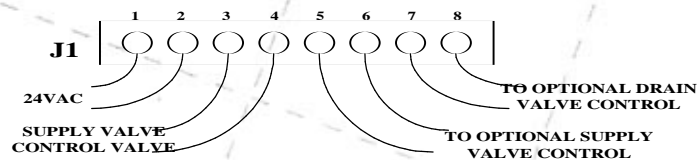
### Connections

J1 is a terminal block connector for supplying power input to the MPR and provides outputs for connecting up to three electronically controlled valves.

The main board controls only the microprocessor regulated valve and the electronic control for this valve connects to pins 3 and 4 of the terminal block.

The supply and drain valve controls are active only if the optional Automatic Freeze Protection board is installed and the drain time on that board is set to a non-zero valve.

Connect the 24VAC power source for the board to pins 1 and 2 of the terminal block.



### Calibration

Calibration mode provides a means of changing the valve open time from its default value to adjust for varying flow rates.

To enter calibration mode, press and hold the calibration pushbutton for two seconds or until the indicator light flashes at a rapid rate, then release the pushbutton.

If the valve is open then it will be closed and the unit will wait indefinitely for another button press. Press and release the calibration button, the valve opens and the blink rate slows. When sufficient water has flowed through the system, press and release the button again and the valve will close (starting a normal off cycle).

The time that the water has been flowing through the system during this procedure will be saved as the calibrated time for all future valve open cycles. The calibrated time is stored in non-volatile memory so that it will be remembered even if power is removed from the unit.

The calibrated time is stored as an offset and therefore has a range of  $\pm 100\%$  of the default value. This offset is cleared upon entering calibration mode. So, to restore the default time, simply enter calibration mode and then turn off the unit. When power is restored, the system will use the default time for the selected configuration.

### **Operation**

When power is applied to the MPR-78PC, system operation is completely automatic. The system monitors the ambient temperature and controls the on and off timing of the valve control according to one of three schedules selected by the configuration jumper.

An on cycle will start only if the ambient temperature exceeds 78° F. and will run for a fixed amount of time. The time will be either the calibrated time or the default time if the unit has never been calibrated or the calibration offset has been cleared.

Off cycle times vary inversely with ambient temperature. During the course of an off cycle, the temperature is sampled at regular intervals so that each off cycle time is based on the average temperature sampled during that period.

Once power is applied, it is easy to determine the status of the system by observing the indicator lights. The green light simply follows the state of the valve and is on whenever the valve is open. The red light blinks at different rates and duty cycles to indicate the current state of the system.

### **System Status Indicator**

<b>Red Indicator Light</b>	<b>System Status</b>
On steady for three seconds	Power-on initialisation
Normally off and blinks on momentarily at one second intervals	Valve open state
Normally on and winks off momentarily at one second intervals	Valve closed state
Normally off and blinks on momentarily four times per second	Pre-calibration state
Equal on and off times of 1/4 of a second	Calibration state
Normally off and blinks on momentarily at two second intervals	Idle state - temperature does no exceed 78° F
Normally off and blinks on momentarily two times per second	Auto-freeze algorithm in progress - temperature has dropped below freeze setting
Normally off and blinks on momentarily at five second intervals	Frozen state - system is drained and temperature does not exceed freeze setting.
On steady for five seconds	Thaw state - system is drained and temperatures exceeds freeze setting