



Water Master Operating Instructions and Technical Specifications

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OVERVIEW

The Water Master is a self contained leak detection appliance designed to minimize, and in most cases, completely eliminate the damage to homes caused by failed or faulty plumbing systems and fixtures. It is installed in the main water supply line at the point of entry into a residence and monitors the entire plumbing system from this location.

The Water Master has no remote sensors or batteries to service or replace. It operates on standard household power and is designed to fail safe (turn the water off) in the event of a power outage. If water is needed while the power is off, the built in *manual bypass valve* can be opened. **The manual bypass valve must be closed after the power is restored.**

In addition to protecting your home, the Water Master also conserves water and saves the owner from costly mistakes such as dripping faucets and forgotten running taps by using the applied logic for all normal exits as well as system faults and failures. The *flow guard knob* located on the main panel allows for a maximum demand time setting. After the demand time setting has expired, the Water Master will automatically shut off the water thus eliminating costly mistakes.

The Water Master is shipped from the factory with the operating program installed and is ready to protect your home as soon as power is applied. It uses a standard 120 VAC outlet for your convenience. The operating program was written and tested to meet the needs of most households. However, due to the vast array of appliances and features installed in homes today, it may be necessary to adjust the program to meet one or more of your specific application needs. Instructions on how to update or revise the operating program can be found in the sections “Technical Data” and “Sequence of Operation” with detailed step-by-step instructions provided in the subsection “Configuration Mode”. If help is needed or questions arise, customer support is only a phone call away at 989-295-0050.

INSTALLATION

NOTE: The Water Master should be installed by a licensed plumber to ensure quality results. Even though the installation process is fairly simple, it is critical that all soldered joints have the highest quality integrity.

The Water Master is designed to be installed in systems having $\frac{3}{4}$ " copper plumbing. If the plumbing system is other than the specified, the required fittings and/or adapters must be provided as well as the additional dimensions considered in the following instructions.

1. Turn off the water supply at the main incoming valve into the residence. Drain the water from the piping system until all flow has stopped.
2. Installation of the Water Master will require a space of 12 $\frac{1}{2}$ " width and 16 $\frac{1}{2}$ " in height. It is recommended that a location where the unit can be installed in the upright position is selected. If the existing piping arrangement is vertical, the necessary fittings to achieve the required alignment should be installed such as a tee/valve/tee branch or a flag type

arrangement. It should be noted that during installation try to use the fewest fittings as possible. **Do not use unions or flex fittings when installing the Water Master.**

3. The Water Master can be mounted on the wall with pipe hangers and stand-offs or be installed directly in a horizontal line.
4. Remove 9” of the existing pipe or if new lines have been installed, prepare the connections as required. Insert the Water Master into the piping or set the new piping in place.
5. Open all three valves on the Water Master to ensure that no damage is caused when solder joints are made.
6. Remove the valve handles from the bypass and isolation valves on the unit.
7. Swing the cover down. The cover is attached at the lower end and will remain in place. Pressure clips retain the position at the top.
8. Protect the inside component and complete the solder joints ensuring all alignment is correct.
9. Place the cover back into position and replace the valve handles on the Water Master.
10. The installation process is now complete and should be tested for leaks.

STARTUP AND TESTING

Plumbing and Water Supply

- Open all taps in the residence. Slowly open the main water supply valve and allow the plumbing system to fill with water. After waiting several moments, close all taps starting from the nearest to the most distant. The objective is to remove as much air from the system as possible.
- Inspect the new installation for leaks and correct as necessary. Close the bypass valve and make sure all valve handles are in the vertical position on the Water Master.

System Power

- Plug the Water Master power cord into a 120 VAC outlet. The Red Power On lamp should turn on.

Initial Flow Check

- Turn the *Flow Guard Knob* to the maximum position of 10 (100 minutes shown by the note reading X 10).
- Open any tap in the plumbing system and observe the flow of water. Water flow should be as usual, slightly slow down, and then go back to normal. This process verifies that the Water Master is sensitive to a water demand request. The yellow Flow Guard Lamp should turn on within 2 seconds and remain on until the tap is shut off.

Excess Flow Fault Check

- Turn the *Flow Guard Knob* to the minimum position of 1 minute.
- Open a tap in the residence. The yellow Flow Guard Lamp should turn on. Allow the water to continuously run while observing the time. In approximately 1 minute, the water will automatically shut off. The yellow Flow Guard Lamp will go out and the red Flow Fault Lamp will come on.

Flow Guard Set Up

- Turn the *Flow Guard Knob* to the desired position for the owner's application. Normally, 20-25 minutes is usually plenty of time for everyday applications. It is recommended that the setting be adjusted to the lowest time possible.

TECHNICAL DATA

User Inputs located on main front panel:

Inputs	Code	Description
System Reset	PB-1	Black button located in the center of the control panel.
Flow Guard Minutes Knob	SP-1	Variable Resister Input (1-10 X 10) located in the lower center of the control panel.
Wireless Remote	RC-1	Radio frequency remote provided with unit featuring four buttons: "A" System Reset "B" Flow Override (Bypass) "C" Vacation Mode (Shutdown) "D" Program Mode (Configuration Mode)

The Water Master by Michigan Aqua-Tech, Inc.

User Outputs located on main front panel:

Inputs	Code	Description	Color
Pilot Lamp	PL-1	Power On	Red
Pilot Lamp	PL-2	Flow Guard	Yellow
Pilot Lamp	PL-3	Flow Fault	Red
Pilot Lamp	PL-4	Leak Guard	Yellow
Pilot Lamp	PL-5	Leak Fault	Red

Standard Inputs (Terminal strip wiring as supplied from the factory):

Inputs	Code	Relay	Description
Power	TB-1		120 VAC; Black-Hot, White-Return/Neutral, Green-Ground
Flow Switch	TB-3	Normally Open Contact	Closes contact at approximately 0.21 gpm on increasing flow.
Pressure Switch	TB-4	Normally Closed Contact	Opens contacts at approximately 30 psig on increasing pressure.

Standard Outputs (Terminal strip wiring as supplied from the factory):

Inputs	Code	Relay	Description
Control Valve	CV-1, TB-6	Normally Closed Contact, Full Port	120 VAC, 60 Hz.

Auxiliary Inputs (Optional terminal strip wiring):

Inputs	Code	Relay	Description
External Reset	TB-5	Normally Open Contact, Multiple switches wired in parallel	This allows the user to reset a fault condition from a hardwired switch.
Flow Guard Override	TB-2	Normally Open Contact, Usually from a relay or flow switch	Indicates that a long demand item needs water (i.e. Sprinkler systems, water softeners, etc.).

Auxiliary Outputs (Optional terminal strip wiring):

Inputs	Code	Relay	Description
Fault	TB-1	Normally Open Contact (Closed on fault), requires power to system for operation.	Security systems link.
Power	TB-8		5VDC and Common (for service only).
Ground	Not Labeled		For shielding far right terminal on PCB.

Non-Stored Configuration Settings:

Inputs	Code	Description
Flow Guard Timer	TM-3	Duration of allowed demand use, located in center of the control panel

- The maximum continuous time water can run, except when there is a *Flow Guard Override Signal*.
- Recommended setting of 20-25 minutes.
- User adjustable time of 1-100 minutes.

EEPROM Stored Configuration Settings:

Timer	Code	Recommended Time Setting	Adjustable Time setting	Description
Leak Test Cycle	TM-1	20-25 Minutes	1-100 Minutes	Interval between leak tests.
Leak Test Decay Timer	TM-2	5 Minutes	1-100 Minutes	Duration of leak test.
Flow Guard Override Timer	TM-4	2 Hours	1-10 Hours	Auxiliary Input, the maximum time water can run when the Flow Guard Time is being overridden.
Surge Flow Timer	TM-5	2 Seconds	1-10 Seconds	Minimum time allowed to establish a flow signal, the time allowed to establish a verified flow. A flow signal pulse from the flow switch is expected when the plumbing system re-pressures. The flow switch must remain activated for the adjustable time period in order for a logical flow signal to be generated.
Surge Window Timer	TM-6	10 Seconds	1-10 Seconds	Time allowed for flow verification. The maximum time allowed for a verified flow signal to be established and begin the next programmable step.
Low Flow Rate Timer	TM-3	8 Seconds	1-20 Seconds	Determines possible low flow use versus leak. The time window at the beginning of a leak test where a low pressure condition is considered a “low flow” instead of a leak.

Limits:

Limit	Code	Default Setting	Adjustable Setting	Description
Leak Failure Limit	RG-1	3	1-10	The number of leak test failures that it takes to realize a leak fault.
Low Flow Failure Limit	RG-2	3	1-10	The number of low flow failures that it takes to realize a flow fault.

Other:

- Last known state (Normal, Leak Fault, Flow Fault, etc.) hardware program is not accessible.
- The state is updated in EEPROM when a fault occurs or a fault is cleared.

Partial List of Internal Variables:

Variable	Description	Setting
Current State	Leak Fault, Flow Fault, Normal, etc.	
Leak Failure Count	The number of leak tests failed due to a possible leak (NOT within the low flow leak time) since the last leak test passed.	The maximum number allowed to fail is set with leak test failures.
Low Flow Failure Count	The number of leak tests failed within the low flow leak time since the last leak test passed.	The maximum number allowed to fail is set with low flow failures.

SEQUENCE OF OPERTATION

Power Up

- The red Power On Lamp is lit. **If power was lost while in a faulted condition, the Water Master will return to the same condition and wait for the system to be reset.**
- Faults are as follows:

Fault	Description	Signal
Leak Guard Fault	Leak Fault	Red pilot lamp on
Flow Guard Fault	Flow Fault	Red pilot lamp on
Low Flow Fault	Leak Fault, Flow Fault	Red pilot lamp on

- All values are set to defaults.
- Timers = Configured values
 - *Leak Failure Count* (RG-1) = 0
 - *Low Flow Failure Count* (RG-2) = 0
- Start *Leak Test Timer* to perform next leak test (TM-1).
- Go to **Stand-By Mode**.

Stand-By Mode

- Go to **Re-pressure Mode** then return to this point.
- Turn the *Water Valve* (CV-1) off.
 - If flow is detected while timing, go to **Demand Flow Mode**.
 - If low pressure is detected go to **Re-pressure Mode**.
 - If the *Reset Button* (PB-1) is pushed, go to **Leak Test Mode**.
 - When the *Leak Test Timer* (TM-1) times out, go to the **Leak Test Mode**.

Re-pressure Mode

- Turn *Water Valve* (CV-1) on.
- Start *Surge Window Timer* (TM-6)
 - If flow starts, start *Surge Flow Timer* (TM-5)
 - If flow continues until *Surge Flow Timer* (TM-5) expires, go to **Demand Flow Mode**.
 - If demand override turns on, go to **Demand Override Mode**.
- When *Surge Window Timer* (TM-6) is up, return to calling mode (**Demand Flow Mode, Leak Test Mode, or Stand-By Mode**).

Demand Flow Mode

- *Flow Guard Indicator* (PL-2) is turned on.
- Turn *Water Valve* (CV-1) on.
- Start *Demand Time Timer* (TM-3).
 - When flow is detected, the *Demand Time Timer* counts down the demand time.
- If any *Reset Button* (PB-1, PB-A, or *Wired Remote Reset* PB-R) is depressed the *Demand Time Timer* (TM-3) will be reset.
- If the *B Button* (PB-B) is pressed on the wireless remote:
 - Keep *Water Valve* (CV-1) open.
 - Wait until water stops *Flowing* (FS-1).
 - The *Flow Guard Indicator* (PL-2) is turned off.
 - Restart *Leak Test Timer* (TM-1).
 - The Water Master returns to **Stand-By Mode**.
- If *Demand Override Input* (TB-2) closes, go to **Water Demand Override Mode**.
- If the *Water Flow* (FS-1) continues past the demand time:
 - The *Water Valve* (CV-1) is turned off.
 - The *Flow Fault Indicator* (PL-3) is turned on.
 - The *Flow Guard Indicator* (PL-2) is turned off.
 - The current state is set to flow fault.
 - The Water Master waits for the reset input.
- If the *Water Flow* (FS-1) stops before the preset time:

- The *Flow Guard Indicator* (PL-2) is turned off.
- Restart *Leak Test Timer* (TM-1).
- The Water Master returns to **Stand-By Mode**.

Water Demand Override Mode

- When *Demand Override Input* (TB-2) is detected, the *Water Valve* (CV-1) is opened.
- The *Flow Guard Indicator* (PL-2) is turned on.
- *Override Timer* (TM-7) starts.
 - If any *Reset Button* (PB-1, PB-A, or PB-R) is depressed the *Override Timer* (TM-7) will be reset.
 - If the *Demand Override Input* (TB-2) stays detected until the *Override Timer* (TM-7) expires:
 - The *Water Valve* (CV-1) is turned off.
 - The *Flow Fault Indicator* (PL-3) is turned on.
 - The *Flow Guard Indicator* (PL-2) is turned off.
 - The current state is set to flow fault.
 - The Water Master waits for the reset input.
 - If the *Demand Override Input* (TB-2) opens before the *Override Timer* (TM-7) expires:
 - The *Flow Guard Indicator* (PL-2) is turned off.
 - Restart *Leak Test Timer* (TM-1).
 - The Water Master returns to **Stand-By Mode**.

Leak Test Mode

- Go to **Re-pressure Mode**.
 - The *Leak Test Indicator* (PL-4) is turned on.
 - The *Water Valve* (CV-1) is turned off thus closing the water inlet and trapping the water pressure in the plumbing system.

Note: The actuated valve can be influenced by head pressure. If head pressure were to fall, the pressure after the valve will follow. If the head pressure rises, the trapped pressure after the valve will stay the same.

- *Leak Decay Timer* (TM-2) starts.
- *Low Flow Leak Timer* (TM-8) is starts.
 - If the *Leak Decay Timer* (TM-2) expires and the *Pressure Switch* (PS-1) never indicated low pressure:
 - The *Water Valve* (CV-1) is turned on.
 - The *Leak Test Indicator* (PL-4) is turned off.
 - The *Leak Failure Count* (RG-1) is set to 0.
 - The *Low Flow Failure Count* (RG-2) is set to 0.
 - The *Leak Test Timer* (TM-1) is reset.

- The Water Master returns to **Stand-By Mode**.
- If there is a drop in pressure the Water Master:
 - Turns *Water Valve* (CV-1) on.
 - If *Flow* (FS-1) is indicated for longer than the *Surge Time* (TM-5) and within the *Surge Window Time* (TM-6):
 - The *Leak Test Indicator* (PL-4) is turned off.
 - The *Leak Test Timer* (TM-1) is reset.
 - The Water Master goes to **Water Demand Override Mode**.
 - If flow is NOT indicated for longer than the *Surge Time* (TM-5) within the *Surge Window Time* (TM-6):
 - If the *Low Flow Leak Timer* (TM-8) has expired when the pressure dropped:
 - *Leak Failure Count* (RG-1) is increased by 1.
 - If the *Leak Failure Count* (RG-1) is greater than or equal to the *Leak Failure Limit* (RG-1):
 - The *Water Valve* (CV-1) is turned off.
 - The *Leak Fault Indicator* (PL-5) is turned on.
 - The *Leak Test Indicator* (PL-4) is turned off.
 - The current state is set to leak fault.
 - The Water Master waits for the reset input.
 - If the *Leak Failure Count* (RG-1) is NOT greater than or equal to the *Leak Failure Limit* (RG-1):
 - The *Leak Test Indicator* (PL-4) is turned off.
 - The *Leak Test Timer* (TM-1) is reset.
 - The Water Master goes to **Stand-By Mode**.
 - If the *Low Flow Leak Timer* (TM-8) has NOT expired when the pressure dropped:
 - The *Low Flow Failure Count* (RG-2) is increased by 1.
 - If the *Low Flow Failure Count* (RG-2) is greater than or equal to the *Low Flow Failure Limit* (RG-2):
 - The *Water Valve* (CV-1) is turned off.
 - The *Flow Fault Indicator* (PL-3) is turned on.
 - The *Leak Fault Indicator* (PL-5) is turned on.
 - The *Leak Test Indicator* (PL-4) is turned off.
 - The current state is set to flow fault.
 - The Water Master waits for the reset input.
 - If the *Low Flow Failure Count* (RG-2) is NOT greater to or equal than the *Low Flow Failure Limit* (RG-2):
 - The *Leak Test Indicator* (PL-4) is turned off.
 - The *Leak Test Timer* (TM-1) is reset.

- The Water Master goes to **Stand-By Mode**.

Wireless Remote Response

Button	Code	Action	Description
A	PB-A	System Reset	Same as pushing the <i>Reset Button</i> (PB-1) on the front panel. If pushed while in Stand-By Mode , the Water Master will perform a leak test.
B	PB-B	Flow Override (Bypass)	If pressed while in Demand Flow Mode , the Water Master keeps the <i>Water Valve</i> (CV-1) open as long as water continues to <i>Flow</i> (FS-1). When water stops <i>Flowing</i> (FS-1), any effects of pressing the button are canceled.
C	PB-C	Vacation Mode (Shutdown)	<i>Water Valve</i> (CV-1) is forced off until the unit is reset. Both <i>Flow Guard</i> (PL-2) and <i>Leak Guard</i> (PL-4) lamps are turned on.
D	PB-D	Program Mode (Configuration Mode)	If pressed 3 times within 6 seconds while in any mode other than Power Up or Fault Modes, the Water Master will enter Program Mode. Pushing this button while in Program Mode will exit the operation and the Water Master will go back to Stand-By Mode .

Configuration Mode

- Configuration Mode is entered by pressed the D Button (PB-D) on the remote 3 times within 6 seconds in any mode except Power Up or Fault Modes.
- The *Water Valve* (CV-1) is opened and remains open for as long as the Water Master remains in Configuration Mode.
- Start the 20 minute *Configuration Timer* (TM-9). If this timer expires while still in Configuration Mode, exit.
- While in Configuration Mode, some of the front panel lamps will be continuously blinking to indicate which configuration setting is being altered:

Lamp	Code	Configuration Setting	Code
Leak Guard	PL-4	Leak Test Cycle Time (1-100 Minutes)	TM-1
Leak Fault	PL-5	Leak Test Decay Time (1-100 Minutes)	TM-2
Flow Guard	PL-2	Override Time (1-10 Hours)	TM-4
Flow Fault	PL-3	Low Flow Leak Time (1-10 Seconds)	TM-8
Leak Guard and Leak Fault	PL-4, PL-5	Leak Test Failure Threshold (1-10 Times)	RG-1
Leak Guard and Flow Fault	PL-4, PL-3	Low Flow Failures Threshold (1-10 Times)	RG-2
Flow Guard and Flow Fault	PL-2, PL-3	Surge Flow Time (1-10 Seconds)	TM-5

Flow Guard and Leak Fault	PL-2, PL-5	Surge Window Time (1-10 Seconds)	TM-6
Flow Guard and Flow Fault	PL-2, PL-3	Restore Default Values	USER
Leak Guard and Leak Fault	PL-4, PL-5		

- Pressing the *A Button* (PB-A) on the remote advances to the next configuration option.
- Pressing the *Reset Button* (PB-1) on the front panel stores a new value into the currently selected configuration option based on the current value of the front panel potentiometer or, in the case of the defaults option, stores default values into all user configurable settings.
- The indicator lights which were blinking then turn solid for 2 seconds to indicate that the value has been stored.
- The Configuration Mode can now be exited by pressing the *D Button* (PB-D) on the wireless remote.
- When exiting Configuration Mode, go to **Stand-By Mode**.

FREQUENTLY ASKED QUESTIONS

See website www.michiganaquatech.com

WARRANTY INFORMATION

2 Year Limited Warranty (Parts and Labor)

PROGRAMMING INSTRUCTIONS

Remote Button Descriptions:

Button	Action	Description
A	System Reset	Advances to the next configuration option.
B	Flow Override (Bypass)	
C	Vacation Mode (Shutdown)	All systems off, Flow Guard and Leak Guard Lamps on.
D	Program Mode (Configuration Mode)	Program, Enter and Exit Configuration Mode.

1. Select board and note the serial number to test records file.
2. Connect power cord and insert PCB into test stand, power up.
3. To load program, connect the cable to interpreter and to PCB.
4. Select program icon on desktop, control program loads.
5. To check configuration, connect cable directly to the PCB serial port.

6. Select configuration icon on desktop, configuration window appears.
7. Select Com Port 4.
8. Press connect.
9. Press retrieve values.
10. Push *D Button* (PB-D) on wireless remote 3 times within 6 seconds.
11. Push *A Button* (PB-A) on wireless remote 1 time to advance to each parameter.

Configuration Setting	Adjustable Setting	Pilot Lamp Indicator	Definition	Default
Leak Test Cycle Time	1-100 Minutes	Leak Guard	The time after each demand when a leak test begins.	20 Minutes
Leak Test Decay Time	1-100 Minutes	Leak Fault	The time allowed for a pressure drop to indicate a leak.	5 Minutes
Manual Override Time	1-10 Hours	Flow Guard	The period that the demand timer has no effect on fault trip.	2 Hours
Low Flow Rate Time	1-20 Seconds	Flow Fault	Time window for low pressure to indicate a low water flow demand.	8 Seconds
Leak Test Fail Count	1-10 Value	Leak Guard/Leak Fault	Number of times allowed for a failed leak test.	3
Low Flow Fail Count	1-10 Value	Flow Fault/Leak Guard	Number of times allowed for a low water flow demand.	3
Surge Flow Time	1-10 Seconds	Flow Guard/Flow Fault	Time required for a demand flow signal to be established.	2 Seconds
Surge Window Time	1-20 Seconds	Flow Guard/Leak Fault	Time allowed for the demand flow signal to verify flow rate.	10 Seconds
Restore Default	N/A	All Pilot Lamps On	Pressing the panel to reset restores all default settings.	Default Values

NOTE: To exit Configuration Mode, press *D Button* (PB-D) on wireless remote at any time.

(Customer) To change a value on a selected unit:

The Water Master by Michigan Aqua-Tech, Inc.

1. To enter Program Mode, push the D Button on the wireless remote 3 times within 6 seconds.
2. Leak Guard Lamp will begin to blink.
3. Select function by pressing the A Button on the wireless remote 1 time for each step of configuration sequence.
4. Verify pilot lamps are still blinking.
5. Adjust to desired value (1-10, 1-20, 1-100) using the adjustable Flow Guard Knob.
6. Send new value to the control system by pushing the system Reset Button on the front of the main panel.
7. Pilot Lamp will be on for 2 seconds showing the value has been accepted.
8. Repeat for any other adjustments.
9. Exit Program Mode by pushing the D Button on the wireless remote 1 time.
10. Value has been loaded and the Water Master will return to normal operation.