

System Operation Overview

- The MSA Control Board can electronically connect up to 5 water heaters.
- It is not recommended that different models be connected together.
- Whenever the flow rate through a water heater exceeds approximately 90% of the calculated maximum flow, another water heater is turned on.
- When multiple water heaters are operating, they will attempt to supply equal amounts of hot water.
- When multiple water heaters are operating, a water heater will turn off whenever the flow through it decreases below approximately 0.7 GPM (gallons/minute).
- The temperature setting for all of the connected water heaters is controlled by the temperature controller connected to the water heater with the Primary Communication PCB. Temperature controllers connected to the other units will provide maintenance codes for their respective units.
- The particular water heaters which turn on, is occasionally rotated among the water heaters in an MSA system and is explained in the Sequence of Operations.

Water Heater Status Indicators

Indicator lights on the MSA Control Board indicate the status of each of the water heaters as follows:

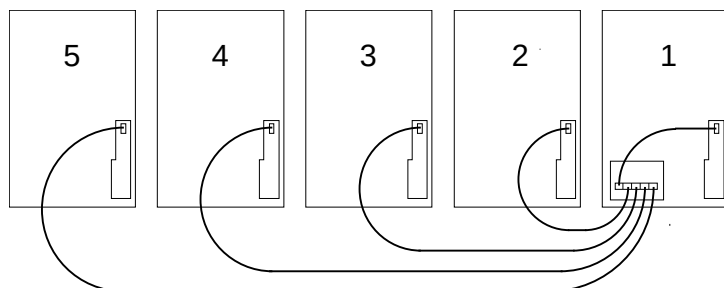
LED	Explanation
Solid	Water flow servo valve is open. When there is no water flow, up to 3 units have their servo valves open. When water flow begins, only the necessary number of water heaters will begin to fire to meet demand. Water heaters not firing will close their valves. (The "In-Use" indicator on each controller indicates whether the unit is firing.)
Flashing Slowly (1.2 sec on / 0.5 sec off)	Water flow servo valve is closed.
Flashing Quickly (0.5 sec on / 0.5 sec off)	An error is detected. (A temperature controller must be connected to this unit to read the error code. To reset the code, the power must be turned off.)
Off	No unit detected at this connection.

MSA Operation

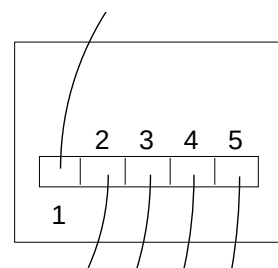
Sequence of Operation

One of the water heaters is treated as the “primary” unit regarding the order in which water heaters are turned on and off. This primary status is occasionally transferred to other water heaters. The term primary used in this context does not necessarily mean the water heater with the MSA control board.

In the diagrams below, the water heaters are numbered according to how they are connected to the MSA control board.

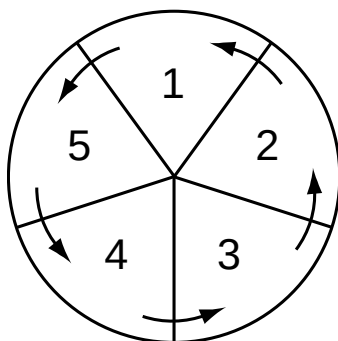


Water Heaters Electronically Connected



MSA Control Board

The circular diagram represents 5 water heaters connected to the MSA control board. The explanations and examples which follow are still applicable for fewer water heaters in an MSA group.



When there is no water flow, the primary unit and the 2 units behind it (clockwise) in the diagram have their water flow control valves open.

If the No. 5 unit is primary, water heaters No. 5, No. 1, and No. 2 have their water flow control valves open when there is no water flow. Once water flow begins and the total demand is determined, only the necessary number of water heaters will begin firing. If only 2 water heaters are needed to meet hot water demand then No. 5 and No. 1 will fire, while No. 2 will close its water flow control valve.

After startup, if flow demand increases and additional water heaters are required, then water heaters fire in the order shown (counter-clockwise from the primary unit).

Continuing the example above, No. 4 will fire next if necessary and will become the primary unit.

If flow demand decreases sufficiently after startup, then the firing unit which is the first in the diagram counter-clockwise from the primary unit will shut off.

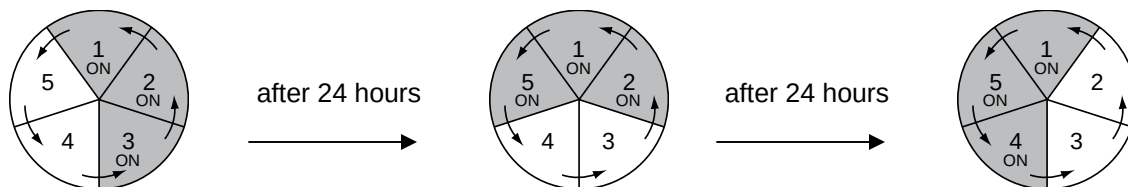
In the example, No. 1 would shut off.

MSA Operation

The following examples show how a unit becomes the primary unit and the order in which units turn on and off.

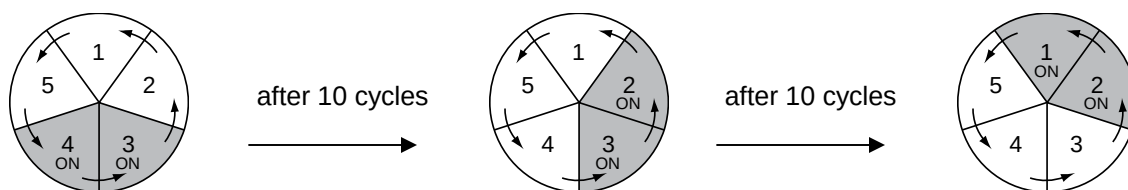
- A. If the same unit or units have been running continuously for 24 hours.

Example: Units 1, 2, and 3 have run continuously for 24 hours. No. 3 will now stop and No. 5 will fire and become the primary unit. In another 24 hours, No. 2 will stop and No. 4 will fire and become the primary unit.



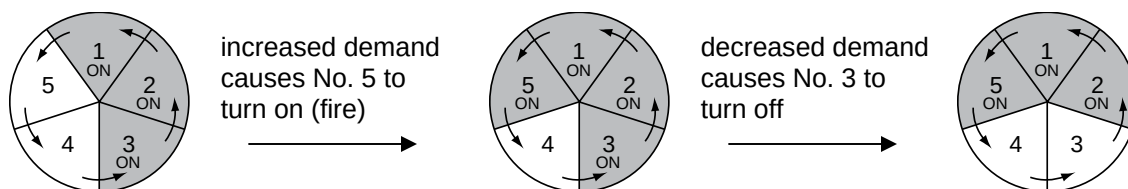
- B. After ten cycles of flow / no flow.

Example: Units 3 and 4 are turned on and off ten times without adding other units. No. 4 will now stop and No. 2 will fire and become the primary unit. After another ten cycles (of just these two, No. 2 and No. 3), No. 3 will stop and No. 1 will fire and become the primary unit.

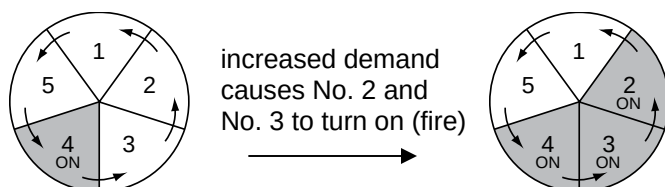


- C. If after initial flow has been established (at startup), flow increases to the point where another water heater fires to meet demand, then that additional water heater becomes the primary.

Example: Based on initial flow, units 1, 2, and 3 fire and run for a few hours at a steady flow. Demand is increased and causes No. 5 to fire and become the primary unit. If flow decreases below about 0.7 GPM at any unit, then No. 3 will shut off.



Example: Based on initial flow, only No. 4 fires. Demand is increased and causes 2 additional units to fire. No. 2 and 3 will fire. No. 2 is primary.



MSA Operation

Troubleshooting

- If a water heater in an MSA group is manually taken out of service, it needs to be disconnected from the MSA control board.
- On VA models whose name ends in “-US” (ex. REU-VA2535FFUD-US), in order for each water heater to have a temperature setting above 140°F (60°C), there are 2 options:
 - ◆ install an MCC-91 controller on each water heater. (The MCC-91 is the commercial controller that allows higher temperature.)
 - ◆ install an MCC-91 controller on the unit with the MSA control board with no controllers on the other units
- On VA models whose name ends in “-UC” (ex. REU-VA2535FFUD-UC), only one MCC-91 controller installed on the water heater with the MSA control board is required to allow all of the water heaters in the MSA group to produce temperatures higher than 140°F (60°C). The other water heaters may have current controllers such as the MC-91.
- If an MC-45 controller is installed on the water heater with the MSA control board, any water heaters with a BC-45 may not produce the same temperature set on the MC-45. The temperature displayed on each controller is the output temperature that each water heater is producing. The largest difference will be seen when the MC-45 is set to 140°F (60°C) and the BC-45 will produce a maximum 120°F (49°C). (Disconnecting the BC-45 on the other units would allow them to match the temperature setting on the MC-45.)
- Units that register error codes will be commanded to close their water flow servo valve and taken out of operation automatically. The MSA system will fire other units (if available) if required.
- Error codes on a unit in an MSA group will not reset when the water flow is stopped. Power to the unit or to the MSA control board will have to be reset.