

Terracotta Irrigation Controller for Latching Solenoids User Manual

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1. Introduction

The Terracotta Irrigation Controller for Latching Solenoids is suitable for automatic sprinkler irrigation or drip irrigation. The Terracotta Irrigation Controller for Latching Solenoids includes a valve that operates with water supply pressure in the range 10 kPa to 800 kPa. The interval between irrigation events responds automatically to the on-site prevailing weather conditions (namely, evaporation and rainfall).

All the power required is provided by a small 9 volt battery inside the control box.

Terracotta is porous and so the water level in the pot falls as water seeps through the pot. A float inside the pot floats on the water. When the water level reaches the low level, a magnet inside the float activates the valve so that the valve opens, water rises up the vertical tube, the float switch opens, the latching solenoid valve opens and the irrigation starts. During the irrigation event a control dripper drips water into the pot and the water level rises. When the water level reaches the high level, the magnet inside the float disengages from the valve so that the valve closes, water drains from the vertical tube, the float switch closes, the latching solenoid valve closes and the irrigation stops.



Float and the water level



Float showing the ring magnet at the bottom of the float



Drain valve and white valve with 15mm inlet and outlet

Conventional drip irrigation systems control the volume of water discharged by a dripper by using PC (pressure compensating) drippers to control the flow rate and an irrigation controller to control the time. In a domestic garden with mains water supply, many zones are usually required to ensure that the pressure in each zone does not fall below the lower limit for pressure compensation. The irrigation controller is programmed so that each zone is irrigated at a different time.

With identical NPC drippers (including the control dripper) at approximately the same level and negligible variations in the pressure within the zone due to frictional head loss, the Terracotta Irrigation Controller for Latching Solenoids ensures that the volume of water discharged by each dripper during the irrigation event is approximately the same regardless of the pressure. If the water supply pressure decreases, the flow rate of the NPC drippers also decreases. However, the duration of the irrigation event increases automatically to ensure that the control volume of water is discharged by each dripper. For domestic gardens on level ground, the irrigation system can usually be designed so that variations in pressure within the zone due to frictional head loss are negligible.

By using the Terracotta Irrigation Controller for Latching Solenoids in this way, many zones with PC drippers can be combined into a single zone with NPC drippers and a single controller, and so the cost of the irrigation system can be reduced dramatically.

2. Key features of the Terracotta Irrigation Controller for Latching Solenoids

1. Use for any size irrigation application with any size latching solenoid valve
2. The power supply is a small 9 volt lithium battery inside the control box
3. Water supply pressure 10 kPa to 800 kPa
4. Use for sprinkler irrigation or drip irrigation
5. Use for gravity feed or pressurised irrigation
6. Use with PC (pressure compensating) drippers or NPC (non pressure compensating) drippers
7. Adjust the water usage rate by adjusting the control dripper
8. Adjust the interval between irrigation events by adjusting the float
9. Responds automatically to on-site evaporation and rainfall
10. The irrigation frequency increases significantly during a heat wave
11. The booster allows the control volume to be set to any value between 720 ml and 1520 ml
12. If the adjustable control dripper is replaced by one of the irrigation drippers, then each dripper in the irrigation application will deliver the control volume during the irrigation event
13. If the adjustable control dripper is replaced by two of the irrigation drippers, then each dripper in the irrigation application will deliver half the control volume during the irrigation event
14. The booster allows the interval between irrigation events to be adjusted by adjusting the exposed surface area of the polyester cloth
15. Provided the same drippers are used throughout the irrigation application (including the control dripper), the dripper discharge is independent of the water supply pressure
16. Irrigate directly from a rainwater tank without using a pump
17. Water in the terracotta pot and the booster is protected from debris, algae, mosquitoes and thirsty animals
18. Simple and low tech, and therefore fewer things can go wrong
19. Leave your irrigation application unattended for months on end

3. Installing the Terracotta Irrigation Controller for Latching Solenoids

- Step 1 Position the Terracotta Irrigation Controller in a suitable location in your garden so that the evaporation at the controller matches the evaporation at your plants.
- Step 2. Connect a water supply to the Terracotta Irrigation Controller and the latching solenoid valve (not provided). The water pressure for the Terracotta Irrigation Controller should be at least 10 kPa during the irrigation event.
- Step 3. Connect the adjustable control dripper to the irrigation zone so that it drips water into the terracotta saucer during the irrigation event.
- Step 4. The control box has 4 colour-coded wires that need to be connected to the latching solenoid and the float switch.



Control box

Connect the **yellow** wire to one of the wires from the float switch inside the Terracotta Irrigation Controller.

Connect the **white** wire to the other wire from the float switch.

Connect the **blue** wire to the red wire from the latching solenoid.

Connect the **green** wire to the black wire from the latching solenoid.

If there are 2 latching solenoid valves, connect the second latching solenoid in parallel with the first latching solenoid.

- Step 5 If you are using the booster, replace the adjustable control dripper by one or more of the irrigation drippers.

4. How to use the Terracotta Irrigation Controller for Latching Solenoids

Move the switch on the control box to the ON Auto position and turn on the water supply. The irrigation should start immediately. The control dripper drips water into the terracotta pot during the irrigation. The irrigation stops automatically after the **control volume** of water has dripped into the pot. The control volume is also the volume of water that seeps through the terracotta pot between irrigation events.

The irrigation starts again automatically after the control volume of water has seeped through the pot. The cycle continues indefinitely and so you can leave your garden unattended for months on end. A saucer sits on top of the pot so that the water in the pot is protected from algae, mosquitoes and thirsty animals. There are 6 small drain holes in the saucer.

When using a conventional irrigation controller, you need to set the start time and the end time for each irrigation event. However, with the Terracotta Irrigation Controller for Latching Solenoids you don't need a timer. The duration of the irrigation event is simply the time it takes for the control volume of water to drip into the pot.

The control dripper provided is adjustable. If you reduce the flow rate of the control dripper, it takes a lot longer for the control volume of water to drip into the pot and so the duration of the irrigation event increases and your plants get more water. On the other hand, if you increase the flow rate of the control dripper, the control volume of water drips into the pot more quickly and so the duration of the irrigation event decreases and your plants get less water. Adjust the control dripper so that the irrigation delivers the appropriate amount of water to your plants at their current stage of growth.



The control dripper is adjustable.

The time it takes for the control volume of water to seep through the pot depends on the prevailing on-site weather conditions. When it is hot and dry, the water seeps more quickly and so the interval between irrigation events is shorter. When it is cool and overcast, the water seeps more slowly and so the interval between irrigation events is longer.

If it rains, rainwater collects in the saucer and drains into the pot. This means that the start of the next irrigation event is delayed. In addition to the control volume of water that needs to seep through the pot between irrigation events, any rainwater that has entered the pot between irrigation events also needs to seep through the pot.

To avoid irrigating during the heat of the day, you can turn off the water supply. Alternatively, a tap timer can be used so that water is only available between sunset and sunrise.

The Terracotta Irrigation Controller for Latching Solenoids uses on-site weather data (namely, evaporation and rainfall). Most smart irrigation controllers do not use on-site weather data. Instead they use weather data from the Bureau of Meteorology.

The Terracotta Irrigation Controller can be used for both gravity feed and pressurised irrigation. It can be used with pressure compensating drippers and non pressure compensating drippers. It can also be used with weeper hose or soaker hose.

You can irrigate directly from a rainwater tank by gravity feed without using a pump provided that the water level in the tank is at least 1 metre higher than the valve at the bottom of the Terracotta Irrigation Controller.

It is recommended that you adjust the interval between irrigation events before adjusting the water usage rate. You may need to adjust the interval between irrigation events and the water usage rate as the plants grow and their water requirements change.

Note that the term **water usage rate** refers to the number of litres per week used by the irrigation system.

How to adjust the interval between irrigation events

You can adjust the interval between irrigation events by adjusting the gap between the upper and lower floats. The interval between irrigation events is the time it takes for the control volume of water to seep through the porous terracotta pot. To adjust the gap by 4 mm, rotate the upper float by two and a quarter turns.

Adjusting the interval between irrigation events does not change the water usage rate. For example, if you increase the interval between irrigation events by increasing the gap between the upper and lower floats, the amount of water used during the irrigation event increases automatically to ensure that the water usage rate remains the same.

The following table shows the control volume for various values of the gap between the upper and lower floats.



To adjust the interval between irrigation events, adjust the gap between the upper and lower floats

gap between the upper and lower floats	control volume
zero gap	105 ml
4 mm	141 ml
8 mm	177 ml
12 mm	214 ml
16 mm	250 ml
20 mm	286 ml
24 mm	322 ml
28 mm	359 ml
32 mm	395 ml

Table 1. Control volume for various gaps between the upper and lower floats

The gap between the upper and lower floats should be chosen so that the next irrigation event starts when there is no further soil moisture available to the plants. Soil moisture sensors or probes may be used to determine the soil moisture profile.

How to adjust the water usage rate

Position an empty measuring container under one of the drippers so that water drips into the container during the irrigation event. At the end of the irrigation event check the amount of water in the measuring container. You should also check the moisture in the soil.

If your plants are not getting enough water, reduce the flow rate of the control dripper. Reducing the flow rate of the control dripper increases the duration of the irrigation event and so your plants get more water. If your plants are getting too much water, increase the flow rate of the control dripper.

Adjusting the water usage rate does not affect the interval between irrigation events.

4. Booster

The booster can be connected to the drain valve on the terracotta pot so that the water level in the booster is the same as the water level in the terracotta pot. By using the booster, the control volume can be set to any value between 720 ml and 1520 ml (see Table 2). A polyester cloth is provided to wick water from inside the booster to outside the booster to evaporate. Make sure that the polyester cloth is wet at all times. The interval between irrigation events is determined by how quickly water evaporates from the booster via the polyester cloth. In addition to adjusting the float, the interval between irrigation events can also be adjusted by exposing more or less of the polyester cloth outside the booster. The lid on the booster protects the water in the booster from debris, algae, mosquitoes and thirsty animals.



Booster



Booster connected to the drain valve on the terracotta pot



Adjust the interval between irrigation events by adjusting the exposed surface area of polyester cloth

gap between the upper and lower floats	control volume using the booster
zero gap	720 ml
4 mm	820 ml
8 mm	920 ml
12 mm	1020 ml
16 mm	1120 ml
20 mm	1220 ml
24 mm	1320 ml
28 mm	1420 ml
32 mm	1520 ml

Table 2. Control volume using the booster for various gaps between the upper and lower floats

If the adjustable control dripper is replaced by one of the irrigation drippers, then each dripper in the irrigation application will deliver the control volume during the irrigation event (assuming that frictional head loss is negligible). A major advantage of using an irrigation dripper as the control dripper is that the dripper discharge can be set to any value between 720 and 1520 ml and the dripper discharge is independent of pressure (this is not the case for the adjustable control dripper). For example, if the water source is a header tank and the gap between the upper and lower floats is set to 16 mm, then each dripper will discharge 1120 ml during the irrigation event, regardless of the water level in the tank. The interval between irrigation events can be decreased by exposing more of the polyester cloth.

Table 3 shows the volume of water discharged by each irrigation dripper for various choices for the control dripper and various choices for the gap between the upper and lower floats. It is assumed that the same drippers are used throughout the irrigation application, that all drippers are at the same level, and that frictional head loss is negligible.

gap between the upper and lower floats	dripper discharge when the control dripper is one irrigation dripper	dripper discharge when the control dripper is two irrigation drippers	dripper discharge when the control dripper is three irrigation drippers	dripper discharge when the control dripper is four irrigation drippers
zero gap	720 ml	360 ml	240 ml	180 ml
4 mm	820 ml	410 ml	273 ml	205 ml
8 mm	920 ml	460 ml	307 ml	230 ml
12 mm	1020 ml	510 ml	340 ml	255 ml
16 mm	1120 ml	560 ml	373 ml	290 ml
20 mm	1220 ml	610 ml	407 ml	305 ml
24 mm	1320 ml	660 ml	440 ml	330 ml
28 mm	1420 ml	710 ml	473 ml	355 ml
32 mm	1520 ml	760 ml	507 ml	380 ml

Table 3. Volume of water discharged by each irrigation dripper for various choices for the control dripper and various choices for the gap between the upper and lower floats

6. Conclusion

The Terracotta Irrigation Controller for Latching Solenoids uses a radically different approach to irrigation scheduling called Measured Irrigation. See the Measured Irrigation website for more information:

www.measuredirrigation.com.au

Conventional irrigation systems **indirectly** control the volume of water discharged by a dripper by using PC drippers to control the flow rate and an irrigation controller to control the time. However, Measured Irrigation **directly** controls the volume of water discharged by a dripper, rather than controlling the flow rate and the time. Because it is no longer necessary to control the flow rate, one can use NPC drippers as well as PC drippers.

NPC drippers can be used with any water supply pressure in the range 10 kPa to 800 kPa.

The Terracotta Irrigation Controller for Latching Solenoids uses on-site weather information rather than information from the Bureau of Meteorology, and so it is ideal for greenhouse applications.

If you are using pressurised irrigation with pressure compensating drippers, the following items are required.

- Pump for the rainwater tank
- Additional solenoid valves (one needed for each additional zone)
- Conventional irrigation controller
- Hose clamps

None of these items are required when you use the Terracotta Irrigation Controller for Latching Solenoids, and so the cost of installing and running the irrigation systems can be reduced dramatically.

The Terracotta Irrigation Controller for Latching Solenoids is a game-changer for automated irrigation on level ground from a rainwater tank.