

Automatic Gravity Feed Drip Irrigation from a Rainwater Tank or Farm Pond

Dr Bernie Omodei
Measured Irrigation
5/50 Harvey Street East, Woodville Park SA 5011
Mobile 0403 935277
Email bomodei@measuredirrigation.com.au
Website www.measuredirrigation.com.au

December 2024



Unpowered Terracotta Irrigation Controller



Unpowered Drip Irrigation Clay Pot Controller

Contents

1.	Introduction	page 2
2.	Installation of a DIY Part Fill Valve	page 3
3.	Installation of the drippers	page 4
4.	Installation of an Unpowered Terracotta Irrigation Controller	page 5
5.	How to use an Unpowered Terracotta Irrigation Controller	page 6
6.	Installation of an Unpowered Drip Irrigation Clay Pot Controller	page 8
7.	How to use an Unpowered Drip Irrigation Clay Pot Controller	page 10
8.	Choosing between the Unpowered Terracotta Irrigation Controller and the Unpowered Dip Irrigation Clay Pot Controller	page 10
9.	Installation of a header tank	page 11
10.	Comparison between automatic gravity feed drip irrigation from a rainwater tank and automatic pressurised drip irrigation from a rainwater tank	page 11

1. Introduction

This article addresses the question of how to water your garden using gravity feed drip irrigation from a rainwater tank when you are away from the garden for months on end.

If you use a conventional programmed irrigation controller with gravity feed irrigation, the dripper discharge will vary as the water level in the tank changes. This is not the case with measured irrigation.

A second problem with using a rainwater tank is that the tank may run dry when you are on holidays. If you have access to mains water, this problem can be solved by connecting a part fill valve to your tank.

If your tank is at ground level, the water pressure may be inadequate when the tank is almost empty. The convention solution to the problem is to use a pump. However, a suitable pump may be expensive and there will be ongoing costs for power. A less expensive approach is to use a small header tank and to use a small inexpensive solar-powered transfer pump to slowly refill the header tank between irrigation events.

This article demonstrates that automatic gravity feed drip irrigation from a rainwater tank or a farm pond does not require access to mains power or batteries. Details are provided for two unpowered controllers, namely, the Unpowered Terracotta Irrigation Controller and the Unpowered Drip Irrigation Clay Pot Controller.

2. Installation of a DIY Part Fill Valve

1. Place the valve next to the tank so that the bottom of the valve is at the same level as the bottom of the tank.



2. Connect the valve inlet to the mains water supply.



3. Connect the valve outlet (barbed) to the tank inlet.

4. Connect the barbed elbow to the tank outlet so that water can flow from the tank to the valve.



5. If there is no vacuum breaker on top of the valve, connect a length of 13mm polypipe to the barb on top of the valve. The top of the polypipe should be higher than the inlet to the tank.



When the water level in the rainwater tank has fallen below 7 cm, mains water will start filling the tank until the water level reaches 10 cm. The water level cycles between 7 cm and 10 cm until it rains and the tank start filling with rainwater.

Having installed the DIY Part Fill Valve, you are now ready to use the rainwater tank to automatically water your garden when you are away from your garden for months on end.

The [DIY Part Fill Valve](#) can be purchased at the Measured Irrigation website.

3. Installation of the drippers

For gravity feed drip irrigation, the flow rate from the dripper will be less than the flow rate for pressurised irrigation. Hence the diameter of the wetted area around the dripper may be quite small,

If you are using dripline with 30cm spacing between the dripper, place a 30cm wide strip of polyester fabric under the dripline to increase the diameter of the wetted area. If you are using online drippers, place a 30cm x 30cm piece of polyester fabric under each dripper. The dripline or drippers will saturate the polyester fabric and increase the size of the wetted area.

Reusable Plant Towels are an alternative to polyester fabric.



Polyester fabric starting to wet



30cm x 30cm wetted polyester fabric



80cm x 80cm wetted polyester fabric



Dry polyester fabric under dripline



Polyester fabric starting to wet under dripper



30cm strip of wetted polyester fabric



Reusable plant towels starting to wet under dripline



Wetted reusable plant towels under dripline

It is recommended that you use mulch to minimise evaporation from the polyester fabric or the reusable plant towels.

Polyester Interlock Fabric is available from Spotlight @ \$4.80 per m².

4. Installation of an Unpowered Terracotta Irrigation Controller

Position the Unpowered Terracotta Irrigation Controller in a suitable location in your garden so that the evaporation matches the evaporation at your plants.

Connect the water supply to the valve inlet and connect the irrigation application to the valve outlet (note that an arrow under the valve indicates the direction of flow).

Connect the control dripper to the irrigation application. Place the terracotta saucer on the terracotta pot so that the control dripper drips water into the pot. The control dripper should be at the same level as the irrigation drippers in your application.



Connect the water supply to the valve inlet



Connect the irrigation application to the valve outlet



Place the terracotta saucer on the terracotta pot so that the control dripper drips water into the pot

5. How to use the Unpowered Terracotta Irrigation Controller

Turn on the water supply and the irrigation starts immediately. The control dripper drips water into the terracotta pot during the irrigation. The **control volume** is defined as the volume of water that drips into the pot during the irrigation event. 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 plot unattended for weeks 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 Unpowered Terracotta Irrigation Controller you don't need a timer. The duration of the irrigation event is the time it takes for the control volume of water to drip into the pot, and the interval between irrigation events is the time it takes for the control volume of water to seep through the terracotta pot.

It is important to note here that the control dripper 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 Unpowered Terracotta Irrigation Controller 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 nearest weather station.

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.

The dripper discharge during the irrigation event is independent of the water level in the tank.

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

The Unpowered Terracotta Irrigation Controller can deliver water to 400 unregulated 2 L/H (at 100 kPa) drippers. If more than 400 drippers are required, then you may need more than one Unpowered Terracotta Irrigation Controller.

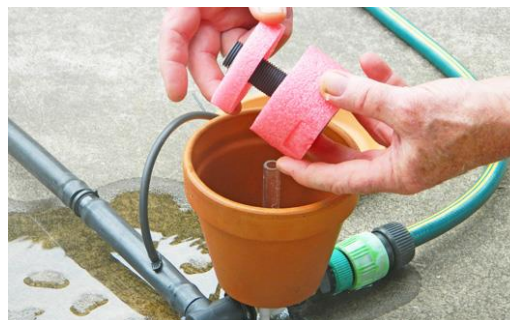
The [Unpowered Terracotta Irrigation Controller](#) can be purchased at the Measured Irrigation website.

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 decrease 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 (litres per week for example) 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

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.

6. Installation of an Unpowered Drip Irrigation Clay Pot Controller

- 1 Select a drip irrigation zone where all the plants in the zone have the same irrigation requirement.
- 2 Select a typical dripper and replace it with a subsurface clay pot.



- 3 Connect the clay pot to the controller.



- 4 Connect a dripper inside the controller.



- 5 Connect the water supply for the zone to the inlet of the controller (between 10 kPa and 800 kPa).



6 Connect the irrigation zone to the outlet of the controller.



7 Fill the controller with water until the float is partially covered.



8 Turn on the water supply and all the plants will be watered automatically without power.

7. How to use an Unpowered Drip Irrigation Clay Pot Controller

The Unpowered Drip Irrigation Clay Pot Controller allows you to automatically irrigate your garden using gravity feed from an elevated rainwater tank without using a pump and without power.

The controller can be used for surface and subsurface irrigation using either non pressure compensating (NPC) drippers or pressure compensating (PC) drippers.

Using PC drippers on sloping land or NPC drippers on flat land, the interval between irrigation events adjusts automatically to ensure that the discharge from each dripper during an irrigation event is the same as the on-demand discharge from the subsurface clay pot since the previous irrigation event.

If more than one dripper is dedicated to each plant, then you may wish to replace the dedicated drippers by the corresponding subsurface clay pots. The number of drippers inside the controller should be the same as the number of subsurface clay pots. In this case the discharge from each dripper during an irrigation event is the same as the average on-demand discharge from the subsurface clay pots since the previous irrigation event.

If you decide that your plants are not receiving sufficient water, you can increase the water usage slightly by opening the lid of the controller.

8. Choosing between the Unpowered Terracotta Irrigation Controller and the Unpowered Drip Irrigation Clay Pot Controller

Note that the Unpowered Drip Irrigation Clay Pot Controller is more expensive and more time-consuming to install than the Unpowered Terracotta Irrigation Controller. Use the following table to decide between the two controllers.

Unpowered Terracotta Irrigation Controller	Unpowered Drip Irrigation Clay Pot Controller
Plants in the zone may have different irrigation requirements	All plants in the zone should have the same irrigation requirements
Adjust the water usage rate by adjusting the control dripper	The water usage is controlled by the demand from the plants
Adjust the interval between irrigation events by adjusting the float	The discharge from each dripper during an irrigation event is the same as the on-demand discharge from the subsurface clay pot since the previous irrigation event
Responds automatically to on-site evaporation and rainfall	As the water needed by your plants changes as the plants grow, the discharge from each dripper during the irrigation event adjusts accordingly

9. Installation of a header tank

If you are using a rainwater tank is at ground level, the water pressure may be inadequate when the tank is almost empty. The convention solution to the problem is to use a pump. However, a suitable pump may be expensive and there will be ongoing costs for power. A less expensive approach is to use a small header tank and to use a small solar-powered transfer pump to slowly refill the header tank between irrigation events. If you have a farm pond, use a small header tank and to use a small solar-powered transfer pump to slowly refill the header tank between irrigation events.

To have enough pressure to operate the Unpowered Terracotta Irrigation Controller, the bottom of the header tank should be at least 1 metre higher than your garden.

A very cheap header tank may simply be a modified 240 litre wheelie bin mounted on a 1 metre high bench. Another cheap option is to use a 1000 litre IBC (Intermediate Bulk Container) mounted on another IBC. The bottom IBC is just a stand and so the plastic part can be damaged.

A suitable small solar-powered transfer [pump](#) is available from the Measured Irrigation website. This is a 12 volt 19 watt pump and it can be operated directly from a 20 watt solar panel (no battery required)

1. Connect the pump to the rainwater tank.
2. Connect the solar panel directly to the pump. The pump will operate whenever there is enough sunlight on the solar panel.
3. Connect the outlet on the pump to the inlet on the header tank.
4. Connect the overflow from the header tank to the inlet on the rainwater tank.

If you have a farm pond with a depth of 4 metres, you should use 2 pumps connected in series to transfer water to the header tank. In this case. a 40 watt solar panel can be connected directly to the pumps,

10. Comparison between automatic gravity feed drip irrigation from a rainwater tank and automatic pressurised drip irrigation from a rainwater tank

The conventional method for drip irrigation of a garden using a rainwater tank is to use a pump to deliver water to regulated (pressure compensating) drippers. Reliable soil moisture sensors are very expensive and so we restrict our attention to weather-based irrigation controllers.

Automatic gravity feed drip irrigation from a rainwater tank or farm pond	Automatic pressurised drip irrigation from a rainwater tank or farm pond
Uses unregulated drippers	Uses regulated drippers (more expensive)
If the rainwater tank is less than a metre higher than the garden, a header tank is required	No header tank required
If the rainwater tank is less than a metre higher than the garden, a 19 watt pump is needed to fill the header tank	For 400 2 L/H regulated drippers, the pump must be at least 800 watts
Uses an Unpowered Terracotta Irrigation Controller or an Unpowered Drip Irrigation Clay Pot Controller	Uses a conventional irrigation controller (programmable)
The irrigation controller includes the valve	A solenoid valve is required
A 20 watt solar panel can power the pump	Mains power is needed to power the pump, the irrigation controller and the solenoid valve
Responds automatically to onsite evaporation and rainfall	Does not respond to onsite evaporation. Uses evapotranspiration data from the Bureau of Meteorology
Hose clamps are not needed	Hose clamps are needed