

# Automatic Gravity Feed Drip Irrigation from a Rainwater Tank

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Unpowered Terracotta Irrigation Controller

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## **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 on holidays.

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 a problem 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 transfer pump to slowly refill the header tank between irrigation events.

For gravity feed drip irrigation you need to use unregulated (non-pressure compensating) drippers.

## 2. Installation of a DIY Part Fill Valve

1. Place the valve next to the tank so that the bottom of the valve



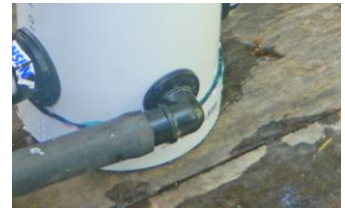
2. Connect the valve inlet to the mains water supply.



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 go on holidays.

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

### 3. 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

## 4. 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.

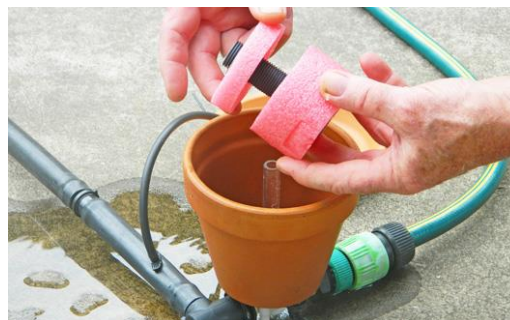


## How to adjust the interval between irrigation events

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.

## 5. Installation of a header 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 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 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 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.

## 6. 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.

| <b>Automatic gravity feed drip irrigation from a rainwater tank</b>   | <b>Automatic pressurised drip irrigation from a rainwater tank</b>                                  |
|---|---|
| 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                               |
| For 400 2 L/H unregulated drippers, a single Unpowered Terracotta Irrigation Controller is required                 | 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 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  |