

Automation Kit for Farm Pond Irrigation

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Unpowered Terracotta Valve

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1. Introduction to the Automation Kit for Farm Pond Irrigation

The Automation Kit for Farm Pond Irrigation is for smallholders with a farm pond or dam and gravity feed drip irrigation from a header tank. Water is pumped automatically from the farm pond to the header tank and your small farm is irrigated automatically by an Unpowered Terracotta Valve. You can leave your farm unattended for weeks on end, and so you can become involved in other activities away from the farm; for example, travelling to the market to sell your produce.

The Automation Kit for Farm Pond Irrigation can be purchased online at the Measured Irrigation website.

It is assumed that the bottom of the farm pond is no more than 4 metres lower than the irrigation drippers. The water supply pressure from the header tank should be at least 1 metre head.



Farm pond in Kenya for gravity feed drip irrigation

The Kit includes an Unpowered Terracotta Valve with a half inch inlet and outlet to supply water to approximately 400 non-pressure compensating (NPC) drippers on flat land (assuming that each dripper has a flow rate of 2 L/H at 100 kPa). If your farm requires more than 400 drippers, you can subdivide your farm into zones with up to 400 drippers per zone (each zone has a separate Unpowered Terracotta Valve). The Unpowered Terracotta Valve can be purchased online from the Measured Irrigation website. Alternatively, if you have a large irrigation application, you can use an Unpowered Wicking Valve with a one inch inlet and outlet.

2. Contents of the Automation Kit for Farm Pond Irrigation

As well as the User Manual, the kit includes the following two components:



Unpowered Terracotta Valve



Double pump (two 19 watt pumps connected in series) with an inlet filter, fittings to connect to 19 mm poly pipe, and 9 metres of waterproof electrical cable

You will need to purchase a 40 watt solar panel to connect directly to the pump (no battery required)

3. Instructions for installing the Automation Kit for Farm Pond Irrigation

Step 1. Connect the pump.

Remove the header tank inlet pipe from the farm pond and connect it to the outlet from the pump.



Step 2. Purchase and install a solar panel (not in kit).

A 12 volt 40 watt solar panel should provide all the power required.



Solar panel mounted on a pole

Step 3. Connect the pump to the solar panel.

Connect the yellow (+) wire from the pump to the yellow (+) wire from the pump.
Connect the black (-) wire from the pump to the black (-) wire from the pump.

Because the pump is connected directly to the solar panel, the pump operates whenever there is sufficient sunlight on the solar panel. You may stop the pump at any time by installing a switch between the solar panel and the pump. Alternatively, you may adjust the solar panel so that there is insufficient sunlight to operate the pump.

Step 4. Connect a pipe to the overflow outlet on the header tank so that the overflow is returned to the farm pond.

Step 6. Submerge the pump in the farm pond

The pump inlet should be at least 15cm above the bottom of the pond to avoid pumping sediment from the bottom of the pond and clogging the inlet filter. If clogging of the filter becomes a problem, you may wish to install a larger filter.

The two pumps provided in the kit are connected in series. If the top of the header tank is less than 3.5 metres higher than the water level in the farm pond, then the flow rate of the pumps may be increased by connecting the two pumps in parallel rather than in series.

Step 7. Installation of the Unpowered Terracotta Valve

Position the Unpowered Terracotta Valve in a suitable location at your farm so that the evaporation matches the evaporation at your plants.

Connect the water supply from the header tank to the inlet pipe and connect the irrigation application to the outlet pipe (note that the control dripper is connected to the outlet pipe).



Connect the water supply to the inlet



Connect the irrigation application to the outlet

4. How to use the Unpowered Terracotta Valve

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 Valve 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 Valve 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.

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 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.



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

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

gap between the upper and lower floats	control volume
zero gap	110 ml
4 mm	144 ml
8 mm	179 ml
12 mm	213 ml
16 mm	247 ml
20 mm	282 ml
24 mm	316 ml
28 mm	350 ml
32 mm	385 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. Troubleshooting

Problem	Possible cause	Solution
Pump has low power	<p>Insufficient sunlight on the solar panel</p> <p>One of the pumps in the double pump has become faulty</p> <p>The pump inlet filter has become clogged</p>	<p>Wait for a sunny day</p> <p>Replace the faulty pump (available online from the Measured Irrigation website: https://www.measuredirrigation.com/product-page/12-volt-14-watt-submersible-pump).</p> <p>Clean the pump filter or replace the filter with a larger filter.</p>
Terracotta pot is dry and the irrigation is no starting	<p>Water supply has been turned off</p> <p>The control dripper is not dripping water into the pot</p> <p>The magnet at the bottom of the float is not opening the valve</p>	<p>Turn on the water supply.</p> <p>Clean the control dripper and position it so that it drips into the pot via the saucer.</p> <p>Push the terracotta pot onto the valve so that the valve opens.</p>
Terracotta pot is overflowing and the irrigation is not stopping	<p>Insufficient space between the top of the float and the bottom of the saucer to allow the magnet to disengage from the valve</p>	<p>Increase the space between the top of the float and the bottom of the saucer by adjusting the upper float. Alternatively, the saucer may be removed.</p>
Some drippers are not working	<p>The pressure at the drippers is too low</p>	<p>Increase the pressure at the drippers by removing some drippers or raising the header tank. Alternatively, you may need to create another zone with a separate Unpowered Terracotta Valve.</p>