

# Unpowered Wicking Irrigation Controller

## User Manual

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## 1. Introduction

It is recommended that you watch the YouTube video Unpowered Wicking Irrigation Controller: <https://www.youtube.com/watch?v=A90f5aAxvHA???>

The Unpowered Wicking Irrigation Controller is suitable for automatic sprinkler irrigation or drip irrigation. The valve inside the controller 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).

Polyester fabric wicks water from inside the polypropylene container to the outside to evaporate. When the water level reaches the low level, a magnet inside a float activates the valve so that the valve opens and the irrigation starts. During the irrigation event a control dripper drips water into the container via holes in the lid 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 and the irrigation stops.



Unpowered Wicking Irrigation Controller showing the float and the water level



Float showing the ring magnet at the bottom of the float

This remarkable invention may enable poor smallholders in remote locations to grow higher-valued crops cost-effectively.

If the flow rate through the valve is inadequate, you may wish to subdivide the irrigation application into zones with a Unpowered Wicking Irrigation Controller for each zone.

A clear acrylic tube is connected to the valve is quite fragile, so be very careful not to break it.

The **control volume** is the volume of water that drips into the container during the irrigation event. It is also the volume of water that evaporates from the container between irrigation events. By adjusting the float, the control volume may be set to any value between 600 ml and 1260 ml.

With identical 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 Unpowered Wicking Irrigation Controller ensures that the control volume of water discharged by each dripper during the irrigation event regardless of the water supply pressure. If the water supply pressure decreases, the flow rate of the 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 a Unpowered Wicking Irrigation Controller in this way, many zones with pressure compensating drippers can be combined into a single zone with non pressure compensating drippers, and so the cost of the irrigation system can be reduced dramatically.

## 2. Installation of the Unpowered Wicking Irrigation Controller

Step 1. Position the controller in a suitable location in your garden so that the evaporation matches the evaporation at your plants.

Step 2. Connect the water supply to the controller inlet and connect the irrigation application to the controller outlet.



Connect the water supply to the controller inlet



Connect the irrigation application to the controller inlet

Step 3. The control dripper should be positioned so that it drips water into the plastic container during the irrigation event.



Position the control dripper so that it drips water into the container



The control dripper may be one or two irrigation drippers

Step 3. Make sure that the polyester fabric is wet.

Step 4. Use the rubber band provided to secure the lid so that it doesn't move when the float jumps up at the end of the irrigation event.

### 3. How to use the Unpowered Irrigation Controller

Turn on the water supply and the irrigation starts immediately. The control dripper drips water into the plastic container during the irrigation event.

The irrigation stops automatically when the control volume of water has dripped into the container. The irrigation starts again automatically after the control volume of water has evaporated from the container via the polyester fabric. The cycle continues indefinitely and so you can leave your garden unattended for months on end. A lid ensures that the water in the container is protected from algae, mosquitoes and thirsty animals. There are small drain holes in the lid.

When using a conventional irrigation controller, you need to set the start time and the run time for each irrigation event. However, with the Unpowered Wicking 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 container, and the interval between irrigation events is the time it takes for the control volume of water to evaporate.

If the control dripper is the adjustable control dripper, you can increase the emitter discharge (sprinkler or dripper) by reducing the flow rate of the control dripper. On the other hand, you can reduce the emitter discharge by increasing the flow rate of the control dripper. Adjust the control dripper so that the irrigation delivers the appropriate amount of water to your plants at their current stage of growth.



The adjustable control dripper

If the control dripper is an irrigation dripper, the control volume of water is discharged by each dripper during the irrigation event. By adjusting the gap between the upper and lower floats, the control volume can be set to any value between 600 ml and 1260 ml. With one or two irrigation drippers as the control dripper, Table 1 shows the dripper discharge for various gaps between the upper and lower floats. The dripper discharge is independent of the water supply pressure.



Irrigation dripper as the control dripper

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
zero gap	600 ml	300 ml
4 mm	682 ml	341 ml
8 mm	765 ml	382 ml
12 mm	847 ml	423 ml
16 mm	929 ml	464 ml
20 mm	1011 ml	505 ml
24 mm	1094 ml	547 ml
28 mm	1177 ml	588 ml
32 mm	1260 ml	630 ml

Table 1. Dripper discharge for various gaps between the upper and lower floats, using one or two irrigation drippers as the control dripper.

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

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

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 polyester fabric should always be wet and so it needs to be washed and dried regularly.

The Unpowered Wicking 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 Bureau of Meteorology.

The controller can be used for both gravity feed and pressurised irrigation. It can be used with sprinklers, drippers, weeper hose and 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 inside the controller.

### **How to adjust the interval between irrigation events**

You can adjust the interval between irrigation events by adjusting the surface area of exposed fabric. gap between the upper and lower floats. To increase the interval between irrigation events, reduce the surface area of exposed fabric. To reduce the interval between irrigation events, increase the surface area of exposed fabric.



To increase the interval between irrigation events, reduce the surface area of exposed fabric



To reduce the interval between irrigation events, increase the surface area of exposed fabric

#### 4. Key features of the Unpowered Irrigation Controller

1. Unpowered (no batteries, no solar panels, no electronics, no computers)
2. Water supply pressure 10 kPa to 800 kPa
3. Use for sprinkler irrigation or drip irrigation
4. Use for gravity feed or pressurised irrigation
5. Can deliver water to at least 400 2 L/H drippers
6. By using one or two irrigation drippers as the control dripper and adjusting the float, the dripper discharge can be set to any value between 302 ml and 1260 ml and is independent of the water supply pressure
7. By using the adjustable control dripper, the emitter discharge (sprinkler or dripper) can be adjusted by adjusting the control dripper
8. Adjust the interval between irrigation events by adjusting the area of exposed fabric
9. Responds automatically to on-site evaporation and rainfall
10. The irrigation frequency increases significantly during a heat wave
11. Irrigate directly from a rainwater tank without using a pump
12. The lid on the plastic container protects the water from debris, algae, mosquitoes and thirsty animals
13. Simple, unpowered, and low tech, and therefore fewer things can go wrong
14. Leave your irrigation application unattended for months on end

#### 5. Conclusion

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

[www.measuredirrigation.com.au](http://www.measuredirrigation.com.au)

Conventional irrigation controllers. **indirectly** control the volume of water discharged by a dripper by using PC (pressure compensating) drippers to control the flow rate and the run time setting 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. It is recommended that NPC (non pressure compensating) drippers be used for measured irrigation.

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

## **Appendix. Comparative costings**

The cost of the Unpowered Wicking Irrigation Controller is on the Measured Irrigation website. All other costings are on the Dural Irrigation website.

### **Dripline irrigation system for 1900 drippers using the Unpowered Wicking Irrigation Controller**

Netafim Miniscape, 30 cm spacing, 640 m	\$641
Unpowered Wicking Irrigation Controller	\$99
<b>Total cost of parts</b>	<b>\$740</b>

### **Dripline irrigation system for 1900 drippers using a conventional irrigation controller**

Netafim Low Flow Inline Pressure Regulator 300 kPa	\$23
Toro Drip Eze PC 2 L/h, 30 cm spacing, 640 m	\$754
Hunter X-Core 8 station controller	\$215
8 Hunter PGC Solenoid Valves	\$232
Dura Manifold Kit	\$225
HR Products Valve Box	\$56
<b>Total cost of parts for mains water supply</b>	<b>\$1505</b>
Bianco INOX45NXT Pressure Pump System	\$395
<b>Total cost of parts for tank water supply</b>	<b>\$1900</b>