Small Terracotta Irrigation Controller User Manual

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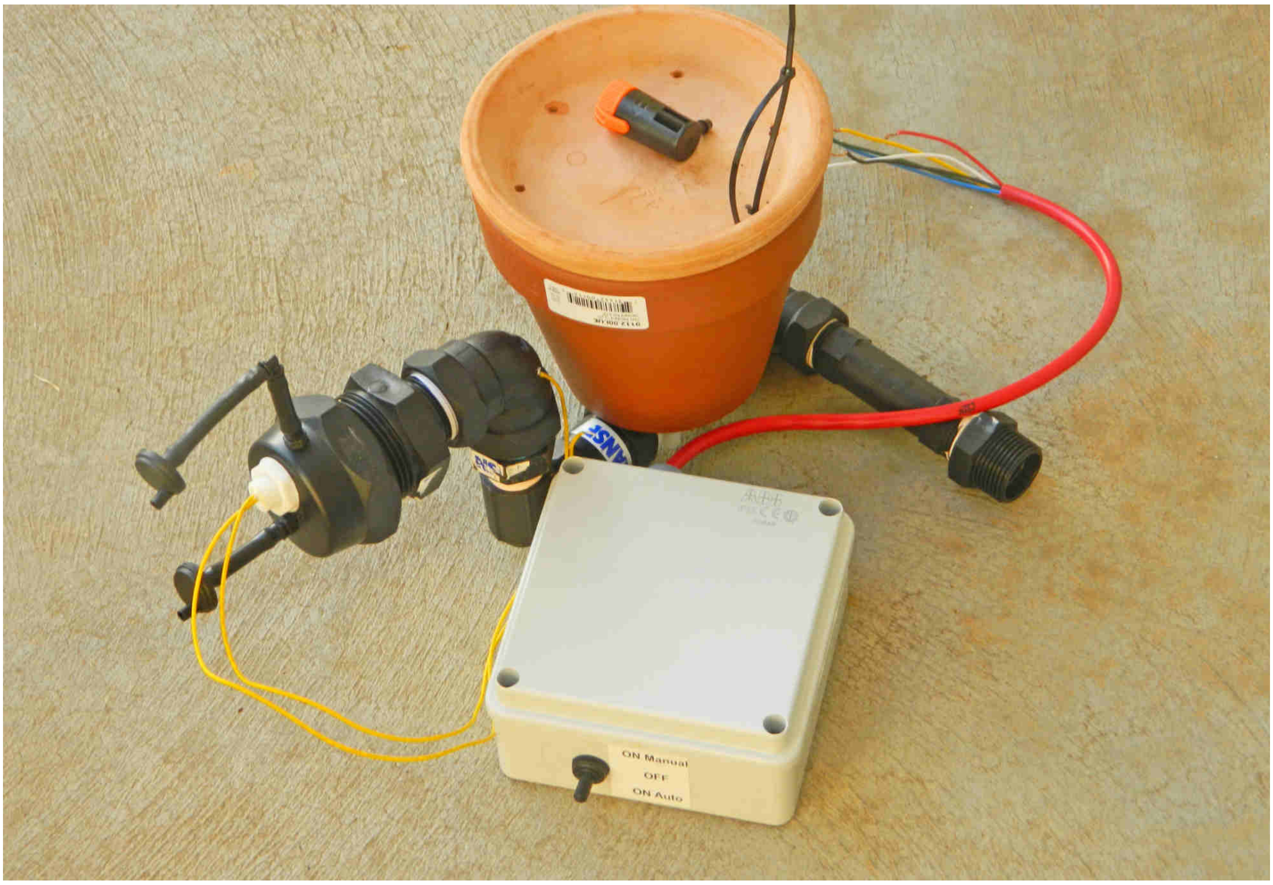


Small Terracotta Irrigation Controller

Contents

1. Introduction

Terracotta is porous and so the water level in the pot falls as water evaporates from the outside surface of 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 an unpowered valve so that the valve opens and the irrigation starts automatically. During the irrigation event, an adjustable 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 and the irrigation stops automatically. The adjustable control dripper is used to adjust the water usage to suit the water requirements of the plants. The adjustable float is used to adjust the frequency of irrigation.

Terracotta pot showing float and water level

Float showing the ring magnet at the bottom of the float

Having set the adjustable control dripper, the water usage (litres per week for example) responds to the prevailing on site evaporation and rainfall. The water usage is proportional to the net evaporation rate (evaporation minus rainfall).

2. Key features of the Small Terracotta Irrigation Controller

1. Use for any size irrigation application with any size solenoid valve (latching or non-latching)
2. The water in the terracotta pot is protected from algae, mosquitoes and thirsty animals
3. Completely automatic
4. Smart irrigation – the irrigation is controlled by the prevailing weather conditions
5. The unpowered valve operates in the pressure range 10 kPa to 800 kPa
6. Use for both gravity feed and pressurised irrigation
7. Use for both sprinkler and drip irrigation
8. Use for both PC (pressure compensating) drippers and NPC (non pressure compensating) drippers
9. Use for porous hose irrigation (for example, weeper hose or soaker hose)
10. Adjust the water usage by adjusting the control dripper
11. Adjust the irrigation frequency by adjusting the float to change the volume of water discharged by the control dripper during the irrigation event (between 90 ml and 275 ml)
12. Adjusting the water usage does not affect the irrigation frequency, and adjusting the irrigation frequency does not affect the water usage
13. The water usage and irrigation frequency are directly proportional to the net evaporation rate (evaporation minus rainfall)
14. Responds appropriately when there is an unexpected heat wave
15. When it rains, water enters the terracotta pot and delays the start of the next irrigation
16. A timer is not required
17. If you are using the same drippers throughout the irrigation application including the control dripper, the water usage is independent of the pressure
18. You can irrigate directly from a rainwater tank without using a pump
19. A light sensor provides the option of irrigating at night time only
20. Uses much less water without affecting the yield
21. Simple and low tech, therefore fewer things can go wrong
22. Provided you have a continuous water supply, you can leave your irrigation application unattended for months on end

3. Installing the Small Terracotta Irrigation Controller

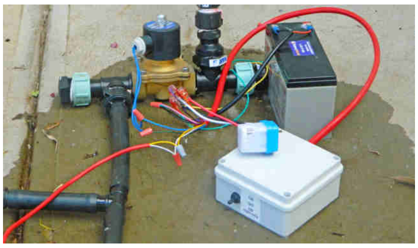
Step 1. Position the Small Terracotta Irrigation Controller in a suitable location in your garden so that the evaporation at the controller matches the evaporation at your plants.

Step 2. Connect a water supply to the irrigation controller. The water pressure 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. Use a cable tie to secure the adjustable dripper

Step 4. The control box has 11 colour-coded wires which need to be connected to the various components as follows:

Control box


Eleven colour-coded wires connected to the relevant components

Connect the **red** wire to the positive terminal from the 12V DC power supply.
Connect the **black** wire to the negative terminal from the 12V DC power supply.
Connect the **yellow** wire to one of the wires from the float switch.
Connect the **white** wire to the other wire from the float switch.
Connect the **blue** wire to one of the wires from the solenoid valve.
Connect the **green** wire to the other wire from the solenoid valve.
Connect the **brown** wire to the white wire from the light sensor (connected prior to shipment).
Connect the **purple** wire to the black wire from the light sensor (connected prior to shipment).
Connect the **orange** wire to the red wire from the light sensor (connected prior to shipment).

12V DC power supply for the solenoid valve

Connect the **pink** wire to the positive terminal from the 12V DC power supply.
Connect the **grey** wire to the negative terminal from the 12V DC power supply.

Alternative power supply for the solenoid valve

Connect the **pink** wire to one of the wires from the alternative power supply.
Connect the **grey** wire to the other wire from the alternative power supply.

4. Small Terracotta Irrigation Controller for latching solenoids valves

This section is only relevant if you have purchased the version of the Small Terracotta Irrigation Controller for latching solenoid valves.

Latching solenoids require power only when they are being turned on or off, and so a small 9 volt battery is often be used (sometimes two 9 volt batteries are used). In order for the battery to also power the irrigation controller the light sensor is not provided.

External connections for the control box

The control box has 6 colour-coded wires which need to be connected to the various components as follows:

Connect the **red** wire to the positive terminal from the 12V DC power supply.
Connect the **black** wire to the negative terminal from the 12V DC power supply.
Connect the **yellow** wire to one of the wires from the float switch.
Connect the **white** wire to the other wire from the float switch.
Connect the **blue** wire to the red wire from the latching solenoid valve.
Connect the **green** wire to the black wire from the latching solenoid valve.

Multiple latching solenoid valves

If there are 2 solenoid valves, connect the second solenoid valve (valve 2) in parallel with the first solenoid valve (valve 1).

If there are more than 2 solenoid valves, you will need additional control boxes. All the control boxes should be connected to the power supply and connected in parallel to the float switch on the Small Terracotta Irrigation Controller.

- Connect solenoid valve 3 to control box 2
- Connect solenoid valve 4 in parallel with solenoid valve 3
- Connect solenoid valve 5 to control box 3
- Connect solenoid valve 6 in parallel with solenoid valve 5
- Connect solenoid valve 7 to control box 4
- Connect solenoid valve 8 in parallel with solenoid valve 7
- Connect solenoid valve 9 to control box 5
- Connect solenoid valve 10 in parallel with solenoid valve 9

Continue in this way until all the solenoid valves are connected.

5. Using the Small Terracotta Irrigation Controller

The switch on the control box had 3 positions: **ON** (switch up), **OFF** (middle position), and **ON night only** (switch down).

Switch in the **ON night time** position

When the switch on the control box is in the **ON** position, the irrigation starts automatically after sufficient water has evaporated from the outside of the porous terracotta pot. The irrigation stops automatically when the control dripper has replaced the evaporated water.

When the switch on the control box is in the **ON night only** position, the irrigation happens at night time only.

Provided the switch is in the ON position, you can start the irrigation manually by pressing the float down. For example, on a very hot day you may wish to irrigate in the middle of the day.

How to adjust the water usage:


Position an empty measuring container under one of the drippers

If you are using drippers, 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, turn the control dripper clockwise to 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, turn the control dripper anticlockwise to increase the flow rate of the control dripper.


Adjusting the control dripper

6. When is water usage independent of pressure?

Ideally, the amount of water used to irrigate your garden should be independent of the water supply pressure. Provided that all of the drippers are identical and at approximately the same level, the Small Terracotta Irrigation Controller can be used to ensure that the dripper discharge is independent of the water supply pressure. Conventional drip irrigation systems control the volume of water discharged by a dripper by using PC (pressure compensating) drippers to control the flow rate of the dripper 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.

Provided that identical drippers are at approximately the same level and the variations in pressure within a zone due to head loss are negligible, the volume of water discharged by each dripper during the irrigation event will be approximately the same. All the drippers may be NPC or PC. For domestic gardens, the irrigation system can usually be designed so that variations in pressure within the zone are negligible.

To ensure that approximately the same volume of water delivered by each dripper during the irrigation event **regardless of the water supply pressure**, the adjustable control dripper must be replaced by an irrigation dripper. Then the volume of water discharged by each dripper will be the same as the volume of water discharged by the control dripper during the irrigation event, namely 250 ml, regardless of the water supply pressure. For example, if the irrigation drippers are Antelco 2 L/H NPC drippers, then the control dripper must also be an Antelco 2 L/H NPC dripper.

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

This means that you can irrigate on level ground directly from a rainwater tank or elevated water supply without using a pump or a timer. The irrigation frequency and water usage (litres per week for example) are controlled by the prevailing weather conditions and are independent of the water level in the tank. The water level can rise and fall dramatically without affecting the volume of water used during the irrigation event. The Small Terracotta Irrigation Controller is a game-changer for automated irrigation on level ground from a rainwater tank or elevated water supply without using a pump or timer.

7. NPC drippers and water usage independent of pressure

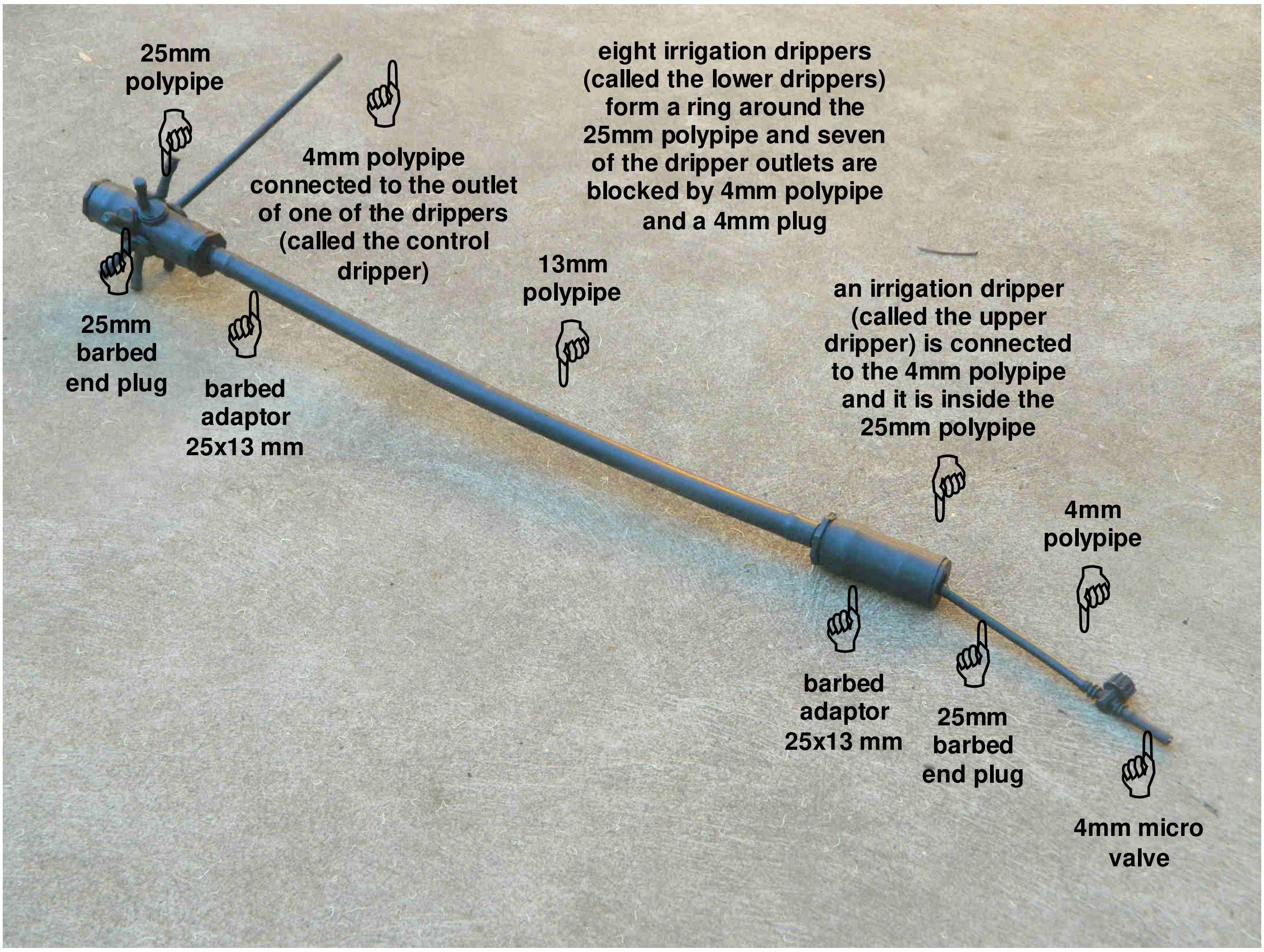
NPC (non pressure compensating) drippers are usually available with flow rates of 2 L/H, 4 L/H and 8 L/H (at a pressure of 100 kPa). Suppose that a combination of these drippers is used for the irrigation drippers. Provided that the control dripper is also an NPC dripper, the following table tells you the approximate volume of water discharged by the various irrigation drippers during the irrigation event when the control dripper is 2 L/H or 4 L/H. Provided that all the drippers have the same emitter discharge exponent, the volume of water discharged by an irrigation dripper during the irrigation event remains approximately constant across a range of operational pressures.

Control dripper	Irrigation dripper	Approximate volume of water discharged by the irrigation dripper during the irrigation event
2 L/H	2 L/H	250 ml
2 L/H	4 L/H	500 ml
2 L/H	8 L/H	1000 ml
4 L/H	2 L/H	125 ml
4 L/H	4 L/H	250 ml
4 L/H	8 L/H	500 ml

8. How to make a fractional dripper

To ensure that each irrigation dripper discharges the appropriate volume of water during the irrigation event (regardless of the water supply pressure) you will need to make a control dripper that delivers a fraction of the volume of water discharged by an irrigation dripper. This can be done for either PC (pressure compensating) drippers or NPC (non pressure compensating) drippers. If you are using PC drippers, then the pressure at PC drippers does not need to be within the pressure range specified by the manufacturer for pressure compensation.

The component parts of the fractional dripper are labelled in the picture below.



The component parts of the fractional dripper are labelled in the above picture

The following pictures provide step by step instructions for making the fractional dripper.

Step 1. Connect 4mm polypipe to the 4mm micro valve. Drill a 13mm hole in the 25mm end plug.

Step 2. Insert the 4mm polypipe through the hole in the end plug.

Step 3. Connect the irrigation dripper to the 4mm polypipe.

Step 4. Insert the 25mm end plug into one end of a 70mm length of 25mm polypipe. Insert a barbed adaptor into the other end of the 25mm polypipe. Insert the other end of the barbed adapter into a 500mm length of 13mm polypipe.

Step 5. Insert eight irrigation drippers in a circle around a 100mm length of 25mm polypipe so that the outlets of the drippers are at the same level.

Step 6. Insert a 25mm end plug into one end of the 100mm length of 25mm polypipe. Insert a barbed adaptor into the other end of the 25mm polypipe. Insert the other end of the barbed adaptor into the 13mm polypipe.

Fractional drippers for dripline

To make a fractional dripper for dripline you will need to cut dripline into short lengths with one dripper per length and with one end blocked.

Make the upper dripper by connecting a short length of dripline to the 4mm polypipe.

Attach eight 4mm micro valves in a circle around a 100mm length of 25mm polypipe so that they are at the same level. Make the lower drippers by attaching a short length of dripline to each micro valve.

9. How to use the fractional dripper

Fractional dripper suspended above the terracotta pot

The control dripper drips water into the terracotta saucer and the remaining seven lower drippers should be blocked.

To install the fractional dripper, replace the adjustable control dripper by a length of 4mm polypipe connected to the fractional dripper so that the fractional dripper is suspended above the Small Terracotta Valve. A length of 4mm polypipe is connected to one of the lower drippers (called the control dripper) so that it drips water into the terracotta saucer during the irrigation event. The remaining seven lower drippers should be blocked using a short length of 4mm polypipe and a 4mm plug. The height of the upper dripper should be approximately the same as the height of the irrigation drippers, and the irrigation drippers should all be at approximately the same level

When the irrigation starts, the upper dripper fills the 13mm polypipe until water start to overflow from the 13mm hole in the 25mm barbed end plug, and the control dripper drips water into the saucer. Progressively unblock the lower drippers until water stops overflowing at the upper dripper. The unblocked drippers (excluding the control dripper) drip water outside the terracotta saucer. As the number of unblocked drippers increases, the flow rate of the control dripper decreases.

Water overflowing from the 13mm hole at the upper dripper

Progressively unblock the lower drippers until water stops overflowing at the upper dripper.

Adjust the fractional dripper by unblocking lower drippers until the irrigation delivers the appropriate amount of water during the irrigation event to your plants at their current stage of growth.

Adjust the fractional dripper by unblocking lower drippers until the irrigation delivers the appropriate amount of water to your plants.

When the water supply pressure is low (gravity feed for example), the difference in level between the upper dripper and the irrigation drippers may mean the difference in flow rate becomes significant. You may be able to adjust the length of the 13mm polypipe so that the upper dripper is at the same level as the irrigation drippers.

When you use the fractional dripper you must always ensure that water is not overflowing at the upper dripper. However, you may be able to stop the water overflowing by increasing the length of the 13mm polypipe.

The following table shows the volume of water discharged by each irrigation dripper during the irrigation event as the number of unblocked drippers increases. The volume of water discharged by each irrigation dripper during the irrigation event is independent of the water supply pressure.

Number of unblocked drippers	Fractional dripper fraction	Volume of water discharged by each irrigation dripper during the irrigation event
1	1	250 ml
2	1/2	500 ml
3	1/3	750 ml
4	1/4	1000 ml
5	1/5	1250 ml
6	1/6	1500 ml
7	1/7	1750 ml
8	1/8	2000 ml

Additional options can be obtained by using more than one lower dripper as the control dripper. For example, the following table shows that volume of water discharged by each irrigation dripper during the irrigation event when 2 lower drippers are used as the control dripper

Number of unblocked drippers	Fractional dripper fraction	Volume of water discharged by each irrigation dripper during the irrigation event
2	1	250 ml
3	2/3	375 ml
4	1/2	500 ml
5	2/5	625 ml
6	1/3	750 ml
7	2/7	875 ml
8	1/4	1000 ml

10. Conclusion

The Small Terracotta 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

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. Because the pressure range is not restricted by pressure compensation, the Small Terracotta Irrigation Controller on level ground with any pressure greater than 10 kPa.

The Small Terracotta Irrigation Controller uses on-site weather information rather than information from the Bureau of Meteorology, and so it is ideal for greenhouse applications or any application where the on-site weather conditions are different from those at the nearest Bureau of Meteorology weather station..

The Small Terracotta Irrigation Controller is a game-changer for automated irrigation on level ground from a rainwater tank. If you are currently using pressurised irrigation with pressure compensating drippers, the following items are required.

- High-pressure pump
- Solenoid valves (one needed for each zone)
- Conventional irrigation controller
- Hose clamps

These items are not required if you use a Small Terracotta Irrigation Controller and so the cost of installing and running the irrigation system can be reduced dramatically.

The most significant difference between the Small Terracotta Irrigation Controller and the Terracotta Irrigation Controller is that the former does not allow the user to adjust the irrigation frequency. Provided that it doesn’t rain, the typical irrigation frequency will be daily or every second day depending on the evaporation rate. The irrigation frequency is proportional to the net evaporation rate (evaporation minus rainfall).