
Automatic Evaporation Pan Operation Manual

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Installation and Set Up Procedure for Automatic Evaporation Pan

The Automatic Evaporation Pan consists of a class A stainless steel evaporation pan, stilling well, precision temperature compensated water depth sensor, solenoid operated inlet valve, control box and data logger.



Water depth sensor and stilling well.



Water depth sensor and stilling well detail.



The water depth sensor is put inside the stilling well.



A small air hole in the water depth sensor cable provides atmospheric pressure to the sensor.

1. Installation Instructions

The evaporation pan must be placed on a perfectly level flat surface. Generally this will be a wooden structure similar to a wooden pallet 100 mm (H) x 1200 mm (W) x 1200 mm (L); however, as long as the surface is level, the pan can be placed on a sand or concrete pad as well.

Level the structure using a spirit level to ensure the pan is level when placed in position. Install the stainless steel water level sensor in the centre of the stilling well, so that the bottom of the sensor is approximately 70 mm from the base of the pan. Secure the water level sensor to the padded bracket at the top of the stilling well with two cable ties. Mount the stilling well on the inside and the control box mounting plate on the outside of the pan through the two pre-drilled holes in the pan rim.

A water supply should be connected to the inlet valve. The pressure is not critical, but should not exceed 50 psi. The logger should be installed nearby in a weatherproof enclosure. A cable from the control box is fitted with a three-pin plug. This plug must be connected to the Sensor Bus input on the logger. It is not necessary to open the control box. The connections to the water level sensor and the solenoid valve have been made at the factory.

The only connection required of the user is to connect a suitable power supply. The 12 volt supply enters the control box through the cable at the top left side. This cable has two wires, red for positive and black for negative. Be sure to observe correct polarity. The control box may be damaged by reverse polarity. If a 12 volt battery is used for the supply, the battery needs to be maintained in a healthy condition. If the battery voltage falls below 12 volts or the battery develops internal resistance, it may not be able to pull in the solenoid.

The automatic filling circuit is only activated for twenty minutes each day, starting at midnight and ending at 00:20. There will be no current drawn from the battery outside this period. The logger also requires power to charge its internal battery. This is normally supplied by the plug pack provided. However, at a remote location, a solar panel is recommended.

2. Initial Setup and Testing

Read the logger instruction manual to find out how to talk to the logger from a computer. From the main logger menu, press **1** to see a list of sensors. If the logger has not already found the water level sensor, press **1** again to commence a new search. The water level sensor will be found and its details displayed. Press **2** to read the water depth. Fill the pan by hose and observe the reading increase once the initial 70 mm offset has been passed.

To measure the daily evaporation, the absolute depth reading is not critical. The nominal range of the sensor is 0 to 200 mm and the depth of the pan is 250 mm. The sensor will over-range to 300 mm, but with reduced accuracy. Hence the recommendation to raise the sensor from the pan floor.

Continue to fill the pan until the level is reached at which it is desired to operate the pan. That is the level to which the pan will automatically refill at midnight. This level must be at least 1 cm or two below pan overflow to ensure that the solenoid valve switches off before the pan begins to overflow. Note the reading from the logger.

At the factory the auto-refill level is set to 180 mm. The position of the water level sensor may be adjusted or a new auto-refill level may be set in the sensor, if required. To set a new auto-refill level, press **4** then **8** then the address of the water level sensor, to access the sensor setup menu. Threshold B controls the solenoid input valve. Press **2** then **1** before entering the new threshold B “On” level. This will become the new auto-fill level. Threshold B “Off” level should remain at -2.32 mm. Threshold B must be activated, reversed, and in alarm mode. These settings will already have been made at the factory when the pan was tested. Read the sensor operating instructions and follow the example given, to understand the use of the thresholds. Note that threshold A is not used in the evaporation pan.

Press the **Esc** key to return to the main logger menu. With these settings, the pan will automatically fill to the threshold B level at midnight. A small amount of overfill can be expected, depending on the actual flow rate into the pan. This is because of the small time delay in the stilling well, and the delay in the sensor filters and the solenoid drop-out time. This overfill will be essentially constant if the input water pressure is constant and is generally of the order of a few tenths of 1 mm. This will not however result in an error in the evaporation, because the logger will be able to record the exact amount of overfill on every occasion if desired. This can be achieved by setting the logging schedule to say every 20 minutes. There will be little evaporation at midnight and the water level at 00:20 will represent the “full” value. Over several days data this value will be observed to be constant. Once the “full” value has been established with confidence, the logging schedule may be substantially reduced if desired. Only the reading at 00:00 is required to calculate the daily evaporation. This is the reading immediately before the pan is refilled.

If there has been rain, a correction for this must be made. An automatic rain gauge may be connected to the logger to record each 0.2 mm rainfall event, as and when it happens. The daily evaporation is the “full” value less the 00:00 reading and any correction for the recorded rainfall.

A good indication of the correct operation of the system can be made by observing the daily maximum and minimums from the water level sensor. On days without rain, the maximum can be expected to be slightly higher than the “full” value by a few tenths of one mm but the minimum should be even closer to the 00:00 reading. The errors are caused by temperature effects in the water, pan, pressure transducer and electronics. The sensor itself is digitally temperature corrected using a second order equation and, provided the temperature at consecutive midnight readings is not wildly different, the errors will be largely self-canceling. For this reason we recommend using the “full” value less the 00:00 reading, rather than the maximum less the minimum value as the more accurate daily evaporation.

The logger supplied is equipped with the Evapotranspiration virtual sensor, which calculates ET by using the Penman-Montieth or Priestly-Taylor formulae. This provides an interesting comparison. However the logger will require inputs from temperature, humidity, wind speed and solar radiation sensors to complete the calculations.

3. Testing the Auto-fill Feature

To test the auto-fill, remove some water from the pan, so the water level is below the auto-fill level (nominally set to 180 mm in the factory). Talk to the logger through the computer or laptop. From the main logger menu, press **4**, then **8**, then the address of the water level sensor, to access the water level set-up menu. From the sensor set-up menu, press **7** to change the time, and then press **1**, to change the sensor’s clock. Enter the time 23:59 and then press **1** to confirm the new clock setting. This procedure only changes the clock in the water level sensor. Press the **Esc** key to return to the main logger menu. After 60 seconds the solenoid valve should open and the pan begin to fill. The pan will continue to fill until the water level sensor reads 180 mm or above.

If the auto-fill level is not reached by 00:20 the filling process will be terminated. This preserves battery power in the event of loss of water pressure or a fault condition. The 20 minute period is plenty of time for the pan to top up after evaporation. It may not be enough time to fill the pan from empty, therefore it is necessary to manually fill the pan to near the auto-fill level on the first use.

The above procedure may be repeated several times to observe correct filling of the pan, however it will be necessary to disconnect the water level sensor from the logger for a few seconds before each test in order to reset the electronics and ensure that the internal timers are starting from zero. In normal operation the master clock inside the logger is used to automatically synchronize all the clocks in the sensors at 23:58 every night, this ensures that the pan will always refill at midnight, when evaporation is at a minimum.

If the solenoid does not operate as expected, check if the solenoid coil is getting slightly warm. If the solenoid coil is warming up, it indicates the water level sensor is attempting to switch it on. This indicates that the 12 volt supply is low, or water pressure is not available. If the solenoid coil remains cold after the 60 seconds has elapsed, use the computer to talk to the sensor again (press **4**, then **8**, then sensor address). Press **0** for a report and confirm the time has advanced through 00:00 and the indicated water level is below the auto-fill level. The report also gives the values of the threshold B “On” and “Off” levels. These should be 180 mm (or your choice) and -2.32 mm respectively. Then press **2** to observe the threshold B set-up options. The menu should appear as below:

- Press 1 to change threshold B “on” level
- Press 2 to change threshold B “off” level
- Press 3 to shutdown threshold B
- Press 4 to normalize threshold B
- Press 5 to put threshold B in control mode
- Press 6 to return to main menu
- Press any other key to exit setup

This indicates that threshold B is active, and inverted, and in alarm mode.

If the menu does not appear as above, press **3**, **4** or **5** until it does. Then try the test again.

4. Specifications

Class A Evaporation Pan

Wall thickness:	1.1 mm
Outside diameter:	1202 mm
Inside diameter:	1200 mm
Depth:	250 mm
Weight:	25 kg

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