Eii MK1.3 EvapoIrrigation Interface+
INSTALLATION AND OPERATION

The Evapoirrigation interface (or Eii for short), developed from the results of extensive Defra and HDRC research and nursery trials, is the latest addition to the E&TS range and further exploits their award winning EvapoSensor (ETS4 pt 100). It automatically adjusts irrigation frequency according to weather conditions, so that water applied matches crop requirements, saving water and improving plant quality. Particularly appropriate for small to medium sized enterprises, it is uncomplicated, grower-friendly and takes the guesswork out of deciding when to irrigate. The key feature of the Eii is its ability to integrate evaporation rate over time. It triggers irrigation when accumulated evaporation reaches a user adjustable target value.

The EII MK1.3 Interface+ extends the EvapoSensing range by storing the starts that would occur during the day, in those problematic areas where wetting would be a concern for personnel or to the general public.

Simplicity is the key; the Interface+ unit will store starts over a period normally during daylight hours and accessed at a time convenient to the grower. A simple 24 hour time clock with a volt free contact is connected to the inhibit input of the Interface+ to initiate irrigation and an end of cycle (E.O.C) relay to connected to the last station of the irrigation controller to signal the end of irrigation.

The Interface+ is compatible with any existing controllers that can accept a remote start signal.

The Eii+ is connected to the signal output of the EvapoSensor which consists of two temperature sensing ‘leaves’ each with a temperature sensitive element formed by wet and dry platinum resistance Pt100 temperature sensors. One leaf remains wet via a wick immersed in a reservoir of distilled water; the other ‘dry’ leaf is exposed to the same conditions as the crop. The EvapoSensor is placed in the growing environment just above plant height where it will be influenced by solar radiation, air temperature, humidity and air movement – i.e. the drivers affecting the rate of transpiration loss from the crop.

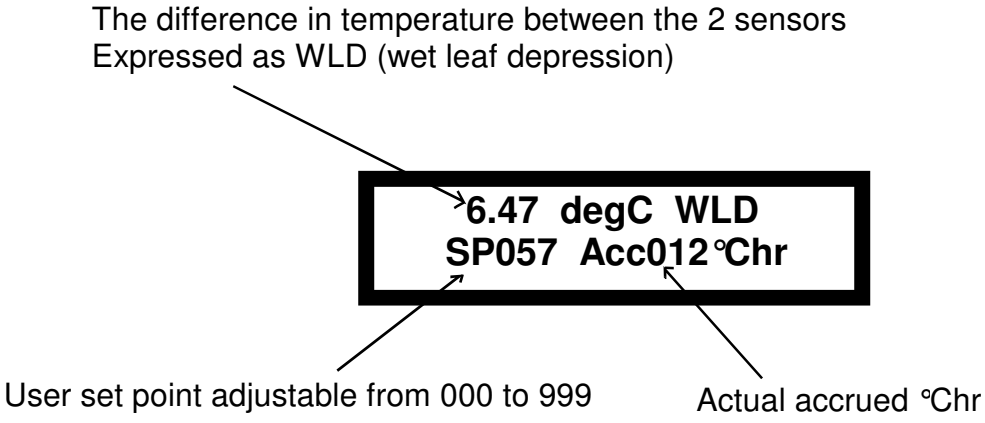
Evaporative cooling from the wick keeps the wet leaf cooler than the dry leaf during the day. The difference in temperature between these artificial leaves is called Wet Leaf Depression or WLD. The higher the WLD the greater the rate of evapotranspiration.

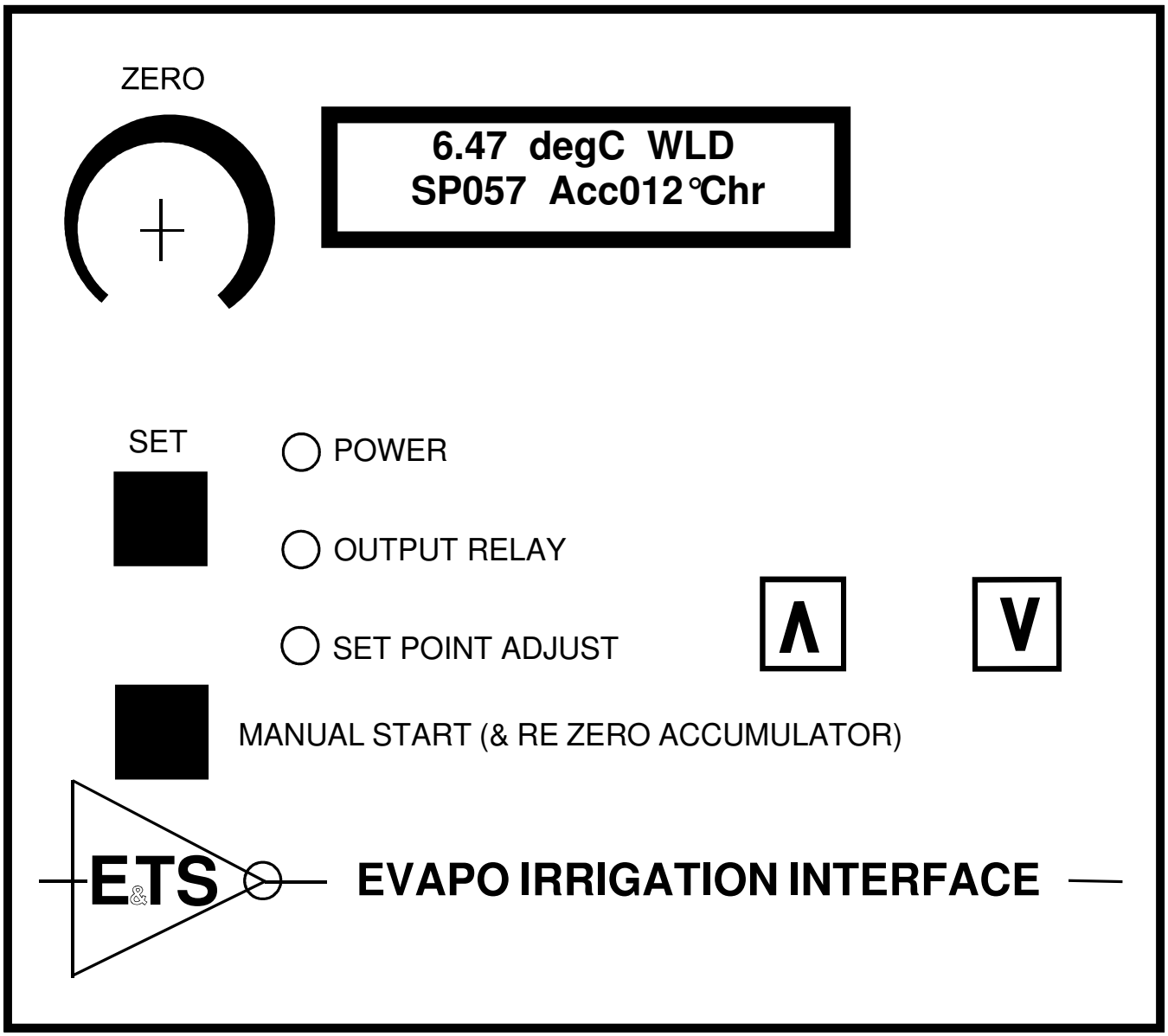
The EvapoIrrigator accurately controls irrigation frequency, as it senses WLD in an analogous way to the transpiration stress experienced by a plant and is approximately proportional to the evaporative demand on the real leaves of plants. Irrigation frequency will be automatically adjusted to changes in the weather to accurately reflect changes in evaporative demand.

The EvapoSensor is better at controlling irrigation by light integration as it factors in air temperature, movement and humidity.

The difference in temperature between the artificial leaves is approximately proportional to the evaporative demand on the real leaves of plants or cuttings. The key feature of the EvapoIrrigator is its ability to accurately integrate the signal from the EvapoSensor. A start is stored when accumulated evaporation reaches a user adjustable target value.

Integration rate is proportional to the WLD, for instance if the WLD displayed is 20ºC the Acc ºC hours will accumulate at the rate of 1ºC per 3 minutes.
If the WLD decreases to 10ºC the Acc ºC hours will accumulate at the rate of 1ºC per 6 minutes. If the WLD decreases to 1ºC the Acc ºC hours will accumulate at the rate of 1ºC per 60 minutes, if WLD is 0.1ºC, the Acc ºC hours will accumulate at the rate of 1ºC per 10 hours. The EvapoIrrigator integrates the complete WLD value and is accurate to 0.1ºC,



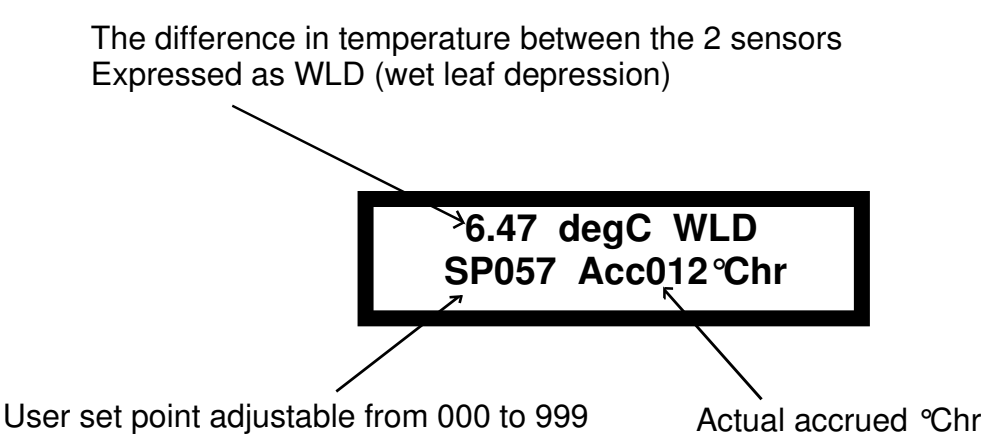

ZERO
6.47 degC WLD
SP057 Acc012°Chr
SET
POWER
OUTPUT RELAY
SET POINT ADJUST
MANUAL START (& RE ZERO ACCUMULATOR)
E&TS
EVAPO IRRIGATION INTERFACE

Front panel controls

Zero
Any small difference in bridge resistance and connecting cable is cancelled by the adjustment of the ZERO control. This is normally set only when a new sensor has been connected. However it can be checked at regular intervals if so desired.

Accumulated evaporation displayed value	0ºC to 999ºC
User adjustable displayed target	0ºC to 999ºC
Integration range	0.1ºC to 20ºC
Integration times	0.1ºC 10 hours 20ºC 3 minutes
WLD displayed	00.00 to 19.99 degC

The POWER LED is on when the controller is supplied with mains, 240Vac.



The SET POINT ADJUST LED is on when the SET tactile push button is pressed. Actuation of either ▲▼ chevron tactile push button adjusts the ºC hours set point displayed up or down from 000 to 999.
If the SET push button is pressed and no data inputted for a period of 10 seconds, the set point facility is disabled and the program returns with the existing ºC hours set point value unchanged.
If the ºC hours set are less than the actual ºC hours accumulated, a start is stored and the Acc ºC hours display is cleared

ACCESSING STORED STARTS:

You can access the stored starts by pushing the ∧ tactile push button.

CLEARING STORED STARTS:

You can clear the stored starts by pushing both the ∧ ∨ tactile push buttons.

Note a strict sequence is followed to avoid mistakes ∧ tactile push button must be pushed before ∨ tactile push button

Once the stored starts are cleared they cannot be restored

The Eii+ has two additional control inputs, inhibit and E.O.C (end of cycle control). The inhibit input is connected to a volt free relay of a 24 hour time clock and the E.O.C input is connected to a volt free relay contact that is connected to the last station of the irrigation controller.

OPERATION
Set up the controller as explained above, setting the zero and the set point to suit the crop.

A basic method of matching set point to Acc ºC is straightforward. **Adjust the set point to 999.** Using your judgement and experience monitor the crop and when you consider irrigation is necessary, zero the Acc ºC and initiate irrigation by pushing the **MANUAL START** tactile push button. Wait until the crop needs further irrigation, **look at the Acc ºC figure accumulated and adjust the set point to read the same value.** The irrigation controller and the EvapoIrrigator+ are now in synch. Small adjustments of set point value may be required to refine the process.

During the day the Interface+ will accumulate degree hours and compares
The Acc deg H to the set point. When the Acc deg H equals the set point a start will be stored in non volatile memory which ensures the validity of the stored data in the event of a power failure.
The stored starts can be accessed or cleared. See above
If the time clock is set to release the inhibit at say 18:00 hours in the evening, the Interface+ looks at the memory location for stored starts. Should a start be stored the output relay is activated for 5 seconds which will trigger the irrigation controller and start an irrigation sequence. The stored starts are decremented by one. During the period that the irrigation controller is active all evapotranspiration is measured and a start will be stored if the Acc= S.P.
All actions such as viewing stored starts, clearing stored starts are accessible.
No further starts are generated until the E.O.C is received. This is a relay contact from the last station to be watered. The contact is normally open and closes when the last station is active. When the E.O.C contact is closed the output relay led flashes (output relay remains open).
When the last station finishes watering the E.O.C contact opens and the E.O.C message is displayed

showing a 5 minute delay and a flashing cursor, the cursor flashes at a 1 second rate. The minutes are decremented by one, 5 -4-3-2-1-0.
When the E.O.C times out the inhibit input is monitored and if still released the next start signal is generated. This process continues until either the stored starts decrement to zero or the inhibit via the time clock is applied.

A manual start can be generated at any time by pushing the **MANUAL START** tactile push button. The output relay and the OUTPUT RELAY LED will be activated for 5 seconds and the normally open pair of contacts close to initiate the standalone irrigation controller. The Acc ºC hours display is cleared

The EvapoIrrigator has two types of output:

1) Relay with Change over contacts, voltage free. Operational time 5 secs

2) Output current proportional to WLD; 0mA, 0ºC – 20mA, 10ºC

0 – 20 mA non isolated linear current output. This can be connected to existing controllers e.g. E&TS 16 station irrigation controller and other common misting, fogging and irrigation control systems that are capable of integrating the signal and adjusting the watering times accordingly. It can also be used for remote display, data logging etc.

Endorsed by years of successful use for propagation of difficult subjects in a research environment at East Malling
Successfully field tested with excellent results on six commercial nurseries in HDC funded research (HNS 159).
Reports available from HDC
Based on sound theoretical concept (Harrison Murray), 1991.
Reference:
HARRISON – MURRAY, R.S. (1991). An electrical sensor for potential transpiration: principle and prototype.
Journal of Horticultural science, 66, 141 – 149

CONNECTIONS:

SUPPLY

Connect a mains 240V ac supply to terminal block TB2
Brown to LIVE
Neutral to BLUE
Green/yellow to Earth.

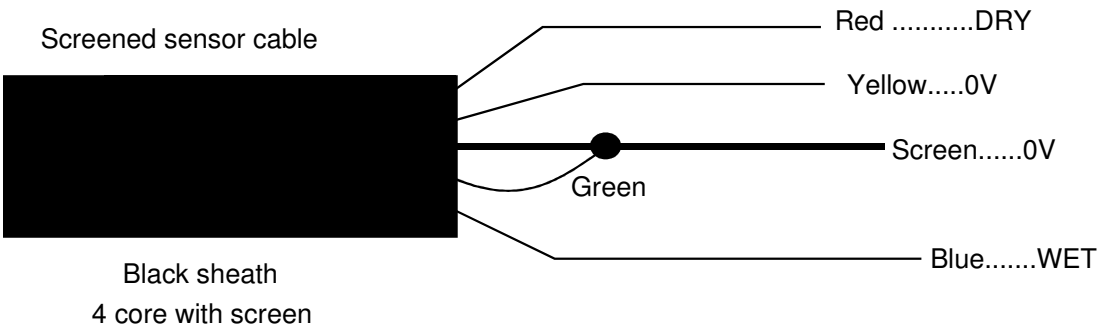
Connect the time clock volt free contact to the inhibit input
Connect E.O.C relay contact to the end of cycle input
Refer to Fig2

SENSOR

1) Connect the EvapoSensor, wet leaf to Wet and 0 on TB1, dry leaf to Dry and 0 on TB1
2) Power up
3) Remove sensor top and fill reservoir with distilled water.
4) Remove wick from Wet sensor, invert top and immerse both sensors into the reservoir. Leave for 10 minutes
5) Stir water (not with finger as the heat could affect the zero point). Carefully adjust the zero control until 0.00 is displayed on DPM. It is 'fiddly' but you can do it ±0.001 or ±0.002 is acceptable but 0.00 is preferable
6) Leave for a further 10 minutes and repeat condition 4.
7) Replace wick and fit sensor top.
   This procedure need only be carried out when new or at the beginning of the growing season.
   The gain and range have been factory set and must not be adjusted,
   Do not adjust VR1, VR2 and VR4.
   If you gently warm the Dry sensor the reading displayed will be positive, if the reading displays a (-) negative reading, swap the sensor connections over and re do zero calibration.

ES4 Evaporation sensor

Fitted with two Pt100 temperature sensors



POSITIONING OF THE EVAPOSENSOR

It is important to position the EvapoSensor in the best position to attain the best results.

Ideally the sensor should be positioned at the height of the cuttings, this may mean placing the sensor unit on an inverted flower pot or other suitable object so that the wet and dry sensor are at the same height as the leaf level

The sensor needs to be placed in a representative area so that it experiences the same growing conditions as the cuttings.

The sensor must not be covered or shaded. Avoid shading from any structure such as risers, pipes, stanchions etc.

Position to the North side of the glass house/poly tunnel to ensure that the sensor is not shaded

For all input/output connections, refer to Diagram 1

OUTPUTS

0 – 20mA connected to terminal block TB4, direction sensitive
Change over voltage free contact connected to TB5

SAFETY

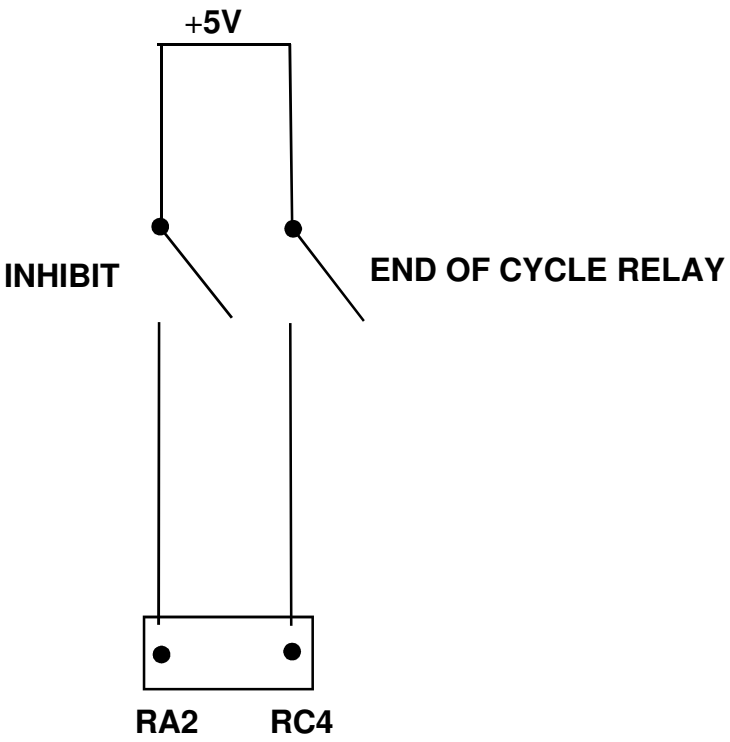
F1 1 amp quick blow 20mm control fuse
F2 500mA slow blow 20mm mains fuse
F3 1 amp quick blow 20mm 24v ac output fuse

SPECIFICATIONS

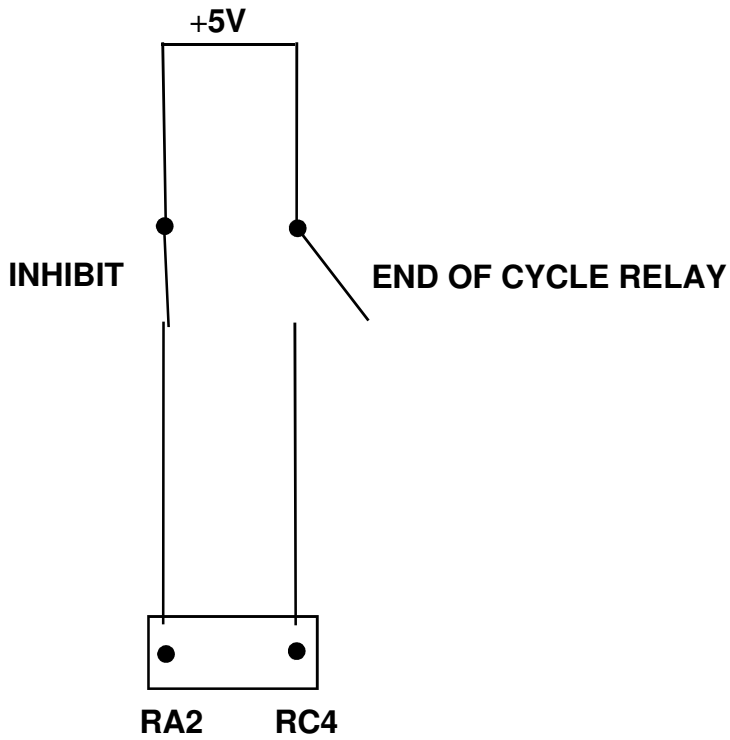
Control range 0º to 20ºC
Displayed reading -16ºC to 20ºC
Integration resolution 0.1ºC
Bridge temperature drift 15ppm 5ºC to 50ºC zero
Bridge zeroing ± 0.1ºC
Maximum bridge error resistance 2 ohm.
High specification bridge differential amplifier with high CMMR.
0 to 20mA non isolated linear current output proportional to the wet leaf depression. Capable of driving long distance into a maximum 350 ohm load. (250 ohm to convert to a 0 – 5V signal, plus max 100 ohm line resistance).

The gain and range have been factory set and must not be adjusted,
Do not adjust VR1, VR2 and VR4.

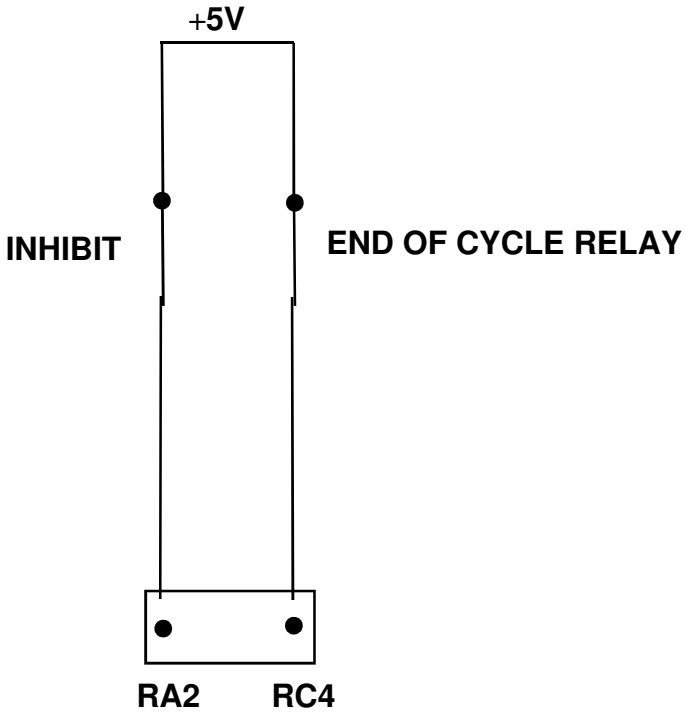
0V connected to mains earth.
Optical isolator switches the relay.
Input voltage 240V ac European harmonized.
Relay output: voltage-free contacts, change-over.
Splash proof box size 175mm x 150mm x 80mm.
Meets all CE requirements.



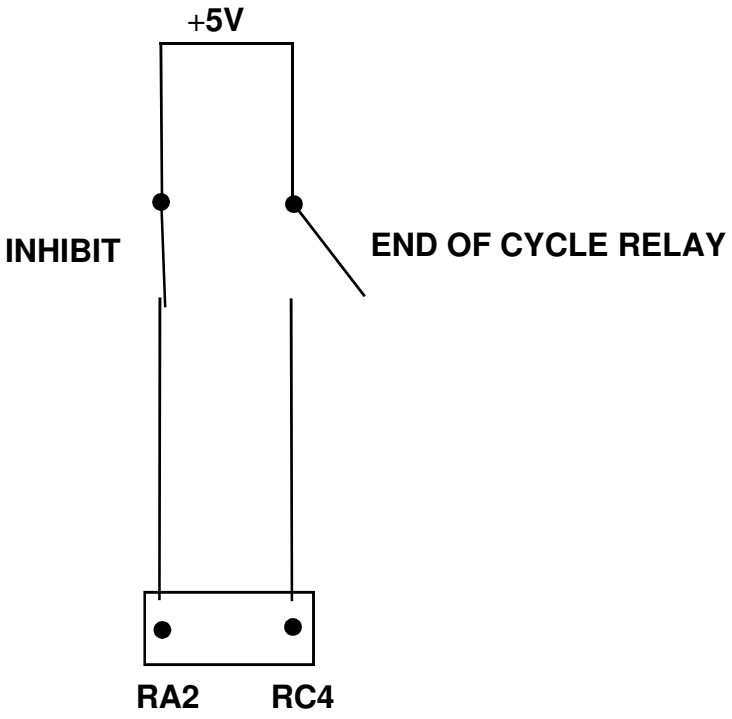
No action, starts being stored, irrigation starts inhibited



Irrigation started, stored counts decremented Further starts are stored. E.O.C contact must Close before next stored start accessed

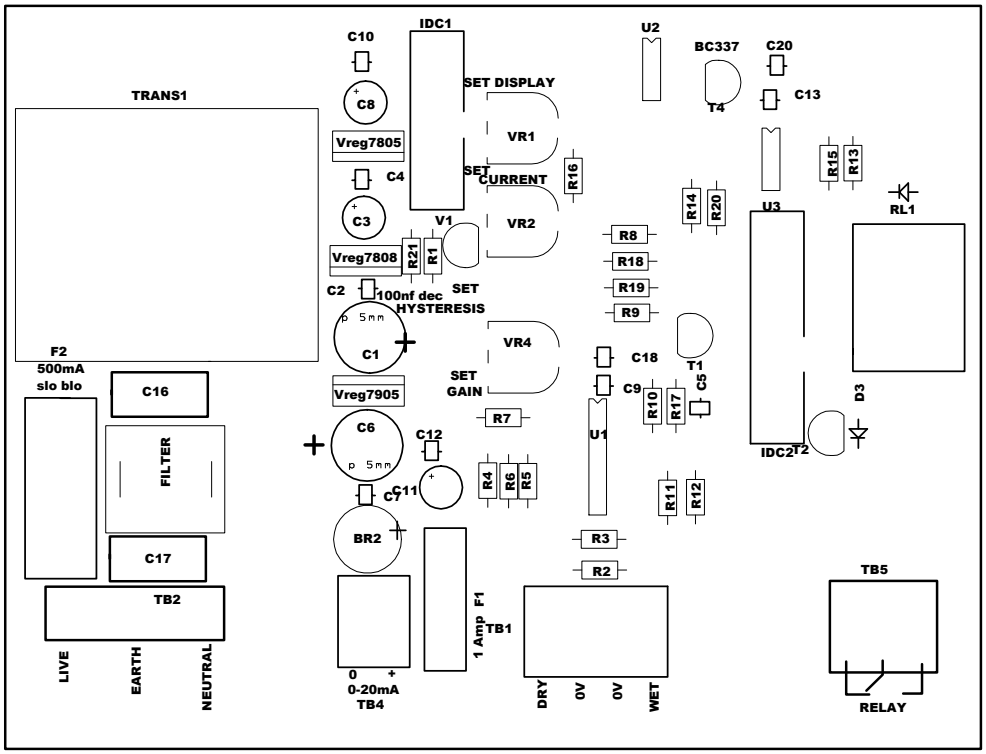


Last station EOC relay closed output LED flashes until E.O.C Is released



E.O.C 5 MINS displayed, count down to zero. Irrigation occurs for as long as the inhibit is Closed or stored starts is zero

EVAPOSENSOR ARTWORK 02 09 2010



Declaration of Conformity

Name of manufacturer	E&TS Ltd
Full postal address	40 Acreville Rd Bebington Wirral Cheshire CH63 2HY
Country of origin	UK
Description of product	Evaporative Controller

Conforms to the requirement of the EMC directive 89/336/EEC, of low voltage directive 73/23/EEC and harmonised European and national standards.

Applied standards:	EN50081-1	EMC generic emission
	EN50082-2	EMC generic immunity

We declare that as the authorised representatives, the above information in relation to the manufacture of this product is in conformity with the stated standards and other related documents following the provision of EEC directives.