Please take time to read this installation and user document.
There is a lot of useful information on the varied and useful things that this controller can do.
Complex control algorithms on the inside makes for a simple to use controller on the outside.

One of the most useful applications is the DIAGNOSTICS mode which is explained fully on P.10 with a sub paragraph FAULY VALVE. Please read this section as I have left LINK 3 in situ, which automatically runs a valve diagnostic test for open circuit and short circuit valves whenever an irrigation cycle is called.

I have done this from my own experience of having to repair a fault on a 16 station situated in a glass house in the middle of a June heat wave. The transformer was burnt out and the failure is always due to a shorted cable or faulty low resistance solenoid valve. You may ask ‘why didn’t the control fuse blow’ the answer is because of residual low cable resistance or low coil resistance, not sufficient current to blow the fuse but enough current to ‘cook’ the transformer leading to premature and permanent failure. I replaced the transformer and two pints of water in me. Having no wish to stay and wilt further, I fitted link 3, run the irrigation sequence and as if by magic station 7 flashed and beeped at me, which when I metered the coil came up as 8 ohms when it should have been 40 ohms. Upon renewing the coil the controller functioned as designed.

The moral of this tale is to leave link 3 fitted, it will save you the cost of replacing the transformer, it will quickly identify your faulty valve or valve wiring and it will save your precious time wandering around the glass house, usually in the middle of a heat wave, manually turning on valves.

You can of course choose to remove link 3, the controller will work fine but with no output diagnostics.

ELECTRONIC & TECHNICAL SERVICES Ltd

INSTALLATION AND USER MANUAL

E&TS IRRIGATION CONTROLLERS

Thank you for purchasing an ETS Irrigation controller

If treated in accordance with the following instructions it should give a long and trouble free service.

OPERATIONAL FEATURES

1) 24 hour time clock 24 starts per day.
2) It is recommended that no more than 2 valves be connected per station in serial configuration and one valve connected per station in parallel configuration. Each valve is individually time in the parallel configuration.
3) Valve base times from 10s of minutes to 1 second, or to 0.2 seconds for misting.
4) Various types of rainfall sensor can be attached and used to over-ride or integrate external irrigation.
5) Continual cycling is available for misting. No difficult programming is required. Simply connect the Mist controller output into the terminal block labelled “Latched input.” Weaning can be achieved by fitting an ETS Mist Wean controller.
6) An irrigation cycle can be initiated by an external start device which connects the terminal blocks “labelled Mom latch.”
7) Watering by ‘hand’ when a solenoid valve is connected to the ‘Hand watering’ terminal block and to the Common terminal.
Pump can be selected from the front panel to run or to be turned off
Feed Valve, if available can also be selected.
8) When the panel is running the pump can be turned on or off from the front panel by pushing the tactile switch labelled ‘pump’. The pump ‘state’ will be stored in memory and applied the next time that the panel runs
9) Error checking systems continuously monitor the condition of the rotary switches and look for open or shorted solenoid valve circuits. A built-in sounder, Status LED and station indicator give warning of any error condition, pulsing at a rate specific for the error condition.
10) The duration of all irrigation times can be altered manually by the “Percentage $\pm$ control” between -90% and +100%.
11) Evaporation or humidity sensors with an output of 0-5Vdc or 0-20mA dc are sampled, integrated and averaged. The algorithm calculates the adjusted irrigation time per station from the output of the sensor.
12)Stations are ‘skipped’ if set above zero with no valve attached. The error checking system will warn of an open circuit valve at the end of the irrigation cycle.
13) The Feed valve can be programmed to any station in serial and to banks of four in parallel

MOUNTING AND WIRING UP THE CONTROLLER
REFER TO FIGURES 3 and 4

On the 16 station controllers remove the four screws holding the front panel to the rear enclosure. On the 24/32/48 station controllers loosen the two screws labelled hinge and remove the other two screws. Gently lift the lid of the box upwards and towards you and twist to the left so that the mounting screws click into slots and act as hinge
.
WITH GREAT CARE for 16 station controllers remove the two flat ribbon cables from their respective sockets. 24 to 32 station controllers remove the three flat ribbon cables and for 48 station controllers remove the four flat ribbon cables. On the 48 station controller one of the two 20 way cables is colour coded to the socket. Please note these are 'keyed' and can only be inserted one way. Refit the cables when wiring complete.
DISCONNECT the two Lucar connectors from the Graslin clock.
DISCONNECT CABLES FROM THE REAR PANEL
NOTE. Removal of the 24/32 and 48 station front panel is only possible after removal of flat ribbon cables. Remove the hinge screws to facilitate this action.
The controller should be mounted on a flat surface and secured by bolts screwed through the mounting brackets attached to the box. Note there are a number of mounting positions on the rear enclosure, choose the two that are most suitable for mounting. The 16 station controller also has provision for mounting through the rear of the box, refer to Fig 4.
Do not make other holes in the box for this purpose and preferably use the **mounting brackets attached.**

The ETS controllers should be wired in accordance with FIG.3.

IMPORTANT

Ensure that the mains supply is disconnected before wiring the controller.

Ensure that the mains supply is clean, and that there are no inductive loads such as large pumps or motors on the same supply. It is recommended that the controller be wired directly to the main distribution board.
We recommend that you protect the controller with an RCD rated at 2 Amps.

Connect:-

The 240Vac live (brown) wire to the fused terminal block labelled L,
The neutral (blue) to the terminal block labelled N,
The earth (green and yellow) to the terminal block labelled E.

Ensure that the Earth terminal runs to a bonded metal pipe or to a dedicated earth rod, and that the impedance to earth is <5 Ohms.

CONNECTING SOLENOID VALVES

Connect the solenoid valve 1 to terminal 1, solenoid valve 2 to terminal 2, and so on for the remaining valves.
Connect the other wire from each of the solenoids to a common return. The terminal blocks for this are labelled **COMM.**

In the U K it is a statutory requirement that you keep all the low voltage cables clear of the 240vac high voltage supply, in accordance with the Low Voltage Directive. Please take care to do this!

MORE EXTERNAL INPUTS AND OUTPUTS

CONNECTING THE FEED VALVE

Connect the solenoid valve across the terminal block labelled **FEED** and the return to **COMM**

REMOTE STOP, LOW RESERVOIR CUT OUT

A closed contact across the terminals labelled **Lo res/0V**, **Lo res** will suspend the program. The alarm led will flash and the sounder will beep on/off until the low reservoir fault condition is removed. The program will continue from point of suspension.
If a float switch is fitted in the water reservoir and connected to the **Lo res** contacts, the program will be suspended when the water level in the reservoir drops below the float switch, causing contact closure. The program will remain suspended until the water level increases above the float switch and opens the contacts.

REMOTE STARTS

There are two kinds of remote starts: momentary and cycling/latched.
1. A momentary start device, such as a closed contact or the output from an **EvapoIrrigator** wired across terminals labelled **MOMENTARY** and **common arrow point** will start an irrigation program.
2. A latched or cycling start can be initiated by a closed contact or the output of an **EvapoMister** wired across terminals labelled **LATCH** and **common arrow point.** The controller will operate the program for as long as these contacts are closed and can be used for misting, multiple cycling and for pulsed irrigation programs.

HAND WATERING

A permanent 24v AC supply is available across **HANDWATER** and **COMM**. When this supply is healthy the LED labelled **ValveSupply OK** is illuminated.
Hand watering can be accomplished in two ways:
i) pump, selected by pushing the **Pump Control** push button.
ii) pump and feed (where applicable) by selecting **Feed Valve** push button.
The pump and feed valve can be turned on/off by repeated pushes on their respective buttons.
The feed valve will always turn off when the pump is turned off.

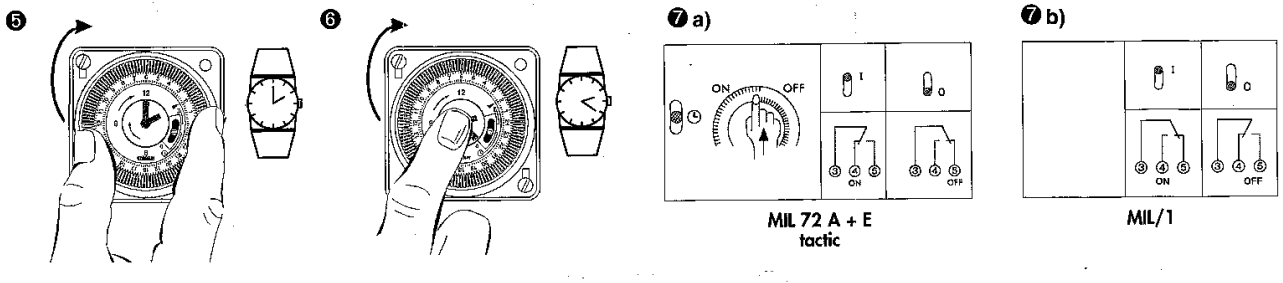
SETTING THE GRASLIN CLOCK

The clock has been pre wired, please refer to the manufacturers instructions for clock setting.

NOTE. When the clock slide switch is in the 'ON' up position, external starts i.e. momentary starts and latched starts are ignored.

When the switch is in the 'AUTO', middle, or 'OFF', down position, external starts will be accepted.

The external latched start initiates a single cycle similar to the momentary start.



Addendum. Latch input can be used as a remote start in the latest controller design as it is not affected by any Graslin start condition. If the Latch input is used it must be a make before break contact, i.e. contact closed followed by contact open.
When the slide switch is in the ON position momentary starts are ignored. When in the auto position momentary starts are ignored for the time set by the ON sector.
Momentary start is a fleeting contact, contact closed followed by contact open.
Latch function is a single start and cannot be used for continuous irrigation starts, such as misting. The continuous function is only available on the digital clock module

SETTING THE IRRIGATION CYCLE

Setting the irrigation cycle is very simple.
1) Set the time base required by turning the TIME BASE rotary switch to the desired time base:- 0.2SECS, SECS, SECS X 10 , MINS, or MINS X 10.
2) Set the station multiplier to the desired setting from 0 to 9. When a particular knob is set to zero, that valve will not be operated, and the controller moves through to the next set station. For example, if the TIME BASE is set to SECS and STN 1 is set to 3 Valve 1 will be on for 3 seconds.
3) Set all remaining stations in the same manner.

SEQUENTIAL OPERATION

This mode is normally used on smaller controllers. To run it, remove the jumper from the terminals labelled **PARALLEL** (located on the lower left centre of the rear board, as shown in fig2).
When the program runs, the LED for station 1 will be illuminated and voltage will be supplied to valve 1, which should open! At the end of the time set, LED 1 will extinguish and valve 1 will close. The program will sequence to station 2, the LED for which will be illuminated, and valve 2 should open. This process is repeated for each station in turn.

PARALLEL OPERATION

This mode is particularly useful for larger controllers. To run it, fit the jumper to the terminals labelled **PARALLEL**, as above. Four stations will operate at the same time, each for the length of time set when it was programmed.
When a program starts, the LED's for stations 1, 2, 3 and 4 will be illuminated and the respective 4 valves will open. As the stations time out the respective station indicator and valve will close. If all the stations are set to the same time all valves and station indicators will open and close together.
With the 16 station controller bank 1 stations 1 to 4 come on first followed by bank 2 stations 5 to 8, bank 3 stations 9 to 12 and finally bank 4 stations 13 to 16. 24 through to 48 stations operate in the same manner

PROGRAMMING FOR FEED.

The software allows the **FEED VALVE** to be programmed for every station. The **FEED** can be programmed on or off. When the panel is in a quiescent state pushing the **ADVANCE** button will illuminate station one and the **FEED VALVE** led indicators.
Pushing the **FEED VALVE** button flashes the **FEED LED** twice and the sounder beeps once. The **FEED LED** is on when **FEED** has been selected and off when deselected. Pushing the **ADVANCE** button sequences to Station two. Carry on programming in this manner to the sixteenth station.
In parallel the feed valve is common to the bank of four stations.
Once programming is complete, push the ADVANCE button to check stored **FEED VALVE** data. Stored **FEED VALVE** data is retained indefinitely in the event of a power failure.
Note that when the feed valve has been selected in a sequence, the **FEED** led flashes twice, the sounder beeps twice. If feed has not been selected the **FEED** led does not flash and the sounder is silent.

INITIATION OF AN IRRIGATION CYCLE

An irrigation cycle can be initiated in three ways:
1)By a timed automatic start.
2)By a manual start.
3)By a remote start.

EXTERNAL STARTS

Any device which makes contact across the terminals labeled **MOM LATCH** or **LATCH** can be used to start the irrigation program remotely. **MOM** is generally used for starting irrigation programs, whilst **LTH** is generally used to start Misting or cycling programs.

PROGRAM ADVANCE

When the irrigation program is running, pushing the Program **ADVANCE** button will advance the program to the next station. In parallel the next bank is selected.

ALTERING PROGRAM SETTINGS

These can be done whilst the program is running, simply by increasing or decreasing the station time, or by selecting a new time base. If you want one station to stop operating, simply set the knob to 0.

PUMP

The pump output is selected by pushing the **PUMP CONTROL** button when the program runs. This state is always remembered even when the panel is turned off. This also applies if the pump has been programmed off. The PUMP led indicator is lit when the pump is running. This output can also be used to operate a master valve, a fertilizer injector or similarly related equipment.

STATUS

When all is healthy the **TIMER/PULSE** led will flash at the time base rate, for instance if the time base is set to 1 second the **TIMER/PULSE** led will flash at 1 second intervals.

SINGLE STATION (serial) SINGLE BANK (parallel)

Initiate an irrigation cycle. Push the **ADVANCE** to select the station or bank to be irrigated. Push the **FEED VALVE** push button once, the sounder and Alarm led will bleep and flash twice. The selected station/bank will irrigate once and when complete the irrigation cycle wil reset. **This feature has to be selected every time an irrigation cycle is initiated.** Note pushing the **FEED VALVE** during the irrigation cycle will reset the irrigation cycle after the current station has finished watering.

DIAGNOSTICS (prevention of glass house flooding)

These are carried out automatically when the program is initiated. The program checks for open circuit switches. At the end of the irrigation cycle the faulty switch is identified by the station indicator. If station 3 switch is faulty, station 3 led and sounder will beep and flash twice. This applies to all 16 stations. Once the fault condition has been rectified sounder and led will turn off.
However even with a faulty switch, irrigation can safely continue. The software will identify the faulty station and will apply a limited amount of irrigation. In serial this is 50% of the time base, i.e. if switch 3 were faulty and the time base set to 10 secs, irrigation would be applied for 5 seconds.
In parallel this is 10% or in the example above 1 second.
This process ensures that the glass house is not flooded but there is limited irrigation on the faulty station.
Once the faulty switch has been identified rotate the switch vigorously to the left and right, this switching action should clean the contacts. An application of WD40 may also help. To do this , pull off cap and 'squirt' down the flat of the spindle. Wipe off excess oil.

FAULTY VALVE (on 16 stations and above)

To select this function, insert the 2 way jumper taped to the Output board (FIG.3) into the header labelled VALVE SCAN and the 2 way jumper taped to the logic board ito the header labelled VALVE TEST. If not required leave VALVE TEST header empty. If not fitted the controller will skip the valve test routine.

In **SERIAL** - If a faulty valve is detected either open circuit or short circuit, the station and valve are skipped and the next station is selected. At the end of the irrigation cycle the faulty valve is identified by the station indicator. If the valve on station 3 is faulty, station 3 led and sounder will beep and flash three times. This applies to all 16/48 stations. Once the fault condition has been rectified sounder and led will turn off.
Upon initiation of an irrigation cycle automatic error checking for all outputs occurs. In serial this consists of a 120mSec sequential pulse to all outputs. Outputs whose stations are set to zero are not checked.
In parallel, each output is checked as above in serial mode and then all outputs in a bank of four are checked (all four led's in the bank are on for 120mSec) for over current.
In serial mode short circuit or open circuit conditions give an error warning of 3 beeps and 3 alarm led flashes.

In **PARALLEL** where 1 or 3 stations are safely powering 3 valves with the 4^{th} station open circuit (no valve), the 4^{th} station indicator will flash 3X and alarm sounder will beep 3X. If one of the stations (1 to3) is short circuited (faulty valve) error warning will be 3 flashes and 3 beeps (open circuit) followed by 4 flashes and 4 beeps (short circuit).

If all or one of the stations are left open circuit all station indicators will flash 3X and 3beeps followed by 4 flashes and 4 beeps. The valve detection circuit will provide a common error for both short and open circuit.

PERCENTAGE ADDITION/SUBTRACTION

To select % addition/subtraction place jumper into MAN header on FIG.2

The operator can use a potentiometer labelled %, mounted on the front panel, to increase or decrease all valve times between SCALE +100% and SCALE -90%. On hot days you would increase the % control on dull overcast days you would decrease the % control.

When the control is set to “CALIBRATED” the irrigation time is the multiplication time shown on the timer scale as described above. Thus
1. if the time on station one was set to 1 and the time base set to 10 SECS, the % control set to CALIBRATED the irrigation time will be 10 secs.
2. If the % control were set to +100% the irrigation time would be 20 secs.
3. If the% control were set to -90% the irrigation time would be 1 second.

The % control will work on the 10 SECS, MINS and MINSX10 time bases, but it has no effect on the 0.2 SECS and SECS time base.
Because of the integration software, if the percentage is adjusted prior to an irrigation cycle the **RESET** button must be pushed, otherwise the percentage would be ‘averaged’. This is explained in greater detail in the integration section.

INTEGRATION

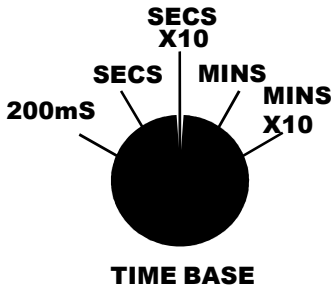
To select integration place jumper into AUTO header on FIG.2 and disconnect the lead from HDR2, if fitted

Simply put, this allows appropriate sensors to adjust the percentage addition/subtraction control described above, automatically and in response to actual conditions..
A 0-5V dc signal is sampled every 5 minutes, indicated by a pulse of the **POWER/INT SAMPLE** led. up to a maximum of 42 hours. The controller monitors a signal from an evaporation device such as a Solarimeter an Evaposensor , Waterbug or a Delta T device over a set period, usually the period between the controller start times. If all parameters have been set up accurately such as the time base and multiplication factor on the station, the algorithm converts the voltage input into an accurate frequency and automatically calculates the exact amount of irrigation time to compensate for the evaporation period. If sampling exceeds 42 hours, which in effect means that no irrigation has been applied for this period, all information is cleared and the process repeats. The signal from the sensor is sampled, digitised and stored every 5 minutes over a maximum period of 42 hours. If during this period an irrigation cycle is initiated the sum of the digitised samples is divided by the number of samples taken and the resulting average is used to adjust the watering times.

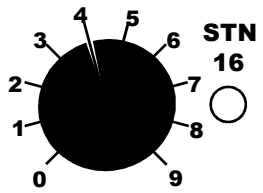
Connect the output of your device to the terminals labelled INTEGRATOR and LOWRES/0V terminals located on the output board, refer to FIG.3

Quick Start

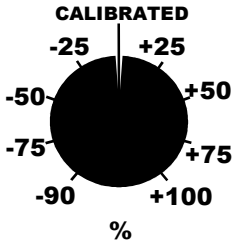
1) Connect controller to the valves, pump and mains supply (refer to the Relevant sections in this installation manual).
2) Set the time base to the desired base time. In the example below



It is set to 10 seconds.
3) Set each station switch to the desired multiplier.The switch positions 0 - 9 are multipliers of the time selected on the time base. In this example the Station switch is set at 4 total irrigation time on station 16 will be 40 seconds. All unused stations set to 0.



4) Set the percentage control to the calibrated position:



5) Push the reset button.
6) Push the slide switch on the Graslin clock to the UP position and return To the AUTO centre position. Refer to the Graslin clock instructions in This installation manual.
7) Controller will run for the irrigation times selected.

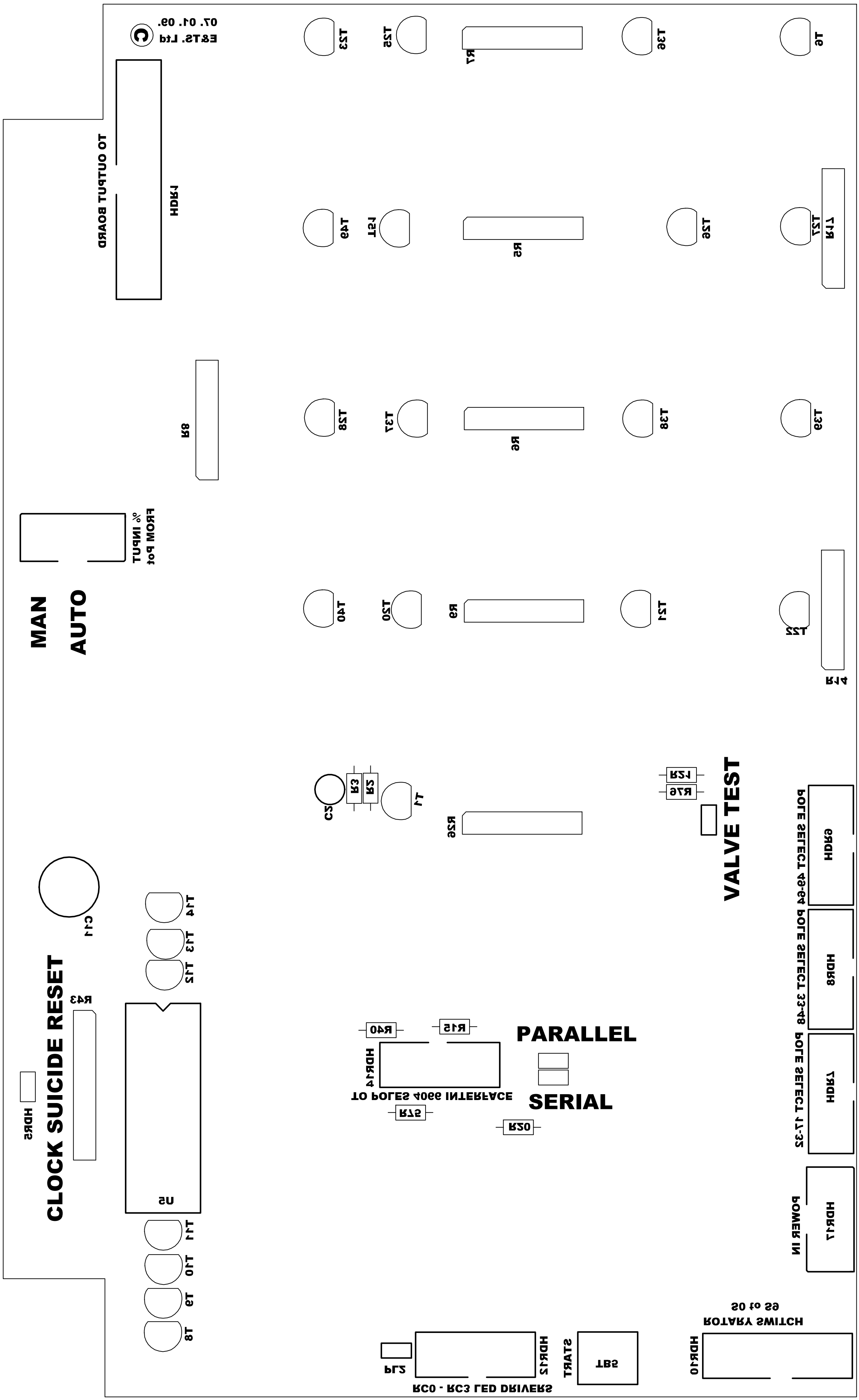
CONTROLLER CARE
Very low maintenance required.
At the end of season keep the mains power applied, this will prevent damp entering and corroding metal parts.
To keep the rotary switch contacts clean turn fully to both end stops, **DO NOT USE FORCE.**
DON'T use sharp or pointed objects to push the tactile switches, use fingers only

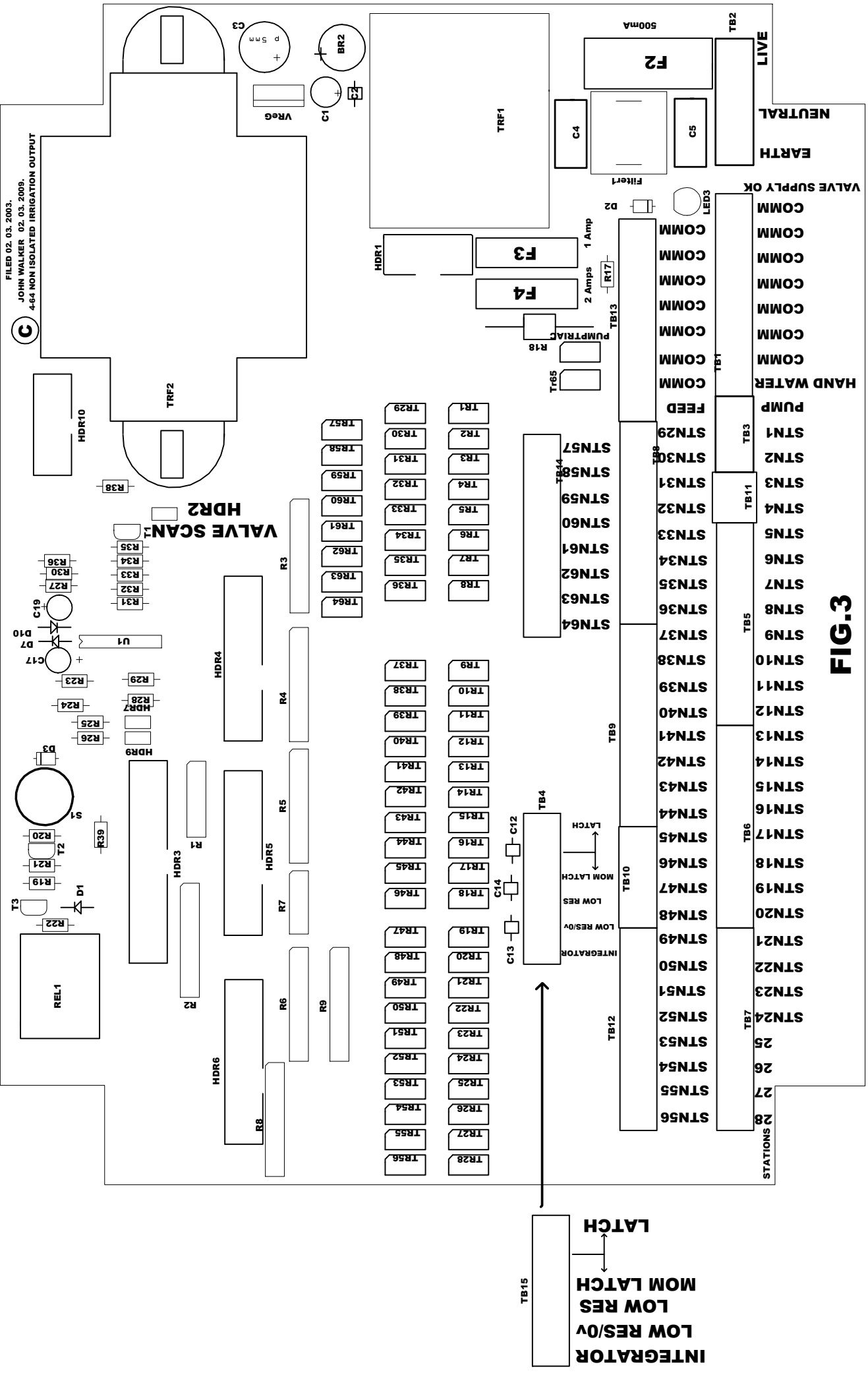
Alarm Conditions

1) Low reservoir 1 beep, continuous, Lo Res led lit
2) Faulty switch 2 beeps, alarm led and station indicator flashes twice.
3) Serial, open circuit valve/short circuit valve 3 beeps, alarm led and station indicator flashes 3X
4) Parallel Open or short circuit valve a combination of 3 and 4 beeps, 3 and 4 alarm led flashes.

ELECTRICAL SPECIFICATIONS.
Operates from a 240V ac mains supply.
Integral 600mA mains suppression filter.
F2 Mains fused input rated at 500mA slow blow 5 x 20mm
24V ac output for valves and pump relay F4 rated at 1.5A quick blow 5x20mm
Low voltage processor supply F3 rated at 1A quick blow 1 amp 5x20mm
30VA, 24v ac secondary toroidal transformer, maximum output 1Amp
Valve common is bonded to Earth
Rechargeable clock battery
Plastic double insulated enclosure, size 240mm x 190mm x 90mm

FIG.2


HDR2
MAN
AUTO
CLOCK SUICIDE RESET
VALVE TEST
PARALLEL
SERIAL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JOHN WALKER 02. 03. 2009.
4-64 NON ISOLATED IRRIGATION OUTPUT
TRF1
TRF2
F2
500mA
F3
1 Amp
F4
2 Amps
LIVE
NEUTRAL
EARTH
VALVE SUPPLY OK
HAND WATER
PUMP
FEED
COMM
STN1
STN2
STN3
STN4
STN5
STN6
STN7
STN8
STN9
STN10
STN11
STN12
STN13
STN14
STN15
STN16
STN17
STN18
STN19
STN20
STN21
STN22
STN23
STN24
25
26
27
28
STATIONS
VALVE SCAN
HDR2
INTEGRATOR
LOW RES/0v
LOW RES
MOM LATCH
LATCH
REL1
FIG.3

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www.ets-controls.co.uk

email john@ets-controls.co.uk

DECLARATION OF CONFORMITY

Name of manufacturer or supplier:	E&TS Ltd
Full postal address including country of origin:	40 Acreville Rd, Bebington, Wirral, CH63 2HY U.K.

Description of product: Sequential/parallel irrigation controllers
Conforms to the following product specifications:

Low Voltage Directive 2006/95/EC

Standard EN61558-1:2005

EMC and harmonised European and national standards

Standard	**2004/108/EC**
Emissions	EN6100-3-2/3/4
Immunity	EN61000-4-2/3/4/5/6/8/11/13/14 EN61000-6-2

Place of Issue: Bebington

Date: 15. 05. 2013

Name of authorised representative: John W Walker

Position of authorised representative: Managing Director

Declaration:
I declare that as the authorised representative, the above information in relation to the supply/manufacture of this product is in conformity with the stated standards and other related documents following the provisions of EEC Directives.

Signature of authorised representative:……..

NOTES