

TIC Electronics Ltd

(TIC Irrigation Controls)

Decoder fault-finding with the iT508/Aquarille Touch

(Also applies to *Smart 127/256* controller coming in 2017)

(Plus Database troubleshooting)



Forward

Fault-finding of decoder irrigation systems is made much easier with a sensitive/leakage type current clamp meter. Suitable clamp meters are available from TIC Irrigation Controls. If sourcing one yourself, ensure that it has a range that displays mA to at least one place of decimals. i.e. 199.9 mA (Milli-amps)

This document focusses on the capabilities of the IT508/Aquarille Touch to run decoder diagnostics and to record & display the results. A basic understanding of electrical theory is essential; knowledge of how it applies to decoder irrigations systems is a distinct advantage. A Google search will turn-up many documents on the subject.

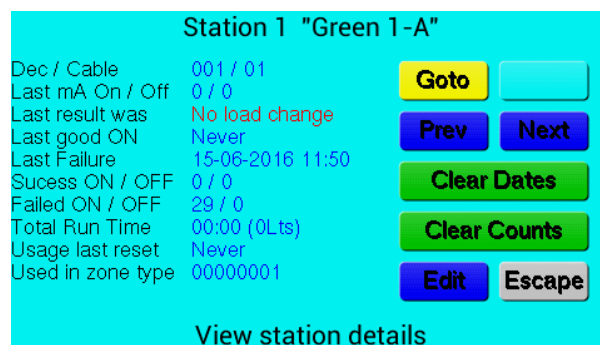
You are strongly advised to check that the controller has the correct current date and time set. All event logging records date and time, and not having the correct real time set can cause much confusion.

Detail

The IT508 (Aquarille Touch) has very powerful built in decoder diagnostic capabilities.

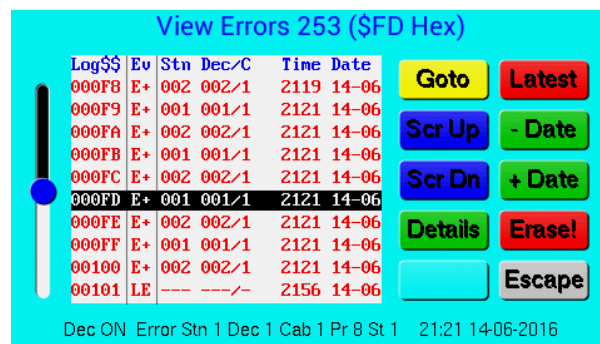
These are located within 5 areas of the controller's functionality.

- 1) During normal irrigation activity. The controller logs the total number successful and unsuccessful attempts to switch decoders ON and OFF. Furthermore it records the time and date of the most recent success, and the time, date and nature of the most recent failure.



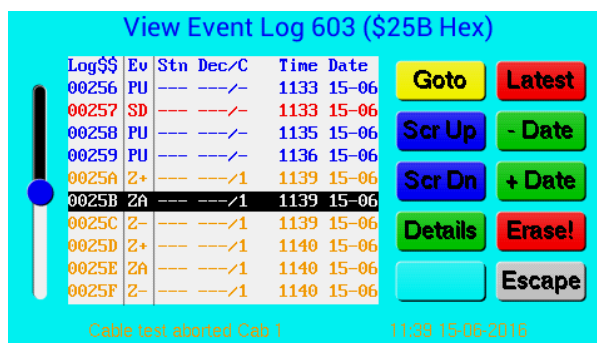
Station Detail Screen

- 2) During normal operations. The controller also records every decoder switching fail event to the error log. These records contain the event Time and Date as well as which program was running, and which start had started that program. The error display list also displays the decoder address and cable number associated with the station. The error log does not record decoder fails during manual or zone testing operations.



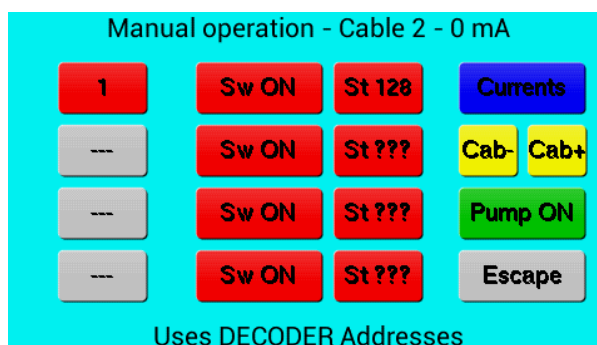
Error Log Screen

- 3) During normal operations many and various events are written to the event log. This information is less about actual decoder switching events, but does help with identifying other events which may have contributed to, or help explain, decoder switching failures.



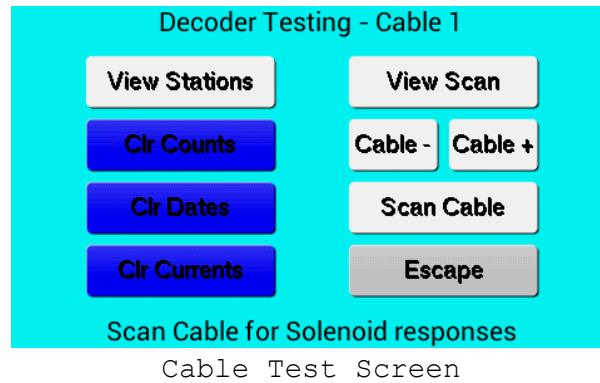
Event Log Screen

- 4) Manual Operations. This allows individual decoder addresses to be signalled on and off. Decoder addresses do not have to be assigned to stations for these operations, but if they are, there are quick links (**St nnn** button) to the station records – which will display the station details, including the status of the most recent signalling event. Note – Failures detected during manual operations are NOT written to the error log.



Manual Testing Screen

5) Cable Testing. This allows single cables, or all 4 cables to be tested automatically. Testing is done sequentially, starting at the lowest possible decoder address, and incrementing to the highest possible decoder address. The results of these tests are recorded (referenced to Decoder addresses) in dedicated test results records that are separate from the station record. These test results contain the success or nature of failure status of decoder switching attempts at each address, together with date and time of testing and the ON and OFF current changes seen. These results remain available to view any time, and are only overwritten when a new cable test(s) is actioned.



General Diagnostics

It is best to adopt a structured and sequenced approach to fault finding.

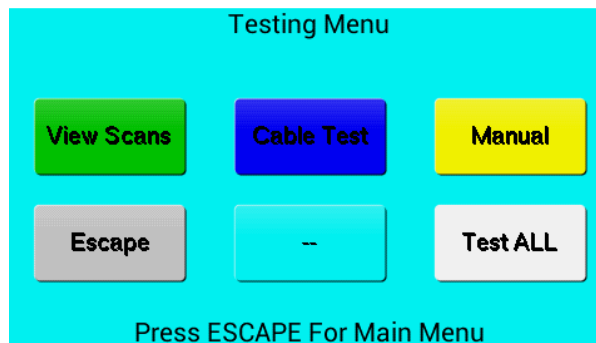
- 1) Do any stations switch OK?
- 2) Does a known good decoder/solenoid work (from Manual screen) when attached directly to the controller?
- 3) Are failures confined to a single cable (multi-zone site)?
- 4) Are failures confined to a single area or cable branch?
- 5) Are cable currents (no decoders commanded ON) consistent with No of known decoders 'times' their quiescent currents?
- 6) Is the 'sensitivity' value set to a realistic value? Default is 100 mA, allowable range 50 ~ 250mA
- 7) Has anyone been digging or trenching recently?

The general approach is to start by considering if the controller is working. Does it power on and display a sensible screen (The home/clock screen on the first page of this document). Does it respond to key presses?

Look thru the data set-up menus and check that the information displayed is consistent with the decoders - and cables they're attached to - known to exist at the site. Please read the appendix below if the system "did work" but now doesn't, **and** database corruption is suspected.

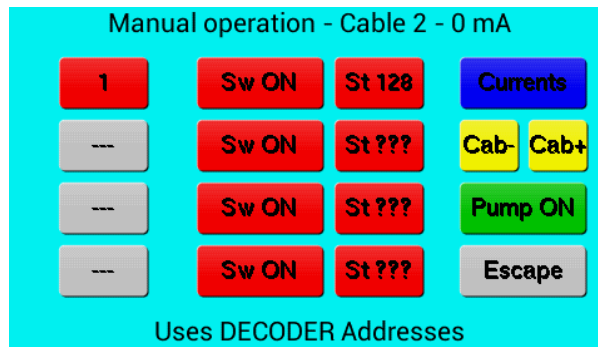
Once you are happy that the controller is functional (*), and the databases are good, navigate to the test menu by pressing **MENU** then **Testing** – The screen below will be displayed.

(*) We're yet to determine if it's able to power the cables and signal decoders



Test Menu Screen

Next Press **Manual** to display the screen below (Cable number will be whatever was last set)



Manual Screen

Use **Cab+** and **Cab-** to select the cable that you wish to investigate. You may signal decoders on one cable, and then do likewise for other cables (max 4 decoders per cable). All cables will remain energised as the cable number is changed, and will only be de-energised when escaping from the manual screen. Additionally you may turn on the pump relay with the green **Pump On** button. Once on, the same button will change to Red, and say **Pump Off** – and pressing it now will turn off the pump relay. The relay is automatically turned off when escaping from the manual screen.

Press the top left button and enter a decoder address – one that you know to exist on the site (on the cable selected), and ideally one that is defined as a station. Once the address is entered, the **St---** value should change to **St nnn** where “nnn” is the station number. If it remains as **St ---** then this indicates that the decoder address entered, on the currently selected cable, is NOT defined as a station in the database.

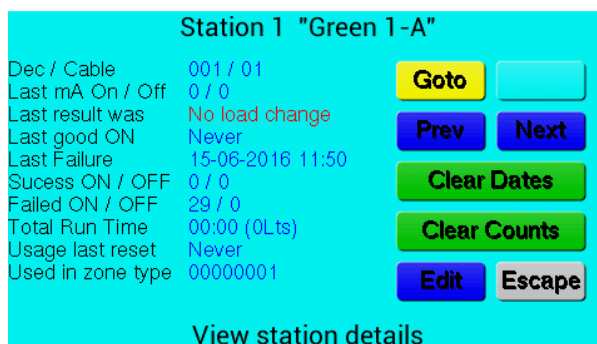
Press **Sw ON** button to the right of the decoder number button. The decoder will now be signalled, and the address button will change to either Green or Red if it refers to a station, or remain grey if it does not. If the decoder switches successfully, the address button will turn Green, and the **Sw ON** button will change to **Sw OFF**. If it remains as **Sw ON** it indicates that the decoder did not switch successfully and the address button will be Red. Pressing the **Stn nnn** will show the detail screen for the station, and give the reason for the failure.

By far the most common reason for failure is “No Load Change”. This happens when the measured change of current between before and after decoder signalling is measured to be less than the sensitivity value set elsewhere in the menu structure. The measured current difference of the most recent decoder signalling operation is also displayed in the Station detail screen. This figure (for a good decoder/solenoid) is typically between 75 and 250mA - Values outside of this range indicate a problem – actual figures vary due to the length and topology of the field cable, and also the type of solenoid fitted at the decoder, and how many solenoids are wired to it (TIC recommends 1 solenoid per decoder, and a maximum of 2). Low values could indicate broken or poorly jointed cable, failed solenoid, or simply no decoder at the address. Too high indicates faulty solenoid or decoder, or faulty cabling between decoder and solenoid.

“Last result was” will show one of the following messages: -

- a) " Success" (Decoder switched OK)
- b) " No load change" (Insufficient current change detected)
- c) “ No AC to cable” (Cable has no AC connected)
- d) “ Never Tried” (Decoder has not been tried since factory reset)

There are several other messages that could be displayed, but they would indicate a system anomaly and should be reported to your supplier/agent.



Station Detail Screen

At this stage it would be useful to measure the AC volts on the selected cable. This should be around 30VAC (i.e. close to the voltage of the transformer supplying the zone – some installations may have higher voltage transformer(s) to overcome limitations of older decoders).

The text at the top of the Manual screen will now show the current being drawn. Additionally the Currents button may be pressed to see live currents being drawn on all cables. Cables that are not energised (because no decoders have been tried in manual) will show 0mA. Once a decoder has been tried, the live cable current will be displayed. If no decoders are on, this will be the total decoder quiescent current.

This is an important number for fault-finding. If cable current figure(s) are not consistent with what is known about the type(s) and quantity of decoders on the cable(s), then this indicates problems. Too much current means there are faulty decoder(s) or current is flowing to earth. Too little means broken cables and/or hi resistance cable joints.

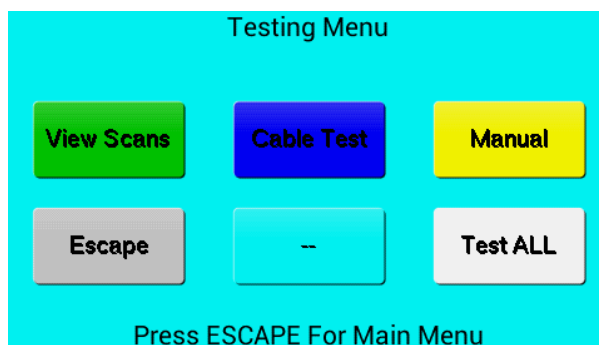
<Add screenshot – Zone Currents Screen>

Show Cable Currents Screen

If you are able to switch decoders from the manual screen – either out on the site, or one brought to the controller and connected directly to the field cable terminals, then you should proceed to run cable test(s). If you cannot get anything to switch, and a directly connected decoder (field cable disconnected) doesn't switch at its known address, then the controller itself is at fault. (Please check it with a decoder programmer.)

Automatic cable tests.

From the home/clock screen press **Menu** then **Testing**.



Test Menu Screen

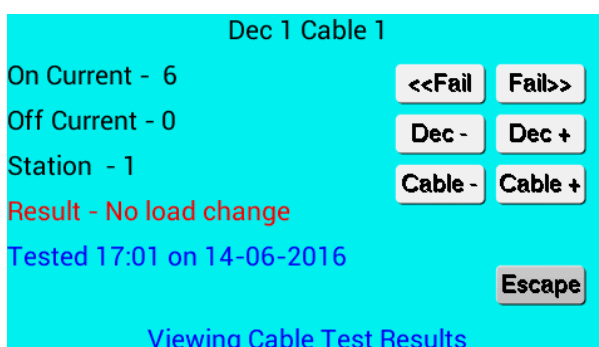
Now press either **Cable Test** or **Test All**. **Test All** simply does **Cable Test** for all 4 cables; it does not test cables that have no AC supply, and does not over-write prior test results if no AC is detected.

You will be asked to confirm that you wish to proceed, and the testing will then start. A 4 zone controller with AC to all 4 cables will take several minutes (at least a cup of tea, perhaps two) to complete the tests. (N.B. A future software version will contain an option to skip decoder addresses that aren't configured as stations)

Once complete press the View Scan button to display the decoder test run results screen. Note - all cable test results reference the decoder number on the given cable. Do not confuse with Station number. The Station number is displayed if a Station is found to exist that is configured to have the decoder/cable combination. The existence of "good" decoders that don't show a station number should be investigated, and ideally configured to be a station, or physically removed from the field cable.

Press <<**FAIL** and **FAIL**>> to jump to previous and next decoder address that failed testing. **DEC+** and **DEC-** take you to the next and previous decoder regardless of whether it failed or not.

Pressing **Cable+** and **Cable-** will access the most recent test runs for the other cables.



Decoder Tests Result Screen

If there are failed results that show current change figures close to the system Sensitivity value, then the latter should be reduced to at least 20mA below the lowest figure seen. If just a few decoders show low figures, whilst all the others are much higher, then this could indicate cable jointing problems.

Generally any situation that indicates a required sensitivity figure below 75mA should be investigated as a possible field cable problem.

We refer to the controller 'Database' as a single entity. Within the controller there are individual databases (Stations, Zones, Programs etc), the singular term refers to a single instance of all these databases as a group. Where the plural term is used, it refers to more than one instance of the grouped database.

The *iT508/Aquarille Touch* holds its live database in battery backed RAM. Electronically this memory is accessed by a formal command structure in the controller software, and therefore corruptions caused by power glitches etc. are very very unlikely.

The memory shares hardware resources with the circuitry that supports the SD Card interface, and therefore to guarantee data integrity - there needs to be a firm rule - ***that SD cards may neither be inserted nor removed whilst power is applied to the controller.*** If an SD card is inserted whilst the controller is powered-on, software immediately stops ALL activity and displays a message asking that the card be removed. Once removed, the controller re-starts.

If the card is left in situ, the controller will not perform any irrigation activity whatsoever.

The risk of a corruption of the databases from the insertion of an SD card is extremely remote, but remains a theoretical possibility and hence the rule.

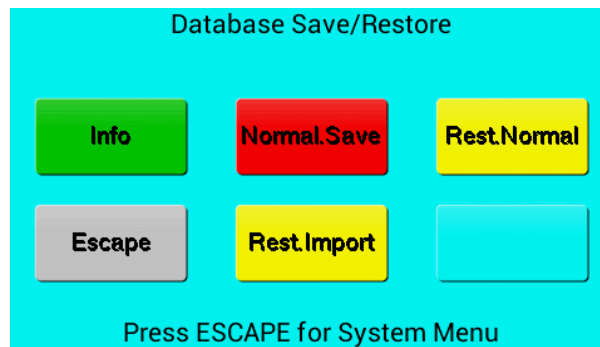
The system deals with databases in two formats. Comma Separated (CSV) and Binary (BIN). The BIN format is used internally (saved in Flash memory), and comprises every element of the database including dates, counts and totals.

The CSV format deals only with the primary database parameters, and not with any counts, dates and totals etc. These values are zeroed when a new CSV is imported.

The CSV format is used for importing and exporting databases from and to Microsoft Excel – typically running on a personal computer. This ability saves a massive effort that would otherwise be required to create and maintain databases via the touch screen interface.

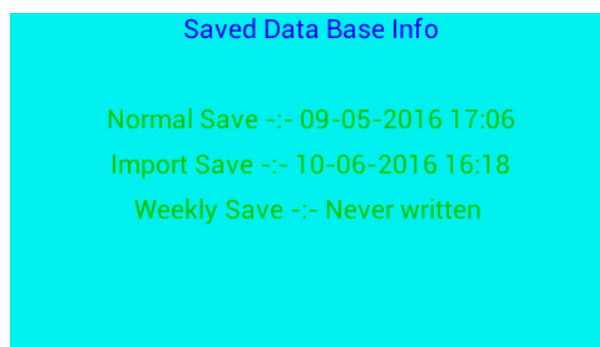
Whilst the CSV format is simple enough to edit with a normal text editor, the appearance of the data as plain text is not helpful for checking that it's correct, and therefore an Excel compatible spreadsheet program is strongly recommended. Please see other documentation that describes the generation and use of CSV files in detail.

BIN databases are manipulated via the Database Save/Restore screen, and in some instances automatically as the result of other actions.



BIN Database Save/Restore Screen

The Green **Info** button displays date information about the 3 internal locations that hold BIN databases. The three locations are referred to as “Normal”, “Import” and “Weekly”.



Saved Database Info Screen

Normal Save is where the database is saved to whenever the Red **Normal.Save** button is pressed. This can be done anytime, perhaps after an extensive database update performed via the touch screen. The Yellow **Rest.Normal** button will restore a previously (**Normal.Save**) saved database, over-writing the current database.

The Import BIN database location is where the database is saved to prior to a CSV database import. The intention here is that if a bad database is imported by CSV, or if (say) a contractor accidentally imports a wrong database, then the database as it was prior to the import can easily be restored.

N.B. The Import BIN is written prior to **each** CSV import, and therefore if you import more than one bad CSV database, the prior (good) database will be overwritten. Therefore if a bad CSV has been imported, it is strongly recommended that the Yellow Rest.Import action is done before trying another CSV file import. Alternatively (and also recommended) you can perform a **Normal.Save** operation prior to performing a CSV import.

The Weekly location is presently unused. The intention was that the controller will save it’s database on a weekly basis. This is not implemented, and there is no plan to implement it in the future as it is not required.

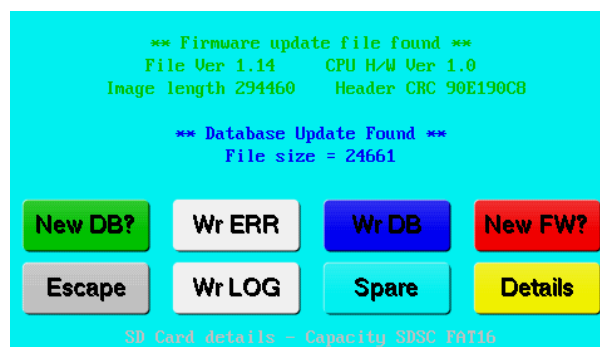
If a database corruption is suspected, then one or some of the following actions may be taken.

- 1) Re-import the database (DB508.CSV) that was generated when the controller was 1st commissioned. It is normal for the user, or the installer to have generated a CSV file (Using Microsoft Excel) on a PC when the system was commissioned. It is also likely (recommended) that any subsequent changes to the database

would have been made in the CSV file and the file re-imported. It is possible that changes may have been entered manually via the touch screen – Whilst this is not recommended for planned upgrades and changes, it is often unavoidable. Any manual changes therefore need to be made in the CSV before re-importing. Also (at the time of writing (*)) the CSV file import and exporting DOES NOT support program steps that call Stations, so any program step that calls individual stations (as opposed to water zones) cannot be exported and imported via CSV, and will be lost. (They are saved and restored via the periodic (Normal) BIN DB save action) and also by the (Import) BIN DB save action that is performed before a CSV import.

(*) This will be addressed in a future firmware upgrade at some version above the current V1.17)

- 2) Restore the periodic (Normal) saved BIN DB as discussed above.
- 3) Restore the pre-import image (Import) BIN DB as discussed above.
- 4) Export the database to a CSV – Do a “Factory” initialise – Re-import the CSV. This is achieved as follows. Switch off the controller and insert an SD card. Re-power and wait for the SD card screen to appear.



SD Card info Screen(*)

Press the Blue **Wr DB** button. This will create a file on the SD card - named **DBSxxxx.CSV** (xxxx is a number that increments every time the controller writes any new file). Next, Turn OFF the controller and move the SD Card to a PC. Open the file with Excel. Examine the contents, and make any corrections or changes required. Save it back out to the SD card under the name DB508.CSV. (Back-up (by renaming) any prior DB508.CSV file if needed)

(*) Note also that the Error and Log files can be written to SD card from the SD-Card info screen.

Back at the controller, navigate thru the menus and perform a factory initialise (pls see other documentation on how to do this). You may wish to perform a **Save.Normal** prior to this if you believe the current live database has any value (You already have it captured as a CSV).

Once the factory initialise has completed, turn off the controller, re-install the SD card and switch on. When the SD Card info screen is displayed, press the Green **New DB?** button. This will read-in the modified CSV file saved from the PC as DB508.CSV. If the green New DB? Button is not displayed, it means that the SD card does not contain the file DB508.CSV – most probably due to it having be miss-named. (Note – because a

factory initialise has been done, this CSV import action will write the import BIN internal database save location with a blank database).

About TIC

TIC Electronics Ltd (Co Reg. 08970010) is the designer and manufacturer of the *IT508/Aquarille Touch* controller electronics. TIC Electronics Ltd trades under the name TIC Irrigation Controls. TIC Electronics Ltd is a general electronic design and manufacturing business, and for non-irrigation activity it trades under the name JC Electronics.

Both “TIC Irrigation Controls” and “JC Electronics” are long standing trading names of our business – which started out in 1991 as “Nigel Bond trading as JC Electronics”.

We have extensive experience of designing, developing and manufacturing reliable and lightning immune irrigation electronics, including our famously reliable “FieldSwitch” ranges of 2 and 3 wire irrigation decoders. We have shipped over 15,000 units since 2007, and to date not a single one has been returned.

We have established relationships with far-eastern component manufacturers and suppliers. We have partnerships with Eastern European sub-contract manufacturers that give us the logistics to support high capacity - mass production and assembly – through to small batch and prototype.

The *IT508/Aquarille Touch* is manufactured by Aquarille Consultants from the electronic assemblies supplied by TIC. Whilst TIC Electronics is keen to provide technical support for our products, live support is provided by Aquarille and/or the installing contractor.

TIC Electronics will always make every effort to support those users who cannot access their usual support. However - we require that these usual sources of support have been exhausted before responding to requests.

We also strongly prefer that support enquires made on TIC are sent via email in the 1st instance, and contain full details of the problem, and what has already been tried – together with as much detail as possible of how/when the problem started and what decoder types etc are fitted.