BAT electronics	Crabtree Endurance Test Lab Panel	CRAB100-1
	Revision No:	01-1
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	Approved by:	F. Emslie

BAT ELECTRONICS

CRABTREE ENDURANCE TEST LAB PANEL

1. Contents

2. INTRODUCTION

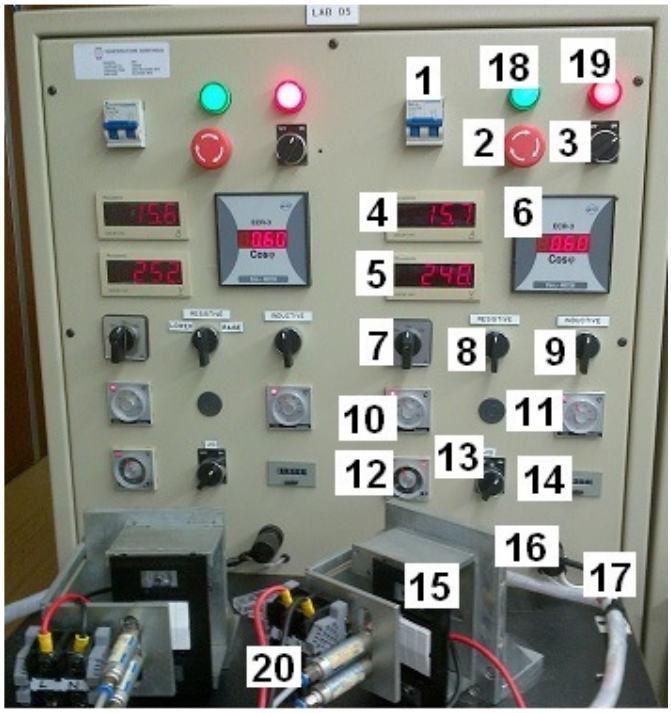
- The scope of this document is to describe the function and operation of the Crabtree Endurance Test Lab Panel.
- The panel is designed to specifically run endurance testing on switch type devices.
- The panel consists of:
  - LAB01 to LAB04 rated for 30 amps testing.
  - LAB05 rated for 60 amps testing.
  - LAB06 automated control interface for LAB01 to LAB05.
- Each of the test panels, LAB01 to LAB05 are able to be used in manual mode and if connected to LAB06 be run automatically.
- In auto mode, LAB06 will control the ON/OFF and JIG function of LAB01 to LAB05.
- LAB06 interface and control will offer the following:
  - Control ON/OFF function.
  - Control JIG on/off function.
  - Measure and display:
    - Amps
    - Volts
    - Power Factor
    - Temperature on Live terminal.
    - Temperature on Neutral terminal.
  - Test type select:
    - Chart test
    - Cycle test
    - Temperature rise test
  - Record, display and save test data files to selected network drive location.
  - Remote test panel capable of being viewed across local network.

3. TEST PANEL FUNCTION OVERVIEW

- LAB01 to LAB05
  - Control, measure and display functions local to control panel.
  - Test voltage power transformer, located external to control panel.
  - Variable load, located external to control panel.
  - Jig function realised using electrical controlled pneumatic cylinders.
  - User to set all test levels as required.
  - User can run test manually by using local timed jig control.
  - Test cycles recorded by manual counter.
  - Use can once test levels set, run test from LAB06 automatically.

- LAB06
  - Control panel based on windows computer layout.
  - Operator interface via:
    - Keyboard
    - LCD display
    - Mouse
  - Amps and Volts measure done via USB Analog to Digital converter.
  - Power factor calculated using measured Amps and Volts phase shift.
  - Temperature measure done via RS485 temperature network connection.
  - Panel ON/OFF and JIG control done via digital control of power relays.
  - Test cycle monitored, data recorded and displayed during test.
  - If test selected that provides PASS/FAIL checking, then test stopped if FAIL condition encountered.

4. LAB01 – 05 CONTROLS



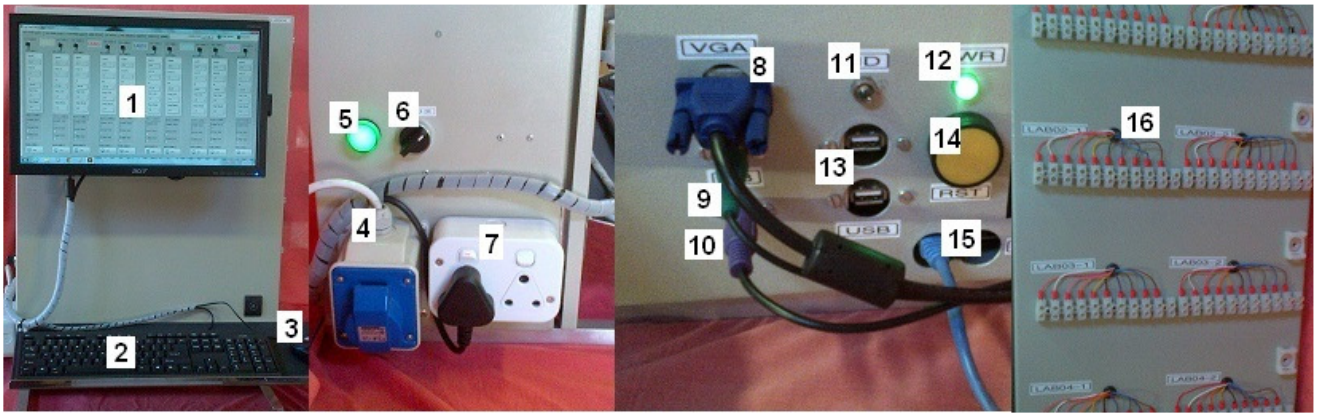
1. Panel circuit breaker, power on.
2. Emergency switch, press to switch power off.
3. Test ON/OFF, used to enable test power to external voltage transformer.
4. Test amps display.
5. Test volts display.
6. Test power factor display.
7. Test voltage selector.
8. Resistive motor control, used to set test amps value.
9. Inductive motor control, used to set test power factor.
10. Temperature cut out control, live output, (red).
11. Temperature cut out control, neutral output, (black).
12. Jig on/off timer.
13. Jig timer output on/off control switch.
14. Jig amps cycle counter.
15. Test jig.
16. Load output terminal, (red live, black neutral).
17. Terminal temperature probe, thermocouple, (red live, black neutral).
18. Circuit breaker on indicator lamp (green).
19. Test power on indicator lamp (red).
20. Test cylinder air pipe quick release.

5. MANUAL TEST PANEL OPERATION

Note; all numbers in brackets (x), refer to front panel controls as described in previous section.

- Select test panel based on test current required:
  - Up to 30 amps, LAB01 to LAB05.
  - Up to 60 amps, LAB05.
- Mount test switch into jig (15).
- Connect test cable as per test specification for required test current to output terminals (16) and then to switch terminal inputs.
- At switch terminals make sure some bear copper is available for temperature clip connection.
- Attach temperature clips (17) to switch live and neutral cable on bear copper section.
- Make sure air connections tight and leak free to test cylinders.
- Release emergency stop switch (2).
- Switch test panel power on at circuit breaker (1), power lamp on (18).
- Note; at this stage all internal control power 220VAC on to enable test jig setup.
- Set temperature cut out control (10) and (11) to around 80 deg. These controls are used to prevent thermal run away and switch off the test panel power circuit in such an event. Note; once the temperature drops below the setting the panel will automatically switch back on.
- Set jig timer control (12) to around 2 seconds.
- Set jig cylinders to initial position to enable test switch to be activated.
- Set jig timer output switch (13) on and check test switch activation.
- Switch timer control (13) off to stop cylinder activation, continue until test switch being activated as required.
- Set test switch to on position, use quick connection (20) to operate ON cylinder to get switch in the on position.
- Set test power switch (3) on. The test panel will switch on power circuit to external voltage transformer, which will enable test load to be set.
- Select required test voltage (7), value will be displayed on voltmeter (5).
- Using resistive (8) and inductive (9) motor control, set test current (4) and power factor (6). Note; Set test current first at some level close to required then adjust power factor, the test current level will change as power factor is adjusted. Continue until required settings achieved.
- Change the air cylinder control so that the switch is in the off position, using the quick air pipe connection (20).
- Reset the cycle counter (14) to zero.
- Set the jig control timer switch (13) on.
- The jig will be cycled at the timer set time, activating the test switch from the Off to On position, each cycle will increment the cycle counter (14).
- Once the required test cycles are reached, switch off test power (3), press in the emergency stop switch (2).
- Test complete.

6. LAB06 CONTROLS



1. LCD display
2. Keyboard
3. Mouse
4. Power input 220VAC.
5. Power on lamp (green)
6. Power ON/OFF switch.
7. LCD display power socket.
8. LCD display VGA connection.
9. PS/2 mouse connection.
10. PS/2 keyboard connection.
11. Hard drive activity lamp indicator.
12. Motherboard power lamp indicator.
13. External USB connection.
14. Motherboard power switch.
15. LAN connection.
16. External connection points for panel control cable.

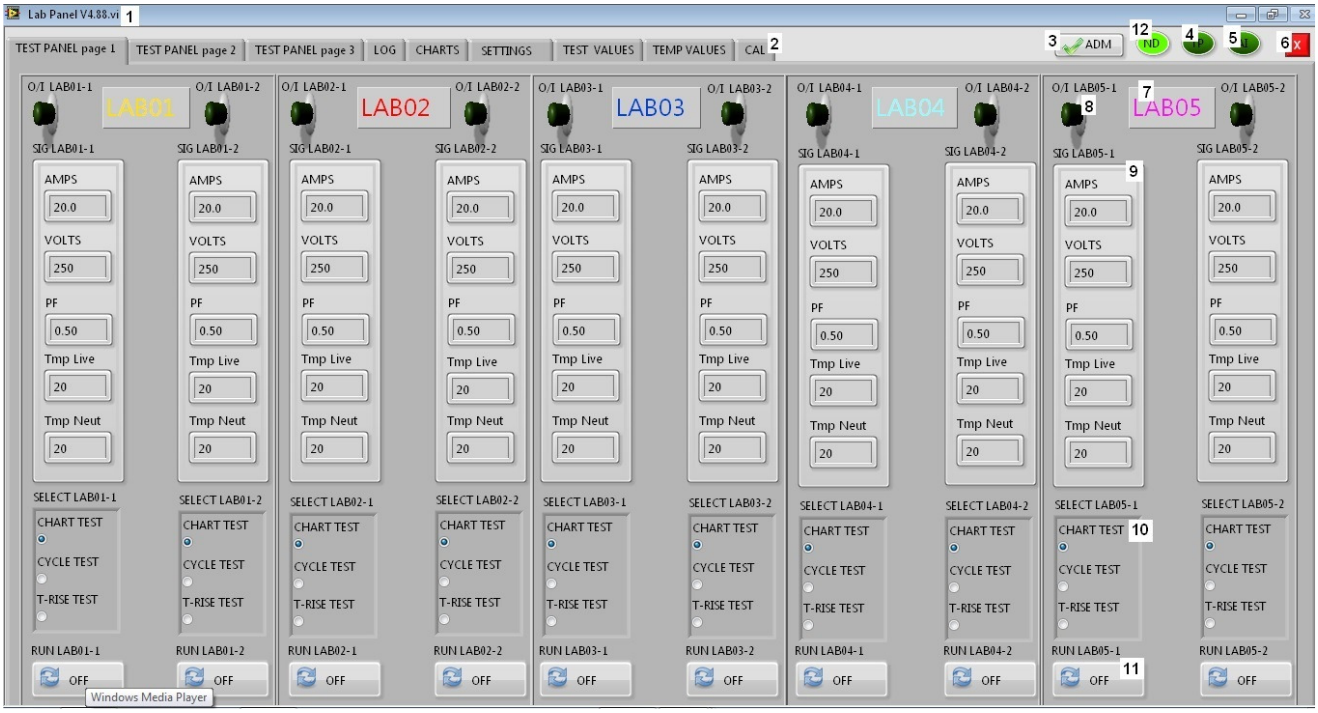
7. LAB06 MACHINE SETUP INSTRUCTIONS

Note; all numbers in brackets (x), refer to front panel controls as described in previous section.

- LAB06 is essentially a windows operating system PC using input and output interface hardware to perform control of LAB01 to LAB05.
- A custom application developed using LabView SDK is being used to perform the test panel control functions on LAB01 to LAB05.
- Make sure each test panel LAB01 to LAB05 has been connected to the external control connections (16).
- Connect LAN (15) cable to network.
- Make sure VGA (8), Mouse (9) and Keyboard (10) connected.
- Connect (4) to 220VAC supply.
- Switch on LCD power (7).
- Switch on panel power (6), lamp on (5).
- Press and release power switch (14), wait for (12) to light up, if not press (14) again.
- Wait for Windows to boot up and follow login procedure, enter password as supplied by IT dept.
- Make sure the network drive being used to save test data to, is logged on.
- Note lamp (11) will show hard drive activity.
- Once login procedure complete and windows main screen is displayed, locate “Lab Panel” icon and run (place mouse pointer on icon and double click).
- It is advisable to leave the panel powered up and only switch off if any maintenance or modifications are required.
- If the test panels LAB01-LAB05 are not being controlled, close the control panel program to avoid unnecessary disk drive space being taken up with “background” windows administrative functions related to the test program.
- Start the program again when required.

8. LAB06 MAIN SCREEN

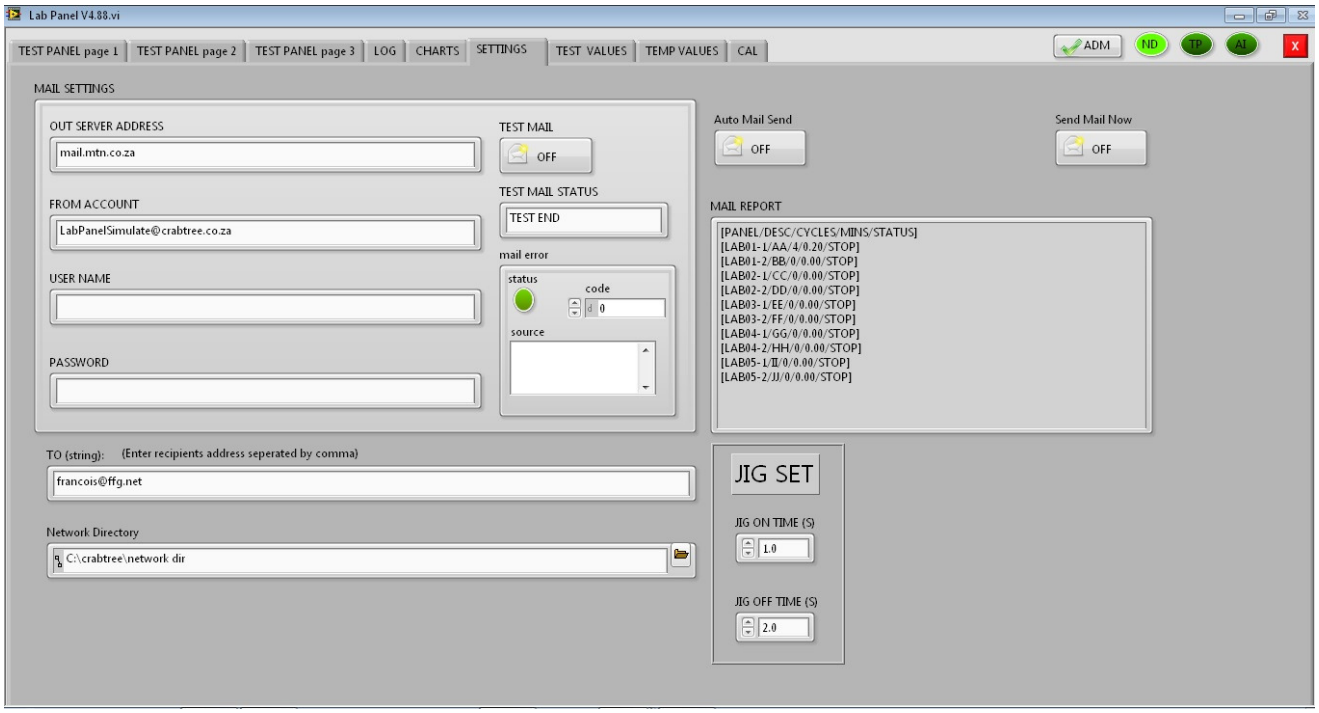
Once the Lab Panel program has been started the main screen below will be displayed. This will provide the user interface for all test control required for LAB01 to LAB05.



1. The program name and version.
2. A selection of 9 tabs that are user selectable for user interface, test setup and control.
3. Administrator selector button, password protected and only available for administrator functions.
4. Indicator to display when active that test panel temperature readings are being taken.
5. Indicator to display when active that test panel Amps and Volts values are being taken.
6. Program END and close.
7. Panel number.
8. Panel ON/OFF selector, OFF (green), ON (red), use mouse pointer and click to activate.
9. Panel test measured values display.
    a. AMPS: test current as set by resistive control.
    b. VOLTS: test volt selected by selector switch.
    c. PF: power factor calculated from amps and volts phase shift, as set by inductive control.
    d. Tmp Live: temperature of live (red) thermocouple clip.
    e. Tmp Neut: temperature of neutral (black) thermocouple clip.
10. Test type selector
11. Test START/STOP selector button, use mouse pointer and click to activate.
12. Network drive location indicator (ND), OK (green), ERROR (red).

9. LAB06 SET MAIL, NETWORK DRIVE & JIG (SETTINGS)

Select tab, “SETTINGS”.

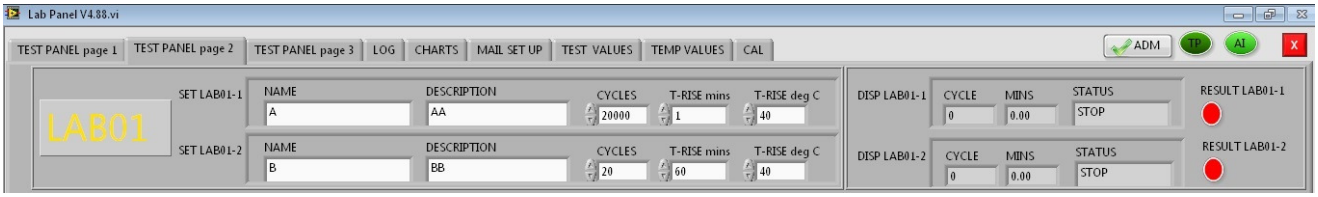


- MAIL SETTINGS:
  - Each time a test is completed the MAIL REPORT will be mailed to the recipients list entered in the “TO (string):” if the “Auto Mail Send” button is set.
  - The MAIL REPORT can be sent on demand by selecting the “Send Mail Now” button.
  - OUT SERVER ADDRESS: Set to the mail server used.
  - FROM ACCOUNT: An account name given to the test panel so that the recipients will recognize the send data. Default name set to: LabPanel@crabtree.co.za
  - USER NAME: Set if mail server requires.
  - PASSWORD: Set if mail server requires.
  - TEST MAIL: Use this button to send a test mail to the recipient list. Once the test is complete TEST END will be displayed in TEST MAIL STATUS.
  - Mail error: Status will indicate if any error occurred during the mail send process.
    - Green: no error detected.
    - Red: error detected and description of error displayed.

- NETWORK DATA DRIVE:
  - Use the 'Network Directory" selector  to navigate to and select the network directory drive location required for test data file storage.
- JIG CONTROL:
  - JIG ON TIME (S): Set the jig on time in seconds, minimum setting 1 second.
  - JIG OFF TIME (S): Set the jig off time in seconds, minimum setting 2 seconds.
  - Note; All test jigs are controlled in parallel.

10. LAB06 SET TEST SAMPLE DATA

Select tab, "TEST PANEL page 2".



- Enter:
  - NAME: A descriptive value that will be recorded in the test data file.
  - DESCRIPTION: A descriptive value that will be recorded in the test data file.
  - CYCLES: The number of test cycles required.
  - T-RISE mins: The number of minutes for a temperature rise test.
  - T-RISE deg C: The maximum value the test clip temperature measurement is allowed to rise above ambient room measured temperature.

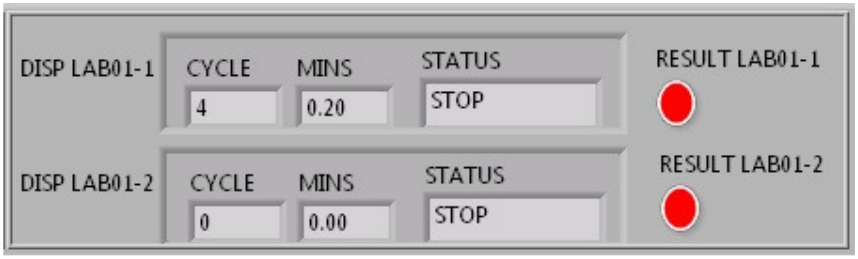
11. LAB06 START TEST

- Select tab “TEST PANEL page 1”.
- Switch test panel main power on, Sec 4 (1).
- Release E-Stop, Sec 4 (2).
- Follow manual test procedure, Sec 5 and set up test parameters.
- During test parameter setup check on main screen for value display, Sec 8 (9).
- Switch off jig timer control, Sec 4 (13).
- Switch off test panel test ON/OFF switch, Sec 4 (3).
- Make sure test sample switch is in the off position.
- Select required test from main screen, Sec 8 (10).
  - CHART TEST:
    - The test will cycle at set jig time.
    - Test data will be saved to network drive at the end of the test.
    - Test will run until set cycles is reached, no pass fail conditions checked for.
  - CYCLE TEST:
    - The test will cycle at set jig time.
    - Test data will be saved to network drive at the end of the test.
    - PASS / FAIL conditions:
      - If set T-RISE deg C, value exceeded for either live or neutral thermocouple, test fails.
      - If for ON jig cycle no test current measured for 10 consecutive cycles, test fails, display AMPS LO.
      - If for OFF jig cycle test current measured for 10 consecutive cycles, test fails, display AMPS HI.
      - If none of the fail conditions detected and test cycles reached, test passes.
  - T-RISE TEST:
    - The test will switch on the jig and run test for set T-RISE mins.
    - During test, cycles converted to time.
    - Test data will be saved to network drive at the end of the test.
    - PASS / FAIL conditions:
      - If set T-RISE deg C, value exceeded for either live or neutral thermocouple, test fails.
      - If no test current measured for 10 consecutive cycles, test fails.
- Set test panel on, set switch on main screen, Sec 8 (8).
- Check test panel switches on, lamp Sec 4 (19) on.
- Check test voltage displayed on main screen, Sec 8 (9).
- Set RUN switch on, Sec 8 (11).
- Once the test is started two checks are done:
  - If the test sample switch is in the on position, amps flow, the user will be notified to switch the test sample off and the test will be aborted.
  - The user will be given the choice to start the test from zero cycles or continue from last cycle value displayed.
- At any stage the test can be aborted by setting the RUN switch, Sec 8 (11), to OFF.

12. LAB06 TEST MONITOR (TEST PANEL page 1)

- Measured values displayed, see section 8.

13. LAB06 TEST MONITOR (TEST PANEL page 2)

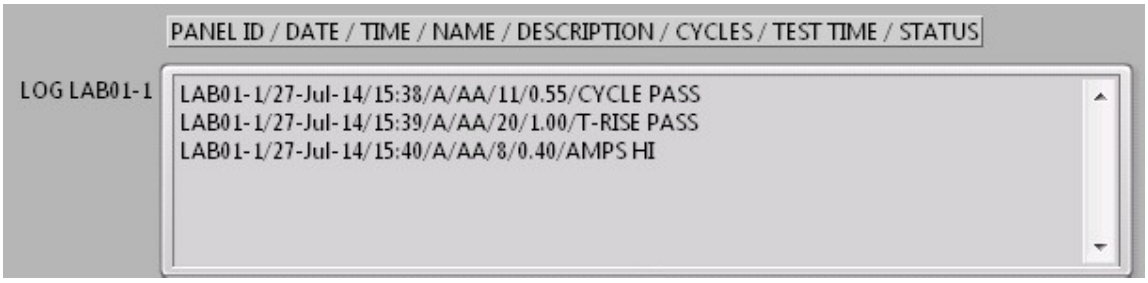


- Cycle number displayed, CYCLE.
- Cycle value converted to time and displayed as, MINS.
- Test status displayed, STATUS.
  - STOP: Test stopped, RUN button set to OFF.
  - AMPS HI: Amps measured for 10 consecutive OFF cycles.
  - AMPS LO: No amps measured for 10 consecutive ON cycles.
  - T-RISE HI: Thermocouple temperature exceeds temperature rise setting.
  - RUN: Test in progress, RUN button set to ON.
- RESULT LAB0X-X:
  - RED: Test failed or stopped.
  - GREEN: Test passed.

14. LAB06 TEST MONITOR (TEST PANEL page 3)

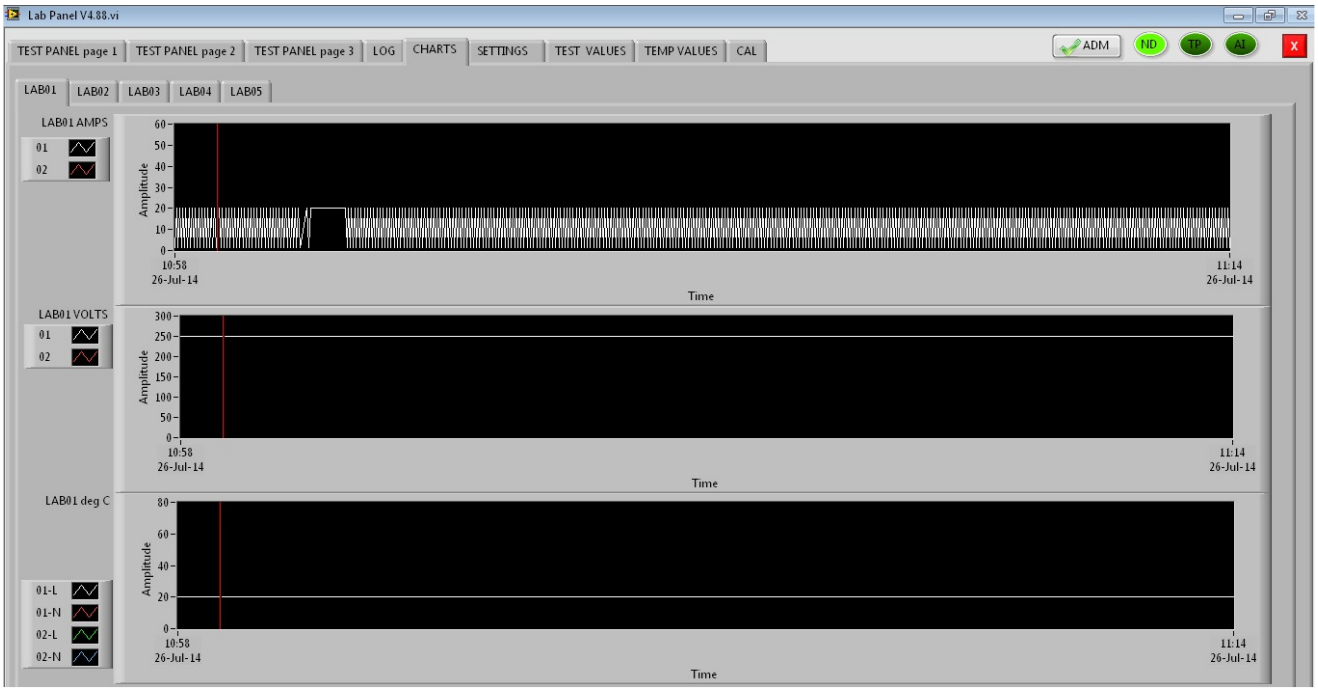
- TEMP START LAB0x-x:
  - The value of the ambient temperature probe at start of the test, for Live (TL) and Neutral (TN) connectors.
- TEMP RISE LAB0x-x:
  - The difference between the ambient start value and measured value, for Live (TL) and Neutral (TN) connections.
  - This gives the temperature rise value.
- JIG LAB0x-x:
  - An indicator showing the JIG control relay output, ON-jig on, OFF-jig off.

15. LAB06 TEST MONITOR (LOG)



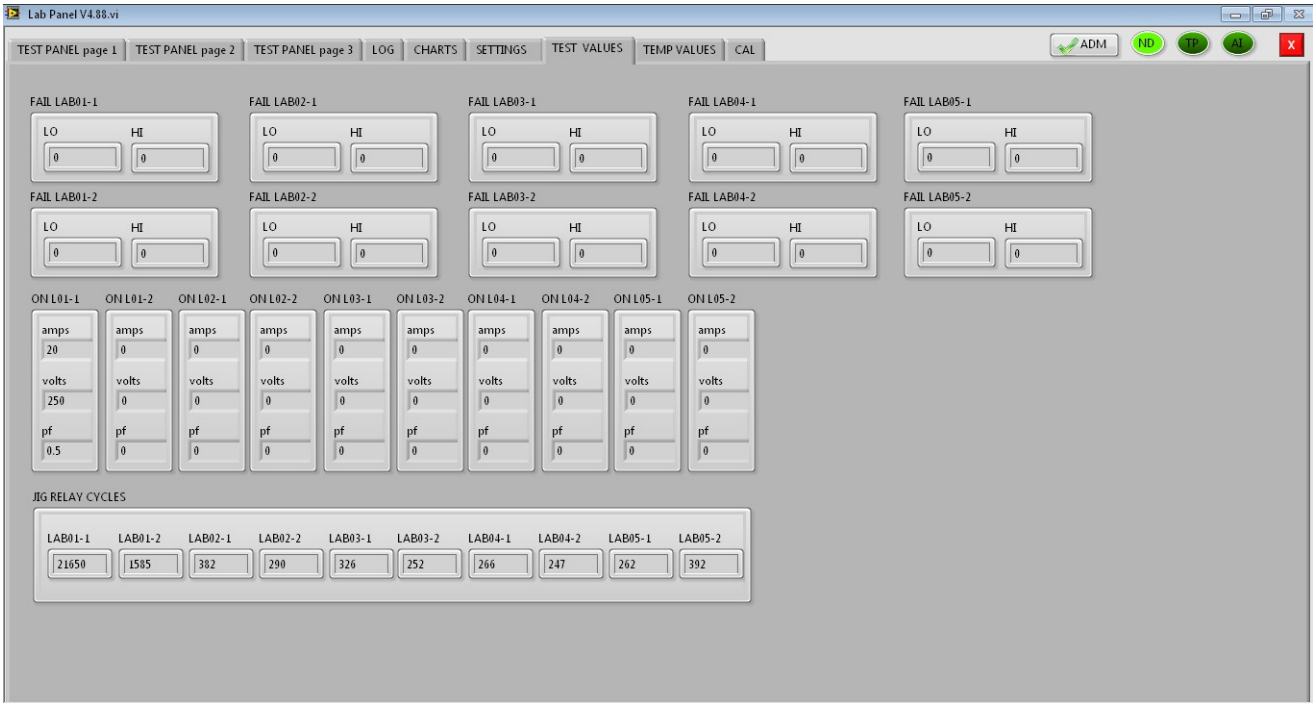
- At the end of a test a one line description of the completed test is displayed, per test panel.
- The log display will be cleared every 30 lines.

16. LAB06 TEST MONITOR (CHARTS)



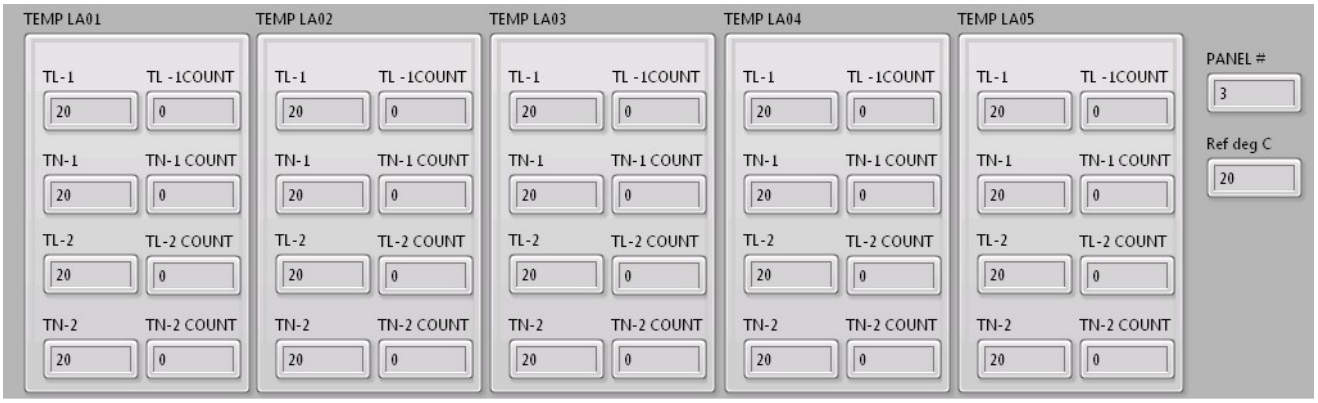
- Each panel has a chart that displays:
  - AMPS: LAB0x-1 and LAB0x-2.
  - VOLTS: LAB0x-1 and LAB0x-2.
  - Deg C: Temperature Live & Neutral LAB0x-1 and LAB0x-2.
- The chart is a sweep type, indicating new measurements on the left of the RED sweep line.
- The Time scale of the chart is +/- 15 minutes.
- The chart will run continuously, changing the Time scale as the end is reached and a new sweep is started.

17. LAB06 TEST MONITOR (TEST VALUES)



- FAIL LAB0x-x:
  - The counter that indicates when a test fail condition is detected, once the counter reaches the fail level (default of 10), the test will stop and FAIL condition displayed.
- ON L0x-x:
  - The test values measured for the jig on cycle.
- JIG RELAY CYCLES:
  - Each jig output cycle is counted and continuously totalled and displayed.
  - This indicates the total number of test cycles run for the particular test station.
  - Once the jig cycle total reaches 1 million cycles a notification message will be displayed. This is an indication that the jig control relay in LAB06 and relevant test panel should be replaced.
  - The notification message will enable the counter to be reset to zero.

18. LAB06 TEST MONITOR (TEMP VALUES)



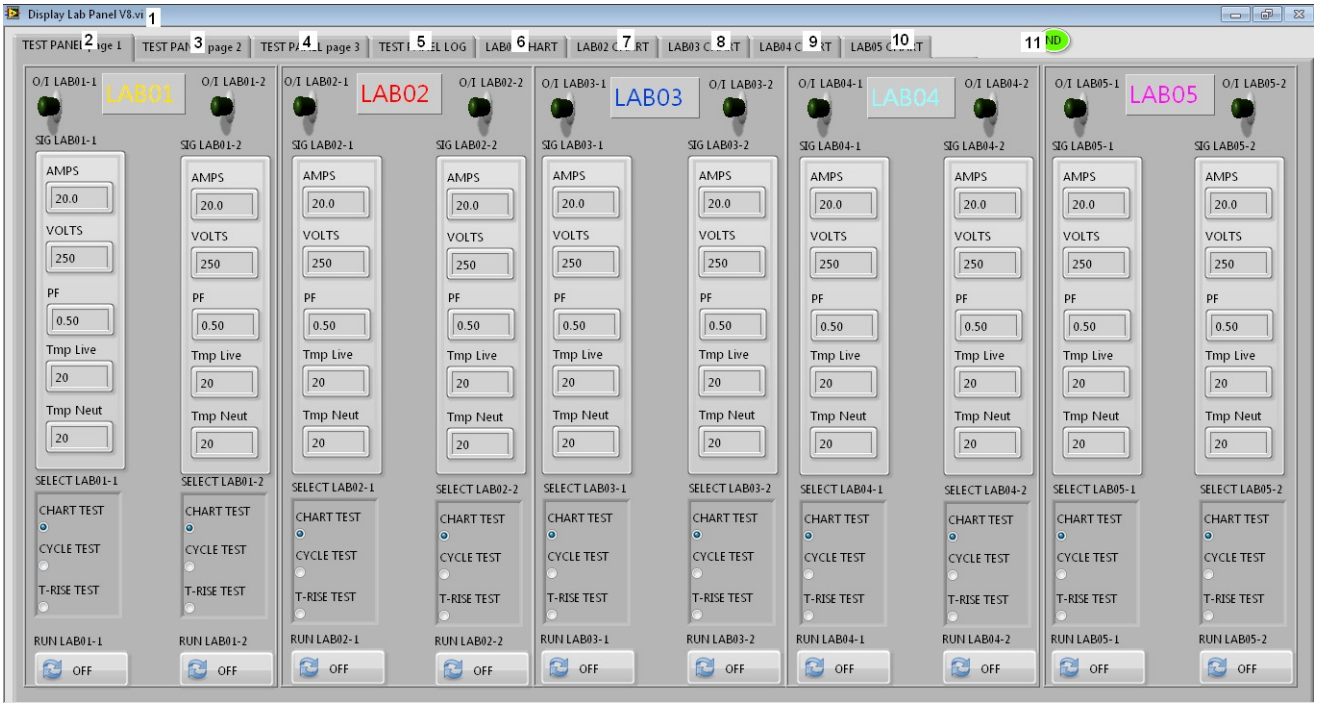
- Tx-x:
  - The displayed value of the temperature probe (clip).
- Tx-x COUNT:
  - To prevent temperature value jumps as a result of electric switching interference, the displayed temperature value is only updated if the measured value has changed by 1 (default setting) degree for 3 (default setting) consecutive measurement cycles.
- PANEL #:
  - Display indicating which test panel temperature measurement cycle is being done.
- Ref deg C:
  - The value of the ambient temperature sensor. This value is used to calculate temperature rise of a test:
    - Temperature rise = Measured temp – Ref deg C.

19. LAB06 TEST MONITOR (CAL)

- This page displays the calibration constants for each measured value.
- The calibration routine is run by selecting the “SET (cal)” button, password protected.

20. REMOTE DISPLAY

- A remote display panel is available that can be viewed over the crabtree network, using Microsoft Internet Explorer.
- The remote panel enables the test panel settings and functions to be viewed.
- Enter the following address into the search bar:
  - http://cra-wad-d-qctes.powertech.local:8000/LAB%20PANEL.html
- If the test panel remote display does not load, contact the IT department to resolve.



1. Remote panel software file name and version.
2. Main program TAB 1 duplicate see section (8).
3. Main program TAB 2 duplicate see section (10).
4. Main program TAB 3 duplicate see section (14).
5. Main program TAB 4 duplicate see section (15).
6. LAB01 display charts see section (16).
7. LAB02 display charts see section (16).
8. LAB03 display charts see section (16).
9. LAB04 display charts see section (16).
10. LAB05 display charts see section (16).
11. Test data network drive indicator, (ND), OK (green), ERROR (red).

21. TEST DATA FILE STORAGE

- At the start of a test a test data file is opened on the LAB06 local “C” drive.
- During the test the data is saved to the file and at the end of the test the test data file is closed and then saved to the network directory selected on the SEETINGS tab, see section (9).
- If the network directory is not available no test data will be saved to the network.
- The network drive is constantly checked for availability, if it is active then the ND indicator on the main screen is green, if it is not available then the ND indicator is red.
- The local “C” drive test data is saved using the following file path convention:
  - C:\crabtree\network drive\LabPanelyyyy\Month\Day\DataFileName.tdms
- The network drive test data is saved using the following file path convention:
  - Drive:\LabPanelyyyy\Month\Day\FAIL or PASS or STOP\DataFileName.tdms

- On the network drive each data file is placed in the Day sub directory depending on the test result:
  - FAIL: All test files for the day that failed.
  - PASS: All the test files for the day that passed.
  - STOP: All the test files for the day where the test was aborted.

- The test file is named as follows:
  - Panel number-Test type – description field – time test started.tdms

22. TEST FILE DATA TYPE

- The data saved to each file:
  - Test set up:
    - The description field, see section (10).
    - The set test cycles, see section (10).
    - The set temperature rise value, see section (10).
    - The set temperature rise test minutes, see section (10).
    - The name field, see section (10).
  - For each cycle (ON & OFF = one cycle):
    - ON cycle amps
    - Off cycle amps
    - Test volts
    - ON cycle power factor
    - Temperature Live connection
    - Temperature Neutral connection
    - Cycle number
    - Time cycle data was measured
  - Test result
    - PASS or FAIL, if fail then the fail condition is listed, see section (13).

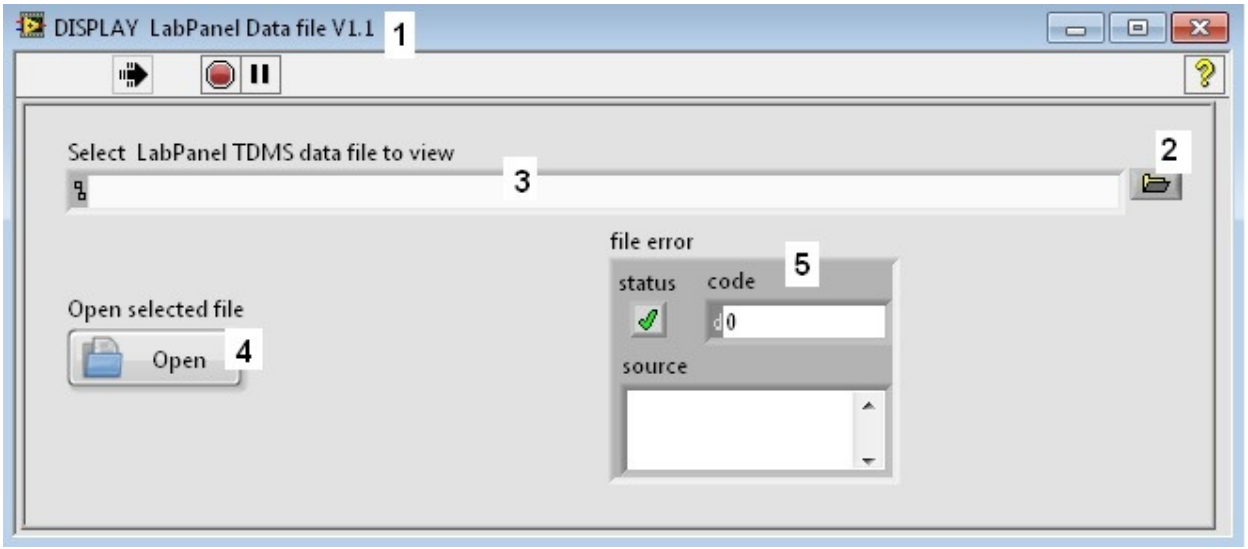
23. TEST DATA VIEW

- The test data file .tdms type can be viewed using Microsoft Excel or custom TDMS file viewer supplied on LAB06.

- Excel:
  - The tdms add in is required to be downloaded and then installed from the National Instruments web site before Excel can be used.
  - Once installed, open the file and navigate around to find the relevant data required.

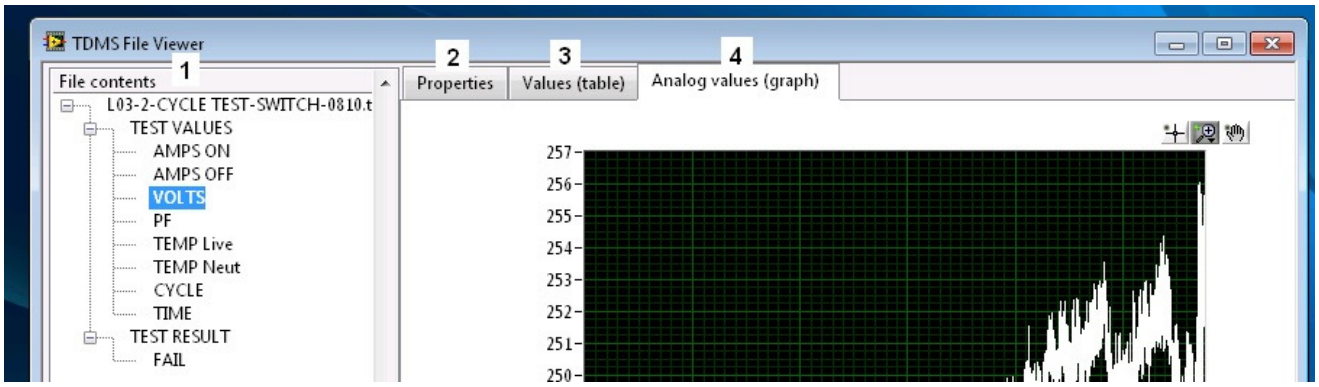
- TDMS file viewer:
  - The file viewer installation file and software resides on the LAB06 local “C” drive. Navigate to C:\crabtree\labview\Lab Panel V2\builds
  - Once the “Installer” is located the complete directory can be copied onto a portable flash drive for installation on any windows machine.
  - Navigate to the “volume” directory and run the “setup.exe” file.
  - The viewer will be installed onto the local drive of the machine.
  - Navigate to “DISPLAY TDMS file” using Windows control icon, “All Programs”.
  - Run or create desktop icon for the “Application” program, TDMS FILE VIEWER.

24. TDMS FILE VIEWER



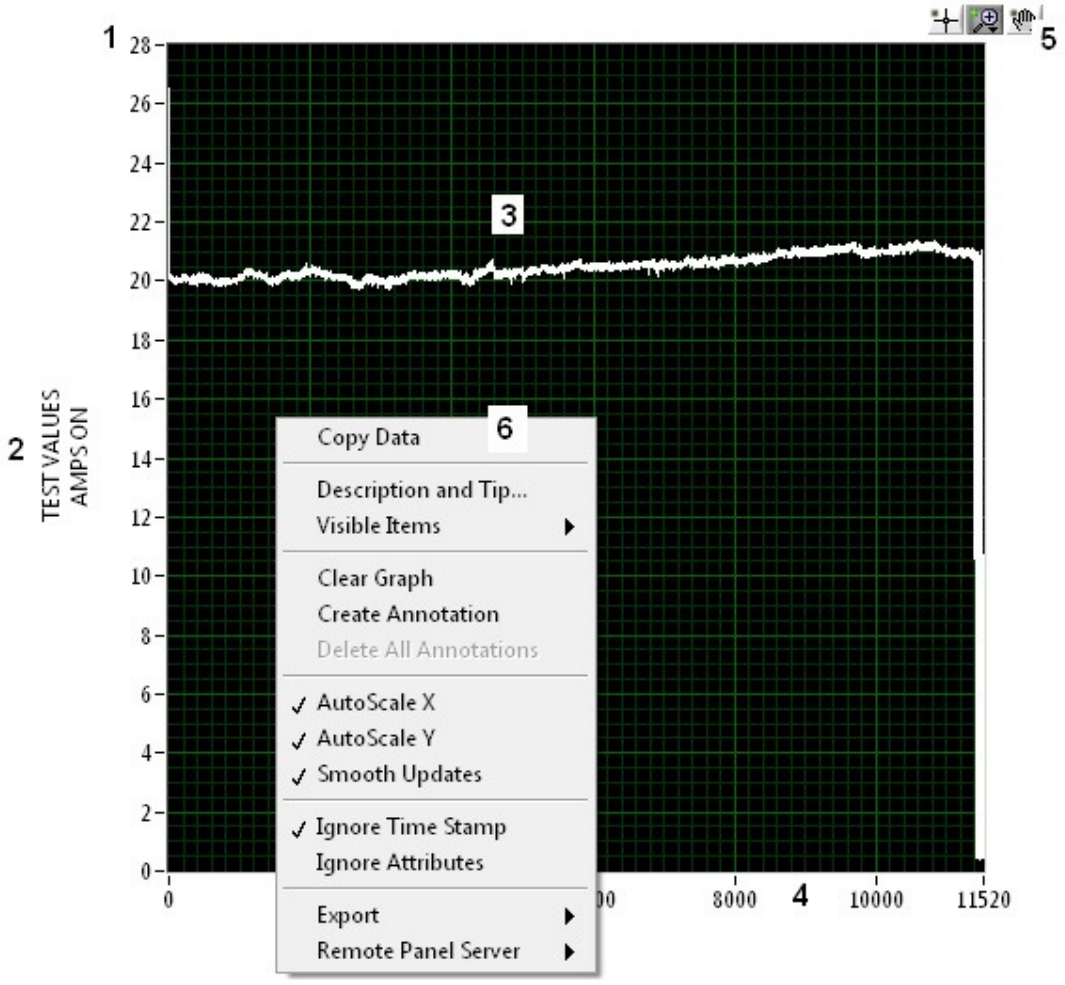
1. File name and version number.
2. File browser and selector, use to browse to required tdms data file.
3. File selected display path.
4. Open button, use to open selected tdms data file.
5. Error message if file corrupt.

25. TDMS FILE VIEWER LAYOUT



1. File contents:
    a. Select file name and tab “Properties” to view test sample test set up data.
    b. Select TEST VALUES and tab “Values (table)”, to view all data in one table.
    c. Select individual item, AMPS ON, AMPS OFF ect to view data.
    d. Select TEST RESULT and tab “Values (table) to view result status.
2. Properties: Various property data of each content item selected, not to important.
3. Values (table): Actual measured data in numerical format.
4. Graphical display of selected item.

26. TDMS GRAPHICAL DISPLAY INTERFACE



1. X scale value, click on the number to change as required, both minimum and maximum value can be changed to change graph view.
2. Name of test data item selected for graph view.
3. Graph display area.
4. Y scale, select “Ignore Time Stamp” from menu (6) to display cycles.
5. Graph zooming and panning tools, select required zoom function and or panning function.
6. Right click mouse to display menu options:
    a. Copy Data: Will copy the displayed data to the windows clipboard.
    b. Visible items: Use to turn display options ON and OFF.
    c. Ignore Time Stamp: Select to change X axis to cycles display.
    d. Export: Various export options available for displayed data.

27. DRAWING LIST

- CE-052000 MAIN POWER DISTRUBUTION FOR ALL TEST PANELS
- CE-052001 EXTERNAL LOAD BANK LAYOUT
- CE-052002 WIRING SCHEMATIC FOR LAB01 – LAB04
- CE-052003 WIRING ACHEMATIC FOR LAB05
- CE-052004 LAB06 POWER AND MOTHERBOARD LAYOUT
- CE-052005 LAB06 SIGNAL MEASUREMNT INTERFACE LAYOUT
- CE-052006 LAB06 CONNECTOR BLOCK NUMBER CONNECTIONS
- CE-052007 LAB06 TEMPERATURE MEASUREMNT NETWORK
- CE-052008 LAB06 PANEL ASSEMBLY LISTING