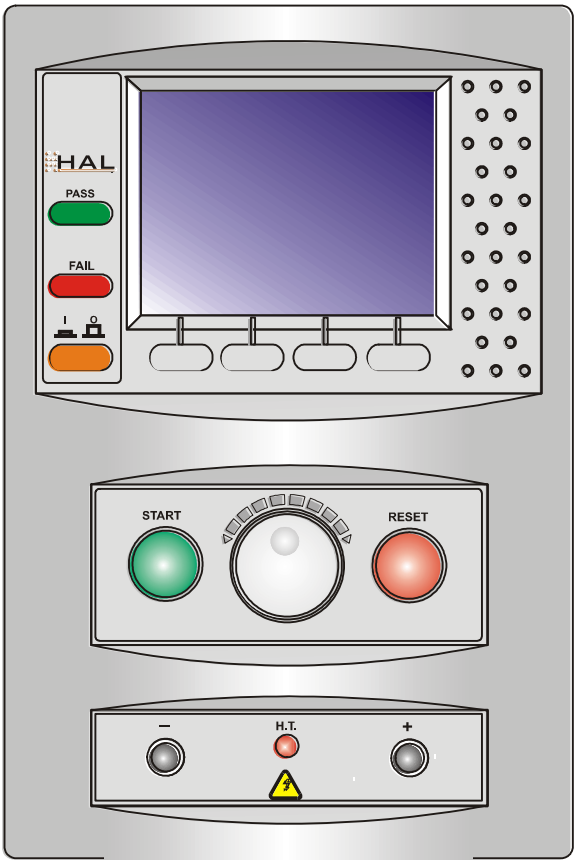
HAL COMBI

Ground Bond
Hipot & DC IR Tester



OPERATING MANUAL

Sept 2004

Issue 1.01

Software Version : ClareH 14c

Limited Warranty & Limitation of Liability

Clare Instruments, guarantees this product for a period of one year. The period of warranty will be effective at the day of delivery.

In order to ensure the continued performance of this product Clare recommends that this tester be serviced and calibrated on an annual basis, by Clare Instruments or any of Clare's authorized service centre using Clare's approved parts and components.

Any unauthorised modifications, tampering or physical damage sustained through negligent use or handling will void your warranty.

Due to a policy of continuous development Clare Instruments reserves the right to alter the equipment specification and description outlined in this publication without prior notice and no part of this publication shall be deemed to be part of any contract for the equipment unless specifically referred to as an inclusion within such contract.

Table of Contents

Declaration of Conformity

for the

Clare Genie Electrical Safety Tester

Manufactured by:

Clare Instruments, Dominion Way, Worthing, West Sussex.

BN14 8NW, England.

Millennium Statement

This product is Millennium compliant, and conforms fully to the document BSI DISC PD2000-1.

Statement of Conformity

Based on test results using appropriate standards, the product is in conformity with Electromagnetic Compatibility Directive 89/336/EEC and Low Voltage Directive 73/23/EEC

Standards used:

EN 61010-1 (2001) Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use

EN 61326: (1998) Class A. Electrical equipment for measurement, control and laboratory use – EMC requirements

The tests have been performed in a typical configuration.

This Conformity is indicated by the symbol CE, i.e. “Conformité Européenne

Before Starting

Upon receipt of your Genie Tester: -

1. Check that all the component parts are present:-
    - Genie Tester
    - Supply lead
    - Accessories (Items 1-5)
    - Instruction Manual
2. Read the operating instructions fully before conducting any tests.
3. Contact Clare Instruments if you need information on training for Electrical Safety Testing. Courses can be arranged at Clare, or at customer premises.
4. Data may be lost or altered in virtually any electronic memory under certain circumstances. Therefore Clare Instruments assumes no responsibility for financial losses or claims due to data lost or otherwise rendered unusable whether as a result of abuse, improper use, defects, disregard of operating instructions or procedures, or any other allied causes.
5. Clare Instruments reserve the right to update the software in instruments returned to them for repair or otherwise, without notifying the customer previously.

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   info@clareinstruments.com

Safety

Note

Please read the following Safety Instructions before use!

Safety Precautions

The manual contains specific warning and caution statements where they apply.

A Warning will identify the conditions and actions that pose hazard(s) to the user.

A caution will identify the conditions and actions that may damage the Tester.

Symbols used within this manual and on the Tester are shown below:

	Risk of electric shock
	Warning of potential hazard
	Conformité Européenne

Use of the instrument in a manner not specified may impair safety. Read the following safety information carefully before attempting to operate the instrument.

Warning

Due to the potential hazards associated with any electrical circuit it is important that the user is familiar with the instructions covering the capabilities and operation of this instrument. The user should ensure that all reasonable safety precautions are followed and if any doubt exists should seek advice before proceeding.

This product is designed for use by suitably trained competent personnel and should be operated strictly in accordance with the instructions supplied.

Failure to comply with these instructions may expose the user to electrical hazard

This Tester performs a number of electrical tests, which involve high voltages and high currents. **Never** touch the Product being tested, or the test leads, whilst a test is in progress. **Never** remove the metal enclosure and touch any internal components whilst the tester is turned ON.

Always check all test leads for signs of damage prior to use. Never use damaged or defective leads.

Always ensure the mains supply to the Tester provides an adequate earth (ground) connection.

This manual contains information and warnings, which must be heeded to ensure user safety during operation. It is essential that this manual be read fully before proceeding with any tests.

Should the Tester behave abnormally do not continue with the testing. Disconnect immediately and contact Clare Instruments for servicing (see Chapter 5 - Maintaining the Tester).

Chapter 1 Introducing the Tester

Introduction

The Clare Genie Safety Electrical Tester is a powerful tool to assist in the analysis of the safety of electrical and electronic equipment. A range of tests are provided, with innovative features to aid difficult test situations, which allow testing of a wide variety of equipment.

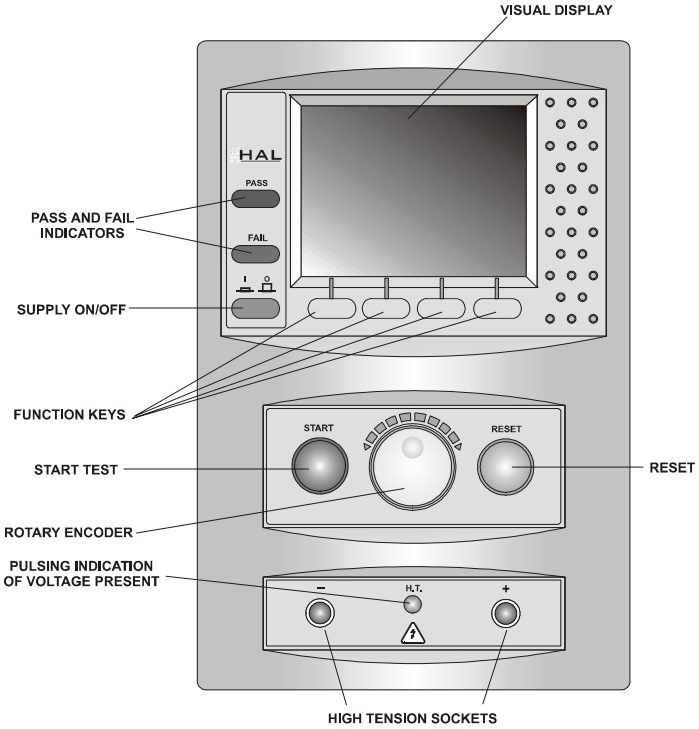
The Tester is designed to be easy to use, and also includes the following innovative features: -

- Universal Supply Input
- Stores up to 6000 results including details of Products, user, location, site, date and time in non-volatile flash memory.
- Highly accurate Ground Bond, Hipot leakage and DC IR measurements.
- Large Full graphics display, Real-time clock
- Connects to PC, Barcode reader and printer
- Compatible with Clare's PATguard and other leading software packages.
- Software adjusts the user interface to differing levels of expertise
- Auto testcode generation
- Uses fully Barcode reading for simple & easy tests initiation
- Fast Start-up
- Fully isolated test outputs, to comply with EN50191.
- 4 wire Ground Bond test measurements
- Usable with the Clare No – Burn Ground Bond probe

Your Genie Tester Accessories

Item Number	Part
1	Mains Supply Lead
2	Guard Plug
3	Test Output Box
4	Hipot Probe and lead
5	Ground Bond No-Burn Probe and lead
6	Hipot Clip (Std. Black) + Lead

The Front Fascia



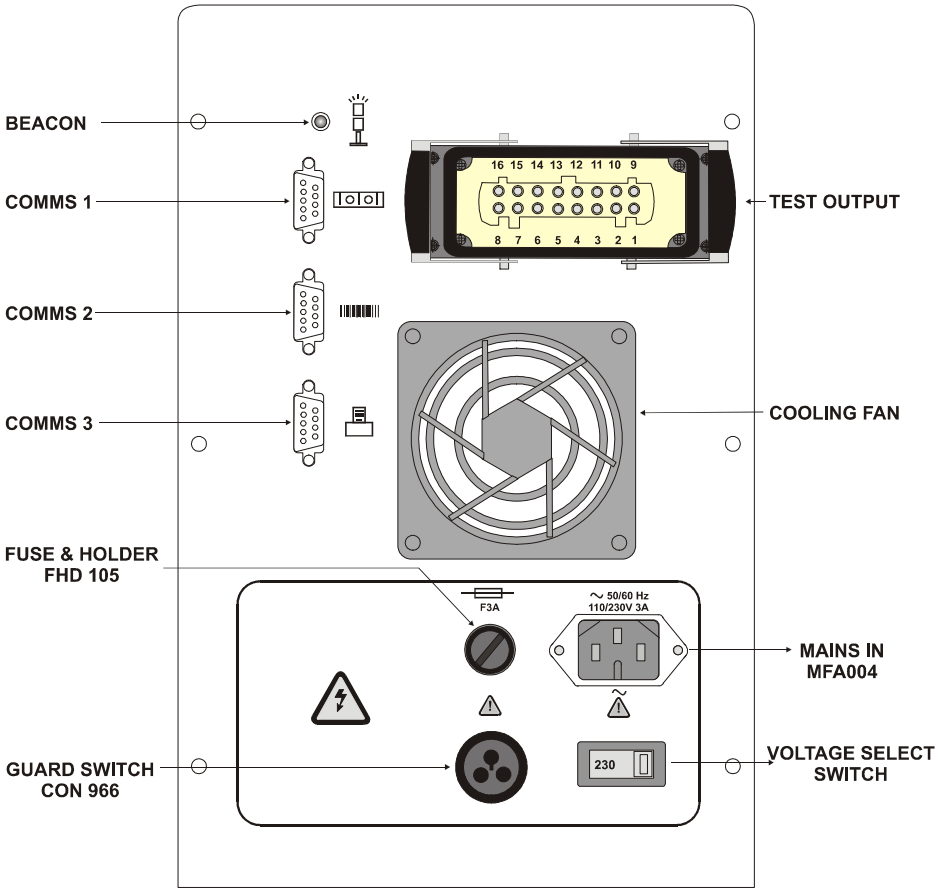
The user is provided with a 320 x 240 1/4 VGA Graphical Liquid Crystal Display (LCD). To the bottom of the screen are four function keys which allow the user fast access to options displayed on the Display

There is a rotary encoder used to navigate the menus.

Either side of the rotary encoder there is a green and red, start and stop button.

The Genie also has the ability to use non-standard characters, which can be displayed by pressing the ‘Symbols’ key during text entry. Simply use the encoder to highlight the required character and press the Green button.

The Rear Panel



Beacon – for connection to external warning beacon

Comms 1 – Communication port 1 for connection to a PC

Comms 2 - Communication port 2 for connection to a compatible Barcode reader or scanner.

Comms 3 - Communication port 3 for connection to a Printer

Test Output – for connection to remote test output box

Definitions

Equipment Under Test	The electrical / electronic apparatus (EUT) which is the subject of testing.
Fast keys -	The keys with symbols to the bottom of the screen. These are used to select menu options displayed on the screen.
Tester -	The Clare Genie Hipot tester.
Un-powered Tests -	The EUT is the subject of electrical tests using stimuli generated within the Tester. The EUT is not provided with mains power.
User -	The test technician using the Tester to perform tests on an EUT

Quick Reference

Editing the date in all modes

On delivery of the Genie it is necessary to ensure that the correct time and a date are stored. Once stored the time/date is retained in memory and does not need to be entered again. To edit the date: from the MAIN MENU select SETUP, select CHANGE DATE/TIME, use the cursor keys to highlight the digit to be changed. To store the changed date/time setting return to the MAIN MENU. The unit will then display the message STORING SYSTEM DATA.

NB: See Sections on How to use Setup for more detailed Instructions

Entering a User Name

On delivery of Genie it is necessary to ensure that a user name(s) is stored. To edit the user list: from the MAIN MENU select SETUP, select EDIT USER LIST / OPTIONS, use the encoder and select a name, a screen will appear "EDIT USER SETTINGS", press Green button, use the encoder to enter in the desired name and press GREEN BUTTON to return to the previous menu.

NB: See Sections on How to use Setup for more detailed Instructions

Editing User Level and Novice Mode

The Genie is delivered with the default setting of novice user level. To change this setting: from the MAIN MENU select SETUP, select EDIT USER LIST/OPTIONS, select USER (Name) from list, select USER LEVEL, select the desired level by selecting either NOVICE or ADVANCED. To store the changed user level setting return to the MAIN MENU. The unit will then display the message STORING SYSTEM DATA.

Storing Product Test Results in Automatic mode

The Product Test Results will not be stored until the end of the test sequence and any COMMENTS menu (if it has been setup) is appropriately acknowledged. The unit will then display the message STORING RESULTS. Your results have now been stored in memory. This will be confirmed when the next **Product** menu box appears.

Storing Product Test Results in Manual mode

The Product Test Results can be stored by selecting the 'Begin Product' field, when in Manual Mode. Enter a product number, either using the encoder or the barcode scanner, and select OK to start saving the results to that product name. The tester will store the results locally, but will not save these results to the results memory, until the 'End Product' field has been selected. The user will be prompted to enter a comment for the product to be stored.

Storing System Data

System Data consists of everything changed from within the SETUP MENU. To store the System Data return to the MAIN MENU from the SETUP MENU. The unit will then display the message STORING SYSTEM DATA. This will only be done if changes have been made; if no changes have been made then the system data will not be updated.

Waiting for a Yes/Cancel response

When you are prompted to respond with YES or CANCEL (NO) you must use the Fast keys under the display.

Using Symbols in Text Fields

Although there is an option to use non-ASCII symbols as Product numbers, Site & Location descriptions, User names and comments does not guarantee that your computer software will support them. If you are unsure avoid using symbols.

15 Digit Restriction

The maximum Product ID length is 15 characters while the maximum line for the comments is extended to 20 characters per line.

Setting up a Password

The Genie is delivered without any password set up. Therefore it is necessary to set in place an appropriate password for the protection of the System Setup. To do this select Setup from Main Menu, then select Change Password and you will be prompted for password entry. Also see section on Change Password for instructions.

Remember: Keep the password discreet for use with authorized users only. It may be useful to print the password in Barcode format for quick entry using the Barcode scanner.

Abbreviation used:

Press Green – denotes pressing the GREEN (Start) button

Press Red - denotes pressing the RED (Reset) button

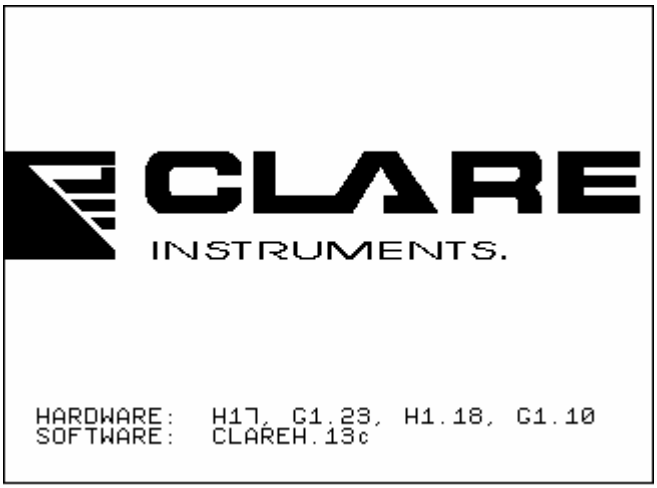
Chapter 2 Connecting the Tester

Connecting the tester

The Tester may be powered by either a 230V or a 115V supply. This is selected on the rear panel of the instrument.

The supply must include a Ground (Earth) connection (e.g. via a 3-pin plug).

When switched on, the Tester will carry out a short self-test procedure (approximately 3 seconds). During this test, the following screen will appear: -



Note

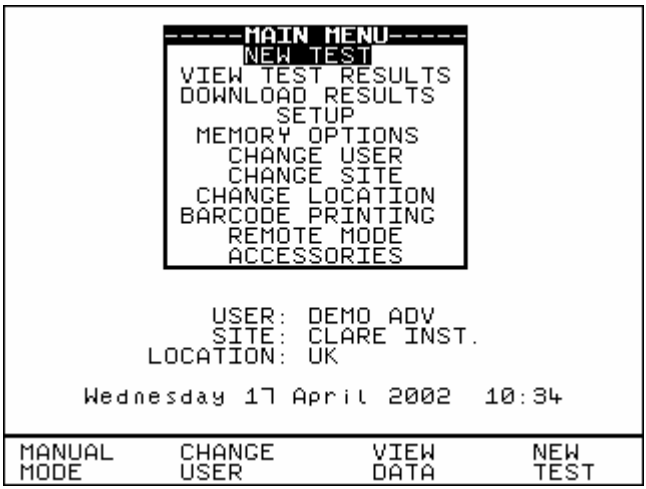
Current revision numbers are shown at the bottom of the screen.

The Tester will then display the Main Menu

Chapter 3 Using the Tester

Introduction

Once the start-up procedure of the Tester has been completed, the following screen will appear: -



Navigation through the menus is by dedicated keys: -

Key	Function
Encoder clockwise	Cursor Right Cursor Down
Encoder anti-clock	Cursor Left Cursor Up
'Red' Button	No / Abort / move back through menu
'Green' Button	Yes/Start/Enter/Execute

There are also the four Fast keys under the LCD whose action will change depending on the function of the Tester at any particular point.

At every start-up the System Setup is Password Protected if a password has been set up. To select an option from the Main Menu, use the encoder or the relevant fast keys command. The selected option will be highlighted by a light-coloured bar. The highlighted selection is activated by pressing the Green button. Depending on current setup you may be prompted to enter in Password at certain stages of navigation or execution of commands. (**Important:** See notes on Restoring Password Protection)

To perform Automatic test select New Test and to conduct Manual Test select Manual Mode using the fast key button.

Also on the Main Menu screen the current details of the User, Site, Location and Date/Time will be displayed respectively.

If you need to change the current User, Site or Location name use the encoder to highlight CHANGE USER, CHANGE SITE or CHANGE LOCATION and press Green to select from the lists.

It should be worth knowing that a barcode scanner can be used optionally to the encoder for Quick entering of products, users, sites, locations, passwords and even comments in barcode format.

Note

The Date/Time will need to be updated only once and this will be retained in memory.

How to....

The remainder of this chapter has been sub-divided into sections to describe the Tester in terms of the essential functions to be performed. A summary is shown below: -

- How to perform Automatic tests
- How to use the Meter display
- How to view Test results
- How to perform Manual tests
- How to Download test results
- How to Print Barcode Labels and Testcodes
- How to use Set-up
- How to use the Memory
- How to change User
- How to change Site
- How to change Location
- How to use Help
- How to use a Barcode Scanner

Note

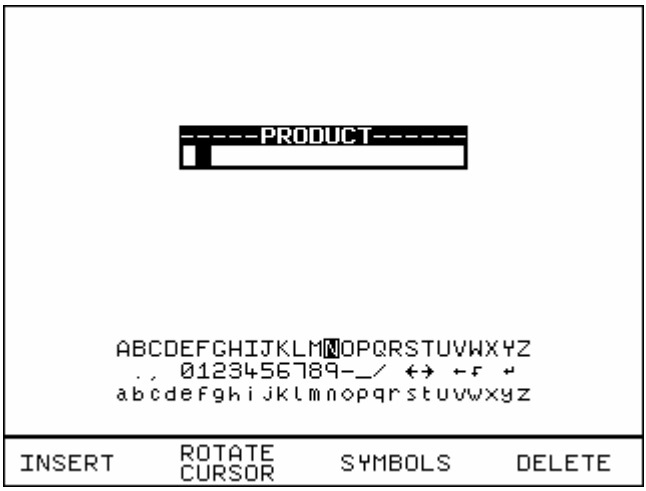
Default settings for User, Site, Location and Test Sequences are pre-loaded into the Tester. See 'How to change…' to select and change these settings and 'How to use Setup' to edit them.

How to perform Automatic Tests

Warning: In order to prevent any unwarranted safety hazards occurring during testing, ensure that the appropriate test conditions are set in accordance to requirements. Proper safety procedures must be in place before performing any Automatic test.

It is important to establish the setup of the current or default test settings in relation to the test conditions formatted. To check or edit these parameters select Setup and then System Configuration.

To perform automatic tests, press New Test fast key or use the encoder to highlight the New Test option on the Main Menu and press Green to display the following menu: -



Use the encoder or a compatible Barcode Reader to enter a Product Number. When using the encoder press the Insert key to enter each character.

Note

See Chapter 4 for tips on using barcodes.

Depending on the System Configuration setup and Test type setup different prompt responses may be displayed e.g. Enter Password, Select Test setting options lists etc.

Once the Product data is entered press Green to display the test Meter screen. Now activate any **Test Start Conditions** and the test will begin. (See instructions on icons for Start conditions).

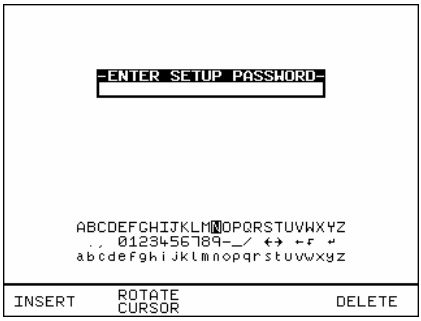
Warning: When the test condition is set to 'No Start Condition' it will go straight to the test if the Guard switch is closed.

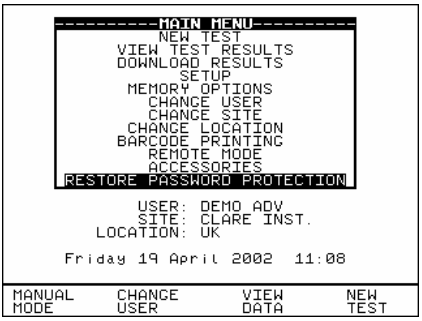
See relevant chapters on **How to**… for detailed instructions to select from change lists and refer sub-sections on **How to use Setup** to edit these fields.

When entering Setup or other Password protected Options Menus you may be prompted to enter your Password. You can use the Barcode Scanner to enter in your authorized password or use the encoder and Insert key to enter it manually.

Once the password is accepted this will unlock all protection to any edit setup fields and including the Password Protection Options formatted in the System Configuration.

Caution: It is recommended to reactivate the Restore Password Protection mode at the Main Menu each time after completing any password accessed Editing menus or Setup changes.





Test Settings

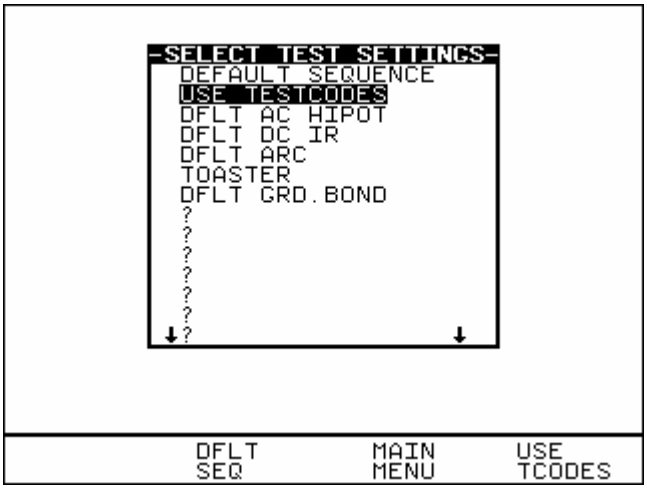
If the user has not fixed the test type in the system configuration the Select Test settings menu will be display each time after New Test is pressed and the product number entered.

The user has the ability to: -

- Set a specific test sequence by selecting DEFAULT SEQUENCE
- Allow use of TESTCODES to determine the test to be carried out
- Use any preprogrammed sequences for specific EUTS, e.g. Toaster

Selecting either of the first two options allows settings to be altered. See Default Sequence & Testcodes Sequence for instructions to edit test sequence variables.

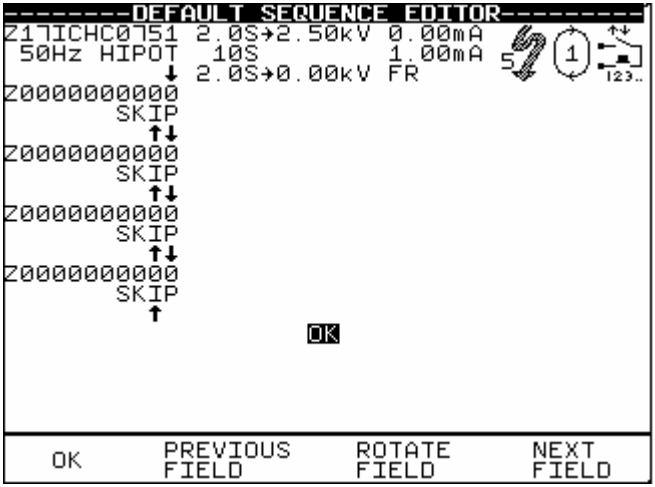
Selecting any of the remaining 20 options (preprogrammed test settings created by user) allows the user to commence immediately with that test. This will also bring up the test meter screen.



Use the encoder to highlight a Test Sequence Setting and press the green button to select the desired option.

Default Sequence

When you first enter this menu all of the previous values are displayed and one of the field descriptions is highlighted.



Use the encoder highlight a field to be changed and press the **Rotate Field** fast key to activate the encoder. Rotate Field will be highlighted. Turning the encoder will now cycle through all the available values for the field. To accept desired value press Rotate Field again to deactivate encoder for further field value change (highlight deselected). Again use encoder (or press **Next** or **Previous Field** fast key) to move cursor to navigate through to other fields including the three icons fields (see test icon descriptions) for any other changes. Repeat process of 'select/deselect' the Rotate Field key & turning encoder to search for values needed until all desired fields are changed to the user's requirements. Press **OK** and a message "storing system data" will be displayed. And depending on the test conditions the test will begin with the Meter screen displayed.

Description of Fields setting and Icons for Test Start conditions:

The first field (1st column from left) displays the **testcode** for the test. The test type (eg. 50Hz Hipot) is shown directly below it. The tests sequence may hold up to 5 unique tests. To add a second testcode for example; highlight **SKIP**, press **Rotate Field**, turn encoder to select values and press Rotate Field again to accept option. Follow through the

arrows to add/delete/edit any levels of testcodes sequence if necessary.

The second column holds the **test** ramp profile **times** (3 fields) for completing a level of test sequence:

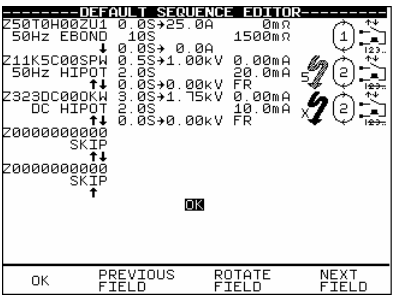
Time up or Ramp Time (to terminal voltage)
Time Hold (for the test at terminal voltage)
Time Down (for final terminal voltage)

The third column indicates the **terminal voltage** (corresponds to Time up) that the test should ramp to after the ramp up time is reached, and the second voltage (corresponds to Time Down) is the **final termination voltage** (usually 0.00KV). But this value can be selected to be "Maintained" to sustain the terminal voltage for execution to the next level of test sequence after the first test time sequence has completed. This is done by highlighting the Time Down, press Rotate Field and select "Maintained" using encoder.

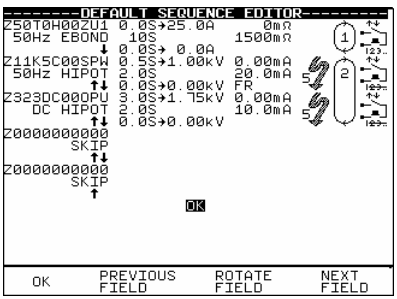
The fourth column holds the **leakage limit** values, low (top) and high (bottom) values respectively. A low value is used to ensure that the EUT is correctly connected. Below the leakage limits are the fields for selecting the tests outputs; **F** for the *front* test sockets (HT +/- terminals) and **R** for the *rear* test output socket (only connect to Test output Box).
A dash (**–)** on the field denotes the port is not selected.

Next the icon (a lightning flash with a number) denotes the **Arc level** for the test. A level of 1 is the most sensitive to arcs, with 9 the least sensitive, and X disables the feature.

The circular icon with a number in the centre denotes the number of **repeats** (loops) for the test. This icon can be joined to other levels of test sequence for different combinations of loops cycle for different unique test sequences, see e.g. below



(Fig. A)



(Fig. B)

Fig. A shows that the 2nd test sequence (50Hz Hipot test) will convene twice before going on to the 3rd test sequence (DC Hipot test) for twice. Where as,
Fig. B shows that the 2nd test sequence (50Hz Hipot test) will convene once then proceeds to 3rd test sequence (DC Hipot test) once and then the process is repeat again once through.
Therefore you must take ***caution*** while selecting (linking) this test repeat loops especially when other levels of test sequence may not be of the same test type nature e.g. DC IR , DC Hipot etc.

The last icon denotes the **Start conditions** for the test. They are as Fig.

1. Reset **Ext**ernal safety guard switch to 'Closed', followed by pressing **Green** to start each repeat of the test. (Start Ext+Green)
2. Reset **Ext**ernal safety guard switch to 'Closed', followed by pressing **Green** once to start the test (1st loop). **No** subsequent pressing of Green button needed for any repeat tests. Repeat loops will immediately convene whilst guard switch is closed. (Start Ext+Green) for 1st loop & (Start None) on any repeats.
3. Reset **Ext**ernal safety guard switch to 'Closed' to start test and each repeat of the test. (Start Ext)
4. Reset **Ext**ernal safety guard switch to 'Closed' to start the test cycle. **No** subsequent stimulus needed for repeat tests. Repeats will automatically be performed, whilst the safety guard is closed. (Start Ext) for 1st loop & (Start None) on any repeats
5. Press **Green** to start test and each repeat of the test. External safety guard switch must remain closed for test to begin. (Start Green)
6. Press **Green** once to start test. **No** subsequent stimulus needed for any repeat loop tests. Repeat loop tests will automatically start. External safety guard switch must remain closed for test to begin. (Start Green) for 1st loop & (Start None) on any repeats.
7. **No** start stimulus required. The test begins immediately after the product data has been entered. This mode is usually a follow-on test from a previous test. *Use this with caution*. (Start None) for all tests

Fig. 1 Fig. 2 Fig. 3 Fig. 4 Fig. 5 Fig. 6 Fig.7

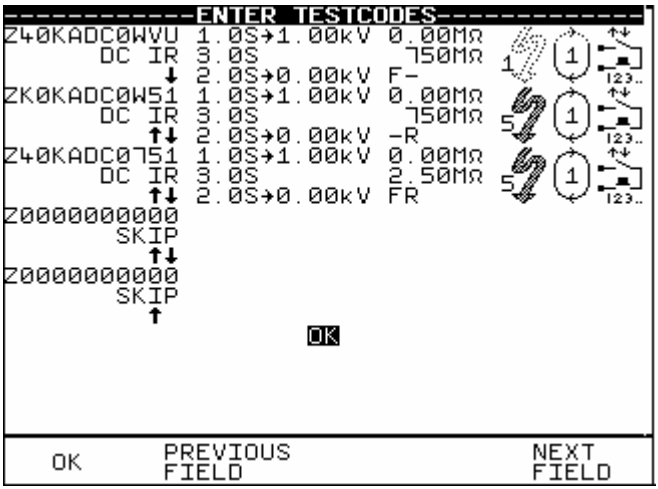
Use Testcodes

This option bypasses the need to edit a specific test sequence, allowing direct entry of a Testcode through the barcode scanner. From the Select Test Setting menu choose Use Testcodes or press Use Tcodes fast key.

Use the encoder to highlight the Testcode sequence (up to 5 levels) to be changed and use a barcode scanner to enter in a Testcode.

Press OK to accept & save Testcode option.

OR press the Red button to abort and return to the previous menu.



NB: The Testcode numbers can also be changed using the encoder. First highlight the testcode to be edited, press Green button to bring up the alpha-numeric options on the screen. Use Rotate cursor & Insert keys to enter any combination of testcodes sequence. However incorrect testcodes will be rejected and activate a warning. See Testcode tables for details.

Perform Test

Use the encoder to highlight the OK field and press Green to perform the test. Pressing the Red Button will return to the previous menu.

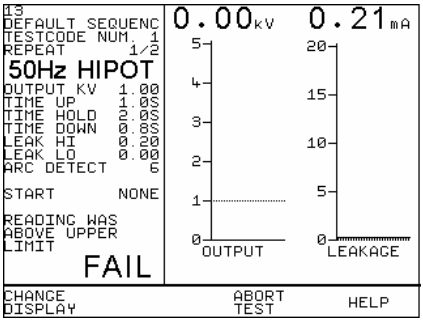
The screen will change to the Meter Display (see separate section - How to use the Meter Display for an explanation).

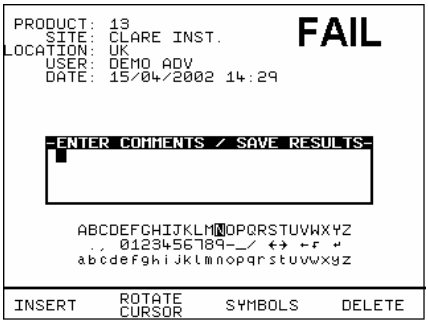
Note

Help screens may be displayed depending on the User Level set. It is possible to stop these appearing by altering the User Level. See EDIT USER LIST OPTIONS. Help can be displayed during any test by pressing the appropriately marked fast key.

All automatic mode test results are stored in memory.

If any test in the test sequence fails, then the test sequence is aborted and a fail message will be displayed with the alarm buzzer beeping continuously. Press Green to acknowledge the status. A Failure Options Menu can be configured or just a Failure Comments box option can be selected at the System configuration setup to indicate these modes.



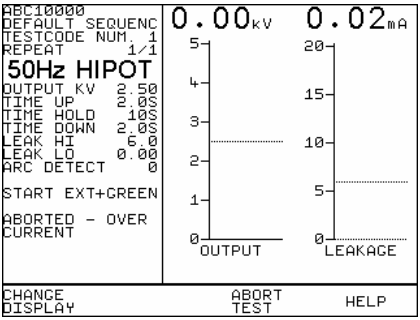


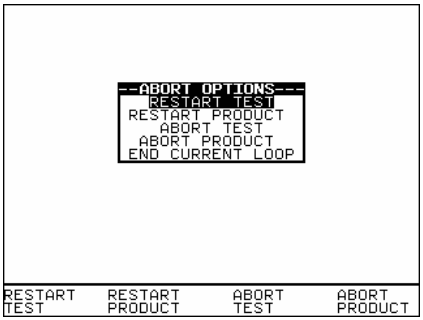
Fail Comments – Use encoder & Insert key to enter in any comments. To skip line or move to next line, highlight Rotate Cursor and turn encoder. Or use barcodes.

Enter Green button to store results/comments.

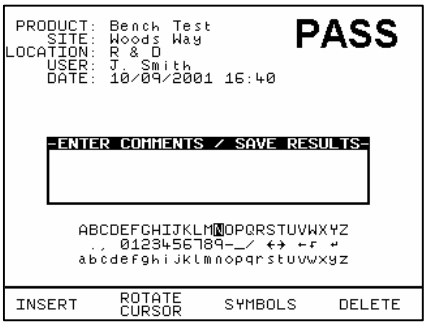
During an automatic test the user may choose to abort test by opening the Guard switch or pressing the Red button. See Abort action for detail.

However if an Abort warning signals during any test indicating an interruption detected due to **Overcurrent**, **Arc detected** or any other reason that causes a tester system fault the test will be aborted immediately with the buzzer beeping continuously until the Green or Reset button is pressed. Then the Abort Options box will show. Select **Abort Product** to exit from test programme. This will ensure No test results are stored against the product number. In any case **Do Not** press **Abort Test** as this will store an empty record to the product data memory.





Add Comments

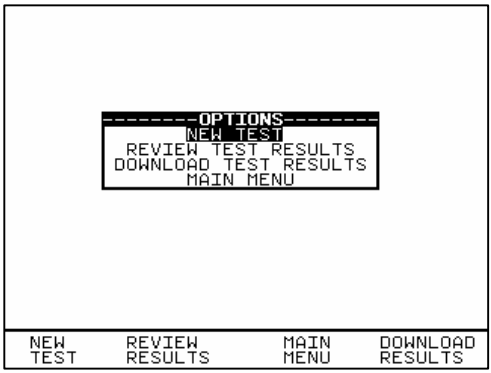


When a test has completed you can add/enter comments reference to the Product number. See system configuration setup to select this option. Use the encoder or barcode scanner to enter comments into the box. Select Rotate Cursor and turn encoder for a new line. To store the comments press Green. Your results and comments will now be stored.

Options after Test

The options menu is selected by entering ‘After Test : **Menu’** in the System Configuration Setup. With this option the following screen is displayed when an Automatic sequence has been completed.

Use the cursor keys to highlight an option after test and press Green to select the desired option.

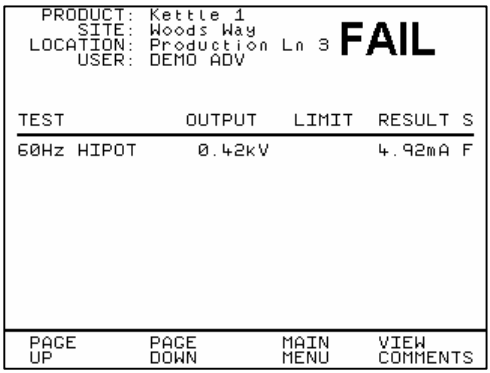


New Test

This is to perform a new test. Enter in the product number will begin the test.

Review Test Results

This option displays the results from the test in tabular form: -



Select View Comments fast key will display the comments stored.

Use the Red button to return to the previous menu.

Download Test Results

When selected a Download Options menu displayed will allow user to download results to a list, pass/fail labels or barcodes using a compatible printer - See section on How to download data for formatting information.
Press OK to start the download. The following message will be displayed.

DOWNLOADING DATA…

If there are problems downloading e.g. due to interfacing problems, then after a delay, the following error message appears: -

----------WARNING----------
PRINTER TIMEOUT: NO PRINTER CONNECTED PRESS START KEY TO CONTINUE

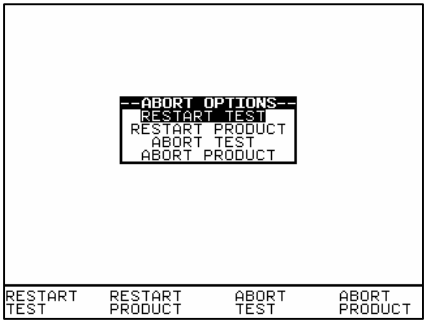
Press the Red Button to return to the previous menu.

Main Menu

Return to the Main Menu.

Abort Actions

During an Automatic test, opening the guard switch or pressing the Red Button immediately stops the test in progress and displays the Abort Options menu: -



Use fast key functions or the encoder to highlight an action following abort and press the green button to select the desired option.

Restart Test

Restart the current test.

Restart Product

Restart the first test in the test sequence for the current Product.

Abort Test

Abort the test without storing a test result and select the next test. **Caution**: Depending on the test Start Conditions set pressing this key will immediately start the next test sequence **without warning**.

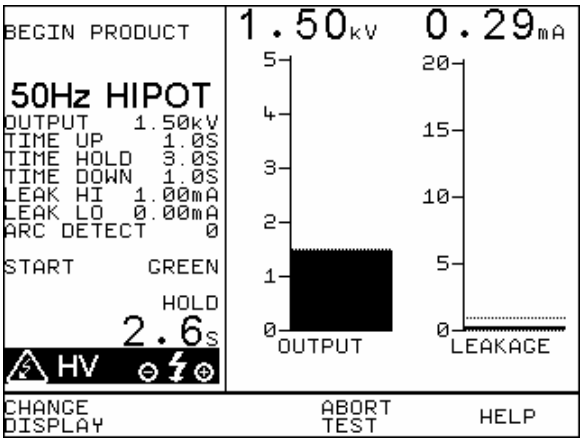
Important: Do not select or press this option if previously the test had been aborted automatically by the tester due to **Overcurrent** or **Arc detected** or any other fault condition.

Abort Product

Abort the test sequence and select a new Product.

How to use the Meter Display

The Meter screen is displayed prior to tests commencing in both Automatic Mode and Manual Mode (shown here) : -



The screen can be considered as two panels, left and right. In the left panel the information is from top to bottom, as follows:

Begin product – this is displayed for manual mode only, If a product number entry is required select this to enter details and it will be displayed above this line. Note: Only tests results with associated product details will be stored in memory.

For automatic mode the product number, test filename, testcode sequence number and test repeat loops are displayed here. See sample

Test type, in this case 50Hz AC Hipot. This could be 60Hz AC Hipot, DC Hipot , DC IR or Ground Bond tests (50Hz EBond or 60Hz EBond).

Output kV – this is the target output voltage value to be reached after the ramp up period.

Time up – this can be set to a specific value using the encoder, or as in this example to be variable (i.e. no time limit set – test terminated by safety guard being released).

Time hold - this can be set to a specific value using the encoder.

Time down - this can be set to a specific value using the encoder.

Leak Hi – this is the upper limit for the leakage current.

Leak Lo – this is the lower limit for the leakage current. It is used to determine that a EUT is correctly connected.

Arc detect – this shows the level set for the detection of any arc that may occur in the EUT, during testing.

Start – shows the action needed to initiate the test sequence. This refers to the usage of the **ext**ernal safety guard switch *only*, the **ext**ernal guard switch *and* the **Green** button or the **Green** button *only*.

Test status – here this shows that the test is in the hold phase. This part of the display is used to indicate what part of the test cycle is being performed.

Elapsed **test time** – this is shown below the test status.

This is displayed to show that a voltage is being generated by the tester, and if connected, will appear at the selected test output sockets for EUT.

This icon denotes that the front HV +/- sockets is the active test output port and will carry the test voltages during test. This icon corresponds to **F** (front) port field selected in the test sequence editor window.

This icon denotes that the active test output port selected is the rear socket which must only be connected to the Clare's test output box provided. This icon corresponds to **R** (rear) port field selected in the test sequence editor window.

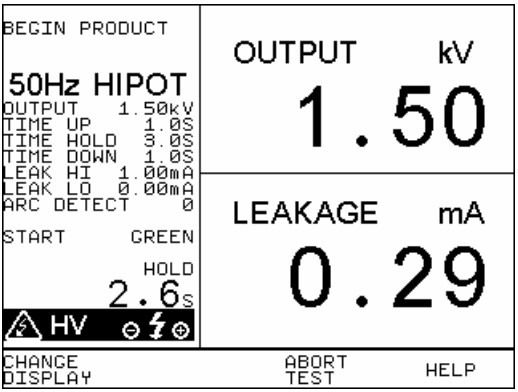
Warning : If both the FR are selected the tester will perform the test twice, once for the front output and then the rear output with a prompting in between the tests. Test voltages will appear respectively.

Note : For **Ground Bond or Earth Bond Test** the test output port is not selectable and Test voltages will only be active at the rear socket via the test output box

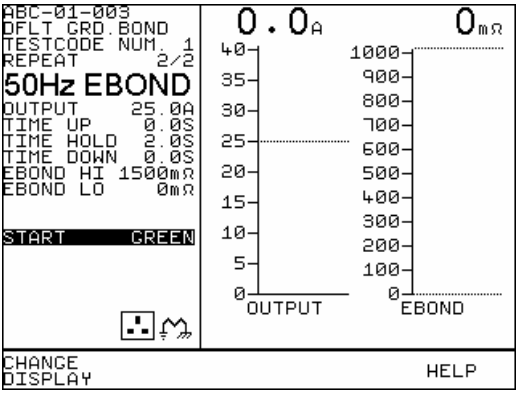
The *right panel* of the display shows the output voltage and leakage current or insulation resistance, depending on which test is being applied.

The bar graphs are clearly marked, and include dashed lines to indicate the limit points. At the top of each bar graph there is a numerical display of the actual value.

Press Change Display - allows the right panel to be changed to display the readings via large high visibility DVM style displays, see below:



E.g. of **Ground Bond (EBOND) Test** Meter Screen :-



Sample Automatic Mode Meter Display

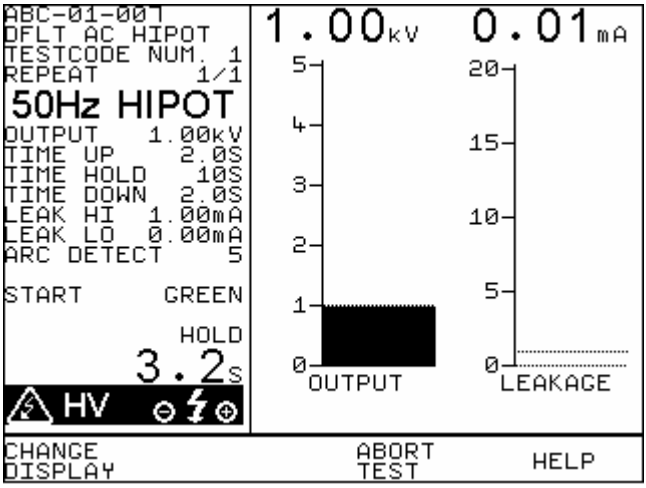
The screen will be similar to that for manual mode as described earlier. However there are a number of extra features denoted as follow:-

Ist line (ABC-01-007) – Product number

2nd line (DFLT AC HIPOT) - the Test type

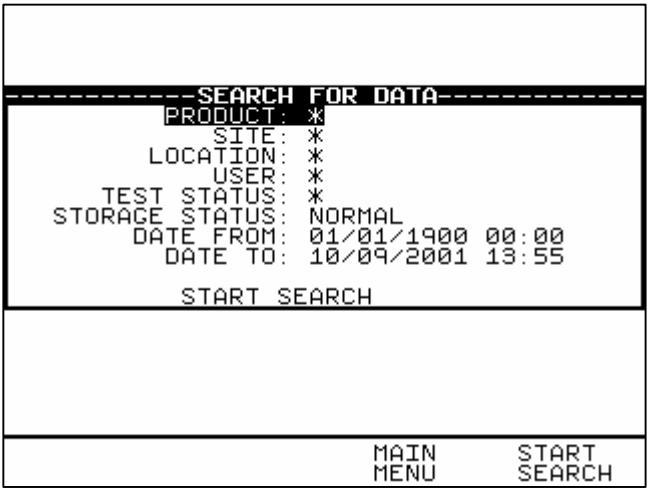
3rd line denotes the Testcode Sequence number, in this case it has only one level setup. A maximum of 5 levels could be setup.

4th line denotes the current test of a loop test being done. Shown here 1/1 means 1st test of ONE test loop currently being carried out. This corresponds to the circular icon with a number in the centre as mentioned in Default sequence description.



How to view (search) Test Results

To view test results stored in memory, press View Data fast key or use the encoder to highlight the View Test Results option on the Main Menu and press Green to display the following Search menu: -



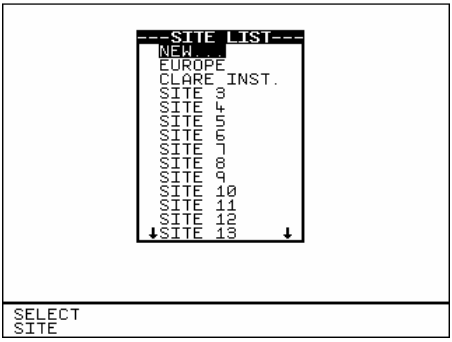
Use the encoder to highlight the required search parameters and press Green to select the desired search field. A ' ***** ' denotes all product test results related to the field parameter. To get *Quick* search pressing Start Search now on the default screen without selecting any specifics will display all results in the memory. Use Page Up/Down to see the full list.

Search result through Product Number

Enter a *Product number* to search for the specific results. If the Product number field is left blank then the character ' ***** ' will be inserted as default, indicating to search for all of the Products. Press **Start Search** to begin. Alternatively use a Barcode scanner to enter a specific product number for the search and press Start Search. A search results will be displayed. A message No Records Found will be shown when products number is incorrect or when other fields data could not be matched. If unsure use ' ***** ' for the search.

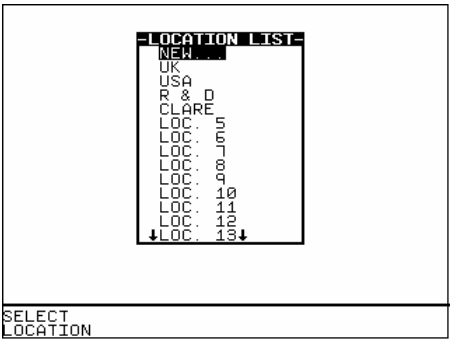
Search result through Site Name

At the **Search For Data** menu highlight **Site** and press **Green** to display the site list. Highlight the Site name to which previously the products could have been tested on and press Select Site. Back at the search menu press **Start Search** to begin. A search results will be displayed.



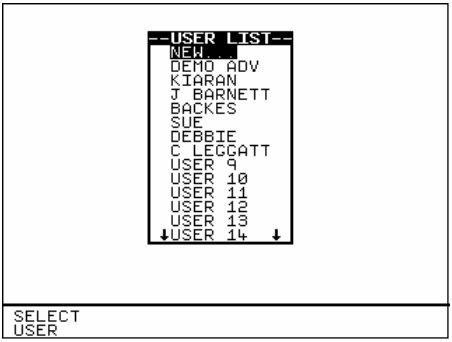
Search result through Location Name

At the **Search For Data** menu highlight Location and press Green to display the location list. Highlight the Location name to which previously the products could have been tested on and press Select Location. Back at the search menu press Start Search to begin. A search results will be displayed.



Search result through User Name

At the **Search For Data** menu highlight User and press Green to display the User list. Highlight the User name to which previously the products could have been tested on and press Select User. Back at the search menu press Start Search to begin. A search results will be displayed.



Test Status

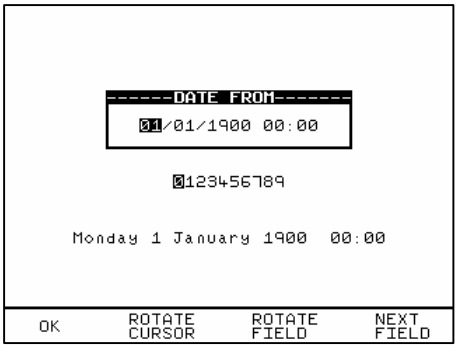
When Test Status is highlighted use the Green button to select the option required, each time you press Green a different option will be displayed. This can be PASS, FAIL or '*' which indicates both.

Storage Status

When Storage Status is highlighted use the green button to select the option required, every time you press Green a different option will be displayed. This can be NORMAL status, DELETED status or '*' which indicates both.

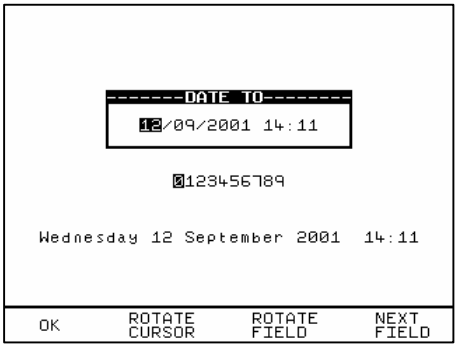
Date From

This option allows the user to search for test results after the selected date. Use the cursor keys to highlight the digit to be changed. Use the encoder to change the value. Select OK to store the settings or press RED to abort them.



Date To

This option allows the user to search for test results before the selected date. Use the encoder to highlight the digit to be changed. Use the encoder to change the value. Select OK to store the settings or press RED to abort them.

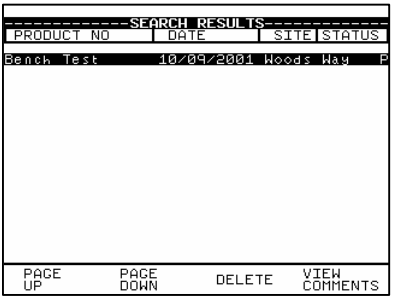


Start Search

After all the search parameters have been set, press Start Search to begin the search. It should be noted that unsure parameter should not be used otherwise this will corrupt the search matching process.

Search Result

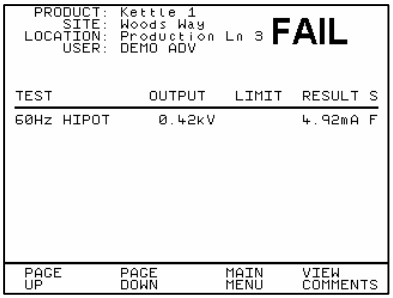
When you select Start Search the following screen will be displayed. This screen indicates the Products that match the search criteria.



You can delete the highlighted Product by pressing the delete key.

Product Test Results

It is possible to view the results obtained for a certain Product by highlighting the Product number and pressing Green.



Pressing the View Comments fast key will display the Comments box. Use the Red button to return to the previous menu.

How to perform Manual Tests

Manual mode provides the user with direct access to the tests. In this mode individual tests can be selected and performed. Product numbers, sites, users and testcodes can still be assigned to Products if required; though this is not essential.

Entering Manual Mode

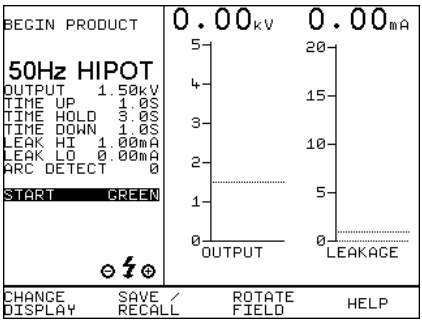
Use the fast key to select Manual Mode from the Main Menu.

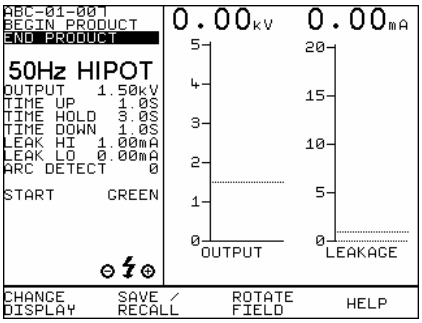
The system will then display the meter screen and allow direct use of the default, or last selected test that was setup. The user may setup 10 unique configurations, and save these for later use. To operate the test the operator must follow the on screen instruction; closure of the safety guard switch, followed by pressing Green. The test may be terminated at any time, either by pressing Red, or opening the safety guard.

Manual mode is primarily intended for use in evaluating EUTs in a laboratory environment, or for performing production line re-testing.

Note

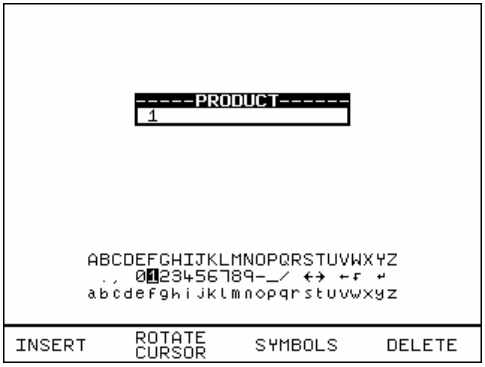
To store tests in memory from Manual mode you must first select BEGIN PRODUCT, perform the tests required for the EUT. When you have completed the required tests select END PRODUCT, upon leaving this option the Hal will now store the results. Note that the Enter Comments option is not displayed until there is something to store. Tests carried out without Product details being entered will not be stored





Create Product Number

This allows all manual tests performed to be stored against the Product number until the Product number is changed.



Use the encoder or a compatible Barcode Reader to enter a Product Number. Use the encoder to select the 'BEGIN PRODUCT' field, then you will be presented with the screen above.

If you need to change the current User, Site or Location profile, return to Main Menu to select from the desire Change lists. Any test results saved against the current profiles will be stored in memory. Old results data will not be altered.

Note

Default settings for Sites and Test Sequences are pre-loaded into the Tester. See 'How to use Setup' to change these settings.

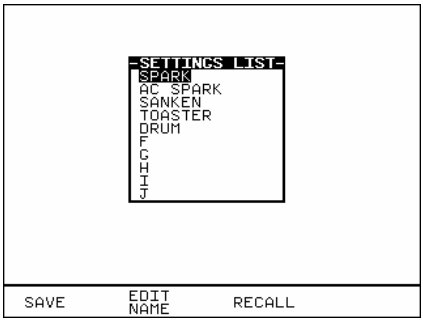
Use the encoder to enter comments into the comments box (4 lines of 20 characters). Press Green for a new line. To store the comments press the OK Fast key. Use the Red button if you do not want to store the comments.

Performing a Manual Test

After selecting the manual test display, you can set test parameters.

The user can change an individual field setting when the field is shown highlighted (use encoder to highlight any fields to be changed). Then press **Rotate Field** fast key (highlighted when selected), and use the encoder (to cycle through) to change the variable in the selected field. Before moving to next field you must deselect Rotate Field. Repeat process until all desired field settings are selected as required.

Now these manual test settings can also be saved to a list of file names (max. of ten) which can be recalled for future tests. Press **Save** to save current setting to highlighted file or select a previously saved file and press **Recall** will bring those settings to the manual test display screen.



Use Edit Name key and the encoder to edit any file name if necessary.

To start the test, select (highlight) the 'START' field, close the safety guard and then press **Green**. Pressing Red or Abort Test fast key will abort the test at any time.

If User wish to print out the test results immediately after the test, pre-select the After Test : **Download** option at System Configuration setup. Alternatively any stored test results can be printed through the Download Results option at Main menu.

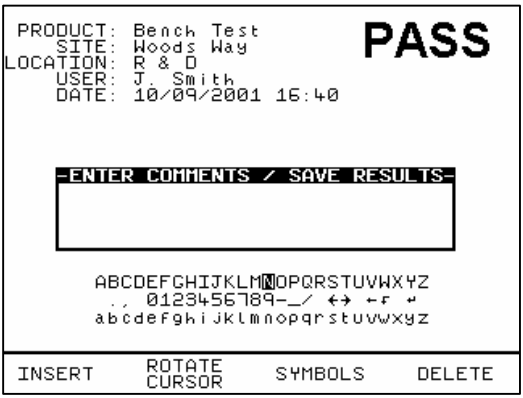
Note

In manual mode you will not get Abort Options, when Abort stimulus is initiated the test will simply stop and revert to the Meter display. The aborted test will not be stored.

If a Product Number has been created, the test result will be stored under the entered number. To store tests to memory choose Enter Comments / Save Results.

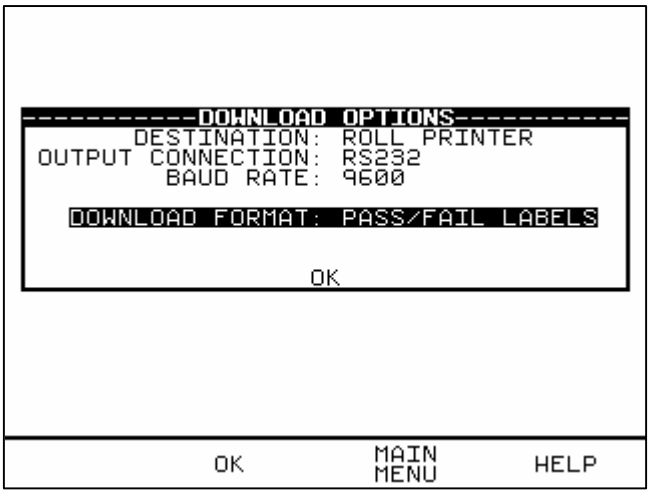
Enter Comments/Save Results

When you have completed a test you can enter comments which will be referenced to the Product number. To select this option, at System configuration setup choose Comments: **Always** to display this box after each test. Alternatively you can choose this comments box only **On Pass**, **On Failure** or **Never**. Use encoder or Barcode scanner to enter comments into box. Select Rotate Cursor and turn encoder for a new line. To store the comments press **Green**. Your results and comments will now be stored.



How to download Data (Results)

To download results stored in memory, use the encoder to highlight the Download Results option from the Main Menu and press Green to display the following menu: -



Use the encoder to highlight the required parameters. Use repeated presses of the green button to show the desired options for destination, output connection and baud rate.

Destination & Download Format

The destination field allows user to direct the download data to a PC, Z-modem, Generic printer or Roll printer. The download format shows the format choices available depending upon the destination option selected.

For downloading to a **PC** or **Z-Modem** the user has the option of sending data in a SSS format – Clare's super system, compatible with Clare's PATGUARD software, Certificate - downloads results in ASCII certificate format. These are done through COMMS 1.

For downloading to a **Generic printer** (A4) the user has the option of sending data as a certificate, or a list, or as pass/fail labels. In the certificate format the user has the option to produce one certificate per page or to produce continuous printouts.

For downloading to a compatible **Roll printer**, including 'till roll' and thermal printers the user has the option of sending data as a continuous list or as pass/fail labels. When using a thermal roll printer selecting:

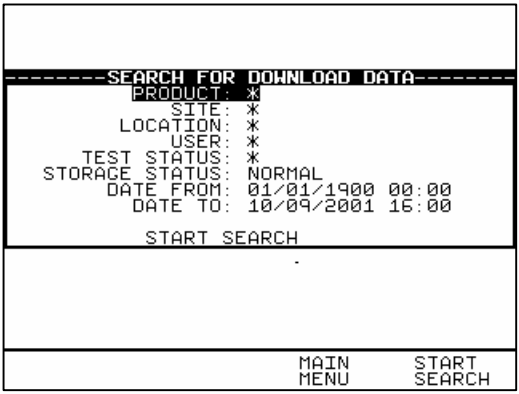
- **List** will produce a print with the Product number, Site, Location, User, Testcodes used, Date & time of test done, Test type & its parameters, Overall Pass/Fail status
- **Pass/Fail** labels will produce a print with the Product number, Date, User, Test status (pass or fail), Next Test due: (left blank) and Product barcode.

However, the restrictions of paper width means that Product numbers representing more than 12 digits cannot be printed and a numbered label will be printed instead. Testcodes over 12 and up to 15 digits can be accommodated since these are displayed as two lines.

All downloading to directly connected printers is through COMMS 3.

Use repeated presses of the Green button to show desired settings for download format. If appropriate the option field will illuminate.

When the download options are as you wish Press the **OK** fast key to display the following menu: -



Use the cursor keys to highlight the required search parameters and press Green to select the desired options list. **Caution**: See Printing Notes before initiating any Start Search.

Product Number

When prompted enter a Product number to search for specific results. If the Product number field is left blank then the character '*' will be inserted, indicating to search for all of the Products. See Fig. 8

Site Name

Use the encoder to highlight a Site name and press Green to select the desired option. Select '*' if you wish your search to include all of the sites. Select 'Other' to search for a Site not in the list (this can happen if a Site Name has been modified during testing). If you select 'other' you are prompted to enter a site name. See Fig. 9

Location Name

Use the encoder to highlight a Location name and press Green to select the desired option. Select '*' if you wish your search to include all of the names. Select 'Other' to search for a Location not in the list (this can happen if a Location name has been modified during testing)'. If you select 'other' you are prompted to enter a location name. See Fig. 10

User Name

Use the encoder to highlight a User name and press Green to select the desired option. Select 'All' if you wish your search to include all of the names. Select 'Other' to search for a User not in the list (this can happen if a User name has been modified during testing). If you select 'other' you are prompted to enter a user name. See Fig.11

Test Status

When Test Status is highlighted use the Green button to select the option required, each time you press Green a different option will be displayed. This can be PASS, FAIL or '*' which indicates both.

Storage Status

When Storage Status is highlighted use the Green button to select the option required, each time you press Green a different option will be displayed. This can be NORMAL, DELETED or '*' which indicates both.

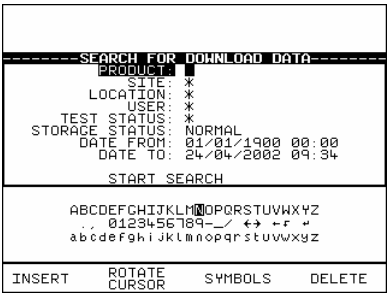


Fig. 8

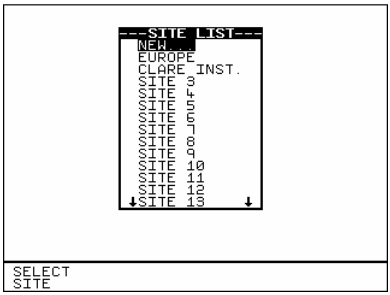


Fig. 9

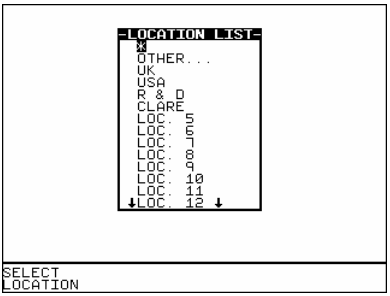


Fig.10

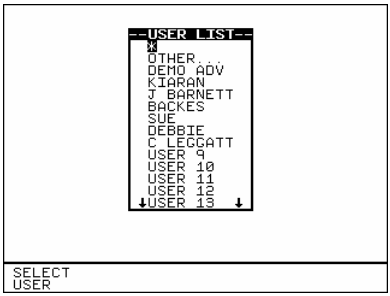


Fig. 11

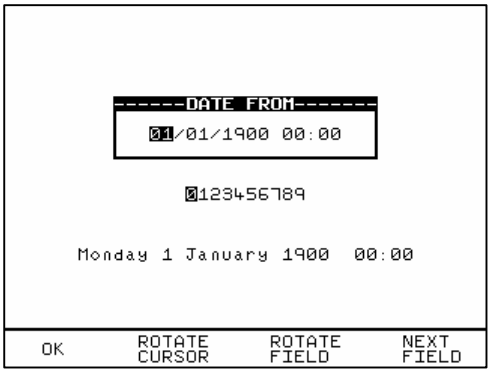
Printing NOTES

When in Download data mode, do not *search all* by entering the character '*****' for **all** the six fields as this would download (print out) **all** the product results for **all** the parameters indicated. This will not stop until **all** printing has completed.

If you need to search and view the list of test results for reminder, exit from this Search for Download Data mode and **use View Test Results** at the Main menu before re-entering this mode for printing.

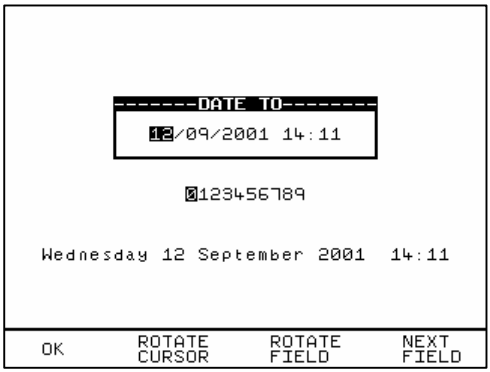
Date From

This option allows the user to search for test results after the selected date. Use the encoder to highlight the digit to be changed. Use the encoder to change the value. Select OK to store the settings or CANCEL to abort them.



Date To

This option allows the user to search for test results before the selected date. Use the encoder to highlight the digit to be changed. Use the encoder to change the value. Select OK to store the settings or CANCEL to abort them.



Search

After all the search parameters have been set, connect the appropriate printer or device. Press START SEARCH key or highlight START SEARCH & press GREEN to initiate search and download process.

If there are problems downloading e.g. due to interfacing problems, then after a short delay, the following error message appears: -

----------WARNING----------
PRINTER TIMEOUT: NO PRINTER CONNECTED PRESS START KEY TO CONTINUE

Press the red button to return to the search menu. On completion of successful downloading, the tester returns to the search for results menu. The user can then conduct on other search or press the red button to return to the main menu.

To print Barcode Pass/Fail Labels

In order to print barcode pass/fail labels the tests results required must be already stored in memory. Otherwise it is necessary to carry out an actual test first (see how to perform automatic tests). After a test is completed and the results stored in memory it is possible to download results to a thermal printer and print the pass/fail labels (see how to download results).

Note

Restrictions of paper width on certain printer means that Barcode representing more than 12 digits cannot be printed and a numbered label will be printed instead.

The print format options available are dependent upon the specific printer chosen. See Chapter 4 on Tips to configure the printer.

How to print Barcode Labels and Testcodes

The Genie is capable of printing barcode labels in conjunction with a compatible thermal printer (see chapter 6 for Accessories).

To print barcode labels for User, Site, Location, Testcode, Product & Test Type select **Barcode Printing** at Main menu and press Green to display the option list (Fig. 12). Highlight the desired option and press Green will bring up a selection list. Highlight option then press **Print Barcode** to print.

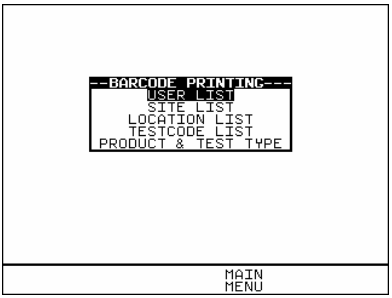
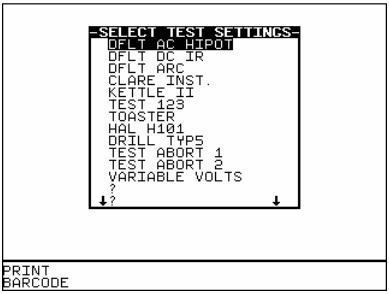


Fig. 12

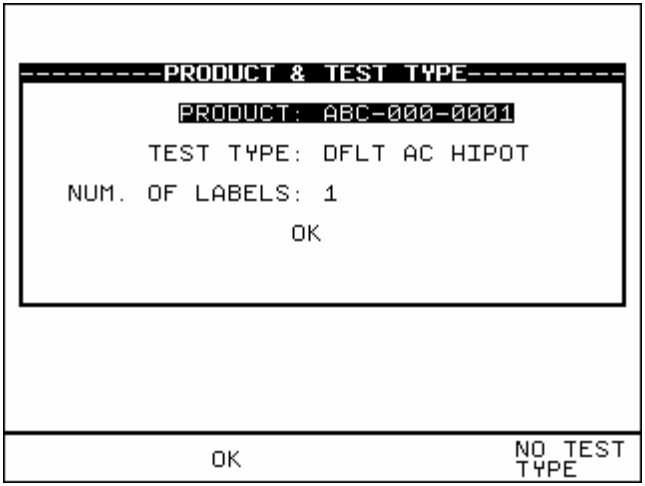
To print barcode testcodes

For example from the select test settings menu (Fig. 13) highlight the desired test e.g. DFLT AC HIPOT. Attach the compatible printer to the port and press PRINT BARCODE fast key on the display to initiate printing. A warning will be displayed if there is no printer connection or a connection problem has occurred (see Chapter 4 on Tips & Trouble Shooting).



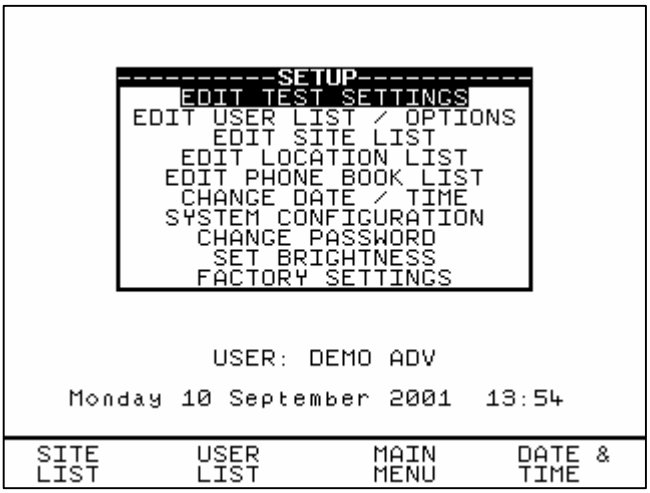
To print barcode Product & Test Type

From the Barcode print menu select **Product & Test Type**, press Green to display the product & test type window. A default product number (representing 12 characters) will be shown in highlight. Press Green to enter the editor to **Insert** the correct product details (up to 15 characters). This option will just print out the barcode and number for the Product only when OK key is pressed. However to print Product number & Test type to be tested, enter details of product first as described then highlight Test type and press Green to display the test settings list. Highlight test type and press SELECT TEST and this displays the data selected as shown in Fig. 14. Notice that the **Numbers of labels** can also be selected for the printing process. Press **OK** key to confirm printing. *Note: Clare's TSP400 printer will print product number with up to 15 characters.*



How to use Setup

To set up the Tester, use the cursor keys to highlight the Setup option on the Main Menu and press Green to display the following menu: -

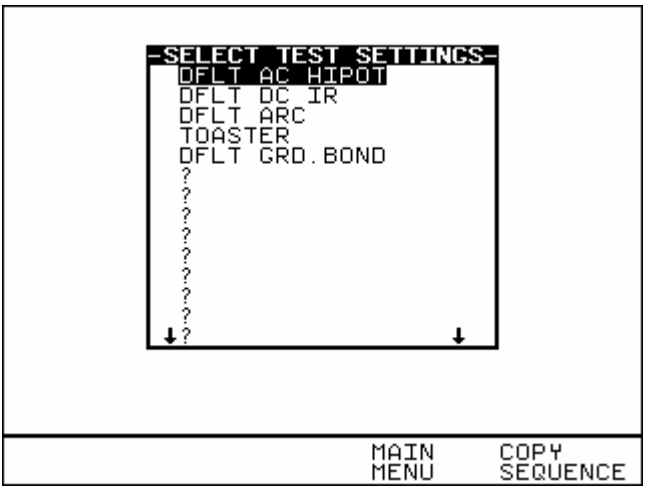


From this menu you can change the way the Tester will operate and also change user levels and sites. Use the encoder to highlight a function and press Green to select the desired option.

Edit Test Settings

This allows the user to add, modify, remove or confirm test settings that can then be selected during automatic testing.

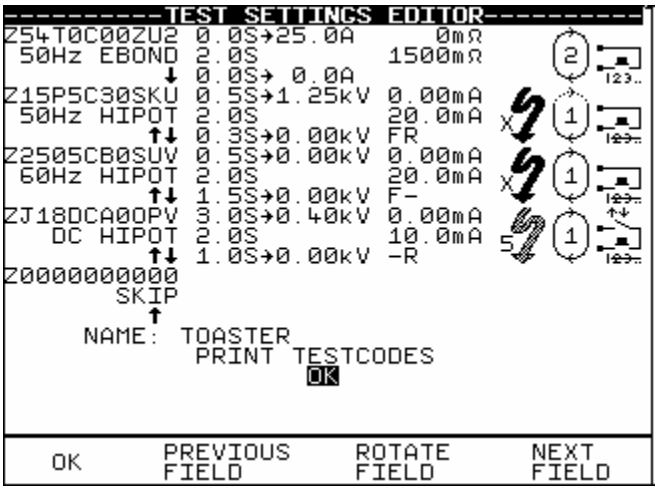
Also see Change Password.



Use the encoder to highlight a Test Setting and press Green to enter the Test Settings Editor: -

Test Settings Editor

The Test Settings Editor allows the test sequence for the selected test to be examined and changed if required: -.



Use the encoder to highlight a field to be changed and press Green to select the desired option. Use the fast key to highlight the desired field, and the encoder to cycle through the range of permissible values for the test parameter. Use the fast key to enter the value. To exit this editing phase, select the OK fast key. Changes will be stored to the system. These fields have been described in detail under the Default Test Settings section.

Name:

Each Sequence is given a name (this case DFLT AC HIPOT); this is to help the user when selecting Sequences during automatic testing. When Name is highlighted press Green, then use the encoder to enter a new name for the Test Sequence (of up to 15 characters) and press Green again to confirm.

Test Parameter Fields

By selecting one of the test parameter fields from the Test Settings Editor, the encoder will cycle through all the available values for the test parameter.

Use the Green button to save the settings and return to the Test Settings Editor. Pressing Red will abort changes made to the settings and return to the Test Settings Editor.

Testcodes

Use the encoder and Green button to select one of the Testcode fields.

A Testcode can be entered manually or through a compatible barcode scanner, reader or wand (see How to use a Barcode Scanner).

Store Settings

Use the encoder to highlight the OK field and press Green to save the settings and return to the previous menu. Pressing Red will abort all of the changes made and return to the previous menu.

Print Testcodes

The testcodes can be printed using a compatible printer - See Chapter 6 for accessories.

Use the Green button to start the print. The following message will be displayed: -

PRINTING TESTCODES WORKING….

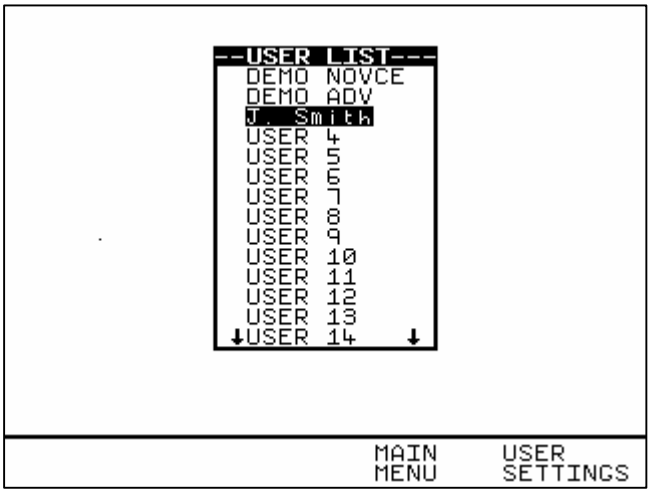
On completion of downloading, the Test Settings Editor menu is displayed.

If there are problems downloading e.g. due to interfacing problems, then after a delay, the following error message appears: -

----------WARNING----------
PRINTER TIMEOUT: NO PRINTER CONNECTED PRESS START KEY TO CONTINUE

Press Red to return to the Test Settings Editor menu. Check if printer cable is connected or power to printer is turned on etc. Also ensure if the proper printer setup has been configured at System Configuration & Download Options menu. Then re-select the printing options and try again.

Edit User List / Options

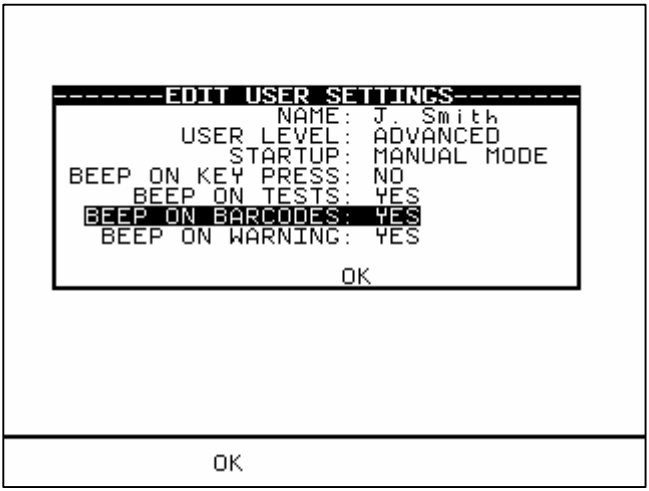


Note

If you change the name of the user during testing all of the previous tests will still be referenced to the old user name; this gives unlimited amounts of users within memory.

Edit User Name

Select **Setup** from Main Menu. The setup screen will be displayed. Select **User list** using fast key or highlight **Edit User List/Options** and press Green to enter. Use the encoder to highlight a user name and press **User settings** fast key or press Green to select the desired option. You will be prompted to edit the current user settings. Highlight setting fields with cursor and press **Green to enter editing**. **Insert** fields as required using fast key. Then press **Green** followed by **Red** to accept new user name. Pressing **Red** during any changes will abort Edit mode.



The settings can be customized as follows for each user requirement.

Name

Highlight user name and press Green to enter field variables editor. Use the cursor key to highlight character and press **Insert** to select each desired option. Then press Green to accept changes.

User Level

Use the cursor key to highlight user level and press Green to select the desired option:

Novice - Selects the user level as a regular user. This provides an average level of help information and additional warnings and prompts.

Advanced - Selects the user level as an advanced user. This provides a minimum level of help information and additional warnings and prompts.

Startup Mode

Use the encoder to highlight a test mode on startup and press Green to select the desired option.

Main Menu (Automatic Mode)

The Tester will start up in Automatic Mode, with the Tester displaying the Main Menu.

Manual Mode

The Tester will start up in Manual Mode, with the Tester displaying the Manual Test Selection Menu.

Beep on Key Press

Use the encoder to highlight a buzzer option and press Green to select the Yes/No option. If **Yes** is selected this option will beep each time a key is pressed.

Beep on Tests

Use the encoder to highlight a buzzer option and press Green to select the Yes/No option. If **Yes** is selected this option will beep whenever the High Voltage Test in progress icon is displayed or when a test has failed.

Beep on Barcodes

Use the encoder to highlight a buzzer option and press Green to select the Yes/No option. If **Yes** is selected this option will beep whenever a barcode has been received.

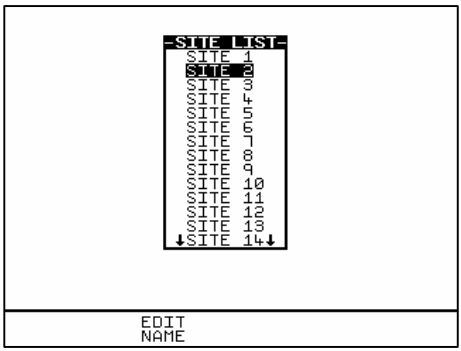
Beep on Warning

Use the encoder to highlight a buzzer option and press Green to select the Yes/No option. If **Yes** is selected this option will beep whenever a warning message is displayed to alert user.

Saving User Settings

After all changes have been made to the **Edit User Settings**, press OK fast key to save these user settings. Then press Red to move back to Setup screen.

Edit Site List

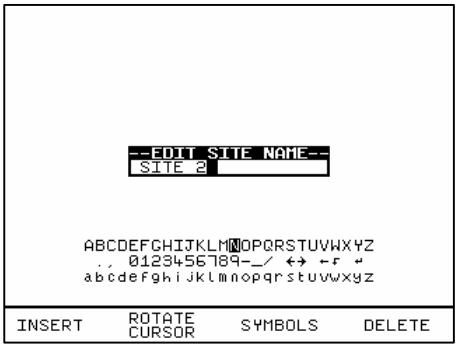


Note

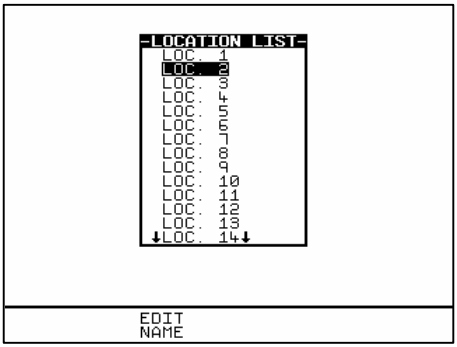
If you change the name of the site during testing all of the previous tests will still be referenced to the old site name; this gives unlimited amounts of sites within memory.

Edit Site Name

Select **Setup** from Main Menu. The setup screen will be displayed. Select **Site list** using fast key or highlight **Edit Site List** and press Green to enter. Use the encoder to highlight a site name and press **Edit Name** fast key or press Green to select the desired option. You will be prompted to edit the existing site name. Select data fields with cursor and press **Insert** key as required. Then press **Green** followed by **Red** to accept new site name. Pressing **Red** during any changes will abort Edit mode.



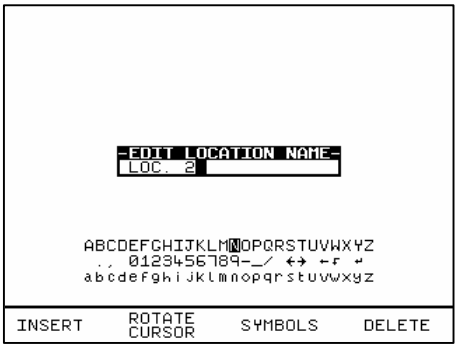
Edit Location List



Note

If you change the name of the location during testing all of the previous tests will still be referenced to the old location name; this gives unlimited amounts of locations within memory.

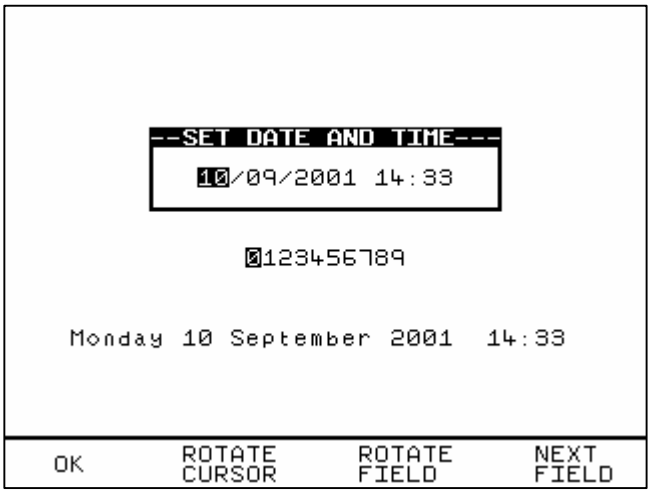
Edit Location Name



Select **Setup** from Main Menu. The setup screen will be displayed. Select **Edit Location List** and press Green to enter. Use the encoder to highlight a location name and press **Edit Name** fast key or press Green to select the desired option. You will be prompted to edit the existing location name. Select data fields with cursor and press **Insert** key as required. Then press **Green** followed by **Red** to accept new location name. Pressing **Red** during any changes will abort Edit mode.

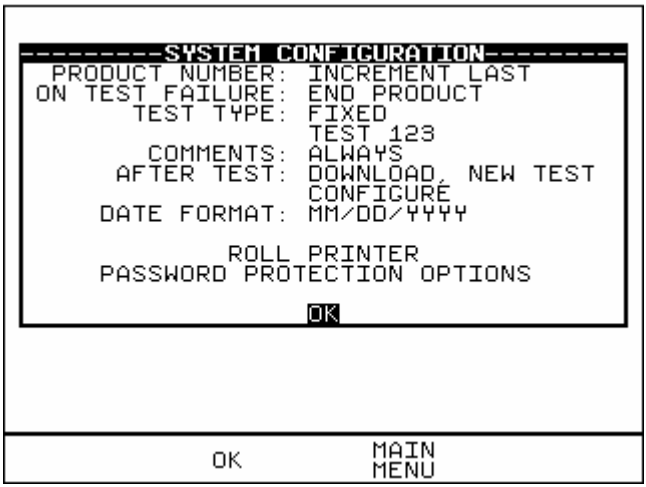
Change Date / Time

This option allows the user to change the Date and Time. Use **Rotate Cursor** (to select or deselect cursor tracking) and use encoder to move to desired fields for edition. Then select **Rotate Field** and use the encoder (to cycle through) to change the value of the field. Repeat above process until all fields have been changed. Select **OK** to store the new settings or press Red to cancel or abort changes. To update the new setting you must return to the MAIN MENU.



System Configuration

The Test Settings are included to cover the wide range of options that may be country or company specific.



How to edit System Configuration

To edit any of the above fields, highlight a field to be changed, press Green (or press Green repeatedly for the options). When all fields have been satisfactorily selected press OK to store changes to memory.

Product Number : (Three options selectable)

- Increment Last

This option allows the tester to proceed to the next product ID (incremented by one) each time a test has completed.

- Repeat Last

This allows the test to be repeated on the previous product ID (same ID)

- Blank

This will bring up a blank Product ID after each test. The user will need to enter in any intended product ID again to proceed.

On Test Failure: (Two options)

- Failure Menu

This gives user the option of having a menu for a failure within an automatic test sequence. The menu will give user the option of retrying a failed test (Restart Test), revise Product detail (Restart Product), end the test (End Product) and aborting the test on the product (Abort Product).

- End Product

This will just end the test sequence immediately once Failure is detected.

Test Type : (Three options)

- Any

This gives user the option of selecting from a test setting list each time before any test is instigated.

- Barcode only

This option allows user to scan in a Barcode representation of any test setting using a Barcode scanner.

- Fixed
  testName (selected from test setting list e.g. Toaster)

This option allows user to keep to only one test setting for every test. To change to a different test setting, select Setup & System Configuration and then highlight testName, press Green. Select a new testName from test setting list.
Otherwise select one of the two options above for more flexibility.

Comments:

- Never
  This will not allow any comments recording after each test.
- Always
  This will always allow user to enter comments after each test.
- On Pass
  This will allow user to enter comments only when a test has Passed.
- On Failure
  This will allow user to enter comments only when a test has Failed.

After Test:

- Menu (Options)
  This allows user to have the options to select New Test, Review test results, Download test results or return to Main Menu after each test.
- New Test
  This option allows user to progress to the 'Next' (new) product test. However the 'next' product ID details displayed after each test will depend on the Product Number options selected. See product number options.

- Download, New Test
  Configure – Highlight this to select Download Options (Sends test results on to a Printer choice, PC or Z-modem medium).
  This will allow user to download the test results to any of the above options before proceeding to next test.

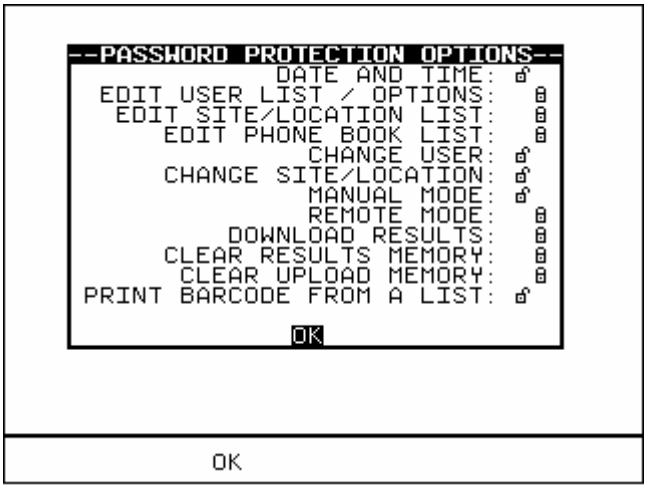
Date Format:
This allows user to select the date convention to be used
(i.e. DD/MM/YYYY or MM/DD/YYYY)

Roll Printer: (TSP 400 or REF 283A954)

This allows the user to define the thermal printer to be used with the Hal. Clare's recommended option is "TSP400". Option selected must match with the printer connected especially for Barcodes printing. See Accessories at Main Menu.

Password Protection Options

This allows the user to password protect a list of selectable options. An existing password must be set-up before this option can be used. To select option highlight the field , press Green to effect 'lock or unlock' of password protection on the field options. Press OK to save format.



'Locked' field denotes that it will be password protected. Invoking any of those settings/options editor menu will required password to access. 'Unlocked' field denotes otherwise.

Change Password

It is possible to Password protect the Test Sequence Editor and the Country Settings.

If you currently do not have password protection you will be asked to enter a new password twice, once for confirmation.

If you currently do have password protection then you will be asked for the old password before entering a new one, again you will be asked for the new password twice.

To clear the password protection simply press Enter when asked for the new password. A warning will show that no password is in place.

Set Brightness

You can now set the Brightness of the display. Use the encoder to change the Brightness, once the Brightness is set press the Green button to accept the changes. Press the Red button to abort any changes made.

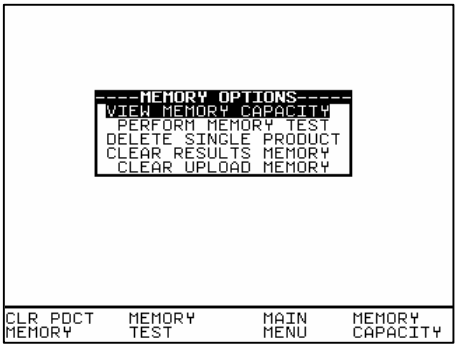
Factory Settings

It is possible to reset the Hal to the settings that were configured from new. This option will first ask you if you are sure, select Yes to reset or press

CANCEL to Abort.

How to use the Memory

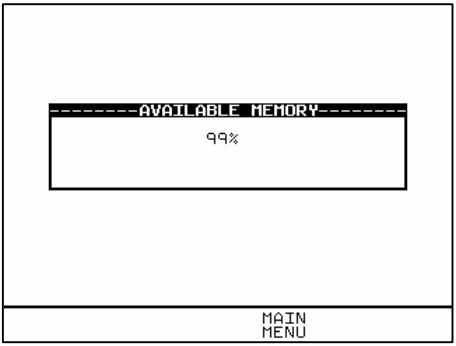
To use the memory tests and functions, use the encoder to highlight the Memory Options option on the Main Menu and press Green to display the following menu: -



Use the encoder to highlight a test or function and press Green to select the desired option.

View Memory Capacity

The Tester allows the user to see how much of the results memory is being used. The following bar graph of the memory remaining is displayed: -



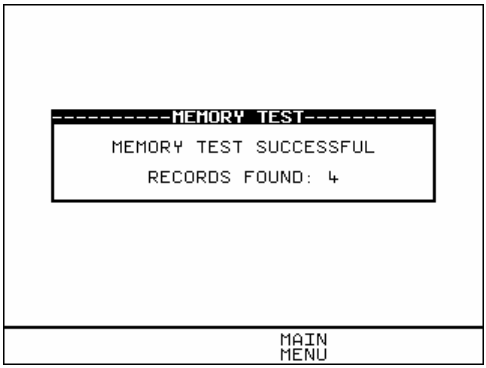
Perform Memory Test

Once the 'Perform memory test' option is highlighted press Green.

The memory test checks all of the Product results against their checksums. If the test result is a pass then no action is taken. If any tests fail then the Memory checksum requires updating. Use the encoder and press Green to choose an action if corrupted tests are found.

Note

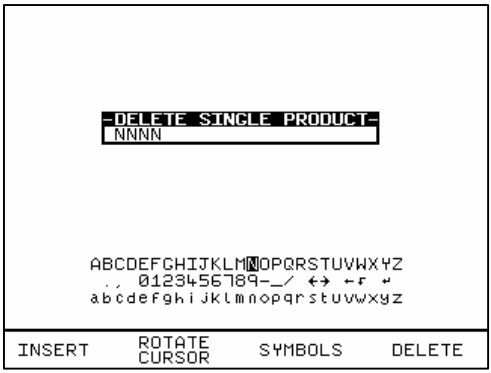
The memory checksum is the sum of all of the memory excluding display data, registers and deleted tests.



Delete Single Product

Enter the Product number to delete a single Product and press Green.

A warning 'Are You Sure?' prompt box will appear. Press **CANCEL** fast key to abort and return to the previous menu or press **Yes** fast key to perform the delete operation and return to the previous menu.



Note:

Deleting Products in this way will delete all of the matched Products across all of the Sites and Locations.

When a single Product is deleted it is not removed from memory but hidden from the user. This test is still resident in memory and is taking up memory space, this test can be reviewed / downloaded at a later date. Since the test is still resident in memory the View Memory Capacity figure may seem false. I.e. whilst you may think you have no results stored and the View Memory Capacity indicates there are results stored, previously deleted Products are resident in memory. In this situation to remove all resident tests select clear results memory.

Clear Results Memory

This option will delete (permanently) **all** the test results of **all** Products tested and currently stored in memory and should be used with **CAUTION**!

A warning 'Are You Sure?' prompt will appear. Press the **CANCEL** (NO) fast key to return to the previous menu or press the **YES** fast key to perform the delete (Clearing) operation and return to the previous menu.

Note

It is recommended that the memory Results should be Downloaded to other retrievable form or format before embarking on clearing them from the system memory. This Deletion is Permanent.

To ensure unauthorized tempering this Option must always be password protected for access.

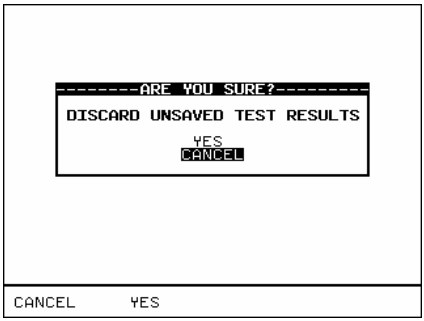
Clear Upload Memory

This option will delete all of the Product codes that have been uploaded from an external computer and should be used with **CAUTION**!

Note

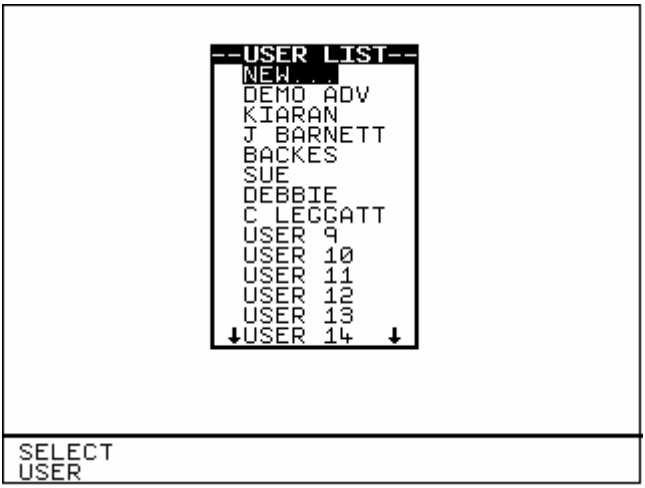
Users will be asked whether they are sure about performing this action.

A warning 'Are You Sure?' prompt will appear. Press the **CANCEL** fast key to return to the previous menu or press the **YES** fast key to perform the delete operation and return to the previous menu.



How to Change User Name

At the Main Menu screen select **Change User** and press Green (or press **Change User** fast key). Use the encoder to highlight a user name and press **Select User** fast key or press Green to select desired option. Selected option will be automatically updated. For a user not found in list, select **New** from list and you will be prompted to enter name of the new user. Press **Insert** to accept each data field entered and then press green button to accept new User name. The total number of users available in list is 20.

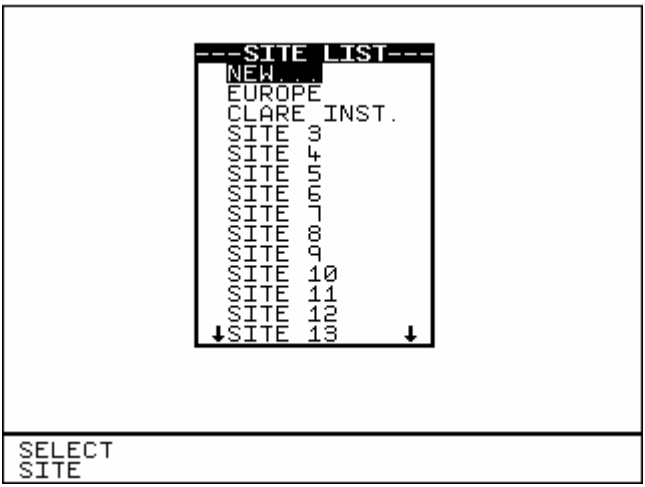


Edit User Name

To edit User name see sections on How to use Setup & Edit User list.

How to Change Site Name

At the Main Menu screen select **Change Site** and press Green. Use the encoder to highlight a site name and press **Select Site** fast key or press Green to select desired site. Selected option will be automatically updated. For a site not found in list, select **New** from list and you will be prompted to enter name of the new site. Press **Insert** to accept each data field entered and press Green to accept New site name. The total number of sites available in list is 20.

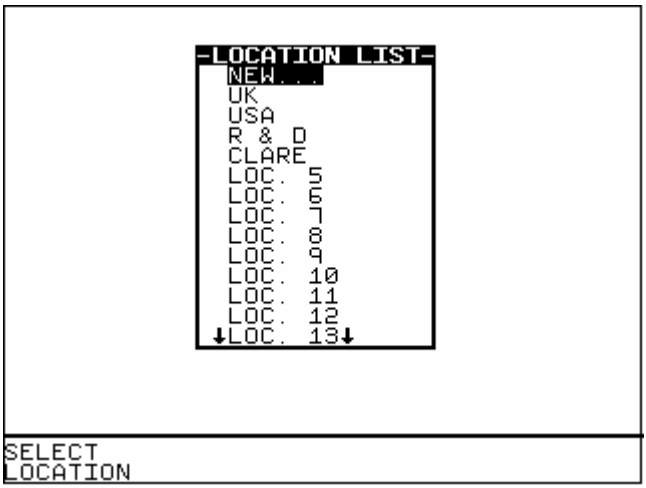


Edit Site Name

To edit Site name see sections on How to use Setup & Edit Site list.

How to Change Location Name

At the Main Menu screen select **Change Location** and press Green. Use the encoder to highlight a location name and press **Select Location** fast key or press Green to accept desired location. Selected option will be automatically updated. For a location not found in list, select **New** from list and you will be prompted to enter name of the new location. Press **Insert** to accept each data field entered and press green to accept New location name. The total number of locations available in list is 50.



Edit Location Name

To edit Location name see sections on How to use Setup & Edit Location list.

How to use Help

The Tester is provided with an on-line help function, which can be called up at during the test screens by pressing the Help fast key.

Each test will have three or four help pages depending on connection information.

Help provided to the User

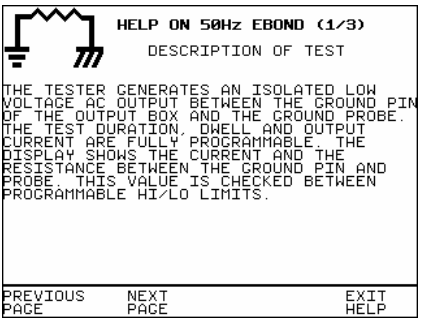
The Help function provides the following information: -

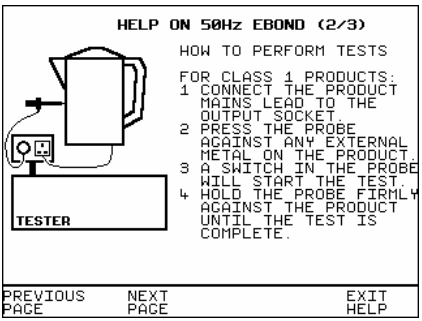
Description of Test

The first help page shown contains information on the particular test, including its icon and a description of the purpose of the test.

How to Perform Tests

The second page of information describes how the Tester performs the test. A diagram showing how to connect the Tester to the EUT is included. An example for the Ground Bond(EBond) test is shown below:





A description of how to connect the test leads and perform the test is provided in a step-by-step format when the Help key on the meter screen is pressed.

Note:

This topic will cover one , two or three pages depending on the connection options available (Insulation and Hipot can be Class 1 or Class 2). Each connection option will have a new page of information.

Why tests fail

The final page of information provides guidance on why a test may fail e.g. connection problems. This includes a step by step checklist to ensure all of the connections are correct and secure.

The effect of User Levels during Test Sequences

There are two possible user levels: Novice and Advanced.

Note

The user level for a new user is set to Novice.

Novice User Level

When the user level is set to Novice Level, the help information is displayed before every new test

Press the Green button key to continue the sequence.

Advanced User Level

When the user level is set to Advanced Level, no help information will be shown before a test. Use the Help/Information key for help information if required at any time.

Chapter 4 Tips & Troubleshooting

Power -On Self tests:

When the tester is powered on, a number of messages can possibly appear as the tester performs safety tests on itself and the mains power supply.

Temperature monitoring

The tester is provided with temperature monitoring facilities to ensure that prolonged tests do not overheat sensitive components. If, during testing a 'Over temperature' warning is displayed, switch off any EUT, and allow the tester to cool. This is provided to allow the EUT to be switched off in a controlled way.

Barcodes

Barcode Scanner Specification

The Hal Tester can be used with barcodes and barcode scanners, readers or wands. These connect to the serial (RS232) connector. The required configuration is as follows: -

Baud Rate:	9600
Start Bits:	2
Data Bits	8
Stop Bits:	1
Parity:	None
Inter-character Delay:	20ms

When to use a Barcode Scanner

Barcodes can be scanned at the following points: -

- Entering a Testcode as part of an Automatic Test or Test Setting Editor
- Selecting Test type
- Entering Product number, changing User, Site or Location
- Entering Comments and where text is needed.

Interfacing

The Tester provides three interfacing ports: -

For connection to a PC, printer or Barcode Reader

To avoid any problems during download, ensure that leads are undamaged and correctly wired.

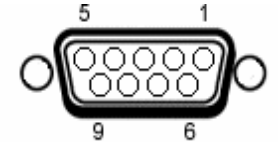
The Connector pin-outs for Serial ports are shown below: -

Parallel - The Genie features a serial port. However a serial to parallel adapter is available to allow interface with parallel ports. See accessories in Chapter 6.

Downloading to Computer Software

Serial Port

The serial port uses a standard 9-way D-type connector



Pin	Description
1.	N.C.
2.	RX
3.	TX
4.	DTR
5.	0V
6.	N.C.
7.	0V
8.	N.C.
9.	+5V

Baud Rate:	9600, 19200, 28800 (selectable)
Start Bits:	2
Data Bits	8
Stop Bits:	1
Parity:	None
Inter-character Delay:	20ms
Flow control	Xon / Xoff

Quick Reference for Printer Configure & Setup

Connections for STAR TSP400 Printer

For connection to the GENIE….

9-way D plug for connection to HAL		**25-way D plug for connection to TSP400 printer**	
RxD (input)	2	2	TxD (output)
TxD (output)	3	3	RxD (input)
Ext GND (screen)	5	1 7	Frame Ground (screen) Signal GND (screen)
DSR (input)	4	20	DTR (output)

For connection to a PC

9-way D socket for connection to PC serial port		**25-way D plug for connection to TSP400 printer**	
Frame Ground (screen)	1	1	Frame Ground (screen)
RxD (input)	2	2	TxD (output)
TxD (output)	3	3	RxD (input)
Signal GND	5	7	Signal GND
DSR (input) and CTS (input)	6 8	20	DTR (output)

STAR TSP400 print modes when used with the GENIE

The TSP400 can be configured for page mode or line mode. Although these settings could be changed by the software, either a power on-off or software reset cycle would be required to effect the changes. A software reset causes a self-test print to be produced.

It is therefore necessary to manually configure the printer for 'page mode with top of form enabled' when printing labels, and 'line mode with top of form disabled' when printing lists. How to do this using the printer's front panel is documented in the printer's user's manual, but a brief summary is in the following table:

Labels (with black alignment marks)	**Paper roll (continuous)**
• Turn off printer. • Hold down ON-LINE and FEED buttons. • Turn on printer and wait for 'NO PAPER' indication. Release ON-LINE and FEED buttons. • Press FEED button once. The TSP400 should beep twice indicating that 'top of form' is enabled.	• Turn off printer. • Hold down ON-LINE and FEED buttons. • Turn on printer and wait for 'NO PAPER' indication. Release ON-LINE and FEED buttons. • Press ON-LINE button once. The TSP400 should beep once indicating that 'top of form' is disabled.
• Turn off printer. • Hold down ON-LINE button. • Turn on printer and wait for 'ERROR' indication. • Release ON-LINE button. • Press ON-LINE button once. The TSP400 should beep once indicating that 'page mode' is selected.	• Turn off printer. • Hold down ON-LINE button. • Turn on printer and wait for 'ERROR' indication. • Release ON-LINE button. • Press FEED button once. The TSP400 should beep twice indicating that 'line mode' is selected.
• Turn off printer. • Insert label stock. • Turn on printer.	• Turn off printer. • Insert paper roll. • Turn on printer.

Chapter 5 Maintaining the Tester

Cleaning the Tester

The Tester case can be cleaned with a damp cloth, with if necessary, a small amount of mild detergent. Prevent excessive moisture around the socket panel or in the lead storage area.

Do not allow liquid inside the Tester, or near the socket panel. Do not use abrasives, solvents, or alcohol.

If any liquid is spilt into the Tester case, the Tester should be returned for repair, stating the cause of the defect.

User Maintenance

The Tester is a rugged quality instrument. However, care should always be taken when using, transporting and storing this type of equipment. Failure to treat the product with care will reduce both the life of the instrument its reliability.

If the Tester is subject to condensation, allow the Tester too completely dry before use.

- Always check the Tester and all test leads for signs of damage and wear before use.
- Do not open the Tester under any circumstances.
- Keep the instrument clean and dry.
- Avoid testing in conditions of high electrostatic or electromagnetic fields.
- Maintenance should only be performed by authorized personnel.
- There are no user replaceable parts in the Tester.
- The unit should be regularly calibrated (at least annually).

For repair or calibration, please return the instrument to: -

Clare Instruments
Dominion Way
Worthing
West Sussex
UK
BN14 8NW
Tel: +44 (0)1903 233314
Fax: +44 (0)1903 216089
info@clareinstruments.com

Chapter 6 Accessories

Standard Accessories

Accessory	**Part Number**
IEC Mains Lead (U.K.)	39044
Guard Plug	CON965/L
Output Box (UK)	G2-5001
IEC Mains Lead(EURO)	48230
Output Box (EURO)	G2-5002
IEC Mains Lead (U.S.A.)	48329
Output Box (U.S.A.)	G2-5003
IEC Mains Lead (DANISH)	G2-5004
No-Burn Ground Bond Probe	01520/1
Hipot Probe	03919/2
Hipot Clip (Std. Black) + Lead	H-5003
Operating Manual	G2-1005

Optional Accessories

Accessory	**Part Number**
Hipot Clip (Red)	H5003/R
Calibration Checkbox	V242
Barcode Scanner	283A922
Hand Held Guard Switch	DCS317
Ground Bond Clip Lead	01521/1
Thermal Label Printer (TSP400)*	PLS001
Thermal Label Printer (Martel)	283A954
Thermal Printer Labels for TSP400	LPG001
Thermal Printer Labels for Martel	283A304
Product Number Labels (250)	194A307
Test Code Labels (240)	194A308
Serial-Printer Lead (9-25way)	H-5013
Serial to Parallel adapter	270A954
Serial-PC Download Lead (9-9 way)	H-5014
Serial-PC Download Lead (9-25way)	194A920
Pass Labels (500)	91B038
Status Beacon(mains cord 230/110V)	H-5017*

NB: * denotes product recommended by Clare Instruments Ltd

Chapter 7 Specifications

Input Rating

Supply Voltage	selectable 115V/230V a.c. RMS
Frequency	50/60 Hz
Fuse	5 amps 250V

GROUND BOND TEST

Test Voltage	6V Nominal
Test Current Range	0.1 – 40A
Accuracy	+/- 1% +/- 2 digits of Reading
Frequency	50 or 60 Hz (Independent of Supply)
Measurement Range	0-1500mΩ
Pass Range	0-1500mΩ +/- 1% +/- 5 digits of Reading
Four Wire measurement	
Compliance Test Range	10A through 0.5Ω
	25A through 0.2Ω
	30A through 0.15Ω

Remote Test Initiation – via No-Burn Ground Bond Probe

Insulation Test

Test Voltage	250V, 500V or 1000V d.c
Trip Current	11mA dc Maximum
Accuracy	250Vdc : 0.03MΩ - 200MΩ, ± 5% ± 5 digits of reading
	> 200MΩ unspecified
	500Vdc : 0.03MΩ - 500MΩ, ± 5% ± 5 digits of reading
	> 500MΩ unspecified

	1000Vdc : 0.03MΩ - 700MΩ, ± 5% ± 5 digits of reading
	700.1MΩ - 1000MΩ, ± 10% ± 5 digits of reading
Display Resolution	0.01 MΩ (<100 MΩ)
	0.1MΩ (>100 MΩ)
Pass Level	0.01MΩ - 1000MΩ Selectable

AC HiPot Test

Test Voltage Range	0.10 – 5.00kV (Programmable)
Frequency	50 or 60 Hz (Independent of Supply)
Voltage Selection Resolution	10V/Step
Voltage Accuracy	+/- 1% +/- 2 digits of Reading

Leakage

Maximum Output Current	20mA @ 5kV
Display Current Range	0.01 – 20.00mA
Display Current Resolution	0.01mA
Pass Level	0.01 – 20.00mA Selectable

DC HiPot Test

Test Voltage Range	0.10 – 6.00kV (Programmable)
Frequency	50 or 60 Hz (Independent of Supply)
Output Voltage Ripple	<5% @ 6kV
Voltage Selection Resolution	10V/Step
Voltage Accuracy	+/- 1% +/- 3 digits of Reading

Leakage

Maximum Output Current	10mA @ 6kV
Display Current Range	0.01 – 10.00mA
Display Current Resolution	0.01mA

Pass Levels	0.01mA – 10.00mA Selectable

Arc Detection

Levels	9 Selectable Settings (or Disabled)

Mechanical

Size	370mm x 300mm x 204mm
Weight	12kg

Environmental

Operating	0ºC to 40ºC (non condensing)
Storage	-10ºC to 50ºC (non condensing)
Maximum R.H	90%

Appendix A Purpose of Tests

Ground (Earth) Bond Test

Caution

6V(no-load) 0- 40A AC test Current

This test is to ensure that the connection between the earth pin in the mains plug of the appliance and the metal casing of the appliance is satisfactory and of sufficiently low resistance. This test is usually done on Class 1 (Metal Case) products only.

During the test, an AC voltage and the test current is applied between the earth pin of the mains supply plug and the ground (earth) bond test lead clip/probe. The test output box must be used for connection to the EUT for this test. When a ground bond test probe (optional item) is used the special (shorted) guard switch plug provided should be used in combination to free user of pressing the guard switch during the test.

A high current is normally used to stress the connection under fault conditions. The length of the test should be limited to prevent damage due to overheating. Tests currents of up to 40A AC are available from this tester. The test output currents, test duration and set resistance HI/LO values limits are fully programmable. The Tester measures the test values using a 4-wire measurement method then displays the resistance measured and allows the user to confirm that sufficiently low resistance exists within the EUT protective bonding path.

Caution

Prolonged use of the ground bond probe at high currents can lead to a high probe temperature. Care should be taken to avoid touching the probe tip under these conditions. The Tester's internal over temperature switch may operate with prolonged repetitive use of high test currents. In this instance an error message will be displayed. In order to proceed with further tests

the Tester must be allowed to cool down.

Hipot Test

Warning

5000V a.c./6000V DC Test voltage

This test is used to determine that the insulation is of sufficient strength to prevent breakdown, particularly where high transient voltages are likely. This test can be omitted when testing equipment with component whose voltage withstand rating is insufficient to accommodate the test without damage. This is especially true of IT equipment.

For Class I Products, a nominal test voltage of 1.5kV AC RMS is applied between the earth pin, and both the live and neutral pins of the Product mains supply plug

For Class II Products, a nominal voltage of 3kV AC RMS is applied between the Hipot probe tip and the live and neutral pins of the Product mains supply plug.

Insulation Test

Warning

1000V, 500 V, and 250 V DC test voltage

This test is used to verify that adequate insulation exists between the mains supply pins and earth.

During the insulation test, a HV DC voltage is applied between the earth pin and both the live and neutral pins of the Product mains supply plug. The Tester displays the resistance measured and allows the user to confirm sufficient insulation exists.

For a product that incorporates over-voltage protection, a 250V DC test voltage is provided to allow a reading to be taken without the protection devices generating a false failure.

Appendix B Reference

Factory-set Test Sequences

1. Name - Default AC Hipot
   Rise Time – 2.0 s
   Hold Time – 10 s
   Fall Time – 2.0 s
   Output Voltage 2.5 kV a.c.
   Low Trip Level – 7.0 mA
   High Trip Level – 10.0 mA
   Arc Detection Setting – Level 5
   Number of Tests – 1
   Start Conditions – External Guard + START Button

2. Name - Default DC Hipot
   Rise Time – 2.0 s
   Hold Time – 2.0 s
   Fall Time – 2.0 s
   Output Voltage 0.5 kV d.c.
   Low Trip Level – 7.0 mA
   High Trip Level – 10.0 mA
   Arc Detection Setting – Level 5
   Number of Tests – 1
   Start Conditions – External Guard + START Button

Testcode Tables

Clare's Testcodes are an 11-character string where each character is in the ASCII range '0' to '9' and 'A' to 'Z'. The character count starts from left to right. The example below shows Z as digit 1 or (character no. 1) and the integer 1 as digit 2 (character no. 2) and so on.

e.g. Z1234567890

Digit 1 (Character 1) – Testcode Type

Digit 1 associates the testcode with Clare Instruments Equipment

	Digit 1 : Testcode Type
'Z'	Clare Instruments Testcode

Digit 2 – Test Type

Digit 2 represents the type of test to be performed

	Digit 2 : Test Type
'0'	Skip Test
'1'	AC Hipot 50Hz
'2'	AC Hipot 60Hz
'3'	DC Hipot
'4'	DC Insulation Resistance, DC IR
'5'	EBond 50Hz
'6'	EBond 60Hz
'7' – '9'	Not Used
'A' – 'Z'	Not Used

Digit 3 – Start Conditions & Base Target Voltage

Digit 3 is a combination of the start conditions for the test and the base target voltage (to which the value encoded in digit 4 is added).

Digit 3				
Start Conditions	**Base Target Voltage**			
	0.0kV	1.6kV	3.2kV	4.8kV
Reset **Ext**. Guard Switch, opened then closed followed by **Green** (START) button to start test and each repeat of test. (All loops)	'0'	'7'	'E'	'L'
Reset **Ext**. Guard Switch, opened then closed followed by **Green** (START) button to start 1st loop. Repeat test loops will convene whilst Guard switch is closed.	'1'	'8'	'F'	'M'
Reset **Ext**. Guard Switch, opened then closed to start test and each repeat of test. (All loops)	'2'	'9'	'G'	'N'
Reset **Ext**. Guard Switch, opened then closed to start 1st loop. Repeat test loops will convene whilst Guard switch is closed.	'3'	'A'	'H'	'O'
Press **Green** (START) Button to start test and each repeat of test. Guard switch must be closed throughout the tests. (All loops)	'4'	'B'	'I'	'P'
Press **Green** (START) Button to start 1st loop. Repeat test loops will follow. Guard switch must be closed throughout any tests.	'5'	'C'	'J'	'Q'
None. Test starts without any activity on Ext. Guard switch or Green button. Guard switch must be closed throughout any tests.	'6'	'D'	'K'	'R'

Note 1 - No test will be started unless the guard switch is closed, and any test in progress is automatically and immediately terminated if the guard switch is opened during a test. Where the external guard switch appears as part of the start conditions it implies that the GUI will wait for the guard switch to be open for 150ms and then remain closed for at least 150ms before the test will be started (or before the START key will be enabled, if required).

Note 2 - For ground (earth) bond tests the earth bond probe micro-switch acts in parallel to the START button. The micro–switch must be open for at least 120ms after any required guard switch activity is complete, and then remain closed for 90ms before a test will be started.

Digit 4 – Target Voltage Offset

Digit 4 represents the output voltage offset to be added to the base target voltage. The target voltage is achieved at the end of the 'Ramp to Target' time and is maintained during the 'Hold' time. During VARIABLE Tests (digit 5 = 'Z' the target voltage is used as the maximum possible output voltage, helping prevent damaging or dangerous voltages being applied to the device under test.

	Digit 4 : HV Test Target Voltage Offset	**Digit 4 : EBOND Test Target Voltage Offset**
'0'	0.00kV	0.0A
'1'	0.05kV	0.1A
'2'	0.10kV	0.2A
'3'	0.15kV	0.3A
'4'	0.20kV	0.4A
'5'	0.25kV	0.5A
'6'	0.30kV	0.6A
'7'	0.35kV	0.7A
'8'	0.40kV	0.8A
'9'	0.45kV	0.9A
'A'	0.50kV	1.0A
'B'	0.55kV	1.5A
'C'	0.60kV	2.0A
'D'	0.65kV	2.5A
'E'	0.70kV	3.0A
'F'	0.75kV	3.5A
'G'	0.80kV	4.0A
'H'	0.85kV	4.5A
'I'	0.90kV	5.0A
'J'	0.95kV	6.0A
'K'	1.00kV	7.0A
'L'	1.05kV	8.0A
'M'	1.10kV	9.0A

'N'	1.15kV	10.0A
'O'	1.20kV	12.5A
'P'	1.25kV	15.0A
'Q'	1.30kV	17.5A
'R'	1.35kV	20.0A
'S'	1.40kV	22.5A
'T'	1.45kV	25.0A
'U'	1.50kV	27.5A
'V'	1.55kV	30.0A
'W'	N/A	32.5A
'X'	N/A	35.0A
'Y'	N/A	37.5A
'Z'	N/A	40.0A

Note that not all combinations of 'Base Target Voltage' and 'Target Offset Voltage' are Valid. AC Hipot Tests have a 5.00kV range, while DC Hipot tests have a 0.1 - 6.00kV range and DC IR Tests have discrete output voltages of 0.25kV, 0.5kV and 1.0 kV.

The Tester's test code editor will not generate invalid combinations and all invalid entry or scanned testcodes will be rejected.

A special 0.00kV or 0.0A output setting is intended to be used as a 'rest' period between other tests in a sequence. Such sequences may be linked or repeated (See digit 11).

Digit 5 – Ramp to Target Time

Digit 6 – Hold Time

Digit 7 – Ramp to Zero Time

Digits 5,6 and 7 represent times during which the out voltage is ramped to the target voltage, held at the target voltage and finally ramped down to zero. All the times are in seconds.

	Digit 5 **Ramp to Target Time**	**Digit 6** **Hold Time**	**Digit 7** **Ramp to Zero Time**
'0'	0.0	0.0	0.0
'1'	0.1	0.1	0.1
'2'	0.2	0.2	0.2
'3'	0.3	0.3	0.3
'4'	0.4	0.4	0.4
'5'	0.5	0.5	0.5
'6'	0.6	0.6	0.6
'7'	0.7	0.7	0.7
'8'	0.8	0.8	0.8
'9'	0.9	0.9	0.9
'A'	1.0	1.0	1.0
'B'	1.5	1.5	1.5
'C'	2.0	2.0	2.0
'D'	3.0	3.0	3.0
'E'	4.0	4.0	4.0
'F'	5.0	5.0	5.0
'G'	7.5	7.5	7.5
'H'	10.0	10.0	10.0
'I'	15.0	15.0	15.0
'J'	20.0	20.0	20.0
'K'	30.0	30.0	30.0
'L'	45.0	45.0	45.0
'M'	60.0	60.0	60.0
'N'	90.0	90.0	90.0
'O'	120.0	120.0	120.0
'P'	150.0	150.0	150.0
'Q'	180.0	180.0	180.0
'R'	240.0	240.0	240.0
'S'	300.0	300.0	300.0
'T' – 'Y'	Not Used	Not Used	Not Used

'Z'	Specifies the output voltage is VARIABLE up to the target voltage using the rotary encoder. Initial value is 0.00kV,digit 6 is ignored whilst digit 7 is acted upon once user ends the variable voltage phase (by pressing the Start button).	Specifies an infinite duration hold time, until the test is terminated.	The current output voltage is used as the start value for the next 'ramp to target' at the beginning of the next test. " Maintained "

Digit 8 – Lower Trip Limit (AC/DC Hipot & DC IR)

Digit 9 – Upper Trip Limit (AC/DC Hipot & DC IR)

Digits 8 and 9 represent the lower and upper trip limits respectively.

	D 8	**D 9**	**D 8**	**D 9**	**D 8**	**D 9**
	AC Hipot		DC Hipot		DC IR	
	Lo	Hi	Lo	Hi	Lo	Hi
'0'	0.0mA	inf	0.0mA	inf	0.0mA	inf
'1'	0.10mA		0.10mA		1.00MΩ	
'2'	0.20mA		0.20mA		1.25MΩ	
'3'	0.30mA		0.30mA		1.50MΩ	
'4'	0.40mA		0.40mA		1.75MΩ	
'5'	0.50mA		0.50mA		2.00MΩ	
'6'	0.75mA		0.75mA		2.25MΩ	
'7'	1.00mA		1.00mA		2.50MΩ	
'8'	1.25mA		1.25mA		2.75MΩ	
'9'	1.50mA		1.50mA		3.0MΩ	
'A'	1.75mA		1.75mA		3.5MΩ	
'B'	2.00mA		2.00mA		4.0MΩ	

'C'		2.25mA		2.25mA		4.5MΩ
'D'		2.50mA		2.50mA		5.0MΩ
'E'		2.75mA		2.75mA		5.5MΩ
'F'		3.00mA		3.00mA		6.0MΩ
'G'		3.50mA		3.50mA		6.5MΩ
'H'		4.00mA		4.00mA		7.0MΩ
'I'		4.50mA		4.50mA		7.5MΩ
'J'		5.00mA		5.00mA		8.0MΩ
'K'		6.00mA		6.00mA		9.0MΩ
'L'		7.00mA		7.00mA		10.0MΩ
'M'		8.00mA		8.00mA		12.5MΩ
'N'		9.00mA		9.00mA		15MΩ
'O'		10.00mA		10.00mA		20MΩ
'P'		12.50mA		N/A		30MΩ
'Q'		15.00mA		N/A		40MΩ
'R'		17.50mA		N/A		50MΩ
'S'		20.00mA		N/A		75MΩ
'T'		N/A		N/A		100MΩ
'U'		N/A		N/A		200MΩ
'V'		N/A		N/A		500MΩ
'W'		N/A		N/A		750MΩ
'X'		N/A		N/A		1000MΩ

Digit 8 – Lower Trip Limit (Ebond)

Digit 9 – Upper Trip Limit (Ebond)

Digit 10 – Lower/Upper Limit (Ebond)

Digits 8, 9, and 10 are used to encode the indices into a lookup table of earth bond limits for the lower limit and the higher limit. By encoding digits 8, 9, and 10 according to the following table, it is possible to generate independent lookup table indices for the lower and higher limits between 0 and 215.

	Digit 8	Digit 9	Digit 10	
	Table Index for LO Limit	**Table Index for HI Limit**	**Table Index for LO Limit**	**Table Index for HI Limit**
'0'	+ 0	+ 0	+ 0	+ 0
'1'	+ 1	+ 1	+ 36	+ 0
'2'	+ 2	+ 2	+ *72*	+ 0
'3'	+ 3	+ 3	+ 108	+ 0
'4'	+ 4	+ 4	+ 144	+ 0
'5'	+ 5	+ 5	+ 180	+ 0
'6'	+ 6	+ 6	+ 0	+ 36
'7'	+ 7	+ 7	+ 36	+ 36
'8'	+ 8	+ 8	+ *72*	+ 36
'9'	+ 9	+ 9	+ 108	+ 36
'A'	+ 10	+ 10	+ 144	+ 36
'B'	+ 11	+ 11	+ 180	+ 36
'C'	+ 12	+ 12	+ 0	+ *72*
'D'	+ 13	+ 13	+ 36	+ *72*
'E'	+ 14	+ 14	+ *72*	+ *72*
'F'	+ 15	+ 15	+ 108	+ *72*
'G'	+ 16	+ 16	+ 144	+ *72*
'H'	+ 17	+ 17	+ 180	+ *72*
'I'	+ 18	+ 18	+ 0	+ 108
'J'	+ 19	+ 19	+ 36	+ 108
'K'	+ 20	+ 20	+ *72*	+ 108
'L'	+ 21	+ 21	+ 108	+ 108
'M'	+ 22	+ 22	+ 144	+ 108
'N'	+ 23	+ 23	+ 180	+ 108
'O'	+ 24	+ 24	+ 0	+ 144
'P'	+ 25	+ 25	+ 36	+ 144
'Q'	+ 26	+ 26	+ *72*	+ 144
'R'	+ 27	+ 27	+ 108	+ 144
'S'	+ 28	+ 28	+ 144	+ 144
'T'	+ 29	+ 29	+ 180	+ 144
'U'	+ 30	+ 30	+ 0	+ 180
'V'	+ 31	+ 31	+ 36	+ 180
'W'	+ 32	+ 32	+ *72*	+ 180

'X'		+ 33	+ 33	+ 108	+ 180
'Y'		+ 34	+ 34	+ 144	+ 180
'Z'		+ 35	+ 35	+ 180	+ 180

The earth bond limit lookup table contains the following milli-ohm values:

	+ 0	+ 36	+ *72*	+ 108	+ 144	+ 180
+ 0	Note 1	36	72	140	340	700
+ 1	1	37	73	145	350	710
+ 2	2	38	74	150	360	720
+ 3	3	39	75	155	370	730
+ 4	4	40	76	160	380	740
+ 5	5	41	77	165	390	750
+ 6	6	42	78	170	400	760
+ 7	7	43	79	175	410	770
+ 8	8	44	80	180	420	780
+ 9	9	45	81	185	430	790
+ 10	10	46	82	190	440	800
+ 11	11	47	83	195	450	810
+ 12	12	48	84	200	460	820
+ 13	13	49	85	205	470	830
+ 14	14	50	86	210	480	840
+ 15	15	51	87	215	490	850
+ 16	16	52	88	220	500	860
+ 17	17	53	89	225	510	870
+ 18	18	54	90	230	520	880
+ 19	19	55	91	235	530	890
+ 20	20	56	92	240	540	900
+ 21	21	57	93	245	550	910
+ 22	22	58	94	250	560	920
+ 23	23	59	95	255	570	930
+ 24	24	60	96	260	580	940
+ 25	25	61	97	265	590	950
+ 26	26	62	98	270	600	960
+ 27	27	63	99	275	610	970
+ 28	28	64	100	280	620	980
+ 29	29	65	105	285	630	990
+ 30	30	66	110	290	640	1000
+ 31	31	67	115	295	650	1100
+ 32	32	68	120	300	660	1200

+ 33	33	69	125	310	670	1300
+ 34	34	70	130	320	680	1400
+ 35	35	71	135	330	690	1500

Note 1: The lookup index of 0 is used to represent 0 milli-ohms for the lower limit,
and 9999 milli-ohms for the upper limit.

Digit 10 – Arc Detection Level (AC/DC Hipot & DC IR)

Digit 10 represents a level of arcing detection, which will terminate the current test sequence when selected level is reached.

	Digit 10 : Arc Detection Level
'X'	Disabled / Off
'1'	Most sensitive setting – All arcs terminate test
'2'	
'3'	
'4'	
'5'	Medium sensitivity
'6'	
'7'	
'8'	
'9'	Least sensitive – Only large arcs terminate test

Digit 11 – Loops to Perform

Digit 11 represents the number of times a test or linked sequence should be performed.

The user may use the red STOP key before or during a test and from the 'abort options menu' elect to move to the next test or the next test after a linked sequence of tests if a smaller number of loops is required. The STOP button will also terminate an unlimited number of loop tests. The value of '0' indicates that a test is as 'follow-on' test and forms part of a linked sequence. The linked sequence begins with a testcode that has a non-zero loops value and ends when there are no more testcodes or when the next testcode has a non-zero loops value. A linked sequence is performed the number of times specified by the first test in the sequence.

	Digit 11 : Loops to Perform
'0'	'Follow-On' Test. A value of '0' in the first testcode is inappropriate and interpreted as '1'
'1'	1
'2'	2
'3'	3
'4'	4
'5'	5
'6'	10
'7'	15
'8'	20
'9'	Unlimited (UL)

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