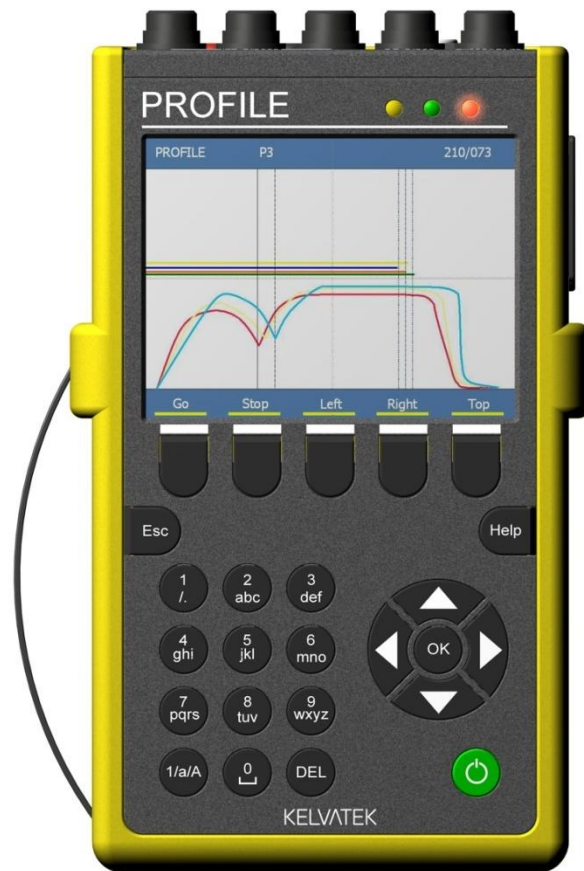


Key Features of the Profile P3 Handset



1. Introduction

Following on the success of the Profile P2, the Profile P3 from Kelvatek offers a range of new features based on customer's requirements. This portable, light weight, hand held device uses non invasive connections to monitor the key current and voltage parameters during the critical first trip operation.

It provides the facility to overlay and compare multiple trip coil profiles on a high resolution anti-glare color screen. A streamlined user interface simplifies the entry of test data and retrieval of results for viewing and analysis.

As well as indicating the 'health' of the circuit breaker trip & close coil mechanisms, other useful information is provided:-

- main contact operating time (MCON)
- auxiliary contact operating time (ACON)
- integrity of control circuit wiring
- problems with dc supply

The integrated design enables 3 phase online measurements to be obtained. A USB port allows the upload of previous records and software upgrades. Also the user has the option of capturing multiple circuit breaker operations over a period of time when there is fault activity on a circuit.

This portable handheld device will be an invaluable addition to the maintenance technician's toolkit that can be used at any circuit breaker location.

2. Key features

The following is a summary of the key features which make the Profile P3 an easy to use handheld device

- Enables onsite analysis of key circuit breaker parameters
 - Has a Graphical User Interface (GUI) that provides fast and accurate test data entry, pre-test confirmation and retrieval of test results by -
 - ✓ Minimising button presses through use of pull down menus
 - ✓ Selecting test details from pre-entered test details or from downloaded circuit breaker database
 - ✓ Use of sort and filter options
 - ✓ Providing a clear visual indication of correct test connections
 - A high resolution colour screen that enables up to four trip coil profiles to be simultaneously displayed for immediate onsite analysis
 - Intelligent power management system which –
 - ✓ Directly powers the DC clamp
 - ✓ Conserves power so that the handheld can operate for up to eight hours without an external power supply
 - ✓ Detects if batteries are rechargeable and recharge as required
 - ✓ Enable the handset to be left armed for a prolonged period of time
 - A self re-arming facility which enables capture of traces on a circuit breaker with multiple fault operations
 - Integration of the 3 phase online measurement into the handset which eliminates the need for a separate interface unit
 - The facility to upload records for comparison of previous shots
 - Expanded memory to hold up to 1000 company circuit breaker records on handheld
- Provision to upgrade software with new features from a USB stick

3. Main Screen

There are 3 distinct areas within the main screen as follows –

- The Application Header is used to display most of the basic handset operation information and is always available on the top part of the screen.
- The Main Application screen is where the details associated with performing a test and analysing the results in both tabular and graphical format are viewed.
- The Application Footer displays a fixed set of 5 ‘soft’ buttons corresponding to 5 Functional keys on the keypad. These are context dependent and each button will correspond to an action available for the current screen.

The start up screen on the Profile P3 is shown in Fig 1 below.

- Option 1: **Circuit Breaker Test** : guides the user through the necessary steps to perform a test
- Option 2: **Auxiliary**: enables stored test details to be viewed, data to be imported into the handset, and the system status to be viewed.
- Option 3 **Setup**: enables the date and time to be changed and the DC trigger level to be adjusted.

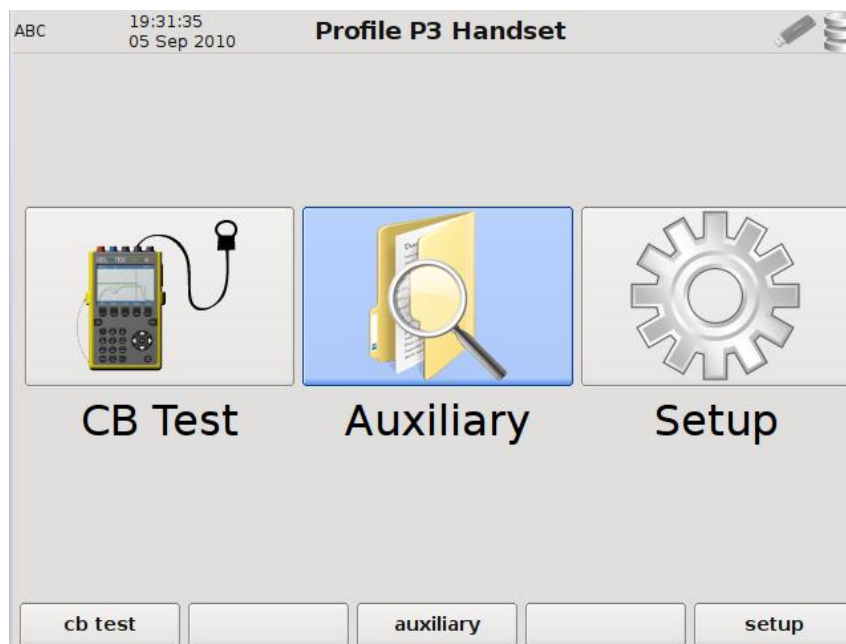


Fig 1 Main Screen

3.1. Circuit Breaker Test Menu

This is where the user will perform a circuit breaker test and capture trip and close profiles. There are three options for entering the test details as shown in Fig 2 below. Once the test details are entered, the user will select the test sequence by choosing the type of operation ie Trip/Close/Trip Free and the test mode ie single or multi-shot . Once the test details are acknowledged then the user is prompted to connect the test probes and is provided with a visual indication that the correct connections have been made before arming the profile ready to capture a profile. There is also an option to set the P3 in a re-armed mode which will allow the user to capture and save multiple trip and close operations. The intelligent power management system enables the handset and dc clamp to be left connected and powered for an indefinite period of time. The re-arm function is a very useful feature for capturing the first trip on repeat fault operations.

A detailed explanation of each stage in preparing the profile to carry out a test is given below.

3.2. Selecting Test Details

The user has the following three methods of entering test details –

1. Enter Manually
2. Select from Pre-Entered Test Details
3. Search and select from Circuit Breaker Database

Each method provides the user with the facility of selecting the details from a pull down menu therefore reducing the necessity to type the test details each time which greatly improves the consistency and speed of data entry.

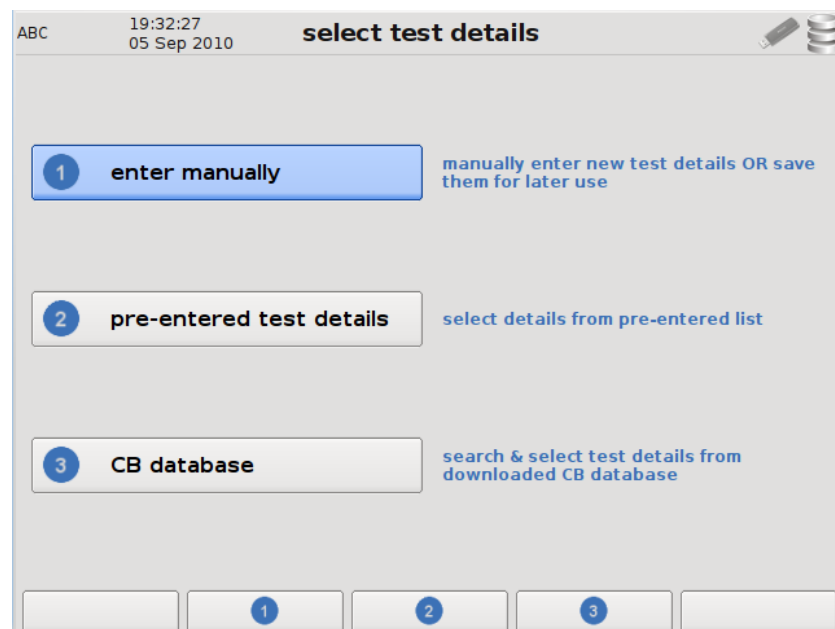


Fig 2 Select Test Details

3.2.1. Enter manually

Selecting this option displays the screen as shown in Fig 3, and allows the user to manually enter new test details into each of the following four fields -

1. Substation - Unique substation name
2. Breaker ID – Unique identifier for the circuit breaker, ie a serial number
3. Breaker Type – Type of Circuit Breaker eg ABB
4. Circuit ID – Unique identifier for the circuit which the circuit breaker is connected to

Note all of these fields can contain both alpha and numeric characters

If the details are already stored within the P3 circuit breaker database, then when the first character is entered in any field, all names beginning with that character are displayed in a pull down menu which the user can then select from.

The following fields are mandatory: Substation name, Breaker type, and Breaker ID, and validation will ensure the correct details are entered provided these details are contained within the circuit breaker database stored on the handset. However the user can also enter new details if they are not contained within the circuit breaker database.

These test details can then be immediately used to carry out a circuit breaker test or saved to the pre-entered test details for future access.

There is also an option for loading the previous test details and editing the required field before either proceeding with the test or again saving them to the pre-entered test details for future access.

ABC 19:33:05
05 Sep 2010

fill in test details

Substation
Substation unique name
Sprucefield

Breaker ID
Unique Breaker Identifier
x1239

Breaker Type
Type of Breaker under test
SW EO1

Circuit ID
Breaker location within substation
P16

Enter alphanumeric characters only. Field length: minimum 3, maximum 35

change focus load previous details save details next

Fig 3 Manually Enter Test Details

3.2.2. Selecting from Pre-entered test details

The user will be able to select details from a pre-entered list which have either been downloaded via the usb port or saved from the manual entry option (see Fig 4). The test details can be selected from the screen by typing the number of the appropriate row (1 to 9) on the keypad. If there are multiple screens of data these results can be paged nine at a time by using the left/right arrow keys. The appropriate row can also be selected by typing the initial part of the substation name in the box provided at the top of the screen. To assist with locating the relevant test details, the user can make use of the sort function which can be applied to any column in order to display the data in ascending or descending order.

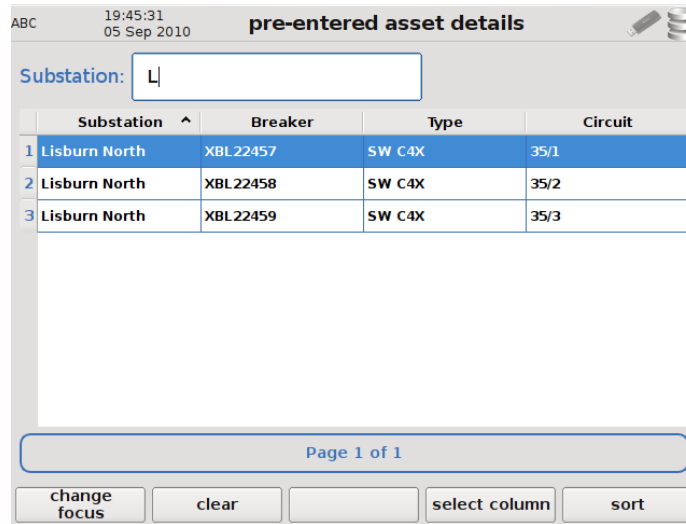


Fig 4 Pre-entered Test details

3.2.3 Selecting from a CB (Circuit Breaker) database

The user can search for the test details within a downloaded circuit breaker database by starting to type the substation name as indicated in Fig 5. If this is held within the database, then a list of substation names will appear in a drop down menu for selection. Once a substation name is selected, a list of breaker ID's from that substation is presented. The circuit breaker to be tested can be selected by either scrolling down the list using the up/down arrow keys then pushing the OK button or starting to type the initial characters in the breaker ID box. The remaining fields (Breaker Type and Circuit ID) are then automatically populated.

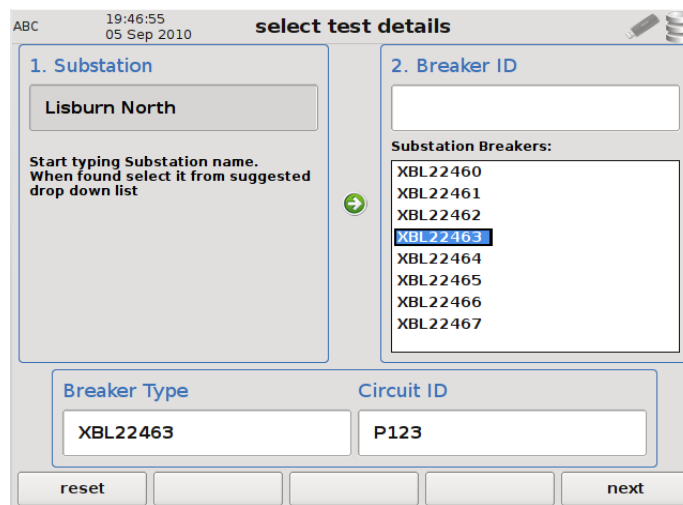


Fig 5 Selecting Test Details from Circuit Breaker Database

3.3 Selecting Test and Operation Mode

Once the initial test details have been entered by one of the three options described in section 3.2, then the test trigger mode of SINGLE or MULTI, and the CB operation mode of TRIP, CLOSE, TRIP FREE can be selected as shown in Fig 6.

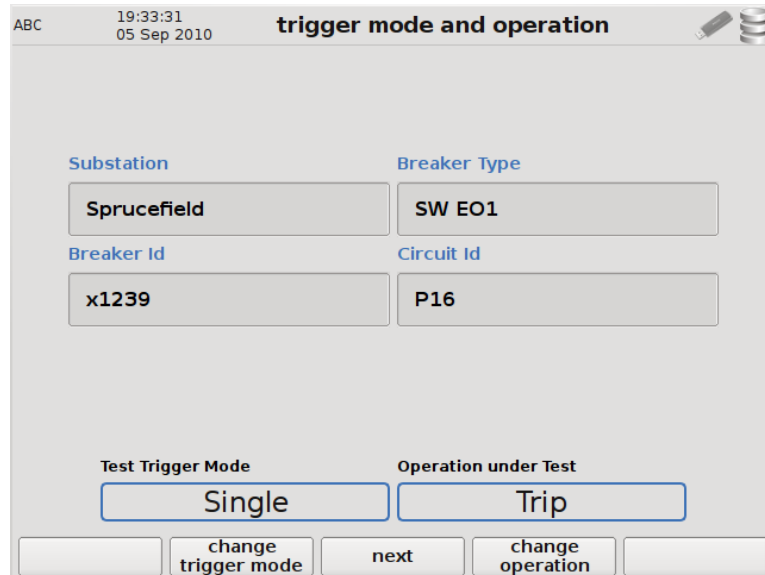


Fig 6 Test Mode

3.4 Pre-Test Confirmation

At this stage the user has entered all the required test details and can then select the **next** option where they are prompted to connect the test probes from the handset to the circuit breaker as shown in Fig 7.

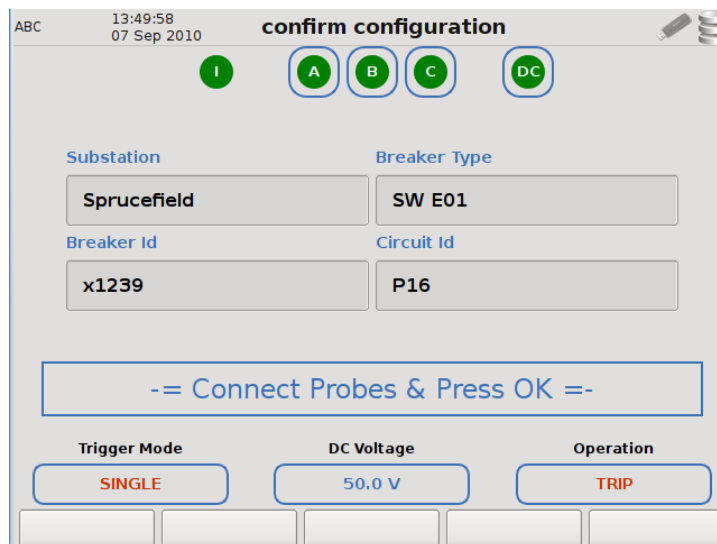


Fig 7 Correct Test Connections

Once the probes are connected there is a clear visual indication to the user that all test probes have been properly connected before operating the circuit breaker. On top of the screen the connected probe status is displayed. A **green** background means a probe has been detected while **orange** is for no connection on that channel and a **blue** circle indicates a current threshold has been exceeded or DC voltage has been detected.

Fig 8 indicates that the wrong test connections have been made to two of the clip-on CT's where one has not been connected and the other has been clipped around the wrong wire. The DC voltage leads have also not been connected properly as there is no DC voltage detected.

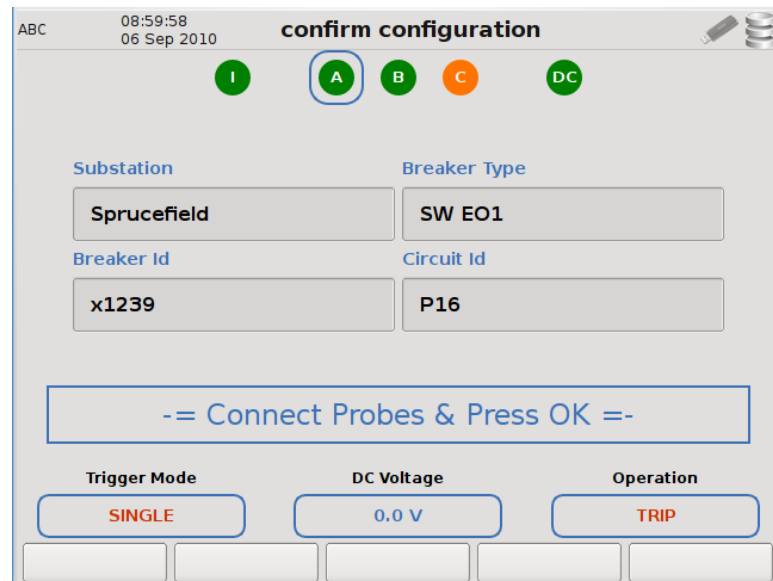


Fig 8 Wrong Test Connections

These test connections which include the following are connected as shown in Fig 8.

- **DC Current Probe**

This is connected directly to the handset and is clamped over the DC wiring within the circuit breaker cubicle. The new DC current probe does not require batteries as it is powered directly from the handset and can measure up to 200A.

- **DC Voltage Sensing**

The set of fused leads provided are connected across the DC battery and measure the DC voltage during the circuit breaker operation.

- **Clip-On Current Transformers (CT's)**

There are three clip-on CT's which are clamped around the protection CT secondary wiring to monitor the AC load current flowing through the circuit breaker during the test. Note there is no longer a requirement for an interface box for three phase online tests.

Fig 9 shows how the profile handset is connected for a standard 3 phase online test.

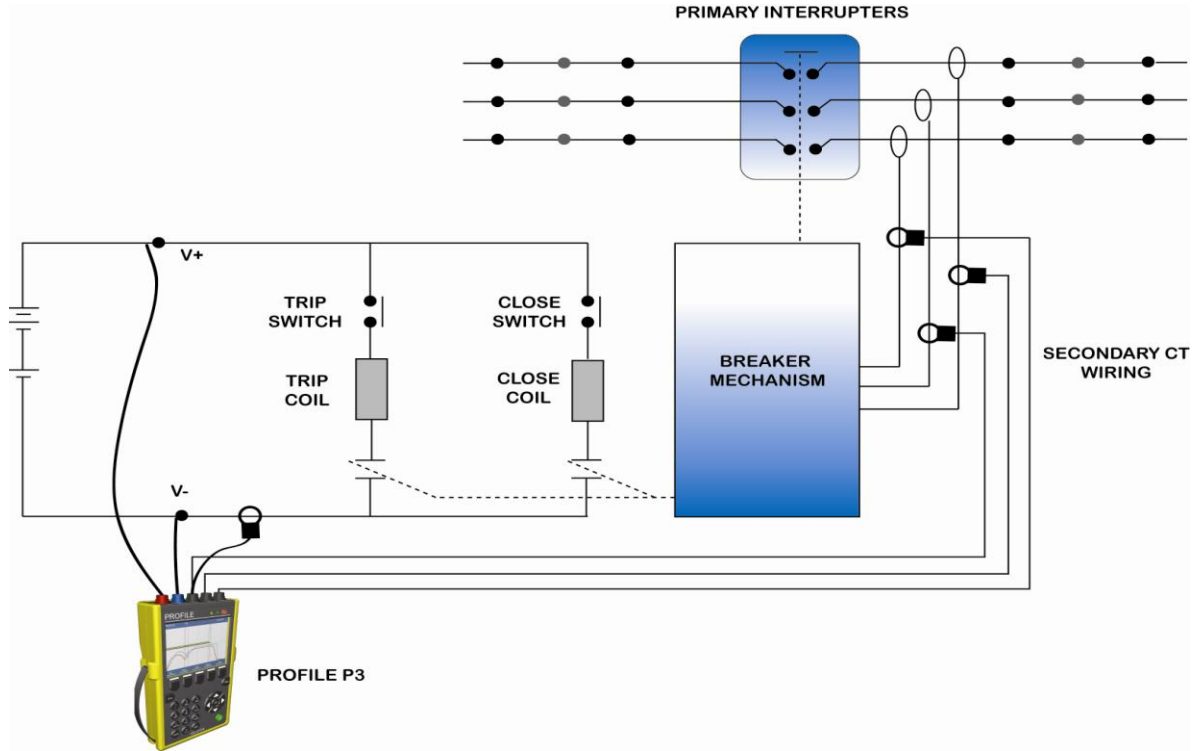


Fig 9 Connections for Profile to Circuit Breaker

3.5 Armed mode

Once the user is satisfied with the pre-test confirmation checks, they can press OK and they will then be presented with the screen as shown in Fig 10 which indicates that the data acquisition module within the P3 is ready to capture data by displaying ARMED.

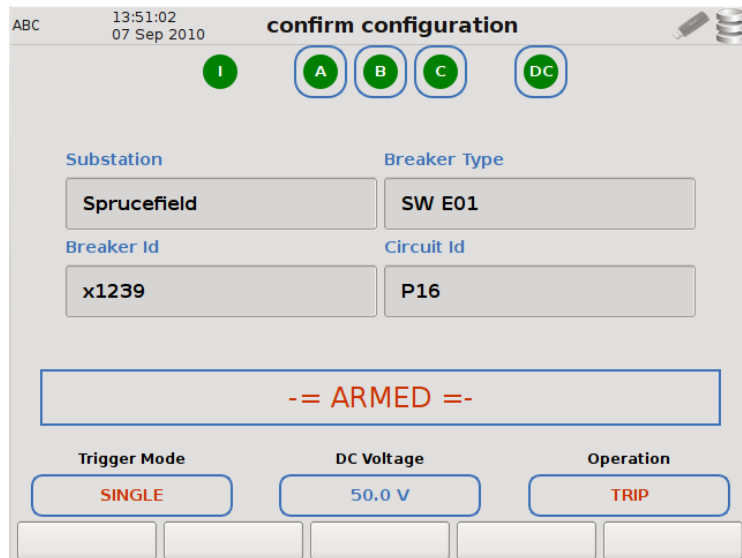


Fig 10 Profile Armed

3.6 Processing Data

With this screen as shown in Fig 11 the user is notified that data has been captured and that the application is processing this data. No action is required from the user and once the processing is complete it will switch to the next screen by default.

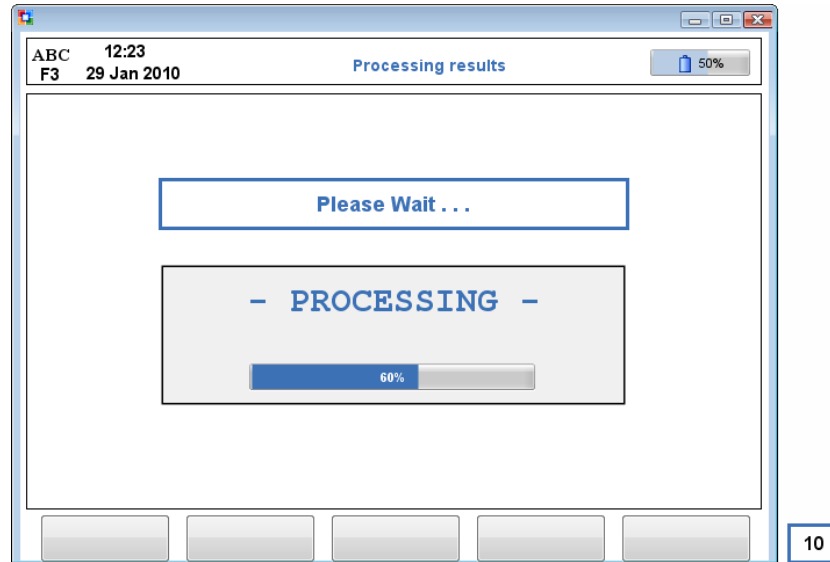


Fig 11 processing data

3.7 Analysis Results

Once the data analysis is completed the results are displayed in both graphical and numerical formats as shown in Fig 12

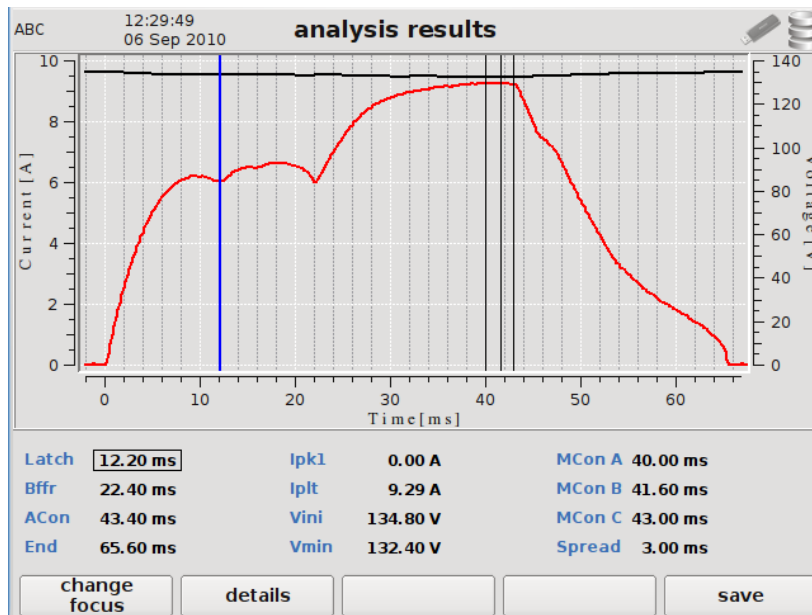


Fig 12 Analysis Results

The user is able to change selection between latch, buffer, acon and end parameters and the corresponding position will be indicated on the graph. The horizontal black lines indicate the MCON times and spread. At this stage a record can be tagged as GOOD, BAD, SUSPECT or SIGNATURE (benchmark trace for breaker type) and comments noted as shown in the example displayed in Fig 13. This is a very useful feature for future analysis of test results.

The screenshot shows a software window titled "test details" with a grey background. At the top left, it displays "ABC", "13:06:01", and "06 Sep 2010". The main content area is divided into several sections:

- Substation:** A text box containing "Sprucefield".
- Breaker Type:** A text box containing "Reyrolle LMT".
- Breaker Id:** A text box containing "x1234".
- Circuit Id:** A text box containing "48/41".
- Date (dd-mm-yyyy):** A date picker showing "25-05-2010".
- Time:** A time picker showing "10:52".
- Quality Selection:** Four radio buttons labeled "good", "bad", "suspect", and "signature". The "suspect" option is selected.
- Notes:** A text area containing the text: "There is a slight deviation between first and second trips on the latch parameter resulting in a 5 msec delay in MCON time".
- Buttons:** At the bottom, there are four buttons: "change focus", an empty button, another empty button, and "apply".

Fig 13 Test details

3.8 Test Results Save Confirmation

Here the user will be allowed to choose what to do with the current record: save, discard results or return to the previous screen and revise the test details.

4 Auxiliary Menu

This screen (Fig 14) is accessible from the main menu and is used to display test records on the handset or import records via a USB device. There is also the option to display information about the handset.

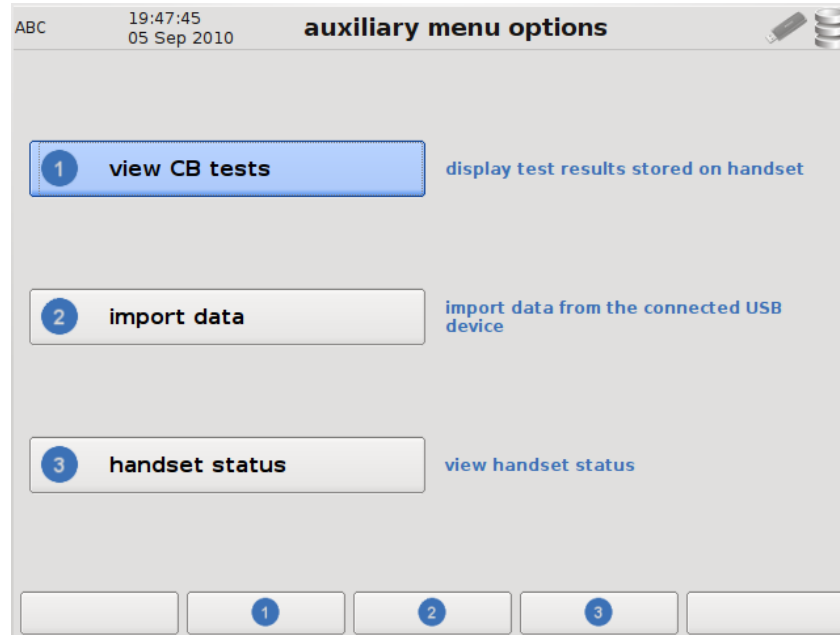


Fig 14 Auxiliary Menu

4.1 Handset Profile Tests

Via this screen (Fig 15), the user can browse through stored records on the handset and see the results in tabular format. There are filter and sort options that can vary the display and selection of records. A record can also be marked for viewing in graphical mode.

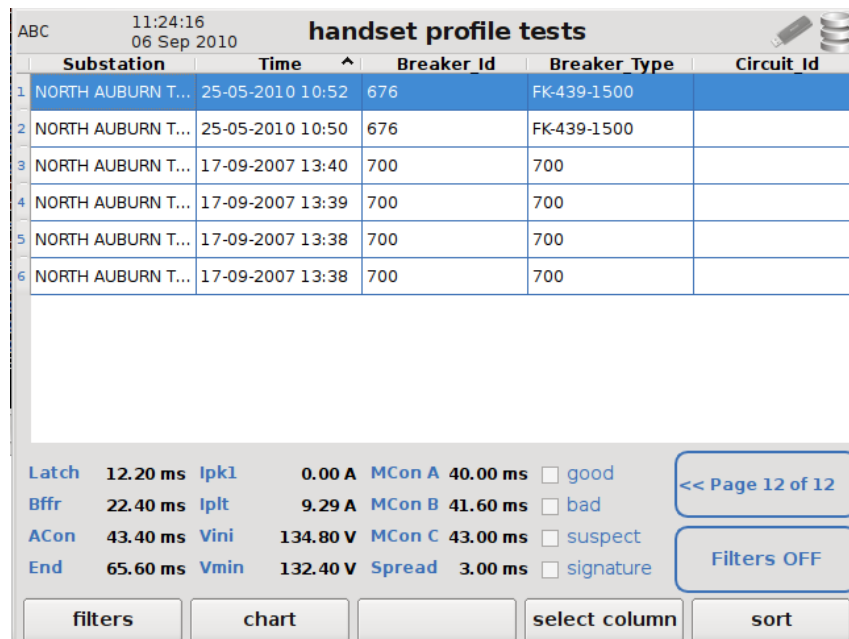


Fig 15 Handset Profile Tests

4.2 Record Filter Options

This enables multiple search criteria to precisely filter the records to be displayed. The search criteria include; profile device, substation, breaker id, breaker type, and records can also be filtered by operation: close, trip, trip free or record tags. The tag list has four options; Good, Bad, Suspect and Signature. The Signature option is where a trace is considered to the optimum for that circuit breaker type. The following two screenshots (Fig 16 & 17) demonstrate how a filter can be applied.

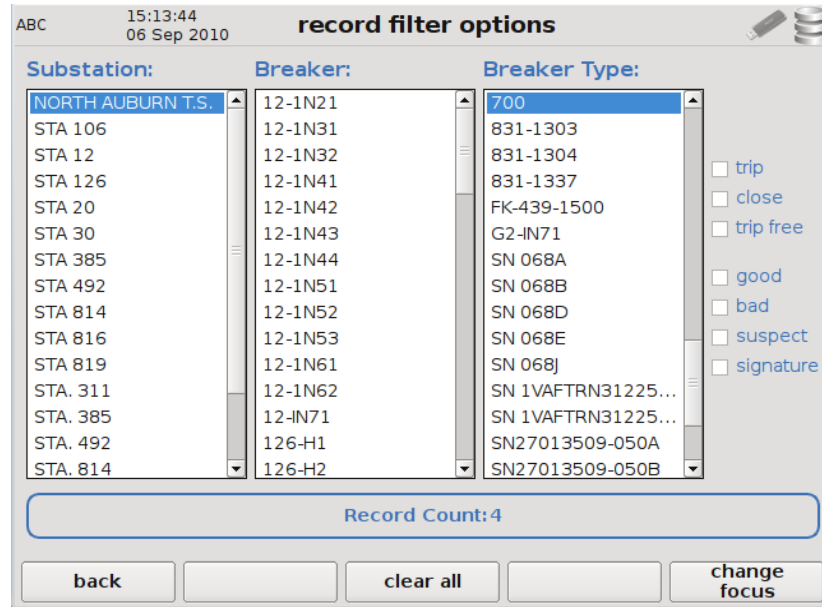


Fig 16 Applying a Filter

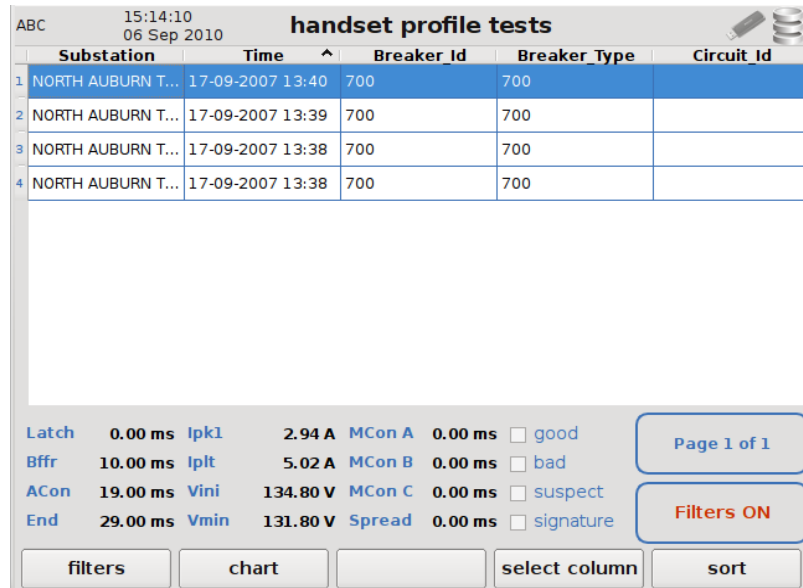


Fig 17 Filtered Result

4.3 Profile Chart

The example in fig 18 shows the charted results of the applied filter in Fig 17 displaying two consecutive trip and close operations which clearly indicate a problem with the auxiliary contacts. This is one of the key features that greatly assist onsite analysis of defects

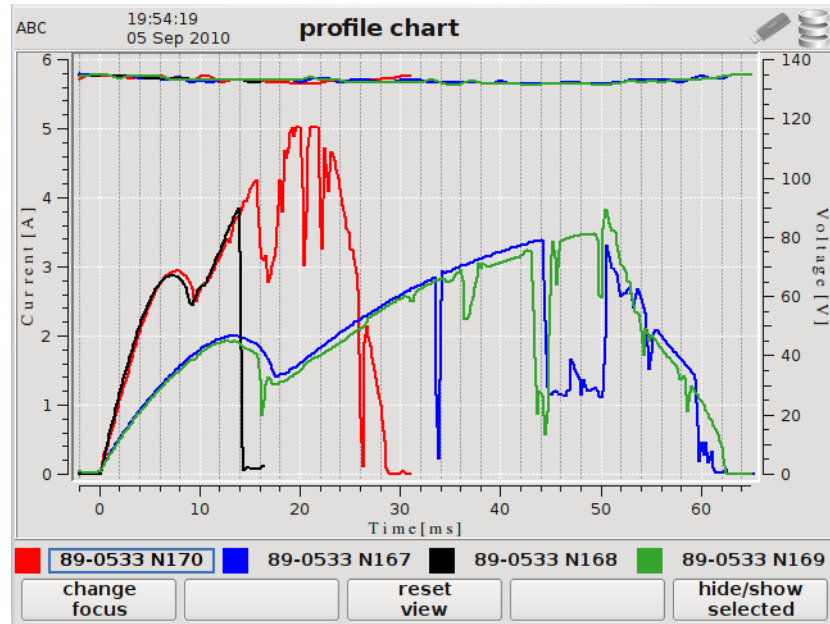


Fig 18 Profile Chart View with up to 4 records overlaid

The example in fig 19 shows only the trip operations with the close operations hidden

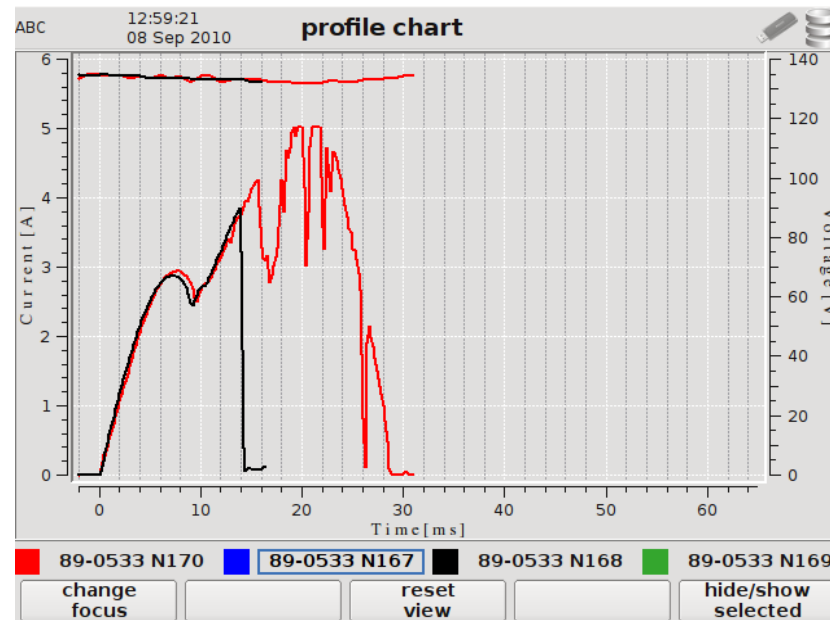


Fig 19 Profile Chart View with 2 records hidden

4.4 Selected Profile Chart Details

This screen displayed in Fig 20 the test shows results from a profile chart and a colour code header clearly identifies which profile chart was selected.

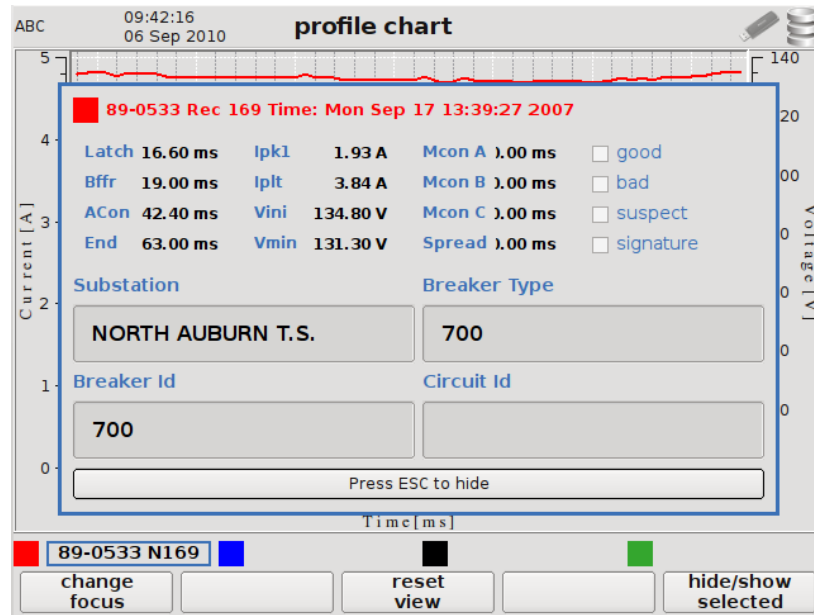


Fig 20 Profile Chart View with test results displayed

5 Setup

This option is accessible from the main menu and allows the following parameters to be configured.

5.1 Date & Time

The facility to set the current date and time is available as shown in Fig 21

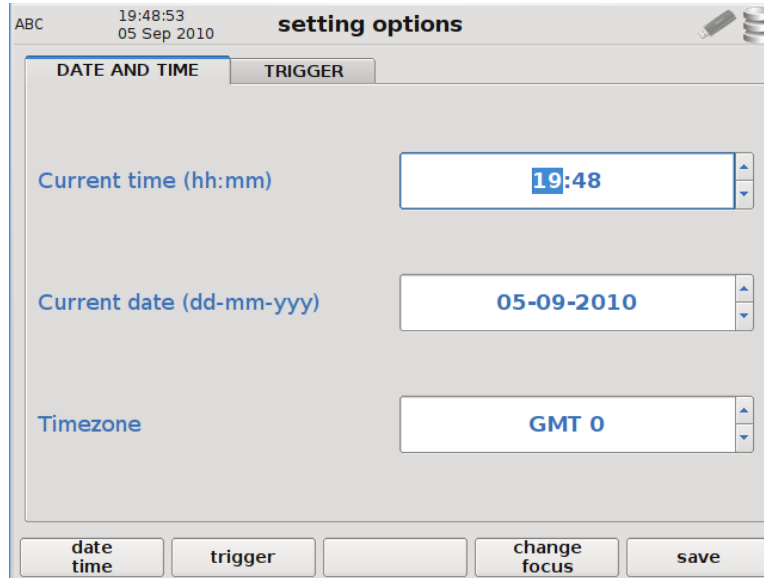


Fig 21 configuring date & time

5.2 Current Trigger Level

The current trigger level used by the data acquisition module can be changed as indicated in Fig 22.

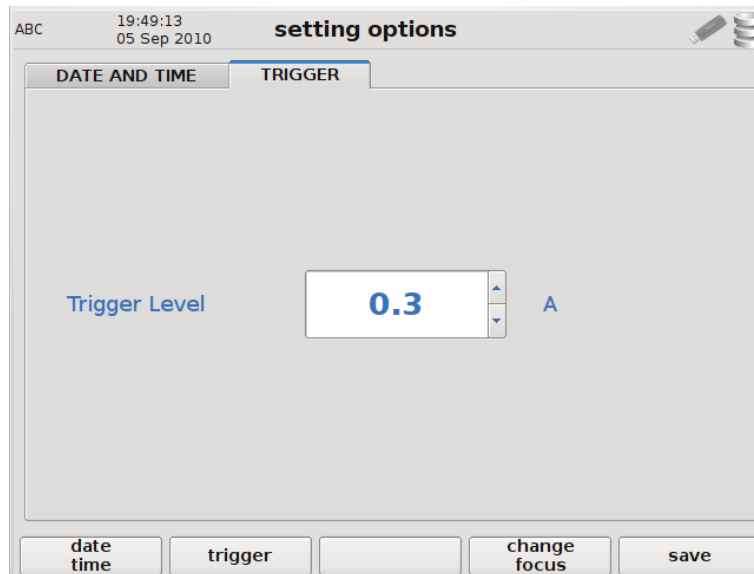


Fig 22 Trigger Level Adjustment