

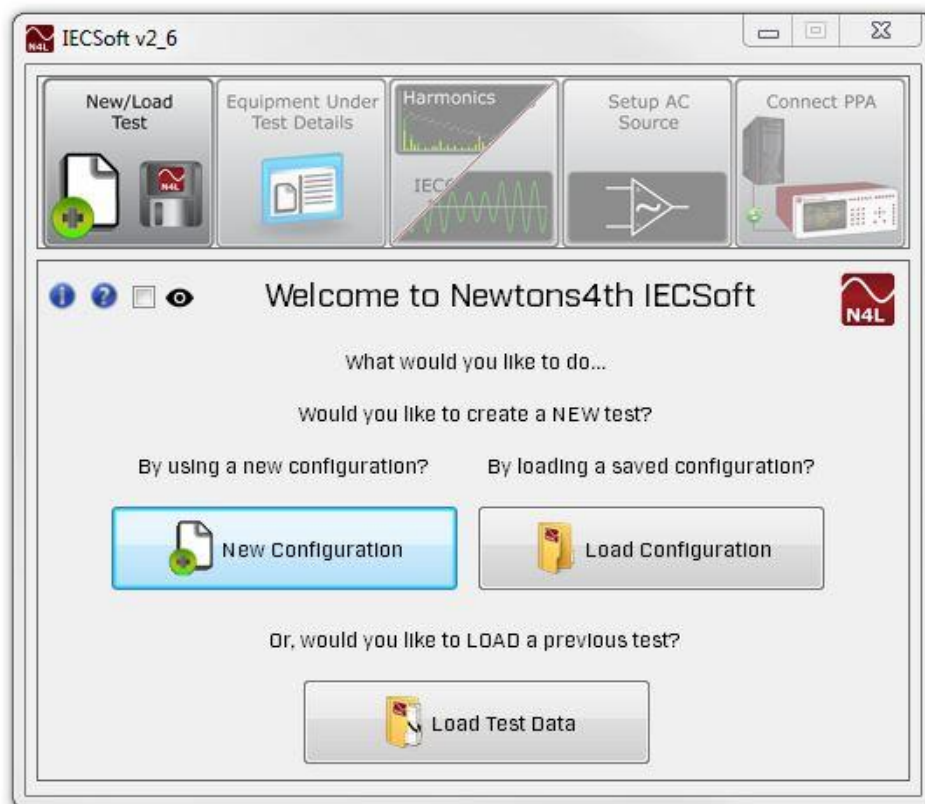


Newton4th Ltd

IECSoft

USER MANUAL - Volume 1

IEC 61000 Harmonics, Flicker and EMC Testing Software



Version 1.07

30th August 2019

ABOUT THIS MANUAL

IECSoft is a self contained executable software program for use with the N4L PPA55xx series power analyzers. The Software can be used to perform IEC compliant single and 3-phase Flicker, Harmonic and EMC Immunity tests.

The following IEC Standards are included in the software:

IEC61000-3-2:2014 –

- Harmonics $\leq 16A$

IEC61000-3-3:2013 –

- Flicker $\leq 16A$

IEC61000-3-11:2001 –

- Flicker $\geq 16A$ and $\leq 75A$

IEC61000-3-12:2011 –

- Harmonics $\geq 16A$ and $\leq 75A$

IEC61000-4-11:2004 –

- Voltage dips, short interruptions & voltage variations

IEC61000-4-13:2002 + A1:2009 –

- Harmonic & Interharmonics low frequency immunity tests.

IEC61000-4-14:1999 + A2:2009 –

- Voltage fluctuation Immunity testing $\leq 16A$.

IEC61000-4-17:1999 + A2:2009 –

- Ripple on DC input power port immunity testing.

IEC61000-4-28:2000 + A2:2009 –

- Variation of Power frequency immunity testing $\leq 16A$.

IEC61000-4-29:2001 –

- DC input Voltage dips, interruptions & voltage variations.

IEC61000-4-34:2007 + A1:2009 –

- Voltage dips, interruptions and voltage variations $\geq 16A$.

Refer to section 2.4.7 and section 7 for further details on the following updated standards.

IEC61000-3-2:2018 – Harmonics $\leq 16A$

IEC61000-3-3:2017 – Flicker $\leq 16A$

IEC61000-3-11:2017 – Flicker $\geq 16A$ and $\leq 75A$

The IECSoft User manual is split into 3 volumes due to the variety of tests available using the software:

Volume 1

IEC61000-3-2 and IEC61000-3-12 - Harmonic testing.

IEC61000-3-3 and IEC61000-3-11 - Flicker testing.

Tests can also be performed to the equivalent BSEN and JIS (Japanese Industrial Standard) versions of these Standards.

Volume 2

IEC61000-4-11 and IEC61000-4-13 Immunity testing.

PST Simulation testing.

Volume 3

IEC61000-4-14, IEC61000-4-17, IEC61000-4-28,
IEC61000-4-29 and IEC61000-4-34 Immunity tests.

Accordingly, the manual first describes the general features and specification of the software as a whole; and then describes the individual functions in detail.

Each function is described in turn, in its own chapter, with details of the principles on which it is based, how to use it, the options available, display options etc.

Revision: 1.07

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30th August 2019

Revision History

Date	Revision	Note
29 th July 2014	Rev. 1	Document first issued.
27 th Feb 2015	Rev. 2	IECSoft version v2.1t release
03 rd Feb 2017	Rev. 3	IECSoft version v2.5a release
12 th Oct 2017	Rev. 4	General Update
09 th April 2018	Rev. 5	IECSoft version v2.5b release
4 th June 2019	Rev. 6	Pre-release of IECSoft version v2.6
30 th August 2019	Rev. 7	IECSoft version v2.6 release

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1 Introduction

1.1 Introduction to IECSoft

IECSoft is a self contained executable software program written in C++ using the Microsoft win32 graphics set.

IECSoft has the ability to connect to a PPA55x1 or PPA55x0 via RS232, USB and LAN. The software includes all measurement modes to reflect instrument operation.

The ability to export directly to Excel, PDF, .CSV and .N4LIEC files is supported by IECSoft.

IECSoft version **v2.6** and PPA55xx Firmware version **v2_179** were used to compile this User Manual.

1.2 PC Requirements

The minimum PC requirements to run the IECSoft software are as follows:

Windows XP (Service Pack 3) or later
At least 1GHz Processor
Minimum of 1GB RAM
At least 100MB of Hard Drive space.

For optimum performance the following PC requirements are recommended:

Windows XP (Service Pack 3) or later
At least 1GHz Processor
2GB RAM or more
At least 1GB of Hard Drive

2 Getting Started

2.1 Download

As with all N4L software, it is available free to download from our website. See www.newtons4th.com/support for more details, once registered and your account is activated you will have access to the software downloads section. The latest PPA firmware releases can also be found on our website.

2.2 Installation

At N4L we develop software that enables the engineer to be up and running and performing tests as soon as possible. With this in mind we have avoided the use of the .net environment and used the Microsoft win32 graphics set.

As such, installation is simple. All that is required is to download the .exe from the N4L website and extract the software to the desired location on your hard drive.

Alternatively the software can be run directly from USB memory stick.

2.3 Firmware Requirements

For full functionality using version **v2.6** of IECSoft Software the following firmware releases are recommended.

PPA55xx Firmware version **v2.179** or later

N4A AC Source Firmware version **v1.29** or later

These provide enhanced frequency detection and noise immunity. Harmonic measurement resolution and stability is improved particularly when monitoring very small Harmonic levels.

2.4 Important Information.

Please read this section before attempting any tests, the information is essential for the correct selection of instrument settings and test settings etc.

2.4.1 Instrument Warm Up Procedure.

The instrument warm up time for the PPA55x1 is 1 hour.

Having allowed the instrument to warm up for 1 hour it must be power cycled. The full warm up procedure is as follows:

1. Initial turn on.
2. Allow to warm up for at least 1 hour.
3. Power off.
4. Wait for 1 minute.
5. Turn on again.

The instrument will then be ready to use.

2.4.2 Impedance Network Switch Setting.

Before running any test check that the three way switch (Harmonics / OFF / Flicker) on the front of the Impedance Network is set to the correct position for the test being performed.

2.4.3 PPA Current and Voltage Range Selection.

When running tests it is extremely important to have the correct current and voltage ranges selected on the PPA.

It is a requirement of the IEC Standards that Auto-Ranging is not used on the instrument during these tests. The IECSoft Software therefore sets the PPA to Manual Ranging with a default current range of 100A and a voltage range of 1kV.

The current range is fixed at 100A in flicker mode. However, in harmonics mode should the default current range be unsuitable for the test, the user can select the correct range using the Manual current selection option on the Test Setup screen. This is described in more detail in section 5.1.3 of this manual.

For Flicker and Harmonics testing, the voltage range is automatically selected in the Software when using a N4L AC Source. When using other types of source the user will need to manually select the correct range using the range options in the "Connect to AC Source" dialog box. This is described in more detail in sections 4.3.2 & 5.5.2 of this manual.

2.4.4 How to select the correct Current Range.

If the current is unknown it can be checked using the following method:

Connect up the test equipment and Device under Test (DUT) ready to perform the tests. The Impedance Network switch should be set to the Harmonic position.

The user can select "Range up only" on the instrument. The PPA will automatically select the range required to prevent clipping during an IEC61000 test. This check should be carried out prior to the IEC61000 tests.

The range confirmed in the above test should then be entered in the Test Setup dialog when performing the IEC61000 tests.

2.4.5 Connecting to AC Sources

The software was primarily developed for use with the N4L Range of AC Sources. When connected to a N4L AC Source the software can automatically control the switching ON and OFF of the Source Output when required whilst running any of the test options.

There is also an option in the "Connect to AC Source" setup window to connect to "Other" types of AC Source. This allows other types of AC Source to be used providing they are compliant with the requirements of the appropriate Standards.

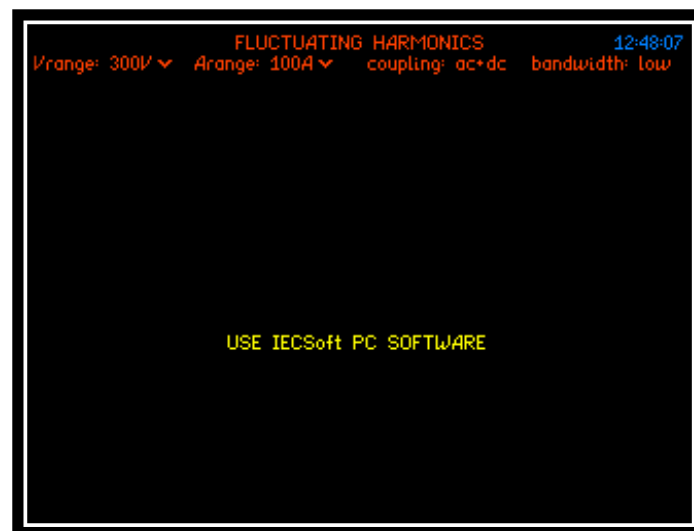
However, it is not possible for the software to control the switching ON or OFF of the Output of other types of AC Source. When selecting the option to use other types of AC Source, the software will display additional messages advising the user when to manually switch on or off the output of the AC Source. Always read these messages carefully and follow the instructions precisely to ensure that the Source Output is switched on and off at the correct time. This will prevent avoidable test failures that can occur if the AC Source output is not switched on or off at the correct time.

2.4.6 Connecting to the PPA

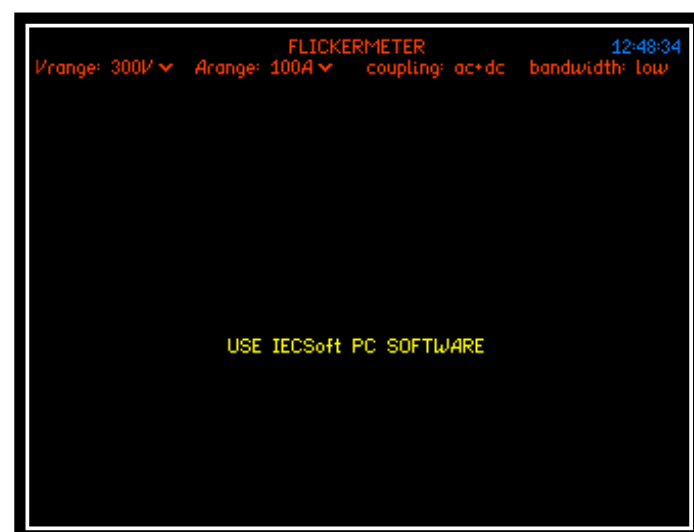
The PPA5511 (single phase) and PPA5531 (3-phase) are IEC specific models of the PPA55xx series of instruments. IECSoft testing can also be performed with a PP5510, PPA5520 or PPA5530. The PPA5512 and PPA5532 can't be used for IECSoft testing.

When performing Harmonics or Flicker testing the Software will connect to the PPA. The PPA display will be locked whilst the test is running with a message displayed on the PPA screen.

PPA Display during a Harmonics Test:



PPA Display during a Flicker Test:



2.4.7 New Releases of IEC Standards

The IECSoft software uses the latest fully released versions of each IEC Standard.

Periodically The IEC Standards committee will issue updated versions of a Standard.

The foreword of each updated Standard includes the following statement:

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under <http://webstore.iec.ch> in the data related to the specific publication. At this date, the publication will be

- *Reconfirmed,*
- *Withdrawn,*
- *Replaced by a revised edition, or*
- *Amended.*

Therefore, the present version of the Standard remains in force and should continue to be used UNTIL the stability date stated on the website is reached.

However, the software includes a test option "Standards awaiting Stability Date. This test option allows the user to test a product to the PROPOSED requirements of the updated Standard.

At the time of release of this version of IECSoft the following proposed versions of standards have been included:

IEC61000-3-2:2018
IEC61000-3-3:2017
IEC61000-3-11:2017

Please refer to section 7 for further details.

3 Initial Configuration.

3.1 IEC Soft Welcome Dialog.

Double click on the IECSoft executable (or shortcut) on the PC to start the software. The start-up screen will be displayed as follows:



This section will explain how to use the software using a new configuration. Section 6.7 in this manual explains how to recall and use saved configuration and test result files. This includes details of the “drag n drop” option to initialise the IECSoft software.

Select “**New Configuration**”

3.2 Equipment under Test Dialog.

The following window will now be displayed.

IECSoft v2_6

New/Load Test Equipment Under Test Details Harmonics Setup AC Source Connect PPA

Equipment Under Test

Equipment Details		Test Details	
Brand:	N/A	Lab Name:	N/A
Model:	N/A	Location:	N/A
Serial:	N/A	Operator:	N/A
Rated Voltage (V):	N/A	Notes:	chars left: 249
Rated Current (A):	N/A		
Rated Freq. (Hz):	N/A		
Rated Power (W):	N/A		
Impedance ID:	N/A		

<< Back Next >>

When the above window is first displayed all details are shown as N/A.

The user has the choice to leave all or some of the details as N/A or to enter their choice of details. There is also the facility to enter any extra comments in the notes section.

The information entered here will be displayed in the final report. These details can be updated on completion of testing before the final excel report is created.

Click "**Next**" when ready to proceed.

3.3 Test Setup Dialog.



The Category Test Setup dialog window is displayed.

Tests can be performed to the following Standards:

IEC - International Electrotechnical Commission Standard.

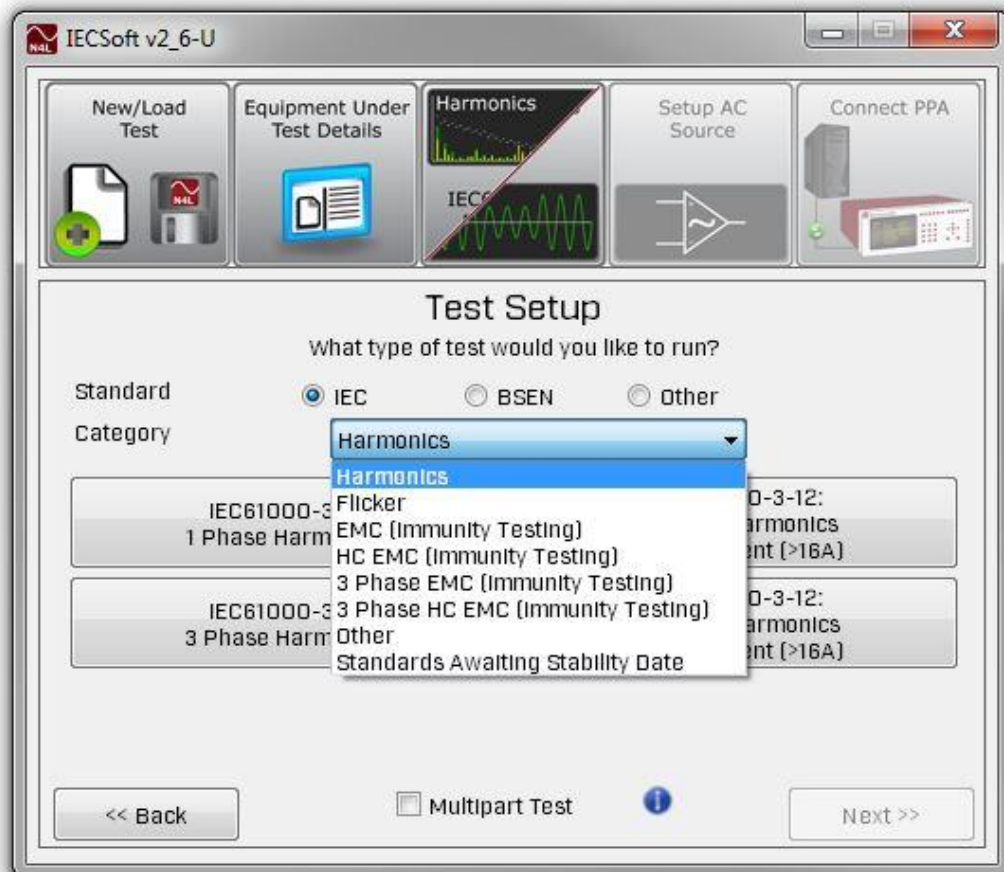
BSEN – British Standard European Norm Standard.

Other – This option should be used for testing to the JIS – Japanese Industrial Standard.

When a Standard is selected the software will automatically apply the appropriate Limits stated in that document to any tests performed.

The software defaults to the IEC standard.

The Test category now needs to be selected. The software defaults to Harmonics, click on category to reveal the drop down menu of test options:



There are eight choices, Harmonics, Flicker, EMC (Immunity Testing), HC EMC, 3-PH EMC, 3-PH HC EMC, Other (Flicker PST simulation) and Standards awaiting stability date. Click on the required category, the software will automatically update the Test Setup window with the available tests for the chosen category.

For some categories certain Standards do not apply or the tests and limits are the same as the other Standards. In this situation the software will update the Test Setup dialog to only display the Standards that are applicable.

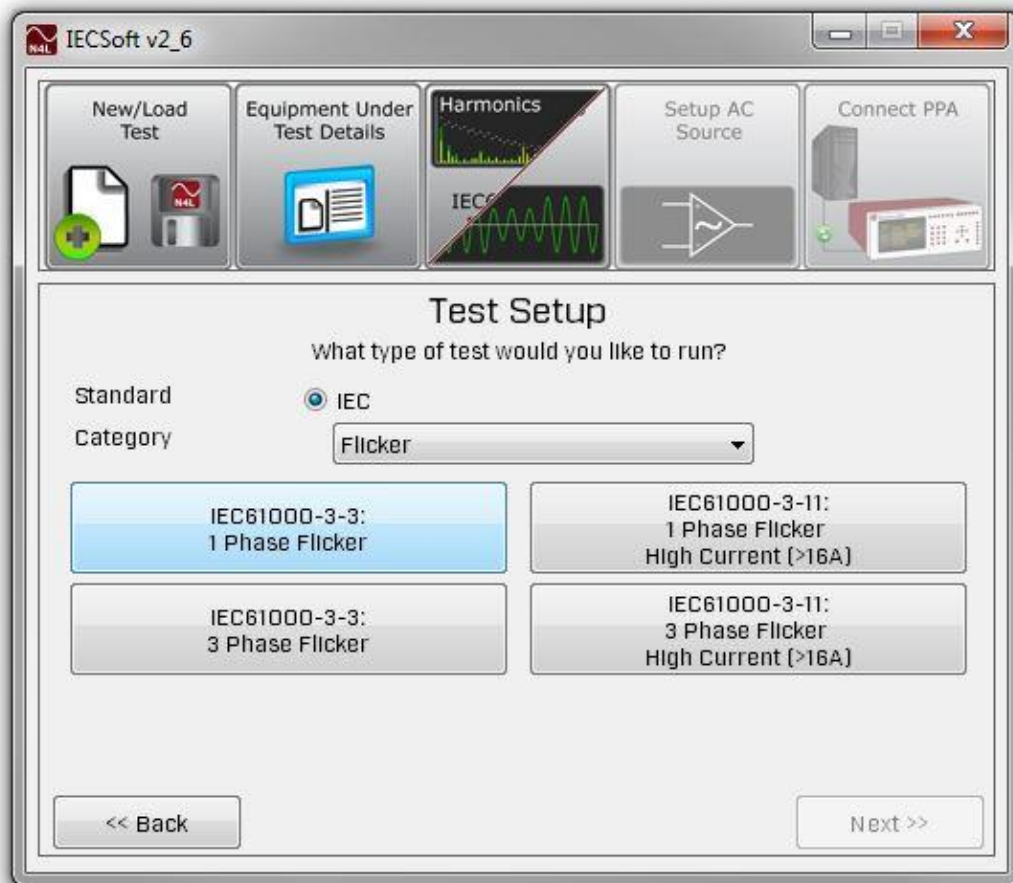
Section 4 of this manual describes the Setup Process and testing options for Flicker testing, details for Harmonic testing can be found in Section 5. Details about EMC and 3-Phase EMC testing can be found in volumes 2 & 3 of the user manuals.

See section 5.17 of this manual for details on Multipart Testing.

Clicking on "**Back**" returns to the previous screen.

4 Flicker Testing

The Category Test Setup dialog window is updated to display the Flicker testing options that are available.



Note:

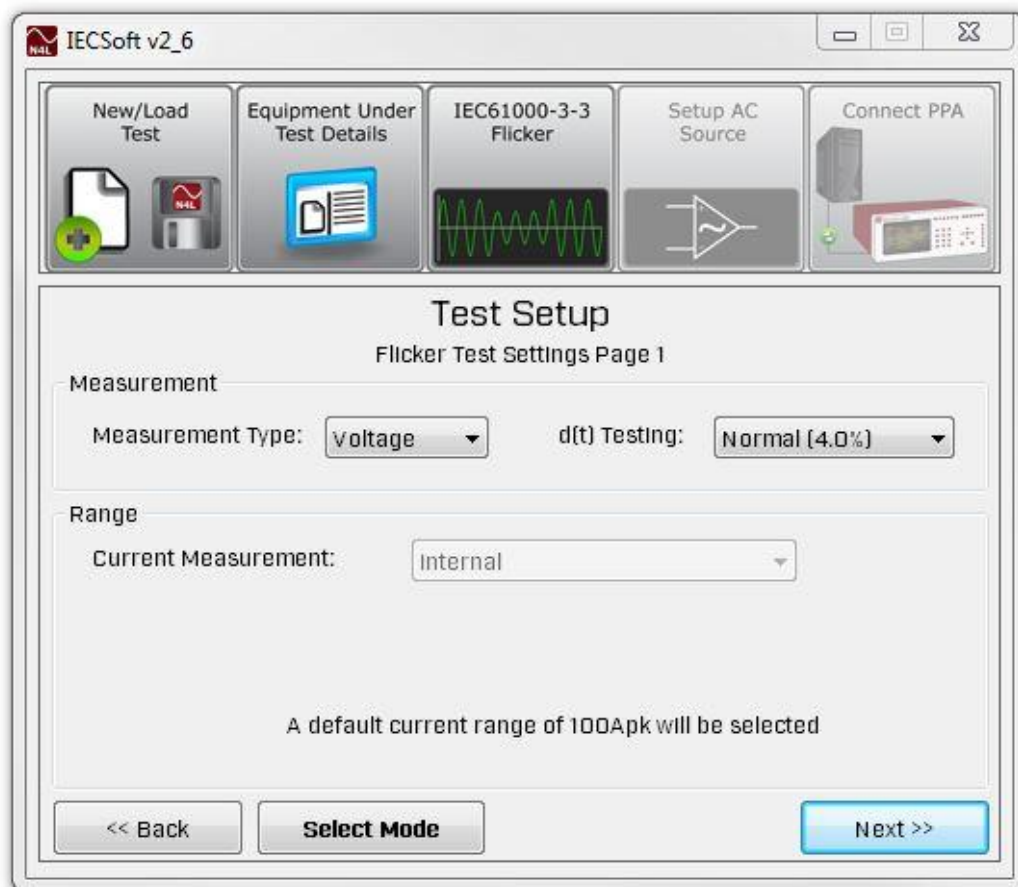
There is no separate Standard document for Japanese (JIS) mode Flicker tests.

The BSEN and IEC Standards also have the same limits.

Therefore, when Flicker testing is selected the software defaults to the IEC (International) Standard. The IEC limits apply to Flicker tests for all Standards.

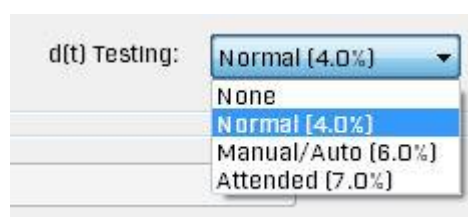
When you click on the required Flicker Test the software automatically displays the first Test Setup screen.

4.1 Category (Flicker) Test Setup Dialog Page 1.



Measurement Type: At present this defaults to Voltage.

D(t) Testing: The default settings is - Normal (4%)



The option should be selected from the drop down menu. For guidance in determining the correct option refer to Section 5 in the IEC61000-3-3 Standard document.

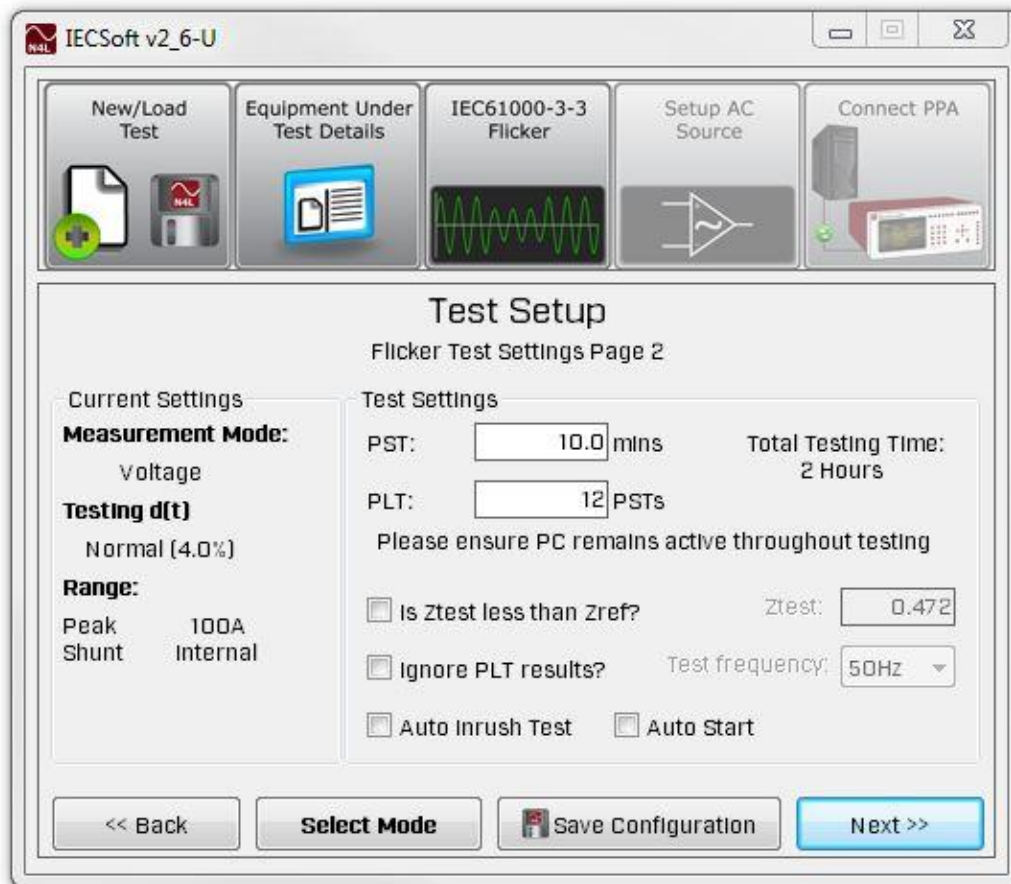
Range > Current Measurement: This defaults to Internal.

Note: In IECSoft version **v2.6** a Default Current Range of 100A is selected. This is fixed and can't be adjusted by the user.

Click on "**Next**" to continue:

4.2 Test Settings Page 2

The second Flicker Test Setup window appears:



This Test Setup dialog displays settings from the earlier setup windows plus the default settings for PST and PLT.

4.2.1 Selecting PST and PLT:

The default test time above is 2 hours (120 minutes) and is derived from the PST and PLT selection ($10 \times 12 = 120$ minutes).

The user can select the length of the PST and PLT test times. The user should choose the appropriate settings for the tests they intend to make. PST can be set in 0.5 minute steps, e.g. 2.5 minutes.

Refer to the Standard for further guidance on the selection of PST and PLT.

4.2.2 Saving Configuration settings:

The user can if they wish save the settings entered by clicking on "**Save Configuration**". Section 6.7 in this manual explains how the configuration settings can be recalled.

4.2.3 "Ignore PLT Results?"

This option is selected by ticking the "Ignore PLT results?" on the Flicker Test Setup dialog screen 2 (see below). This is selected when the IEC standard states there is no requirement for the evaluation of PLT.

IECSoft v2_6-U

New/Load Test Equipment Under Test Details IEC61000-3-3 Flicker Setup AC Source Connect PPA

Test Setup
Flicker Test Settings Page 2

Current Settings
Measurement Mode:
Voltage
Testing d(t)
Normal (4.0%)
Range:
Peak 100A
Shunt Internal

Test Settings
PST: 10.0 mins Total Testing Time: 2 Hours
PLT: 12 PSTs
Please ensure PC remains active throughout testing
☐ Is Ztest less than Zref? Ztest: 0.472
☒ Ignore PLT results? Test frequency: 50Hz
☐ Auto Inrush Test ☐ Auto Start

<< Back Select Mode Save Configuration Next >>

When this option is selected the PLT result is no longer highlighted in Red, Amber or green in the REALTIME view window or in TABLE view mode.

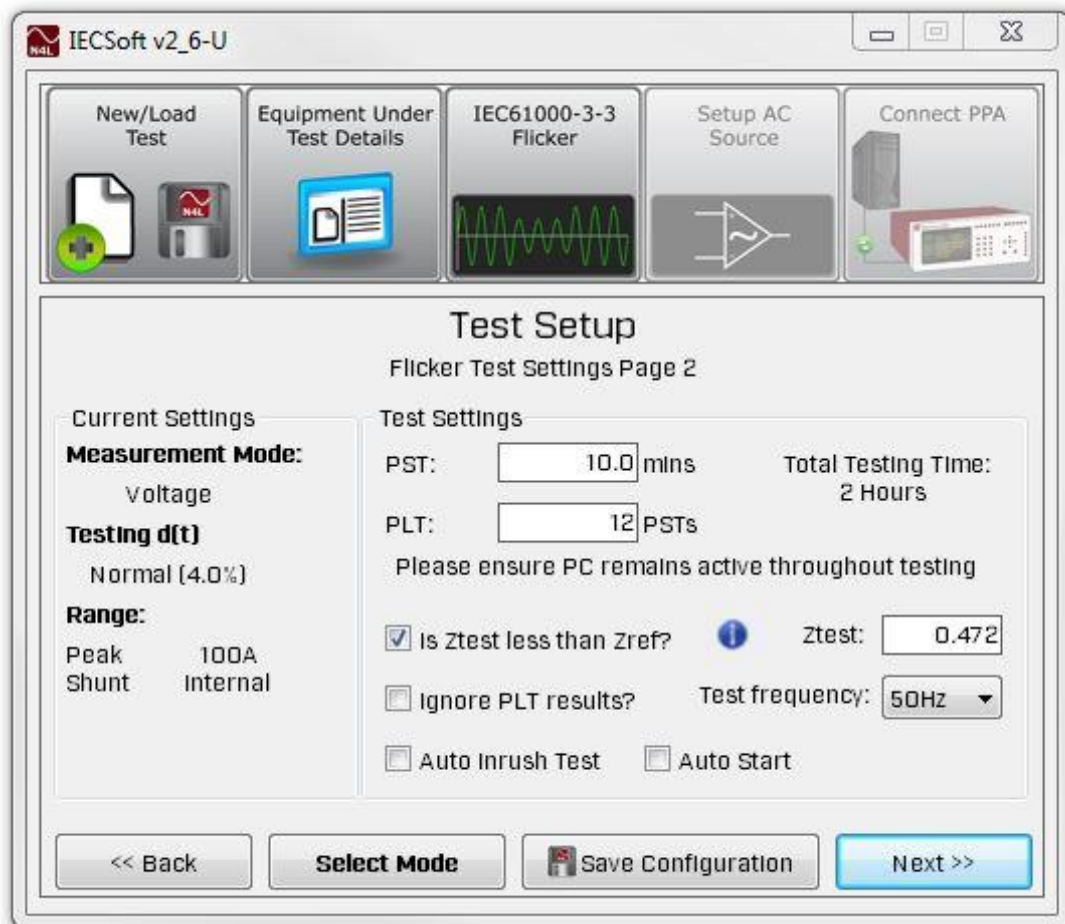
On the Flicker results tab of the Excel report no value is shown for PLT, the value is replaced by N/A.

4.2.4 “Is Ztest less than Zref?”

It is acceptable to use a Z_{test} value less than Z_{ref} when testing to IEC61000-3-11. This is permitted because it is sometimes not possible to dissipate the heat emitted with the full Z_{ref} reference impedance. In order to not limit the user to using the N4L IMP range of impedance networks (Which feature full Z_{ref} impedances up to 75Arms) IECSoft enables the user to define a Z_{test} if it is less than Z_{ref} .

This option is only applicable to equipment tested to the IEC 61000-3-11 standard.

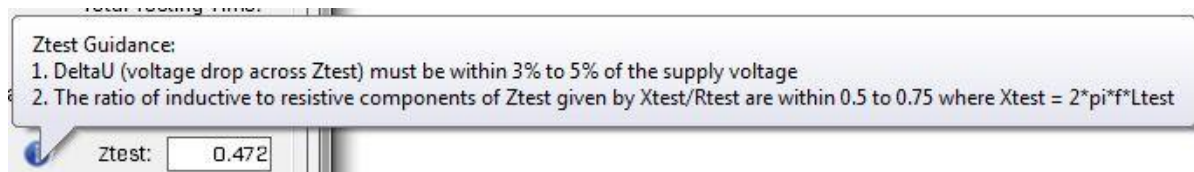
Please refer to Appendix F (section 9.6) in this manual for details of the definitions of the parameters such as Z_{test} and Z_{ref} that can be found in the IEC61000-3-11 standard. Also included are details on how to calculate these values along with the conditions that Z_{test} must maintain.



To select this option Select the “Is Ztest less than Zref?” option on the 2nd Flicker Test Setup dialog shown on the previous page.

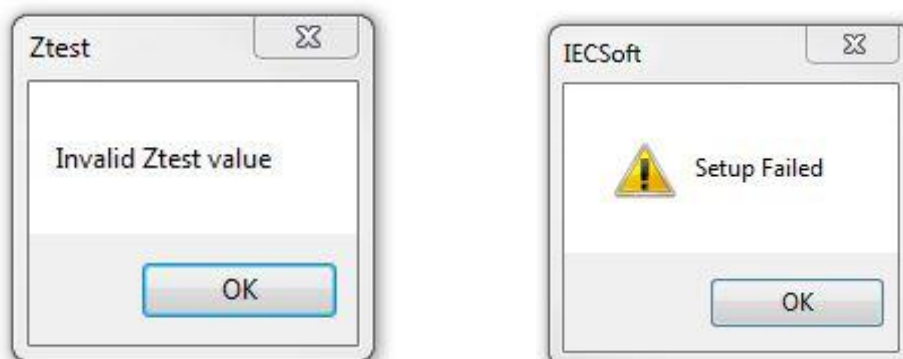
With this option selected the user is able to enter the new value for Ztest and select the test frequency of either 50Hz or 60Hz.

For assistance the user can hover over the  information icon. The following information window is then displayed.

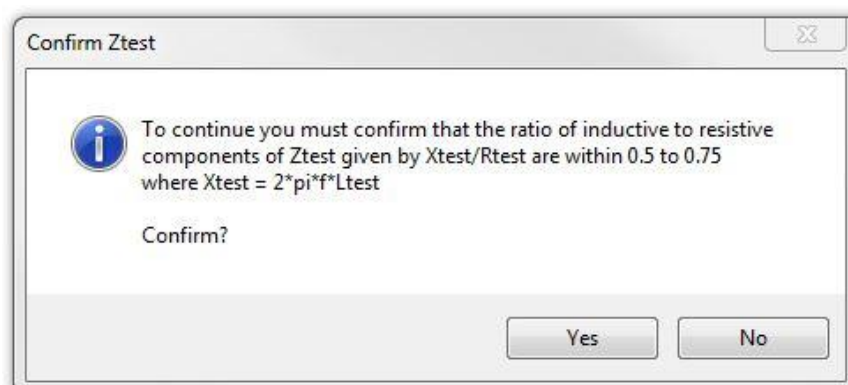


Enter the new value for Ztest and click “**Next**” to continue:

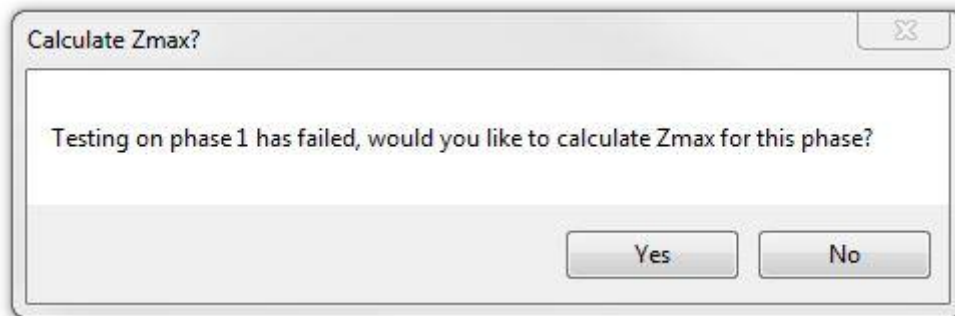
If an invalid value is entered the following warning messages are displayed. Click OK and then enter a valid Ztest value.



The following window is displayed asking the user to confirm that the entered value of Ztest conforms to the requirements of the standard.



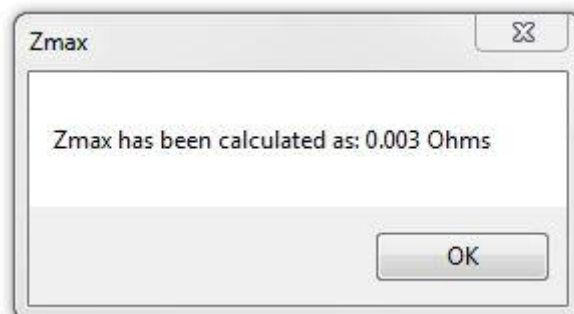
Click on "**Yes**" to confirm this and to continue testing. The AC Source Dialog is now displayed. The Flicker tests now continue as per Section 4.2 of this user manual.



In the event that the high current tests fail the window shown above will be displayed. Details of the failure will be displayed along with asking the user if they wish to calculate "Z_{max}" for the phase that failed test. If more than one phase fails, a message will appear for each failed phase. However, only one failure window is displayed at a time. Once the user responds to the first window, that window will close. If another phase has failed the window for that phase will appear.

Click "**No**" and the test complete message is displayed.

Click "**Yes**" and the following window appears displaying the calculated value for Z_{max}. Click "**OK**" and the test complete message is displayed.



Note: The calculated value for Z_{max} will also be displayed on the front page of the excel report. An example is shown below.

Results	Phase1: FAIL*
* The equipment shall only be connected to a supply with a system impedance of lower than 0.185, in accordance with IEC61000-3-11:2001 - Section 6.2.2	

4.2.5 Auto Inrush Test

Selecting the "Auto Inrush Test" option will display the Inrush test window a few seconds after displaying the IFS Graph Screen.

4.2.6 Auto Start

Selecting "Auto Start" will automatically start the flicker testing once the IFS Graph screen is displayed.

NOTE: Selecting "Auto start" AND "Auto Inrush Test" - The Inrush test window will be displayed a few seconds after displaying the IFS graph. The Inrush tests will not start automatically because the user needs to select the required test parameters. However, when the Inrush test window is closed the AC Source will be powered on and the Flicker tests will start automatically after the 1 minute filter stabilisation period.

Should the user wish to change the selected Test option or Category they can return to the Category Selection Setup dialog window by clicking on the "**SELECT MODE**" option on the Flicker or Harmonic Test Setup screens.

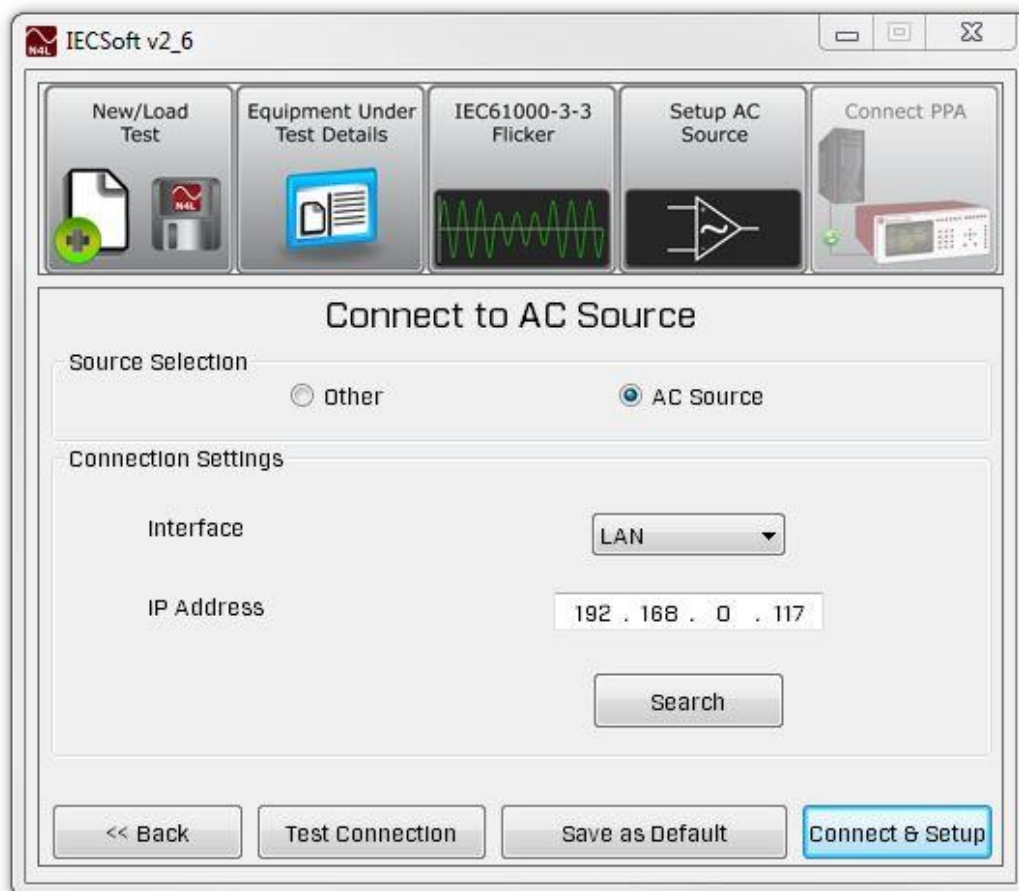
Click "**Next**" when ready to proceed with the tests:

4.3 Connect to AC Source Dialog.

There are two Source Selection options: AC Source and Other. Selecting AC source allows the software to control the output of a Newtons4th N4A series AC Source. Alternative types of AC Source can be used by selecting the “Other” option.

4.3.1 Connecting to a N4L AC Source.

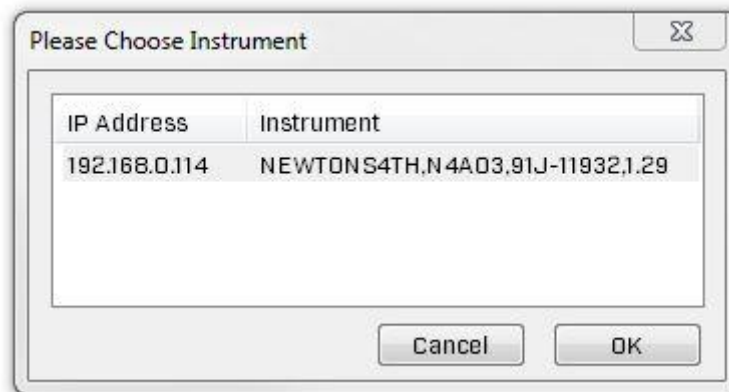
Select **AC Source**.



Before continuing, connect the PC to the AC Source and PPA via LAN, Serial or USB. Connect the instruments to the Device under Test (DUT) and any other test equipment. The instruments and the other test equipment should now be powered up. Ensure that the interface setting selected in the software is the same as that set on the instrument.

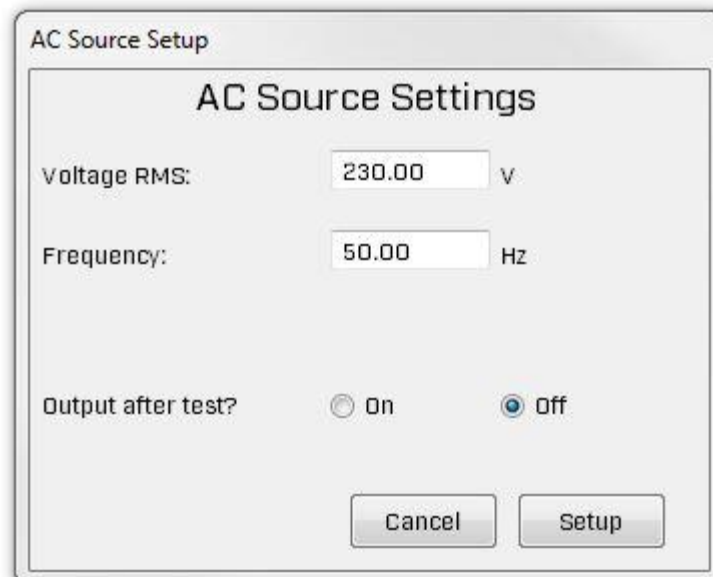
For Serial and USB interfaces select the correct Com Port and for Serial select a Baud Rate of 19200.

If selecting the LAN Interface click on **SEARCH**. The following "Please Choose Instrument" window will appear, select the correct instrument from the list of instruments connected to the LAN bus and then press the **OK** button.



Once the required Interface has been selected Click "**Connect & Setup**" to continue.

The AC Source Settings window appears. Set the required Frequency and Voltage for the test to be performed.



The user can also decide if the Source output remains **ON** or is switched **OFF** once the test is completed.

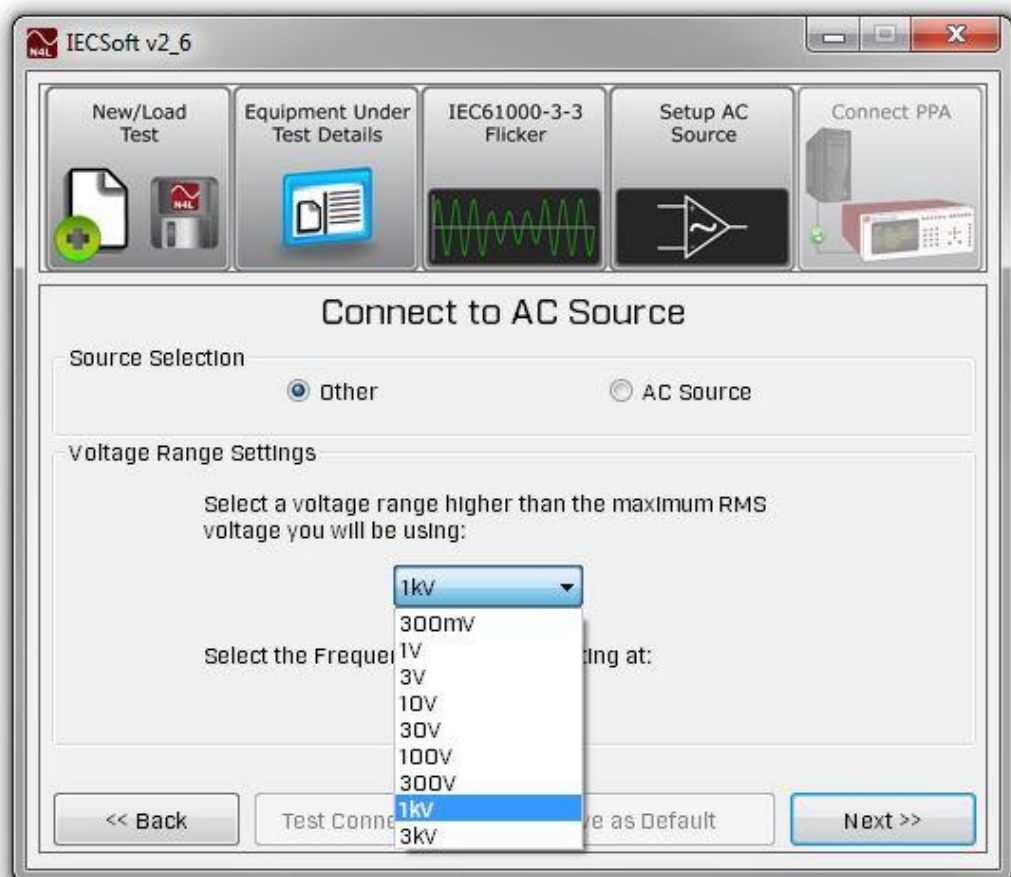
WARNING: Remember that the DUT will remain "**LIVE**" if selecting the option to leave the Output **ON**.

Click on "**Setup**" to continue.

4.3.2 Connecting to “Other” types of AC Source.

The IECSoft Software can be used with any make of AC Source providing they conform to the requirements stated in the various Standard documents.

To use other makes of AC source select “**Other**” in the Source selection options.



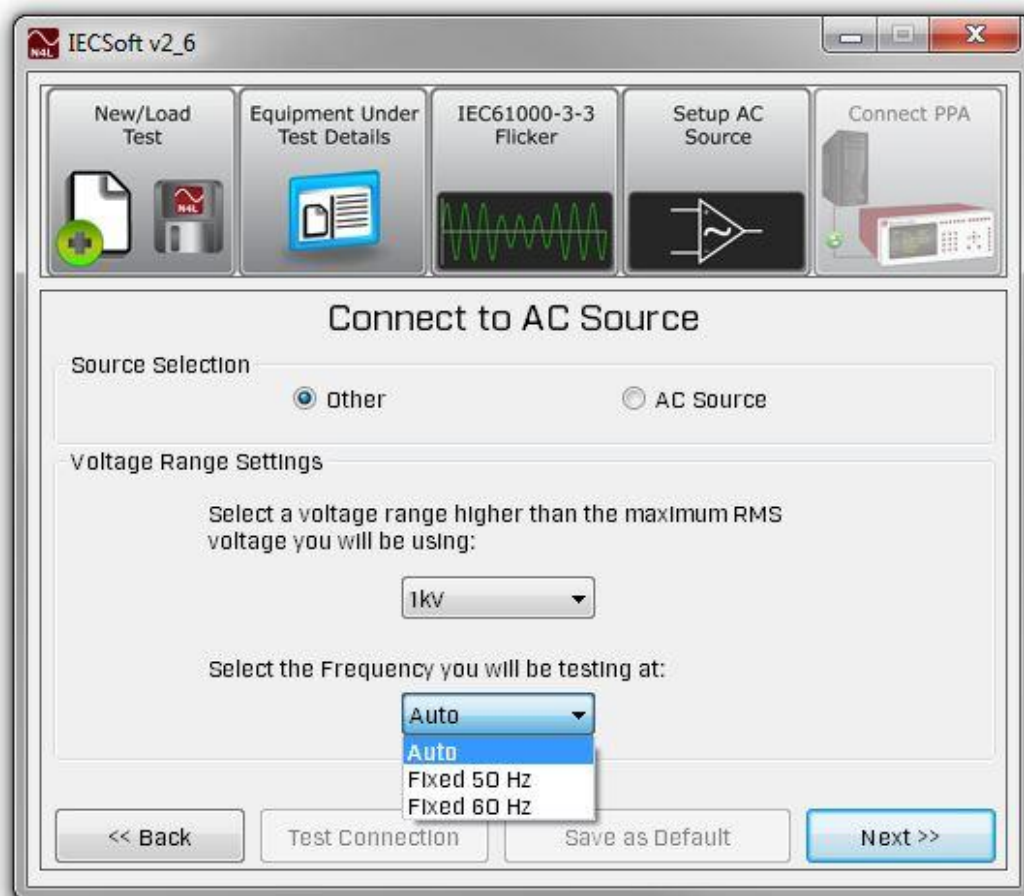
The correct voltage range will need to be selected for the DUT. Click on the voltage range setting to display the drop down menu and then select the appropriate Voltage Range.

NOTE:

When the user selects Source selection “Other” the Software will be unable to control the output of the AC source. The User will have to ensure that the source settings are correct and that the source Output is switched **ON** before the test begins and **OFF** again on completion of the test.

The test frequency is selected automatically by the software but there is the option to select it manually. The default setting of AUTO should normally be used.

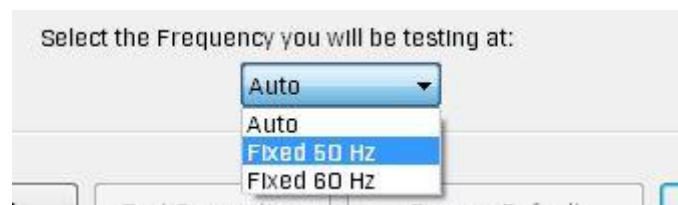
On very rare occasions a few makes of AC Source have caused problems monitoring the frequency whilst the test is running. If this should occur the frequency can be selected manually in the software and the test repeated. Further details can be found later in this section of the manual.



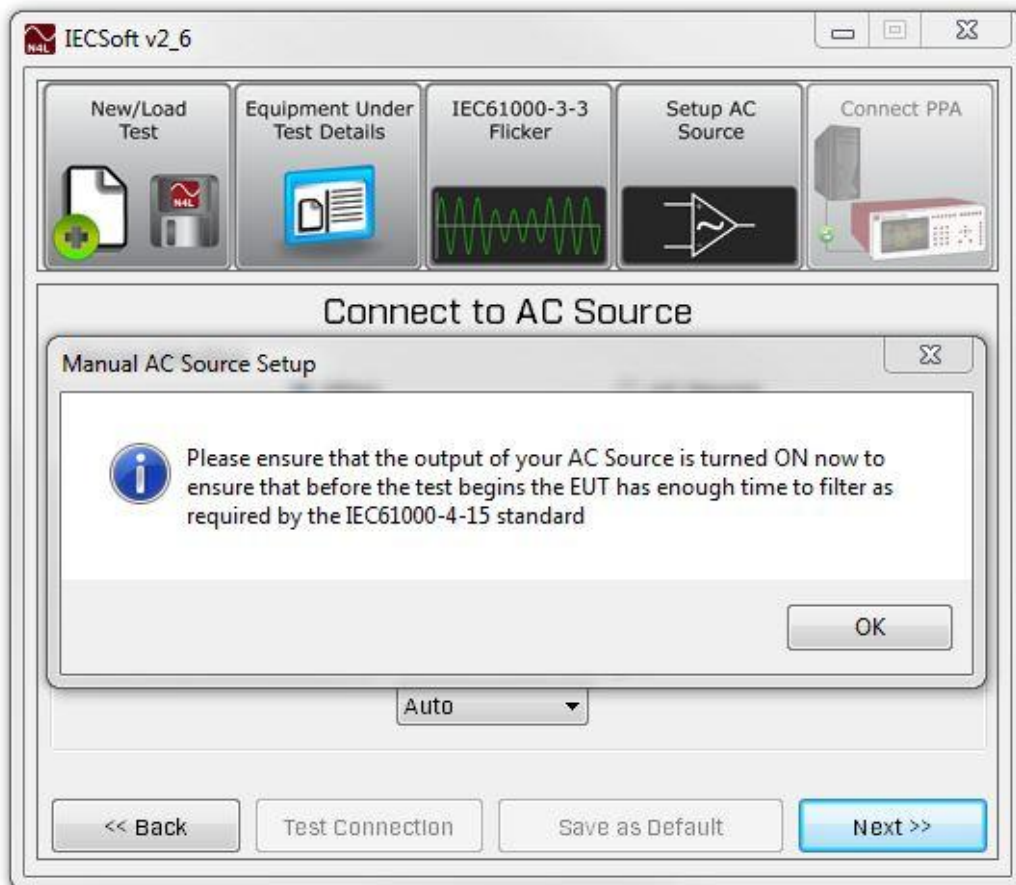
Should there be a problem with running a Flicker test or the flicker test doesn't seem to be set up correctly, for example the PSTs take significantly less time, or significantly more time than defined in the setup, switching to Real Time Mode will allow various parameters to be verified:

Frequency	Vrms
53.637 Hz	1.2073 V
PSTO	PST
82.260 m	0.0000

If there is a problem with the frequency displayed in the Real Time window as in the example on the previous page, the equipment setup and AC Source settings should be checked. If no problems are found the user should return to the Connect to AC Source screen and manually set the frequency to a fixed value of 50Hz or 60Hz.



Having selected the AUTO option or manually set the Test Frequency the user should click on "**Next**" to continue.



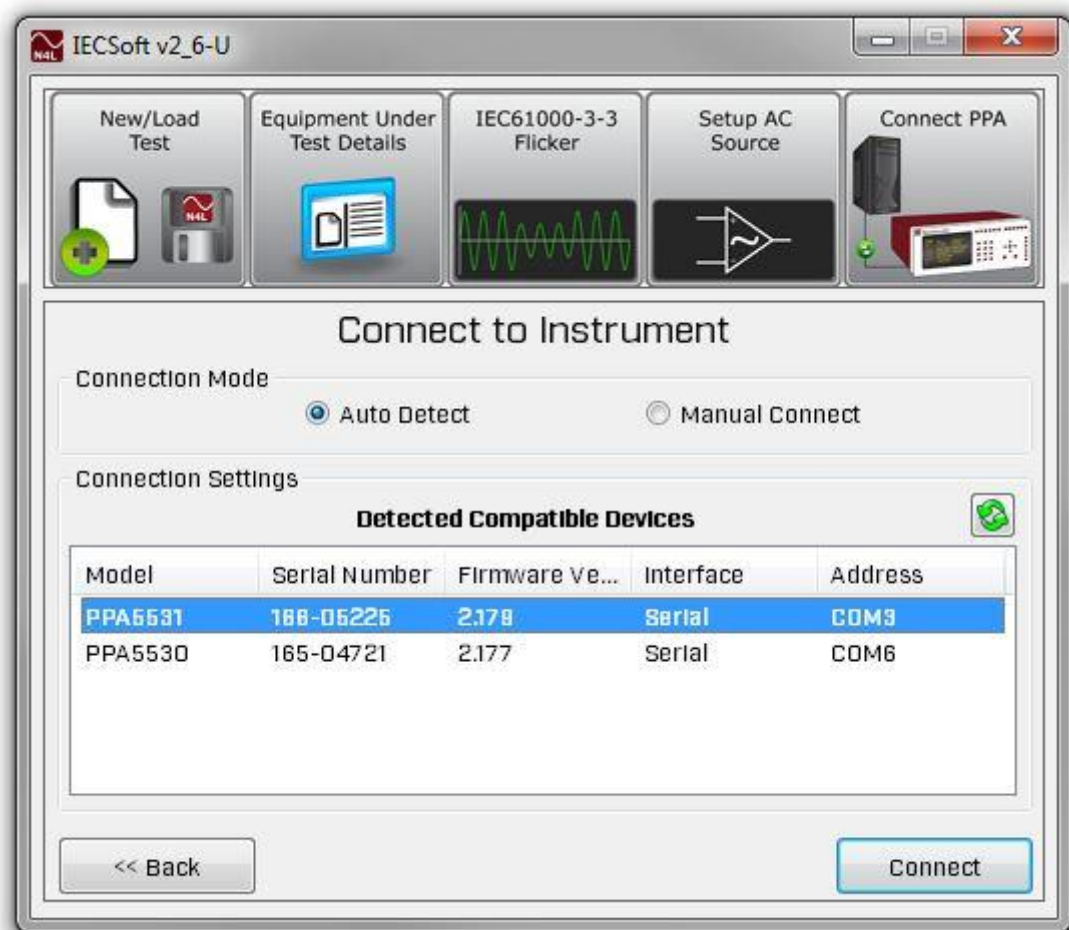
The above message is displayed. The user **MUST** switch **ON** the AC Source output before clicking **OK** to continue. The EUT doesn't have to be turned on now but it must be turned on before clicking on the START button in the Flicker test window.

Note: Failure to follow this procedure can cause the instrument to be setup incorrectly which can cause unnecessary test failures.

Click on **OK** to clear the message and then click on **NEXT** to continue with the test setup procedure.

4.4 Connect to Instrument Dialog.

After a short delay the Connect to Instrument dialog appears.

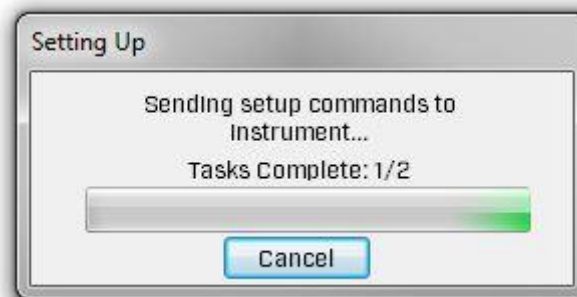
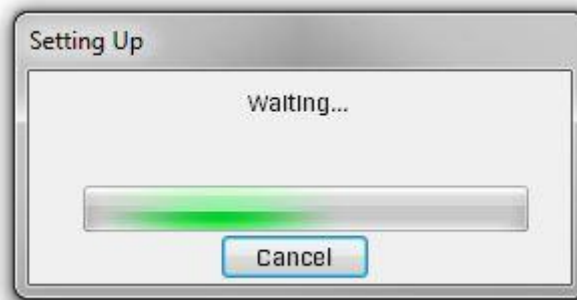


The PPA should be powered up and connected to the other instruments and PC as indicated in the previous section.

Selecting "**Auto Detect**" connection option will display all instruments that the software can connect to. In this example IECSoft auto detected a PPA5511 and a PPA5531. Highlight the required instrument and click on Connect.

It is also possible to double click on the instrument to connect to it.

The following series of windows are displayed for several seconds whilst IECSoft sends the setup commands to the instrument.



The Flicker test window appears and the test is ready to begin.

4.4.1 Out of Date Firmware message

When connecting to the instrument the IECSoft software checks the firmware version installed on the instrument. Should the firmware version be below the minimum version for use with this version of IECSoft the following message will be displayed.



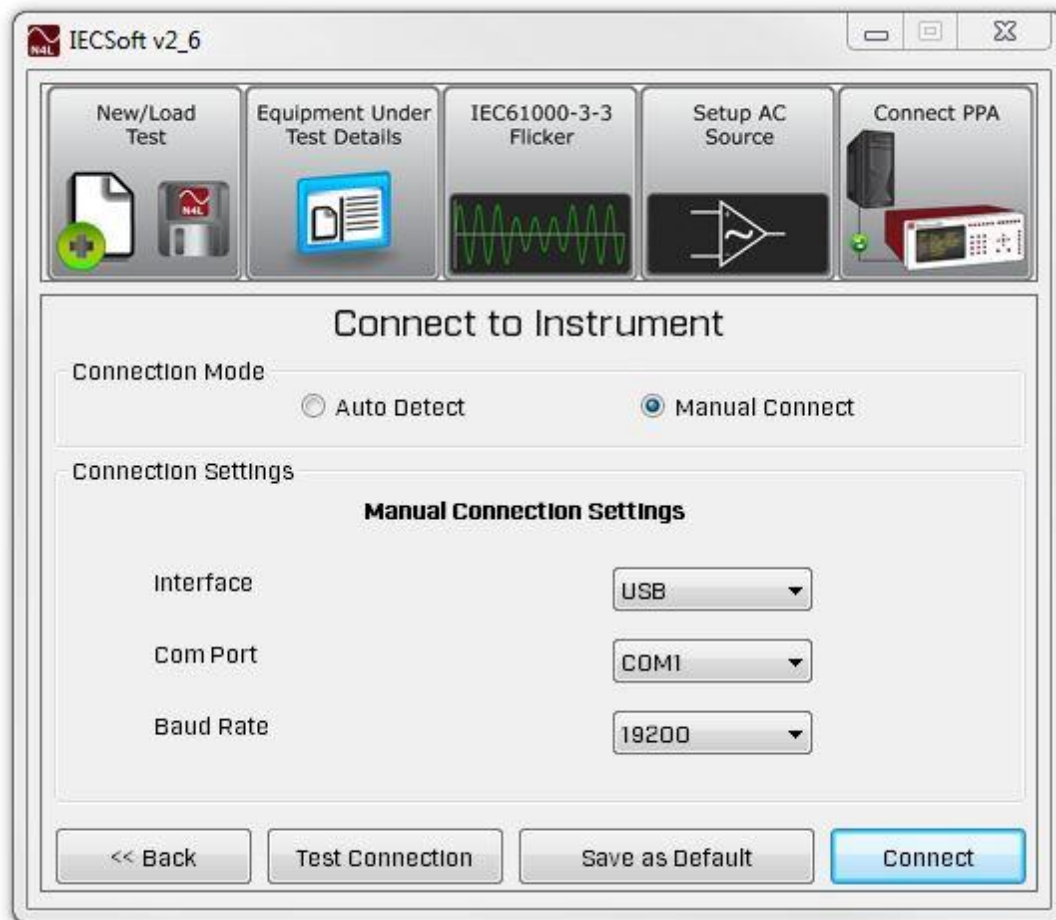
If this message appears the firmware should be upgraded before performing any IECSoft tests.

When upgrading the instrument firmware it is recommended to update to the latest version. At the time of updating this user guide the recommended minimum firmware version is **v2.179**.

Please refer to our website to download the latest version or contact our office or your local distributor.

4.4.2 Manual Connection

This option can be used if having any problems detecting instruments connected to the PC:



Check the Interface option selected on the PPA and set the Interface option in the Manual connection window (above) to the same setting. Depending on chosen interface option, set the correct baud rate and select the appropriate Com Port.

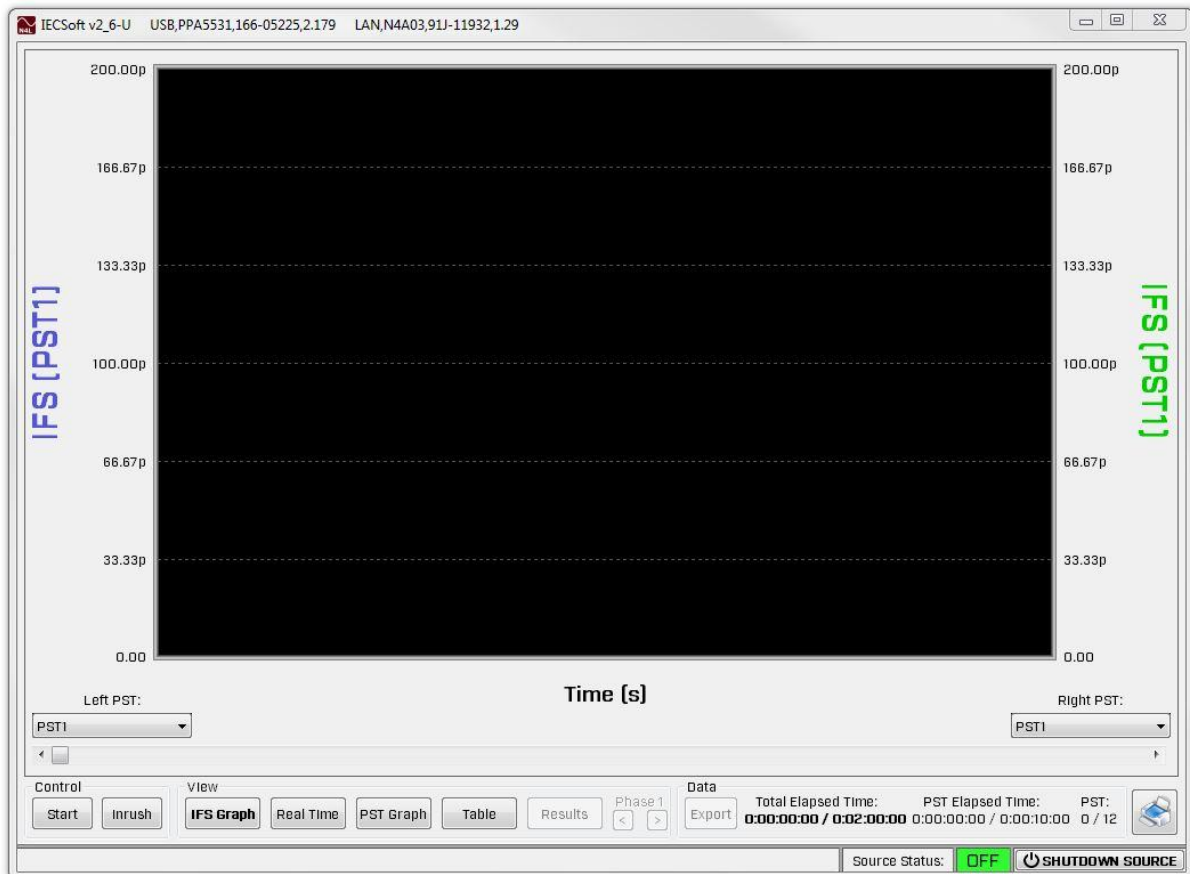
Click on "**Connect**" to connect to the PPA.

The series of setup windows are displayed for several seconds whilst IECSoft sends the setup commands to the instrument.

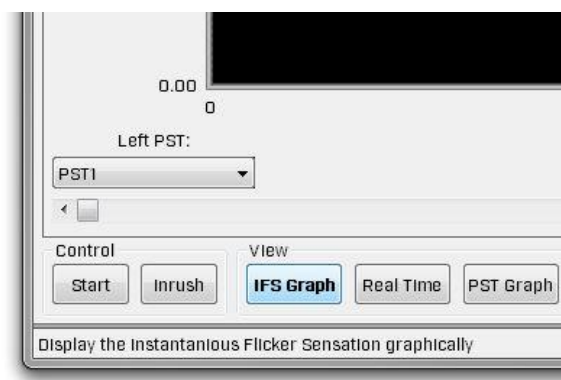
The Flicker test window appears and the test is ready to begin.

4.5 Performing a Flicker Test.

The “IFS Graph” viewing window is displayed by default. This window is fully described in the next section. One of the other viewing options can be selected before the test is started.

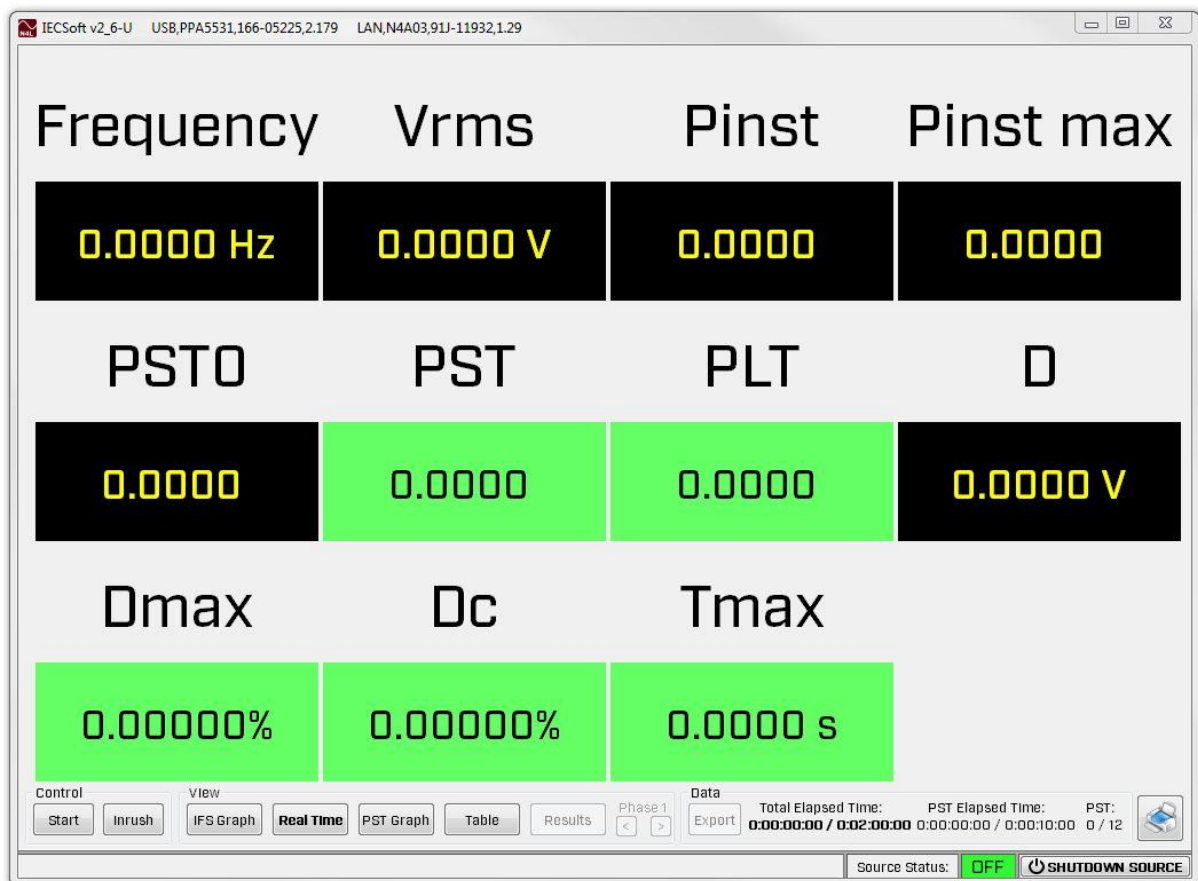


Moving the cursor over the test buttons displays a description of the function of that button in the bottom left hand corner of the test window.



This also applies to moving the cursor over test result boxes on the “Real time” view screen etc.

For the tests described in this User Guide the “REAL TIME” viewing option was selected.



AC Source Status

For all Flicker (and Harmonic) tests the status of the AC Source (**ON** or **OFF**) is displayed in the bottom right hand corner of the test window. The AC Source can be shut down at any time by clicking on the “**SHUTDOWN SOURCE**” button. This is a safety feature and is designed ONLY for use in an emergency to isolate the Equipment under Test (EUT) should a problem occur.

This button should **NOT** be used to control the AC Source during the normal test procedure.

When ready to begin the Flicker Test press the “**Start**” button.

The source output switches on and the status changes to **ON**.

The following window is displayed for 1 minute whilst the IECSoft software allows a 1 minute filter stabilisation period as specified in the IEC61000 standard. The timer counts down to indicate when the software will be ready to continue.



After the 1 minute stabilisation period the software will stop until the user is ready to continue tests by clicking on the "**Continue**" button. This allows the user to delay starting the test for any DUT with a stabilisation period greater than 1 minute.



Click on **Continue**:

The processing filters message will disappear and the test starts running. The test period is defined by the previously selected values for PST and PLT.

The total test period and the present total elapsed time are shown to the bottom right hand corner of the test window. The selected PST time period and present elapsed times are also displayed. The number of PST tests selected and the actual number of the present PST test are also displayed. In the above example 12 PST tests have been selected with a test period of 10 minutes each. This will give a total test period of 120 minutes / 2 hours.

Whilst the test is running the user is able to change the viewing mode to view the IFS / PST graphs or the results in table format.

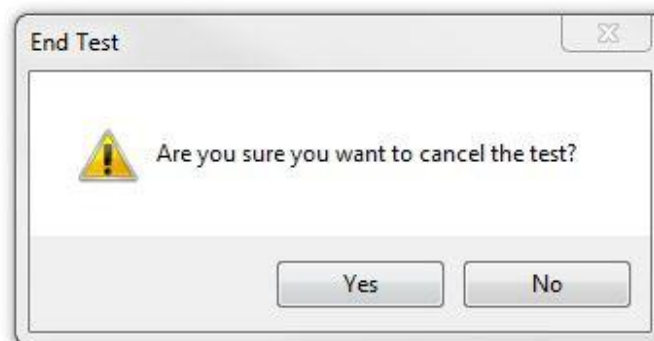
On completion of the tests a “**Test Complete**” message is displayed as shown below. The option is available to disable this message.



Click “**OK**” to view the test data.

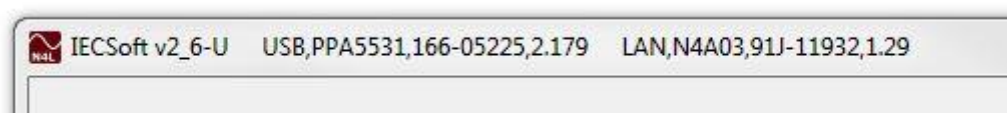
4.5.1 Stopping a test before completion.

The test can be stopped at any time by clicking on the **stop** button in the bottom left hand corner of the Flicker Test window. A message will be displayed (see next page) asking the user to confirm they want to cancel the test. Click on “**Yes**” to stop the test.



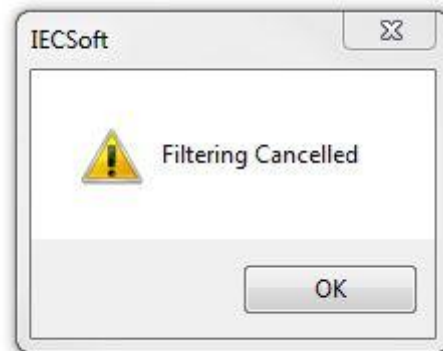
4.5.2 Instrument Details.

Along the top of any of the test windows are details of the instruments connected to the software including the serial numbers along with the IECSoft software version number.



4.5.3 Cancelling a test during the filter setup period.

The user is able to cancel the test if required. Click on cancel and the cancel window is displayed.



Click "**OK**" to cancel the filtering and return to the previous results window.

4.5.4 Skipping the filter setup period.

There is the option to skip this delay. Clicking on "**skip**" will result in the following window being displayed. This states that for testing to comply with the standard the stabilisation period is compulsory. Any test results are considered to be invalid and this will be indicated on the test results report.



4.5.5 Phase Selection buttons:



These can be found along the bottom of the Flicker Test dialog but are only available when running 3-phase tests. The Flicker test dialog defaults to displaying results for Phase 1 but these buttons can be used to display the results for Phase 2 or Phase 3 instead.

4.5.6 Print Screen Facility:



Dialog boxes or Result windows displaying this icon can be printed by clicking on the Icon.

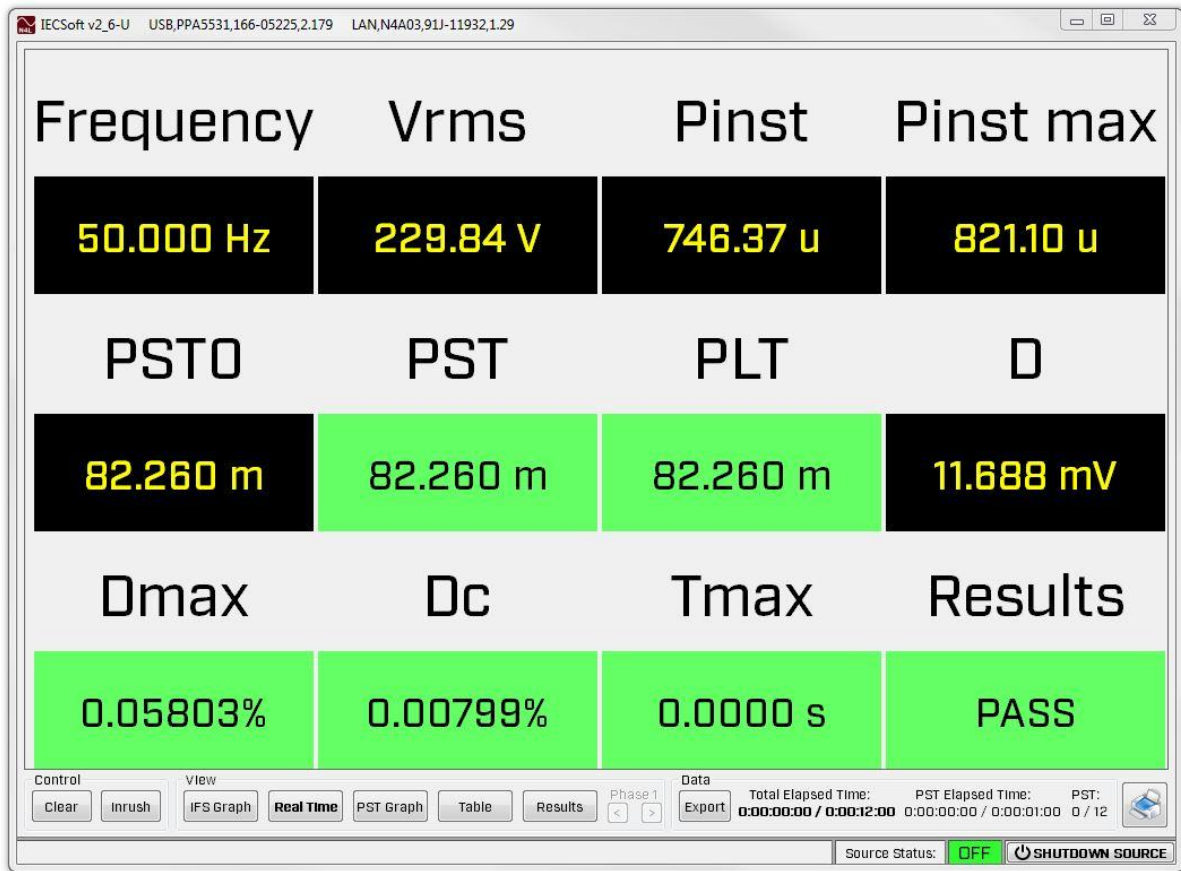
A print screen Format box is displayed (see below). Select the required format and press ok to continue.



The document will be displayed in the specified Excel format on the PC to allow the user to view & save a copy of the document if required. Use the print option in Excel to print the document.

4.6 Flicker Results – Viewing options.

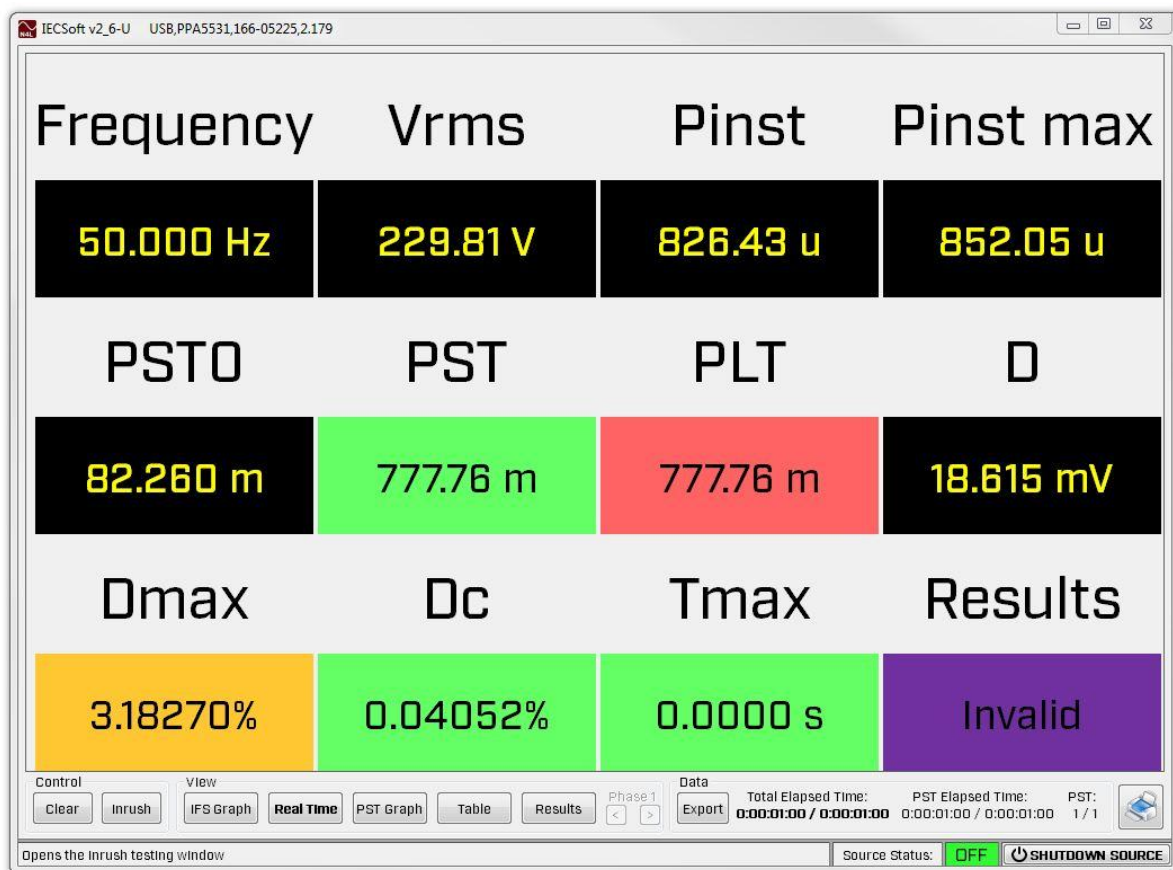
4.6.1 Flicker Results – Real Time view mode.



The above screenshot is of the REALTIME view window on completion of the test. The test was completed successfully and the AC Source was switched off at the end of the test.

Hovering over the title of one of the Real time result boxes displays more information about that parameter in the bottom left hand corner of the test window. E.g.: Pinst –Instantaneous Flicker Sensation.

The following screenshot of a REALTIME window demonstrates how the IECSoft Software uses colour coding to highlight whether the results were within the limits defined in the Standards or not.



Measurements shaded black are for User reference. No limits for these parameters are defined in the Standard.

Measurements that have defined limits are shaded green if they are within the limits or red if they fail to meet the limits.

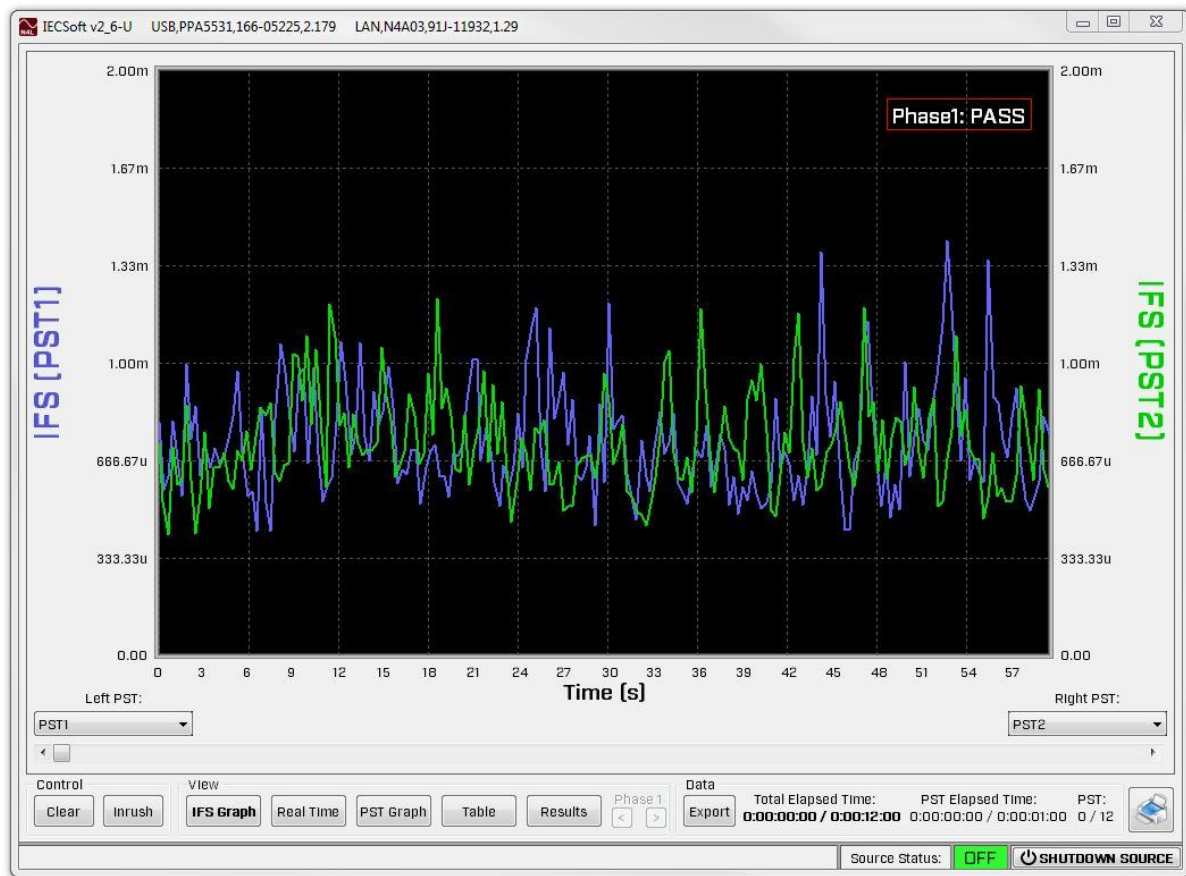
Measurements shaded amber indicates that the result is approaching the limit but is still within the specified limit. For results stated in percentages this is 1%. For the remaining results they turn orange if the result is within 0.1 of the limit.

REALTIME view displays a final PASS / FAIL result once the testing is completed. This is also colour coded, green representing a Pass and red a Fail. Invalid is displayed shaded purple when SKIP is selected rather than waiting for the filter stabilisation period to end before starting the test.

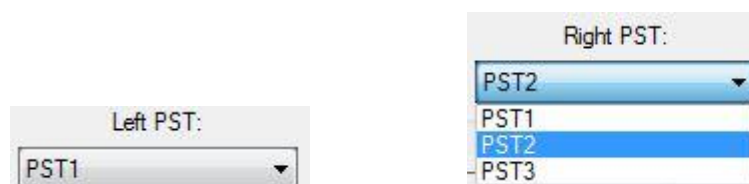
Hovering over the value of one of the coloured boxes on the Real-time view displays more information about the current status of that parameter in the bottom left hand corner of the test window. E.g.: Dmax is currently under the limit of 4%

4.6.2 Flicker Results – IFS Graph view mode.

Instantaneous Flicker Sensation Graph



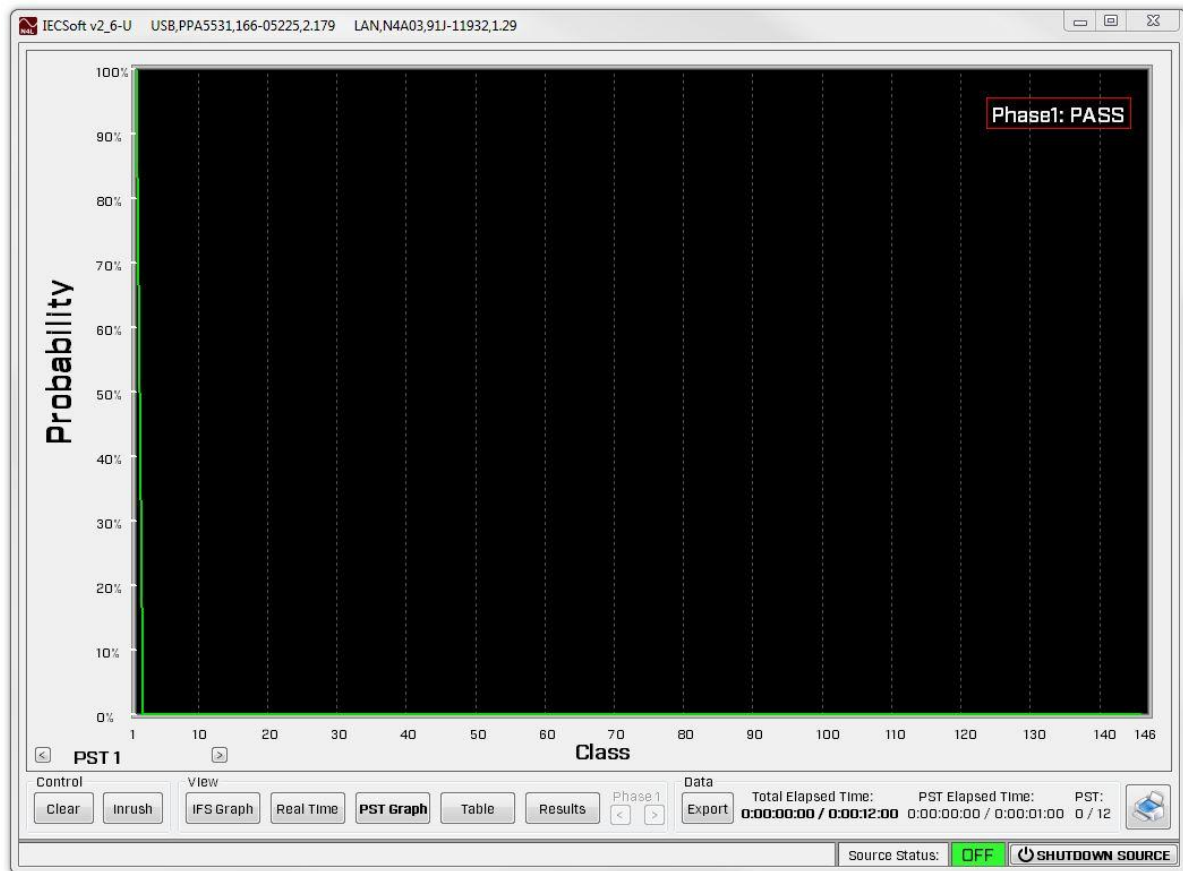
When a flicker test involves 2 or more PST's, the IFS graph can display the results for any 2 of the PST's.



The PST's displayed are selected using the Left PST and Right PST drop down menus shown above. The actual PST results displayed on the graph are shown on the drop down menu bars and on the vertical axis of the graph.

The slider bar is used to move the Time axis so that the results for any particular period during the test can be viewed on the graph.

4.6.3 Flicker Results – PST Graph view mode.



Only one PST graph can be displayed at a time on the PST graph. The left and right arrow keys (see below) are used to select the PST to be displayed on the graph.



It is also possible to display an additional graph "PST SUM".

The actual PST that is displayed on the graph is displayed between the arrow keys.

4.6.4 Flicker Results – Table view mode.

IECSoft v2_6-U USB,PPA5531,166-05225,2,179 LAN,N4A03,91J-11932,1,29

Data ...	Phase	Time	Frequency (...)	Vrms [V]	Pinst	Pinst max	PST0	PST	PLT	D	Dmax (%)	Dc (%)	Tmax (s)
1	1	+31545:55.0...	49.9996	229.8455	0.0008	0.0008	0.0823	0.0000	0.0000	0.0256	0.0265	0.0000	0.0000
2	1	+00:00:00.318	50.0001	229.8462	0.0006	0.0008	0.0823	0.0000	0.0000	0.0136	0.0278	0.0000	0.0000
3	1	+00:00:00.6...	49.9996	229.8447	0.0006	0.0008	0.0823	0.0000	0.0000	0.0139	0.0278	0.0000	0.0000
4	1	+00:00:00.9...	50.0000	229.8445	0.0008	0.0009	0.0823	0.0000	0.0000	0.0117	0.0278	0.0080	0.0000
5	1	+00:00:01.263	50.0000	229.8423	0.0007	0.0009	0.0823	0.0000	0.0000	0.0148	0.0278	0.0080	0.0000
6	1	+00:00:01.551	50.0002	229.8403	0.0005	0.0009	0.0823	0.0000	0.0000	0.0117	0.0278	0.0080	0.0000
7	1	+00:00:01.857	50.0001	229.8369	0.0010	0.0012	0.0823	0.0000	0.0000	0.0045	0.0278	0.0080	0.0000
8	1	+00:00:02.163	50.0001	229.8340	0.0007	0.0012	0.0823	0.0000	0.0000	0.0008	0.0278	0.0080	0.0000
9	1	+00:00:02.4...	49.9997	229.8318	0.0008	0.0012	0.0823	0.0000	0.0000	0.0068	0.0278	0.0080	0.0000
10	1	+00:00:02.7...	49.9999	229.8313	0.0006	0.0012	0.0823	0.0000	0.0000	0.0100	0.0278	0.0080	0.0000
11	1	+00:00:03.105	50.0001	229.8313	0.0007	0.0012	0.0823	0.0000	0.0000	0.0030	0.0278	0.0080	0.0000
12	1	+00:00:03.4...	49.9999	229.8325	0.0006	0.0012	0.0823	0.0000	0.0000	0.0137	0.0278	0.0080	0.0000
13	1	+00:00:03.742	49.9998	229.8347	0.0007	0.0012	0.0823	0.0000	0.0000	0.0169	0.0278	0.0080	0.0000
14	1	+00:00:04.0...	50.0004	229.8384	0.0007	0.0012	0.0823	0.0000	0.0000	0.0077	0.0278	0.0080	0.0000
15	1	+00:00:04.3...	49.9998	229.8426	0.0007	0.0012	0.0823	0.0000	0.0000	0.0099	0.0278	0.0080	0.0000
16	1	+00:00:04.6...	49.9997	229.8459	0.0007	0.0012	0.0823	0.0000	0.0000	0.0111	0.0278	0.0080	0.0000
17	1	+00:00:04.9...	49.9998	229.8484	0.0008	0.0012	0.0823	0.0000	0.0000	0.0010	0.0278	0.0080	0.0000
18	1	+00:00:05.2...	50.0005	229.8491	0.0010	0.0012	0.0823	0.0000	0.0000	0.0118	0.0278	0.0080	0.0000
19	1	+00:00:05.613	50.0001	229.8489	0.0007	0.0012	0.0823	0.0000	0.0000	0.0046	0.0278	0.0080	0.0000
20	1	+00:00:05.9...	50.0001	229.8494	0.0005	0.0012	0.0823	0.0000	0.0000	0.0038	0.0278	0.0080	0.0000
21	1	+00:00:06.2...	50.0000	229.8479	0.0006	0.0012	0.0823	0.0000	0.0000	0.0027	0.0306	0.0080	0.0000
22	1	+00:00:06.5...	49.9998	229.8484	0.0004	0.0012	0.0823	0.0000	0.0000	0.0009	0.0306	0.0080	0.0000
23	1	+00:00:06.8...	50.0003	229.8474	0.0008	0.0012	0.0823	0.0000	0.0000	0.0057	0.0306	0.0080	0.0000
24	1	+00:00:07.192	50.0001	229.8472	0.0005	0.0012	0.0823	0.0000	0.0000	0.0113	0.0306	0.0080	0.0000
25	1	+00:00:07.511	49.9998	229.8484	0.0004	0.0012	0.0823	0.0000	0.0000	0.0029	0.0306	0.0080	0.0000
26	1	+00:00:07.827	50.0000	229.8486	0.0008	0.0012	0.0823	0.0000	0.0000	0.0036	0.0306	0.0080	0.0000
27	1	+00:00:08.136	50.0000	229.8496	0.0011	0.0012	0.0823	0.0000	0.0000	0.0027	0.0306	0.0080	0.0000
28	1	+00:00:08.4...	50.0004	229.8499	0.0010	0.0012	0.0823	0.0000	0.0000	0.0095	0.0306	0.0080	0.0000
29	1	+00:00:08.7...	50.0002	229.8486	0.0008	0.0012	0.0823	0.0000	0.0000	0.0183	0.0306	0.0080	0.0000
30	1	+00:00:09.0...	50.0005	229.8474	0.0007	0.0012	0.0823	0.0000	0.0000	0.0149	0.0308	0.0080	0.0000
31	1	+00:00:09.3...	49.9999	229.8472	0.0010	0.0012	0.0823	0.0000	0.0000	0.0050	0.0308	0.0080	0.0000
32	1	+00:00:09.713	49.9996	229.8472	0.0010	0.0012	0.0823	0.0000	0.0000	0.0018	0.0308	0.0080	0.0000
33	1	+00:00:10.032	50.0000	229.8459	0.0007	0.0012	0.0823	0.0000	0.0000	0.0018	0.0308	0.0080	0.0000
34	1	+00:00:10.348	50.0000	229.8459	0.0010	0.0012	0.0823	0.0000	0.0000	0.0239	0.0308	0.0080	0.0000

Control View Data
 Clear Inrush IFS Graph Real Time PST Graph Table Results Phase 1
 Total Elapsed Time: 0:00:00:00 / 0:00:12:00 PST Elapsed Time: 0:00:00:00 / 0:00:01:00 PST: 0 / 12
 Source Status: OFF SHUTDOWN SOURCE

The measurements with defined limits are shaded green if they are within the limits or red if they are outside of the limits.

Measurements shaded orange are values that are close to, but still within the specified limit. For results stated in percentages this is 1%. For the remaining results they turn orange if the result is within 0.1 of the limit.

4.6.5 Flicker Results – Results view mode.

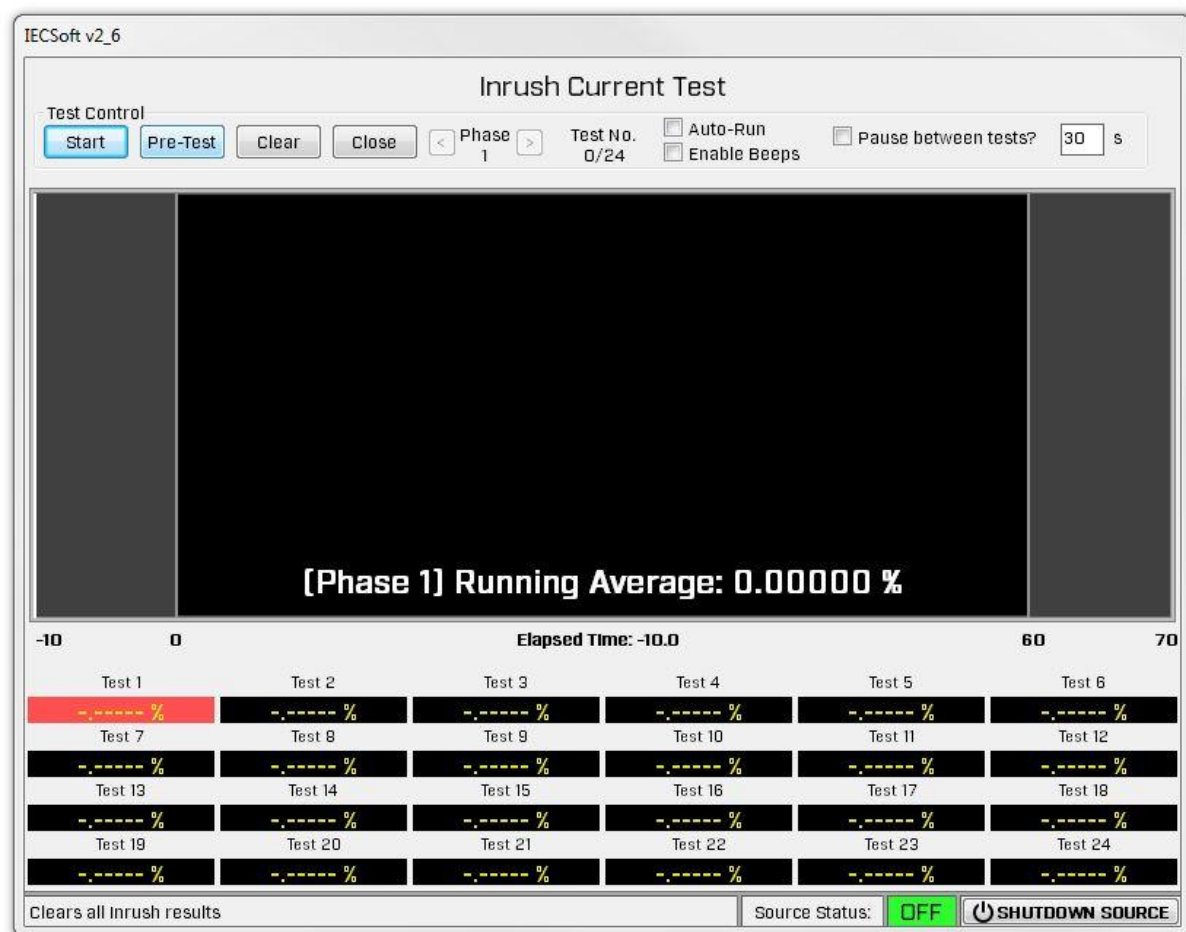
#	PHASE	STATUS	PST	PLT
1	1	PASS	0.0823	0.0823
2	1	PASS	0.0823	0.0823
3	1	PASS	0.0823	0.0823
4	1	PASS	0.0823	0.0823
5	1	PASS	0.0823	0.0823
6	1	PASS	0.0823	0.0823
7	1	PASS	0.0823	0.0823
8	1	PASS	0.0823	0.0823
9	1	PASS	0.0823	0.0823
10	1	PASS	0.0823	0.0823
11	1	PASS	0.0823	0.0823
12	1	PASS	0.0823	0.0823

Control: Clear Inrush View: IFS Graph Real Time PST Graph Table Results Phase 1 Data: Export Total Elapsed Time: 0:00:00:00 / 0:00:12:00 PST Elapsed Time: 0:00:00:00 / 0:00:01:00 PST: 0 / 12 Source Status: OFF SHUTDOWN SOURCE

4.7 Flicker Testing - Inrush Tests.

Click the Inrush button in the Flicker Test window to open the Inrush Current Test window.

Inrush current tests can be carried out before or after running Flicker tests. It is also possible to run the Inrush tests without completing a Flicker Test. The results can be saved as described in section 6.1.1 of this manual but only the Inrush results will be exported.

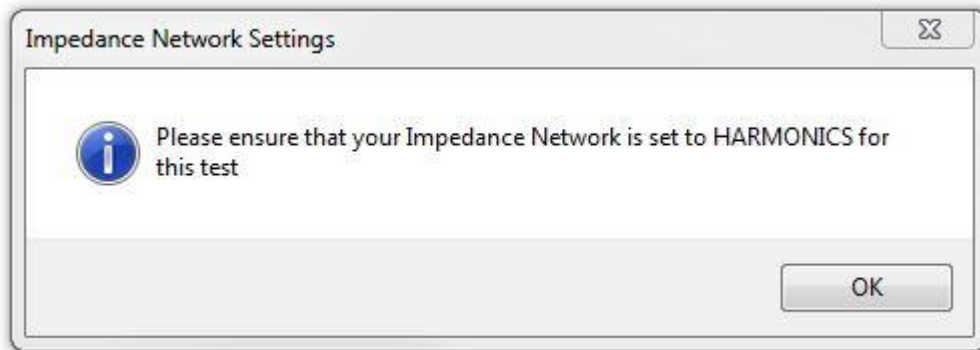


4.7.1 Inrush Pre-test

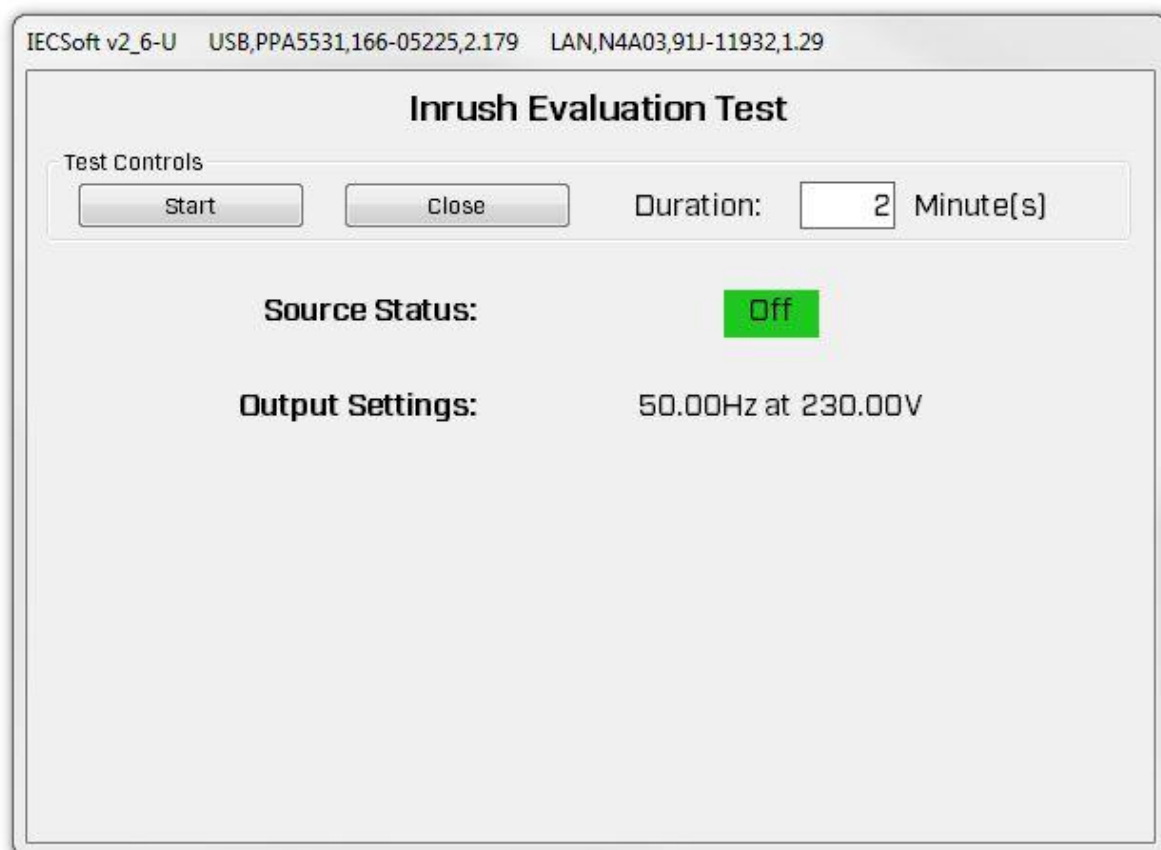
This mode performs an Inrush evaluation test of between 1 and 10 minutes duration. The Inrush Current and Inrush Ripple are measured to determine if they are below the limits of 20A and 1.5A respectively. If both are below the limits the DUT is considered to be exempt from the requirement to perform the Inrush tests detailed in Section 4.7.2 of this manual.

Click on "**Pre-Test**"

When using an N4A AC source and Impedance Network the following warning message will be displayed to ensure the test equipment is correctly setup to perform the test.



Click on "**OK**" to display the Inrush Evaluation Test Window:



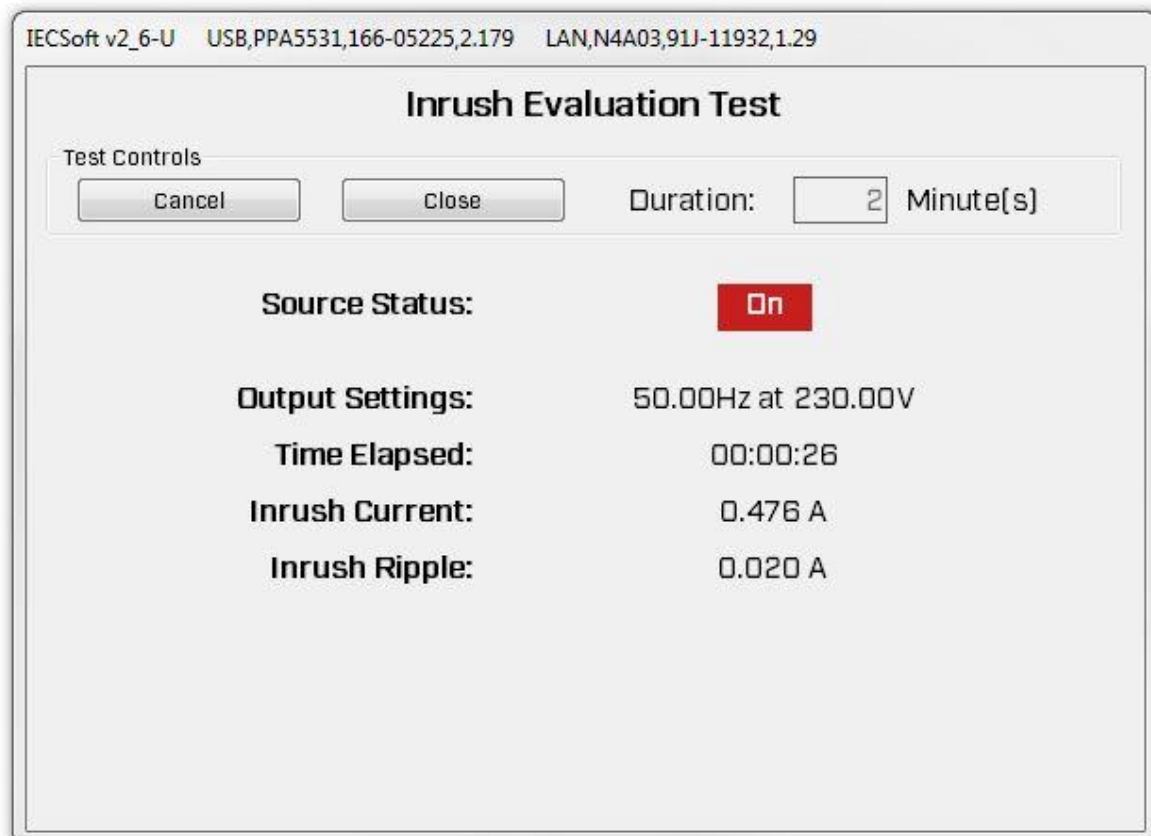
The test window displays the AC source settings for the test to be performed along with the current status of the Source output. The duration can be between 1 and 10 minutes with the software having a default value of 2 minutes.

The test can be stopped at any time by clicking on "**Cancel**".

The "**Close**" button can then be used to close the window.

The DUT output must be **OFF** before beginning the test.

Press "**Start**" to begin the Test:



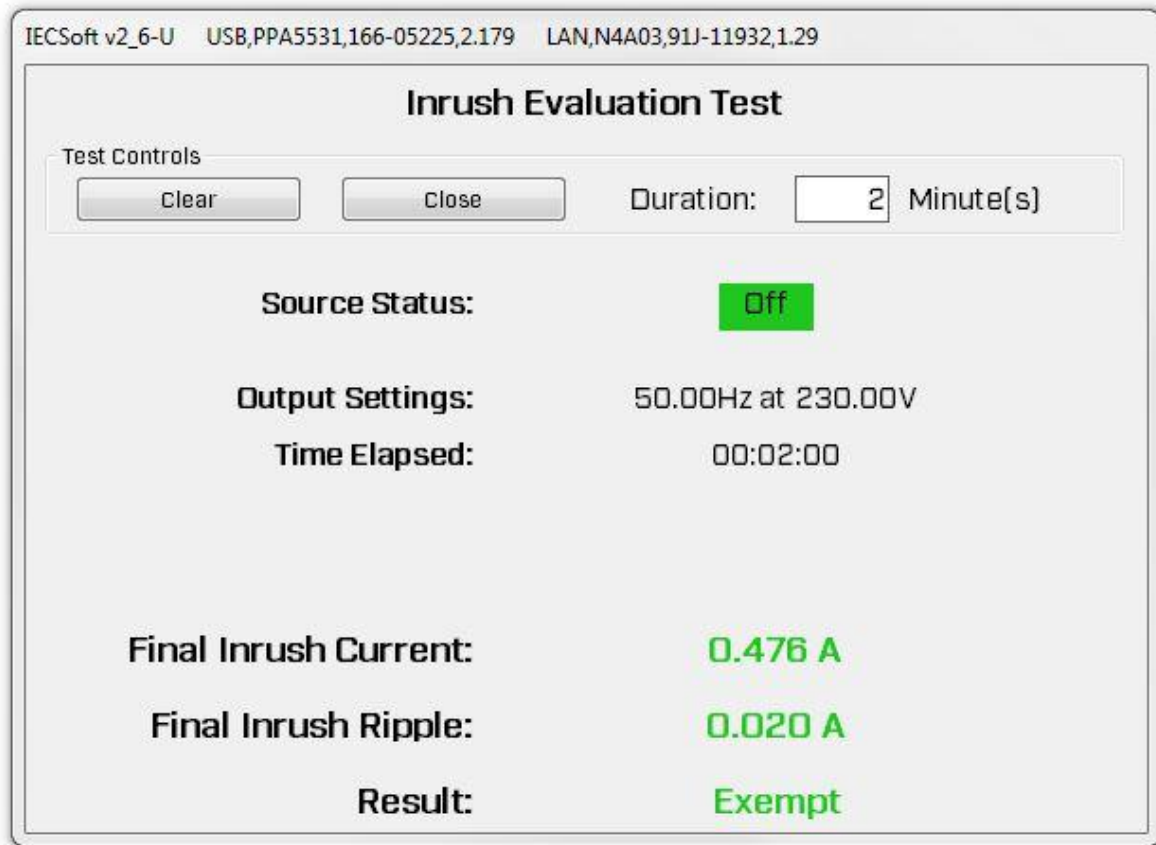
The AC source output is automatically switched ON. The AC Source status will be updated to warn that the Output is **ON** and that power is applied to the DUT.

The window will display the Inrush Current and Input Ripple which will be updating for the duration of the test. The Elapsed time is also displayed and updating until the selected duration is reached.

With the test running the DUT output should be switched ON. The software will display the updated Inrush current and inrush ripple values.

The test will end and the AC Source Output is automatically switched off once the specified test duration is achieved.

The Test window is updated:

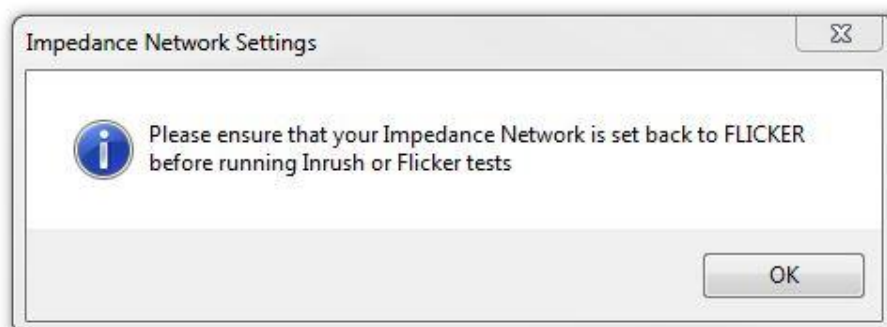


The AC Source status is updated to confirm that the DUT is no longer powered up.

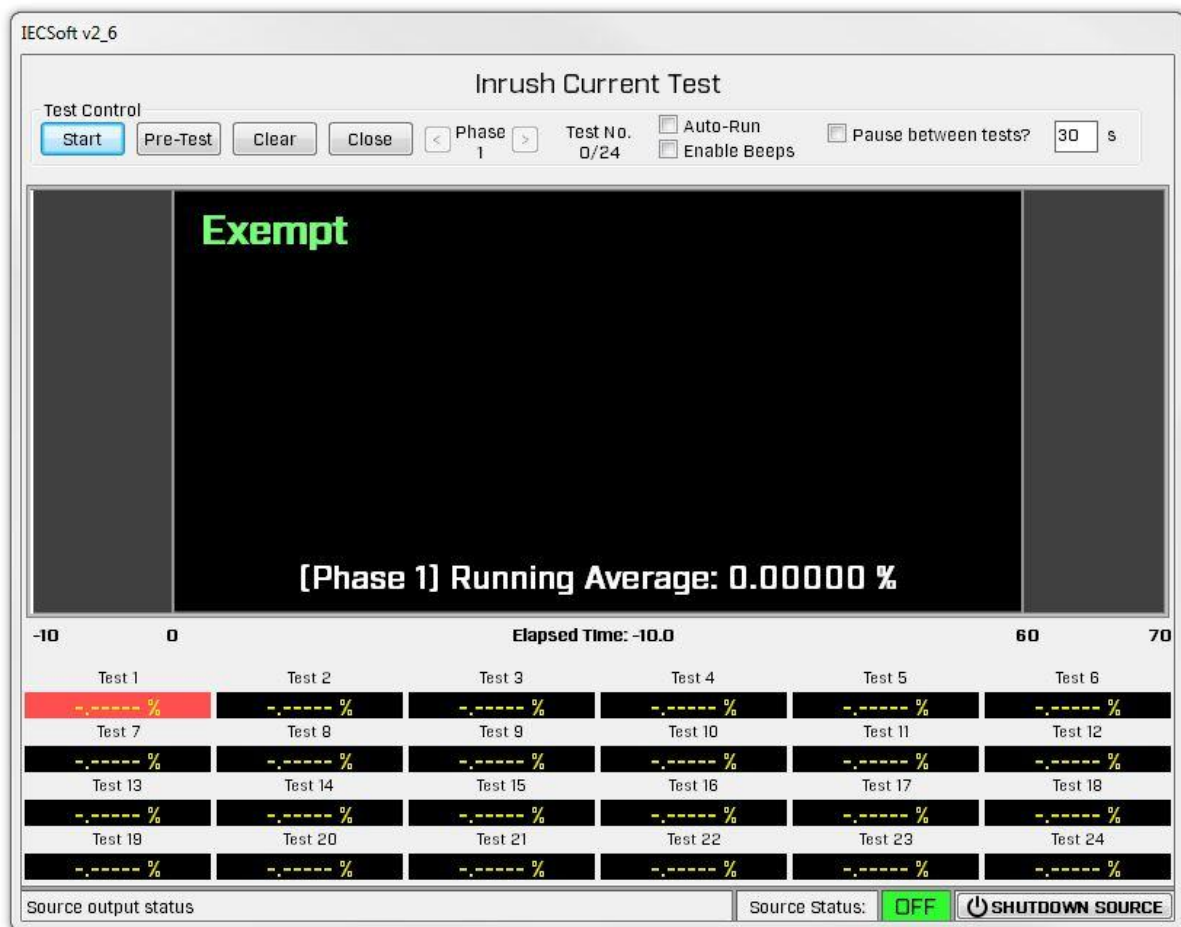
The final values of Inrush Current and Inrush Ripple are displayed. The Result confirms if the DUT is Exempt from Inrush Testing or not.

The "**Clear**" button can be used to clear the results to repeat the test.

When connected to a N4A AC Source and Impedance network the "**Close**" button will display the following message:



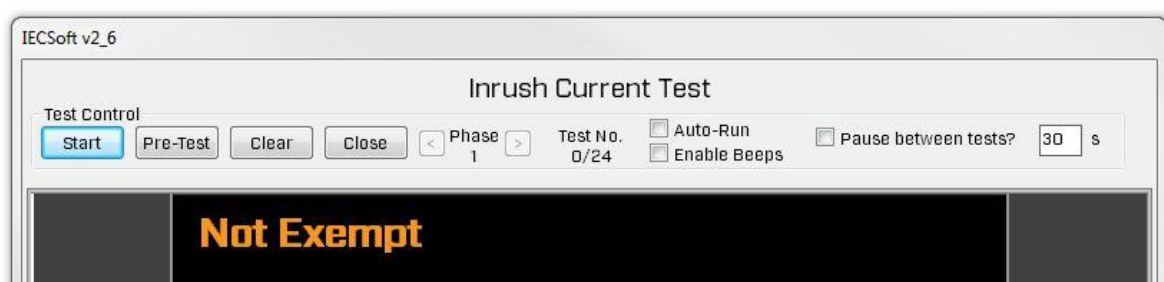
Check the test equipment is correctly setup and then click “**OK**” to return to the Inrush Current Test Window.



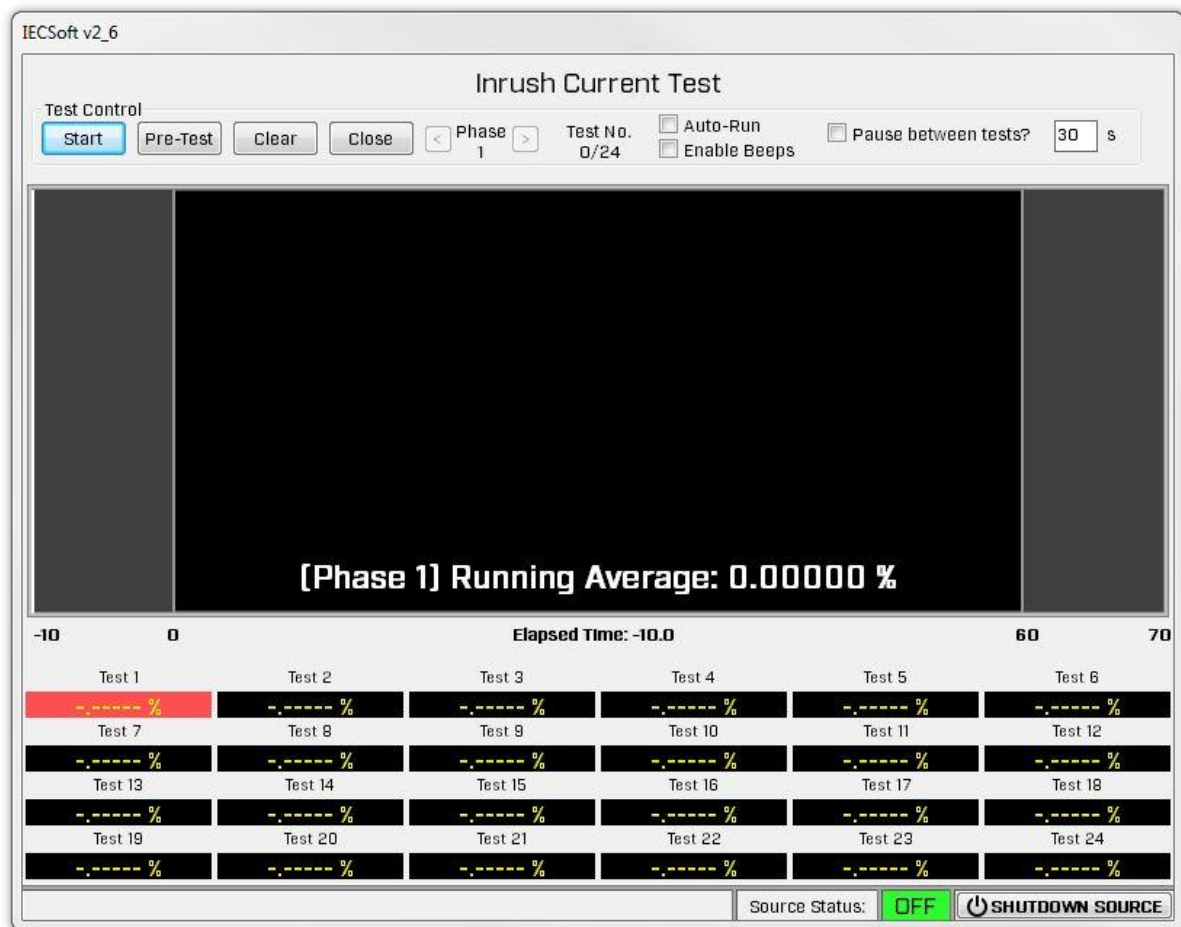
If the DUT is Exempt from Inrush testing this will be displayed in the test window.

The front page of the Excel Results Report will also confirm that the DUT is Exempt from Inrush testing.

If the DUT is not exempt this will be displayed in the Inrush Evaluation test window and in the Inrush Current test window.



4.7.2 Performing an Inrush test.



The Inrush tests can be completed one at a time by clicking on the **START** button to begin the next test once the previous test has been completed. If the auto-run box is ticked all 24 (or all remaining) tests will be completed automatically. The auto-run testing can be stopped at any time by removing the tick from the auto-run box.

Click on "**Clear**" to clear the stored results of any previous Inrush tests. If the previous test results have not been cleared when you click on "**Start**" the testing will begin from the first test number with no displayed result.

NOTE: AC Source status. When performing single tests the AC source is switched **OFF** at the end of each test performed. When using the "Auto-Run" function the AC source remains **ON** at all times until all 24 tests have been completed.

In auto-run mode it is possible to set up a delay period between the completion of one test and the start of the next. This is achieved by ticking the "**Pause between tests?**" box and entering the required delay in the "**Time between tests in seconds**" box. This option can be selected, deselected or the Pause period adjusted but not whilst a test is running. If running in Auto-Run mode, deselect Auto-run and wait for the present test to end. Now make the required changes to the "Pause between tests" options. Reselect Auto-Run and click on "**Start**" to resume the Inrush tests. This gives the user the facility to allow the device under test to "cool down" if required between each Inrush test.

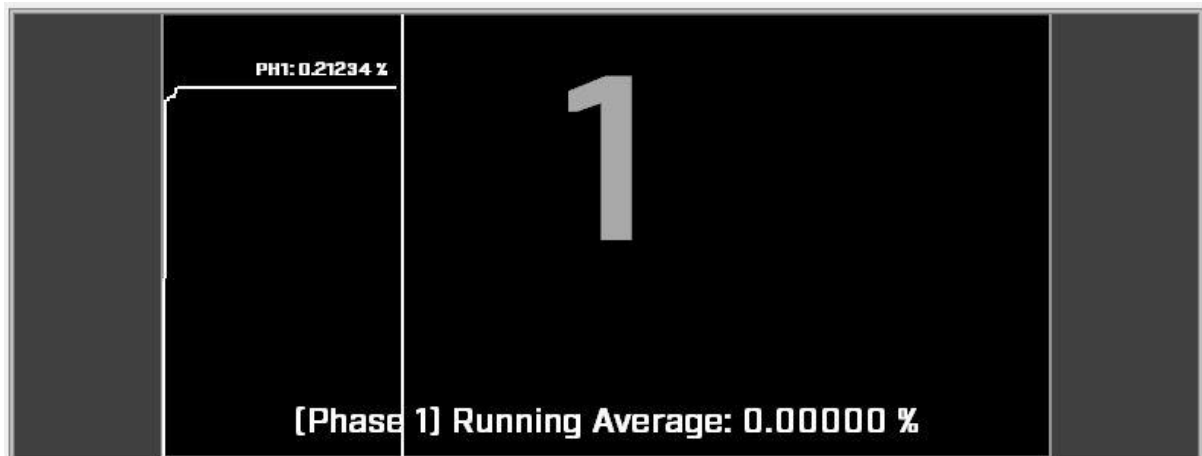
When each of the 24 Inrush tests starts a "**WAIT**" message is displayed for several seconds:



The message changes to "**START DUT**" to instruct the user to **Switch ON** the device under test at the correct time:



No message is displayed during the test:



At the end of each test a "**STOP DUT**" message is displayed to instruct the user when to **switch OFF** the DUT (using the on/off button not by switching the AC source output off):

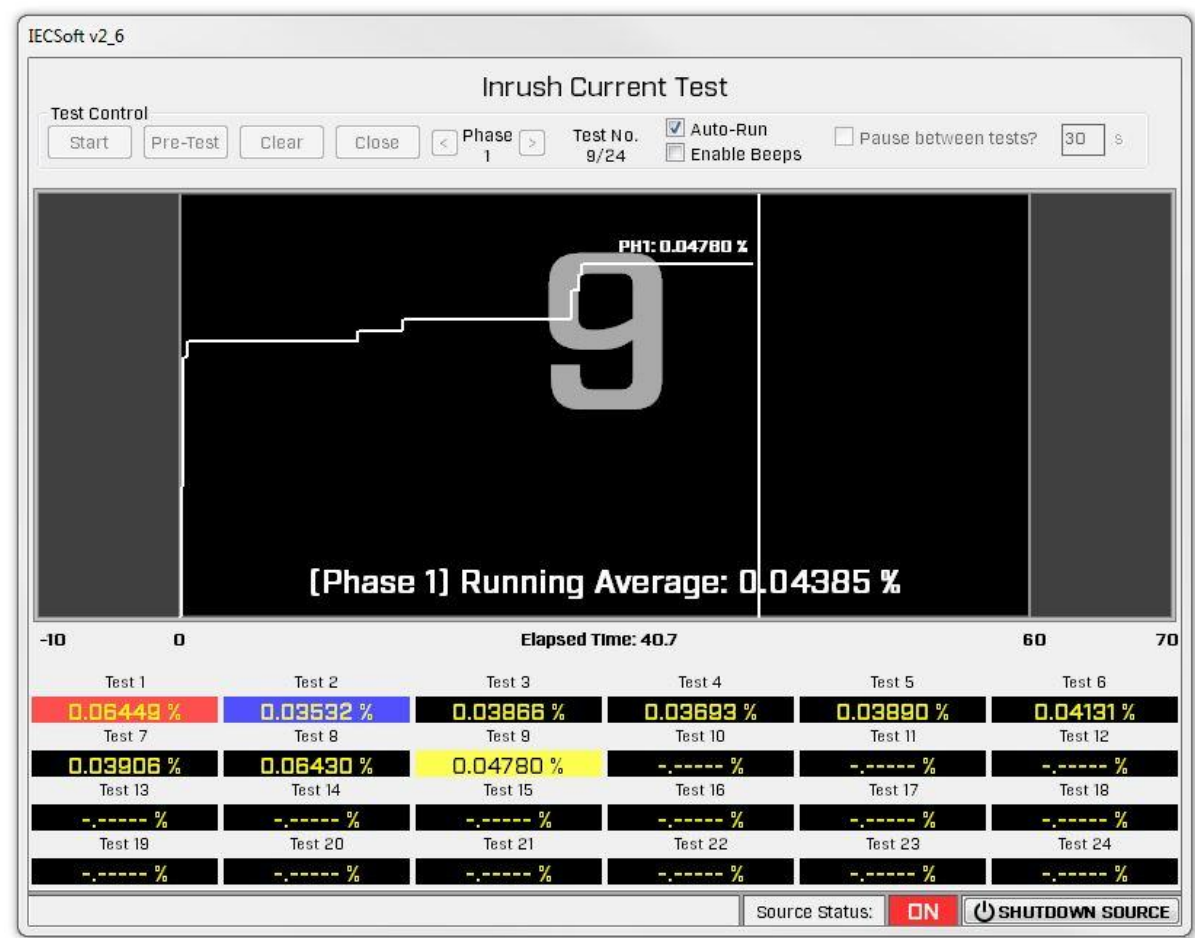


Another "**WAIT**" message is then displayed for a few seconds before the test is completed.

There is the option to set an audible beep to be emitted during the "**START DUT**" and "**STOP DUT**" periods to aid users switching the DUT on and off at the correct time if they are unable to view the messages in the software window. The beep is enabled or disabled in the menu along the top of the Inrush test window. The Unit under test can be "cooling down" during the "**WAIT**" periods.

During the tests, the number of the actual test being made will be shown in the main Inrush test window and near the Auto-run button at the top of the screen.

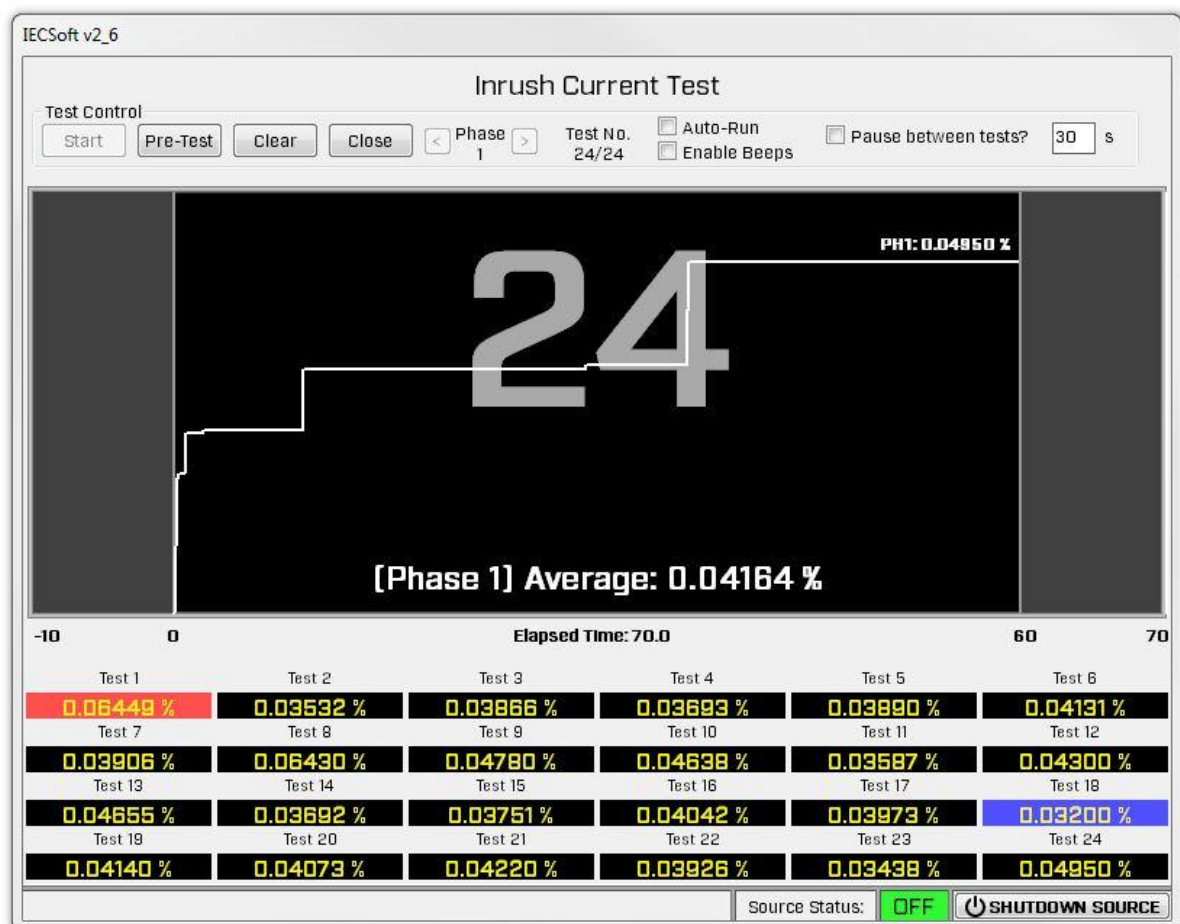
The active test (the test that is currently being run) is highlighted in yellow.



The test that produced the lowest Inrush result is highlighted blue whilst the test that produced the highest Inrush result is highlighted red. These are updated when each of the 24 Inrush tests is completed.

At the end of the final test the AC source is switched OFF. The Source status is updated to show that the Source output is now **OFF**.

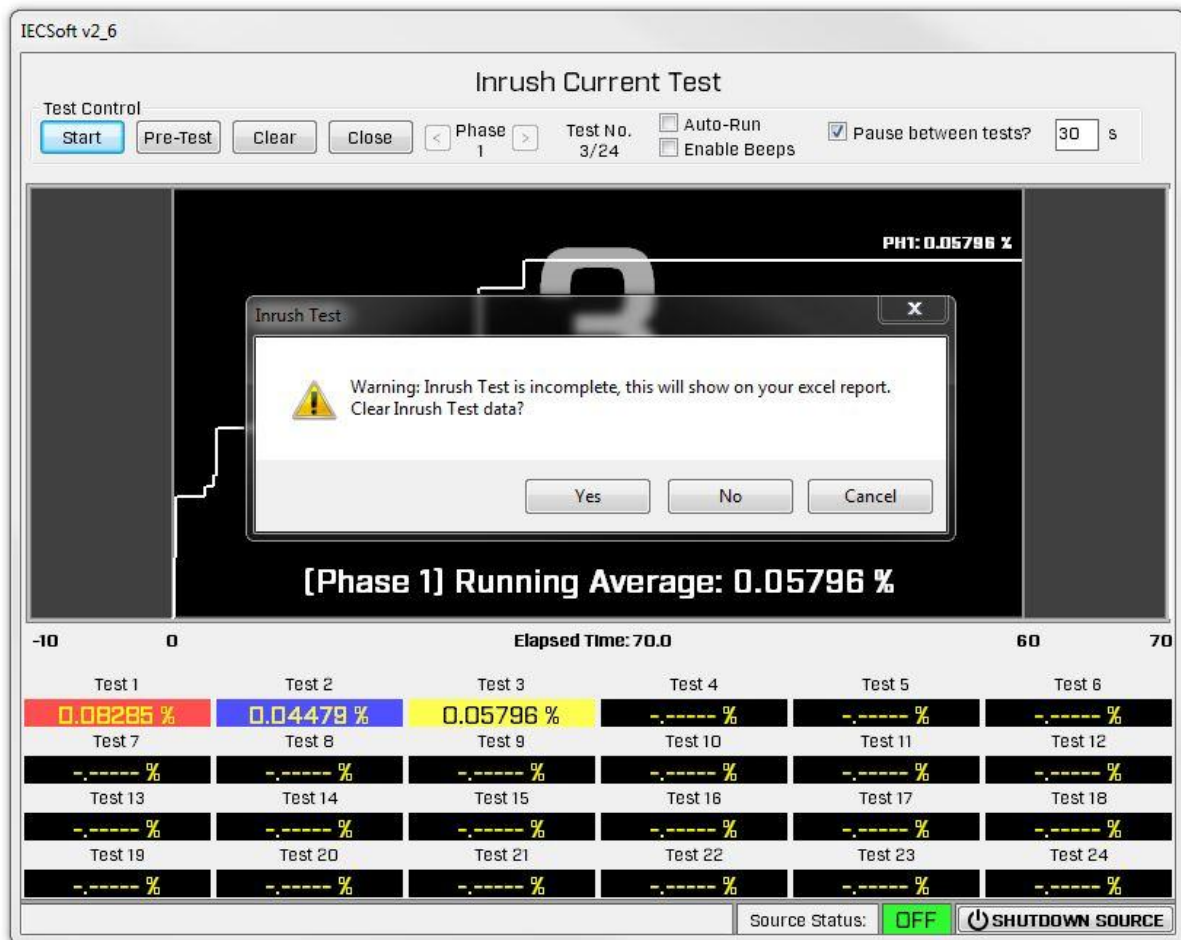
The screen shot below shows the test window with all tests completed. There is now no active test so no test is now highlighted yellow. The highest and lowest dmax results are highlighted in red and blue.



An example Inrush report can be found in section 9.1.1 on page 162 of this document. There is also an explanation of how the Dmax results above and the running average are used to determine if the inrush tests were satisfactory or not.

Click on **"Close"** to return to the main flicker test window.

Closing the inrush window without completing all 24 tests will result in the following message being displayed.



Clicking on "**Yes**" will exit Inrush testing and clear the test results. Clicking on "**No**" will exit Inrush testing but the results will be saved and included when the test results are exported.

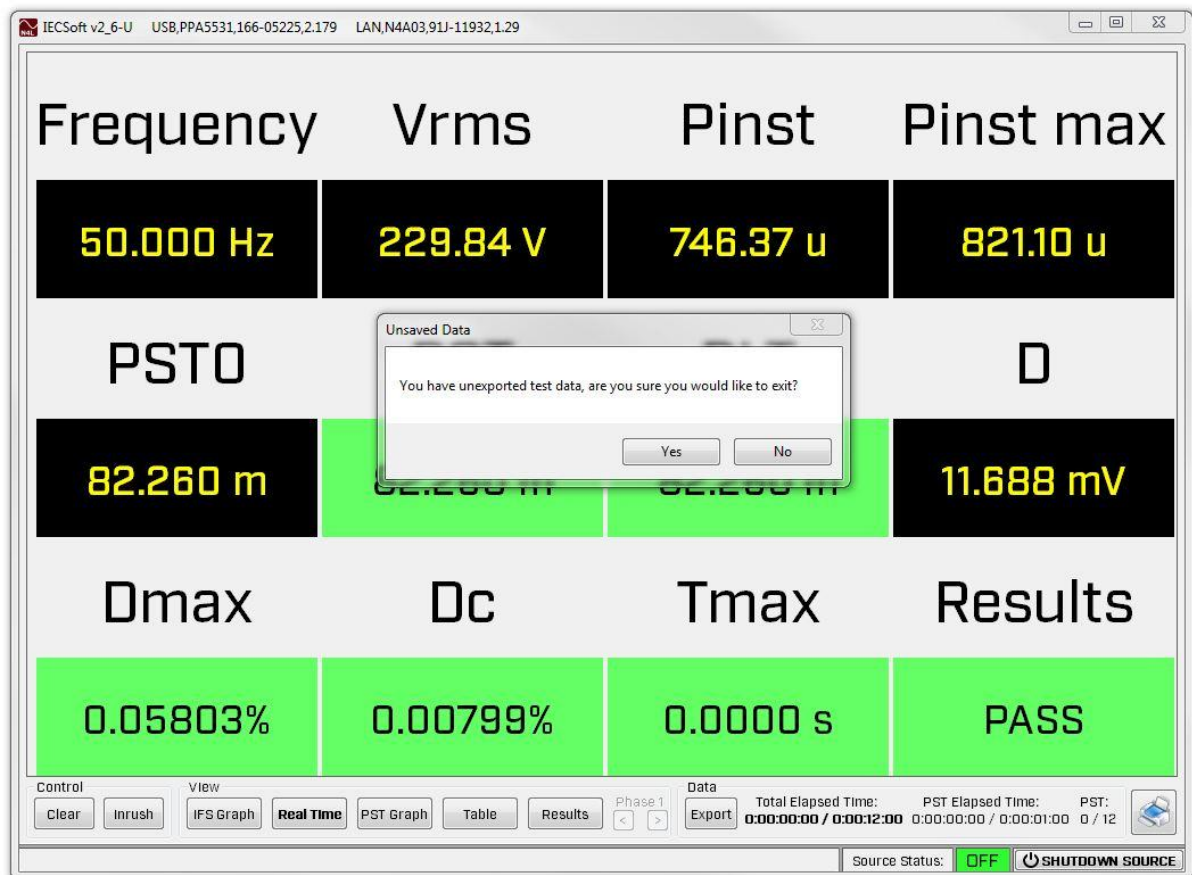
Clicking on "**Cancel**" returns to the Inrush Testing screen.

4.8 Saving Flicker Results.

There are a number of options for saving the results of flicker tests. Section 6.2 of this document provides details of the options available and how to save the results in these options. It is also possible to edit the DUT results before creating the final report.

Please refer to Appendix A (section 9.1 of this document) for examples of Excel and PDF reports for Flicker testing.

4.9 Closing the Flicker test window.



To prevent the accidental loss of test data the above message appears if you attempt to close the Flicker test window after performing a test but not having saved the results.

Clicking on YES will close the window and any unsaved test data will be lost. Clicking on NO will cancel the request to close the test window allowing the test data to be saved.

5 Harmonic Testing.

There are 3 Standards that apply to Harmonic Testing:



International (IEC) Mode:

1 or 3 phase Harmonics - $\leq 16A$.

1 or 3 phase Harmonics - $> 16A$ and $\leq 75A$.

BSEN Mode:

1 or 3 phase Harmonics - $\leq 16A$.

1 or 3 phase Harmonics - $> 16A$ and $\leq 75A$.

Other (JIS) Mode:

1 or 3 phase harmonics ($\leq 16A$).

NOTE: There is no "Other (JIS)" mode for High Current tests. International (IEC) Mode applies.

The Dialog displayed depends on the option selected in the Initial Test setup Dialog (refer to Section 3.3 of this manual).

See section 5.17 of this manual for details on Multipart Testing.

5.1 IEC/BSEN Modes 1 & 3 Phase Harmonics $\leq 16A$

Dialog 1



The test windows appear the same for IEC and BSEN modes but details of the actual mode and appropriate limits are detailed in the Reports.

The user can select the following:

5.1.1 The class of equipment to be tested:

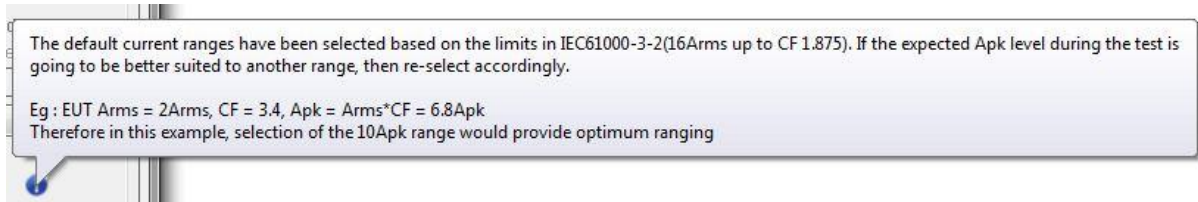
Refer to IEC61000-3-2 and IEC61000-3-12 if you are unsure of the test class for your device. Refer to sections 5.14 to 5.17 of this manual for information about Class C – Dimmer, Class C – Waveform, Class D – Fridge mode and Vacuum modes.

5.1.2 Measurement settings:

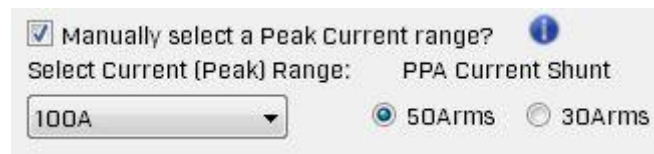
Measured limits are used for all classes except for classes C and D where the user is able to enter Specified Limits for certain measurements.

5.1.3 Manually Selecting PPA Range Settings:

Note: The Range selection defaults to 100A pk – this is because the IEC standard prohibits the use of automatic ranging on the instrument. The info Icon provides further information.



Tick the box “**Manually select a Peak current Range?**” to manually select the current range.



It is very important to use the correct current Range when performing Harmonic tests.

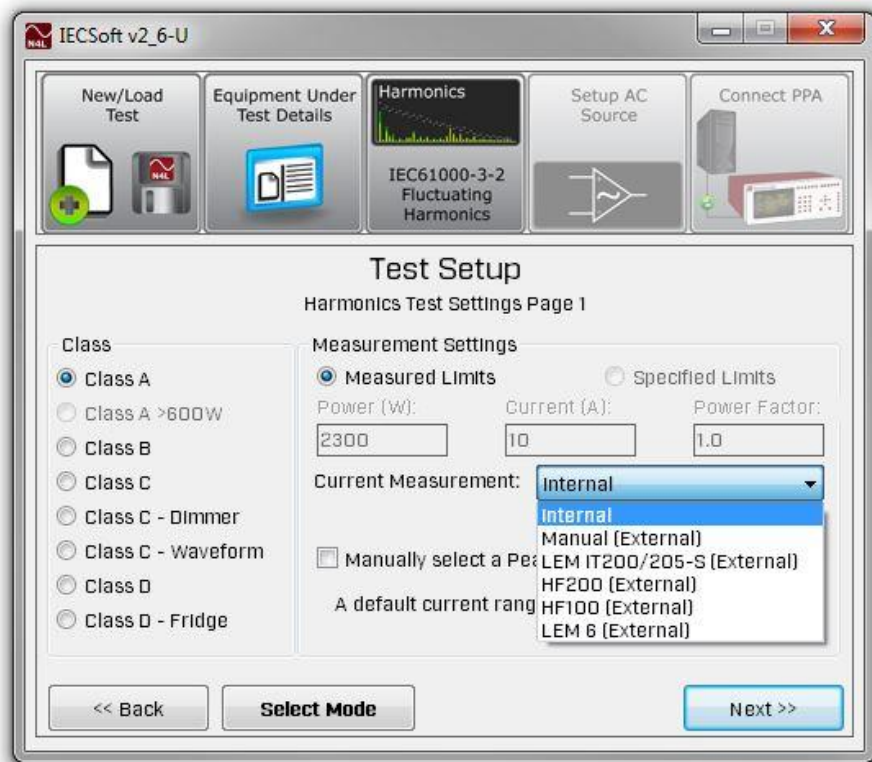
The PPA Current Shunt can be selected by confirming the current rating of the PPA in use for the tests. The current range can be selected from the drop down menu.

The range selected is determined by prior knowledge of the expected maximum peak current during the test or experimentation in normal “power mode” on the PPA.

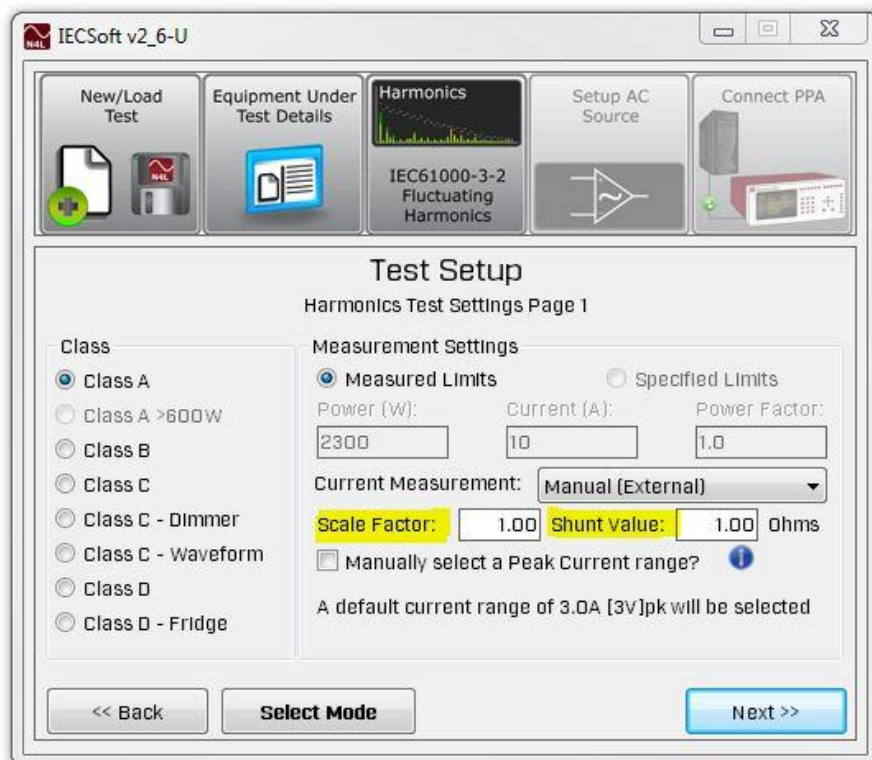
If the correct Current Range is not known, refer to section 2.4.4 for more details on how to determine the correct range.

5.1.4 Current Measurement - Shunt Selection:

The software defaults to Internal shunt selection. If using external current shunts clicking on **Current Measurement** in the Test Setup dialog box will display a drop down menu with a number of External shunt options:



Selecting the Manual (External) option causes the Scale Factor and Shunt Value settings to appear in the Test Setup window.



The appropriate Scale Factor and Shunt Value should be entered before clicking on "**Next**" to continue.

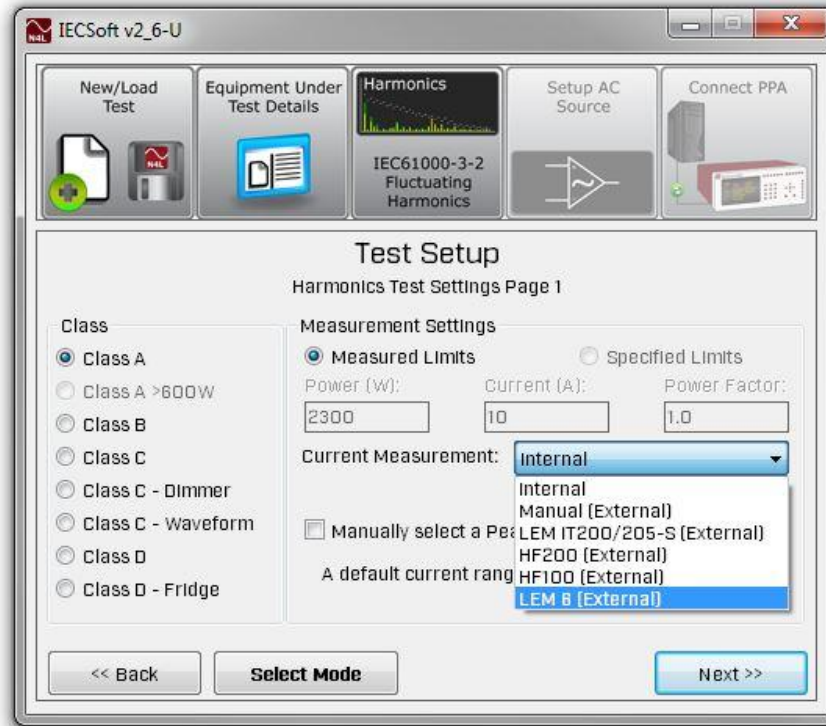
For the HF100 & HF200 options the scale factor and shunt value are not displayed because they are selected automatically:

Click on “**Next**” to continue:

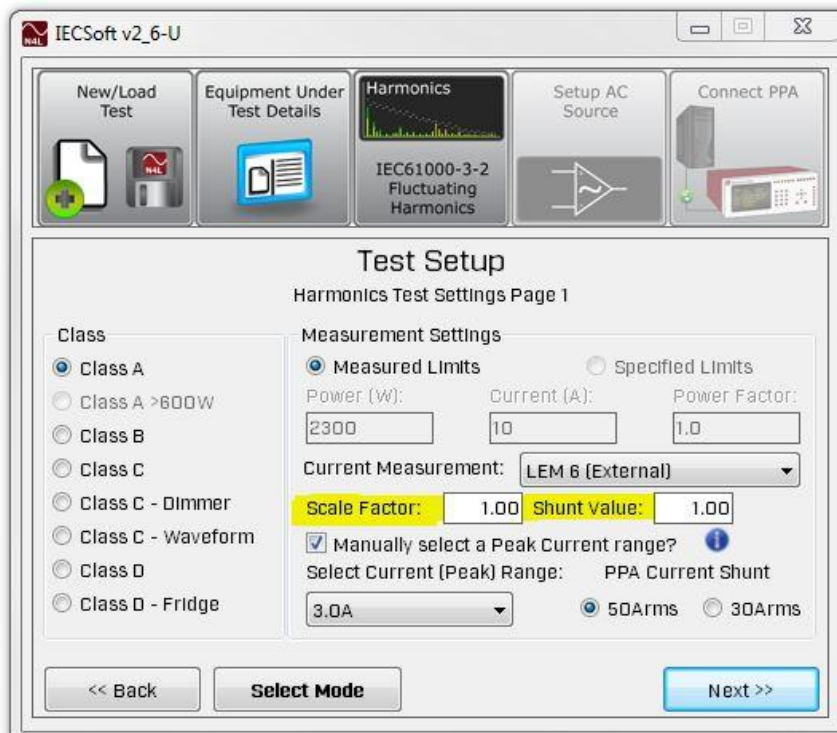
The settings entered on the previous page are displayed.

5.1.5 Shunt Selection options: The LEM 6

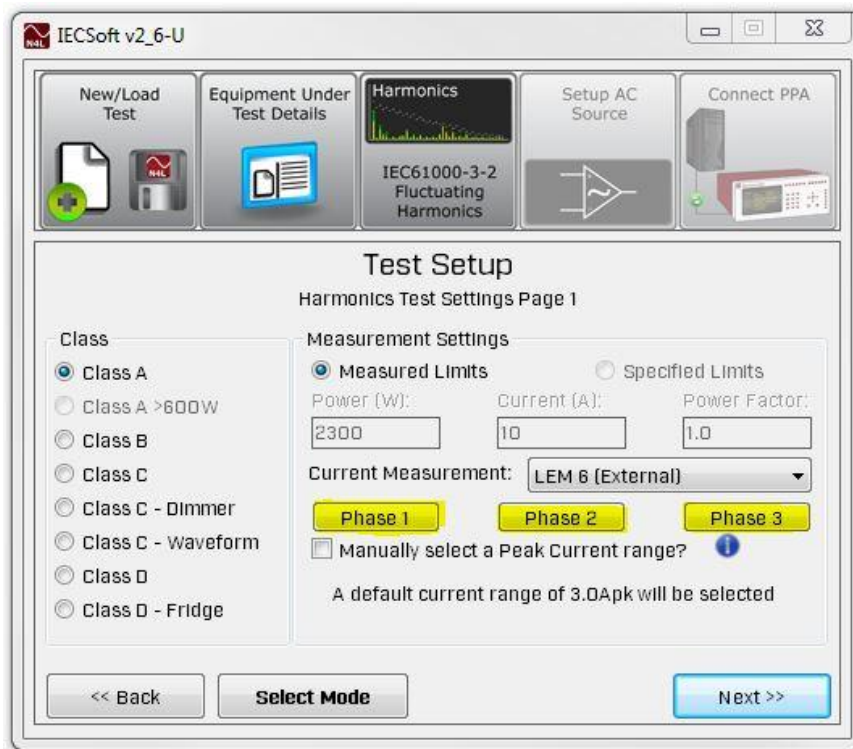
When using a LEM6 for IECSoft testing this option can be selected from the drop down menu.



When performing a single phase test the Scale Factor and Shunt Value can be entered directly in the Test Setup window:

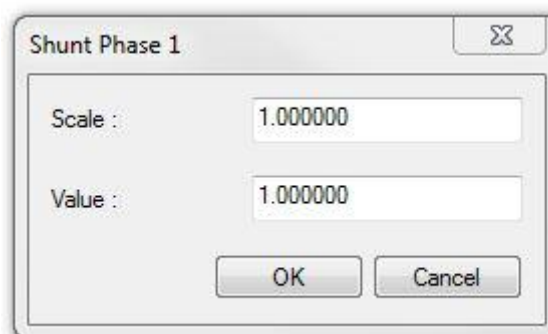


When selecting a 3-phase test the actual Scale factor and Shunt values are not displayed. Three additional buttons appear called Phase 1, Phase 2 and Phase 3.



To enter the Scale Factor and Shunt Values:

Click on **Phase 1** to display the Phase 1 shunt settings menu:

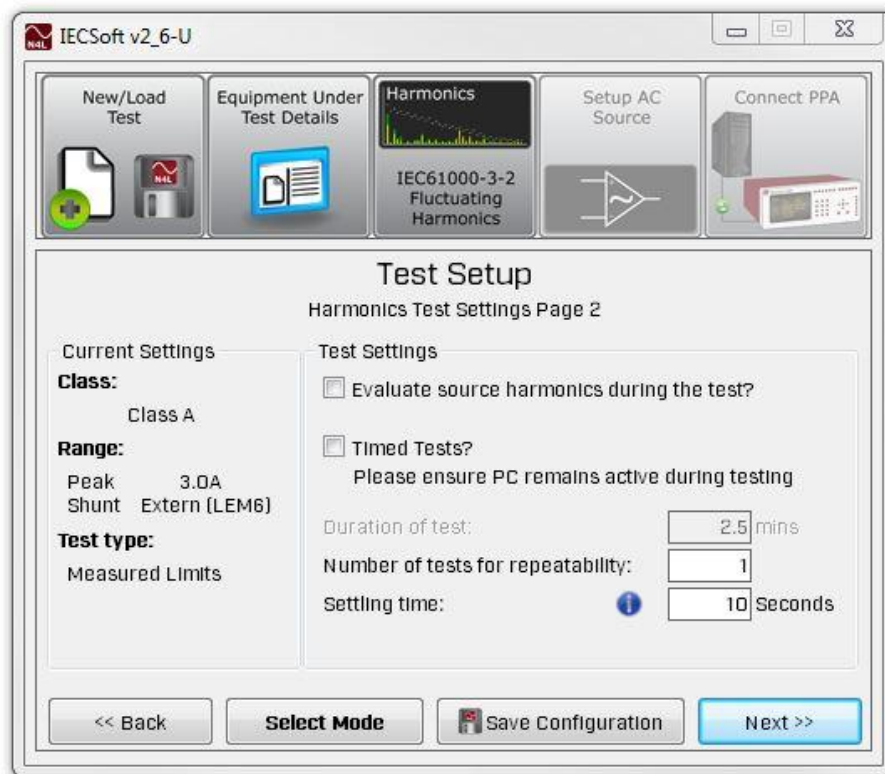


Refer to the calibration label on the LEM 6 instrument and then enter the scale factor and shunt value for Phase 1.

Click **OK** to enter the settings.

Repeat this process for Phase 2 and Phase 3.

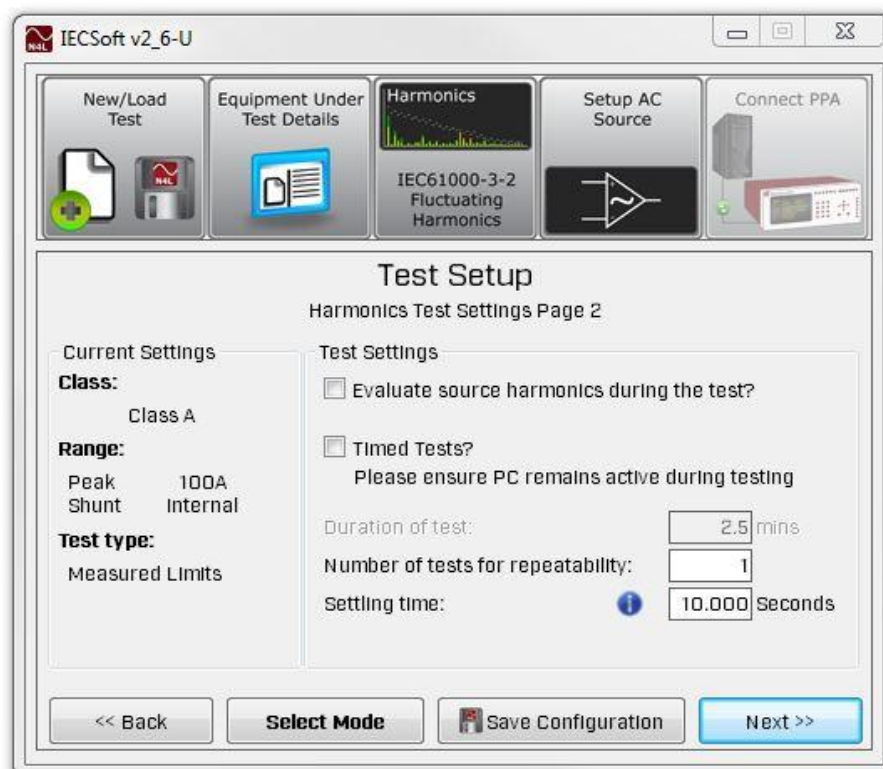
Once all the settings have been entered click on **Next** to continue:



Test Setup page 2 is displayed which is updated to indicate that the LEM6 shunt option was selected. The actual scale factors and shunts values are not displayed but these values will be sent to the instrument before the test begins.

Continue to Section 5.2 in this manual for further details on the Test Setting options in this window.

5.2 Test Settings Page 2



5.2.1 Evaluate Source Harmonics during the test:

Clicking on “Evaluate source Harmonics during the test?” verifies that during the test period the source voltage harmonic levels are below the limits specified in IEC61000-3-2. The limits are specified in appendix E (section 9.5) of this manual.

The default setting is for evaluating source harmonics to NOT be selected.

5.2.2 Duration of Test:

The tests can run indefinitely or for a user defined period. For tests of a defined period Tick the “Timed Tests?” box and enter the required test duration.

This default setting for each test is 2.5 minutes.

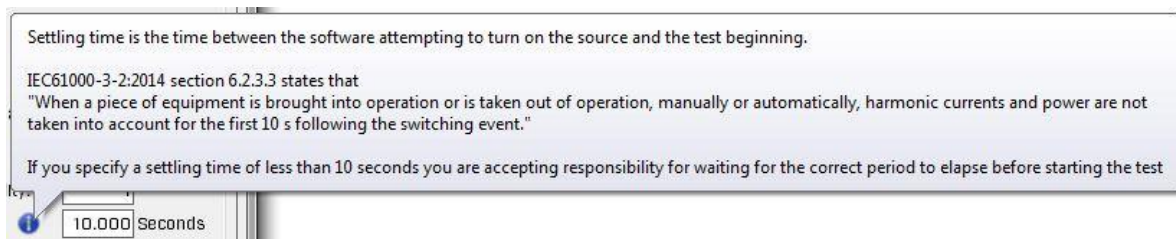
5.2.3 Number of tests for Repeatability:

If testing for reproducibility (refer to section 5.13 of this manual) the number of times the test is to be repeated can be selected.

5.2.4 Settling time:

The "Settling Time" can also be adjusted. The default value is 10 seconds which is defined in the Standard document IEC61000-3-2:2014. This can be adjusted to allow for DUT's that have a settling time of greater than 10 seconds before they are ready for testing to proceed.

Hovering over the info Icon provides more information:



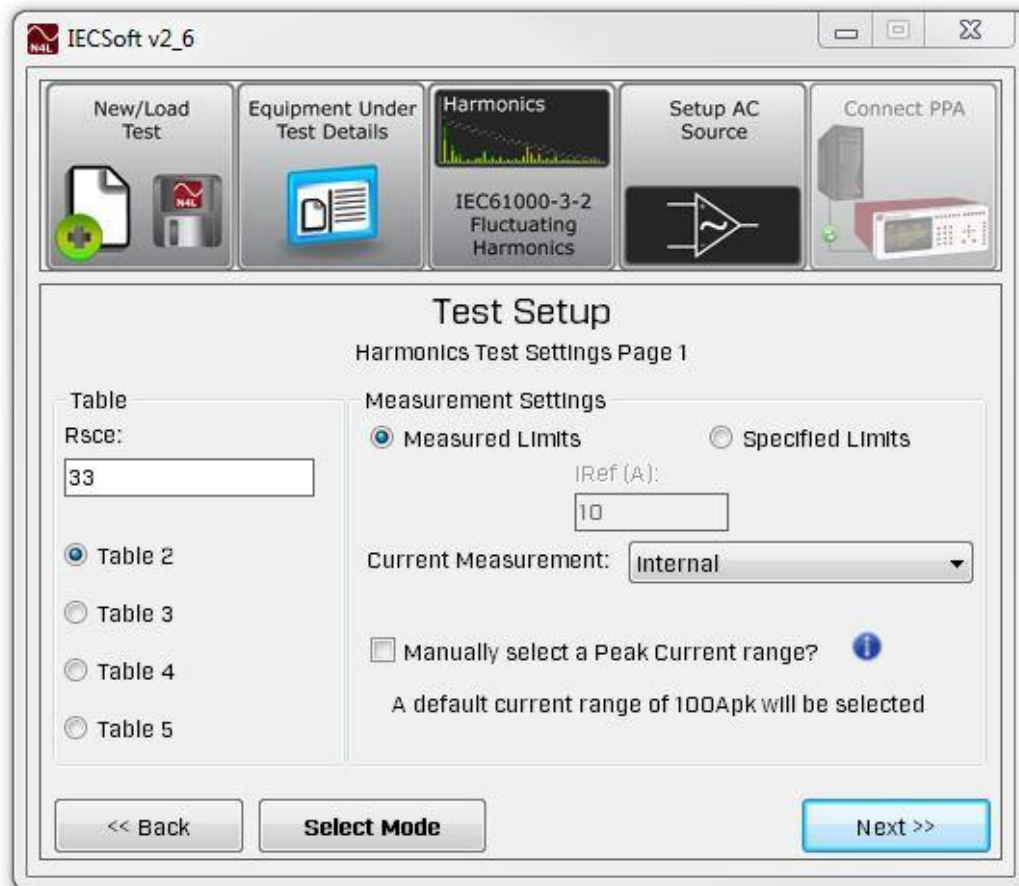
5.2.5 Saving Configuration settings:

The user can if they wish save the "Setup" settings entered so far by clicking on **Save Configuration**. Section 6.7 in this manual will explain how the configuration settings can be recalled.

Click "**Next**" when ready to proceed.

5.3 IEC / BSEN Modes 1 & 3 Phase Harmonics (>16A and ≤75A).

Dialog 1



The user can now select the following:

The Rsce setting default value is 33 but other values can be selected.

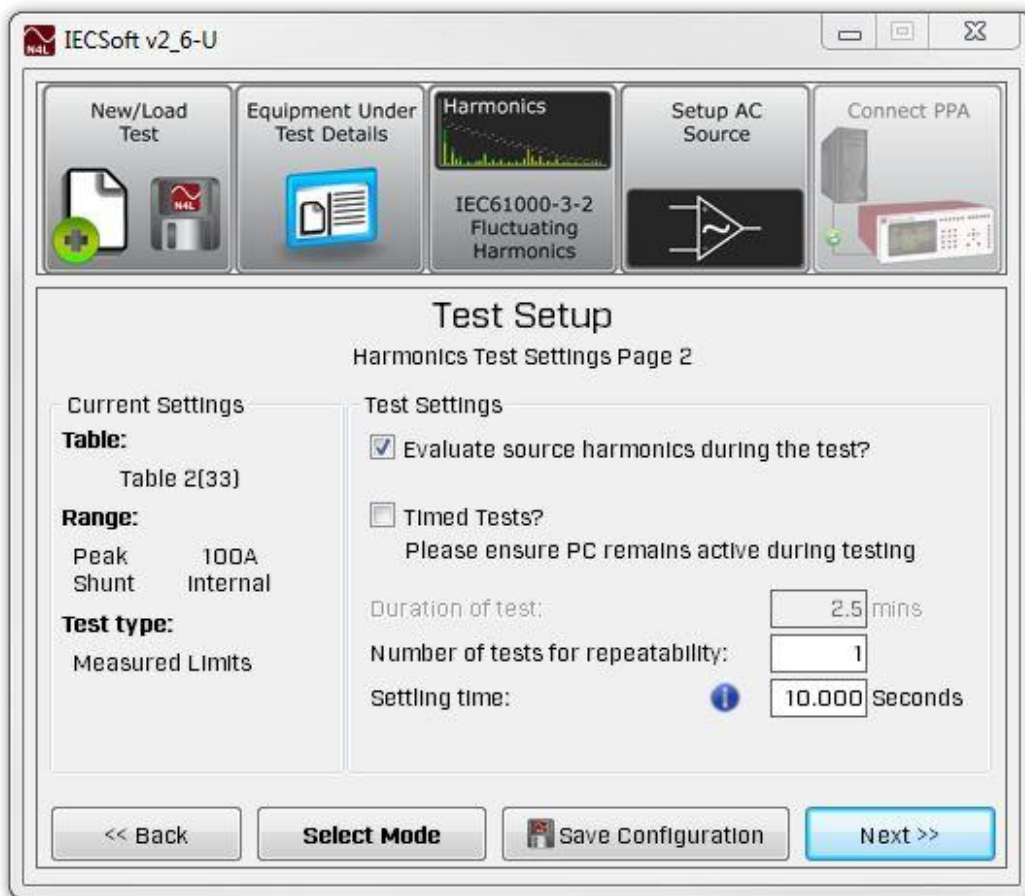
The Table number for the class of equipment to be tested.

Refer to IEC61000-3-2 and IEC61000-3-12 if you are unsure of the correct Rsce setting or table number for the device.

The Range selection defaults to 100A – this is because the IEC standard prohibits the use of automatic ranging on the instrument. See section 5.1.3 in this manual for further information.

Specified Limits can be entered for certain measurements.

Dialog 2



The settings entered on the previous page are displayed.

Note:

Refer to sections 5.1 and 5.2 in this manual for further details on the following settings:

Manually selecting the PPA Range
Shunt selection options
Other settings on Test Setup page 2

Click "**Next**" when ready to proceed.

5.4 Other (JIS) Mode 1 & 3 phase harmonics ≤16A



This is the option that should be selected when testing to Japanese (JIS) Standards.

Only the above two options are available in this mode.

Note: There is no Japanese Standard for Flicker testing so the IEC mode will need to be selected.

Click on the required option and click "**Next**" to continue:

Dialog 1



The user can now select the following:

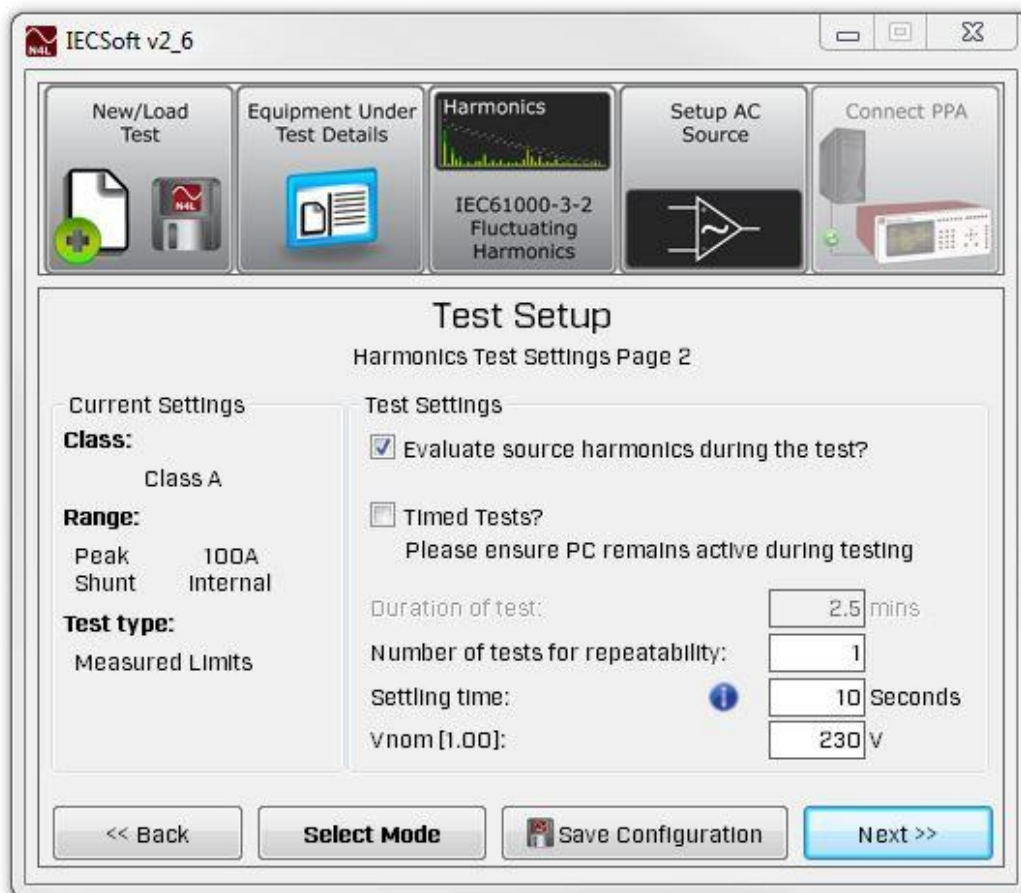
The class of equipment to be tested (Refer to JIS C 61000-3-2) if you are unsure of the test class for your device).

The Range selection defaults to 100A – this is because the IEC standard prohibits the use of automatic ranging on the instrument. See section 5.1.3 in this manual for further information.

For classes C and D the user is able to enter Specified Limits for certain measurements.

In Other (JIS) mode the user also needs to enter the voltage to be used when making the measurements. The software will then display the value of "Vnom" against the test voltage. The default setting is 230V.

Dialog 2



The settings entered on the previous page are displayed.

Note:

Refer to sections 5.1 and 5.2 in this manual for further details on the following settings:

Manually selecting the PPA Range
Shunt selection options
Other settings on Test Setup page 2

Click "**Next**" when ready to proceed.

5.5 Connect to AC Source Dialog.

There are two Source Selection options: AC Source and Other. Selecting AC source allows the software to control the output of a Newtons4th N4A series AC Source. Alternative types of AC Source can be used by selecting the "Other" option.

5.5.1 Connecting to a N4L AC Source.

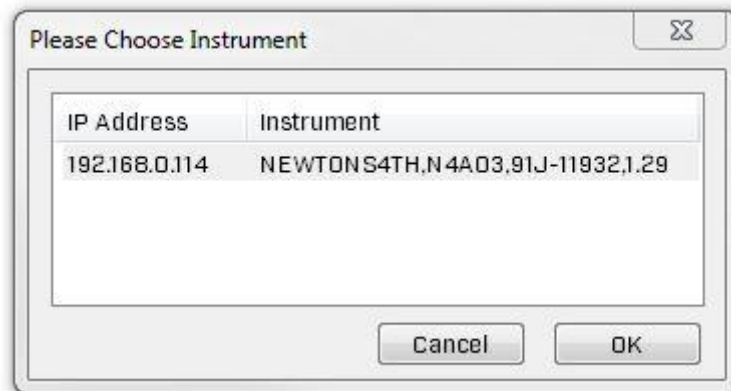
Select **AC Source**.



Before continuing, connect the PC to the AC Source and PPA via LAN, Serial or USB. Connect the instruments to the Device under Test (DUT) and any other test equipment. The instruments and the other test equipment should now be powered up. Ensure that the interface setting selected in the software is the same as that set on the instrument.

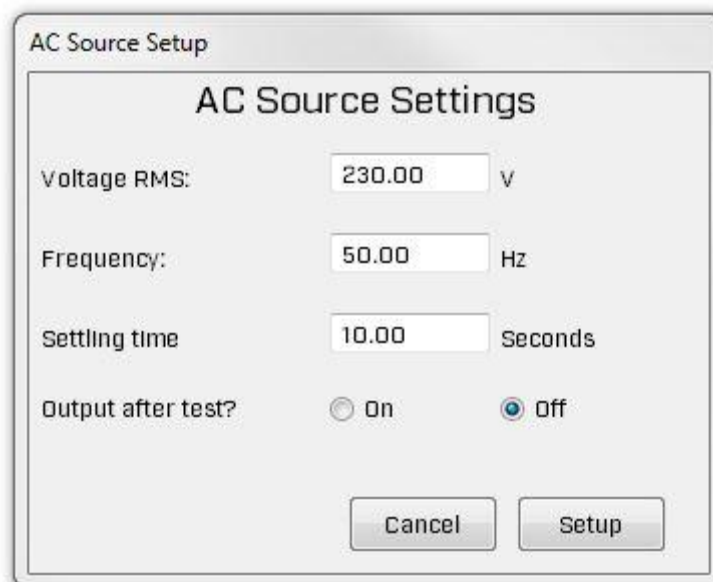
For Serial and USB interfaces select the correct Com Port and for Serial select a Baud Rate of 19200.

If selecting the LAN Interface click on **SEARCH**. The following "Please Choose Instrument" window will appear, select the correct instrument from the list of instruments connected to the LAN bus and then press the **OK** button.



Once the required Interface has been selected Click "**Connect & Setup**" to continue.

The AC Source Settings window appears. Set the required Frequency and Voltage for the test to be performed.



The Settling time defaults to 10 seconds, which is the minimum requirement stated in the Harmonics Standard document. The user is able to adjust this value which causes a delay between starting the test and the test actually starting. The user must ensure that the DUT is stable and the requirements of the appropriate Standard are observed.

The user can also decide if the Source output remains **ON** or is switched **OFF** once the test is completed.

WARNING: Remember that the EUT will remain “**LIVE**” if selecting the option to leave the Output ON after the test is completed.

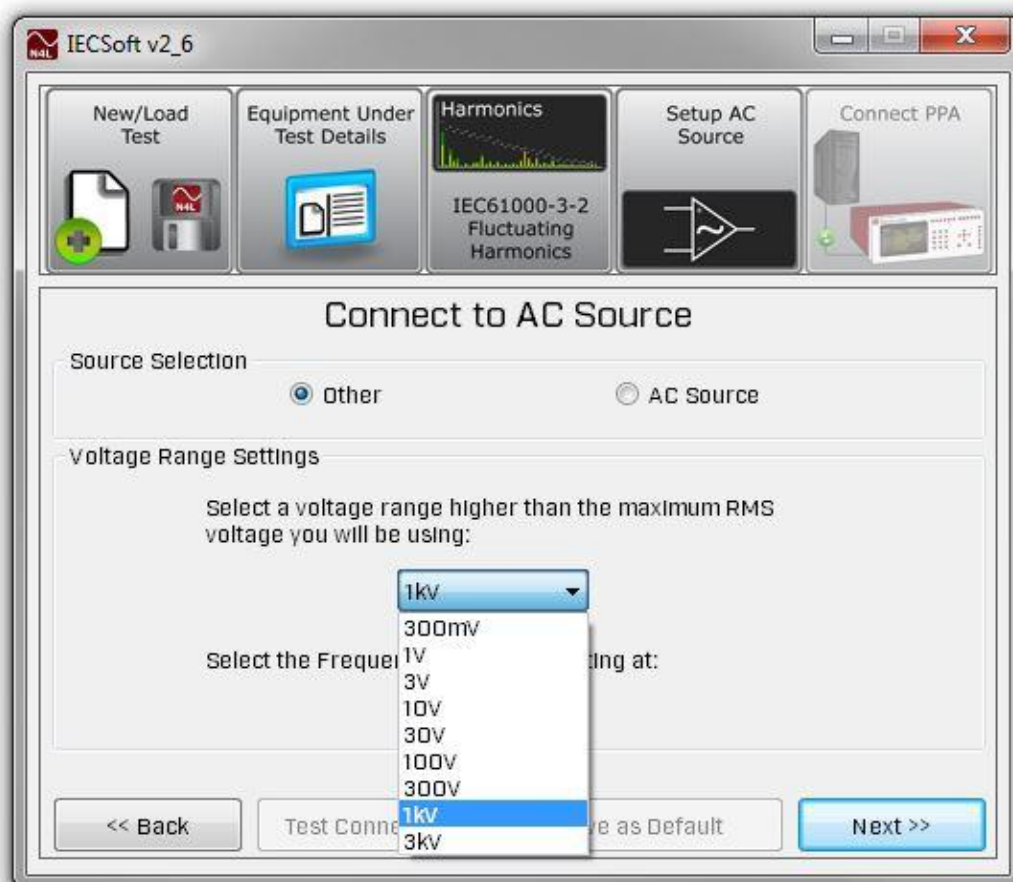
Click on “**Setup**” to continue.

After a short delay the Connect to Instrument dialog appears.

5.5.2 Connecting to “Other” types of AC Source.

The IECSoft Software can be used with any make of AC Source providing they conform to the requirements stated in the various Standard documents.

To use other makes of AC source select “**Other**” in the Source selection options.



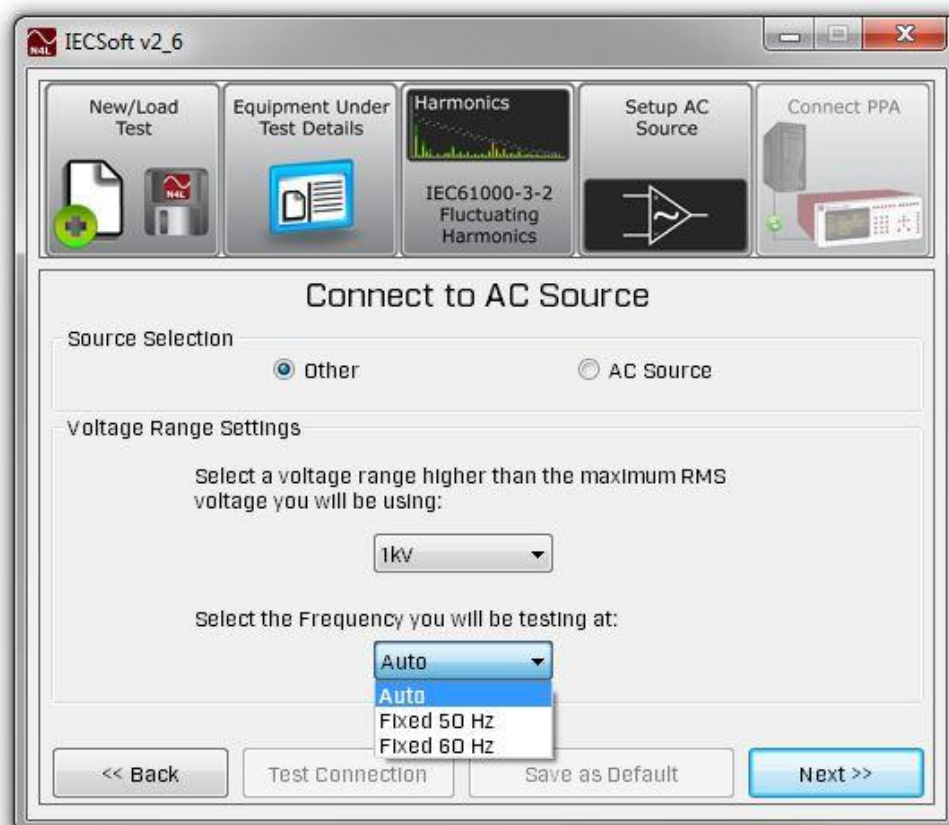
The correct voltage range will need to be selected for the EUT. Click on the voltage range setting to display the drop down menu and then select the appropriate Voltage Range.

NOTE:

When the user selects Source selection "Other" the Software will be unable to control the output of the AC source. The User will have to ensure that the source settings are correct and that the source Output is switched **ON** before the test begins and **OFF** again on completion of the test.

The test frequency is selected automatically by the software but there is the option to select it manually. The default setting of **AUTO** should normally be used.

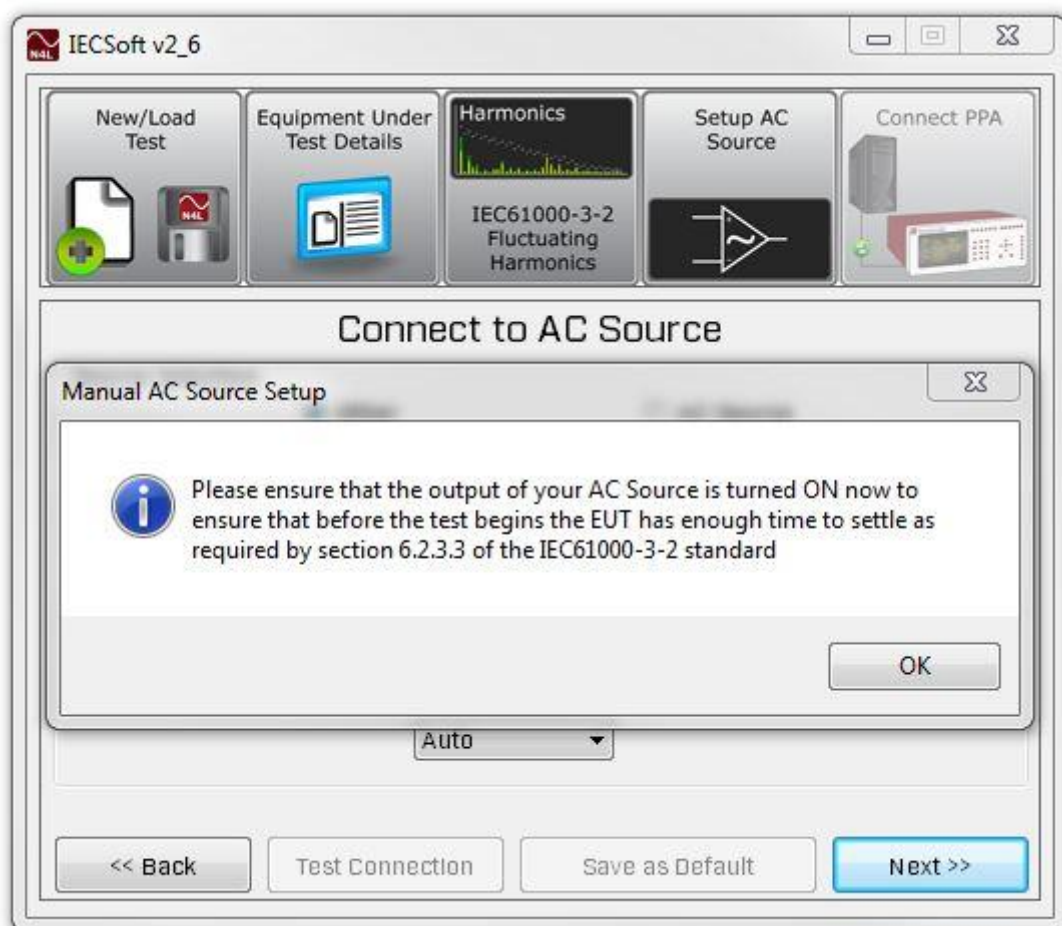
On very rare occasions a few makes of AC Source have caused problems monitoring the frequency whilst the test is running. If this should occur the frequency can be selected manually in the software and the test repeated. Further details can be found later in this section of the manual.



Should there be a problem detecting the frequency when the test starts running (refer to section 5.7.1 in this manual) a warning message will be displayed. The user should return to the Connect to AC Source screen and manually set the frequency to a fixed value of 50Hz or 60Hz.



Having selected the AUTO option or manually set the Test Frequency the user should click on "**Next**" to continue.



The above message is displayed. The user **MUST** switch ON the AC Source output before clicking **OK** to continue. The EUT doesn't have to be turned on now but it must be turned on before clicking on the START button in the Flicker test window.

Note: Failure to follow this procedure can cause the instrument to be setup incorrectly which can cause unnecessary test failures.

Click on **OK** to clear the message and then click on **NEXT** to continue with the test setup procedure.

5.6 Connect to Instrument screen.

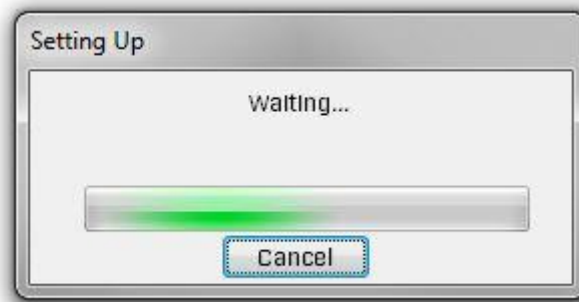


The PPA should be powered up and connected to the other instruments and PC as indicated in the previous section.

Selecting "**Auto Detect**" connection option will display all instruments that the software can connect to. In this example IECSoft auto detected a PPA5511 and a PPA5531. Highlight the required instrument and click on Connect. It is also possible to double click on the instrument to connect to it.

Finally click on "**Connect**" to connect to the PPA.

A series of Setup windows is displayed:



The first window is displayed for a few seconds. A number of Setup windows appear whilst the software sends the necessary commands to prepare the instrument. Finally another WAITING window appears which disappears when the setup procedure is complete.

There is an option to cancel the setup in each of the windows as they appear. Clicking on "**Cancel**" will return you to the "Connect to Instrument" dialog box.

Once the Setup windows are cleared the Harmonic View Real Time Graph is displayed.

5.6.1 Out of Date Firmware message

When connecting to the instrument the IECSoft software checks the firmware version installed on the instrument. Should the firmware version be below the minimum version for use with this version of IECSoft the following message will be displayed.



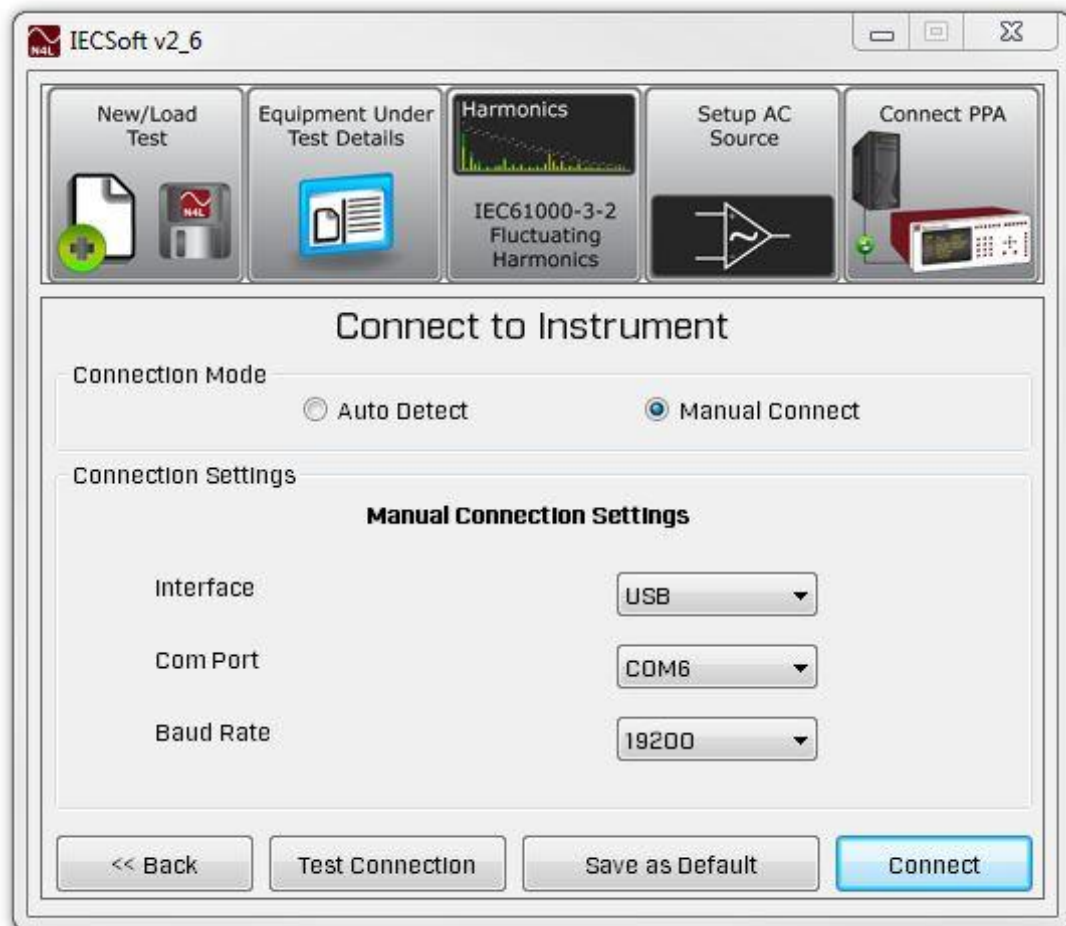
If this message appears the firmware should be upgraded before performing any IECSoft tests.

When upgrading the instrument firmware it is recommended to update to the latest version. At the time of updating this user guide the recommended minimum firmware version is **v2.179**.

Please refer to our website to download the latest version or contact our office or your local distributor.

5.6.2 Manual Connection

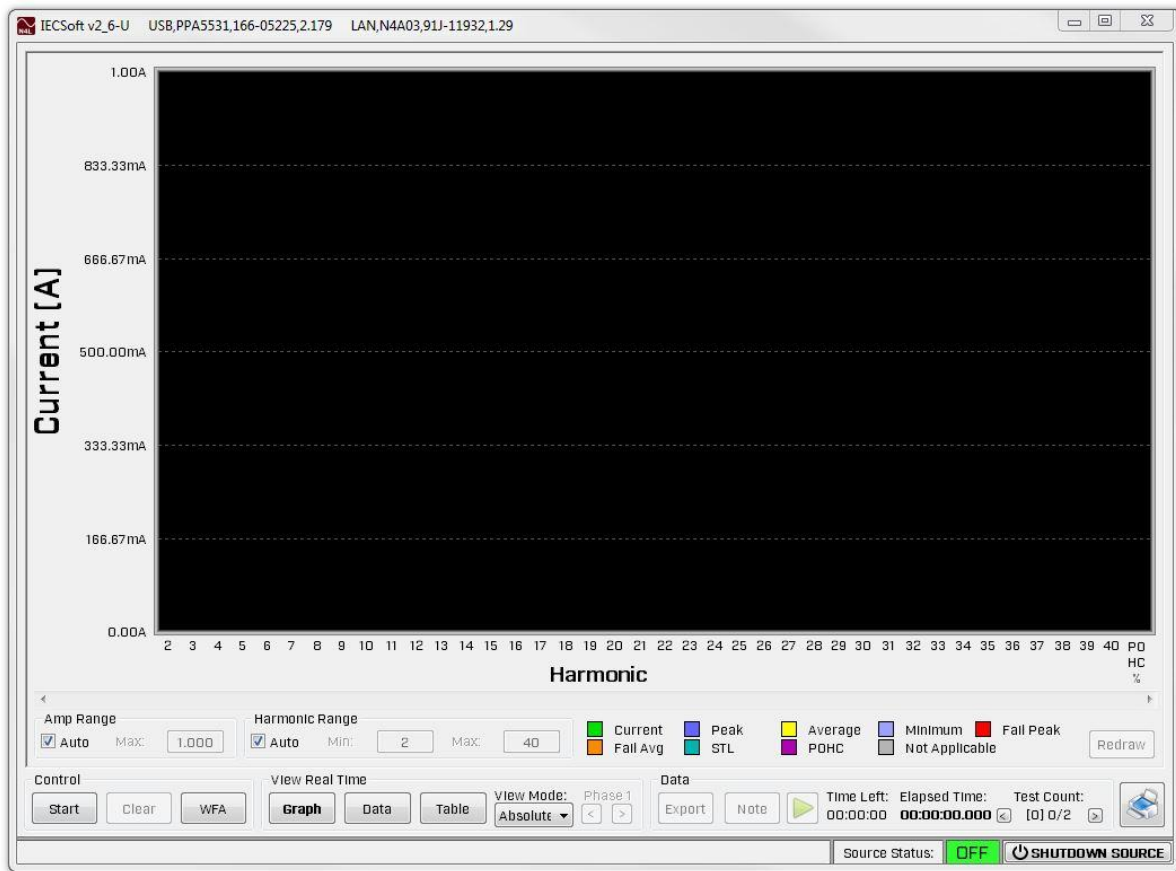
This option can be used if having problems detecting any instruments connected to the PC:



Check the Interface option selected on the PPA and set the Interface option in the Manual connection window (above) to the same setting. Depending on chosen interface option, set the correct baud rate and select the appropriate Com Port.

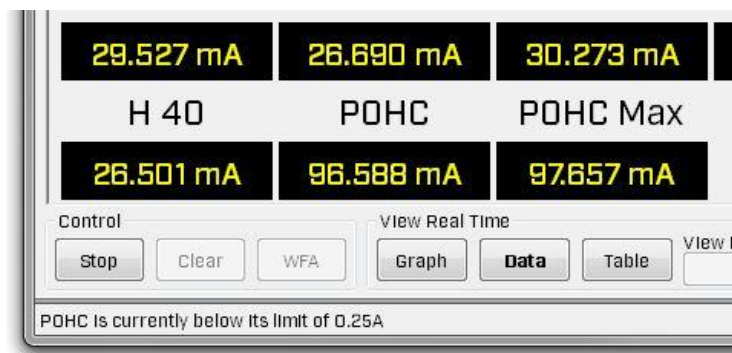
5.7 Performing a Harmonic Test.

The Harmonic View Real Time Graph is displayed by default.



This can be changed to Data view or Table view.

Moving the cursor over the test buttons displays a description of the function of that button in the bottom left hand corner of the test window. This also applies to the result boxes on the View Real Time Data screen etc. In the example below the cursor was placed over the POHC result box.



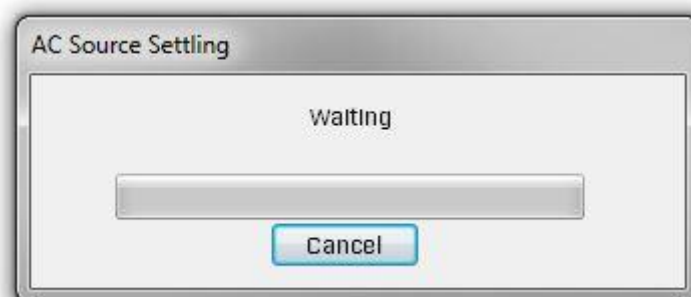
For the tests in this guide Data view was selected before proceeding with the test.

Harmonics data view test window.



Click on “**Start**” to proceed with the test.

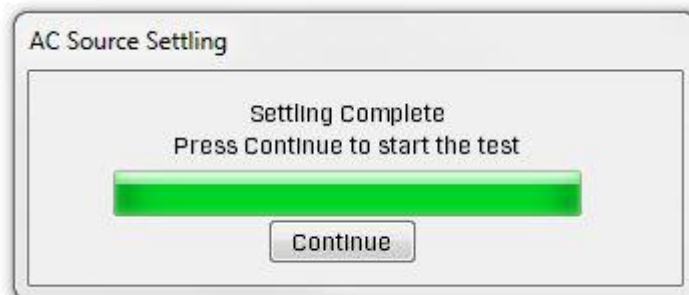
The following window appears for a few seconds when the AC Source Output is switched on.



The window is then updated to display the remaining time until the test continues. This is the Settling time previously entered into the second Test Setup dialog box.



The following message will then be displayed. The user must click on CONTINUE for the test to start.



Note: This allows the user to delay starting the test if required to allow longer for the DUT to stabilise etc.

The test will now start to run with the parameters in the Data view window being updated. The "Time Left" and "Elapsed Time" figures will reflect the selected running time of the test.

Whilst the test is running the view mode can be changed as required to view the results in Graph, Data or Table format.

On completion of the tests a "Test complete" message will be displayed as shown below.



Click "**OK**" to clear the message.

The user can choose not to display this message in future tests if they wish to by ticking the box in the window.

5.7.1 Test Start-up Problems.

When clicking on the START button (highlighted yellow below) to start the test running, the software will check that the AC Source and PPA are correctly setup for the test to begin. If the software detects a problem it will stop the test and automatically start the test again. This will be repeated up to 5 times. The START button will change to Stop and back to Start again each time the test is restarted

If there is still a problem on the fifth attempt the test will be stopped and the message below will be displayed.



Click on NO and check the equipment to confirm everything is setup correctly and that the Source Output is being switched on at the correct time. If there is still a problem the frequency should be fixed to 50Hz or 60Hz (section 5.5.2 in this manual) and the test repeated.

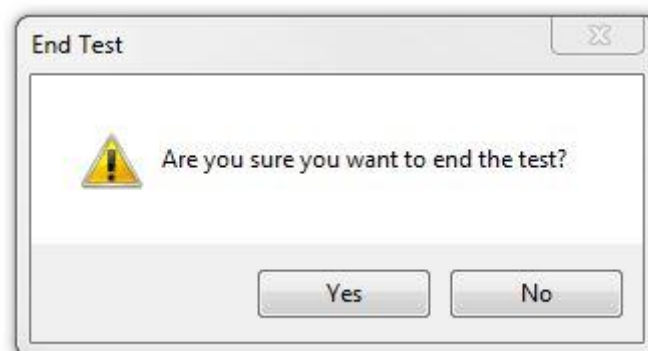
There is the option to click on YES and continue with the test anyway even though the DUT was not detected. This is only for fault investigation purposes etc and the displayed test data will probably be inaccurate. The test will be declared Invalid on completion due to the start up issues. The displayed result in the Excel / PDF report will be "Test – N/A. Invalid DUT".

5.7.2 Running Multiple Tests

When performing more than one Harmonic test the above "Test Complete" message appears when each test is completed. The "Start" button will also be renamed "Next Test". Click on "**OK**" in the Test Complete window and then click on "**Next Test**" to start running the next test.

5.7.3 Stopping the Test

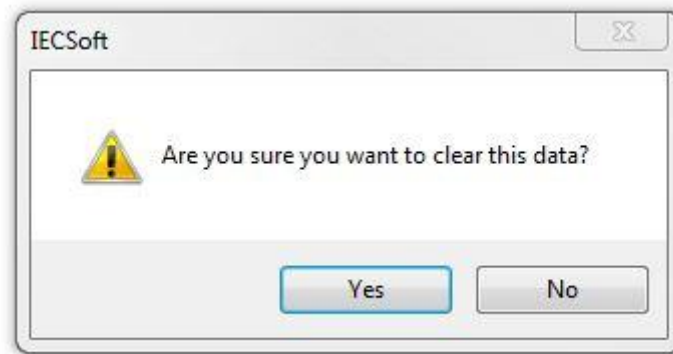
The test can be stopped at any time by clicking on the stop button. A message will be displayed (see below) asking the user to confirm they want to stop the test.



Click on "**Yes**" to confirm that the testing is to be ended. The testing will stop and because the results of the test are valid the Test Complete window is displayed.

5.7.4 Clearing the Results.

The CLEAR button can be found in the bottom left hand corner of the Harmonic test window.



Clicking on this option displays the above message. This is to ensure that the user does wish to clear the data. Clicking on **"Yes"** will erase all of the test data which can't then be retrieved. Clicking **"No"** will cancel the option.

5.7.5 Phase Selection buttons:



These can be found along the bottom of the Harmonic Test dialog but are only available when running 3-phase tests. The Harmonic test dialog defaults to displaying results for Phase 1 but these buttons can be used to display the results for Phase 2 or Phase 3 instead.

This example is an "International (IEC)" 1-phase harmonic test. Class A is selected, running a timed test of 1 minute duration with the number of Tests for Repeatability set to 2. Evaluation of source harmonics is also selected.

5.8 Harmonic Results – Viewing Options.

5.8.1 Harmonic Results – Data viewing mode.

IECSoft v2_6-U USB,PPA5531,166-05225,2,179 LAN,N4A03,91J-11932,1,29

Frequency	Vrms	Arms	Watts	Power Factor	Voltage CF	Current CF
50.000 Hz	229.04 V	762.31 mA	86.653 W	0.4963	1.4043	3.5785
Current THD	THC	THC Avg	H 1	H 2	H 3	H 4
171.4135%	658.03 mA	656.14 mA	384.00 mA	1.6446 mA	358.49 mA	2.0349 mA
H 5	H 6	H 7	H 8	H 9	H 10	H 11
326.91 mA	2.1536 mA	283.79 mA	2.1632 mA	233.25 mA	2.2010 mA	180.13 mA
H 12	H 13	H 14	H 15	H 16	H 17	H 18
2.1064 mA	129.08 mA	2.1335 mA	84.581 mA	1.9552 mA	50.444 mA	2.1172 mA
H 19	H 20	H 21	H 22	H 23	H 24	H 25
30.700 mA	2.1429 mA	26.196 mA	1.8478 mA	27.564 mA	1.7816 mA	25.900 mA
H 26	H 27	H 28	H 29	H 30	H 31	H 32
1.9375 mA	21.446 mA	1.8776 mA	15.619 mA	1.8047 mA	10.352 mA	1.9610 mA
H 33	H 34	H 35	H 36	H 37	H 38	H 39
7.5285 mA	1.9082 mA	6.8482 mA	1.9844 mA	6.5217 mA	1.8737 mA	5.3203 mA
H 40	POHC	POHC Max	Harmonics	Source	Repeatability	
1.9431 mA	55.464 mA	55.864 mA	PASS	PASS	PASS	

Control

Add Test

Clear

WFA

View Real Time

Graph

Data

Table

View Mode: Phase 1

<

>

Data

Export

Note

Time Left: 00:00:00

Elapsed Time: 00:00:00.000

Test Count: [1] 3/3

Source Status: OFF

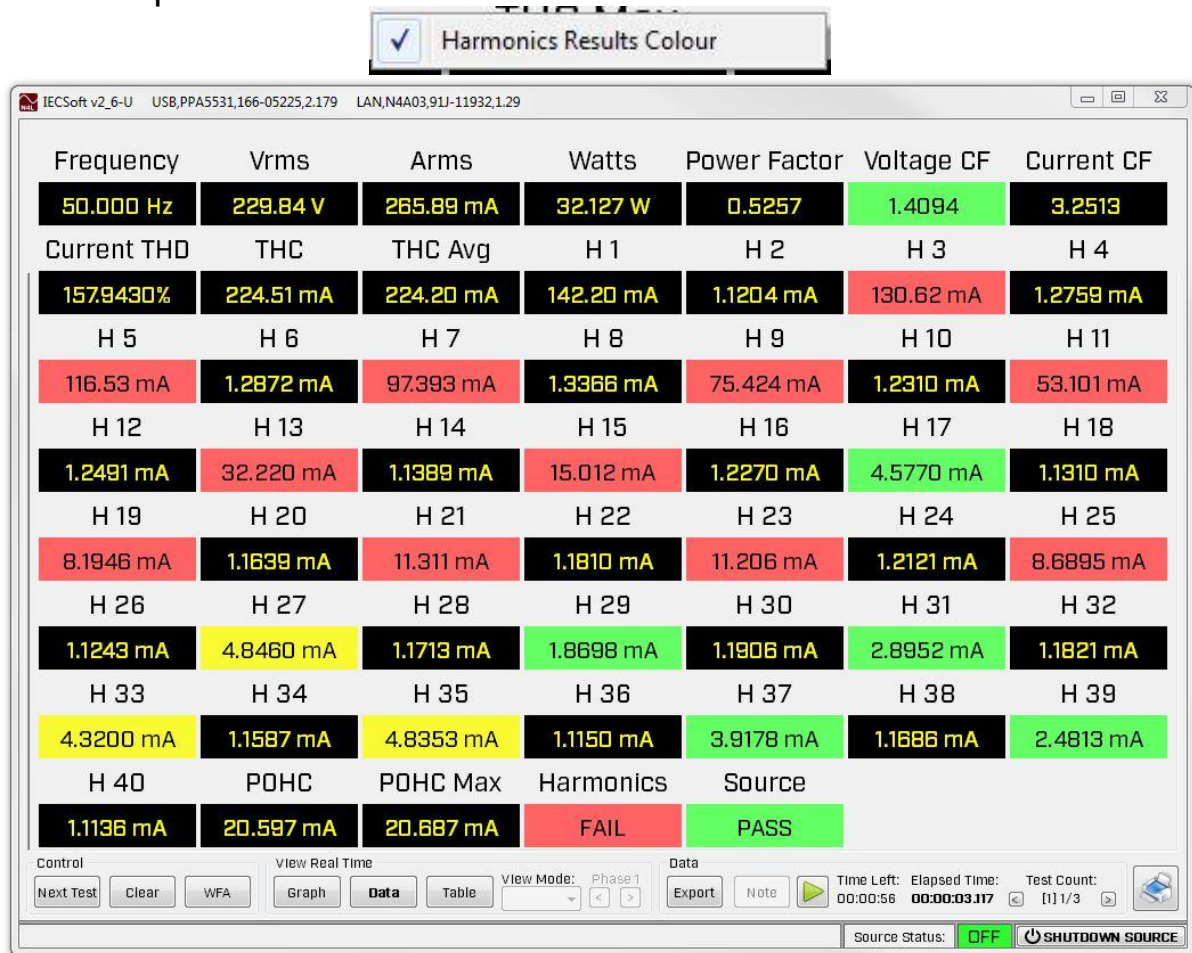
SHUTDOWN SOURCE

In the Data View window the results of the measurements are shown including all harmonics. Additionally final Pass / Fail result windows are shown for the Harmonic and Source tests. If Repeatability tests were performed then a Final result for these tests will also be displayed.

5.8.2 Colour coding of Harmonics

In Data View the Harmonics have a default background colour of black. It is possible to select a coloured background where the colour represents the pass / fail status of each harmonic.

To activate / de-activate this mode right click anywhere in the Data View dialog box and tick / un-tick the Harmonics Results Colour option.



Harmonics are shaded green if they are within the limits or red if the fail to meet the limits.

Measurements shaded yellow indicate that the result is approaching the limit but is still within the specified limit.

Measurements shaded orange (not shown) indicate that they would have failed but have been saved by a STL or POHC exception.

Measurements that are still shaded black have no limits.

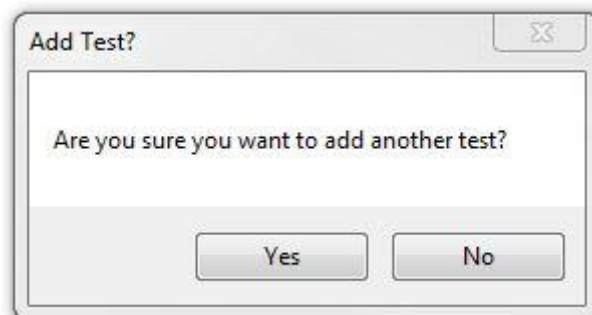
Hovering over any value in the window will display the limit for that value in the bottom left hand corner of the window. E.g. Harmonic 34 is below its average limits of 30mA and is below its peak limit of 50mA.

5.8.3 Add Test option.

On completion of the harmonics test, the start /stop button (see below) changes to "Add Test". This applies to all viewing modes.



This allows the user to run an extra harmonics test if required. Clicking the "Add Test" button will result in the following window being displayed.



Click yes to confirm that you want to add another test. An additional test will be added to the test count at the bottom right of the Viewing window. The "Add Test" button changes back to "Start". Click on "Start" to run the additional test.

If only one Harmonic test had been selected, the "Add Test" option will set the software into Repeatability Testing mode, refer to sections 5.1.1 to 5.1.4 and 5.13 in this manual for further details.

On completion of the additional test the "Add Test" button is again displayed. This allows the user to keep adding extra tests one at a time if required.

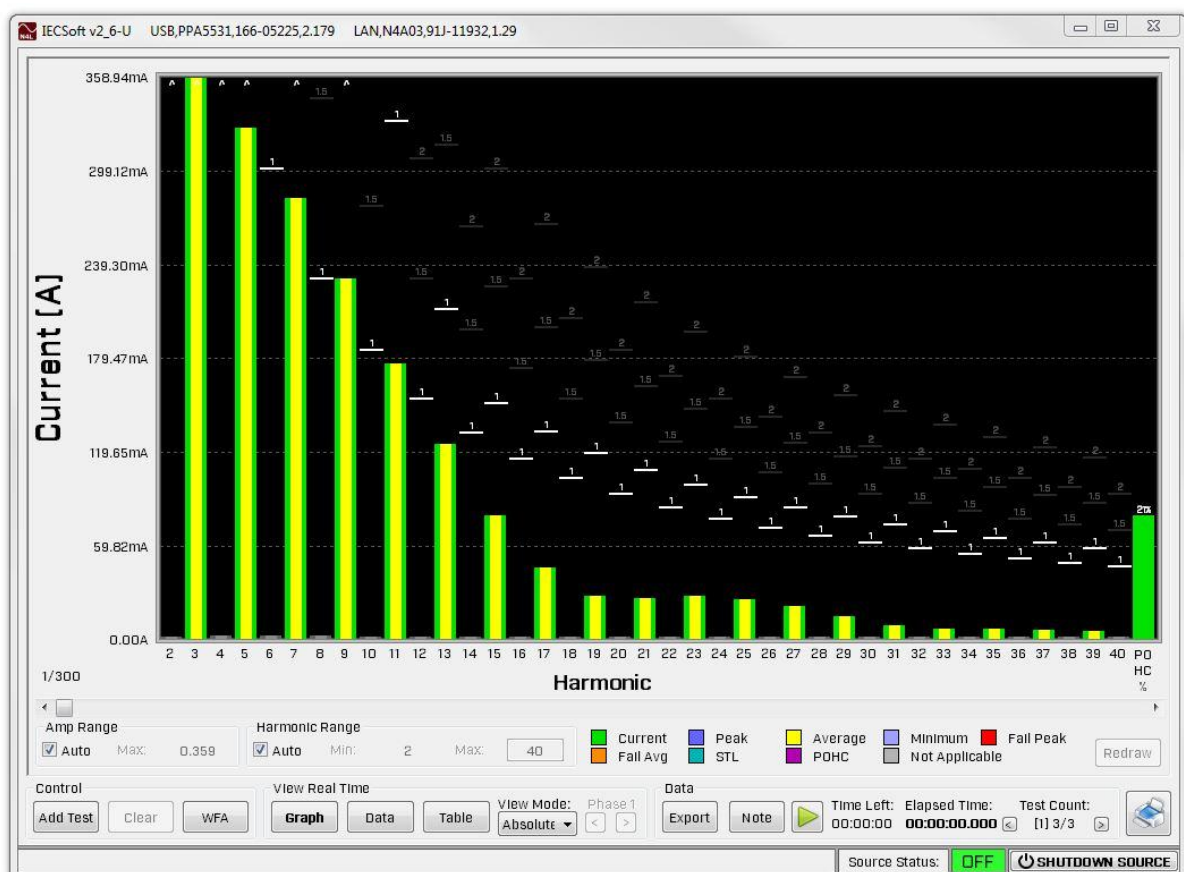
5.8.4 Harmonic Results – Graph viewing mode.

In this mode it is possible to display several graphs of results.

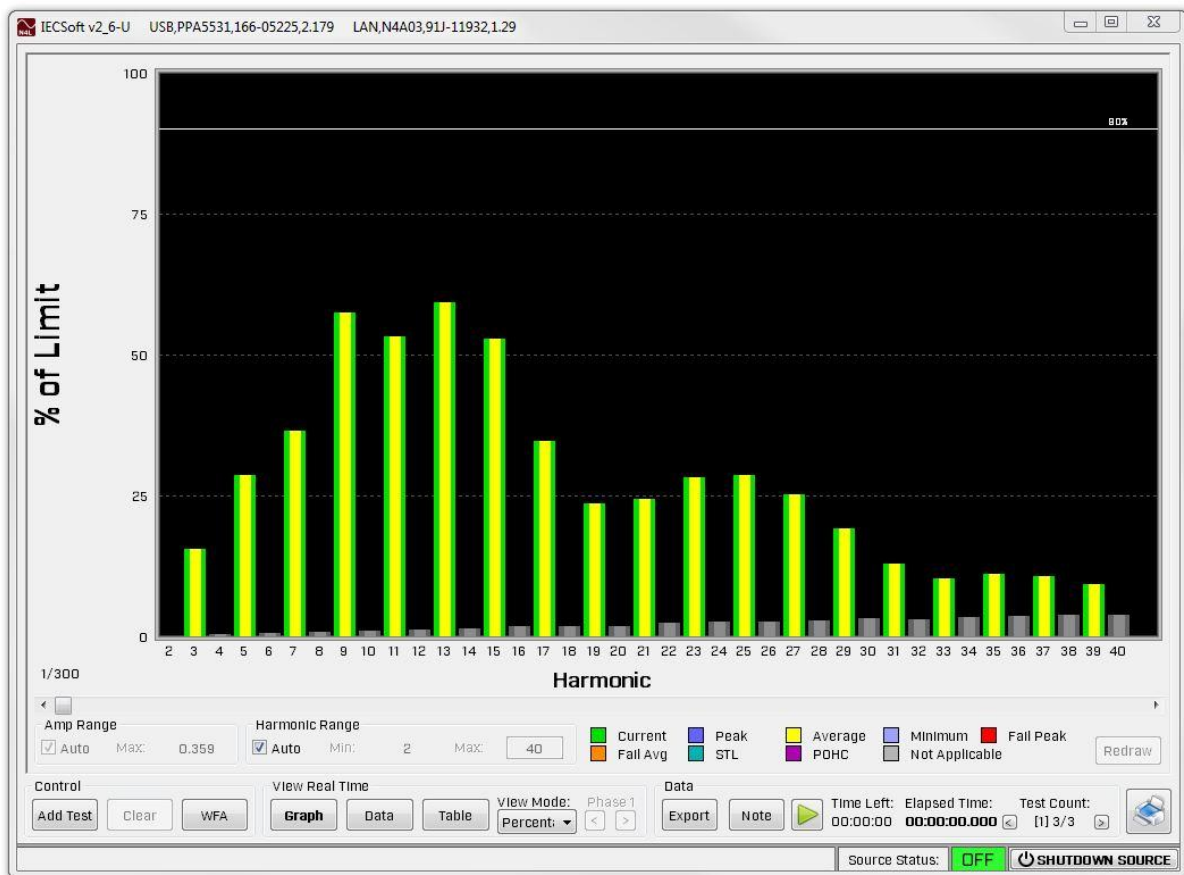
These are:

Absolute
Percentage
Individual
Results
Source

Absolute Graph.



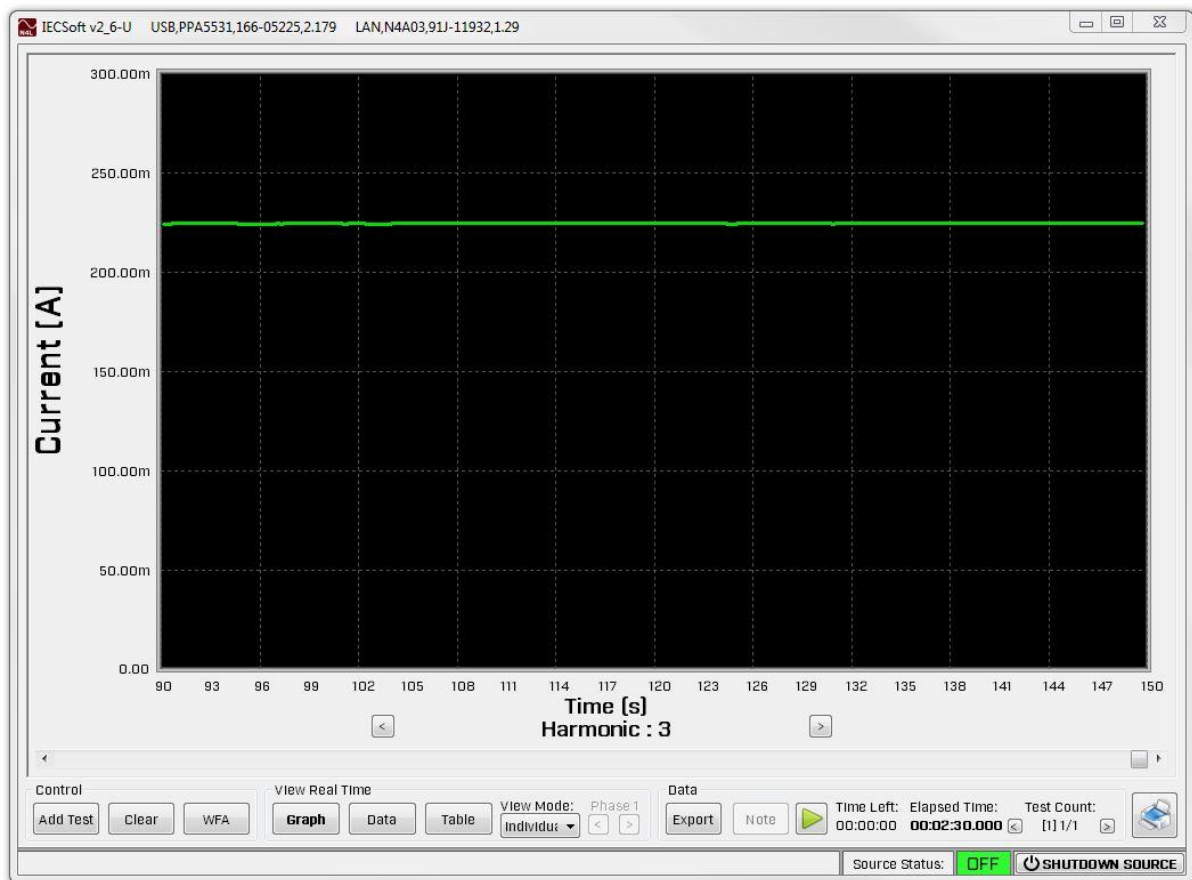
Percentage Graph.



The vertical axis on the Percentage Graph defaults to display 100% when the results obtained are less than 100% of the limit. The axis would automatically be adjusted to display the maximum value for results that are above 100% of the limit.

In this example a line is drawn on the graph to display the 90% of limit level. Depending on the scaling of the axis similar lines will be shown for the 150% and 200% of limit levels.

Individual graph.

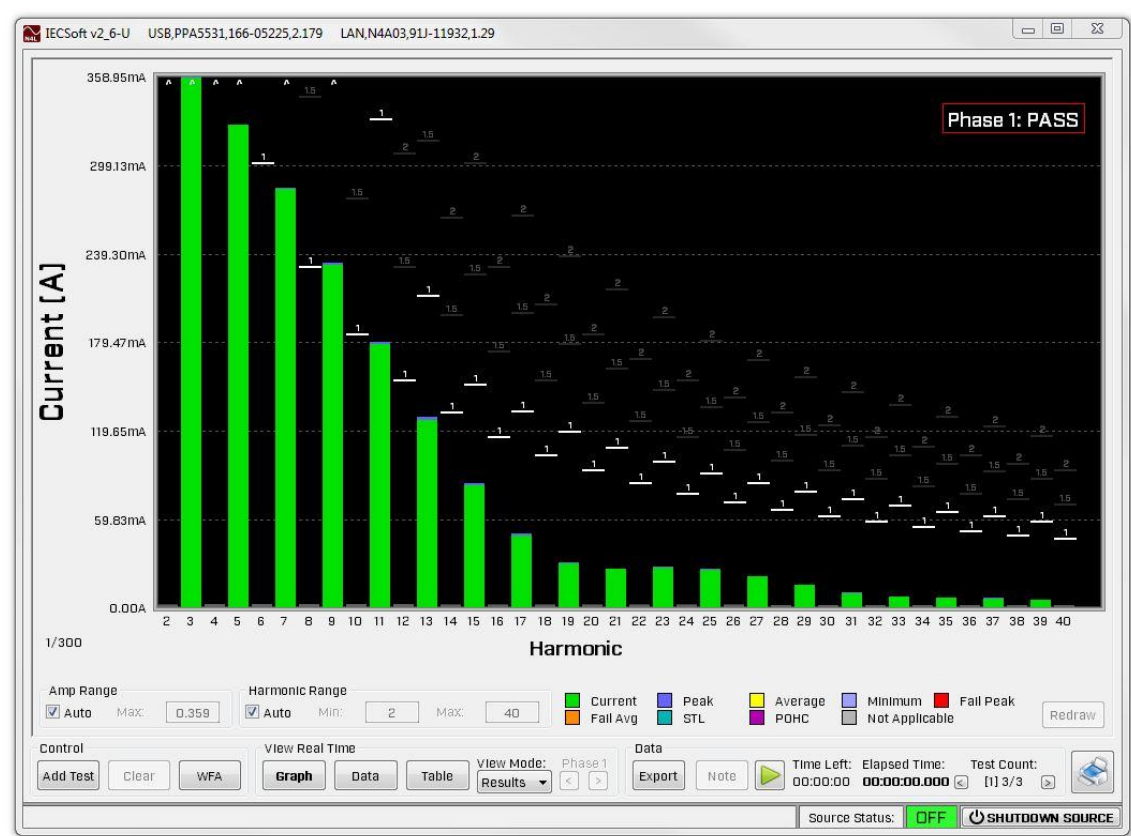


This graph displays the results for a single harmonic.

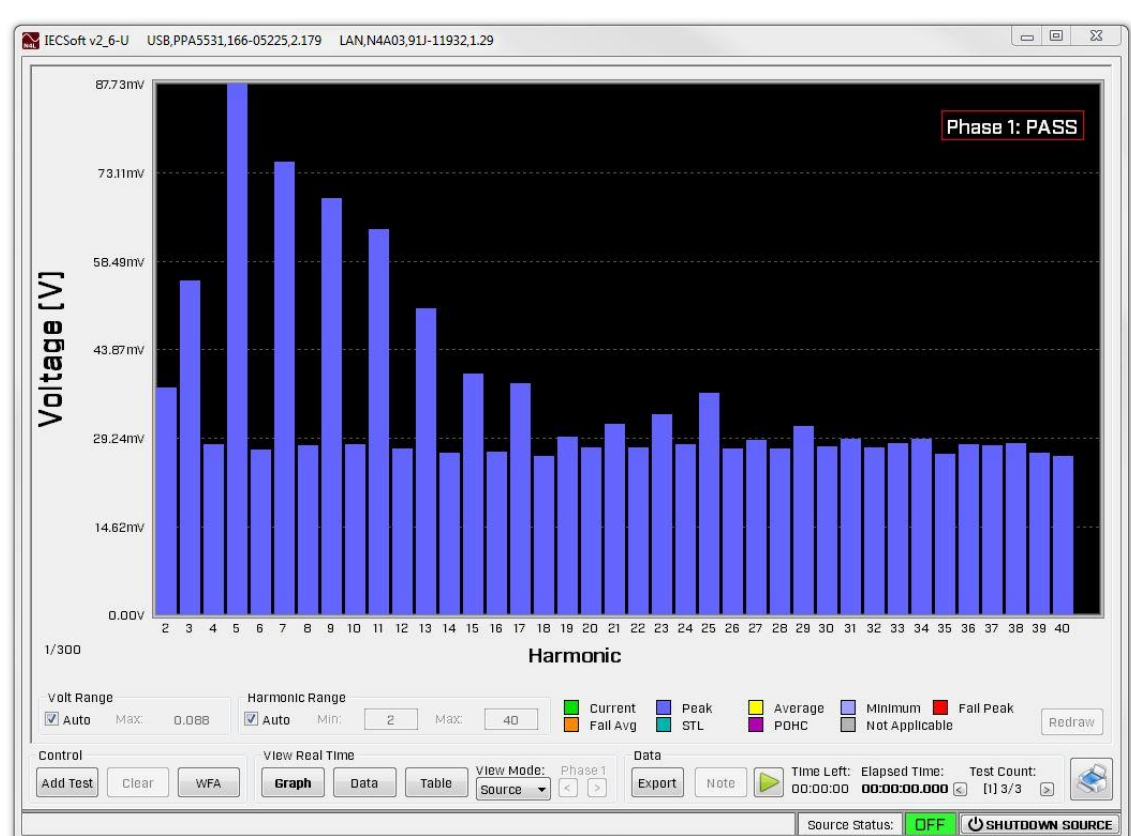
The harmonic that the graph represents is displayed near the base of the graph.

The  and  keys are used to select the actual harmonic to be displayed on the graph.

Results Graph.



Source Graph.



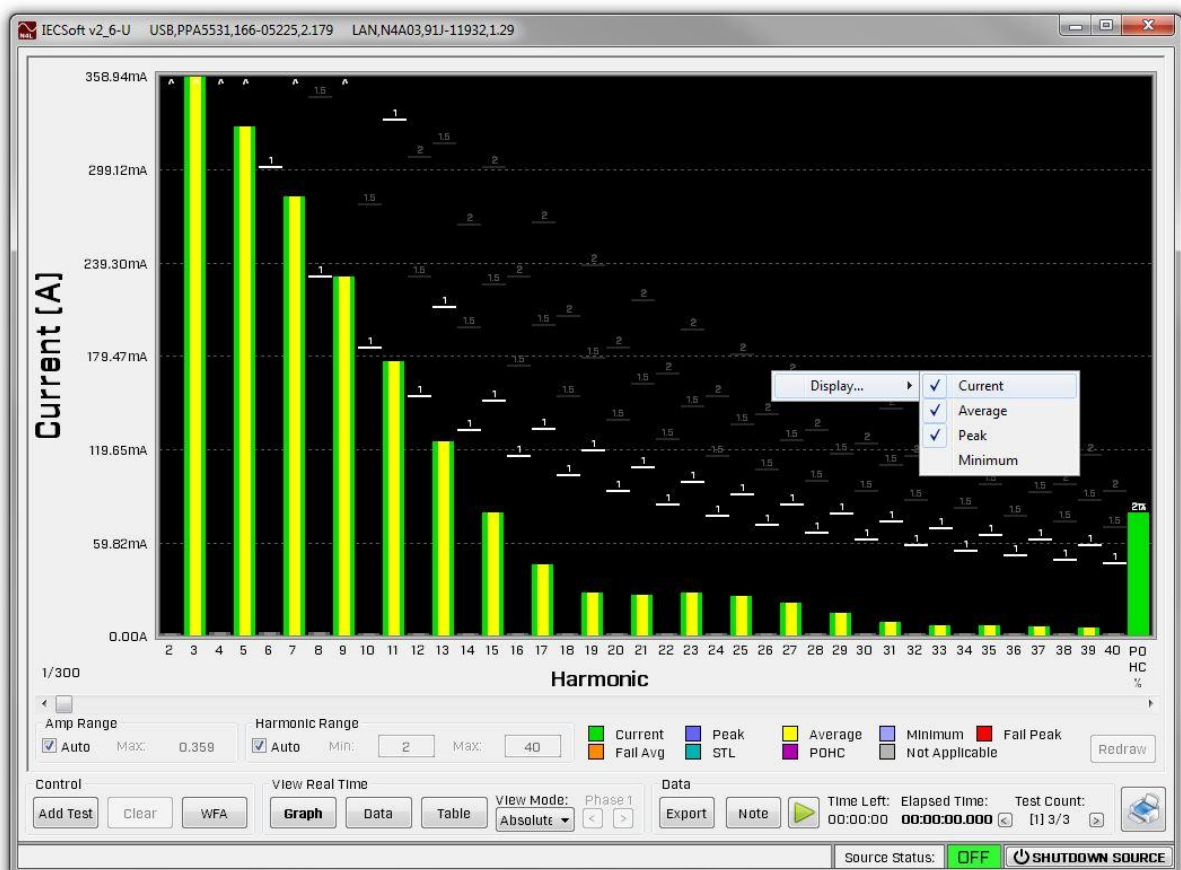
5.8.5 Selection of Parameters displayed on graphs.

On the Absolute and Percentage graphs it is possible to select which parameters are displayed on the bars of the graph.

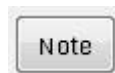
Moving the cursor over the graph area and then right clicking on the PC mouse results in the "Display" option appearing on the graph, move the cursor over "display" results in the display parameters being displayed. Now select the parameters to be displayed on the graph.

Only one parameter can be changed at a time. It is necessary to right click on the graph area again and follow the above procedure for each parameter to be changed. The graph changes automatically when a parameter is selected or de-selected.

The 4 parameters that can be changed are Average, Current, Peak and Minimum. The default setting for the graphs is Minimum de-selected and the other parameters all selected.

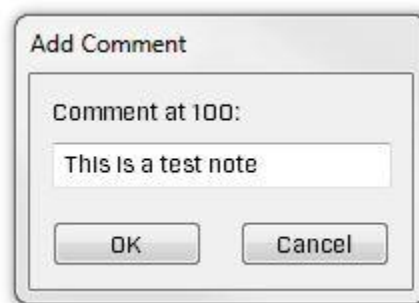


5.8.6 Adding Notes to graphs:

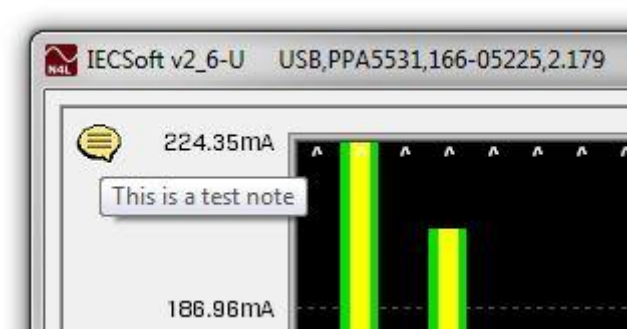


Notes can be added to the Absolute and Percentage graphs. A slider bar can be seen on the graph below the title for the horizontal axis. Just above the slider bar to the left hand side of the graph are the test number/ total number of tests and the total test time. Moving the slider bar adjusts the test number and the test time at that test number.

To add a Note move the slider bar to the required data number. Then click on the NOTE Icon to open the "Add Comment" window. Enter the Notes / Comments and then click on "OK" to save the Notes and close the window.



A message Icon is displayed in the top left hand side corner of the graph window for any test number with a saved Note.



To read a stored message move the slider bar and stop on any test when the message icon appears. To view the message hover the mouse over the message icon. The message will be displayed just below the message icon for 5 seconds.

5.8.7 Harmonics graph playback mode:



When this button (green arrow) is pressed the software will playback the harmonic test results stepping through the data in real time. Any of the graph viewing modes can be replayed. Whilst replaying the test the icon changes to the red square, playback can be stopped at any time by clicking on the button. The icon will revert to a green arrow, click on it again to start playback again from the beginning.

5.8.8 Customised Amplitude and Harmonic Ranges:

The user can customise the settings for the amplitude and harmonics ranges on certain graphs. The table below indicates the ranges that can be customised on each of the graph options.

	Y axis	X (Harmonic) axis
Absolute	Yes	Yes
Percentage	No	Yes
Individual	N/A	N/A
Results	Yes	Yes
Source	Yes	Yes

To change the Y axis Range remove the "tick" from the Volt Range Auto box and then enter the new Max: Range value. Click on "Redraw" to display the graph using the new range. These settings can be found at the base of the graph.

The X axis Range defaults to display Harmonics from 2 to 40. To display a different range of harmonics on the graph remove the "tick" from the Harmonic Range auto box. Enter the number of the minimum and maximum harmonics to be displayed. Click on "Redraw" to display the graph using the new range of harmonics.

5.8.9 Harmonic Results – Table viewing mode.

	Te...	P...	Time	Frequency (...)	Vrms (V)	Arms (A)	Watts (W)	Power Factor	Voltage CF	Current CF	Current THD...	THC (A)	THC Avg...	Pl
1	1	1	08:50:11...	50.0000	229.0107	0.7585	86.8335	0.4999	1.4042	3.5401	1.6984	0.6533	0.6533	0.
2	1	1	08:50:11...	49.9999	229.0042	0.7586	86.8290	0.4998	1.4040	3.5388	1.6982	0.6533	0.6533	0.
3	1	1	08:50:12...	50.0000	229.0073	0.7587	86.8264	0.4997	1.4041	3.5376	1.6985	0.6534	0.6534	0.
4	1	1	08:50:12...	50.0000	229.0044	0.7588	86.8231	0.4997	1.4042	3.5433	1.6985	0.6535	0.6534	0.
5	1	1	08:50:12...	50.0000	228.9993	0.7588	86.8229	0.4997	1.4036	3.5406	1.6986	0.6536	0.6534	0.
6	1	1	08:50:12...	50.0000	229.0020	0.7587	86.8131	0.4997	1.4037	3.5456	1.6990	0.6535	0.6534	0.
7	1	1	08:50:12...	50.0000	228.9976	0.7587	86.8098	0.4997	1.4037	3.5464	1.6993	0.6535	0.6535	0.
8	1	1	08:50:13...	50.0000	229.0061	0.7587	86.8076	0.4996	1.4036	3.5469	1.6992	0.6535	0.6535	0.
9	1	1	08:50:13...	50.0000	229.0093	0.7587	86.8076	0.4996	1.4038	3.5483	1.6988	0.6535	0.6535	0.
10	1	1	08:50:13...	50.0000	229.0037	0.7587	86.8020	0.4996	1.4039	3.5587	1.6992	0.6536	0.6535	0.
11	1	1	08:50:13...	50.0000	229.0112	0.7587	86.8025	0.4996	1.4039	3.5563	1.6996	0.6537	0.6535	0.
12	1	1	08:50:13...	50.0000	229.0117	0.7588	86.8053	0.4995	1.4043	3.5621	1.6997	0.6537	0.6535	0.
13	1	1	08:50:14...	50.0000	229.0073	0.7589	86.8146	0.4995	1.4041	3.5590	1.6997	0.6538	0.6535	0.
14	1	1	08:50:14...	50.0000	229.0129	0.7589	86.8208	0.4995	1.4041	3.5724	1.6992	0.6538	0.6536	0.
15	1	1	08:50:14...	50.0000	229.0127	0.7590	86.8275	0.4995	1.4038	3.5716	1.6992	0.6538	0.6536	0.
16	1	1	08:50:14...	50.0000	229.0129	0.7590	86.8236	0.4995	1.4037	3.5699	1.6995	0.6538	0.6536	0.
17	1	1	08:50:14...	50.0000	229.0066	0.7590	86.8223	0.4995	1.4036	3.5660	1.6998	0.6539	0.6536	0.
18	1	1	08:50:15...	49.9999	229.0093	0.7590	86.8167	0.4995	1.4039	3.5626	1.6996	0.6539	0.6536	0.
19	1	1	08:50:15...	50.0000	229.0127	0.7590	86.8132	0.4994	1.4040	3.5584	1.6998	0.6539	0.6536	0.
20	1	1	08:50:15...	50.0000	229.0100	0.7591	86.8069	0.4994	1.4046	3.5570	1.6999	0.6540	0.6537	0.
21	1	1	08:50:15...	50.0000	229.0120	0.7591	86.8046	0.4994	1.4049	3.5595	1.6994	0.6539	0.6537	0.
22	1	1	08:50:15...	50.0000	229.0081	0.7590	86.8009	0.4994	1.4047	3.5631	1.6995	0.6538	0.6537	0.
23	1	1	08:50:16...	50.0000	229.0161	0.7589	86.7950	0.4994	1.4048	3.5673	1.6995	0.6538	0.6537	0.
24	1	1	08:50:16...	50.0000	229.0159	0.7589	86.7965	0.4994	1.4045	3.5695	1.6994	0.6537	0.6537	0.
25	1	1	08:50:16...	50.0000	229.0188	0.7590	86.7900	0.4993	1.4047	3.5689	1.7002	0.6539	0.6537	0.
26	1	1	08:50:16...	50.0000	229.0227	0.7591	86.7852	0.4992	1.4046	3.5661	1.7008	0.6540	0.6537	0.
27	1	1	08:50:16...	50.0000	229.0222	0.7591	86.7811	0.4992	1.4044	3.5614	1.7012	0.6540	0.6537	0.
28	1	1	08:50:17...	50.0000	229.0210	0.7592	86.7798	0.4991	1.4044	3.5639	1.7018	0.6542	0.6537	0.
29	1	1	08:50:17...	50.0000	229.0247	0.7593	86.7854	0.4991	1.4049	3.5637	1.7017	0.6543	0.6538	0.
30	1	1	08:50:17...	50.0000	229.0273	0.7592	86.7784	0.4991	1.4047	3.5642	1.7017	0.6542	0.6538	0.
31	1	1	08:50:17...	50.0000	229.0249	0.7592	86.7844	0.4991	1.4050	3.5633	1.7018	0.6543	0.6538	0.
32	1	1	08:50:17...	50.0000	229.0237	0.7592	86.7800	0.4991	1.4045	3.5594	1.7014	0.6543	0.6538	0.
33	1	1	08:50:18...	50.0000	229.0256	0.7591	86.7832	0.4991	1.4041	3.5580	1.7007	0.6542	0.6538	0.

In Table viewing mode results can be seen for:

Absolute
Results
Difference
Source

Note: The data in the Difference table is used for Repeatability tests. These tests are described in more detail in section 5.13 of this manual.

5.9 Saving Harmonic Results.

Section 6.2 in this manual provides details of the options available and how to save the results in these options. It is also possible to edit the DUT results before creating the final report.

Please refer to Appendix B (section 9.2) in this manual for examples of Excel and PDF reports for Harmonic testing.

5.10 Closing the Harmonic test window.



To prevent the accidental loss of test data the above message appears if you attempt to close the Harmonic test window after performing a test but not having saved the results.

Clicking on YES will close the window and any unsaved test data will be lost. Clicking on NO will cancel the request to close the test window allowing the test data to be saved.

5.11 Harmonic Results – STL and POHC Exceptions.

It certain circumstances it is acceptable for the harmonics to exceed the specified limits. These incidents are called exceptions.

There are two of these exceptions. These are called:

Short Term Limit (STL) Exception
Partial Odd Harmonic (POHC) Exception

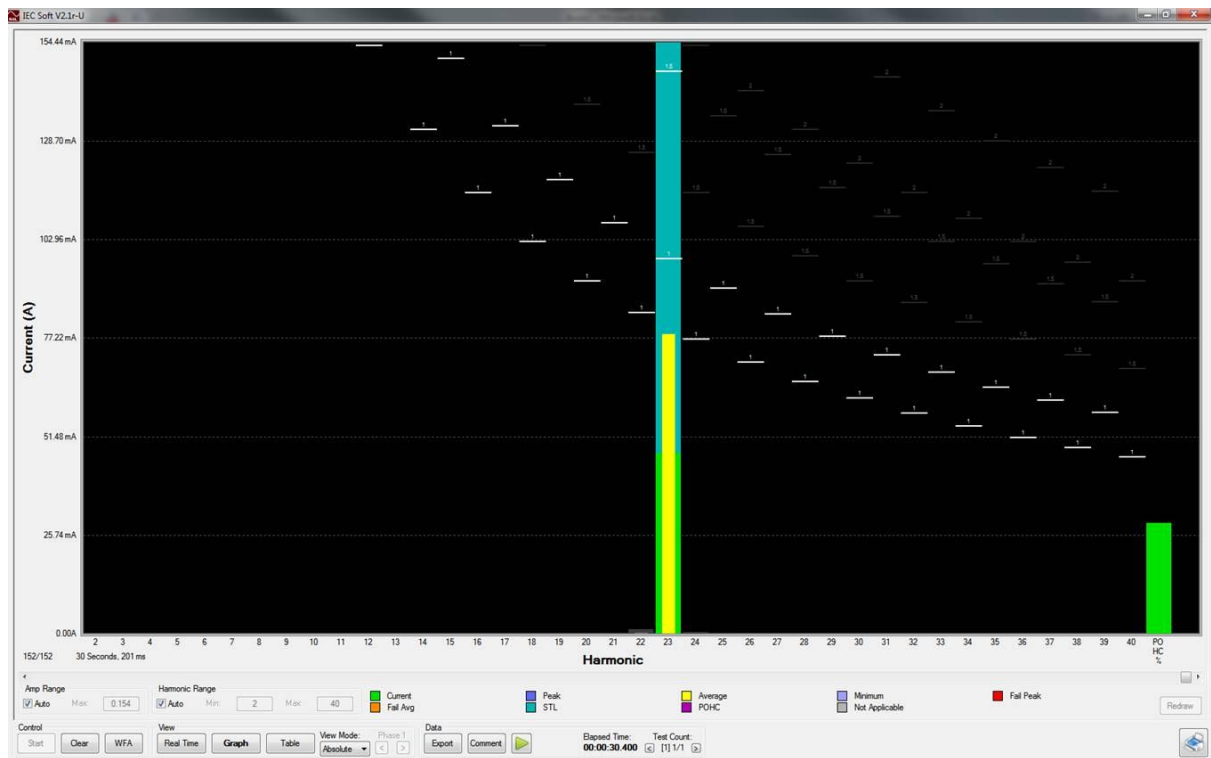
The definitions of the above exceptions are explained in section 6.2.3.4 of the IEC 61000-3-2 Standard. They are also included in Appendix D (section 9.4) of this user manual.

When an exception occurs the final result for the harmonic test would still be shown has a pass but the exception would be displayed on the graphs and in the tables. The following screen shots show examples of how these exceptions are displayed in the IECSoft software.

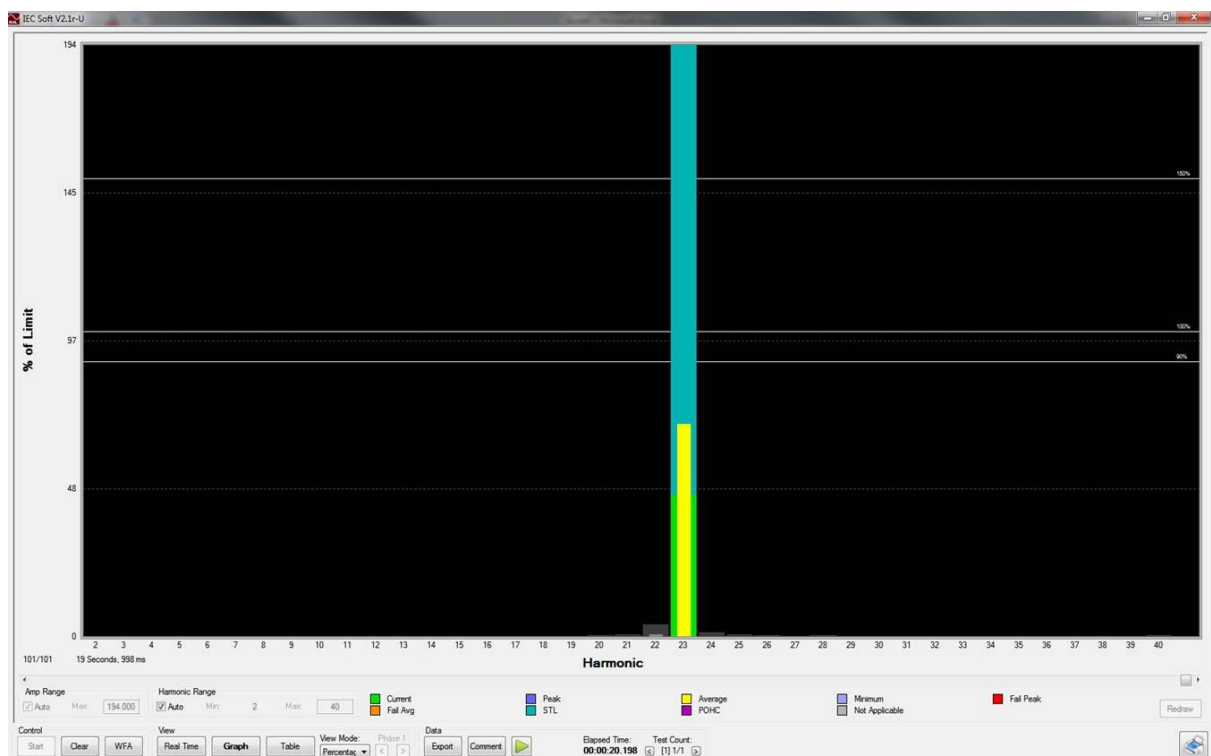
Note: The following examples are for reference purposes only. They have been simulated to allow the user to easily identify when an exception occurs and where it will be displayed in the results produced when using the IECSoft software. Normally data would be displayed for all harmonics on the tables and in the graphs.

The Short Term Limit (STL) Exception:

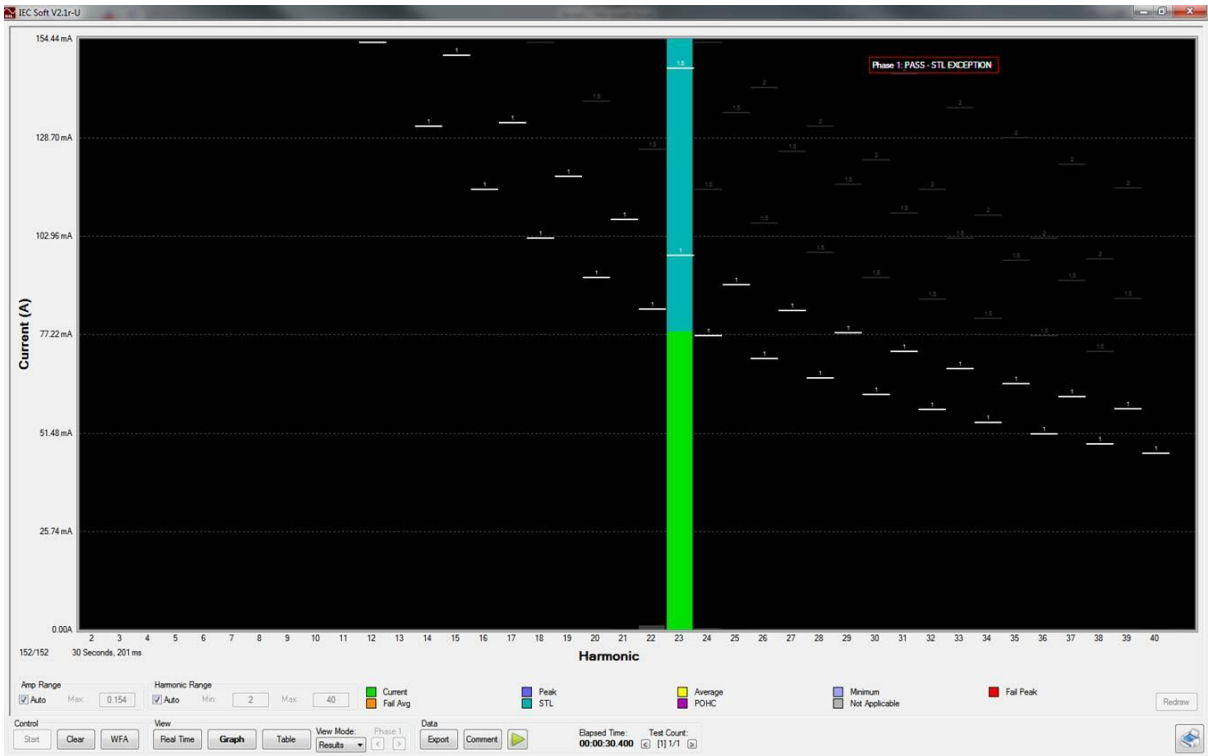
STL Exception displayed on the Absolute Graph:



STL Exception displayed on the Percentage Graph:



STL Exception displayed on the Result Graph:



STL Exception displayed in the Table:

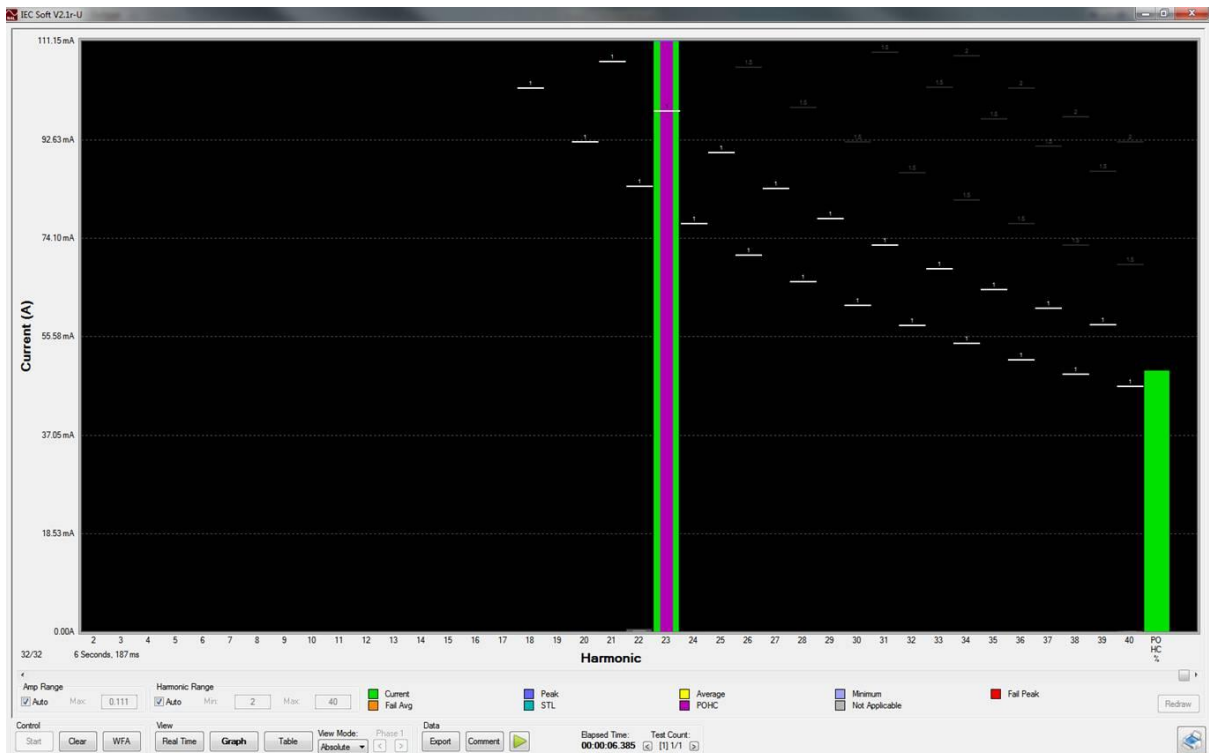
Harmonic	Phase	Status	Maximum	Average	Limit	Limit2	Limit3
2	1	PASS	0.0000	0.0000	1.0800	1.6200	2.1600
3	1	PASS	0.0000	0.0000	2.3000	3.4500	4.6000
4	1	PASS	0.0000	0.0000	0.4200	0.6450	0.8600
5	1	PASS	0.0000	0.0000	1.1400	1.7100	2.2800
6	1	PASS	0.0000	0.0000	0.3000	0.4500	0.6000
7	1	PASS	0.0000	0.0000	0.7700	1.1550	1.5400
8	1	PASS	0.0001	0.0000	0.2300	0.3450	0.4600
9	1	PASS	0.0000	0.0000	0.4000	0.6000	0.8000
10	1	PASS	0.0000	0.0000	0.1840	0.2760	0.3680
11	1	PASS	0.0000	0.0000	0.3300	0.4950	0.6600
12	1	PASS	0.0000	0.0000	0.1533	0.2300	0.3067
13	1	PASS	0.0000	0.0000	0.2100	0.3150	0.4200
14	1	PASS	0.0000	0.0000	0.1314	0.1971	0.2629
15	1	PASS	0.0001	0.0001	0.1500	0.2250	0.3000
16	1	PASS	0.0000	0.0000	0.1150	0.1725	0.2300
17	1	PASS	0.0001	0.0000	0.1324	0.1985	0.2647
18	1	PASS	0.0001	0.0000	0.1022	0.1533	0.2044
19	1	PASS	0.0001	0.0000	0.1184	0.1776	0.2368
20	1	PASS	0.0002	0.0000	0.0920	0.1380	0.1840
21	1	PASS	0.0003	0.0001	0.1071	0.1607	0.2143
22	1	PASS	0.0011	0.0003	0.0836	0.1255	0.1673
23	1	PASS - STL EXCEPTION	0.1544	0.0780	0.0978	0.1467	0.1957
24	1	PASS	0.0004	0.0001	0.0767	0.1150	0.1533
25	1	PASS	0.0002	0.0000	0.0900	0.1350	0.1800
26	1	PASS	0.0001	0.0000	0.0708	0.1062	0.1415
27	1	PASS	0.0001	0.0000	0.0833	0.1250	0.1667
28	1	PASS	0.0001	0.0000	0.0657	0.0986	0.1314
29	1	PASS	0.0001	0.0000	0.0776	0.1164	0.1552
30	1	PASS	0.0002	0.0001	0.0613	0.0920	0.1227
31	1	PASS	0.0000	0.0000	0.0726	0.1089	0.1452
32	1	PASS	0.0001	0.0000	0.0575	0.0863	0.1150
33	1	PASS	0.0000	0.0000	0.0652	0.1023	0.1364
34	1	PASS	0.0000	0.0000	0.0541	0.0812	0.1082
35	1	PASS	0.0000	0.0000	0.0643	0.0964	0.1286
36	1	PASS	0.0000	0.0000	0.0511	0.0767	0.1022
37	1	PASS	0.0000	0.0000	0.0608	0.0912	0.1216
38	1	PASS	0.0001	0.0000	0.0484	0.0726	0.0968
39	1	PASS	0.0000	0.0000	0.0577	0.0865	0.1154
40	1	PASS	0.0002	0.0001	0.0460	0.0690	0.0920

STL Exception displayed in the Report:

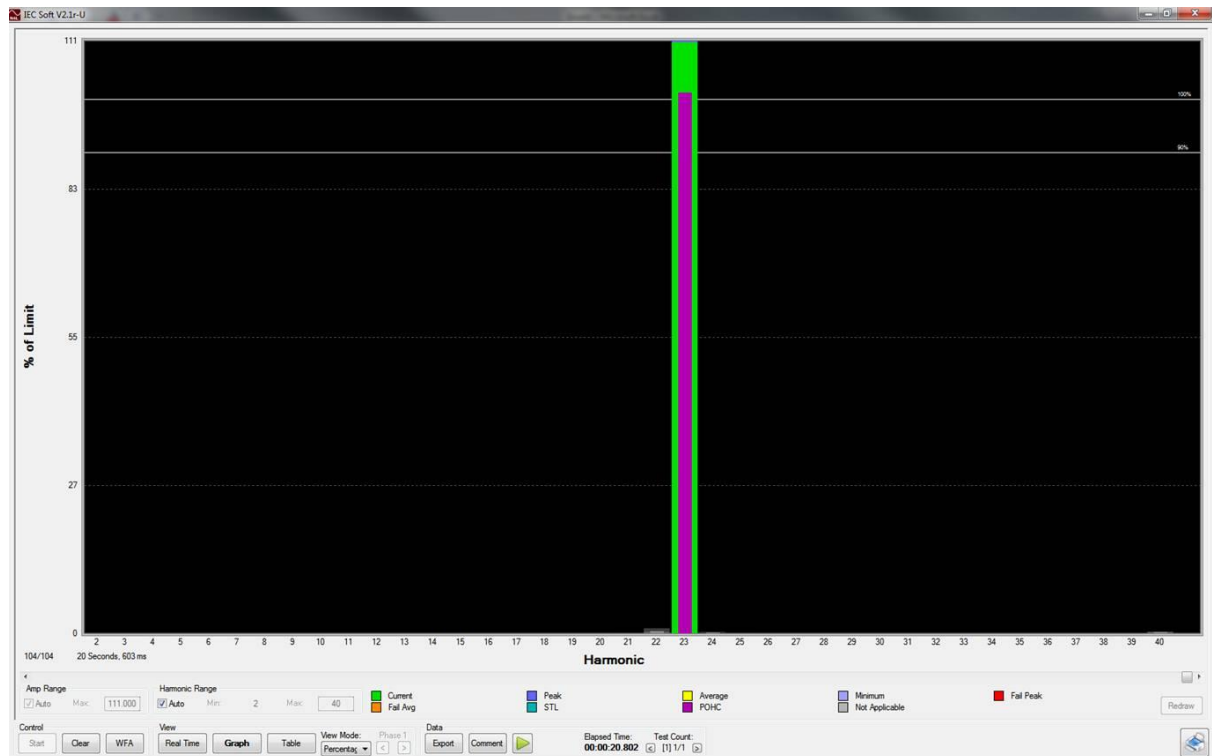
Harmonic	Status	Avg (A)	Avg (uA)	Avg %ofL	Max (A)	Max (uA)	Max %ofL
1	PASS	0.000001	No Limit	N/A	0.000026	No Limit	N/A
2	PASS	0	1.08	0.000015	0.000005	1.62	0.000332
3	PASS	0	2.3	0.000004	0.000003	3.45	0.000099
4	PASS	0	0.43	0.000033	0.000007	0.645	0.001027
5	PASS	0.000001	1.14	0.000037	0.00001	1.71	0.000559
6	PASS	0	0.3	0.000086	0.000014	0.45	0.00306
7	PASS	0.00001	0.77	0.001298	0.000045	1.155	0.003939
8	PASS	0.000019	0.23	0.000883	0.000065	0.345	0.01891
9	PASS	0	0.4	0.000076	0.000009	0.6	0.001492
10	PASS	0	0.184	0.000206	0.000009	0.276	0.00132
11	PASS	0	0.33	0.000114	0.000009	0.495	0.001844
12	PASS	0.00001	0.15333	0.000332	0.00001	0.229995	0.004473
13	PASS	0.00001	0.21	0.000358	0.000014	0.315	0.004375
14	PASS	0.000003	0.13143	0.000209	0.000026	0.197145	0.013412
15	PASS	0.000063	0.15	0.042301	0.000014	0.225	0.062169
16	PASS	0.000003	0.115	0.002916	0.00003	0.1725	0.017615
17	PASS	0.000027	0.13235	0.030471	0.000093	0.138525	0.046666
18	PASS	0.000006	0.10222	0.005685	0.000072	0.15333	0.046652
19	PASS	0.000011	0.11842	0.009051	0.000111	0.17763	0.062264
20	PASS	0.000015	0.092	0.016613	0.000156	0.138	0.112819
21	PASS	0.000056	0.10734	0.052117	0.000297	0.16071	0.185091
22	PASS	0.000298	0.083636	0.354034	0.001143	0.125454	0.91133
23	PASS - STL EXCEPTION	0.077978	0.097826	79.71092	0.15444	0.146739	105.2481
24	PASS	0.000085	0.076667	0.111229	0.000417	0.115001	0.362964
25	PASS	0.000022	0.09	0.03445	0.000226	0.135	0.167496
26	PASS	0.000012	0.070769	0.016475	0.000147	0.106154	0.138714
27	PASS	0.000007	0.083333	0.008479	0.000116	0.125	0.093096
28	PASS	0.000005	0.065714	0.008332	0.000092	0.098371	0.09311
29	PASS	0.000005	0.077586	0.005845	0.000078	0.116379	0.066895
30	PASS	0.000073	0.061333	0.115468	0.000156	0.091999	0.169403
31	PASS	0.000002	0.072581	0.002487	0.000039	0.108872	0.035642
32	PASS	0.000002	0.0575	0.003875	0.000059	0.08625	0.068548
33	PASS	0.000002	0.068182	0.002386	0.000035	0.102273	0.04592
34	PASS	0.000001	0.054118	0.002018	0.000028	0.081177	0.035079
35	PASS	0.000002	0.064286	0.003002	0.000049	0.096429	0.051108
36	PASS	0.000001	0.051111	0.002142	0.000029	0.076666	0.038433
37	PASS	0.000006	0.060811	0.010206	0.000046	0.091216	0.050839
38	PASS	0.000016	0.048421	0.032744	0.000075	0.072832	0.102614
39	PASS	0.000001	0.057692	0.001893	0.000029	0.086538	0.033329
40	PASS	0.000098	0.046	0.212652	0.000202	0.069	0.292971

Partial Odd Harmonic (POHC) Exception

POHC Exception displayed on the Absolute Graph:



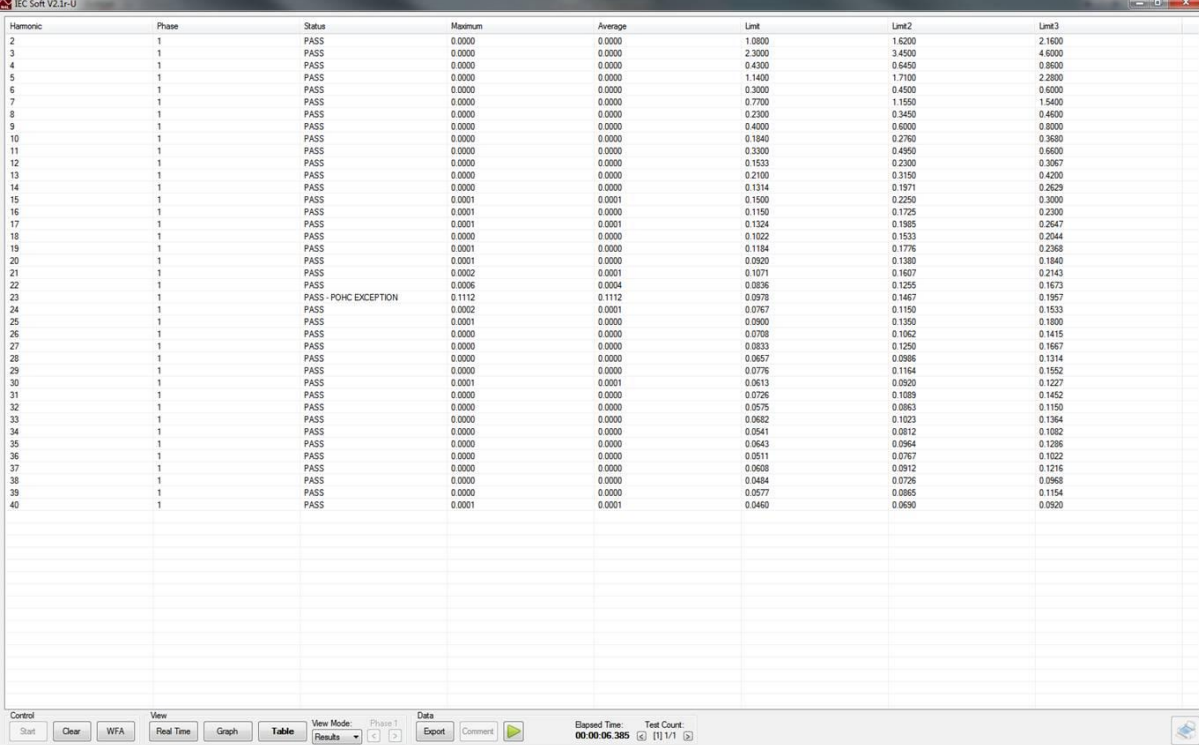
POHC Exception displayed on the Percentage graph:



POHC Exception displayed on the Result graph:

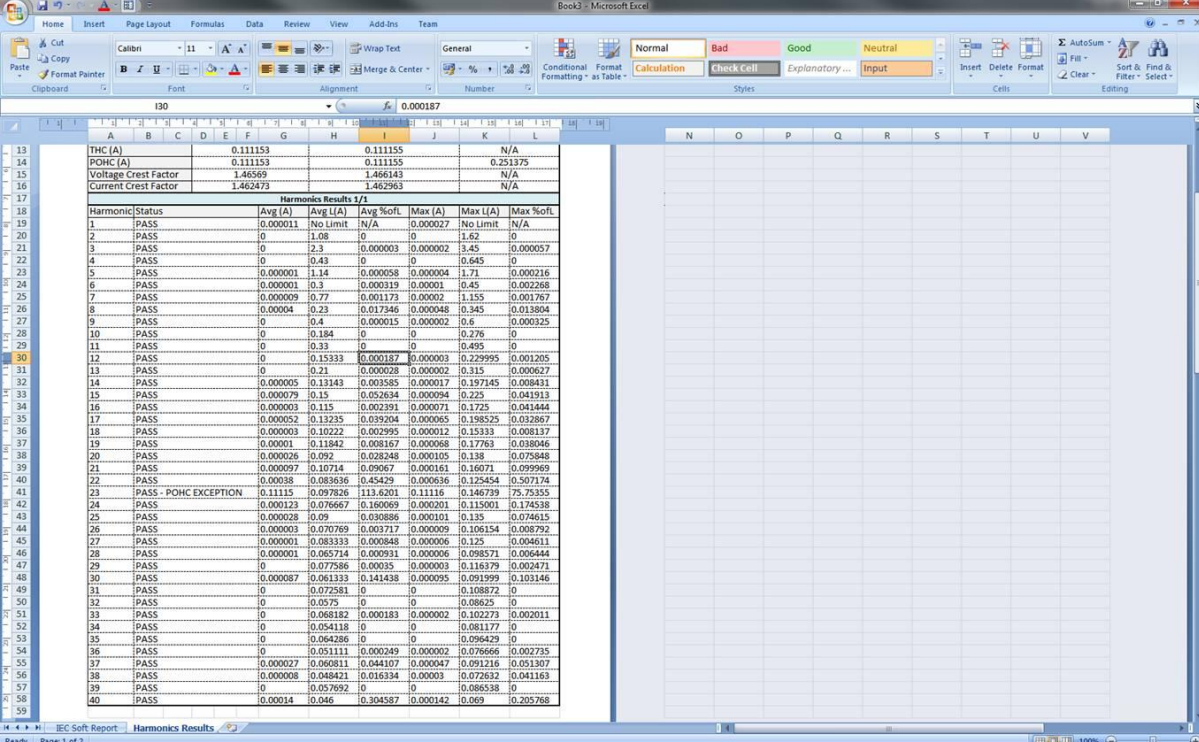


POHC Exception displayed in the table:



Harmonic	Phase	Status	Maximum	Average	Limit	Limit2	Limit3
2	1	PASS	0.0000	0.0000	1.0800	1.6200	2.1600
3	1	PASS	0.0000	0.0000	2.3000	3.4500	4.6000
4	1	PASS	0.0000	0.0000	0.4500	0.6750	0.9000
5	1	PASS	0.0000	0.0000	1.1400	1.7100	2.2800
6	1	PASS	0.0000	0.0000	0.3000	0.4500	0.6000
7	1	PASS	0.0000	0.0000	0.7700	1.1550	1.5400
8	1	PASS	0.0000	0.0000	0.2300	0.3450	0.4600
9	1	PASS	0.0000	0.0000	0.4000	0.6000	0.8000
10	1	PASS	0.0000	0.0000	0.1840	0.2760	0.3680
11	1	PASS	0.0000	0.0000	0.3300	0.4950	0.6600
12	1	PASS	0.0000	0.0000	0.1533	0.2300	0.3067
13	1	PASS	0.0000	0.0000	0.2100	0.3150	0.4200
14	1	PASS	0.0000	0.0000	0.1314	0.1971	0.2629
15	1	PASS	0.0001	0.0001	0.1500	0.2250	0.3000
16	1	PASS	0.0001	0.0001	0.1150	0.1725	0.2300
17	1	PASS	0.0001	0.0001	0.1324	0.1985	0.2647
18	1	PASS	0.0000	0.0000	0.1022	0.1533	0.2044
19	1	PASS	0.0001	0.0000	0.1184	0.1776	0.2368
20	1	PASS	0.0001	0.0000	0.0820	0.1230	0.1640
21	1	PASS	0.0002	0.0001	0.1071	0.1607	0.2143
22	1	PASS	0.0006	0.0004	0.0836	0.1255	0.1673
23	1	PASS - POHC EXCEPTION	0.1112	0.1112	0.0978	0.1467	0.1957
24	1	PASS	0.0002	0.0001	0.0767	0.1150	0.1533
25	1	PASS	0.0001	0.0000	0.0900	0.1350	0.1800
26	1	PASS	0.0000	0.0000	0.0708	0.1062	0.1415
27	1	PASS	0.0000	0.0000	0.0833	0.1250	0.1667
28	1	PASS	0.0000	0.0000	0.0857	0.0986	0.1314
29	1	PASS	0.0000	0.0000	0.0776	0.1164	0.1552
30	1	PASS	0.0001	0.0001	0.0613	0.0920	0.1227
31	1	PASS	0.0000	0.0000	0.0726	0.1089	0.1452
32	1	PASS	0.0000	0.0000	0.0575	0.0863	0.1150
33	1	PASS	0.0000	0.0000	0.0582	0.1023	0.1364
34	1	PASS	0.0000	0.0000	0.0541	0.0812	0.1082
35	1	PASS	0.0000	0.0000	0.0643	0.0964	0.1286
36	1	PASS	0.0000	0.0000	0.0511	0.0767	0.1022
37	1	PASS	0.0000	0.0000	0.0508	0.0762	0.1016
38	1	PASS	0.0000	0.0000	0.0484	0.0726	0.0968
39	1	PASS	0.0000	0.0000	0.0577	0.0865	0.1154
40	1	PASS	0.0001	0.0001	0.0460	0.0690	0.0920

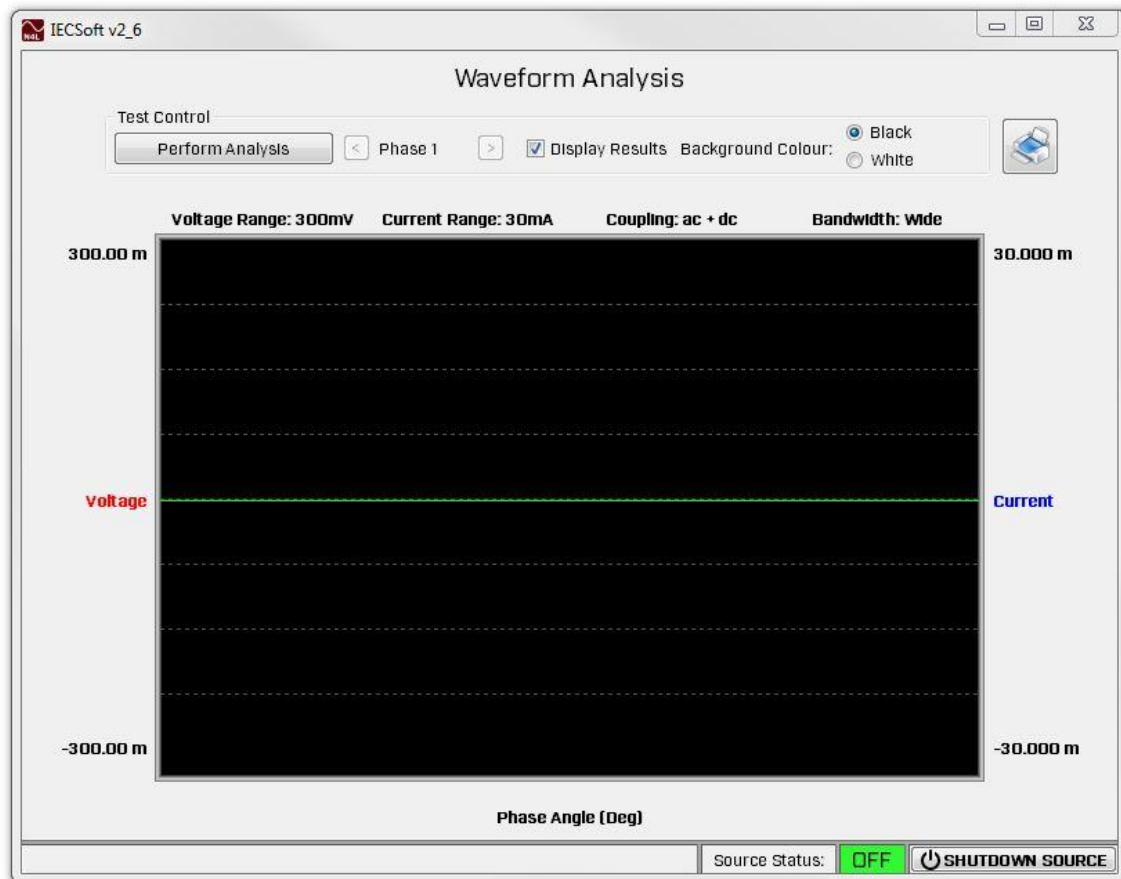
POHC Exception displayed in the report:



Harmonic	Status	Avg [A]	Avg [L/A]	Max [A]	Max [L/A]	Max %ofL
1	PASS	0.000011	No Limit	N/A	0.000027	No Limit
2	PASS	0	1.08	0	1.62	0
3	PASS	0	2.3	0.000003	0.000002	3.45
4	PASS	0	0.43	0	0.645	0
5	PASS	0.000001	1.14	0.000058	0.000004	1.71
6	PASS	0.000001	0.3	0.0000319	0.00001	0.45
7	PASS	0.000009	0.77	0.000173	0.00002	1.155
8	PASS	0.00004	0.23	0.017346	0.000048	0.345
9	PASS	0	0.4	0.000015	0.000002	0.6
10	PASS	0	0.184	0	0.276	0
11	PASS	0	0.33	0	0.495	0
12	PASS	0	0.15333	0.000187	0.000003	0.229995
13	PASS	0	0.21	0.000028	0.000002	0.315
14	PASS	0.000005	0.11143	0.003585	0.000017	0.197145
15	PASS	0.000079	0.15	0.052634	0.000094	0.225
16	PASS	0.000003	0.115	0.002391	0.000071	0.1725
17	PASS	0.000051	0.13235	0.039204	0.000065	0.138525
18	PASS	0.000003	0.10222	0.002595	0.000012	0.15333
19	PASS	0.00001	0.11842	0.008167	0.000068	0.17763
20	PASS	0.000026	0.092	0.028248	0.000105	0.138
21	PASS	0.000097	0.10714	0.09067	0.000161	0.16071
22	PASS	0.00018	0.08936	0.45429	0.00036	0.12454
23	PASS - POHC EXCEPTION	0.11115	0.097826	113.6201	0.11116	0.146739
24	PASS	0.000123	0.076667	0.160069	0.000201	0.115001
25	PASS	0.000028	0.09	0.038886	0.000101	0.135
26	PASS	0.000003	0.070769	0.003717	0.000009	0.106154
27	PASS	0.000001	0.083333	0.000848	0.000006	0.125
28	PASS	0.000001	0.065714	0.000931	0.000006	0.098571
29	PASS	0	0.077586	0.00035	0.000003	0.116379
30	PASS	0.000087	0.061133	0.141438	0.000035	0.091999
31	PASS	0	0.072581	0	0	0.108872
32	PASS	0	0.0575	0	0	0.08625
33	PASS	0	0.068182	0.000183	0.000002	0.102273
34	PASS	0	0.054118	0	0	0.081177
35	PASS	0	0.064286	0	0	0.096429
36	PASS	0	0.051111	0.000249	0.000002	0.076666
37	PASS	0.000027	0.060811	0.044107	0.000047	0.091216
38	PASS	0.000008	0.048421	0.161334	0.00003	0.077832
39	PASS	0	0.057692	0	0	0.086538
40	PASS	0.00014	0.046	0.304587	0.000142	0.069

5.12 Harmonic Testing - WFA (Waveform Analysis)

Click on “**WFA**” to open the WFA Test window.



Click on “**Perform Analysis**” to run the test. The AC Source Settling time window will appear briefly. The WFA test can be cancelled if required during this period.



At the end of the setup period the test will start running. After a few seconds the graph will be updated.



Note: This response is an example only. The actual response obtained would be dependent on the device being tested.

There are several options along the top of the WFA window:

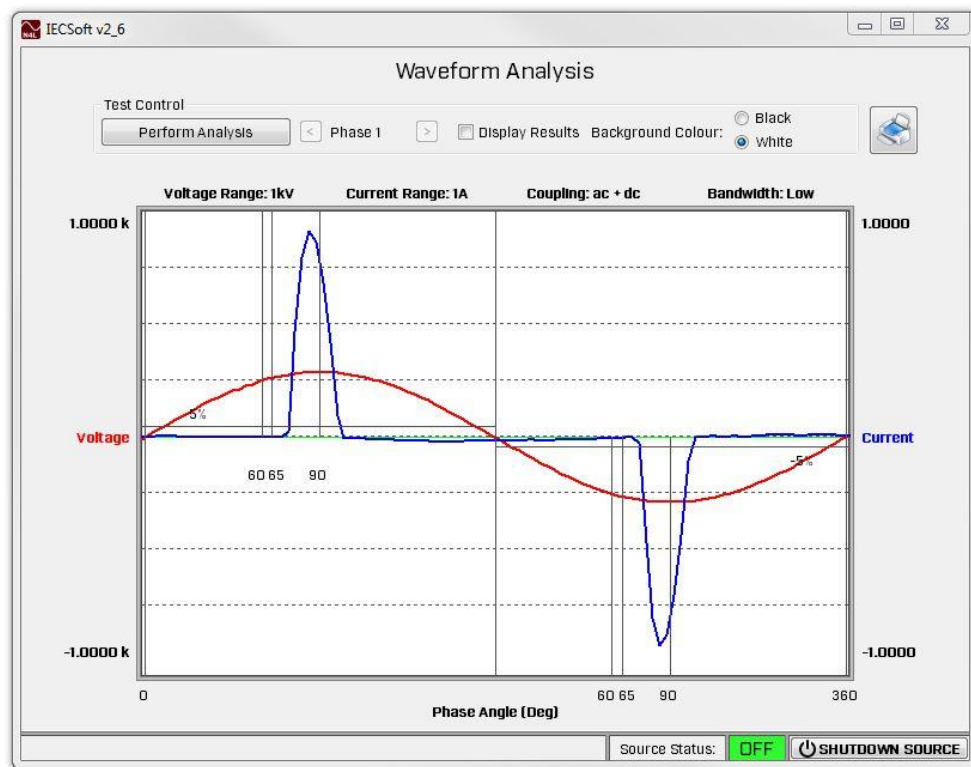
Selection of the phase to be displayed when 3 phase testing.

The option to NOT display the results on the graph.

Choice of background shading, either black or white.

An example can be found on the next page.

Example: White background selected with no results displayed.



To close the WFA test and return to the main menu close the window by clicking on the "X" in the top right hand corner.

The series of Setup windows are displayed (see section 5.6 in this manual) for a few seconds, the WFA window will then close.

5.13 Harmonics – Repeatability testing.

Repeatability tests can be made in any of the harmonic test options. The user can select the number of tests to run to check that repeatability tests are within limits. The number of tests is selected on Test Setup dialog screen 2 (refer to sections 5.1.1 to 5.1.4 in this manual).

An additional page is created in the final report that details the results of the repeatability tests.

The harmonics for the two tests with the closest readings are displayed. The differences between these readings are then compared to the allowance limit and the result displayed in the Difference column on the report. The table below is used to determine if the result for each harmonic is a pass or fail.

Key:	
Ignored	Since both values are less than 5mA or 0.6% of the Input Current this harmonic is ignored
Good	The difference is less than 50% of the allowance
OK	The difference is between 50% of the allowance and 75% of the allowance
Poor	The difference is between 75% of the allowance and 100% of the allowance
Fail	The difference has exceeded the allowance

The Difference column on the report uses the colour coding in the above table so that it is easily visible to see the percentage difference between results. The status column displays whether or not each harmonic achieved the Repeatability limits (pass / fail) or was not checked for Repeatability (N/A) because the values were below the minimum levels (5mA or 0.6% of the input current) stated in the Standard document.

7	0.22404	1	0.22474	2	0.004875	0.0007	PASS
8	0.001186*	2	0.0011886*	1	0	0	N/A
9	0.18576	1	0.18711	2	0.0024375	0.00135	PASS
10	0.0011151*	1	0.0011151*	2	0	0	N/A
11	0.14496	1	0.14687	2	0.00170625	0.00191	FAIL
12	0.0010193*	1	0.001028*	2	0	0	N/A
13	0.10492	1	0.10719	2	0.00144375	0.00227	FAIL
14	0.000000*	1	0.000000*	2	0	0	N/A

Note: Tests that are confirmed to be Valid (meet the test requirements) and resulted in a Test Pass are used where possible for these comparisons. Valid / failed tests are used if there are insufficient passed tests.

On completion of the selected number of tests for Repeatability it is possible to add additional tests one at a time using the "Add Test" option. Details about this can be found in section 5.8.3 of this manual.

The Repeatability results in the final report will be updated to include any additional tests. For example, If 10 tests were initially made the closest 2 tests would be displayed in the report. If an extra 2 tests were added using the "Add Test" option then IECSoft would compare the results for all 12 tests and the use the results for the closest 2 tests in the report.

If only 1 test was originally requested then on selecting an additional test the repeatability test results will be created and added to the final report. The second "Test Setup" dialog box (refer to sections 5.1.1 to 5.1.4 of this manual) is updated to reflect the new total number of tests.

Harmonic excel report overall result.

The results of the Repeatability testing are NOT included when determining if the final result for the complete Harmonic test is a Pass or failure. Should the Repeatability limits not be achieved a message to confirm this is displayed below the Final Result on the front sheet of the excel report.

Signature	
Results	PASS *
The test failed to pass the repeatability limits according to section 6.2.3.1 of the IEC61000-3-2:2014 standard.	

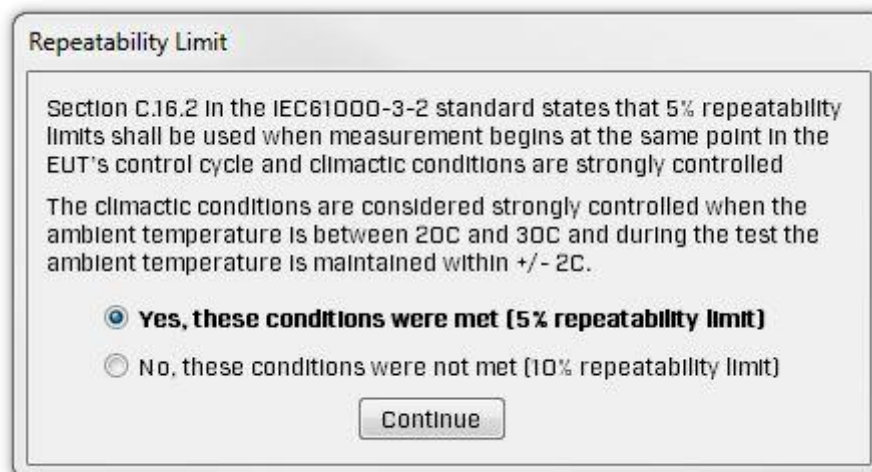
It is therefore acceptable for a PASS to be displayed for the full test along with a message below it confirming that the test failed to pass the Repeatability limits. Refer to section 6.2.3.1 of the Standard for further details.

Repeatability Limits

The nominal limits are stated in section 6.2.3.1 of the Standard. The limits are +/- 5% of the applicable limit.

However, when performing Class D – Fridge mode tests there are occasions when a 10% limit applies. Full details of the specific circumstances when the 10% limit applies are stated in Annex C section C.16.2 of the Standard.

Therefore, for Class D – Fridge mode **ONLY** the following message is displayed when the Export button is pressed to create the Excel report.



A screenshot of a software dialog box titled "Repeatability Limit". The dialog box has a light gray background and a thin border. Inside, there is a text area with the following content: "Section C.16.2 in the IEC61000-3-2 standard states that 5% repeatability limits shall be used when measurement begins at the same point in the EUT's control cycle and climactic conditions are strongly controlled. The climactic conditions are considered strongly controlled when the ambient temperature is between 20C and 30C and during the test the ambient temperature is maintained within +/- 2C." Below the text area, there are two radio button options. The first option is selected, indicated by a blue dot, and reads "Yes, these conditions were met (5% repeatability limit)". The second option is unselected, indicated by a gray dot, and reads "No, these conditions were not met (10% repeatability limit)". At the bottom center of the dialog box, there is a button labeled "Continue".

Repeatability Limit

Section C.16.2 in the IEC61000-3-2 standard states that 5% repeatability limits shall be used when measurement begins at the same point in the EUT's control cycle and climactic conditions are strongly controlled

The climactic conditions are considered strongly controlled when the ambient temperature is between 20C and 30C and during the test the ambient temperature is maintained within +/- 2C.

☒ Yes, these conditions were met (5% repeatability limit)

☐ No, these conditions were not met (10% repeatability limit)

Continue

The user should refer to section C.16.2 in the Standard before deciding which option to select. The Excel and PDF reports will then be created using the appropriate limits. The limits used are displayed on the Repeatability tabs of the Excel and PDF reports.

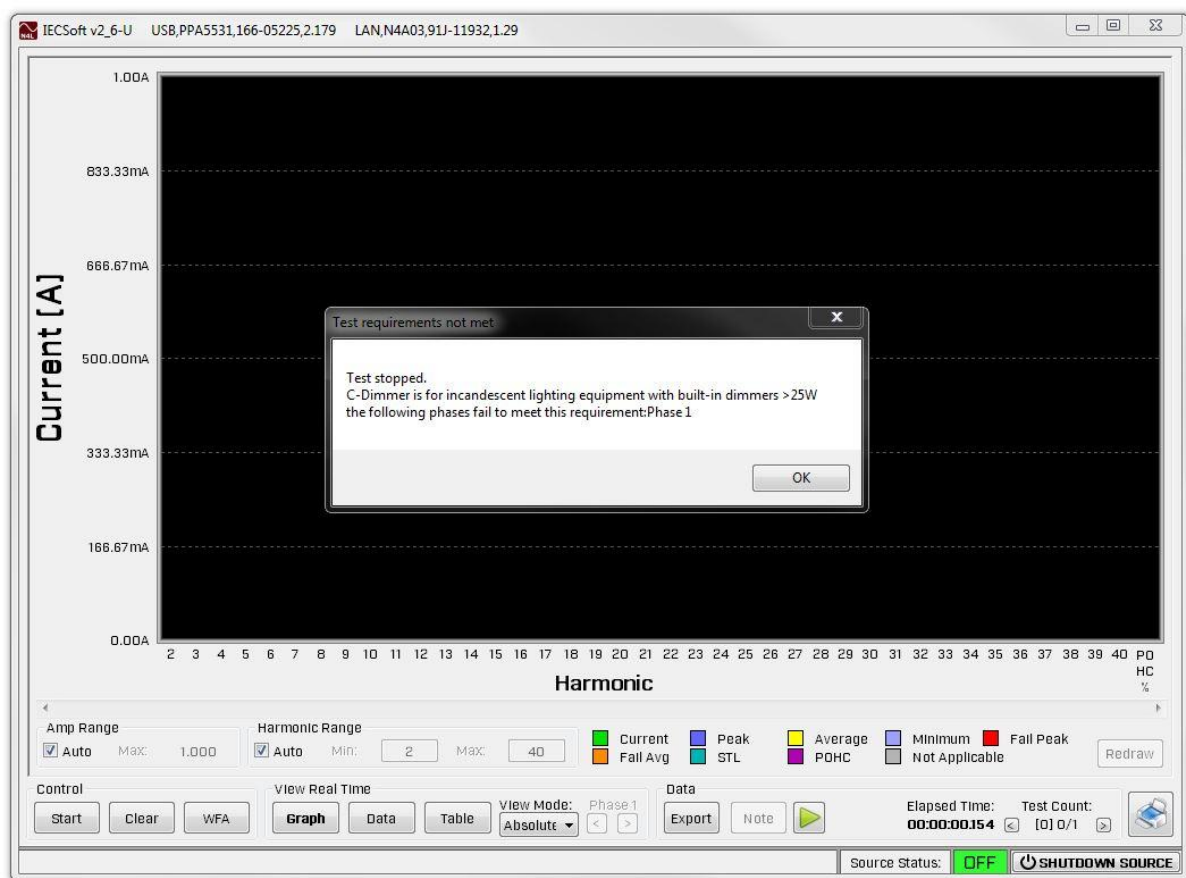
5.14 Class C – Dimmer Testing

For this test to comply to the requirements of the Standard the Power must be greater than 25Watts.

When the test begins the Power level is checked. If the power is less than 25W the test will be stopped and a Test Complete message displayed. Clicking "**OK**" to this message displays the following message explaining why the test was stopped. The User should then select the correct test class and then repeat the test.

The power level is monitored constantly during the test so the test will also be stopped if the power level falls below 25W whilst the test is running.

Refer to section 7 in the Standard document BS EN 61000-3-2:2014 for further details of the test requirements.



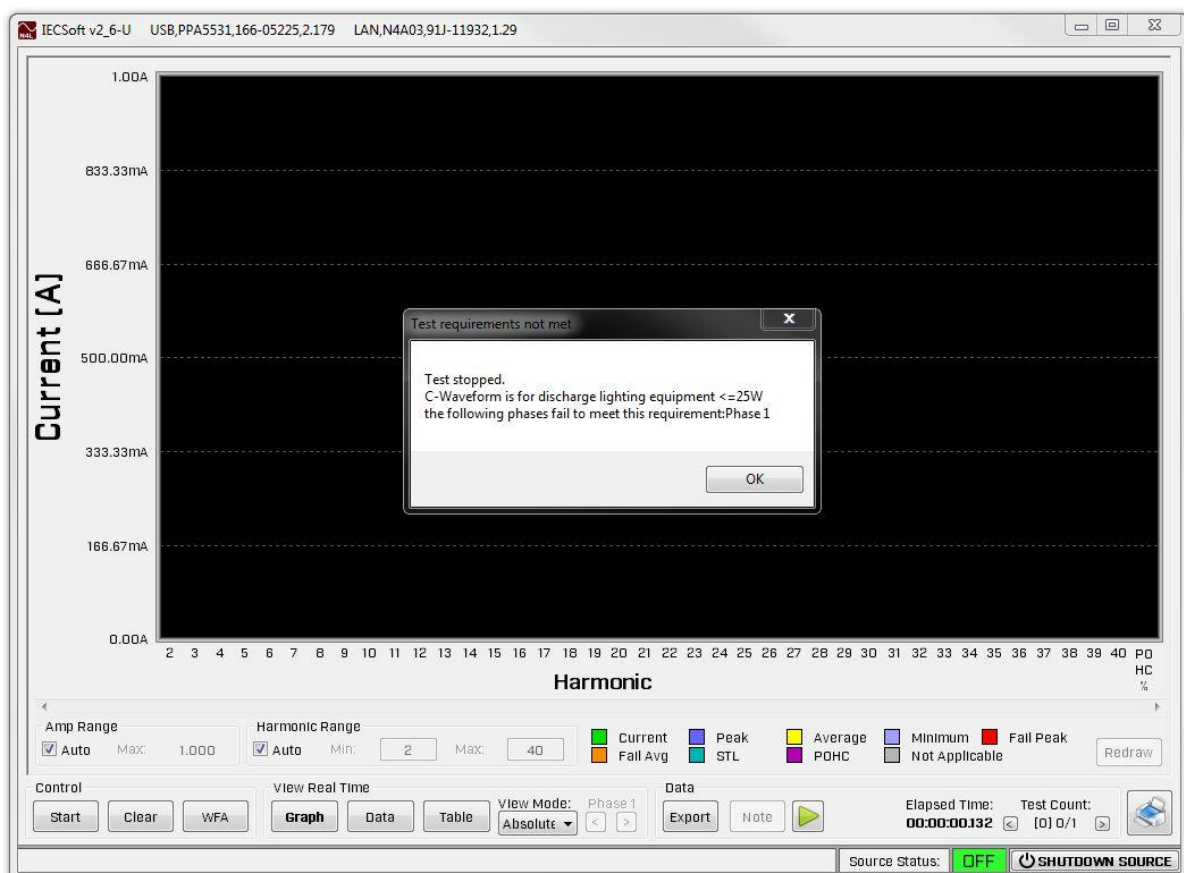
5.15 Class C – Waveform Testing

For this test to comply to the requirements of the Standard the Power must be less than 25Watts.

When the test begins the Power level is checked. If the power is greater than 25W the test will be stopped and a Test Complete message displayed. Clicking “**OK**” to this message displays the following message explaining why the test was stopped. The User should then select the correct test class and then repeat the test.

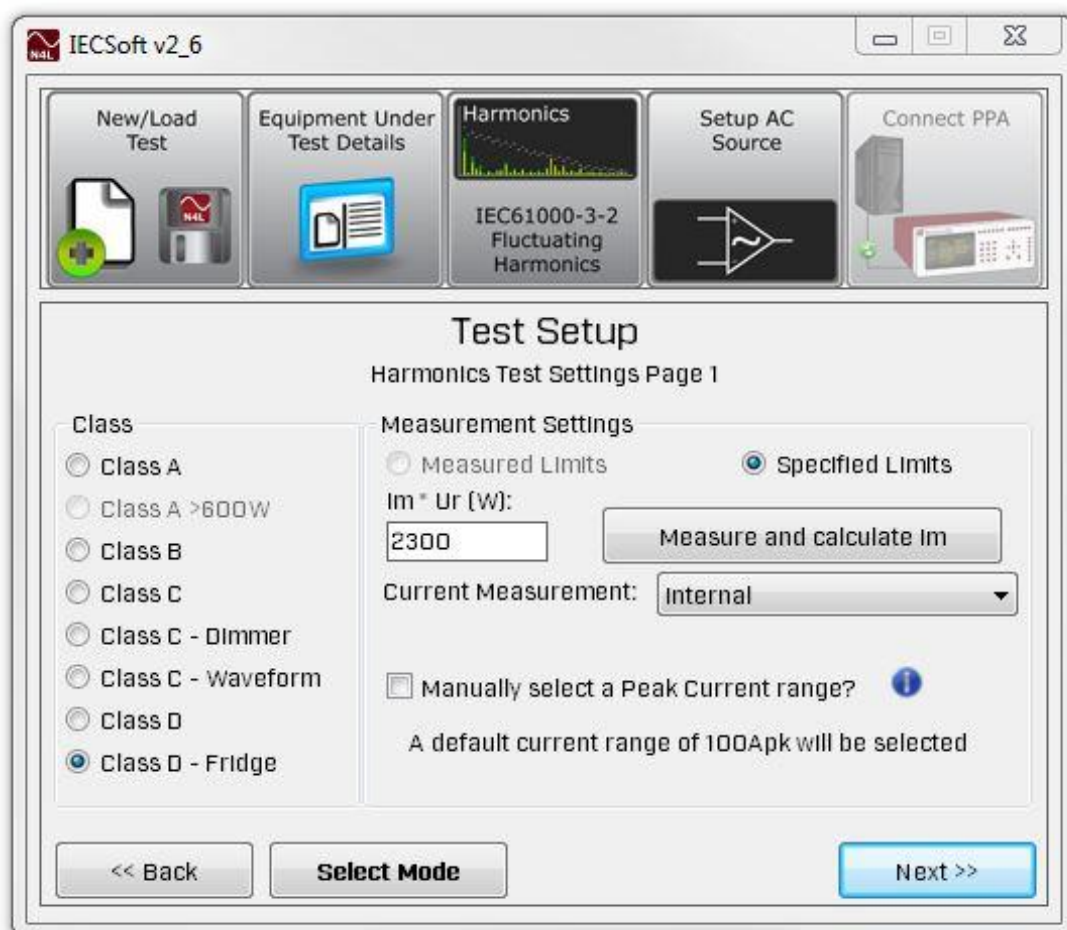
The power level is monitored constantly during the test so the test will also be stopped if the power level rises above 25W whilst the test is running.

Refer to section 7 in the Standard document BS EN 61000-3-2:2014 for further details of the test requirements.



5.16 Class D – Fridge Testing

Dialog 1.



This section explains how to perform a Class D – Fridge test. It also describes the methods used to achieve the requirements stated in Annex C, Section C.16 of the Standard document BS EN 61000-3-2:2014.

5.16.1 Definitions:

The software uses the parameters ***P_i***, ***I_m*** and ***U_r*** to calculate the limits to determine if a test is a pass or failure, they are also displayed in the Excel report. The formula used to calculate these parameters are defined in the above document.

Deviating from 6.2.2, the value of the input power to be used for the calculation of limits shall be determined according to the formula below:

$$P_i = 0,78 \times I_m \times U_r$$

where

P_i is the active input power in watts, to be used for the calculation of Class D limits (see Table 3);

I_m is the current in amperes of the appliance measured according to IEC 60335-2-24, 10.2;

U_r is the rated voltage in volts of the appliance. If the appliance has a rated voltage range, U_r has the value that has been used for measuring I_m .

NOTE 2 P_i is used for the calculation of limits instead of the measured active input power to eliminate the influence of other loads than the VSD, e.g. lighting devices or heating elements for defrosting, on the limit calculation. This also increases the repeatability of the measurement.

U_r is the Device under Test's (DUT) rated voltage, it is specific to the DUT so will be determined by the user.

I_m should be calculated with a 1 hour test using the highest value of a rolling 5 minute average window throughout that 1 hour. This is the definition of how **I_m** is calculated in the document IEC60335-2-24.

10.2 Modification:

Replace the third dashed item of the first paragraph of the test specification by the following:

- *the appliance being operated under **normal operation** except that user adjustable temperature controls are set to give the lowest temperature.*

Addition:

The appliance is operated for a period of 1 h or the maximum setting of an incorporated timer whichever is shorter. Excluding starting current, the maximum value of the current averaged over any 5 min period is obtained. The interval between current measurements shall not exceed 30 s.

If the value of **I_m** is already known it can be used to calculate the power value ($I_m \times U_r$) which is entered into the Test Setup window. If required the IECsoft Software can be used to determine the value of **I_m** . The value of **I_m** is calculated to the requirements of IEC60335-2-24.

Refer to section 5.16.4 in this manual for further information and instructions on how to calculate **I_m** .

5.16.2 How to perform a Class D Fridge mode test.

In the Test Setup window "Specified Limits" are automatically selected.

Using the known values of ***Im*** and ***Ur*** the user should enter the specified power value using the following formula:

$$\text{Power} = \text{Im} \times \text{Ur}$$

The user should then click on **NEXT** and run the test using the same procedure as other harmonic tests.

5.16.3 Calculation of Limits.

The value of "***Im x Ur***" entered on the Test Setup window is displayed under "Specified Power" on the front page of the Excel Report.

The software uses this value to calculate the value of ***Pi*** ($0.78 \times \text{Im} \times \text{Ur}$). ***Pi*** is then used when required to calculate the limits displayed in the excel report; this is a requirement of IEC61000-3-2 indicated above.

In document IEC 61000-3-2, Class D limits are specified in table 3. There are two columns for determining Class D limits; the actual column used to calculate the limits depends on the power level of the EUT.

The software determines the value for Harmonic H3 and calculates the limits using both of the options displayed in Table 3. The column in table 3 that creates the tightest limits is the one used for the limits displayed in the report.

Example 1: Specified Power ($I_m \times U_r$) = 100W:

The limit for H3 using column A is 3.4mA per Watt. The limit is $0.0034 \times 100 \times 0.78 = 0.2652A$

The limit for H3 using column B is 2.3A

The tightest limits should be used which is column A so the limit in the report for H3 is 0.2652A.

Column A is also used to calculate the remaining limits.

Example 2: Specified Power ($I_m \times U_r$) = 1300W:

The limit for H3 using column A is 3.4mA per watt. The limit is $0.0034 \times 1300 \times 0.78 = 3.4476A$

The limit for H3 using column B is 2.3A

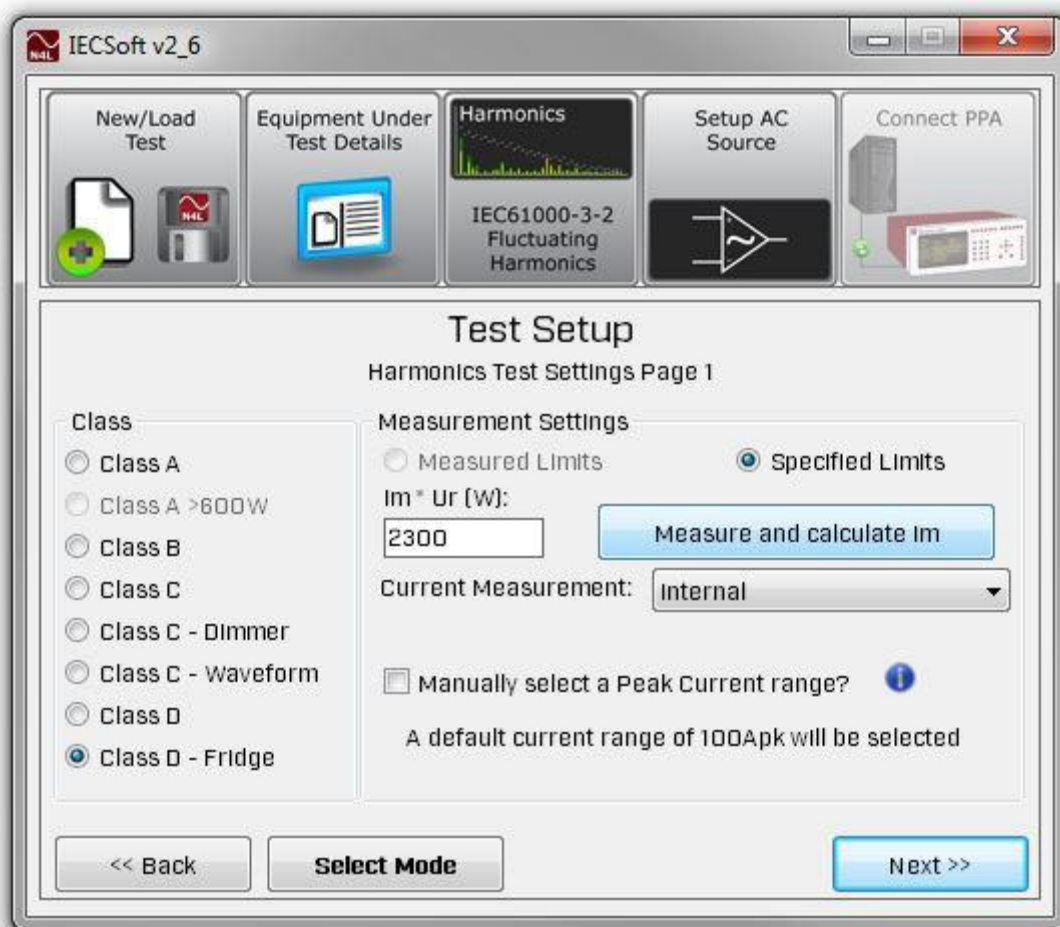
The tightest limits should be used which is column B so the limit in the report for H3 is 2.3A (same limits as class A).

Column B is also used to calculate the remaining limits.

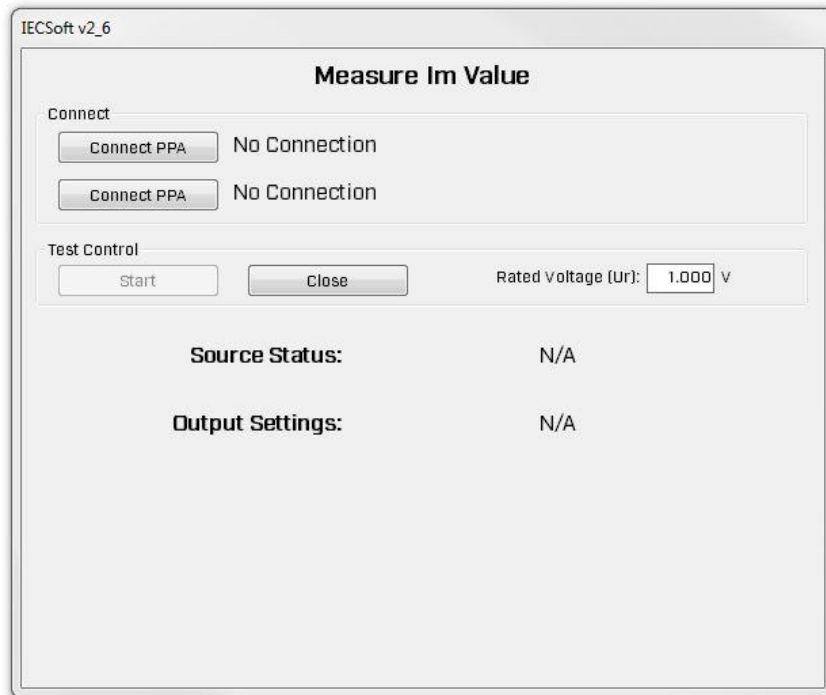
5.16.4 Class D – Fridge Testing, calculating I_m

When “Class D – Fridge” mode is selected an option appears in the test setup window to measure current I_m and then display the Specified Power ($I_m \times U_r$) in the test setup window.

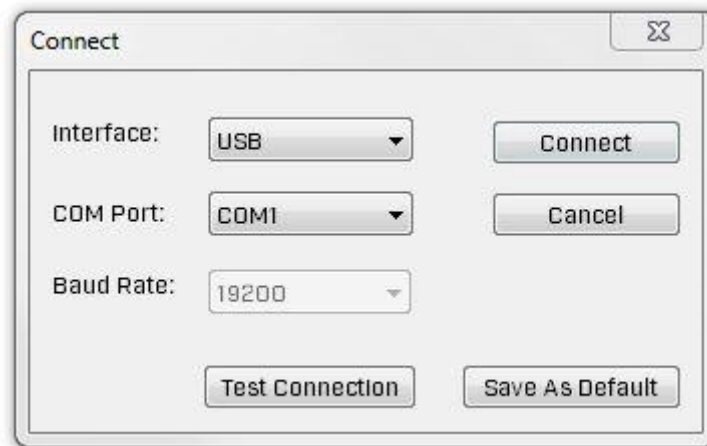
The test runs for one hour displaying the latest recorded current value, the present 5 minute average current and the maximum 5 minute average current value measured whilst the test has been running.



Select **Class D – Fridge** and then click on “**Measure and Calculate I_m** ” to display the Measure I_m test window:



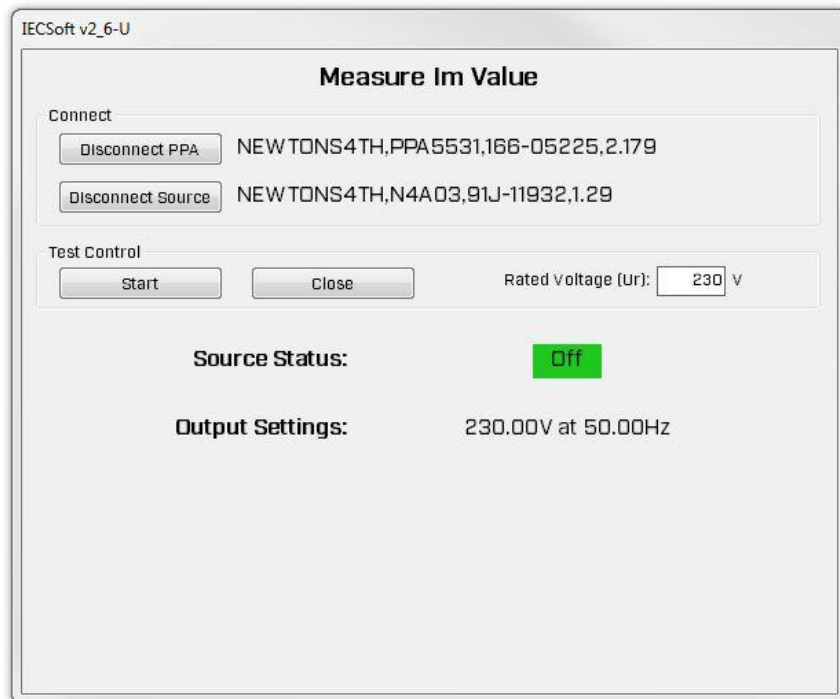
Click on “**Connect PPA**” and follow the instructions in the CONNECT window that appears to connect to the PPA.



If using a N4L AC Source click on “**Connect Source**” and follow the instructions to connect to the source.

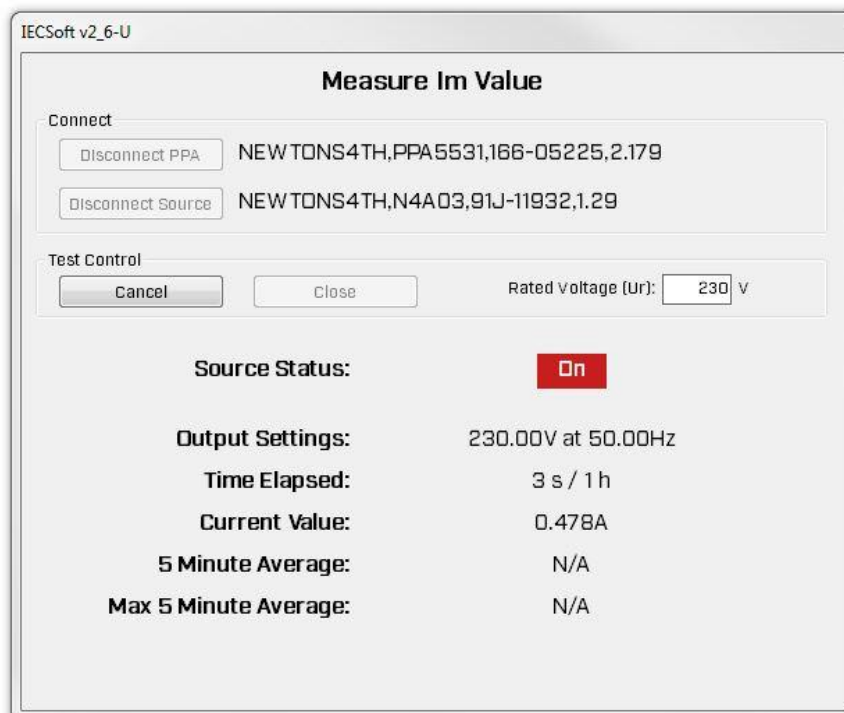
Also enter the Rated voltage.

The test window will now include details of the instrument(s) connected to the software. If connected to the AC Source the selected settings will displayed along with the current status of the Source Output.



Click on **"Start"** to begin the one hour test.

The source status will now be **ON** and highlighted in red to warn that the DUT is now powered up. The elapsed time and Current Value will start updating.



Initially the 5 minute Average and Max 5 minute Average parameters will not be updating. After running for 5 minutes they will start to be updated.

IECSoft v2_6-U

Measure Im Value

Connect

Disconnect PPA: NEW TONS4TH,PPA5531,166-05225,2.179

Disconnect Source: NEW TONS4TH,N4A03,91J-11932,1.29

Test Control

Cancel Close Rated voltage (Ur): 230 V

Source Status: On

Output Settings: 230.00V at 50.00Hz

Time Elapsed: 8 m, 20 s / 1 h

Current Value: 0.485A

5 Minute Average: 0.485A

Max 5 Minute Average: 0.485A

On completion of the 1 hour test period the Source is switched off and the status changed in the test window. The test parameters are removed from the test window and replaced by the Calculated *Im* Current.

IECSoft v2_6-U

Measure Im Value

Connect

Disconnect PPA: NEW TONS4TH,PPA5531,166-05225,2.179

Disconnect Source: NEW TONS4TH,N4A03,91J-11932,1.29

Test Control

Clear Close Rated voltage (Ur): 230 V

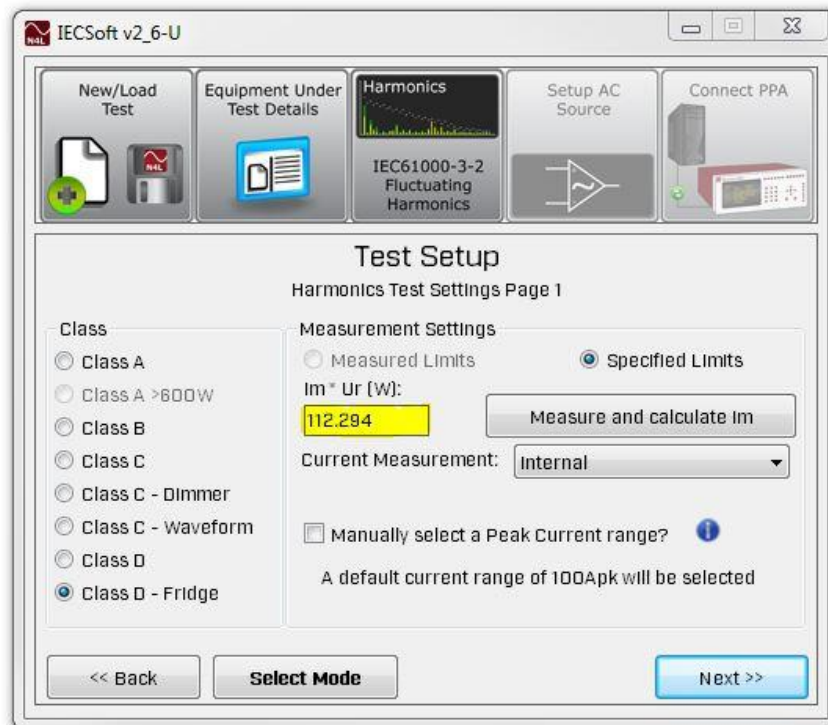
Source Status: Off

Output Settings: 230.00V at 50.00Hz

Time Elapsed: 1 h / 1 h

Calculated Im: 0.488A

The calculated I_m current uses the Maximum 5 minute Average result measured during the 1 hour test. This value is used to calculate the power ($I_m \times U_r$). The power value is displayed in both Test Setup dialog boxes when the Harmonic Class D – Fridge test is performed.



IECSoft v2_6-U

New/Load Test Equipment Under Test Details Harmonics IEC61000-3-2 Fluctuating Harmonics Setup AC Source Connect PPA

Test Setup

Harmonics Test Settings Page 1

Class

- ☐ Class A
- ☐ Class A >600W
- ☐ Class B
- ☐ Class C
- ☐ Class C - Dimmer
- ☐ Class C - Waveform
- ☐ Class D
- ☒ Class D - Fridge

Measurement Settings

☐ Measured Limits ☒ Specified Limits

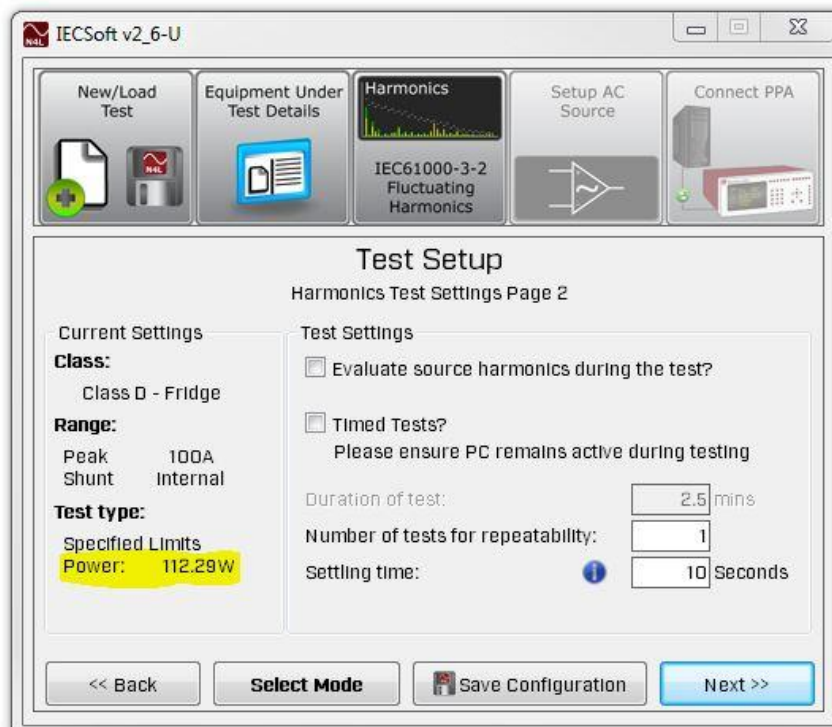
$I_m \times U_r$ (W): 112.294

Current Measurement: Internal

☐ Manually select a Peak Current range? 

A default current range of 100Apk will be selected

<< Back Select Mode Next >>



IECSoft v2_6-U

New/Load Test Equipment Under Test Details Harmonics IEC61000-3-2 Fluctuating Harmonics Setup AC Source Connect PPA

Test Setup

Harmonics Test Settings Page 2

Current Settings

Class: Class D - Fridge

Range:

Peak	100A
Shunt	Internal

Test type:

Specified Limits

Power: 112.29W

Test Settings

☐ Evaluate source harmonics during the test?

☐ Timed Tests?

Please ensure PC remains active during testing

Duration of test: 2.5 mins

Number of tests for repeatability: 1

Settling time: 10 Seconds

<< Back Select Mode Save Configuration Next >>

5.16.5 3-Phase “Measure Im” Test window

When running a 3-phase test the test window displays the results for each phase.

IECSoft v2_6

Measure Im Value

Connect

Disconnect PPA NEW TONS4TH,PPA5531,166-00691,2.174

Disconnect Source NEW TONS4TH,N4A03,91J-11932,1.21c

Test Control

Cancel Close Rated Voltage (Ur): 230 V

Source Status: On

Output Settings: 230.00V at 50.00Hz

Time Elapsed: 7 m, 3 s / 1 h

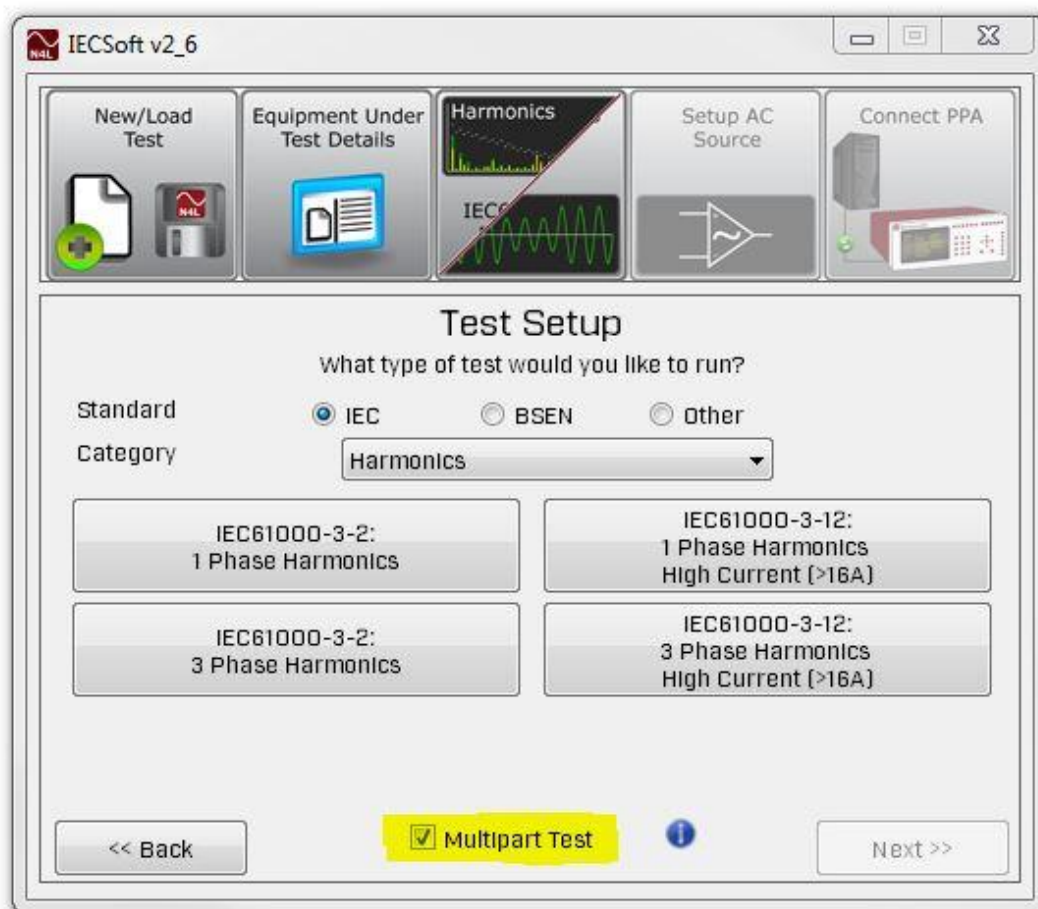
Current Value:	0.546A	0.546A	0.546A
5 Minute Average:	0.545A	0.544A	0.544A
Max 5 Minute Average:	0.545A	0.544A	0.544A

On completion of the test the software compares the results of the Max 5 minute average for each phase. The highest result of the 3 is selected and used to calculate the Power ($I_m \times U_r$) which is then displayed on the Test Setup screens.

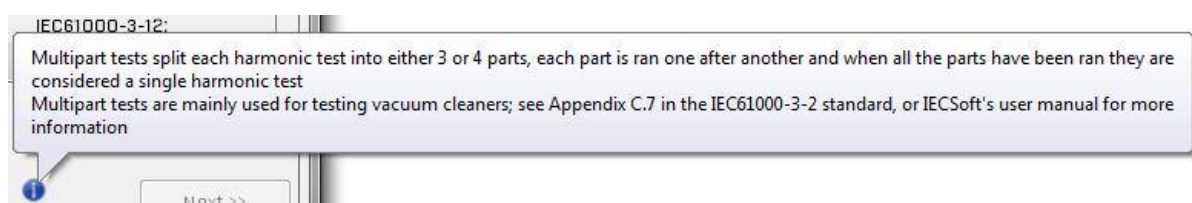
5.17 Vacuum Mode

Multi-part Harmonic Test Mode.

This new mode allows a Harmonic test to be performed in several parts allowing the DUT settings to be adjusted before continuing to the next part of the test. The results displayed in the report will include the data for all of the individual parts of the test unless shown otherwise in the setup procedure below.

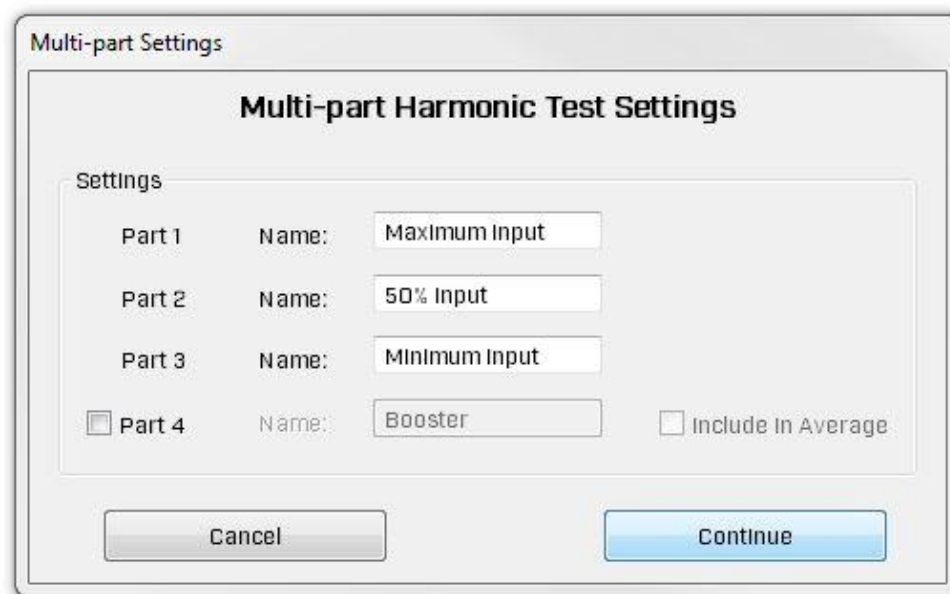


Clicking on the information icon displays further details about the Multipart performing multipart tests:



To select this test mode tick the checkbox at the bottom of the Test Setup dialog box when Harmonics is selected for the Category. This mode applies to all Harmonic tests; therefore select the required Harmonic test in the Test Setup dialog box to continue:

Selecting a harmonics test with the button checked brings up this window:



The image shows a dialog box titled "Multi-part Settings" with a sub-header "Multi-part Harmonic Test Settings". Inside, there is a "Settings" section containing a table with four rows for "Part 1" through "Part 4". Each row has a "Name:" label and a text input field. The input fields contain "Maximum Input", "50% Input", "Minimum Input", and "Booster" respectively. To the right of the "Booster" input field is a checkbox labeled "Include In Average". At the bottom of the dialog are two buttons: "Cancel" and "Continue".

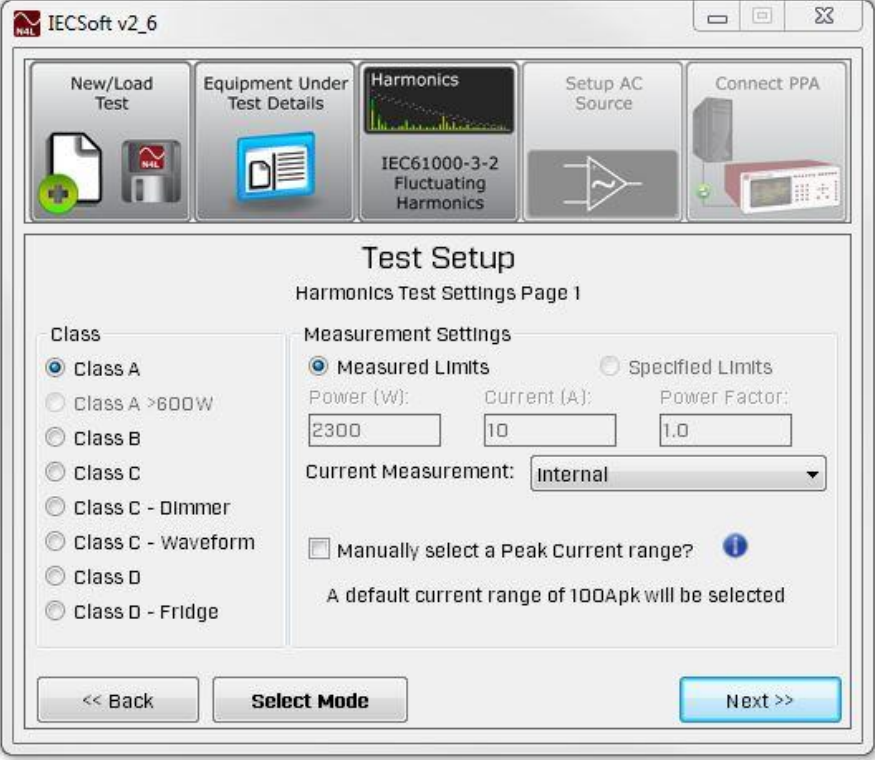
Part	Name:	
Part 1	Name:	Maximum Input
Part 2	Name:	50% Input
Part 3	Name:	Minimum Input
☐ Part 4	Name:	Booster ☐ Include In Average

The test will consist of three parts with the option to add a 4th part to the test. The default names are shown but the user can change the names if desired.

When Part 4 is selected the "Include in Average" option becomes available. If selected this includes the data for Part 4 in the Averages displayed in the Excel report, the data is also used for all average calculations for limits etc.

NOTE: When performing vacuum mode tests, the data for Part 4 (Booster) must NOT be included in the averages. Please refer to the standard document for further details.

Pressing "**Continue**" displays the normal Harmonics Setup dialog box:



IECSoft v2_6

New/Load Test Equipment Under Test Details Harmonics IEC61000-3-2 Fluctuating Harmonics Setup AC Source Connect PPA

Test Setup

Harmonics Test Settings Page 1

Class

- ☒ Class A
- ☐ Class A >600W
- ☐ Class B
- ☐ Class C
- ☐ Class C - Dimmer
- ☐ Class C - Waveform
- ☐ Class D
- ☐ Class D - Fridge

Measurement Settings

☒ Measured Limits ☐ Specified Limits

Power (W): 2300 Current (A): 10 Power Factor: 1.0

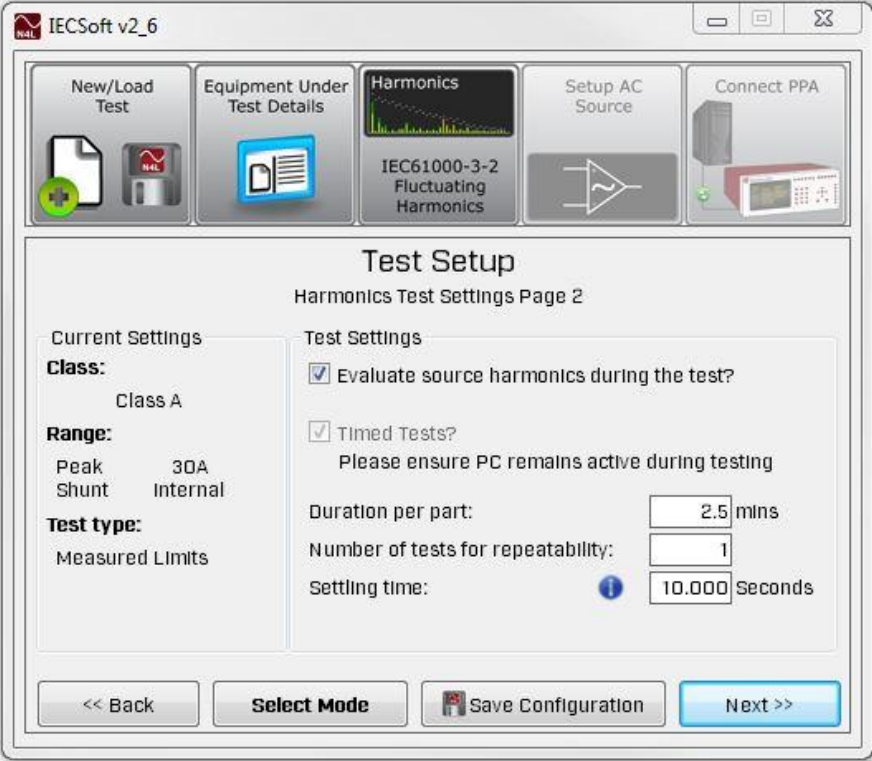
Current Measurement: Internal

☐ Manually select a Peak Current range? 

A default current range of 100Apk will be selected

<< Back Select Mode Next >>

With one slight exception, there is only the option to run a timed test (which is called “duration per part” when doing a multipart test); this is because the standard states that each “part” needs to be the same length as all other parts:



IECSoft v2_6

New/Load Test Equipment Under Test Details Harmonics IEC61000-3-2 Fluctuating Harmonics Setup AC Source Connect PPA

Test Setup

Harmonics Test Settings Page 2

Current Settings

Class: Class A

Range: Peak 30A Shunt Internal

Test type: Measured Limits

Test Settings

☒ Evaluate source harmonics during the test?

☒ Timed Tests? Please ensure PC remains active during testing

Duration per part: 2.5 mins

Number of tests for repeatability: 1

Settling time:  10.000 Seconds

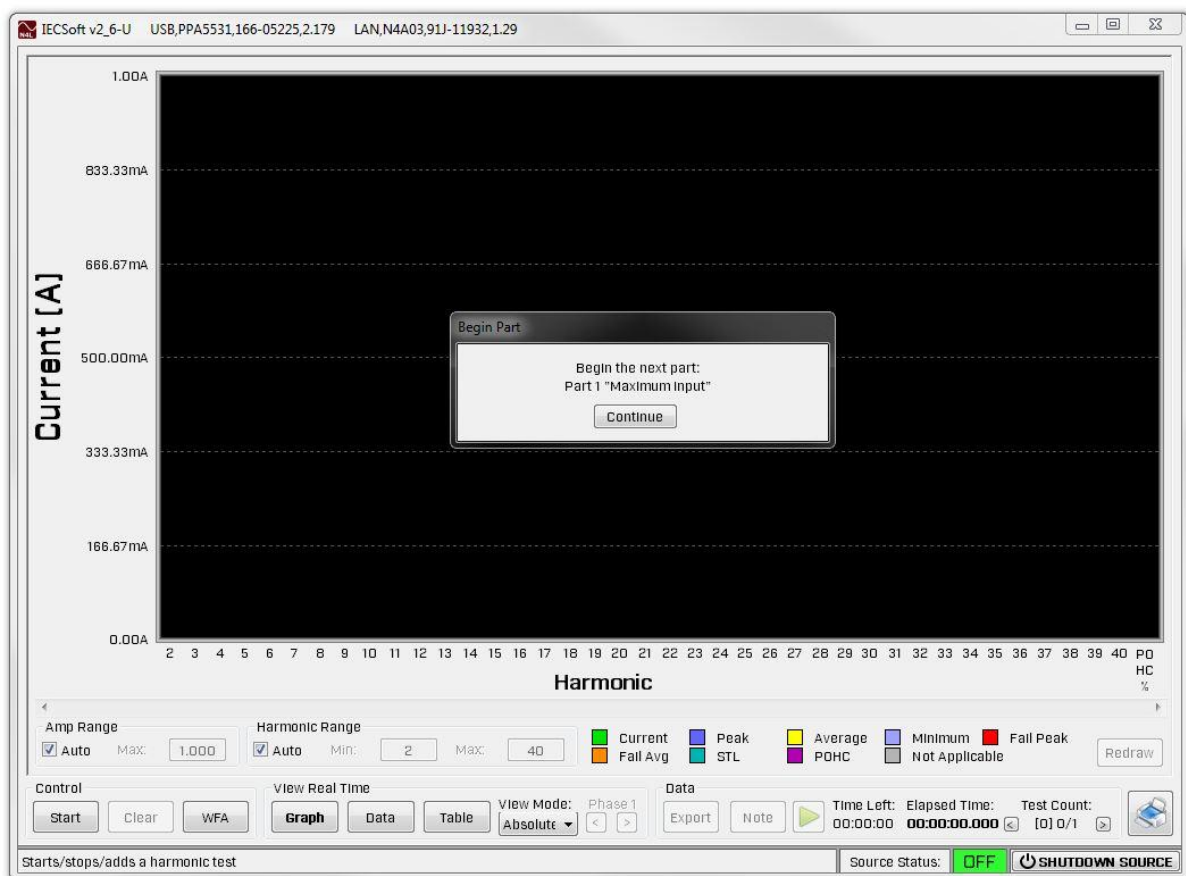
<< Back Select Mode Save Configuration Next >>

NOTE: When performing vacuum mode tests, the “Duration per part” must be set to a minimum of 2 minutes to comply with the requirements of the Standard.

Follow the Normal Harmonic mode setup procedure to connect to the instruments and display the Harmonic Test window.

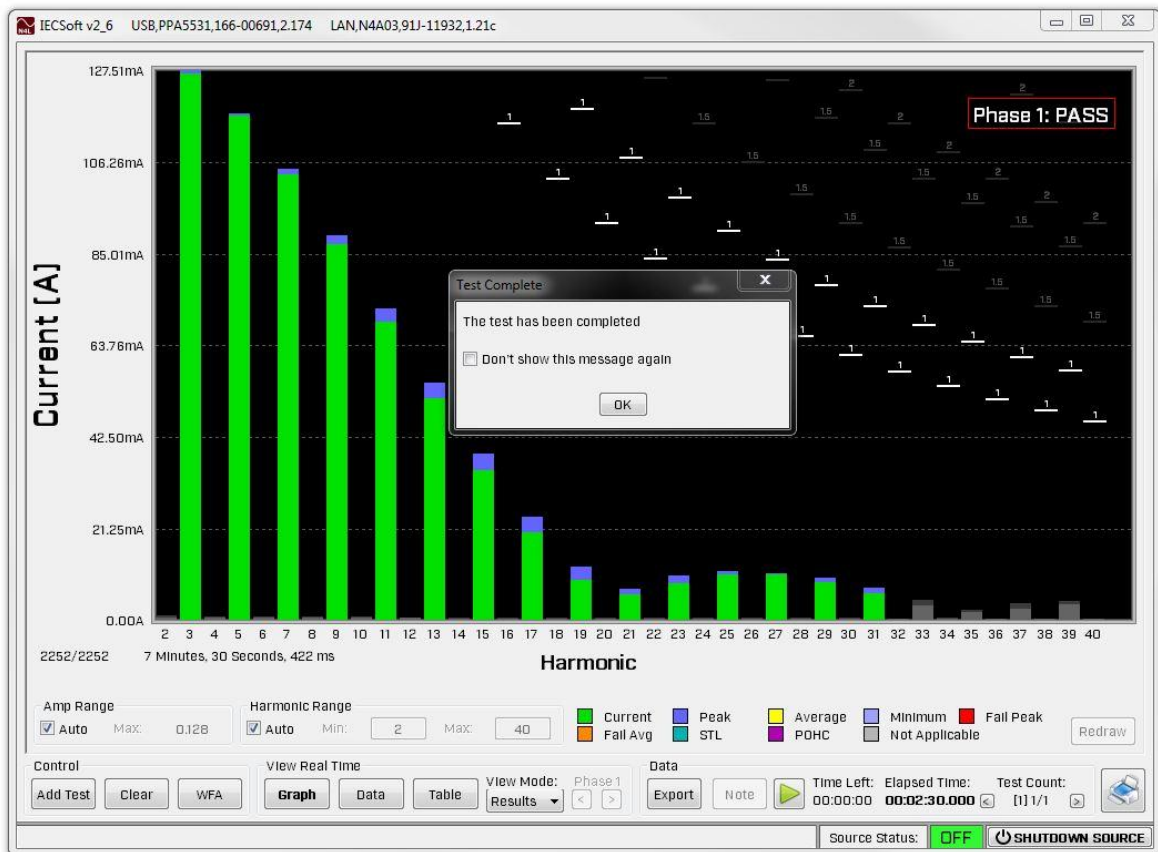
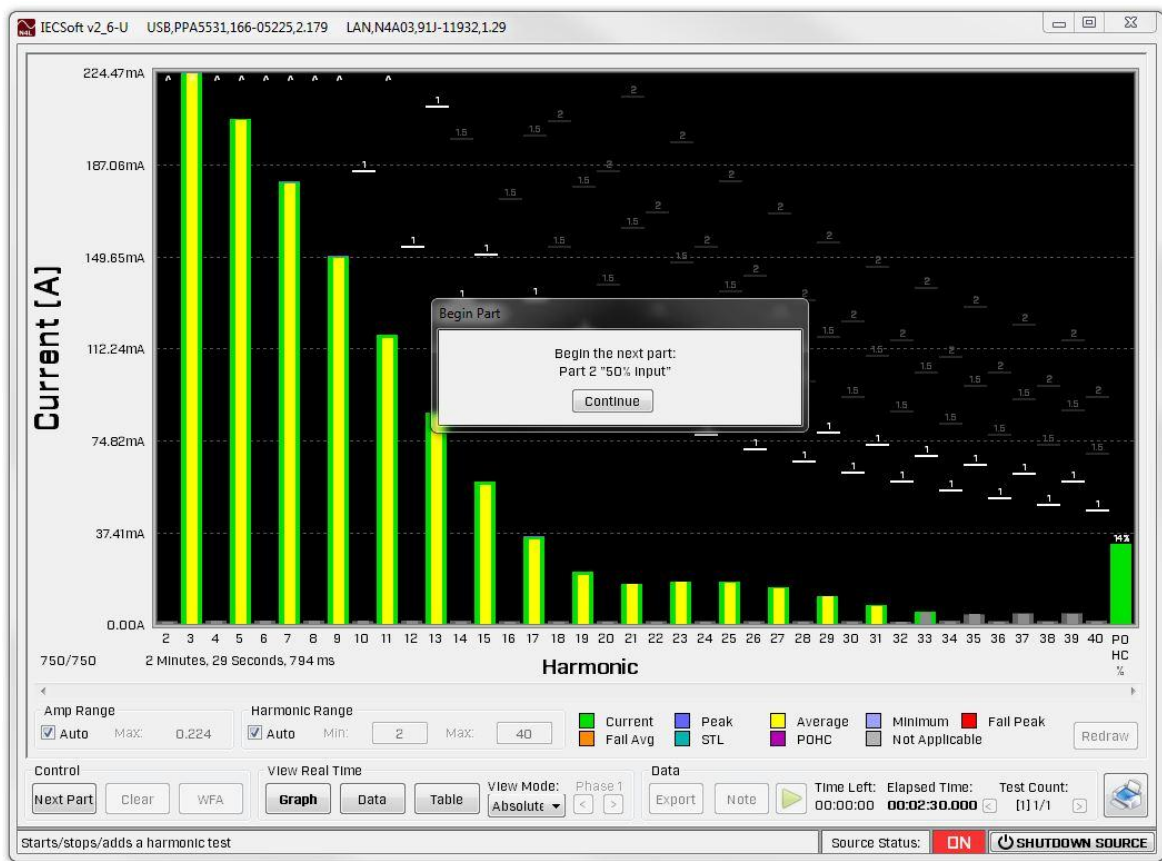
Each time you select Start, a message is displayed telling you which “part” of the test you are running.

Ensure the DUT is correctly set to the required Power setting for that PART of the test before clicking on “Continue”



When each part finishes, the source is left on, the PPA will still say “test running” and most of the buttons are still disabled.

Press **"Next Part"** to continue:



When you've performed each part to complete a full test the source will be switched off, and all the buttons are available again. The Test Complete window is also displayed.

Each part is treated as though it continues on from the end of the previous part including Part 4 if this is selected during the setup procedure; this is a requirement of the Standard. The timer below the horizontal axis of the graph continues counting upwards when the next part of the test starts, however Time Left and Elapsed Time reset with each part.

All 3 (or 4) parts are considered as one whole test for the Repeatability tests.

The only difference in the Excel / PDF report is that the Test duration tells you the total duration as well as how long each part is.

Test Conditions		
	User Entered	Measured
Rated Voltage	N/A	229.864V
Rated Current	N/A	276.739mA
Rated Frequency	N/A	50.000Hz
Rated Power	N/A	30.784W
Additional Test Information		
Measured Power Factor	0.484	
Max Current THD	179.86%	
Average THC	240.364mA	
Max Power	31.074W	
Max F.Current	137.814mA	
Average F.Current	136.536mA	
Minimum Current	30A	
Test Duration	7.5 minutes (3 parts, 2.5 minutes each)	
Additional Test Details		
Operator	N/A	
Lab Name	N/A	
Location	N/A	

NOTE: When performing vacuum mode tests the Test Duration will include Part 4 "Booster" if this was selected in the Setup options.

Multi-part test Excel report - Harmonic Results.

Extra Test Information							
Current THDG	179.80%						
	Average	Peak				Limit	
THC	240.364mA	244.532mA				N/A	
POHC	22.293mA	22.457mA				251.375mA	
Voltage Crest Factor	1.404	1.405				1.40 to 1.42	
Current Crest Factor	3.625	3.691				N/A	
Harmonics Results 1/1							
Harmonic	Status	Avg (A)	Avg L(A)	Avg %ofL	Peak (A)	Peak L(A)	Peak %ofL
1	PASS	0.13653	No Limit	N/A	0.13781	No Limit	N/A
2	PASS	0.000666	1.08	0.0616509	0.001043	1.62	0.0643642
3	PASS	0.12678	2.3	5.51217	0.12751	3.45	3.69594
4	PASS	0.000692	0.43	0.160933	0.001002	0.645	0.155271
5	PASS	0.11704	1.14	10.2667	0.1175	1.71	6.87135
6	PASS	0.00065	0.3	0.216707	0.00088	0.45	0.195471
7	PASS	0.10347	0.77	13.4377	0.10477	1.155	9.071
8	PASS	0.000604	0.23	0.262735	0.000846	0.345	0.245203
9	PASS	0.08715	0.4	21.7875	0.089398	0.6	14.8997
10	PASS	0.000563	0.184	0.306245	0.000793	0.276	0.287264
11	PASS	0.069402	0.33	21.0309	0.072425	0.495	14.6313
12	PASS	0.000526	0.15333	0.343299	0.000741	0.229995	0.322216
13	PASS	0.051503	0.21	24.5252	0.055164	0.315	17.5124
14	PASS	0.000503	0.13143	0.382964	0.000699	0.197145	0.354764
15	PASS	0.034765	0.15	23.1767	0.038722	0.225	17.2098
16	PASS	0.000481	0.115	0.417852	0.000686	0.1725	0.397507
17	PASS	0.020311	0.13235	15.3464	0.024141	0.198525	12.1602
18	PASS	0.000471	0.10222	0.461015	0.000632	0.15333	0.412118
19	PASS	0.009484	0.11842	8.00912	0.012452	0.17763	7.01008
20	PASS	0.000463	0.092	0.50325	0.000616	0.138	0.446471
21	PASS	0.005959	0.10714	5.56188	0.007212	0.16071	4.48765
22	PASS	0.000453	0.083636	0.54186	0.000624	0.125454	0.497409
23	PASS	0.008705	0.097826	8.89835	0.010452	0.146739	7.12285
24	PASS	0.000454	0.076667	0.591676	0.000653	0.115001	0.567432
25	PASS	0.010701	0.09	11.89	0.011323	0.135	8.38741

The Harmonic Results displayed in the main body of the report (above) includes the data for Part 4 if this was selected in the Multi-part Harmonic Test Settings window.

The Average values displayed in the Extra Test Information area of the report (above), will only include the data for part 4 if the "Include in average" box was checked in the Multi-part Harmonic Test Settings window.

NOTE: When performing vacuum mode tests, the "include in average" box must not be checked and the data for Part 4 (Booster) not included in the Averages displayed in the report or in the calculation of the Average limits. The data for Part 4 is always included in the "Harmonic Results"

5.18 THDG and THDS

Total **harmonic distortion** or THD is a common measurement of the level of **harmonic distortion** present in power systems. THD can be related to either **current harmonics** or voltage **harmonics**, and it is defined as the ratio of total **harmonics** to the value at fundamental frequency times 100%.

The harmonic analysis for both current and voltage is as per IEC61000-4-7. THDS applies only to voltage and is computed as harmonic subgroups, see IEC61000-4-7 section 3.2.5. THDG applied to current and is computed as harmonic groups; see IEC61000-4-7 section 3.2.4.

IECSoft version **v2.6** determines the values of THDG and THDS and includes them in the Excel report. Current THDG can be found in the Extra Test Information on the Harmonics Results tab of the report. Voltage THDS can be found in the Extra Test Information on the Source Harmonics tab of the excel report.

Appendix D (section 9.4) in this user manual provides more details on the formulas used to calculate THDG and THDS.

6 The Export function.

In both Harmonic and Flicker modes this function allows Excel and PDF reports to be created. The test data can also be saved to “.CSV” and “.N4Liec” files.

In addition to producing an Excel or PDF report it is recommended that the test data is saved to an “.N4Liec” file described in section 6.6 of this manual. This allows the test data to be reviewed again in IECSoft at a later date allowing you to re-create the Excel report along with allowing further tests to be performed using the same settings etc. The file can also be used to aid Technical Support should this be required.

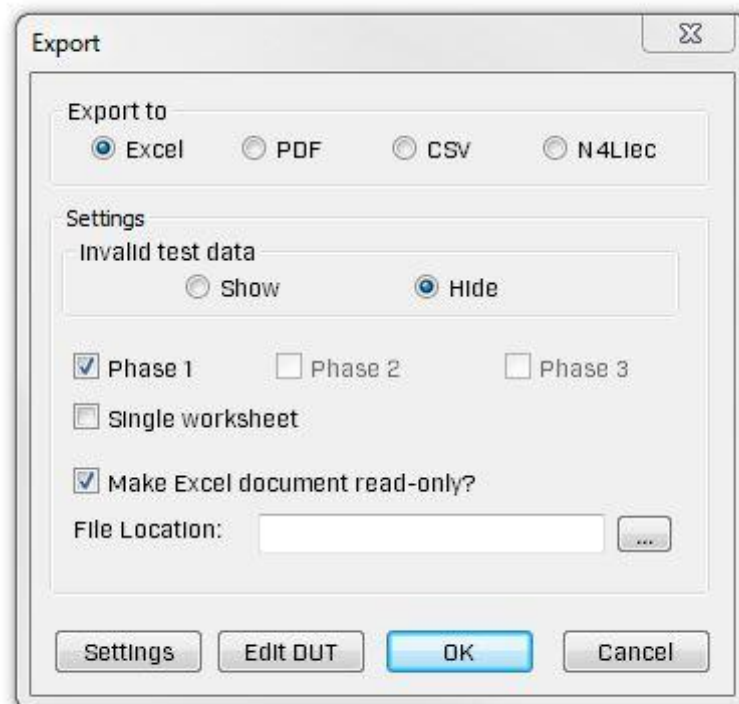
READ ONLY / EDITABLE Excel Reports:

The default setting is to create Excel Reports that are READ ONLY documents. It is possible to de-select this option in the Export window so that the report can be edited. However, the user should consider that this will allow the data in the Excel report to be edited at ANY time in the future. Refer to section 6.3 of this manual for more details about creating the report.

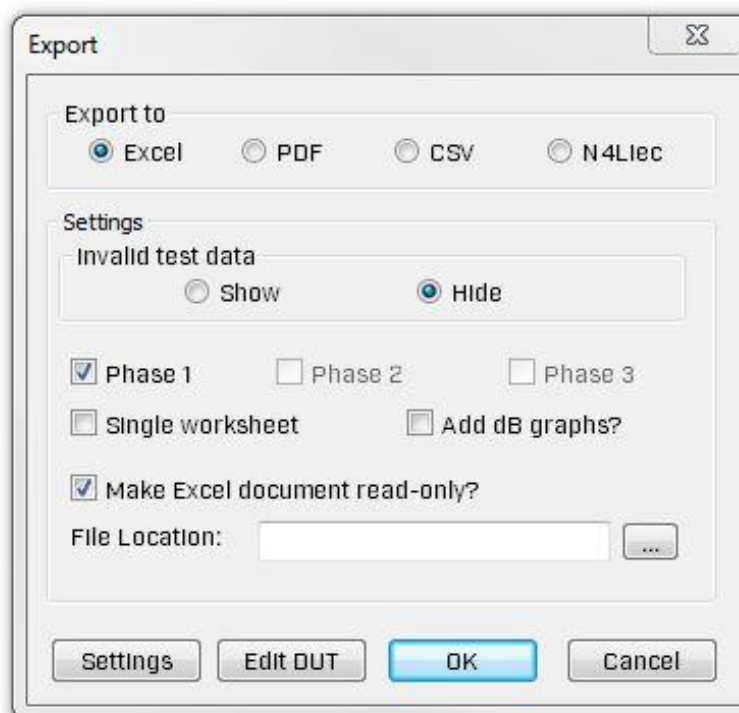
6.1 Data Export window

To save any results click on the Data Export button which can be found at the bottom of the main Flicker and Harmonics test windows. The Flicker and Harmonic export windows are very similar to each other. The only difference is the option to “add dB graphs” which is only available in Harmonics mode.

6.1.1 Flicker Test Results Export window:



6.1.2 Harmonics Test Results Export window:



6.2 Export Window selection options:

6.2.1 “Export to” options:

The results can be exported and saved into 4 file types:

Excel report document - A document containing all of the results and graphs for either Flicker or Harmonics.

PDF report document - A document containing all of the results and graphs for either Flicker or Harmonics.

“.CSV” file – A file containing the result data that can be viewed using “notepad”.

“.N4Liec” file – A file containing all of the data that can be recalled into IECSoft using the “Load IEC Test” (or using drag and drop) function on the welcome screen.

6.2.2 Including Invalid Test Data (Excel report only):

The default Excel Reports does not include any Invalid test data, for example the data from tests where the Rated Power is less than 75W. Also not displayed are any disabled limits such as the PLT limit when running a Harmonic test with “Ignore PLT” selected. Selecting “Show” Invalid test data in the Export window will include ALL data and limits in the report.

6.2.3 3-phase Testing:

For the results of 3-phase testing a separate excel report is created for each phase. The default setting is to create reports for all 3 phases. However, in the Export window the User can choose to create a report(s) for a single phase, any two phases or all 3 phases. Only Phase 1 is available when running single phase tests.

6.2.4 Single worksheet option (Excel report only):

Normal Excel reports contain several tabs but if this option is selected the pages will all be created on a single worksheet.

6.2.5 Add Harmonic dB graphs (Excel report only):

It is possible to include an additional graph displaying Loss factor (With respect to the fundamental current component) in Decibels for all of the harmonics.

To select this option place a tick in the "Add dB Graphs" box on the Harmonic Export window.

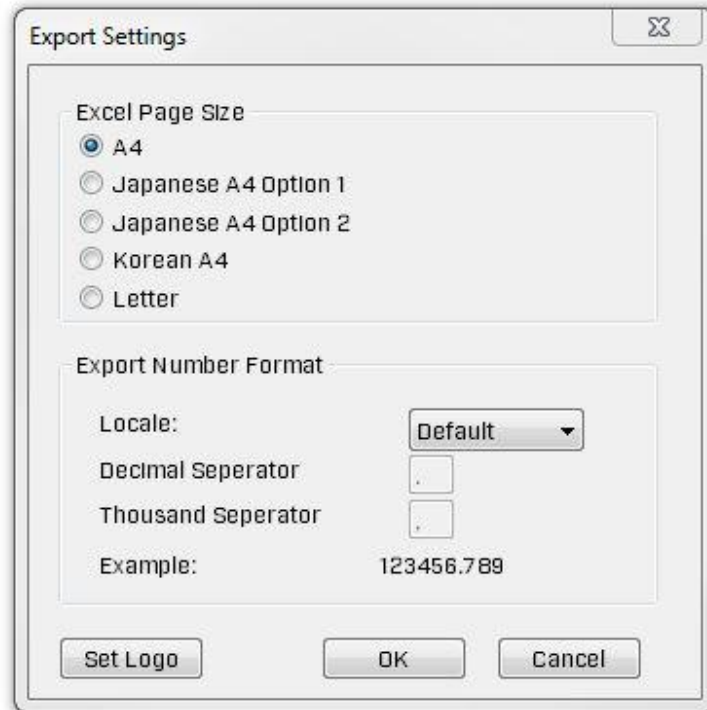
The Loss factor graph is then included in the exported Fluctuating Harmonics Report. The Loss Factor graph can be found below the Current Harmonics graph on the Harmonic Results tab of the report. An example graph can be found in Appendix B (section 9.2) of this manual.

6.2.6 Make Excel document read-only:

The default setting is to create a Read Only Excel document. By deselecting this option the Excel report can be edited at a later date.

6.2.7 Export Settings Button.

Click on the "**Settings**" button in the Flicker or Harmonics Export window to display the Export settings window:



Excel page size:

There are a number of Excel Report page size options that can be selected by the user:

A4 – Standard A4 size for the UK and Europe.

Japanese A4 Option 1 – Required for use with Japanese Excel version 2013 and later.

Japanese A4 Option 2 – Required for use with Japanese Excel version 2010 and earlier.

Korean A4 – Required for use with Korean versions of Excel.

Letter – Letter style format. (Mainly used in the USA).

Note: The User should select the appropriate option for the version of Excel installed on their PC or Laptop. This will ensure that the report is displayed and printed out correctly.

Export Number format:

The number format can be adjusted by the User. This allows the format to be adjusted to agree with the version of Excel to ensure that numbers are correctly displayed in the reports.

6.2.8 Edit DUT Button:

Before saving the results it is possible to add or amend the information entered into the "Equipment under Test" window in Section 3.2 of this manual.

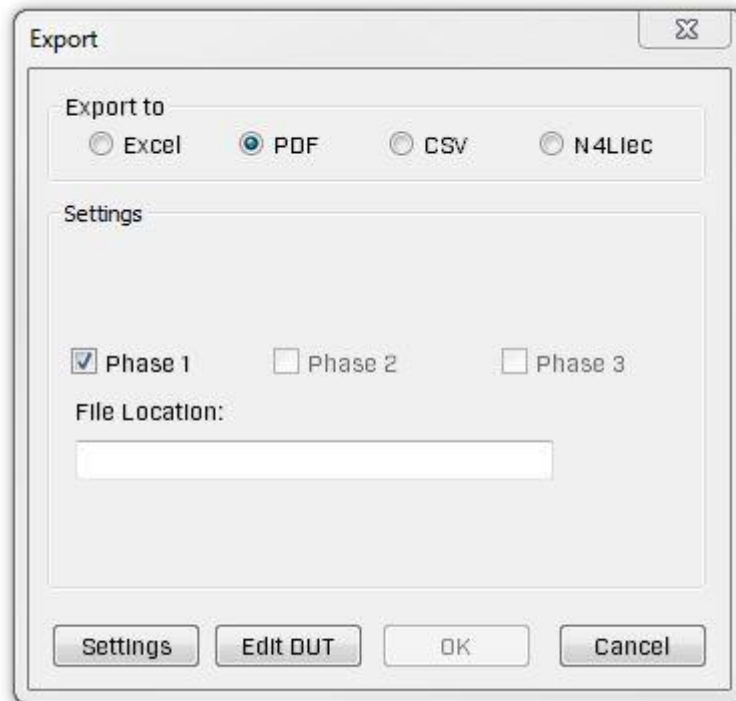
Click on "**Edit DUT**" in the Export window on the following page will open:

The screenshot shows a dialog box titled "Additional Details". It contains two columns of input fields. The left column, labeled "Device Details", includes fields for Brand, Model, Serial, Rated Voltage (V), Rated Current (A), Rated Frequency (Hz), Rated Power (W), and Impedance ID, each with a text input field containing "N/A". The right column, labeled "Test Details", includes fields for Lab Name, Location, and Operator, each with a text input field containing "N/A", and a large text area for Notes with a "chars left: 249" indicator. At the bottom of the dialog are "Cancel" and "OK" buttons.

Any of the details can be amended if required and comments can be entered into the Notes section. Click "**OK**" to save the changes and close the window. The information entered here will then be included in the report or results file.

6.3 Creating a PDF report

Click on "Export to PDF". The following window will open:



The DUT details can be added or updated if required and the Settings can also be adjusted if necessary.

Click on the file location box, the "Choose File Location" window will be displayed. Select the location to where you want the file to be stored.

IECSOft automatically gives the file a name based on the date and time. This file name can be kept or deleted and a new file name entered. Click "**Save**" which will close the window and then click on "**OK**" in the Export window.

The following message will be displayed for a short period.



The file will then be stored to the requested location. The following message is displayed to confirm that the PDF document was successfully saved to the required location.



Click on **Close** to clear the message.

Note: The Harmonic dB graph, single worksheet and the Inclusion of invalid test data options are not available when creating a PDF report. The Export to Excel option should be used if any of these options are required.

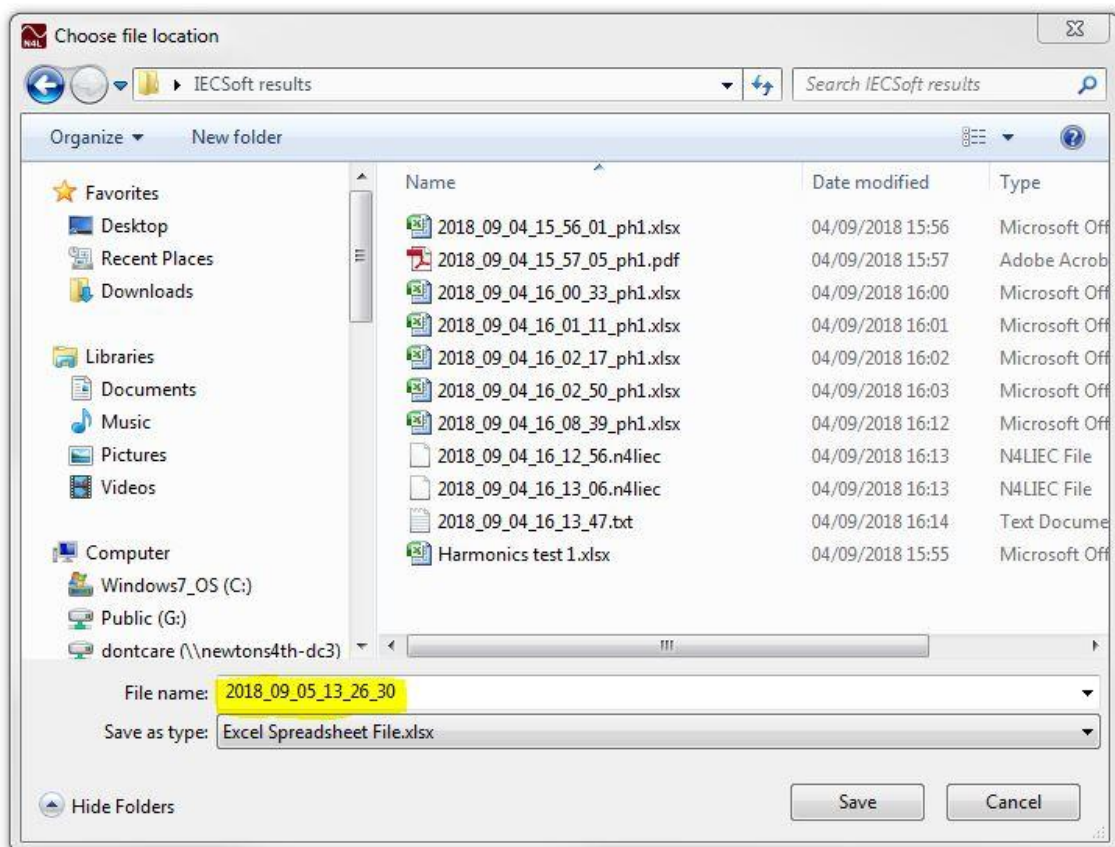
6.4 Creating an Excel report.

The default Excel report will contain locked spreadsheets with "Finalize document" applied to prevent the data from being changed at a later date. It is possible to produce an editable document but this **MUST** be selected at the time the Excel report is produced. The locked report can't be unlocked by the user. However, if an ".N4Liec" file was created at the time the test was performed this file can be loaded back into IECSoft to create a new unlocked Excel document.

6.4.1 Non-Editable Documents.

Ensure "Export to Excel" and "Make Excel document read-only?" are still selected in the Export window along with any other optional selections.

Click on the file location box, the "Choose File Location" window will be displayed.



Select the location to where you want the file to be stored.

You will see that IECSoft automatically gives the file a name based on the date and time. This file name can be kept or deleted and a new file name entered. Click "**Save**" which will close the window and then click on "**OK**" in the Export window.

The following message will be displayed for a short period.

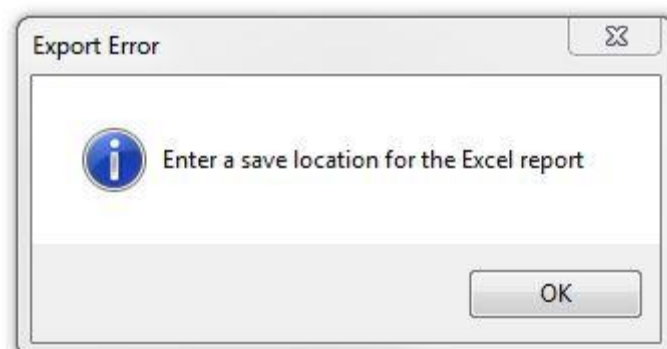


The file will then be stored to the requested location and will also open up on the PC. The following message is then displayed to confirm that the excel document was successfully saved to the required location.



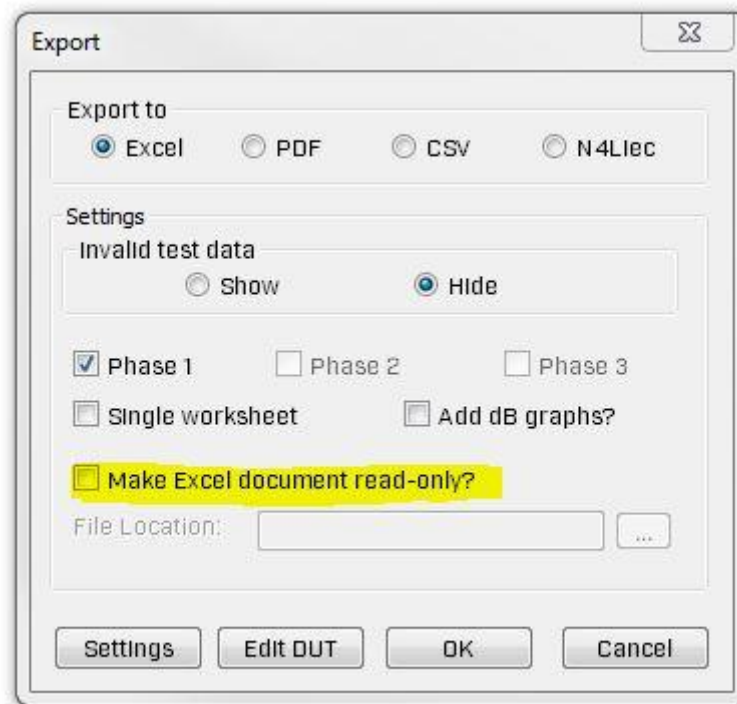
Click on **Close** to clear the message.

Note: If you click on "**OK**" without entering a file location the following error message is displayed. Click on "**Ok**" and enter a file location as described above.



6.4.2 Excel documents that can be edited.

Ensure in the Export window that “Make Excel document read-only?” is not selected.



Note: It is not possible to enter a file name and save the file directly to the PC. The file must be saved once it is open.

Click on “**OK**” in the Export window,

The following message will be displayed for a short period.



The file will then be open up on the PC.

The following message is then displayed to confirm that the excel document was successfully opened on the PC.

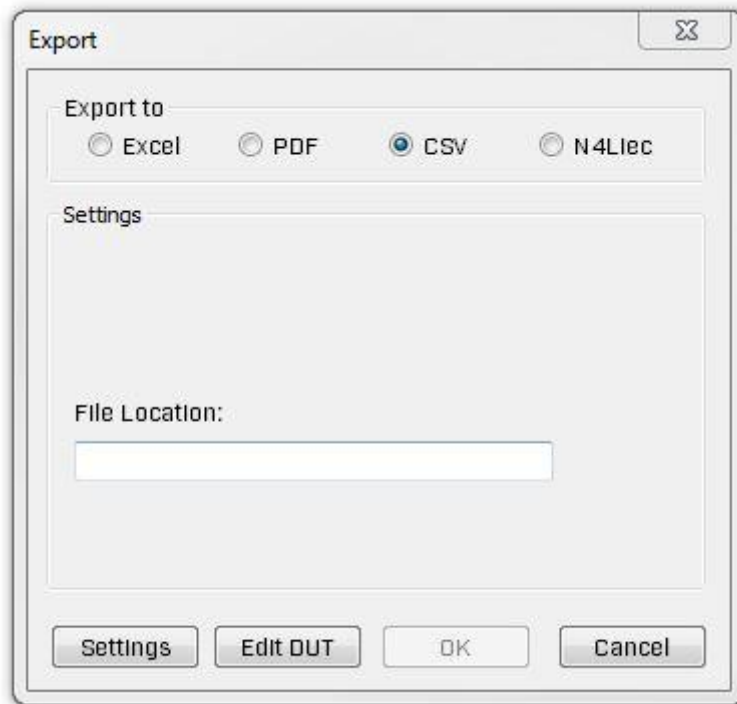


Click on **Close** to clear the message.

The Excel file can now be edited but remember the document **MUST** be saved before it is closed otherwise it will be lost and can't be recovered if the test window is already closed.

6.5 Creating “.CSV” files.

Click on “Export to .CSV”. The following window will open:



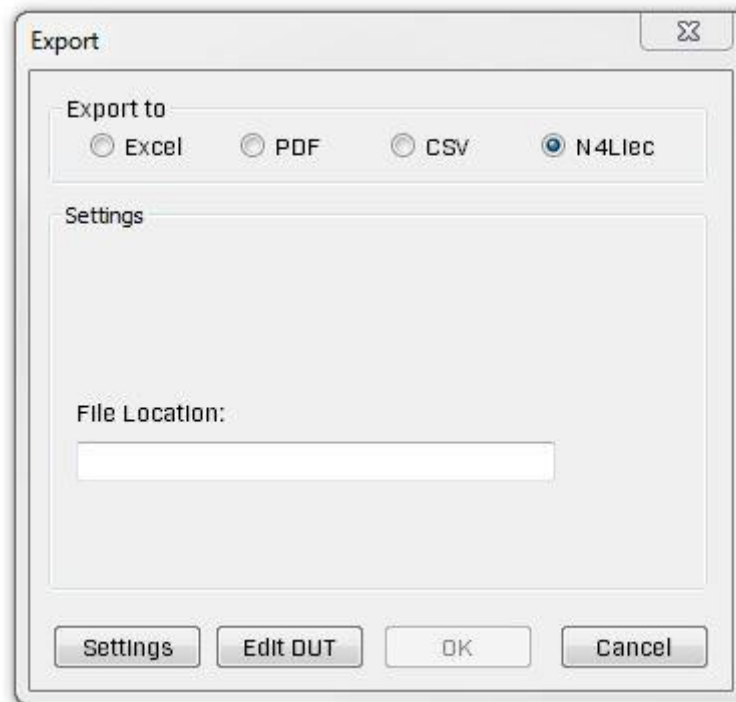
The DUT details can be added or updated if required and the Settings can also be adjusted if necessary.

Click on the file location box, the “Choose File Location” window will be displayed. Select the location to where you want the file to be stored.

IECSOFT automatically gives the file a name based on the date and time. This file name can be kept or deleted and a new file name entered. Click “**Save**” which will close the window and then click on “**OK**” in the Export window to save the file in “.CSV” format to the requested location.

6.6 Creating “.N4Liec” files.

Click on “Export to .N4Liec”. The following window will open:



The DUT details can be added or updated if required and the Settings can also be adjusted if necessary.

Click on the file location box, the “Choose File Location” window will be displayed. Select the location to where you want the file to be stored.

IECSOft automatically gives the file a name based on the date and time. This file name can be kept or deleted and a new file name entered. Click **“Save”** which will close the window and then click on **“OK”** in the Export window to save the file in “.N4Liec” format to the requested location.

6.7 Recalling stored Configuration & Result files.

Configuration settings can be recalled into IECSoft using stored configuration files (.iecfg files). Sections 4.2.2 and 5.2.5 in this manual describe how to create the configuration files.

Result files can be recalled into IECSoft and then viewed using stored result files (.N4Liec). Section 6.6 in this manual describes how to create the result files.

There are two methods of recalling the ".iecfg" configuration and the ".N4Liec" Result files. These are:

- 1) Using the IECSoft Welcome screen.
- 2) Using Drag "n" drop.

6.7.1 Using the Welcome Screen.



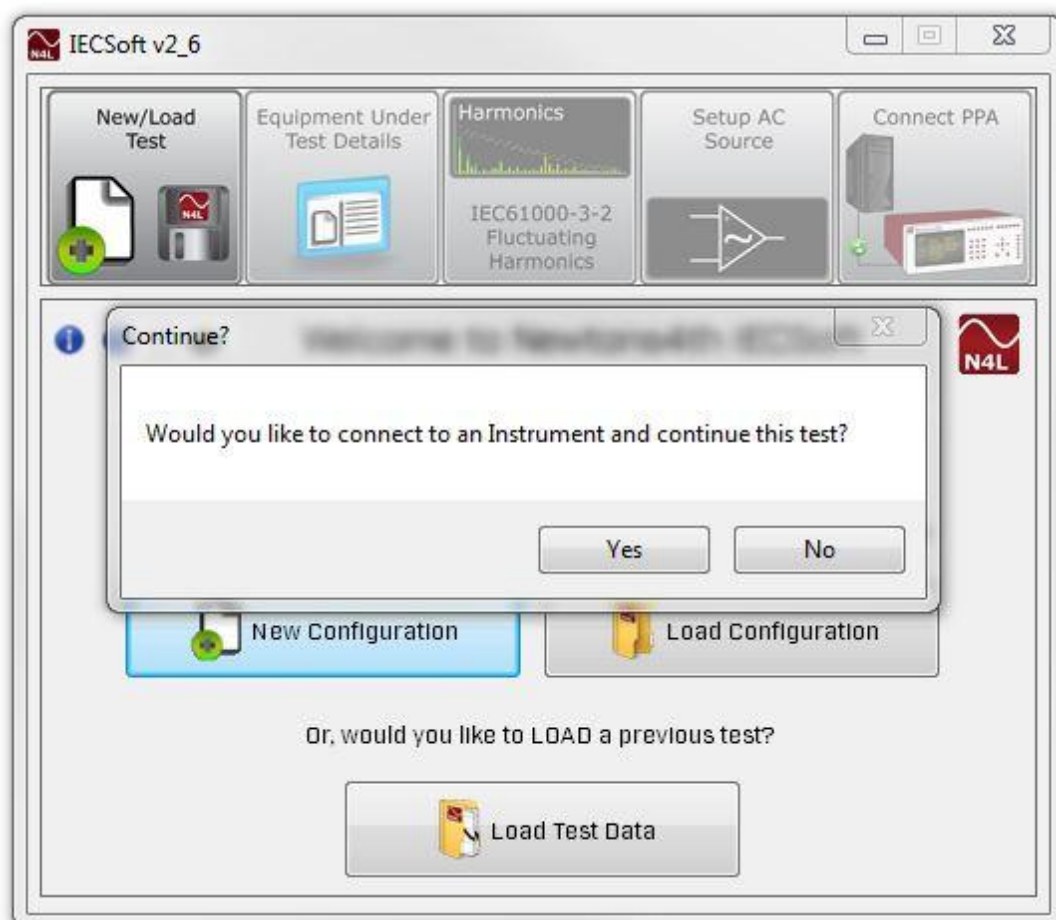
To Load Configuration Files.

To load a stored “.iecfg” Configuration file click on **“Load Configuration”**. Double click on the file once it is located on the computer. The configuration settings will then be recalled into IECSoft and the “Test Setup – page 2” dialog will be displayed.

Click **“Next”** to continue with the instrument Setup and to perform the tests.

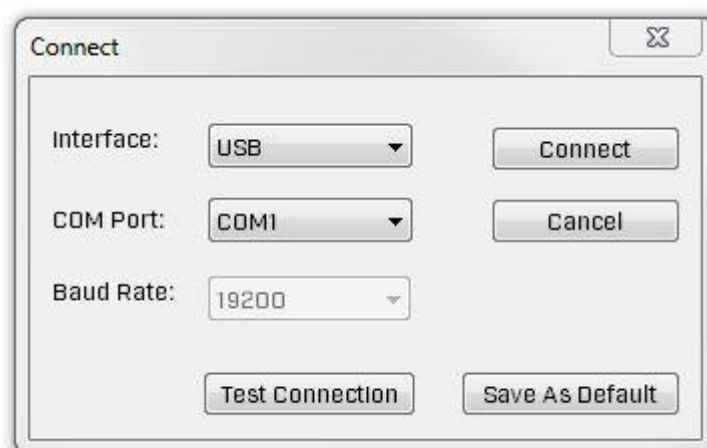
To Load Result files.

To load a stored “.N4Liec” Result file click on **“Load Test Data”**. Double click on the file once it is located on the computer. The following message window appears:



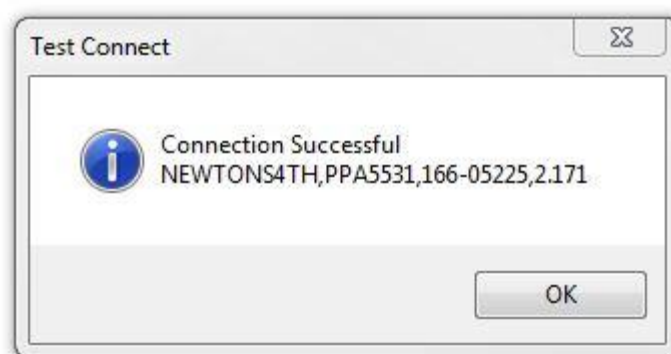
Click on "**NO**" and the Realtime Graph window will appear displaying the saved results for a Harmonic N4Liec file. The IFS graph window appears if a Flicker N4Liec file is loaded. The software will not be connected to the instrument but the user can view the saved Flicker or Harmonic results in the various formats and export the results again if required.

Click on "**YES**" and the connection window is displayed:

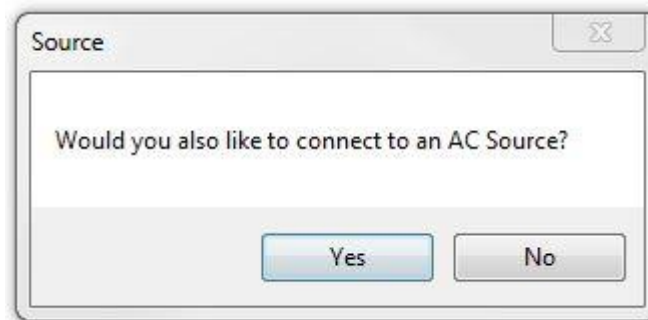


Select the required Interface option and ensure the instrument is set to the same option. For a LAN interface click on search and select the IP address of the instrument. For Serial and USB select the appropriate COM Port. For serial interface connections only ensure the Baud Rate in the connection window *and* on the instrument are set to 19200.

Click on "**Connect**": The test Connection window appears.

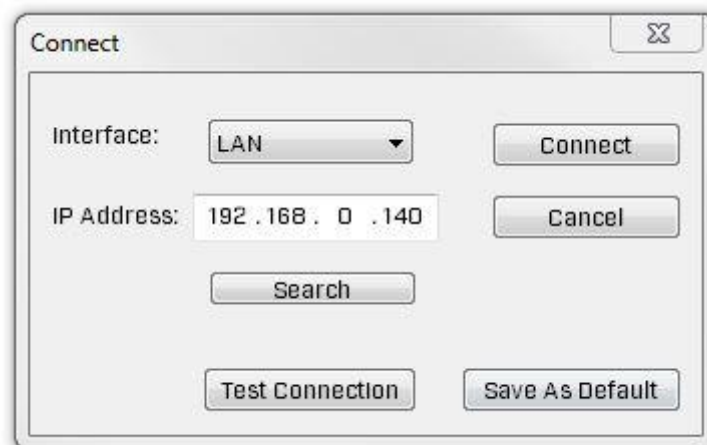


Click on "**OK**": The Source connection window appears:

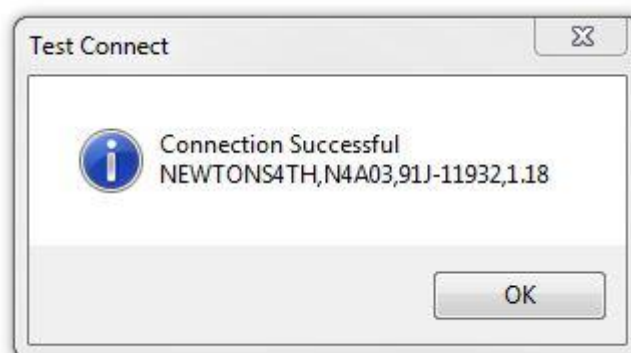


Click "**NO**": The Setup windows appear and then the IFS graph.

Click "**YES**": The Source connection window appears.



Select the correct Interface settings then click on "**Connect**":



Click on "**OK**": The Setup windows will then appear.

The Flicker or Harmonic Test results are recalled into IECSoft displaying the Harmonic Absolute Graph or the Flicker IFS Graph. The other graphs, data and results table can be viewed by selecting the required viewing option using the menu along the base of the window.

To run an additional Harmonic test click on the "ADD TEST" button. The software will run another harmonic test and then include the results with the previously saved results.

In Flicker mode click on "clear" to reset the flicker window and click YES to clear the data. Click on START to run the test using the previous settings.

6.7.2 Drag "n" drop.

Drag an ".iecfg" Configuration file on to the IECSoft ".exe" file or shortcut. IECSoft will then automatically start up and load the configuration settings from the stored file. The "Test Setup Page 2" dialog will be displayed. Click "**Next**" to continue with the setup and connect to the instrument to perform the tests.

Drag an ".N4Liec" Result file on to the IECSoft ".exe" file or shortcut. IECSoft will then automatically start up and display the "Would you like to connect to an Instrument and continue this test?" message. Click on "**NO**" to view the results data or "**YES**" to connect to an instrument, view the results data and perform further tests.

6.8 Clearing the IECSoft file storage area on PC's.

When the results for a flicker or Harmonics test are exported into an Excel document, copies of the graphs created for the reports are also stored on to the PC.

The storage area can be found at: My pictures / N4L / IECSoft.

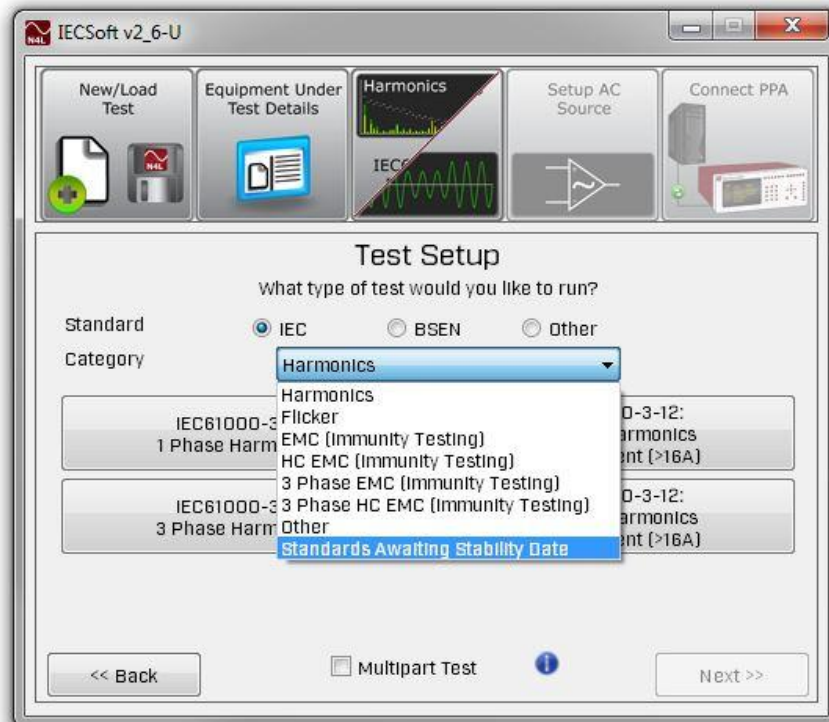
Users may want to periodically clear this storage area as the folder size can become rather large especially on PC's dedicated to running IECSoft software.

Note: The graphs in this storage area that are associated with any Excel report that the user wishes to keep should be retained. Otherwise they will disappear when the report is next loaded into Excel.

If the ".N4Liec" file was retained for the test associated with the report then it is possible to re-export the data to create a new report and graphs.

7 New releases of IEC Standards

Selecting the **Standards Awaiting Stability Date** Category displays the recently released proposed updates to Standards that are included in our IECSoft software.



Tests can be performed to these updated versions of the Standards but the User should be aware that these ARE ONLY proposed changes to the Standards concerned. They are subject to change at any time until the stability date which is still to be advised by the IEC Committee.

These versions of the Standards have been included in the software to allow the user to check the performance of the DUT against the updated requirements of the Standard. However it will be noted on the report that the version of the Standard used for the test has not yet been deemed "stable" by the IEC committee.

Only the fully released versions of the Standards found in the main test categories of the software should be used to perform fully compliant IEC testing.

When selecting the “Standards Awaiting Stability Date” category the Test Setup window will be updated to display all of the test options that fall into this category.



At the time of release of this version of IECSoft the following proposed standards have been included:

IEC61000-3-2:2018
IEC61000-3-3:2017
IEC61000-3-11:2017

The test procedures are the same as for tests performed using fully released versions of the Standards. Click on the required option in the Test Setup window and follow the displayed instructions.

8 IECSoft Warning Messages

8.1 Harmonic Over Ranging

During Harmonic testing the Data View screen and graphs will display a warning should the Current and / or Voltage be Over Ranging.

On the Data View screen Vrms is shaded purple if the voltage is Over Ranging and Arms is shaded purple if the current is Over Ranging.

IECSoft v2_6-U USB,PPA5531,166-05225,2,179 LAN,N4A03,91J-11932,1,29

Frequency	Vrms	Arms	Watts	Power Factor	Voltage CF	Current CF
50.000 Hz	109.52 V	130.46 mA	6.1790 W	0.4325	1.0922	2.5359
Current THD	THC	THC Avg	H 1	H 2	H 3	H 4
140.6279%	105.88 mA	105.91 mA	75.305 mA	1.5529 mA	65.156 mA	1.4487 mA
H 5	H 6	H 7	H 8	H 9	H 10	H 11
55.770 mA	1.2789 mA	43.217 mA	1.0343 mA	29.096 mA	789.83 uA	15.123 mA
H 12	H 13	H 14	H 15	H 16	H 17	H 18
515.09 uA	2.8658 mA	267.30 uA	6.5339 mA	136.81 uA	12.324 mA	238.59 uA
H 19	H 20	H 21	H 22	H 23	H 24	H 25
14.448 mA	356.89 uA	13.344 mA	394.20 uA	9.8702 mA	404.25 uA	5.1333 mA
H 26	H 27	H 28	H 29	H 30	H 31	H 32
324.08 uA	287.84 uA	220.71 uA	3.9705 mA	158.55 uA	6.6358 mA	138.25 uA
H 33	H 34	H 35	H 36	H 37	H 38	H 39
7.5695 mA	203.75 uA	6.8528 mA	280.79 uA	4.9140 mA	269.36 uA	2.3130 mA
H 40	POHC	POHC Max	Harmonics	Source		
277.47 uA	22.214 mA	22.260 mA	PASS	FAIL		

Control

Add Test

Clear

WFA

View Real Time

Graph

Data

Table

View Mode: Phase 1

<

>

Data

Export

Note

Time Left: 00:02:24

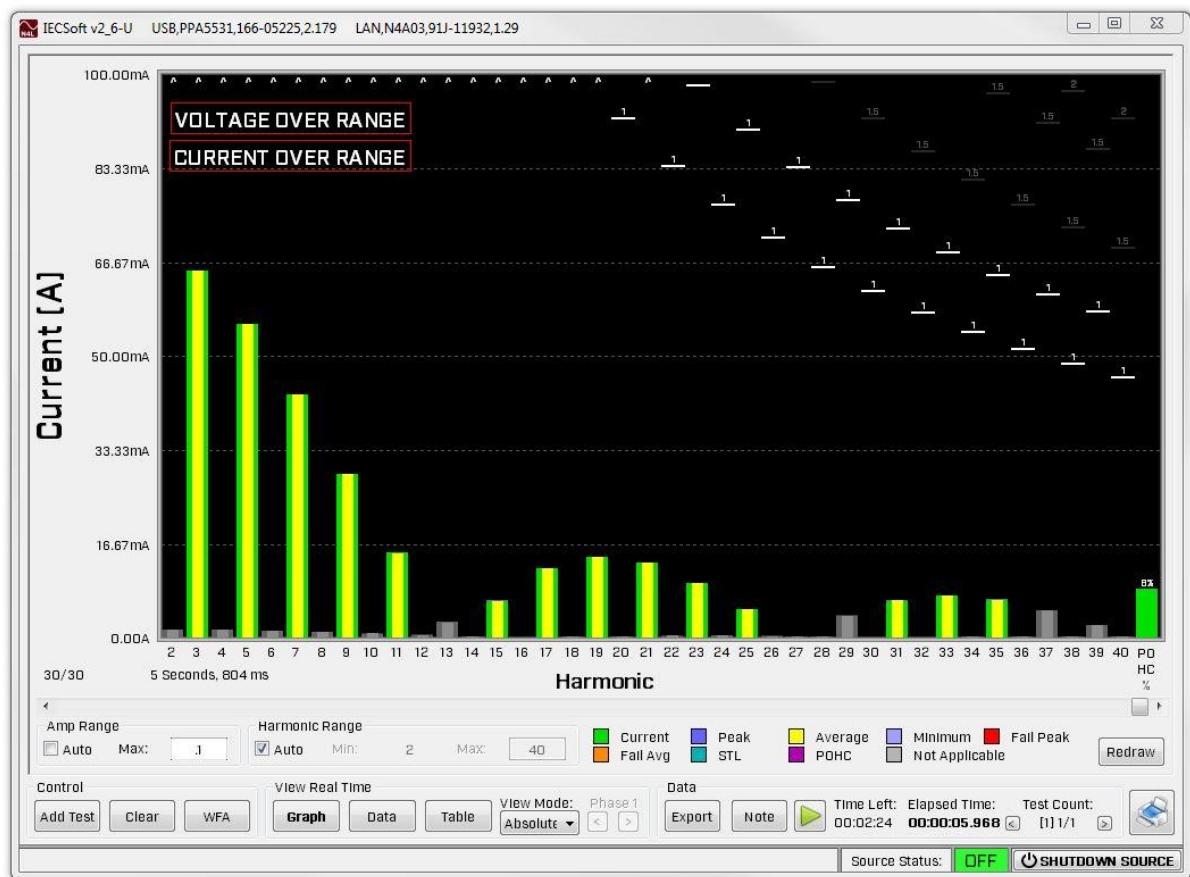
Elapsed Time: 00:00:05.968

Test Count: 1/1

Source Status: OFF

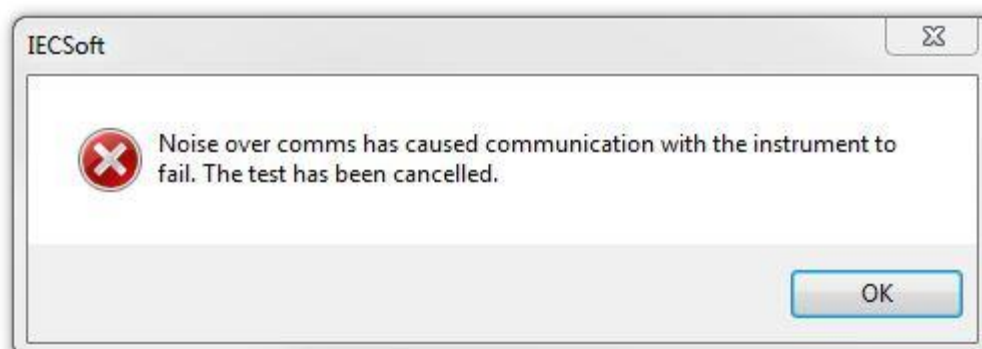
SHUTDOWN SOURCE

The Harmonic graphs display Current Over Range and Voltage Over Range warning messages should Over Ranging occur.



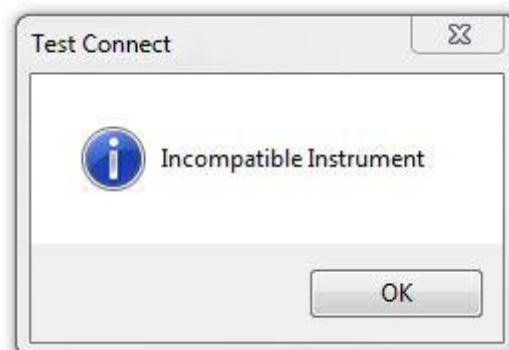
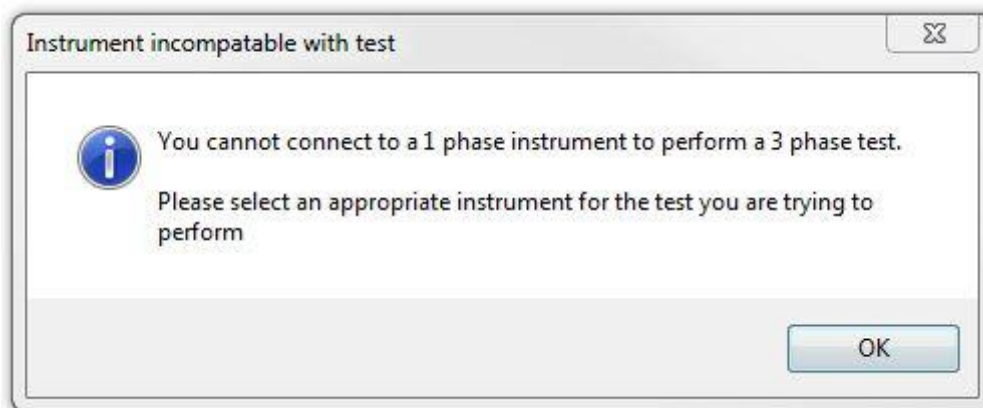
8.2 Communication Problems

Should a communication error occur between the Instrument and the PC whilst the test is running the following error message is displayed. The test will be ended because of the loss of communication. The user will have to re-initialise the interface connection between the instrument and the PC and repeat the test.



8.3 Instrument Compatibility

When a test is selected in the IECSoft software, the software checks to confirm that the instrument selected is capable of performing the selected test. The following warning messages are displayed should the instrument selected be incompatible with the selected test.



Clicking on "**OK**" will allow the User to reselect the test to be performed or to connect to an alternative instrument.

9 Appendices

Appendix A	Excel Flicker test Report / Results
Appendix B	Excel Harmonic test Report / Results
Appendix C	Welcome Dialog assistance Icons
Appendix D	Definitions: Tmax and d(t). Dmax. Short Term Limit (STL) Exception. Partial odd Harmonic (POHC) Exception. THDG and THDS.
Appendix E	IEC61000 Source Limits
Appendix F	IEC61000-11 - References to Z_{test} & Z_{ref}
Appendix G	Help and Assistance

9.1 Appendix A – Example Flicker Reports

9.1.1 Excel Flicker Results Report

Excel Flicker Results Report – Front sheet.

Click to add header

06th August 2019 - 16:24:50		Page 1/4		IECSoft v2_6	
		IEC61000-3-3:2013 Ed.3.0			
		Flickermeter			
Instrument Details					
Instrument Model	PPA5531				
Serial Number	166-05225				
Firmware Version	2.179				
N4L Calibration Date	26th September 2017				
Instrument Version	Low Current				
Source Details					
Source Model	N4A03				
Source Serial	91J-11932				
Source Frequency	50.000Hz				
Source Voltage RMS	230.000V				
Test Settings					
Class	Voltage				
Mode	Normal (4.0%)				
Minimum Current	10A				
PST	1 minutes				
PLT	3 PSTs				
Equipment Under Test					
Brand	N4L				
Model	Z100				
Serial	P1234				
Impedance Network ID	IMP001				
Test Conditions					
	User Entered		Measured		
Rated Voltage	230.000V		228.417V		
Rated Current	5.000A		N/A		
Rated Frequency	50.000Hz		50.000Hz		
Rated Power	1.000kW		N/A		
D max	1.1270% (Limit: 4.0%)				
T max	0.0000 s (Limit: 0.5 s)				
DC max	0.3057% (Limit: 3.3%)				
Inrush Test	3.091% (Limit: 4.0%)				
Inrush Results	Phase1: Pass				
Additional Test Details					
Operator	KAR				
Lab Name	N4L				
Location	LAB1				
Notes	Flicker and Inrush test data				
Signature					
Results		Phase1: PASS			

Excel Flicker Results – Inrush.

Click to add header

06th August 2019 - 16:24:50		Ph:1 Page 2/4		IECSoft v2_6			
IEC61000-3-3:2013 Ed.3.0 Flickermeter							
Instrument Details							
Instrument Model		PPA5531					
Instrument Serial		166-05225					
Instrument Firmware		2.179					
Equipment Under Test							
Brand		N4L					
Model		Z100					
Serial		P1234					
Inrush Current Results							
Test Number		Dmax (%)		Running Average (%)		Status	
1		2.1726		2.1726		OK	
2		3.9136		3.0431		OK	
3		2.371		2.81907		OK	
4		3.2701		2.93182		OK	
5		2.4712		2.8397		OK	
6		3.1852		2.89728		OK	
7		2.7765		2.88003		OK	
8		2.9817		2.89274		OK	
9		4.0585		3.02227		OK	
10		4.3377		3.15381		OK	
11		3.026		3.14219		OK	
12		2.0468		3.14219		Lowest	
13		4.4999		3.14219		Highest	
14		3.6378		3.18349		OK	
15		2.0571		3.09685		OK	
16		2.1357		3.02819		OK	
17		3.068		3.03085		OK	
18		2.1422		2.97531		OK	
19		3.1448		2.98528		OK	
20		4.4128		3.06458		OK	
21		2.7285		3.04689		OK	
22		4.3175		3.11042		OK	
23		3.1253		3.11113		OK	
24		2.6665		3.09092		OK	

The running average is calculated from the Dmax results in the previous column. The value is the average of the Dmax results for that test number and all previous tests, with the exclusion of the highest and lowest Dmax results which are highlighted in red and blue in the above table.

E.g. in the above table the “running average” for test 24 is the average value of Dmax for tests 1-11 & 14-24.

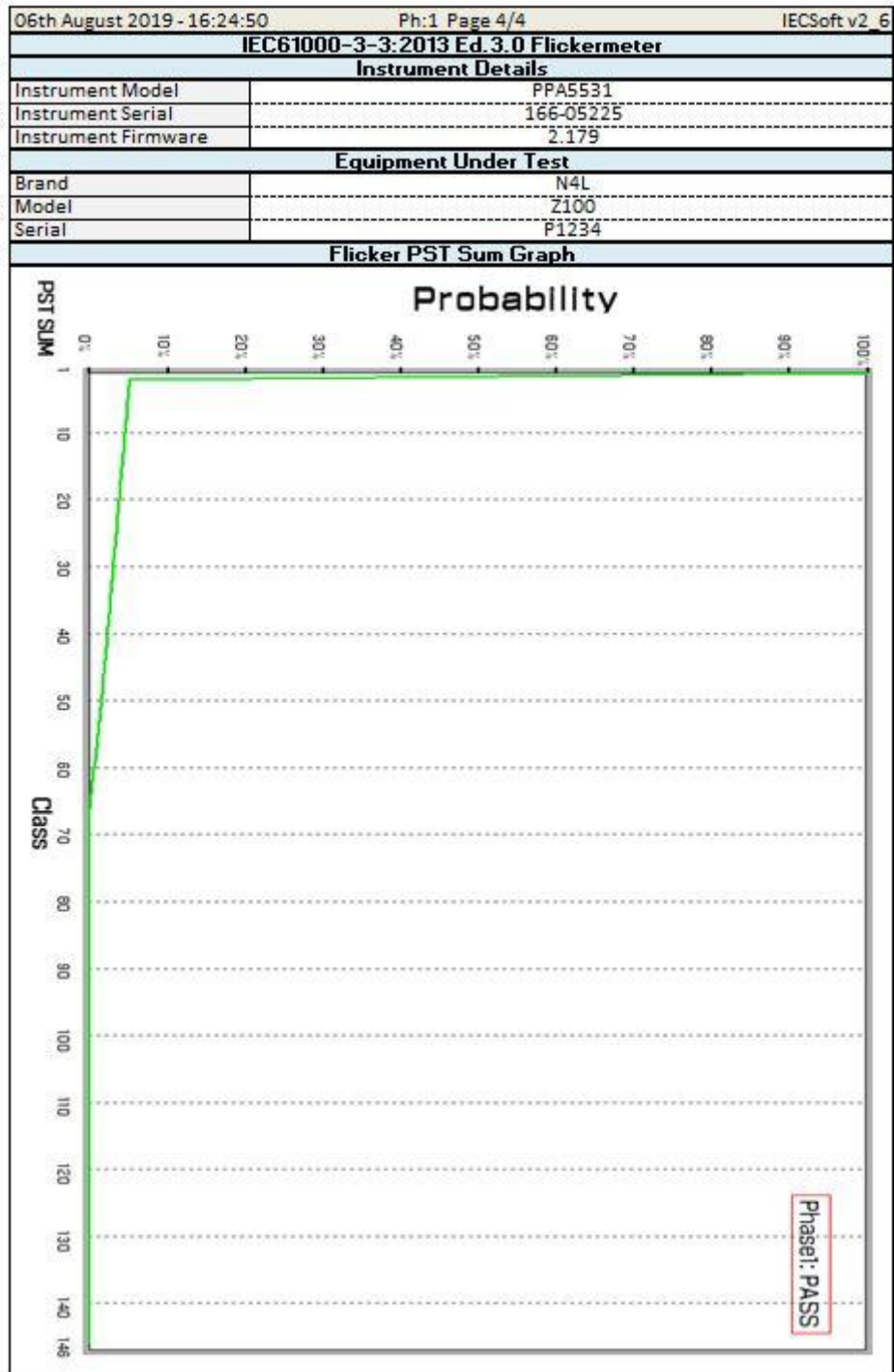
Excel Flicker Results – Flicker.

Click to add header

06th August 2019 - 16:24:50			Ph:1 Page 3/4			IECSoft v2_6		
IEC61000-3-3:2013 Ed.3.0 Flickermeter								
Instrument Details								
Instrument Model		PPA5531						
Instrument Serial		166-05225						
Instrument Firmware		2.179						
Equipment Under Test								
Brand		N4L						
Model		Z100						
Serial		P1234						
Flicker Test Results								
PST no.	Status	DC (%)	Dmax (%)	Tmax (s)	PST	PST Lim	PLT	PLT Lim
1	Phase1: PASS	0.09432	1.12704	0.00000	0.55676	1.00000	0.55676	N/A
2	Phase1: PASS	0.30575	1.12704	0.00000	0.51077	1.00000	0.53475	N/A
3	Phase1: PASS	0.30575	1.12704	0.00000	0.08226	1.00000	0.46743	0.65000

Excel Flicker Results – PLT Graph.

Click to add header



9.1.2 PDF Flicker Report

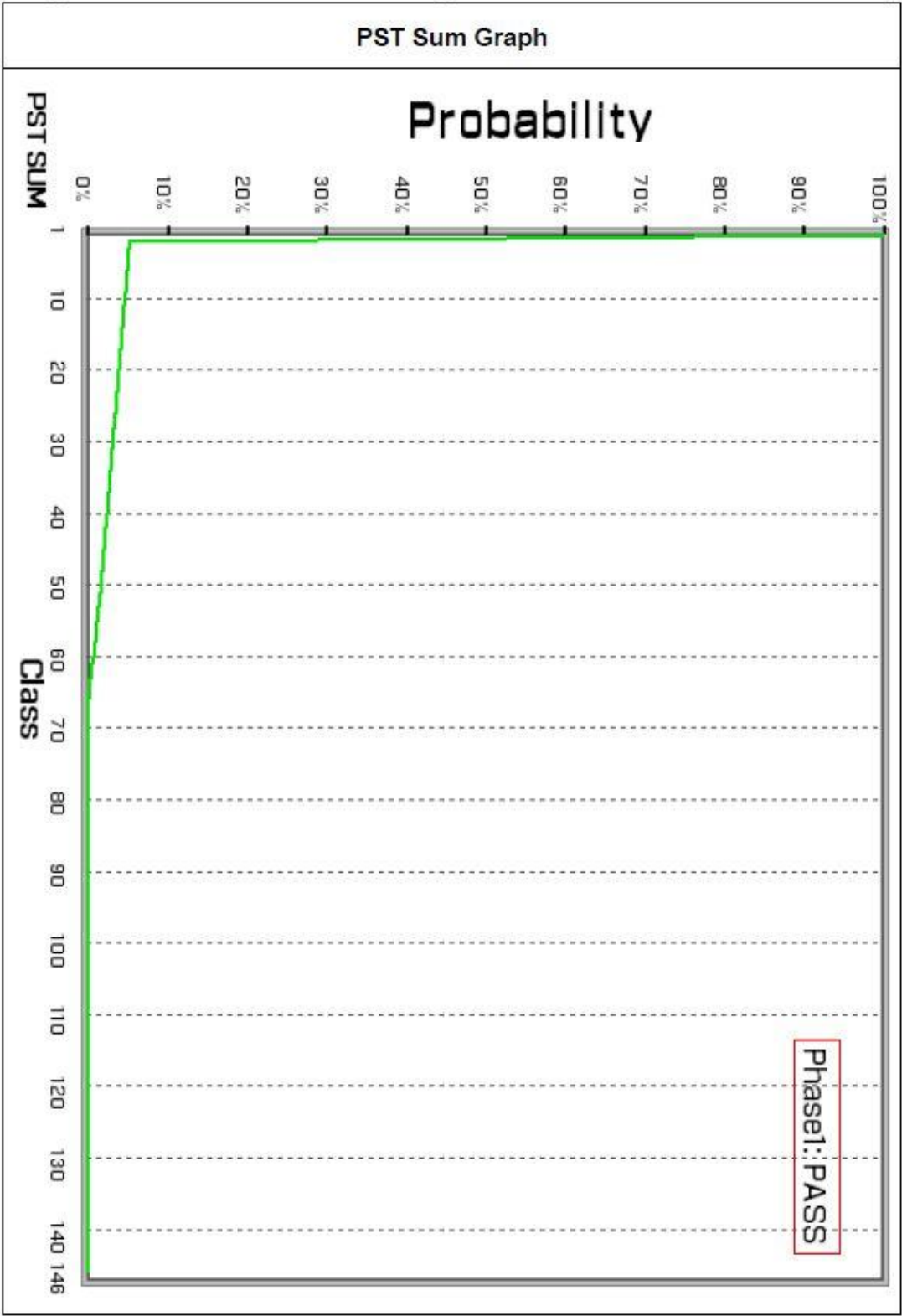
06th August 2019 - 16:24:50		Page 1/3	IECSoft v2_6
IEC61000-3-3:2013 Ed.3.0 Flickermeter			
Measurement Equipment	Instrumentation Details Newtons4th PPA5531 STD SN: 166-05225 Firmware: v2.179 Last calibration date: 28th September 2017		
AC Source	Newtons4th N4A03 SN: 91J-11932 Firmware: v1.29		
Impedance Network ID	IMP001		
EUT Details	Brand: N4L Model: Z100 Serial: P1234		
Rated Voltage	User: 230.000V		Measured: 228.417V
Rated Current	User: 5.000A		Measured: N/A
Rated Frequency	User: 50.000Hz		Measured: 50.000Hz
Rated Power	User: 1.000kW		Measured: N/A
Class	Voltage		
Mode	Normal (4.0%)		
Minimum Current	10A		
PST	1 minute(s)		
PLT	3 PSTs		
D max	1.127% (Limit: 4%)		
T max	0 s (Limit: 0.5 s)		
DC max	0.3057% (Limit: 3.3%)		
Inrush Test	3.091% (Limit: 4%)		
Inrush Results	Phase1: Pass		
Operator	KAR		
Lab Name	N4L		
Location	LAB1		
Notes	Flicker and Inrush test data		
Signature			
Results	Phase1: PASS		

Test Data Page 1

PST No.	DC	Dmax	Tmax	PST	PST Limit	PLT	PLT Limit	Result
1	0.09432%	1.12704%	0s	0.55676	1.000	0.556762	N/A	PASS
2	0.30575%	1.12704%	0s	0.51077	1.000	0.534753	N/A	PASS
3	0.30575%	1.12704%	0s	0.08226	1.000	0.467433	0.65	PASS

Inrush Data

Test Number	DMax	Running Average	Status	Note
1	2.1726%	2.1726%	OK	
2	3.9136%	3.0431%	OK	
3	2.371%	2.81907%	OK	
4	3.2701%	2.93182%	OK	
5	2.4712%	2.8397%	OK	
6	3.1852%	2.89728%	OK	
7	2.7765%	2.88003%	OK	
8	2.9817%	2.89274%	OK	
9	4.0585%	3.02227%	OK	
10	4.3377%	3.15381%	OK	
11	3.026%	3.14219%	OK	
12	2.0468%	3.14219%	--	Lowest
13	4.4999%	3.14219%	--	Highest
14	3.6378%	3.18349%	OK	
15	2.0571%	3.09685%	OK	
16	2.1357%	3.02819%	OK	
17	3.068%	3.03085%	OK	
18	2.1422%	2.97531%	OK	
19	3.1448%	2.98528%	OK	
20	4.4128%	3.06458%	OK	
21	2.7285%	3.04689%	OK	
22	4.3175%	3.11042%	OK	
23	3.1253%	3.11113%	OK	
24	2.6665%	3.09092%	OK	



9.2 Appendix B – Example Harmonic Reports.

9.2.1 Excel Harmonics Results Report – Front Sheet.

Click to add header

01st August 2019 - 08:55:37		Page 1/18		IECSoft v2_6	
		IEC61000-3-2:2014 Fluctuating Harmonics			
Instrument Details					
Instrument Model	PPA5531				
Serial Number	166-05225				
Firmware Version	2.179				
N4L Calibration Date	26th September 2017				
Instrument Version	Low Current				
Source Details					
Source Model	N4A03				
Source Serial	91J-11932				
Source Frequency	50.000Hz				
Source Voltage RMS	230.000V				
Source Settling Time	10.0 s				
Test Settings					
Class	Class A				
Mode	Measured				
Equipment Under Test					
Brand	N4L				
Model	Z100				
Serial	P1234				
Impedance Network ID	IMP001				
Test Conditions					
	User Entered		Measured		
Rated Voltage	230.000V		229.080V		
Rated Current	5.000A		763.069mA		
Rated Frequency	50.000Hz		50.000Hz		
Rated Power	1.000kW		86.670W		
Additional Test Information					
Measured Power Factor	0.4958				
Max Current THD	172.30%				
Average THC	663.480mA				
Max Power	86.833W				
Max F.Current	384.908mA				
Average F.Current	384.170mA				
Minimum Current	30A				
Test Duration	1.0 minute				
Additional Test Details					
Operator	KAR				
Lab Name	N4L				
Location	LAB1				
Notes	Harmonic Class A test data.				
Signature					
Results	Phase 1: PASS				

Excel Harmonic Repeatability Test Results.

Click to add header

01st August 2019 - 08:55:37			Ph:1 Page 2/18			IECSoft v2 6		
IEC61000-3-2:2014 Fluctuating Harmonics								
Instrument Details								
Instrument Model			PPA5531					
Instrument Serial			166-05225					
Instrument Firmware			2.179					
Equipment Under Test								
Brand			N4L					
Model			Z100					
Serial			P1234					
Harmonic Difference								
Harmonic	Lowest Average (A)	Test #	Highest Average (A)	Test #	Limit Allowance (A)	Difference (A)	Status	
2	1.837m*	3	1.852m*	2	0.054	0	N/A	
3	358.560m	2	358.730m	3	0.115	0.00017	PASS	
4	2.333m*	3	2.336m*	2	0.0215	0	N/A	
5	327.230m	2	327.660m	3	0.057	0.00043	PASS	
6	2.247m*	3	2.273m*	2	0.015	0	N/A	
7	284.360m	2	285.080m	3	0.0385	0.00072	PASS	
8	2.227m*	3	2.234m*	2	0.0115	0	N/A	
9	234.100m	2	235.010m	3	0.02	0.00091	PASS	
10	2.238m*	2	2.253m*	3	0.0092	0	N/A	
11	181.130m	2	182.330m	3	0.0165	0.0012	PASS	
12	2.185m*	2	2.224m*	3	0.007667	0	N/A	
13	130.110m	2	131.390m	3	0.0105	0.00128	PASS	
14	2.145m*	3	2.160m*	2	0.006571	0	N/A	
15	85.520m	2	86.710m	3	0.0075	0.00119	PASS	
16	2.082m*	2	2.086m*	3	0.00575	0	N/A	
17	51.144m	2	52.026m	3	0.006618	0.000882	PASS	
18	2.055m*	3	2.060m*	2	0.005111	0	N/A	
19	31.109m	2	31.506m	3	0.005921	0.000397	PASS	
20	1.992m*	2	2.047m*	3	0.0046	0	N/A	
21	26.441m	3	26.448m	2	0.005357	0.000007	PASS	
22	1.972m*	3	2.003m*	2	0.004182	0	N/A	
23	27.408m	2	27.417m	3	0.004891	0.000009	PASS	
24	1.966m*	2	1.982m*	3	0.003833	0	N/A	
25	26.073m	2	26.311m	3	0.0045	0.000238	PASS	
26	1.933m*	2	1.952m*	3	0.003538	0	N/A	
27	21.671m	2	22.063m	3	0.004167	0.000392	PASS	
28	1.923m*	2	1.944m*	3	0.003286	0	N/A	
29	15.820m	2	16.204m	3	0.003879	0.000384	PASS	
30	1.920m*	3	1.933m*	2	0.003067	0	N/A	
31	10.407m	2	10.714m	3	0.003629	0.000307	PASS	
32	1.884m*	3	1.914m*	2	0.002875	0	N/A	
33	7.376m	2	7.463m	3	0.003409	0.000087	PASS	
34	1.898m*	3	1.906m*	2	0.002706	0	N/A	
35	6.741m	3	6.742m	2	0.003214	0.000001	PASS	
36	1.900m*	3	1.924m*	2	0.002556	0	N/A	
37	6.539m	2	6.569m	3	0.003041	0.000003	PASS	
38	1.867m*	3	1.884m*	2	0.002421	0	N/A	
39	5.340m	2	5.500m	3	0.002885	0.000016	PASS	
40	1.901m*	3	1.946m*	2	0.0023	0	N/A	
Key:								
Ignored	Since both values are less than 5mA or 0.6% of the Input Current this harmonic is ignored							
Good	The difference is less than 50% of the allowance							
OK	The difference is between 50% of the allowance and 75% of the allowance							
Poor	The difference is between 75% of the allowance and 100% of the allowance							
Fail	The difference has exceeded the allowance							

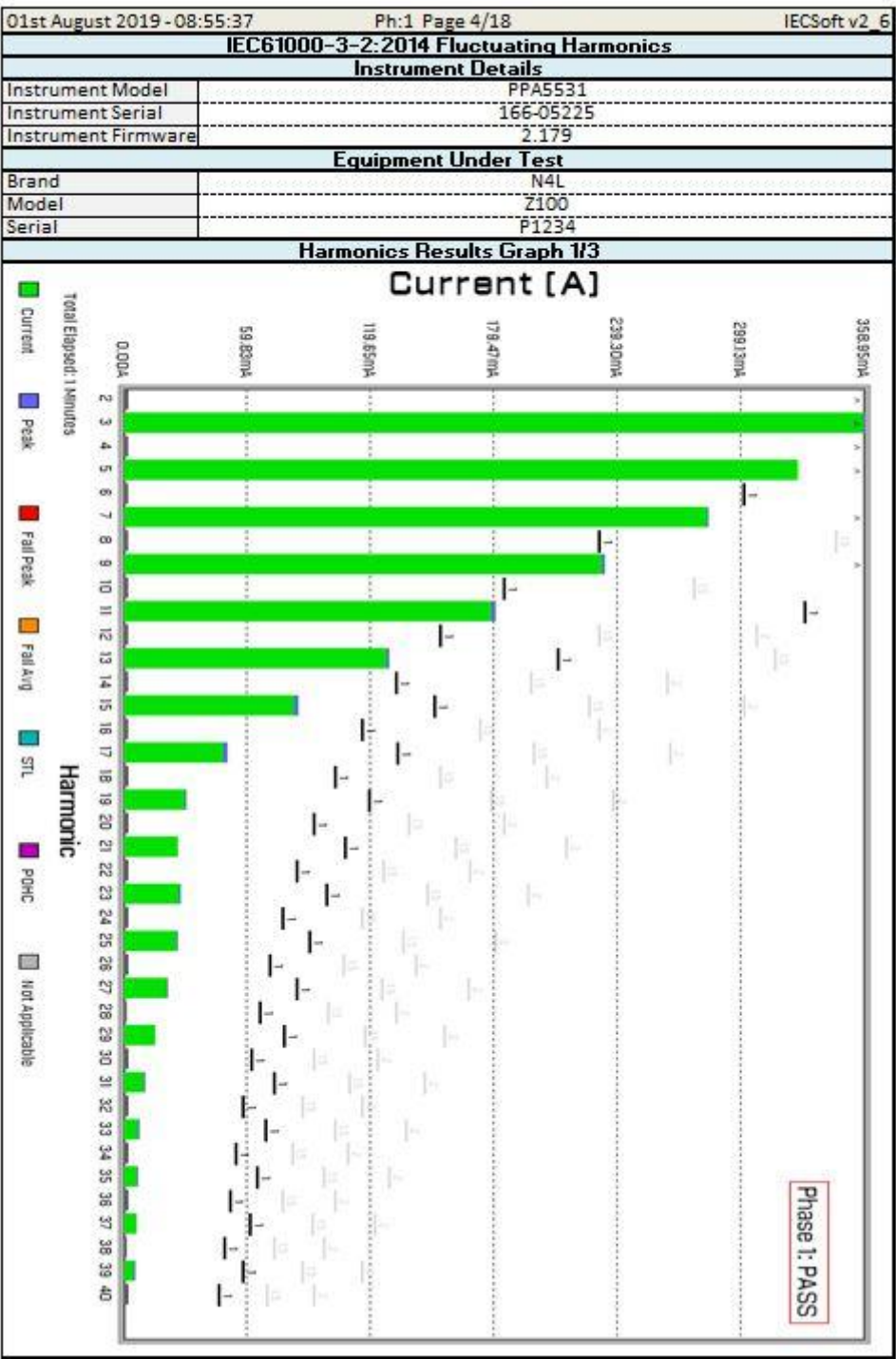
Excel Harmonic Test Results.

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01st August 2019 - 08:55:37		Ph:1 Page 3/18		IECSoft v2.6			
IEC61000-3-2:2014 Fluctuating Harmonics							
Instrument Details							
Instrument Model		PPA5531					
Instrument Serial		166-05225					
Instrument Firmware		2.179					
Equipment Under Test							
Brand		N4L					
Model		Z100					
Serial		P1234					
Extra Test Information							
Current THDG		171.40%					
	Average	Peak				Limit	
THC	656.137mA	658.036mA				N/A	
POHC	55.466mA	55.864mA				251.375mA	
Voltage Crest Factor	1.404	1.405				N/A	
Current Crest Factor	3.569	3.6				N/A	
Harmonics Results 1/3							
Harmoni	Status	Avg (A)	Avg L(A)	Avg %ofL	Peak (A)	Peak L(A)	Peak %ofL
1	PASS	0.38437	No Limit	N/A	0.38491	No Limit	N/A
2	PASS	0.00178	1.08	0.16504	0.00221	1.62	0.13624
3	PASS	0.35853	2.3	15.5883	0.35895	3.45	10.4043
4	PASS	0.00227	0.43	0.52684	0.00264	0.645	0.40885
5	PASS	0.32674	1.14	28.6614	0.32709	1.71	19.1281
6	PASS	0.00222	0.3	0.74043	0.00252	0.45	0.56036
7	PASS	0.28313	0.77	36.7701	0.28396	1.155	24.5853
8	PASS	0.00222	0.23	0.96678	0.00246	0.345	0.7133
9	PASS	0.23219	0.4	58.0475	0.23331	0.6	38.885
10	PASS	0.00224	0.184	1.21755	0.00255	0.276	0.9225
11	PASS	0.17868	0.33	54.1455	0.18019	0.495	36.402
12	PASS	0.00221	0.15333	1.44394	0.00248	0.23	1.07624
13	PASS	0.12736	0.21	60.6476	0.12921	0.315	41.019
14	PASS	0.00215	0.13143	1.63654	0.00247	0.19715	1.25491
15	PASS	0.08268	0.15	55.118	0.08461	0.225	37.6062
16	PASS	0.00209	0.115	1.8213	0.00236	0.1725	1.36783
17	PASS	0.04868	0.13235	36.7828	0.05044	0.19853	25.4094
18	PASS	0.00205	0.10222	2.00362	0.00229	0.15333	1.49312
19	PASS	0.02967	0.11842	25.0583	0.03076	0.17763	17.3146
20	PASS	0.00199	0.092	2.16424	0.00227	0.138	1.64812
21	PASS	0.02623	0.10714	24.4773	0.02656	0.16071	16.5285
22	PASS	0.00197	0.08364	2.35604	0.00222	0.12545	1.77292
23	PASS	0.0275	0.09783	28.1111	0.0278	0.14674	18.9466
24	PASS	0.00198	0.07667	2.58116	0.00223	0.115	1.93964
25	PASS	0.02601	0.09	28.8944	0.02633	0.135	19.5052
26	PASS	0.00193	0.07077	2.72294	0.00217	0.10615	2.046
27	PASS	0.02129	0.08333	25.5481	0.02161	0.125	17.2897
28	PASS	0.00188	0.06571	2.86773	0.00203	0.09857	2.05801
29	PASS	0.01526	0.07759	19.6711	0.01573	0.11638	13.5145
30	PASS	0.00189	0.06133	3.08007	0.00216	0.092	2.34425
31	PASS	0.00994	0.07258	13.6945	0.01036	0.10887	9.51489
32	PASS	0.00192	0.0575	3.33617	0.00208	0.08625	2.41414
33	PASS	0.00729	0.06818	10.6931	0.00762	0.10227	7.45074
34	PASS	0.00193	0.05412	3.57349	0.00215	0.08118	2.65223
35	PASS	0.00685	0.06429	10.653	0.00721	0.09643	7.48198
36	PASS	0.00192	0.05111	3.76064	0.00214	0.07667	2.78909
37	PASS	0.00651	0.06081	10.7032	0.00681	0.09122	7.46367
38	PASS	0.00188	0.04842	3.87291	0.00206	0.07263	2.83155
39	PASS	0.00536	0.05769	9.2876	0.00562	0.08654	6.48859
40	PASS	0.00187	0.046	4.05739	0.00209	0.069	3.03044

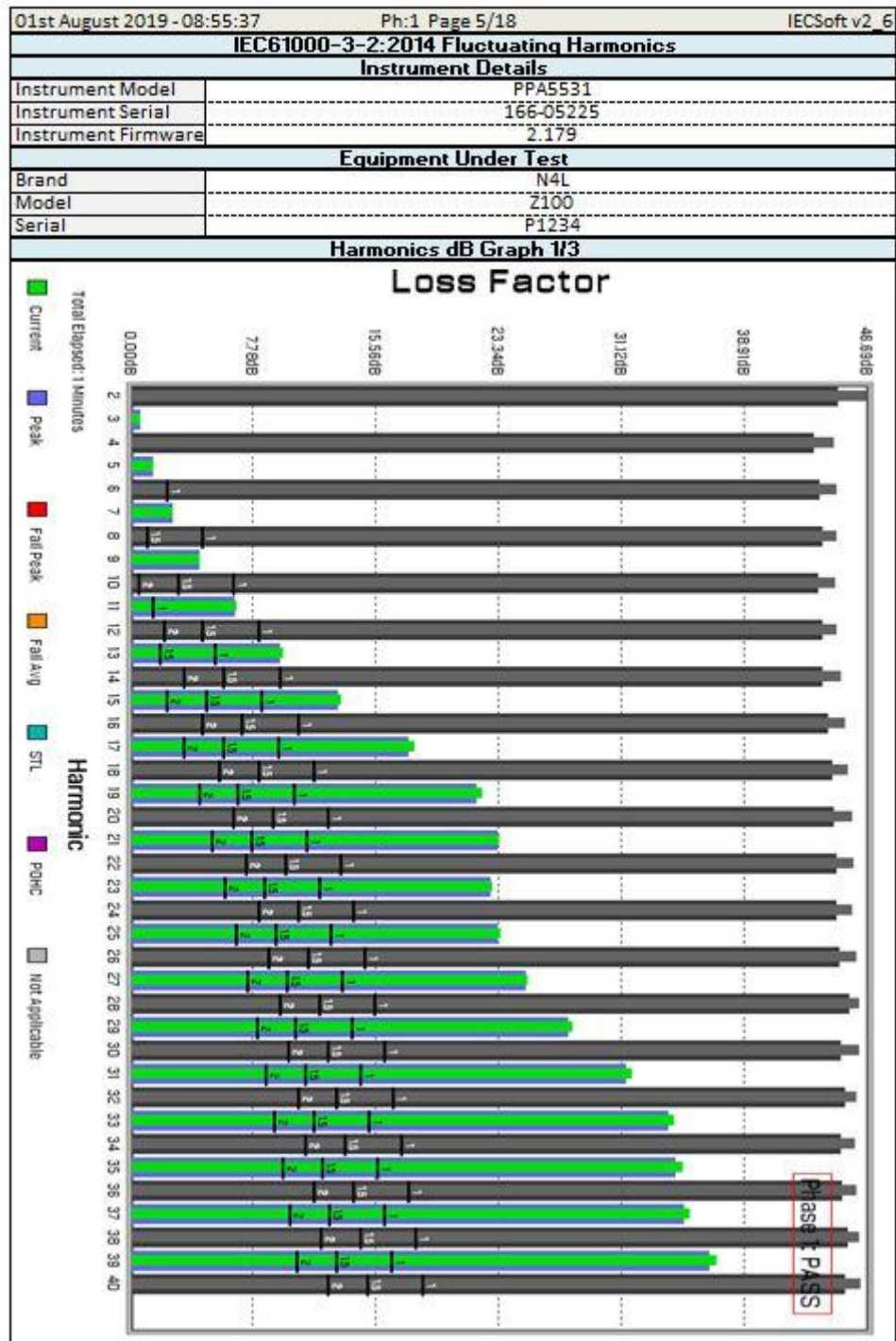
Excel Harmonics Graph.

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Excel Harmonic dB / Loss Factor Graph.

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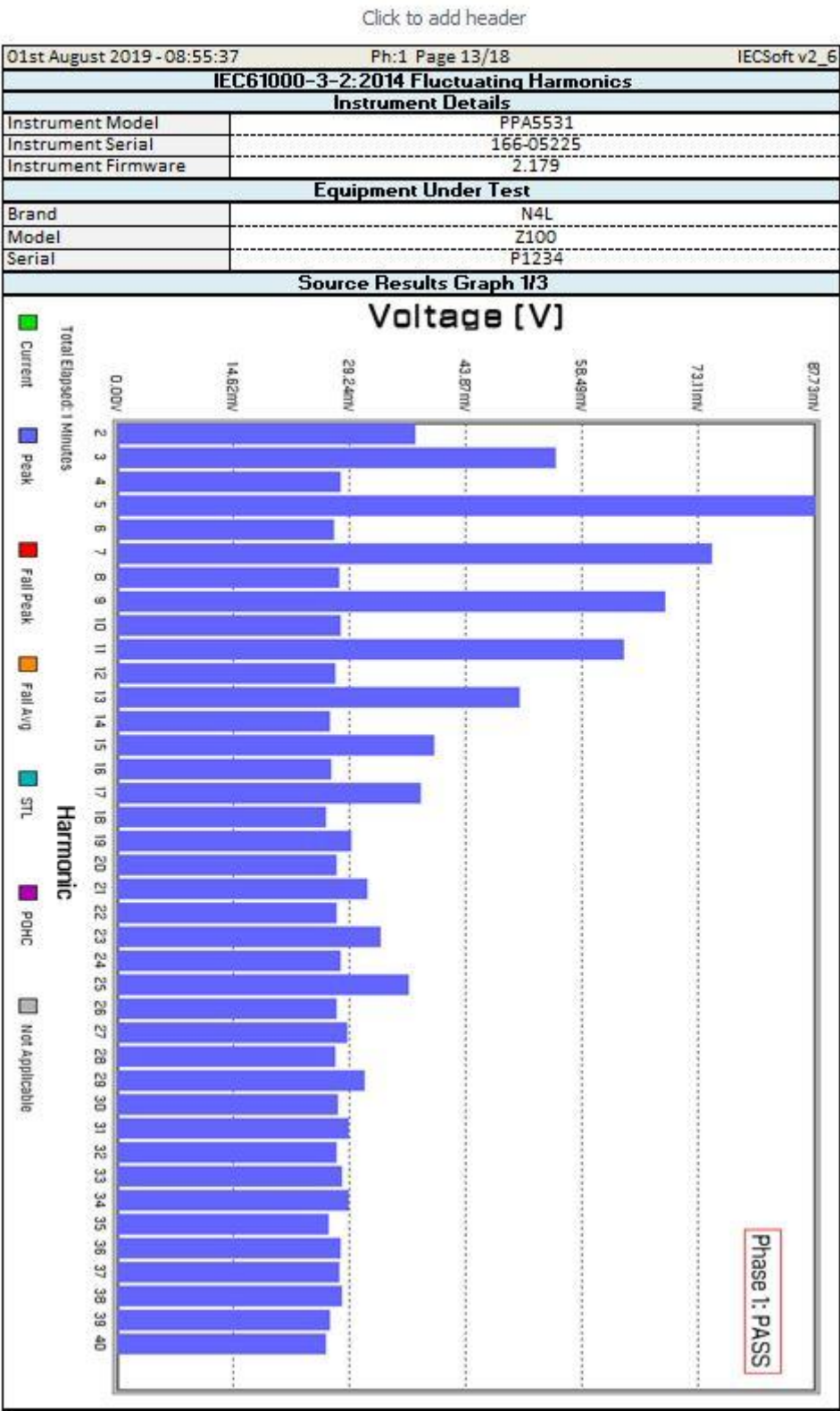


Excel Source Harmonic Test Results.

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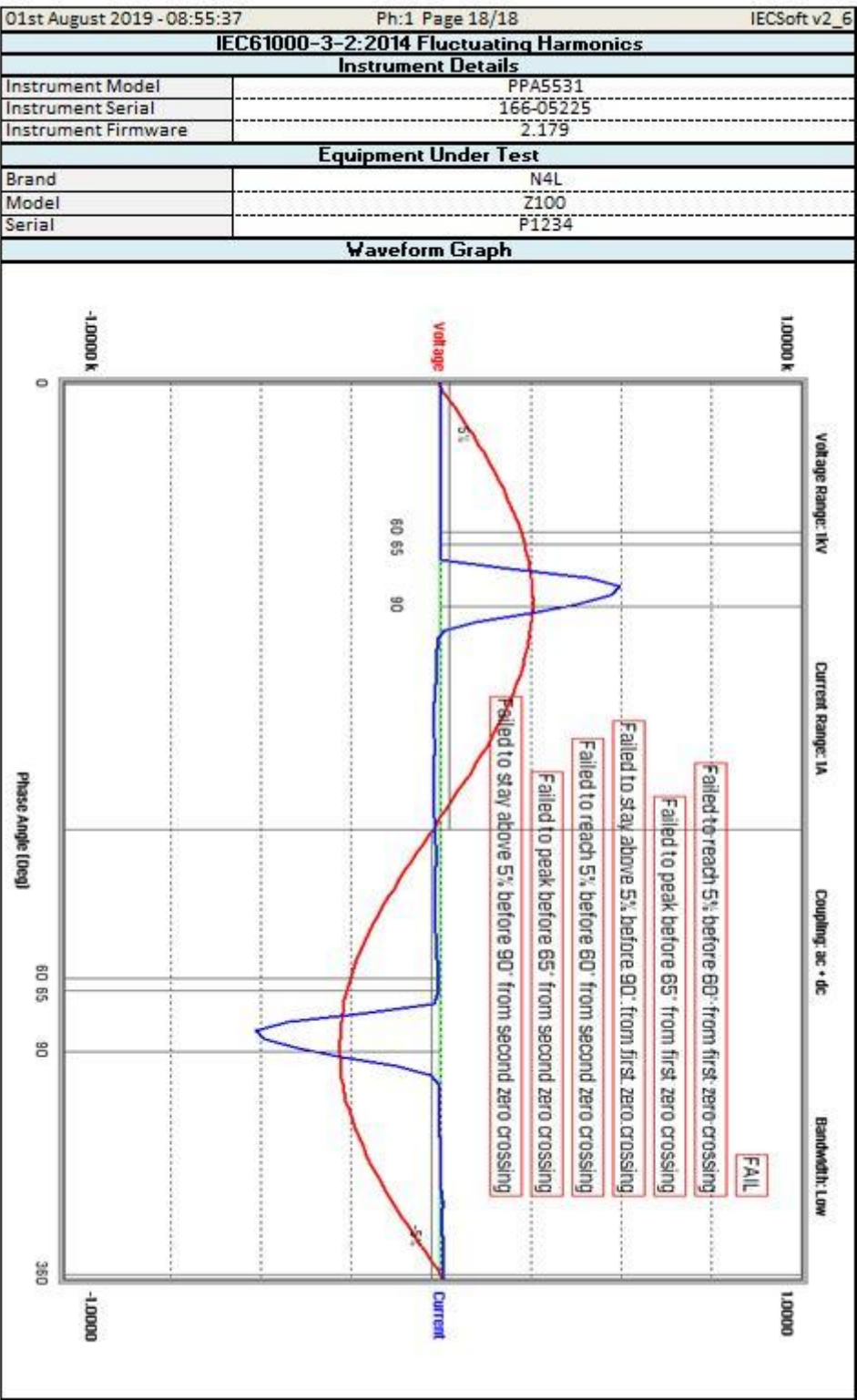
01st August 2019 - 08:55:37		Ph:1 Page 12/18		IECSoft v2_6
IEC61000-3-2:2014 Fluctuating Harmonics				
Instrument Details				
Instrument Model	PPA5531			
Instrument Serial	166-05225			
Instrument Firmware	2.179			
Equipment Under Test				
Brand	N4L			
Model	Z100			
Serial	P1234			
Extra Test Information				
Voltage THDS	0.09%			
Source Results 1/3				
Harmonic	Status	Peak (V)	Average (V)	Limit (V)
1	PASS	229.77	229.76	No Limit
2	PASS	0.03757	0.028876	0.458034
3	PASS	0.055275	0.042302	2.061155
4	PASS	0.028226	0.02356	0.458034
5	PASS	0.08773	0.07554	0.916069
6	PASS	0.027307	0.023124	0.458034
7	PASS	0.074928	0.066992	0.687052
8	PASS	0.027996	0.023354	0.458034
9	PASS	0.06891	0.062832	0.458034
10	PASS	0.028177	0.024048	0.458034
11	PASS	0.063762	0.058205	0.229017
12	PASS	0.027432	0.02317	0.229017
13	PASS	0.050747	0.043976	0.229017
14	PASS	0.026742	0.022233	0.229017
15	PASS	0.039849	0.035495	0.229017
16	PASS	0.026895	0.022892	0.229017
17	PASS	0.038245	0.031956	0.229017
18	PASS	0.026279	0.02265	0.229017
19	PASS	0.02942	0.025242	0.229017
20	PASS	0.027716	0.023687	0.229017
21	PASS	0.031524	0.026374	0.229017
22	PASS	0.027651	0.022881	0.229017
23	PASS	0.03315	0.028344	0.229017
24	PASS	0.028147	0.022368	0.229017
25	PASS	0.036681	0.031048	0.229017
26	PASS	0.027588	0.022797	0.229017
27	PASS	0.028986	0.023285	0.229017
28	PASS	0.027513	0.022926	0.229017
29	PASS	0.031206	0.025502	0.229017
30	PASS	0.027804	0.023211	0.229017
31	PASS	0.029179	0.023819	0.229017
32	PASS	0.02763	0.023035	0.229017
33	PASS	0.028331	0.023083	0.229017
34	PASS	0.029087	0.024056	0.229017
35	PASS	0.026666	0.022743	0.229017
36	PASS	0.028134	0.022566	0.229017
37	PASS	0.028035	0.023752	0.229017
38	PASS	0.028306	0.023876	0.229017
39	PASS	0.026803	0.023092	0.229017
40	PASS	0.026302	0.022456	0.229017

Excel Source Harmonics Graph.



Excel Harmonic WFA Test Results.

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9.2.2 PDF Harmonics Results Report.

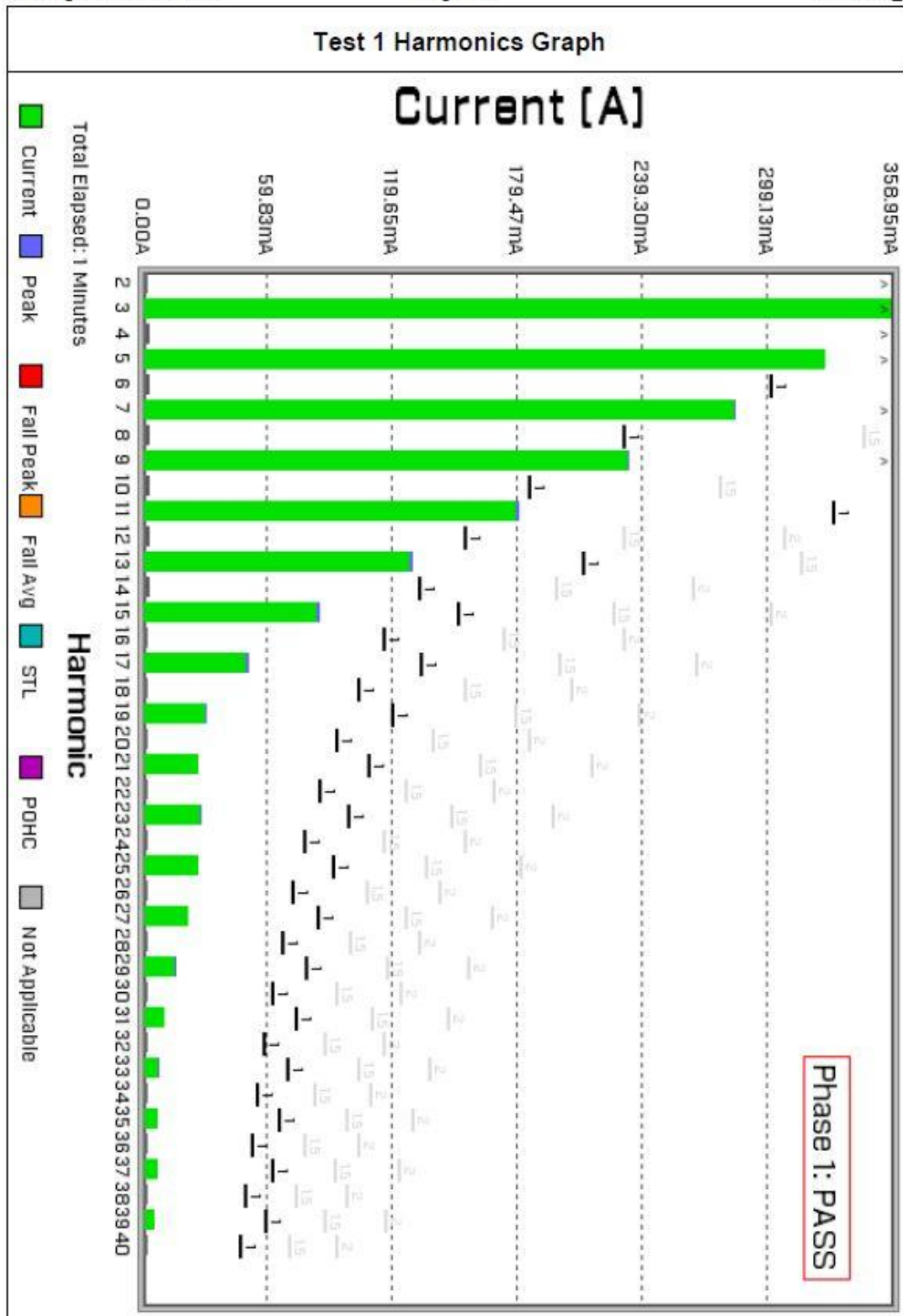
01st August 2019 - 08:55:37		Page 1/15		IECSoft v2_6	
IEC61000-3-2:2014 Fluctuating Harmonics					
Measurement Equipment AC Source Impedance Network ID EUT Details Rated Voltage Rated Current Rated Frequency Rated Power Measured Power Factor Max Current THD Average THC Max Power Max F. Current Average F. Current Minimum Current Test Class Test Mode Test Duration Operator Lab Name Location Notes		Instrumentation Details Newton4th PPA5531 STD SN: 166-05225 Firmware: v2.179 Last calibration date: 26th September 2017 Newton4th N4A03 SN: 91J-11932 Firmware: v1.29 IMP001 Brand: N4L Model: Z100 Serial: P1234 Test Information User: 230.000V Measured: 229.080V User: 5.000A Measured: 763.069mA User: 50.000Hz Measured: 50.000Hz User: 1.000kW Measured: 86.670W 0.4958 172.300% 663.480mA 86.833W 384.908mA 384.170mA 30A Test Settings Class A Measured 1.0 minute Operating Conditions KAR N4L LAB1 Harmonic Class A test data.			
Signature					
Results		Phase 1: FAIL - WAVEFORM			

Repeatability Harmonics Data

Harmonic	Lowest		Highest		Limit		Status
	Average	Test	Average	Test	Allowance	Difference	
2	1.837mA*	3	1.852mA*	2	54.000mA	0.000A	N/A
3	358.560mA	2	358.730mA	3	115.000mA	170.000uA	PASS
4	2.333mA*	3	2.336mA*	2	21.500mA	0.000A	N/A
5	327.230mA	2	327.660mA	3	57.000mA	430.000uA	PASS
6	2.247mA*	3	2.273mA*	2	15.000mA	0.000A	N/A
7	284.360mA	2	285.080mA	3	38.500mA	720.000uA	PASS
8	2.227mA*	3	2.234mA*	2	11.500mA	0.000A	N/A
9	234.100mA	2	235.010mA	3	20.000mA	910.000uA	PASS
10	2.238mA*	2	2.253mA*	3	9.200mA	0.000A	N/A
11	181.130mA	2	182.330mA	3	16.500mA	1.200mA	PASS
12	2.185mA*	2	2.224mA*	3	7.667mA	0.000A	N/A
13	130.110mA	2	131.390mA	3	10.500mA	1.280mA	PASS
14	2.145mA*	3	2.160mA*	2	6.571mA	0.000A	N/A
15	85.520mA	2	86.710mA	3	7.500mA	1.190mA	PASS
16	2.082mA*	2	2.086mA*	3	5.750mA	0.000A	N/A
17	51.144mA	2	52.026mA	3	6.618mA	882.000uA	PASS
18	2.055mA*	3	2.060mA*	2	5.111mA	0.000A	N/A
19	31.109mA	2	31.506mA	3	5.921mA	397.000uA	PASS
20	1.992mA*	2	2.047mA*	3	4.600mA	0.000A	N/A
21	26.441mA	3	26.448mA	2	5.357mA	7.000uA	PASS
22	1.972mA*	3	2.003mA*	2	4.182mA	0.000A	N/A
23	27.408mA	2	27.417mA	3	4.891mA	9.000uA	PASS
24	1.966mA*	2	1.982mA*	3	3.833mA	0.000A	N/A
25	26.073mA	2	26.311mA	3	4.500mA	238.000uA	PASS
26	1.933mA*	2	1.952mA*	3	3.538mA	0.000A	N/A
27	21.671mA	2	22.063mA	3	4.167mA	392.000uA	PASS
28	1.923mA*	2	1.944mA*	3	3.286mA	0.000A	N/A
29	15.820mA	2	16.204mA	3	3.879mA	384.000uA	PASS
30	1.920mA*	3	1.933mA*	2	3.067mA	0.000A	N/A
31	10.407mA	2	10.714mA	3	3.629mA	307.000uA	PASS
32	1.884mA*	3	1.914mA*	2	2.875mA	0.000A	N/A
33	7.376mA	2	7.463mA	3	3.409mA	87.200uA	PASS
34	1.898mA*	3	1.906mA*	2	2.706mA	0.000A	N/A
35	6.741mA	3	6.742mA	2	3.214mA	1000.000nA	PASS
36	1.900mA*	3	1.924mA*	2	2.556mA	0.000A	N/A
37	6.539mA	2	6.569mA	3	3.041mA	30.000uA	PASS
38	1.867mA*	3	1.884mA*	2	2.421mA	0.000A	N/A
39	5.340mA	2	5.500mA	3	2.885mA	160.400uA	PASS
40	1.901mA*	3	1.946mA*	2	2.300mA	0.000A	N/A

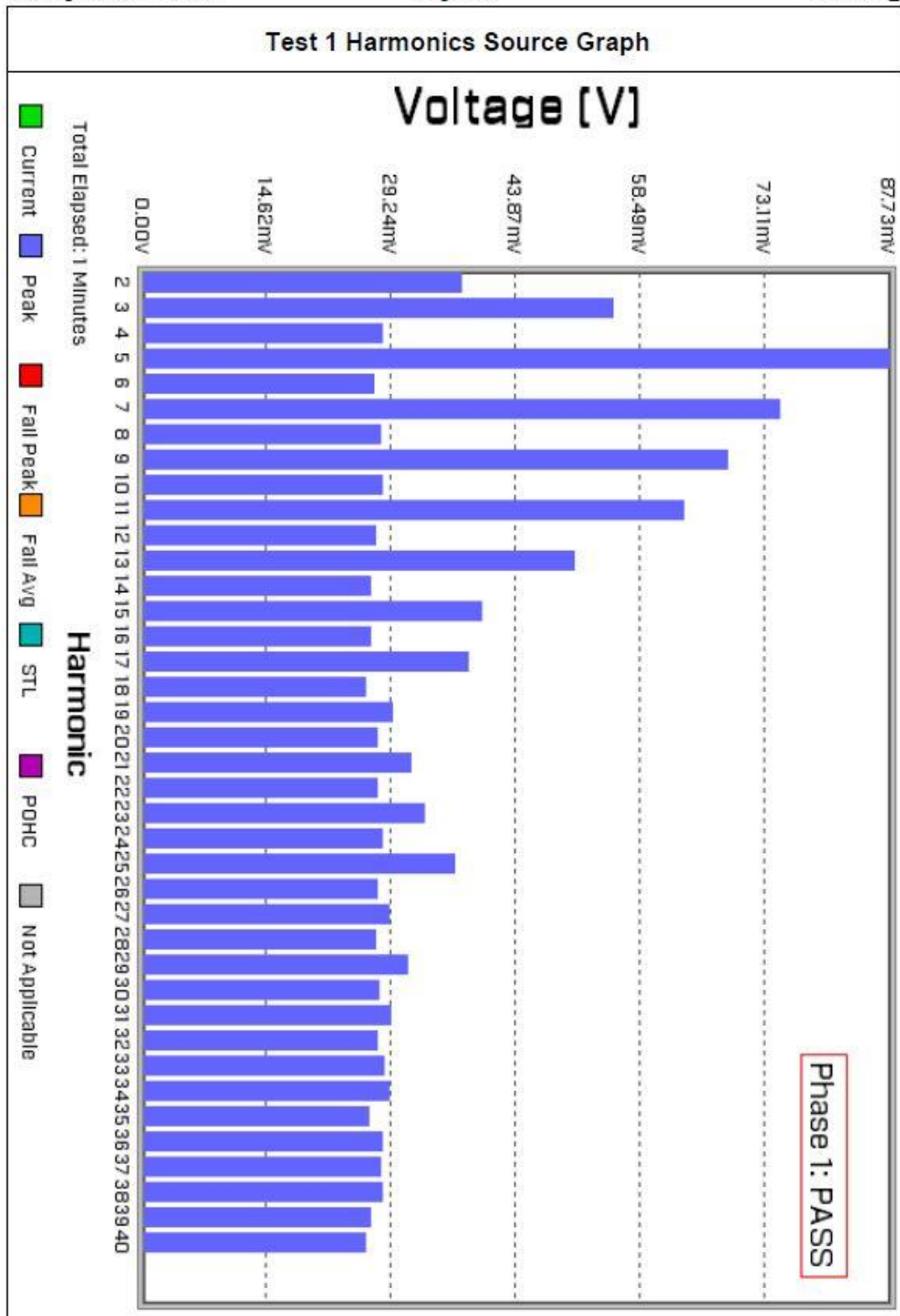
Test 1 Harmonics Data

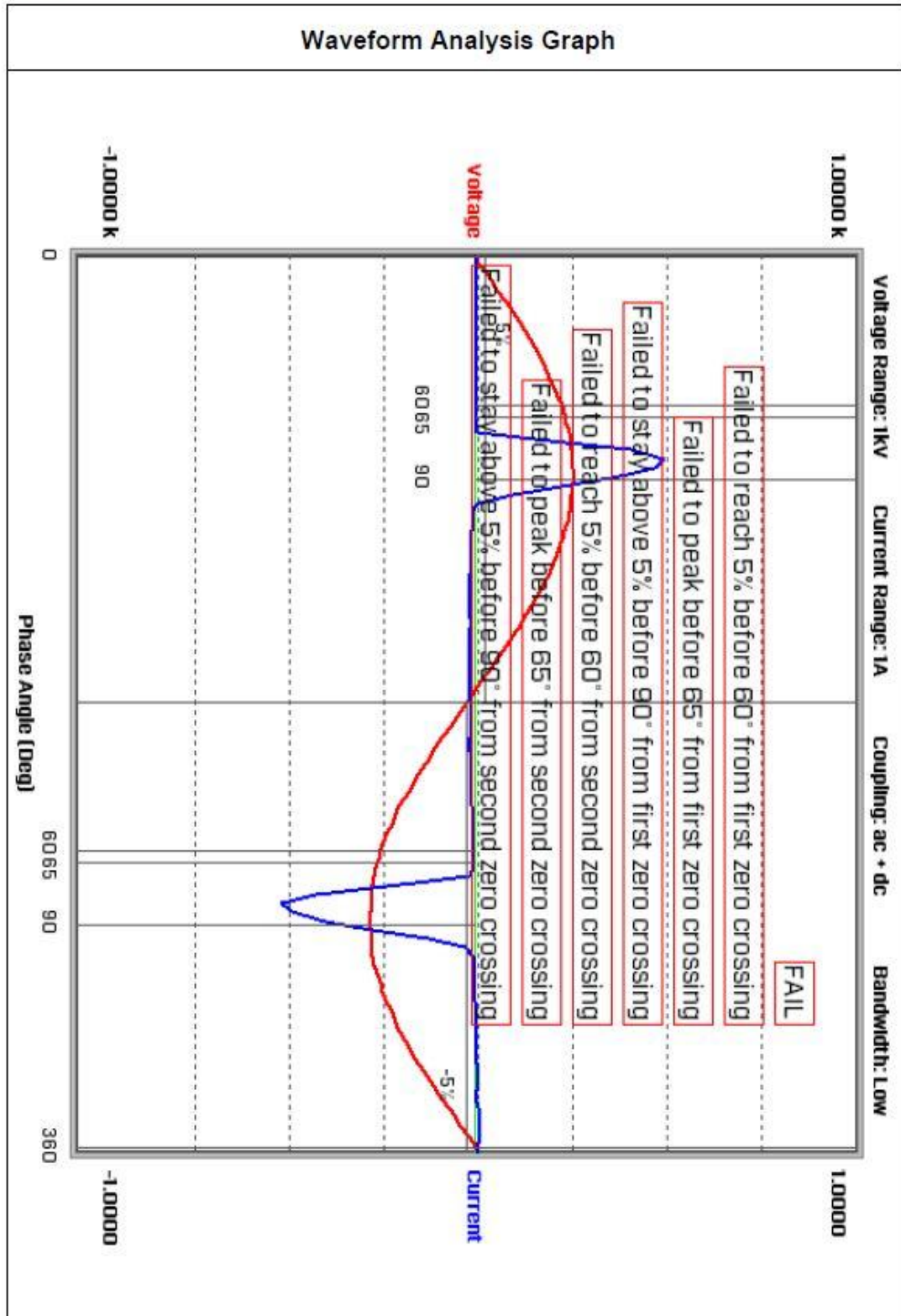
Test Conditions Average: 656.137mA Maximum: 658.036mA Limit: N/A Average: 55.466mA Maximum: 55.864mA Limit: 251.375mA Voltage Crest Factor Average: 1.404 Maximum: 1.405 Limit: N/A Current Crest Factor Average: 3.569 Maximum: 3.600 Limit: N/A Current THDG 171.400%							
Harmonic	Average	Peak	Average Limit	% of Limit	Peak Limit	% of Limit	Status
1	384.370mA	384.910mA	No Limit	N/A	No Limit	N/A	PASS
2	1.782mA	2.207mA	1.080A	0.165%	1.620A	0.136%	PASS
3	358.530mA	358.950mA	2.300A	15.588%	3.450A	10.404%	PASS
4	2.265mA	2.637mA	430.000mA	0.527%	645.000mA	0.409%	PASS
5	326.740mA	327.090mA	1.140A	28.661%	1.710A	19.128%	PASS
6	2.221mA	2.522mA	300.000mA	0.740%	450.000mA	0.560%	PASS
7	283.130mA	283.960mA	770.000mA	36.770%	1.155A	24.585%	PASS
8	2.224mA	2.461mA	230.000mA	0.967%	345.000mA	0.713%	PASS
9	232.190mA	233.310mA	400.000mA	58.047%	600.000mA	38.885%	PASS
10	2.240mA	2.546mA	184.000mA	1.218%	276.000mA	0.922%	PASS
11	178.680mA	180.190mA	330.000mA	54.145%	495.000mA	36.402%	PASS
12	2.214mA	2.475mA	153.330mA	1.444%	229.995mA	1.076%	PASS
13	127.360mA	129.210mA	210.000mA	60.648%	315.000mA	41.019%	PASS
14	2.151mA	2.474mA	131.430mA	1.637%	197.145mA	1.255%	PASS
15	82.677mA	84.614mA	150.000mA	55.118%	225.000mA	37.606%	PASS
16	2.095mA	2.360mA	115.000mA	1.821%	172.500mA	1.368%	PASS
17	48.682mA	50.444mA	132.350mA	36.783%	198.525mA	25.409%	PASS
18	2.048mA	2.289mA	102.220mA	2.004%	153.330mA	1.493%	PASS
19	29.674mA	30.756mA	118.420mA	25.058%	177.630mA	17.315%	PASS
20	1.991mA	2.274mA	92.000mA	2.164%	138.000mA	1.648%	PASS
21	26.225mA	26.563mA	107.140mA	24.477%	160.710mA	16.529%	PASS
22	1.970mA	2.224mA	83.636mA	2.356%	125.454mA	1.773%	PASS
23	27.500mA	27.802mA	97.826mA	28.111%	146.739mA	18.947%	PASS
24	1.979mA	2.231mA	76.667mA	2.581%	115.001mA	1.940%	PASS
25	26.005mA	26.332mA	90.000mA	28.894%	135.000mA	19.505%	PASS
26	1.927mA	2.172mA	70.769mA	2.723%	106.153mA	2.046%	PASS
27	21.290mA	21.612mA	83.333mA	25.548%	125.000mA	17.290%	PASS
28	1.885mA	2.029mA	65.714mA	2.868%	98.571mA	2.058%	PASS
29	15.262mA	15.728mA	77.586mA	19.671%	116.379mA	13.514%	PASS
30	1.889mA	2.157mA	61.333mA	3.080%	91.999mA	2.344%	PASS
31	9.940mA	10.359mA	72.581mA	13.694%	108.872mA	9.515%	PASS
32	1.918mA	2.082mA	57.500mA	3.336%	86.250mA	2.414%	PASS
33	7.291mA	7.620mA	68.182mA	10.693%	102.273mA	7.451%	PASS
34	1.934mA	2.153mA	54.118mA	3.573%	81.177mA	2.652%	PASS
35	6.848mA	7.215mA	64.286mA	10.653%	96.429mA	7.482%	PASS
36	1.922mA	2.138mA	51.111mA	3.761%	76.666mA	2.789%	PASS
37	6.509mA	6.808mA	60.811mA	10.703%	91.216mA	7.464%	PASS
38	1.875mA	2.057mA	48.421mA	3.873%	72.632mA	2.832%	PASS
39	5.358mA	5.615mA	57.692mA	9.288%	86.538mA	6.489%	PASS
40	1.866mA	2.091mA	46.000mA	4.057%	69.000mA	3.030%	PASS



Test 1 Harmonics Source Data

Voltage THDS		Test Conditions 0.089%		

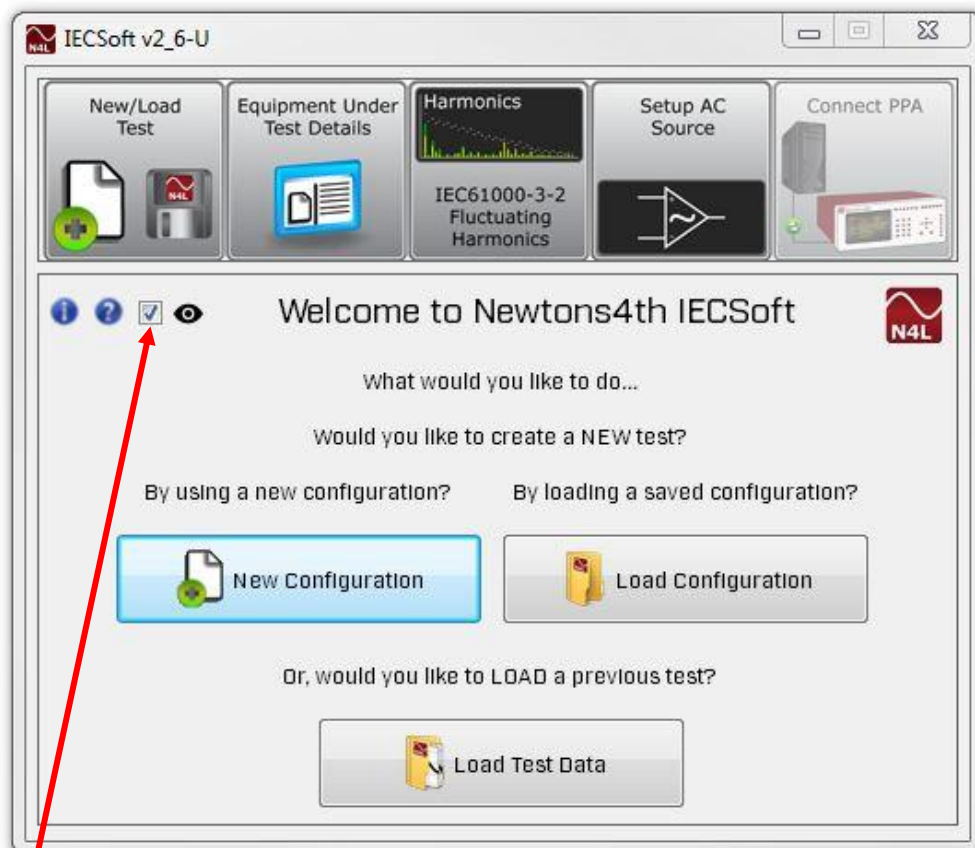




9.3 Appendix C – Welcome Dialog Icons.

IECSoft Debug Mode.

This is an additional mode that the user might be asked to use by our Technical Support staff. Should a user suffer technical difficulties the data file created contains additional information to aid the investigation of the problem.



When IECSoft is first opened, tick the box highlighted above by the red arrow. A window will then open asking the user to select a location to save the file. Choose a suitable location; a text file will be created called "IECSoft_comms". Then just continue to use the software in the usual way.

IECSoft Information Icon.



Clicking on this icon displays details of this version of IECSoft.



Website Support Link



Clicking on this icon opens a link to the Support Resources Section Of the Newtons4th Ltd website.

9.4 Appendix D – Definitions.

The section contains definitions for the following:

Tmax and d(t).

Dmax.

Short Term Limit (STL) Exception.

Partial odd Harmonic (POHC) Exception.

THDG and THDS

9.4.1 Tmax and d(t)

The parameter Tmax is an abbreviation for “t d(t) > 3.3%”. At the end of the test it is the largest value of “t d(t) > 3.3%” which is tested against the limit.

So if there are two changes between steady states (see table C.2 on p31 of BS EN 61000-3-3:2013) dt is the sum of the two of them; but if there are two changes separated by periods of steady state then it is the larger dt value which is reported.

The Standard BS EN 61000-3-3:2013 describes Tmax and d(t) as follows:

“Tmax maximum time duration during the observation period that the voltage deviation d(t) exceeds the limit for dc

Note 1 to entry: During a voltage change characteristic the time duration Tmax is accumulated until a new steady state condition is established.

Note 2 to entry: The Tmax limit evaluation in this standard is generally intended to evaluate the inrush current pattern of the equipment under test. Thus, as soon as a new steady state condition is established, the Tmax evaluation is ended. When a new voltage change occurs that exceeds the limit for dc, a new Tmax evaluation is started. The maximum duration that d(t) exceeds the limit for dc for any of the individual Tmax evaluations during the observation period, is used for the comparison against the Tmax limit, and is reported for the test”

9.4.2 Dmax

The standard BS EN 61000-3-3:2013 describes Dmax:

– The maximum relative voltage change d_{max} is expressed as a percentage of the nominal voltage.

Section 5 specifies the limits as:

– The maximum relative voltage change d_{max} , shall not exceed

a) 4 % without additional conditions;

b) 6 % for equipment which is:

– switched manually, or

– switched automatically more frequently than twice per day, and also has either a delayed restart (the delay being not less than a few tens of seconds), or manual restart, after a power supply interruption.

c) 7 % for equipment which is: – attended whilst in use (for example: hair dryers, vacuum cleaners, kitchen equipment such as mixers, garden equipment such as lawn mowers, portable tools such as electric drills), or – switched on automatically, or is intended to be switched on manually, no more than twice per day, and also has either a delayed restart (the delay being not less than a few tens of seconds) or manual restart, after a power supply interruption.

In the case of equipment having several separately controlled circuits in accordance with 6.6, limits b) and c) shall apply only if there is delayed or manual restart after a power supply interruption; for all equipment with automatic switching which is energized immediately on restoration of supply after a power supply interruption, limits a) shall apply; for all equipment with manual switching, limits b) or c) shall apply depending on the rate of switching.

The 7% limit in c) above applies to arc welding equipment. Further information can be found in section A.15.1 of the Standard document.

Appendix A.2 in the Standard also confirms that some devices are deemed to comply with the *dmax* standard and are not required to be tested.

9.4.3 Short Term Limit (STL) exception.

In the IEC61000-3-2 standard, section 6.2.3.4 defines an STL exception as:

The average values for the individual harmonic currents, taken over the entire test observation period shall be less than or equal to the applicable limits.

For each harmonic order, all 1,5 s smoothed r.m.s. harmonic current values, as defined in 6.2.2, shall be either:

*a) less than or equal to 150 % of the applicable limits, or
b) less than or equal to 200 % of the applicable limits under the following conditions, which apply all together:*

- 1) the EUT belongs to Class A for harmonics;*
- 2) the excursion beyond 150 % of the applicable limits lasts less than 10 % of the test observation period or in total 10 min (within the test observation period), whichever is smaller, and*
- 3) the average value of the harmonic current, taken over the entire test observation period, is less than 90 % of the applicable limits.*

Harmonic currents that are less than 0,6% of the input current measured under the test conditions, or are less than 5mA, whichever is greater, are disregarded.

This means that the harmonic values for class A need to be: less than 150% (this is a MAX pass, no matter what) OR less than 200% for less than 10% of the test (MAX:10 mins) AND for the average for that harmonic to be less than 90% of the limit. (The STL Exception).

9.4.4 Partial odd harmonic Exception (POHC).

In the IEC61000-3-2 standard, section 6.2.3.4 defines a POHC exception as:

For the 21st and higher odd order harmonics, the average value obtained for each individual odd harmonic over the full observation period, calculated from the 1,5 s smoothed r.m.s. values according to 6.2.2, may exceed the applicable limits by 50 % provided that the following conditions are met:

- *the measured partial odd harmonic current does not exceed the partial odd harmonic current which can be calculated from the applicable limits;*
- *all 1,5 s smoothed r.m.s. individual harmonic current values shall be less than or equal to 150 % of the applicable limits.*

NOTE: These exemptions (the use of the partial odd harmonic current for the average values and the 200 % short term limit for single 1,5 s smoothed values) are mutually exclusive and cannot be used together.

Essentially meaning the AVERAGE harmonics values for Class A can exceed the 100% limits provided that:

- a) The Partial Odd Harmonics Current value of the odd harmonics from the 21st onwards (21, 23, 25, 27 ... 39) does not pass the POHC limit.
- b) No individual average passes 150% of that Harmonic's limit.

Section 3.16 of the standard states that the POHC value is calculated as follows:

3.16

partial odd harmonic current

total r.m.s. value of the odd harmonic current components of orders 21 to 39

$$\text{partial odd harmonic current} = \sqrt{\sum_{n=21,23}^{39} I_n^2}$$

Where "I_n" is the current value (I) of the harmonic (n)

Partial Odd Harmonic Current is calculated from the Current Values, Partial Odd Harmonic Current Limit is calculated from the Limit Values in Table 1 (Class A) in section 7.4

The STL Exception and POHC exceptions cannot occur at the same time. This is because for a POHC exception the average needs to be over 100% whilst a STL exception requires it to be below 90%.

9.4.5 THDG and THDS

IEC61000-4-7 sections 3.3.2 and 3.3.3 provide more details about THDG and THDS and the formula used to calculate them:

3.3.2

group total harmonic distortion

THD

THDG (symb.)

ratio of the r.m.s. value of the harmonic groups (*g*) to the r.m.s. value of the group associated with the fundamental:

$$THDG = \sqrt{\sum_{n=2}^H \left(\frac{G_{gn}}{G_{g1}} \right)^2} \quad (5)$$

3.3.3

subgroup total harmonic distortion

THDS

THDS (symb.)

ratio of the r.m.s. value of the harmonic subgroups (*sg*) to the r.m.s. value of the subgroup associated with the fundamental:

$$THDS = \sqrt{\sum_{n=2}^H \left(\frac{G_{sgn}}{G_{sg1}} \right)^2} \quad (6)$$

9.5 Appendix E – IEC61000 Source Limits.

This section contains extracts the “standards” used to calculate the limits for the testing of source harmonics.

BS EN 61000-3-2:2014. Equipment input current < 16A per phase.

Section A.2.c. Supply source.

The harmonic ratios of the test voltage (U) shall not exceed the following values with the EUT connected as in normal operation:

- 0,9 % for harmonic of order 3;*
- 0,4 % for harmonic of order 5;*
- 0,3 % for harmonic of order 7;*
- 0,2 % for harmonic of order 9;*
- 0,2 % for even harmonics of order from 2 to 10;*
- 0,1 % for harmonics of order from 11 to 40.*

BS EN 61000-3-12:2011. Low voltage Systems. Input Current >16A and <75A.

Section 7.1. The supply source shall meet the following requirements:

The harmonic ratios of the output voltage *U* in no-load condition shall not exceed:

- 1,5 % for harmonic of order 5;
- 1,25 % for harmonics of order 3 and 7;
- 0,7 % for harmonic of order 11;
- 0,6 % for harmonics of order 9 and 13;
- 0,4 % for even harmonics of order 2 to 10;
- 0,3 % for harmonics of order 12 and 14 to 40;

Note: The above limits were also used for JIS testing with and input current > 20A.

JIS C 61000-3-2: 2011. Input Current <20A.

A.2.c. Power supply for measurement.

The voltage ratio to fundamental harmonic included in the power supply for measurement shall not exceed the following values with the EUT connected as in normal operation:

- 0.9% for harmonic of order 3
- 0.4% for harmonic of order 5
- 0.3% for harmonic of order 7
- 0.2% for harmonic of order 9
- 0.2% for even harmonics of order from 2 to 10
- 0.1% for harmonics of order from 11 to 40

9.6 Appendix F - IEC61000-11 Z_{test} and Z_{ref}

References to Z_{test} & Z_{ref}.

Section 3.3 - Conditional Connections.

Connection of equipment which requires the user's supply at the interface point to have an impedance lower than the reference impedance Z_{ref} in order that the equipment emissions comply with the limits in this standard.

NOTE Meeting the voltage change limits is not the only condition for connection; emission limits for other phenomena such as harmonics, may also have to be satisfied.

Section 6 - Suffixes and their applications.

Z_{sys} is the modulus of the impedance of the system to which the equipment may be connected in order to meet a particular limit. A number after the subscript identifies a particular calculation.

Z_{ref} is the reference impedance.

Z_{act} is the modulus of the actual impedance of the supply existing at the interface point.

Z_{max} is the modulus of the maximum value of the supply impedance at which equipment meets all the limits of this standard.

Z_{test} is the modulus of the test circuit impedance at which the emission test is performed and d_{ctest} , d_{max} test, P_{st} test and P_{it} test are measured values.

Section 6.1.1 - Test impedance – Z_{test}

The test impedance Z_{test} may be lower than Z_{ref} , particularly for equipment having a rated input current >16 A. To find the optimal test impedance, two conditions shall be met.

- firstly, the voltage drop, U , caused by the equipment shall be within the range 3 % to 5 % of the test supply voltage;
- secondly, the ratio of inductive to resistive components of Z_{test} given by $X_{\text{test}} / R_{\text{test}}$ shall be within the range 0,5 to 0,75 (i.e. similar to the ratio of the components of Z_{ref}).

NOTE The 3 % to 5 % condition ensures that the relative current changes of the equipment in the real network situation will be nearly the same as those during the test.

Section 6.1.3 - Evaluation against Z_{ref}

If Z_{test} is not equal to Z_{ref} , the measured values shall be recalculated using the following formulae:

$$d_c = d_{c \text{ test}} \cdot \frac{Z_{\text{ref}}}{Z_{\text{test}}}$$

$$d_{\text{max}} = d_{\text{max test}} \cdot \frac{Z_{\text{ref}}}{Z_{\text{test}}}$$

$$P_{\text{st}} = P_{\text{st test}} \cdot \frac{Z_{\text{ref}}}{Z_{\text{test}}}$$

$$P_{\text{lt}} = P_{\text{lt test}} \cdot \frac{Z_{\text{ref}}}{Z_{\text{test}}}$$

The values d_c , d_{max} , P_{st} , P_{lt} are similar to those which would be obtained by measurements using Z_{ref} as the conditions placed on Z_{test} in 6.1.1 ensure that the modulus values of Z_{test} and Z_{ref} are approximately "in phase" and that the measured voltage, P_{st} and P_{lt} values can be converted to equivalent values with reasonable accuracy by multiplying them by the ratio:

$$\frac{Z_{\text{ref}}}{Z_{\text{test}}}$$

Provided that the conditions for d_c and d_{max} are met with Z_{test} , $d(t)$ shall be deemed to be satisfied.

Section 6.2.2 - Calculation of the maximum permissible system impedance.

The following evaluation procedure shall be applied if the equipment emissions cannot meet the technical requirements of IEC 61000-3-3 and therefore the equipment cannot be declared compliant by the manufacturer in accordance with 6.2.1. In such a case the equipment shall only be connected to a supply having a system impedance lower than Z_{ref} .

To calculate the lower system impedance, Z_{sys} , the values of d_c , d_{max} , P_{st} and P_{lt} calculated according to 6.1.3 shall be used in the following formulae.

For manual switching:

$$Z_{sys1} = Z_{ref} \cdot \frac{\text{(The } d_{max} \text{ limit given in clause 5 appropriate to the EUT)}}{d_{max}}$$

$$Z_{sys2} = Z_{ref} \cdot \frac{3,3 \%}{d_c}$$

$$Z_{sys3} = Z_{ref} \cdot \left(\frac{1}{P_{st}} \right)^{\frac{3}{2}}$$

$$Z_{sys4} = Z_{ref} \cdot \left(\frac{0,65}{P_{lt}} \right)^{\frac{3}{2}}$$

The minimum of the four calculated values of Z_{sys} is the maximum permissible system impedance, Z_{max} which the manufacturer shall declare in accordance with clause 4.

In consideration of voltage changes caused by manual switching, it is only required to calculate Z_{sys1} and Z_{sys2} ; Z_{max} is the minimum of the two values.

Provided that the conditions for d_c and d_{max} are met with Z_{test} , $d(t)$ shall be deemed to be satisfied.

9.7 Appendix G – Help and Assistance.

If you require any further assistance with the operation of IECSOFT please do not hesitate to contact your local distributor or N4L on support@newtons4th.com