



N4L Newtons4th Ltd

PIM-10/30 Series

Power Impedance Module

User manual

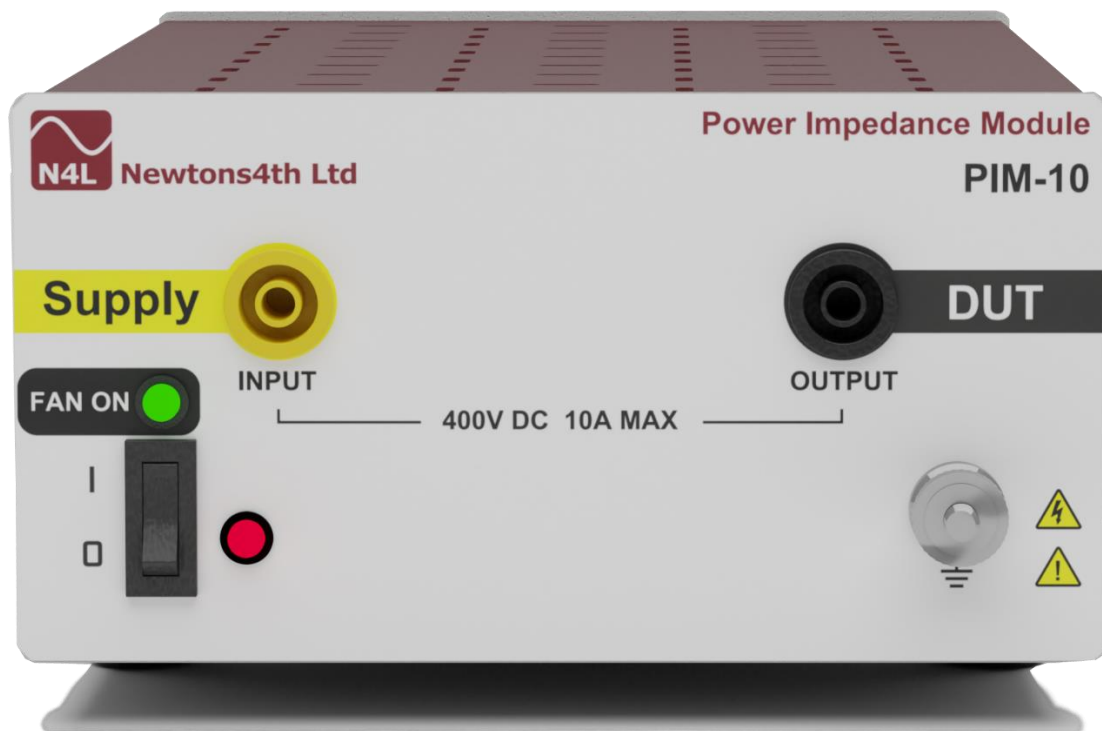


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Safety

Important safety Information

This manual contains important information that must be followed to ensure the safety of all operatives, this instrument and any accessories attached.

General Safety Information

Use the product only as detailed in this manual. Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. Carefully read all instructions. Retain these instructions for future reference.

For correct and safe operation of this instrument, it is essential that you follow generally accepted safety procedures in addition to the safety precautions specified in this manual.

The product is designed to be used by trained personnel only. It is designed to comply with BSEN 61010-1 (Safety requirements for electrical equipment for measurement, control, and laboratory use)

Ensure that the supply voltage agrees with the rating of the instrument printed on the back panel before connecting the mains cord to the supply.

Ensure that the supply voltage agrees with the rating of the instrument printed on the front of the panel before connecting the Supply and DUT to the instrument.

This appliance must be earthed. Ensure that the instrument is powered from a properly grounded supply outlet.

The input, output connectors and the internal circuitry are isolated from earth - do not exceed 400V DC at the Supply terminals.

We recommend that after running the instrument at full rated current, disconnect the load, letting the fan run for between 5-10 minutes until any latent heat build-up within the unit is removed.

This unit is fitted with safety BNC signal input and shunt output connections, appropriate safety BNC cables must be used, standard metal BNC cables will damage these connectors, and most importantly the metal shrouding around a standard metal BNC will be at a DC potential of up to 400V which is a major electrical shock hazard.

The Supply & DUT connections require 4mm safety test leads rated at 20A (for the PIM-10, 36A for the PIM-30 or greater, the use of lower rated leads may cause a fire hazard.

The cover(s) should not be removed to attempt repair, maintenance, or adjustment, as this instrument contains no user serviceable parts. All repairs, maintenance or adjustment should only be carried out by Newtons4th Ltd or one of our official distributors.

While using this product, you may need to access other parts of a larger system. Read the safety sections of the other system component manuals for warnings and cautions related to operating the system.

When incorporating this equipment into a system, the safety of that system is the responsibility of the of the system integrator.

To avoid fire or personal injury

Use the correct rated 4mm shrouded test leads rated to 20A/36A dependant on model, or greater to prevent a fire hazard.

Ground the instrument. This instrument is grounded through the grounding terminal. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the instrument, ensure that the instrument is properly grounded.

Power disconnect. Do not position the instrument so that it is difficult to disconnect the 4mm shrouded test leads; it must always remain accessible to the user to allow for quick disconnection if needed in an emergency.

Connect and disconnect properly. Switch off the instrument and ensure the output current has fallen to zero before disconnecting an inductive load from the output.

Observe all terminal ratings. To avoid fire or shock hazard, observe all rating and markings on the instrument. Consult the specifications in this user manual for further ratings information before making connections to the product. Do not exceed the Measurement Category (CAT) rating and voltage or current rating of the lowest rated individual component of a product, probe, or accessory.

Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.

Avoid exposed circuitry. Do not touch exposed connections and components when power is present.

Do not operate with suspected failures. If you suspect that there is damage to this instrument, have it inspected by Newtons4th Ltd or one of our official distributors. Do not use the instrument if it is damaged or operates incorrectly. If in doubt about safety of the instrument, turn it off and disconnect the mains lead. Clearly mark the instrument to prevent its further operation. Before use, inspect test leads, and accessories for mechanical damage and replace when damaged. Do not use probes or test leads if they are damaged.

Use proper fuse. Use only the fuse type and rating specified for this product. If the fuse needs replacing use a 10x38mm cartridge fuse rated for 10/35Amp, and 400V or higher.

Do not operate in wet/damp conditions. Be aware that condensation may occur if a unit is moved from a cold to a warm environment.

Do not operate in an explosive atmosphere.

Keep product surfaces clean and dry. Remove the input signals before you clean the product, only use a dry cloth for cleaning. Do not use chemicals or cleaning products on this instrument.

Provide proper ventilation. Installation into a system integration requires that the instrument has proper ventilation. Slots and openings are provided for ventilation and should never be covered or otherwise obstructed. Do not push objects into any of the openings.

Provide a safe working environment. Always place the instrument in a location convenient for viewing and operation. Use care when lifting and carrying the product.

Terms in the manual

These terms may appear in this manual:



WARNING. Warning statements identify conditions or practices that could result in injury or loss of life.



CAUTION. Caution statements identify conditions or practices that could result in damage to this product or other property.



INFORMATION. Information statements identify instructions or commands that may save time or provide extra functionality

Terms on the product

These terms may appear on the product:

- DANGER indicates an injury hazard immediately accessible as you read the marking.
- WARNING indicates an injury hazard not immediately accessible as you read the marking.
- CAUTION indicates a hazard to property including the product.

Symbols on the product



When this symbol is marked on the product, be sure to consult the manual to find out the nature of the potential hazards and any actions which must be taken to avoid them.

The following symbol(s) may appear on the instrument.



Instrument GND

Conventions used to signify control keys, screen menu options and remote control commands are differentiated as shown below.

control keys	<i>ACQU</i>	denoted by <i>italicised font</i>
menu options	bandwidth	denoted by <i>bold italicised font</i>
script commands	* <i>CLS</i>	denoted by <i>grey, bold italicised font</i>

Environmental compliance

This section provides information about the environmental impact of the product.

Product end-of-life handling

Observe the following guidelines when recycling an instrument or component:

Equipment recycling. Production of this equipment required the extraction and use of natural resources.

The equipment may contain substances that could be harmful to the environment or human health if improperly handled at the product's end of life. To avoid release of such substances into the environment and to reduce the use of natural resources, we encourage you to recycle this product in an appropriate system that will ensure that most of the materials are reused or recycled appropriately.



This symbol indicates that this product complies with the applicable European Union requirements according to Directives 2012/19/EU and 2006/66/EC on waste electrical and electronic equipment (WEEE) and batteries. For information about recycling options, check with your local authorities.

Declaration of Conformity



Manufacturer: Newtons4th Ltd.
Address: 1 Bede Island Road
Leicester
LE2 7EA

We declare that the product:

Description: Power Impedance Module
Model: PIM -10 & PIM - 30

Conforms to the EEC Directives:

2014/30/EU relating to electromagnetic compatibility:
EN 61326-1:2013

2014/35/EU relating to Low Voltage Directive:
EN 61010-2-030:2010:

August 2024

Oliver Handford
(Design Engineer Newtons4th Ltd.)

Preface

This manual covers the Newtons4th Ltd Power Impedance Modules PIM-10 & PIM-30, unless otherwise stated the use of the term PIM refers to both the PIM10 & the PIM-30

The PIM is an AC injection device designed to induce a small AC signal on a powered DC line, the PIM is designed only for use with the N4L PSM3750 range.

The PIM should be placed on the live line in series between the supply and DUT, the rating for the Supply voltage is up to 4kVA DC

The control signal used by the PIM to inject the AC level to the DUT, is supplied by the Generator O/P of the PSM3750 being used. The frequency band available is 10Hz to 100kHz.



INFORMATION. The voltage of the signal output from the PSM should not be higher than 200mVrms, if higher signal voltages are used there is potential to harm the DUT. It's recommended a signal voltage in the range of 25-50mVrms is used for the best results.

If the ripple is visible in scope mode and measurable, a higher signal value is not required

PIM contains a N4L proprietary shunt used to measure the current through the DUT via channel 2 of the PSM3750, the voltage across the DUT is measured directly across the DUT by channel 1 of the PSM3750.

The PIM is powered by a supplied 12V DC PSU.

Key Features

- 4kVA max supply
- Bandwidth of 10Hz to 100kHz
- Full capability only available when used with PSM3750
- Isolated BNC
400V peak
- Isolated 4mm socket
400V peak
- High accuracy N4L proprietary planar internal shunt
- Isolated from ground to prevent earth loops
- Robust metal enclosure

Warranty

This product is guaranteed to be free from defects in materials and workmanship for a period of 36 months from the date of purchase.

In the unlikely event of any problem within this guarantee period, first contact Newtons4th Ltd. or your local representative, to give a description of the problem. Please have as much relevant information to hand as possible – particularly the serial number which is on a label adhered to the rear panel.

If the problem cannot be resolved directly then you will need to request an RMA number from the support section of our website. <https://resources.newtons4th.com/> and return the unit. The unit will be repaired or replaced at the sole discretion of Newtons4th Ltd.

This guarantee is limited to the cost of the PIM itself and does not extend to any consequential damage or losses whatsoever including, but not limited to, any loss of earnings arising from a failure of the product or software.

In the event of any problem with the instrument outside of the guarantee period, Newtons4th Ltd. offers a full repair service.

Please contact your local Distributor or the N4L office for further details of N4L's instrument repair service.



INFORMATION. The PIM does not require any calibration.

Specification

Parameter	PIM-10	PIM-30	Units
Supply Input	Isolated 4mm	Isolated 4mm	
DUT Output	Isolated 4mm	Isolated 4mm	
Signal Input	Isolated BNC	Isolated BNC	
Shunt Output	Isolated BNC	Isolated BNC	
Internal Shunt	100m	10m	Ω
Power Input	12 DC	12 DC	V
Max Supply voltage	400 DC	400 DC	V
Max Supply current	10	30	A
Max DUT voltage	400 DC	400 DC	V
Max DUT current	10	30	A
Signal input bandwidth	10 – 100K	10 – 100K	Hz
Temperature range	0 - 40	0 - 40	$^{\circ}\text{C}$
Size	145 x 290 x 85	145 x 290 x 85	cm
Weight (approx)	2	2	Kg

Notes:

All specifications are typical values unless otherwise stated.

¹ The input voltages should be limited to ensure no damage to the device

User Guide

In the following text, we describe the use of the PIM, including details on the correct signal input amplitude to use, setting up the PSM3750 for either input or output impedance measurements, and performing a frequency sweep.

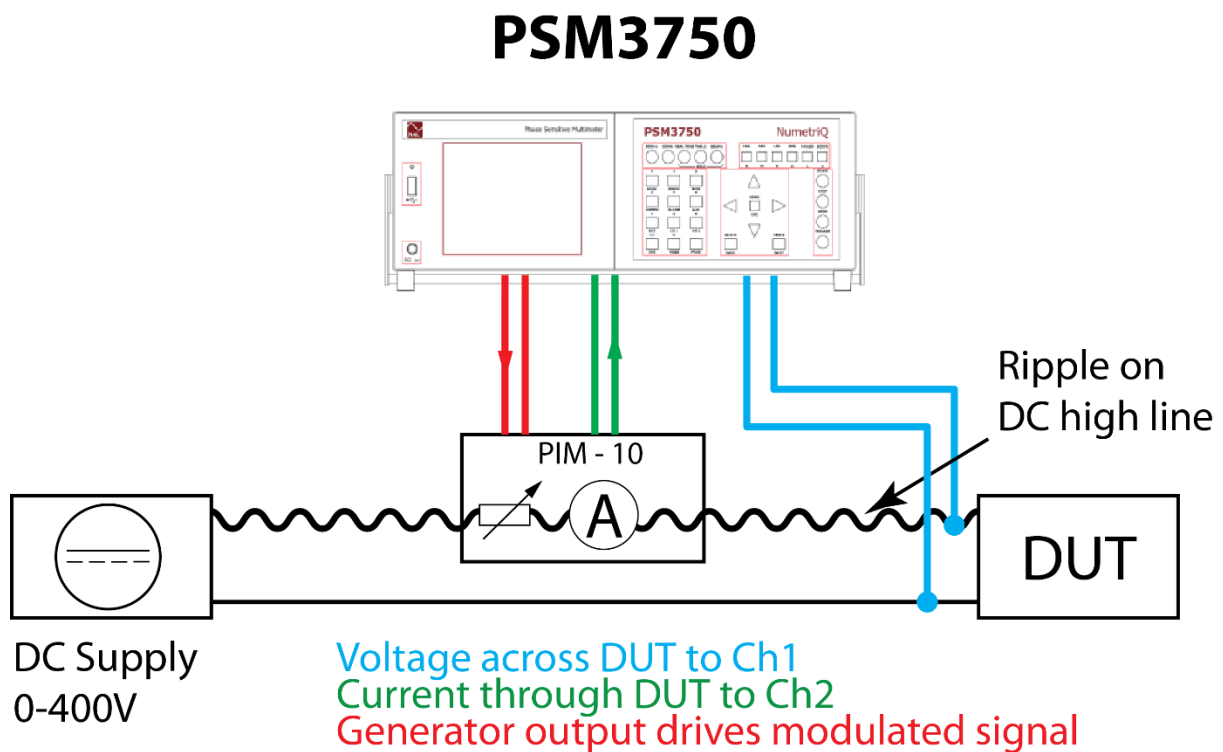
Supply Input: The supply input uses a 4mm plug, this input is intended for the Live line from the supply to be connected to via a test lead. It's important to note the PSU (Supply) being used must have relatively low noise output.

DUT Output: The DUT Output uses a 4mm plug, this input must be connected to the DUT live input using a 4mm test lead.

Signal Input: The PIM features a signal input in the form of an isolated BNC on the rear, this input is connected to the generator output on the PSM3750 via a safety BNC lead

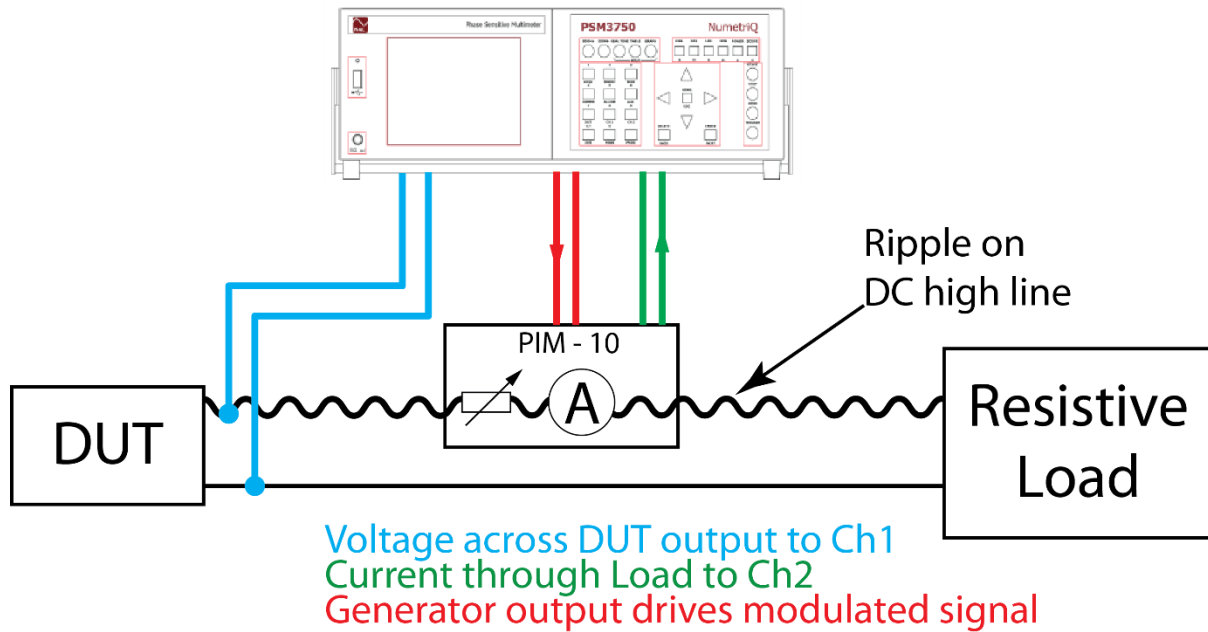
Shunt Output: The shunt output is an isolated BNC; this output is connected to channel 2 on the PSM 3750 using a safety BNC lead.

Voltage across DUT: Two test leads (4mm safety) are connected in parallel across the DUT to channel 1 on the PSM 3750, these leads are supplied with the PIM.



Connection schematic when measuring input impedance of DUT

PSM3750



Connection schematic when measuring output impedance of DUT

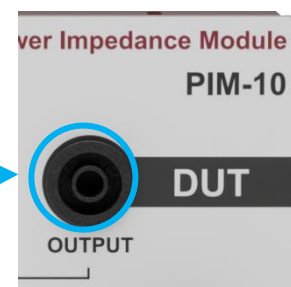
Setting up the PSM3750 for the PIM

Making a frequency sweep- connecting the PIM and setting the menus

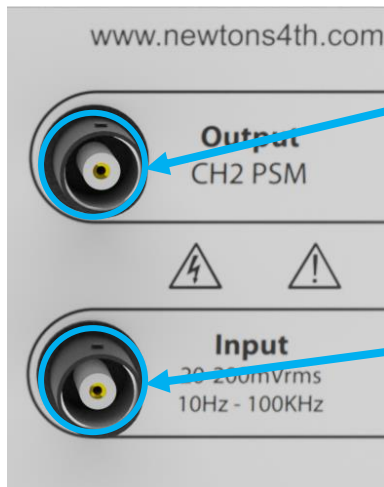


Connect the positive side of the DC supply to the PIM **Supply** connection on the front of the unit and coloured yellow using the 4mm safety cables provided.

Connect the **Output** terminal on the PIM front panel and coloured black to the positive input terminal of the DUT, using the 4mm safety cables provided.



Connect the negative side of the DC supply directly to the negative side of the DUT.



Connect **Channel 2** on the rear of the PSM3750 to the BNC on the rear of the PIM, marked **OUTPUT CH2 PSM** with a BNC touch proof safety cable.

Connect the signal generator **Output** on the rear of the PSM3750 to the BNC on the rear of the PIM, marked **Input** with a BNC touch proof safety cable.

Connect the red and black 4mm terminals marked **CH1** on the PSM3750 with the supplied 2x 4mm safety leads across the DUT, keeping in mind the requirement for safety at the DUT connections as these connections will be at line voltage.

The following parameters need to be set up on the PSM36750 prior to starting a test.

- 1 Output **amplitude** and **frequency**
- 2 Ranging and scale factor for both channel 1 and channel 2
- 3 Sweep parameters

Signal input amplitude: It is important to use the correct level for the AC amplitude signal from the generator when using the PIM. If a signal is set that is too low, the results may not be measurable by the PSM3750, conversely a signal that is set too high can cause distortion due to clipping.

To avoid either of these extremes, it's good practice to initially set the amplitude within the range of 25-50mVpk (Figure 1), higher loads may require slightly more voltage up to 200mV which is the advised maximum.

Examples of too low, too high, and the correct signal input is shown in Figures 2, 3, & 4.

To set the amplitude, use the **OUT** key on the PSM3750 to access the **OUTPUT** menu, the parameters, **amplitude**, and **frequency** can be set by use of the ◀ ▶ ▲ ▼ keys Figure 5

The output should be left off until the test is ready to be started.



Figure 1 (Setting amplitude)

The following screen shots demonstrate the type of trace experienced with too low or too high input signal

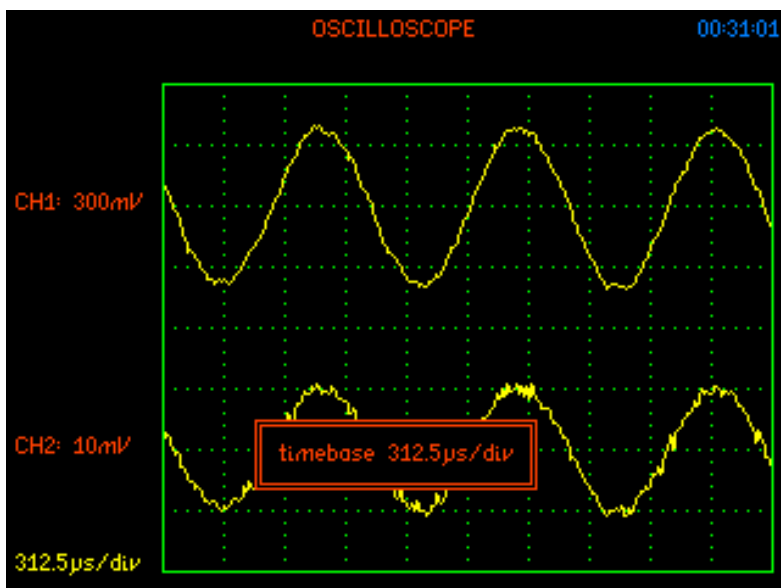


Figure 2 (Signal Input too Low)

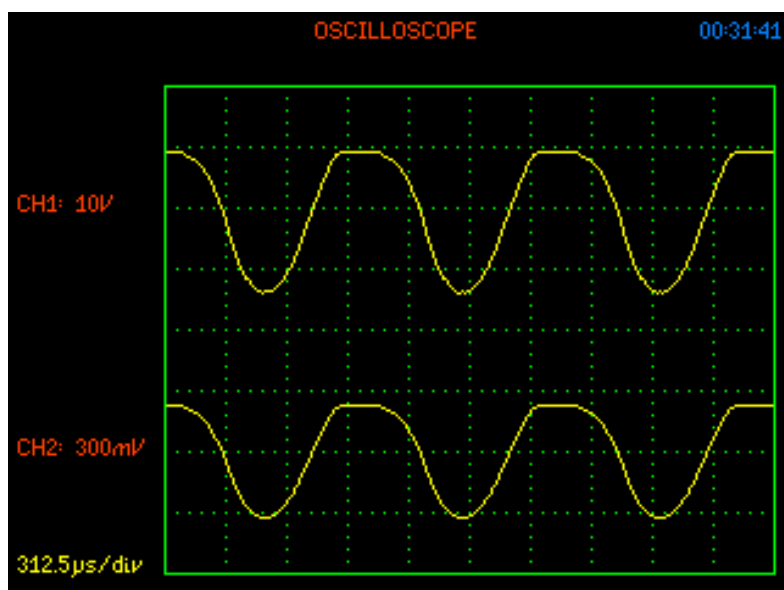


Figure 3 (Signal Input too High)

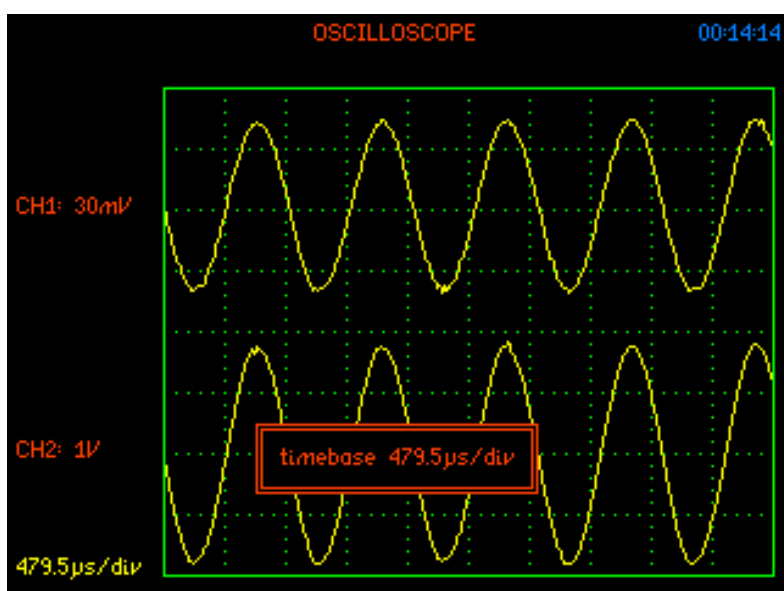


Figure 4(Correct Signal Input)

Setting the range parameters to suit the PIM.

Press the **CH2** key to select the ranging menu for channel 2, the **Input** parameter will be set to **direct** by default, select this parameter and change it to **external shunt**.

Set the parameter **shunt** to the value shown on the label fixed to the rear panel, it is nominally **100.00mΩ** for the PIM-10 and **10mΩ** for the PIM-30, however this shunt is calibrated in production and the actual value noted on the rear panel. Finally, the **scale factor** should be set to **-1** as shown below.

Now using the **CH1** key, the parameters can be set for channel (Figure 6) . In the ranging menu the parameters for input and scale factor can be left with the default values.

However, in both cases, **CH1** & **CH2** should be set to **AC** coupling (Figure 5 & 6)

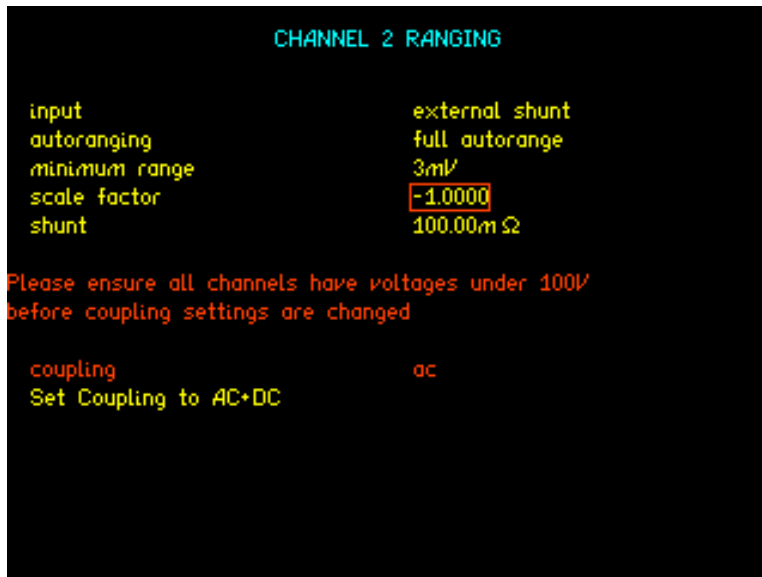


Figure 5 (Channel 2 PSM)

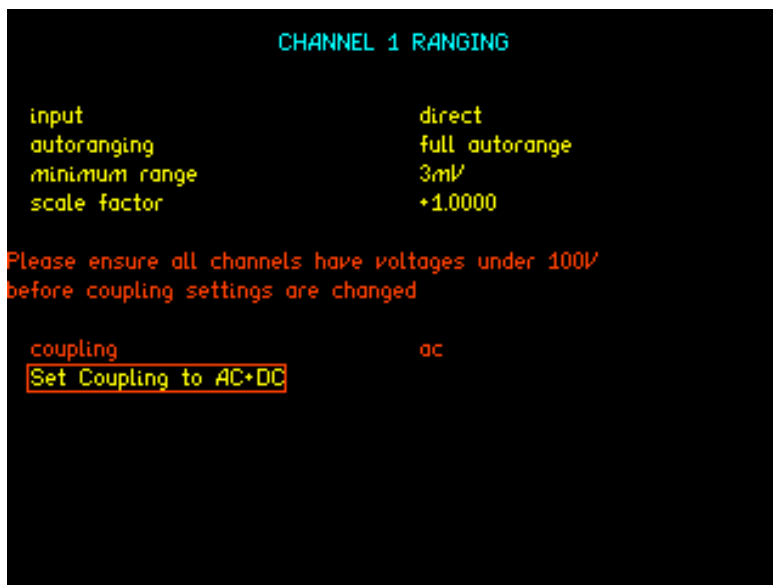


Figure 6 (Channel 1 PSM)

Setting the frequency sweep parameters:

Full details of setting up a frequency sweep can be found in the PSM3750 User manual on pages 52, 53, 128, 135, & 136

Following the instructions in the PSM3750 manual, the following parameter settings should be entered.

Sweep start frequency should be set to 10Hz.
 Sweep end frequency should be set to 100kHz
 The number of steps should be set to 100.

Within the *ACQU* menu the number of cycles can be set, the default is 1, 10 is the suggested initial setting to work with.

If the value is set to a value greater than 1, this will extent the overall sweep time by a factor of *n*, as each frequency point is swept *n* times where *n* is the number of cycles. This will have a smoothing effect on the data and give a cleaner more accurate set of measurements.

Performing the sweep

Once all the connections have been made and the PSM3750 set up correctly, the output from the PSM3750 generator should be turned on, this is the last parameter in the *OUT* menu.

Ensure that the fan on the PIM is set to on and when the PIM is turned on, that the indication light is illuminated, the DC power can now be switched on to the DUT and the sweep can be initiated by pressing the *START* key on the PSM3750 at the far right hand side of the keyboard.

Typical results

Figure 7 below, shows the results when conducting a frequency sweep with a 4Ω shunt under a typical DC load. The impedance of the shunt increases a small amount with frequency due to there being a small amount of inductance which is found in most resistors, especially prevalant in wire wound resistors as shown here.

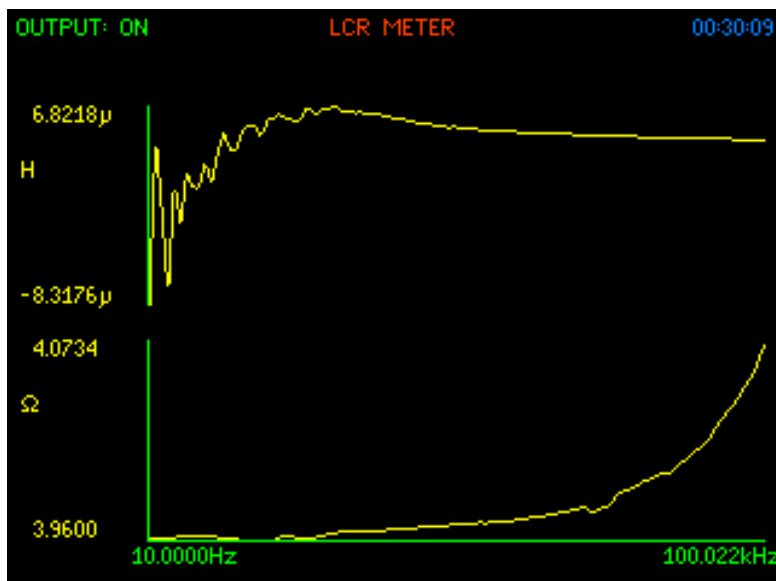
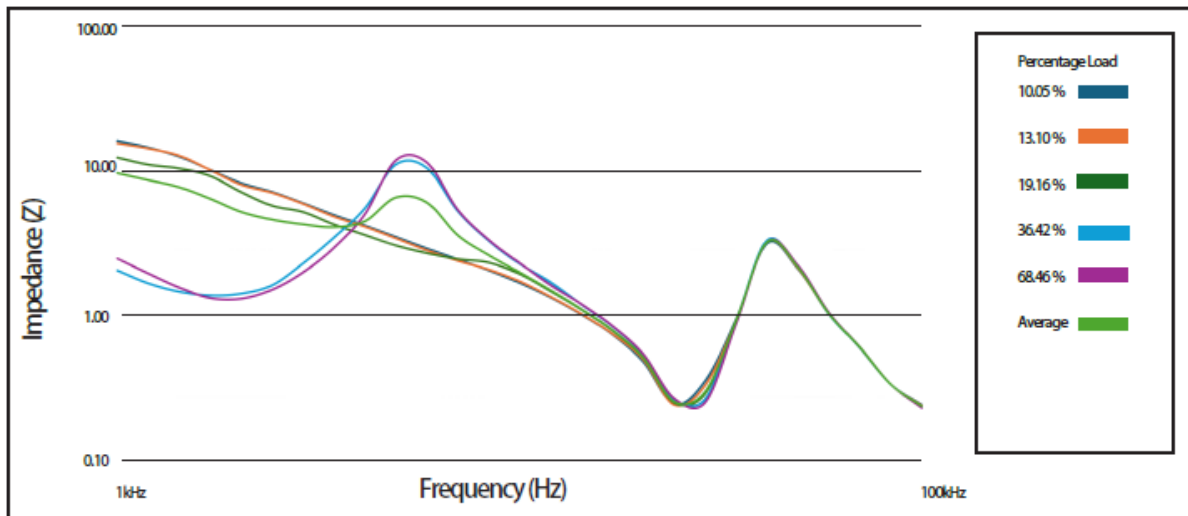


Figure 7 (typical wire wound shunt results)

Alternatively, by using PSMComm2 software multiple sweeps can be performed at varying loads on the DUT, the results can then be exported to Excel for further analysis. A typical set of varying load sweeps are shown below as impedance against frequency.



N4L Software Packages

All N4L software packages are available free of charge as a downloadable file from our website <https://resources.newtons4th.com/>

If you are not already registered with us, then please take the time to visit our website and register by completing the registration section on the right hand side and clicking the Register key.

Once approved (within UK office hours) you will receive an email with your login details. Login on the left hand side of the screen and click the Software menu option on the far left. You will also find in the support section all the latest:

Instrument Firmware, PC Software and Manuals.

Upon initial activation of our Software with your PC you will be asked for an unlock code, these codes are readily available from your local distributor or by emailing us directly at support@newtons4th.com

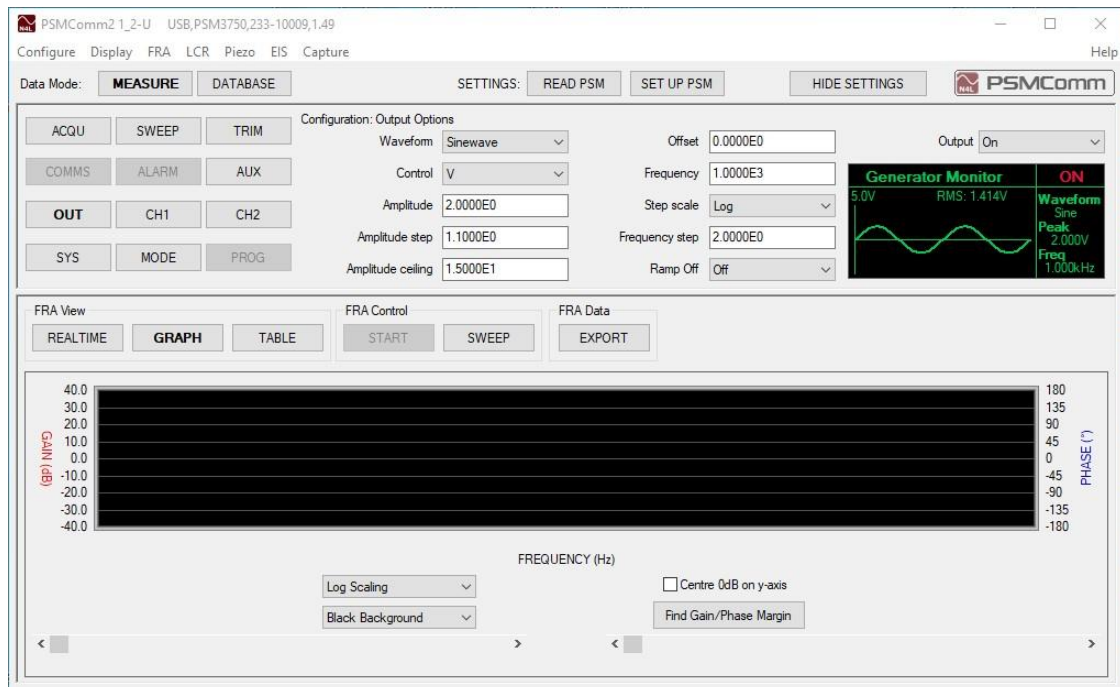
PSMComm2

PSMComm2 is a self-contained executable software program written in C++[™] using the Microsoft win32 graphics set.

PSMComm2 connects to the PSM 3750 via RS232, USB, and LAN. The software includes all measurement modes to reflect instrument operation.

PSMComm2 supports the ability to export text files in CSV format as well as export directly to Microsoft Excel[™].

PSMComm2 is available as a free download from our website <https://resources.newtons4th.com/>



Full details and further instructions can be found in the PSMComm2 User manual which is available to download from the N4L website. <https://resources.newtons4th.com/>

Contact details

Please direct all queries or comments regarding the PIM instrument or manual to:

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At Newton4th Ltd. we have a policy of continuous product improvement and are always keen to hear comments, whether favourable or unfavourable, from users of our products.

An example comment form can be found at the end of this manual – if you have any comments or observations on the product, please fill a copy of this form with as much detail as possible then scan and email it to us at the above email address.

PIM-10/30 comments		
serial number:		date:
your contact details:		
comments:		
detailed description of application or circumstances:		
Please post or scan and email to Newtons4th Ltd.		