Newtons4th Ltd

PSM3750

Start Up Guide

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1. Getting Started

1.1 Unpacking

Remove the instrument and accessories from the packaging and check them against the supplied packing list. Please contact your N4L office or local sales distributor should any items found to be missing or damaged during transportation.

Please retain the original packaging to ensure easy and safe return of the equipment for calibration etc.

If rack mounting brackets have been fitted to the equipment, please remove them before packaging the equipment for return. This reduces the risk of damage to the equipment during transportation.

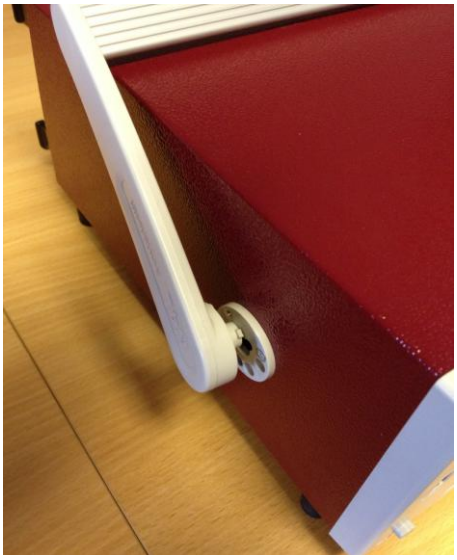
1.2 Fitment of the PSM3750 Carry/Tilt handle

The PSM3750 Phase Sensitive Multimeter is supplied with a Carry / Tilt Handle that is located within the accessory pack.

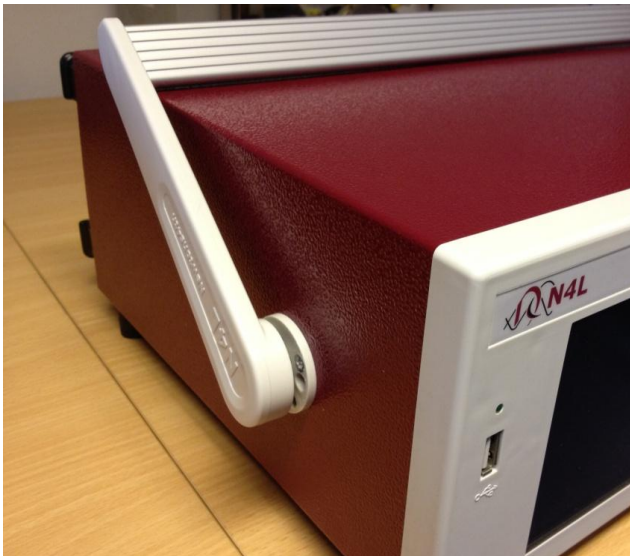
The handle allows a user to position the instrument upwards at one of two angles for easier viewing when the instrument is positioned below the line of sight. The design also allows storage under the unit without obstruction of the rubber feet so that instruments can be stacked and is easily removed to allow the connection of rack mounting brackets without the need to remove instrument covers.

Correct installation of the handle is important to ensure the correct operation and long life the handle.

The following pictures illustrate correct and incorrect handle fitment:



Correct 1



Correct 2

Correct 1/2 – Correct fitting is from the top of the unit as shown here

Correct 3

Correct 4

A correctly fitted handle will have the 'N4L Newtons4th' wording in the correct reading plane when the handle is to the front of the instrument (Pic. 3)

Also, a correctly fitted handle will allow storage under the unit (Pic. 4)

Incorrect 1

Incorrect 2

Fitting the handle from the bottom of the unit as shown here is wrong (Incorrect 1)

Incorrect fitting can be seen because the handle does not fit correctly under the unit and handle sides do not fit flush with the registration washer (Incorrect 2)

2. Safety

2.1 IMPORTANT SAFETY INSTRUCTIONS

This equipment is designed to comply with BSEN 61010-1 (Safety requirements for electrical equipment for measurement, control, and laboratory use) – observe the following precautions:

- 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.
- This appliance ***must*** be earthed. Ensure that the instrument is powered from a properly grounded supply.
- The inputs and outputs must not be connected to common mode signals greater than 500V peak.
- The inputs must not be connected to signals greater than 500V peak.
- Keep the ventilation holes on the underneath and sides free from obstruction.
- Do not operate or store under conditions where condensation may occur or where conducting debris may enter the case.
- There are no user serviceable parts inside the instrument – do not attempt to open the instrument, refer service to the manufacturer or his appointed agent.

Input Connections:

It is critical that the 4mm inputs and BNC inputs on each PSM input channel are not connected to any external circuit at the same time.

You MUST only use EITHER the 4mm OR the BNC connection – NOT both, this applies to both Voltage and Current inputs.

Note: Newtons4th Ltd. shall not be liable for any consequential damages, losses, costs or expenses arising from the use or misuse of this product however caused.

2.2 CAUTIONS

- **Do not use a damaged power cord or cables**

  Doing so may cause an electric shock or a fire

- **Do not place any object on this instrument**

- **Do not use this instrument if faulty**

  If you suspect the instrument to be faulty, contact your local N4L office or representative for repair (see section 12)

3. 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 a problem within this guarantee period, first contact Newtons4th Ltd or your local representative to give a description of the problem. Please have as much relative information to hand as possible – particularly the serial number and release number these can be found by pressing the SYSTEM button then the "Left Arrow"

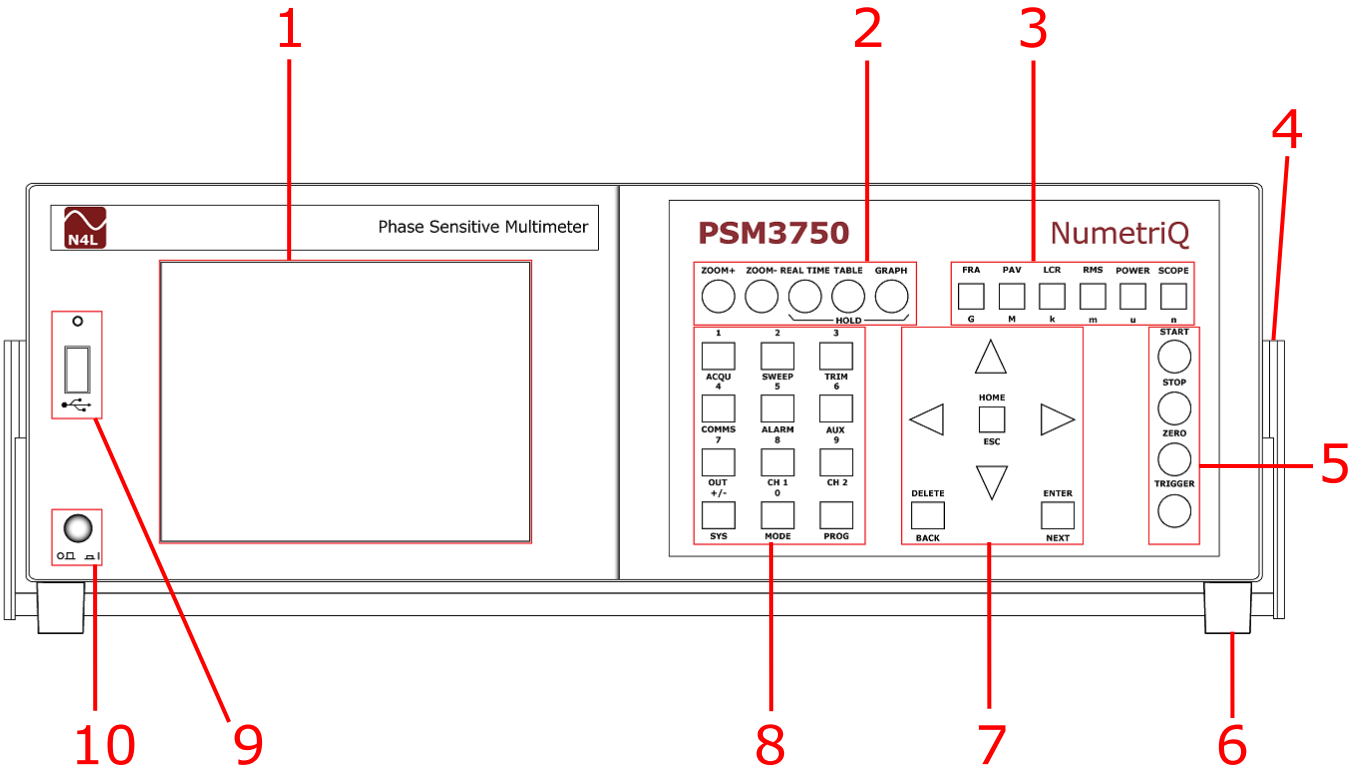
If the problem cannot be resolved directly then you will be given an RMA number and asked to return the unit. The instrument will be repaired or replaced at the sole discretion of Newtons4th Ltd

This guarantee is limited to the cost of the PSM3750 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 and re-calibration service. Contact your local representative. It is recommended that the PSM3750 be re-calibrated annually

4. Front Panel Layout

1. Display Screen
2. Screen Display Function Buttons
3. PSM Function Mode Buttons
4. Handle
5. Measurement Control Function Keys
6. Rubber Feet
7. Menu Selection and Cursor Controls
8. Measurement Settings Buttons
9. Front USB Port
10. Power On / Off Button



4.1. PSM3750 Display Key Functions

Key & Sub Categories	Description
ACQU	Acquisition Control: Used for configuring inputs appropriate to source and nature of signals being analyzed

Input	Channel selection dependent upon model
PSM3750-2CH	Only 2 input channels available
PSM3750-3CH	Select between 2 or 3 channel inputs

Speed	In normal acquisition mode the window over which the measurements are computed is adjusted to give an integral number of cycles of the input waveform. The results from each window are passed through a smoothing filter. There are 5 pre set speed options that adjust the nominal size of the window, and therefore the update rate and time constant of the filter. Greater stability is achieved at a slower speed at the expense of a slower update rate
Very Slow	Update rate = 10s. Results window size will update every 10 seconds
Slow	Update rate = 2.5s. Results window size will update every 2.5 seconds
Medium	Update rate = 1/3s. Results window size will update 3 times per second
Fast	Update rate = 1/12s. Results window size will update 12 times per second
Very Fast	Update rate = 1/50s. Results window size will update 50 times per second
Window	The window application will allow the user to input their own speed settings different to any of the 5 pre set settings above

Cycles	Manually input number of measurements to be made at each measurement point, of which the average will be taken. Set between 1 and 100

Smoothing	Smoothing filter will gather the data and average out over a sliding window time scale. This is very useful when gathering data which could be affected by noise. Each speed above has its own time constant for filtering and data updates. Smoothing does not affect a single sweep as each point is a single measurement. If Sweep is set to continuous then the smoothing is applied to each new sweep result
Normal	With Normal smoothing applied the following update windows will apply to the relevant speed selected. V.Fast =0.1s, Fast = 0.4s, Medium = 1.5s, Slow = 12s, V.Slow = 48s
Slow	With Slow smoothing selected all results are X4 greater than in normal smoothing mode
None	With no smoothing to computed results the data update will be dictated by the speed only

Smoothing Response	
Auto Reset	The smoothing response is by default set to "auto reset" where the filtering described in "smoothing" is reset in response to a significant change in data. This speeds up the response of the instrument to changing conditions
Fixed Time	Auto reset can be disabled so that the filtering has a fixed time constant, which would have an exponential response to a step change

Phase Reference	In the case where there is very little signal on CH1, the reference for the phase can be set to another channel to give a more accurate measurement. This does not change the phase results it only helps to reduce the uncertainty due to noise.
Channel 1	Select to choose Channel 1 as reference
Channel 2	Select to choose Channel 2 as reference
Channel 3	Select to choose Channel 3 as reference (If fitted)

Low Frequency	When the generator is not used and so the measurement is synchronised to the input frequency measured on CH1, there is a low frequency option that extends the frequency measurement down to 10μHz. This low frequency option also applies a digital filter which can be useful when measuring in low frequency, noisy environments
Off	Select to switch this mode Off
On	Select to switch this mode On

Bandwidth	The bandwidth of the instrument usually set to "Auto" can be forced to "Wide" or "Low" when not in "Auto" mode, heterodyning is disabled
Wide	Select to set bandwidth to 5MHz
Low	Select to set bandwidth to 100KHz
Auto	Select to set bandwidth into auto mode

ACQU ADVANCED OPTIONS	
DFT Selectivity	Analysis of the **fundamental** component uses a DFT (Discrete Fourier Transform) algorithm. The selectivity of the DFT analysis is a compromise between noise rejection of frequencies close to the frequency of the fundamental component and the required stability of the frequency component
Normal	Default settings for the fundamental calculations
Narrow	Selecting "narrow" increases the selectivity of the DFT analysis (reducing the effective bandwidth at each component) which has the effect of improving the noise rejection. It does however require that the frequency of the fundamental component is more stable

Ignore Overload	In a noisy application any spikes present on the signal may push the instrument onto a higher range than is necessary for the signal being measured. If the nature of the spurious spikes are such that they do not contribute to the measurement and can safely be ignored then the range can be manually set to the appropriate range for the signal to be measured and the instrument can be told to ignore any overload. If using this mode it is wise to check the signal on the oscilloscope to be sure that the signal being measured is not genuinely over range
Off	Select to switch this mode Off
On	Select to switch this mode On

Frequency Lock	In a very noisy application, where the frequency of the signal is known but the instrument is unable to measure the frequency even with low frequency mode filters applied, it is possible to manually enter the frequency to be used for analysis
Normal	Utilises N4L unique signal processing techniques for fundamental frequency synchronisation including hysteresis to increase frequency noise immunity
Constant	Constant selection will allow the user to overwrite the present measured frequency with the known frequency. This entered frequency is then used for all the analysis and the frequency of the input signal is not measured

High Speed	High speed mode can be selected for data log speeds less than 100ms
Disabled	Disable high speed function
Enabled	Activate high speed data log function

SWEEP	All ac measurements using the PSM3750 generator can be swept across a frequency range

Sweep Start	Manually input sweep start frequency

Sweep End	Manually input sweep end frequency

Steps	Manually enter number of steps the frequency sweep data is to be analyzed over. Up to a max of 2000 steps

Steps	
Log	Set to view the resultant data in a Logarithmic format
Linear	Set to view the resultant data in a Linear format

Sweep	Select between either a single or repeating sweep

Graph 1 Scaling	The graph normally sets the Y axis automatically to the extremes of the measurement
Auto	Select to leave graph in auto mode
Manual	Select to independently manually set the Y axis

Graph 2 Scaling	The graph normally sets the Y axis automatically to the extremes of the measurement
Auto	Select to leave graph in auto mode
Manual	Select to independently manually set the Y axis

Frequency Marker	A vertical marker can be placed on the graph to reference a specific frequency. If selected a new parameter will open to allow the user to manually input the frequency reference required

TRIM	The trim function is a powerful and versatile feature that allows closed loop control of the generator amplitude
ac Trim Data	
Disabled	Select to disable ac trim function
Channel 1	Select to allow the generators output to be adjusted, and maintain the measured voltage or current from CH1
Channel 2	Select to allow the generators output to be adjusted, and maintain the measured voltage or current from CH2
Channel 3	Select to allow the generators output to be adjusted, and maintain the measured voltage or current from CH3 (If fitted)

COMMS	
Resolution	Press to set the data resolution and change the format to which the instrument responds to future commands via Comms interface
Normal	Data resolution set to 5 decimal points
High	Data resolution set to 6 decimal points
Binary	Data transmitted in binary format

Interface	Communications type between instrument and pc
RS232	RS232 Comms interface
USB	USB Comms interface
LAN	LAN Comms interface
GPIB	GPIB Comms interface

Recall with Program	When enabled recalls communication port settings from any stored memory location
Off	Turn OFF this option
On	Turn ON this option

Screen Print	
Disabled	No screen print option selected
RS232	Print screen via RS232 cable i.e. to a printer
USB Memory Stick	Print screen directly onto a USB memory stick. To activate press and hold the START button for 2 seconds and then release. A BMP file is then transferred to the memory stick

ALARM	
Alarm 1 Data	Alarm on selected parameter and threshold
Zoom 1	Zoom 1 parameter selected for alarm threshold
Zoom 2	Zoom 2 parameter selected for alarm threshold
Zoom 3	Zoom 3 parameter selected for alarm threshold
Zoom 4	Zoom 4 parameter selected for alarm threshold

Alarm Type (Alarm 1)	
Disabled	No alarm
Linear	Frequency of beep increases linearly as value reaches its limit
Alarm if High	Alarm will sound if values exceed a threshold
Alarm if Low	Alarm will sound if values fall below a threshold
Outside Window	Alarm will sound if values are outside a permitted window setting
Inside Window	Alarm will sound if values are within a permitted window setting

Alarm 2 Data	Alarm on selected parameter and threshold
Zoom 1	Zoom 1 parameter selected for alarm threshold
Zoom 2	Zoom 2 parameter selected for alarm threshold
Zoom 3	Zoom 3 parameter selected for alarm threshold
Zoom 4	Zoom 4 parameter selected for alarm threshold

Alarm Type (Alarm 2)	
Disabled	No alarm
Linear	Frequency of beep increases linearly as value reaches its limit
Alarm if High	Alarm will sound if values exceed a threshold
Alarm if Low	Alarm will sound if values fall below a threshold
Outside Window	Alarm will sound if values are outside a permitted window setting
Inside Window	Alarm will sound if values are within a permitted window setting

Analogue Output	
Disabled	No analogue output
Zoom 1	Set an analogue output voltage representative of zoom 1
Zoom 2	Set an analogue output voltage representative of zoom 2
Zoom 3	Set an analogue output voltage representative of zoom 3
Zoom 4	Set an analogue output voltage representative of zoom 4
Manual	Set a constant analogue output voltage

AUX	
None	No auxiliary device connected
IAI	Impedance Analysis Interface- converts the PSM3750 into a high performance LCR meter with true 4 wire kelvin connections that are taken directly to the component under test without the need for external shunts. Buffering, amplification and selectable shunts provide LCR measurements over a wide frequency and impedance range

OUT	PSM3750 has a wide bandwidth, isolated, generator output that can be used as a signal generator to produce various waveforms
Waveform	
Sinewave	Select for sinewave output signal
Squarewave	Select for squarewave output signal
Triangle	Select for triangle output signal
Sawtooth	Select for sawtooth output signal
White Noise	Select for true white noise output signal

Amplitude Control	
V	Set amplitude as a peak output voltage
dBm	Set amplitude in dBm with reference to 600Ω load

Amplitude	Manually enter the amplitude Vpk value to be applied To the DUT

Amplitude Step Size	Manually enter a value by which the amplitude will increase / decrease in relation to pressing the up and down arrows, the new value will be displayed within the real-time display (except for the Harmonic and Power Analyzer where the up and down arrow step the selected harmonic)

Amplitude Ceiling	Amplitude ceiling represents the maximum value allowed to the output of the generator, this is used when you are using the "trim" function and do not want the output of the generator to go above a certain value, for example if the PSM output is being used to control a DC+AC load bank and you do not want the load bank to go above or below a certain resistance

Offset	Manually enter any offset to bias the signal or to null out any dc present

Frequency	Manually set the frequency of the generator. This can be adjusted by a fixed increment set within the "Frequency step size" via the left and right arrows

Step Type	
Logarithmic	dBm
Linear	V

Frequency Step Size	Manually enter a value by which the frequency will increase / decrease in relation to pressing the left and right arrows

Ramp Off	
Off	Output will turn off instantly
On	Output will ramp down to zero when turned off

Output	
Off	Signal generator output will be switched off
On	Select to switch on signal generator
dc Only	Select signal generators output control to be dc only

Advanced Options	
Adjust Generator	Select to adjust (trim) the generator output if required
Adjustment Factor	Adjustment to the Generator output

CH1	Channel 1 input control
Input	
Direct	Select if input signal is connected directly into the PSM3750 internal shunt connectors
External Shunt	Select if Channel 1 input signal is via an external shunt
External Attenuator	Select if Channel 1 input signal is via an external attenuator

Autoranging	
Full Autorange	Default setting. Full autoranging will be selected and implemented within the instrument
Range up Only	Selecting this option will allow the test being carried out to find the highest range via peak detection and hold on this range. Once this value has been found another test can be carried out by pressing the "Trigger" button which will restart from the minimum value parameter. Essential for low frequency measurements
Manual	Selecting this option will allow the user to set up the range from the configured measurements available. Essential for low frequency measurements

Minimum Range	Select the minimum voltage range from the drop-down menu

Scale Factor	Manually set the scale factor required

Attenuator	Manually enter scale factor if input is via external attenuator

Shunt	Manually enter shunt value if input is via external shunt

Coupling	
ac+dc	Default setting will allow both ac and dc signals to be calculated in all measurements
ac	Select ac for measuring signals that are biased on a dc level (such as an amplifier operating on a single supply or the output of a dc PSU)

CH2	Channel 2 input control
Input	
Direct	Select if input signal is connected directly into the PSM3750 internal shunt connectors
External Shunt	Select if Channel 2 input signal is via an external shunt
External Attenuator	Select if Channel 2 input signal is via an external attenuator

Autoranging	
Full Autorange	Default setting. Full autoranging will be selected and implemented within the instrument
Range up Only	Selecting this option will allow the test being carried out to find the highest range via peak detection and hold on this range. Once this value has been found another test can be carried out by pressing the "Trigger" button which will restart from the minimum value parameter. Essential for low frequency measurements
Manual	Selecting this option will allow the user to set up the range from the configured measurements available. Essential for low frequency measurements

Minimum Range	Select the minimum voltage range from the drop down menu

Scale Factor	Manually set the scale factor required

Attenuator	Manually enter scale factor if input is via external attenuator

Shunt	Manually enter shunt value if input is via external shunt

Coupling	
ac+dc	Default setting will allow both ac and dc signals to be calculated in all measurements
ac	Select ac for measuring signals that are biased on a dc level (such as an amplifier operating on a single supply or the output of a dc PSU)

SYS	General system options
Set Clock	Manual setting required. Use numerical keys
Set Date	Manual setting of date and year required, month settings are preset

Display	
Colour	Select to set screen display in colour
White on Black	Select to set screen display in White font on a Black background
Black on White	Select to set screen display in Black font on a White background

Brightness	
Low	Screen brightness will be set to low
High	Screen brightness will be set to high

Phase Convention	Measurements of Phase can be expressed in one of three formats:
-180º to +180º	Commonly used in circuit analysis
0º to -360º	Commonly used in power applications
0º to +360º	Select as required

Phase Reference	Phase Reference "Sine" or "Cosine" only changes the phase of a harmonic, you will see this within Harmonic Mode only
Cosine	Select as required
Sine	Select as required

Blanking	Blanking only activates for LCR mode when compensation changes the measured value by a factor of 8 or more, the display will blank to zero
Off	Function will be disabled
On	Function will be enabled

Keyboard Beep	Audible sound when keys are pressed
Disabled	Audible sound disabled
Enabled	Audible sound enabled

High Voltage Protection Mode	When enabled autozero is disabled if any of the channels show a measurement of 100V or above
Off	Function will be disabled
On	Function will be enabled

Begin Measurements on power up	Enables and disables High Voltage Protection message when instrument is switched on.
Off	Message is displayed, press home key to continue
On	Message is disabled

Program 1-6 Direct Load	Program 1-6 may be recalled with a direct press of the function keys (FRA, PAV, LCR, RMS etc)
Disabled	Function will be disabled
Enabled	Function will be enabled

Zoom 2 High Resolution	The data displayed in zoom 2 may be displayed to one digit greater resolution than normal
Disabled	Function will be disabled
Enabled	Function will be enabled

Show Scaled Range	
Disabled	Function will be disabled
Enabled	If enabled and you set a scale factor on CH1 or CH2 the "re-scaled range" would appear in the relevant column

Step Message	
Disabled	Function will be disabled
Enabled	Function will be enabled

←System Information	The information given in this section cannot be changed by the user
Serial Number	Instruments unique serial number
Manufacturing Code	Code attributed to build date of instrument
Main release	Current firmware release installed in instrument
DSP Release	Digital Signal Processing release version
FPGA Release	Field Programmable Gate Array release version
Boot Release	Release version of instruments boot up firmware
Last Calibration	Instruments last calibration date
Auxiliary Calibration	Associated IAI auxiliary device calibration information

→ User Data	
Supervisor Access	Enable or Disable
User Data	Manually enter company name
User Data	Manually enter individual or company
User Data	Manually enter unique ID for instrument
Save	Save all above settings

MODE	Function Control
True RMS Voltmeter	The RMS voltmeter measures the total rms of the signal present at the input terminals to the bandwidth of the instrument (>1MHz). Care must be taken when measuring low signal levels to minimise noise pick up on the input leads
Frequency Response Analyzer	PSM3750 Frequency response analyzer measures the gain and phase of channel 2 relative to channel 1 using a Discrete Fourier Transform (DFT) algorithm at the fundamental frequency
Power meter	The power meter measures the total power and fundamental power of the signal present at the input terminals to the bandwidth of the instrument (>1MHz). Above 5MHz only the fundamentals are measured
LCR Meter	In LCR meter mode, channel 1 measures the voltage across the component under test and channel 2 measures the current through it. To measure the current, channel 2 must be connected across an appropriate external shunt (eg IAI)
Harmonic Analyzer	The PSM3750 harmonic analyzer computes multiple DFT's on the input waveforms in real time
Vector Voltmeter	A phase angle voltmeter (or vector voltmeter, or phase sensitive voltmeter) measures the signal at one input compared to the phase of the signal at a reference input. The results may be expressed as magnitude and phase, or as separate in-phase and Quadrature components
Oscilloscope	The PSM3750 provides a storage oscilloscope function in order to view the waveforms being measured

PROG	Recall/Store/Delete of non-volatile programs
Memory	Program store / recall options
Internal	Instruments internal memory utilised to store or recall data to / from
USB Memory Stick	External USB memory stick utilised to store or recall data to / from

Data	
Program	Upload or download a program
Results	Upload or download results

Action	
Recall	Recall any **Data** selections from above
Store	Store any **Data** selections from above
Delete	Delete any **Data** selections from above

Location	999 selectable locations for data to be; stored, recalled or deleted from. Each location has an associated name of up to 20 characters that can be entered by the user to aid identification

Name	User entered location name, otherwise blank

Execute	Press to recall / store or delete program

OTHER KEYS	
ZOOM +	Increases font size on selected parameters on the display screen

ZOOM -	Decreases font size on selected parameters on the display screen

REAL TIME	Press real time to return to the display screen and see all data in real time. Pressing real time will also put the display screen into hold mode

TABLE	Press table to view results either during, or at the completion of a frequency sweep in tabular format

GRAPH	Press graph during frequency sweep to view plotted data points whilst sweep is in process, or view graph plots once sweep is complete. Press "GRAPH" to move through screen display options

FRA	Direct button to Frequency Response Analyzer mode

PAV	Direct button to Vector Voltmeter mode

LCR	Direct button to Impedance Meter mode

RMS	Direct button to True RMS Voltmeter MODE

POWER	Direct button to Power Meter mode

SCOPE	Direct button to Scope mode where waveforms can be viewed from measurements being taken. The left and right directional arrows will allow the time base to be changed and the up and down directional arrows will allow the trigger level to be set

START	Start button will commence any frequency sweep. Is also the button used to initialise a screen dump of any data displayed onto a USB memory stick

STOP	Stop button will stop any frequency sweep

ZERO	Zero button will reset the inputs to zero

TRIGGER	Trigger returns display screen back to real time from a hold command. Also triggers a single shot in scope mode, all trigger settings can be found by pressing the "scope" button whilst in scope mode

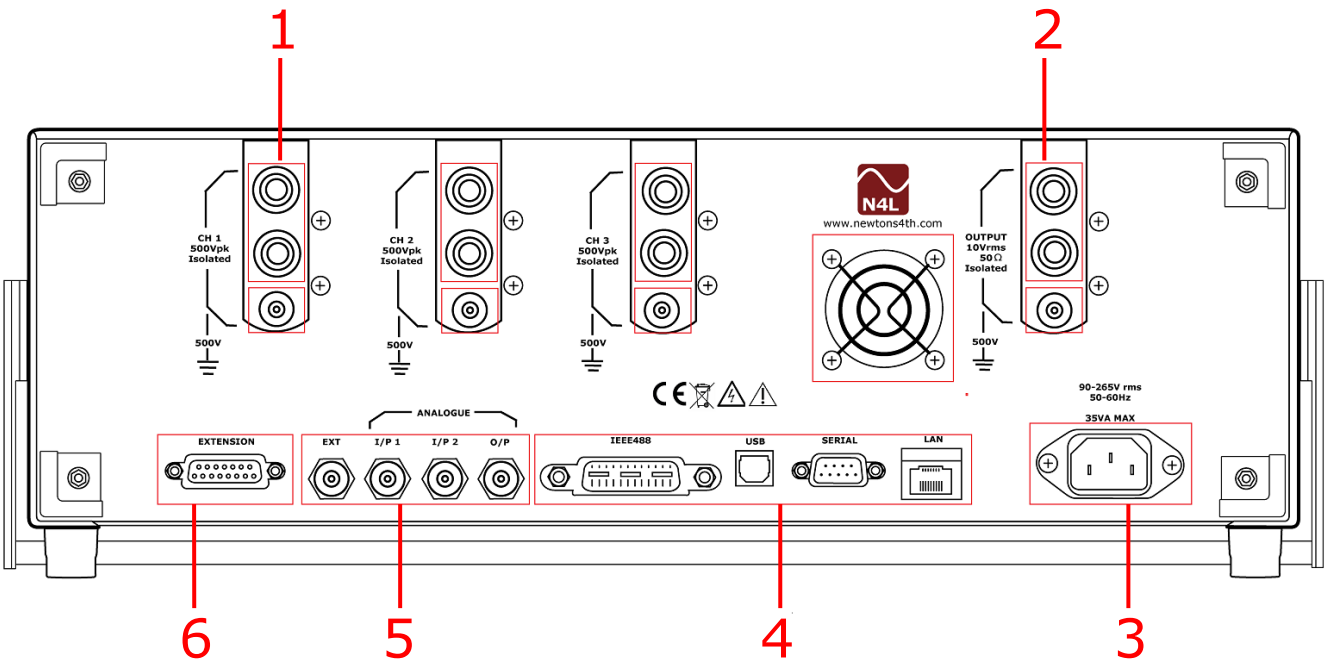
ENTER / NEXT (Dual use button)	Enter / Next button will enable the user to confirm any configurations they have set within the menu's and will scroll through the display screen whilst in scope mode

DELETE / BACK (Dual use button)	Delete / Back will enable the user to delete any inputted data or scroll back through any results screens

HOME / ESC (Dual use button)	Home / Esc will enable the user to return to the home page once data within parameters have been adjusted and entered, or will escape from any screen view and return to the selected mode's home screen

5. Rear Panel Layout

1. Input Connections
2. Output Connections
3. Mains Supply Inlet
4. Communication Ports
5. Auxiliary Ports
6. IAI2 Connection Port



6. Basic Key Operations

This chapter is designed to help the user familiarise themselves with the instrument by setting up some basic functions

6.1 SET UP FOR POWER ON

Install Equipment	⇨	Installation of Equipment
Plug in and turn on power	⇨	Power Supply Connection

6.2 SETTING THE TIME

Power Analyzer Default Screen Appears

Press "SYS" Key	⇨	System Option Screen Opens
Press ▼ Key	⇨	Flashing Red Cursor will surround Hrs
Use Numerical Keys	⇨	Set Hours within cursor
Press Enter Key	⇨	Hours in clock now set
Press ▼ Key	⇨	Flashing Red Cursor moves to Minutes
Use Numerical Keys	⇨	Set Minutes within cursor
Press Enter Key	⇨	Minutes in clock now set
Press ▼ Key	⇨	Flashing Red Cursor moves to Seconds
Use Numerical Keys	⇨	Set Seconds within cursor
Press Enter Key	⇨	Clock settings will now be complete

6.3 SET THE DATE

Press ▼ Key	⇨	Flashing Red Cursor moves to Date
Use Numerical keys	⇨	Set Date within Flashing Box
Press Enter Key	⇨	Numerical Day of Month is set
Press ▼ Key	⇨	Flashing Red Cursor moves to Month
Press ▶ Key	⇨	Month Calendar Opens
Press ▼ Key	⇨	Select Month to be entered
Press Enter Key	⇨	Month will be set
Press ▼ Key	⇨	Flashing Red Cursor moves to Year
Use Numerical Keys	⇨	Set Year within Cursor
Press Enter Key	⇨	Date will now be Set

6.4 ADJUSTING THE DISPLAY FONT COLOUR

Press ▼ Key	⇨	Flashing Red Cursor moves to Display
Press ▶ Key	⇨	Opens up dropdown menu for selection
Press ▼▲ Key	⇨	Select font display to be Colour, White on Black or Black on White
Press Enter Key	⇨	Font display will be selected

6.5 ADJUST KEYBOARD BEEP

Press ▼ Key 4 Times	⇨	Red cursor moves to Keyboard beep
Press ◄ Key	⇨	Changes between Enable / Disable option
Press Enter Key	⇨	Keyboard beep now set

Now that you have familiarised yourself with the instruments keypad we can complete this section by filling in the User Data Information

6.6 USER DATA

Press "SYS" Key	⇨	System option screen opens
Press ► Key	⇨	User settings screen appears
Press ▼ Key	⇨	Red cursor moves to supervisor access
Press ◄ Key	⇨	Changes between Enable / Disable option
Press Enter Key	⇨	Supervisor access selected
Press ▼ Key	⇨	Red cursor moves to User Data
Use Numerical Keys	⇨	On this line we can enter a Company Name
Press Enter Key	⇨	Company Name now set
Press ▼ Key	⇨	Red Cursor moves to User Data
Use Numerical Keys	⇨	Enter an Individual Name or Department
Press Enter Key	⇨	Name / Department now set
Press ▼ Key	⇨	Red cursor moves to User Data
Use Numerical Keys	⇨	Enter a Unique ID for the instrument
Press Enter Key	⇨	User Data now set
Press ▼ Key	⇨	Red cursor moves to Save
Press Enter Key	⇨	All User Data details will be saved

7. PSM3750 Quick User Guide

N4L Frequency Response Analyzer PSM3750 is a self contained test instrument, with one output and two or three input channels which incorporates a suite of test functions.

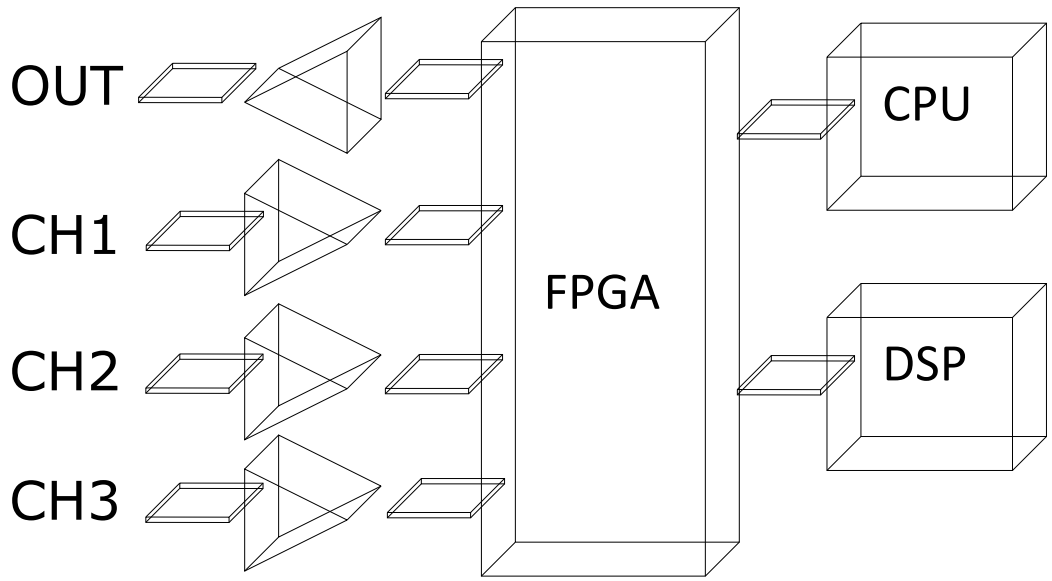
PSM3750 has a wide bandwidth, isolated, generator output that can be used as a signal generator for sine, square, triangle, sawtooth waveforms or true white noise. A dc offset may be added to the signal generator output. The output is fully isolated from earth to 600Vpk cat II.

PSM3750 has two or three isolated, high bandwidth, voltage inputs which use direct digital analysis at low frequencies and a heterodyning technique to give high accuracy at high frequencies. The inputs are fully isolated from each other and from earth to 600Vpk cat II

The PSM3750 has two processors:

1. DSP (digital signal processor) for data analysis
2. CPU (central processing unit) for control and display

At the heart of the system is an FPGA (field programmable gate array) that interfaces the various elements, see diagram below



7.1 GETTING STARTED

The PSM3750 is supplied ready to use – it comes complete with an appropriate power lead and either 2 or 3 sets of test leads (dependent upon model). It is supplied fully calibrated and does not require anything to be done by the user before it can be put into service.

Switch on the PSM3750. The display should illuminate with the model name and firmware version for a few seconds while it performs some initial tests. Note that the switch on message can be personalised – see section 5.6 User Data.

After the tests, the instrument will display a message letting the user know that the high voltage protection mode is enabled.

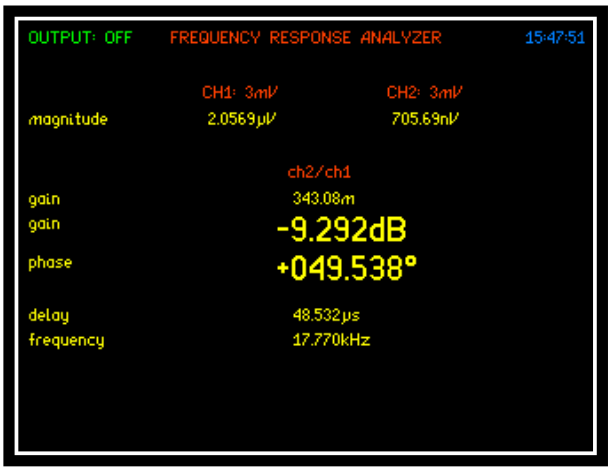
The High Voltage Protection feature disables autozero if any of the channels shows a measurement of 100 volts or above.

The user will need to press the HOME button to begin measurements.

The user can disable the protection message and begin measurements at powerup by setting the "Begin measurements on PowerUp" in the SYSTEMS OPTIONS menu to ON. This however, will not disable the high voltage protection mode.

It is recommended that a warm up period of 30 minutes is given to the instrument before commencing any tests to ensure accurate readings.

Default screen FRA will be displayed after initialisation.



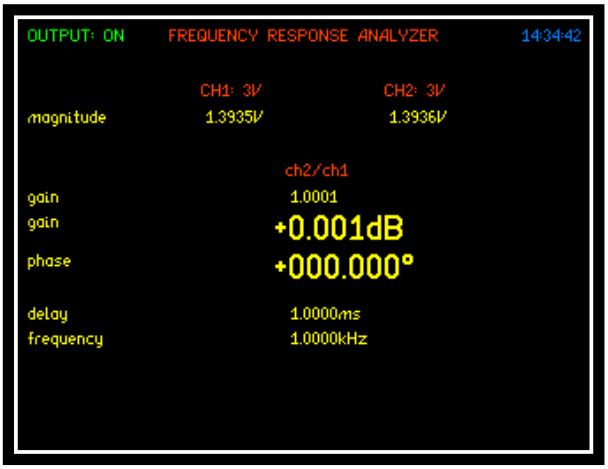
Due to the fact that the PSM3750 generator is switched off by default, the display may read some random values due to noise pick up as shown.

Connect the output leads to the 4mm sockets on the rear of the PSM3750 and connect the Input probes to the BNC connectors on each of the Input Channels. Connect the Black output lead with the black clips on the input probe lead, and the Red output lead with the actual input probe. Note this is easiest to do by connecting across a resistor.

Press the "OUT" key to invoke the output menu, using the down arrow select the output on/off control then the right key and select "ON".

Exit the menu by pressing the "ENTER" button or the "HOME" button twice

The display should now indicate a magnitude value of about 1.4V on all channels, each of which should indicate the 3V range having been selected. Check that the gain reads 0.000dB ±0.010dB, and that the phase reads 0.000° ±0.010° .



7.2 ZOOM FUNCTION

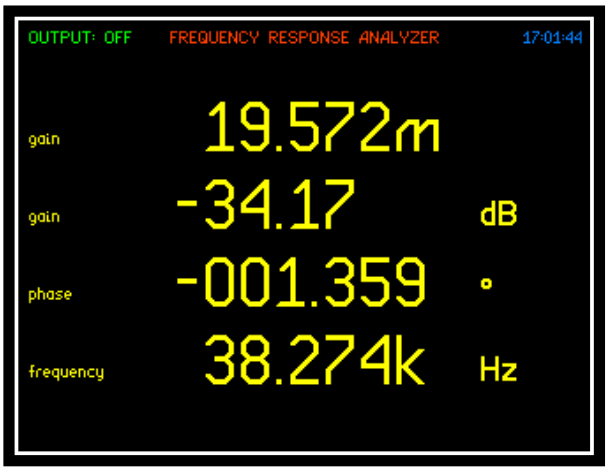
Within the display screen you are able to select up to 4 measurements that can be made more prominent from the rest, these can be selected and changed by the user as required.

To select or change any zoom measurement

Action	**Result**
Press "ZOOM-"	All measurement parameters revert to same size
Press "ZOOM+"	Red boxes will flash around currently selected zoom parameters
Press "DELETE"	Red Boxes will disappear replaced by 1 white flashing box
Press ▲▼◀▶ Keys	Move Box to desired measurement parameter to be zoomed
Press "ENTER"	Measurement will be selected
Press ▲▼◀▶ Keys	Move Box to next desired measurement parameter to be zoomed
Press "ENTER"	Measurement will be selected

Continue until all measurements you require are selected, up to a maximum of 4

By pressing the ZOOM+ or ZOOM- button you can now alter the on screen display to show a different configuration of the selected measurements.

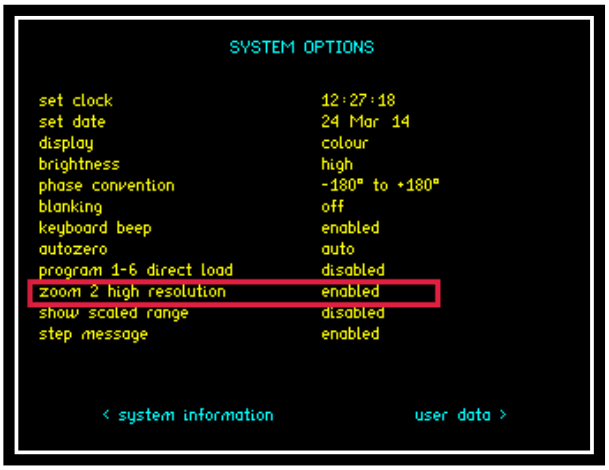


Zoom 2 Mode

Press Zoom+ to display the 4 selected zoomed measurements as shown

Note: These will be displayed in the order they were selected.

Most data is displayed to 5 digits but for extra resolution 6 digits, this can be displayed when enabled in ZOOM level 2 or 3.

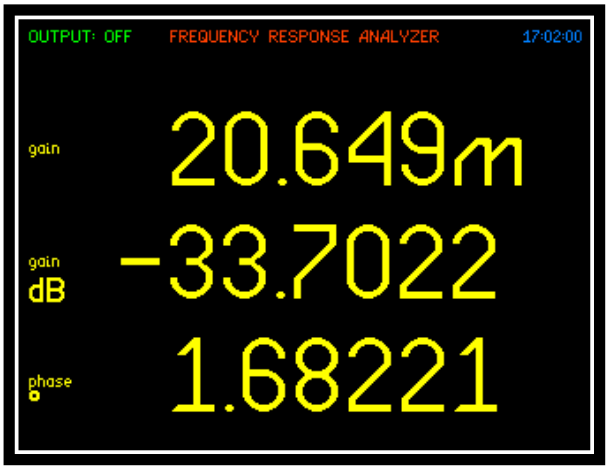


To set ZOOM 2 or 3 to high resolution, access the SYSTEM OPTIONS menu and scroll down to "zoom 2 high resolution" as shown. Press the ◀ key to enable this function.

Zoom 3 Mode

Pressing Zoom+ again will display only the first 3 selected zoomed measurements as shown

Press ZOOM- button to revert real time display back to all measurement parameters

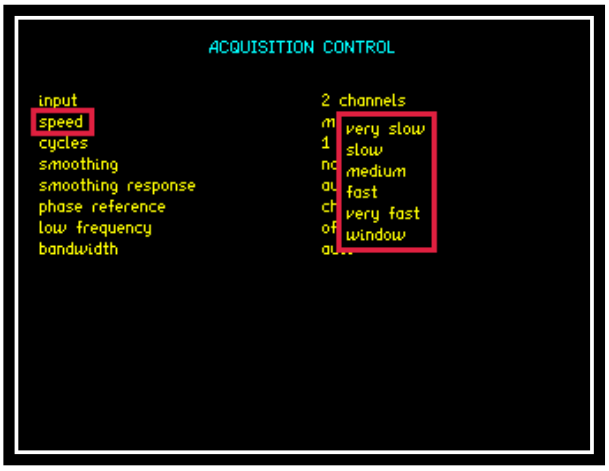


7.3 MEASUREMENT OPTIONS

7.4 ACQU – Acquisition Options

PSM3750 comes in either a 2 or 3 channel version. The 3 channel version can be set to display just 2 channels if the third channel is not in use.

In normal acquisition mode, the window over which the measurements are computed is adjusted to give an integral number of cycles of the input waveform. The results from each window are passed through a digital filter equivalent to a first order RC low pass filter.

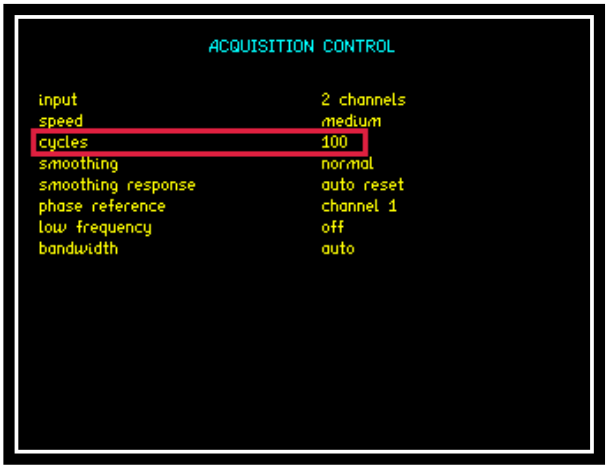


There are 5 pre-set speed options that adjust the nominal size of the window, and therefore the update rate and the time constant of the filter. Greater stability is obtained at the slower speed at the expense of a slower update rate.

There is also an option to set a specific size of the window to a value other than the 5 pre-set options. In order to synchronise to an integral number of cycles the window size is either reduced by up to 25% or increased as necessary.

Speed	Update Rate
Very Slow	10s
Slow	2.5s
Medium	0.333s
Fast	0.083s
Very Fast	0.02s
Window	Manually input window size for data update

All measurements have to be made over a complete waveform cycle so the window is extended to cover one or more complete cycles even if this is a longer period than the nominal update rate. The minimum number of cycles to be measured in each window can be set from 1 to 100.

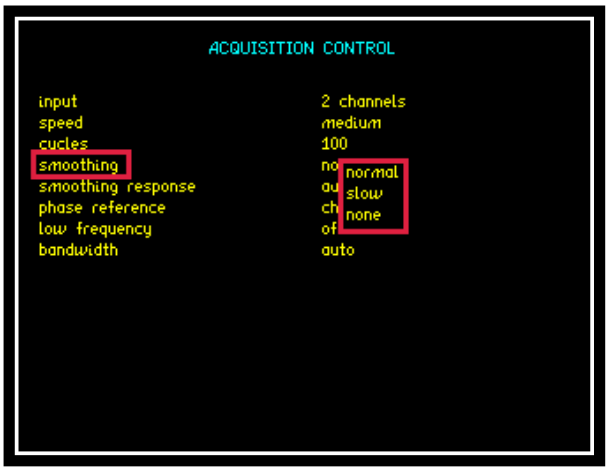


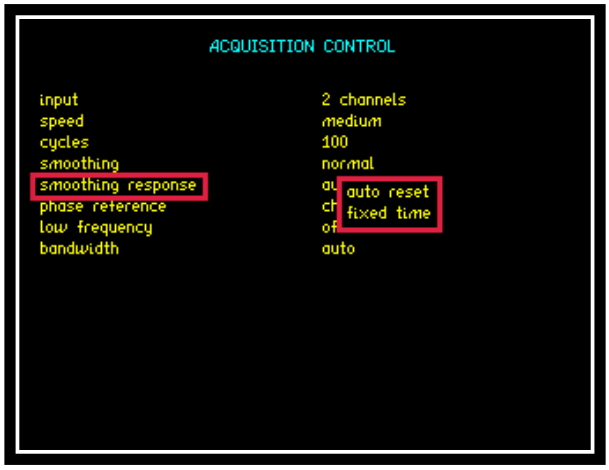
To change the number of complete cycles to be measured in each window between 1 and 100 either use the ◀ ▶ arrows or manually input using the numerical keypad and pressing "ENTER".

There are two time constants for the smoothing filter, Normal or Slow or the filter can be deselected. The filter applies an auto reset function to give a fast-dynamic response to a change of measurement. Smoothing does not affect a single sweep as each point is a single measurement. If sweep is set to continuous then the smoothing is applied to each new sweep result

The nominal values are:

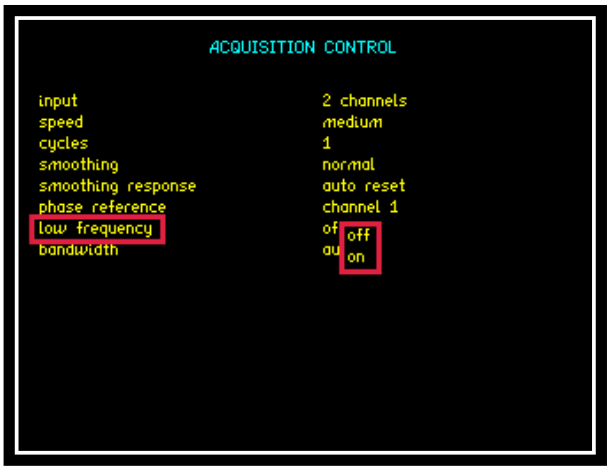
Speed	Normal Smoothing: applicable to relevant speed	Slow Smoothing: applicable to relevant speed
Very Slow	48s	192s
Slow	12s	48s
Medium	1.5s	6s
Fast	0.4s	1.5s
Very Fast	0.1s	0.4s

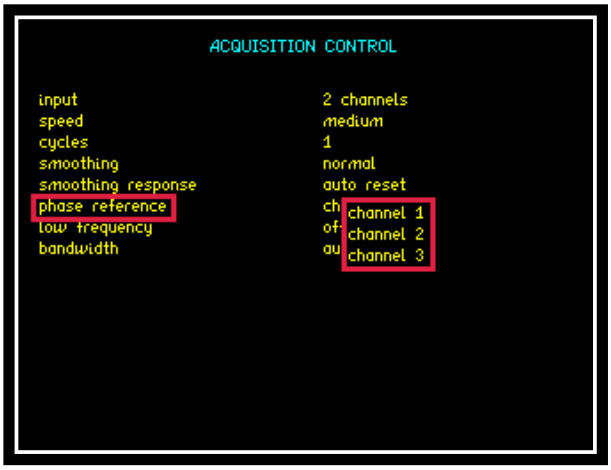




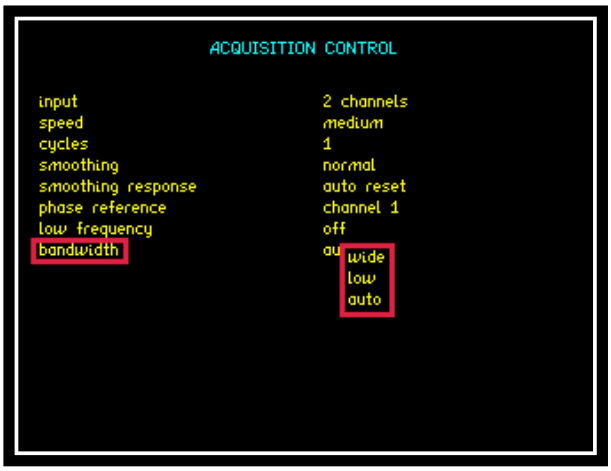
The filter dynamics are usually set to "auto reset" where the filtering is reset in response to a significant change in data. This speeds up the response of the instrument to changing conditions. The function can be disabled so that the filtering has a fixed time constant, which would have an exponential response to a step change. The filter can also be reset by pressing "TRIGGER".

When the PSM3750's own generator is not used and so the measurement is synchronised to the input frequency measured on CH1, there is a low frequency option that extends the frequency measurement down to 10μHz. This low frequency option also applies a digital filter which can be useful when measuring in a low frequency, noisy environment.





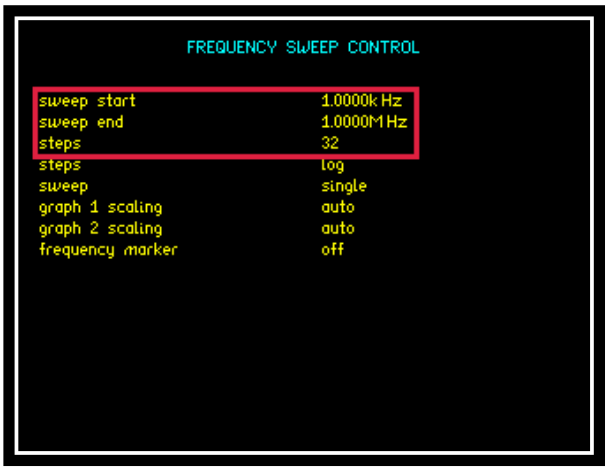
In the case where there is very little signal on CH1, the reference for the phase can be set to another channel to give a more accurate measurement. This does not change the phase result it only helps to reduce the uncertainty due to noise.



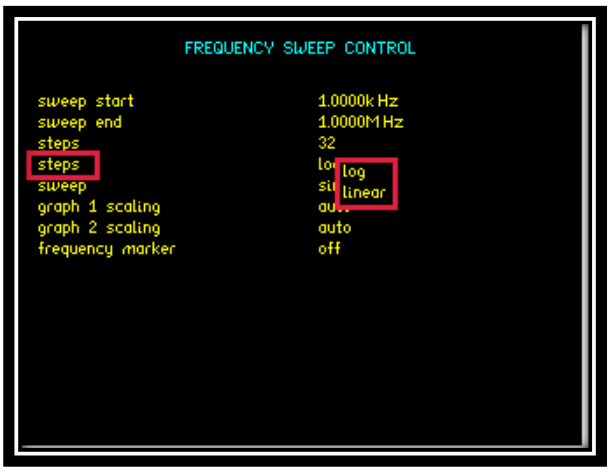
The bandwidth of the instrument usually set to "auto" can be forced to "wide" or "low". When not in auto selection, heterodyning is disabled and the bandwidth is either 5MHz wide or 100 KHz low to minimise noise when making measurements at low frequencies.

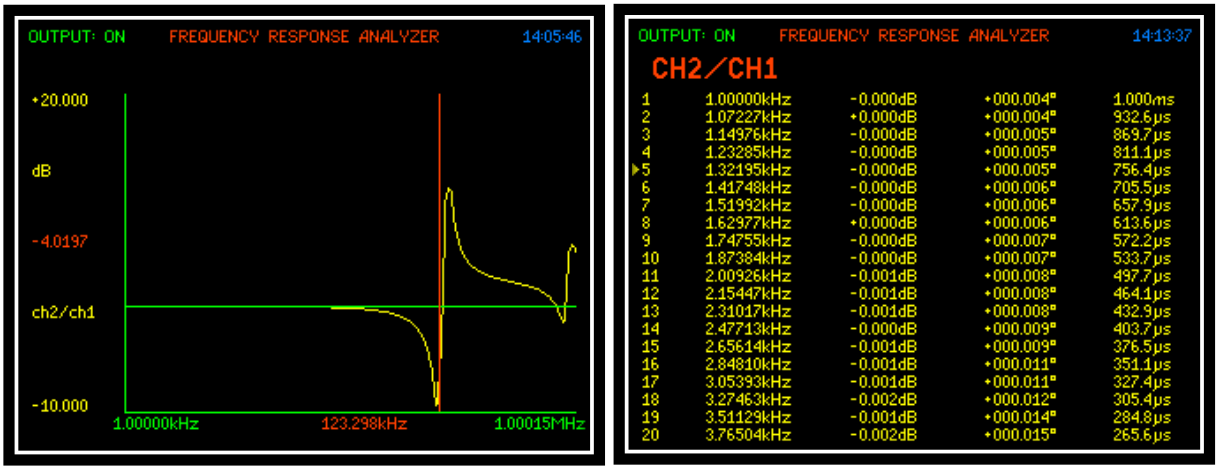
7.5 SWEEP – Frequency sweep options

All AC measurements using the PSM3750 can be swept across a frequency range. The start frequency, stop frequency and number of steps up to 2000 can be entered manually by the user.

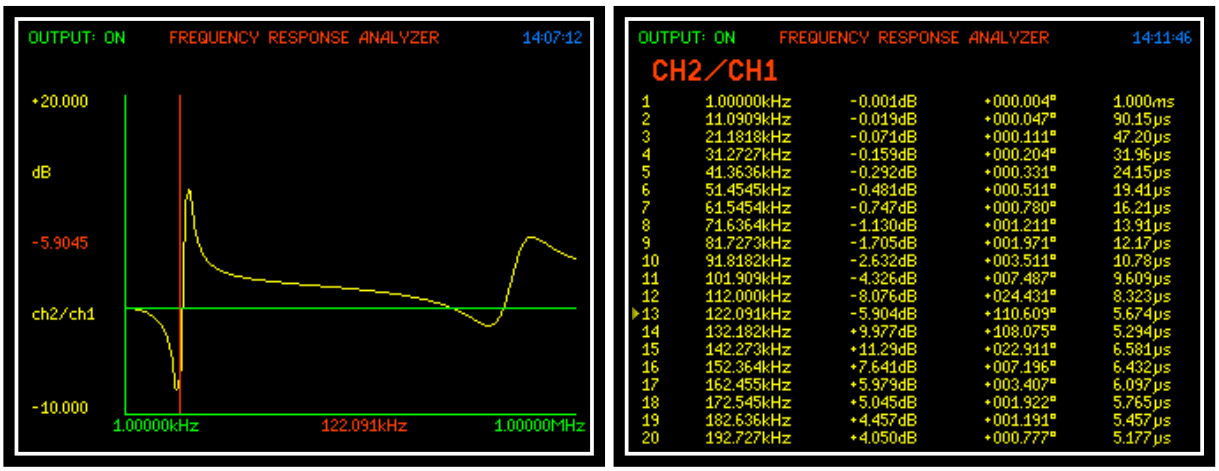


Setting the "steps" parameter to log or linear will show how all the data points will be displayed within the resultant graph display.



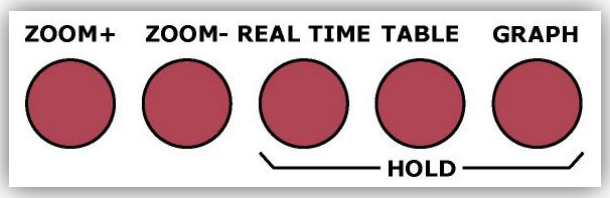


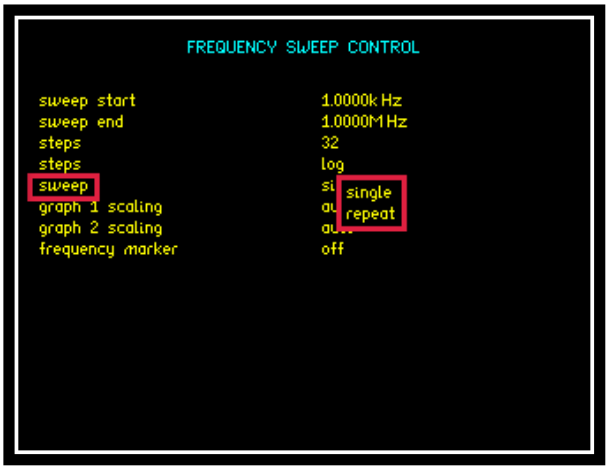
Graph and Table results from a sweep set to "Linear"



Graph and Table results from a sweep set to "Log"

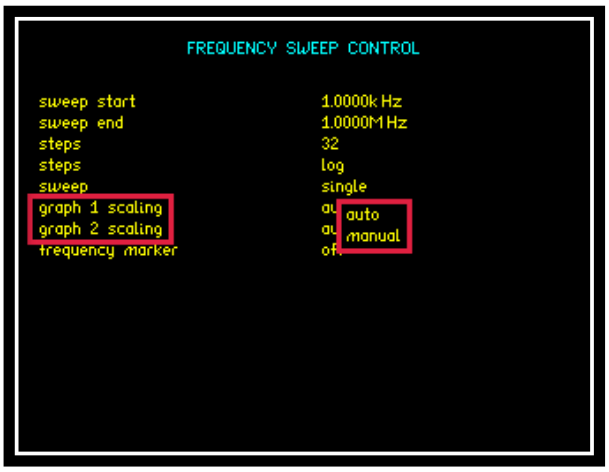
To view the Graph or Table data as displayed above either during or upon the completion of a sweep, push the appropriate button from the instruments front panel.

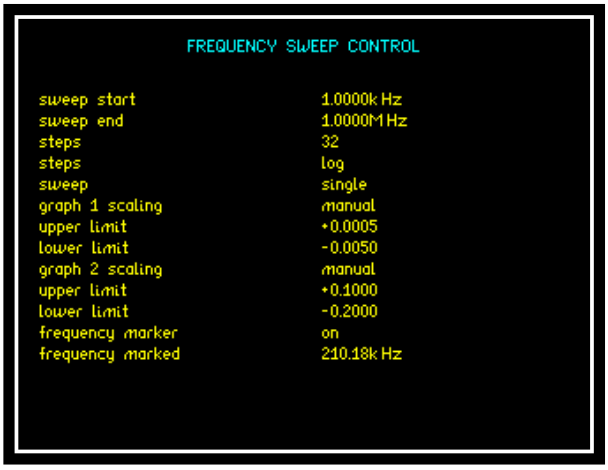




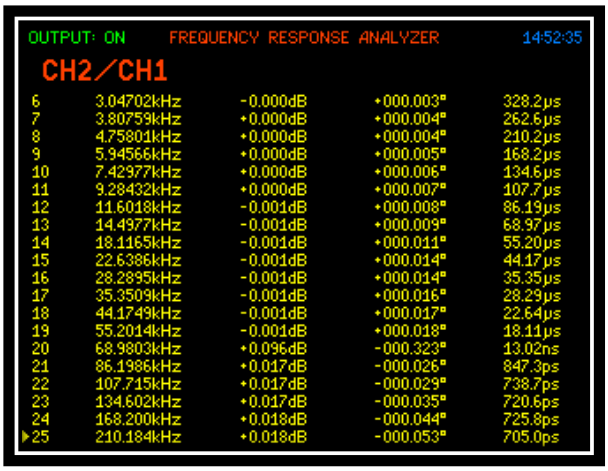
Each sweep can be configured to be either a single or repeating sweep.

Each graph can be configured to be left in auto scaling mode or be set manually by the operator.



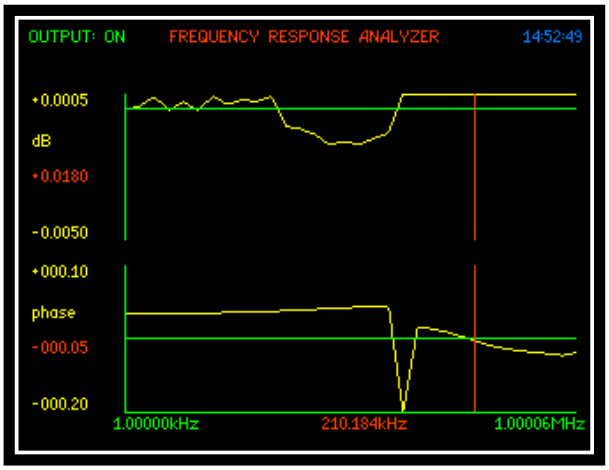


When "graph 1" or "graph 2" scaling is set to manual the user will have the opportunity to manually enter the upper and lower limits applicable to each graph. This is very useful when the measurements are very small between each data points.



Within the display screenshot we can observe that there is a very small change within the dB and Phase data points from a sweep carried out. In auto scaling these points would form a straight line but by manually setting each scale as in the earlier screenshot we are then able to view this data as a plotted graph.

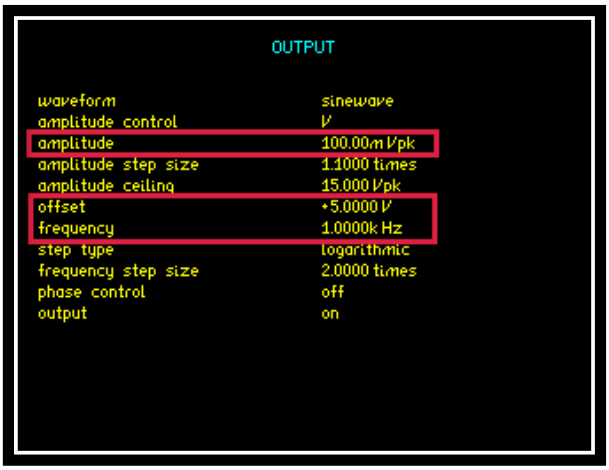
Displayed right is the graph with the appropriate scaling as set earlier. Also displayed is a frequency marker set at 210.18 KHz which reflects the appropriate results obtained from the data point 25 displayed in the screenshot above with a small yellow arrow. This marker can be moved step by step through the frequency sweep data points by using the ▶ ◀ keys.

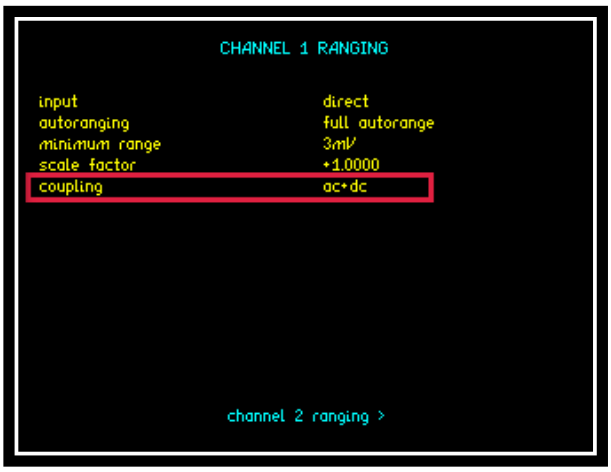


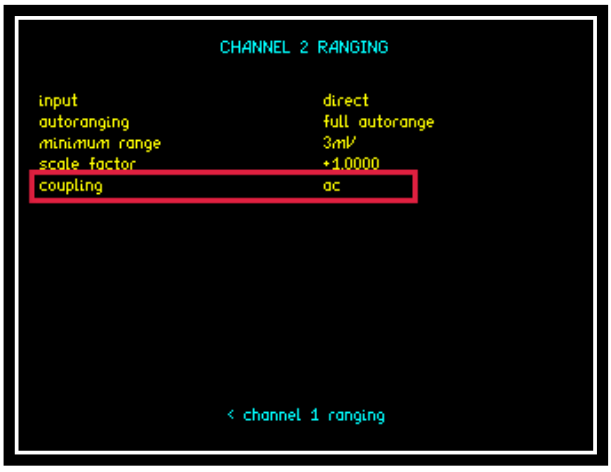
7.6 FRA Sweep with AC Coupling

When conducting a sweep in FRA Mode it is always advisable to set the coupling to AC only. AC coupling is useful because the DC component of a signal acts as a voltage offset, and removing it from the signal can increase the resolution of signal measurements as shown in the following screenshots.

Signal generator set as below with a 100mVpk sinewave and a 5V dc offset connected across the PSM3750's CH1 & CH2 Inputs.



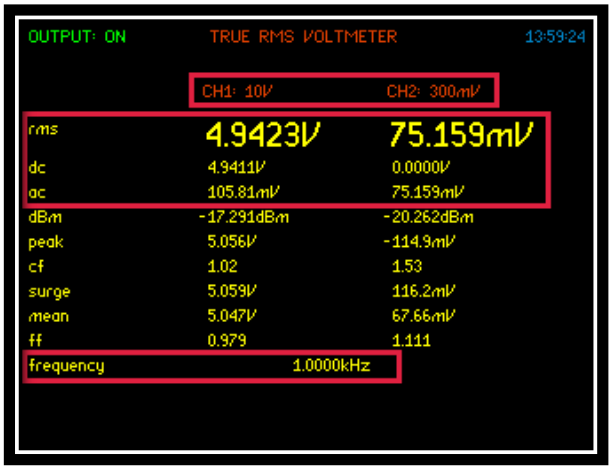




CH1 settings with coupling left as ac+dc

CH2 settings with coupling set to ac

Autoranging is left at "Full Autorange" on both channels this will display the peak range scale on both channels with the different coupling configured.

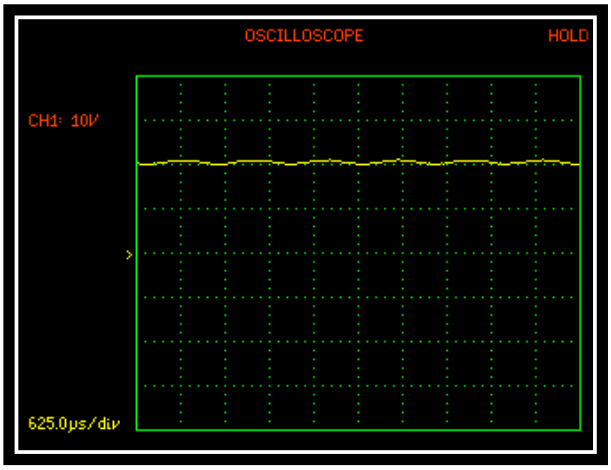


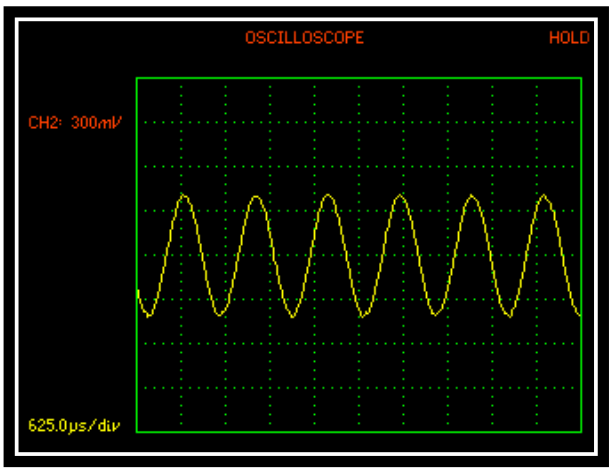
From the RMS Voltmeter display screen we can see the 2 sets of measurements from the same input. CH1 is displaying both the ac+dc components of the input signal with the ranging set onto the 10V scale.

CH2 which is set to ac only displays the rms ac measurement from the 100mV input whilst ignoring the 5V dc offset with the autoranging now set onto the 300mV range.

Accuracy for the RMS mode =
0.075% range + 0.075% reading + 0.05mV <10 kHz

So the greater accuracy is achieved on CH2 by extracting the dc component of the signal through enabling a smaller range to be used.

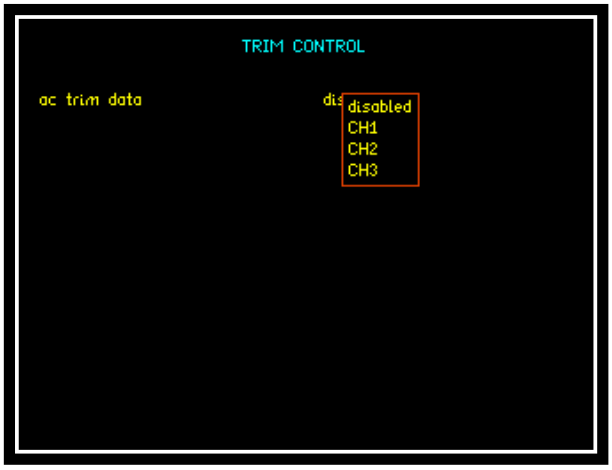


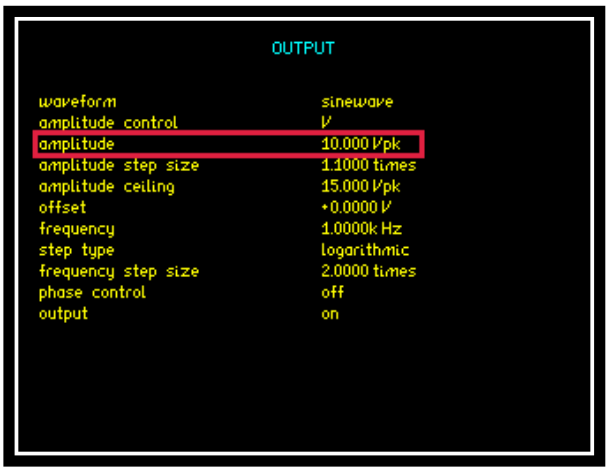


Viewing both channels within the Oscilloscope mode it is clear that by setting the coupling to ac only, the same ac waveform is much more visible within CH2's screenshot.

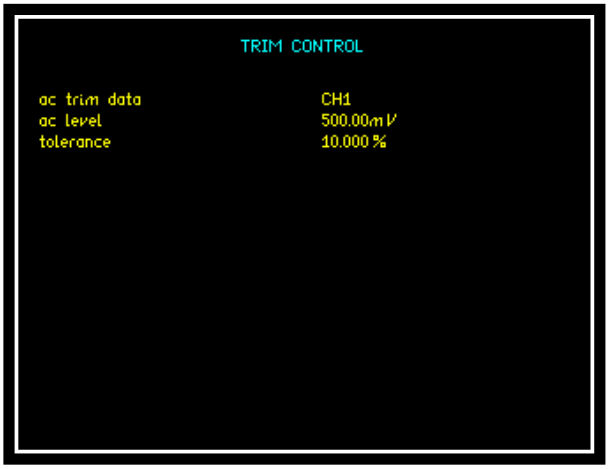
7.7 TRIM

The trim function on the PSM3750 allows closed loop control of the generator amplitude. It will allow a specific measurement on CH1, CH2 or (CH3 if fitted) to be set and the generator output will be adjusted to maintain this fixed voltage or current.





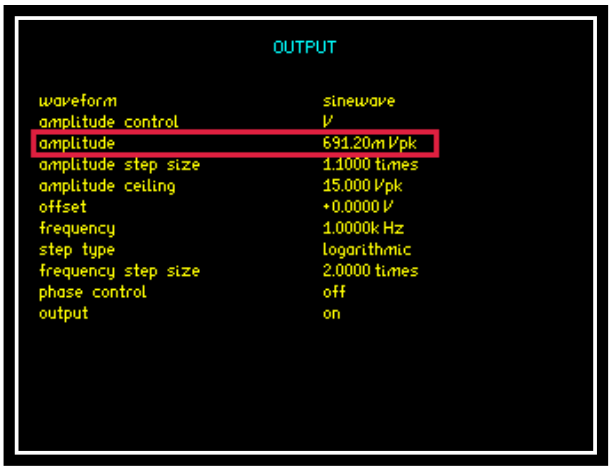
Viewing the "output" display before setting the trim parameters the amplitude is set at 10Vpk.



Selecting the ac trim data to be CH1 we can set the ac level at 500mV with a tolerance of 10%

Note this will be an RMS setting. Press "Enter" to confirm the settings

Revisiting the "output" display you will now see that the amplitude has been reset to the Vpk level applicable to the rms ac level set within the TRIM CONTROL display.



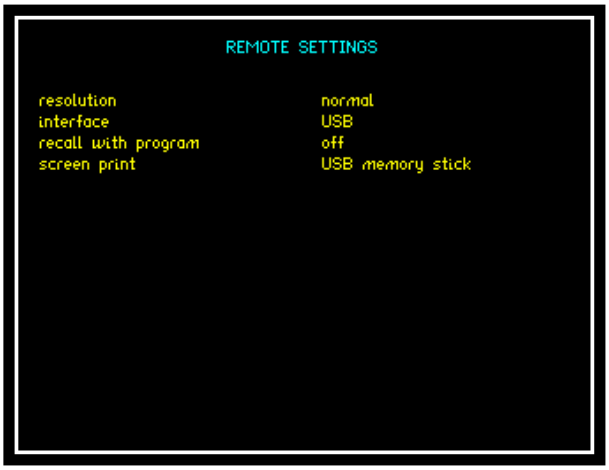
This will now be the maintained measured voltage or current and will allow a much more controlled level over changing levels such as a frequency sweep

At each measurement point, the measured level is checked against the specified level and tolerance; if an adjustment is needed the data is discarded and a new measurement made at the new output level. The user will be alerted to this adjustment by an audible beep

Configuring the "Amplitude Ceiling" parameter sets a limit to the maximum voltage at the output of the instruments generator

7.8 COMMS

The "COMMS" mode will allow the user to set up how the measurement data will be displayed within the data resolution parameter and change the format to which the instrument responds to future commands via a Comms interface

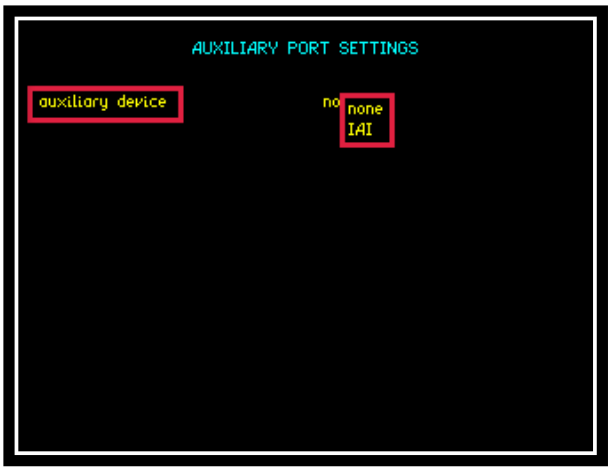


For further information on each parameter please refer to section 4.1

ALARM

For further information on each parameter please refer to section 4.1

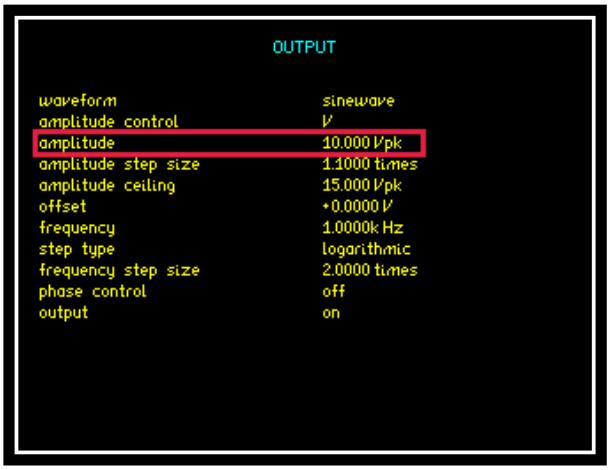
AUX



The PSM3750 can be connected with an IAI2 Impedance Analysis Interface This converts the PSM3750 into a high performance LCR meter with true 4 wire Kelvin connections.

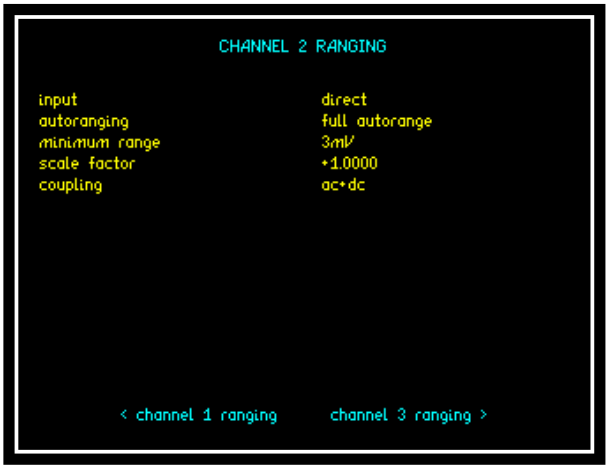
More information relating to the IAI can be found within section 7.2 PSM3750 + IAI.

OUT



The "OUT" mode refers to the PSM3750 output generator. Information relating to all of the outputs parameters can be found in section 4.1

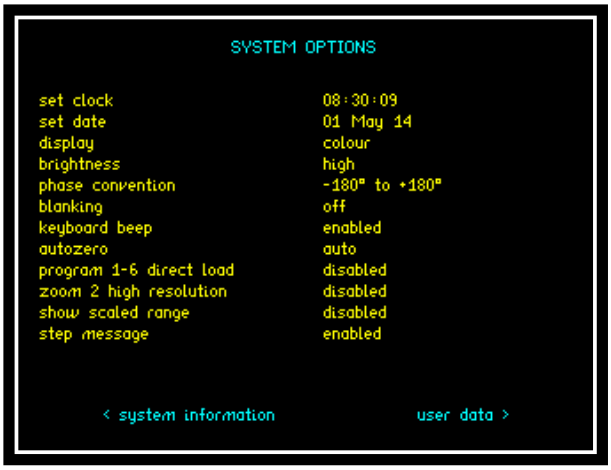
INPUT CHANNELS



The PSM3750 can be supplied with either 2 or 3 Input Channels. For a break down on each parameter within CH1, CH2 and CH3 (if fitted) please refer to section 4.1

To access CH3 input channel press CH2 then the ▶ key.

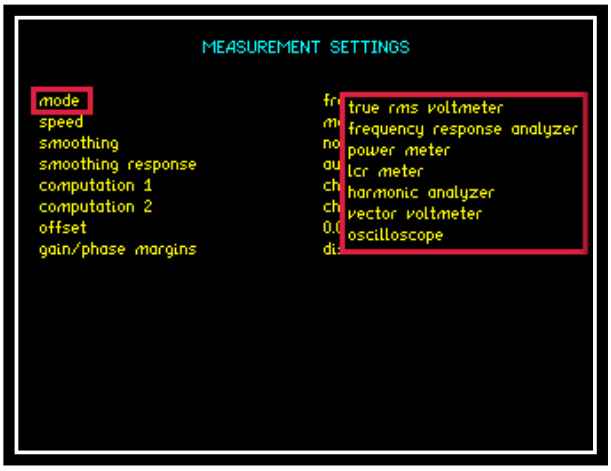
SYS



For further information on each parameter please refer to section 4.1

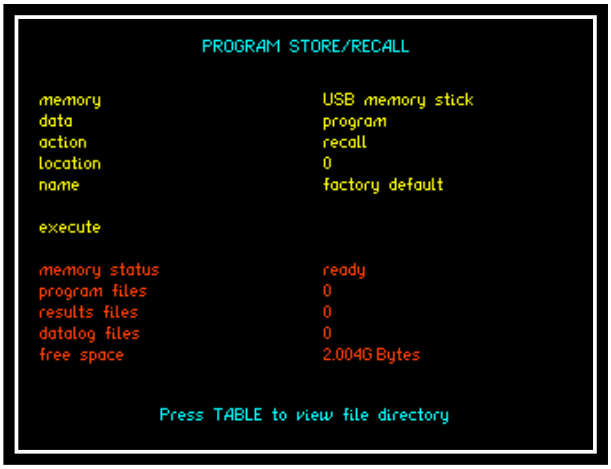
Further options are available by using the ▶ ◀ keys.

MODE



Within the "MODE" parameter the user can select which measurement function they wish to select from the drop down menu. These are also available via the direct function button on the PSM3750's front panel (Except Harmonic Analyzer).

PROG



The program store / recall mode will allow the user to store, recall or delete any non volatile program. More information on each parameter is available within section 4.1

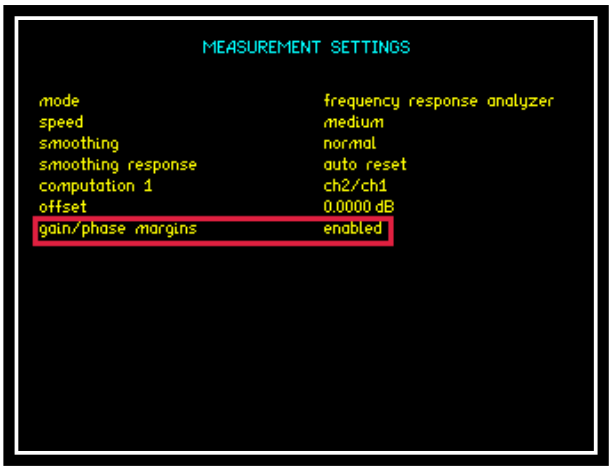
8. PSM3750 – Measurement Functions:

8.1 FRA - Frequency Response Analyzer

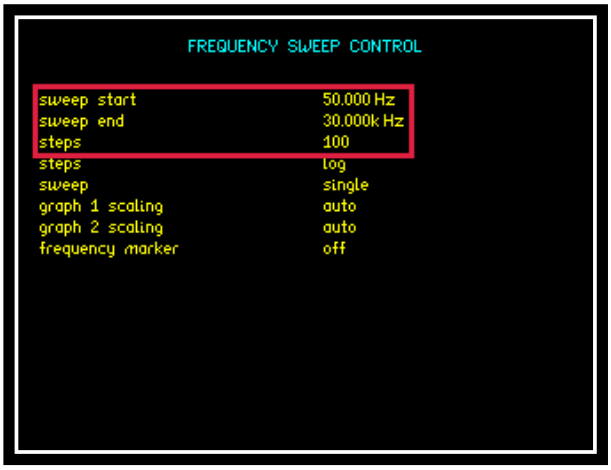
PSM3750 measures the gain and phase of channel 2/3 (dependant on model) relative to channel 1 using a Discrete Fourier Transform (DFT) algorithm at the fundamental frequency.

Test Equipment: 1 x SMPS (Switch Mode Power Supply) Test Box

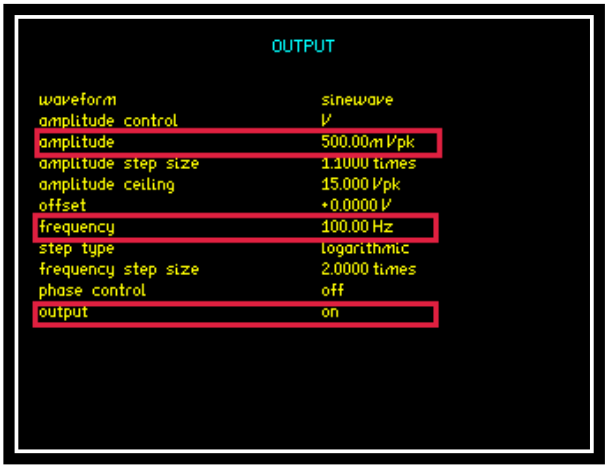
1 x PSM3750



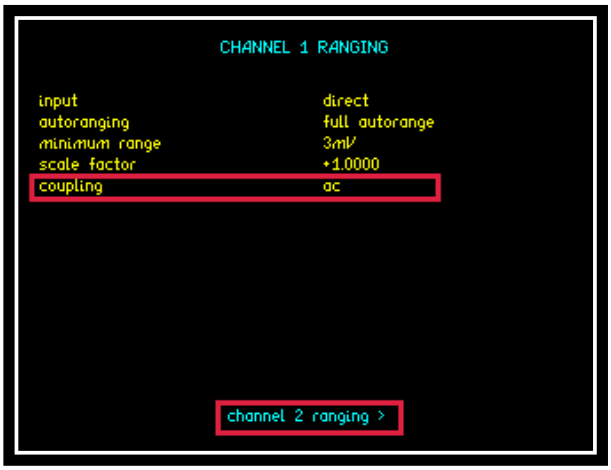
Enter "FRA" mode by pressing the FRA button. Use the ▼ arrow until the red box surrounds the gain/phase margins parameter now press ◀ arrow to enable this function, these parameters will now be displayed within the graph results display as shown later in this section.



Enter "SWEEP" control mode by pressing the Sweep button. Set the start and finish frequencies that you wish to conduct your sweep across these can be inputted using the numerical buttons on the PSM's front panel. Set the amount of steps (Data Points) within your sweep to be displayed within the results screens.



Within the "OUTPUT" mode set the amplitude parameter to the peak voltage signal required from the instruments generator. Frequency can be set to display the on screen measurements at this stated frequency, once all parameters are set then change the "output" to ON.



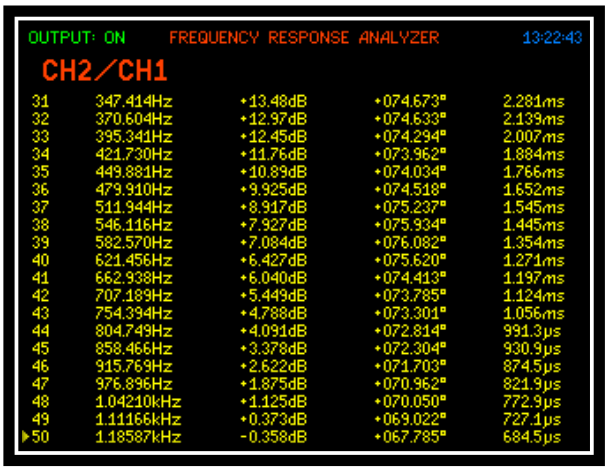
Within the CH1 /CH2 menu set the coupling to ac only as described in an earlier section called "FRA Sweep with ac Coupling". Pressing ▶ will take you directly to the CH2 display.

Channel 3 ranging is accessed from within Ch2 mode by using the ▶ arrow.

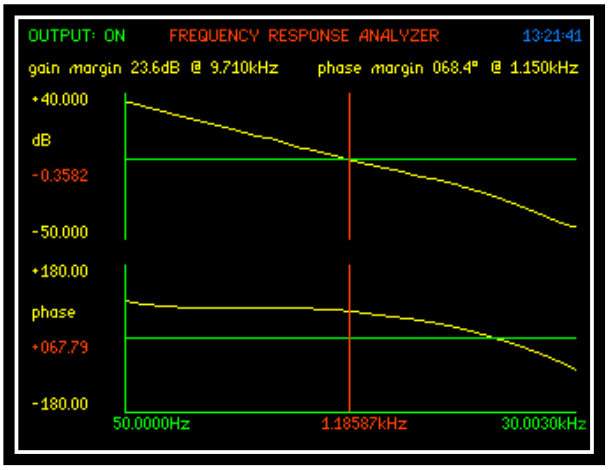
Upon pressing the "START" button the Frequency Sweep will commence and the measurements can be viewed in; Real time, Table or Graph mode.

Gain, Phase and Delay measurements at each frequency point are displayed.

The following screenshots are the results obtained from our SMPS 10Ω load test

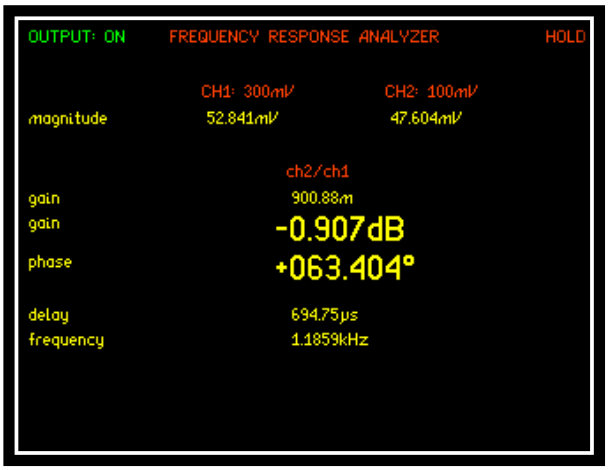


Upon completion of the sweep pressing "Table" will present all measurement points within a tabular format as shown. You will notice that there is a small yellow arrow at the side of the 50th data point this will correspond with the next 2 screenshots.



Moving from "TABLE" to "GRAPH" presents the same data but as a bode plot presentation, it can be noticed that a cursor is also present on the graph at the same frequency point as we saw in the table display above, using the ▶◀ arrows will move the cursor through the frequency sweep. Graph axes shown with max and min values of each axes plus the corresponding cursor value.

Note: The Gain and Phase Margins set earlier can now be seen at the top of the display screen.



Moving from "Table" or "Graph" to "REAL TIME" will display measurements from the selected frequency in real time.

Moving back to either Graph or Table will display measurements from the last sweep.

8.2 PAV – Phase Angle Voltmeter

A phase angle voltmeter (or vector voltmeter, or phase sensitive voltmeter) measures the signal at one input compared to the magnitude + phase of the signal at a reference input. The results may be expressed as magnitude and phase, or as separate in-phase and quadrature components.

The PSM3750 measures the in-phase and quadrature components at the fundamental frequency using DFT analysis as described in the section on frequency response analysis. CH2, the measurement input, is phase referred to CH1, the reference input. The individual components are filtered separately to minimise the effects of noise, which would have random phase and would therefore be filtered out. The true rms of the input signals is also computed.

CH1 and CH2 may be voltage inputs or may use external shunts.

From the phase referred fundamental components, (a + jb), the following results can be derived:

magnitude = $\sqrt{(a^2 + b^2)}$

phase = $\tan^{-1}(b/a)$

tan ϕ = b/a

in-phase ratio = a2 / a1

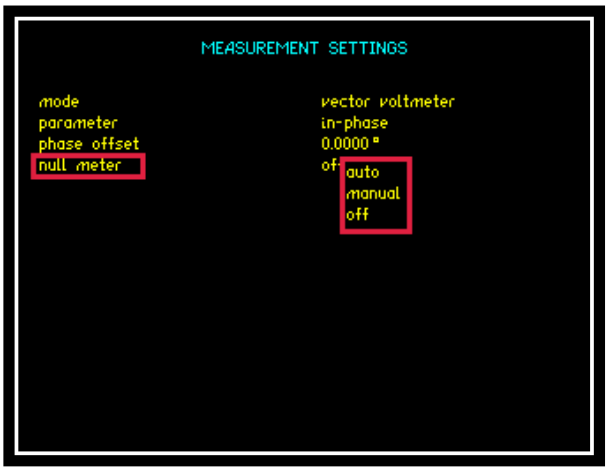
LVDT (diff) = scale * a2 / a1

LVDT (ratio) = scale * (m1-m2) / (m1+m2)

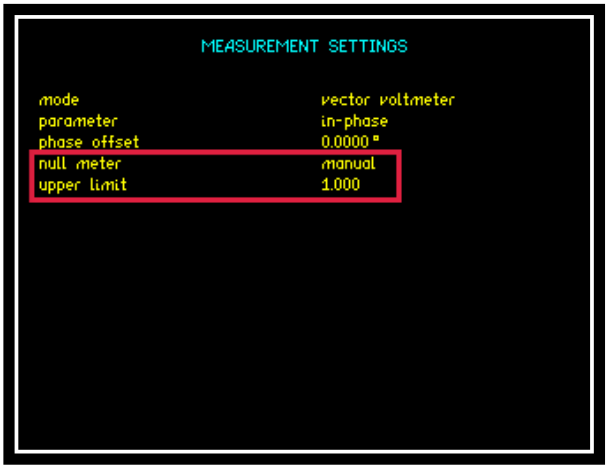
Where a1 and a2 are the in-phase components, and m1 and m2 are the magnitudes, of the signals present at ch1 and ch2 respectively.

The parameter of interest is selected via the PAV or MODE menu. The frequency and phase are always displayed.

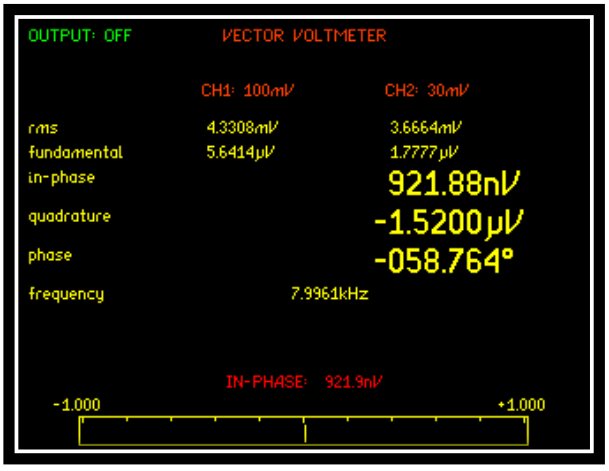
A null meter display may be selected via the PAV menu to allow adjustment of a circuit for minimum phase or component.



To activate the "null meter" function press the "PAV" button and then press the ▼ arrow until the red box surrounds the null meter parameter, press the ▶ arrow to open up the drop down menu as shown. Select either "auto" or "manual" range.



Selecting "manual" will allow the user to set their own upper limit to be displayed on the bar graph within the real time display as shown below.



Within the "Real Time" display we now have the null meter at the bottom of the screen with limits shown as 1 as set within the previous screenshot.

The parameter on the display depends on the selected component:

parameter	display	null meter
in-phase		in-phase
quadrature		quadrature
tanϕ	tanϕ	tanϕ
magnitude	magnitude	magnitude
phase	phase	
rms	rms	rms2
rms2/1	rms2/rms1	rms2/rms1
in-phase ratio	in-phase ratio	in-phase ratio
LVDT diff	LVDT	LVDT
LVDT ratio	LVDT	LVDT

The null meter may be manually ranged or will automatically range as the signal varies. When manually ranging, ZOOM+ and ZOOM- adjust the range by a decade.

There is a phase offset option that applies a vector rotation of a user selectable phase shift to the CH2 input data.

The PSM3750 can operate either in real time mode at a single frequency where the measurements are filtered and updated on the display; or it can sweep a range of frequencies and present the results as a table or graphs. Before performing a sweep, the desired parameter must be selected.

The frequency points to be measured are specified with three parameters:

number of steps

start frequency

end frequency

PSM3750 computes a multiplying factor that it applies to the start frequency for the specified number of steps. Note that due to compound multiplication it is unlikely that the end frequency will be exactly that programmed. The frequency sweep is initiated by the START key, and when completed the data can be viewed as a table or graphs or printed out.

The window over which the measurements are computed is adjusted to give an integral number of cycles of the input waveform. In real time mode the results from each window are passed through a digital filter equivalent to a first order RC low pass filter; in sweep mode each result comprises a single window without any filtering.

The ZOOM function can be used to select up to four parameters from the display when in real time mode. It has no function following a sweep.

Although it is most usual to use the PSM3750's generator when making Phase Angle Voltmeter measurements, there may be circumstances where this is impractical, for example measuring LVDT displacement under actual circuit conditions. In this case, turn off the PSM3750's generator (OUT menu) and the frequency reference for the analysis is measured from channel 1. Provided that the signal is clean enough for an accurate frequency measurement (and for DFT analysis the frequency does need to be accurately known), then the measurements can be made reliably.

When using an external frequency reference there can be no sweep function.

8.3 LCR – Impedance Meter

Impedance Analysis – an overview

Real Components are never ideal resistors, capacitors or inductors because of unwanted parasitic effects arising from their construction.

It is useful to model a real component as an appropriate combination of ideal resistance, capacitance and inductance. For example, a real inductor at a frequency below its resonant frequency may be modelled as a pure inductor with a series resistor; a real resistor may be modelled as a pure resistor with a series inductance or by a pure resistor with a parallel capacitance; a capacitor is most commonly modelled as a pure capacitor with a series resistance.

The parameters of real components vary with the conditions of frequency and voltage/current under which they are used.

In many cases, components are used under conditions where the parasitic effects of the component become critical and must be measured reliably over a wide range of operating conditions.

The impedance is analysed by measurement of the complex impedance, **Z** under controlled conditions of frequency and voltage or current:

Z = V / I

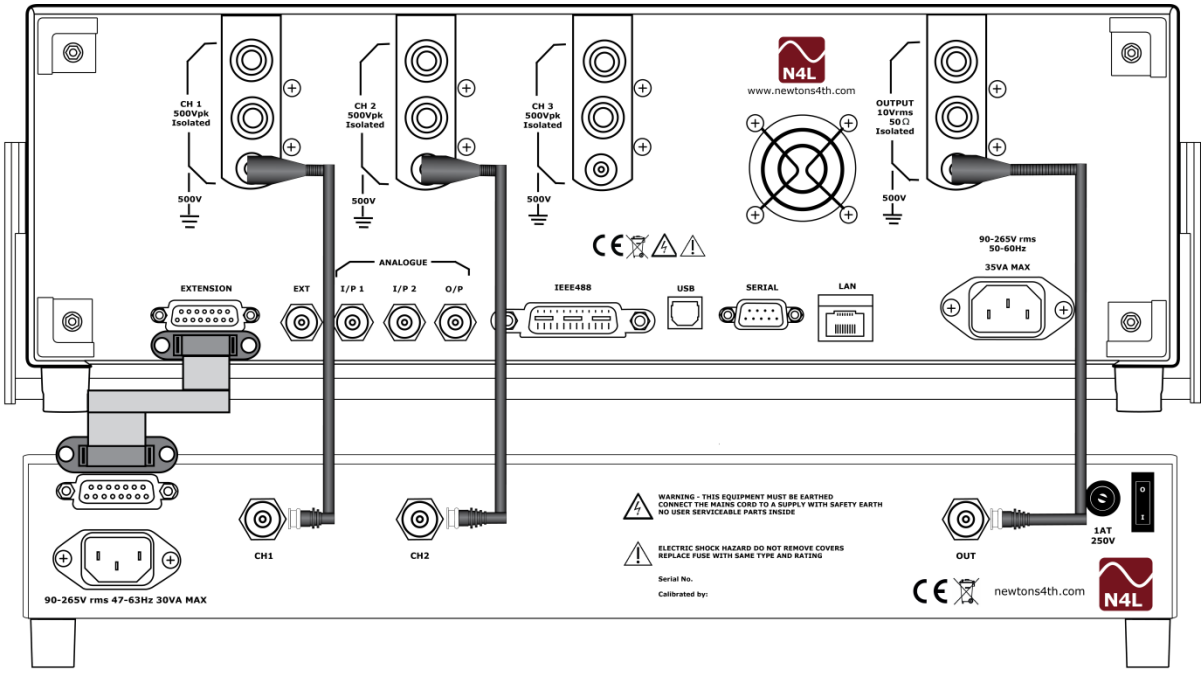
Where **V** is the voltage across the component
I is the current through the component

Z, V and **I** are complex values which may be represented as magnitude and phase or by in-phase and Quadrature components. The LCR measurement is performed by the PSM3750 using a discrete Fourier transform (DFT) at the frequency of operation. This gives the complex impedance directly in the form of an in-phase component and a Quadrature component.

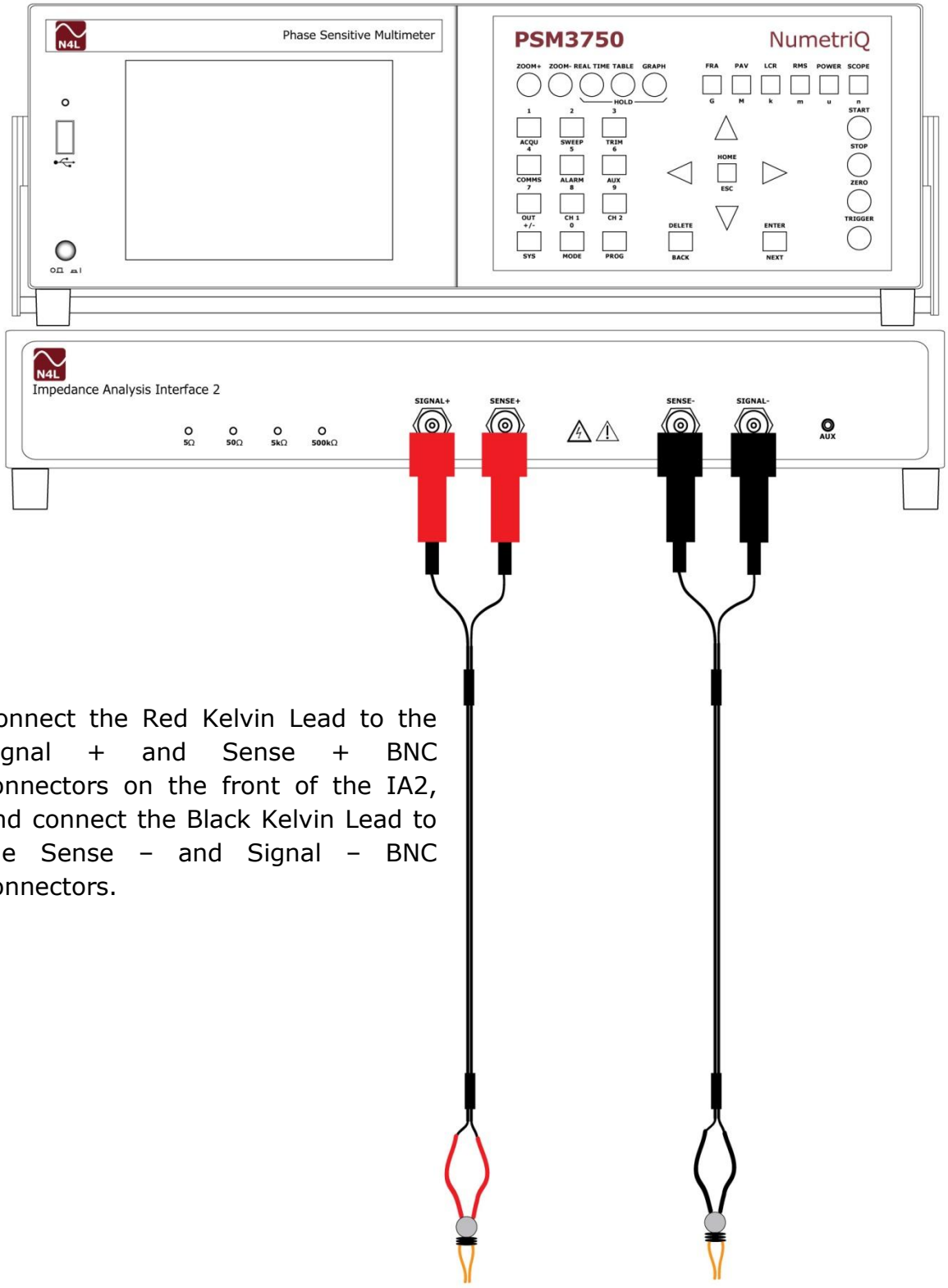
It is important to characterise the component over all the frequencies that are relevant for a given application. For this reason the IAI2 can be used in conjunction with the PSM3750 to sweep across a frequency range.

Setting Up

Site the IAI2 under the PSM3750; connect the 3 short BNC leads from the BNC connectors on the rear of the IAI2 (OUT, CH1, and CH2) to the corresponding isolated BNC connectors on the PSM3750 above it. Connect the ribbon cable from the extension port on the rear of the IAI2 to the extension port on the rear of the PSM3750 as shown in the diagram below.



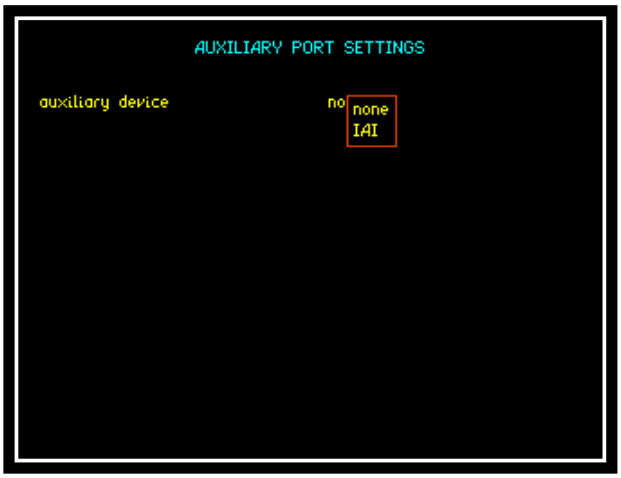
Front View



Connect the Red Kelvin Lead to the Signal + and Sense + BNC connectors on the front of the IA2, and connect the Black Kelvin Lead to the Sense – and Signal – BNC connectors.

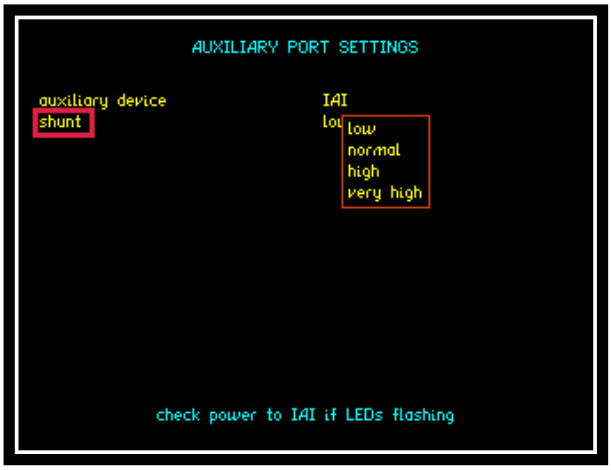
Switch on the IAI2 and the PSM3750. All 4 led's on the front of the IAI2 should illuminate. The display on the front of the PSM3750 should illuminate with the model name and the firmware version for a few seconds whilst it performs some initial tests. It will then default into the RMS Voltmeter display unless a program has been stored within PROG 1.

Configuration of PSM3750 + IAI2



Press the "AUX" key on the PSM3750. The auxiliary device will appear as shown from the dropdown menu, select IAI and press "ENTER" to confirm.

Once the IAI has been confirmed a second parameter will appear asking for the user to select an appropriate shunt from the drop down list. Use the ▼ key until the red box surround "Normal" and press "ENTER". Only the normal LED should now be illuminated on the front of the IAI2.

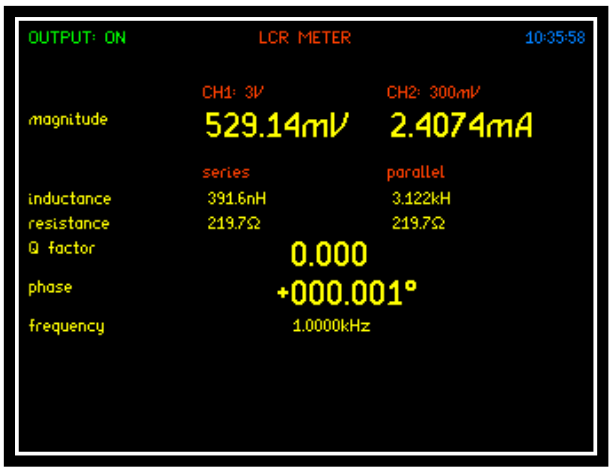


If the PSM3750 displays the following message:

Then check that the extension port cable has not been damaged and has been correctly fitted between the IAI2 and the PSM3750.

If the message does not appear but all 4 led's remain illuminated and flashing then check that the IAI2 is correctly connected to the supply, switched on at the rear and the fuse is intact.

To test that the IAI2 is responding, connect across the Kelvin leads an appropriate test component, for example a 220Ω resistor and switch on the PSM's generator from the "OUT" menu. Press the "LCR" key and make sure that the test component is measured correctly as shown below.



Using the IAI2

The device under test (DUT) is measured by the IAI2 in a configuration where the component is ground referenced. This allows the IAI2 to be used to measure the impedance of devices even when one terminal is connected to earth.

The IAI2 has 4 selectable shunts to sense the current through the DUT

SHUNT	VALUE
LOW	5Ω
NORMAL	50Ω
HIGH	5kΩ
VERY HIGH	500kΩ

When the "Shunt" is selected on the instrument via the "AUX" menu as described earlier, the resistance value is automatically entered as the external shunt for channel 2. The shunt may be selected manually or the PSM3750 can be configured to select it automatically.

For high precision measurement under some conditions it may be necessary to compensate for parasitic within the test connections this is explained within a later chapter on compensation

Shunt Selection

The different shunts built into the IAI2 allow the test conditions to be modified to optimise the measurement accuracy. In general a higher value shunt increases the magnitude of the current signal at the A/D and decreases the magnitude of the voltage signal across the component; conversely a lower value shunt decreases the magnitude of the current signal at the A/D and increases the magnitude of the voltage signal.

Optimum accuracy is when the voltage and current signals are approximately equal (the impedance of the shunt is approximately the same as the impedance of the DUT), but good results can be obtained with impedances within a factor of 100 of the shunt value.

It is necessary to take great care in order to achieve the best accuracy of measurement. The leads of the component must be scrupulously clean and for repeatability the component must be connected in exactly the same position. Slight variations in connection can result in significantly different measured values, especially at high frequencies.

In general the "very high" shunt should only be used for high impedance measurements (>1MΩ) at low frequencies (<1kHz).

The "low" shunt is used with higher current testing of low impedances as it includes a current boosting amplifier that can deliver up to 0.5Arms.

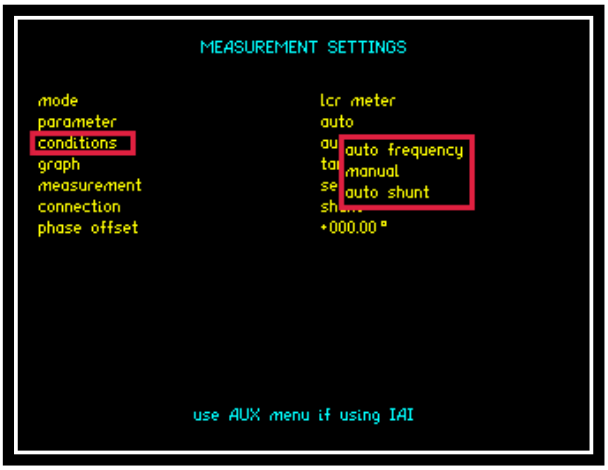
Warning: High Voltages can be generated when the current flowing through an inductive component is interrupted. So turn the output OFF before disconnecting an inductive or unknown component

The “normal” and “high” shunts are general purpose and between them cover a wide impedance range.

SHUNT	IMPEDANCE RANGE	FREQUENCY RANGE
LOW	<50Ω	<10MHz
NORMAL	50mΩ to 50kΩ	all
HIGH	5Ω to 5MΩ	all
VERY HIGH	>1MΩ	<1kHz

Of course this table is only a guide and each “shunt” can be used beyond the limits quoted.

Automatic shunt selection can be configured within the LCR mode (shown below) on the PSM3750; selecting auto shunt will select the appropriate shunt applicable to the test conditions and the measured impedance.

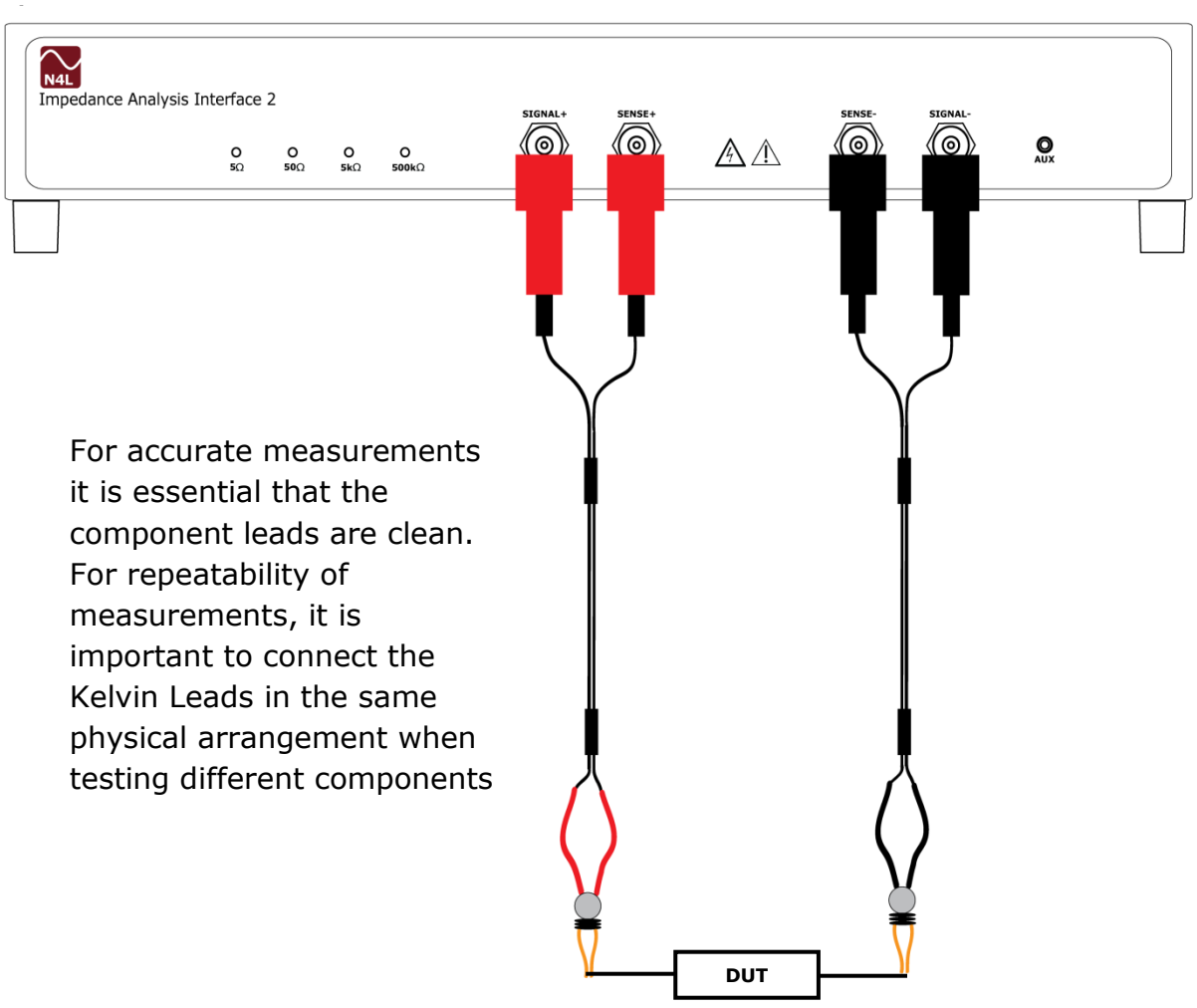


Connecting to the DUT

Kelvin Leads:

The IAI2 comes supplied with a pair of Kelvin Leads for low frequency use (<5MHz) which make simple connections to a discrete component

The Kelvin Leads can be clipped onto the body of the DUT, as close as possible to the component

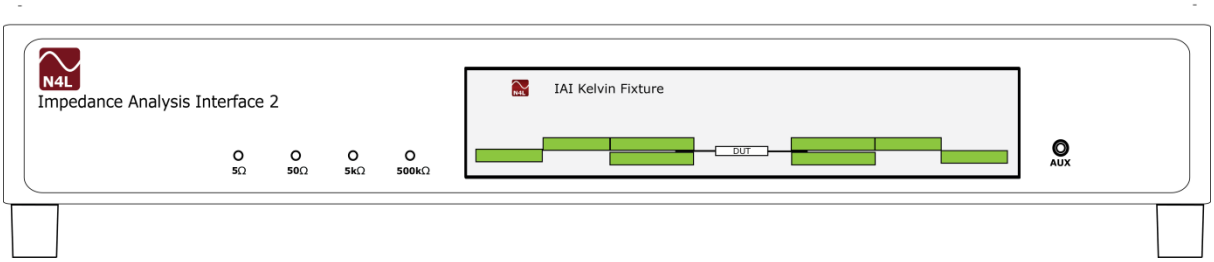


For accurate measurements it is essential that the component leads are clean. For repeatability of measurements, it is important to connect the Kelvin Leads in the same physical arrangement when testing different components

High Frequency Fixture:

For testing components over all frequencies, there is a dedicated test fixture available from N4L as an accessory. This can clip directly onto the front of the IAI2 by means of 4 BNC to BNC couplers supplied with the fixture to minimise effects due to cabling.

Connection is made to the component by four gold plated contact area's in a four wire Kelvin arrangement; SIGNAL+ and SIGNAL- appear on the lower contacts, whilst SENSE+ and SENSE- are picked up from the upper pair of contacts.



The lower pair of contacts are secured to the connectors attached to the IAI2 and do not move; the upper pair of contacts can be lifted by light finger pressure.

To insert a component push up the upper contact plate so that the legs of the component can be inserted. If necessary push up the upper contact plate on one side first and then the other side to allow the component to be pushed home. For high frequency work it is essential for the component to be inserted as far as possible.

The HF fixture can be connected to the IAI2 via short BNC leads instead of the BNC couplers.

Compensation:

Any cables or fixtures used to interface the DUT to the IAI2 will introduce measurement errors because of the stray impedances. At low frequencies the stray effects can usually be ignored except when measuring at the extremes of the impedance range or when exceptionally high accuracy is needed. At higher frequencies it is almost always necessary to compensate for stray effects unless using the HF component fixture connected to the front of the IAI2.

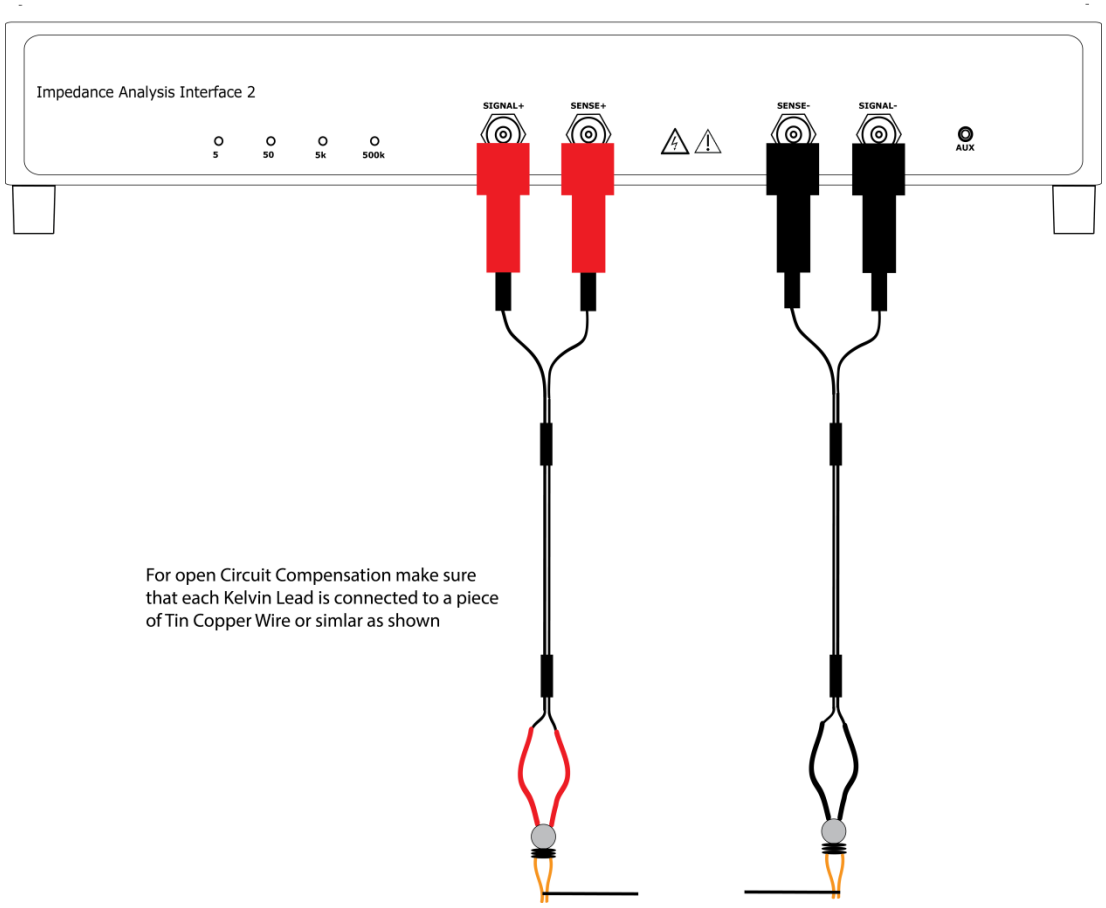
There are 2 forms of compensation:

1. Short Circuit – For measuring Low Impedances
2. Open Circuit – For measuring High Impedances

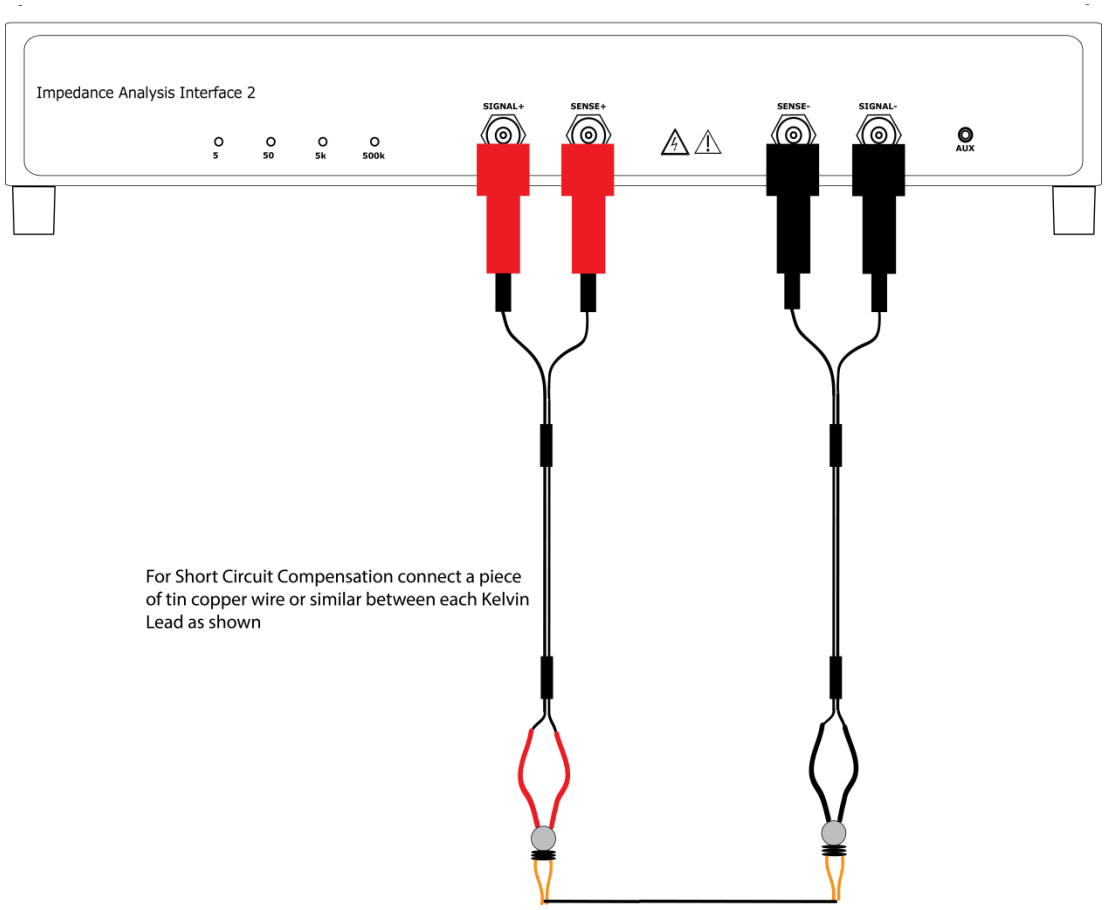
It is only necessary to perform one of the two forms of compensation but both can be performed. For best results, if more than one test is to be performed they should be performed in the sequence given above.

Compensation Connections

OPEN CIRCUIT CONNECTION

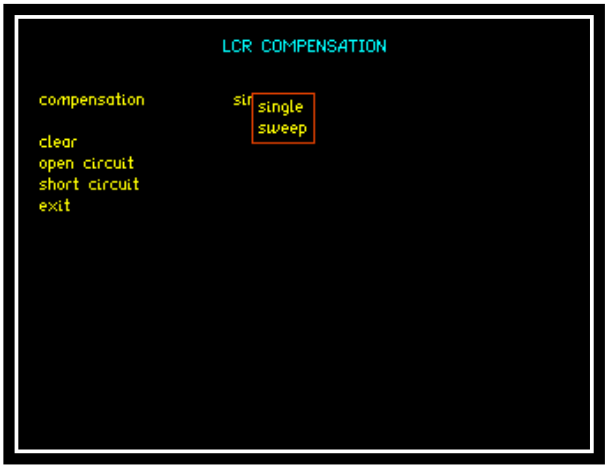


SHORT CIRCUIT CONNECTION



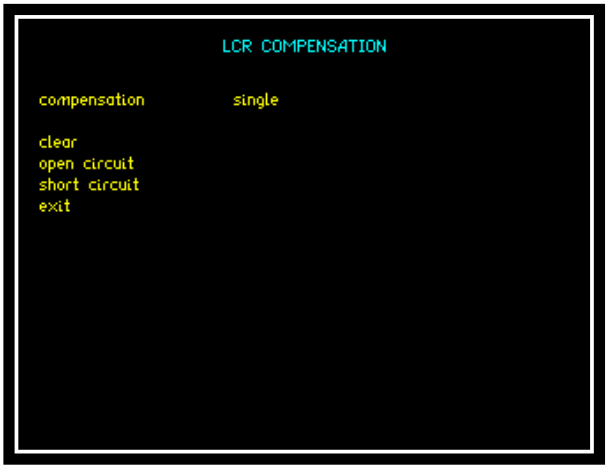
Compensation Menu Settings

With the PSM3750 set in LCR mode, press the "ZERO" button to display the LCR compensation screen as shown below.



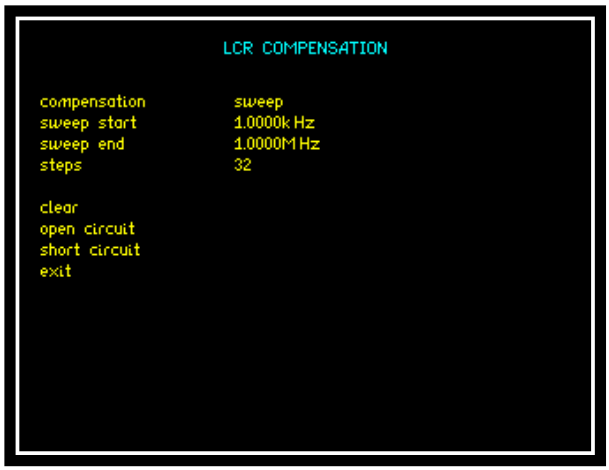
Select the compensation parameter to correspond with the test to be undertaken on the DUT.

Single Compensation:



Selecting single compensation will conduct zero compensation, short or open circuit at the same desired frequency that the test will be carried out at.

Sweep Compensation:



Sweep compensation needs to be configured exactly the same as the sweep details for the DUT to be tested. Frequency start, frequency end and steps all need to be replicated. If "auto shunt" is selected within the LCR menu which it will be by default then sweep compensation will be carried out on each individual shunt in turn over the sweep parameters set earlier.

Note: When undertaking open compensation, it is advisable to use a solid piece of wire to connect to each Kelvin Lead or on each side of the Kelvin Fixture.

For short circuit compensation, it is advisable to use a solid piece of wire to connect the two Kelvin Leads together or connect between the two sides of the Kelvin Fixture.

Saved Compensation

When the instrument settings are saved to a program file in the internal flash memory of the PSM3750 (refer to section 9.2), any single point or multiple point sweep compensation that has been undertaken will be included in that file.

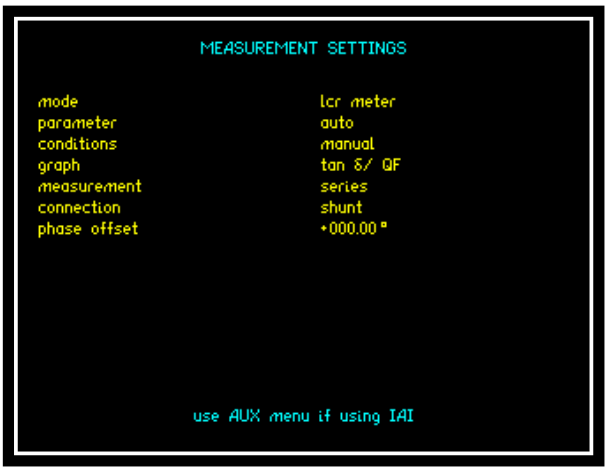
When the program file is recalled any compensation settings will also be recalled and will then be applicable. Each program memory location can include its own saved Single point or multiple point sweep compensation settings, these settings will be applied when that program is recalled including after the power cycling of the instrument.

Note:

When recalling programs with saved Compensation settings it is important to consider any repositioning or replacement of cables or fixtures etc used to interface the DUT to the instrument since the compensation was originally performed. It may be necessary to repeat the Compensation procedure before performing the tests.

LCR Measurements:

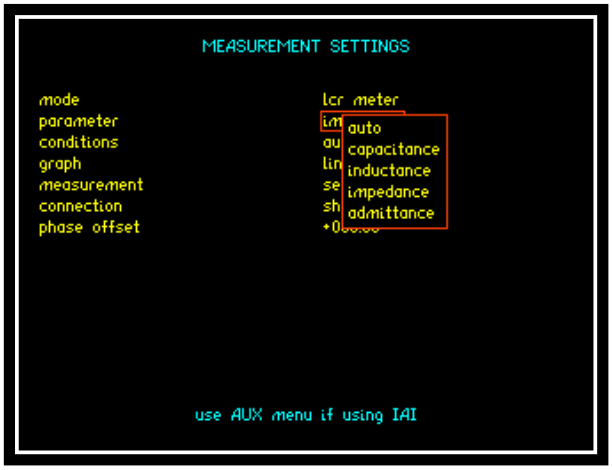
Press the LCR mode button on the front of the PSM3750 Instrument to enable LCR measurement settings to be made as shown below.



Parameter setting

If the parameter option within the LCR menu is set to "auto" the PSM3750 will display capacitance or inductance according to the phase of the measurement.

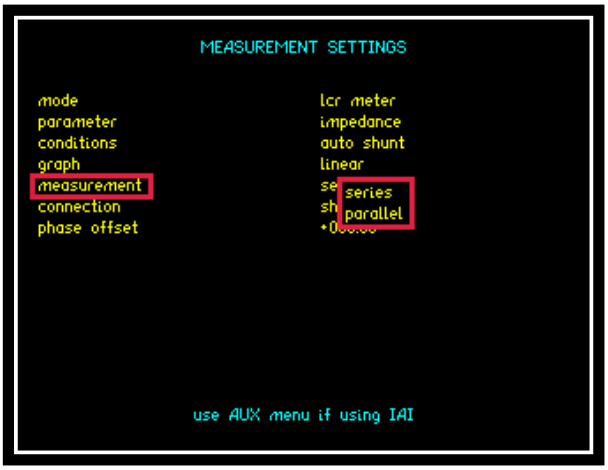
Alternatively, any individual parameter may be set from the drop down menu displayed within the screenshot below.



Conducting a sweep in LCR mode:

The PSM3750 is able to operate either in Real time mode at a single frequency where the measurements are filtered and updated on the display; alternatively it can sweep a range of frequencies and present the results as a table or graph.

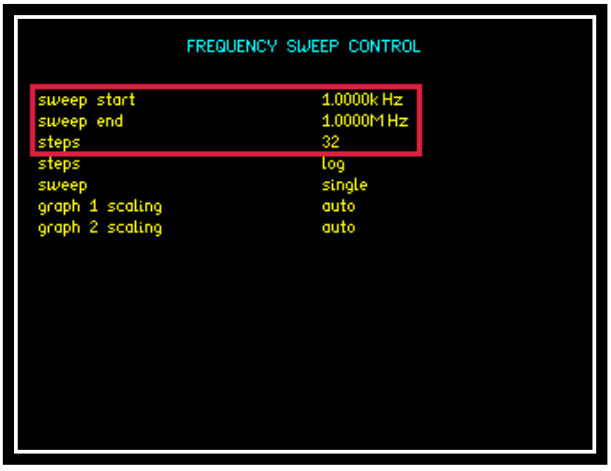
Before performing a sweep, either series circuit or parallel circuit must be selected from within the LCR mode as per the screenshot below.



The frequency points to be measured are specified with three parameters

1. Number of Steps
2. Start frequency
3. End Frequency

All parameters are set within the "SWEEP" button



The PSM3750 computes a multiplying factor that it applies to the start frequency for the specified number of steps. Note that due to compound multiplication it is unlikely that the end frequency will be exactly that programmed. The frequency sweep is initiated by the "START" button, and when completed the data can be viewed as a table or graph or printed out.

The window over which the measurements are computed is adjusted to give an integral number of cycles of the input waveform. In real time mode the results from each window are passed through a digital filter, in sweep mode each result comprises a single window without any filtering unless repeat sweep is selected.

External frequency Reference:

Although it is most unusual not to use the PSM3750's generator when performing LCR measurements, there may be circumstances where this is impractical, for example measuring the inductance of a transformer primary winding under load. In this case, turn OFF the PSM3750's generator within the "OUT" menu and the frequency reference for the analysis is measured from Channel 1. Provided that the signal is clean enough for an accurate measurement (for DFT analysis then the frequency does need to be accurately known), then the measurements can be made reliably.

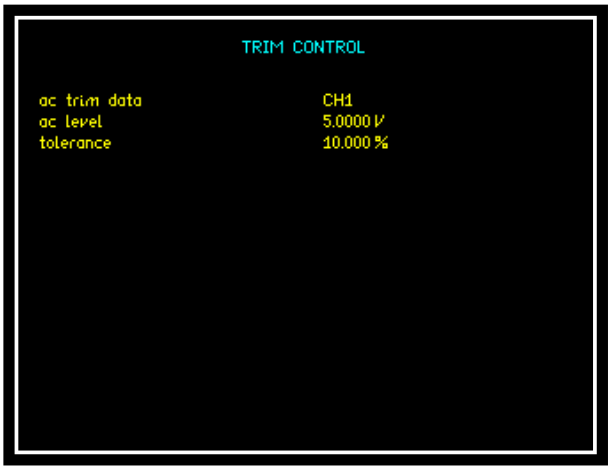
When using an "External frequency reference" then there can be NO sweep function.

Selecting Test Conditions:

The Frequency and Voltage of the generator are selected on the PSM3750 Instrument. The actual Voltage across the DUT depends upon the Impedance of the component at the test frequency and the impedance of the selected shunt.

The PSM3750 instrument clearly displays the measured Voltage across the DUT and the measured Current through it.

To fix the test voltage at a specified level, enable ac trim on CH1 using the "TRIM" menu on the PSM3750 and set the desired rms level for Vdut. The instrument will then adjust the generator output level until the measured voltage across the component is as specified.



NOTE:

AC level and tolerance parameters are set for screenshot purposes only.

The optimum test conditions to use depend on the component or DUT and the application as many components change their characteristics with frequency and test voltage. The PSM3750 instrument can automatically select test conditions or they can be entered manually.

DC offsets can also be added to the test voltage where required, for example testing electrolytic capacitors which need a bias voltage. In this case, it may be best to set the PSM3750 to AC coupling which will increase the measured accuracy in cases where the AC signal is small relative to the DC level.

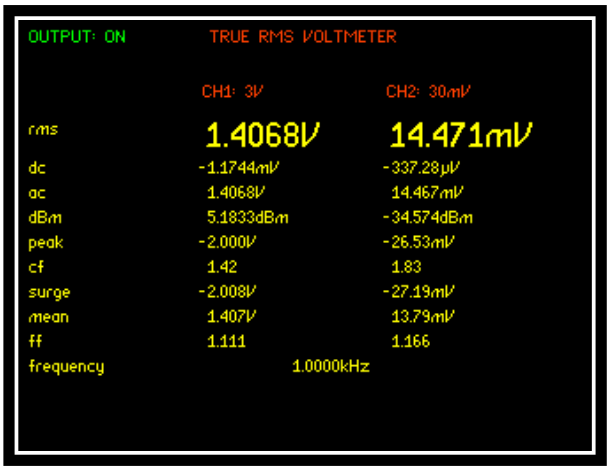
8.4 RMS – True RMS Voltmeter

The RMS Voltmeter measures the total rms values of the signal present at the input terminals to the bandwidth of the instrument (<5MHz). Care must be taken when measuring low signal levels to minimise noise pick up on the input leads.

The RMS Voltmeter measures the following elementary values:

1. Rms
2. Dc
3. Peak
4. Surge
5. Mean

And derives the values: ac, dBm, crest factor and form factor



Figures shown are for illustration purposes only

The peak measurement is simply the value with the largest magnitude. Positive and Negative peaks are independently filtered then the result with the largest magnitude is taken as the peak value.

In order to measure surge conditions, the maximum instantaneous peak value (unfiltered) is also recorded. It is important that the PSM3750 does not autorange whilst measuring surge – either set the range to manual or repeat the test with ranging set to up only. To reset the maximum press "START"

Crest Factor is derived from peak and rms

cf = peak / rms

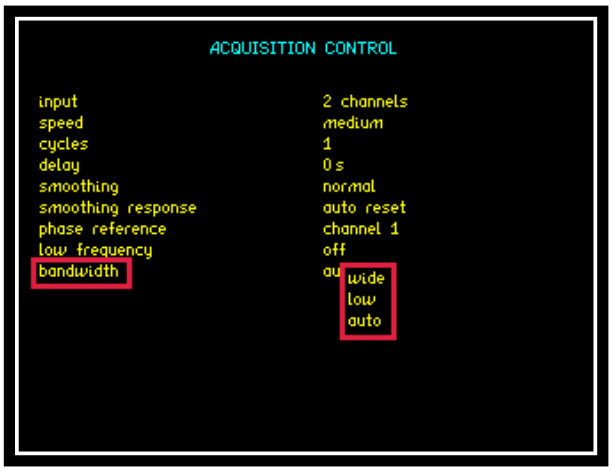
Form Factor is derived from the normalised mean and rms

ff = mean / rms

The measurements are computed over rectangular windows with no gaps. The processing power of the DSP allows the measurements to be made in real time without missing any samples. In this way the measured rms is a true value even if the signal is fluctuating. The only occasion when data is missed is when an autozero measurement is requested – this can be disabled within the "SYSTEM" menu if required.

The ZOOM function can be used to select any combination of up to four parameters from the display.

Note that the wideband nature of true rms measurements prevents the use of heterodyning so the frequency range of the measurements is limited to 5MHz. To minimise noise there is a 100 kHz filter applied by default. To obtain the full bandwidth press "ACQU" highlight bandwidth and select "wide".



8.5 POWER – Power meter

The power meter measures the total power and fundamental power of the signal present at the input terminals to the bandwidth of the instrument (>1MHz). Above 5MHz only the fundamentals are measured.

One of the inputs on the PSM3750 must be configured as an external shunt input. The external shunt may be a simple resistor or dedicated high frequency precision shunts which are available as accessories from N4L. Current Transformers and clamps may be used if fitted with a suitable burden resistor.

The power meter will operate either from its own generator or more normally will use the frequency measured on CH1 (usually voltage).

The power meter measures the elementary values:

1. W
2. V rms
3. A rms
4. V fundamental (in-phase and quadrature)
5. A fundamental (in-phase and quadrature)
6. V dc
7. A dc
8. V harmonic (in-phase and quadrature)
9. A harmonic (in-phase and quadrature)
10. Frequency

and derives the following values:

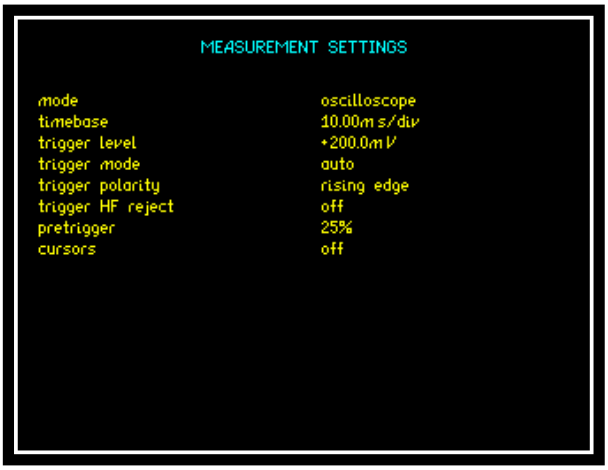
1. V&A fundamental magnitude
2. VA (true and fundamental)
3. Power Factor (true and fundamental)
4. Fundamental W
5. Harmonic W
6. Phase Shift

8.6 SCOPE – Oscilloscope Mode

The PSM3750 provides a digital storage oscilloscope function in order to view the waveforms being measured.

The settings for the oscilloscope are configured by pressing the "SCOPE" button twice.

Upon entering the "SCOPE" menu, the following screenshot will be displayed.



Timebase: The display for the oscilloscope is divided into 10 divisions along the time axis with the selected timebase displayed in the bottom left hand corner of the display. The timebase may be set to any real value between 15µs/div to 5s/div. Pressing the ◀ ▶ arrows on the main panel will adjust the timebase by a factor of 2.

Trigger Reference: The data source for the trigger can be selected to be Channel 1, Channel 2 or Channel 3 (if fitted).

Trigger Level: The trigger level is set directly in Volts in relation to the trigger reference settings and does not change if the range is changed. The trigger level is displayed by a small > on the extreme left hand edge of the display. If the trigger is set to a value above or below the range of the input channel then a small carat ^ is shown at the top or inverted at the bottom of the display as appropriate.

Trigger Mode: The trigger mode may be set to be;

Auto (trigger if possible but do not wait)

Normal (wait indefinitely for trigger)

Single shot (wait for trigger then hold)

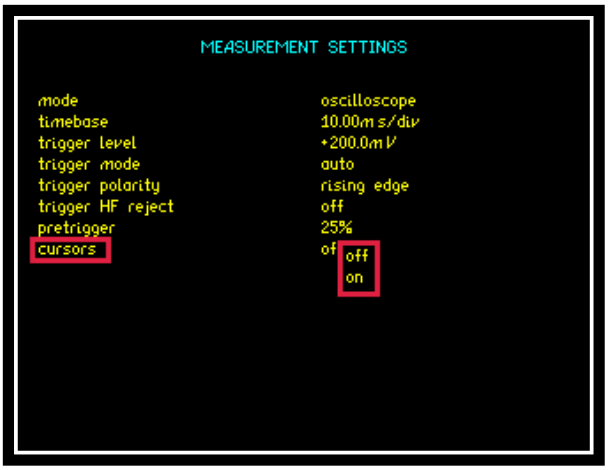
The single shot option is reset using the "TRIGGER" key

Trigger Polarity: The trigger polarity may be set to rising edge or falling edge

Trigger HF Reject: Select to be either "ON" or "OFF". When set to "ON" a low pass filter is applied to the trigger data to stabilise the trace with noisy signals. The filter only influences the trigger detection and does not change the data displayed.

Pretrigger: The pretrigger may be set to none, 25%, 50% or 75% using the drop down menu.

Cursors: Two cursors can be enabled on the display as per the screenshot below.



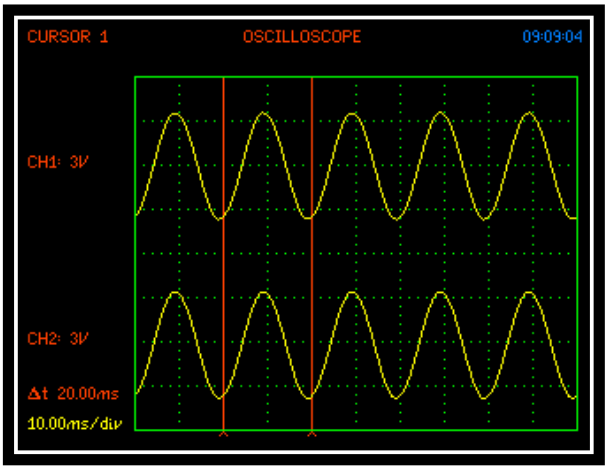
When enabled use the ▲ ▼ keys to enable and switch between Cursor 1 and Cursor 2.

Use the ▶ ◀ keys to move the selected cursor along the timescale.

NOTE:

When the cursors are enabled then the "LEFT" and "RIGHT" arrows no longer adjust the timebase.

Screenshot from Scope display with “Dual” cursors configured



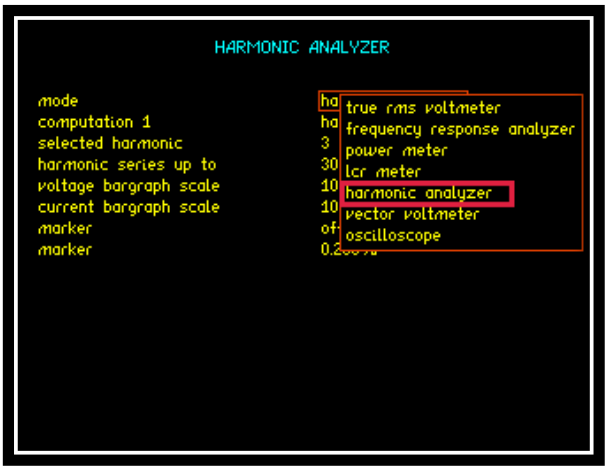
From the screenshot above (output set to 50Hz / 2Vpk) the display shows all fundamental measurements from the position of cursor 1. Also displayed is the time difference between the 2 cursors, “delta t” = 20.00ms with the timebase set to 10ms/div.

8.7 HARM – Harmonics Mode

The PSM3750 Instrument contains a harmonic analyser which computes multiple DFTs on the input waveforms in real time.

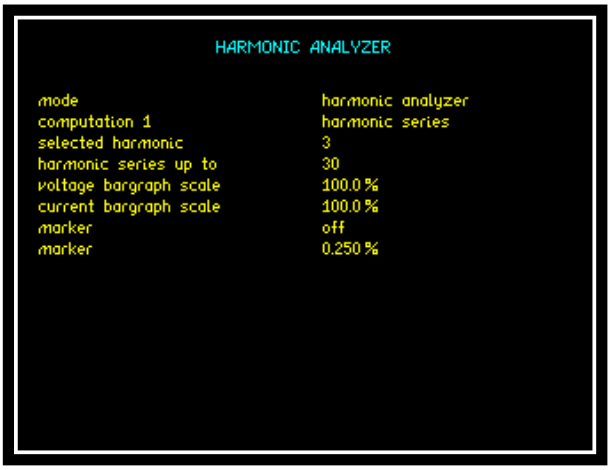
The settings for the harmonic analyzer are configured from within the "MODE" function as there is no direct button to press.

Press "MODE" and select harmonic analyzer from the dropdown menu within the mode parameter as shown below.

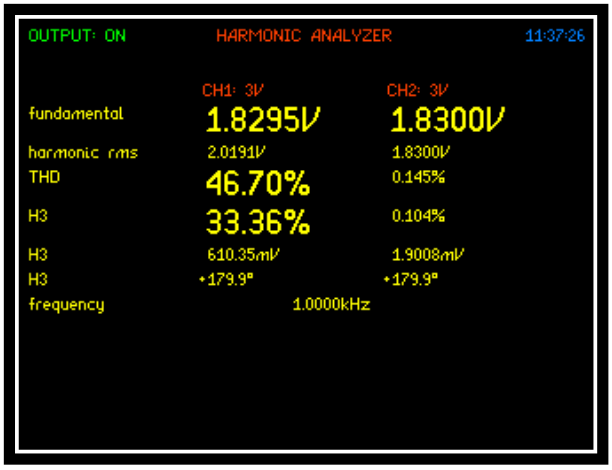


Configure all the parameters within the harmonic analyzer menu once selected

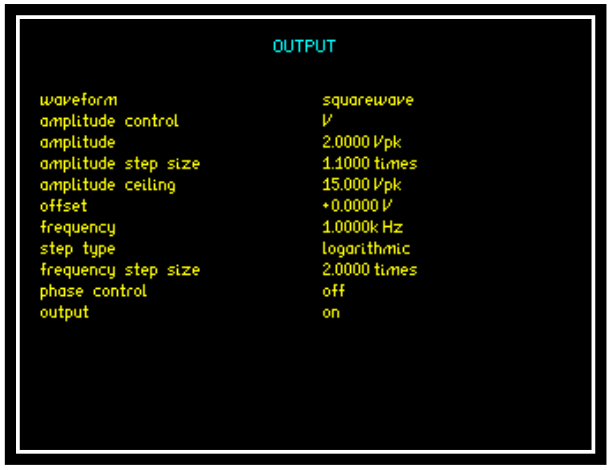
(Selections below are for demonstration purposes only)



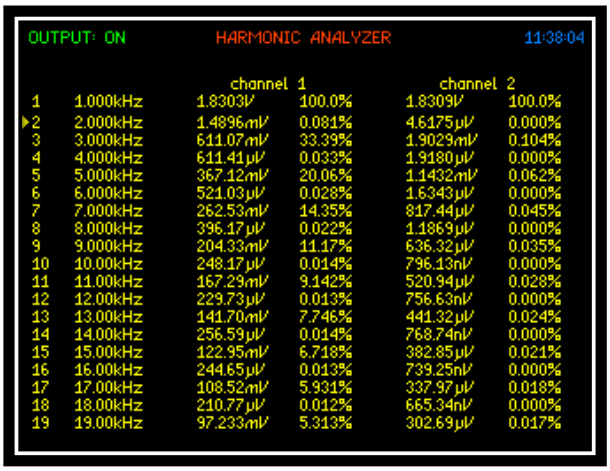
Press "ENTER" once all selections have been made, this will take you directly to the Harmonics Real time Display and results shown will be referenced to the input signal frequency as shown below.

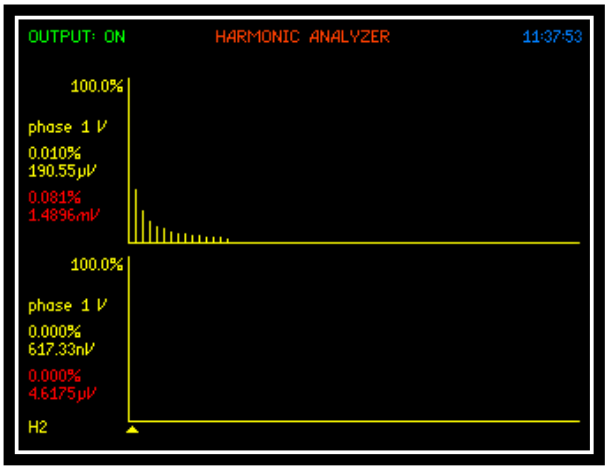


For the purpose of this manual the output signal was generated using the PSM3750's own generator as shown within the next screenshot, where it can be seen that the output frequency was set to 1 kHz.

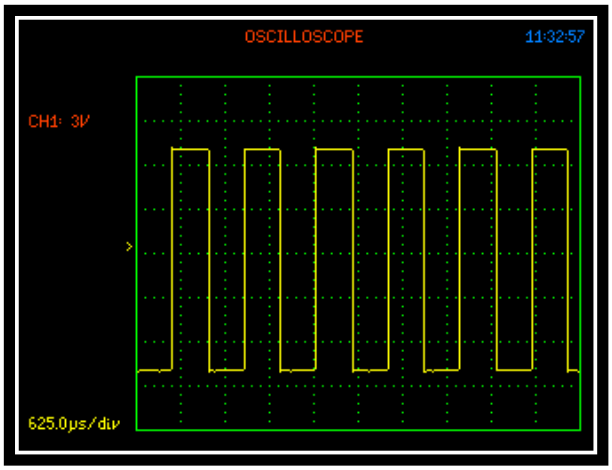


From the real time display you are able to view the collected data in either a table or bar graph format as shown below. For the bar graph data this will be represented in accordance to the settings made earlier within the harmonic analyzer menu screen.





To view the input signal within the oscilloscope mode then simply press the "SCOPE" button on the instruments front panel, this will display the waveform of the signal being received as shown.



Here we are able to view the squarewave signal that was previously set within the "OUTPUT" menu screen and which was being analyzed for this guide.

NOTE: If the "SCOPE" button is pressed to view a waveform whilst in harmonic analyzer mode then to return to the harmonic screen the user will have to return via the "MODE" button as stated earlier in this section.

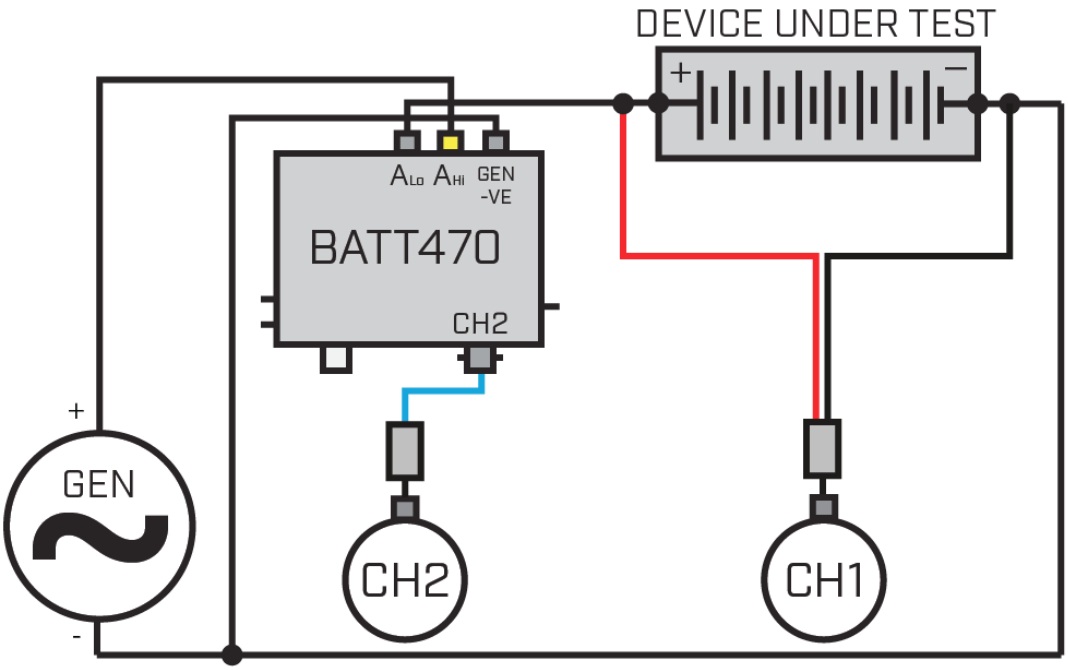
8.8 EIS - Electrochemical Impedance Spectroscopy

Electrochemical Impedance Spectroscopy is performed using the following accessories;

- BATT470 EIS Current Shunt
- 1x Oscilloscope Probe
- 2x Crocodile Clips
- 2x ESF10m 10mHz AC coupling units
- 4x 4mm Banana leads
- 1x BNC lead (Safety isolated)

For easy configuration of the PSM3750, refer to the N4L website in order to download a PSM3750 "BATT470" configuration file. This is available within the applications section - Battery Cell Electrochemical Impedance Spectroscopy application note 33 (APP033). Loading the configuration file is performed via the front USB port.

Connection diagram:



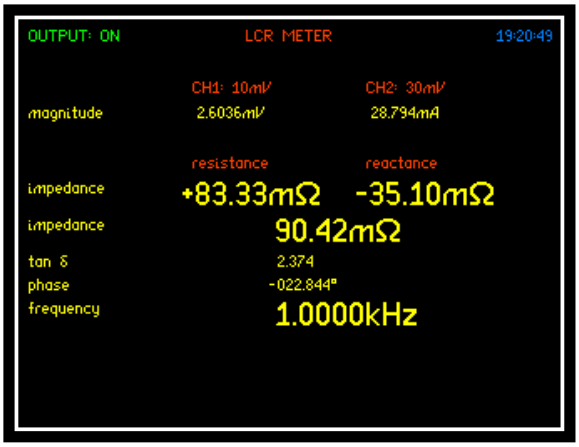
An impedance sweep can then be performed between the frequency limits of interest. This can be displayed in Nyquist form within PSMComm (EIS Mode) if preferred.

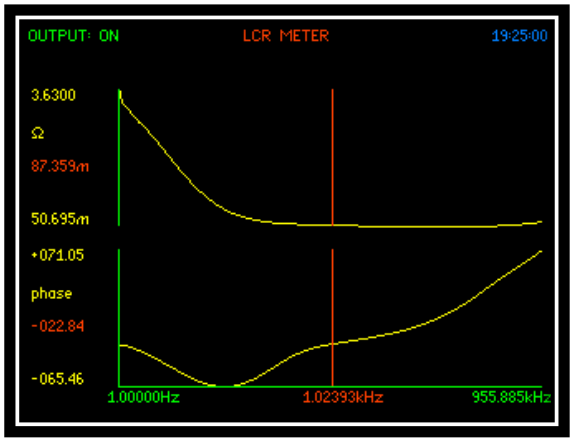
TEST PROCEDURE:

1. Set SW1 + SW2 to "PRE-CHARGE"
2. Wait 1 minute for settling
3. Connect GEN -ve to BATT470
4. Connect ESF10m to PSM CH1 and CH2 Input
5. Connect PSM CH2 to BATT470 CH2
6. Connect DUT -ve to GEN -ve
7. Connect GEN +ve to BATT470 AHi
8. Connect DUT +ve to BATT470 ALo
9. Connect PSM CH1 across DUT +/-ve
10. Set SW1 + SW2 to "TEST"
11. Wait 1 minute for settling
12. Perform Test

Note 1: Ensure SW1 and SW2 are ALWAYS set to PRE-CHARGE before connecting DUT

Note 2: SW3 can be used to rapidly discharge BATT470m (30 second discharge)



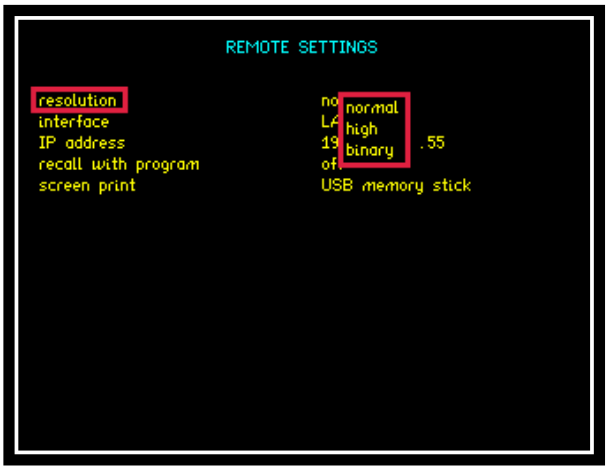


Real Time view and Graphic view of the cell impedance measurements

9. Comms Settings

The Comms Settings menu provides an interface for the user to set the method of connection and the ability to configure the ports as required.

Resolution



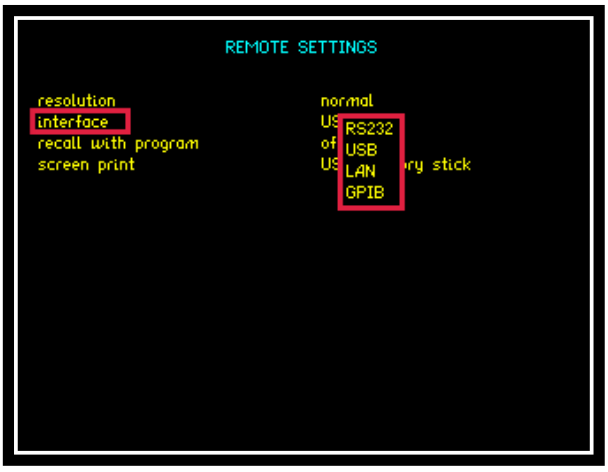
The default resolution setting for the PSM3750 is "Normal" this will set the Data Resolution to 5 decimal points plus any exponent eg: +1.2345+E00.

Selecting "High" will set the Data Resolution to 6 decimal points plus any exponent eg: +1.23456+E00.

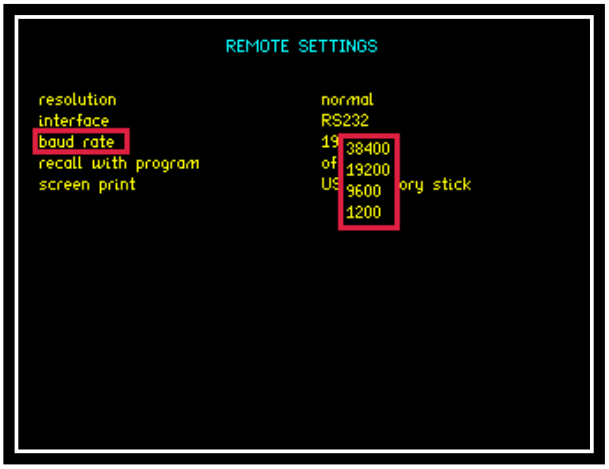
For higher speed transfer a proprietary binary format can be selected which compresses the data into 4 bytes.

Interface

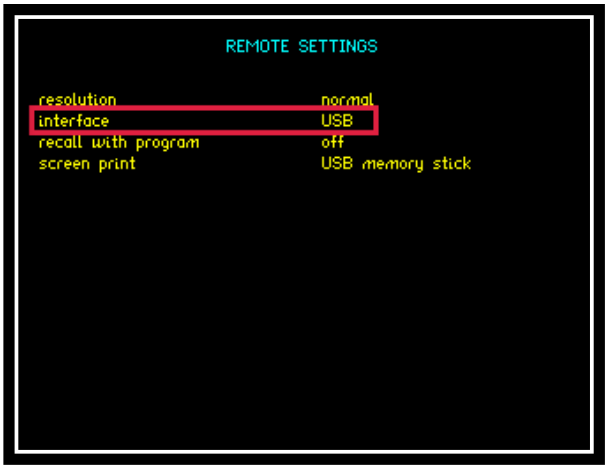
The PSM3750 is fitted as standard with an RS232 serial communications port and USB, LAN and IEEE488 (GPIB) Interfaces for communication purposes between the instrument and PC.



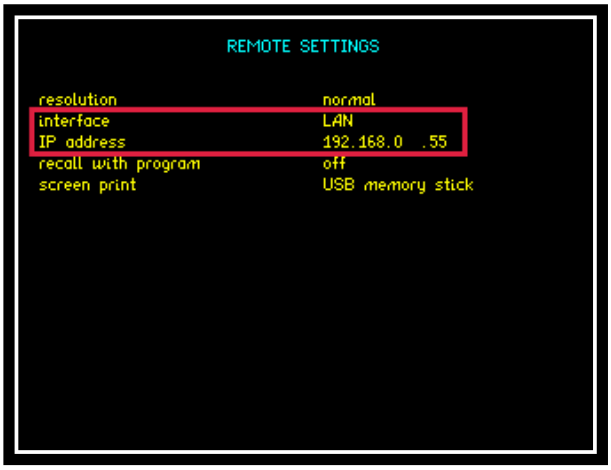
Selection is made via the interface parameter within the comms settings.



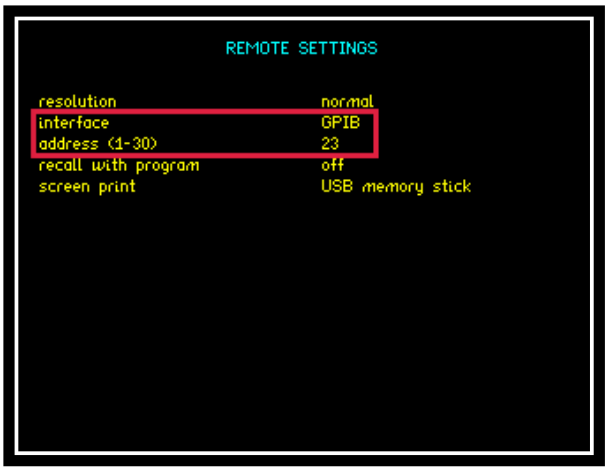
Selecting RS232 will then open up the "Baud Rate" option. Select an applicable data speed rate from the 4 options given in the drop down menu (Default Setting is 19200).



To use a USB lead to connect, set the interface parameter to read "USB".

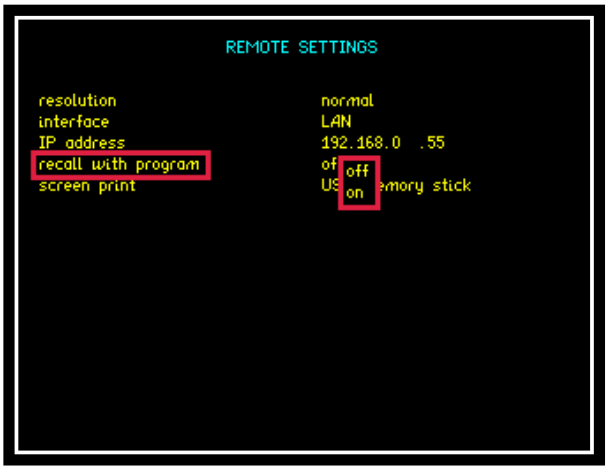


Configuring the interface to LAN will then display the IP address applicable to your instrument. This address will be required upon connection to any software to enable correct connection to the instrument; this is changed using the numerical keypad.



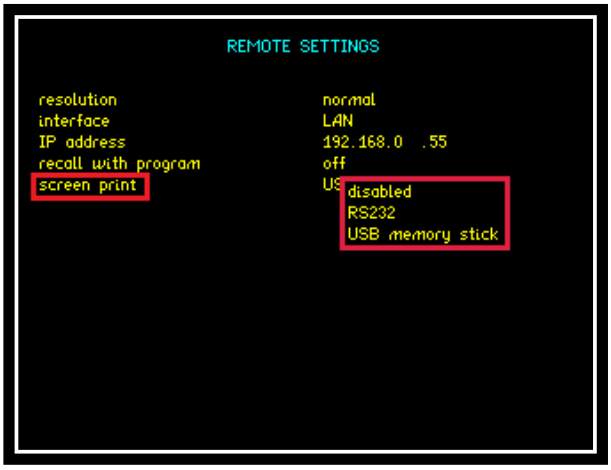
Configuring the instruments interface to GPIB will automatically set the IEEE address to 23 this can be changed within the address parameter in the range 0 to 30 (31 total possible addresses available).

Recall with Program



The recall with program parameter will allow any pre-set Comms configuration to be recalled if saved along with a nominated program within the "PROG" settings. To recall a Comms configuration set the recall option to "ON" then recall the appropriate program (Remember to set this first before recalling your saved program).

Screen Print

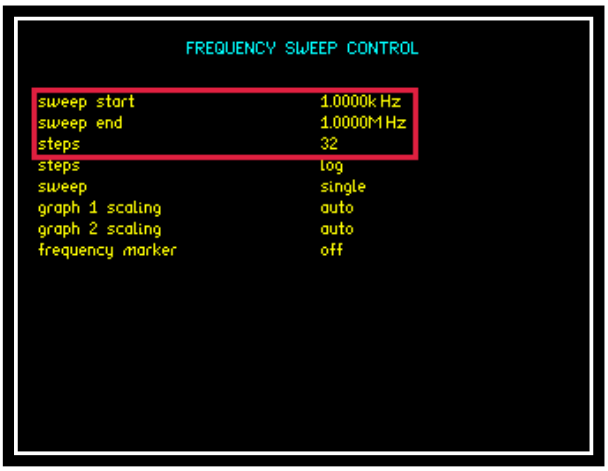


The Screen Print option will allow any screen display on the PSM3750 to be copied either to an RS232 printer or USB memory stick, select the appropriate transfer method required or alternatively this parameter can be disabled. To print the screen display press and hold the "START" button for 3 seconds. A BMP file will be transferred to the memory stick.

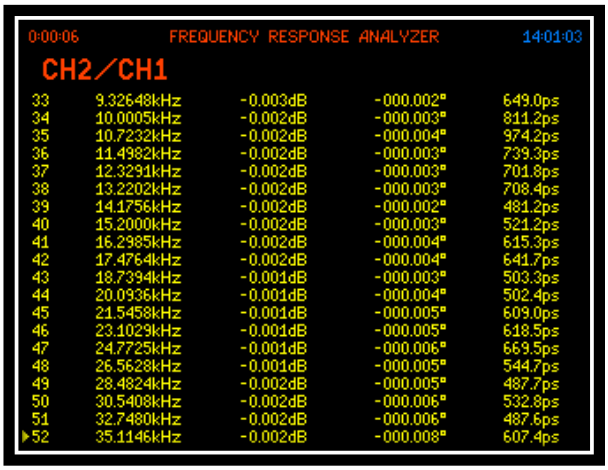
9.1 Saving Sweep details to USB Memory Stick

The following section explains the procedure for storing a Frequency Sweep onto USB memory stick.

1. Setup Sweep Parameters (SWEEP MENU)

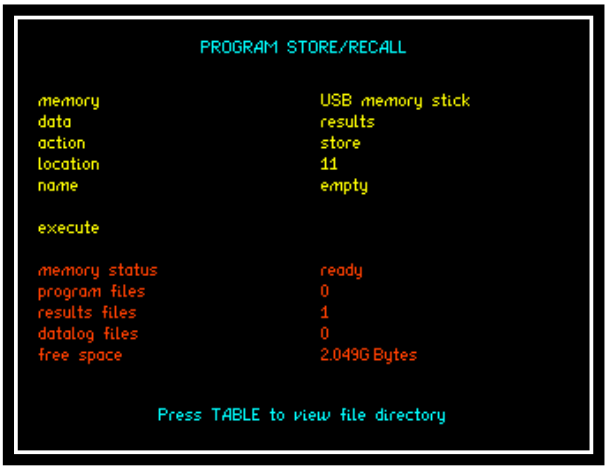


2. Press START to commence Sweep



3. Insert Memory Stick into front USB memory port

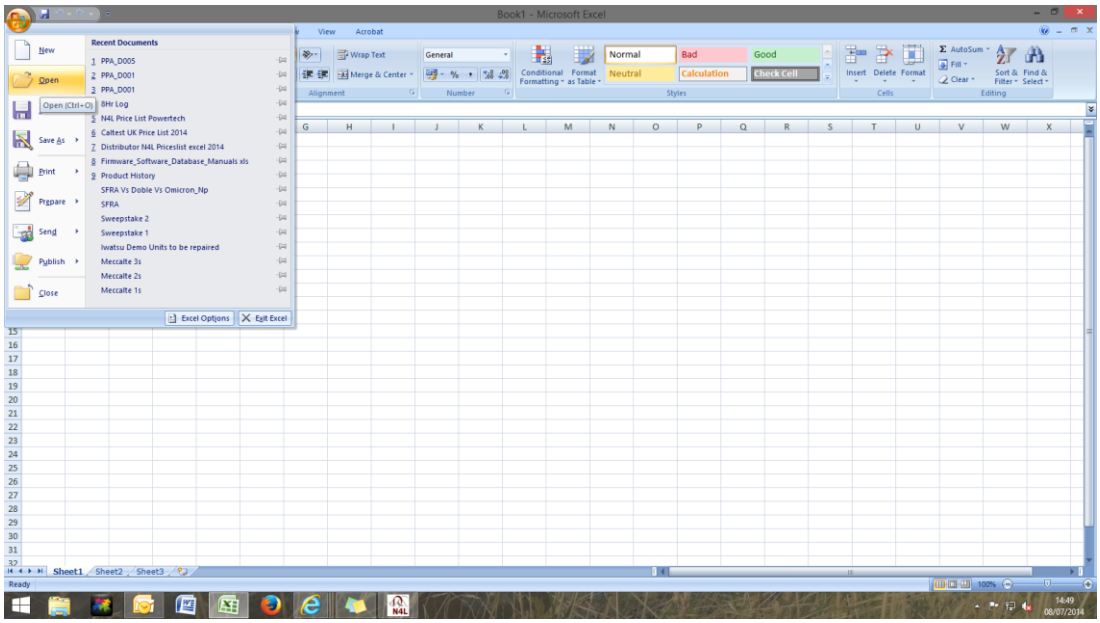
4. Setup Memory Location (PROG MENU)



- Select memory storage to USB memory stick
- Select data to be stored as results
- Select action for the data to store
- Select a location for the data to be stored (999 available)
- Select a suitable name for your tests for ease of identification
- Select "execute" and press enter to transfer data to memory stick

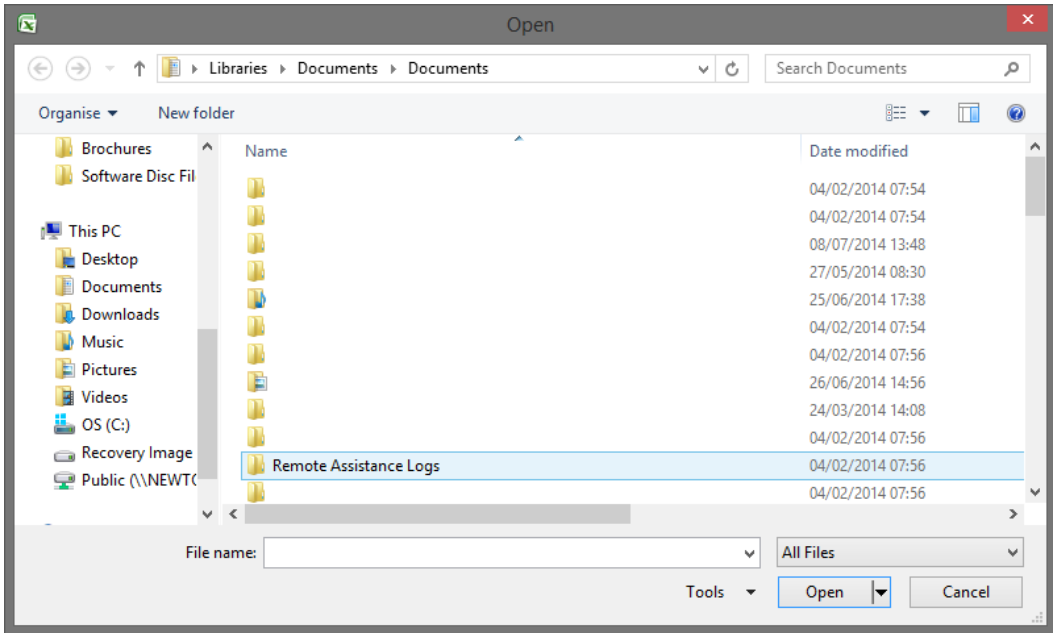
5. Message will appear on screen "writing to USB please wait"
6. Data will be transferred onto the memory stick
7. Locate stored file on memory stick , the file format will have a .txt extension as shown

8. To convert .txt file into an Excel spreadsheet, save .txt file to a folder within your PC
9. Open up excel file as shown

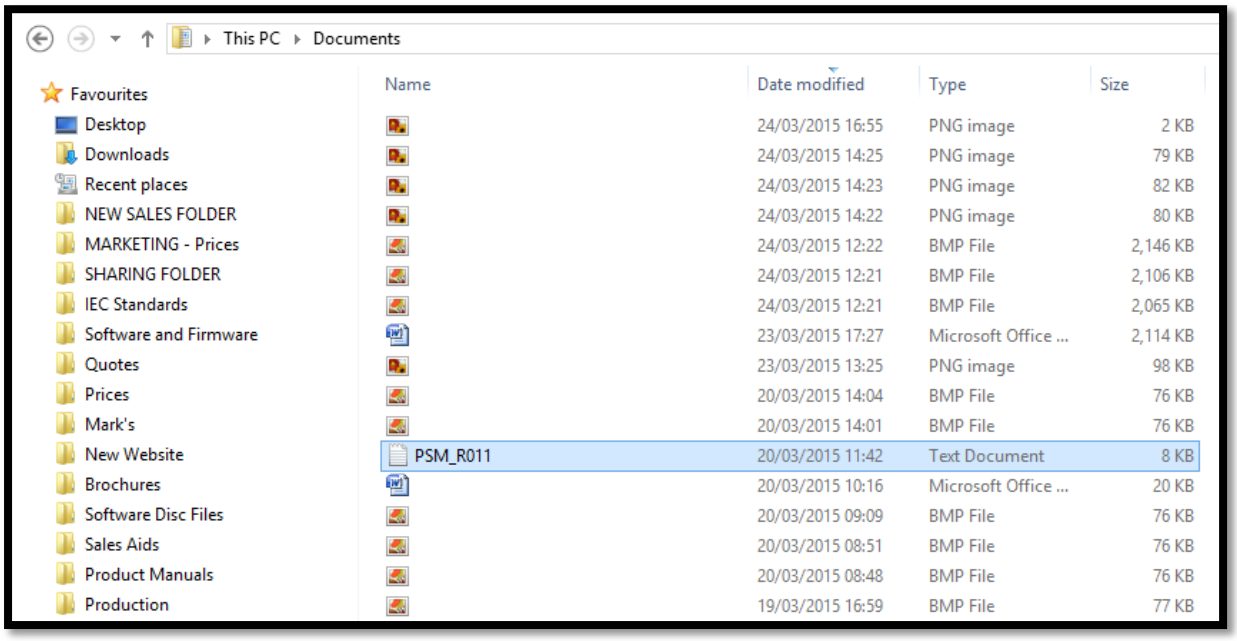


10. Click on "OPEN" new spreadsheet

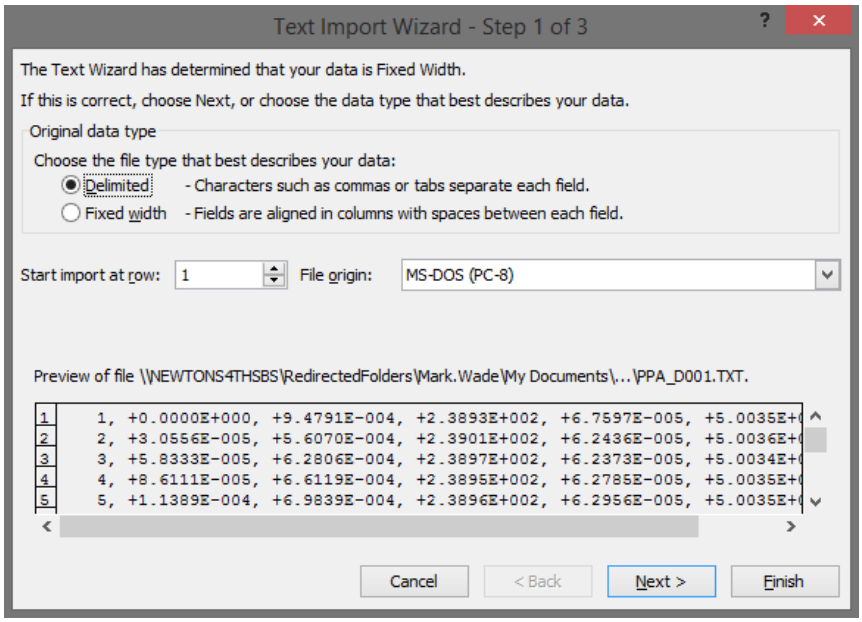
11. File location box will appear as below



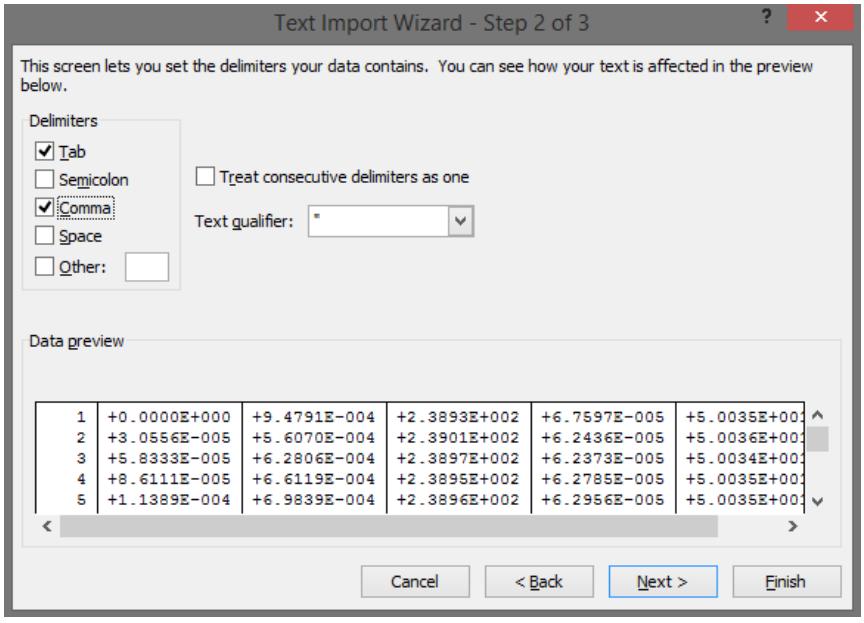
12. Click on and open the dropdown menu box showing "All Excel Files" and change to "All Files"
13. Locate saved .txt file from folders
14. Double click on selected file to open



15. After opening your file a further screen will appear as shown below, now change file type from "Fixed width" to "Delimited"



16. With "Delimited" selected click on "Next"
17. Delimiters screen will appear as shown within the next screenshot



18. Make sure that the "Tab" and "Comma" delimiters are ticked as shown above then click on "Next"

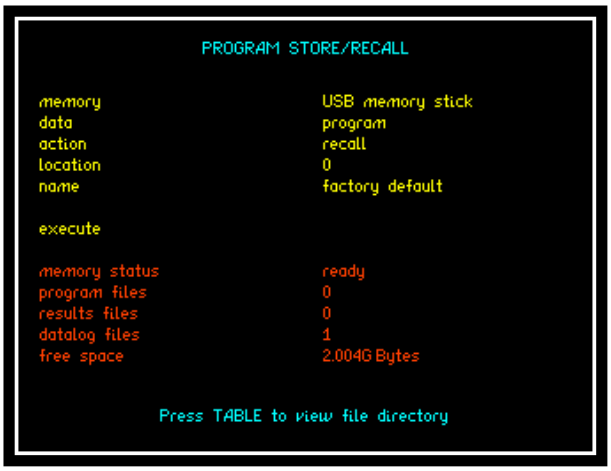
19. New screen will appear then click on "Finish". Data will be exported into an Excel spreadsheet as shown

	A	B	C	D	E	F
1	1	0.00E+00	9.48E-04	2.39E+02	6.76E-05	5.00E+01
2	2	3.06E-05	5.61E-04	2.39E+02	6.24E-05	5.00E+01
3	3	5.83E-05	6.28E-04	2.39E+02	6.24E-05	5.00E+01
4	4	8.61E-05	6.61E-04	2.39E+02	6.28E-05	5.00E+01
5	5	1.14E-04	6.98E-04	2.39E+02	6.30E-05	5.00E+01
6	6	1.42E-04	8.28E-04	2.39E+02	6.38E-05	5.00E+01
7	7	1.69E-04	3.71E-04	2.39E+02	6.56E-05	5.00E+01
8	8	1.97E-04	4.57E-04	2.39E+02	6.74E-05	5.00E+01
9	9	2.25E-04	4.82E-04	2.39E+02	6.83E-05	5.00E+01
10	10	2.53E-04	5.96E-04	2.39E+02	6.85E-05	5.00E+01
11	11	2.81E-04	1.60E-03	2.39E+02	7.30E-05	5.00E+01
12	12	3.08E-04	1.32E-03	2.39E+02	7.19E-05	5.00E+01
13	13	3.36E-04	1.16E-03	2.39E+02	7.27E-05	5.00E+01
14	14	3.64E-04	1.12E-03	2.39E+02	7.28E-05	5.00E+01
15	15	3.91E-04	1.12E-03	2.39E+02	7.24E-05	5.00E+01

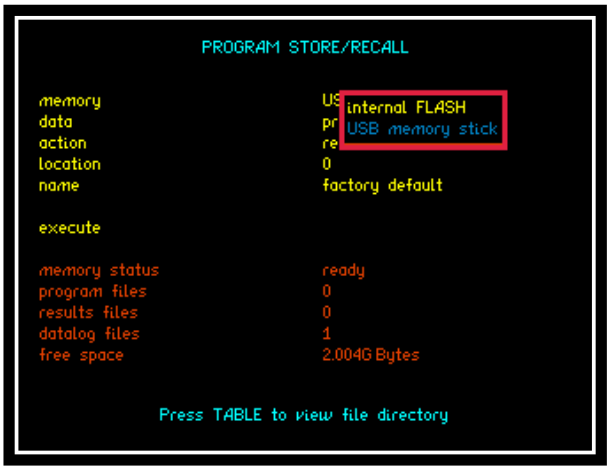
9.2 Program Store / Recall / Delete

The following section explains the procedure for storing / recalling or deleting a program to or from the instruments internal memory or USB memory Stick.

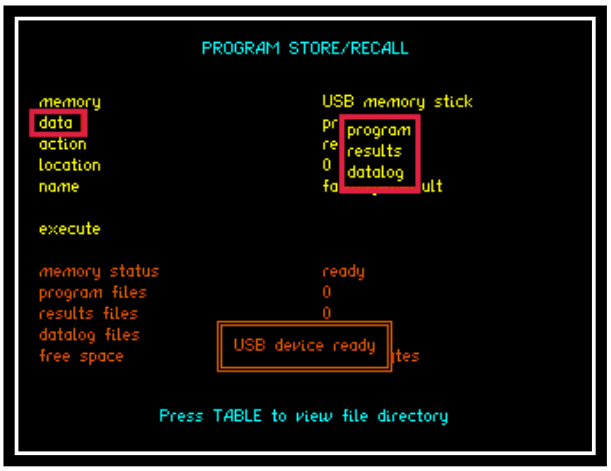
1. Press "PROG" button to open up program store / recall mode



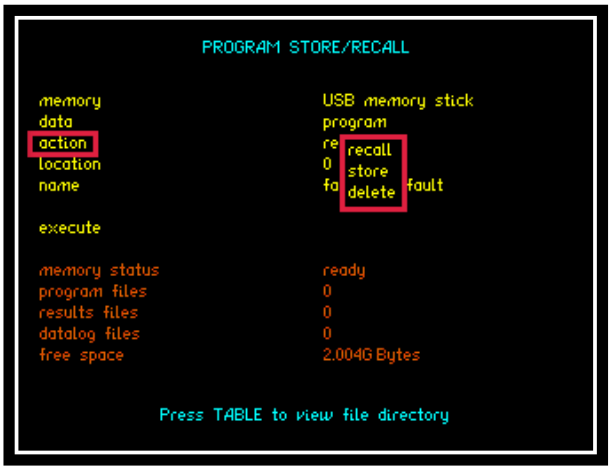
2. Select memory type to be used for action from the dropdown menu



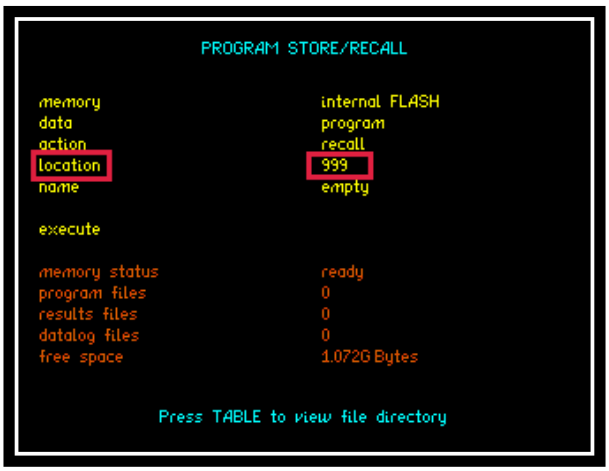
3. Select which data type you require to be actioned from the list shown



4. Select the action to be taken in association with the data selected



5. Select the location that the associated action is to be recalled from, stored to or deleted from, there are 999 locations available

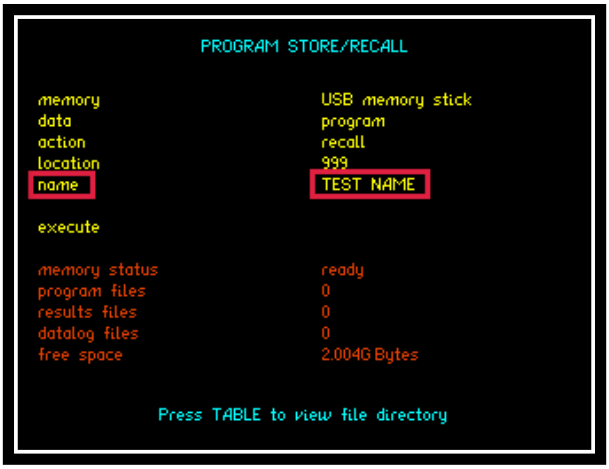


NOTE:

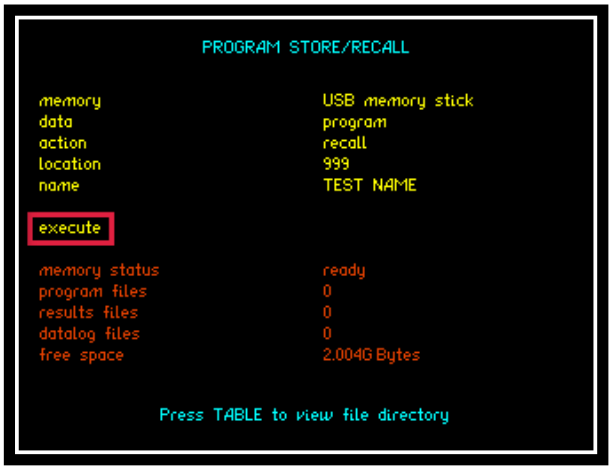
Location 0 = FACTORY DEFAULT and cannot be changed

Location 1 = Upon start up should any program be stored within program 1 then the PSM will automatically recall this program.

6. Enter a name within this parameter to aid the user in relation to storing / recalling a program to / from memory for future reference. To enter a name, use the Alpha / Numerical keypad on the instruments front panel.



7. Upon implementing any of the above actions then remember to scroll down to “EXECUTE” and press “ENTER” to validate your selection / action.



10. PSMComm2 – N4L Software Package

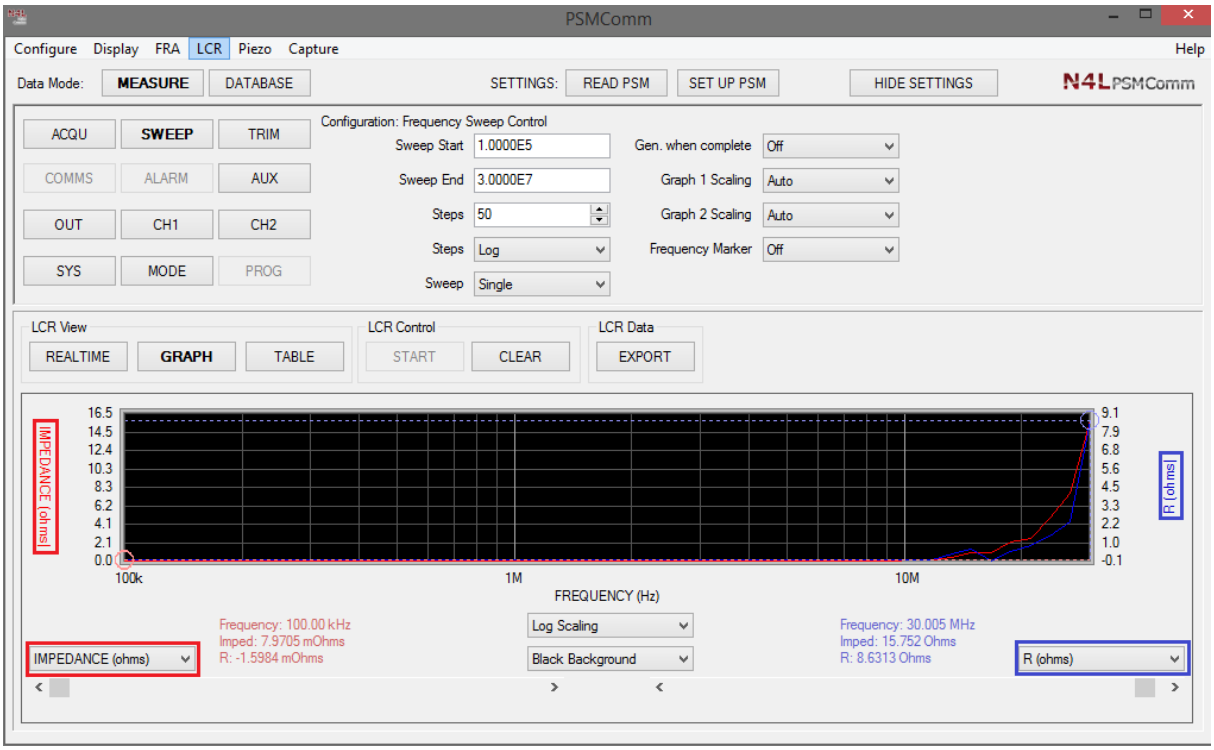
All N4L software packages are available free of charge as a downloadable file from our website www.newtons4th.com

If you are not already registered with us then please take the time to visit our website and register by clicking the support section on the main header, then clicking on the "go to downloads" link, at this point you will be asked to login or register.

Once your registration has been authorised you will then be authorised to visit our support section where you will find all the latest:

Instrument Firmware, PC Software and Manuals

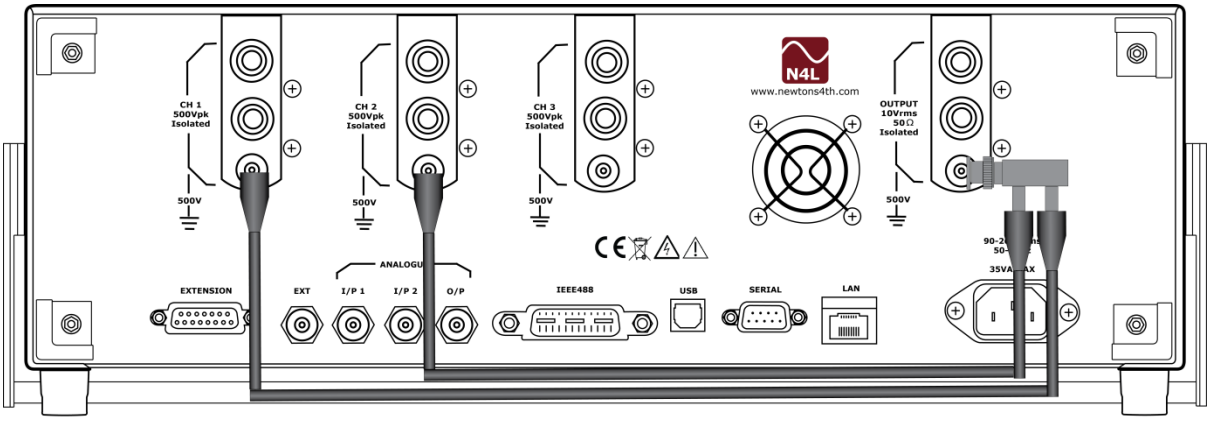
Upon initial activation of our Software with your PC you will be asked for an unlock code, these codes are readily available from your local distributor or by emailing us directly at support@newtons4th.com



11. PSM3750 Guide for testing the basic sweep functionality on the instrument

Switch on the Instrument and allow a 30 minute warm up period

1. Connect BNC leads to the rear of the instrument as shown

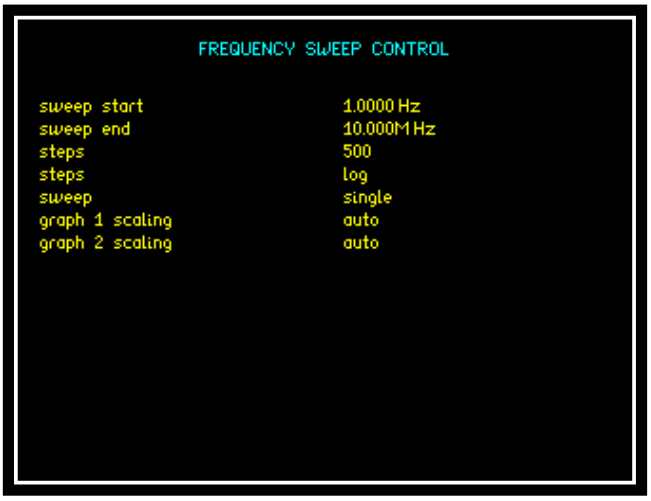


- Connect a double BNC connector to the "OUTPUT" BNC then run 2 separate BNC leads from the output connecting to CH1 BNC and to CH2 BNC

2. Make sure program 0(factory default) is set within the "PROG" menu Note: any program stored in location 1 will always be recalled upon activation of the instrument

Remember to scroll down to execute and press ENTER to confirm settings

3. Set up Sweep parameters (1hz to 10MHz sweep over 500 steps)

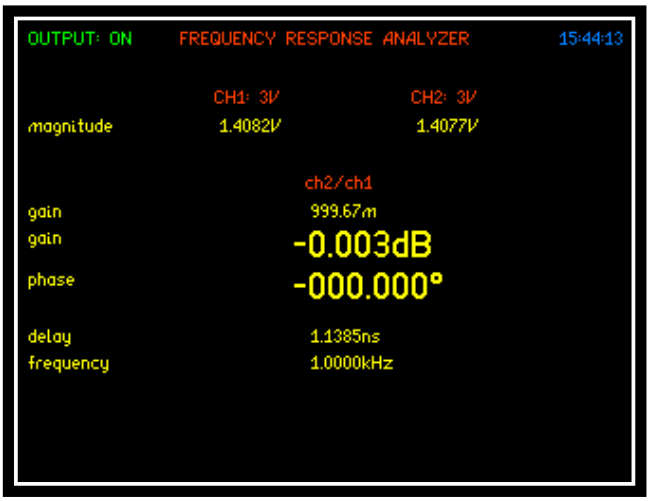


- Press "SWEEP" button
- Use the ▼ arrow to scroll to sweep start, enter 1 from the numerical keypad and press "ENTER" 1.0000hz will now be set
- Use the ▼ arrow to scroll to sweep end, enter 10 from the numerical keypad and then press the "PAV" / "M" button on the front panel, this button is a direct button to set this parameter as MEGA Hertz, press "ENTER" 10.000MHz will now be set
- Use the ▼ arrow to scroll to steps, enter 500 from the numerical keypad and press "ENTER" 500 will now be set

4. Switch on Generator Output

- Press "OUT" button
- Use the ▼ arrow until the red box surrounds the output parameter at the bottom of the display
- Press the ◀ arrow twice to change this parameter from off to on and press "ENTER" output will now be switched "ON"

5. Press the "HOME" button twice to set the display back to FRA real time as shown below

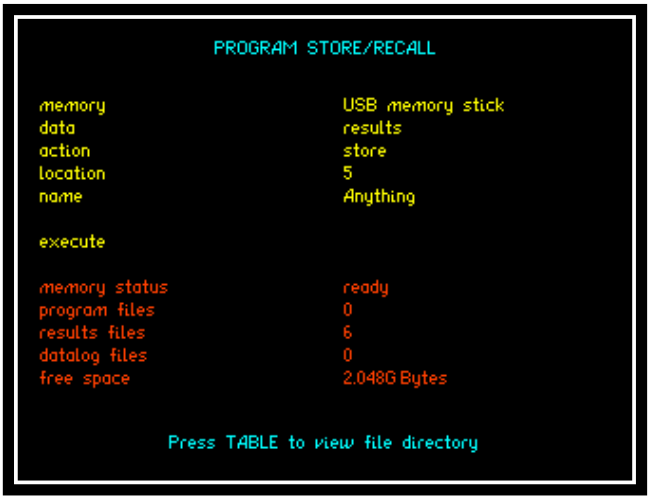


6. Commence Sweep

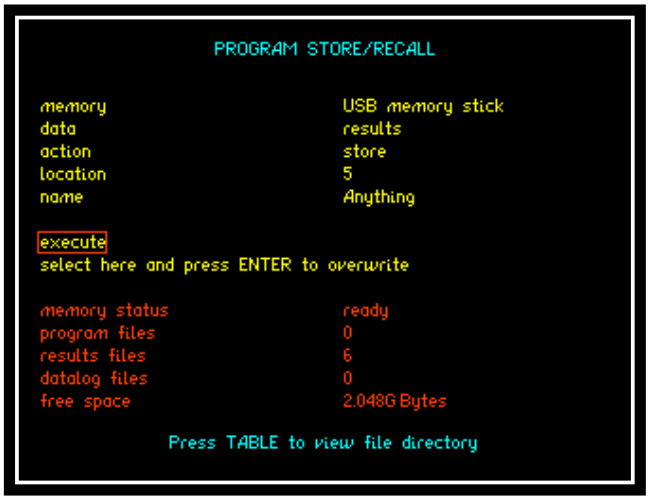
- Press the "START" button to commence sweep
- Press the "TABLE" button to see results being accumulated across the full frequency range. Sweep will cease upon the completion of 500 steps which will be at a frequency of 10MHz

7. Store Results

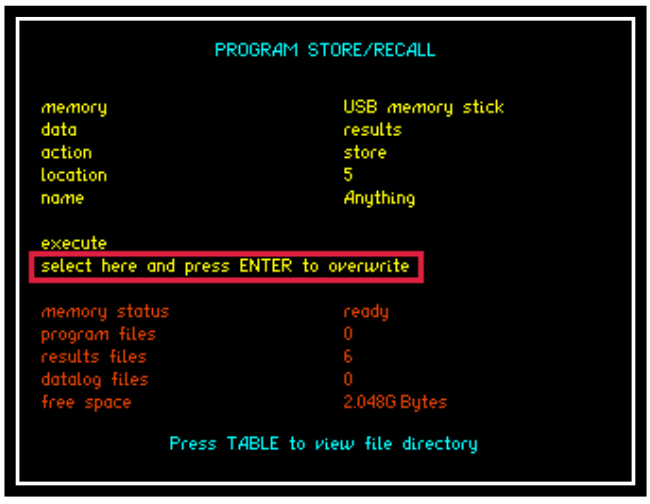
- Upon completion of your sweep press the "PROG" button
- Insert Memory Stick into front USB port
- Set up parameters as below to save results to memory Stick
- Location will refer to a memory location on the memory stick
- Name refers to the sweep details as reference for the user



- Upon completion of the top 5 parameters use the ▼ arrow until the red box surrounds execute



- Press "ENTER" a message will appear underneath execute as shown
- Use the ▼ to move the red box to the new message and press "ENTER"



- Data results will now be transferred onto the memory stick and an onscreen message will be displayed upon completion
- Inserting the memory stick into your PC you will now find 2 files a .txt and N4L file as shown below, save these to a location on your PC

R005 represents "location 5" as set earlier within the "PROG" home screen

12. Repair / Recalibration

In the event of any problem with the instrument, during or outside of the guarantee period, contact your local representative.

Newtons4th Ltd offer a full repair and re-calibration service

It is recommended that the instrument be re-calibrated annually

Contact details:

1. Newtons4th Ltd

1 Bede Island Road
Leicester
LE2 7EA
United Kingdom

Tel: (0116) 230 1066 International: +44 116 230 1066
Fax: (0116) 230 1061 International: +44 116 230 1061

E-mail address: sales@newtons4th.com
office@newtons4th.com

Web site: www.newtons4th.com

We have a policy of continuous product improvement and are always keen to hear comments, whether favourable or unfavourable from users of our products. Please telephone, fax, write or e-mail with your comments.

13. PSM3750 Specifications

MEASUREMENT SPECIFICATION	
Frequency Response Analyser	
Measurement	Magnitude, Gain (CH1/CH2, CH2/CH1), Gain (dB), offset gain (dB), phase (º)
Frequency Range	10µHz – 50MHz
Gain Accuracy in dB	0.01dB + 0.01dB/MHz < 5MHz 0.31dB + 0.04dB/MHz < 50MHz
Phase Accuracy	0.025º < 10kHz 0.05deg + 0.00015deg/kHz < 50MHz
Frequency Source	Generator or CH1 Input
Measurement	Real Time DFT, no missing data
Speed	Up to 100 reading per second
Filter	Selectable from 0.2 seconds

Phase Angle Voltmeter	
Measurement	In Phase, Quadrature, TanΦ, Magnitude, Phase, in-phase ratio, rms, rms ratio, LVDT differential, LVDT ratiometric
Frequency Range	10µHz – 50MHz
Basic Accuracy (AC)	0.075% range + 0.075% reading + 50µV < 10kHz 0.075% range + 0.25% + 0.001% / kHz rdg + 50µV < 1MHz 0.075% range + 0.01% + 0.00025% / kHz rdg + 50µV < 50MHz

L C R Meter	
Functions	L, C, R (AC), Q, Tan delta, Impedance, Phase – Series or Parallel Circuit
Frequency Range	10µHz – 50MHz
Current Shunt	External or Optional IAI2 Impedance Interface
Ranges (External Shunt)	Inductance 1µH to 100H Capacitance 100pF to 100µF Resistance 1Ω to 1MΩ
Basic Accuracy	0.1% + Tolerance of Shunt
Sweep Capability	All AC Functions

True RMS Voltmeter	
Channels	2 (Optional 3rd Channel Available)
Frequency Range	DC to 5 MHz 5MHz to 50MHz fundamental only
Measurement	RMS, AC, DC, Peak, CCF, Surge, dBm
Basic Accuracy (AC)	As Phase Angle Voltmeter + 0.05mV
Basic Accuracy (DC)	0.1% range + 0.1% reading + 0.5mV

Power Meter	
Measurements	W, VA, PF, V, A – Total, Fundamental and Integrated, Power Harmonics
Frequency Range	DC & 10mHz to 5 MHz 5MHz to 50MHz fundamental only
Current Shunt	External
Current Accuracy	As Voltage + External Shunt Tolerance
Watts Accuracy	0.1% VA range + 0.1% reading + External Shunt Tolerance

Signal Generator	
Type	Fully Isolated 10Vrms output protected to 500Vpk. Direct Digital Synthesis
Frequency	10µHz to 50MHz
Waveforms	Sine, Square, triangle, Sawtooth, White Noise
Accuracy (no trim)	Frequency ±0.05% Amplitude ±5% < 10MHz Amplitude ±10% < 50MHz
Impedance	50 Ohm ± 2% - 100pf to Chassis
Output Level	35mVrms to 10Vrms
Offset	±10Vdc, Resolution 20mV

Harmonic Analyser	
Scan	Single or Series
Frequency range	20mHz to 5Mhz 5MHz to 50 MHz fundamental only
Measurement	Harmonic, Series THD, Difference THD
Max Harmonic	100

Input Ranges	
Differential Inputs	2 or 3 x Isolated Inputs 500Vpk
Connectors	Isolated BNC
Coupling	AC+DC, AC (<10Vdc), AC (<500Vdc)
Max Common Mode	500Vpk from earth
Input Ranges	3mV, 10mV, 30mV, 100mV, 300mV, 1V, 3V, 10V, 30V, 100V, 500V, 300mV*, 1V*, 3V*, 10V* *High Voltage Attenuator
Scaling	1x10^-9 to 1x10^9
Ranging	Full auto, Up only or Manual
Input Impedance	1M Ohm Differential / 100pf to Chassis

MODEL NUMBERS Available Packages	
PSM3750-2CH	2 Channel PSM3750
PSM3750-3CH	3 Channel PSM3750
PSM3750-2CH + IAI2	2 Channel PSM3750 + Impedance Analyser Interface
PSM3750-3CH + IAI2	3 Channel PSM3750 + Impedance Analyser Interface

IAI2–Impedance Analyser Interface Specification	
Frequency Range	10µHz to 50MHz
Measurement Parameters	L, C, R, Phase, QF, Tan (δ), Series and Parallel Circuit
Measurement Ranges	10nH to 10kH, 10pf to 1000µf, 1mΩ to 500MΩ
Basic Accuracy	0.1% < 1KhZ 0.2% + 0.002% / kHz < 1MHz 0.2% + 0.0005% / kHz < 35MHz 0.2% + 0.001% / kHz < 50MHz
Internal Shunts	5Ω, 50Ω, 5kΩ, 500kΩ
Internal Shunt Phase Accuracy	Low 5Ω – 0.1deg + 0.01deg / kHz Normal 50Ω – 0.05deg + 0.005deg / kHz High 5kΩ - 0.05deg + 0.005deg / kHz Very High 500kΩ – 0.1deg + 0.05deg / kHz

ACCESSORIES AND PORTS Accessories	
Probes	4 off with 2 Channel, 6 off with 3 Channel
Leads	Output, RS232, USB, Power
Software	CommView, PSMComm2
Documentation	Calibration Certificate, User and Comms Manuals

Ports	
RS232	Baud Rate to 19200, RTS/CTS flow control
Analog Output	Bipolar ±10V on any measured function - BNC
Sync Output	Pulsed Synchronised to generator
Extension Ports (N4L Accessories)	2 15 pin female D type
LAN (Standard)	10/100 base-T Ethernet auto sensing RJ45
GPIB (Standard)	IEEE488.2 Compatible

SYSTEM SPECIFICATIONS

Datalog	
Functions	Up to 4 measured functions, user selectable
Datalog Window	From 10ms with no gap between each log
Memory	RAM or Non-Volatile Memory up to 16,000 records

General	
Display	480X272 dot full colour TFT, White LED backlit
Dimension	92Hx215Wx312D mm excluding feet
Weight	3.3kg (2 Channel) 3.5kg (3 Channel)
Program Store	100, Location 1 loaded on power up
Sweep Stores	2000, all parameters in any sweep function
Remote Operation	Full Capability, Control and Data
Temperature	5 to 40°C ambient temperature, 20 to 90% non-condensing RH
Power Supply	90-264Vrms 47-63Hz 30VAmax
CMRR	140dB @ 240Vrms-50Hz, 120dB @ 100Vrms-1kHz
Warranty	3 Years

Environmental	
Operating Temperature range	0°C to +50°C
Storage Temperature range	-10°C to +60°C
Relative Humidity Range	20 to 95% Non-Condensing
Maximum Altitude	2,000 Metres