CalPower

Via Acquanera, 29 22100 COMO
tel. 031.526.566 (r.a.) fax 031.507.984
info@calpower.it www.calpower.it

ilac

UKAS CALIBRATION 7949

PPA500
PPA1500
PPA3500
PPA4500
PPA5500

The PPA Series

Leading power measurement solutions with a shared design philosophy

PPA5/1500 PPA3500 PPA45/5500

Product Overview	
Best in class Wideband Accuracy	Basic 0.01%(PPA5500) with class leading high frequency performance
New Voltage Attenuator Design	3.3Mohm(PPA3500. 4500, 5500), Low burden and heat dissipation, maintaining excellent frequency response
Wide Frequency Range	500kHz (PPA500), 1MHz (PPA1500, PPA3500 and PPA4500) and 2MHz (PPA5500)
Fast Sample Rate and No-Gap	2.2M samples/s (PPA5500), 1M samples/s (PPA500, PPA1500, PPA3500 and PPA4500)
Leading Phase Accuracy	0.005 Degrees plus 0.01 degrees per kHz (0.003 Degrees - Transformer Edition)
Built in High Precision Current Shunt	10Arms, 20Arms, 30Arms or 50Arms with up to 1000Apk direct plus a wide range of external sensors
Versatile Interfaces	RS232, USB, LAN, GPIB as standard (PPA5500) plus direct torque and speed
Range of PC software options	Remote control, monitoring and recording of real time data, tables and graphs
PWM Motor Drive Measurements	Highest performance power analyzer on the market for PWM Motor Drive evaluation
External Voltage BNC Connector	Unique external BNC connector with high sensitivity to interface with external High Voltage Probes
HF + TE Accuracy	Increased high frequency and low power factor as standard, -HF and -TE certification optional

Wideband Power Analysis

How do you choose a modern power analyzer ?

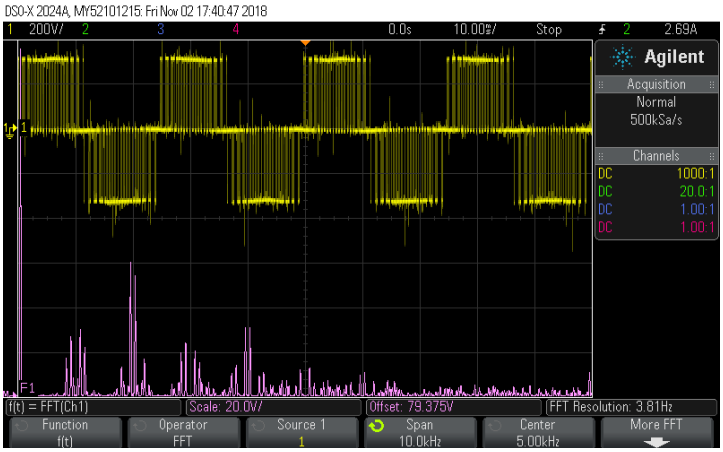
In an increasingly digital world, it is common to imagine that the digital stage of a measurement instrument is the key to performance, where the ADC spec appears to be a valid question. However, the unique challenge in all modern power electronics is noise, distortion, phase and frequency components that are only addressed with good hardware design. It is always these elements that dominate accuracy.

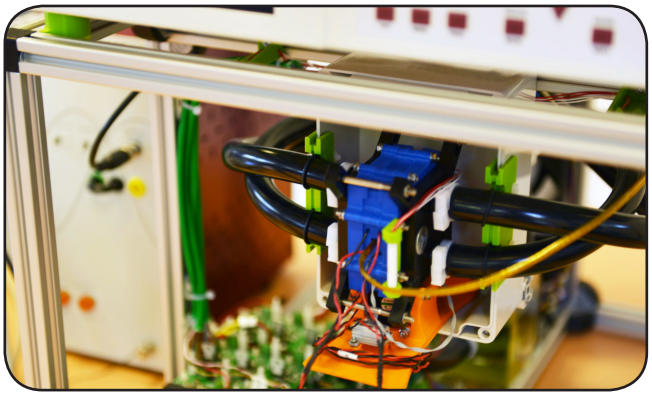
- Wideband Linearity
- Real-Time Gapless Sampling
- Synchronous Windowing
- Optimised Ranging Techniques
- Traceability

Wideband Power Spectrum from the output of an Inverter - an illustration of why you need Wideband linearity

Unrivalled Wideband Linearity

Our Power analyzers utilise innovative analogue design methods which provide unrivalled accuracy, stability and repeatability. This is complemented by careful selection and design integration of highly linear, no missing code analogue to digital converters, optimised for power measurement. Distorted waveforms such as the inverter drive waveform to the right can be measured at high speed without filtering and without sampling gaps.

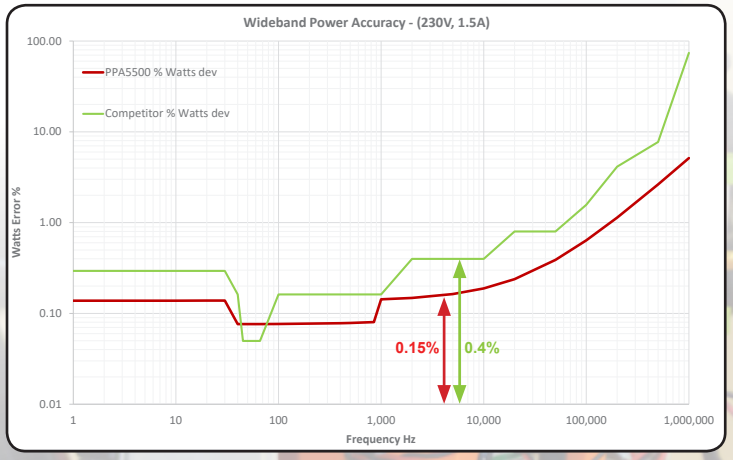




7949

Wideband Accuracy

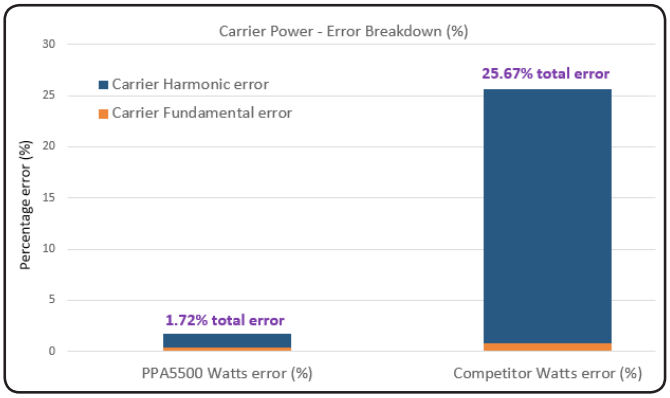
N4L Power Analyzers offer wideband accuracy that is not matched by other instruments. The graph to the right illustrates wideband accuracy of the PPA5500 in comparison to our closest competitor. Selective optimisation of accuracy at line frequency is misleading, because most modern loads are not sinusoidal. The total accuracy of any non-sinusoidal waveform is always dependant on wideband accuracy.



Learn more about N4L's wideband accuracy here [Doc ref: D000128]

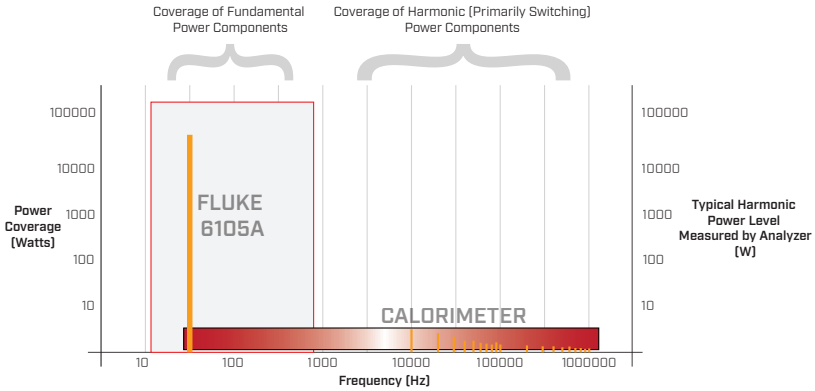
Do not Underestimate Wideband Power Errors

The influence of wideband accuracy when measuring a distorted DUT such as an inverter in an automotive or aerospace application is significant. The graph to the right illustrates the large error contribution from harmonic power components of a carrier waveform when measuring a modern PWM motor drive.



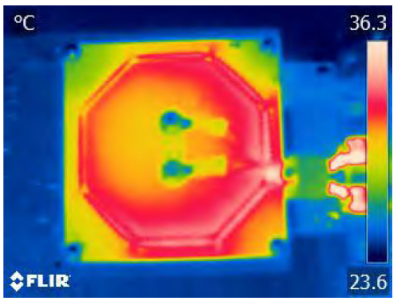
Calibrated over the Entire Frequency Range

N4L are the only power analyzer manufacturer with ISO17025 accreditation for power calibration up to 2MHz. Our calibration facility includes high VA, Power, Phase, Harmonics and Flicker with a Fluke 6105A, proprietary wideband calibration systems covering DC and 10uHz to 2MHz plus 45Hz to 2MHz Calorimetry.



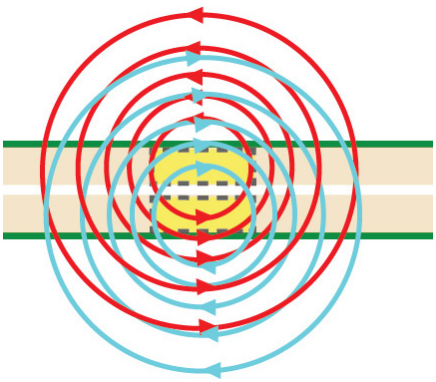
Low thermal Drift design

Proprietary shunt and heat dissipation design results in low operating temperatures and market leading thermal performance.



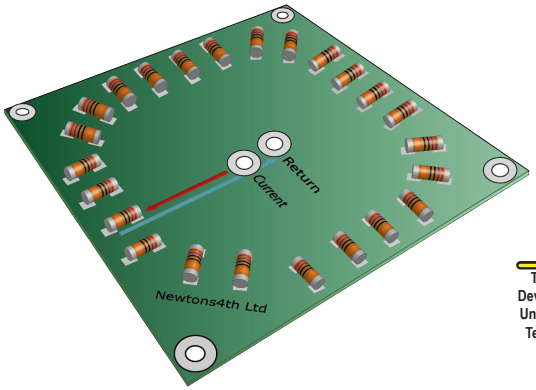
N4L Current Shunt Technology - the Key to Wideband current Accuracy

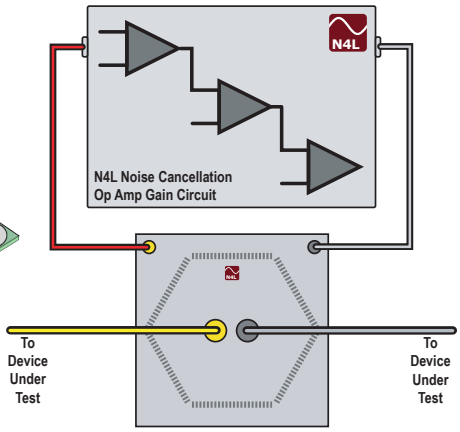
Since power is the product of in-phase voltage and current components, phase accuracy is a key to any precision power measurement. Wideband applications become a particular challenge since phase error is directly proportional to frequency, so low frequency phase accuracy is no assurance of correct wideband power measurement. An innovative planar design with almost perfect field cancellation and therefore negligible parasitic inductance, achieves a combination of magnitude and phase linearity that no conventional shunt or current transformer technique can match.

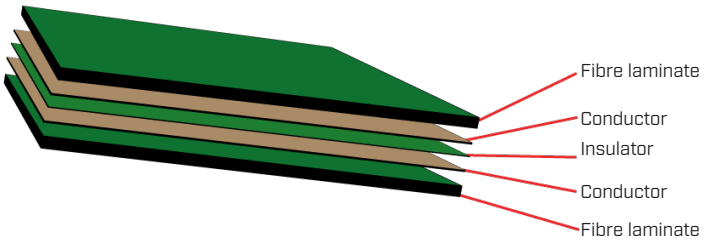


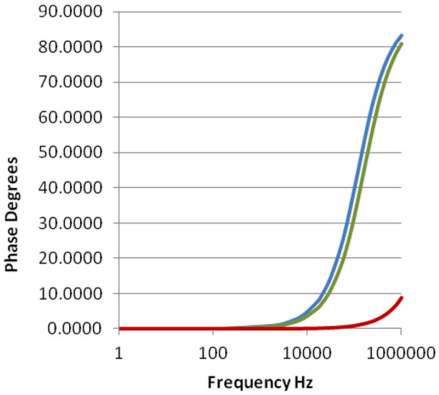
N4L Field cancellation technology

Proprietary Shunt design unique to N4L









$$Phase = arctan\left(\frac{2\pi fL}{R}\right)$$

Low Inductance Benchmark Shunt 1 20nH
Low Inductance Benchmark Shunt 1 10nH
Newtons4th 10mOhm 250pH

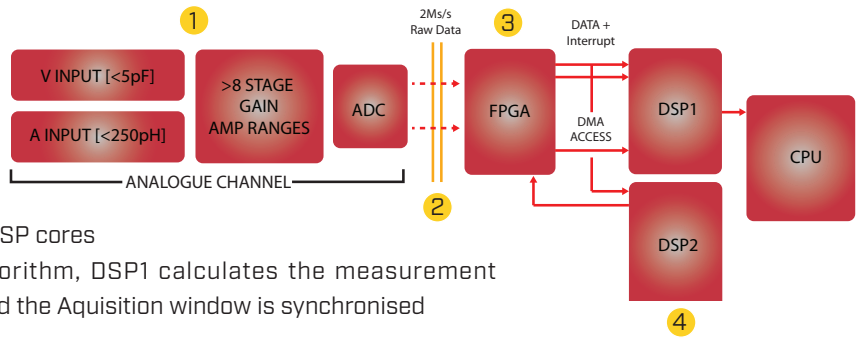
Learn more about N4L shunt technology here [Doc ref: D000125]

Our Technology

Unique hardware structure with Synchronous Windowing gives leading accuracy and stability

An N4L power analyzer is built upon a system topology that prioritises gapless high bandwidth measurements while maintaining exceptional levels of accuracy. Innovative analog design, coupled with digital signal processing techniques proprietary to N4L achieve unrivalled wideband performance, essential for modern day measurement applications which usually exhibit significant wideband distortion.

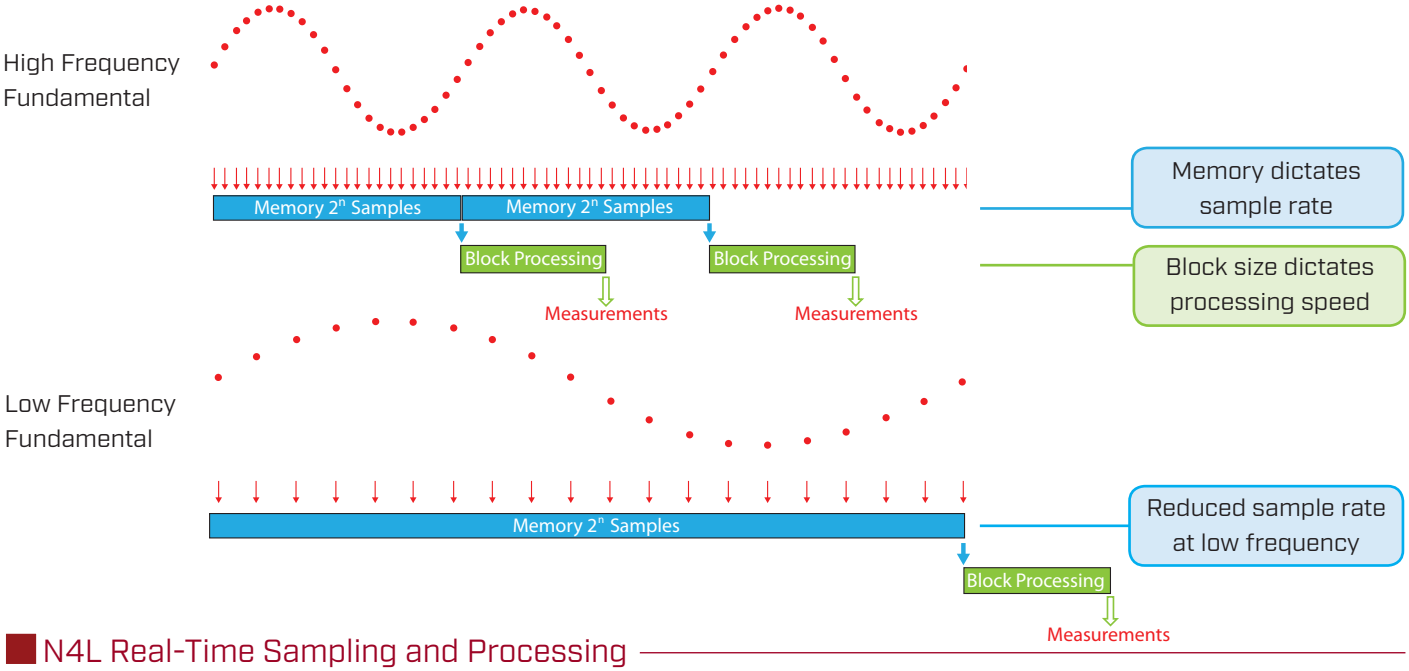
1 Analogue signal chain with unique voltage and current sensors, solid state ranging and optimum digital design for high speed gapless sampling.
2 Digitised high speed data is transfered across N4L proprietary isolation barrier
3 FPGA parallel processes and passes data to 2x DSP cores
4 DSP2 calculates frequency using a DFT algorithm, DSP1 calculates the measurement parameters and passes the data to the main CPU and the Aquisition window is synchronised



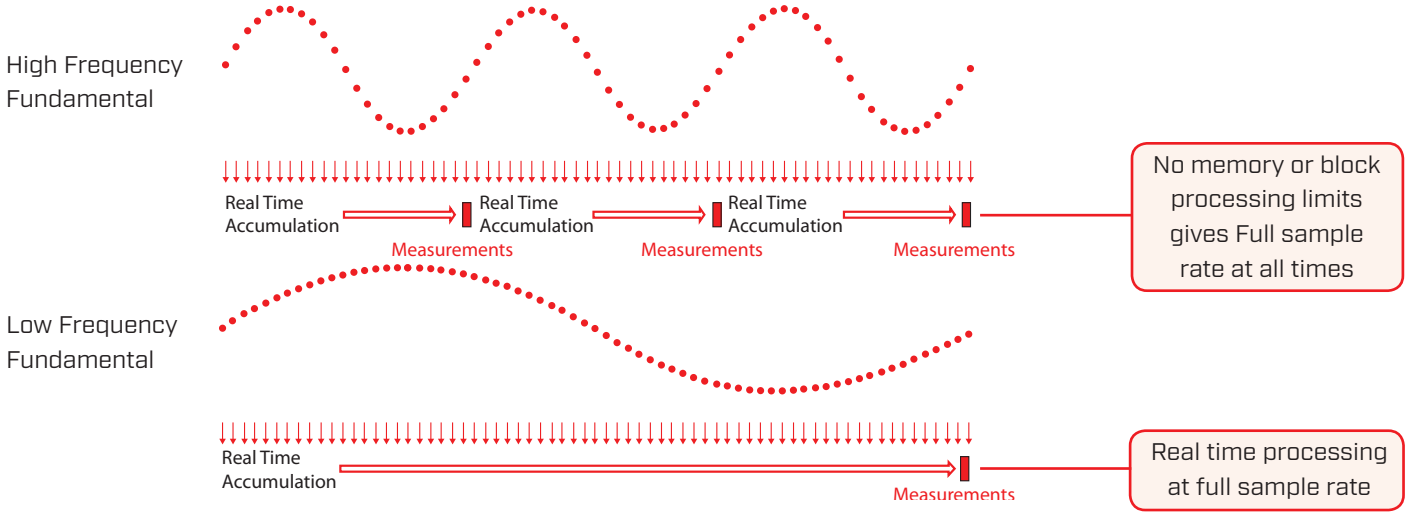
Real-Time Sampling and Measurement Computation

In all conventional digital systems, samples are temporarily stored in buffer memory then processing is carried out on a block of samples. Modern power electronics represents a challenge for such systems because finite memory inevitably limits the sample rate at low frequencies, therefore also the ability to correctly resolve high frequency components in modern switching devices. N4L do not use a buffer or block processing and continuously process the incoming samples. The result is that N4L power analyzers never have to reduce their sample rate, regardless of the fundamental time period or window length.

Conventional Sampling with Buffer Memory and Data Block Processing



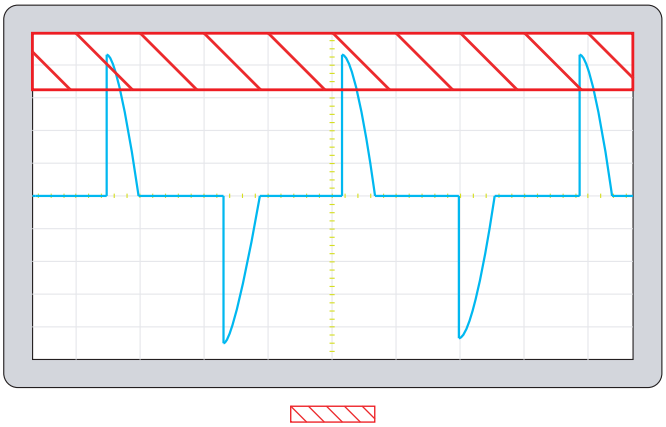
N4L Real-Time Sampling and Processing



Click here to read N4L's white paper covering ADC selection theory for power measurement [Doc ref: D000123]

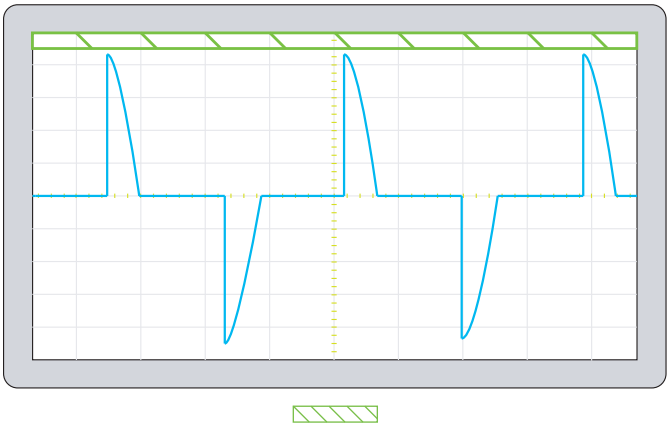
Optimised Ranging Techniques

Example RMS Ranging system, commonly used in older instrument designs (RMS ranging)



Waveform within red hashed area is clipped by an RMS ranging system and fixed crest factor setting

Modern Peak Ranging System, implemented on all N4L Power Analyzers



Peak Ranging system auto-detects the peak of the input signal and selects the ideal range

Model	Maximum Crest Factor (Auto-Ranging)
Closest Competitor	6
N4L PPA5500	20

Click here for more information about N4L's ranging techniques [Doc ref: D000126]

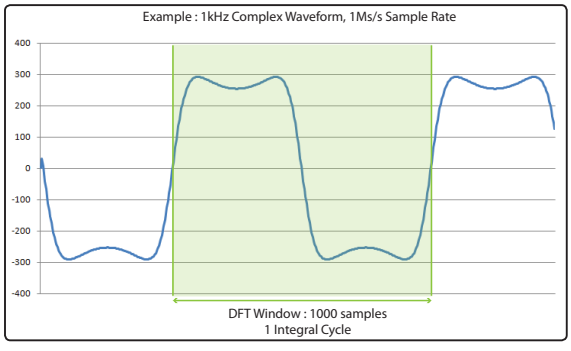
Common Mode Rejection Ratio

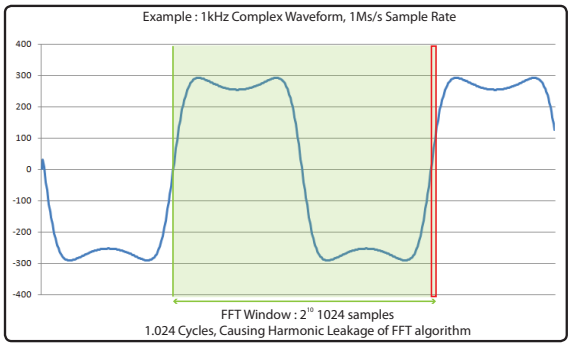
N4L's pulse transformer isolation circuitry, in combination with innovative analogue and signal conditioning circuit design provides 130dB CMRR at 100kHz. This allows the use of precision shunts in noisy applications where products with low resilience to common mode noise require isolated sensors.

Model	CMRR
Closest Competitor	80dB
N4L PPA5500	130dB

Discrete Fourier Transform allows Synchronous Windowing

	DFT (N4L)	FFT (Competitor)
Harmonic Leakage	No	Yes
Sampling Window Restrictions	No, any integer number of samples	Yes, restricted to 2^n samples, eg 1024, 2048, 4096 etc
Accuracy	Good	Degraded
Processing Cost	High	Medium



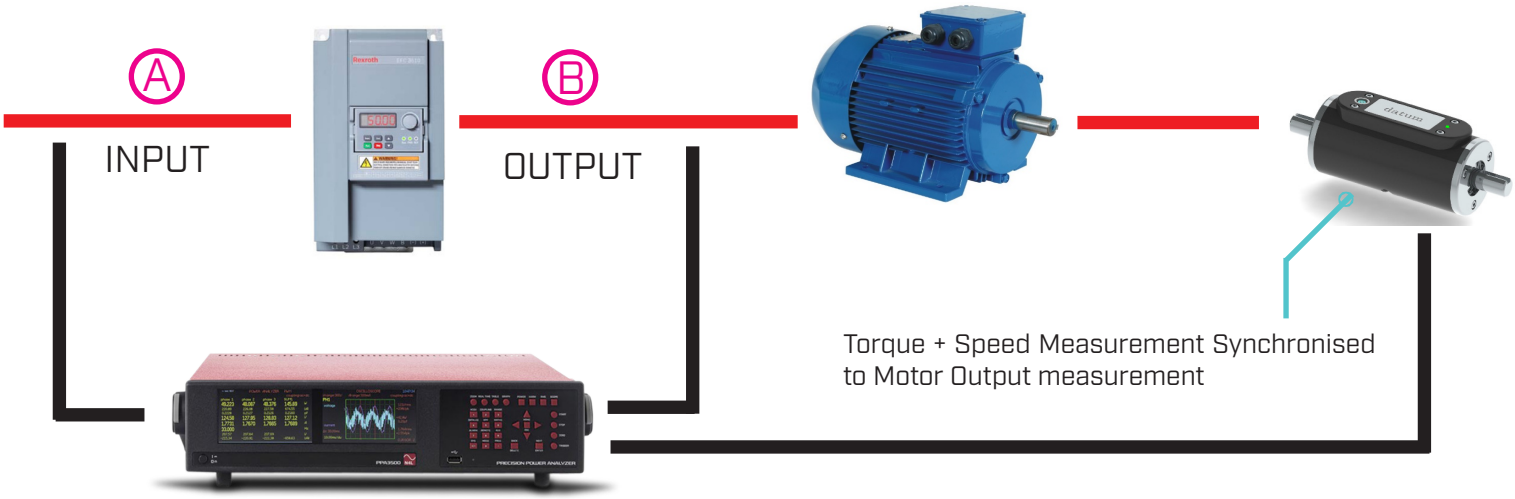


*Contact N4L for detailed application notes discussing our market leading ADC design

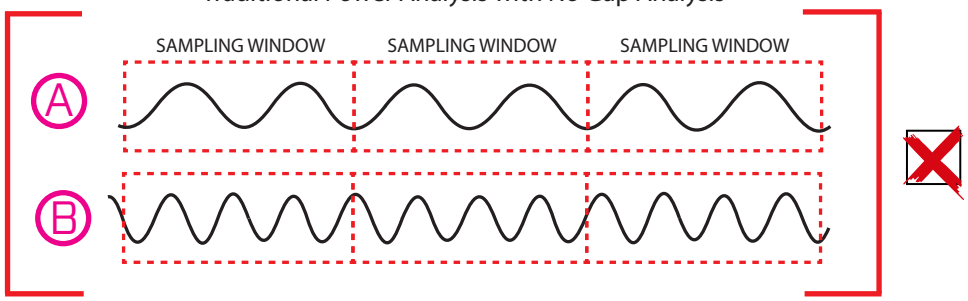
Click here for more information about the advantages of DFT harmonic analysis [Doc ref: D000127]

Quick and stable efficiency measurement via Independent input and output Windowing

N4L Power Analyzers independently synchronize with both the input and output waveforms of any product that has differing input and output operating frequencies. This allows integer cycle measurement, which increases both the speed and stability of efficiency measurement, without the "beating" effect that occurs in conventional fixed window techniques.

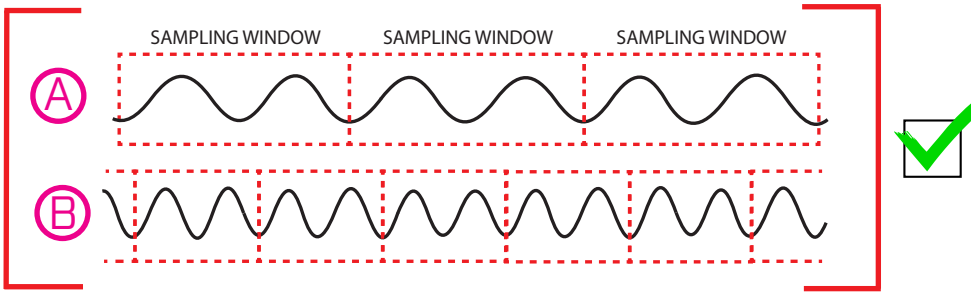


Traditional Power Analysis with No Gap Analysis



Traditional power analyzers fix the data acquisition window so that the input and output of a DUT share the same window. This may seem intuitively correct when aiming to measure system efficiency, but for all typical asynchronous systems, this introduces error and instability.

Newton4th Power Analysis with No Gap Analysis



Maximum stability, accuracy and speed of efficiency measurement in an asynchronous system requires asynchronous acquisition windows. N4L Power analyzers dynamically adjust the input and output data acquisition windows to achieve optimum efficiency measurement.

Click here to read N4L's white paper on windowing in asynchronous applications [D000120]

N4L offer the widest range of power measurement accessories

Current Transducers uA's to 1000's Arms	Plug and Play LEM Interfaces	Voltage Probes Up to 15kV	CAN-BUS Interface	Analogue Interfaces
				

Distributed by:

CalPower

Via Acquanera, 29 22100 COMO
tel. 031.526.566 (r.a.) fax 031.507.984
info@calpower.it www.calpower.it

Document Ref : D000124 Iss3