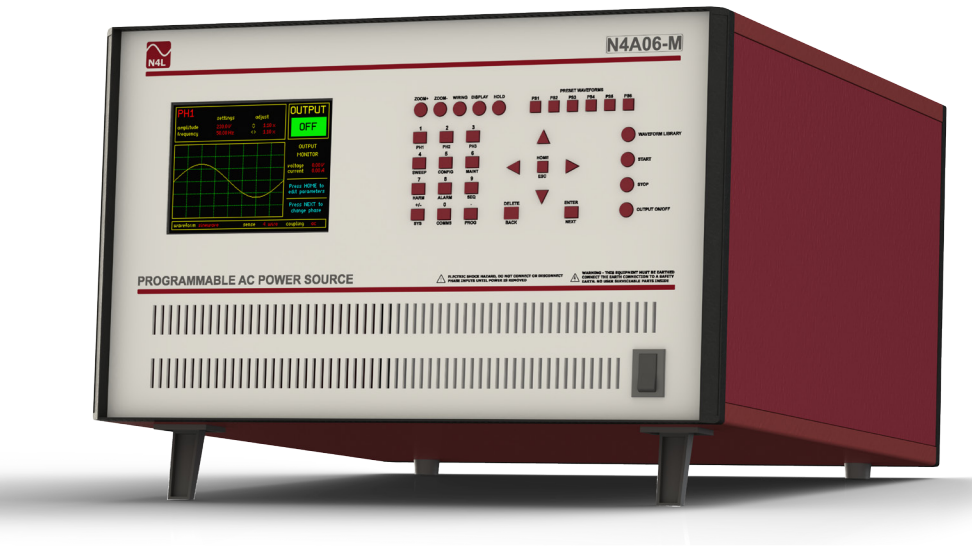
# Newtons4th Ltd

# N4A DC+AC Power Sources




**Single Phase**
**N4A03 - 3kVA**
**N4A06 - 6kVA**

**Three Phase**
**N4A18 - 18kVA**
**N4A30 - 30kVA**
**N4A67 - 67kVA**

**67kVA Variants**
**N4A67-HV**
**N4A-REGEN**

Compliant Testing In Accordance with:IEC/EN61000-3-2; -3-3; -3-11; & -3-12

Unique to N4L  On-site remote calibration on all N4A sources

| Product Overview | |
|---|---|
| Low THD | <0.3% (0.1% typical) |
| DC+AC Output | DC-1kHz (10kHz small signal bandwidth) |
| Single Phase and 3 Phase | Single Phase and 3 Phase systems available |
| EMC Compliance | IEC61000-3-2/3/11/12, IEC61000-4-11†/13/17/29† |
| Market Leading Inrush | 2x* Continuous Output for 3 seconds<br>[*1.33x for 67kVA models] |
| Fast Switch on Time | Proprietary Design |
| Versatile Interfaces | RS232, USB, LAN |
| Arbitary Waveform | Custom Arbitrary Waveform, Sequencing and More |
| Pre Set Waveforms | Stored in Hardware for Fast Recall |
| High Efficiency | >80% |
| Up to 67kVA Available | 67kVA 3 Phase Solutions |
| Full Regen | Available on 67kVA model |
| Compact Design | High Power Density |

† 1-5µS Rise / Fall time achieved with an external DIP generator, contact N4L for details.

## ■ Product Overview

N4A03 N4A06 N4A18 N4A30 N4A67 N4A67-HV N4A67-REGEN

The N4A range of Programmable AC Power Sources offer complete flexibility for a wide range of applications. All N4A sources feature dual channel arbitrary waveform generators utilising direct digital synthesis providing the user with simultaneous multiple harmonic generation, frequency sweeping and long sequencing capabilities. The metrology of the arbitrary generator permits long custom waveform sequences to be produced without a reduction in the resolution of each individual waveform. The N4A AC Source also features 10 bit vertical resolution and a maximum waveform resolution of 16,384 points to produce a single periodic waveform. There is also an internal storage function for imported custom waveforms featuring user intuitive library menus that display the waveform

## ■ Key Technical Advantages over traditional Linear Topologies

N4A03 N4A06 N4A18 N4A30 N4A67 N4A67-HV N4A67-REGEN

In the past, low distortion power sources have been restricted to the use of linear based output stage topologies. Whilst this approach offered low levels of distortion, it came with drawbacks such as poor low power factor performance, lower output power capability when the output voltage is less than "rail voltage", increased size and many more. N4L's proprietary switching design offers all of the benefits of a linear supply without the drawbacks,

### Comparison between N4L "6 Leg Modulation" and traditional linear topology*

| N4L Advanced Power Source | Traditional Linear Power Source |
|---|---|
| Market leading Inrush Current capability - 2x Rated current for up to 3 seconds | Linear designs do not typically have any significant inrush current capability and usually require "over rating" when used in applications such as motor development |
| Able to drive into loads exhibiting high crest factors | Ouput power capacity is often reduced at high crest factors |
| Able to drive into loads with very low power factor at full current over complete voltage range | Ouput power capacity is often reduced at low power factors due to heating effects within linear output section |
| Efficiency of better than 80% irrespective of type of load | Linear power sources offer lower efficiencies of around 60% |
| Intelligent IGBT output modules exhibit superior reliability, facilitated via integrated protection on Si wafer. | Tradional designs often do not feature integrated Si wafer protection |
| Very low THD equivalent to the highest performing linear amplifiers on the market, 6 leg modulation topology extends the equivalent switching frequency of the inverter | Low THD is no longer a differentiator between the linear designs and N4L 6 leg modulation approach |
| Extremely robust design as a result of power filters situated in between the active power section and the EUT | Expensive output stage is susceptible to damage |

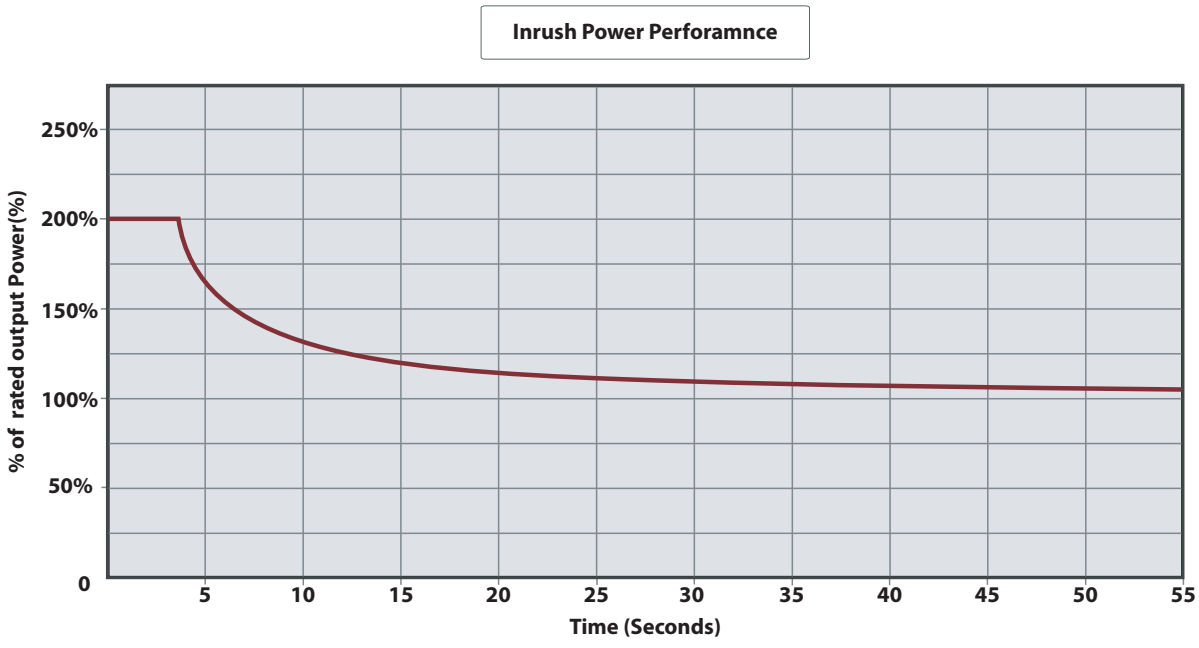
*According to N4L research, Oct 2014

## ■ True Multiple Cycle Inrush Current Capability

N4A03 N4A06 N4A18 N4A30

N4A AC Power Sources feature 3 second 200% current output overload capability (N4A67 133%), this feature is extremely useful when supplying power to devices with high inrush current such as compressors and motors. As a result there is no requirement to over size an Amplifier for short inrush currents.

### Power Overload Capability (300Vrms)



## ■ Low THD equivalent to Linear Power Sources

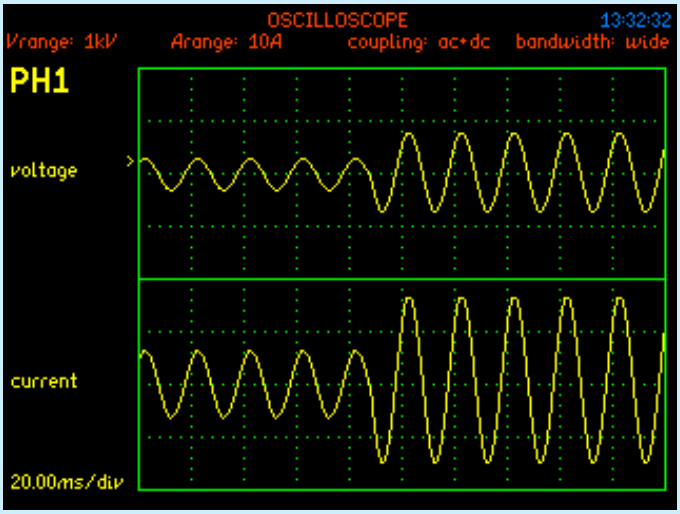
N4A03 N4A06 N4A18 N4A30 N4A67 N4A67-HV N4A67-REGEN

N4A Advanced Power Amplifiers feature proprietary noise suppression analgoue electronics known as "6 leg modulation" topology which produces an output waveform during high loads with less than 0.1% THD. This level of distortion has only previously been possible with linear power sources. Due to modern developments in amplifier design we can now offer excellent distortion in a smaller package, with higher efficiency. The ability to generate

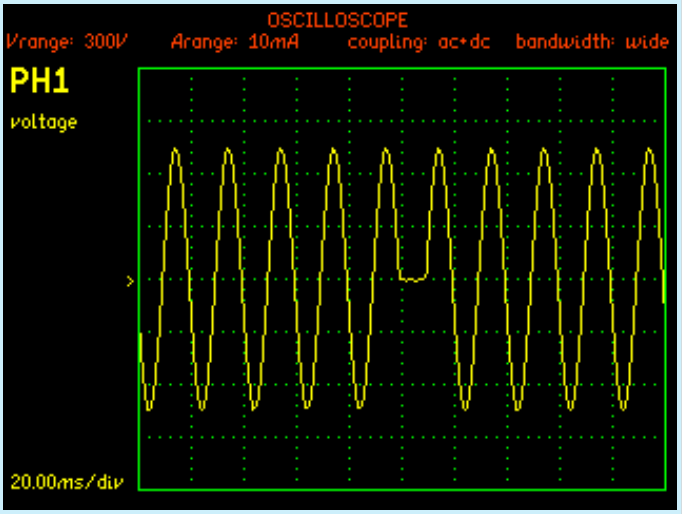
## ■ Programmable Surge/Sag and Drop out

N4A03 N4A06 N4A18 N4A30 N4A67 N4A67-HV N4A67-REGEN

The N4A Advanced Power Amplifier features a surge/sag capability, enabling the user to set both surge/sag magnitudes as well as the phase angle at which to switch to the programmed value. There is also the ability to drop out portions of a waveform.




Example Surge waveform (recorded on PPA5500 Power Analyzer), amplitude change at 0°

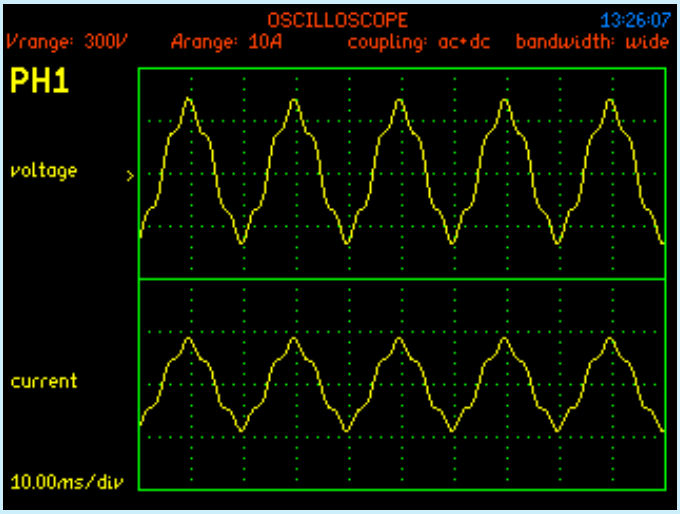



Example negative half cycle drop out

## ■ Programmable Harmonic Synthesis

N4A03 N4A06 N4A18 N4A30 N4A67 N4A67-HV N4A67-REGEN

Harmonic synthesis is performed digitally permitting excellent flexibility with respect to waveform distortion synthesis at high accuracy.

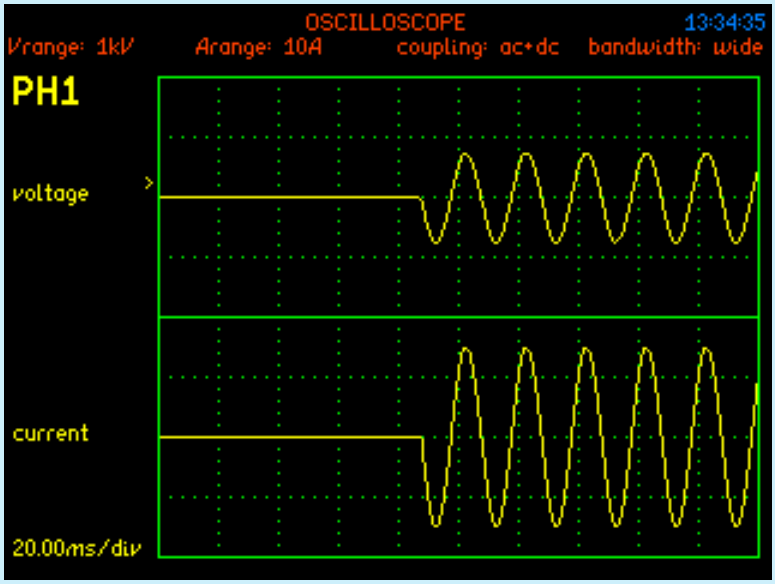



Example harmonically distorted waveform, 5th harmonic component

## ■ Specified Phase Angle Switch On

N4A03 N4A06 N4A18 N4A30 N4A67 N4A67-HV N4A67-REGEN

The N4A Advanced AC Power Sources feature a programmable "switch on" feature that enables testing of phase sensitive capacitive/inductive loads. The N4A combined with one of N4L's Precision Power Analyzers provides an

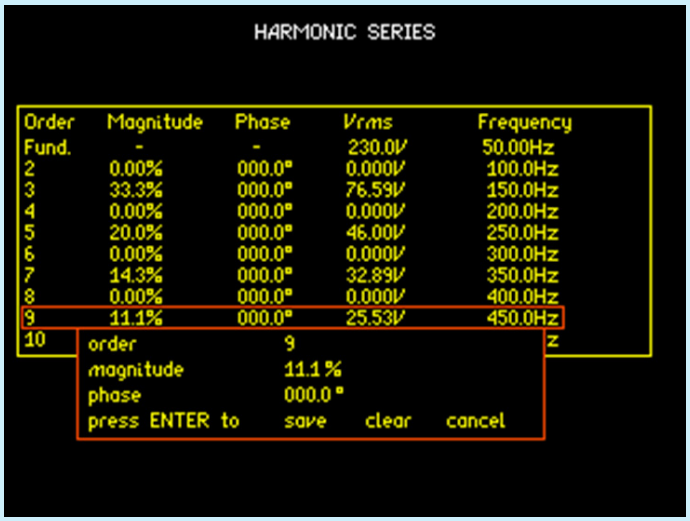



Example 180° switch on

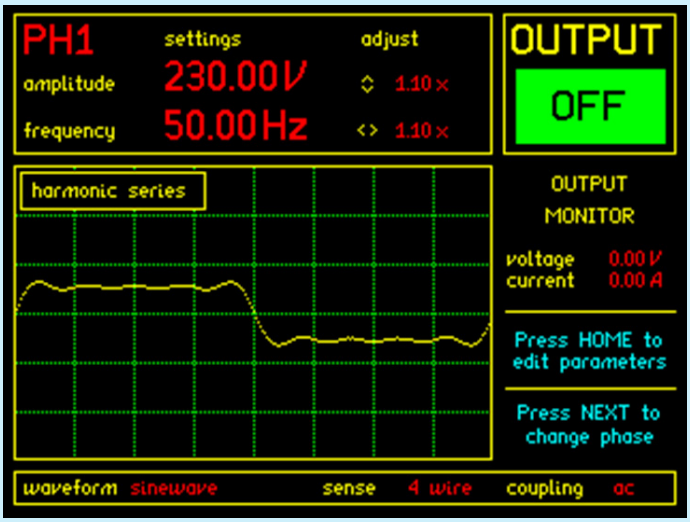
## ■ N4A PCU (Programmable Controller Unit)

N4A03 N4A06 N4A18 N4A30 N4A67 N4A67-HV N4A67-REGEN

The N4A PCU provides a wide range of output waveforms, from Harmonic synthesis to waveform sequencing. The N4A range of Advanced AC Power Sources are available with single phase (N4A03 + N4A06) and three phase (N4A18, N4A30 + N4A67) outputs.



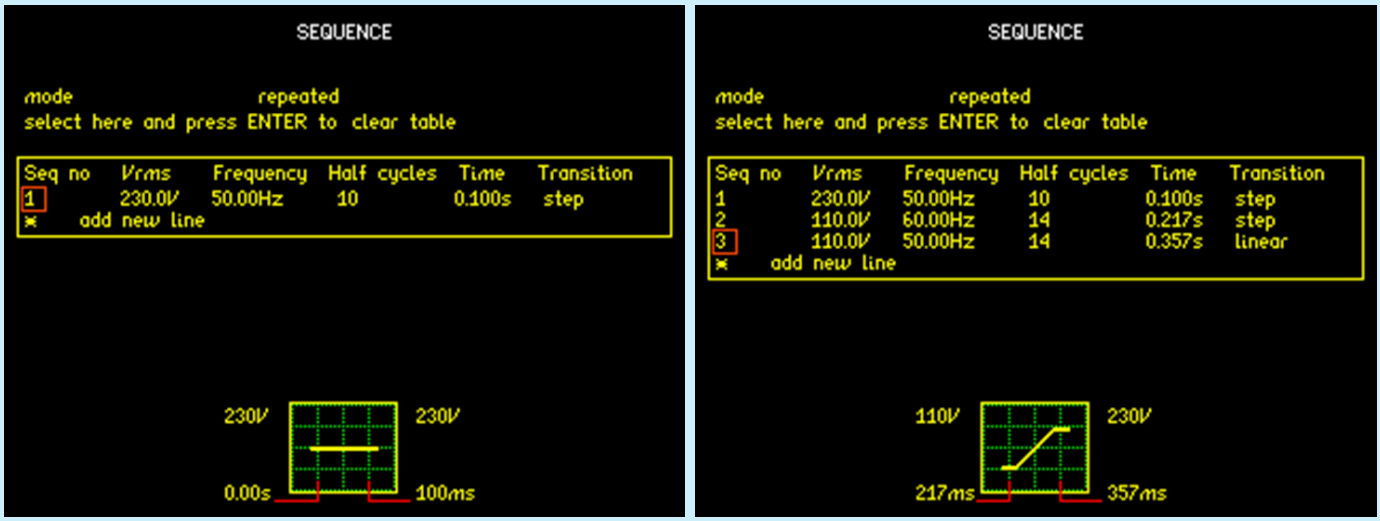

Example Harmonic Sequence entry via keyboard




Sequence display

The PCU can be programmed with either a harmonic sequence either directly from the keyboard, or remotely via the supported programing commands described in the User Manual. A total of 100 steps can be programed.

Alternatively the source can also be programed to produce simple AC sequences by describing the voltage, frequency, number of half cycles, time span, and transition type for the desired waveform.




## Programmable Controller Unit Specification

| PCU Generator | |
|---|---|
| **Output** | |
| Memory Depth | 128k Data Points |
| External Data Upload | Ability to upload external waveform capture via oscilloscope |
| Amplitude Control Resolution | Normal = 0.1Vrms ÷10 = 0.01Vrms |
| Phase Control Resolution | 0.1 deg |
| Maximum Output Frequency (Fundamental) | 1kHz |
| Maximum Output Frequency (Harmonic) | 10kHz |
| Min Slew Rate (at output of amplifier) | 3V/us |
| No of outputs | All Master units (N4A06-M, N4A18-M and N4A30-M) feature 3 outputs, providing future upgrade path to a 3 Phase system |
| Output DAC Resolution | 12 bit |
| Output Connector | BNC (Connects directly to inverter stage at rear of instrument, can be used as low voltage trigger output) |
| Waveform Run Modes | Continuous, Triggered, Sequence, Sweep |
| Sequence Length | 50 |
| Easy to Use | Intuitive user interface facilitates quick operation and fast learning time |
| **Communications** | |
| Interfaces | RS232, LAN, USB |
| Maximum Baud Rate | 19200 |

## ■ Wide Bandwidth To 10kHz for Small Signal Distortion Generation

N4A03 N4A06 N4A18 N4A30 N4A67 N4A67-HV N4A67-REGEN

The N4A series Programmable AC Power Sources offer unity gain to 1kHz and small signal bandwidth to 10kHz. With an equivalent bandwidth of 10kHz, the N4A can generate square wave signals at 300V to above 500Hz fundamental frequency.

## ■ Power Output Monitoring

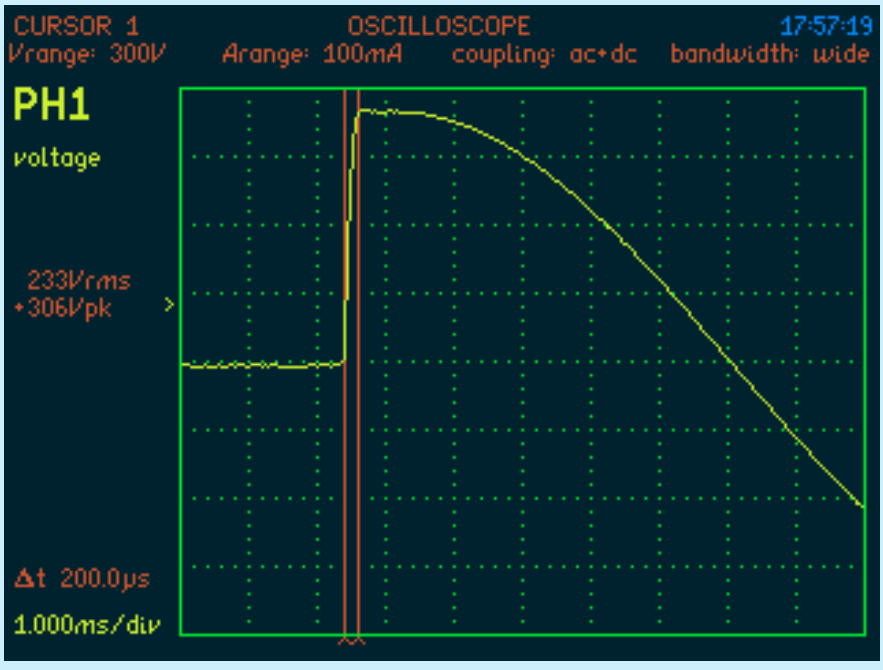
N4A03 N4A06 N4A18 N4A30 N4A67 N4A67-HV N4A67-REGEN

The N4A Advanced AC+DC Power Source provides real time monitoring of the output voltage and current on each phase. For the highest of power measurement accuracy and market leading harmonic analysis our Precision Power

## ■ Rapid Switch on Times

Due to an innovative "6 leg" output topology the N4A Advanced Power Amplifiers offer rapid switch on times as seen in the oscilloscope screenshot below.

Rapid Switch on Times



## ■ IEC61000-3-2/12 and IEC61000-3-3/11 Harmonics and Flicker

N4A06 N4A18 N4A30 N4A67 N4A67-HV N4A67-REGEN

N4A Advanced AC Power Sources offer full compliance to IEC61000-3-2/12 and IEC61000-3-3/11 (N4A06/18/30/67). Featuring very low distortion (<0.1% THD typical) and very low output impedance, the N4A range of power amplifiers can be supplied as a stand alone AC power source to be integrated into another test system or as a standalone power souce supplied with racking system direct from N4L. Alternatively, the N4A AC Power Source can be supplied along with the N4L PPA55x1 Harmonics and Flicker Analyzer and N4L IMP161, IMP163, IMP323 or IMP753 Impedance Network integrated into one complete test system. N4L are currently the only Harmonics and Flicker test system manufacturer in the world* to hold our own ISO17025 (UKAS) Accreditation for the calibration of Harmonics and Flicker Analyzers to IEC61000-3-2/12 and IEC61000-3-3/11.

*According to N4L research November 2014

## ■ Waveform Sequencing

N4A03 N4A06 N4A18 N4A30 N4A67 N4A67-HV N4A67-REGEN

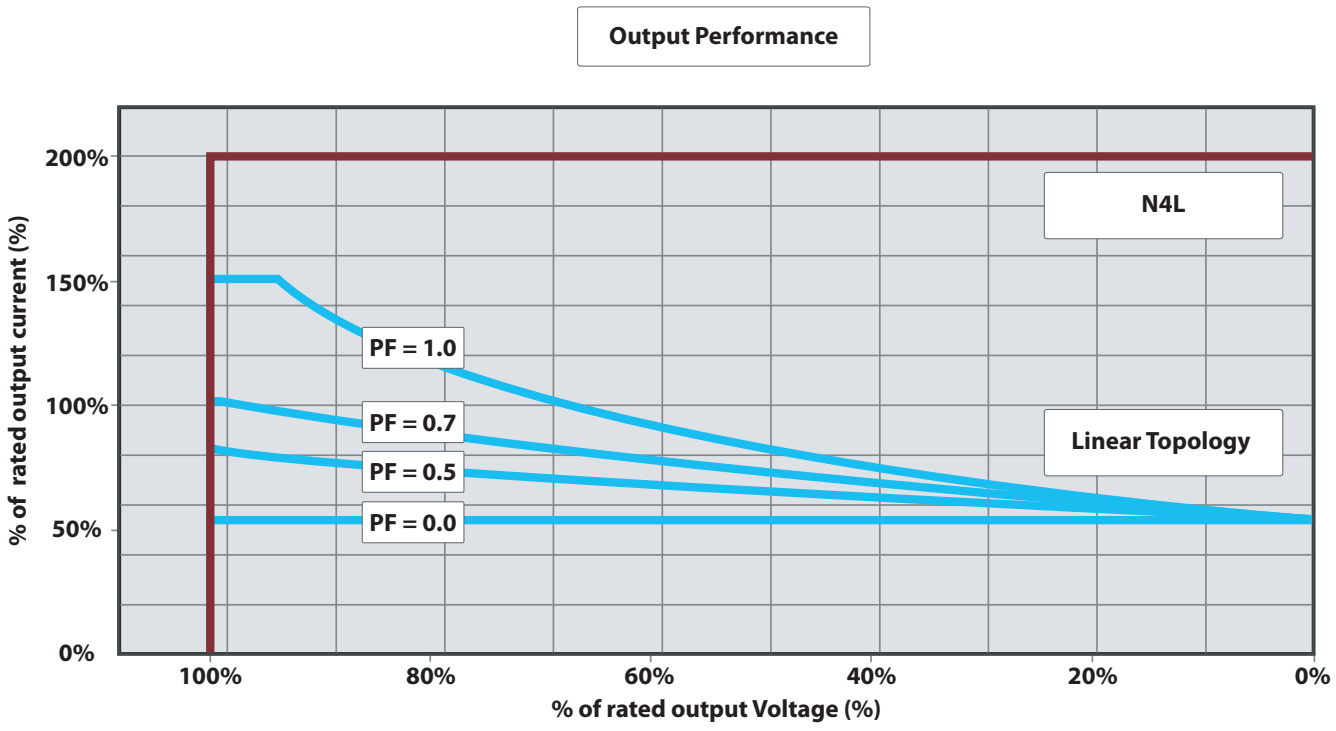
The PCU generator features a proprietary "Sequencing Mode", this mode allows the user to enter a table of parameters of which the generator will step through in sequence. Each entry in the table is specified with the related Voltage, Frequency and time before stepping through to the next entry in the sequence table.

The generator can be programed to continuously cycle through the sequence, cycle once upon an external trigger (via comms or TTL signal level) or cycle continuously upon trigger. The minimum time period at each step in any sequence is 40ms, whilst the maximum time period at each step is 12 hours.

## ■ 200% Output Current Capability at any Power Factor

N4A03 N4A06 N4A18 N4A30

N4L's proprietary switching topology not only provides excellent THD performance, the N4A power sources can also provide 200% output current for 3 seconds (N4A67 133%) and then 100% output current continuously at any power factor. This is due to significantly lower heat loss in the output switching devices, solving an unavoidable bottleneck for linear output stages.



## ■ 3 Phase AC Power Sources up to 67kVA with REGEN

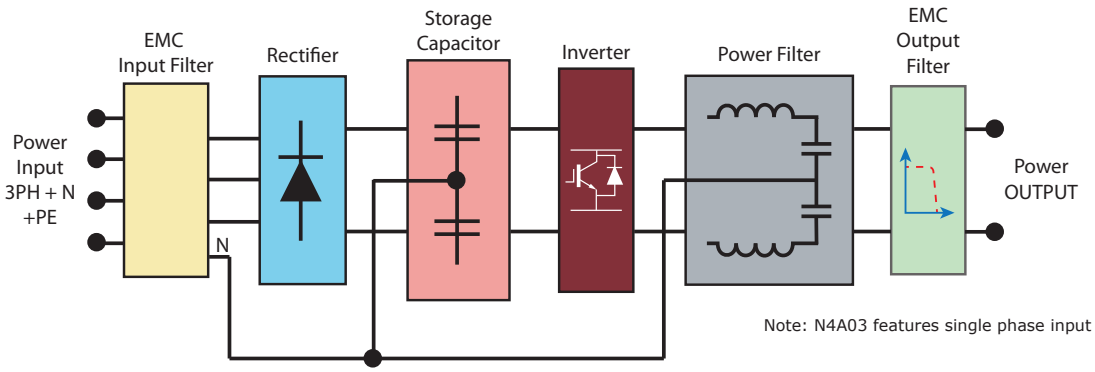
N4A18 N4A30 N4A67 N4A67-HV N4A67-REGEN

N4A Advanced AC Power Sources are available in 3 phase configurations as well as single phase configuration. Three phase systems feature a master unit (N4A18-M pictured below) and two slave units (N4A18-S pictured below), the N4A three phase configurations offer a convenient solution when servicing is required as only the master and slave units themselves need to be shipped, offering significant savings on shipment costs. All N4A three phase systems feature fully isolated outputs, very low harmonic distortion even under heavy load and the

N4A18 3 Phase AC+DC Power Source, 18kVA (6kVA per phase)

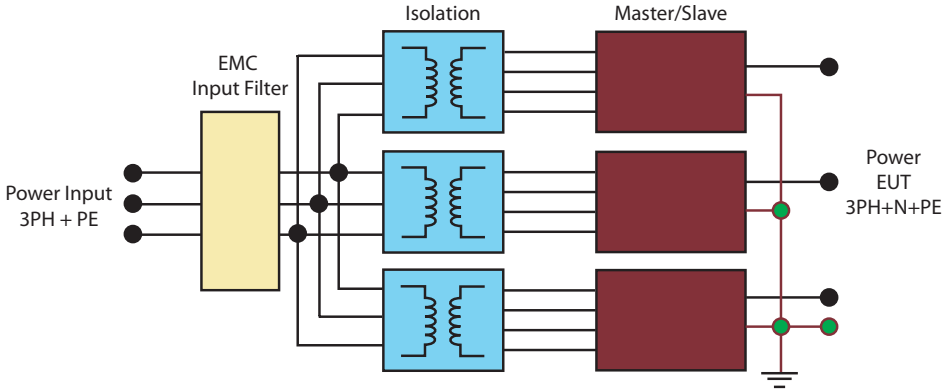
## Schematic Diagram

N4A03 N4A06




## Schematic Diagram

N4A18 N4A30 N4A67 N4A67-HV N4A67-REGEN




# IEC61000 Harmonics and Flicker Test Systems

| System Configuration | | | |
|---|---|---|---|
| Overall System Description | Single Phase 16A Harmonics and Flicker Test System | Single+Three Phase 16A Harmonics and Flicker Test System | Single+Three Phase up to 75A Harmonics and Flicker Test System |
| Compliant Standards (Limits) | IEC61000-3-2:2018+A1:2020<br>IEC61000-3-3:2013+A1:2017+A2:2021+ COR1:2022<br>IEC61000-4-11:2020 †<br>IEC61000-4-13:2002+A1:2009<br>IEC61000-4-14:1999+A1:2001+A2:2009<br>IEC61000-4-17:1999+A1:2001+A2:2008<br>IEC61000-4-28:1999+A1:2001+A2:2009<br>IEC61000-4-29:2000 †<br>IEC61000-4-34:2005+A1:2009† | IEC61000-3-2:2018+A1:2020<br>IEC61000-3-3:2013+A1:2017+A2:2021+ COR1:2022<br>IEC61000-4-11:2020 †<br>IEC61000-4-13::2002+A1:2009<br>IEC61000-4-14:1999+A1:2001+A2:2009<br>IEC61000-4-17:1999+A1:2001+A2:2008§<br>IEC61000-4-28:1999+A1:2001+A2:2009<br>IEC61000-4-29:2000 †<br>IEC61000-4-34:2005+A1:2009† | IEC61000-3-2:2018+A1:2020<br>IEC61000-3-3:2013+A1:2017+A2:2021+ COR1:2022<br>IEC61000-3-11:2017<br>IEC61000-3-12:2011+A1:2021<br>IEC61000-4-11:2020 †<br>IEC61000-4-13::2002+A1:2009<br>IEC61000-4-14:1999+A1:2001+A2:2009<br>IEC61000-4-17:1999+A1:2001+A2:2008§<br>IEC61000-4-28:1999+A1:2001+A2:2009<br>IEC61000-4-29:2000 †<br>IEC61000-4-34:2005+A1:2009† |
| Compliant Measurement Standards | IEC61000-4-7<br>IEC61000-4-15 | IEC61000-4-7<br>IEC61000-4-15 | IEC61000-4-7<br>IEC61000-4-15 |
| Output Power | 6kVA | 18kVA | 67kVA |
| Power Source | N4A06 | N4A18 | N4A67 |
| Impedance Network | IMP161 Single Phase 16A Impedance Network | IMP163 Three Phase 16A Impedance Network | IMP753 Three Phase 75A Impedance Network |
| Software Included | IECSoft IEC61000 Test Suite | | |
| Harmonics and Flicker Analyzer | N4L PPA5511 Combined Harmonics and Flicker + Power Analyzer | N4L PPA5531 Combined Harmonics and Flicker + Power Analyzer | N4L PPA5531 Combined Harmonics and Flicker + Power Analyzer |
| Current Transformers and Interface | N/A | N/A | 3 x LEM IT200-S CT<br>3 x LEM-1 Interface<br>1 x LEM-1 PSU |
| Power Measurement Parameters | W, VA, Var, pf, V & A - rms, rectified mean, AC, DC, Peak, Surge, Crest Factor, Form Factor, Star to Delta Voltage<br>Frequency (Hz), Phase (deg), Fundamentals, Impedance, - Harmonics, THD, TIF, THF, TRD, TDD - Integrated Values, Datalog, Sum and Neutral values | | |
| ISO17025 UKAS Cetification | Optional - Power Analyzer and Impedance Network Calibration | Optional - Power Analyzer and Impedance Network Calibration | Optional - Power Analyzer and Impedance Network Calibration |
| Integration of Equipment | Analyzer + Impedance Network fully integrated into rack system | | |

† 1-5µS Rise / Fall time achieved with an external DIP generator, contact N4L for details.

§ Single Phase only

## N4A67 Models

N4A67 N4A67-HV N4A67-REGEN

Standard N4A67

0-300Vrms L-N

520Vrms L-L

0-425V DC

67.5kVA

N4A67

N4A67-HV

0-360Vrms

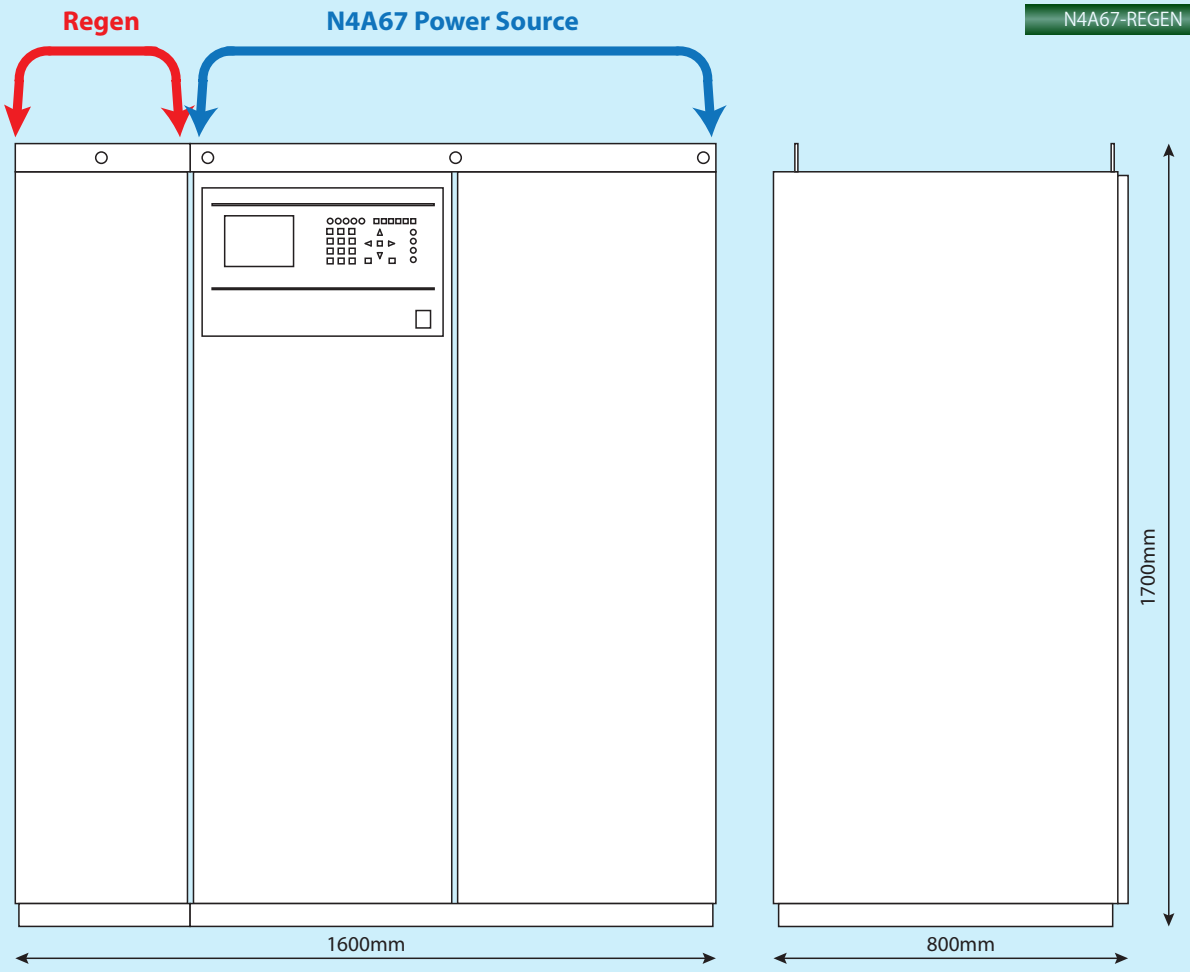
0-623Vrms L-L

0-500V DC

67.5kVA

N4A67-HV

N4A67-REGEN




N4A67-REGEN
0-300Vrms L-N; 520Vrms L-L; 452V DC; 67kVA Output; Full 67kVA Regeneration capability

# SPECIFICATION

| | N4A03 (1 Phase) | N4A06 (1 Phase) | N4A18 (3 Phase) | N4A30 (3 Phase) | N4A67 (3 Phase) |
|---|---|---|---|---|---|
| **Frequency Range** | | | | | |
| Nominal Output Power | 3,000VA | 6,000VA | 18,000VA | 30,000VA | 67,500VA |
| **Output** | | | | | |
| Output Voltage (AC) | 0-300Vrms | 0-300Vrms | 0-300Vrms | 0-300Vrms | 0-300Vrms |
| Output Voltage (DC) | 0-425V DC | 0-425V DC | 0-425V DC | 0-425V DC | 0-425V DC |
| Maximum Continuous Output Power (AC) | 3000VA | 6000VA | 18,000VA (6,000VA/phase) | 30,000VA (10,000VA/phase) | 67,500VA (22,500VA/ phase) |
| Maximum Inrush (3 Second) Output Power (DC) | 6000VA | 12000VA | 36,000VA | 60,000VA | 90,000VA |
| Maximum Output Current (Continuous) | 10Arms | 20Arms | 20Arms (Per Phase) | 33Arms (Per Phase) | 75Arms (Per Phase) |
| Maximum Output Current (Inrush) | 20Arms | 40Arms | 40Arms (Per Phase) | 67Arms (Per Phase) | 100Arms (Per Phase) |
| Output Frequency | DC - 1kHz | DC - 1kHz | DC - 1kHz | DC - 1kHz | DC - 1kHz |
| Min Slew Rate | 3V/µs | 3V/µs | 3V/µs | 3V/µs | 3V/µs |
| Output Voltage Stability | Better than 0.1% | Better than 0.1% | Better than 0.1% | Better than 0.1% | Better than 0.1% |
| Output Voltage Accuracy | Better than 0.5% | Better than 0.5% | Better than 0.5% | Better than 0.5% | Better than 0.5% |
| THD | Better than 0.3%* | Better than 0.3%* | Better than 0.3%* | Better than 0.3%* | Better than 0.3%* |
| Output Noise | <500mVrms | <500mVrms | <500mVrms | <500mVrms | <500mVrms |
| Recovery Time of Output Waveform | Better than 50µs | Better than 50µs | Better than 50µs | Better than 50µs | Better than 50µs |
| Max Compensated drop on wires (w.r.t voltage setting) | 5% | 5% | 5% | 5% | 5% |
| Recovery Time of Drop on Wires | Less than 200ms | Less than 200ms | Less than 200ms | Less than 200ms | Less than 200ms |
| Maximum Crest Factor Output (Current) | [Inrush Imax*1.41]/RMS Load Current | [Inrush Imax*1.41]/RMS Load Current | [Inrush Imax*1.41]/RMS Load Current | [Inrush Imax*1.41]/RMS Load Current | [Inrush Imax*1.41]/RMS Load Current |
| **General** | | | | | |
| Dimensions | 281mm x 471mm x 513mm | 281mm x 471mm x 513mm | 1785mm x 930mm x 755mm | 1785mm x 930mm x 755mm | 1800mm x 1200mm x 800mm |
| Weight | 30kg | 45kg | 740kg | 740kg | 1300kg |
| Input Voltage (Specify at point of order) | 220V AC +/- 10% 1PH<br>230V AC +/- 10% 1PH | 380V AC +/- 10% 3PH<br>400V AC +/- 10% 3PH<br>415V AC +/- 10% 3PH | 380V AC +/- 10% 3PH<br>400V AC +/- 10% 3PH<br>415V AC +/- 10% 3PH | 380V AC +/- 10% 3PH<br>400V AC +/- 10% 3PH<br>415V AC +/- 10% 3PH | 380V AC +/- 10% 3PH<br>400V AC +/- 10% 3PH<br>415V AC +/- 10% 3PH |
| Input Frequency | 45-65Hz | 45-65Hz | 45-65Hz | 45-65Hz | 45-65Hz |
| Operating Temperature | 0-35degC | 0-35degC | 0-35degC | 0-35degC | 0-35degC |
| Input Current | 24Arms | 16Arms Phase / 27A Neutral | 60A continuous 120A inrush / Phase | 80A continuous 160A inrush / Phase | 160A continuous 220A inrush / Phase |
| Efficiency | | Better than 80% | Better than 80% | Better than 80% | Better than 80% |
| **Specifications of N4A67-HV & N4A67-Regen where different** | | | | | |
| | N4A67-HV | N4A67-REGEN | | | |
| Output Voltage (AC) | 0-360Vrms | N/A | | | |
| Output Voltage (DC) | 0-500V DC | N/A | | | |
| Regen Power | N/A | 67kVA | | | |
| Dimensions | N/A | 1600 x 800 x 1700mm 1400kg | | | |

The N4L product range also includes Power, Frequency Response and Impedance Analyzers, Selective Level Meters and Laboratory Power Amplifiers

*At Nominal Voltage with Linear Load

## Newtons4th

Newtons4th Ltd (abbreviated to N4L) was established in 1997 to design, manufacture and support innovative electronic equipment to a world-wide market, specialising in sophisticated test equipment particularly related to phase measurement. The company was founded on the principle of using the latest technology and sophisticated analysis techniques in order to provide our customers with accurate, easy to use instruments at a lower price than has been traditionally associated with these types of measurements. Flexibility in our products and an attitude to providing the solutions that our customers really want has allowed us to develop many innovative functions in our ever increasing product range.

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