N4L Newtons4th Ltd

N4A Series

Programmable
AC Power Sources.

USER MANUAL

Version 1.09

14 May 2018

DANGER OF ELECTRIC SHOCK
Only qualified personnel should install this equipment, after reading and understanding this user manual. If in doubt, consult your supplier.

RISQUE D'ELECTROCUTION
L'installation de cet équipement ne doit être confiée qu'à un personnel qualifié ayant lu et compris le présent manuel d'utilisation. Dans le doute, s'adresser au fournisseur.

GEFAHR VON ELEKTRISCHEM SCHOCK
Nur entsprechend ausgebildetes Personal ist berechtigt, diese Ausrüstung nach dem Lesen und Verständnis dieses Anwendungshandbuches zu installieren. Falls Sie Zweifel haben sollten, wenden Sie sich bitte an Ihren Lieferanten.

RISCHIO DI SCARICHE ELETTRICHE
Solo personale qualificato può installare questo strumento, dopo la lettura e la comprensione di questo manuale. Se esistono dubbiconsultate il vostro rivenditore.

PELIGRO DE DESCARGA ELÉCTRICA
Solo personal cualificado debe instalar este instrumento, después de la lectura y comprensión de este manual de usuario. En caso de duda, consultar con su suministrador.

<u>IMPORTANT SAFETY INSTRUCTIONS</u>

This product can generate lethal voltages. Observe all 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:

- The 3-phase inputs need to be wired into the connector on the rear of the unit. Use caution and ensure that the 3-phase supply is not live when connecting or disconnecting from the unit.

- For mains powered instruments 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 two main output terminals are NOT grounded and should not be grounded under any circumstance.**

- **The maximum output from the unit is 300V AC. Switch off the amplifier and ensure that the output current has fallen to zero before connecting or disconnecting anything to / from the outputs of the unit.**

- Keep the ventilation holes on the front and rear 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.

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.

DECLARATION OF CONFORMITY

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

We declare that the product:

    Description: Programmable AC Power Source
    Product name: N4A
    Model: N4Axx Family

Conforms to the requirements of Council Directives:

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

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

March 2017

Eur Ing Allan Winsor BSc CEng MIEE
(Director Newtons4th Ltd.)

WARRANTY

This product is guaranteed to be free from defects in materials and workmanship for a period of 12 months from the date of purchase.

In the unlikely event of any problem within this guarantee period, first contact Newtons4th Ltd. or your local representative, to give a description of the problem. Please have as much relevant information to hand as possible – particularly the serial number and release numbers (press SYSTEM then LEFT).

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

This guarantee is limited to the cost of the instrument 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 instrument is re-calibrated annually. Users can perform re-calibration of the N4A if they have access to a N4L Precision Power Analyzer. Alternatively, the instrument can be returned to us for re-calibration.

ABOUT THIS MANUAL

This manual describes the general features, usage and specifications of the N4A range of Programmable AC power sources.

The N4A power source range comprises:

N4A03   -240V ac mains input, 3KVA Single Phase Output
N4A06   -Three phase input, 6KVA Single Phase Output
N4A18   -Three phase input, 18KVA Three Phase Output
N4A30   -Three phase input, 30KVA Three Phase Output
N4A67   -Three phase input, 67KVA Three Phase Output
N4A100   -Three phase input, 100KVA Three Phase Output

Optional hardware (N4A18/30/67 units only):

Parallel
          - PH1+PH2+PH3 current on a single-phase connector

HV Transformer
          - External transformer for 440Vrms Line to Neutral

Firmware version v1_19 was used for the preparation of this User Manual.

Document Version 1.09

CONTENTS

1 Introduction – general principles of operation

The N4A range of self-contained Programmable AC power sources has a number of modes and functions that share common resources such as the keyboard and display.

The instruments are normally supplied with 3-phase inputs with a choice of models that have single phase or 3-phase outputs. There is also a single phase "mains" input, single phase output version.

On single phase units, output and sense are accessed via four 4mm safety terminal. 3-phase units are provided with screw terminals.

The frequency range of the generator is from 1Hz to 10KHz. The output voltage range is 0V to 300Vrms at a frequency up to 1KHz. Above 1KHz the maximum voltage available reduces with the increase in frequency.

The output waveform type is also selectable and can be set to Sinewave, Squarewave and Triangular waveform.

Software commands are available to control the generator output from a PC using N4L software programs such as CommView2, N4ASoft and IECSoft.

Harmonic, Sequence and Sweep modes are also available. The settings for these modes are user selectable.

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

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

Getting started

The N4A is supplied calibrated and requires no further action by the user before operating the unit.

1.1   Unpacking

Inside the carton there should be the following items:

Single Phase Units:

>   one N4A unit
>   one 6" BNC to BNC cable
>   one null modem cable
>   one USB cable
>   one User / Communications manual.

3-Phase Units:

>   one N4A 3-phase unit
>   one null modem cable
>   one USB cable
>   one User / Communications manual.

Having verified that the entire above list of contents is present, it is recommended to verify that your N4A has not been damaged in transit and operates correctly.

1.2   Connecting the input supply to the N4A unit

With the exception of the mains powered N4A03, the unit requires a 3-phase supply of either 400VAC±10%, 480VAC±10% or 200VAC±10%.

Power is supplied to the N4A03 and N4A06 units through the black input connector on the rear of the unit. All units with 3-phase outputs are powered via screw terminals located on the rear.

A flat head screwdriver or similar tool must be inserted into the two tabs at the bottom of the black input connector lid to gain access. The small 'bridge' piece can then be removed to allow the supply cable to be inserted.

CAUTION: Ensure the supply cable is removed from its socket at the inlet end and can be seen to avoid the possibility of an electric shock.

The connector should be wired as:
1. Live 1
2. Live 2
3. Live 3
4. Neutral
5. Neutral
6. Safety Earth

Once these wires have been securely fastened, replace the bridge piece and close the lid.

1.3   N4A power up sequence

Ensure the rocker switch on the front of the unit is set to position 0. Switch on the 3-Phase input to the N4A by setting the rotary "Power" switch on the rear of the unit to position 1.

Power to the instrument is now controlled by the rocker switch on the front panel. Switch on the N4A.

The instrument will begin by displaying the *sign*-on screen. The firmware and model numbers are displayed, as well as a number of user-definable strings (See 9.2). The display will then default to the output summary screen and after a few seconds amplifier status data will start being received and displayed.

The N4Axx-M contains a 3-phase waveform generator unit. Outputs of the generator are located at the back of the instrument and are labelled "Generator Output – PH1, PH2, PH3". The reference input to the power amplifier is located below the outputs and is labelled "PH1 IN". The 6 inch BNC cable must be connected between the PH1 output and PH1 input for any signal to be present at the main amplifier output.

The generator is off by default, but the *OUTPUT MONITOR* may show a small voltage reading (100mV) due to the tolerance of the measurement device.

1.4   Amplifier output

Although the output terminals are not the conventional high and low, for clarity the left hand (BLACK) terminal can be considered as the positive and the right hand (BLUE) as the negative terminal.

1.5   Output warnings

It should be noted that the two main output terminals on the amplifier are NOT grounded and should not be grounded under any circumstances.

The three HI output terminals on a 3-Phase unit MUST NOT be connected to the same point under any circumstances.

In the event of any problem with this procedure, please contact customer services at Newtons4th Ltd. or your local authorised representative: contact addresses and telephone numbers are given in the appendix at the back of this manual.

N4A Series User Manual

2 Using the menus

The N4A is a versatile instrument with many configurable parameters. These parameters are accessed from the front panel via a number of menus.

Each of the main menus may be accessed directly from a specific key.

KEY	FUNCTION
PH1	PH1 generator output settings
PH2	See PH1, Available on 3-phase versions only.
PH3	See PH1, Available on 3-phase versions only.
SWEEP	This option is not presently available
CONFIG	Amplifier settings such as sense and coupling
MAINT	Time since last maintenance of each phase
HARM	Adding harmonics to a waveform
ALARM	This option is not presently available
SEQ	Creating a sequence of amplitudes and frequencies
SYS	General system options such as communications recall, display brightness and keyboard beep.
COMMS	Communications options (USB / LAN / Serial)
PROG	Recall, store and delete non-volatile programs.

Each menu starts with the currently set parameters visible but no cursor. In this condition, pressing the menu key again or the HOME key aborts the menu operation and reverts back to normal operation.

To scroll through parameters, press the UP or DOWN key to move the cursor through the menu. Pressing ENTER or using the numerical keypad allows the user to edit the parameter highlighted by the cursor. In this condition, the keys take on their secondary function such as numbers 0-9 or +/-.
Pressing the HOME key once removes the cursor from the display. Pressing the HOME key a second time exits the current menu and reverts back to the summary display.

Parameters can also be altered from the main summary display screen. To change a parameter, first press the HOME key to bring up the cursor. Scroll through parameters by using the UP and DOWN arrow keys and edit by pressing ENTER or a numerical key. Remove the cursor with the HOME key, at this point a voltage or frequency step can be performed by using the arrow keys. The UP and DOWN arrow keys step the output voltage up or down by the multiplier parameter displayed. Frequency can also be stepped up or down by using the LEFT and RIGHT arrow keys.

To abort the menu sequence, press the HOME key twice.

There are three types of data entry:

> selection from a list
> numeric
> text

In addition, there is a special entry mode for table creation.

2.1   Selection from a list

This data type is used where there are only specific options available such as the coupling may be '2-wire' or '4-wire'.

Use the UP and DOWN arrow keys to move the cursor through the menu items, Either ENTER or RIGHT can be used to open the drop-down list for a highlighted item.

The number keys 0-9 step directly to that point in the list, which provides a quick way to jump through long lists. The ENTER key should then be pressed to confirm a selection.

2.2   Numeric data entry

Frequency and Voltage parameters are entered as real numbers.

Real numbers are entered using the number keys, decimal point key, or +/- key (if signed value is permitted). When the character string has been entered, pressing the ENTER key sets the parameter to the new value. Until the ENTER key is pressed, pressing the HOME key aborts the data entry and restores the original number.

If a data value is entered that is beyond the valid limits for that parameter then a warning is issued and the parameter set as close to the requested value as possible. For example, the maximum frequency of the N4A source is 10 KHz; if a value of 15 KHz is entered, a warning will be given and the frequency set to the maximum of 10 KHz.

When the parameter is first selected there is no character cursor visible – in this condition, a new number may be entered directly and will overwrite the existing number.

To edit a data value rather than overwrite it, press the RIGHT key and a cursor will appear. The cursor can be moved using the LEFT and RIGHT keys. New characters are inserted at the cursor position as the keys are pressed, or the character before the cursor position can be deleted with the DELETE key.

Data values are always shown in engineering notation to at most 5 digits (1.0000-999.99 and a multiplier).

2.3   Text entry

There are occasions where it is useful to enter a text string; for example, a non-volatile program may have some text as a title.

Text is entered by selecting one of 9 starting characters using the Setup keys / Numeric keypad (Section 4.3), then stepping forwards or backwards through the alphabet with the UP and DOWN keys.

Keys 2 to 9 and +/- provide starting letters A,D,G,J,M,P,T,W and space. For example, the letter C is entered by pressing the 2 / PH2 key three times.

The UP and DOWN keys step forward and backward using the ASCII character definitions – other printable characters such as # or ! can be obtained by stepping on from the space. The available character set is given in the Appendix.

When entering alphabetic characters, the PROG key selects upper and lower case respectively for the character preceding the cursor and the next characters to be entered.

The editing keys, RIGHT, LEFT, DELETE and ENTER operate in the same way as for numeric entry.

2.4   Table entry

For the SWEEP, HARM and SEQ menus, data is entered into a table. As some of these tables can have up to 100 entries, the whole table is not always visible on the display.

By pressing the DOWN arrow, the cursor can be used to highlight each value in a table. To bring up the parameters held in a highlighted cell, press ENTER. Values within that cell are then edited in the same way as in any other menu. Once new values have been chosen, highlight the SAVE option within the box and press ENTER. You will now see the new values stored within the table.

3 Using remote control

The N4A is fitted with RS232, USB serial and LAN communication ports as standard. All the interfaces use the same ASCII protocol.

	Rx expects	Tx sends
RS232	carriage return (line feed ignored)	carriage return and line feed
USB	carriage return (line feed ignored)	carriage return and line feed
LAN	carriage return (line feed ignored)	carriage return and line feed

All three communications ports offer the same functionality i.e. firmware upgrades, reading and writing parameters.

The commands are not case sensitive and white space characters are ignored (e.g. tabs and spaces). Replies from the N4A are always upper case, delimited by commas, without spaces.

Only the first six characters of any command are important – any further characters will be ignored. For example, the command to set the generator frequency is FREQUE but the full word FREQUENCY may be sent as the redundant NCY at the end will be ignored.

Fields within a command are delimited by comma, multiple commands can be sent on one line delimited with a semi-colon e.g.
        MODE,DC; AMPLIFIER,SENSE,WIRE2

Mandatory commands specified in the IEEE488.2 protocol have been implemented, (e.g. *IDN? *RST) and all commands that expect a reply are terminated with a question mark.

The N4A maintains an error status byte consistent with the requirements of the IEEE488.2 protocol (called the standard

event status register) that can be read by the mandatory command *ESR? (See section 4.1).

The N4A also maintains a status byte consistent with the requirements of the IEEE488.2 protocol, that can be read by the mandatory command *STB? Over RS232 or LAN (see section 5.2).

RS232 data format is: start bit, 8 data bits (no parity), 1 stop bit. Flow control is RTS/CTS (see section 5.2); baud rate is selectable via the COMMS menu. When connecting to a PC use the supplied null modem cable.

A summary of the available commands is given in the Appendix. Details of each command are given in the communication command manual.

Commands are executed in sequence except for two special characters that are immediately obeyed:

Control T (20) – reset interface (device clear)

Control U (21) – warm restart

3.1 Standard event status register

PON		CME	EXE	DDE			OPC

bit 0 OPC   (operation complete)
        cleared by most commands
        set when data available or sweep complete
bit 3 DDE   (device dependent error)
        set when the instrument has an error
bit 4 EXE   (execution error)
        set when the command cannot be executed
bit 5 CME   (command interpretation error)
        set when a command has not been recognised
bit 7 PON   (power on event)
        set when power first applied or unit has reset

The bits in the standard event status register except for OPC are set by the relevant event and cleared by specific command (*ESR? *CLS, *RST). OPC is also cleared by most commands that change any part of the configuration of the instrument (such as MODE or START).

3.2   Serial Poll status byte

		ESB	MAV		FDV	SDV	RDV

bit 0 RDV   (result data available)
        set when results are available to be read as
        enabled by DAVER

bit 1 SDV   (sweep data available)
        set when sweep results are available to be read as
        enabled by DAVER

bit 2 FDV   (fast data available (streaming))
        set when data streaming results are available to be
        read as enabled by DAVER

bit 4 MAV (message available)
        set when a message reply is waiting to be read

bit 5 ESB   (standard event summary bit)
        set if any bit in the standard event status register
        is set as well as the corresponding bit in the
        standard event status enable register (set by
        *ESE).

3.3   RS232 connections

The RS232 port on the N4A uses the same pinout as a standard 9 pin serial port on a PC or laptop (9-pin male 'D' type).

Pin	Function	Direction
1	DCD	in (+ weak pull up)
2	RX data	in
3	TX data	out
4	DTR	out
5	GND	
6	DSR	not used
7	RTS	out
8	CTS	in
9	RI	not used

The N4A will only transmit when CTS (pin 8) is asserted, and can only receive if DCD (pin 1) is asserted. The N4A constantly asserts (+12V) DTR (pin 4) so this pin can be connected to any unwanted modem control inputs to force operation without handshaking. The N4A has a weak pull up on pin 1 as many null modem cables leave it open circuit. In electrically noisy environments, this pin should be driven or connected to pin 4.

To connect the N4A to a PC, use a 9 pin female to 9 pin female null modem cable:

```
1 & 6  -      4
    2  -      3
    3  -      2
    4  -      1 & 6
    5  -      5
    7  -      8
    8  -      7
```

4   Keyboard functions

The keyboard is divided into 5 blocks of keys:

    Preset waveform keys (six keys top right)
    Menu control (cursor) keys (seven centre keys)
    Display control keys (five keys top left)
    Setup keys and numeric keypad (twelve keys lower left)
    Control keys (four keys lower right)

In normal operation, the cursor keys give one-touch adjustment of the frequency and voltage parameters without having to access the menu system. The left / right cursor keys adjust the frequency whilst the up / down cursor keys adjust the voltage levels.

The Setup keys and numeric keypad provide access to the menus and are used for numeric data entry.

4.1   Preset waveform keys

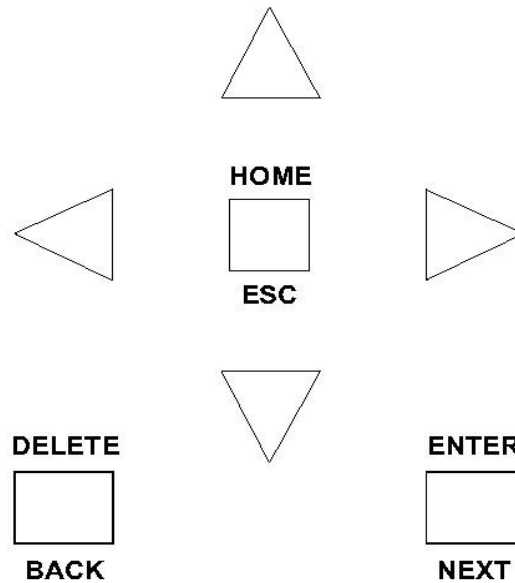| PS1 | PS2 | PS3 | PS4 | PS5 | PS6 |
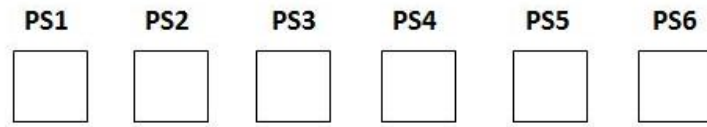
This row of preset keys is used to recall saved programs from internal non-volatile memory. For the keys to perform this operation, the user must first assign a saved program to a key. To assign a program to a key, by entering the *preset key* menu, press the PROG key and then RIGHT arrow.

Further details of assigning these keys can be found in section 10.1.2.

Menu control (cursor) keys

```
              △
            HOME
  ◁          □          ▷
            ESC

            ▽
  DELETE              ENTER
   □                  □
  BACK                NEXT
```

**ENTER/NEXT** confirms a selection or parameter value/data entry. Also allows the user to move between home screens for each phase.

HOME/ESC returns to the original entry or to a previous action.

DELETE/BACK removes a previous selection or value, or returns to your previous action.

ARROW KEYS (Up, Down, L, R) to move around menu options, make incremental/decremental changes etc.

4.2   Display control keys
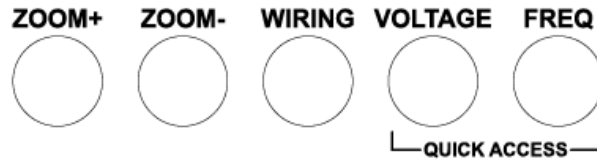
4.2.1   ZOOM+ and ZOOM-

These keys are currently non operational.

4.2.2   WIRING

1-phase is displayed on a single phase instrument.

On a 3-phase instrument, 1-phase or 3-phase options will be available.

4.2.3   VOLTAGE

This shortcut key highlights the cursor over the voltage parameter on the HOME screen, allowing the user to update the output voltage.

4.2.4   FREQ

This shortcut key highlights the cursor over the fundamental frequency parameter on the HOME screen, allowing the user to update the output voltage. This key has no function when the N4A is in DC mode.

4.3   Setup keys and numeric keypad
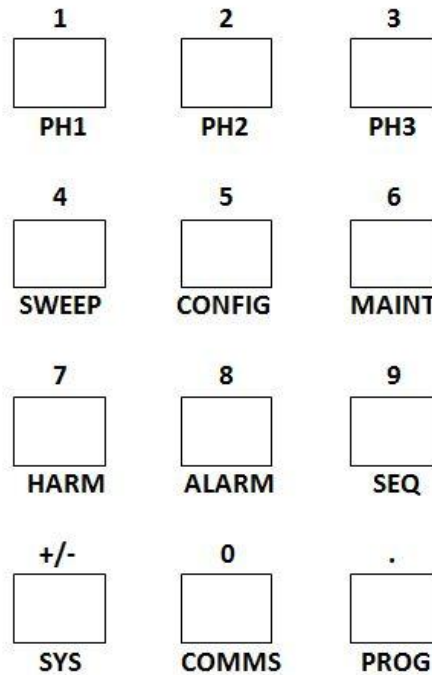
4.3.1   Setup keys

These keys provide access to various N4A parameters.

4.3.1.1 PH1

This key is used to set the main output voltage and frequency of the PH1 amplifier. The MODE of operation is also set within this menu. Other mode specific settings will be displayed.

4.3.1.2   PH2

This key is used to set the output voltage and frequency of the PH2 amplifier; in addition, the PH2 phase offset can be set in relation to PH1.
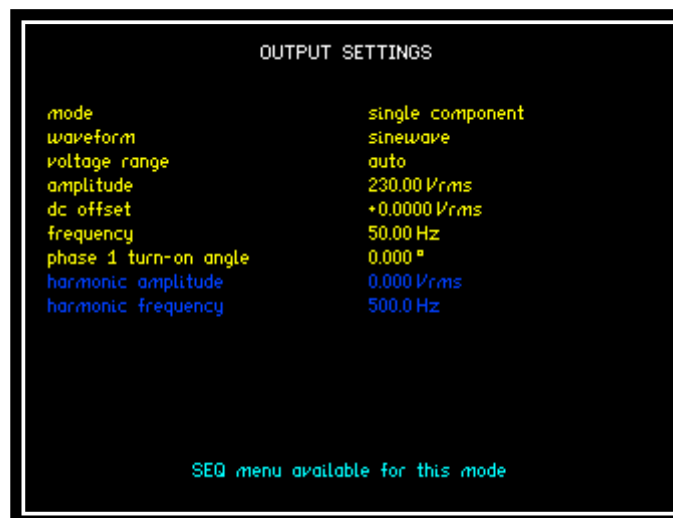
4.3.1.3   PH3

This key is used to set the output voltage and frequency of the PH3 amplifier; in addition, the PH3 phase offset can be set in relation to PH1.

4.3.1.4   SWEEP

This key is currently non operational. This function will be added at a later date.

4.3.1.5   CONFIG

This key is used to access amplifier specific settings, such as coupling and sense.

4.3.1.6   MAINT

This key will display the time since the last service. For 3-phase instruments the time for each phase will be displayed.

4.3.1.7   HARM

This key allows access to the harmonic series creator and is currently only available in HARMONIC SERIES mode. This mode allows the addition of up to 99 harmonics, of independent magnitude and phase, to a sinewave.

As this menu is not available in all modes, the following message may be displayed when the HARM key is pressed:
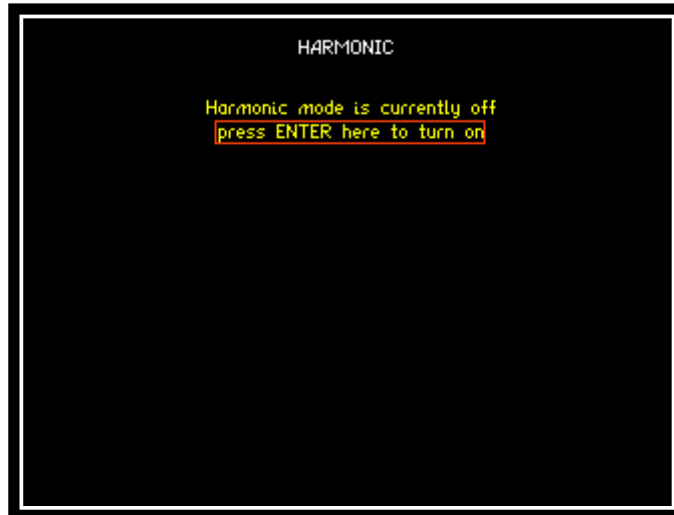
This reminds the user that the N4A mode has to be updated to use the HARM menu. Use the DOWN arrow to highlight the text shown above, press ENTER to update the MODE and show the menu.

4.3.1.8   ALARM

This key is currently non operational. This function will be added at a later date.

4.3.1.9   SEQ

Sequence mode enables the user to generate a table of output voltage and frequency values and to specify the time each entry is present at the output. This table of entries can be executed once or cycled through continuously. See section 7.8 for a detailed view of this menu.

4.3.1.10   SYS

This key displays various system parameters such as display brightness and keyboard beep.

4.3.1.11   SYS

This key displays various system parameters such as display brightness and keyboard beep. Use the LEFT and RIGHT arrow keys to access user data and system information from this menu.

4.3.1.12   COMMS

Use this key to change communication port.

4.3.1.13   PROG

Use this key to store and recall N4A parameters, as a single block of data.

4.3.2   Numeric entry

Use ***ENTRY KEYS*** for number, multiplier, decimal point, or +/− to enter parameter value.

Press ENTER (***MENU CONTROL KEYS)*** to set value.

Press HOME (***MENU CONTROL KEYS)*** to abort data entry, restore original.

(Values may be overwritten, or edited by use of the R, L and DELETE keys)

4.4   Control keys

WAVEFORM LIBRARY

START

STOP

OUTPUT ON / OFF
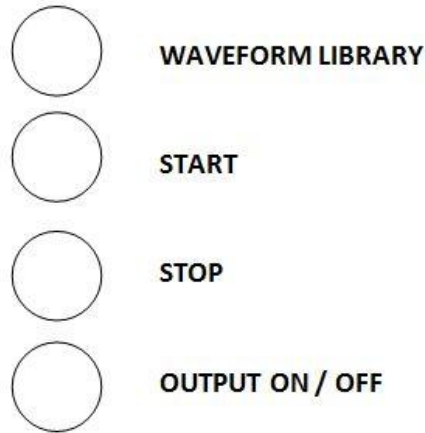
4.4.1   WAVEFORM LIBRARY

This key is currently non-operational and will be added at a later date.

4.4.2   START

Press this key to start a sequence or to update the output waveform in harmonic series mode.

4.4.3   STOP

Press this key to stop a sequence.

4.4.4   OUTPUT ON/OFF

To turn on the generator output press and hold this button until the output switches on. Press and release this key to turn off the amplifier. This should be done from the HOME screen.

5 Program settings

The PROG menu allows the user to save all instrument settings to a non-volatile memory location. Any sequence data entered into a table is also saved within the program.
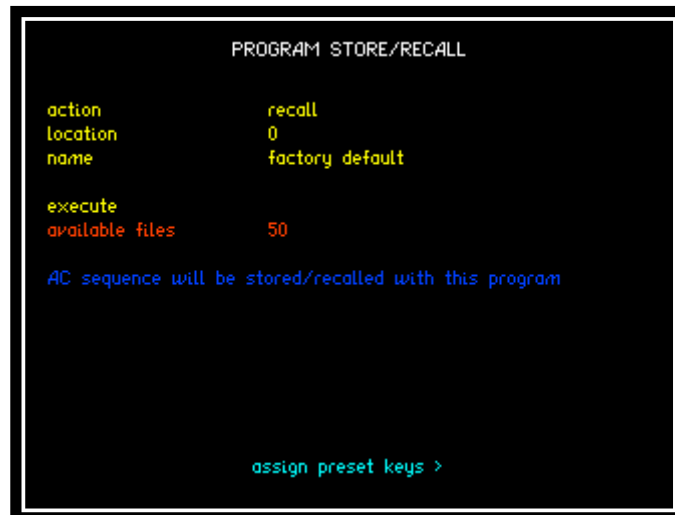
5.1 Store/recall

The steps for saving or recalling a program are shown below:

1. Press the PROG button to open up program store / recall mode.
2. Select the action to be taken – store, recall or delete.
3. Select the location that is to be recalled from, stored to or deleted from, there are 50 locations available.

Location 0 = FACTORY DEFAULT and cannot be changed.
Location 1 = Programs stored within program location 1 can be automatically recalled when the instrument is switched on.

4. 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.

5. Remember to scroll down to EXECUTE and press ENTER to validate your selection / action.

5.2   Power on program

The instrument will power up with program settings in one of three states:

> Program 1
> Factory default
> As last used

The power on program option is set in the SYS menu under initial settings.

5.2.1   Program 1

The instrument first looks for a valid program saved in memory location 1 and then if able to, loads it as the active configuration.

If program 1 is empty, the default program is loaded

5.2.2   Factory default

This is the default set up of the N4A and cannot be changed by the user.

5.2.3   As last used

The instrument saves the active instrument configuration in non-volatile memory. This means the instrument settings will not be effected by cycling the power.

6 Display Layout and Parameter adjustment

The default display or HOME screen provides a quick reference view of the fundamental N4A settings. There is a dedicated view for each output phase, which can be accessed using the NEXT and BACK keys.
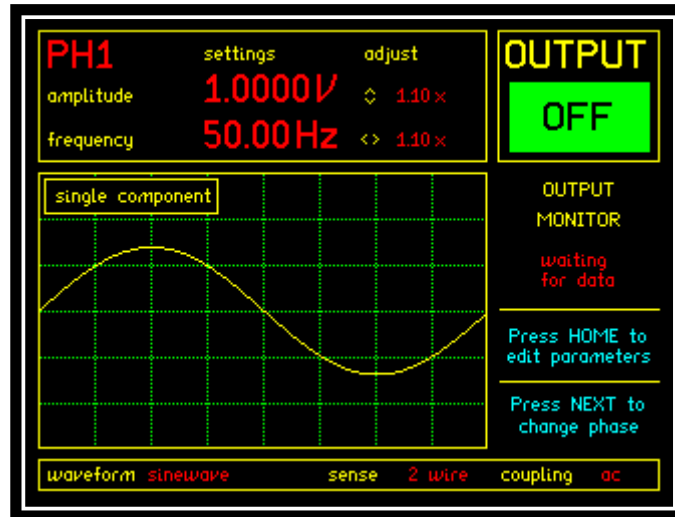
6.1   Layout Breakdown

6.1.1   Generator settings

The box on the top left of the screen displays the amplitude, frequency and step size for the indicated phase.

6.1.2   Mode and Waveform

The central window displays the selected mode along with a corresponding waveform.

Note: The waveform display is not an accurate representation of the output; it is simply a quick reference.

6.1.3   Output Monitor

The top right hand corner of the display indicates the state of the amplifier output relay. On 3-phase units, there is a separate relay for each output and a corresponding OUTPUT display. Voltage and current readings taken at the output

terminals are displayed below this indicator. If an amplifier alarm becomes active, such as overvoltage, the readings are replaced by a warning message.

6.1.4 Help and Information

The Help and information text displayed in light blue gives mode-dependant warnings, which may flash to remind the user that they have not completed a particular operation.

6.1.5 Further Settings

The box at the bottom of the display allows the user to update the waveform (mode permitting), sense and coupling can also be updated for each phase.

6.2 Direct Parameter Adjustment

From the HOME screen it is possible to edit the parameters displayed, allowing quick access to fundamental N4A settings. There are two ways this can done.

6.2.1 Step Adjustment

The arrow keys are used to change the amplitude and frequency parameters, without entering a menu. The step size is set by the two ADJUST values shown to the right of these parameters. For example, 230V x 1.1 becomes 253V when the UP arrow is pressed.

6.2.2 Direct Adjustment

Pressing the HOME / ESC key brings up the cursor and allows the user to scroll through editable parameters with the UP and DOWN keys. Changing settings is performed in the same way as in a menu.

Press the HOME / ESCAPE key to exit the adjustment screen.

7 Modes of operation

The N4A currently has five modes of operation:

> Single component
> Harmonic series
> Dual component
> DC only
> IEC61000-4-13
> UL2231

In each mode certain features, such as sequence, may or may not be available.

Mode	Available feature		
	Harm	Seq	Sweep
Single component	x	**Y**	x
Harmonic series	**Y**	x	x
Dual component	x	x	x
DC only	x	**Y**	x
IEC61000-4-13	x	x	x
UL2231	x	x	x

7.1 Single component

This mode can be used to generate simple waveforms, such as sine, triangle and square with no harmonics. For single-phase units the PH1 key should be used to edit fundamental voltage and frequency. For 3-phase units PH1, PH2 and PH3 keys give access to settings for their corresponding phase outputs.

To enter the output settings menu press the PH1 key.

```
                    OUTPUT SETTINGS

mode                        single component
waveform                    sinewave
voltage range               auto
amplitude                   230.00 Vrms
dc offset                   +0.0000 Vrms
frequency                   50.00 Hz
phase 1 turn-on angle       0.000 °
harmonic amplitude          0.000 Vrms
harmonic frequency          500.0 Hz



               SEQ menu available for this mode
```
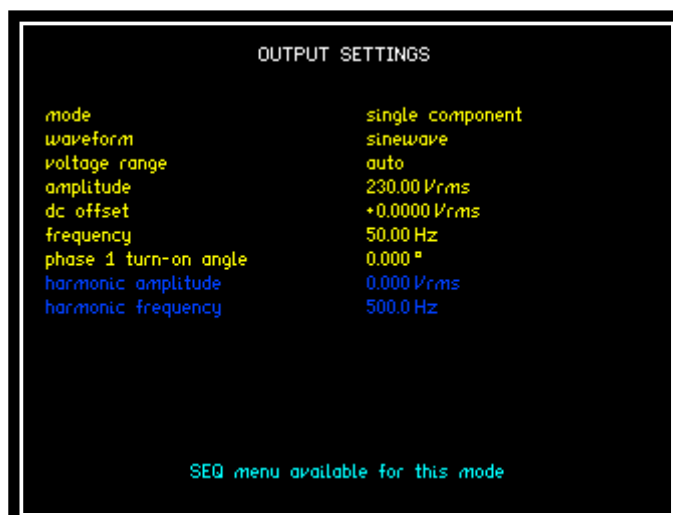
7.1.1   Voltage setting

To change the value of the RMS output voltage, select *amplitude* using the arrow keys, enter the desired value with the keypad and then press enter. Values between 0 and 300Vrms can be entered.

7.1.2   DC offset

A dc offset can be applied to the AC output of the N4A by using the *dc offset* parameter. A range of +400V to -400V is available.

7.1.3   Frequency setting

The frequency setting is accessed in the same way as voltage, through the PH1 menu. A frequency range of 1Hz to 10 KHz is available.

7.1.4   Range setting

The instrument has two voltage ranges of 30V and 300V. The output can be fixed to either of these ranges by selecting them from the *voltage range* menu item. Alternatively, the instrument can automatically select the most appropriate range when *voltage range* is set to auto.

7.1.5　　Phase 1 turn on angle

This parameter allows the user to set the phase angle at which the N4A output turns on. The PPA oscilloscope image below shows a 3-phase N4A starting up at +90°. Values between 0° and +360° are valid for this option.
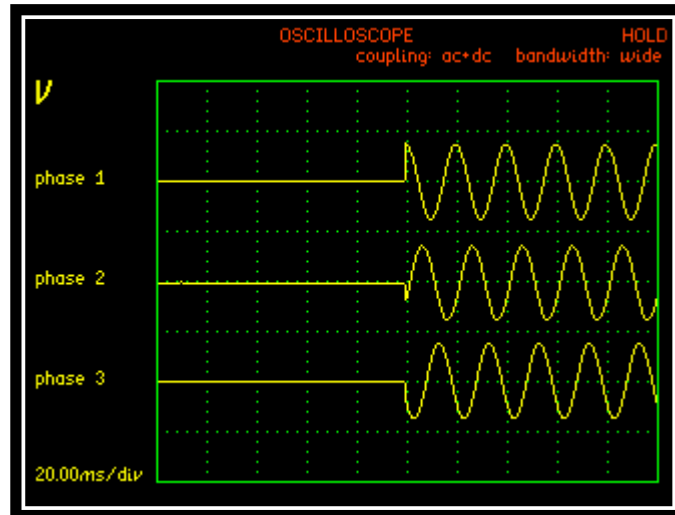
N4A18 with +90° turn on angle

7.1.5.1　Setting a DC offset Voltage

It is possible to apply a DC offset to the AC sinewave output of the N4A source. The nominal accuracy of the applied DC level is +/- 500mV so where necessary slight adjustments to the DC output of the Source will need to be made to obtain the required offset. The DC level can be monitored using the True RMS Voltmeter mode on a PPA connected to the Output terminals of the Source.

Instrument Setup details:

Press the Config button on the Source to display the Configuration menu.
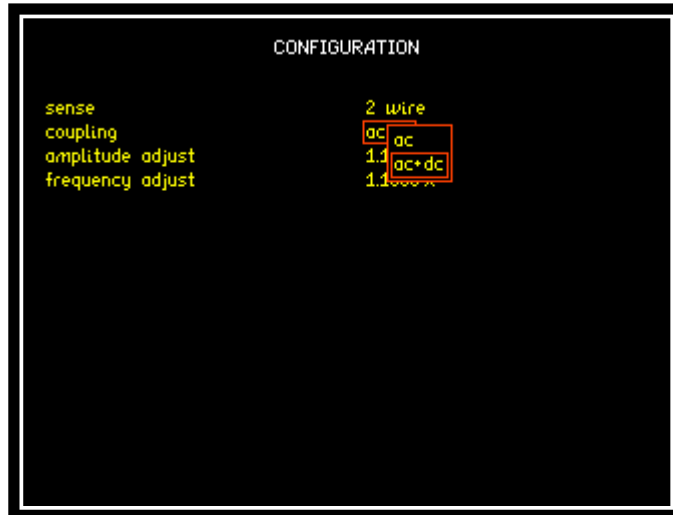
Using the arrow keys highlight the coupling option and then select "*ac+dc*" from the drop down menu. Press the ENTER button twice to return to the default display.

Press the PH1 key to display the Output Settings Menu.
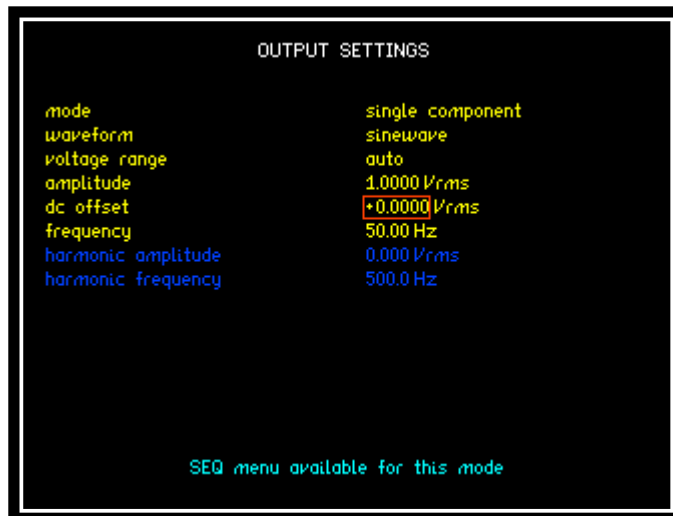
Check that the mode is set to Single component.
Use the arrow keys to highlight the required parameter in the menu to be set. Type in the required value and press enter. Use the arrow keys to select the next parameter and repeat the process. The required Amplitude, Frequency and DC offset need to be entered:
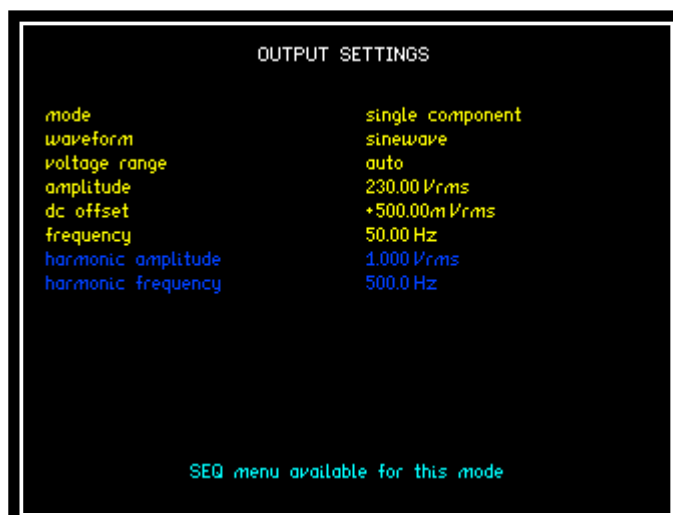
Press the enter button to return to the default screen. Check that the PPA is connected and set to RMS Voltmeter mode. Hold down the Output On/Off key for a second until the Output turns on.
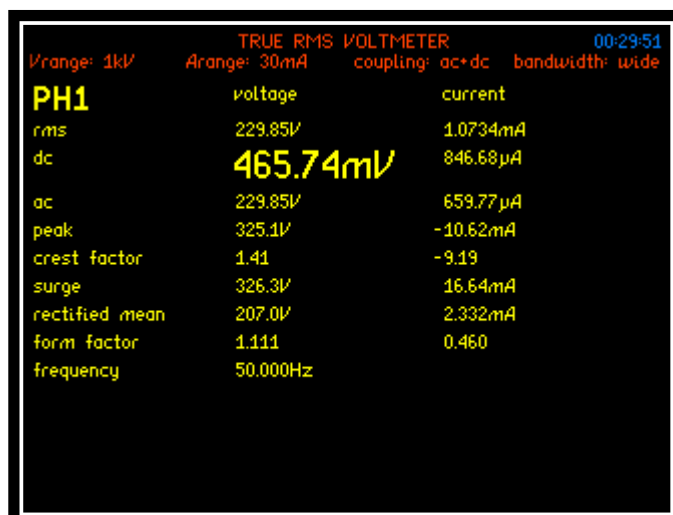
Observe the DC level displayed on the PPA. If necessary press the PH1 key on the Source to return to the Output Settings menu. Use the process above to make slight adjustments to the DC Offset value until the required DC level is displayed on the PPA.

7.2   Harmonic series

Harmonic series mode allows the addition of multiple harmonic components to a sine wave. This is achieved through the HARM menu by creating a table of magnitudes and phases for individual harmonic components.

```
                    OUTPUT SETTINGS

  mode                      harmonic series
  waveform                  sinewave
  voltage range             auto
  amplitude                 230.00 Vrms
  frequency                 50.00 Hz
  phase 1 turn-on angle     0.000 °




            Use the HARM menu for this mode
```
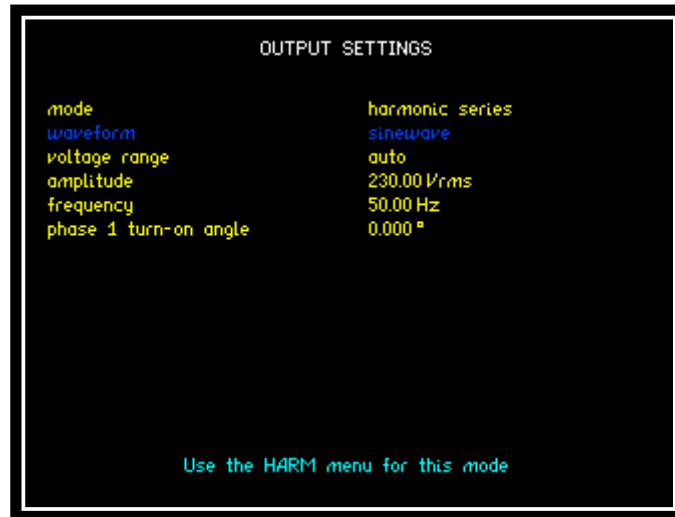
For further details of using the HARM menu, see section 7.7.

7.3   Dual component

This mode allows the generation of two independent frequency components. Voltage and frequency, for each component, are set in the same way as *single component* mode.

```
                    OUTPUT SETTINGS

mode                        dual component
waveform                    sinewave
voltage range               auto
amplitude                   230.00 Vrms
frequency                   50.00 Hz
harmonic amplitude          18.40 Vrms
frequency                   499.3 Hz




               No options available for this mode
```
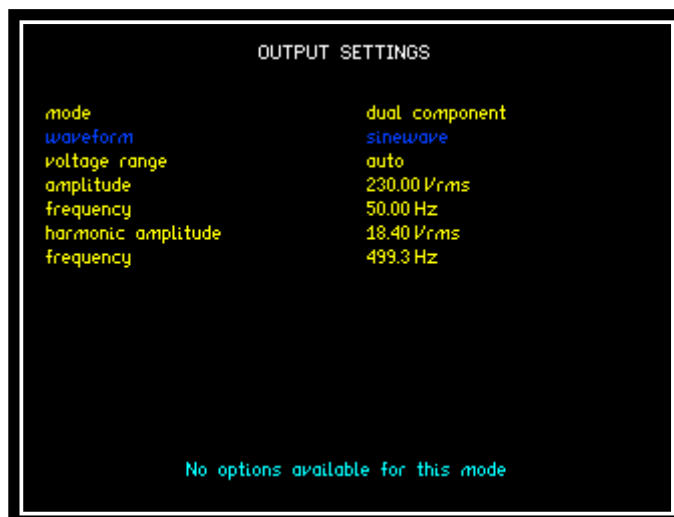
Note that in 3-phase mode, the voltage parameters displayed in PH2 and PH3 are independent, but the frequency applies to all three phases.

For example:

Primary settings

> PH1 Voltage = 230 Vrms, Frequency = **50** Hz
> PH2 Voltage = 210 Vrms, Frequency = **50** Hz
> PH3 Voltage = 235 Vrms, Frequency = **50** Hz
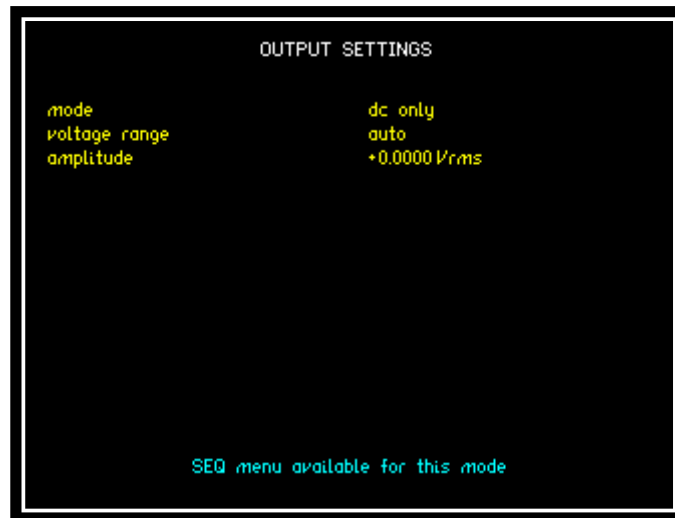
Secondary (harmonic) settings

> PH1 Voltage = 15 Vrms, Frequency = **480** Hz
> PH2 Voltage = 23 Vrms, Frequency = **480** Hz
> PH3 Voltage = 12 Vrms, Frequency = **480** Hz

7.4   DC only

This mode provides a DC only output voltage, when in use make sure that *coupling* is set to *ac+dc.*
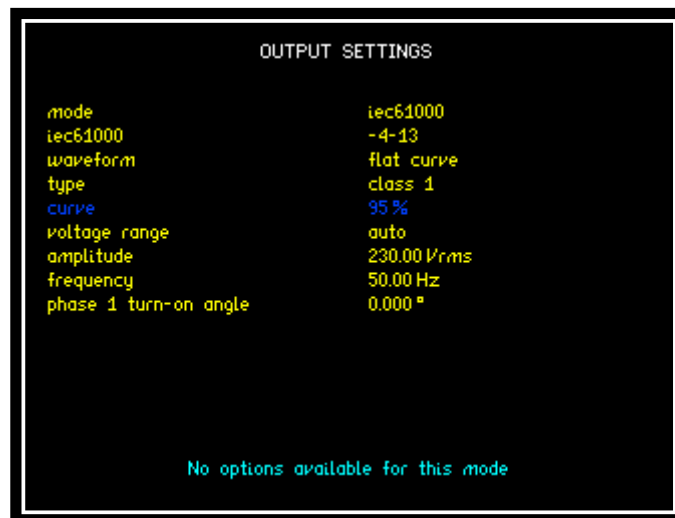

The *Sequence* menu is available in this mode, see section 7.8 for further details.

7.5 IEC61000

This mode provides IEC61000-4-13 and IEC61000-4-17 standard specific waveforms. Use the *iec61000* menu parameter to change between standards.

7.5.1 IEC61000-4-13 - Flat curve

The instrument can provide a flat curve waveform for class 1, 2 and 3 tests. By selecting *type > class x* the user can set flat curve to any value between 70% and 99%. The amplitude and frequency is set in the same way as in other modes.

```
                      OUTPUT SETTINGS

    mode                    iec61000
    iec61000                -4-13
    waveform                flat curve
    type                    class 1
    curve                   95 %
    voltage range           auto
    amplitude               230.00 Vrms
    frequency               50.00 Hz
    phase 1 turn-on angle   0.000 °




              No options available for this mode
```

In accordance with the standard, the flat part of the sine wave is calculated as a percentage of the peak. The output is then multiplied by a scale factor Ky, so that the resulting RMS voltage equals that of a normal sine wave of equivalent amplitude.

The harmonic over swing test is not currently available from the menus, but can be performed through IECSoft.

See www.newtons4th.com for further details.

7.5.2   IEC61000-4-17 – D.C. ripple

In accordance with the IEC61000-4-17 standard, the N4A can superimpose an AC rectifier like ripple onto a DC voltage. Both single and 3-phase rectifiers options are available. Use the *rectifier* menu parameter to change between the two options.

```
                    OUTPUT SETTINGS

    mode                    iec61000
    iec61000                -4-17
    rectifier               single-phase
    dc ripple voltage       1.00 %
    voltage range           auto
    amplitude               230.00 Vrms
    frequency               50.00 Hz
    phase 1 turn-on angle   0.000 °




              No options available for this mode
```

The ac and dc components are calculated from the *dc ripple voltage* and *amplitude* parameters:

$$amplitude = \ Udc = Umax - \ 0.5 * (Umax - Umin)$$

Where

$$Umax = Udc + Udc * \frac{ripple\ voltage}{2}(\%)$$

For 230V amplitude with 10% ripple

$$Umax = 230 + (230 * 5\%) = 241.5V$$

$$Umin = 230 - (230 * 5\%) = 218.5V$$

7.6   UL2231

This mode allows the injection of a high frequency ringing waveform on to a 60Hz fundamental sinusoid, in accordance with UL2231-2: 24.9.

The ring decays exponentially with a time constant of 1.6ms, and has a magnitude equal to 40% of the fundamental amplitude.

The ringing frequency is user selectable within the range of 1,2,3,4 and 5 kHz and lasts for 8ms as required by the standard.
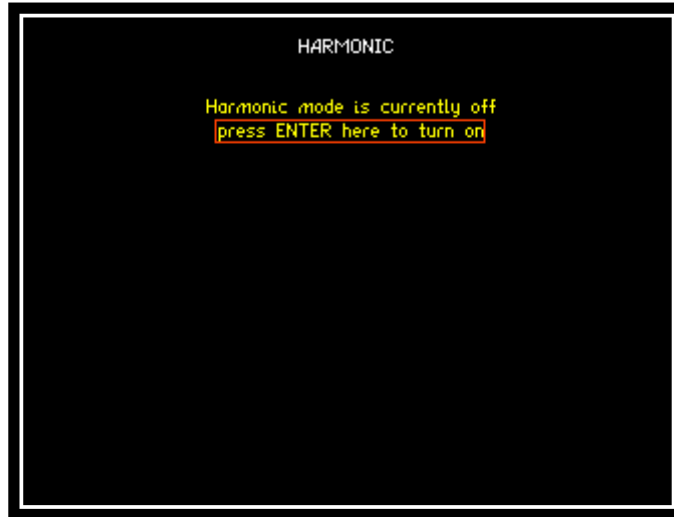
The waveform is applied by pressing the START key. Each press of the key applies the ringing only once, so that it can be applied 5 times randomly.
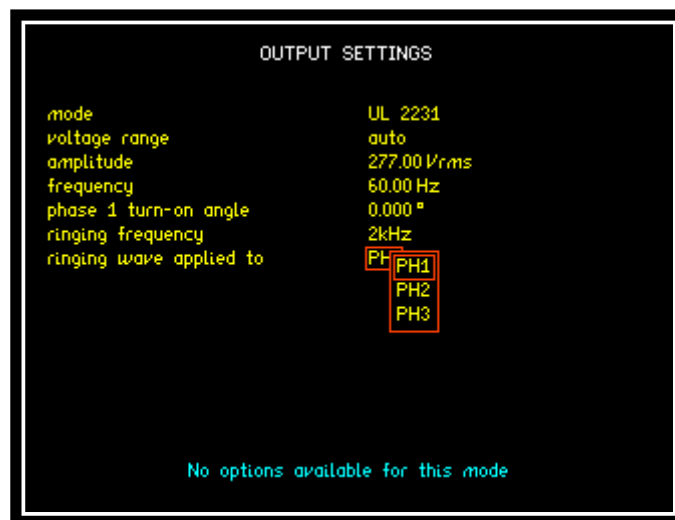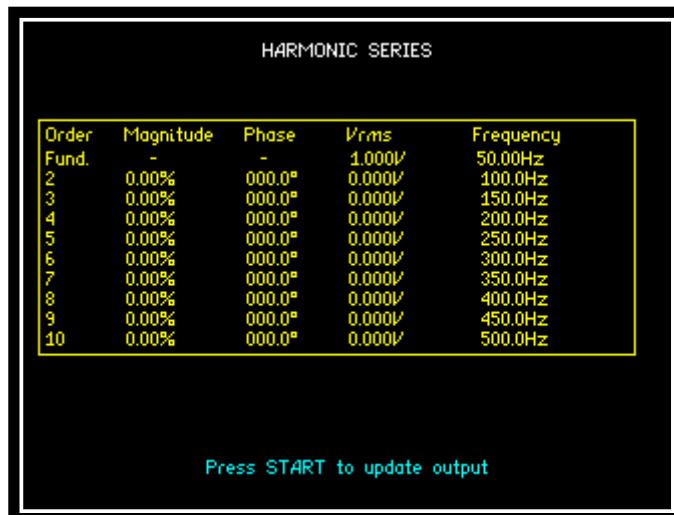
If using a 3-phase instrument the ringing waveform can be injected on to any of the three output phases.

7.7   Using Harmonic Series

The Harmonic settings menu can be accessed through the HARM key. If not already in *harmonic series* mode, use the DOWN arrow key to highlight "press ENTER here to turn on".

Press the Enter/Next key to activate Harmonics mode and display the harmonic series table.

To begin editing the table use the DOWN arrow key to bring up the cursor.

First, set the fundamental voltage and frequency by highlighting *Fund* and pressing ENTER. Use the arrow keys to navigate between parameters and update as required.

Before pressing HOME, highlight *Save* and press ENTER to add the new values to the table. Use the same process to add harmonics of order 2 to 100. Magnitude is limited to values between 0 - 50%. Once all values have been entered, press the START key to update the output waveform.
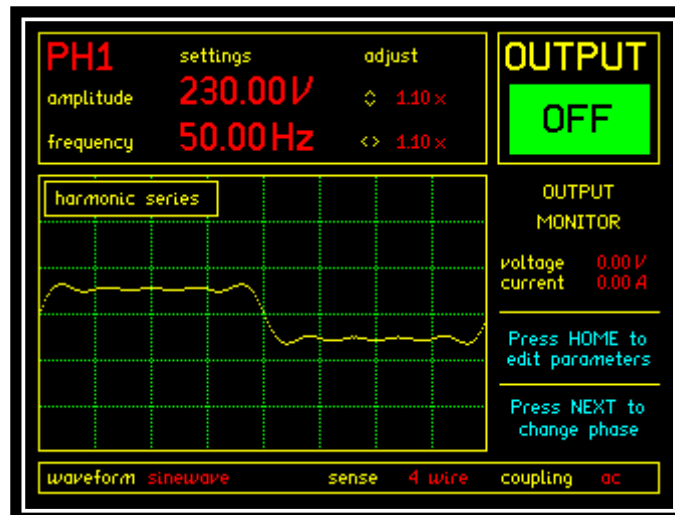
Although only 10 table entries are displayed at once, the UP and DOWN arrows provide access to all 99. Entering a number when the *order* parameter is highlighted, will also jump to that point in the table.

7.8   Using Sequence

Sequence mode enables the user to generate a series of voltages (and frequencies in *generator mode*), each for a specified period. When the START key is pressed the N4A will automatically run through the points. This table of entries can be executed once or cycled through continuously. An overview of the parameters associated with sequence, are given below:

- *Mode:* Set the sequence to run through once (single shot) or run continuously (Repeated) until the stop button is pressed.

- *Add new line:* Select *add new line* and press ENTER to open the table entry box.
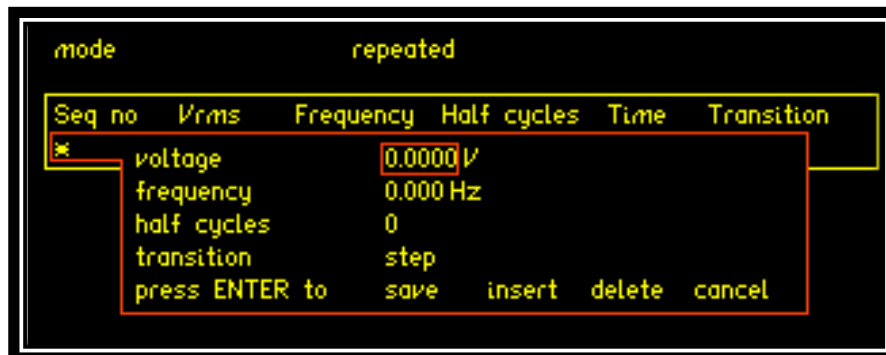
- *Voltage:* Set the starting amplitude for the specified sequence number in the table. Selectable from 0.00Vrms to 300.00Vrms in generator mode and 0Vdc − 430Vdc in DC only mode.

- *Frequency:* Set the frequency for the specified step number in the table. Selectable from 1.0Hz to 10.000KHz.

- *Half cycles:* Select the required number of half cycles. Selectable from 1 to 20000. For example, at 50Hz the time period of each half cycle is 10ms. So if a time period of 30ms is required at a frequency of 50Hz then 3 half cycles would need to be selected.

- *Transition:* Can be set to either *step* or *linear*. Sets the type of transition between voltage points.

- *Save:* Once the parameters have been set for a sequence entry, highlight *Save* with the cursor and press ENTER.

- *Insert*: To insert a new table entry between entry[n] and entry[n+1], select entry[n] with the cursor and press ENTER. Add the parameters for the new entry, highlight *Insert* and then press ENTER.

  Once each line of the sequence is entered, it can be saved by moving the cursor to *Save* and pressing the Enter key. By reselecting *add new line* another line in the sequence can be added. It is also possible to insert a new line in the middle of the sequence and to delete lines within the sequence, by using the *insert* and *delete* functions.

7.8.1 Simple example of an AC sequence
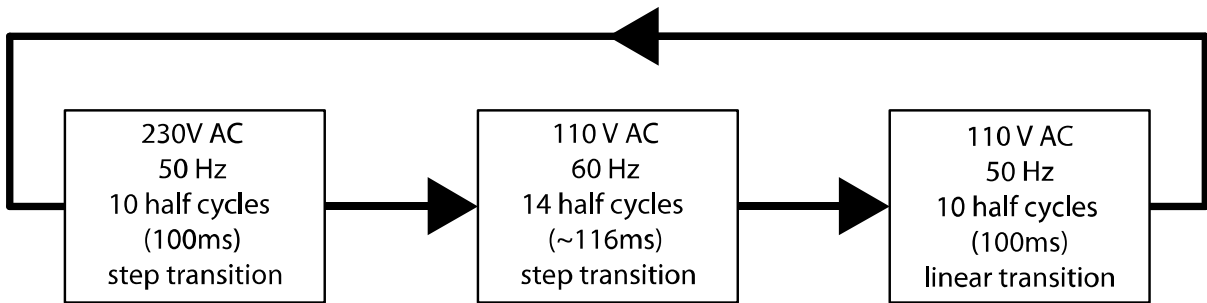
This example will run through the process of creating a simple 3 step repeating sequence:

- Enter the sequence menu by pressing the SEQ key.
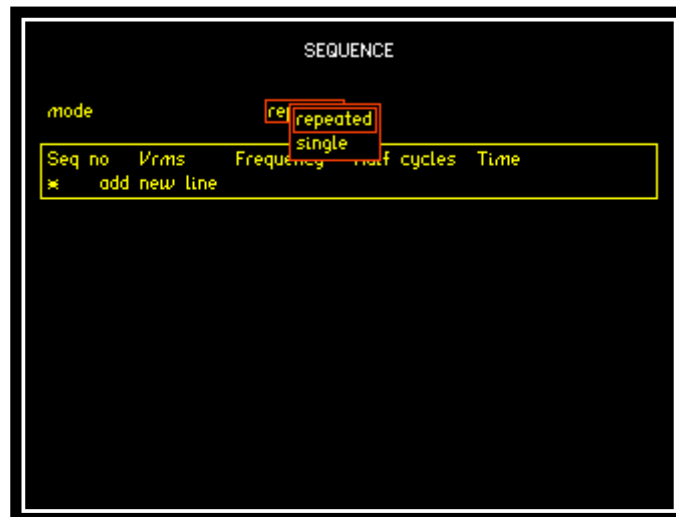
- Ensure that the sequence *mode* is set to *repeated*, as shown above.

- Use the DOWN arrow key to move the cursor to highlight *Add new line*.

- Press the ENTER or RIGHT arrow key.
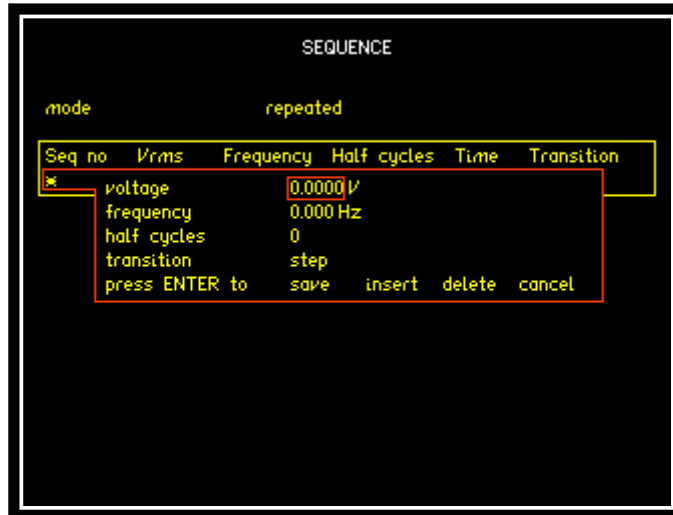
- The cursor will highlight the *voltage* parameter, enter *230* using the keypad and press ENTER.

- Use the DOWN arrow key to highlight frequency, enter *50* and press ENTER as per the previous step.

- Enter *10* half cycles and ensure transition is set to *step*.

- Use the DOWN arrow to highlight *save* and press ENTER. This step must be completed for the entry to be saved.

The first line of the sequence should now be complete as shown in the following screenshot:
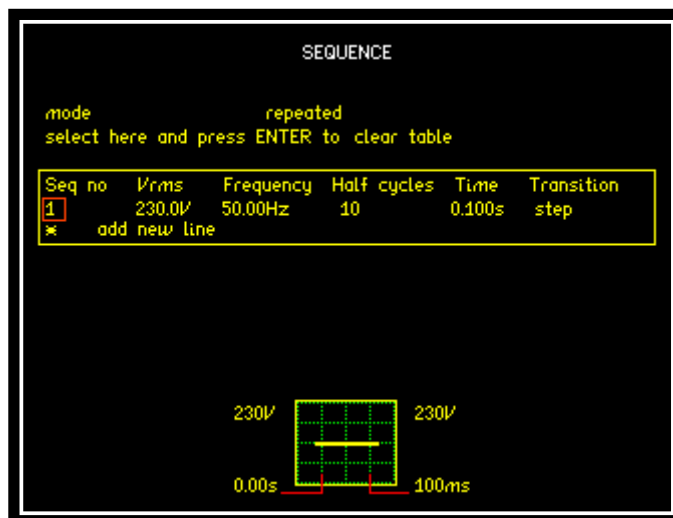
Use the above procedure to enter the next two lines in the sequence. The completed sequence will then look like this:
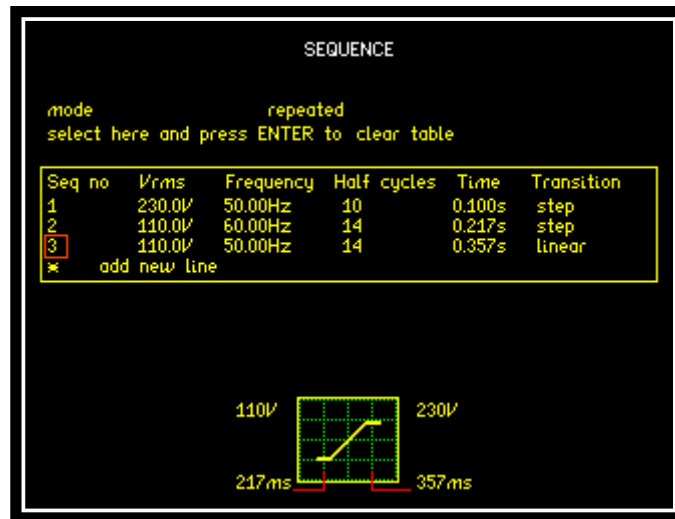
As the cursor is moved over each entry, a help box will appear at the bottom of the display indicating what the RMS voltage transition will look like:
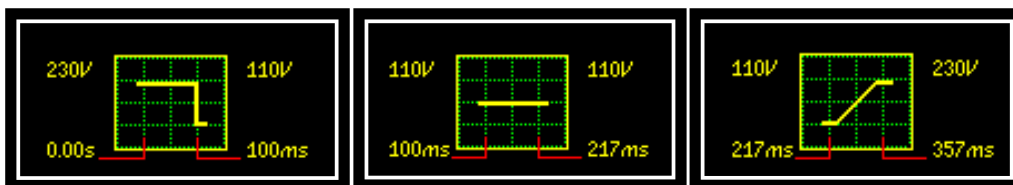
Note that in the third help box, the transition shown is a linear ramp from 110V (Seq no[3]) to 230V (Seq no[1]), this will only occur when the sequence *mode* is set to *repeated*.

To run the sequence:

- Remove the cursor by pressing the HOME button.

- Hold down OUTPUT until the amplifier turns on.

- Press the START key to start the sequence.

- Press the STOP key to abort the sequence.

7.8.2   Checking the operation of the sequence

It is possible to check if the sequence is still running or has been completed.

Sending the Command SEQUEN? will return a value of 0 or 1.

If the returned value is 0, the Sequence has completed.

If the returned value is 1, the Sequence is still running.

8 Three-phase settings

There are a number of menus and parameters only available for 3-phase N4As. This section applies to the N4A18, N4A30 and N4A67.

8.1   Output settings

Modifying the amplitude, dc offset and phase angle for phase-2 is performed through the PH2 key. The same is true for phase-3 through the PH3 key.
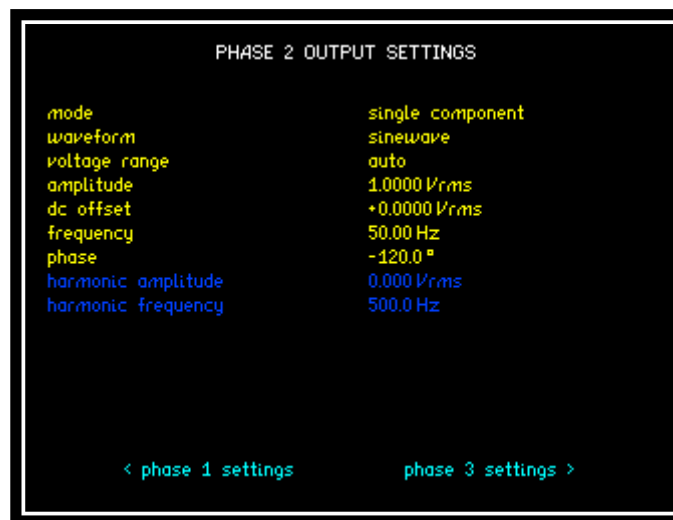
The *mode*, *waveform* and *voltage range* options are displayed in the PH1-3 menus, but are not independent. Changing *waveform* in the PH1 menu will update the *waveform* on all three phases.

8.2   Wiring menu

A 3-phase N4A can be configured to output on all 3 phases or just phase 1. This is controlled by the *output type* option in the WIRING menu.

By default, the amplitude and dc offset values for phase 1-3 are linked. For example, setting a*mplitude* to 250V in the PH2 menu will update the output *amplitude* for PH1 and PH3. If independent *amplitudes* are required, set the *phase amplitudes* option to *independent*.
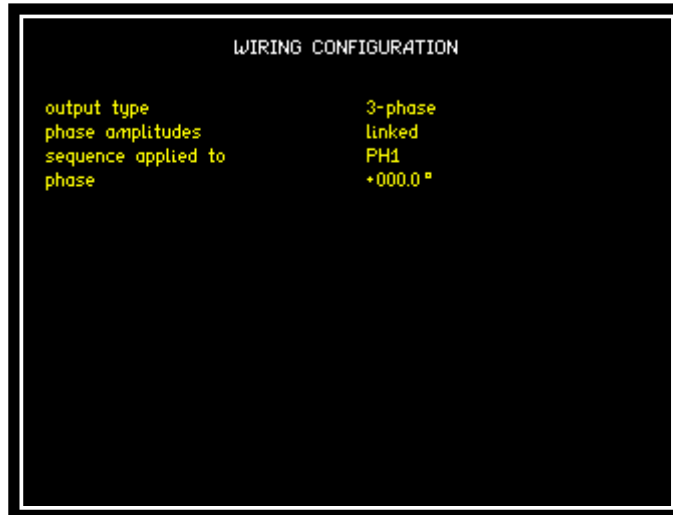
By default, when a sequence is run it is applied to the phase 1 output, while phase 2 and phase 3 remain unchanged. The option to apply the sequence to phase 2 or 3 is available through the *sequence applied to* option. Selecting ALL from the menu will apply the sequence table to all three phases, but at the point in time where phase 1 is at its minimum value.

8.3   Parallel option

If an N4A is supplied with the optional parallel output, this is enabled and disabled through the WIRING menu.
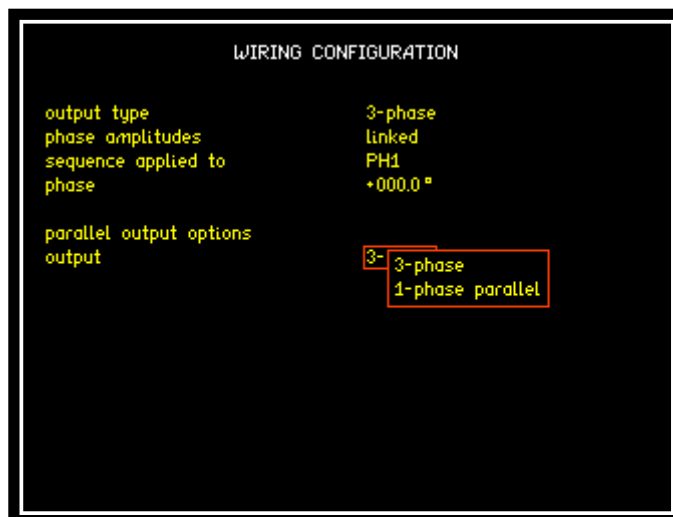
When changing this option, allow ~10s for set-up completion. A relay click should be heard as the outputs turn off and on.

8.4   High voltage transformer options

8.4.1   N4A18/30

The N4A18 3-phase transformer allows line-to-neutral voltages of up to 440Vrms to be achieved. To preserve the accuracy of the standard 300Vrms output range, the transformer unit can be switched out of circuit with a bypass switch. The bypass switch state is displayed on the N4A HOME screen (2):
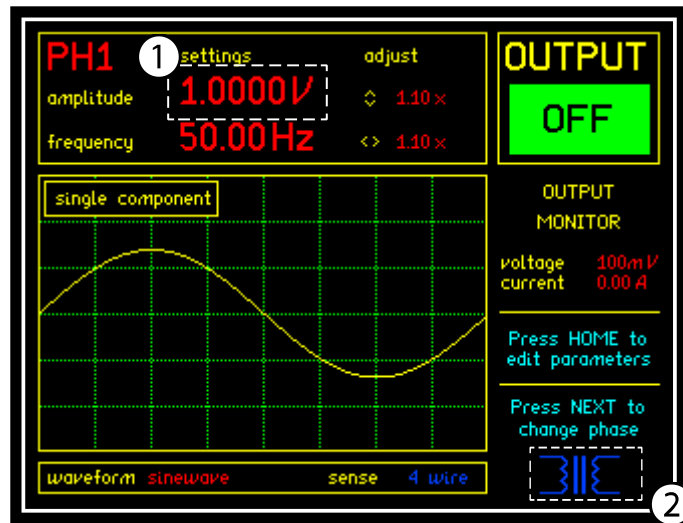
Symbol 2 is blue when the transformer is not in-circuit and flashes red and white when it is. Whenever a voltage greater than 300Vrms is requested (1), the transformer will automatically switch in.

The transformer can be manually switched in and out through the WIRING menu. By default the transformer is bypassed and will switch in when the output voltage is set higher than 300Vrms.
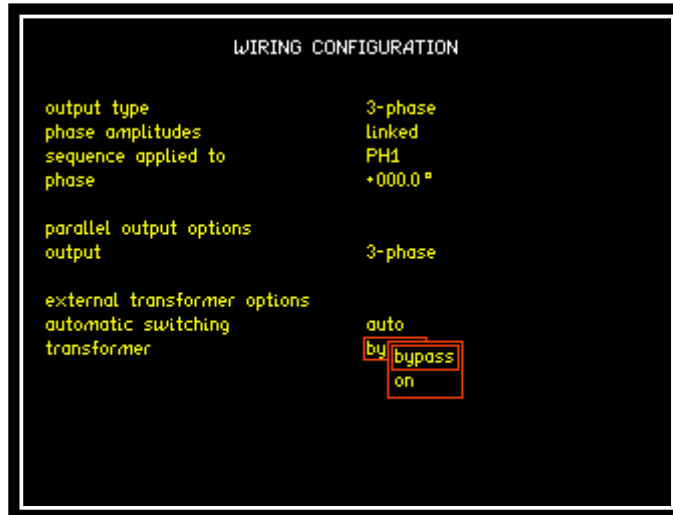
To force the transformer into a particular state, it is advisable to set *automatic switching* to *off* and then use the *transformer* menu item.
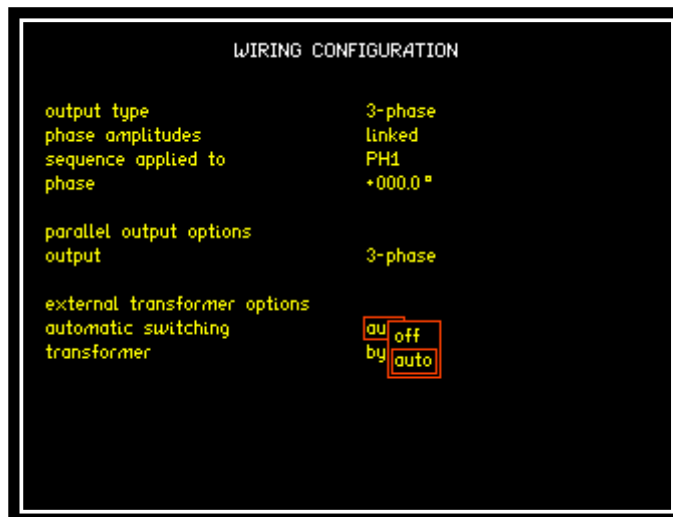
NOTE: The N4A18/30 with transformer is calibrated as a system; under no circumstances should the transformer unit be disconnected from the N4A18/30 while power is applied.

8.4.2   N4A100

The N4A100 has two ranges on separate output terminals: 270Vrms (bypass) and 404Vrms (transformer - on). For this reason the transformer will not switch in and out automatically, it must be done manually through the WIRING menu.

```
              WIRING CONFIGURATION

output type                   3-phase
phase amplitudes              linked
sequence applied to           PH1
phase                         +000.0°

external transformer options
transformer                   bypass
```
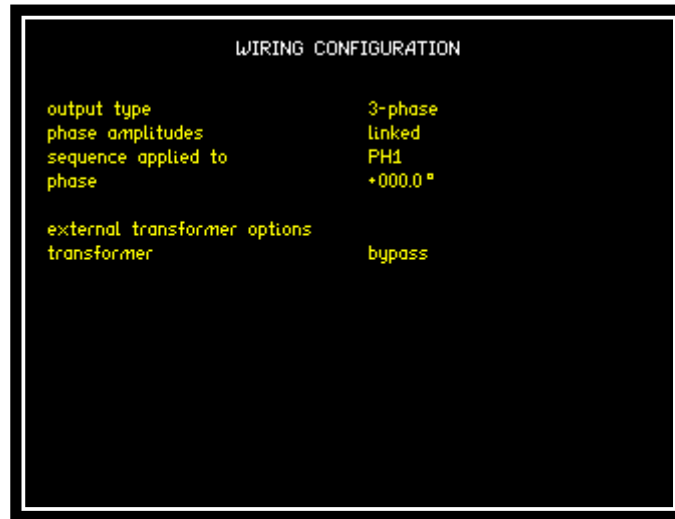
The N4A100 has two and four wire sense options on both sets of output terminals. This option is set either through the HOME screen or using the CONFIG menu.

```
PH1      settings      adjust      OUTPUT

amplitude  1.0000V    ↕ 1.10×       OFF

frequency  50.00Hz    <> 1.10×

single component                  OUTPUT
                                  MONITOR

                                    ready

                                Press HOME to
                                edit parameters

                                Press NEXT to
                                change phase

waveform sinewave    sense  2 wire   ⇒‖⇐
```
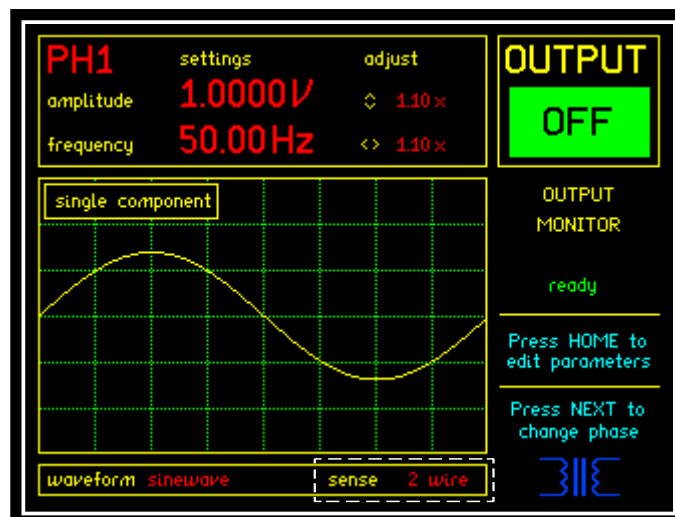
No AC only coupling is available on this unit, but all DC options are disabled when using the transformer.

9 System settings

The *system* menu provides general N4A settings and information. The LEFT and RIGHT arrows are used to access *system information* and *user data*.

9.1   System Options (SYS)
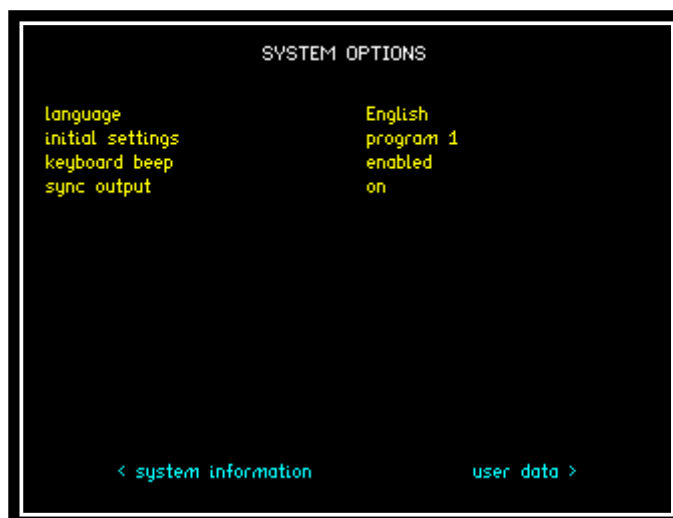
9.1.1   Language

By default, the N4A menu strings are displayed in English. A single additional language can also be loaded into the instrument, with a choice of Italian, French and Russian currently available. When an additional language is loaded into the N4A, select it from the *language* drop-down.

9.1.2   Initial settings

This option determines what settings (e.g. waveform, ac coupling) are recalled from memory on power-up.

Factory default will recall the default program.

Program 1 will recall the settings saved in location 1, providing a valid program is available. If no such program exists, the default program is recalled.

The N4A saves a copy of all user-definable parameters in non-volatile memory. *As last used* recalls these parameter settings, the next time the instrument is powered up.

9.1.3 Keypad Beep

Each key press is normally accompanied by an audible 'beep' as well as the tactile 'click'. The 'beep' can be disabled for quiet environments if the feel of the key is sufficient feedback.

9.1.4 Sync Output

The sync output on the rear of the N4A provides a logic-level active high pulse for triggering scopes and other devices. Providing a valid sequence is available, pressing the START key or sending the START command will trigger a sync pulse. The pulse will remain high for 0.5/f seconds, where f is the frequency of the first sequence step. This also applies in the UL2231 mode when pressing start.

9.2 User Data

The N4A can be personalised by entering up to three strings of up to 32 characters in length. The strings can be read out, via any of available communications methods, by sending the command "USER?".

Typical arrangement of the user data might be:
    line 1 company name
    line 2 department or individual name
    line 3 unique identifying number (eg. asset number)

9.3   System Information

Pressing the SYSTEM key displays information about the instrument, it cannot be changed by the user.

```
                        N4A06

  serial number       91J-00011
  manufacturing code  SQ2415
  main release        1.14
  FPGA release        1.05
  boot release        1.02
  last calibration    13 MAR 2015 1204 AMW




                     return >
```
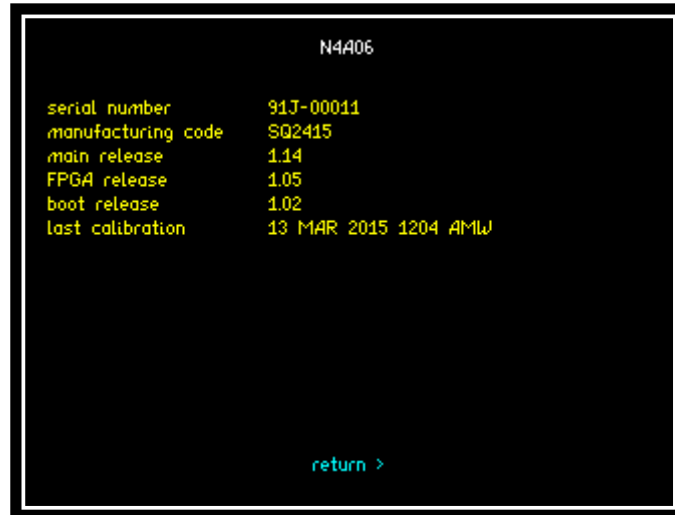
Serial Number: Instruments unique serial number.
Manufacturing Code: Code attributed to build date of the instrument.
Main release: Current firmware release installed in the instrument.
FPGA Release: Field Programmable Gate Array release version.
Boot Release: Release version of instruments boot up firmware.
Last Calibration: Instruments last calibration date.

10   Programs

10.1.1   Store /recall (PROG)
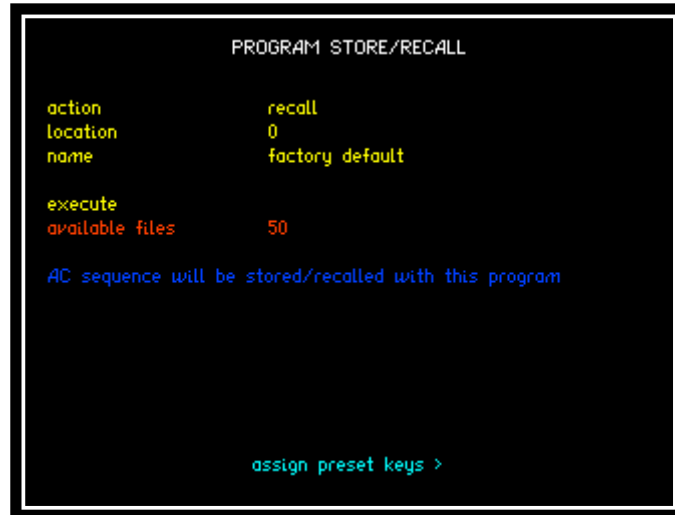
1. Press the PROG button to open up program store / recall menu.
2. Select the action to be taken – store / recall or delete.
3. Select the location that the associated action is to be recalled from, stored to or deleted from, there are 50 locations available.

NOTE:
Location 0= FACTORY DEFAULT and cannot be changed.
Location 1= A program stored in program location 1 is automatically recalled when the instrument is switched on (provided *system options > initial settings* = program 1).

4. 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.
5. Upon implementing any of the above actions, remember to scroll down to EXECUTE and press ENTER to validate your selection / action.

6. *Single component* and *DC only* modes have a sequence table associated with them; this table will be updated when a program is recalled and saved when a program is stored.

10.1.2   Preset keys

The top right row of keys is used to quickly recall saved programs. To do this they must first be assigned in the PRESET KEYS menu.

In this example a program has already been saved to location 2, with the name "230Vac 50Hz"

From the PROG menu screen, press the right arrow key to enter the PRESET KEYS menu.

You should be presented with a list of menu options as shown below:

The first line (*assign preset key)* is used to select the key you wish a program to be assigned to. If the key has already been assigned, the text on the right hand side will turn green and display the program name.

The second line (*to program location*) is used to search through the program locations (0-50) to find a valid program to assign. The blue text will display the program name, if available.

Once a valid program has been selected, the bottom line will become selectable. Highlight ASSING with the cursor and press ENTER to save your selection. Pressing the PS1 key will now load program 2.

11   Specifications

Nominal Output Power	
N4A03 (1-phase)	3000VA
N4A06 (1-phase)	6000VA
N4A18 (3-phase)	18000VA
N4A30 (3-phase)	30000VA
N4A67 (3-phase)	67500VA

11.1 Outputs

Output Voltage (AC)	
N4A03 (1-phase)	0-300Vrms
N4A06 (1-phase)	0-300Vrms
N4A18 (3-phase)	0-300Vrms
N4A30 (3-phase)	0-300Vrms
N4A67 (3-phase)	0-300Vrms
High Voltage Transformer option	
N4A18/30/67	0 – 440Vrms

Output Voltage (DC)	
N4A03 (1-phase)	0-425V DC
N4A06 (1-phase)	0-425V DC
N4A18 (3-phase)	0-425V DC
N4A30 (3-phase)	0-425V DC
N4A67 (3-phase)	0-425V DC

Maximum Continuous Output Power (AC)	
N4A03 (1-phase)	3000VA
N4A06 (1-phase)	6000VA
N4A18 (3-phase)	18000VA
N4A30 (3-phase)	30000VA
N4A67 (3-phase)	67500VA

Maximum Inrush (3 Second) Output Power	
N4A03 (1-phase)	6000VA
N4A06 (1-phase)	12000VA
N4A18 (3-phase)	36000VA
N4A30 (3-phase)	60000VA
N4A67 (3-phase)	90000VA

Maximum Output Current (Continuous)	
N4A03 (1-phase)	10Arms
N4A06 (1-phase)	20Arms
N4A18 (3-phase)	20Arms (Per Phase)
N4A30 (3-phase)	33Arms (Per Phase)
N4A67 (3-phase)	75Arms (Per Phase)
Parallel output option	
N4A18	60Arms
N4A30	99Arms

Maximum Output Current (Inrush)	
N4A03 (1-phase)	20Arms
N4A06 (1-phase)	40Arms
N4A18 (3-phase)	40Arms (Per Phase)
N4A30 (3-phase)	64Arms (Per Phase)
N4A67 (3-phase)	100Arms (Per Phase)
Parallel output option	
N4A18	120Arms
N4A30	200Arms

Output Frequency	
N4A03 (1-phase)	DC - 1kHz
N4A06 (1-phase)	DC - 1kHz
N4A18 (3-phase)	DC - 1kHz
N4A30 (3-phase)	DC - 1kHz
N4A67 (3-phase)	DC - 1kHz
High Voltage Transformer option	
N4A18/30/67	45Hz – 10kHz

Min Slew Rate	
N4A03 (1-phase)	3V/us
N4A06 (1-phase)	3V/us
N4A18 (3-phase)	3V/us
N4A30 (3-phase)	3V/us
N4A67 (3-phase)	3V/us

Output Voltage Stability	
N4A03 (1-phase)	Better than 0.1%
N4A06 (1-phase)	Better than 0.1%
N4A18 (3-phase)	Better than 0.1%
N4A30 (3-phase)	Better than 0.1%
N4A67 (3-phase)	Better than 0.1%

Output Voltage Accuracy	
N4A03 (1-phase)	Better than 0.5%
N4A06 (1-phase)	Better than 0.5%
N4A18 (3-phase)	Better than 0.5%
N4A30 (3-phase)	Better than 0.5%
N4A67 (3-phase)	Better than 0.5%

THD	
N4A03 (1-phase)	Better than 0.3%*
N4A06 (1-phase)	Better than 0.3%*
N4A18 (3-phase)	Better than 0.3%*
N4A30 (3-phase)	Better than 0.3%*
N4A67 (3-phase)	Better than 0.3%*

Output Noise	
N4A03 (1-phase)	<500mVrms
N4A06 (1-phase)	<500mVrms
N4A18 (3-phase)	<500mVrms
N4A30 (3-phase)	<500mVrms
N4A67 (3-phase)	<500mVrms

Recovery Time of Output Waveform	
N4A03 (1-phase)	Better than 50us
N4A06 (1-phase)	Better than 50us
N4A18 (3-phase)	Better than 50us
N4A30 (3-phase)	Better than 50us
N4A67 (3-phase)	Better than 50us

Max Compensated drop on wires (w.r.t voltage setting)	
N4A03 (1-phase)	5%
N4A06 (1-phase)	5%
N4A18 (3-phase)	5%
N4A30 (3-phase)	5%
N4A67 (3-phase)	5%

Recovery Time of Drop on Wires	
N4A03 (1-phase)	Less than 200ms
N4A06 (1-phase)	Less than 200ms
N4A18 (3-phase)	Less than 200ms
N4A30 (3-phase)	Less than 200ms
N4A67 (3-phase)	Less than 200ms

Maximum Crest Factor Output (Current)	
N4A03 (1-phase)	[Inrush Imax*1.41]/RMS Load Current
N4A06 (1-phase)	[Inrush Imax*1.41]/RMS Load Current
N4A18 (3-phase)	[Inrush Imax*1.41]/RMS Load Current
N4A30 (3-phase)	[Inrush Imax*1.41]/RMS Load Current
N4A67 (3-phase)	[Inrush Imax*1.41]/RMS Load Current

11.2 General

Dimensions	
N4A03 (1-phase)	281mm x 471mm x 513mm
N4A06 (1-phase)	281mm x 471mm x 513mm
N4A18 (3-phase)	1785mm x 930mm x 755mm
N4A30 (3-phase)	1785mm x 930mm x 755mm

N4A67 (3-phase)	1800mm x 1200mm x 800mm

Weight	
N4A03 (1-phase)	30kg
N4A06 (1-phase)	45kg
N4A18 (3-phase)	740kg
N4A30 (3-phase)	740kg
N4A67 (3-phase)	1300kg

Input Voltage	
N4A03 (1-phase)	230V AC +/- 10% 3PH
N4A06 (1-phase)	400V AC +/- 10% 3PH
N4A18 (3-phase)	400V AC +/- 10% 3PH
N4A30 (3-phase)	400V AC +/- 10% 3PH
N4A67 (3-phase)	400V AC +/- 10% 3PH

Input Frequency	
N4A03 (1-phase)	45-65Hz
N4A06 (1-phase)	45-65Hz
N4A18 (3-phase)	45-65Hz
N4A30 (3-phase)	45-65Hz
N4A67 (3-phase)	45-65Hz

Operating Temperature	
N4A03 (1-phase)	0-35degC
N4A06 (1-phase)	0-35degC
N4A18 (3-phase)	0-35degC
N4A30 (3-phase)	0-35degC
N4A67 (3-phase)	0-35degC

Input Current	
N4A03 (1-phase)	25Arms
N4A06 (1-phase)	16Arms Phase / 27A Neutral
N4A18 (3-phase)	60A continuous 120A inrush / Phase
N4A30 (3-phase)	80A continuous 160A inrush / Phase
N4A67 (3-phase)	160A continuous 220A inrush / Phase

Efficiency	
N4A03 (1-phase)	Better than 80%
N4A06 (1-phase)	Better than 80%
N4A18 (3-phase)	Better than 80%
N4A30 (3-phase)	Better than 80%
N4A67 (3-phase)	Better than 80%

*At Nominal Voltage with Linear Load

12   Resetting the N4A to factory default mode

This will clear any user defined programs that might be stored in the N4A and recalled when the instrument is switched on.

To access Program Store / Recall mode:

Press "PROG" button

Press ▼ Key until

Red Box surrounds the number adjacent to "Location"

Enter "0"

Press ▼ Key until

Red Box surrounds "Execute"

Press "ENTER" - This will now reset the instrument to factory default mode.

12.1   Firmware Programming

N4L CommView2 software is used to program the N4A with updated firmware. LAN, Serial and USB interfaces can be used.

13 Repair / Recalibration & Servicing

13.1 Servicing

This instrument requires servicing after the following periods:

20,000 hours – Ventilator replacement
40,000 hours – DC bus capacitor replacement

13.2 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. This can be performed by the user if they have access to a N4L Precision Power Analyzer.

Contact details:

    Newtons4th Ltd
    1 Bede Island Road
    Leicester
    Leicestershire
    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.

Appendix A – Accessories

Supplied Standard Accessories

Single Phase Units:

> one N4A unit
> one 6" BNC to BNC cable
> one null modem cable
> one USB cable
> one communications manual

3-Phase Units:

> one N4A unit
> one null modem cable
> one USB cable
> one communications manual

Documentation:

> Calibration Certificate
> Combined User Manual & Communications manual

Appendix B – Connection Diagrams

Appendix B.1   IMP161 Connections

The diagram below shows the connections required to connect the AC Source, IMP161 Impedance Network, and PPA5511 Power Analyzer.
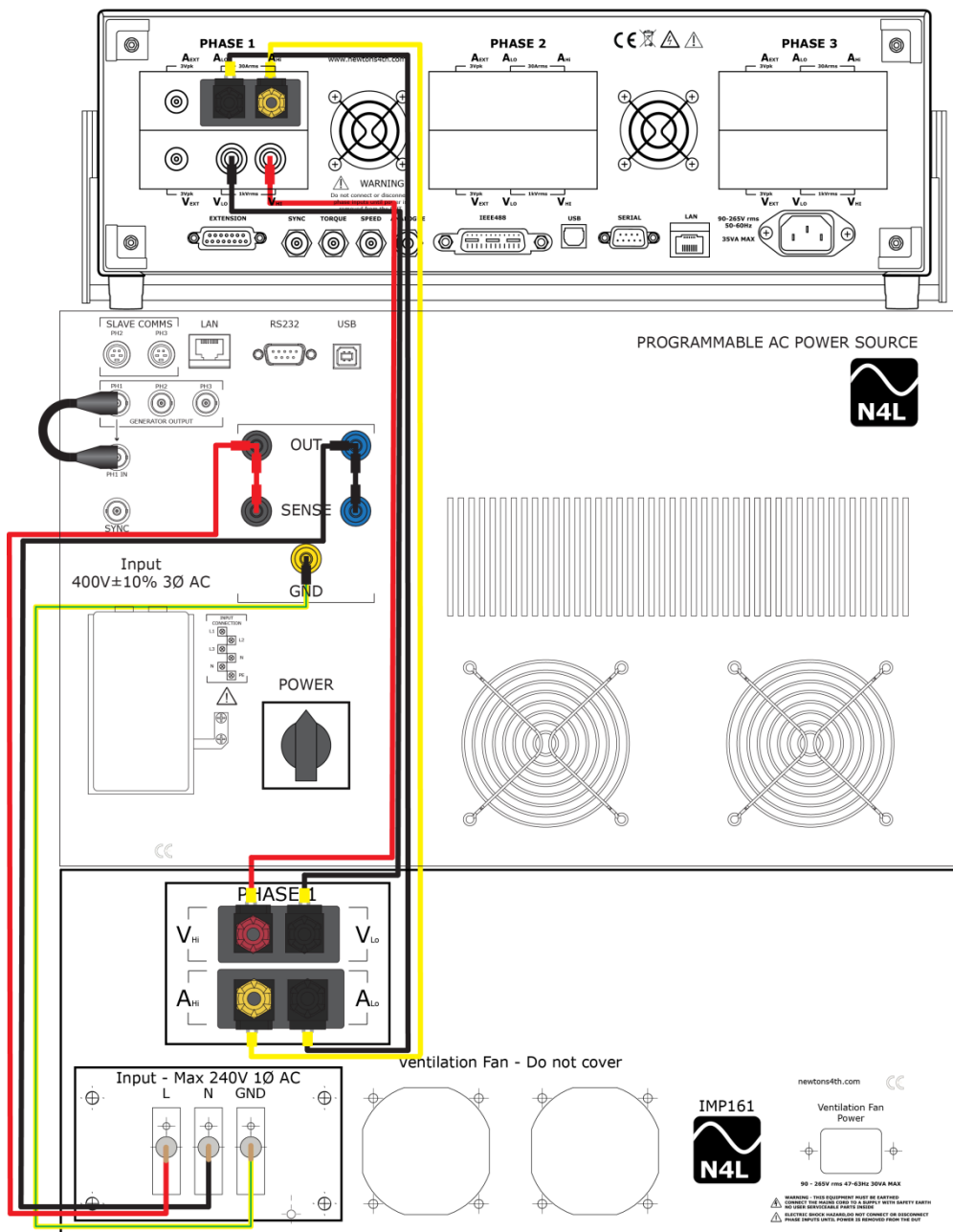
PPA - IMP161 Connections - All leads supplied are 36A rated 4mm shrouded / stackable test leads 1.5mtrs. N4L Part Number: 517-009
AC Source - IMP161 Connections - Single Phase 4mm test leads, Red (L), Black (N) & Green / Yellow (GND). N4L Part Number 517-010

Make connections as shown:

AC Source – Impedance Network
L – L
N – N
GND - GND

Impedance Network – PPA5511 Power Analyzer

4mm Yellow Lead – A Hi – A Hi
4mm Black Lead – A Lo – A Lo
4mm Red Lead – V Hi – V Hi
4mm Black Lead – V Lo – V Lo

Appendix B.2   IMP163 Connections

The diagram below shows the connections required to connect the AC Source, IMP163 Impedance Network, and PPA5531 Power Analyzer.
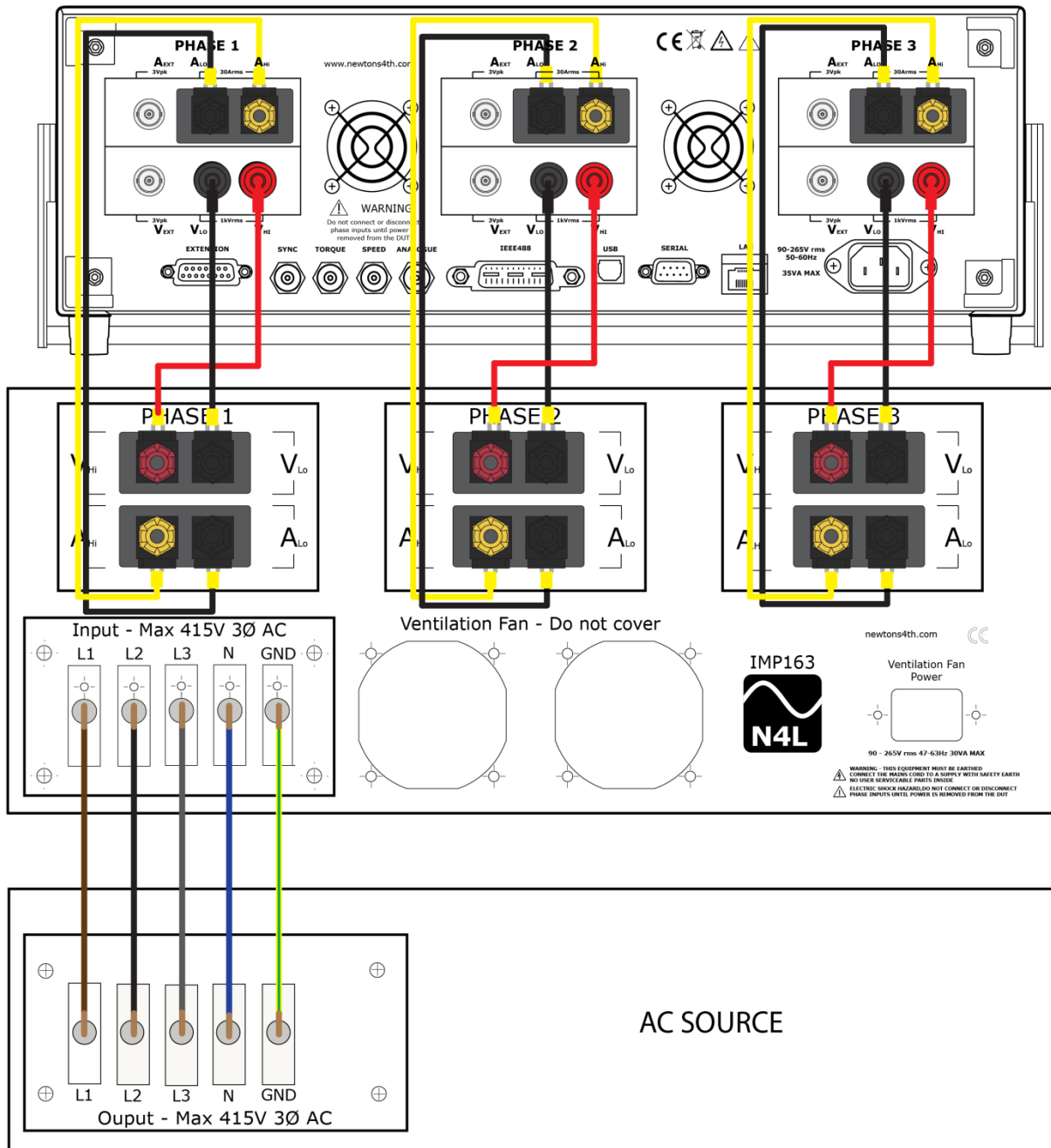
PPA - IMP163 Connections - All leads supplied are 36A rated 4mm shrouded / stackable test leads 1.5mtrs. N4L Part Number 517-009
IMP - AC Source Connections - 16mm tri-rated, 3 Phase + N + E Lead Set. N4L Part Number 517-012

Appendix B.3   IMP323 Connections

The diagram below shows the connections required to connect the AC Source, IMP323 Impedance Network, and PPA5531 Power Analyzer.
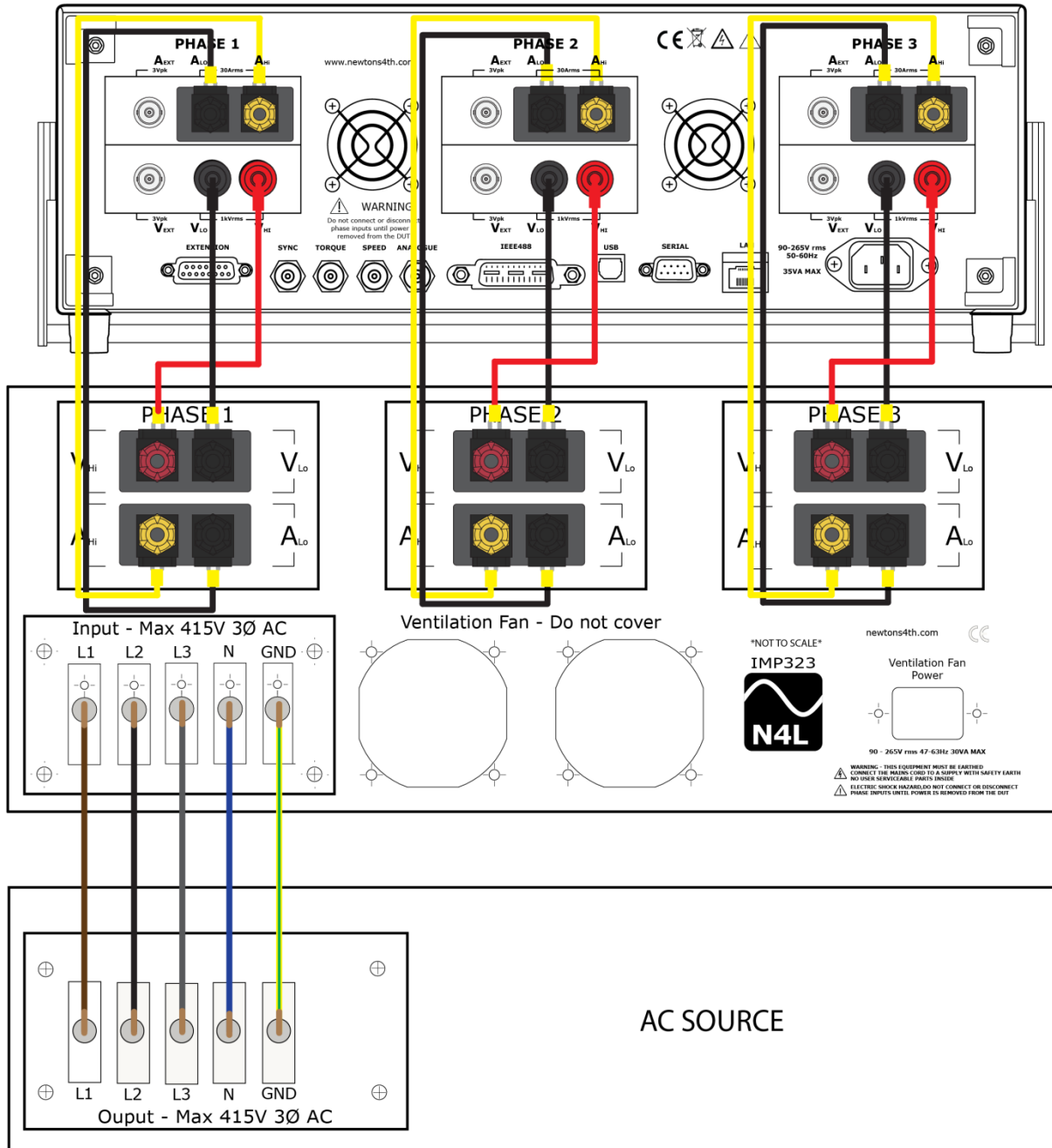
PPA - IMP323 Connections - All leads supplied are 36A rated 4mm shrouded / stackable test leads 1.5mtrs. N4L Part Number 517-009
IMP - AC Source Connections - 16mm tri-rated, 3 Phase + N + E Lead Set. N4L Part Number 517-012

Appendix B.4   IMP753 Connections

The diagram below shows the connections required to connect the AC Source, IMP753 Impedance Network, and PPA5531 Power Analyzer.
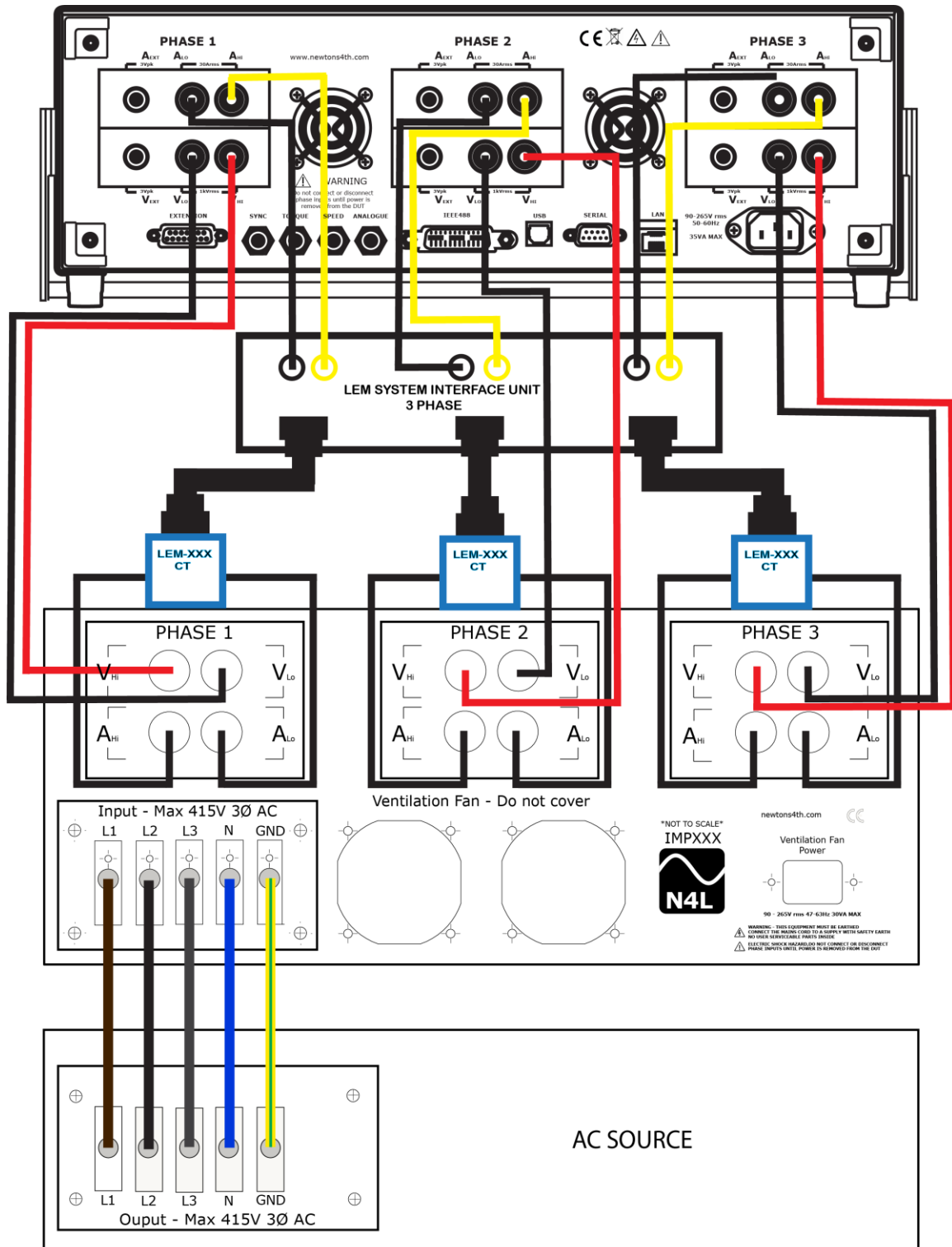
PPA - IMP753 Connections - Voltage leads supplied are 36A rated 4mm shrouded / stackable test leads 1.5mtrs.
Current Leads are 25mm tri-rated Black 2mtrs supplied with bare ends for temination. N4L Part Number 517-017
IMP - AC Source Connections - 25mm tri-rated, 3 Phase + N + E Lead Set. N4L Part Number 517-014

Appendix B.5   N4A SENSE Connection Details

The diagram below shows the connections required to connect the Sense terminals on a 3-phase AC Source to a 3-phase IMPxxx Impedance Network and a PPA5531 Power Analyzer.
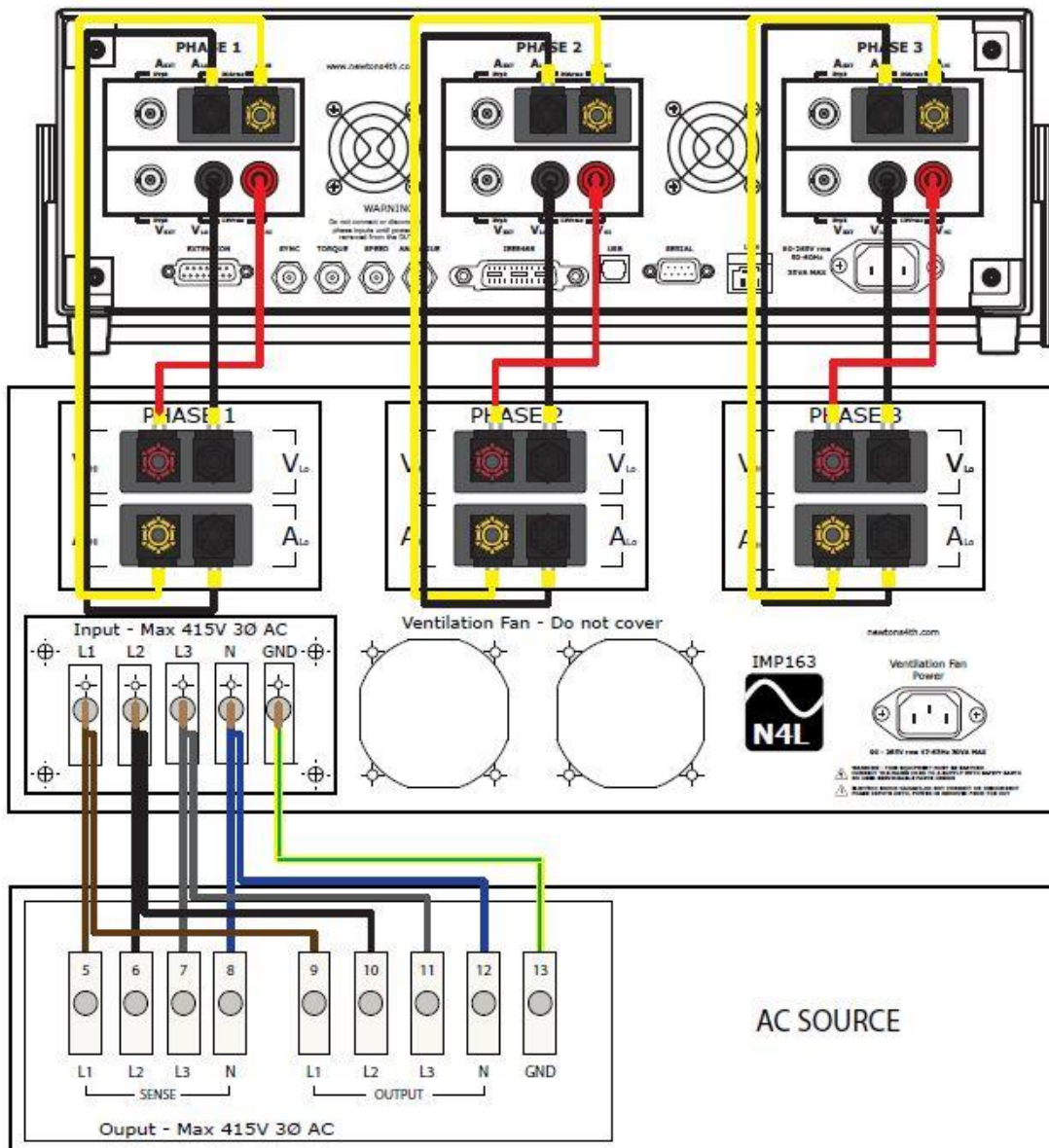
PPA - IMP163 Connections - All leads supplied are 36A rated 4mm shrouded / stackable test leads 1.5mtrs. N4L Part Number 517-009
IMP - AC Source Connections - 16mm tri-rated, 3 Phase + N + E Lead Set. N4L Part Number 517-012

Appendix B.6   N4A18 Connection Details

This section identifies the terminals that can be found on the rear of the N4A18

Rear Connection Terminal Blocks associated with the N4A18
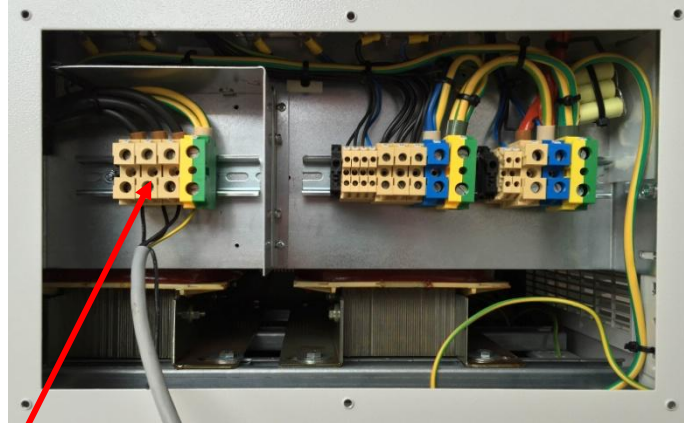
1,2,3,4   3 phase input and earth
L1, L2, L3, Earth (No Neutral)

5,6,7,8   Three phase and Neutral sense terminals
L1, L2, L3, Neutral
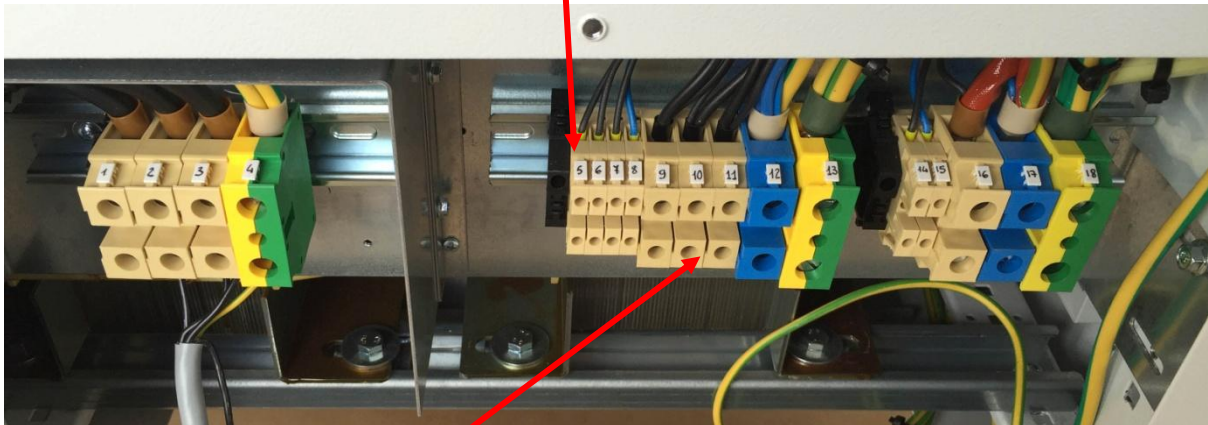
9, 10,11,12,13   Three phase and Neutral / Earth output terminals
L1, L2, L3, Neutral, Earth

14, 15   Single phase (parallel) sense terminals
L, N
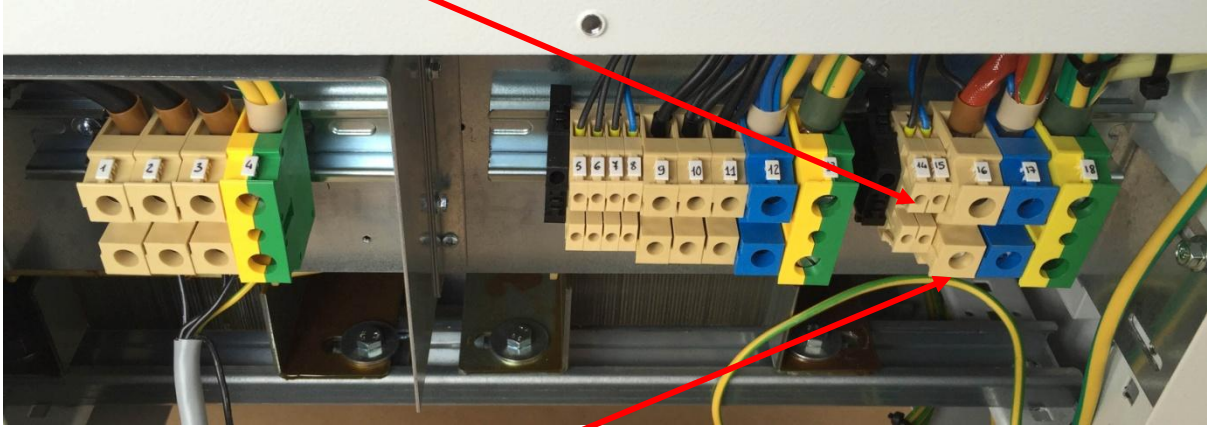
16, 17, 18   Single phase high current (parallel) output with Low / Earth
L, N, Earth

Appendix B.7   N4A30 Connection Details

This section identifies the terminals that can be found on the rear of the N4A30

Rear Connection Terminal Blocks associated with the N4A30
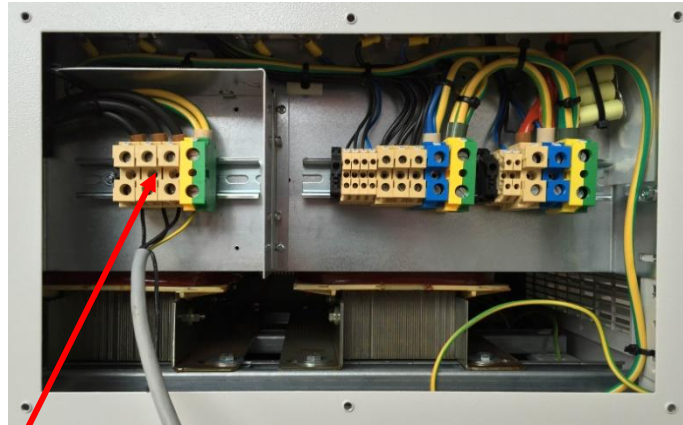
1,2,3,4   3 phase input and earth
L1, L2, L3, Earth (No Neutral)

5,6,7,8   Three phase and Neutral sense terminals
L1, L2, L3, Neutral
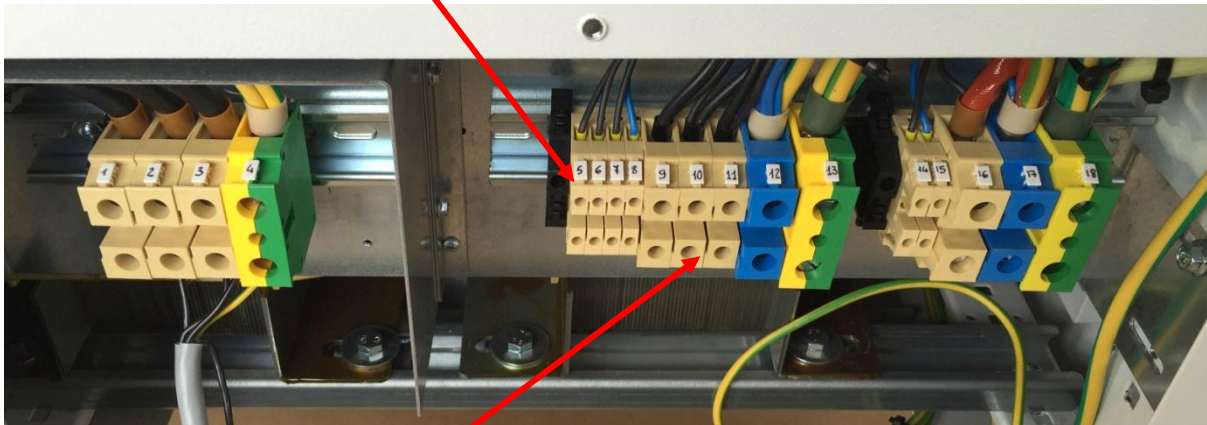
9, 10,11,12,13   Three phase and Neutral / Earth output terminals
L1, L2, L3, Neutral, Earth

14, 15   Single phase (parallel) sense terminals
L, N
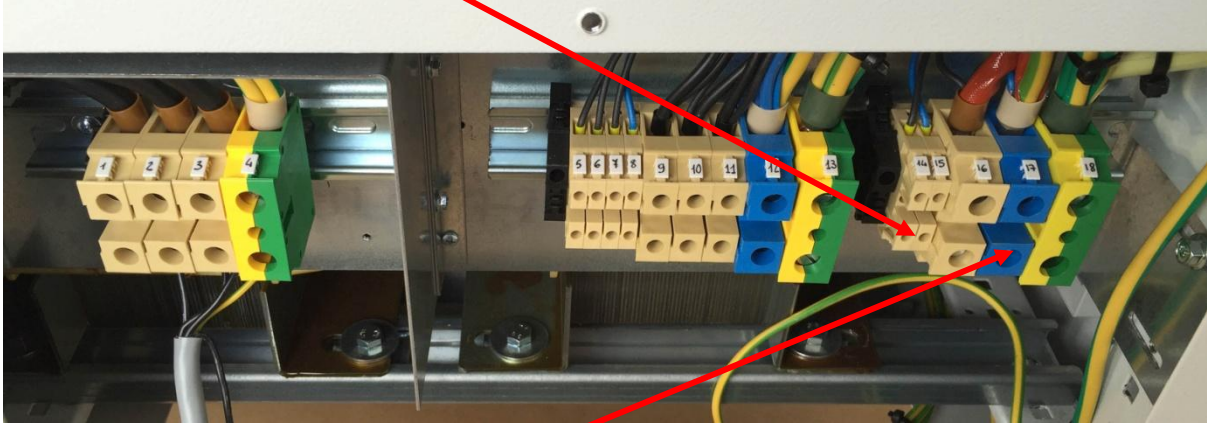
16, 17, 18   Single phase high current (parallel) output with Low / Earth
L, N, Earth

Appendix B.8   N4A67 Connection Details

This section identifies the terminals that can be found on the rear of the N4A67.

Rear Connection Terminal Blocks associated with the N4A67
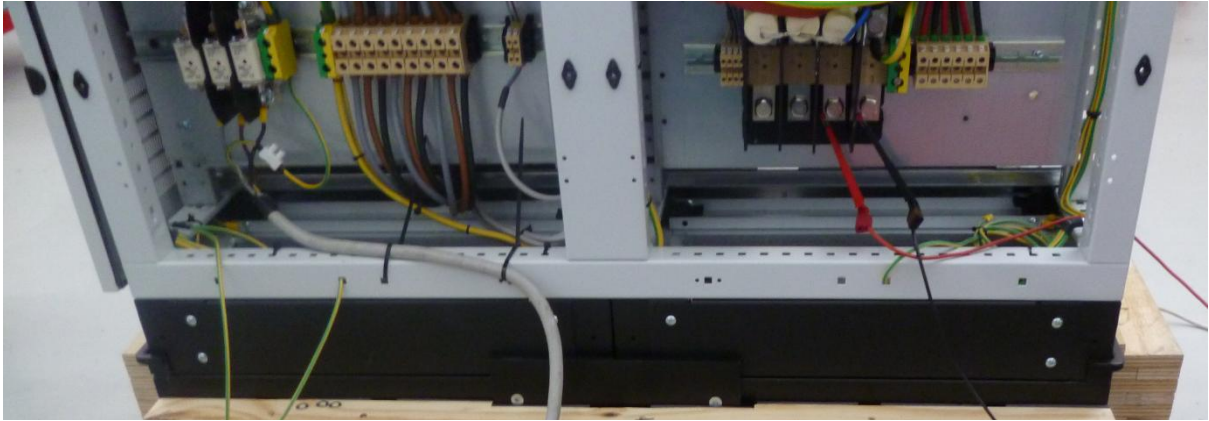
Input connections:
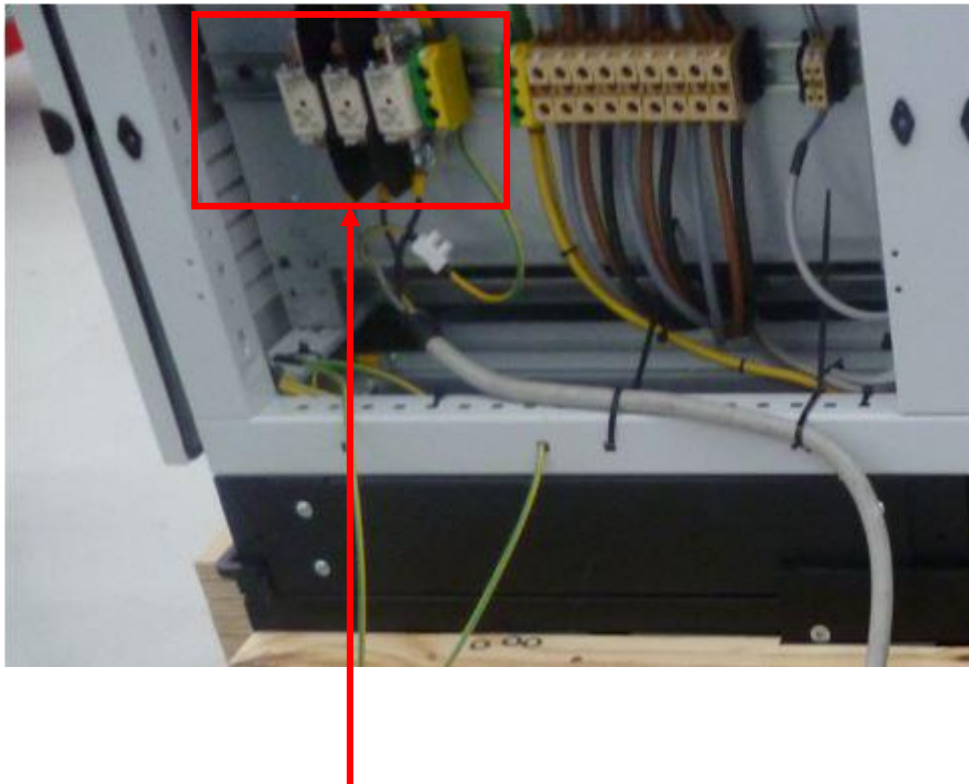
3 phase input and earth
L1, L2, L3, Earth (No Neutral)

Output connections:

Sense Terminals   REGEN bus connector
                                                   (optional)
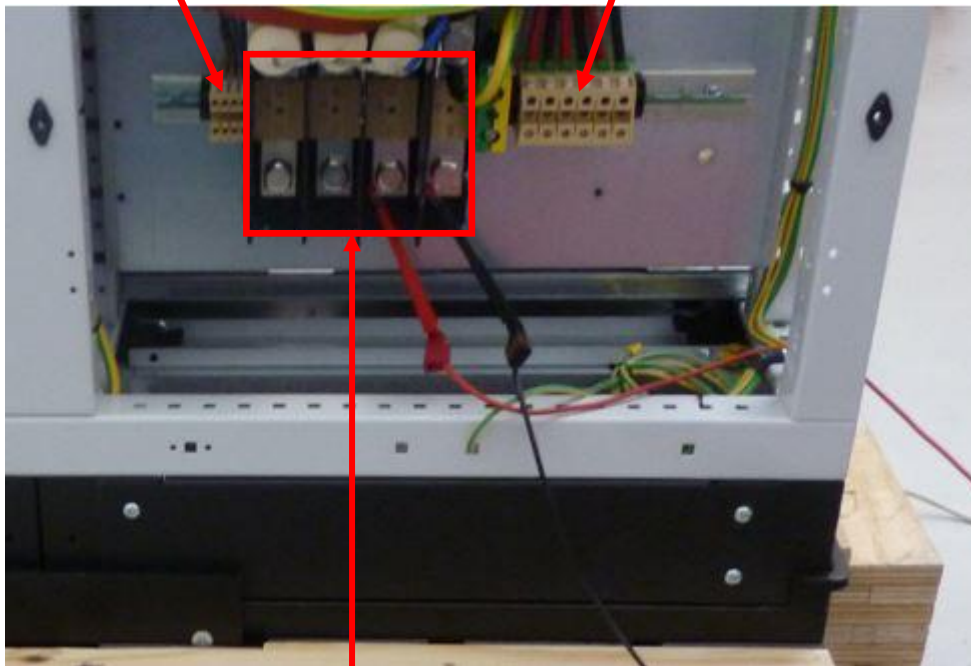
Three phase and Neutral Output terminals
L1, L2, L3, Neutral

N4A67 Connection Diagram

INPUT				SENSE 3PH				OUTPUT 3PH					BUS L1		BUS L2		BUS L3	
F1	F2	F3	PE	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94
L1	L2	L2	PE	L1	L2	L3	N	L1	L2	L3	N	E	L1 Vbus +	L1 Vbus −	L2 Vbus +	L2 Vbus −	L3 Vbus +	L3 Vbus −

Optional REGEN bus connections
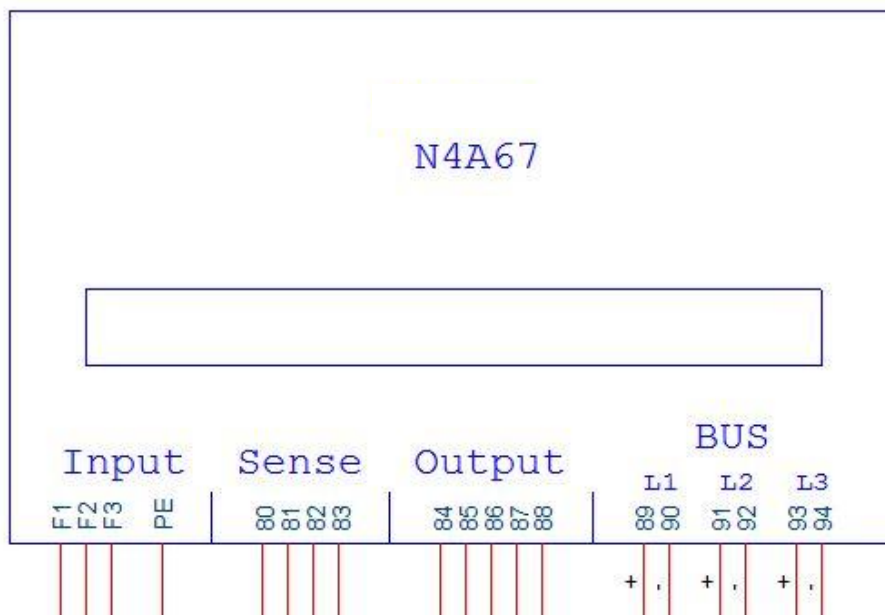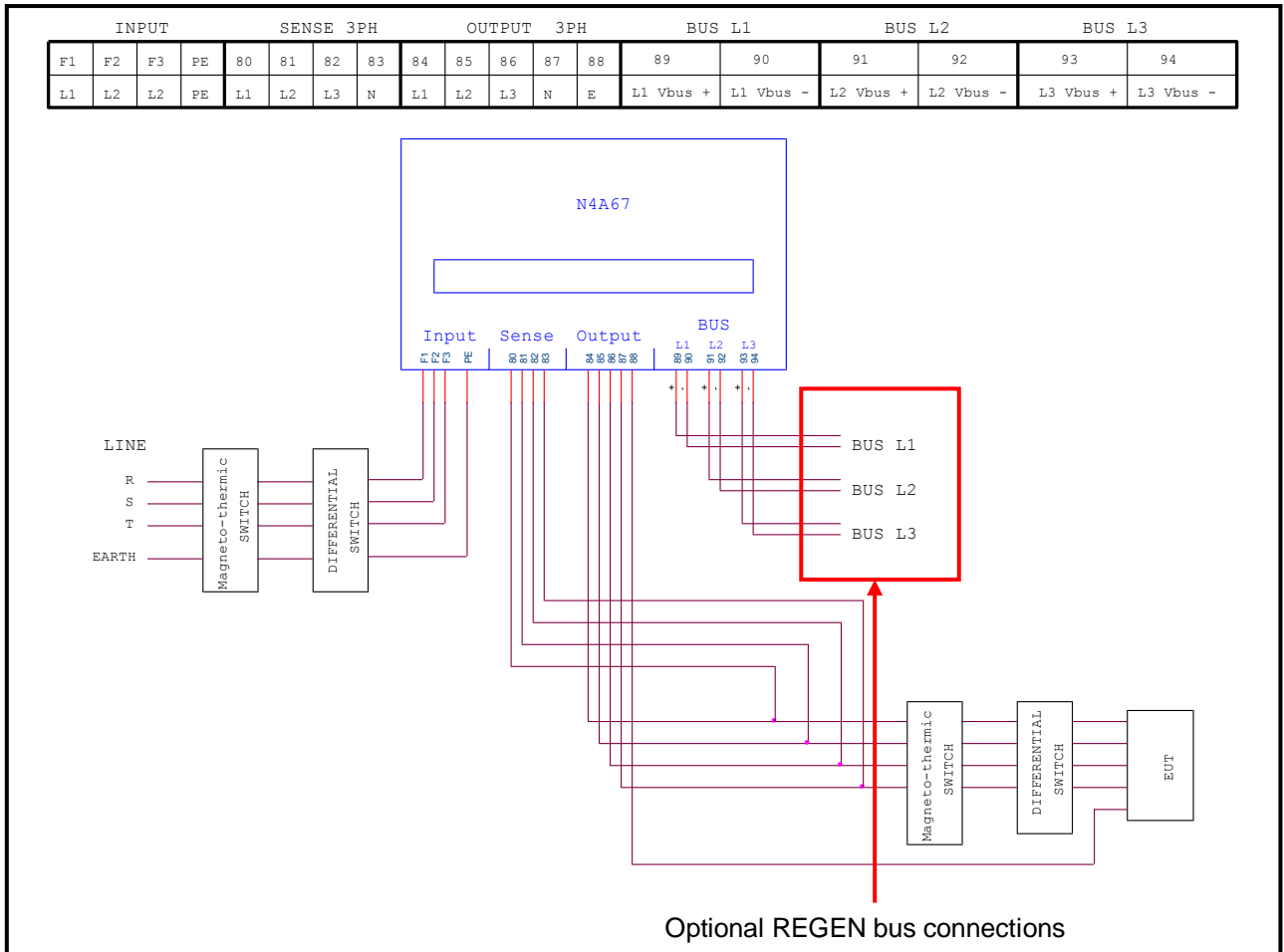
Appendix C – CommView2 PC Software

CommView2 is a self contained software program for PC, which facilitates communication over RS232, USB or LAN.

CommView2 allows strings to be sent and received between a PC and the N4A. The strings can be viewed in a window and optionally stored in a file. Data received from the N4A may be displayed in normal scientific notation with an identifying label.

Strings to be sent to the N4A can be stored in a "script file" and executed automatically. The script file is created with any text editor and includes three types of lines (interpreted by the first character on each line):
      lines beginning with " are sent to the N4A
      lines beginning with # are commands for CommView2
      any other line is a comment.

The # commands that are recognised:
#beep	*sound the beeper on the PC*
#label,i,string	*apply a label to data value[i]*
#pause,t	*wait for time t*
#reply,t	*wait time t for a reply*

For an example script file, look at example.scr on the CommView2 release disc.

Other functions in CommView2:
save results	*results menu*
set COM port parameters	*configure menu*
firmware upgrade	*instrument menu*
read/store user programs	*instrument menu*

Appendix D – N4ASoft PC Software

The N4A source can be controlled remotely from a PC using N4ASoft. The software can send commands over LAN, RS232 and USB interfaces.

Features include:

Output relay control including an immediate SHUTDOWN SOURCE option.

Waveform type, amplitude and frequency can be selected.

Schedule mode allowing:

Setting of start time, stop time, amplitude, frequency and output setting after test completion.
Multiple tests can be scheduled and re-scheduled at any time.
Count down until start of the next scheduled test.
Test settings displayed along with test time remaining.
The next test can be started immediately.
Present test can be stopped at any time.

Appendix E – N4A Communications Commands

This section provides details on the following communication commands that can be used to control the N4A Source.

AMPLIF
AMPLIT
DC
FREQUE
HARMON
HARMSE
IEC413
IEC417
LINKED
MODE
OFFSET
OUTPUT
PARALL
RANGE
RELAY?
RING
SEQDC
SEQUEN
SEQUEN?
START
STOP
WAVEFORM
WIRING

AMPLIF

Description: Control various amplifier settings

Format: AMPLIF, set, value

Arguments:
     Set: SENSE
     Value: WIRE2   (2 wire sense)
                 WIRE4   (4 wire sense)

     Set: COUPL
     Value: AC   (AC coupling)
                 ACDC   (DC coupling)

(External transformer option only)
     Set: TRANSFORMER
     Value: OFF   (standard output)
                 ON   (extended output)

(External transformer option only)
     Set: AUTO
     Value: OFF
                 ON

Reply: None

Example: AMPLIF, SENSE, WIRE4

Notes:

Use AMPLIF,AUTO,OFF to keep transformer switched in when the voltage (AMPLIT,CH1A,…) is set below the 300V threshold. The transformer will switch in when the amplitude is set greater than 300Vrms, regardless of the state of automatic switching.

AMPLIT

Description: Set the output voltage of the N4A

Format: AMPLIT, channel, amplitude

Arguments:
    Channel: CH1A   main output amplitude - PH1
             CH1B   secondary output amplitude - PH1
             CH2A   main output amplitude – PH2
             CH2B   secondary output amplitude – PH2
             CH3A   main output amplitude – PH3
             CH3B   secondary output amplitude – PH3
    Amplitude:
             range of 0 – 300 (AC) and -425 - +425 (DC)

Reply: None

Example: AMPLIT, CH1A, 240

DC

Description: Set the DC offset output, in single component
                 mode

Format: DC, phase, value

Arguments:
    Phase: PH1
              PH2
              PH3
    Value: +/- 400 V

Reply: None

Example: DC, PH2, -15

FREQUE

Description: Set the fundamental frequency of the N4A

Format: FREQUE, freq

Arguments:
Freq: Range of 1 – 10,000

Reply: None

Example: FREQUE, 50

HARMON

Description: Set the secondary amplitude and frequency for dual component mode

Format: HARMON, amp, freq

Arguments:
Amp: Range of 0 – 300
Freq: Range of 1 – 10,000

Reply: None

Example: HARMON, 15, 500

HARMSE

Description: Create a complex waveform comprising a fundamental component and up to 100 harmonics

Format: HARMSE, type, [value1, value2]

Arguments:
    Type: CLEAR
                  Integer between 1 - 100
    Value 1:   FUNDAMENTAL VOLTAGE
                  HARMONIC MAGNITUDE
    Value 2:   FUNDAMENTAL FREQUENCY
                  HARMONIC PHASE ANGLE

Reply: None

Example: HARMSE, CLEAR
                HARMSE, 1, 230, 50
                HARMSE, 3, 33.3, 0

Notes: The above example clears the table, sets the fundamental voltage and frequency and adds a 3rd order harmonic of magnitude 33.3%.

IEC413

Description: Set-up the N4A for the IEC61000-4-13 flat
                   curve test

Format: IEC413, FLAT, class, [value]

Arguments:
    Class: CLASS1-3
              CLASSX   (value applies)
    Value: 70 – 99%

Reply: None

Example: MODE, IEC610
                   IEC413, CLASSX, 75

Notes:

IEC417

Description: Set-up the N4A for the IEC61000-4-13 flat
                   curve test

Format: IEC417, type, [value]

Arguments:
    Type: 1PHASE   (rectifier waveform)
              3PHASE   (rectifier waveform)
              RIPPLE   (value applies)
    Value: 1 – 30%

Reply: None

Example: MODE, IEC610
                   IEC417, 1PHASE
                   IEC417, RIPPLE, 4

Notes

LINKED

Description: Link phase amplitude values, or set independently.

Format: LINKED, value

Arguments:
    Value: ON   (amplitudes linked)
              OFF   (amplitudes independent)

Reply: None

Example:

Independent amplitudes

            LINKED,OFF
            AMPLIT,CH1A,230
            AMPLIT,CH2A,150
            AMPLIT,CH3A,220

Linked amplitudes (Phase 1,2 and 3 all 230Vrms)

            LINKED,ON
            AMPLIT,CH1A,230

MODE

Description: Set the basic operating mode of the N4A

Format: MODE, type

Arguments:
    Type: GEN   single component
                HARM   harmonics
                DUAL   dual frequency
                DC   dc only
                IEC610   iec61000 options
                UL2231   ringing wave

Reply: None

Example: MODE, HARM

OFFSET

Description: Set the phase angle for each line of a 3-phase
                  output (PH2 and PH3 are relative to PH1)

Format: OFFSET, phase, value

Argument:
    Phase: PH2
              PH3
    Value: -360 to 0

    Phase: PH1
    Value: 0 to 360

Reply: None

Example: OFFSET, PH2, -120

Notes:

OFFSET,PH1 defines the turn on phase angle. (See 7.1.5)

OFFSET,[PH2/PH3] defines phase angle relative to phase 1.

OUTPUT

Description: Turn the output relay of the N4A on and off

Format: OUTPUT,state
               OUTPUT,TYPE,phase

Arguments:
    State: ON
                  OFF

    Phase: 1PHASE
                  3PHASE

Reply: None

Example: OUTPUT,ON
               OUTPUT,TYPE,1PHASE

PARALL

Description: Turn N4A parallel output on and off

Format: PARALL, state

Arguments:
    State: ON
                  OFF

Reply: None

Example: PARALL, ON

Notes:

This command only applies to 3-phase units purchased with a parallel output option.

RANGE

Description: Set the output range option for each phase

Format: RANGE, phase, type

Argument:
  Phase: PH1
    PH2
    PH3

  Type: AUTO
    HIGH
    LOW

Reply: None

Example: RANGE,PH3,HIGH

Notes:

For standard units high = 300Vrms, low = 30Vrms

RELAY?

Description: Read back state of output relay(s).

Format: RELAY?
           RELAY,phase?

Arguments:
    phase:
           PH1
           PH2
           PH3

Reply: 0 or 1   (single phase)
          0,0,0   (three phase)

Example: RELAY,PH2?

Notes:

Response format for RELAY? is either x or x,y,z, depending on the model variant being used.

RING

Description: Set the UL2231 ringing options

Format: RING,option

Argument:
Option1: PH1
PH2
PH3

Option2: 1kHz
2kHz
3kHz
4kHz
5kHz

Reply: None

Example: RING,PH2
RING,*X*kHz

Notes:

Set the phase on which the ringing is applied to in UL mode.

Set the ringing frequency in UL mode, where *X* is 1,2,3,4 or 5.

SEQDC

Description: Used to create and run through a series of dc voltage points.

Format 1:   SEQDC, option

Arguments:
    Option: SINGLE   (single shot)
               REPEAT   (continuous sequence loop)
               CLEAR   (clear sequence table)

Format 2:   SEQUEN, entry, volt, time, trans

Arguments:
    Entry: integer value range 1 - 50
    Volt: amplitude in range of 0 – 300 (AC)
    Time: output period in seconds
    Trans: LINEAR or STEP transition between entries

Reply: None

Example: SEQDC, 1, 10, 0.1, LINEAR
                SEQDC, 2, 90, 0.1, STEP

Notes:

SEQUEN

Description: Used to create and run through a series of ac
              voltage and frequency points.

Format 1:   SEQUEN, option

Arguments:
    Option: SINGLE   (single shot)
              REPEAT   (continuous sequence loop)
              CLEAR   (clear sequence table)

Format 2:   SEQUEN, EVENT, phase, value

Arguments:
    Phase: PH1, PH2, PH3 (phase the sequence applies to)
    Value: phase offset applied 0 – 360 deg

Format 3:   SEQUEN, entry, volt, freq, cycles, event, trans

Arguments:
    Entry: integer value range 1 - 50
    Volt: amplitude in range of 0 – 300 (AC)
    Freq: frequency in range of 1 – 10,000
    Cycles: output period in half cycles
    Event: 0 – inactive, 1 – active
    Trans: LINEAR or STEP transition between entries

Reply: None

Example: SEQUEN, 1, 10, 50, 10, 0, LINEAR
              SEQUEN, 2, 90, 50, 10, 0, STEP

Notes:

A more detailed view of sequence mode is given in section 7.8.

SEQUEN?

Description: The sequence can be queried to check if it still running or has finished

Format: SEQUEN?

Arguments: None

Reply: 0   (Sequence complete)
              1   (Sequence running)

Example: SEQUEN?
              Data returned (0 or 1)
Notes:

START

Description: Start a sequence, update a harmonic table or inject a ringing waveform

Format: START

Arguments: None

Reply: None

Example: HARMSE, 1, 230, 50
              HARMSE, 3, 33.3, 0
              START
Notes:

STOP

Description: Stop a repeating sequence

Format: STOP

Arguments: None

Reply: None

Example: SEQUEN, REPEAT
                SEQUEN, 1, 10, 50, 10, 0, LINEAR
                SEQUEN, 2, 90, 50, 10, 0, STEP
                START
                STOP

Notes:

WAVEFORM

Description: Control output waveform in single component
                mode

Format: WAVEFORM, wave

Arguments:
    Wave: SINEWAVE
                TRIANGLE
                SQUARE

Reply: None

Example: WAVEFORM, TRIANGLE

WIRING

Description: Control output configuration

Format: WIRING, value

Arguments:
     Value: 1PHASE
                3PHASE

Reply: None

Example: WIRING, 3PHASE

Appendix F – Available character set

The following characters can be selected in text entry mode. The table is to be read across then down (eg, starting at space and repeatedly pressing NEXT gives ! " # $ % & ' ( ) * etc.)

	!	"	#	$	%	&	'
(	)	*	+	,	-	.	/
0	1	2	3	4	5	6	7
8	9	:	;	<	=	>	?
@	A	B	C	D	E	F	G
H	I	J	K	L	M	N	O
P	Q	R	S	T	U	V	W
X	Y	Z	[	\	]	^	_
'	a	b	c	d	e	f	g
h	i	j	k	l	m	n	o
p	q	r	s	t	u	v	w
x	y	z	{	|	}		

Appendix G – Contact details

Please direct all queries or comments regarding the N4Axx instrument or manual to:

Newtons4th Ltd.
1 Bede Island Road
Leicester.
Leicestershire.
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

At Newtons4th Ltd. we have a policy of continuous product improvement and are always keen to hear comments, whether favourable or unfavourable, from users of our products.

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

Alternatively send an e-mail with your comments.

AC Power Source comments

serial number:		date:
your contact details:		
comments:		
detailed description of application or circumstances:		

Please post or fax to Newtons4th Ltd.