



Newton4th Ltd

LEM-6

3-6 Channel Interface

User Manual



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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.

IMPORTANT SAFETY INSTRUCTIONS

This equipment is designed to comply with BSEN 61010-1 (2010) (Safety requirements for electrical equipment for measurement, control, and laboratory use) – observe the following precautions:

- This instrument is to be connected and operated only by qualified personnel.
- This appliance **must** be earthed. Ensure that the instrument is powered from a properly grounded supply before connecting to any live inputs.
- 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.
- Keep the ventilation slots in the top and sides of the cover free from obstruction.
- Do not operate or store under conditions where condensation may occur or where conducting debris may enter the case. Do not use in a wet environment.
- 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

Newton4th Ltd.
1 Bede Island Road
Leicester
LE2 7EA

We declare that the product:

Description: LEM CT Interface

Product name: LEM6

Model: LEM6-x Family

Conforms to the EEC Directives:

2014/30/EU relating to electromagnetic compatibility:

EN 61326-1:2013

EN 55022 class A

EN 61000-3-2:2014

EN 61000-3-3:2013

2014/35/EU relating to Low Voltage Directive:

EN 61010-2-030:2010

EN 61010-1:2010

January 2021

Jigar Patel
(Senior Engineer Newton4th Ltd.)

WARRANTY

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

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

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 be re-calibrated annually.

ABOUT THIS MANUAL

This manual describes the general features, usage and specifications of the

LEM6-x range of LEM CT interfaces.

LEM6 User Manual

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1 Getting started

LEM6 is supplied ready to use – it comes complete with an appropriate power lead and a set of test leads. It is supplied calibrated and does not require anything to be done by the user before it can be put into service.

1.1 Temperature Limits

The temperature limits for storage of the instrument and during shipping / transportation are:

-20° C to +70° C

The instrument must be within 5° C of the ambient temperature before operation.

1.2 Unpacking

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

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

Before connecting the test leads to an active circuit first connect the mains cord from a properly grounded supply outlet to the inlet on the rear panel of the LEM6. LEM6 has a universal mains input and accepts any supply voltage from 100-240VAC at 50 or 60Hz, maximum 6A.

Switch on the LEM6 and allow 30 minutes warm up time before commencing any measurements in order to ensure accurate results.

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.

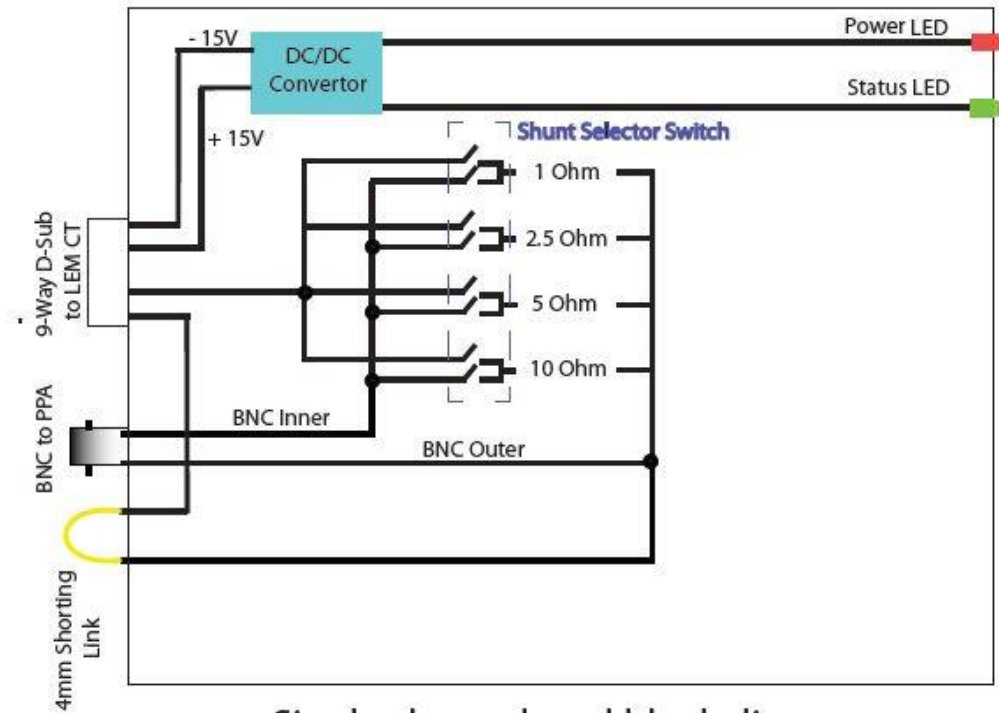
2 Description of operation

N4L LEM-6 Interface serves as a high accuracy, highly stable interfacing unit allowing simple "plug and play" connection of any N4L PPA to the LEM current transducers listed in Appendix A.

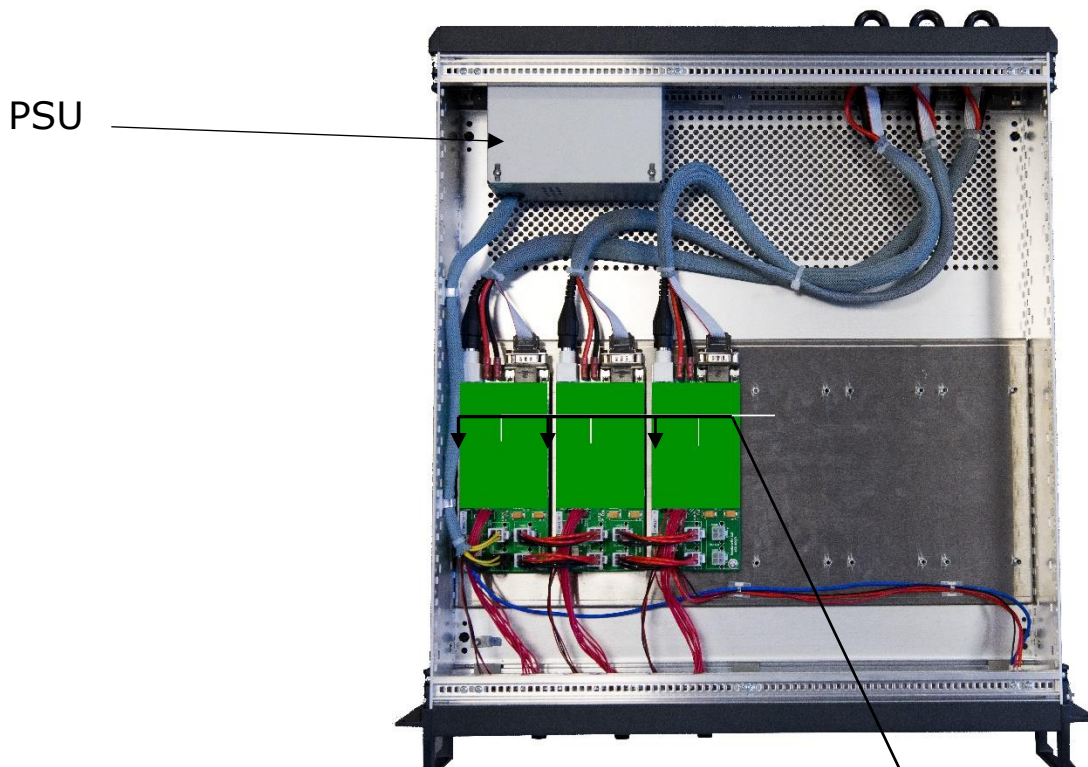
The LEM-6 supplies the LEM transducer with a highly stable isolated supply voltage; each channel is isolated from the next providing excellent cross channel coupling immunity. There are 4x current shunts per channel, ranging from $1\Omega \sim 10\Omega$, this ensures the transducer can be utilized accurately throughout its dynamic range without the introduction of noise into the measurement.

The LEM-6 is 19-inch rack mountable and available in 3~6 phase configurations.

3 Basic circuit inside LEM



Single channel card block diagram

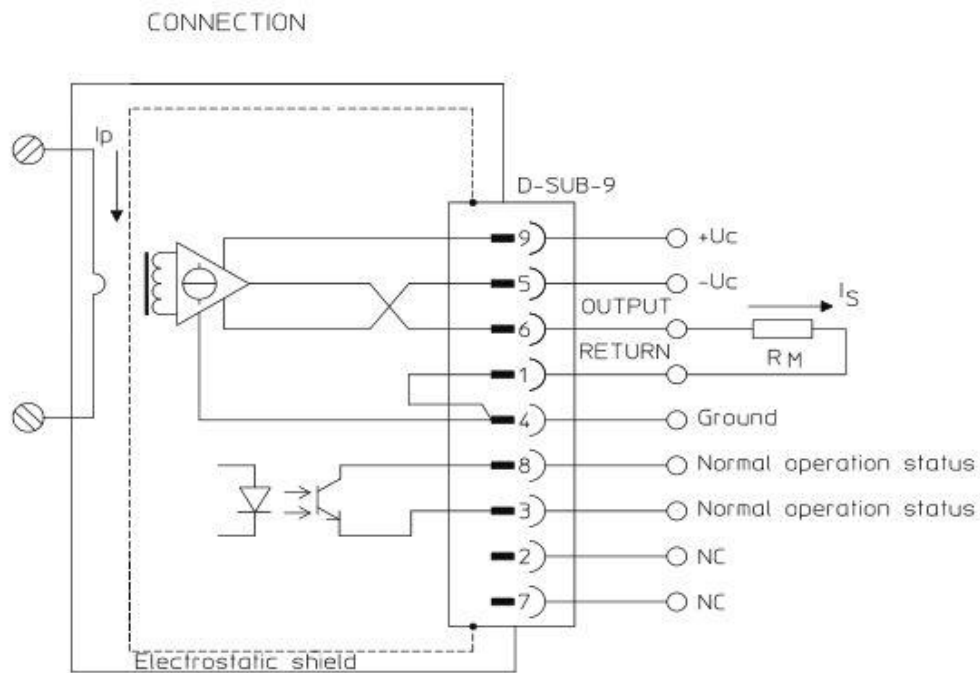


Shunt Cards 3 shown

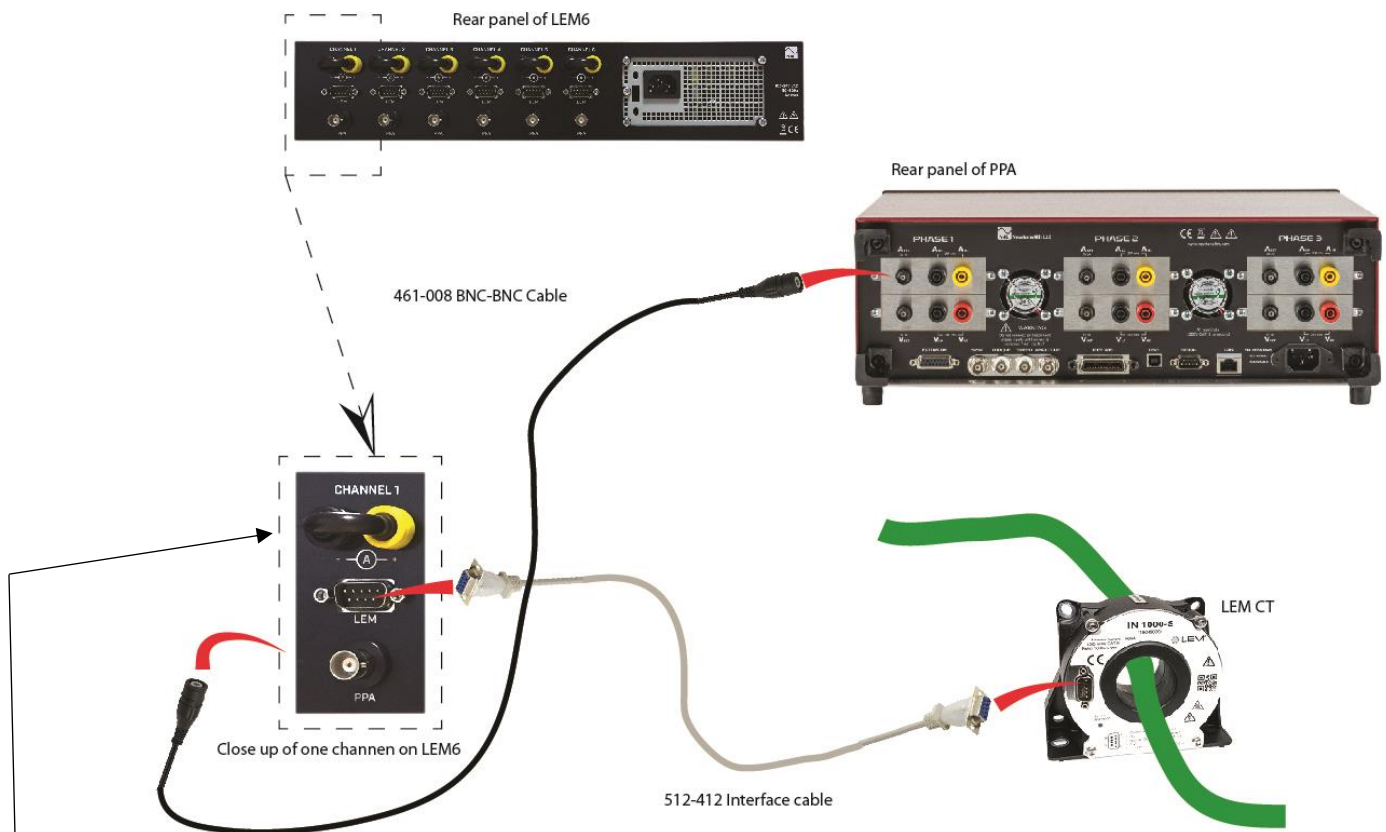
4 Pin out

Each channel is connected from the LEM6 on the rear 9 pin D Sub connector to the LEM CT via the supplied interface lead.

4.1 9 Pin D-sub pinout diagram



4.2 Connection Diagram



In normal operation ensure that a 4mm shorting link is fitted to each channel.

5 Setting up LEM6

5.1 Choice of shunt

Each channel of the LEM6 has a selection switch to choose between the four available shunt values of 1Ω , 2.5Ω , 5Ω , and 10Ω .

Some care and consideration should be taken into the selection of the correct shunt value for each channel as well as the choice of CT.

The combination should be chosen to give as close to 3Vpk as the output from the BNC marked PPA.

In a typical application the correct shunt should be chosen from the supported range (see Appendix B) so that the expected current to be measured is close to the top range of the CT, with a tolerance.

For example, if you suspect the measured current to be approx. 500A_{pk} then the IT405-S would be ideal.

The conversion ratio is 1:1500 therefore 500A_{pk} would give a secondary current I_s of 333mA_{pk}

For an ideal of 3Vpk output this would give a shunt value of 9Ω , however if the closest numerical value shunt of 10Ω were chosen, then the Ext input limit of 3Vpk would be exceeded. Therefore the 5Ω shunt would be used in this case.

The EXT input of the PPA has 8* calibrated ranges from the maximum 3Vpk down to 1mVpk*, i.e. a 3000:1* ratio. So, in most cases, lower current (and therefore voltage into the EXT input) is handled by the wide range system without any risk of overrange damage if current is higher than expected. Consequently, wherever possible the 1 Ohm shunt should be selected unless current is so low that sensitivity needs to be increased further. Overrange of the lower ranges is not a problem, If, for example 3Vpk is applied when the 1mV range is

selected, there will be an overrange message, but no damage will occur to the EXT input. However, the 3Vpk limit MUST NOT be exceeded as this will damage the EXT input.

Once the shunts values have been chosen, they should not require changing until the rig is used to test a different set up.

If they need to be changed then for the increased longevity of the shunt selection switch, the switch should only be changed when under no load with no current flowing through the switch.

*9, 300 μ Vpk, and 10000:1 for the PPA5500 series.

5.2 Setting PPA Ranges

Setting up the PPA depends upon whether the LEM-6 is being used as part of a calibrated system or not.

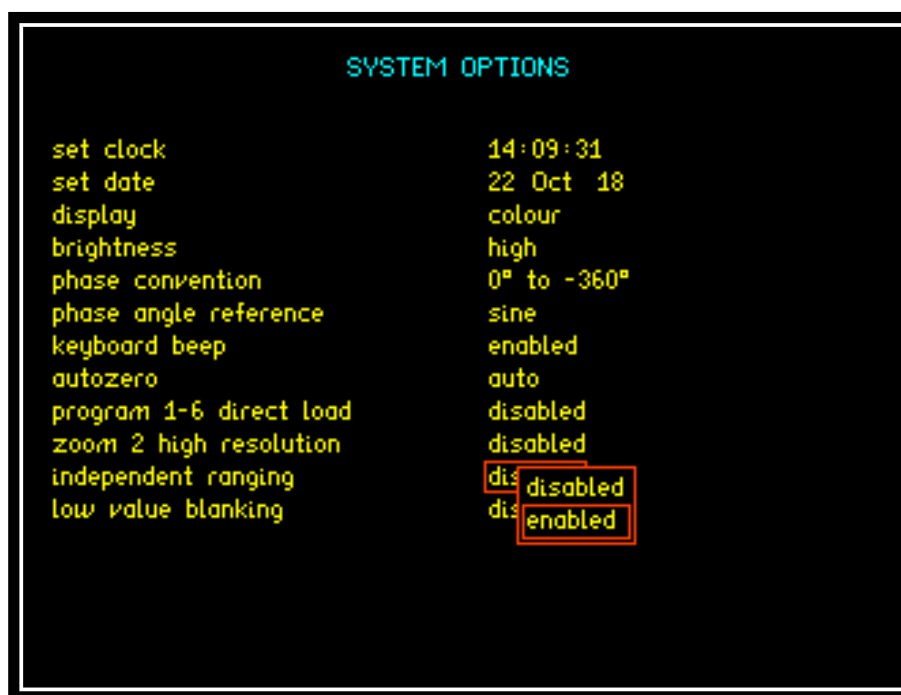
If the LEM-6 is purchased with an N4L power analyzer and LEM transducers, the LEM-6 Interface can be "system calibrated" within N4L's ISO17025 UKAS laboratory. This provides the engineer with a single uncertainty figure and improved accuracy performance.

5.2.1 Use with non-system calibrated CT's

Press the SYS key

Press the DOWN ARROW key until Independent ranging is highlighted red

Press the RIGHT ARROW, select Enabled with the DOWN ARROW key.



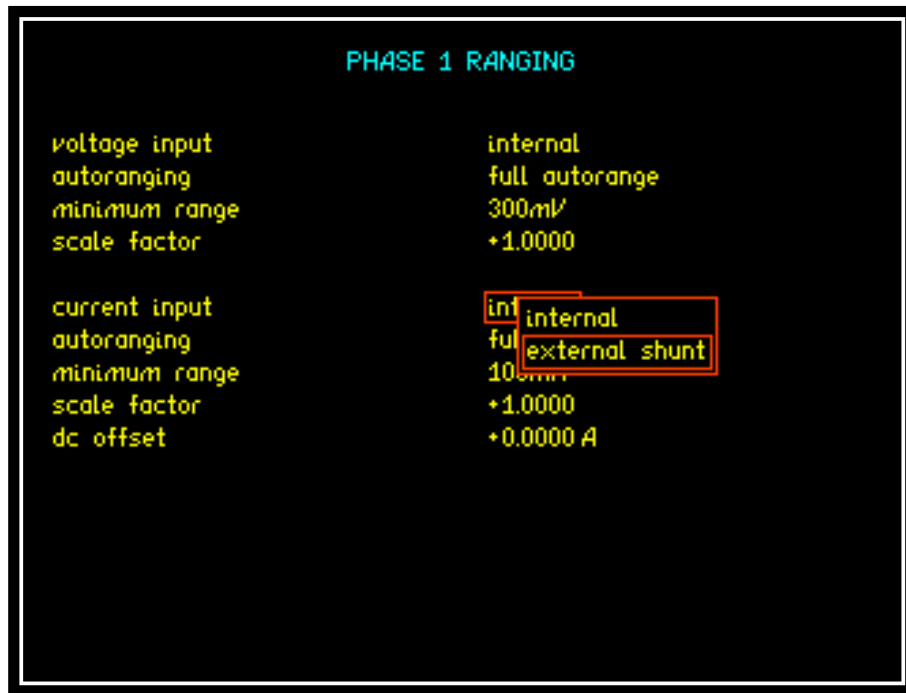
Press ENTER key twice to return to the power analyser screen.

Press the RANGE key.

Press the DOWN ARROW key five* times until Current Input is highlighted.

Press RIGHT ARROW key, then DOWN ARROW key to select External shunt.

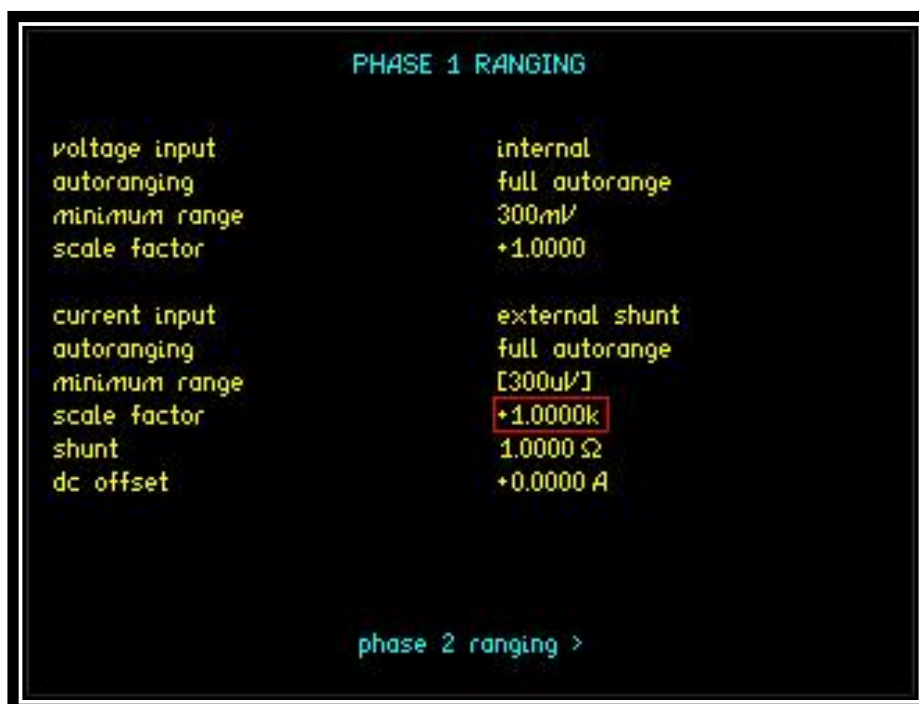
*If voltage channel is set to external, Current input will be selected by an additional press of the DOWN ARROW



Press ENTER key

Press DOWN ARROW key 3 times and set the Scale factor to suit the CT in use. The scale factors are listed in section 7 Appendix A.

For example, the scale factor would need to be set to 1000 for an IT200-S as shown below.



Press the ENTER key to save the new scale factor value.

Now press the DOWN ARROW once to select the shunt value. Set the shunt value to the actual value from calibration label on the right-hand side of the case. Shown ringed in red for clarity.



LEM6/3 - 91M-12844

0.1% Shunt Values
Calibration Date: 8 May 2019

		Channel					
		1	2	3	4	5	6
Range	1 Ω [100%]	1.0357 Ω	1.0344 Ω	1.0352 Ω	N/A	N/A	N/A
	2.5 Ω [40%]	2.5746 Ω	2.5719 Ω	2.5725 Ω	N/A	N/A	N/A
	5 Ω [20%]	5.0231 Ω	5.0254 Ω	5.0248 Ω	N/A	N/A	N/A
	10 Ω [10%]	10.057 Ω	10.059 Ω	10.056 Ω	N/A	N/A	N/A



Press the ENTER key to save the new shunt value.

Press the HOME key then using RIGHT ARROW key go to the next phase.

Repeat the preceding steps for each phase, setting the scale factor and shunt values from the calibration label.

5.2.2 Use with system calibrated CT's

Note:

The following procedure is for system calibrations that have all CT's connected to the external inputs of the instrument.

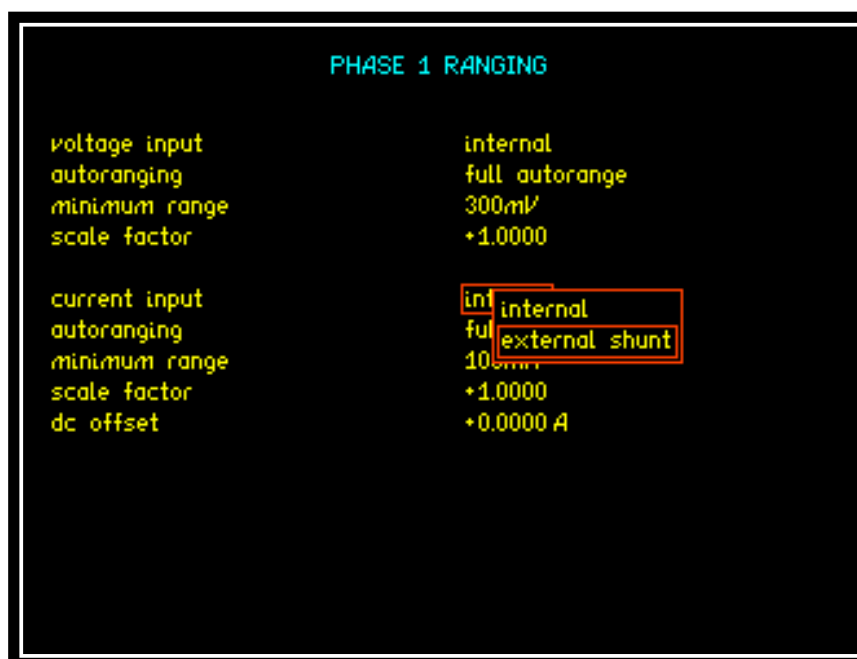
For setups only having CT's on certain inputs or using a combination of internal and external inputs, the instrument should first have independent ranging enabled in the SYS menu options. The Range instructions below will then have to be repeated for each phase to individually set each phase to internal or external shunt.

Press the **RANGE** key.

Press the DOWN ARROW key five* times until Current Input is highlighted.

Press RIGHT ARROW key, then DOWN ARROW key to select External shunt.

*If voltage channel is set to external, Current input will be selected by an additional press of the DOWN ARROW



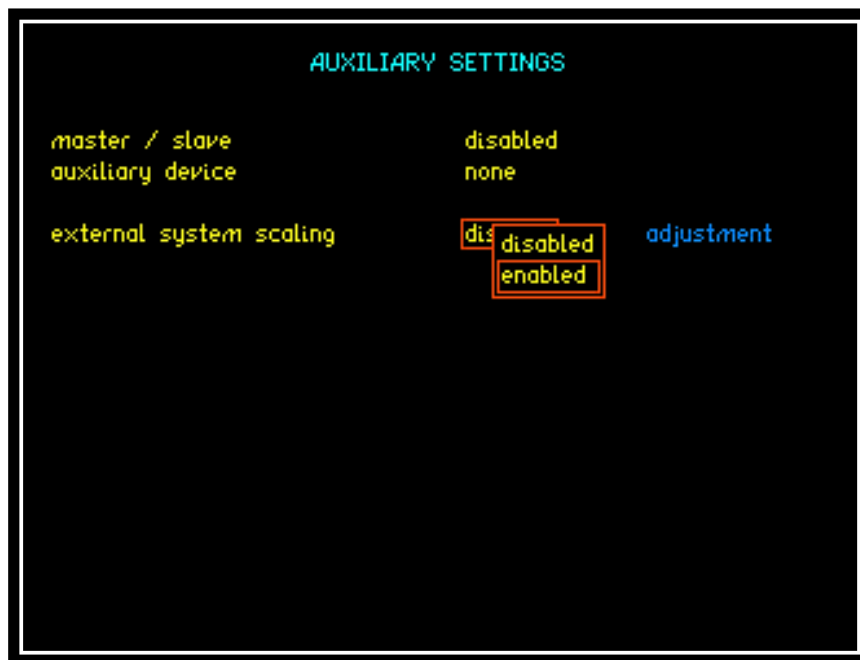
Press the ENTER key twice.

Press **AUX** to open the AUX menu.

Press DOWN ARROW 3 times to highlight External system scaling.

Press RIGHT ARROW

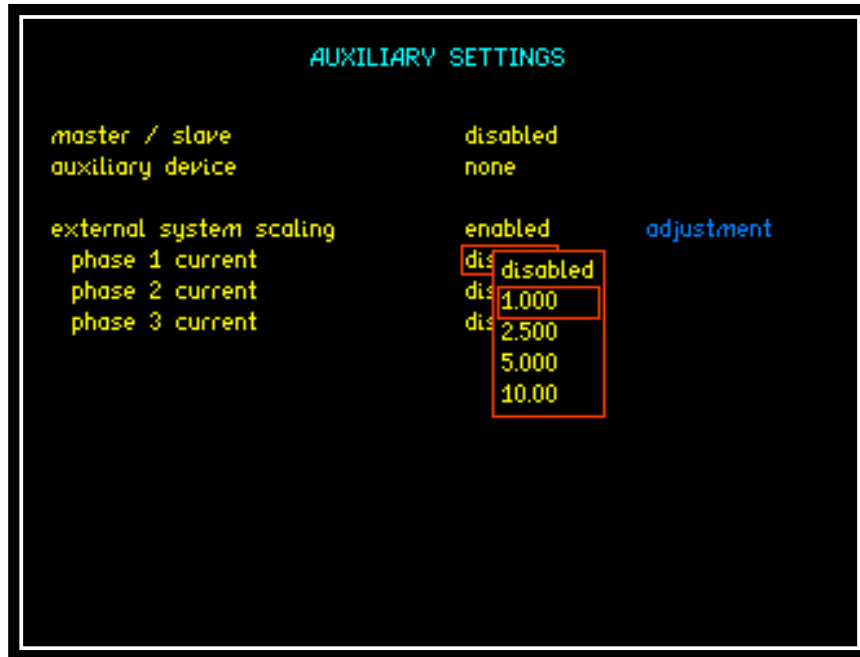
Press DOWN ARROW to select enabled.



Press ENTER key

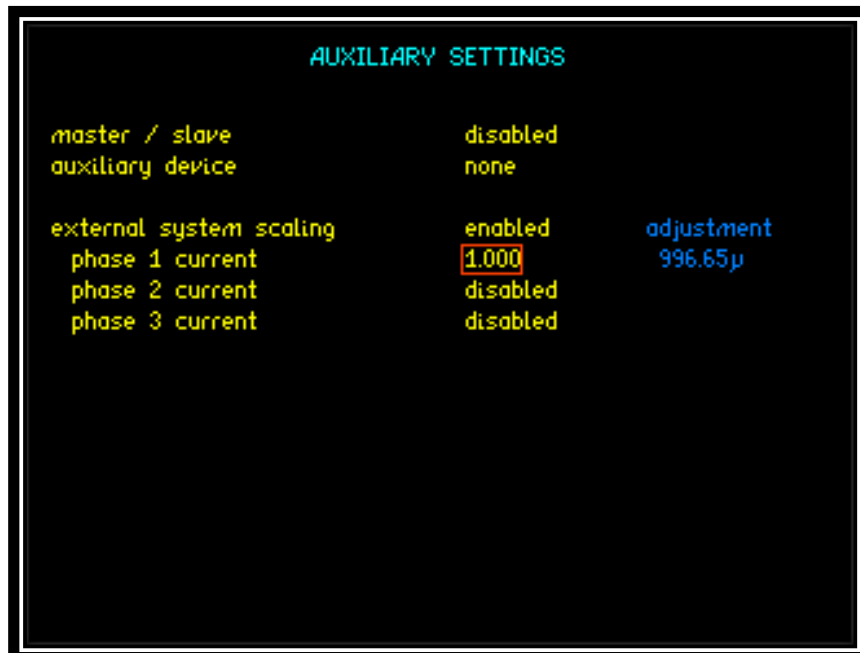
Press DOWN ARROW to highlight Phase 1

Press RIGHT ARROW, this now displays a sub menu showing shunts available.



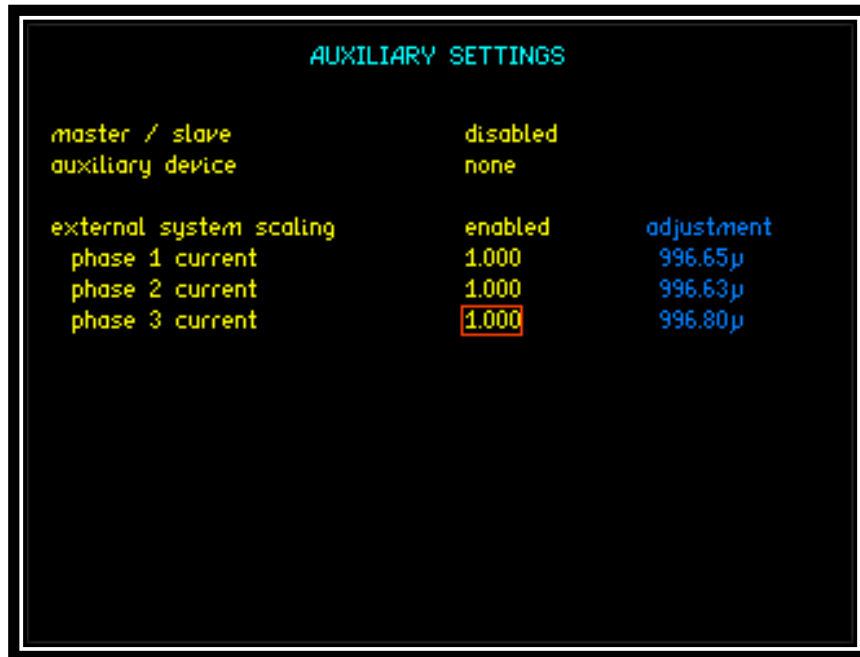
Using the DOWN ARROW selects shunt value, press ENTER and in blue the adjustment value for the selected shunt is shown.

Press ENTER.



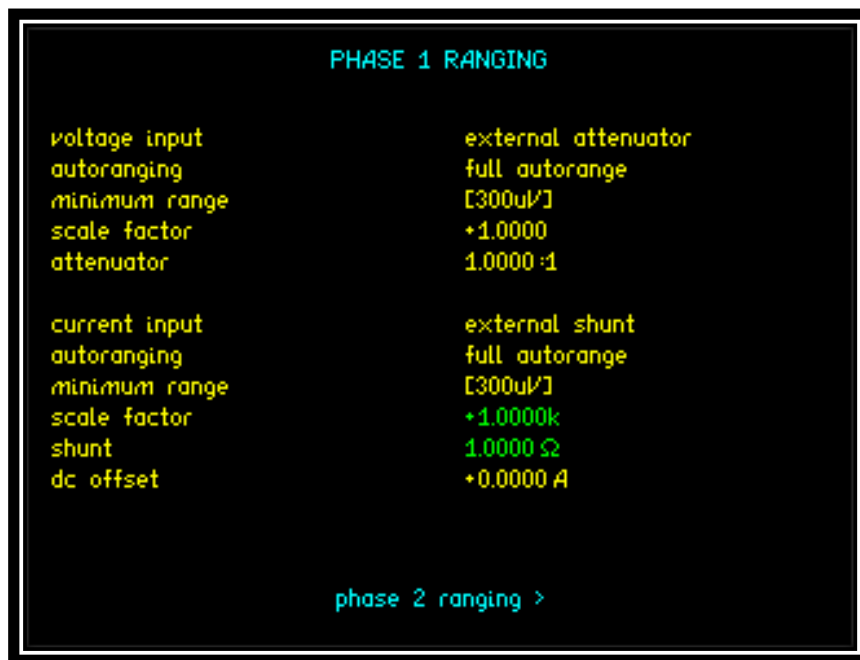
Repeat for each channel of the LEM6.

The adjustment value for each shunt is shown:



Press the Enter Key.

If **RANGE** is pressed the RANGING menu will confirm that the external system scaling has been selected in the AUX menu, by displaying the Scale factor and the nominal shunt value in green text.



The above screenshot shows the settings for Phase 1. The left and right arrow keys can be used to display the settings for Phase 2 and Phase 3.

6 Specifications

Number of Phases	3 - 6
Number of Ranges	4 (1.0Ω, 2.5Ω, 5.0Ω, & 10.0Ω)
Compatible Transducers	See Appendix A
Output Voltage @ BNC connector	+/- 3Vpk
Output Current @ 4mm Terminal	+/- 1Apk
Shunt Accuracy	0.1%
(Typical with system calibration, Dependent on CT chosen)	0.04%

Physical

Size	LEM-6 - 90H x 450W x 485D mm – Excl. feet
Weight	6.0kg – 6 phase

Electrical

Safety isolation	Conductor may need extra insulation dependent on CT chosen, consult appropriate LEM data sheet.
Power supply	100-240 VAC 50-60Hz
Interface Cable Length	2 metres standard – Up to 6 metres available as an option
Output connectors	Safety BNC (voltage) or 4mm (current) – shorting links supplied

Environmental

Operating Temperature Range	0°C to +50°C
Storage Temperature Range	-20°C to +70°C
Relative Humidity Range	20 to 95% Non-Condensing
Maximum Altitude	2,000 Metres

All specifications at 23°C ± 5°C.

These specifications are quoted in good faith but Newtons4th Ltd reserves the right to amend any specification at any time without notice

7 Appendix A – Compatible CT's

Model Number	Current Rating		Conversion Factor
IT60-S	60Apk	42Arms	600
IT65-S §	85Apk	60Arms	600
IN100-S	150Apk	100Arms	500
IT200-S	200Apk	141Arms	1000
IN200-S	300Apk	200Arms	1000
IT205-S §	283Apk	200Arms	1000
IT400-S	400Apk	282Arms	2000
IN400-S	600Apk	400Arms	1500
IT405-S §	566Apk	400Arms	1500
IT600-S	400Apk	282Arms	1500
ITN600-S	600Apk	424Arms	1500
IT605-S §	849Apk	600Arms	1500
IT700-S	700Apk	495Arms	1750
LF510-S *	800Apk	500Arms	5000
LF1010-S *	2700Apk	1000Arms	5000
LF2010-S *	4250Apk	2000Arms	5000

*Overall accuracy at Primary nominal RMS current

LF510-S 0.6%

LF1010-S 0.4%

LF2010-S 0.3%

[0.1% with system calibration AC+DC]

CT's marked § are legacy devices no longer available new

7.1 Appendix B – Contact Details

Please direct all queries or comments regarding the LEM-6 instrument or manual to:

Newton4th Ltd.
1 Bede Island Road
Leicester
LE2 7EA
United Kingdom

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

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

web site: www.newtons4th.com

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

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

Alternatively send an e-mail with your comments.

LEM-6 comments		
serial number:		date:
your contact details:		
comments:		
detailed description of application or circumstances:		
Please post or fax to Newtons4th Ltd.		