

International Electrical Symbols

⚠ Caution! Refer to this manual before using the meter
⚡ Meter is protected by Reinforced or Double Insulation

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1. INTRODUCTION

The advanced design of B&K Precision's Power Clamp series instruments ensures reliable and accurate measurements under a wide range of operating conditions. Power meter features include:

- AC/DC voltage and current measurement
- True RMS for complex and distorted waveforms
- Watts, VA, VAR, PF and Hz
- Built in 3 phase power capability
- Bargraph for dual parameter display
- REC mode and Smart Hold to save a complete set of readings for power measurements
- Digital output for data logging*

Additional Features 5331A

- Measurement of Peak Voltage and Current
- THD, DF, CF and Ripple Measurement
- Digital Waveform output for harmonics analysis*

These instruments conform to the latest international directives and standards concerning safety and electromagnetic compatibility.

- European Low Voltage Directives 73/23/EEC and 93/68/EEC
- European EMC Directives 89/336/EEC and 93/68/EEC
- Submitted for approval to UL 3111-1

Safety Standards

IEC 1010-1: 1992-09 Safety requirements for electrical equipment for measurement, control and laboratory use.
 Part 2-032 : 1994-12 Particular requirements for hand held current clamps for electrical measurement and test.
 Part 2-031 : 1993-02 Particular requirements for hand held probe assemblies for electrical measurement and test.

600V Cat III Pollution degree 2

EMC Standards

RF Susceptibility
 EN 50082-1: 1992 3V/m Residential, Commercial and Light Industry

RF Emissions

EN 50081-1: 1992 Residential, Commercial and Light Industry
 FCC Part 15 Class B

*Requires optional WinLog accessory

1.1 Instrument Features

The main operating features of the instrument are as follows. See Fig. 1.

- (1) Clamp-on jaws for current measurement
- (2) Jaw opening lever
- (3) Rotary switch for function selection
- (4) Push button switch
 In Watts mode selects VA, VAR and PF
 In Peak V/A mode (5331A)
 selects THD, DF, CF and Ripple
 Press and hold for 2 sec. for REC mode (Min, Max, Av)
- (5) Push button switch for HOLD, saves complete data set when in single phase Watts mode. Press and hold for 2 seconds for Amps ZERO.
- (6) Digital output for logging to a PC.
- (7) and (8) - Test lead input terminals

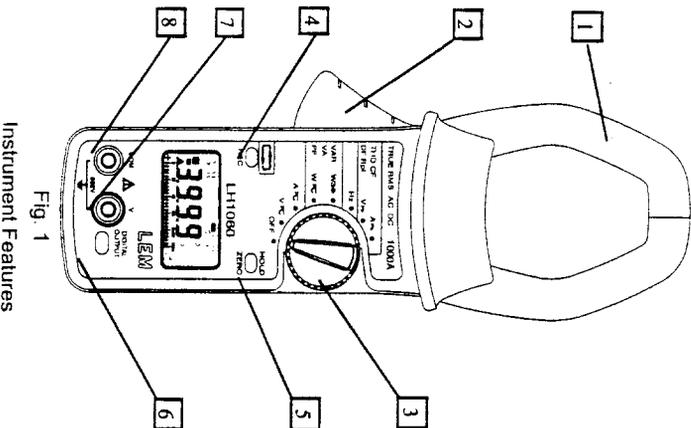


Fig. 1

Instrument Features

2. SPECIFICATION

2.1 Electrical data

(All accuracy's stated at 23°C ± 1°C)

2.1.1 Current measurement

DC, DCRMS, ACRMS

Measuring range.....	0 -1000A DC or AC Pk
Autorange facility.....	400A / 1000A
Resolution.....	100mA in 400A range 1A in 1000A range
Accuracy	I > 20A..... ± 1.5% rdg ± 5 dgits I ≤ 20A..... ± 1A
Pk (Peak)	I > 20A ± 5% rdg ± 5 dgits I < 20A ± 1A
CF (Crest Factor)	1 ≤ CF < 3 ± 3% rdg ± 5 dgits 3 ≤ CF < 5 ± 5% rdg ± 5 dgits Resolution 0.01
Rpl (Ripple)	2% ≤ RPL < 100%..... ± 3% rdg ± 5 dgits 100% ≤ RPL < 600%..... ± 5% rdg ± 5 dgits Resolution 0.1% I _{DC} > 10A, I _{AC} > 2A

All measurements DC and 10Hz to 1kHz Maximum overload 10,000A or RMS x frequency < 400,000 Amps RMS is a true RMS measurement

Harmonics

THD (Total Harmonic Distortion)

1% ≤ THD < 100%.....	± 3% rdg ± 5 dgits
100% ≤ THD < 600%.....	± 5% rdg ± 5 dgits
Resolution.....	0.1%

DF (Distortion Factor)

1% ≤ DF < 100%.....	± 3% rdg ± 5 dgits
100% ≤ CF < 600%.....	± 5% rdg ± 5 dgits
Resolution.....	0.1%

All measurements up to 25th harmonic
Frequency range F₀ 45Hz to 65Hz

I_{DCRMS} > 10A

2.1.2 Voltage measurement

DC, DCRMS, ACRMS

Measuring range.....	0 - 600V DC or ACRMS
Autorange facility.....	400V / 600V
Resolution.....	100mV in 400V range 1V in 600V range
Accuracy	V > 40V ± 1% rdg ± 5 dgits V ≤ 40V ± 1V
Pk	V > 40V ± 5% rdg ± 5 dgits V < 40V ± 1V
CF (Crest Factor)	1 ≤ CF < 3 ± 3% rdg ± 5 dgits 3 ≤ CF < 5 ± 5% rdg ± 5 dgits Resolution..... 0.01
RPL (Ripple)	2% ≤ RPL < 100%..... ± 3% rdg ± 5 dgits 100% ≤ RPL < 600%..... ± 5% rdg ± 5 dgits Resolution..... 0.1% V _{DC} > 20V, V _{AC} > 4V

All measurements DC and 10Hz to 1kHz.

Maximum overload 1,000 V RMS

Volts RMS is a true RMS measurement (AC + DC)

Harmonics

THD (Total Harmonic Distortion)

1% ≤ THD < 100%.....	± 3% rdg ± 5 dgits
100% ≤ THD < 600%.....	± 5% rdg ± 5 dgits
Resolution.....	0.1%

DF (Distortion Factor)

1% ≤ DF < 100%.....	± 3% rdg ± 5 dgits
100% ≤ CF < 600%.....	± 5% rdg ± 5 dgits
Resolution.....	0.1%

All measurements up to 25th harmonic
Frequency range F₀ 45Hz to 65Hz

V_{ACRMS} > 20V

2.1.3 Watts measurement (Single and 3 Phase)

(DC, DCRMS, ACRMS)

Measuring range.....	0 - 600kW DC or 425kW in AC
Autorange facility.....	40kW, 400kW 600kW
Resolution.....	10W in 40kW 100W in 400kW 1kW in 600kW
Accuracy.....	2.5% rdg ± 5 dgits W 10 < 2kW ± 0.08kW W 30 < 4kW ± 0.25kW

2.1.4 VA measurement (Single and 3 Phase) (DC, DCRMS, ACRMS)

Measuring range..... 0-600kVA DC or 425kVA in AC
 Autorange Facility..... 40kVA, 400kVA, 600kVA
 Resolution..... 10VA in 40kVA, 100VA in 400kVA, 1kVA in 600kVA
 Accuracy VA > 2kVA..... ± 2.5% rdg ± 5 dgts
 VA < 2kVA..... ± 0.08kVA

2.1.5 VAR measurement (Single and 3 Phase) (ACRMS)

Measuring range..... 0-425kVAR
 Autorange Facility..... 40kVAR, 400kVAR, 600kVAR
 Resolution..... 10VAR in 40kVAR, 100VAR in 400kVAR, 1kVAR in 600kVAR
 Accuracy VAR > 4kVAR..... ± 2.5% rdg ± 5 dgts
 VAR < 4kVAR..... ± 0.26kVAR
 Power Factor Range..... 0.99 > PF > 0.3

2.1.6 Power Factor (Single Phase)

Measuring range 0.3cap... 1.0 ... 0.3 ind
 (72.5° cap ... 0° ... 72.5° ind)
 Resolution..... 0.01
 Accuracy..... ± 3°

All measurements

Frequency range..... 10Hz to 1kHz
 Voltage range..... 40V to 600V RMS
 Current range..... 20A to 700A RMS
 Measurement overload..... 1000V / 10,000A

2.1.7 Frequency measurement

(From Current or Voltage sources)
 Measuring range..... 10Hz to 1kHz
 Resolution..... 0.1Hz
 Accuracy 40 - 70Hz..... ± 0.5% rdg
 10 - 1000Hz..... ± 1% rdg
 Current Range..... 10A to 700A RMS
 Voltage Range..... 10V to 600V RMS

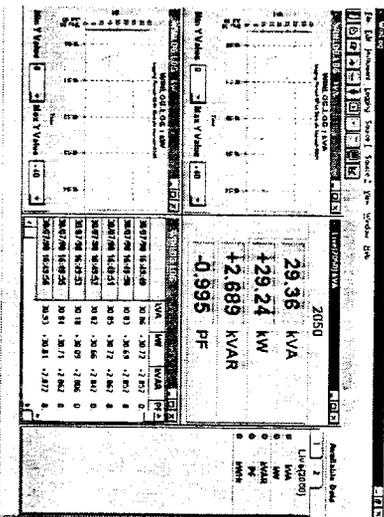
2.1.8 Digital output

A digital interface and PC software (WinLog) is available as an optional accessory for data logging. The instrument outputs the displayed value. Additional data is sent when in Watts, Hz and Peak settings:

Function
 Watts.....
 Hz.....
 Peak (5331A).....
 Output rate.....
Output
 Watts, VA, VAR, PF
 Hertz, Volts or Amps
 Pk, THD, DF, CF, Rpl
 and Waveform
 9600 baud

WinLog

Winlog is the PC resident software for the 5330A and 5331A series. The software is used to continually log electrical power measurements to a Personal Computer for further analysis.



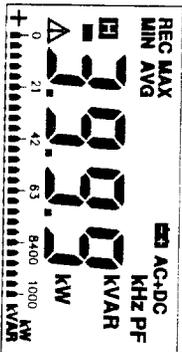
Key features include:

- Easy to use Windows format
- Data presentation in display mimic, table and chart modes
- Harmonics analysis of waveforms (5331A)
- Logging of up to 5 parameters
- Simple exporting of data and trends into other applications

2.2 General Data

2.2.1 Display

Display 4000 count 10mm high characters.



Low battery indicator
 MIN REG, Mode minimum, maximum or average readings
 MAX
 AVG]
 Hold

WARNING (See Manual)

AC+DC Identifies AC, DC or AC + DC

25 Segment bargraph display

2.2.2 Power Supply

Battery Type 9V Alkaline PP3 ,NEDA1604 or IEC 6LR61

Battery life typically 12 hours continuous operation.

2.2.3 Environmental

FOR INDOOR USE ONLY

Reference conditions: All accuracy's stated at 23°C ± 1°C

Temperature coeff. of current ±0.1% of rdg per °C

Temperature coeff. of voltage ±0.1% of rdg per °C

Operating Temperature 0°C to 50°C (32°F to 122°F)

Maximum Relative Humidity 80% for temperatures up to 31°C (87°F) decreasing linearly to 50% relative humidity at 40°C (104°F)

Storage Temperature -20°C to +60°C (-4°F to 140°F)

Maximum operating altitude 2000m.

2.2.4 Mechanical

Dimensions: Length 251mm / 9.88"
 Width 98mm / 3.86"
 Depth 52mm / 2.05"
 Weight 500g / 1.1 lbs.
 Case Material Bayblend T85MN
 Jaw Opening 55mm / 2.2"

Accessories: Voltage probes

Digital Interface lead

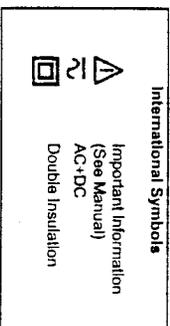
Carrying case

Operators manual

Cleaning: The unit can be cleaned with an Isopropanol impregnated cloth. Do not use abrasives or other solvents.

* Optional accessory

3. OPERATING INSTRUCTIONS



The instrument function is selected by a rotary switch with the following positions :-

OFF	Instrument off
$V\sim$	Volts TRMS
$A\sim$	Amps TRMS
$W\sim$	Watts TRMS
$W3\emptyset$	3 Phase Watts
Hz	Frequency
V Pk (5331A)	Volts Peak, THD, DF, CF, Ripple
A Pk (5331A)	Amps Peak, THD, DF, CF, Ripple

On power up the instrument enters a calibration mode in which CAL is displayed. During this period the instrument must not be clamped on any current carrying conductors.

3.1 Current Measurement

3.1.1 True RMS measurement

- Remove any Voltage test leads from the Instrument.
- Move the rotary switch to the Amps position
- Press the trigger to open the jaws and clamp them around the current carrying conductor as shown in Fig. 2
- Read the display
- Press the HOLD / ZERO button to freeze the display. Press and hold (2 seconds) to zero the display.
- Press and hold the REC button (2 seconds) to activate the REC mode.

- Press the REC button again to cycle through Min, Max, Average readings. Press and hold the REC button (2 seconds) to exit the REC mode.

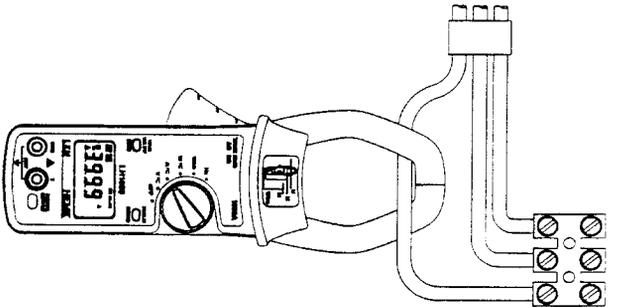


Fig. 2
Current Measurement

3.1.2 Peak / THD / DF / CF / Ripple measurement (5331A)

- Move the rotary switch to the Amps Pk position
- Press the trigger to open the jaws and clamp them around the current carrying conductor as shown in Fig. 2
- Read the display
- Use the button to cycle through the THD, DF, CF, Ripple measurements. In all modes the bargraph displays the peak current value.
- Press the HOLD / ZERO button to freeze the display. When in Peak mode, the Smart Hold function saves all power quality parameters which can then be viewed by pressing the button

3.2 Voltage Measurement

SAFETY WARNING

To avoid possible electric shock and damage to the instrument, do not attempt to measure any voltage that might exceed the maximum range of the instrument - 600Vrms and 1kHz

3.2.1 True RMS measurement

- Move the rotary switch to the Volts position.
- Insert the test leads into the sockets on the front of the instrument, the red lead to the V Ω terminal and the black-lead to the COM terminal, as shown in Fig. 3.
- Apply the test leads across the component whose voltage is to be measured. Read the displayed value.
- Press the HOLD / ZERO button to freeze the display.
- Press and hold the REC button (2 seconds) to activate the REC mode.
- Press the REC button again to cycle through Min, Max, Average readings. Press and hold the REC button (2 seconds) to exit REC mode.

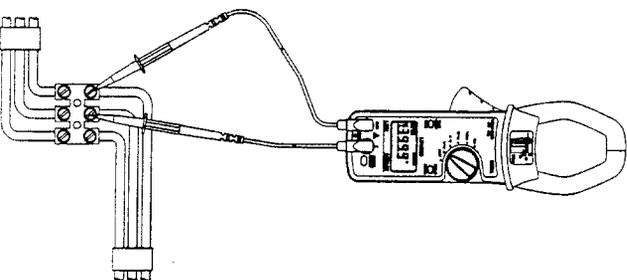


Fig. 3
Voltage Measurement

3.2.2 Peak / THD / DF / CF / Ripple measurement (5331A)

- Move the rotary switch to the Volts Pk position
- Press the trigger to open the jaws and clamp them around the current carrying conductor as shown in Fig. 3
- Read the display
- Use the \leftarrow button to cycle through the THD, DF, CF, Ripple measurements. In all modes the bargraph displays the peak voltage value.
- Press the HOLD / ZERO button to freeze the display. When in Peak mode, the Smart Hold function saves all power quality parameters which can then be viewed by pressing the \leftarrow button

3.3 Power Measurement (Single phase)

- Move the rotary switch to the W position
- Insert the test leads into the sockets on the front of the instrument. Connect the red lead to the V terminal, and the black lead to the COM terminal
- Press the trigger to open the jaws, and clamp them on the current carrying conductor, as shown in Fig. 4
- Apply the test leads to the circuit under test. Read the displayed value. A negative Watts reading indicates that energy flow is in the opposite direction to the arrow on the instrument case
- Use the VAR VA PF/REC button to cycle through the W, VA, VAR, PF measurements. In PF mode the bargraph displays the corresponding Watts value. A negative PF reading indicates the current lags the voltage (inductive load).
- Press and hold for more than 2 seconds to enter or exit from the REC mode. Single pushes will then allow movement through the MIN, MAX, AVG and present readings.
- Press the HOLD / ZERO button to freeze the display. When in Watts single phase mode the Smart Hold function saves all parameters which can then be viewed by pressing the VA, VAR, PF button or moving the rotary switch to the required setting.

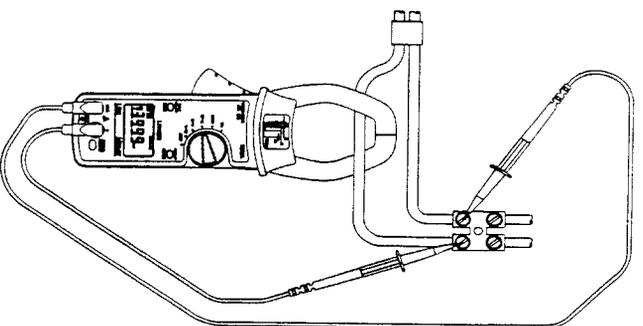


Fig. 4
Single Phase Power Measurement

3.4 Power Measurement (3 ϕ , 3 phase)

- Move the rotary switch to the W3 ϕ position
- Insert the test leads into the sockets on the front of the instrument. Connect the red lead to the V terminal, and the black lead to the COM terminal
- Press the trigger to open the jaws, and clamp them on the phase L1 current carrying conductor as shown Fig. 5
- Apply the test leads to the circuit under test
- The positive lead to L2 and the negative lead to L3
- Read the displayed value. Use the VAR VA PF/REC button to cycle through the W, VA, VAR, PF measurements. In PF mode the bargraph displays the corresponding Watts value. Press and hold for more than 2 seconds to enter or exit from the REC mode. Single pushes will then allow movement through the MIN, MAX, AVG and present readings
- Press the HOLD / ZERO button to freeze the display. When in Watts 3 phase mode the Smart Hold function saves all other power parameters which can then be cycled through using the VA VAR PF button

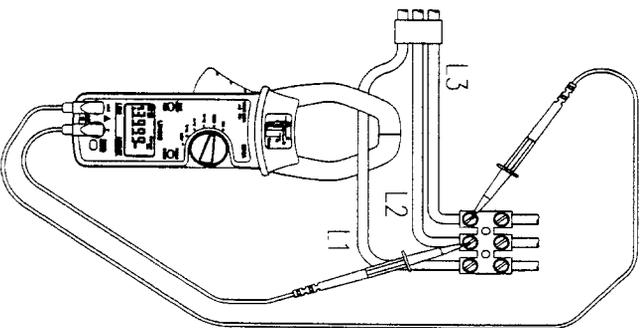


Fig. 5
3Ø Power Measurement

3.5 Frequency Measurement

- Move the rotary switch to the Hz position
- Insert the test leads into the sockets on the front of the instrument. Connect the red lead to the V terminal, and the black lead to the COM terminal
- To measure the frequency of the voltage supply apply the test leads to the circuit as shown in Fig. 3 and read the display
- To measure the frequency of the current press the trigger to open the jaws, and clamp them on the current carrying conductor, as shown in Fig. 2 and read the display

- When configured to measure power (Fig. 4) with the test leads connected and the jaws clamped around a current carrying conductor, the instrument displays the frequency of the current source (providing ARMS > 10A) If ARMS < 10 OA, a volts frequency measurement will be made (providing VRMS > 10V), otherwise ---- will be displayed
- Press the HOLD / ZERO button to freeze the display.
- The bargraph displays the corresponding current or voltage value
- Press and hold the VAR VA PF REC button for more than 2 seconds to enter or exit from the REC

mode. Single pushes will then allow movement through the MIN, MAX, AVG and present readings

3.6 Logging

A slider switch located in the battery compartment enables the data output. When the data output is enabled the autopower off is disabled to allow continuous data logging.

Slide switch Position	Autopower off	Data output
OFF	Enabled	Disabled
ON	Disabled	Enabled

An interface cable for connecting the instrument to the serial port of a PC together with Windows software (WinLog) is available as an optional accessory.

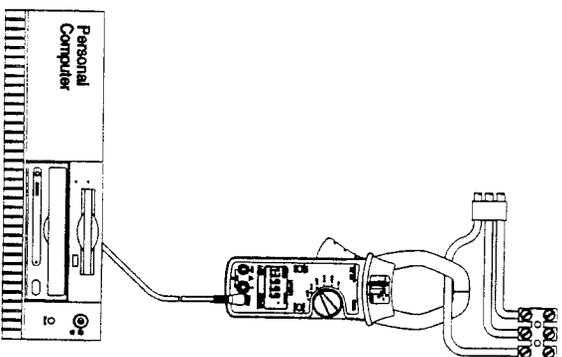


Fig. 6
Current Measurement / Logging

4. SAFETY

The instrument has been designed to comply with IEC1010-2-032 Installation Category (Overvoltage Category) III 600V Pollution degree 2 and UL 311-1. The product range conforms with the EEC Low Voltage Directive 73/23/EEC and 93/68/EEC. IEC 1010 is a safety standard which has the following features:

- Installation categories I to IV relate the maximum working voltage to overvoltage transients that can be expected in the measuring environment. 600V CAT III, the maximum expected transients must not exceed 6kV peak.
- In a pollution degree 2 environment the internal design of the instrument can cope with transient conductivities due to condensation.

Safe operation of the instrument is the responsibility of the operator who must be suitably qualified and/or authorised.

Users of this equipment and or their employees are reminded that Health and Safety Legislation require them to carry out valid risk assessments of all electrical work so as to identify potential sources of electrical danger and risk of electrical injury such as from inadvertent short circuits.

Where the assessments show that the risk is significant then the use of fused test leads constructed in accordance with the HSE guidance note GS38 'Electrical Test Equipment for use by Electricians' is advised.

If the instrument is used in a manner not specified by the manufacturer, then the protection provided by the equipment may be impaired.

Maximum Safe Voltage

Current :- 600V MAXIMUM AC RMS or DC between uninsulated conductor and ground and maximum frequency of 1KHz. This limitation applies to bare conductors only.

Voltage:- 600V MAXIMUM AC RMS or DC between live conductor and ground. 600V MAXIMUM AC RMS or DC between V and COM terminals and a maximum frequency of 1KHz.

Important Information

- The instrument is intended for indoor use only.
- Do not attempt to take any measurement of current or voltage higher than the maximum range of the instrument.
- The unit is not hermetically sealed and should NOT be brought into contact with surface water.
- Frequently inspect the test leads and the instrument for damage. If the instrument is physically damaged or does not function properly, it should not be used.

USE ONLY SUITABLY RATED VOLTAGE TEST LEADS TO IEC 1010-2-031, (600V CAT III Pollution Degree 2).

5. BATTERY REPLACEMENT

Replacement with other than the specified battery will invalidate the warranty.

Fit only Battery Type 9V Alkaline MN1604, IEC 6LR61 or equivalent.

 will appear on the top row of the LCD display to indicate that the minimum operating battery voltage has been reached.

SAFETY WARNING

Before removing the battery cover, make sure that all external voltages are disconnected from the instrument. For certainty remove all leads.

To change the battery, see Fig. 7

- Switch off the instrument
- Undo the retaining screw on the battery cover and lift the cover clear of the unit.
- Replace the used battery.
- Ensure the battery cover is replaced and the locking screw tightened, before further use.

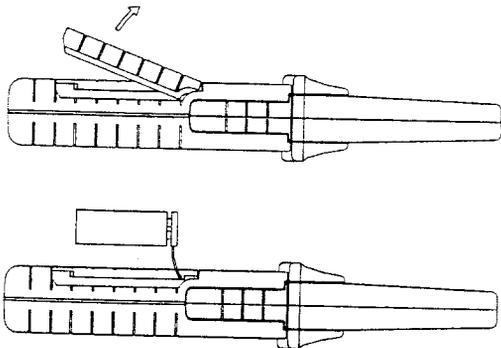


Fig. 7
Battery Replacement

6. WARRANTY

Your clamp on power meter is guaranteed for one year from the date of purchase against defective material or workmanship. If the meter fails during the warranty period, we shall at our discretion, repair or replace it with a new or reconditioned unit provided we are satisfied that the failure is due to defective material or workmanship. To make a claim under warranty, the meter should be returned to us, postage prepaid, with a description of the defect. The use of a battery, other than that specified invalidates this warranty.

Goods alleged by the buyer to be defective shall not form the subject of any claim for injury, loss, damage, or any expense howsoever incurred whether arising directly or indirectly from such alleged defects other than death or personal injury resulting from the seller's negligence.

No condition is made or to be implied nor is any warranty given or to be implied as to the life or wear of goods supplied or that they will be suitable for any particular purpose or for use under specific conditions, notwithstanding that such purpose or conditions may be made known to the seller.

7. OTHER PRODUCTS

B&K Precision offers a wide range of instrumentation for the measurement and analysis of current, voltage and power. Visit www.bkprecision.com to view the whole line of B&K products.

B&K Precision's policy is one of continuous product improvement and the company reserves the right to revise the above specifications without notice.

DECLARATION OF CONFORMITY

Equipment Name/Type Number: 5330A/5331A

Manufacturer: LEM HEME LIMITED
Address: 1 Penketh Place, West Pirnbo,
Skelmersdale,
Lancashire, WN8 9QX.
United Kingdom.

European Standards: -

EMC EN50082-1 : 1992 Generic Immunity
Standard, Part 1, Residential, commercial
and light industry.

EN50081-1 : 1992 Generic Emission
Standard, Part 1, Residential, commercial
and light industry.

Safety BSEN61010-1 : 1993 General Requirements,
Safety requirements for electrical equipment
for measurement, control and laboratory use:-

BSEN61010-2-032 : 1995, Particular
requirements for hand held current clamps for
electrical measurement and test.

BSEN61010-2-031 : 1993-12, Particular
requirements for hand held probe assemblies
for electrical measurement and test.

**Description of Equipment: AC/DC Clamp On Power
Meter.**

I certify that the apparatus identified above conforms to
the requirements of Council Directives:-

- (1) Electromagnetic Compatibility Directive
89/336/EEC
- (2) Low Voltage Directive 73/23/EEC
- (3) CE Marking Directive 93/68/EEC

Signed: 
Name : BRIAN M. HOPKINS
OPERATIONS DIRECTOR
Date : 9/9/98