CASTLE SONUS RANGE

Sound Level Meter
&
Dose Meter

Operating Manual

www.castlegroup.co.uk

Thank you for buying a Castle product, I am sure you will find both the goods and the service to be of the highest quality but if not, then please feel free to write to me personally and I will ensure that your needs are dealt with immediately.

This manual is designed to show you the operation of the goods you have purchased and a very brief insight into acoustics itself. If you would like to become a competent person in the eyes of the law, then you may like to know more about our Competent Persons training course for the Noise at Work Regulations.

It is my intention for Castle Group Ltd to provide a complete range of Noise and Vibration products and Services of the highest standard. If you would like to know more about any of our other products and services then please telephone on +44(0)1723 584250.

Simon Bull
Managing Director

To the Safety, Health and Environment Professional ...

The issues faced every day by Health, Safety and Environmental professionals are vast and varied. At Castle, we have spent a lot of time developing products and services to make your life easier!

Castle Group Ltd are one of the leading international group specialists in technical safety, health and environment solutions. Whether you are in Industry, Construction, Local Authority or anywhere there are safety or environment issues, we are a resource you really could use. We can help with Noise, Vibration, Air sampling, Gas detection, Light and temperature and just about anything else that needs measuring. The following services show you how we can help.

FREE Health & Safety Training Seminars!

To get you off the ground, refresh your knowledge or just to get a taste, Castle is continually running FREE Safety, Health and Environmental seminars around the country. Covering subjects from Noise at Work, to COSHH and Audiometry, the list is ever growing, as are the locations. Check out our web site for the next seminar near you.

www.castlegroup.co.uk

Castle Instruments

Dealing with many Safety, Health and Environmental issues may well mean you need access to a plethora of **equipment** and **instrumentation** to carry out measurements and assessments necessary for the job.

At Castle we can provide you with just about any of the equipment you might need. All our equipment comes with the **guarantee** of back-up and support you only get from a company with 40 years under its belt! Here are a few of the core products we can offer, but we can also source anything you may need!

Noise and Vibration Measurement Equipment
Audiometers, Otoscopes and Booths
Air-Sampling Pumps, Calibrators and Consumables
Gas-Detection and Personal Monitors
Emissions and Air Quality
Light, Temperature, Humidity and Airflow

www.castlegroup.co.uk

Castle Training Academy

Training is becoming an ever more important area of consideration to industry **professionals** and the Castle Training Academy is fulfilling the need for more and more companies every year. The Academy now offers **competence** training along with IOSH and CIEH **qualifications**. What is more, look out for our NEW City & Guilds provision. All courses come with professional **CPD** points and many are eligible for CITB and Train to Gain **grant funding**.

You can see a full list of courses and book-online on our website.

www.castletrainingacademy.com

Castle Rent

There are a number of **reasons** why rental may be the solution for you. You may only have a one-off use, a special contract, a limited budget or a need for supplementary products. In any case, our **flexible booking** system, next day a.m. delivery and open-pricing mean that you can address any of these issues without delay. For long-term contracts, such as construction projects, Castle Rent is also a **tax efficient** way to 'own' equipment. Finally, for peace of mind, what better way is there to try a product before deciding to buy it? We even give you money back if you do purchase!

The Advantages of Castle Rent: -

Easier on cash-flow
Rent for long- or short-term as you need it
Let the Tax Man pay for you!
Try before you buy
Four weeks for the price of three
No on-going maintenance costs
Sourcing service for any other equipment you need

www.castle-rent.com

Castle Care

Measurement instrumentation must be **regularly** calibrated to a traceable standard and this is certainly true for most health, Safety and Environmental monitoring equipment. At Castle, our team of **highly trained and experienced** technical staff can service and calibrate almost any type of monitoring equipment from Noise and Vibration meters to Thermometers to Scales. The Castle **'Premier Service'** includes menu pricing and a normal turnaround time within 5 days. What is more, we will evaluate any instrument and return it for **FREE** if you do not want to proceed.

Castle premier service and calibration offers...

Free Evaluation Service
Clear and Simple Pricing
UKAS Accreditation Available
Large range of equipment calibrated
4 Levels of calibration available for most equipment
Annual contract calibrations with up to 20% off

www.castle-care.com

Castle Contracts

For companies with **multiple** pieces of **equipment**, there is also Castle's 'Contract Calibrations'; an annual scheme to take the hassle out of maintaining equipment certification. Castle will issue calibration **reminders**, collect your equipment if required and return it calibrated as soon as possible. This scheme also affords a **saving** of up to 20% on annual calibration charges.

www.castle-care.com

Castle Consultancy

Castle **experts** are waiting to help you. Because we have a **network** of consultants across the country, we are poised to **react** to your requirement. Not only can we normally provide a local service, but we can usually help right away if you need us to!

Whether you are limited for time, in need of further **expertise** or just want some **advice**, we can assist. We have provided a wide range of services to many top companies for projects large and small.

Here are some of the services we can provide, but if it's not here, just ask!

Noise or Vibration risk assessments
Building Acoustics
COSHH compliance
Environmental Impact Assessments
Air Quality Monitoring
Occupational Health Screening programmes

www.castle-consultancy.com

Castle Online

You can access all our products and services online whenever you want, just go to www.castlegroup.co.uk and you will find a **knowledgebase** packed full of useful facts and information. You will also find details of all our upcoming **FREE seminars** and training courses as well as product information on literally hundreds of health, safety and environmental items, which are available to purchase directly through a secure server. Among other things you will find:

HS&E Measurement Products
Books, Standards and Publications
HS&E CD's DVD's
Stopwatches and Timers
Scales and Distance Measurement
Water Testers

You will also find our shop on ebay of all places - **http://stores.ebay.co.uk/Castle-Group-Safety** or just go onto ebay and type **Castle Group Safety** in the shops section.

Who are Castle

For 40 years, Castle has been driving forward with product and service innovation. For a number of the early years, the company focused on the development of sound and vibration measuring equipment. This was then progressed by adding training courses, rental and consultancy eventually leading to the Castle of today, which is helping many customers deal with a vast range of health, safety and environmental issues in a variety of ways. The future is a very exciting place at Castle and we are working on many new initiatives with our customers firmly in mind!

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Precautions

- Only operate the instrument as described in this manual.

- These are precision instruments, protect from shocks and vibrations.

- Take special care with the microphone. The diaphragm is made from a very thin metal and is easily damaged.

- Ambient conditions for the operation of the unit are as follows:-

    Temperature: -10°C to +50°C
    Relative Humidity: 25 to 90%

- Protect the unit from extremes of temperature and humidity, direct sunlight and air with a high salt or sulphur content.

- Always turn the unit off after use. Remove the batteries from the instrument when not in use for extended periods of time.

- Do not use any solvents or cleaning agents on the instrument. Use only a soft dry cloth or a soft cloth lightly moistened with water when necessary.

- Do not allow any conductive objects, such as wire or metal scraps to enter the unit.

- Do not try to disassemble the instrument or attempt any repairs as this will invalidate your warranty. Take a note of the condition of the instrument and contact your authorised Castle service station.

- To ensure continued precision performance of your instrument have it checked and serviced at regular intervals.

Contacting Castle Group

This manual contains complete operating instructions for the Castle Pro DX Vocis Meter, read it carefully and you will quickly become familiar with your instrument and its operation.

If you do encounter problems with the operation of your instrument please feel free to contact customer support with your enquiry on: -

Telephone:	+44 (0)1723 584250
Fax:	+44 (0)1723 583728
Website:	www.castlegroup.co.uk
Email:	techsupport@castlegroup.co.uk
	sales@castlegroup.co.uk

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Introduction

Thank you for purchasing your product from Castle Group Ltd. The Sonus range of pocket sound level meters brings simplicity and power to the worlds of Noise at Work and Environmental sound monitoring.

From a basic sound pressure meter to full data logging, combined sound and dose-meter, the range of systems covers a wide diversity of applications.

Mobility of instrumentation is essential for effective noise measurement. As the name indicates, the Castle Sonus Pocket Meter packs all the necessary features into pocket sized proportions.

Future Proof...

The built in firmware for these meters is designed to suit future upgrading for feature enhancements, legislative changes or instrument upgrades. Details are mailed to customers as soon as they become available. With the Castle range of Sonus Pocket meters you will always be in step with the law and market requirements. Periodic enhancements or bug fixes to the software will be supplied free of charge for a period of one year from the purchase date.

Sonus Variations

Sonus L

GA116L – Class 1, Ln's, User Selectable Modes
GA216L – Class 2, Ln's, User Selectable Modes

Available in either class 1 or class 2, this top of the range model is a Noise at Work and Environmental Sound Meter boasting a combined Integrating Sound Level Meter and Dose Meter with full data logging capability.

Simply unplug the Sound Meter Microphone and plug in the Dose Meter cable to convert to a fully functional Dose Meter.

This model also features dual measurement capability meaning two versions of applicable parameters can be measured simultaneously. This feature means you only ever need to measure once to capture all the data you need!

The instrument has user selectable operating modes for instant automatic setup of the instrument for Noise at Work or Environmental parameters, alternatively the instrument can be configured manually to meet your exact requirements.

Analysis of recorded data can be achieved by transferring the data from the instrument into the software dBdataPro using the instruments USB port.

GA257L –Dose Meter

This model is a dedicated Dose Meter with full data logging capabilities which also features dual measurement capability meaning two versions of applicable parameters can be measured simultaneously. This feature means you only ever need to measure once to capture all the data you need!

Analysis of recorded data can be achieved by transferring the data from the instrument into the software dBdataPro using the instruments USB port.

Sonus I

GA116I – Class 1
GA216I – Class 2

Available in either class 1 or class 2, this model is a low cost integrating sound level meter that measures simultaneous Leq and peak measurement for assessments and compliance with the Health and Safety at work Act; Noise at Work Regulations 1989.

Sonus B

GA116B – Class 1
GA216B – Class 2

Available in either class 1 or class 2, this model is a general purpose low cost non-integrating sound level meter that can assist with compliance to the Health and Safety at Work Act; Noise at Work Regulations 1989.

GA257B –Dose Meter

A low cost dedicated Dose Meter giving simultaneous Sound Exposure (L_{AE}) and peak measurement for assessments to the Noise at Work Regulations 1989.

Chapter 1

Microphone

Measurement microphones by the very nature of their manufacture are precision components that are easily damaged through incorrect use. Great care must be taken when using the instrument to ensure the longevity of the microphone.

PLEASE NOTE THAT DEPENDING ON YOUR INSTRUMENT MODEL, IT MAY BE SUPPLIED WITH A PROTECTIVE WHITE PLASTIC CAP COVERING THE END OF THE MICROPHONE. IF SUPPLIED THIS CAP MUST BE REMOVED PRIOR TO USING THE INSTRUMENT.

Microphone Types

Three different types of microphone are manufactured, each designed for measuring noise in different applications which is out of the scope of this manual. Each one however has a different sound incidence angle. The sound incidence angle determines the angle the instrument is held relative to the actual noise source being measured.

1. Free Field
Sound Incidence Angle = 0°
Point the sound meter directly towards the noise source

2. Pressure
Sound Incidence Angle = 90°
Point the sound meter at 90° towards the noise source

3. Random Incidence
Point the sound meter at approximately 70° towards the noise source

All Sonus meters are supplied with **Free Field** measurement microphones.

Microphone Polarisation

Microphones require a polarisation voltage to operate and are manufactured in two ways: -

1. Externally Polarised
These microphones require an external charge for the microphone to operate which is generally 200V and supplied by the sound level meter.

2. Pre-Polarised
These microphones generate the polarisation voltage internally and do not require the externally generated 200V polarisation charge.

All microphones supplied with Sonus meters are **Pre-Polarised**.

Microphone Sensitivity

The sensitivity of a microphone is determined by the output voltage it produces for a defined sound source.

Microphones are manufactured with numerous sensitivity levels and operate within a specified tolerance. Different microphones of the same model may therefore give slight differences in readings when used on the same sound meter. To allow for this all Sonus meters have been designed to accommodate any variations in the tolerance of the supplied microphone up to ±3dB.

All Sonus meters have been designed for microphones with a sensitivity of 25mv/Pa.

Great care must be taken to ensure the microphone and sound meter sensitivities match otherwise incorrect readings will occur.

Certifiable Calibration

The calibration process includes the microphone, pre-amplifier and sound level meter. Any change in this measurement chain will require a new certifiable calibration.

Castle Group Ltd offers a complete calibration service offering either a full UKAS calibration or a standard NPL traceable calibration which can be supplied with or without a test report.

It is recommended that your sound meter instrumentation is calibrated annually to ensure your measuring equipment is completely accurate and fully compliant.

Pre-Amplifier and Microphone Removal and Fitting

Measurement microphones by the very nature of their manufacture are precision components that are easily damaged through incorrect use. Great care must be taken when using the instrument to ensure the longevity of the microphone.

Removal of Microphone

The microphone can be fitted to the pre-amplifier by screwing the microphone in a clockwise direction ensuring that the pre-amplifier spring pin is located centrally in the microphone. To remove the microphone unscrew in an anti-clockwise direction.

The microphone has a protection grid which can also be unscrewed and removed, great care must be taken to ensure that this is not removed. Underneath the protection grid is the microphone diaphragm which should never be touched or be subject to dust or dirt. Doing so may damage the microphone beyond repair or affect its acoustic response.

Attaching & Removing the Pre-Amplifier
Models GA116L, GA116I & GA216L-P

To attach the pre-amplifier, position the orientation key on the pre-amplifier which is identified with a RED mark, with the RED identification mark on the instrument and gently push the pre-amplifier into the connector. To remove, gently pull the pre-amplifier stem away from the instrument body. **DO NOT TWIST THE MICROPHONE STEM**.

Attaching & Removing the Microphone Extension Cable (Model L Only)

To attach the microphone extension cable, position the orientation key on the extension cable connector which is identified with a RED mark, with the RED identification mark on the instrument and gently push the extension cable into the connector on the instrument. To fit the pre-amplifier to the extension cable see **Attaching & Removing the Pre-Amplifier** above.

To remove, gently pull the extension cable connector by pulling on the knurled part of the stem. **DO NOT TWIST THE MICROPHONE STEM**.

Chapter 2

Measuring Sound

Always calibrate your instrument prior to, and after taking measurements using a known sound source such as the Castle GA607 sound level calibrator. The type of microphone supplied with your instrument is **Free Field** and requires an incidence angle of 0 degrees, therefore whilst measuring always point your Sonus Pocket Meter directly towards the noise source being measured.

Sound Level – General Advice

In some environments, high levels of noise can occur. The Castle Sonus Pocket sound meter has therefore been designed for complete accuracy up to sound levels of 140dB.

Before you record measurements take the time to ensure you have chosen the optimum range for the process to be recorded. Wherever possible, the optimum range is when the average measured signal is approximately half way between the top of the range and the bottom of the range.

Where high levels of noise are encountered the meter may register an overload and in these circumstances the meter will display that this has occurred, it is therefore advisable to determine if an Over Load occurs on the selected range. In such cases you will need to select a higher range to accommodate the higher peak levels. See **Technical Specifications** for peak range limits on each individual range.

If the noise levels are too low for the range selected then the meter will display an under range condition. Under these circumstances you will need to select a lower range.

For more detailed information see **Overload and Under Range Conditions** and **Measuring Ranges**.

If measuring low level noise then be aware of the inherent noise levels caused by a combination of thermal and electrical noise from both the microphone and the sound level meter. Measuring data that lies within 10dB of the lowest quoted level on the lowest measuring range may be influenced by the self noise of the system. See **Technical Specifications** for inherent noise levels and range limits.

Reflections

The sound level meter operator and the sound level meter itself can interfere with the measurements being made, reflecting the noise signal. The instrument case for the Sonus range of sound level meters has therefore been designed to minimize reflections whilst also being of rugged construction.

To minimize reflections from the operator hold the sound level meter at arm's length, mount the sound meter on a suitable tripod (adapter required) or use a microphone extension cable (if applicable).

Time Weighting

The time weighting is a time constant that modifies the response of the instrument to fluctuating noise levels. Without time weighting the meter display would fluctuate following the measured noise level and would be unreadable, the selected time weighting therefore softens these fluctuations over the time periods described below and in doing so the meter has a more readable display.

Depending on your instrument type (see **Technical Specifications** for further details), the following standardised time weightings are available: -

Slow Weighting

Shows a slow rise in the Sound Pressure Level even for a sharp rise in the noise level, likewise a rapid reduction in noise will be shown as a slow decrease in Sound Pressure Level. The rise and fall times applied for Slow Weighting are 1 second.

Fast Weighting

The most commonly used time weighting which follows the noise level closer than slow weighting by displaying a fast rise and fall in the Sound Pressure Level. The rise and fall times applied for Fast Weighting are 125m Seconds.

Impulse Weighting – (Model 'L' Only)

Allows your meter to show rapid rises in the noise level but has a very slow decay. The rise and fall times for Impulse Weighting are 35m Seconds and 1.5 Seconds respectively.

Frequency Weighting Filters

Frequency Weightings are where the Sound Pressure Level (SPL) is modified by use of filtering. All Sonus Pocket Meters use electronic frequency weighting filters between the standardised frequencies of 10Hz and 20,000Hz. Depending on your instrument type (see **Technical Specifications** for further details), the following standardised frequency weightings are available: -

'A' Weighting

The SPL is filtered in such a manner as to reflect the hearing response of a human ear. The signal is progressively attenuated at the higher and lower ends of the audible frequency range but much more attenuation occurs at the lower end of the audible frequency range. Generally this is the most common used frequency weighting.

'C' Weighting

The signal is progressively attenuated at the higher and lower ends of the audible frequency range, however the attenuation at the lower end is much less than with A Weighing. The response has a flat area between 200Hz and 1250Hz and has -3dB points at 31.5Hz and 8kHz. It is generally used for the acoustic emissions of machinery and for peak sound levels.

'Z' Weighting (Zero)

Often referred to as the FLAT or LIN response, this weighting has a virtually flat response over the entire audible frequency range having -3dB points at 10Hz and 22kHz.
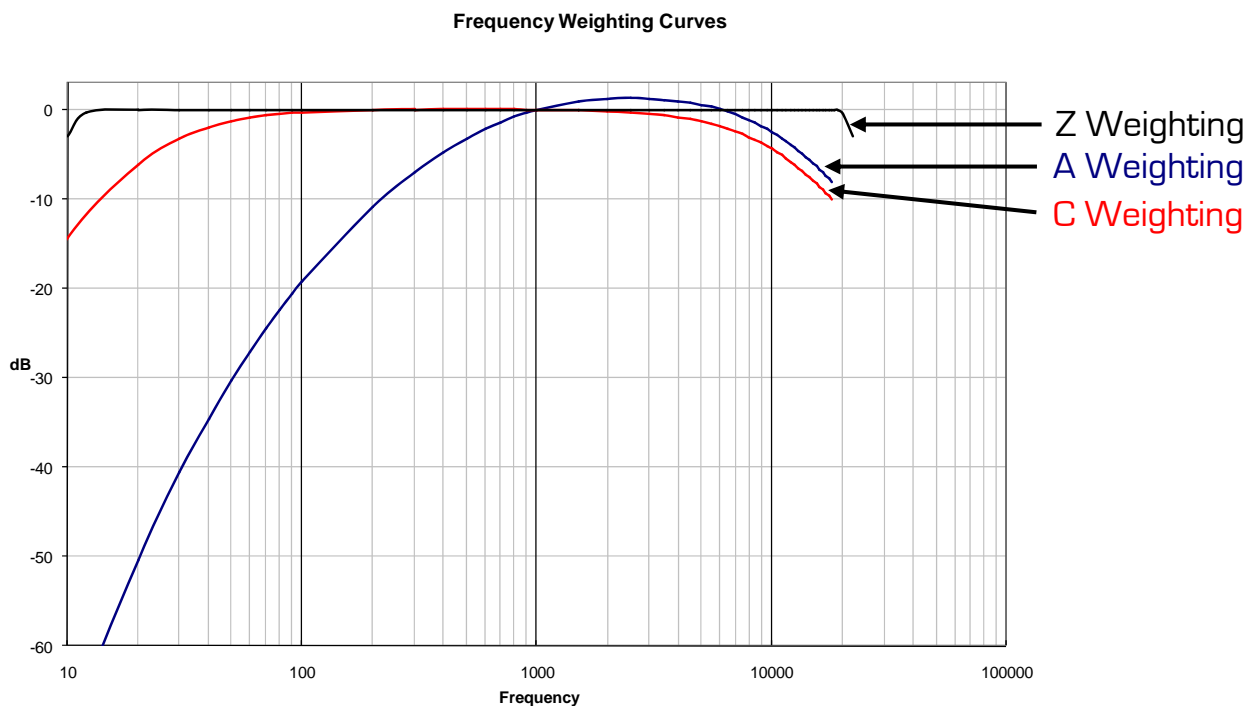

Figure 1 - Frequency Weighting Curves

Overload and Under Range Conditions

Overload Condition

An overload condition occurs when the peak signal starts to exceed the signal handling capability of the pre-amplifier circuitry.

If the noise source is greater than 0.5dB over the top of the range selected, an overload condition occurs and an overload indicator is displayed on your meter. The overload indicator will flash for a minimum of one second or while the overload condition remains.

```
OVERLOAD
```

In such circumstances it is highly recommended you change to a higher range with a lower sensitivity (i.e. less gain) as your meter will be out of specification. An overload indication can occur in both Stop or Record Mode on 'L' models and only in Record Mode for models 'I' and 'B'.

All models have an overload latch indicator which can be viewed by scrolling through the available parameters. Depending on whether an overload has occurred or not, the overload latch screen will display either off the following: -

```
O.L.  NO
```
```
O.L. YES
```

On models 'I' and 'B' if an overload has been latched it can be removed in Stop Mode or Record Mode by resetting the parameters.

On model 'L' instruments a latched overload can be removed in Stop Mode by resetting parameters and if in Record Mode it is automatically removed when the recording has been stopped.

Under Range Condition

An under range condition occurs when the noise source is more than 0.1dB below the bottom of the range selected, at which point an under range indicator will flash on the display of your meter. In such circumstances it is highly recommended to change to a higher range with a higher sensitivity (i.e. more gain) as your meter will be out of specification.

```
**UR**
```

The under range indicator will flash for a minimum of one second or while the under range condition remains.

Where the noise source is more than 0.5dB below the bottom of the selected range, no value or under range warning is displayed.

```
LAF --.-
```

Measuring Ranges

The Sonus instrument range has been specifically designed to utilise only three measuring ranges. The three available ranges ensure complete accuracy throughout the entire dynamic range whilst ensuring the instrument remains low power to maximise operational life from one PP3 battery.

The measuring display ranges available are as follows: -

Models L (dB)	Models I & B (dB)
30 – 100	35 – 100
50 – 120	55 – 120
70 – 140	75 – 140

Please note that the GA257L and GA257B Dose meter models operate on the fixed range 70-140 dB and 75-140 dB respectively.

Changing Range – All models except GA257B and GA257L

To change the measuring range, press the key on the keypad.

The current measuring range will be shown and indicated with an asterisk *.

| 50-120* | | 55-120* |

Use the **Up** and **Down** Arrow Keys to scroll through the available ranges.

Press the OK key to select the required range. The instrument briefly displays the following to confirm a change has been made and returns to the last parameter screen unless multiple screens have been accessed in which case the sound pressure level parameter screen will be displayed: -

| DONE |

Press the key to return to the previous screen without selection. If multiple screens have been accessed the sound pressure level parameter screen will be displayed.

Press the C key to return to sound pressure level parameter screen without making a selection. Returning to the previous screen is also possible

Lock Keypad – GA257B and GA257L

Press ⊙ to immediately place the instrument in Lock mode. The instrument will constantly display the battery status.

To UNLOCK the keypad press **C, OK** then **C** respectively**.**

It is also possible to LOCK the keypad on GA116L and GA216L models through the options available under the Main Menu. Use the same procedure as above to UNLOCK the keypad.

The LOCK feature is used to lock the instrument keypad. All keypad functions are therefore disabled including the POWER key. This function is often used to avoid inadvertent operation or tampering while the instrument is being used.

Chapter 3

Getting Started

All models of the Sonus range of instruments have two modes of operation referred to as: -

- Stop Mode
- Record Mode

Whilst the instrument is in Record Mode the noise activity is analysed and all parameters available on your instrument are calculated.

On 'L' models only, all data captured can be saved to the internal flash memory and viewed or downloaded to Castle's noise analysis software **dBdataPro** as and when required.

Whilst the instrument is in Stop Mode, on 'I' and 'B' models noise activity is not monitored and parameter calculations are halted during this period. On 'L' models calculations are displayed but not stored in flash memory.

Models I and B

During Stop Mode and whilst viewing parameter display screens, the display will flash between the parameter and the following: -

```
STOP
```

Models L

During Stop Mode and whilst viewing parameter display screens, the displayed parameter name will not blink: -

```
LAF 49.4
```

Non Blinking Parameter Name Indicates Stop Mode

On all models when the meter is first switched on, the instrument defaults into Stop Mode.

To set the instrument into Record Mode press the ⊙/■ key located on your instruments keypad, see **Stop / Record Mode** in **Chapter 5** for more information.

To place the instrument back into Stop Mode press the ⊙/■ key again.

All Models

Changing the settings of your instrument and performing a calibration are all found under the **Main Menu**.

To activate the **Main Menu** press the (menu) Key on your instruments keypad.

Use the **Up** and **Down** Arrow Keys (▲)(▼) to scroll through the available options.

Press the (OK) key to select the required menu option or press the (C) key to cancel and return to the parameter display screen.

Some options may also have further sub-menus where further options are available. Again use the **Up** and **Down** Arrow Keys to scroll through the available options.

The **Main Menu** is described in detail in **Chapter 4**.

Keypad Layout – GA116, GA216 Models B, I and L

Up Arrow

Down Arrow

Main Menu

Information

Power On / Off

OK

Cancel

Measuring Range

Stop / Record

Figure 2 - Keypad Layout (Sound Meter)

Keypad Layout – GA257L & GA257B

Figure 3 - Keypad Layout (Dose Meter)

Powering Your Sonus Meter

Your Sonus meter can be powered from either one 9V PP3 battery and Model 'L' instruments can also be powered using an external 12V DC Power Supply which can be purchased separately if required (PSU4:SONUS).

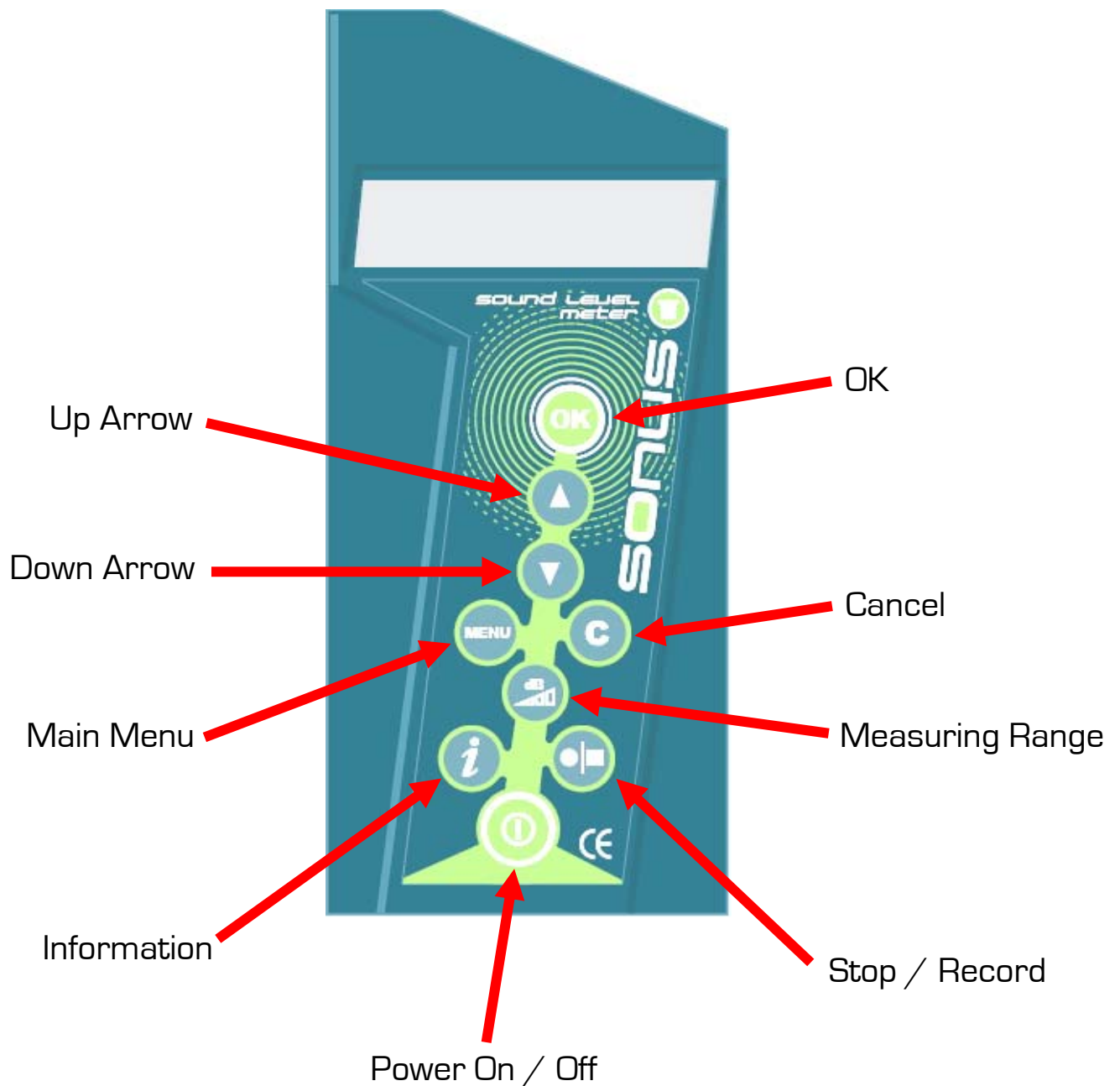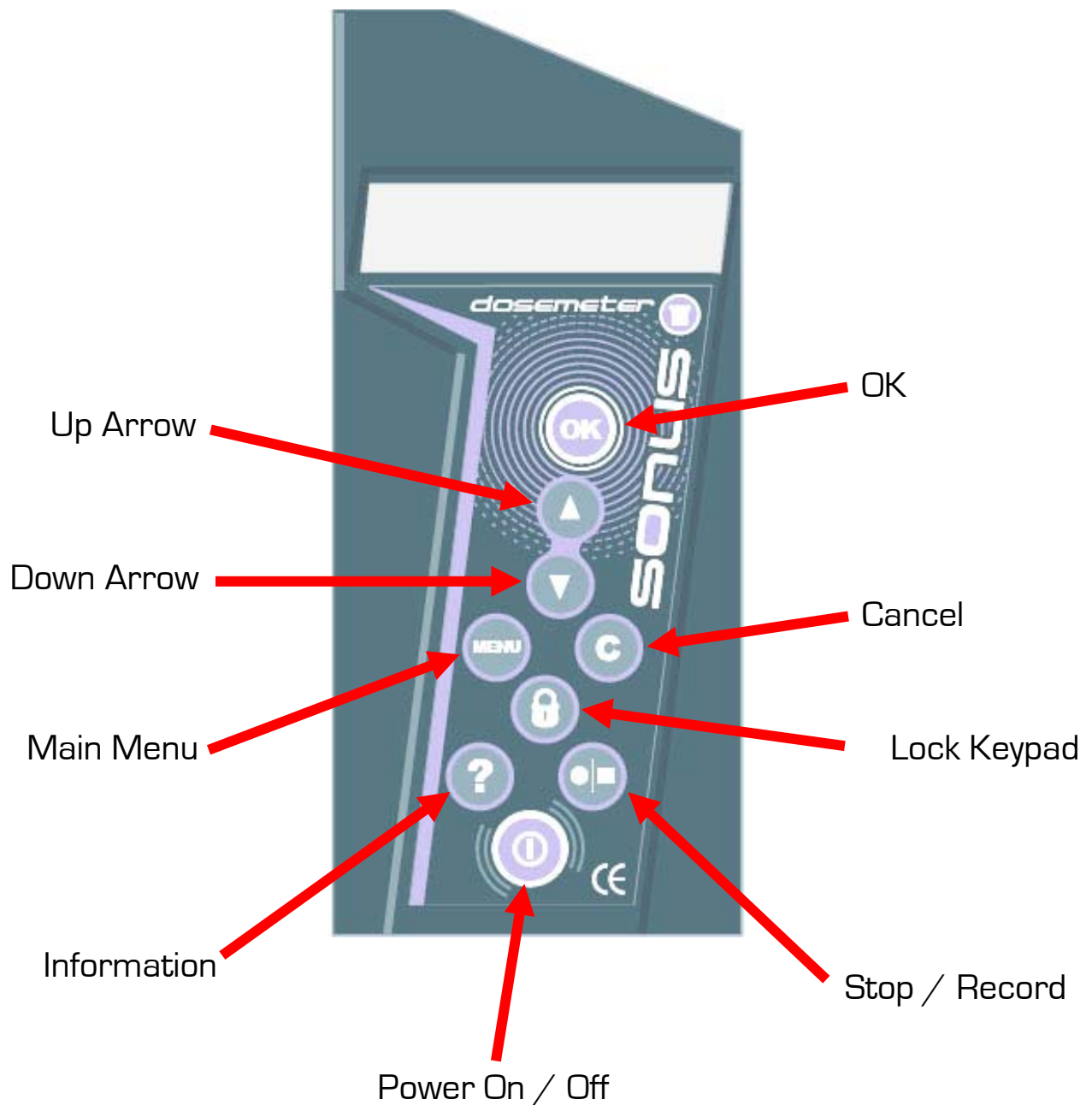The battery compartment is located on the bottom left hand side of your instrument. Open the battery door by sliding the cover downwards towards the bottom of the instrument. The cover will now swing open exposing the battery compartment. Insert the battery observing the correct polarity as marked on the case wall inside the battery compartment.

To achieve a greater battery life from your instrument, it is strongly recommended you use alkaline type batteries.

To power the instrument via the Castle DC Power Supply (purchased separately), plug your Power Adapter Cable into the 9 pin Lemo connector located at the right side of the instrument. Ensure the red dots are aligned before insertion. Insert the DC power supply into the DC socket on the adapter cable. Ensure the DC power supply is plugged into a mains socket and switch on power to the socket.

Your Sonus meter is equipped with a four stage battery level indicator; this is displayed during the power up sequence and can also be viewed using the information key.

| BAT:■■■■ | BAT:■■■ | BAT:■■ | BAT:■ |

A series of four bars indicates that the battery is fully charged whilst only one bar indicates the battery is almost flat.

It is strongly recommended that if the instrument is displaying only one bar that the battery is replaced as soon as possible.

When the battery charge is too low for the instrument to operate the instrument will flash the following message: -

| BAT. LOW |
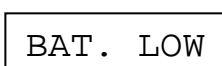
All meters will shut down and Model 'L' instruments will automatically save any data if the instrument is in **Record Mode**.

Switching Your Sonus Meter On/Off

To turn on your instrument press and hold the Power On/Off key ⏻ for approximately one second.

Your meter will display the start-up screen and initialise any saved settings.

Once the start-up sequence is complete the instrument is placed in **Stop Mode** and the parameter sound pressure level is displayed.

It is recommended that you calibrate your instrument before use, see the heading **Calibration** in **Chapter 4** for detailed information on calibration of your specific model of instrument.

To turn off Model 'I' or 'B' instruments press and release the Power On/Off key ⏻ at any time.

Models 'I' and 'B' will now power down.

Model 'L' instruments display the following:-

```
INS OFF?
```

Press the (OK) key to confirm or the (C) key to cancel and return to the previous screen.

Please be aware that on Model 'L' instruments the Power On/Off key ⏻ is disabled whilst the instrument is in **Record Mode** or if the instrument is **Locked**.

On the GA116I and GA257B instruments the Power On/Off key ⏻ is disabled if the instrument is **Locked**.

To preserve instrument settings and saved data always turn your instrument off using the Power On/Off Key ⏻.

On model 'I' and 'B' instruments please ensure that all required readings have been taken from the instrument before turning off the instrument as all data is lost when the instrument is powered off.

Chapter 4

Main Menu Structure

The **Main Menu** is activated by pressing the **MENU** Key (menu) once.

Pressing the (menu) Key again will return the instrument to the last parameter display screen unless multiple screens have been accessed in which case the sound pressure level parameter screen will be displayed.

Pressing the (C) Key always returns to the sound pressure level parameter screen unless sub menus are open in which case refer to the specific function in the user manual to determine its action.

Use the **Up** and **Down** Arrow Keys (▲)(▼) to scroll through the available options.

Press the (OK) key to select the required menu option.

Some options may also have further sub-menus where further options are available. Again use the ▲ ▼ Arrow Keys to scroll through the available options and use the **OK** key to accept.

Depending on your instrument model, the following Menu options are available: -

Display	Description	Instrument
CAL <OK	Calibrate Instrument	ALL
ET <OK	Set Exposure Time	GA116I/GA216I/GA257B
WTG <OK	Set Frequency & Time Weightings	GA116I/GA116B GA216I/GA216B
EXCH <OK	Set Exchange Rate	GA116I/GA257B
CRIT <OK	Set Criterion Level	GA116I/GA257B
THR <OK	Set Threshold Level	GA116I/GA257B
LOCK <OK	Lock Instrument Keypad	GA116I
CONT <OK	Adjust Display Contrast	ALL

Calibration [CAL <OK]

It is recommended that the instrument's calibration is checked and adjusted where necessary with a calibrator before readings being taken. The calibration should be re-checked after taking readings to confirm the validity of the results.

The calibrators recommended for use are the Castle GA601/GA607, which supply typically 94dB/ 104dB (relative to 20µPa pressure) at a frequency of 1kHz.

Press $\textit{i}$ to check the battery condition, scroll to the battery indicator screen using the ▲ ▼ arrow keys if required. Replace the battery if the indication is low.

In the **MENU** display screen use the ▲ ▼ arrow keys as required until the following is displayed: -

```
CAL <OK
```

Press OK and the instrument will now display the previous calibration level e.g. >94.0.

The calibration will be performed at the selected level e.g. 94.0dB but may be changed in 0.1 or 1 dB steps using the following keys: -

Key	Calibration Level Adjustment (dB)
▲	+0.1
▼	-0.1
i	-1.0
●/■	+1.0

Ensure the calibrator is attached to the microphone by gently inserting the microphone into the cavity of the calibrator. A certain amount of resistance should be felt whilst inserting the microphone as the o-ring seal on the calibrator forms a seal around the microphone.

Ensure that the calibrator is switched on and set to the chosen level and all correction factors for atmospheric pressure and microphone type have been accounted for.

The pressure to free-field correction value to be applied when used with a Castle calibrator GA601, GA607, or a B&K4231 is as follows:

Calibrator	Correction (dB)
Castle GA607	-0.2
Castle GA601	-0.2
B&K4231	-0.2

Press **(OK)** and the instrument will calibrate to the level of the calibrator. The display will show **CAL WAIT** while calibrating to the chosen level. When calibrated the display will show **COMPLETE** and will return to the Sound Pressure Level display.

It is recommended that the unit is then placed into **STOP** mode and data is cleared. The instrument is now ready to take measurements.

If the calibration is interrupted or the input level is not within +/- 3dB of the chosen reference level then the display will show **CAL FAIL**.

An error message of **NO INPUT** is shown if the input level is lower than or greater than 3dB.

Check to make sure the calibrator is switched on and emitting the correct level before proceeding again as indicated above.

Exposure Time [ET <OK]

It is possible to select alternative exposures of an employee in hours and minutes. Exposure Time is used for calculating projected dose and projected Lep'd calculations.

In the **MENU** display screen use the ▲ ▼ arrow keys as required until the following is displayed: -

```
ET <OK
```

Press (OK) and the instrument will now display the currently selected exposure time in hours. Use the ▲/▼ arrow keys to alter this figure between 00 and 24.

Press (OK) again and the instrument will display the currently selected number of minutes. Use the ▲/▼ arrow keys to alter this figure between 00 and 59.

Press (OK) to confirm the changes and return to the Sound Pressure Level display screen.

Frequency / Time Weighting [WTG <OK]

In the **MENU** display screen use the ▲ ▼ arrow keys as required until the following is displayed: -

```
WTG <OK
```

Press (OK) and the instrument will display the currently selected Frequency and Time Weighting, indicated with an asterisk *.

```
A, F*
```

Scroll through the available options using the ▲ ▼ arrow keys: -

Display	Description
A, S	'A' Frequency Weighting, Slow Time Weighting
A, F	'A' Frequency Weighting, Fast Time Weighting
C, F	'C' Frequency Weighting, Fast Time Weighting
C, S	'C' Frequency Weighting, Slow Time Weighting

Press (OK) to confirm or (C) to cancel and return to the Sound Pressure Level display screen.

Exchange Rate [EXCH <OK]

In the **MENU** display screen use the ▲ ▼ arrow keys as required until the following is displayed: -

```
EXCH <OK
```

Press (OK) and the instrument will display the currently selected Exchange Rate, indicated with an asterisk *.

```
3dB *
```

Scroll through the available options using the ▲ ▼ arrow keys: -

Display
3dB
4dB
5dB

Press (OK) to confirm or (C) to cancel and return to the Sound Pressure Level display screen.

Criterion [CRIT <OK]

In the **MENU** display screen use the ▲ ▼ arrow keys as required until the following is displayed: -

```
CRIT <OK
```

Press (OK) and the instrument will display the currently selected Criterion Level, indicated with an asterisk *.

```
85dB *
```

Scroll through the available options using the ▲ ▼ arrow keys: -

Display
80dB
85dB
90dB

Press (OK) to confirm or (C) to cancel and return to the Sound Pressure Level display screen.

Threshold [THR <OK]

It is possible to select a threshold level for the lower limit of noise levels which are used to measure dose.

In the **MENU** display screen use the ▲ ▼ arrow keys as required until the following is displayed: -

```
THR <OK
```

Press (OK) and the instrument will display the currently selected Threshold Level, indicated with an asterisk *.

```
-10dB *
```

Scroll through the available options using the ▲ ▼ arrow keys: -

Display
-10dB
-5dB
OFF

Press (OK) to confirm or (C) to cancel and return to the Sound Pressure Level display screen.

Keypad Lock [LOCK <OK]

In the **MENU** display screen use the ▲ ▼ arrow keys as required until the following is displayed: -

```
LOCK <OK
```

Press (OK) to confirm, the instrument is placed in Lock mode and the instrument displays the battery status.

To UNLOCK the keypad press **C, OK** then **C** respectively.

The LOCK feature is used to lock the instrument keypad. All keypad functions are therefore disabled including the POWER key. The function is often used to avoid inadvertent operation or tampering while the instrument is being used.

Display Contrast [CONT <OK]

Select to adjust the contrast level of your instrument.

In the **MENU** display screen use the ▲ ▼ arrow keys as required until the following is displayed: -

```
CONT <OK
```

Press (OK) and the instrument will display the following or (C) to cancel and return to the Sound Pressure Level display screen: -

```
CONT ADJ
```

Use the ▲ ▼ arrow keys to adjust the contrast as required.

Press (OK) to confirm a change and the instrument will briefly display: -

```
DONE
```

Or press (C) to cancel and return to the Sound Pressure Level display screen.

Models GA116L, GA216L, GA257L

Display	Description	Instrument
CAL	Calibrate Instrument	ALL
SETUP	Change Instrument Settings	ALL
MODE	Set Operating Mode	GA116L/GA216L
LOGS	View Saved Log	ALL
DELETE	Delete Saved Log	ALL
DEFAULTS	Reset to Default Settings	ALL
LOCK	Lock Instrument Keypad	GA116I/GA216B

Calibration [CAL]

It is recommended that the instrument's calibration is checked and adjusted where necessary with a calibrator before readings being taken. The calibration should be re-checked after taking readings to confirm the validity of the results.

The calibrators recommended for use are the Castle GA601/GA607, which supply typically 94dB/ 104dB (relative to 20μPa pressure) at a frequency of 1kHz.

Press $\textbf{\textit{i}}$ to check the battery condition, scroll to the battery indicator screen using the ▲ ▼ arrow keys if required. Replace the battery if the indication is low.

In the menu display screen use the ▲ ▼ arrow keys as required until the following is displayed: -

    CAL

Press **OK** and the instrument will now display the previous calibration level e.g. 94.0.

The calibration will be performed at the selected level e.g. 94.0dB but may be changed in 0.1 or 1 dB steps using the following keys: -

Key	Calibration Level Adjustment (dB)
▲	+0.1
▼	-0.1
i	-1.0
●/■	+1.0

Ensure the calibrator is attached to the microphone by gently inserting the microphone into the cavity of the calibrator. A certain amount of resistance should be felt whilst inserting the microphone as the o-ring seal on the calibrator forms a seal around the microphone.

Ensure that the calibrator is switched on and set to the chosen level and all correction factors for atmospheric pressure and microphone type have been accounted for.

The pressure to free-field correction value to be applied when used with a Castle calibrator GA601, GA607, or a B&K4231 is as follows:

Calibrator	Correction (dB)
Castle GA607	-0.2
Castle GA601	-0.2
B&K4231	-0.2

Press (OK) and the instrument will calibrate to the level of the calibrator. The instrument will countdown from five seconds and the display will show: -

```
WAIT  5s
```

When calibrated the display will show **DONE** and will return to the Sound Pressure Level display.

The instrument is now ready to take measurements.

If the calibration is interrupted or the input level is not within +/- 3dB of the chosen reference level then the display will show **CAL FAIL**.

An error message of **NO INPUT** is shown if the input level is lower than or greater than 3dB.

Check to make sure the calibrator is switched on and emitting the correct level before proceeding again as indicated above.

Instrument Settings [SETUP]

In the menu display screen use the ▲ ▼ arrow keys as required until the following is displayed: -

> SETUP

Press (OK) to enter the **SETUP** sub menu page.

Depending on your instrument model, the following **SETUP** options are available: -

Instruments GA116L, GA216L, GA257L

Display	Description	Instrument
FREQ WGT	Set Frequency Weighting	ALL (Mode Dependant*)
TIME WGT	Set Time Weighting	ALL (Mode Dependant*)
INTERVAL	Set Interval Period	ALL
CONTRAST	Set Display Contrast	ALL
USER Ln	Set Percentile Level	ALL (Mode Dependant*)
CRIT	Set Criterion Level	ALL (Mode Dependant*)
THR	Set Threshold Level	ALL (Mode Dependant*)
EXCH	Set Exchange Rate	ALL (Mode Dependant*)
TIMER	Set Timer Function	ALL
DATE	Set Real Time Date	ALL
TIME	Set Real Time Clock	ALL

*See **User Mode** for further details.

Frequency Weighting [FREQ WGT]

The frequency weighting of the instrument can only be changed if the instrument has the User Mode set to ALL. See **User Mode** for further details.

Channel 1 is always ON and fixed to 'A' Weighting.

Channel 2 can either be 'C' or 'Z' weighted and can be switched OFF either by User Mode selection or selecting only 'A' weighting.

In the **SETUP** display screen use the ▲ ▼ arrow keys as required until the following is displayed: -

```
FREQ WGT
```

Press (OK) and the instrument will display the currently selected Frequency Weighting, indicated with an asterisk *.

```
A, F*
```

Scroll through the available options using the ▲ ▼ arrow keys: -

Display	Description
A	Channel 1 = 'A' Frequency Weighting
A, C	Channel 1 = 'A' Frequency Weighting Channel 2 = 'C' Frequency Weighting
A, Z	Channel 1 = 'A' Frequency Weighting Channel 2 = 'Z' (LIN) Frequency Weighting

Press (OK) to confirm a change and the instrument will briefly display: -

```
DONE
```

Or press (C) to cancel and return to the Sound Pressure Level display screen.

If the frequency weighting is selected for Channel 'A' only then Channel 2 is OFF. No parameters will be available, displayed or recorded for Channel 2.

Time Weighting [TIME WGT]

The time weighting of the instrument can only be changed if the instrument has the User Mode set to ALL. See **User Mode** for further details.

The selected time weighting applies to both channels (if Channel 2 is ON).

In the **SETUP** display screen use the ▲ ▼ arrow keys as required until the following is displayed: -

```
TIME WGT
```

Press (OK) and the instrument will display the currently selected Time Weighting, indicated with an asterisk *.

```
FAST
```

Scroll through the available options using the ▲ ▼ arrow keys: -

Display	Description
FAST	Select FAST Time Weighting
SLOW	Select SLOW Time Weighting
IMPULSE	Select IMPULSE Time Weighting

Press (OK) to confirm a change and the instrument will briefly display: -

```
DONE
```

Or press (C) to cancel and return to the Sound Pressure Level display screen.

For more information on Time Weighting see **Time Weighting** in **Chapter 2**.

If an interval period is selected then the instrument will record data at each interval period selected from the log start time.

Example:-

If a log interval of 1 second is selected and the start time of the log is 10:00:00 then the instrument will log data at 1 second interval periods from the start time: -

10:00:01
10:00:02
10:00:03 etc until the recording is stopped.

Approximately 2100 interval periods can be recorded on your instrument before the internal flash memory is full. Always ensure the interval period is set accordingly such that the total recording period is suitable.

Example:-

To record over a period of 10 hours:-

Convert period length to minutes (10h * 60m) = 600m
Convert period length to seconds (600m * 60s) = 36000s
Min Interval Period (36000 / 2100) = 17.14s

The nearest available selection above an interval period of 17.14 seconds would therefore be chosen i.e. 1 minute (5 minutes on GA257L).

The above calculation is based on an instrument with no logs stored in the internal flash memory, if logs are already stored on the instrument then these would need to be taken into account before using the calculation. See **Chapter 5** for more information.

In the **SETUP** display screen use the ▲ ▼ arrow keys as required until the following is displayed: -

INTERVAL

Press (OK) and the instrument will display the currently selected Interval Period, indicated with an asterisk *.

1s

Scroll through the available Interval Periods using the ▲ ▼ arrow keys: -

Display	Description
OFF	Intervals OFF – Cumulative Data Only
1s	1 second interval period *
10s	10 second interval period *
1m	1 minute interval period *
5m	5 minute interval period
10m	10 minute interval period
15m	15 minute interval period
30m	30 minute interval period
60m	1 hour interval period
8hr	8 hour interval period
12hr	12 hour interval period

* Not available on instrument GA257L

If an interval period is not required select OFF. Only cumulative data will then be displayed / recorded.

Press (OK) to confirm a change and the instrument will briefly display: -

```
DONE
```

Or press (C) to cancel and return to the Sound Pressure Level display screen.

Display Contrast [CONTRAST]

Select to adjust the contrast level of your instrument. The selected contrast level is remembered on model 'L' instruments.

In the **SETUP** display screen use the ▲ ▼ arrow keys as required until the following is displayed: -

```
CONTRAST
```

Press (OK) and the instrument will display the following or (C) to cancel and return to the Sound Pressure Level display screen: -

```
CONT ADJ
```

Use the ▲ ▼ arrow keys to adjust the contrast as required.

Press (OK) to confirm a change and the instrument will briefly display: -

```
  DONE
```

Or press (C) to cancel and return to the Sound Pressure Level display screen.

Percentiles [USER Ln]

Model 'L' instruments have one user selectable percentile level and two fixed percentile levels. Percentile is commonly abbreviated to Ln where n denotes the actual dB (A Weighted) level exceeded n% of the time, example L99.

Percentiles are only available if the User Mode is set to ALL or ENV. See **User Mode** for further information.

Fixed percentile levels are: -

- L10
- L90

In the **SETUP** display screen use the ▲ ▼ arrow keys as required until the following is displayed: -

```
USER Ln
```

Press (OK) and the instrument will display the currently selected User Ln indicated with an asterisk *.

```
95*
```

Scroll through the available User Selectable Percentiles using the ▲ ▼ arrow keys: -

Display	Description
1	L1 – dB(A) Level exceeded 1% of the time
5	L5 – dB(A) Level exceeded 5% of the time
50	L50 – dB(A) Level exceeded 50% of the time
95	L95 – dB(A) Level exceeded 95% of the time
99	L99 – dB(A) Level exceeded 99% of the time

Press (OK) to confirm a change and the instrument will briefly display: -

```
DONE
```

Or press (C) to cancel and return to the Sound Pressure Level display screen.

Criterion Level [CRIT]

In the **SETUP** display screen use the ▲ ▼ arrow keys as required until the following is displayed: -

```
  CRIT
```

Press (OK) and the instrument will display the currently selected Criterion Level, indicated with an asterisk *.

```
  85dB*
```

Scroll through the available options using the ▲ ▼ arrow keys: -

Display
75dB
80dB
85dB
90dB

Press (OK) to confirm or (C) to cancel and return to the Sound Pressure Level display screen.

Threshold [THR]

In the **SETUP** display screen use the ▲ ▼ arrow keys as required until the following is displayed: -

```
  THR
```

Press (OK) and the instrument will display the currently selected Threshold Level, indicated with an asterisk *.

```
 -10dB *
```

Scroll through the available options using the ▲ ▼ arrow keys: -

Display
-10dB
-5dB
OFF

Press (OK) to confirm or (C) to cancel and return to the Sound Pressure Level display screen.

Exchange Rate [EXCH]

In the **SETUP** display screen use the ▲ ▼ arrow keys as required until the following is displayed: -

> EXCH

Press (OK) and the instrument will display the currently selected Exchange Rate, indicated with an asterisk *.

> 3dB*

Scroll through the available options using the ▲ ▼ arrow keys: -

Display
3dB
4dB
5dB

Press (OK) to confirm or (C) to cancel and return to the Sound Pressure Level display screen.

Record Timer [TIMER]

The Record Timer is a user selectable time that will govern the recording length after a recording has started. For example if the Record Timer is set to 00:01:00 (hh:mm:ss) then the instrument will automatically end the recording after a period of 1 minute.

In the **SETUP** display screen use the ▲ ▼ arrow keys as required until the following is displayed: -

> TIMER

Press (**OK**) and the instrument will display: -

> TMR=OFF

Scroll through the available options using the ▲ ▼ arrow keys: -

Display	Description
TMR=OFF	Record Timer OFF
TMR=ON	Record Timer ON

Press (**OK**) to confirm your selection or (**C**) to cancel.

If **TMR=ON** is selected then the following time entry screen is displayed using the following 24 hour format (hh:mm:ss): -

> 00:00:00

The adjustable figure flashes, this always starts with the **HOUR** figure.

Use the ▲ ▼ arrow keys as required until the desired hour figure is displayed.

Press (**OK**) to confirm your selection and proceed to **MINUTES** and then **SECONDS** using the same procedure.

Press (**C**) to cancel changes and return to the SETUP screen.

Current Date [DATE]

In the **SETUP** display screen use the ▲ ▼ arrow keys as required until the following is displayed: -

```
   DATE
```

Press (OK) and the instrument will display the following date entry screen using the following format (dd:mm:yy): -

```
01:07:09
```

The adjustable figure flashes, this always starts with the **DAY** figure.

Use the ▲ ▼ arrow keys as required until the desired **DAY** figure is displayed.

Press (OK) to confirm your selection and proceed to **MONTH** and then **YEAR** using the same procedure.

Press (C) to cancel changes and return to the SETUP screen.

If an invalid date is entered the following will be briefly displayed: -

```
  ERROR
```

The date entry screen will then be displayed again and a correct date must be entered.

Real Time Clock [TIME]

In the **SETUP** display screen use the ▲ ▼ arrow keys as required until the following is displayed: -

```
   TIME
```

Press (OK) and the instrument will display the following time entry screen using the following 24 hour format (hh:mm:ss): -

```
09:05:09
```

The adjustable figure flashes, this always starts with the **HOUR** figure.

Use the ▲ ▼ arrow keys as required until the desired **HOUR** figure is displayed.

Press (OK) to confirm your selection and proceed to **MINUTES** and then **SECONDS** using the same procedure.

Press (C) to cancel changes and return to the SETUP screen.

User Mode [MODE]

The option to set a User Mode is only available on GA116L and GA216L instruments.

Selecting a User Mode is a quick and straightforward way to correctly set your instrument up for taking measurements. Parameters are only displayed and recorded where required.

In the **MENU** display screen use the ▲ ▼ arrow keys as required until the following is displayed: -

MODE

Press (OK) and the instrument will display the currently selected User Mode, indicated with an asterisk *.

ALL*

Scroll through the available options using the ▲ ▼ arrow keys: -

Display	Description
ALL	Select MODE = ALL
N@W	Select MODE = Noise At Work
ENV	Select MODE = Environmental

Press (OK) to confirm a change and the instrument will briefly display: -

DONE

Or press (C) to cancel and return to the Sound Pressure Level display screen.

Selecting a User Mode sets the instrument as follows:-

Mode	Description
ALL	Freq Weighting=A, C Time Weighting=FAST Percentiles=ON
N@W	Freq Weighting=A, C Time Weighting=FAST Percentiles=OFF
ENV	Freq Weighting=A Time Weighting=FAST Percentiles=ON

See **Parameters – Chapter 6** for further information on viewable and recorded parameters based on the selected User Mode.

View Saved Logs [LOGS]

Select this option to view saved logs on your instruments display. Only cumulative information is available to view on the instrument, if you wish to view this or recorded interval data then download via a USB port into the supplied software dBdataPro-LITE.

Logs are sorted by date and time, first select the date the recording was made and then select the time using the following procedure: -

In the **MENU** display screen use the ▲ ▼ arrow keys as required until the following is displayed (If no logs are available this option is not shown): -

```
LOGS
```

Press (OK) and the instrument will display the currently saved logs in date order.

```
30.06.09
```

Scroll through the available dates using the ▲ ▼ arrow keys.

Press (C) to exit without selection or (OK) to confirm the selection, the instrument will then display the currently saved logs by time recorded: -

```
10.35.10
```

Scroll through the available times using the ▲ ▼ arrow keys.

Press (C) to exit without selection and return to the date list or (OK) to confirm the selection, the instrument will then view the saved cumulative information for the log selected.

```
LAq 56.3
```

Every 5 seconds the screen will flash the following display to remind the user that they are currently viewing a saved log: -

```
LOG VIEW
```

Scroll through the available data using the ▲ ▼ arrow keys.

Press (C) to exit and return to the parameter display screen when required.

Delete Saved Logs [DELETE]

This option is only available if the instrument has saved logs.

Take extreme caution when deleting logs as they cannot be recovered.

In the **MENU** display screen use the ▲ ▼ arrow keys as required until the following is displayed: -

```
DELETE
```

Press (OK) and the instrument will display the following: -

```
ONE LOG
```

Scroll through the available options using the ▲ ▼ arrow keys: -

Mode	Description
ONE LOG	Delete Individual Saved Logs
ALL LOGS	Delete ALL Saved Logs

Press (OK) to confirm or (C) to cancel and return to the parameter display screen.

If **ONE LOG** is selected then the available logs are sorted by date and time, first select the date the recording was made and then select the time using the following procedure: -

Scroll through the available dates using the ▲ ▼ arrow keys: -

Press (C) to exit without selection or (OK) to confirm the selection, the instrument will then display the currently saved logs by time recorded: -

Scroll through the available times using the ▲ ▼ arrow keys.

Press (C) to exit without selection and return to the date list or (OK) to confirm the selection.

For either ONE LOG or ALL LOGS the following is displayed: -

```
CONFIRM?
```

Press (OK) to confirm or (C) to cancel and return to the parameter display screen.

When deleted, the instrument will return to the parameter display screen.

Set Instrument Defaults [DEFAULTS]

In the **MENU** display screen use the ▲ ▼ arrow keys as required until the following is displayed: -

DEFAULTS

Press **OK** and the instrument displays the followings: -

CONFIRM?

Press **OK** to confirm or **C** to cancel and return to the parameter display screen.

Default settings are as follows (where applicable): -

Description	Default Setting
Operating Range	50-120
User Mode	ALL
Frequency Weighting	CH1 = A, CH2 = C
Time Weighting	Fast
Calibration Level	94.0
Recording Interval Period	OFF
User Percentile	95
Criterion	85
Threshold	-10
Exchange	3
Record Timer	OFF

Keypad Lock [LOCK]

In the **MENU** display screen use the ▲ ▼ arrow keys as required until the following is displayed: -

> LOCK

Press **OK** and the following is displayed: -

> LOCK?

Press **OK** to confirm, the instrument is placed in Lock mode and the instrument displays the battery status.

Alternatively press or **C** to cancel and return to the parameter display screen.

To **UNLOCK** the keypad press **C, OK** then **C** respectively.

The LOCK feature is used to lock the instrument keypad. All keypad functions are therefore disabled including the POWER key. The function is often used to avoid inadvertent operation or tampering while the instrument is being used.

Chapter 5

Stop / Record Mode

All models of the Sonus range of instruments have two modes of operation referred to as: -

- Stop Mode
- Record Mode

Whilst the instrument is in **Record** mode the noise activity is analysed and all parameters available on your instrument are calculated.

On 'L' models only, all data captured can be saved to the internal flash memory and viewed or downloaded to Castle's noise analysis software **dBdataPro** as and when required.

All instruments start in **Stop** mode. Whilst the instrument is in **Stop** mode, on 'l' and 'B' models noise activity is not monitored and parameter calculations are halted during this period. On 'L' models calculations are displayed but not stored in flash memory.

Model 'l' & 'B' Instruments

Whilst in **Stop** mode the meter will flash between the current parameter and the following: -

> STOP

To enter **Record** mode press the **STOP / RECORD** Key ⊙/■ on your instruments keypad and the following is briefly displayed: -

> REC MODE

During **Record** mode the noise activity is analysed and all parameters available on your instrument are calculated.

All functions can be held so that they do not update by pressing the ⊙/■ key again. The meter is now again in **STOP** mode.

In **STOP** mode the display may be read as normal, allowing the user to take note of any required readings.

Toggle operation using the ⊙/■ key as required.

Always RESET data before **Record** mode is entered. See **Reset Data** for more information.

Model 'L' Instruments

On 'L' model instruments whilst in **Stop** mode only the parameter name and value are displayed.

To enter **Record** mode press the **STOP / RECORD** Key ⊙/■ on your instruments keypad and the following is briefly displayed: -

```
REC MODE
```

Data is automatically reset when a recording begins.

During **Record** mode the noise activity is analysed and all parameters available on your instrument are calculated using the settings made under **SETUP**.

To identify you are currently in **Record** mode the parameter name flashes.

To stop the recording and enter **Stop** mode, press the ⊙/■ key again. The following screen is then displayed: -

```
SAVE YES
```

Scroll through the available options using the ▲ ▼ arrow keys: -

Display	Description
SAVE YES	Save the current log
SAVE NO	Do NOT save the current log

Press (OK) to confirm or (C) to cancel and return to the Sound Pressure Level display screen.

If the instrument has been set to **User Mode = ENV** then the log is automatically saved otherwise an Exposure Time can be entered on the following screen which uses the following 24 hour format (hh:mm:ss): -

```
00:00:00
```

The adjustable figure flashes, this always starts with the **HOUR** figure.

Use the ▲ ▼ arrow keys as required until the desired **HOUR** figure is displayed.

Press (OK) to confirm your selection and proceed to **MINUTES** and then **SECONDS** using the same procedure.

Press (C) to cancel changes and return to the parameter display screen.

Exposure Time is used in DOSE and LEpd calculations.

All Models

On all instruments in either **Stop** or **Record** mode it is possible to quickly view information and settings of your instrument.

Press the (*i*) key once to access the information screen. Use the ▲ **or** ▼ arrow keys to scroll through the available list.

Pressing the (*i*) key again returns to the previous screen. If multiple screens have been accessed then the sound pressure level parameter screen will be displayed.

Press the (**C**) key to always return to the Sound Pressure parameter display.

The information listings are shown below: -

Model 'I' & 'B' Instruments – Information Screen

Display	Description	Instrument
BAT:■■■■	Battery capacity remaining	ALL
A, F	Indicates the current frequency and time weighting	ALL
ET 08:00	Shows the exposure time period	GA116I/GA216I /GA257B
85/3	Indicates the current criterion and exchange level	GA116I/GA257B
TH -10dB	Shows the threshold setting (relative to the criterion level)	GA116I/GA257B
Ver 1.00	Indicates the firmware version number	ALL
REC MODE or STOP	Indicates that the instrument is in either Record or Stop Mode	ALL

Model 'L' Instruments – Information Screen

Display	Description	Instrument
BAT ■■■■	Battery capacity remaining	ALL
MODE:ALL	Indicates the current User Mode	GA116L/GA216L
CH1: A,F	Show the Frequency and Time Weightings for Channel 1	ALL
CH2: C,F	Show the Frequency and Time Weightings for Channel 2 (Can be OFF and User Mode dependent)	ALL
CRIT: 85	Shows the Criterion Level (User Mode dependent)	ALL
EXCH: 3	Shows the Exchange Rate (User Mode dependent)	ALL
THR: -10	Shows the threshold setting (relative to the criterion level) (User Mode dependent)	ALL
L95	Show the User Selectable Percentile Level (User Mode dependent)	ALL
INT:OFF	Show the Selected Recording Interval Period	ALL
TMR: OFF	Show if Record Timer is ON or OFF	ALL
MEM: 85%	Show available memory (%)	ALL
09:15:07	Show Current Time	ALL
01.07.09	Show Current Date	ALL
SN 67000	Show Instrument Serial Number	ALL
VER 0.19	Show Instrument Firmware Number	ALL
GA116L	Show Instrument Model	ALL
CAL07.10	Show Factory Calibration Due Date	ALL

Reset Data

On all instruments it is possible to manually reset all current parameter data and status flags.

When the instrument is first switched on all data is automatically reset.

Models 'I' & 'B'

Whilst in **Stop** or **Record** mode, press the $\left(\text{C}\right)$ key to display the following: -

CONFIRM?

Press $\left(\text{OK}\right)$ to confirm and reset data or $\left(\text{C}\right)$ to cancel and return to the parameter display screen.

WARNING: Reset data values cannot be retrieved.

Model 'L'

Data is automatically reset whenever **Record** mode is entered.

Whilst in **Stop** mode, press the $\left(\text{C}\right)$ key to display the following: -

CONFIRM?

Press $\left(\text{OK}\right)$ to confirm and reset data or $\left(\text{C}\right)$ to cancel and return to the parameter display screen.

WARNING: Reset data values cannot be retrieved.

Chapter 6

Parameters

On all instruments whilst in **Stop** or **Record** mode it is possible to change the parameter display screen.

Scroll through the available parameter screens using the ▲ ▼ arrow keys: -

Models 'I' & 'B'

GA116I	GA216I
Sound Pressure	Sound Pressure
Leq	Leq
Max rms Level	Max rms Level
Peak Level	Peak Level
Elapsed Time	Elapsed Time
LEp'd	LEp'd
Projected LEp'd	Projected LEp'd
Sound Exposure	Sound Exposure
Dose	Overload Yes / No
Projected Dose	
Dose per Hour	
Pascal Squared Hours	
Overload Yes / No	

GA116B	GA216B	GA257B
Sound Pressure	Sound Pressure	Sound Pressure
Max rms Level	Max rms Level	Leq
Peak Level	Peak Level	Peak Level
Elapsed Time	Elapsed Time	Elapsed Time
Overload Yes / No	Overload Yes / No	LEp'd
		Projected LEp'd
		Dose
		Projected Dose
		Dose per Hour
		Pascal Squared Hours
		Overload Yes / No

The table below is a breakdown of all the possible display parameters with a brief description. Please see the previous tables to determine which parameters your instrument displays.

Display	Description
LAF 93.7	Frequency and Time Weighted Sound Pressure Level. LAF = A Weighted, Fast LCF = C Weighted, Fast LAS = A Weighted, Slow LCS = C Weighted, Slow
LAq 93.7	Displays the Frequency Weighted Leq LAq = A Weighted Leq LCq = C Weighted Leq
Amx 97.3	Maximum rms Sound Pressure Level – Freq Weighted Amx = A Weighted Max Level Cmx = C Weighted Max Level
Cpk 100.3	Maximum Peak Level Reached – Freq Weighted (Fixed) Cpk = C Weighted Peak Level (All except GA257B) Zpk = Flat or Linear Weighted Peak Level (GA257B Only)
00:01:33	Run time duration of REC MODE (Elapsed Time) hh:mm:ss
Lep 87.1	Displays the Lep'd
Ple 78.6	Displays the projected Lep'd assuming an exposure length set in the Exposure Time
LAE 93.1	Sound Exposure Level - Freq Weighted LAE = A Weighted Sound Exposure Level LCE = C Weighted Sound Exposure Level
Do% 27.2	Dose (dependent on exchange and criterion)
Pr% 212	Displays the projected DOSE assuming an 8 hour shift
Hr% 53.2	Dose per Hour
P2h 0.02	Indicates the energy that has been received in Pascal Squared Hours
O.L. NO O.L. YES	Overload latch that indicates if an OVERLOAD has occurred (Can only be reset by pressing the 'C' key)
—.—	Indicates when values are 0 or significantly lower than the bottom of the current range selected e.g. when instrument is first powered on or after being reset whilst in STOP mode.

Parameter	Instrument
Sound Pressure - Channel 1	ALL
Sound Pressure - Channel 2	ALL (Can be OFF and User mode dependent)
Leq - Channel 1	ALL
Leq - Channel 2	ALL (Can be OFF and User mode dependent)
Max rms Level - Channel 1	GA116L / GA216L (User mode dependent)
Max rms Level - Channel 2	GA116L / GA216L (Can be OFF and User mode dependent)
Peak Level - Channel 2	ALL (Can be OFF and User mode dependent)
LEp'd	ALL (User mode dependent)
Dose	ALL (User mode dependent)
Dose per Hour	ALL (User mode dependent)
Pascal Squared Hours	ALL (User mode dependent)
Sound Exposure	GA116L / GA216L (User mode dependent)
L10	GA116L / GA216L (User mode dependent)
L90	GA116L / GA216L (User mode dependent)
User Percentile	GA116L / GA216L (User mode dependent)
Overload Yes / No	ALL
Measurement Time	ALL
Interval Period	ALL (**Record** mode Only)

The following table below is a breakdown of all the possible display parameters with a brief description. Please see the previous tables to determine which parameters your instrument displays.

Display	Description
LAF 93.7	Frequency and Time Weighted Sound Pressure Level. LAF = A Weighted, Fast LAS = A Weighted, Slow LAI = A Weighted, Impulse LCF = C Weighted, Fast LCS = C Weighted, Slow LCI = C Weighted, Impulse LZF = Z Weighted, Fast LZS = Z Weighted, Slow LZI = Z Weighted, Impulse
LAq 93.7	Displays the Frequency Weighted Leq LAq = A Weighted Leq LCq = C Weighted Leq LZq = Z Weighted Leq
Amx 97.3	Maximum rms Sound Pressure Level – Freq Weighted Amx = A Weighted Max Level Cmx = C Weighted Max Level Cmx = C Weighted Max Level
Cpk 100.3	Maximum Peak Level Reached – Freq Weighted Cpk = C Weighted Peak Level Zpk = Flat or Linear Weighted Peak Level
Lep 87.1	Displays the Lep'd
Do% 27.2	Dose (dependent on exchange and criterion)
Hr% 53.2	Dose per Hour
P2h 0.02	Indicates the energy that has been received in Pascal Squared Hours
LAE 93.1	Sound Exposure Level - Freq Weighted LAE = A Weighted Sound Exposure Level
L10 45.4	dB(A) level exceeded for n% of the time n = 10, 90 and user selectable (L10, L90, Lxx)
O.L. NO O.L. YES	Overload latch that indicates if an OVERLOAD has occurred (Can be reset by pressing the 'C' key in **Stop** mode)
00:01:33	Duration of **Record** mode (Measurement Time - MT) hh:mm:ss
PER 10s	Duration of the selected Recording Interval Period remaining – Only available in **Record** mode
—–.—	Indicates when values are 0 or significantly lower than the bottom of the current range selected e.g. when instrument is first powered on or after being reset whilst in STOP mode.

Chapter 7

Downloading Saved Recordings – Model 'L' Only

As standard all model 'L' instruments are shipped with Castle's dBdataPro – LITE noise analysis software.

The full version of the software is available by purchasing a simple license key, consult your software user manual or contact Castle for further details.

Using the software dBdataPro it is possible to download the stored recordings on your meter to your PC allowing the data to be viewed and printed in professional reports.

Communication between a PC and your Sonus meter is made via the 9 pin connector at the right side of your instrument to a free USB port on your PC or laptop. The cable is supplied as standard with all Sonus instruments.

Your Sonus Instrument has specialised USB drivers that MUST be installed correctly for the instrument to successfully download.

For comprehensive instructions please refer to the dBdataPro user manual.

The instrument does not need to be placed in any special mode or any menu option selected to download, simply follow the operational instructions for the software and also ensure the following: -

- Supplied USB drivers are installed correctly
- Instrument is ON
- Communication cable attached to instrument and PC
- Software version 3.0 or higher is installed

It is highly recommended that data is not downloaded whilst the instrument is currently in **Record** mode and recording data. Under such circumstances it is possible that transferred data may become corrupt.

Chapter 8

Miscellaneous

Available Accessories

GA607	Dual Level Calibrator (Class 1)
GA601	Single Level Calibrator (Class 2)
PC007	dBdataPro Noise Analysis Software
ZL1107-02	USB Download Cable (1.8m)*
KA020	Weatherproof System*
MW402	Weatherproof Microphone Housing*
PSU4:SONUS	Power Supply*
ZL1094-01	Microphone Extension Cable (1m)
ZL1064-01	AC Output Cable (1m)*
KG205	Windshield 60mm
MK79	ACO 7052 25mV/Pa Microphone Capsule (Class 2)
MK80	ACO 7146A 25mV/Pa Microphone Capsule (Class 1)
MK579DP1B	Dose Meter Plug-in Microphone Capsule and Assembly
KG204	Dose Meter Windshield
KG205	Windshield 60mm
KA010	Small Attaché Case (Holds Instrument and Calibrator)
6LR61	9V Battery (Pack of 10)

* Only available for model 'L' instruments

Warranty and After Sales Service

Castle Group Ltd design and manufacture precision instruments, which if treated with reasonable care and attention should provide many years of trouble free service.

In the event of a fault occurring, during the warranty period, the instrument should be returned to Castle Group Ltd, in its original packaging, or to an authorized agent. Please enclose a clear description of the fault or symptom.

Details of the warranty cover are available from Castle Group Ltd or an authorized agent.

All instruments are designed to meet rigid British and International Standards. An annual calibration is recommended to ensure that these high standards are maintained. This is particularly important for cases in which instrument readings are to be used in litigation or compliance work.

For warranty and service return to: -

The Service Department
Castle Group Ltd
Salter Road
Cayton Low Road Industrial Estate
Scarborough
North Yorkshire
YO11 3UZ
United Kingdom

Telephone: +44 (0)1723 584250
Fax: +44 (0)1723 583728
Email: techsupport@castlegroup.co.uk
Web: www.castlegroup.co.uk

Any misuse or unauthorized repairs will invalidate the warranty.

Damage caused by faulty or leaking batteries is not covered by the warranty.

Trouble Shooting

Question	Answer
My instrument will not turn on?	Check that there is a battery fitted to the instrument. Check that the battery is not flat.
What is the white plastic cap fitted to the top of the microphone?	This is a protective cover for the sensitive microphone. You must remove it before using the instrument.
Where have my results gone?	Models I or B do not have a backup memory so all readings are lost when the instrument is switched off. Always take a note of important readings before switching off the instrument
My instrument is on but will not respond to keypad presses?	Have you locked the keypad ?
I keep getting CAL FAIL when trying to calibrate my instrument – what am I doing wrong?	Is the instruments microphone properly inserted in the calibrator? Is the calibrator switched on and working? Has the instrument and/or calibrator been knocked or moved as the calibration routine is taking place? Has the microphone been damaged?
What is the black o-ring inside my calibrator's cavity for?	The o-ring is essential to seal around the microphone stabilizing the pressure in the calibrator's cavity. If the o-ring is missing and/or damaged the instrument will not calibrate properly (see above).
When taking readings the display is constantly flashing *UR* – what does this mean?	This means that the noise you are measuring is below the bottom of the range you have the instrument selected to. Try selecting a lower range
My readings are within range but I keep getting OVERLOAD flashing on the screen – why is this?	The overload is triggered by the Peak reading whereas LP and LEQ are rms figures which are lower. Some noises feature very high peaks compared to the rms.

Question	Answer
My instrument has stopped responding to noise since I calibrated it?	Is the microphone capsule loose on the instrument? When removing the microphone from the calibrator it is possible to accidentally unscrew the microphone.
Why is my projected Lep'd not the same as the LEQ?	The Exposure Time may be set to a time other than 8 hours
After taking my readings the figures are a lot higher than expected?	Did you clear the memory after calibration?

Instrument Disposal

The symbol shown opposite can be found on your instrument and means that the product is classed as electrical or electronic equipment and should be disposed of at the end of its life separately to your commercial or household waste.

The Waste of Electrical and Electronic Equipment Directive (2002/96/EC) has been established to help reduce the influx on landfill sites and effectively treat hazardous substances by using best practices for the recovery and recycling of products.

There are various collection systems in place within the EU for the disposal of your product. To find the nearest UK waste recycling point in your area, enter your postcode in the website **www.recycle-more.co.uk**

For more information please contact your local authority, the dealer where you purchased your product or Castle Group Ltd.

Chapter 9

Technical Specification

The individual characteristic applies to each instrument unless specifically worded otherwise.

Instrument Standards:

GA116I, GA116L
IEC 61672-1 : 2002 Class 1 Group X
BS EN 61672-1 : 2003 Class 1 Group X
IEC 61252 : 1993
BS EN 61252 : 1997 + A1:2001

GA116B
IEC 61672-1 : 2002 Class 1 Group X
BS EN 61672-1 : 2003 Class 1 Group X

GA216I, GA216B, GA216L
IEC 61672-1 : 2002 Class 2 Group X
BS EN 61672-1 : 2003 Class 2 Group X

GA216L-P
IEC 61672-1 : 2002 Class 2 Group X
BS EN 61672-1 : 2003 Class 2 Group X
IEC 61252 : 1993
BS EN 61252 : 1997 + A1:2001

GA257B, GA257L
IEC 61252 : 1993
BS EN 61252 : 1997 + A1:2001

Time Weighting:

GA116I
SLOW and FAST according to IEC 61672-1 Class 1

GA116L
SLOW, FAST and IMPULSE according to IEC 61672-1 Class 1

GA216I, GA216B

SLOW and FAST according to IEC 61672-1 Class 2

GA216L, GA257L

SLOW, FAST and IMPULSE according to IEC 61672-1 Class 2

GA257B

FAST according to IEC 61672-1 Class 2

Frequency Weighting:

GA116I

A and C weightings according to IEC 61672-1 Class 1

GA116L

A, C and Z weightings according to IEC 61672-1 Class 1

GA216I, GA216B

A and C weightings according to IEC 61672-1 Class 2

GA216L, GA216L-P, GA257L

A, C and Z weightings according to IEC 61672-1 Class 2

GA257

A weighting according to IEC 61672-1 Class 2

Peak Frequency Weighting:

GA116I

C weighted to IEC 61672-1 Class 1

GA116L

C weighted to IEC 61672-1 Class 1, Z weighted to IEC 61672-1 Class 1

GA216I, GA216B

C weighted to IEC 61672-1 Class 2

GA216L, GA21L-P, GA257L

C weighted to IEC 61672-1 Class 2, Z weighted to IEC 61672-1 Class 2

GA257

Z weighted to IEC 61672-1 Class 2

Measurement Parameters:

GA116I
Lp, Leq, Lmax, Cpeak, LE, Pa²h, Lep'd, Projected Lep'd, DOSE%, Projected DOSE%, Dose Per Hour, Elapsed time, Overload

GA116L
Lp, Leq, Lmax, peak, LE, Pa²h, Lep'd, DOSE%, Dose Per Hour, L10, L90, L$_{user}$, Measurement Time, Overload, Interval Duration

GA216I
Lp, Leq, Lmax, Cpeak, LE, Lep'd, Projected Lep'd, Elapsed time, Overload

GA216L, GA216L-P
Lp, Leq, peak, LE, Pa²h, Lep'd, DOSE%, Dose Per Hour, L10, L90, L$_{user}$, Measurement Time, Overload, Interval Duration

GA116B, GA216B
Lp, Lmax, Cpeak, Elapsed time, Overload

GA257B
Lp, Leq, Zpeak, Pa²h, Lep'd, Projected Lep'd, DOSE%, Projected DOSE%, Dose Per Hour, Elapsed time, Overload

GA257L
Lp, Leq, peak, LE, Pa²h, Lep'd, DOSE%, Dose Per Hour, Measurement Time, Overload, Interval Duration

Display:

Digital 1 x 8 alphanumeric, digit size 7mm x 5mm Liquid Crystal Display

Display Refresh Rate:

250ms

Detector Characteristics:

RMS and Peak

Warm up time:
< 2 minutes

Environmental Stabilization Time:
30 minutes

Linear Operating Range: (IEC 61672:2002)

Model 'I' & 'B' Instruments

Test start point for frequencies 31.5Hz, 1kHz, 4kHz and 8kHz:

Display Range	Start Point (dB)
35 – 100 dB	74.0
55 – 120 dB	94.0
75 – 140 dB	114.0

A Weighted

Display Range	Frequency (Hz)			
	31.5 (dB)	1000 (dB)	4000 (dB)	8000 (dB)
35 – 100 dB	41.0 – 60.6	41.0 – 100.0	41.0 – 100.0	41.0 – 100.0
55 – 120 dB	55.0 – 80.6	55.0 – 120.0	55.0 – 120.0	55.0 – 119.0
75 – 140 dB	75.0 – 100.6	75.0 – 140.0	75.0 – 140.0	75.0 – 140.0

C Weighted

Display Range	Frequency (Hz)			
	31.5 (dB)	1000 (dB)	4000 (dB)	8000 (dB)
35 – 100 dB	41.0 – 60.6	41.0 – 100.0	41.0 – 100.0	41.0 – 100.0
55 – 120 dB	55.0 – 80.6	55.0 – 120.0	55.0 – 120.0	55.0 – 119.0
75 – 140 dB	75.0 – 100.6	75.0 – 140.0	75.0 – 140.0	75.0 – 140.0

For the GA257B instrument refer only to the display range 75-40dB.

Model 'L' Instruments

Test start point for frequencies 31.5Hz, 1kHz, 4kHz and 8kHz:

Display Range	Start Point (dB)
30 – 100 dB	74.0
50 – 120 dB	94.0
70 – 140 dB	114.0

A Weighted

Display Range	Frequency (Hz)			
	31.5 (dB)	1000 (dB)	4000 (dB)	8000 (dB)
30 – 100 dB	32.0 – 60.6	32.0 – 100.0	32.0 – 100.0	32.0 – 100.0
50 – 120 dB	50.0 – 80.6	50.0 – 120.0	50.0 – 120.0	50.0 – 119.0
70 – 140 dB	70.0 – 100.6	70.0 – 140.0	70.0 – 140.0	70.0 – 140.0

C Weighted

Display Range	Frequency (Hz)			
	31.5 (dB)	1000 (dB)	4000 (dB)	8000 (dB)
30 – 100 dB	33.0 – 60.6	33.0 – 100.0	33.0 – 100.0	33.0 – 100.0
50 – 120 dB	50.0 – 80.6	50.0 – 120.0	50.0 – 120.0	50.0 – 119.0
70 – 140 dB	70.0 – 100.6	70.0 – 140.0	70.0 – 140.0	70.0 – 140.0

Z or LIN Weighted

Display Range	Frequency (Hz)			
	31.5 (dB)	1000 (dB)	4000 (dB)	8000 (dB)
30 – 100 dB	34.0 – 60.6	34.0 – 100.0	34.0 – 100.0	34.0 – 100.0
50 – 120 dB	50.0 – 80.6	50.0 – 120.0	50.0 – 120.0	50.0 – 119.0
70 – 140 dB	70.0 – 100.6	70.0 – 140.0	70.0 – 140.0	70.0 – 140.0

For the GA257L instrument refer only to the display range 70-40dB.

Total Measuring Range:

The difference between the lowest possible measurement on the most sensitive range and the highest level on the least sensitive range at a frequency of 1kHz.

	Models 'I' & 'B'	Model 'L'
A Weighted	41.0 – 140.0 (dB)	32.0 – 140.0 (dB)
C Weighted	41.0 – 140.0 (dB)	33.0 – 140.0 (dB)
Z or LIN Weighted	N.A	34.0 – 140.0 (dB)

Peak Operating Range @ 1kHz:

Display Range	Models 'I' & 'B'	Models 'L'
30 – 100 dB	63.0 – 103.0	40.0 – 103.0
50 – 120 dB	83.0 – 123.0	60.0 – 123.0
70 – 140 dB	103.0 – 143.0	80.0 – 143.0

Acoustic Frequency Range:

Microphone	Frequency Range (Hz)
ACO 7146A	20 to 8000
ACO 7052	20 to 8000

Electrical Characteristics:

Frequency Range (Hz)
1 to 20000

Reference Points:

	Models 'I' & 'B'	Model 'L'
Description	Value	Value
Sound Pressure Level	94.0dB	94.0dB
Range	55 - 120	50 - 120
Frequency	1kHz	1kHz

Typical Electrical Self Generated Noise Level:

Model	'A' Weighting (dB)	'C' Weighting (dB)	'Z' Weighting (dB)
'I' & 'B'	32.0	38.0	N.A
'L'	23.0	24.0	25.0

Electrical Signal Input:

Electrical signals can be applied to the Castle Sonus range of sound level meters by removing the acoustical microphone and replacing with a dummy microphone having a series capacitor of 18pF ±2%. The BNC termination is then used to interface with a suitable signal generator with an output impedance of 600Ω at 1kHz.

Maximum Peak to Peak Electrical Signal Input For No Damage:

Model	Max Input Voltage (V)
'I' & 'B'	7.0
'L'	21.0

Upper Frequency for Periodic Acoustic Testing:
4kHz - (IEC 61672-3:2006)

Windshield:

The effects of using the KG205 (60mm) windshield			
31.5Hz	0.0	1kHz	0.2
63Hz	0.1	2kHz	0.2
125Hz	0.1	4kHz	0.7
250Hz	0.1	8kHz	0.0
500Hz	0.2		

The meter conforms to the Standards quoted when fitted with the windshield.

Microphone [GA116I, GA116L]:

ACO ½" Electret Condenser Microphone Cartridge Type 7146A. Microphone reference point is the centre of the diaphragm.

Type MK80 (ACO 7146A)	Specification
Diameter (inch)	0.5
Response Type	Free-Field
Polarization (V)	0.0
Frequency Range (Hz)	20 - 8000
Sensitivity (mV/Pa)	25.0
Sensitivity (dB re 1V/Pa)	-32.0 ±1.5dB
Capacitance (pF)	18.0
Max. Sound Pressure Level (dB)	146.0
Temperature Coefficient (dB/°C)	-0.01

The pressure to free-field correction value to be applied when used with a Castle calibrator GA601/GA607 or B&K4231 is as follows: **-0.2dB**

The capsule can be removed by unscrewing anti-clockwise although great care must be taken when doing this to avoid damage to either the capsule or the instrument. Re-fitting is a reverse of the above.

Type MK80 (ACO 7146A) Typical Microphone Response			
16Hz	0.0	1kHz	0.0
31.5Hz	0.0	2kHz	0.0
63Hz	0.0	4kHz	-0.1
125Hz	0.0	8kHz	-0.7
250Hz	0.0	16kHz	1.0
500Hz	0.0		

Typical Actuator to free field correction factors(dB) of an MK80 (ACO 7146A) microphone (Based on 500Hz = 0)			
250Hz	0.0	2.5kHz	1.0
315Hz	0.0	3.15kHz	1.2
400Hz	0.0	4kHz	1.5
500Hz	0.0	5kHz	2.0
630Hz	0.0	6.3kHz	2.5
800Hz	0.0	8kHz	3.8
1kHz	0.0	10kHz	4.6
1.25kHz	0.2	12.5kHz	6.8
1.6kHz	0.4	16kHz	8.8
2kHz	0.5	20kHz	10.0

Microphone [GA216I, GA216B, GA216L, GA257B, GA257L]:

MK79 ACO ½" Electret Condenser Microphone Cartridge Type 7052. Microphone reference point is the centre of the diaphragm.

Type MK79 (ACO 7052)	Specification
Diameter (inch)	0.5
Response Type	Free-Field
Polarization (V)	0.0
Frequency Range (Hz)	20 - 8000
Sensitivity (mV/Pa)	25.0
Sensitivity (dB re 1V/Pa)	-32.0
Capacitance (pF)	18.0
Max. Sound Pressure Level (dB)	146.0
Temperature Coefficient (dB/°C)	-0.01

The pressure to free-field correction value to be applied when used with a Castle calibrator GA601/GA607 or B&K4231 is as follows: **-0.2dB**

The capsule can be removed by unscrewing anti-clockwise although great care must be taken when doing this to avoid damage to either the capsule or the instrument. Re-fitting is a reverse of the above.

Type MK79 (ACO 7052) Typical Microphone Response			
31.5Hz	0.2	1kHz	0.0
63Hz	0.1	2kHz	0.0
125Hz	0.0	4kHz	0.0
250Hz	0.0	8kHz	0.5
500Hz	0.0		

Typical Actuator to free field correction factors(dB) of an MK79 (ACO 7052) microphone (Based on 500Hz = 0)			
20Hz	0.0	500Hz	0.0
25Hz	0.0	630Hz	0.0
31.5Hz	0.0	800Hz	0.0
40Hz	0.0	1kHz	0.1
50Hz	0.0	1.25kHz	0.2
63Hz	0.0	1.6kHz	0.3
80Hz	0.0	2kHz	0.4
100Hz	0.0	2.5kHz	0.5
125Hz	0.0	3.15kHz	0.8
160Hz	0.0	4kHz	1.2
200Hz	0.0	5kHz	1.6
250Hz	0.0	6.3kHz	2.3
315Hz	0.0	8kHz	3.6
400Hz	0.0		

Maximum SPL at the Microphone for No Damage:

ACO 7146A	ACO
146.0 dB	146.0 dB

Calibration Reference Conditions:

	Models 'l' & 'B'	Model 'L'
Sound Field	Free Field	Free Field
Air Temperature	23°C (73°F)	23°C (73°F)
Relative Humidity	50%	50%
Atmospheric Pressure	101.325 kPa	101.325 kPa
Sound Pressure Level	94.0dB	94.0dB
Reference Level Range	55 – 120dB	50 – 120dB
Reference Frequency	1kHz	1kHz

The reference direction of incidence for all microphones is perpendicular to the front face (diaphragm surface) of the microphone.

Operating range:
Class 1: -10°C to +50°C
Class 2: 0°C to +40°C

Warning: DO NOT subject the instrument to temperatures greater than 70°C or less than -20°C for any length of time.

Effect of Temperature:

Class 1: Accuracy better than ± 0.5 dB over the range -10 to +50°C
Class 1: Accuracy better than ± 0.5 dB over the range 0 to +40°C

Effects of Humidity:

Less than 0.5 dB over the range 25 to 90% relative humidity (provided there is no Condensation), relative to the value at 50% relative humidity and 40°C.

Storage range: 0 to 90% relative humidity in the absence of condensation

Effects of Vibration:
From 20Hz to 1kHz at 1ms^2 no noticeable effect

Magnetic Field:
No noticeable effect

Operator Presence in Free Field:

No noticeable effect when operator standing more than 2m behind the instrument

Overload:

Positive overload warning when the input circuit saturates

Log Interval Periods: Model 'L' Only

User Selectable with a minimum integrating period of one second
Maximum potential log size approximately 2100 intervals

Timer Function: Model 'L' Only

An adjustable countdown timer to stop recordings with a user defined total measurement period.

Time & Date: Model 'L' Only

Battery backed Real time clock and calendar

Overall Dimensions:

210mm x 60mm x 35mm (approx.)

Batteries:

1 x 9V PP3 Alkaline Cell

Life Expectancy: 12 hours continuous use (approx)

Min Battery Level: 5.4V DC

Max Battery Level: 9.4V DC

Overall Weight including Batteries:

220g

Case Reflections:

Stalk length 75mm from front of microphone grid to top of case body			
Frequency (Hz)	Case Effect (dB)	Frequency (Hz)	Case Effect (dB)
31.5	0.0	800	0.2
40	0.0	1000	0.0
50	0.0	1250	-0.3
63	0.0	1600	-0.2
80	0.0	2000	-0.5
100	0.0	2500	0.4
125	0.0	3150	-0.2
160	0.0	4000	-0.2
200	0.0	5000	0.1
250	0.1	6300	0.1
315	0.1	8000	0.0
400	0.1	10000	0.0
500	0.1	12500	-0.2
630	0.1	16000	0.0

AC Output: GA116I

Vout ≈ 16.4mVrms at 94.0dB

The output is un-weighted and not affected by the measurement range.

DC Output: GA116I

Vout ≈ 40mV/dB

Vout ≈ 3.3 – [[(top of range +3) - (reading in dB)] x 0.04]

Output affected by: -

- Frequency Weighting

- Measurement Range

Output Socket: GA116I

Both AC and DC outputs require load impedance's to exceed 10kΩ, however load impedance's > 100KΩ are recommended.

Front View

DC Output — GND — AC Output
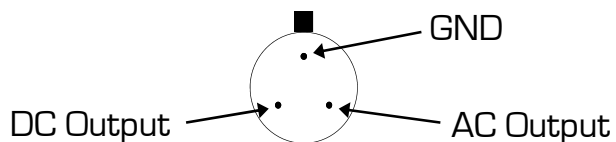
AC Output: Model 'L' Instruments

Vout ≈ 20.0mVrms at 94.0dB

The output is un-weighted and not affected by the measurement range.

Output Socket: Model 'L' Instruments

The AC output requires the load impedance to exceed 10kΩ, however load impedance's > 100KΩ are recommended.

Front View

AC Output (pin 6)

GND (pin 5)
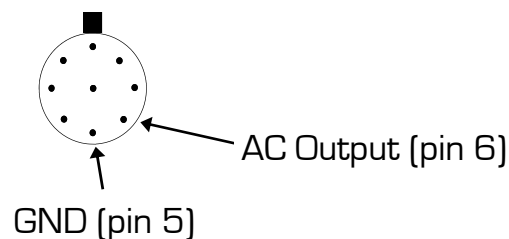
Radio Frequency Fields:

The Sonus Pocket Range fall into classification X for the susceptibility to Radio Frequency Fields.

Manufacturers Data:

Uncertainty figures for all manufacturers' data are under review at the time of going to print. Please contact Castle Group Ltd for up-to date information.

EC Declaration of Conformity:

CE   The CE marking of this Castle Product indicates compliance with the EMC Directive.

Castle Group Ltd declares that the: -

- *GA116, GA216, GA257 Pocket Sound Level Meters*

have in accordance with the following Electromagnetic Compatibility Directives: -

- *89/336/EEC*

been designed and manufactured to the following specification:

- *EN61326-1:1997 + A1:1998*

with the following Tests:

- *Radiated Emissions: EN55022:1995 Class: B*

- *ESD: EN61000-4-2:1995 Levels: ±4kV (C) , ± 8kV (A)*

- *Radio-frequency EM field amplitude mod: EN61000-4-3:1996 Level: 3V/m*

No differences in radio frequency emissions are apparent between the available operating ranges where applicable on the Sonus range of instruments.

Approved cables for use with the Castle Sonus Range of instruments to comply with these standards:-

Cable	Order Code	Length
USB Download – Model 'L'	ZL1107-02	1.8m
Microphone Extension	ZL1094-01	1m
Microphone Extension	ZL1094-10	10m

We hereby declare that the instruments named above have been designed to comply with the relevant sections of the above referenced specifications, and that the above named instruments comply with all essential requirements of the specified Directives.

EMC tests conducted at the standard test level of 74dB

Chapter 10

A Guide to Acoustical Terms and Units

Sound Pressure Level (SPL)

Sound level meters measure acoustic pressure, and by international agreement they are calibrated in decibels (dB). The Sound Pressure Level in decibels is defined as:

$$SPL = 20 LOG \frac{P}{P_o}$$

Where: P is the measured **rms** sound pressure
          P_0 is the reference **rms** sound pressure.

Note that the decibel is a ratio of two quantities which have dimensions of power, and is not a unit.

The reference sound pressure P_0 is by agreement taken as 20 Pa, which is the minimum audible pressure to a person with 'normal' hearing. The use of a logarithmic scale, such as the decibel permits the wide range of audible sound pressures (approximately 1,000,000 to 1) to be compressed into a scale of 120 units. Hence a faint whisper may be measured as 20dBA where as a chipping hammer of a road workman may produce 105dBA.

Standardised frequency curves

Because the ear is relatively insensitive to very low and very high frequencies, sound level meters have by international agreement weighted frequency responses. Hence different frequency weightings will produce for the same sound source different SPL readings.

Castle sound level meters may have any one of three frequency weightings.

- 'A' weighting, which best expresses the human ears response to loudness is the most commonly used frequency weighting.
- 'C' weighting, this is often used to ascertain the acoustic emissions of machines it has a much broader spectrum than that of the 'A' weighting curve.
- Zero or 'Z' weighting (often termed un-weighted). It may vary between differing instruments as its characteristics are very dependent on the quality of the microphone and associated pre-amplifier. It is often used in conjunction with octave band filters. A typical Z weighted response would be flat from 20 Hz to 16 KHz.

Time weighting - Fast, Slow, Impulse and Peak

It is important to understand that the SPL is an rms (root mean square) quantity and is therefore averaged within the constraints of an averaging time constant. These time constants are helpfully termed Slow, Fast and Impulse and are sometimes referred to as the time weighting.

The SPL therefore is not only affected by the frequency weighting but by the time weighting of the instrument also. Hence by selecting **Slow** on the sound level meter a sharp rise in noise will be shown as a gradual rise in the SPL, alternatively a sharp fall in noise will be shown as a gradual decrease in the SPL. By using the **Fast** weighting on the instrument in both of the above scenarios the SPL will rise and fall on a more rapid scale. The **Impulse** response is not as commonly used as the above, it is used in situations of sharp impulsive noises typically a piling operation may require an impulse time weighting. It has a very fast rise time but a very slow exponential fall time.

The **Peak** weighting is very different from Slow, Fast and Impulse weighting in that it is not an rms quantity. It is simply the crest of the sound pressure level and it is shown as the highest Peak achieved within the measuring period. The rise time of the Peak is extremely sharp and it is not uncommon for the Peak to be much higher than the SPL (rms).

Lmax, Lmin, Peak

Lmax is the highest rms sound pressure level within the measuring period (with slow, fast or impulse time weighting selected).

Lmin is the lowest rms sound pressure level within the measuring period (with slow or fast time weighting selected).

Peak is the crest (linear) of the sound pressure within the measuring period, not rms.

Leq - Equivalent Continuous Sound Pressure Level

Leq is the constant noise level that would result in the same total sound energy being produced over a given period. It can be measured using 'A' , 'C' or 'Z' frequency weighting.
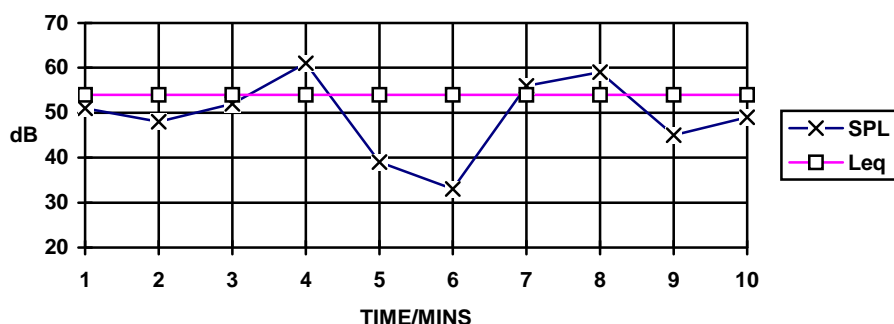
Leq can be described mathematically by the following equation:

$$L_{eqT} = 10\log_{10}\left[\frac{1}{t_2-t_1}\int_{t_1}^{t_2}\left(\frac{P(t)}{P_0}\right)^2 dt\right]$$

Where: Leq is the equivalent continuous linear-weighted sound pressure level re 20 µPa, determined over a measured time interval TM (sec's).

P(t) is the instantaneous sound pressure of the sound signal.
P_0 is the reference sound pressure of 20 µPa.

When the instantaneous A-weighted sound pressure (P_A) of the sound signal is introduced, then the equivalent continuous A-weighted sound pressure level determined over time interval T_M is as follows:

$$L_{Aeq} = 10\log_{10}\frac{1}{T_M}\int_0^{T_M}\left[\frac{P_A(t)}{P_o}\right]^2 dt$$

In practice when measuring noise it is possible to take Leq readings with your instrument of short duration i.e. <5 minutes providing all variations of noise emissions are covered. If the measured environment changes greatly, then the longer the Leq reading is taken, the more accurate the measurement.

LAE, Level Exposure (formerly SEL)

This is in effect an Leq normalised to 1 second. It can be used to compare the energy of noise events which have different time duration's. The LAE can be described mathematically as below.

$$L_{AE} = 10\log_{10}\int_0^{T_M}\left[\frac{P(t)}{P_o}\right]^2 dt$$

Where T_M is measured in seconds.

Ln, Percentile Levels

Percentile levels are used greatly when measuring environmental noise, i.e. that which may pollute the environment.

Ln, where n may be anything from 1 to 99 is that noise level exceeded for n % of the measurement time. By definition of percentiles, L1 must be greater than or equal to L2 which must be greater than or equal to L3 etc.   It is often the case that only a few Ln values are ever used.
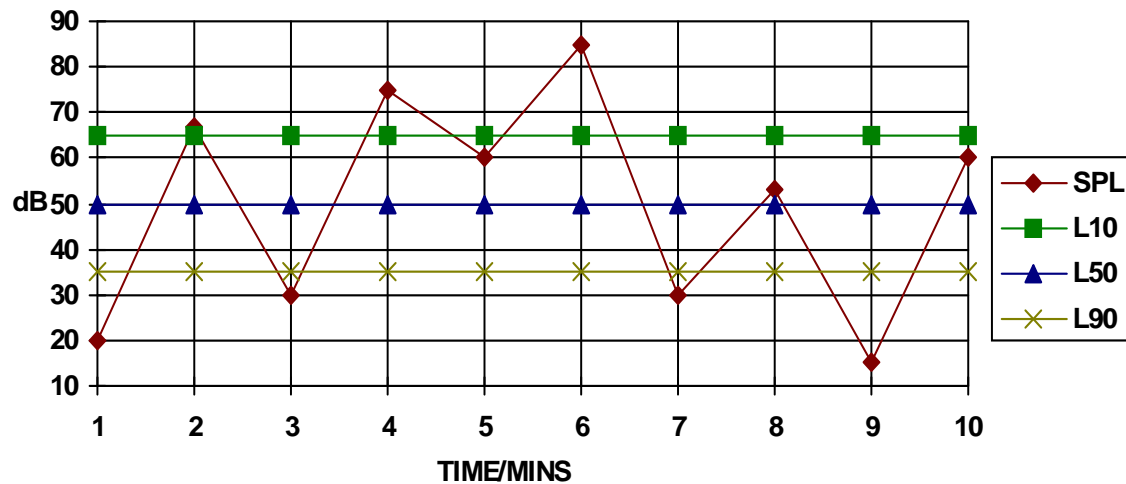
The above figure shows L10, L50 and L90.

L10 is the noise level exceeded for 10% of the measurement duration. This is often used to give an indication of the upper limit of fluctuating noise, such as that from road traffic.

L50 is the noise level exceeded for 50% of the measurement duration.

It is mathematically inaccurate to add, subtract or average percentile values.

L90 is taken to the ambient or background noise level as used, for example, in BS4142: 'Rating industrial noise affecting mixed residential and industrial areas'.

(L10-L90) is often used to give a prediction of noise nuisance, as noise with widely varying level is more annoying than a constant noise level. (L10-L90)is used in such noise indices as Traffic Noise Index:-

TNI = 4[L10 – L90] + L90 – 30

L50 is simply the 'middle point' exceeded for 50% of the measurement duration ad has been incorporated in some American Community Noise Assessments.

DOSE

DOSE is a percentage measure of noise exposure similar to LEp'd, and can be described with the following statement: 100% DOSE = 85dBA for 8 hours

The operation of dose can be mathematically described by the following equation which relates the percentage exposure D to the integrated sound power.

$$D = \frac{100}{T_c} \int_0^T \uparrow \left(\frac{L - L_c}{q} \right) dt$$

Where:

↑	represents the anti-log
D	= Percentage exposure (%).
T_C	= Criterion sound duration (usually 8 hours).
T	= Measurement duration in (hr)
L	= Weighted sound level
L_C	= Criterion level (usually dBA)
q	(Exchange rate parameter, expressed as dB) =(3/log2) for an exchange rate of 3 dB (Approx 9.96578) =(5/log2) for an exchange rate of 5 dB (Approx 16.61096)

For discrete time intervals at a constant sound level the equation can be rewritten as below:

$$D = \frac{100}{T_c} t_i 10^{\left(\frac{L_i - L_c}{q}\right)}$$

Where:

Li = Weighted sound pressure level in the ith time interval
ti = Time spent in the ith interval (hr)

The dose can be converted to an Leq.

$$L_{eq} = L_c + 10.\log_{10}[[(D/100).(T_c/T_M)]]$$

Where:
Leq = the equivalent continuous sound level, with A-weighting, from the time T_M.
Lc = Typically 85 dBA in the UK.
D = indicated dose index (%).
Tc = reference time base 8 hours.
Tm = measurement time in hours.

Tables D1, D2 & D3 give examples of how DOSE is related to exposure time and LEp'd (assuming a criterion of 85 100% DOSE = 85dBA for 8 hours.)

Table D1. Effect of changing SPL

SPL (dBA)	Exposure Time (hours)	Dose (%)	LEp'd (dBA)
94	8	800	94
91	8	400	91
88	8	200	88
85	8	100	85
82	8	50	82
79	8	25	79

Table D2. Effect of changing exposure time.

SPL (dBA)	Exposure Time (hours)	Dose (%)	LEp'd (dBA)
85	16	200	85
85	12	150	86.76
85	8	100	85
85	4	50	82
85	2	25	79
85	1	12.5	76

Table D3. Effect of changing SPL and exposure time.

SPL (dBA)	Exposure Time (hours)	Dose (%)	LEp'd (dBA)
88	4	100	85
85	8	100	85
80	8	31.5	80
82	4	25	79
79	4	12.5	76

Each time the sound level increases by 3dB the DOSE doubles given the same exposure time, similarly if the sound level decreases by 3dB the DOSE will halve for the same exposure time.

Doubling the exposure time doubles the DOSE and halving the exposure time halves the DOSE given the same sound level.

Projected DOSE

DOSE measurements usually require the noise exposure to be measured over a full 8 hour working day. This can be simplified by using Projected DOSE.

Projected DOSE allows the present accumulated DOSE over the elapsed logged time duration to be projected forward to give the predicted 8 hour dose.

For example, if you had been logging for 30 minutes with an accumulated DOSE of 5%, the Projected DOSE would show:

5% x 8 hours/0.5 hours = 80% DOSE.

i.e. you would receive an 80% DOSE if you were to stay in this area with the same equivalent level of noise for the full 8 hours.

The following should be taken into consideration when reporting Projected DOSE figures:

1. The Projected DOSE assumes that the current DOSE rate at the time of reading will remain constant, i.e. the sound level does not change over the measurement period compared to the total 8 hour period.

2. The Projected DOSE will be more accurate if the measurement duration is as long as possible.

3. DOSE, and therefore Projected DOSE are measured with 'A' frequency weighting selected.

4. If, say, a 12 hour day is worked the 8 hour Projected DOSE should simply be multiplied by 1.5 (i.e. 12/8) to calculate what the DOSE would be after 12 hours.

LEp'd Daily Personal Noise Exposure (formerly LEX)

LEp'd is a measure of exposure that depends not only on the sound pressure level but also on the duration of the noise exposure. It is intended to be used to measure the daily exposure of a worker, and therefore is dependent on shift duration. Unlike DOSE, LEp'd is displayed as a dB(A) value, and is derived from the equation shown below.

$$LEp'd = 10\log_{10}\frac{1}{28800}\int_0^{T_M}\left[\frac{P_A(t)}{P_o}\right]^2 dt$$

Note the similarity between this definition and that of Leq. Since LEp'd is normalised to 8 hours the LEp'd would equal the 8 hour Leq of a worker exposed for 8 hours.

Although similar to Leq, LEp'd will present a different value to the Leq if the exposure time is greater than or less than 8 hours. See tables, D1, D2, and D3.

The relationship between LEp'd and DOSE is given by the following equations:

$$LEp'd = 85 + 10.\log_{10}[DOSE/100]\quad\text{(For a criterion level of 85)}$$

$$LEp'd = L_{eq} + 10.\log_{10}[t/T]$$

Where: t = logging time
           T = 8 hours reference (28800 seconds)

Note that LEp'd is a logarithmic measurement as opposed to DOSE which is a linear function. Hence DOSE can be added arithmetically but since LEp'd is logarithmic, values cannot be added arithmetically.

Each time the sound level increases the LEp'd increases. If the exposure time doubles, say 4 hours to 8 hours, the LEp'd increases by 3dB.

Glossary of Acoustical Terms

This section describes and defines many terms used in acoustics.

Term	Unit or Abbreviation	Definition
Decibels	dB	Ten times the logarithm (to base 10) of the ratio of two mean square values of sound pressure.
Frequency	Hz	The number of cyclical variations per unit time
Octave Bands	Hz	Frequency ranges in which the upper limit of each band is twice the lower limit. Octave bands are identified by their geometric mean frequency or centre frequency.
Sound Power	W	The acoustic power of a sound source expressed in Watts.
Sound Power Level	L_W	The acoustic power radiated from a given sound source as related to a reference power level (typically 10^{-12} W); expressed in decibel as: $$L_W = 10\log_{10}(\frac{W}{10^{-12}})dB$$ or $$L_W = 10\log_{10}W + 120dB$$ W = acoustic power in Watts. i.e. 1 Watt = 120 dB for L_W
Sound Pressure	P	Fluctuations in air pressure caused by the presence of sound waves.
Sound Pressure Level	SPL	The ratio expressed in decibels of mean - square sound pressure to a reference mean - square pressure which by convention has been selected to be equal to the assumed threshold of hearing. $$SPL = 20\log_{10}(\frac{P}{P_o})$$ Where: SPL = Sound Pressure Level P = Root Mean Square sound pressure $P_o = 2 \times 10^{-5}$ Nm^{-2} = 20µPa (R M S)
Weighting Network	A - dB(A)	An electronic or digital filter in a sound level meter which approximates under defused conditions the frequency response of the human ear. The A - Weighting network is the one most commonly used.
Equivalent Continuous Frequency Weighted Sound Pressure Level	$L_{EQ}T$	The equivalent continuous level which is a measure of the energy content of a sound over a time period. It gives a single figure expressing the equivalent of a varying level. It is an energy average.

Term	Unit or Abbreviation	Definition
Dose	Do%	Noise dose is a percentage number where: 100% Dose = 85 dB(A) for 8 hours. Note that not only is the sound level important (85 dBA) but also the time a person was exposed (8 hours).
Dose per Hour	Hr%	Designed to show the Dose exposure over each hour.
Projected Dose	Pr%	Projected dose allows the present accumulated dose over the present logged time duration to be projected forward to give the predicted 8 hour dose. This assumes the logged dose rate remains constant over the 8 hour period. A time inhibit on Castle instruments prevents projections being made if the measurement duration is less than five minutes.
Noise Exposure	LEp'd	Personal noise exposure; usually referred to a daily 8 hour rate. "Exposed" means exposed whilst at work; expressed in dB(A) $$LEp'd = 10\log_{10}\frac{1}{T_o}\int_0^{T_e}[\frac{P_A(t)}{P_o}]^2 dt$$ Where: T_e = the duration of the person's personal exposure to sound. T_0 = 8 hours = 28800 seconds. P_0 = 20 µPa P_A = the time - varying value of A weighted instantaneous sound pressure in Pascal's in the undisturbed field in air at atmospheric pressure to which the person is exposed.
Percentile Sound Levels	L_n	The dB(A) level exceeded n% of the time.

Disclaimer

Whilst every effort is made to ensure the accuracy and reliability of both the instrument described and the associated documentation, Castle Group Ltd makes no representation or warranties as to the completeness or accuracy of this information.

Castle Group Ltd assumes no responsibility or liability for any injury, loss or damage incurred as a result of misinterpreted or inaccurate information.

Any documentation supplied with your product is subject to change without notice.

Instrument Details

For your records and for future correspondence with Castle Group Ltd regarding your instrument, please complete the following details: -

Instrument Model

Instrument Serial Number

Purchase Date

HB/0116/005/A5 Rev 1.01