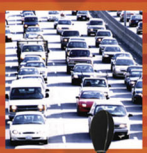
Castle GROUP

technical safety & environmental solutions

Pro-DX VOCIS

the future of sound measurement



OPERATING MANUAL

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CASTLE PRO-DX VOCIS
Sound Level Meters

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Sound Level Meters Operating Manual

Published by Creativ Partnership Ltd

Vocis
HB / 0131 / 027 / A4 Rev K

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

Copyright

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.
- 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 particles 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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To the safety, health and environment professional...

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 website 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

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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.

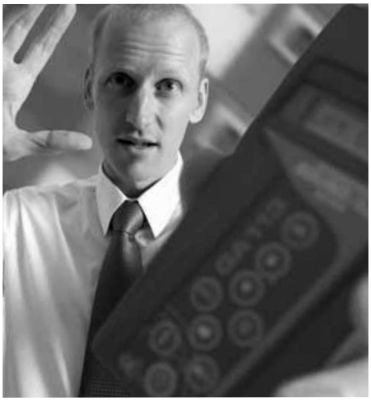
CastleRent

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

www.castlegroup.co.uk

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 focussed on the development of sound and vibration measuring equipment supply and calibration. 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!

Introduction

Thank you for purchasing your product from Castle Group Ltd. The Pro-DX Vocis range of sound level meters bring to you unrivalled power and usability with real time octave and one third octave measurement, just about all the sound parameters you could possibly need and the ability to have up to 128Mb of on-board memory... Sound measurement technology has finally arrived.

A Tough Case For All Weathers...

Not only is the physical design and construction of the Castle Pro-DX casing extremely tough and durable, it is also dust-proof and weatherproof! This means that, wherever you go and whatever you do, your Vocis can go with you without being letting you down.

Talking To the Outside World...

Saved data can be transmitted directly to the Castle GA505 Portable Printer providing ready formatted numeric and graphic print-outs. The Vocis series features a bi-directional RS232 interface for communication with a PC and with the printer interface cable to third party printers.

To gain the most out of your measured data, Castle dBdataPro software is the way to go. Post measurement analysis and presentation of graphical data can all be done using this package. dBdataPro allows seamless integration with word processing and spreadsheet packages enabling you to use your own standard report formats in programs that you are familiar with.

Simplicity and Power...

Using the meter couldn't be simpler. The intuitive Pro-DX operating system tells you where you are and what you want to do next. The massive power of the technology in the instrument is tamed by the user interface such that you are presented with information in a concise and unambiguous format. Menu choices are logical and straightforward and make maximum use of the clearly defined operation keys and the 'mobile phone' style 'soft' function keys.

Future Proof...

The built in software 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 Castle Pro-DX 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.

With the addition of the Castle weatherproofing system, and the option of adding a DAT recorder, this instrument makes the ideal environmental noise measuring system. The simplicity of use and the data logging capabilities mean that this system can be used for general environmental spot checks, industrial boundary measurements, construction site monitoring, road noise, neighbourhood noise nuisance, entertainment noise and other measurement tasks.

Pro-DX Vocis Variations

Industrial Safety – Vocis I

GA131I – Class 1, Parallel 1 / 1 Octaves
GA231I – Class 2, Parallel 1 / 1 Octaves

The Vocis I (Class 1 or Class 2) is primarily designed for use in Industry as an occupational hygiene or health and safety tool, or anywhere where there is a specific requirement for the measurement of 1 / 1octave bands. The opportunity to automatically compare measurements with hearing protection attenuation data or noise control materials is a particularly useful feature. The measurement parameters included in this model allow for concise data to be monitored without the user being swamped with excessive and unnecessary information. The Class 1 model is particularly suitable for applications where the nature of the data is more critical, while the Class 2 version is well suited to most industrial screening and risk assessment applications.

Environmental – Vocis E

GA131E – Class 1, Ln's, No Filters
GA231E – Class 2, Ln's, No Filters

The Vocis E (Class 1 or Class 2) is primarily designed for environmental monitoring, where long-term data logging is the key consideration. The uncluttered nature of this variation means that long term, unattended measurements produce just the results needed. The Vocis E does not have frequency analysis, and as such offers a highly powerful data-logging tool.

Combined (Industrial / Environmental

GA131C – Class 1, Ln's, Parallel 1 / 1 Octaves

The Vocis C (Class1 only) combines all the power and all the features of the Vocis I and E. This makes the Vocis C a multi-function sound level meter that will satisfy the needs of the most advanced user, whilst maintaining the usability for which Castle is renowned.

Multi Function

GA131M – Class 1, Ln's, Parallel 1 / 1 and 1 / 3 Octaves

The Vocis M (Class 1 only) is the flagship of the Vocis range which proudly boasts all the features of the rest of the range and then adds 1 / 3 Octave band analysis to create the ultimate in hand-held sound analysis. The main features of this model are; Two channels, Parallel 1 / 1 and 1 / 3 Octave bands, 19 simultaneous parameters, A-HPD - Advanced Hearing Protection Database, Wide dynamic range, Low Noise Floor, Large memory capacity and ultimate user flexibility.

Chapter 1

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.

Attaching & Removing the Pre-Amplifier with Class 1 Instruments

The microphone supplied with the GA131 class 1 range is a pre-polarised ½ Microtech Gefell MK250.

On the pre-amplifier locate the orientation key and on the instrument locate the RED keying identification mark. Position the pre-amplifier so that the orientation key is in line with the RED mark and then gently push the pre-amplifier into the instruments socket. To pull the two connections tightly together and hold the pre-amplifier securely in place simply screw the knurled retaining ring in a clockwise direction over the instruments threaded top assembly. DO NOT TWIST THE MICROPHONE STEM.

Figure 1 – Attaching the Pre-Amplifier with a Class 1 Instrument

To remove the pre-amplifier unscrew the knurled retaining ring on the pre-amplifier and gently pull the pre-amplifier from the instrument.

Attaching & Removing the Pre-Amplifier with Class 2 Instruments

The microphone supplied with the GA231 class 2 range is a pre-polarised ½ ACO 7146.

The Pro DX Range of class 2 instruments use a different pre-amplifier assembly to that of the class 1 range. 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 by pulling on the knurled part of the stem. DO NOT TWIST THE MICROPHONE STEM.

Removal of Microphones

Either microphone type 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 microphones have 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.

PLEASE NOTE THAT YOUR INSTRUMENT MAY BE SUPPLIED WITH A PROTECTIVE WHITE PLASTIC CAP COVERING THE END OF THE MICROPHONE WHEN DELIVERED. THIS CAP MUST BE REMOVED PRIOR TO USING THE INSTRUMENT.

Attaching & Removing the Microphone Extension Cable

To attach the microphone extension cable, insert the 5 pin connector into the instrument as illustrated in Figure 2 below. This is achieved by aligning the RED marks on both the instrument and connector and then gently pushing.

For class 1 instruments, align the orientation key on the pre-amplifier assembly with the RED identification mark on the tapered adaptor and then gently push the pre-amplifier assembly gently into the tapered adaptor. Screw the knurled retaining ring over the threaded tapered adaptor in a clockwise direction to make connection between the two connectors and securely hold the pre-amplifier in place.

For class 2 instruments, align both RED marks on both the pre-amplifier connector and the tapered adaptor and gently push the pre-amplifier housing into place.

To remove reverse the above procedure.

Figure 2 - Attaching and Removing the Microphone Extension Cable

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. Whilst measuring always point your Castle Pro DX meter directly towards the noise source being measured.

Sound Level General Advice

In some environments, high levels of noise can occur. The Castle Pro DX sound level meter has therefore been designed with six measurement ranges 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 **Under Range & Overload Conditions** and **Range Selection.**

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 Pro DX sound level meter case 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 arms length, mount the sound meter on a tripod or use a microphone extension cable.

Time Weighting

The time weighting is a time constant that modifies the response of the SPL (Sound Pressure Level).

The available standardised time weightings are as follows: -

Slow Weighting

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

Fast Weighting

Follows the noise level closer than slow weighting by displaying a fast rise and fall in the SPL. The rise and fall times applied for Fast Weighting are 125m Seconds.

Impulse Weighting

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.

10ms Weighting

Displays a very fast rise and fall time of the noise source. The rise and fall times for this weighting are 10m Seconds.

Frequency Weighting Filters

Frequency Weightings are where the Sound Pressure Level (SPL) is modified by use of filtering. On your Pro DX Meter this filtering is done digitally through a powerful DSP (Digital Signal Processor). All of the weightings on your Pro DX Meter are standardised between 10Hz and 20,000Hz. The available standardised time weightings are as follows: -

'A' Weighting

The SPL is filtered in such a manner as to reflect the hearing response of a human ear. Generally this is the most common used frequency weighting. When selected your data will be displayed as dBA (decibels A weighted).

'C' Weighting

This does not filter the SPL as much as 'A' weighting and is generally used for the acoustic emissions of machinery and for peak sound levels. When selected your data will be displayed as dBC (decibels C weighted).

'Z' Weighting

No filtering of the SPL occurs, i.e. the SPL is un-weighted which is often referred to as the FLAT or LIN response. This weighting is generally used in conjunction with octave band filters. When selected your data will be displayed as dBZ (decibels Z weighted).

The graph below shows the frequency response for each of the weightings available on your Pro DX Meter: -

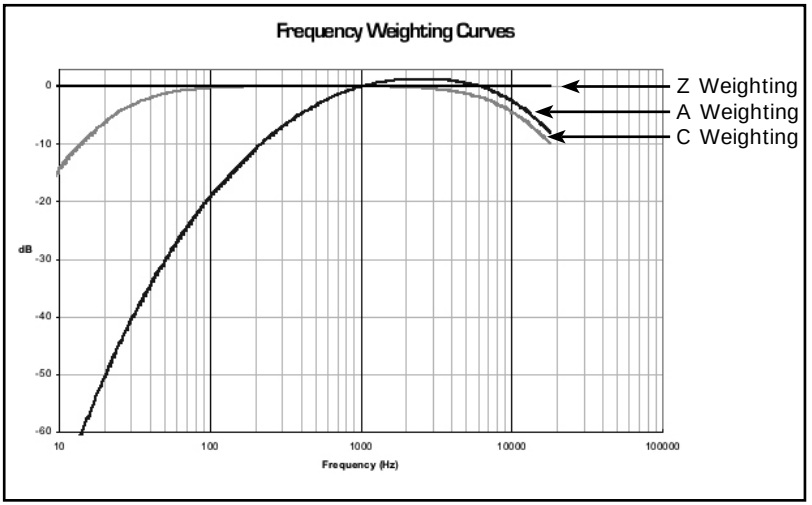


Figure 3 – Frequency Weighting Curves

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 0.1dB over the top of the range selected, an overload condition occurs and an overload indicator is displayed on your meter. 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.

The overload indicator will remain for a minimum of one second or while the overload condition remains.

In real time operation, where time average or sound exposure parameters are shown and an overload condition has occurred, the overload indication is latched on and can only be removed by resetting the parameters.

Whilst recording, where time average or sound exposure parameters are shown and an overload condition has occurred, the overload indication is latched on and is only reset after the recording has been stopped.

If whilst recording an overload occurs, then an overload flag is saved for the channel that caused the overload condition.

Overload indicator locations are shown for each display mode below: -

SLM Mode Overload Indicators

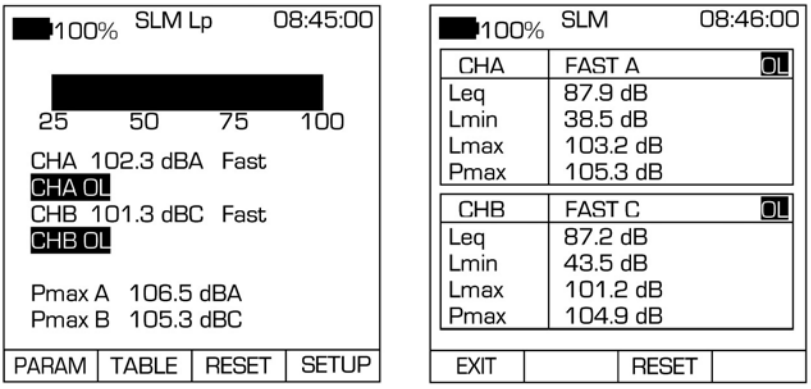
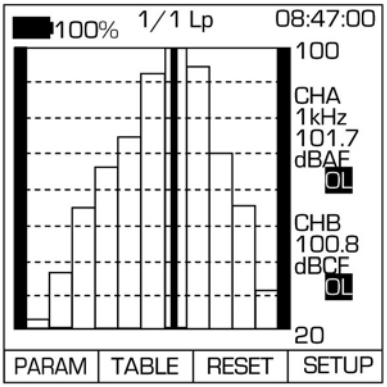
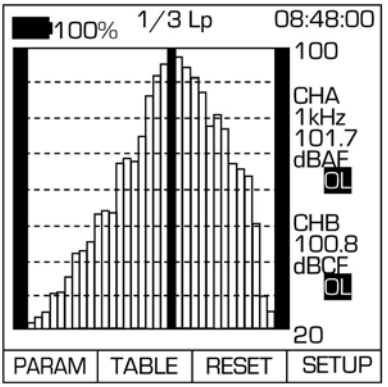


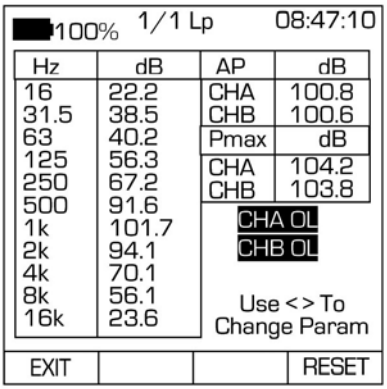
Figure 4 - SLM Mode Overload Indicators

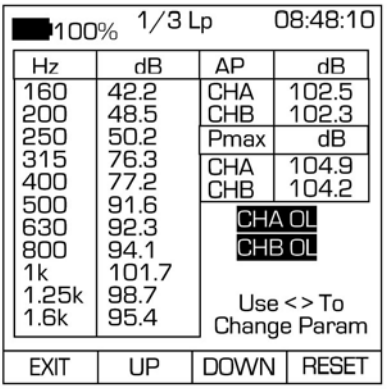
Full Octave & Third Octave Mode Overload Indicators

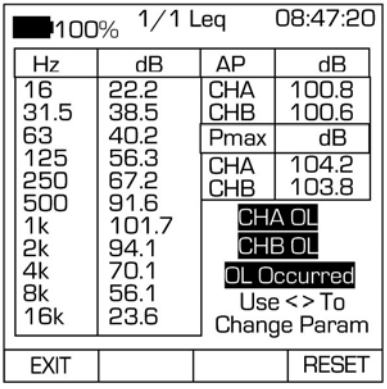
Full Octave Mode	Third Octave Mode











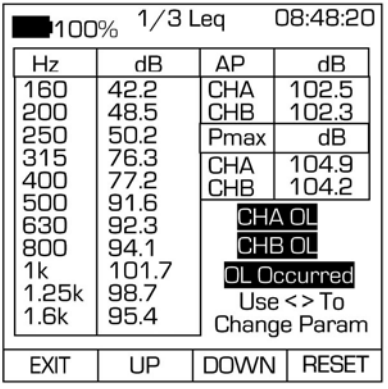


Figure 5 - Full Octave & Third Octave Mode Overload Indicators

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 be displayed on your meter. In such circumstances it is highly recommended to change to a lower range with a higher sensitivity (i.e. more gain) as your meter will be out of specification. The under range indicator will remain for a minimum of one second or while the under range condition remains. Under Range indicator locations are shown for each display mode below: -

SLM Mode Under Range Indicators

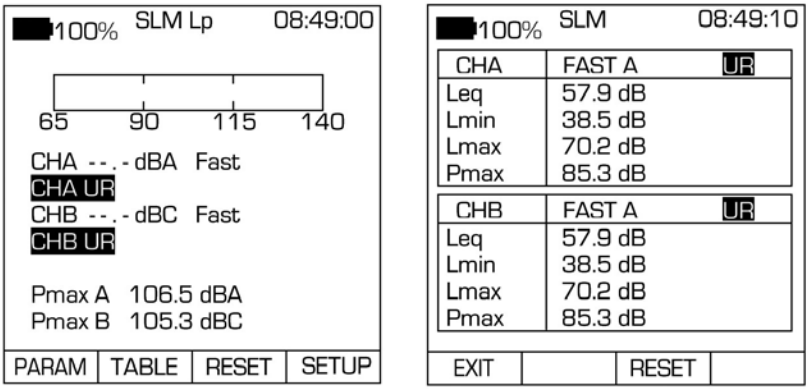


Figure 6 - SLM Mode Under Range Indicators

Full Octave Mode Under Range Indicators

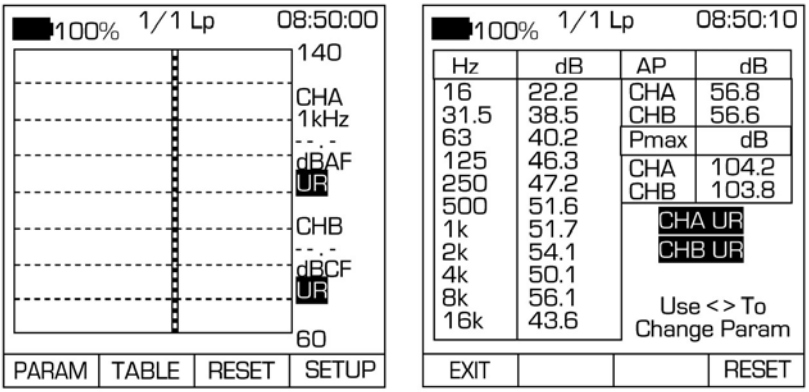
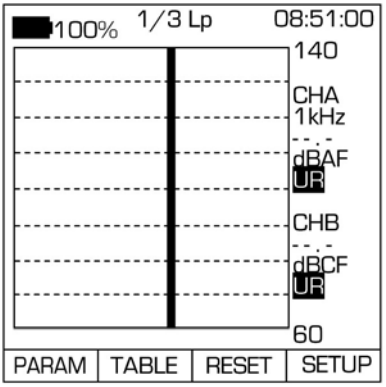


Figure 7 - Full Octave Mode Under Range Indicators

Third Octave Mode Under Range Indicators



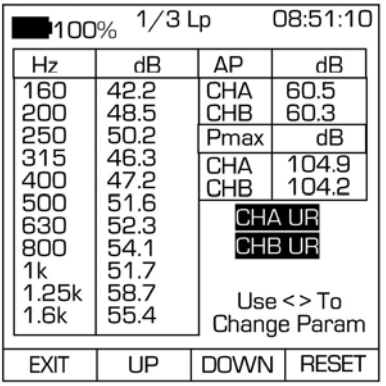


Figure 8 - Third Octave Mode Under Range Indicators

Measuring Ranges

The Pro DX Vocis sound level meter has been specifically designed to utilise six measuring ranges. The six ranges ensure complete accuracy throughout the entire dynamic range whilst also being lower power.

The measuring display ranges available are as follows: -

SLM Mode (dB)	Full Octave & Third Octave Mode (dB)
15 – 90	10 – 90
25 – 100	20 – 100
35 – 110	30 – 110
45 – 120	40 – 120
55 – 130	50 – 130
65 – 140	60 – 140

The displayed range on Full Octave and Third Octave Modes are intentionally different for graphing purposes only. The linear operating range remains as given at 75dB.

Chapter 3

Getting Started

Your Pro DX Vocis meter has two running states of operation:-

- **Real Time**
- **Recording**

Real Time operation does not record any measurements (see **Real Time Operation** for more information and procedures).

To record data and obtain the meter must be placed into Recording Operation (see **Recording Operation** for more information and procedures).

When the meter is first switched on, the meter defaults to Real Time Operation.

Your meter is equipped with a simple to use navigation system using the four Light Blue keys **(Soft Keys)** located at the top of the keypad.

Where appropriate, on the display directly above each Soft Key will be a description, pressing the Soft Key will bring up further menus or change the function as described.

The **Main Menu** is activated by pressing the **MENU** Key (menu) once. Pressing the Menu Key again will put the instrument into Real Time measurement mode.

The Main Menu and other sub menus use a numbered menu system. When displayed you are presented with a list of selectable options, to activate the required option press the corresponding number using the numeric keypad on your instrument.

Some options may also have further sub-menus where further options are listed.

The **Main Menu** and **Sub Menus** are described in detail in **Chapter 4**.

Keypad Layout

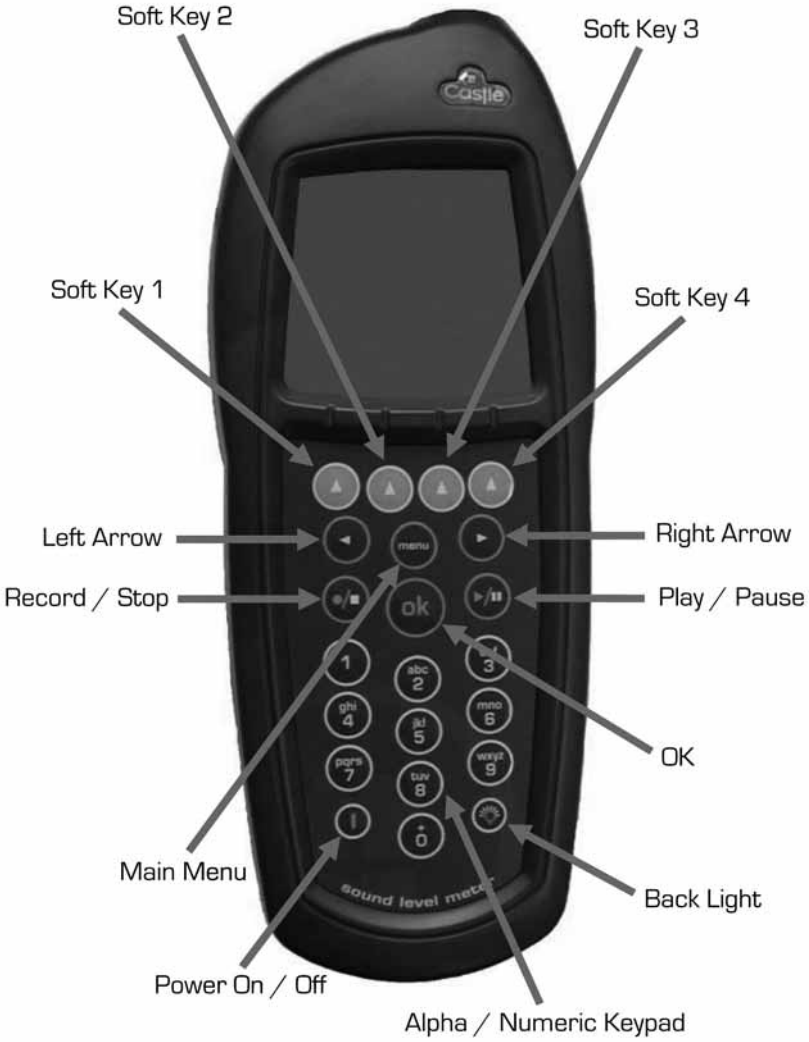


Figure 9 - Keypad Layout

Sample Screen Layouts

Sound Level Meter Mode

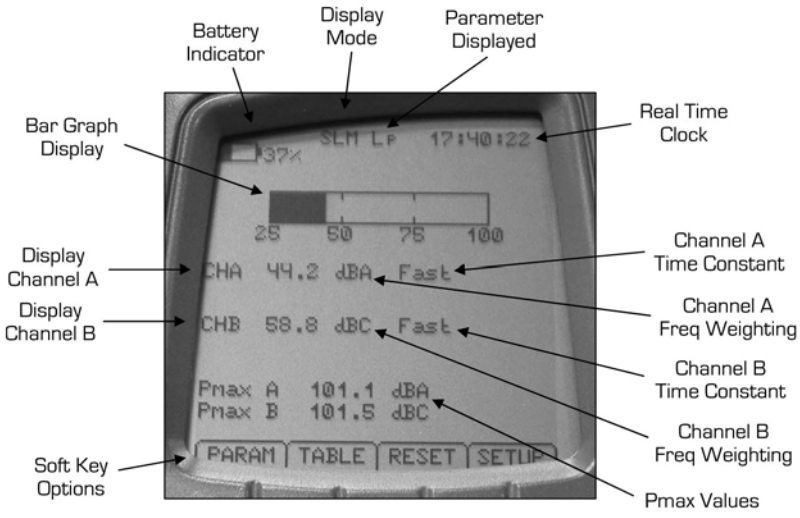


Figure 10 - SLM Mode Screen Layout

Octave Band Mode

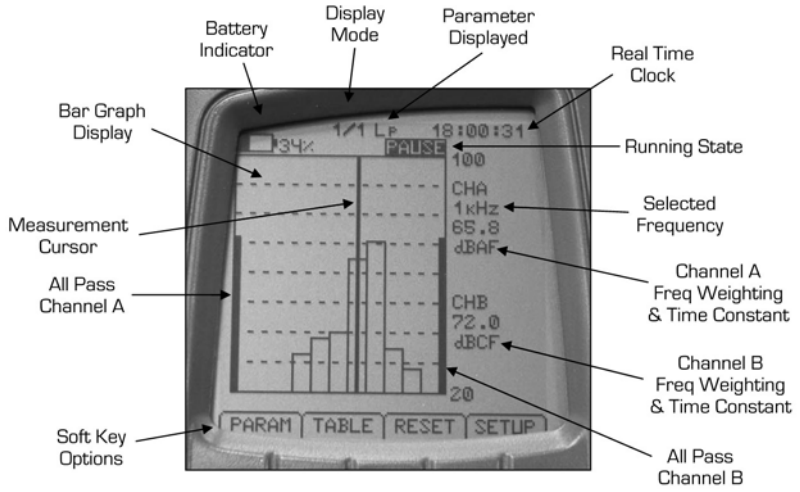


Figure 11 – Full Octave Mode Screen Layout

Powering Your Pro DX Vocis Meter

Your Pro DX Vocis meter can be powered from either 6*AA batteries or an external Castle 12V DC Power Supply which can be purchased separately if required (PSU3).

The battery compartment is located on the rear of your instrument and its cover can easily be removed and fastened by the use of your thumb or a coin if required. Place each individual battery with the positive terminal to the positive markings which are moulded into the case in the battery compartment. To achieve higher battery life of your instrument it is strongly recommended you use Alkaline type batteries.

With your Pro DX meter off, keypad scanning circuitry is still active within your meter. It is therefore recommended you remove at least one battery whilst not in use. This procedure will ensure you get the maximum life span from your batteries.

To power the instrument via the Castle DC Power Supply, firstly plug your PC or Printer cable into the 9 pin male connector located at the base of the unit. The correct orientation is such that the flying DC socket connected to the 9 pin female connector on the cable is inserted in the base of your Pro DX meter. Your DC power supply is now inserted into the flying DC socket.

Your Pro DX meter is equipped with a battery level indicator; this is given both graphically and as a percentage readout on the meters display. If batteries are low the indicator will flash **LOW** and if not changed the instrument will auto power down. When your Pro DX meter is powered externally via the DC power supply this indicator will remain at 100%.

To preserve your data always turn your instrument off using the Power Key.

Below is a typical graph which approximately indicates the Pro DX battery level with respect to time.

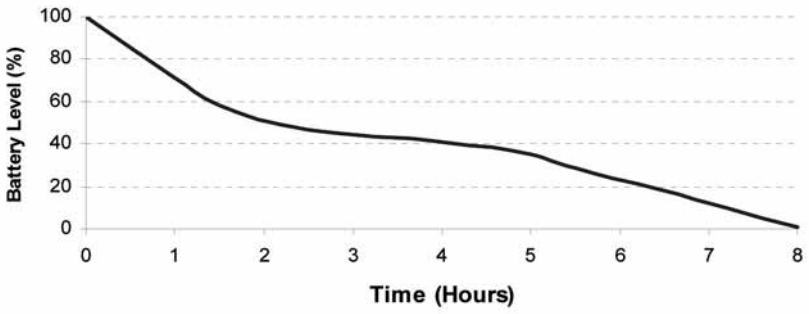


Figure 12 - Approximate Alkaline Battery Life

Switching Your Pro DX Vocis Meter On/Off

To turn on your instrument press and hold the Power On / Off key ⏻ for approximately one second. Your instrument will emit a single beep to inform you that the instrument is activated.

Your meter will now begin its boot sequence, display the start-up screen and initialise the internal digital signal processor. Once the boot sequence is complete you will be prompted if you wish to calibrate your instrument by selecting either **YES** or **NO**. Use the light blue Soft Keys directly beneath the display to confirm your selection.
It is recommended that you calibrate your instrument before use, see the heading **Calibration** in **Chapter 4** for detailed information on calibration of your instrument.

Figure 13 - Pre-Calibration

After calibration or if the calibration is bypassed your meter will be ready for operation in Real Time mode with the previously used settings.

To turn your instrument off press the Power On / Off key ⏻ at any time.

Please be aware that the Power On / Off key ⏻ is disabled whilst the instrument is recording.

To preserve your data always turn your instrument off using the Power Key.

Chapter 4

Main Menu Structure

The **Main Menu** is activated by pressing the **MENU** Key (menu) once. Pressing the Menu Key again will put the instrument into Real Time measurement mode. Your Pro DX Vocis meter is equipped with a simple to use numbered menu system. To select an option simply press its corresponding number key on the Alpha / Numeric keypad of your instrument.

The **Main Menu** and **Sub Menu** options are listed below: -

Main Menu

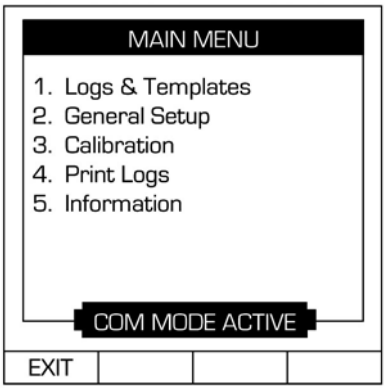


Figure 14 - Main Menu Options

Function	Description
Logs & Templates	Instrument settings can be set for a specific measurement task
General Setup	Set and change generic instrument parameters and settings
Calibration	For performing user field calibration
Print Logs	Send stored data directly to a portable printer
Information	Specific instrument details including battery levels

Please be aware that all communications made to your PC via a standard serial cable or a USB to RS232 adaptor are made when the instrument is in the Main Menu.

Logs & Templates

Logs are recordings made by the user that contain all the data for specific events. Saving a log allows the user to view the recorded information again on the instrument or download to a PC using the software dBdataPro (available separately).

Templates are the way in which the Vocis stores different instrument settings on which you can base future measurements, much in the same way word processing software has templates for basing future documents on. Castle Group has produced 6 sample templates for your convenience, these are as follows: -

Function	Description	Instrument
BS4142	Environmental Standard BS4142	Type C,E and M only
ENVTHD	Basic Environmental Measurements using Third Octave Bands	Type M only
LDEN	Day, Evening and Night Measurements	Type C,E and M only
NAW	Noise At Work Regulations	All Variations
NAWOCT	Noise At Work Regulations using Full Octave Bands	Type C,I and M only
PPG24	Planning for Noise	Type C,E and M only

Each of the templates above cannot be deleted and modifications made to them will not be saved ensuring that your settings are correct every time.

Above and beyond this, the user can set up as many templates as required. These can then be managed, edited and deleted as necessary. Templates are the best way of ensuring consistent measurements for various applications.

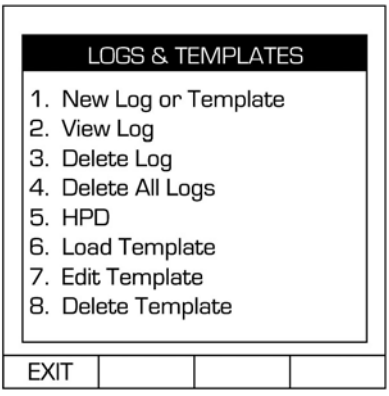


Figure 15 – Logs & Templates Options

New Log or Template

Select this option to setup the instrument with the required settings for creating a log and / or saving the settings as a template for future use.

The first screen displayed is the Logs & Templates Setup screen where instrument settings can be changed. Two pages of options are available. Use the keypad to select **More Options** to access **page 2** and **Prev Options** to return to **page 1**. See **Setup Options** in **Chapter 5** for details on changing settings.

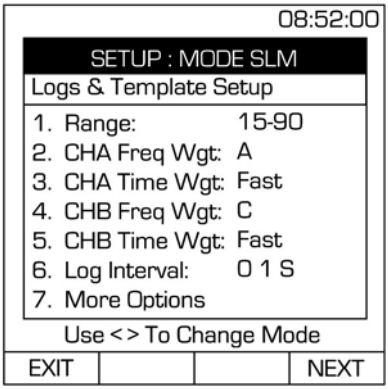


Figure 16 - New Log or Template

When settings have been made press **Soft Key 4** labelled **NEXT** to continue or press **Soft Key 1** labelled **EXIT** to return to the previous screen.

The next screen displayed is the Timer Selection screen where timer functions can be set as required. Select the Timer function you require by pressing its corresponding number on the keypad.

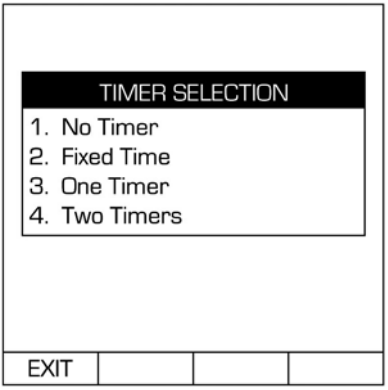


Figure 17 - Timer Selection Screen

The versatile timer functions allow you to start and stop logging automatically at predetermined times. When a timer function is used your instrument is placed in Sleep Mode to enhance battery life. When the start timer is reached your instrument wakes up resuming full power, the instrument then starts logging with the settings you defined in the **Logs & Templates Setup** screen.

The Timer Functions available are as follows: -

Timer	Description
Fixed Timer	Recordings are started manually and stopped automatically after a fixed duration specified by the user
One Timer	Recordings are started and stopped at specific times specified by the user
Two Timers	Recordings are started and stopped twice but at different specific times, both being specified by the user

Always check the battery level before long period timers are used. It is strongly recommended that an external Castle DC power supply (PSU3) or KA018 weatherproof enclosure, complete with heavy duty batteries are used under these circumstances.

No Timer

Select for manually starting and stopping the recording.

Fixed Timer

Enter values using **Soft Key 2** labelled **UP** and **Soft Key 3** labelled **DOWN**. Use the **Left** and **Right Arrow** Keys ◀ ▶ to move the cursor across and repeat the procedure. Each time period digit can be **0** to **9** and the unit can be **S**, **M** or **H** for Seconds, Minutes and Hours respectively.

As an example set as **6 0 M** or **0 1 H** for a time recording period of 1 hour.

Press **Soft Key 4** labelled **NEXT** to continue or **Soft Key 1** labelled **EXIT** to return to the previous screen.

One Timer

Choose which option to change and use the **Left** and **Right Arrow** Keys ◀ ▶ to move the cursor across for the time period selections. For all selections use **Soft Key 2** labelled **UP** and **Soft Key 3** labelled **DOWN** to change the values. The minimum time increment is 10 minutes.

Press **Soft Key 4** labelled **NEXT** to continue or **Soft Key 1** labelled **EXIT** to return to the previous screen.

Two Timers

Enter the details for the first timer by choosing which option to change and use the **Left** and **Right Arrow** Keys ◀ ▶ to move the cursor across for the time period selections. For all selections use **Soft Key 2** labelled **UP** and **Soft Key 3** labelled **DOWN** to change the values. The minimum time increment is 10 minutes.

Press **Soft Key 4** labelled **NEXT** to continue or **Soft Key 1** labelled **EXIT** to return to the previous screen.

Enter the details for the second timer by repeating the process above.

Press **Soft Key 4** labelled **NEXT** to continue or **Soft Key 1** labelled **EXIT** to return to the previous screen.

Saving a Template & Preparing to Record

Selecting **NEXT** to continue or choosing **No Timer** takes you to the **LOG DETAILS** screen where a file name is entered for the log.

Enter details using the alpha / numeric keypad up-to a maximum of 8 characters.

Press **Soft Key 2** labelled **NUMBER** to enter numerals, press **Soft Key 2** again labelled **LETTER** to enter letters. The default entry selection is letters.

Use the **Left Arrow** Key to delete entries as required.

Press **Soft Key 1** labelled **EXIT** to return to the previous screen or press **OK** to accept the file name.

Once accepted the **Template Options** screen is displayed asking if you wish to save the details entered as a Template for future use. Press **Soft Key 2** labelled **YES** to save as a template or **Soft Key 2** labelled **NO** to continue without saving as a template.

If **YES** to save as a template is selected the **TEMPLATE DETAILS** screen is displayed where a file name is entered for the template.

Enter details using the alpha / numeric keypad up-to a maximum of 8 characters.

Press **Soft Key 2** labelled **NUMBER** to enter numerals, press **Soft Key 2** again labelled **LETTER** to enter letters. The default entry selection is letters.

Use the **Left Arrow** Key to delete entries as required.

Press **Soft Key 1** labelled **EXIT** to return to the previous screen or press **OK** to accept the template name.

Once accepted, or if the option **NO** to save as a template was selected then for **One** or **Two Timers** the instrument will go into **Hibernation Mode** until the start time of the timer is reached.

If **No Timer** or **Fixed Time** were selected the **LOG CREATION** screen will be displayed asking if you wish to start the recording now or later. Press the **STOP / RECORD** Key (●/■) on your instruments keypad to start the recording now or press **Soft Key 4** labelled **LATER** to start the recording later.

Press **Soft Key 1** labelled **EXIT** to return to the previous screen.

View Log

Selecting this option from the **LOGS & TEMPLATES** menu displays a list of saved log files. Where more than 8 files are saved use **Soft Keys 2** and **3** labelled **UP** and **DOWN** respectively to scroll through the list of available files.

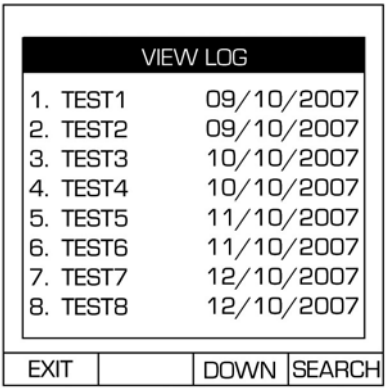


Figure 18 - View Log Screen

To search for a file or files using a filter press **Soft Key 4** labelled **SEARCH**.

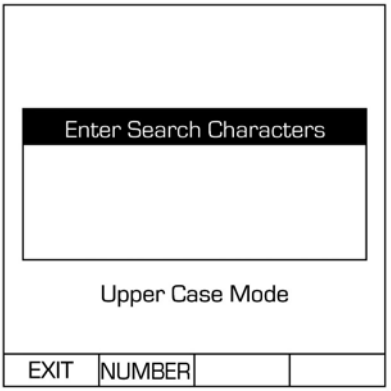


Figure 19 - Search for Saved Logs Screen

Enter search characters using the alpha / numeric keypad. Toggle entry between numbers and letters using **Soft Key 2** labelled as **NUMBER** or **LETTER**. Press **OK** to confirm or **Soft Key 1** labelled **EXIT** to return to the previous screen.

In each case select which file you wish to view from the displayed list using the numeric keypad.

When a recorded log file has been selected the **LOG INFORMATION** screen is displayed which shows the start time and date, the operating mode (SLM,1 / 1, 1 / 3) , Channel A and B time and frequency weightings, the log interval length and if percentiles have been recorded.

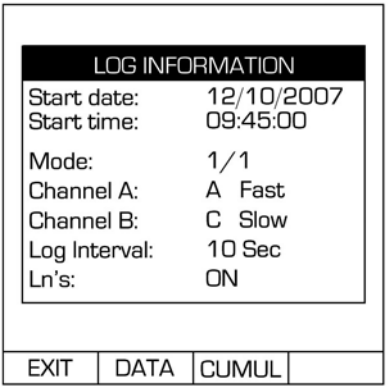


Figure 20 - Log Information Screen

Press **Soft Key 2** labelled **DATA** to view the recorded interval data or **Soft Key 3** labelled **CUMUL** to view the recorded cumulative data.

When viewing interval data, repeat press **Soft Key 2** labelled **DATA** to view each recorded interval in turn.

To change the viewable parameter for either interval or cumulative data, press **Soft Key 4** labelled with an **ARROW** and then repeat press **Soft Key 1** labelled **PARAM** until the required parameter is displayed.

Third Octave data is displayed over 3 pages. Use **Soft Key 4** labelled as an **ARROW** to display more **Soft Key** options, and where shown use **Soft Key 2** and **3** labelled **UP** and **DOWN** respectively to scroll between the pages of Third Octave data.

To return to the log information screen press the **Soft Key** labelled **INFO** when displayed.

Printing is also possible by selecting the **Soft Key** labelled **PRINT** when displayed.

To return to the previous screen select **Soft Key 1** when labelled as **EXIT**.

Delete Log

Selecting this option from the **LOGS & TEMPLATES** menu displays a list of saved log files that can be individually deleted. Where more than 8 files are saved use **Soft Keys 2** and **3** labelled **UP** and **DOWN** respectively to scroll through the list of available files.

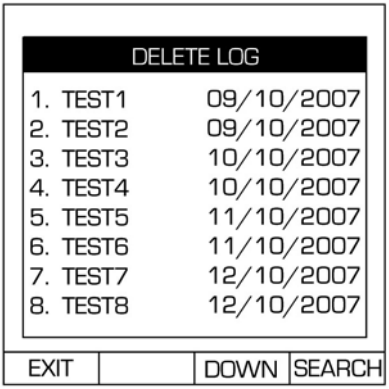


Figure 21 - Delete Log Screen

To search for a file or files using a filter press **Soft Key 4** labelled **SEARCH**. Enter search characters using the alpha / numeric keypad. Toggle entry between numbers and letters using Soft Key 2 labelled as **NUMBER** or **LETTER**. Press **OK** to confirm or **Soft Key 1** labelled **EXIT** to return to the previous screen.

In each case select which individual file you wish to delete from the displayed list using the numeric keypad. You will be prompted with a warning screen: -

Figure 22 – Delete Log Warning Screen

Select **Soft Key 2** labelled **YES** to delete the selected file and return to the previous screen. Press **Soft Key 3** labelled **NO** to return to the previous screen without deleting the selected file.

Delete All Logs

Select this option from the **LOGS & TEMPLATES** menu to delete all saved log files. Use with extreme caution as deleted logs are non recoverable.

Upon selecting you will be prompted with a warning screen: -

Figure 23 – Delete All Logs Warning Screen

Select **Soft Key 2** labelled **YES** to delete all saved files and return to the previous screen. Press **Soft Key 3** labelled **NO** to return to the previous screen without deleting the files.

HPD (Hearing Protection Database)

Select from the **LOGS & TEMPLATES** menu to access the Hearing Protection Database (HPD) which has been specifically developed by Castle Group Ltd.

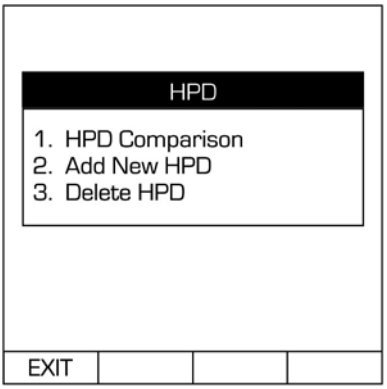


Figure 24 - HPD Selection Screen

Choose an option from the displayed list or press **Soft Key 1** labelled **EXIT** to return to the previous screen. The options are described below: -

HPD Comparison

Select this option to compare a saved Full Octave data file against any of the hearing protectors specified in the Hearing Protector Database (HPD).

The HPD comparison only works with logs created in Full Octave. Error messages are displayed if trying to compare with SLM or Third Octave mode logs.

To compare with Third Octave mode recordings the PC software dBdataPro is required, (order code PC007) purchased separately.

Selecting this option displays a list of saved log files, if more than 8 files are saved use **Soft Keys 2** and **3** labelled **UP** and **DOWN** respectively to scroll through the list of available files.

To search for a file or files using a filter press **Soft Key 4** labelled **SEARCH** which allows a search for all or part of a filename. Enter search characters using the alpha / numeric keypad. Toggle entry between numbers and letters using **Soft Key 2** labelled as **NUMBER** or **LETTER**. Press **OK** to confirm or **Soft Key 1** labelled **EXIT** to return to the previous screen.

The list of Hearing Protector manufacturers is now shown on the display screen. Up to eight are listed at a time and can be scrolled using **Soft Key 2** or **Soft Key 3** labelled **UP** and **DOWN** respectively. To select a manufacturer press the associated number listing using your numeric keypad. The screens below show the first screen of available manufactures and also the first screen of available protectors from the manufacturer 3M.

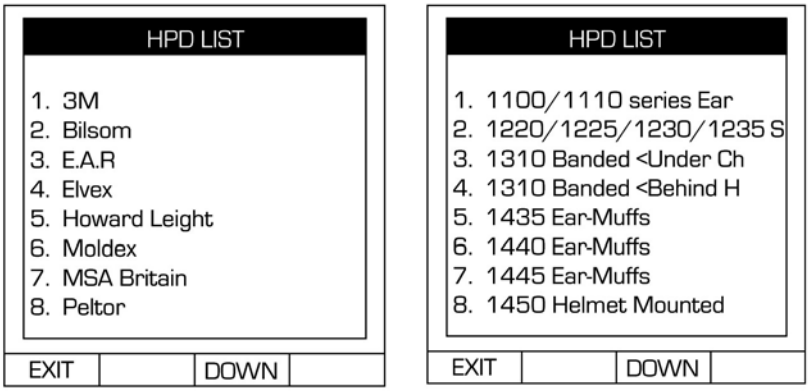


Figure 25 - HPD List of Manufacturers & Models

The complete list of hearing protectors for this manufacturer will then be shown on your display screen, up to a maximum of eight at one time. Use **Soft Key 2** or **Soft Key 3** labelled **UP** and **DOWN** respectively to scroll through the available hearing protectors. To select a hearing protector for comparison press its associated number listing using the numeric keypad.

You will then be prompted with the following screen: -

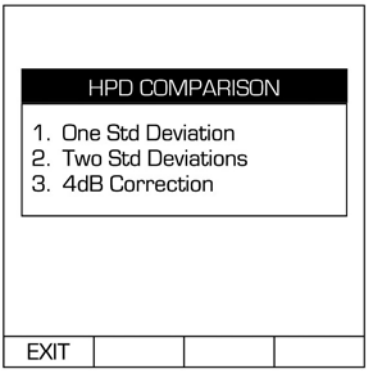


Figure 26 - HPD Comparison Method Screen

The standard deviation is given in the manufacturers data for the particular hearing protector, these options allow you to select how the comparison is calculated.

Selection is made by pressing either **1, 2** or **3** on the numeric keypad.

One Standard Deviation

Select to calculate the comparison by removing only one standard deviation from the manufacturers tested figures.

Two Standard Deviations

Select to calculate the comparison by removing two lots of the standard deviation from the manufacturers tested figures.

4dB Correction

Select to calculate the comparison using one standard deviation and then modifies by +4dB. This is the current approach adopted by the HSE in guidance L108, 2005.

In General, One Standard Deviation is used.

Once selected the comparison will be calculated and displayed on screen, an example is shown below: -

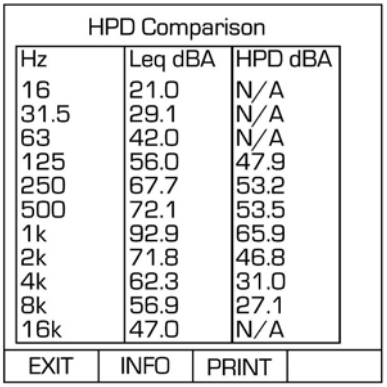


Figure 27 - HPD Comparison Results Screen

The first column listed is the frequency in Hertz (Hz), the second is the Leq data from the saved log file with 'A' weighting applied. Log files that have been recorded with either 'C' Weighting or 'LIN' Weighting are converted to 'A' Weighting for the purpose of HPD comparison. The saved log file is not adjusted in any way. The last column labelled HPD dBA is the Leq value adjusted with that particular hearing protector.

Press **Soft Key 1** labelled **EXIT** to return to the previous screen or **Soft Key 3** labelled **PRINT** to print out the HPD comparison to your GA505 thermal printer (available separately).

Pressing **Soft Key 2** labelled **INFO** will give the following display showing the log file name, the hearing protector selected, deviation selection, overall Leq of the log file and the overall Leq value with adjustments with the particular hearing protector selected: -

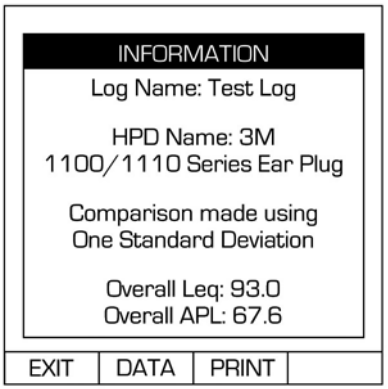


Figure 28 - HPD Cumulative Information

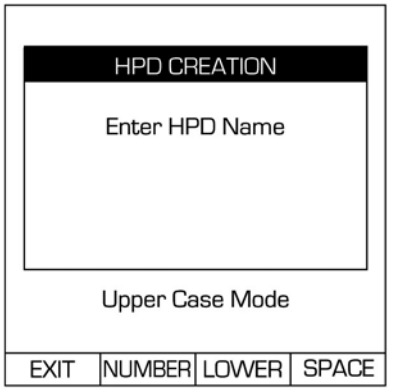
Press **Soft Key 1** labelled **EXIT** to return to the HPD Comparison Method Selection Screen or **Soft Key 3** labelled **PRINT** to print out the HPD comparison to your GA505 thermal printer (available separately).

Press **Soft Key 3** labelled **DATA** to return to the previous screen and view as octave data.

Add New HPD

Select this option to manually add hearing protector data to the database. Any data added to the database is stored as **User Defined** under the manufacturers list.

Once selected you will be prompted to enter a HPD name: -



TIP:

This can also be used to enter details of noise control materials or enclosures to make comparisons with measured data.

Figure 29 - Add HPD File Name Entry

Press **Soft Key 1** labelled **EXIT** to return to the previous screen or enter a HPD name using the alpha / numeric keypad up-to a maximum of 18 characters. Toggle entry between numbers and letters using **Soft Key 2** labelled as **NUMBER** or **LETTER** and toggle between upper and lower case using **Soft Key 3** labelled **LOWER** or **UPPER**. Press **Soft Key 4** labelled **SPACE** to insert a space in the HPD name.

Use the **Left Arrow** key to delete entries as required and press **OK** to confirm and proceed to the HPD Data Entry screen.

The HPD Data Entry Screen allows you to enter data for Mean Attenuation and Standard Deviation for each of the frequencies given on the hearing protector data sheet. Where data is not given on the data sheet for any frequency you must enter 0.0 for both the mean attenuation and standard deviation at these frequencies on your Vocis Pro DX meter.

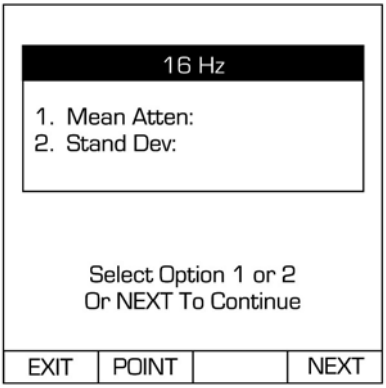


Figure 30 - HPD Data Entry Screen

TIP:

The figures for this are supplied by the hearing protector manufacturer, an example of which is shown below: -

Value Type	63	125	500	1000	2000	4000	8000
Mean Att	22.5	23.3	24.6	27.4	34.1	41.6	40.4
Standard Dev	5.4	5.3	3.6	4.8	3.1	3.5	6.4
APV	16.9	18.1	20.9	22.6	30.9	38.1	34

Entering Mean Attenuation Data

Select **Option 1** labelled **Mean Atten** to enter the Mean Attenuation data supplied. At the right hand side of Mean Atten you will be prompted with the last figure entered for mean attenuation at this frequency. This is defaulted as 0.0

Use the numeric keypad to enter the new mean attenuation figure in conjunction with **Soft Key 2** labelled **POINT** to insert a decimal point. The **Left Arrow Key** can be used to delete if required.

Press the **OK** key to accept your entry.

Entering Standard Deviation Data

Select **Option 2** labelled **Stand Dev** to enter the Standard Deviation data supplied. At the right hand side of Stand Dev you will be prompted with the last figure entered for standard deviation at this frequency. This is defaulted as 0.0

Use the numeric keypad to enter the new mean attenuation figure in conjunction with **Soft Key 2** labelled **POINT** to insert a decimal point. The **Left Arrow Key** can be used to delete if required.

Press the **OK** key to accept your entry.

Press **Soft Key 4** labelled **NEXT** to move onto entry for the next frequency.

Follow the same steps as outlined for the following frequencies: -

Frequency (Hz)
16
31.5
63
125
250
500
1000
2000
4000
8000
16000

When all frequencies have been entered the screen returns to the HPD Selection Screen.

Deleting HPD Entries

Only manually entered HPD data can be deleted. The factory supplied database cannot be deleted.

To delete manual entries in the HPD select **Option 3** in the HPD Selection screen labelled **Delete HPD**. You will then be prompted with a list of all manual entries. If more than eight entries exist you may need to locate the file using the Soft Keys labelled **UP** and **DOWN** to page through all the available entries.

To delete the required entry simply press the key associated with entry. You will then be prompted if you wish to delete the file. Use **Soft Key 2** labelled **YES** to delete the entry or **Soft Key 3** labelled **NO** if you do not wish to delete the entry.

Press **Soft Key 1** labelled **EXIT** to return to the previous screen.

Load Template

Selecting this option from the LOGS & TEMPLATES menu displays a list of saved templates. Where more than 8 files are saved use **Soft Keys 2** and **3** labelled **UP** and **DOWN** respectively to scroll through the list of available templates.

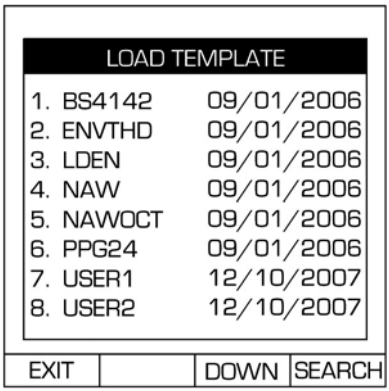


Figure 31 – Load Template List Screen

TIP:

Setting up templates or using preprogrammed ones saves lots of time in setting up the meter to use.

To search for a template press **Soft Key 4** labelled **SEARCH**.

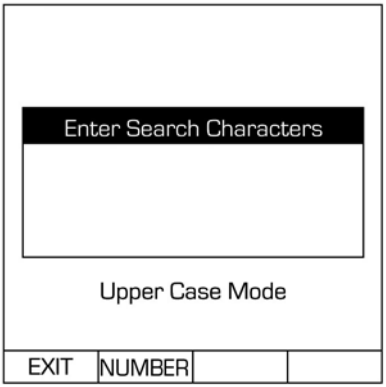


Figure 32 - Search for Saved Templates Screen

Enter search characters using the alpha / numeric keypad. Toggle entry between numbers and letters using **Soft Key 2** labelled as **NUMBER** or **LETTER**. Press **OK** to confirm or **Soft Key 1** labelled **EXIT** to return to the previous screen.

In each case select which template you wish to load from the displayed list using the numeric keypad. Your instrument will then take the settings specified within the template.

Edit Template

Selecting this option from the LOGS & TEMPLATES menu displays a list of saved templates. Where more than 8 files are saved use **Soft Keys 2** and **3** labelled **UP** and **DOWN** respectively to scroll through the list of available templates.

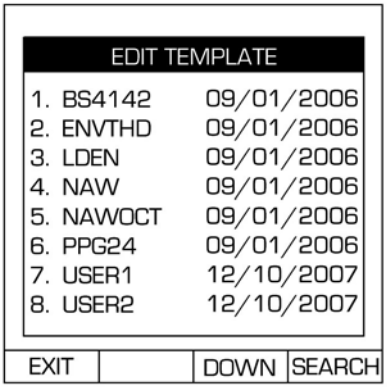


Figure 33 – Edit Template List Screen

TIP:

Create a new template based on a preprogrammed one to save time in setting up templates.

To search for a template press **Soft Key 4** labelled **SEARCH**.

Enter search characters using the alpha / numeric keypad. Toggle entry between numbers and letters using **Soft Key 2** labelled as **NUMBER** or **LETTER**. Press **OK** to confirm or **Soft Key 1** labelled **EXIT** to return to the previous screen.

In each case select which template you wish to edit from the displayed list using the numeric keypad, the **Edit Template** screen will then be displayed: -

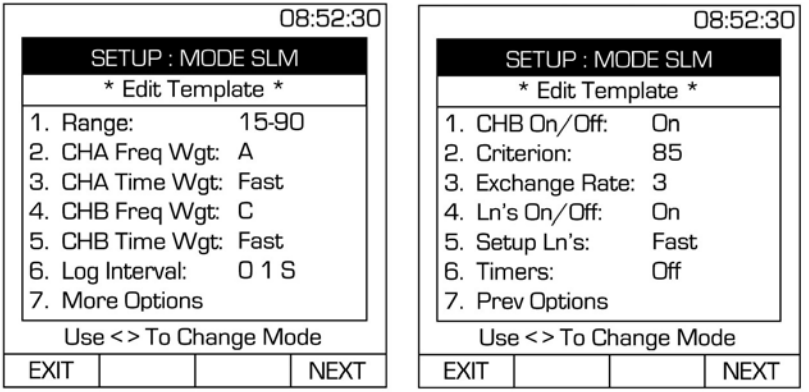


Figure 34 - Edit Template Settings Screen

Note that Ln's are only displayed on selected models. See Pro DX Variations for a list of models and available functions.

Change the settings for the template as described under **Setup Options** in **Chapter 5.**

If you wish the template to operate using Timers then select the option named **Timers** on page 2 of the available options and set to **Fixed**, **One** or **Two** using **Soft Keys 2** and **3** labelled **UP** and **DOWN** respectively. Press **OK** to confirm the selection.

Press **Soft Key 1** labelled **EXIT** to return to real time operation or press **Soft Key 4** labelled **NEXT** to continue.

Upon continuing and a timer selection was made the appropriate **Timer Entry** screen will appear. See the required timer function under **Logs & Templates** in **Chapter 4** for details.

When timers have been setup or if timers were not selected the **TEMPLATE DETAILS** screen is displayed prompting for a template name to be entered:-

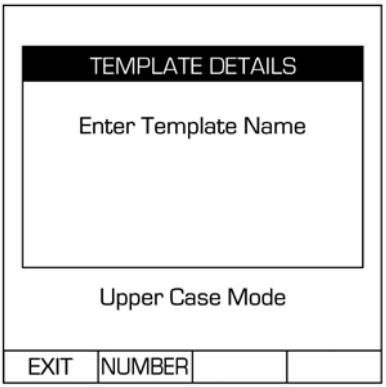


Figure 35 - Template Details Entry Screen

Press **Soft Key 1** labelled **EXIT** to return to the previous screen or enter a template name using the alpha / numeric keypad up-to a maximum of 8 characters. Toggle entry between numbers and letters using **Soft Key 2** labelled as **NUMBER** or **LETTER**. Use the **Left Arrow** key to delete entries as required and press **OK** to confirm and save the template. Changed to preinstalled templates are not overwritten.

If **No Timer** or **Fixed Time** were selected the **LOG CREATION** screen will be displayed asking if you wish to start the recording now or later. Press the **STOP / RECORD** Key (●/■) on your instruments keypad to start the recording now or press **Soft Key 4** labelled **LATER** to start the recording later.

If **One** or **Two Timers** were selected the instrument may be placed into hibernation mode until the timer start time is reached.

Press **Soft Key 1** labelled **EXIT** to return to the previous screen.

Delete Template

Selecting this option from the LOGS & TEMPLATES menu displays a list of saved templates. Where more than 8 templates are saved use **Soft Keys 2** and **3** labelled **UP** and **DOWN** respectively to scroll through the list of available templates.

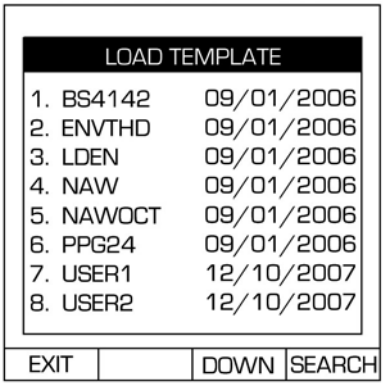


Figure 36 – Load Template List Screen

To search for a template press **Soft Key 4** labelled **SEARCH**.

Enter search characters using the alpha / numeric keypad. Toggle entry between numbers and letters using **Soft Key 2** labelled as **NUMBER** or **LETTER**. Press **OK** to confirm or **Soft Key 1** labelled **EXIT** to return to the previous screen.

In each case select which template you wish to delete from the displayed list using the numeric keypad. Pre-installed templates cannot be deleted.

Figure 37 - Delete Template Screen

Press **Soft Key 2** labelled **YES** to delete the named template or **Soft Key 3** labelled **NO** to return to the previous screen without deleting

General Setup

General Setup can be accessed by selecting **option 2** from the **Main Menu**.

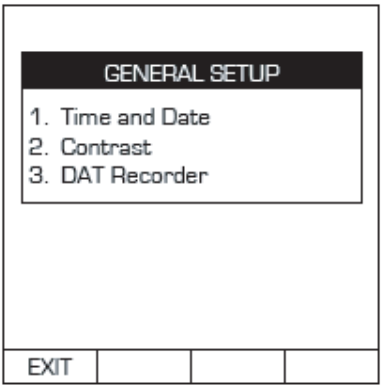


Figure 38 – General Setup Options

Time and Date

Select this option display the SET TIME AND DATE selection screen. Choose option 1 to change the date and option 2 to change the time: -

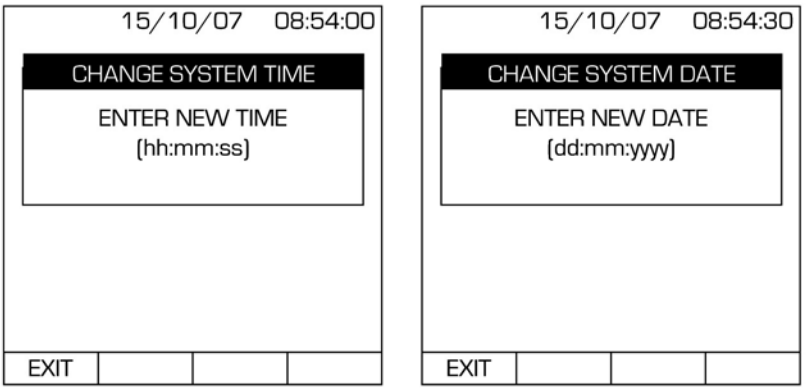


Figure 39 - Date & Time Entry Screens

Enter both the time and date using the numeric keypad. The date is entered using the format dd / mm / yyyy whilst the time is entered using the 24 hour format hh:mm:ss.

As an example, if the date was 12 th July 2008 you would press the following on your keypad **12072008**, and if the time was 7:02 pm you would enter the following on your keypad **190200**.

Press **OK** to confirm or use the **Left Arrow** key on your keypad to erase any errors. Press **Soft Key 1** labelled **EXIT** to return to the previous screen.

Contrast

Select this option to adjust the screen contrast: -

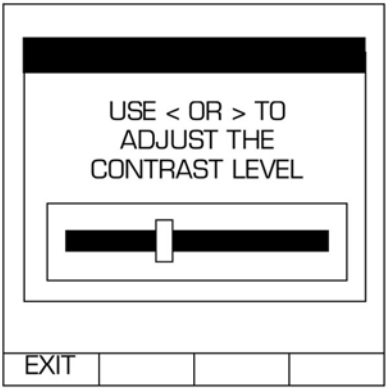


Figure 40 - Contrast Adjustment Screen

Use the **Left** and **Right Arrow** Keys ◀ ▶ to adjust the contrast, **Left Arrow** to decrease and **Right Arrow** to increase. Press **Soft Key 1** labelled **EXIT** to return to the previous screen.

DAT Recorder

Available on selected models only. Use to adjust the level at which the DAT recorder is activated and if the DAT is switched on: -

Figure 41 - DAT Recorder Selection Screen

Select an option and follow on screen instructions for changing parameters. Press **OK** to confirm each change.

Press **Soft Key 1** labelled **EXIT** to return to the previous screen.

Calibration

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 calibrator recommended for use is the Castle GA607, which supplies typically 94dB / 104dB (relative to 20µPa pressure) at a frequency of 1kHz.

Calibration can be completed from first power on, or alternatively by selecting Option 3 labelled **Calibration** from the Main Menu.

On the calibration screen you will be presented with a calibration level, this is the previous level your instrument was calibrated to. This figure can be adjusted up or down with a resolution of ±0.1dB or ±1dB by using the 4 Light Blue Soft Keys.

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. Please refer to your Castle Calibrator Manual for more detail.

The pressure to free-field correction value to be applied when used with Castle calibrators GA607, GA601 and a B&K 4231 are as follows: -

Microtech Gefell MK250 Microphone Capsule

Castle GA607 Calibrator Pressure To Free Field Correction	= - 0.2dB
Castle GA601 Calibrator Pressure To Free Field Correction	= - 0.2dB
B&K 4231 Calibrator Pressure To Free Field Correction	= - 0.2dB

ACO 7146 Microphone Capsule

Castle GA607 Calibrator Pressure To Free Field Correction	= - 0.3dB
Castle GA601 Calibrator Pressure To Free Field Correction	= - 0.3dB
B&K 4231 Calibrator Pressure To Free Field Correction	= - 0.3dB

When you have selected the correct calibration figure and have the calibrator in position press the **OK** button on your instrument to begin calibration. Your instrument will display **CALIBRATING INSTRUMENT TO** and an elapsed time. Calibration completes in 5 seconds.

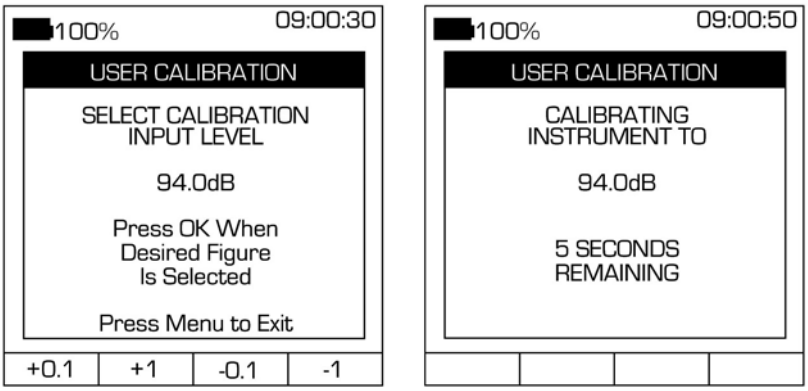


Figure 42 - User Calibration Screen

If the calibration is interrupted or the input level is not within +/- 3dB of the chosen reference level then the display will show **CALIBRATION FAILURE**. Check to make sure the calibrator is switched on and emitting the correct level before proceeding again as indicated above. Please note that the calibrator automatically turns OFF after approximately 1 minute.

TIP:

Refer to the manual for your GA607 calibrator for further information on setting up correction levels.

Print Logs

Selecting this option from the **Main Menu** displays a list of saved files. Where more than 8 files are saved use **Soft Keys 2** and **3** labelled **UP** and **DOWN** respectively to scroll through the list of available files.

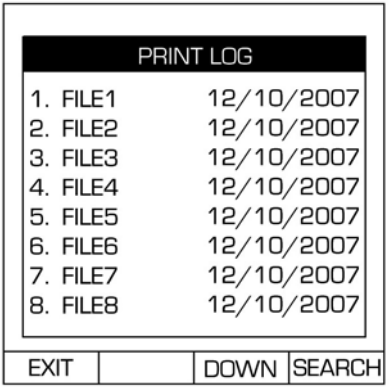


Figure 43 – Print Log List Screen

To search for a file press **Soft Key 4** labelled **SEARCH**. Enter search characters using the alpha / numeric keypad. Toggle entry between numbers and letters using **Soft Key 2** labelled as **NUMBER** or **LETTER**. Press **OK** to confirm or **Soft Key 1** labelled **EXIT** to return to the previous screen.

In each case select which file you wish to print from the displayed list using the numeric keypad and then select which data from the log you wish to be printed:-

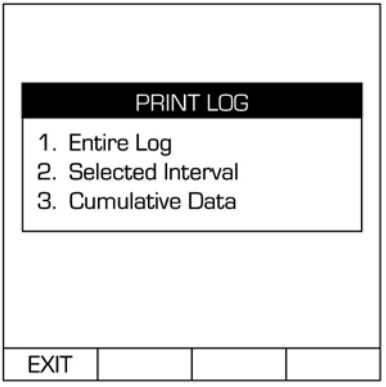


Figure 44 – Print Log Data Selection Screen

Press **Soft Key 1** labelled **EXIT** to return to the previous screen without printing.

Information

Select this from the **Main Menu** to display the following specific instrument information: -

Information
Instrument Model
Serial Number
Firmware Version Number
Factor Re-Calibration Date
Remaining Main Battery Charge
Remaining Lithium Battery Charge
Free Space Available (kilobytes)

Press **Soft Key 1** labelled **EXIT** to return to the Main Menu screen.

Chapter 5

Real Time Operation

Real Time operation can be identified by having a Soft Key option labelled **RESET** also no recording duration timer is displayed.

Display Modes

The Pro DX Vocis Range has up to three display modes depending on the variation of your meter. These are as follows: -

- SLM Mode (Sound Level Meter or Broadband)
- Full Octave Band Mode (1 / 1)
- Third Octave Band Mode (1 / 3)

The table below highlights which display options are available on each instrument type.

Vocis Type	SLM Mode	Full Octave Mode	Third Octave Mode
I – Industrial Safety	✓	✓	
E – Environmental	✓		
C – Combined	✓	✓	
M – Multi Function	✓	✓	✓

Each display mode can display information graphically or in a tabular format. By default the meter displays the information graphically.

Graphical Display Screens

The following parameters are available graphically: -

- Lp - The weighted running rms (Root Mean Square) value
- Leq - The weighted, time averaged value
- Lmin - The minimum Lp level reached
- Lmax - The maximum Lp level reached

In SLM mode the parameter Pmax is also displayed on the screen. Pmax is the highest peak level of the instantaneous sound level.

Whilst viewing the parameters graphically, the parameter displayed can be changed by pressing **Soft Key 1** labelled **PARAM**.

The graphical display screens for the parameter Lp are illustrated below for each mode, showing the display when only Channel A is selected and instances where both Channel A and B are selected: -

SLM Mode

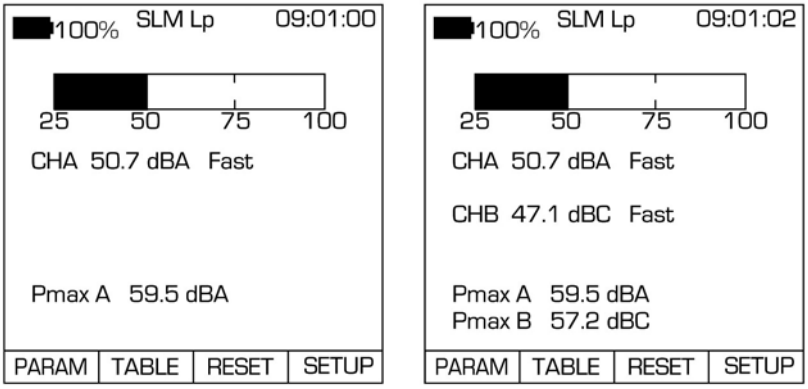


Figure 45 – Graphical SLM Mode Display Mode Screen

Full Octave Mode

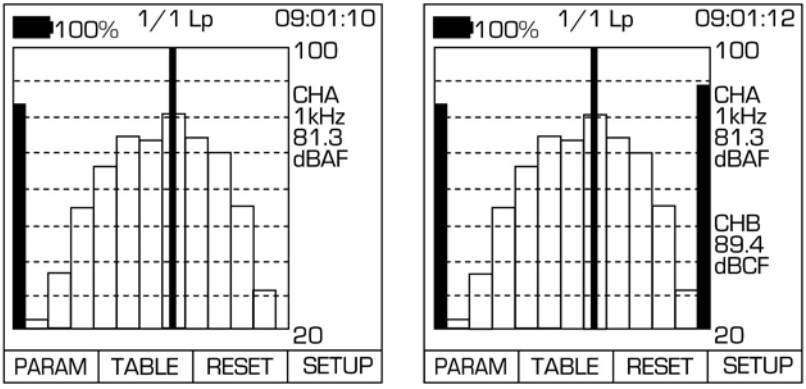


Figure 46 – Graphical Full Octave Mode Display Screen

Third Octave Mode

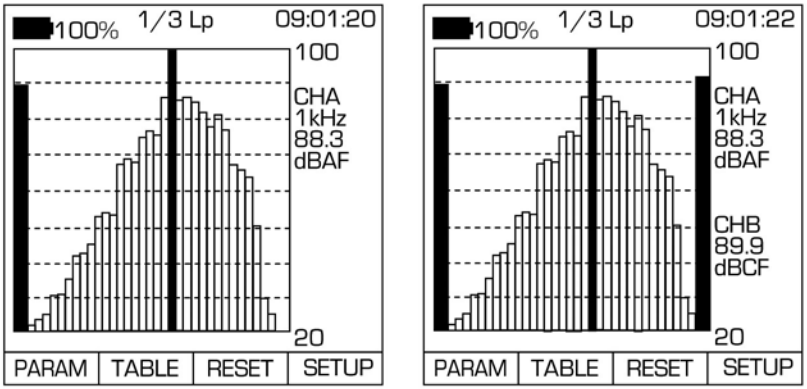


Figure 47 – Graphical Third Octave Mode Display Screen

Tabular Display Screens

To view data in tabular format press Soft Key 2 labelled TABLE. To return to viewing graphically press Soft Key 1 labelled **EXIT**.

The tabular display screens are illustrated below for each mode, showing the display where both Channel A and B are selected: -

SLM Mode

The following parameters are available in tabular format: -

- Leq, Lmin, Lmax, Pmax

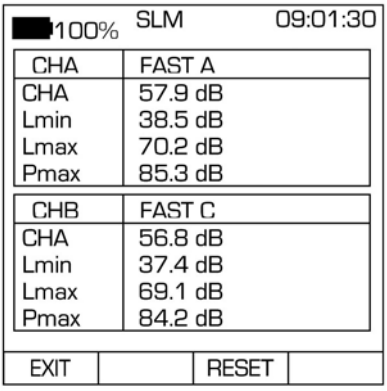


Figure 48 - Tabular SLM Mode Display Screen

Full Octave & Third Octave Mode

The following parameters are available in tabular format: -

- Lp, Leq, Lmin, Lmax, Pmax

The Lp figure is displayed individually as an All Pass (AP) or cumulative figure of all the octave bands along with the Pmax figure at the right hand side of the screen.

Individual Full Octave or Third Octave data is also displayed for the following parameters: -

- Lp, Leq, Lmin, Lmax

Use the **Left** and **Right Arrow** Keys ◀ ▶ to scroll through the different parameters.

All frequencies displayed are on one page for Octave Band mode. Third Octave Band mode requires three pages to display the entire frequency range. To scroll through the available pages use **Soft Key 2** labelled **UP** and **Soft Key 3** labelled **DOWN**.

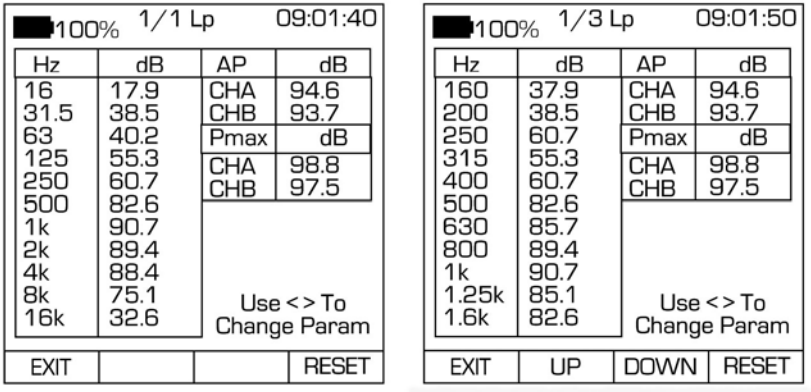


Figure 49 – Tabular Full & Third Octave Mode Display Screens

Resetting Parameter Values

Pressing the **Soft Key** labelled **RESET** or the **OK** button when viewed graphically or in tabular format will reset all parameters and any latched overload indicators.

Parameters are updated after the refresh rate time period.

Setup Options

Whilst viewing data graphically press **Soft Key 4** labelled **SETUP** to display and change display and logging parameters.

The setup screen displays which display mode the instrument is currently in and if any templates are loaded.

Two pages of options are available. Use the keypad to select **More Options** to access **page 2** and **Prev Options** to return to **page 1**.

Once selections have been made press **Soft Key 1** labelled **EXIT** to return to real time operation utilising the selections made. All settings are remembered when the instrument is powered down.

Please be aware that the options regarding Ln's that are shown below are only available on selected models.

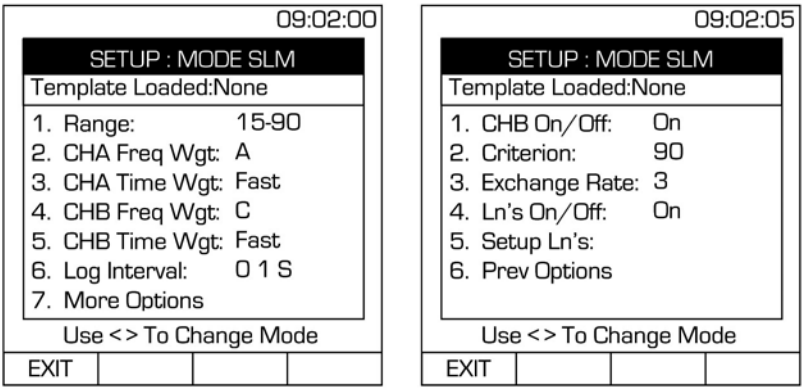


Figure 50 - Setup Options

Changing the Display Mode

On either page of available options and where Full Octave or Third Octave modes are available, use the **Left** and **Right Arrow** Keys ◀ ▶ to switch to the required display mode.

For a list of available modes for each instrument type see **Display Modes** under **Chapter 4**.

Changing the Range

Change the range by selecting **Option 1** labelled **Range** on page 1 of the available options. The range selection will highlight and flash, changes can be made using **Soft Key 2** labelled **UP** and **Soft Key 3** labelled **DOWN**.

Press the **OK** key to accept the change.

The measuring display ranges available are as follows: -

SLM Mode (dB)	Full Octave & Third Octave Mode (dB)
15 - 90	10 - 90
25 - 100	20 - 100
35 - 110	30 - 110
45 - 120	40 -120
55 - 130	50 - 130
65 - 140	60 - 140

For more information on ranges see **Measuring Ranges** in **Chapter 2**.

Changing the Frequency Weighting

On page 1 of available options, the Frequency Weighting for Channel A or Channel B (if turned on) can be changed using **Option 2** and **Option 4** labelled **CHA Freq Wgt** and **CHB Freq Wgt** respectively.

The frequency weighting selection will highlight and flash, changes can be made using **Soft Key 2** labelled **UP** and **Soft Key 3** labelled **DOWN**.

Press the **OK** key to accept the change.

The frequency weighting filters available are as follows: -

Frequency Weighting
A
C
Z (Linear or Flat)

For more information on frequency weighting see **Frequency Weighting Filters** in **Chapter 2**.

Changing the Time Weighting

On page 1 of available options, the Time Weighting for Channel A or Channel B (if turned on) can be changed using **Option 3** and **Option 5** labelled **CHA Time Wgt** and **CHB Time Wgt** respectively.

The time weighting selection will highlight and flash, changes can be made using **Soft Key 2** labelled **UP** and **Soft Key 3** labelled **DOWN**.

Press the **OK** key to accept the change.

The time weighting constants are as follows: -

Time Weighting
Fast
Slow
Imp (Impulse)
10ms

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

Changing the Log Interval

This setting is changed whilst in real time mode but only used whilst recording and is the time interval that data is repeatedly recorded.

The Log Interval unit can be in either **Seconds**, **Minutes** or **Hours** and the period can have values between **01** and **99**.

To change the Log Interval settings, select **Option 6** labelled **Log Interval** on page 1 of the available options.

Use the **Left** and **Right Arrow** Keys ◀ ▶ to highlight the first or second digit value, or the unit of time. The highlighted item also flashes.

Use **Soft Key 2** labelled **UP** and **Soft Key 3** labelled **DOWN** to adjust the digit values between **0** and **9** and the units to either **M**, **S** or **H** for minutes, seconds and hours respectively.

Press the **OK** key to accept any changes. Repeat the procedure as required.

As an example set as **6 0 S** or **0 1 M** for a log interval of 1 minute (60 seconds).

TIP:

Ensure you set an appropriate Log Interval Length. Inadvertently setting this to 1 second will capture and record vast amounts of information and is perfectly suitable for short duration recordings, however long duration recordings at these short duration log intervals will inevitably mean huge file sizes resulting in slow download to a PC and viewing on your Vocis instrument.

A short duration recording may be considered as 1 to 5 minutes. At most your Pro DX Vocis meter will store 1852 bytes at each log interval. If the log duration is 5 minutes and with a log interval of 1 second, the total amount to save is: -

- 1852 * 60 * 5 = 555,600 bytes (approximately 0.5 Mega Bytes)

This is a fairly large log file and in the majority of instances it is not necessary to contain all this information. Setting the log interval to 5 seconds may be acceptable.

If your recording length is in hours rather than minutes, then set your log interval accordingly. A common figure is 5 minutes.

Turning Channel B On/Off

On page 2 of the available options, select **Option 1** labelled **CHB On/Off,** the channel B selection will highlight and flash.

Turn channel B on using **Soft Key 2** labelled **ON** or **Soft Key 3** labelled **OFF** to turn channel B off.

Press the **OK** key to accept the change.

Channel B is independent of channel A and can have different time or frequency weightings, overload conditions are however generic to both channels.

Where installed no full octave, third octave or Ln data is recorded for channel B.

The following cumulative parameters are also not recorded for channel B: -

- Dose
- Projected Dose
- Lex
- Projected Lex
- LE

Changing the Criterion Level

The criterion is used in the calculation of the parameter DOSE, this value is generally set at 85dB for use in the UK.

To allow for changes in legislation or for use in other countries the criterion can be set to one of the following levels: -

Criterion Levels (dB)
75
80
85
90

On page 2 of the available options, select **Option 2** labelled **Criterion**, the criterion level will highlight and flash. Adjust the level using **Soft Key 2** labelled **UP** or **Soft Key 3** labelled **DOWN** accordingly.

Press the **OK** key to accept the change.

Changing the Exchange Rate Level

The exchange rate is used in the calculation of the parameter DOSE, this value is generally set at 3dB for use in the UK.

To allow for changes in legislation or for use in other countries the exchange rate can be set to one of the following levels: -

Exchange Rate (dB)
3
4
5

On page 2 of the available options, select **Option 3** labelled **Exchange Rate**, the exchange rate level will highlight and flash. Adjust the level using **Soft Key 2** labelled **UP** or **Soft Key 3** labelled **DOWN** accordingly.

Press the **OK** key to accept the change.

Turning Ln's (Percentiles) On/Off

This option is only available on selected models. See **Pro DX Vocis Variations** for further information.

Where installed select **Option 4** from page 2 of the available options labelled **Ln's On / Off**, the Ln selection will highlight and flash.

Turn Ln's on using **Soft Key 2** labelled **ON** or **Soft Key 3** labelled **OFF** to turn Ln's off.

Press the **OK** key to accept the change.

TIP:

Ln values are only generally used for monitoring environmental noise and turning them off can save time in data download analysis.

Setting Ln (Percentile) Values

This option is only available on selected models. See **Pro DX Vocis Variations** for further information. Where installed select **Option 5** from page 2 of the available options labelled **Setup Ln's**. A new screen titled **SETUP Ln's** will be displayed.

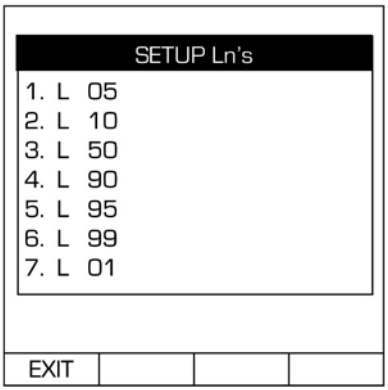


Figure 51 - Setting Ln Values Display Screen

A total of 7 user definable percentiles are available on your Vocis instrument. To set an Ln value select the appropriate Ln using the keypad (1 to 7) and the Ln selection will highlight and flash.

Using the numeric keypad enter a value for the Ln between **00** and **99**. Setting an Ln level to **00** turns the individual Ln **OFF**.

The default percentile levels are as follows: -

Percentile	Description
L5	The dB(A) level exceeded for 5% of the time
L10	The dB(A) level exceeded for 10% of the time
L50	The dB(A) level exceeded for 50% of the time
L90	The dB(A) level exceeded for 90% of the time
L95	The dB(A) level exceeded for 95% of the time
L99	The dB(A) level exceeded for 99% of the time
L1	The dB(A) level exceeded for 1% of the time

Press the **OK** key to accept the change.

Press **Soft Key 1** labelled **EXIT** to return to the previous page of operation.

Shortcut Keys

The Pro DX Vocis Range has upto 5 shortcut keys depending on the model of instrument.

The shortcut keys are only available on the Real Time Graphical display screens and are listed below: -

Shortcut Key	Function
2	Up Range
4	Change Frequency Weighting Channel A
5	Change Mode (Instrument Specific)
6	Change Time Weighting Channel A
8	Down Range

Chapter 6

Recording Operation

Recording is achieved by pressing the **STOP / RECORD** Key on your instruments keypad.

All settings / parameters from within **SETUP** in Real Time mode will be used or logged when a recording is started.

It is not possible to reset any parameter, change range or adjust any settings whilst recording.

Recording operation can be identified by having a duration value showing the total duration that the recording has been running and the mnemonic ► REC ◄ by the side of the total duration.

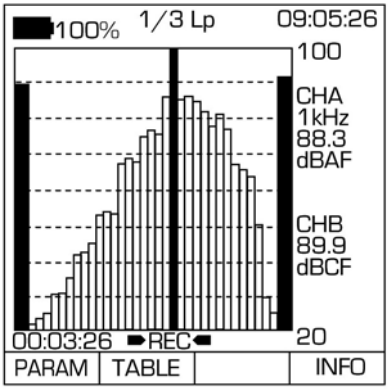


Figure 52 - Sample Recording Screen

As with real time operation it is possible to change the displayed parameter and view data in a tabular format. See **Real Time Operation** in **Chapter 5** for procedures.

By pressing the **PAUSE** Key on the keypad it is possible to pause the recording. The mnemonic ► REC ◄ will be replaced with ► PAUSE ◄ to identify the instrument is in pause mode. No data is being recorded or calculated in pause mode. The option to change the displayed parameter and view in tabular format can still be achieved whilst in pause mode.

To revert back to instantaneous readings press the **PAUSE** Key once again.

The **Power On / Off** Key is disabled whilst Recording to prevent the instrument from accidentally powering down with probable data loss.

Viewing Log Information

To view specific information about the recording press **Soft Key 4** labelled **INFO** whilst viewing graphically.

The information screen gives you the template name if loaded, the mode of operation, the log interval selected, frequency and time weightings for each channel, the elapsed time of the recording, if the instrument is recording or in paused and if the overload flag has been triggered.

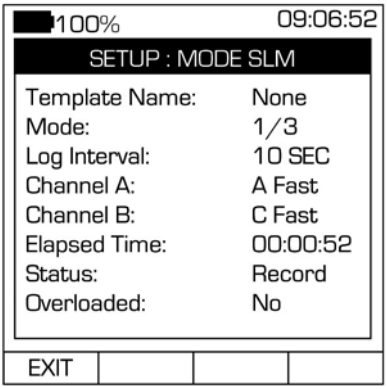


Figure 53 - Log Information Screen

To return to viewing the recording data graphically press **Soft Key 1** labelled **EXIT.**

Ending a Recording

To stop recording at any time, press the **STOP / RECORD** Key on your instruments keypad again and the **LOG CREATION** screen will be displayed asking if you wish to save the log: -

Figure 54 – Save Log Screen

To return to real time operation without saving the log data press **Soft Key 3** labelled **NO.**

To save the recorded data as a log file press **Soft Key 2** labelled **YES**. A new **LOG CREATION** screen will be displayed prompting to save the file using the last file name used or if a new name is to be used.

Figure 55 - Save or Rename Log Screen

TIP:

Note that the default file name will over write the previous log so beware when naming files.

To save using the current file name and return to real time operation press **Soft Key 2** labelled **YES**. To enter a new file name press **Soft Key 3** labelled **NO**. Enter the new name using the alpha / numeric keypad. A maximum of 8 characters can be used. Use **Soft Key 2** labelled **NUMBER** or **LETTER** to toggle between entering numbers or letters. Press the **Left Arrow** key to delete entries and press **OK** to save and return to real time operation.

Chapter 7

Miscellaneous

Templates

Templates are the way in which the Vocis stores different instrument settings on which you can base future measurements, much in the same way word processing software has templates for basing future documents on. Castle Group has produced 6 sample templates for your convenience, these are as follows: -

Template	Description	Instrument
BS4142	Environmental Standard BS4142	Type C, E and M only
ENVTHD	Basic Environmental Measurements using Third Octave Bands	Type M only
LDEN	Day, Evening and Night Measurements	Type C, E and M only
NAW	Noise At Work Regulations	All Variations
NAWOCT	Noise At Work Regulations using Full Octave Bands	Type C, I and M only
PPG24	Planning For Noise	Type C, E and M only

Each of the templates above cannot be deleted and modifications made to them will not be saved ensuring that your settings are correct every time.

Above and beyond this, the user can set up as many templates as required. These can then be managed, edited and deleted as necessary. Templates are the best way of ensuring consistent measurements for various applications.

Template Setup Options

The Vocis always measures a standard set of parameters in Channel A and a lesser set in Channel B as follows: -

Channel A:

Leq, Lmin, Lmax, Ltm3, Ltm5, LE, Pmax, DOSE, Proj DOSE, Lex, Proj Lex

Channel B:

Leq, Lmin, Lmax, Pmax

The options below are additional to these fixed measurements and represent the options available when setting up a template. Each term is explained.

Following this is a description of the standard templates included in each Vocis type. Standard templates are protected and cannot be over-written.

Basic Options

SLM, 1/1 or 1/3	Selects the analysis mode between broadband, 1/1 or 1/3 octaves
Channel A or Channel A&B	1 or 2 channel measurements

Channel A	
Range	Selects the measurement range
FWTG	Frequency weightings A, C, or Z (Flat)
TWTG	Time weightings SLOW, FAST, IMPULSE or 10ms
Log Int	Time for each measurement interval
Ln's On/Off	Switches statistical measurements on or off (eg L90)
Ln Choice	User selects which Ln values to measure (7 available)

Channel A	
FWTG	Frequency weightings A, C, or Z (Flat)
TWTG	Time weightings SLOW, FAST, IMPULSE or 10ms

No Timer	Manual start and stop of log
Fixed Timer	Log will run for a pre-selected time
One Timer	Set start and stop time and day
Two Timers	Set two separate start and stop times, with day

Log Name	Default name under which data will be saved

Template Name	Name of template where the above settings are saved

Noise at Work with Octave Bands (NAWOCT)

1 / 1
Channel A&B

Channel A
Range: 60 - 140
FWTG: A
TWTG: Fast
Log Int: 5mins
Ln's Off

Channel B
FWTG: C
TWTG: Fast

No Timer
Log Name: NAWOCT
Template Name: NAWOCT

Noise at Work without Octave Bands (NAW)

SLM
Channel A&B

Channel A
Range: 60 - 140
FWTG: A
TWTG: Fast
Log Int: 5mins
Ln's Off

Channel B
FWTG: C
TWTG: Fast

No Timer
Log Name: NAW
Template Name: NAW

Environmental Noise with 1 / 3 Octave Bands – (ENVTHD)

1 / 3
Channel A only

Channel A
Range: 10 - 90
FWTG: A
TWTG: Fast
Log Int: 1 minute
Ln's On
Ln Choice: L1, L5, L10, L50, L90, L95, L99

No Timer
Log Name: ENVTHD
Template Name: ENVTHD

BS4142 UK – (BS4142)

SLM
Channel A only

Channel A
Range: 10 - 90
FWTG: A
TWTG: Fast
Log Int: 5 minute
Ln's On
Ln Choice: L90

No Timer
Log Name: BS4142
Template Name: BS4142

PPG24 – (PPG24)

SLM
Channel A&B only

Channel A
Range: 10 - 90
FWTG: A
TWTG: Fast
Log Int: 5 minute
Ln's On
Ln Choice: L90

Channel B
FWTG: A
TWTG: Slow

No Timer
Log Name: PPG24
Template Name: PPG24

Lday evening night – (LDEN)

SLM
Channel A only

Channel A
Range: 10 - 90
FWTG: A
TWTG: Fast
Log Int: 1 hour
Ln's Off

Fixed Timer: 24 hours
Log Name: LDEN
Template Name: LDEN

Backlight

Your Pro DX Vocis meter is equipped with even illumination EL backlighting.

The backlight can be turned on or off at any time by pressing the **Back Light Key** which is located and the bottom right hand side of your keypad.

Generally in daylight conditions the backlight will not be visible hence care must be implemented to avoid unnecessary use as the backlight function will reduce the battery life span.

Downloading Recordings To a PC

Using the software dBdataPro (available separately) 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 Vocis meter is made via the 9 pin connector at the base of your instrument.

To allow your instrument to be found by the software your instrument must be displaying the **Main Menu** screen.

For comprehensive instructions please refer to the dBdataPro user manual.

Available Accessories

GA607:	Dual Level Class 1 Calibrator
GA505:	Portable, Battery Operated, Thermal Printer DPU-414
ZL1083-01:	Printer Cable for use with GA505 (1 Metre)
PC007:	dBdata Pro Windows Analysis Software (supplied with ZL1103-02)
ZL1103-02:	PC to Vocis Download Cable (2 Metres)
KA016:	Kit Case for Vocis and Printer (GA505)
KA018:	Weatherproof Enclosure
PSU4:	Power Supply
ZL1092-01:	Microphone Extension Cable (1 Metre)
ZL1092-10:	Microphone Extension Cable (10 Metres)
ZL1061-01:	AC Output Cable (1 Metre)
MKDXP:	Pre Amplifier Assembly (Class 1 GA131 Series)
MKDXPC2:	Pre-Amplifier Assembly (Class 2 GA231 Series)
MK75:	ACO 7146 Microphone (Class 2)
MK78:	Microtech Gefell MK250 Microphone (Class 1)
KG202:	Windshield 90mm
KG205:	Windshield 60mm

Trouble Shooting Guide

Question	Answer
The instrument will not power on.	Check condition of batteries and replace if required.
	If batteries are inserted and are of adequate charge, remove one battery for approximately 10 seconds and replace.
The Instrument is not responding to sound levels.	Turn the instrument Off, wait 10 seconds to allow the instrument to reset and then turn back On.
	Ensure the microphone pre-amplifier is correctly connected to the instrument.
The overload indicator is permanently on.	Change to a higher range.

Instrument Disposal

The symbol shown here 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.

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 unlikely event of a fault occurring with your product during the warranty period, the instrument should be returned in its original packaging to Castle Group Ltd or to an authorised agent. Please enclose a clear description of the fault to ensure your instrument is dealt with as quickly as possible.

Any misuse or unauthorised repairs will invalidate your warranty.

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

Details of the warranty cover are available upon request from Castle Group Ltd or your authorised agent.

All instruments designed and manufactured by Castle Group Ltd adhere to strict British and International standards. To ensure your instrument remains compliant with these standards it is highly recommended that your instrument is returned annually for calibration.

Annual calibration is particularly important for cases in which instrument readings are to be used in litigation or compliance work.

For warranty or service please return your instrument to: -

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

Chapter 8

Technical Specification

Instrument Standards:

GA131C **GA131I** **GA131M**	IEC 61672-1: 2002 Class 1 Group X BS EN 61672-1:2003 Class 1 Group X IEC 60651: 1979 Type 1 + A1: 1993 + A2: 2000 Group X BS EN 60651: 1994 Type 1 Group X IEC 60804: 2000 Type 1 Group X BS EN 60804: 2000 Type 1 Group X IEC 61260: 1995 + A1: 2001 Class 2 BS EN 61260: 1996 Class 2

GA131E	IEC 61672-1: 2002 Class 1 Group X BS EN 61672-1:2003 Class 1 Group X IEC 60651: 1979 Type 1 + A1: 1993 + A2: 2000 Group X BS EN 60651: 1994 Type 1 Group X IEC 60804: 2000 Type 1 Group X

GA231I	IEC 61672-1: 2002 Class 2 Group X BS EN 61672-1:2003 Class 1 Group X IEC 60651: 1979 Type 2 + A1: 1993 + A2: 2000 Group X BS EN 60651: 1994 Type 2 Group X IEC 60804: 2000 Type 2 Group X BS EN 60804: 2000 Type 2 Group X IEC 61260: 1995 + A1: 2001 Class 2 BS EN 61260: 1996 Class 2

GA231E	IEC 61672-1: 2002 Class 2 Group X BS EN 61672-1:2003 Class 1 Group X IEC 60651: 1979 Type 2 + A1: 1993 + A2: 2000 Group X BS EN 60651: 1994 Type 2 Group X IEC 60804: 2000 Type 2 Group X BS EN 60804: 2000 Type 2 Group X

Frequency Weightings:
'A' and 'C' to IEC 61672-1: 2002 Class 1 and IEC 60651: 2001 Type 1
'Z' to IEC 61672-: 2002 Class 1

Resolution:
All Parameters: 0.1dB

Warm up time:
≤ 2 minutes

Environmental Stabilization Time:
30 minutes

Level Ranges: SLM Mode Operation

(IEC 60651:1979 / IEC 60804:2000 & IEC 61672-1:2000 where stated):

Display Range	Linear Operating Range (IEC 60804: 2000 4kHz)	Primary Indicator Range (IEC 60651 : 1979 1kHz)	Peak Range (C Weighted) (IEC 60804: 2000) (IEC 60651: 1979) (IEC 61672-1: 2002)
15 – 90 dB	33 – 90 dB	28 – 70dB	55 – 93 dB
25 – 100 dB	33 – 100 dB	28 – 80dB	55 – 103 dB
35 – 110 dB	35 – 110 dB	35 – 90dB	63 – 113 dB
45 – 120 dB	45 – 120 dB	45 – 100dB	73 – 123 dB
55 – 130 dB	55 – 130 dB	55 – 110dB	83 – 133 dB
65 – 140 dB	65 – 140 dB	60 – 120dB	93 – 143 dB

Primary Indicator Range allows for a crest factor of 10 (20dB)

Level Ranges: Full & Third Octave Band Mode Operation

(IEC 60651:1979 / IEC 60804:2000 & IEC 61672-1:2000 where stated):

Display Range	Linear Operating Range (IEC 60804: 2000 4kHz)	Primary Indicator Range (IEC 60651 : 1979 1kHz)	Peak Range (C Weighted) (IEC 60804: 2000) (IEC 60651: 1979) (IEC 61672-1: 2002)
10 – 90 dB	33 – 90 dB	28 – 70dB	55 – 93 dB
20 – 100 dB	33 – 100 dB	28 – 80dB	55 – 103 dB
30 – 110 dB	35 – 110 dB	35 – 90dB	63 – 113 dB
40 – 120 dB	45 – 120 dB	45 – 100dB	73 – 123 dB
50 – 130 dB	55 – 130 dB	55 – 110dB	83 – 133 dB
60 – 140 dB	65 – 140 dB	60 – 120dB	93 – 143 dB

Primary Indicator Range allows for a crest factor of 10 (20dB)

Frequency Range:

Acoustic Characteristics

Microphone	Frequency Range (Hz)
MK250	12.5 to 20.000
ACO7146	20.0 to 20.000

Electrical Characteristics

1Hz to 20,000Hz

Linear Operating Range (IEC 61672:2002):

Test start point for frequencies > 31.5Hz = 94.0dB on the following display ranges, otherwise 84.0dB:

25 - 100	35 - 110	45 - 120	55 - 130	65 - 140

Test start point for frequency of 31.5Hz = 84.0dB on the following display ranges, otherwise 74.0dB:

25 - 100	35 - 110	45 - 120	55 - 130	65 - 140

A Weighted

Display Range (SLM Mode)	Display Range (1 / 1 or 1 / 3 Mode)	Frequency (Hz)				
		31.5 (dB)	1000 (dB)	4000 (dB)	8000 (dB)	12,500 (dB)
15 – 90 dB	10 – 90 dB	29 - 53	28 - 90	33 - 90	29 - 90	23 - 89
25 – 100 dB	20 – 100 dB	31 - 63	28 - 100	33 - 100	30 - 100	25 - 99
35 – 110 dB	30 – 110 dB	35 - 73	35 - 110	35 - 110	35 - 110	35 - 109
45 – 120 dB	40 – 120 dB	45 - 83	45 - 120	45 - 120	45 - 120	45 - 119
55 – 130 dB	50 – 130 dB	55 - 93	55 - 130	55 - 130	55 - 130	55 - 129
65 – 140 dB	60 – 140 dB	65 - 103	65 - 140	65 - 140	65 - 140	65 - 139

C Weighted

Display Range (SLM Mode)	Display Range (1 / 1 or 1 / 3 Mode)	Frequency (Hz)				
		31.5 (dB)	1000 (dB)	4000 (dB)	8000 (dB)	12,500 (dB)
15 – 90 dB	10 – 90 dB	33 - 90	33 - 90	34 - 90	33 - 90	30 - 87
25 – 100 dB	20 – 100 dB	35 - 100	33 - 100	34 - 100	33 - 100	30 - 97
35 – 110 dB	30 – 110 dB	49 - 110	35 - 110	35 - 110	35 - 110	35 - 107
45 – 120 dB	40 – 120 dB	59 - 120	45 - 120	45 - 120	45 - 120	45 - 117
55 – 130 dB	50 – 130 dB	69 - 130	55 - 130	55 - 130	55 - 130	55 - 127
65 – 140 dB	60 – 140 dB	79 - 140	65 - 140	65 - 140	65 - 140	65 - 137

LIN or 'Z' Weighted

Display Range (SLM Mode)	Display Range (1 / 1 or 1 / 3 Mode)	Frequency (Hz)				
		31.5 (dB)	1000 (dB)	4000 (dB)	8000 (dB)	12,500 (dB)
15 – 90 dB	10 – 90 dB	37 - 90	37 - 90	37 - 90	38 - 90	33 - 90
25 – 100 dB	20 – 100 dB	37 - 100	37 - 100	37 - 100	38 - 100	33 - 100
35 – 110 dB	30 – 110 dB	52 - 110	38 - 110	39 - 110	38 - 110	35 - 110
45 – 120 dB	40 – 120 dB	63 - 120	45 - 120	45 - 120	46 - 120	45 - 120
55 – 130 dB	50 – 130 dB	73 - 130	55 - 130	55 - 130	57 - 130	57 - 130
65 – 140 dB	60 – 140 dB	83 - 140	65 - 140	65 - 140	65 - 140	65 - 140

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.

A Weighted	28 - 140
C Weighted	33 - 140
LIN or 'Z' Weighted	37 - 140

Typical Inherent Noise Level:

A combination of Electrical and Microphone Thermal Noise.

MK250 Microphone

Range	'A' Weighting	'C' Weighting	'Z' Weighting
15 - 90	<18dB(A)	<21dB(C)	<27dB(Z)
25 - 100	<18dB(A)	<21dB(C)	<27dB(Z)

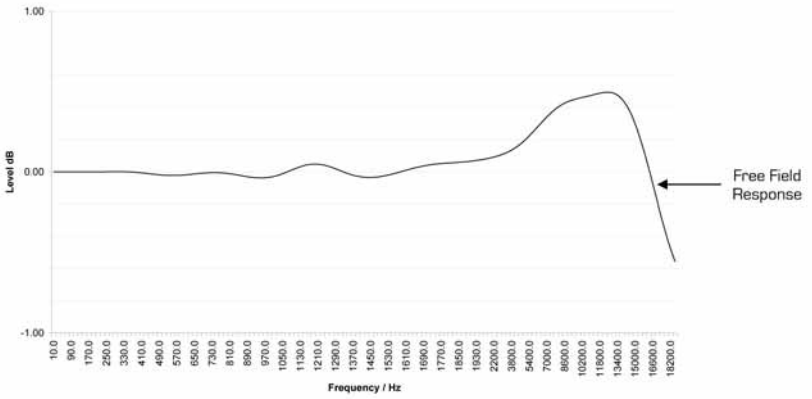
ACO 7146 Microphone

Range	'A' Weighting	'C' Weighting	'Z' Weighting
15 - 90	<18dB(A)	<21dB(C)	<27dB(Z)
25 - 100	<18dB(A)	<21dB(C)	<27dB(Z)

Microphone:

Type (MK250)	Specification
Diameter (inch)	0.5 (13.2mm)
Response Type	Free-Field
Polarization (V)	0
Frequency Range (Hz)	3.5 –20000 (±2dB)
Sensitivity (mV / Pa)	50
Capacitance (pF)	18
Reference Point	Centre of Diaphragm
Max. Sound Pressure Level (dB) For No Damage	146
Temperature Coefficient (dB / °C)	-0.01
Instrument Range	All GA131 Variations

Microtech Gefell Type MK250 Typical Microphone Response:



Microtech Gefell Type MK250 Typical Microphone Response:

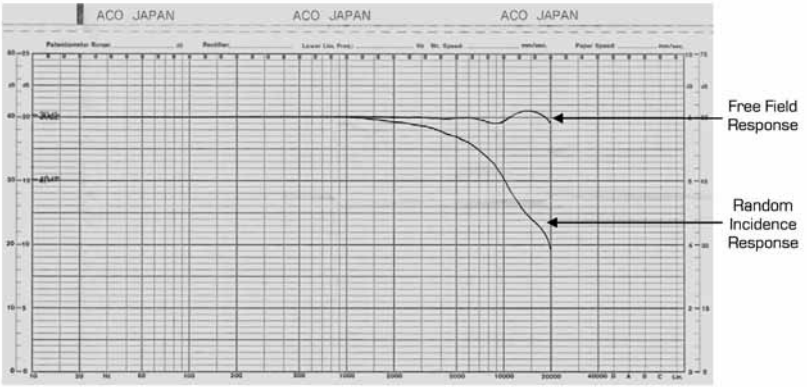
Hz	dB	Hz	dB	Hz	dB
12.5	0.0	1330	0.04	5310	0.13
16	0.0	1410	0.0	5620	0.145
20	0.0	1500	-0.035	5960	0.16
25	0.0	1580	-0.0.3	6310	0.18
31.5	0.0	1680	0.015	6680	0.21
40	0.0	1780	0.04	7080	0.23
50	0.0	1880	0.055	7500	0.26
63	0.0	2000	0.07	7940	0.3
80	0.0	2110	0.07	8410	0.31
100	0.0	2240	0.07	8910	0.36
125	0.0	2370	0.073	9440	0.39
160	0.0	2510	0.077	10000	0.43
200	0.0	2660	0.08	10600	0.44
250	0.0	2820	0.08	11200	0.45
315	0.0	2990	0.08	11900	0.46
400	0.0	3160	0.085	12600	0.48
500	-0.01	3350	0.09	13300	0.49
630	-0.02	3550	0.09	14100	0.5
800	-0.01	3760	0.09	15000	0.48
1000	-0.035	3980	0.095	15800	0.41
1060	-0.035	4220	0.1	16800	0.27
1120	-0.015	4470	011	17800	0.03
1190	0.02	4730	0.11	18800	-0.23
1260	0.05	5010	0.12	20000	-0.55

Microphone:

ACO 1/2" Electret Condenser Microphone Cartridge Type 7146:

Type (7146)	Specification
Diameter (inch)	0.5 (13.2mm)
Response Type	Free-Field
Polarization (V)	0
Frequency Range (Hz)	20 - 20000 (±2dB)
Sensitivity (mV / Pa)	50
Capacitance (pF)	18
Reference Point	Centre of Diaphragm
Max. Sound Pressure Level (dB) For No Damage	146
Temperature Coefficient (dB / °C)	-0.01
Instrument Range	All GA231 Variations

ACO Type 7146 Typical Microphone Response:



ACO Type 7146 Typical Microphone Response:

Hz	dB
16	0.0
31.5	0.0
63	0.0
125	0.0

Hz	dB
250	0.0
500	0.0
1000	0.0
2000	0.0

Hz	dB
4000	-0.1
8000	-0.7
16000	1.0

Electrical Signal Input:

Electrical signals can be applied to the Pro-DX Vocis 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:

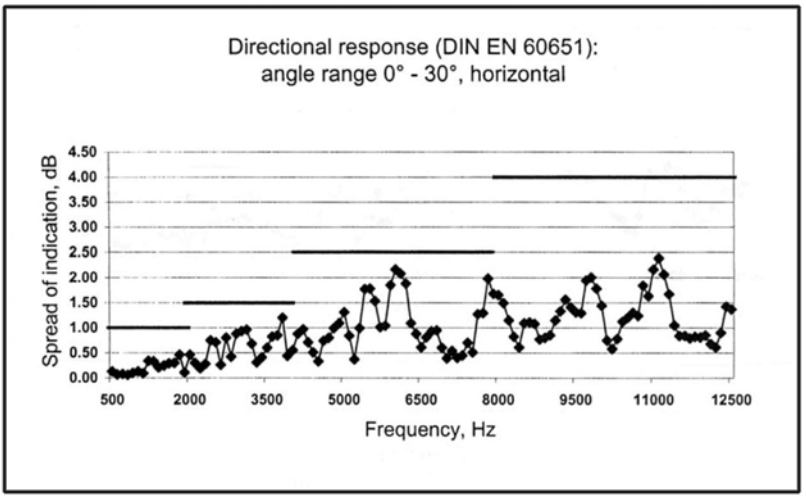
40 Volts

Typical Electrical Self Generated Noise Level:

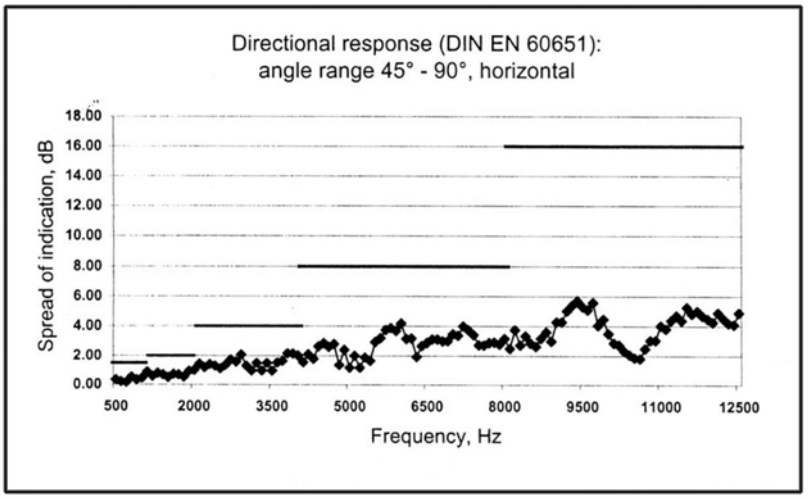
Range	'A' Weighting	'C' Weighting	'Z' Weighting
15 - 90	<18dB(A)	<21dB(C)	<27dB(Z)
25 - 100	<18dB(A)	<21dB(C)	<27dB(Z)

Case Reflections:

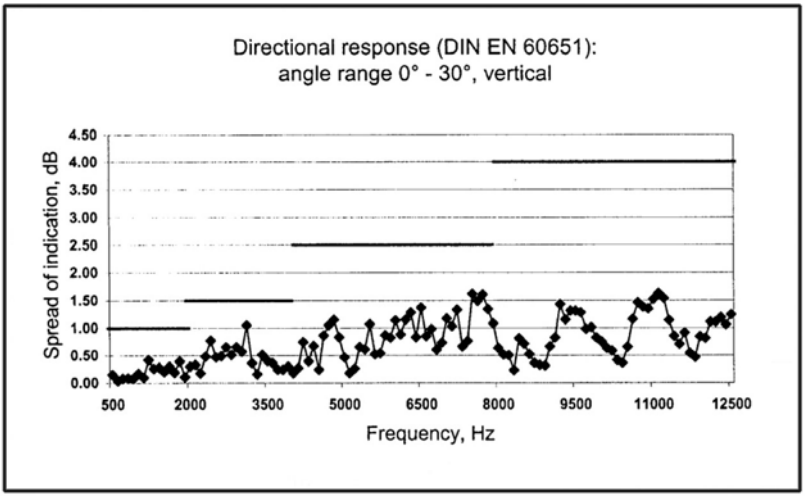
Directional Response, Angle 0° - 30°, Horizontal



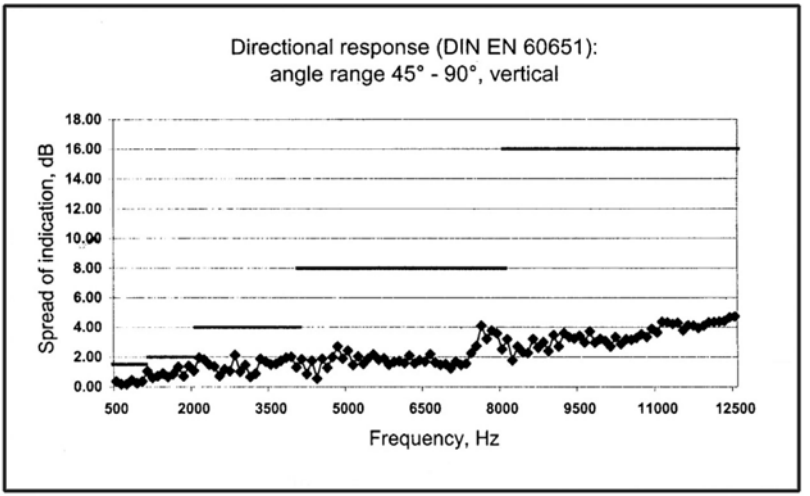
Directional Response, Angle 45° - 90°, Horizontal



Directional Response, Angle 0° - 30°, Vertical



Directional Response, Angle 45° - 90°, Vertical



Case Reflections Only with ACO 7146 microphone fitted:
Absolute error at 1kHz equals -0.4dB

Frequency (Hz)	Error in dB re 1kHz
63	0.3
80	0.5
100	0.3
125	0.4
160	0.4
200	0.4
250	0.3
315	0.6
400	0.8
500	0.3
630	0.2
800	0.2
1000	REF
1250	0.6
1600	0.6
2000	0.1
2500	0.3
3150	0.7
4000	0.5
5000	0.0
6300	- 0.1
8000	0.1

Case Reflections Only with MK250 microphone fitted:
Absolute error at 1kHz equals -0.1dB

Frequency (Hz)	Error in dB re 1kHz
63.00	0.0
80.00	0.0
100.00	0.0
125.00	0.0
160.00	0.1
200.00	- 0.1
250.00	0.0
315.00	0.4
400.00	0.4
500.00	0.2
630.00	0.0
800.00	- 0.1
1000.00	REF
1059.25	-0.5
1122.02	- 0.1
1188.50	0.0
1250.00	0.2
1333.52	0.4
1412.54	- 0.6
1496.24	0.4
1600.00	0.7
1678.80	0.5
1778.28	0.5
1883.65	0.2
2000.00	0.1
2113.49	- 0.9
2238.72	- 0.9
2371.37	0.2
2500.00	0.3
2660.73	0.4
2818.38	0.8

Frequency (Hz)	Error in dB re 1kHz
2985.38	0.4
3150.00	- 0.4
3349.65	- 0.7
3548.13	- 0.4
3758.37	0.5
4000.00	- 0.4
4216.97	- 0.1
4466.84	0.5
4731.51	- 0.1
5000.00	- 0.5
5308.84	- 0.1
5623.41	0.6
5956.62	0.0
6300.00	0.3
6683.44	0.1
7079.46	- 0.3
7498.94	- 0.6
8000.00	0.3
8413.95	0.4
8912.51	- 0.1
9440.61	0.4
10000.00	- 0.3
10592.54	0.5
11220.18	- 0.3
11885.02	- 0.1
12500.00	0.1
13335.21	0.4
14125.38	0.0
14962.36	- 0.3
16000.00	- 0.4

Normal Operating Mode:

Display Mode = Broadband (SLM)

Class 1 instruments fitted with pre-amplifier type MKDXP and microphone MK250.

Class 2 instruments fitted with pre-amplifier type MKDXPC2 and microphone type ACO 7146.

Pre-amplifier assemblies are clearly labeled with type and unique serial number.

Windshields types KG202 or KG205 may be used and fitted by gently placing the windshield over the microphone which is mounted on the pre-amplifier. Push the windshield down over the microphone and preamplifier as far as the groove allows.

See 'Pre-Amplifier and Microphone Removal and Fitting' section for the procedure to attach and remove the pre-amplifier and microphone to either a class 1 or class 2 instrument.

Effect of Fitting Accessories:

GA131C, GA131E, GA131I and GA131M meters fitted with either windscreen or using the microphone extension cable will remain within class 1 tolerances.

Windscreens

90mm Diameter Windscreen (KG202)

Frequency (Hz)	Error in dB re 1kHz
31.5	- 0.2
63	- 0.2
80	- 0.2
100	- 0.2
125	- 0.1
160	- 0.2
200	- 0.2
250	- 0.1
315	- 0.2
400	- 0.2
500	- 0.3
630	- 0.2
800	- 0.1
1000	REF
1250	0.0
1600	0.2
2000	0.3
2500	0.3
3150	0.2
4000	- 0.4
5000	- 0.4
6300	- 0.1
8000	- 0.8
10000	- 0.5
12500	- 1.2
16000	- 1.6

Absolute error at 1kHz equals +0.2dB

60mm Diameter Windscreen (KG205)

Frequency (Hz)	Error in dB re 1kHz
31.5	- 0.2
63	- 0.1
80	- 0.2
100	- 0.1
125	- 0.1
160	0.0
200	- 0.1
250	- 0.1
315	- 0.1
400	0.0
500	0.0
630	0.0
800	0.0
1000	REF
1250	0.0
1600	0.3
2000	0.0
2500	0.5
3150	0.4
4000	0.5
5000	- 0.1
6300	- 0.5
8000	- 0.2
10000	- 0.5
12500	- 0.9
16000	- 1.3

Absolute error at 1kHz equals +0.2dB

Extension Cable

ZL1092-01 (1 metre)

Frequency (Hz)	Error in dB re 1kHz
31.5	0.0
63	0.0
80	0.0
100	0.0
125	- 0.1
160	0.1
200	- 0.1
250	0.0
315	0.0
400	0.1
500	0.1
630	0.1
800	0.1

Frequency (Hz)	Error in dB re 1kHz
1000	REF
1250	- 0.1
1600	0.0
2000	0.0
2500	0.1
3150	- 0.3
4000	0.1
5000	0.0
6300	0.1
8000	- 0.2
10000	- 0.1
12500	- 0.1
16000	- 0.1

Absolute error at 1kHz equals 0.0dB

Typical Actuator to Free Field Correction Factors:

Frequency (Hz)	Error in dB re 1kHz	ACO 7146 Microphone (dB)
25	0.0	0.0
31.5	0.0	0.0
40	0.0	0.0
50	0.0	0.0
63	0.0	0.0
80	0.0	0.0
100	0.0	0.0
125	0.0	0.0
160	0.0	0.0
200	0.0	0.0
250	0.0	0.0
315	0.0	0.0
400	0.0	0.0
500	0.0	0.0
630	0.0	0.0
800	0.0	0.0
1000	0.0	0.0
1250	0.1	0.0
1600	0.1	0.0
2000	0.2	0.1
2500	0.4	0.3
3200	0.6	0.6
4000	1.0	1.0
5000	1.4	1.5
6300	2.1	2.2
8000	3.1	2.9
10000	4.6	4.2
12500	6.0	6.5
16000	8.5	8.2
20000	10.3	10.0

Adjustment Data Test Frequency

8kHz

Calibration Reference Conditions:

Sound Field:	Free Field
Air Temperature:	23°C (73°F)
Relative Humidity:	50%
Atmospheric Pressure:	101.325kPa
Sound Pressure Level:	94dB
Reference Level Range:	55 – 130 dB (Automatically selected whilst calibrating)
Reference Frequency:	1kHz (Used as Calibration Check Frequency)

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

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.

Measurement Parameters:

All Variations (I, E, C & M)
Lp (SPL), Leq, Lmax, Pmax (Lpeak), Ltm3, Ltm5, LAE, Lmin, 7 user-definable Ln values (pre-set to: L1, L5, L10, L50, L90, L95, L99) plus LAF* for Noise act assessment.

Variations I, C & M:
DOSE %, projected DOSE %, user definable criterion (75, 80, 85 or 90), user definable exchange rate (3, 4 or 5), Lex (Lep'd) , projected Lex (Lep'd), 1 / 1 Octave values in Lp, Leq, Lmax, Lmin. Hearing Protection figures in APL. NR (noise rating).

Vocis M:
1 / 3 Octave values in Lp, Leq, Lmax, Lmin.

Display:
Electro-Luminescent, White Back-lit LCD panel (160x160 pixels)
Sound Level Meter and Analyzer Display
Numerical: Tabular results on-screen
Bar graph: 1 / 1 & 1 / 3 octaves
Refresh Rate ≤ 500mS
Displayed parameter at each update interval is the value at the time of the update interval. It is recommended that a calculation settling period of 60 seconds is allowed for in any data log file.

Temperature Operating range:
-10°C to +50°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:
Accuracy better than ± 0.5 dB over the range -10°C to +50°
Storage range: 0% to 90% relative humidity in the absence of condensation

Vibration:
From 20Hz to 1kHz at 1ms -2 no noticeable effect

Humidity
< 0.5 dB from 25% RH to 90% RH

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.

Operator presence in Free Field:
No noticeable effect when operator standing more than 2m behind instrument

Overload:
Positive overload warning when the input circuits saturate

Log time Intervals:
User definable in one second intervals (all parameters).
Minimum integrating period equals 1 second.
Maximum potential log size recommended at 67,500 intervals (1/3 octave with Ln's selected)

Timer Function:
A Program Log Timer to give multiple Start-Stop timings.

Time:
Battery backed Real Time clock and calendar

Memory:
2Mb on-board FLASH
2Mb on-board RAM
128Mb Useable for File Storage

Communication Port:

RS-232: 115200 max. Baud-rate, 8 bit, no parity, bi-directional 9 pin 'D'-sub

Output Socket:

AC Output:	Unweighted, 0.953V rms at full scale on each range
	Load Impedance > 10K recommended
	Short circuit protected
	Cable Colours: Red – Signal, Blue - Ground

Batteries:

Internal Backup:	CR2032 coin cell
Main:	6 x MN1500 (size AA) alkaline cells
Life:	8 hours continuous use (approx) without backlight
Min Battery Level:	7.5V DC

External Power Supply:

Mains Power (option):	12V DC mains adapter 1.25A, Centre Terminal +12v, Outer Terminal 0V Powered from nominal AC supply of 230V ±10% , 50 / 60Hz
Min Voltage Level:	11V DC
Max Voltage Level:	18V DC

Processing:

A to D Converter:	24-bit Stereo, 60kHz sampling
DSP:	32-bit 61MHz processor sampling at 60kHz
Controller:	100MHz, 486SX running at 16MHz

Overall Dimensions:

Dimensions:	250mm x 100mm x 50mm (approx.) without microphone assembly
Weight:	870g including microphone assembly and batteries

EC Declaration of Conformity

The CE marking of the Castle Pro DX Vocis Sound Level Meter indicates compliance with the EMC Directive.

Castle Group Ltd declares that the: -

- *Pro DX Vocis GA131 / GA231 Sound Level Meter*

has in accordance with the following Directive: -

- *89/336/EEC 'The Electromagnetic Compatibility Directive' and associated amending Directives*

been designed and manufactured to the following specification: -

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

meeting the following tests:-

- *Radiated Emissions:* *EN55022:1995 Class: A*
- *ESD:* *EN61000-4-2:1995*
  Levels: ±4kV(C) , ±8kV(A)
- *RF EM Amplitude Mod:* *EN61000-4-31996:*
  Levels: 3V/m & 10V/m (Compliance not guaranteed beyond 10V/m)

Normal mode of operation is SLM or broadband display mode. No differences in radio frequency emissions are apparent between operating modes of the instrument.

No performance or function degradation is noticeable whilst subject to electrostatic discharge or a.c power frequency and radio frequency fields under any operating mode with the meter. Greatest susceptibility to a.c power frequencies at 180° to source.

Approved cables for use with Castle Pro DX meters to comply with these specifications: -

Cable	OrderCode	Length
Printer	ZL1183-01	1m
PC to Vocis	ZL1103-02	2m
Microphone Extension	ZL1092-01	1m
Microphone Extension	ZL1092-10	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 Directive.

EMC tests conducted at the standard test level of 74dB

Chapter 9

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:

$$SPL = 20LOG \frac{P}{P_0}$$

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 (some times 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

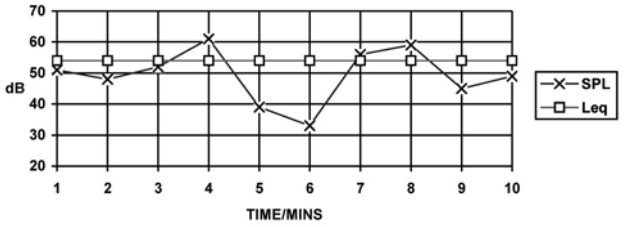
Lmax is the highest rms sound pressure level within the measuring period (with slow, fast or impulse time weighting selected).

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 in either A-Weighted, C-Weighted, or ZWeighted mode.



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 T_M (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.

DOSE

DOSE is a percentage measure of noise exposure similar to LEX, 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 LEX (assuming a criterion of 85 100% DOSE = 85dBA for 8 hours.)

Table D1. Effect of changing SPL

SPL (dBA)	Exposure Time (hours)	Dose (%)	Lex (dBA)
95	8	800	95
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 (%)	Lex (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 (%)	Lex (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.

LEX Daily Personal Noise Exposure.

Lex 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, Lex is displayed as a dB(A) value, and is derived from the equation shown below.

$$L_{EX} = 10\log_{10}\frac{1}{28800}\int_0^{T_M}\left[\frac{P_A(t)}{P_o}\right]^2 dt$$

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

Although similar to Leq, Lex, 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 LEX and DOSE is given by the following equations:

$L_{EX} = 85 + 10.\log_{10}[DOSE/100]$ (For a criterion level of 85)

$L_{EX} = L_{eq} + 10.\log_{10}[t/T]$

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

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

Each time the sound level increases the Lex increases. If the exposure time doubles, say 4 hours to 8 hours, the Lex 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. $SPL = 20\log_{10}(\frac{P}{P_0})$ Where: SPL = Sound Pressure Level P = Root Mean Square sound pressure $P_0 = 2 \times 10^{-5}$ 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 A - Weighted Sound Pressure Level	L_{AEQT}	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
Equivalent Continuous A - Weighted Sound Pressure Level	$L_{AEQ}T$	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.
Dose	D	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	DOHR	Designed to show the Dose exposure over each hour.
Projected Dose	Proj D	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	LEX	Personal noise exposure; usually referred to a daily 8 hour rate. "Exposed" means exposed whilst at work; expressed in dB(A) $L_{EX} = 10\log_{10} \frac{1}{T_o} \int_0^{T_e} (\frac{P_A(t)}{P_o})^2 dt$ Where: T_e = the duration of the person's personal exposure to sound. T_O = 8 hours = 28800 seconds. P_O = 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

Castle GROUP

technical safety & environmental solutions




THE VOCIS AND YOU

The demands on safety and environment specialists are ever increasing in complexity and variety, with new legislation and standards seemingly introduced on a weekly basis. To cope with these demands requires powerful and future-proof equipment. The Castle Pro-DX Vocis fulfils this role perfectly, with the functionality and upgradability to suit almost any noise measurement application. Specialised templates are included for a range of health and safety and environmental applications plus any number of bespoke set-up's can be added.

VOCIS SYSTEMS

There are seven system varieties, put together to fit almost any application and covering the entire range of Vocis models. The KV001 for example is a professional safety system and contains all the equipment and accessories needed for noise at work risk assessments. There are also weatherproof, outdoor systems and even a noisy neighbour kit!

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