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The ‘New’ BS 4142:2014

Methods for rating and Assessing Industrial and Commercial Sound

Corrections For Character of Sound

Norsonic

What is BS4142?

- One of the most widely used UK standards for assessment of environmental noise.
- The document is British Standard 4142:2014 and its title is '**Methods for rating and assessing industrial and commercial sound'**
- The standard is basic in principle but the detail can be complex. If you wish to use it, a copy of the latest version will be required.

2014 vs Previous Revision

- Need to state credentials of the author to demonstrate competence
- Consideration of the context of the report
- Clarification on which scenarios are suitable and which are not
- Night time measurement periods altered from 5mins to 15mins
- Exclusion of the use of Class/Type 2 instruments
- **Graduated correction for Tonal Noise**
- **Gradual scale for Impulse noise penalties**
- Consideration of levels of uncertainty

BS4142 – Scope

Used for:

- investigating complaints;
- assessing sound from proposed, new, modified or additional source(s) of sound of an industrial and/or commercial nature
- assessing sound at proposed new dwellings or premises used for residential purposes.

BS4142 - Scope

Not Used for

- Noise nuisance – Use statutory noise nuisance powers
- Public road and railway (CRTN and CRN)
- Motorsport/ Music Events
- Shooting grounds (CIEH guidance)
- Construction, Demolition (BS 5228)
- Domestic animals
- People/ PA systems
- Other sources falling in the remit of other standards

The main concepts of BS 4142 are as follows:

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- make measurements of all noise at the assessment location, including the "problem" noise, in terms of **LAeq** - termed the "ambient" noise level
- a measurement is then made of all the noise excluding the "problem" noise in terms of both LAeq and **LA90**; these measurements are termed the "residual" and "background" noise levels respectively.
- the "residual" LAeq measurement is then **subtracted** (logarithmically) from the "ambient" LAeq measurement to produce the noise level produced by the "problem" noise alone - termed the "specific" noise level

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The main concepts of the standard are as follows:

- if the "problem" noise is tonal [containing a noticeable hiss, whine or hum] or if it is impulsive [contains bangs clatters, clicks or thumps] or if it is irregular enough to attract attention a correction is added to the "specific" level to produce the "rating level“.
- the "background" LA90 measurement is then compared against the "rating" level.
- If the "rating" level exceeds the "background" by around 10 dBA or more this "indicates a significant adverse impact". A difference of around 5 dBA ‘indicates an adverse impact’; at a difference below 5 dBA, the lower the adverse impact and below 0dBA – Low adverse impact likely – ‘All dependant on the context’

Making Measurements

- Measurements of the sound level
  - When the source is running - LAeq
  - When the source is Not running - LAeq
  - Background noise when the source is not running – LA90. This should be based on the mode of the LA90 measurements. Ie the most common LA90 value not the lowest.

  Measurement time periods
  - Day 1 Hour (7am to 11pm)
  - Night 15 Minutes (11pm to 7am)

  Duration of measurement or number of sample periods will depend on how stable the source and background noise is.

Making Measurements

Where to measure

- At nearest residential premises – Garden
- Possibly at other noise sensitive receptors
- Site of proposed dwellings

If you cannot measure with the specific sound off then it is possible to measure at equivalent location for background and residual noise.

Make sure it is representative!

- Microphone position at ear height 1.2 to 1.5m
- 3.5m at least away from reflecting facades

What to Measure

Set your sound level meter to measure

- LAeq and LA90
- Frequency analysis 1/3 Octaves, audio recordings, fast time data logging 25ms or quicker for impulsive calculations.

Alternatively – Prediction can be used to calculate specific noise levels.

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Norsonic 140 Set-Up for BS4142

- Getting the Settings Right

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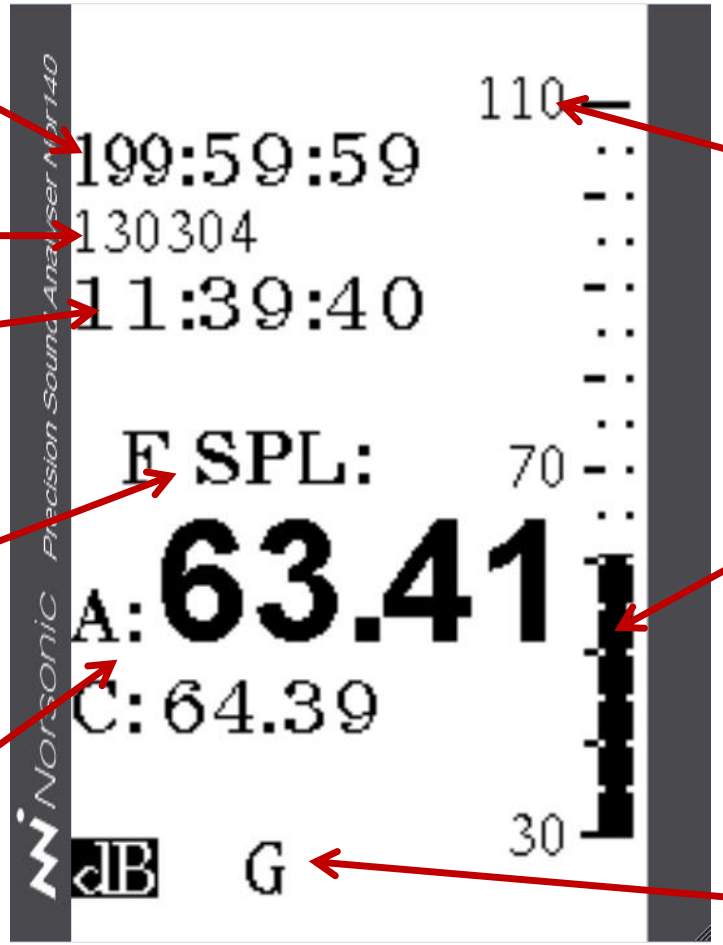
Front/Standby Screen Explained



Current Measurement Duration

Current Date

Current Time

Time Constant & Function (Currently Fast Sound Pressure Level). Adjusted using keys 8 for Time Constant and 3 to change display function

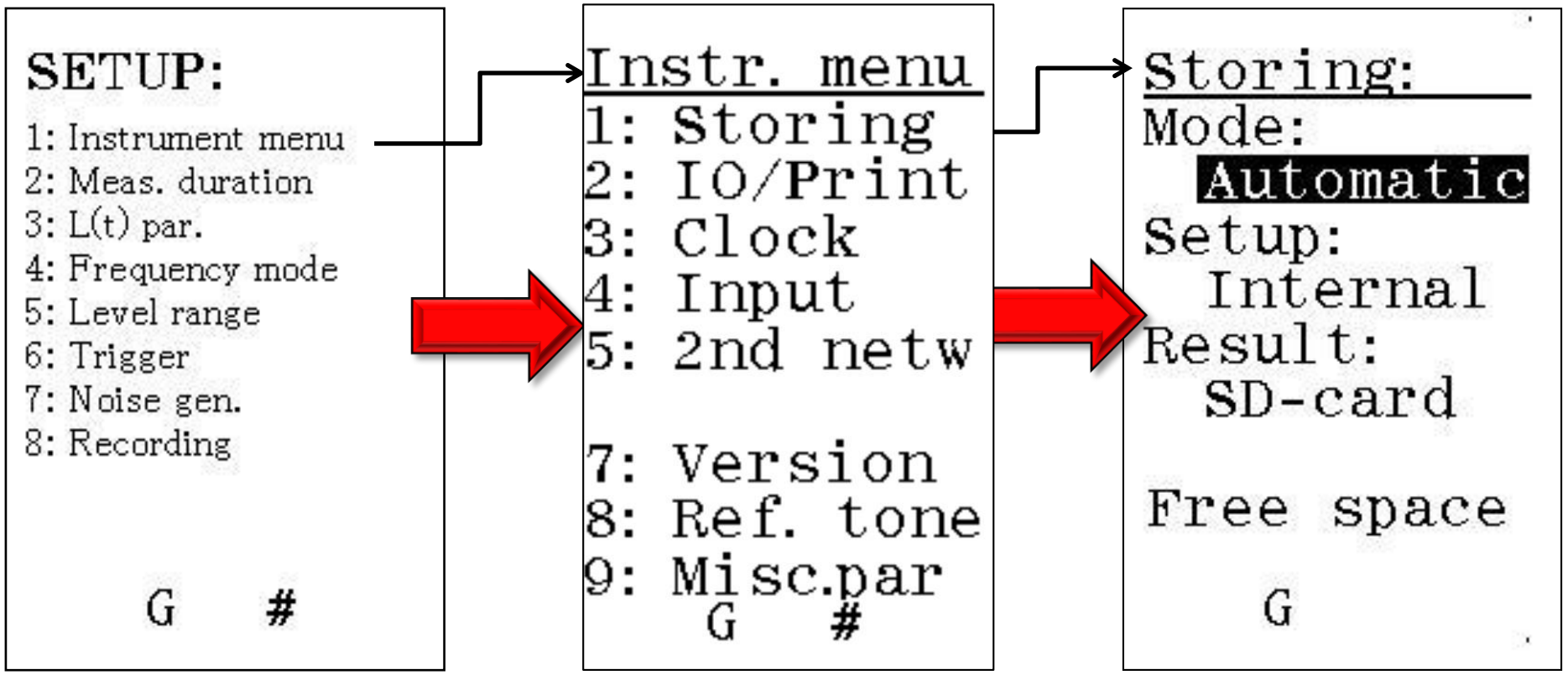
A-weighted and 2nd network Weighted readings

Display Range Values. Adjusted using inc & dec keys. Note this Does not alter the measurement Range

Graphical dB reading

Corrections Applied (G is pre-amp)

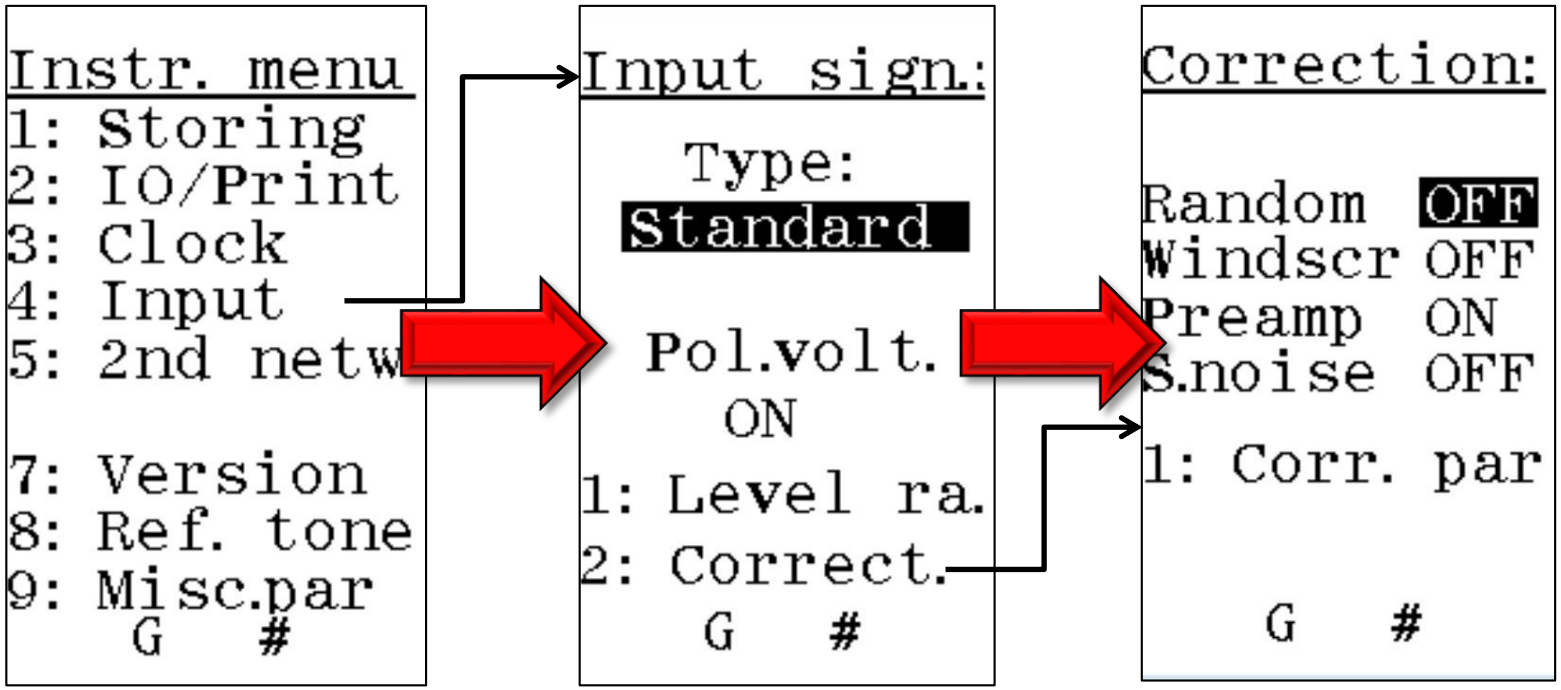
Screen Shots – Storing Method



Automatic – Automatic saving, Repeat – Repeat measurement duration and save until stopped, Syncro – Synchronise with the clock, Manual – Waits for Store/Record key to be pressed before saving.

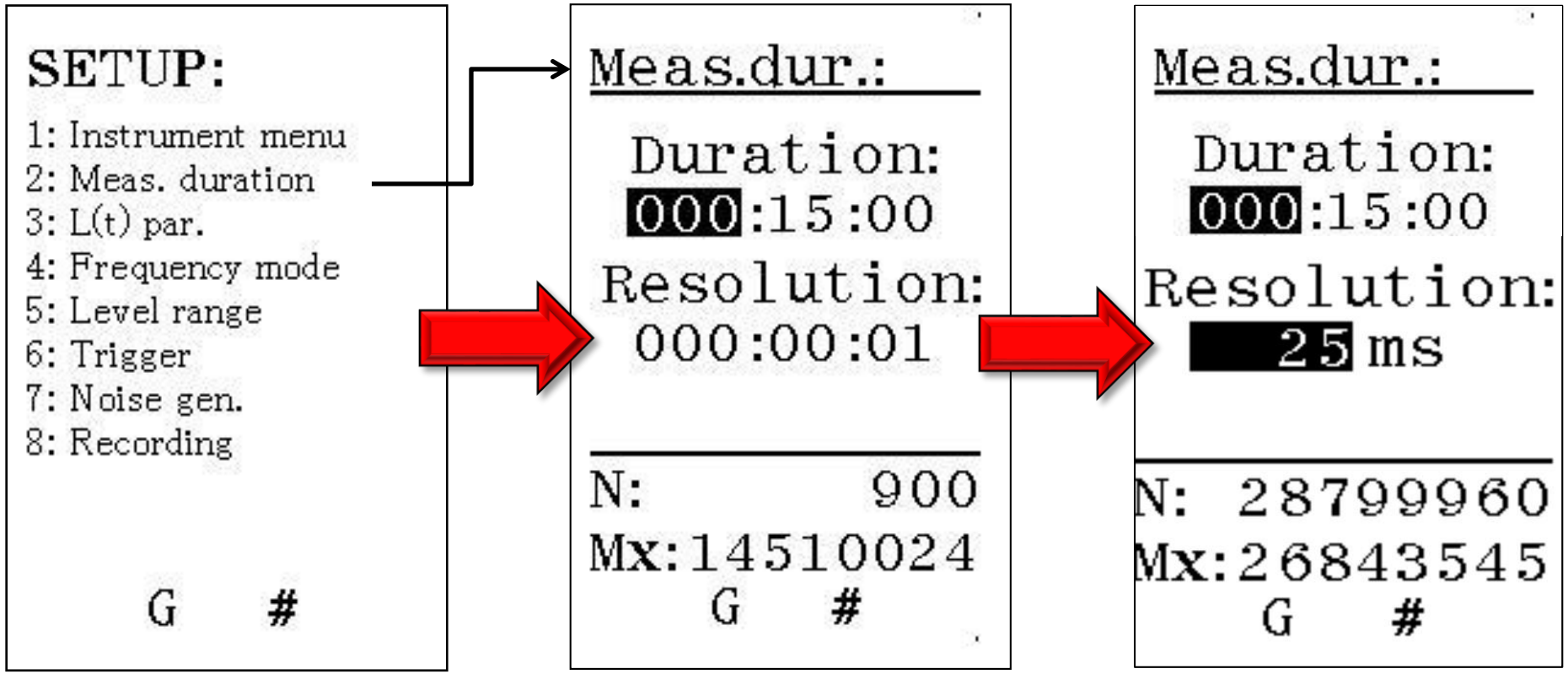
Screen Shots – Input & Corrections

For most assessments the input type should be standard with the Pol. Volts set to On. If very low levels are measured on the front screen then it is likely that the voltage to the microphone is turned off.



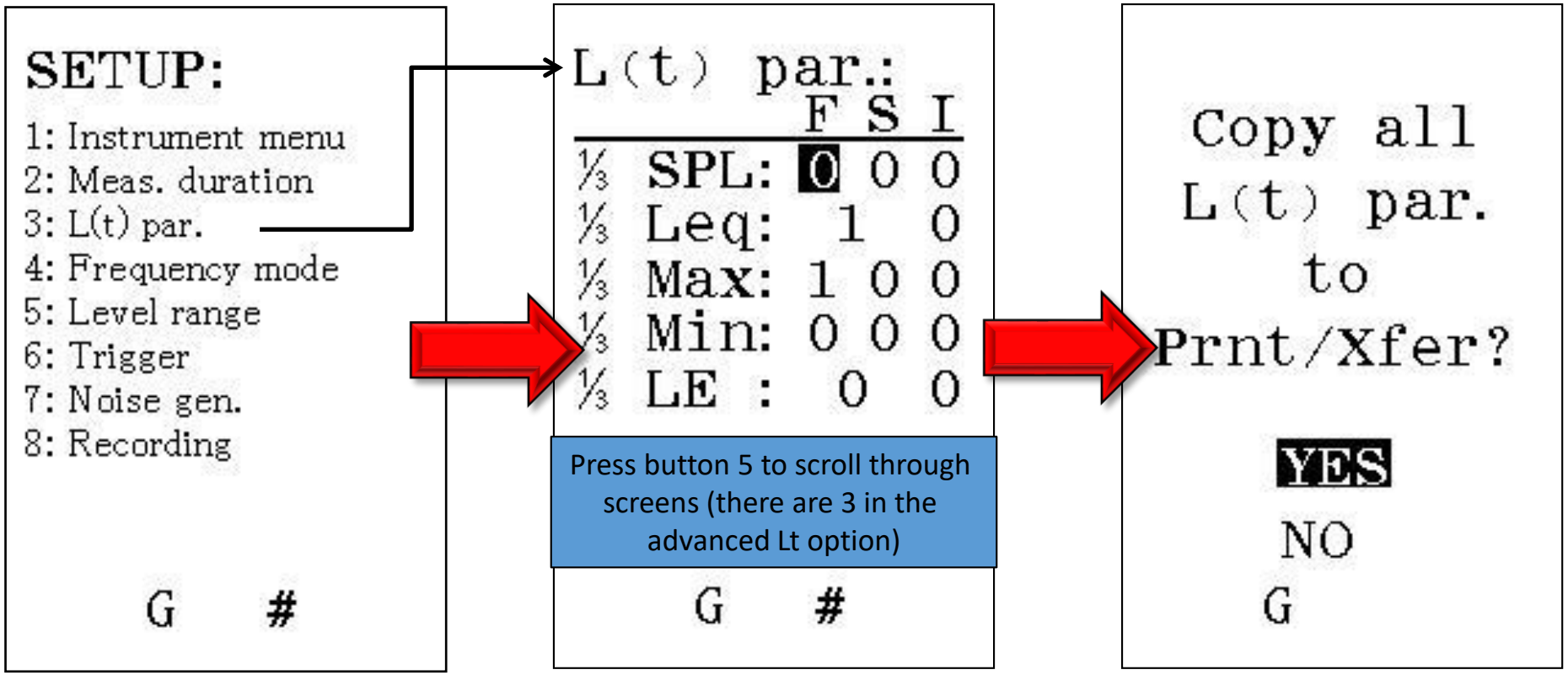
Active corrections are displayed by letters at the base of every screen. The preamp correction should be the only one active unless using a random incident microphone or a different composition windscreen.

Screen Shots – Measurement Durations



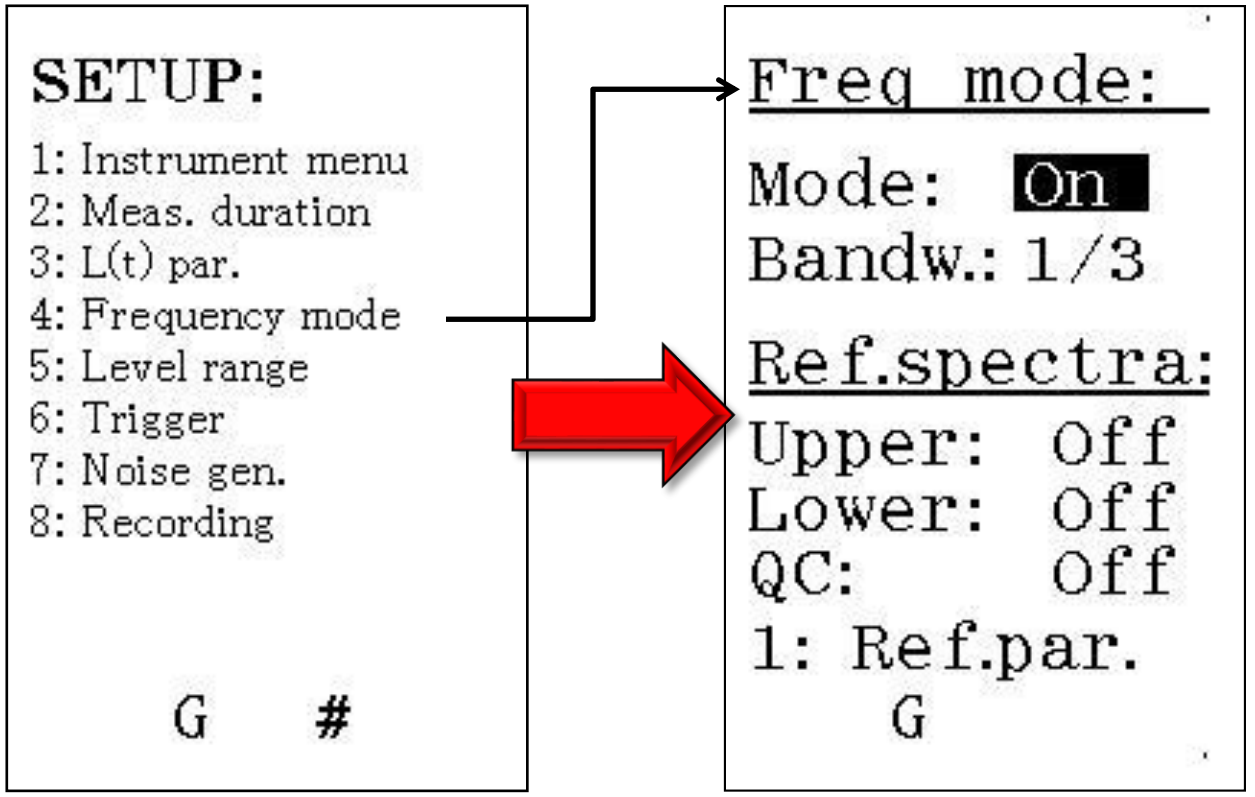
To move between boxes – type the number, press enter, use arrow keys to move to next box.
Resolution reduced using 'inc' and 'dec' keys.

Screen Shots – L(t) Parameters



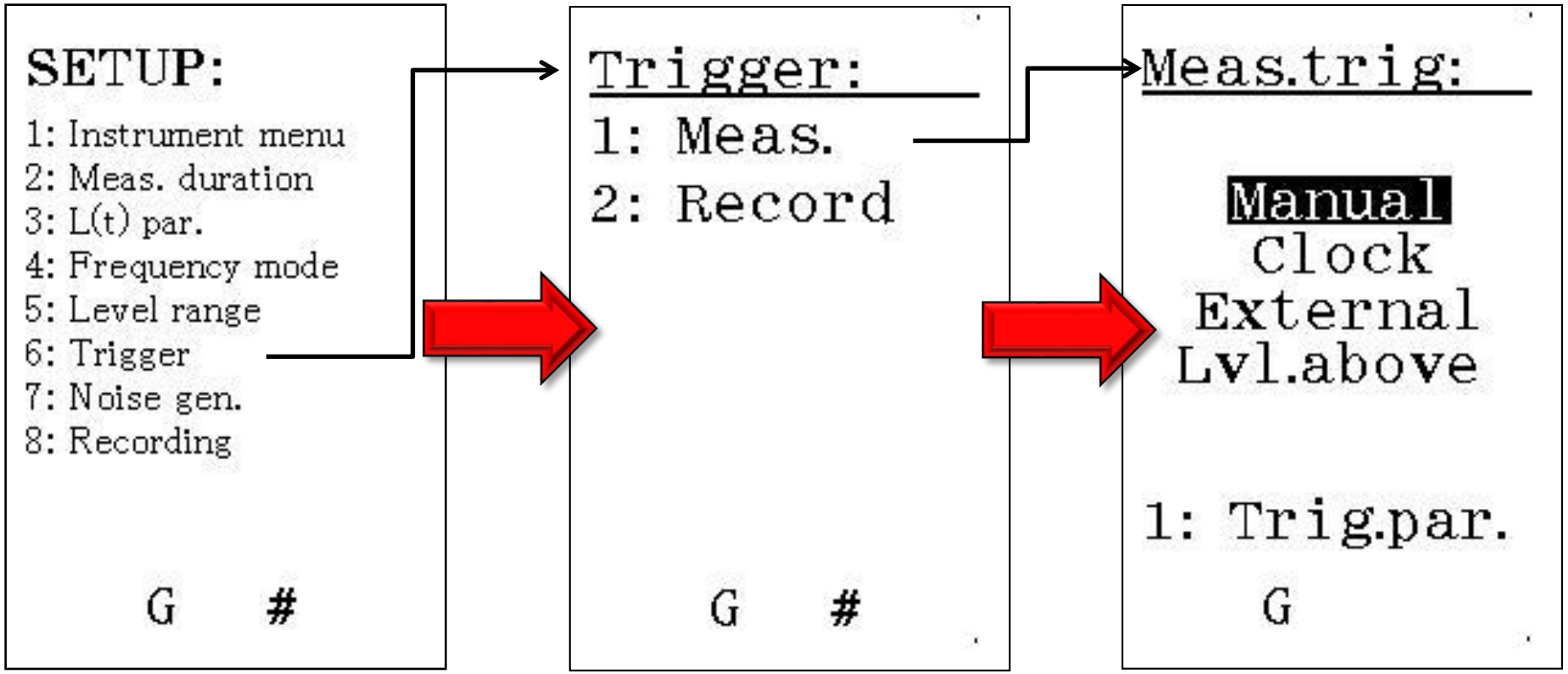
1 = will be stored every second (can plot level vs time graph)
0 = will only appear in the global file

Screen Shots – Frequency Mode



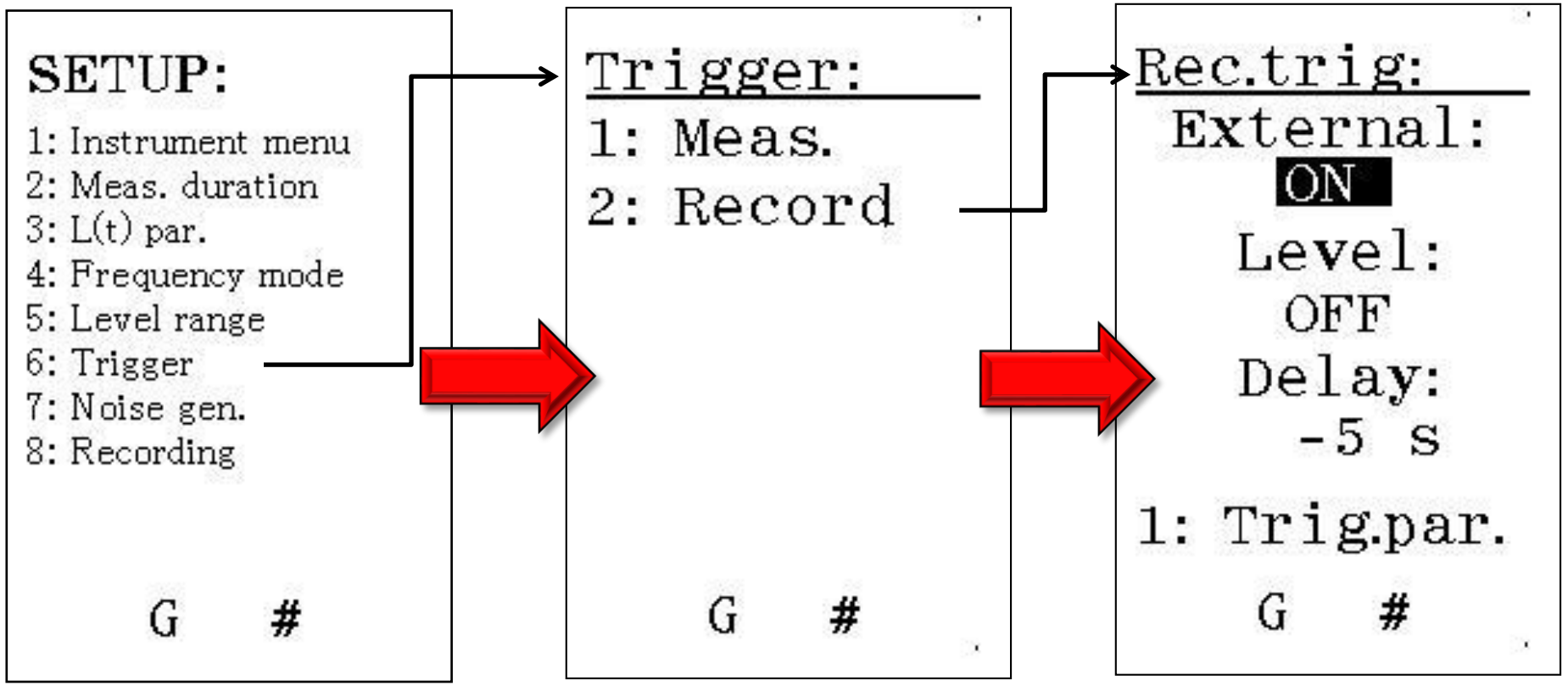
1/3 = 6.3Hz – 20kHz (standard microphone measurement capabilities)
1/3w = 0.4Hz – 20kHz (for use with accelorometer)

Screen Shots - Trigger



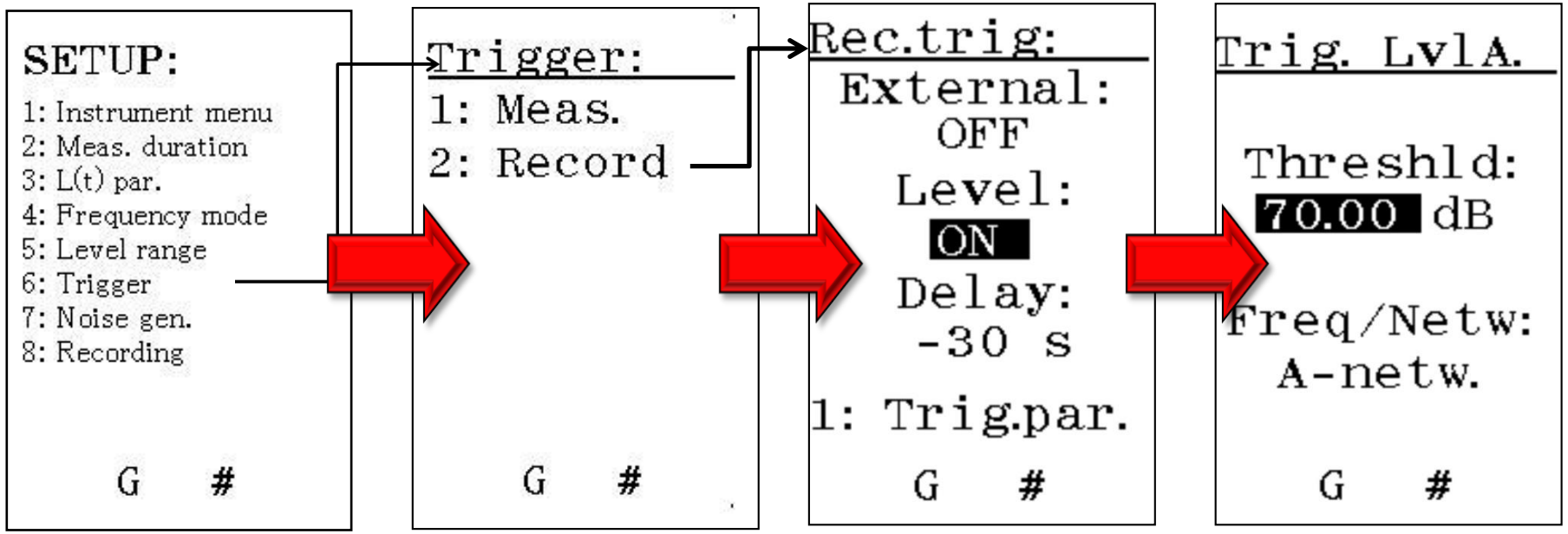
Manual – Start key starts measurement, **Clock** (press 1 when highlighted) – measurement starts at specified time and runs for measurement duration, **External** – Link to bluetooth, 3G etc, **Level Above** - (press 1 when highlighted) set dB level to exceed before measurement starts.

Screen Shots - Trigger



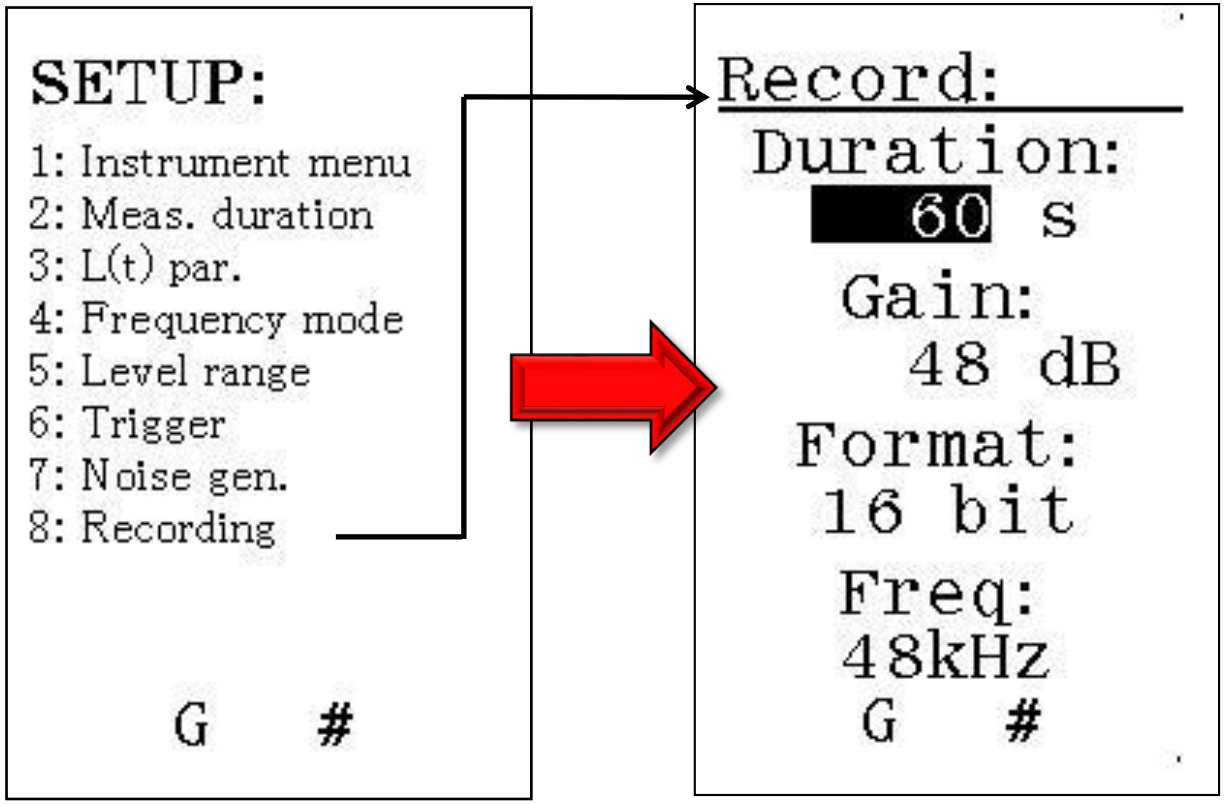
External is the handswitch audio trigger.
Level gives you a level above trigger. Press 1 to access settings.
Delay is the pre-trigger that can be up to -99seconds.

Screen Shots – Level Trigger

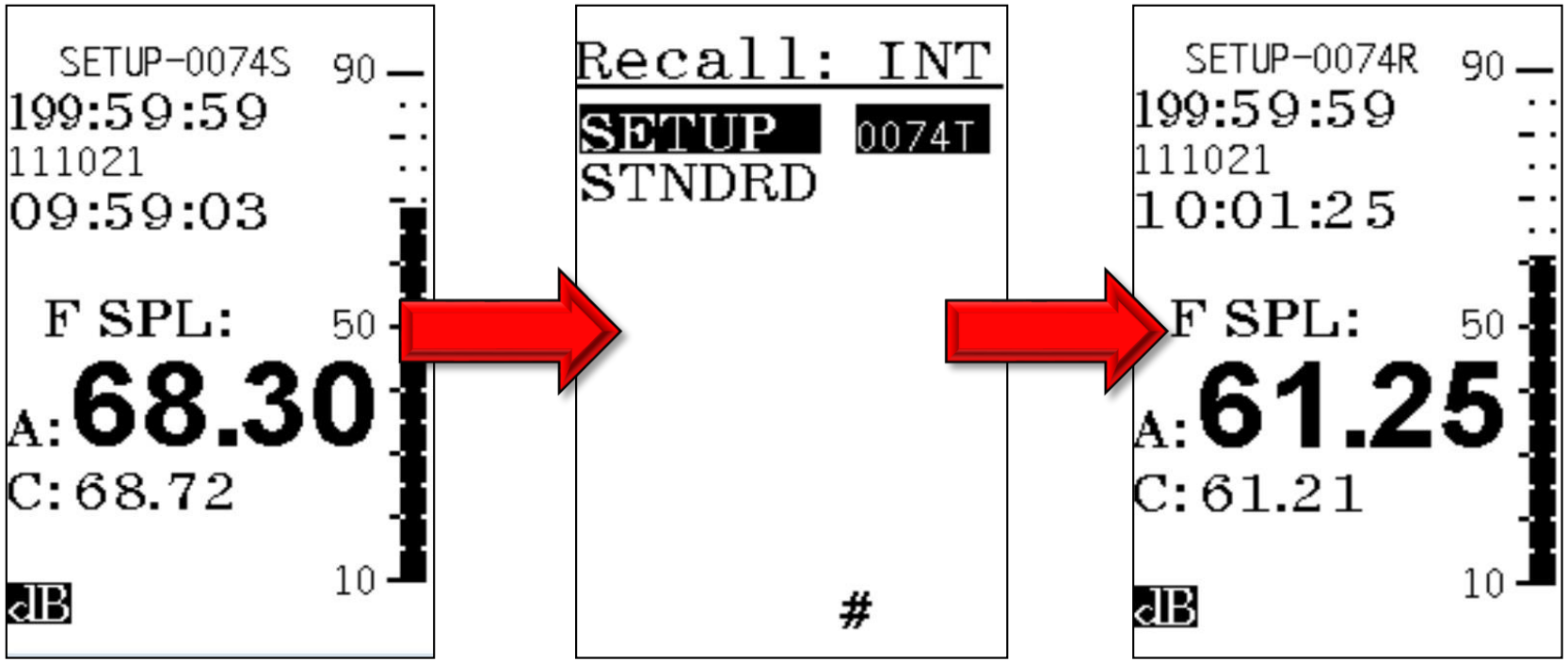


To activate audio recordings without the handswitch you can use the level trigger option. This is in set-up 6) Trigger – 2) Record Trigger and then change the external to off (handswitch) and the level to on. Press button 1 with the Level 'On' highlighted to change the dB level. With this set the meter will record audio every time the noise goes above this Threshold. Be careful when using this as manned properties will set the trigger off more often.

Screen Shots – Recording Settings



Saving Settings & Recalling



When in the main standby screen press the Store/Record key and a set-up number will appear at the top of the screen with a 'S' to indicate it has been saved. To load the set-up press the 'Recall' key and make sure the letters In the top right say 'INT' for internal memory (SDC is SD card and you will need to press the inc or dec key to change). Find the correct set-up number and press enter. The set-up number will then appear at the top of the screen with the letter 'R' next to it to indicate it has been recalled.

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Running Measurements

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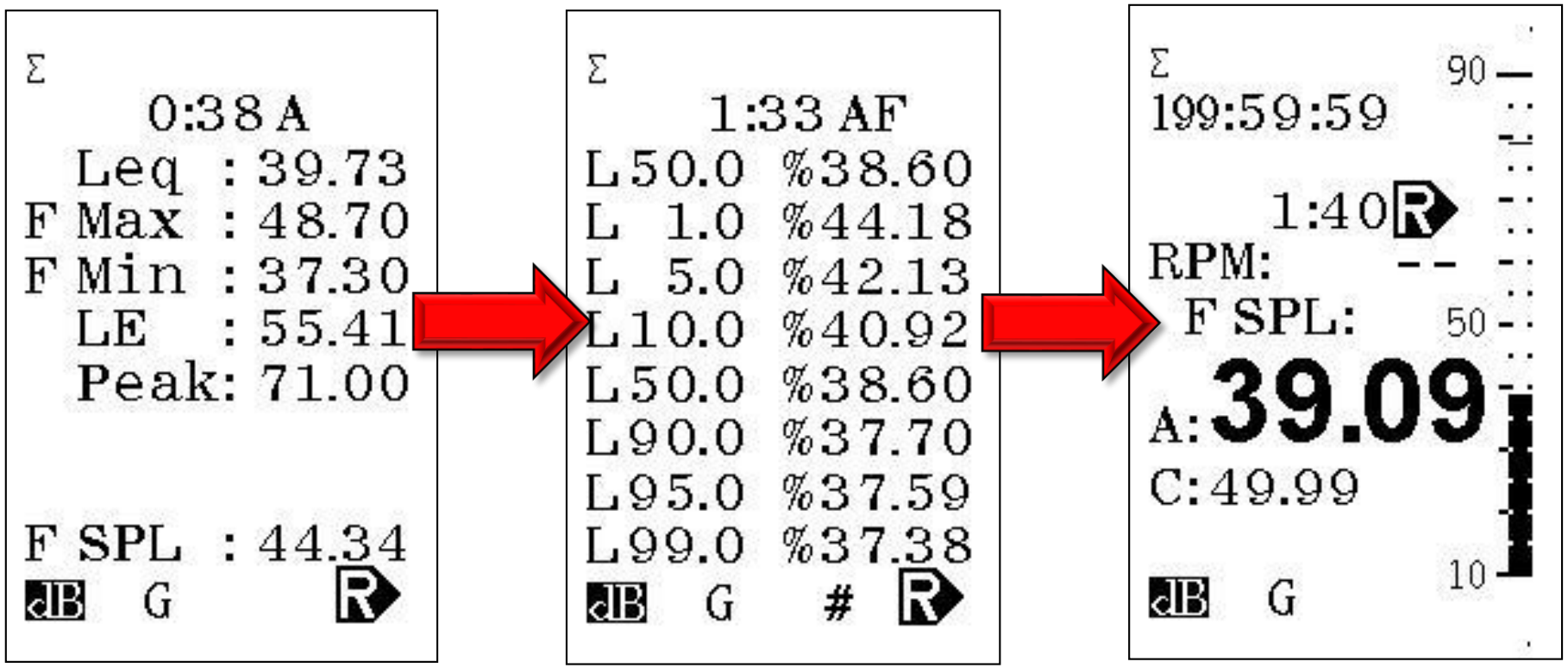
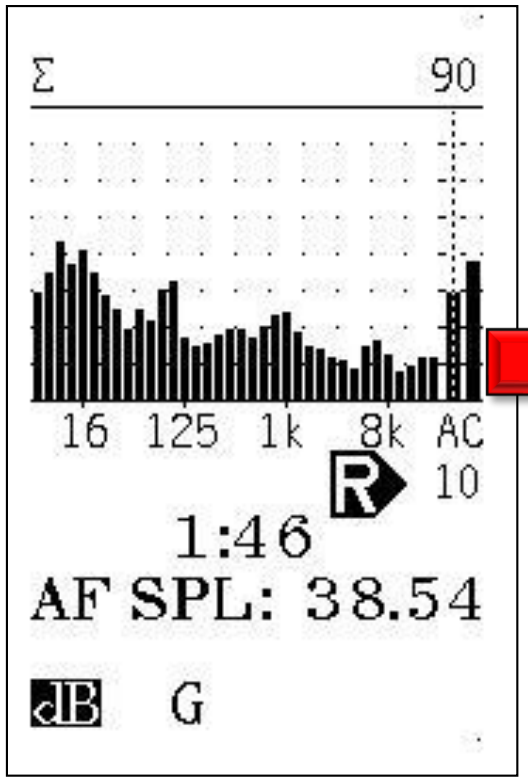
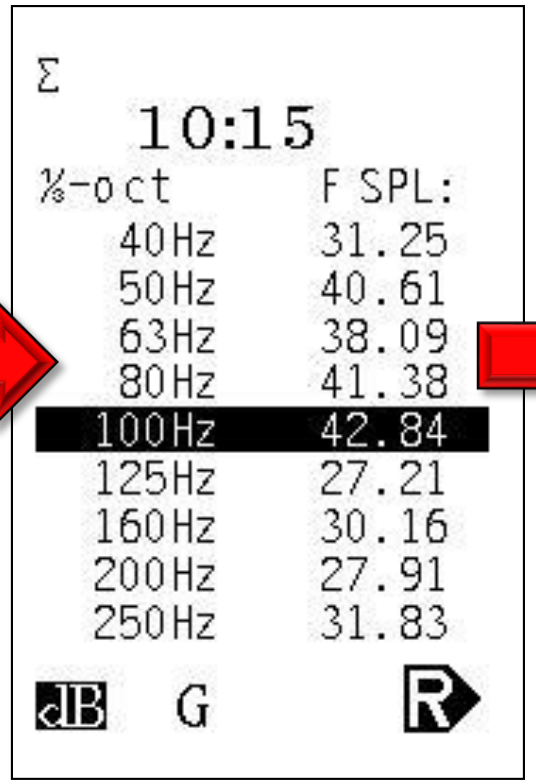
Button 1 - Table Functions



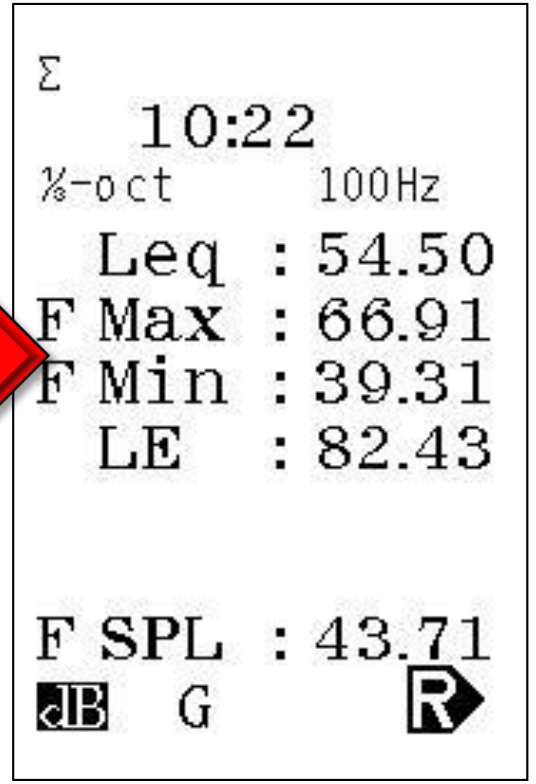
Button 2 – Frequency Analysis



Use cursor to select frequency

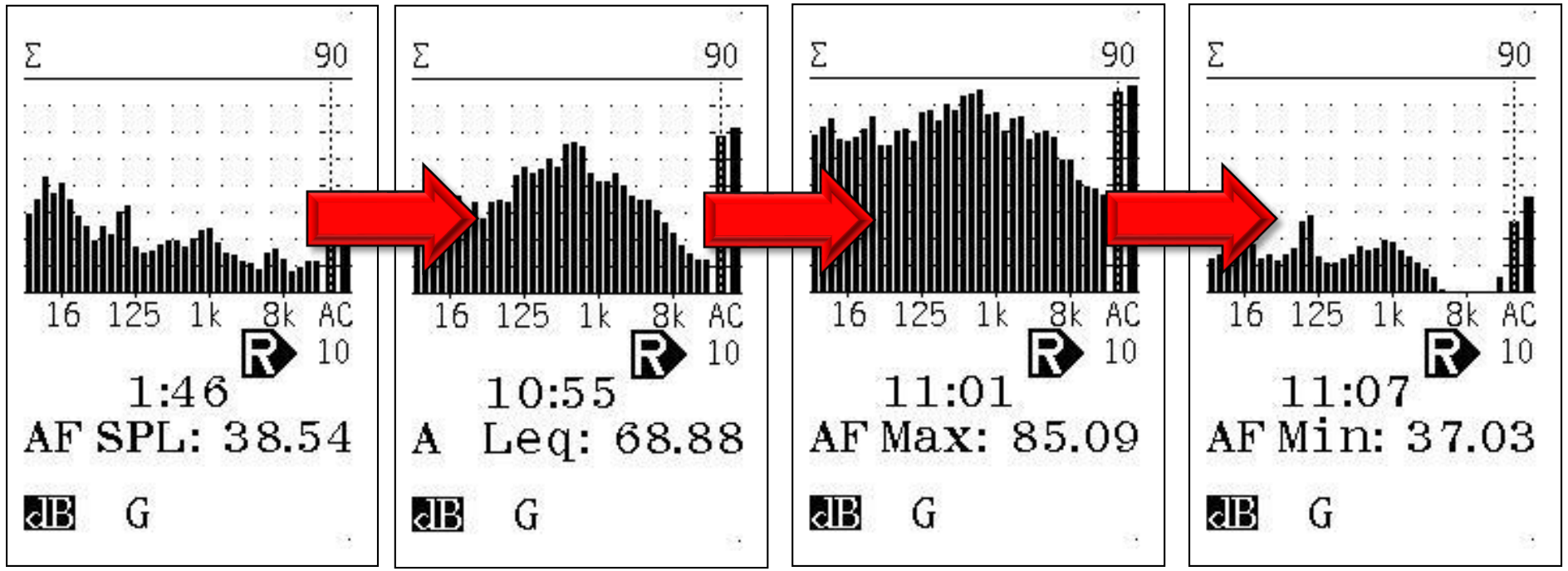


Button 1 displays table of figures.



Button 1 again shows stats at that highlighted frequency

Button 3 – Function Display



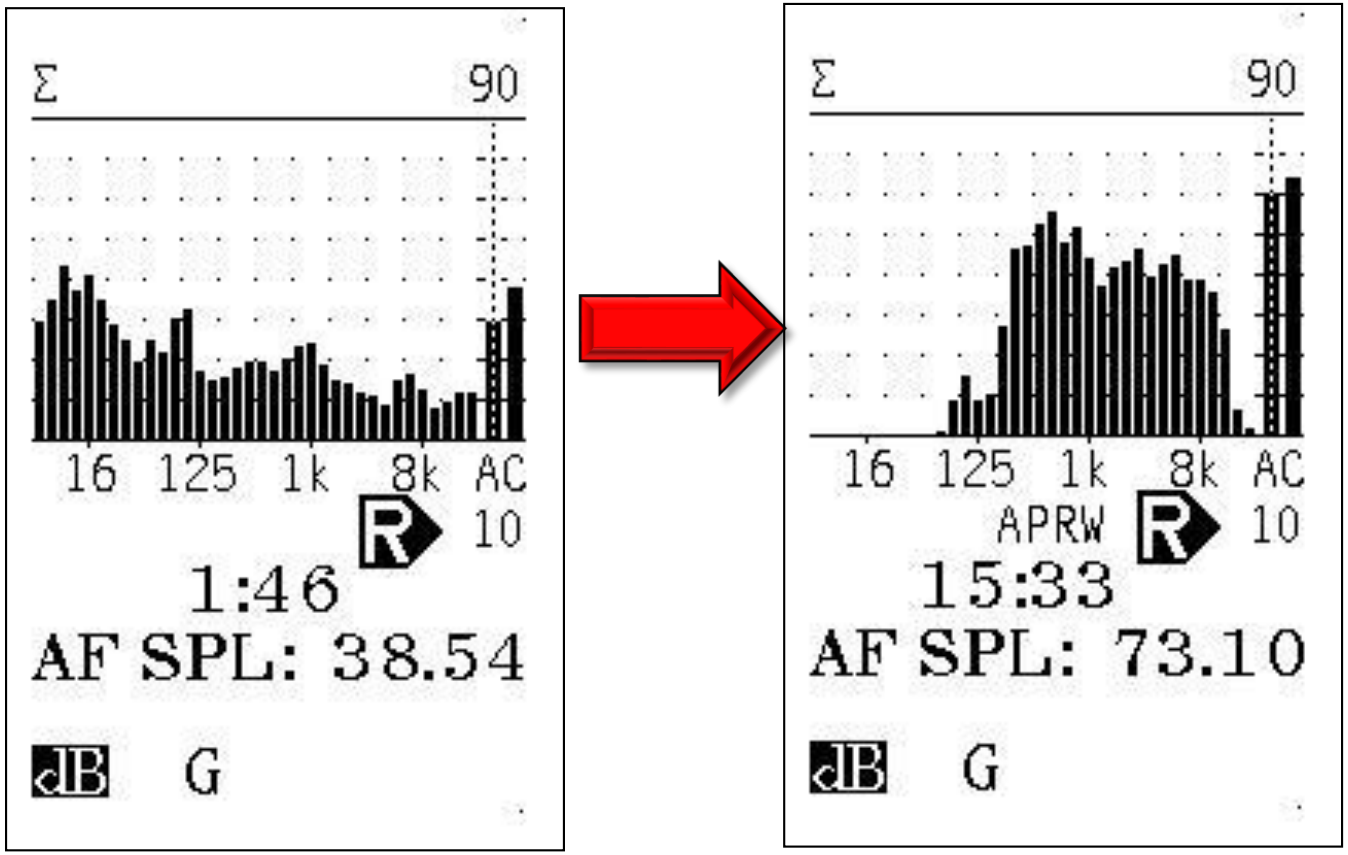
Sound Pressure Level

Leq

Max

Min

Button 9 – A Pre-weighting Display



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Assessment

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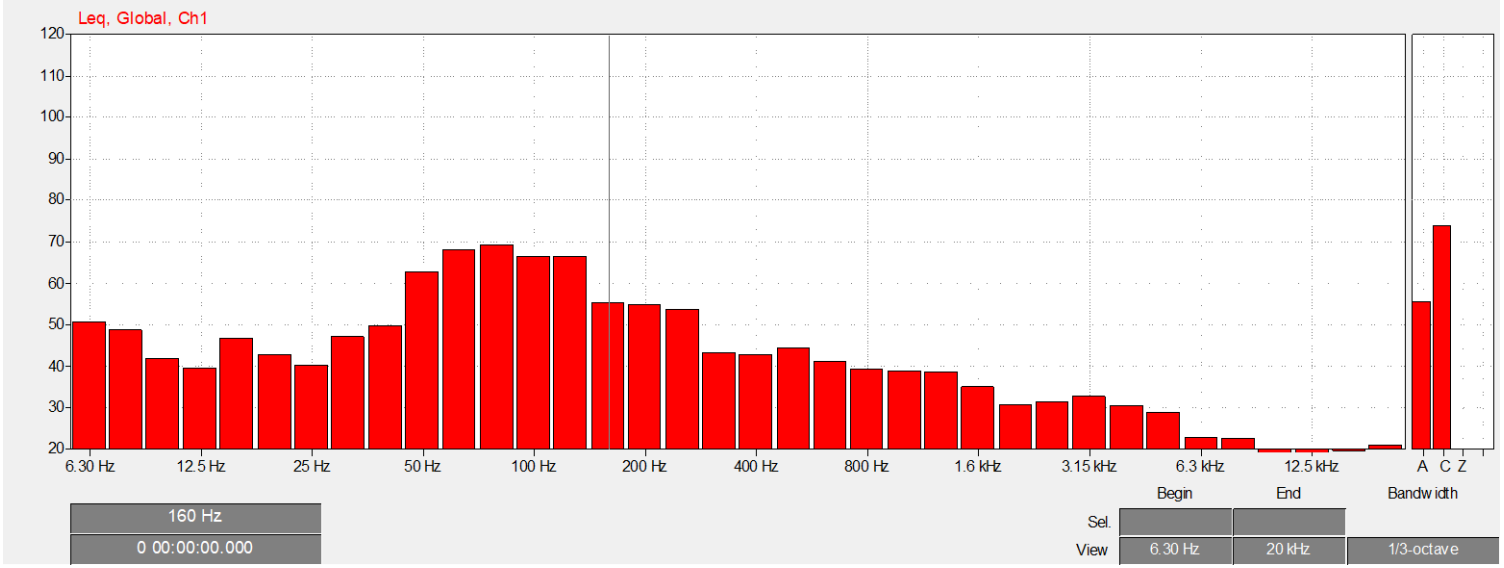
Tonal Penalty Options – Annex D



Subjective

- 2dB –Just Perceptible
- 4dB –Clearly Perceptible
- 6dB –Highly Perceptible

Objective

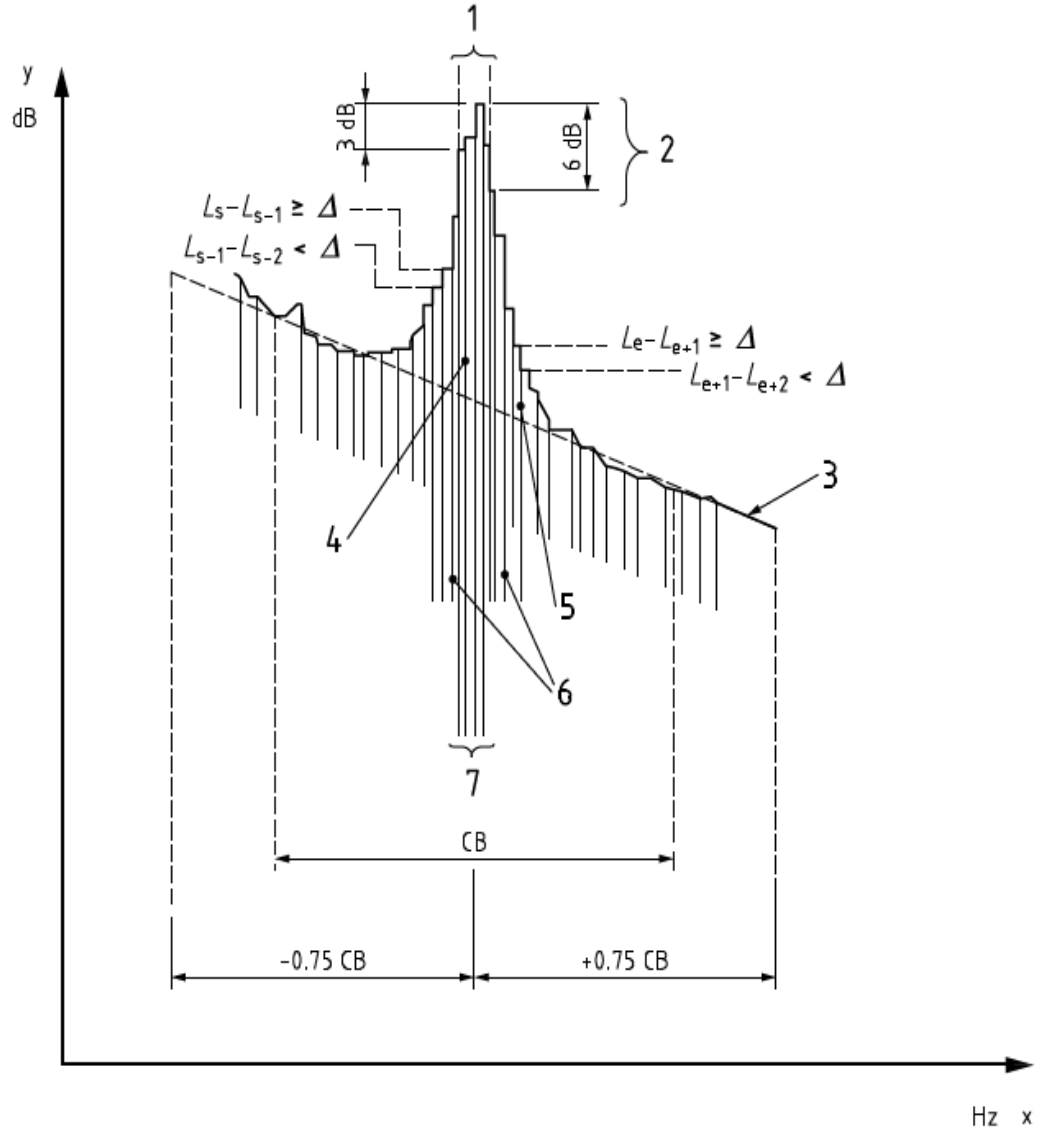
- The 6dB penalty is also applied instead of the above if the adjacent 1/3 octave values;
- Exceeds by 15dB from 25Hz-125Hz
- Exceeds by 8dB from 160-400Hz
- Exceeds by 5dB from 500-10kHz

Tonal Penalty Options – Annex D

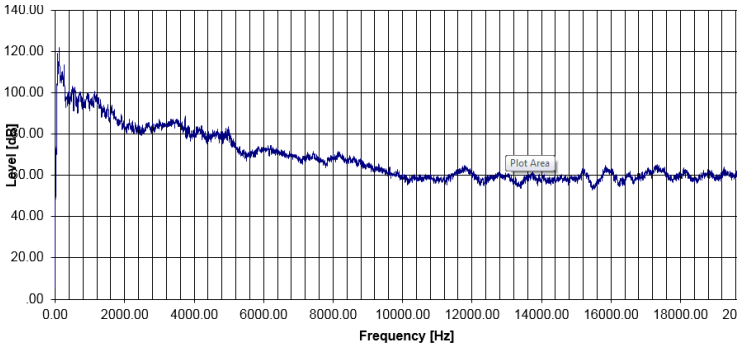
Objective continued – Method 3 is preferred (complex)

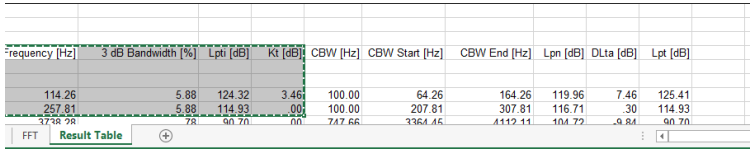
- Uses FFT in accordance with ISO 1996-2 to determine the tones.
- calculation of the tonal audibility compared to adjacent frequencies

Record a high resolution audio recording and ask the software to calculate the tones.



Tonal Example





Frequency [Hz]	Kt [dB] Correction
114.26	3.46
257.81	.00

Impulsive Correction – Annex E

Subjective

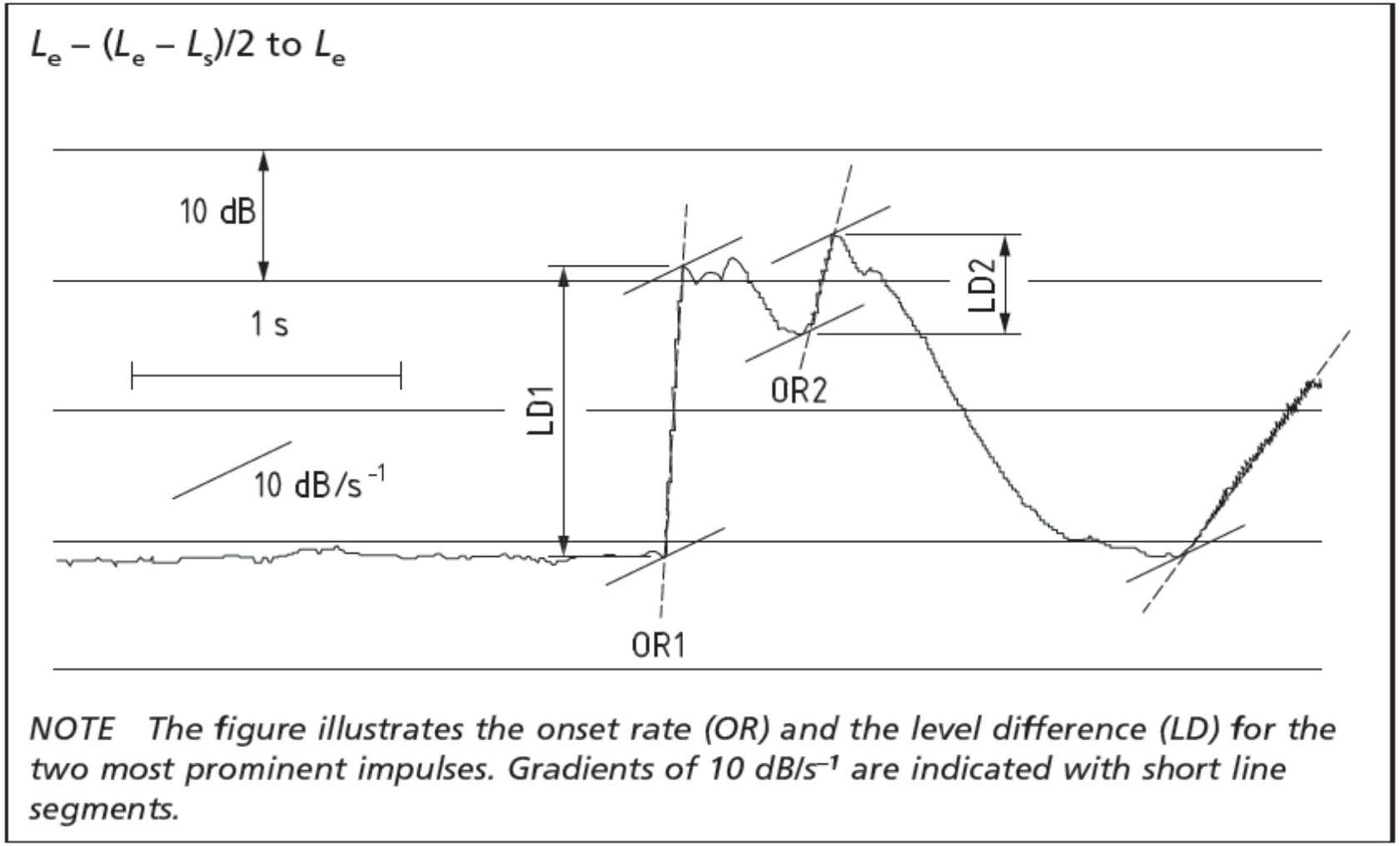
- 3dB –Just Perceptible
- 6dB –Clearly Perceptible
- 9dB –Highly Perceptible

Objective – Nordtest Method (complex)

- The 10ms-25ms A SPL are reviewed
- Difference between start and end of impulse used to calculate the Onset rate. This is turn is used to calculate the Prominance and in turn to calculate Penalty between 0 and 9dB.

Impulsive Correction – Annex E

Time history of the A-weighted sound pressure levels with time weighting F



NOTE The figure illustrates the onset rate (OR) and the level difference (LD) for the two most prominent impulses. Gradients of 10 dB/s^{-1} are indicated with short line segments.

Impulsive Correction – Annex E

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Table E.1 **Examples of the prominence *P* and the adjustment K_I for different sound sources**

Sound source	L_{AFmax} dB	Level diff. dB	Onset rate dBs	Prominence *P*	Adj. K_I dB
Background sound $L_{PA,F}$ = 40 dB					
Tyre change, pneumatic tool, L	48	7	38	6.4	2.6
Tyre change, pneumatic tool, H	67	17	76	8.1	5.5
Compressed air release, L	48	9	65	7.3	4.1
Compressed air release, H	67	27	140	9.3	7.8
Metal hammering, L	54	15	194	9.2	7.6
Metal hammering, H	75	35	222	10.1	9.2

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Impulsive Example

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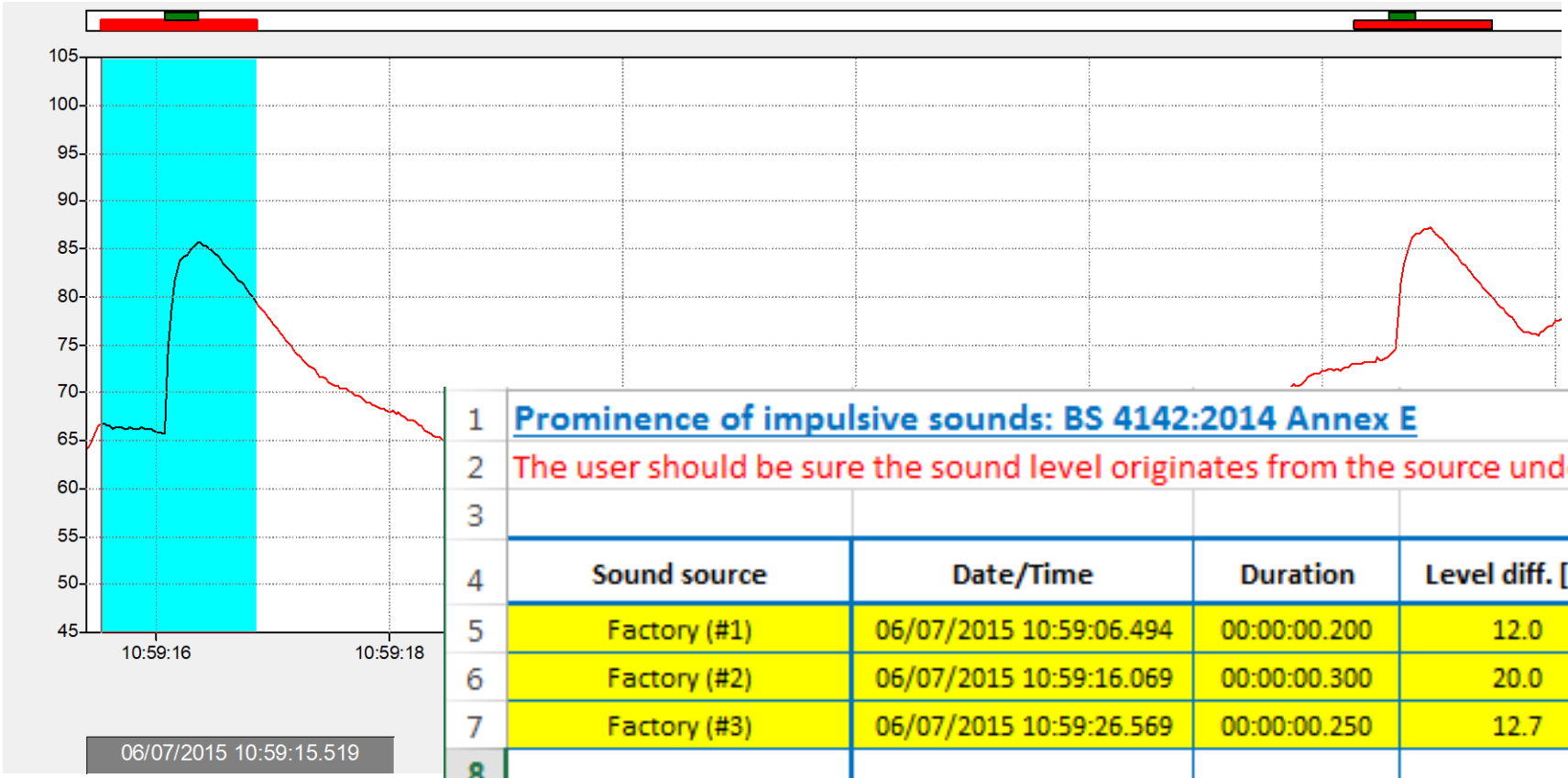
Impulsive Correction – Annex E

Objective – Software Calculations



Prominence of impulsive sounds: BS 4142:2014 Annex E

The user should be sure the sound level originates from the source under investigation before applying penalties

Sound source	Date/Time	Duration	Level diff. [dB]	Onset rate [dBs]	Prominence	Adj. Ki [dB]
Factory (#1)	06/07/2015 10:59:06.494	00:00:00.200	12.0	77.2	7.8	5.1
Factory (#2)	06/07/2015 10:59:16.069	00:00:00.300	20.0	53.7	7.8	5.0
Factory (#3)	06/07/2015 10:59:26.569	00:00:00.250	12.7	66.1	7.7	4.8

Applying Corrections – Caution

- Corrections are cumulative and can be large!
- Software calculations are very useful when justifying penalties…..
- Be careful when running the calculations that they are on the source under investigation!

Prominence of impulsive sounds: BS 4142:2014 Annex E
The user should be sure the sound level originates from the source under investigation before applying penalties

- Bird song nearby is tonal and impulsive.
- Record audio in parallel with measurements so you can be sure what you are analysing.

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Notes

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