Institute of Acoustics

VARIABLE TIME COMMUNITY NOISE LOGGING

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INTRODUCTION

Noise logging instruments require great flexibility. The instruments might require attended operation to gather data of certain types of noise such as diesel trucks, or unattended operation to pick out disturbing noises in the night. Average information such as Equivalent Sound Level (Leq), Time weighted Sound Level (Ldn), Sound Exposure Level (SEL), or statistical levels (Ln) provide only gross information. However, instruments which gather huge quantities of data often require extensive computer programmes to present the information in an understandable way.

This paper will examine two instruments, one, which in addition to calculating information such as Leq, Ldn, SEL, Ln, statistical distribution, and peak, maximum, and minimum levels and times also provides variable time histories of short term Leq, peak and maximum levels. Extensive editing capability is included so data can be edited directly on a printer. While a computer interface is provided and can be very useful for a skilled operator, it is often not necessary to use this to get an edited printout.

The second unit only acquires data which then is transferred to a computer for analysis and is called a 'data logging Leq meter', This can store up to 114,000 separate data sets in it's internal memory as a stand-alone unit. With this large number of measurements, a computer is required to readout the information. All the data that we can present with the editing unit can be produced to a greater resolution. However, with the data logger, the penalty is complexity and the total reliance on a computer instead of a simple printer.

We hope to show, how these instruments can fit together in a measurement environment, giving two possible routes to a particular measurement task.

TIME HISTORY PROBLEMS

Microprocessor based instruments are capable of storing thousands of individual values. Storing 24 hours of 1 minute Leq, peak, and maximum levels is no longer a problem. The problem is printing out the resultant 4320 values. At one value per line it would take over 65 pages of paper. Even combining data to 5 minutes per line, still requires 13 pages. If non-essential data is compressed into 1 hour per line, the printout can be reduced to a little more than one page. Naturally however, interesting data could be lost.

The instrument could also be pre-programmed to store time history data into 5 or 10 minute intervals, but then much of the short term data would be lost.

Since pre-programming the instrument is not acceptable, a means is required to edit the data, either as it is accumulated or when it is printed. Algorithms can be developed which compress data when it is collected. This works well for specific cases but, in general, is not quite what is desired. For general use it is better to collect as much data as possible and edit it as required.

The problem then becomes, how best to edit data. An external computer can be used for the editing and we will present an instrument to do this. It is however, often simpler and more convenient to edit the data directly on a printer. The first unit we present, demonstrates a method of data editing to a printer, while the second makes no attempt to print the data and leaves all the measurement task to the external computer.

VARIABLE TIME HISTORY PRINTOUT

If the time history is stored in the instrument with high resolution such as every 10 seconds, but, is printed at 10 minutes per line, then a complete days printout could be only 1 or 2 pages long. If 1 minute histogramme data was stored, it could be printed at 1 hour per line. The result would be that 24 hours would only take 24 lines. If finer resolution is required at certain times, the printout can be changed while printing to increase the resolution over a particular period.

As an example, if the noise was excessive between 1600 and 1700, the printout could be 1 hour per line outside these times but print out a 1 minute histogramme for that 1 hour. If this is done during the printout all that is required is to press the 1 minute key when the printout reads 17:00 and to shift back to 1 hour per line at 17:00.

TRAFFIC NOISE EXAMPLE

A 24 hour survey of traffic noise on a residential street was done using a Quest M-28 noise logging dosimeter, the first unit we present. One minute histogrammes were accumulated plus data for Leq, Ldn, Ln and percentile calculations. At selected times, separate events were stored. After 24 hours, the total printout was 6 pages long. The data was then edited to show 1 minute histogrammes during the busiest half hour, 5 minute histogrammes for the rest of the time between 0700 and 1800 and 1 hour per line at night. This compressed the time history to 1 page. The summary, the events and Ln's took another page. This was done using only the M-28 and a printer, no computer was required. Since NO data is lost during a printout, additional printouts may be made to illustrate different features of the noise.

Up to 16 separate events can be stored during the time histogramme. The event function prints out 11 different values including Leq and SEL. Perhaps the most useful is the Exposure in Pascal squared seconds. If the exposure is multiplied by the number of similar events, the total contribution of similar events can be estimated. The time histogramme and the Ln's are useful in determining the number of similar events. Subtracting the exposure from the total exposure shows the results if certain events were eliminated. If the exposure is reduced by 50% the Leq will be reduced by 3dB.

AIRPORT NOISE EXAMPLE

A time history was taken near an airport using the M-28. The unit was set for 10 second histogrammes of Leq and maximum levels. Specific data was gathered on certain types of aircraft. A threshold could have been used to show only noise above the threshold level to better estimate disturbing noise.

A complete printout for six hours was 14 pages long. When the data was compressed to show 10 second data for a representative hour and 10 minutes per line for the rest of the day, the printout was less than 3 pages long.

The percent time distribution also showed the time at each level. This was done without the threshold and shows the actual percent time at each level. Ln's, of course, are also done without a threshold. Since the only instrumentation required is a noise logging dosimeter and a printer this may be a very cost effective method of gathering data, particularly for small airports. If the same data were taken by the CRL 2.36, the actual printout is only decided at replay time.

COMPUTER INTERFACE AND THE DOSEMETER

The raw data stored in the M-28 can be dumped into a computer. It is then possible to edit and recompute the data as well as save it for later processing. As an example, it is possible to set different thresholds and compute sound exposure levels on noise above the threshold. However, for most applications, a computer is not necessary and the data can be edited directly on a printer. If data is required to be computer manipulated, both Quest and Cirrus can provide programmes which can do this. In principle, the same programmes can be used with both the M-28 and the CRL 2.36, but as of this time commercial release has not taken place.

SHORT Leq METER

Using the concept of computer data storage, instead of the internal processing of the type used in the M-28, we can store the data as a series of Short Leq values. If this is done, as in the second unit we present, there is no possibility of using a printer to edit or dump the data. If a simple data acquisition unit is used such as the Cirrus Research CRL 2.36, the data must be transferred to an external computer for analysis. While this is much more powerful in many ways, it does not have the same ease of use as the semi "in-box" processing of the M-28. In Short Leq, the resolution, that is the minimum time that can be measured, is usually much shorter, down to 125 milliseconds. This means that for a very impulsive signal, data may have more meaning with the shorter time interval. As a direct corollary, the amount of data becomes more in direct proportion. It would therefore require many hundreds of pages of printout to read a simple event.

Thus, for a given noise event, a choice is possible. If the form and type of noise is known to a rough order and simplicity of manipulation is desired, the M-28 will produce results, more cheaply and more quickly than will a data logging meter such as the CRL 2.36. Also, as the M-28 is small in size, it can be body worn, the CRL 2,36, being much bulkier, cannot easily be so used. However, if the maximum possible data is to be collected and little is known of the form and type, then the CRL 2.36 will produce data, if it is possible within the technology.

SUMMARY

Microcomputer based equipment is now available which can store thousands of data sets. A computer can be used to reprocess the data, or it can be edited directly on a simple printer, costing less than £100. Battery powered printers can process the data directly in the field to assure valid data at the time the data is collected. Alternatively, data can be simply stored inside the Leq meter for computer analysis later. Both the units we describe can produce data which only a few years ago was not possible with battery operated field instruments. Taken together, they form the basis of a practical measurement system for the real world of practical measurement.