SAFE & SOUND

The new IS-mini intrinsically safe sounders and beacons fill the gap in the audible output level spectrum, says Peter Fay of E2S. Here he explains the thinking behind their development.

THE ORIGINAL DRIVING FORCE FOR THE development of the IS-mini family by E2S was the identification of a gap in the market for a small, intrinsically safe sounder with an output level of 100dB(A). The importance of the output level cannot be over-estimated, because if the sounder layout is based on a false assumption of performance level, it will not effectively carry out its only function, alerting people of danger once a hazard has been detected.

Once the original sounder development project was underway, the logical extension, given the current trend for reinforcing an audible warning with a visual one, was to produce an LED beacon. Given the energy limitation inherent in using Zener barriers or galvanic isolators, this would be far more effective with a much brighter output. It was then only a further short step to develop the first intrinsically safe combined sounder and beacon unit, potentially providing major system cost savings as the unit can be powered from a single Zener barrier or galvanic isolator.

There are three variants in the family, all of 89mm diameter cylindrical construction: the IS-minialarm (100dB(A) sounder), the IS-minialite (a beacon using an array of 6 high intensity LEDs) and the IS-minialert (a combined unit with the LED beacon mounted in the centre of the sounder horn). The design features a common base fitted with two 20mm cable entry knockouts; the device itself is fitted to the base using a bayonet latch mechanism and a separate security screw. The units have obtained an EC Type Examination Certificate from Sira for compliance to the ATEX directive, and can be used in Zones 0, 1 and 2 and Gas Group IIC application. Testing to EN54-3 for compliance to the CPD directive is underway.

Potential applications for the units are extremely diverse: the obvious onshore and offshore petrochemical industries are joined by the increasing number of industry sectors where Zone 0, 1 or 2 manufacturing environments exist: pharmaceuticals, food manufacture and the cosmetics industry are but three examples. In such environments, the IS-mini range will either be fitted to equipment within the facility, or it will form part of the fire and life safety system protecting the hazardous area inside the plant itself. Low current draw and high output make the units particularly applicable for use in fire systems installed in hazardous areas, and for integration into process control equipment in a wide variety of manufacturing industries.

The effectiveness of a sounder is highly dependent on the frequency of the tone being generated. The efficiency of the transducer is frequency dependent, as is the attenuation of the generated sound, on distance. The convention followed by most manufacturers is to state a dB(A) output level at 1 metre. But specifiers should carefully read the small print in the specification, because in a multi-tone sounder, the dB levels of the various user-selectable tones of different frequency can vary dramatically. In general, for lower frequency tones of less than 1000Hz, the lower the dB output level, and for higher frequency ones – greater than 1000Hz and therefore not BS 5839 compliant – the higher the dB level. Given that sound is a pressure wave, it is not difficult to see that to convert electrical energy into sound is less efficient at lower frequencies, because the transducer has to move larger volumes of air to achieve the same sound pressure level. The attenuation factor with distance is also frequency dependent with the attenuation slope steeper at higher frequencies: in everyday life, this is why one only hears the

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bass notes from a loud source of music some distance away. The other consideration to be taken into account is the tolerance specified for the output level: 3dB makes quite a difference.

In the real world, the rule-of-thumb inverse square law can be confidently used to plan the sounder layout. It is quite simple – every time the distance from a sounder doubles, subtract 6dB from the output level (see chart for a handy reference).

BS5839 Part 1 states that the effective range of a sounder is when the calculated dB(A) is at least 5dB above the known ambient background noise. For example, the effective distance of a 100dB(A)@1 metre sounder in an ambient of 65dB(A) is 32m, the distance at which the sounder output level reduces to 70dB(A): 100dB - 30dB = 70dB. Compare the effective distance, 32m, of a 100dB(A) sounder with that of an 88dB(A) unit which, from the table opposite, is 8m giving an area coverage 16 times greater with a 12dB difference in output level – hence the importance of the output level against frequency. But high output sounders should not be used in low ambient noise areas nor as a means of 'drenching' the area in sound – alarm systems that are too loud may be dangerous, cause panic or discomfort, and make communication very difficult, impeding evacuation procedures. The overall alarm level should be a maximum of 10 to 15dB above the ambient background noise.

In the open, sound will spread in all directions but in an enclosed space some of it will be reflected, giving an increased sound level. The closer a wall-mounted sounder is positioned to the ceiling, the more sound will be reflected. For a ceiling mounted unit, the reverse is equally true, while a sounder mounted on a wall is more effective than when mounted on a pillar. Sounders should be sited so as to avoid immediate obstacles and at an ideal height of 2m to 2.5m, while synchronised sounders give a more effective overall effect.

Many countries, such as Germany, France, Holland and Australia, have a national 'evacuate tone' but the UK does not. The relevant standard for fire alarm systems – BS5839 Part 1 – merely states that the evacuate tone should contain frequencies within the range 500Hz to 1000Hz.

In offshore and other hazardous installations PFEER (Prevention of Fire and Explosion and Emergency Response) regulations apply. In summary, these regulations state the person or company responsible for an installation is also responsible for protecting people on the installation from fire and explosion, and securing effective emergency response.

This implies many requirements, one of them being that a suitable means of informing people on the installation of certain alarm states (with sounders and or speech/PA systems, beacons may also be required to supplement the audible signals). There must be provision for three types of alarm on the installation/platform:

1. **Prepare for evacuation**
2. **Toxic gas (also where necessary red beacon/strobe)**
3. **Other cases for alarm (fire) (also where necessary yellow beacon/strobe)**

Audible tone patterns for relevant alarms may be specified by a number of standards or authorities, for example UKOOA (UK Offshore Operators Association Ltd) and IMO (International Marine Organisation).

The IS-minialarm

The IS-minialarm offers a choice of 49 tones and three alarm stages, making it one of the most versatile units on the market and enabling it to be used in nearly all applications throughout the world. Its output is rated at 100dB(A) at 1 metre, and specified as having an effective range of 40m at 1kHz. The sounder has a volume control so that the output level can be reduced if a lower level is required. It is extremely efficient, typically drawing 25mA from a 24VDC supply when powered through a 300 Ohm Zener barrier. Sealed to IP65, the units are physically compact with a diameter of 89mm and a depth of 99mm. Nevertheless, there is plenty of cable room in the base of the unit, accessed via two M20 cable entry knockouts.

A beacon or strobe visual indicator is a luminous source within a coloured transparent enclosure and is used in many applications, primarily as reinforcement to an audible signal in the event of danger. A beacon should never be relied on to give an evacuation indication without an audible alarm; it should always be used as reinforcement to an audible evacuation tone.

All round light dispersion should be the first consideration when installing a beacon. Particularly important with filament bulb beacons is to avoid vibration, and the latest high intensity LED beacons are more robust. Light travels in straight lines, so the beacon will be far more effective if positioned in the line of sight rather than relying on reflections. The perceived brightness of the beacon is dependent on the intensity of the light source and the lens colour of the visual signal; as a rule of thumb, the intensity of a beacon is reduced by 25% when the viewing distance is doubled.

The IS-minialite beacon uses an array of ultra bright amber, red, blue or green LEDs to produce a selectable 1Hz or 2Hz flashing warning signal, giving a far brighter and more noticeable visual warning than traditional intrinsically safe Xenon tube beacon alternative in a hazardous area. High output LEDs have a number of advantages over alternative

technologies: they are mechanically robust, highly efficient at converting electrical energy into light and draw very little current, enabling their full output to be achieved when powered via a Zener barrier or galvanic isolator.

It is becoming increasingly common for specifications to call for both sounders and strobes to be used to provide the best possible warnings of emergencies. Obviously, independent units can easily be installed, but combining the two devices into a single housing will reduce equipment and installation costs quite considerably. The IS-minialert has the beacon unit mounted in the centre of the sounder so, apart from a slight increase in depth to 116mm, the device is identical in size to the stand-alone sounder or beacon unit. The main advantage is that advanced electronics and an acoustically efficient folded horn design means that the combined unit can be powered though a single Zener barrier or galvanic isolator.

Sounders are the primary mechanism for alerting people in the event of an emergency; the main job of the system designer is to ensure that the audible and visual output levels are adequate throughout the protected area. The IS-mini family is a cost-efficient addition to the intrinsically safe sounder and beacon sector, filling an existing gap in the market and providing system designers and OEM equipment manufacturers the opportunity better to match the outputs levels to the requirements of the operating environment.

SOUNDER DISTANCE CHART

Distance m	Reduction dB
1	0
2	6
4	-12
8	-18
16	-24
32	-30
64	-36
128	-42
256	-48
512	-54