ISCE

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Institute of Sound and
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Autumn 2017

ISCE

Inside this issue

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Introduction from our President

Welcome to our Autumn 2017 edition of the ISCE magazine.

I hope you all enjoyed the summer and your holidays. The weather has certainly been a 'mixed bag'. Now the evenings are drawing in, I hope you will find time to have a good read of this edition. You will find again, some interesting technical articles, plus some alternative viewpoints, provided by our contributors.

If you have ever thought of writing a feature, why not consider this for our future publications? We also welcome stories of interesting projects and you can contact Ros to discuss this.

Your Council and Secretariat have been really busy over the Summer months. The ECS Card Scheme has got off to a positive start, with a number of members and indeed, new members, sitting the Health & Safety exam and they are now proud recipients of their cards. At the recent PLASA London Show, we received outstanding interest for new membership, which Ros and our Membership Committee are now following up.

You may remember that in the Summer magazine, I mentioned that we are introducing a new 'cloud-based' membership database. Well, the 'behind the scenes' work on this is moving forward really well. We are now working on the new Members' Access Portal. This portal will also allow registrations for our events in the future and we hope that the first major use of this will be for visitor registration for ISCEx 2018. We will keep you all fully informed when this is ready to go live.

As President, I am really pleased to announce that our Directors and Council have unanimously agreed to the investment in the creation of a brand new ISCE website.

Work has just started on this long-term project. The new site will be a central focus for all ISCE activities – going forward. Eventually it will offer a 'Centre of Technical Learning' for our industry. The site will also offer 'E-Commerce' facilities through the Members' Portal for subscription payments, event registration and relevant payments. The site will 'go live' in stages – hopefully before the end of this year, with sections being added throughout 2018.

The site will also be tablet and smartphone friendly and there will be a new focus on more up-to-date industry news within the site.

ISCE will again be present at the 'BPM/Pro' trade show at the NEC on 22 and 23 October and we look forward again to seeing some members at this event.

The exhibitor list is continuing to grow for ISCEx 2018 and it is time to consider booking a table for the ISCE Networking Dinner on the eve of the exhibition. Please look and register for this on the dedicated ISCEx website – **www.iscex.org.uk** ◆

Phil Price

Forthcoming events diary

18–19 October 2017
The Showman's Show
Newbury Showground, Newbury, UK

20 October 2017
ISCE ECS Card Health & Safety Assessment Day
House of Commons, Houses of Parliament, London, UK

22–23 October 2017
BPM/PRO
Genting Arena, NEC, Birmingham, UK

21–23 November 2017
Reproduced Sound 2017
Nottingham Conference Centre, Nottingham, UK

6 March 2018
ISCEx 2018
Networking Dinner
Coombe Abbey, Nr Coventry, UK

7 March 2018
ISCEx 2018
Exhibition and Seminar Day
Coombe Abbey, Nr Coventry, UK

We welcome your contributions to the magazine with editorial and advertising.

Please send news or articles to **Ros**

The government tender

By Roland Hemming *MInstSCE*

Thank you for wishing to apply to work on this Government Project. We use a streamlined procurement process to make the process easy.

This tender is for the supply of services of audio systems, lighting, video, staging, cleaning materials, transport, security barriers, equestrian equipment and services not limited to, but limited to those mentioned above.

Fill in this form online using black ink only. You may access instructions for completing this tender any time by leaving this page and going to the following LINK.

DO NOT LEAVE THIS PAGE WHILST FILLING IN THIS TENDER or the systems will reset and you will have to start again.

If you are a framework services supplier please fill in sections 1 to 13, 27 and 31 to 57. DO NOT fill in sections 24 or 27. Fill in the final sections in reverse order.

If you are a specialist services provider fill in all other odd numbered sections, except those where you are not permitted to do so (where applicable).

To ascertain whether you are specialist services provider or a framework services provider please consult the UK Government advice note A2457A, unless your company was incorporated before July 1992.

Your team

For each key team member working on the project please give full name, date of birth, gender, hair colour, collar size, religion, details of both relevant industry and non-industry experience, work on other UK government projects except UK dependant territories, UK territorial territories and UK Crown dependant territories. Include full career history, education, qualifications, dietary requirements, hobbies and any awards or citations, except those exempt under Regulation 47R

Please do not include CVs as these contain unnecessary information and your application will be deemed invalid and you will not be permitted to submit further tenders for a period of five years.

Your personnel data must match the total of essential staff (non-critical) and critical staff (non-essential) that you entered in 14 J and K. If staff numbers do not match, this form will reset and you will have to start again. →

Company profile

You may upload a profile document outlining your company services. This must be in portrait mode with margins no less than 1.1 inches on the left and 18mm top and bottom. Print must be visible in 300 LUX at a distance of 38cm. Provide evidence of readability.

Acceptable formats include PaperClip, Locoscript or Gobe.

Microsoft Word or PDFs will not be accepted due to security concerns.

Project data

For your convenience, project data is available from the following FTP site. The download is 950GB and contains 37,500 documents. All project documents are in one ZIP file. The files use a coded naming system with no sub folders. The download includes ceiling plans, floor plans, sections, plumbing details, wall colours, carpet swatches, network diagrams, sketches, satellite photos, rejected drawings and obsolete designs.

Please review the appropriate documents to enable you to price this project.

Legal

Please detail any legal action or contract infractions during the course of your business over the last 25 years. This is not limited to civil and criminal proceedings, liquidated damages, parking tickets and speeding fines by any member of staff either during the course of their duties or outside.

Financial information

Please include financial statements since your company was founded. Sections 103 to 107 include projected income and profit for the next twelve years with full evidence of those projections.

To indicate company stability you must demonstrate a margin of at least 15% on each project that you carry out.

Provide insurance certificates for public liability, products liability, insurers liability, professional indemnity. We require a minimum cover on all policies of £500m.

Small businesses (those with a turnover of less than £3.6 billion) may apply for an insurance exemption reduction by applying to the Department of Trade in writing.

Pricing

Bidders must demonstrate a margin of no more than 5% on all items.

We require assurance of a 15-year warranty on all items, including consumables.

List all project items with product name, Amazon link, quantity, price, colour, country of origin, weight (boxed and unboxed), power consumption, instruction manual, datasheet, 3D drawings, heat output, dimensions, materials used and means of disposal.

Failure to include all product information will render your submission invalid and you will be barred from applying from all UK Government tenders for a period of no less than fifteen years.

We require that you keep the pricing given in this tender valid for a period of 36 months.

Adherence to standards

This project complies with BS 7829, 7830, 81930 (withdrawn), EN 6000027 parts 1 to 14, the Department of Trade Purple guide and the Ladybird Book of Sound Engineering.

Please provide evidence of ownership of all relevant standards including any future standards and draft legislation.

This page will expire in 15 minutes. Failure to fill in the entire tender in the time available will result in the systems being reset and you will have to start again. ■

With apologies to Bill Bryson

Acoustic investigation and development at Kingsley Hall, London

By Sound Systems UK Ltd

Kingsley Hall is an active centre with a long and illustrious history of community and humanitarian events and support; it offers a multi-function performing space that is used for music events; both acoustic and amplified, worship, readings and lectures.

In early 2017, we were invited to a meeting with the trustees at Kingsley Hall to experience and then discuss the prevailing acoustics within the Hall that had long been proving difficult, particularly in respect of speech presentations.

During our discussion, which was held in the hall, it was clear that for a space of relatively modest proportions, the reverberation was considerable and that there were many acoustic reflections that were destructive of speech for listeners that were also causing difficulty to readers on the stage with or without reinforcement from a sound system.

The building

The hall is of a very substantial brick construction as one might expect from a building completed in 1928; it is rectangular in shape being 13.7 metres from the rear wall where the entrance doors emerge to the stage step and it is 9 metres wide.

Whilst the ceiling is flat and of a height of approximately 5 metres, a quarter circle arch having a significant radius is formed at the meeting of the ceiling and side walls and to the rear of the stage is a quarter dome below which is housed a statue of Mahatma Ghandi in celebration of his association with the hall.

Clearly, the precious nature of the interior would preclude any changes from being made to those radius surfaces.

Our method of approach

Following our discussion it was quickly acknowledged that we should investigate and calculate the high level of reverberation and to identify the most destructive of the room surfaces with a view to bringing about the most economical improvements.

We therefore commenced measuring the interior and recording the surface materials so that in the traditional fashion we could use this data in order to work with the appropriate formulae and to arrive at the prevailing RT60 i.e. the time taken for sound intensity to fall by 60dB

Referring to the internationally accepted charts for coefficients of absorption and then inputting that data into our equations we were able to establish that the reverberation time within Kingsley Hall was between 3 seconds and 4 seconds: clearly an excessive figure for a room of modest proportions when used for speech or amplified music applications.

Solution

Taking into account that when talking from the stage, reflections from the rear wall were clearly and unhelpfully audible and also that opportunities for installing acoustic treatment on other surfaces were limited; it was decided to propose covering as much of the rear wall as possible with acoustically absorbent panels of as significant depth as possible in order to maximise effectiveness.

This approach was intended to achieve maximum cost and acoustic effectiveness with minimum intrusion into the aesthetics of the interior whilst still leaving the potential to further reduce the reverberation by installing additional panels if that should be required.

We calculated that a mix of panels 90cm x 60cm and 90cm x 50cm would enable us to arrive at a pattern which fitted within the arches, doorways and windows while a panel thickness of 75mm was selected to maximise absorption.

A sample panel was then produced in the client's cloth covering of choice and following approval, twenty panels in total were ordered and installed; eight on each side of the entrance and four above.

Immediately following installation it was clear that the reduction in reverberation and destructive reflections had been entirely successful with all communication being much easier and less tiring than before in the untreated hall.

Our calculations indicate that the RT60 has been reduced to somewhere less than 2 seconds and so there is still potential to introduce additional treatment if required subject to a period of trial to enable the large variety of events to take place ranging from speech to choral before making that decision – all subject to 'feedback' from audiences and performers we await comments. ◆

www.soundsystemsuk.co.uk

David Boxall FInstSCE becomes the first recipient of the Warren-Barnett Technical Innovation Award

David Boxall's career in the PA industry spans more than 45 years and for the past 35 he has been the 'Boxall' in Baldwin Boxall. Prior to setting up the company with Terry Baldwin in 1982, David was principle electronic design engineer at Millbank Electronics having started out on his audio career path with Sound Diffusion and germanium transistors.

During his career, David Boxall has designed many innovative products for the public address industry, ranging from 100V line amplifiers, hearing loop amplifiers , PA&VA system surveillance monitoring units to automatic ambient noise sensing and level adjustment circuits to the latest digital signal processing and routing units.

Although perhaps one of the more senior audio engineers in the country, David Boxall is still very much hands on and actively involved with the technical direction of the company. David Boxall, having spent a lifetime dedicated to the technology of the PA industry, was nominated by Peter Mapp to be the ideal first recipient of this new ISCE award.

David Boxall thanked everyone at the ISCE who was involved in organising and presenting the award to him. He said: "I am thrilled to receive this award - it was totally unexpected. It is a real honour to receive recognition for my work, especially as it is linked with Hayden Warren and Peter Barnett, both of who I knew well and held in such high esteem." ◆

Peter Mapp HonFInstSCE (left) and Doug Edworthy HonFInstSCE (right) present the award on behalf of ISCE, to David Boxall FInstSCE

Loudspeakers and not-so-loudspeakers

By Joules Newell *MInstSCE*

Most people, when choosing a loudspeaker, have great interest in knowing if it will be loud enough for the intended purpose. When a project is budget conscious and must meet mandatory specifications, it is essential that the specifier of the equipment chooses the most appropriate unit for the purpose. Manufacturers often provide this important information on product specification sheets and many products are chosen based on this data. This seems a simple process, yet many systems-engineers have fallen at this hurdle at some point in their career. So why is this simple process so fraught with danger? Well it all comes back to that same old evil: marketing. If we are to be kind we could call them untruths, but it is almost universal that the specifications of how loud a loudspeaker will go are simply not true. In fact, it is often far from true; and occasionally written to deceive.

But surely, it is simply a question of a manufacturer putting a loudspeaker in a measurement-rig and turning it up until it goes no louder, or fails, then recording that result. Well, yes; that would be a relatively certain way of knowing some of how it would behave, but it is also not very useful as a measure for what the loudspeaker would do. The loudspeaker may well be sounding abominably horrible at that level, and the output may well not be what we would consider useful. Manufacturers have generally settled on a 'cheat' figure because it gives the best-looking number, and as we all know, in selling speakers, 'louder is better'.

Unfortunately, manufacturers do know that the specifications they publish are not truthful, or at least in the spirit of truthfulness. Why is this? Well, what manufacturers do is usually take a half-space response and a measured-on-axis sensitivity figure, recorded over some often-arbitrary bandwidth, and apply a simple calculation intentionally 'mis-assuming' that this all rises linearly with power-input, all the way to the AES program maximum power rating, before catastrophic damage. And that is it! That is all they usually do. However, as manufacturers know, there are significant factors that make this calculation incorrect, and not just by a few decibels here and there – it can often be as much as 10dB, or more, away from the specified number. This is huge, and certainly enough to cause a system to fail a compliance-test to a point where tweaking will not bring it into compliance.

So where is it going wrong?

Where should I start? Let us start with our old enemy, power-compression. Power compression is a nasty horrible thing, it steals our valuable amplifier power away from us as we go louder. Power compression is a simple function of voice coil temperature increasing with input power, and voice coil resistance increasing with temperature. As the voice coil resistance increases, the coil presents less load to the amplifier (draws less current) and therefore consumes less power. The amplifier then needs to present a proportionally higher voltage to deliver any increase in power, and therefore, output, but this further increases the temperature and resistance and requires even more input to proportionally achieve any more output. The more you push into the driver, the more it will proportionally suffer from power compression. As a direct-radiating loudspeaker often has an efficiency below 10%, what is not converted to acoustic output mostly gets converted to heat in the motor mechanism, or lost in unwanted mechanical output. Power compression is not simply related to power input, different loudspeakers behave very differently depending on their electrical, thermal, and mechanical properties. It is not a constant figure that can be simply applied to all measurements. ▸

If we look back 20 or 30 years we will see that most high-performance loudspeakers are largely the same as modern high-performance loudspeakers in most mechanical aspects, with the exception of one major property, power handling. The biggest advances in recent years has not been in complex, more-linear motor-technology, but in adhesives and materials. Modern loudspeakers have adhesives that can tolerate far higher operating temperatures, and are made from materials that do not burn or warp until they are substantially hotter. Suspension adhesives have advanced greatly, as have the materials that the suspensions are made from. Other proprietary technologies, like the dual rear suspensions which were used by Gauss Loudspeakers in the 1970s, have become open technologies benefiting many products, and to some minor degree, cooling technologies have advanced.

In most aspects however, the big advance that allows us to drive 2 kW into a couple of grams of copper coil is simply the thermal tolerance of the motor materials; not cooler running coils. We have not really built a better transducer, rather we have actually built a better heater. As the overall moving-mass of many of the high-power loudspeakers has increased due to the more robust materials used, often the sensitivity has fallen relative to their older counterparts. We often find ourselves confronted with a 2 kW loudspeaker that is no more capable of any more output than a 200 W loudspeaker of 1987. (The latter being a lighter, more efficient loudspeaker with a nominal sensitivity in the low 100 dBs, and the former being a heavier, more robust loudspeaker with a nominal sensitivity in the mid 90 dBs, with more power compression.

As amplifier power has become cheaper (at least in terms of the cost of the hardware) we have become more cavalier with its use. More worryingly, many modern, high-tech, lightweight amplifiers are often not even capable of maintaining sustained output to the power that they are rated. It is common to see footnotes to specifications, quietly warning that maximum output is time limited to a very short period indeed.

There have been limited ventures into resolving the power-compression issue, and the Community Professional Loudspeakers, AirForce system, was one notable example. It was a true monster of a system, with drive units that were both fluid and force air cooled. It contained drive units with high-power blower units mounted in the rear of the cabinets, run from multi-stage program-adaptive power supplies. I had the luck to work with this system, as well as on its continued system-development for a period of time. It was incredible to hear what a system virtually free of power compression is capable of.

Is this really such a big problem for a short period of operation?

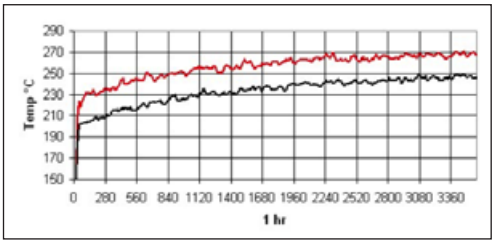


Figure 1 coil temperature against time (seconds) power unspecified. Image – 18 sound

Some question the dynamics of power compression and some claim it takes a while for this to happen, but this is simply not the case. It is exceptionally quick, and a function of some simple laws of physics. It is a matter of a few seconds, certainly not minutes, before any loudspeaker receiving high power levels is well into power compression. How quickly something heats up is a simple function of the power applied, its thermal conductivity, its mass, and its ability to dissipate that heat.

A loudspeaker voice-coil is, by design, a highly conductive material, and being copper or aluminium it will transfer heat very rapidly indeed. Most loudspeaker voice-coils are of only a few grams of mass, so there is little thermal transfer latency in the materials themselves, especially when they are, in their entirety, the source of the heat. We will not see a voice coil take much time at all to saturate with heat. In a high-power loudspeaker of, say, 1 kW, the amount of energy applied is very high indeed, and, considering that the motor efficiency is very low, we see an overwhelming amount of energy driven into a small conductive mass, with only a small surface area to dissipate this heat to somewhere else.

Most loudspeaker voice-coil formers are made from thermally insulating materials, such as fibreglass, Nomex, Kapton, polyimide, or paper, with only aluminium being a thermally conductive material (aluminium, however, being one of the least popular materials due to many of its negative properties).

Most coils are wound on one side of these formers, and thus only one side of the coil is able to efficiently dissipate heat. Inside-outside wound coils have twice the dissipation surface.

We also see significant effects within the motor structure itself. Our only hope is that the voice-coil heat is mainly transferred away by the air, but sadly, in a loudspeaker driver, this is not a great help. Most loudspeaker motors do not have a good flow of cold air to the outside, most simply pump the same old air back and forth, close to the motor inside a cabinet. The actual air flow is therefore commonly very low, and worse still, air itself is not a good conductor of heat, and we need to get a lot of it away from something very small very quickly.

Some loudspeaker manufacturers have turned to ferrofluid for improved thermal conductivity, and in some cases this can improve matters, mainly in lower-powered high frequency drivers. Ferrofluid is, however, not without its own problems. In high powered loudspeakers, the voice coil temperatures can thermally overload the ferrofluid. In this case the coil exceeds the boiling-point of the ferrofluid carrier liquid, and the liquid can boil off leaving a thick, sticky, crystallised deposit in the coil gap. In tests on an 800 W low frequency driver, I managed to vaporise the ferrofluid carrier in just over 5 seconds using music-program at high level. On lower powered midrange units, I observed over time that the high-mid response would deteriorate, even though the temperatures did not greatly exceed the thermal limits of the ferrofluid in such a dramatic way that the woofer did. There, we took to replacing the ferrofluid periodically. Ferrofluid is only useable at temperatures of up to 150° C for long periods, yet many loudspeaker voice coils can reach as much as 300° C before failure.

In many cases, the degree of power compression is related to several factors, such as the power applied, the voice-coil size, the voice-coil surface area, the air-flow and the conductivity of the motor components. Depending upon the power of the loudspeaker and the thermal qualities of the motor, we can often see between 3 dB and, in poorly engineered systems, above 6 dB of loss of output related directly to power compression.

If a manufacturer does not factor-in measured power compression losses to their calculated maximum output figures, then they are hiding some truths. All manufacturers know their loudspeakers suffer from power compression. Some manufacturers even put these figures on their data sheets, but others ignore them completely.

Without knowing exactly what a loudspeaker's power compression figures are, we can usually play safe and deduct 6 dB from their calculated maximum SPL figures to get closer to the actual maximum output.

This is not the whole problem: there is more at the other end of the scale

What is the sensitivity of a loudspeaker, how is it measured, and how should it be measured? Again, we are in a fine mess. A loudspeaker simply does not have a sensitivity figure; but there is more to it than this. Loudspeakers have frequency responses and directivity responses. Both affect the output. First, we must know what bandwidth we need the loudspeaker to work in; and then over what area we need it to cover.

Let's look at the first part here: bandwidth

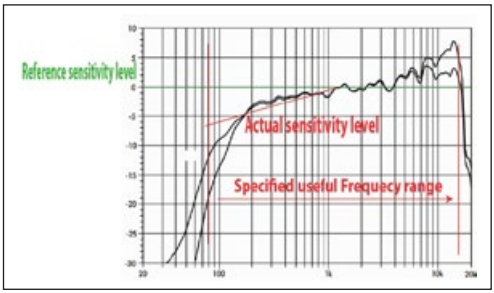


Figure 2 Actual sensitivity in the useable frequency band.

If we know what bandwidth we need the loudspeaker to work in, and what type of program we will be reproducing, we can look at a more accurate sensitivity figure. Will we need to equalise the loudspeaker flat? Will we have important program in a part of the bandwidth that is lower output than the headline sensitivity figure? If the answer to those questions is yes, we then cannot believe the spec' sheet sensitivity figures.

The answer to our sensitivity question is usually the lowest wide-Q sensitivity point on the frequency response plot within the range we want to use the ▸

speaker. If we are thinking of maximum output capacity and we add equalisation or raise program level over significant bandwidth of the unit, we still only have the same maximum power handling capacity, and we have used some of that up when flattening the response.

We will therefore hit maximum power, sooner. Thus, if we add 10 dB at 100 Hz, we reduce the wide-band power-handling capacity by a factor of 10, and our maximum wide-band output by 10 dB, assuming our program has required (flat) content around 100 Hz.

If we take the loudspeaker in the plot in Figure 2 and we want a relatively flat response over the 80 Hz to 1 6 kHz nominal bandwidth, we will have to equalise it to bring the red line up to the green line (and we are being generous here in allowing a little LF roll-off). In effect, we will be adding at least 6dB of boost in the region where the input-signal demands most power from the system (the LF). At a low operating level, we have increased our system bass output, but as we have not increased our power handling capacity, by the time we get close to maximum output we hit system power handling limits 6 dB sooner because of the extra 6 dB we added to the signal to flatten the bass. This is a situation where a high-sensitivity loudspeaker that needs equalising to become flat may well provide less maximum output than a less-sensitive loudspeaker with a flatter useable frequency response. In this case, our maximum output SPL figures completely mislead us. The quieter loudspeaker, on paper, may well be the louder loudspeaker in use.

A single SPL figure is largely useless to tell how loud a loudspeaker will be. We need to look at the frequency response, find the lower points, decide if we need to correct that dip with EQ, and then modify our figures by subtracting the EQ. If we do not EQ we must decide if the dip is in an important part of our program, and if this is so, we must take that dip as the sensitivity figure, not the overall sensitivity. [It is worth noting that in some circumstances we can get away with boosting higher frequencies without impacting power handling as the program material is often lower in power in the high frequency region. One-way or single cone loudspeakers can often take large amounts of HF boost without adverse effect.]

Who needs to hear the system?

So, on to part two: directivity. We have to be careful of where the sensitivity figure was measured, but it is usually perpendicular, on axis, at the point where the output is often highest. In order to see what we really get, we need to see a measured polar plot of the loudspeaker and look at how the on-axis response relates to the off-axis response. The majority of listeners will often be off-axis, so if we have to achieve a percentile coverage figure from a loudspeaker, we will need to know what the sensitivity is over a certain percentage of the directivity plot. If a loudspeaker strongly beams on axis, we could see as much as 6 dB discrepancy between specified sensitivity and, for example, 60% of the specified coverage area. Many loudspeakers have nominal coverage within a -6dB beam width, although a better loudspeaker may only have a 3 dB reduction, but very few indeed will have the full specified sensitivity over a large, useful percentage of their specified coverage.

We should beware, as beaming (narrowing of the directivity) often happens at higher frequencies, and many people assume this to be the case, but there are also other factors. If we take a simple two-way loudspeaker with a 15" woofer and a one-inch-throat horn, we have two points where it will beam. The most obvious being up in the very high frequency range, however, to get a 15" woofer to meet a 1" compression driver is no easy feat. There are few 1" compression drivers and horns that will go low enough to meet a 15" loudspeaker before it is well into beaming, this means that often we see a narrowing of directivity right in the middle of the critical vocal region as well as in the HF. If we are not careful we can find ourselves with low coverage over large areas of our intended audience: it may be covering great at 3,000 Hz, but with little coverage at 1,000 Hz, right where you need it. All this has to be factored into the SPL calculations over the desired coverage area.

So where are we at now, and what does all this mean?

Well, we were told that loudspeaker 'X' had a maximum calculated output of 125 dB at full rated power. Loudspeaker 'X' is a value-engineered product for mass market install, so of reasonably inexpensive construction but impressive power handling capacity. This is quite a common situation. ▸

If we guess it has 5 to 6 dB of power compression when given the 1.5 kW it claims to handle, we can now take the calculated maximum output down to 119 dB.

Now, we look at the frequency response and find a typical average requirement that it needs 5 dB of responsible conservative tailoring, to get it to sound as we want. This EQ (either boosting dips or cutting peaks) will bring us down another few dB depending on the nature of the EQ. Our 119 dB is now looking more like 114 dB – if we are kind.

If we now look at the directivity over the required area and see that our required coverage area is within the -5 dB coverage angles, we can now re-calculate our maximum output again, and our 114 dB has now become 109 dB.

But beware, even at this lower figure there is no guarantee that the loudspeaker is playing clearly, or is free from distortion or other mechanical stress. Power handling figures are often simply endurance tests, and do not require the loudspeaker to remain linear in any useful way.

This is catastrophic!

This is not a minor miscalculation! Many systems specified based on data-sheet figures have failed to achieve anything close to the expected results in the field. For our purposes, over our required coverage area, equalised to sound correct and at full power, what we were told was a 125 dB-output loudspeaker is actually a 109 dB-output loudspeaker over the required coverage area. If we believed the published specification we were hoodwinked. Tests we have carried out have shown that it can be very difficult indeed to get mid-priced loudspeakers claiming 120 db+ max output, outdoors, to output useable actual program material cleanly much over 110 dBa at 1m

From a systems specifier's point of view, it is a minefield, and one that need not exist if only we had a truthful measurement done to an international standard, such as we have for power-handling.

All system specifiers and installers should really be well aware of this issue, yet many are not. In some cases, it can mean a life-safety system falling way short of what is required to function safely. However, in other cases it is 'just' a disappointed customer. Many times, I have seen very-skilled systems suppliers lose tenders which took into account the perceived excessive product-specifications, compared to other tenders which only met the requirements on paper. Those people managing the tenders were clearly blissfully unaware of the pack of untruths within the product specifications. Time and time again, the cheaper tender wins, but the installation then falls short at the commissioning stage, as everyone hides their heads in the sand and re-measures and re-re-measures the system until they can find some trick to make it 'pass'. It can be devilishly difficult to persuade purchasers that the paper specifications are simply not in the real world. After the system is in the air it is always too late to realise.

What can be done?

There is plenty that the industry can do if people choose to raise the issues. While there are good loudspeaker measurement standards like IEC 60268 which could be far better implemented, and there is the ability to raise the issue within societies that influence new more robust standards creation, it first requires an industry wide acceptance that the current situation we have is not acceptable. Manufacturers could be put under more pressure to publish factual, real world measured data, not hypothetical idealised 'mythical' numbers calculated from incomplete data sets. There is plenty of ability within the industry to create new more robust standards irrespective of manufacturer's sales department desires, should an adequate weight of industry members so wish. System specifiers and installers hold the key to the use of properly specified products, we don't have to accept fictitious figures, it would only take a few large contracts to demand the use of products correctly specified to real-world measured standards to stop this nonsense. If the current standards are not adequate it is up to us in places like the ISCE and others to do something about it. ◆

This article is based on separate background work being carried out by SMPTE and AES groups currently looking into why cinema sound systems are not capable of cleanly playing back valid program material in a comfortable manner at reference level despite the program playing back comfortably in the dubbing stage where it was created. People are looking at this problem.

Joules Newell is co-chair of the AES technical committee for cinema sound, and an SMPTE standards member co-chairing groups looking into future standards for cinema audio reproduction.

Minority interests

Should we design sound systems for the average listener or cater for the more discerning or needful?

By Peter Mapp *HonFInstSCE*

As I have often said, you cannot necessarily rely on your own hearing when making decisions about sound quality and performance. Having said that, this is exactly what we have to do most of the time in order to get the job done! Can you imagine a mixing console being simultaneously operated by a 'committee' of three mix engineers at a live event to even out individual proclivities? So whilst we do indeed have to rely on our own hearing, we must be mindful that not everyone is going to be hearing what we hear and will react in the same way. Let me explain a little more about what I mean and some potential implications.

Let's start with intelligibility and required performance standards. Almost universally around the globe, it is now agreed that a sound system used for voice alarm or emergency communication purposes should achieve at least a value 0.5 STI. While there are variations on how this is defined such as an average or minimum values, the target is effectively the same, as this has been agreed to provide adequate intelligibility for the average listener. But what about the non-average listener consider for example:

- Those with noticeable hearing loss (around 12–14% of the population)
- Children – primary school students and indeed those up to about the age of about 14 require far higher intelligibility in order to achieve the same level of speech understanding as adults. For this group the STI needs to be >0.60 to be equivalent to the 0.50 standard
- Non-native language listeners or people whose first language is not that of the broadcast announcement also need a higher STI in order to adequately understand an announcement or broadcast speech. Again typically a value of ≥ 0.60 is required to be equivalent to the target 0.50 STI.

Therefore, if we are designing or setting up a sound system where it is known that such a group may make up a significant proportion of the potential listeners such as an international airport, a church with an elderly demographic or a school, then surely we should be taking this into account? None of the emergency sound system standards, as far as I am aware, cater for these minorities.

While on this particular topic and considering children in particular, does any engineer or legislator ever consider the effect that loud sounds (albeit speech but particularly alarm tones) can have on autistic children? Fire alarms (bells or sirens / klaxons etc.) are designed to be loud and can literally paralyse the autistic – they generally hate loud sound and instead of getting out of the building or danger, will often freeze from panic and remain where they are. This means that teachers and carers have to put themselves in danger by staying with the panicked child and trying to get them out.

But do these devices need to be so loud? The simple answer is NO they don't. It's just that the designer's brief is to make them as loud. I have been in situations where fire alarms have gone off and the noise level was such that I couldn't think straight and was not able to make a rational decision as to where or ▸

which way to go. You just want to get away from the noise – straight into the path of the fire or danger? While on the topic of fire and smoke alarms, has their effectiveness ever been specifically tested with children? The assumption is that the design and test engineers can hear them, so why wouldn't children? Well, if the research had been done, the lives of several children could probably have been saved. An investigation after a domestic fire here in the UK where six children (aged 5–13) died, found standard alarms to be ineffective. In a pilot study over 80% of the 34 children tested did not respond to the standard smoke detector alarms. In the study, only two children woke up every time the alarms were sounded and none of the 14 boys woke at all. Interestingly replacing the alarm signal with the voice of a parent had a 90% success rate. So let me say it again, just because you can hear something it doesn't mean that the intended audience does.

Distortion is another sound system parameter that appears to provide a huge divergence concerning its audibility. I don't know if I am particularly sensitive to distortion – and here I mean harmonic distortion (THD) not spectral or temporal, but I have often pointed out the unacceptability of system due to this. Recently I was discussing a church sound system that, among a number of issues, distorted badly when the radio microphones were used, but no one seemed to be aware of this. Equally, I recall an occasion when listening to a particular loudspeaker with its designer. I needed to establish if the unit could produce the SPL required for a project, so we cranked it up. However, several dB short of what I needed and was being claimed, the sound began to clearly distort and as I diplomatically said 'it was disgusting and totally unacceptable'. The designer looked to be quite offended at my opinion, which I couldn't understand, as clearly the speaker was doing a very good impression of being a square wave generator. Only some time later, when formal measurements were made under anechoic conditions, was it shown that the acoustic output was around 6 dB lower than claimed and at anything higher, the sound was measured to be grossly distorted. The interesting issue to me was that this was a very competent loudspeaker design engineer, many of whose other designs I liked very much, so I could not understand why he was apparently happy with the gross distortion I was hearing. I can only assume that he simply did not hear it.

I also find it interesting to note the difference of opinion that exists as to the correct synchronisation delay that should be used when setting up a system (by this I mean the synchronisation of the sound arrivals from different loudspeakers at a listening position). Haas (of 'Haas Effect' fame) for example found that under a given set of conditions that 10% of the listeners were disturbed by a delay of 42ms whereas the average delay time for disturbance (ie 50%) was 68ms and not until 90ms was the delay disturbing to 90% of the listeners. In a different experiment he found that a delay of 60ms was disturbing to 10% of the listeners but 50% of listeners were not disturbed by the echo until it was increased to 110ms. These are huge differences but this helps explain why I find a given missynchronisation annoying whilst those around me do not hear the problem.

When it comes to setting and optimising (tuning) the frequency balance of a system, then all bets are off and that is a discussion for another time. But until then, just remember that what you are 'hearing' is probably not the same as everyone else and do stop and consider the significant minorities that also may need to listen to your work. ◆

Audio-Technica expands UK professional audio team, aligning with increased commercial application focus

Audio-Technica has announced the recruitment of Jason Williams MInstSCE to a newly-created role as the company's business development manager, conferencing professional audio for UK and Ireland.

Williams' arrival continues the expansion and evolution of Audio-Technica's UK professional audio sales team, following the recruitment of Rich Soper, business development manager for live touring and rental and Tom Macklin, area sales manager, commercial north and Alex Farell's move to commercial sales manager south.

With 27 years of engineering and consulting experience in delivering AV and multimedia solutions across a number of vertical markets, Williams has focused on the conference market for the last eight years. Previous roles include senior positions at Brahler and Taiden, where he collaborated with Audio-Technica, rolling out over 600 UK courtroom installations featuring the company's PRO Series microphones in 2012.

Audio-Technica's UK sales manager Gary Maguire said, "In his new role, Jason will be positioned to offer clients advice and support on commercial projects involving Audio-Technica conference system products and those of its distributed brands in the UK – Allen & Heath, Apart Audio and Artnovion."

Matthias Exner, Audio-Technica director of sales and marketing EMEA professional audio said, "With Audio-Technica's increased presence in the conferencing solutions market, I'm delighted to welcome Jason to the Audio-Technica UK team. He brings a wealth of knowledge and understanding of client needs and I look forward to working with him in further developing Audio-Technica's focus in this rapidly expanding/growing market."

Williams added, "I'm very pleased to be joining Audio-Technica and working with existing and new customers to build its conferencing business in the UK. As the company expands its activity in this area it's an exciting time to be part of a dynamic team, and I'm looking forward to some great projects ahead." ◆

www.audio-technica.co.uk

Everything you ever needed to know about USB, and likely some more you weren't at all interested in

By Martin Bonsoir *MInstSCE*

USB is undoubtedly one of the better known and most used connections. I doubt many devices used to create, edit, or read this wonderful publication lack USB support, and chances are that you have a few USB-enabled devices within reach right now. Nope, I'm not spying, I swear.

Officially Universal Serial Bus, but USB to friends and family, it is a standard (or a series of standards, depending on how you count them) that defines cables, connectors and communications protocols between computers and electronic devices, encompassing both data and power transfer.

Available since 1996, and designed by companies like Compaq, DEC, IBM, Intel, Microsoft and Nortel; USB was conceived to provide a common method to connect peripherals to their host computer. This was a project born out of the industry's frustration with the then-current range of non-interoperable, proprietary and/or aging technologies. Supposedly bitter rivals came together to solve a common problem, delivering an excellent solution that everybody in the industry could benefit from. All hail technology democracy.

Indeed, rather than fence the new standard behind the iron gates of licensing agreements and proprietary hardware, the USB Implementation Forum (USB-IF), a non-profit corporation, was founded to promote, guarantee compliance with, maintain and develop USB in its various forms. USB-IF has many members, with perhaps the most notable being behemoths like Hewlett-Packard, Microsoft, Intel and Apple. Companies wishing to develop USB solutions needn't be a member of USB-IF though, but all USB solutions desiring to obtain a compliance certificate must obtain a Vendor ID. As I wrote recently, the model of open standards maintained by non-profit organisations really can do wonders for an industry.

One could argue USB got its big push when the iMac was released, featuring only USB ports. Others maintain USB had already gained critical mass by then, but irrespective of which product(s) made USB famous, the reality is that it can be found today on devices ranging from printers to laptops, from mobile phones to storage drives, from webcams to professional audio devices. Yes, professional audio devices. And therefore, we have an interest in USB, as it provides a very convenient solution to interconnect computers, laptops and/or mobile devices to installed professional audio equipment, fulfilling the needs created by the BYOD trend, the increased reliance on soft-codecs and cloud solutions and the expectation of the modern user to 'extend the desktop'. ▸

Versions

Each version of USB has provided increase robustness and general improvements, but perhaps the more eye-catching stats are the increases in power delivery and data transfer capability. With version 1.0, USB was capable of data transfer rates of 1.5 Mbps or 12 Mbps (low and high speed modes). Those speeds were maintained in USB 1.1, released a couple of years later.

Nearing the end of 2001, the good people at USB-IF ratified the specification for USB 2.0, increasing the data transfer rate to a comparatively impressive 480 Mbps. This was dwarfed by the 5Gbps maximum capacity of USB 3.0, which was published in November 2008 (although only appearing in mass-marketed devices in 2010).

USB 3.1, released in 2013 and implemented commercially about a year later, brought data transfer rates to a dizzying 'up to 10Gbps'.

Power delivery has also grown from an initial respectable but rather modest 5V at 1.5A, to the current extremely useful 20V at 5A. Yep, a full 100 watts of DC goodness.

It is worth noting that not all USB cables and connectors can support the maximum power delivery. Fortunately, USB standards will prevent excessive power being delivered through a connection, thus avoiding setting your office on fire. (They leave that job to mobile phone and hoverboards battery manufacturers.)

And while on the topic of connectors, another interesting snippet of information is that USB Type-C is a distinct specification to USB 3.1, despite often being bundled together as if they were the same thing. (They were developed almost at the same time and introduced together on several products so we can't be too hard on people, although I do approve of correction as long as appropriate smugness protocol is observed).

Type-C introduced a new, reversible physical connection system intended to replace the various Type-A and Type-B connectors of old. Its scope does not include the many other aspects included in USB 3.1.

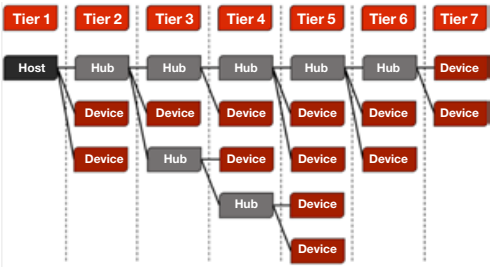
Progress is relentless. As recently as July 2017, work on an improved specification for Type-C cables was announced, and USB-IF is finalising USB 3.2, which will support transfer speed of up to 20Gbps.

Just as with previous versions, these new specifications will maintain one of the great things about USB: backwards compatibility. A host supporting a newer version of USB will happily lower its specifications to cater for devices supporting older versions. Of course, functionality will be that of the older USB standard, but data and power will still flow.

Tiered approach

USB's design architecture is asymmetrical. In any system, there is a host and one or several downstream ports with up to 127 peripheral devices connected in a tiered star topology. USB hubs can provide multiple USB ports, and thus allow for branching. The host often has a hub, known as a root hub.

A USB network permits up to 7 tiers, including the host and the last device. Beyond those limits, things just won't work well. Below is a graph of a possible valid USB network.



While the theory is relatively simple, in practice tiers can sometimes be tricky to count. A physical USB device can be of composite type, consisting of multiple logical sub-devices that provide different functions. For example, a webcam can be a single device, comprised of one video and one audio sub-devices. But there can also be compound devices, having multiple devices inside, each receiving a distinct address by the host, and connecting through a built-in hub. Additionally, sometimes we start our network by connecting to a port in tier 2 rather than straight to the host, and may be using a mix of passive and active hubs (which aren't always counted in the same way). Extenders add an additionally layer of uncertainty, as they sometimes behave as true extenders (transparent to the host and thus to the Tiered structure), but other times they enumerate as a device, and therefore consuming one Tier level. ▸

When designing systems, the recommendation is to keep to as few tiers as possible. But if they start to add up, we will be well served by keeping a close eye on things.

Data transfer modes

USB has a few different data transfer modes. Control and status messages are usually handled through a bi-directional pipe between the host and the endpoint device. But data is transferred through uni-directional pipes that can support three different transfer modes:

- Interrupt transfer modes are used for devices that require fast responses with minimum latency. Keyboards and mice are common devices using this mode.
- Bulk transfer mode is generally used for file transfer, offering the use of all instantly available remaining bandwidth, at the expense of not guaranteeing latency nor sustained transfer rate.
- Isochronous transfers, besides providing a pronunciation nightmare to a non-native English speaker like me, offer guaranteed sustained data transfer rates, without delaying delivery even at the risk of some data loss.

It is very important to note that isochronous mode (together with the other two) is used by devices providing real-time services like video and audio. However, few hubs and switches in the market provide support for isochronous transfer mode, and are thus incompatible with audio devices. In my experience, this is one of the most common reasons for USB problems in professional AV installations.

Classes

USB devices are categorised in classes, based on their functionality. During enumeration, a USB device informs the host of its class, triggering the mechanisms required to get the services up and running. One such mechanism is the load of software drivers, either part of the host's operating system, or provided by the USB device.

There are many device classes defined, covering keyboards and mice, mass storage devices, and hubs, for example. For audio devices, there are three distinct classes, creatively named audio class 1, audio class 2, and audio class 3.

The first two types support generic audio devices, while class 3 is reserved (at least in intention) for powered audio headsets.

The differences between audio class 1 and 2 are mostly centered in the specification they support. For example, whilst class 1 devices usually support up to 24bit, 96KHz audio; class 2 devices are often capable of 32bit, 192KHz.

Channel count also varies. Audio class 1 was defined at the time of USB 1.1, and thus it can ▸

usually manage up to 8 channels each way (24bit, 48KHz), whilst audio class 2 devices can sometimes handle 128 channels in each direction without breaking a sweat.

Beyond that, a very practical difference worth noting is that drivers enabling support for audio class 1 services are included in the great majority of operating systems, whilst class 2 devices almost always require specialist drivers. This is often a major factor when deploying USB audio in corporate environments, when installation of specialist drivers is a cumbersome and unwelcome security risk and management headache. If the capabilities of audio class 1 devices suffice to cover the needs of the user, choosing them over class 2 devices is often the most sensible, if perhaps initially counterintuitive, option.

Cable length and extenders

Another aspect of USB to consider is the maximum supported cable length. It varies depending on the version used, but 3 and 5 (metres) are the magic numbers.

Up to 5 meters is generally fine for USB 1.1 low speed mode connections and USB 2.0, while USB 1.1 full speed connections and USB3.0 are almost always restricted to 3 metres. For the purist amongst you, please note that USB 3.0 doesn't specify a maximum length, but the 3-metre figure is the practical length achievable when using copper cable, in my humble opinion. Use longer cables if you wish, but please do not say I didn't warn you.

These lengths betray the origins of USB: a solution to connect peripherals to a computer. Rather often, customers in commercial applications demand longer reaches, and thus we require the use extenders.

I'm sure no ISCE member would ever attempt to extend USB using a passive method. The sight of a female to male USB passive extender cable should be enough to make any grown person weep.

When choosing active extenders, it is necessary they support the USB version we are attempting to use (is USB 1.1 enough? Maybe we need 2.0, or even 3.0?), and of course, that they allow interrupt, bulk and isochronous data transfer modes. Unsurprisingly enough, cheap unbranded extenders found on the internet do not tend to accommodate such luxuries.

Another common customer request is the deployment of USB switchers. In a commercial scenario, it makes sense that multiple hosts would want to access the installed peripherals. In turn, of course. We cannot be having two hosts in one network if we want to respect law and order.

USB switchers offer a potentially elegant solution here, allowing multiple hosts to be connected to the switcher concurrently, but allowing access to the USB network to a single host at the time. As with extenders, reading the data sheets' small print will greatly assist with the prevention of embarrassment and frustration come installation time.

It's a connected world

USB is ubiquitous and it is almost impossible to work in professional audio without coming across it at some point. Its origins in the world of computing and widespread use in the consumer market may suggest it is misplaced in a professional environment. But it is an extremely robust, very capable, and massively convenient connectivity solution and as such, we will be failing our customers if we are to dismiss it. ◆

Martin Bonsoir MInstSCE is the International Applications Engineering Manager at Biamp Systems, overseeing technical operations globally outside of the Americas. With more than 23 years of industry experience, Martin's passion for people and all things audiovisual continues to add richness and insight to his work every day.

Following the change of ownership in 2016, Penton UK are pleased to announce that they are introducing an extensive range of electronics covering public address / voice alarm (PA/VA) and audio over IP products to complement their established range of PA/VA Loudspeakers.

The addition of these products will allow Penton UK to offer a fully integrated service across PA/VA and audio over IP. The flexibility of products will also give Penton clients a greater opportunity to obtain both product and systems from one source.

Penton's Management Team said "We are delighted to bring this range of ATËIS and Terracom products under our UK wing. The products have shown to be of very high quality and allow us the flexibility to now offer an all in one solution for our customers".

The new range will be available from 1 October and will be stocked and serviced from the UK, ensuring shorter lead times, better availability and technical support.

Notable site references and installations already include Kings Cross Railway Station, Silverstone Racetrack, American Express Community Stadium, ExCel London, London Zoo, London City Airport and The Royal Festival Hall.

Penton UK will be running a series of roadshows in the New Year, in Birmingham, Manchester and London and these will offer customers the opportunity to view products and attend seminars and training. ◆

For more information please contact Penton UK on 01903 215315 or www.pentonuk.co.uk

Installation as easy as 1-2-3:

Bosch introduces LB 20 commercial loudspeakers for indoor and outdoor use with timesaving wall-mount system

The LB 20 series is the latest member of the Bosch family of compact loudspeakers for installed applications. Every aspect of the LB 20 series has been designed from the ground up to ensure efficient installation for the contractor and excellent results for the end-user. The series includes 4-inch, 5.25-inch, and 8-inch 2-way models with a matching dual-10-inch subwoofer, making it easy to select a suitable model a specific space – a new go-to solution for distributed sound systems.

All LB 20 models offer Bosch-engineered components for superior sound quality, low-profile looks and robust reliability for a wide range of indoor and outdoor applications. These include retail environments, hospitality settings, such as bars, lounges, patios, pool areas and restaurants. Conference and meeting rooms, fitness clubs, performing arts and sports venues and houses of worship. The series offers true weatherproof construction for outdoor spaces, confirmed by extensive and rigorous testing above and beyond industry norms. All models are paintable and IP54 certified for weather resistance; an IP65 weatherproof version is available for the 5.25-inch loudspeaker cabinet and the subwoofer models.

The innovative, new wall-mount system makes installation literally "as easy as 1-2-3" – quicker and easier than ever before: Attach the wall-mount (a built-in bubble level saves time) and terminate the cables inside, apply the paint cover to protect the wall-mount until construction is completed (when the cover can be removed), and then simply slide the pre-wired speaker with adjustable arm onto the wall-mount and lock into place. ◆

For more information about the LB 20 series and other Bosch Public Address solutions, visit www.boschsecurity.com

PLASA Show celebrates successful return to West London

The 40th anniversary of the PLASA Show saw its re-focussed direction paying dividends, with an increase in visitor numbers, a sold-out show floor and a 25% increase in the number of audio companies exhibiting. Exhibitors reported continually busy stands and a high quality of visitor across all three days, with a particular increase in the number of international attendees, whilst visitors were pleased with the number of brand new products on show and the content-rich seminar programme.

On the SSE Audio Group stand there was a line-up of new products on display including the recently launched DiGiCo SD12 digital mixing console and Sennheiser Digital 6000 Series microphones, Speechline Digital Wireless conference system and XS Wireless 1 and 2 vocal microphone sets. "We've been exhibiting at PLASA for around 10 years and have built our stand as an audio village. We feature a selection of the manufacturers we work closely with and they all bring their latest technology to the show," says SSE Audio's managing director John Penn. "By sharing a big space and resources, we can display a good cross section of products. We show both competing and complementary technologies, allowing our customers to see the differences between them and no one feels they're getting the hard sell. It works very well." In the audio demo room, visitors could listen to 15-minute demos of a variety of leading loudspeaker systems including Bose Professional's new compact yet versatile ShowMatch DeltaQ line-array system, as well as systems from Aura Audio, KV2 Audio, Shermann Audio and TiMAX.

"This year's Show was a fantastic celebration of 40 years of PLASA and a real validation of our decision to return to West London," says PLASA's Christopher Toulmin, Director of Events. "The show floor was extremely busy across all three days, there was a tangible atmosphere of urgency and engagement and we're delighted with the feedback from both our exhibitors and visitors to the show. Work has already begun on PLASA Show 2018 and we look forward to it with great anticipation." ◆

The AV Awards

The AV Awards took place at the Grosvenor House Hotel, London, on Friday 29 September with more than 1,100 key industry representatives in attendance. The AV Awards recognise best practice, reward innovation and celebrate excellence across the global audio-visual industry. This was the 19th staging of the event and the evening was compered by broadcaster, writer, actor and former MP, Gyles Brandreth. AV distributor, Audiologic was a category sponsor of the event, and was proud to present the award for Audio Product of the Year to Shure for Microflex Advance (MXA), its new range of ceiling and table array microphones.

Andy Lewis, Sales and Marketing Director at Audiologic commented:

"As well as being a thoroughly enjoyable gathering, The AV Awards are an important indicator of technological and commercial progress within the industry. The winning projects and products all set benchmarks and challenge the competition to stretch the boundaries further in pursuit of excellence. Owing to our unique position with Shure - Audiologic is the only UK audio distributor with access to MXA - we're delighted to see them take this well-deserved award for what is an exceptional product, one that is already carving a significant niche in the conferencing sector."

Audiologic itself continues to enjoy sustained growth and is now firmly established as one of the UK's leading audio solutions providers, something underlined by the company's own appearance on the AV Awards shortlist for Distributor of the Year, a category in which it was the Highly Commended runner-up. ◆

More about racks

By Barry Raynaud *HonMInstSCE*
(At one time – Design & Development Engineer at PYE Records, London)

It was with great interest that I read David Howe's article (p.17 Summer 2017 ISCE Mag). I was involved from 1955 to about 1980, in setting up and wiring of the 'standard rack', mainly for sound reproducing, distribution and recording purposes. How do these odd 'standard rack' dimensions come about? They have not altered since the earliest periods of telephone communications of the 1890s. The basic unit is a panel of 16g or 1/16" steel or aluminium, 19" wide and 1.3/4" high. This derived from a row of twenty ¼" gauge sockets, with their fixing screws (6 BA) mounted vertically. With a ¼" designation strip, this gives a minimum panel height of 1.3/4" – known as 1u (one unit).

Regarding the horizontal measurements, the 19" panel has its fixing screws (0BA or M6) on 18.5/16" pitch (=465 mm). The actual 'aperture' varies from maker to maker, but is approximately 17". So with twenty sockets, each ½" wide, and 5/16" spaces, this would give a component width of about 16.1/2".

So the panels, with fixing slots or holes, are available in multiples of 1.3/4": 2u = 3.1/2", 3u = 5.1/4", 4u = 7", 5u = 8.3/4" and 6u = 10.1/2". The side panels are one-piece top to bottom and the rack heights with which I am familiar were 36u (coming to a total of 65.1/2" with base plate and ventilator at top) and 48u (total of just over 7 ft). I believe that some continental telephone exchanges use a 22" width panel but the heights remain the same as British standard. The depth, front to back, is about 25" to 26.1/2". At Pye some smaller units were mounted rear of the rack – care must then be taken with the interior space as priority is always given to the front-mounted units. The panel/rack finishes we used were light grey (BS 631) and dark grey (BS 632) and matt black. The finishes BS 631 and BS 632 were often referred to in the paint-spraying trade as AP 631 and AP632 – 'Admiralty Pattern'. One popular finish used was produced by adding a special oil to the paint (I don't remember the trade name) which produced a tough 'orange-peel' effect after spraying and baking – but I never favoured this, as in time it collected grease and dirt.

It was a habit of mine to fit handles on all equipment we possibly could, all on a 16.1/2" pitch. This made insertion and de-mounting of heavy equipment much easier and safer – definitely a four-man job! It also meant that any panel promoted by the addition of a chassis (with side-cheeks as Mr Howe recommended) the handles are already in situ.

This brings me now to the question of 'earthing' – essential in the interests of safety. Each equipment chassis mounted on a panel will have its own earth connection, but during my experiences at the BBC, it was very occasionally found some 'blanks' were picking up a charge: HT/DC or mains. I was asked to cure this problem. One solution as a wire from each blank to the main earthing bus-bar – but I devised a kit of parts consisting of a panel-screw with a 'shoulder' cut into it, with an external-toothed washer, held in by a 1BA fibre washer. The paint was removed at the lower-R.H. cage-nut area and on tightening made a good electrical contact. The kit also contained the usual well-plated outside ¼" holed washer. On removal of the panel for test/inspection etc. the panel with holes drilled would allow the entire kit to be reused, but the slotted version generally required the fibre washer to be cut free for re-assembly and a new fibre used to retain the toothed washer from falling into the unit below. Two versions were made, one M6 and one 0BA. Cage-nuts (also known as captive-nuts) should be mounted in a vertical line. Both there, and at Pye, we worked to a standard of all items having a resistance to the main earthing points of 0.2 ohm or better. Incidentally, the use of cage-nuts only (where needed) is a much cheaper construction than drilling and tapping the vertical bars entirely, both front and back, top to bottom. Only a quarter or so of these tapped-holes will ever be used.

Useful features which I included inside all the racks used for recording purposes were : a small switched light near the top of the cabinet, and 13A mains sockets, about four, mounted on a panel at bottom rear of rack. These proved of great utility when using soldering-irons, mains-powered oscillators and level meters etc. for maintenance, setting-up, testing and modifications.

I agree with most of the points in David's most interesting, informative article…detail is so important in engineering. But just one point I would disagree with. He does not recommend the soldering ('tinning') of stranded-cable ends used in screw terminating blocks. We always tinned just the tip of open cable ends to make sure no stray 'whiskers' could cause trouble and, wherever possible , only used the 'Klippon' variety of block where the screw was never directly in contact with the cable which was protected by a metal shim. Dis-connection and re-connection could be done many times if required (line-testing etc.) with no damage done. In my time these were in 10- or 12- way biscuit-coloured blocks, but could be cut to any size. Also where a cable had to be terminated under a pan-headed screw, the requisite 'spade' or ring-tag was used, (Crimped or soldered). Where an 'ordinary' screw-block was already fitted to an 'outside' maker's equipment, we also used ferrules or heavy-gauge wire 'spills' with rubber sleeves over the solder joints.

Finally, I would keep a record of all the work done on each rack. Starting with the actual layout, all equipment and blank panels, front and back, would be drawn to scale (6:1 or 8:1 approx). The connectors using plugs/sockets would be on numbered panels, with an alpha-numeric marking system, duplicated on the cable. Those cables which directly terminated onto the equipment, eg, jackfields, had their own unique coding. Regarding 'pinning', those with pre-markeed schemes such as 1-2-G, or L-N-E, were obvious, but odd items, such as 7-pin F&E, or octal, would be fully documented. At Pye, we also had our own in-house colour-coding for cable-strands and sleeves. So detailed drawings and lists were made, and re-issued when changes were made. Inside each rack an up-to-date set of specifications were kept in an envelope… the time saved for the installer and maintenance technicians made it well worth the effort. ◆

ISCE sound engineer ECS cards

Congratulations to the Institute, Council and the Secretariat on achieving recognition to issue ECS cards for site work. It was some twenty years ago that I suggested the Institute seek permission to launch a scheme similar to that run by the Gas and Electricity Council at the time.

After several meetings with our Council, I felt that it was too hard a mountain to climb at that time. I am delighted to find that the ascent has started. I look forward to the time when all sound installations must be overseen by those holding ISCE approved qualifications. Well done everyone!

Harold Smart FInstSCE

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A response to AVB/TSB article

By Roland Hemming MInstSCE

Last quarter's ISCE magazine had an article from Martin Bonsoir discussing AVB/TSN. I thought it might be helpful for members to hear things from another perspective.

The article he writes is similar to those written for many years by members of the AVnu alliance, the promoters of AVB. They highlight the great benefits such as, that it is an IEEE standard, that some very large companies are associated with it and that it offers features such as bandwidth reservation.

While Martin's perspective is not unique, it is not the only one and in this article the alternatives will be discussed.

Since 2008 AVnu has marketed AVB/TSN as the next big thing for our industry. This has never fully materialised. Large companies like Harman have withdrawn from AVB development with no new AVB product in several years. Companies such as Sennheiser announced AVB products but never shipped them as they saw the market reality and the limits of the technology. After nine years, only six manufacturers actually ship AVB certified audio products.

Investor details given from Audinate's (the inventors of Dante) recent IPO gave some further insight into the size of the market. With expected revenue this year around £11m, that's a colossal number of networking cards being put into products. There are currently over 1,000 shipping products using Dante and over 160 using RAVENNA against just 26 that use AVB. With each of these three initiatives around a decade old, AVB is the clear laggard.

Our research on the actual use of audio networking took place in spring 2015 and 2016. It was an online survey with around 600 responses each time. We asked readers of Installation, Pro Sound Asia, Pro Sound Middle East and Systems Contactor News to participate. In 2016 we also added Pro Tools Expert, the largest online forum for Pro Tools users.

Our product research is carried out on cooperation with AVnu alliance, Audinate, RAVENNA and the MNA – the media networking alliance. They all have access to, and contribute to, our database of networked products. This is updated three times a year.

RH Consulting's research found most uses of AVB were not multi-manufacturer solutions. They are mostly single manufacturer sales, sold because of the benefits that product offers. Our view is that these products would sell anyway because they are good products, not because they use a particular protocol.

Enthusiasts argue that AVB is part of what makes their solution superior, but even if true, this has to be set against the huge limit in product choice and interoperability against choosing another protocol. At the time of writing, there is no AVB certified mixer, only four loudspeakers, two amplifiers, no microphones, no intercom, no audio player/recorder. No useful choice for the vast majority of projects.

Martin argues that open standards are the answer and warns of the 'dangers' of proprietary technology. However, our research put standards seventh in what users look for when choosing a networking protocol.

Everyone preferred things like choice of product or the expectation that the protocol might be around in a few years. The simple fact is that most people simply want to get the job done using technology that works. No one answered 'based on standards' as their priority.

De jure standards don't really matter anyway, as long there is technology that does the job and it is licensed fairly. A good example to illustrate the point is the PDF, which has proprietary technology from Adobe and few complain about that. This can be thought of in ▸

terms of what is 'under the hood' for example Powersoft and B&O provide OEM amplifier modules to dozens of manufacturers with no fanfare and probably without the appreciation of the consumer. Almost all audio products contain technology either built or developed elsewhere sometimes this is for technical reasons and often times it is a commercial concern. Private organisations can invest in a technology and can be more agile than any standards committee. Audinate's success demonstrates that an investment lead approach works.

If you or your clients don't like the proprietary approach, AVB is not the only open option. You can freely adopt RAVENNA, it's all published, or choose to pay for support and naming rights or buy interface cards from several suppliers. AES67 has been published for a couple of years now and is an open standard.

No one can predict the future, and perhaps AVB will, in many years, provide some underlying benefit for our industry, but the work on AVB from audio companies is nowhere near as vigorous as AVnu would like you to think. The absolute reliance on, generally more expensive, AVB-aware network switches, which have barely been adopted by the IT industry, is likely to take many years to overcome.

Initiatives like AES67 provide interoperability between a number different audio protocols such as Dante, RAVENNA and Q-Lan, but alas not AVB. There are already over 200 AES67 compliant products. Furthermore, AES67 has been picked as the audio element of SMPTE ST2110, the new video over IP standard for the broadcast industry.

For all the benefits AVB may offer, there are just as many other features and benefits in Dante and RAVENNA, with many more engineers putting time and effort into those and related initiatives. For example, Audinate are launching a Dante domain manager and with RAVENNA you can use GPS as the timing clock.

So, if AVB is not significant, why do I care? The reason is because I think it is wrong for those interested in AVB to continue to ask the audio industry to be at the vanguard of all of this. Millions of pounds has already been invested on the development of AVB audio products and it is virtually no further forward than when it was first demonstrated to me nine years ago.

What should have happened is that, in fifteen years time, had AVB enabled switches been in wide use, we would have noticed the technology and then started to develop audio products to take advantage of it.

There may be benefits in automotive, industrial and consumer uses of AVB/TSN technology, but it is not commercially viable and barely technically relevant to the pro audio industry. Any meaningful growth in AVB for pro-audio is several product cycles away because it is significantly dependent on the IT industry choosing whether to seriously adopt it.

Let's not waste any more time and money on a possible future hope, when there is other audio networking development work that can reward us all now. ◆

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Pulse Sound and Vision

Pulse Sound and Vision, based in Andover, Hampshire, provides personally selected audio and lighting products for health and fitness, corporate and domestic clients.

The company has almost 30 years' experience in audio, A/V installation and mood lighting. From a single screen to complete A/V packages for corporate/business clients, no project is too big or small. We can even offer a select range of products from batteries, head mic's to complete audio systems for the instructor, from projection systems and screens to larger back ground music systems.

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Starting from humble beginnings with a staff of three and a transit van we have grown to a talented team of 50 with offices in London, Dubai and Qatar.

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Our projects vary greatly in size – in location, content and complexity. We have 30 years of project management experience, from the smallest of shows to concerts, television projects and large-scale public events.

We like presenting a professional face at all times and believe membership of the ISCE helps demonstrates our commitment to always delivering the very best.

www.deltatelecom.co.uk ◆

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John O'Brien
Hearing Help UK

ISCE welcomes new supporting members

SSE Audio

SSE Audio Group is the largest professional audio service provider in the UK, offering an unparalleled depth and breadth of equipment, expertise and reputation. Established in 1976 as a PA hire company, SSE has expanded over its 40 years to include hire, sales and installations departments with offices in Redditch, London and Heywood, Manchester. Wigwam Acoustics and ETA Sound also form part of the group.

Together, we offer a massive rental stock for concerts and events, new equipment sales as dealers of the major audio brands and a complete installations service at a huge variety of venues, from tiny pop-up restaurants to the O2 Arena. In addition, we manufacture our own products through our fabrications and electronics department, Sigma Fabrications.

We believe in the importance of staying up-to-date with the latest practices and standards, and adhering to these across all areas of the company; becoming a Supporting Member of the ISCE shows our commitment to these values. The partnership will allow us to communicate with the wider industry to share knowledge and expertise with other members, which we recently demonstrated when hosting the ISCE's Electrical Safety for Sound Engineers training course at our London offices.

www.sseaudio.com ◆

Reflex Soundpoint

30 years of industry knowledge

Reflex Soundpoint is the dedicated sound division of Reflex Systems Ltd; established since 1987 Reflex continue to work extensively across many sectors delivering innovative and leading-edge solutions, engineering and installation expertise and the ability to integrate with associated building technologies.

The Soundpoint team focuses on design and delivery of next generation sound systems including IP and networked applications. Projects range from business music, commercial sound and distributed PA to heavily certified life safety applications and specialist environments.

We work closely with our customers and technology partners at every stage from the design consultation to completion and commissioning to offer the best combination of choice, performance and reliability regardless of scale.

We hold all relevant accreditation and professional certification and consider ISCE membership to be an integral part of standards recognition for Reflex Soundpoint.

www.reflex-soundpoint.co.uk ◆

If you want to join a select group of companies who have chosen to encourage us in our efforts to improve technical standards and practices within the sound industry, contact Ros for an application form or go to **www.isce.org.uk/supporting-members/**

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Easing the way for very large PAVA/PAGA systems

By Tony Barns *MInstSCE*

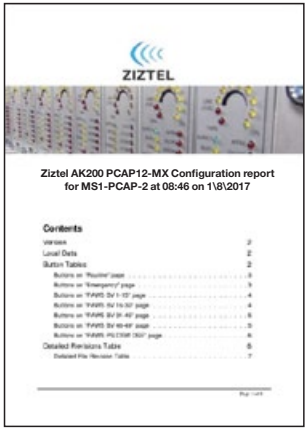
Exciting times in technology

Being given an almost clean slate when invited to design a range of products for very large Public Address and Voice Alarm (PAVA) or Public Address and General Alarm (PAGA) installations is always an absolute delight, but especially now. We see such advances in the components we use to create these systems and the tools we use to design them that give us the opportunity to move the state of the art even further along.

But first, a brief reminder of our task: A PAGA system is the only means of effectively distributing vital emergency warnings and instructions to personnel working on an industrial site. The broadcast requirements become increasingly critical where the on site process is of a potentially dangerous nature, for example a petrochemical installation, where there is the additional risk of igniting an explosion, or a nuclear complex with possible radiation hazard. So we must deliver high levels of reliability and employ carefully engineered architectures.

In doing so, it is now not only possible, but of great benefit, to use the enhanced power of modern microprocessors to run many of the tedious tasks automatically that used to be done manually. Our latest product assists engineers and end users with such benefits as

- Automated distribution of software updates, taking just minutes now against the hours or days it took before automation. Even devices that are offline will get their update automatically when they next come online. The engineer can trigger this mechanism from anywhere on the system.
- On-demand compilation of a complete document describing the product, its configuration details, revision status, etc.. The microcomputer in each hardware module can create a very attractive document in PDF format, complete with images, graphics and tables, in a matter of seconds and deliver it to the engineer. This cuts hours off the task of producing 'as delivered' documentation.
- The ability to view operational, configuration and diagnostic information from anywhere on the system's network. This is a real help for engineers, saving the time and inconvenience of having to visit the system's plant rooms personally.
- And more ... but you get the idea, and probably have ideas of your own.



ZIZTEL

Ziztel AK200 PCAP12-MX Configuration report
for MS1-PCAP-2 at 08:46 on 1\8\2017

Contents

Example cover page of a PDF document created on demand by the equipment itself

But the speed of advance in technology also sows the seeds for problems in the future how to design a system that accommodates future advances. Technology will have moved on, and our product range expanded and matured, in a few years time. Many of the systems we install now are on sites that that will need additional equipment as the facility expands over the years. How will our future products work with our older products? Will the new products be backwardscompatible, or the earlier products be capable of efficient and reliable upgrade? As facilities grow, the need for efficient and engineerfriendly tools to manage them increases. So, being given a clean slate is a great opportunity to design well for scale and maintainability. Let's look at some of the issues.

Problems of scale

Very large Public Address systems are especially difficult to maintain and modify because of their sheer scale. Equipment is usually spread over many racks situated in various locations around the site, or several sites, often in places that are difficult to access. Simply visiting all of the racks can take many days, even when access to them has been organised beforehand. We do well to provide such systems with comprehensive telemetry so that the running status, fault status and revision status of all parts of the system are visible from a central location. In extreme cases engineers may want to work in a safe area that is not even on site. We have addressed this by making as much data as possible accessible from any point on the network that connects the various parts of the system. Engineers can use simple tools to view various aspects of the system status, view live data (i.e. events as they happen) and even eavesdrop on the system's audio channels.

Where to store configuration data

Many systems have microprocessordriven devices in many locations, each offering a slightly different service or performing a slightly different task. Exactly what each device does is determined not only by the code it runs but also what data it works with some of which is semipermanent configuration data. The question is where should we keep configuration data. If we concentrate it in one place, we have created a single point of failure; if this location fails, we have nothing. If, on the other hand, we distribute configuration data amongst all the devices that need it, we have a distribution and maintenance nightmare. We decided to use an approach analogous to an internet cloud service, although it is entirely private and not dependent on the internet. Nevertheless, the idea is to keep vital configuration data in several places, synchronised automatically, where devices can find their configuration data. They are also notified of any changes automatically. This means that to change the legend on a group of screenbased paging panels, for instance, we give the cloud the new legend and it distributes the news to all interested devices, whether it's just one or a hundred. The change is almost instantaneous and, if a paging panel is offline at the time, it will still get news of the change when it returns. All devices are also perfectly happy to run ▸

without the cloud, using cached data. The process is extremely fast, copes with distant devices as easily as local ones, and avoids human error.

Using a wireless tablet to view operational and status information

Reducing downtime

PAVA/PAGA systems sometimes need to be taken out of service while maintenance, upgrade or expansion of facilities is performed. Since these are lifesafety systems, the end user is usually reluctant to have their system out of service for any longer than absolutely necessary; often only offering a few hours, at best, when alternative, minimal arrangements for danger warnings are provided.

Maintenance usually starts with engineers assessing the state of the system before they start to make any changes. So having comprehensive telemetry, electronic fault logs and equipment usage statistics, all visible from a convenient location, speeds this part of the work. Indeed, engineers may be given access to to this information in advance of the planned downtime, so that they can bring new or replacement parts as necessary.

When it comes to software upgrades, we have chosen to employ the system's cloud services to automate distribution of new application software as well. This has provided enormous advantages to both engineers and end users alike. Any new software is delivered, just once, to the system cloud, and its automated distribution mechanism ensures that every concerned module is updated with immediate effect, and without human error or omission. Even modules that are offline when the update is issued will get their upgrade when they go online. In one example of this benefit, we expect to see over sixty outlying devices over a site many kilometres in size get their software updates and all be back in service within minutes.

Problems of longevity

Most PAVA/PAGA systems will outlive the product manufacture cycle; they may even outlive the product designers. But the company that installed the system will very often be invited to return to site some time, perhaps many years, after the initial installation to expand the scope of the system and add new equipment. How do we ease the coupling between old and new equipment? Well, recall how computers negotiate with printers or any other device when they are connected via the Universal Serial Bus (USB) they work out between themselves what capabilities the device has and what services it needs from the computer. Or how two Ethernet switches negotiate between them to find the best data rate to use. We have employed a similar scheme to allow newly designed products in our range to work with older products; they know how to negotiate between themselves for a common working practice. Each device has a comprehensive capabilities file in a format that is both human and machine readable. This forms a set of descriptors that can be used by devices to find and declare how they will work together. The purpose of all this is to allow us to evolve the product line whilst maintaining backwards compatibility. But remember also that the upgrade mechanism is there to assist in bringing old equipment up to date, as far as its hardware allows.

Having the right tools

Modern microprocessors have such increased capabilities that we have been able to include the engineers' tools right inside the equipment itself. The various tools used for configuration, fault finding, monitoring status etc. are programmed into the equipment and pulled out, as if on an umbilical cord, by the engineer's laptop, tablet or PC. This not only ensures that the right tools are available for the job in hand and work correctly with the equipment, it also means that no tools need to be installed on the engineer's PC, only a slim programme, similar in concept to a web browser, that calls the tools out from inside the target system.

In brief

We have taken full advantage of new technology to add vital features to the most demanding products in our marketplace – high integrity networked audio systems. These features may not have much impact on everyday service, but assist greatly with system flexibility, scalability and longevity. ◆

Standards update

By Andy Scott *FInstSCE*

EN 303 348
Induction loop systems intended to assist the hearing impaired in the frequency range 10 Hz to 9 kHz

This has to be written to enable Induction loop amplifiers and receivers to continue to be CE marked and placed on the market after the Radio Equipment Directive came into force on 13 June.

The standard was published in July and can be downloaded from www.etsi.org/standards/looking-for-an-etsi-standard

However, it has not yet been published in the Official Journal of the European Union and so cannot yet be used to demonstrate conformity with the RED.

EN 54-24
(Voice alarm) Loudspeakers

CEN TC72 WG23 has started to work on a standard for active loudspeakers, including large phased arrays but is waiting for publication of a new DIN standard on active loudspeakers, which will hopefully provide practical requirements and tests that will be acceptable to industry.

Meetings on this subject have been suspended for the time being.

EN 54-16
Voice alarm control and indicating equipment

CEN TC72 WG23 has set up a task group which has completed its review of the comments. Work is still taking place to tidy up the draft and to ensure that it is in line with proposed changes to EN 54-2 (Fire Alarm Control and Indicating Equipment).

Two task group meetings are planned and it is hoped that the draft will be ready for review by WG23 before the end of 2017.

BS 5839-8
Fire detection and re-alarm systems for buildings – Part 8: code of practice for the design, installation, commissioning and maintenance of voice alarm systems

BS 5839-1 (Fire alarm installation) was published in August. This is handled by BSI/FSH/12/5 and the next meeting in early November will discuss which changes in 5893-1 are relevant and should be revised in 5839-8.

FSH/12/5 will also discuss whether to incorporate some of the elements of its European cousin, CEN/TS 54-32, Fire detection and fire alarm systems – Part 32: Planning, design, installation, commissioning, use and maintenance of voice alarm systems.

BS 5839-9
Fire detection and fire alarm systems for buildings – Part 9: code of practice for the design, installation, commissioning and maintenance of emergency voice communication systems

A request was made to split BS 5839-9 into two standards, one for product and one for installation so that Certificates of Conformity can be produced. BSI has rejected this but FSH/12/6 may consider a revision that separates the installation and product parts more clearly.

PD/IEC/TR 63079
Code of practice for hearing loops (HLS)

In September, BSI published the updated version of BS 7594 as PD/IEC/TR 63079. As an International Standard Technical Report, it has world-wide status. BSI will withdraw BS 7594 in due course.

Disclaimer

This information is believed to be correct but it is not guaranteed and neither the ISCE nor its officers can accept any responsibility in respect of the contents or any events arising from use of the information contained within this article. ◆

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