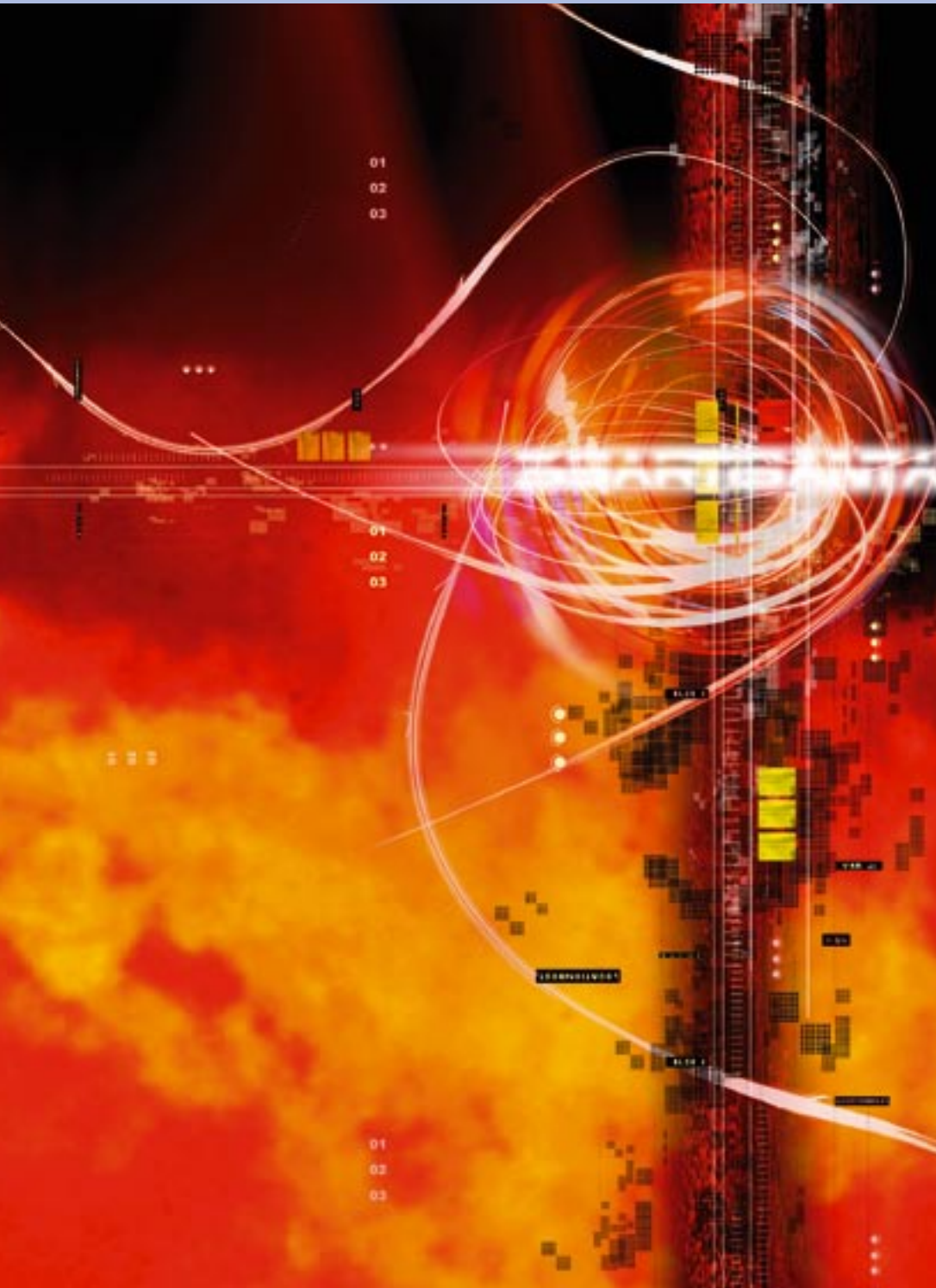


# Section 7:

# Voice Alarm Design Guide

**GENT**  
by Honeywell



## 7: VOICE ALARM DESIGN GUIDE

**GENT**  
by Honeywell

The following is a guide for designers on VA / PA systems, and their use in conjunction with advanced fire detection systems, incorporating the requirements of BS 5839-8:1998. It will highlight some of the main difficulties in system design paying particular attention to intelligibility, which is the key differentiator between good and poor design.

### Contents

#### 1 Background research: why Voice Alarm is the future for Fire Alarm systems

#### 2 The difference between Public Address (PA) and Voice Alarm (VA)

#### 3 BS 5839 - 8 :1998 Fire detection and alarm systems for buildings

3.1 Section 1 General

3.2 Section 2 Design considerations

3.3 Section 3 Workmanship, installation & commissioning

3.4 Section 4 User responsibilities

3.5 Annexes

#### 4 Current solutions

4.1 Voice sounders

4.2 Central Rack systems

4.3 Distributed amplifiers

4.4 Loop powered micro amplifiers

#### 5 Guideline for future designs

#### 1 Background research: why Voice Alarm is the future for Fire Alarm systems

"It has often been observed that occupants – in the initial moments of a fire, upon smelling smoke or hearing the fire alarm – do not react; they deny there is danger or they ignore the situation. This seems especially true in public buildings where occupants do not want to be seen to overreact to a false alarm or to a situation that is already under control. Such avoidance behaviour in a dangerous situation often results in a delayed start to evacuating a building or taking protective action". This statement by Dr Guylène Proulx<sup>1</sup> was further illustrated by research carried out by Brian Piggott of the Fire Research Centre and published by David Canter of Surrey University<sup>2</sup> which showed that in the event of a fire:

- 13% of people reacted to bells
- 45% of people reacted to text
- 75% of people reacted to voice!

It was also made clear that in the event of an alarm people generally exit by the entrance they first used and need to be directed to the nearest escape route. A Voice Alarm system can be used to give people clear information about when to evacuate and what route to take and hence alleviate some of the problems highlighted above.

#### 2 The difference between Public Address (PA) and Voice Alarm (VA)

Many people believe they can simply use their PA system to provide a voice message in the event of an emergency like a fire.

Unfortunately PA systems, whilst very good for providing music and messages, are not guaranteed to work when there is an emergency. This is where the British Standard BS 5839 - 8:1998 on Voice Alarm comes into use, as it clearly defines the requirements of a true VA system. A true VA system is a HIGHLY SECURE PUBLIC ADDRESS system which has the following features;

- All internal and external circuits are monitored for faults
- A minimum battery back up of 24 hours standby and 30 minutes alarm.
- A monitored secure link to a fire alarm panel
- A number of pre-recorded emergency messages
- Incorporates an emergency 'firemans' microphone

The use of speech sounders is not considered as a true VA system and the recommendations detailed within 'annexe E' of the standard should be consulted.

#### References

1: Guylène Proulx, Ph.D, 'Misconceptions about human behaviour in fire emergencies' published in Canadian Consulting Engineer, March 1997, pp36, 38.

2: David Canter, 'Studies of Human Behaviour in Fire: Empirical results and their implications for education and design.' Published by BRE, July 1985

### 3 BS 5839 - 8 :1998 Fire detection and alarm systems for buildings

There is no substitute for reading the standard, this section only deals with the most obvious or possibly contentious issues facing the designer. Copies of this standard can be obtained from: British Standards Institute (BSI) at [www.bsi-online.com](http://www.bsi-online.com) We also suggest reference is made to BS 5839 - 1:2002.

The standard is split into various sections, the following looks at the key points for designers in each section.

#### 3.1 Section 1 General

The key part of this section for a new design is the need to exchange information with interested parties, as it is likely that the information gathered here will form the basis of the design. An understanding needs to be gained of what messages are to be played in the event of a fire or other emergencies as well as what the system may be asked to do in addition, ie music and/or paging.

This section also provides a full planning schedule as a check list which is well worth following, especially for anyone who is embarking on a design for the first time.

The designers' check list is as follows :

- Survey of the site and/or a detailed examination of site drawings including an acoustic assessment
  - Assessment of usage of the building including;
  - Periods of non occupation
  - Areas with high noise levels
  - Personnel including those hard of hearing
  - Actions that take place in the event of a fire
- Liaison with all manufacturers to ensure compatibility between the fire and voice alarm systems
- A system specification and requirements for estimation purposes
- Tendering and quotation
- Consideration of proposals
- Consideration of servicing requirements
- Agreement on proposals and confirmation of 'Fire plan'
- Agreement on the 'controls' ie microphones etc
- Detailed system design
- Ordering
- Agreement on final specification including any variations
- Production, pre-delivery acceptance certificate and delivery
- Installation and testing phase
- Commissioning
- System documentation and user training
- Acceptance by client
- Handover of system
- Service agreement



## 7: VOICE ALARM DESIGN GUIDE

**GENT**  
by Honeywell

It goes on to suggest that for large sites considerations be included for:

- Understanding the stages of a 'critical path' chart
- Siting and accommodation of the control equipment
- On site work not conflicting with other services
- Temporary physical protection to avoid deterioration of equipment due to damp, dust etc
- Ensuring final commissioning of the VA system is carried out when all parties can witness the results under various occupation levels – it may be necessary to consider partial occupation and soak testing to ensure all parties are ultimately satisfied with the final result



### 3.2 Section 2 Design consideration

Like all the Fire application standards this section is by far the largest and additional training on this section is advised for anyone heavily involved in VA design.

Some of the KEY issues the designer should consider are:

#### ***The Distribution of the speaker circuits***

Consideration should be given to the degree of monitoring required, particularly for the speaker circuits. In certain circumstances it is recommended that they are interleaved to ensure the voice message is delivered throughout a zone, irrespective of whether one of the two circuits have failed.

#### ***The Choice and siting of the speakers***

Loudspeakers should be positioned to achieve the correct sound pressure (dB) level and good intelligibility, with an STI (speech transmission index) of 0.5 considered to be acceptable.

Speaker selection should not be a simple matter of aesthetics and it is often advisable to carry out an acoustic survey to establish the best solution for a particular application.

#### ***The Link between the Fire and VA control panels***

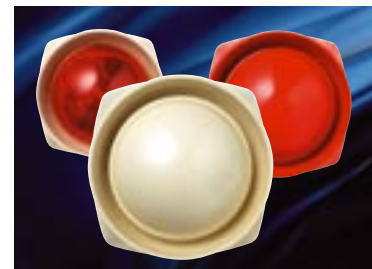
The link between the fire control panel and the Voice alarm control unit needs to be secure, that is monitored for open and short circuits and wired in recognised fire resistant cables to avoid failure, as the VA may be the only means of warning people there is a fire.

In complex buildings where activation of the Evacuate and Alert signal can be manually overridden it should be clearly indicated on the control panel which area is receiving which message.

#### ***Combined use of Fire Sounders with VA system***

In certain circumstances a site may require VA in public areas whereas sounders can be used in staff only areas.

- In such cases the operation of the sounders should not affect the intelligibility of the VA system
- The sander tone should be the same as the 'attention drawing tone' used by the VA system
- The procedures for operating such systems should be simple to avoid confusion in the event of an emergency
- If it is necessary to silence the alarm sounders to enable a voice message to be broadcast then restarting of the sounders should be automatic. There should not be a silent period exceeding 10 seconds between broadcast and sounders



### 3.3 Section 3 Workmanship, installation & commissioning

The installation requirements follow closely the recommendations within BS5839-1:2002. However the crucial issue here is the commissioning stage especially checking of the sound pressure levels (dB's) and intelligibility.

Specialist equipment may be required to check the audibility and intelligibility. However the standard suggests that to check the sound pressure level, a standard sound level meter set to 'A' weighting and 'slow response' will give an approximate reading, as long as the speech is slow in delivery with virtually no gaps.

Intelligibility is a little more difficult and whilst a minimum STI of 0.5 is quoted it may be difficult or near impossible to measure under all circumstances. The standard suggests that a subjective assessment of intelligibility may be sufficient as long as all interested parties agree. In the case of dispute it is recommended that an appropriate method of measurement detailed within BS EN 60268-16 may be called into play.

### 3.4 Section 4 User responsibilities

The major issue for the user, besides ensuring the equipment is not showing any faults and is healthy at all times, is training of the operators.

This may be an ongoing requirement as personnel change and complex procedures for phased evacuation, which require manual intervention, may be in place.

### 3.5 Annexes

The annexes A to E provide a designer with some useful data in respect of loudspeaker capabilities, typical noise levels in different buildings, a battery standby calculator, a model certificate and a guideline or recommendations for the use of voice sounders

## 4 Current solutions

There are three main methods of providing voice messages, these consist of;

- Stand alone voice sounders
- Central Rack amplifier systems
- Distributed amplifier systems

All these types have possible use dependent on the type and size of building where they are being installed.

### 4.1 Voice enhanced sounders

Although these devices can not be considered a true VA they do offer voice messages, with each device containing a 'memory' chip that has a number of pre-recorded standard messages, operated directly from the fire alarm control panel.

It is important that the control panel does have a 'synchronisation' capability so all the independent recorded messages are delivered at the same time.

This is particularly important when you have two or more alarm zones where different messages are required, i.e. an Evacuate and Alert message, as synchronisation and intelligibility may be affected.

Furthermore additional cables may be required to switch from one message to another.

It is therefore, suggested that these devices are generally used for the smaller properties where there is a 'one out - all out' evacuation required and no messaging or background music facility is needed.

## 7: VOICE ALARM DESIGN GUIDE

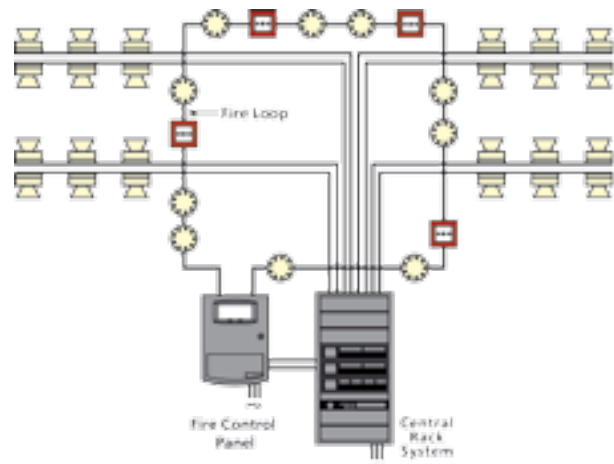
**GENT**  
by Honeywell

### 4.2 Central Rack systems

Central Rack systems consist of a rack or racks of amplifiers that control all the speaker circuits, which are radially wired as shown. This rack may also contain facilities for zone selection, music input, emergency and general paging announcements.

The issues with this type of set up are:-

- To ensure the link between the fire control panel and the rack is fully protected and monitored
- The correct cables sizes, to allow for volt drop, are provided for the speaker circuits particularly if they extend across many floors
- The battery standby capacity has been properly calculated and there is some contingency to extend in the future



### 4.3 Distributed amplifiers

Distributed amplifiers (DAU) are the latest innovation allowing the speakers to be connected to local amplifiers, often on the fire system loop communication cables, as shown.

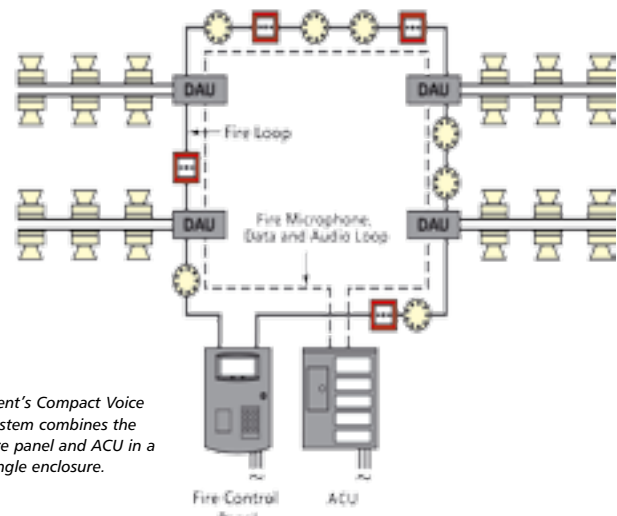
The benefits of this approach are:-

- There is a lot less cable needed for the speaker circuits
- The cables will often be smaller in size and therefore cost less
- The system can easily be extended at minimal cost as extra DAU's can be connected on the fire communication loops
- The central control unit (ACU) for the voice system is much smaller as it contains no amplifiers
- DAU's are easier to accommodate than central racks

The issues or options with this approach are:-

- There is a requirement to provide additional audio circuits between all the DAU's, shown on the diagram in a dashed line. These will be needed for synchronised voice messages and to provide an emergency 'firemans' speech facility.
- A choice is available whereby on some medium size buildings the DAU's can obtain their power direct from the fire communication loop cable

#### Distributed Amplifiers



*Gent's Compact Voice system combines the fire panel and ACU in a single enclosure.*

## 5 Guideline for future designs

Finally, for anyone setting out to provide a VA system we would suggest the following guideline:-

- Obtain and read a copy of BS 5839-8:1998
- Consult all interested parties and agree the 'Fire Plan' and other uses for the system
- Agree Evacuation/Paging zones and the messages you require
- Involve someone who can assess the acoustics and calculate the loudspeaker types and requirements
- Decide which system to use
- Check the intelligibility after completion and obtain a certificate
- Ensure the End User is trained on its use and is aware of their responsibilities