ZEST PAGA ARCHITECTURE

TDS-038 Issue 01

Thank you for your interest in Ziztel - we are a UK based manufacturer of PAGA and Intercom products. Our systems are mainly designed for use in the Military, Marine and Hazardous Oil, Gas / Petrochemical industries.

Ziztel ZEST PAGA is destined for use in dangerous industrial work places as a means of efficiently delivering emergency voice and warning alarm broadcasts to personnel working therein.

Unlike paging and alarm systems available from other vendors, ZEST is not derived from an intercom design and hence fully supports a proper redundant architecture to secure mission critical high integrity PAGA suitable for life safety applications.

The Ziztel A + B PAGA / MBS system solution has attained SIL Level 2.

A + B PAGA SYSTEM TOPOLOGY

- *Single fault tolerance site wide* – no common equipment software/hardware
- *Reduction of broadcast sound pressure level SPL maximum -3dBA under any single fault scenario*
- *Synchronization of broadcasts* - no inter-subsystem dependency

Back ground

The Ziztel ZEST PAGA / MBS system can be delivered based on a single central core with unduplicated networks / field devices or, for critical applications, with certain key equipment held either on 'hot stand by' or duplicated. For security the system can be assigned with full redundancy, i.e. A+B or, for ultimate safety, a combination of A+B with N+1 or N+2 execution.

This technical data sheet introduces the concepts of the A + B dual PAGA solution and compares this architecture to N + 1 which is another commonly specified topology. In both cases input/controls to the PAGA system, example microphone access units, interfaces to Fire and Gas panel/ICSS/ESD, are each assigned dedicated connecting cables (primarily to improve integrity but also speed of service). Multiple access positions sharing single cables are eliminated in the ZEST design to deliver highest possible security. Note it is impossible to deliver the required security from a system that from the onset has not been designed primarily for high integrity PAGA service. General purpose PA/paging systems and intercom server/intercom systems cannot reliably support the required package architectures required for a mission-critical PAGA and at best feature many common mode failure points.

Duplicated features throughout the design including microphones, transceivers and status indications; the intent - no common mode failure possibility.

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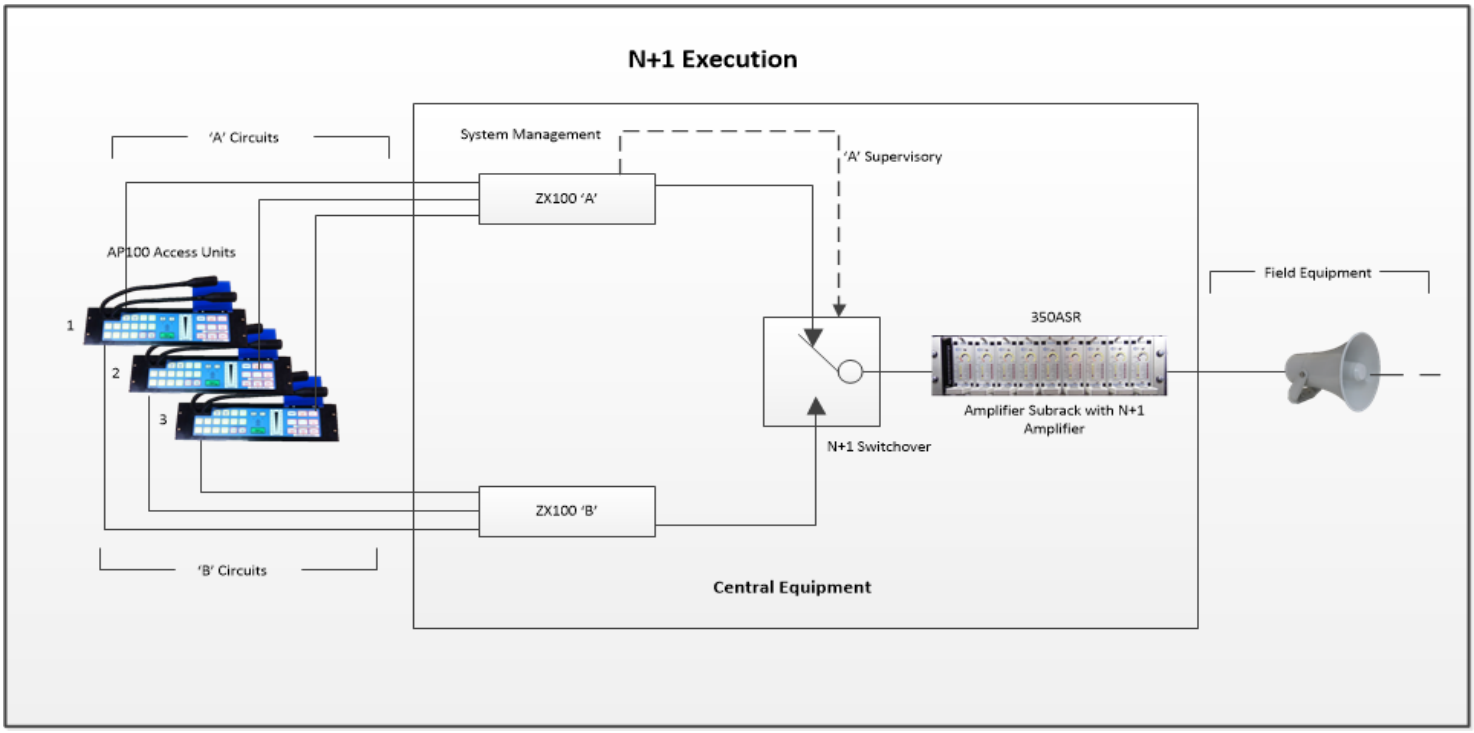
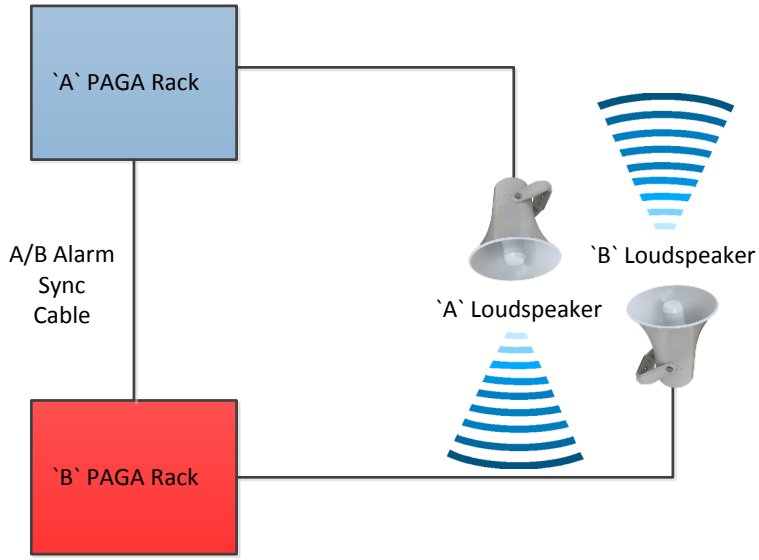
N + 1 architecture

Where a redundant central processor N+1 architecture is specified it should be noted that duplication is extended to the entire front end - *including* cable interconnections and interfaces to external systems including Fire and Gas detection, DCS and ICSS systems. This also includes full duplication of the associated front end hardware – i.e. dual access panel microphones, dual controls, and dual status indications. The ZEST PAGA system is designed from the onset for critical life-safety applications.



A + B architecture

A + B differs from N + 1, described above, by duplicating not only the front end but also the entire critical path. This includes provision of two identical central equipment racks and duplicated field cable networks, loudspeakers and flashing beacons.



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In A+B system execution the amplification and visual warning beacon controls are fully duplicated; field devices are interleaved to ensure continued no break coverage in event of catastrophic failure of either A or B subsystem.

Both A and B systems are on line at the same time, switching in the critical path is eliminated to deliver highest possible integrity.

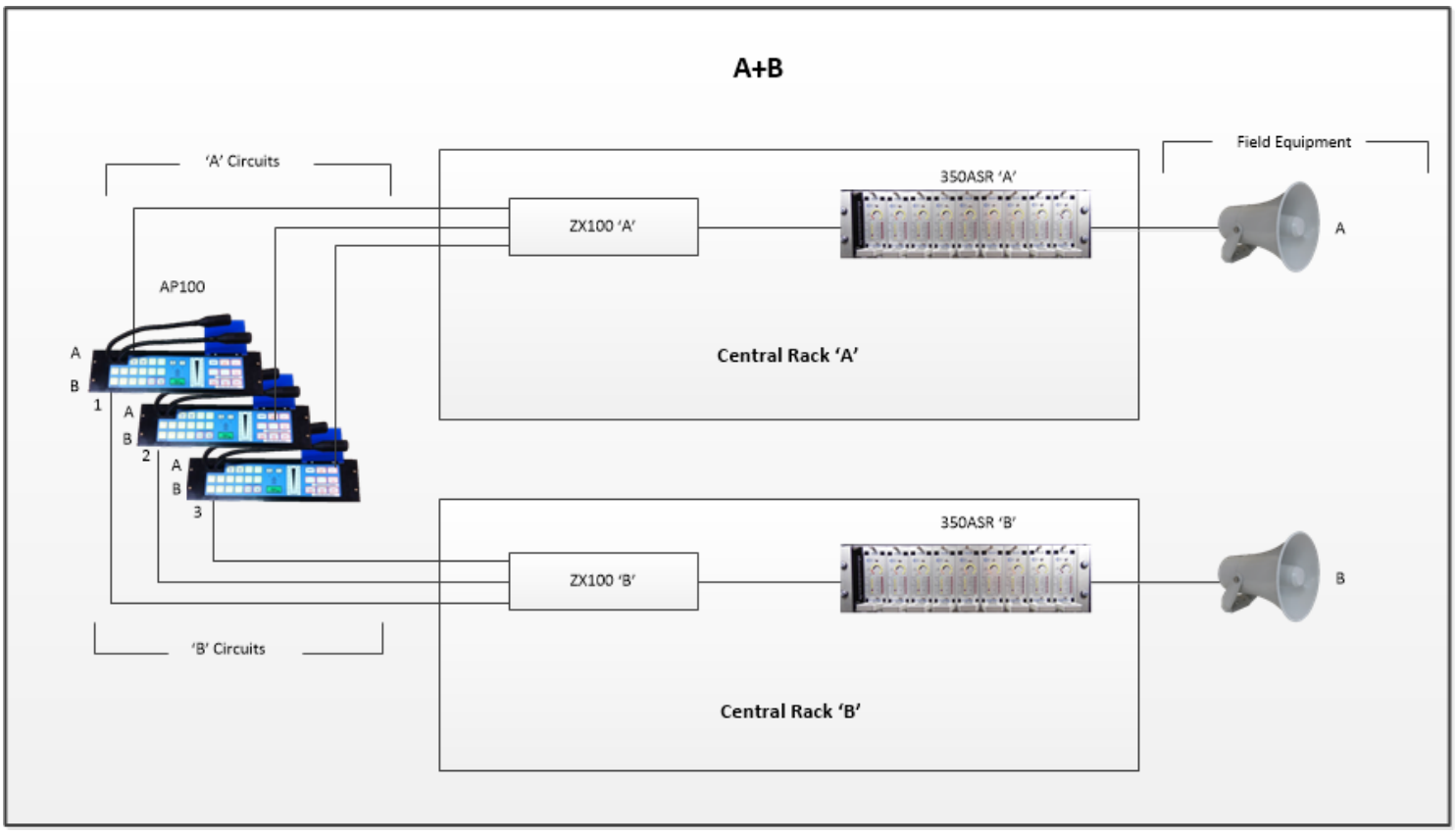
An acoustic study determines the position of the A/B field equipment to ensure:

- A maximum loss of -3dBA in broadcast sound pressure level.
- Visual coverage is maintained from the remaining operational flashing beacons.

Field devices and associated cables from the A/B system are segregated to eliminate as far as possible the risk of common mode failure. To this end loudspeakers and beacons are mechanically separated and cables engage diverse routing using different cable trays, transits raceways, etc. Each compartment is fitted with two loudspeakers (and flashing beacons in noisy areas) independently and discreetly driven from respective A and B central PAGA racks, this ensures that in the event of catastrophic failure of either sub system continued PAGA is maintained by the remaining operational system.

Use of 'dual type' loudspeaker enclosures where A and B loudspeaker units are integrated into a single housing are avoided to maintain the mechanical segregation required to achieve true redundancy.

The respective A+B central racks are isolated by an A-60 firewall wherever possible.



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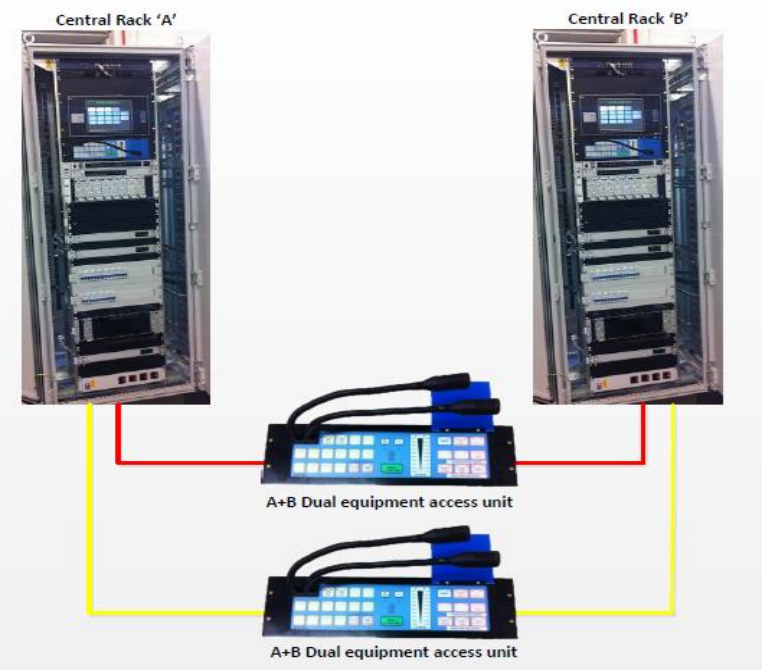
In an A+B configuration there are dedicated cable connections between each device and respective A/B sub system central racks.



Each A/B system has self-contained resources including independent generation of the site alarm tones. There is no A/B sub system interconnection except for a non-critical optically isolated cable pair (or fibre) between each central rack.
Loss of alarm synchronisation does not impact on speech intelligibility or audibility, the link is intended only to ensure that A and B generated alarm tones are broadcast in step. (Note the only consequence of link failure between the two sub systems is the eventual possible drifting of the A/B alarm tone cadence relative to each other, in all other aspects the alarm is delivered regardless) *see TDS016 for further information on A + B alarm synchronisation.*

Field devices

Field devices such as loudspeakers and visual alarms, i.e. flashing beacons, column light indicators are connected on self-healing loops to improve security. *See TDS019 for details of field device connectivity*

System configuration

There are several possible system configurations available on a ZEST PAGA package:-

- N+1
- A+B
- A+B N+2 *see TDS 031 for further information on this architecture.*

The basic architectures can be extended on large sites to serve multiple sector PAGA systems each configured on the basis of the above and each interconnected on possible redundant media.

Configuration philosophy in all cases is as follows:-

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- Multiple loudspeaker outputs – no shared lines. A failure in one circuit does not impact on remaining operational circuits.
- Multiple access control inputs – no shared lines. A catastrophic failure of one access position (for example; a fire or an explosion), does not disable access from other locations.
- Multiple visual warning flashing light outputs – no shared lines. A failure in one circuit does not impact on proper site coverage from other devices.
- Field device cabling philosophy – loudspeakers and flashing beacons are loop wired to allow self-healing/single-fault tolerance.
- Auto alarm control inputs – example Fire and Gas, are star wired no shared lines.

Summary

Hot standby N + 1

Certain elements of the system are duplicated to improve availability. Namely the front end and hot standby loudspeaker amplifier which are assigned backup to take the place of possible on-line processor front end / amplifier trouble.

Duplication A + B

To improve security the complete system is duplicated A + B, with hardware arranged such that there can be *no common mode failure* and that coverage is maintained with a major fault resident in either the A or B sub-system. There is no common mode failure possibility, each subsystem operating independently of the other. There is no inter A / B sub system switching.

A single optical cable connection interconnects the A / B racks for alarm synchronisation purposes, failure of this link cannot impact on the operation of the alarm tone generation systems in each rack.

Typical A+B ZEST PAGA system undergoing FAT in our factory. Note the two identical panels which each drive associated A+B field equipment to ensure no common mode failure possibility.

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