

Iskrateł Personnel Notification System

PNS



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1 Introduction

The document contains information about Iskratel PNS system. Denomination »SI3000 PNS« stands as »**Iskratel Personnel Notification System**«.

Iskratel PNS solution provides a reliable audio notification system for the personnel in different working environments.

It fulfills demanding requirements and ensures content management, distribution and reproduction of audio information with high reliability and availability, along with comfortable use and a full overview of the whole situation. The solution combines communications, controlling, monitoring and announcements functionalities.

Typical PA/GA system in industrial environments should provide different kind of information to different target groups:

- Safety information in cases of emergency, e.g.:
 - Standard alarm and evacuation directives to increase safety of the business processes in industrial environments,
 - Optional tone generation for emergencies and code calling;
- Broadcasting of audio information dedicated to specific zones to:
 - Deliver prompt information to the proper employee groups,
 - Replace trivial memos and by this shorten the working process costs;
- Location of personnel to:
 - Increase productivity,
 - Achieve greater accessibility of customer service,
 - Increase professional image of the enterprise;
- Ambient background to:
 - Increase the productivity and conversation privacy,
 - Mask background noise;

Solution connects to data technologies and integrates audio technology which enables highly graded functionalities and is intended for use in indoor as also in outdoor conditions.

Build from set of modules which offer management and control over the system, it enables distribution of audio information towards the users.

Iskratel PNS solution can be implemented in many different configurations as a standalone solution or as a part of the general information and communication solution.

Main characteristics of the solution:

- Flexible equipment options,
- High availability,
- Tailored solution for customer requirements,
- Secure and fast distribution of audio information and notifications,
- Simplified working process using high-end features,
- Easy and reliable communications,

- Up-to date technologies for communication control and managing (e.g. SIP, SOAP ...), ensures adaptation to every customer working environment.

The solution is therefore adaptable and customizable to detailed customers' requirements. For that reason only few used cases are presented.

As the PNS solution is flexible and tailored to the customer's requests, figures used in the document are considered to be possible subject of changes.

Note:

Presented Notification services devices (Phone terminals, Amplifiers, Speakers ...) are subject to changes without prior notice.

2 SI3000 PNS (Personnel Notification System)

2.1 Background

Accurate informing of personnel about general events happening in their working environment is one of the crucial points of a modern enterprise segment. The goal of every company is to enable powerful information, alarm and event handling system, as well as the priority levels of live notifications, messages, pre-recorded alarming via messages and external audio announcements or signals. Ambient background information or just relaxing music can provide the company's personnel achieving of better results in his daily working obligations.

The solution should be designed in a way to properly correspond to different environments - from typical enterprise office to highly challenging industrial areas. Growing companies should have ability to improve their notification systems as the needs occur regarding the system functionalities and volume.

2.2 Briefly about PNS

IskrateI PNS offers high availability with fully redundant configurations, while being a central server driven solution. PNS can be either as a stand-alone solution or integrated as a crucial part of operational and technological communications in enterprise telecommunications systems.

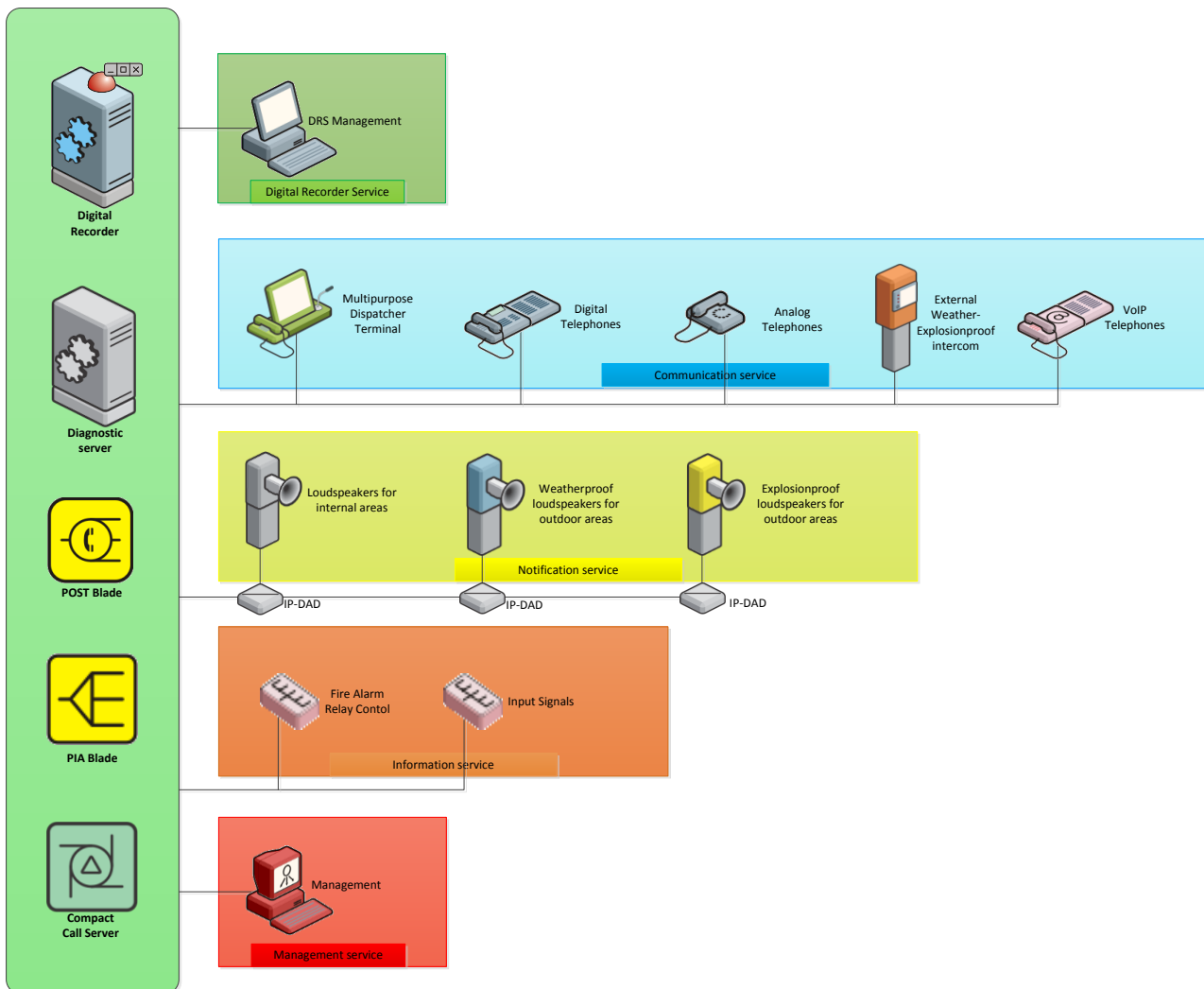


Figure 1: Example of PNS solution

In addition to the reproduction of VoIP audio streams, the intelligent client can also control alarms, priorities and covers the diagnostics of the full audio path followed by triggering redundancy systems in 1+1 or N+1 configurations.

Informing is divided in zones, where each zone is controlled with its own intelligent client and modular amplifiers. Virtually unlimited number of properly powered zones is available with possibility of reproducing dedicated audio information simultaneously to every zone.

Intelligent client controller ensures automatic adjustment of transmission volume according to the environmental conditions.

For noisy environments solution uses SIP-controlled intercom stations with option of additional self-powered speakers to insure loud and clear announcements.

Digital Acoustic echo eliminator and powerful noise-cancelling algorithms enable hands free intercom use with full duplex operation even at more than 100 dB ambient noise level.

3 PNS architecture

PNS solution architecture can be divided into three basic areas:

- Communication platform
- Information and Notification services,
- Audio information delivery systems;

The solution is based on Iskratel standard and dedicated modules:

- SI3000 cCS – Compact Call Server,
- SI3000 DRS – Digital Recorder Server,
- SI3000 ES - Ethernet Switches,
- SI3000 MN – Management Node,
- SI3000 FMS – Fault Management System,
- SI3000 MPS – Modular Power Supply;

The system comprises of large set of user terminals:

- SI3000 MPD – Multi Purpose Dispatcher
- Analog phone terminals – standard terminals can be used,
- DECT phone terminals – standard terminals can be used,
- ISDN phone terminals - standard terminals can be used, dedicated Iskratel terminals are to be used for special purposes,
- IP phone terminals – standard terminals can be used, dedicated Iskratel terminals are to be used for special purposes;

A large set of output devices is integrated in the system:

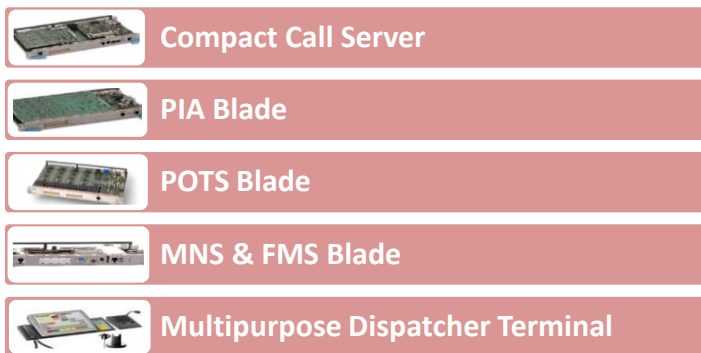
- Intercom systems,
- Audio systems, (loudspeakers);

System enables wide use of standard equipment and can be also customized for other specific types of equipment, based on customer requirements.

4 PNS platform

PNS platform consist of different modules which present Communication and Notification services..

4.1 Communication subsystem



PNS Communication subsystem enables communication to the service environment which comprises of:

- PNS subscribers,
- Monitoring devices,
- Audio information delivery system devices;

4.1.1 SI3000 cCS – compact Call Server

SI3000 cCS provides several application options and can be used in the network as:

- Switch-access node or telephone exchange which enables connectivity to subscribers and access and service nodes.
- IP gateway that includes signaling and media gateway for the conversion of TDM signaling and media traffic to IP and vice versa.
- A service node with the option of connecting additional application servers for voice-enabled, call and other services.
- Point of interaction with the environment through I/O ports.
- A converged notification server through peripheral interface (PIA blade) towards equipment for audio content distribution.
- A multifunctional node that enables the combination of the above-listed functionalities.

4.1.2 SI3000 PIA Blade – Peripheral Interface Adapter

PIA blade functionalities are as following:

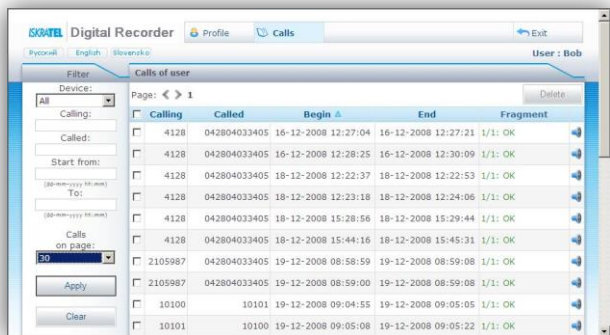
- Universal I/O interface with dry contact, what enables including of monitoring detectors,
- Universal analog outgoing trunks for driving of notification devices,
- Assuring of HD voice quality;

4.1.3 SI3000 POTS Blade

POTS blade enables attachment of POTS terminals (e.g. notification devices).

4.1.4 SI3000 DRS – Digital Recorder Server

SI3000 DRS enables recording of user calls within the PNS system. The system enables:



- Centralized or remote recording,
- Setting of recorded device criteria by different criteria:
 - Dialed prefix,
 - User number,
 - Trunk number,
 - Dispatcher circuits;
- Recording for all types of accesses (analog, ISDN, VoIP user accesses, dispatcher terminals, CAS, E1, SIP ... trunks),
- Web access application for the DRS users;

Triggering of start/end of conversation is realized through monitoring of the recorded device signaling or in special cases by VAD (Voice Activity Detection) criteria, no additional equipment is needed for plugging the DRS device.

4.1.5 SI3000 MN – Management Node

SI3000 MN is managing all Iskratel PNS equipment. CtrlSrv application on application server (SI3000 AS) is managing the dispatcher terminals.

4.1.6 SI3000 FMS – Fault Management System

SI3000 FMS is managing reports of the entire PNS system, gathering and presenting them in an interactive way, showing exact place of fault on pre-defined and specified location maps.

4.1.7 SI3000 MPD – Multi Purpose dispatcher

The same type of professional working place as for operative dispatchers is foreseen also for multipurpose dispatcher/ operator. For more effective work additional modules like secondary LCD monitor, keyboard and mouse can be added.

Role management assures redundancy between dispatchers. In case of failure of any SI3000 MPD the active and waiting calls are transferred to another dispatcher which takes over the role.

Dispatcher terminals are compact based industrial PC without moving parts, passive cooling and touchscreen LCD monitor. The speaker and microphone combination can be separated from compact housing for easier positioning and placement on the workplace.

Implemented SIP interface enables audio and video communication.



Figure 2: MPD with handset and speaker box with goose neck microphone

The size of the basic configuration of the terminal is: (including side covers): 409 x 343 x 109 mm

MPD has special features which enable better usage, easier and more efficient handling and extends the life of the equipment itself:

- Bright display adjustable to any lighting conditions.
- Resistive touch screen monitor:
 - Can be used with any mechanical element not just fingers.
- Two ETHERNET ports
 - Can be used for separation of traffic to two VLANs or redundant connection to network.
- Pedal for PTT (Push To Talk) function
- Additional modules for expansion of the terminal:
 - Keyboards with direct call keys,
 - LCD monitor, alphanumeric keyboard, mouse.

4.1.8 SIP phone terminal fitted for PNS

Basic Iskratel PNS terminal is designed on the SIP phone terminal enabling all necessary features for seamless work.

The phone for announcement workplace offers:

- HD voice, handset, speaker
- Full-duplex hands-free speakerphone with external gooseneck microphone:
 - Cardioid directional characteristic
 - Optimal speaking distance approximately 30cm up to 1m
 - Including the relevant microphone windscreen
- Additional keyboards with direct keys and LCD display or LED for status indication of each contact

- Optional PTT pedal



4.2 PNS Notification services

- Redundancy & Diagnostic Subsystem**
- Intercom Devices**
- A/D & D/A Converters**
- Amplifiers**
- Speakers**

PNS Notification services consist of:

- Management subsystem,
- Subsystem for delivery of **audio** information to the enterprise networks, energy segments, power utilities, etc. - mainly for distribution of live announcements, alarm messages and also background (ambient) music.

4.2.1 Redundancy & Diagnostics subsystem

Astro Manager is a platform for digital systems, on which it is possible to build the optimal and specific configuration, using standard hardware & software functional units ("building blocks") listed in list of components produced by Fitre or by third parties but tested and guaranteed by **Fitre**. It enables managing of the PNS network configurations and transferring of the notification devices status towards the SI3000 FMS system.



4.2.2 Intercom devices

All telephone terminals, which can accept request for Auto-answer (or is preset for Auto answer in hands free mode automatically) can be used for delivery of audio notifications to the employees.

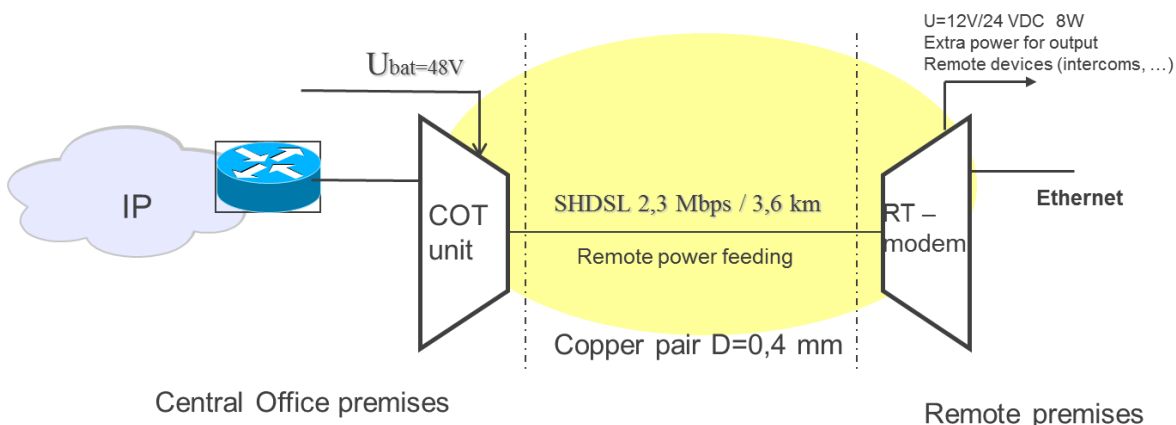
4.2.2.1 Solutions for powering IP terminals in copper infrastructure

SI3000 system provides a wide range of possible implementations of communication with intercoms.

Powering of the IP intercoms is usually not a problem, while external speakers, sirens, warning lights, etc. requires considerable amount of power. Wherever there is no possibility to ensure local power supply, energy has to be transferred from the central side.

Powering of IP terminals:

- in LAN area (up to 100m) are powered by Ethernet PoE,
- for longer distance up to 3,6km the distribution of VoIP & power to the end SIP devices is possible over single copper pair with PoDSL (Power over DSL) equipment.



For longer distances and additional equipment (like speakers, beacon lights etc.) with power consumption higher than 8W, additional pairs have to be used for power transfer.

Example of RT modem units:



In plastic housing for outdoor installation (working temperature range from -40°C).



In metallic housing for indoor installation to DIN-rail.

4.2.3 Digital audio conversion units

The “IP Digital Audio Decoder and Encoder” module units are designed in order to meet all the functional requirements in voice announcement applications and/or in any application where the connection with analogue systems is required.

The units are designed according to the industrial standards in order to be used in tough ambient conditions.

The IP-DAD unit operates as audio decoder from IP to analogue output. It supports SIP VoIP protocol, and has built-in the self-diagnostic features.

The IP-DAE unit is designed for opposite direction, for transferring the audio signal from analog input to the IP network with standard SIP protocol. The IP-DAE module is typically used in order to send an analog audio signal to one or more digital VoIP devices located in any point of the LAN.



Technical characteristics:
 Local power supply: 24-48Vdc (150 mA @ 24 Vdc)
 Ethernet connection: 18-60mA (advised 25-50mA)
 Operating temperature: -20°C +70°C
 Weight: 0,7 Kg
 19” rack board dimensions: 100 x 160 mm. 2TE

4.2.4 Amplifiers (audio information delivery subsystem)

There is a number of modular, industry grade **amplifiers** available, from 60W to 500W with their main features:

- High efficiency Class D amplifiers,
- Mains voltage (230 VAC) and 24VDC operation,
- Two audio inputs, primary input with priority and double socket for parallel connection of several amplifiers,
- Forced fan-cooling with electronic control and protection circuit,
- Front panel signaling of overloads and thermal protection,
- RS-485 output for communication with Astro Manager for the control of all amplifier functions and line fault detection,
- Compliance with EN-60849 standard for PA/GA equipment.



Figure 8: Modular audio amplifiers

4.2.5 Speakers

Different types of speakers are introduced to fulfill all customers' need:

- **Indoor speakers**
 - Wall,
 - Ceiling,
 - Cabinet,
 - Wall volume regulators with bridging relay;
- **Outdoor speakers**
 - Weather-proof (IP56 – IP67),
 - Explosion-proof,
 - Horns from metal or composite (plastic),
- **Passive speakers** for connection to 100V line
- **Wall volume regulator** with relay for bypassing the attenuation in case of notification in emergency situation
- **Active speakers:**
 - With built-in amplifier only,
 - With built-in amplifier and volume regulation regarding to the environment noise;



Speakers can be mounted based on customers needs, so the sound waves spread uninterruptedly and smoothly on the desired height on the platform.

Speakers can also be combined with flashing beacons to attract attention when announcement is emitting in noisy environments.

4.2.6 Video surveillance integration

Multipurpose dispatcher also offers integration with video surveillance systems. By using the touch screen interface, the operator can easily switch between various cameras. The goal of integrated multipurpose dispatcher and video surveillance is to display critical information from both systems on a single user interface. The system can automatically launch live video stream from camera associated with the caller or with the audio notification zone.

Sensors such as door switches, smoke detectors, IR detectors or glass break detectors can be used for triggering launch of live camera stream and provide faster incident response and enhance security.

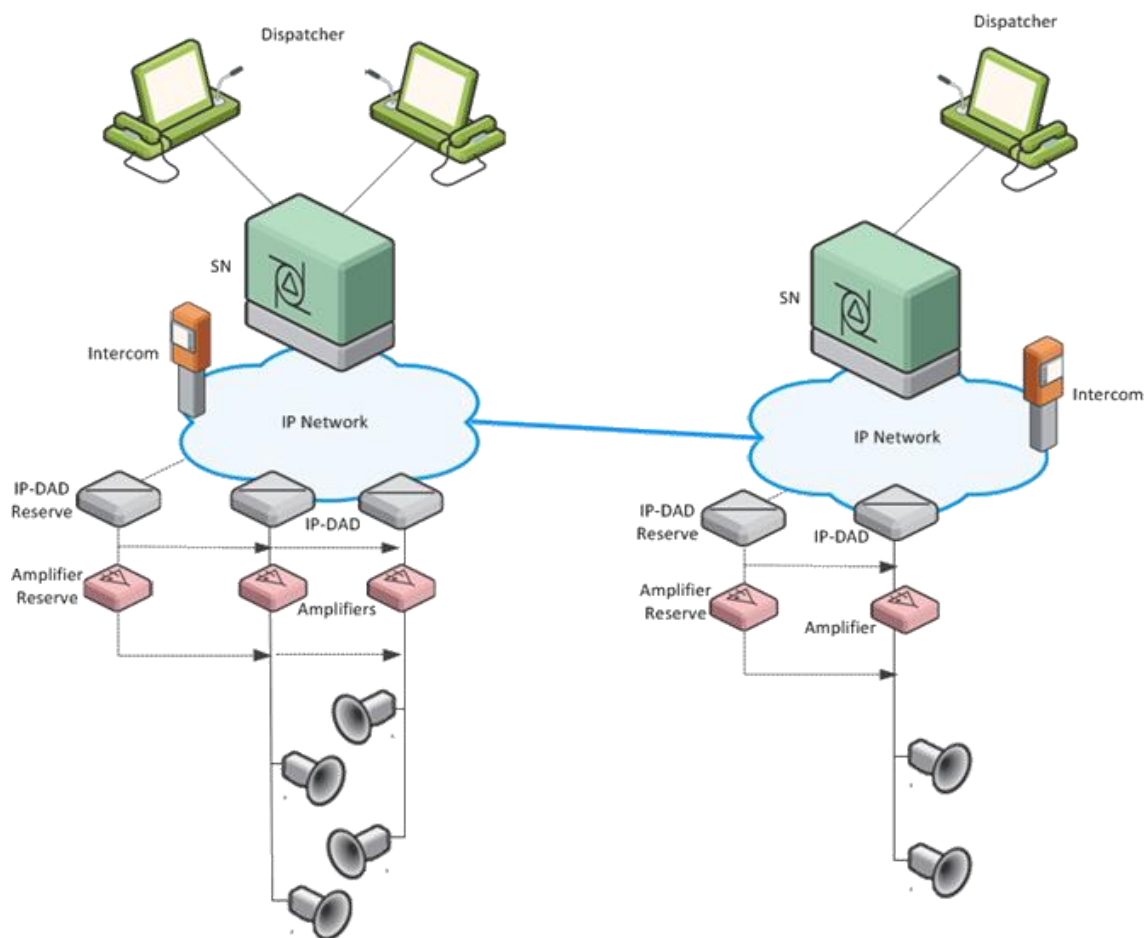
For audio notification optimization, system provides auto-notifications with pre-defined audio messages, triggered by Intelligent Video Analytics.

Intelligent Video Analytics system of Video surveillance enables automatic triggering of audio notifications based on detection of sensor events.

5 Availability of the PNS system

PNS system supports fully redundancy and diagnostics to deliver complete availability that is demanded in highly challenging environments where personnel safety comes in first in critical situations. The redundancy of Iskratel PNS system is available for next elements:

- Redundancy of dispatcher terminals,
- Redundancy of notification controlling,
- Redundancy of circuit notification.



The diagnostics for all elements of PNS system is available from central alarm management and dispatcher terminal. From central alarm managements system administrator can monitor and supervise detail information of all PNS system equipment. Basic alarms for critical equipment such as phone, intercoms, zones and controlled servers is available from dispatcher terminal, so that operators can react quick and efficient in case of equipment failure.

According to the nature of the PNS system high availability of the system is requested. In order to achieve it, PNS audio distribution system can be (optionally) configured as redundant in different ways:

- Implementation of A+B redundancy, where:
 - Failure of one Audio-decoder has no affect to announcements.
 - Failure of one amplifier partially reduces the audibility (up to 6dB max), but it is still provided through other line of speakers.
 - In the zones with high ambient noise speakers can be combined with flashing beacons.
- Implementation of N+1 redundancy, where switchover to redundant unit based on real-time diagnostics is realized:
 - On IP network level via SIP routing.
 - On audio signal level via low-power relay contacts.
 - On 100V outputs from amplifiers via power relay contacts.

HD quality of voice is assured by Iskratel Peripheral Interface blade (PIA blade) for IP/analog conversion.

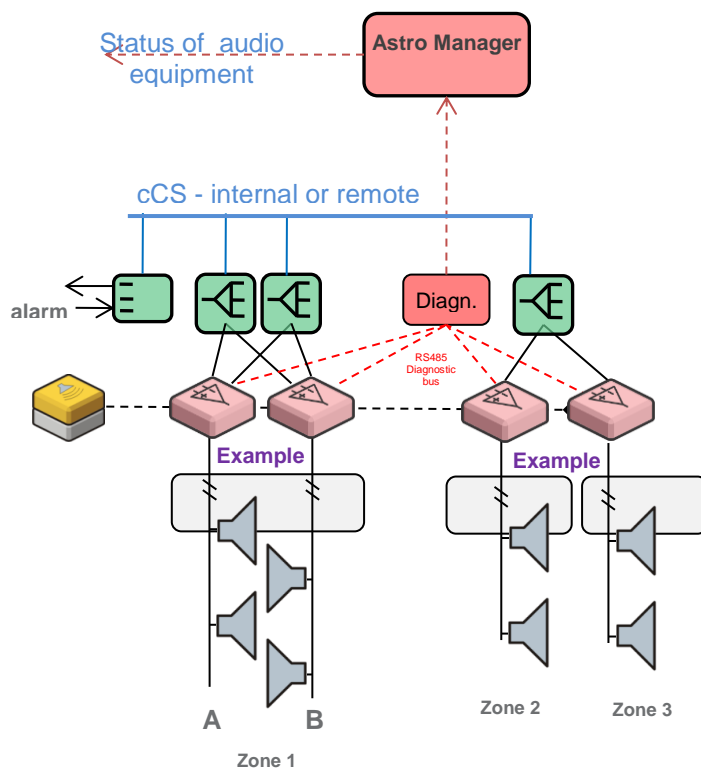


Figure 3: A+B redundant audio information system configuration (in Zone 1)

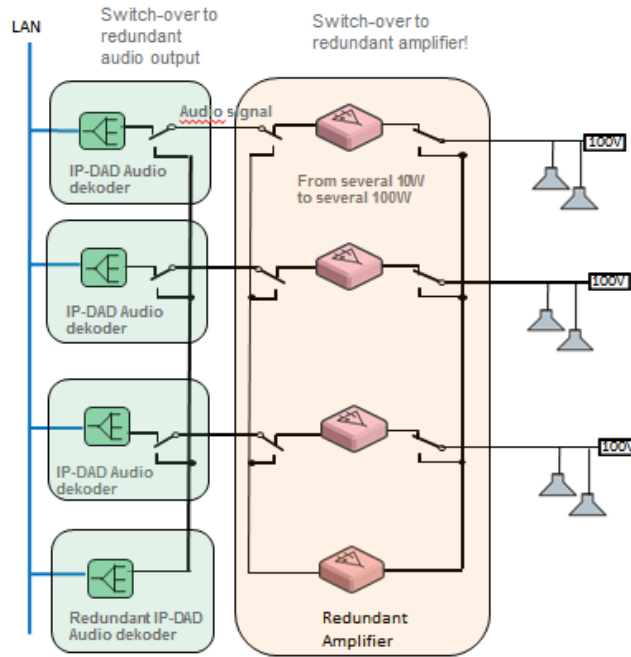
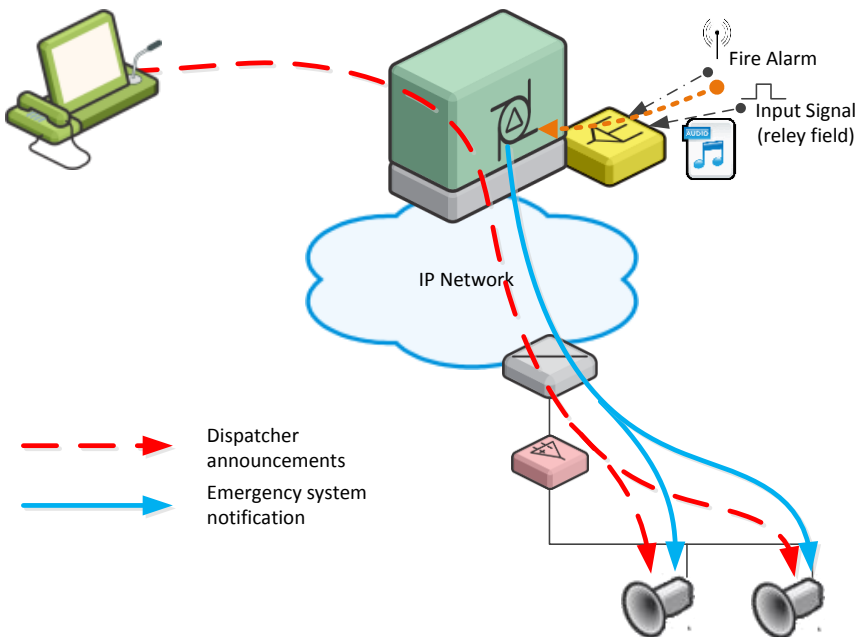


Figure 7: N+1 redundant audio information system configuration

6 Use cases

6.1 Notifications in case of emergency situation



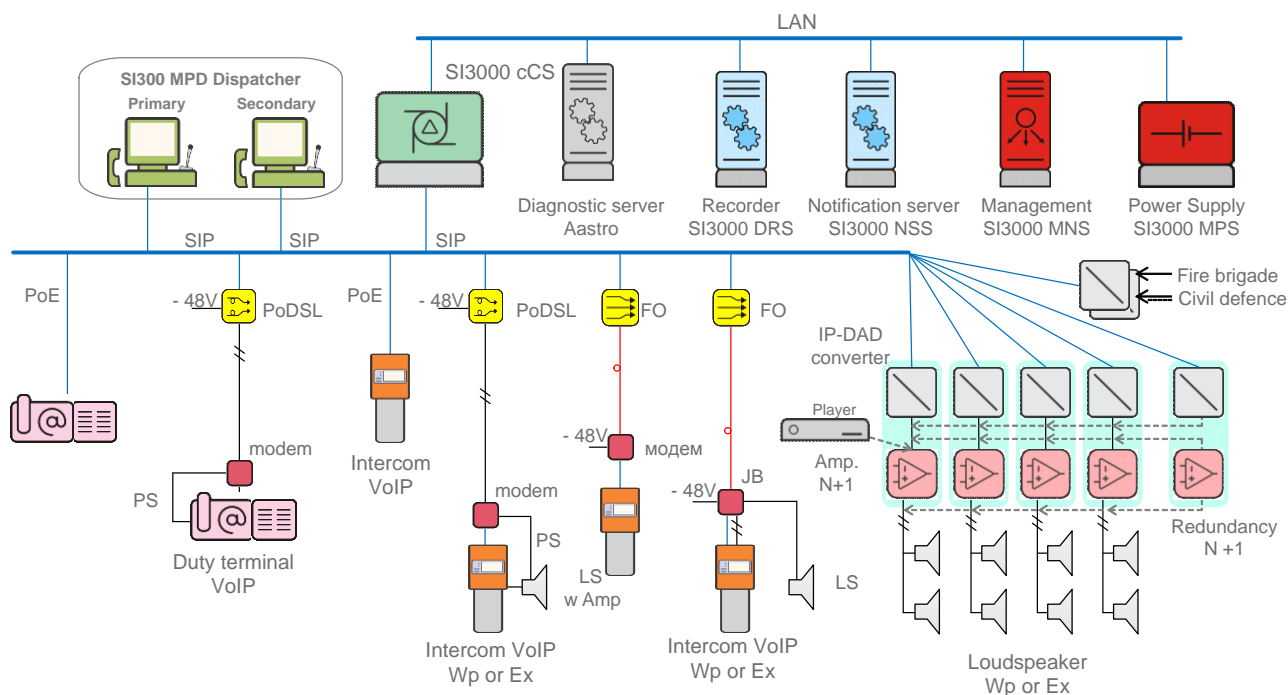
In case of emergency situation detected by PIA dry contact monitoring detectors, automatic or live notification can be delivered to the personnel.

In such cases the notification messages are reproduced through the PNS speakers.

If the same speaker devices are already used for e.g. dispatcher announcement, this announcement is cut due to the emergency notification call higher priority and the last is delivered to the personnel.

6.2 General PNS solution scheme

Following chapter presents a general PNS solution scheme where depending on the specific requirements of the customer all or a limited set of functional components can be included.



Solution components are:

- SI3000 cCS which enables control over communication between all devices, managing of the compounds relay control inputs, implementation of control functions (e.g. conference / selector, call recording ...),
 - IP-DAD unit which enables communication with alarm zones amplifiers, communication with notification devices , notification devices diagnostics reporting, amplifier and powering redundancy switching , controlling of signals and their priorities,
 - Amplifier units which enable switching of speaker devices and self-diagnostics and speaker device diagnostics reporting,
 - Astro subsystem for diagnostic of devices that do not have this function, providing data to the control system and the control room,
 - AM / FM radio, CDs and MP3 reproduction systems,
- Remote SI3000 MPD provides operational management of unilateral and bilateral communications, switching between modes of communication, displaying of devices' alarms, etc.
- Telephone terminals, analog, digital and VoIP, which enable communication with each other and the dispatcher,
- Specialized communication devices which enable communication in industrial sites and in hazardous areas,
- Recording Server (DRS) which enables recording of calls and authorized access to voice recordings,
- Notification Server, which enables organized mass notification via phone calls or/and SMS messaging,
- Management Server MN which enables administration, equipment monitoring and communication with third party systems (such as OSS / BSS).

7 Abbreviations

Abbreviation	Meaning
cCS	SI3000 Compact Call Server
DECT	Digital Enhanced Cordless Telecommunications
DRS	Digital Recording Server
ES	SI3000 Ethernet Switches
FMS	SI3000 Fault Management System
HD	High Definition
I/O	Input/Output device
IP	Internet Protocol
IP-DAD	IP Digital/Analog Decoder
IP-DAE	IP Digital/Analog Encoder
ISDN	Integrated Services for Digital Network
LCD	Liquid Crystal Display
LED	Light-emitting diode
MN	SI3000 Management Node
MPD	Multi-Purpose Dispatcher
MPS	SI3000 Modular Power Supply
OSS/BSS	Open Source Software/Business Support System
PA/GA	Personal Address System
PIA	Peripheral Interface Adapter
PNS	Personnel Notification System
PTT	Push To Talk
RINS	Railways Information and Notification System
SIP	Session Initiation Protocol
SOAP	Simple Object Access Protocol
TDM	Time Division Multiplexing
VAD	Voice Activity Detection
VLAN	Virtual LAN
VoIP	Voice over Internet Protocol

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