ASTRO-PA/GA SYSTEM EN 54-16

01 rel.201612 - v.201906

ASTRO-PAGA – Digital IP Public Address & General Alarm SYSTEM for INDUSTRIAL SAFETY APPLICATIONS

- ***Stand-alone, High Availability full redundant A&B system architecture via LAN connection***
- ***EN54-16 certified***
- ***Modular, scalable and high reliable system based on distributed master/slave and master/master distributed architecture with hierarchic managing***
- ***Single of Point of Failure managing***
- ***Installation cost saving thanks to the IP network: the power amplifiers are located where the loudspeakers & visual beacons are required***
- ***Simple and easy-to-use ASTRO/Client GUI interface in order to configure the system as well to handle the diagnostic information. ASTRO/Client software can be installed on a dedicated unit or fully integrated into the ASTRO Call Manager unit or it can be accessed by any customer's PC via VNC (Virtual Network Computing)***
- ***Redundant LAN connection (C-ring) among the digital devices assembled in each cabinet***
- ***Ring Network Management software integrated in ASTRO Call Manager***
- ***Fully digital IP Access Panels and intercom stations based on the state of the art VoIP technology with standard SIP and FastPA streaming protocol configured with echo and ambient noise canceller***
- ***Powerful digital noise cancelling algorithm developed on the basis of Fitre's long experience in heavy industrial plants in order to guarantee to communicate in hands-free and real full-duplex mode even if the ambient noise level is more than 100 dB.***
- ***Modular and flexible construction in 19" rack cabinets for easy and speed access to any part of the system***
- ***Each device is equipped with the relevant integrated Ethernet 10/100 interface suitable to be connected to any existing LAN avoiding the use of dedicated connections and/or digital networks***
- ***Integrated PBX features for selective calls, group calls and all call of the intercom stations with possibility for interfacing ASTRO Call Manager system to any existing PABX and/or Telecom network (PSTN) through Trunk-SIP and FXS/FXO interfaces***
- ***Configurable Priority Levels handling***
- ***Emergency & Intercom calls handling with 100% of simultaneous conversations***
- ***Remote diagnostic capability***
- ***Remote maintenance and software up/down-load capability through Internet (LAN)***
- ***Powerful Alarm event handling capability in order to broadcast alarm tone/messages linked to the active alarm contact(s). The alarm/tone /message are stored in the static memory of ASTRO server unit. The user can easily record the live voice messages***
- ***Loudspeaker line impedance monitoring***
- ***Visual beacon line monitoring***
- ***Speech test diagnostic for checking the full audio path***
- ***Emergency microphone for broadcasting alarm messages even in case of dramatic fault of the main system manage***
- ***Automatic E-MAIL and/or SMS notification in the event of failure***

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ASTRO-PAGA System: the state of the art Digital IP Public Address and General Alarm EN54-16 Certified Systems with LAN architecture – GENERAL System overview

ASTRO/PAGA system is designed for broadcasting alarm tones, pre-recorded messages, emergency and standard live voice messages to single or group or all areas of the plant. In areas where the ambient noise is high, ASTRO-PAGA system handles the visual beacons, too.
ASTRO-PAGA is based on modular, flexible and reliable architecture with cost effect benefits. Each device of the system is equipped with the relevant integrated Ethernet interface in order to guarantee the maximum level of the modularity and scalability. Thanks to the digital architecture, it is possible to remote any part of the system, including the booster amplifiers, in order to cut the costs of the cabling.
The maintenance personnel, using the GUI user interface can configure the system and he can also access to the diagnostic information in easy and fast way even from remote site via Ethernet/Internet connection.
ASTRO-PAGA system operates with the standard SIP and FastPA streaming protocol (***audio voice bandwidth: 8 KHz***).
Avoiding any proprietary solution, the customer benefits of the wide range of standard applications saving time and money for developing proprietary special equipment.
ASTRO-PAGA has been developed in order to solve the high quality, reliability, availability and safety requirements in ***on&offshore oil & gas, petrochemical, transport and, generally, in all the applications where the safety is the most important point of the project***.
In order to reduce at the minimum, the power consumption and to increase the MTBF value, all the amplifiers are Class-D type.

Each amplifier is directly connected to the redundant LAN via the relevant IP-DAD module, equipped with integrated Ethernet interface. Thanks to this, the zones modularity is the single amplifier and there is not a real limit in terms of zones/amplifiers to be configured in the plant.
Each access panel and/or intercom station are available for indoor and outdoor installation, including the weatherproof and explosion-proof ATEX certified Zone1 types.

ASTRO-PAGA system is designed for handling the alarm events as well the priority levels of the communication: voice live messages, recorded alarm tones/messages, telephone user voice messages, external audio files and/or signals.
Thanks to the open and standard architecture, ASTRO-PAGA system can be interfaced with external systems (for example, Scada, DCS, F&G, PABX and so on) using standard software interfaces TCP/IP, Web service, SIP-trunk through the LAN.
ASTRO-PAGA system can be configured as stand-alone unit and in ***full duplicated architecture (Systems "A" and "B"***): in case of fault of Astro1 then Astro2 becomes automatically the manager of the whole system without any limitation in terms of functionality.
All the digital devices assembled inside the cabinet are connected through the ***redundant network LAN (C-Ring)***

ASTRO Call Manager Unit – Technical Specifications

LAN/WAN connection	➢ n. 2 - 10/100/1000 BaseT Ethernet RJ45 (expandable up to 4) – IP static address or DHCP ➢ VLAN on-board
Power supply unit	Low power consumption 24 VDC /max. 30 W
Memory	64 Gbyte Static Mass storage of which about 40 Gbyte are available for recording the alarm tones/messages and the conversations
Communication protocol	Standard SIP
Remote configuration capability	➢ Web server ➢ Download of the configuration files ➢ Upgrading through TFTP, HTTP ➢ Access by password
Software interface with external supervisor systems	Web-Service
Real time diagnostic facility	ASTRO/Client (for handling the Diagnostic / Maintenance / Configuration services) even via VNC
PABX and/or PSTN interface	Through GFX unit(s)
IPBX interface	Through Trunk-SIP protocol
PA and PAGA audio interface	Through IP-DAD unit(s) and ECxI I/O module(s) for handling the alarm inputs/outputs as well the visual beacons and the relevant diagnostic
Operating temperature	-5° to +60°C
MTBF	112.000 hours @ 25°C
Dimensions/Weight	19" 1U rack (D. 300 mm.) / 4,1 kg.

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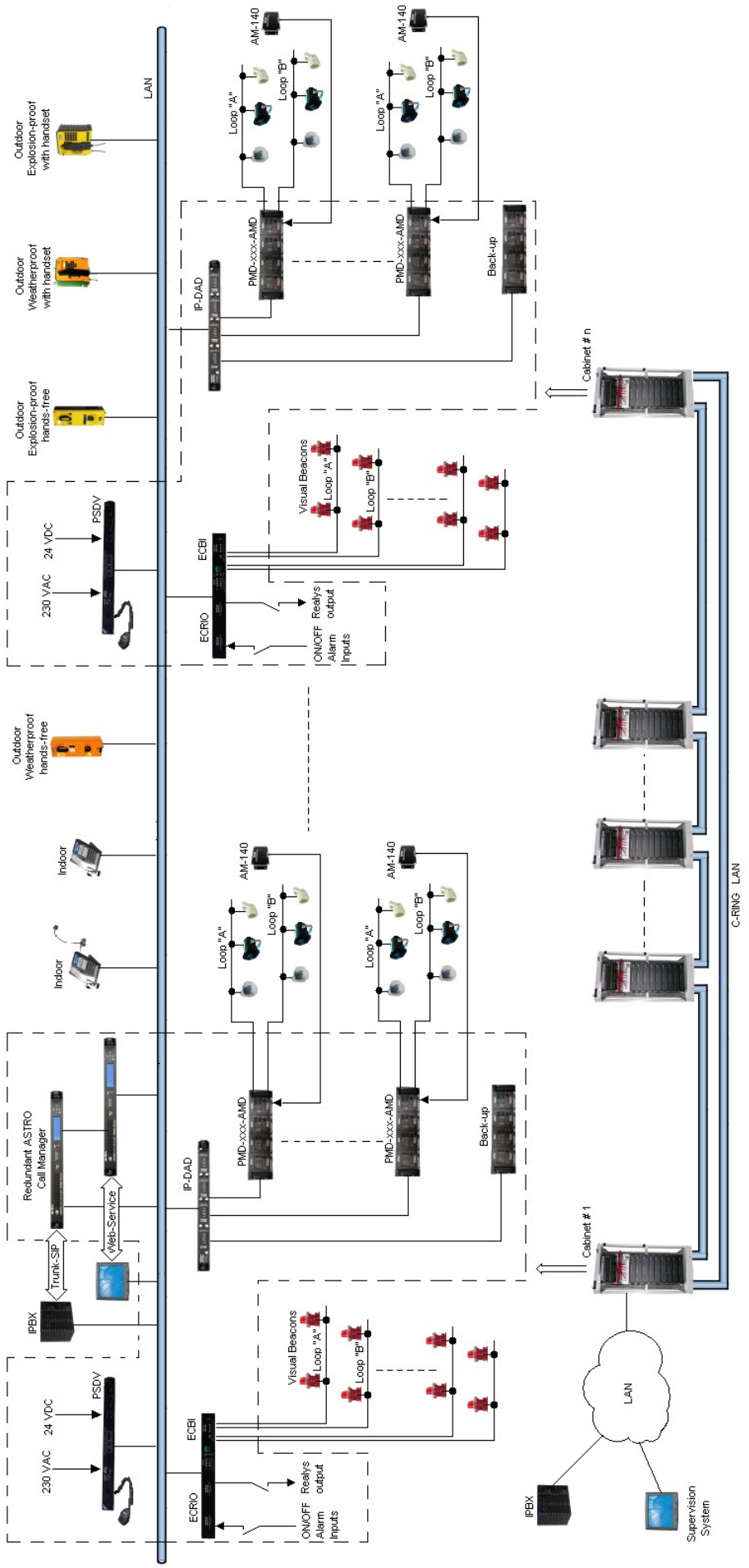

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System Functionality

ASTRO-PAGA & Intercom system handles the emergency events broadcasting the proper alarm tones/messages in order to allow the safe evacuation and the paging of the personnel.

One or more operators, through a digital and/or analog access panels /intercom stations, can initiate manually an alarm tone/message.
In addition, external systems (like F&G, DCS, Emergency Shutdown System) can activate the automatic broadcasting of alarm tone/messages.
When the telephone interface is required, then any telephone user can access to the loudspeakers net in order to broadcast voice live messages and/or to call any station of the PAGA system (according to the configuration).

Each area/zone of the plant is handled by one or more power amplifiers with automatic change-over with the back-up power amplifier (n+1 redundancy); it is possible to configure the system even with 1+1 as well n+x redundancy.

Thanks to the digital LAN architecture, each amplifier and/or group of amplifiers used for handling the same zone are a node of the LAN. Each node is addressable by any of the two ASTRO-PAGA duplicated systems. So, even in case of fault of one of the two systems, the second one can handles all the addresses of the devices connected on the LAN (stations, amplifiers, alarm inputs). As result of this, the user has not any functional limitation and there is not any loose of sound power in any zone. Assuming that in each area there are several loudspeakers handled by system "A" and several loudspeakers handles by system "B", even in case of fault on one system, in that area both group of loudspeakers ("A" and "B") operate, broadcasting the alarm tones/messages and/or live messages.

Each access panel (station) supports the voice announcement and the alarm initiating. On the basis of the configuration, the operator can activate the alarm tone and/or pre-recorded message to be broadcast in one or in a group of zones as well in all zones.
Each VoIP digital station is equipped the integrated microphone and loudspeaker for hands-free full-duplex conversations and voice announcements as well with the display for visualising the status of the stations and of the system. The access panels and intercom station are available also with the handset.

Each VoIP digital station is a node of the LAN and it isn't directly connected to any of the two ASTRO-PAGA systems. Thanks to this architecture, the digital VoIP stations can be installed in any location (even geographically remote from the plant) just over the LAN connection. There is not need of a dedicated cable (with length limitation) between the station and the cabinets where the systems are assembled.

ASTRO-PAGA system handles the priority levels according to the configuration; there is not a real limitation in terms of quantity of levels and logical rules for activating the alarm tones/messages as well the zone combinations where it is necessary to broadcast the alarm tone/messages.

ASTRO-PAGA system supports a wide range of interfaces with external telephone PABX, digital IPBX or audio sources.
According to the configuration, ASTRO-PAGA will handle the proper priority level considering the audio interfaces and the relevant audio channels as well the alarm ON/OFF inputs and/or alarm events received through TCP/IP protocols and/or serial connections with external systems.

ASTRO-PAGA system is designed for handling simultaneously the broadcasting of different audio signal into different loudspeakers zones.

In order to avoid any acoustic feed-back (larsen effect) risk, ASTRO-PAGA can be configured for delaying the live message broadcasting.

As option, ASTRO-PAGA supports also the ambient microphone units in order to detect the ambient noise level and to adjust automatically and in real-time the output of the relevant amplifier. Thanks to the exclusive FITRE algorithm, ASTRO discriminates the voice announcement by the ambient noise level; so, during the announcements, ASTRO adjusts the audio output of the amplifiers just and only according to the noise level variation.

ASTRO-PAGA system can be used for handling the intercom service, too. In this case, the stations are equipped with the standard telephone keypad and the user can dial any subscriber number or a limited quantity of subscriber numbers of the system (according to the configuration).

Each digital device of the system (including the stations and the IP-DAD digital audio interfaces are equipped with an extensive software diagnostic tool, capable for detecting the fault even on the microphone and loudspeaker device (speech-test).
The diagnostic tool of ASTRO-PAGA includes the test of each power amplifier, the test of each field loudspeaker loop as well of each visual beacon loop.

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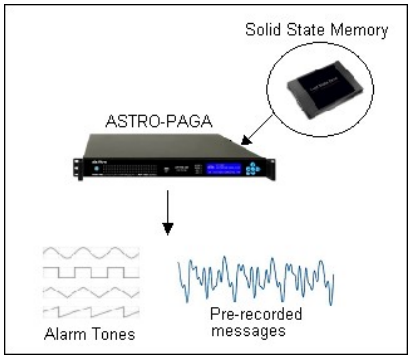
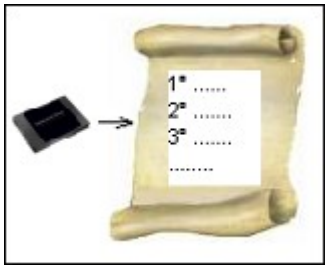
MAIN SYSTEM FEATURES



Alarm tones/pre-recorded messages configuration

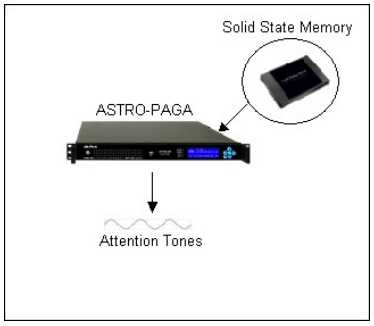
all the alarm tones and pre-recorded messages are recorded into the memory of ASTRO-PAGA system. There is not limitation in terms of quantity and length of the messages. The alarm tones/messages are imported as .wave and/or mp3 files through a very simple and powerful graphic interface (ASTRO-Manager). So, the customer can program own messages even in own local language as well he can program own special tone independently by the manufacturer tone generator and/or list of messages.

ASTRO-PAGA system can handle any combination of alarm inputs triggering, linking any alarm tone/message to the alarm event in order to broadcast it in the programmed zone, group of zones or in all the zones.



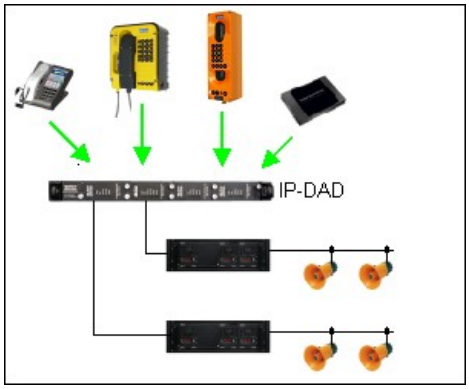
Priority handling

ASTRO-PAGA system handle all the priority levels among alarm inputs and audio sources. The priority level list is fully programmable and reconfigured even onsite.



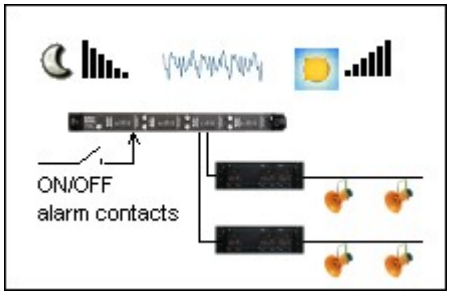
Attention-tones

Also the attention/warning tones are stored into the memory of ASTRO-PAGA system and they can be imported as .wave and/or mp3 files. In order to help the immediate understanding of the message, the customer can link a type of attention-tone to any pre-recorded and/or live message.



Loudspeaker zones

ASTRO-PAGA system can broadcast any type of alarm tone/message as well of live voice message into a single zone, into a group of zones and into all the loudspeaker zones according to the programmable level priority list.



Programmable audio level

The user can configure the audio output level of each alarm tone and/or alarm message. This feature can be programmed as automatic event handling (for example, output level reduction during the night time).

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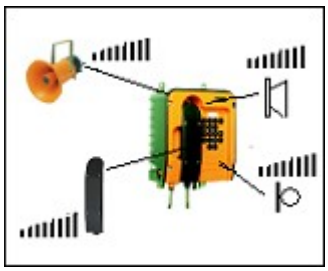
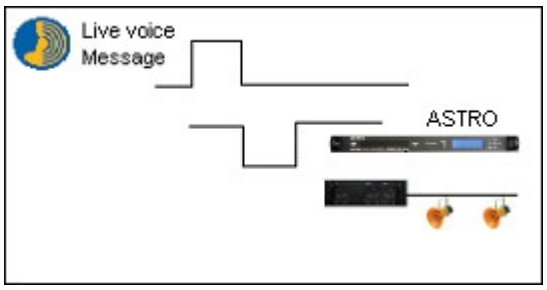


Audio characteristics

ASTRO-PAGA system is a real full digital VoIP system with high capability in terms of control of the audio signals.
Mainly, each digital VoIP station cab be configured in order to adjust by remote the integrated microphone and loudspeaker levels as well the audio output for handling an external amplified loudspeaker, connected to the station itself in order to boost the audio signal when the station is installed in noisy area.



Acoustic feed-back facility

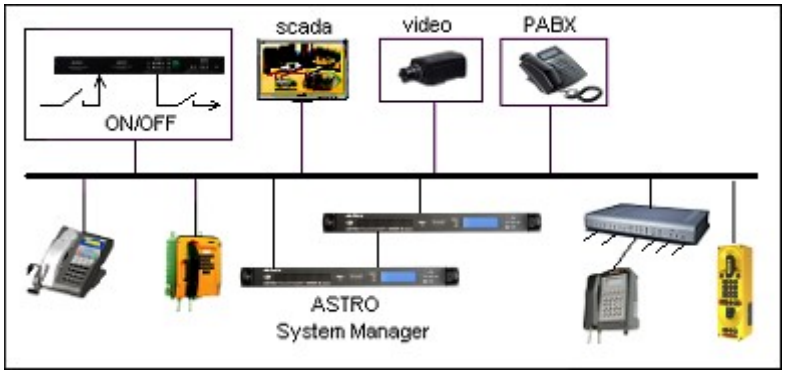
In order to avoid any acoustic feed-back (larsen effect) risk, ASTRO-PAGA can be configured for delaying the live message broadcasting.

Power Amplifiers

ASTRO-PAGA system can operate with different types of power amplifiers with different output power values: 125 – 250 and 500 W. Each of these power amplifiers is equipped with own diagnostic circuit relevant to the amplifier itself as well to the controlled loudspeaker loop. The diagnostic circuit is designed for detecting the following fault events:

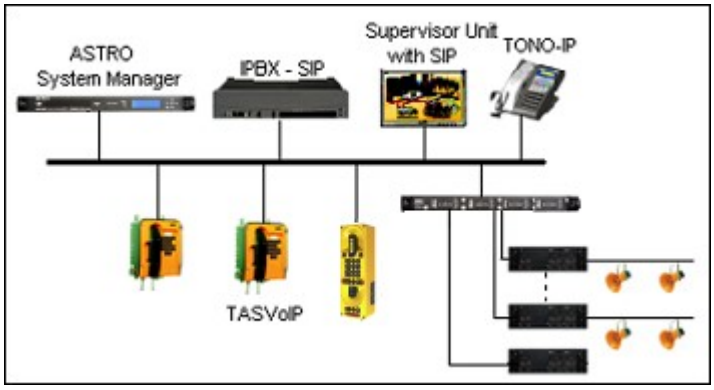
- output over-load
- output short-circuit
- over-temperature
- variation of the impedance value of the loudspeaker loop

Each power amplifier is equipped with own integrated power supply: input 230 VAC and 24 VDC. According to the application specification, the system can be configured for handling the change-over with one back-up amplifier: one back-up unit per each zone or one back-up unit per each system "A" and "B".
In case of fault of one of the service power amplifiers then ASTRO-PAGA system activates automatically the swapping with the back-up amplifier, signalling the fault event to the operator(s) and to the maintenance terminal.



Network Connectivity

Each ASTRO-PAGA system is equipped with two 10/100/1000 BaseT Ethernet RJ45 with UTP cable – IP static address or DHCP and VLAN board.
Typically, one Ethernet RJ45 is used for connecting ASTRO-PAGA to the LAN; the second port is used when the full duplicated architecture is required.
All the digital devices (stations, IP-DAD audio interface for handling the power amplifiers, GFX for handling the interface with the telephone PABX) are equipped with the Ethernet RJ45 interface. So, each of them is just a node of the LAN with own IP address and there is not any limitation in terms of quantity of the devices and their location in the plant and/or in any other location.



Redundancy

- Each VoIP digital station can be registered on several different VoIP system manager
- The power amplifiers are configured in N+1 mode with the relevant back-up unit (one per zone or one per system).
- The IP-DAD digital audio decoder interfaces are configured in N+1 mode with the relevant back-up unit (one per zone or one per system).

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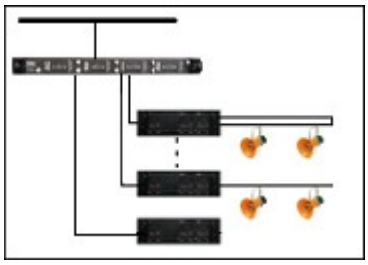
System Duplication

ASTRO-PAGA system can be configured as full duplicated system: System "A" and System "B". Each of the two systems are based on the ASTRO unit with redundant power supply and redundant hard-disk.
In this architecture, the ASTRO units operate in cluster mode: Astro1 and Astro2. Typically, Astro1 is the primary node and Astro2 is the hot back-up unit, configured exactly in the same way as Astro1.
In case of fault of Astro1, then Astro2 becomes automatically the primary node signalling the fault event to the operator(s) and to the maintenance terminal (High-Availability-Cluster)
The two Astro units are connected through a direct Ethernet link using the DRBD (Distributed Replicated Block Device) in order to activate the automatic reconstruction of the data, including all the variations (RAID1 like)
The cluster status can be checked by the operator through a standard Web-Server connection.
Thanks to this architecture, one ASTRO unit can handle all the resources of the whole PAGA system, including all the stations, all the IP-DAD audio interfaces (all the power amplifiers) and all the loudspeakers.
Even in case of fault of one of the two ASTRO units, *there is not any audio power reduction!*

Diagnostic

Each digital device and power amplifier and loudspeaker loop are continuously controlled by ASTRO-Manager diagnostic and maintenance and configuration software.
In particular, ASTRO-Manager can check the status of the audio path of each digital and/or station sending an audio test tone on the loudspeaker of the station and checking the audio level detected by the microphone of the station itself.

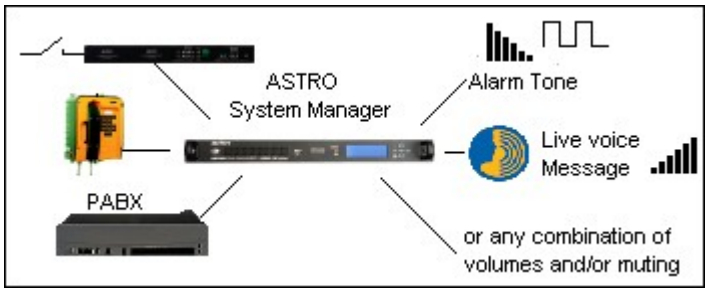


Loudspeaker loop Monitoring

ASTRO-PAGA system is designed for monitoring the integrity of the loudspeaker loops in order to verify the total impedance value, the short-circuit and open-circuit condition. The fault event is signalled automatically on the operator console(s) and on the maintenance terminal.
The fault event can be detected by frequency over the two wires of the loudspeakers or by additional cable (physical loop connection).

Voice Audio Recording

ASTRO-PAGA system can be configured in order to record automatically the conversations between the operator and the field users as well the live messages originated from the telephone or from the radio or from any audio sources.
In addition, the main operator can also be configured in order to listen the audio message originated by the telephone or radio users and get the permission for broadcasting the messages.
Through ASTRO-Manager the operator can search and play the recorded conversations and/or messages.



Alarm Attenuation

ASTRO-PAGA can be configured for handling several broadcasting modes when an alarm is active: muting of the message is in progress, level attenuation of the alarm tone, and so on.

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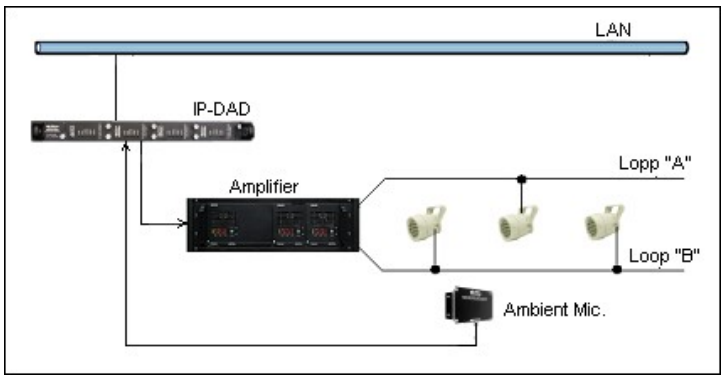
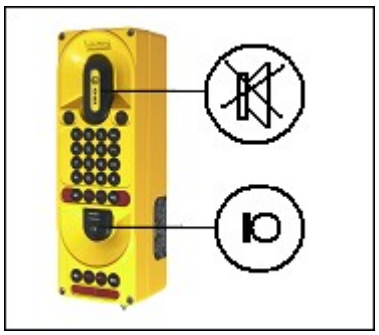


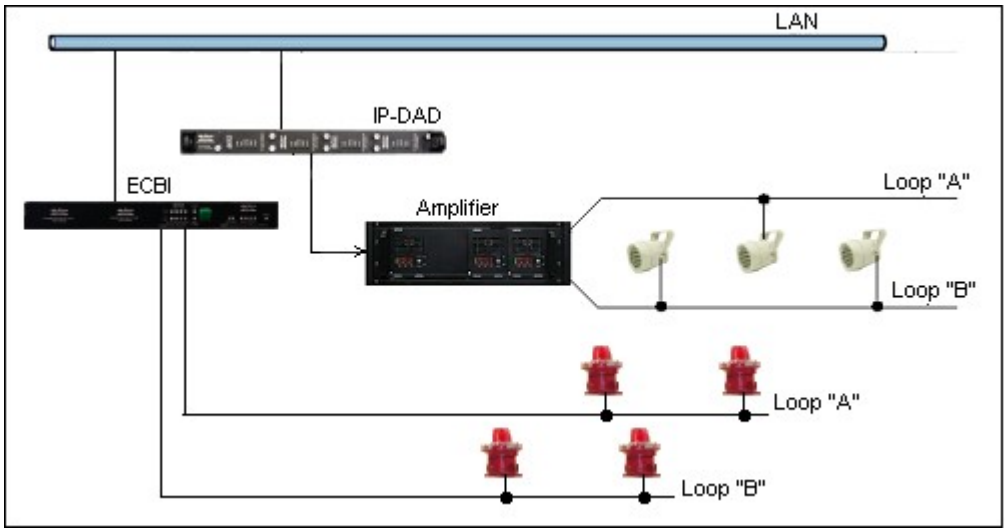
Automatic Volume Adjustment

ASTRO can be configured for adjusting automatically the output volume according to the ambient noise level detected by the ambient microphone.
The automatic noise level detection is based on one ambient microphone per each amplifier (zone). Thanks to the exclusive FITRE algorithm, ASTRO discriminates the voice announcement by the ambient noise level; so, during the announcements, ASTRO adjusts automatically the audio output of the amplifiers just and only according to the noise level variation.



Audio Ambient Listening

The operator can activate the "silent listening" mode on each station in order to detect the ambient noise and/or, in public areas, to listen a risk situation.



Visual Beacons

ASTRO-PAGA system is designed for handling the switching ON/OFF of the visual beacons, to be installed in areas where the ambient noise is very high.
The visual signalling increases the personnel attention when an alarm tone/message must be broadcast.

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MAIN SYSTEM DEVICES/COMPONENTS

ASTRO-PAGA is a digital modular system suitable for standard 19" rack assembly.

ASTRO Call Manager configured with software certified EN54-16, designed for managing all the communication functions either in terms of PAGA and Emergency and Intercom functions. ASTRO is designed on the basis of the stare of the art industrial PC platform equipped with solid state memory and low power consumption in order to guarantee the maximum level of reliability and availability of the system.

PSDV: intelligent distribution and visualisation unit designed for managing the power voltages inputs, for visualising the status of the system as well the integrated emergency microphone.

IP-DAD: intelligent digital audio decoder for managing the Class-D power amplifiers as well the ambient noise microphones. The IP-DAD boards are assembled in the standard 19" rack, each of them can be configurable up to 4 IP-DAD modules. ASTRO-PAGA system is designed for managing as many as necessary IP-DAD racks/modules and there is not a real limitation in terms of quantity.

PMD-xxx-AMC modular Class-D power amplifiers (modularity: 125 W – 250 W and 500 W). The PMD- AMD series amplifiers are assembled in the standard 19" rack, each of them can be configurable up to 4 PMD-125 or 250 W and up to 2 PMD-500 W. ASTRO-PAGA system is designed for managing as many as necessary PMD-AMD series racks/amplifiers and there is not a real limitation in terms of quantity.

ECxI: intelligent I/O interface. The ECxI rack is fully configurable with the relevant I/O interfaces: ECBI and ECRI. Each ECxI rack can be configured with max. 3 mixed I/O interfaces. ASTRO-PAGA system is designed for managing as many as necessary ECxI series racks/I-O modules and there is not a real limitation in terms of quantity

- ***ECBI*** interface (to be assembled in the ECxI rack): equipped with n. 4 channels for feeding and managing the diagnostic of the relevant visual beacon line connections. Each line connection can be configured as single line (two wires) or loop (4 wires). On each line the beacons are connected to the output of the ECBI interface. The ECBI interface is designed for checking the line status and for reporting the fault vents (short or open or ground leakage) to ASTRO Call Manager and, through the standard Web-Service software to the external supervision system.
- ***ECRI*** interface (to be assembled in the ECxI rack): equipped with n. 8 digital ON/OFF inputs for managing the external alarm events and with n. 8 output relays for activating external devices and/or for reporting to the external supervision systems the status information.

ASTRO is designed for managing also ***additional communication services / functions***; so, in the same PAGA system it is possible to integrate the intercom as well the emergency calls management under the ASTRO's control.
Thanks to this flexible architecture, one ASTRO manages several communication functions avoiding the additional cost for dedicated servers (one per each function/system).

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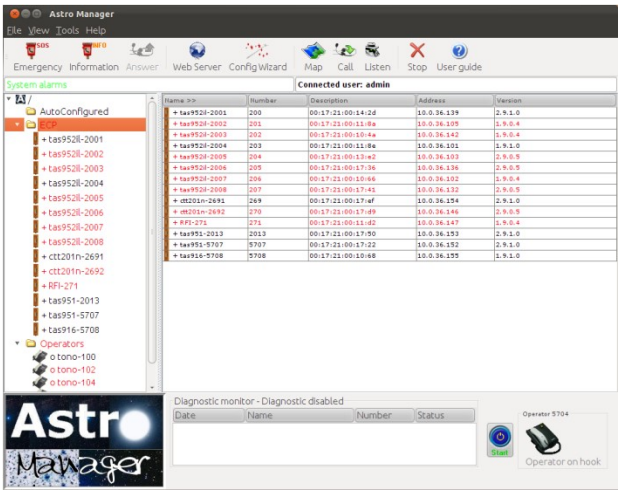
ASTRO Call Manager Diagnostic GUI interface

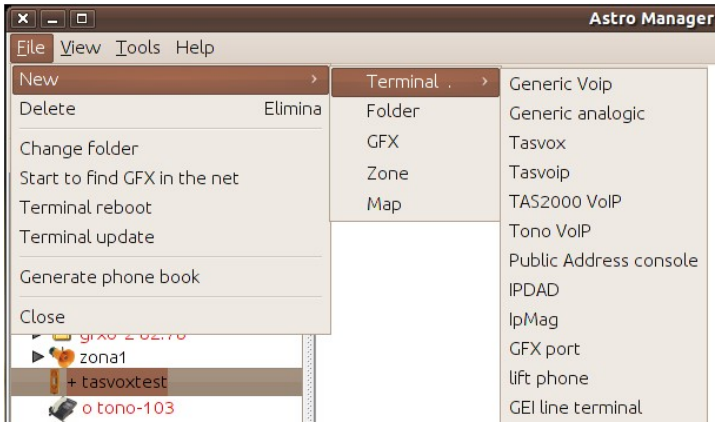
There are three possible ways (each password protected) to enter the Astro Manager application:

- Dedicated PC
- Access with keyboard, mouse and monitor directly attached to Astro
- Remote access with open source VNC software

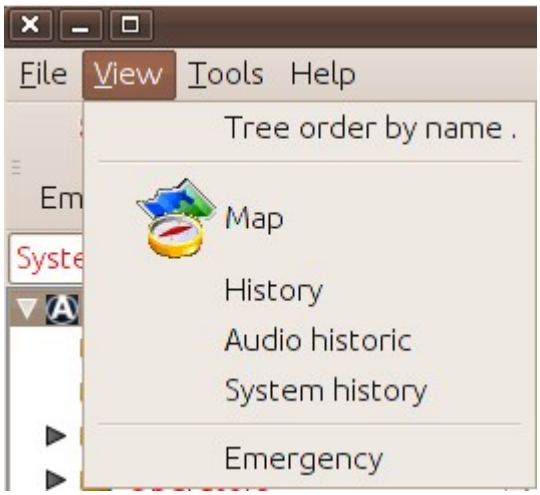
Main screen



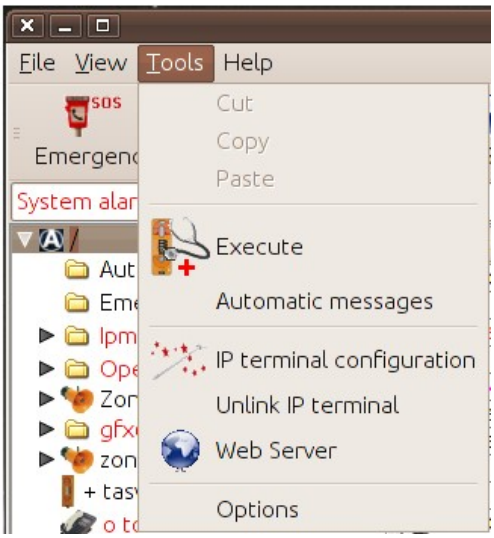
Main menu and tool bar – Creation from scratch

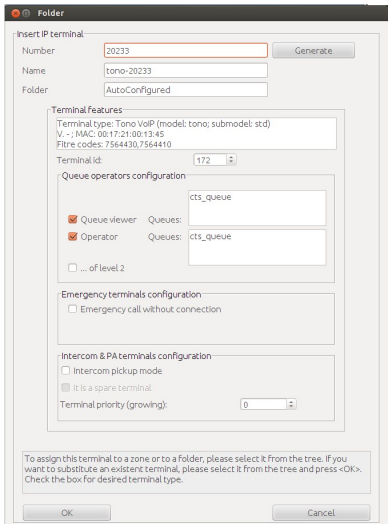


View



Tools





Creation with wizard

Enables automatic set-up of a terminal that is presented to the system. The command operates with the terminals that are located under the folder of 'auto-configured' type and on the folders of type GFX. All the trained VoIP terminals that are connected to a network where Astro is DHCP server are automatically moved to the 'auto-configured' folder. The Astro system also features self-provisioning, which allows automatic set-up of all the terminals without the need for manual configuration by the wizard.

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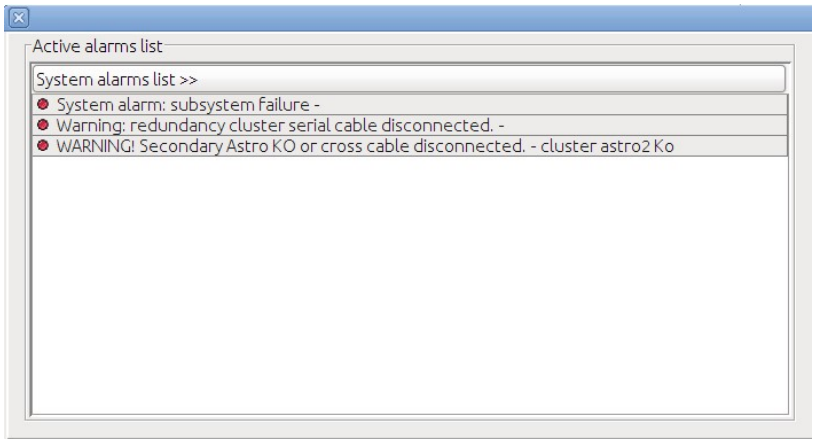
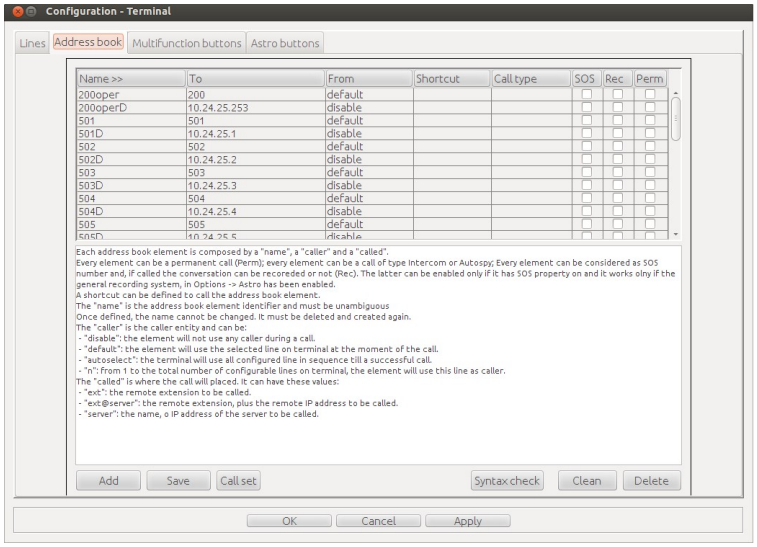


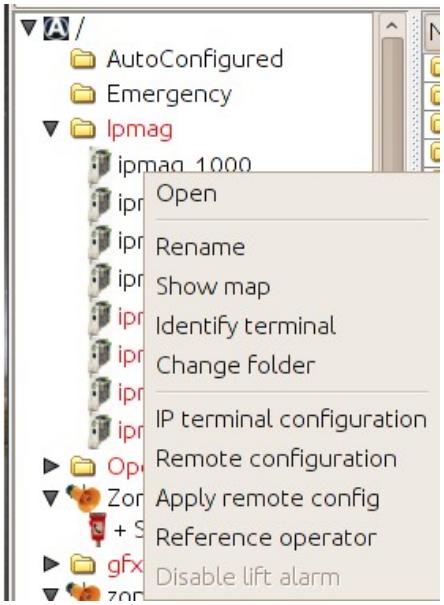
System Status

- ***Audio Alarms***: they are all the system alarms generated by the Astro software
- ***External alarms***: they are all the system alarms generated by Astro hardware and elements external to Astro

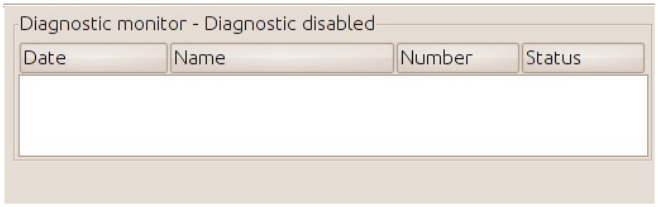
Global address book



Phone tree management



Selection of a group of terminals
Open the contextual windows of the drop-down commands



Diagnostic monitor

Programming of the tests planned by the automatic diagnostics function: each row of the table corresponds to a test on a phone with the relevant data and status (diagnostic) information

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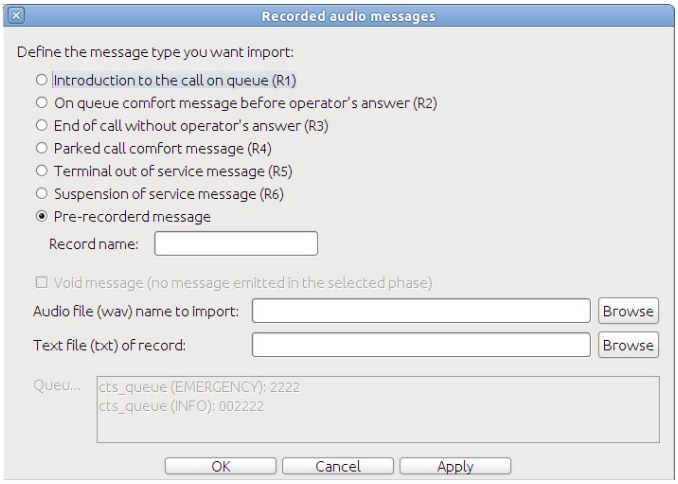
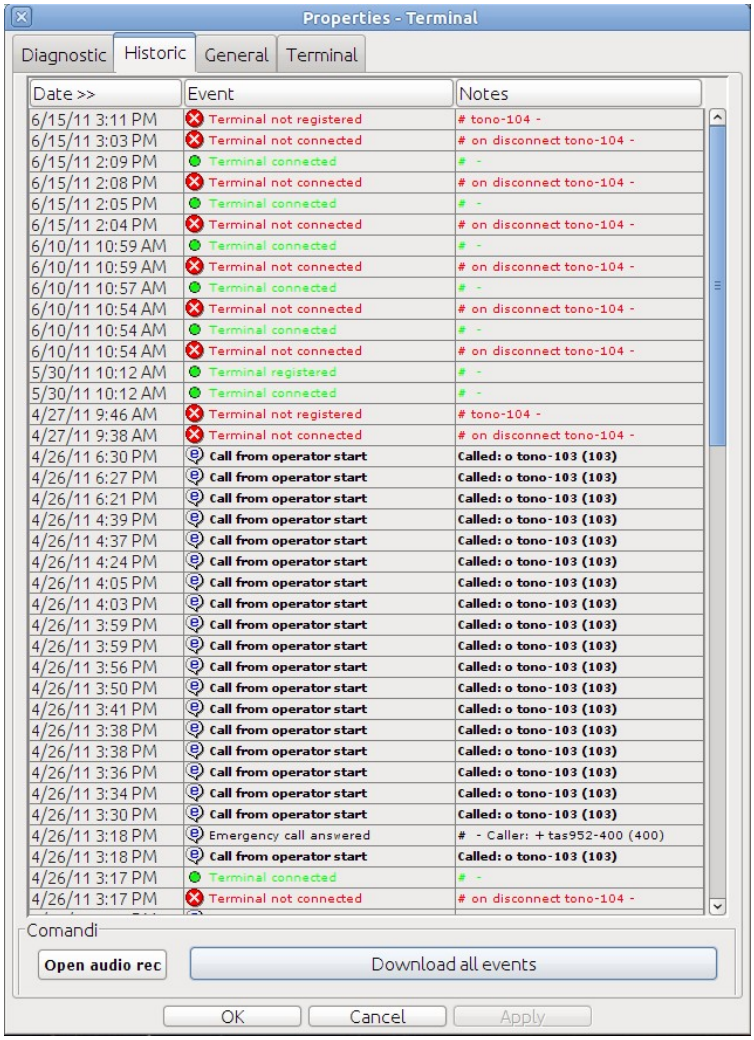


Setting up Automatic messages

The set-up of the automatic messages can reconfigure audio comfort messages associated with each queue and global comfort messages

Setting up Options

- Set-up of the automatic diagnostics of the system, including:
  - the check for connection and recording
  - the ***Speech Tests*** on the complete audio chain of the intercom station (handset, speakerphone, external speakers, and related microphones)
  - the Updating of parameters
- Put the system off at pre-set times. This feature is useful for instance if it is provided that the facility where the emergency terminals are installed stops the service at night (for instance a subway). In this case it is possible to stop the emergency call activity in the period when the service is not manned.
- Enable or disable audio recordings of emergency calls.
- enable or disable audio recordings of calls made from an Operator Station
- Program the duration of a call in the queue.



History

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