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Studio Production and Directing

Communication

Vladimir Maksimovic

University of Mitrovica (UPKM)

Where is it used?

The intercom allows instant communication between all team members.

•Without an intercoms, coordination during live recording is impossible.

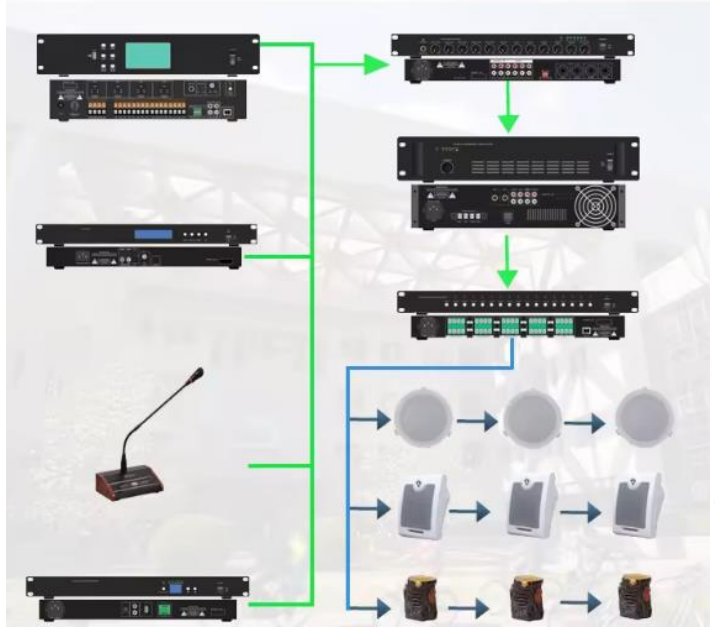
•It is used to control cameras, lighting, audio, and production.

•In the studio, it connects the control room, sound engineer, camera operators and presenters.

•It connects hundreds of people in different zones at sporting events.

•In OB, it is the central point of communication on site.

•Modern intercom integrates with video and IP networks.



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Where is it used?

- TV studios and newsrooms.
- OB trucks for external broadcasts and sports events
- Concerts and music productions.
- Theaters and stage events.
- Conferences and corporate events.
- Airports and control centers.
- Industrial monitoring and security services.

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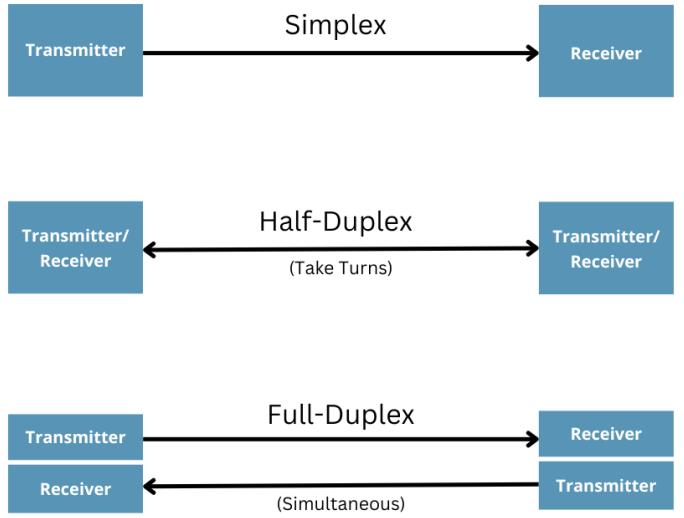
Methods of two-way communication

- Full-duplex allows simultaneous speaking and listening.
- Half-duplex allows communication only in one direction at a time.
- Intercom systems most often use full-duplex for natural communication.
- Half-duplex is used in simple systems or when it is important to reduce noise.
- Walkie-talkie devices are a typical example of a half-duplex system.
- Professional wireless intercoms use full-duplex technology.
- Modern systems can combine both modes as required.

- Practice: Combination!



Return channel for presenters and reporters

- IFB (Interruptible Foldback) allows the director to send instructions to presenters and reporters.
- The presenter hears the program and the director voice at the same time.
- Used in the studio and in the field during live broadcasts.
- It can be wired or wireless, depending on the environment.
- The IFB integrated into an intercom enables easier channel management.
- It is crucial for precise live show direction.
- Modern IFB systems use IP and digital audio processing.

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What is Party-line communication

- Party-line allows group communication on a single channel.
- All participants can hear each other in real time.
- Suitable for small productions and stage events.
- Easy to install and use.
- Limited by the number of channels and scalability.
- Digital versions reduce noise and improve quality.
- Still popular in theaters and smaller studios.

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What is Party-line communication

• Small TV stations, reportage vans - multi-user intercom systems *(*party-line), **where all participants hear everyone and can talk to all.**

• Large TV stations – *matrix intercom systems* - enable point-to-point connection, easy configuration changes, and simple expansion.

• **Wireless** – can be either type; frequency is important to avoid interfering with other systems.

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Multi-user intercom systems (party-line)

Thez consist of: **a main station** and user station (beltpack, speaker station, rack mount).

- **Supporting equipment** (power supply, connection cables, headset, panel microphones, power button microphones.

- **Additional equipment** for customized systems according to the characteristic impedance.

Party-line

•Analog systems used to be the standard, but today they are increasingly rare.

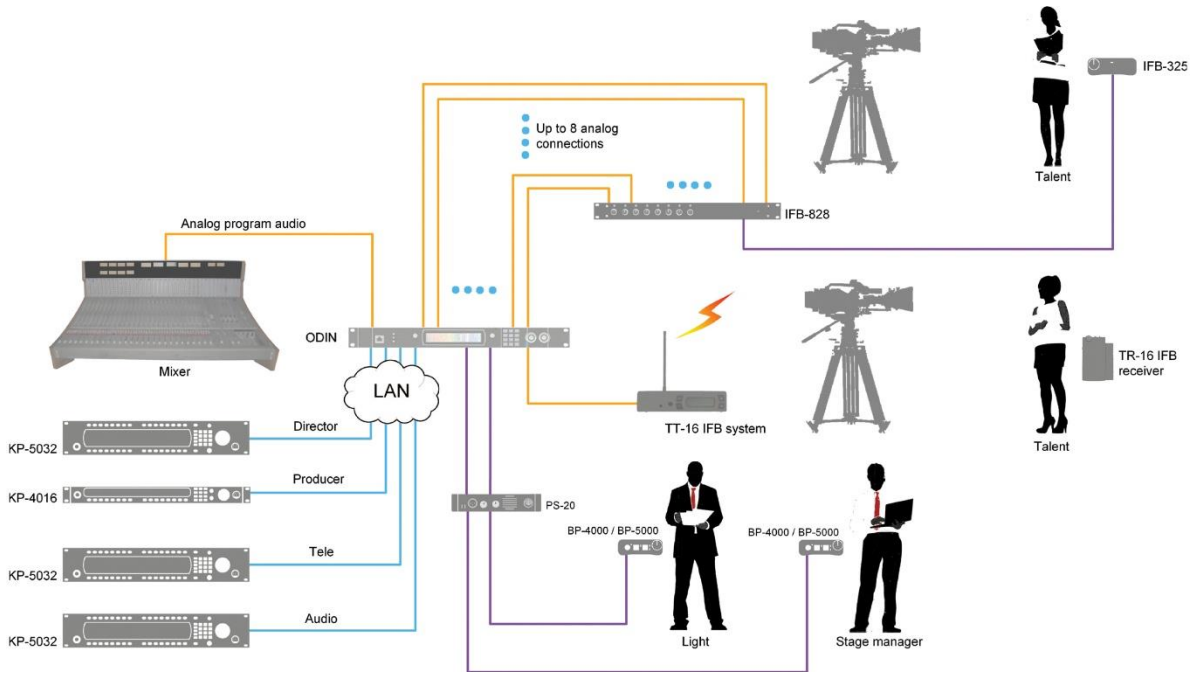
•Digital systems provide better sound quality and more functionality.

•They are limited by the number of channels, usually 1 to 4.

•The power supply and audio signal pass through the same cable.

•Suitable as backup systems in modern productions.

•Sometimes a hybrid approach (analog+digital) is used – quite often!



Party- line

- They operate in full duplex mode - all users can talk and listen at the same time
- In practice, the director’s microphone is constantly on and addresses the entire team, while the other microphones are muted. When a team member has something to say, they turn on their microphone and mute it again after speaking

- **For more complex projects**: on channel A, all participants handling audio and video (camera operators, sound engineers, technical directors, cinematographers, mixers, etc.) are connected; on channel B, **the production team** (producers, stage crew, assistant directors); on channel C, **backstage**, and so on.

- The program director has the option to address **each group individually, combine multiple groups** or address everyone over the PA system.

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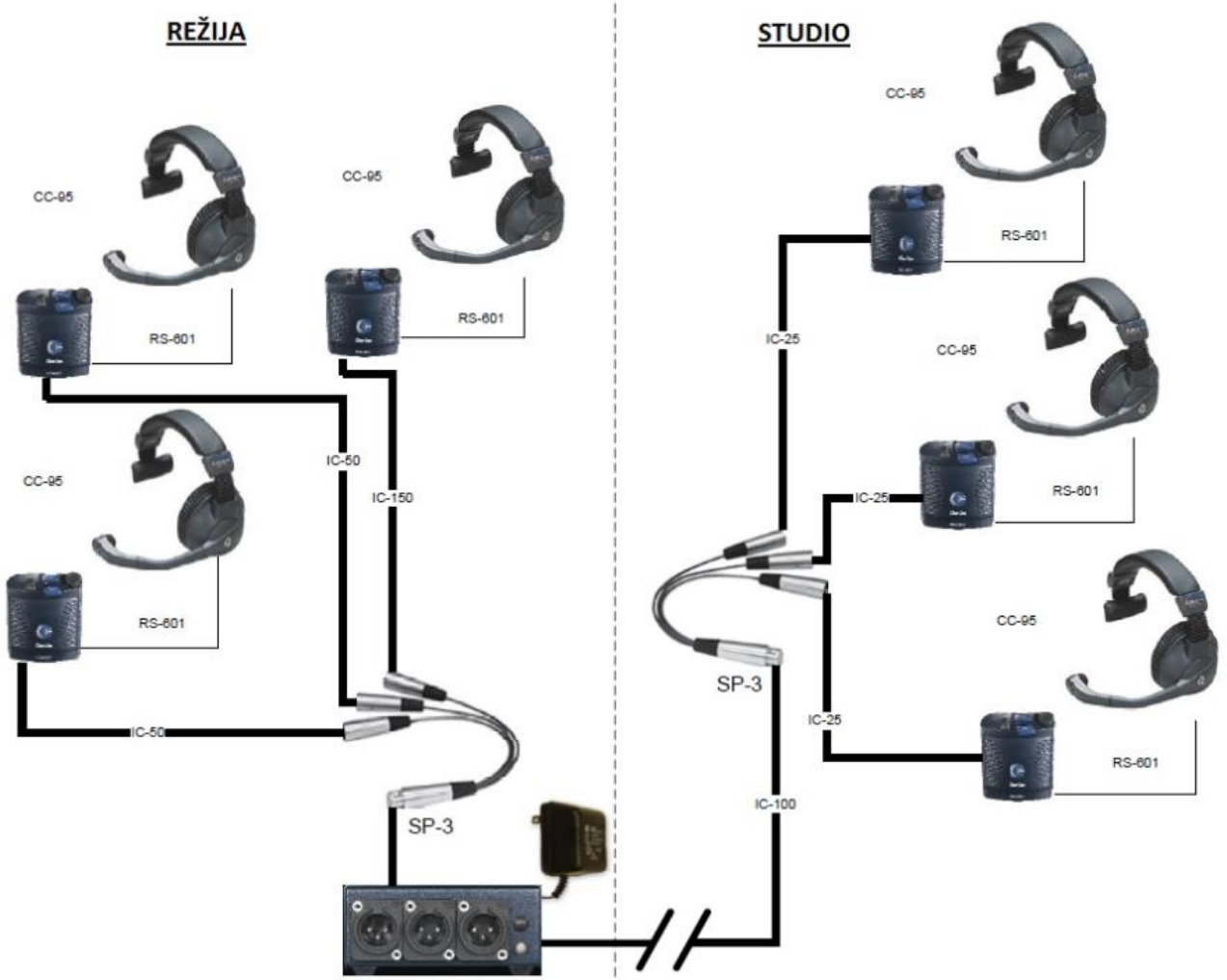
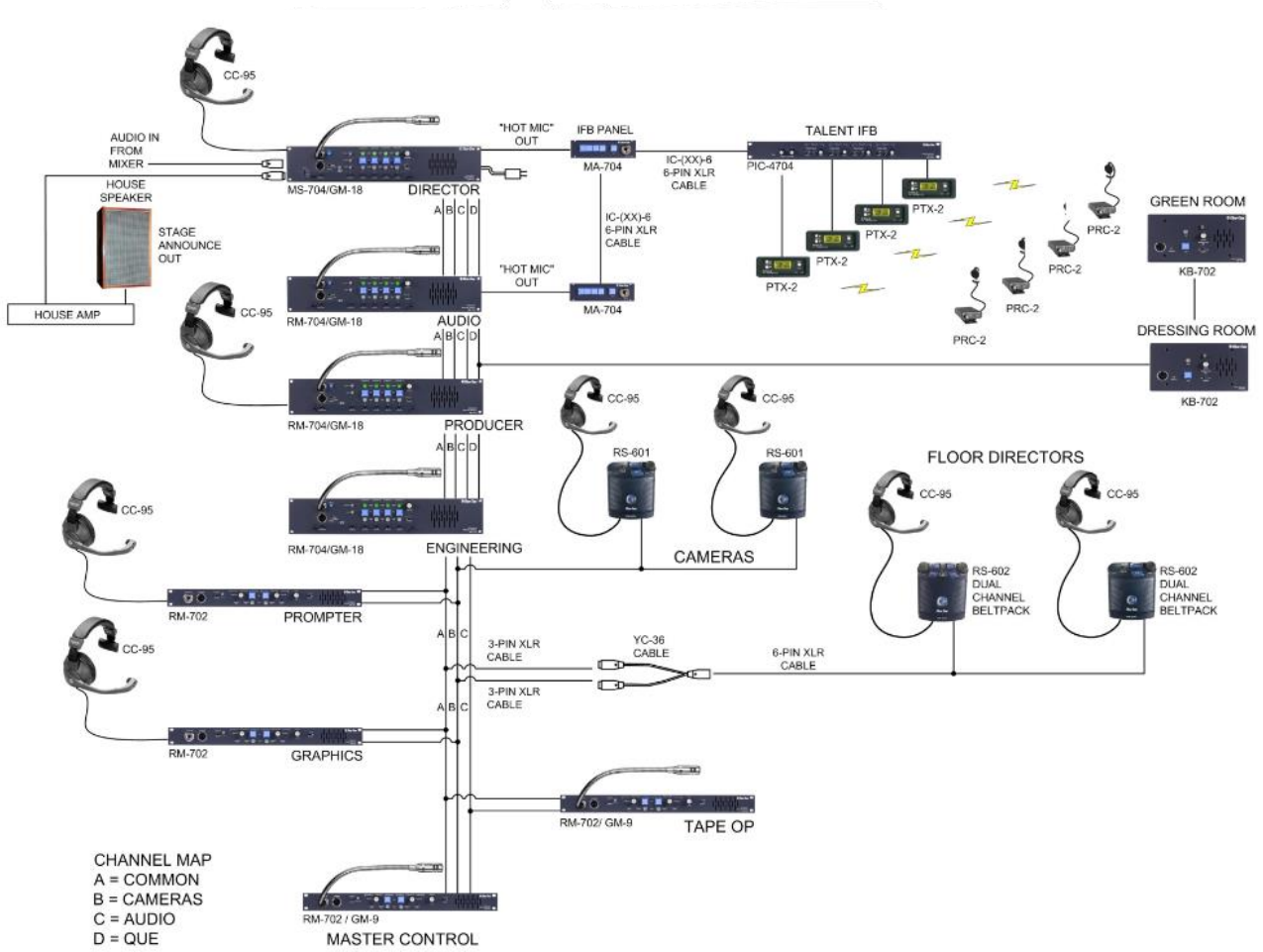
Analogue party line (small station)



Analogue party line (TV station)



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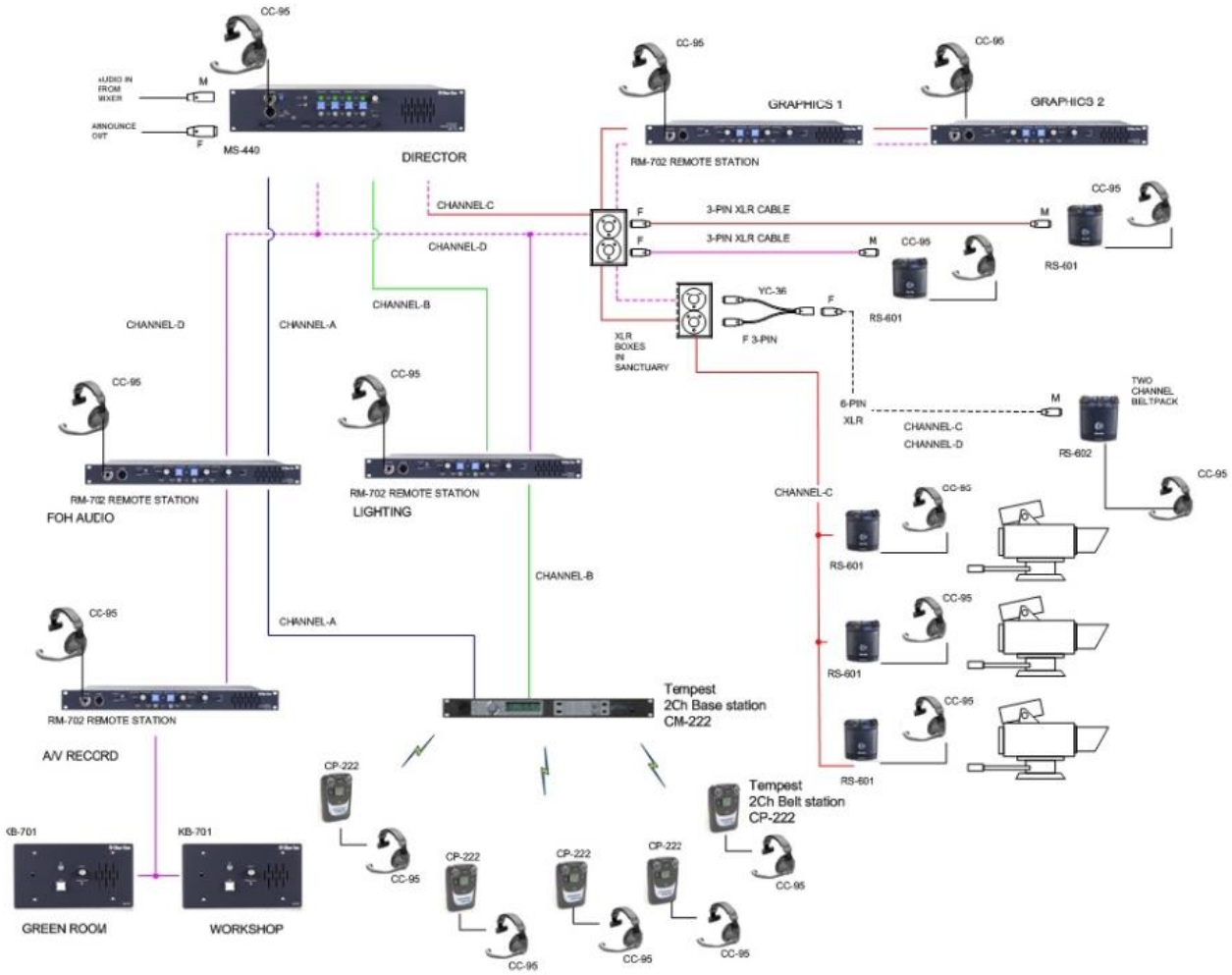
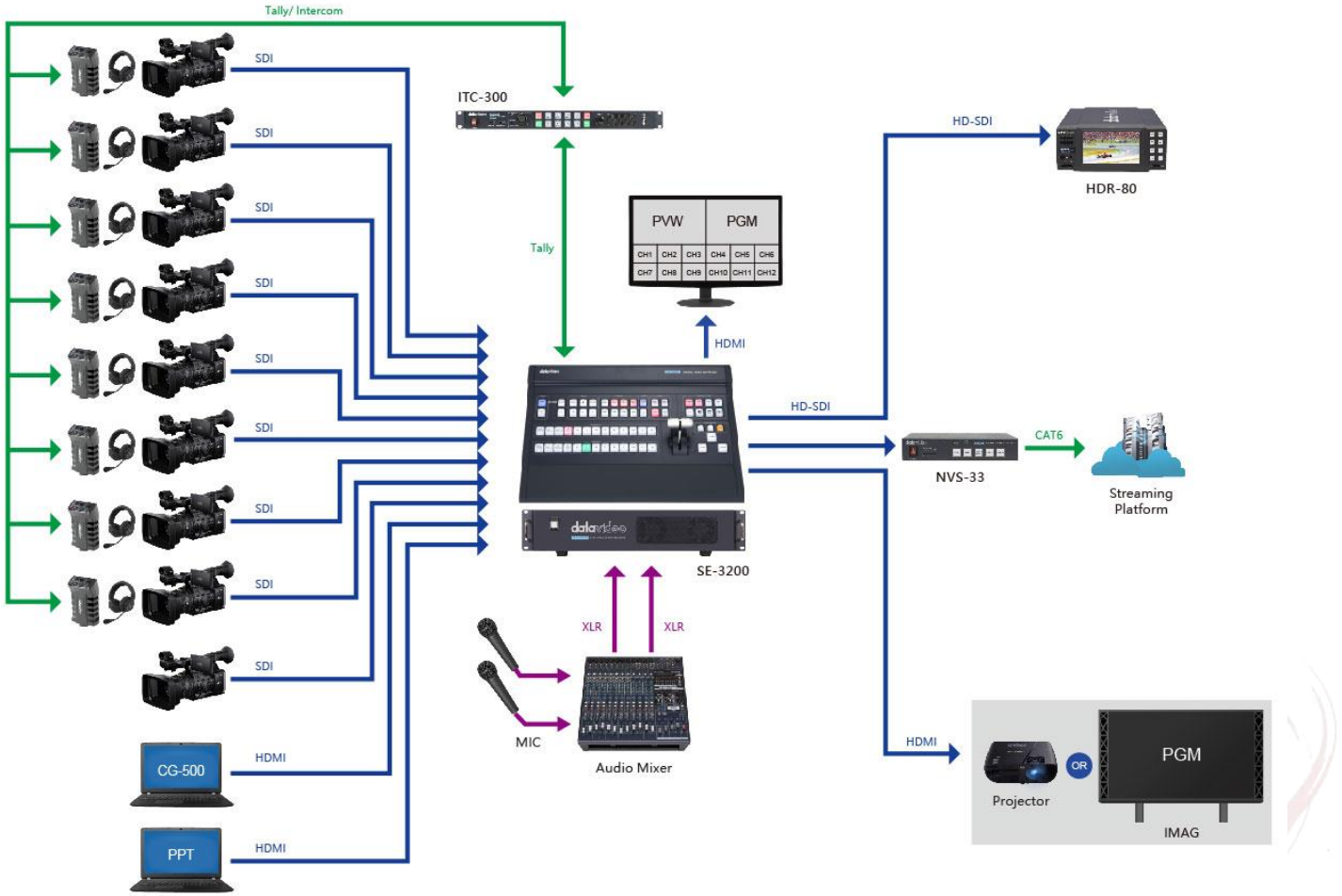
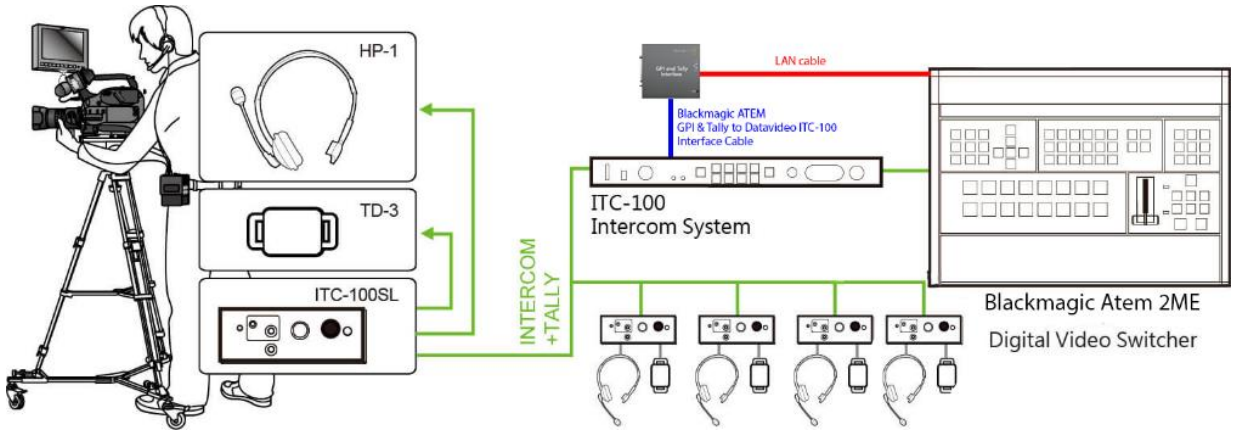
Analogue party line (TV station)



Analogue party line (ICT Datavideo 200-300)



Analogue party line (FTN TV)



Pin 1 = 1R (Main 1)
Pin 2 = N/A
Pin 3 = 1Y (Sub 1)
Pin 4 = R COMMON
Pin 5 = 4R (Main 4)
Pin 6 = 2R (Main 2)
Pin 7 = N/A
Pin 8 = 2Y (Sub 2)
Pin 9 = N/A
Pin 10 = N/A
Pin 11 = 3R (Main 3)
Pin 12 = N/A
Pin 13 = 3Y (Sub 3)
Pin 14 = Y COMMON
Pin 15 = 4Y (Sub 4)

Tally- 1		
Video Channel	Red LED (AIR)	Yellow LED (Sub)
1	Pin 1, 4 (short)	Pin 3, 14 (short)
2	Pin 6, 4 (short)	Pin 8, 14 (short)
3	Pin 11, 4 (short)	Pin 13, 14 (short)
4	Pin 5, 4 (short)	Pin 15, 14 (short)

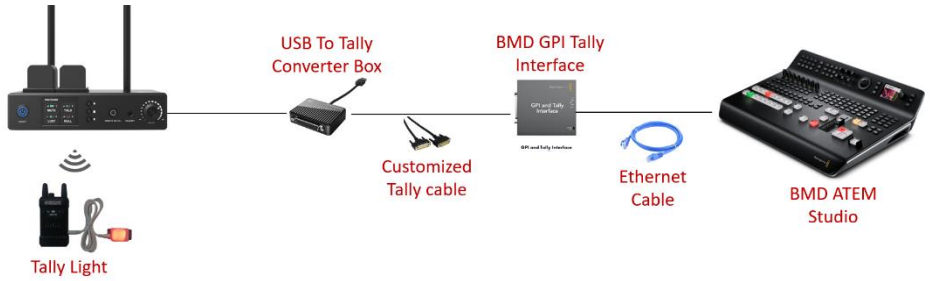
Tally- 2		
Video Channel	Red LED (AIR)	Yellow LED (Sub)
5	Pin 1, 4 (short)	Pin 3, 14 (short)
6	Pin 6, 4 (short)	Pin 8, 14 (short)
7	Pin 11, 4 (short)	Pin 13, 14 (short)
8	Pin 5, 4 (short)	Pin 15, 14 (short)

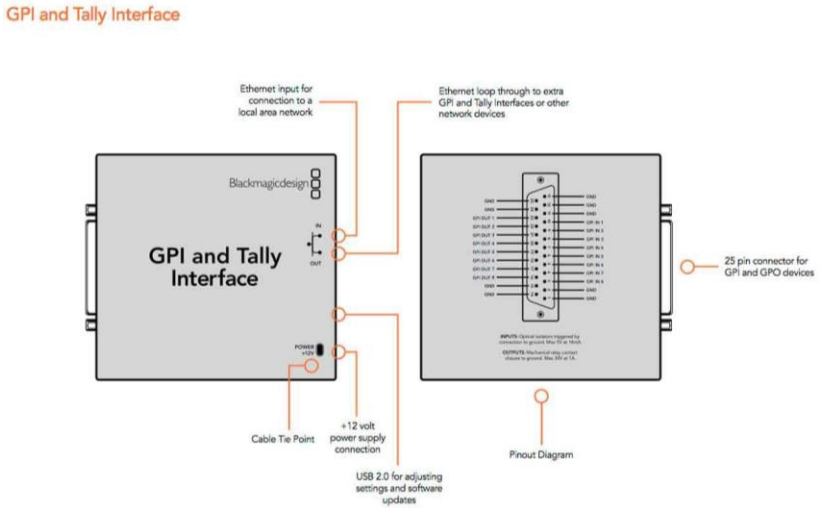
Basic concepts of the tally system

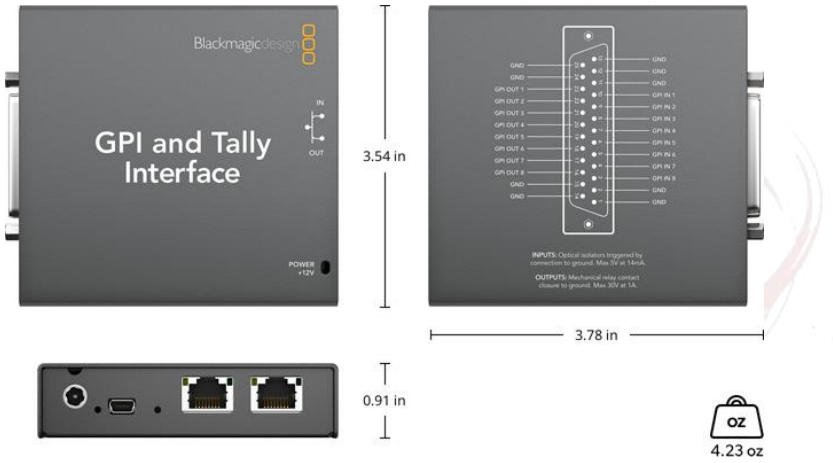
- Tally signaling indicates the status of the camera or signal source.
- **Red light – the** camera is live (*On-Air*).
- **Green light – the** camera is ready (*Preview*).
- Used to inform camera operators and production staff about the active signal.
- Enables synchronization between the utility and field crews.
- Connected directly to video mixers and intercom.
- Crucial for precise coordination during live recording.

Traditional GPI systems

- **GPI (General Purpose Interface)** connectors and cables were used.
- Each camera was connected with a direct cable to the mixer.
- Limited flexibility – physical connection required for each function.
- A large amount of cabling complicated instalation and maintenance.
- There is no centralized control or software interface.
- Difficulties with expansion and integration with other devices.
- They have been replaced by IP-based solutions.







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Advantages of IP tally system

- All tally signals are transmitted over a standard Ethernet network.
- There is no need for special physical cables.
- Easy integration with video mixers, intercoms and multiviewers.
- Software interface for configuration and monitoring.
- Scalability for small and large systems.
- Fast and simple integration with different brands.
- Remote control and monitoring via the Internet.

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Why switch to digital party lines

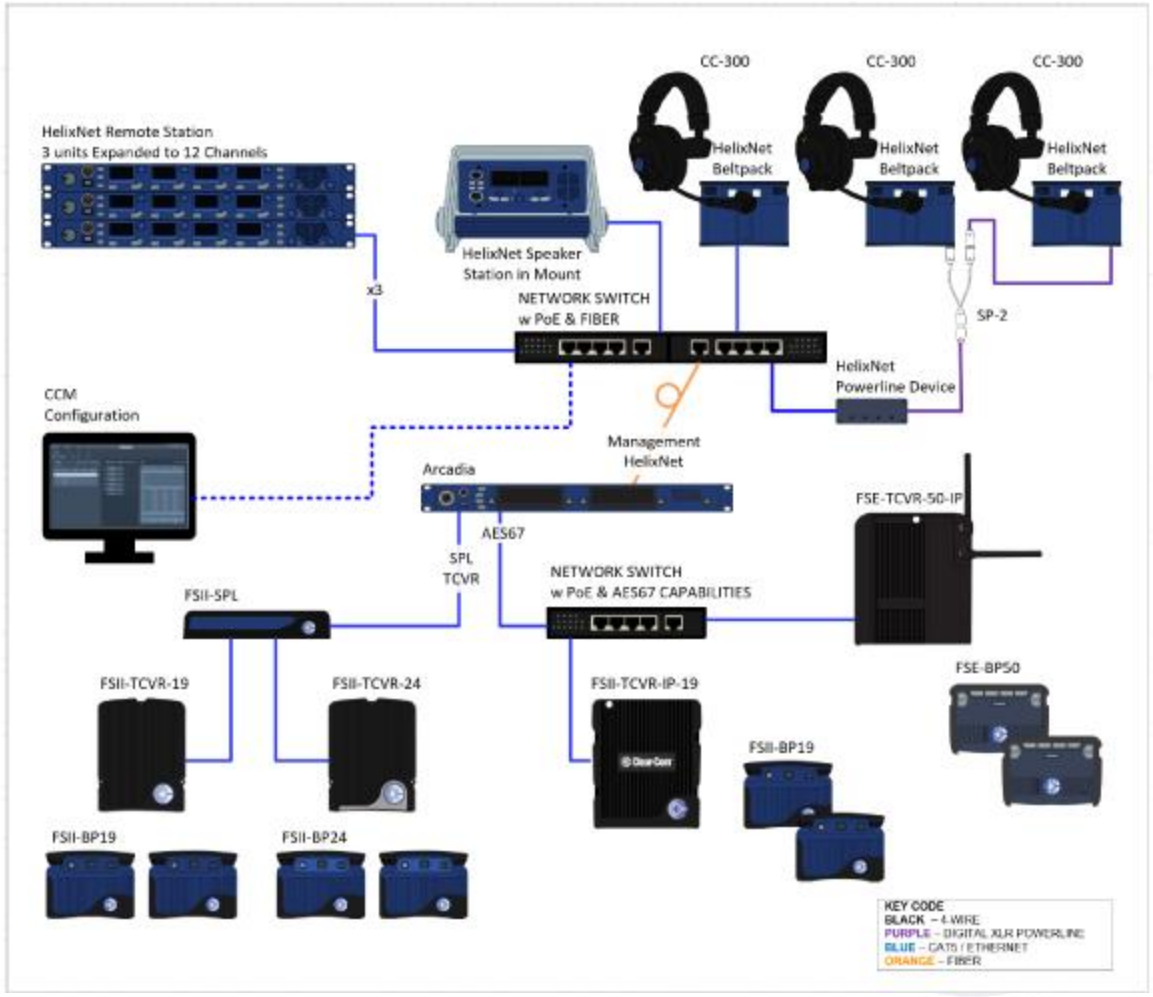
- Noise and signal degradation over long cables.
- There is no possibility of integration with IP networks.
- Limited number of users and channels.
- There is no dynamic call routing.
- More difficult maintenance in complex systems.
- Inability to monitor user status in real time.
- Digital systems offer significantly greater flexibility.

Basics of the digital party-line system

- It operates over an Ethernet network (IP-based).
- No noise and no loss of signal quality.
- Easy scaling by adding new devices.
- Integration with matrix systems and software.
- Enables power supply via the PoE standard.
- Greater flexibility in creating groups and channels.

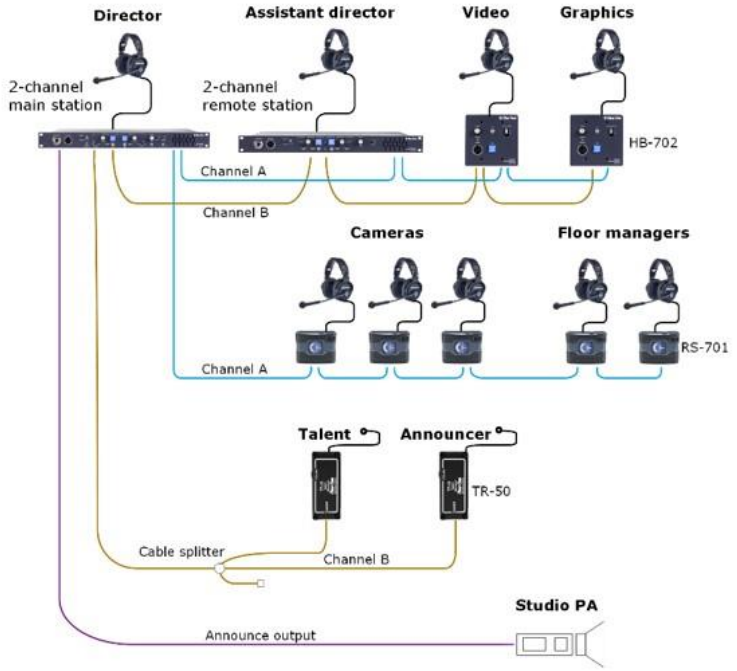
Clear-Com GelixNet Example

- Works entirely over the Ethernet network.
- Supports up to 24 channels per network.
- Each device is powered by a PoE connection.
- The central station manages all channels and users.
- All devices use the standard CAT5-CAT7 cable.
- Easy expansion without additional hardware.
- Perfect for small and medium-sized TV productions.



Analog vs digital party-line

- Analog: noise, signal degradation, limited number of channels.
- Digital: clear audio, flexible expansion and IP integration.
- Analog: no advanced functions such as software monitoring.
- Digital: remote configuration and monitoring over the network.
- Analog: limited number of users.
- Digital: virtually unlimited number of users.
- The industry trend is heading towards full digitization.



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Why switch to IP intercom

- A single network is used for transmitting audio, video and intercom traffic.
- Drastically reduces the number of cables and installation complexity.
- Easily addition of new devices without additional hardware.
- Greater flexibility and dynamic channel routing.
- Integration with software panels and mobile applications.
- Lower system maintenance and expansion costs.
- Higher level of redundancy and security.

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How IP intercom works

- Audio channels are transmitted as digital packets through an Ethernet network.
- Uses **Audio over IP (AoIP)** technology.
- Intercom devices communicate using multicast and unicast protocols.
- All devices use standard network hardware (switch, router).
- They support PTP synchronization for precise latency control.
- Software tools enable system control and monitoring.
- Easily integrates with existing broadcast infrastructure.

AES67 – Audio over IP Basis

- Audio channels are transmitted as digital packets through an Ethernet network.
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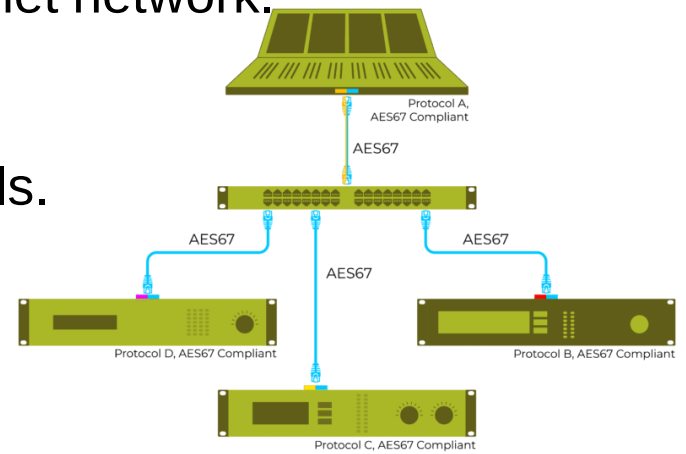


SMPTE ST2110 standard

•Defines the transport of video, audio and additional signals over an IP network.

•ST2110-30 – transports audio signal (based on AES67).

•ST2110-31 – transports control and special signals (e.g. intercom).

•Uses multicast for efficient distribution.

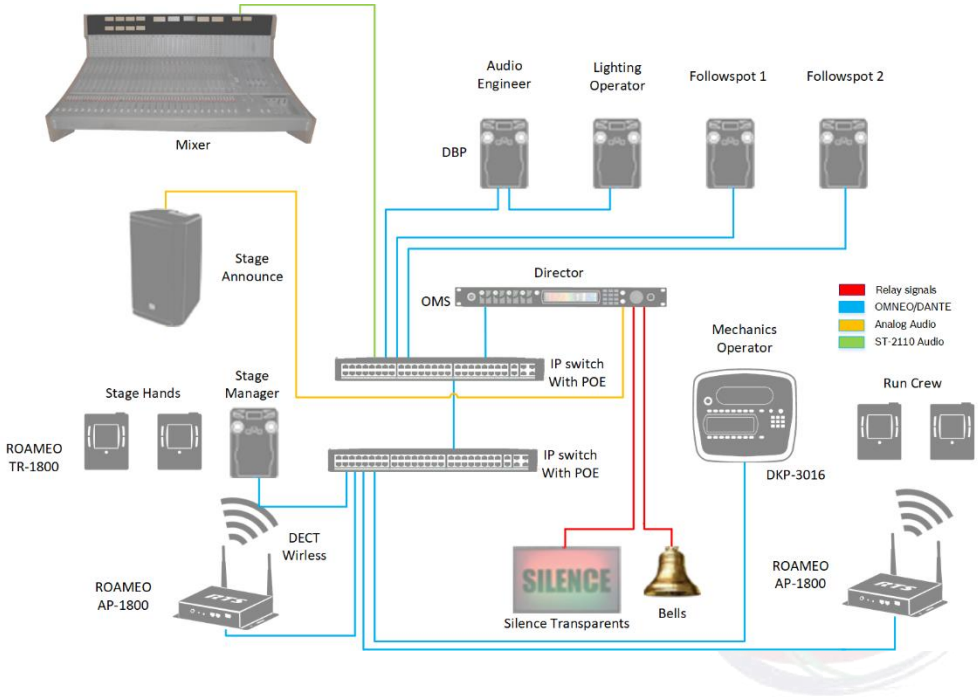
•Provides the foundation for a fully IP television infrastructure.

•Supports PTP synchronization.

•Standardized and globally accepted in the broadcast industry

•PTPv2 enables accurate devices time synchronization and is used to synchronize audio and video streams.

•Required by ST2110 standard.



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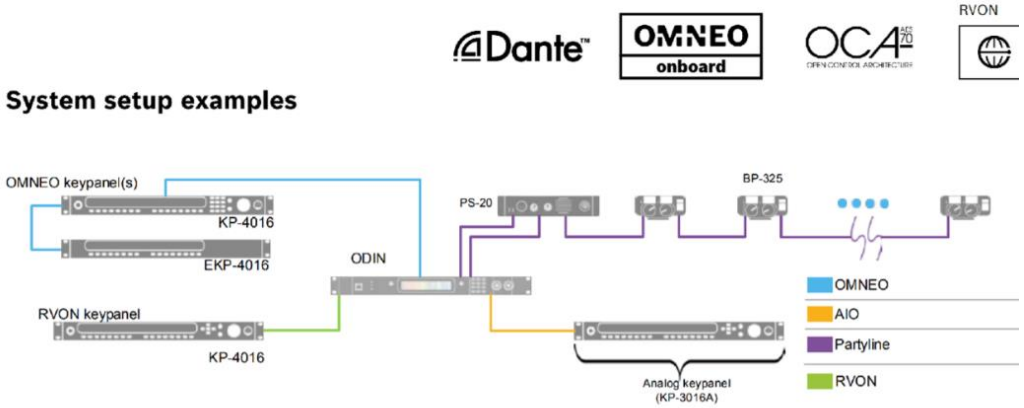
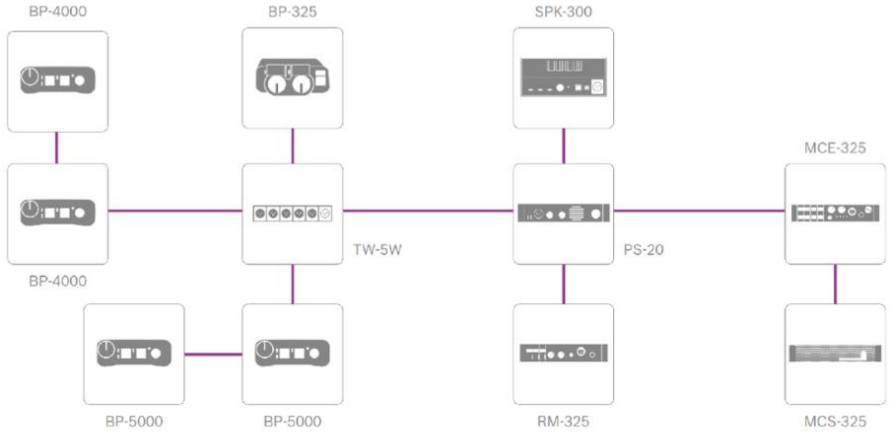
Modern IP intercom products

- **RTS OMNEO / ODIN** – IP intercom matrix.
- **Riedel Artist** – modular IP matrix for broadcast.
- **Clear-Com Eclipse HX + E-IPA card** – IP integration.
- **Telos Infinity** – IP intercom without classical matrix.
- Software panels – Agent-IC, Station-IC.
- Integration with Dante and AES67 devices.
- Flexibility for all types of productions.

Example: RTS OMS OMNEO





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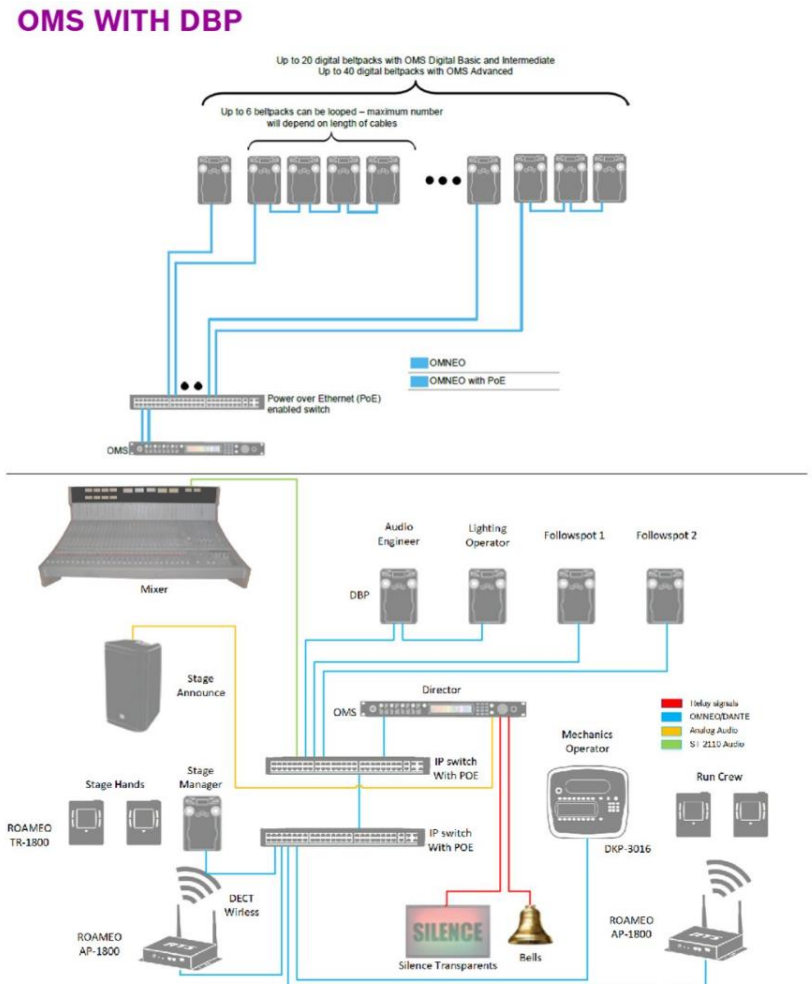
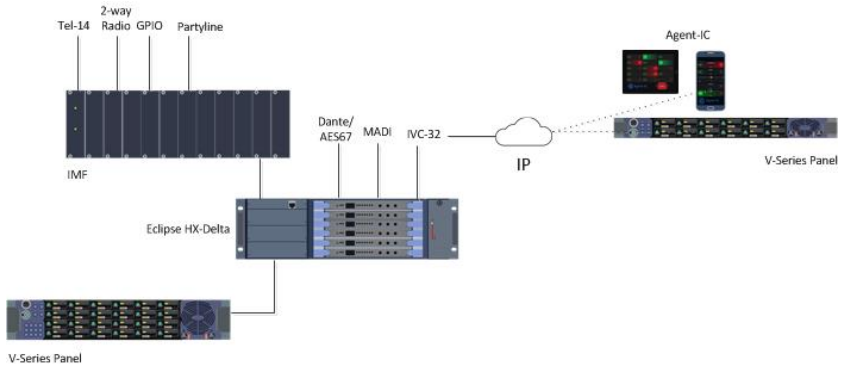
Example: RTS OMS OMNEO



Basic concept of matrix intercom

- The matrix is a central device that connects all intercom channels.
- Enables point-to-point communication between any two users.
- Each user can have their own routes and private lines.
- Channel management is performed by software through the matrix configuration.
- In the past, matrices were based on TDM technology.
- Today, IP-based matrices dominate.
- A central component for complex productions.



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Modern approach to matrix intercom

- **Supported communication types :**

– **Conference connection or party-line**

– **Isolated connection (isolate – ISO)** – private conversation between two users

– **IFB** – temporary interrupts the program signal for private conversation

– **Group call** – addressing a group of users with a single button

– **Relay** – pressing a configured button activates a relay, usually turning on a transmitter to send audio wirelessly.

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Modern approach to matrix intercom

- They use a standard Ethernet network instead of special cables.
- Easier adding and removing of users without manual work.
- The software configuration allows fast channel routing.
- They support AES67 and ST2110 compatibility standards.
- They can operate locally or through cloud integration.
- They enable remote production and linking of distant studios.
- Greater flexibility, security and scalability.
- Up to 1,024 ports in one system.

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Development of wireless intercom technology

•The first generation used analog VHF/UHF systems.

•Manual frequency coordination and protective spacing is required.

•The second generation introduced digital UHF systems, but with limitations.

•The third generation is based on **DECT 1.9 GHz** technology.

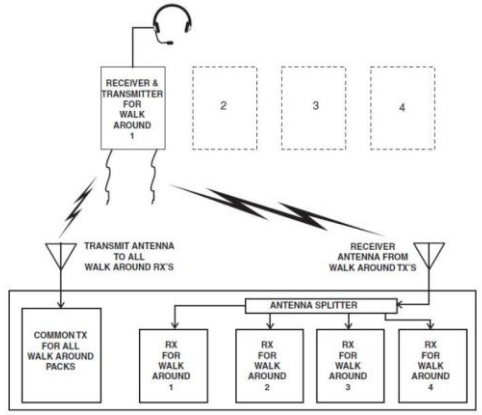
•DECT enables automatic channel management and roaming.

•Wi-Fi systems are used for special applications and mobile apps.

•Today's standard is a combination of DECT and IP networks.

•Old analog VHF/UHF systems required manual coordination and 12 MHz guard band, which is no longer applicable in modern DECT systems.

Why DECT dominates modern systems



•License free band in most countries (1.9 GHz).

•Automatic channel management and reduced interference.

•Full-duplex communication for all users.

•Provides a stable signal even in large and complex enviroments.

•Supports roaming – the user moves between the antennas without losing connection.

•Integration with IP network and AES67 standard.

•Low operating costs and high reliability.

•The receiver must detect the unique carrier emitted by the transmitter and extract from it a signal that is a copy of the original source signal.

•The power of the waves decreases with the square of the distance from the antenna. This means that if we want to double the range of the transmitter, the transmission power must be increased fourfold.

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User stability and mobility

- Roaming allows the user to move freely between antennas without interruption.
- The system automatically switches the signal to the nearest antenna.
- Adaptive Diversity Reception prevents disconnections.
- Automatic frequency management reduces the need for manual adjustments.
- The user does not notice the antenna change during operation.
- Critical for sport events and large production sets.
- A mandatory standard in modern DECT systems.

BOLERO Wireless Intercom

- Professional wireless intercom based on DECT 1.9 GHz technology.
- Connects up to 250 beltpacks in one system.
- Each antenna supports up to 10 simultaneous beltpacks.
- Integration with the IP network through AES67/ST2110 standards.
- Advanced ADR technology prevents interference.
- Bluetooth and hands-free options for additional flexibility.
- Designed for broadcast and sports productions.

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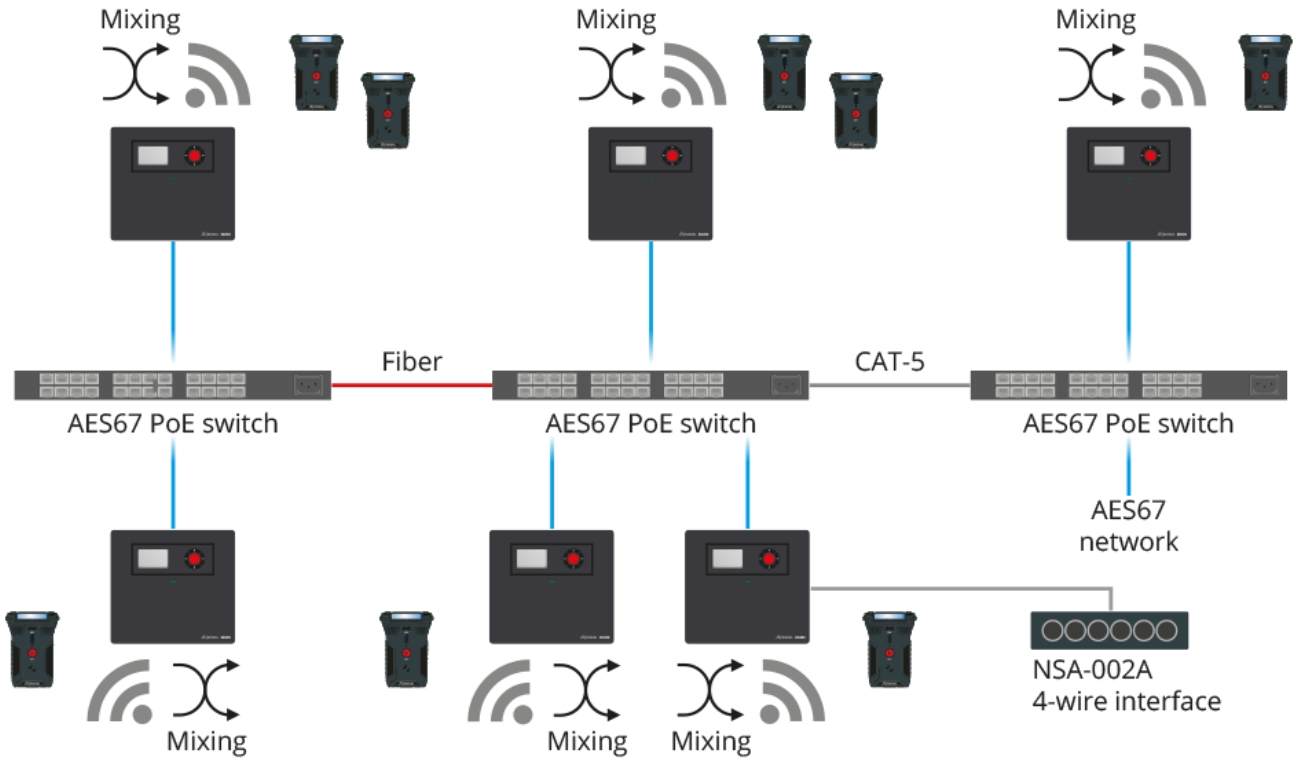
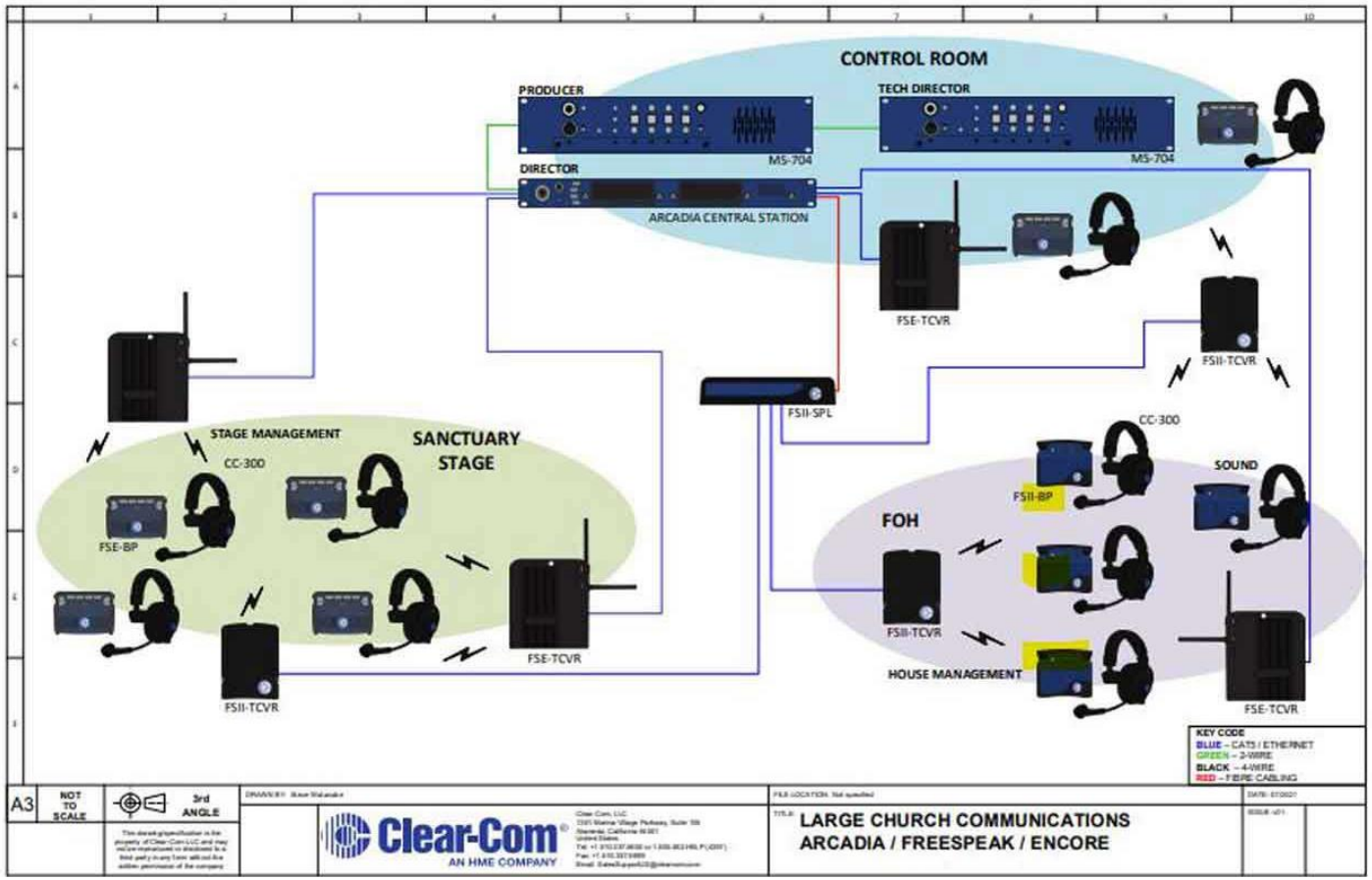
BOLERO Wireless Intercom



Clear-Com FreeSpeak II



SKU# 43478DF-10

Clear-Com AN HME COMPANY

FreeSpeak II Digital Wireless Intercom — **10 Station Package**

Broadcast Wireless Intercom System (1.9 or 2.4GHz) Basestation supports up to 25 wireless beltpacks

(10) Clear-Com CC-110 Single Ear Lightweight Headsets

(2) FreeSpeak FSII-TCVR Active Anten-

Package Includes:
(1) FreeSpeak FSII-BASE Base Station (supports 25 Beltpacks)
(10) FreeSpeak FSII-BP (1.9 or 2.4GHz) Digital Wireless Beltpacks
(10) Clear-Com CC-110 Single Ear Lightweight Headsets
(2) FreeSpeak FSII-TCVR Active Antennas
(10) FreeSpeak II Lithium-Ion Batteries
(2) AC-60 5-Bay Battery Chargers

(10) FreeSpeak II Lithium-Ion Batteries

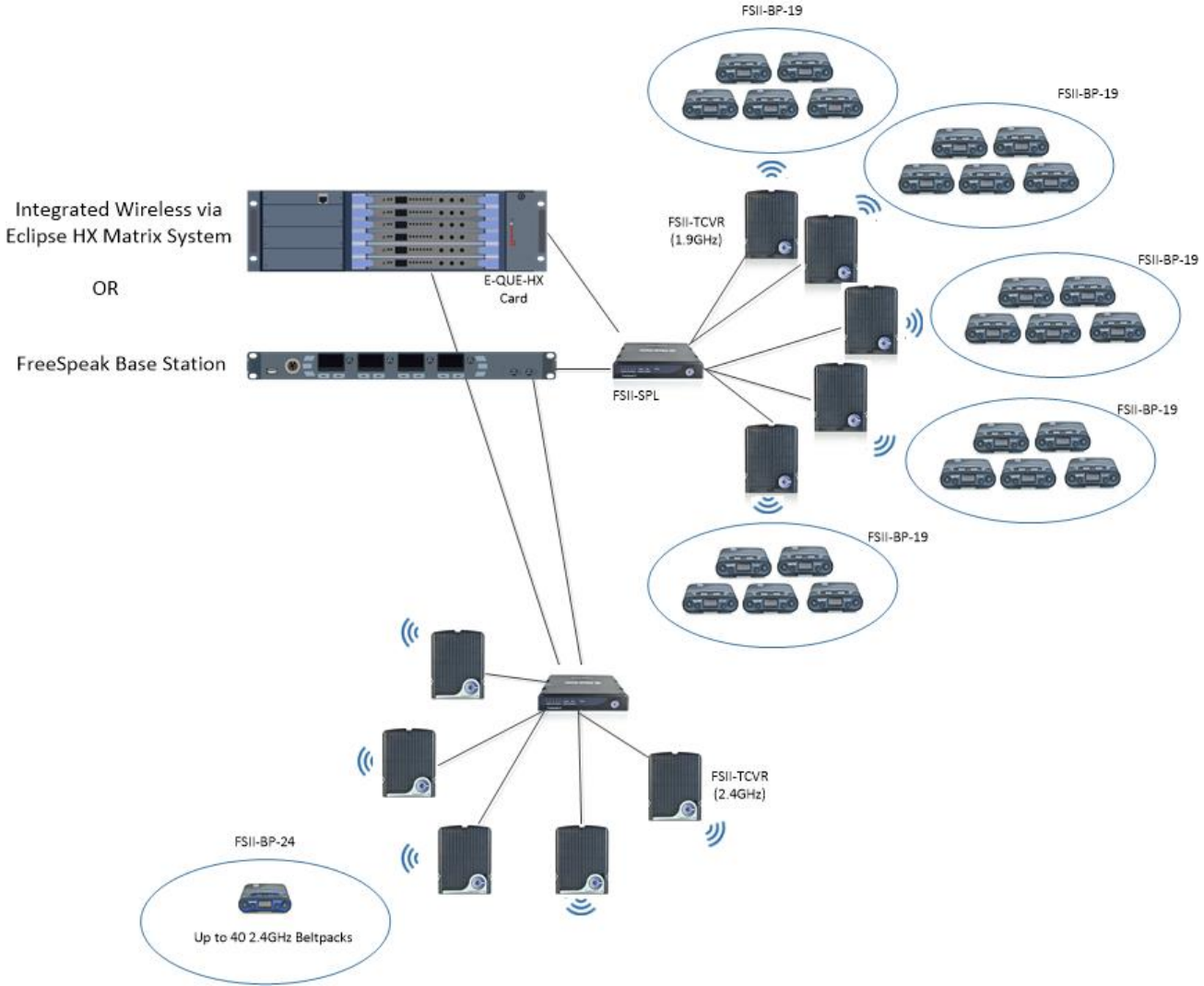
(10) FreeSpeak FSII-BP (1.9 or 2.4GHz) Digital Wireless Beltpacks

(2) AC-60 5-Bay Battery Chargers

ONLY $40,290

Payments as low as $894 per month!
One Year Warranty. 30 Days FREE Tech Support (up to 2 hours)
"Plus 10% Off any additional accessories purchased within 30 days"

Clear-Com FreeSpeak II



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How to plan signal coverage

- Mapping the location and potential signal obstacles.
- Installation of antennas for optimal coverage.
- Using coverage simulation software.
- Planning roaming zones between antennas.
- Redundant antennas for critical locations.
- Signal testing before the event begins.
- Documentation and logging of all settings.

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How to choose the right system

- **Small productions**: Wi-Fi intercom or small DECT system.
- **Medium production**: DECT with 2–3 antennas and software control.
- **Large productions**: DECT network with roaming and redundant antennas.
- **OB vehicles**: integration of DECT with the matrix system.
- **Sports and concerts**: Bolero or FreeSpeak II with maximum capacity.
- **Cloud productions**: Wi-Fi + software panels for remote users.
- Always plan backup channels.

- **Mobile apps???**

Why software intercom?

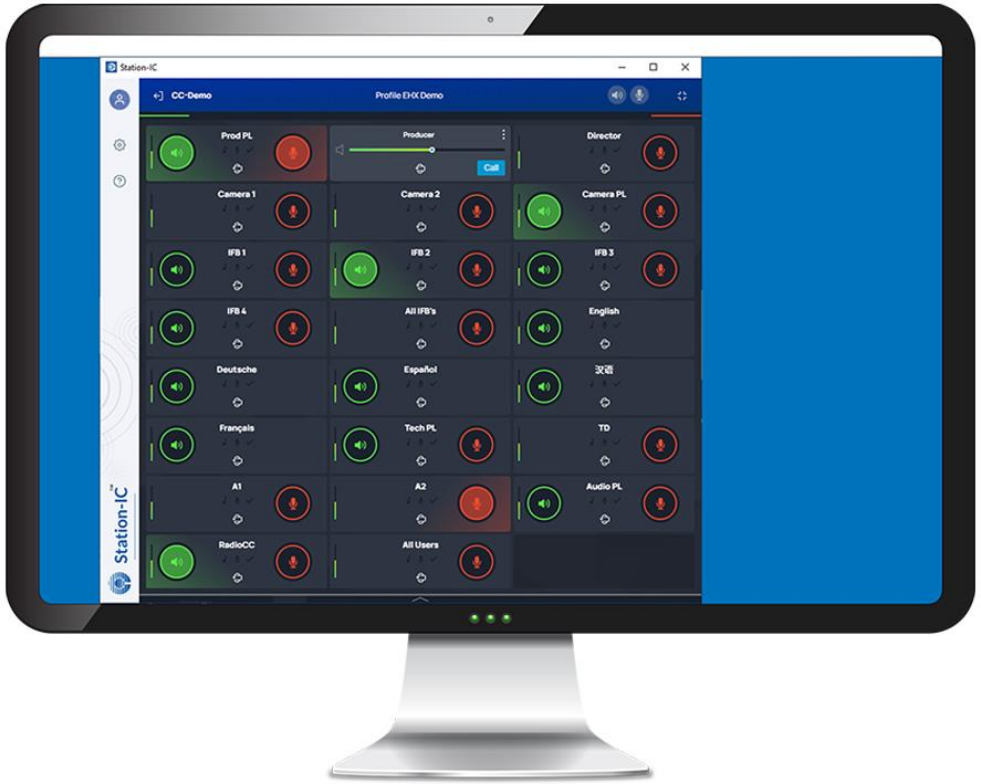
- Allows use of computer or phone as an intercom station.
- No need for additional physical devices or panels.
- Ideal for remote productions and remote teams.
- Reduces costs for small and medium productions.
- Flexible addition of new users without hardware limitations.
- Integration with existing IP matrix systems.
- Works online or on a local network.

Mobile intercom on phone

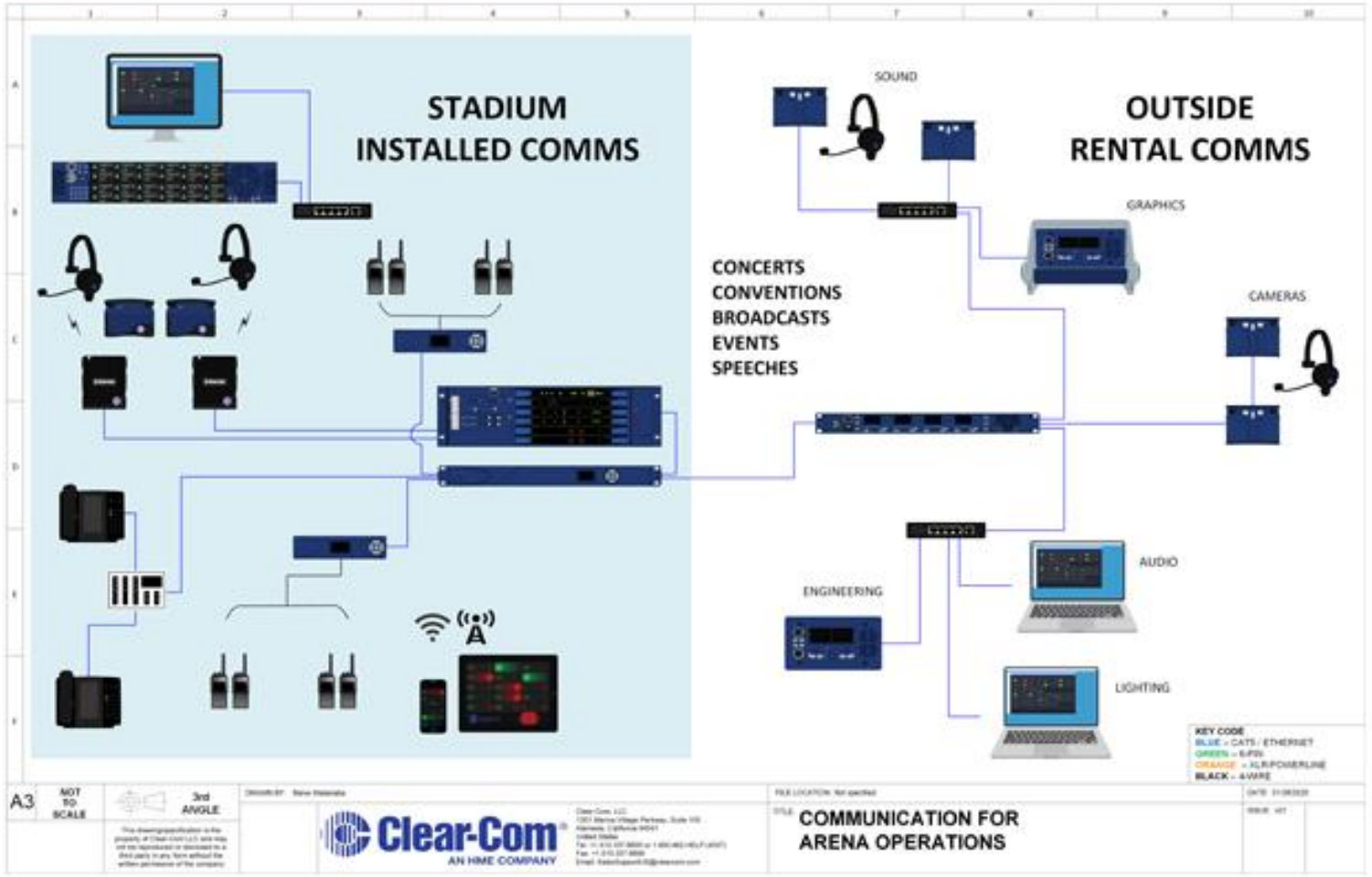
- **Agent-IC** turns a mobile phone into an intercom beltpack.
- Available for iOS and Android platforms.
- Works over Wi-Fi, 4G, 5G or LTE.
- Supports full-duplex communication.
- Integration with Clear-Com Eclipse HX and LQ systems.
- Ideal for remote users and temporary positions.
- Enables operation with standard intercom channels.

Computer as intercom panel

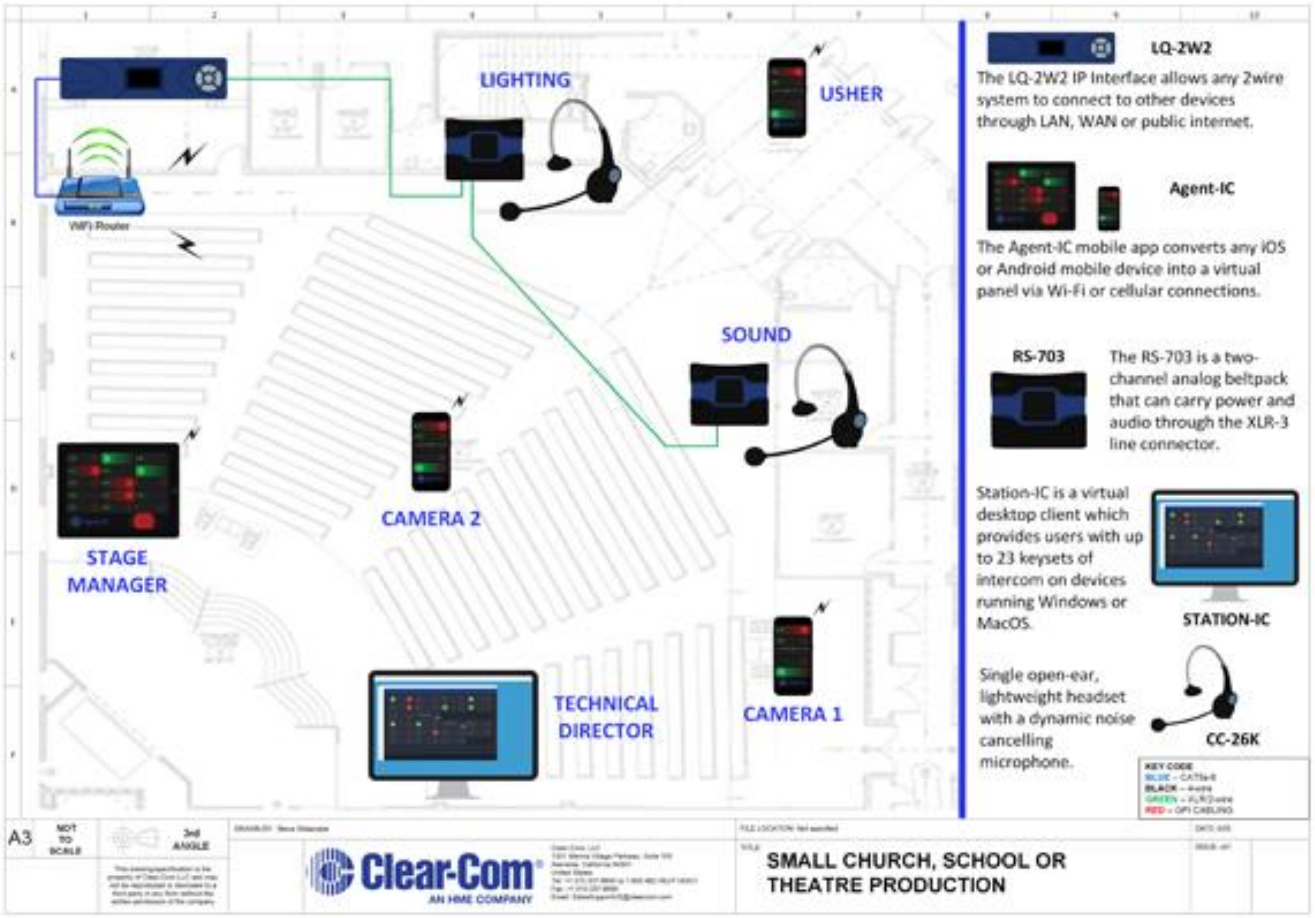
- **Station-IC** is software that runs on Windows and MacOS platforms.
- Turns a laptop or PC into a professional intercom panel.
- Supports all functions as a physical hardware panel.
- Integration with IFB and party-line channels.
- Ideal for multi-site productions.
- Works with IP network and software licenses.
- Fast installation and easy configuration.



example


STADIUM
INSTALLED COMMS
OUTSIDE
RENTAL COMMS
SOUND
GRAPHICS
CAMERAS
CONCERTS
CONVENTIONS
BROADCASTS
EVENTS
SPEECHES
ENGINEERING
AUDIO
LIGHTING
KEY CODE
BLUE = CAT5 / ETHERNET
GREEN = SDI
ORANGE = XLR/POWERLINE
BLACK = 4-WIRE
A3
NOT TO SCALE
3rd ANGLE
Clear-Com
AN HME COMPANY
COMMUNICATION FOR
ARENA OPERATIONS

example


LIGHTING
USHER
WiFi Router
SOUND
CAMERA 2
STAGE MANAGER
TECHNICAL DIRECTOR
CAMERA 1
LQ-2W2
The LQ-2W2 IP Interface allows any 2wire system to connect to other devices through LAN, WAN or public internet.
Agent-IC
The Agent-IC mobile app converts any iOS or Android mobile device into a virtual panel via Wi-Fi or cellular connections.
RS-703
The RS-703 is a two-channel analog beltpack that can carry power and audio through the XLR-3 line connector.
Station-IC is a virtual desktop client which provides users with up to 23 keysets of intercom on devices running Windows or MacOS.
STATION-IC
Single open-ear, lightweight headset with a dynamic noise cancelling microphone.
CC-26K
A3
Clear-Com
AN HME COMPANY
SMALL CHURCH, SCHOOL OR THEATRE PRODUCTION

Traditional way of connecting phones and intercoms

- Before VoIP technology, analog telephone hybrids were used.
- They allowed the telephone line to be connected to the audio system.
- Typically, they worked with only one or two channels simultaneously.
- Interference and noise were a common problem.
- They required additional physical cables and adapters.
- They did not offer advanced functions such as digital control.
- Today, they are only used as a reserve option or backup.

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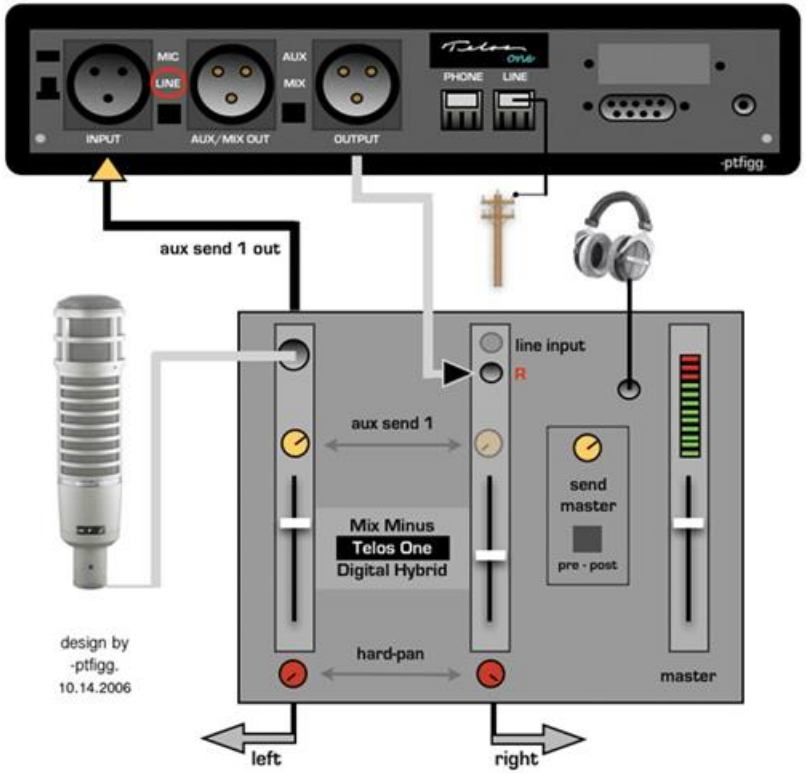
Why they became obsolete

- Limited number of simultaneous telephone connections.
- Low reliability and high level of signal noise.
- Manual control without digital management.
- No possibility of integration with the IP intercom.
- High maintenance and spare parts costs.
- Inability to work over the Internet or VPN network.
- They have been replaced by modern VoIP and SIP solutions.

Digital phone hybrid



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Modern approach to connecting phones and intercoms

- **SIP (Session Initiation Protocol)** is a standard for VoIP communication.
- Phone calls are transmitted as IP packets over the network.
- No need for additional physical adapters or hybrids.
- Multiple telephone lines can be integrated into the intercom matrix.
- SIP allows direct connection to mobile and fixed networks.
- Flexibility for local and remote users.
- Support for redundant VoIP servers.

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Clear-Com and Telos Infinity SIP solutions

- The **Clear-Com E-IPA-HX** card adds SIP functionality to the Eclipse HX matrix.
- Supports up to **64 SIP lines** per card.
- **Clear-Com LQ SIP Gateway** connects telephone lines and intercom channels.
- **Telos Infinity** allows operation without a classic matrix, fully IP-based.
- Enables integration with VoIP servers and cloud platforms.
- Scalable solution for small and large productions.
- Ideal for remote interlocutors and guests on the program.

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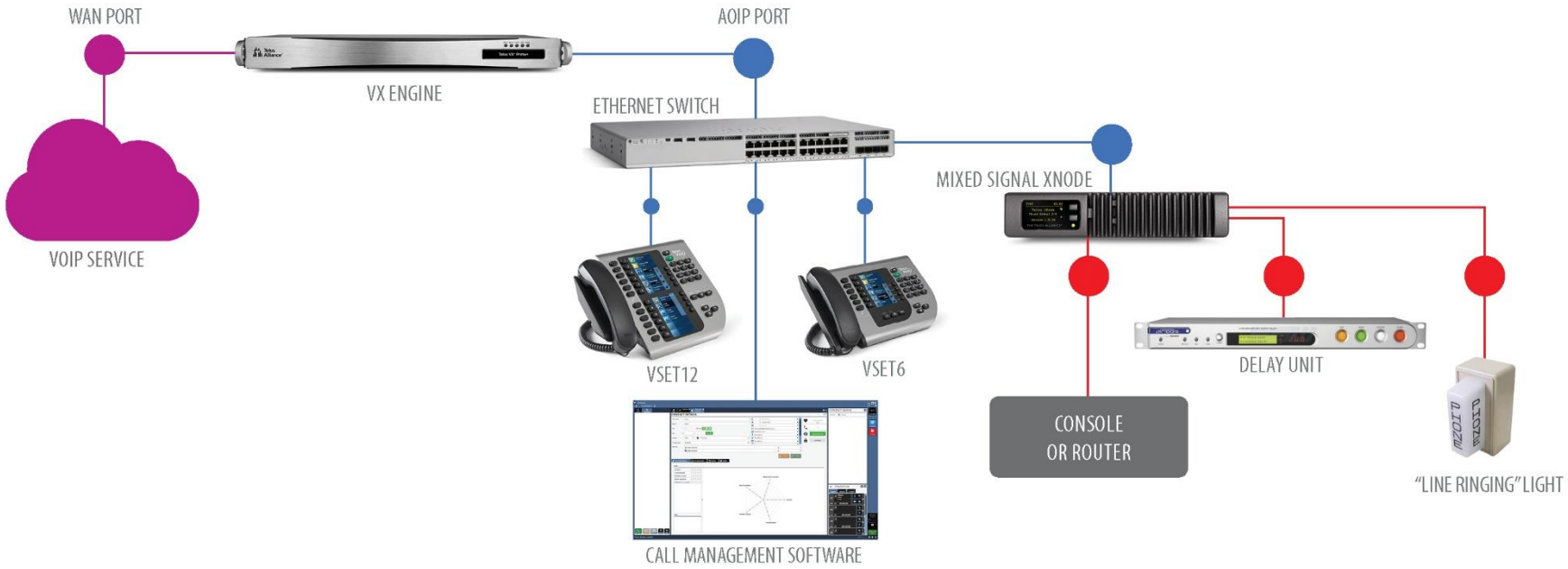
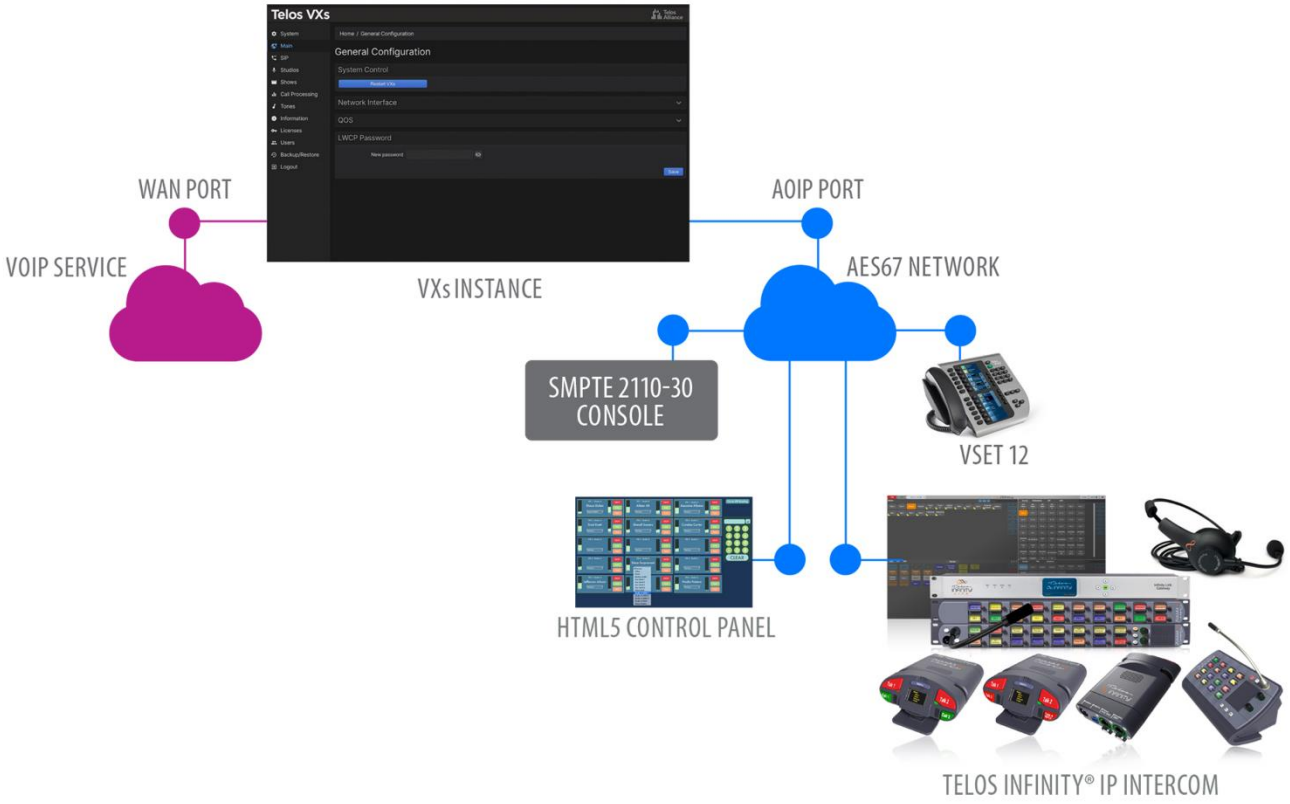
How is SIP used in real production

- The producer can call a remote guest directly from the intercom panel.
- The phone call is transmitted over the IP network without additional devices.
- Intercom users and telephone participants are in the same system.
- The software enables real time monitoring of line status.
- SIP integration eliminates noise and analog interference.
- All channels can be recorded and archived over the IP network.
- Fully compatible with VoIP and cloud services.

Modern approach to connecting phones and intercoms



Modern approach to connecting phones and intercoms



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WBnet

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Questions & Answers

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Network of centers for regional short study programs in the countries of the Western Balkans

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