The Tempest® 2.4GHz Multi-BaseStation Guide

Brief Review of the Tempest Multi-BaseStation

Overview

The Tempest 2.4GHz system is designed to work together to provide a scalable solution for real world wireless communications.

Connections

Sync. When using multiple Tempest 2.4GHz BaseStations, it is imperative that all the BaseStations share a common sync source.

No sync. This is not recommended for any Tempest 2.4GHz installation using two or more BaseStations. With no sync source present, the BaseStations will not be coordinated in time or frequency, which can cause poor RF performance.

Accu-Sync. Accu-Sync is provided by simply connecting the Tempest 2.4GHz BaseStation ‘Base Sync Out’ of the first BaseStation to the ‘Base Sync In’ of the next Tempest 2.4GHz BaseStation of that sequence. Continue to connect ‘Base Sync Out’ of one BaseStation to ‘Base Sync In’ on the next BaseStation until all collocated Tempest 2.4GHz BaseStations are connected in this fashion. Accu-Sync provides synchronization only in the time domain, meaning that all connected BaseStations will be transmitting at the same time, helping to prevent harmful desensing. However, there is no synchronization of frequency(s) that can lead to a variation in performance, from power up to power up.

ZSync™. ZSync requires the same connections as Accu-Sync, with the addition of connecting a ‘ZSync Dongle’ to the first BaseStation in a system with Accu-Sync cables already connected, or ‘Parallel Sync Generator’ to the ‘Sync’ input of all BaseStations in a system. ZSync provides synchronization in both the time and frequency domain, meaning that all connected BaseStations will be transmitting at the same time on coordinated frequencies, allowing a total of 11 collocated bases.

Never connect any Sync from a 2.4GHz system to a 900MHz Tempest system

External Hardware Com

2-wire. Using the Parallel 3-pin XLR connectors on the BaseStation, any Clearcom Partyline, RTS Partyline*, or AudioCom Balanced Partyline can be cascaded to all of the 2.4GHz Collocated BaseStations. (*Reminder, an RTS 2CH Party line connected to Tempest 2.4GHz BaseStation “Channel A” XLR connector will automatically be assigned to Tempest 2.4GHz Channels A and B.)

4-wire. Using the RJ-45 connectors on the BaseStation, any analog 4-wire signal can be connected directly to any of the BaseStations four talk channels. These connections provide a simple, discrete connection for integration with large matrix style intercom systems, 2-wire/4-wire interfaces, and discrete audio in/audio
out type applications. (Note – A discrete 4-wire connection is required for every channel of every base in a system.)

Stage Announce

**Stage Announce.** A discrete 3-pin XLR-f output from the BaseStation. When the “Stage” button on the BeltStation is pressed, all other audio sends from the enabled BeltStation are suspended, and the Mic signal is routed to ‘the Stage Ann’ output on the back of the BaseStation.

External destination mixing of Stage Announce

*When using multiple BaseStations, the Stage Announce function does not automatically connect between bases.*

Using a simple line mixer, the Stage Announce outputs of multiple BaseStations can be combined so that multiple sources can address the same destination. By enabling and connecting a BaseStations relay(s) to a paging systems contact closures, you can enable different BeltStations to address different destinations within your paging system.

**Aux Out/Aux In (program).** ¼” Balanced connectors enabling audio in to, or out of, the BaseStation.

External source mixing

*When using multiple BaseStations, the Aux-In function does not automatically connect between bases.*

Using a simple line mixer, multiple sources can be combined to a single BaseStations Aux-In. This can be useful for creating an “un-interruptible” source for critical cueing without taking up an intercom channel.

External destination mixing

*When using multiple BaseStations, the Aux-Out function does not automatically connect between bases.*

Using a simple line mixer/router, a BaseStations Aux-Out can be sent to multiple destinations. This can be useful for routing BaseStation audio to video recording, paging systems and listen-only systems.

Relay

Multi-base relay schemes

*When using multiple BaseStations, the Relay function does not automatically connect between bases.*

**Single relay – multiple closures.** In this setup we are using a single BaseStation Relay to trigger multiple discrete contact closures. An example would be Stage Announce to a multiple zone paging system, using the single relay to open all zones of a paging system to the Stage Announce output.

**Multiple relays – single closure.** In this setup we are using multiple BaseStation Relays to trigger a single closure. An example would be multiple BaseStations Stage Announce controlling the same contact closure.
Antenna

**BaseStation Antenna(s).** The BaseStation antenna connectors provide connections for the provided 2dbi omni-directional antennas. These can also be extended to locate antennas free from obstruction, optimize coverage in close proximity to the BaseStation.

**Remote Tranceiver(s).** The BaseStation Remote Transceiver allows for a BaseStation’s antennas to be located up to 1500 feet from the BaseStation itself.

**Antenna Placement Strategies.** In an ideal world, your antenna would be placed at the very center of an un-obstructed coverage area as high as possible. This is not the world we live in, therefore compromise is needed.

**Helpful Hints:**

1. **Height vs. obstruction:** More vertical height is better, until it isn’t. The best compromise position is one that gives the greatest amount of “line of sight” between the antenna and the BeltStation, in the conditions the system is expected to work in.
2. **Be realistic and plan ahead:** Imagine a large empty room, with a Tempest BaseStation and Antenna in the center of it, with the antenna 3 feet off the ground. First, power up your BeltStations and walk test the system everywhere in the room, and everything is functioning as expected. Now, 1000 people fill the room and it is shoulder to shoulder and very crowded. Do you expect the Tempest system is going to function exactly as it did before those people were in the room? Had the antenna been placed in a position that took this change into account, it should. But, because of the amount of obstructions those people caused between the antenna and the BeltStation, performance would be affected. A good understanding of the system expectations and the environment in which it will be used will prevent a lot of problems.
3. **WiFi and Tempest 2.4GHz:** The Tempest 2.4GHz manual has a very good section on this topic and should be referred to for technical information. While the Tempest 2.4GHz is not affected by WiFi systems operating in the same area, placement of a Tempest antenna in close proximity to a WiFi access point will cause antenna de-sensing and decreased RF performance in both the Tempest and WiFi systems. You have to keep them separate!
4. **Ask for help!** Contact Clear-Com support for specific help with your installation.

**Systems overview**

**2-wire system integration**

**Cascade.** This is as simple as connecting your 2-wire XLR to the desired channel on the back of the Tempest 2.4GHzBaseStation, then connecting its opposite sex XLR to the next Tempest 2.4GHz BaseStation in the system.
Fixed gain 2-wire and Tempest explained: Fixed gain 2-wire systems all require power, proper termination, and system null.

4-wire system integration

I/O conservation. One of the most common concerns about integrating Tempest Wireless into a matrix intercom system is the amount of 4-wire I/O that multiple BaseStations require.

4-wire gain staging

ECAN (Echo Cancellation) on 4-wire

What it does. Same as on the 2-wire side, the ECAN seeks to find any audio that is lower in level than the primary speech level, and eliminate it. In a proper gain stage, and balanced system, this process is very seamless.

Why you should. In a situation where open panel mics and live panel speakers are a part of the work flow, the ECAN on 4-wire can help to eliminate annoying echo and delay on the Tempest 2.4GHz system.

Why you shouldn’t. In a situation where there are large numbers of open mics and ambient noise, the ECAN circuit may try to process needed background noise that users are referencing as echo, and work to eliminate it.

4-wire conversion to 2-wire cascade

As a way to conserve I/O ports on a matrix system, converting a 4-wire comms channel to a 2-wire party line may be an option. However, it is critical to remember that there will be some loss of fidelity through conversion, and that proper gain staging will take a bit longer this way.

Things to consider. When working with 4-wire to 2-wire conversion, you are essentially creating a bridge between your matrix and your wireless system(s). And while there may be a savings on the matrix I/O side, you will pay a price in a more complicated process in balancing these interconnected systems.

Gain Staging. As with any audio circuit, proper gain staging is critical to efficient and clean audio signal. However, this is one of the most common problems in professional communications systems. Because of the 4-wire/2-wire interface in this type of system, it requires balancing the individual halves then bringing them together. Begin with balancing the matrix system as you normally would, then balance all of your systems linked via the 2-wire connections. Finally, balance the matrix to the 2-wire. This will most likely require adjustments at both the 4-wire/2-wire interface and their accompanying matrix ports.

The Null. Because your Tempest 2.4GHz BaseStations are linked via 2-wire, this will require that each BaseStation has its “auto null” run to eliminate 2-wire line reflections. However, great care should be taken to establish a proper null on the 2-wire system as a whole as well, as the Tempest 2.4GHz BaseStation auto null is relative to that base.