

1 Introduction

This document details the typical use and installation of a directional Yagi Antenna with a CWSI CP3000 System. Yagi antennas are highly directional antennas that are typically used to provide long distance reception and re-transmission of signals to outlying facilities that are quite far away. Typical distances for properly aligned (vertical) Yagi to Yagi antennas is from 3000 to 3500 feet and sometimes farther, although these distances can vary depending upon your local installation and local conditions.

This document is provided as a guide to help determine whether a Yagi antenna may be called for and if so the best use and location for the Yagi antennas. Our field testing has found that the yagi antennas are best suited for unobstructed line of sight reception and transmission. When utilized in dense clustered applications the reception radius on the sides of the antenna have not fared as well as omni antenna reception. The following information should help you in planning your installation, but does not eliminate the need for an on-site RF survey, which should always be performed to help ensure the best installation prior to system installation.

2 When to Consider Using Yagi Antennas

The use of a Yagi Antenna or matching Yagi Antennas should be considered when you have at least one building that is farther than a typical Omni repeater to repeater installation can handle, which is typically about 1100 feet when there is a clear unobstructed line of sight. The other case would be when you have a large installation and you would like to have one direct link from the farthest point out to help reduce the number of repeaters that the data would flow through.

3 System Data Flow

The CWSI system is designed as a mesh-network that forwards data from Repeater to Repeater in such a manner to forward data to the CP3000 main panel. If a repeater goes down the network will automatically reroute data to other repeaters to forward data to the CP3000 provided you have performed the signal survey to assure redundant links.

3.1 Repeater Basics

All wireless devices (smoke detectors, transmitters, manual stations) are considered slaves. Slaves transmit their data to the local master antenna where it is acknowledged by that same master antenna. This slave to master RF link is bi-directional. The data is then forwarded from that repeaters Slave antenna to the next Master antenna in the chain up to the CP3000 main panel which only has a Master Antenna.

- Data flow is from slave to master.
- The previous standard antennas that came with a CP 3000 or an AR-3 repeater were Omni-directional (Omni) antennas. They receive and transmit equally in a 360 degree pattern.

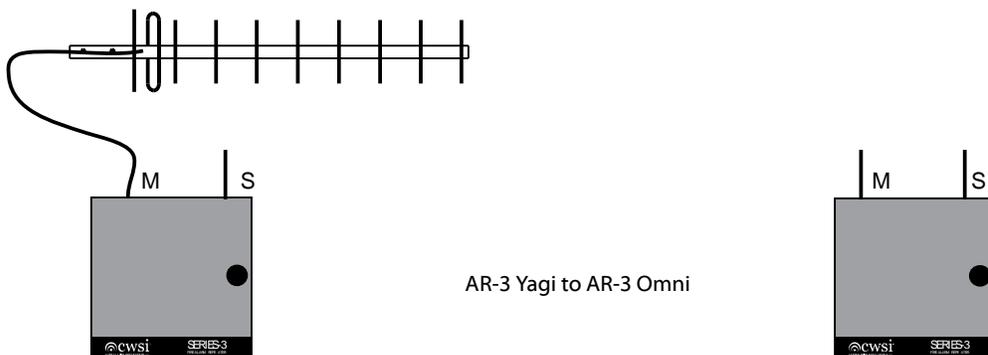
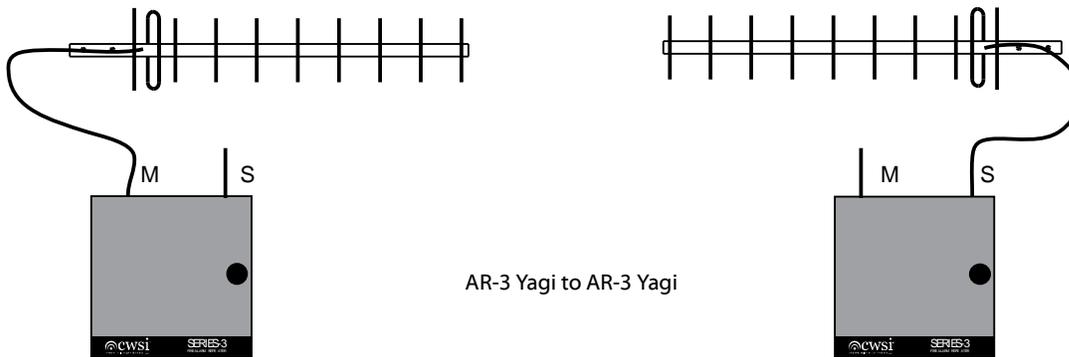
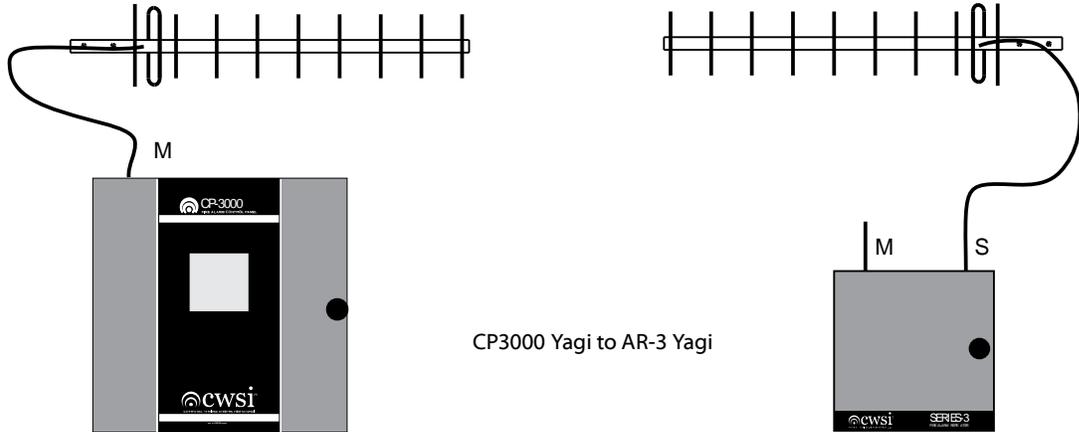
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- The antenna on the LEFT side of the repeater is the MASTER. The antenna on the RIGHT side of the repeater is the SLAVE.
- The CP 3000 has an antenna on the MASTER side only

SLAVES ALWAYS TALK TO MASTERS. Therefore, all transmitters report to the left side (master) of the repeater. The repeater then transmits the data through the right side (slave) to the left side (master) of the next repeater that it talks to.

4 Antenna Characteristics

The Yagi Antenna has a very narrow and highly directional radiation pattern. The majority of the RF energy is focused to come out the front end of the antenna, i.e. where you point the antenna is where 90% of the RF signal is transmitted. The radiated pattern of a Yagi antenna can be considered a straight line with a very narrow corridor running its length that may be able to be tapped into depending upon



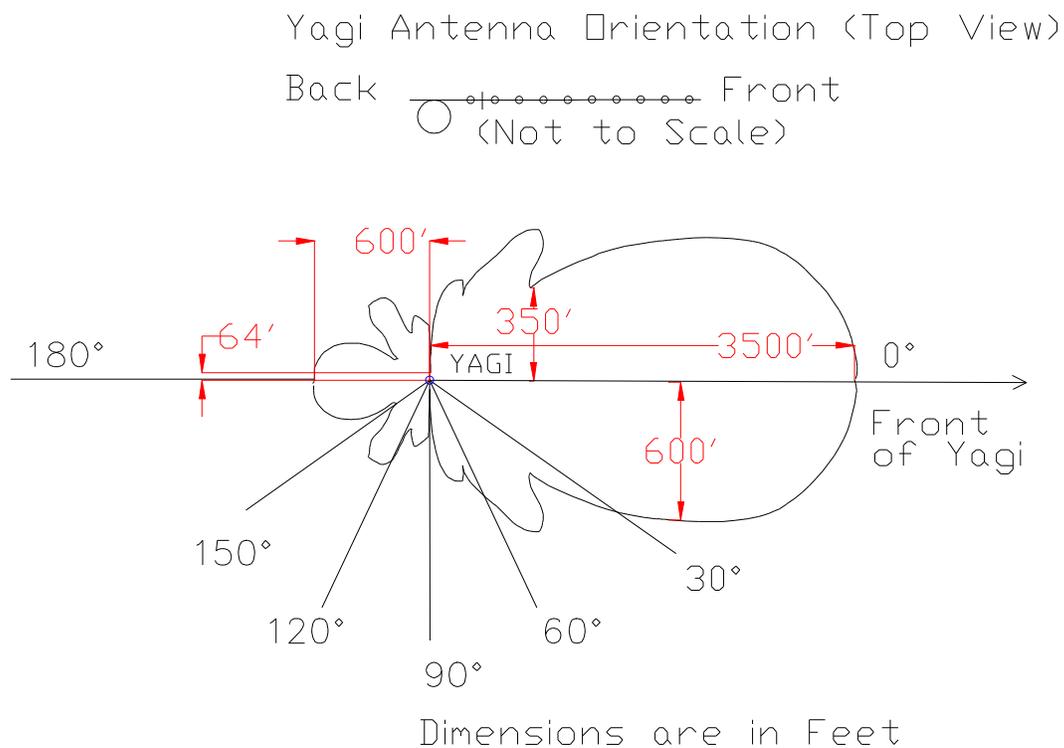
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the antenna type, the distance from the source Yagi antenna and the off-access angle of the "tapping" antenna.

The back of the antenna is where the cable connector is located, the front is the opposite end furthest away from the cable connector. Properly mounted the tines are aligned vertically in the same orientation as the Omni Antennas on the Repeaters and the CP3000.

The following drawing shows the Ideal radiation patterns of a Yagi to Yagi antenna. These results were determined during RF field measurements.

Note- All readings are subject to ideal testing conditions using Yagi antennas mounted at 8 to 15 feet above ground and aligned for survey testing. Distances experienced by installers in the field are subject to local conditions and variations in building construction. These distances are to be used as a guideline and are subject to a final site survey for confirmation.



5 Sample Installations

ANTENNA PLACEMENT

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There are two basic ways of designing a system. If you have multiple buildings in an area and want the signals from the wireless devices to report to the CP-3000, you may have antennas on the SLAVE side of the repeaters in the field pointing towards the CP-3000 or the repeater above the CP 3000. The master side of the repeaters will gather signals from the slave transmitters in the field and the slave side will transmit those signals in a narrow direction towards the master side of the next repeater or the CP-3000.

You can have an antenna on the CP-3000. Since the CP-3000 is a master only, that antenna will be in a receiving or gathering mode.

The second design is a bit different. If you have a long distance application, such as multiple buildings on an industrial site, you can have antennas on both sides of the repeater, the master side gathering signals and the slave side transmitting to the next repeater master or the CP-3000 master.

The Yagi antenna will always be mounted with the main body of the antenna parallel to the ground pointing in the direction you want to receive or transmit signals. The spines will always be in a vertical position pointing up and down as depicted in the picture below.



6 Summary

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Yagi Antenna's offer the installer a design choice and as mentioned are more suitable for long distance applications. The cost of the Yagi is considerably more than an Omni antenna however in the proper application a Yagi repeater may accomplish what it would take three Omni repeaters to do, as such making the total installation more cost effective. The key is the signal survey and keep in mind the mesh technology. Create redundant links to assure multiple signaling paths.