Product Summary, CA12CD-S Cordless Push-to-Talk Adapter
Introduction

This document summarizes the features of all versions of the CA12CD-S cordless push-to-talk headset adapter. It is intended for customers who need general information about this product as an aid for their purchasing and planning decisions.

Specific details about the installation and use of this product line are available in the user guide and in the document, *Audio Settings Guide for the CA12CD-S*, both of which are available on the Plantronics website.

Figure 1: Model CA12CD-S
Features and Functions

- Compatible with most air-traffic-control and public-safety-dispatch voice switches
- Quick Disconnect™ for compatibility with all Plantronics H-Series headsets
- Ten-foot coiled interface cable with various connector options available (the PJ-7 connector shown in Figure 1 is typical)
- Spare battery pack supplied with every unit
- Two battery-charging wells—one for the remote unit, and one for the spare battery pack
- Lithium-ion batteries
- Eight hours talk time, minimum
- Security in compliance with USA regulation 45 CFR 164.312(a)(2)(iv) and the Health Insurance Portability and Accountability Act (HIPAA).

Remote-unit Controls

- Push-to-talk (PTT) switch that is robust and field-proven
- Selector for setting the PTT switch to be momentary-only or momentary with locking option
- Receive-volume fine-adjust
- Audio Link LED button to enable/disable the audio-and-PTT link, with integrated link-status LED

Base-unit Controls

- Receive sensitivity coarse-adjust control (bottom of unit)
- Send-sensitivity control (bottom of unit) for user-selectable emulation of carbon, electret, and dynamic microphones
- Subscription button (back of unit)
- Send-sensitivity fine-adjust controls: Talk Volume buttons, top of unit

Visual Indicators

- Link-status LED, top of remote unit (integrated into the Audio Link LED button), that also indicates when subscription is underway
- Battery charge-status LEDs, top of base unit
- Talk LED that indicates PTT switch state, top of base unit
- Base-unit power LED, top of base unit

Audible Indicators (Earcons)

- Receive fine-adjust level change
- Send fine-adjust level change
- Low-battery warning
- Loss of remote-to-base link warning
- Returning into range indication

Electrical and RF Features

- DECT™ (Digital Enhanced Cordless Telecommunications) radio operating in the UPCS band (CA12CD-S) for North-American applications and full DECT version (CA12CD-S/A and variants) for areas such as the European Union and Australia.
- User-selectable carbon-, electret-, and dynamic-mic output characteristics
- Over-the-air subscription

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1 This assumes a new, fully-charged battery. Please see the section, Battery System, for further details.

2 Please refer to the section, Functional Description, for an explanation of this button’s function.
Functional Description

The CA12CD-S is a cordless push-to-talk (PTT) headset adapter that provides wireless communications and PTT functionality for Public Safety Dispatch and Air Traffic Control facilities. The CA12CD-S has a Quick Disconnect that allows compatibility with all Plantronics H-Series headsets. The CA12CD-S consists of a base unit and a remote unit.

The base has two charging wells, send- and receive-sensitivity controls, status LEDs, and a 10-foot coil cord with various connector options. The charging wells accommodate the remote and a spare battery pack. The LEDs show battery-charge status, power, and PTT status. The send controls consist of a configuration switch to emulate the outputs of different microphone types and a send-sensitivity fine-adjust control. The receive-sensitivity control selects among four different sensitivity ranges, and the receive sensitivity can be fine-tuned by a control on the remote. The console interface cable connects to the base via a 6-pin modular connector. When the user presses the PTT switch on the remote unit, a relay is closed in the base that places a short circuit across the PTT contacts of the host-equipment-end connector. This short circuit “keys up” the communications radio to enable voice transmissions.

The remote unit has a PTT switch, an On-Off switch with incorporated LED, a metal belt clip, a receive-sensitivity fine-adjust control, and a twelve-inch cable terminated in a Quick Disconnect to which any Plantronics H-Series headset can be connected.

The On-Off switch (referred to in the user guide as the Audio Link LED Button) enables audio and PTT, and is on by default. When the switch is turned off, the radio link is placed into an idle-locked state in which audio and PTT are no longer enabled. In this state, the remote and the base use minimal radio bandwidth to stay in touch with each other. As long as the base and the remote are powered up, the RF link is maintained regardless of the state of the Audio Link LED button. Even when the base is powered down, the remote will continue to run so that the link is reestablished should the base be turned on again. Therefore, to completely power-down the remote unit, it is necessary to remove the battery.

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3 Examples of H-Series headsets commonly used in air-traffic control and public-safety dispatch are: H31-CD, H81N-CD, H251-CD, H252N-CD, and H261N-CD. Please see the Plantronics website for further information.
Product Architecture

Base Unit

The block diagram of the base unit is shown in Figure 2.

![Base Unit Block Diagram](image)

**Figure 2: Base-Unit Block Diagram**
Remote Unit

The block diagram of the remote unit is shown in Figure 3.

![Remote Unit Block Diagram]

Figure 3: Remote-Unit Block Diagram

Audio Performance

A wide range of audio levels can be achieved using the coarse-adjust and fine-adjust controls provided for both the send and the receive channels. See the CA12CD-S User Guide and the document, Audio Settings Guide for the CA12CD-S for details on optimizing these controls for the best audio performance. Both of these documents are shipped with the CA12CD-S, and both are also available from the Plantronics website.

Sidetone

The CA12CD-S uses an echo canceller to remove sidetone that is generated by the host equipment, and it replaces this sidetone via a sidetone path in the remote unit.

The reason for minimizing sidetone from the customer equipment is due to the delay introduced by the digital architecture (TDMA\(^4\)) of the DECT radio link. Sidetone generated in the customer equipment is delayed by about 20 mS by the time it reaches the user’s ears. This is enough of a delay to be unpleasant to the user.

Under normal conditions, the echo canceller is sufficient to prevent sidetone and network-generated echoes from reaching the user, but if the transmit signal is too high, or if there is non-linear processing in the sidetone path, sidetone breakthrough can occur. If this happens, the user might hear distorted

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\(^4\) Time Division Multiple Access
sidetone; they might hear their own voice in the headset as they speak, and it might sound harsh and thin. Following the steps outlined in the document, Audio Settings Guide for the CA12CD-S, (provided with the CA12CD-S and available online) should help the user avoid this problem. The general procedure for avoiding sidetone problems is to avoid unnecessarily-high talk-volume levels and to keep the sidetone controls on the host equipment—if present—set to their minimum positions. The sidetone controls on the host equipment might be user-accessible, or they might be accessible only to service personnel.

Radio Performance

Protocol and Frequency Bands
The DECT radio protocol is used for its power efficiency, which allows extended operation from a relatively small battery pack. A new, freshly-charged battery will provide about eight hours of talk time.\(^5\)

The CA12CD-S/A and its variants operate in the European DECT frequency band of 1880 to 1900 MHz. The CA12CD-S for North America also uses DECT technology, but it operates in the Unlicensed Personal Communications Services (UPCS) 1920- to 1930-MHz band.

Radio Power
The base and the remote both operate at approximately +6.5 dBm (4.5 mW).

Operating the CA12CD-S near Other Radio Products
The CA12CD-S’s radios automatically avoid interference from other radio products operating in or near its frequency band. Such products can include other DECT/UPCS products, such as cordless handsets, as well as some cellular products whose frequency bands are very close to those used by the CA12CD-S.

However, if the signal strength from any of these products is sufficiently strong, interference with the CA12CD-S might occur despite the CA12CD-S’s interference-avoiding algorithms. This can result in buzzing, pops, or irregular mutes of the talk and/or listen audio, and the range might also be shortened. The following steps can improve the performance of a CA12CD-S that is experiencing interference:

- Repositioning the base
- Limiting the distance between the base and the remote while in use
- Repositioning the interfering equipment, if known, and if possible

If the CA12CD-S base or remote is placed within a few inches of a cellular phone, the CA12CD-S might experience interference. Also, a cellular signal booster in the same vicinity as the CA12CD-S might interfere with the CA12CD-S. Reposition the cellular equipment or the CA12CD-S base or remote to increase the separation if this problem occurs. For any anticipated co-locations of CA12CD-Ss and cellular signal boosters, please contact Plantronics technical assistance.

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\(^5\) Please see the section, Battery System, for further details.
Range and User Density
Range can be maximized by taking the following steps:

- Maximizing the amount of separation between the CA12CD-Ss
- Placing the CA12CD-Ss so that they are separated by items such as cubicle walls and furniture
- Turning off all unused bases and removing the batteries from the unused remotes
- Insuring that no other equipment is operating in the same frequency band as the CA12CD-S; interference may come from systems well outside the coverage area, as the range for interference is greater than the coverage range

As a general guideline, a maximum range of about 100 feet can be obtained in a low-density installation of 5 units separated from each other by at least 10 feet. In a high-density installation of 30 units at 18-inch spacing, the range could be as little as 10 feet. A medium-density installation of 40 units at four- to eight-foot spacing should result in good audio and range for all users. In all cases, range will be greatest when the users are closer to their own bases than they are to other users’ bases.

The effective limit to range is set by the onset of audio artifacts as the user gets further away from the base, and by the user’s tolerance for these artifacts. Range can be reduced within a building by the obstruction of interior walls, or by the presence of other equipment operating in the CA12CD-S’s frequency band, or by the presence of a large number of other CA12CD-Ss in the immediate area.

In a high-density installation the CA12CD-S may take some time to reestablish connectivity with its base when the user returns to the coverage area after having been out of range. It normally takes a few seconds for the remote to find the base’s signal as the user reenters the coverage area, but this process can take a minute or so in a high-density installation.

Predicting the effective range and region of susceptibility to interference for individual environments and building layouts is of sufficient complexity as to be beyond the scope of this discussion. The preceding information is provided as a reference for system planning, and the performance of individual installations may vary.

Frequency Hopping
The CA12CD-S uses aperiodic adaptive frequency hopping when the audio link is enabled, as indicated by the LED on the top of the remote unit blinking once per second. The system hops channels whenever there is another user sharing the same channel and producing interference. In an environment with many users, this adds a layer of security because users change channels from time-to-time, rather than staying in a fixed channel. This adaptive approach offers improved security relative to other systems which use a single, common, and fixed hop sequence.

The CA12CD-S uses fixed-rate adaptive frequency hopping during the idle-locked state, which is when the base and the remote are both powered-up and in range of each other, but audio is not enabled (the LED on the top of the remote unit is not on). The hop sequence is random, on the basis of the physical environment. This ensures that the base and the remote are compensating for changes in the radio-signal spectrum due to other users and the presence of interferers, and thus improves the reliability of the link while adding an extra layer of security.

In the event of operation in a high-density installation where no better channel and timeslot is available, two users near each other and sharing the same channel and timeslot might experience occasional mutes of the receive or transmit audio and occasional audio-distortion artifacts, rather than intercepted audio.

Voice Privacy
The CA12CD-S provides excellent security against eavesdropping. This security is achieved through frequency hopping (described above) and encryption.
Encryption
The protection against deliberate eavesdropping is through user authentication and 64-bit true digital encryption of voice data according to the standard algorithm of EN 300 175-7. A description of the public portion of this encryption algorithm is available through the website of the European Telecommunications Standards Institute (ETSI) at www.etsi.org. Individuals and organizations having a credentialed need for more detail regarding the encryption scheme should contact Plantronics Engineering through the Technical Assistance Center. The CA12CD-S in particular and the DECT standard in general are considered secure-enough for commercial applications requiring voice privacy. This assurance is based on the 64-bit digital encryption of speech and the internationally-recognized and standardized encryption algorithm used.

Subscription
The CA12CD-S remote and base are paired uniquely. The process by which the remote and the base are paired is called, “subscription.” Please see the user guide for step-by-step instructions for subscribing a base and a remote to each other.

The communications protocol permits audio exchange only between a remote and a base that are paired. The user can subscribe a new remote to an existing base to create a new pairing, or an existing remote can be subscribed to a new base, but a base can be paired with only one remote at a time, and a remote can be paired with only one base at time. When a new pairing is established, the old pairing is lost.

Battery System
The battery packs provided with the CA12CD-S contain lithium-ion batteries. Each battery has an integrated protection module that protects the battery from short circuits and other conditions that might damage the battery.

The charging system charges the batteries with a typical lithium-ion charge protocol that maximizes the life of the battery while providing the best battery capacity. Beginning with a period of constant-current charging, the system switches to charging with a constant voltage when the battery voltage reaches a pre-determined level. During the constant-voltage portion of the charge cycle, the current drawn by the battery from the charge controller gradually drops off, and the charge cycle is terminated when this current drops below a set level.

Lithium-ion batteries will typically provide good capacity for about 400 charge/discharge cycles. Battery life can be maximized by:

- Recharging frequently: lithium-ion batteries last longer when they are never too-deeply discharged. Unlike some other battery chemistries, lithium-ion does not have a so-called “memory effect,” and it never needs to be completely discharged.
- Always placing the remote unit in its charging well when it is not actively being used
- Detaching the battery pack from the remote unit if the remote unit is to be stored, shipped, or otherwise not used for an extended period of time. This is necessary because a remote unit will always draw a small amount of power from an attached battery pack so that it can be located by its base unit if it is powered up, and will thus eventually completely discharge the battery.
- Avoiding exposing the battery packs to elevated temperatures.