CTPhone 1900 System

application manual

Systems Ltd.

ctphone 1900 system

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Contents

1 CTPhone 1900 System Overview

2 CTPhone 1900 System Planning

3 CTPhone 1900 System Hardware & Software Installation

4   *CTPhone 1900 System Configuration and Activation*

5   *Diagnostics and Troubleshooting*

6 CTPhone 1900 System Specifications

A Regulatory Information (United States)

Figures

Tables

1

CTPhone 1900 System Overview

CTP Systems CTPhone™ 1900 system adds wireless phone service to new or existing Private Branch Exchanges (PBX), Centrex service, or key systems. The CTPhone 1900 system operates in both single building and campus environments.

Components of the CTPhone 1900 system are base stations, handsets, a CTPhone Controller, and CTPhone Manager software. Base stations are installed throughout a facility to relay calls between the portable handsets and office telephone system. The CTPhone Controller connects to an office telephone system and accommodates one or two base stations and up to 32 CTPhone handset users. Each eight-channel base station provides eight channels (each four-channel "Mini" base station provides four channels) and up to 333,560 square feet (31,000 square meters) of calling coverage.

CTPhone handset users have access to the office telephone system features in addition to being free to make and receive calls away from their desks. The handset is small, lightweight, and easy to use. It also features a display area for alphanumeric information and icons that report handset status.

The CTPhone 1900 system operates in the 1920–1930 MHz range, which is specifically set aside by the FCC for unlicensed Personal Communications Services (U-PCS) in the United States.

The remainder of this chapter describes:

- CTPhone 1900 system components (page 1-12)

- how CTPhone calls take place (page 1-14)

- regulatory information (page 1-15)

- CTPhone 1900 system features (page 1-16)

CTPhone 1900 System Components

The components of the CTPhone 1900 system are:

- base stations

- CTPhone handsets

- CTPhone Controller (connected to analog line cards in the existing PBX, Centrex or key system)

Figure 1-1 illustrates a CTPhone 1900 system connected to a PBX. Analog lines in the PBX connect to the CTPhone Controller and provide a signal to the Base Stations. The Base Stations convert the analog signal to a Radio Frequency (RF) signal for transmission to the handsets. The same lines may be connected to wired extensions for users that desire both CTPhone and wired extensions.
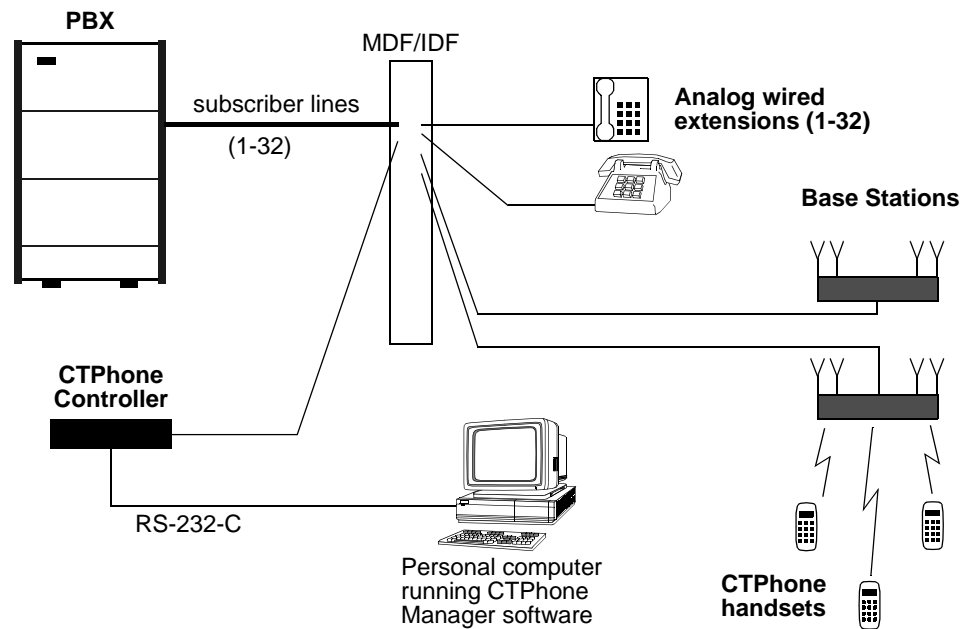
Figure 1-1. CTPhone 1900 System Components

CTPhone Controller

Connected to analog lines from an office telephone system, the CTPhone Controller provides an interface between the telephone system and CTPhone 1900 system. The CTPhone Controller supports one or two base stations; the configuration is determined by traffic and customer application requirements.

The CTPhone Controller is designed for mounting on walls or in industry standard 19-inch rack mounts. Side brackets on the Controller can be rotated depending on the type of installation (see Figure 1-2).

Mounting bracket
(rotated for rack mount)   LEDs   Reset
                                                                        button
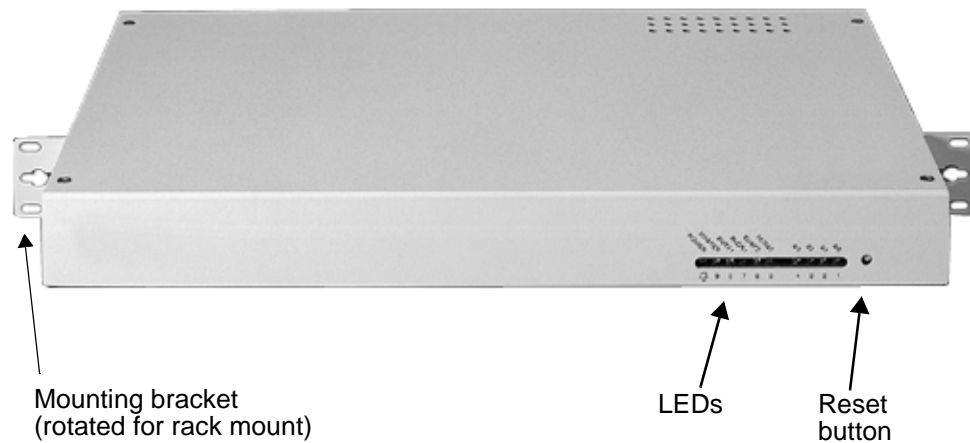
Figure 1-2. CTPhone Controller

Information configured and stored on the CTPhone Controller defines CTPhone handset IDs and handset feature operation. Accompanying the CTPhone Controller is CTPhone Manager software which runs under Microsoft® Windows™ on a Personal Computer (PC) and allows a system administrator to configure CTPhone extension numbers and handset feature operation on the CTPhone Controller.

Base Station

The CTPhone base station has radio transmitters and receivers that handle communication with CTPhone handsets. Connected to an office telephone system via a CTPhone Controller, it relays calls between portable CTPhone handsets and other phones and trunks connected to the telephone system.

Each Base Station provides coverage for a particular area, or cell, and supports eight simultaneous conversations (each four-channel "Mini" base station supports four simultaneous conversations). However, since individual CTPhone handsets are not in continuous conversation, a system supports more than eight handsets (to a maximum of 32). The number of handsets (users) a base station supports depends on the traffic requirements of your system. Engineering guidelines are provided in the *CTPhone 1900 System Planning* chapter.

Base stations may be mounted on walls or ceilings up to 800 feet (244 meters) from the CTPhone Controller using twisted pair cable. Base stations receive power from the CTPhone Controller, but may also be locally powered, in which case they may be installed up to 3280 feet (1000 meters) from the CTPhone Controller (for exact details, see Table 3-C on page 3-6).

CTPhone Handset

The CTPhone handset is easy to use. A Liquid Crystal Display (LCD) shows dialed numbers, icons that report the handset status, and prompts that assist callers to make calls and execute telephone features. The handset has a 12-button keypad and additional keys that facilitate handset use.

The handset's small size and light weight make it convenient for carrying in pockets or attaching to belts. It also features an internal antenna which adds to ease-of-use while protecting the antenna from physical damage.

How CTPhone Calls Take Place

Call Initiation

CTPhone calls are similar to other calls that take place in a telephone system, except that every call to or from a CTPhone handset involves establishing an RF (radio frequency) link between the handset and a base station. In idle state, a handset scans system base stations and locks onto the base station with the best signal.

System and handset IDs assigned in the system also affect CTPhone calls. The CTPhone Controller is assigned a unique system ID, and a CTPhone handset must be programmed with that system ID and a unique handset ID before it can communicate with a base station connected to that CTPhone Controller. Up to eight system IDs with associated handset IDs may be programmed into a CTPhone handset, allowing it to operate in multiple CTPhone 1900 systems. For more information on system and handset IDs, see Table 4-D on page 4-10.

Calls to a CTPhone Handset

1   The CTPhone Controller receives a call to a CTPhone extension.

2   To locate the called party, the CTPhone Controller sends a request containing the ID of the called CTPhone handset to all system base stations.

3   The system base stations signal the handset and the handset responds to the base station onto which it is locked.

4   The base station responds to the CTPhone Controller and the RF link is established. The call then proceeds like any other call in the office telephone system.

Calls Initiated from a CTPhone Handset

1   The handset locks onto a system base station and initiates a service request.

2   The base station transmits calling information to the CTPhone Controller. The call then proceeds like any other call in the office telephone system.

Call Termination

Call termination involves freeing a voice channel and transition of the CTPhone handset to a standby state. When the CTPhone Controller determines that a call has terminated, it sends a release message to the base station. The base station and handset then terminate the RF link.

In some cases, the base station must initiate call termination by sending a message to the CTPhone Controller. Loss of handset power, interference with the RF signal, or a user stepping out of base station coverage are examples of events that cause the base station to terminate a call.

Regulatory Information (United States Only)

The CTPhone 1900 system complies with Federal Communications Commission (FCC) Regulations Part 15 and Part 68 Subpart C. The FCC Part 68 registration number is 5RYISR-23723-WC-T. The Ringer Equivalence Number is specified as 0.6B.

The CTPhone 1900 system is designed to operate under FCC Part 15 rules for Unlicensed Personal Communications Service (U-PCS) equipment in the 1920–1930 MHz band. Part 15 ID numbers for the eight-channel base station, four-channel "Mini" base station, and handset are MTU-1900-BS-A1, MTU-1900-BS-B1, and MTU-1900-HS-A1, respectively.

Because microwave services are currently also offered in the 1920–1930 MHz band, the FCC has designated UTAM, Inc. to coordinate the transition of microwave services to other frequency bands and manage the installation of new U-PCS equipment in the band. CTP Systems' CTPhone UTAM certification ID is MTUCCLUM00006.

The CTPhone 1900 system complies with Underwriters Laboratories specification UL1459 for safety. The compliance ID is C86-0345.

Detailed information on these requirements is in Appendix A.

CTPhone 1900 System Features

System Features

Base Stations

The eight-channel CTPhone base station is shown in Figure 1-3.

antennas   antennas

LEDs
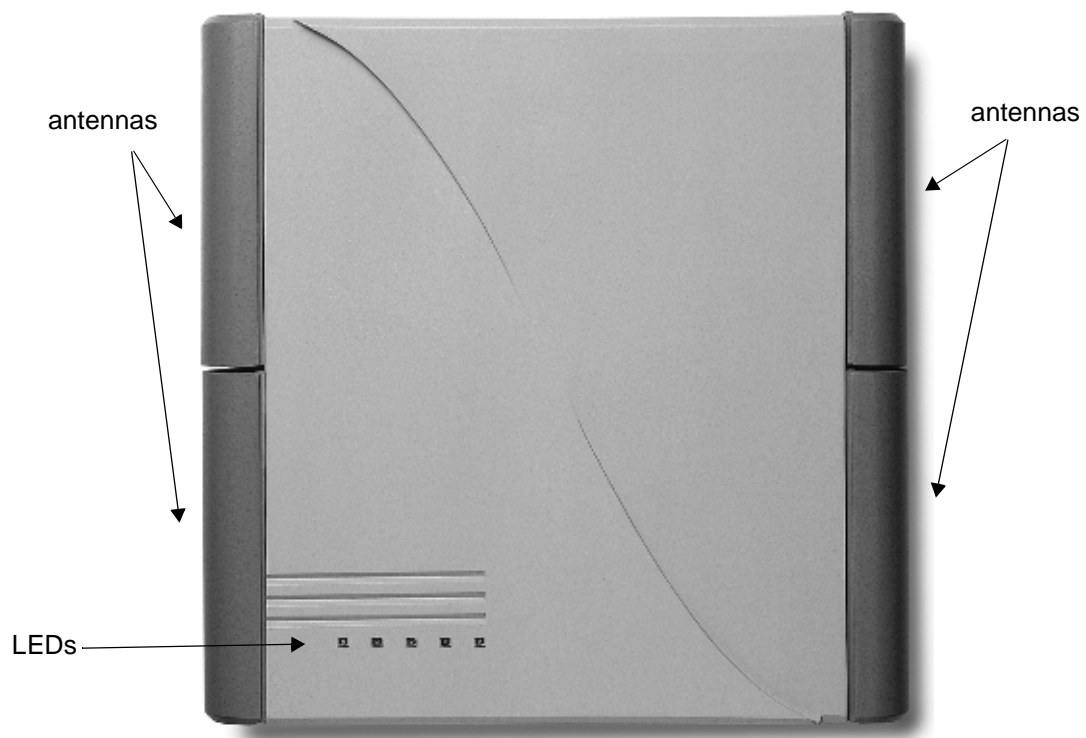
Figure 1-3. Eight-Channel CTPhone Base Station

Base stations may be mounted on walls or ceilings up to 800 feet (244 meters) from a CTPhone Controller when they receive power from the Controller. They may also be locally powered, in which case they can be installed up to 3280 feet (1000 meters) from the Controller (for exact details, see Table 3-C on page 3-6). Each CTPhone Controller supports a maximum of two base stations and up to 32 users.

In office environments, each base station has a broadcast range of 328 feet (100 meters) and supports an area of 333,560 square feet (31,000 square meters). The range may increase to a maximum of 3280 feet (1000

meters) outdoors. LEDs on the base station provide diagnostic information for system administrators. See *Base Station LEDs* page 5-11 for details.

Typical office environment
328 feet (100 meters)
333,560 square feet
(31,000 square meters)

Base Station

Outdoors environment
3280 feet maximum (1000 meters)
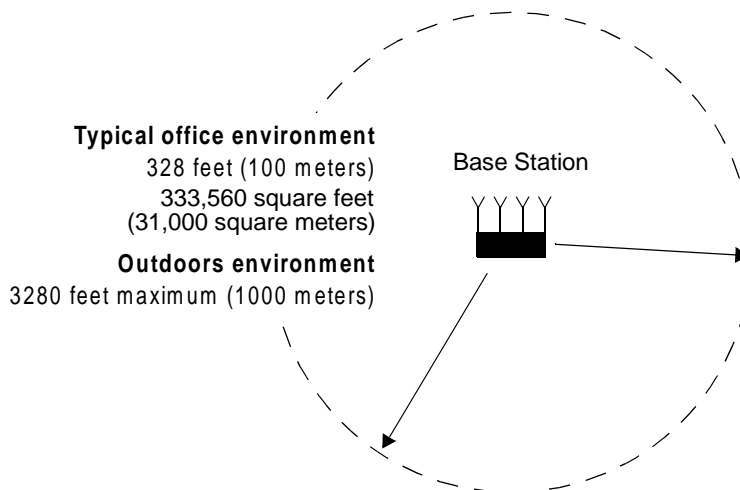
Figure 1-4. Eight-Channel Base Station Broadcast Range

The four-channel "Mini" CTPhone base station is shown in Figure 1-5.

Figure 1-5. Four-Channel "Mini" CTPhone Base Station

The four-channel "Mini" base station provides a compact, cost-reduced option for providing coverage in small to medium traffic areas. Similar in design to the eight-channel base station, the "Mini" also offers four internal antennas plus a fifth antenna feature (described below). The four-channel "Mini" base station supports four simultaneous conversations and up to 333,560 square feet (31,000 square meters) of calling coverage.

Fifth Antenna Option

"Mini" base stations offer a fifth antenna option to provide additional coverage for isolated spaces at a lower cost.

Outdoor Base Station

A base station designed specifically for outdoor installations. The outdoor base station resists dust, rain, and withstands temperatures ranging from -40° to 122° F (-40° to 50° C). You may mount the outdoor base station on a wall or on a circular mast up to 3280 feet (1000 meters) from the controller. A lightning/surge protection card mounted inside the base station enclosure shields DC/data lines against indirect surge.

Antenna Diversity

CTPhone base stations feature four antennas which allow the system to choose the best antenna for receiving and transmitting the strongest signal. Antenna diversity maximizes signal reception at the base station.

Co-location

Multiple base stations may be placed one meter apart in the same coverage area to increase traffic capacity without interference.

AC or DC Power

The base station may be powered from the CTPhone Controller or powered from AC outlets using a local power supply.

Software Download from CTPhone Controller

When needed, software upgrades to the base station are downloaded via the CTPhone Manager software. Downloading software from the CTPhone Controller simplifies CTPhone 1900 system administration and eliminates the need to remove base stations for system upgrades.

System Administration

The CTPhone 1900 system includes a software program which runs under Microsoft Windows on a Personal Computer and is used to configure CTPhone extensions and CTPhone handset features on the CTPhone Controller. CTPhone Manager software also runs diagnostics, and reports alarms and traffic statistics.

CTPhone Only or Twinning

CTPhone 1900 systems may be set up to offer users a CTPhone only option or CTPhone handsets integrated with wired phones. In the latter case, calls to a particular extension ring the wired and CTPhone extension.

Roaming

Roaming allows a handset to make and receive calls in all cells of the CTPhone 1900 systems in which it is programmed to operate. The handset chooses the base station with the best signal for a particular call and allocates a channel to carry it.

Handoff

Handoff is the ability of the system to maintain a call as a user moves from one base station cell to another.

Digital Transmission

The CTPhone 1900 system features full digital transmission from the CTPhone Controller to the CTPhone handset. Digital transmission offers superior voice quality.

Statistics

The CTPhone Manager software provides statistics on base station channel usage throughout the system. The statistics reported per base station are peg counts and usage counts related to channel activity and to all-channels-busy conditions. Peg counters report the number of occurrences of specific events and usage counters report the amount of time a base station satisfies a particular condition.

The statistics collected by the CTPhone Manager are described in detail in the CTPhone Manager on-line help.

Diagnostics

The CTPhone Manager software lets a system administrator check base station status, and remove and restore service to base stations.

Base station LEDs also provide diagnostic information for system administrators.

See also *Bit Error Rate Test*, below.

Alarm Monitoring

The CTPhone Controller sends information about operation of and alarm conditions in the CTPhone 1900 system out its RS-232-C port. The CTPhone Manager program is capable of receiving and displaying alarm information received from the CTPhone Controller.

Bit Error Rate Test

The CTPhone handset provides a Bit Error Rate (BER) test which reports the quality of coverage of a given base station at the handset. BER testing helps an installer determine that base station placement will provide adequate coverage and is also useful for troubleshooting. This test may only

be accessed by entering a password at the handset and is not available to general users.

Multiple Simultaneous Users

The CTPhone 1900 system accommodates 16 users (8 per cell) in simultaneous conversation with no degradation in performance.

Unlicensed Operation

The CTPhone 1900 system operates in the 1920–1930 MHz band, which is designated by the FCC for unlicensed operation. Therefore, an FCC license is not required to install and operate the system in the United States.

CTPhone Handset Features

The CTPhone handset is designed for ease-of-use whether users are at their desks or moving throughout a facility.

- The handset is small (2.25" wide x 6" long x 1" thick) and light-weight (approximately 7.0 ounces).

- The display contains call information, prompts, and icons that report the status of the handset extension.

- The keypad contains specially labeled keys that assist callers in making calls and executing telephone features.

The CTPhone handset is shown in Figure 1-6

Figure 1-6. CTPhone Handset

Handset Display

The CTPhone handset features a four line display that contains two lines for alphanumeric information and two lines for icon displays.

The text display area displays date and time and information about activity taking place, such as dialed number. It also provides prompts that assist callers through various tasks like storing speed dial numbers and setting ring type.

You can also control the amount of contrast in the handset display.

Handset icons used with the CTPhone 1900 system are shown below.

off-hook   signal strength/
                                      lock

battery   ringing/ring volume
strength

ABC   alphanumeric
             mode
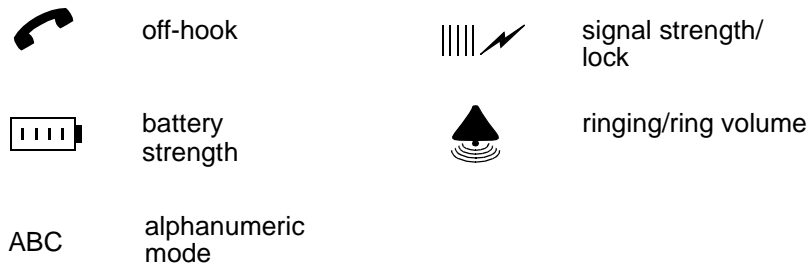
Internal Antenna

The CTPhone handset features an internal antenna which is not subject to physical damage because it is not extracted or retracted during phone use.

Security

The CTPhone handset encrypts voice information before transmitting it. Encryption ensures that conversations are private and inaccessible to electronic eavesdropping.

Configurable Ringing

Users can set ring type and volume on their handset. Eight ring types, three volumes, and no ring are available.

Ringer Mute

The handset ringer can be muted.

Key Press Feedback

The CTPhone handset can be configured to beep when any key is pressed.

Keypad Lock

The handset keypad can be locked to prevent accidental pressing of keys. A locked handset does not respond to any key except the power or "unlock" keys, but releases the keypad when you receive an incoming call and relocks it again when the call terminates.

Low Battery Alert

The CTPhone handset displays a low battery message and beeps when you are about to lose a call due to low battery. After the first low battery warning beep, another beep occurs after 60 seconds and then every 30 seconds thereafter until the handset display goes blank. The beep occurs every 60 seconds when the handset is in standby mode.

Multiple System Access

The CTPhone handset holds up to eight system IDs. Multiple system IDs allow a single handset to be used in up to eight different CTPhone 1900 systems. Each system must have the appropriate configuration when this option is used.

Speed Dial

The CTPhone handset stores up to 70 speed dial numbers. To dial a speed dial number, users can:

- press and hold 0–9 for frequently dialed numbers

- dial a two-digit memory location

- scroll through memory locations

- enter a name stored with a speed dial number

The handset assists a user though the process of storing, editing, and deleting speed dial numbers by displaying prompts in the handset display. Instructions for dialing and storing speed dial numbers are in the *CTPhone Handset User Guide*.

Volume Control

Volume keys on the handset allow users to adjust speaker volume up or down while in conversation.

Low Power Consumption

The CTPhone handset supports 4 hours of talk time and 40 hours of standby time (on and available for calls) on a fully charged battery.

Removable Battery Pack

The CTPhone handset has a battery pack that is easily removed and replaced. Figure 1-7 illustrates the back of the handset with and without battery.
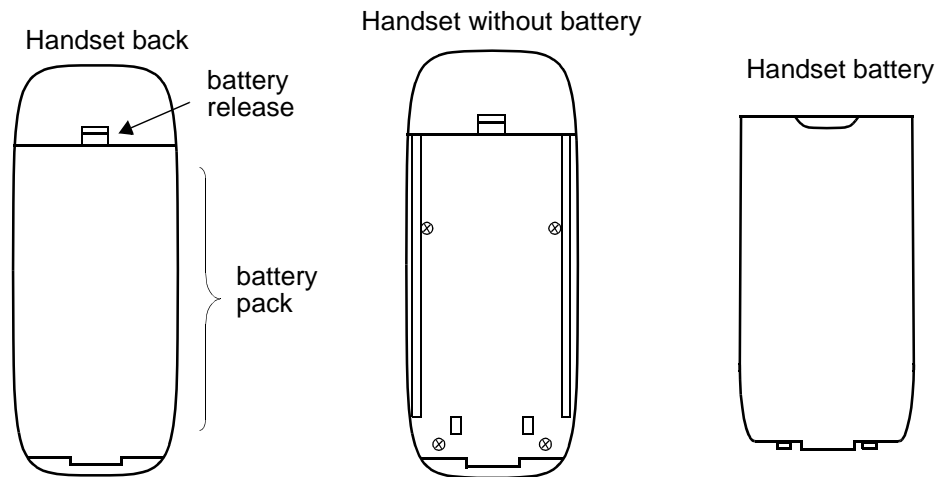
Figure 1-7. CTPhone Handset Battery

Handset batteries are Nickel Metal Hydride (NiMH).

Desk Top Charger

The CTPhone handset comes with a charger that accommodates both handset and spare battery. LEDs on the charger indicate that charging is in progress. See *CTPhone Handset Charger* on page 5-17 for detailed information.

Figure 1-8. Handset Charger

Carrying Case

The CTPhone 1900 handset has multiple carrying case options:

- Belt Clip (P/N PST20034)

- Leather Case with Belt Clip and Strap (P/N PST20035; available with or without a keypad cover)

- Belt Clip with Vibrating Alert (P/N to be determined)

2

CTPhone 1900 System Planning

This chapter contains information to help you design your CTPhone 1900 system. It covers the following topics:

- possible CTPhone 1900 system configurations (page 2-2)

- how to design a CTPhone 1900 system so that base stations provide optimum coverage and support expected traffic (page 2-6)

- testing for optimum base station placement (page 2-18)

Possible System Configurations

This section describes several ways to set up a CTPhone 1900 system. Reading this section will help you decide the best way to set up your system. Reading *Pre-installation Tasks* on page 2-6 will help you finalize base station placement.

Single System with One or Two Base Stations

Figure 2-1 illustrates the most common arrangement of a CTPhone 1900 system. The base stations may be placed in varying locations based on the requirements of your system. For example, they could be placed in the same general area or on separate floors but with the cells slightly overlapping to provide the greatest coverage area. They could also be located as close as one meter apart in high traffic areas.

Coverage: 31,000 square meters (333,560 square feet) per base station

Maximum Number of Configured Users: 32
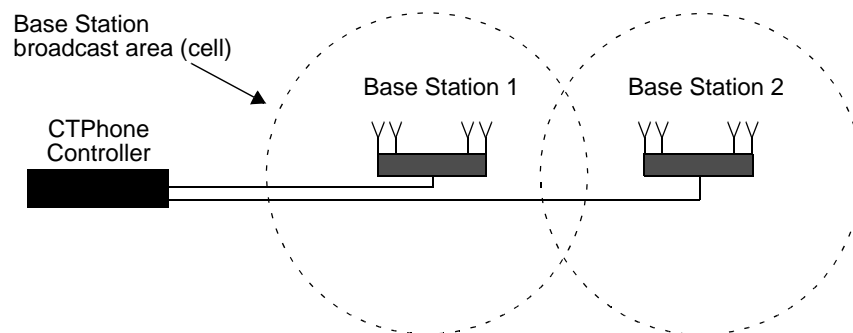
Figure 2-1. Single System with Two Base Stations

Multiple Systems (CTPhone Controllers) in Separate Locations

Figure 2-2 illustrates two CTPhone Controllers installed in completely separate areas of a facility. Each CTPhone Controller represents a distinct system and is configured with a unique system ID. (For information on system IDs, see Table 4-D on page 4-10.) This configuration might be used when CTPhone extensions are needed in different functional areas of a business such as manufacturing and purchasing and CTPhone handset users do not plan to operate their phones within the other system.

Handset users can operate their phones within both systems if their handsets are programmed with both system IDs and their handset extensions are configured within each system. However, since having two CTPhone extensions requires two separate analog lines, special configuration of the office telephone system is necessary to ensure that a user receives outside calls to either system in an acceptable manner. Furthermore, handoff does not operate between base stations connected to different CTPhone Controllers.

Coverage: 31,000 square meters (333,560 square feet) per base station

Maximum Number of Configured Users: 32 per system (CTPhone Controller)
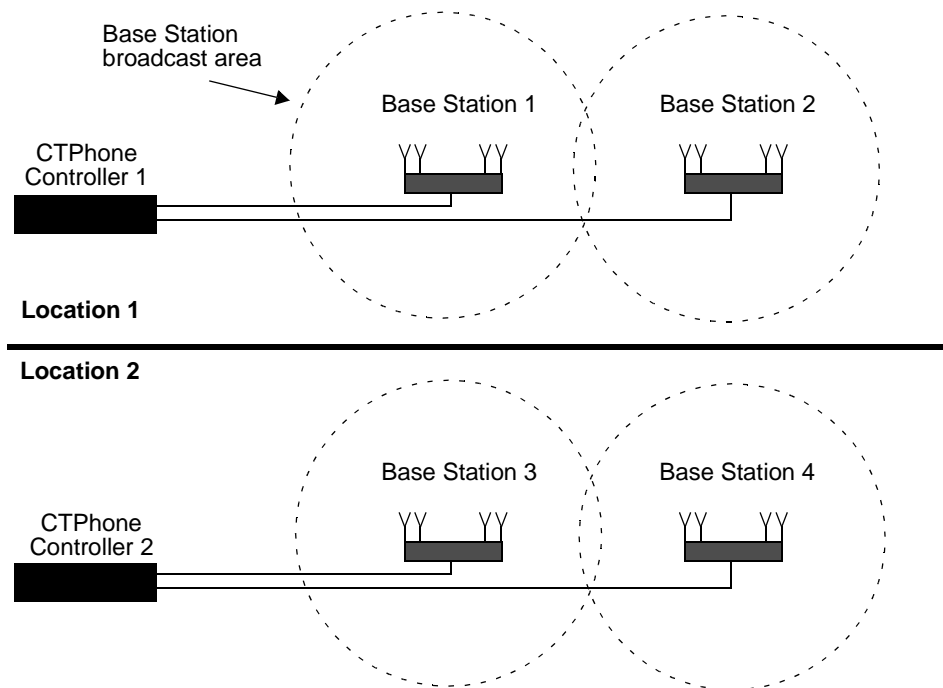
Figure 2-2. Multiple Systems

Multiple Systems Configured as a Single System

Figure 2-3 illustrates two CTPhone Controllers connected to the same 32 analog lines. The purpose of this configuration is to create a system with greater coverage area.

In this configuration, CTPhone handsets must be programmed with both system IDs. (For information on system IDs, see Table 4-D on page 4-10.) Users can place and receive calls in any cell, although handoff does not operate between base stations connected to different CTPhone Controllers.

Coverage: 31,000 square meters (333,560 square feet) per base station

Maximum Number of Configured Users: 32
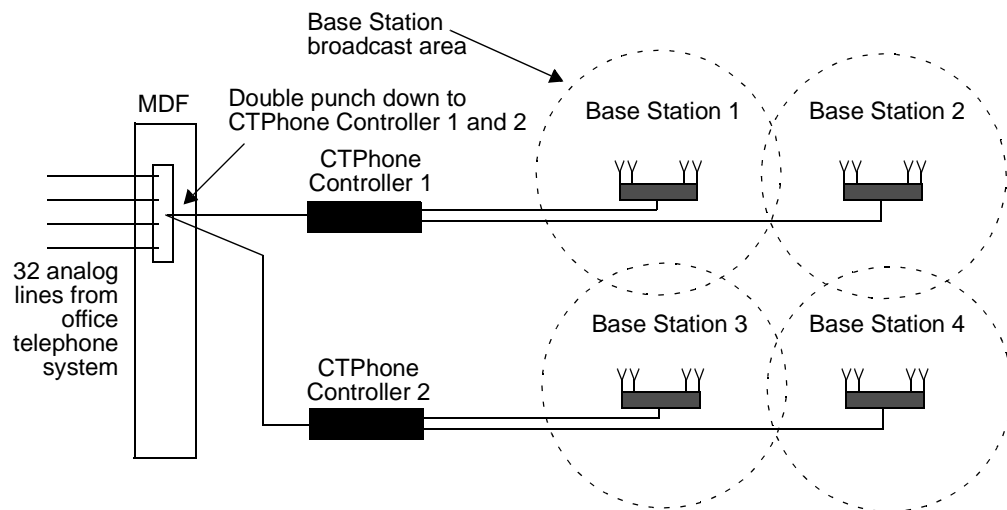
Figure 2-3. Double Punch Down to Two Controllers for Increased Roaming Coverage Area

Multiple Overlapping Systems

Figure 2-4 illustrates multiple overlapping systems. The reason for using this configuration is to create a system with greater user capacity. Up to four systems can be configured in this way.

In this configuration, CTPhone handsets must be programmed with both system IDs. (For information on system IDs, see Table 4-D on page 4-10.) Handoff does not operate between base stations connected to different CTPhone Controllers.

Coverage: 31,000 square meters (333,560 square feet) per base station

Maximum Number of Configured Users: 64
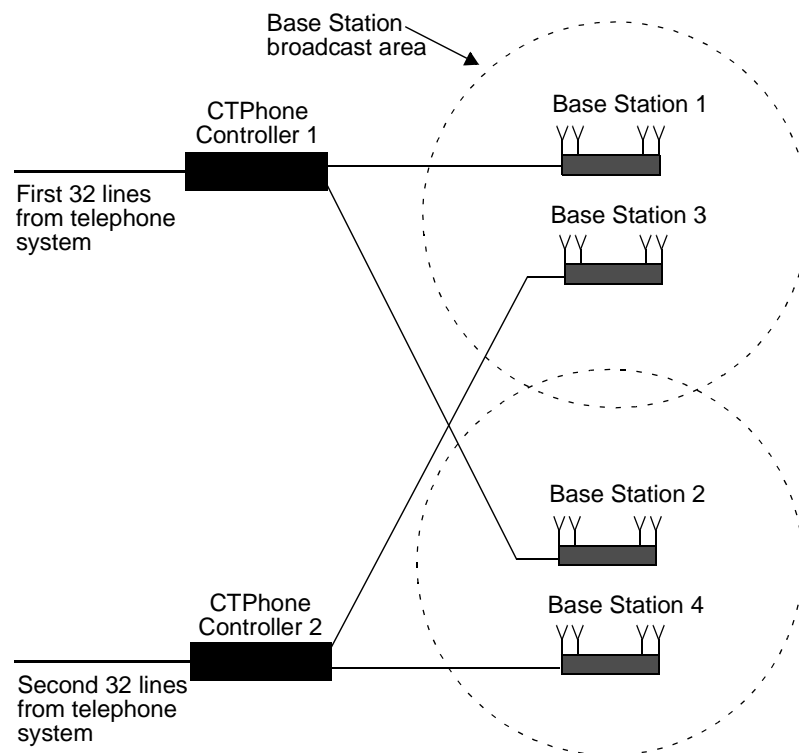
**Figure 2-4. Overlapping Systems to Increase Number of Handset Users**

Pre-installation Tasks

Several factors affect the quality of service for a CTPhone 1900 system:

- location of base stations

- number of CTPhone handset users within base station range

- obstructions between base stations and CTPhone handsets

- coverage area

- the desired grade of service and quality of coverage

The purpose of this section is to provide you with information and explain tasks that you should complete to ensure the best operation of your system.

Site Survey

1   Obtain building blueprints.

2   Note the construction materials used in walls (including insulation) and floors between multi-story buildings, and note window coatings and coverings. Also note any large metal objects, such as equipment, doors, and fluorescent lamp shades.

    In general, signals are attenuated to some degree when they have to pass through any barrier, however, some materials such as metal, attenuate to a much greater degree.

3   Note high traffic areas, such as conference rooms, cafeterias, and manufacturing floors.

4   Note office locations and numbers of CTPhone handset users within the site.

Determining Base Station Requirements

To determine the number of base stations you need in a system, you must consider base station broadcast range and your traffic requirements.

Base Station Broadcast Range

In a typical office environment, each base station has a broadcast range of 100 meters (328 feet) and supports an area of 31,000 square meters. The range may increase to a maximum of 1000 meters (3280 feet) outdoors.

Typical office environment
100 meters (328 feet)
31,000 square meters

Base Station

Outdoors environment
1000 meters (3280 feet)
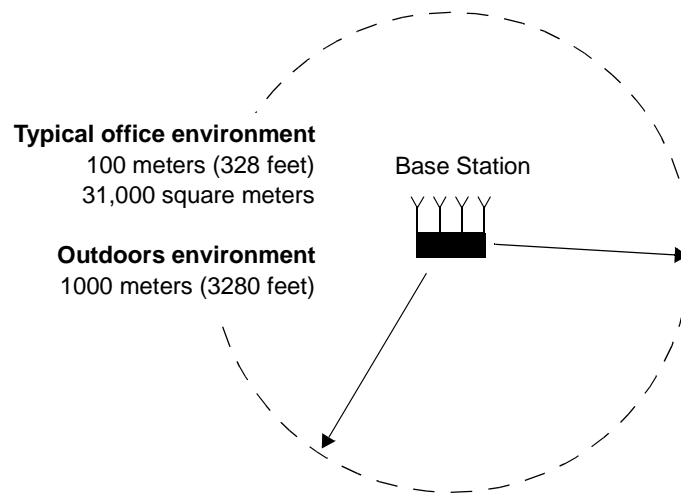
Figure 2-5. Base Station Broadcast Range

Traffic Guidelines

Each eight-channel base station supports eight simultaneous conversations (each "Mini" base station supports four simultaneous conversations), but because all users are not in constant conversation, a base station can support a greater number of CTPhone handset users.

For example, two base stations (BS1 and BS2) are required to support 32 CTPhone handset users in the factory area in the site illustrated in Figure 2-6.

320'

168'

concrete

concrete

BS1 BS2

manufacturing floor
(32 CTPhone
handset users)
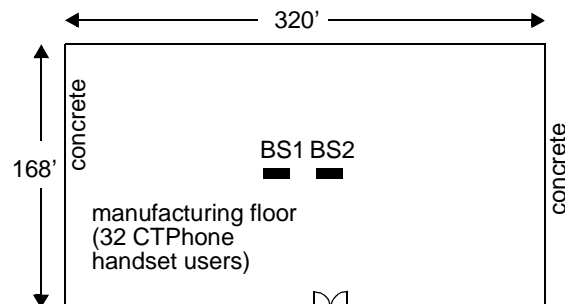
Figure 2-6. Using Multiple Base Stations to Handle Traffic Requirements

You can use Table 2-A to help you determine how many base stations you need to accommodate various numbers of users at several different traffic levels. The table assumes users have access to all base stations in a high traffic environment as seen in Figure 2-6.

Table 2-A. Base Station Traffic Requirements[1]

Erlangs[2] Per User	Number of Users	Total Erlangs	Equivalent CCS[3]	Required Channels	Base Stations Required	"Mini" Base Stations Required
.1	10	1	36	5	1	2
	20	2	72	6	1	2
	30	3	108	8	1	2
	32	3.2	115.20	8	1	2
.15	10	1.5	54	6	1	2
	20	3	108	8	1	2
	32[4]	4.8	172	11	2	3
.2	10	2	72	6	1	2
	16	3.2	115.20	8	1	2
	32[4]	6.4	230.4	13	2	4

[1] This table assumes a P.01 grade of service (one call blocked out of 100 attempts).

[2] Typical usage assumes .1, .15, and .2 Erlangs (6 minutes, 9 minutes, and 12 minutes, respectively) per line during the busiest hour of the day.

[3] CCS stands for centi-call seconds, or 100 seconds of phone conversation.

[4] Assuming base stations are co-located.

Determining Base Station Placement

Once you have completed the steps described in *Site Survey* on page 2-6 and determined the number of base stations you need, you should determine where to install the base stations for optimum coverage and operation of the CTPhone 1900 system. This section provides guidelines and examples you can use to determine base station placement in your site.

General Guidelines

1 In open, symmetrical areas, mount base stations in a centralized location on the ceiling, and rotate the antennas perpendicular to the ceiling. You can mount a base station above a dropped ceiling as long as the dropped ceiling is not metallic.

2 In corridors or non-symmetrical areas, mount base stations on walls and facing towards the area you want to provide the greatest coverage. You should mount them mid-way between the floor and permanent ceiling, but above any obstructions such as cubicle walls. Antennas on wall-mounted base stations must be rotated parallel to the wall.

3 Place base stations to maximize direct line of sight between handsets and base station antennas. Signals should begin their path with a clear line of sight to reduce the affect of signal fading.

4 Do not place base stations on or near metallic objects or on walls that have metallic content such as metal girders or foil-backed insulation.

5 Do not place base stations near large obstructions. For example, do not mount them near doors that could temporarily obstruct antennas when the doors open.

6 Overlap coverage of base stations by approximately 25%.

7 To minimize blocking in high traffic areas, install the number of base stations required to meet the estimated traffic demand (see *Traffic Guidelines* on page 2-7.) When multiple base stations are needed in the same location, you may mount base stations as close as one meter apart.

   The base stations are designed to automatically use frequencies that are not already in use, so there is no problem of interference between base stations that are mounted near each other.

8 In multi-story environments, plan coverage for each floor separately. However, because RF signals can travel between floors, a single base station could support multiple floors as long as base station broadcast area, traffic requirements, and other general guidelines are followed.

Radio Frequency Radiation Characteristics

The following discussion covers some basic considerations regarding the behavior of radio frequency energy as it affects planning for your CTPhone Wireless System layout.

CTPhone Base Station Radiation Pattern

The CTPhone Base Station uses an *omnidirectional* antenna system. Radio frequency (RF) energy *radiates*, or *propragates*, equally in all directions on a horizontal plane. RF energy behaves like a pebble tossed into water. When a pebbles hits the water, ripples move outward across the water's surface in concentric circles on a horizontal plane (Figure 2-7).

Top View
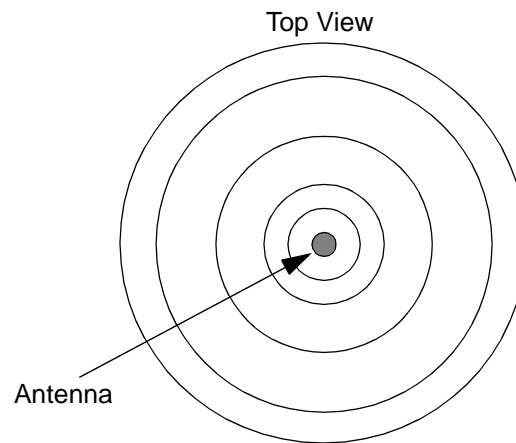
Antenna

Figure 2-7. Omnidirectional Radiation Pattern

Antenna Polarization

CTPhone Base Stations use vertically polarized antennas. That means the four retractable antennas should maintain vertical orientation relative to the earth's horizon. For example, antennas should be fully extended at a 90° angle in relation to the base station when the unit is ceiling mounted.

For best results, position receiver and transmitter antennas so they have the same polarization (Figure 2-8).

YES

Antennas

NO
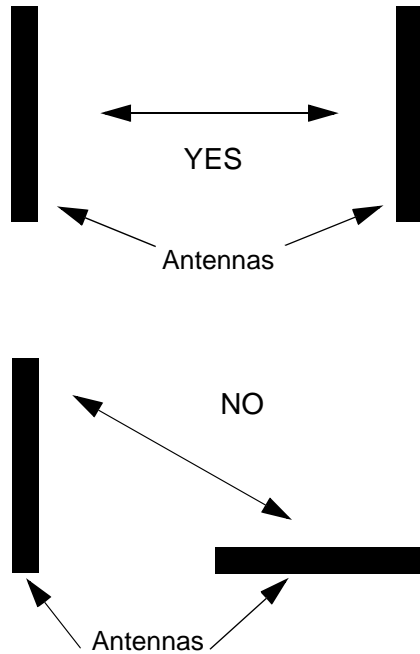
Antennas

Figure 2-8. Antenna Polarization

Multipath Effect

All metallic materials reflect RF energy, creating conditions for *multipath interference*. RF energy reflects at a 180° angle from the arriving wave. This creates a condition where reflected signal waves arrive from many directions at many different angles, which disperses the original signal

wave and may cause fading (See *Fading* on page 2-14) of the intended signal (Figure 2-9).

Arriving Wave

Reflected Wave

Arriving Angle

Reflected Angle
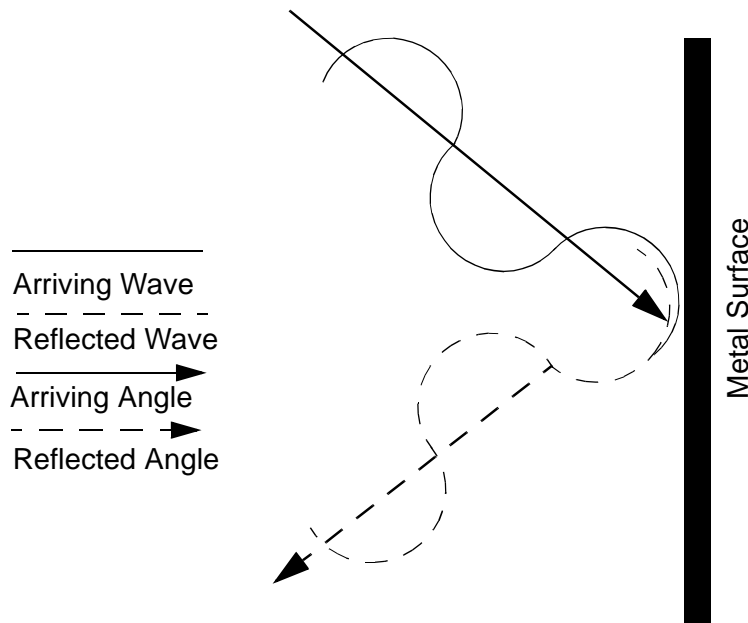
Metal Surface

Figure 2-9. Reflection of Radio Frequency

Multipath is the condition when two or more signals from the same origin arrive at a receiving antenna out of phase with one another. Radio wave reflections off of metallic surfaces and users' mobility create conditions for multipath propagation.

To avoid multipath interference...

Attenuation

When determining base station placement, you must consider the effects of attenuation. Attenuation is the loss of strength of an RF signal due to distance, antenna positioning, and obstructions. The guidelines provided in *Determining Base Station Placement* on page 2-9 take attenuation into account, but this section provides additional important concepts.

The magnitude of change in signal strength is measured in decibels (dB). Increases or reductions of 3 dB result in doubling or halving signal power strength.

You should try to limit total loss (accumulated by range and obstructions) to 100 dB.

Distance

Figure 2-10 illustrates the signal attenuation caused by distance in direct line of sight conditions.

| Power: -30 dBm | -50 dBm | -62 dBm | -78 dBm | -90 dBm |
| Loss: 40 dB | 60 dB | 72 dB | 88 dB | 100 dB |

| 1 meter | 10 meters | 20 meters | 50 meters | 100 meters |
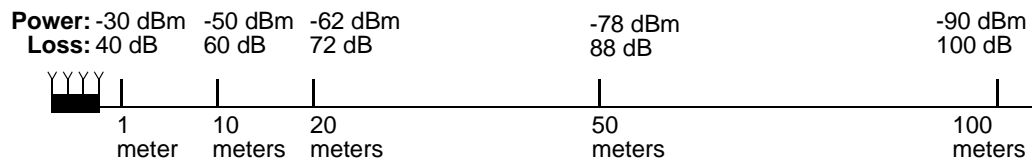
Figure 2-10. Signal Attenuation Caused by Range

Obstructions

RF signals are also attenuated by obstructions in their path. Table 2-B illustrates attenuation caused by common materials in a building.

Table 2-B. Signal Attenuation Caused by Building Materials

Object	Approximate Loss in dB
Concrete	20
with metal siding	30
Brick	15
Plaster	10
Walls with windows	10
with metal coating	20
Venetian blinds	
open	10
closed	20
Soft partitioning	3 to 4

Although signals can travel through obstacles, you should place base stations so that signals begin their travel with a clear line of sight and travel through obstacles afterwards. In the example shown in Figure 2-11, the base station is placed to maximize line of sight and oriented to provide greater coverage down the horizontal corridor.
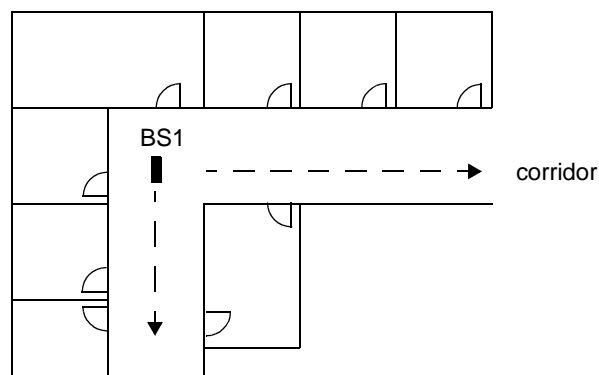
Figure 2-11. Maximizing Line of Sight

Fading

Fading refers to the attenuation caused when a signal is reflected and a receiving antenna receives multiple instances of the signal.

CTPhone base stations are designed with multiple antennas and the capacity to choose the antenna best suited for carrying the strongest signal. This design minimize chances of fading.

You should place base stations so that signals begin their travel with a clear line of sight as illustrated in Figure 2-11. This limits the effect of signal fading.

Examples

Example 1 — Centralizing Base Stations

Figure 2-12 illustrates a site with factory and adjoining office area. Both base stations are placed in the manufacturing area to accommodate the greater number of users in that area. However, base station BS2 is placed closer to the office area to provide coverage in the office area and maximize line of sight through the doorway. This is especially important if the wall between the office and manufacturing areas is concrete.

To satisfy guidelines 1 and 2, the base stations are mounted on the ceilings and away from any potential obstructions to the antennas.

If there was another area to the left of the manufacturing area, moving the base station BS1 to the left would probably allow support for users in that area as well. If the manufacturing area does not obstruct base station antennas, their broadcast range will be greater.
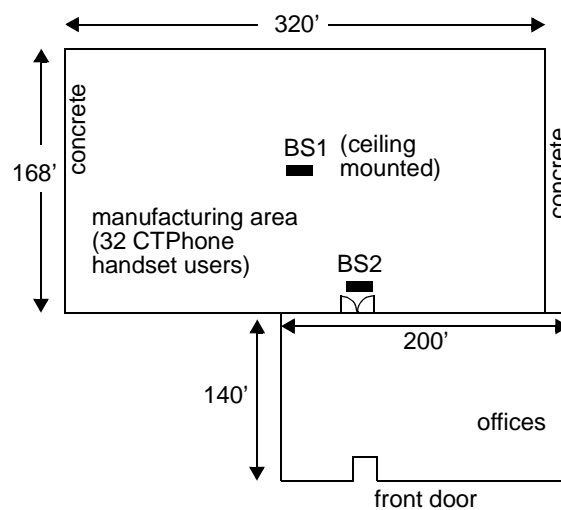
Figure 2-12. Centralized Base Station Placement

Example 2 — Base Station Coverage in Adjoining Areas

Corridors can act as natural pathways for RF signals. When you are trying to cover two types of areas, placing a base station near a corridor may optimize coverage in both areas.

In the site shown in Figure 2-13, the entrance from the manufacturing area into the cafeteria is a high traffic area. Placing a base station in the entry area of the cafeteria will block line of sight to other areas in the cafeteria. Therefore, BS2 is centrally located in the cafeteria area. BS1 is centrally located in the manufacturing floor area, but aligned with the entrance into the cafeteria to provide coverage into the cafeteria.
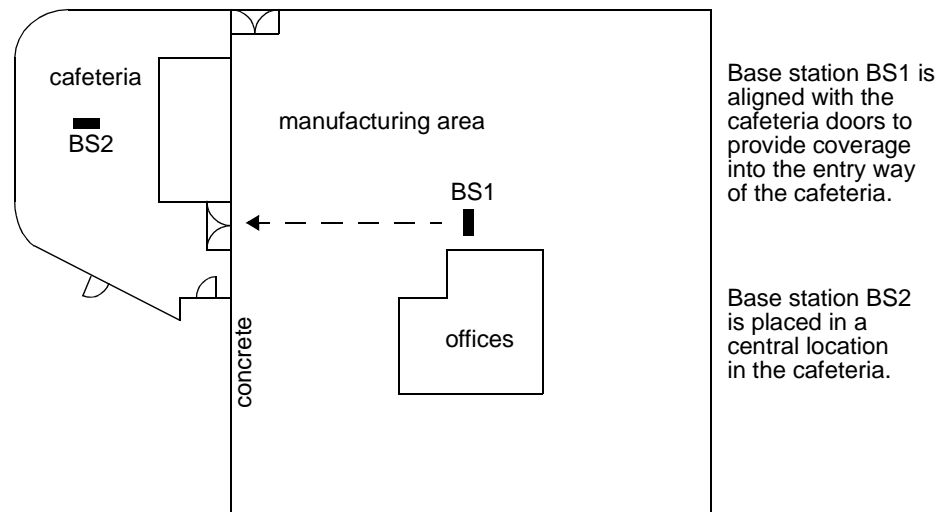
Figure 2-13. Base Station Aligned with Corridor to Adjoining Area

Example 3 — Maximizing Line of Site

Figure 2-14 illustrates an office area containing walled offices, cubicles, and conference rooms. Although the number of base stations in this environment would depend on the number of CTPhone handset users, the base stations in the example are aligned with corridors to maximize line of sight. Instead of placing both base stations close to each other, BS1 is placed near the conference rooms and entrance area to accommodate greater potential traffic in these areas.
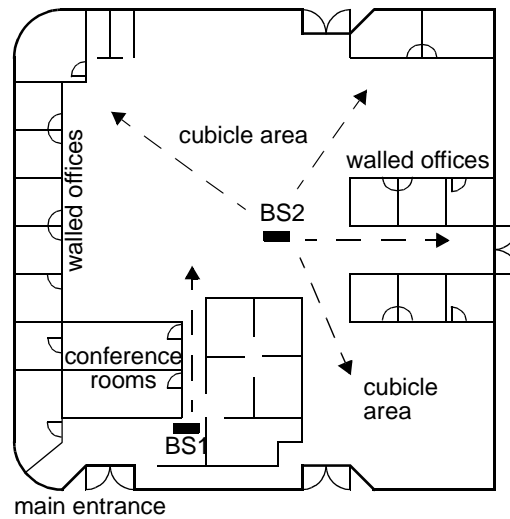
Figure 2-14. Base Station Placement in Office Environment

Base Station Wall Mounting Vs. Ceiling Mounting

Base Station Radiation Pattern (Wall Mounting)

When the base station is mounted vertically on the wall, the radiation pattern is approximately a 2 to 1 (2:1) forward to back ratio. This is due to the absorptive effects of the wall on the signal and the orientation on th the flat antenna shape aimed diagonally off of the corners (Figure 2-15).
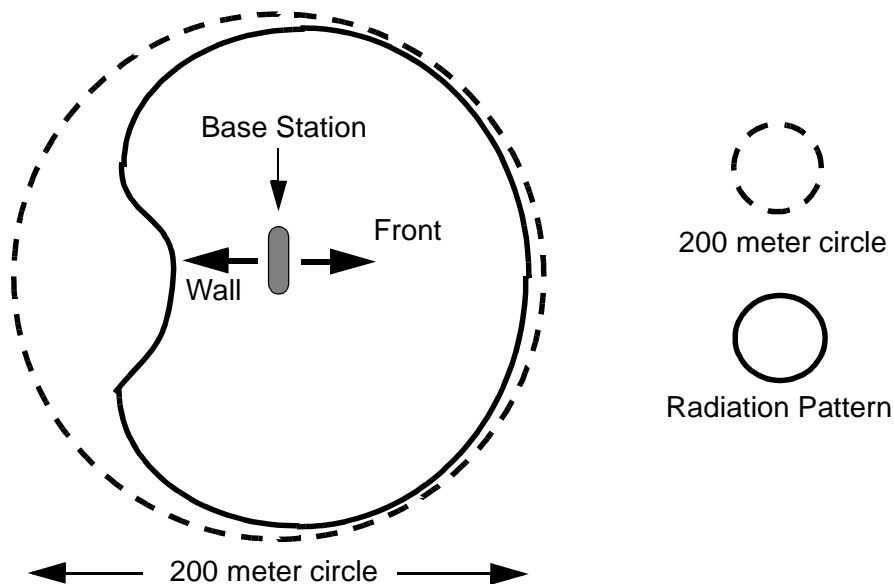
Figure 2-15. Base Station Wall Mounting Radiation Pattern

Base Station Radiation Pattern (Ceiling Mounting)

When the base station is mounted horizontally on the ceiling with the antennas extended at a 90° angle, it radiates in a true omnidirectional pattern or circle. Ceiling mounting is best for optimum performance (Figure 2-16).
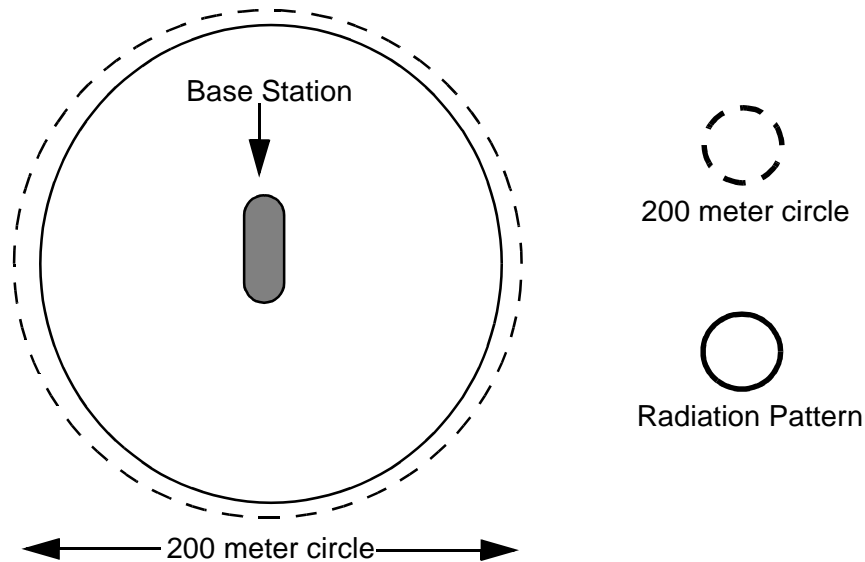
Figure 2-16. Base Station Ceiling Mounting Radiation Pattern

Base Station Elevation Angle

The vertical height the base station radiates is determined by the materials used for floor and ceiling, but can be represented by oval shaped lobes.

Note The total vertical height of approximately 260 feet (open space only with not obstructions;Figure 2-17).
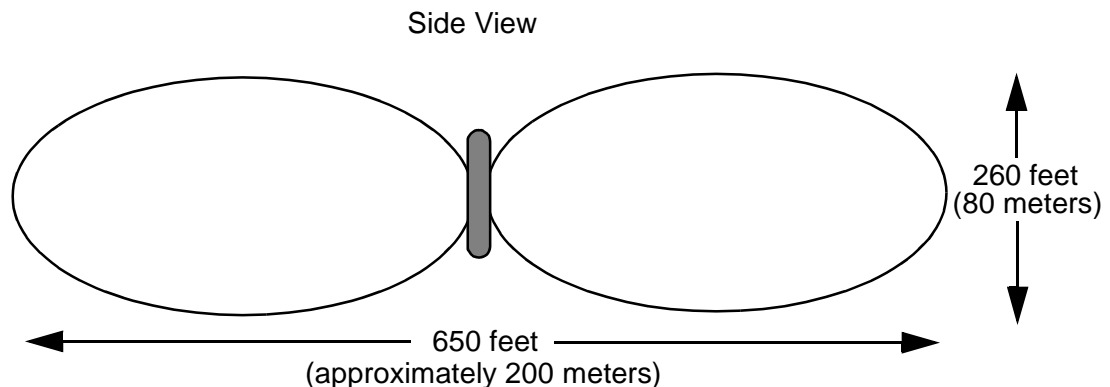
Figure 2-17. Base Station Elevation Angle: Wall & Ceiling Mounting

Stand-Alone (Test) Base Station

After considering your site layout, possible obstructions (walls, doors, large metal objects), traffic patterns, and number of handset users, you will have a good idea of where you need to mount your base stations for optimum coverage at your site. Before you permanently mount your base stations, it is recommended that you test the proposed base station locations with a stand alone base station used as follows:

Stand-Alone Base Station Operating Instructions

Required Equipment:

1 CTPhone Stand-Alone (Test) Base Station

2 CTPhone Base Station power supply with cord

3 One or more CTPhone handsets with fully charged batteries

4 Floor plan of the facility that you are surveying

✛ *Stand-Alone Base Station Set-Up*

Step	Procedure
1	Determine the best location for a base station using the guidelines described in this chapter.
2	Temporarily mount the Stand-Alone Base Station as closely as possible to the selected base station location with appropriate vertical and horizontal orientation.

Note When mounting horizontally, rotate all four antennas to a 90° angle.

Step	Procedure
3	Plug the base station power supply into the +5 VDC connector on the bottom of the Stand-Alone Base Station and into a 110 VAC outlet.
4	Observe the LEDs on front of the Stand-Alone Base Station until all red LEDs are off and only the green LED is on.

✛ *Handset Set-Up*

Step	Procedure
1	Make sure that your handsets are fully charged.
2	Press (PWR) to turn on the handset

✚ *Handset Set-Up (continued)*

3   Enter **10** and then press **FCN** to access the system configuration. The LED displays *SYSTEM CONFIG*.

4   Press **FCN** again. The LED displays *SID #0.*

5   Enter **7171.**

6   Press ▼ (located to the right of **ABC**). The LCD displays *HID #0.*

7   Enter **1.**

8   Press **END**. The handset returns to idle.

9   Repeat steps 2-8 of the Handset Set-up procedure, substituting a different number for the *HID #* (for example, choose 2, 3, 4, 5, etc.) in Step 7, for each additional handset.

✚ *Audio Coverage Test:*

Step   **Procedure**

1   Press **PWR** to turn on the handset.

2   Press **CALL**.

3   Listen for a continuous tone in the handset speaker while walking around the facility observing the coverage area boundaries.

        Mark the floor plan where:
- the continuous tone warbles (indicating the beginning of a hand-off overlap area).
- the continuous tone breaks or stops (indicating the end of the coverage area).

4   Press **END** to return the handset to the idle state.

✚ *Handset Bit Error Rate (BER) Test:*

Note   This is an optional test. Refer to *Bit Error Rate (BER) Testing* on page 5-14 for additional information.

Step   **Procedure**

1   With the handset in the idle state, enter **## ****

✛   *Handset Bit Error Rate (BER) Test: (continued)*

2   Observe the handset display while walking around the facility observing coverage area boundaries.

Mark floor plan where:
- the LCD display permanently changes from **MAX** to **GOOD** (indicating the beginning of the handoff overlap area).
- the LCD display permanently changes from **GOOD** to **POOR** (indicating the end of the coverage area).

3   Press ⬭**END** . The handset returns to the idle state.

3

CTPhone 1900 System Hardware & Software Installation

This chapter explains how to install and configure your CTPhone 1900 system. It covers the following topics:

- how to install and cable the hardware components (base stations and CTPhone Controller) of the CTPhone 1900 system (page 3-2)

- how to install CTPhone Manager software on a personal computer (page 3-19)

- how to install CTPhone software on the CTPhone Controller (page 3-22)

- how to activate the CTPhone 1900 system (page 3-24)

- how to perform software upgrades (page 3-26)

Before installing your system, you should design your system using the information provided in the *CTPhone 1900 System Planning* chapter.

Hardware Installation

Equipment Check List

CTP Systems-provided Equipment

- CTPhone Controller

- CTPhone Controller personal computer cable (P/N CBL30004) with DB9 adapter (P/N PST20043) or DB25 adapter (P/N PST20042)

- CTPhone Manager software

- optional power supply for CTPhone Controller [P/N PSY30104, also requires a power cord (P/N CBL30001)] (if AC powered; see *CTPhone Controller Input Power* on page 3-13 for specifications)

- optional power supply for locally powered base stations [P/N PSY30102, also requires a power cord (P/N CBL30001)] (see page 3-9 for specifications)

- CTPhone base stations, handsets, and chargers

Customer-provided Equipment

CTPhone Controller

- DC power cord (if DC powered from office telephone system; see *CTPhone Controller Input Power* on page 3-13 for specifications)

- personal computer for CTPhone Manager software (see Table 3-F on page 3-19 for hardware and software requirements)

- two 25-pair shielded (with tinned copper braid) 24-gauge telephone cables (Champlain® Cable Corp. 150005 or equivalent) and two 50-position metal hoods (similar to Amphenol #157-72500-3) for CTPhone Controller connection to MDF

- grounding wire (for gauge requirements, see Table 3-D on page 3-15)

- optional external alarm (see Figure 3-2 on page 3-7 for specifications)

Base Station

- base station cable (see requirements in Table 3-C on page 3-6)

Recommended Installation Order

Following is the recommended order for installing your CTPhone 1900 system.

Table 3-A. Installation Order

	Task	Instructions
1	Install system cabling.	page 3-4
2	Complete base station installation.	page 3-8
3	Complete physical installation and grounding of the CTPhone Controller. Do not connect the CTPhone Controller to power at this point.	page 3-13
4	Connect a personal computer to the CTPhone Controller.	page 3-17
5	Install CTPhone Manager software on the personal computer.	page 3-21
6	Copy CTPhone software onto the personal computer. You must copy the software to the SOFT-WARE subdirectory underneath the CTPhone Manager directory.	page 3-22
7	Start the CTPhone Manager and open the Status Window.	page 3-22
8	Connect the power cable to the CTPhone Controller. Then connect the cable to power. (You'll see warning messages in the status window; this is normal.)	page 3-13
9	Using the CTPhone Manager, perform a software upgrade to upload the CTPhone software from the personal computer to CTPhone Controller.	page 3-23
10	Perform UTAM activation (if required).	page 3-24
11	Configure System Settings.	page 3-24
12	Repeat the software upgrade process to complete loading software from the personal computer to the base stations.	page 3-25
13	Check CTPhone Controller LEDs to make sure they do not indicate any failures. Note that dim or flashing LEDs may indicate a problem. If LED S2 on the CTPhone Controller remains lit after powering the CTPhone Controller trying reloading software using the instructions on page 3-25.	page 5-9
14	Check base station LEDs to make sure they do not indicate a failure. Note that dim or flashing LEDs may indicate a problem.	page 5-11
15	If the LEDs indicate a problem, use troubleshooting procedures to determine the problem.	page 5-2

CTPhone 1900 System Cabling

Figure 3-1 presents an overview of CTPhone 1900 system cabling. The CTPhone Controller has two 25-pair connectors that connect to analog lines and base stations. Punching down two sets at each connector block allows users to have both CTPhone and wired extensions.

Note To meet UL1459 regulations in the United States, there are special installation requirements which are explained in Appendix A.
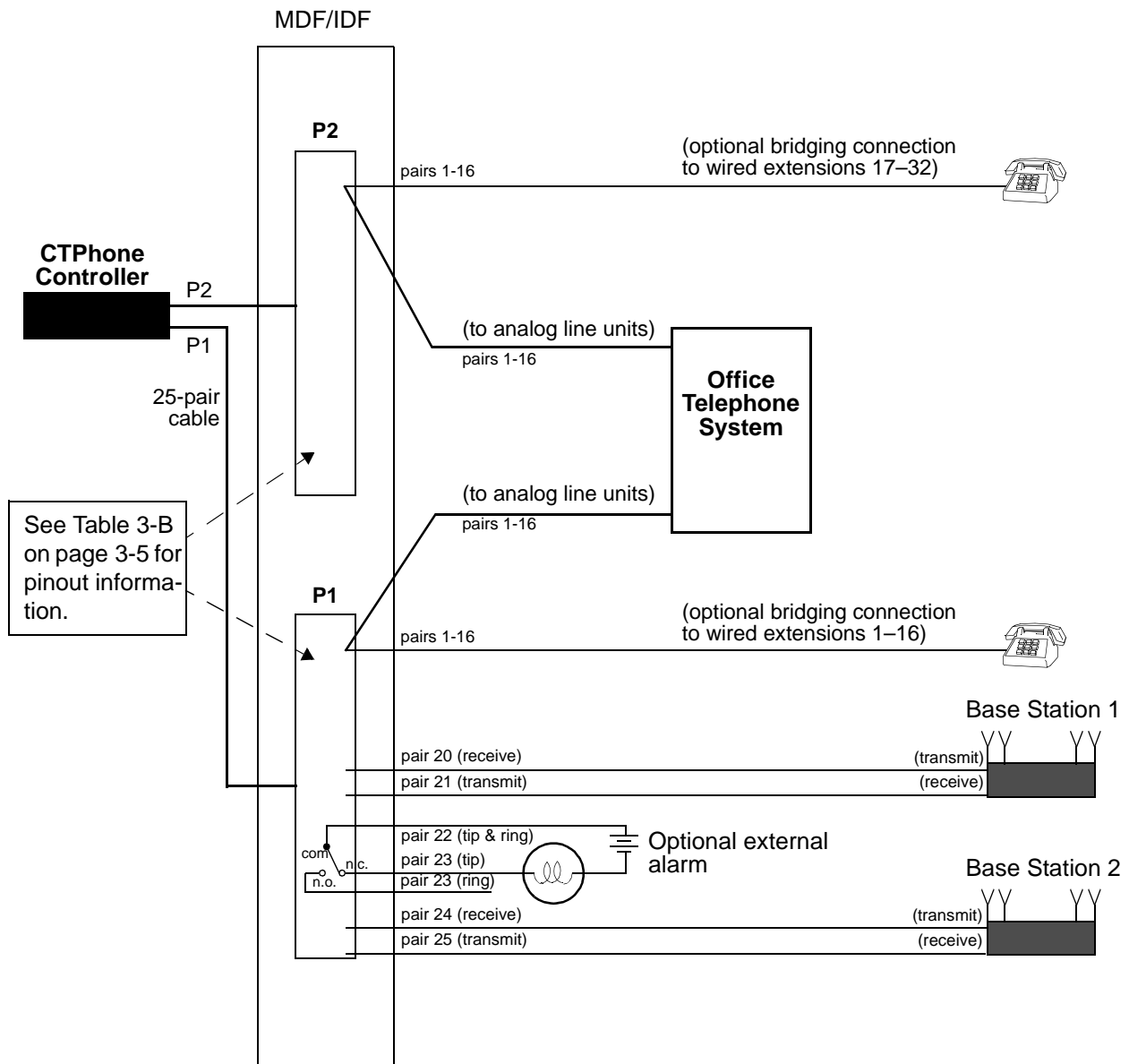
Figure 3-1. Overview of CTPhone 1900 System Cabling

CTPhone Controller Connections

Table 3-B describes how the CTPhone Controller connects to other elements of the system.

⚠️

Cautions

- Bridge taps are not allowed between the CTPhone Controller and base stations.

- Current limiting (fuse style) primary protectors must not be used for current protection on the transmit and receive pairs between the CTPhone Controller and base stations. (Recommended primary protectors are listed in Appendix A.)

Table 3-B. CTPhone Controller Pinouts

Pair	P1	P2
1	Tip, ring — station 1	Tip, ring — station 17
2	Tip, ring — station 2	Tip, ring — station 18
3	Tip, ring — station 3	Tip, ring — station 19
4	Tip, ring — station 4	Tip, ring — station 20
5	Tip, ring — station 5	Tip, ring — station 21
6	Tip, ring — station 6	Tip, ring — station 22
7	Tip, ring — station 7	Tip, ring — station 23
8	Tip, ring — station 8	Tip, ring — station 24
9	Tip, ring — station 9	Tip, ring — station 25
10	Tip, ring — station 10	Tip, ring — station 26
11	Tip, ring — station 11	Tip, ring — station 27
12	Tip, ring — station 12	Tip, ring — station 28
13	Tip, ring — station 13	Tip, ring — station 29
14	Tip, ring — station 14	Tip, ring — station 30
15	Tip, ring — station 15	Tip, ring — station 31
16	Tip, ring — station 16	Tip, ring — station 32
20	Receive from base station 1	
21	Transmit to base station 1	
22	Tip, ring — external alarm connection	
23	Tip, ring — external alarm connection	
24	Receive from base station 2	
25	Transmit to base station 2	

Cable Requirements

Table 3-C shows cable requirements and distance limitations for base stations based on line and local power.

Table 3-C. Cable Requirements and Distance Limits

Cable Requirement (AWG)[1]	Base Station Distance from CTPhone Controller	
	Line Power	Local Power
24	244 meters (800 feet)	838 meters (2750 feet)
22	381 meters (1250 feet)	1000 meters (3280 feet)

[1]   Category 3 or higher is recommended. Using a mix of categories 2, 3, 4, or 5 is okay.

The following procedure assumes you have determined the locations where you will mount base stations:

✛ Cabling the CTPhone Controller

Step	Procedure
1	Based on the size of your system, connect 8 or 16 pairs from the telephone system analog line unit(s) to a connecting block labeled P1 on the MDF. Pairs are shown in Table 3-B.
2	If your system has more than 16 CTPhone extensions, connect another 8 or 16 pairs from the telephone system analog line unit(s) to another connecting block labeled P2 on the MDF. Pairs are shown in Table 3-B.
3	Punch down a second pair on the connecting blocks for users that will have both wired phone and CTPhone handset and connect them to analog line sets.
4	Connect cables to pair 20 (receive) and pair 21 (transmit) on connecting block P1. Run the cables to the first base station and attach RJ11 connectors to them.
	See Table 3-C on page 3-6 for cable requirements. Note that bridge taps are not allowed between the CTPhone Controller and base stations.
5	Connect cables to pair 24 (receive) and pair 25 (transmit) on connecting block P1. Run the cables to the second base station and attach RJ11 connectors to them. See Table 3-C on page 3-6 for cable requirements.

✛ Cabling the CTPhone Controller

6   If you want critical alarms registered by the CTPhone Controller to activate an external alarm, connect pair 22 on connecting block P1 to one input on the external alarm device. Then connect tip (normally closed) or ring (normally open) of pair 23 on connecting block P1 to the other input of the alarm device, depending on how you want the device to operate.

Lamp or Buzzer

Maximum switched power 60W
0.5A, 125 VAC resistive
1.0A, 48 VDC resistive

Pair 22 – relay common
Pair 23, tip – normally closed contact
Pair 23, ring – normally open contact
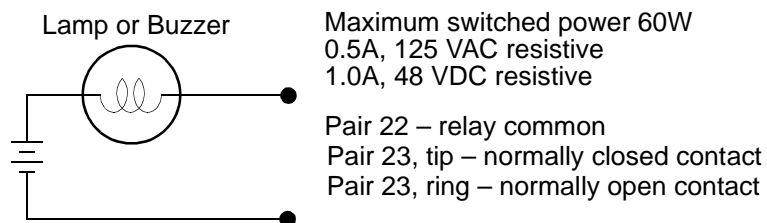
Figure 3-2. Optional External Alarm

7   Connect one end of each 25-pair shielded 24-gauge cable to a 50-position metal hood. Ensure that the shield of the 25-pair cable is grounded to the metal hood.

8   Connect one of the 25-pair cables to connector P1 (Figure 3-3) on the CTPhone Controller. Punch down the cable on connecting block P1 on the MDF.

power cord strain relief

J1   GND ●   J3 J2   P2   P1

-48 VDC
input

not
used

RJ45
(admin port)

25-pair female connectors
(to analog lines and base stations)
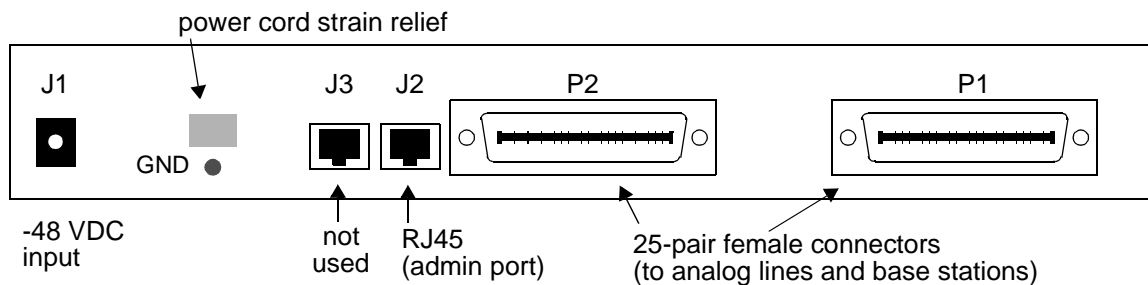
Figure 3-3. CTPhone Controller (Rear View)

9   Connect the other 25-pair cable to connector P2 (Figure 3-3) on the CTPhone Controller. Punch down the cable on connecting block P2 on the MDF.

10   For instructions on connecting transmit and receive cables installed in steps 4 and 5 to base stations, see See *Mounting Base Stations* on page 3-8.

Base Station Installation

Before mounting base stations permanently, you should determine locations that provide the best coverage. Base station placement guidelines are provided in *Determining Base Station Placement* on page 2-9.

Mounting Base Stations

✛ Mounting Base Stations

Step   Procedure

1   Rotate base station antennas to expose mounting tabs as illustrated in Figure 3-4.

rotated antenna

mounting tabs

mounting tab (enlarged view)
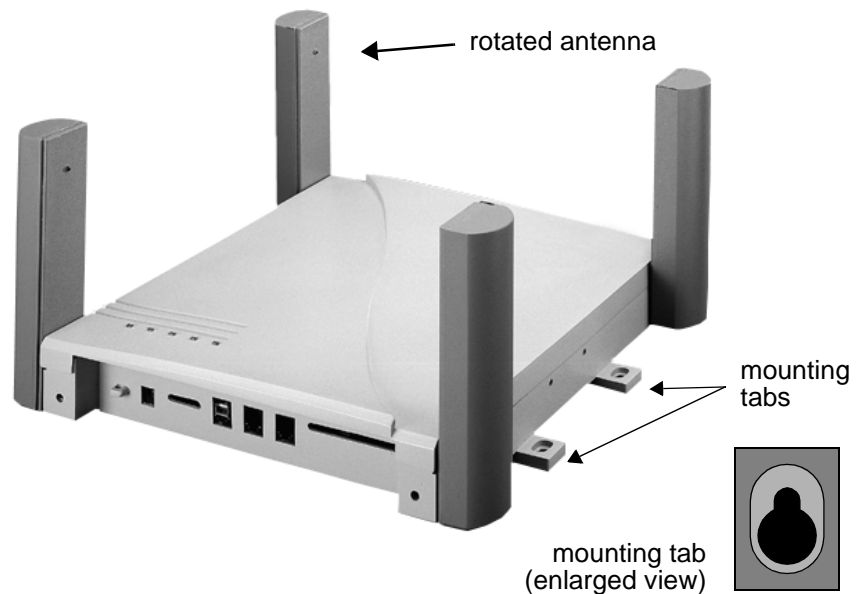
Figure 3-4. Base Station with Exposed Mounting Tab

2   Drill four holes in a fixed wall or ceiling. To properly position the holes, you can measure the tabs on the base station or mark the surface through the tab eyelets while holding the base station in place.

> **Note** Do **not** mount base stations on movable surfaces such as acoustic drop ceilings.

3   Insert anchors into the drilled holes. Then insert #8 screws in the anchors, leaving a gap between the wall and screw head.

4   Mount the base station eyelets on the screws.

✛   *Mounting Base Stations*

5   On wall-mounted the base stations only, rotate antennas parallel to the body of the base station. (Antennas on ceiling-mounted base stations should remain rotated perpendicular to the base station.)

6   Connect the transmit cable (pair 21 or 25) to the base station's receive jack (see Figure 3-5).

7   Connect the receive cable (pair 20 or 24) to the base station's transmit jack (see Figure 3-5).
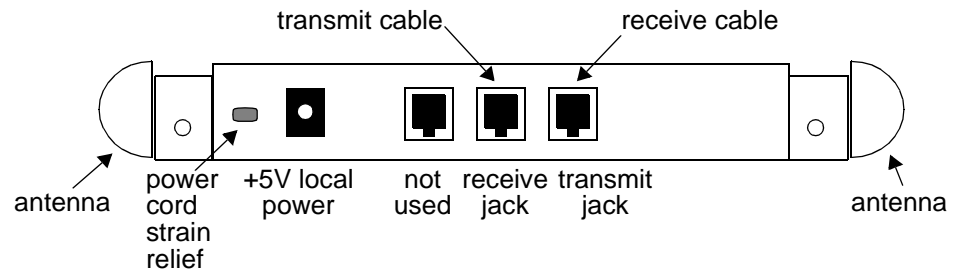
Figure 3-5. Base Station Connections

Base Station Input Power

The base station may receive input (line) power from the CTPhone Controller or from an optional local power supply. Using a power supply increases the distance base stations may be located from the CTPhone Controller.

CTP Systems provides an optional universal 115/230 V, 50/60 Hz power supply with barrel jack connection to the base station [P/N PSY30102, also requires a power cord (P/N CBL30001)]. The specifications for the connection are shown in Figure 3-6.
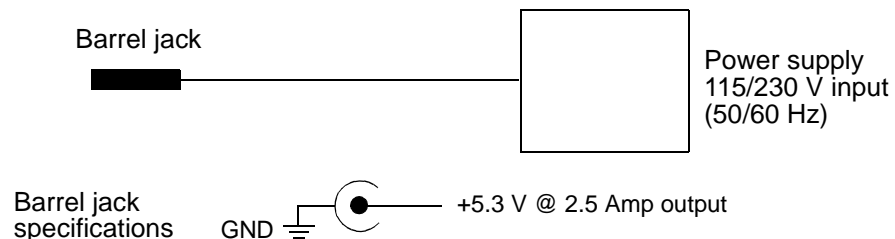
Figure 3-6. Base Station Local Power Supply Specifications

Base Station Indicators

For information on Base Station LEDs, see the *Diagnostics and Trouble-shooting* chapter.

"Mini" Base Station Installation

WARNING:

- Do not remove the blank RJ-45 connector.

- Do not install any other connector instead.

- Do not open the plastic case

+ *"Mini" Base Station Installation*

Step	Procedure
1	Assemble an E1 cable with the following description: **Cable type:** 4 wire, (24-26 AWG) **Number of sides:** 2 • Side one - "Mini" base station: One RJ-11 connector • Side two - PBX: Use same configuration as before, but use only one cable
2	Connect side one connectors to the "Mini" base station.
3	Connect side two connectors to the PBX exits.
4	Confirm that all red LEDs are **off** and that the green LED is **on.**
5	If the "Mini" base station is not operating, try switching connectors on the PBX side.

"Mini" Base Station (MBS)

Wiring Table:

RJ11 (MBS)	PBX
1 Ring 1	RX - 1
2 Tip 1	RX - 2
3 No Connection	
4 No Connection	
5 Ring 2	TX - 1
6 Tip 2	TX - 2

Figure 3-7. "Mini" Base Station Wiring Diagram

Fifth Antenna Installation

A professional installer, trained and endorsed by the Manufacturer, must install the fifth antenna using an SMA connector and RG 58 cable. Use no more than 100 feet (30 meters) of cable for best performance [this should cover a 20 x 20 foot (6 x 6 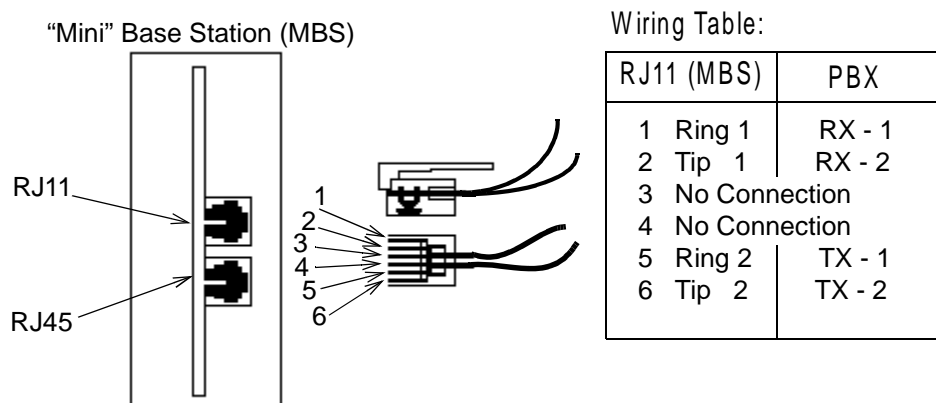meter) space]. If you need to replace the fifth antenna, it must be professionally installed using a replacement of the same type with a gain not to exceed 3dBi, including the cable.

Outdoor Base Station Installation

TEXT TO BE ADDED.

Replacing a Base Station

+ Replacing a Base Station

Step	Procedure
1	Disconnect transmit and receive cables of the base station you want to replace. Then lift the base station off the mounting screws.
2	Mount the new base station and connect the transmit and receive cables.
3	If the base station does not come on-line within a minute, perform a software upgrade using the latest version of software you have. See *Upgrading Base Station or CTPhone 1900 System Software* on page 3-26.

Adding a Second Base Station

Specific CTPhone software is required for systems with two base stations. When adding a second base station to a system, you may also need to perform a software upgrade.

+ Adding a Second Base Station

Step	Procedure
1	Determine the location of the second base station.
2	Complete the necessary cabling for the base station. See *CTPhone 1900 System Cabling* on page 3-4.
3	Install the base station. See *Base Station Installation* on page 3-8.

+ *Adding a Second Base Station*

4   In the System Settings database of the CTPhone Manager, change the Second BS Service Enabled parameter to TRUE and assign an ID to the second base station. See page 4-7 for more information.

5   If your current system software doesn't support two base stations, copy the new CTPhone software to the personal computer and perform a software upgrade, as described on page 3-22 and page 3-23.

CTPhone Controller Installation

Physical Installation

The CTPhone Controller is designed for mounting on walls or in industry standard 19-inch rack mounts. Side brackets on the Controller should be rotated depending on the type of installation as shown in Figure 3-8.
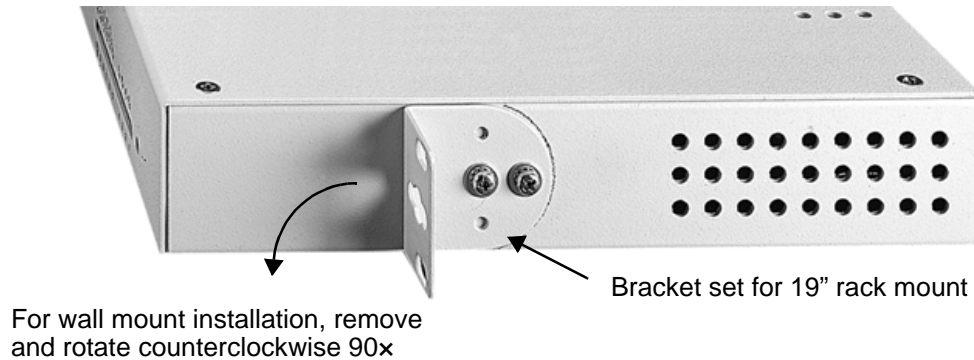

Bracket set for 19" rack mount

For wall mount installation, remove and rotate counterclockwise 90×

Figure 3-8. CTPhone Controller Mounting Bracket

CTPhone Controller Input Power

The CTPhone Controller requires -48V DC input power which may be provided by the office telephone system or AC outlet via a local power supply.

DC Power

The customer must supply a power cord with the following requirements:

- 18 AWG wire

- 2.1mm ID x 5.5mm OD barrel jack (Switchcraft, Inc. S765 or equivalent) with minus (–) potential center lead and positive (+) shield lead

The barrel jack connects to the CTPhone Controller at J1 (see Figure 3-3 on page 3-7). Battery source requirements are -44 to -56 VDC @2 Amps. An inline fuse (rated 3 Amps/ @250 V Slow-Blow) must be installed as close as possible to the battery source on the minus potential side.

To prevent accidental removal of the power cord connected to J1 on the CTPhone Controller, the power cord should be attached by ty-rap to the power strain relief above the ground screw on the CTPhone Controller (see Figure 3-3 on page 3-7).

AC Power

CTP Systems supplies an optional power supply that has universal input (110/220V AC), operates at 50–60 Hz, and provides 48V DC. The power supply includes a cable with barrel jack connection to the CTPhone Controller and 110V AC cable.

Customers with 220V AC outlets can:

- Purchase another power cord to fit the universal connector (3 conductor IEC 320 power inlet) on the power supply

- Replace the 110 plug on the cable with an appropriate 220 plug.

- Connect a North American-to-220 adapter to the 110 plug.

Grounding Requirements

✛ Grounding the CTPhone Controller

Step	Procedure
1	Remove the nut and washer from the ground screw of the CTPhone Controller.
2	Attach a ground lug to one end of a stranded wire. Table 3-D on page 3-15 provides gauge requirements.
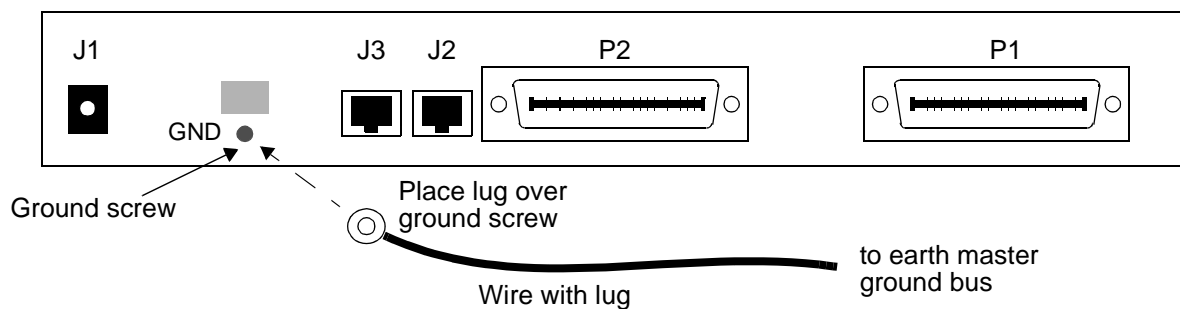
Figure 3-9. CTPhone Controller Ground Requirements

Step	Procedure
3	Place the ground lug over the CTPhone Controller ground screw and replace the washer and nut.
4	Connect the other end of the ground wire to earth master ground bus.

Ground Wire Requirements

Table 3-D provides the recommended gauge for ground wire based on the distance between the CTPhone Controller and the master grounds bus on the office telephone system. The proper gauge wire ensures that DC resistance does not exceed 0.25 ohms.

Table 3-D. Ground Wire Requirements

Distance Between CTPhone Controller and Master Ground Bus	Recommended Gauge
0 – 18 feet	16 AWG
0 – 30 feet	14 AWG
0 – 46 feet	12 AWG
0 – 73 feet	10 AWG
0 – 113 feet	8 AWG

CTPhone Controller Indicators

For information on CTPhone Controller LEDs, see the *Diagnostics and Troubleshooting* chapter.

Adding Analog Line Modules to the CTPhone Controller

The CTPhone Controller supports a maximum of 8, 16, 24, or 32 CTPhone handset users, depending on its configuration. You may add groups of 8 users to a CTPhone Controller configured for less than 32 users by installing an Analog Line Module (ALM) in the CTPhone Controller.

Caution When unplugging an Analog Line Module, unplug the card from connectors J4, J5, or J6 first before disconnecting it from the standoffs. Do not apply diagonal pressure to the DIN connectors (see Figure 3-11 on page 3-16).

✚   Installing an Analog Line Module in the CTPhone Controller

Step   Procedure

1   Power down the CTPhone Controller.

2   Remove the screws securing the cover of the CTPhone Controller case and lift the cover.

+ *Installing an Analog Line Module in the CTPhone Controller*
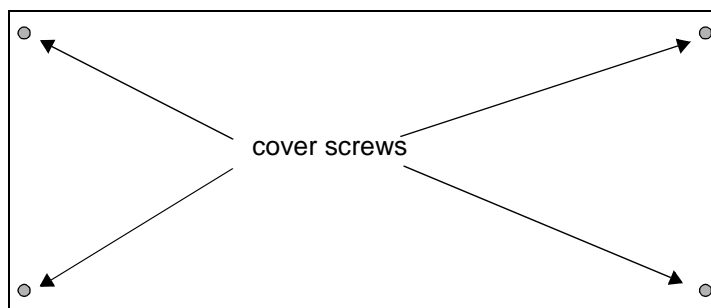
3

Figure 3-10. CTPhone Controller Case (Top View)

4   Align the Analog Line Module with DIN connector J4, J5, or
         J6 and the nylon standoffs on the CTPhone Controller as
         shown in Figure 3-11. Gently press the card into the DIN con-
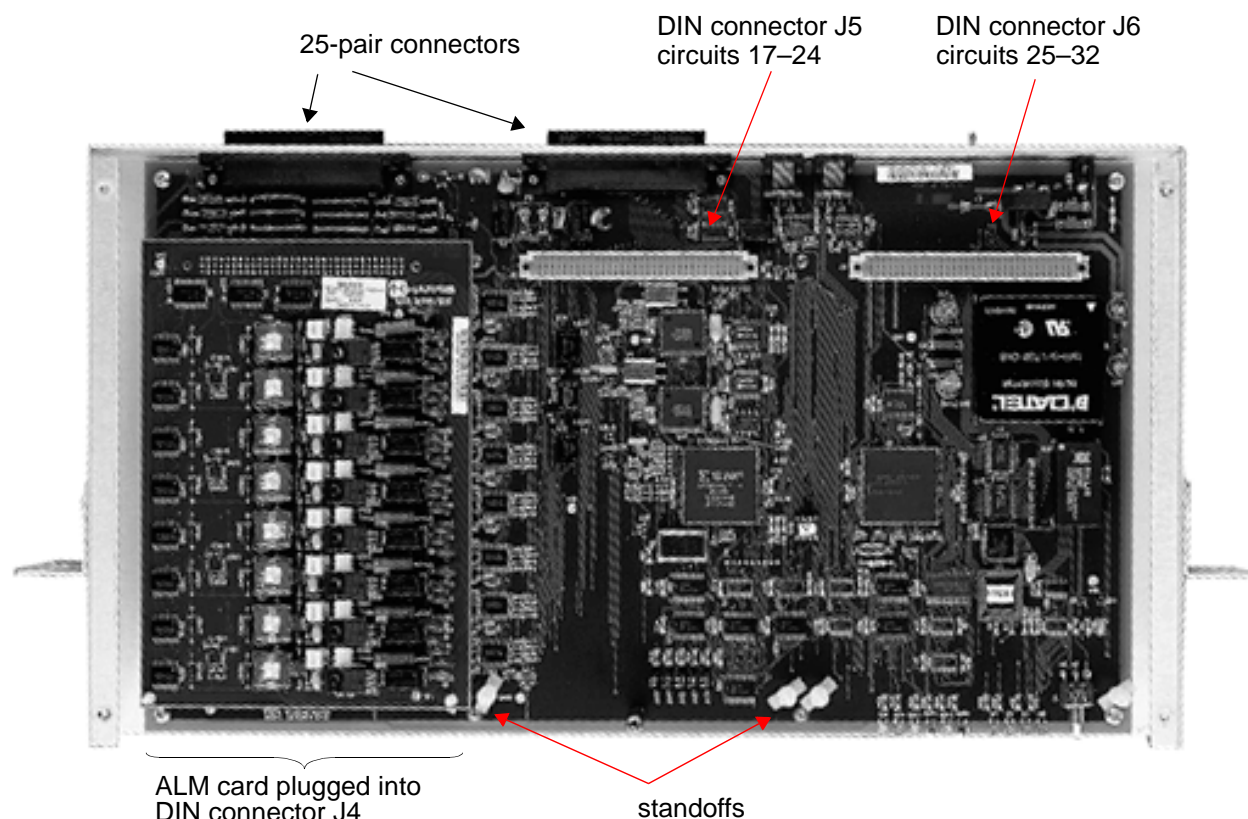   nector and standoffs.

Figure 3-11. ALM Connections on the CTPhone Controller

+   ***Installing an Analog Line Module in the CTPhone Controller***

   5   Replace the CTPhone Controller cover and reinstall cover
            screws.

   6   Power on the CTPhone Controller.

Connecting a Personal Computer to a CTPhone Controller

CTPhone Manager software accompanying the CTPhone Controller lets a
system administrator configure CTPhone extension and telephone feature
operation on the CTPhone Controller. This software runs on a personal
computer (see specifications in Table 3-F on page 3-19). Figure 3-12 illus-
trates the connection between the CTPhone Controller and personal com-
puter.

RS-232-C

CTPhone
Controller

RJ45 connector
with adapter*

RJ45
connector
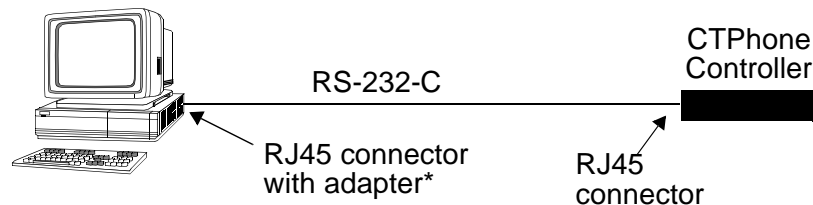
* A female to female DB9 adapter or DB25 adapter is available for
connection to the PC.

Figure 3-12.   CTPhone Controller to Personal Computer Cable

+   ***Connecting a Personal Computer to the CTPhone Controller***

   Step   Procedure

   1   Insert one end of the CTPhone Controller personal computer
            cable in connector J2 of the CTPhone Controller.

power cord strain relief

J1   GND   J3   J2   P2   P1

-48 VDC   not   RJ45   25-pair female connectors
input   used (admin port) (to analog lines and base stations)
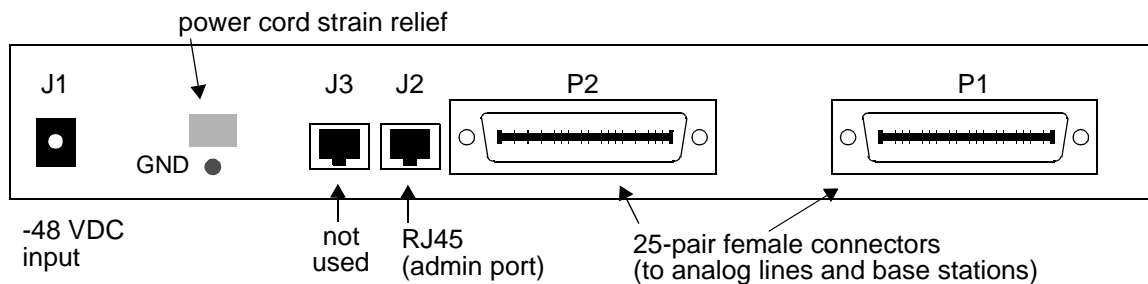
Figure 3-13.   CTPhone Controller RS-232-C Connection

CTPhone 1900 System Hardware & Software Installation

✛ Connecting a Personal Computer to the CTPhone Controller

2   Connect the other end of the cable to the DB9 or DB25 adapter according to the requirements of the RS-232-C port on the PC. See Table 3-E on page 3-18 for pinout information.

3   Connect the adapter to the RS-232-C port on the PC.

Adapter Pinouts

Table 3-E lists the pinouts of the adapters, although they do come assembled.

Table 3-E. DB9 and DB25 Adapter Pinouts

8 Pin Jack	DB9-F	DB25-F
1/BLU	not connected	not connected
2/ORG	7	4
3/BLK	8	5
4/RED	2	3
5/GRN	3	2
6/YEL	5	7
7/BRN	not connected	not connected
8/WHT	not connected	not connected

Software Installation

The following sections describe the steps involved in loading CTPhone Manager and CTPhone 1900 system software on a personal computer. Exactly follow the process as described.

CTPhone Manager Hardware and Software Requirements

The CTPhone Manager, which runs under Microsoft® Windows™, is used to configure CTPhone extensions and CTPhone handset features on the CTPhone Controller. CTPhone Manager software also runs diagnostics, and reports alarms and traffic statistics.

After installing the software, you will perform a software upgrade using the CTPhone Manager in order to upload the CTPhone software to the CTPhone Controller.

Table 3-F lists the minimum and recommended hardware and software requirements for running CTPhone Manager.

Table 3-F. Hardware and Software Requirements

Requirement	Minimum	Recommended
Processor	386DX 33MHz	486 DX2 66MHz
Operating System	MS DOS 5.0 Windows 3.1	MS DOS 5.0 Windows 3.1 or 95
Hard Disk Space	1.5 Mbytes	3 Mbytes
System Memory	4 Mbytes	8 Mbytes
Video	VGA	SVGA
Mouse	Any supported by Windows	same
Floppy Disk	1.44 MB 3.5 inch	same

Software Installation Process

The general steps to completing software installation are listed below. Each step is described in the sections following.

1   Install CTPhone Manager.

2   Copy CTPhone Manager system software provided on diskette onto the personal computer.

3   Start the CTPhone Manager.

4   Perform a software upgrade using the CTPhone Manager in order to upload the application software to the CTPhone Controller.

5   For systems requiring UTAM activation, perform activation.

6   Configure basic system settings.

7   Perform a software upgrade again to complete loading of software onto the base stations.

Note During a first-time software installation process on systems requiring UTAM activation, the upgrade procedure has to be performed in two steps. Once a system is UTAM-activated, software upgrades load the software on the Controller and base stations in one step.

CTPhone Manager in Multiple System Environments

If you use a single PC to maintain two systems, beware that the CTPhone Manager only reports general alarms when it is connected to a CTPhone Controller. The CTPhone Controller does store up to 12 critical alarms in a rolling buffer.

Installing CTPhone Manager on a Personal Computer

1   Insert the floppy diskette containing the CTPhone Manager software in the disk drive.

2   Open the Windows Program Manager. Close any applications you are running.

3   In the File menu, select Run.

4   Type the letter of the floppy drive, followed by a colon, backslash, and setup as shown in the example below.

a:\setup

Then click OK.

The Wireless Manager Setup screen appears. Then the Setup program warns you to close other Windows applications and asks if you want to continue installation.

5   Click Yes to continue the installation or click No if you need to close any applications.

The system displays a dialog box requesting the source path for the Wireless Manager disk(s).

6   Make sure the drive containing the installation disk is correct and click OK.

The system displays a dialog box suggesting a destination path of C:\WIRELESS for the Wireless application software.

7   Click OK to accept C:\WIRELESS as the destination. Otherwise, change the destination drive and/or directory and click OK.

The system displays a dialog box requesting whether to install system files in a program directory or Windows System directory. Either directory is okay, although using the program directory is advised.

8   Select the type of directory, program or Windows System, in which to install the files and click OK.

The Setup program copies files to the hard disk and creates a Wireless program group containing the CTPhone Manager software and on-line help on your PC.

For information on starting and using the CTPhone Manager see the *CTPhone 1900 System Configuration* chapter.

Installing CTPhone Software on the CTPhone Controller

To install the CTPhone software on the CTPhone Controller, you must complete the following steps:

- install the CTPhone Manager as described in *Installing CTPhone Manager on a Personal Computer* on page 3-21

- copy the CTPhone software to the personal computer connected to the CTPhone Controller

- start the CTPhone Manager

- perform a software upgrade

The following sections provide more complete instructions for each of these steps.

Copying the CTPhone Software to the Personal Computer

The CTPhone Manager installation program creates a /SOFTWARE subdirectory under the /WIRELESS directory. After installing the CTPhone Manager software, copy the contents of the floppy diskette containing the CTPhone software into the /SOFTWARE subdirectory.

Starting CTPhone Manager (First-Time Startup)

1 Make sure the PC is connected to a CTPhone Controller.

2 Turn on the PC and start Windows.

3 In the Wireless program group, double-click the Wireless Manager icon.

The following CTPhone Manager Setup dialog box appears.

4   Type your name, company name, and desired password in the Setup dialog box. Click Continue.

5   When the Password Verification dialog box appears, retype the password and click OK.

   Note You can change the password inside CTPhone Manager. See the on-line help for details.

6   Click Continue in the Wireless Manager Setup dialog box.

   The system starts the Wireless Manager software program and displays the usual opening dialog box which requests a password.

   Note If you receive a warning message that says Wireless Manager cannot open Port 1 or 2, it means that communication port configuration does not match hardware configuration. You should correct the software configuration by following the instructions in *Setting COM Ports* on page 4-3 after CTPhone Manager starts.

7   Type your password in the dialog box, and press RETURN or click OK.

   The CTPhone Manager tool bar appears.

Figure 3-14. CTPhone Manager Tool Bar

Performing a Software Upgrade (First-Time)

To complete installation of the CTPhone software onto the CTPhone Controller, you must perform a software upgrade using the CTPhone Manager.

1   In the Wireless Manager tool bar, click on the [icon] icon to open the Status Window.

   Keep this window open throughout the software installation process. This allows you to see the status messages (illustrated on page 3-25) that appear when you power up the CTPhone Controller.

2   In the Wireless Manager tool bar, click on the [icon] icon.

3   In the dialog box, select the file you installed in the Wireless \SOFT-WARE subdirectory.

4   Click on OK.

5   Click OK to confirm the software upgrade process.

6   Press the CTPhone Controller reset button. (For the location of the reset button, see Figure 1-2 on page 1-13.)

The CTPhone Controller runs through a series of tests, performs a software upgrade on the CTPhone Controller, and then attempts to perform a software upgrade on the system base stations. If your system requires UTAM activation, the base station upgrade will fail and you will see an alarm in the Status Window which reports that UTAM activation is needed.

Activating the CTPhone System (United States only)

In the United States, an activation process is required to complete the installation process:

• after a CTPhone system is first installed

• when a CTPhone system is moved to another location

The activation process complies with FCC Part 15 and UTAM rules for Unlicensed Personal Communications Service (U-PCS) equipment in the 1920 - 1930 MHz band. FCC regulations prohibit movement of U-PCS equipment without prior authorization from your manufacturer and UTAM.

To comply with FCC regulations, the CTPhone base stations will not transmit after initial installation until the activation process is completed. In addition, base stations will cease transmitting if the CTPhone Controller is powered down for more than four hours.

Activation Process

See the CTPhone Manager on-line help for information on the activation. During the activation process, you'll retrieve information from the CTPhone Controller, call CTPhone Systems for an activation code, and send the activation code to the CTPhone Controller.

Configuring Basic System Settings

This step is required to ensure proper uploading of the system software to the base stations. To make this step very simple, do the following:

1   In the Wireless Manager tool bar, click [icon].

2   In the Configure Window, double click System Settings.

The System Settings dialog box appears.

3   Configure each system setting; to simplify the process now, use the recommended settings shown in Table 4-A on page 4-7. If your system has two base stations, make sure to enter TRUE in for the Second BS Service Enabled parameter.

4   Click on [icon] to send the system settings to the base stations.

Repeating the Software Upgrade

To complete uploading software to the base stations, repeat the steps listed in *Performing a Software Upgrade (First-Time)* on page 3-23.

Following is an example of the status messages that appear when the upgrade is successful and call processing software is running on the CTPhone Controller.

The status window may also report alarms; if you have a question about an alarm, check the CTPhone Manager on-line help for information on system alarms.

```
- WF Controller Boot SW Version B19.00 -

    SRAM Test          Passed
    Boot Flash Cksm    Passed
    CP Flash Cksm      Passed
    CMOS Battery       Passed
    Real Time Clock    Passed
    Clock Interrupt    Passed
    SCT #1             Passed
    SCT #1 LLB         Passed
    SCT #1 Interrupt   Passed
    SCT #2             Passed
    SCT #2 LLB         Passed
    SCT #2 Interrupt   Passed

-Call Processing Software Version xx.xx -

    Waiting for Wireless Manager

- WF Controller CP SW Started -
12:10:09 06/13/96
```

Note   If the software upgrade does not complete successfully, repeat the upgrade procedure. The message *Waiting for Wireless Manager* must appear in the Status window before the first Rebooting Wireless Controller progress bar times out.

Software Reloading

If LED S2 on the CTPhone Controller remains lit after powering the CTPhone Controller, you should try reloading software. (See *CTPhone Controller LEDs* on page 5-9 if you need more information.)

To reload software, follow instructions in *Performing a Software Upgrade (First-Time)* on page 3-23.

Software Upgrades

Upgrading Base Station or CTPhone 1900 System Software

CTP Systems provides upgrade software for the CTPhone Controller and base stations which can be installed using the CTPhone Manager. Whenever you perform an upgrade you should use the latest software upgrade that you have. The upgrade updates software for the entire system (CTPhone Controller and base station).

1   Follow instructions in the CTPhone Manager on-line help for upgrading software.

    Note The upgrade automatically causes a reboot of the CTPhone Controller. If LED S2 on the CTPhone Controller remains lit after the reset, perform the upgrade again.

2   After the upgrade is complete, follow instructions in the CTPhone Manager on-line help for checking software version. Verify that the software version is correct.

Upgrading Handset Software

Upgrades of handset software are done at the factory.

4

CTPhone 1900 System Configuration

This chapter explains how to configure and activate your CTPhone 1900 system. It covers the following topics:

- startup of the CTPhone Manager (page 4-2)

- guidelines for completing software configuration (page 4-2)

- how to initialize a CTPhone handset (page 4-10)

- tips for assisting users in performing telephone features on the handset (page 4-12)

Before configuring your system, you should have completed all of the steps described in the *CTPhone 1900 System Hardware & Software Installation* chapter.

System Configuration

The CTPhone Manager is used to configure CTPhone extensions and CTPhone handset features on the CTPhone Controller. CTPhone Manager software also runs diagnostics, and reports alarms and traffic statistics.

The CTPhone Manager software is so easy to use that instructions for using it are included in on-line help. The purpose of this section is to provide you with an overview of system configuration and what information is useful to have before working with CTPhone Manager.

Starting the CTPhone Manager (Normal Startup)

1   Make sure the PC is connected to a CTPhone Controller.

2   Turn on the PC and start Windows.

3   In the Wireless program group, double-click the Wireless Manager icon.

4   Type a password in the dialog box, and press RETURN or click OK.

The Wireless Manager tool bar appears.

Note If you receive a warning message that says Wireless Manager cannot open Port 1 or 2, communication port configuration does not match hardware configuration. You can change the software configuration by following the instructions in *Setting COM Ports* on page 4-3.

The following sections tell you how to get started using the CTPhone Manager.

Getting Help

To start the CTPhone Manager on-line help, click on the [?] icon in the CTPhone Manager tool bar (see Figure 3-14 on page 3-23).

To get context-sensitive help on a particular CTPhone Manager screen or dialog box, press function key F1 on your keyboard.

Configuration Check List

Following is a list of things you must do to configure a CTPhone 1900 system. This check list is also in the CTPhone Manager on-line help.

☐   Check COM ports

☐   Set system date and time

☐   Configure system parameters

☐   Configure CTPhone extensions

☐   Configure CTPhone handset features

☐   Save a copy of your configuration

Important Note The PC communication port connected to the CTPhone Controller is stored on the CTPhone Controller. This allows you to communicate with the CTPhone Controller. Because this information is important, information for setting communication port is described below, although it is also explained in the on-line help.

Setting COM Ports

If you start CTPhone Manager and receive a warning message that says CTPhone Manager cannot open Port 1 or 2, it means that communication port configuration does not match hardware configuration. You can use the following instructions to change the software configuration.

1   In the Wireless Manager tool bar, click 👤 .

2   In the Configure menu bar, choose Port Setting from the Preferences menu.

The Port Settings Dialog box appears.
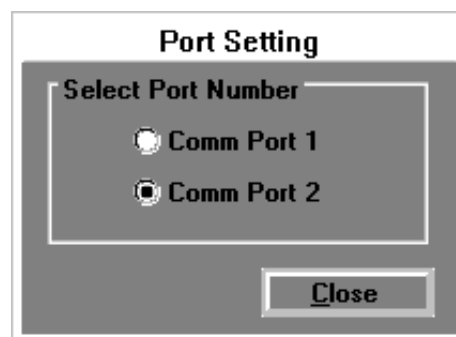
3   Click Comm Port 1 or 2 to tell CTPhone Manager what port to use for transferring data to and from the PC.

4   Click Close to close the dialog box.

CTPhone 1900 System Configuration

Important Tips for Using CTPhone Manager

Working with Configuration Information

When you are working in the CTPhone Manager, you can:

- configure system parameters, CTPhone extensions, and CTPhone handset features in CTPhone Manager dialog boxes

- save information you configure in CTPhone Manager to a file

- open a configuration file stored on disk

- send configuration information displayed in a CTPhone Manager dialog box to the CTPhone Controller

    The CTPhone Controller puts new configuration information into effect immediately. Adding a second base station does cause a reset of the base station, but the system continues to function.

- get, or display, configuration from the CTPhone Controller in a CTPhone Manager dialog box

CTPhone Manager dialog boxes offer these options in a tool bar as shown in Figure 4-1. They are also offered in menus.

Empty the contents of the current dialog box
Open an existing database file
Save a database file
Print the contents of this window
Get database information from CTPhone Controller
Send database information to CTPhone Controller

New   Open   Save   Print   Get   Send   text edit box
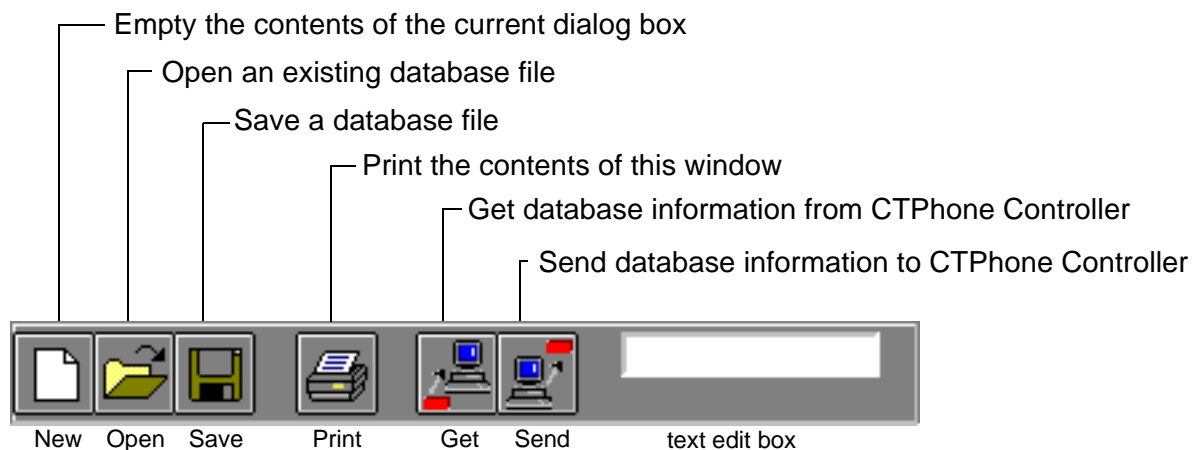
Figure 4-1. System Settings, User Database, & Feature Table Dialog Box Tool Bar

Recommended Configuration Method

Before making changes or adding information to configuration databases, the recommended method is:

1 **Get** the current configuration from the CTPhone Controller.

2 **Save** the current configuration to a file on the PC.

3 **Open** and edit a copy of the current configuration on the PC.

4 **Send** the new configuration to the CTPhone Controller.

Using this method ensures that you retain a copy of the current configuration and that you edit (add to or change) existing data.

Caution Sending configuration information to the CTPhone Controller overwrites existing information on the CTPhone Controller. You must make sure the configuration you are sending contains *all* required configuration information, not just the few additions or changes you wish to put into effect.

Required Configuration Information

System Settings Table

Table 4-A on page 4-7 provides a table you can use to collect configuration data for system parameters. The table also describes each system parameter.

Note You have already configured this table as part of the software installation process. However, at this time, you may want to make some changes to your initial settings.

CTPhone Extensions – User Table

Table 4-B on page 4-8 provides a table you can use to collect configuration data for CTPhone extensions. The extension number is the extension number configured in the office telephone system; see Table 4-D on page 4-10 for an explanation of handset ID.

Note Even though the table shows all 32 lines, you should only configure as many extensions as your CTPhone Controller will support (8, 16, 24, or 32).

CTPhone Handset Features – Feature Table

Table 4-C on page 4-9 provides a table you can use to collect configuration data for CTPhone handset features. The table consists of sequences of events that occur when users press certain key combinations. Events may be:

- commands the CTPhone Controller sends to the office telephone system to execute telephone features

- text displays that the CTPhone Controller sends to the handset during feature operation

The CTPhone Manager on-line help explains how the commands and displays operate.

General Guidelines for Configuring Event Sequences

- Consider the order in which commands and text displays should occur during the execution of a telephone feature.

- The Terminate Call command can only be used as the last event in a sequence.

Table 4-A. System Settings

Parameter	Description	Units/Range	Recommended Setting	Your Setting
System ID	ID for this CTPhone 1900 system. Handsets must be programmed with this ID to operate in this system. The ID for your system is written on a label on the CTPhone Controller.	n.a.	ID shown on Controller label	
Base Station 1 ID	ID of the first base station connected to this CTPhone Controller.	0–31		
Base Station 2 ID	ID of the second base station connected to this CTPhone Controller.	0–31		
Stop Ringing Time	Length of time the CTPhone Controller waits after last detection of ring voltage on a line before concluding ringing has stopped.	100 ms[1]	45	
Dial Tone Delay	Length of delay between a user pressing CALL key and receiving dial tone. The delay may be necessary to eliminate the possibility of a user dialing before the office telephone system is ready.	100 ms[1]	2	
DTMF Cycle Duration	Duration of the full DTMF cycle (length of tone plus length of silence between tones) used to perform dialing and other telephone system operations.	10 ms[2]	20	
DTMF Off Duration	Duration of silence between DTMF tones.	10 ms[2]	10	
Hook Flash Duration	Duration of the hookflash used to signal the office telephone system.	100 ms[1]	5	
FT Pause Duration	Duration of pause events in Feature Table.	100 ms[1]	10	
FT Inter-Event Pause	Duration of pause between events in Feature Table.	100 ms[1]	1	
Second BS Service Enabled	TRUE if this CTPhone Controller provides service for a second base station; FALSE if it doesn't or the second base station is out of order.	n.a.		

[1]   For example, a setting of 2 means 2 x 100 ms or 200 ms.

[2]   For example, a setting of 2 means 2 x 10 ms or 20 ms.

Table 4-B. CTPhone Extension Data – CTPhone Manager User Table

Analog Line	Amphenol Connector / Pair	Handset ID (1–1535)	Extension # (1–10 digits)	User Name/Comment (1–12 characters)
1	P1, pair 1			
2	P1, pair 2			
3	P1, pair 3			
4	P1, pair 4			
5	P1, pair 5			
6	P1, pair 6			
7	P1, pair 7			
8	P1, pair 8			
9	P1, pair 9			
10	P1, pair 10			
11	P1, pair 11			
12	P1, pair 12			
13	P1, pair 13			
14	P1, pair 14			
15	P1, pair 15			
16	P1, pair 16			
17	P2, pair 1			
18	P2, pair 2			
19	P2, pair 3			
20	P2, pair 4			
21	P2, pair 5			
22	P2, pair 6			
23	P2, pair 7			
24	P2, pair 8			
25	P2, pair 9			
26	P2, pair 10			
27	P2, pair 11			
28	P2, pair 12			
29	P2, pair 13			
30	P2, pair 14			
31	P2, pair 15			
32	P2, pair 16			

Table 4-C. CTPhone Handset Feature Data – CTPhone Manager Feature Table

Key Sequence	Events 1–20 (Use commands or text displays listed below.)																			
FLSH																				
FNC 1																				
FNC 2 (call back)																				
FNC 3 (transfer)																				
FNC 4 (conference)																				
FNC 5																				
FNC 6																				
FNC 7 (mail)																				
FNC 8 (call wait)																				
FNC 9																				
FNC 0																				
FNC *																				
FNC #																				

CTPhone Controller Commands

digit 1	digit 7	Pause	Echo (digits entered)	
digit 2	digit 8	User extension	Keypad (enable)	
digit 3	digit 9	Hookflash		
digit 4	digit 0	Onhook		
digit 5	*	Offhook		
digit 6	#	Terminate Call		

Text Displays

CALL WAIT	OK
CALLBACK	TRANSFER
CAMPON	V-MAIL
CONF	VMS
E-MAIL	clear display
NOT AVAIL	

CTPhone Handset Initialization

After configuring a CTPhone extension in the CTPhone Manager, you must complete other steps to operate a CTPhone handset. These steps in their recommended order are:

1   Enter system and handset IDs into the CTPhone handset.

2   Make a phone call to store the handset's ESN in the CTPhone Controller.

Note You should back up configuration files on the CTPhone Controller after completing step 2 by using the Get function (see Figure 4-1).

Table 4-D explains the IDs configured in a CTPhone 1900 system. Figure 4-2 illustrates the relationship between these IDs.

Table 4-D. IDs Affecting CTPhone Handset Operation

ID	Description	Where Stored
System ID	Determines what CTPhone 1900 systems a handset may operate in.	**CTPhone Controller**: configured in System Settings database **Handset**: up to 8 stored by system administrator or user; each system ID is stored with an associated handset ID
CTPhone handset ID	Uniquely identifies a handset within a given CTPhone 1900 system.	**CTPhone Controller**: configured per handset in the User Database **Handset**: up to 8 stored by system administrator or user; each handset ID is stored with an associated system ID
Electronic Serial Number (ESN)	Unique to every CTPhone handset, regardless of the systems it operates in.	**CTPhone Controller**: automatically stored when handset with configured system/handset IDs gets first dial tone **Handset**: factory programmed

System ID — 1000
Handset ID — 1111
ESN — 1234

System Settings Database
System ID: 1000

CTPhone Controller

User Database
Handset ID: 1111
ESN: 1234
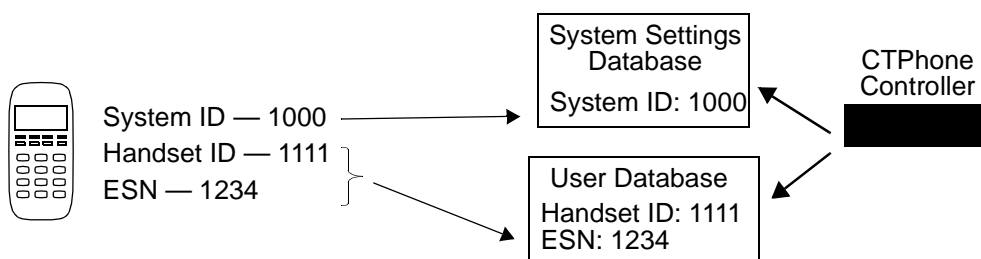
Figure 4-2. Relationship Between ESN, System ID, & Handset ID

Storing IDs in the CTPhone Handset

1   Press (PWR) to turn on the handset.

2   Press (FCN).

    MENU OPERATION appears in the display

3   Press (▼) until SYSTEM CONFIG. appears in the display.

4   Press (FCN).

    SID #0 appears in the display.

5   Enter the system ID for a CTPhone 1900 system in which you want the handset to operate.

    If you make a mistake, press (CLR) to erase the last digit.

6   Press (▼).

    HID #0 appears in the display.

7   Enter the handset ID (1–1535) for the system ID you entered in step 4.

8   Press (▼).

    SID #1 appears in the display.

9   Repeat steps 5–7 until you have entered all the system and handset IDs required for the handset you are configuring.

    You can store a maximum of eight system IDs and associated handset IDs in a handset. If you don't need that many, press (END). When you press (END) or press (▼) after entering the eighth handset ID, the handset displays its ESN for a brief moment and then exits menu operation to idle mode.

Storing ESN in the CTPhone Controller

Unique Electronic Serial Numbers (ESN) are programmed into CTPhone handsets at the factory and are automatically configured in the CTPhone Controller the first time a user makes a phone call or goes off-hook. CTP Systems recommends that the system administrators make the initial call on all CTPhone handsets to ensure that ESNs are stored with correct handset IDs.

After storing ESNs on the CTPhone Controller, the system administrator should back up the User Database on the CTPhone Controller. An ESN remains in the database on the CTPhone Controller until its related handset ID is changed or deleted. When the handset ID is changed, the corresponding ESN is removed from the database.

Providing FCN Key Feature Access Information to Users

As a system administrator, you may need to train users how to perform telephone features such as call back, camp-on, or conference using the FCN key on the CTPhone handset. In many cases, executing a feature requires completing other steps before pressing the FCN key. For example, in Table 4-E below, you can see that to start a conference you must:

1   Enter into conversation with one party.

2   Place that party on hold.

3   Dial another party.

4   Initiate the conference pressing FCN, then 4.

Table 4-E. Sample FCN Key Feature Access

Feature	Starting State	Press or Dial[1]				
Call Back	Busy or ring-back	**FCN**	**2**			
Camp-on Pickup	Conversation	**FCN**	**8**			
Conference	Conversation	FLSH	Call another party	**FCN**	**4**	
Transfer	Conversation	FLSH	Call another party	FLSH	**FCN**	**3**
Voice Mail Pickup	Idle	CALL	**FCN**	**7**		

[1]   Steps required before dialing the FCN key are in regular type face.

CTPhone Handset User Instructions

Operating instructions for the CTPhone handset are in the CTPhone Handset User Guide.

5

Diagnostics and Troubleshooting

This chapter covers diagnostic and troubleshooting information for the CTPhone 1900 system.

- *Troubleshooting* on page 5-2 covers troubleshooting procedures.

- *General Information* on page 5-9 covers information and operation of the system that may be useful to you while troubleshooting the system.

Troubleshooting

General System Troubleshooting

When troubleshooting problems, here is a general list of information sources and things to check:

- handset and battery symptoms and handset displays

- base station and CTPhone Controller LEDs

- alarms reported in the CTPhone Manager

- traffic statistics reported in the CTPhone Manager

- line, base station channel, and call status reports in the CTPhone Manager

- power sources

- polarity

- cable connections and continuity

System Problems

System problems include any of the following problems:

- The interface between the office telephone system and the CTPhone Controller does not operate properly.

- CTPhone Controller does not power up properly (LEDs indicate problems).

- Base stations do not power up properly (LEDs indicate problems).

- The CTPhone Controller and base stations do not communicate.

- Base stations and handsets do not communicate.

This section contains a series of suggestions for diagnosing and fixing these problems.

Power

Check power sources.

Polarity

Check that transmit and receive pairs are consistent between the CTPhone Controller and base stations throughout the system. Sometimes switching pairs at the base station will solve a problem quickly.

Continuity

You can use an installer's test set at individual MDF/IDF locations to check analog line continuity throughout a system.

Check for any bridge taps on the base station transmit/receive cables. Remove them, if found. Check all punch downs and cable connections.

CTPhone Controller/Base Station Communication

One method of testing whether system problems are due to a communication problem between the CTPhone Controller and base station is to perform a software version query of the base station from the CTPhone Manager. If you receive no response to the query, check the cables between the CTPhone Controller and base stations, the RS-232-C cable between the PC and CTPhone Controller, and that the base stations and CTPhone Controller are running normally.

Distance Limitations

The allowed distances between CTPhone Controller and base station (whether using line power from the CTPhone Controller or a local power supply) may be exceeded during an installation. You can use the following test to measure DC resistance between the CTPhone Controller and base stations, which will determine if this is the case.

To perform this test the following tools are needed:

- Digital multimeter that has resistance measuring capability with a resolution of at least units of ohms and a basic accuracy of better than 1%

- RJ-11 female to female line adapter

Table 5-A lists the maximum DC resistance allowed for line or local power.

Table 5-A. DC Resistance on Base Station/Controller Cables

Input Power	Wire Gauge	Maximum DC Resistance Allowed
Line	22, 24, or mixed 22/24	98 ohms
Local	22	108 ohms
	24	171 ohms

✛   *Checking CTPhone Controller-Base Station Cable Distance*

Step	Procedure
1	Make sure all wiring between the CTPhone Controller, MDF/IDFs, and base stations is complete. In addition, make sure primary protectors are installed, if they are required. (For information on primary protection requirements for UL1459 compliance in the United States, see Appendix A; see also the caution on page 3-5.)
2	Disconnect the CTPhone Controller from power.
3	Disconnect the 25-pair cables from P1 and P2 on the CTPhone Controller. (Make sure to perform this step before step 4.)
4	Disconnect the transmit and receive cables from the base station and connect them into each end of the RJ-11 line adapter.
5	Set the multimeter to ohms scale with a resolution of units of ohms.
6	To check the distance to base station one, connect the multimeter probes between pins 20 and 46 of the 25-pair cable that connects to P1 on the CTPhone Controller. If no reading or a high resistance is reported, measure between pins 20 and 21. A reading should register at only one of the pairs and must be less than the values listed in Table 5-A.
7	Based on which pins returned a valid reading in step 6, check readings between the following pairs: Valid reading pins 20/46 – measure pins 21/45 Valid reading pins 20/21 – measure pins 45/46 The readings between the sets of pins you measure should be similar.
8	To check the distance to base station two, connect the multimeter probes between pins 24 and 50. If no reading or a high resistance is reported, measure between pins 24 and 25. A reading should register at only one of the pairs and must be less than the values listed in Table 5-A.

+ ### Checking CTPhone Controller-Base Station Cable Distance

9   Based on which pins returned a valid reading in step 8, check readings between the following pairs:

Valid reading pins 24/50 – measure pins 25/49
Valid reading pins 24/25 – measure pins 49/50

The readings between the sets of pins you measure should be similar.

10   If the multimeter reports no reading or high resistance, check the readings between any of the other pins specified in step 6 – step 9.

If you get correct readings after performing step 10, the transmit and receive pairs are probably reversed or shorted somewhere in the installation. If not, there are open connections somewhere in the installation; check and correct all punch down connections and repeat step 6 – step 9.

Analog Line Circuit

If users complain about noisy circuits or problems with dial tone, try switching the user to another circuit on the office telephone system. If a circuit is not operating at all, you can also use an installer's test set at individual MDF/IDFs to check continuity throughout a system.

If multiple users are complaining about noise, check whether the problems are isolated to circuits 1–8, 9–16, 17–23, or 24–32. The problems might be related to a faulty Analog Line Module in the CTPhone Controller. This problem could be checked or isolated by switching Analog Line Modules (see page 3-15 for instructions).

Component Problems

If one system component is indicating a problem, try replacing it with a known good one. For example, you can switch individual base stations, Analog Line Modules, or handsets to see if problems persist.

System Reset

As a last resort, sometimes resetting the CTPhone Controller will clear up system problems. Before resetting your system, collect as much information as possible in the current CTPhone Manager log file. Get traffic statistics reports, call status reports, line and base station status reports, and alarm reports. Then save the information in the log file to a file of another name by using the Save As command.

To reset the system, follow the instructions in the CTPhone Manager on-line help.

CTPhone Handset Problems

Called party can hear you but cannot be heard
Conversation broken up
Handoff clicks occur during conversation

The handset signal strength is inadequate. Try moving closer to a base station. If the problem is reported by many individuals, try moving the base station to a location that provides better coverage.

For best results the signal strength icon should show three to five bars. The Bit Error Rate (BER) test should report Good or Max results. (See page 5-14 for instructions on how to perform this test.)

Display does not contain date, time and signal strength

The handset is not locked onto a base station. Try powering off and powering on the handset or moving to another location closer to a base station. Note that sometimes it may take up to a minute for the full display to appear.

If the problem persists, check system and handset ID configuration in the CTPhone Controller and handset.

These symptoms may also occur if the CTPhone Controller or base station is being reset.

Off-hook icon (📞) flashes when CALL button is pressed
Handset operated correctly and now cannot make calls

The handset's ESN may be improperly configured in the CTPhone Controller. To fix this problem, complete the following steps:

1   Reprogram the handset with proper system and handset IDs.

2   Get the User database from the CTPhone Controller and change the handset ID configured for the handset to any valid ID not already in use. Send the change to the CTPhone Controller.

3   Change the handset ID in the User database to match the ID programmed in the handset. Send the change to the CTPhone Controller.

4   Make a call on the handset to store its ESN in the CTPhone Controller.

5   Save and back up the databases.

Invalid ESN reported for handset (alarm)

The same handset ID and system ID were programmed into two phones and the databases on the CTPhone Controller, and the handset ESNs

were associated with the wrong analog line when the first phone call was made. The alarm reports the handset ID. To fix this problem, you will need to locate both handsets and correct the databases using the following instructions:

1   Get the User database to determine which handsets are involved.

2   Check the Handset ID configuration in both handsets to make sure they are correct.

Very likely the "other" handset is configured with an incorrect ID. Changing the ID in the handset and making another call will correct the ESN configuration for that phone.

3   To correct configuration for the handset that reported invalid ESN, follow these steps:

•   Get the User database from the CTPhone Controller and change the handset ID configured for the handset to any valid ID not already in use. Send the change to the CTPhone Controller.

•   Change the handset ID in the User database to match the ID programmed in the handset. Send the change to the CTPhone Controller.

•   Make a call on the handset to store its ESN in the CTPhone Controller.

•   Save and back up the databases.

No dial tone

Make sure the handset keypad is not locked and check the handset volume level. If the problem remains, the handset is not locked onto a base station. Try powering off and powering on the handset or try moving to another location closer to a base station. Check the analog line with an installer's test set to ensure the telephone system is operating properly, and if it is, check the wiring between the CTPhone Controller and the telephone system.

A handset is properly locked when you see the handset date, time, and signal strength icons after power up.

This problem may also occur if the CTPhone Controller or base station is being reset or there is faulty wiring in the analog line.

Weak or delayed dial tone

Check the handset volume level. Then make sure to align the handset with the ear rather than mouth and don't watch the display. Consider using the predial method to make calls by dialing the number and pressing the CALL button (rather than pressing CALL and waiting for dial tone).

NO SERVICE! message

You pressed CALL on a handset that is not locked, due to being out of range or all eight channels of the base station are being used for other calls (or all four channels of the "Mini" base station are in use).

Try powering off and powering on the handset or try moving to another location closer to a system base station. A handset is properly locked when you see the handset date, time, and signal strength icons after power up.

You may also receive this message if the CTPhone Controller or base station is being reset.

SYSTEM BUSY message

The handset was locked onto a base station when the CALL key was pressed and was able to request service, but did not get an answer from the base station. One or more base station channels may be in a maintenance busy state or the handset may not be locked well enough to complete the request for service.

Unexpected digits in display

It is very easy to inadvertently press keys on the handset keypad while the handset is not in use. Consider using the keypad lock feature. To clear digits from the display, use the handset CLR key.

Battery Problems

Battery has diminished talk/standby time

Try discharging and recharging the battery using the instructions on page 5-17. Another possibility is that a fully charged handset left unpowered for a long period of time will slowly drain.

Make sure users are not removing batteries from the charger before the green LED appears, because they find that the handset battery strength icon shows full power after a short period of charging. Users should let the full charging cycle complete before using batteries. They should also use the handset during the day and recharge it at the end of the day, rather than performing intermittent charging during the day.

Charger has green flashing LED

Try recharging the battery using the instructions on page 5-17. If the problem continues, the battery may be defective.

General Information

This section covers information and operation of the system that you will need to refer to when troubleshooting the CTPhone 1900 system.

CTPhone Controller LEDs

Boot Sequence

After power is applied to the CTPhone Controller, all LEDs except for POWER, RLOS1, and RLOS2 go through the changes described below.

Note The POWER LED is always lit when the CTPhone Controller has power. The RLOS LEDs flicker during boot tests and are lit when there is a problem with base station connections.

1   LEDs are lit for one second to show that they all work.

2   LEDs are turned off for a brief moment.

3   LEDs are lit.

4   Each LED is turned off as the test(s) that corresponds to that LED passes.

If an LED remains lit after the boot tests complete, one or more hardware integrity tests have failed. Call processing software will usually start even if some of the tests fail, although some failures prevent call processing software from starting.

The MASTER LED is not turned off during boot up because it does not correspond to a boot test.

Table 5-B on page 5-10 explains the meaning of various states of the LEDs on the CTPhone Controller during boot up and normal operation.

Table 5-B. CTPhone Controller LEDs During Boot Up and Normal Operation

LED #/Label	Color	Meaning When Lit
☀ POWER	Green	CTPhone Controller power is on.
9 MASTER	Yellow	This LED should always be lit.
8 BUSY1	Green	**Boot Up:** The test(s) to check integrity of the connection to base station 1 failed. **Normal Operation:** One or more channels on base station 1 are busy. If flashing, a software upgrade is in process.
7 RLOS1	Red	Receive loss of synchronization on base station 1. Synchronization is lost with base station 1 due to poor connection, bad cable, base station failure, or CTPhone Controller failure.
6 BUSY2	Green	**Boot Up:** The test(s) to check integrity of the connection to base station 2 failed. **Normal Operation:** One or more channels on base station 2 are busy.
5 RLOS2	Red	Receive loss of synchronization on base station 2. Synchronization is lost with base station 2 due to poor connection, bad cable, base station failure, CTPhone Controller failure, or the Second BS Service Enabled parameter being set to TRUE in the System Settings database when the system has one base station only.
4 S3	Yellow	**Boot Up:** The test(s) to check integrity of the CTPhone Controller real time clock failed. **Normal Operation:** If flashing, a critical alarm has occurred.
3 S2	Yellow	**Boot Up:** The test(s) to check integrity of call processing software stored in non-volatile memory failed. Try reloading the software (for instructions, see page 3-25).
2 S1	Yellow	**Boot Up:** The test(s) to check integrity of boot software stored in non-volatile memory failed, which means there is a hardware failure.
1 S0	Yellow	**Boot Up:** The test to check volatile memory failed, which means there is a hardware failure.

Diagnostics and Troubleshooting

CTPhone Controller Critical Alarm Relay

When a critical alarm is detected, a relay on the CTPhone Controller is triggered and LED S3 flashes. The relay activates an external alarm, if one is installed (see installation instructions and specifications in Figure 3-2 on page 3-7).

To reset the alarm relay and determine the cause of the critical alarm, check the critical alarm report in the CTPhone Manager. Checking the critical alarm report also stops the flashing of the LED.

To view the critical alarm report in the CTPhone Manager:

1   Click on the [icon] icon in the CTPhone Manager tool bar.

    The Status Window appears.

2   In the Diagnostics menu, select Critical Alarm.

    The CTPhone Manager displays the last twelve critical alarms detected in the Status Window.

Base Station LEDs

The base station has five LEDs as illustrated in Figure 5-1. The four LEDs on the left indicate error conditions during power on/reset and during the diagnostic tests that run during normal operation. The green LED on the right is the power indicator.
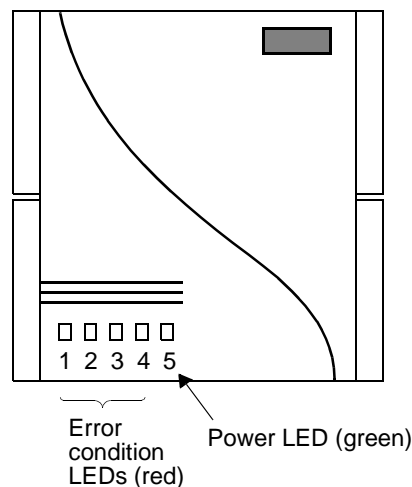
Figure 5-1. Base Station LEDs

Base Station LEDs During Power On/Reset

The Table 5-C explains how to interpret base station LED readings that occur during power on or reset. The LEDs must be read in combination to understand their meaning. The footnotes to the table contain troubleshooting suggestions.

Table 5-C. Base Station LEDs During Power On/Reset

Test Failed	Red LEDs (in Combination)			
	1	**2**	**3**	**4**
Memory test 1[1]	off	off	off	blinking
Memory test 2[1]	off	off	blinking	off
Memory test 3[1]	off	off	blinking	blinking
BS Interface/processor test[2]	off	blinking	off	off
BS Interface external communication test[3]	off	blinking	off	blinking
ASIC test[4]	off	blinking	blinking	off
Frequency test[5]	off	blinking	blinking	blinking
Vocoder Initialization test[6]	blinking	off	Vocoder # (0–3)	
			0: off	off
			1: off	on
			2: on	off
			3: on	on
Signaling channel test[7]	blinking	blinking	off	off
Memory flash test[5]	blinking	blinking	off	blinking

[1]   Indicates a base station failure in most cases. Verify that the base station power supply is stable by checking cable connections or replacing transmit/receive cables or local power supply.

[2]   Verify that the base station power supply is stable by checking cable connections or replacing transmit/receive cables or local power supply.

[3]   Check whether the base station transmit/receive cables allow another base station to initialize.

[4]   Verify power supply.

[5]   Test the base station on the other CTPhone Controller base station port and with transmit/receive different cables.

[6]   Try replacing the transmit/receive cables.

[7]   Reset the CTPhone Controller.

Base Station LEDs During Normal Operation

The Table 5-D explains how to interpret base station LED readings that occur during self diagnostic tests that run during normal operation. The LEDs must be read in combination to understand their meaning. The footnotes to the table contain troubleshooting suggestions.

Table 5-D. Base Station LEDs During Normal Operation

Test Failed	Red LEDs (in Combination)			
	1	**2**	**3**	**4**
ASIC test[1]	off	off	off	on
Phase lock loop lock test[2]	on	off	on	off
Vocoder test[3]	off	on	Vocoder # (0–3)	
			0: off	off
			1: off	on
			2: on	off
			3: on	on
Synthesizer unlock test[4]	on	off	off	on
Waiting for configuration test[5]	off	on	on	off
Phase lock loop initialization test[2]	off	on	off	off
BS Interface clock test[2]	on	on	off	off
Receive loss[6]	off	off	on	on
Loss of control channel[7]	on	off	off	off

1   Test the base station on another CTPhone Controller base station port and with different transmit/receive cables.

2   Reset the base station and test the base station on the other CTPhone Controller base station port. You can reset a base station by unplugging and plugging its transmit or receive cable. You can reset all base stations by resetting the CTPhone Controller.

3   Reset the base station. You can reset a base station by unplugging and plugging its transmit or receive cable. You can reset all base stations by resetting the CTPhone Controller from the CTPhone Manager.

4   Test base station transmit/receive cables by replacing the base station with a functional one.

5   If persistent, make sure the CTPhone 1900 system has been activated or check CTPhone Controller configuration. Also try resetting the CTPhone Controller from the CTPhone Manager.

6   Reset the CTPhone Controller and check transmit/receive cables.

7   Check for RF interference.

Diagnostics and Troubleshooting

CTPhone Handset Functions

Bit Error Rate (BER) Testing

After activating your system, you can use a CTPhone handset to perform Bit Error Rate (BER) testing. During a BER test, the handset displays results that help you determine the quality of coverage of the base station the handset is locked onto. Handsets do not perform handoff during BER tests so that you can test specific base stations. BER testing is especially important when you are trying to maximize base station coverage.

Starting BER Testing on the CTPhone Handset

BER testing is one of the password protected functions of the CTPhone handset. To initiate BER testing on a handset:

1   In idle mode, dial **##****.

2   Press **ABC**, then **CALL**.

    BER MEASURE appears briefly in the handset display and then the handset starts reporting BER test readings.

    See *Reading the BER Values* on page 5-15 for information on how to read the BER values in the handset display.

    See *BER Testing Guidelines* below for guidelines to follow when performing the test.

3   Press **END** to end the BER test.

BER Testing Guidelines

When performing BER tests, you want to simulate real use, rather than trying to get the best readings. Therefore, make sure to do the following:

•   Perform tests in all possible areas that users may carry their handsets. There may be areas of interference that you were not aware of when first determining base station placement.

•   When checking an area, turn in a 360 degree circle to check the effects of standing in different directions.

•   Keep the handset slightly raised.

•   Test while walking and standing.

Note BER readings may take a few seconds to register. Make sure to remain in an area long enough to get an accurate reading.

Reading the BER Values

During a BER test, the handset checks the number of bit errors received by the handset (HS) and base station (BS), and reports results as shown in Figure 5-2. The possible BER results reported for the handset and base station are Max, Good, Poor and Bad.
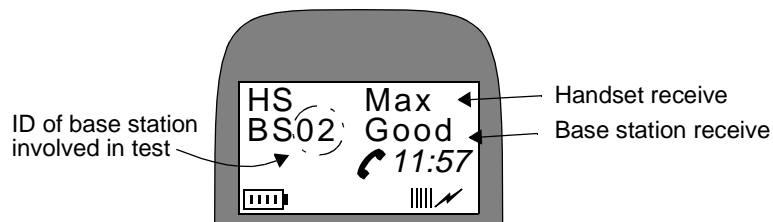
Figure 5-2. Handset Display During Bit Error Rate Testing

Table 5-E. Explanation of Possible BER Test Results

BER Result	What it Indicates
Max or Good	Values required for clear conversation.
Poor	The boundaries of a cell. Call setup is not advisable, although calls in progress may survive.
Bad	An area not sufficiently covered to support call traffic. Relocate other base stations or put up another base station.
Mismatched values (e.g. Good/Bad)	Faulty equipment or interference close to the handset or base station.

Handset Operation/Functions Under Password Protection

Table 5-F lists functions in the handset that are accessed by password. Note that some functions are for use by CTP Systems only.

Table 5-F. Handset Password Protected Functions

Function	What it Does
Bulker DU	CTP Systems use only.
Unique BS	Locks the handset onto a base station with a particular ID. 0 means normal operation.
Software version	Displays handset's software version.
Beep on roam	Causes an idle handset to beep when the base station it is locked onto changes.
Handoff by recall	Allows the RCL key to initiate handoff to another base station in the system while a call is in progress.

Diagnostics and Troubleshooting

Table 5-F. Handset Password Protected Functions (cont.)

Function	What it Does
Bulker call	CTP Systems use only.
Bulker end	CTP Systems use only.
Reset to factory defaults	Restores the handset to factory default settings. All changes made via the handset menu are removed.

Accessing Password Protected Functions

1   In idle mode, dial **1234**.

2   Press ⟨ABC⟩, then ⟨FCN⟩.

    BULKER DU appears in the handset display.

Unique BS

After entering the password and seeing BULKER DU in the display:

1   Press ⟨▼⟩ until UNIQUE BS appears in the display.

2   Enter a base station ID to lock the handset onto a particular base station, or enter 0 to restore a handset to normal operation.

Software Version

After entering the password and seeing BULKER DU in the display:

1   Press ⟨▼⟩ until SOFTWARE VERSION appears in the display.

2   Press ⟨FCN⟩. to see the software version.

Beep On Roam

After entering the password and seeing BULKER DU in the display:

1   Press ⟨▼⟩ until BEEP ON ROAM appears in the display.

2   Press ⟨FCN⟩ until the option you want, BEEP ON ROAM ON or BEEP ON ROAM OFF, appears in the display.

3   Press ⟨END⟩ to return to idle mode or press ⟨▼⟩ to go the next password protected function.

Handoff by Recall

After entering the password and seeing BULKER DU in the display:

1   Press ⬇ until HAND OFF BY RCL appears in the display.

2   Press **FCN** until the option you want, HAND OFF RCL ON or HAND OFF RCL OFF, appears in the display.

3   Press **END** to return to idle mode or press ⬇ to go the next password protected function.

Reset to Factory Defaults

After entering the password and seeing BULKER DU in the display:

1   Press ⬇ until RESET TO FACT DFLT appears in the display.

2   Press **FCN**.

    RESET DONE appears in the display.

CTPhone Handset Charger

Charging Batteries

The battery charger charges a handset with battery and a spare battery.

To charge a battery:

1   Insert handset with battery (power off) in the charger's front pocket.

2   Insert spare battery in the charger's rear pocket.

    The front pocket LED changes to amber and then changes to red to indicate that rapid charging is in progress.

    If a spare battery is in the rear pocket, the rear pocket LED changes to amber while waiting for the handset to finish charging or alternates between green and amber to indicate discharge is in progress.

    Only one battery is charged at a time. When the handset is fully charged, the front pocket LED changes to green and the rear pocket LED changes to red to indicate that charging is in progress.

3   When LEDs change to green, remove the handset or spare battery.

    When charging of a handset or battery is complete, the charger switches to trickle charge until you remove the handset or battery.

Diagnostics and Troubleshooting

If you place a fully charged battery in the charger, it will detect the charged condition and cancel rapid charging. The LED changes to amber, red, and then green.

Important Note Do not use a battery before it has completed the rapid charge cycle, even if the handset battery icon reports full strength. The battery will have a diminished talk/standby time under these conditions.

To discharge a battery:

The rear pocket of the charger has a discharge function which is initiated when the charger detects that discharging is necessary. You should try discharging a battery when it shows a significant reduction in talk/standby time.

1   Insert the battery in the rear pocket of the charger.

2   If the LED alternates between green and amber, leave the battery in the charger to complete discharging.

    After the discharge cycle complete the LED changes to red to indicate rapid charging is in progress.

3   When LED changes to green, you can remove the battery.

Handset Charger LEDs

Table 5-G. Handset Charger LEDs

LED	State	Meaning
Red	Steady	Battery is rapid charging.
	Flashing	Internal battery fault. Charge the battery again. If the problem persists, replace the battery.
Green	Steady	Battery is charged and OK.
	Flashing	Battery is charged, but it may have a diminished standby/talk time. Repeated rapid charging may rejuvenate the battery. If not, replace the battery.
Amber	Steady	The charger is evaluating handset or battery state, or waiting for one battery to complete charging.
	Flashing	Short circuit or over-discharged battery is detected. Make sure contacts are clean and allow the battery to remain in the charger until rapid charging starts and completes.
Amber/green	Alternate flashing	Battery is discharging.

Replacing a Defective Handset

Step	**Procedure**

1   In the Wireless Manager tool bar, click

2   In the Configure Window menu bar, pull down the Select Database
     menu.

3   Click User Database.
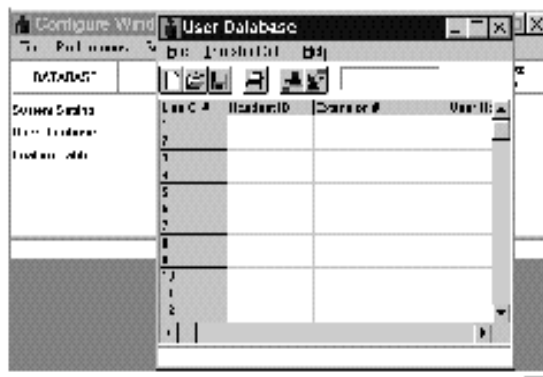
4   From the User Database toolbar, click Get.
     The current CTPhone Controller
     information displays.

5   Highlight the handset ID to be replaced and delete the ID.

6   From the User Database toolbar, click Send.
     CTPhone Wireless Manager prompts for
     confirmation.

7   Click OK. The new data is uploaded to the CTPhone Controller.

8   Input the original handset ID.

9   From the User Database toolbar, click Send.
     CTPhone Wireless Manager prompts for
     confirmation.

10   Click OK. The data is uploaded to the CTPhone Controller.

11   Go off-hook and press CALL
     The new ESN is locked into the CTPhone Controller.

Diagnostics and Troubleshooting

6

CTPhone 1900 System Specifications

System Specifications

Operating frequency band:	1920–1930 mHz sub-band FCC 15.323 Isochronous device
Maximum base stations:	32
Maximum number of cells	32
Maximum users per system:	1535
Maximum channels per base station:	8
Maximum handsets/system:	1535
Maximum simultaneous calls/system:	256
Typical indoor base station to handset distance:	30-70 meters (98-230 feet)
Maximum base station to handset distance:	1000-2000 meters (3280-6560 feet)
Typical coverage per base station:	31,416 square meters (338,036 square feet)
Maximum coverage per base station:	3,141,580 square meters (33,803,400 square feet)

CTPhone Controller Specifications

Input power:	-48 V DC, or 110/220V AC with optional power supply
Size (L x W x H):	42.77 cm x 23.6 cm x 4.45 cm (16.84" x 9.29" x 1.75")
Weight:	4.6 pounds (without Analog Line Modules)
Mounting:	Wall or industry-standard rack mount
Operating temperature:	10° to 40° C
Storage temperature:	-20° to 53° C
Operating humidity:	20 to 80 %, non-condensing
Storage humidity:	5 to 95%, non-condensing
Operating altitude:	1500 meters (4920 feet). Systems operating above 1500 meters in low humidity areas may require additional cooling.
Storage altitude:	-300 to 3000 meters (-940 to 9400 feet)

Base Station Specifications

Eight-Channel Base Station

Size (L x W x D):	33.5 cm x 33.5 cm x 6.3 cm (13.25" x 13.25" x 2.5")
Weight:	4 pounds, 11.5 ounces (2.2 kg)
Mounting:	Wall or ceiling, 4 screw holes
Color:	Standard Light Gray (RAL 7035)
Input power:	-48 V DC line power (from Controller) +5.2 V DC local power
Operating temperature:	0° to 40° C
Storage temperature:	-10° to 70° C
Peak transmission power:	80 milliwatts

Average transmission power: 40 milliwatts

Access method: FDMA/TDMA/TDD

Channels: 8 duplex, 1 control

Frequency: 1920–1930 MHz

Modulation technique: π/4 differential (QPSK)

Gross Bit Rate: 384 Kbs (QPSK)

Max. distance from Controller:
   Line power: 244 meters (800 feet), 24 AWG
     381 meters (1250 feet), 22 AWG
   Local power: 838 meters (2750 feet), 24 AWG
     1000 meters (3280 feet), 22 AWG

Cabling: Two twisted pair

Antennas: 4

Antenna gain: 4 dBi maximum, 3 dBi typical

Power consumption: 13.5 watts line power

Other characteristics: Line powered, local power option, voice encryption

Base Station Power Supply (Local Power Option Only)

Size (L x W x H):   12.7 cm x 7.62 cm x 5.715 cm (5" x 3" x 2.25")

Weight (without cable):   15.5 ounces (0.439 kg)

Style: Desktop

Cable: IEC 320, American three-prong

Input power: 115/230 V AC 0.6/0.3 A 50/60 Hz

Output power: 5.2 V DC@ 2.5 A Max 20 W

Operating temperature: 10° to 40° C

Storage temperature: 0° to 50° C

Four-Channel "Mini" Base Station

Size (L x W x D):	10.3" x 7.2" x 3.0"
Weight:	TBD
Mounting:	Wall or ceiling, 4 screw holes
Color:	Standard Light Gray (RAL 7035)
Input Power:	-48 V DC (10 - 20 watts) remote power +5 V DC (20 watts) local power
Operating temperature:	0° – 40° C
Storage temperature:	-10° – 70° C
Peak transmission power:	80 milliwatts
Average transmission power:	20 milliwatts
Access method:	FDMA/TDMA/TDD
Channels:	4 duplex, 1 control
Frequency:	1920 - 1930 MHz
Modulation technique:	$\pi/4$ differential (QPSK)
Gross Bit Rate:	384 Kbs (QPSK)

Max. distance from Controller:
  Line power:
 	
  Local power:
	
	2725 feet (830 meters), 24 AWG
	3280 feet (1000 meters), 22 AWG
	3280 feet (1000 meters), 24 AWG
	3280 feet (1000 meters), 22 AWG

Cabling:	Two twisted pair
Antennas:	4 internal 1 external (Fifth antenna option)
Antenna gain:	4 dBi maximum, 3 dBi typical
Power consumption:	8 watts, line powered
Other characteristics:	Line powered, local power option, voice encryption

Outdoor Base Station Enclosure

Size (L x W x D)	118.11 " x 96.46 " x 55.12 " (300 cm x 245 cm x 140 cm)
Temperature Range	-40° to 176° F (-40° to 80° C)

IP xy Rating (x=water proof characteristics) (y=dust proof characteristics)	IP 65
Material	Polyester with fiberglass
Fire resistance specification	VO (highly resistant)
Color	Standard Light Gray (RAL 7035)
UV ray resistance	Resistant
Weight	6 pounds 13.43 ounces (3.1 kg)

Handset Specifications

Handset

Size (L x W x D):	15.5 cm x 5.7 cm x 2.9 cm (6.125" x 2.25" x 1.125")
Weight:	8 ounces
Color:	Black
Operating temperature:	0° to 40° C
Storage temperature:	0° to 50° C (without battery) -10 to 70° C (with battery)
Peak transmission power:	80 milliwatts
Average transmission power:	5 milliwatts
Modulation technique:	$\pi/4$ differential (QPSK)
Antennas:	1 internal
Antenna gain:	3 dBi maximum, 2 dBi typical
Ringer: Variable ring types: Variable ring volumes:	8 3, plus mute (no ring)

Display features:
    Lines: 2
    Characters: 9
    Type: LCD
    Date/Time: 12-hour or 24-hour
    Icons: Off-hook, base station lock, signal strength, battery strength, ring volume, alphanumeric mode
    Other: System busy, call duration, low battery warning, current date/time, mute indication

Display features:	
Lines:	2
Characters:	9
Type:	LCD
Date/Time:	12-hour or 24-hour
Icons:	Off-hook, base station lock, signal strength, battery strength, ring volume, alphanumeric mode
Other:	System busy, call duration, low battery warning, current date/time, mute indication
Dialing mode:	Cellular (predial) and cordless (postdial)
Typical telephone features (dependent on office telephone system):	Call Back Call Forward Call Hold Call Wait (Camp-on) Conference Transfer
Feature options:	Redial, auto-answer
Speed dial features:	
Numbers supported:	70
Max. name length:	8
Max. number length:	32
Speed dial access:	Dial by name, scroll, dial by code
Other:	Programmable pause, programmable wait, available numbers display
Programmable features:	Ring type, ring volume, keypad beeper, auto-answer operation, display contrast, time format, idle message, CTPhone 1900 system access
Other features:	Internal antenna, multi-system use (up to 8), microphone mute, ringer mute, call volume control, feature key labels, tactile and tone feedback at key press, bit error rate test

Handset Battery

Size (L x W x D):	11.7 cm x 5.6 cm x 1.25 cm (4.6" x 2.25" x 0.5")
Weight:	5.25. ounces (0.148 kg)
Type:	Nickel Metal Hydride (NiMH)
Voltage:	3.6 V nominal

Current rating:	600 mA per hour
Operating temperature:	10° to 40° C
Storage temperature:	0° to 50° C
Talk time:	4 hours
Standby time:	40 hours

Handset Charger Specifications

Size (L x W x D):	4.4 cm x 9.5 cm x 12.5 cm (1.73" x 3.75" x 4.9")
Weight:	16 ounces (0.453 kg)
Capacity:	One handset and one battery simultaneously
Color:	Black
Mounting:	Desktop
Operating temperature:	10° to 40° C
Storage temperature:	-10° to 50° C
Input voltage (wall plug in transformer):	120 V/60 Hz 230 V/50 Hz
Output voltage:	9V 1A DC -15 + 10% output
Rapid charging current:	600 mA
Rapid charging time:	2 hours maximum

System Administration

System Administration:	CTPhone Manager (Windows™-based software program)

Diagnostics:	CTPhone handset bit error rate test
	Handset base station lock indicator
	Base station channel status report
	Analog line status report
	Base station channel disable
	Analog line disable
	Call status report
Indicators:	Alarm text
	Base station LEDs
	CTPhone Controller LEDs
	Handset charger LEDs (fast charge, slow charge, discharge)
	CTPhone handset signal strength indicator
Statistics:	Base station busy, all-channels-busy, and over-flow peg counts
	Base station busy and all-channels-busy usage
Security:	System registration of handsets

A
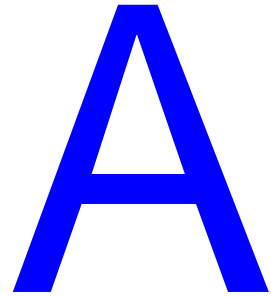
Regulatory Information (United States)

This appendix covers the following regulatory information for the CTPhone 1900 system.

- FCC Part 68

- FCC Part 15

- UL 1459

- UTAM

FCC Part 68

The CTPhone 1900 UPCS equipment complies with Part 68 of FCC rules. Product labels contain, among other information, the FCC registration number. You must provide this information to the telephone company if they request it.

Use the ringer equivalence number (REN) to determine the number of devices you can connect to the telephone line. Excessive RENs on the telephone line may result in devices not ringing in response to an incoming call. In most, but not all areas, the sum of the RENs should not exceed five (5). Contact the telephone company to determine the maximum REN for the calling area.

Table A-A lists the trunks available with the system with the associated FCC information:

Table A-A. Available Trunks and Associated FCC Information

Trunk	REN	Service Code	Facility Interface Code	USOC Jack
Loop Start	0.6B	N/A	02LS2	RJ11C/RJ21X

An FCC-compliant telephone cord and modular plug is provided with this equipment. This equipment is designed to be connected to the telephone network or premises wiring using a compatible modular jack which is Part 68 compliant.

If the CTPhone 1900 UPCS equipment causes harm to the telephone network, the telephone company will notify you in advance. If advance notice isn't practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the operation of the CTPhone 1900 UPCS. If this happens, the telephone company will provide advance notice in order for you to make the necessary modifications to maintain uninterrupted service.

If you experience trouble with the CTPhone 1900 UPCS equipment, please contact CTP Systems, Inc., 20300 Stevens Creek Blvd. Suite #465, Cupertino CA 95014. Phone number 1-408-777-2700 for repair and/or warranty information. If the trouble is causing harm to the telephone network, the telephone company may request that you remove the CTPhone 1900 UPCS equipment from the network until the problem is resolved. User repairs must not be made. Doing so voids the user's warranty.

Do not install the CTPhone 1900 UPCS equipment on public coin service provided by the telephone company. Connection to Party Line service is subject to state tariffs. (Contact your state public utilities commission for information.)

It is recommended that the customer install an AC surge arrestor in the AC surge arrestor in the AC outlet to which this device is connected. This is to avoid damaging the equipment caused by local lightning strikes and other electrical surges.

The CTPhone 1900 UPCS equipment is capable of providing users access to interstate providers of operator services through the use of equal access codes. Modifications by aggregators to alter these capabilities may be a violation of the telephone operator consumer services improvement act of 1990 and Part 68 of the FCC Rules.

FCC Part 15

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Changes or modifications not expressly approved by CTP Systems, Inc. can void the user's authority to operate the equipment.

The 25 pair cable used to connect the CTPhone Controller to an MDF/IDF must be shielded to meet FCC emissions limits under Part 15 Class A.

UL1459 Compliance

To ensure that installations are fully protected from fire hazards, Underwriters Laboratories specification UL1459 specifies primary and secondary protectors for circuits that interconnect to the telephone network, or for cables that exit/enter buildings. Locations for primary and secondary protectors are shown in Figure A-1.

Primary and Secondary Protectors

When using 66-50 connecting blocks for your MDF, CTP Systems recommends protector ITW Linx SCP-9 for secondary protection and out-of-building primary protection (see Figure A-1). Protector SCP-9 provides overvoltage protection of 600 VAC/DC and overcurrent protection of 350mA. It installs in series with the telephone loop.

Protectors may be used to replace bridging clips when installed across two horizontal 66 block terminals.

Line Circuit Requirements

Line circuits do not require protectors unless the circuit is cross-connected to out-of-building circuits. Out-of-building circuits require primary/secondary protectors. CTP Systems recommends ITW Linx's SCP-9, a single

block-mounted protector that provides both primary and secondary protection for out-of-building circuits.

Key

(A) = Primary Protection (Gas Discharge Tubes or
        equivalent and ITW Linx's SCP-9 or equivalent)

(B) = Bridge Clips

ONS = On-premise Equipment

OPS = Off-premise Equipment
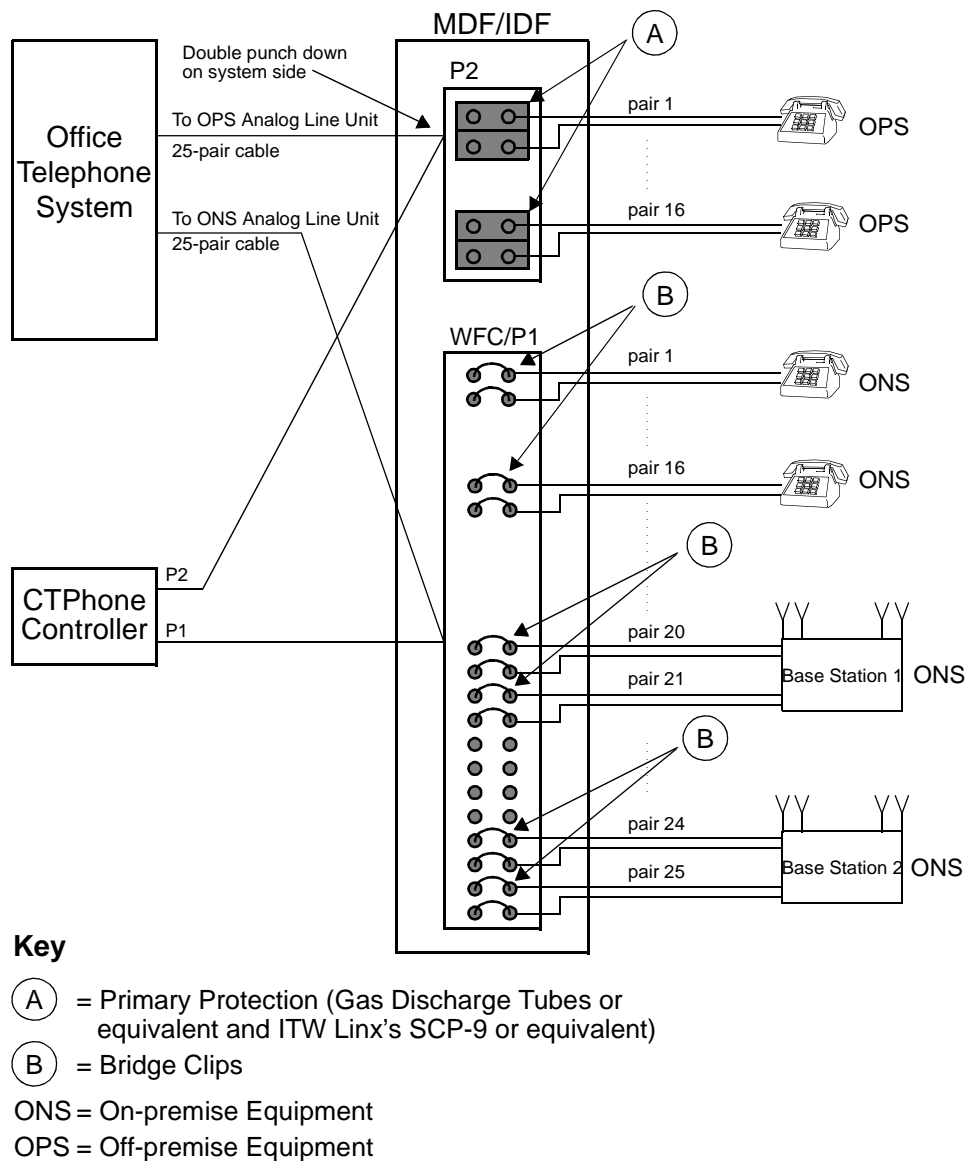
Figure A-1. Primary and Secondary Protectors

UTAM Requirements

The CTPhone 1900 system is also designed to operate under FCC Part 15 rules for Unlicensed Personal Communications Service (U-PCS) equipment in the 1920–1930MHz band. Because microwave services are currently also offered in this band, the FCC has designated UTAM, Inc. to coordinate the transition of microwave services to other frequency bands and manage the installation of new U-PCS equipment in the 1920–1930MHz band until all microwave users are cleared from the band.

The FCC has modified FCC Part 15 Rules and Regulations to include a description of UTAM's and manufacturers' responsibilities in the coordination and production of U-PCS equipment. Each device requesting FCC Part 15 certification to operate in the 1920–1930MHz band must have an affidavit from UTAM stating that the device meets the requirements of Rules 15.307(d), (e), and (h), regarding UTAM location verification and disablement.

The basic requirements that must be met are:

1   The CTPhone handset must cease transmitting when it is not within the coverage area of any system base stations.

2   A base station must not begin operation until it is confirmed to be in a UTAM coordinated area and it must be attached to a permanent structure such as a building so that it cannot be easily relocated.

3   If a U-PCS system is removed from its original installed location and reinstalled at another location, the system must not be able to begin operation until the new location is verified as a UTAM authorized area.

Meeting these FCC requirements requires an activation process after you install your system. This process is described in *Activating the CTPhone System (United States only)* on page 3-24.

Index

CTP Systems Ltd.