



Quick Installation Guide

DECT 6.0 8-Channel IP Cell Station Unit

Model No. **KX-NCP0158**

Thank you for purchasing a Panasonic DECT 6.0 8-Channel IP Cell Station Unit.
Please read this manual carefully before using this product and save this manual for future use.

Important Information

SAVE THESE INSTRUCTIONS

Safety Notices

Please observe the safety notices in this manual in order to avoid danger to users or other people, and prevent damage to property.

The notices are classified as follows, according to the severity of injury or damage:

| | |
|-----------------------|-----------------------------------------------------------------------------|
| <u>WARNING</u> | This notice means that misuse could result in death or serious injury. |
| <u>CAUTION</u> | This notice means that misuse could result in injury or damage to property. |

WARNING

SAFETY REQUIREMENTS

- The product must only be installed and serviced by qualified service personnel. The product should be used as-is from the time of purchase; it should not be disassembled or modified. Disassembly or modification can cause a fire, electric shock, or damage to the product.
- Make sure that the wall that the unit will be attached to is strong enough to support the unit (approx. 440 g [16 oz]). If not, it is necessary for the wall to be reinforced.
- Only use the wall-mounting equipment (screws, washers, wall mounting plate) included with the unit.
- When this unit is no longer in use, make sure to detach it from the wall.
- Do not connect or disconnect the AC plug with wet hands.
- Disconnect the unit from the AC outlet, disconnect the LAN cable, and contact the dealer if:
 - The AC adaptor cord, AC cord, AC plug, or DC extension cable (PQJA10200) becomes damaged or frayed.
 - The unit is exposed to rain, water, or any other liquid.
 - The unit is dropped or damaged.
 - Internal components are exposed due to damage.
 - The unit does not operate properly.
 - Performance deteriorates.
- Disconnect the unit from the AC adaptor/DC extension cable (PQJA10200), and LAN cable if the unit emits smoke, an abnormal smell, or makes unusual noise. These conditions can cause fire or electric shock. Confirm that smoke has stopped and contact an authorized service center.
- Clean the AC plug periodically with a soft, dry cloth to remove dust and other debris.
- Do not touch the unit, AC adaptor, AC adaptor cord, AC cord, or DC extension cable (PQJA10200) during a lightning storm.
- If using an AC adaptor, use only the optional AC adaptor KX-A421 (PSLP1662).
- Do not allow anything to rest on the AC adaptor cord, AC cord, DC extension cable (PQJA10200), or LAN cable. Do not locate this unit where the AC adaptor cord, AC cord, DC extension cable (PQJA10200), or LAN cable may be stepped on or tripped on.

CAUTION

SAFETY REQUIREMENTS

- The CS should be kept free of dust, moisture, high temperature (more than 40 °C [104 °F]), low temperature (less than 0 °C [32 °F]), and vibration, and should not be exposed to direct sunlight.
- The CS should not be placed outdoors (use indoors).

- The CS should not be placed near high-voltage equipment.
- The CS should not be placed on a metal object.
- The DC jack cover poses a choking hazard. Keep the DC jack cover out of reach of children.
- When driving the screws into the wall, be careful to avoid touching any metal laths, wire laths or metal plates in the wall.
- To prevent malfunction, deformity, overheating, rust, and discoloration, do not install or place equipment in the following types of locations:
 - Locations where air ventilation is poor.
 - Locations that may be exposed to sulphurous gas, such as near hot springs.
 - Near devices that emit heat, such as heaters.
 - Near devices that emit electromagnetic noise, such as radios or televisions.
 - Near devices that emit high-frequency noise, such as sewing machines or welders.
- Do not stretch or bend the cables. Also, do not allow anything to rest on the cables.
- Use cables that are fire-resistant or fireproof.
- The CS and the cables should never be placed near or over a radiator or other heat source.
- Do not bundle cables that are connected to the CS with the AC power cords of machines located nearby.
- Make sure the cables are securely fastened to the wall.
- The AC adaptor is used as the main disconnect device. Ensure that the AC adaptor is located near the unit and is easily accessible.
- Disconnect the AC adaptor cord and all cables from the unit before cleaning. Clean the unit with a soft, dry cloth. Do not use liquid, aerosol cleaners, abrasive powders, or chemical agents to clean the unit.
- When left unused for a long period of time, disconnect the unit from the AC outlet. When the unit receives power from a PoE power supply, disconnect the LAN cable.
- **Medical**—consult the manufacturer of any personal medical devices, such as pacemakers, to determine if they are adequately shielded from external RF (radio frequency) energy. (The unit operates in the frequency range of 1920 MHz to 1930 MHz, and the output peak power level is less than 0.12 W.) Do not use the unit in health care facilities if any regulations posted in the area instruct you not to do so. Hospitals or health care facilities may be using equipment that could be sensitive to external RF (radio frequency) energy.

SECURITY REQUIREMENTS

Preventing Data Disclosure Over the Network

- To ensure the security of private conversations, only connect the unit to a secure network.
- To prevent unauthorized access, only connect the unit to a network that is properly managed.
- Make sure all personal computers that are connected to the unit employ up-to-date security measures.

Notice

SAFETY REQUIREMENTS

- Before connecting the unit, confirm that the unit supports the intended operating environment.
- If the unit does not operate properly, disconnect the AC adaptor cord and LAN cable, then connect again.
- The unit may not operate in the event of a power failure.
- Do not move the unit while it is in use.
- Satisfactory operation, interoperability, and compatibility cannot be guaranteed with all equipment connected to the unit, nor with all services provided by telecommunications providers over networks connected to the unit.

SECURITY REQUIREMENTS

- Privacy of communications may not be ensured when using the wireless systems.
- Keep a copy of all important data (such as your network information) before sending the machine for repair.

Important Information

- This product can store your private/confidential information. To protect your privacy/confidentiality, we recommend that you initialize the product to erase all user data and restore the factory default settings before you dispose, transfer or return the product.

Additional Information

F.C.C. REQUIREMENTS AND RELEVANT INFORMATION

CAUTION

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this device.

Note

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the distance between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Some wireless telephones operate at frequencies that may cause interference to nearby TVs and VCRs. To minimize or prevent such interference, the base of the wireless telephone should not be placed near or on top of a TV or VCR. If interference is experienced, move the wireless telephone further away from the TV or VCR. This will often reduce, or eliminate, interference.

RF Exposure Warning:

This product complies with FCC radiation exposure limits set forth for an uncontrolled environment. To comply with FCC RF exposure requirements, this product must be installed and operated in accordance with the provided instructions. The installed unit requires a minimum 20 cm (8 inches) of spacing between the antenna and a person's body (excluding hands, wrists and feet) during wireless modes of operation.

This transmitter must not be co-located or operated in conjunction with any other antennas or transmitters.

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1 Overview

System Overview

The IP Cell Station Unit (IP-CS) can be connected to a PBX via a LAN. The IP-CS supports existing DECT 6.0 Portable Stations (PSs) with the same features as using a traditional CS. The IP-CS allows for easy and cost-saving installation using an existing IP network infrastructure.

The IP-CS provides the following:

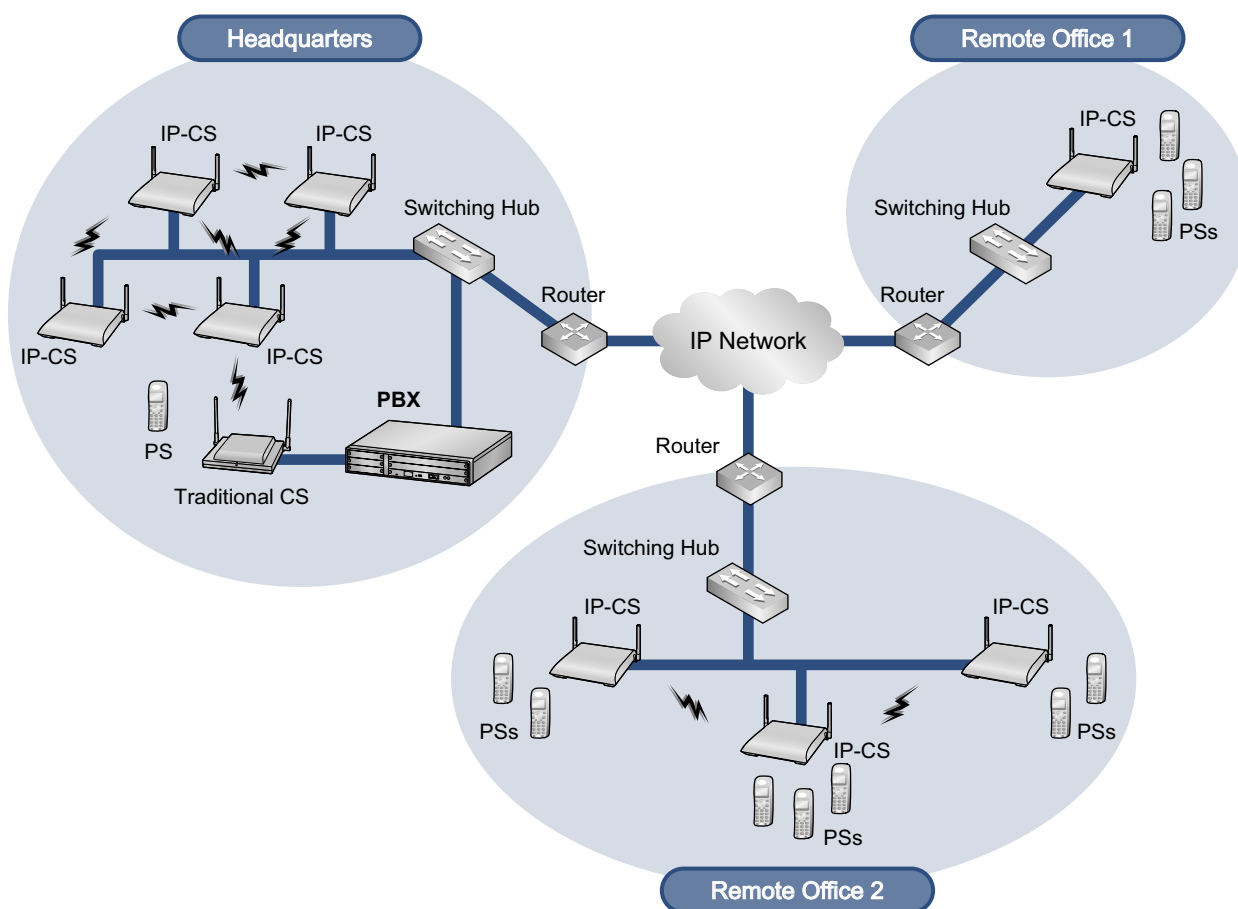
- Wireless systems using a converged voice and data network infrastructure.
- Wireless branch offices and wireless solutions by long distance installation on larger premises.
- Reliable wireless communication using DECT 6.0 technology over an IP network.

Note

In this manual, the illustrations of the PBX and screen shots of the Maintenance Console are based on the KX-NCP500.

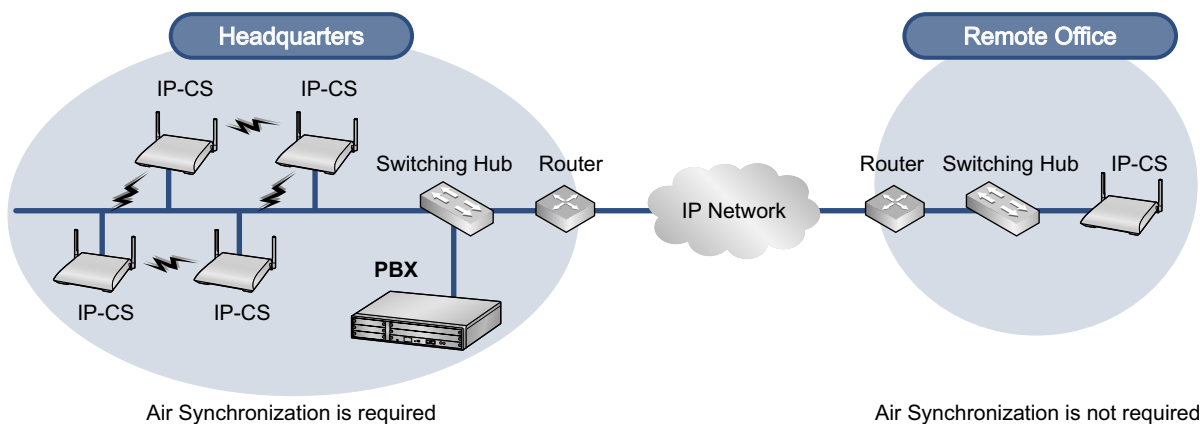
The following is an example of IP-CS installation using an IP network.

⚡ : Handover is working.



Air Synchronization

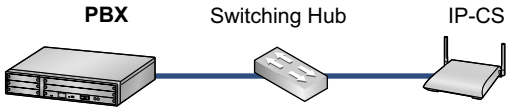
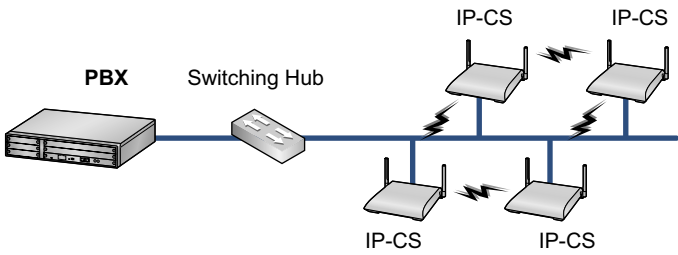
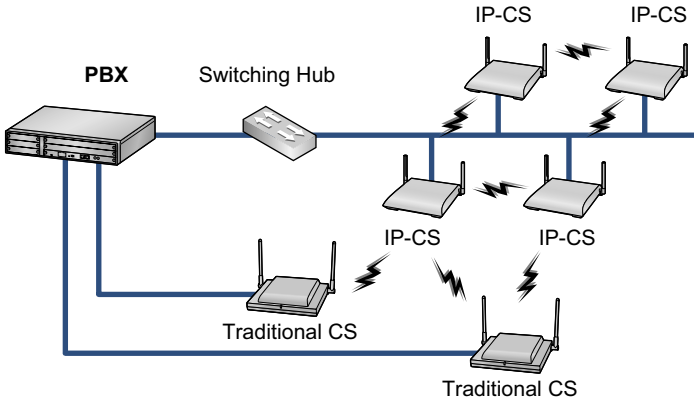
It is necessary to establish synchronization for stable operation and handover between IP-CSs and other CSs. As a method of synchronization, air synchronization is used.



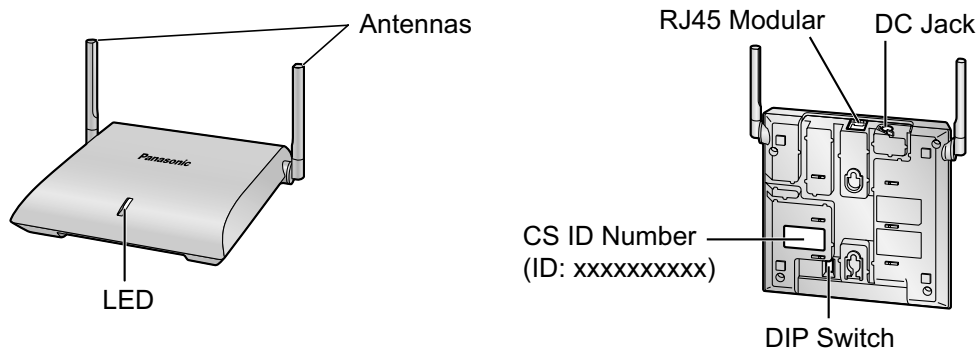
CSs are classified into one of the following three classifications for implementing air synchronization:

| CS Class | Description |
|-------------------------------------------|----------------------------------------------------------------------------------------------------|
| Master CS1 (synchronization source clock) | Generates clock signal. |
| Master CS2 (backup for Master CS1) | Receives clock signal from Master CS1 (can also generate clock signal if Master CS1 malfunctions). |
| Slave CS | Receives clock signal from other CSs. |

System Connection Examples

| Connection Example | Characteristics |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Using one IP-CS only When installing only one IP-CS at a remote office.</p>  <p>The diagram shows a PBX (Private Branch Exchange) connected via a line to a Switching Hub. The Switching Hub is then connected to a single IP-CS (IP-Cordless System) unit.</p> | <ul style="list-style-type: none"> No need to conduct site planning and site survey for air synchronization. |
| <p>Using multiple IP-CSs When creating a new wireless network.</p>  <p>The diagram shows a PBX connected via a line to a Switching Hub. The Switching Hub is then connected to a network of multiple IP-CS units. The units are connected to each other via a mesh network, indicated by double-headed arrows between them.</p> | <ul style="list-style-type: none"> Need to conduct site planning and site survey for air synchronization. |
| <p>Using multiple IP-CSs and traditional CSs When adding IP-CSs to an existing wireless network.</p>  <p>The diagram shows a PBX connected via a line to a Switching Hub. The Switching Hub is then connected to a network of multiple IP-CS units and two Traditional CS (Cordless System) units. The IP-CS units are connected to each other via a mesh network, indicated by double-headed arrows. The Traditional CS units are connected to the network via a separate line from the PBX.</p> | <ul style="list-style-type: none"> Need to conduct site planning and site survey for air synchronization. Need to update the software version of traditional CSs to 5.000 or later. |

Names and Locations



Unpacking

Unpack the box and check the items below:

| | |
|---------------------|---|
| Cell Station | 1 |
| Wall Mounting Plate | 1 |
| Screws | 2 |
| Washers | 2 |

LED Indications

| Indication | Color | Description |
|------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| STATUS | Green/Red/ Amber | <p>CS status indication</p> <ul style="list-style-type: none"> • OFF: Power Off/CS Software downloading • Green ON: Stand-by (no active calls) • Slow Green Flashing: Talk (active calls) • Moderate Green Flashing: Busy^{*1} • Red ON: Fault • Slow Red Flashing: Out of Service/Starting up (data link establishment → air synchronization) • Moderate Red Flashing: Starting up (power on → data link establishment) • Amber ON: Stand-by (unstable synchronization [no active calls]) • Slow Amber Flashing: Talk (unstable synchronization [active calls]) • Moderate Amber Flashing: Busy^{*1} (unstable synchronization) <p>CS status indication during the site survey</p> <ul style="list-style-type: none"> • Moderate Red Flashing: Starting up • Amber ON: Radio signal is being transmitted. • Slow Amber Flashing: Radio signal is interrupted. <p>CS status indication while restarting the CS</p> <ul style="list-style-type: none"> • Moderate Red Flashing: The CS is restarting. <p>Note</p> <p>LED flashing patterns are as follows:</p> <ul style="list-style-type: none"> • Slow Flashing: 60 times per minute • Moderate Flashing: 120 times per minute |

^{*1} All 8 channels are occupied.

Compatible PBX

| Cell Station | PBX | |
|--------------|------------|---------------------------------------------|
| | Model No. | MPR Software Version |
| KX-NCP0158 | KX-NCP500 | PBMPR Software File Version 2.0200 or later |
| | KX-NCP1000 | |
| | KX-TDE100 | PMMPR Software File Version 3.0000 or later |
| | KX-TDE200 | |
| | KX-TDE600 | PGMPR Software File Version 3.0000 or later |

Maximum Number of Calls

| Cell Station | Maximum Calls | Compatible Portable Station |
|--------------|---------------|---------------------------------------------------------------------------------------------------|
| KX-NCP0158 | 8 | <ul style="list-style-type: none"> KX-TD7685 KX-TD7695 KX-TD7696 |

Note

For more details about the Portable Station (PS), refer to the Operating Instructions of the PS.

Maximum Number of CSs Supported by PBX

Notice

The CSs are for connection to specified Panasonic PBXs only.
The following number of CSs can be supported by each PBX.

| PBX | Connected via | Maximum Number |
|-------------------------------|---------------|----------------|
| | | KX-NCP0158 |
| KX-NCP500/KX-NCP1000 | LAN | 8 |
| KX-TDE100/KX-TDE200/KX-TDE600 | | 16 |

Required Distances between Equipment

CAUTION

Maintain the distances listed below between equipment in order to prevent noise, interference or the disconnection of a conversation. (The distance may vary depending on the environment.)

| Equipment | Distance |
|----------------------------------------------------------------------|-----------------------------|
| CS and office equipment such as a computer, telex, fax machine, etc. | More than 2 m (6 ft 7 in) |
| CS and PS | More than 1 m (3 ft 3 in) |
| Each CS | More than 3 m (10 ft) |
| Each PS | More than 0.5 m (1 ft 8 in) |
| PBX and CS | More than 2 m (6 ft 7 in) |

Notice

If multiple CSs cover the same area, the phone connection may become noisy or the number of possible simultaneous calls with PSs may decrease due to interference between the CSs. For details, refer to "5 Site Survey Using the KX-TD7685/KX-TD7695/KX-TD7696—Testing the Radio Signal Strength". The required distance between CSs may vary depending on the environment of the installation site and conditions in which the wireless system is used. Conduct a site survey to determine the appropriate distance.

RF Specification

| Item | Description |
|---------------------------|--------------------------------------------------------|
| Radio Access Method | MultiCarrier TDMA-TDD |
| Frequency Band | 1920 MHz to 1930 MHz |
| Number of Carriers | 5 |
| Carrier Spacing | 1728 kHz |
| Bit Rate | 1152 kbps |
| Carrier Multiplex | TDMA, 24 (Tx12, Rx12) slots per frame |
| Frame Length | 10 ms |
| Modulation Scheme | GFSK |
| | Roll-off factor=0.5 50 % roll-off in the transmitter |
| Data Coding for Modulator | Differential Coding |
| Voice Codec | 32 kbps ADPCM (CCITT G.726) |

CAUTION

- The CS should be kept free of dust, moisture, high temperature (more than 40 °C [104 °F]), low temperature (less than 0 °C [32 °F]), and vibration, and should not be exposed to direct sunlight.
- The CS should not be placed outdoors (use indoors).
- The CS should not be placed near high-voltage equipment.
- The CS should not be placed on a metal object.

2 Procedure Overview

When connecting the wireless system, use extreme care in conducting the site survey. Site surveys can be conducted using the KX-TD7685/KX-TD7695/KX-TD7696 PS. An incorrectly performed site survey can result in poor service area, frequent noise, disconnection of calls, and synchronization failure for CSs.

Notice

- When installing the DECT 6.0 wireless system in an area where another wireless system (2.4 GHz) is already installed, it is necessary to reconduct the site survey to find the optimum position for the CS. If you install the new CS in the same position as the old CS, it may result in a poor service area, frequent noise, and disconnection of calls.
- In this case, it is necessary to perform system initialization. For details about the system initialization procedure, refer to "Starting the PBX" in the Installation Manual for your PBX.

1. Investigate the installation site

Refer to "3 Site Planning".

- Obtain a map of the CS installation site.
- Identify the service area required by the user on the map.
- Plan the location of each CS, taking account of distance, building materials, etc.

2. Prepare for site survey

Refer to "4 Before Site Survey".

- Check and assign the CS ID number to the PS.
- Assign a channel number to each CS by setting the DIP switches on the back of the CS.
- Supply electricity to each CS using an AC adaptor or by connecting them to a PoE hub/PoE adaptor.
- Install each CS temporarily as planned.

Note

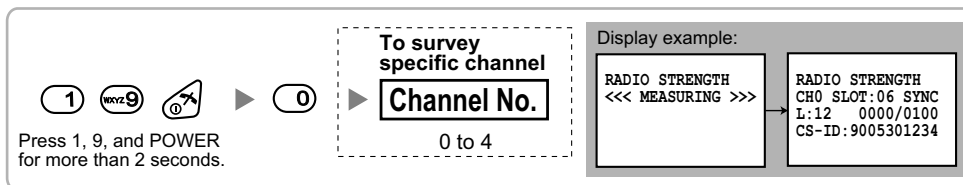
- Install at least 2 m (6 ft 7 in) above the floor.
- Place the antennas so that they are pointing in directions that are 90 degrees apart (for antenna diversity).

3. Conduct the site survey

Refer to "5 Site Survey Using the KX-TD7685/KX-TD7695/KX-TD7696".

- Test the radio signal strength using the PS.
Confirm that the radio signal strength level is "12" near the CS.

Using the KX-TD7685/KX-TD7695/KX-TD7696



- By walking away from the CS with the PS, check the radio signal strength. The radio signal strength weakens as you walk away from the CS.
- Map the CS coverage area at radio signal strength levels "03" and "07".

- d. Plan the location of the CS so that its clock signal source is within range of the CS where the radio signal strength level is "07".
- e. Make sure that the radio signal strength level is greater than "03" at any location within the service area required by the user.

4. Finish the site survey

Refer to "6 After Site Survey".

- a. Turn off the PS.
- b. Stop supplying power, and return all DIP switches of each CS to the OFF position.

5. Connect the CS to the PBX

Refer to "7 Connecting IP Cell Stations".

- a. Assign IP address information to the CS using the IP Terminal Maintenance Console.
- b. Connect the CS to the PBX over a LAN.

6. Register the CS to the PBX

Refer to "8 Registering IP Cell Stations".

- a. Register the CS to the PBX using the Maintenance Console.
- b. Assign the Master CSs and set the synchronizing CS search order using the Maintenance Console.

7. Confirm the status of Air Synchronization for the CS

Refer to "9 Confirming the Status of Air Synchronization for IP Cell Stations".

- a. Check the status of air synchronization for the CS using the Maintenance Console.
- b. If the monitoring results are not satisfactory, relocate the CS or change the CS that it is currently synchronized with to another CS using the Maintenance Console.

8. Connect the PS to the PBX and test the operation

Refer to "10 Registering Portable Stations".

- a. Register the PSs to the PBX.
- b. Walk around the service area while having a conversation using a registered PS. If noise is frequent or conversations disconnect, relocate the CSs or install an additional CS.

9. Mount the CS on the wall

Refer to "11 Wall Mounting".

- a. If there are no problems in testing, mount the CS on the wall.

3 Site Planning

Choosing the best site for the CS requires careful planning and testing of essential areas. The best location may not always be convenient for installation. Read the following information before installing the unit.

Understanding Radio Waves

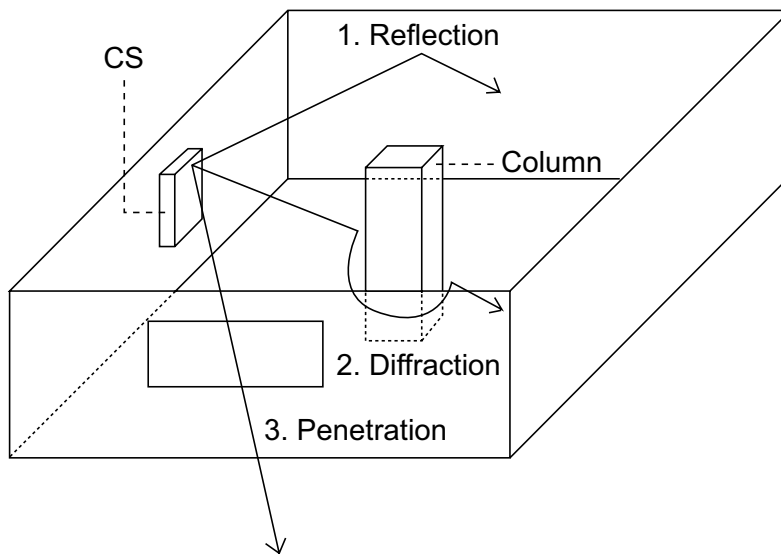
Characteristics of Radio Waves

The transmission of radio waves and the CS coverage area depend on the structure and materials of the building.

Office equipment, such as computers and fax machines, can interfere with radio waves. Such equipment may create noise or interfere with the performance of the PS.

The illustration below shows the special transmitting patterns of radio waves.

1. Radio waves are reflected by objects made of materials such as metal.
2. Radio waves are diffracted by objects such as metallic columns.
3. Radio waves penetrate objects made of materials such as glass.



Relationships Between Radio Waves and Building Structure and Materials

- The CS coverage area is affected more by the building materials and their thickness than the number of obstacles.
- Radio waves tend to be reflected or diffracted by conductive objects and rarely penetrate them.
- Radio waves tend to penetrate insulated objects and are rarely reflected by them.
- Radio waves penetrate thin objects more than thick objects.
- The table below shows the transmission tendency of radio waves when they reach objects made from various materials.

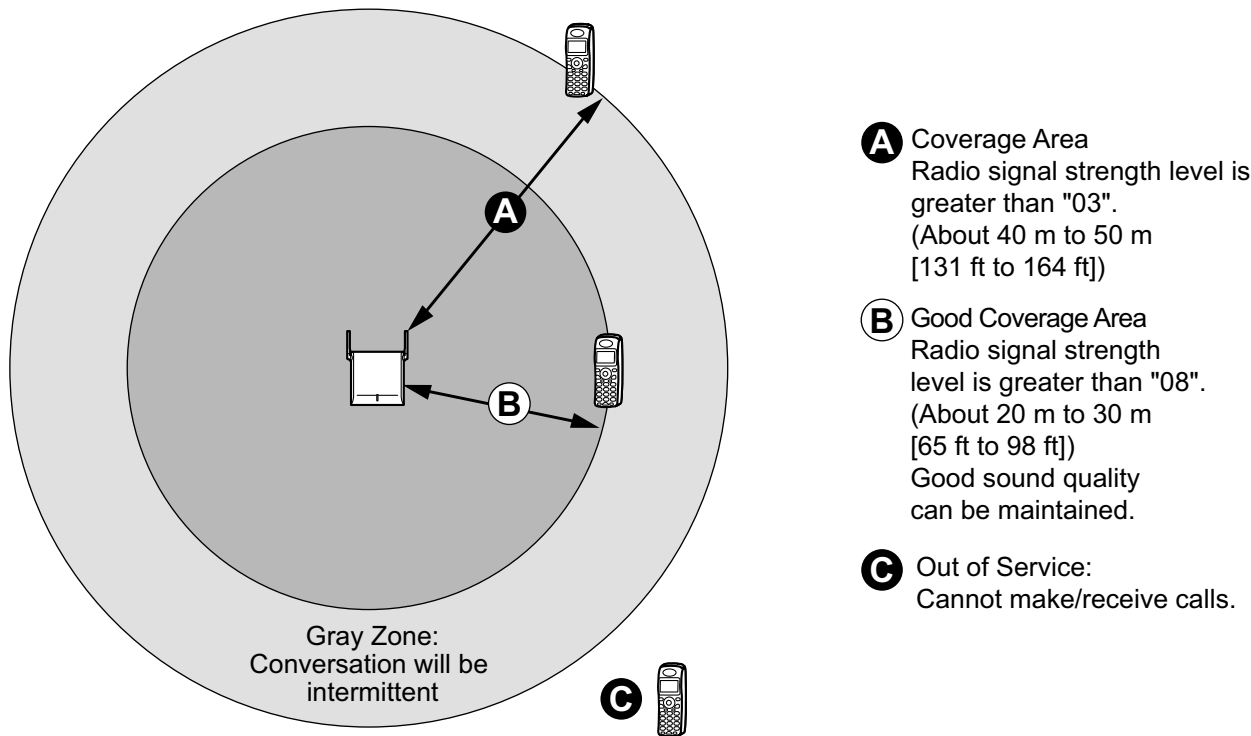
| Object | Material | Transmission Tendency |
|-----------|----------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| Wall | Concrete | The thicker they are, the less radio waves penetrate them. |
| | Ferroconcrete | Radio waves can penetrate them, but the more iron there is, the more radio waves are reflected. |
| Window | Glass | Radio waves usually penetrate them. |
| | Glass with wire net | Radio waves can penetrate them, but tend to be reflected. |
| | Glass covered with heat-resistant film | Radio waves are weakened considerably when they penetrate windows. |
| Floor | Ferroconcrete | Radio waves can penetrate them, but the more iron there is, the more radio waves are reflected. |
| Partition | Steel | Radio waves are reflected and rarely penetrate them. |
| | Plywood, Glass | Radio waves usually penetrate them. |
| Column | Ferroconcrete | Radio waves can penetrate them, but the more iron there is, the more radio waves tend to be reflected or diffracted. |
| | Metal | Radio waves tend to be reflected or diffracted. |
| Cabinet | Steel | Radio waves are usually reflected or diffracted, and rarely penetrate them. |
| | Wood | Radio waves can penetrate them, but they are weakened. |

CS Coverage Area for Establishing Conversations Using PSs

The example below shows the size of the area where one CS can cover PSs, if it is installed in an area with no obstacles.

Note

Radio signal strength levels are measured during the site survey (refer to "5 Site Survey Using the KX-TD7685/KX-TD7695/KX-TD7696").



Radio Signal Strength Levels

| | | |
|-----------------|---|--------------------------------------|
| Level: 11 to 12 | ↑ | Better |
| Level: 08 to 10 | | Good |
| Level: 03 to 07 | | May receive noise |
| Level: 01 to 02 | ↓ | Receives noise easily or disconnects |
| Level: 00 | | Out of range |

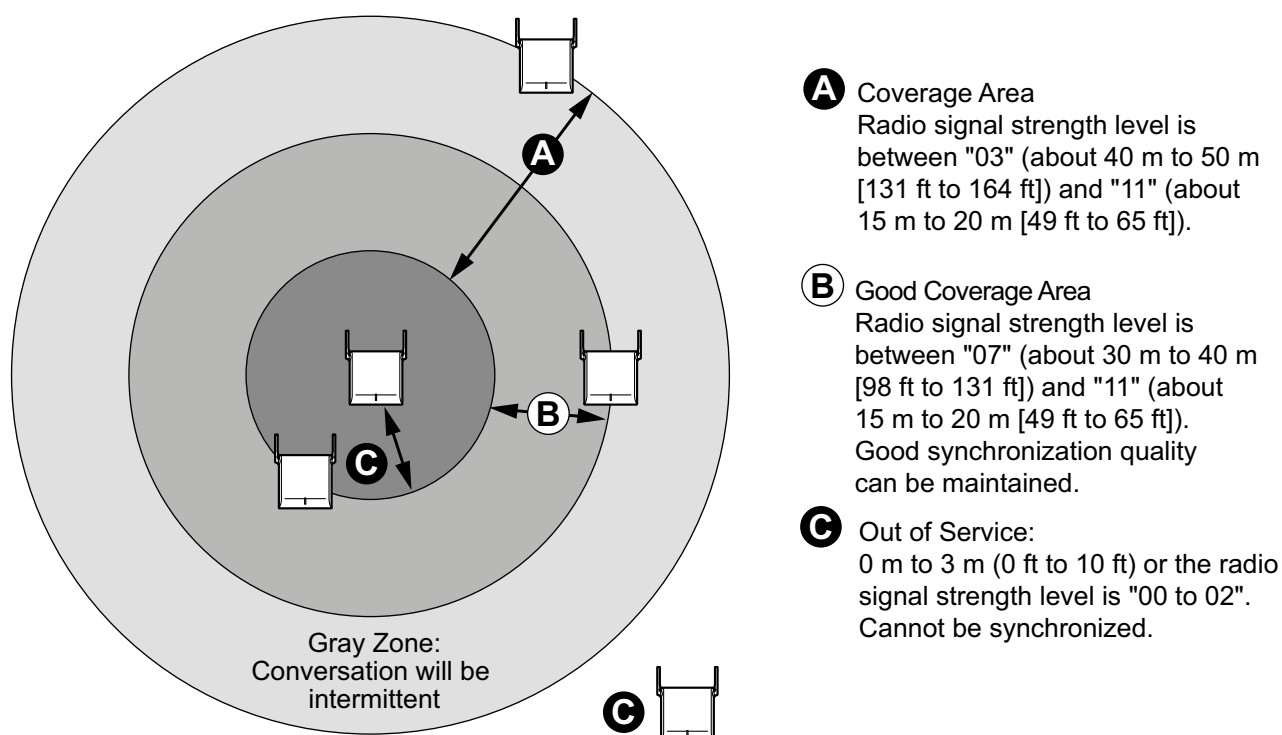
Implementing Air Synchronization

CS Coverage Area for Air Synchronization between CSs

The example below shows the size of the area where one CS can synchronize with other CSs, if it is installed in an area with no obstacles.

Note

Radio signal strength levels are measured during the site survey (refer to "5 Site Survey Using the KX-TD7685/KX-TD7695/KX-TD7696").



Radio Signal Strength Levels

| | |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Level: 12 | Up to 2 CSs: Good More than 2 CSs: May be reset due to synchronization failure of CSs |
| Level: 09 to 11 | Good |
| Level: 08 | Better |
| Level: 07 | Good |
| Level: 03 to 06 | Air synchronization is established. However, it is necessary to monitor the status of synchronization using the Maintenance Console. This is necessary because IP-CSs may be reset due to synchronization failure if the radio signal strength fluctuates depending on changes in the installation environment such as opening/closing doors. |
| Level: 00 to 02 | May be reset due to synchronization failure of CSs |

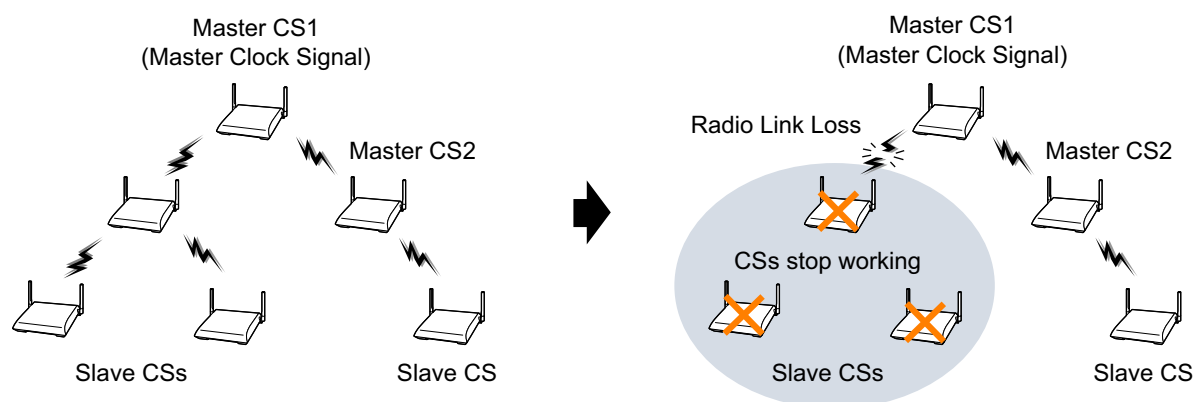
CS Classifications

CSs are assigned to any one of the following three classifications for implementing air synchronization:

| CS Class | Description |
|-------------------------------------------|----------------------------------------------------------------------------------------------------|
| Master CS1 (synchronization source clock) | Generates clock signal. |
| Master CS2 (backup for Master CS1) | Receives clock signal from Master CS1 (can also generate clock signal if Master CS1 malfunctions). |
| Slave CS | Receives clock signal from other CSs. |

Synchronization Hierarchy

Air synchronization has a hierarchical structure with a Master CS1 at the top. Therefore, it is necessary to conduct the site survey with extreme care to ensure stable synchronization since one disruption of the radio link could loss of service to a wide area.



Search Order (Primary/Secondary)

The search order used for synchronizing CSs must be set. If the CS cannot synchronize with the Primary CS for some reason, it will try to synchronize with the Secondary CS.

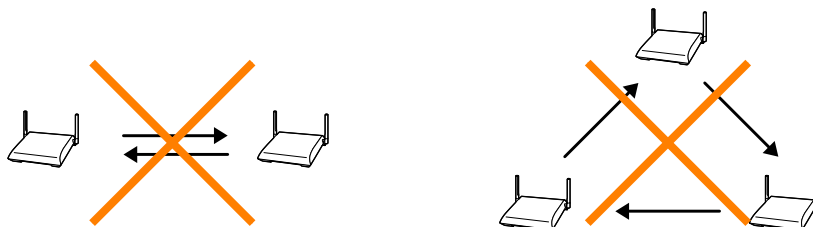
| CS Class | Primary CS | Secondary CS |
|------------|-------------------------------------|-------------------------------------------|
| Master CS1 | None | None |
| Master CS2 | Master CS1 | None |
| Slave CS | Master CS1, Master CS2, or Slave CS | Master CS1, Master CS2, Slave CS, or None |

For example, if synchronization is completely lost by malfunction of the Master CS etc., handover will not work and ongoing calls will be disconnected after a while. In addition, new calls cannot be made or received. Therefore, it is recommended to not only assign the Primary CS but also the Secondary CS as an alternative source for synchronizing CSs.

Conditions for Configuring the Air Synchronization

- Master CS2 must be within range of Master CS1.
- It is recommended that Master CSs be placed in the middle of the installation site.
- Both a Primary CS and Secondary CS should be assigned to Slave CSs.
- When using only two IP-CSs on the network (only two IP-CSs are connected to the PBX), make sure that you do not create a Master CS2.
- All traditional CSs are automatically assigned and fixed as Master CS1.
- When using IP-CSs and traditional CSs in the same area, make sure that you do not create a Master CS2.
- When synchronizing CSs, do not create loops as in the examples below:

[Examples]



- It is recommended that the number of levels in the synchronization hierarchy is minimized for stable air synchronization. The maximum number of levels is 4.

Note

For your convenience, IP-CSs are automatically classified according to the order of their registration to the PBX. Therefore, it is recommended to register the CS that you want to assign to Master CS1 first. For example, when using IP-CSs and traditional CSs in the same area, connect the traditional CSs to the PBX first.

Notice about Mutual Interference of Radio Waves

Mutual interference of radio waves may occur under the following conditions. This could lead to loss of air synchronization.

[Installation Environment]

As shown in the diagram below,

- CS **B** is synchronized with CS **A**.
- CS **C** is outside the area where the radio signal strength level of CS **A** is "03".
- CS **B** is within the area where the radio signal strength level of CS **C** is "03".

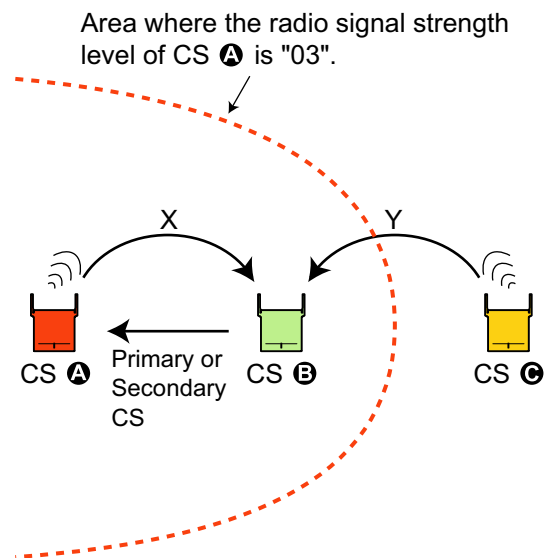
[Conditions]

X = radio signal strength level of CS **A**, Y = radio signal strength level of CS **C**

- Y is greater than X.
- X and Y are nearly equal.

[Result]

CS **B** loses air synchronization since the radio waves of CS **C** interfere with the radio waves of CS **A** received by CS **B**.

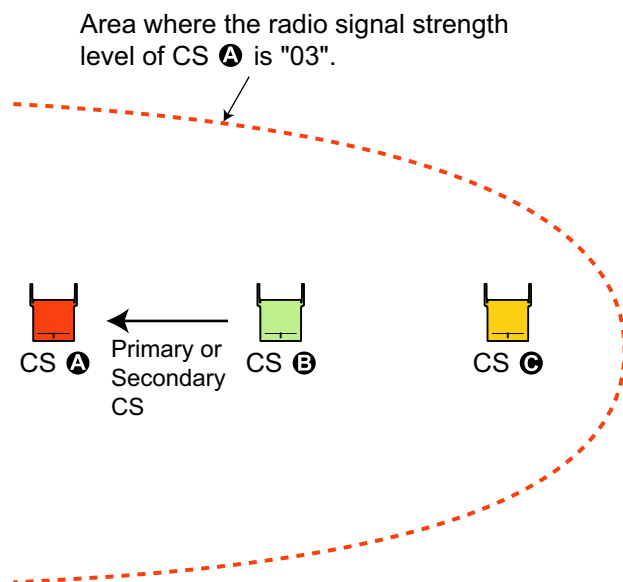


Solution

Move CS **C** to within the area where the radio signal strength level of CS **A** is "03".

[Result]

Radio wave interference will not occur since CS **A** and CS **C** will monitor each other's radio waves.



When Installing Additional CSs

Ensure that the following conditions are met when installing additional CSs.

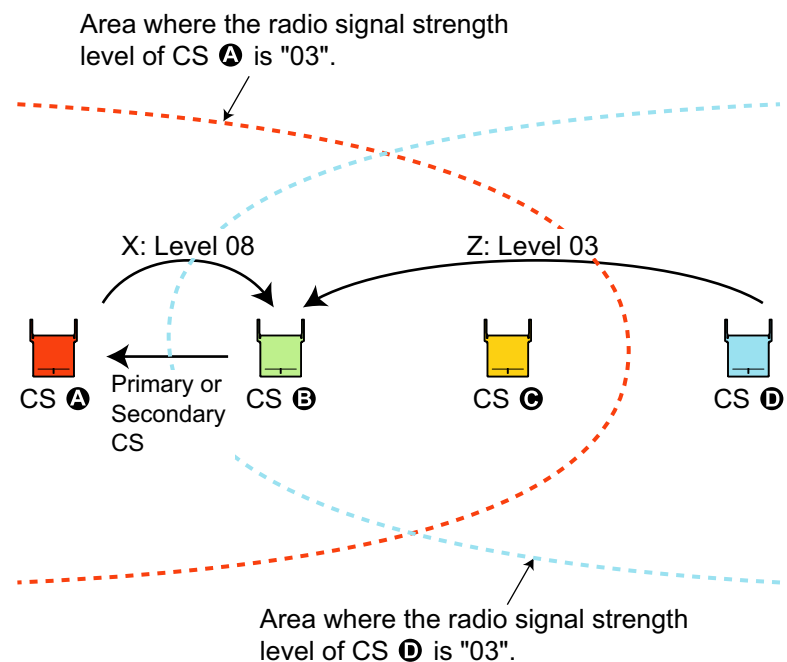
- Locate CS **B** within the area where the radio signal strength level of CS **A** is "08".
- Locate CS **B** within the area where the radio signal strength level of CS **D** is "03".

[Result]

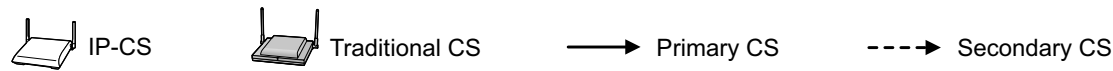
X = radio signal strength level of CS **A**, Z = radio signal strength level of CS **D**.

- X is much greater than Z.

The radio waves of CS **D** are not a source of interference since the radio waves that CS **B** receives from CS **A** are stronger than those received from CS **D**.

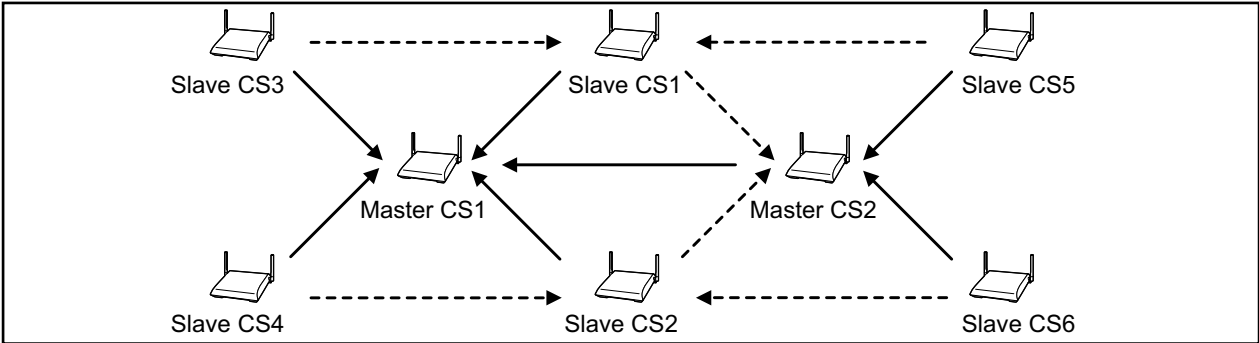


Recommended Configuration

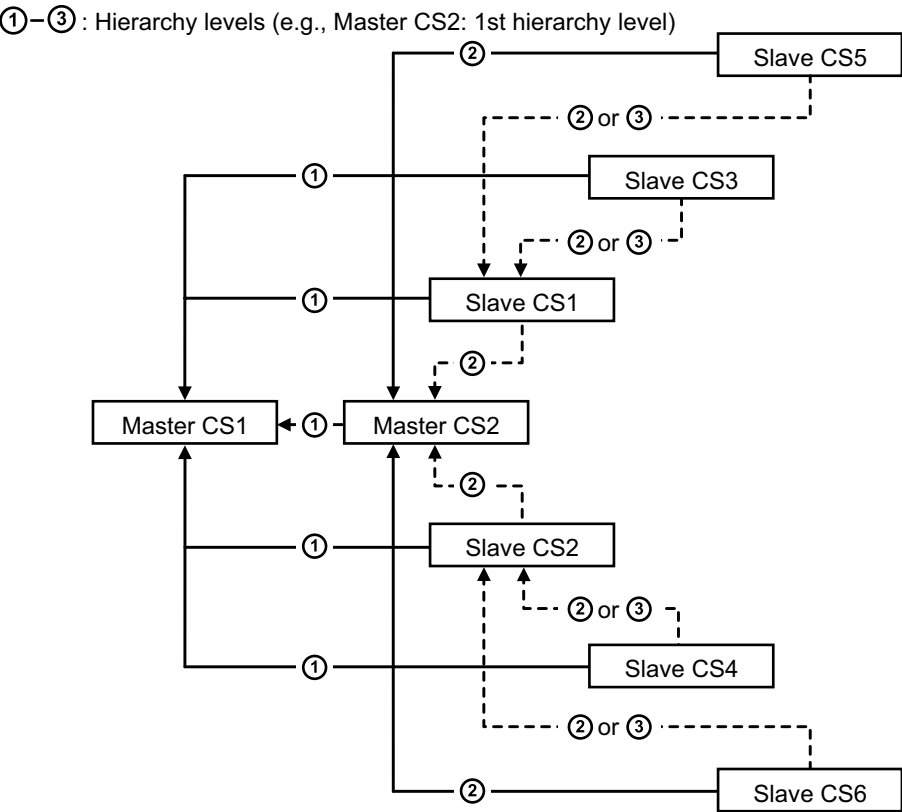


[Configuration Example 1]

Diagram



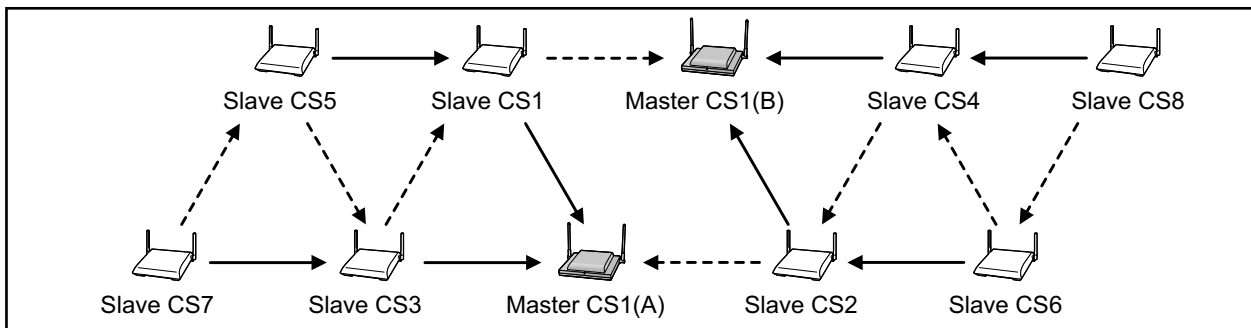
Air Synchronization Tree



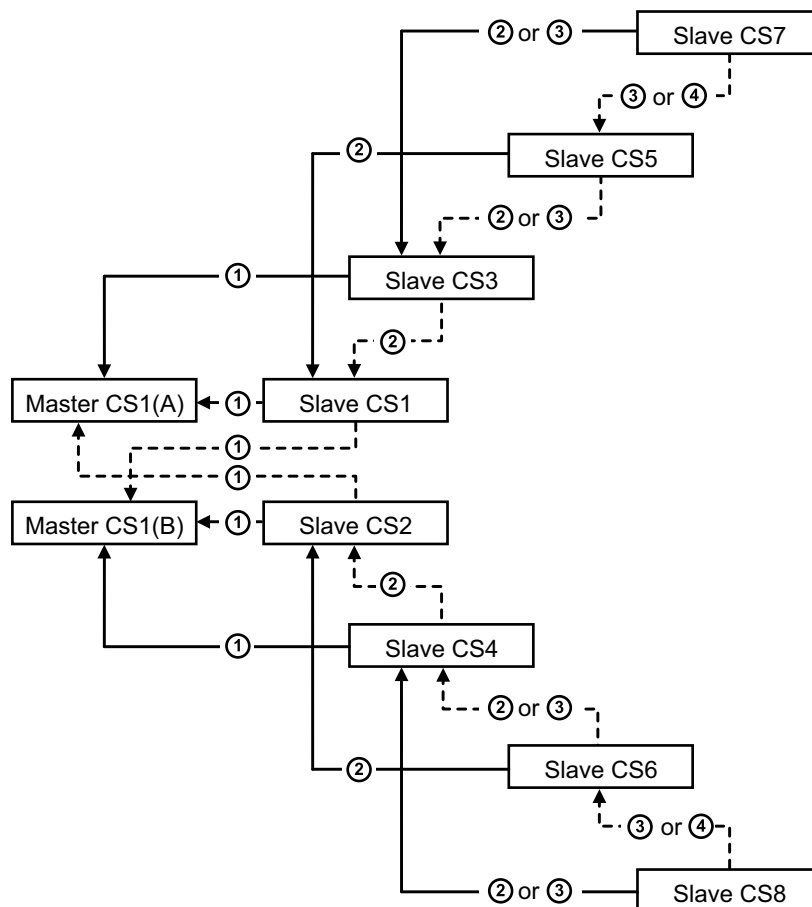
Note

Ensure that the Slave CSs in the first column are located within the area where the radio signal strength level of the respective CSs in the second column is "03".

| | |
|-------------------------|------------|
| Slave CS3 and Slave CS4 | Master CS2 |
| Slave CS5 and Slave CS6 | Master CS1 |

[Configuration Example 2]**Diagram****Air Synchronization Tree**

①—④ : Hierarchy levels (e.g., Slave CS1: 1st hierarchy level)

**Note**

Ensure that the Slave CSs in the first column are located within the area where the radio signal strength level of the respective CSs in the second column is "03".

| | |
|-----------|---------------|
| Slave CS3 | Master CS1(B) |
| Slave CS4 | Master CS1(A) |

| | |
|-----------|--------------------------------------|
| Slave CS5 | both Master CS1(A) and Master CS1(B) |
| Slave CS6 | both Master CS1(A) and Master CS1(B) |
| Slave CS7 | both Master CS1(A) and Slave CS1 |
| Slave CS8 | both Master CS1(B) and Slave CS2 |

Site Survey Preparation

1. Obtain a map and investigate the installation site.
 - a. Check the obstacles (e.g., shelves, columns, and partitions).
 - b. Check the materials of the structures (e.g., metal, concrete, and plywood).
 - c. Check the layout and dimensions of the room, corridor, etc.
 - d. Write down the above information on the map.
2. Examine the service area required by the user on the map.
 - a. Examine the coverage area for air synchronization.
 Draw the coverage area around a CS. Extend the coverage area 20 m to 40 m (65 ft to 131 ft) in each direction, depending on the materials of the building structures and obstacles in the installation site.
 Note that a CS cannot be installed outside a building.
 - b. Examine the coverage area for establishing conversations using PSs.
 Draw the coverage area around a CS. Extend the coverage area 20 m to 50 m (65 ft to 164 ft) in each direction, depending on the materials of the building structures and obstacles in the installation site.
 - c. If one CS cannot cover the entire service area, install additional CSs as required. Overlap the coverage areas of adjacent CSs.
 Where CS coverage areas overlap, the PS will start call handover to the next CS if the signal from one CS becomes weak. However, if a PS moves away from a CS and there are no CSs available for handover, the PS may go out of range and the call could be lost.
3. Keep a record of the air synchronization tree for reference.

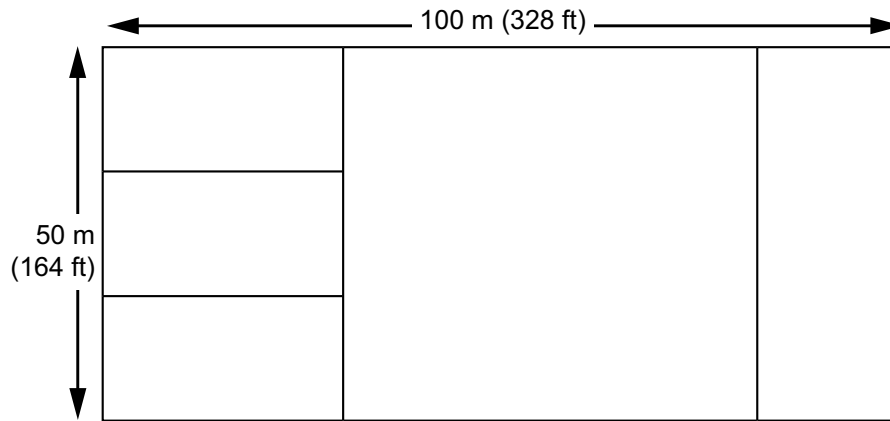
Example: Installing in a Room Separated by Interior Walls

Things to take note of:

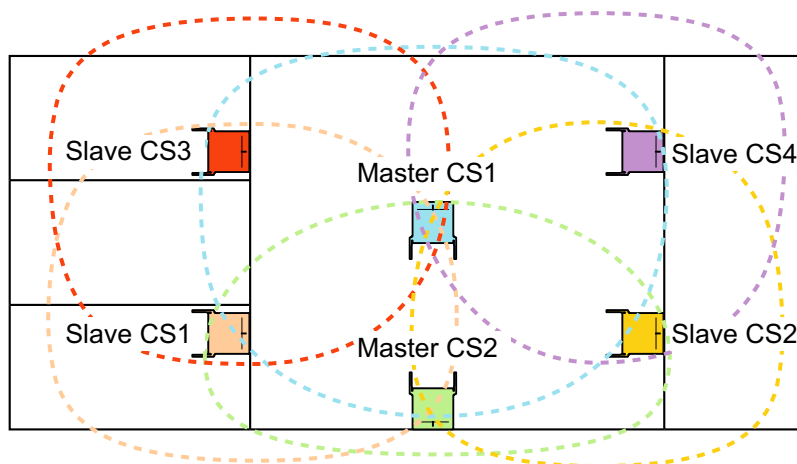
- The room is separated by interior walls.
- The room is surrounded by concrete walls.

CS installation plan:

- The coverage area of each CS will not extend as far as when there are no obstacles, because the radio signals will be weakened by separating walls. Therefore, you will need 6 CSs to cover the entire room.

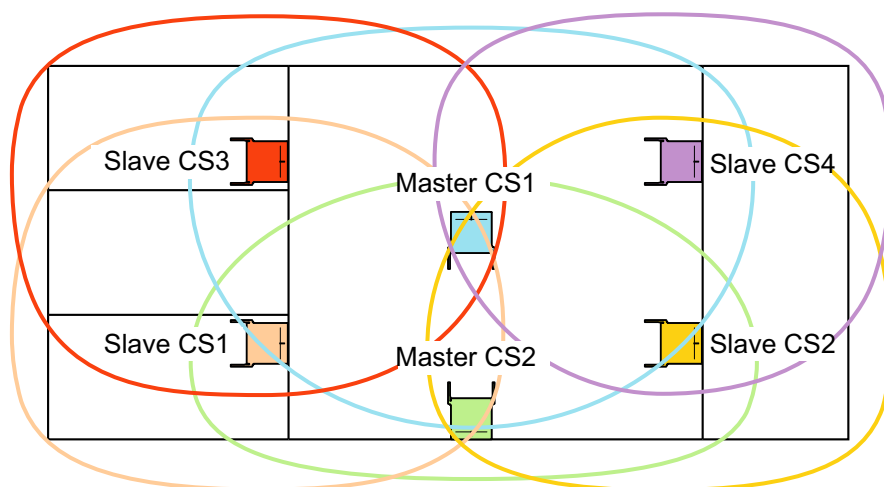


Area Coverage Example for Air Synchronization

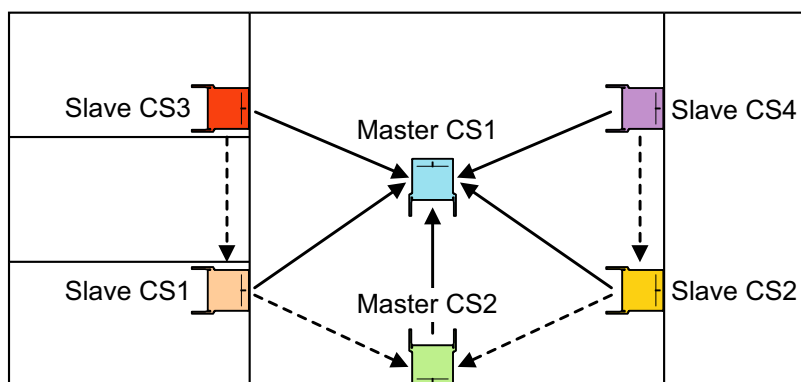


Note

Make sure that Master CS2 is within the area where the radio signal strength levels of Slave CS3 and Slave CS4 are "03".

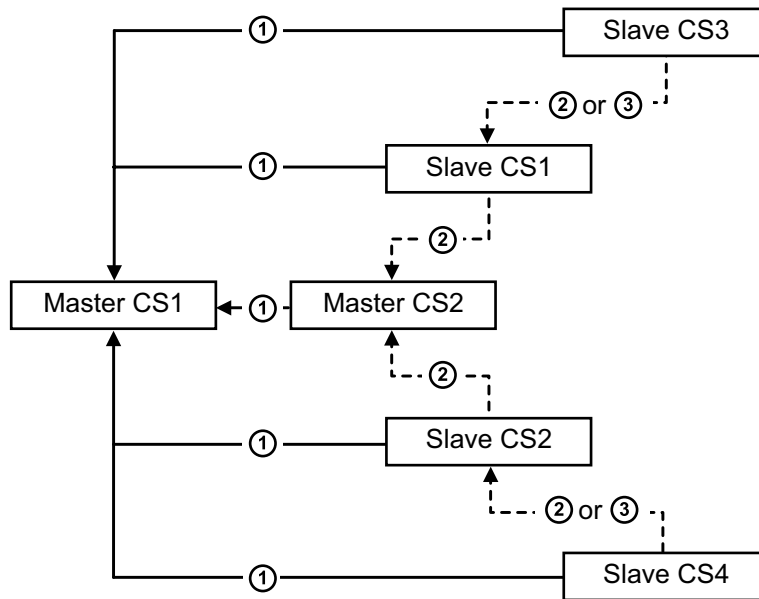
Area Coverage Example for Establishing Conversations Using PSs

—▶ Primary CS
- - - -▶ Secondary CS



Air Synchronization Tree

- Primary CS
- - - - -→ Secondary CS
- ①-③ Hierarchy levels (e.g., Master CS2: 1st hierarchy level)



4 Before Site Survey

Use the KX-TD7685/KX-TD7695/KX-TD7696 PS to conduct the site survey.

Note

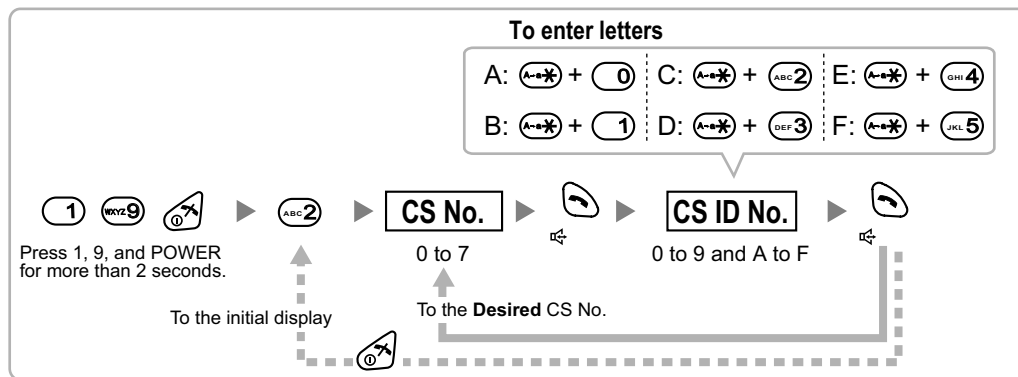
Display prompts for the site survey are only available in English.

Checking the CS ID Number

Check the CS ID number label attached to the CS. If the CS ID number label is not attached to the CS, check the CS ID number using the Maintenance Console. For details, refer to "Utility—CS Information" in the PC Programming Manual or the On-line Help for your PBX.

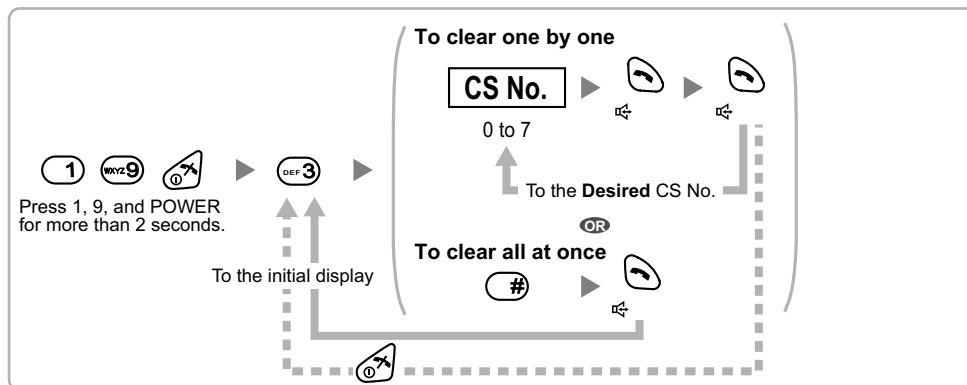
Assigning the CS ID Number to the PS

Using the KX-TD7685/KX-TD7695/KX-TD7696



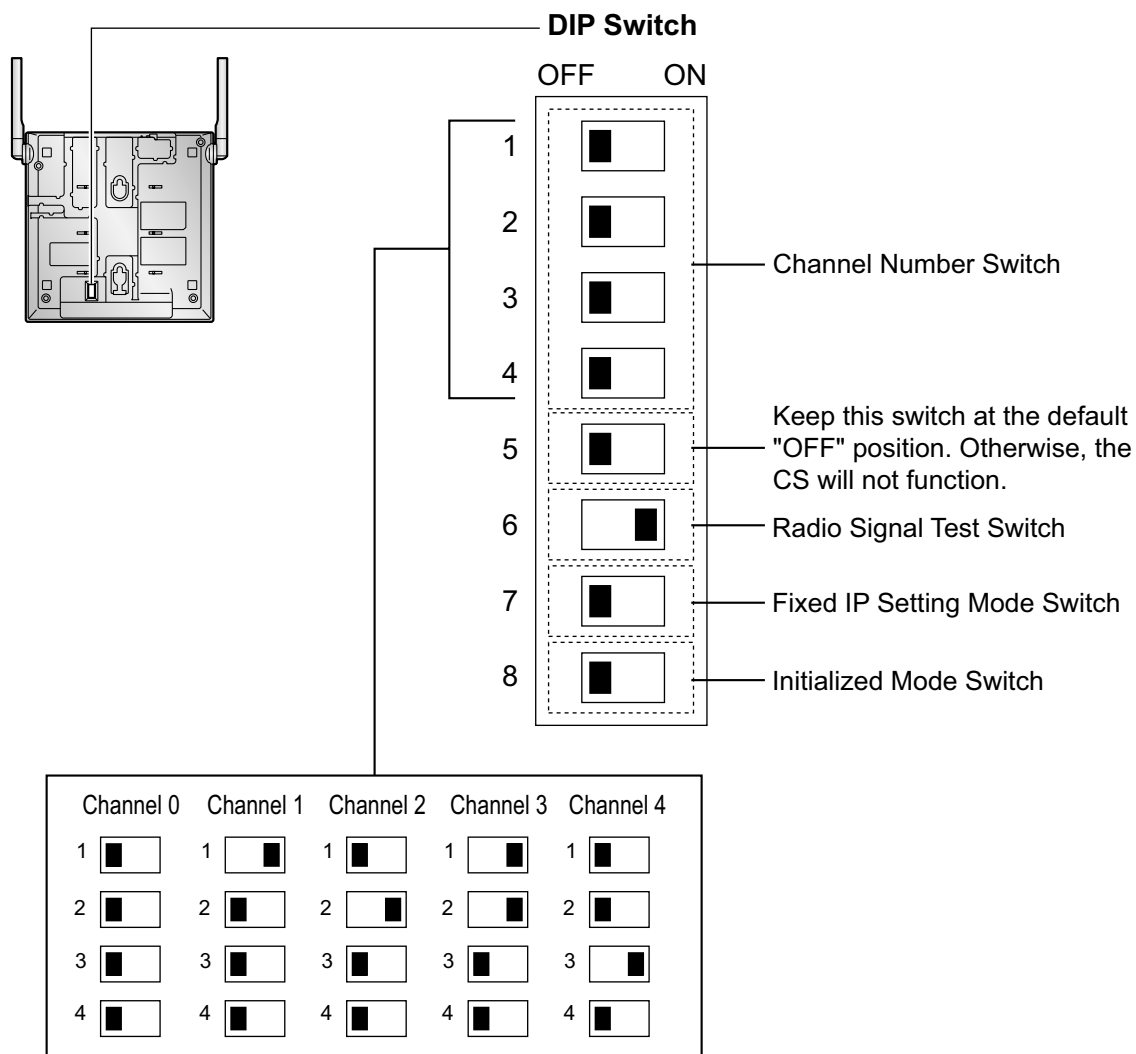
Note

To clear the CS ID number assigned to the PS, follow the procedure below:



Setting and Installing the CS Temporarily for Site Survey

1. Switch the Radio Signal Test switch from OFF to ON.
2. Set the channel number switches as desired.



Note

- If more than one CS is in Radio Signal Test mode, each CS must have a unique channel number.
- For details about the Initialized Mode Switch, refer to "13 Initializing the IP Cell Station".

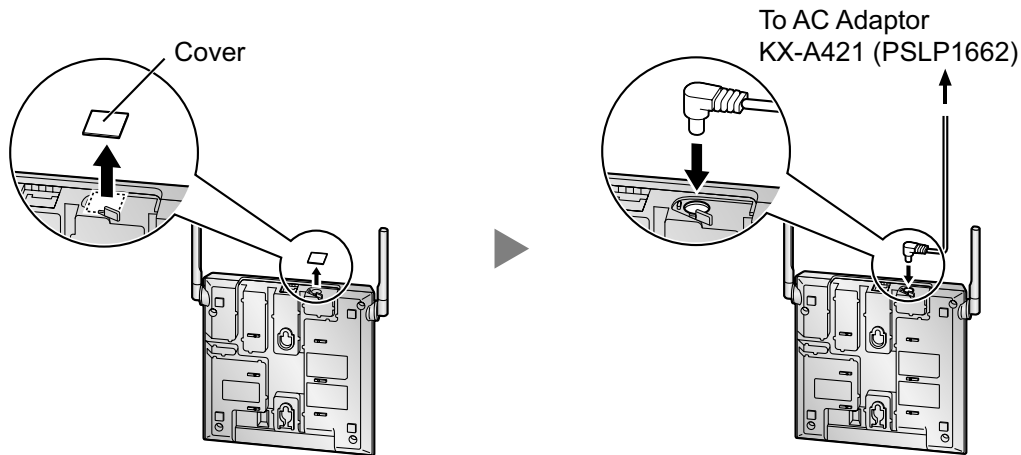
3. After setting the DIP switches, connect the CS to an AC adaptor, battery, PoE hub, or PoE adaptor.
[Connecting the AC Adaptor]

WARNING

When installing or testing a product with an external AC adaptor, the AC adaptor should be plugged into a wall outlet or floor-mounted AC outlet. Do not connect the AC adaptor to a ceiling-mounted AC outlet, as the weight of the adaptor may cause it to become disconnected.

CAUTION

The DC jack cover poses a choking hazard. Keep the DC jack cover out of reach of children.

**[Connecting the Battery]****WARNING**

- Make sure that you do not short the battery or cables.
- There is a danger of explosion if the battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the battery manufacturer. Dispose of the used battery according to the manufacturer's instructions.

CAUTION

- The DC jack cover poses a choking hazard. Keep the DC jack cover out of reach of children.
- Use only the specified battery and battery cable (PSJS02P57) for the CS.
- Make sure that the battery cable is securely fastened to both the battery and the CS.
- Make sure that the polarities of the battery and wiring are correct.

Notice

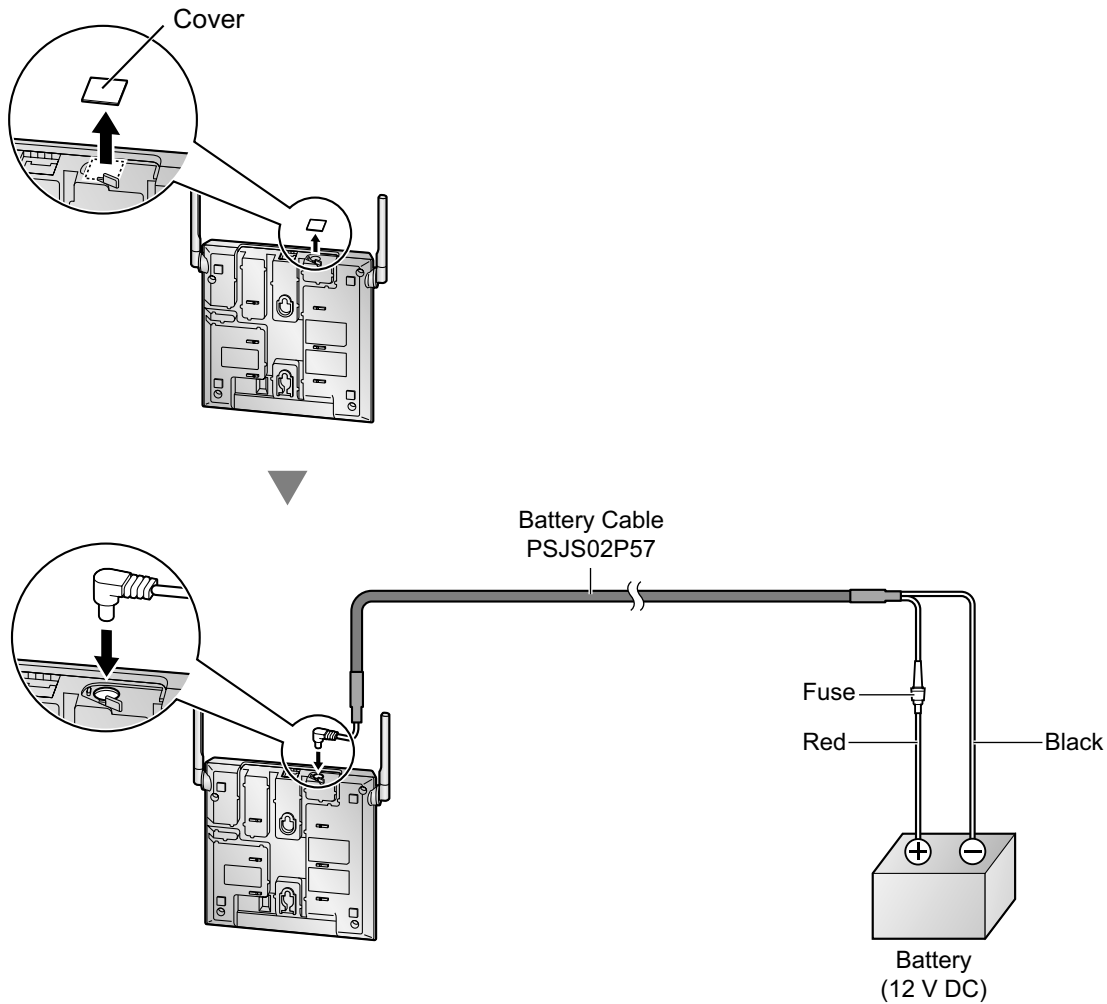
Be sure to comply with applicable local regulations (e.g., laws, guidelines).

Note

- The battery cable should not be exposed to direct sunlight. Keep the battery cable and the battery away from heating appliances and fire. Place the battery in a ventilated place.
- For details about the battery, refer to the manual for the battery.

User-supplied Items

- Battery: VRLA (Valve Regulated Lead Acid) 12 V DC × 1
- Battery cable: PSJS02P57



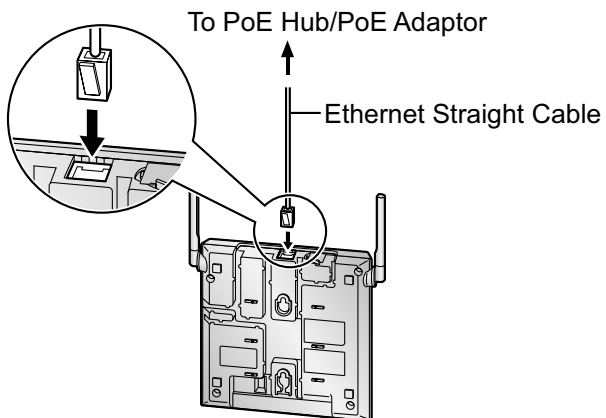
Power Supply Duration

Battery Conditions: 12 V DC, 2.5 Ah to 28 Ah

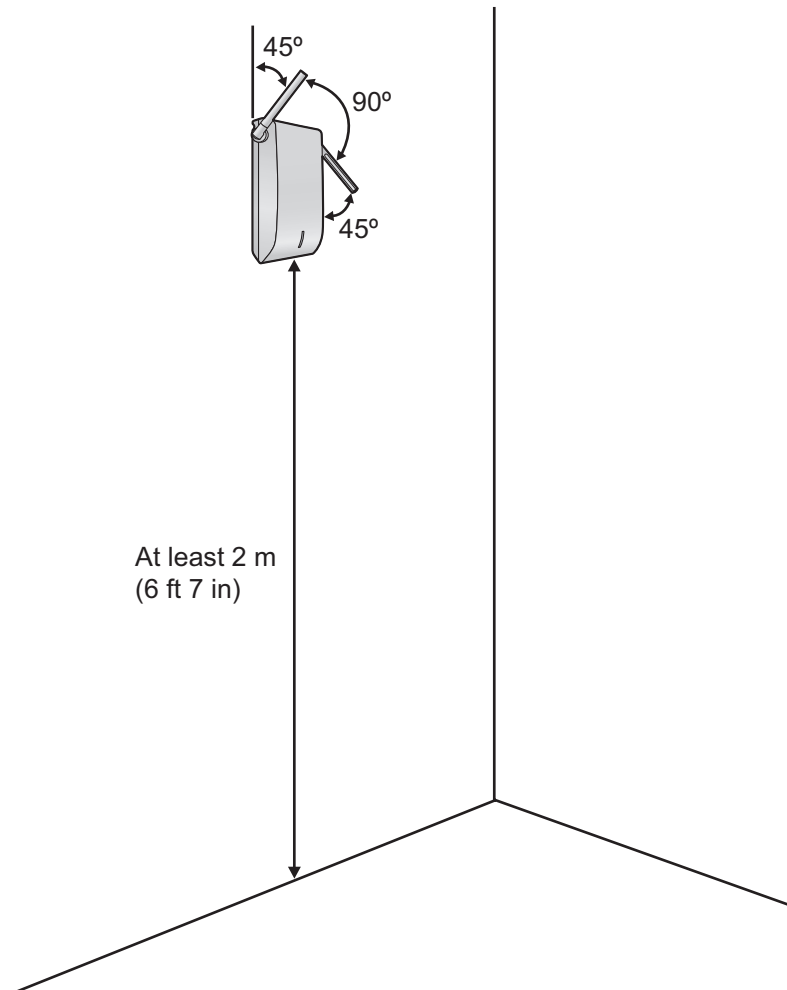
Example

| Battery Capacity | Power Supply Duration ^{*1} |
|------------------|--------------------------------------------|
| 4 Ah | 10 hours (when conducting the site survey) |

^{*1} The duration may vary depending on the conditions.

[Connecting the PoE Hub or PoE Adaptor]

4. Install the CS temporarily for the site survey. Install the CS at least 2 m (6 ft 7 in) above the floor, and place the antennas so that they are pointing in directions that are 90 degrees apart (for antenna diversity), as follows:



5 Site Survey Using the KX-TD7685/ KX-TD7695/KX-TD7696

The PS has a Radio Signal Test mode that monitors the state of the radio link to the CS for site survey. In Radio Signal Test mode, the frame loss and signal strength of a synchronous slot, and the signal strength of the other slots can be measured when the PS is monitoring the CS. After installing the CSs temporarily as planned during site planning, set the PS to Radio Signal Test mode and locate each CS to measure its coverage area. Then, record the results on the map of the installation site.

Notice

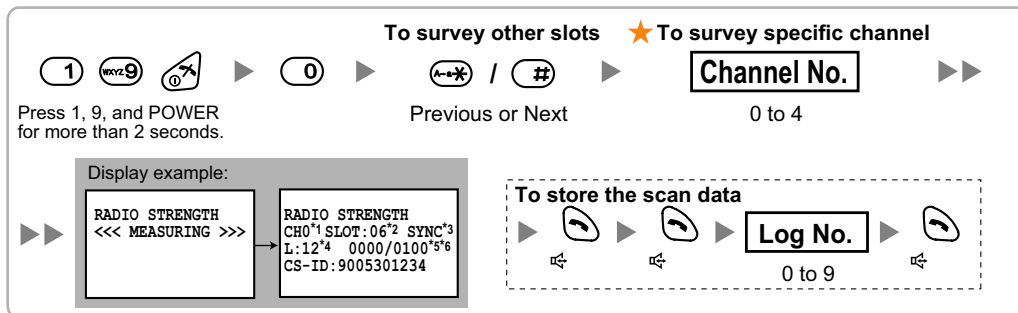
An incorrectly performed site survey may cause the CS to reset due to synchronization failure. Therefore, it is necessary to conduct the site survey and plan the location of CSs with extreme care. Especially, when using multiple CSs in the same area, conduct the site survey starting with the highest hierarchy level in the air synchronization tree (Master CS1 → Master CS2 → hierarchy level order of Slave CSs).

Testing the Radio Signal Strength

After locating the CS(s) temporarily, execute the Radio Signal Test using the PS. Directly after entering Radio Signal Test mode, the PS scans channel 0 for a CS that it can connect to. The channel to be scanned can be changed by pressing the appropriate keys 0 through 4.

1. Enter Radio Signal Test mode.

Using the KX-TD7685/KX-TD7695/KX-TD7696



- *1 Channel number
- *2 Slot number
- *3 When a slot is synchronized, "SYNC" is displayed.
- *4 Radio signal strength level (12 to 00)
- *5 Frame error (0000 to 9999)/Frame counter (0000 to 9999). Frame error indicates the number of errors out of 10 000 radio signal receptions. An increased number of frame errors indicates greater radio signal interference and more frequent noise during conversation. The ideal number of frame errors is "0000".
- *6 Error rate (%) = Frame error (0000 to 9999) / Frame counter (0000 to 9999) × 100

Note

- Storing the scan data will clear all phonebook data.
- The PS will not operate in normal mode if scan data is saved on it. For details on clearing scan data, refer to "Clearing the Stored Scan Data".

2. Measure the error rate and the radio signal strength by moving towards and away from the CS.

Note

- When the error rate is 3% or more, measure the error rate at the same location at least 5 times. You must disconnect the CS and then reconnect it to take each measurement. If the error rate is

consistently 3% or more, there may be interference from external wireless equipment. In this case, the following may happen regardless of the radio signal strength level.

Error Rate for Establishing Conversations Using PSs

| Error Rate | Description |
|-------------|--------------------------------|
| Approx. 3% | May receive noise |
| Approx. 10% | May fail to make/receive calls |

Error Rate for Air Synchronization between CSs

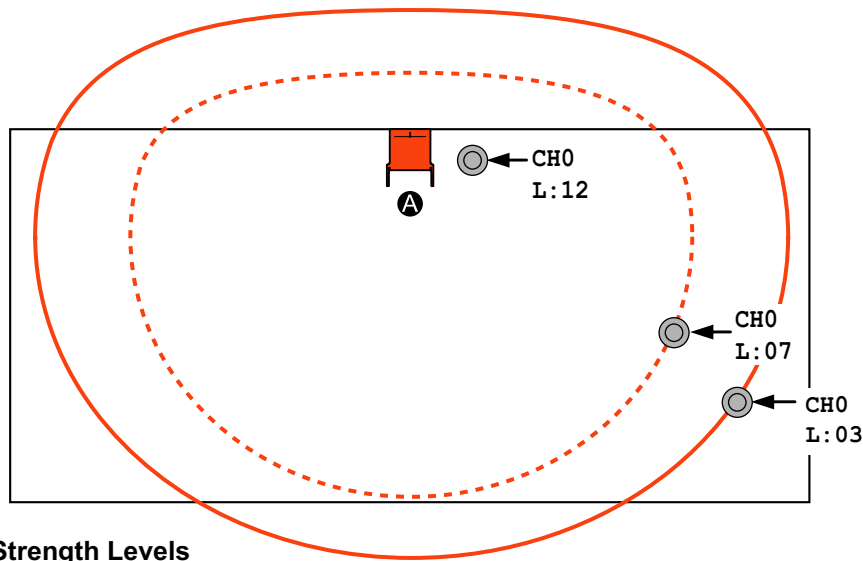
| Error Rate | Description |
|-------------|----------------------------------------------------|
| Approx. 10% | May be reset due to synchronization failure of CSs |

If the frame error value continues to increase abnormally (100 per second), the radio signal has been lost. In this case, re-perform the procedure in step 1 starting from ★.

The above is a rough standard, and may vary depending on the environment.

- When deciding where to install the CS, priority should be given to an error rate rather than a radio signal strength level.
 - After installing the CS according to the results of the survey, confirm that calls can be made and received, and conversations can be heard clearly.
- a. Move to the CS until the radio signal strength level becomes "12".
 - b. Move away from the CS and identify the CS coverage area within which the radio signal strength level is greater than "07". Draw the area on the map.

- c. Move away from the CS and identify the CS coverage area within which the radio signal strength level is greater than "03". Draw the area on the map.



Radio Signal Strength Levels

For Establishing Conversations Using PSs

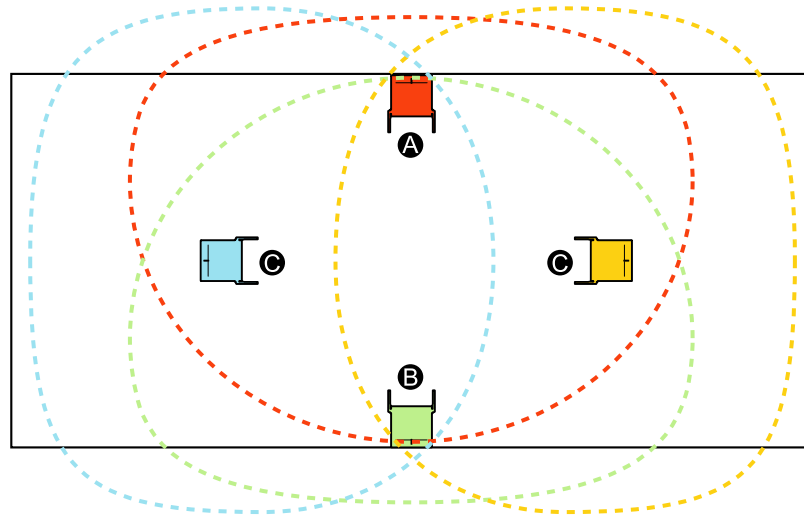
| | | |
|-----------------|------------------------|--------------------------------------|
| Level: 11 to 12 | Better Out of range | Better |
| Level: 08 to 10 | | Good |
| Level: 03 to 07 | | May receive noise |
| Level: 01 to 02 | | Receives noise easily or disconnects |
| Level: 00 | | Out of range |

For Air Synchronization between CSs

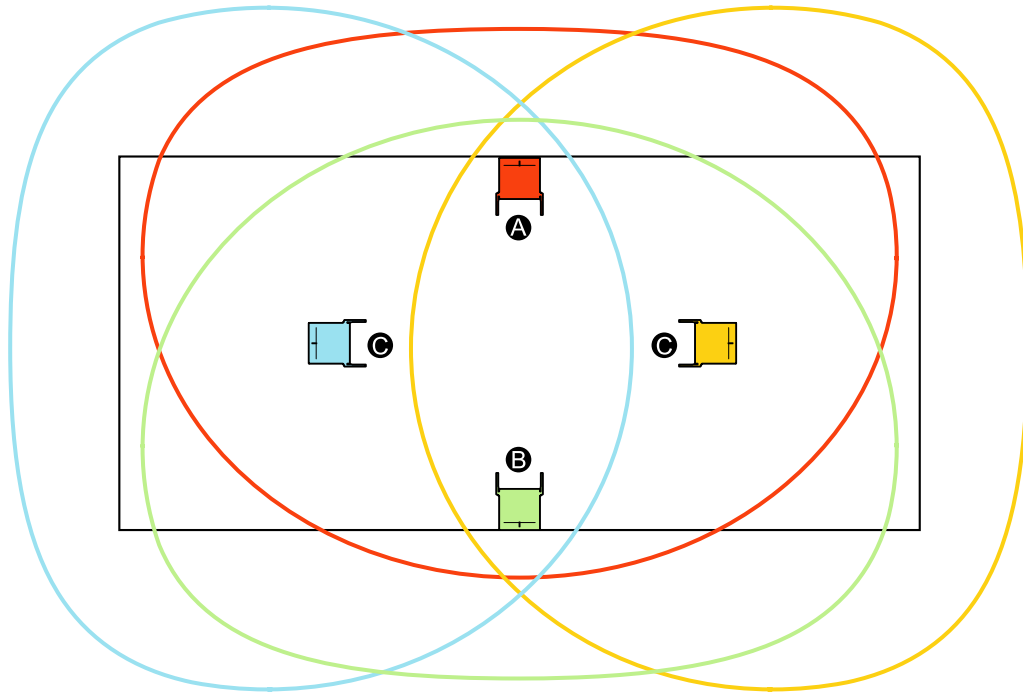
| | |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Level: 12 | Up to 2 CSs: Good More than 2 CSs: May be reset due to synchronization failure of CSs |
| Level: 09 to 11 | Good |
| Level: 08 | Better |
| Level: 07 | Good |
| Level: 03 to 06 | Air synchronization is established. However, it is necessary to monitor the status of synchronization using the Maintenance Console. This is necessary because IP-CSs may be reset due to synchronization failure if the radio signal strength fluctuates depending on changes in the installation environment such as opening/closing doors. |
| Level: 00 to 02 | May be reset due to synchronization failure of CSs |

3. Repeat steps 1 and 2 for other CSs, and relocate the CSs when necessary.
- a. Plan the location of the CS so that its clock signal source is within range of the CS where the radio signal strength level is "07".
- Example**
- Ⓐ: Master CS1
 - Ⓑ: Master CS2
 - Ⓒ: Slave CSs (Primary CS: Master CS1, Secondary CS: Master CS2)
 - When planning the location of CS Ⓑ, make sure that CS Ⓐ (clock signal source) is within the area where the radio signal strength level of CS Ⓑ is "07".

- When planning the location of CS ③, make sure that CSs ① and ② (clock signal sources) are within the area where the radio signal strength level of CS ③ is "07".



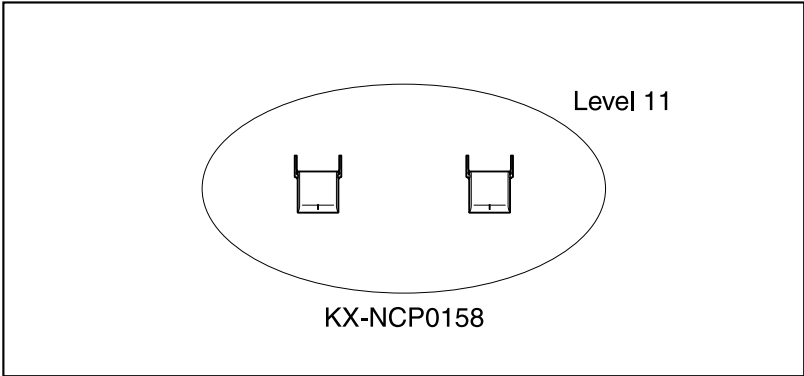
- b.** Make sure that the radio signal strength level is greater than "03" at any location in the service area required by the user.



Note

- If a channel is set, the results of measurement for the 24 slots on the channel are saved each time. If the same channel is set, the new results override the previous ones. Therefore, a measurement of 5 channels × 24 slots in total can be made.
- If correct results cannot be obtained (e.g., there are many frame errors), change the location of the CS and repeat the site survey to select the best location.

- If multiple CSs cover the same area, the phone connection may become noisy or the number of possible simultaneous calls with PSs may decrease due to interference between the CSs. As a guideline, the maximum number of CSs in an area with a radio signal strength of "11" is 2.



Referring to the Stored Scan Data

Using the KX-TD7685/KX-TD7695/KX-TD7696

1

WXYZ9

▶

1

▶

Log No.

▶

▶▶

Press 1, 9, and POWER
for more than 2 seconds.

0 to 9

To go to other slots

To go to specific channel

▶▶

A↔X

/

#

▶

Channel No.

▶

Previous or Next

0 to 4

Clearing the Stored Scan Data

When "CLEAR SCAN DATA" is displayed after turning on the PS, you are required to clear the scan data.

Using the KX-TD7685/KX-TD7695/KX-TD7696

1

WXYZ9

▶

GHI4

▶

Press 1, 9, and POWER
for more than 2 seconds.

6 After Site Survey

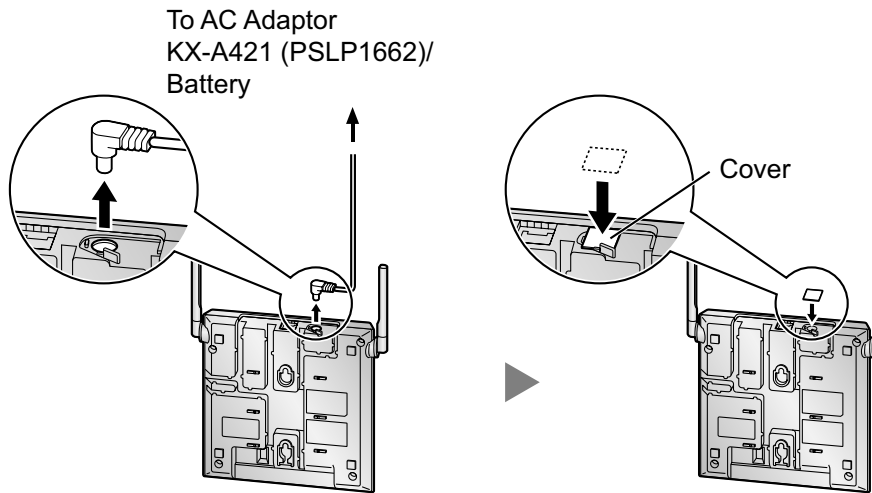
After obtaining the proper measurement results, exit Radio Signal Test mode by following the procedure below, before registering the CS to the PBX.

1. Hold down the POWER button on the PS until the PS is off.
2. Disconnect the CS from the AC adaptor, battery, PoE hub, or PoE adaptor to stop supplying electricity.

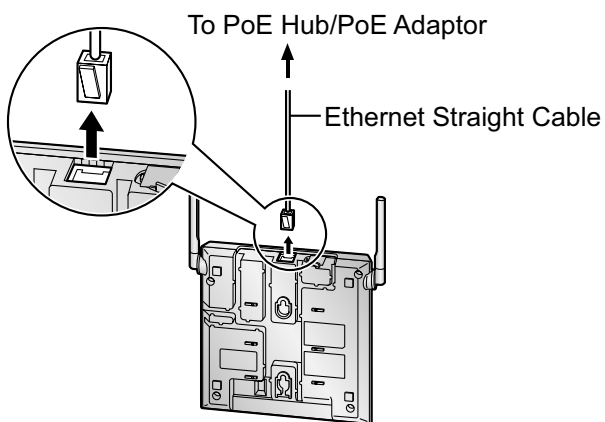
[Disconnecting the AC Adaptor or Battery]

Notice

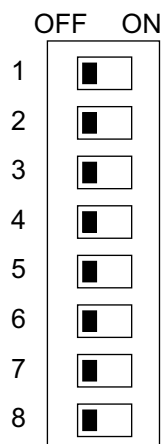
Be sure to attach the cover to the DC jack after disconnecting the CS from the AC adaptor or battery.



[Disconnecting the PoE Hub or PoE Adaptor]



3. Switch all DIP switches on the CS from ON to OFF.



7 Connecting IP Cell Stations

Assigning IP Address Information

When the IP-CS is connected to the LAN for the first time, you must assign IP addressing information to the IP-CS. The IP addressing information for the IP-CS can be assigned automatically through a DHCP server or entered manually using the IP Terminal Maintenance Console.

Note

- It is assumed that you have already installed the Maintenance Console on your PC.
- The contents and design of the software are subject to change without notice.

Preparation

Assign the following IP address and subnet mask address to the PC:

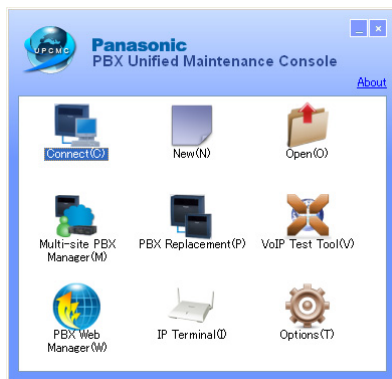
- IP address: 192.168.2.xxx (xxx: 1–254 except 101)
- Subnet mask address: 255.255.255.0

1. Start the Maintenance Console from the Start menu.
"Information before programming" appears.
2.
 - a. Carefully read this important additional information, which includes updates to this and other manuals.
 - b. Click **OK** to close this window.
3.
 - a. Enter the Installer Level Programmer Code (default: **INSTALLER**).

CAUTION

To avoid unauthorized access and possible abuse of the PBX, we strongly recommend:

- a. Keeping the password secret.
 - b. Changing your password regularly.
 - c. Selecting a complex, random password that cannot be easily guessed.
- b. Click **OK**.
The program launcher appears.



4. Click **IP Terminal**.
The IP Terminal Maintenance Console appears.
5. Click **Next**.

6. To set the default IP address mode, set the DIP switch no.7 (Fixed IP Setting Mode switch) of the IP-CS to the ON position.

Note

For details about the DIP switches of the IP-CS, refer to "Setting and Installing the CS Temporarily for Site Survey".

7. Click **Next**.
8. Connect the IP-CS that you want to register to the PC using the switching hub, then supply electricity to the IP-CS using the AC adaptor, PoE hub, or PoE adaptor.
The IP-CS starts with its default IP address (192.168.2.101).
9. Click **Next**.
10. Assign the IP addressing information automatically through a DHCP server or enter it manually.

Note

It is not necessary to configure the **PBX IP Address** setting regardless of whether or not you are using a DHCP server, because it is detected automatically. However, if the IP-CS and PBX belong to different subnets, it is necessary to configure the **PBX IP Address** setting.

When using a DHCP server:

- a. Select **Enable** for the **DHCP Client** setting.
- b. Click **Next**.
A dialog box will appear.

| Configure IP Terminal Setting | |
|-------------------------------|--------------|
| Expand All | Collapse All |
| Device Data Open Telnet | |
| Network Settings | |
| DHCP Client | Enable |
| IP Address | |
| Subnet Mask | |
| Default Gateway | |
| PBX IP Address | 0.0.0.0 |

When not using a DHCP server:

- a. Select **Disable** for the **DHCP Client** setting.
- b. In the **IP Address** box, type the IP address of the IP-CS.¹
- c. In the **Subnet Mask** box, type the subnet mask address of the network.²
- d. In the **Default Gateway** box, type the IP address of the default gateway.¹
- e. Click **Next**.
A dialog box will appear.

| Configure IP Terminal Setting | |
|-------------------------------|---------------|
| Expand All | Collapse All |
| Device Data Open Telnet | |
| Network Settings | |
| DHCP Client | Disable |
| IP Address | 192.168.2.101 |
| Subnet Mask | 255.255.255.0 |
| Default Gateway | 0.0.0.0 |
| PBX IP Address | 0.0.0.0 |

11. Click **Yes**.
If the assignment is successful, the dialog box will show "Setup Successful!".
12. Click **Next Device** to assign the IP addressing information for other IP-CSs, or click **Main Screen** to return to the main screen.
13. Click **Exit**.
14. Disconnect the IP-CS from the AC adaptor, PoE hub, or PoE adaptor to stop supplying electricity.
15. Return the Fixed IP Setting Mode switch of the IP-CS to the OFF position.

¹ Valid IP address range: "1.0.0.0" to "223.255.255.255"

² Valid subnet mask address range: "0-255.0-255.0-255" (except 0.0.0.0 and 255.255.255.255)

Note

For information on other parameters, refer to "E Information about IP Terminal Maintenance Console".

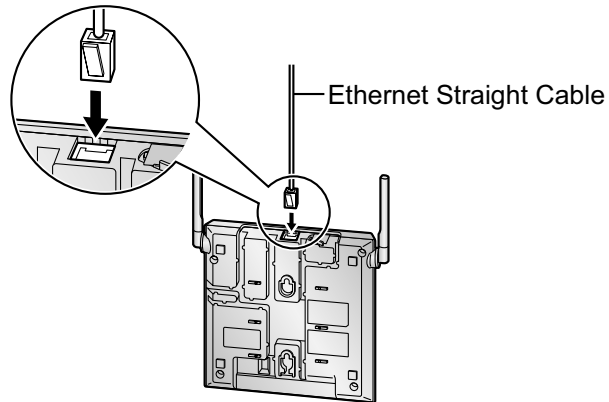
Connecting an IP-CS to a LAN

When connecting an IP-CS to the LAN, connect it to a switching hub.

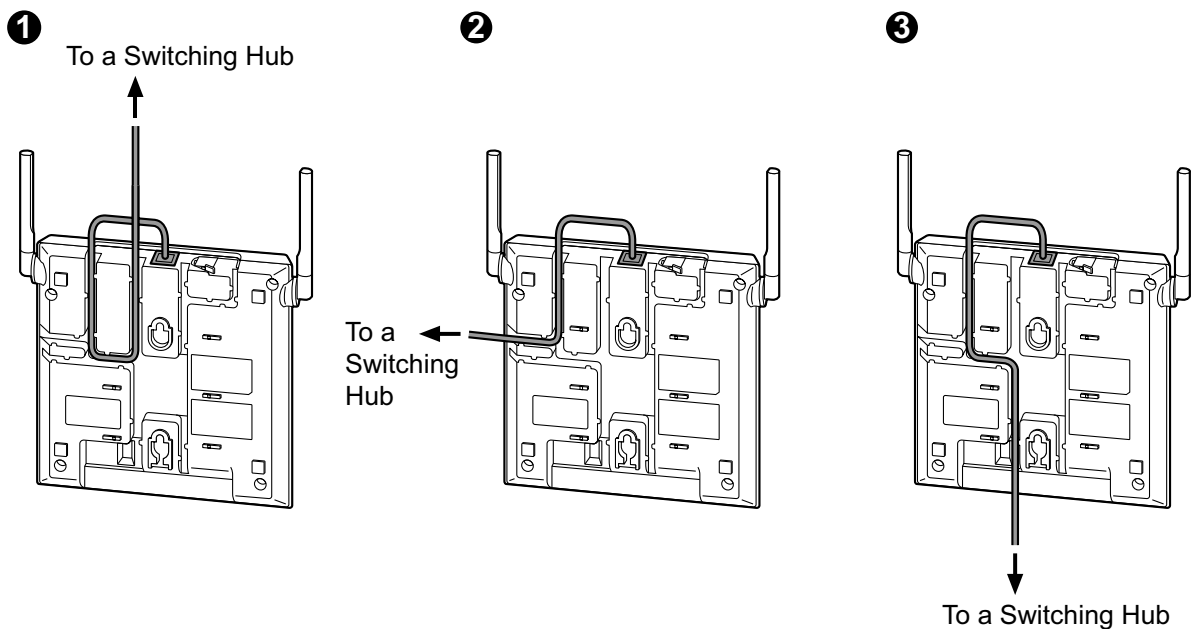
Note

- Use an Ethernet straight cable with an RJ45 connector to connect the IP-CS to a switching hub. The cable should be a 10BASE-T/100BASE-TX CAT 5 (Category 5) or higher cable, and the diameter of the cable must be 6.5 mm or less.
- It is possible to connect the IP-CS to the LAN while registering the IP-CS to the PBX. For details, refer to "8 Registering IP Cell Stations".

1. Connect the cable to the IP-CS.



2. Pass the cable through the groove of the IP-CS in one of the following three ways.



3. Connect the other end of the cable to the switching hub.

Connecting an AC Adaptor to an IP-CS

IP-CSs comply with the IEEE 802.3af Power-over-Ethernet (PoE) standard. If PoE is available on your network, these IP-CSs can receive the necessary power supply from the network through the network cable. In this case, no AC adaptor is needed for the IP-CSs.

However, if PoE is not available, you will need to connect an AC adaptor to the IP-CS.

WARNING

When installing or testing a product with an external AC adaptor, the AC adaptor should be plugged into a wall outlet or floor-mounted AC outlet. Do not connect the AC adaptor to a ceiling-mounted AC outlet, as the weight of the adaptor may cause it to become disconnected.

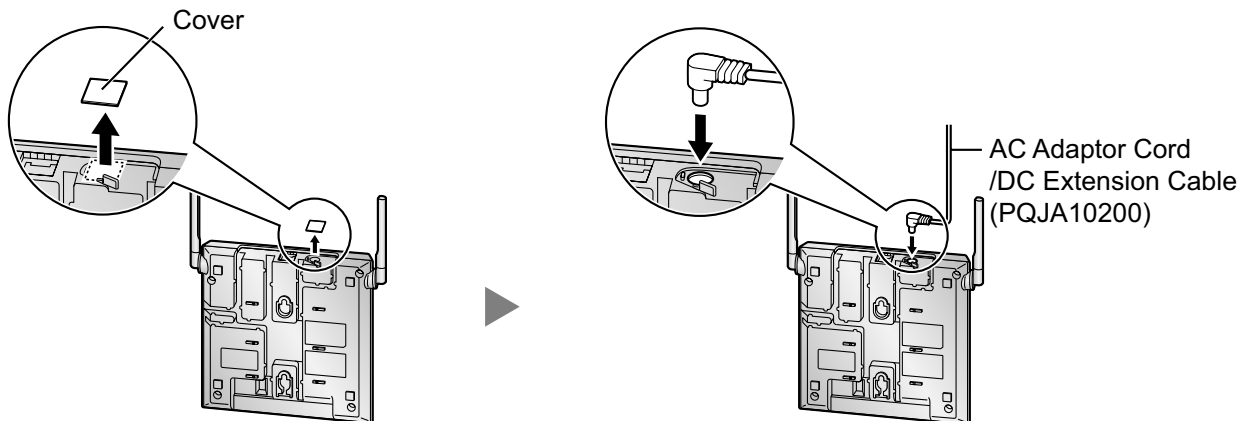
CAUTION

The DC jack cover poses a choking hazard. Keep the DC jack cover out of reach of children.

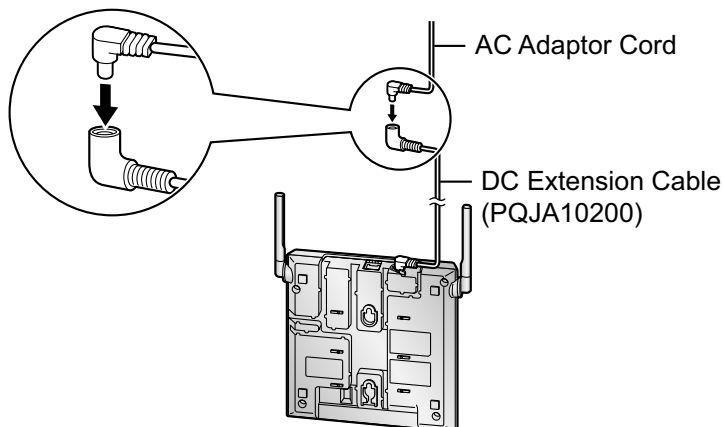
Note

- Use only the optional AC adaptor KX-A421 (PSLP1662) for the IP-CS.
- If the AC adaptor cord is not long enough for installation, use the DC extension cable (PQJA10200). If the AC adaptor cord is long enough, it is not necessary to use the DC extension cable (PQJA10200).

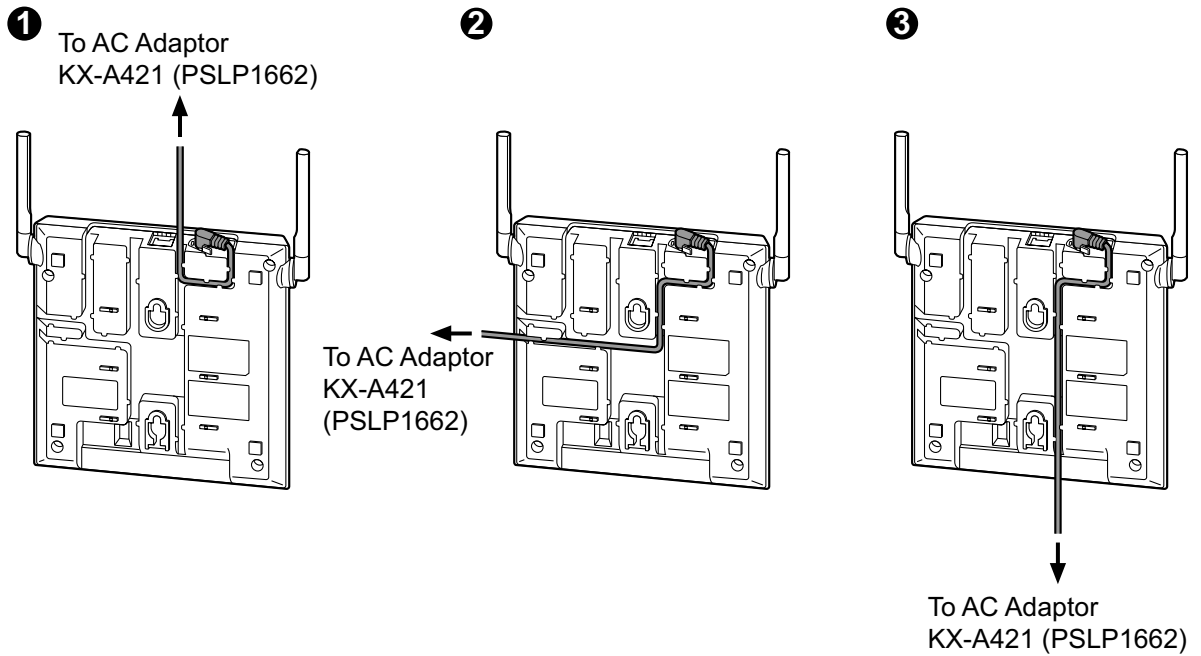
1. Remove the DC jack cover, and connect the AC adaptor cord or the DC extension cable (PQJA10200) to the IP-CS.



2. When using the DC extension cable (PQJA10200), connect the AC adaptor cord to the other end of the DC extension cable (PQJA10200).



3. Pass the cord through the groove of the IP-CS in one of the following three ways.



4. Connect the AC cord to the AC adaptor, then connect the AC cord to an AC outlet.

8 Registering IP Cell Stations

Registering the IP-CS

Note

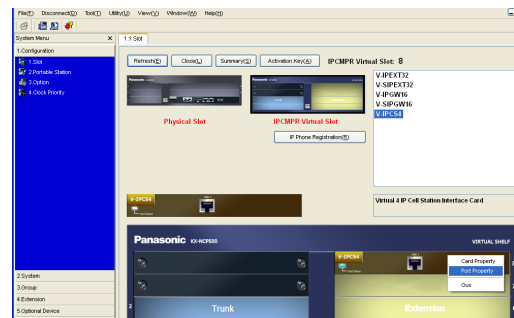
When using a traditional CS in the same area, connect it to the PBX first, as Master CS1, and then register IP-CSs.

1. Connect the PC to the PBX with an Ethernet straight cable or RS-232C cross cable.
2. Click **Connect** from the program launcher.
3.
 - a. Select your PBX model from **PBX Model**.
 - b. Select the **LAN** or **RS-232C** tab, depending on the type of PC connection with the PBX.
 - c. Specify the settings as required.
 - d. Enter the system password for installer (default: **1234**).

CAUTION

To avoid unauthorized access and possible abuse of the PBX, we strongly recommend:

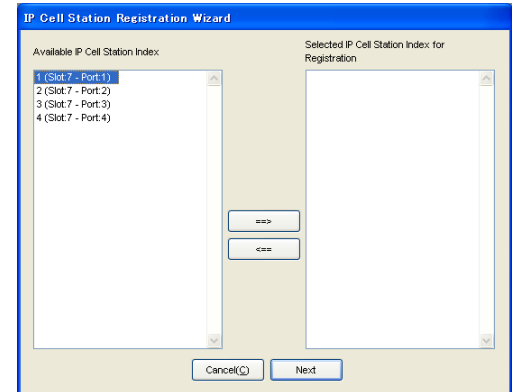
- a. Keeping the password secret.
 - b. Changing your password regularly.
 - c. Selecting a complex, random password that cannot be easily guessed.
- e. Click **Connect**.
4.
 - a. Under **Configuration**, click **Slot**.
 - b. For the KX-NCP500/KX-NCP1000, move the mouse pointer over the PBX image of **IPCMPR Virtual Slot** at the top of the screen, and click **Select Shelf**. For the KX-TDE100/KX-TDE200/KX-TDE600, move the mouse pointer over the white PBX image of **IPCMPR Virtual Slot** (for the KX-TDE100/KX-TDE200)/**IPCEMPR Virtual Slot** (for the KX-TDE600) at the bottom of the screen, and click **Select Shelf**. Move the mouse pointer over the V-IPCS4 card. A menu will be shown under the mouse pointer.
 - c. Click **Port Property**.
5. Click **Registration**.
A dialog box will appear. Non-registered (available) IP-CSs are displayed on the left.



6.
 - a. Highlight IP-CSs and click the right arrow to select them for registration.
 - b. Click **Next**. A screen will appear with information on the selected IP-CS for programming.

Note

- If the IP-CS has been connected to the LAN and power has been turned on, the IP address of the PBX will be assigned automatically.
 - If not, connect the IP-CS to the LAN and turn the power on within 15 minutes after this operation is done. For details, refer to "Connecting an IP-CS to a LAN". The IP address of the PBX will then be assigned automatically.
- c. If the registration is still in progress, the dialog box will show "Registration Executing".
If the registration is successful, the dialog box will show "Registration Completed". Click **Close**.



Once the IP-CS is successfully registered, the status of the IP-CS will update to show "Registered".

Note

When you need to change the Master CSs (Master CS1 and Master CS2) to different CSs, refer to "Assigning the Synchronizing CSs".

Assigning the Synchronizing CSs

Assigning the Master CSs

Note

- When using IP-CSs and traditional CSs in the same area, the traditional CSs must be classified as Master CS1.
 - When using IP-CSs and traditional CSs in the same area, make sure that you do not create a Master CS2.
 - When using only one IP-CS at an installation site, assign it as Master CS1 so that it can generate the clock signal.
1. Under **Maintenance**, click **Air Synchronization**.
 2. Select the desired cell in the **Connection** column, and then click **Command** to change the status of the port to "OUS".

3. Select the desired classification for the CS in the **CS Class** column.

Note

For details about other parameters on this screen, refer to the PC Programming Manual or the On-line Help for your PBX.

4. Click **Apply**.

Note

Please wait about one minute after clicking **Apply** to allow changes to take effect.

5. Click **Command** to return the status of the port to "INS".

Setting the Synchronizing CS Search Order (Primary/Secondary)

The search order of each CS can be set by the following procedure:

1. Under **Maintenance**, click **Air Synchronization**.
2. Select the desired cell in the **Connection** column, and then click **Command** to change the status of the port to "OUS".
3. Select the desired CS number in the **Index** column for each **Primary CS** and **Secondary CS**.

Note

For details about other parameters on this screen, refer to the PC Programming Manual or the On-line Help for your PBX.

4. Click **Apply**.

Note

Please wait about one minute after clicking **Apply** to allow changes to take effect.

5. Click **Command** to return the status of the port to "INS".

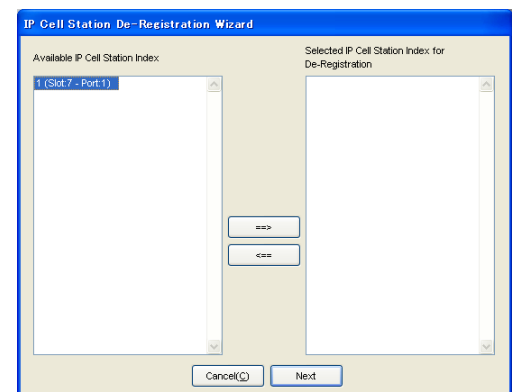
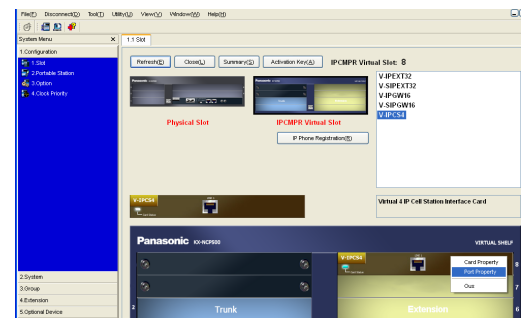
De-registering the IP-CS

When uninstalling an IP-CS that has been installed once, de-register the IP-CS.

Note

When uninstalling IP-CSs that are supplying the clock signal, air synchronization is lost. If there is an IP-CS that is synchronized with the IP-CS that is being uninstalled, reconstruct the air synchronization tree beforehand so that the uninstalled IP-CS is not supplying the clock signal to any IP-CSs.

1.
 - a. Under **Configuration**, click **Slot**.
 - b. For the KX-NCP500/KX-NCP1000, move the mouse pointer over the PBX image of **IPCMPR Virtual Slot** at the top of the screen, and click **Select Shelf**. For the KX-TDE100/KX-TDE200/KX-TDE600, move the mouse pointer over the white PBX image of **IPCMPR Virtual Slot** (for the KX-TDE100/KX-TDE200)/**IPCEMPR Virtual Slot** (for the KX-TDE600) at the bottom of the screen, and click **Select Shelf**. Move the mouse pointer over the V-IPCS4 card. A menu will be shown under the mouse pointer.
 - c. Click **Port Property**.
2. Click **De-registration**.
A dialog box will appear. Registered IP-CSs are displayed on the left.
3.
 - a. Highlight IP-CSs and click the right arrow to select them for de-registration.
 - b. Click **Next**.
A dialog box will appear.
 - c. Click **Confirm**.
If the de-registration is successful, the dialog box will show "De-registration succeed!".
 - d. Click **Close**.

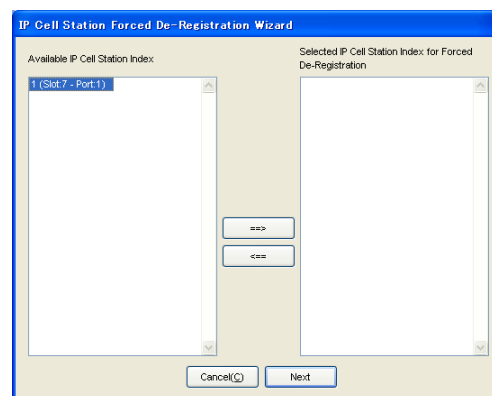
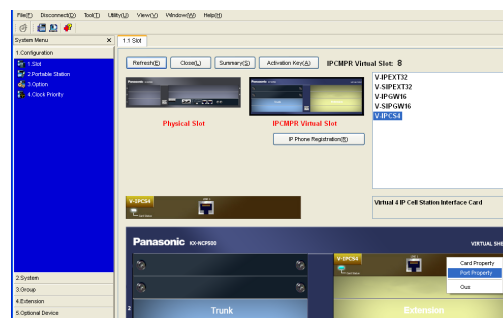


Once the IP-CS is successfully de-registered, the status of the IP-CS will update to show "None".

Forced De-registering the IP-CS

Follow the steps below to forcibly de-register an IP-CS when normal de-registration was unsuccessful.

1.
 - a. Under **Configuration**, click **Slot**.
 - b. For the KX-NCP500/KX-NCP1000, move the mouse pointer over the PBX image of **IPCMPR Virtual Slot** at the top of the screen, and click **Select Shelf**. For the KX-TDE100/KX-TDE200/KX-TDE600, move the mouse pointer over the white PBX image of **IPCMPR Virtual Slot** (for the KX-TDE100/KX-TDE200)/**IPCEMPR Virtual Slot** (for the KX-TDE600) at the bottom of the screen, and click **Select Shelf**. Move the mouse pointer over the V-IPCS4 card. A menu will be shown under the mouse pointer.
 - c. Click **Port Property**.
2. Click **Forced De-registration**.
A dialog box will appear. Registered IP-CSs are displayed on the left.
3.
 - a. Highlight IP-CSs and click the right arrow to select them for de-registration.
 - b. Click **Next**.
A dialog box will appear.
 - c. Click **OK**.
A dialog box will appear.
 - d. Click **Confirm**.
If the de-registration is successful, the dialog box will show "Forced de-registration succeed!".
 - e. Click **Close**.



Once the IP-CS is successfully de-registered, the status of the IP-CS will update to show "None".

9 Confirming the Status of Air Synchronization for IP Cell Stations

After registering the IP-CS to the PBX, it is necessary to monitor the status of air synchronization for the IP-CS. If the monitoring results are not satisfactory, relocate the IP-CS or change the IP-CS that it is currently synchronized with to another CS using the Maintenance Console.

Monitoring Air Synchronization

The status of air synchronization for IP-CSs can be displayed and collected by the following procedure:

1. From the **Utility** menu, select **CS Status Monitor**.
2. From the **Interval Timer** drop-down list, select the desired interval time for monitoring.
3. Click **Start** to monitor the status of air synchronization.

Note

For details about other parameters on this screen, refer to the PC Programming Manual or the On-line Help for your PBX.

4. Confirm the value in the **Monitored Level** column.
The monitored level is indicated as follows:

| Monitored Level | Description |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 12 | Up to 2 CSs: Good More than 2 CSs: May be reset due to synchronization failure of CSs |
| 09 to 11 | Good |
| 08 | Better |
| 07 | Good |
| 03 to 06 | Air synchronization is established. it is necessary to monitor the status of synchronization using the Maintenance Console. This is necessary because IP-CSs may be reset due to synchronization failure if the radio signal strength fluctuates depending on changes in the installation environment such as opening/closing doors. |

| Monitored Level | Description |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 00 to 02 | May be reset due to synchronization failure of CSs. Relocate the IP-CS or manually change the IP-CS that the target IP-CS is currently synchronized with to a different CS. |

Note

For details about the procedure for changing the synchronizing CS, refer to "Assigning the Synchronizing CSs".

5. If you want to collect the monitored data, click **Capture**.
A dialog box will be displayed.
6. Navigate to the folder in which you want to save the file.
7. Enter a file name.
8. Click **Save**.
9. Click **Start** to collect the monitoring data.
10. Click **Stop** to finish collecting the monitoring data.
11. Click **Close**.
The dialog box will close.

10 Registering Portable Stations

Registering the PS

The PS must be registered to the PBX before it can be used. Programming of both the PS and PBX is required. A Proprietary Telephone (PT) with multiline display (e.g., KX-T7636 6-line display) is required to perform the PBX system programming.

Note

For details about system programming using a PT, refer to "PT Programming" in the Feature Manual, and "PT Programming" in the PT Programming Manual for your PBX.

Entering the PBX System Programming Mode Using a PT

Administrator Level



Note

◆ means default value.

Setting the Personal Identification Number (PIN) for PS Registration

To prevent registering the PS to a wrong PBX, a PIN for PS registration can be set to the PBX. Before registering the PS to the PBX, enter the PIN set to the PBX into the PS. By doing so, the PS will only be registered to the PBX with the matching PIN.

CAUTION

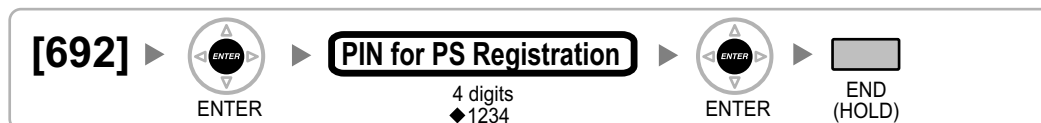
To avoid unauthorized access and possible abuse of the PBX, we strongly recommend:

- Keeping the password (PIN for PS registration) secret.
- Not using the default password and changing the password regularly.
- Selecting a complex, random password that cannot be easily guessed.

Note

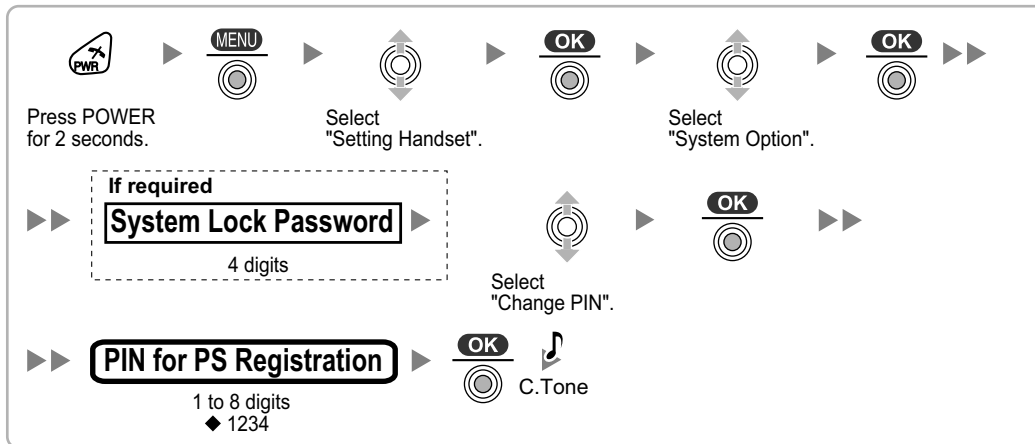
The PIN for PS registration will only be used when registering the PS to the PBX. Therefore, during normal operation after registration, even if there is more than 1 PBX with the same PIN near the PS, the PS will not be inadvertently linked to a different PBX.

Setting the PIN for PBX

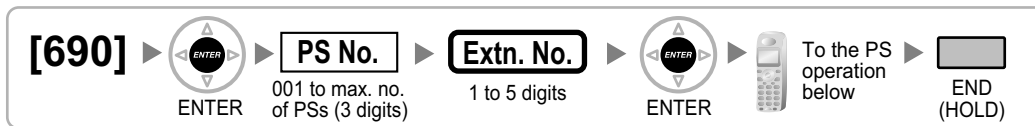


Setting the PIN for PS

Using the KX-TD7685/KX-TD7695/KX-TD7696



PS Registration



When the PS has not been registered yet

When registering the PS for the first time, it is possible to select the desired language for the display. (You do not need to enter the PS system programming mode when registering for the first time.)

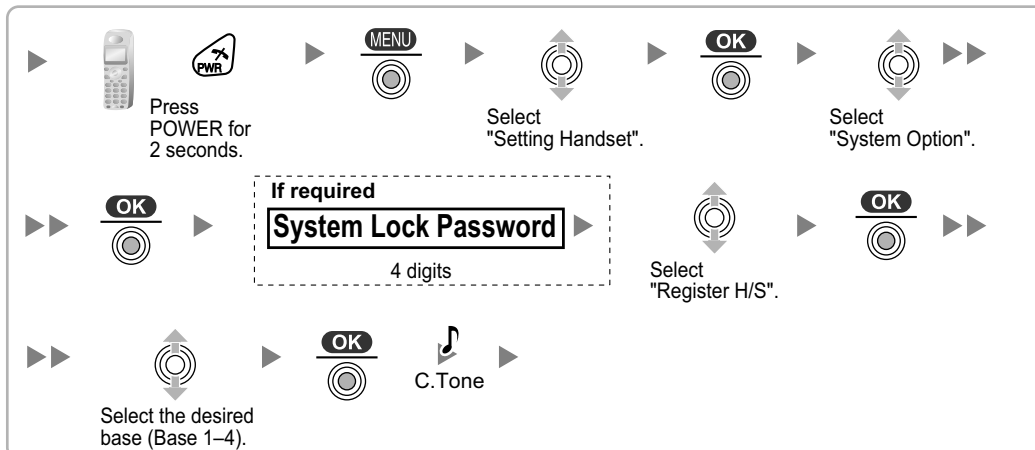
Using the KX-TD7685/KX-TD7695/KX-TD7696



When the PS has already been registered to another PBX

One PS can be registered to a maximum of 4 different PBXs.

Using the KX-TD7685/KX-TD7695/KX-TD7696



Setting the System Lock

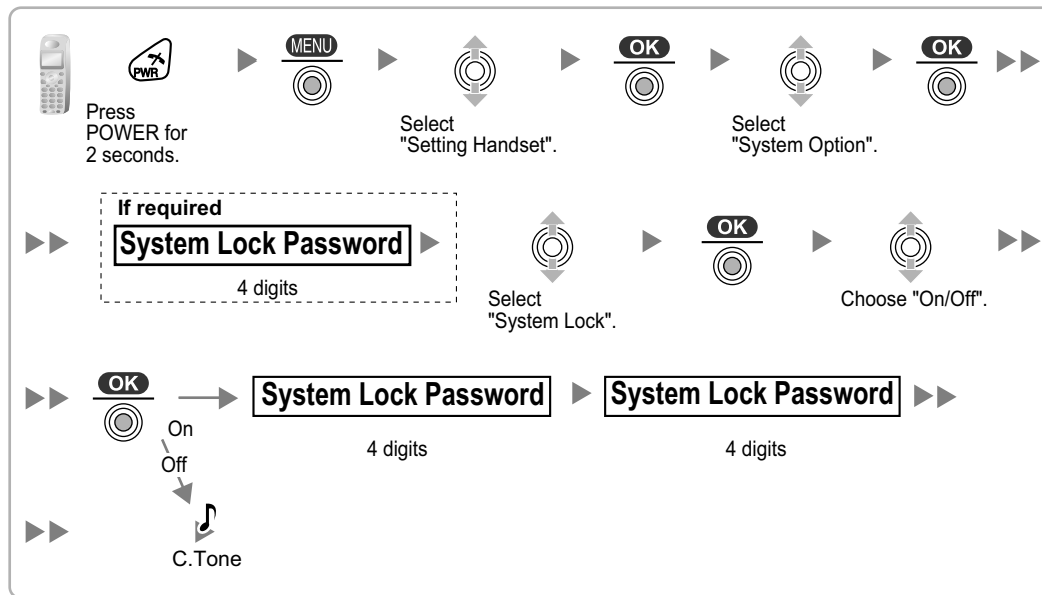
After PS registration, it is possible to set a 4-digit system lock password to prevent unauthorized access to PS system settings. When system lock is enabled, the system lock password will be required to access PS system settings.

CAUTION

To avoid unauthorized access and possible abuse of the PBX, we strongly recommend:

- Keeping the password secret.
- Changing your password regularly.
- Selecting a complex, random password that cannot be easily guessed.

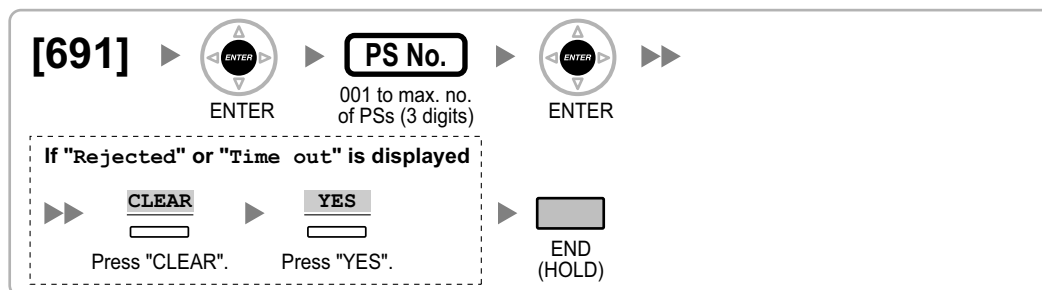
Using the KX-TD7685/KX-TD7695/KX-TD7696



PS Termination

Confirm the following before cancelling the PS registration:

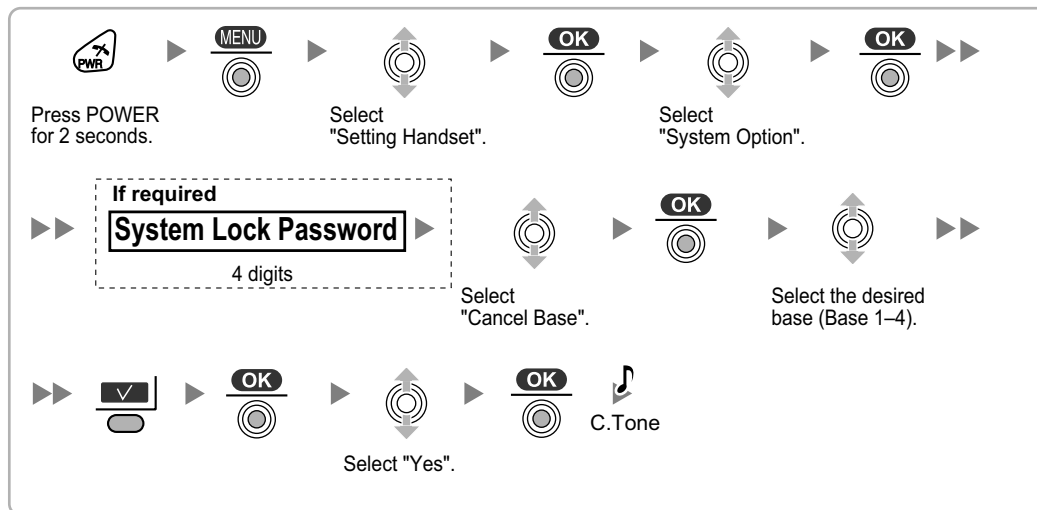
- The PS is turned on.
- The PS is within range.



If "Rejected" or "Time out" is displayed

The registration information is still stored in the PS. You need to delete the registration information from the PS.

Using the KX-TD7685/KX-TD7695/KX-TD7696



Testing the Operation

Walk around the service area while having a conversation using a registered PS. If noise is frequent or conversations disconnect, relocate the CSs or install an additional CS.

11 Wall Mounting

Mounting

WARNING

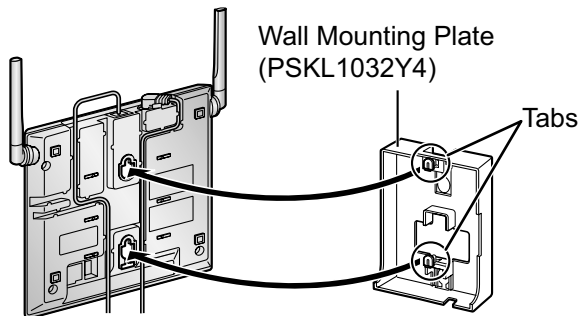
- Make sure that the wall that the unit will be attached to is strong enough to support the unit (approx. 440 g [16 oz]). If not, it is necessary for the wall to be reinforced.
- Only use the wall-mounting equipment (screws, washers, wall mounting plate) included with the unit.
- When this unit is no longer in use, make sure to detach it from the wall.

CAUTION

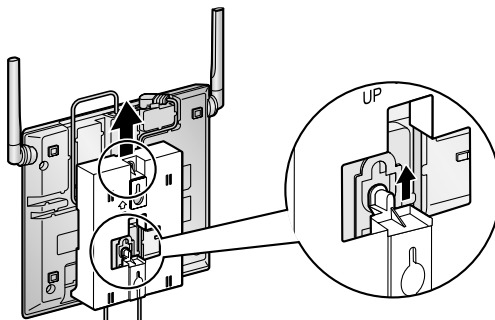
- When driving the screws into the wall, be careful to avoid touching any metal laths, wire laths or metal plates in the wall.
 - Do not stretch or bend the cables. Also, do not allow anything to rest on the cables.
 - Use cables that are fire-resistant or fireproof.
 - The CS and the cables should never be placed near or over a radiator or other heat source.
 - Do not bundle cables that are connected to the CS with the AC power cords of machines located nearby.
 - Make sure the cables are securely fastened to the wall.
1. Place the reference for wall mounting on the wall to mark the 2 screw positions.
 2. Install the 2 screws and washers (included) into the wall.

Note

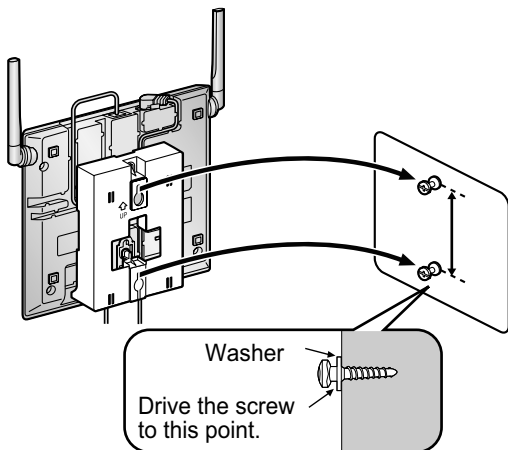
- Make sure that the screw heads are at the same distance from the wall.
 - Install the screws perpendicular to the wall.
3. Insert the upper and lower tabs of the wall mounting plate into the designated openings in the base unit.



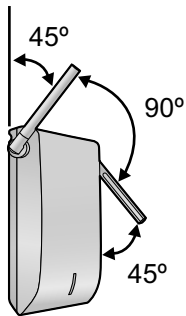
4. Slide the wall mounting plate in the direction of the arrow until it clicks.



5. Hook the CS on the screw heads.

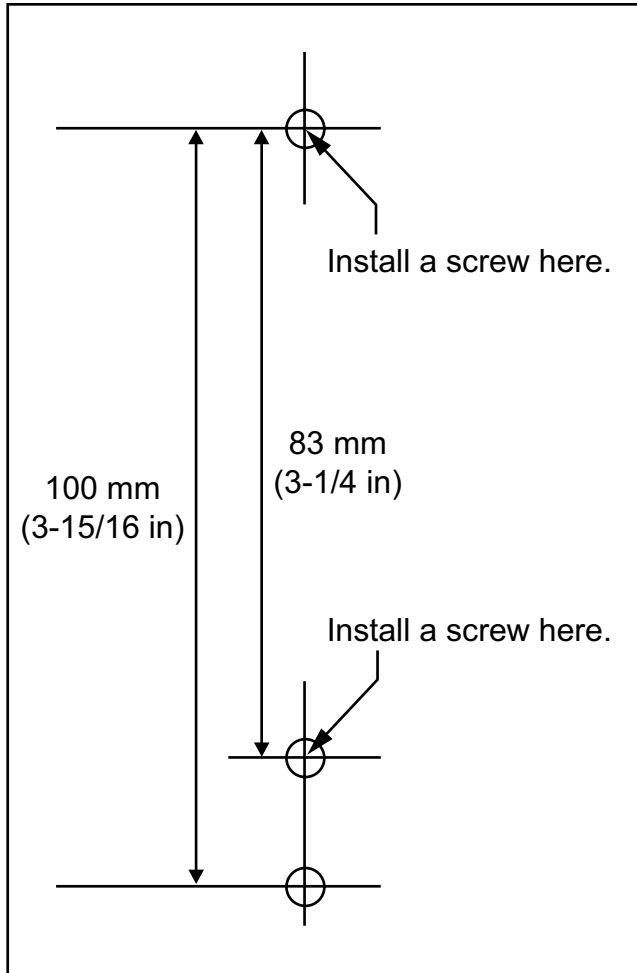


6. Place the antennas so that they are pointing in directions that are 90 degrees apart (for antenna diversity), as follows:



Reference for Wall Mounting

Please copy this page and use as a reference for wall mounting.



Note

Make sure to set the print size to correspond with the size of this page. If the dimension of the paper output still deviates slightly from the measurement indicated here, use the measurement indicated here.

12 Troubleshooting

| PROBLEM | PROBABLE CAUSE | SOLUTION |
|------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> The LED of the CS does not change to Green ON. | <ul style="list-style-type: none"> CS is not connected properly. | <ul style="list-style-type: none"> Make sure that the cable is connected properly with correct pin assignments. Also, make sure that the cable does not make short circuits. |
| | <ul style="list-style-type: none"> CS is not set for normal operation. | <ul style="list-style-type: none"> Switch all DIP switches off. |
| | <ul style="list-style-type: none"> The status of the port that the CS is connected to is Out of Service. | <ul style="list-style-type: none"> Change the port status from Out of Service to In Service using the Maintenance Console. |
| <ul style="list-style-type: none"> The LED of the CS stays Red ON during normal operation. | <ul style="list-style-type: none"> CS malfunction | <ul style="list-style-type: none"> Replace the CS. |
| | <ul style="list-style-type: none"> Network failure | <ul style="list-style-type: none"> Configure the network settings again using the IP Terminal Maintenance Console. |
| <ul style="list-style-type: none"> "CLEAR SCAN DATA" is displayed on the PS's screen after turning on the PS. | <ul style="list-style-type: none"> The PS cannot be used for normal operation when scan data is stored on the PS. | <ul style="list-style-type: none"> Clear the scan data by following the procedure described in "Clearing the Stored Scan Data" in "5 Site Survey Using the KX-TD7685/KX-TD7695/KX-TD7696". |
| <ul style="list-style-type: none"> Cannot register the CS even when maximum number of CSs is not exceeded. | <ul style="list-style-type: none"> The information of traditional CSs that are not currently used is left on the system. | <ul style="list-style-type: none"> Change the Air Synchronization Group No. to None using the Maintenance Console (refer to "3.24 [1-1] Slot—Port Property - Extension Port—DPT Type—Air Sync Group No" in the PC Programming Manual or the On-line Help for your PBX). |
| <ul style="list-style-type: none"> Cannot register the PS. | <ul style="list-style-type: none"> Wrong Personal Identification Number (PIN) is registered to the PS. | <ul style="list-style-type: none"> Enter the PIN set to the PBX into the PS. |
| <ul style="list-style-type: none"> PS becomes out of range. Cannot make calls using the PS. | <ul style="list-style-type: none"> Location of CS is not good. Access system of the PS is not properly set. | <ul style="list-style-type: none"> Locate the CS properly (refer to "5 Site Survey Using the KX-TD7685/KX-TD7695/KX-TD7696"). Change the access system setting of the PS to the appropriate system or automatic. |

| PROBLEM | PROBABLE CAUSE | SOLUTION |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> Noise is frequent while using the PS. Conversations disconnect while using the PS. There is noise during a phone call. Call handover is not working. "NO SERVICE" is displayed on the PS's screen. | <ul style="list-style-type: none"> The clock signal source CS is out of range for air synchronization. PS is out of CS coverage area. | <ul style="list-style-type: none"> Locate the CS properly (refer to "5 Site Survey Using the KX-TD7685/KX-TD7695/KX-TD7696"). |
| | <ul style="list-style-type: none"> Air synchronization between Master CS1 and Master CS2 has failed and each CS is generating its own clock signal. | <ul style="list-style-type: none"> Confirm the error log from Utility—Error Log—Minor using the Maintenance Console. If "369 IP-CS Handover error" is displayed for the error log, restart Master CS1 and Master CS2. |
| <ul style="list-style-type: none"> The CS is not busy (i.e., the status of the LED is not Moderate Green Flashing [120 times per minute]), but calls cannot be made or received. There is noise during a phone call. | <ul style="list-style-type: none"> CSs are located too close together in the same area. | <ul style="list-style-type: none"> Reduce the number of CSs in the area, or increase the distance between CSs (refer to "5 Site Survey Using the KX-TD7685/KX-TD7695/KX-TD7696"). |
| When traditional CSs are assigned as Master CSs: <ul style="list-style-type: none"> IP-CSs reset frequently. | <ul style="list-style-type: none"> The software version of the traditional CSs is old. | <ul style="list-style-type: none"> Update the traditional CSs to version 5.000 or later. |
| <ul style="list-style-type: none"> PS stays out of service when the CS status is changed from Out of Service to In Service. | <ul style="list-style-type: none"> It may take about 20 s for the CS to start up after the status has been changed to In Service. | <ul style="list-style-type: none"> Wait until the CS starts up. |
| <ul style="list-style-type: none"> IP-CSs are installed at a remote site after installing CSs at a local site, but the IP-CSs do not operate. | <ul style="list-style-type: none"> IP-CSs are not properly synchronized with any CS. | <ul style="list-style-type: none"> When using only one IP-CS at a remote site, assign the IP-CS as Master CS1. When using multiple IP-CSs at a remote site, establish air synchronization between IP-CSs. |
| <ul style="list-style-type: none"> After uninstalling some CSs, other CSs do not operate. | <ul style="list-style-type: none"> Master CS is uninstalled. | <ul style="list-style-type: none"> Assign a Master CS again for air synchronization (refer to "Assigning the Synchronizing CSs"). |
| <ul style="list-style-type: none"> When performing Utility—File Transfer FTP to IP Equipment using the Maintenance Console, the programs stored in IP-CSs cannot be updated. | <ul style="list-style-type: none"> The network is busy. | <ul style="list-style-type: none"> Set the value of Keep Alive Time-Out to 40 seconds or more for Slot—Card Property - Virtual IPCS. <p>Notice</p> <p>Be sure to change the value back to its previous value after the update is complete.</p> |

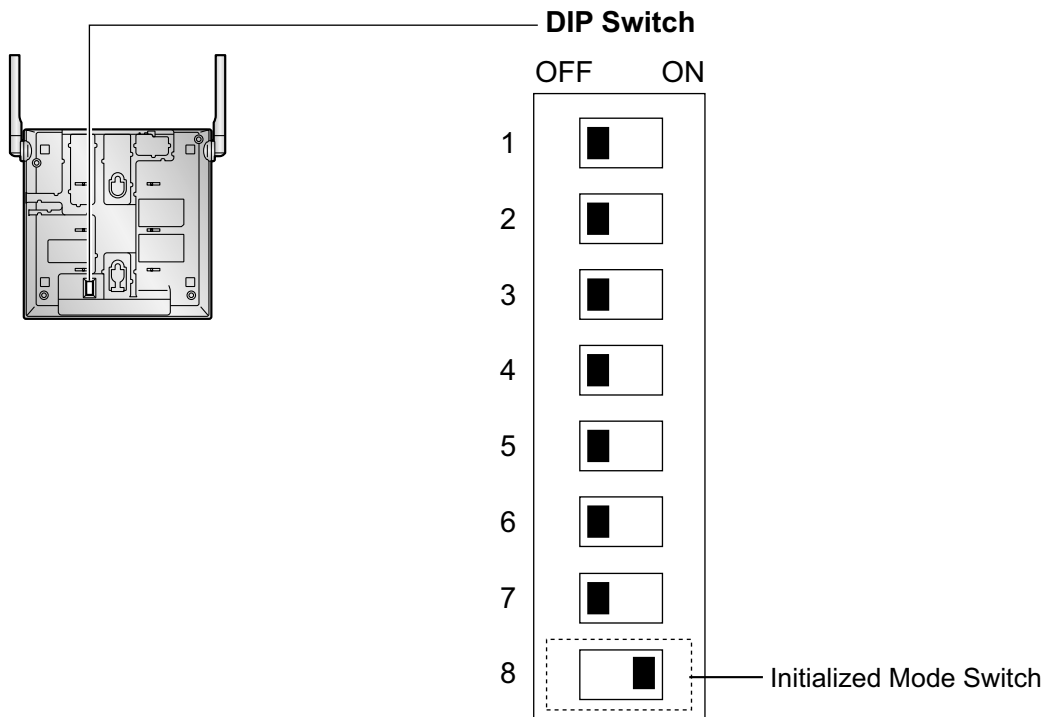
13 Initializing the IP Cell Station

If the IP-CS does not operate properly, initialize the IP-CS. Before initializing the IP-CS, try the system feature again to confirm whether there definitely is a problem or not.

The settings that are configured by using the IP Terminal Maintenance Console are changed back to their factory default by initializing the IP-CS. For more details, refer to "E Information about IP Terminal Maintenance Console".

While initializing the IP-CS, calls cannot be made or received and ongoing conversations will be disconnected.

1. Switch the Initialized Mode switch from OFF to ON.



2. Supply electricity to the IP-CS using an AC adaptor, PoE hub, or PoE adaptor (turn on the IP-CS).
3. While the LED indicator flashes red (Moderate Flashing: 120 times per minute), switch the Initialized Mode switch from ON to OFF.

Note

When the LED turns off for a while then flashes red, initialization is complete.

A Step-by-step Instructions for Easy Installation

A.1 Importance of Site Survey for Air Synchronization

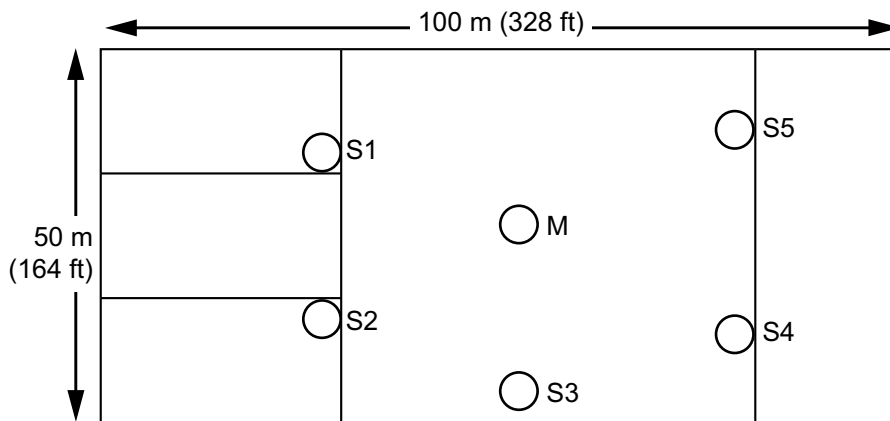
A traditional CS receives the clock signal from the connected PBX. Unlike a traditional CS, an IP-CS cannot receive the clock signal from a PBX, because the IP-CS is connected to a LAN rather than directly to a PBX. Air synchronization is necessary to send/receive the clock signal between IP-CSs.

An incorrectly performed site survey may cause IP-CSs to reset due to synchronization failure. Therefore, it is necessary to conduct the site survey and plan the location of IP-CSs with extreme care.

A.2 [Case 1] One Master CS; Slave CSs are Synchronizing with the Master CS only

Step 1 - Site Planning

1. Obtain a site map from your customer.
2. Plan the location of each IP-CS.
 - a. Locate the Master CS at the center of the installation site.
 - b. Locate the Slave CSs around the Master CS.
3. Give a name to each IP-CS, and write it down in the map.



Note

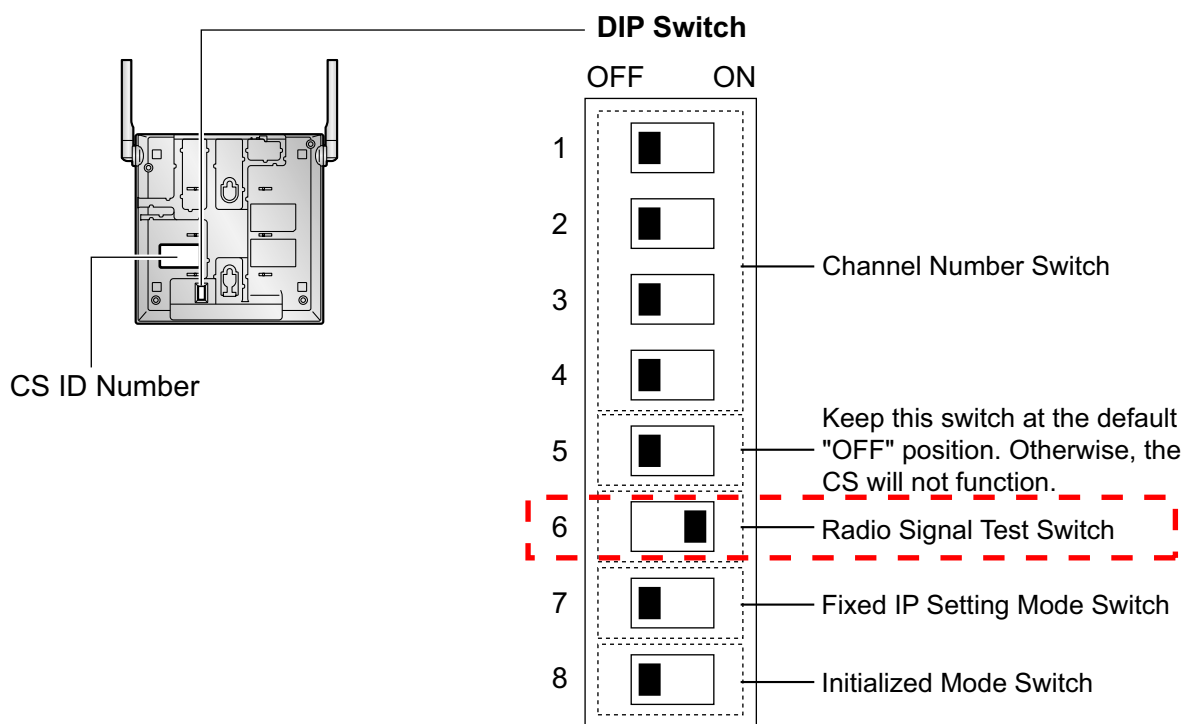
Draw the coverage area around each IP-CS. Extend the coverage area 20 m to 40 m (65 ft to 131 ft) in each direction, depending on the materials of the building structures and obstacles in the installation site.

Step 2 - Setting and Installing IP-CSs for the Site Survey

1. Prepare the following items for the site survey:

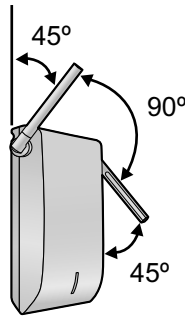
| Item | | Quantity | Description |
|--------------|---------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Power Supply | AC Adaptor | One of either | KX-A421 |
| | User-supplied items | | <ul style="list-style-type: none"> Battery: VRLA (Valve Regulated Lead Acid) 12 V DC Battery cable: PSJS02P57 |
| | PoE Hub | | IEEE802.3af certified |
| | PoE Adaptor | | IEEE802.3af certified |
| LAN cable | | 1 | If using PoE as a power supply, CAT 5 or higher required. |
| IP-CS | | 1 | KX-NCP0158 |
| PS | | 1 | KX-TD7685, KX-TD7695, or KX-TD7696 |

2. Switch the Radio Signal Test switch from OFF to ON.



3. Turn on the IP-CS (by connecting the IP-CS to an AC adaptor, battery, PoE hub, or PoE adaptor).

- Temporarily install the IP-CS at least 2 m above the floor, and place the antennas so that they are pointing in directions that are 90 degrees apart (for antenna diversity), as follows:

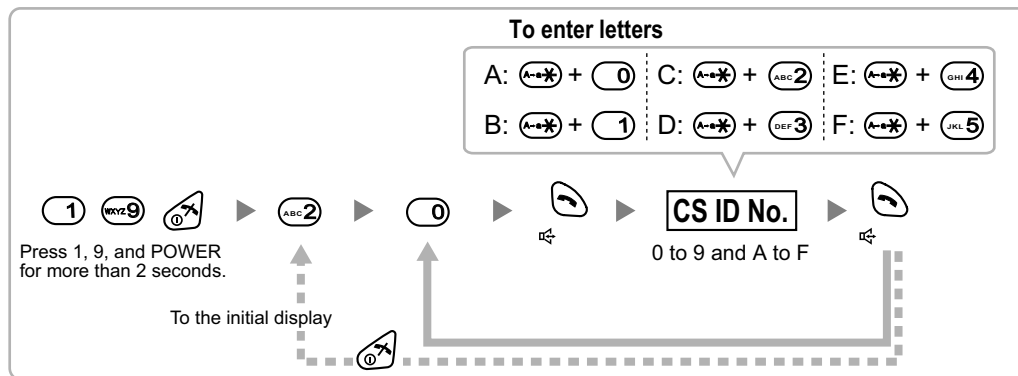


Notice

Be sure to install the Master CS at the center of the installation site.

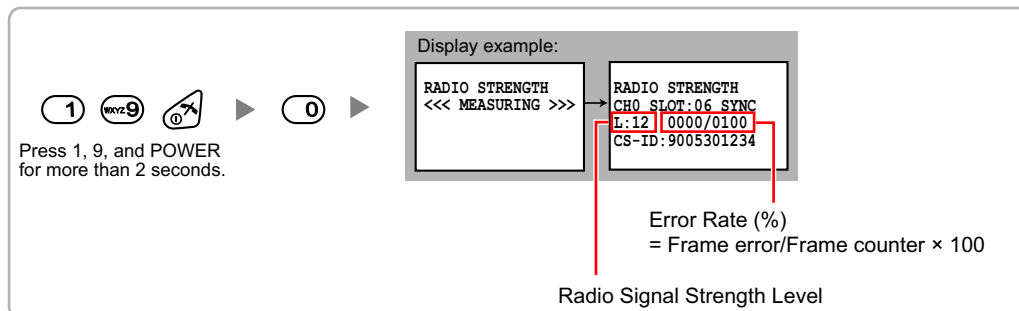
Step 3 - Setting a PS for the Site Survey

Assign the CS ID number to the PS.



Step 4 - Site Survey

- Enter Radio Signal Test mode.



Note

When the error rate is 3% or more, measure the error rate at the same location at least 5 times. You must disconnect the CS and then reconnect it to take each measurement. If the error rate is consistently

3% or more, there may be interference from external wireless equipment. In this case, the following may happen regardless of the radio signal strength level.

Error Rate for Establishing Conversations Using PSs

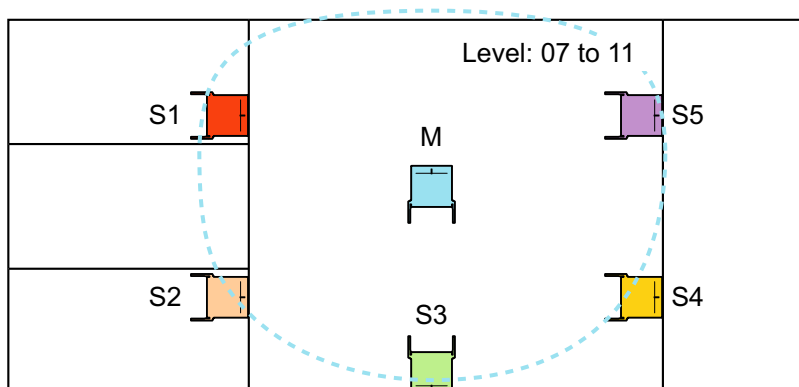
| Error Rate | Description |
|-------------|--------------------------------|
| Approx. 3% | May receive noise |
| Approx. 10% | May fail to make/receive calls |

Error Rate for Air Synchronization between CSs

| Error Rate | Description |
|-------------|----------------------------------------------------|
| Approx. 10% | May be reset due to synchronization failure of CSs |

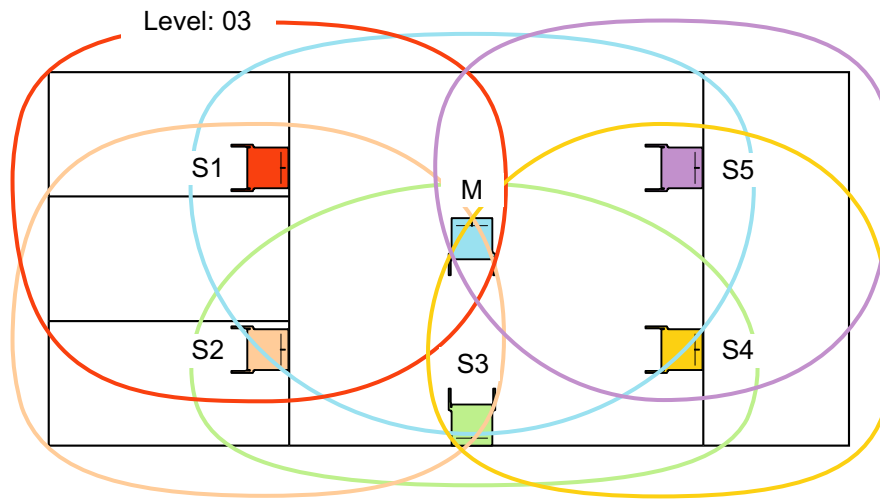
If the frame error value continues to increase abnormally (100 per second), the radio signal has been lost. In this case, enter "0" again and retry measuring the error rate and the radio signal strength. The above is a rough standard, and may vary depending on the environment.

2. Walk around the Master CS to identify the coverage area within which the radio signal strength level is between "07" and "11".
3. Draw the coverage area on the map.



4. When necessary, relocate Slave CSs so that they are within the area where the radio signal strength level of the Master CS is between "07" and "11".
5. Walk around each IP-CS to identify the coverage area within which the radio signal strength level is greater than "03".

6. Draw the coverage area on the map.



Step 5 - Ending the Site Survey

1. Hold down the POWER button on the PS until the PS is off.
2. Turn off the IP-CS (by disconnecting the IP-CS from an AC adaptor, battery, PoE hub, or PoE adaptor).
3. Set DIP switch no. 6 (Radio Signal Test switch) from ON to OFF.

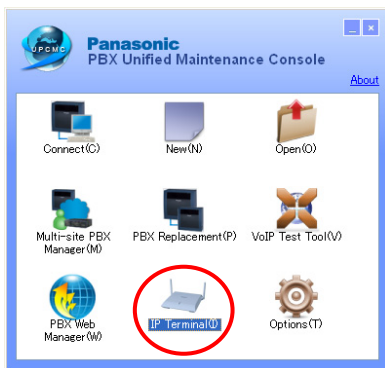
Step 6 - Assigning IP Addressing Information to IP-CSs

1. Prepare the following items:

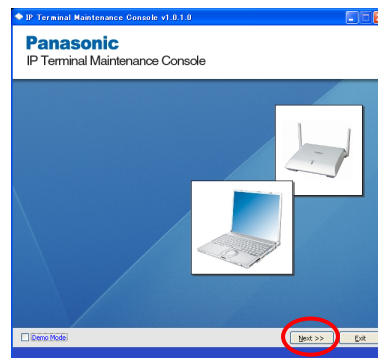
| Item | | Description |
|------------------------|-------------|--------------------------------|
| Power Supply | AC Adaptor | KX-A421 |
| | PoE Hub | IEEE802.3af certified |
| | PoE Adaptor | IEEE802.3af certified |
| Switching Hub | | Use a 10BASE-T/100BASE-TX hub. |
| LAN cable | | CAT 5 or higher required. |
| IP-CS | | KX-NCP0158 |
| PC Maintenance Console | | Latest version |

2. Assign the following IP address and subnet mask address to the PC:
 - IP address: 192.168.2.xxx (xxx: 1–254 except 101)
 - Subnet mask address: 255.255.255.0
3. Follow the directions indicated on the IP Terminal Maintenance Console.

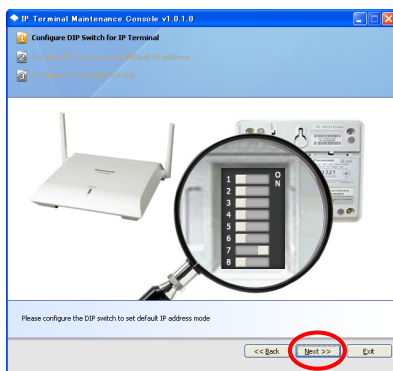
1



2

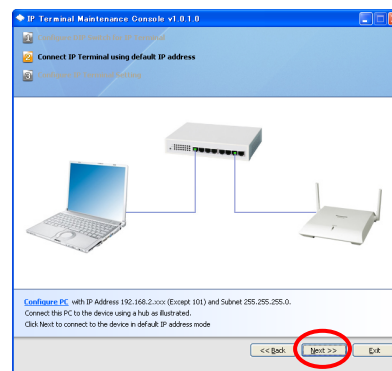


3



- Set DIP switch no. 7 (Fixed IP Setting Mode switch) to the ON position.

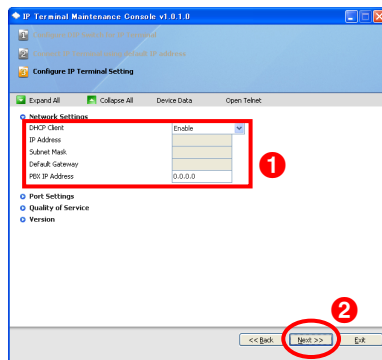
4



- Connect the IP-CS to the PC, and then turn it on.

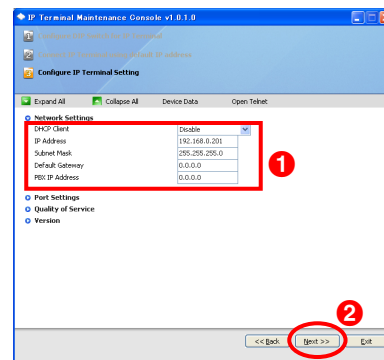
5

[When using a DHCP server]



OR

[When not using a DHCP server]



- **DHCP Client:** Enable
- **PBX IP Address:** 0.0.0.0 (default)

Note

If the IP-CS and PBX belong to different subnets, it is necessary to set **PBX IP Address**.

- **DHCP Client:** Disable
- **IP Address:** IP-CS's IP address
- **Subnet Mask, Default Gateway:** Match your network's settings.
- **PBX IP Address:** 0.0.0.0 (default)

Note

If the IP-CS and PBX belong to different subnets, it is necessary to set **PBX IP Address**.

6



- **Next Device:** Assign IP addressing information to other IP-CSs.
- **Main Screen:** Return to the main screen.

4. Turn off the IP-CS.
5. Return DIP switch no. 7 to the OFF position.
6. Return the IP address and subnet mask address of the PC to their original values.

Step 7 - Registering IP-CSs to the PBX

1. In addition to the items you prepared in Step 6, prepare the following items:

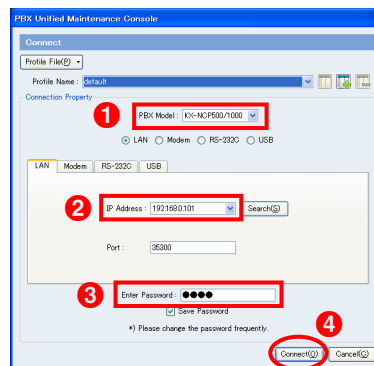
| Item | Description |
|------|----------------------------------------------------------------------------------------------------------------------|
| PBX | KX-TDE series: MPR Software File Version 3.0000 or later KX-NCP series: MPR Software File Version 2.0200 or later |

2. Follow the directions indicated on the PC Maintenance Console.

1

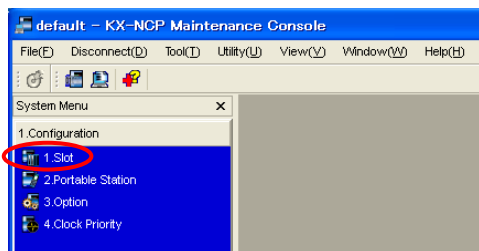


2

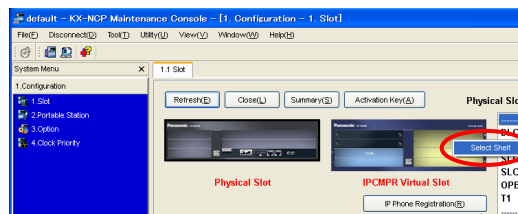


- **PBX Model:** Your PBX's model
- **IP Address:** Your PBX's IP address
- **Enter Password:** 1234 (default)

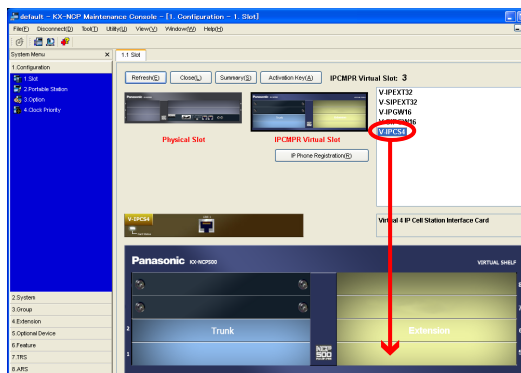
3



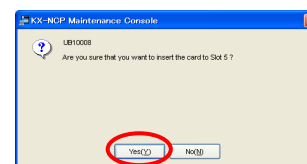
4



5

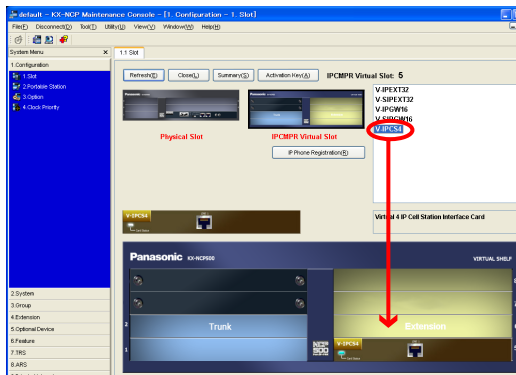


6

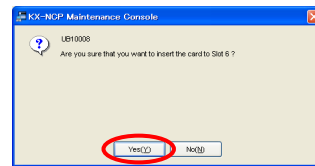


- Four ports are added.

7

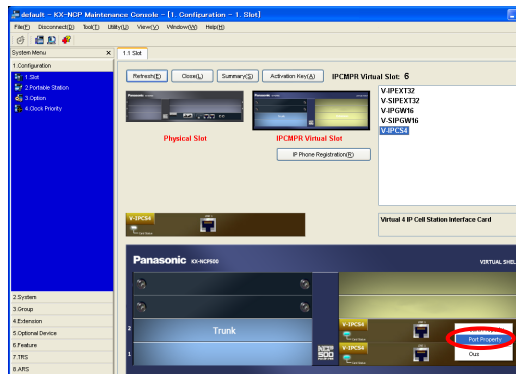


8

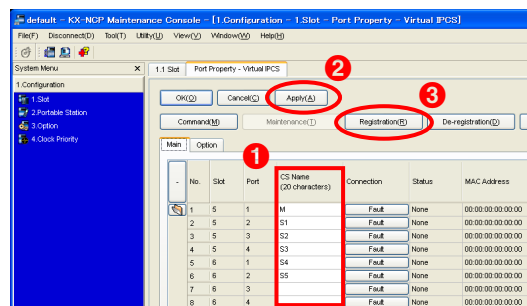


- Four more ports are added.

9

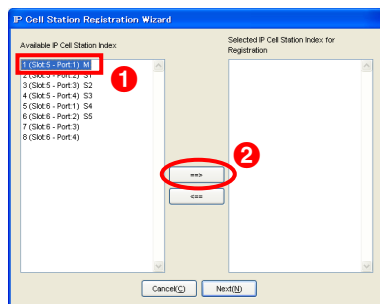


10

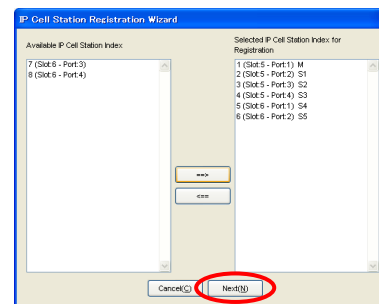


- CS Name:** The name you gave each IP-CS in "Step 1 - Site Planning".

11

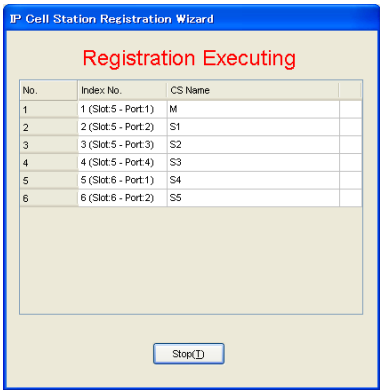


12



- Repeat for "S1" through "S5".

13



- Turn on the IP-CS "M".

14



- After the green check mark is displayed for "M", turn on the next IP-CS ("S1"). In this way, after the green check mark is displayed for each IP-CS, turn on the next IP-CS, in the following order:
S2 → S3 → S4 → S5
- Identify each IP-CS by its CS name (e.g., by attaching a name label to the IP-CS).

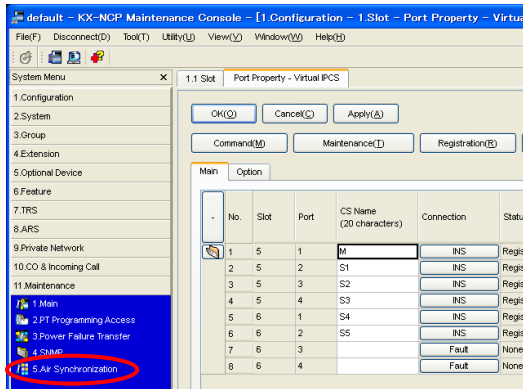
15



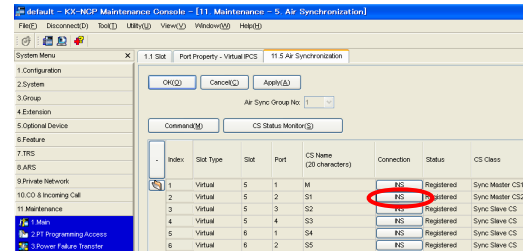
Step 8 - Air Synchronization Settings

Follow the directions indicated on the PC Maintenance Console.

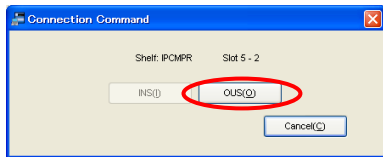
1



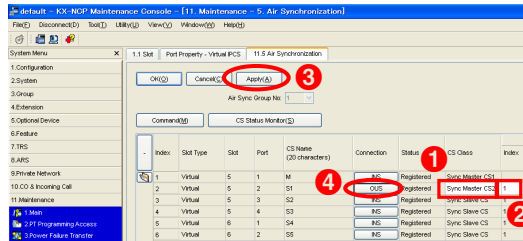
2



3

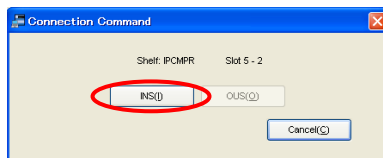


4

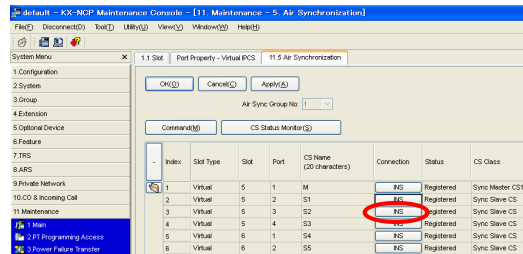


- **CS Class: Sync Slave CS**
- **Index: 1**

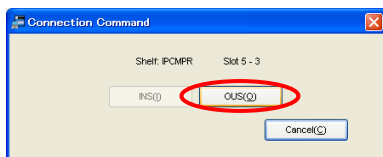
5



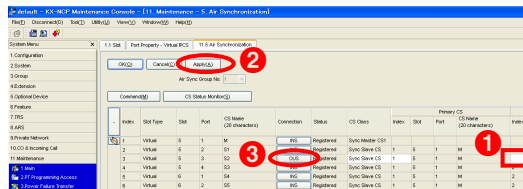
6



7

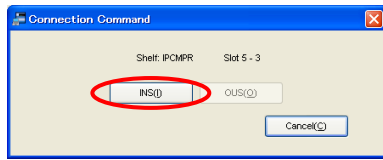


8



- **Select [blank] for the Index setting for the Secondary CS.**

9



- Repeat steps 6 to 9 for "S3" through "S5".

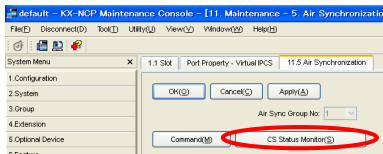
Step 9 - Locating the IP-CSs

Locate the IP-CSs in the positions established in the site survey.

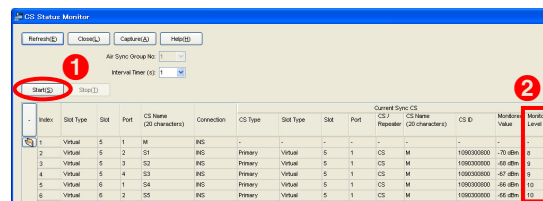
Step 10 - Confirming the Status of Air Synchronization

Follow the directions indicated on the PC Maintenance Console.

1



2



- Monitored Level:** Between "7" and "11".

Notice

If the monitored level is not between "7" and "11", relocate the IP-CS.

Step 11 - Registering PSs

Refer to "10 Registering Portable Stations".

Step 12 - Testing PS Operation

Walk around the service area while having a conversation using a registered PS. If noise is frequent or the conversation is disconnected, relocate the IP-CS or install an additional IP-CS.

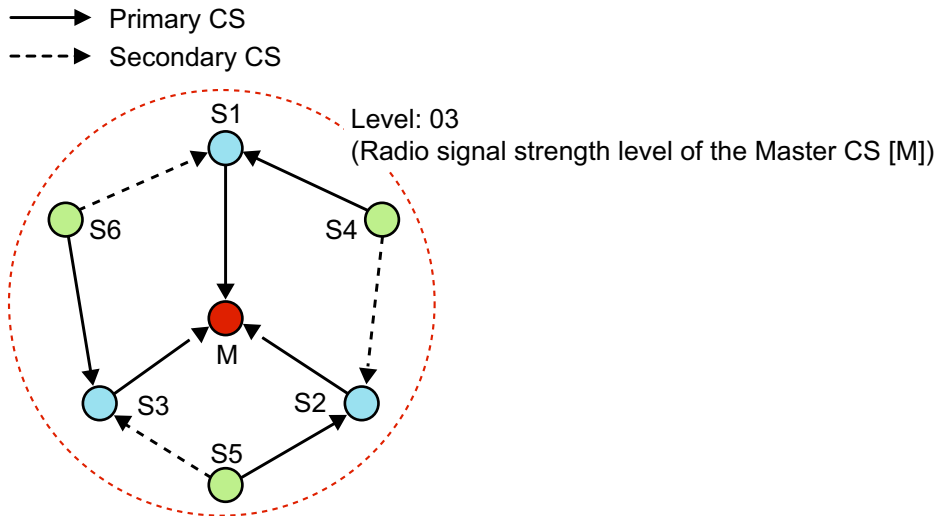
Step 13 - Wall Mounting

Refer to "11 Wall Mounting".

A.3 [Case 2] One Master CS; Slave CSs are Synchronizing with the Master CS and Other Slave CSs

In addition to the steps described in [Case 1], the following conditions must be met to enable this configuration. Each Slave CS should be within the coverage area where the radio signal strength levels of other IP-CSs are as indicated in the chart below.

[Installation Configuration]



[Radio Signal Strength Level Chart for Air Synchronization]

L : The radio signal strength level of **A**. **B** should also be within this area.

Yellow : **B** is synchronizing with **A** by receiving the clock signal from **A**.

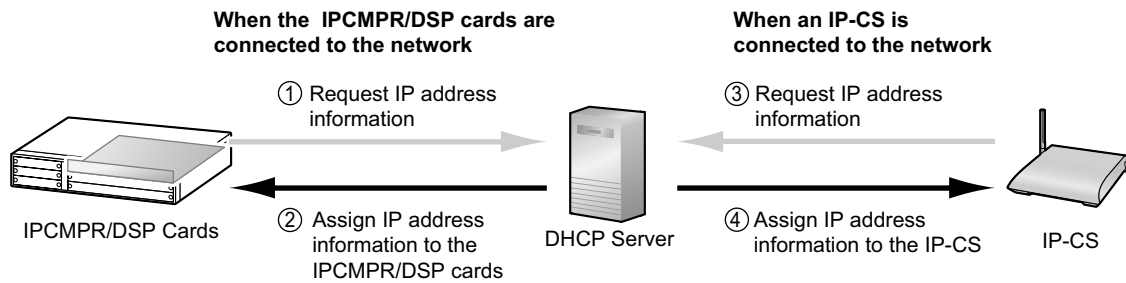
Blue : **B** is NOT synchronizing with **A**.

| A \ B | M | S1 | S2 | S3 | S4 | S5 | S6 |
|-------|---|----------|----------|----------|----------|----------|----------|
| M | | L: 07-10 | L: 07-10 | L: 07-10 | L: 03-06 | L: 03-06 | L: 03-06 |
| S1 | | | | | L: 07-10 | | L: 07-10 |
| S2 | | | | | L: 07-10 | L: 07-10 | |
| S3 | | | | | | L: 07-10 | L: 07-10 |
| S4 | | | | | | | |
| S5 | | | | | | | |
| S6 | | | | | | | |

B Network Management

DHCP (Dynamic Host Configuration Protocol) Server

To establish communication over a VoIP network, IP addresses must be assigned to IP-CSs and the PBX to identify their locations on the network. While these addresses can be assigned manually, it is also possible to use a DHCP server to automatically assign IP address information. Using a DHCP server allows you to centrally manage and automate the assignment of IP addresses.



Note

- The PBX is not able to act as a DHCP server. To use the DHCP client function of IP-CSs, a separate DHCP server is required on the network, as shown above.
- An IP-CS cannot request IP addresses from a DHCP server on another LAN (connected through an IP network). They can only receive IP addresses from a DHCP server on the same LAN. Therefore, when IP-CSs are located on several LANs, a DHCP server is required on each LAN. If a DHCP server is not present on the LAN, IP addresses for IP-CSs on that LAN must be assigned manually.

C Packet Control Features

Jitter Buffer

When voice signals are packetized and transmitted, individual packets can take different paths through the network and arrive at the destination at varied timings. This is referred to as "jitter", and it can cause degradation in speech quality. To compensate for jitter problems, the "jitter buffer" accumulates the packets temporarily for processing.

To set the size of the jitter buffer, refer to "3.4 [1-1] Slot—Card Property - IPCMPR/IPCEMPR—VoIP-DSP Option" in the PC Programming Manual or the On-line Help for your PBX.

Voice Activity Detection (VAD)

The VAD conserves bandwidth by detecting silent periods during a call and suppressing the packets of silence from being sent to the network. This feature can be enabled or disabled for codec G.711.

To configure the VAD feature, refer to "3.21 [1-1] Slot—Port Property - Virtual IPCS—Voice Activity Detection for G.711" in the PC Programming Manual or the On-line Help for your PBX.

Note

To use the VAD feature for a certain codec, be sure to enable it for that codec on both the local and remote gateway devices.

D Guidance for VoIP Installation

D.1 VoIP Requirements

Bandwidth Assessment

When using IP-CSs, you must ensure that the IP network in use has enough bandwidth to support VoIP communications. If the amount of bandwidth required for VoIP communications is more than the network can accommodate, speech quality will be compromised. In addition, there may be an adverse effect on the performance of other applications (e.g., email or web applications) that use the same network. Therefore, care must be taken when assessing bandwidth requirements.

Inform your network administrator of the required bandwidth, and make sure that the network can support VoIP communications even under conditions of maximum network traffic.

Required Bandwidth for a Call via an IP-CS

The required bandwidth depends on what combination of codecs and packet sending intervals is used. Keep in mind the following points about the type of codecs and packet sending intervals, in terms of speech quality:

- The speech quality of the codecs varies as follows: G.711 (High), G.729A (Low)^{††}
- The shorter the packet sending interval, the higher the speech quality.
- The higher the speech quality the IP-CSs provide, the more bandwidth the IP-CSs require.

^{††} When the preferred codec of each party differs, the call will be established using the lower codec. For example, if the caller prefers G.711 while the called party prefers G.729A, the call will be established using G.729A.

| Codec | Packet Sending Interval | | | |
|--------|-------------------------|-----------|-----------|-----------|
| | 20 ms | 30 ms | 40 ms | 60 ms |
| G.711 | 87.2 kbps | 79.5 kbps | — | — |
| G.729A | 31.2 kbps | 23.5 kbps | 19.6 kbps | 15.7 kbps |

Required Bandwidth for Each Virtual IP-CS Card

To allow all IP-CSs to handle calls simultaneously, it is necessary to keep available the bandwidth required by a virtual IP-CS card with the maximum number of IP-CSs connected.

Provided below is the formula to calculate the amount of bandwidth required for each virtual IP-CS card.

| |
|---------------------------------------------------------------------|
| Required Bandwidth = (Bandwidth for a call via an IP-CS × 4) |
|---------------------------------------------------------------------|

Network Configuration

You must evaluate the structure of the existing network to see if a VoIP network can be implemented. Below are the points that should be evaluated.

Is the IP network a managed network?

A VoIP network should be implemented on a managed IP network such as Frame Relay, Leased Line, or IP-VPN (Virtual Private Network).

An unmanaged network, such as the Internet (including an Internet VPN), cannot be used to employ a VoIP network because delays and loss in data transmission can cause huge degradation in speech quality.

Is it possible to have static IP addressing?

IP-CSs on the network always perform VoIP communications through the PBX. Therefore, the PBX must be assigned static IP addresses, which must be programmed to each IP-CS on the network.

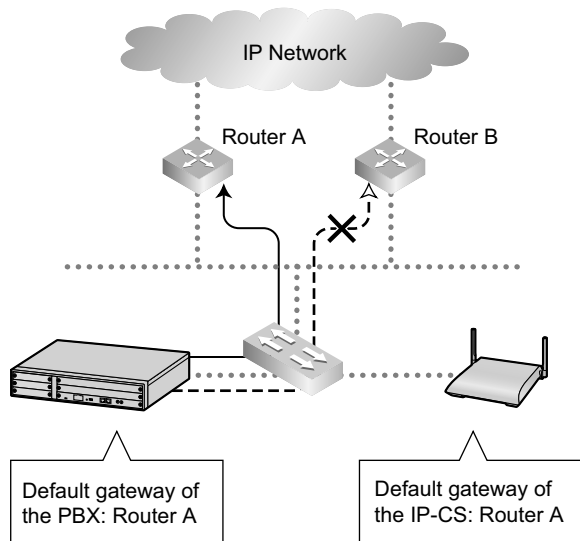
Note

When a DHCP server (which automates IP addressing of devices on the network) is not used, static IP addressing must also be enabled for all IP-CSs.

Does only a single router provide access to the IP network?

In a dual network, 2 routers provide access to the IP network as shown in the diagram below. However, only one router can be used as an access point to the network.

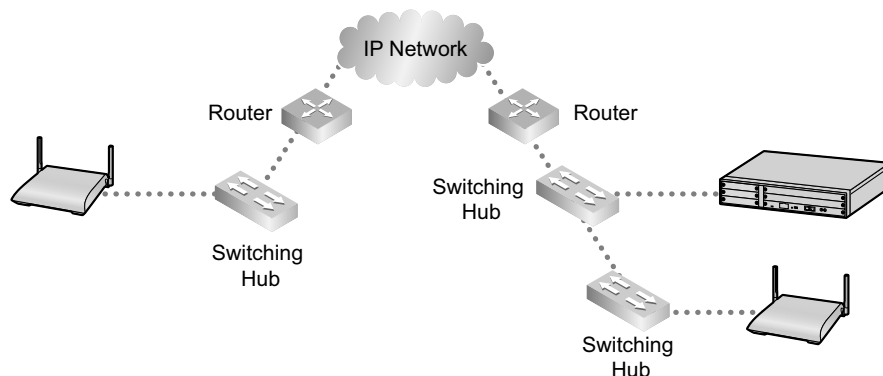
Therefore, in the diagram below, if router A, whose IP address is assigned as the default gateway IP address of the PBX and the IP-CSs, fails, VoIP communications are no longer possible; they are not able to switch their default gateway from router A to router B to access the IP network.



Are the network devices located appropriately for effective VoIP communications?

Transmission delays can cause pauses and loss in VoIP communications. The more network devices (e.g., routers and switching hubs) there are between the PBX and IP-CSs or the IP network interface, the longer the transmission delays. This is because a certain amount of delay is inevitable when packets go through each network device.

To prevent unnecessary delays, it is recommended to connect the PBX as close to the IP-CSs and the IP network interface as possible so that the number of the network devices is kept to a minimum.



Network Devices

You must evaluate the network devices that are used in the existing network to see if a VoIP network can be implemented. Below are the points that should be evaluated.

Can the firewall pass packets appropriately?

If the VoIP network contains a firewall, the firewall must be configured appropriately to allow VoIP packets, listed in the table below, to pass through the network without being blocked by filtering.

For more information, consult your network administrator.

[IP Packets from IPCMP/IPCMP Card and IP-CSs]

| Protocol | Description | TCP/UDP | Default Port No. |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|------------------|
| RTP (IP-CS) | Real-time Transport Protocol. Used for voice data transmission. | UDP | 12000 to 12255 |
| Maintenance (IPCMP/IPCMP) | Panasonic proprietary protocol. Used for communication parameter negotiation with the PBX, download of country/area data, confirmation of connection with the PBX, and notification of error messages and statistical information to the PBX. | UDP | 39300 |
| Maintenance (IP-CS) | | UDP | 9301 |
| MGCP (IPCMP/IPCMP) | Media Gateway Control Protocol. Used for call control command data and LCD/LED data transmission. | UDP | 32727 |
| MGCP (IP-CS) | | UDP | 2427 |
| DHCP (IPCMP/IPCMP) | Dynamic Host Configuration Protocol. Used for receiving an IP address from a DHCP server. | UDP | 67 |
| DHCP (IP-CS) | | UDP | 68 |

| Protocol | Description | TCP/UDP | Default Port No. |
|-----------------|--------------------------------------------------------------------------------------------------------------|---------|------------------|
| FTP (Port mode) | File Transfer Protocol. Used for receiving a data file from a FTP server to upgrade the firmware version. | TCP | 21 |

Are layer 2 or higher switches used?

Use of repeater hubs can increase the network load, and therefore may result in degradation in speech quality. To ensure high speech quality, use only layer 2 or higher switches. Use of layer 2 or higher switches is also strongly recommended for connecting IP-CSs.

Note

Note that the port of the switching hub that connects to the IPCMPR/IPCEMPR card should be set to operate under "Auto Negotiation" mode.

Are Category 5 (CAT 5) or higher cables used?

When connecting network devices, make sure to use CAT 5 or higher cables. If other types of cables are used, communications may not be carried out normally.

D.2 VoIP Requirements Checklist

Use the following checklists to see if you can implement a VoIP network. The answers identified in **underlined bold-face letters** are the required answers for the corresponding questions.

Bandwidth Assessment

| No. | Question | Answer | Memo | Ref. |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1 | <p>Does the network have enough bandwidth to support VoIP communications?</p> <p>Make sure that there is more bandwidth available for VoIP communications than the amount actually required.</p> | <input type="checkbox"/> <u>Yes</u> <input type="checkbox"/> No | <ul style="list-style-type: none"> IP network bandwidth = kbps Available bandwidth for VoIP = kbps Required bandwidth for VoIP = kbps | p. 80 |

Network Configuration

| No. | Question | Answer | Memo | Ref. |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|---------------------|-------|
| 2-a | <p>Is the IP network a managed network?</p> <p>Make sure to use a managed IP network such as Frame Relay, Leased Line, or IP-VPN (Virtual Private Network). The IPCMP/ IPCEMPR card is not intended for use on the Internet (including an Internet VPN).</p> | <input type="checkbox"/> <u>Yes</u> <input type="checkbox"/> No | Type of IP network: | p. 80 |
| 2-b | Is it possible to have static IP addressing? | <input type="checkbox"/> <u>Yes</u> <input type="checkbox"/> No | | p. 80 |
| 2-c | Does only a single router provide access to the IP network? | <input type="checkbox"/> <u>Yes</u> <input type="checkbox"/> No | | p. 81 |
| 2-d | <p>Are the network devices located appropriately for effective VoIP communications?</p> <p>It is recommended to connect the PBX as close to IP-CSs and the IP network interface as possible.</p> | <input type="checkbox"/> <u>Yes</u> <input type="checkbox"/> No | | p. 82 |

Network Devices

| No. | Question | Answer | Memo | Ref. |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|--------------------|-------|
| 3-a | <p>Can the firewall pass packets appropriately?</p> <p>When a firewall is used, make sure to configure the firewall appropriately to allow VoIP packets to pass through the network without being blocked by filtering.</p> | <input type="checkbox"/> <u>Yes</u> <input type="checkbox"/> No | Model of firewall: | p. 82 |

| No. | Question | Answer | Memo | Ref. |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|------------------|-------|
| 3-b | Are layer 2 or higher switches used? Do not use repeater hubs as they can increase the network load. Also note that the port of the switching hub that connects to the IPCMPR/IPCEMPR card should be set to operate under "Auto Negotiation" mode. | <input type="checkbox"/> <u>Yes</u> <input type="checkbox"/> No | Model of switch: | p. 83 |
| 3-c | Are Category 5 (CAT 5) or higher cables used? | <input type="checkbox"/> <u>Yes</u> <input type="checkbox"/> No | | p. 83 |

E Information about IP Terminal Maintenance Console

Parameters

Network Settings

| Parameter | Value Range |
|-----------------|--------------------------------------------------------------|
| DHCP Client | Disable, Enable |
| IP Address | 1-223.0-255.0-255.0-255 |
| Subnet Mask | 0-255.0-255.0-255.0-255 (except 0.0.0.0 and 255.255.255.255) |
| Default Gateway | 0-223.0-255.0-255.0-255 |
| PBX IP Address | 0-223.0-255.0-255.0-255 |

Port Settings

| Parameter | Value Range |
|-----------------------------|----------------|
| PTAP Server Port No. | 1024-65535 |
| PTAP Client Port No. | 1024-65535 |
| DHCP Server Port No. | 67, 1024-65535 |
| DHCP Client Port No. | 68, 1024-65535 |
| FTP Server Control Port No. | 21, 1024-65535 |
| FTP Client Control Port No. | 0, 1024-65535 |
| FTP Client Data Port No. | 0, 1024-65535 |

Quality of Service

| Parameter | Value Range |
|-------------------|-----------------|
| Diffserv | Disable, Enable |
| Diffserv DS Field | 0-7.0-7 |

Version

| Parameter | Value Range |
|--------------|-------------------------------------|
| MAC Address | 00:00:00:00:00:00–FF:FF:FF:FF:FF:FF |
| LDR Version | Version number |
| BIND Version | Version number |

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