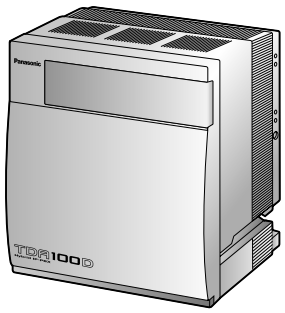
Panasonic



# Information about IP Proprietary Telephones

## Hybrid IP-PBX

**Model No.** KX-TDA100D

Thank you for purchasing a Panasonic Hybrid IP-PBX.
Please read this manual carefully before using this product and save this manual for future use.

**KX-TDA100D: PDMPR Software File Version 5.1000 or later**

In this manual, the suffix of each model number is omitted (e.g., KX-TDA100D**CE**).

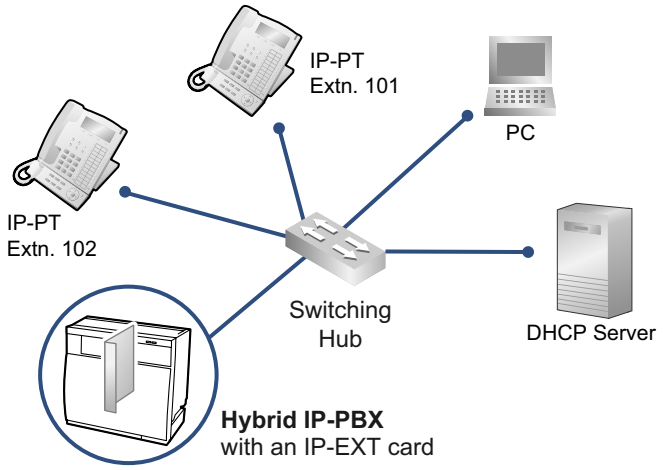
# Table of Contents

# Section 1
# Introduction

# 1.1 Overview

## 1.1.1 Using IP Proprietary Telephones on a Local Office LAN

Panasonic KX-NT series IP proprietary telephones (IP-PTs) allow voice communication over the data network by converting the voice into data. The following diagram shows a simple Voice over Internet Protocol (VoIP) network using the IP-PTs at the local office.




### Network Parameters

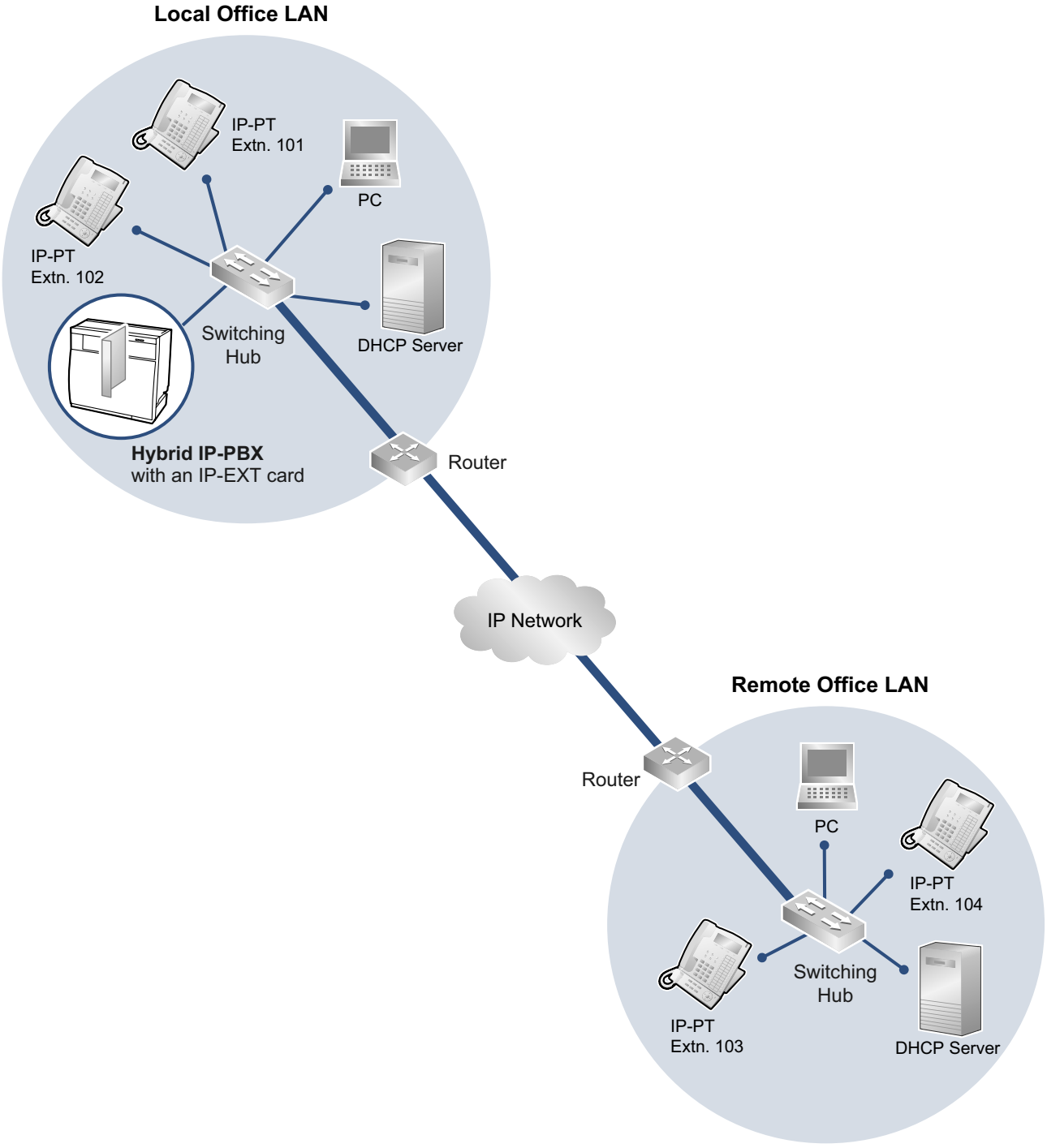
You will need to have the following IP addressing and QoS information to use IP-PTs on your network. This information is typically supplied by a network administrator.
The numbers in the table below are given as examples. Consult your network administrator for specific values.

| Parameter | Description | Example Entry | |
|---|---|---|---|
| | | IP-PT Extn. 101 | IP-PT Extn. 102 |
| IP-PT IP Address | Identifies the location of IP-PTs on the network. Each IP-PT must have a unique IP address. | 192.168.0.101 | 192.168.0.102 |
| Subnet Mask Address | Defines which digits of an IP address are used for the network address and the host address at each network location. The IP addresses of the IP-PTs and IP-EXT card must fall within the same subnet as that of the default gateway (e.g., router) of the LAN. | 255.255.255.0 | |
| Default Gateway Address | Identifies the IP address of the primary gateway (typically a router or similar device) that exchanges IP packets with the other gateways on the VoIP network. | 192.168.0.1 | |
| PBX IP Address | Identifies the location of the IP-EXT card with which IP-PTs will communicate. | 192.168.0.100 | |

| Parameter | Description | Example Entry | |
|---|---|---|---|
| | | IP-PT Extn. 101 | IP-PT Extn. 102 |
| VLAN ID | Identifies the ID of the logical segment within the corporate LAN, through which voice packets from IP-PTs travel. For details, refer to "1.2.2 VLAN (Virtual LAN)". | 1 | |
| DiffServ (DS) | Identifies the value for the DS field in the header of IP packets, which determines the priority given to packets travelling from IP-PTs. For details, refer to "4.3 Setting the Diffserv Parameters". | 0.0 | |

# 1.1.2 Using IP Proprietary Telephones on Local and Remote Office LANs

By connecting the local office LAN to other LANs at different locations, the IP-PTs on the remote office LANs can be used as extensions of the PBX at the local office.



## Network Parameters

To use IP-PTs at the remote office, you will need to have the IP addressing and QoS information described in "1.1.1 Using IP Proprietary Telephones on a Local Office LAN".

| Parameter | Local Office | | Remote Office | |
|---|---|---|---|---|
| | IP-PT Extn. 101 | IP-PT Extn. 102 | IP-PT Extn. 103 | IP-PT Extn. 104 |
| IP-PT IP Address | 192.168.0.101 | 192.168.0.102 | 10.75.0.103 | 10.75.0.104 |
| Subnet Mask Address | 255.255.255.0 | | 255.255.255.0 | |
| Default Gateway Address | 192.168.0.1 | | 10.75.0.1 | |
| PBX IP Address | 192.168.0.100 | | | |
| VLAN ID | 1 | | | |
| DiffServ (DS) | 0.0 | | | |

## Types of IP Network

When using IP-PTs over LANs at different locations, first confirm the type of IP network connecting the LANs. The speech quality depends on the type of IP network in use. Managed IP networks provide better speech quality compared to unmanaged networks such as the Internet, where quality of service cannot be guaranteed.

### Examples of recommended IP networks

- Digital Leased Line
- IP-VPN (Virtual Private Network)
- Frame Relay

### Not recommended

- Internet (including an Internet VPN)

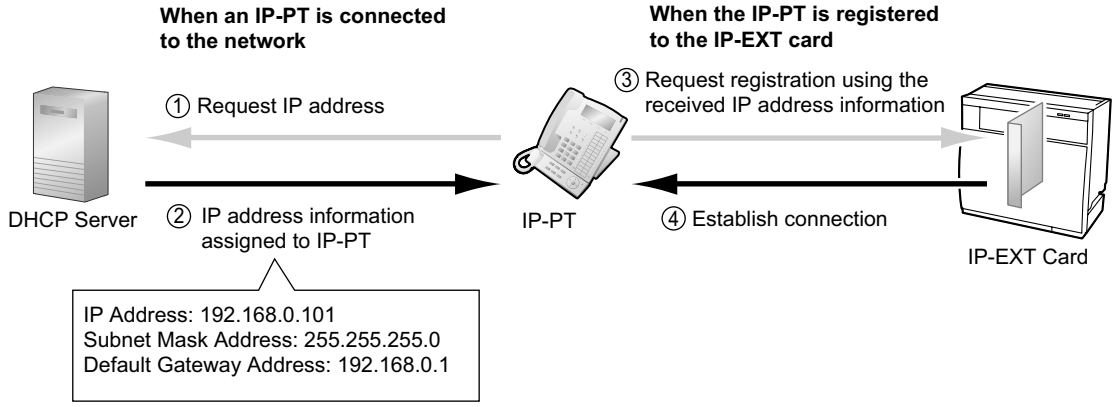
**Note**

Unlike an IP-VPN, which is set up over a network provider's own IP network, an Internet VPN is set up over the Internet. Internet VPNs are not recommended for IP-PT communication because transmission delays and loss of data are likely to occur.

# 1.2 Network Management

## 1.2.1 DHCP (Dynamic Host Configuration Protocol) Server

For IP-PTs to communicate over a network, an IP address must be assigned to each IP-PT to identify its locations on the network. While these addresses can be assigned manually at each IP-PT, it is also possible to use a DHCP server.
A DHCP server automatically assigns IP addresses to IP-PTs when they are connected to the network. An IP-PT then uses the received IP address information to register to the IP-EXT card.
Using a DHCP server allows you to centrally manage and automate the assignment of IP addresses.



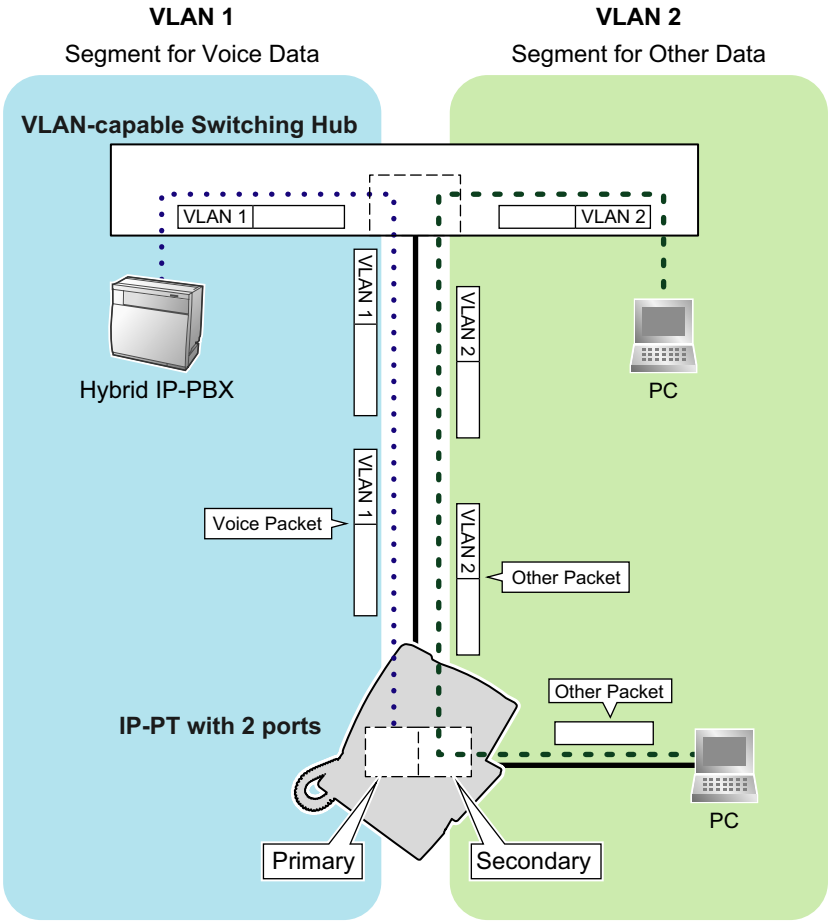

**Note**

- The PBX is not able to act as a DHCP server. To use the DHCP client function of IP-PTs, a separate DHCP server is required on the network, as shown above.
- The IP address for the IP-EXT card cannot be assigned automatically using a DHCP server. This IP address must be assigned manually by using the Maintenance Console (PC programming software of the PBX). For details, refer to "4.1 Programming the IP-EXT Card".
- An IP-PT cannot request an IP address from a DHCP server on another LAN (connected through an IP network). An IP-PT can only receive IP address information from a DHCP server on its own LAN. Therefore, when IP-PTs 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-PTs on that LAN must be assigned manually.

# 1.2.2 VLAN (Virtual LAN)

VLANs are logical segments within a corporate LAN. By assigning VLAN settings to IP-PTs, it is possible to separate the packets transmitted by an IP-PT according to the type of data, and specify which VLAN each data type will be sent over. This allows you to avoid generating unnecessary network traffic on each segment, and to reduce the load on the network. As a consequence, speech quality can be assured.
Therefore, we recommend using the VLAN feature to perform VoIP communication effectively.

Some IP-PTs (e.g., KX-NT136) are equipped with 2 ports, primary and secondary, for packet communication. Allocating these ports to different VLANs enables you to split the paths for packets depending on whether the packet contains voice signals or data.
VLAN settings (VLAN ID and VLAN priority) for the primary port affect voice data transmitted by the IP-PT, whereas VLAN settings for the secondary port apply to data transmitted by a PC connected to the IP-PT. When sending packets, the IP-PT can attach information on which VLAN the packets are to be transmitted over (VLAN Tagging). The switching hub that receives these packets reads the VLAN information and sends the packets over the appropriate VLAN. This helps to ensure bandwidth for IP-PT voice transmissions.
In this way, an IP-PT with 2 ports can transmit voice packets from the primary port with higher priority than other packets from the secondary port.




**Note**

- This VLAN feature complies with IEEE (Institute of Electrical and Electronics Engineers) 802.1Q.
- The PBX receives VLAN settings only from the connected switching hub. Therefore, VLAN settings for the PBX must be assigned at the switching hub.

- Some PC LAN cards allow VLAN settings to be assigned. However, when using a PC connected to an IP-PT with 2 ports, the VLAN settings for PC communications must be assigned only to the secondary port of the IP-PT. Any VLAN settings assigned to the PC LAN card must be disabled. These settings can usually be identified by "802.1Q", "802.1p", or "VLAN" in their name.
- If you are using an IP-PT with a primary port only (e.g., KX-NT265), a PC cannot be connected to the IP-PT.

# 1.3 Packet Control Features

## 1.3.1 Jitter Buffer

When voice signals are packetised 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. The size of the Jitter Buffer can be set as required.

### 1.3.1 Jitter Buffer

# Section 2

# Guidance for VoIP Installation

# 2.1 VoIP Requirements

## 2.1.1 Bandwidth Assessment

When using IP-PTs, 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 larger 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 per IP-PT for a Call

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 codec and packet sending interval, in terms of speech quality:

- The speech quality of the G.711 codec is higher than that of the G.729A codec.*1
- The shorter the packet sending interval, the higher the speech quality.
- The higher the speech quality the IP-PTs provide, the more bandwidth the IP-PTs require.

*1 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 IP-EXT Card

To allow all IP-PTs to make calls simultaneously, it is necessary to keep available the bandwidth required by an IP-EXT card with the maximum number of IP-PTs connected.
Provided below is the formula to calculate the amount of bandwidth required for each card.

Required Bandwidth = (Required Bandwidth per IP-PT × 16)

## 2.1.2 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?

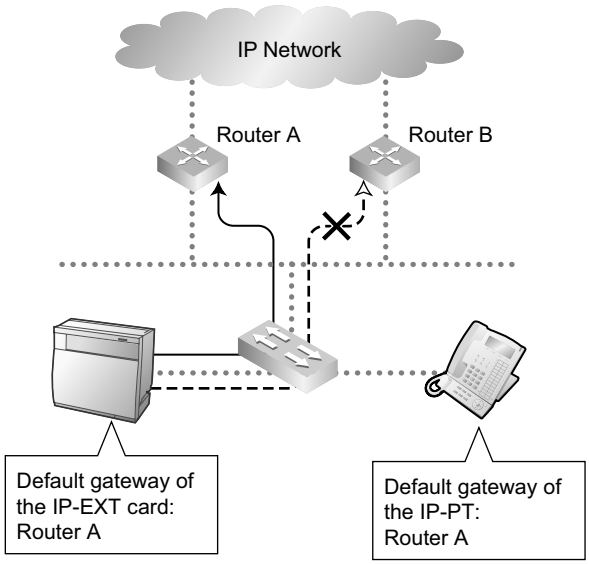
IP-PTs on the network must always communicate with each other through the IP-EXT card, not directly. Therefore, the card must be assigned a static IP address, which must be programmed to each IP-PT on the network.

**Note**

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

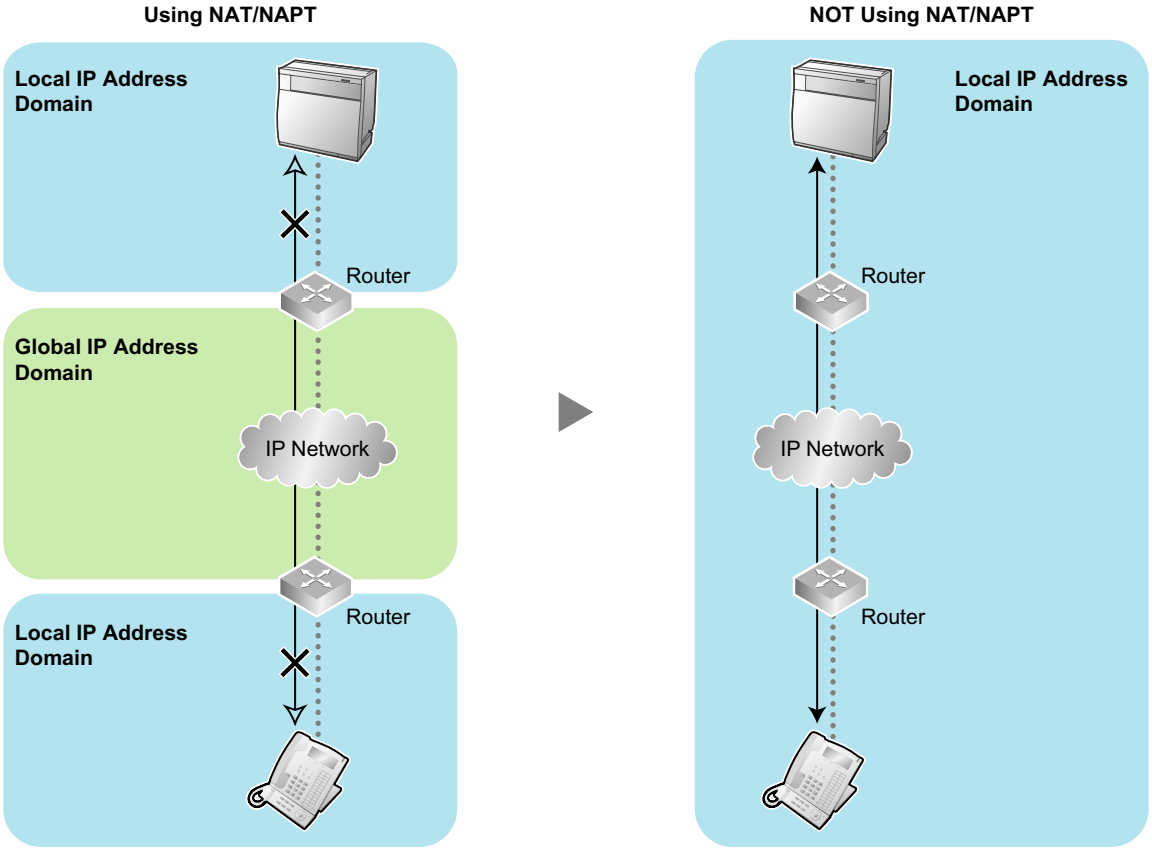
## Does only a single router provide IP-PT access to the IP network?

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 for all IP-PTs.
Therefore, in the diagram below, if router A, whose IP address is assigned as the default gateway IP address of the IP-PT and IP-EXT card, 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.



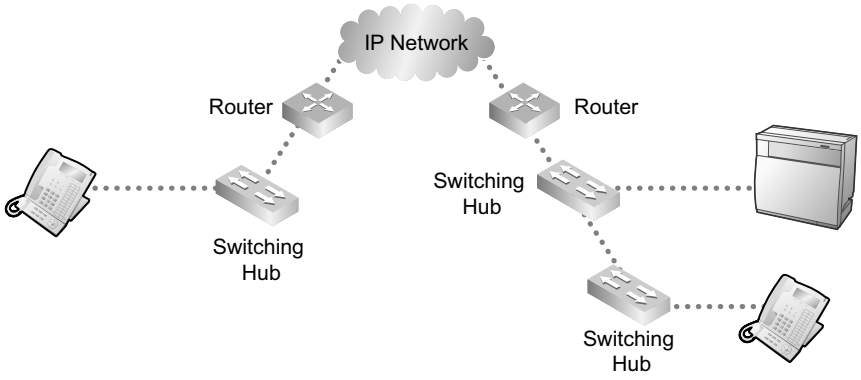
## Does the router not use network address translation (NAT/NAPT)?

If the router uses address translation techniques (e.g., NAT/NAPT) to convert between global and local IP addresses, VoIP communications between the IP-EXT card and IP-PT cannot be carried out effectively. Therefore, the routers used to access the IP network must not use NAT/NAPT. Generally, NAT and NAPT are features that are available with routers.



## Are the IP-EXT card and IP-PTs located appropriately?

Transmission delays can cause pauses and loss in VoIP communications. The more routers there are between the IP-EXT card and IP-PTs, the longer the transmission delays. This is because a certain amount of delay is inevitable when packets pass through each router.
Additionally, the more switching hubs between the card and IP-PTs, the longer the transmission delays, because the switching hubs must also handle the network traffic generated by other terminal devices (e.g., PCs) connected to them.
To prevent unnecessary delays, it is recommended to connect the card and IP-PTs so that there are as few network devices (e.g., routers, switching hubs) between them as possible.




# 2.1.3 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 from IP-PTs?

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.

| Protocol | Description | TCP/UDP | Default Port No. |
|---|---|---|---|
| RTP (IP-EXT) | Real-time Transport Protocol. Used for voice data transmission. | UDP | 8000 to 8063 |
| RTP (IP-PT) | | UDP | 8000 to 8063 |
| Maintenance (IP-EXT) | 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 | 9300 |
| Maintenance (IP-PT) | | UDP | 9301 |
| MGCP (IP-EXT) | Media Gateway Control Protocol. Used for call control command data and LCD/LED data transmission. | UDP | 2727 |
| MGCP (IP-PT) | | UDP | 2427 |
| DHCP | Dynamic Host Configuration Protocol. Used for receiving an IP address from a DHCP server. | UDP | 67, 68 |

| Protocol | Description | TCP/UDP | Default Port No. |
|---|---|---|---|
| FTP (Port mode) | File Transfer Protocol.<br>Used for receiving a data file from a FTP server to upgrade the firmware version. | TCP | 20, 21 |

## Are layer 2 or 3 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 3 switches when connecting the IP-EXT card to the LAN. Use of layer 2 or 3 switches is also strongly recommended for connecting IP-PTs.

**Note**

Note that the port of the switching hub that connects to the IP-EXT 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.

# 2.2 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 | **Does the network have enough bandwidth to support VoIP communications?**<br>Make sure that there is more bandwidth available for VoIP communications than the amount actually required. | ☐ **Yes**<br>☐ No | • IP network bandwidth<br>= kbps<br>• Available bandwidth for VoIP<br>= kbps<br>• Required bandwidth for VoIP<br>= kbps | p. 14 |

### Network Configuration

| No. | Question | Answer | Memo | Ref. |
|---|---|---|---|---|
| 2-a | **Is the IP network a managed network?**<br>Make sure to use a managed IP network such as Frame Relay, Leased Line, or IP-VPN (Virtual Private Network). The IP-EXT card is not intended for use on the Internet (including an Internet VPN). | ☐ **Yes**<br>☐ No | Type of IP network: | p. 14 |
| 2-b | **Is it possible to have static IP addressing?** | ☐ **Yes**<br>☐ No | | p. 15 |
| 2-c | **Does only a single router provide IP-PT access to the IP network?** | ☐ **Yes**<br>☐ No | | p. 15 |
| 2-d | **Does the router not use network address translation (NAT/NAPT)?** | ☐ **Yes**<br>☐ No | | p. 16 |
| 2-e | **Are the IP-EXT card and IP-PTs located appropriately?**<br>It is recommended to connect the card and IP-PTs as close to each other on the network as possible. | ☐ **Yes**<br>☐ No | | p. 17 |

### Network Devices

| No. | Question | Answer | Memo | Ref. |
|---|---|---|---|---|
| 3-a | **Can the firewall pass packets from IP-PTs?**<br>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. | ☐ **Yes**<br>☐ No | Model of firewall: | p. 17 |

| No. | Question | Answer | Memo | Ref. |
|---|---|---|---|---|
| 3-b | **Are layer 2 or 3 switches used?**<br>Do not use repeater hubs as they can increase the network load.<br>Also note that the port of the switching hub that connects to the IP-EXT card should be set to operate under "Auto Negotiation" mode. | ☐ **Yes**<br>☐ No | Model of switch: | p. 18 |
| 3-c | **Are Category 5 (CAT 5) or higher cables used?** | ☐ **Yes**<br>☐ No | | p. 18 |

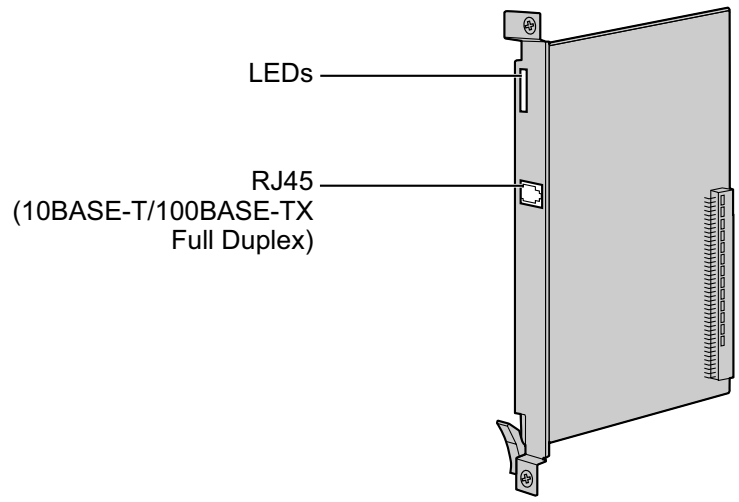
# Section 3

# Installation

*This section describes the physical installation process of each IP-EXT card covering the following topics: (1) installing the card in the PBX, and (2) connecting the card and IP-PTs to the LAN.*

# 3.1 Installing in the PBX

## 3.1.1 Names and Locations of IP-EXT16 Card




### Indication Light (LED)

When the IP-EXT16 card is operating under normal conditions, each LED should show the status identified in **bold-face letters**.

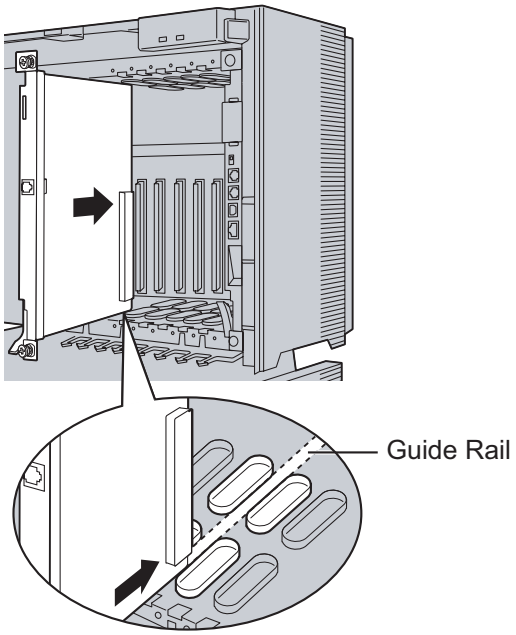
| Indication | Colour | Description |
|---|---|---|
| CARD STATUS | Green/Red | Card status indication<br>• OFF: Power Off<br>• **Green ON: Normal (all ports are idle)**<br>• Green Flashing (60 times per minute): Normal (a port is in use)<br>• Red ON: Fault (includes reset)<br>• Red Flashing (60 times per minute): Out of Service |
| ONLINE | Green | On-line status indication<br>• **ON: At least one port is in use (an IP-PT is connected)**<br>• OFF: No ports are in use (no IP-PTs are connected)<br>**Note**<br>If the LINK indicator is OFF, the ONLINE indicator will also be OFF. |
| ALARM | Red | Alarm indication<br>• ON: Alarm<br>• **OFF: Normal** |
| VoIP BUSY | Green | Panasonic proprietary VoIP protocol process indication<br>• OFF: VoIP process inactive<br>• ON: VoIP process active |
| LINK | Green | Link status indication<br>• **ON: Normal connection**<br>• OFF: Connection error |

| Indication | Colour | Description |
|---|---|---|
| DATA | Green | Data transmission indication<br>• ON: Data being transmitted<br>• OFF: No data transmitted |

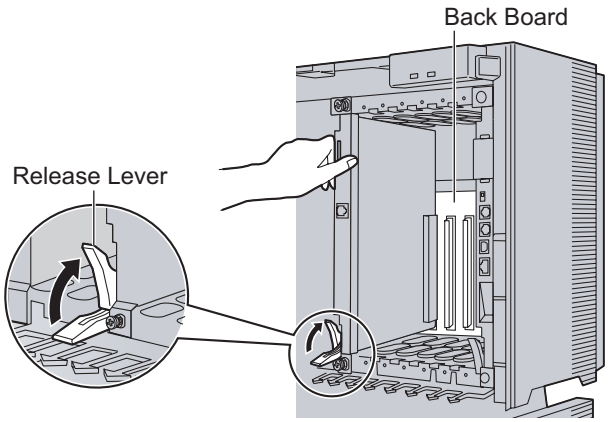
## 3.1.2 Installation

Install the IP-EXT16 card in a free slot of the PBX.

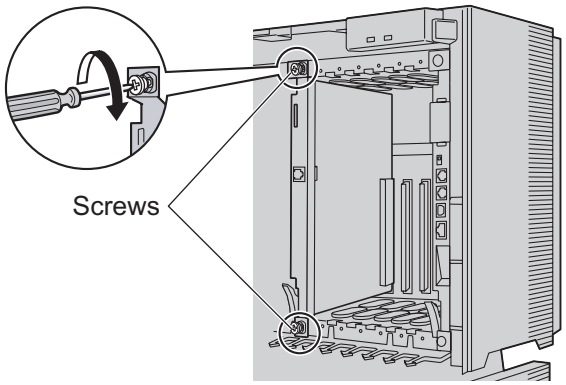
**1.** Insert the card along the guide rails.




**2.** Holding the card as shown below, push the release lever in the direction of the arrow so that the card engages securely with the connector on the back board.



**3.** Turn the 2 screws clockwise to fix the card in place.




**Note**

Make sure the screws are tightened to earth the card securely.

# 3.2 Connecting to the LAN

## 3.2.1 Connecting the IP-EXT Card

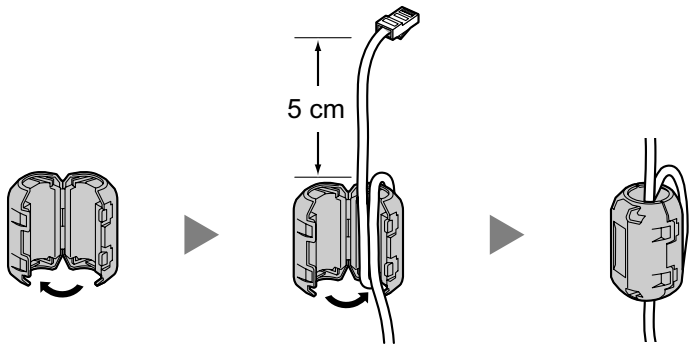
Refer to the following example to connect the IP-EXT card to the LAN.
When the IP-EXT card is connected to the LAN for the first time, you must assign IP addressing information to the card. Refer to "4.1 Programming the IP-EXT Card" for instructions.

**Note**

- Use an Ethernet straight cable with an RJ45 connector to connect the IP-EXT card to a switching hub. The cable should be a 100BASE-TX CAT 5 (Category 5) or higher cable.
- Before connecting the IP-EXT card, attach a ferrite core (included with the card) to the cable.
- Make sure to set the port of the switching hub that connects to the IP-EXT card to operate under "Auto Negotiation" mode.
- When using the VLAN feature on the network, make sure that the IP-EXT card is connected to a layer 2 switch that is IEEE 802.1Q compliant, and that is configured for VLANs. In addition, the port of the switching hub to which the IP-EXT card is connected must be set to "Untagged". Consult your network administrator for details.
- To use a KX-NT265, make sure that the Local Processor (LPR) software of the IP-EXT card is as follows:
  – PIPEXT Software Version 1.001 or later.
  – PVOIPEX Software Version 1.011 or later.
- To use a KX-NT300 series IP-PT, make sure that the LPR software of the IP-EXT card is as follows:
  – PIPEXT Software Version 2.000 or later.
  – PVOIPEX Software Version 2.000 or later.

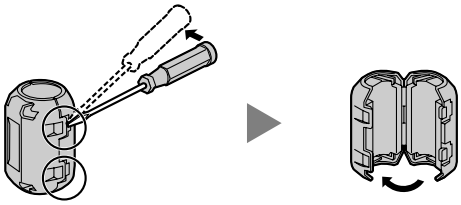
1. Wrap the cable once around the ferrite core, leaving 5 cm between the ferrite core and the connector.
2. Close the case of the ferrite core.

**Attaching a ferrite core to the cable**



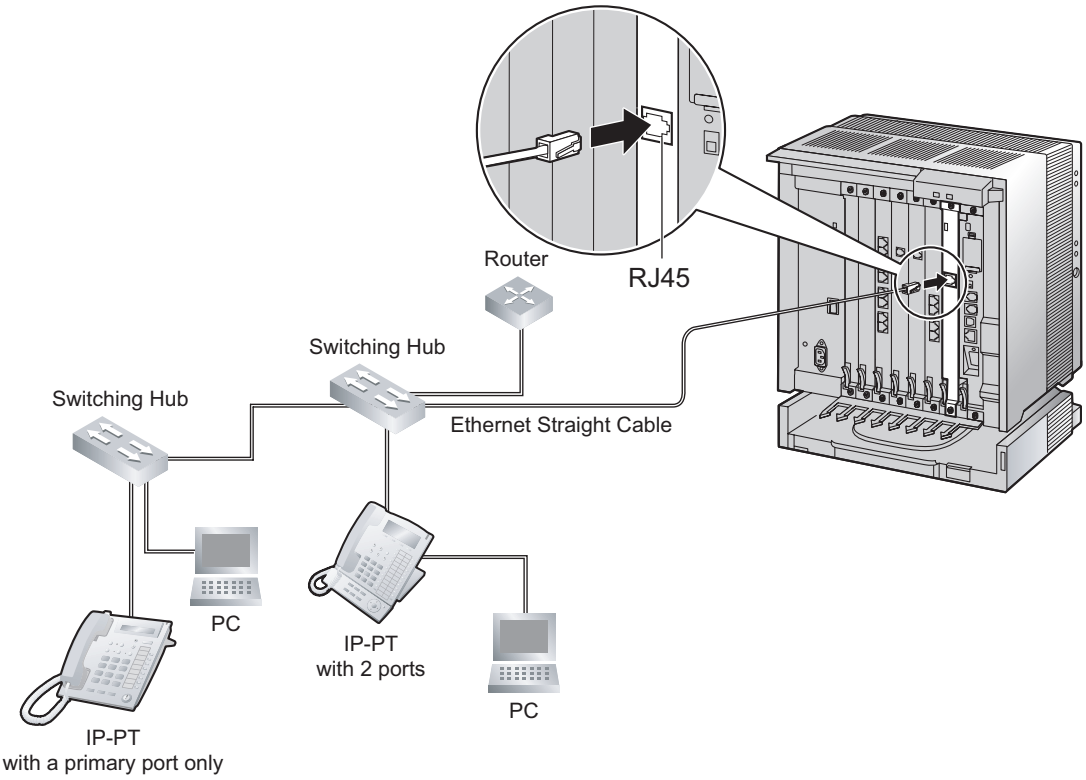
**Note**

If you need to open the ferrite core, use a flathead screwdriver to unlatch the case.



3. Connect the cable to the RJ45 connector of the card.
4. Connect the other end of the cable to the switching hub.

### Connecting to a switching hub



# 3.2.2 Connecting the IP Proprietary Telephones

When an IP-PT is connected to the LAN and power is supplied for the first time, you will be prompted to set network parameters. The network parameters must be set for the IP-PT before it can be used. Refer to "4.2 Programming the IP Proprietary Telephone" for instructions.

**Note**

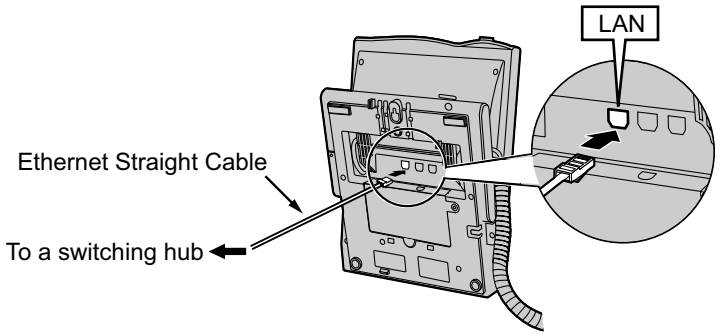
The connection example shown here is for the KX-NT136 IP-PT.

## Connecting an IP-PT to a Switching Hub

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

**Note**

- Use an Ethernet straight cable with an RJ45 connector to connect the IP-PT to a switching hub. The cable should be a 100BASE-TX CAT 5 (Category 5) or higher cable.
- When using the VLAN feature on the network, make sure that the switching hub to be connected is IEEE 802.1Q compliant and is configured for VLANs. In addition, the port of a switching hub that the IP-PT is connected to must be set to "Trunk" port, to allow VLAN tagging. Consult your network administrator for details.

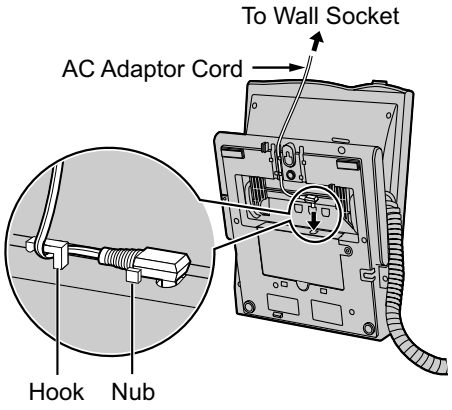


## Connecting an AC Adaptor to an IP-PT

IP-PTs comply with the IEEE 802.3af Power-over-Ethernet (PoE) standard. If PoE is available on your network, the IP-PT can receive the necessary power supply from the network through the network cable. In this case, no AC adaptor is needed for the IP-PT.
However, if PoE is not available, you will need to connect an AC adaptor to the IP-PT.

**Note**

- Only use the dedicated AC adaptor for your IP-PT.
- Make sure to connect the AC adaptor firmly to the IP-PT parallel to the nub near the connector. Then, pass the cord through the hook as indicated in the illustration below.

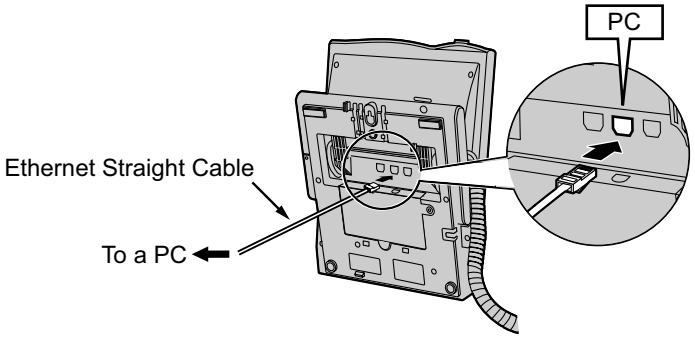



## Connecting a PC to an IP-PT (except KX-NT265)

You can connect a PC to an IP-PT by using the IP-PT's secondary port. In this case, only a single port from the LAN's network interface (switching hub) is required to connect both the IP-PT and PC to the LAN.

**Note**

- Use an Ethernet straight cable with an RJ45 connector to connect a PC to the IP-PT. The cable should be a 100BASE-TX CAT 5 (Category 5) or higher cable.
- Only a PC can be connected to the secondary port of an IP-PT. Other IP-PTs, or network devices such as routers or switching hubs, cannot be connected.
- Generally, it is recommended that you connect no more than one PC to the secondary port of each IP-PT.



# Section 4

# Programming

*This section describes the process of programming the IP-EXT card and IP-PTs covering the following topics: (1) setting network parameters for the card and IP-PTs, and (2) registering the IP-PTs to the PBX.*

# 4.1 Programming the IP-EXT Card

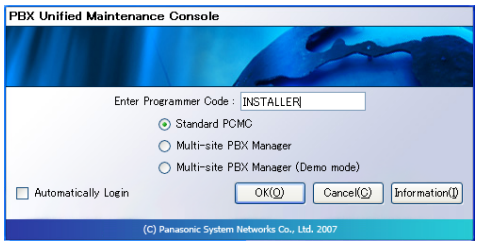
## 4.1.1 Assigning the IP Addressing Information

When an IP-EXT card is placed on the LAN for the first time, it is necessary to assign IP addressing information to the card. This is done by using the Maintenance Console.

**Note**

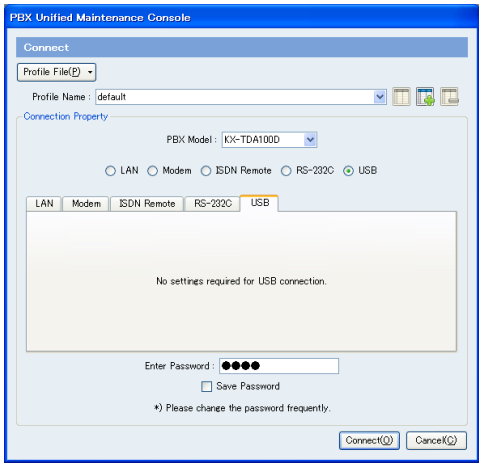
- It is assumed that you have already installed the Maintenance Console on your PC.
- The contents and design of the software are subject to change without notice.
- Microsoft product screen shot(s) reprinted with permission from Microsoft Corporation.

1. Start the Maintenance Console from the Start menu.
2. "Information before programming" appears.
   a. Carefully read this important additional information, which includes updates to this and other manuals.
   b. Click **OK** to close this window.

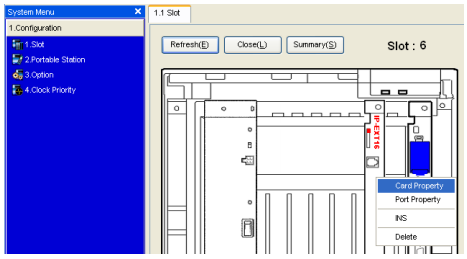



3. a. Enter the Installer Level Programmer Code (default: **INSTALLER**).
   b. Click **OK**.

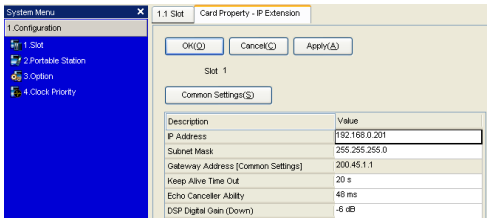

4. Click **Connect**.



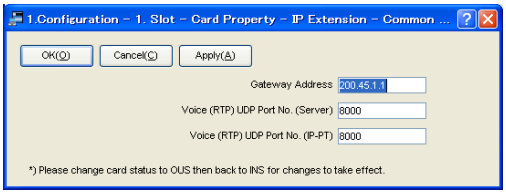

5. a. Select **KX-TDA100D** from **PBX Model**.
   Depending on the type of Maintenance Console used, you may not be required to select a PBX model.
   b. Select the **USB** tab.
   c. Enter the system password for installer (default: **1234**).
   d. Click **Connect**.
   The system menu appears.




6. **a.** Under **Configuration**, click **Slot**.
   **b.** Move the mouse pointer over the IP-EXT card. A menu will be shown under the mouse pointer.
   **c.** Click **OUS** to set the card to out-of-service status.
   **d.** Move the mouse pointer over the IP-EXT card, then click **Card Property**.




7. **a.** In the **IP Address** box, type the IP address of the card[*1].
   **b.** In the **Subnet Mask** box, type the subnet mask address of the network[*2].
   **c.** Click **Apply**.




8. If the IP address of the default gateway needs to be entered:
   **a.** Click **Common Settings**. A dialogue box will appear.
   **b.** In the **Gateway Address** box, type the IP address of the default gateway[*3].
   **c.** Click **OK**.

**Note**

To activate any changes made in step **8**, it is necessary to set all installed IP-EXT cards to out-of-service status (**OUS**), then back to in-service status (**INS**).

9. Move the mouse pointer over the IP-EXT card, then click **INS** to set the card to in-service status.

*1 Valid IP address range: "1.0.0.0" to "223.255.255.255"
*2 Valid subnet mask address range: "0–255.0–255.0–255.0–255" (except 0.0.0.0 and 255.255.255.255)
*3 Valid IP address range: "1.0.0.0" to "223.255.255.255"

# 4.2 Programming the IP Proprietary Telephone

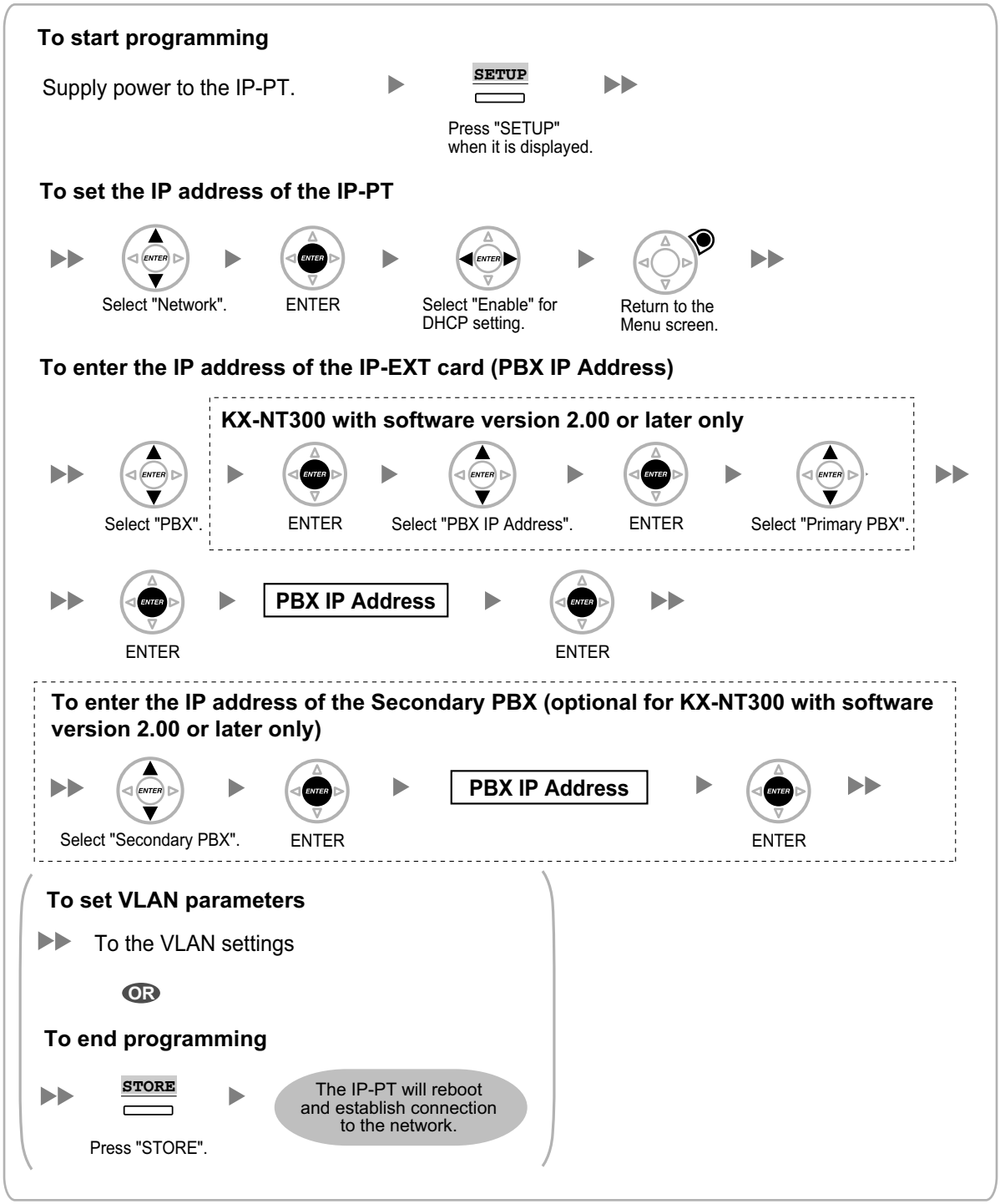
## 4.2.1 Assigning the IP Addressing Information

### When Assigning IP Addresses to IP-PTs Using a DHCP Server

When using a DHCP server to automate IP address assignment of IP-PTs, only the IP address of the IP-EXT card (PBX IP address) must be entered manually.
Other addresses (i.e., the IP address of the IP-PT, the subnet mask address, and the default gateway address) will be assigned automatically by the DHCP server.

Follow the procedure below for all IP-PTs on the LAN that a DHCP server is used.
If you need to set VLAN parameters, follow the procedure described in "4.2.2 Setting the VLAN Parameters" after assigning the IP addresses without ending programming.

## IP-PTs with a multiline display (e.g., KX-NT300 series [except KX-NT321])



## KX-NT265

### To start programming

Supply power to the IP-PT. ▶ PROG. PROGRAM ▶▶

Press PROGRAM while "Searching" is displayed.

### To set the IP address of the IP-PT

▶▶ VOL VOLUME ▶ SP-PHONE ▶ VOL VOLUME ▶ HOLD ▶▶

Press VOLUME to select "Network". Press SP-PHONE. Press VOLUME to select "DHCP (Enable)". Press HOLD to return to the Menu screen.

### To enter the IP address of the IP-EXT card (PBX IP Address)

▶▶ VOL VOLUME ▶ SP-PHONE ▶ **PBX IP Address** ▶ SP-PHONE ▶ HOLD ▶▶

Press VOLUME to select "PBX". Press SP-PHONE twice. Press SP-PHONE. Press HOLD to return to the Menu screen.

### To set VLAN parameters

▶▶ To the VLAN settings

OR

### To end programming

▶▶ AUTO DIAL STORE ▶ The IP-PT will reboot and establish connection to the network.

Press STORE.

## KX-NT321

### To start programming

Supply power to the IP-PT. ▶ PROGRAM ▶▶

Press PROGRAM while "Searching" is displayed.

### To set the IP address of the IP-PT

▶▶ ▶ SP-PHONE ▶ ▶ HOLD ▶▶

Select "Network". Press SP-PHONE. Select "DHCP (Enable)". Press HOLD to return to the Menu screen.

### To enter the IP address of the IP-EXT card in the Primary PBX (PBX IP Address)

▶▶ ▶ SP-PHONE ▶ ▶ SP-PHONE ▶ ▶

Select "PBX". Press SP-PHONE. Select "PBX IP Address". Press SP-PHONE. Select "Primary PBX".

▶▶ SP-PHONE ▶ **PBX IP Address** ▶ SP-PHONE ▶▶

Press SP-PHONE. Press SP-PHONE.

### To enter the IP address of the Secondary PBX (if required)

▶▶ ▶ SP-PHONE ▶ **PBX IP Address** ▶ SP-PHONE ▶▶

Select "Secondary PBX". Press SP-PHONE. Press SP-PHONE.

▶▶ HOLD ▶▶

Press HOLD twice to return to the Menu screen.

### To set VLAN parameters

▶▶ To the VLAN settings

OR

### To end programming

▶▶ AUTO DIAL / STORE ▶ The IP-PT will reboot and establish connection to the network.

Press STORE.

**Note**

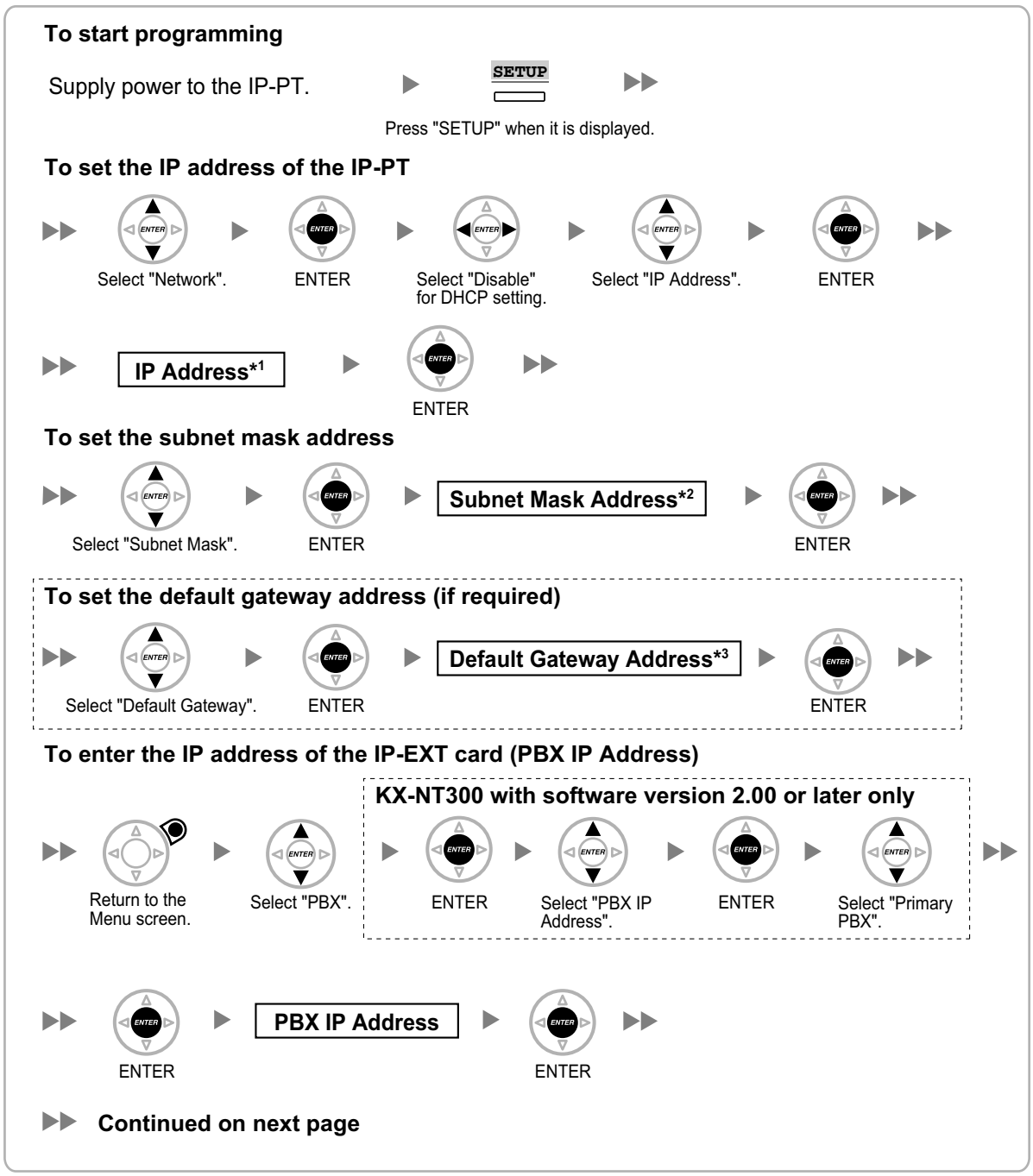
To confirm the connection to the secondary PBX after programming, (1) turn the IP-PT's power off, and (2) hold the STORE button and **2** key while turning the power on.

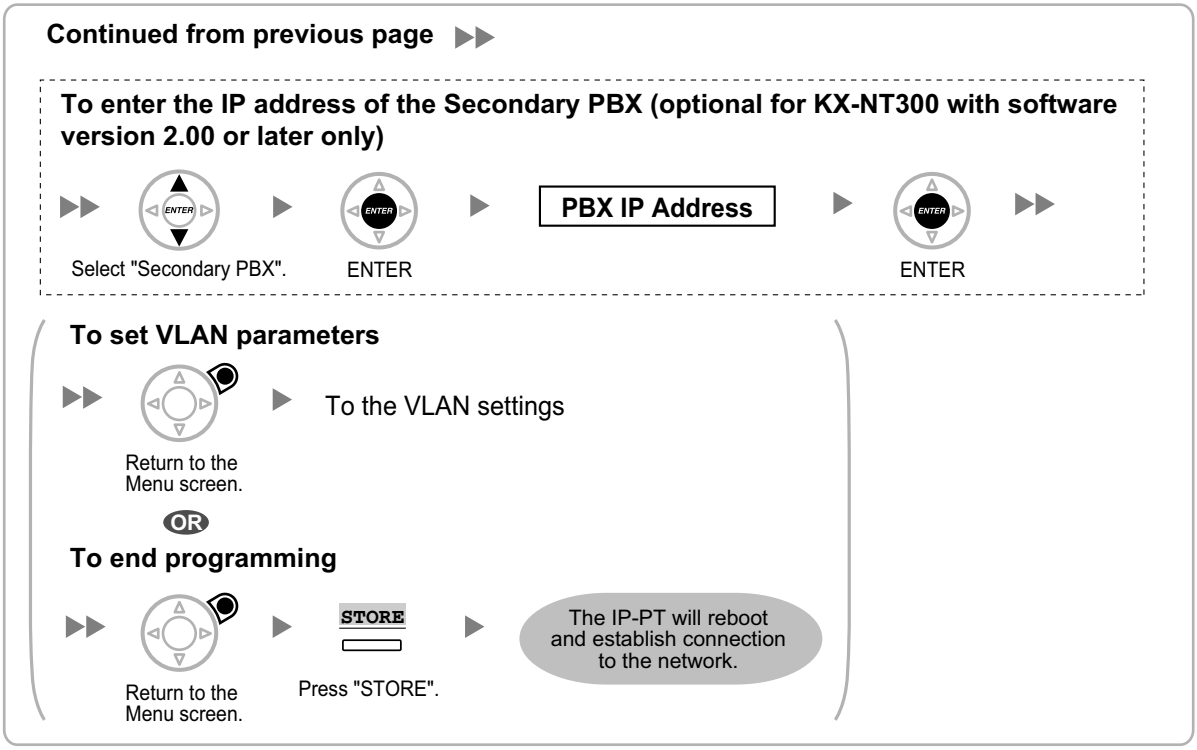
# When Assigning IP Addresses to IP-PTs Without Using a DHCP Server

If you are not using a DHCP server on the network, you will have to set an IP address and subnet mask address to the IP-PT, in addition to the PBX IP address. If necessary, also enter the IP address of the default gateway.

Follow the procedure below for all IP-PTs on the network, using appropriate IP addressing information. If you need to set VLAN parameters, follow the procedure described in "4.2.2 Setting the VLAN Parameters" after assigning the IP addresses without ending programming.

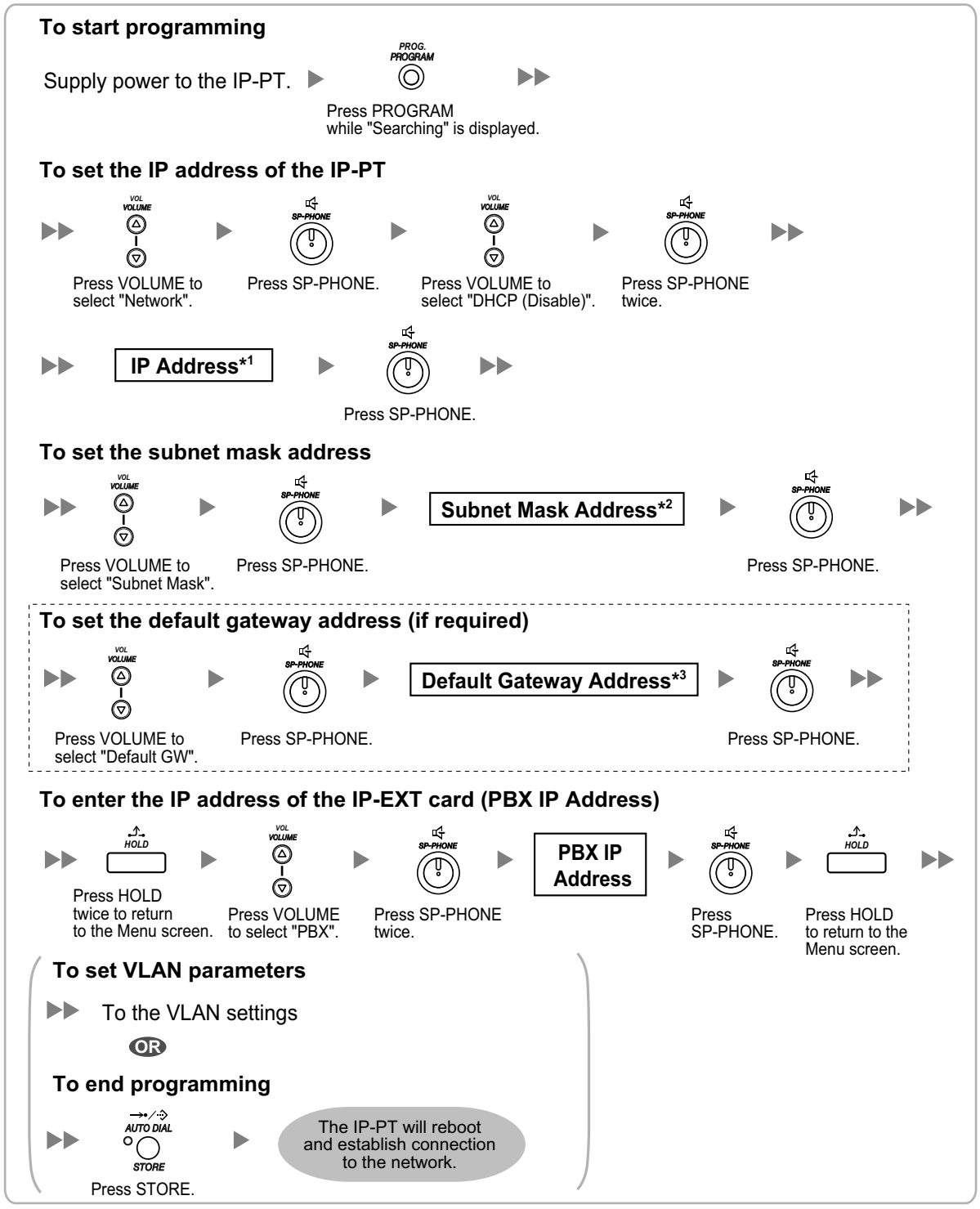
### IP-PTs with a multiline display (e.g., KX-NT300 series [except KX-NT321])






*1 Valid IP address range: "1.0.0.0" to "223.255.255.255"
*2 Valid subnet mask address range: "0–255.0–255.0–255.0–255" (except 0.0.0.0 and 255.255.255.255)
*3 Valid IP address range: "1.0.0.0" to "223.255.255.255"

## KX-NT265




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

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

*3 Valid IP address range: "1.0.0.0" to "223.255.255.255"

## KX-NT321

### To start programming

Supply power to the IP-PT. ▶ PROGRAM ▶▶

Press PROGRAM while "Searching" is displayed.

### To set the IP address of the IP-PT

▶▶ (Select "Network".) ▶ SP-PHONE (Press SP-PHONE.) ▶ (Select "DHCP (Disable)".) ▶ SP-PHONE (Press SP-PHONE twice.) ▶▶

▶▶ **IP Address*1** ▶ SP-PHONE (Press SP-PHONE.) ▶▶

### To set the subnet mask address

▶▶ (Select "Subnet Mask".) ▶ SP-PHONE (Press SP-PHONE.) ▶ **Subnet Mask Address*2** ▶ SP-PHONE (Press SP-PHONE.) ▶▶

### To set the default gateway address (if required)

▶▶ (Select "Default GW".) ▶ SP-PHONE (Press SP-PHONE.) ▶ **Default Gateway Address*3** ▶ SP-PHONE (Press SP-PHONE.) ▶▶

### To enter the IP address of the IP-EXT card in the Primary PBX (PBX IP Address)

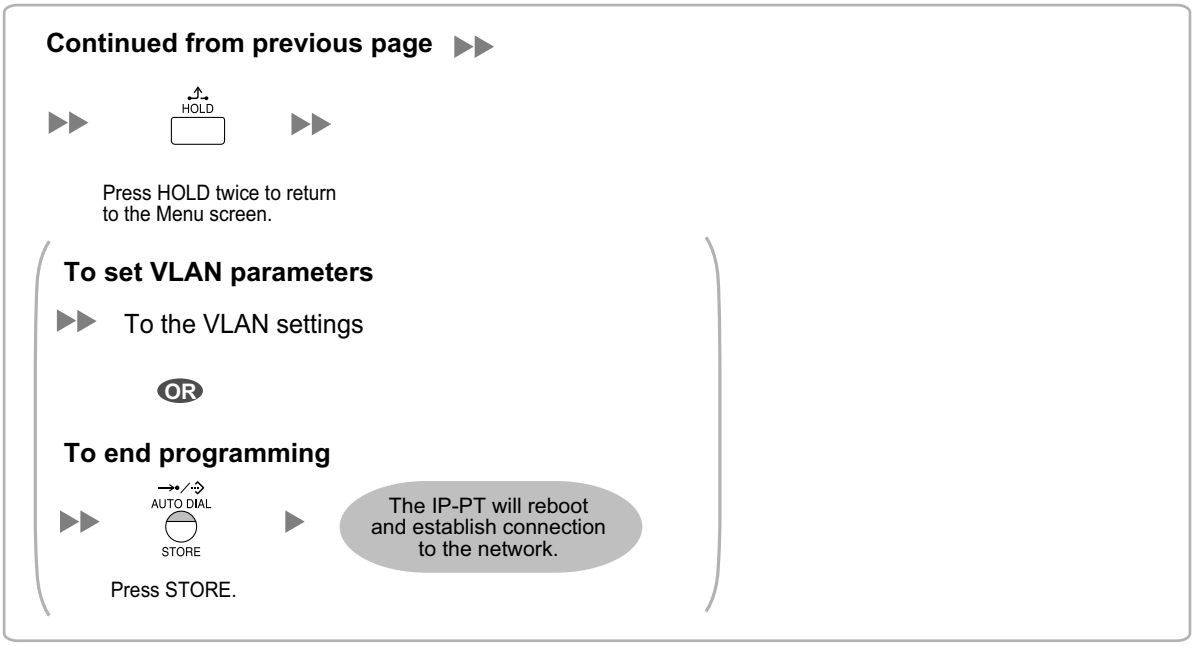
▶▶ HOLD (Press HOLD to return to the Menu screen.) ▶ (Select "PBX".) ▶ SP-PHONE (Press SP-PHONE.) ▶ (Select "PBX IP Address".) ▶ SP-PHONE (Press SP-PHONE.) ▶ (Select "Primary PBX".) ▶▶

▶▶ SP-PHONE (Press SP-PHONE.) ▶ **PBX IP Address** ▶ SP-PHONE (Press SP-PHONE.) ▶▶

### To enter the IP address of the Secondary PBX (if required)

▶▶ (Select "Secondary PBX".) ▶ SP-PHONE (Press SP-PHONE.) ▶ **PBX IP Address** ▶ SP-PHONE (Press SP-PHONE.) ▶▶

▶▶ **Continued on next page**




*1 Valid IP address range: "1.0.0.0" to "223.255.255.255"
*2 Valid subnet mask address range: "0–255.0–255.0–255.0–255" (except 0.0.0.0 and 255.255.255.255)
*3 Valid IP address range: "1.0.0.0" to "223.255.255.255"

**Note**

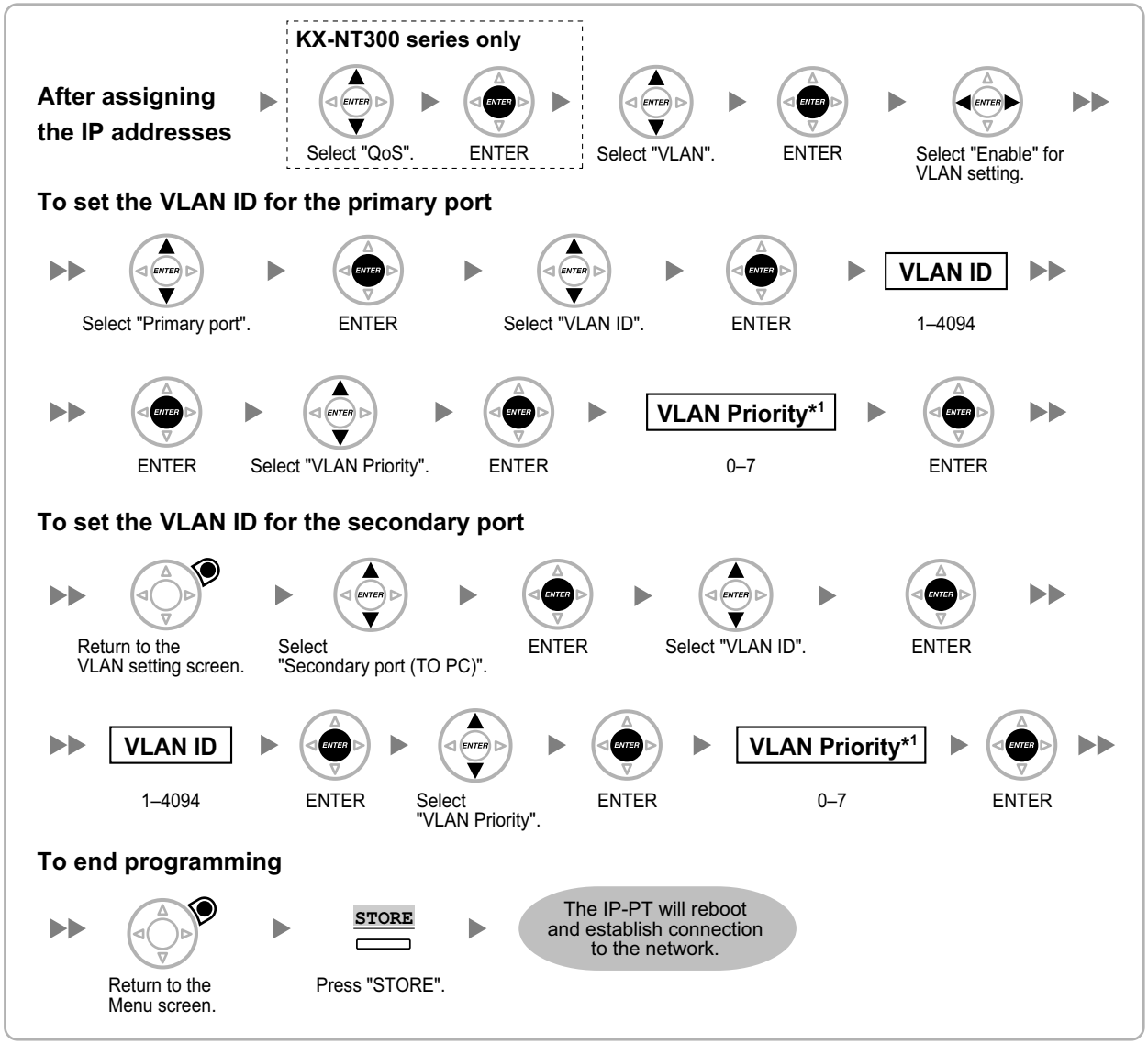
To confirm the connection to the secondary PBX after programming, (1) turn the IP-PT's power off, and (2) hold the STORE button and **2** key while turning the power on.

# 4.2.2 Setting the VLAN Parameters

To establish voice communications between IP-PTs, the primary ports of the IP-PTs and the connected PBX must belong to the same VLAN. Consult your network administrator and obtain the appropriate VLAN ID.
If you are using an IP-PT with 2 ports, it is possible to place primary and secondary ports on different VLANs by assigning separate VLAN IDs to each port.

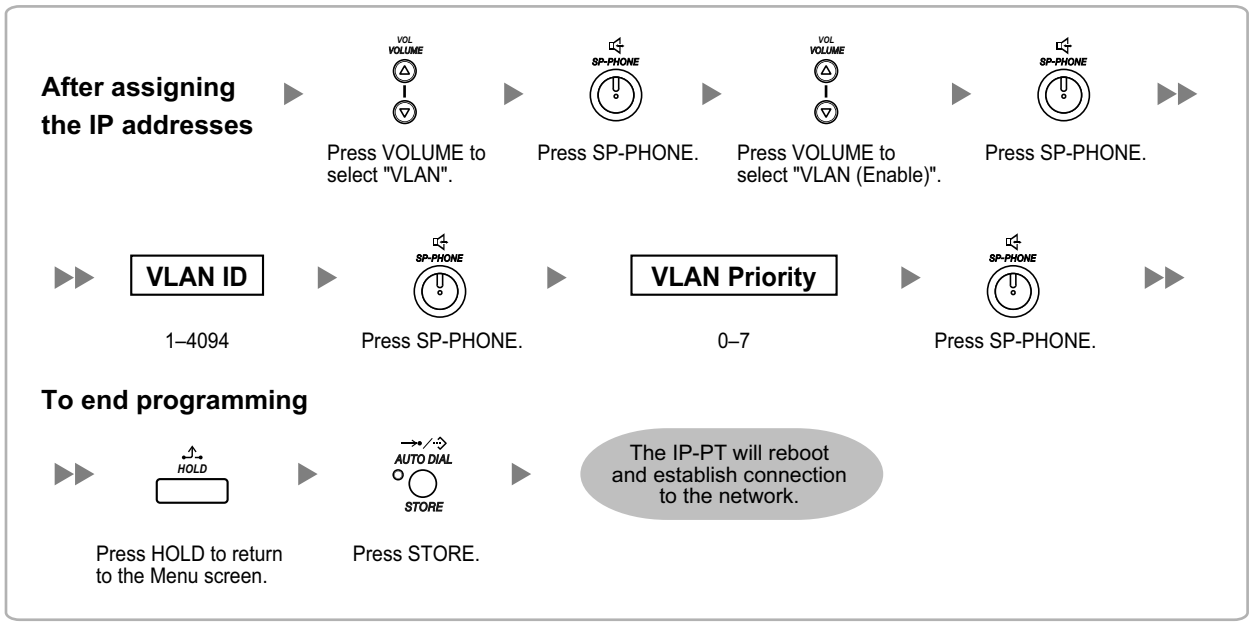
Follow the procedure below for all IP-PTs on the network, using appropriate VLAN IDs.

### IP-PTs with a multiline display (e.g., KX-NT300 series [except KX-NT321])

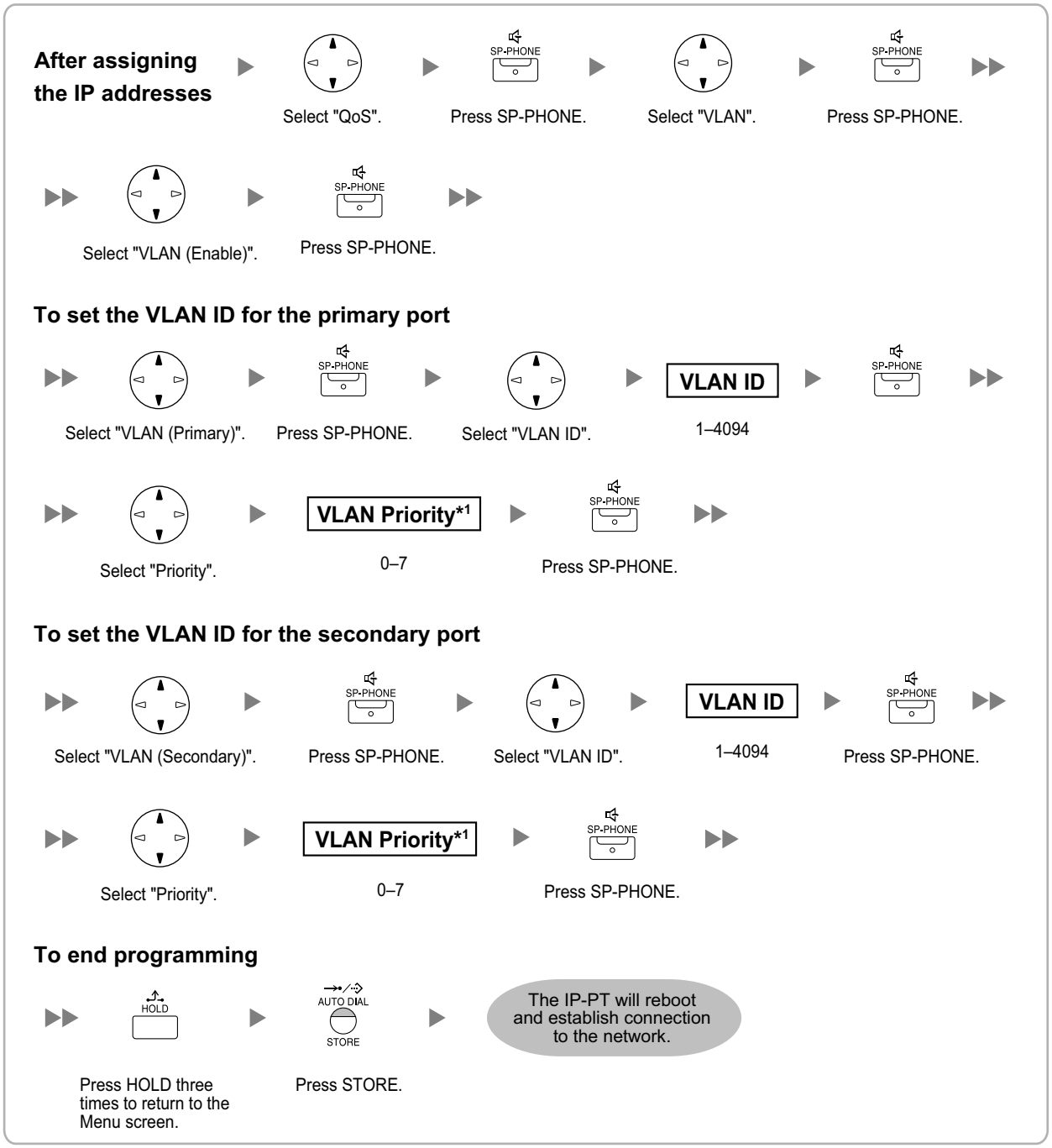



*1 The VLAN priority of the primary port must be set higher than the priority of the secondary port. The larger the number, the higher the priority.

## KX-NT265


After assigning the IP addresses
VOL VOLUME
Press VOLUME to select "VLAN".
SP-PHONE
Press SP-PHONE.
VOL VOLUME
Press VOLUME to select "VLAN (Enable)".
SP-PHONE
Press SP-PHONE.
VLAN ID
1–4094
SP-PHONE
Press SP-PHONE.
VLAN Priority
0–7
SP-PHONE
Press SP-PHONE.
To end programming
HOLD
Press HOLD to return to the Menu screen.
AUTO DIAL
STORE
Press STORE.
The IP-PT will reboot and establish connection to the network.

## KX-NT321




*1 The VLAN priority of the primary port must be set higher than the priority of the secondary port. The larger the number, the higher the priority.

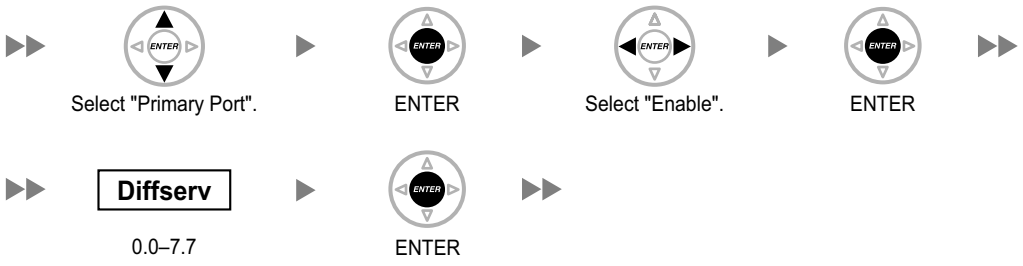
# 4.3 Setting the Diffserv Parameters

Differentiated Services (DiffServ, or DS) is an IP-based QoS technique used to control QoS of VoIP communications by setting the DS field in the header of IP packets. Consult your network administrator for the appropriate setting values for the DS field.
Follow the procedure below to set the Diffserv parameters. Only KX-NT300 series IP-PTs and KX-NT265 IP-PTs (software version 2.00 or later) can be used to set the parameters.

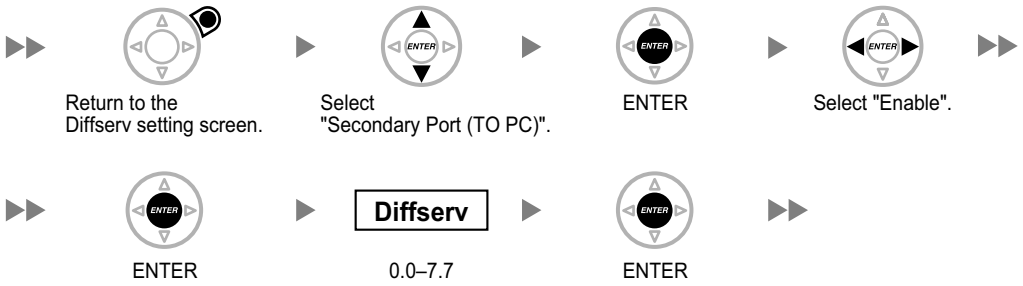
### KX-NT300 series (except KX-NT321)

**To start programming**


**To set the DS field value for the primary port**




**To set the DS field value for the secondary port**




**To end programming**

## KX-NT321

### To start programming


Press PROGRAM while "Searching" is displayed. → Select "QoS". → Press SP-PHONE. → Select "Diffserv". → Press SP-PHONE.

### To set the DS field value for the primary port


Select "Primary Port". → Press SP-PHONE. → Select "DS (Enable)". → Press SP-PHONE.


0.0–7.7 → Press SP-PHONE.

### To set the DS field value for the secondary port


Press HOLD to return to the Diffserv setting screen. → Select "Secondary Port". → Press SP-PHONE. → Select "DS (Enable)".


Press SP-PHONE. → 0.0–7.7 → Press SP-PHONE.

### To end programming


Press HOLD to return to the Menu screen. → Press STORE.

## KX-NT265 (software version 2.00 or later only)

### To start programming


Press PROGRAM while "Searching" is displayed.

Press VOLUME to select "QoS".

Press SP-PHONE.

Press VOLUME to select "Diffserv".

Press SP-PHONE.

### To set the DS field value


Press VOLUME to select "DS (Enable)".

Press SP-PHONE.

0.0–7.7

Press SP-PHONE.

### To end programming

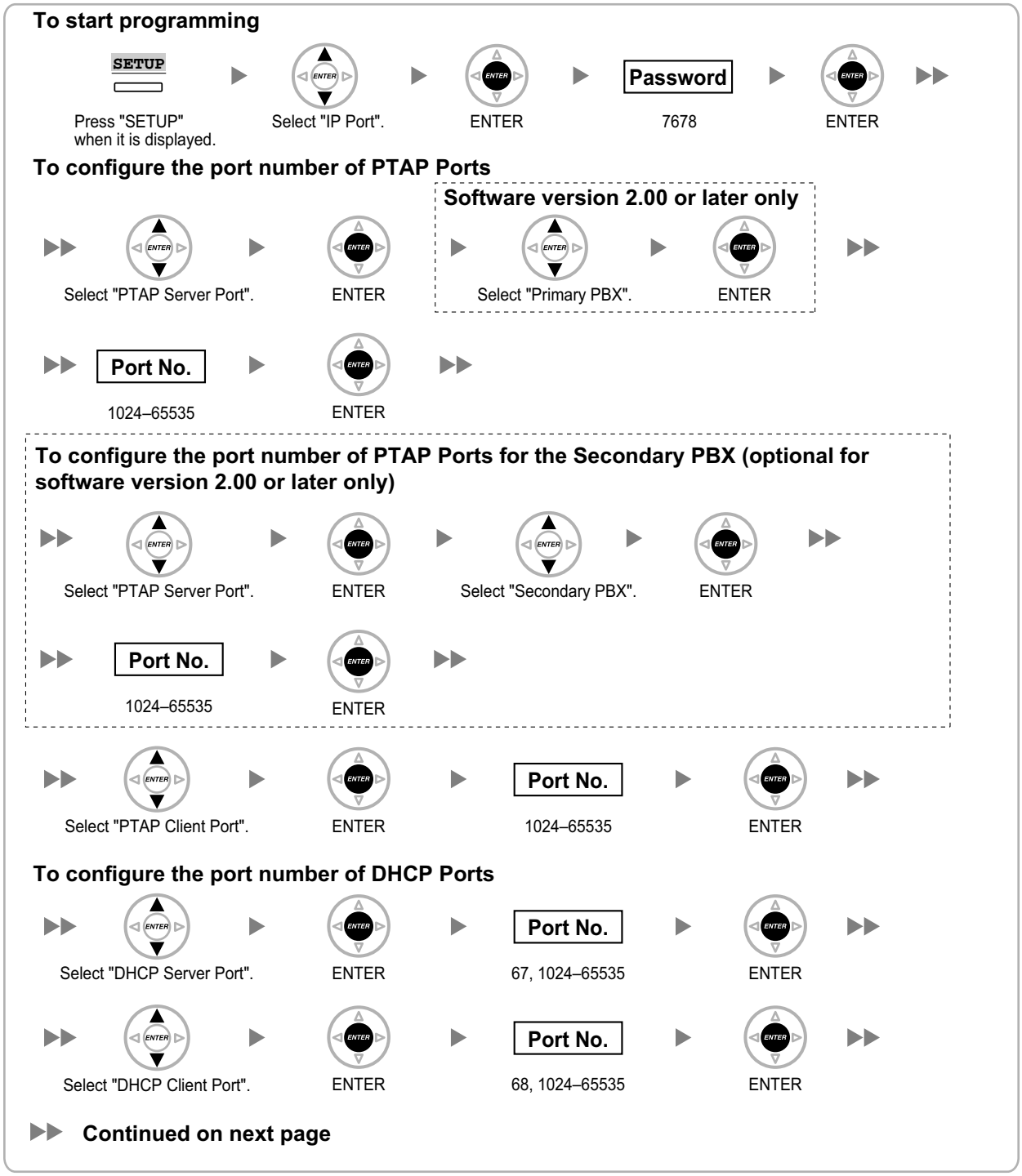

Press HOLD to return to the Menu screen.

Press STORE.

# 4.4 Configuration of IP Ports

A KX-NT300 series IP-PT user or KX-NT265 IP-PT (software version 2.00 or later) user can configure the port number of PTAP, DHCP, and FTP ports. Consult your network administrator to check whether the configuration of the IP ports is required.
Follow the procedure below to configure the port number of the IP ports.

### KX-NT300 series (except KX-NT321)




▶▶ **Continued on next page**

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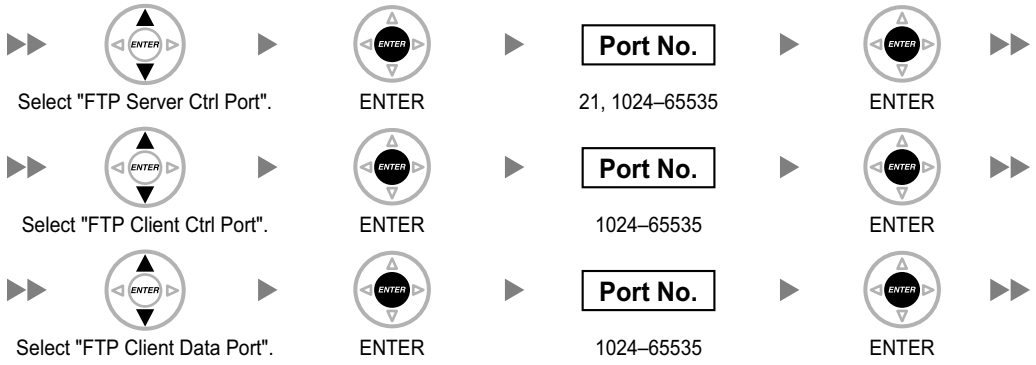
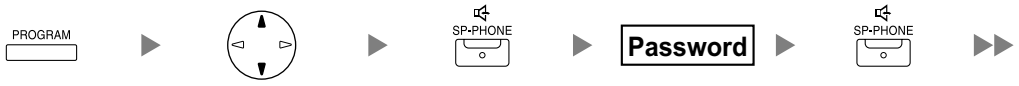
**To configure the port number of FTP Ports**




**To end programming**

## KX-NT321

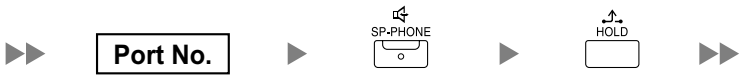
### To start programming




Press PROGRAM while "Searching" is displayed. | Select "IP Port". | Press SP-PHONE. | 7678 | Press SP-PHONE.

### To configure the port number of PTAP Ports

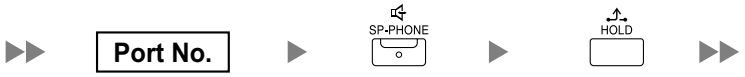

Select "PTAP Server". | Press SP-PHONE. | Select "Primary PBX". | Press SP-PHONE.




1024–65535 | Press SP-PHONE. | Press HOLD.

### To configure the port number of PTAP Ports for the Secondary PBX (if required)


Select "PTAP Server". | Press SP-PHONE. | Select "Secondary PBX". | Press SP-PHONE.




1024–65535 | Press SP-PHONE. | Press HOLD.


Select "PTAP Client". | Press SP-PHONE. | 1024–65535 | Press SP-PHONE.

### To configure the port number of DHCP Ports


Select "DHCP Server". | Press SP-PHONE. | 67, 1024–65535 | Press SP-PHONE.


Select "DHCP Client". | Press SP-PHONE. | 68, 1024–65535 | Press SP-PHONE.

▶▶ **Continued on next page**

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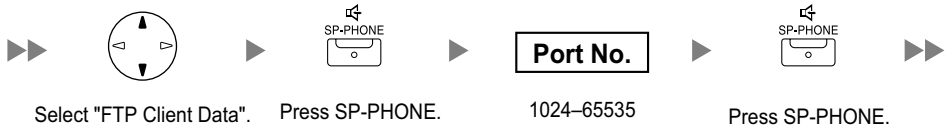
### To configure the port number of FTP Ports


Select "FTP Server Ctrl". Press SP-PHONE. 21, 1024–65535 Press SP-PHONE.


Select "FTP Client Ctrl". Press SP-PHONE. 1024–65535 Press SP-PHONE.




Select "FTP Client Data". Press SP-PHONE. 1024–65535 Press SP-PHONE.

### To end programming


Press HOLD to return to the Menu screen. Press STORE.

## KX-NT265 (software version 2.00 or later only)

### To start programming


Press PROGRAM while "Searching" is displayed. → Press VOLUME to select "IP Port". → Press SP-PHONE. → 7678 → Press SP-PHONE.

### To configure the port number of PTAP Ports


Press VOLUME to select "PTAP Server". → Press SP-PHONE. → 1024–65535 → Press SP-PHONE.


Press VOLUME to select "PTAP Client". → Press SP-PHONE. → 1024–65535 → Press SP-PHONE.

### To configure the port number of DHCP Ports


Press VOLUME to select "DHCP Server". → Press SP-PHONE. → 67, 1024–65535 → Press SP-PHONE.


Press VOLUME to select "DHCP Client". → Press SP-PHONE. → 68, 1024–65535 → Press SP-PHONE.

### To configure the port number of FTP Ports


Press VOLUME to select "FTP Server Ctrl". → Press SP-PHONE. → 21, 1024–65535 → Press SP-PHONE.


Press VOLUME to select "FTP Client Ctrl". → Press SP-PHONE. → 1024–65535 → Press SP-PHONE.


Press VOLUME to select "FTP Client Data". → Press SP-PHONE. → 1024–65535 → Press SP-PHONE.

### To end programming


Press HOLD to return to the Menu screen. → Press STORE.

**Note**

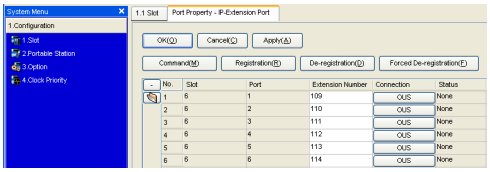
If you wish to change the port number back to default, enter **0** as the port number for the desired port.

# 4.5 Registering IP Proprietary Telephones

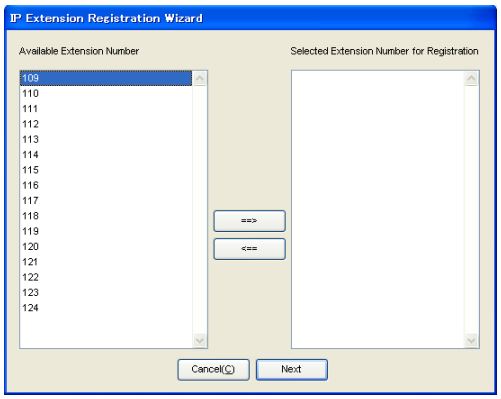
## 4.5.1 Registering the IP-PTs

After the programming of both the IP-EXT card and IP-PT is finished, the IP-PT must be registered to the PBX. This is done by using the Maintenance Console.

### Registration




1. **a.** Under **Configuration**, click **Slot**.
   **b.** Move the mouse pointer over the IP-EXT card. A menu will be shown under the mouse pointer.
   **c.** Click **Port Property**.
2. Click **Registration**.
   A dialogue box will appear. Non-registered (available) extension numbers are displayed on the left.

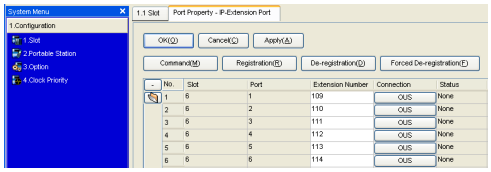



3. **a.** Highlight numbers and click the right arrow to select them for registration.
   **b.** Click **Next**. A screen will appear with information on the current IP-PT extension number and index number for programming.
   **c.** Click **Next**.
   - If the registration is still in progress, the dialogue box will show "Waiting for IP-PT to register…". Click **OK**.
   - If the registration is successful, the dialogue box will show "Registration Succeed". If there are more IP-PTs to be registered, click **Continue** to resume or **Cancel** to terminate the registration. If not, click **Close**.

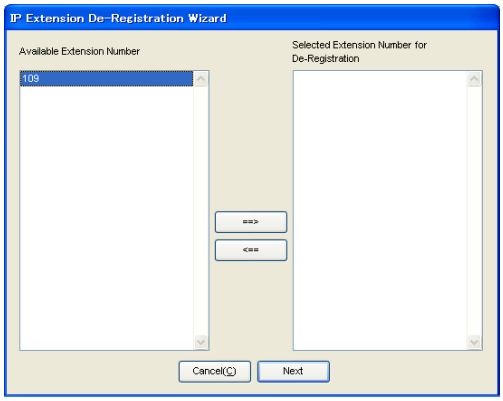
Once the IP-PT is successfully registered, the status of the IP-PT will update to show "Registered".

# 4.5.2 De-registering IP-PTs

## De-registration



1. **a.** Under **Configuration**, click **Slot**.
   **b.** Move the mouse pointer over the IP-EXT card. A menu will be shown under the mouse pointer.
   **c.** Click **Port Property**.
2. Click **De-registration**.
   A dialogue box will appear. Registered extension numbers are displayed on the left.



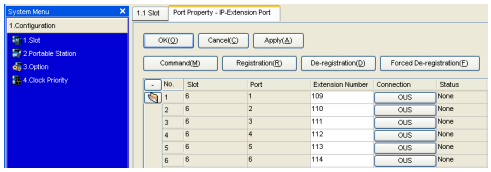

3. **a.** Highlight numbers and click the right arrow to select them for de-registration.
   **b.** Click **Next**.
   A dialogue box will appear.
   **c.** Click **Confirm**.
   - If the de-registration is successful, the dialogue box will show "De-registration Succeed".

   **d.** Click **Close**.

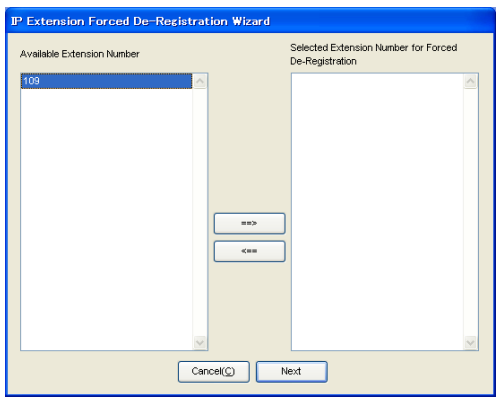
Once the IP-PT is successfully de-registered, the status of the IP-PT will update to show "None".

## Forced De-registration

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



1. **a.** Under **Configuration**, click **Slot**.
   **b.** Move the mouse pointer over the IP-EXT card. A menu will be shown under the mouse pointer.
   **c.** Click **Port Property**.
2. Click **Forced De-registration**.
   A dialogue box will appear. Registered extension numbers are displayed on the left.




3. **a.** Highlight numbers and click the right arrow to select them for de-registration.
   **b.** Click **Next**.
   A dialogue box will appear.
   **c.** Click **OK**.
   A dialogue box will appear.
   **d.** Click **Confirm**.
   - If the de-registration is successful, the dialogue box will show "Forced De-registration Succeed".

   **e.** Click **Close**.

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

# *Appendix A*

# *Troubleshooting*

# A.1 Troubleshooting

## A.1.1 Operation

| Problem | Probable Cause | Solution |
|---|---|---|
| Cannot set the IP address, subnet mask address, and PBX IP address to the IP-PT. | An unusable value is being set. | • Set an IP address within the valid range.<br>IP address of the IP-PT/PBX: "1.0.0.0" to "223.255.255.255"<br>Subnet mask address: "0–255.0–255.0–255.0–255" (except 0.0.0.0 and 255.255.255.255) |
| Cannot register the IP-PT. | The necessary network parameters are not set for the IP-PT. | • When not using a DHCP server, set the IP address, subnet mask address, and enter the PBX IP address. If necessary, also enter the IP address of the default gateway.<br>• When using a DHCP server, enter the PBX IP address. |
| The IP-PT cannot connect to the PBX. | The wrong IP address, subnet mask address, PBX IP address, or default gateway address was entered. | • Check each parameter and enter the correct value. |
| | The Ethernet cable is not connected correctly. | • Check the Ethernet cable connections. |
| | The DHCP server is not active. | • Restart the DHCP server.<br>• Disable DHCP and re-enter settings as appropriate (refer to "4.2.2 Setting the VLAN Parameters"). |

# A.1.2 Error Messages

When a major system error occurs, an error message is displayed on the IP-PT.
For IP-PTs with a single line display (e.g., KX-NT265), only an error code (i.e., ERR XXXX-XXXX) will be displayed.

| Error Message & IP-PT Activity | Probable Cause | Solution |
|---|---|---|
| **ERR 1001-0000**<br>**HARDWARE ERROR**<br>Displays error and stops operating. | • Sub CPU malfunction | • Repair or replace the IP-PT. |
| **ERR 1002-0000**<br>**HARDWARE ERROR**<br>Displays error and stops operating. | • Sound hardware malfunction | |
| **ERR 1003-0000**<br>**HARDWARE ERROR**<br>Displays error and stops operating. | • Flash memory malfunction | |
| **ERR 1004-XXXX**<br>**HARDWARE ERROR**<br>Displays error and stops operating. | • PHY (network control IC) error | |
| **ERR 1005-0000**<br>**HARDWARE ERROR**<br>Displays error and stops operating. | • SDRAM error | |
| **ERR 1006-0000**<br>**HARDWARE ERROR**<br>Displays error and stops operating. | • SRAM error | |
| **ERR 1051-0000**<br>**SOFTWARE ERROR**<br>Displays error and stops operating. | • PBX software version error | • Consult your network administrator. |
| **ERR 2001-XXXX**<br>**SYSTEM ERROR**<br>Resets and displays error for 5 seconds while starting up. | • Unexpected error | • If this error is displayed frequently, repair or replace the IP-PT. |
| **ERR 2002-0000**<br>**POOR LAN CONNECTION**<br>Resets and displays error for 5 seconds while starting up. | • Transmission error | • Check with the network administrator whether there is a problem with the LAN.<br>• If this error is displayed frequently, repair or replace the IP-PT. |
| **ERR 2003-0000**<br>**POOR LAN CONNECTION**<br>Resets and displays error for 5 seconds while starting up. | | |
| **ERR 2004-0000**<br>**UNREGISTERED TO SERVER**<br>Resets and displays error for 5 seconds while starting up. | • IP-PT not registered | • Check the registration status of the IP-PT. |
| **ERR 2005-0000**<br>**NO MORE CONNECTIONS**<br>Resets and displays error for 5 seconds while starting up. | • Connection refused by the PBX | |

| Error Message & IP-PT Activity | Probable Cause | Solution |
|---|---|---|
| **ERR 2006-XXXX**<br>**DHCP SERVER REJECTION**<br>Resets and displays error for 5 seconds while starting up. | • IP address lease time from DHCP server has expired<br>• IP address lease renewal was refused by DHCP server | • Consult your network administrator. |
| **ERR 2007-0000**<br>**HARDWARE ERROR**<br>Resets and displays error for 5 seconds while starting up. | • Communication error with sub CPU | • If this error is displayed frequently, repair or replace the IP-PT. |
| **ERR 2008-0000**<br>**HARDWARE ERROR**<br>Resets and displays error for 5 seconds while starting up. | • Sound hardware control error | |
| **ERR 2009-XXXX**<br>**MGCP SERVER REJECTION**<br>Resets and displays error for 5 seconds while starting up. | • Error information from the PBX (MGCP server) | • Consult your network administrator. |
| **ERR 3001-0000**<br>**HARDWARE ERROR**<br>Displays error until reset the IP-PT. | • Communication error with sub CPU | • If this error is displayed frequently, repair or replace the IP-PT. |
| **ERR 3002-0000**<br>**HARDWARE ERROR**<br>Displays error until reset the IP-PT. | • Sound hardware control error | |
| **ERR 3003-XXXX**<br>**DHCP SERVER NOT FOUND**<br>Displays error until reset the IP-PT. | • IP address lease renewal was refused by DHCP server | • Consult your network administrator. |
| **ERR 3100-0000**<br>**BLUETOOTH ERROR**<br>Resets the Bluetooth®*1 wireless headset. | • Bluetooth hardware error | • Repair or replace the Bluetooth wireless headset. |

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