

Panasonic

IP Networking Guide

Pure IP-PBX

Model No. **KX-TDE100**
KX-TDE200/KX-TDE600



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

KX-TDE100/KX-TDE200: PMMPR Software File Version 2.0000 or later
KX-TDE600: PGMPR Software File Version 2.0000 or later

In this manual, the suffix of each model number is omitted (e.g., KX-TDE100**NE**).

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Section 1

Introduction

1.1 Overview

1.1.1 Establishing a VoIP Network with the Pure IP-PBX

Panasonic Pure IP-PBX supports Panasonic KX-NT series IP proprietary telephones (IP-PTs), Panasonic IP softphones, and SIP (Session Initiation Protocol) Extensions (hardphones and softphones) for communication on a Voice over Internet Protocol (VoIP) network. These IP telephones can be used as extensions of the PBX when the local office LAN is connected to other LANs at different locations.

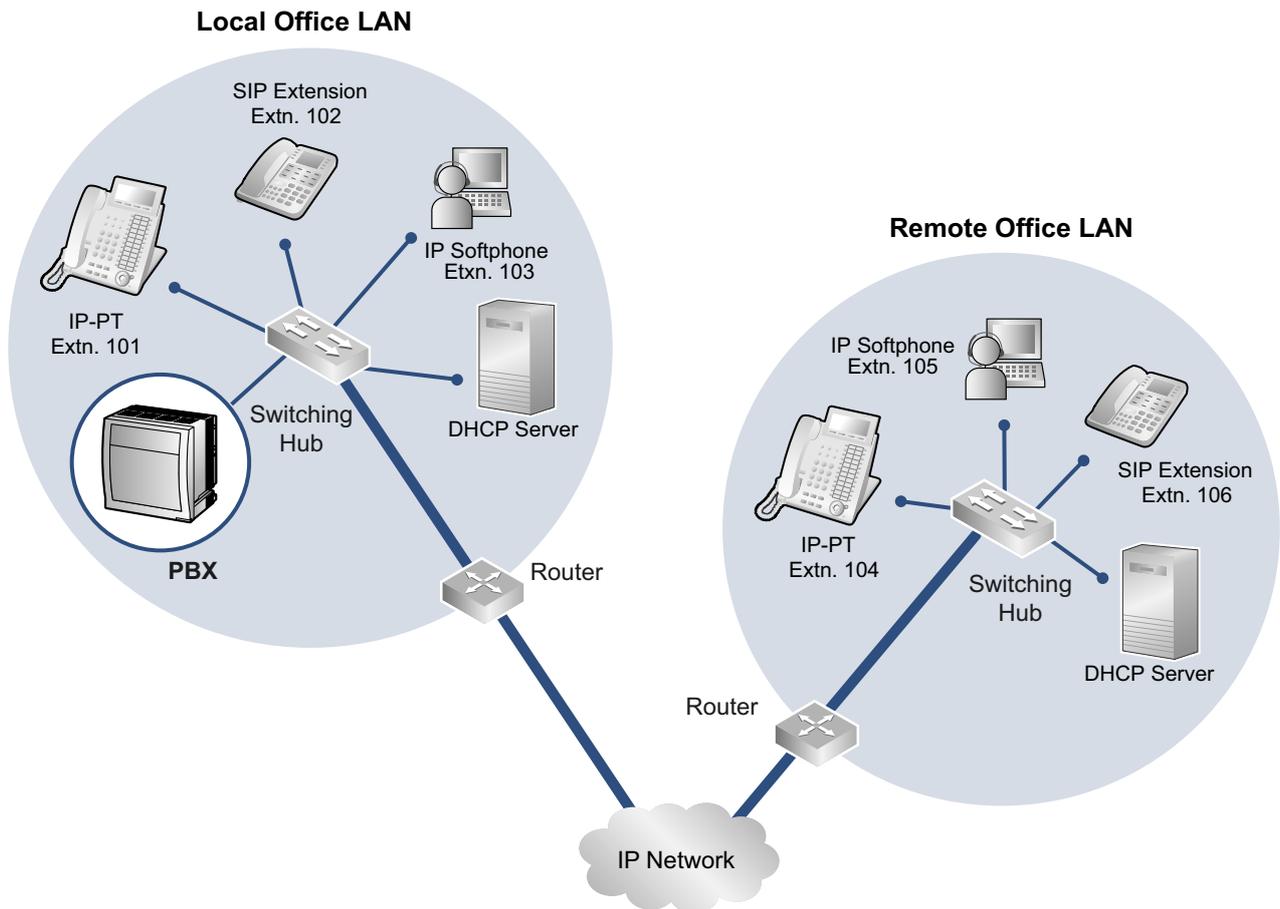
The Pure IP-PBX also enables VoIP communication with PBXs installed at different locations. Since the communication does not take place over conventional telephone network, the high cost of long distance communication is virtually eliminated.

The following diagrams illustrate VoIP network with (i) a remote office LAN and (ii) another PBX installed at different location.

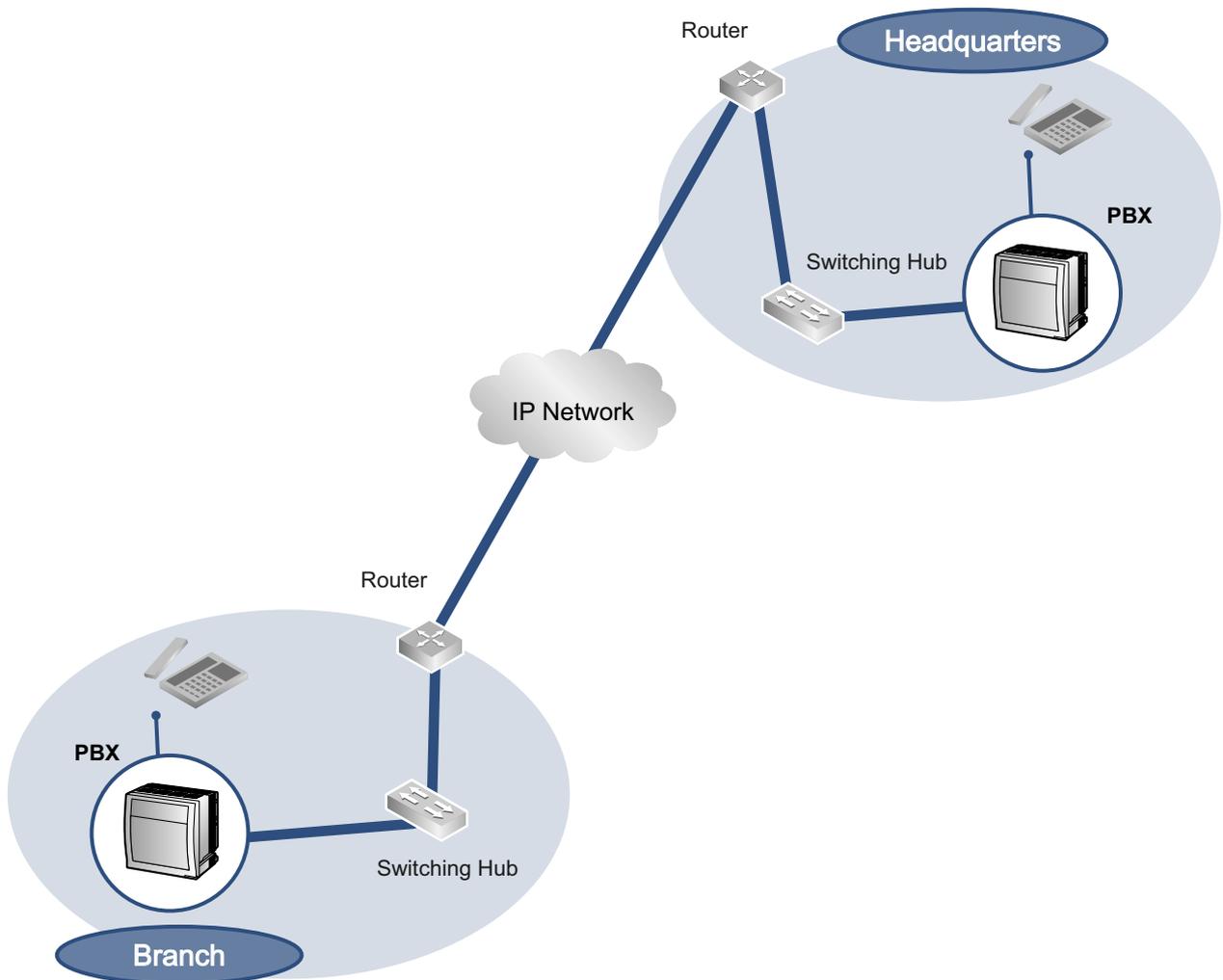
Note

In this manual, the illustrations of the PBX are based on the KX-TDE200.

(i) VoIP Network with Remote Office LAN



(ii) VoIP Network with Another PBX



Network Parameters

You will need to have the following IP addressing and QoS information to establish VoIP communication on your network. This information is typically supplied by a network administrator. Consult your network administrator for specific values.

Parameter	Description
IP telephone IP Address	Identifies the location of IP telephones on the network. Each IP telephone must have a unique IP address.
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 telephones and the PBX must fall within the same subnet as that of the default gateway (e.g., router) of the LAN.
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.

1.1.1 Establishing a VoIP Network with the Pure IP-PBX

Parameter	Description
PBX IP Address	Identifies the location of the PBX in the network during VoIP communications.
VLAN ID	Identifies the ID of the logical segment within the corporate LAN, through which voice packets from IP telephones travel. For details, refer to "1.2.2 VLAN (Virtual LAN)".
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 telephones. For details, refer to "4.3.3 Setting the Diffserv Parameters".

Types of IP Network

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)

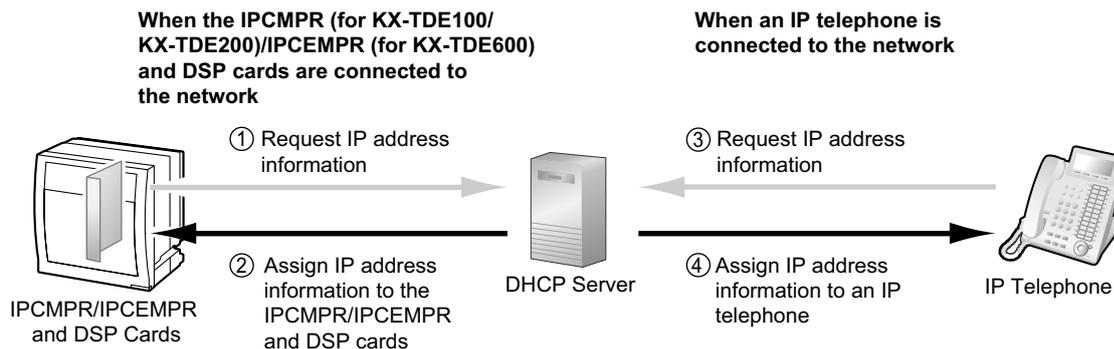
Note

- Peer-to-peer calls between KX-NT300 series IP-PTs installed at different locations may not be possible if packet communication cannot be established between the respective networks. In this case, you need to configure the network settings (e.g., a VPN router when using an IP-VPN) to establish packet communication.
- 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 VoIP 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

To establish communication over a VoIP network, IP addresses must be assigned to IP telephones 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 IP address for the IP-EXT16 card cannot be assigned automatically using a DHCP server. This IP address must be assigned manually using the Maintenance Console (PC programming software of the PBX). For details, refer to "4.2 Programming the IP-EXT16 Card".
- The PBX is not able to act as a DHCP server. To use the DHCP client function of IP telephones and the IPCMPR/IPCEMPR/DSP cards, a separate DHCP server is required on the network, as shown above.
- An IP telephone and the IPCMPR/IPCEMPR/DSP cards 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 telephones 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 telephones and the IPCMPR/IPCEMPR/DSP cards on that LAN must be assigned manually.

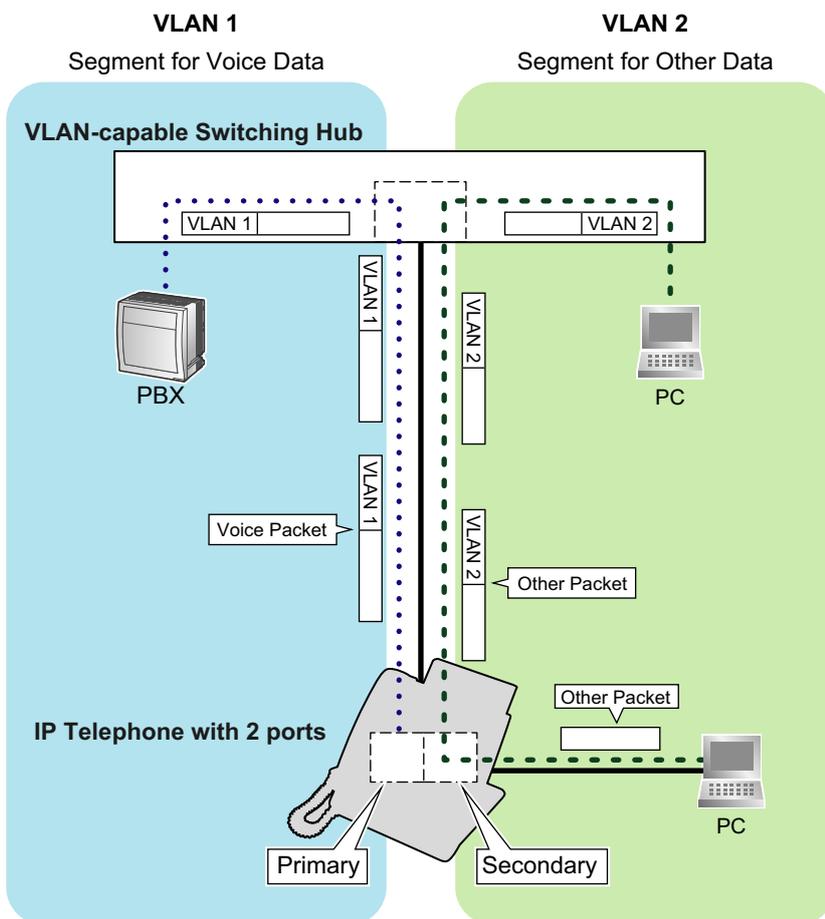
1.2.2 VLAN (Virtual LAN)

VLANs are logical segments within a corporate LAN. By assigning VLAN settings to IP telephones, it is possible to separate the packets transmitted by an IP telephone 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 telephones (e.g., KX-NT300 series) 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 telephone, whereas VLAN settings for the secondary port apply to data transmitted by a PC connected to the IP telephone. When sending packets, the IP telephone 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 telephone voice transmissions.

In this way, an IP telephone 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 telephone with 2 ports, the VLAN settings for PC communications must be assigned only to the secondary port of the IP telephone. 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 telephone with a primary port only (e.g., KX-NT265), a PC cannot be connected to the IP telephone.

1.2.3 Gatekeeper

The following are the general functions of a gatekeeper:

- Dialed number-to-IP address translation
- Authentication
- Bandwidth control

The gatekeeper provides these network management functions to registered clients. To register with the gatekeeper, you need to configure the V-IPGW16 card to use the gatekeeper and program the GK Settings table through system programming. For details, refer to "3.9 [1-1] Slot—Shelf Property - Virtual IP Gateway —◆ Gatekeeper Available" and "3.10 [1-1] Slot—Shelf Property - Virtual IP Gateway—GK Settings" in the PC Programming Manual. After programming, the V-IPGW16 card attempts to register with the gatekeeper using registration information such as the IP address of the IPCMPR/IPCEMPR card, and destination telephone numbers specified in the GK Settings table.

Note

- For more information about gatekeeper functions, consult the documentation of the gatekeeper.
- When using a gatekeeper, make sure to choose a compatible model. For more information about gatekeeper compatibility with the V-IPGW16 card, consult a certified dealer.

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.

To set the size of the jitter buffer, refer to "3.4 [1-1] Slot—Card Property - IPCMPR—VoIP-DSP Option" in the PC Programming Manual.

1.3.2 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 each available CODEC: G.711 and G.729A.

To configure the VAD feature, refer to the appropriate section in the PC Programming Manual.

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.
- The VAD feature cannot be used between the V-IPGW16 and IP-GW4 cards since the V-IPGW16 card does not support the G.723 CODEC (although calls can be made and received as normal).
- The VAD feature between the V-IPGW16 and IP-GW16 cards can be enabled through system programming. Refer to "Main—◆ Connection for IP-GW16" under "3.11 [1-1] Slot—Shelf Property - Virtual IP Gateway—GW Settings" in the PC Programming Manual.

1.3.2 Voice Activity Detection (VAD)

Section 2

Guidance for VoIP Installation

2.1 VoIP Requirements

2.1.1 Bandwidth Assessment

When using the IP telephones and V-IPGW16 card, 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.

Bandwidth Assessment for IP Extension Card

Required Bandwidth per IP Telephone 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 CODECs and packet sending intervals, in terms of speech quality:

- The speech quality of the CODECs varies as follows: (High) G.722, G.711, G.729A (Low)^{*1}
- The shorter the packet sending interval, the higher the speech quality.
- The higher the speech quality the IP telephones provide, the more bandwidth the IP telephones 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.722 ^{*1} /G.711	87.2 kbps	79.5 kbps	—	—
G.729A	31.2 kbps	23.5 kbps	19.6 kbps	15.7 kbps

^{*1} G.722 is only available for the KX-NT300 series IP-PTs and some SIP Extensions that support this CODEC during peer-to-peer communication. For details, refer to "1.31.3 Peer-to-Peer Connection" in the Feature Guide.

Required Bandwidth for Each IP Extension Card

To allow all IP telephones to make calls simultaneously, it is necessary to keep available the bandwidth required by an IP Extension card with the maximum number of IP telephones connected.

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

When using the IP-EXT16 card:

Required Bandwidth = (Required Bandwidth per IP telephone × 16)

When using the V-IPEXT32/V-SIPEXT32 card:

Required Bandwidth = (Required Bandwidth per IP telephone × 32)

Bandwidth Assessment for V-IPGW16 Card

Required Bandwidth for One VoIP Channel

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 the speech quality:

- The speech quality of the G.711 CODEC is higher than that of the G.729A CODEC.
- The shorter the packet sending interval, the higher the speech quality.

- The higher the speech quality the V-IPGW16 card provides, the more bandwidth the card requires.

Via LAN

CODEC	Packet Sending Interval				
	20 ms	30 ms	40 ms	60 ms	90 ms
G.711	87.2 kbps	79.5 kbps	75.6 kbps	71.7 kbps	—
G.729A	31.2 kbps	23.5 kbps	19.6 kbps	15.7 kbps	—

Via WAN (PPP: Point-to-Point Protocol)

CODEC	Packet Sending Interval				
	20 ms	30 ms	40 ms	60 ms	90 ms
G.711	84 kbps	77.3 kbps	74 kbps	70.7 kbps	—
G.729A	28 kbps	21 kbps	18 kbps	14.7 kbps	—

Bandwidth Calculation

Provided below is the formula to find out the amount of bandwidth required for VoIP communications:

Required Bandwidth

$$= (\text{No. of Fax Machines} \times \text{Required Bandwidth for the G.711 CODEC}) + [(\text{16} - \text{No. of Fax Machines}) \times \text{Required Bandwidth for Voice Communication}]$$

Example

Consider the following case as an example:

- Communication: via LAN
- No. of Fax Machines: 2
- G.711 Packet Sending Interval: 20 ms (requiring 87.2 kbps per channel)
- G.729A Packet Sending Interval for Voice Communication: 20 ms (requiring 31.2 kbps per channel)

In this case, the required bandwidth will be as follows:

Required Bandwidth

$$= (2 \times 87.2) + [(16 - 2) \times 31.2]$$

$$= 611.2 \text{ (kbps)}$$

Therefore, inform your network administrator and make sure that the network can support a bandwidth of 611.2 kbps even when the network is under conditions of maximum traffic.

Note

It is recommended that all cards on a VoIP network have the same packet sending interval.

Additional Information

As described above, it is possible to control the required bandwidth by selecting a certain combination of CODEC and packet sending interval. However, it is also possible to control required bandwidth by limiting the number of available virtual VoIP channels.

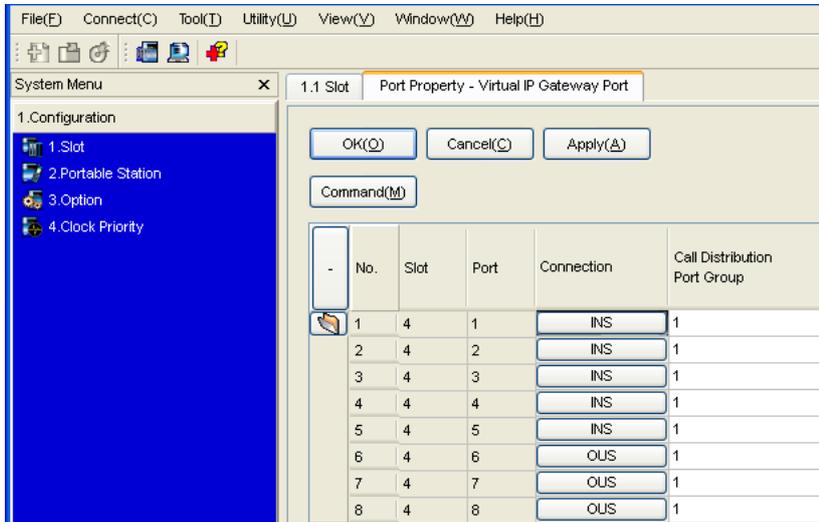
The V-IPGW16 card supports a total of 8 ports, each having 2 separate channels. By disabling some of the ports, you can reduce the bandwidth required for VoIP communications.

To limit the number of VoIP channels:

Set the status of the ports you wish to disable (starting from the highest-numbered port) to **OUS**.

2.1.1 Bandwidth Assessment

For example, if you wish to use only 10 of the available 16 virtual VoIP channels (i.e., disable 6 channels), set ports 8, 7, and 6 to **OUS** as shown below:



In this case, the equation for bandwidth calculation, based on the previous example, will change as follows:

Required Bandwidth

$$\begin{aligned} &= (\text{No. of Fax Machines} \times \text{Required Bandwidth for the G.711 CODEC}) + \\ &[(\mathbf{10} - \text{No. of Fax Machines}) \times \text{Required Bandwidth for Voice Communication}] \\ &= (2 \times 87.2) + [(\mathbf{10} - 2) \times 31.2] \\ &= 424 \text{ (kbps)} \end{aligned}$$

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 telephones 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 telephone on the network.

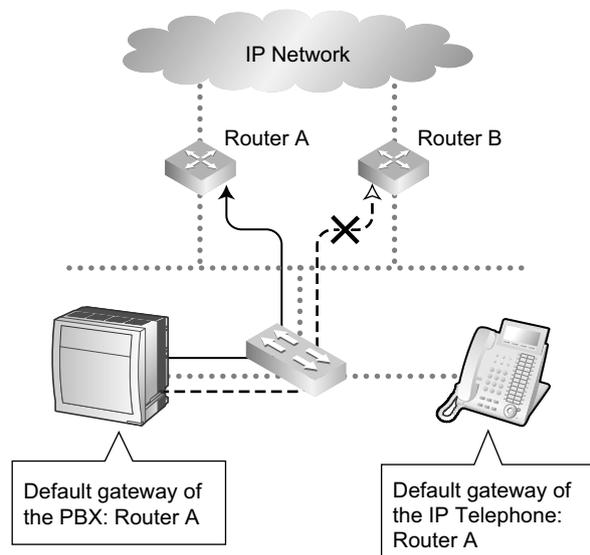
Note

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 telephones.

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

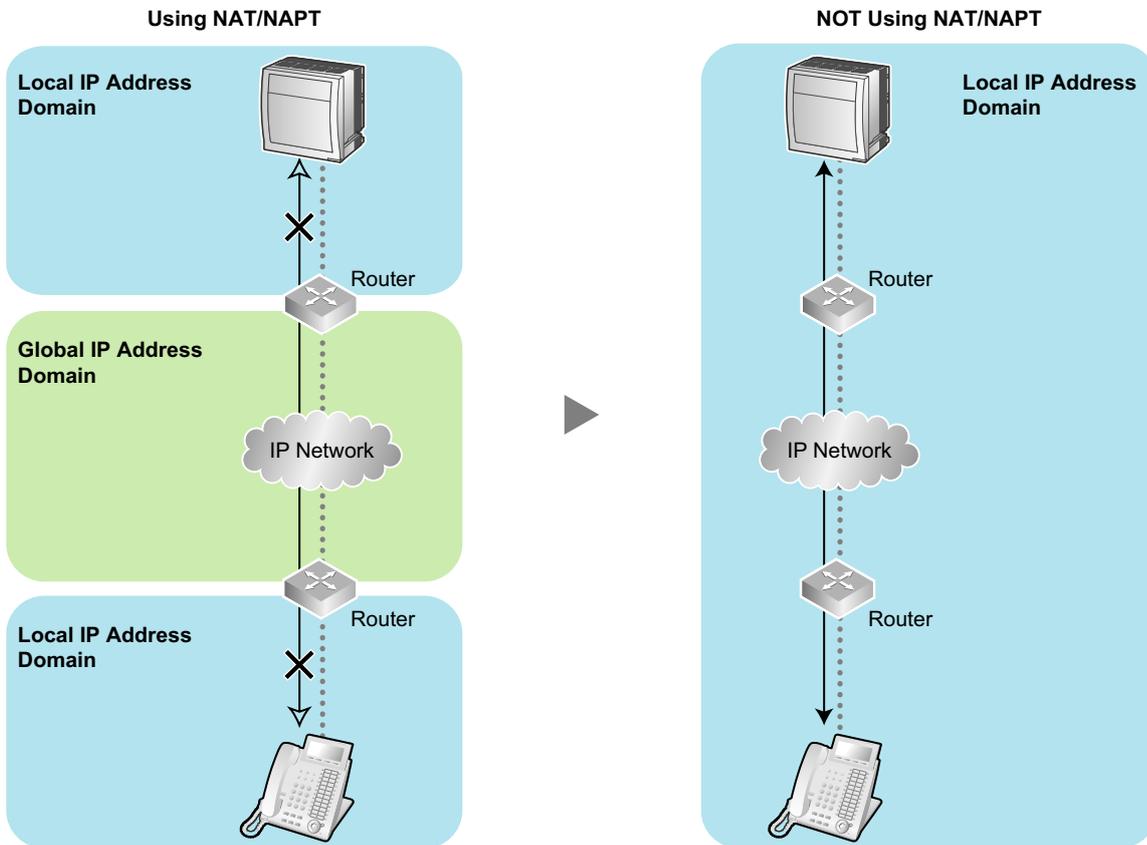
In a dual network, 2 routers provide access to the IP network as shown in the diagram below. However, only one router can be used as an access point to the network.

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 telephones, 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 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.

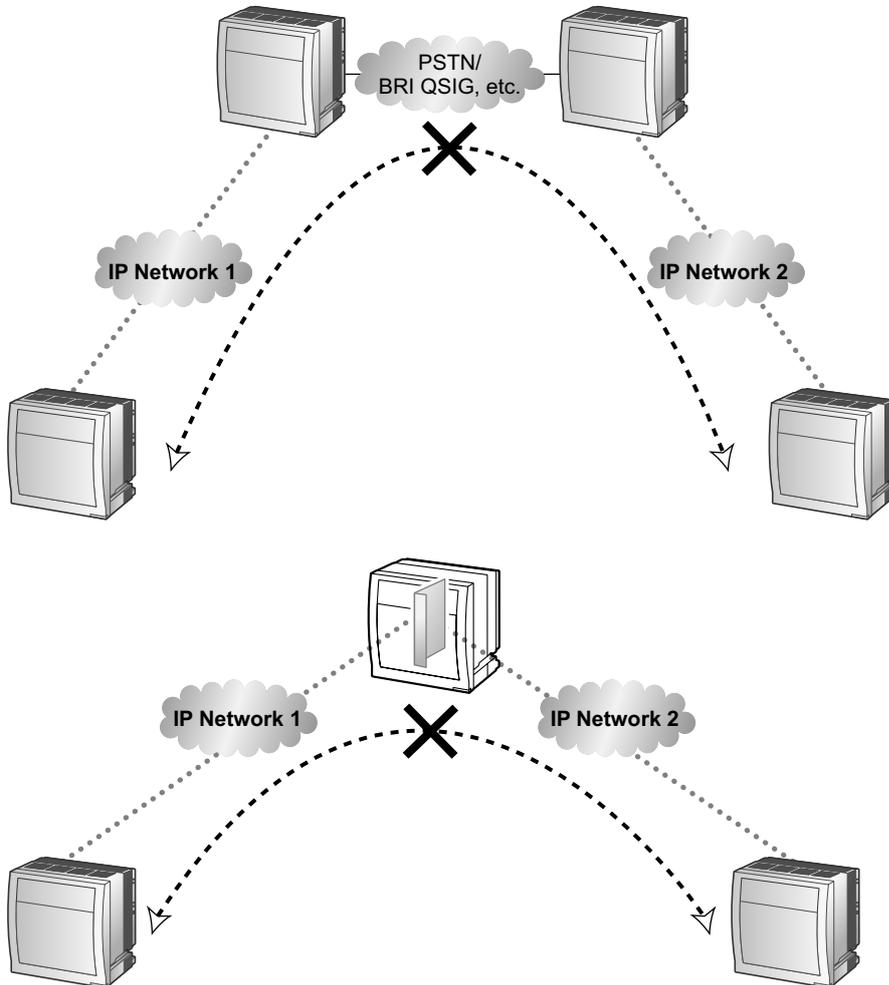


Note

If the network devices (e.g., router, firewall) support NAT features, it may be possible to have VoIP communications over the network. For more information, consult your network administrator.

Is there only a single IP network between 2 ends of a call?

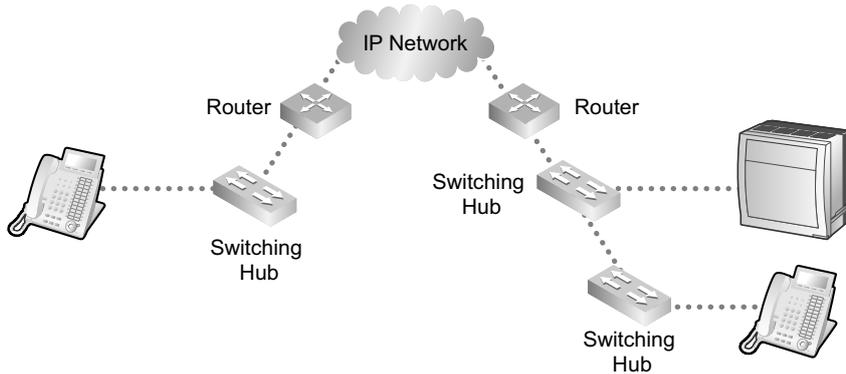
A huge degradation in speech quality will be produced when calls are made through multiple IP networks as shown below; therefore, it is recommended that you avoid establishing a VoIP network in this fashion.



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 telephones 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 telephones and the IP network interface as possible so that the number of the network devices is kept to a minimum.



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 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 IPCMPR/IPCEMPR/IP-EXT16 Card and IP Telephones]

Protocol	Description	TCP/UDP	Default Port No.
RTP (IP telephone connected to IPCMPR/IP-CEMPR)	Real-time Transport Protocol. Used for voice data transmission.	UDP	12000 to 12255
RTP (IP-PT connected to IP-EXT16)		UDP	8000 to 8063
Maintenance (IPCMMPR/IPCEMPR)	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	35300
Maintenance (IP-EXT16)		UDP	9300
Maintenance (IP telephone)		UDP	9301
MGCP (IPCMMPR/IP-CEMPR/IP-EXT16)	Media Gateway Control Protocol. Used for call control command data and LCD/LED data transmission.	UDP	2727
MGCP (IP telephone)		UDP	2427
DHCP (IPCMMPR/IP-CEMPR)	Dynamic Host Configuration Protocol. Used for receiving an IP address from a DHCP server.	UDP	67, 68
DHCP (IP telephone)		UDP	67, 68
FTP (Port mode)	File Transfer Protocol. Used for receiving a data file from a FTP server to upgrade the firmware version.	TCP	20, 21
SNTP (IPCMMPR/IP-CEMPR)	Simple Network Time Protocol. Used for clock synchronisation.	UDP	123
SNMP (IPCMMPR/IP-CEMPR)	Simple Network Management Protocol. Used for monitoring network-attached devices.	UDP	161

[IP Packets from V-IPGW16 Card]

Protocol	TCP/UDP	Default Port No.
HTTP	TCP	10000 to 10447
RTP/RTCP	UDP	
H.245	TCP	

2.1.3 Network Devices

Protocol	TCP/UDP	Default Port No.
H.225.0 Call Signalling	TCP	1720
H.225.0 RAS	UDP	1719
QSIG Connectionless Tunnelling	TCP	1718
QSIG Connectionless Tunnelling	UDP	1717

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 telephones.

Note

Note that the port of the switching hub that connects to the IPCMPR/IPCEMPR/IP-EXT16 cards 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.

2.1.4 QoS (Quality of Service)

Some routers permit the configuration of priority control features. This allows the router to give higher priority to voice packets and lower the rate of loss and delays during transmissions, hence improving speech quality. It is strongly recommended that you use this feature, especially in networks where traffic is heavy.

Typically, a router identifies what packets to pass in priority by checking the value in the ToS field of the header of IP packets. The V-IPGW16 card has the ability to set the ToS field of outgoing voice packets. When the card is appropriately configured, the router can give voice packets from the card higher priority.

Consult your network administrator when setting the ToS field, as the setting value must conform to the router's specifications.

Note

- Some switches also permit the configuration of priority control features. For more information, consult your network administrator.
- To adjust the value in the ToS field, refer to "3.9 [1-1] Slot—Shelf Property - Virtual IP Gateway" in the PC Programming Manual.

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	<p>Does the network have enough bandwidth to support VoIP communications? Make sure that there is more bandwidth available for VoIP communications than the amount actually required.</p>	<input type="checkbox"/> Yes <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. 14

Network Configuration

No.	Question	Answer	Memo	Ref.
2-a	<p>Is the IP network a managed network? Make sure to use a managed IP network such as Frame Relay, Leased Line, or IP-VPN (Virtual Private Network). The IPCMP/IPCMP/ IP-EXT16 cards are not intended for use on the Internet (including an Internet VPN).</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No	Type of IP network:	p. 17
2-b	Is it possible to have static IP addressing?	<input type="checkbox"/> Yes <input type="checkbox"/> No		p. 17
2-c	Does only a single router provide access to the IP network?	<input type="checkbox"/> Yes <input type="checkbox"/> No		p. 17
2-d	Does the router not use network address translation (NAT/NAPT)?	<input type="checkbox"/> Yes <input type="checkbox"/> No		p. 18
2-e	Is there only a single IP network between 2 ends of a call?	<input type="checkbox"/> Yes <input type="checkbox"/> No		p. 19
2-f	<p>Are the network devices located appropriately for effective VoIP communications? It is recommended to connect the PBX as close to IP telephones and the IP network interface as possible.</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No		p. 20

Network Devices

No.	Question	Answer	Memo	Ref.
3-a	<p>Can the firewall pass packets appropriately? 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"/> Yes <input type="checkbox"/> No	Model of firewall:	p. 21

No.	Question	Answer	Memo	Ref.
3-b	<p>Are layer 2 or higher switches used? Do not use repeater hubs as they can increase the network load.</p> <p>Also note that the port of the switching hub that connects to the IPCMPR/IPCEMPR/IP-EXT16 cards should be set to operate under "Auto Negotiation" mode.</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No	Model of switch:	p. 22
3-c	<p>Are Category 5 (CAT 5) or higher cables used?</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No		p. 22

QoS (Quality of Service)

No.	Question	Answer	Memo	Ref.
4	<p>Can the router or switch be configured to use priority control features?</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No	<p>Model of the router/switch:</p> <p>V-IPGW16 card's ToS field setting:</p>	p. 23

2.2 VoIP Requirements Checklist

Section 3

Connection to the LAN

This section describes the process of connecting the IPCMPR/IPCEMPR/IP-EXT16 cards and IP telephones to the LAN.

3.1 Connecting the IPCMPR/IPCEMPR/IP-EXT16 Card to the LAN

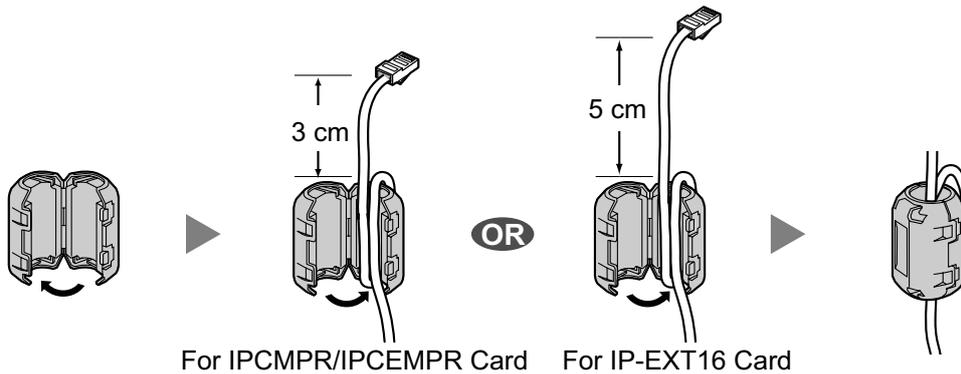
Refer to the following example to connect the IPCMPR/IPCEMPR/IP-EXT16 card to the LAN. When IPCMPR/IPCEMPR/IP-EXT16 cards are connected to the LAN for the first time, you must assign IP addressing information to them. Refer to "4.1 Programming the IPCMPR/IPCEMPR Card" or "4.2 Programming the IP-EXT16 Card" for instructions respectively.

Note

- Use an Ethernet straight cable with an RJ45 connector to connect the card to a switching hub. The cable should be a 10BASE-T/100BASE-TX CAT 5 (Category 5) or higher cable.
- Before connecting the card, attach the included ferrite core to the cable.
- Make sure to set the port of the switching hub that connects to the card to operate under "Auto Negotiation" mode.
- When using the VLAN feature on the network, make sure that the 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 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-EXT16 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-EXT16 card is as follows:
 - PIPEXT Software Version 2.000 or later.
 - PVOIPEX Software Version 2.000 or later.

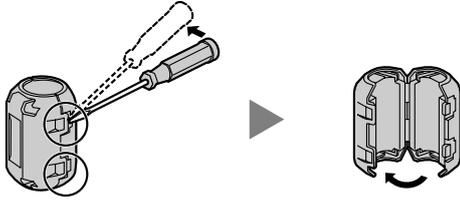
Attaching a ferrite core to the cable

1. Wrap the cable once around the ferrite core, leaving a space between the ferrite core and the connector as specified below.
2. Close the case of the ferrite core.

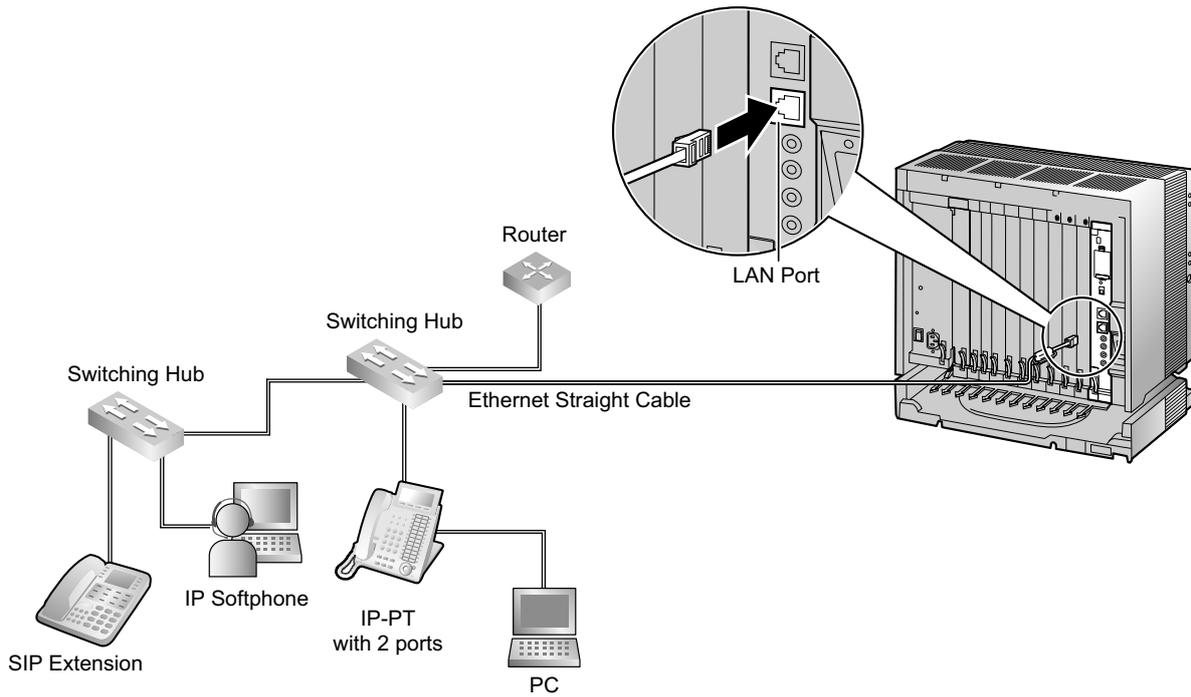


Note

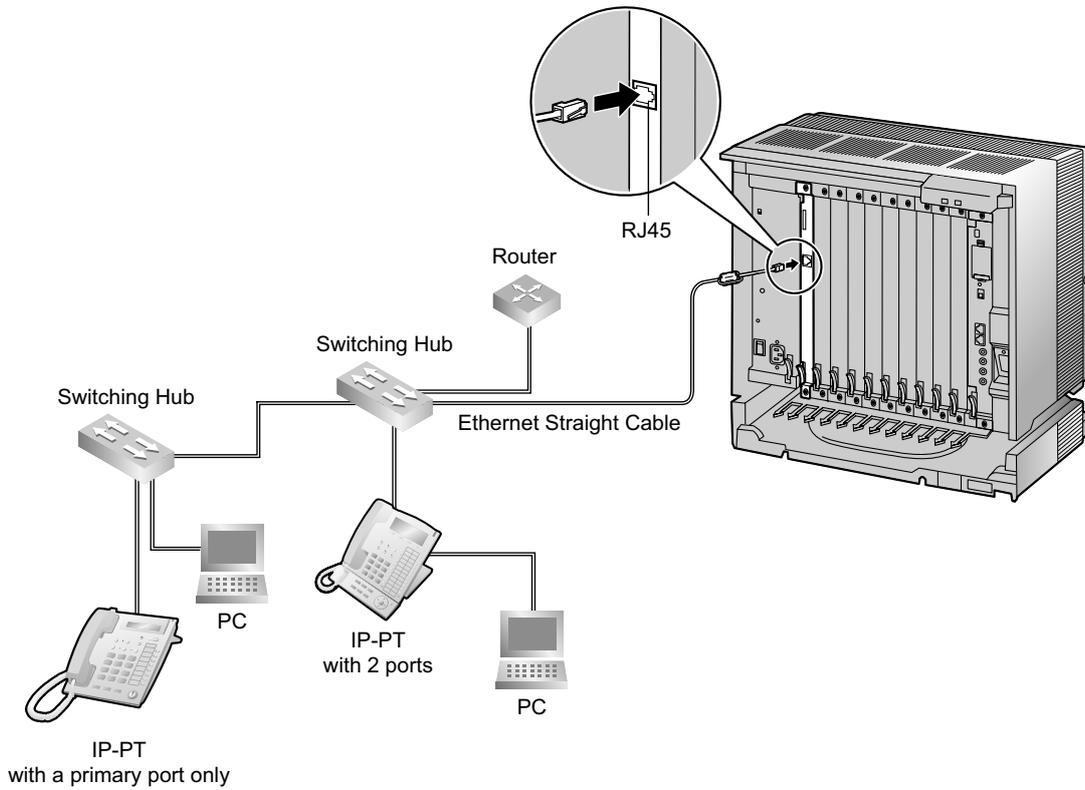
If you need to open the ferrite core, use a flathead screwdriver to unlatch the case.



Connecting the IPCMPR/IPCEMPR card to a switching hub



Connecting the IP-EXT16 card to a switching hub



3.2 Connecting the IP Telephones

When an IP telephone 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 telephone before it can be used. Refer to "4.3 Programming the IP Telephones" for instructions.

Connecting an IP Telephone to a Switching Hub

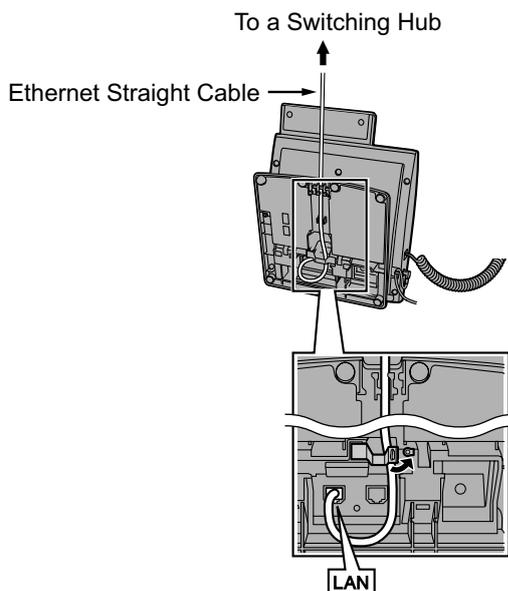
When connecting an IP telephone to the LAN, connect it to a switching hub.

Note

- Use an Ethernet straight cable with an RJ45 connector to connect the IP telephone to a switching hub. The cable should be a 10BASE-T/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 telephone is connected to must be set to "Trunk" port, to allow VLAN tagging. Consult your network administrator for details.
- Since an IP softphone is installed and operates on a PC, the PC must be connected to the LAN to use the IP softphone on the network.

The diagram below is for connecting an IP-PT to a switching hub. For SIP Extensions, refer to the documentation of your SIP Extension.

Example: KX-NT346



Connecting an AC Adaptor to an IP Telephone

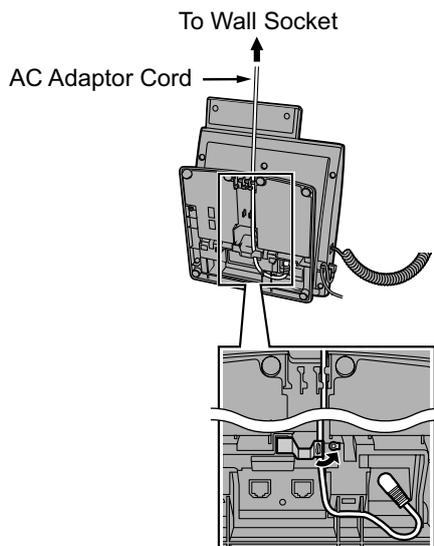
IP-PTs and some SIP Extensions comply with the IEEE 802.3af Power-over-Ethernet (PoE) standard. If PoE is available on your network, these IP telephones can receive the necessary power supply from the network through the network cable. In this case, no AC adaptor is needed for the IP telephones.

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

Note

Use only the specified type of AC adaptor for each IP telephone. For details, refer to the documentation of your IP telephone.

Example: KX-NT346



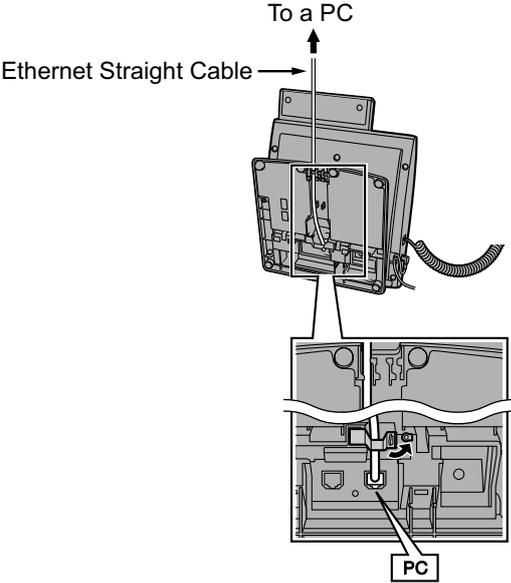
Connecting a PC to an IP Telephone

You can connect a PC to some IP telephones (e.g., KX-NT300 series) using the IP telephone'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 telephone and PC to the LAN.

Note

- Use an Ethernet straight cable with an RJ45 connector to connect a PC to the IP telephone. The cable should be a 10BASE-T/100BASE-TX CAT 5 (Category 5) or higher cable.
- Only a PC can be connected to the secondary port of an IP telephone. Other IP telephones, 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 telephone.

Example: KX-NT346



3.2 Connecting the IP Telephones

Section 4

Programming

This section describes the process of programming the IPCMPR/IPCEMPR card, the IP-EXT16 card and IP telephones covering the following topics: (1) setting network parameters for the cards and IP telephones, and (2) registering and de-registering the IP telephones.

4.1 Programming the IPCMPR/IPCEMPR Card

4.1.1 Assigning the IP Addressing Information

The IP addressing information for the IPCMPR/IPCEMPR card can be assigned automatically through a DHCP server or entered manually 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.

Programming from Quick Setup

1. Connect the PC to the PBX with an Ethernet straight cable or RS-232C cross cable.
2. Start the Maintenance Console from the Start menu.
3. "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.
4.
 - a. Enter the Installer Level Programmer Code (default: **INSTALLER**).
 - b. Click **OK**.
5. Click **Connect**.
6.
 - 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.

Note

When connecting to the PBX for the first time selecting **LAN**, the **IP Address** and **Port Number** must be set to **192.168.0.101** and **35300** respectively.

- d. Enter the system password for installer (default: **1234**).
 - e. Click **Connect**.
7. Quick Setup will launch automatically. In Quick Setup—Step 4, the IP addressing information for the IPCMPR/IPCEMPR card can be assigned automatically through a DHCP server or entered manually.

When using a DHCP server:

- a. Select **Enable** for the **DHCP Client** setting.
- b. Click **Apply**.

Note

The boxes will turn grey and the IP addresses will be assigned automatically after the PBX is reset.

The screenshot shows a window titled "Quick Setup - Step 4" with a "LAN Setting" section. Under "DHCP Client", the "Enable" radio button is selected. Below this are four input fields: "IP Address for IPCMPR-Card:", "IP Address for VoIP-DSP:", "Subnet Mask:", and "Default Gateway:". The fields are currently empty.

When not using a DHCP server:

- a. Select **Disable** for the **DHCP Client** setting.
- b. For KX-TDE100/KX-TDE200, type the IP address of the IPCMPR card in the **IP Address for IPCMPR Card** box. For KX-TDE600, type the IP address of the IPCEMPR card in the **IP Address for IPCEMPR Card** box.¹
- c. In the **IP Address for VoIP-DSP** box, type the IP address of the DSP16 or DSP64 card.²
- d. In the **Subnet Mask** box, type the subnet mask address of the network.³
- e. In the **Default Gateway** box, type the IP address of the default gateway.⁴
- f. Click **Apply**.

The system menu appears.

Quick Setup - Step 4

LAN Setting

DHCP Client

Enable Disable

IP Address for IPCMPR-Card : 192.168.0.1

IP Address for VoIP-DSP : 192.168.0.2

Subnet Mask : 255.255.0.0

Default Gateway : 48.48.48

Programming from the system menu

1. The IP addressing information for the IPCMPR/IP-CEMPR card can also be assigned from the system menu.
 - a. Under **Configuration**, click **Slot**.
 - b. Move the mouse pointer over the IPCMPR/IP-CEMPR card. A menu will be shown under the mouse pointer.
 - c. Click **Card Property**.
2. **When using a DHCP server:**
 - a. Click the **LAN Setting** tab, then select **Enable** for the **DHCP Client** setting.
 - b. Click **Apply**.



System Menu x 1.1 Slot Card Property - IPCMPR

OK(O) Cancel(C) Apply(A)

LAN Setting	VoIP-DSP Option	Port Number	LAN Status	DH
Description				
DHCP Client			Enable	
MAC Address for IPCMPR-Card			00:00:00:00:00:00	
IP Address for IPCMPR-Card				
MAC Address for VoIP-DSP			00:00:00:00:00:00	
IP Address for VoIP-DSP				
Subnet Mask				
Default Gateway				

When not using a DHCP server:

- a. Click the **LAN Setting** tab, then select **Disable** for the **DHCP Client** setting.
- b. For KX-TDE100/KX-TDE200, type the IP address of the IPCMPR card in the **IP Address for IPCMPR Card** box. For KX-TDE600, type the IP address of the IPCEMPR card in the **IP Address for IPCEMPR Card** box.¹
- c. In the **IP Address for VoIP-DSP** box, type the IP address of the DSP16 or DSP64 card.²
- d. In the **Subnet Mask** box, type the subnet mask address of the network.³
- e. In the **Default Gateway** box, type the IP address of the default gateway.⁴
- f. Click **Apply**.

System Menu x 1.1 Slot Card Property - IPCMPR

OK(O) Cancel(C) Apply(A)

LAN Setting	VoIP-DSP Option	Port Number	LAN Status	DH
Description				
DHCP Client			Disable	
MAC Address for IPCMPR-Card			00:00:00:00:00:00	
IP Address for IPCMPR-Card			192.168.0.1	
MAC Address for VoIP-DSP			00:00:00:00:00:00	
IP Address for VoIP-DSP			192.168.0.2	
Subnet Mask			255.255.0.0	
Default Gateway			48.48.48.48	

4.1.1 Assigning the IP Addressing Information

3.
 - a. A screen will appear with information that any changes made in step 2 will be activated after the PBX is restarted.
 - b. Click **OK** to restart the PBX.

Notice

- Do not change the IP addresses of the IPCMPR/IPCEMPR and DSP cards once IP telephones are registered to the PBX using these IP addresses.
The IP telephones will not operate properly if these IP addresses are changed.
- A DHCP server must be able to use a "client identifier" option specified by RFC 2131.
- The PBX will not start properly if the IP addresses cannot be assigned automatically by the DHCP server when DHCP Client is set to Enable. In this case, you need to consult your network administrator because the DHCP server on your network may not be running or a network failure may have occurred. If the DHCP server is not available, change the DHCP Client setting to Disable and set fixed IP addresses, then restart the PBX.

To change the DHCP Client setting, connect the PC with an RS-232C cross cable or Ethernet straight cable. When connecting the PC with an Ethernet straight cable, make sure the PBX is disconnected from the LAN and then connect the PC with an Ethernet straight cable using 192.168.0.101 for the IP address of the IPCMPR/IPCEMPR card.

^{*1} Valid IP address range: "1.0.0.0" to "223.255.255.255"

^{*2} Valid IP address range: "1.0.0.0" to "223.255.255.255"

^{*3} Valid subnet mask address range: "0–255.0–255.0–255" (except 0.0.0.0 and 255.255.255.255)

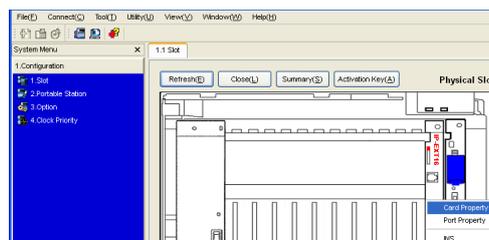
^{*4} Valid IP address range: "1.0.0.0" to "223.255.255.255"

4.2 Programming the IP-EXT16 Card

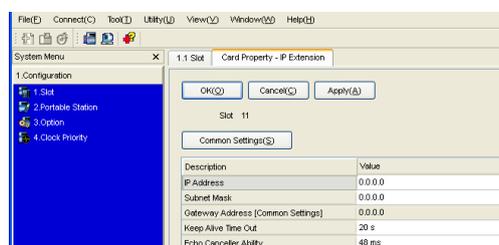
4.2.1 Assigning the IP Addressing Information

When an IP-EXT16 card is placed on the LAN for the first time, it is necessary to assign IP addressing information to the card. This is done using the Maintenance Console.

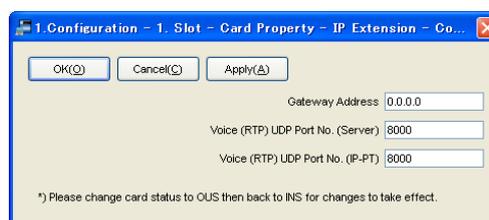
1.
 - a. Under **Configuration**, click **Slot**.
 - b. Move the mouse pointer over the IP-EXT card. A menu will be shown under the mouse pointer.
 - c. Click **Out** to set the card to out-of-service status.
 - d. Move the mouse pointer over the IP-EXT card, then click **Card Property**.



2.
 - 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**.



3. 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 3, it is necessary to set all installed IP-EXT cards to out-of-service status (**OUS**), then back to in-service status (**INS**).

4. 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"

4.3 Programming the IP Telephones

4.3.1 Assigning the IP Addressing Information

The IP address of an IP telephone, the subnet mask address, the default gateway address, and the PBX IP address must be assigned to the IP telephone before it can be used on the network. These IP addressing information can be assigned in the following ways:

For IP-PTs connected to the IPCMPR/IPCEMPR Card

1. Using a DHCP server when the IP-PT is on the same LAN with the PBX

The DHCP server automatically assigns the IP address of the IP-PT, the subnet mask address, and the default gateway address to the IP-PT.

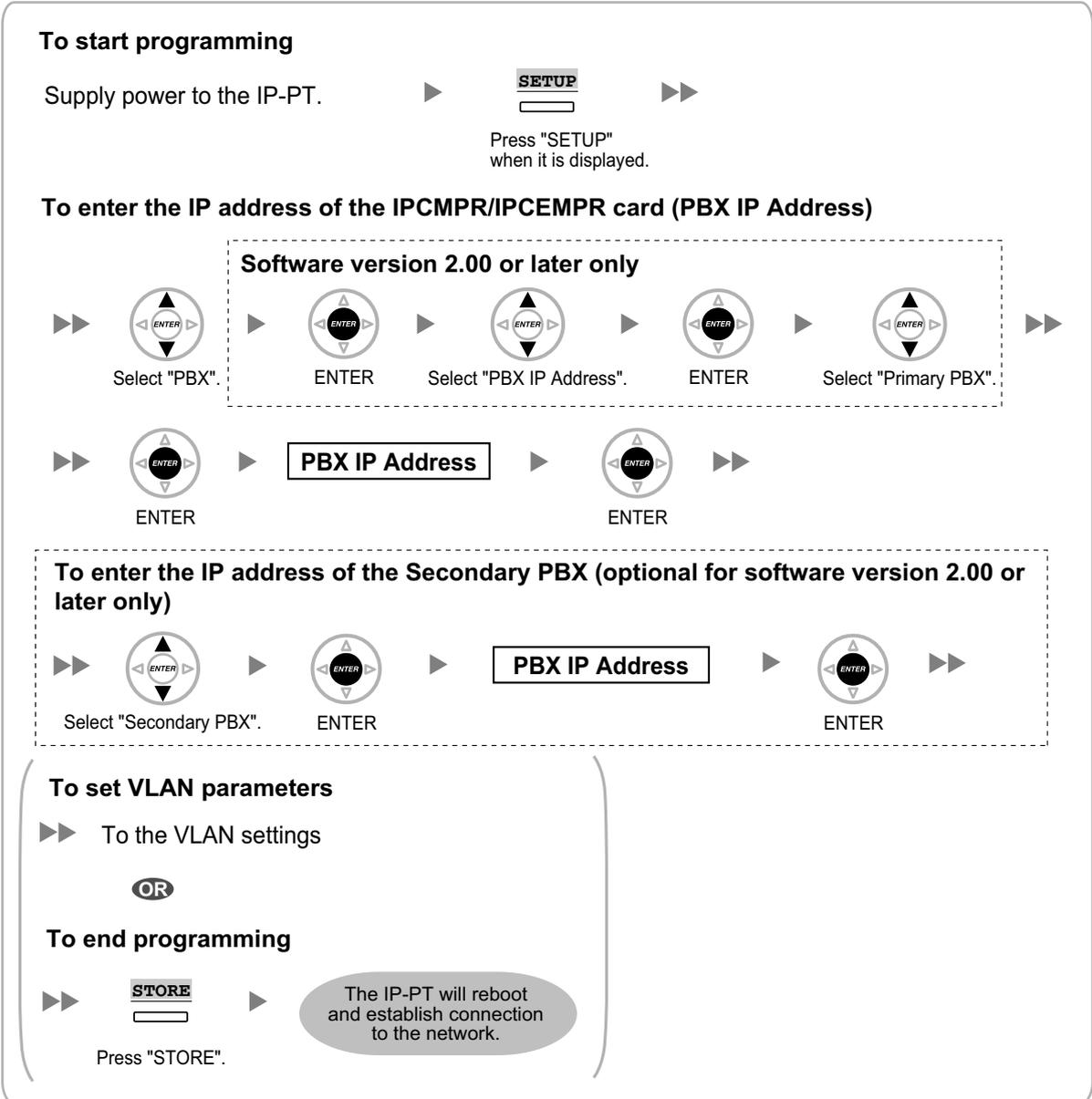
The PBX IP address can also be assigned automatically to the IP-PT in process of being registered to the PBX. For details about registering the IP-PT, refer to "4.4.1 Registering IP Telephones".

2. Using a DHCP server when the IP-PT is on the remote office LAN

While the DHCP server automatically assigns the IP address of the IP-PT, the subnet mask address, and the default gateway address to the IP-PT, only the PBX IP address must be assigned manually. Follow the procedure below to assign the PBX IP address.

If you need to set VLAN parameters, follow the procedure described in "4.3.2 Setting the VLAN Parameters" after assigning the IP addresses without ending programming.

KX-NT300 series (except KX-NT321)



4.3.1 Assigning the IP Addressing Information

KX-NT321

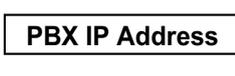
To start programming

Supply power to the IP-PT.  
Press PROGRAM while "Searching" is displayed.

To enter the IP address of the IPCMPR/IPCEMPR card in the Primary PBX (PBX IP Address)

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

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

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

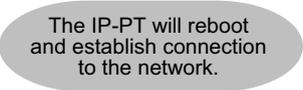
  
Press HOLD twice to return to the Menu screen.

To set VLAN parameters

  To the VLAN settings

OR

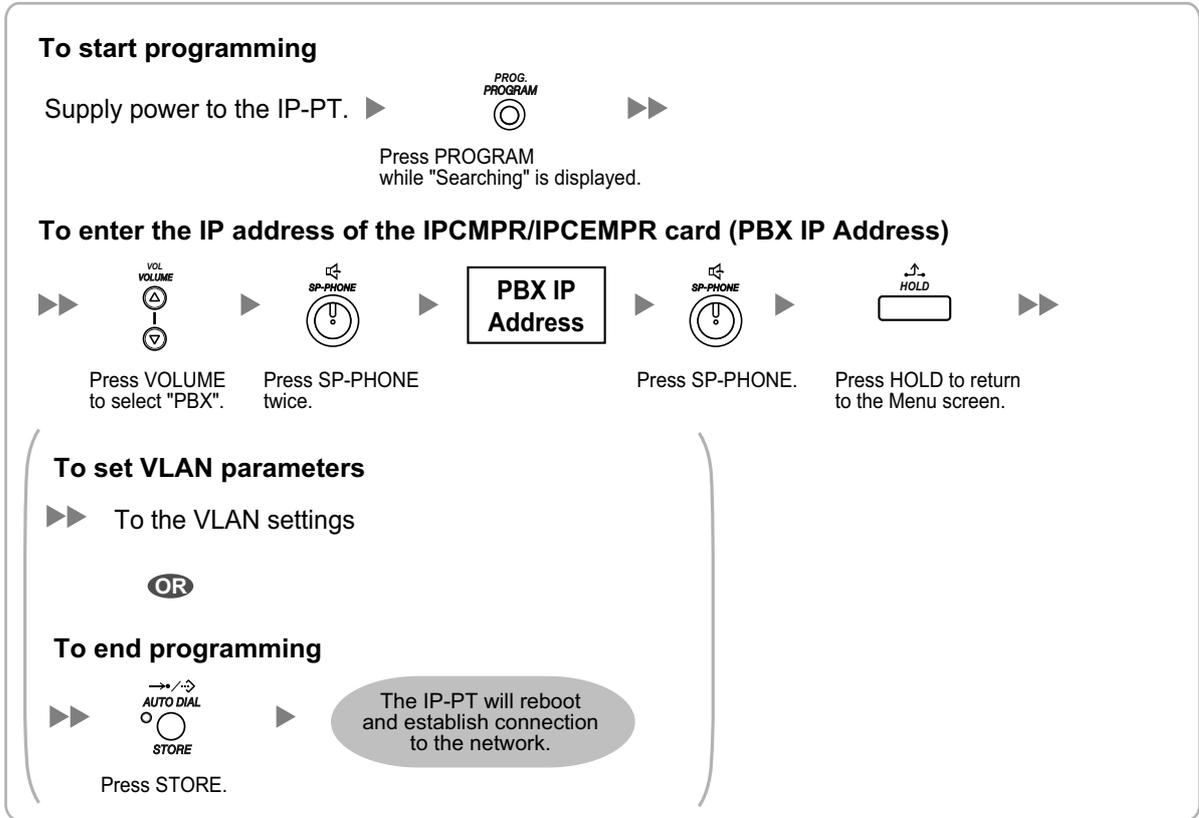
To end programming

   
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.

KX-NT265 (Software version 2.00 or later only)



4.3.1 Assigning the IP Addressing Information

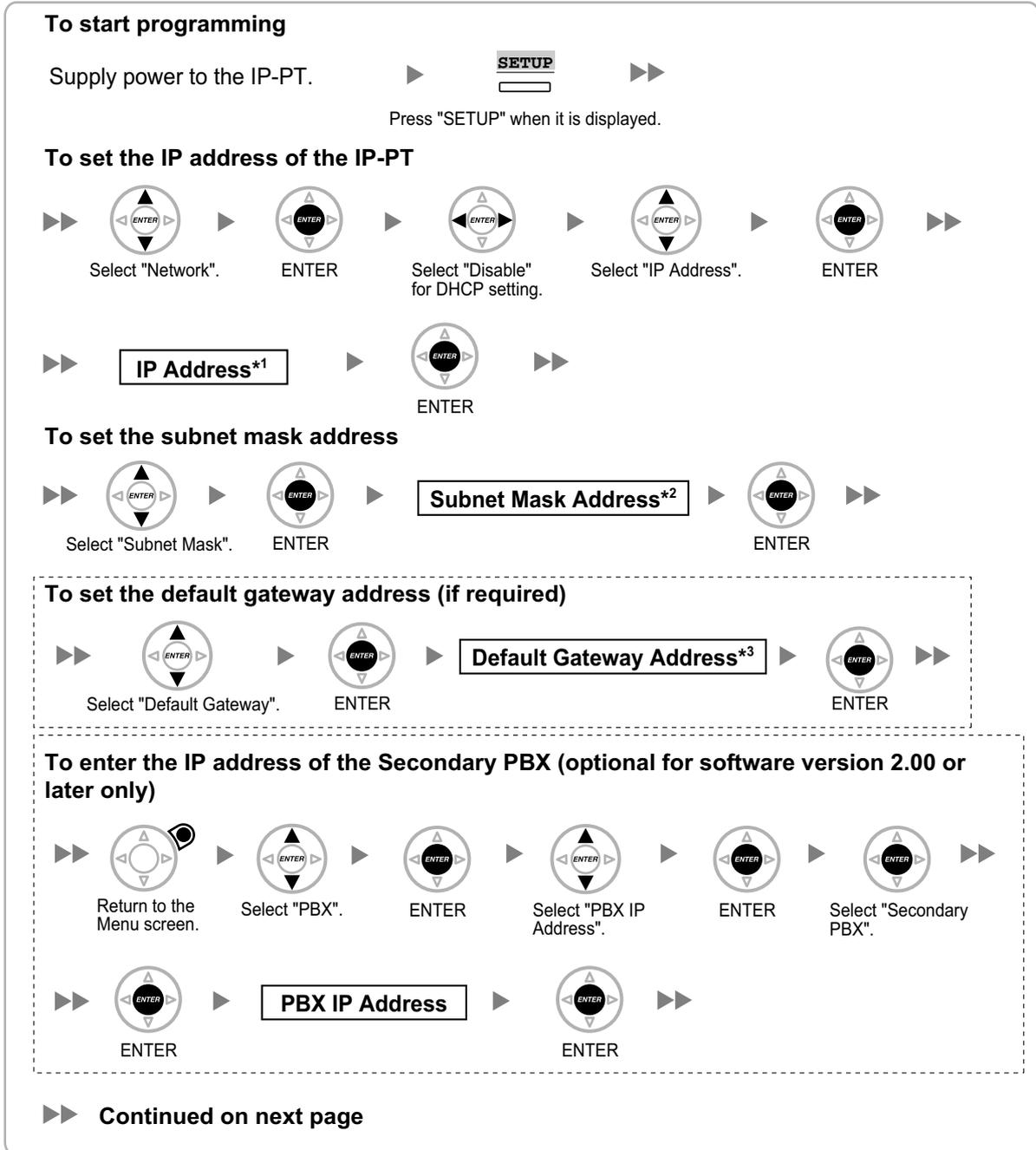
3. Not using a DHCP server when the IP-PT is on the same LAN with the PBX

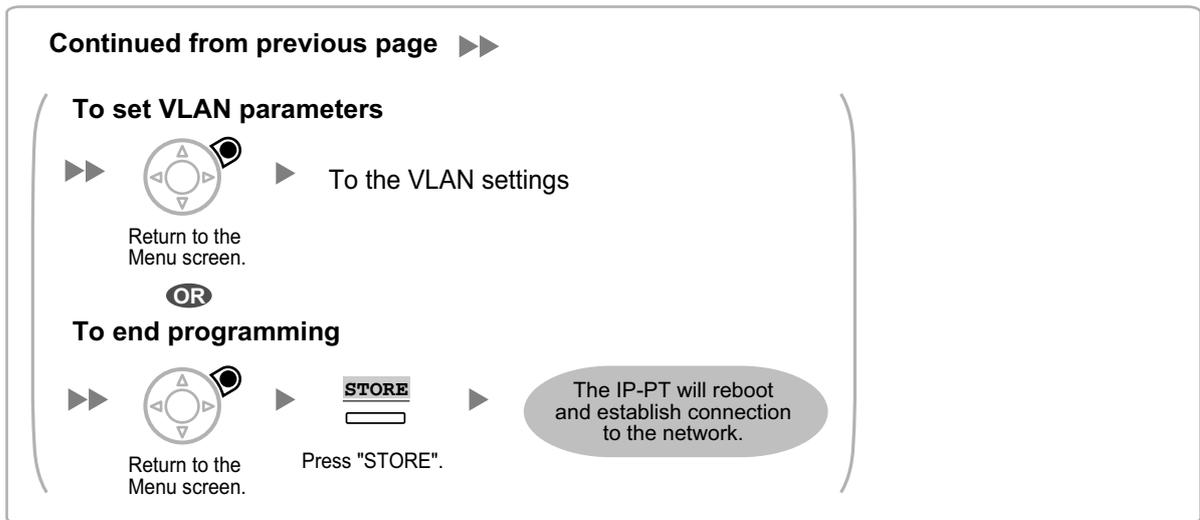
Only the PBX IP address can be assigned automatically to the IP-PT in process of being registered to the PBX. For details about registering the IP-PT, refer to "4.4.1 Registering IP Telephones".

Follow the procedure below to assign the IP address of the IP-PT, the subnet mask address, and the default gateway address manually.

If you need to set VLAN parameters, follow the procedure described in "4.3.2 Setting the VLAN Parameters" after assigning the IP addresses without ending programming.

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"

4.3.1 Assigning the IP Addressing Information

KX-NT321

To start programming

Supply power to the IP-PT.  
Press PROGRAM while "Searching" is displayed.

To set the IP address of the IP-PT

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

    
Press SP-PHONE.

To set the subnet mask address

        
Select "Subnet Mask". Press SP-PHONE. Press SP-PHONE.

To set the default gateway address (if required)

        
Select "Default GW". Press SP-PHONE. Press SP-PHONE.

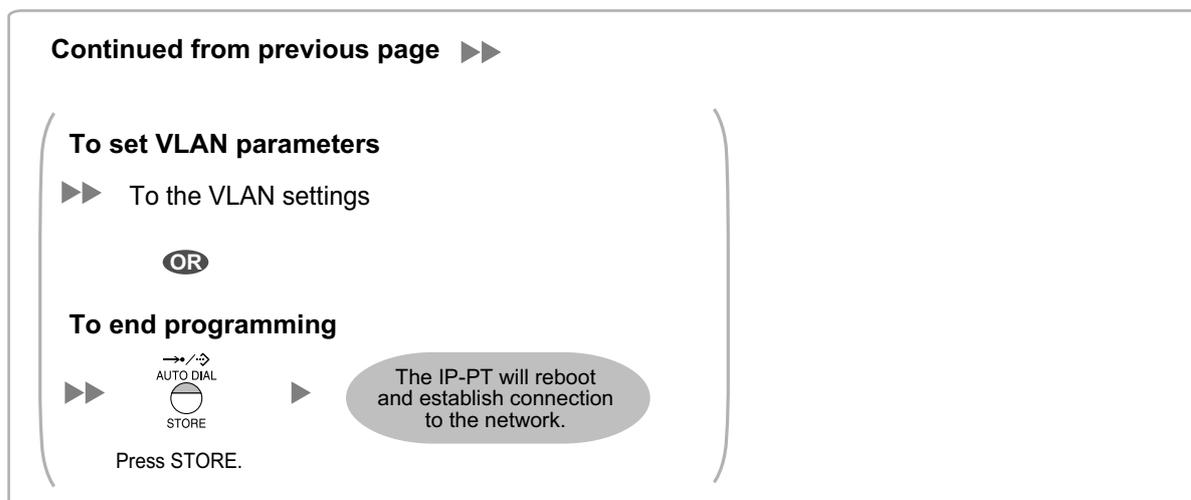
To enter the IP address of the Secondary PBX (if required)

            
Press HOLD to return to the Menu screen. Select "PBX". Press SP-PHONE. Select "PBX IP Address". Press SP-PHONE. Select "Secondary PBX".

      
Press SP-PHONE. Press SP-PHONE.

  
Press HOLD twice to return to the Menu screen.

 **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" (except 0.0.0.0 and 255.255.255.255)

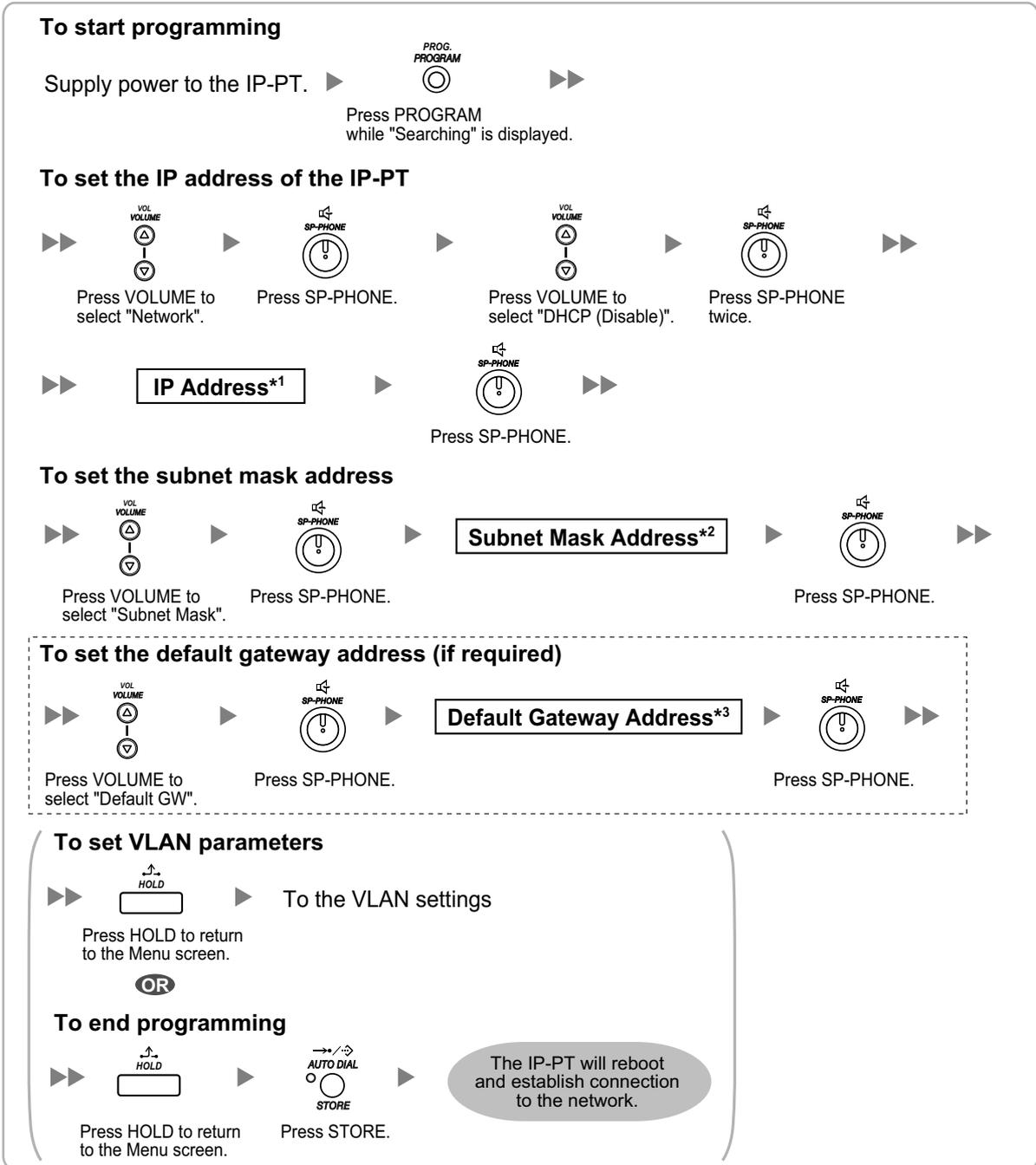
*3 Valid IP address range: "1.0.0.0" to "223.255.255.255"

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.

4.3.1 Assigning the IP Addressing Information

KX-NT265 (Software version 2.00 or later only)



*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. Not using a DHCP server when the IP-PT is on the remote office LAN

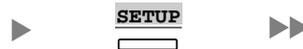
All the IP addressing information must be assigned manually.

Follow the procedure below to assign the IP addressing information.

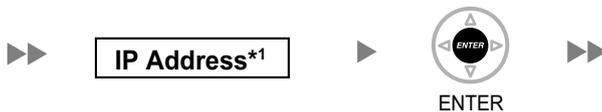
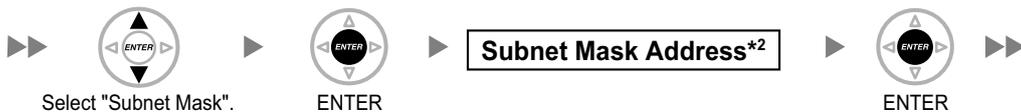
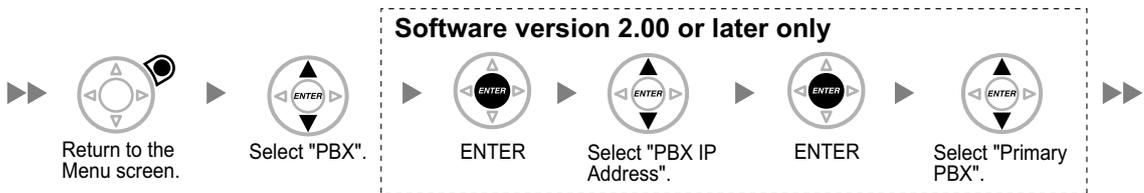
If you need to set VLAN parameters, follow the procedure described in "4.3.2 Setting the VLAN Parameters" after assigning the IP addresses without ending programming.

KX-NT300 series (except KX-NT321)**To start programming**

Supply power to the IP-PT.

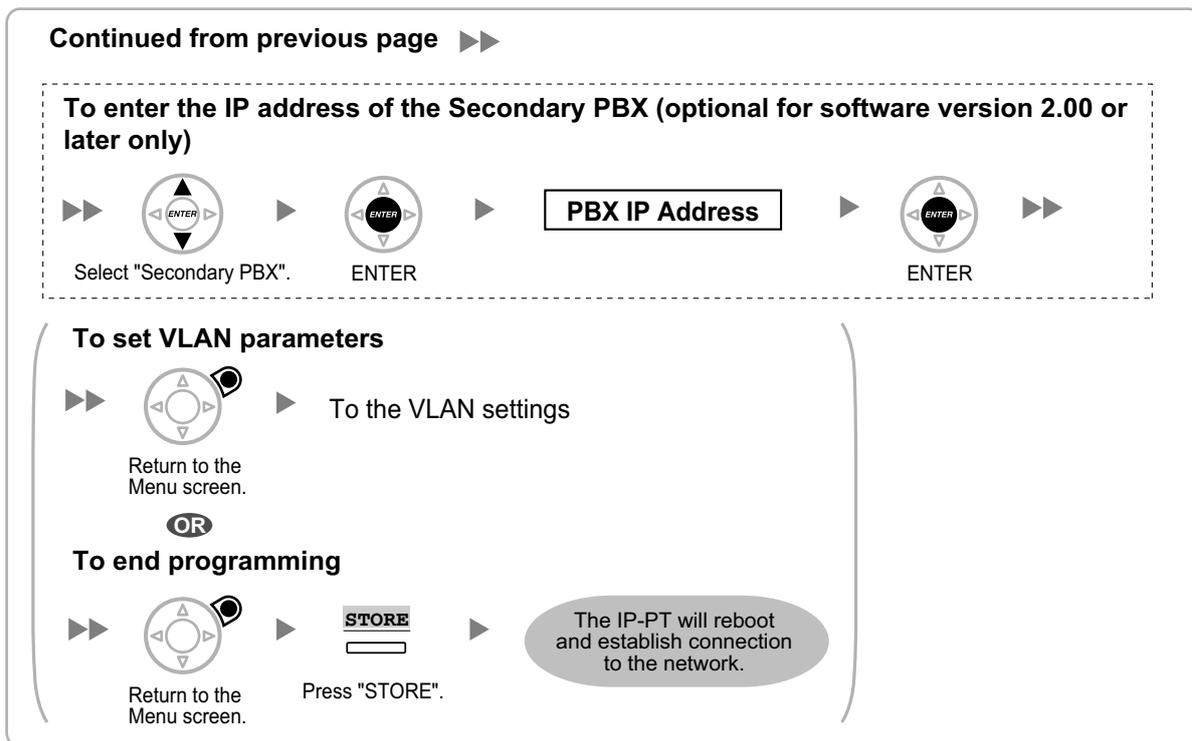


Press "SETUP" when it is displayed.

To set the IP address of the IP-PT**To set the subnet mask address****To set the default gateway address****To enter the IP address of the IPCMPR/IPCEMPR card (PBX IP Address)**

▶▶ **Continued on next page**

4.3.1 Assigning the IP Addressing Information



*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.  
 Press PROGRAM while "Searching" is displayed.

To set the IP address of the IP-PT

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

    
 Press SP-PHONE.

To set the subnet mask address

        
 Select "Subnet Mask". Press SP-PHONE. Press SP-PHONE.

To set the default gateway address

        
 Select "Default GW". Press SP-PHONE. Press SP-PHONE.

To enter the IP address of the IPCMPR/IPCEMPR card in the Primary PBX (PBX IP Address)

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

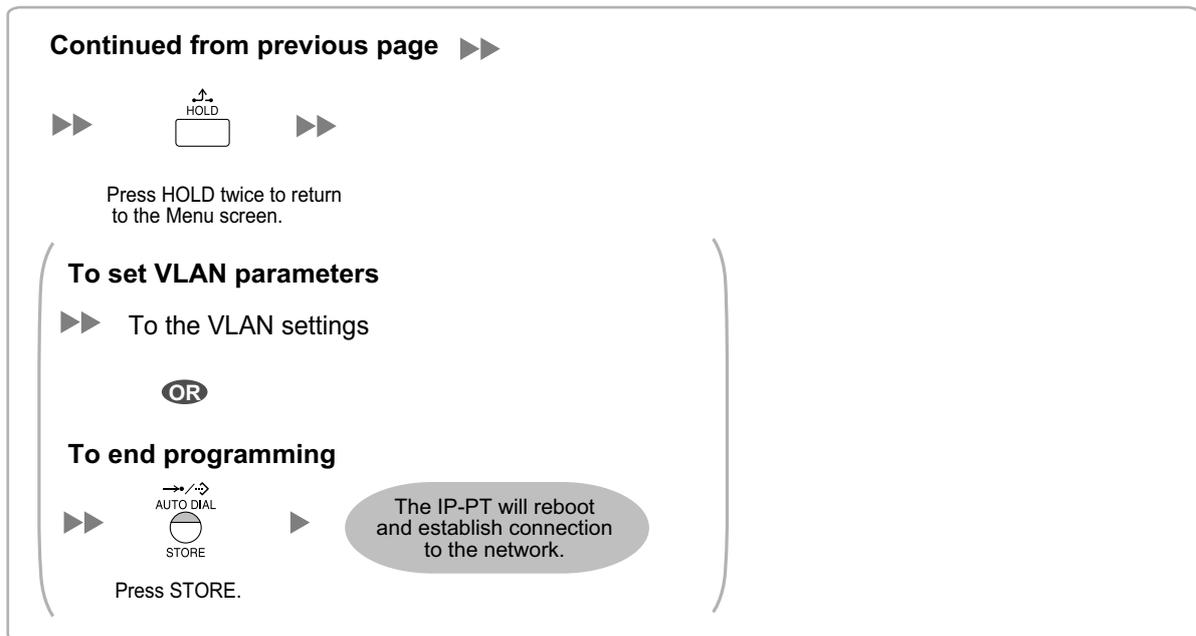
      
 Press SP-PHONE. Press SP-PHONE.

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

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

 **Continued on next page**

4.3.1 Assigning the IP Addressing Information



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

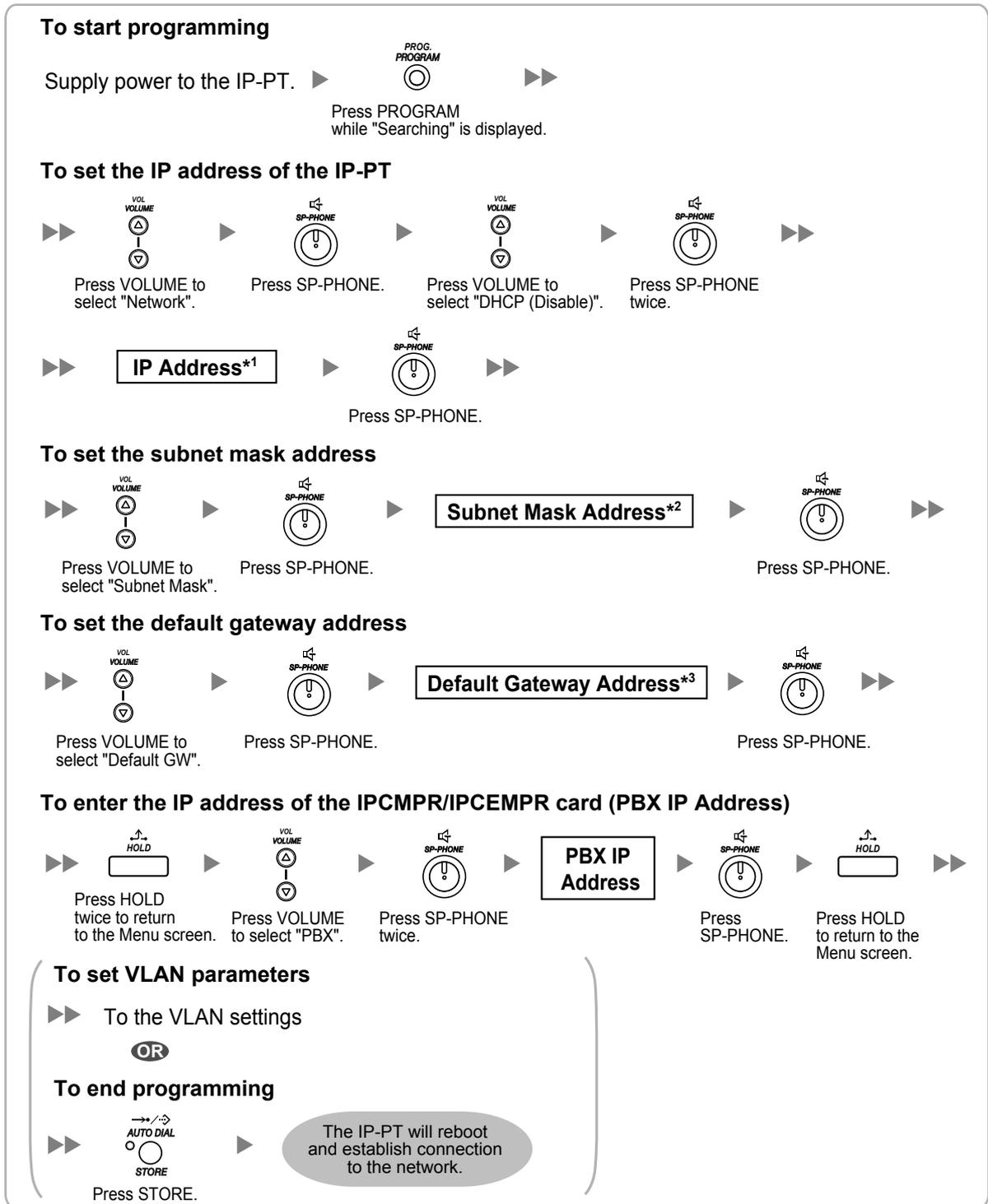
*2 Valid subnet mask address range: "0-255.0-255.0-255.0-255" (except 0.0.0.0 and 255.255.255.255)

*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.

KX-NT265 (Software version 2.00 or later only)



*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"

For IP-PTs connected to the IP-EXT16 Card

1. Using a DHCP server to automate the assignment of IP addressing information

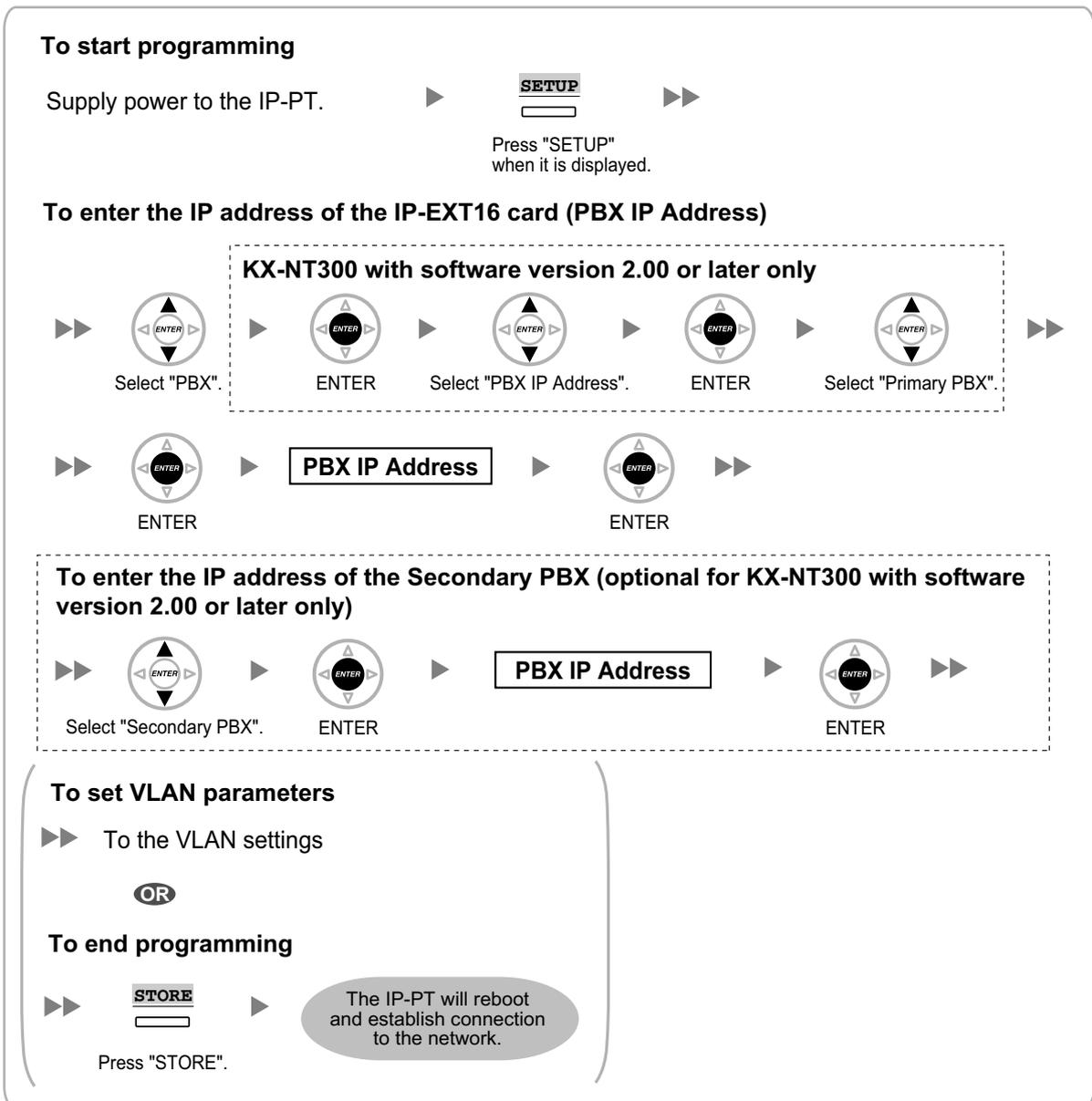
The IP address of the IP-PT, the subnet mask address, and the default gateway address can be assigned automatically by the DHCP server.

Only the IP address of the IP-EXT16 card (PBX IP address) must be assigned manually.

Follow the procedure below to assign the PBX IP address.

If you need to set VLAN parameters, follow the procedure described in "4.3.2 Setting the VLAN Parameters" after assigning the IP addresses without ending programming.

KX-NT300 series (except KX-NT321)/KX-NT136



KX-NT321

To start programming

Supply power to the IP-PT. ►  ►►

Press PROGRAM while "Searching" is displayed.

To enter the IP address of the IP-EXT16 card in the Primary PBX (PBX IP Address)

►►  ►  ►  ►  ►  ►►

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

►►  ►  ►  ►►

Press SP-PHONE. Press SP-PHONE.

To enter the IP address of the Secondary PBX (If required)

►►  ►  ►  ►  ►►

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

►►  ►►

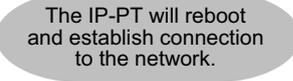
Press HOLD twice to return to the Menu screen.

To set VLAN parameters

►► To the VLAN settings

OR

To end programming

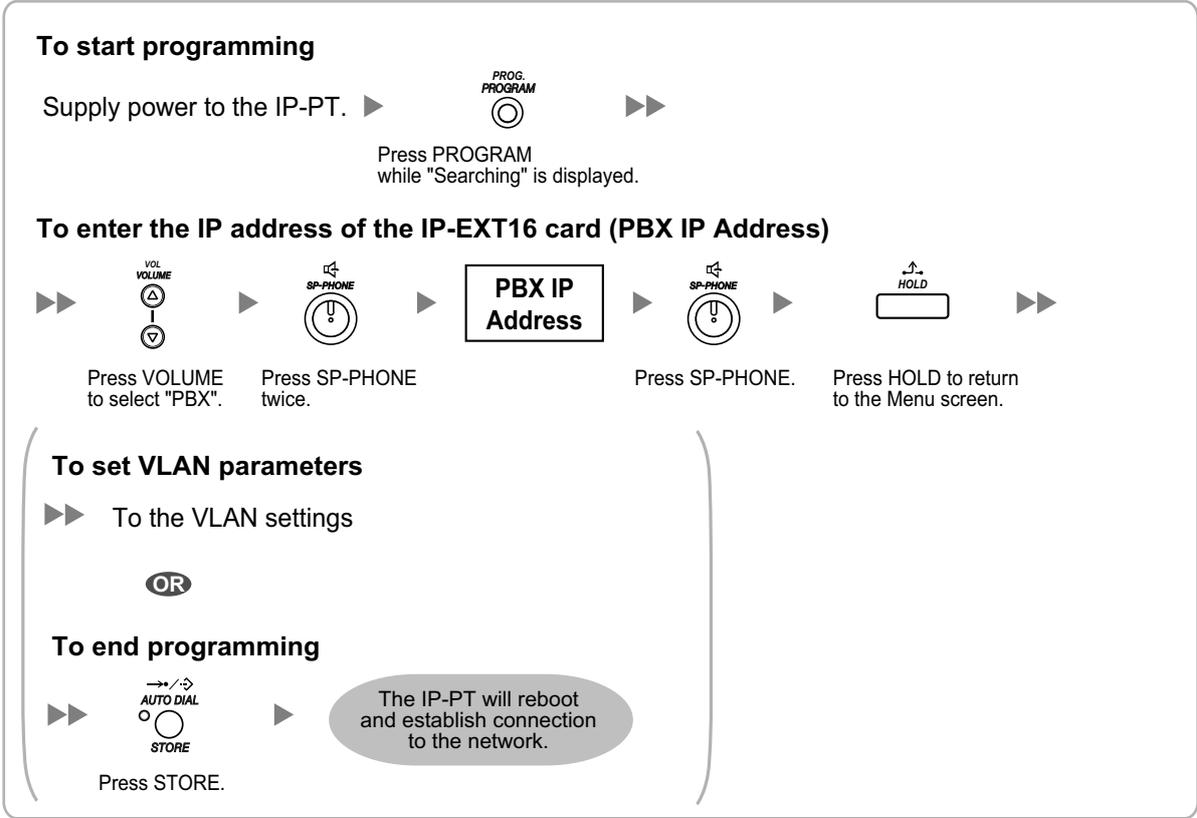
►►  ► 

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.

KX-NT265



2. Not using a DHCP server when assigning IP addressing information

All the IP addressing information must be assigned manually.

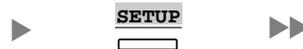
Follow the procedure below to assign the IP addressing information.

If you need to set VLAN parameters, follow the procedure described in "4.3.2 Setting the VLAN Parameters" after assigning the IP addresses without ending programming.

KX-NT300 series (except KX-NT321)/KX-NT136

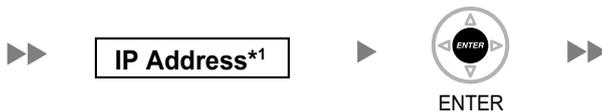
To start programming

Supply power to the IP-PT.

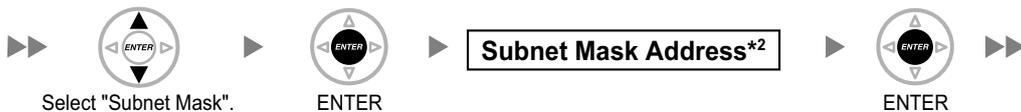


Press "SETUP" when it is displayed.

To set the IP address of the IP-PT



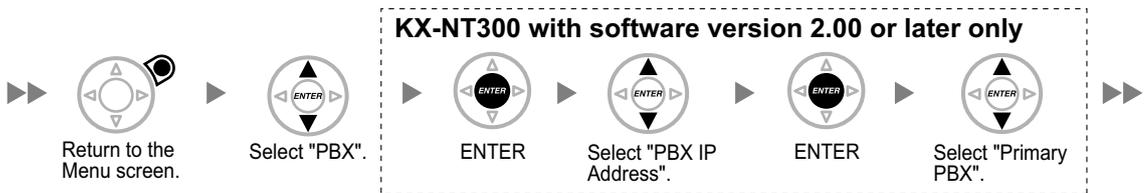
To set the subnet mask address



To set the default gateway address (if required)

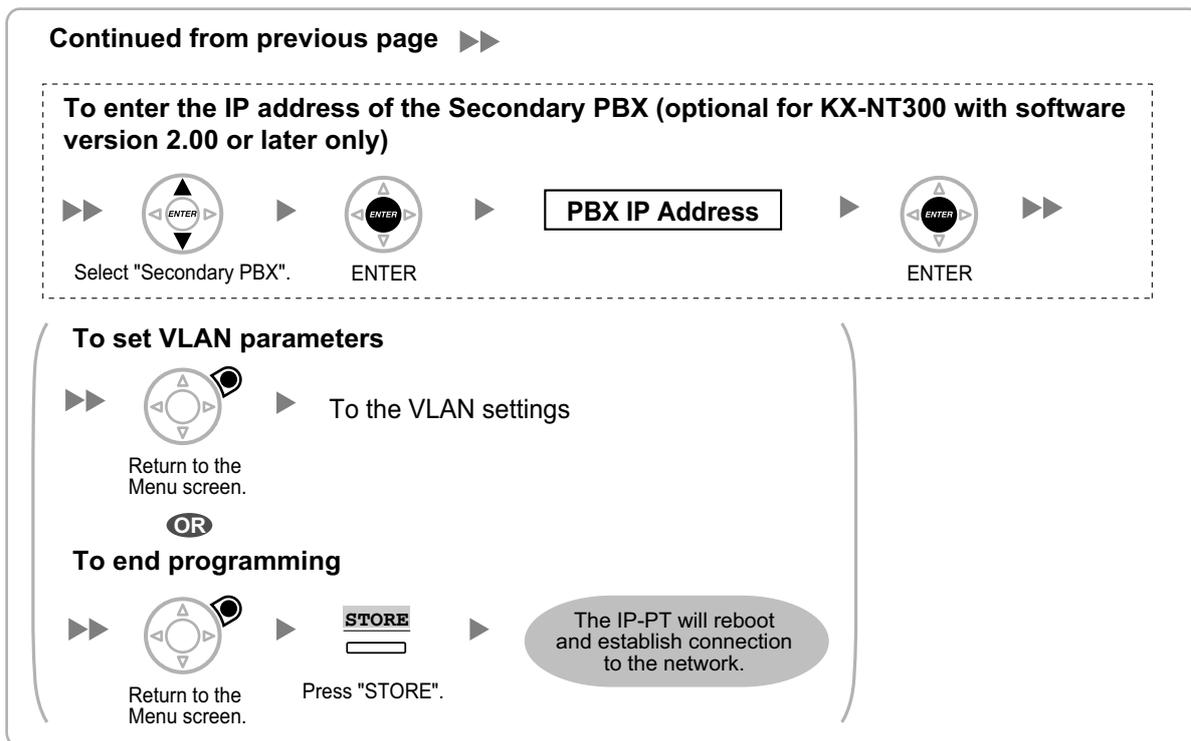


To enter the IP address of the IP-EXT16 card (PBX IP Address)



Continued on next page

4.3.1 Assigning the IP Addressing Information



*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"

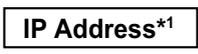
KX-NT321

To start programming

Supply power to the IP-PT.  
 Press PROGRAM while "Searching" is displayed.

To set the IP address of the IP-PT

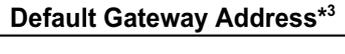
        
 Select "Network". Press SP-PHONE. Select "DHCP (Disable)". Press SP-PHONE twice.

    
 Press SP-PHONE.

To set the subnet mask address

        
 Select "Subnet Mask". Press SP-PHONE. Press SP-PHONE.

To set the default gateway address (if required)

        
 Select "Default GW". Press SP-PHONE. Press SP-PHONE.

To enter the IP address of the IP-EXT16 card in the Primary PBX (PBX IP Address)

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

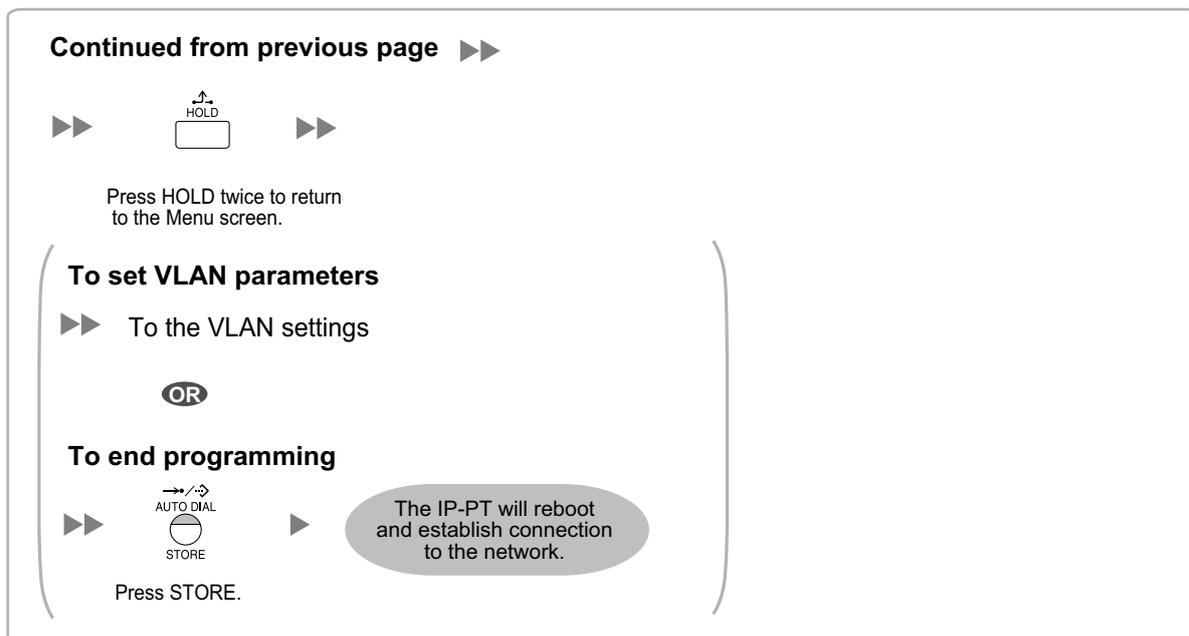
      
 Press SP-PHONE. Press SP-PHONE.

To enter the IP address of the Secondary PBX (If required)

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

 **Continued on next page**

4.3.1 Assigning the IP Addressing Information



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

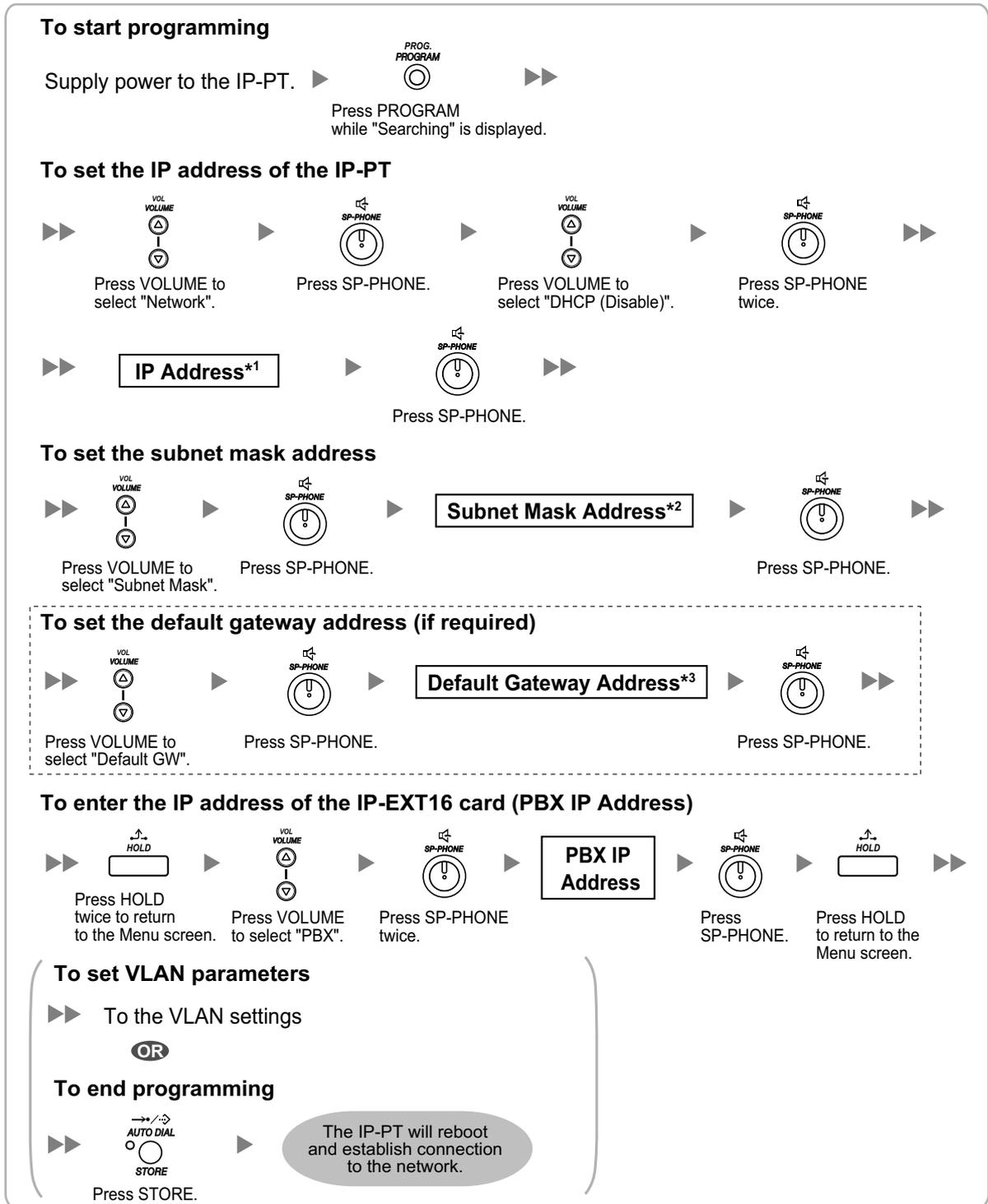
*2 Valid subnet mask address range: "0-255.0-255.0-255.0-255" (except 0.0.0.0 and 255.255.255.255)

*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.

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"

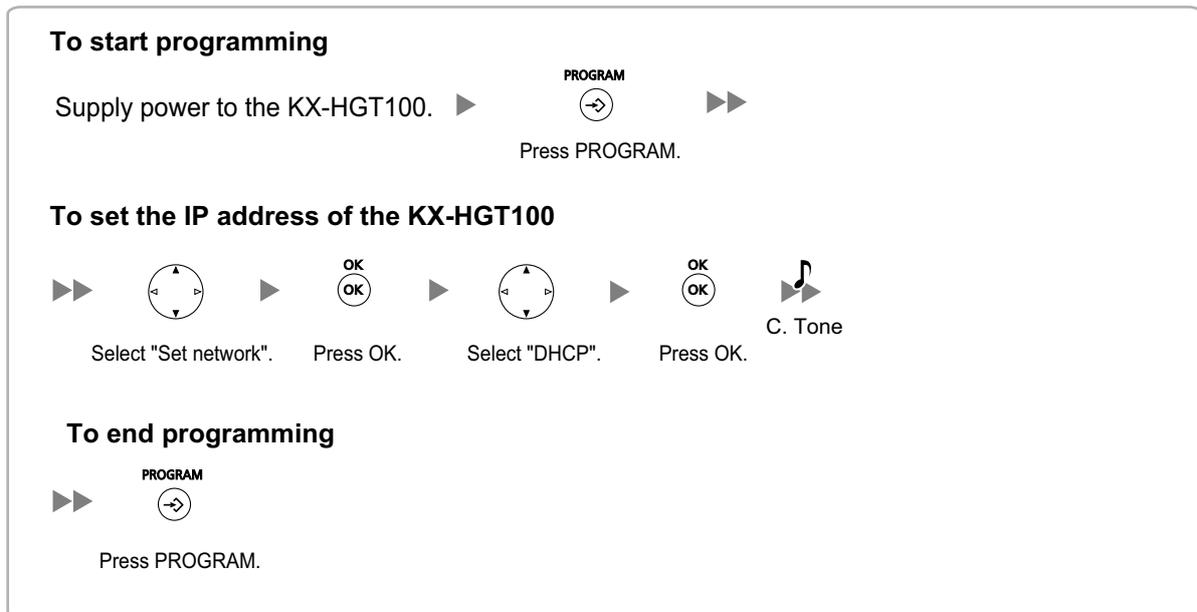
For KX-HGT100 SIP Telephones

1. Using a DHCP server to automate the assignment of IP addressing information

The DHCP server automatically assigns the IP address of the KX-HGT100, the subnet mask address, and the default gateway address to the KX-HGT100.

The PBX IP address can be assigned to the KX-HGT100 through Web Programming. For details, refer to "4.4.1 Registering IP Telephones".

Follow the procedure below to assign IP addressing information automatically.

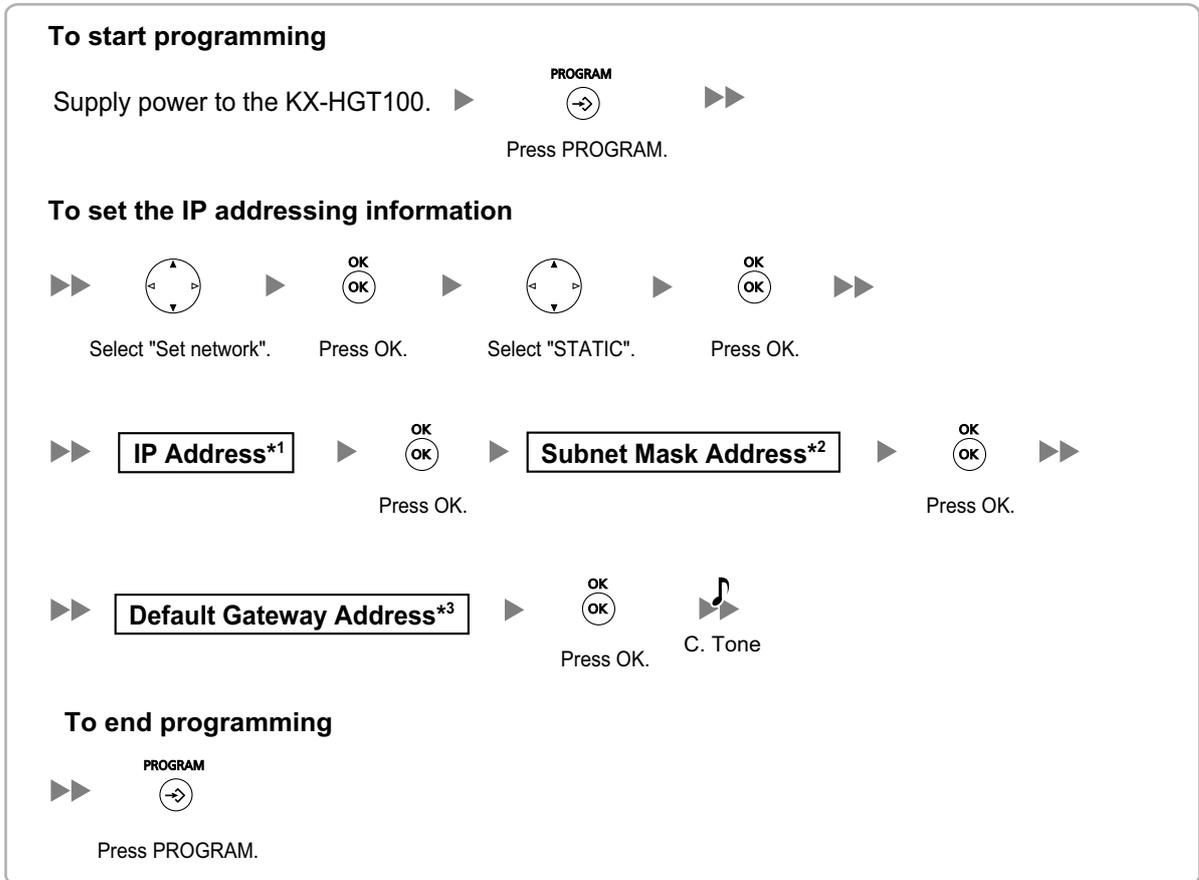


2. Not using a DHCP server when assigning IP addressing information

The IP address of the KX-HGT100, the subnet mask address, and the default gateway address must be assigned manually.

The PBX IP address can be assigned to the KX-HGT100 through Web Programming. For details, refer to "4.4.1 Registering IP Telephones".

Follow the procedure below to assign IP addressing information manually.



*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"

For SIP Extensions (except KX-HGT100)

1. Using a DHCP server to automate the assignment of IP addressing information

The IP address of the SIP Extension, the subnet mask address, and the default gateway address can be assigned to the SIP Extension automatically by the DHCP server.

The IP address of the IPCMPR/IPCEMPR card (PBX IP address) must be assigned manually on the SIP Extension side.

For instructions, refer to the documentation of the SIP Extension.

2. Not using a DHCP server when assigning IP addressing information

All the IP addressing information must be assigned manually.

For instructions, refer to the documentation of the SIP Extension.

Note

- SIP Extensions can only receive IP addressing information from a DHCP server on its own LAN. Therefore, when SIP Extensions are located on several LANs, a DHCP server is required on each LAN.
- When the DHCP client function is enabled for SIP Extensions, simply connect the SIP Extensions to the LAN to use the DHCP server. For the DHCP client function setting, refer to the documentation of the SIP Extension.

4.3.2 Setting the VLAN Parameters

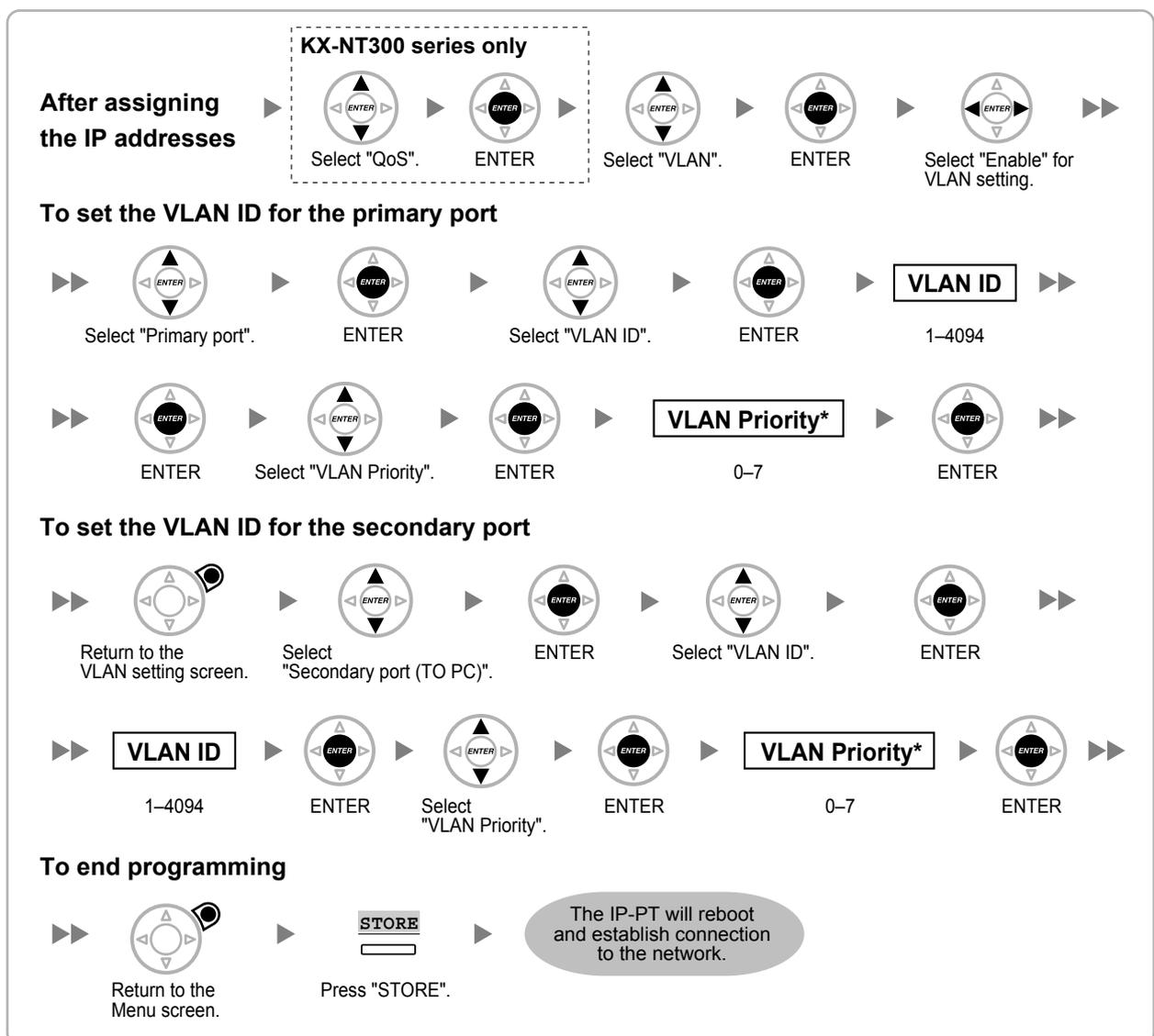
To establish voice communications between IP telephones, the primary ports of the IP telephones and the connected PBX must belong to the same VLAN. Consult your network administrator and obtain the appropriate VLAN ID.

If you are using an IP telephone equipped with two ports, it is possible to place primary and secondary ports of the IP telephone 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.

Note

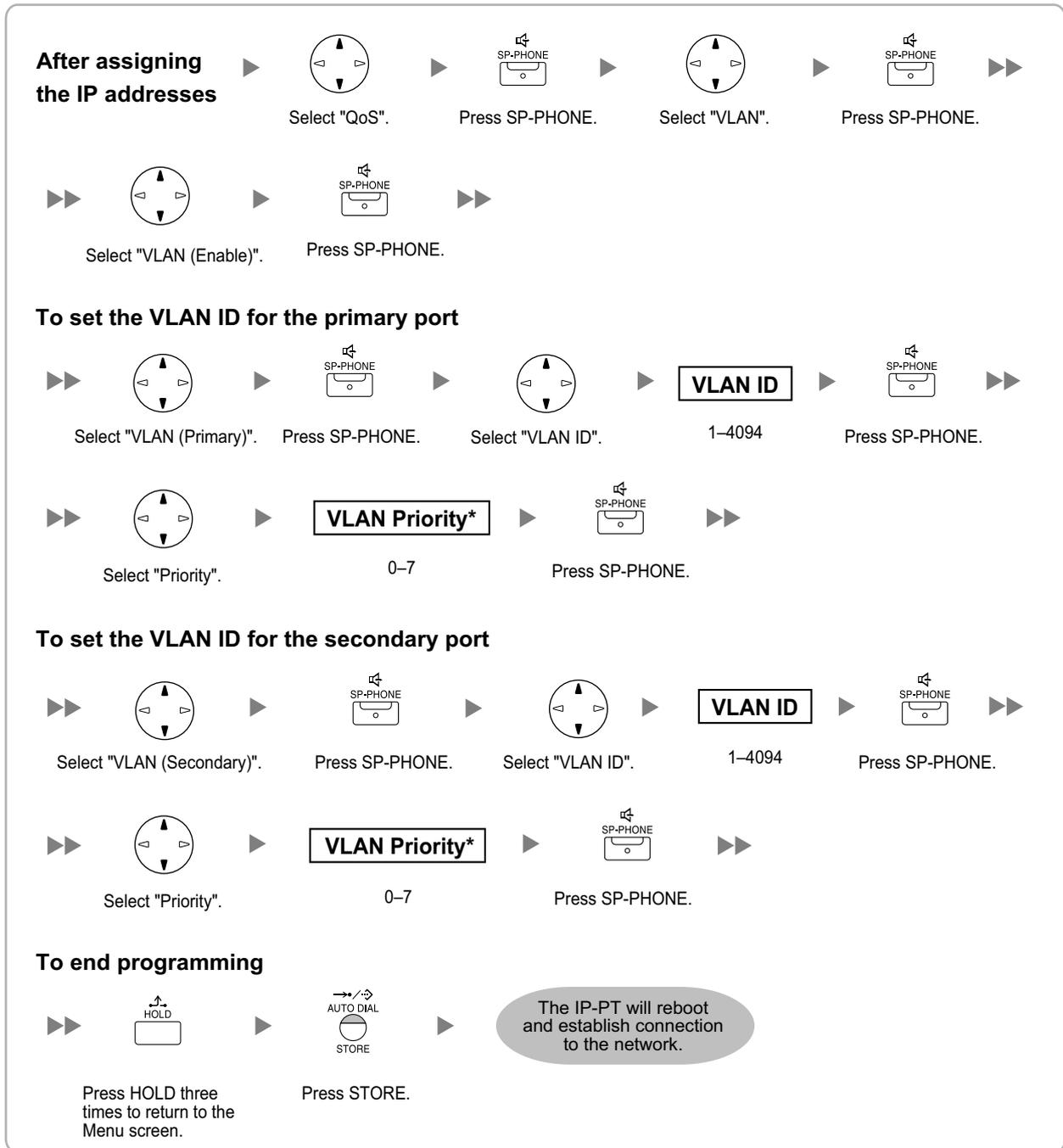
The procedure for SIP Extensions may vary depending on the type of the SIP Extension being used. Refer to the documentation of your SIP Extension for instructions.

KX-NT300 series (except KX-NT321)/KX-NT136



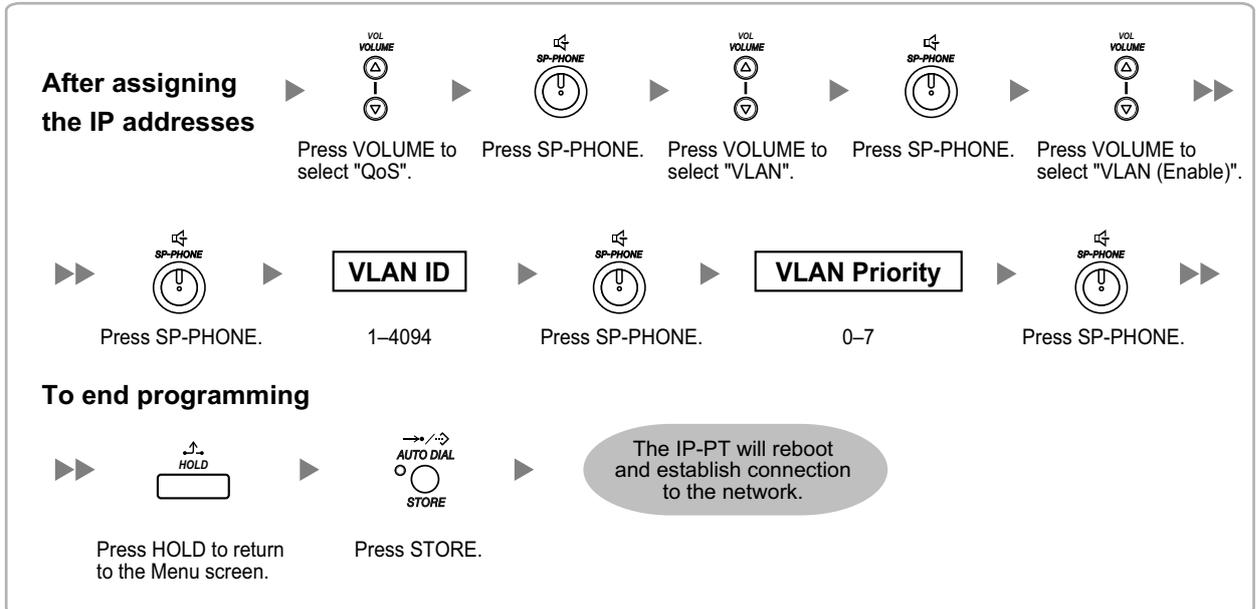
¹¹ The VLAN priority of the primary port must be set higher than the priority of the secondary port. The larger the number, the higher the priority.

KX-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

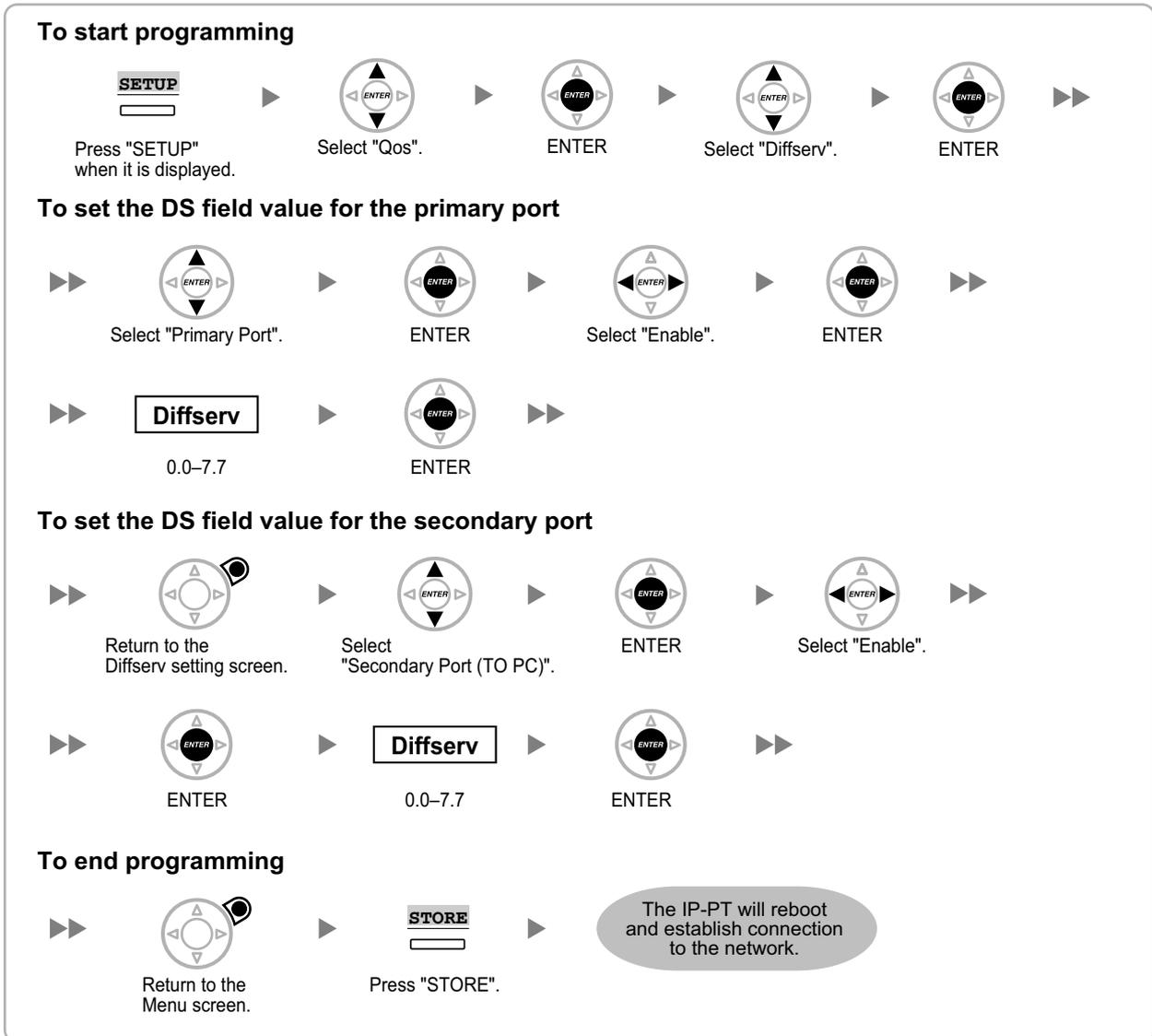


4.3.3 Setting the Diffserv Parameters

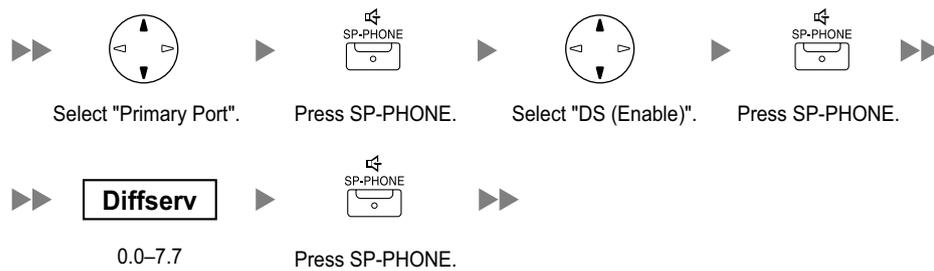
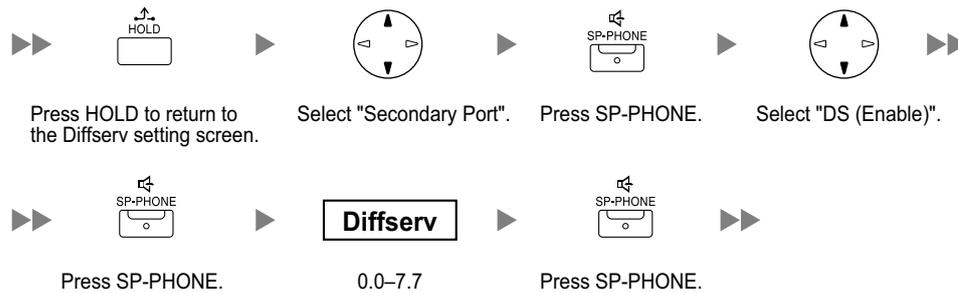
Differentiated Services (DiffServ, or DS) is an IP-based QoS technique used to control QoS of VoIP communications by setting the DS field in the header of IP packets. Consult your network administrator for the appropriate setting values for the DS field.

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)

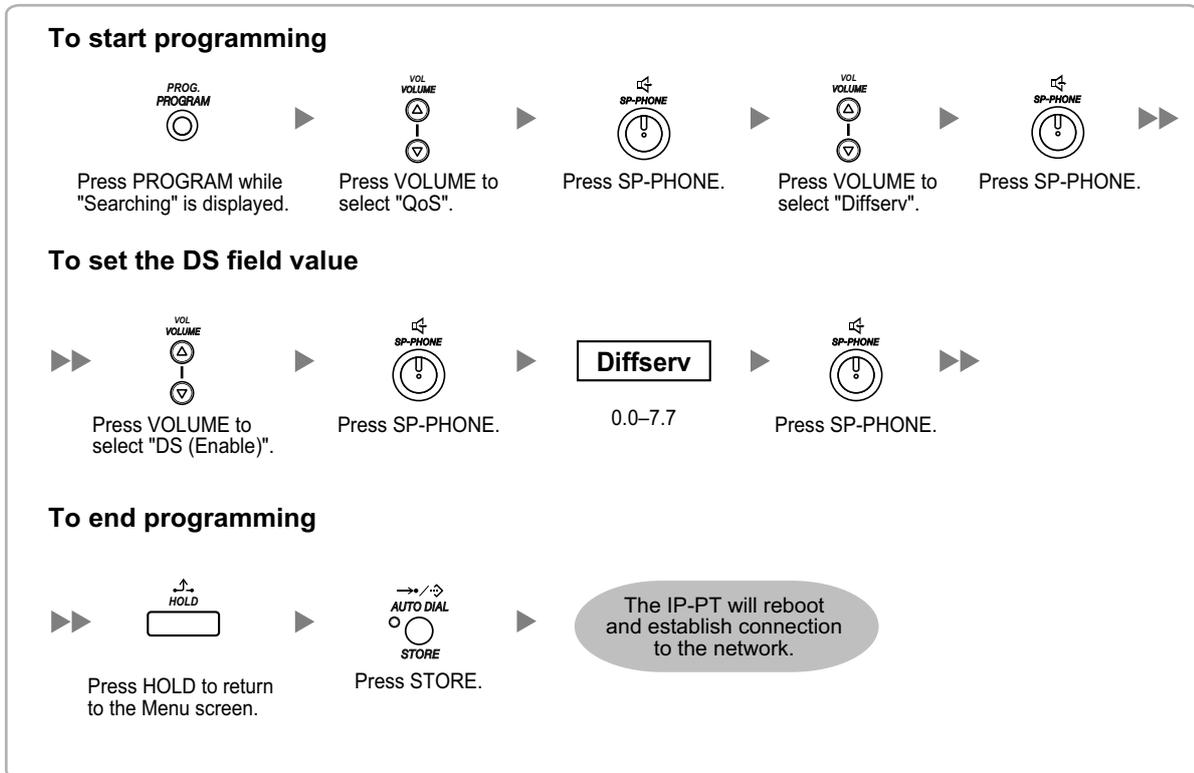


KX-NT321

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**

4.3.3 Setting the Diffserv Parameters

KX-NT265 (Software version 2.00 or later only)



4.3.4 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.

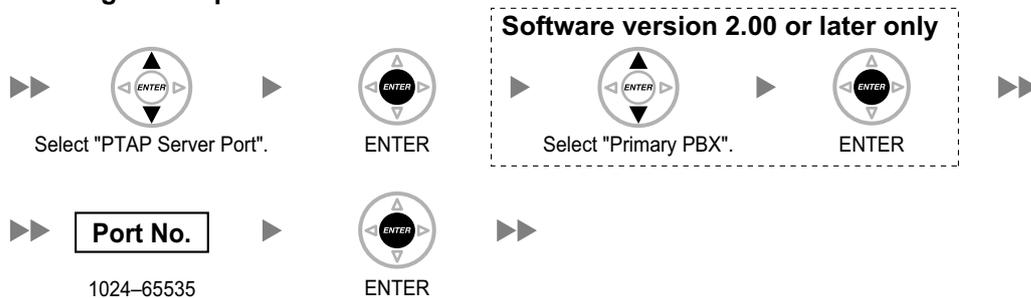
Follow the procedure below to configure the port number of the IP ports.

KX-NT300 series (except KX-NT321)

To start programming



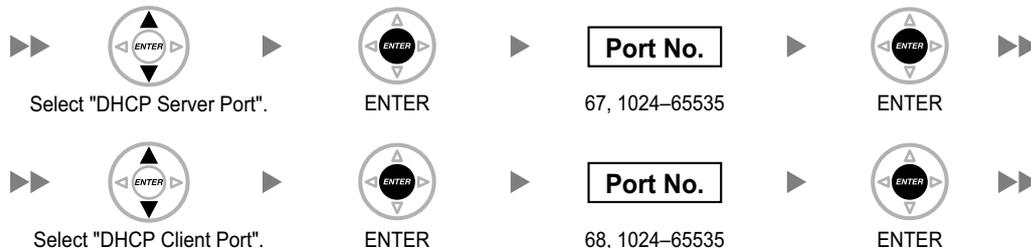
To configure the port number of PTAP Ports



To configure the port number of PTAP Ports for the Secondary PBX (optional for software version 2.00 or later only)



To configure the port number of DHCP Ports



▶▶ Continued on next page

4.3.4 Configuration of IP Ports

Continued from previous page >>

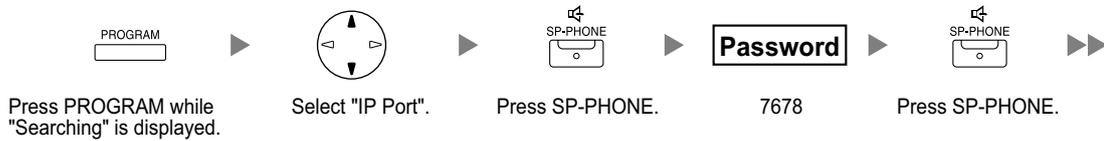
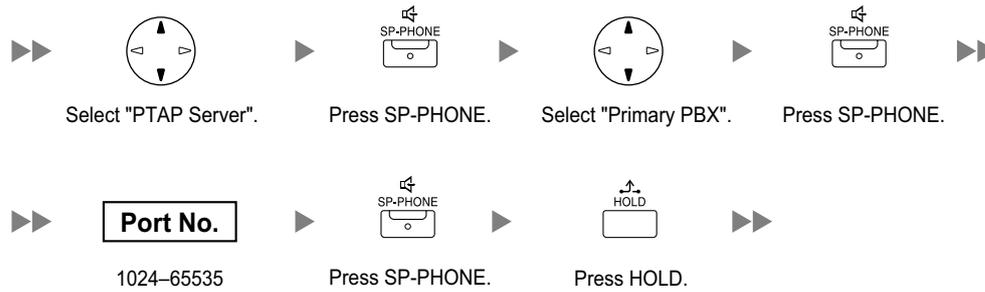
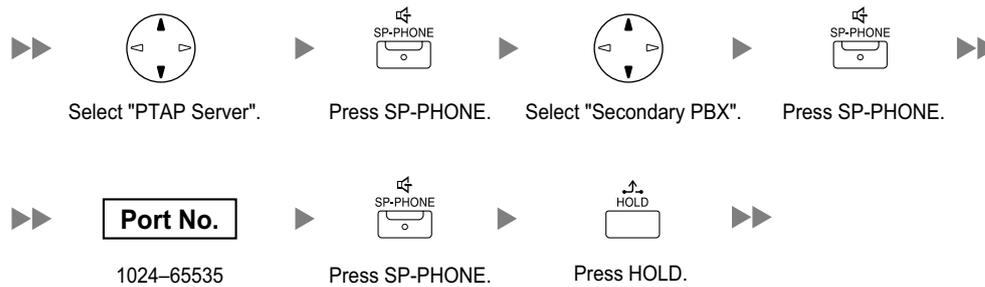
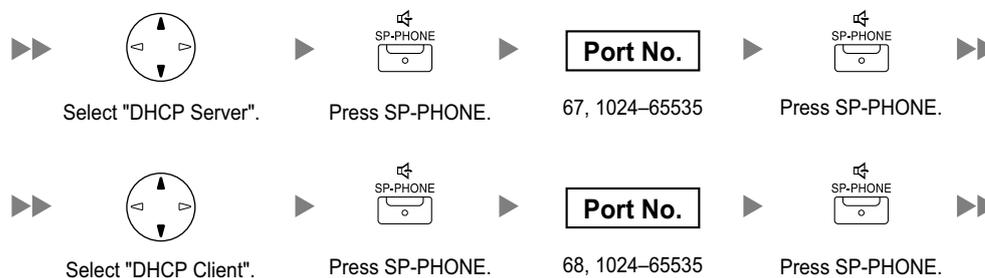
To configure the port number of FTP Ports



To end programming



KX-NT321

To start programming**To configure the port number of PTAP Ports****To configure the port number of PTAP Ports for the Secondary PBX (if required)****To configure the port number of DHCP Ports**

►► **Continued on next page**

4.3.4 Configuration of IP Ports

Continued from previous page >>

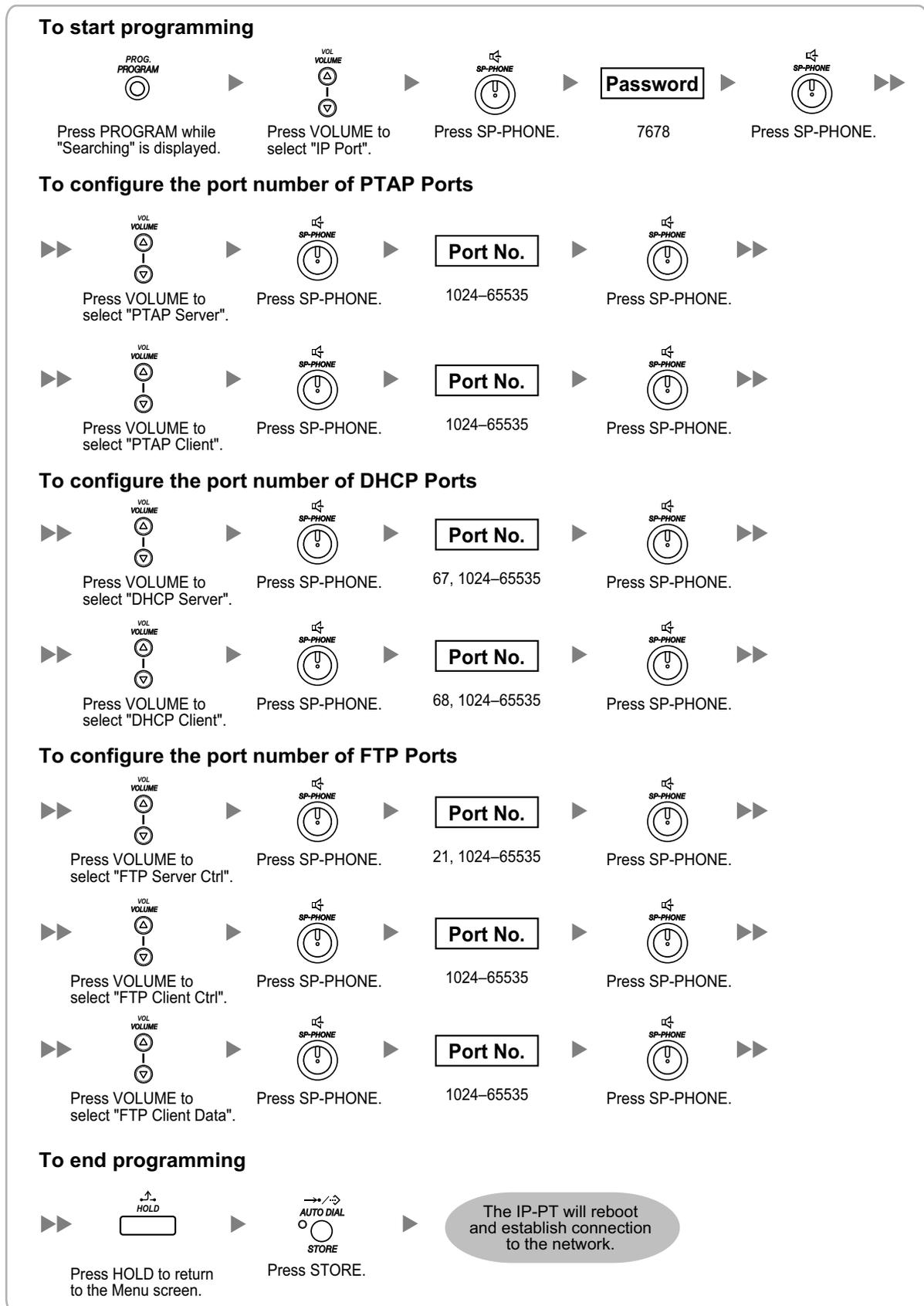
To configure the port number of FTP Ports



To end programming



KX-NT265 (Software version 2.00 or later only)



4.3.4 Configuration of IP Ports

Note

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

4.4 Registering IP Telephones

4.4.1 Registering IP Telephones

After the programming of the PBX and IP telephone is finished, the IP telephone must be registered to the PBX. This is done using the Maintenance Console.

Registration of IP-PTs

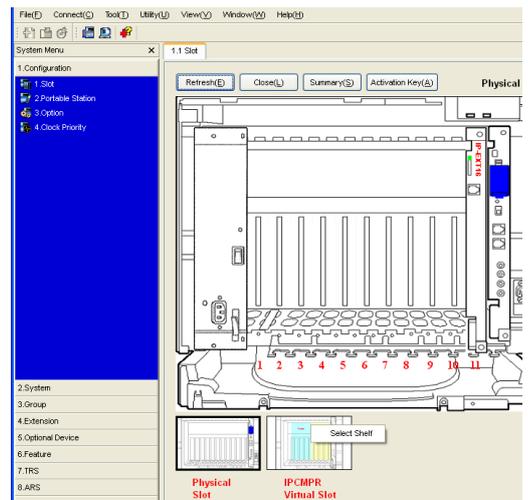
1. a. Under **Configuration**, click **Slot**.
- b. **When registering with V-IPEXT32 Card:**
Move the mouse pointer over the white PBX image at the bottom of the screen for the virtual slots, and click **Select Shelf**. Move the mouse pointer over the V-IPEXT32 card. A menu will be shown under the mouse pointer.

When registering with IP-EXT Card:

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.

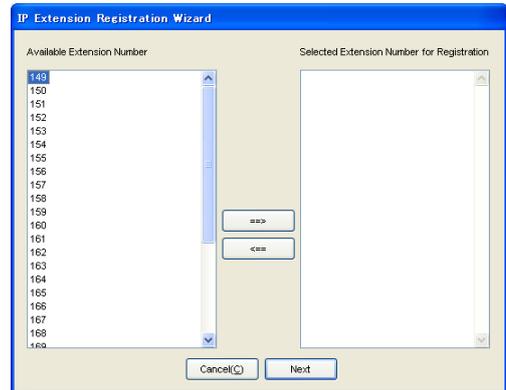


4.4.1 Registering IP Telephones

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.

Note

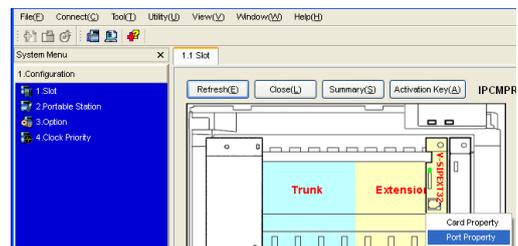
- If the IP-PT has been connected to the LAN and power has been turned on, the IP address of the IPCMPR/IPCEMPR card will be assigned automatically.
 - If not, connect the IP-PT to the LAN and turn the power on within 15 minutes after this operation is done. The IP address of the IPCMPR/IPCEMPR card will then be assigned automatically.
- 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**.
 - Click **Automatic response** to register several IP-PTs automatically. Clicking this button means that all remaining IP-PTs will be registered without having to click any other buttons.



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

Registration of SIP Extensions

1.
 - a. Under **Configuration**, click **Slot**.
 - b. Move the mouse pointer over the white PBX image at the bottom of the screen for the virtual slots.
 - c. Click **Select Shelf**.
 - d. Move the mouse pointer over the V-SIPEXT32 card. A menu will be shown under the mouse pointer.
 - e. Click **Port Property**.

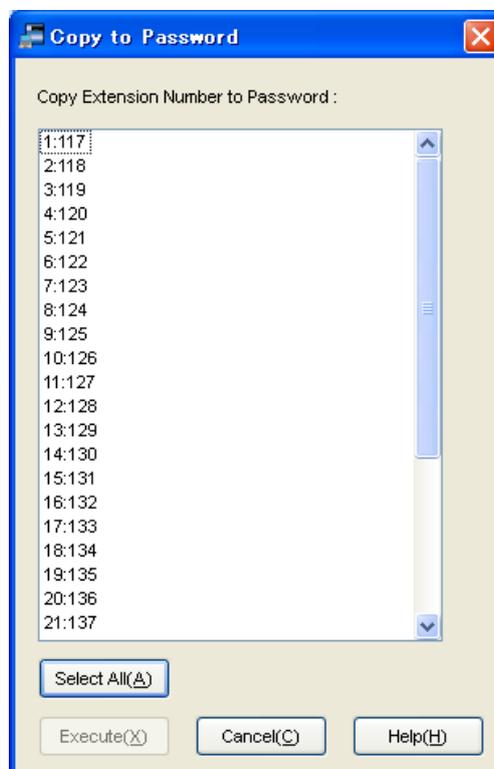
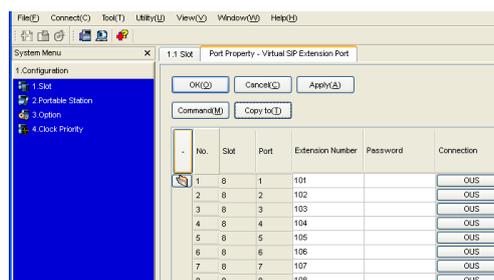
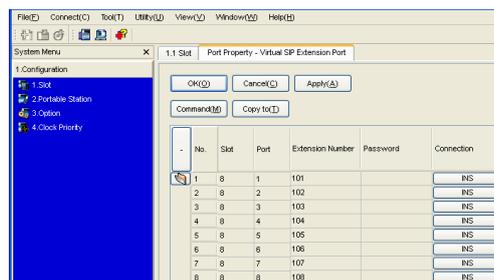


2. Assign extension numbers to the SIP Extensions.
 - If the Automatic Extension Number Set for Extension Card feature is enabled, the extension numbers of SIP Extension are automatically assigned. To programme this feature, refer to "3.59 [1-3] Option—◆ New Card Installation—Automatic Extension Number Set for Extension Card" in the PC Programming Manual.
 - If not, enter the extension number for each SIP Extension manually.
3. Set passwords for the SIP Extensions.
 - a. Click the cell in the **Connection** column for each SIP Extension you wish to register. The Command Connection screen appears.
 - b. Click **OUS**.
 - c. Enter a password in the Password box for each SIP Extension.
 - d. Click **Apply**.
 - e. Click the cell in the **Connection** column for each SIP Extension to which a password has been assigned. The Command Connection screen appears.
 - f. Click **INS**.
 - g. Click **OK**.

Note

Alternatively, it is possible to set an extension number as a password for each SIP Extension automatically.

- In order to set the password automatically, do the following in substitution for step c of the procedure above.
 - a. Click **Copy to**. A screen will appear with information on assigned extension numbers for SIP Extensions.
 - b. Click **Select All**.
 - c. Click **Execute** to copy each Extension Number to Password.
 - d. Click **Yes**.
 - e. Click **OK** to return to the Port Property screen.



4.4.1 Registering IP Telephones

4. Programme the SIP Extension you wish to register.

[For SIP Extensions (except KX-HGT100)]

- a. Set the IP address of the IPCMPR/IPCEMPR card, extension number, and password in the corresponding fields for your SIP Extension.
- b. Send a request from the SIP Extension to the PBX for registration.
 - If the authentication information of the SIP Extension and the PBX match, the registration is successful.

Note

- When programming the SIP Extension, the names of the corresponding fields may differ depending on the type of SIP Extension you are using.
- For details about the actual operation of SIP Extensions, refer to the documentation of the SIP Extension.
- For certain SIP Extensions, you may need to set a Sign-in name, which should consist of the extension number and the IP address of the IPCMPR/IPCEMPR card (e.g., 350@192.168.0.101).

[For KX-HGT100 SIP Telephones]

It is necessary to programme the KX-HGT100 through Web Programming to register to the PBX. Follow the procedures below to prepare your PC for Web Programming and programme the KX-HGT100.

Preparing the PC

System Requirements

- Microsoft® Internet Explorer® 6.0 or later

Trademarks

- Microsoft, Windows, and Internet Explorer are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.
- All other trademarks identified herein are the property of their respective owners.

Note

The procedures vary depending on the operating system of the PC. This example is based on the Windows® XP operating system.

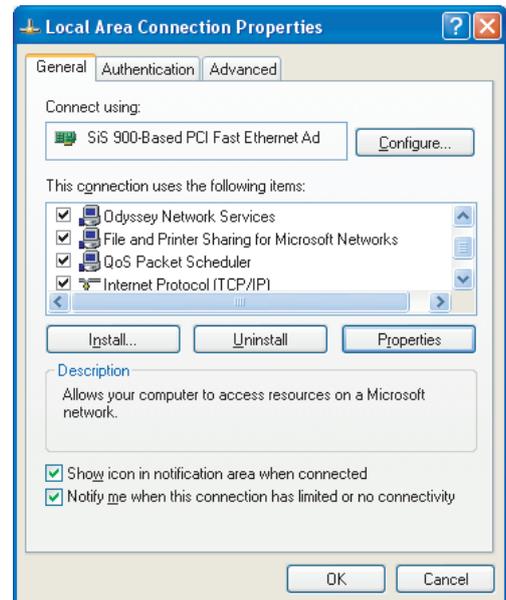
1. Open **Control Panel** from the **Start** menu.

2.
 - a. Double-click **Network Connections**.
 - b. Double-click **Local Area Connection**.
 - c. Click **Properties**.
 - d. Confirm that **Internet Protocol (TCP/IP)** is listed.

Note

If **Internet Protocol (TCP/IP)** is not listed, you must install TCP/IP. For details about installation, refer to the documentation for Windows XP.

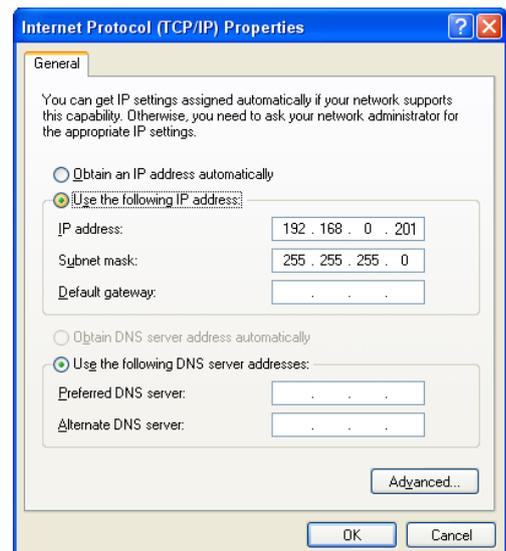
3. Select **Internet Protocol (TCP/IP)** and click **Properties**.



4.
 - a. Select **Use the following IP address:**.
 - b. In the **IP address** box, type **192.168.0.201**. This is an example entry. Type an IP address different from that assigned to the KX-HGT100 in "4.3.1 Assigning the IP Addressing Information".
 - c. In the **Subnet mask** box, type **255.255.255.0**.
 - d. Click **OK**.

Note

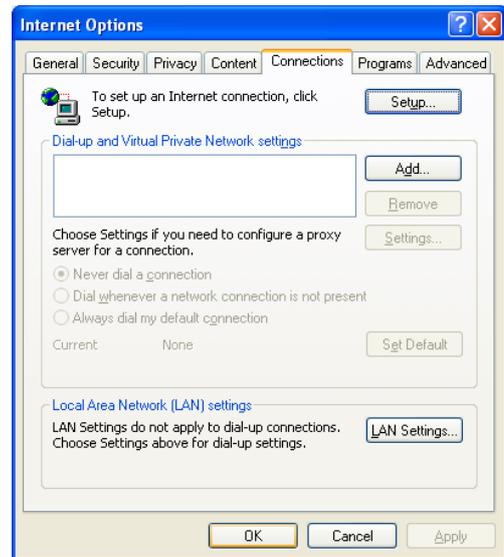
To obtain an IP address automatically, select **Obtain an IP address automatically**.



5.
 - a. Start Internet Explorer from the **Start** menu.
 - b. Click **Internet Options** from the **Tools** menu.

4.4.1 Registering IP Telephones

6.
 - a. Click the **Connections** tab.
 - b. Select **Never dial a connection** if necessary.
 - c. Click **LAN Settings**.



7. When Not Using a Proxy Server

Note

If you will use a proxy server, see **When Using a Proxy Server**.

- a. Clear all check boxes.
- b. Click **OK**.

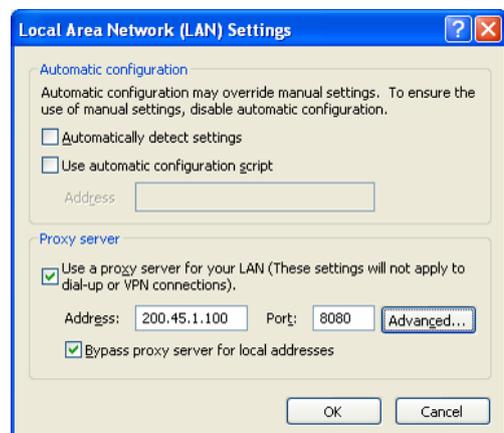
Your PC is now ready for programming through direct access to the KX-HGT100.



When Using a Proxy Server

If the network has a proxy server installed, you must apply the appropriate proxy settings to your PC. In this case, follow the steps below instead of step 7 above:

7.
 - a. Check all boxes for **Proxy server**.
 - b. Click **Advanced**.



8. a. Under **Do not use proxy server for addresses beginning with:**, type the IP address of the LAN port of the card.
- b. Click **OK**.

Your PC is now ready for programming the KX-HGT100 through an IP network.



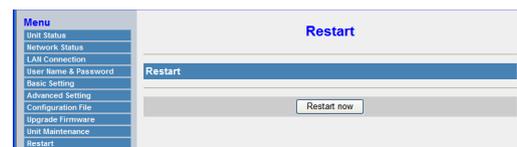
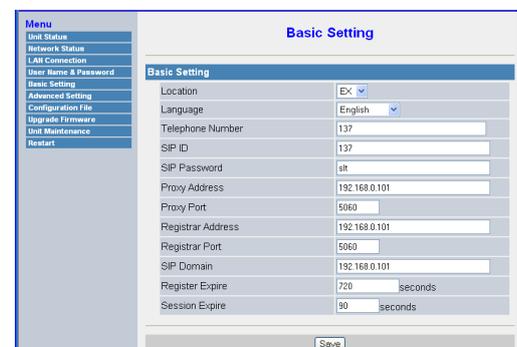
Programming the KX-HGT100

1. Start Internet Explorer from the **Start** menu.
2. a. Enter the IP address of the KX-HGT100 in the address box.
b. Press the Enter key.
3. The log-in screen will appear.
 - a. In the **User name** box, type the user name (default: **KX-HGT100**).
 - b. In the **Password** box, type the password (default: **kx-hgt100**).
 - c. Click **OK**.
4. The top page will appear.
 - a. Click **Basic Setting**.
 - b. In the **Telephone Number** and **SIP ID** boxes, type the extension number.
 - c. In the **SIP Password** box, type the password.
 - d. In the **Proxy Address, Registrar Address, and SIP Domain** boxes, type the IP address of the IPCMPR/IPCEMPR card.
 - e. Click **Save**.
 - f. Click **Return to top page**.

Note

For information on other parameters, refer to Parameter Descriptions.

5. a. Click **Restart**.
- b. Click **Restart now** for changes to take effect. The KX-HGT100 will be restarted.
If the authentication information of the KX-HGT100 and the PBX match, the registration is successful.



Note

To access Web Programming after restarting the KX-HGT100, it is necessary to (1) turn the KX-HGT100 power off, and (2) hold the OK and MUTE buttons while turning the power on.

Parameter Descriptions

Basic Setting

The screenshot shows the 'Basic Setting' configuration page. On the left is a 'Menu' sidebar with options: Unit Status, Network Status, LAN Connection, User Name & Password, Basic Setting (highlighted), Advanced Setting, Configuration File, Upgrade Firmware, Unit Maintenance, and Restart. The main area is titled 'Basic Setting' and contains the following fields:

- Location: EX (dropdown)
- Language: English (dropdown)
- Telephone Number: 137 (text input)
- SIP ID: 137 (text input)
- SIP Password: slt (text input)
- Proxy Address: 192.168.0.101 (text input)
- Proxy Port: 5060 (text input)
- Registrar Address: 192.168.0.101 (text input)
- Registrar Port: 5060 (text input)
- SIP Domain: 192.168.0.101 (text input)
- Register Expire: 720 seconds (text input)
- Session Expire: 90 seconds (text input)

A 'Save' button is located at the bottom center of the configuration area.

Parameter	Description
Location ¹	Specifies the location where the KX-HGT100 is installed.
Language	Specifies the language to be displayed on the LCD.
Proxy Port	Specifies the port number associated with the IP address entered in Proxy Address .
Registrar Port	Specifies the port number associated with the IP address entered in Registrar Address .
Register Expire	Specifies the length of time (1–4294967295 seconds) that the KX-HGT100 sends the REGISTER message to the PBX. ²
Session Expire	Specifies the length of time (60–65535 seconds) after which the KX-HGT100 terminates SIP sessions when no communication is detected.

¹ This parameter is not available with KX-HGT100C.

² This setting will be overwritten by the SIP Location Hold Time Max. setting of the PBX. For details, refer to "3.17 [1-1] Slot—Card Property - Virtual SIP Extension" in the PC Programming Manual.

Advanced Setting

Advanced Setting	
RTP Port Min	<input type="text" value="16000"/>
RTP Port Max	<input type="text" value="20000"/>
Codec Priority	<input type="text" value="PCMA,G726-32,G729A,PCMU"/>
Outband DTMF	<input type="text" value="YES"/>
One time Caller ID Deny Code	<input type="text" value="*67"/>
One time Caller ID Permit Code	<input type="text" value="*68"/>
SIP Listen Port	<input type="text" value="5060"/>
RTP TOS	<input type="text" value="0"/> (0-7)
SIP TOS	<input type="text" value="0"/> (0-255)

Parameter	Description
RTP Port Min	Specifies the minimum port number for RTP transmission and reception (even number only).
RTP Port Max	Specifies the maximum port number for RTP transmission and reception (even number only).
Codec Priority	Specifies the CODEC types in order of priority. (The CODEC typed first has the highest priority.)
Outband DTMF	Specifies whether to use Outband (RFC2833) DTMF tones or not. If NO is selected, Inband DTMF tones will be used.
One time Caller ID Deny Code	Specifies the number to dial when preventing the calling party's telephone number from being displayed on the called party's telephone for outside calls. ^{*1}
One time Caller ID Permit Code	Specifies the number to dial when showing the calling party's telephone number on the called party's telephone for outside calls. ^{*1}
SIP Listen Port	Specifies the port number to listen for incoming SIP calls.
RTP TOS	Specifies the ToS value in the IP header of RTP packets.
SIP TOS	Specifies the Diffserv (ToS) value in the IP header of SIP packets.

*1 The number entered in this box has priority over features set via the PBX that use the same feature number.

4.4.2 De-registering IP Telephones

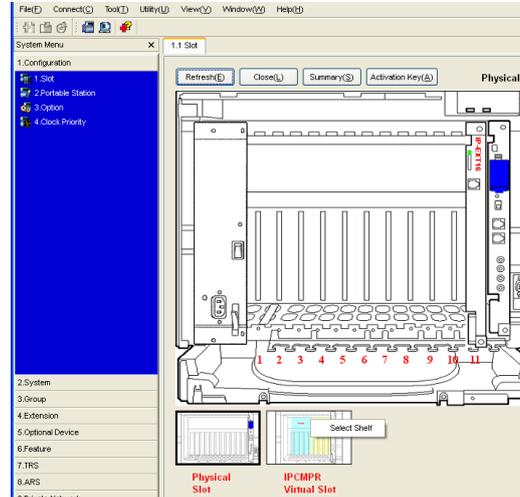
De-registration of IP-PTs

1.
 - a. Under **Configuration**, click **Slot**.
 - b. **When de-registering from V-IPEXT32 Card:**
Move the mouse pointer over the white PBX image at the bottom of the screen for the virtual slots, and click **Select Shelf**. Move the mouse pointer over the V-IPEXT32 card. A menu will be shown under the mouse pointer.

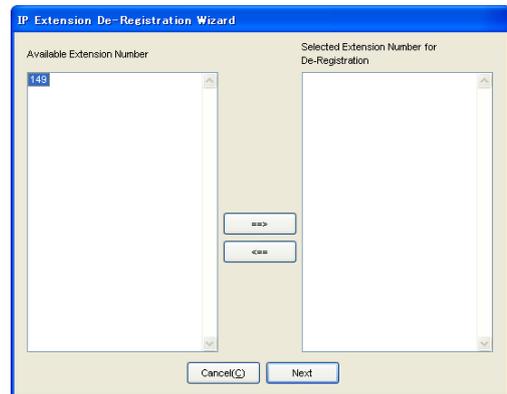
When de-registering from IP-EXT Card:

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 of IP-PTs

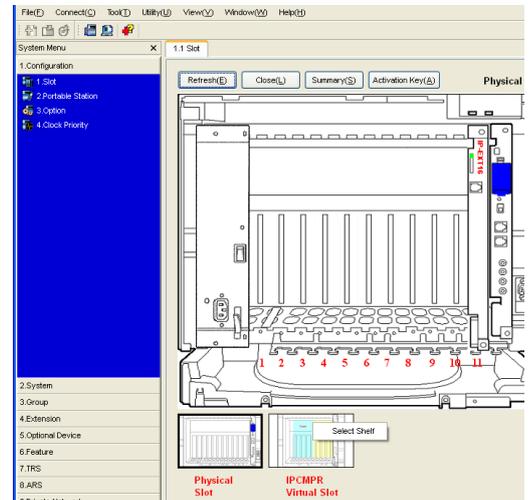
Follow the steps below to forcibly de-register an IP-PT when normal de-registration was unsuccessful.

1.
 - a. Under **Configuration**, click **Slot**.
 - b. **When de-registering from V-IPEXT32 Card:**
Move the mouse pointer over the white PBX image at the bottom of the screen for the virtual slots, and click **Select Shelf**. Move the mouse pointer over the V-IPEXT32 card. A menu will be shown under the mouse pointer.

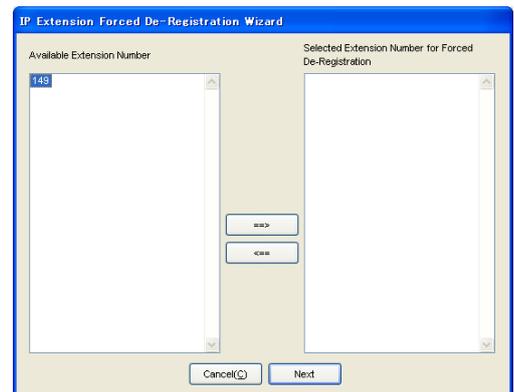
When de-registering from IP-EXT Card:

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**.

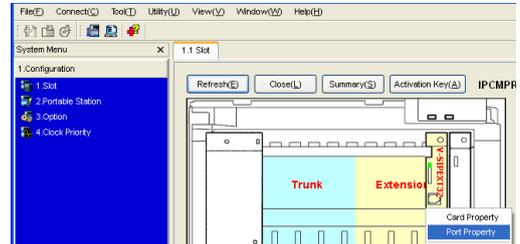


Once the IP-PT is successfully de-registered, the status of the IP-PT will update to show "None".

De-registration of SIP Extensions

The de-registration of SIP Extensions is carried out by deleting either the extension number or password registered in the PBX.

1.
 - a. Under **Configuration**, click **Slot**.
 - b. Move the mouse pointer over the white PBX image at the bottom of the screen for the virtual slots.
 - c. Click **Select Shelf**.
 - d. Move the mouse pointer over the V-SIPEXT32 card. A menu will be shown under the mouse pointer.
 - e. Click **Port Property**.
2. Delete either the extension number or password in the boxes shown right.



The screenshot shows a dialog box titled 'Port Property - Virtual SP Extension Port'. It contains a table with columns: No., Slot, Port, Extension Number, Password, and Connection. The table lists 8 rows of data. The 'Connection' column contains a dropdown menu for each row, currently set to 'OUS'.

No.	Slot	Port	Extension Number	Password	Connection
1	8	1	117	117	OUS
2	8	2	118	118	OUS
3	8	3	119	119	OUS
4	8	4	120	120	OUS
5	8	5	121	121	OUS
6	8	6	122	122	OUS
7	8	7	123	123	OUS
8	8	8	124	124	OUS

Appendix A

Troubleshooting

A.1 Error Message

When a major system error occurs, an error message is displayed on the IP-PT.

For the IP-PT 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 HARDWARE ERROR Displays error and stops operating.	<ul style="list-style-type: none"> Sub CPU malfunction 	<ul style="list-style-type: none"> Repair or replace the IP-PT.
ERR 1002-0000 HARDWARE ERROR Displays error and stops operating.	<ul style="list-style-type: none"> Sound hardware malfunction 	
ERR 1003-0000 HARDWARE ERROR Displays error and stops operating.	<ul style="list-style-type: none"> Flash memory malfunction 	
ERR 1004-XXXX HARDWARE ERROR Displays error and stops operating.	<ul style="list-style-type: none"> PHY (network control IC) error 	
ERR 1005-0000 HARDWARE ERROR Displays error and stops operating.	<ul style="list-style-type: none"> SDRAM error 	
ERR 1006-0000 HARDWARE ERROR Displays error and stops operating.	<ul style="list-style-type: none"> SRAM error 	
ERR 1007-0000 HARDWARE ERROR Displays error and stops operating.	<ul style="list-style-type: none"> Sub CPU malfunction for Self Labelling 	
ERR 1051-0000 SOFTWARE ERROR Displays error and stops operating.	<ul style="list-style-type: none"> PBX software version error 	<ul style="list-style-type: none"> Consult your network administrator.
ERR 2001-XXXX SYSTEM ERROR Resets and displays error for 5 seconds while starting up.	<ul style="list-style-type: none"> Unexpected error 	<ul style="list-style-type: none"> If this error is displayed frequently, repair or replace the IP-PT.
ERR 2002-0000 POOR LAN CONNECTION Resets and displays error for 5 seconds while starting up.	<ul style="list-style-type: none"> Transmission error 	<ul style="list-style-type: none"> Check with the network administrator whether there is a problem with the LAN. If this error is displayed frequently, repair or replace the IP-PT.
ERR 2003-0000 POOR LAN CONNECTION Resets and displays error for 5 seconds while starting up.		

Error Message & IP-PT Activity	Probable Cause	Solution
ERR 2004-0000 UNREGISTERED TO SERVER Resets and displays error for 5 seconds while starting up.	<ul style="list-style-type: none"> IP-PT not registered 	<ul style="list-style-type: none"> Check the registration status of the IP-PT.
ERR 2005-0000 NO MORE CONNECTIONS Resets and displays error for 5 seconds while starting up.	<ul style="list-style-type: none"> Connection refused by the PBX 	
ERR 2006-XXXX DHCP SERVER REJECTION Resets and displays error for 5 seconds while starting up.	<ul style="list-style-type: none"> IP address lease time from DHCP server has expired IP address lease renewal was refused by DHCP server 	<ul style="list-style-type: none"> Consult your network administrator.
ERR 2007-0000 HARDWARE ERROR Resets and displays error for 5 seconds while starting up.	<ul style="list-style-type: none"> Communication error with sub CPU 	<ul style="list-style-type: none"> If this error is displayed frequently, repair or replace the IP-PT.
ERR 2008-0000 HARDWARE ERROR Resets and displays error for 5 seconds while starting up.	<ul style="list-style-type: none"> Sound hardware control error 	
ERR 2009-XXXX MGCP SERVER REJECTION Resets and displays error for 5 seconds while starting up.	<ul style="list-style-type: none"> Error information from the PBX (MGCP server) 	<ul style="list-style-type: none"> Consult your network administrator.
ERR 2010-0000 HARDWARE ERROR Resets and displays error for 5 seconds while starting up.	<ul style="list-style-type: none"> Communication error with sub CPU for Self Labelling 	<ul style="list-style-type: none"> If this error is displayed frequently, repair or replace the IP-PT.
ERR 3001-0000 HARDWARE ERROR Displays error until reset the IP-PT.	<ul style="list-style-type: none"> Communication error with sub CPU 	
ERR 3002-0000 HARDWARE ERROR Displays error until reset the IP-PT.	<ul style="list-style-type: none"> Sound hardware control error 	
ERR 3003-XXXX DHCP SERVER NOT FOUND Displays error until reset the IP-PT.	<ul style="list-style-type: none"> IP address lease renewal was refused by DHCP server 	<ul style="list-style-type: none"> Consult your network administrator.
ERR 3100-0000 BLUETOOTH ERROR Resets the Bluetooth [®] 1 wireless headset.	<ul style="list-style-type: none"> Bluetooth hardware error 	<ul style="list-style-type: none"> Repair or replace the Bluetooth wireless headset.

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