KENWOOD

NXR-5700/ NXR-5800

Function Reference (FUNC)

Version:	5.21
Last Updated:	August 24, 2018
Language:	English
Type:	E

About this Manual

NXR-5700/ NXR-5800 is the VHF/UHF repeater to be used for business communications. NXR-5700/ NXR-5800 supports Analog Conventional communications and NXDN digital communications (Conventional and NEXEDGE 2nd Generation trunking).

This manual describes the functions for Analog Conventional and NXDN Conventional.

This document was created for the product having the following design specifications:

Item	Specifications	How to Verify
Market Code	E	Printed on the label on the product.
Firmware Version of the Repeater	5.20.00 or later	Can be viewed in the **Repeater Information** dialog box of KPG-D2.
Version of KPG-D2	V 5.20 or later	Can be viewed in the **About** dialog box of KPG-D2.
KPG-110SM	V 5.20 or later	Can be viewed in the **About** dialog box of KPG-110SM.
Version of KPG-149RM/ KPG-149SA	V 2.10 or later	Can be viewed in the **About** dialog box of KPG-149RM/ KPG-149SA.

E: Designed for the European markets.

How to Read the In-depth Manual

The In-depth Manual has the following sections:

NXR-5700/ NXR-5800 Function Reference (FUNC) (this document)

Describes the functions for Analog Conventional and NXDN Conventional of NXR-5700/ NXR-5800.

NEXEDGE 2nd Generation Function Reference (FUNC)

Describes the NEXEDGE 2nd Generation system.

NX-5000 Series NXDN Function Reference (NXDN FUNC)

Describes the NXDN functions of a subscriber unit.

NEXEDGE 2nd Generation Basic Configuration

Describes software configurations to build the NEXEDGE 2nd Generation system.

NEXEDGE 1st Generation System Programming Reference (SYSM)

Describes software configurations to build the NEXEDGE 1st Generation system.

About Notations

The following notations are used in this manual:

[ ]

The characters in [ ] indicate the name of the operating portion of the repeater and the key of the PC.

“ ” (Double Quotation Marks)

The characters in “ ” indicate the name of the functions, buttons, and menus shown on KPG-D2, or the display of the repeater.

Bold Letters

The characters in bold letters indicate the name of the windows, tabs, checkboxes in KPG-D2 and functions assigned to the keys on the repeater.

[ ] + [ ]

This notation is used for describing functions activated by pressing 2 keys on the PC keyboard at the same time. For example, the notation to enter a capitalized A on the PC is **[Shift]** + **[a]** for pressing the **[a]** key while pressing the **[Shift]** key.

PF (Programmable Function) Key

This notation is used for describing the key of the repeater to which any function is assigned. When the Reset function is assigned to the **[A]** key, the **[A]** key is described as the “**Reset** key”.

Notations for KPG-149RM/ KPG-149SA

KPG-149RM Repeater Monitor and KPG-149SA NEXEDGE Repeater Monitor are referred to collectively as “KPG-149RM/ KPG-149SA Repeater Monitor” in this document.

About the Notation of the Supported Models

This manual describes the supported models according to the following rules:

Model Name	Notation	
NXR-5700	Repeater	VHF
NXR-5800		UHF

About Examples of the Subscriber Unit Display

This manual describes by using the display examples of NX-5x00 series if the subscriber unit display needs to be explained.

Abbreviations Used in this Document

The following abbreviations are used in this in-depth manual. Refer to the abbreviation table below.

Abbreviation	Full Spelling or Meaning
ACK	Acknowledgment
AUX	Auxiliary
Ch	Channel
COM port	Communication port
COR	Carrier Operated Relay
CW	Continuous Wave
deg	degree(s)
DQT	Digital Quiet Talk
DTMF	Dual Tone Multi-Frequency
EIA	Electronics Industries Alliance, U.S.A.
GID	Group ID
I/O	Input/Output
LNA	Low Noise Amplifier
Mic	Microphone
PF	Programmable Function
QT	Quiet Talk
RA	Receive Audio Output
RAN	Radio Access Number
RD	Received Data
RSSI	Received Signal Strength Indication
RX	Reception, Receiver
SU	Subscriber Unit
TA	Talk Around, Transmitted Audio
TD	Transmitted Data
TOR	Tone Operated Relay
TOT	Time-out Timer
TX	Transmission, Transmitter
TX LED	Transmission LED
TXS	Transmission Sense
UID	Unit ID
VCO	Voltage Controlled Oscillator
VCXO	Voltage Controlled Crystal Oscillator

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About NXDN

NXDN™ is a very narrowband protocol employing 6.25 kHz/12.5 kHz FDMA technology.

NXDN™ is the result of a joint technical alliance between Icom Incorporated and JVC KENWOOD Corporation.

About NEXEDGE

NEXEDGE is a generic term to describe the KENWOOD proprietary digital communications system which complies with NXDN common air interface specifications.

About the Conventional System

NXR-5700/ NXR-5800 can be operated in each of the Analog Conventional communication system and the NXDN Conventional communication system. (Refer to STRUCTURE OF A CONVENTIONAL SYSTEM.)

In a Conventional system, repeaters can be operated in either base station mode (simplex or duplex) or a repeater system.

Also, the NXDN Conventional system supports the Conventional IP network; therefore, the communication area can be enlarged by interconnecting multiple repeaters by using an IP network in a repeater system.

Devices Structuring the Conventional System

If repeaters operated in base station mode or a single repeater system, the repeaters can be operated by a single repeater.

If repeaters are operated in a Conventional IP network system, multiple repeaters and network devices for connecting to an IP network, such as a hub or router, are required. Also, if multicast communications are used in a Conventional IP network system, network devices that support multicast communications need to be used.

About the Programming Software

Various functions and parameters of the repeater can be configured by using the KPG-D2 software. Each configuration can be enabled by connecting a PC and the repeater with a USB Type-B cable and writing the data configured by using KPG-D2 to the repeater. In this manual, a corresponding reference in the help texts of KPG-D2 is described. Therefore, you can configure the function by referring to the function also appearing in the help texts.

About the Notation of “Configuration Using KPG-D2”

In this manual, for the description of each function written as “Configuration using KPG-D2”, a corresponding reference in the help texts of KPG-D2 is described. Therefore, you can configure the function by referring to the function also appearing in the help texts of KPG-D2.

About the Web Browser

SCU can be accessed by using a web browser (Internet Explorer 11 is supported) on a client PC.

About Options to Use the Functions Described in This Document

To use the functions described in this document, the following KENWOOD optional accessories need to be prepared on your own as necessary:

- KPG-D2
- KFL
- KAS-10
- KPG-149RM/ KPG-149SA
- KPG-150AP/ KPG-180AP
- KPG-110SM
- KPT-110SDK
- KTI-4
- KWD-NX50VTR
- KAS-20

How to Search for Information

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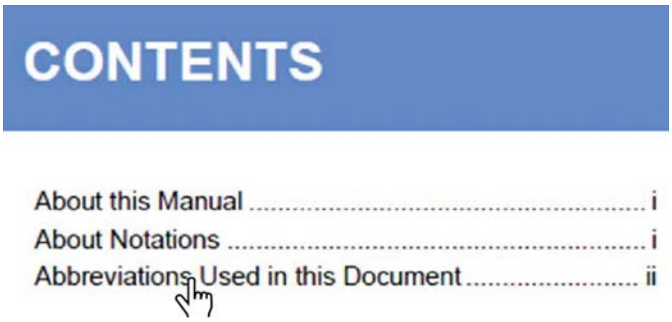
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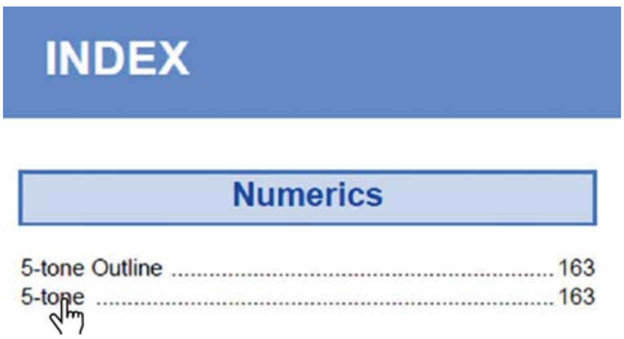
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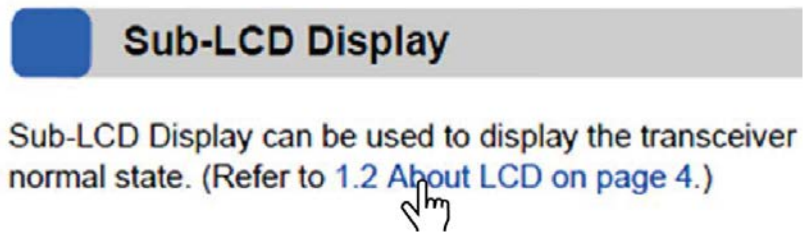

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Revision History

Date	Description
2016.7.29	1) Corrected each version information in “About this Manual”. 2) Added “NEXEDGE 1st Generation System Programming Reference (SYSM)” in “How to Read the In-depth Manual”. 3) Added the reference of the description about the NEXEDGE 1st Generation system in “Contents by Purpose”. 4) Added the behavior description and the description about portions used in trunking mode in “1 FUNCTIONS AND PANEL LAYOUT”. 5) Added “3.4 Using PF Keys”. 6) Added the note about the operation in trunking mode in “5 AVAILABLE FUNCTIONS FOR THE PF KEYS”. 7) Added the description about the behavior in trunking mode in “6 USING FUNCTION PORTS”. 8) Added the description about the behavior in trunking mode to “TOR” in Table 6-8. 9) Added the note about the behavior in trunking mode in “Restricting the Continuous Transmission Time for the Repeater (Time-out Timer)”. 10) Added “13 NEXEDGE 1ST GENERATION SYSTEM”. 11) Added “15 TELEPHONE INTERCONNECT”. 12) Added the following items in “A.1 LED”: Control Channel LED OCXO LED 13) Replaced the following screens: Figure 10-1 Repeater Information Dialog Box Figure 10-3 KFL Dialog Box (Write) Figure 10-6 Firmware Update (Browse) 14) Changed the version number from 1.00 to 5.00.
2018.8.24	1) Corrected each version information and added the version of KPG-149RM/ KPG-149SA in “About this Manual”. 2) Added the following options to “About Options to Use the Functions Described in This Document”: KPG-110SM KPT-110SDK KTI-4 KWD-NX50VTR KAS-20 3) Changed “External Reference” to “Startup Delay” in “3.8 About the Functions of When Using an External Reference Signal (Reference Frequency)”. 4) Replaced the following screens: Figure 10-1 Repeater Information Dialog Box Figure 10-3 KFL Dialog Box (Write) 5) Added the following figure: Figure 10-7 Firmware Update (Update) 6) Added the description on System Firmware Version Unmatch Error in Table A-5. 7) Changed the version number from 5.00 to 5.21.

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NXR-5700/ NXR-5800 can be operated in a repeater system or the base station mode.

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Page 4

Operating in the Base Station Mode

The base station mode is used when NXR-5700/ NXR-5800 is operated as a base station.

BASE STATION (SIMPLEX/ DUPLEX)
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Operating in a Single Repeater System

A single repeater system is used for subscriber units to communicate with each other via a single repeater.

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Communicating by Connecting Multiple Repeaters by Using an IP Network

The communication area can be enlarged by interconnecting multiple repeaters installed in different locations by using an IP network.

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Operating in Trunking Mode of a NEXEDGE 1st Generation System

NXR-5700/ NXR-5800 can be used as a control channel or traffic channel to structure a site in the NEXEDGE 1st Generation system.

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Configuring the Operation Mode for Transmission and Reception

Depending on the task of the repeater, the repeater can be operated in various modes.

Configuring the Operation Mode of the Repeater (Operation Mode)

Page 119

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Repeaters can be operated by switching the transmission power to high power, mid power, or low power.

Configuring the Transmission Power Level

Page 130

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Multiple causes for transmission exist for repeaters, and the repeaters can be operated by configuring the priority order of each cause for transmission.

Configuring the Priority Order of When Multiple Causes for Transmission Occur Together (PTT Priority)

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Configuring the available duration of continuous transmission prevents the repeater from occupying the frequency for too long.

Restricting the Continuous Transmission Time for the Repeater (Time-out Timer)

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If a channel to be used for the repeater to transmit is being used by other parties, the transmission of the repeater on the channel is automatically restricted.

Avoiding Interference with Other Communications (Busy Channel Lockout)

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The functions assigned to **PF** keys and AUX ports can be controlled by using an Air Remote code.

REMOTE CONTROL

Page 59

Enhancing the Confidentiality of Communications

NXR-5700/ NXR-5800 is equipped with the functions which can enhance the confidentiality of communications for each of analog channels and NXDN digital channels.

Communication Security (Voice Scrambler/ Encryption)

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Display/ Sound

Learning about the Contents Displayed on the LED Display

The various statuses of the repeater are displayed on the 17-segment LED display.

17-segment LED

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Learning about the Tones Used for the Repeater

Various tones sound from the repeater according to the operation of the repeater.

Tones that Sound When a User Operates the Repeater or When the Repeater Status Is Changed

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Analog Communication Functions

Sharing the Same Channel (Frequency) by Multiple Groups

QT/DQT is the analog signaling to be used for facilitating communication within a group if the same channel is shared by multiple groups.

Analog Signaling System

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Multiple signaling (QT/DQT) can be waited and received.

Waiting to receive multiple QT/DQT (Multiple Encode/Decode Table)

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The transmission of the configured analog channel can be tested.

Confirming Whether the Configured Analog Channel of the Repeater Works Properly (Test Tone)

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NXDN Digital Communication Functions

Sharing the Same Channel (Frequency) by Multiple Groups

RAN code is the NXDN digital signaling to be used for facilitating communication within a group if the same channel is shared by multiple groups.

Digital Signaling System

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Communicating by Connecting Multiple Repeaters by Using an IP Network

By interconnecting multiple repeaters installed in different locations by using an IP network, a subscriber unit can communicate with a distant subscriber unit via an IP network.

Configuring for Broadcasting a Call in a Wide Area by Connecting Repeaters by Using an IP Connection (Intersite Call)

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Making a Selective Call

Voice communications such as Individual Calls and Group Calls can be made in the NXDN digital base station mode.

Voice Calls in the NXDN Digital Base Station Mode (Selective Call)

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Adjusting the Quality of Communications

The quality of various communications in the NXDN format can be adjusted.

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The Group IDs and Unit IDs for repeat transmission can be restricted.

Restricting the IDs for Repeat Transmission (User List)

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Avoiding Interference with Other Communications

The repeater can restrict transmission in order to prevent the transmission from interfering with other communications if the channel is being used by another subscriber unit when the repeater transmits using the Repeat PTT control.

Avoiding Interference of Other Parties and Preventing Interference to Other Parties (Cross-busy)

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1.1 Front Panel

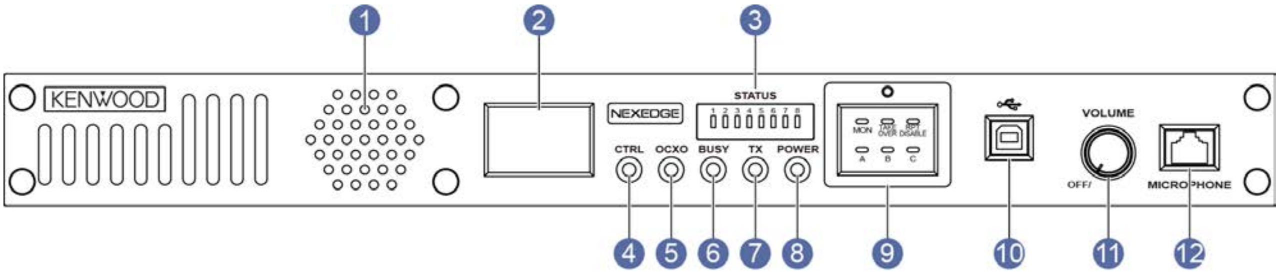


Figure 1-1 Front Panel

❶ **Speaker**

The received audio and the Alert Tone sound from the speaker.
The audio sounds as follows while the repeater is in trunking mode:

- **If the repeater functions as a control channel:**
  Nothing sounds from the speaker.

- **If the repeater functions as a traffic channel:**
  The repeater can monitor communications on a traffic channel. However, the repeater cannot properly monitor scrambled audio signals. If the repeater is also used for an analog conventional channel, the repeater also emits analog audio signals.

❷ **17-segment LED display**

Displays the channel name and error status with the 2-digit 17-segment LED display. (Refer to 17-segment LED.)

❸ **STATUS LED**

Notifies the repeater status with 8 STATUS LEDs. (Refer to STATUS LED.)

❹ **CTRL LED**

Lights green when the repeater behaving as a Voting receiver starts transmission to an IP network in a Voting system of the NXDN Conventional system. (Refer to Structuring a Voting System (Voting Repeater/ Voting Receiver).)
Lights or flashes green when the repeater is operated as a control channel if the repeater is operated in a trunking system. (Refer to Control Channel LED.)

❺ **OCXO LED**

This LED is used when the repeater is operated in a trunking system. (Refer to OCXO LED.)

❻ **BUSY LED**

Lights green while the repeater is receiving a signal. (Refer to BUSY LED.)

❼ **TX LED**

Lights red while the repeater is transmitting. (Refer to TX LED.)

❽ **POWER LED**
Lights green when the repeater is turned on. (Refer to POWER LED.)

❾ **PF key**
If any **PF** key is pressed, the LED lights red and the function assigned to the key is activated or enabled. (Refer to AVAILABLE FUNCTIONS FOR THE PF KEYS.)
If the repeater is operated in a trunking system, the functions assigned to the **[MON]**, **[TAKE OVER]** and **[RPT DISABLE]** keys at the top are fixed. The **[A]**, **[B]**, and **[C]** keys at the bottom cannot be used. (Refer to PF Key with LED.)

❿ **USB Port**
This is the port used when writing data to the repeater and reading data from the repeater.

⓫ **Volume**
Adjusts the volume level of the speaker.

⓬ **Microphone Connector**
An 8-pin optional microphone can be connected to this connector.
A microphone cannot be used while the repeater is operated in trunking mode.

1.2 Rear Panel

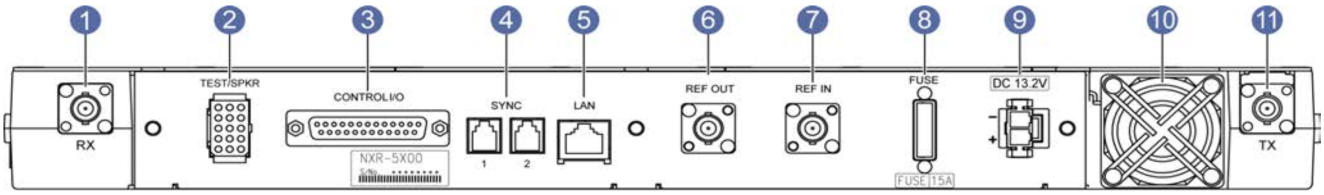


Figure 1-2 Rear Panel

① **RX IN**
Connects a receiving antenna or a duplexer.

② **TEST/SPKR (15-pin Connector)**
Available for the input and output test. This connector also connects an external speaker.

③ **CONTROL I/O (D-Sub 25-pin Connector)**
Connects an external controller.

④ **SYNC 1, 2**
These are the connectors allowing each repeater structuring a site to connect while the repeater is operated in trunking mode. This connector is used to synchronize repeaters.

⑤ **LAN (RJ-45)**
Connects an IP device such as a hub (100 BASE-TX/ 10 BASE-T).
This connector connects to devices such as each repeater and IP device structuring a site while the repeater is operated in trunking mode.

⑥ **REF OUT**
This is the connector allowing the repeater to supply reference signals to other repeaters in the same site while the repeater is operated in trunking mode.

⑦ **REF IN**
This is the input connector for an external reference oscillator. This connector can be used to improve the frequency accuracy by connecting a highly accurate external reference oscillator, such as a GPS receiver unit.

⑧ **FUSE**
Stops automatically supplying the power source to the repeater if the current running through the repeater exceeds a certain amount.

⑨ **DC IN**
Connects DC 13.2 V power source.

⑩ **FAN**
This is a cooling fan that discharges the heat in the repeater generated due to transmission. This cooling fan rotates at the same time as turning on the repeater. If the temperature sensor senses the temperature below the reference temperature, the fan stops spinning.

⑪ **TX OUT**
Connects a transmitting antenna or a duplexer.

2 STRUCTURE OF A CONVENTIONAL SYSTEM

There are 2 modes available for the Conventional system; one is the base station mode, and the other is the repeater system. The desired mode can be configured for each channel. (Refer to Configuring the Operation Mode of the Repeater (Operation Mode).)

2.1 Operating in the Base Station Mode

Base station mode is the mode in which the repeater transmits and receives using the **PTT** (microphone) switch or the External PTT control. In order to use NXR-5700/ NXR-5800 as a base station, this mode must be selected.

There are 2 modes available for the base station mode; one is the simplex mode which enables communications by toggling the repeater between transmission and reception, and the other is the duplex mode which enables both transmission and reception simultaneously.

Simplex Mode

Simplex mode is the mode that enables communications by toggling the repeater between transmission and reception. In order to use this mode, “Simplex” needs to be configured in **Operation Mode** by using KPG-D2.

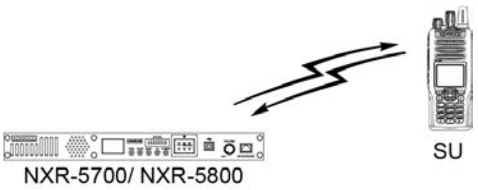


Figure 2-1 Simplex Mode

Duplex Mode

Duplex mode is the mode that enables both transmission and reception simultaneously. In order to use this mode, “Duplex” needs to be configured in **Operation Mode** by using KPG-D2.

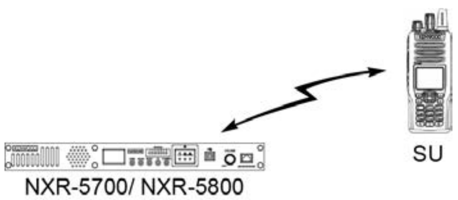


Figure 2-2 Duplex Mode

2.2 Operating in a Repeater System

The repeater system allows subscriber units to communicate with each other via a single repeater or multiple repeaters interconnected by using an IP network.

Single Repeater System

The single repeater system is the system that relays the received signal by using the Repeat PTT control if the repeater receives a signal from a subscriber unit. This system is used to allow subscriber units to communicate with each other via a single repeater in an Analog Conventional or NXDN Conventional system.

Figure 2-3 Single Repeater System

Conventional IP Network System

The NXDN Conventional system can interconnect multiple repeaters installed in different locations by using an IP network.
By using this system, a subscriber unit can communicate with a distant subscriber unit via an IP network.

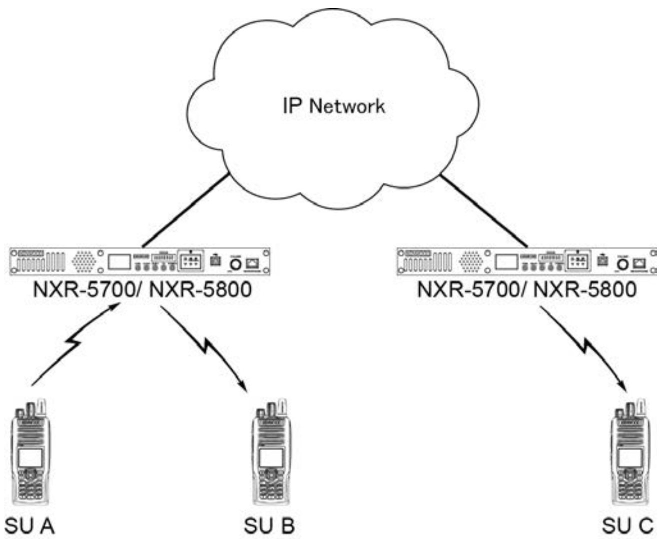


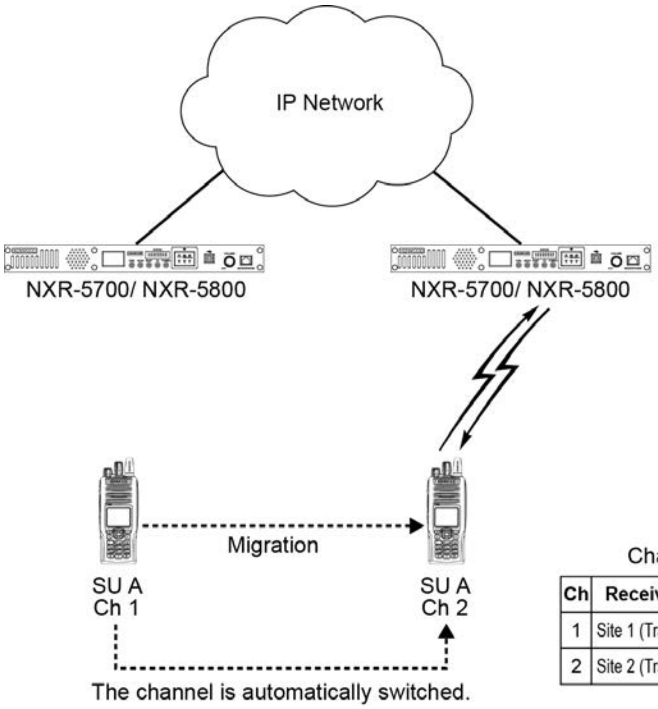
Figure 2-4 Conventional IP Network System

Note

- By using RF Link, even in an environment where a physical IP network does not exist, a multi-site can be structured in a Conventional system by installing the repeater dedicated to connection between sites (RF Link mode). The repeater in the RF Link mode transmits a received signal by using the transmit frequency only to the repeater connected via an IP network, and the repeater that receives the IP data via an IP network transmits this signal by using the transmit frequency.

Site Roaming

Site Roaming is the function to migrate automatically to the site (channel) providing better radio environment if a subscriber unit is operated in an NXDN Conventional system. Even if a moving subscriber unit goes outside the communication area, if a repeater connected to an IP network exists in the location where the subscriber unit is used, the subscriber unit can communicate via the repeater.



Channel Configuration of SU A

Ch	Receive Frequency	Transmit Frequency
1	Site 1 (Transmit Frequency)	Site 1 (Receive Frequency)
2	Site 2 (Transmit Frequency)	Site 2 (Receive Frequency)

Figure 2-5 Site Roaming

Voting system (Voting Repeater/ Voting Receiver)

Voting is the function to control a signal from a subscriber unit among the repeaters connected by an IP network according to the level of the received signal.

A Voting system allows subscriber units at remote locations to communicate with each other by installing multiple Voting receivers in the transmission area of the subscriber unit and transmitting the strongest and optimal signal from the subscriber unit to a Voting repeater via these repeaters.

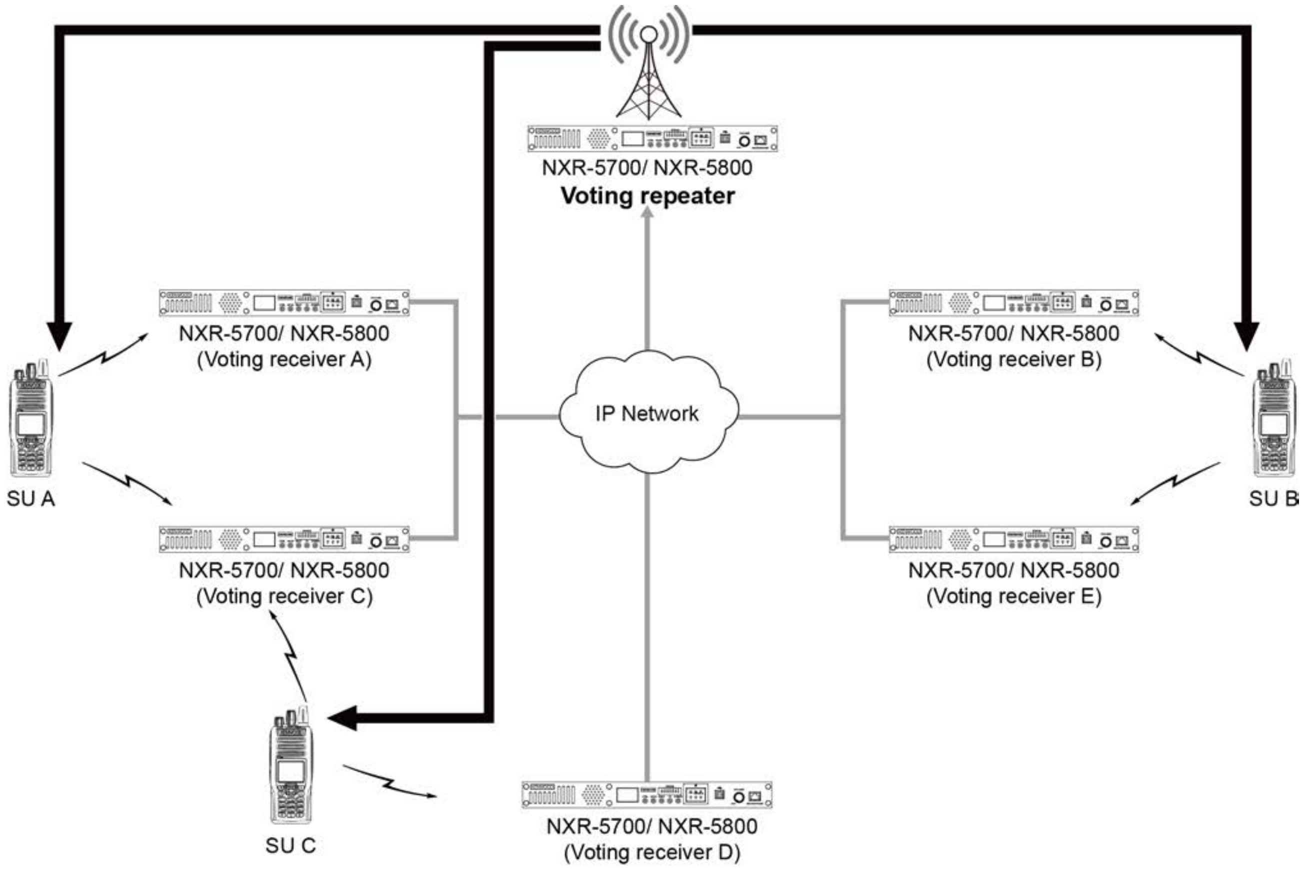


Figure 2-6 Voting System

About Communication Methods

The following communication methods are available in the base station mode and the repeater system. (Refer to Configuring the Usage Type of the Channel (Channel Type).)

Analog Conventional

This is the communication method to transmit and receive an analog signal. The channel utilizing this communication method is referred to as an "analog channel".

NXDN Conventional

This is the communication method to transmit and receive a digital signal using the NXDN protocol. The channel utilizing this communication method is referred to as an "NXDN digital channel".

In both the base station mode and a repeater system, **Unit ID (Own)** is used when the repeater transmits an NXDN digital signal by using the **PTT** (microphone) switch.

Mixed (Analog/ NXDN Digital)

This is the communication method to wait to receive both an analog signal and an NXDN digital signal. The channel utilizing this communication method is referred to as a "mixed channel". The behavior of the repeater for transmission varies depending on the communication mode. The configuration is effective if the repeater is to be operated with a digital signal and an analog signal at the same time.

- **Base station mode**

  The repeater transmits using the transmission mode (Analog or NXDN) configured in **Transmit Mode**. However, the communication method to be used varies depending on the receiving conditions. Refer to "Transmitting by Using the Communication Method of Reception (Signaling Reset Timer)" for details.

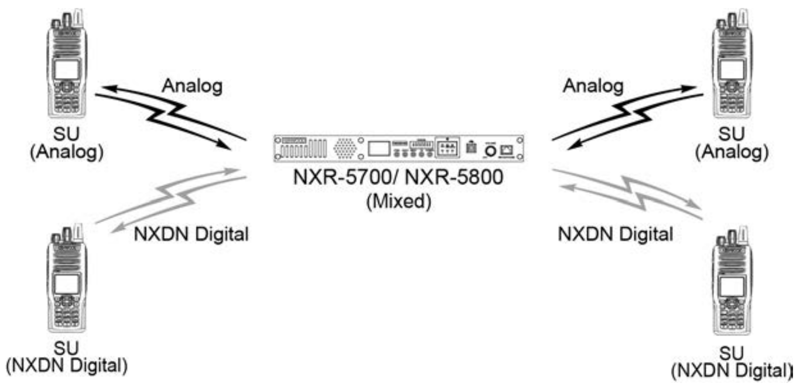


Figure 2-7 Mixed (Base Station Mode)

- **Repeater system**

The repeater transmits using analog communications if the received signal is analog, and the repeater transmits using NXDN digital communications if the received signal is in the NXDN digital format.

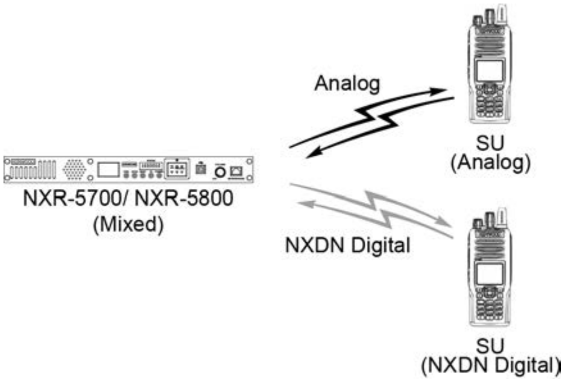


Figure 2-8   Mixed (Repeater System)

3.1 Starting Up the Repeater

The repeater is turned on if DC 13.2 V is supplied to DC IN on the rear panel.

If the repeater is turned on, the channel name appears on the LED display. The displayed channel name blinks until the frequency is stabilized. After the frequency is stabilized, the displayed channel name stops blinking and remains lit and the repeater becomes usable.

While the repeater is turned on, the POWER LED lights green.

Note

- If any **PF** key on the front panel is pressed while the displayed channel name is blinking, the displayed channel name stops blinking and remains lit and the repeater becomes usable. In this case, the frequency may not be stabilized.

Assigning Functions that Become Active or Enabled When the Repeater Starts Up (Startup)

Startup is the function to activate or enable the preconfigured functions when the repeater is turned on. A maximum of 3 different functions can be configured and the configured functions become activated or enabled in the order of 1st, 2nd and 3rd when the repeater is turned on. For example, if a channel to be selected immediately after the power is turned on exists, the channel (from Channel 1 to Channel 30) is assigned.

The following are the functions that can be assigned as **Startup** functions:

Note

- This function can be used only if the repeater is operated in conventional mode.

Table 3-1 Available Functions for Startup

Function Name	Description	Remarks
None	No function is activated.	
AUX Out 1 Off to AUX Out 5 Off	Deactivates the corresponding AUX Output port.	• Refer to USING FUNCTION PORTS • This function can be assigned only if “Selectable” is configured in **AUX Out 1** to **AUX Out 5**.
AUX I/O 1 Off to AUX I/O 6 Off	Deactivates the corresponding AUX I/O port.	• Refer to USING FUNCTION PORTS • This function can be assigned only if “Selectable” is configured in **AUX In/Out 1** to **AUX In/Out 6**.
AUX Out 1 On to AUX Out 5 On	Activates the corresponding AUX Output port.	• Refer to USING FUNCTION PORTS • This function can be assigned only if “Selectable” is configured in **AUX Out 1** to **AUX Out 5**.

Function Name	Description	Remarks
AUX I/O 1 On to AUX I/O 6 On	Activates the corresponding AUX I/O port.	• Refer to USING FUNCTION PORTS • This function can be assigned only if “Selectable” is configured in **AUX In/Out 1** to **AUX In/Out 6**.
Channel 1 to Channel 30	Migrates to the corresponding channel.	
Channel Down	Decreases the channel number by one step.	
Channel Up	Increases the channel number by one step.	
CW ID On	Sends the CW ID.	
CW Message 1 to CW Message 8	Sends the corresponding CW message.	
DC Power Save Off	Disables DC Power Save Mode.	• Refer to REDUCING THE CURRENT CONSUMPTION OF THE REPEATER (DC POWER SAVE) • **Display Off**, **Display On**, and **Display On/Off** can be activated only while the repeater is in DC Power Save Mode.
DC Power Save On	Enables DC Power Save Mode.	
Display Off	Disables **Display On**. The LED which is lighted by **Display On** turns off and the power sourced to an audio amplifier is shut off.	
Display On	While DC Power Save Mode is enabled, the LED lights normally and the power is supplied to an audio amplifier for the length of time configured in **Save Delay Time**.	
Hold Time Disable	Disables **Repeater Hold Time**.	• Refer to Continuing Transmission for a Certain Length of Time After Reception Stops (Repeater Hold Time) • This function can be assigned only if anything other than “Off” is configured in **Repeater Hold Time**.
Hold Time Enable	Enables **Repeater Hold Time**.	
Local TX Disable	Disables the capability to transmit by pressing the **PTT** (microphone) switch.	Refer to Toggling the Transmission by Pressing the PTT (Microphone) Switch between Enabled and Disabled (Local TX Enable/Disable)
Local TX Enable	Enables the capability to transmit by pressing the **PTT** (microphone) switch.	
Low Power Off	Switches the transmission power from low power to high power.	This function can be activated only on a channel with “High” configured in **Transmit Power**. (Refer to Configuring the Transmission Power Level.)
Low Power On	Switches the transmission power from high power to low power.	

<table>
<tr><th>Function Name</th><th>Description</th><th>Remarks</th></tr>
<tr><td>Monitor Off</td><td>Enables the signaling decoding with the QT tone, DQT code or RAN code. The repeater unmutes the speaker when the signaling matches.</td><td rowspan="2">Refer to Temporarily Disabling the Signaling (Monitor)</td></tr>
<tr><td>Monitor On</td><td>Disables the signaling decoding with the QT tone, DQT code or RAN code.
On an analog channel, the repeater unmutes the speaker when the repeater receives a signal. The repeater unmutes the speaker upon detection of a frame on an NXDN digital channel.</td></tr>
<tr><td>Decode Signaling Disable</td><td>Disables the signaling decoding with the QT tone, DQT code or RAN code.</td><td rowspan="2">• Refer to Toggling the QT/DQT decoding between enabled and disabled (Decode Signaling Enable/Disable)
• Refer to Toggling the RAN decoding between enabled and disabled (Decode Signaling Enable/Disable)</td></tr>
<tr><td>Decode Signaling Enable</td><td>Enables the signaling decoding with the QT tone, DQT code or RAN code.
The repeater decodes with the QT tone, DQT code or RAN code configured for a channel.</td></tr>
<tr><td>Encode Signaling Disable</td><td>Disables the signaling encoding with the QT tone, DQT code or RAN code.</td><td rowspan="2">• Refer to Toggling the QT/DQT encoding between enabled and disabled (Encode Signaling Enable/Disable)
• Refer to Toggling the RAN encoding between enabled and disabled (Encode Signaling Enable/Disable)</td></tr>
<tr><td>Encode Signaling Enable</td><td>Enables the signaling encoding with the QT tone, DQT code or RAN code.
The repeater sends the QT tone, DQT code or RAN code configured for the channel when the repeater transmits.</td></tr>
<tr><td>Repeat Disable</td><td>Disables the capability to transmit the received signal by using the Repeat PTT control.</td><td rowspan="2">Refer to Toggling the Repeat Behavior between Enabled and Disabled (Repeat Enable/Disable)</td></tr>
<tr><td>Repeat Enable</td><td>Enables the capability to transmit the received signal by using the Repeat PTT control.</td></tr>
<tr><td>Scrambler/Encryption Off</td><td>Disables Voice Scrambler or Encryption.</td><td rowspan="2">Refer to Communication Security (Voice Scrambler/ Encryption).</td></tr>
<tr><td>Scrambler/Encryption On</td><td>Enables Voice Scrambler or Encryption.</td></tr>
<tr><td>Squelch Off</td><td>On an analog channel, the repeater opens the squelch and unmutes the speaker.
On an NXDN digital channel, the repeater disables the signaling decoding by the RAN code and unmutes the speaker just by detecting an NXDN frame.</td><td rowspan="2">Refer to Squelch.</td></tr>
<tr><td>Squelch On</td><td>Closes the squelch and mutes the received audio.</td></tr>
</table>

Function Name	Description	Remarks
Test Tone Off	Disables the function to transmit a test tone.	Refer to Confirming Whether the Configured Analog Channel of the Repeater Works Properly (Test Tone).
Test Tone On	Enables the function to transmit a test tone.	
TOT Disable	Disables **Time-out Timer**.	Refer to Restricting the Continuous Transmission Time for the Repeater (Time-out Timer)
TOT Enable	Enables **Time-out Timer**.	
TX Disable	Disables all transmissions.	Refer to Toggling the Transmission Behavior between Enabled and Disabled (TX Enable/Disable).
TX Enable	Enables all transmissions.	
Voting Tone Off	Inhibits the transmission of a Voting pilot tone signal.	Refer to Configuring to Transmit a Voting Pilot Tone Signal (Voting Pilot Tone).
Voting Tone On	Permits the transmission of a Voting pilot tone signal.	

Configuration using KPG-D2

Assigning a function to **Startup** (See Edit > Optional Features > Other > Startup)

3.2 Restarting the Repeater (Reset)

The repeater can be reset by a software reset.

If the **Reset** key is pressed, or if a signal is input to the AUX Input port to which "Reset" is assigned, a software reset is executed, and the repeater restores the state immediately after startup. (Refer to Available Functions for the AUX Input Ports.)

Note

- This function can be used only if the repeater is operated in conventional mode.

Configuration using KPG-D2

Assigning functions to the **PF** keys (See Edit > Key Assignment)

3.3 Adjusting the Volume Level

Rotating the **Volume** control clockwise increases the volume level. Rotating the **Volume** control counterclockwise decreases the volume level.

Note

- The volume level for Warning Tone and Control Tone are fixed to the value configured in **Tone Volume**. Therefore, the volume level cannot be changed by using the **Volume** control. (Refer to Configuring the Volume Level of Each Tone (Tone Volume).)

3.4 Using PF Keys

If any key is pressed, the LED lights red and the function assigned to the key is activated or enabled.

If the repeater is operated in trunking mode, the functions assigned to the **[MON]**, **[TAKE OVER]** and **[RPT DISABLE]** keys at the top are fixed. The **[A]**, **[B]**, and **[C]** keys at the bottom cannot be used. (Refer to AVAILABLE FUNCTIONS FOR THE PF KEYS.)

3.5 Tones that Sound When a User Operates the Repeater or When the Repeater Status Is Changed

The following tones are used by the repeater:

Table 3-2 Tone List

Tone Name	Type	Tone Pattern
Warning Tone	Warning Tone A	continuous beep 697 Hz (until the **PTT** switch is released)
	TOT Pre-alert Tone	3 beeps 1633 Hz (50 ms)
	PLL Un Lock Tone	1 beep 1400 Hz (50 ms)
	Busy Tone	continuous beep 697 Hz (until the **PTT** switch is released)
Control Tone	Key Beep A	1 beep 1633 Hz (50 ms)
	Key Beep B	1 beep 1633 Hz (50 ms)
	Key-entry Error Tone	1 beep 697 Hz (100 ms)
	Roll Over Tone	1 beep 1633 Hz (50 ms)

Configuring the Volume Level of Each Tone (Tone Volume)

Tone Volume is the function to adjust the volume level of various tones.

This function can be used to change the volume level of the tones or mute tones depending on a usage environment.

The configuration in **Tone Volume** applies to each of the following tones:

- Warning Tone
- Control Tone

The range is from 0 to 31. Higher values result in greater volume. If “0” is configured in **Tone Volume**, no tone sounds from the repeater.

Configuration using KPG-D2

Configuring **Tone Volume** (See Edit > Optional Features > Common Page 2 > Tone)

Warning Tone

Warning Tone is the tone which sounds from the repeater before or when the repeater becomes disabled from transmitting, or when the repeater attempts to transmit while the repeater is disabled from transmitting.

The volume level of Warning Tone can be configured using KPG-D2. (Refer to Configuring the Volume Level of Each Tone (Tone Volume).)

Table 3-3 Warning Tone

Tone Name	Description
Warning Tone A	This tone sounds from the repeater while the **PTT** (microphone) switch is pressed and held after the **Time-out Timer** for the **PTT** (microphone) switch is expired or while the **TOT Rekey Time** is counting down. This tone sounds from the repeater if the External PTT control is active after the **Time-out Timer** for the External PTT control is expired. Also, this tone sounds from the repeater when the repeater attempts to transmit while transmission is disabled by a function such as **TX Disable**.
TOT Pre-alert Tone	This tone sounds from the repeater when the transmission is about to be inhibited by **Time-out Timer**.
PLL Un Lock Tone	This tone sounds from the repeater when PLL is unlocked.
Busy Tone	This tone sounds from the repeater when the **PTT** (microphone) switch is pressed and held while transmission is inhibited by the **Busy Channel Lockout** function.

Configuration using KPG-D2

Configuring **Warning Tone** to be enabled or disabled (See Edit > Optional Features > Common Page 2 > Tone)

Control Tone

Control Tone is the tone which sounds from the repeater when a **PF** key is pressed.

The volume level of Control Tone can be configured using KPG-D2. (Refer to Configuring the Volume Level of Each Tone (Tone Volume).)

Table 3-4 Control Tone

Tone Name	Description
Key Beep A	This tone sounds from the repeater when a function is activated or enabled by pressing a **PF** key. This tone sounds from the repeater when a **PF** key is pressed and the key operation is accepted.
Key Beep B	This tone sounds from the repeater when a function is deactivated or disabled by pressing a **PF** key.
Key-entry Error Tone	This tone sounds from the repeater when a **PF** key is pressed and the key operation is not accepted.
Roll Over Tone	This tone sounds from the repeater when the lowest channel is selected by pressing a **PF** key.

Configuration using KPG-D2

Configuring **Control Tone** to be enabled or disabled (See Edit > Optional Features > Common Page 2 > Tone)

3.6 Changing the Channel

If the **Channel 1** to **Channel 30** key is pressed, the repeater migrates to the corresponding channel.

Or, pressing the **Channel Down** key decreases the channel number by one step. Pressing the **Channel Up** key increases the channel number by one step. When the repeater migrates to the first channel by pressing the **Channel Down** or **Channel Up** key, a Roll Over Tone (1 beep) sounds from the repeater.

Note

- This function can be used only if the repeater is operated in conventional mode.
- The channel changes approximately 1 sec after the **Channel Down** or **Channel Up** key is pressed.

Configuration using KPG-D2

Assigning functions to the **PF** keys (See Edit > Key Assignment)

3.7 Configuring the Conditions for the Fan to Function (Fan Action)

Fan Action is the function which activates the fan equipped on the rear panel of NXR-5700/ NXR-5800 depending on the status of the repeater.

The following are the behaviors that vary depending on the configuration by using KPG-D2:

Table 3-5 Fan Action

Configuration	Description
Continuous	Starts the fan spinning when the repeater is turned on and keeps the fan spinning all the time. If the temperature sensor senses the temperature below zero degrees, the fan stops spinning.
Temperature	The fan is stopped when the repeater is turned on. The fan behaves as follows at 2 levels of rotations speed depending on the temperature inside the repeater: Approximately 55 °C or higher: slow rotation Approximately 80 °C or higher: high-speed rotation Also, the fan spins slowly if the temperature inside the repeater becomes lower than approximately 70 °C while the fan spins high-speed, and the fan stops if the temperature inside the repeater becomes lower than approximately 40 °C.

Note

- The fan cannot be configured to not operate at all.

Configuration using KPG-D2

Configuring **Fan Action** (See Edit > Optional Features > Common Page 1)

3.8 About the Functions of When Using an External Reference Signal (Reference Frequency)

The following functions are configured if an external reference signal is used in a NEXEDGE 2nd Generation trunking system:

- 50 Ohm Termination
- Startup Delay

Refer to “NEXEDGE 2nd Generation Function Reference” for the details of these functions.

Signaling is the identification signal to be used for facilitating communication within a group if the same channel is shared by multiple groups (Talkgroup).

In a wireless communications system, the same frequency is used for communications even in different groups in adjacent areas to use signals effectively. In normal communications, a signaling signal (identification signal) such as QT/DQT and RAN is put on the carrier wave of the transmitting repeater and transmitted in order to avoid receiving the communications of other groups. The receiving repeater receives the signaling signal, and if the signaling signal matches the signaling signal preconfigured for the repeater, the repeater unmutes the speaker and can communicate.

4.1 Analog Signaling System

In an Analog Conventional system, QT/DQT is used as signaling.

QT/DQT is the signaling used for analog communications by the repeater to transmit and receive an analog signal. If a QT tone or DQT code is configured for each group, the repeater continues to mute the speaker even if the repeater receives a call from other groups, except for a call from the group which the repeater waits to receive. Therefore, a user can communicate smoothly only to group members without listening to unwanted conversations among those in other groups.

This signaling does not affect voice communications because the audible frequency spectrum below 300 Hz is used for this signaling. In addition, the repeater can decode the signaling even if the repeater receives the signaling during a call because a continuous tone is used for this signaling.

- **QT (Quiet Talk)**

  QT is a type of signaling using a continuous sub-audible sine wave (67.0 Hz to 254.1 Hz). The frequency can be configured in steps of 0.1 Hz.

- **DQT (Digital Quiet Talk)**

  DQT is a type of signaling using “1” and “0” in the 23-bit word. An octal code with a number between 000 and 777 can be configured. The DQT signal has a polarity and can be configured as Normal or Inverted, corresponding to the circuit configuration of a repeater or a target repeater.

QT/DQT Decode

QT/DQT Decode is the signaling which is used by the repeater to wait to receive an analog signal.

On a channel with “Analog” or “Mixed” configured in **Channel Type**, if the received QT tone or DQT code matches the QT tone or DQT code configured for the channel, the repeater unmutes the speaker and emits received audio. If the repeater is on a channel with “Repeat” configured in **Operation Mode**, the repeater starts the repeat behavior.

If a subscriber unit receives a QT Reverse Burst code or DQT Turn-off code, the subscriber unit mutes the speaker. (Refer to Preventing the receiving party from emitting the squelch tail noise after transmission ends (Squelch Tail Elimination).)

Also, a maximum of 15 combinations of QT tone and DQT code (Current) can be configured in addition to the QT tone and DQT code (Primary) configured for each channel, and the repeater can wait to receive using the QT/DQT configured for Primary and Current. (Refer to Waiting to receive multiple QT/DQT (Multiple Encode/Decode Table).)

Configuration using KPG-D2

Configuring **QT/DQT Decode** (See Edit > Channel Information/ Channel Edit)

Waiting to receive multiple QT/DQT (Multiple Encode/Decode Table)

Multiple Encode/Decode Table is the table in which the Encode/Decode signaling that the repeater waits to receive along with the Primary signaling (the QT tone or DQT code) configured for each channel is configured. If this function is used, the repeater can wait to receive a maximum of 16 combinations of signaling (a combination of Primary + 15 combinations of Encode/Decode tones and codes).

A maximum of 15 combinations of QT/DQT can be configured in **Multiple Encode/Decode Table**. The signaling configured for each channel is used as Primary for "No.1" in **Multiple Encode/Decode Table**.

Also, by assigning the function to change **Multiple Encode/Decode Table** to an AUX Input/Output port, the signaling table to be used can be changed depending on the status of the port. (Refer to Available Functions for the AUX Input/Output Port.)

To use this function, the following configurations need to be configured using KPG-D2:

- **Configuring Multiple Encode/Decode Table**

  A maximum of 15 **Multiple Encode/Decode Tables** can be configured. A maximum of 15 combinations of QT/DQT are configured for each table. The QT/DQT configured for each channel is used as Primary for "No.1" in **Multiple Encode/Decode Table**.

- **Configuring the Multiple Encode/Decode Table number to be used for each channel**

  The number of **Multiple Encode/Decode Table** (1 to 15) can be configured for each channel. The repeater can wait to receive the QT/DQT configured for a channel and the QT/DQT configured in the **Multiple Encode/Decode Table** of the specified number.

- **Configuring Encode Tone (Multiple)**

  The QT/DQT to be used to transmit using the **PTT** (microphone) switch or the External PTT control can be configured if the repeater receives the QT/DQT on the channel with **Multiple Encode/Decode Table** configured. (Refer to Configuring the conditions for the QT/DQT encoding while waiting to receive multiple signaling (Encode Tone (Multiple)).)

Configuration using KPG-D2

Configuring **Multiple Encode/Decode Table** (See Edit > Multiple Encode/Decode Table)

Toggling the QT/DQT decoding between enabled and disabled (Decode Signaling Enable/ Disable)

Decode Signaling Enable/Disable is the function to enable or disable the QT/DQT decoding.

When **Decode Signaling Disable** is enabled, the repeater cannot decode QT/DQT.

The QT/DQT decoding can be enabled or disabled when a **PF** key is pressed, when the signal is applied to an AUX Input port, or when the repeater is turned on.

Table 4-1 Toggling the QT/DQT Decoding between Enabled and Disabled

Trigger	Assigned Functions	See
PF key	Decode Signaling Enable/Disable	AVAILABLE FUNCTIONS FOR THE PF KEYS
AUX Input Port	Decode Signaling Disable Decode Signaling Enable Decode Signaling Enable/Disable	Available Functions for the AUX Input Ports
Startup	Decode Signaling Disable Decode Signaling Enable	Assigning Functions that Become Active or Enabled When the Repeater Starts Up (Startup)

Note

- The QT/DQT decoding cannot be toggled between enabled and disabled while the repeater is repeating. The QT/DQT decoding can be toggled between enabled and disabled during transmission other than the repeat behavior.
- When the repeater transmits by using the Repeat PTT control while **Decode Signaling Disable** is enabled, the QT/DQT (Primary) configured for each channel of the repeater is used as the signaling of the downlink signal from the repeater.

QT/DQT Encode

QT/DQT Encode is the signaling for calling which is used by the repeater to transmit an analog signal.

If the repeater transmits on a channel with “Analog” configured in **Channel Type** or a channel with “Analog” configured in **Transmit Mode**, the repeater sends the QT tone or DQT code configured for the channel.

When transmission ends on a channel for which a DQT code is configured, a DQT Turn-off code is sent.

Also, if **QT Reverse Burst** is enabled, a QT Reverse Burst code is sent when transmission ends on a channel for which a QT code is configured. (Refer to Preventing the receiving party from emitting the squelch tail noise after transmission ends (Squelch Tail Elimination).)

Configuration using KPG-D2

Configuring **QT/DQT Encode** (See Edit > Channel Information/ Channel Edit)

Preventing the receiving party from emitting the squelch tail noise after transmission ends (Squelch Tail Elimination)

Squelch Tail Elimination is the function to prevent the speaker of the receiving party from emitting the squelch tail noise after transmission ends.

● DQT Turn-off Code

DQT Turn-off Code is the function to prevent the speaker of the receiving party from emitting the squelch tail noise by sending a DQT Turn-off code after transmission ends on a channel for which DQT Encode is configured.

If the receiving subscriber unit receives a DQT Turn-off code, the received audio signal is muted.

The duration to send a DQT Turn-off code can be configured according to the DQT Decode characteristics of the subscriber unit used in a repeater system.

Note

- Adjust the duration to send a DQT Turn-off code in **DQT Turn-off Code** if the receiving subscriber unit emits the squelch tail noise due to a failure in receiving a DQT Turn-off code.

● QT Reverse Burst

QT Reverse Burst is the function to prevent the speaker of the receiving party from emitting the squelch tail noise by sending a QT Reverse Burst code after transmission ends on the channel with the QT Encode configured.

If the receiving subscriber unit receives a QT Reverse Burst code, the received audio signal is muted.

Whether to send a QT Reverse Burst code can be configured for each channel. Also, the duration to send a QT Reverse Burst code can be configured according to the QT Decode characteristics of the subscriber unit used in a repeater system.

Note

- If the receiving subscriber unit cannot receive a QT Reverse Burst code and the squelch tail noise is generated, adjust the duration to send a QT Reverse Burst code in **QT Reverse Burst Time** by using KPG-D2.

Configuration using KPG-D2

- Configuring **DQT Turn-off Code** (See Edit > Optional Features > Common Page 1)
- Configuring **QT Reverse Burst** to be enabled or disabled (See Edit > Channel Information/ Channel Edit)
- Configuring **QT Reverse Burst Time** (See Edit > Optional Features > Common Page 1)

Configuring the conditions for the QT/DQT encoding while waiting to receive multiple signaling (Encode Tone (Multiple))

Encode Tone (Multiple) is a signaling type to be used to transmit using the **PTT** (microphone) switch or the External PTT control if the repeater receives signaling on a channel for which **Multiple Encode/Decode Table** is configured.

The repeater can wait to receive multiple signaling by using **Multiple Encode/Decode Table**. (Refer to Waiting to receive multiple QT/DQT (Multiple Encode/Decode Table).)

On a channel using **Multiple Encode/Decode Table**, whether the signaling configured in **Multiple Encode/Decode Table** is used for transmission or the signaling configured for the channel is used for transmission can be configured in **Encode Tone (Multiple)**.

● Repeater behavior when "Primary" is configured in Encode Tone (Multiple)

The repeater always transmits with the signaling configured for the channel when the repeater transmits using the **PTT** (microphone) switch or the External PTT control.

Table 4-2 Primary

Repeater Status	PTT Priority	Operation	Action
A channel is available or the received signaling and the signaling configured in **Multiple Encode/ Decode Table** do not match	Repeat PTT < **PTT** (microphone) switch, External PTT	Request for transmission using the **PTT** (microphone) switch or the External PTT control	The repeater encodes a signal using the signaling (Primary) configured for each channel. The repeater continues encoding using Primary even if the signaling (Current) configured in **Multiple Encode/Decode Table** matches while the repeater is transmitting. In this case, if the **PTT** (microphone) switch or External PTT control becomes disabled first, the repeater starts encoding using Current after sending a Primary QT Reverse Burst code or DQT Turn-off code.
	Repeat PTT > **PTT** (microphone) switch, External PTT		The repeater encodes a signal using the signaling (Primary) configured for each channel. The repeater starts encoding with the signaling (Current) configured in **Multiple Encode/Decode Table** if the signaling configured in **Multiple Encode/Decode Table** matches while the repeater is transmitting. In this case, if the signaling configured in **Multiple Encode/Decode Table** becomes inconsistent first, the repeater starts encoding using Primary after sending a Current QT Reverse Burst code or DQT Turn-off code.
If the signaling configured in **Multiple Encode/ Decode Table** matches and the repeater transmits using the Repeat PTT control	Repeat PTT < **PTT** (microphone) switch, External PTT		The repeater encodes a signal using the signaling (Primary) configured for each channel. If the transmission by using the Repeat PTT control continues when the **PTT** (microphone) switch or External PTT control is disabled, the repeater starts encoding using Current after sending a Primary QT Reverse Burst code or DQT Turn-off code.
	Repeat PTT > **PTT** (microphone) switch, External PTT		The repeater continues encoding using the signaling (Current) configured in **Multiple Encode/Decode Table**. If the **PTT** (microphone) switch or External PTT control is enabled when the signaling configured in **Multiple Encode/Decode Table** becomes inconsistent, the repeater starts encoding using Primary after sending a Current QT Reverse Burst code or DQT Turn-off code.

● Repeater behavior when “Current” is configured in Encode Tone (Multiple)

When the repeater waits to receive the signaling configured in **Multiple Encode/Decode Table**, the repeater transmits by using the encode signaling corresponding to the signaling currently decoded when the repeater transmits by using the **PTT** (microphone) switch or External PTT control.

When the repeater does not wait to receive the signaling configured in **Multiple Encode/Decode Table**, the repeater transmits by using the signaling configured for the channel when the repeater transmits by using the **PTT** (microphone) switch or External PTT control. In this case, the signaling encoding continues even if the repeater receives a signal during transmission.

Table 4-3 Current

<table>
<tr><th>Repeater Status</th><th>PTT Priority</th><th>Operation</th><th>Action</th></tr>
<tr><td rowspan="2">A channel is available or the received signaling and the signaling configured in Multiple Encode/ Decode Table do not match</td><td>Repeat PTT < PTT (microphone) switch, External PTT</td><td rowspan="4">Request for transmission using the PTT (microphone) switch or the External PTT control</td><td>The repeater encodes a signal using the signaling (Primary) configured for each channel.
The repeater continues encoding using Primary even if the signaling (Current) configured in Multiple Encode/Decode Table matches while the repeater is transmitting. In this case, if the PTT (microphone) switch or External PTT control becomes disabled first, the repeater starts encoding using Current after sending a Primary QT Reverse Burst code or DQT Turn-off code.</td></tr>
<tr><td>Repeat PTT > PTT (microphone) switch, External PTT</td><td>The repeater encodes a signal using the signaling (Primary) configured for each channel.
The repeater starts encoding with the signaling (Current) configured in Multiple Encode/Decode Table if the signaling configured in Multiple Encode/Decode Table matches while the repeater is transmitting. In this case, if the signaling configured in Multiple Encode/Decode Table becomes inconsistent first, the repeater starts encoding using Primary after sending a Current QT Reverse Burst code or DQT Turn-off code.</td></tr>
<tr><td rowspan="2">If the signaling configured in Multiple Encode/ Decode Table matches and the repeater transmits using the Repeat PTT control</td><td>Repeat PTT < PTT (microphone) switch, External PTT</td><td>The repeater continues encoding using the signaling (Current) configured in Multiple Encode/Decode Table.
Even if the signaling configured in Multiple Encode/Decode Table becomes inconsistent while the PTT (microphone) switch or External PTT control is enabled, the repeater continues encoding by using Current while the transmission using the same PTT continues.</td></tr>
<tr><td>Repeat PTT > PTT (microphone) switch, External PTT</td><td>The repeater continues encoding using the signaling (Current) configured in Multiple Encode/Decode Table.
If the PTT (microphone) switch or External PTT control is enabled when the signaling configured in Multiple Encode/ Decode Table becomes inconsistent, the repeater starts encoding using Primary after sending a Current QT Reverse Burst code or DQT Turn-off code.</td></tr>
</table>

Note

- Because the repeater cannot receive and transmit at the same time if the repeater is on a channel with “Simplex” configured in **Operation Mode**, the repeater always transmits with “Primary” configured.
- Because the repeater can also receive a signal in a mode different from **Transmit Mode** on a channel with “Mixed” configured in **Channel Type**, the repeater always transmits with “Primary” configured.
- Refer to “Transmitting by Using the Communication Method of Reception (Signaling Reset Timer)” for the transmission behavior on a channel with “Mixed” configured in **Channel Type** and “None” configured in **Multiple Encode/Decode Table**.

Configuration using KPG-D2

Configuring **Encode Tone (Multiple)** (See Edit > Channel Information/ Channel Edit)

Toggling the QT/DQT encoding between enabled and disabled (Encode Signaling Enable/ Disable)

Encode Signaling Enable/Disable is the function to enable or disable the QT/DQT encoding.

When **Encode Signaling Disable** is enabled, the repeater cannot encode QT/DQT.

The QT/DQT encoding can be enabled or disabled when a **PF** key is pressed, when the signal is applied to an AUX Input port, or when the repeater is turned on.

Table 4-4 Toggling the QT/DQT Encoding between Enabled and Disabled

Trigger	Assigned Functions	See
PF key	Encode Signaling Enable/Disable	AVAILABLE FUNCTIONS FOR THE PF KEYS
AUX Input Port	Encode Signaling Disable Encode Signaling Enable Encode Signaling Enable/Disable	Available Functions for the AUX Input Ports
Startup	Encode Signaling Disable Encode Signaling Enable	Assigning Functions that Become Active or Enabled When the Repeater Starts Up (Startup)

Note

- The QT/DQT encoding cannot be toggled between enabled and disabled while the repeater is transmitting by using anything other than the External PTT control.

4.2 Digital Signaling System

In an NXDN Conventional system, a RAN code is used as signaling.

RAN (Radio Access Number) is the signaling for NXDN digital communications used by the repeater to transmit and receive a digital signal. If a RAN code is configured for each group, the repeater continues to mute even if the repeater receives a call from other groups, except for a call from the group which the repeater waits to receive. Therefore, a user can communicate smoothly only to group members without listening to unwanted conversations among those in other groups.

The repeater can decode the signaling even if the repeater receives the signaling during a call because a continuous tone is used for this signaling.

Also, the repeater transmits using the Repeat PTT control only if the repeater receives a signal matching the RAN code while the repeater transmits the received signal using the Repeat PTT control.

- **RAN (Radio Access Number)**

  RAN is a digital signaling having the same functions as analog QT/DQT. RAN code 1 to RAN code 63 can be configured.

RAN Decode

RAN Decode is the signaling for waiting to receive used by the repeater to receive an NXDN digital signal.

On a channel with “NXDN” or “Mixed” configured in **Channel Type**, if the received RAN code matches the RAN code configured for the channel, the repeater unmutes the speaker and emits received audio. If the repeater is on a channel with “Repeat” configured in **Operation Mode**, the repeater starts the repeat behavior.

Also, a maximum of 15 RAN codes (Current) in addition to the RAN code (Primary) configured for each channel can be configured, and the repeater can wait to receive using the RAN codes configured for Primary and Current. (Refer to Waiting to receive multiple RAN codes (Multiple Encode/Decode Table).)

Configuration using KPG-D2

Configuring **RAN Decode** (See Edit > Channel Information/ Channel Edit)

Waiting to receive multiple RAN codes (Multiple Encode/Decode Table)

Multiple Encode/Decode Table is the table in which the Encode/Decode signaling that the repeater waits to receive along with the Primary signaling (RAN code) configured for each channel is configured. If this function is used, the repeater can wait to receive a maximum of 16 combinations of signaling (a combination of Primary + 15 combinations of Encode/Decode tones and codes).

A maximum of 15 combinations of RAN codes can be configured in **Multiple Encode/Decode Table**. The signaling configured for each channel is used as Primary for “No.1” in **Multiple Encode/Decode Table**.

Also, by assigning the function to change **Multiple Encode/Decode Table** to an AUX Input/Output port, the signaling table to be used can be changed depending on the status of the port. (Refer to Available Functions for the AUX Input/Output Port.)

To use this function, the following configurations need to be configured using KPG-D2:

- **Configuring Multiple Encode/Decode Table**

  A maximum of 15 **Multiple Encode/Decode Tables** can be configured. A maximum of 15 combinations of RAN codes are configured for each table. The RAN code configured for each channel is used as Primary for “No.1” in **Multiple Encode/Decode Table**.

- **Configuring the Multiple Encode/Decode Table number to be used for each channel**

  The number of **Multiple Encode/Decode Table** (1 to 15) can be configured for each channel. The repeater can wait to receive the RAN code configured for a channel and the RAN code configured in the **Multiple Encode/Decode Table** of the specified number.

- **Configuring Encode Tone (Multiple)**

  The RAN code to be used to transmit using the **PTT** (microphone) switch or the External PTT control can be configured if the repeater receives the RAN code on the channel with **Multiple Encode/Decode Table** configured. (Refer to Configuring the conditions for the RAN encoding while waiting to receive multiple signaling (Encode Tone (Multiple)).)

Note

- When the repeater is operated in the base station mode (simplex or duplex), **Multiple Encode/Decode Table** cannot be used for data communications (Status Call, Short Data Call, Long Data Call, etc.) between the repeater and a subscriber unit. In this case, the repeater receives only the data that matches the Primary RAN code. This is because an acknowledgment is sent by using the Primary RAN code even if the data is received by using the RAN code configured in **Multiple Encode/Decode Table**. However, even if the data added to the audio signal matches the RAN code configured in **Multiple Encode/Decode Table**, this audio signal can be received. Also, if the repeater is operated in a repeater system, data communications between the repeater and a subscriber unit can be repeated by using **Multiple Encode/Decode Table**. However, no means exists for confirming which number of the signaling in **Multiple Encode/Decode Table** the signal being received matches.

Configuration using KPG-D2

Configuring **Multiple Encode/Decode Table** (See Edit > Multiple Encode/Decode Table)

Toggling the RAN decoding between enabled and disabled (Decode Signaling Enable/ Disable)

Decode Signaling Enable/Disable is the function to enable or disable the RAN code decoding.

When **Decode Signaling Disable** is enabled, the repeater cannot decode a RAN code.

The RAN decoding can be enabled or disabled when a **PF** key is pressed, when the signal is applied to an AUX Input port, or when the repeater is turned on.

Table 4-5 Toggling the RAN Decoding between Enabled and Disabled

Trigger	Assigned Functions	See
PF key	Decode Signaling Enable/Disable	AVAILABLE FUNCTIONS FOR THE PF KEYS
AUX Input Port	Decode Signaling Disable Decode Signaling Enable Decode Signaling Enable/Disable	Available Functions for the AUX Input Ports
Startup	Decode Signaling Disable Decode Signaling Enable	Assigning Functions that Become Active or Enabled When the Repeater Starts Up (Startup)

Note

- The RAN decoding cannot be toggled between enabled and disabled while the repeater is repeating. The RAN decoding can be toggled between enabled and disabled during transmission other than the repeat behavior.
- When the repeater transmits by using the Repeat PTT control while **Decode Signaling Disable** is enabled, the RAN code (Primary) configured for each channel of the repeater is used as the signaling of the downlink signal from the repeater.

RAN Encode

RAN Encode is the signaling for calling which is used by the repeater to transmit an NXDN digital signal.

If the repeater transmits on a channel with “NXDN” configured in **Channel Type** or a channel with “NXDN” configured in **Transmit Mode**, the repeater sends the RAN code configured for the channel.

Configuration using KPG-D2

Configuring **RAN Encode** (See Edit > Channel Information/ Channel Edit)

Configuring the conditions for the RAN encoding while waiting to receive multiple signaling (Encode Tone (Multiple))

Encode Tone (Multiple) is a signaling type to be used to transmit using the **PTT** (microphone) switch or the External PTT control if the repeater receives signaling on a channel for which **Multiple Encode/Decode Table** is configured.

The repeater can wait to receive multiple signaling by using **Multiple Encode/Decode Table**. On a channel using **Multiple Encode/Decode Table**, whether the signaling configured in **Multiple Encode/Decode Table** is used for transmission or the signaling configured for the channel is used for transmission can be configured in **Encode Tone (Multiple)**. (Refer to Waiting to receive multiple RAN codes (Multiple Encode/Decode Table).)

- **Repeater behavior when “Primary” is configured in Encode Tone (Multiple)**

  The repeater always transmits with the signaling configured for the channel when the repeater transmits using the **PTT** (microphone) switch or the External PTT control.

Table 4-6 Primary

Repeater Status	PTT Priority	Operation	Action
A channel is available or the received signaling and the signaling configured in **Multiple Encode/ Decode Table** do not match	Repeat PTT < **PTT** (microphone) switch, External PTT	Request for transmission using the **PTT** (microphone) switch or the External PTT control	The repeater encodes a signal using the signaling (Primary) configured for each channel. The repeater continues encoding using Primary even if the signaling (Current) configured in **Multiple Encode/Decode Table** matches while the repeater is transmitting. In this case, if the **PTT** (microphone) switch or External PTT control becomes disabled first, the repeater starts encoding using Current after sending a Primary TX REL message.
	Repeat PTT > **PTT** (microphone) switch, External PTT		The repeater encodes a signal using the signaling (Primary) configured for each channel. The repeater starts encoding with the signaling (Current) configured in **Multiple Encode/Decode Table** if the signaling configured in **Multiple Encode/Decode Table** matches while the repeater is transmitting. In this case, if the signaling configured in **Multiple Encode/Decode Table** does not match first, the repeater starts encoding using Primary after sending a Current TX REL message.
If the signaling configured in **Multiple Encode/ Decode Table** matches and the repeater transmits using the Repeat PTT control	Repeat PTT < **PTT** (microphone) switch, External PTT		The repeater encodes a signal using the signaling (Primary) configured for each channel. If the repeater continues to transmit using the Repeat PTT control while the **PTT** (microphone) switch or the External PTT control is disabled, the repeater starts encoding using Current after sending a Primary TX REL message.
	Repeat PTT > **PTT** (microphone) switch, External PTT		The repeater continues encoding using the signaling (Current) configured in **Multiple Encode/Decode Table**. If the **PTT** (microphone) switch or External PTT control is enabled when the signaling configured in **Multiple Encode/Decode Table** does not match, the repeater starts encoding using Primary after sending a Current TX REL message.

- **Repeater behavior when “Current” is configured in Encode Tone (Multiple)**

When the repeater waits to receive the signaling configured in **Multiple Encode/Decode Table**, the repeater transmits by using the encode signaling corresponding to the signaling currently decoded when the repeater transmits by using the **PTT** (microphone) switch or External PTT control.

When the repeater does not wait to receive the signaling configured in **Multiple Encode/Decode Table**, the repeater transmits by using the signaling configured for the channel when the repeater transmits by using the **PTT** (microphone) switch or External PTT control. In this case, the signaling encoding continues even if the repeater receives a signal during transmission.

Table 4-7 Current

Repeater Status	PTT Priority	Operation	Action
A channel is available or the received signaling and the signaling configured in **Multiple Encode/ Decode Table** do not match	Repeat PTT < **PTT** (microphone) switch, External PTT	Request for transmission using the **PTT** (microphone) switch or the External PTT control	The repeater encodes a signal using the signaling (Primary) configured for each channel. The repeater continues encoding using Primary even if the signaling (Current) configured in **Multiple Encode/Decode Table** matches while the repeater is transmitting. In this case, if the **PTT** (microphone) switch or External PTT control becomes disabled first, the repeater starts encoding using Current after sending a Primary TX REL message.
	Repeat PTT > **PTT** (microphone) switch, External PTT		The repeater encodes a signal using the signaling (Primary) configured for each channel. The repeater starts encoding with the signaling (Current) configured in **Multiple Encode/Decode Table** if the signaling configured in **Multiple Encode/Decode Table** matches while the repeater is transmitting. In this case, if the signaling configured in **Multiple Encode/Decode Table** does not match first, the repeater starts encoding using Primary after sending a Current TX REL message.
If the signaling configured in **Multiple Encode/ Decode Table** matches and the repeater transmits using the Repeat PTT control	Repeat PTT < **PTT** (microphone) switch, External PTT		The repeater continues encoding using the signaling (Current) configured in **Multiple Encode/Decode Table**. Even if the signaling configured in **Multiple Encode/Decode Table** becomes inconsistent while the **PTT** (microphone) switch or External PTT control is enabled, the repeater continues encoding by using Current while the transmission using the same PTT continues.
	Repeat PTT > **PTT** (microphone) switch, External PTT		The repeater continues encoding using the signaling (Current) configured in **Multiple Encode/Decode Table**. If the **PTT** (microphone) switch or External PTT control is enabled when the signaling configured in **Multiple Encode/ Decode Table** does not match, the repeater starts encoding using Primary after sending a Current TX REL message.

Note

- Because the repeater cannot receive and transmit at the same time if the repeater is on a channel with “Simplex” configured in **Operation Mode**, the repeater always transmits with “Primary” configured.
- Because the repeater can also receive a signal in a mode different from **Transmit Mode** on a channel with “Mixed” configured in **Channel Type**, the repeater always transmits with “Primary” configured.
- Refer to “Transmitting by Using the Communication Method of Reception (Signaling Reset Timer)” for the transmission behavior on a channel with “Mixed” configured in **Channel Type** and “None” configured in **Multiple Encode/Decode Table**.

Configuration using KPG-D2

Configuring **Encode Tone (Multiple)** (See Edit > Channel Information/ Channel Edit)

Toggling the RAN encoding between enabled and disabled (Encode Signaling Enable/ Disable)

Encode Signaling Enable/Disable is the function to enable or disable the RAN code encoding.

When **Encode Signaling Disable** is enabled, the repeater cannot encode a RAN code.

The RAN encoding can be enabled or disabled when a **PF** key is pressed, when the signal is applied to an AUX Input port, or when the repeater is turned on.

Table 4-8 Toggling the RAN Encoding between Enabled and Disabled

Trigger	Assigned Functions	See
PF key	Encode Signaling Enable/Disable	AVAILABLE FUNCTIONS FOR THE PF KEYS
AUX Input Port	Encode Signaling Disable Encode Signaling Enable Encode Signaling Enable/Disable	Available Functions for the AUX Input Ports
Startup	Encode Signaling Disable Encode Signaling Enable	Assigning Functions that Become Active or Enabled When the Repeater Starts Up (Startup)

Note

- The RAN encoding cannot be toggled between enabled and disabled while transmitting by using anything other than the External PTT control.

4.3 Transmission Mode of a Mixed Channel

The repeater can wait to receive both analog signals and NXDN digital signals on a channel with “Mixed” configured in **Channel Type** (mixed channel). On a mixed channel, when the repeater transmits by using the **PTT** (microphone) switch or External PTT control, the repeater transmits by using the communication method configured in **Transmit Mode** (Analog or NXDN). However, if **Signaling Reset Timer** is configured, the repeater can transmit by using the same communication method as the received signal regardless of the configuration in **Transmit Mode**.

Transmitting by Using the Communication Method of Reception (Signaling Reset Timer)

Signaling Reset Timer is the length of time to transmit in the same communication method (either Analog or NXDN) as the communication method of the received signal regardless of the configuration in **Transmit Mode**, if the repeater receives a signal on a mixed channel and the received signaling matches the signaling preconfigured for the repeater.

On a mixed channel, whether the repeater transmits in analog mode or the NXDN digital mode can be configured in **Transmit Mode**. Configuring **Signaling Reset Timer** enables the repeater to receive an analog signal, and if the received QT tone or DQT code matches the QT tone or DQT code preconfigured for the repeater, the repeater transmits in the same analog mode as the received signal during the length of time configured in **Signaling Reset Timer**.

Or, if the repeater receives an NXDN digital signal and the received RAN code matches the RAN code preconfigured for the repeater, the repeater transmits in the same NXDN digital mode as the received signal during the length of time configured in **Signaling Reset Timer**.

Signaling Reset Timer starts counting down after reception has been completed.

This function can be used only if the repeater transmits using the **PTT** (microphone) switch or the External PTT control.

The following are the communication methods on a mixed channel depending on the receiving conditions and the configuration in **Transmit Mode**:

Table 4-9 Signaling Reset Timer (1 sec to 300 sec)

Receiving Conditions	Transmit Mode	Communication Method for Transmission Using the PTT (microphone) Switch or External PTT Control
If no signal is received or no received signaling matches the signaling preconfigured for the repeater on a mixed channel used for transmission	Analog	Analog
	NXDN	NXDN
If an **NXDN** digital signal is received and the received signaling matches the signaling preconfigured for the repeater	Analog	NXDN
	NXDN	NXDN
If the reception of an **NXDN** digital signal ends and while the length of time configured in **Signaling Reset Timer** is counting down	Analog	NXDN
	NXDN	NXDN
If the reception of an **NXDN** digital signal ends and the length of timer configured in **Signaling Reset Timer** elapses	Analog	Analog
	NXDN	NXDN
If an analog signal is received and the received signaling matches the signaling preconfigured for the repeater	Analog	Analog
	NXDN	Analog
If the reception of an analog signal ends and while the length of time configured in **Signaling Reset Timer** is counting down	Analog	Analog
	NXDN	Analog
If the reception of an analog signal ends and the length of time configured in **Signaling Reset Timer** elapses	Analog	Analog
	NXDN	NXDN

If “Off” is configured in **Signaling Reset Timer**, the length of time is no longer restricted, and the repeater transmits in the mode where the repeater has received a signal previously using the **PTT** (microphone) switch or External PTT control. This condition is reset if a channel is changed, if the software is re-started, or if the repeater is turned off.

Table 4-10 Signaling Reset Timer (Off)

Receiving Conditions	Transmit Mode	Communication Method for Transmission Using the PTT (microphone) Switch or External PTT Control
If no signal is received or no received signaling matches the signaling preconfigured for the repeater on a mixed channel used for transmission	Analog	Analog
	NXDN	NXDN
If an NXDN digital signal is received and the received signaling matches the signaling preconfigured for the repeater	Analog	NXDN
	NXDN	NXDN
If an NXDN digital signal is received and the received signaling matches the signaling previously configured for the repeater	Analog	NXDN
	NXDN	NXDN
If an analog signal is received and the received signaling matches the signaling preconfigured for the repeater	Analog	Analog
	NXDN	NXDN
If an analog signal is received and the received signaling matches the signaling previously configured for the repeater	Analog	Analog
	NXDN	Analog

Note

- Even on a mixed channel, the repeater always transmits by using the communication method configured in **Transmit Mode** on a channel with **Multiple Encode/Decode Table** used if the transmission is made using the **PTT** (microphone) switch or External PTT control regardless of the configuration in **Signaling Reset Timer** and receiving conditions.

Configuration using KPG-D2

Configuring **Signaling Reset Timer** (See Edit > Optional Features > Common Page 1)

5 AVAILABLE FUNCTIONS FOR THE PF KEYS

Functions can be assigned to each key of the **PF 1** to **PF 6** keys on the repeater. Pressing the **PF** key activates or enables the preconfigured function.

The following are the functions that can be assigned to the **PF** keys:

Note

- If the repeater is operated in trunking mode, the functions assigned to the **[MON]**, **[TAKE OVER]** and **[RPT DISABLE]** keys at the top are fixed. The **[A]**, **[B]**, and **[C]** keys at the bottom cannot be used.

Table 5-1 Available Functions for the PF Keys

Function Name	Description	Remarks
None	No function is activated.	
AUX Out 1 On/Off to AUX Out 5 On/Off	Activates or deactivates the corresponding AUX Output port.	• Refer to USING FUNCTION PORTS. • This function can be assigned only if “Selectable” is configured in **AUX Out 1** to **AUX Out 5**.
AUX I/O 1 On/Off to AUX I/O 6 On/Off	Activates or inactivates the corresponding AUX I/O port.	• Refer to USING FUNCTION PORTS. • This function can be assigned only if “Selectable” is configured in **AUX In/Out 1** to **AUX In/Out 6**.
Channel 1 to Channel 30	Migrates to the corresponding channel.	
Channel Down	Decreases the channel number by one step.	
Channel Up	Increases the channel number by one step.	
CW ID On	Sends the CW ID.	
CW Message 1 to CW Message 8	Sends the corresponding CW message.	
DC Power Save On/Off	Enables or Disables DC Power Save Mode.	• Refer to REDUCING THE CURRENT CONSUMPTION OF THE REPEATER (DC POWER SAVE). • **Display On/Off** can be activated only while the repeater is in DC Power Save Mode.
Display On/Off	Enables or disables **Display On**.	
Hold Time Enable/ Disable	Enables or disables **Repeater Hold Time**.	• Refer to Continuing Transmission for a Certain Length of Time After Reception Stops (Repeater Hold Time). • This function can be assigned only if anything other than “Off” is configured in **Repeater Hold Time**.

Function Name	Description	Remarks
Local TX Enable/ Disable	Enables or disables the transmissions by using the **PTT** (microphone) switch.	Refer to Toggling the Transmission by Pressing the PTT (Microphone) Switch between Enabled and Disabled (Local TX Enable/Disable).
Low Power On/Off	Switches the transmission power to low power or high power.	This function can be activated only on a channel with "High" configured in **Transmit Power**. (Refer to Configuring the Transmission Power Level.)
Monitor Momentary	Disables the signaling decoding with the QT tone, DQT code, or RAN code while the **Monitor Momentary** key is pressed and held. On an analog channel, the repeater unmutes the speaker when the repeater receives a signal. The repeater unmutes the speaker upon detection of a frame on an NXDN digital channel.	Refer to Temporarily Disabling the Signaling (Monitor).
Monitor On/Off	Enables or disables the signaling decoding with the QT tone, DQT code, or RAN code. If the signaling decoding with the QT tone, DQT code, or RAN code is disabled, the repeater unmutes the speaker when the repeater receives a signal on an analog channel. The repeater unmutes the speaker upon detection of a frame on an NXDN digital channel.	
Decode Signaling Enable/Disable	Enables or disables the signaling decoding with the QT tone, DQT code, or RAN code.	• Refer to Toggling the QT/DQT decoding between enabled and disabled (Decode Signaling Enable/Disable). • Refer to Toggling the RAN decoding between enabled and disabled (Decode Signaling Enable/Disable).
Encode Signaling Enable/Disable	Enables or disables the signaling encoding with the QT tone, DQT code, or RAN code.	• Refer to Toggling the QT/DQT encoding between enabled and disabled (Encode Signaling Enable/ Disable). • Refer to Toggling the RAN encoding between enabled and disabled (Encode Signaling Enable/ Disable).
Repeat Enable/Disable	Enables or disables the capability to transmit the received signal by using the Repeat PTT control.	Refer to Toggling the Repeat Behavior between Enabled and Disabled (Repeat Enable/Disable).
Reset	The repeater returns to the same state as when the repeater is turned on.	Refer to Restarting the Repeater (Reset).
Scrambler/Encryption On/Off	Enables or disables **Voice Scrambler** or **Encryption**.	Refer to Communication Security (Voice Scrambler/ Encryption).

Function Name	Description	Remarks
Squelch Off Momentary	Disables the signaling decoding with QT tone, DQT code, or RAN code while the **Squelch Off Momentary** key is pressed and held. On an analog channel, the repeater opens squelch and unmutes the speaker while the **Squelch Off Momentary** key is pressed and held. On an NXDN digital channel, the repeater opens squelch and unmutes the speaker when the repeater detects a frame while the **Squelch Off Momentary** key is pressed and held.	Refer to Squelch.
Squelch On/Off	Enables or disables the squelch.	
Take Over On/Off	Enables or disables the control from an external device. If this function is enabled, controls from the external devices connected to the following ports are prohibited: • External Monitor • External PTT • AUX Input • AUX I/O (Input)	Refer to Disabling Control from External Devices (Take Over).
Test Tone On/Off	Enables or disables the function to transmit a test tone.	Refer to Confirming Whether the Configured Analog Channel of the Repeater Works Properly (Test Tone).
TOT Enable/Disable	Enables or disables **Time-out Timer**.	Refer to Restricting the Continuous Transmission Time for the Repeater (Time-out Timer).
TX Enable/Disable	Enables or disables all transmissions.	Refer to Toggling the Transmission Behavior between Enabled and Disabled (TX Enable/Disable).
Voting Tone On/Off	Permits or inhibits the transmission of a Voting pilot tone signal.	Refer to Configuring to Transmit a Voting Pilot Tone Signal (Voting Pilot Tone).

Configuration using KPG-D2

Assigning functions to the **PF** keys (See Edit > Key Assignment)

NXR-5700 and NXR-5800 are equipped with the following input and output ports to which functions can be assigned:

The specifications of each port vary depending on the repeater operating mode (conventional mode or trunking mode).

- **AUX Input/Output 1 to AUX Input/Output 6**

Conventional mode:

Functions of AUX Input ports or AUX Output ports can be assigned to each AUX Input or Output ports. In addition, depending on the status of ports, the functions which changes a channel or signaling to be used can be assigned to AUX Input and Output ports. (Refer to Available Functions for the AUX Input/Output Port.)

Trunking mode:

Functions of AUX Input ports or AUX Output ports can be assigned to the AUX Input/Output 1 to AUX Input/ Output 5 ports. When the ports are used as an AUX Output port, various functions associated with AUX Output can be assigned to each port. (Refer to Available Functions for the AUX Output Ports.)

The AUX Input/Output 6 port can be used as an Internal Busy Output port. Internal Busy Output is the port to notify external devices that the repeater is serving as a channel in an NXDN Trunking system. If the repeater is shared for use in both an NXDN Trunking system and LTR Trunking system, the command that disables the repeater from being used in an LTR Trunking system while the system is serving as an NXDN Trunking system can be issued to an LTR Controller by using this port. (Refer to Sharing a Traffic Channel with a Different System (Cross-busy).)

- **AUX Input 1 to AUX Input 3**

Conventional mode:

AUX Input ports behave as the port to detect the voltage level of the control signal which is externally applied to AUX Input ports. A function assigned to the AUX Input port is activated or deactivated, or enabled or disabled by the level of the voltage externally applied to AUX Input ports. (Refer to Available Functions for the AUX Input Ports.)

Trunking mode:

The AUX Input 1, AUX Input 2, and AUX Input 3 ports can be used respectively as the following ports:

- External Busy Input (AUX Input 1)
  External Busy Input is the port that can be used to prevent the repeater from serving as a channel in an NXDN Trunking system upon detection of a busy signal from an external device. To prevent interference with other transceivers and systems, a busy signal can be acquired from the external device which monitors the transmit frequency by use of this port. Also, if the repeater is shared for use in both an NXDN Trunking system and LTR Trunking system, the repeater can be disabled from being used in an NXDN Trunking system while that the repeater is serving in an LTR Trunking system is detected. (Refer to Sharing a Traffic Channel with a Different System (Cross-busy).)
- Remote System Standby External Input (AUX Input 2)
  Remote System Standby External Input is a port used for temporarily deactivating a control channel in a site or reactivating the channel as a control channel. (Refer to Deactivating Temporarily the Control Channel by Remote Control (Remote System Standby).)
- Failure Channel Input (AUX Input 3)
  Failure Channel Input is the port to activate **Failure Control Channel Switching**. (Refer to Allocating Another Channel As a New Control Channel (Failure Control Channel Switching/ Failure Traffic Channel Remove).)

- **AUX Output 1 to AUX Output 5**

  Conventional mode/ Trunking mode:

  Various functions to control external devices can be assigned to the AUX Output ports. The repeater transfers control signals to the external device depending on the repeater status. (Refer to Available Functions for the AUX Output Ports.)

Each input port and output port is available on the D-sub 25-pin connector and 15-pin connector on the rear panel of the repeater. (Refer to Rear Panel.)

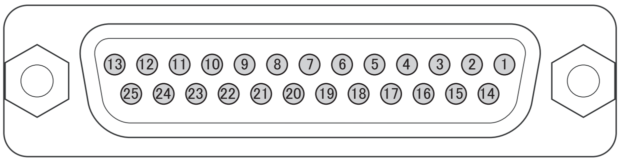


Figure 6-1 D-sub 25-pin Connector

Table 6-1 Input/Output Ports on the D-sub 25-pin Connector

Pin Number	Signal Name	Input/ Output	Description
4	AUXI 1 (AI1)	Input	Conventional mode: Programmable Function Input 1 Trunking mode: External Busy Input
5	AUXI 2 (AI2)	Input	Conventional mode: Programmable Function Input 2 Trunking mode: Remote System Standby External Input
6	AUXI 3 (AI3)	Input	Conventional mode: Programmable Function Input 3 Trunking mode: Failure Channel Input
20	AUXIO 1 (IO1)	Input/ Output	Conventional mode: Programmable Function Input/ Output 1 Trunking mode: Programmable Function Input/ Output 1
21	AUXIO 2 (IO2)	Input/ Output	Conventional mode: Programmable Function Input/ Output 2 Trunking mode: Programmable Function Input/ Output 2
22	AUXIO 3 (IO3)	Input/ Output	Conventional mode: Programmable Function Input/ Output 3 Trunking mode: Programmable Function Input/ Output 3
23	AUXIO 4 (IO4)	Input/ Output	Conventional mode: Programmable Function Input/ Output 4 Trunking mode: Programmable Function Input/ Output 4
24	AUXIO 5 (IO5)	Input/ Output	Conventional mode: Programmable Function Input/ Output 5 Trunking mode: Programmable Function Input/ Output 5

Pin Number	Signal Name	Input/ Output	Description
25	AUXIO 6 (IO6)	Input/ Output	Conventional mode: Programmable Function Input/ Output 6 Trunking mode: Internal Busy Output

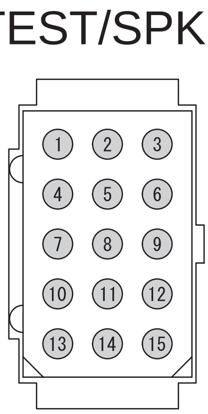


Figure 6-2 15-pin Connector

Table 6-2 Input/Output Ports on the 15-pin Connector

Pin Number	Signal Name	Input/ Output	Description
10	Auxiliary output 1 (AO1)	Output	Conventional mode: Auxiliary output 1 Trunking mode: Auxiliary output 1
11	Auxiliary output 2 (AO2)	Output	Conventional mode: Auxiliary output 2 Trunking mode: Auxiliary output 2
13	Auxiliary output 3 (AO3)	Output	Conventional mode: Auxiliary output 3 Trunking mode: Auxiliary output 3
14	Auxiliary output 4 (AO4)	Output	Conventional mode: Auxiliary output 4 Trunking mode: Auxiliary output 4
15	Auxiliary output 5 (AO5)	Output	Conventional mode: Auxiliary output 5 Trunking mode: Auxiliary output 5

6.1 Available Functions for the AUX Input/Output Port

One of the following functions can be assigned to the AUX Input/Output port:

- **AUX Input**
  The AUX Input port is assigned.

- **AUX Output**
  The AUX Output port is assigned.

- **Channel Select**
  The repeater migrates to one of the channels (1 to 16) if the voltage level of the AUX Input/ Output port goes high level or low level. A maximum of 30 channels can be configured for the repeater, but only 16 channels can be selected with **Channel Select**.

  Channel Select can be assigned only to AUX Input/Output 1 to AUX Input/Output 4 ports. The following are the channels to which the repeater can migrate according to the configuration:

Table 6-3 Channel Select 1

Assigning the Channel Select	Migratable Channels
AUX Input/Output 1 to AUX Input/Output 4	1 to 16
AUX Input/Output 1 to AUX Input/Output 3	1 to 8
AUX Input/Output 1 to AUX Input/Output 2	1 to 4
AUX Input/Output 1	1 or 2

Table 6-4 Channel Select 2

H: High, L: Low

Channel	AUX Input/ Output 4	AUX Input/ Output 3	AUX Input/ Output 2	AUX Input/ Output 1
1	H	H	H	L
2	H	H	L	H
3	H	H	L	L
4	H	L	H	H
5	H	L	H	L
6	H	L	L	H
7	H	L	L	L
8	L	H	H	H
9	L	H	H	L
10	L	H	L	H
11	L	H	L	L
12	L	L	H	H
13	L	L	H	L
14	L	L	L	H
15	L	L	L	L
16	H	H	H	H

● Multiple Enc/Dec Table Select

When the voltage level of an AUX Input/Output port is at either high level or low level, the **Multiple Encode/ Decode Table** to be used in analog communications can be selected. (Refer to Waiting to receive multiple QT/ DQT (Multiple Encode/Decode Table), Waiting to receive multiple RAN codes (Multiple Encode/Decode Table).)

Multiple Enc/Dec Table Select can be assigned only to the AUX Input/Output 1 to AUX Input/Output 4 ports.

Table 6-5 Multiple Enc/Dec Table Select

H: High, L: Low

Table No.	AUX Input/ Output 4	AUX Input/ Output 3	AUX Input/ Output 2	AUX Input/ Output 1
1	H	H	H	L
2	H	H	L	H
3	H	H	L	L
4	H	L	H	H
5	H	L	H	L
6	H	L	L	H
7	H	L	L	L
8	L	H	H	H
9	L	H	H	L
10	L	H	L	H
11	L	H	L	L
12	L	L	H	H
13	L	L	H	L
14	L	L	L	H
15	L	L	L	L
Preset	H	H	H	H

Note

- If all ports for which **Multiple Encode/Decode Table Select** is configured are inactive, the repeater uses the preconfigured **Multiple Encode/Decode Table**.
- If a port for which **Multiple Encode/Decode Table Select** is configured is activated, the repeater uses the **Multiple Encode/ Decode Table** specified in **Multiple Encode/Decode Table Select**.
- If the **Multiple Encode/Decode Table** in which both QT/DQT and a RAN code are blank is specified, the repeater uses the preconfigured **Multiple Encode/Decode Table**.
- If the **Multiple Encode/Decode Table** in which all QT/DQT are blank is specified on an analog channel, the repeater uses the preconfigured **Multiple Encode/Decode Table**.
- If the **Multiple Encode/Decode Table** in which all RAN codes are blank is specified on an NXDN digital channel, the repeater uses the preconfigured **Multiple Encode/Decode Table**.
- The repeater behaves as follows on a mixed channel:

  If both the QT/DQT and the RAN code are blank in the specified Multiple Encode/Decode Table:

  The repeater functions using the Primary signaling.

  If both the QT/DQT and the RAN code are configured in the specified Multiple Encode/Decode Table:

  The repeater functions using the signaling specified with **Multiple Enc/Dec Table Select**.

  If either QT/DQT or the RAN code is blank in the specified Multiple Encode/Decode Table:

  If no signaling is configured in **Multiple Encode/Decode Table**, the repeater functions using the Primary signaling. If a signaling type is configured in **Multiple Encode/Decode Table**, the repeater functions using the signaling specified with **Multiple Enc/Dec Table Select**.
- If **Multiple Encode/Decode Table** is specified on a channel for which **Multiple Encode/Decode Table** is not preconfigured, the Multiple Encode/Decode Table is deactivated and the repeater uses the Primary signaling.
- If **Multiple Encode/Decode Table** is specified while the repeater is transmitting, the repeater stops transmitting and uses the signaling specified in **Multiple Encode/Decode Table Select**.

Configuration using KPG-D2

Assigning functions to the AUX Input/Output port (See Edit > Function Port > AUX Select)

6.2 Available Functions for the AUX Input Ports

The following functions can be assigned to the AUX Input port.

Three functions (1st, 2nd and 3rd) can be assigned to an AUX Input port. If a signal input to the AUX Input port is detected, all assigned functions are activated or enabled.

Table 6-6 Available Functions for the AUX Input Ports

Function Name	Description	Remarks
None	No function is activated.	
AUX Out 1 Off to AUX Out 5 Off	Deactivates the corresponding AUX Output port. If “Level” is configured in **AUX Input Trigger**, the corresponding AUX Output port becomes active when the status of the port goes high level.	• Refer to USING FUNCTION PORTS. • This function can be assigned only if “Selectable” is configured in **AUX Out 1** to **AUX Out 5**.
AUX I/O 1 Off to AUX I/O 6 Off	Deactivates the corresponding AUX I/O port. If “Level” is configured in **AUX Input Trigger**, the corresponding AUX I/O port becomes active when the status of the port goes high level.	• Refer to USING FUNCTION PORTS. • This function can be assigned only if “Selectable” is configured in **AUX In/Out 1** to **AUX In/Out 6**.
AUX Out 1 On to AUX Out 5 On	Activates the corresponding AUX Output port. If “Level” is configured in **AUX Input Trigger**, the corresponding AUX Output port becomes inactive when the status of the port goes high level.	• Refer to USING FUNCTION PORTS. • This function can be assigned only if “Selectable” is configured in **AUX Out 1** to **AUX Out 5**.
AUX I/O 1 On to AUX I/O 6 On	Activates the corresponding AUX I/O port. If “Level” is configured in **AUX Input Trigger**, the corresponding AUX I/O port becomes inactive when the status of the port goes high level.	• Refer to USING FUNCTION PORTS. • This function can be assigned only if “Selectable” is configured in **AUX In/Out 1** to **AUX In/Out 6**.
AUX Out 1 On/Off to AUX Out 5 On/Off	Activates or deactivates the corresponding AUX Output port.	• Refer to USING FUNCTION PORTS. • This function can be assigned only if “Selectable” is configured in **AUX Out 1** to **AUX Out 5**. • This function can be assigned only if “Trailing Edge” is configured in **AUX Input Trigger**. (Refer to Trigger Detection at the AUX Input Port (AUX Input Trigger).)

Function Name	Description	Remarks
AUX I/O 1 On/Off to AUX I/O 6 On/Off	Activates or inactivates the corresponding AUX I/O port.	• Refer to USING FUNCTION PORTS. • This function can be assigned only if “Selectable” is configured in **AUX In/Out 1** to **AUX In/Out 6**. • This function can be assigned only if “Trailing Edge” is configured in **AUX Input Trigger**. (Refer to Trigger Detection at the AUX Input Port (AUX Input Trigger).)
Channel 1 to Channel 30	Migrates to the corresponding channel.	
Channel Down	Decreases the channel number by one step.	
Channel Up	Increases the channel number by one step.	
CW ID On	Sends the CW ID.	
CW Message 1 to CW Message 8	Sends the corresponding CW message.	
DC Power Save Off	Disables DC Power Save Mode.	• Refer to REDUCING THE CURRENT CONSUMPTION OF THE REPEATER (DC POWER SAVE). • **DC Power Save On/Off** and **Display On/Off** can be configured only if “Trailing Edge” is configured in **AUX Input Trigger**. (Refer to Trigger Detection at the AUX Input Port (AUX Input Trigger).) • **Display Off**, **Display On**, and **Display On/Off** can be activated only while the repeater is in DC Power Save Mode.
DC Power Save On	Enables DC Power Save Mode.	
DC Power Save On/Off	Enables or Disables DC Power Save Mode.	
Display Off	Disables **Display On**. The LED which is lighted by **Display On** turns off and the power sourced to an audio amplifier is shut off.	
Display On	While DC Power Save Mode is enabled, the LED lights normally and the power is supplied to an audio amplifier for the length of time configured in **Save Delay Time**.	
Display On/Off	Enables or disables **Display On**.	
Hold Time Disable	Disables **Repeater Hold Time**. If “Level” is configured in **AUX Input Trigger**, the AUX Input port enters the “Hold Time Enable” state when the status of the port goes high level.	• Refer to Continuing Transmission for a Certain Length of Time After Reception Stops (Repeater Hold Time). • This function can be assigned only if anything other than “Off” is configured in **Repeater Hold Time**.
Hold Time Enable	Enables **Repeater Hold Time**. If “Level” is configured in **AUX Input Trigger**, the AUX Input port enters the “Hold Time Disable” state when the status of the port goes high level.	

Function Name	Description	Remarks
Hold Time Enable/ Disable	Enables or disables **Repeater Hold Time**.	• Refer to Continuing Transmission for a Certain Length of Time After Reception Stops (Repeater Hold Time). • This function can be assigned only if “Trailing Edge” is configured in **AUX Input Trigger**. (Refer to Trigger Detection at the AUX Input Port (AUX Input Trigger).) • This function can be assigned only if anything other than “Off” is configured in **Repeater Hold Time**.
Local TX Disable	Disables the capability to transmit by pressing the **PTT** (microphone) switch. If “Level” is configured in **AUX Input Trigger**, the AUX Input port enters the “Local TX Enable” state when the status of the port goes high level.	Refer to Toggling the Transmission by Pressing the PTT (Microphone) Switch between Enabled and Disabled (Local TX Enable/Disable).
Local TX Enable	Enables the capability to transmit by pressing the **PTT** (microphone) switch. If “Level” is configured in **AUX Input Trigger**, the AUX Input port enters the “Local TX Disable” state when the status of the port goes high level.	
Local TX Enable/ Disable	Enables or disables the transmissions by using the **PTT** (microphone) switch.	• Refer to Toggling the Transmission by Pressing the PTT (Microphone) Switch between Enabled and Disabled (Local TX Enable/ Disable). • This function can be assigned only if “Trailing Edge” is configured in **AUX Input Trigger**. (Refer to Trigger Detection at the AUX Input Port (AUX Input Trigger).)
Low Power Off	Switches the transmission power from low power to high power. If “Level” is configured in **AUX Input Trigger**, the AUX Input port enters the “Low Power On” state when the status of the port goes high level.	This function can be activated only on a channel with “High” configured in **Transmit Power**. (Refer to Configuring the Transmission Power Level.)
Low Power On	Switches the transmission power from high power to low power. If “Level” is configured in **AUX Input Trigger**, the AUX Input port enters the “Low Power Off” state when the status of the port goes high level.	

<table>
<tr><th>Function Name</th><th>Description</th><th>Remarks</th></tr>
<tr><td>Low Power On/Off</td><td>Switches the transmission power to low power or high power.</td><td>• This function can be activated only on a channel with “High” configured in Transmit Power. (Refer to Configuring the Transmission Power Level.)
• This function can be assigned only if “Trailing Edge” is configured in AUX Input Trigger. (Refer to Trigger Detection at the AUX Input Port (AUX Input Trigger).)</td></tr>
<tr><td>Monitor Off</td><td>Enables the signaling decoding with the QT tone, DQT code or RAN code. The repeater unmutes the speaker when the signaling matches.
If “Level” is configured in AUX Input Trigger, the AUX Input port enters the “Monitor On” state when the status of the port goes high level.</td><td rowspan="2">Refer to Temporarily Disabling the Signaling (Monitor).</td></tr>
<tr><td>Monitor On</td><td>Disables the signaling decoding with the QT tone, DQT code or RAN code.
On an analog channel, the repeater unmutes the speaker when the repeater receives a signal. The repeater unmutes the speaker upon detection of a frame on an NXDN digital channel.
If “Level” is configured in AUX Input Trigger, the AUX Input port enters the “Monitor Off” state when the status of the port goes high level.</td></tr>
<tr><td>Monitor On/Off</td><td>Enables or disables the signaling decoding with the QT tone, DQT code, or RAN code.
If the signaling decode with the QT tone, DQT code or RAN code is disabled, the repeater unmutes the speaker when the repeater receives a signal on an analog channel. The repeater unmutes the speaker upon detection of a frame on an NXDN digital channel.</td><td>• Refer to Temporarily Disabling the Signaling (Monitor).
• This function can be assigned only if “Trailing Edge” is configured in AUX Input Trigger. (Refer to Trigger Detection at the AUX Input Port (AUX Input Trigger).)</td></tr>
</table>

Function Name	Description	Remarks
Decode Signaling Disable	Disables the signaling decoding with the QT tone, DQT code or RAN code. If “Level” is configured in **AUX Input Trigger**, the AUX Input port enters the “Decode Signaling Enable” state when the status of the port goes high level.	• Refer to Toggling the QT/DQT decoding between enabled and disabled (Decode Signaling Enable/Disable). • Refer to Toggling the RAN decoding between enabled and disabled (Decode Signaling Enable/Disable).
Decode Signaling Enable	Enables the signaling decoding with the QT tone, DQT code or RAN code. The repeater decodes with the QT tone, DQT code or RAN code configured for a channel. If “Level” is configured in **AUX Input Trigger**, the AUX Input port enters the “Decode Signaling Disable” state when the status of the port goes high level.	
Decode Signaling Enable/Disable	Enables or disables the signaling decoding with the QT tone, DQT code, or RAN code.	• Refer to Toggling the QT/DQT decoding between enabled and disabled (Decode Signaling Enable/Disable). • Refer to Toggling the RAN decoding between enabled and disabled (Decode Signaling Enable/Disable). • This function can be assigned only if “Trailing Edge” is configured in **AUX Input Trigger**. (Refer to Trigger Detection at the AUX Input Port (AUX Input Trigger).)
Encode Signaling Disable	Disables the signaling encoding with the QT tone, DQT code or RAN code. If “Level” is configured in **AUX Input Trigger**, the AUX Input port enters the “Encode Signaling Enable” state when the status of the port goes high level.	• Refer to Toggling the QT/DQT encoding between enabled and disabled (Encode Signaling Enable/Disable). • Refer to Toggling the RAN encoding between enabled and disabled (Encode Signaling Enable/Disable).
Encode Signaling Enable	Enables the signaling encoding with the QT tone, DQT code or RAN code. The repeater sends the QT tone, DQT code or RAN code configured for the channel when the repeater transmits. If “Level” is configured in **AUX Input Trigger**, the AUX Input port enters the “Encode Signaling Disable” state when the status of the port goes high level.	

Function Name	Description	Remarks
Encode Signaling Enable/Disable	Enables or disables the signaling encoding with the QT tone, DQT code, or RAN code.	• Refer to Toggling the QT/DQT encoding between enabled and disabled (Encode Signaling Enable/ Disable). • Refer to Toggling the RAN encoding between enabled and disabled (Encode Signaling Enable/ Disable). • This function can be assigned only if "Trailing Edge" is configured in **AUX Input Trigger**. (Refer to Trigger Detection at the AUX Input Port (AUX Input Trigger).)
Repeat Disable	Disables the capability to transmit the received signal by using the Repeat PTT control. If "Level" is configured in **AUX Input Trigger**, the AUX Input port enters the "Repeat Enable" state when the status of the port goes high level.	Refer to Toggling the Repeat Behavior between Enabled and Disabled (Repeat Enable/Disable).
Repeat Enable	Enables the capability to transmit the received signal by using the Repeat PTT control. If "Level" is configured in **AUX Input Trigger**, the AUX Input port enters the "Repeat Disable" state when the status of the port goes high level.	
Repeat Enable/Disable	Enables or disables the capability to transmit the received signal by using the Repeat PTT control.	• Refer to Toggling the Repeat Behavior between Enabled and Disabled (Repeat Enable/Disable). • This function can be assigned only if "Trailing Edge" is configured in **AUX Input Trigger**. (Refer to Trigger Detection at the AUX Input Port (AUX Input Trigger).)
Reset	The repeater returns to the same state as when the repeater is turned on.	Refer to Restarting the Repeater (Reset).
Scrambler/Encryption Off	Disables **Voice Scrambler** or **Encryption**. If "Level" is configured in **AUX Input Trigger**, the AUX Input port enters the "Scrambler/Encryption On" state when the status of the port goes high level.	Refer to Communication Security (Voice Scrambler/ Encryption).
Scrambler/Encryption On	Enables **Voice Scrambler** or **Encryption**. If "Level" is configured in **AUX Input Trigger**, the AUX Input port enters the "Scrambler/Encryption Off" state when the status of the port goes high level.	

Function Name	Description	Remarks
Scrambler/Encryption On/Off	Enables or disables **Voice Scrambler** or **Encryption**.	• Refer to Communication Security (Voice Scrambler/ Encryption). • This function can be assigned only if "Trailing Edge" is configured in **AUX Input Trigger**. (Refer to Trigger Detection at the AUX Input Port (AUX Input Trigger).)
Squelch Off	On an analog channel, the repeater opens the squelch and unmutes the speaker. On an NXDN digital channel, the repeater disables the signaling decoding by the RAN code and unmutes the speaker just by detecting an NXDN frame. If "Level" is configured in **AUX Input Trigger**, the AUX Input port enters the "Squelch On" state when the status of the port goes high level.	Refer to Squelch.
Squelch On	Closes the squelch and mutes the received audio. If "Level" is configured in **AUX Input Trigger**, the AUX Input port enters the "Squelch Off" state when the status of the port goes high level.	
Squelch On/Off	Enables or disables the squelch.	• Refer to Squelch. • This function can be assigned only if "Trailing Edge" is configured in **AUX Input Trigger**. (Refer to Trigger Detection at the AUX Input Port (AUX Input Trigger).)
TA line Pre-emphasis Off	Disables the Pre-emphasis of the TA port. The AUX Input port enters the default (TA line Pre-emphasis On) state when the status of the AUX Input port goes high level.	This function can be assigned only if "Level" is configured in **AUX Input Trigger**. (Refer to Trigger Detection at the AUX Input Port (AUX Input Trigger).)
TA line Pre-emphasis On/Off	Enables or Disables the Pre-emphasis of the TA port.	This function can be assigned only if "Trailing Edge" is configured in **AUX Input Trigger**. (Refer to Trigger Detection at the AUX Input Port (AUX Input Trigger).)

Function Name	Description	Remarks
Test Tone Off	Disables the function to transmit a test tone. If "Level" is configured in **AUX Input Trigger**, the AUX Input port enters the "Test Tone On" state when the status of the port goes high level.	Refer to Confirming Whether the Configured Analog Channel of the Repeater Works Properly (Test Tone).
Test Tone On	Enables the function to transmit a test tone. If "Level" is configured in **AUX Input Trigger**, the AUX Input port enters the "Test Tone Off" state when the status of the port goes high level.	
Test Tone On/Off	Enables or disables the function to transmit a test tone.	• Refer to Confirming Whether the Configured Analog Channel of the Repeater Works Properly (Test Tone). • This function can be assigned only if "Trailing Edge" is configured in **AUX Input Trigger**. (Refer to Trigger Detection at the AUX Input Port (AUX Input Trigger).)
TOT Disable	Disables **Time-out Timer**. If "Level" is configured in **AUX Input Trigger**, the AUX Input port enters the "TOT Enable" state when the status of the port goes high level.	Refer to Restricting the Continuous Transmission Time for the Repeater (Time-out Timer).
TOT Enable	Enables **Time-out Timer**. If "Level" is configured in **AUX Input Trigger**, the AUX Input port enters the "TOT Disable" state when the status of the port goes high level.	
TOT Enable/Disable	Enables or disables **Time-out Timer**.	• Refer to Restricting the Continuous Transmission Time for the Repeater (Time-out Timer). • This function can be assigned only if "Trailing Edge" is configured in **AUX Input Trigger**. (Refer to Trigger Detection at the AUX Input Port (AUX Input Trigger).)

<table>
<tr><th>Function Name</th><th>Description</th><th>Remarks</th></tr>
<tr><td>TX Disable</td><td>Disables all transmissions.
If “Level” is configured in AUX Input Trigger, the AUX Input port enters the “TX Enable” state when the status of the port goes high level.</td><td rowspan="2">Refer to Toggling the Transmission Behavior between Enabled and Disabled (TX Enable/Disable).</td></tr>
<tr><td>TX Enable</td><td>Enables all transmissions.
If “Level” is configured in AUX Input Trigger, the AUX Input port enters the “TX Disable” state when the status of the port goes high level.</td></tr>
<tr><td>TX Enable/Disable</td><td>Enables or disables all transmissions.</td><td>• Refer to Toggling the Transmission Behavior between Enabled and Disabled (TX Enable/Disable).
• This function can be assigned only if “Trailing Edge” is configured in AUX Input Trigger. (Refer to Trigger Detection at the AUX Input Port (AUX Input Trigger).)</td></tr>
<tr><td>Voting Tone Off</td><td>Inhibits the transmission of a Voting pilot tone signal.
If “Level” is configured in AUX Input Trigger, the AUX Input port enters the “Voting Tone On” state when the status of the port goes high level.</td><td rowspan="2">Refer to Configuring to Transmit a Voting Pilot Tone Signal (Voting Pilot Tone).</td></tr>
<tr><td>Voting Tone On</td><td>Permits the transmission of a Voting pilot tone signal.
If “Level” is configured in AUX Input Trigger, the AUX Input port enters the “Voting Tone Off” state when the status of the port goes high level.</td></tr>
<tr><td>Voting Tone On/Off</td><td>Permits or inhibits the transmission of a Voting pilot tone signal.</td><td>• Refer to Configuring to Transmit a Voting Pilot Tone Signal (Voting Pilot Tone).
• This function can be assigned only if “Trailing Edge” is configured in AUX Input Trigger. (Refer to Trigger Detection at the AUX Input Port (AUX Input Trigger).)</td></tr>
</table>

Configuration using KPG-D2

Assigning functions to the AUX Input port (See Edit > Function Port > AUX > AUX Input)

Trigger Detection at the AUX Input Port (AUX Input Trigger)

AUX Input Trigger is the detection method for the signal input to the AUX Input port.
According to the configuration for **AUX Input Trigger**, the repeater behaves as follows:

Table 6-7 AUX Input Trigger

Configuration	Description
Trailing Edge	Detects the trigger using trailing edge of the input signals.
Level	Detects the trigger using the Active Low state. If the AUX Input port becomes active when the repeater is turned on, the repeater detects the trigger.

Configuration using KPG-D2

Configuring **AUX Input Trigger** (See Edit > Function Port > AUX > AUX Input)

6.3 Available Functions for the AUX Output Ports

The following functions can be assigned to the AUX Output port.
If the function assigned to the AUX Output port is enabled, the output port becomes active.

Table 6-8 Available Functions for the AUX Output Port

Function Name	Description	Remarks
None	No function is activated.	
COR	The output port becomes active if the repeater receives a signal. The output port becomes inactive if the repeater receives no signal.	This function can be used only if the repeater is operated in conventional mode.
Fan Status	The output port becomes active if the fan starts running. The output port becomes inactive if the fan stops.	
Power Supply Lower Limit 1	The output port becomes active if **Power Supply Monitor 1** becomes active. The output port becomes inactive if **Power Supply Monitor 1** becomes inactive.	Refer to Monitoring the Power Supply of the Repeater and Notifying by a Warning Tone (Power Supply Monitor).
Power Supply Lower Limit 2	The output port becomes active if **Power Supply Monitor 2** becomes active. The output port becomes inactive if **Power Supply Monitor 2** becomes inactive.	
Receive Signal (Threshold)	The output port becomes active if the RSSI voltage is reduced. The output port becomes inactive if the RSSI voltage is increased.	The reference RSSI level can be configured using **Lowest Receive Level Threshold**. (Refer to Identifying the RSSI Level by Using the Auxiliary Output Port (Lowest Receive Level Threshold).) This function can be used only if the repeater is operated in conventional mode.
Receive Unlock	The output port becomes active if RX PLL is unlocked. The output port becomes inactive if RX PLL is locked.	
RF Power Down Detection	The output port becomes active if the transmission power is below the threshold level. The output port becomes inactive if the transmission power is above the threshold level.	Considering the time until the transmission power stabilizes, **RF Power Down Detection** is not activated because the transmission power is not detected for 150 ms from the start of transmission by the repeater.

Function Name	Description	Remarks
Selectable	The output port is controlled by the following functions that are assigned to the **PF** keys or AUX Input ports: • AUX Out 1 Off to AUX Out 5 Off • AUX I/O 1 Off to AUX I/O 6 Off • AUX Out 1 On to AUX Out 5 On • AUX I/O 1 On to AUX I/O 6 On • AUX Out 1 On/Off to AUX Out 5 On/Off • AUX I/O 1 On/Off to AUX I/O 6 On/Off	Refer to USING FUNCTION PORTS. This function can be used only if the repeater is operated in conventional mode.
TOR	According to the configuration for **Channel Type**, the repeater behavior varies as follows: ● **Analog** If the repeater receives an analog signal and the received QT tone or DQT code matches the QT tone or DQT code preconfigured for the repeater, the output port becomes active. If the received QT tone or DQT code does not match the QT tone or DQT code preconfigured for the repeater, the output port becomes inactive. If no QT tone or DQT code is preconfigured, the output port becomes active when the repeater receives an analog signal. The output port becomes inactive if the transmission ends. ● **NXDN** If the repeater receives an NXDN digital signal and the received RAN code matches the RAN code preconfigured for the repeater, the output port becomes active. If the received RAN code does not match the RAN code preconfigured for the repeater, the output port becomes inactive. If no RAN code is preconfigured, the output port becomes active even if any RAN code is received. The output port becomes inactive if the transmission ends. If the repeater is operated in trunking mode, the site number configured by using KPG-110SM is used to verify the RAN code. This verification functions only on a traffic channel. ● **Mixed** If the repeater receives an analog signal, the repeater behaves in the similar manner as when it receives a signal on an analog channel. If the repeater receives an NXDN digital signal, the repeater behaves in the similar manner as when it receives a signal on an NXDN digital channel.	Refer to Configuring the Usage Type of the Channel (Channel Type).
TXS	The output port becomes active when the repeater transmits. The output port becomes inactive if the repeater exits transmit mode.	
Transmit Unlock	The output port becomes active if TX PLL is unlocked. The output port becomes inactive if TX PLL is locked.	

Note

- If the repeater unmutes the speaker by activating **Squelch Off**, the COR port does not become active unless the repeater is receiving a signal even if the BUSY LED lights.
- Even if the repeater unmutes the speaker by activating **Monitor On**, if a signaling is configured, the TOR port does not become active until the received signaling matches the one preconfigured for the repeater.

Configuration using KPG-D2

- Assigning functions to the AUX Output port (See Edit > Function Port > AUX > AUX Output)
- Configuring the threshold value of **RF Power Down Detection** (See Program > Test Mode > Tuning Items > RF Power Down Detection)

Configuring the Logic of the AUX Output Port (Logic Type)

Logic Type is the logic of when the AUX Output port is activated or deactivated.

According to the configuration for **Logic Type**, the repeater behaves as follows:

Table 6-9 Logic Type

Configuration	Description
Active Low	The status of the AUX Output port goes low level when the AUX Output port is activated.
Active High	The status of the AUX Output port goes high level when the AUX Output port is activated.

Configuration using KPG-D2

Configuring **Logic Type** (See Edit > Function Port > AUX > AUX Output)

7 REMOTE CONTROL

Remote Control is the function to control the functions assigned to **PF** keys or AUX ports by using an Air Remote code.

Air Remote code is a series of DTMF codes preconfigured for the repeater for control. (Refer to About the Functions When a DTMF Code Is Sent.)

This function can be used to remotely control the repeater in the case that the repeater is located in a place where the repeater cannot directly be operated, such as when the repeater is operated in the repeater system.

If the DTMF code sent from the external subscriber unit matches the Air Remote code preconfigured for the receiving repeater, functions (**Channel Up**, **Repeat Enable/Disable**, etc.) optionally configured for the repeater become activated or deactivated, or enabled or disabled.

In this case, a Transpond code can be sent to notify that an Air Remote code has been received or processed.

Also, an Air Remote code can be sent if the status of the AUX Output port is changed.

Note

- If “Level” is configured in **AUX Input Trigger**, the repeater does not respond even if an Air Remote code to which a function of the same series is assigned is received when the AUX Input port to which the function is assigned is activated. For example, if the AUX Input port to which **Squelch On** is assigned is activated, the repeater does not respond even if an Air Remote code to which a function related to squelch (**Squelch Off** and **Squelch On**) is assigned is received.
- The repeater does not accept Air Remote codes during transmission. The repeater does not respond even if an Air Remote code is received while the repeater is transmitting. However, the repeater does accept an Air Remote code during repeat transmission (also including while the **Repeater Hold Time** is counting down).
- If transmission is started such as by using the **PTT** (microphone) switch or CW ID before a Transpond code is sent, the transmission of a Transpond code and the behavior of the remote control are canceled.

7.1 About the Functions When a DTMF Code Is Sent

DTMF (Dual Tone Multi-Frequency) is the signaling using the tone signal with 2 different frequencies. DTMF is used as an Air Remote code when the repeater is remotely controlled.

DTMF signaling is a combination of 2 different frequencies, consisting of a high frequency and a low frequency, and consists of 0 to 9, A to D, * and # tones.

Table 7-1 DTMF Frequency List

Low/ High	1209 Hz	1336 Hz	1477 Hz	1633 Hz
697 Hz	1	2	3	A
770 Hz	4	5	6	B
852 Hz	7	8	9	C
941 Hz	*	0	#	D

The following functions for sending a DTMF code can be configured by using KPG-D2:

- DTMF Speed
- First Digit Delay Time
- First Digit Time
- * and # Digit Time
- Encode/Decode List

DTMF Speed

DTMF Speed is the speed to send out the DTMF code.

Transmit speed of the DTMF code can be configured using the number digits to be sent per second. The repeater sends the DTMF code at the configured speed.

The number of digits per second to transmit the DTMF code can be configured by selecting from 6, 8, 10 or 15 by using KPG-D2.

The following are the periods for Digit Time (transmit time) and Gap Time (muted time) depending on the selected value:

Table 7-2 DTMF Speed

Configuration	Digit Time (transmit time for 1 digit)	Gap Time (muted time)
6 digits/s	84 ms	84 ms
8 digits/s	62 ms	62 ms
10 digits/s	50 ms	50 ms
15 digits/s	34 ms	34 ms

Configuration using KPG-D2

Configuring **DTMF Speed** (See Edit > DTMF > Encode Setting)

First Digit Delay Time

First Digit Delay Time is the length of time from when the repeater starts transmitting until the first digit of the DTMF code is sent out.

Until the length of time configured in **First Digit Delay Time** elapses, the repeater transmits an unmodulated signal.

Configuration using KPG-D2

Configuring **First Digit Delay Time** (See Edit > DTMF > Encode Setting)

First Digit Time

First Digit Time is the function to extend the length of time from when the repeater starts transmitting the DTMF code until the first digit of the DTMF code is sent out.

Extending the transmission time of the first digit of the DTMF code helps the receiving subscriber unit to easily recognize the incoming DTMF code in order to avoid failure in receiving the DTMF code while the subscriber unit is in the battery saver mode or scanning.

The length of time until the first digit of the DTMF code is sent out is the sum of the transmission time (Digit Time) configured in **DTMF Speed** and **First Digit Time**.

Transmit time for the 1st digit of the DTMF code = value configured in **DTMF Speed** (Digit Time) + value configured in **First Digit Time**

Example: **First Digit Time**: 100 ms, **Encode Code**: 123

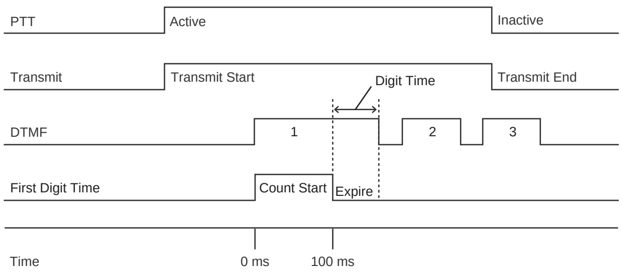


Figure 7-1 First Digit Time

Note

- If the first digit of the DTMF code is the * tone or # tone, the first digit is sent out for the length of time configured in **First Digit Time** or in *** and # Digit Time**, whichever is longer.

Configuration using KPG-D2

Configuring **First Digit Time** (See Edit > DTMF > Encode Setting)

* and # Digit Time

*** and # Digit Time** is the function to extend the period longer than normal for the repeater to send the * tone and # tone of the DTMF code.

Because the * tone and # tone are more frequently used for special tasks compared to the tones from 0 to 9, this function is used for the * tone and # tone to easily recognize the receiving subscriber unit.

The length of time to send the * tone and # tone is the sum of the transmission time (Digit Time) configured in **DTMF Speed** and *** and # Digit Time**.

Transmit time for the * and # tones = value configured in **DTMF Speed** (Digit Time) + value configured in *** and # Digit Time**

Example: *** and # Digit Time**: 100 ms, **Encode Code**: *01

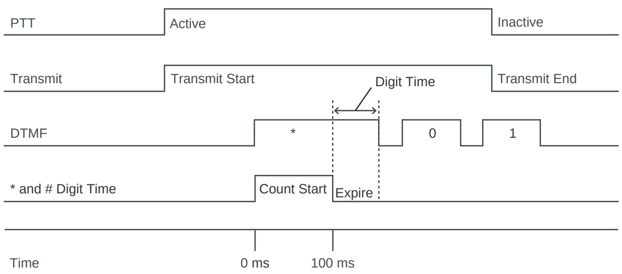


Figure 7-2 * and # Digit Time

Note

- If the first digit of the DTMF code is the * tone or # tone, the first digit is sent out for the length of time configured in **First Digit Time** or in *** and # Digit Time**, whichever is longer.

Configuration using KPG-D2

Configuring *** and # Digit Time** (See Edit > DTMF > Encode Setting)

Encode/Decode List

Encode/Decode List is the list in which the DTMF code used for encoding and decoding in **Remote Control** is configured.

● Encode

DTMF encode code is the DTMF code to be sent if the repeater receives a command from an external device or if the function assigned to the AUX port becomes activated or deactivated, or enabled or disabled. A DTMF code consisting of a maximum of 16 digits can be sent.

The following functions for encoding a DTMF code can be configured by using KPG-D2:

Table 7-3 Configuration of Encode/Decode List > Encode

Configuration	Description
Frequency	**Frequency** is a transmit tone frequency to send a Transpond code using a single tone when the repeater receives an Air Remote code or when the function assigned to a **PF** key or AUX ports becomes activated or deactivated or the function is enabled or disabled.
Period	**Period** is the length of time for sending a Transpond code using a single tone when the repeater receives an Air Remote code or when the function assigned to a **PF** key or AUX ports becomes activated or deactivated or the function is enabled or disabled.
Sidetone	**Sidetone** is the function to emit the sidetone of the DTMF code from the speaker while the repeater sends the DTMF code. However, no sidetone of the DTMF code sounds if the channel for transmission is in the simplex mode.

● Decode

DTMF decode code is the DTMF code used by the repeater to wait to receive the code which is sent from another subscriber to remotely control the repeater. If the received DTMF code matches the DTMF code preconfigured for the repeater, a function assigned to a **PF** key and AUX ports on the repeater is activated or deactivated, or toggled between enabled and disabled. The repeater can wait to receive a maximum of 16 digits of DTMF code.

Configuration using KPG-D2

- Configuring **Encode/Decode List** (See Edit > Encode/Decode List)
- Configuring **Frequency** (See Edit > Encode/Decode List > Encode > Transpond Single Tone Setting)
- Configuring **Period** (See Edit > Encode/Decode List > Encode > Transpond Single Tone Setting)
- Configuring **Sidetone** to be enabled or disabled (See Edit > Encode/Decode List > Encode)

7.2 Controlling the Functions Assigned to PF Keys

The functions assigned to **PF** keys can be controlled using an Air Remote code.

The following functions relevant to **PF** key control can be configured using KPG-D2:

- Activation (PF Key)
- Deactivation (PF Key)
- Transponder (PF Key)
- Single Tone (PF Key Transponder)
- Activation (PF Key Transponder)
- Deactivation (PF Key Transponder)

Activation (PF Key)

Activation (PF Key) is the function to activate or enable a function assigned to the **PF** key when the repeater receives an Air Remote code.

If the received Air Remote code matches the decode code preconfigured for the repeater, the repeater activates or enables a function assigned to the **PF** key.

Example of the repeater behavior

An example of the repeater behavior if the repeater is configured as follows:

Function (PF 1 key): Squelch On/Off

Air Remote Code (Activation): 159D (Decode)

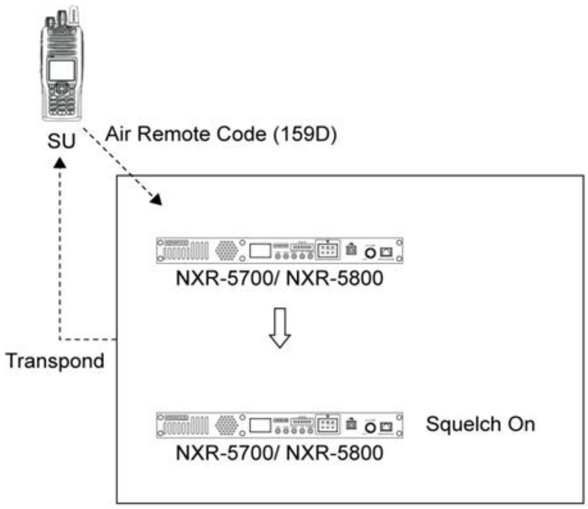


Figure 7-3 Activation (PF Key)

The Air Remote code to be used can be configured by selecting from **Encode/Decode List** for DTMF. (Refer to Encode/Decode List.)

Configuration using KPG-D2

Configuring **Activation (PF Key)** (See Edit > Remote Control > PF Key > PF Key)

Deactivation (PF Key)

Deactivation (PF Key) is the function to deactivate or disable a function assigned to the **PF** key when the repeater receives an Air Remote code.

If the received Air Remote code matches the decode code preconfigured for the repeater, the repeater deactivates or disables a function assigned to the **PF** key.

Example of the repeater behavior

An example of the repeater behavior if the repeater is configured as follows:

Function (PF 1 key): Squelch On/Off

Air Remote Code (Deactivation): 160D (Decode)

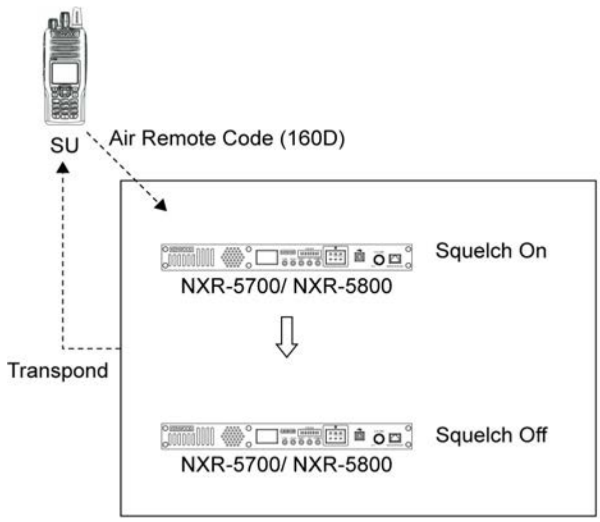


Figure 7-4 Deactivation (PF Key)

The Air Remote code to be used can be configured by selecting from **Encode/Decode List** for DTMF. (Refer to Encode/Decode List.)

Configuration using KPG-D2

Configuring **Deactivation (PF Key)** (See Edit > Remote Control > PF Key > PF Key)

Sending a Transpond Code (PF Key)

Transponder (PF Key) is the function to notify the transmitting subscriber unit by sending a Transpond code that the repeater has received the Air Remote code, when the repeater receives an Air Remote code and then the function assigned to the **PF** key becomes activated or deactivated, or enabled or disabled.

The timing to send a Transpond code can be selected from “None”, “Before”, “After”, and “Both” for each function.

Table 7-4 Transponder (PF Key)

Configuration	Description
None	The repeater does not send a Transpond code.
Before	The repeater sends a Transpond code when the repeater receives an Air Remote code. If transmission is disabled, the repeater does not send a Transpond code.
After	The repeater sends a Transpond code after the repeater processes the received Air Remote code. If transmission is disabled, the repeater does not send a Transpond code. Also, the repeater does not send a Transpond code if the repeater cannot process the Air Remote code.
Both	The repeater sends a Transpond code when the repeater receives an Air Remote code (Before) and after the repeater processes the received Air Remote code (After). If transmission is disabled, the repeater does not send a Transpond code. Also, the repeater does not send a Transpond code (After) if the repeater cannot process the Air Remote code.

About the configuration of a Transpond code

Each Transpond code which is sent when the function assigned to the **PF** key becomes active or inactive, or enabled or disabled, after the repeater receives an Air Remote code can be configured.

A Transpond code can be configured in each of **Activation (PF Key Transponder)** and **Deactivation (PF Key Transponder)** by using KPG-D2.

Table 7-5 PF Key Transponder

Configuration	Description
Activation	The repeater sends a Transpond code when the repeater receives an Air Remote code and then the function assigned to the **PF** key becomes active or enabled.
Deactivation	The repeater sends a Transpond code when the repeater receives an Air Remote code and then the function assigned to the **PF** key is deactivated or disabled.

About the configuration of Single Tone

Single Tone is the function to send a Transpond code by using a single tone.

If this function is enabled, the repeater sends a Transpond code by using a single tone. In this case, the frequency and transmission time of the single tone to be sent can be configured by selecting from **Encode/Decode List** for DTMF. (Refer to Encode/Decode List.)

If this function is disabled, the repeater sends the DTMF code preconfigured in **Encode/ Decode List** as a Transpond code.

Configuration using KPG-D2

- Configuring **Transponder (PF Key)** (See Edit > Remote Control > PF Key > PF Key)
- Configuring **PF Key Transponder** (See Edit > Remote Control > PF Key > PF Key Transponder)
- Configuring **Single Tone** to be enabled or disabled (See Edit > Remote Control > PF Key > PF Key Transponder)

7.3 Controlling the Functions Assigned to an AUX Input Port

The functions assigned to an AUX Input port can be controlled using an Air Remote code.

The following functions relevant to the control of an AUX Input port can be configured using KPG-D2:

- Activation (AUX Input)
- Deactivation (AUX Input)
- Transponder (AUX Input)
- Single Tone (AUX Transponder)
- Activation (AUX Transponder)
- Deactivation (AUX Transponder)

Activation (AUX Input)

Activation (AUX Input) is the function to activate or enable the function assigned to the AUX Input port when the repeater receives an Air Remote code.

If the function is assigned to the AUX Input port, a decode code that activates or enables the function assigned to the AUX Input port when the repeater receives an Air Remote code can be configured. If the received Air Remote code matches the decode code preconfigured for the repeater, the repeater activates or enables the function assigned to the AUX Input port (Example of the repeater behavior 1).

If no function is assigned to the AUX Input port (None), the encode code to be sent when the port is enabled can be configured. The repeater can encode codes linked with a sensor input of external devices, etc. (Example of the repeater behavior 2).

Example of the repeater behavior 1

An example of the repeater behavior if the repeater is configured as follows:

Function (AUX Input 1: 1st): Squelch On

Air Remote Code (Activation): 159D (Decode)

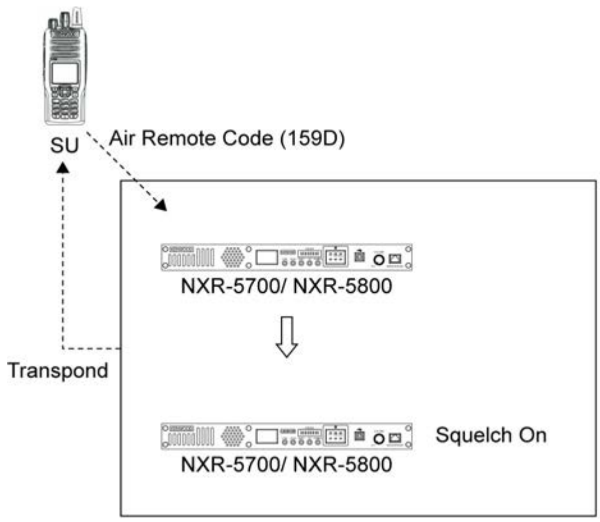


Figure 7-5 Activation (AUX Input) 1

If functions are configured for **2nd** and **3rd** in the AUX Input 1, only the function configured for **1st** works.

The Air Remote code to be used can be configured by selecting from **Encode/Decode List** for DTMF. (Refer to Encode/Decode List.)

Example of the repeater behavior 2

An example of the repeater behavior if the repeater is configured as follows:

Function (AUX Input 1): None

Air Remote Code (Activation): 159D (Encode)

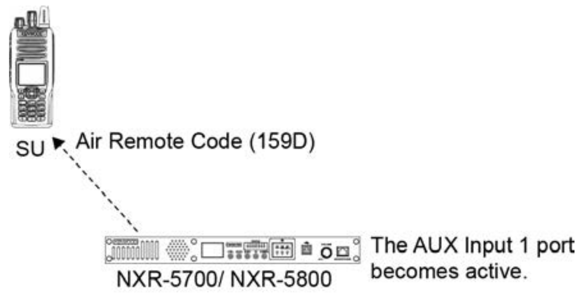


Figure 7-6 Activation (AUX Input) 2

The Air Remote code to be used can be configured by selecting from **Encode/Decode List** for DTMF. (Refer to Encode/Decode List.)

Configuration using KPG-D2

Configuring **Activation (AUX Input)** (See Edit > Remote Control > AUX Input/Output > AUX Input)

Deactivation (AUX Input)

Deactivation (AUX Input) is the function to deactivate or disable the function assigned to the AUX Input port when the repeater receives an Air Remote code.

If a function is assigned to the AUX Input port, a decode code that deactivates or disables the function assigned to the AUX Input port when the repeater receives an Air Remote code can be configured. If the received Air Remote code matches the decode code preconfigured for the repeater, the repeater deactivates or disables the function assigned to the AUX Input port (Example of the repeater behavior 1).

If no function is assigned to the AUX Input port (None), the encode code to be sent when the port is disabled can be configured. The repeater can encode codes linked with a sensor input of external devices, etc. (Example of the repeater behavior 2).

Example of the repeater behavior 1

An example of the repeater behavior if the repeater is configured as follows:

Function (AUX Input 1: 1st): Squelch On

Air Remote Code (Deactivation): 160D (Decode)

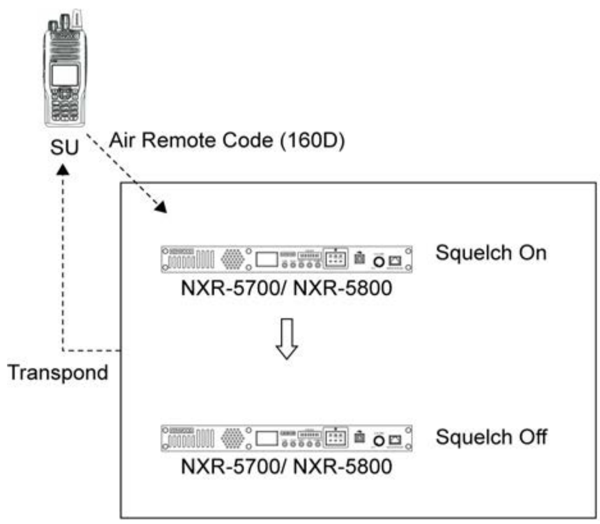


Figure 7-7 Deactivation (AUX Input) 1

If the repeater receives the Air Remote code (160D) while squelch is turned off, the repeater status does not change.

If functions are configured for **2nd** and **3rd** in the AUX Input 1, only the function configured for **1st** works.

The Air Remote code to be used can be configured by selecting from **Encode/Decode List** for DTMF. (Refer to Encode/Decode List.)

Example of the repeater behavior 2

An example of the repeater behavior if the repeater is configured as follows:

Function (AUX Input 1): None

Air Remote Code (Deactivation): 160D (Encode)

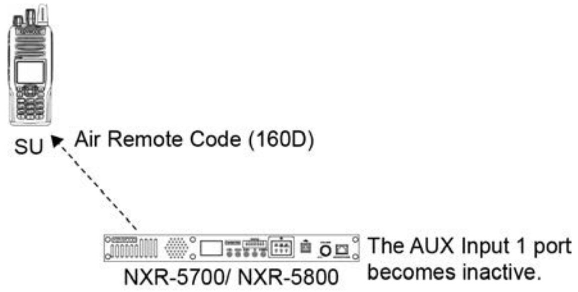


Figure 7-8 Deactivation (AUX Input) 2

The Air Remote code to be used can be configured by selecting from **Encode/Decode List** for DTMF. (Refer to Encode/Decode List.)

Configuration using KPG-D2

Configuring **Deactivation (AUX Input)** (See Edit > Remote Control > AUX Input/Output > AUX Input)

Sending a Transpond Code (AUX Input)

Transponder (AUX Input) is the function to notify the transmitting subscriber unit by sending a Transpond code that the repeater has received the Air Remote code, when the repeater receives an Air Remote code and then the function assigned to the AUX Input port becomes active or inactive, or enabled or disabled.

The timing to send a Transpond code can be selected from "None", "Before", "After", and "Both" for each function.

Table 7-6 Transponder (AUX Input)

Configuration	Description
None	The repeater does not send a Transpond code.
Before	The repeater sends a Transpond code when the repeater receives an Air Remote code. If transmission is disabled, the repeater does not send a Transpond code.
After	The repeater sends a Transpond code after the repeater processes the received Air Remote code. If transmission is disabled, the repeater does not send a Transpond code. Also, the repeater does not send a Transpond code if the repeater cannot process the Air Remote code.
Both	The repeater sends a Transpond code when the repeater receives an Air Remote code (Before) and after the repeater processes the received Air Remote code (After). If transmission is disabled, the repeater does not send a Transpond code. Also, the repeater does not send a Transpond code (After) if the repeater cannot process the Air Remote code.

About the configuration of a Transpond code

Each Transpond code which is sent when the function assigned to the AUX Input port becomes active or deactivated, after the repeater receives an Air Remote code can be configured.

A Transpond code can be configured in each of **Activation (AUX Transponder)** and **Deactivation (AUX Transponder)** by using KPG-D2.

Table 7-7 AUX Transponder

Configuration	Description
Activation	The repeater sends a Transpond code when the repeater receives an Air Remote code and then the function assigned to the AUX Input port becomes active.
Deactivation	The repeater sends a Transpond code when the repeater receives an Air Remote code and then the function assigned to the AUX Input port is deactivated.

About the configuration of Single Tone

Single Tone is the function to send a Transpond code by using a single tone.

If this function is enabled, the repeater sends a Transpond code by using a single tone. In this case, the frequency and transmission time of the single tone to be sent can be configured by selecting from **Encode/Decode List** for DTMF. (Refer to Encode/Decode List.)

If this function is disabled, the repeater sends the DTMF code preconfigured in **Encode/ Decode List** as a Transpond code.

Configuration using KPG-D2

- Configuring **Transponder (AUX Input)** (See Edit > Remote Control > AUX Input/Output > AUX Input)
- Configuring **AUX Transponder** (See Edit > Remote Control > AUX Input/Output > AUX Transponder)
- Configuring **Single Tone** to be enabled or disabled (See Edit > Remote Control > AUX Input/Output > AUX Transponder)

7.4 Notifying the Change for an AUX Output Port by Using an Air Remote Code

When the function assigned to the AUX Output port is activated or enabled, an Air Remote code can be sent out to notify that the status of the AUX Output port is changed.

The following functions relevant to the control of an AUX Output port can be configured using KPG-D2:

- Activation (AUX Output)
- Deactivation (AUX Output)
- Transponder (AUX Output)
- Logic Type
- Single Tone (AUX Transponder)
- Activation (AUX Transponder)
- Deactivation (AUX Transponder)

Activation (AUX Output)

Activation (AUX Output) is the function to send an Air Remote code when the function assigned to the AUX Output port becomes active or enabled.

If a function is assigned to the AUX Output port, the repeater sends an Air Remote code when the function assigned to the AUX Output port is activated, or when the function is enabled (Example of the repeater behavior 1).

The decode code can be specified if no function is assigned to the AUX Output port (None). If the repeater receives an external Air Remote code which matches the decode code configured for the repeater, the port output status can be controlled (Example of the repeater behavior 2).

Example of the repeater behavior 1

An example of the repeater behavior if the repeater is configured as follows:

Function (AUX Output 1): COR

Air Remote Code (Activation): 159D (Encode)

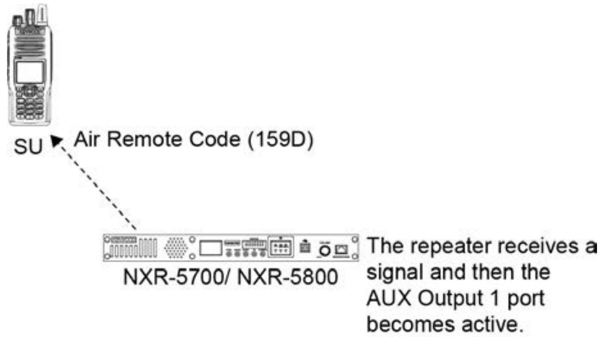


Figure 7-9 Activation (AUX Output) 1

The Air Remote code to be used can be configured by selecting from **Encode/Decode List** for DTMF. (Refer to Encode/Decode List.)

Example of the repeater behavior 2

An example of the repeater behavior if the repeater is configured as follows:

Function (AUX Output 1): None

Air Remote Code (Activation): 159D (Decode)

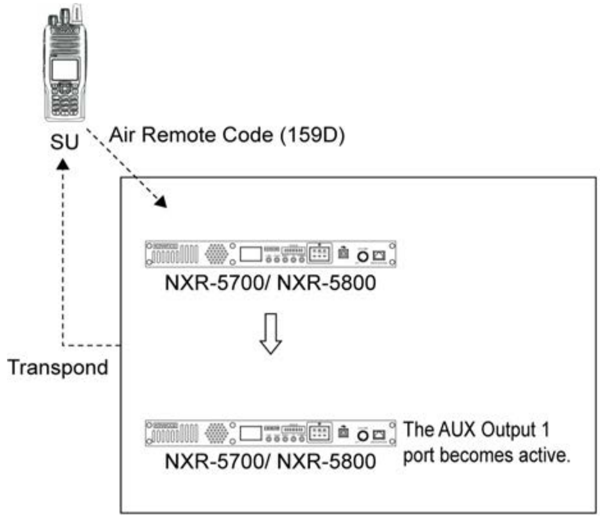


Figure 7-10 Activation (AUX Output) 2

The Air Remote code to be used can be configured by selecting from **Encode/Decode List** for DTMF. (Refer to Encode/Decode List.)

Note

- This function cannot be used if “TXS” or “Transmit Unlock” is assigned to the AUX Output port.

Configuration using KPG-D2

Configuring **Activation (AUX Output)** (See Edit > Remote Control > AUX Input/Output > AUX Output)

Deactivation (AUX Output)

Deactivation (AUX Output) is the function to send an Air Remote code when the function assigned to the AUX Output port is deactivated or disabled.

If a function is assigned to the AUX Output port, the repeater sends an Air Remote code when the function assigned to the AUX Output port is deactivated, or when the function is disabled (Example of the repeater behavior 1).

The decode code can be specified if no function is assigned to the AUX Output port (None). If the repeater receives an external Air Remote code which matches the decode code configured for the repeater, the port output status can be controlled (Example of the repeater behavior 2).

Example of the repeater behavior 1

An example of the repeater behavior if the repeater is configured as follows:

Function (AUX Output 1): COR

Air Remote Code (Deactivation): 160D (Encode)

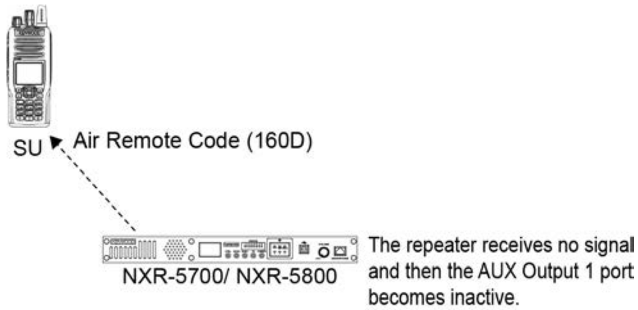


Figure 7-11 Deactivation (AUX Output) 1

The Air Remote code to be used can be configured by selecting from **Encode/Decode List** for DTMF. (Refer to Encode/Decode List.)

Example of the repeater behavior 2

An example of the repeater behavior if the repeater is configured as follows:

Function (AUX Output 1): None

Air Remote Code (Deactivation): 160D (Decode)

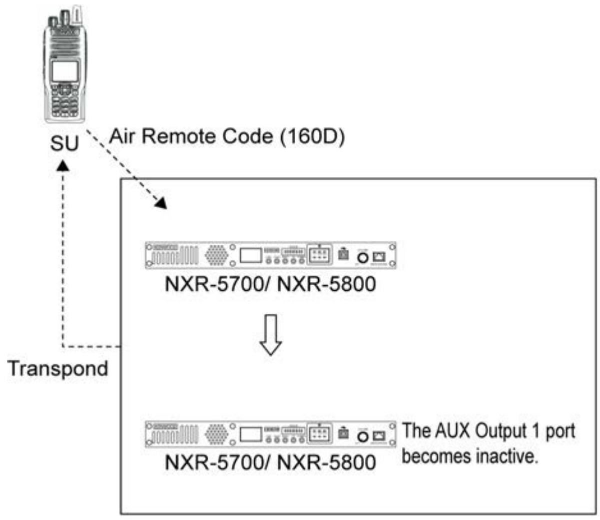


Figure 7-12 Deactivation (AUX Output) 2

The Air Remote code to be used can be configured by selecting from **Encode/Decode List** for DTMF. (Refer to Encode/Decode List.)

Note

- This function cannot be used if “TXS” or “Transmit Unlock” is assigned to the AUX Output port.

Configuration using KPG-D2

Configuring **Deactivation (AUX Output)** (See Edit > Remote Control > AUX Input/Output > AUX Output)

Sending a Transpond Code (AUX Output)

Transponder (AUX Output) is the function to notify the transmitting subscriber unit by sending a Transpond code that the repeater has received the Air Remote code when the repeater receives an Air Remote code and the status of the AUX Output port is changed.

This function can be used only if no function is assigned to the AUX Output port (None).

The timing to send a Transpond code can be selected from “None”, “Before”, “After”, and “Both” for each function.

Table 7-8 Transponder (AUX Output)

Configuration	Description
None	The repeater does not send a Transpond code.
Before	The repeater sends a Transpond code when the repeater receives an Air Remote code. If transmission is disabled, the repeater does not send a Transpond code.
After	The repeater sends a Transpond code after the repeater processes the received Air Remote code. If transmission is disabled, the repeater does not send a Transpond code. Also, the repeater does not send a Transpond code if the repeater cannot process the Air Remote code.
Both	The repeater sends a Transpond code when the repeater receives an Air Remote code (Before) and after the repeater processes the received Air Remote code (After). If transmission is disabled, the repeater does not send a Transpond code. Also, the repeater does not send a Transpond code (After) if the repeater cannot process the Air Remote code.

About the configuration of a Transpond code

Each Transpond code sent when the repeater receives an Air Remote code and the status of the AUX Output port is changed can be configured.

A Transpond code can be configured in each of **Activation (AUX Transponder)** and **Deactivation (AUX Transponder)** by using KPG-D2.

Table 7-9 AUX Transponder

Configuration	Description
Activation	The repeater sends the Transpond code when the AUX Output port becomes active after the repeater receives the Air Remote code.
Deactivation	The repeater sends the Transpond code when the AUX Output port is deactivated after the repeater receives the Air Remote code.

About the configuration of Single Tone

Single Tone is the function to send a Transpond code by using a single tone.

If this function is enabled, the repeater sends a Transpond code by using a single tone. In this case, the frequency and transmission time of the single tone to be sent can be configured by selecting from **Encode/Decode List** for DTMF. (Refer to Encode/Decode List.)

If this function is disabled, the repeater sends the DTMF code preconfigured in **Encode/ Decode List** as a Transpond code.

Configuration using KPG-D2

- Configuring **Transponder (AUX Output)** (See Edit > Remote Control > AUX Input/Output > AUX Output)
- Configuring **AUX Transponder** (See Edit > Remote Control > AUX Input/Output > AUX Transponder)
- Configuring **Single Tone** to be enabled or disabled (See Edit > Remote Control > AUX Input/Output > AUX Transponder)

Configuring the Logic of the AUX Output Port (Logic Type (Remote Control))

Logic Type is the logic of when the AUX Output port is activated or deactivated using an Air Remote code.

This function can be used only if no function is assigned to the AUX Output port (None).

According to the configuration for **Logic Type**, the repeater behaves as follows:

Table 7-10 Logic Type

Configuration	Description
Active Low	The status of the AUX Output port goes low level when the AUX Output port is activated.
Active High	The status of the AUX Output port goes high level when the AUX Output port is activated.

Configuration using KPG-D2

Configuring **Logic Type** (See Edit > Remote Control > AUX Input/Output > AUX Output)

7.5 Preventing an Air Remote Code from Repeating (Remote Access with QT/DQT)

Remote Access with QT/DQT is the function to accept an Air Remote code depending on the matching state of the QT tone or DQT codes when the repeater receives an Air Remote code on an analog channel.

If this function is enabled, the repeater accepts an Air Remote code only if the received QT tone or DQT code matches the QT tone or DQT code preconfigured for the repeater. The repeater can transmit using the Repeat PTT control, but the repeater cannot transmit using the Repeat PTT control if **Repeat Disable** is enabled.

If this function is disabled, the repeater accepts an Air Remote code even if only a signal is received or the received QT tone or DQT code does not match the QT tone or DQT code preconfigured for the repeater. However, the repeater cannot transmit using the Repeat PTT control if no conditions to repeat are fulfilled.

Note

- This function is applicable only to receiving an Air Remote code.
- If this function is enabled, the repeater can proceed to decode QT/DQT for an Air Remote code even if the decoding of QT/DQT is disabled as follows:
  - When **Off-hook Decode** is disabled and the microphone is in the off-hook state
  - When the **Monitor** function is activated

Configuration using KPG-D2

Configuring **Remote Access with QT/DQT** to be enabled or disabled (See Edit > Remote Control)

7.6 Waiting for Transmission of a Transpond Code When the Channel Is Busy (Clear to Transpond)

Clear to Transpond is the function used by the repeater to wait to send a Transpond code until the channel becomes available if the channel is busy when the repeater receives an Air Remote code and sends a Transpond code.

If this function is enabled and a channel is busy, the repeater waits to send a Transpond code until the channel becomes available.

If this function is disabled, the repeater sends a Transpond code even if a channel is busy.

Configuration using KPG-D2

Configuring **Clear to Transpond** to be enabled or disabled (See Edit > Remote Control)

7.7 Disabling Control from External Devices (Take Over)

Take Over is the function to disable control from external devices.

If this function is enabled, control depending on each of the External PTT control, **External Monitor**, **AUX Input** and **AUX Input/Output** (Input only) functions is blocked.

If **Take Over** is enabled while transmitting using the External PTT control, the repeater stops transmission. If **Take Over** is disabled while the External PTT control is active, the repeater starts transmission.

If "Channel Select" is assigned to the AUX Input/Output port and functions to control the channel (such as **Channel Up**) are assigned to the **PF** keys, although channel control is normally available by **Channel Select** only, channel control only by the **PF** keys is enabled when **Take Over** is enabled.

Take Over can be enabled or disabled by operating the **Take Over On/Off** key.

Note

- Control depending on each of the **AUX Output** and **AUX Input/Output** (Out) functions is not blocked.
- Control depending on **Remote Control** works even if **Take Over** is enabled.

Configuration using KPG-D2

Assigning functions to the **PF** keys (See Edit > Key Assignment)

8 REDUCING THE CURRENT CONSUMPTION OF THE REPEATER (DC POWER SAVE)

DC Power Save is the function to reduce the current consumption of the repeater. If **DC Power Save** is enabled, the repeater turns the LED off and shuts off the power sourced to an audio amplifier to reduce the current consumption.

8.1 Enabling or Disabling DC Power Save Mode

DC Power Save can be enabled or disabled when a **PF** key is pressed, when the signal is applied to an AUX Input port, or when the repeater is turned on.

Table 8-1 DC Power Save On/Off

Trigger	Assigned Functions	See
PF Key	DC Power Save On/Off	AVAILABLE FUNCTIONS FOR THE PF KEYS
AUX Input Port	DC Power Save Off DC Power Save On DC Power Save On/Off	Available Functions for the AUX Input Ports
Startup	DC Power Save Off DC Power Save On	Assigning Functions that Become Active or Enabled When the Repeater Starts Up (Startup)

If **DC Power Save** is enabled, TX LED, BUSY LED, Key LED, and the 17-segment LED display are turned off and the power sourced to an audio amplifier is shut off.
If **DC Power Save** is disabled, TX LED, BUSY LED, Key LED, and the 17-segment LED display lights normally and the power is sourced to an audio amplifier.
Also, while **DC Power Save** is enabled, each LED can temporarily lights normally by using the following functions assigned to a **PF** key, an AUX Input port, or **Startup**.

Table 8-2 Display On/Off

Trigger	Assigned Functions	See
PF Key	Display On/Off	AVAILABLE FUNCTIONS FOR THE PF KEYS
AUX Input Port	Display Off Display On Display On/Off	Available Functions for the AUX Input Ports
Startup	Display Off Display On	Assigning Functions that Become Active or Enabled When the Repeater Starts Up (Startup)

If **Display On** is enabled, each LED lights normally and the power is sourced to an audio amplifier for the length of time configured in **Save Delay Timer**. If **Display On** is disabled (**Display Off** is enabled), each LED turns off and the power sourced to an audio amplifier is shut off. (Refer to Save Delay Timer .)

Note

- Even if **DC Power Save** is enabled, POWER LED remains lit.
- While **DC Power Save** is enabled, Key LED does not light even if any key other than the **Display On/Off** key or the **Display On** key is pressed. However, the function assigned to keys are executed because the key operation is enabled.
- If transmission is executed while **DC Power Save** is enabled, the repeater transmits with TX LED turned off. Also, while **DC Power Save** is enabled, the sidetones, such as CW, cannot sound because the power sourced to an audio amplifier is shut off.
- While **DC Power Save** is enabled, no beep sounds. Therefore, Key Beep A (1 beep) and Key Beep B (2 beeps) do not sound from the repeater even if the **DC Power Save On/Off** key is pressed.

Configuration using KPG-D2

- Assigning functions to the **PF** keys (See Edit > Key Assignment)
- Assigning functions to the AUX Input port (See Edit > Function Port > AUX > AUX Input)
- Assigning the **Startup** functions (See Edit > Optional Features > Other > Startup)

8.2 Save Delay Timer

Save Delay Timer is the length of time to light LEDs normally and source the power to an audio amplifier if **Display On** becomes enabled.

If **Display On** becomes enabled while **DC Power Save** is enabled, LEDs light normally and the power is sourced to an audio amplifier for the length of time configured in **Save Delay Timer**.

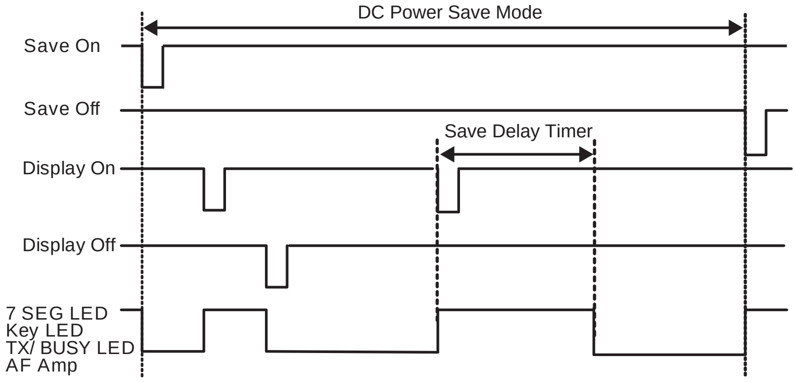


Figure 8-1 Save Delay Timer

Note

- If **Display On** is disabled (**Display Off** is enabled), each LED turns off and the power sourced to an audio amplifier is shut off even if the length of time configured in **Save Delay Timer** is not elapsed.

Configuration using KPG-D2

Configuring **Save Delay Timer** (See Edit > Optional Features > Other > DC Power Save)

Communications by a serial command can be made by using a communication port equipped on the repeater.

9.1 Making Serial Command Communications by Using Communication Ports

The repeater is equipped with 2 communication ports, COM port 1 and COM port 2.

- **COM port 1**

  The USB connector (USB Type-B) of the repeater can be used as COM port 1.

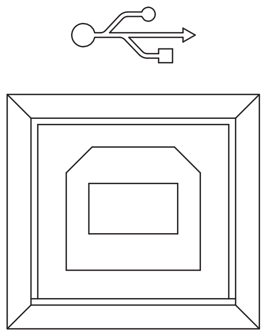


Figure 9-1 USB Connector

- **COM port 2**

  The pin 2 (RXD2) and pin 3 (TXD2) of the D-Sub 25-pin connector located on the repeater can be used as COM port 2.

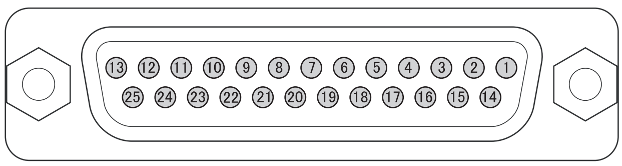


Figure 9-2 D-sub 25-pin Connector

Table 9-1 COM Port 2

Pin Number	Signal Name	Input/ Output	Description
2	RXD2	Input	Asynchronous Receive Data
3	TXD2	Output	Asynchronous Send Data

Available Functions for Communication Ports

The following functions can be assigned to the communication port:

Table 9-2 Available Functions for Communication Ports

Function	Description
None	The repeater can communicate with KPG-D2.
Data	The repeater can be remotely controlled by using a PC command. Data communications such as Status Call, Short Data Call, and Long Data Call can be made. The repeater can communicate with KPG-D2.
Data + GPS Data Output	The repeater can be remotely controlled by using a PC command. Upon the receipt of GPS data, the GPS data is transferred with STX and ETX added. Also, GPS data in the Full or Short format can be received. Data communications such as Status Call, Short Data Call, and Long Data Call can be made. The repeater can communicate with KPG-D2.

Note

- If “Data” or “Data + GPS Data Output” is assigned to either communication port, only “Data” or “Data + GPS Data Output” cannot be assigned to the other communication port.

Configuration using KPG-D2

Assigning functions to the communication port of the repeater (See Edit > Optional Features > Common Page 4 > COM port)

Parameters Applied to Communication Ports

The parameters that determine the communication port behavior can be configured.

Table 9-3 Parameters of Communication Ports

Function	Description
Stop Bit	**Stop Bit** is the bit information of the stop bit used for data communications. A value of 1 or 2 can be configured in **Stop Bit**.
Baud Rate	In **Baud Rate**, the configuration of the baud rate of the communication port for data communications can be configured. One of 1200 bps, 2400 bps, 4800 bps, 9600 bps, and 19200 bps can be configured in **Baud Rate**. Normally, 9600 bps is configured for Baud Rate.

Configuration using KPG-D2

Configuring **Stop Bit**, **Baud Rate** (See Edit > Optional Features > Common Page 4 > COM port)

9.2 Configuring the Version of PC Interface Protocol

For the format and procedure of commands to be used for the remote control of the repeater by using PC commands, whether the existing (Version 1) or the upgrade (Version 2) is used can be specified.

Table 9-4 PC Interface Protocol

Version	Description
Version 1	This command starts with STX (Start of Text) and ends with ETX (End of Text). The repeater executes the control by the command, and the results are output as serial data.
Version 2	The data format of this command is almost the same as Version 1, but the serial number (SEQ) is added to the Version 1 command. The repeater first sends as serial data whether to execute the received command. Then, the repeater executes the control by the command, and the results are sent as serial data.

Configuration using KPG-D2

Configuring **PC Interface Protocol** (See Edit > Optional Features > Common Page 4)

9.3 Sending Serial Data from Communication Ports

The repeater can send the data, such as a received status message, a received short message, and a received Unit ID, from the communication ports of the repeater.

Status Message Serial Output

Status Message Serial Output is the function to send the received status message and the caller ID from the communication port of the repeater when the repeater receives a status message.
The status message sent from the communication port can be transferred to the external devices connected to the communication ports, such as a PC.
Using this function, a system administrator can monitor received status messages in real time.

Note
- In order to use this function, “Data” or “Data + GPS Data Output” needs to be assigned to any communication port.

Configuration using KPG-D2

Configuring **Status Message Serial Output** to be enabled or disabled (See Edit > Optional Features > Common Page 4 > Serial Output)

Short Message Serial Output

Short Message Serial Output is the function to send the received short message and the caller ID from the communication port of the repeater when the repeater receives a short message.
The short message sent from the communication port can be transferred to the external devices connected to the communication ports, such as a PC.
Using this function, a system administrator can monitor received short messages in real time.

Note
- In order to use this function, “Data” or “Data + GPS Data Output” needs to be assigned to any communication port.

Configuration using KPG-D2

Configuring **Short Message Serial Output** to be enabled or disabled (See Edit > Optional Features > Common Page 4 > Serial Output)

Unit ID Serial Output

Unit ID Serial Output is the function to send the received Unit ID from the communication port of the repeater when the repeater receives a Unit ID.

The Unit ID sent from the communication port can be transferred to the external devices connected to the communication ports, such as a PC.

Using this function, a system administrator can monitor the calling subscriber unit in real time. Also, the Unit ID sent from the communication port can also be used for management of the call log.

Even if the condition to unmute the speaker is not satisfied, the repeater sends the received Unit ID from the communication port with the speaker muted upon receipt of a Unit ID.

Also, even if the repeater is called by Selective Call, the repeater sends the received Unit ID from the communication port. In this case, a Unit ID is sent regardless of the configuration for **Unit ID Serial Output**.

Note

- Depending on the reception status of receiving repeater, multiple Unit IDs may be sent even if a single call is made.
- In order to use this function, “Data” or “Data + GPS Data Output” needs to be assigned to any communication port.
- This function can be used only on an NXDN digital channel or a mixed channel.
- In order to receive a Unit ID, the received RAN code needs to match the RAN code preconfigured in the repeater.

Configuration using KPG-D2

Configuring **Unit ID Serial Output** to be enabled or disabled (See Edit > Optional Features > Common Page 4 > Serial Output)

J Command Serial Output

J Command Serial Output is the function to send a PC command automatically from the communication port when the repeater status changes.

Using this function notifies the change of the repeater status by automatically sending a PC command, such as J Command, from the communication port when the indication of the display changes or some functions become enabled or disabled.

Enabling this function automatically sends a PC command when the repeater status changes.

Disabling this function sends a PC command only when a request command is received from a PC.

Note

- Refer to the PC Interface Protocol manual for the details of a PC command.
- In order to use this function, “Data” or “Data + GPS Data Output” needs to be assigned to any communication port.

Configuration using KPG-D2

Configuring **J Command Serial Output** to be enabled or disabled (See Edit > Optional Features > Common Page 4 > Serial Output)

DTMF Code Serial Output

DTMF Code Serial Output is the function to send the received DTMF code from the communication port of the repeater when the repeater receives a DTMF code.

Note

- Refer to the PC Interface Protocol manual for the details of a PC command.
- In order to use this function, “Data” or “Data + GPS Data Output” needs to be assigned to any communication port.

Configuration using KPG-D2

Configuring **DTMF Code Serial Output** to be enabled or disabled (See Edit > Optional Features > Common Page 4 > Serial Output)

9.4 Specifying the Output Format of GPS Data

In the NXDN digital mode, the repeater can extract the data in the NMEA-0183 format from the received GPS data and send the extracted data from the communication port of the repeater. Also, in the NXDN digital mode, the repeater can create the KENWOOD proprietary sentence from the received GPS data and send the created data from the communication port of the repeater.

The data sent from the communication port can be transferred to the external devices connected to the communication ports, such as a PC. The data in the NMEA-0183 format extracted from the GPS data contains the calling subscriber unit's positioning information. Also, the KENWOOD proprietary sentence created from the GPS data contains the Unit ID and the status information in addition to the calling subscriber unit's positioning information.

Information contained in the data transferred to a PC can be viewed on mapping applications, such as CAD or AVL.

The output formats of GPS data are as follows:

Table 9-5 Output Formats of GPS Data

Output Format	Description
Map Header NMEA1 ($GPGGA)	Upon receipt of the GPS data, the repeater extracts the $GPGGA data in the NMEA-0183 format from the received GPS data and sends the extracted data from the communication port.
Map Header NMEA2 ($GPGLL)	Upon receipt of the GPS data, the repeater extracts the $GPGLL data in the NMEA-0183 format from the received GPS data and sends the extracted data from the communication port.
Map Header NMEA3 ($GPRMC)	Upon receipt of the GPS data, the repeater extracts the $GPRMC data in the NMEA-0183 format from the received GPS data and sends the extracted data from the communication port.
Map Header KW1 ($PKNDS)	Upon receipt of the GPS data, the repeater creates the $PKNDS data which is the KENWOOD proprietary sentence from the received GPS data and sends the created data from the communication port. The $PKNDS data contains the $GPRMC data in the NMEA-0183 format, Unit ID, and the status information.
Map Header KW2 ($PKNID)	Upon receipt of the GPS data, the repeater creates the $PKNID data which is the KENWOOD proprietary sentence from the received GPS data and sends the created data from the communication port. The repeater extracts only the Unit ID and the status information from the received GPS data and sends the extracted data from the communication port. This sentence is recommended to be used along with $GPGGA (NMEA), $GPGLL (NMEA) or $GPRMC (NMEA). For example, if $GPGGA (NMEA) and $PKNID are used simultaneously, the repeater sends from the communication port of the repeater the $GPGGA data in addition to the Unit ID and the status information extracted from the GPS data.
Map Header KW3 ($PKNSH)	Upon receipt of the GPS data, the repeater creates the $PKNSH data which is the KENWOOD proprietary sentence from the received GPS data and sends the created data from the communication port. The $PKNSH data contains the $GPGLL data in the NMEA-0183 format and the Unit ID.

Note

- In order to use this function, “Data” or “Data + GPS Data Output” needs to be assigned to any communication port.
- This function can be used only on the NXDN digital channel or mixed channel in the repeater operated in the base station mode.
- In order to receive the GPS data, the received RAN code needs to match the RAN code preconfigured for the repeater.
- During transmission, the repeater cannot receive the GPS data.

Configuration using KPG-D2

Configuring the output formats of GPS data to be enabled or disabled (See Edit > Optional Features > Common Page 4 > Base Station Settings)

9.5 Configuring the Number of Data Transfer Retries (Number of Retries)

If the repeater cannot receive an acknowledgment after the repeater sends data and then the length of time configured in **Maximum ACK Wait Time** elapses, the repeater resends data. **Number of Retries** is the number of times for the repeater to resend data.

If an acknowledgment is not returned even if the repeater resends data up to the number of times configured in **Number of Retries**, the repeater stops sending data.

A smaller number is configured if communicating conditions are good, and a larger number is configured if communicating conditions are poor.

Configuration using KPG-D2

Configuring **Number of Retries** (See Edit > NXDN > Data > Parameter)

9.6 Configuring the Duration to Wait If the Communication Capability Is Busy When Sending Data (Transmit Busy Wait Time)

The repeater distinguishes that the communication capability is available before sending data and then starts sending data when the capability becomes available. **Transmit Busy Wait Time** is the duration to wait for the communication capability to become available.

If the communication capability is still unavailable after the length of time configured in **Transmit Busy Wait Time** elapses, the transmission is canceled.

Note

- We recommend that this function be used in the default configuration (10.0 sec).

Configuration using KPG-D2

Configuring **Transmit Busy Wait Time** (See Edit > NXDN > Data > Parameter)

9.7 Configuring the Maximum Length of Time to Wait for an Acknowledgment from the Target (Maximum ACK Wait Time)

Maximum ACK Wait Time is the length of time for the repeater to wait for an acknowledgment from the target after the repeater sends data.

If the acknowledgment does not come back even after the length of time configured in **Maximum ACK Wait Time** elapses, the repeater resends the data up to the number of times configured in **Number of Retries**.

Note

- We recommend that this function be used in the default configuration (2.0 sec).
- A long message is received divided over several times. The repeater waits to receive the next data for the length of time configured in **Maximum ACK Wait Time** after receiving the previous data. The repeater exits the receiving mode for a long message if the repeater does not receive any data during the period.

Configuration using KPG-D2

Configuring **Maximum ACK Wait Time** (See Edit > NXDN > Data > Parameter)

9.8 Configuring the Length of Time from When the Repeater Receives Data until the Repeater Sends the Acknowledgment (ACK Delay Time)

ACK Delay Time is the length of time from when the repeater receives data until the repeater sends the acknowledgment.

The repeater sends the acknowledgment when the length of time configured in **ACK Delay Time** elapses after the repeater receives data.

ACK Delay Time needs to be shorter than **Maximum ACK Wait Time** configured for the transmitting repeater.

Note

- We recommend that this function be used in the default configuration (0.5 sec).

Configuration using KPG-D2

Configuring **ACK Delay Time** (See Edit > NXDN > Data > Parameter)

9.9 Configuring the Length of Time to Transmit the DELAY Frame Prior to the First Data Transmission (Transmit Delay Time (Receive Capture))

Transmit Delay Time (Receive Capture) is the length of time to transmit the DELAY frame prior to the first data transmission.

The repeater transmits the DELAY frame and the receiving subscriber unit temporarily stops scanning to reliably receive the data. In this way, **Transmit Delay Time (Receive Capture)** can be used for the receiving subscriber unit to reliably receive data even if the receiving subscriber unit is using the scan function or the battery saver function.

Transmit Delay Time (Receive Capture) is configured to be longer if many subscriber units need to be scanned by the subscriber unit within a group.

Data Transmit Modulation Delay Time becomes active after the length of time configured in **Transmit Delay Time (Receive Capture)** elapses. Therefore, the time until the data is actually sent is the sum of the times configured in **Data Transmit Modulation Delay Time** and **Transmit Delay Time (Receive Capture)**.

Configuration using KPG-D2

Configuring **Transmit Delay Time (Receive Capture)** (See Edit > NXDN > Data > Parameter)

9.10 Configuring the Length of Time That the DELAY Frame Is Transmitted (Data Transmit Modulation Delay Time)

Data Transmit Modulation Delay Time is the length of time from when the repeater starts transmitting data until the repeater starts modulating the data frame.

Data Transmit Modulation Delay Time is required to start modulating the data frame after the transmitted radio signal is stabilized. However, it may be difficult to establish data communications when the transmit and receive frequencies are widely separated or always used in extremely cold areas. In such cases, extending **Data Transmit Modulation Delay Time** may improve the reliability of data communications.

Data Transmit Modulation Delay Time becomes active after the length of time configured in **Transmit Delay Time (Receive Capture)** elapses. Therefore, the time until the data is actually sent is the sum of the times configured in **Data Transmit Modulation Delay Time** and **Transmit Delay Time (Receive Capture)**.

Configuration using KPG-D2

Configuring **Data Transmit Modulation Delay Time** (See Edit > NXDN > Data > Parameter)

9.11 Reducing the Possibility of Transmission Collision When Communicating Data among Multiple Repeaters (Random Access)

Random Access is the function to stagger the timing at random of starting transmission for each repeater, if the repeater transmits after the channel becomes available from being busy.

If a large number of repeaters start transmitting immediately after the channel becomes available from being busy, the collision of transmissions may occur. Staggering the timing at random of starting transmission for each repeater prevents the collision of transmissions.

Depending on the configuration for **Channel Spacing** (Narrow or Very Narrow), the length of time for **Random Access** varies as follows:

- **Narrow**
  The length of time for **Random Access** is one of 40 ms, 80 ms, or 160 ms ••• 400 ms at 40-ms intervals.
- **Very Narrow**
  The length of time for **Random Access** is one of 80 ms, or 160 ms ••• 800 ms at 80-ms intervals.

Configuration using KPG-D2

Configuring **Random Access** to be enabled or disabled (See Edit > NXDN)

By updating the firmware, the latest functions are available in the repeater in operation.

Also, by testing and adjusting transmit and receive capabilities of the repeater, and by using the function to monitor the power supply voltage and using applications to monitor the hardware information of the repeater, the status of the repeater can be confirmed and maintenance can be done as needed.

10.1 Confirming the Firmware Version of the Repeater

The firmware version of the repeater can be confirmed in the **Repeater Information** dialog box of KPG-D2.

Repeater information such as unique information, firmware version, and checksum can be confirmed in the **Repeater Information** dialog box. Repeater information can be read to KPG-D2 by using serial communication or IP network communication.

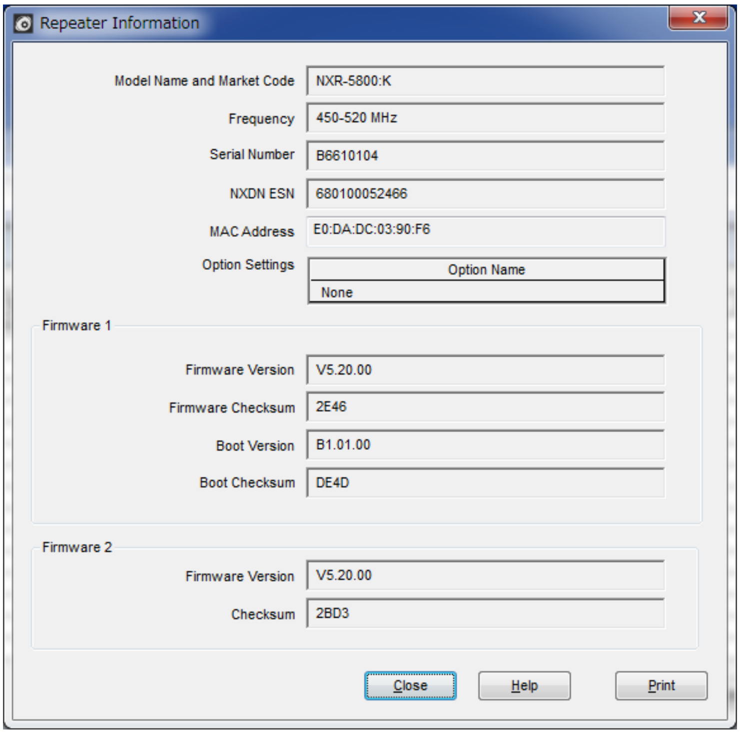


Figure 10-1 Repeater Information Dialog Box

- **Reading repeater information by using serial communication**

  To read repeater information by using serial communication, the port connected to NXR-5700/ NXR-5800 needs to be specified after **COM** is configured in **Communication Port** of KPG-D2.

  If the repeater is connected to a PC by using a USB Type-B cable, and “Repeater Information” is selected from **Tool** of KPG-D2, the information configured for the repeater appears in the **Repeater Information** dialog box.

- **Reading repeater information by using IP network communication**

  If the repeater is connect to an IP network, the repeater information can be read to KPG-D2 via the IP network. To read repeater information by using IP network communication, “Direct” or “Site Select” needs to be selected after **LAN** is configured in **Communication Port** of KPG-D2.

  If “Repeater Information” is selected from **Tool** of KPG-D2, and reading is executed after the IP address (when “Direct” is configured) or the site number (when “Site Select” is configured) of the target site for communications is specified, the information configured for the repeater appears in the **Repeater Information** dialog box.

For operation methods, refer to the help texts supplied with KPG-D2. (See Tools > Repeater Information)

10.2 Updating the Firmware Version of the Repeater

By updating the firmware of the repeater, the latest functions of the repeater are available to the user. To update the firmware of the repeater, the firmware data needs to be obtained from KENWOOD and written to the repeater.

To write the firmware data, KFL in the file to which KPG-D2 has been installed is used, or writing can done on a web browser via an IP network.

Writing firmware data by using KFL

Follow the procedure below to write firmware data by using KFL.

1 **Connect the repeater to a PC by using a USB Type-B cable.**

2 **Execute the firmware programming software (KFL.exe) in the file to which KPG-D2 has been installed.**

KFL starts.

3 **Configure the communications settings.**

The communication port of a PC is configured in **COM port**.
“Auto” is configured in **Baud rate**.

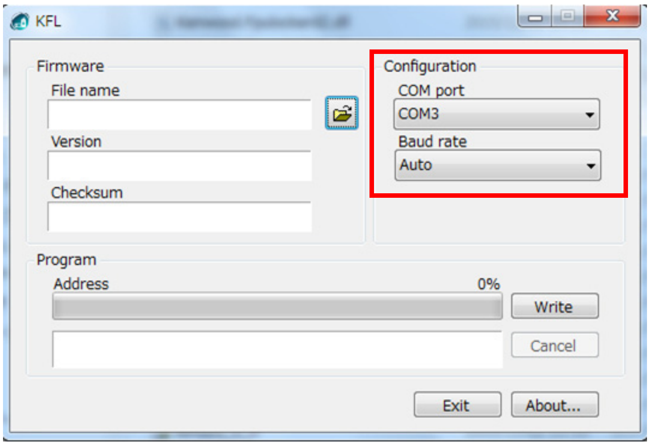


Figure 10-2 KFL Dialog Box (Configuration)

4 Click the “” button.

The firmware file selection screen appears.

5 Select a firmware file (file extension: .bin) to be written, and then click the “Open” button.

The file name, version, and checksum of the selected firmware file appear.

6 Click the “Write” button.

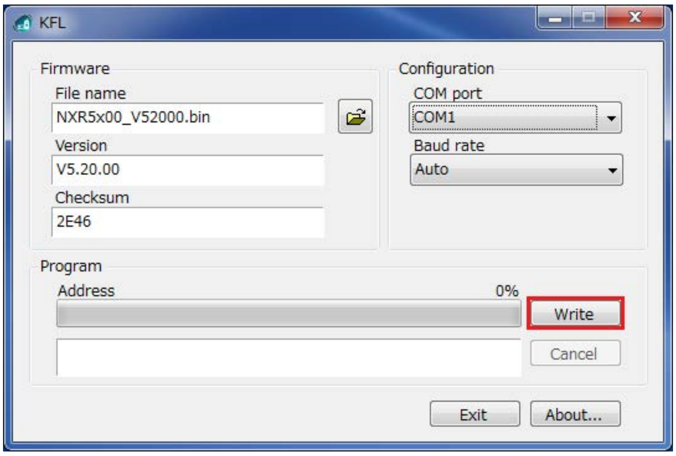


Figure 10-3 KFL Dialog Box (Write)

The writing of firmware starts.
When the writing of the firmware properly completes, a message appears.

7 Click the “OK” button.

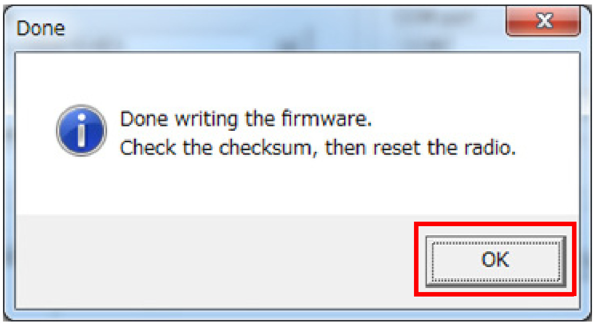


Figure 10-4 Writing Completion Message

Writing firmware data by using IP network communication

If the repeater is connected to an IP network, follow the procedure below to write the firmware data to the repeater by using IP network communication.

1 Enter the IP address of the repeater into the address field of the web browser.

The login screen appears.

Note
- The IP address of the repeater can be configured using KPG-D2. (Refer to Configuring the IP Network Information.)

2 Enter a user name and password with Administrator authority, and then click the “Login” button.

The following is the default user name and password:
User Name: admin
Password: (blank)

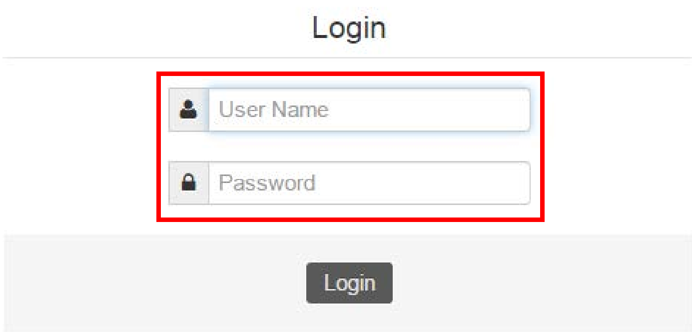


Figure 10-5 Login

The web interface appears.

3 **Click the "Browse" button in New Network Firmware of Maintenance > System > Firmware Update on the web interface.**

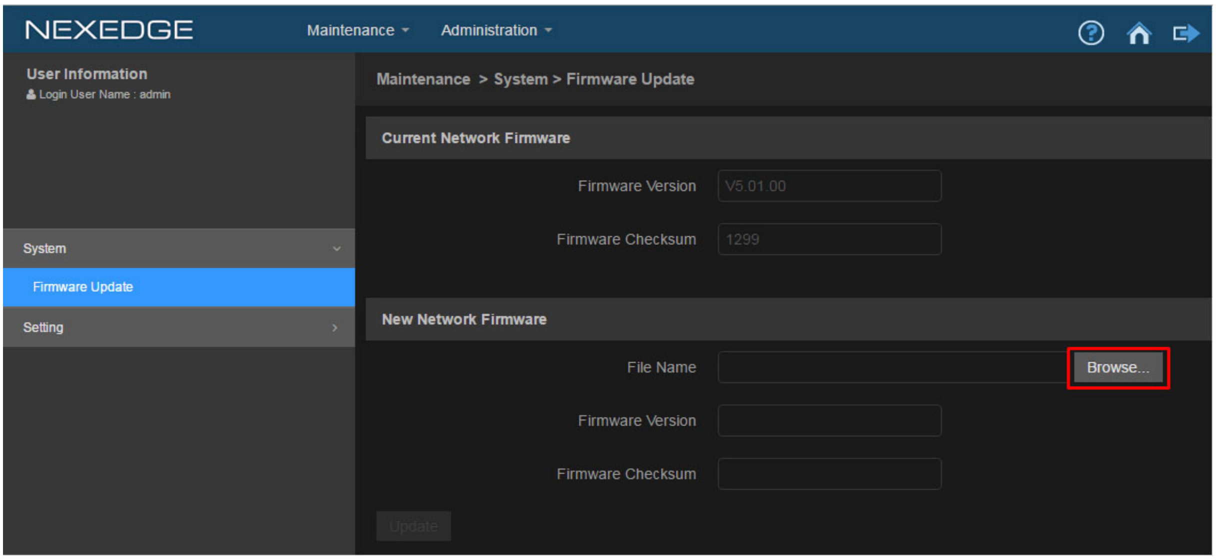


Figure 10-6 Firmware Update (Browse)

The firmware file selection screen appears.

4 **Select a firmware file (file extension: .bin) to be written, and then click the "Open" button.**

The file name, version, and checksum of the selected firmware file appear.

5 **Click the "Update" button.**

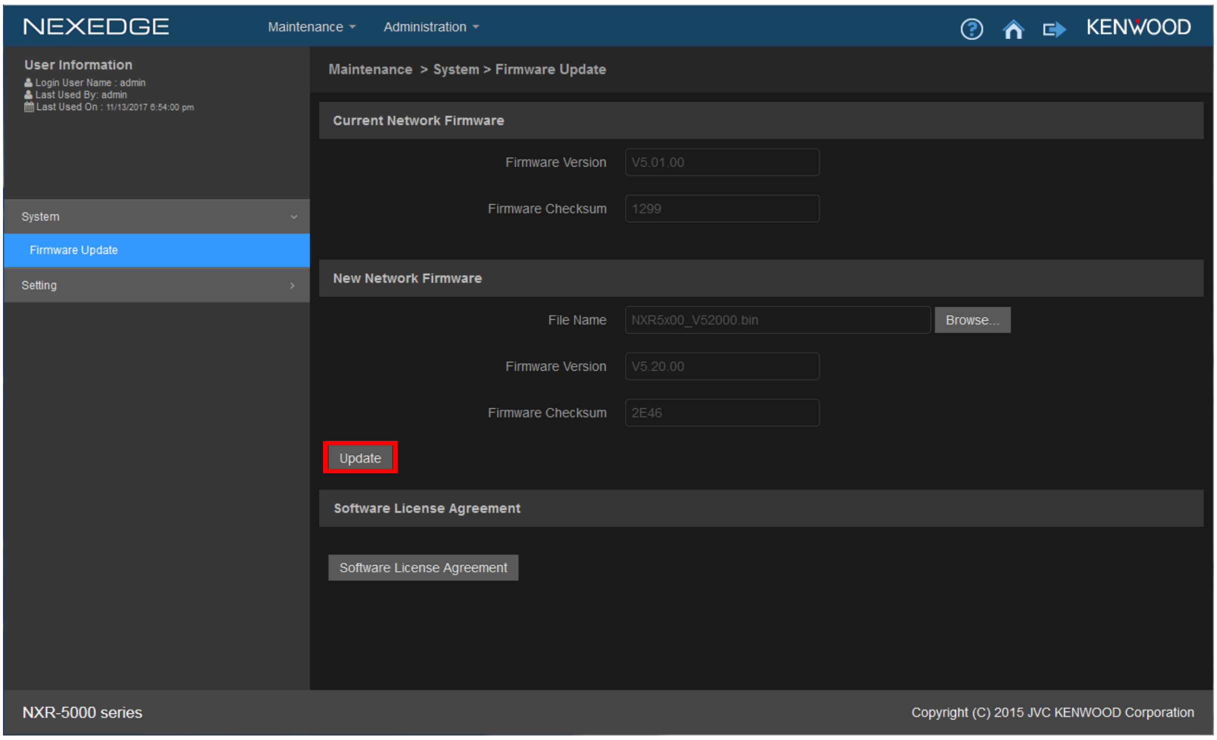


Figure 10-7 Firmware Update (Update)

The firmware is updated.
When the firmware update completes, the repeater automatically logs out from the web interface.

10.3 Monitoring the Power Supply of the Repeater and Notifying by a Warning Tone (Power Supply Monitor)

Power Supply Monitor is the function to monitor the power supply of the repeater and warn a user according to the voltage level that the voltage of the repeater is reduced.

Using the AUX Output port or transmitting a tone warns a user that the voltage of the repeater is reduced.

Power Supply Monitor has 2 warning levels: **Power Supply Monitor 1** and **Power Supply Monitor 2**. The warning voltage (**Power Supply Lower Level**) at each warning level can be configured using KPG-D2. In addition, at each of the warning levels, a warning tone and an operation tone can be configured. According to emergency levels, such as a caution or a warning, these tones can be used.

Configuring the Threshold Value to Detect the Reduced Voltage Level (Power Supply Lower Level)

Power Supply Lower Level is the threshold level of the voltage to detect that the voltage of the repeater is reduced and activate **Power Supply Monitor**.

If the power supply of the repeater is lower than the voltage level configured in **Power Supply Lower Level**, **Power Supply Monitor** becomes active. If the power supply of the repeater is higher than the voltage level configured in **Power Supply Lower Level**, **Power Supply Monitor** becomes inactive.

If **Power Supply Monitor** becomes active, the repeater warns a user that the voltage of the repeater is reduced according to the configuration by using KPG-D2.

Power Supply Lower Level can be configured for both **Power Supply Monitor 1** and **Power Supply Monitor 2**.

Configuration using KPG-D2

Configuring **Power Supply Lower Level** (See Edit > Optional Features > Common Page 3)

Warning by the AUX Output Port

Assigning “Power Supply Lower Limit” to the AUX Output port, the active or inactive status of **Power Supply Monitor** is sent to the AUX Output port. The status of the port can be selected from “Active High” or “Active Low”. (Refer to Available Functions for the AUX Output Ports.)

Two types of functions, “Power Supply Lower Limit 1” and “Power Supply Lower Limit 2”, can be assigned to the AUX Output port. Each function respectively corresponds to **Power Supply Monitor 1** and **Power Supply Monitor 2**.

Configuration using KPG-D2

Assigning functions to the AUX Output port (See Edit > Function Port > AUX > AUX Output)

Warning by Warning Tone

If **Power Supply Monitor** becomes active, transmitting a warning tone warns a user that the voltage of the repeater is reduced.

A warning tone is transmitted for 5 sec upon lapse of 500 ms after **Power Supply Monitor** becomes active.

The transmitted warning tone can be configured as desired. In addition, a warning tone can be configured to be transmitted to the RA port simultaneously while being transmitted to a user.

Frequency: 1630 Hz

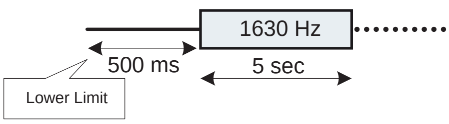


Figure 10-8 Warning Tone

Note

- Because the warning tone is transformed by the vocoder if a warning tone is transmitted on an NXDN digital channel, the warning tone may not be transmitted with the originally configured tone frequency, and the tone frequency may slightly drift from the original tone frequency.
- The deviation for a warning tone cannot be adjusted individually. The following is the volume when a warning tone is transmitted:

  Analog: Applies the deviation for a test tone.

  Digital: The fixed value
- A warning tone is transmitted even if **Power Supply Monitor** becomes active while transmitting. However, the transmission of a warning tone is suspended while **Transpond** or an Air Remote code, etc. using the **Remote Control** function is transmitted, or while a CW ID or CW message is sent. In this case, a transmission of a warning tone starts upon lapse of 500 ms after transmissions of each signal ends.
- If **Power Supply Monitor** becomes active while a test tone is being transmitted, the test tone transmission ends and a warning tone transmission starts.
- No warning tone is transmitted even if **Power Supply Monitor** becomes active while **TX Disable** is enabled. Also, transmission of a warning tone ends if **TX Disable** becomes enabled while a warning tone is being transmitted.

Configuration using KPG-D2

Configuring **Warning Tone** (See Edit > Optional Features > Common Page 3)

Warning by Operation Tone

If **Power Supply Monitor** becomes active, transmitting an operation tone warns a user that the voltage of the repeater is reduced.

If the transmission is initiated by using the Repeat PTT control or the **PTT** (microphone) switch while **Power Supply Monitor** is active, the operation tone is transmitted at certain time intervals.

The tone frequency of an operation tone to be transmitted and the transmission time intervals for an operation tone can be configured as desired. In addition, an operation tone can be configured to be transmitted to the RA port simultaneously while being transmitted to a user.

An operation tone which is transmitted by control of **Power Supply Monitor 1** is a single tone.

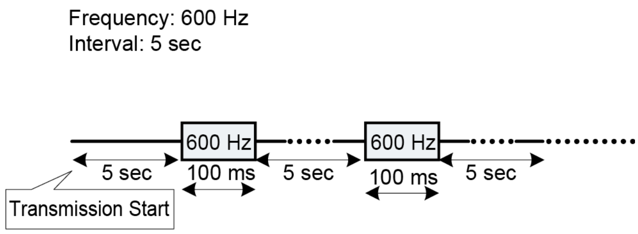


Figure 10-9 Operation Tone (Power Supply Monitor 1)

An operation tone which is transmitted by control of **Power Supply Monitor 2** is a dual tone.

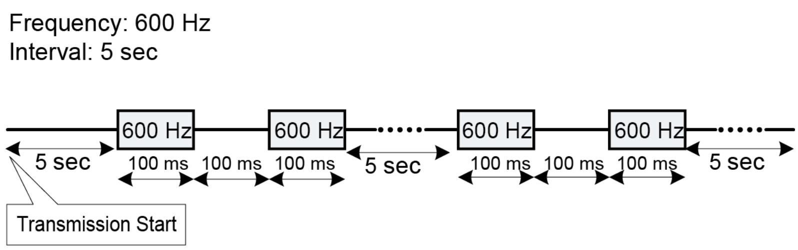


Figure 10-10 Operation Tone (Power Supply Monitor 2)

Note

- Although an operation tone is superimposed with a voice signal and then modulated if the operation tone is transmitted on an analog channel, the voice signal is intermittently interrupted and the operation tone is modulated if an operation tone is transmitted on an NXDN digital channel.
- Because an operation tone is transformed by the vocoder if the operation tone is transmitted on an NXDN digital channel, the operation tone may not be transmitted with the originally configured tone frequency, and the tone frequency may slightly drift from the original tone frequency.
- The deviation for an operation tone cannot be adjusted individually. The following is the volume when an operation tone is transmitted:

  Analog: Applies the deviation for a CW ID tone.

  Digital: The fixed value
- An operation tone is not transmitted even if the transmission interval time for an operation tone elapses while a CW ID or a CW message is sent or while a test tone is transmitted.

.

Configuration using KPG-D2

Configuring **Operation Tone** (See Edit > Optional Features > Common Page 3)

10.4 Confirming the Repeater Status by Remote Control via an IP Network

The repeater status can be confirmed via an IP network by using KPG-149RM/ KPG-149SA Repeater Monitor.

KPG-149RM/ KPG-149SA Repeater Monitor is the application software that can be configured to monitor the hardware information of a NEXEDGE-supporting repeater with an IP connection, and notify the user of a repeater failure by an alert.

By connecting a PC with KPG-149RM/ KPG-149SA Repeater Monitor installed to an IP network of a communication system (conventional or trunking) structured with NXR-5700/ NXR-5800, a system administrator can monitor the status of each repeater in real time even from a remote location.

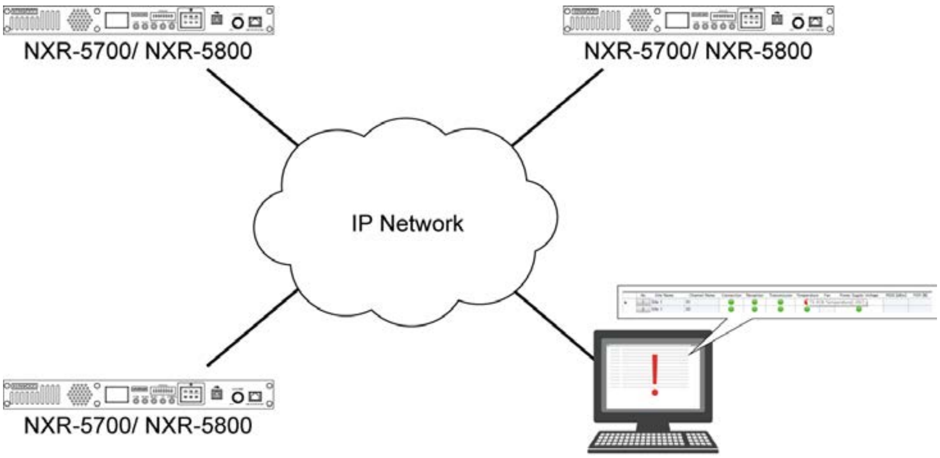


Figure 10-11 Example of the System Structure

Table 10-1 Items Available for Monitoring by KPG-149RM/ KPG-149SA Repeater Monitor

Category	Monitoring Item
Connection	Connection to Repeater
Reception	Current Consumption (LNA)
	VCO Control Voltage (Reception)
	PLL Lock Detection
	Down Converter Saturation
Transmission	VCO Control Voltage (Transmission)
	PLL Lock Detection
	Current Consumption (OCXO)
	Forward Power Level
	RF Power Down Detection
	Current Consumption (HPA)
	Failure Channel Input
	MOD PLL Lock Detection
	REF PLL Lock Detection
	DSP PLL Lock Detection
	MOD PLL Voltage
	REF PLL Voltage
	DSP PLL Voltage
Temperature	TX PCB Temperature
	RX PCB Temperature
	Control PCB Temperature
	Final PCB Temperature
Fan	Fan Lock Detection
Power Supply	Power Supply Voltage
	Power Supply Voltage Status
Other	RSSI
	FER

If a failure occurs in the repeater, a system administrator is notified by a red alert indicator being displayed and an alert tone sounding by KPG-149RM/ KPG-149SA Repeater Monitor. An administrator of the repeater can be also notified by being sent an email when a failure occurs in the repeater.

Also, KPG-149RM/ KPG-149SA Repeater Monitor can display the log data of the hardware information read from the repeater. The acquired log data can be saved in the CSV format.

Refer to “KPG-149RM Repeater Monitor Basic Operations” for the details of KPG-149RM/ KPG-149SA Repeater Monitor.

10.5 Confirming Whether the Configured Analog Channel of the Repeater Works Properly (Test Tone)

Test Tone is the function to modulate and send a single tone for the frequency configured using KPG-D2.

This function can be used to test the transmission on a configured analog channel.

For example, by initiating transmission on an analog channel of the repeater positioned on top of a mountain, an operator at the bottom of the mountain can confirm that the analog channel being used for transmission works properly by receiving a single tone on a subscriber unit.

A single tone is transmitted during transmission if transmission starts using the **PTT** (microphone) switch, External PTT control, or Repeat PTT control on an analog channel with the test tone transmission function enabled.

The test tone transmission function can be enabled or disabled when a **PF** key is pressed, when the signal is applied to an AUX Input port, or when the repeater is turned on.

Table 10-2 Enabling or Disabling the Test Tone Transmission Function

Trigger	Assigned Functions	See
PF key	Test Tone On/Off	AVAILABLE FUNCTIONS FOR THE PF KEYS
AUX Input port	Test Tone Off Test Tone On Test Tone On/Off	Available Functions for the AUX Input Ports
Startup	Test Tone Off Test Tone On	Assigning Functions that Become Active or Enabled When the Repeater Starts Up (Startup)

Note

- This function can be used only on an analog channel. On an NXDN channel, the test tone transmission function can be switched, but a test tone is not transmitted. However, on a mixed channel, a test tone is transmitted when the repeater transmits or repeats an analog signal.
- A test tone is not transmitted while a CW ID, CW message, DTMF code, or Courtesy Tone is sent.
- A voice is not modulated while a test tone is being transmitted.

Configuration using KPG-D2

Configuring **Test Tone** (See Edit > Optional Features > Common Page 1)

10.6 Testing the Transmit and Receive Capabilities of the Repeater (PC Test Mode)

PC Test Mode is the mode to test the transmit and receive capabilities of the repeater by using KPG-D2.
The repeater can enter PC Test Mode by connecting the repeater to a PC by using a USB Type-B cable, and operating KPG-D2.
In PC Test Mode, transmit and receive capabilities of the repeater can be tested using the preconfigured test channel and test signaling.

Note
- Refer to the service manual for instructions on how to operate the repeater in PC Test Mode.

Configuration using KPG-D2

Using PC Test Mode (See Program > Test Mode)

10.7 Adjusting the Transmit and Receive Capabilities of the Repeater (PC Tuning Mode)

PC Tuning Mode is the mode to adjust the transmit and receive capabilities of the repeater by using KPG-D2.
The repeater can enter PC Tuning Mode by selecting an adjustment item in PC Test Mode.

Note
- Refer to the service manual for instructions on how to operate the repeater in PC Tuning Mode.

Configuration using KPG-D2

Using PC Tuning Mode (See Program > Test Mode > Tuning Item)

This section explains the functions and configurations required for operating the repeater in the base station mode.

Base station mode is the mode in which the repeater transmits and receives using the **PTT** (microphone) switch or the External PTT control. In order to use NXR-5700/ NXR-5800 as a base station, this mode must be selected.

There are 2 modes available for the base station mode; one is the simplex mode which enables communications by toggling the repeater between transmission and reception, and the other is the duplex mode which enables both transmission and reception simultaneously.

● Simplex Mode

Simplex mode is the mode that enables communications by toggling the repeater between transmission and reception. In order to use this mode, “Simplex” needs to be configured in **Operation Mode** by using KPG-D2.

Figure 11-1 Simplex Mode

● Duplex Mode

Duplex mode is the mode that enables both transmission and reception simultaneously. In order to use this mode, “Duplex” needs to be configured in **Operation Mode** by using KPG-D2.

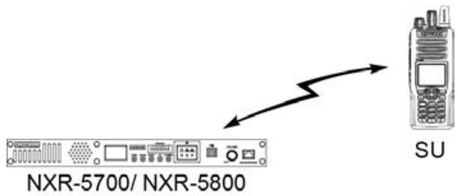


Figure 11-2 Duplex Mode

11.1 Configuring Channel Information

A maximum of 30 channels can be configured for the repeater. A channel can be switched by operating a **PF** key or according to the change of AUX Input port status. (Refer to Operation to Change the Channel.)

To operate the repeater in the base station mode, the following basic functions need to be configured for each channel by using KPG-D2.

- RX Frequency/ TX Frequency
- Channel Type
- Transmit Mode
- QT/DQT Decode/ QT/DQT Encode
- QT Reverse Burst
- RAN Decode/ RAN Encode
- Channel Name
- Channel Spacing
- Operation Mode
- Compander

Configuring Transmit and Receive Frequencies (RX Frequency/ TX Frequency)

Transmit and receive frequencies are pairs of frequencies used by the repeater to transmit and receive. The transmit and receive frequencies of the repeater can be configured for each channel.

Table 11-1 Transmit/ Receive Frequency Range and Step Size

Model	Transmit and Receive Frequencies	
	Range	In steps of
NXR-5700	136 MHz to 174 MHz	2.5 kHz/ 3.125 kHz/ 5 kHz/ 6.25 kHz
NXR-5800	450 MHz to 520 MHz 400 MHz to 470 MHz 350 MHz to 400 MHz	3.125 kHz/ 5 kHz/ 6.25 kHz

Configuration using KPG-D2

Configuring the transmit and receive frequencies for a channel (See Edit > Channel Information/ Channel Edit)

Configuring the Usage Type of the Channel (Channel Type)

Channel Type is the usage type for each channel.

Whether to transmit and receive in analog communications, transmit and receive in NXDN digital communications, or wait to receive both analog signals and NXDN digital signals can be configured.

Table 11-2 Channel Type

Configuration	Description
Analog	The repeater always receives and transmits in analog communications.
NXDN	The repeater always receives and transmits in NXDN digital communications.
Mixed	The repeater waits to receive both analog signals and NXDN digital signals. According to the configuration in **Transmit Mode**, the repeater transmits in analog communications or NXDN digital communications when transmitting. (Refer to Configuring the Transmission Mode for a Mixed Channel (Transmit Mode).)

Configuration using KPG-D2

Configuring **Channel Type** (See Edit > Channel Information/ Channel Edit)

Configuring the Transmission Mode for a Mixed Channel (Transmit Mode)

Transmit Mode is the mode used when the repeater transmits on a channel with “Mixed” configured in **Channel Type** by using the **PTT** (microphone) switch or the External PTT control.

If the repeater transmits using the **PTT** (microphone) switch or the External PTT control, the repeater transmits in the mode configured in **Transmit Mode**. However, the transmit mode varies depending on the receiving condition if **Signaling Reset Timer** is configured. (Refer to Transmitting by Using the Communication Method of Reception (Signaling Reset Timer).)

Table 11-3 Transmit Mode

Configuration	Description
Analog	The repeater transmits in analog communications if the repeater transmits using the **PTT** (microphone) switch or the External PTT control.
NXDN	The repeater transmits in NXDN digital communications if the repeater transmits using the **PTT** (microphone) switch or the External PTT control.

Configuration using KPG-D2

Configuring **Transmit Mode** (See Edit > Channel Information/ Channel Edit)

Configuring the Analog Signaling (QT/DQT Decode/ QT/DQT Encode)

QT/DQT is the signaling used for analog communications by the repeater to transmit and receive an analog signal.

Refer to “Analog Signaling System” for details of QT/DQT.

Configuration using KPG-D2

Configuring **QT/DQT Decode/ QT/DQT Encode** (See Edit > Channel Information/ Channel Edit)

Configuring to Send the QT Reverse Burst Code on an Analog Channel (QT Reverse Burst)

QT Reverse Burst is the function to prevent the speaker of the receiving party from emitting the squelch tail noise by sending a QT Reverse Burst code after transmission ends on the channel with the QT Encode configured.

Refer to “Preventing the receiving party from emitting the squelch tail noise after transmission ends (Squelch Tail Elimination)” for details of **QT Reverse Burst**.

Configuration using KPG-D2

Configuring **QT Reverse Burst** to be enabled or disabled (See Edit > Channel Information/ Channel Edit)

Configuring the Digital Signaling (RAN Decode/ RAN Encode)

RAN (Radio Access Number) is the signaling for NXDN digital communications used by the repeater to transmit and receive a digital signal.

Refer to “Digital Signaling System” for details of RAN.

Configuration using KPG-D2

Configuring **RAN Decode/ RAN Encode** (See Edit > Channel Information/ Channel Edit)

Configuring a Channel Name (Channel Name)

A channel name of up to 2 alphanumeric characters and symbols can be configured for each channel. The configured channel name appears on the LED display of the repeater.

Configuration using KPG-D2

Configuring **Channel Name** (See Edit > Channel Information/ Channel Edit)

Configuring the Channel Spacing (Channel Spacing)

Channel Spacing is the channel spacing used by the repeater to transmit and receive.

Channel spacing is the spacing of frequencies between adjacent channels.

Channel Spacing (Analog)

Following are the channel spacing to be used by the repeater for transmission and reception on an analog channel.

Channel spacing can be configured for each channel by using KPG-D2.

Table 11-4 Channel Spacing (Analog)

Channel Spacing	Bandwidth
Wide or Wide 5k	25 kHz
Wide 4k	20 kHz
Narrow	12.5 kHz

Note

- The configurable items vary as below depending on the market code of the repeater:
  NXR-5700(K), NXR-5800(K, K3, K5): Wide, Narrow
  NXR-5700(E), NXR-5800(E): Wide 5k, Wide 4k, Narrow

Channel Spacing (NXDN)

Following are the channel spacing to be used by the repeater for transmission and reception on an NXDN digital channel.

Table 11-5 Channel Spacing (NXDN)

Channel Spacing	Bandwidth
Narrow	12.5 kHz
Very Narrow	6.25 kHz

Configuration using KPG-D2

Configuring **Channel Spacing (Analog)/ Channel Spacing (NXDN)** (See Edit > Channel Information/ Channel Edit)

Configuring the Operation Mode of the Repeater (Operation Mode)

Operation Mode is the mode in which the repeater transmits and receives.

Depending on the task of the repeater, the repeater can be operated in one of the following modes. (Refer to STRUCTURE OF A CONVENTIONAL SYSTEM.)

If the repeater is operated in the base station mode, configure “Duplex” or “Simplex” in **Operation Mode**.

Table 11-6 Operation Mode

Operation Mode	Description
Duplex	**Duplex** is the mode in which the repeater can transmit and receive simultaneously by using 2 different frequencies. Even if the repeater receives a request for transmission while receiving, the repeater does not mute the received audio and starts transmitting.
Repeat	**Repeat** is the mode in which the repeater transmits by repeating the received signal. If the received QT tone, DQT code or RAN code matches the QT tone, DQT code or RAN code preconfigured for the repeater, the repeater transmits using the configured transmit frequency and Encode QT tone, DQT code or RAN code by using the Repeat PTT control. This function can be used only by the repeater which is operated in a single repeater system or Conventional IP network system. (Refer to SINGLE REPEATER SYSTEM, CONVENTIONAL IP NETWORK SYSTEM.)
Simplex	**Simplex** is the mode in which the repeater transmits and receives by using a frequency or 2 frequencies. The repeater cannot transmit and receive simultaneously. If the repeater receives a request for transmission using the **PTT** (microphone) switch or the External PTT control while receiving, the repeater mutes the received audio and starts transmitting.
RF Link	**RF Link** is the mode in which the repeater transmits the received signal only to a Conventional IP network upon receipt of a signal. If the received RAN code matches the RAN code preconfigured for the repeater, the repeater sends the received signal to the Conventional IP network. Although the signal sent to the Conventional IP network is the same as the one transmitted by the repeater relaying the received signal, this signal is not transmitted using the transmit frequency. However, if the repeater receives a signal from the Conventional IP network, the repeater transmits the received signal using the transmit frequency. This function can be used only by the repeater which is operated in a Conventional IP network system. (Refer to CONVENTIONAL IP NETWORK SYSTEM.)
Voting Repeater	The repeater behaves as the Voting repeater. The repeater can receive a signal using wireless communication, or from multiple Voting receivers via an IP network. The repeater selects a signal with the optimum receiving level among the received signals and sends only the signal to an IP network or transmits using wireless communication. This function can be used only by the repeater which is operated in a Conventional IP network system. (Refer to CONVENTIONAL IP NETWORK SYSTEM.)
Voting Receiver	The repeater behaves as the Voting receiver. The repeater sends the signal only to the network if the repeater receives a signal using wireless communication. The signal is sent to the Voting repeater configured for each channel by using KPG-D2. The signal is sent using the unicast communications regardless of the configuration for IP Casting. If the repeater receives a signal via an IP network, the repeater discards the signal without transmitting by use of the transmit frequency. Also, the repeater does not transmit using the transmit frequency. This function can be used only by the repeater which is operated in a Conventional IP network system. (Refer to CONVENTIONAL IP NETWORK SYSTEM.)

Note

- If the transmit frequency and receive frequency are the same, the repeater cannot behave in the following modes:
  Duplex
  Repeat
  Voting Repeater
- The following modes can be used only on an NXDN digital channel:
  RF Link
  Voting Repeater
  Voting Receiver
- If an analog signal is received on a mixed channel with “RF Link” configured in **Operation Mode**, the received analog signal is not transmitted to the network. Also, the received analog signal is not transmitted by using the transmit frequency. If a transmission request is made by the **PTT** (microphone) switch or the External PTT control, the repeater transmits using the transmit frequency.
- If an analog signal is received on a mixed channel with “Voting Receiver” configured in **Operation Mode**, the received analog signal is not transmitted to the network.
- If the repeat behavior is activated on an NXDN digital channel where “RF Link” or “Voting Receiver” is configured in **Operation Mode**, **Time-out Timer** is not activated.
- “Voting Repeater” can be configured in **Operation Mode** only if **Voting Repeater** is enabled in **Enhanced Features**.

Configuration using KPG-D2

- Configuring **Operation Mode** (See Edit > Channel Information/ Channel Edit)
- Configuring **Voting Repeater** to be enabled or disabled (See Model > Product Information > Enhanced Features)

Improving the Audio Quality on an Analog Channel (Compander)

Compander is the combination term of COMpressor and exPANDER, and is the function to improve the quality of the received signal by reducing the noise in communications. This function is used for improving the S/N ratio of voice communications by compressing the audio during modulation, and then expanding the audio after demodulation.

If the repeater transmits on the analog channel for which **Compander** is enabled, the repeater compresses and modulates the audio signal. Also, if the repeater receives on the analog channel for which **Compander** is enabled, the repeater demodulates the received signal and expands the signal to emit the audio.

Note

- This function can be used only on an analog channel.
- To use this function effectively, enabling **Compander** is recommended on both the transmitting party and the receiving party.

Configuration using KPG-D2

Configuring **Compander** to be enabled or disabled (See Edit > Channel Information/ Channel Edit)

Operation to Change the Channel

If the **Channel 1** to **Channel 30** key is pressed, the repeater migrates to the corresponding channel.

Or, pressing the **Channel Down** key decreases the channel number by one step. Pressing the **Channel Up** key increases the channel number by one step.

Also, the channel can be changed when the signal is applied to an AUX Input port, or when the repeater is turned on.

Table 11-7 Channel Change

Trigger	Assigned Functions	See
PF key	Channel 1 to Channel 30 Channel Down Channel Up	AVAILABLE FUNCTIONS FOR THE PF KEYS
AUX Input port		Available Functions for the AUX Input Ports
Startup		Assigning Functions that Become Active or Enabled When the Repeater Starts Up (Startup)

11.2 Configuring the Functions Related to Reception

This section explains the functions and configurations related to reception used when the repeater is operated in the base station mode.

Squelch

Squelch is the function to eliminate the noise which is generated while the received signal level is low by muting the speaker. The received signal level to unmute the speaker can be changed according to conditions; for instance, when the repeater is operated in the environment of an excessively interfering signal.

Adjusting the reception sensitivity of the repeater (Squelch Level)

Squelch Level is the threshold receive level by which the repeater can determine that the received signal has a carrier.

If the repeater is not receiving any signals, noise is automatically eliminated. Only when the repeater receives the signal having the higher level than the configured signal level, Squelch opens and the received audio becomes audible.

The level of the received signal which unmutes the speaker can be adjusted by changing the value of **Squelch Level** depending on how the repeater is used; for instance, when an excessively interfering signal is present.

If the repeater receives a signal, the speaker is usually unmuted and emits the received audio at the point adjusted by **Squelch Open**; however if the maximum value of 15 is configured in **Squelch Level**, the speaker is unmuted at the point adjusted by **Squelch Tight**. If a value of 0 is configured in **Squelch Level**, the repeater is always placed in the receive mode.

If the signaling for reception (QT tone or DQT code) is not configured, the speaker is unmuted on an analog channel and a mixed channel. Also, if “Repeat” is configured in **Operation Mode**, the repeater executes the repeat behavior. However, **Squelch Level** is disabled on an NXDN digital channel.

Note

- **Squelch Open** and **Squelch Tight** can be adjusted in PC Tuning Mode by using KPG-D2. (Refer to Adjusting the Transmit and Receive Capabilities of the Repeater (PC Tuning Mode).)

Temporarily disabling the squelch (Squelch Off)

Squelch Off is the function to unmute the speaker.

On an analog channel, enabling the **Squelch Off** disables the signaling decoding by QT tone or DQT code, and the speaker is unmuted.

On an NXDN digital channel, enabling the **Squelch Off** disables the signaling decoding by a RAN code, and the speaker is unmuted just by detecting an NXDN frame.

Squelch Off can be enabled or disabled when a **PF** key is pressed, when the signal is applied to an AUX Input port, or when the repeater is turned on.

Table 11-8 Toggling the Squelch Off between Enabled and Disabled

Trigger	Assigned Functions	See
PF key	Squelch On/Off Squelch Off Momentary[*1]	AVAILABLE FUNCTIONS FOR THE PF KEYS
AUX Input port	Squelch Off Squelch On Squelch On/Off	Available Functions for the AUX Input Ports
Startup	Squelch Off Squelch On	Assigning Functions that Become Active or Enabled When the Repeater Starts Up (Startup)

[*1] Pressing the **Squelch Off Momentary** key enables **Squelch Off** while the key is pressed and held.

Note

- If the repeater is operated in the repeater system, even if **Squelch Off** is enabled, the repeater does not transmit by using the Repeat PTT control unless the signaling matches.

Configuration using KPG-D2

Configuring **Squelch Level** (See Edit > Optional Features > Common Page 1)

Temporarily Disabling the Signaling (Monitor)

Monitor is the function to unmute the speaker if the level of the received signal is high, even if the received signaling (the QT tone, DQT code or RAN code) does not match the signaling preconfigured for the repeater (the QT tone, DQT code or RAN code). This function can be used to check in advance whether or not a channel to be used for transmission is already being used by other groups.

Monitor can be enabled or disabled when a **PF** key is pressed, when the signal is applied to an AUX Input port, or when the repeater is turned on.

Table 11-9 Toggling the Monitor between Enabled and Disabled

Trigger	Assigned Functions	See
PF key	Monitor On/Off Monitor Momentary[*1]	AVAILABLE FUNCTIONS FOR THE PF KEYS
AUX Input port	Monitor Off Monitor On Monitor On/Off	Available Functions for the AUX Input Ports
Startup	Monitor Off Monitor On	Assigning Functions that Become Active or Enabled When the Repeater Starts Up (Startup)

[*1] Pressing the **Monitor Momentary** key enables **Monitor** while the key is pressed and held.

The following are the repeater behaviors that may vary depending on the configuration for **Channel Type**. (Refer to Configuring the Usage Type of the Channel (Channel Type).)

Table 11-10 Toggling the Monitor between Enabled and Disabled

Channel Type	Description
Analog	Disables the signaling decoding by the QT tone or DQT code and unmutes the speaker just by receiving a carrier.
NXDN	Disables the signaling decoding by the RAN code and unmutes the speaker just by detecting a NXDN frame. The repeater does not unmute the speaker just by receiving a carrier.
Mixed	Disables the signaling decoding by the QT tone, DQT code or RAN code. If an analog signal is received, the speaker is unmuted just by receiving a carrier. If an NXDN digital signal is received, the speaker is unmuted just by detecting the NXDN frame.

Note

- If the repeater is operated in the repeater system, even if **Monitor** is enabled, the repeater does not transmit by using the Repeat PTT control unless the signaling matches.

Monitoring the Usage Status of a Channel (External Monitor)

External Monitor is the function to monitor the availability of channels by activating the preconfigured **Squelch Off** or **Monitor** when the External Monitor port becomes active.

Table 11-11 External Monitor

Configuration	Description
Squelch Off	If the External Monitor port is activated, **Squelch Off** becomes enabled. On an analog channel, enabling the **Squelch Off** disables the signaling decoding by QT tone or DQT code, and the speaker is unmuted. On an NXDN digital channel, enabling the **Squelch Off** disables the signaling decoding by a RAN code, and the speaker is unmuted just by detecting an NXDN frame.
Monitor	If the External Monitor port is activated, **Monitor** becomes enabled. Refer to "Temporarily Disabling the Signaling (Monitor)" for the repeater behavior.

Note

- The External Monitor port is assigned to pin 15 (EMON) of the D-sub 25-pin connector on the rear panel of the repeater. The External Monitor port is controlled by an external device.
- The logic of the External Monitor port is fixed to Active Low.

Configuration using KPG-D2

Configuring **External Monitor** (See Edit > Optional Features > Common Page 1)

Unmuting the Speaker by Linking with the Microphone (Off-hook Decode)

Off-hook Decode is the function to decode the received signaling (the QT tone, the DQT code, or the RAN code) in conjunction with the microphone of the **PTT** (microphone) switch on- or off-hook state.

If **Off-hook Decode** is enabled, the repeater unmutes the speaker regardless of the microphone on- or off-hook state when the received signaling matches the configured signaling.

If **Off-hook Decode** is disabled, the repeater unmutes the speaker when the repeater receives a signal while the microphone is in the off-hook state. The repeater unmutes the speaker if the received signaling matches the configured signaling while the microphone is in the on-hook state.

Configuration using KPG-D2

Configuring **Off-hook Decode** to be enabled or disabled (See Edit > Optional Features > Common Page 1)

Configuring the Length of Time until Restarting the QT Decode (QT Decode Delay)

QT Decode Delay is the length of time from when the matching state of the received QT tone becomes inconsistent until the repeater restarts the decoding of the QT tone.

This length of time is configured to prevent the QT Reverse Burst code which is sent from the subscriber unit from being detected as a normal QT tone by the repeater.

Normally, the repeater closes the squelch and stops transmitting when the repeater receives the QT Reverse Burst code in which the phase of the configured QT tone is reversed. However, if the transmit duration of the QT Reverse Burst code is too long, the repeater may erroneously detect the received QT Reverse Burst code as the QT tone configured for the repeater and resume transmitting. Delaying the timing to resume the decoding of the QT tone for the period configured in **QT Decode Delay** prevents the erroneous detection of the QT Reverse Burst code.

Note

- If “Off” is configured in **QT Decode Delay**, the repeater starts the decoding of the QT tone immediately after the received QT tone becomes inconsistent.
- This function can be used only on an analog channel or a mixed channel.

Configuration using KPG-D2

Configuring **QT Decode Delay** (See Edit > Optional Features > Common Page 1)

Toggling the Signaling Decoding between Enabled and Disabled (Decode Signaling Enable/Disable)

Decode Signaling Enable/Disable is the function to enable or disable the decoding of signaling (QT tone, DQT tone, or RAN code).

When **Decode Signaling Disable** is enabled, the repeater cannot decode signaling.

The signaling decoding can be enabled or disabled when a **PF** key is pressed, when the signal is applied to an AUX Input port, or when the repeater is turned on.

Table 11-12 Toggling the Signaling Decoding between Enabled and Disabled

Trigger	Assigned Functions	See
PF key	Decode Signaling Enable/Disable	AVAILABLE FUNCTIONS FOR THE PF KEYS
AUX Input port	Decode Signaling Disable Decode Signaling Enable Decode Signaling Enable/Disable	Available Functions for the AUX Input Ports
Startup	Decode Signaling Disable Decode Signaling Enable	Assigning Functions that Become Active or Enabled When the Repeater Starts Up (Startup)

Note

- The signaling decoding cannot be toggled between enabled and disabled while the repeater is repeating. The signaling decoding can be toggled between enabled and disabled during transmission other than the repeat behavior.
- When the repeater transmits by using the Repeat PTT control while **Decode Signaling Disable** is enabled, the signaling (Primary) configured for each channel of the repeater is used as the signaling of the downlink signal from the repeater.

Identifying the RSSI Level by Using the Auxiliary Output Port (Lowest Receive Level Threshold)

Lowest Receive Level Threshold is the reference RSSI level at which the repeater toggles the **Receive Signal (Threshold)** assigned to the AUX Output port between activated and deactivated.

If the RSSI level is lower than the level configured for **Lowest Receive Level Threshold**, the AUX Output port to which **Receive Signal (Threshold)** is assigned becomes active, and if the level is higher than the configured level, the AUX Output port becomes inactive. (Refer to Available Functions for the AUX Output Ports.)

Configuration using KPG-D2

Configuring **Lowest Receive Level Threshold** (See Edit > Optional Features > Common Page 1 > Level)

Configuring to Transmit a Voting Pilot Tone Signal (Voting Pilot Tone)

Voting Pilot Tone is the function to transmit a Voting pilot tone signal from the RA port by using the preconfigured frequency while the repeater is receiving no signal.

The repeater can be used as the receiver in the Voting system. The repeater always transmits a Voting pilot tone signal to the RA port while the repeater is not receiving a signal. When the repeater receives a signal, the repeater stops transmitting a Voting pilot tone signal, and then transmits the received signal to the RA port. If the signal drops out, the repeater starts transmitting a Voting pilot tone signal again.

Transmitting a Voting pilot tone signal can be permitted or inhibited when a **PF** key is pressed, when the signal is applied to an AUX Input port, or when the repeater is turned on.

Table 11-13 Configuration to Transmit a Voting Pilot Tone Signal

Trigger	Assigned Functions	See
PF key	Voting Tone On/Off	AVAILABLE FUNCTIONS FOR THE PF KEYS
AUX Input port	Voting Tone Off Voting Tone On Voting Tone On/Off	Available Functions for the AUX Input Ports
Startup	Voting Tone Off Voting Tone On	Assigning Functions that Become Active or Enabled When the Repeater Starts Up (Startup)

Note

- The repeater sends a Voting pilot tone signal while the repeater is receiving no signal even if the repeater is transmitting.
- The RA port is assigned to pin 11 (RA) of the D-sub 25-pin connector on the rear panel of the repeater.
- The repeater stops sending a Voting pilot tone signal while a beep sounds. In this case, the repeater transmits a Voting pilot tone signal if the beep is configured not to sound by configuring “0” in **Tone Volume**, or disabling **Control Tone** and **Warning Tone**. (Refer to Warning Tone, Control Tone.)

Configuration using KPG-D2

Configuring **Voting Pilot Tone** to be enabled or disabled and configuring the frequency (See Edit > Optional Features > Common Page 2 > Voting Pilot Tone)

11.3 Configuring the Functions Related to Transmission

This section explains the functions and configurations related to transmission used when the repeater is operated in the base station mode.

Configuring the Priority Order of When Multiple Causes for Transmission Occur Together (PTT Priority)

The following methods for transmission are available for the repeater:

- Mic PTT (**PTT** (microphone) switch)
- External PTT
- Repeat PTT
- Console PTT
- Network PTT

PTT Priority is the priority order for these transmission methods. Multiple causes for transmission may occur together while the repeater is operated. In this case, transmission can be switched to a PTT having a higher priority while a PTT having a lower priority is transmitting by switching to signaling matching the PTT having priority, or switching to a modulation signal line.

If a PTT having a higher priority is activated while the repeater is transmitting using a PTT having a lower priority, the repeater changes the signaling and modulation signal line configured for the PTT having the higher priority and transmits.

Table 11-14 PTT Priority

PTT	Signaling	Modulation Signal Line
Mic PTT	Depends on the **Encode Tone (Multiple)** configuration. (Refer to Configuring the conditions for the QT/DQT encoding while waiting to receive multiple signaling (Encode Tone (Multiple)), Configuring the conditions for the RAN encoding while waiting to receive multiple signaling (Encode Tone (Multiple)).)	Local Mic
External PTT		TA
Repeat PTT		Received audio
Console PTT		Received audio (IP network)
Network PTT	Depends on the Network-wide RAN configuration. (Refer to Controlling the Intersite Call of the Receiving Repeater by Using a RAN Code (Network-wide RAN).)	

Configuration using KPG-D2

Configuring **PTT Priority** (See Edit > Optional Features > Common Page 1)

Configuring the Transmission Power Level

One of “High”, “Mid”, and “Low” can be configured for each channel as the transmission power of the repeater.

Table 11-15 Transmission Power

Model	Transmission Power		
	Low	Mid	High
NXR-5700	0.5 W	5 W	25 W
NXR-5800	0.5 W	5 W	25 W

If a channel with “High” or “Mid” configured in **Transmit Power** is selected, the transmission power can be temporarily switched to low power, when a **PF** key is pressed, when the signal is applied to an AUX Input port, or when the repeater is turned on.

Table 11-16 Switching the Transmission Power

Trigger	Assigned Functions	See
PF key	Low Power On/Off	AVAILABLE FUNCTIONS FOR THE PF KEYS
AUX Input port	Low Power Off Low Power On Low Power On/Off	Available Functions for the AUX Input Ports
Startup	Low Power Off Low Power On	Assigning Functions that Become Active or Enabled When the Repeater Starts Up (Startup)

Note
- The transmission power cannot be switched while the repeater is transmitting.

Configuration using KPG-D2

Configuring **Transmit Power** (See Edit > Channel Information/ Channel Edit)

Restricting the Continuous Transmission Time for the Repeater (Time-out Timer)

Time-out Timer (TOT) is the function to restrict the continuous transmission time for the repeater.

This function is used to prevent a user from occupying the repeater or frequency which is shared with other users. The repeater automatically stops transmitting and releases the channel if it continuously transmits longer than the configured time.

Timers, such as **TOT Pre-alert**, **TOT Rekey Time**, and **TOT Reset Time**, relevant to **Time-out Timer** can be configured.

By using KPG-D2, functions relevant to **Time-out Timer** can be configured for each transmission using the Repeat PTT control, External PTT control, Network PTT control, or Console PTT control, or using the **PTT** (microphone) switch in a Conventional system.

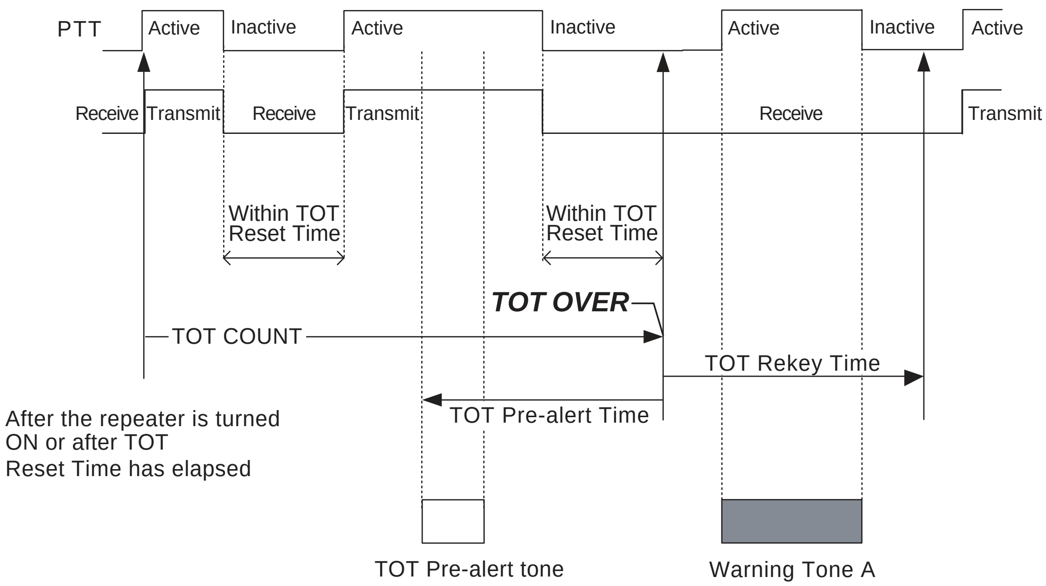


Figure 11-3 Timing to Activate the Time-out Timer and the Relevant Functions

Note

- If a channel is changed or the repeater is turned off, the countdown for **Time-out Timer** is reset.
- If “Off” is configured in **Time-out Timer**, the repeater does not terminate transmitting by timeout.
- When a CW ID, an Air Remote code of **Remote Control**, and a Transpond code are sent, **Time-out Timer** is not activated.
- Each function of **Time-out Timer** for transmission using the **PTT** (microphone) switch cannot be used if the repeater is operated in trunking mode.

Notifying a user that the continuous transmission is about to end (TOT Pre-alert)

TOT Pre-alert is the function to notify a user that a continuous transmission is about to end by the **Time-out Timer**. A TOT Pre-alert Tone (3 beeps) sounds from the repeater before the repeater stops the continuous transmission by the **Time-out Timer**.

Example: Time-out Timer: 30 sec, **TOT Pre-alert**: 4 sec

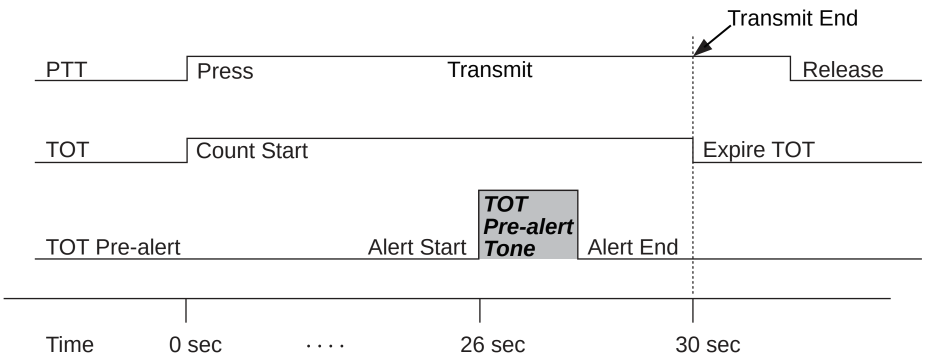


Figure 11-4 TOT Pre-alert

Note
- If “Off” is configured in **TOT Pre-alert**, no TOT Pre-alert tone sounds from the repeater.
- This function cannot be used while the repeater is operated in trunking mode.

Configuring the length of time from when the transmission is automatically terminated by Time-out Timer until the transmission becomes possible again (TOT Rekey Time)

TOT Rekey Time is the length of time from when the transmission ends by the **Time-out Timer** until the transmission becomes possible again.

Example: Time-out Timer: 30 sec, **TOT Rekey Time:** 20 sec

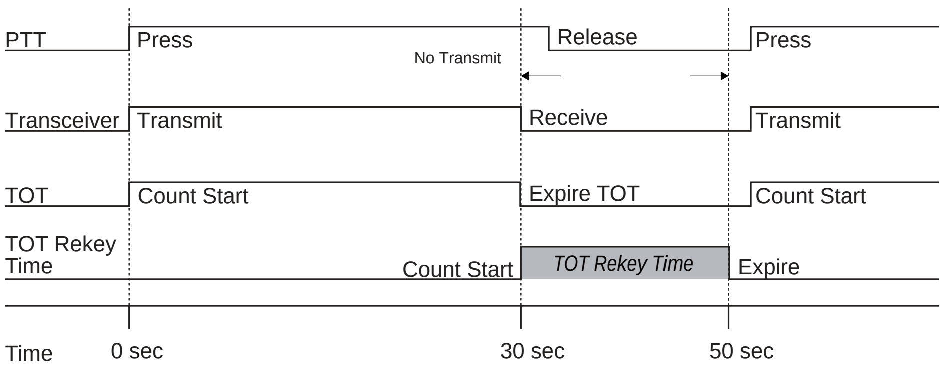


Figure 11-5 TOT Rekey Time

Note
- If “Off” is configured in **TOT Rekey Time**, the repeater is immediately ready to transmit.
- This function cannot be used while the repeater is operated in trunking mode.

Configuring the time before starting to initialize and reset the Time-out Timer (TOT Reset Time)

TOT Reset Time is the time required to initialize and reset the elapsed time for **Time-out Timer**.

Example 1: Time-out Timer: 30 sec, **TOT Reset Time:** 10 sec

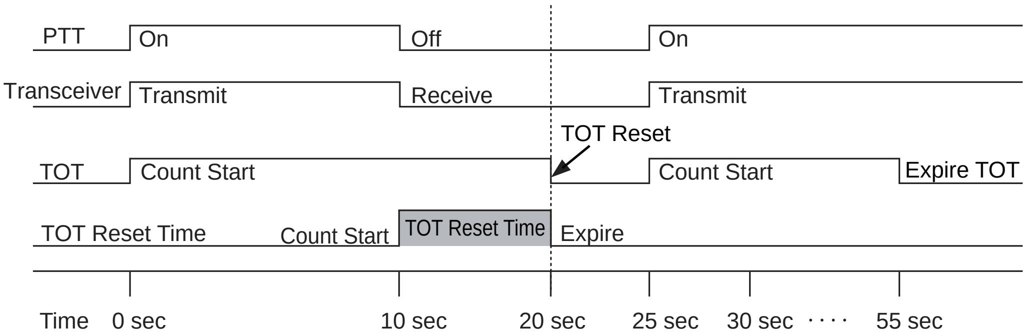


Figure 11-6 TOT Reset Time 1

Also, the retransmission within the configured time in TOT Reset Time is treated as a continuous transmission by the repeater. In the following example, the counting of **Time-out Timer** continues because the transmission is started while the **TOT Reset Time** is counting down.

Example 2: Time-out Timer: 30 sec, **TOT Reset Time:** 10 sec

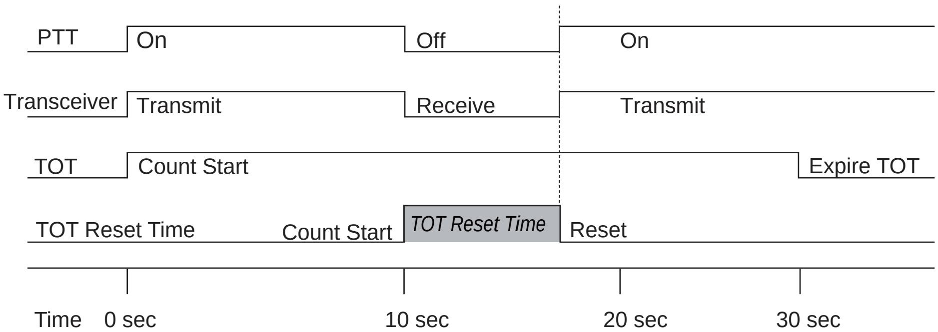


Figure 11-7 TOT Reset Time 2

Note

- If “Off” is configured in **TOT Reset Time**, the **Time-out Timer** will be reset immediately after the repeater finishes transmitting.
- This function cannot be used while the repeater is operated in trunking mode.

Configuration using KPG-D2

- Configuring each function of **Time-out Timer (TOT)** when using the **PTT** (microphone) switch (See Edit > Optional Features > Common Page 2 > Local Mic PTT)
- Configuring each function of **Time-out Timer (TOT)** when using the Repeat PTT control, External PTT control, Network PTT control or Console PTT control (See Edit > Optional Features > Common Page 1 > Repeater/ External/ Network/ Console PTT)

Avoiding Interference with Other Communications (Busy Channel Lockout)

Busy Channel Lockout is the function to automatically restrict the transmission in order to avoid interfering with the communications of other parties if the channel on which the repeater attempts to transmit using the **PTT** (microphone) switch is already used by another group. Using this function, the repeater can transmit without interfering with the communications of other parties without checking the usage status of the channel.

Busy Channel Lockout of each of an analog channel and an NXDN digital channel can be configured.

Table 11-17 Busy Channel Lockout (Analog)

Configuration	Description
No	**Busy Channel Lockout** is disabled. Transmission is not restricted even if the analog channel on which the repeater attempts to transmit is busy.
Carrier Only	The repeater cannot transmit while the repeater is receiving a signal.
Incorrect Tone	The repeater cannot transmit if the repeater receives a signal and the received QT tone or DQT code does not match the QT tone or DQT code preconfigured for the repeater. However, the repeater can transmit if the received QT tone or DQT code matches the QT tone or DQT code preconfigured for the repeater.

Table 11-18 Busy Channel Lockout (NXDN)

Configuration	Description
No	**Busy Channel Lockout** is disabled. Transmission is not restricted even if the analog channel on which the repeater attempts to transmit is busy.
Carrier Only	The repeater cannot transmit while the repeater is receiving a signal.
Incorrect RAN	The repeater cannot transmit if the repeater receives a signal and the received RAN code does not match the RAN code preconfigured for the repeater.
Correct RAN	The repeater cannot transmit if the repeater receives a signal and the received RAN code matches the RAN code preconfigured for the repeater.

To transmit on a mixed channel, the repeater is controlled as follows according to the configuration in **Transmit Mode**:

- **If "Analog" is configured in Transmit Mode:**
  The repeater transmits according to the configuration in **Busy Channel Lockout (Analog)**.

- **If "NXDN" is configured in Transmit Mode:**
  The repeater transmits according to the configuration in **Busy Channel Lockout (NXDN)**.

In addition, if the **Signaling Reset Timer** is activated on a mixed channel, the repeater transmits according to the configuration in **Busy Channel Lockout** in the same mode (either Analog or NXDN) as the mode used for the received signal. If the repeater receives an analog signal, the repeater transmits according to the configuration in **Busy Channel Lockout (Analog)**. If the repeater receives an NXDN signal, the repeater transmits according to the configuration in **Busy Channel Lockout (NXDN)**.

Configuration using KPG-D2

- Configuring **Busy Channel Lockout (Analog)** (See Edit > Optional Features > Common Page 2 > Local Mic PTT)
- Configuring **Busy Channel Lockout (NXDN)** (See Edit > Optional Features > Common Page 2 > Local Mic PTT)

Toggling the Transmission by Pressing the PTT (Microphone) Switch between Enabled and Disabled (Local TX Enable/Disable)

Local TX Enable/Disable is the function to enable or disable the transmission by using the **PTT** (microphone) switch.

If the **PTT** (microphone) switch is pressed while **Local TX Disable** is enabled, the Warning Tone A (continuous beep) sounds from the repeater and transmission cannot occur.

The transmission using the **PTT** (microphone) switch can be enabled or disabled when a **PF** key is pressed, when the signal is applied to an AUX Input port, or when the repeater is turned on.

Table 11-19 Toggling the Transmission by Using the PTT (Microphone) Switch between Enabled and Disabled

Trigger	Assigned Functions	See
PF key	Local TX Enable/Disable	AVAILABLE FUNCTIONS FOR THE PF KEYS
AUX Input port	Local TX Disable Local TX Enable Local TX Enable/Disable	Available Functions for the AUX Input Ports
Startup	Local TX Disable Local TX Enable	Assigning Functions that Become Active or Enabled When the Repeater Starts Up (Startup)

Note

- If **Local TX Disable** is enabled during transmission, the repeater immediately stops transmission using the **PTT** (microphone) switch. When a CW ID or CW message is multiplexed and sent, the CW ID or CW message is sent until the end while the mic modulation line is muted.
- If the PTT having the lower priority than the **PTT** (microphone) switch becomes ready to start transmission when the transmission using the **PTT** (microphone) switch ends by enabling **Local TX Disable** during the transmission, the repeater continues the transmission by changing the modulation signal line. (Refer to Configuring the Priority Order of When Multiple Causes for Transmission Occur Together (PTT Priority).)

Toggling the Transmission Behavior between Enabled and Disabled (TX Enable/Disable)

TX Enable/Disable is the function to enable or disable all transmissions.

When **TX Disable** is enabled, all transmissions by the following PTT cannot be done:

- Mic PTT (**PTT** (microphone) switch)
- External PTT
- Repeat PTT
- Network PTT
- Console PTT

Transmissions by all PTTs can be enabled or disabled when a **PF** key is pressed, when the signal is applied to an AUX Input port, or when the repeater is turned on.

Table 11-20 Toggling the Transmission by All PTTs between Enabled and Disabled

Trigger	Assigned Functions	See
PF key	TX Enable/Disable	AVAILABLE FUNCTIONS FOR THE PF KEYS
AUX Input port	TX Disable TX Enable TX Enable/Disable	Available Functions for the AUX Input Ports
Startup	TX Disable TX Enable	Assigning Functions that Become Active or Enabled When the Repeater Starts Up (Startup)

Note

- When **TX Disable** is enabled, a CW ID, CW message, Air Remote code of **Remote Control**, and Transpond code cannot be sent.
- If **TX Disable** is enabled during transmission, the repeater immediately stops all transmissions.

Toggling the Pre-emphasis of the TA Port between Enabled and Disabled (TA line Pre-emphasis On/Off)

TA line Pre-emphasis On/Off is the function to enable or disable the pre-emphasis of the TA port.

The pre-emphasis of the TA port can be toggled between enabled and disabled when a signal is applied to an AUX Input port.

Table 11-21 Toggling the Pre-emphasis of the TA Port between Enabled and Disabled

Trigger	Assigned Functions	See
AUX Input port	TA line Pre-emphasis Off TA line Pre-emphasis On/Off	Available Functions for the AUX Input Ports

Note

- The pre-emphasis of the TA port can be toggled between enabled and disabled only when transmitting using the External PTT control.

Notifying the Other Party that the Communication Ends in Analog Communications (Courtesy Tone)

Courtesy Tone is the function for the repeater to transmit a Courtesy Tone when the transmission by using the Repeat PTT control, **PTT** (microphone) switch, or External PTT control ends. This tone notifies a subscriber that the communication is finished and the repeater is available.

Whether **Courtesy Tone** is enabled or disabled, and the following configurations related to **Courtesy Tone** can be configured using KPG-D2:

- Frequency
- Period
- Encode Pause Time
- Tone to RA port

Configuring the frequency of a Courtesy Tone (Frequency)

The frequency of a Courtesy Tone can be configured in the range from 300 Hz to 3000 Hz.

Configuring the transmission time of a Courtesy Tone (Period)

The length of time to send a Courtesy Tone can be configured in the range from 100 ms to 1000 ms.

Preventing an unnecessary Courtesy Tone from being sent (Encode Pause Time)

The threshold value at which the repeater transmits a Courtesy Tone can be configured. This function is available only while the repeater transmits using the Repeat PTT control. Configuring this function can prevent unnecessary Courtesy Tone transmission caused by the squelch flutter in a weak electric field.

The repeater transmits a Courtesy Tone when the transmission using the Repeat PTT control ends after the time configured in **Encode Pause Time** elapses.

Emitting a Courtesy Tone from the speaker of the repeater (Tone to RA port)

Whether or not a Courtesy Tone is emitted from the RA port (the front speaker) of the repeater can be configured.

Configuration using KPG-D2

Configuring **Courtesy Tone** to be enabled or disabled and configuring each function (See Edit > Optional Features > Common Page 2 > Courtesy Tone)

Configuring the transmission conditions for signaling encoding (Encode Tone (Multiple))

Encode Tone (Multiple) is a signaling type to be used to transmit using the **PTT** (microphone) switch or the External PTT control if the repeater receives signaling on a channel for which **Multiple Encode/Decode Table** is configured.

Refer to “Configuring the conditions for the QT/DQT encoding while waiting to receive multiple signaling (Encode Tone (Multiple))” and “Configuring the conditions for the RAN encoding while waiting to receive multiple signaling (Encode Tone (Multiple))” for details of **Encode Tone (Multiple)**.

Toggling the Signaling Encoding between Enabled and Disabled (Encode Signaling Enable/Disable)

Encode Signaling Enable/Disable is the function to enable or disable the QT/DQT and RAN code encoding.

Refer to “Toggling the QT/DQT encoding between enabled and disabled (Encode Signaling Enable/Disable)” and “Toggling the RAN encoding between enabled and disabled (Encode Signaling Enable/Disable)” for details of **Encode Signaling Enable/Disable**.

Waiting to Receive Multiple Signaling (Multiple Encode/Decode Table)

Multiple Encode/Decode Table is the table in which the Encode/Decode signaling that the repeater waits to receive along with the Primary signaling (the QT tone, DQT code, or RAN code) configured for each channel is configured. If this function is used, the repeater can wait to receive a maximum of 16 combinations of signaling (a combination of Primary + 15 combinations of Encode/Decode tones and codes).

Refer to “Waiting to receive multiple QT/DQT (Multiple Encode/Decode Table)” and “Waiting to receive multiple RAN codes (Multiple Encode/Decode Table)” for details of **Multiple Encode/Decode Table**.

Configuring the Length of Time to Transmit in the Same Mode as When the Repeater Receives a Signal on a Mixed Channel and the Received Signaling Matches (Signaling Reset Timer)

Signaling Reset Timer is the length of time to transmit in the same communication method (either Analog or NXDN) as the method for the received signal regardless of the configuration in **Transmit Mode** if the repeater receives a signal on a mixed channel and the received signaling matches the signaling preconfigured for the repeater.

Refer to “Transmitting by Using the Communication Method of Reception (Signaling Reset Timer)” for details of **Signaling Reset Timer**.

Preventing the Receiving Party from Emitting the Squelch Tail Noise (Squelch Tail Elimination)

Squelch Tail Elimination is the function to prevent the speaker of the receiving party from emitting the squelch tail noise after transmission ends.

Refer to “Preventing the receiving party from emitting the squelch tail noise after transmission ends (Squelch Tail Elimination)” for details of **Squelch Tail Elimination**.

Preventing the Receiving Party from Wrongly Detecting a Signal due to Chassis Radiation from the Repeater (Standby on Transmit Frequency)

Standby on Transmit Frequency is the function to wait to receive on the transmit frequency configured for each channel while the repeater is in the standby mode. This function must be disabled if the repeater waits to receive on a frequency shifted from the transmit frequency.

For instance, a user having a subscriber unit may be within several meters of the repeater if the repeater system is placed within a building, other than the roof of a building or mountain top. In such a case, if the repeater is locked on the frequency that TX VCO is preprogrammed, the subscriber unit may become busy due to chassis radiation from the repeater even if the repeater is not transmitting. The same phenomenon may occur during a repeater operation check while installing the system or demonstrating.

If **Standby on Transmit Frequency** is disabled, this trouble can be avoided because the repeater waits to receive shifting the TX VCO by 18.75 kHz while the repeater is in the standby mode. However, the rise time of transmission is delayed approximately 15 ms to 20 ms if this function is disabled; therefore, we recommend enabling this function except in the above-mentioned cases.

Configuration using KPG-D2

Configuring **Standby on Transmit Frequency** to be enabled or disabled (See Edit > Optional Features > Common Page 1)

Preventing the Beginning of the Digital Frame from Being Undetected (Preamble Length)

Preamble Length is the function to extend the time for sending a preamble when the digital frame is sent. Extending the transmission time of a preamble prevents the non-detection of the beginning of the received digital frame (for example, the prevention of missing the beginning of audio) on the receiving subscriber unit.

The extended time of a preamble is determined by using the following equation:

Time [sec] = 1/2400 x 4 x Configuration value for **Preamble Length**

Note

- This function can be used only in NXDN digital communications.
- If used in a repeater system, the repeater repeats the received digital frame from the beginning. Therefore, if the length of preamble is extended, the repeating is delayed further.

Configuration using KPG-D2

Configuring **Preamble Length** (See Edit > NXDN > General)

Periodically Sending a Preconfigured CW ID

CW ID is the function to automatically and periodically send Morse code configured for a channel. A maximum of 32 alphanumeric characters and symbols can be configured for a CW ID and sent.

The CW ID can also be sent when a **PF** key is pressed, when the signal is applied to an AUX Input port, or when the repeater is turned on.

Table 11-22 Sending a CW ID

Trigger	Assigned Functions	See
PF key	CW ID On	AVAILABLE FUNCTIONS FOR THE PF KEYS
AUX Input port		Available Functions for the AUX Input Ports
Startup		Assigning Functions that Become Active or Enabled When the Repeater Starts Up (Startup)

Whether to enable or disable **CW ID** can be configured for each channel by using KPG-D2. Also, the following functions related to sending a CW ID can be configured:

- CW ID
- Transmit Interval Time
- Transmit Delay Time
- CW Speed
- CW Modulation Delay Time
- Audio Frequency
- Interval Activity Transmit
- CW ID Override
- CW ID to RA port
- CW ID on Channel Change
- Encode with QT/DQT

Note

- The repeater switches to analog modulation mode when the repeater sends the CW ID on an NXDN digital channel. However, the **CW ID Override** and **Encode with QT/DQT** functions cannot be used on an NXDN digital channel.

CW ID

A maximum of 32 characters of Morse code can be configured. A single CW ID can be configured for each channel.

Transmit Interval Time

Transmit Interval Time is the interval to send the CW ID. The repeater sends the CW ID repeatedly using the interval configured in **Transmit Interval Time**.

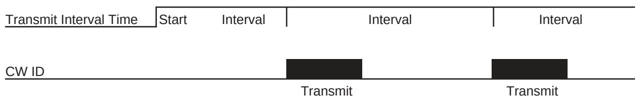


Figure 11-8 Transmit Interval Time

Note

- **Transmit Interval Time** starts counting down if one of the following events occurs:
  - The repeater is reset.
  - A channel is changed.
  - The **CW ID On** function is activated.

Transmit Delay Time

Transmit Delay Time is the length of time from when the repeater enters one of the following states until the repeater starts sending the CW ID:

- When **Transmit Interval Time** elapses
- When the channel is changed while **CW ID on Channel Change** is enabled
- When the repeater stops transmitting while **CW ID Override** is disabled

The repeater actually starts sending the CW ID when the length of time configured in **CW Modulation Delay Time** elapses after the repeater starts transmitting.

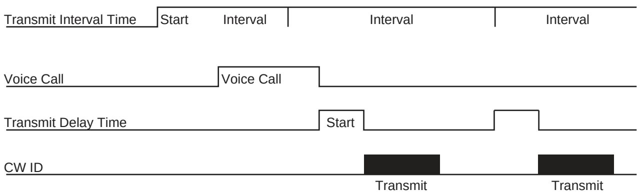


Figure 11-9 Transmit Delay Time

Note

- **Transmit Delay Time** is not applied when the repeater sends the CW ID by using the **CW ID On** function.
- If Off is configured in **Transmit Delay Time**, the repeater immediately starts transmitting.

CW Speed

CW Speed is the speed to send the CW ID.

CW Modulation Delay Time

CW Modulation Delay Time is the length of time from when the repeater starts transmitting until the repeater starts sending the CW ID.

During the period from when the repeater starts transmitting until the length of time configured in **CW Modulation Delay Time** elapses, the repeater transmits an unmodulated signal. If the length of time configured in **CW Modulation Delay Time** elapses, the repeater starts sending a modulated signal of the CW ID.

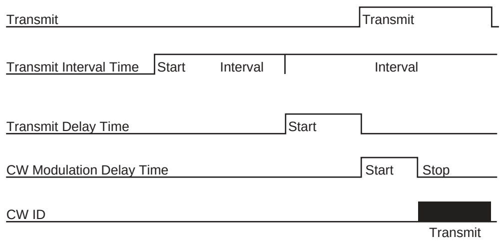


Figure 11-10 CW Modulation Delay Time

Note

- If "Off" is configured in **CW Modulation Delay Time**, the repeater sends the CW ID immediately after the repeater starts transmitting.

Audio Frequency

Audio Frequency is the frequency used to send the CW ID.

Interval Activity Transmit

Interval Activity Transmit is the function to control the intervals to send the CW ID.

If this function is enabled, the repeater sends a CW ID after the length of time configured in **Transmit Interval Time** elapses only if the repeater starts transmitting while the length of time configured in **Transmit Interval Time** is counting down. If no transmission is made after sending the CW ID last time, the repeater does not send the CW ID even after the length of time configured in **Transmit Interval Time** elapses.

If this function is disabled, regardless of whether or not the repeater has transmitted, the repeater sends the CW ID when the length of time configured in **Transmit Interval Time** elapses.

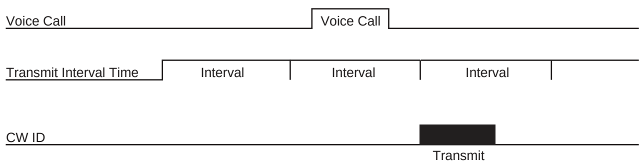


Figure 11-11 Interval Activity Transmit

Note

- **Interval Activity Transmit** is not applied when the repeater sends the CW ID by using the **CW ID On** function.

CW ID Override

CW ID Override is the function to send the CW ID along with the audio signal even if the repeater is still transmitting when the length of time configured in **Transmit Interval Time** elapses.

If this function is enabled, the repeater sends the CW ID along with the audio signal even if the repeater is still transmitting when the length of time configured in **Transmit Interval Time** elapses.

If this function is disabled, the repeater sends the CW ID after ending the transmission if the repeater is still transmitting when the length of time configured in **Transmit Interval Time** elapses.

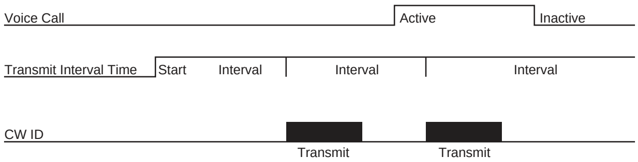


Figure 11-12 CW ID Override

Note

- This function cannot be used on an NXDN digital channel.
- If the repeater sends a CW ID for which **CW ID Override** is enabled during transmission, the currently used QT tone or DQT code is sent regardless of the configuration of **Encode with QT/DQT**.
- If this function is disabled, the repeater does not send the CW ID even if the **CW ID On** function becomes active while the repeater is transmitting.

CW ID to RA port

CW ID to RA port is the function to send the CW ID signal to the RA port and emit the CW ID audio from the front speaker too at the same time the repeater sends the CW ID.

Note

- No CW ID audio sounds from the front speaker but the CW ID signal is sent to only the RA port if the channel is used in Simplex Mode.

CW ID on Channel Change

CW ID on Channel Change is the function to send the CW ID when the channel is changed.

If this function is enabled, the repeater sends the CW ID when a channel is changed regardless of the configuration in **Transmit Interval Time**.

Encode with QT/DQT

Encode with QT/DQT is the function to simultaneously encode the QT tone or DQT code (Primary) configured for each channel when the repeater sends the CW ID.

Note

- This function cannot be used on an NXDN digital channel.
- If the CW ID is independently sent and if **Encode with QT/DQT** is enabled, the QT tone or DQT code configured for the channel is sent out. If **Encode with QT/DQT** is disabled, no QT tone or DQT code is sent.

Configuration using KPG-D2

- Configuring **CW ID** to be enabled or disabled (See Edit > Channel Information/ Channel Edit > CW ID)
- Configuring each function of **CW ID** (See Edit > Channel Information/ Channel Edit > CW ID)

11.4 Configuring the Functions Related to Calls on an NXDN Digital Channel

This section explains the various functions and configurations used for a call in the NXDN digital base station mode.

Configuring the Unit ID or ID Name of the Repeater

To initiate various communications in the NXDN digital base station mode, a **Unit ID (Own)**, the identification code of a repeater, needs to be configured for the repeater. An ID name can be configured in **Unit ID (Own)**.

Unit ID (Own)

Unit ID (Own) is the ID used as an own ID for making various communications in the NXDN digital base station mode. When an NXDN digital signal is transmitted by using the **PTT** (microphone) switch or the External PTT control, the **Unit ID (Own)** is embedded as a source Unit ID in the message and sent.

A single **Unit ID (Own)** can be configured for each repeater.

Unit ID Name (Own)

Unit ID Name (Own) is the text information added to the **Unit ID (Own)**.

Since the text information configured in **Unit ID Name (Own)** of the transmitting party is sent along with audio signals, the text information appears on the display of the receiving subscriber unit.

Note

- If no **Unit ID Name (Own)** is configured, the repeater sends only the Unit ID (Own).
- If **Over-the Air Alias** is disabled, no **Unit ID Name (Own)** is sent but only the **Unit ID (Own)** is sent.

Over-the-Air Alias

Over-the-Air Alias is the function that enables the ID name of the transmitting repeater to appear on the display of the receiving subscriber unit when the receiving subscriber unit receives a call even if the ID name of the transmitting repeater is not configured for the receiving subscriber unit.

If this function is enabled, since the text information configured in **Unit ID Name (Own)** is sent along with audio signals, the text information appears on the display of the receiving subscriber unit.

If the repeater transmits using the **PTT** (microphone) switch or the External PTT control while NXR-5700/ NXR-5800 is operated in the NXDN digital base station mode, this function is activated. This function cannot be used while NXR-5700/ NXR-5800 is operated in the repeater system.

Note

- If this function is enabled and **Unit ID Name (Own)** is not configured for the repeater, the repeater sends only the **Unit ID (Own)**. Also, in this case, no ID name appears even if the receiving subscriber unit receives a signal to which a **Unit ID Name (Own)** is appended.

Configuration using KPG-D2

- Configuring **Unit ID (Own)** (See Edit > NXDN > General)
- Configuring **Unit ID Name (Own)** (See Edit > NXDN > General)
- Configuring **Over-the-Air Alias** (See Edit > NXDN > General)

Controlling the Speaker Mute by the Received Optional Signaling (NXDN)

Optional Signaling (NXDN) is the function to receive an individual call or a group call. The repeater unmutes the speaker if the received Optional Signaling matches the Optional Signaling preconfigured for the repeater.

For the repeater, “NXDN ID” can be configured in **Optional Signaling (NXDN)**.

NXDN ID is the signaling type using the Unit ID or Group ID stored in the NXDN data frame.

Whether the Optional Signaling matches when the repeater receives the NXDN digital signal is determined according to the following conditions. If the Optional Signaling matches, the repeater unmutes the speaker.

- **Individual Call**

  The Optional Signaling is determined to be matched if the received RAN code matches the RAN code preconfigured for the repeater, and if the received Unit ID matches the **Unit ID (Own)** preconfigured for the repeater.

- **Group Call**

  The Optional Signaling is determined to be matched if the received RAN code matches the RAN code preconfigured for the repeater, and if the received Group ID matches the Group ID preconfigured for the repeater.

Note

- In Group Call, the Group ID that the repeater waits to receive varies according to the configuration in **GID Scan (NXDN)**.

GID Scan (NXDN)

GID Scan (NXDN) is the function to wait to receive a Group Call from all Group IDs.

If this function is enabled, the repeater can wait to receive a Group Call from all Group IDs configured in **Group ID List**. (Refer to Group ID List.)

If this function is disabled, the repeater can wait to receive only the Group Call from the Group ID configured as the target ID to be called by **Selcall on PTT**. (Refer to Executing an Individual Call by Pressing the PTT (Microphone) Switch (Selcall on PTT).)

Configuration using KPG-D2

- Configuring **Optional Signaling (NXDN)** (See Edit > Channel Information/ Channel Edit)
- Configuring **GID Scan (NXDN)** to be enabled or disabled (See Edit > Channel Information/ Channel Edit)

Executing an Individual Call by Pressing the PTT (Microphone) Switch (Selcall on PTT)

Selcall on PTT (NXDN) is the function used by the repeater to start an Individual Call or Group Call when the **PTT** (microphone) switch is pressed.

- **Individual Call**

  In order to make an Individual Call, “Individual Call” needs to be configured in **Selcall on PTT (NXDN)**, and the list number of **Unit ID List** needs to be configured in **ID List Number (NXDN)** by using KPG-D2. By selecting the channel configured as above and then pressing the **PTT** (microphone) switch, the repeater starts an Individual Call.

- **Group Call**

  In order to make a Group Call, “Group Call” needs to be configured in **Selcall on PTT (NXDN)**, and the list number of **Group ID List** needs to be configured in **ID List Number (NXDN)** by using KPG-D2. By selecting the channel configured as above and then pressing the **PTT** (microphone) switch, the repeater starts a Group Call.

Configuration using KPG-D2

- Configuring **Selcall on PTT (NXDN)** (See Edit > Channel Information/ Channel Edit)
- Configuring **ID List Number (NXDN)** (See Edit > Channel Information/ Channel Edit)

Unit ID List

In the NXDN digital base station mode, the repeater can communicate using an individual ID (Unit ID and Group ID). The Unit ID of the target party to be called using Individual Call needs to be configured for the repeater in advance by using KPG-D2. A maximum of 30 Unit IDs can be configured in **Unit ID List**.

Table 11-23 Unit ID List Configuration

Configuration	Description
ID	Unit ID can be configured in the range of 1 to 65519.
Transmit Inhibit	Whether to enable the transmission to the corresponding Unit ID can be configured. This function can be used if a user wants to receive an Individual Call from the corresponding Unit ID but not to call the Unit ID. If a call from the Unit ID not configured in **Unit ID List** is received, the repeater behaves in the same manner as when **Transmit Mode** is disabled. In this case, a user can respond to the received Unit ID.

Configuration using KPG-D2

Configuring **Unit ID List** (See Edit > NXDN > Unit ID List)

Group ID List

In the NXDN digital base station mode, the repeater can communicate using an individual ID (Unit ID and Group ID). The Group ID of the target party to be called using Group Call needs to be configured for the repeater in advance by using KPG-D2. A maximum of 50 Group IDs can be configured in **Group ID List**.

Table 11-24 Group ID List Configuration

Configuration	Description
ID	Group ID can be configured in the range of 1 to 65519 or ALL. Using the Group ID for which “ALL” is configured, the repeater can call all groups.
Transmit Inhibit	Whether to enable the transmission to the corresponding Group ID can be configured. This function can be used if a user wants to receive a Group Call from the corresponding Group ID but not to call the Group ID.

Configuration using KPG-D2

Configuring **Group ID List** (See Edit > NXDN > Group ID List)

Configuring Auto Reset Timer

Auto Reset Timer is the function to reset the matching state automatically after the received Unit ID or Group ID matches the Unit ID or Group ID preconfigured for the repeater.

After the time configured in **Auto Reset Timer** elapses, the matching state is automatically reset.

By using KPG-D2, **Auto Reset Timer** can be configured. According to the configuration for **Auto Reset Timer**, the repeater behaves as below:

Table 11-25 Auto Reset Timer Configuration

Configuration	Description
Auto Reset Timer: Off	**Auto Reset Timer** is disabled.
Auto Reset Timer: 1 sec to 300 sec	The matching state of the Unit ID or Group ID is automatically reset when the configured time elapses.
LED	If this function is enabled, the BUSY LED that flashes orange by **Selective Call Alert LED** turns off when the time configured in **Auto Reset Timer** elapses.

Selective Call Alert LED

Selective Call Alert LED is the function to flashes the BUSY LED orange if the repeater receives an Individual Call or a Group Call.

By flashing the LED orange, the repeater notifies a user that the repeater is receiving an Individual Call or a Group Call.

Configuration using KPG-D2

- Configuring **Auto Reset Timer** (See Edit > NXDN > General > Auto Reset)
- Configuring **Selective Call Alert LED** to be enabled or disabled (See Edit > NXDN > General)

11.5 Adjusting Audio Characteristics in NXDN Digital Communications

Audio characteristics for making communications in the NXDN digital base station mode can be adjusted by combining the configuration values of the following functions:

- Low Cut
- Audio Filter
- Noise Suppressor

Cutting Off the Frequencies Outside of the Audible Frequency Band upon Reception (Low Cut)

Low Cut is the function to cut off the frequencies outside of the audible frequency band when the repeater receives a signal in the NXDN digital mode.

The received audio may not be clearly audible in the NXDN digital mode when a user communicates using an earphone or while communicating in noisy environments.

In this case, frequencies of 300 Hz and lower can be cut off in the receiving subscriber unit by using this function. By this, the sound of the received audio in Digital Mode will be similar to the received audio in Analog Mode; hence, the received audio may be understood easily.

If **Low Cut** is enabled, frequencies of 300 Hz and lower can be cut off when the repeater receives a signal in the NXDN digital mode.

Configuration using KPG-D2

Configuring **Low Cut** to be enabled or disabled (See Edit > NXDN > General > Audio > Audio Response)

Configuring an Audio Characteristic of the Audio Emitted from the Speaker (Audio Filter)

Audio Filter is the function to switch an audio characteristic of the received audio.

The received audio may sound differently depending on the effects of an usage environment of the repeater and optional devices, such as a microphone and a speaker equipped with the repeater. Also, the received audio may sound differently depending on whether to use a speaker or headphones to play the received audio. An audio characteristic of the received audio can be switched according to user convenience.

Table 11-26 Audio Filter

Configuration	Description
Filter 1	The filter has a narrow audio characteristic. The filter is less affected by various usage environments and external connector devices such as an external microphone and speaker.
Filter 2	The filter has the broader audio characteristic than that of **Filter 1**. This filter is effective for a user to hear conversations clearly because a broad range of sounds from low frequency to high frequency is emitted.
Filter 3	The filter has the broader audio characteristic than that of **Filter 1** and emphasizes the middle range of sound frequencies. This filter is effective for a user to easily distinguish who is speaking into the microphone.

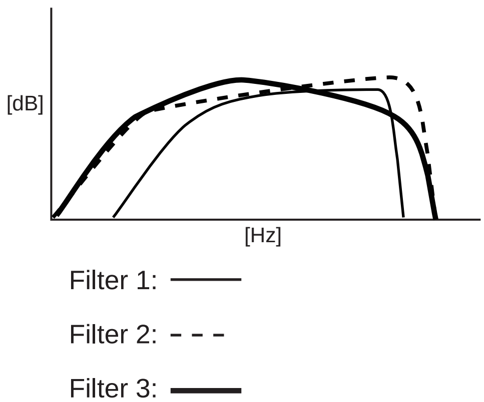


Figure 11-13 Audio Filter

Configuration using KPG-D2

Configuring **Audio Filter** to be enabled or disabled (See Edit > NXDN > General > Audio > Audio Response)

Reducing the Background Noise upon Transmission (Noise Suppressor)

Noise Suppressor is the function to transmit a signal by reducing the background noise when the repeater transmits an NXDN digital signal.

If this function is enabled, the repeater transmits a signal by reducing the background noise so that the noise of the received audio will be less in the receiving subscriber unit. However, a part of audio component may be omitted, so that an inward received audio will sound. In this case, disabling this function allows the repeater to transmit an audio signal which is similar to an analog signal; therefore, the received audio may be heard clearly in the receiving subscriber unit.

Configuration using KPG-D2

Configuring **Noise Suppressor** to be enabled or disabled (See Edit > NXDN > General > Audio)

11.6 Communication Security (Voice Scrambler/ Encryption)

NXR-5700/ NXR-5800 is equipped with the functions which can enhance the confidentiality of communications for each of analog channels and NXDN digital channels.

- **Voice Scrambler**

  Voice Scrambler is the function provided for analog channels to scramble speech to allow subscribers to engage in private communications.

  The repeater is equipped with the function for **Voice Scrambler** using a frequency inversion method. Using this function enables the repeater to scramble the voice by inverting the audio frequencies during transmission using the **PTT** (microphone) switch or the External PTT control, and the contents of communications can be prevented from being intercepted.

  On a channel in the repeater system, this function is disabled and the audio data cannot be scrambled and sent.

- **Encryption**

  Encryption is the function provided for NXDN digital channels to scramble voice communications using NXDN digital signals in order to allow subscribers to engage in private communications.

  The data to be encrypted is the voice data sent using the **PTT** switch (microphone) or the External PTT control. The **Key Data** used for communications can be configured for each channel.

  On a channel in the repeater system, this function is disabled and the audio data cannot be encrypted and sent.

Enabling Voice Scrambler on an Analog Channel

Whether to enable or disable **Voice Scrambler** can be configured for each channel by using KPG-D2.

Voice Scrambler can be toggled between enabled and disabled when a **PF** key is pressed, when the signal is applied to an AUX Input port, or when the repeater is turned on.

Table 11-27 Toggling the Voice Scrambler between Enabled and Disabled

Trigger	Assigned Functions	See
PF key	Scrambler/Encryption On/Off	AVAILABLE FUNCTIONS FOR THE PF KEYS
AUX Input port	Scrambler/Encryption Off Scrambler/Encryption On Scrambler/Encryption On/Off	Available Functions for the AUX Input Ports
Startup	Scrambler/Encryption Off Scrambler/Encryption On	Assigning Functions that Become Active or Enabled When the Repeater Starts Up (Startup)

Note

- **Voice Scrambler** cannot be toggled between enabled and disabled on an NXDN digital channel.
- On a mixed channel, **Voice Scrambler** can be toggled between enabled and disabled; however, if “NXDN” is configured in **Transmit Mode**, **Voice Scrambler** cannot be toggled between enabled and disabled. In this case, **Encryption** is toggled between enabled and disabled.
- **Voice Scrambler** cannot be toggled between enabled and disabled while the repeater is transmitting.

Configuration using KPG-D2

Configuring **Voice Scrambler** to be enabled or disabled (See Edit > Channel Information/ Channel Edit > Scrambler Setting)

Enabling Encryption on an NXDN Digital Channel

Whether to send encrypted voice data can be configured by enabling or disabling **Encryption** by using KPG-D2.

Encryption can be toggled between enabled and disabled when a **PF** key is pressed, when the signal is applied to an AUX Input port, or when the repeater is turned on.

Table 11-28 Toggling the Encryption between Enabled and Disabled

Trigger	Assigned Functions	See
PF key	Scrambler/Encryption On/Off	AVAILABLE FUNCTIONS FOR THE PF KEYS
AUX Input port	Scrambler/Encryption Off Scrambler/Encryption On Scrambler/Encryption On/Off	Available Functions for the AUX Input Ports
Startup	Scrambler/Encryption Off Scrambler/Encryption On	Assigning Functions that Become Active or Enabled When the Repeater Starts Up (Startup)

Note

- **Encryption** cannot be toggled between enabled and disabled on an analog channel.
- On a mixed channel, **Encryption** can be toggled between enabled and disabled; however, if “Analog” is configured in **Transmit Mode**, **Encryption** cannot be toggled between enabled and disabled. In this case, **Voice Scrambler** is toggled between enabled and disabled.
- The **Encryption** function cannot be used on a channel with “Repeat”, “RF Link”, “Voting Repeater”, or “Voting Receiver” configured in **Operation Mode**.

Repeater behaviors

If **Encryption** is enabled, the repeater sends encrypted voice data. If Encryption is disabled, the repeater transmits without encryption.

Upon receipt of an encrypted signal, the repeater behaves as follows according to the status of **Encryption**, either enabled or disabled, and the configuration in **Encryption Type**:

- **If Encryption is enabled:**
  Regardless of the configuration in **Encryption Type**, the received audio sounds from the speaker according to the conditions for the audio control. In this case, the repeater decrypts the received data using the **Key Data** for use with communications that is configured for a channel. If the received data is decrypted normally, the received audio sounds from the speaker. If the received data cannot be decrypted normally, the received audio sounds from the speaker without being decrypted.

- **If Encryption is disabled:**
  The repeater behaves as follows according to the configuration in **Encryption Type** (Type 1 or Type 2):
  - **Type 1**
    The received audio sounds from the speaker according to the conditions for audio control. In this case, the repeater decrypts the received data using the **Key Data** for use with communications that is configured for a channel. If the received data is decrypted normally, the received audio sounds from the speaker. If the received data cannot be decrypted normally, the received audio sounds from the speaker without being decrypted.
  - **Type 2**
    The received audio does not sound from the speaker.

Note

- If the repeater receives a non-encrypted NXDN digital signal, the repeater emits the received audio according to the conditions for audio control regardless of the **Encryption** status, either enabled or disabled, and the configuration in **Encryption Type**.

Configuration using KPG-D2

- Configuring **Encryption** to be enabled or disabled (See Edit > Channel Information/ Channel Edit > Encryption Setting)
- Configuring **Key Data** (See Edit > Channel Information/ Channel Edit > Encryption Setting)
- Configuring **Encryption Type** (See Edit > NXDN > General)

Retaining the Scrambler/ Encryption Status (Enabled or Disabled) (Scrambler/Encryption Status Memory)

Scrambler/Encryption Status Memory is the function to memorize the **Voice Scrambler** and **Encryption** statuses (enabled or disabled) even if the repeater is turned off.

If this function is enabled, the repeater can retain the **Voice Scrambler** and **Encryption** statuses (enabled or disabled) and update the initial data configured using KPG-D2.

If this function is disabled, the repeater clears the **Voice Scrambler** and **Encryption** statuses (enabled or disabled) when the repeater is turned off and restores the initial data configured using KPG-D2 when the repeater is turned on again.

Configuration using KPG-D2

Configuring **Scrambler/Encryption Status Memory** to be enabled or disabled (See Edit > Optional Features > Common Page 1)

12 SINGLE REPEATER SYSTEM

This section explains the functions and configurations required for operating the repeater in the single repeater system.

The single repeater system is the system that relays the received signal by using the Repeat PTT control if the repeater receives a signal from a subscriber unit. This system is used to allow subscriber units to communicate with each other via a single repeater in an Analog Conventional or NXDN Conventional system.

Figure 12-1 Single Repeater System

12.1 Configuring Channel Information

A maximum of 30 channels can be configured for the repeater. A channel can be switched by operating a **PF** key or according to the change of the AUX Input port status. (Refer to Operation to Change the Channel.)

To operate the repeater in the single repeater system, the following basic functions need to be configured for each channel by using KPG-D2.

- RX Frequency/ TX Frequency
- Channel Type
- Transmit Mode
- QT/DQT Decode/ QT/DQT Encode
- QT Reverse Burst
- RAN Decode/ RAN Encode
- Channel Name
- Channel Spacing
- Operation Mode
- Compander

Configuring Transmit and Receive Frequencies (RX Frequency/ TX Frequency)

Transmit and receive frequencies are pairs of frequencies used by the repeater to transmit and receive. The transmit and receive frequencies of the repeater can be configured for each channel.

Refer to “Configuring Transmit and Receive Frequencies (RX Frequency/ TX Frequency)” in “BASE STATION (SIMPLEX/ DUPLEX)” for the details of the transmit and receive frequencies.

Configuration using KPG-D2

Configuring the transmit and receive frequencies for a channel (See Edit > Channel Information/ Channel Edit)

Configuring the Usage Type of the Channel (Channel Type)

Channel Type is the usage type for each channel.

Whether to transmit and receive in analog communications, transmit and receive in NXDN digital communications, or wait to receive both analog signals and NXDN digital signals can be configured.

Refer to “Configuring the Usage Type of the Channel (Channel Type)” in “BASE STATION (SIMPLEX/ DUPLEX)” for the details of **Channel Type**.

Configuration using KPG-D2

Configuring **Channel Type** (See Edit > Channel Information/ Channel Edit)

Configuring the Transmission Mode for a Mixed Channel (Transmit Mode)

Transmit Mode is the mode used when the repeater transmits on a channel with “Mixed” configured in **Channel Type** by using the **PTT** (microphone) switch or the External PTT control.

Refer to “Configuring the Transmission Mode for a Mixed Channel (Transmit Mode)” in “BASE STATION (SIMPLEX/ DUPLEX)” for the details of **Transmit Mode**.

Configuration using KPG-D2

Configuring **Transmit Mode** (See Edit > Channel Information/ Channel Edit)

Configuring the Analog Signaling (QT/DQT Decode/ QT/DQT Encode)

QT/DQT is the signaling used for analog communications by the repeater to transmit and receive an analog signal.
Refer to “Analog Signaling System” for details of QT/DQT.

Configuration using KPG-D2

Configuring **QT/DQT Decode/ QT/DQT Encode** (See Edit > Channel Information/ Channel Edit)

Configuring to Send the QT Reverse Burst Code on an Analog Channel (QT Reverse Burst)

QT Reverse Burst is the function to prevent the speaker of the receiving party from emitting the squelch tail noise by sending a QT Reverse Burst code after transmission ends on the channel with the QT Encode configured.
Refer to “Preventing the receiving party from emitting the squelch tail noise after transmission ends (Squelch Tail Elimination)” for details of **QT Reverse Burst**.

Configuration using KPG-D2

Configuring **QT Reverse Burst** to be enabled or disabled (See Edit > Channel Information/ Channel Edit)

Configuring the Digital Signaling (RAN Decode/ RAN Encode)

RAN (Radio Access Number) is the signaling for NXDN digital communications used by the repeater to transmit and receive a digital signal.
Refer to “Digital Signaling System” for details of RAN.

Configuration using KPG-D2

Configuring **RAN Decode/ RAN Encode** (See Edit > Channel Information/ Channel Edit)

Configuring a Channel Name (Channel Name)

A channel name of up to 2 alphanumeric characters and symbols can be configured for each channel. The configured channel name appears on the LED display of the repeater.

Configuration using KPG-D2

Configuring **Channel Name** (See Edit > Channel Information/ Channel Edit)

Configuring the Channel Spacing (Channel Spacing)

Channel Spacing is the channel spacing used by the repeater to transmit and receive.

Channel spacing is the spacing of frequencies between adjacent channels.

Refer to “Configuring the Channel Spacing (Channel Spacing)” in “BASE STATION (SIMPLEX/ DUPLEX)” for the details of **Channel Spacing**.

Configuration using KPG-D2

Configuring **Channel Spacing (Analog)/ Channel Spacing (NXDN)** (See Edit > Channel Information/ Channel Edit)

Configuring the Operation Mode of the Repeater (Operation Mode)

Operation Mode is the mode in which the repeater transmits and receives.

Depending on the task of the repeater, the repeater can be operated in one of the following modes. (Refer to STRUCTURE OF A CONVENTIONAL SYSTEM.)

To operate the repeater in the single repeater system, configure “Repeat” in **Operation Mode**.

Refer to “Configuring the Operation Mode of the Repeater (Operation Mode)” in “BASE STATION (SIMPLEX/ DUPLEX)” for the details of **Operation Mode**.

Configuration using KPG-D2

Configuring **Operation Mode** (See Edit > Channel Information/ Channel Edit)

Improving the Audio Quality on an Analog Channel (Compander)

Compander is the combination term of COMpressor and exPANDER, and is the function to improve the quality of the received signal by reducing the noise in communications.

Refer to "Improving the Audio Quality on an Analog Channel (Compander)" in "BASE STATION (SIMPLEX/DUPLEX)" for the details of **Compander**.

Configuration using KPG-D2

Configuring **Compander** to be enabled or disabled (See Edit > Channel Information/ Channel Edit)

12.2 Configuring the Functions Related to Reception

This section explains the functions and configurations related to reception used when the repeater is operated in the repeater system.

Squelch

Squelch is the function to eliminate the noise which is generated while the received signal level is low by muting the speaker. The received signal level to unmute the speaker can be changed according to conditions; for instance, when the repeater is operated in the environment of an excessively interfering signal.

Refer to “Squelch” in “BASE STATION (SIMPLEX/ DUPLEX)” for the details of squelch.

Temporarily Disabling the Signaling (Monitor)

Monitor is the function to unmute the speaker if the level of the received signal is high, even if the received signaling (the QT tone, DQT code or RAN code) does not match the signaling preconfigured for the repeater (the QT tone, DQT code or RAN code). This function can be used to check in advance whether or not a channel to be used for transmission is already being used by other groups.

Refer to “Temporarily Disabling the Signaling (Monitor)” in “BASE STATION (SIMPLEX/ DUPLEX)” for the details of **Monitor**.

Note

- Even if **Monitor** is enabled, the repeater does not transmit by using the Repeat PTT control unless the signaling matches.

Monitoring the Usage Status of a Channel (External Monitor)

External Monitor is the function to monitor the availability of channels by activating the preconfigured **Squelch Off** or **Monitor** when the External Monitor port becomes active.

Refer to “Monitoring the Usage Status of a Channel (External Monitor)” in “BASE STATION (SIMPLEX/ DUPLEX)” for the details of **External Monitor**.

Configuration using KPG-D2

Configuring **External Monitor** (See Edit > Optional Features > Common Page 1)

Toggling the Signaling Decoding between Enabled and Disabled (Decode Signaling Enable/Disable)

Decode Signaling Enable/Disable is the function to enable or disable the decoding of signaling (QT tone, DQT tone, or RAN code).

Refer to "Toggling the Signaling Decoding between Enabled and Disabled (Decode Signaling Enable/Disable)" in "BASE STATION (SIMPLEX/ DUPLEX)" for the details of **Decode Signaling Enable/Disable**.

Unmuting the Speaker by Linking with the Microphone (Off-hook Decode)

Off-hook Decode is the function to decode the received signaling (the QT tone, the DQT code, or the RAN code) in conjunction with the microphone of the **PTT** (microphone) switch on- or off-hook state.

If **Off-hook Decode** is enabled, the repeater unmutes the speaker regardless of the microphone on- or off-hook state when the received signaling matches the configured signaling.

If **Off-hook Decode** is disabled, the repeater unmutes the speaker when the repeater receives a signal while the microphone is in the off-hook state. The repeater unmutes the speaker if the received signaling matches the configured signaling while the microphone is in the on-hook state. However, if the repeater is operated in the repeater system, even if the microphone is in the off-hook state, the repeater does not transmit by using the Repeat PTT control unless the signaling matches.

Configuration using KPG-D2

Configuring **Off-hook Decode** to be enabled or disabled (See Edit > Optional Features > Common Page 1)

Configuring the Length of Time until Restarting the QT Decode (QT Decode Delay)

QT Decode Delay is the length of time from when the matching state of the received QT tone becomes inconsistent until the repeater restarts the QT Decode.

Refer to "Configuring the Length of Time until Restarting the QT Decode (QT Decode Delay)" in "BASE STATION (SIMPLEX/ DUPLEX)" for the details of **QT Decode Delay**.

Configuration using KPG-D2

Configuring **QT Decode Delay** (See Edit > Optional Features > Common Page 1)

Identifying the RSSI Level by Using the Auxiliary Output Port (Lowest Receive Level Threshold)

Lowest Receive Level Threshold is the reference RSSI level at which the repeater toggles the **Receive Signal (Threshold)** assigned to the AUX Output port between activated and deactivated.

If the RSSI level is lower than the level configured for **Lowest Receive Level Threshold**, the AUX Output port to which **Receive Signal (Threshold)** is assigned becomes active, and if the level is higher than the configured level, the AUX Output port becomes inactive. (Refer to Available Functions for the AUX Output Ports.)

Configuration using KPG-D2

Configuring **Lowest Receive Level Threshold** (See Edit > Optional Features > Common Page 1 > Level)

Configuring to Transmit a Voting Pilot Tone Signal (Voting Pilot Tone)

Voting Pilot Tone is the function to transmit a Voting pilot tone signal from the RA port by using the preconfigured frequency while the repeater is receiving no signal.

Refer to “Configuring to Transmit a Voting Pilot Tone Signal (Voting Pilot Tone)” in “BASE STATION (SIMPLEX/ DUPLEX)” for the details of **Voting Pilot Tone**.

Configuration using KPG-D2

Configuring **Voting Pilot Tone** to be enabled or disabled and configuring the frequency (See Edit > Optional Features > Common Page 2 > Voting Pilot Tone)

12.3 Configuring the Functions Related to Transmission and Repeat

This section explains the functions and configurations related to transmission used when the repeater is operated in the repeater system.

Configuring the Priority Order of When Multiple Causes for Transmission Occur Together (PTT Priority)

The following methods for transmission are available for the repeater:

- Mic PTT (**PTT** (microphone) switch)
- External PTT
- Repeat PTT
- Console PTT
- Network PTT

PTT Priority is the priority order for these transmission methods.

Refer to "Configuring the Priority Order of When Multiple Causes for Transmission Occur Together (PTT Priority)" in "BASE STATION (SIMPLEX/ DUPLEX)" for the details of **PTT Priority**.

Configuration using KPG-D2

Configuring **PTT Priority** (See Edit > Optional Features > Common Page 1)

Configuring the Transmission Power Level

One of "High", "Mid", and "Low" can be configured for each channel as the transmission power of the repeater.

Refer to "Configuring the Transmission Power Level" in "BASE STATION (SIMPLEX/ DUPLEX)" for details.

Configuration using KPG-D2

Configuring **Transmit Power** (See Edit > Channel Information/ Channel Edit)

Restricting the Continuous Transmission Time for the Repeater (Time-out Timer)

Time-out Timer (TOT) is the function to restrict the continuous transmission time for the repeater.

This function is used to prevent a user from occupying the repeater or frequency which is shared with other users. The repeater automatically stops transmitting and releases the channel if it continuously transmits longer than the configured time.

Refer to "Restricting the Continuous Transmission Time for the Repeater (Time-out Timer)" in "BASE STATION (SIMPLEX/ DUPLEX)" for the details of **Time-out Timer (TOT)**.

Notifying a user that the continuous transmission is about to end (TOT Pre-alert)

TOT Pre-alert is the function to notify a user that a continuous transmission is about to end by the **Time-out Timer**.

Refer to "Notifying a user that the continuous transmission is about to end (TOT Pre-alert)" in "BASE STATION (SIMPLEX/ DUPLEX)" for the details of **TOT Pre-alert**.

Configuring the length of time from when the transmission is automatically terminated by Time-out Timer until the transmission becomes possible again (TOT Rekey Time)

TOT Rekey Time is the length of time from when the transmission ends by the **Time-out Timer** until the transmission becomes possible again.

Refer to "Configuring the length of time from when the transmission is automatically terminated by Time-out Timer until the transmission becomes possible again (TOT Rekey Time)" in "BASE STATION (SIMPLEX/ DUPLEX)" for the details of **TOT Rekey Time**.

Configuring the time before starting to initialize and reset the Time-out Timer (TOT Reset Time)

TOT Reset Time is the time required to initialize and reset the elapsed time for **Time-out Timer**.

Refer to "Configuring the time before starting to initialize and reset the Time-out Timer (TOT Reset Time)" in "BASE STATION (SIMPLEX/ DUPLEX)" for the details of **TOT Reset Time**.

Configuration using KPG-D2

Configuring each function of **Time-out Timer (TOT)** when using the Repeat PTT control, External PTT control, Network PTT control or Console PTT control (See Edit > Optional Features > Common Page 1 > Repeater/ External/ Network/ Console PTT)

Avoiding Interference with Other Communications (Busy Channel Lockout)

Busy Channel Lockout is the function to automatically restrict the transmission in order to avoid interfering with the communications of other parties if the channel on which the repeater attempts to transmit using the **PTT** (microphone) switch is already used by another group.

Refer to "Avoiding Interference with Other Communications (Busy Channel Lockout)" in "BASE STATION (SIMPLEX/ DUPLEX)" for the details of **Busy Channel Lockout**.

Configuration using KPG-D2

- Configuring **Busy Channel Lockout (Analog)** (See Edit > Optional Features > Common Page 2 > Local Mic PTT)
- Configuring **Busy Channel Lockout (NXDN)** (See Edit > Optional Features > Common Page 2 > Local Mic PTT)

Toggling the Transmission by Pressing the PTT (Microphone) Switch between Enabled and Disabled (Local TX Enable/Disable)

Local TX Enable/Disable is the function to enable or disable the transmission by using the **PTT** (microphone) switch.

Refer to "Toggling the Transmission by Pressing the PTT (Microphone) Switch between Enabled and Disabled (Local TX Enable/Disable)" in "BASE STATION (SIMPLEX/ DUPLEX)" for the details of **Local TX Enable/Disable**.

Toggling the Repeat Behavior between Enabled and Disabled (Repeat Enable/Disable)

Repeat Enable/Disable is the function to enable or disable the repeat behavior.

If **Repeat Disable** is enabled, the repeater does not repeat the signal even if the repeater receives a signal which matches the signaling.

The repeat behavior can be enabled or disabled when a **PF** key is pressed, when the signal is applied to an AUX Input port, or when the repeater is turned on.

Table 12-1 Toggling the Repeat Behavior between Enabled and Disabled

Trigger	Assigned Functions	See
PF key	Repeat Enable/Disable	AVAILABLE FUNCTIONS FOR THE PF KEYS
AUX Input port	Repeat Disable Repeat Enable Repeat Enable/Disable	Available Functions for the AUX Input Ports
Startup	Repeat Disable Repeat Enable	Assigning Functions that Become Active or Enabled When the Repeater Starts Up (Startup)

Note

- If **Repeat Disable** is enabled during transmission, the repeater immediately stops the repeat transmission.
- If the PTT having the lower priority than the Repeat PTT control becomes ready to start transmission when the transmission using the Repeat PTT control ends by enabling **Repeat Disable** during the transmission, the repeater continues the transmission by changing the modulation signal line. (Refer to Configuring the Priority Order of When Multiple Causes for Transmission Occur Together (PTT Priority).)

Toggling the Transmission Behavior between Enabled and Disabled (TX Enable/Disable)

TX Enable/Disable is the function to enable or disable all transmissions.

Refer to “Toggling the Transmission Behavior between Enabled and Disabled (TX Enable/Disable)” in “BASE STATION (SIMPLEX/ DUPLEX)” for the details of **TX Enable/Disable**.

Toggling the Pre-emphasis of the TA Port between Enabled and Disabled (TA line Pre-emphasis On/Off)

TA line Pre-emphasis On/Off is the function to enable or disable the pre-emphasis of the TA port.

Refer to “Toggling the Pre-emphasis of the TA Port between Enabled and Disabled (TA line Pre-emphasis On/Off)” in “BASE STATION (SIMPLEX/ DUPLEX)” for the details of **TA line Pre-emphasis On/Off**.

Continuing Transmission for a Certain Length of Time After Reception Stops (Repeater Hold Time)

Repeater Hold Time is the length of time from when the repeater stops receiving a signal until the repeater terminates transmission using the Repeat PTT control while the repeater transmits the received signals using the Repeat PTT control.

The repeater can continue transmitting for the time configured in **Repeater Hold Time** even if the communication using the Repeat PTT control is finished.

Repeater Hold Time can be enabled or disabled when a **PF** key is pressed, when the signal is applied to an AUX Input port, or when the repeater is turned on.

Table 12-2 Toggling the Repeater Hold Time between Enabled and Disabled

Trigger	Assigned Functions	See
PF key	Hold Time Enable/Disable	AVAILABLE FUNCTIONS FOR THE PF KEYS
AUX Input port	Hold Time Disable Hold Time Enable Hold Time Enable/Disable	Available Functions for the AUX Input Ports
Startup	Hold Time Disable Hold Time Enable	Assigning Functions that Become Active or Enabled When the Repeater Starts Up (Startup)

Note

- If “Off” is configured in **Repeat Hold Time**, the repeater terminates transmitting immediately after the repeater stops receiving a signal.
- While a timer for **Repeater Hold Time** is counting down, the repeater mutes the transmission audio.
- If **Repeater Hold Time** is disabled while the timer for **Repeater Hold Time** is counting down, the timer for **Repeater Hold Time** continues to count down and the transmission is retained. **Repeater Hold Time** becomes disabled after the transmission ends upon lapse of the time configured in **Repeater Hold Time**.

Configuration using KPG-D2

Configuring **Repeater Hold Time** (See Edit > Optional Features > Common Page 1 > Repeater/ External/ Network/ Console PTT)

Notifying the Other Party that the Communication Ends in Analog Communications (Courtesy Tone)

Courtesy Tone is the function for the repeater to transmit a Courtesy Tone when the transmission by using the Repeat PTT control, **PTT** (microphone) switch, or External PTT control ends. This tone notifies a subscriber that the communication is finished and the repeater is available.

Refer to “Notifying the Other Party that the Communication Ends in Analog Communications (Courtesy Tone)” in “BASE STATION (SIMPLEX/ DUPLEX)” for the details of **Courtesy Tone**.

About the transmission of a Courtesy Tone by using the Repeat PTT control

A Courtesy Tone is transmitted when the transmission using the Repeat PTT control ends after the time configured in **Encode Pause Time** elapses.

If “Off” is configured in **Repeater Hold Time**, the transmission by using the Repeat PTT control ends after a Courtesy Tone is transmitted.

If **Repeater Hold Time** is configured, a Courtesy Tone is transmitted before the time configured in **Repeater Hold Time** elapses. After a Courtesy Tone is transmitted, the transmission by using the Repeat PTT control ends when the time configured in **Repeater Hold Time** elapses. (Refer to Continuing Transmission for a Certain Length of Time After Reception Stops (Repeater Hold Time).)

A Courtesy Tone is transmitted by the following timing:

- **If a Courtesy Tone is transmitted:**

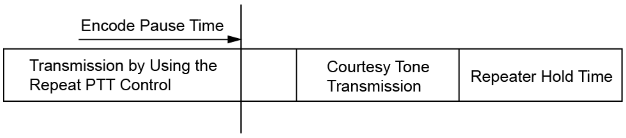


Figure 12-2 Courtesy Tone 1

- **If a Courtesy Tone is not transmitted:**

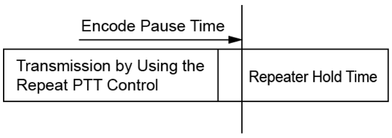


Figure 12-3 Courtesy Tone 2

The repeater does not transmit a Courtesy Tone if the transmission period using the Repeat PTT control is shorter than the **Encode Pause Time** after the PTT switch having a higher priority is activated and deactivated while the repeater transmits using the Repeat PTT control.

PTT Priority 1: Mic PTT (**PTT** (microphone) switch)

PTT Priority 2: Repeat PTT

Encode Pause Time: 2 sec

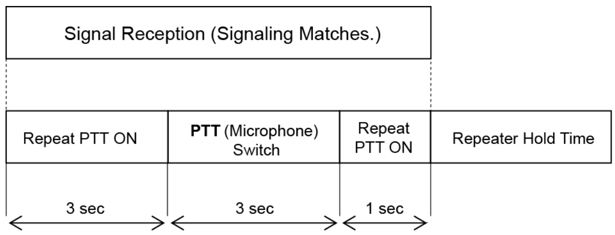


Figure 12-4 Courtesy Tone 3

Configuration using KPG-D2

Configuring **Courtesy Tone** to be enabled or disabled and configuring each function (See Edit > Optional Features > Common Page 2 > Courtesy Tone)

Toggling the Signaling Encoding between Enabled and Disabled (Encode Signaling Enable/Disable)

Encode Signaling Enable/Disable is the function to enable or disable the QT/DQT and RAN code encoding.

Refer to "Toggling the QT/DQT encoding between enabled and disabled (Encode Signaling Enable/Disable)" and "Toggling the RAN encoding between enabled and disabled (Encode Signaling Enable/Disable)" for details of **Encode Signaling Enable/Disable**.

Waiting to Receive Multiple Signaling (Multiple Encode/Decode Table)

Multiple Encode/Decode Table is the table in which the Encode/Decode signaling that the repeater waits to receive along with the Primary signaling (the QT tone, DQT code, or RAN code) configured for each channel is configured. If this function is used, the repeater can wait to receive a maximum of 16 combinations of signaling (a combination of Primary + 15 combinations of Encode/Decode tones and codes).

Refer to "Waiting to receive multiple QT/DQT (Multiple Encode/Decode Table)" and "Waiting to receive multiple RAN codes (Multiple Encode/Decode Table)" for details of **Multiple Encode/Decode Table**.

Configuring the Length of Time to Transmit in the Same Mode as When the Repeater Receives a Signal on a Mixed Channel and the Received Signaling Matches (Signaling Reset Timer)

Signaling Reset Timer is the length of time to transmit in the same communication method (either Analog or NXDN) as the method for the received signal regardless of the configuration in **Transmit Mode** if the repeater receives a signal on a mixed channel and the received signaling matches the signaling preconfigured for the repeater.

Refer to “Transmitting by Using the Communication Method of Reception (Signaling Reset Timer)” for details of **Signaling Reset Timer**.

Preventing the Receiving Party from Emitting the Squelch Tail Noise (Squelch Tail Elimination)

Squelch Tail Elimination is the function to prevent the speaker of the receiving party from emitting the squelch tail noise after transmission ends.

Refer to “Preventing the receiving party from emitting the squelch tail noise after transmission ends (Squelch Tail Elimination)” for details of **Squelch Tail Elimination**.

Preventing the Receiving Party from Wrongly Detecting a Signal due to Chassis Radiation from the Repeater (Standby on Transmit Frequency)

Standby on Transmit Frequency is the function to wait to receive on the transmit frequency configured for each channel while the repeater is in the standby mode.

Refer to “Preventing the Receiving Party from Wrongly Detecting a Signal due to Chassis Radiation from the Repeater (Standby on Transmit Frequency)” in “BASE STATION (SIMPLEX/ DUPLEX)” for the details of **Standby on Transmit Frequency**.

Configuration using KPG-D2

Configuring **Standby on Transmit Frequency** to be enabled or disabled (See Edit > Optional Features > Common Page 1)

Preventing the Beginning of the Digital Frame from Being Undetected (Preamble Length)

Preamble Length is the function to extend the time for sending a preamble when the digital frame is sent.

Refer to “Preventing the Beginning of the Digital Frame from Being Undetected (Preamble Length)” in “BASE STATION (SIMPLEX/ DUPLEX)” for the details of **Preamble Length**.

Configuration using KPG-D2

Configuring **Preamble Length** (See Edit > NXDN > General)

Periodically Sending a Preconfigured CW ID

CW ID is the function to automatically and periodically send Morse code configured for a channel.

Refer to "Periodically Sending a Preconfigured CW ID" in "BASE STATION (SIMPLEX/ DUPLEX)" for the details of **CW ID**.

Configuration using KPG-D2

- Configuring **CW ID** to be enabled or disabled (See Edit > Channel Information/ Channel Edit > CW ID)
- Configuring each function of **CW ID** (See Edit > Channel Information/ Channel Edit > CW ID)

Restricting the IDs for Repeat Transmission (User List)

User List is the function to restrict the IDs to be transmitted by using the Repeat PTT control on the NXDN digital channels for which **User List** is enabled.

In a system where user limit is used, all Unit IDs may be temporarily enabled for a reason such as an operation check. With this function, a system administrator can temporarily release the authorization to use the repeaters without deleting **User List**.

If the repeater receives a Group Call, the repeater can repeat the call only if both the received Group ID and Unit ID are permitted to use the repeater.

If the repeater receives an Individual Call, the repeater can repeat the call only if the received Unit ID is permitted to use the repeater. In this case, the usage status (permitted or not permitted) of the Group ID makes no difference.

Note

- This function can be used only on an NXDN digital channel.

Configuring the Group ID used for enabling the repeat transmission (Group ID List)

Group ID List is the list for which the Group ID used for enabling repeat transmission on an NXDN digital channel is configured.

The repeater only repeats a signal from a Group ID configured in **Group ID List** and if "Yes" is configured in **Valid**. Because subscriber units with an unauthorized Group ID are not repeated, the subscriber units cannot communicate. If the User ID of a subscriber unit is not authorized in the **Unit ID List**, the subscriber unit cannot communicate even if Group ID is authorized.

A maximum of 1000 Group IDs can be configured in **Group ID List** by using KPG-D2.

Configuring the Unit ID used for enabling the repeat transmission (Unit ID List)

Unit ID List is the list for which the Unit ID used for enabling repeat transmission on an NXDN digital channel is configured.

The repeater only repeats a signal from a Unit ID configured in **Unit ID List** and if "Yes" is configured in **Valid**. Because subscriber units with an unauthorized Unit ID are not repeated, the subscriber units cannot communicate.

A maximum of 1000 Unit IDs can be configured in **Unit ID List** by using KPG-D2.

Configuring the User List to be enabled or disabled (User List)

Whether the configuration for **User List** is enabled or disabled can be configured for each channel by using KPG-D2.

If this function is enabled, the repeater sends only calls using the ID authenticated in the **User List** to a receiving subscriber unit.

If this function is disabled, the repeater sends all calls made using the NXDN digital signal to the receiving subscriber unit.

However, the RAN code must match the RAN code preconfigured for the repeater in order to repeat communications as a principle repeating condition in any case.

According to the configuration for **User List**, the repeater behaves as follows:

Table 12-3 User List

Configuration	Description
None	The repeater sends all calls made using the NXDN digital signal to the receiving subscriber unit.
Group ID List	Only **Group ID List** is enabled. Because all Unit IDs are allowed to be used, the repeater repeats all Individual Calls if the repeater receives an Individual Call. If the repeater receives a Group Call, the repeater repeats the call only if the Group ID of the target party is permitted to use the repeater. (Refer to Configuring the Group ID used for enabling the repeat transmission (Group ID List).)
Unit ID List	Only **Unit ID List** is enabled. The repeater allows all Group IDs to be used. If the repeater receives an Individual Call or Group Call, the repeater repeats only if the received Unit ID is allowed to use the repeater. (Refer to Configuring the Unit ID used for enabling the repeat transmission (Unit ID List).)
Both	Both **Unit ID List** and **Group ID List** are enabled. If the repeater receives an Individual Call, the repeater repeats the call only if the received Unit ID is allowed to use the repeater. If the repeater receives a Group Call, the repeater repeats the call only if the received Unit ID and the Group ID of the target party are permitted to use the repeater.

Avoiding Interference of Other Parties and Preventing Interference to Other Parties (Cross-busy)

Cross-busy is the function to restrict transmission in order to prevent the transmission from interfering with other communications if the channel is being used by another subscriber unit when the repeater transmits using the Repeat PTT control.

Refer to “Avoiding Interference of Other Parties and Preventing Interference to Other Parties (Cross-busy)” in “CONVENTIONAL IP NETWORK SYSTEM” for the details of **Cross-busy**.

12.4 Configuring the Functions Related to Calls on an NXDN Digital Channel

This section explains various functions and configurations for making calls by using the **PTT** (microphone) switch in the NXDN digital repeater system.

Configuring the Unit ID or ID Name of the Repeater

To make various communications by using the **PTT** (microphone) switch in the NXDN digital repeater system, a **Unit ID (Own)**, the identification code of a repeater, needs to be configured for the repeater. An ID name can be configured in **Unit ID (Own)**.

Refer to "Configuring the Unit ID or ID Name of the Repeater" in "BASE STATION (SIMPLEX/ DUPLEX)" for details.

Configuration using KPG-D2

- Configuring **Unit ID (Own)** (See Edit > NXDN > General)
- Configuring **Unit ID Name (Own)** (See Edit > NXDN > General)
- Configuring **Over-the-Air Alias** (See Edit > NXDN > General)

Controlling the Speaker Mute by the Received Optional Signaling (NXDN)

Optional Signaling (NXDN) is the function to receive an individual call or a group call. The repeater unmutes the speaker if the received Optional Signaling matches the Optional Signaling preconfigured for the repeater.

Refer to "Controlling the Speaker Mute by the Received Optional Signaling (NXDN)" in "BASE STATION (SIMPLEX/ DUPLEX)" for the details of **Optional Signaling (NXDN)**.

Configuration using KPG-D2

- Configuring **Optional Signaling (NXDN)** (See Edit > Channel Information/ Channel Edit)
- Configuring **GID Scan (NXDN)** to be enabled or disabled (See Edit > Channel Information/ Channel Edit)

Executing an Individual Call by Pressing the PTT (Microphone) Switch (Selcall on PTT)

Selcall on PTT (NXDN) is the function used by the repeater to start an Individual Call or Group Call when the **PTT** (microphone) switch is pressed.

Refer to "Executing an Individual Call by Pressing the PTT (Microphone) Switch (Selcall on PTT)" in "BASE STATION (SIMPLEX/ DUPLEX)" for the details of **Selcall on PTT (NXDN)**.

Configuration using KPG-D2

- Configuring **Selcall on PTT (NXDN)** (See Edit > Channel Information/ Channel Edit)
- Configuring **ID List Number (NXDN)** (See Edit > Channel Information/ Channel Edit)

Configuring Auto Reset Timer

Auto Reset Timer is the function to reset the matching state automatically after the received Unit ID or Group ID matches the Unit ID or Group ID preconfigured for the repeater.

Refer to "Configuring Auto Reset Timer" in "BASE STATION (SIMPLEX/ DUPLEX)" for the details of **Auto Reset Timer**.

Configuration using KPG-D2

- Configuring **Auto Reset Timer** (See Edit > NXDN > General > Auto Reset)
- Configuring **Selective Call Alert LED** to be enabled or disabled (See Edit > NXDN > General)

13 NEXEDGE 1ST GENERATION SYSTEM

NXR-5700/ NXR-5800 can be used as a control channel or traffic channel to structure a site in the NEXEDGE 1st Generation system. This chapter explains each function for the NEXEDGE 1st Generation system (hereinafter referred to as “NEXEDGE system”).

Note

- Each function for the NEXEDGE system described in this chapter can be configured using KPG-D2 and KPG-110SM. Refer to NEXEDGE 1st Generation System Programming Reference for instructions on how to configure functions by using KPG-110SM.

13.1 Channel Configuration of the System

A site is an assembly of repeaters in the system. A site consists of 1 control channel and multiple traffic channels.

Control Channel

A control channel is the channel used to constantly transmit control signals and control a NEXEDGE system. (Refer to Configuring the Usage Mode of a Channel (Channel Type).)

If multiple control channels exist in the NEXEDGE system, the channel having the lowest channel number is preferentially configured as the control channel. If the **Automatic Rollover** function is activated, a control channel behaves as the control channel in order from the lowest channel number.

The following are main functions of the control channel:

- Processing Voice Call requests and Data Call requests
- Specifying the channel used to make a Voice Call and Data Call
- Providing information of adjacent sites
- Accepting the location registration request

Traffic Channel

A traffic channel is the channel used for communications such as Voice Calls and Data Calls. (Refer to Configuring the Usage Mode of a Channel (Channel Type).)

The following are main functions of the traffic channel:

- Repeating Voice Calls and Data Calls
- Terminating Voice Calls and Data Calls
- Notifying of a Priority Monitor Call

Dual-functional Channel

A Dual-functional Channel is a channel that can behave as both a control channel and a traffic channel. (Refer to Configuring the Usage Mode of a Channel (Channel Type).)

If the **Automatic Rollover** function is activated, the channel that behaved as a traffic channel can be used as a control channel.

To use a Dual-functional Channel as a control channel, the Dual-functional Channel needs to be preconfigured as a control channel candidate for the subscriber unit as well.

Configuring the Usage Mode of a Channel (Channel Type)

Channel Type is the usage mode of a channel in a NEXEDGE system. “Control Channel”, “Traffic Channel” or “Dual-functional Channel” can be configured in **Channel Type** by using KPG-110SM.

Table 13-1 Channel Type (KPG-110SM)

Item	Description
Control Channel	A channel with “Control Channel” configured in **Channel Type** behaves as a control channel. A control channel constantly transmits control signals and controls a NEXEDGE system. (Refer to Control Channel.)
Traffic Channel	A channel with “Traffic Channel” configured in **Channel Type** behaves as a traffic channel. A traffic channel is used for communications such as Voice Calls and Data Calls. (Refer to Traffic Channel.)
Dual-functional Channel	A channel with “Dual-functional Channel” configured in **Channel Type** behaves as a channel that can operate as both a control channel and a traffic channel. (Refer to Dual-functional Channel.)

Configuration using KPG-110SM

Configuring **Channel Type** (See NEXEDGE 1st Generation System Programming Reference 7.4.4 Channel Type)

Configuring the Usage Type of the Channel (Channel Type)

Channel Type is the usage type of a channel in a NEXEDGE system. “NXDN”, “Shared”, or “AUX” can be configured in **Channel Type** by using KPG-D2.

Table 13-2 Channel Type (KPG-D2)

Item	Description
NXDN	An NXDN channel transmits and receives NXDN digital signals as a traffic channel. Or, the channel controls the communications using NXDN digital signals as a control channel.
Shared	A Shared channel can share the traffic channel of a NEXEDGE system with Analog Conventional mode. An analog subscriber unit already operating is not dropped and can continue to be used by using the Shared Channel function. Then, digital subscriber units can be installed sequentially as additions, and can be operated in a NEXEDGE system. With this function, existing devices can be effectively used.
AUX	On an AUX channel, the repeater can be used as a duplex repeater in analog mode or as a traffic channel in digital mode while the repeater behaves as a traffic channel. The repeater transmits in analog mode if the **PTT** switch is activated by an external device while the repeater is not used as a traffic channel in an NXDN Trunking system. Using the Cross-busy function at the same time enables the connection to a Trident or Zetron LTR controller.

Configuration using KPG-D2

Configuring **Channel Type** (See Edit > Channel Information/ Channel Edit)

Configuring a Channel Number (Channel Number)

Channel Number is the number assigned to each repeater in the site. Channel Number is used as the identification number in the system along with the site number.

Configuration using KPG-110SM

Configuring **Channel Number** (See NEXEDGE 1st Generation System Programming Reference 7.4 Channel Edit Window)

Configuring a Frequency Number (Frequency Number)

Frequency Number is a number for the combination of receive and transmit frequencies configured for each repeater.

The traffic channel is assigned on a control channel by associating the number with the transmit and receive frequencies. If this value is incorrect, a system error may occur, such as a subscriber unit may not distinguish the system properly or cannot initiate a call.

Configuration using KPG-110SM

Configuring **Frequency Number** (See NEXEDGE 1st Generation System Programming Reference 7.4 Channel Edit Window)

13.2 Available Calls

A NEXEDGE system supports the following call types:

- Group Call
- Individual Call
- Status Call
- Short Data Call
- Long Data Call
- Voice with Data Call
- Emergency Call
- Priority Call
- Telephone Call

Group Call

Group Call is the function that allows multiple subscriber units to communicate with each other. Group Call is used if a subscriber wishes to communicate with multiple subscriber units at the same time.

If a Group Call request is received from a subscriber unit on a control channel, a NEXEDGE system allocates a channel for communications. If a Group Call message is received on a control channel, the transmitting and receiving subscriber units migrate to the specified traffic channel and then initiate a Group Call.

Individual Call

Individual Call is the function that allows two subscriber units to communicate with each other. Individual Call is used if a subscriber wishes to communicate only with a specific party.

If an Individual Call request is received from a subscriber unit on a control channel, a call message is sent to the receiving subscriber unit to confirm the presence of the subscriber unit in a NEXEDGE system. If the presence of the subscriber unit is confirmed, the NEXEDGE system allocates a channel for communications. If an Individual Call message is received on a control channel, the transmitting and receiving subscriber units migrate to the specified traffic channel and then initiate an Individual Call.

Status Call

Status Call is the data communication function using a status message on a control channel. A status message is suitable for quickly transmitting and receiving preconfigured short information. This function can be used to notify the status of a user to the dispatcher or the status of the peripheral devices that are input to the base station such as from a sensor.

A status message is represented by numbers from 1 to 255. The area available for a user is from 1 to 199.

Note

- Status Call can be used in both a Group Call and an Individual Call. However, for a Group Call, the repeater cannot retransmit since the receiving subscriber unit does not send the acknowledgment. Therefore, the possibility that the receiving subscriber unit does not receive a status message is higher for a Group Call than for an Individual Call.

Short Data Call

Short Data Call is the data communication function using data transfer on a control channel. Short Data Call is suitable for quickly sending and receiving short messages. This function can be used such as to send and receive GPS data and short text messages. Short Data Call can send and receive data with a maximum of 100 bytes.

Long Data Call

Long Data Call is the data communication function using data transfer on a traffic channel. Long Data Call is suitable for communicating large amounts of data. This function can be used for file transfers, database access, and other purposes. Long Data Call can send and receive data with a maximum of 4096 bytes.

Voice with Data Call

Voice with Data Call is the communication function to send information data along with the voice data during a voice call. This function can be used such as to transfer GPS data. This function allows subscribers to communicate without interruption even if a subscriber unit sends GPS data during a voice call.

If a user who frequently makes a voice call uses GPS communications, calls may be interrupted due to the increase of communication traffic. This problem can be avoided by using the Voice with Data Call function. However, the voice data cannot be sent while making a Data Call.

Emergency Call

Emergency Call is the function to prioritize a call from a party in an emergency situation. If an Emergency Call request is received from a subscriber unit, a connection is established with the highest priority in a NEXEDGE system. However, a channel cannot be immediately allocated if all traffic channels are busy in the NEXEDGE system. In this case, the call having the lowest priority is disconnected and the channel is allocated to the Emergency Call in the NEXEDGE system.

Priority Call

Priority Call is the function to prioritize calls according to the priority levels of the transmitting subscriber units. This function is suitable for prioritizing calls from a subscriber unit having high priority, such as the dispatcher.

If all traffic channels are busy, new call requests are stored in the call Queue in a NEXEDGE system. The order in the Queue is determined according to the priority levels of the subscriber units configured for the NEXEDGE system. If a traffic channel becomes available, the call request from the subscriber unit having the highest priority in the Queue is accepted by the system, and the call is initiated.

Telephone Call

Telephone Call is the function that enables intercommunication between the system and a telephone line, such as PSTN and PABX. To use Telephone Call, an optional Interconnect Adapter (KTI-4) is required. (Refer to TELEPHONE INTERCONNECT.)

13.3 Configuring Class of Service

Class of Service (hereafter referred to as "COS") is the function to simplify the management of subscriber units by consolidating and patterning the function use restriction management for the subscriber units.

For instance, COS can be sorted and configured according to the subscriber units' usage purposes, such as creating a COS where only voice communication is enabled, and creating a COS where both data communication and voice communication are enabled. A maximum of 127 COS available for a GID and a maximum of 127 COS available for a UID can be configured.

The permission and inhibition of the service available for a UID or GID need to be configured for a COS. If a function request, such as a call request from a subscriber unit, is received, the function request is verified with the preconfigured COS, and the connection is allowed in the system if the service is permitted. If the service is inhibited, an error message is sent back and the connection is not allowed.

About Primary COS and Secondary COS

There are 2 types of COS: primary COS and secondary COS.

- **Primary COS**
  Primary COS is applied when a NEXEDGE system functions normally. (Refer to Configuring a GID COS, Configuring a UID COS.)

- **Secondary COS**
  Secondary COS is applied when a site cannot connect to the home site, such as with a disconnected IP network. In this case, the site accepts communication requests within the range permitted by secondary COS. (Refer to Configuring a Secondary GID COS, Configuring a Secondary UID COS.)

About the COS for All Groups Call

The Service Class used to communicate using an All Groups Call can be configured in the same manner as the COS for GID. All Groups Call is the communication system whereby a call can be initiated to all groups that are currently used in the system. (Refer to Configuring an All Groups Call COS.)

About the COS for Telephone Call

The COS used to communicate using a Telephone Call can be configured. (Refer to Configuring a Telephone Call COS.)

Configuring a GID COS

A GID COS is a COS which defines available functions for GIDs.

The following functions relevant to the GID COS can be configured using KPG-110SM:

Table 13-3 GID COS

Function		Description
General	Valid	**Valid** allows a system administrator to configure whether a GID COS is enabled. If **Valid** is enabled, the GID COS is enabled and services are provided according to the configuration of the GID COS. If **Valid** is disabled, the GID COS is disabled. The GID to which the disabled GID COS is allocated cannot use any service.
	Class Name	**Class Name** is the name of a GID COS. The Class Name is configured to distinguish the configured GID COS.
	Comment	**Comment** allows a system administrator to enter text of complementary information about a GID COS.
	Late Entry	**Late Entry** allows a system administrator to configure whether the **Late Entry** function is enabled for a GID COS. **Late Entry** is the function to repeatedly send an instruction message to a traffic channel on a control channel at certain intervals by using a Group Call. Even if a message by Group Call cannot be received because the subscriber unit is temporarily outside the communication area, the subscriber unit can participate in a Group Call midway through the call after returning to the communication area.
	Priority Monitor	**Priority Monitor** allows a system administrator to configure whether the **Priority Monitor** function is enabled for a GID COS. **Priority Monitor** is the function to notify the Group Call information even on a traffic channel. If the subscriber unit detects a Group Call having higher priority than the current Group Call by using the Group Call information that is notified on a traffic channel, the subscriber unit can participate in the Group Call having higher priority.
	Time-out Timer	**Time-out Timer** allows a system administrator to configure the maximum continuous transmission time for a subscriber unit to communicate by use of a Group Call. The maximum continuous transmission time for a subscriber unit is instructed by an instruction message for communication allocation of a Voice Call. The subscriber unit restricts the maximum continuous transmission time of a Voice Call up to the notified value in **Time-out Timer**. Note • If “Unlimited” is configured in **Time-out Timer**, the subscriber unit behaves according to the configuration in **Time-out Timer** configured for the subscriber unit. • In **Time-out Timer**, do not configure a value longer than the value in **Occupation Timer**. (Refer to Various Timers Used by the System.) • The configuration in **Time-out Timer** is applied only to a Voice Call.

Function		Description
Call Type	Available Calls	**Available Calls** is the function to restrict available various calls for a subscriber unit. The NEXEDGE system checks for the value in **Available Calls** for a communication request from a subscriber unit and sends an error back to the subscriber unit if the requested call has been inhibited. A system administrator can configure whether or not to permit communications using the following calls for GIDs: Voice Call Status Call Short Data Call Long Data Call
Intersite	Intersite Call	**Intersite Call** allows a system administrator to configure whether or not to permit communications using a Voice Call and Data Call (Status Call, Short Data Call, and Long Data Call) between sites. If this function is enabled, the communications using a Voice Call and Data Call can be initiated between sites that are configured in **Intersite Call Table**. The target sites for an Intersite Group Call can be configured in **Intersite Call Table**. However, the communication method used for an Intersite Group Call and the number of sites which can be configured in **Intersite Call Table** vary as follows depending on the configuration in **Multicast Group Call**: ● **If Multicast Group Call is enabled:** The audio packet data of an Intersite Group Call is sent by the Multicast method in a NEXEDGE system. Multicast is the communication method to send packet data to multiple sites in a communications network at the same time. This communication method enables the NEXEDGE system to send the audio packet data to each site with low loads. For this communication method, a maximum of 48 sites can be configured as the target sites for an Intersite Group Call. ● **If Multicast Group Call is disabled:** The audio packet data of an Intersite Group Call is sent by the conventional Unicast method in a NEXEDGE system. Unicast is the communication method to send packet data to a site in a communications network. For this communication method, a maximum of 16 sites can be configured as the target sites for an Intersite Group Call.

Function		Description
Intersite	Busy System Wait	**Busy System Wait** allows a system administrator to configure connection conditions for the start of communication when initiating communication using a Group Call between sites. If this function is enabled, a NEXEDGE system connects to the site having an available channel when a Group Call is transmitted, and then the site starts communications. If no channel is available for the site, the call will be queued. If a channel becomes available in a busy site during communications, the NEXEDGE system allows sites to start communications in the order that the sites become available by using Late Entry. Queue is applied to both the transmitting site and the receiving site. (Refer to About the Behavior of a System When a New Call Request Is Received While All Traffic Channels Are in Use (Call Queuing).) If this function is disabled, a System Busy is sent back to a subscriber unit and the call is immediately canceled if even one busy site exists among the sites to be connected, including the transmitting sites. Note • The configuration in **Busy System Wait** is enabled only for Group Calls (Conference/ Broadcast). An Individual Call is transmitted and received by both the transmitting subscriber unit and the receiving subscriber unit according to the configuration for Queue regardless of the configuration in **Busy System Wait**.
	Group Refusal	**Group Refusal** is the function for a NEXEDGE system to notify a subscriber unit not to remain in a site if the subscriber unit executes Group Registration for the site but Group Registration is disabled for the site by the configuration in **Intersite Call Table**. If this function is enabled, the subscriber unit determines that the subscriber unit cannot be used in the corresponding site, and searches for another site. If this function is disabled, the subscriber unit cannot make a Group Call of the selected GID in the corresponding site, but the subscriber unit remains in the corresponding site because other communications such as an Individual Call are available.
	Valid	**Valid** allows a system administrator to configure whether to make each site the target of a Group Call.
	Dynamic Allocation	If a site where no subscriber unit succeeded in Group Registration exists, **Dynamic Allocation** allows a system administrator to configure whether or not to allocate a traffic channel to the site. Even if a traffic channel is assigned to a site where no subscriber unit succeeded in Group Registration, the subscriber units in the site cannot make a Group Call. Use of this function prevents an invalid traffic channel from being assigned to a site, and the channel resources can be effectively used.
Telephone	Incoming Call from Telephone Line	**Incoming Call from Telephone Line** allows a system administrator to configure whether or not to enable a subscriber unit to receive an incoming call from a telephone line. (Refer to TELEPHONE INTERCONNECT.) This function is configured to permit a Voice Call (Interconnect) from a telephone line. If this function is enabled, a Voice Call (Interconnect) from a telephone line is permitted. If this function is disabled, a Voice Call (Interconnect) from a telephone line is inhibited.

Configuration using KPG-110SM

- Configuring GID COS (See NEXEDGE 1st Generation System Programming Reference 7.7 Class of Service Information Window, 7.8 GID Class of Service Edit Window)
- Configuring **Multicast Group Call** to be enabled or disabled (See NEXEDGE 1st Generation System Programming Reference 7.1.6 Network Tab)

Configuring a UID COS

A UID COS is a COS which defines available functions for UIDs.

The following functions relevant to the UID COS can be configured using KPG-110SM:

Table 13-4 UID COS

Function		Description
General	Valid	**Valid** allows a system administrator to configure whether a UID COS is enabled. If **Valid** is enabled, the UID COS is enabled and services are provided according to the configuration of the UID COS. If **Valid** is disabled, the UID COS is disabled. The UID to which the disabled UID COS is allocated cannot use any service.
	Class Name	**Class Name** is the name of a UID COS. The Class Name is configured to distinguish the configured UID COS.
	Comment	**Comment** allows a system administrator to enter text of complementary information about a UID COS.
	Late Entry	**Late Entry** allows a system administrator to configure whether the **Late Entry** function is enabled for a UID COS. **Late Entry** is the function to repeatedly send an instruction message to a traffic channel on a control channel at certain intervals using an Individual Call. Even if a message by Individual Call cannot be received because the subscriber unit is temporarily outside the communication area, the subscriber unit can participate in an Individual Call midway through the call after returning to the communication area.
	Queue Level	**Queue Level** allows a system administrator to specify the priority order of a behavior in a NEXEDGE system if the available traffic channels in a site are in use when a new call request is received. (Refer to About the Behavior of a System When a New Call Request Is Received While All Traffic Channels Are in Use (Call Queuing).)
	Time-out Timer	**Time-out Timer** allows a system administrator to configure the maximum continuous transmission time for a subscriber unit to communicate by use of an Individual Call. The maximum continuous transmission time for a subscriber unit is instructed by an instruction message for communication allocation of a Voice Call. The subscriber unit restricts the maximum continuous transmission time of a Voice Call up to the notified value in **Time-out Timer**. Note • If "Unlimited" is configured in **Time-out Timer**, the subscriber unit behaves according to the configuration in **Time-out Timer** configured for the subscriber unit. • In **Time-out Timer**, do not configure a value longer than the value in **Occupation Timer**. (Refer to Various Timers Used by the System.) • The configuration in **Time-out Timer** is applied only to a Voice Call.

<table>
<tr><th colspan="2">Function</th><th>Description</th></tr>
<tr><td rowspan="2">General</td><td>Individual Call Response Type (Voice)</td><td>Individual Call Response Type (Voice) allows a system administrator to configure the behavior of a NEXEDGE system when calling the receiving subscriber unit by using a Voice Call (Individual).
The calling behavior using a Voice Call (Individual) can be configured according to the operation method of the NEXEDGE system.
Normal:
The NEXEDGE system allocates a traffic channel without waiting for a response from the receiving subscriber unit. Since the NEXEDGE system does not wait for a response from the receiving subscriber unit, the link speed is the same as a Group Call, but whether communications are actually established cannot be confirmed until a response is sent from the receiving subscriber unit.
Response:
The NEXEDGE system allocates a traffic channel after a wait for a response from the receiving subscriber unit. If no response is received for a certain time, an error message is sent back to the transmitting subscriber unit. Since the transmitting subscriber unit waits for a response from the receiving subscriber unit, the link speed is slower than a Group Call.

Note
• This function functions only if “Transmission Trunked” is configured in Trunking Type. (Refer to Determining the System Behavior of When Starting or Ending a Voice Call (Trunking Type).)</td></tr>
<tr><td>Individual Call Response Type (Data)</td><td>Individual Call Response Type (Data) allows a system administrator to configure the behavior of a NEXEDGE system when calling the receiving subscriber unit by using a Long Data Call (Individual).
The calling behavior using a Long Data Call (Individual) can be configured according to the operation method of the NEXEDGE system.
Normal:
The NEXEDGE system allocates a traffic channel without waiting for a response from the receiving subscriber unit. However, whether communications are actually established cannot be confirmed until a response is sent from the receiving subscriber unit.
Configure “Normal” to use a Long Data Call (Individual) mainly for notifying a data message.
Response:
The NEXEDGE system allocates a traffic channel after a wait for a response from the receiving subscriber unit. If no response is received for a certain time, an error message is sent back to the transmitting subscriber unit.
Configure “Response” mainly to make data communications with the receiving subscriber unit.

Note
• This function functions regardless of the configuration in Trunking Type. (Refer to Determining the System Behavior of When Starting or Ending a Voice Call (Trunking Type).)</td></tr>
</table>

Function		Description
Call Type	Available Calls	**Available Calls** is the function to restrict available various calls for a subscriber unit. The NEXEDGE system checks for the value in **Available Calls** for a communication request from a subscriber unit. If the requested call is inhibited, the system sends an error back for a request from a subscriber unit. A system administrator can configure whether or not to permit communications using the following calls for UIDs: Group Call Individual Call Voice Call Status Call Short Data Call Long Data Call All Groups Call
Telephone	Incoming Call from Telephone Line	**Incoming Call from Telephone Line** allows a system administrator to configure whether or not to enable a subscriber unit to receive an incoming call from a telephone line. (Refer to TELEPHONE INTERCONNECT.) This function is configured to permit a Voice Call (Interconnect) from a telephone line. If this function is enabled, a Voice Call (Interconnect) from a telephone line is permitted. If this function is disabled, a Voice Call (Interconnect) from a telephone line is inhibited.
	Outgoing Call to Telephone Line	**Outgoing Call to Telephone Line** allows a system administrator to configure whether or not to enable a subscriber unit to send an outgoing call to a telephone line. (Refer to TELEPHONE INTERCONNECT.) This function is configured to permit a Voice Call (Interconnect) from a subscriber unit to a telephone line. If this function is enabled, a Voice Call (Interconnect) from a subscriber unit to a telephone line is permitted. If this function is disabled, a Voice Call (Interconnect) from a subscriber unit to a telephone line is inhibited.
	Call Restriction Table Number	**Call Restriction Table Number** allows a system administrator to configure the number of **Call Restriction Table** referenced by a subscriber unit when making a call to a telephone line. This function can restrict the number of digits and area codes of the telephone number to be called from a subscriber unit. For example, long-distance calls to the telephone number with certain area codes can be restricted by using this function.

Configuration using KPG-110SM

- Configuring a UID COS (See NEXEDGE 1st Generation System Programming Reference 7.7 Class of Service Information Window, 7.9 UID Class of Service Edit Window)
- Configuring **Call Restriction Table** (See NEXEDGE 1st Generation System Programming Reference 7.1.9 Call Restriction Tab)

Configuring an All Groups Call COS

If a use of **All Groups Call** is permitted in the configuration in **Available Calls** of UID COS, an All Groups Call COS needs to be configured.

All Groups Call COS is a special COS when All Groups ID (0xFFFF) is specified. The All Groups Call COS is the same as a GID COS except the All Groups Call COS is connected with a specific ID and a part of the configuration is restricted.

The following functions relevant to the All Groups Call COS can be configured using KPG-110SM:

Table 13-5 All Groups Call COS

Function		Description
General	Late Entry	**Late Entry** allows a system administrator to configure whether the **Late Entry** function is enabled for an All Groups Call COS. **Late Entry** is the function to repeatedly send an instruction message to a traffic channel on a control channel at certain intervals by using an All Groups Call. Even if a message by All Groups Call cannot be received because the subscriber unit is temporarily outside the communication area, the subscriber unit can participate in an All Groups Call midway through the call after returning to the communication area.
	Priority Monitor	**Priority Monitor** allows a system administrator to configure whether the **Priority Monitor** function is enabled for an All Groups Call COS. **Priority Monitor** is the function to notify the All Groups Call information even on a traffic channel. If a subscriber unit detects an All Groups Call having higher priority than the current All Groups Call by using the All Groups Call information that is notified on a traffic channel, the subscriber unit can participate in the All Groups Call having higher priority.
	Time-out Timer	**Time-out Timer** allows a system administrator to configure the maximum continuous transmission time for a subscriber unit to communicate by use of an All Groups Call. The maximum continuous transmission time for a subscriber unit is instructed by an instruction message for communication allocation of a Voice Call. The subscriber unit restricts the maximum continuous transmission time of a Voice Call up to the notified value in **Time-out Timer**. Note • If “Unlimited” is configured in **Time-out Timer**, the subscriber unit behaves according to the configuration in **Time-out Timer** configured for the subscriber unit. • In **Time-out Timer**, do not configure a value longer than the value in **Occupation Timer**. (Refer to Various Timers Used by the System.) • The configuration in **Time-out Timer** is applied only to a Voice Call.
Call Type	Available Calls	**Available Calls** is the function to restrict available various calls for a subscriber unit. The NEXEDGE system checks for the value in **Available Calls** for a communication request from a subscriber unit. If the requested call is inhibited, the system sends an error back for a request from a subscriber unit. A system administrator can configure whether or not to permit communications using the following calls for All Groups IDs: Voice Call Status Call Short Data Call Long Data Call

<table>
<tr><th colspan="2">Function</th><th>Description</th></tr>
<tr><td rowspan="3">Intersite</td><td>Intersite Call</td><td>Intersite Call allows a system administrator to configure whether or not to permit communications using a Voice Call and Data Call (Status Call, Short Data Call, and Long Data Call) between sites.
If this function is enabled, communications using a Voice Call by All Groups Call and a Data Call can be initiated between sites that are configured in Intersite Call Table.
The target sites for an All Groups Call can be configured in Intersite Call Table. However, the communication method used for an All Groups Call and the number of sites which can be configured in Intersite Call Table vary as follows depending on the configuration in Multicast Group Call:
● If Multicast Group Call is enabled:
The audio packet data of an All Groups Call is sent by the Multicast method in a NEXEDGE system.
Multicast is the communication method to send packet data to multiple sites in a communications network at the same time. This communication method enables the NEXEDGE system to send the audio packet data to each site with low loads. For this communication method, a maximum of 48 sites can be configured as the target sites for an All Groups Call.
● If Multicast Group Call is disabled:
The audio packet data of an All Groups Call is sent by the conventional Unicast method in a NEXEDGE system.
Unicast is the communication method to send packet data to a site in a communications network. For this communication method, a maximum of 16 sites can be configured as the target sites for an All Groups Call.</td></tr>
<tr><td>Busy System Wait</td><td>Busy System Wait allows a system administrator to configure connection conditions for the start of communication when initiating communication using an All Groups Call between sites.
If this function is enabled, a NEXEDGE system connects to the site having an available channel when transmitting an All Groups Call and then starts communications. If no channel is available for the site, the call will be queued. If a channel becomes available in a busy site during communications, the NEXEDGE system allows sites to start communications in the order that the sites become available by using Late Entry. Queue is applied to both the transmitting site and the receiving site. (Refer to About the Behavior of a System When a New Call Request Is Received While All Traffic Channels Are in Use (Call Queuing).)
If this function is disabled, a System Busy is sent back to a subscriber unit and the call is immediately canceled if even one busy site exists among the sites to be connected, including the transmitting sites.</td></tr>
<tr><td>Valid</td><td>Valid allows a system administrator to configure whether to make each site the target of an All Groups Call.</td></tr>
<tr><td>Telephone</td><td>Incoming Call from Telephone Line</td><td>Incoming Call from Telephone Line allows a system administrator to configure whether or not to enable a subscriber unit to receive an incoming call from a telephone line. (Refer to TELEPHONE INTERCONNECT.)
This function is configured to permit a Voice Call (Interconnect) from a telephone line.
If this function is enabled, a Voice Call (Interconnect) from a telephone line is permitted.
If this function is disabled, a Voice Call (Interconnect) from a telephone line is inhibited.</td></tr>
</table>

Configuration using KPG-110SM

- Configuring an All Groups Call COS (See NEXEDGE 1st Generation System Programming Reference 7.10 All Groups Call Window)
- Configuring **Multicast Group Call** to be enabled or disabled (See NEXEDGE 1st Generation System Programming Reference 7.1.6 Network Tab)

Configuring a Secondary GID COS

Secondary GID COS is a COS which defines available functions for GIDs when a site is in a state where the site cannot connect to a system controller.

The following functions relevant to the Secondary GID COS can be configured using KPG-110SM:

Table 13-6 Secondary GID COS

Function		Description
General	Late Entry	**Late Entry** allows a system administrator to configure whether the **Late Entry** function is enabled for a Secondary GID COS. **Late Entry** is the function to repeatedly send an instruction message to a traffic channel on a control channel at certain intervals by using a Group Call. Even if a message by Group Call cannot be received because the subscriber unit is temporarily outside the communication area, the subscriber unit can participate in a Group Call midway through the call after returning to the communication area.
	Priority Monitor	**Priority Monitor** allows a system administrator to configure whether the **Priority Monitor** function is enabled for a Secondary GID COS. **Priority Monitor** is the function to notify the Group Call information even on a traffic channel. If the subscriber unit detects a Group Call having higher priority than the current Group Call by using the Group Call information that is notified on a traffic channel, the subscriber unit can participate in the Group Call having higher priority.
	Time-out Timer	**Time-out Timer** allows a system administrator to configure the maximum continuous transmission time for a subscriber unit to communicate by use of a Group Call. The maximum continuous transmission time for a subscriber unit is instructed by an instruction message for communication allocation of a Voice Call. The subscriber unit restricts the maximum continuous transmission time of a Voice Call up to the notified value in **Time-out Timer**. Note • If “Unlimited” is configured in **Time-out Timer**, the subscriber unit behaves according to the configuration in **Time-out Timer** configured for the subscriber unit. • In **Time-out Timer**, do not configure a value longer than the value in **Occupation Timer**. (Refer to Various Timers Used by the System.) • The configuration in **Time-out Timer** is applied only to a Voice Call.

Function		Description
Call Type	Available Calls	**Available Calls** is the function to restrict available various calls for a subscriber unit. The NEXEDGE system checks for the value in **Available Calls** for a communication request from a subscriber unit. If the requested call is inhibited, the system sends an error back for a request from a subscriber unit. A system administrator can configure whether or not to permit communications using the following calls for GIDs: Voice Call Status Call Short Data Call Long Data Call
Telephone	Incoming Call from Telephone Line	**Incoming Call from Telephone Line** allows a system administrator to configure whether or not to enable a subscriber unit to receive an incoming call from a telephone line. (Refer to TELEPHONE INTERCONNECT.) This function is configured to permit a Voice Call (Interconnect) from a telephone line. If this function is enabled, a Voice Call (Interconnect) from a telephone line is permitted. If this function is disabled, a Voice Call (Interconnect) from a telephone line is inhibited.

Configuration using KPG-110SM

Configuring a Secondary GID COS (See NEXEDGE 1st Generation System Programming Reference 7.11 Secondary UID Class of Service Window)

Configuring a Secondary UID COS

Secondary UID COS is a COS which defines available functions for UIDs when a site is in a state where the site cannot connect to a system controller.

The following functions relevant to the Secondary UID COS can be configured using KPG-110SM:

Table 13-7 Secondary UID COS

Function		Description
General	Late Entry	**Late Entry** allows a system administrator to configure whether the **Late Entry** function is enabled for a Secondary UID COS. **Late Entry** is the function to repeatedly send an instruction message to a traffic channel on a control channel at certain intervals using an Individual Call. Even if a message by Individual Call cannot be received because the subscriber unit is temporarily outside the communication area, the subscriber unit can participate in an Individual Call midway through the call after returning to the communication area.
	Queue Level	**Queue Level** allows a system administrator to specify the priority order of a behavior in a NEXEDGE system if the available traffic channels in a site are in use when a new call request is received. (Refer to About the Behavior of a System When a New Call Request Is Received While All Traffic Channels Are in Use (Call Queuing).)
	Time-out Timer	**Time-out Timer** allows a system administrator to configure the maximum continuous transmission time for a subscriber unit to communicate by use of an Individual Call. The maximum continuous transmission time for a subscriber unit is instructed by an instruction message for communication allocation of a Voice Call. The subscriber unit restricts the maximum continuous transmission time of a Voice Call up to the notified value in **Time-out Timer**. Note • If “Unlimited” is configured in **Time-out Timer**, the subscriber unit behaves according to the configuration in **Time-out Timer** configured for the subscriber unit. • In **Time-out Timer**, do not configure a value longer than the value in **Occupation Timer**. (Refer to Various Timers Used by the System.) • The configuration in **Time-out Timer** is applied only to a Voice Call.

<table>
<tr><th colspan="2">Function</th><th>Description</th></tr>
<tr><td rowspan="2">General</td><td>Individual Call Response Type (Voice)</td><td>Individual Call Response Type (Voice) allows a system administrator to configure the behavior of a NEXEDGE system when calling the receiving subscriber unit by using a Voice Call (Individual).
The calling behavior using a Voice Call (Individual) can be configured according to the operation method of the NEXEDGE system.
Normal:
The NEXEDGE system allocates a traffic channel without waiting for a response from the receiving subscriber unit. In this case, since the NEXEDGE system does not wait for a response from the receiving subscriber unit, the link speed is the same as a Group Call, but whether communications are actually established cannot be confirmed until a response is sent from the receiving subscriber unit.
Response:
The NEXEDGE system allocates a traffic channel after a wait for a response from the receiving subscriber unit. If no response is received for a certain time, an error message is sent back to the transmitting subscriber unit. Since the transmitting subscriber unit waits for a response from the receiving subscriber unit, the link speed is slower than a Group Call.
Note
• This function functions only if “Transmission Trunked” is configured in Trunking Type. (Refer to Determining the System Behavior of When Starting or Ending a Voice Call (Trunking Type).)</td></tr>
<tr><td>Individual Call Response Type (Data)</td><td>Individual Call Response Type (Data) allows a system administrator to configure the behavior of a NEXEDGE system when calling the receiving subscriber unit by using a Long Data Call (Individual).
The calling behavior using a Long Data Call (Individual) can be configured according to the operation method of the NEXEDGE system.
Normal:
The NEXEDGE system allocates a traffic channel without waiting for a response from the receiving subscriber unit. However, whether communications are actually established cannot be confirmed until a response is sent from the receiving subscriber unit.
Configure “Normal” to use a Long Data Call (Individual) mainly for notifying a data message.
Response:
The NEXEDGE system allocates a traffic channel after a wait for a response from the receiving subscriber unit. If no response is received for a certain time, an error message is sent back to the transmitting subscriber unit.
Configure “Response” mainly to make data communications with the receiving subscriber unit.
Note
• This function functions regardless of the configuration in Trunking Type. (Refer to Determining the System Behavior of When Starting or Ending a Voice Call (Trunking Type).)</td></tr>
</table>

Function		Description
Call Type	Available Calls	**Available Calls** is the function to restrict available various calls for a subscriber unit. The NEXEDGE system checks for the value in **Available Calls** for a communication request from a subscriber unit. If the requested call is inhibited, the system sends an error back for a request from a subscriber unit. A system administrator can configure whether or not to permit communications using the following calls for UIDs: Group Call Individual Call Voice Call Status Call Short Data Call Long Data Call All Groups Call
Telephone	Incoming Call from Telephone Line	**Incoming Call from Telephone Line** allows a system administrator to configure whether or not to enable a subscriber unit to receive an incoming call from a telephone line. (Refer to TELEPHONE INTERCONNECT.) This function is configured to permit a Voice Call (Interconnect) from a telephone line. If this function is enabled, a Voice Call (Interconnect) from a telephone line is permitted. If this function is disabled, a Voice Call (Interconnect) from a telephone line is inhibited.
	Outgoing Call to Telephone Line	**Outgoing Call to Telephone Line** allows a system administrator to configure whether or not to enable a subscriber unit to send an outgoing call to a telephone line. (Refer to TELEPHONE INTERCONNECT.) This function is configured to permit a Voice Call (Interconnect) from a subscriber unit to a telephone line. If this function is enabled, a Voice Call (Interconnect) from a subscriber unit to a telephone line is permitted. If this function is disabled, a Voice Call (Interconnect) from a subscriber unit to a telephone line is inhibited.
	Call Restriction Table Number	**Call Restriction Table Number** allows a system administrator to configure the number of **Call Restriction Table** referenced by a subscriber unit when making a call to a telephone line. This function can restrict the number of digits and area codes of the telephone number to be called from a subscriber unit. For example, long-distance calls to the telephone number with certain area codes can be restricted by using this function.

Configuration using KPG-110SM

- Configuring a Secondary UID COS (See NEXEDGE 1st Generation System Programming Reference 7.12 Secondary UID Class of Service Window)
- Configuring **Call Restriction Table** (See NEXEDGE 1st Generation System Programming Reference 7.1.9 Call Restriction Tab)

Configuring a Telephone Call COS

Telephone Call COS is a special COS for a Telephone Call. The Telephone Call COS is the same as a UID COS except the Telephone Call COS is connected with a specific ID and a part of the configuration is restricted.

In Telephone Call COS, the **Time-out Timer** for Telephone Call COS can be configured by using KPG-110SM.

Table 13-8 Telephone Call COS

Function	Description
Time-out Timer	**Time-out Timer** allows a system administrator to configure the maximum continuous transmission time for a subscriber unit to communicate by use of a Telephone Call. The maximum continuous transmission time for a subscriber unit is instructed by an instruction message for communication allocation of a Telephone Call. The subscriber unit restricts the maximum continuous transmission time of a Telephone Call up to the notified value in **Time-out Timer**. Note • If “Unlimited” is configured in **Time-out Timer**, the subscriber unit behaves according to the configuration in **Time-out Timer** configured for the subscriber unit. • In **Time-out Timer**, do not configure a value longer than the value in **Occupation Timer**. (Refer to Various Timers Used by the System.) • The configuration in **Time-out Timer** is applied only to a Telephone Call.

Configuration using KPG-110SM

Configuring a Telephone Call COS (See NEXEDGE 1st Generation System Programming Reference 7.13 Telephone Call Window)

13.4 Registering a Subscriber Unit in a System (Registration)

Registration is the function to register the location in a NEXEDGE system when a subscriber unit, such as a transceiver or IP console, uses the NEXEDGE system. The NEXEDGE system registers a UID in the system when a registration request is received from a subscriber unit.

The location of the subscriber unit is registered in the NEXEDGE system when the subscriber unit searches and acquires a control channel, such as when the subscriber unit is turned on. By registering the location, the NEXEDGE system can recognize the site in which the subscriber unit exists and identify the site in the communication area. Therefore, an incoming call request can be sent immediately to the site in which the subscriber unit which can be called by an Individual Call exists, and the system can be operated efficiently because the search for the subscriber unit is no longer needed.

Registering a GID in a System (Group Registration)

Group Registration is the function that allows a subscriber unit to register the Group ID to be used in a Group Call to a NEXEDGE system.

If Group Call is used in a multi-site system, subscriber units belonging to a group are called using the channel resources (frequencies) across multiple sites. In this case, to use channel resources effectively, the locations of subscriber units that are waiting for a Group Call need to be recognized efficiently and appropriately, and transmission on the channel that receives the Group Call needs to be suppressed.

If a subscriber unit executes Group Registration, the NEXEDGE system records the information.

If a Group Call occurs in a multi-site, the NEXEDGE system determines the call range of the GID and then initiates the call. By using Group Registration, the GID can be called in a site configuration where frequencies change dynamically, and frequencies can be used efficiently.

The following are the behaviors of Group Registration:

Behavior of a subscriber unit

- If a subscriber unit finds an available site in the hunt sequence and registers the own station in the site, the subscriber unit registers the own UID and GID. If the preconfigured GID is changed by key operation, a new GID is registered.
- If a subscriber unit accesses a control channel with anything other than an already registered GID, the subscriber unit always sends a group registration request for the NEXEDGE system. However, the subscriber unit does not send the group registration request when accessing the traffic channel, such as when receiving a call. After communications on the traffic channel are completed, if the preconfigured GID on the control channel is different from the registered GID, the subscriber unit sends a group registration request again.
- The subscriber unit always registers a GID when the subscriber is turned on.
- The subscriber unit deletes the registered GID when the subscriber unit is turned off or when migrating to a Conventional zone.

Behavior of the system

- The NEXEDGE system registers the GID of the subscriber unit upon receipt of a group registration request from a subscriber unit. If the GID is previously registered by the subscriber unit, the NEXEDGE system deletes the registration information of the GID and registers a new GID.
- Upon receipt of a Group Call request from a subscriber unit, the NEXEDGE system refers to the configuration for Service Class of the GID and then identifies whether the called site exists in the Intersite Call List if **Intersite Call** is enabled. If the called site is configured in **Intersite Call Table**, the NEXEDGE system accepts a Group Call request and initiates a Group Call in the area registered in the Intersite Call Table.
- The NEXEDGE system deletes the registration information of the GID if the GID is not used from when the registration information of the GID is last updated until the amount of time configured in **Group Registration Reset Time** elapses. The registration information is updated when initiating or responding to a Group Call and when executing Group Registration. (Refer to Automatically Deleting the Registration Information of a GID (Group Registration Reset Time).)
- If no subscriber unit successful in Group Registration exists in the site where **Dynamic Allocation** is enabled, the traffic channel is not allocated to a Group Call.
- If **Group Refusal** is enabled, the call area of a Group Call (a site where Group Registration succeeded) can be configured as the service area of the subscriber unit. The subscriber unit outside the call area of the Group Call (a site where Group Registration failed) indicates that the subscriber unit is out of range.

Configuration using KPG-110SM

Configuring **Group Registration** to be enabled or disabled (See NEXEDGE 1st Generation System Programming Reference 7.1.5 Optional Tab)

Automatically Deleting the Registration Information of a GID (Group Registration Reset Time)

Group Registration Reset Time is the length of time until the registration information of a GID is automatically deleted from a NEXEDGE system.

The NEXEDGE system deletes the registration information of the GID if the GID is not used from when the registration information of the GID is last updated until the amount of time configured in **Group Registration Reset Time** elapses. The registration information is updated when initiating or responding to a Group Call and when executing Group Registration.

The registration information of a GID is the only information deleted when the **Group Registration Reset Time** elapses. The registration information of a UID is not deleted.

Configuration using KPG-110SM

Configuring **Group Registration Reset Time** (See NEXEDGE 1st Generation System Programming Reference 7.1.5 Optional Tab)

13.5 About the Behavior of a System When a New Call Request Is Received While All Traffic Channels Are in Use (Call Queuing)

Call Queuing is used by the system while all traffic channels in the site are busy in order to retain the call request from a subscriber unit in the Queue and assign a channel when a traffic channel becomes available.

If all traffic channels are being used, the system cannot immediately assign a channel even if the subscriber receives a call request. In this case, the subscriber unit must request a call again if the system rejects the call request from the subscriber unit. By use of this function, a user can wait for the system to assign a channel while pressing and holding the **PTT** switch. This function can also be used to configure the priority level for the subscriber units when assigning a channel.

Note

- The call request of an Emergency Call has the highest priority.
- The **Call Queuing** function cannot be used in a system using **Non-dedicated Control Channel**. (Refer to Using a Control Channel as a Traffic Channel (Non-dedicated Control Channel).)

Queue Level

Queue Level is the function to specify the behavior of a NEXEDGE system for each **Queue Level** if the available traffic channels in a site are all in use when a new call request is received.

One of “Preemption” which prioritizes a new call request, “Queue” which waits until a channel is open, or “None” which rejects receipt of a new call request can be specified for the behavior in a NEXEDGE system.

Queue Level can be specified by 8 levels. Level 1 has the highest priority and Level 8 has the lowest priority. Also, an Emergency Call has a higher priority than all calls because the Emergency Call is Level 1 in a NEXEDGE system.

The three behaviors (Preemption, Queue, and None) can each be selected and configured to the levels. These three behaviors are a priority order of Preemption > Queue > None, and the lower level behavior cannot be configured to exceed the higher level behavior in priority.

Table 13-9 Queue Level

Configuration	Description
Preemption	“Preemption” is configured if a new call request is to be prioritized over the currently ongoing call. The call in which “Preemption” is configured is prioritized over the currently ongoing call in allocating a traffic channel. When a call request in which “Preemption” is configured is received, the traffic channel of the currently ongoing call is released if no traffic channel for allocation is available. The traffic channel of the currently ongoing call to be released is selected in the following order: 1) The lowest **Queue Level** call amongst the calls lower than the **Queue Level** of a new call request 2) The call of the longest communication time if multiple calls with the same **Queue Level** exist amongst the calls targeted for releasing If no call is targeted for releasing, the new call request is held in the Queue. If the new call request is Preemption from a subscriber unit, the traffic channel is immediately released after the **PTT** switch of the transmitting subscriber unit is released in a call targeted for releasing. In this case, the value configured in **Hold Timer** is ignored. If the new call request is from an IP console, the traffic channel is immediately released in a call targeted for releasing even if the subscriber unit is transmitting.

Configuration	Description
Queue	“Queue” is configured if the currently ongoing call is prioritized over a new call request. A traffic channel is allocated to the call in which “Queue” is configured after the channel is opened. When a call request in which “Queue” is configured is received, the new call request is held in the Queue in the order according to the **Queue Level** if no traffic channel for allocation is available.
None	“None” is configured if the currently ongoing call is prioritized and if the call is canceled when a free channel does not exists. When the call request in which “None” is configured is received, the call request is not held in the Queue and the call is canceled in the system if no traffic channel for allocation is available.

Note

- In a Message Trunked (Enhanced) system, if the traffic channel allocated by the Preemption behavior cannot be used temporarily by the **Cross-busy** function, the response from a subscriber unit on the traffic channel is restricted.
- The start of the preempted and prioritized call may be cut off because a preempted call is allocated on the traffic channel allocated by Preemption after ending the call to be released.

Configuration using KPG-110SM

Configuring **Queue Level** (See NEXEDGE 1st Generation System Programming Reference 7.1.3 Queue Tab)

Number of Queues

Number of Queues is the number of calls that the system can queue.

Call requests preempted or queued are sorted in the following order:

1) In descending order of the **Queue Level**

2) If the order in condition 1) is the same, in order of consoles > subscriber units

3) If the orders in condition 1) and 2) are the same, in order of arrival

The number configured in **Number of Queues** becomes the number of call requests that can be held in the Queue, and a call request more than the configured number is canceled.

Calls held in the Queue wait for allocation of a traffic channel up to 30 seconds. A call request waiting for longer than 30 seconds is canceled.

Call requests held in the Queue can be canceled by the requesters.

Configuration using KPG-110SM

Configuring **Number of Queues** (See NEXEDGE 1st Generation System Programming Reference 7.1.3 Queue Tab)

13.6 Various Timers Used by the System

Hold Timer and **Occupation Timer** are used in the NEXEDGE system when a user communicates on a traffic channel.

Holding a Traffic Channel for Always Calling Back (Hold Timer)

Hold Timer is the length of time to maintain the connection to a traffic channel after the **PTT** switch of the transmitting subscriber unit is released. By pressing the **PTT** switch of the transmitting subscriber unit or of the receiving subscriber unit during this period, the call can be continued without acquiring a traffic channel again.

When the system is busy and the traffic channels are fully occupied when a subscriber unit attempts to respond to the call, the interruption in the communication can be avoided.

Hold Timer can be configured for each of Broadcast Call, Conference Call. and Individual Call according to the configuration in **Trunking Type**. Also, the function can be configured as the timer of a Telephone Call. While making these calls, a subscriber unit stays on a traffic channel as long as **Hold Timer** is active. A subscriber can continue the communication without pressing the **PTT** switch in order to re-link to the system as long as the subscriber unit is on a traffic channel.

Configuration using KPG-110SM

Configuring **Hold Timer** (See NEXEDGE 1st Generation System Programming Reference 7.1.4 Timers Tab)

Limiting the Occupation Time of a Traffic Channel (Occupation Timer)

Occupation Timer is the maximum length of time to maintain the call if the connection to a traffic channel is held. This timer is used to restrict a group call or individual call by the same group or caller if the call is overly long.

If the amount of time configured in **Occupation Timer** elapses and the **PTT** switch of the transmitting subscriber unit is released, the traffic channel is available. A traffic channel needs to be held again to continue the call.

The following 7 types of **Occupation Timer** can be configured:

- Voice Call
  - Broadcast Call
  - Conference Call
  - Individual Call
  - Telephone Call
- Data Call
  - Broadcast Call
  - Conference Call
  - Individual Call

A system administrator can construct the system that suits the operation environment of the system by configuring these timers. For example, shortening the occupation time of a traffic channel for the system where congestion frequently occurs can allocate traffic channels for more calls.

Configuration using KPG-110SM

Configuring **Occupation Timer** (See NEXEDGE 1st Generation System Programming Reference 7.1.4 Timers Tab)

Determining the System Behavior of When Starting or Ending a Voice Call (Trunking Type)

Trunking Type is the function to control the communication method on a traffic channel. There are three types of **Trunking Type**: “Transmission Trunked”, “Message Trunked” and “Message Trunked (Enhanced)”.

Table 13-10 Queue Level

Item	Description
Transmission Trunked	● **When starting a call** Only the transmitting subscriber unit can start a call. ● **When ending a call** The traffic channel is immediately released.
Message Trunked	● **When starting a call** Only the transmitting subscriber unit can start a call. ● **When ending a call** When the length of time configured in **Hold Timer** elapses, a call ends and the traffic channel is released in a NEXEDGE system. However, the call can also be ended by a subscriber unit.
Message Trunked (Enhanced)	● **When starting a call** The transmitting subscriber unit and the receiving subscriber unit can start a call. ● **When ending a call** A call can be ended by a subscriber unit. However, when the length of time configured in **Hold Timer** elapses, the call ends and the traffic channel is released in a NEXEDGE system.

Note

- For “Message Trunked (Enhanced)”, the call procedure for an Individual Call is different from the other configurations in **Trunking Type**. Therefore, an Individual Call may not be communicated if the configuration in **Trunking Type** for the system and for the subscriber unit differs. **Trunking Type** of the system and that of the subscriber unit needs to be the same configuration.
- If “Message Trunked (Enhanced)” is configured in **Trunking Type**, the configuration in **Individual Call Response Type (Voice)** is disabled. (Refer to Configuring a UID COS, Configuring a Secondary UID COS.)

Configuration using KPG-110SM

Configuring **Trunking Type** (See NEXEDGE 1st Generation System Programming Reference 7.1.4 Timers Tab)

13.7 Configurations Related to Adjacent Site Information (Adjacency)

Adjacency is the function that allows the system to notify subscriber units of the information of adjacent sites in order to select the optimal site. The system notifies Adjacency Information by using information of adjacent sites preconfigured for each site.

Adjacent site information includes **Adjacent Control Channels**, **Additional Control Channels**, and **Delete Control Channels**.

Adjacent Control Channels

Adjacent Control Channels is the function that induces a subscriber unit to use a control channel providing better receiving conditions by sending a Broadcast Message notifying the subscriber unit of the control channel information of adjacent sites.

The system can notify the subscriber unit of the control channel information of a maximum of 8 adjacent sites. To use this function, the **Site Number** of an adjacent site and the **Frequency Number** configured for the site need to be specified.

If the system is operated in a multi-site, “Auto” can be configured in **Frequency Number**. If “Auto” is configured, control channel information of an adjacent site is automatically collected and notified to the subscriber unit.

Site Number and **Frequency Number** of **Adjacent Control Channels** are configured by using KPG-110SM.

Configuration using KPG-110SM

- Configuring **Site Number** of **Adjacent Control Channels** (See NEXEDGE 1st Generation System Programming Reference 7.3.3 Adjacency Tab)
- Configuring **Frequency Number** of **Adjacent Control Channels** (See NEXEDGE 1st Generation System Programming Reference 7.3.3 Adjacency Tab)

Additional Control Channels

Additional Control Channels is the function that notifies a subscriber unit of the control channel information of an updated adjacent site by using a Broadcast Message. The subscriber unit can shorten the channel search time by using the acquired control channel information.

The system can notify the subscriber unit of the control channel information of a maximum of 48 adjacent sites. To use this function, the **Site Number** of an adjacent site and the **Frequency Number** configured for the site need to be specified.

Configuration using KPG-110SM

- Configuring **Site Number** of **Additional Control Channels** (See NEXEDGE 1st Generation System Programming Reference 7.3.3 Adjacency Tab)
- Configuring **Frequency Number** of **Additional Control Channels** (See NEXEDGE 1st Generation System Programming Reference 7.3.3 Adjacency Tab)

Delete Control Channels

Delete Control Channels is the function that notifies a subscriber unit of the control channel information of a deleted adjacent site by using a Broadcast Message. The subscriber unit can shorten the channel search time by excluding acquired control channel information from the channel search list. Also, if a control channel that is received as a Deleted Control Channel is stored as an Additional Control Channel in non-volatile memory of the subscriber unit, the information is deleted.

The system can notify the subscriber unit of the control channel information of a maximum of 48 adjacent sites. To use this function, the **Site Number** of an adjacent site and the **Frequency Number** configured for the site need to be specified.

Configuration using KPG-110SM

- Configuring **Site Number** of **Delete Control Channels** (See NEXEDGE 1st Generation System Programming Reference 7.3.3 Adjacency Tab)
- Configuring **Frequency Number** of **Delete Control Channels** (See NEXEDGE 1st Generation System Programming Reference 7.3.3 Adjacency Tab)

Transmit Interval Time of Adjacent Site Information

Transmit Interval Time of Adjacent Site Information is the time intervals for notifying the subscriber unit of the frequency number of a control channel in an adjacent site.

The system regularly notifies the frequency number of a control channel in an adjacent site that is configured as the Frequency No. in **Adjacent Control Channels**, and the frequency numbers are notified 3 numbers at a time to a subscriber unit by using a control channel.

This information is used for Background Hunt by a subscriber unit.

Configuration using KPG-110SM

Configuring **Transmit Interval Time of Adjacent Site Information** (See NEXEDGE 1st Generation System Programming Reference 7.1.5 Optional Tab)

13.8 Managing a System by Using the ESN of a Subscriber Unit

Access by unauthorized subscriber units can be prevented by verifying the ESN of the subscriber unit during registration in a NEXEDGE system. Also, the manufacturers with access can be limited by distinguishing the manufacturer codes of ESNs during registration in a NEXEDGE system.

Duplication is very difficult because ESNs are written by manufacturers and closely managed. Strong security can be provided by checking the ESNs in a NEXEDGE system.

Removing Unregistered Subscriber Units (NXDN ESN Validation)

NXDN ESN Validation is the function to prevent access by unauthorized subscriber units. Unauthorized use of a NEXEDGE system can be prevented by associating a Unit ID with an NXDN ESN and checking.

If the authentication of a subscriber unit ESN is not complete when the subscriber unit is registered, the ESN of the subscriber unit is requested in a NEXEDGE system. The received ESN is compared to the manufacturer unique numbers of **Manufacturer Limitation**, or ESNs of individual subscriber units registered beforehand in a NEXEDGE system. If the comparison results match, registration of the subscriber unit is permitted. If the comparison results do not match, registration of the subscriber unit is rejected.

The **NXDN ESN Validation** function does not function if no NXDN ESN is configured for a Unit ID or if **Manufacturer Limitation** is not configured, even if **NXDN ESN Validation** is enabled.

Configuration using KPG-110SM

Configuring **NXDN ESN Validation** to be enabled or disabled (See NEXEDGE 1st Generation System Programming Reference 7.1.5 Optional Tab)

Specifying the Time and Clearing Registration Information (NXDN Validation Reset Time)

NXDN ESN Validation Reset Time is the function to record ESN authentication for each UID in the NEXEDGE system, and to delete the ESN authentication records at the configured time.

When registration is executed, such as when the subscriber unit migrates sites, if the ESN of the UID is already authenticated, an ESN request is not made to the subscriber unit in a NEXEDGE system. An ESN is requested of the subscriber unit in a NEXEDGE system only if the ESN of the UID is not authenticated.

If **NXDN ESN Validation** is enabled, the authentication of an ESN occurs when registering the subscriber unit. Therefore, when multiple subscriber units migrate simultaneously to one site, such as if, for example, some of the close-by sites are stopped, registration of all subscriber units takes more time compared to when **NXDN ESN Validation** is disabled. By configuring **NXDN ESN Validation Reset Time**, the time to complete registration of all subscriber units can be shortened even if this state occurs.

Table 13-11 NXDN ESN Validation Reset Time

Configuration	Description
OFF	The authentication of an ESN in a NEXEDGE system is not recorded. Every time registration of a subscriber unit is executed, an ESN is requested of the subscriber unit in a NEXEDGE system.
0 to 23	ESN authentication is recorded for each UID in a NEXEDGE system, and the authentication record of the ESN is cleared at the configured time. If the ESN matches and registration of the subscriber unit is permitted, the completion of ESN authentication for the UID of the subscriber unit is recorded in a NEXEDGE system. If registration of the subscriber unit of an authenticated ESN is executed, an ESN is not requested of the subscriber unit in a NEXEDGE system. ESN authentication records are retained even if a NEXEDGE system restarts. At the time configured in **NXDN ESN Validation Reset Time**, the ESN authentication records are cleared and the ESNs of all UIDs are no longer authenticated. In the registration of the next subscriber unit, an ESN is requested of the subscriber unit in a NEXEDGE system. If the ESN matches, the completion of ESN authentication for the UID is recorded again in a NEXEDGE system. By configuring any configuration other than “OFF” in **ESN Validation Reset Time**, the occupation of a traffic channel for ESN authentication can be reduced.

Note
- This function behaves only if **NXDN ESN Validation** is enabled.

Configuration using KPG-110SM

Configuring **NXDN ESN Validation Reset Time** (See NEXEDGE 1st Generation System Programming Reference 7.1.5 Optional Tab)

Limiting the Manufacturers of Available Subscriber Units (Manufacturer Limitation)

Manufacturer Limitation is the function to limit the manufacturers of available subscriber units.

Because ESN authentication occurs using the ESN of a subscriber unit with the manufacturer unique number included, a function preventing unauthorized use can be provided with easy configuration. Also, because the KENWOOD subscriber unit supports configuration restrictions by using a System Key File, a strong function preventing unauthorized use can be easily provided along with Manufacturer Limitation.

If the authentication of a subscriber unit ESN is not complete when the subscriber unit is registered, the ESN of the subscriber unit is requested in a NEXEDGE system.

The received ESN is compared to the manufacturer unique numbers of **Manufacturer Limitation** registered beforehand in a NEXEDGE system. If the comparison results match, registration of the subscriber unit is permitted. If the comparison results do not match, registration of the subscriber unit is rejected.

Note

- A maximum of 8 manufacturer codes (Code) can be configured.
- If **Manufacturer Limitation** is enabled and a manufacturer code is not configured, registrations of all subscriber units in a NEXEDGE system are rejected.
- The manufacturer code of KENWOOD is “68”.
- This function behaves only if **NXDN ESN Validation** is enabled.

Configuration using KPG-110SM

Configuring **Manufacturer Limitation** (See NEXEDGE 1st Generation System Programming Reference 7.1.5 Optional Tab)

NXDN ESN

ESN (Electronic Serial Number) is a serial number allocated to each subscriber unit.

Configuring the ESN of a subscriber unit that uses UIDs in **NXDN ESN** can avoid the unauthorized use of the subscriber unit by using the **NXDN ESN Validation** function.

Configuration using KPG-110SM

Configuring **NXDN ESN** (See NEXEDGE 1st Generation System Programming Reference 7.18 UID Information Window)

13.9 Sharing a Traffic Channel with a Different System (Cross-busy)

Cross-busy is the function that prevents own system from interference by other stations and also from interfering other stations in case an existing system may be coexistent with own system in the same frequency.

This function is provided by use of the 3 functions below:

- **Control Channel Burst**

  Control Channel Burst is the function to stop transmission on the control channel and to monitor the busy state of the receiver and the external busy trigger at constant time intervals. If interference from other parties is detected after monitoring the busy state, the repeater continues to stop using the control channel and the control channel is served again when the interference disappears. (Refer to Control Channel Burst.)

- **Cross-busy Input**

  Cross-busy Input is the function to restrict the use of the repeater as a channel in a NEXEDGE system by sending a signal from an external device.

  Example of use:

  - Acquiring the busy signal from an external device that monitors the transmit frequency
  - Acquiring the usage request from an external device (transmission request from the LTR controller, etc.)

- **Cross-busy Output**

  Cross-busy Output is the function to notify external devices that the repeater is serving as a channel in an NEXEDGE system.

  Example of use:

  Sending a command for suspending request of use to external devices (suspension of use control for the LTR controller, etc.)

Operations of Cross-busy are as follows:

■ Common Behavior of Repeaters Served as a Control Channel and Traffic Channels

● Cross-busy Input

If low-level signals are entered to the Cross-busy Input port (pin 4 of the 25-pin D-sub connector (AUXI 1)), the repeater detects and recognizes its state that an external device is being used, and if high-level signals are entered, the repeater detects and recognizes its state that no external device is in use.

Cross-busy Input enables the repeater to restrict the use of channel by determining the busy state by an internal trigger, an external trigger, or both internal and external triggers. The external trigger determines the level (high or low) on the Cross-busy Input port. If low-level signals are entered to the Cross-busy Input port, the repeater detects and recognizes that the frequency is occupied by another system, and then restricts the use of that channel. Also, an internal trigger activates a signal detection, and the result of the detection is used as an internal trigger.

● Cross-busy Output

While the repeater is served in a NEXEDGE system, low-level signals can be transferred via a Cross-busy Output port (pin 25 of the 25-pin D-sub connector (AUXIO 6)). An external device can recognize the busy state of the repeater by detecting the logic level of the Cross-busy Output port.

■ Behavior of Repeater Served as a Control Channel

● Control Channel Burst

A control channel pauses transmission at the intervals configured in **Control Channel Active Timer**.

A control channel pauses transmission for the amount of time configured in **Control Channel Wait Timer**. The transmission resumes on the control channel when the amount of time configured in **Control Channel Wait Time** elapses.

(Refer to Control Channel Active Timer, Control Channel Wait Timer.)

● Cross-busy Input

Busy state by receiving signals on a control channel can be monitored during the amount of time configured in **Control Channel Wait Time**. In the case of the busy state as a result of monitoring, the repeater stops serving as a control channel. In this case, the repeater cannot start transmitting as a control channel even after the amount of time configured in **Control Channel Wait Time** elapses. If a control channel does not enter busy state from when the control channel exits the busy state until the amount of time configured in **Control Channel Wait Time** elapses, the repeater resumes the transmission as a control channel.

● Cross-busy Output

The Cross-busy Output port is always active (Low) on the control channel regardless of **Control Channel Active Timer** and **Control Channel Wait Time**.

■ Behavior of Repeaters Served as Traffic Channels

● Cross-busy Input

On a traffic channel, the busy state can be monitored using the internal trigger or external trigger, and whether the repeater can be used as a traffic channel is determined. While the repeater is being used as a traffic channel, it continues functioning as a traffic channel and the call cannot be interrupted midway. If a traffic channel enters the busy state while the repeater is not being used as a traffic channel, the channel cannot be allocated as a traffic channel. In the case of internal trigger, the repeater recognizes that a traffic channel is in the busy state while a signal is detected on the traffic channel or it is being used. Therefore, **Traffic Channel Release Delay Time** is activated after the current communication ends, and then the traffic channel cannot be used for a certain length of time. (Refer to Traffic Channel Release Delay Timer.)

Conditions for using the repeater as a traffic channel again vary depending on the configuration in **Cross-busy Input Trigger**. (Refer to Cross-busy Input Trigger.)

● Cross-busy Output

While a traffic channel is being used, low-level signals are transferred from the Cross-busy Output port and the repeater notifies other controllers (LTR, etc.) sharing the frequency that the frequency is being used.

While the repeater is assigned as a traffic channel and additionally the amount of time configured in **Traffic Channel Release Delay Time** is counting down, low-level signals are transferred form the Cross-busy Output port. If no traffic channel is used, high-level signals are transferred from the Cross-busy Output port.

● Congestion on the Shared Channel

If the busy input from an external device and use of an internal channel simultaneously occur on a traffic channel and the shared channel is simultaneously used, the traffic channel is used until the current transmission ends. When the transmission ends, the traffic channel is immediately available.

Note

- If the activation of the **Control Channel Burst** function and Station ID (Analog CW ID) transmission occur at the same time, Station ID transmission has priority.
- While transmission on a control channel is disabled, no message can be sent on the control channel; hence, the message is discarded. To avoid this problem, the dedicated frequency must be retained as the control channel and the **Cross-busy** function must not be used.
- If **Cross-busy** is enabled, the repeater receives analog signals while the repeater is not used as a traffic channel. In this case, the received analog audio can sound from the speaker. Therefore, interfering signals are also audible when the repeater receives interfering signals; hence the interfering signals can be identified.

Configuration using KPG-110SM

Configuring **Cross-busy** to be enabled or disabled (See NEXEDGE 1st Generation System Programming Reference 7.1.5 Optional Tab)

Control Channel Burst

Control Channel Burst is the function to stop transmission on the control channel and to monitor the busy state of the receiver and the external busy trigger at constant time intervals. If interference from other parties is detected after monitoring the busy state, the repeater continues to stop using the control channel and the control channel is served again when the interference disappears.

Using this function can build a site even if the control channel cannot acquire a frequency license for a continuous transmission.

If this function is enabled, transmission on a control channel continues for the amount of time configured in **Control Channel Active Timer** and then the transmission pauses when this amount of time elapses. The transmission on the control channel starts when the amount of time configured in **Control Channel Wait Timer** elapses after the transmission pauses. Subsequently, the control channel becomes active at the intervals configured in **Control Channel Active Timer** and **Control Channel Wait Timer**.

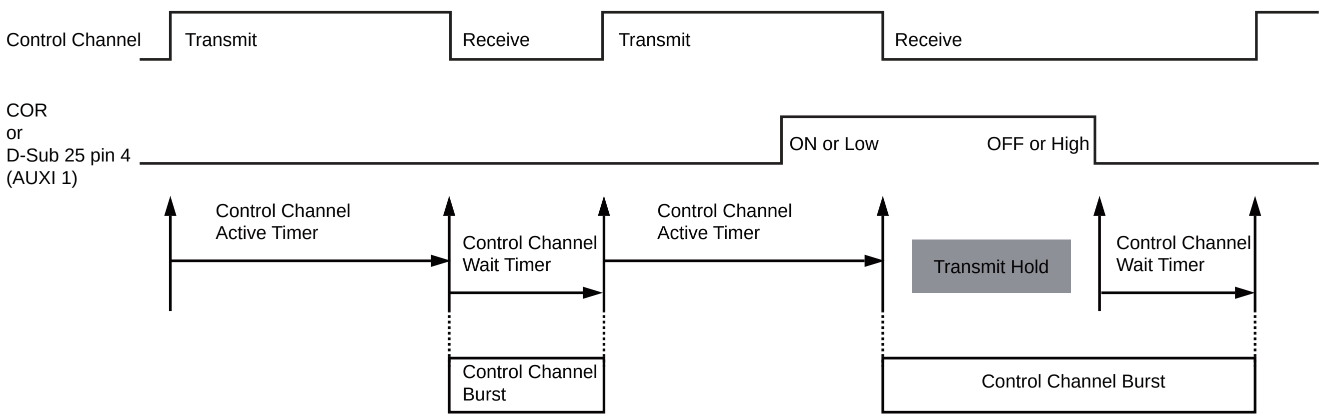


Figure 13-1 Control Channel Burst

Configuration using KPG-110SM

Configuring **Control Channel Burst** to be enabled or disabled (See NEXEDGE 1st Generation System Programming Reference 7.1.5 Optional Tab)

Control Channel Active Timer

Control Channel Active Timer is the length of time a repeater can continuously transmit on a control channel.
Transmission on a control channel continues for the amount of time configured in **Control Channel Active Timer** and then the transmission pauses when this amount of time elapses. The transmission on the control channel starts when the amount of time configured in **Control Channel Wait Timer** elapses after the transmission pauses.

- If the timing of Station ID (Analog CW ID) transmission comes while the **Control Channel Active Timer** is counting down, the Station ID (Analog CW ID) transmission immediately starts on the control channel. The counting of the **Control Channel Active Timer** internally continues as shown in the diagram below.

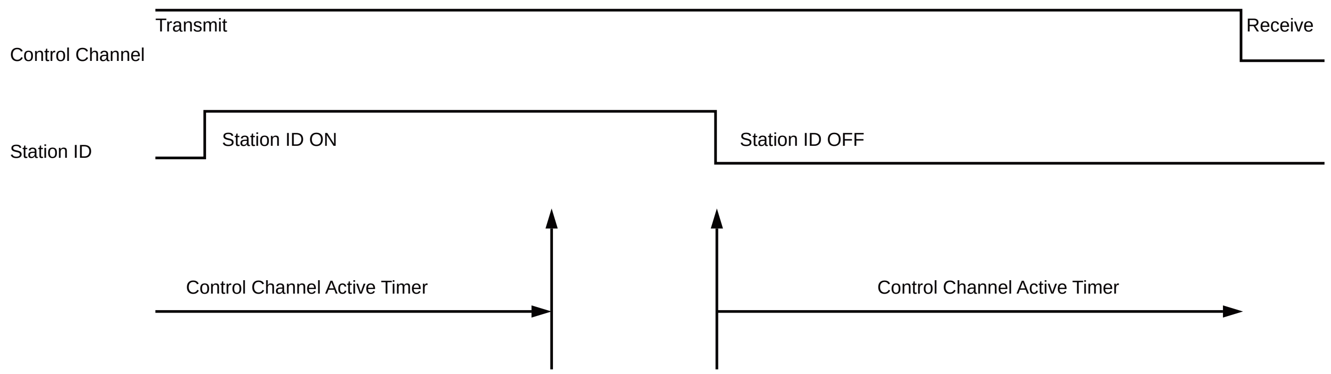


Figure 13-2 The Behavior of the Control Channel Active Timer During Station ID Transmission

- If **Repeat Disable** is activated while the **Control Channel Active Timer** is counting down, the transmission on the control channel immediately stops.

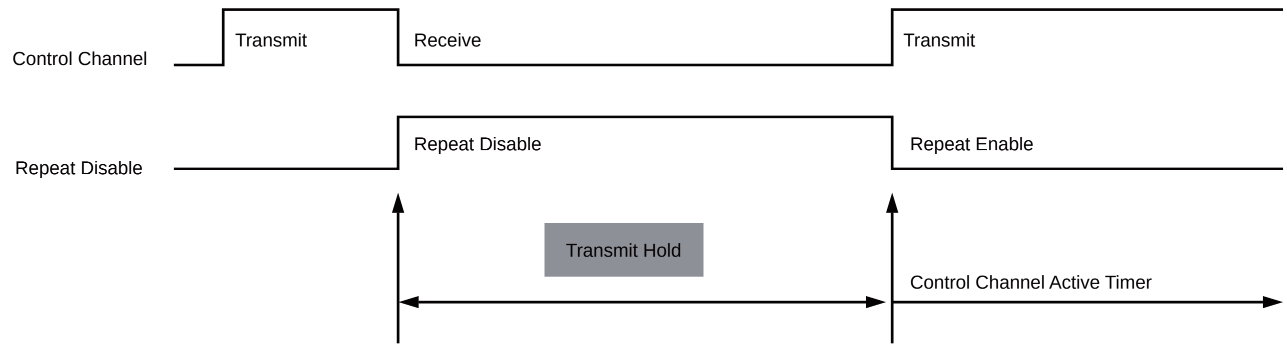


Figure 13-3 Behaviors of Cross-busy Burst Transmission and Repeat Disable (Control Channel Active Timer)

Configuration using KPG-110SM

Configuring **Control Channel Active Timer** (See NEXEDGE 1st Generation System Programming Reference 7.1.5 Optional Tab)

Control Channel Wait Timer

Control Channel Wait Timer is the length of a time slot that transmission on a control channel is paused.

Transmission on a control channel continues for the amount of time configured in **Control Channel Active Timer** and then the transmission pauses when this amount of time elapses. The transmission on the control channel starts when the amount of time configured in **Control Channel Wait Timer** elapses after the transmission pauses.

- If the timing of Station ID (Analog CW ID) transmission comes while the **Control Channel Wait Timer** is counting down, the Station ID (Analog CW ID) transmission immediately starts on the control channel even in the reception state. The counting of the **Control Channel Wait Timer** internally continues as shown in the diagram below.

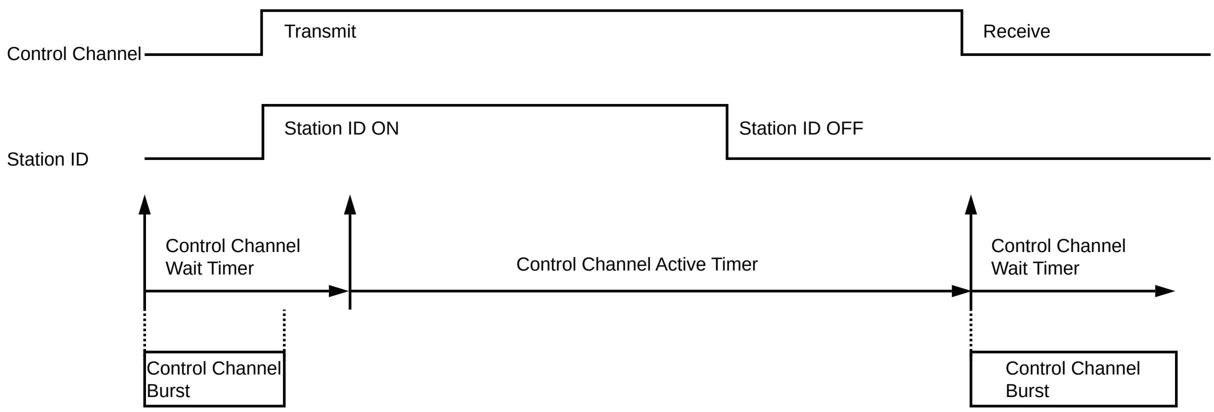


Figure 13-4 The Behavior of the Control Channel Wait Timer During Station ID Transmission

- If the repeater recognizes that the control channel is in the busy state by Cross Busy Input while **Repeat Disable** is active, the transmission stops until the busy state is reset even if **Repeat Disable** is deactivated. If the **Control Channel Wait Timer** elapses after the busy state is reset, the transmission on the control channel resumes.

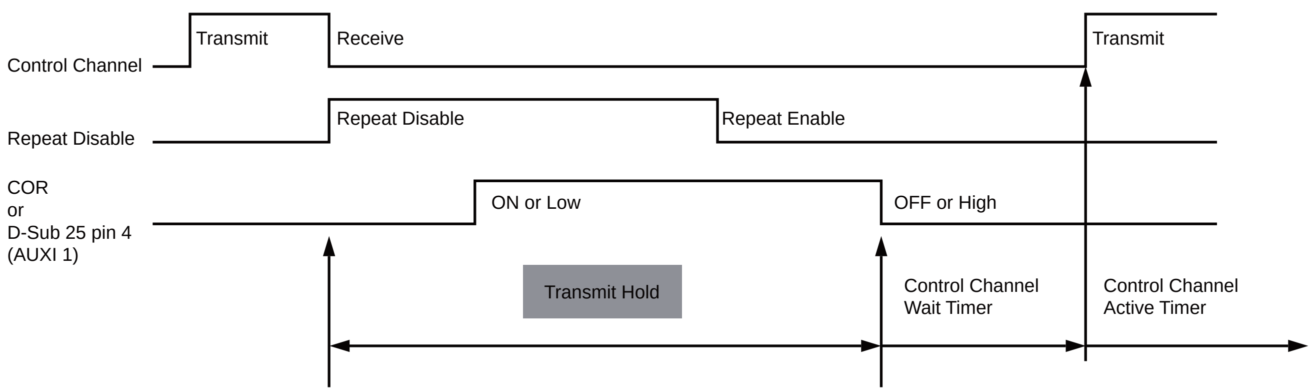


Figure 13-5 Behaviors of Cross-busy Burst Transmission and Repeat Disable (Control Channel Wait Timer)

Note

- The length of one time slot is 40 ms if “Narrow” is configured in **Channel Spacing**, and 80 ms if “Very Narrow” is configured in **Channel Spacing**.

Configuration using KPG-110SM

Configuring **Control Channel Wait Timer** (See NEXEDGE 1st Generation System Programming Reference 7.1.5 Optional Tab)

Traffic Channel Release Delay Timer

Traffic Channel Release Delay Timer is the amount of time from when the busy state of a traffic channel controlled by an external device is reset until the traffic channel becomes available again.

- **Cross-busy Input behavior**
  The traffic channel is unavailable from when **Cross-busy Input Trigger** (External, Internal, Both) is disabled until the **Traffic Channel Release Delay Timer** elapses.

- **Cross-busy Output behavior**
  While a channel is allocated as a traffic channel and additionally the amount of time configured in **Traffic Channel Release Delay Timer** is counting down, low-level signals are transferred from the Cross-busy Output port (pin 25 of the 25-pin D-sub connector (AUXIO 6)). If a channel is not used, high-level signals are transferred.

Configuration using KPG-110SM

Configuring **Traffic Channel Release Delay Timer** (See NEXEDGE 1st Generation System Programming Reference 7.1.5 Optional Tab)

Cross-busy Input Trigger

Cross-busy Input Trigger is the function to control the busy state of a traffic channel using the **Cross-busy** function.

Table 13-12 Cross-busy Input Trigger

Configuration	Description
External	The repeater cannot be used as a traffic channel from when the external trigger is disabled until the **Traffic Channel Release Delay Timer** elapses. The repeater can be used as a traffic channel when the amount of time configured in **Traffic Channel Release Delay Timer** elapses.
Internal	The repeater cannot be used as a traffic channel from when the internal trigger is disabled until the **Traffic Channel Release Delay Timer** elapses. The repeater can be used as a traffic channel when the amount of time configured in **Traffic Channel Release Delay Timer** elapses. If the repeater receives a signal on the receive frequency for a traffic channel or “Shared” is configured for a traffic channel, the internal trigger is enabled after the call is completed in conventional mode.
Both	The repeater cannot be used as a traffic channel from when either internal trigger or external trigger is disabled until the **Traffic Channel Release Delay Timer** elapses. The repeater can be used as a traffic channel when the amount of time configured in **Traffic Channel Release Delay Timer** elapses. If the repeater receives a signal on the receive frequency for a traffic channel or “Shared” is configured for a traffic channel, the internal trigger is enabled after the call is completed in conventional mode.

Configuration using KPG-110SM

Configuring **Cross-busy Input Trigger** (See NEXEDGE 1st Generation System Programming Reference 7.4.7 Cross-busy Input Trigger)

13.10 Using a Control Channel as a Traffic Channel (Non-dedicated Control Channel)

Non-dedicated Control Channel is the function to use a control channel as a traffic channel when all the traffic channels in a site are being used.

If a control channel is operated as a dedicated channel, the number of traffic channels becomes 1 less than the total number of channels stored in a site. When all of the traffic channels are being used in a site with a small number of channels, temporarily dedicating a control channel as a traffic channel and handling an additional channel for calls may be better.

Using this function can temporarily use a control channel as a traffic channel when all the traffic channels in a site are being used. While the control channel is behaving as a traffic channel, the site enters the state where no control channel exists. Therefore, even if another call finishes and the channel becomes available, the system cannot accept a new call request while no control channel exists.

A **Non-dedicated Control Channel** immediately starts the behavior as a traffic channel if a call request is received from a subscriber unit while all the traffic channels are being used.

The **Non-dedicated Control Channel** is allocated as a traffic channel only if all the traffic channels are being used.

The NEXEDGE system behaves as follows according to depending on the configuration in **Non-dedicated Control Channel**:

Table 13-13 Non-dedicated Control Channel

Item	Description
Disabled	The **Non-dedicated Control Channel** function does not function.
Enabled	A control channel is used as a traffic channel when all of the traffic channels in a site are used. The system temporarily has no control channel while a **Non-dedicated Control Channel** is used as a traffic channel. Even if another call finishes and the traffic channel becomes available, the system cannot accept a new call request while no control channel exists. **Late Entry** is temporarily disabled when the **Non-dedicated Control Channel** is used as a traffic channel. When the call is finished and the channel is activated again as a control channel, **Late Entry** becomes enabled and a subscriber unit can participate in the ongoing call midway through the call.

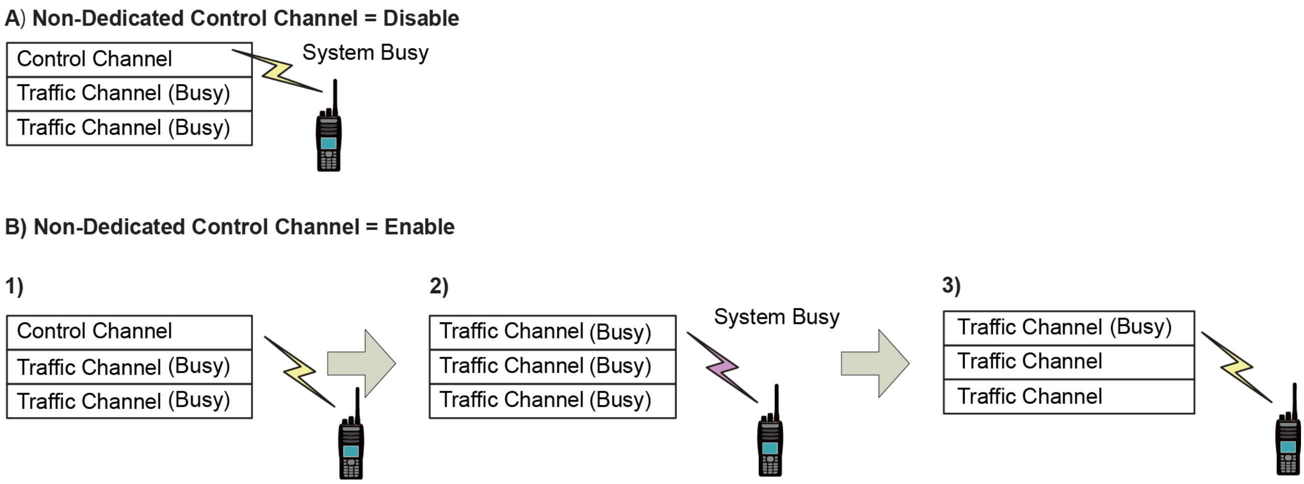


Figure 13-6 Examples of Non-dedicated Control Channel behavior

A)

Because **Non-Dedicated Control Channel** is disabled, the number of traffic channels is two. And because the two of the traffic channels are busy, a call cannot be initiated even if a new call request is received.

B)

1) Because **Non-Dedicated Control Channel** is enabled, the control channel behaves as a traffic channel when a new call request is received and accepts the call request while the two of the traffic channels are busy.
2) When the 3 traffic channels are busy, a call cannot be initiated even if a new call request is received.
3) Even if another call finishes and the traffic channel becomes available, the system cannot accept a new call request while no control channel exists.

Note

- In a site where the **Non-dedicated Control Channel** is used, Queue behaviors cannot be accepted because a control channel is allocated as a traffic channel when all traffic channels in the site are being used.
- The site cannot receive a new call while the **Non-dedicated Control Channel** is used as a traffic channel.
- **Non-dedicated Control Channel** behaves only on a channel with “Dual-functional Channel” configured in **Channel Type** by using KPG-110SM. The function does not behave on a channel with “Control Channel” or “Traffic Channel” configured in **Channel Type**.
- In a NEXEDGE system which has **Hold Timer** and is operated by Message Trunked, the traffic channel is retained while the **Hold Timer** is counting down in consideration of the continuity of communications even if a subscriber unit completes transmission. However, in a NEXEDGE system, if a control channel is used as the traffic channel, the control channel immediately returns to the control channel behavior without counting down the **Hold Timer** when the subscriber unit completes transmission. The subscriber unit necessarily performs the link behavior after the call is completed.
- While making an Individual Call by Message Trunked (Enhanced), the **Non-dedicated Control Channel** cannot be allocated to a traffic channel. In this case, the **Non-dedicated Control Channel** cannot be allocated to the traffic channel; therefore, caution is required when configuring.

Configuration using KPG-110SM

Configuring **Non-dedicated Control Channel** to be enabled or disabled (See NEXEDGE 1st Generation System Programming Reference 7.2.4 Non-dedicated Control Channel)

13.11 Allocating Another Channel As a New Control Channel (Failure Control Channel Switching/ Failure Traffic Channel Remove)

Failure Control Channel Switching is the function to allocate another traffic channel as a new control channel if the current control channel cannot be used due to detectable hardware problems, such as an unlocked state of the control channel. This is the function to continue operating the NEXEDGE system even if a failure occurs on the control channel.

In the case that the repeater cannot transmit a signal, for instance, due to a malfunction of an external device, such as the power amplifier, etc., other repeaters that are properly working can be allocated as a control channel by emitting the malfunction status of the external device to the external input port (pin 6 on the 25-pin D-sub connector (AUXI 3)).

The alternative control channel can be selected from channels where “Control Channel” or “Dual-functional Channel” is configured in **Channel Type** by using KPG-110SM.

If multiple control channel candidates exist, the channel dedicated as a control channel has the highest priority and other channels are allocated in ascending order.

Failure Traffic Channel Remove is the function that does not allow the repeater to be allocated as a traffic channel when the system detects that the repeater serving as a traffic channel cannot properly send signals due to a malfunction of the repeater.

For example, if the repeater cannot transmit a signal due to the malfunction of an external device such as power amplifier failure, this repeater cannot be allocated as a traffic channel by inputting malfunction status of the external device to the external input port (pin 6 on the 25-pin D-sub connector (AUXI 3)). After the external device recovers from its malfunction so that the repeater can properly send a signal, the repeater can be reallocated as a traffic channel.

Note

- The frequency of the control channel is changed if the channel that is generally used as the traffic channel is substituted for the control channel. In this case, channels may not be able to be hunted depending on the subscriber unit configuration. To avoid this problem, all control channel candidates must be preconfigured for the subscriber unit.
- **Failure Control Channel Switching** and **Failure Traffic Channel Remove** are automatically activated if multiple control channel candidates exist. The following are triggers to activate these functions:
  - PLL Unlock (RX, TX, and standard signals)
  - No receive frequency or transmit frequency is configured when the control channel becomes active
  - External input port (Pin 6 on the 25-pin D-sub connector (AUXI 3))
- The repeater behaves as follows depending on the state of the external input port:
  - The external input port remains active until the repeater is turned off or restarts.
  - The error code (E8) appears on the 17-segment LED display while the external input port remains active.
  - **Take Over** automatically becomes enabled when the external input port becomes active.
  - The repeater can recover from its malfunction by disabling **Take Over** when the external input port becomes inactive.

13.12 Averaging the Operation Time of a Repeater By Periodically Switching a Control Channel (Automatic Rollover)

Automatic Rollover is the function to automatically switch a control channel in a site at specified intervals. This function is used to level off the deterioration of peripheral equipments such as the power amplifier connected to the repeater by averaging the transmission time of the control channel.

Use **Rollover Time** to switch the control channel at a certain time of a day. For example, the switching time can be configured such as to late at night when the operation rate of the system is low.

The control channel is switched to a channel in order from the lowest channel number among the channels where “Control Channel” or “Dual-functional Channel” is configured in **Channel Type** by using KPG-110SM.

Note

- The subscriber unit and the system needs to be configured so that the subscriber unit can acquire a control channel even if the control channel is switched.
- At a timing when the control channel is switched, if a channel where “Dual-functional Channel” is configured is used as a traffic channel or is used in analog transmission, the channel is skipped, and the next available channel for a control channel is selected.

Configuration using KPG-110SM

Configuring **Automatic Rollover** to be enabled or disabled (See NEXEDGE 1st Generation System Programming Reference 7.3. Site Edit Window)

Rollover Time

Rollover Time is the time to automatically switch a control channel in a site. The control channel can automatically be switched by using a time slot when the operation rate of the system is low. Use this function to switch the control channel once a day.

If **Automatic Rollover** is enabled, the time to switch the control channel can be configured by hours.

For example, if “1” is configured in **Rollover Time**, the control channel is automatically switched at 1 o'clock in the night.

Configuration using KPG-110SM

Configuring **Rollover Time** (See NEXEDGE 1st Generation System Programming Reference 7.3. Site Edit Window)

13.13 Deactivating Temporarily the Control Channel by Remote Control (Remote System Standby)

Remote System Standby is the function that enables temporary deactivation of a control channel in a site or reactivation of the control channel by remote control from a subscriber unit.

The repeater stops transmitting on the control channel and the system is temporarily disabled in the following situations:

- The preconfigured **Remote System Standby Setup Code** is received on the control channel.
- The logic state of any external input port (Pin 5 on the 25-pin D-sub connector (AUXI 2)) on the controller in the site goes low level while **External Trigger** is enabled.

The control channel is reactivated after the system is temporarily disabled in one of the following situations:

- The **Remote System Standby Cancellation Code** is received on the control channel.
- The logic state of all external input ports (Pin 5 on the 25-pin D-sub connector (AUXI 2)) on the controller in the site goes high level while **External Trigger** is enabled.

Configure the following by using KPG-110SM:

- Configuring **Remote System Standby** to be enabled or disabled
- **Remote System Standby Setup Code**
- **Remote System Standby Cancellation Code**
- Configuring **External Trigger** to be enabled or disabled

Note

- A repeater that has received the **Remote System Standby Setup Code** waits for a **Remote System Standby Cancellation Code**.
- If the repeater is turned off and on again, the state of **Remote System Standby** is not retained and the system starts. However, if the system has entered **Remote System Standby** state with an external input port (Pin 5 on the 25-pin D-sub connector (AUXI 2)), the system does not start unless the logic state of the external input ports on all repeaters in the site goes high level.
- If **Power-on Standby** is enabled, a control channel is activated in System Standby Mode when the system is restarted after writing the configuration data to the repeater by using KPG-110SM. (Refer to Restricting the Repeat Behaviors after Startup (Power-on Standby).)

Configuration using KPG-110SM

Configuring each function of **Remote System Standby** (See NEXEDGE 1st Generation System Programming Reference 7.3.1 General Tab)

13.14 Restricting the Repeat Behaviors after Startup (Power-on Standby)

Power-on Standby is the function that places a control channel in the standby state when a repeater starts.

This is a function that disables the transmission capability until the frequency is stabilized when the optional reference oscillator OCXO (KXK-3) is used. The control channel can be activated when the frequency is stabilized after the repeater starts.

If this function is enabled, the control channel is activated in the standby state when the repeater starts. The LED of the **[RPT DISABLE]** key for a control channel lights while in the standby state. If the **[RPT DISABLE]** key on any of the repeaters in a site is pressed, the LEDs on all the repeaters are turned off. At this time, the standby state is reset, and then transmission starts on a control channel.

If this function is disabled, the control channel is not activated in the standby state and transmission immediately starts when the repeater starts.

Note

- The standby state by **Power-on Standby** can be remotely deactivated by receiving on the control channel the **Remote System Standby Setup Code** sent from a subscriber unit. (Refer to Deactivating Temporarily the Control Channel by Remote Control (Remote System Standby).)
- OCXO is not initialized after writing the configuration data to the repeater by using KPG-D2 or KPG-110SM; hence, no wait time is required for the frequency stabilization.
- If **Power-on Standby** is enabled, a control channel is activated in System Standby Mode when the system is restarted after writing the configuration data to the repeater by using KPG-110SM.

Configuration using KPG-110SM

Configuring **Power-on Standby** to be enabled or disabled (See NEXEDGE 1st Generation System Programming Reference 7.3.1 General Tab)

13.15 Sending a Preconfigured Station ID at Certain Time Intervals (Station ID)

Station ID is the function that uses the downlink frequency of the repeater to notify the identifier that is preconfigured in the repeater site for certain time intervals on the hour every hour as a standard. A maximum of 32 alphanumeric characters and symbols can be configured and sent.

In some countries and regions, it is legally required to send the identification number of the repeater site. If the identifier transmission by using a Station ID is allowed, the identification number preconfigured for the repeater site can be sent in a short amount of time by using a Station ID.

By configuring **Transmit Interval Time**, a Station ID can be automatically sent at certain time intervals based on the hour every hour. Whether to send a Station ID can be configured for each channel.

A Station ID can be sent in digital format or in analog format according to the configuration in **Type**.

Table 13-14 Type (Station ID)

Item	Description
NXDN Digital	If a Station ID is sent on a traffic channel, the repeater checks whether the traffic channel is used when the amount of time configured in **Transmit Interval Time** elapses and the time to initiate Station ID transmission arrives. If the traffic channel is already busy, the repeater sends the Station ID when the call ends. If a Station ID is sent on a control channel, the repeater sends the Station ID when the amount of time configured in **Transmit Interval Time** elapses and the time to initiate Station ID transmission arrives.
Analog CW ID	If a Station ID is sent on a traffic channel, the repeater checks whether the traffic channel is used when the amount of time configured in **Transmit Interval Time** elapses and the time to initiate Station ID transmission arrives. If the traffic channel is already busy, the repeater sends the Station ID when the call ends. If a Station ID is sent on a control channel, the repeater sends the Station ID notification when the amount of time configured in **Transmit Interval Time** elapses and the time to initiate Station ID transmission arrives. Then, the repeater forcibly stops the control channel behavior and migrates to analog mode. After that, the repeater sends the Station ID. When the Station ID transmission completes, the control channel is immediately available. A subscriber unit which does not receive a Station ID notification during this period starts the channel hunt behavior to search for another site, because the subscriber unit does not find the control channel.

Configuration using KPG-110SM

- Configuring **Station ID** (See NEXEDGE 1st Generation System Programming Reference 7.6 Station ID Window)
- Configuring **Transmit Interval Time** (See NEXEDGE 1st Generation System Programming Reference 7.6 Station ID Window)

Inhibiting the Transmission of a Station ID on a Control Channel (Station ID Inhibit)

Station ID Inhibit is the function to disable transmission of a Station ID on a control channel.

If this function is enabled in a site, the channel in the site being operated as a control channel cannot send a Station ID even if the channel is configured to be enabled to send a Station ID.

The transmission of a Station ID can be disabled if multiple Dual-functional Channels behave as a control channel by using such functions as **Automatic Rollover** or **Failure Control Channel Switching**.

Configuration using KPG-110SM

Configuring **Station ID Inhibit** to be enabled or disabled (See NEXEDGE 1st Generation System Programming Reference 7.3.1 General Tab)

13.16 About IP Console

Use of an external device (hereinafter referred to as “IP console”) conforming to the IP Network Interface provides the communication with a subscriber unit from outside a wireless area.

The following communications are available by using the IP console.

- **Registration**

  The IP console can be registered in the system. A maximum of 10 IP consoles can be connected to each site and a maximum of 100 IP consoles can be connected to the system.

- **Group Registration**

  The Group ID used for an IP console can be registered for the site. A maximum of 100 Group IDs for a single IP console can be registered to the site at a time. Group Registration is required for an IP console to receive a Group Call from the system.

- **Status Call**

  Status Call provides simple communications using the fixed messages. The following Statuses can be sent:

  Status: 1 to 207 (which can be defined by a user)

  Emergency Status: 224 (which cannot be defined by a user)

  Man-down Emergency Status: 225 (which cannot be defined by a user)

  Emergency Termination: 226 (which can be defined by a user)

- **Remote Control**

  Remote Control can control the subscriber unit by using a command from an IP console.

  The following controls are available:

  - Remote Stun
  - Remote Revive
  - Remote Kill

- **Short Data Call**

  Short Data Call provides short message communications. Transmission or reception of a maximum of 100 digits of text data is available. The following functions are available using User Data Area:

  - AUX Status Request
  - GPS Data Request
  - ESN Data Request
  - Remote Regrouping
  - Transparent

- **Voice Call**

  The following voice communications are available:
  - Group Call
  - Voice Call

- **Data Call**

  Data Call can be used for data transmissions and receptions such as file transfers, database access, etc.
  Transmission or reception of a maximum of 4096 digits of text data is available.
  - Long Data Call
  - Transparent

Note

- To use an IP console, a Unit ID also needs to be assigned to an IP console in the same manner as a subscriber unit. The Unit ID assigned to an IP console cannot be used for a subscriber unit.

Configuration using KPG-110SM

- Configuring an IP console to be enabled or disabled (See NEXEDGE 1st Generation System Programming Reference 7.1.7 IP Console Tab)
- Configuring various functions of IP console (See NEXEDGE 1st Generation System Programming Reference 7.20 Console Information Window, 7.21 Console Edit Window)

13.17 Enabling Subscriber Units Selecting Different GIDs to Participate in the Same Communication (GID Association)

GID Association is the function that enables a subscriber unit selecting a GID other than the Target GID to participate in a Group Call for the Target GID. This function can be used by configuring a GID (Target GID) registered in the system as an Associated GID. Since an Associated GID can be related with a Target GID, even if a subscriber unit selects a GID other than the Target GID, the subscriber unit can participate in a Group Call for the Target GID.

When the system starts a Group Call by the Target GID, both the site called by the Target GID and the site called by the Associated GID are called by the Target GID. This enables the subscriber unit selecting the Associated GID to participate on a traffic channel allocated for the Group Call with the Target GID. However, to use this function, the Target GID needs to be included in the IDs targeted for scanning or the Target GID needs to be configured as a Priority Monitor ID for the subscriber unit selecting the Associated GID.

A maximum of 4 Associated GIDs can be configured for one Target GID.

According to the values configured in **Intersite Call** and **Dynamic Allocation**, a system allocates a traffic channel to the site as follows:

Table 13-15 GID Association

Target GID		Associated GID		Traffic Channel Allocation
Intersite Call	Dynamic Allocation	Intersite Call	Dynamic Allocation	
Enable	Disable	Disable	Disable	Static
Enable	Enable	Disable	Disable	Variable
Enable	Disable	Enable	Disable	Static
Enable	Disable	Enable	Enable	Static
Enable	Enable	Enable	Disable	Static
Enable	Enable	Enable	Enable	Variable

Static: A traffic channel is always allocated.
Variable: A traffic channel is allocated only if the Group Registration for the Target GID or Associated GID has succeeded.

Configuration using KPG-110SM

Configuring Associated GID (See NEXEDGE 1st Generation System Programming Reference 7.17. GID Edit Window)

13.18 Securing the Minimum Communication Capability When a Network Failure Occurs (Failsoft Mode)

Failsoft Mode is the function that can provide the minimum communication capability for subscriber units in a site even if the NEXEDGE system cannot provide the trunking capability for the site due to a failure of a device in the site.

The channel where this function is enabled enters Failsoft mode when a network connection between channels is disconnected due to the failure of a hub or repeater etc., or if a control channel candidate or traffic channel candidate, or both a control channel candidate and a traffic channel candidate do not exist among channels which can function normally.

The channel which detects such as a network failure behaves as a Failsoft channel if the channel is a channel where **Failsoft Mode** is enabled. The channel where **Failsoft Mode** is disabled stops serving. A Failsoft channel behaves as a channel dedicated to Failsoft. The Failsoft channel periodically notifies subscriber units that the channel has been in Failsoft mode.

While in Failsoft mode, UIDs and GIDs are not checked, and all digital call requests are repeated.

Only group voice communications within the site are available.

If a failure such as a network failure is resolved, the channel which detects the failure resolution resumes normal operation.

If this function is disabled, Failsoft does not work. The channel which detects the failure stops transmission and enters the standby mode. If the failure is resolved, the channel which detects the failure resolution resumes normal operation.

Note

- During Failsoft mode, the control channel information of adjacent sites is periodically sent. However, if a failure occurs in network communications, the information before the failure occurrence is sent, therefore, the content may not be correct.
- A subscriber unit executes a channel hunt while the NEXEDGE system is restarting.
- A call during Failsoft mode is not recorded in a communication log.
- The **Repeat Disable** status before the channel enters Failsoft mode continues when the channel enters Failsoft mode. The **Repeat Disable** operation during Failsoft mode works as a function to stop and resume transmission for each channel, and the status change is not retained. Therefore, the **Repeat Disable** status after the channel restores from Failsoft mode is the same status as before the channel enters Failsoft mode.
- A Station ID is not sent during Failsoft mode.
- No analog signal is repeated even if the channel configured as a Shared Channel starts working as a Failsoft channel.

Configuration using KPG-110SM

Configuring **Failsoft Mode** to be enabled or disabled (See NEXEDGE 1st Generation System Programming Reference 7.4.8 Failsoft Mode)

Restricting a Continuous Transmission of a Repeater during Failsoft Mode (Time-out Timer in Failsoft Mode)

Time-out Timer in Failsoft Mode is the function to configure a time limit for a continuous transmission of a repeater during Failsoft mode.

This function is used to avoid occupying a repeater in Failsoft mode.

The configuration value of the timer is periodically notified to subscriber units on a Failsoft channel. The subscriber units determines the continuous transmission time on the Failsoft channel by receiving this notification.

If "Unlimited" is configured in **Time-out Timer in Failsoft Mode**, the continuous transmission time of the subscriber unit is the length of time configured for the subscriber unit.

Configuration using KPG-110SM

Configuring **Time-out Timer in Failsoft Mode** (See NEXEDGE 1st Generation System Programming Reference 7.1.4 Timers Tab)

About Failsoft Mode Viewed From a Subscriber Unit

If a control channel starts working as a Failsoft channel, a subscriber unit executes a channel hunt, and then enters Failsoft mode when the subscriber unit finds the Failsoft channel. If transmission on the Failsoft channel stops and the control channel enters normal operation, the subscriber unit executes a channel hunt and exits Failsoft mode. The subscriber unit executes a background hunt during Failsoft mode.

About Relationship with Secondary Class of Service

If the network connection with another site is disconnected while the single site is properly working, because there may be sites that cannot exchange information in the NEXEDGE system, the system runs the multi-site system within the available connection. In this case, the repeater does not enter Failsoft mode and the system provides restrictive communication service to the subscriber units in order to prevent the system from being down. If the subscriber unit cannot access the home site since the home site is disconnected from the network, the system accepts the communication requests within the range permitted by Secondary Class of Service. If the connection to the network is restored and communication to another site is re-established, the call between the sites can automatically be recovered.

13.19 Notifying Subscriber Units that the Network Between Sites Is Disconnected (Network Failure Information)

Network Failure Information is the function to notify subscriber units that the site is temporarily isolated from the network because a network failure occurred among sites in a multi-site system.

With this function, a user notices that the site the user is currently accessing cannot provide a function to use the network.

If the site determines that the network connection between sites has been disconnected because of the incapability of connecting to any site, the site notifies subscriber units that the site has been isolated from the network. When the site connects to another site again via the network, the site notifies the subscriber units that the site has recovered from the isolated status.

When a subscriber unit receives the notification of the network failure from the NEXEDGE system, the subscriber unit notifies the site status to the user by showing it on the display and by an alert tone according to the configuration of the subscriber unit.

Note

- Every 10 minutes, each site monitors whether a network failure occurs between the site and another site. Therefore, when a network disconnection occurs among sites, a maximum of 10 minutes are required before the network disconnection is detected.

This section explains the functions and configurations required for operating the repeater in the Conventional IP network system.

The NXDN Conventional system can interconnect multiple repeaters installed in different locations by using an IP network.

By using this system, a subscriber unit can communicate with a distant subscriber unit via an IP network.

Also, in the Conventional IP network system, the following functions are available: the **Site Roaming** function which enables the repeater to automatically migrate to a site (channel) providing better radio environment, and the **Voting** function which controls among the repeaters connected via an IP network the signal from the subscriber units according to the received signal level.

14.1 Configuring Channel Information

A maximum of 30 channels can be configured for the repeater. A channel can be switched by operating a **PF** key or according to the change of AUX Input port status. (Refer to Operation to Change the Channel.)

To operate the repeater in the single repeater system, the following basic functions need to be configured for each channel by using KPG-D2.

- RX Frequency/ TX Frequency
- Channel Type
- Transmit Mode
- RAN Decode/ RAN Encode
- Channel Name
- Channel Spacing (NXDN)
- Operation Mode

Configuring Transmit and Receive Frequencies (RX Frequency/ TX Frequency)

Transmit and receive frequencies are pairs of frequencies used by the repeater to transmit and receive. The transmit and receive frequencies of the repeater can be configured for each channel.

Refer to "Configuring Transmit and Receive Frequencies (RX Frequency/ TX Frequency)" in "BASE STATION (SIMPLEX/ DUPLEX)" for the details of the transmit and receive frequencies.

Configuration using KPG-D2

Configuring the transmit and receive frequencies for a channel (See Edit > Channel Information/ Channel Edit)

Configuring the Usage Type of the Channel (Channel Type)

Channel Type is the usage type for each channel.

Whether to transmit and receive in analog communications, transmit and receive in NXDN digital communications, or wait to receive both analog signals and NXDN digital signals can be configured.

Refer to “Configuring the Usage Type of the Channel (Channel Type)” in “BASE STATION (SIMPLEX/ DUPLEX)” for the details of **Channel Type**.

Configuration using KPG-D2

Configuring **Channel Type** (See Edit > Channel Information/ Channel Edit)

Configuring the Transmission Mode for a Mixed Channel (Transmit Mode)

Transmit Mode is the mode used when the repeater transmits on a channel with “Mixed” configured in **Channel Type** by using the **PTT** (microphone) switch or the External PTT control.

Refer to “Configuring the Transmission Mode for a Mixed Channel (Transmit Mode)” in “BASE STATION (SIMPLEX/ DUPLEX)” for the details of **Transmit Mode**.

Configuration using KPG-D2

Configuring **Transmit Mode** (See Edit > Channel Information/ Channel Edit)

Configuring the Digital Signaling (RAN Decode/ RAN Encode)

RAN (Radio Access Number) is the signaling for NXDN digital communications used by the repeater to transmit and receive a digital signal.

Refer to “Digital Signaling System” for details of RAN.

Configuration using KPG-D2

Configuring **RAN Decode/ RAN Encode** (See Edit > Channel Information/ Channel Edit)

Configuring a Channel Name (Channel Name)

A channel name of up to 2 alphanumeric characters and symbols can be configured for each channel. The configured channel name appears on the LED display of the repeater.

Configuration using KPG-D2

Configuring **Channel Name** (See Edit > Channel Information/ Channel Edit)

Configuring the Channel Spacing (Channel Spacing (NXDN))

Channel Spacing is the channel spacing used by the repeater to transmit and receive.

Channel spacing is the spacing of frequencies between adjacent channels.

The following are the channel spacing to be used by the repeater for transmission and reception on an NXDN digital channel:

Table 14-1 Channel Spacing (NXDN)

Channel Spacing	Bandwidth
Narrow	12.5 kHz
Very Narrow	6.25 kHz

Configuration using KPG-D2

Configuring **Channel Spacing (NXDN)** (See Edit > Channel Information/ Channel Edit)

Configuring the Operation Mode of the Repeater (Operation Mode)

Operation Mode is the mode in which the repeater transmits and receives.

Depending on the task of the repeater, the repeater can be operated in one of the following modes. (Refer to STRUCTURE OF A CONVENTIONAL SYSTEM.)

To operate the repeater in the Conventional IP network system, configure “Repeat”, “RF Link”, “Voting Repeater” or “Voting Receiver” in **Operation Mode**.

Refer to “Configuring the Operation Mode of the Repeater (Operation Mode)” in “BASE STATION (SIMPLEX/ DUPLEX)” for the details of **Operation Mode**.

Configuration using KPG-D2

Configuring **Operation Mode** (See Edit > Channel Information/ Channel Edit)

14.2 Configuring the Functions Related to Reception

This section explains the functions and configurations related to reception used when the repeater is operated in the Conventional IP network system.

Squelch

Squelch is the function to eliminate the noise which is generated while the received signal level is low by muting the speaker. The received signal level to unmute the speaker can be changed according to conditions; for instance, when the repeater is operated in the environment of an excessively interfering signal.

Refer to “Squelch” in “BASE STATION (SIMPLEX/ DUPLEX)” for the details of squelch.

Temporarily Disabling the Signaling (Monitor)

Monitor is the function to unmute the speaker if the level of the received signal is high, even if the received signaling (the RAN code) does not match the signaling preconfigured for the repeater (the RAN code). This function can be used to check in advance whether or not a channel to be used for transmission is already being used by other groups.

Refer to “Temporarily Disabling the Signaling (Monitor)” in “BASE STATION (SIMPLEX/ DUPLEX)” for the details of **Monitor**.

Note

- Even if **Monitor** is enabled, the repeater does not transmit by using the Repeat PTT control unless the signaling matches.

Monitoring the Usage Status of a Channel (External Monitor)

External Monitor is the function to monitor the availability of channels by activating the preconfigured **Squelch Off** or **Monitor** when the External Monitor port becomes active.

Refer to “Monitoring the Usage Status of a Channel (External Monitor)” in “BASE STATION (SIMPLEX/ DUPLEX)” for the details of **External Monitor**.

Configuration using KPG-D2

Configuring **External Monitor** (See Edit > Optional Features > Common Page 1)

Toggling the Signaling Decoding between Enabled and Disabled (Decode Signaling Enable/Disable)

Decode Signaling Enable/Disable is the function to enable or disable the signaling decoding (Ran code).

Refer to “Toggling the Signaling Decoding between Enabled and Disabled (Decode Signaling Enable/Disable)” in “BASE STATION (SIMPLEX/ DUPLEX)” for the details of **Decode Signaling Enable/Disable**.

Unmuting the Speaker by Linking with the Microphone (Off-hook Decode)

Off-hook Decode is the function to decode the received signaling (the RAN code) in conjunction with the microphone of the **PTT** (microphone) switch on- or off-hook state.

If **Off-hook Decode** is enabled, the repeater unmutes the speaker regardless of the microphone on- or off-hook state when the received signaling matches the configured signaling.

If **Off-hook Decode** is disabled, the repeater unmutes the speaker when the repeater receives a signal while the microphone is in the off-hook state. The repeater unmutes the speaker if the received signaling matches the configured signaling while the microphone is in the on-hook state. However, if the repeater is operated in the repeater system, even if the microphone is in the off-hook state, the repeater does not transmit by using the Repeat PTT control unless the signaling matches.

Configuration using KPG-D2

Configuring **Off-hook Decode** to be enabled or disabled (See Edit > Optional Features > Common Page 1)

Identifying the RSSI Level by Using the Auxiliary Output Port (Lowest Receive Level Threshold)

Lowest Receive Level Threshold is the reference RSSI level at which the repeater toggles the **Receive Signal (Threshold)** assigned to the AUX Output port between activated and deactivated.

If the RSSI level is lower than the level configured for **Lowest Receive Level Threshold**, the AUX Output port to which **Receive Signal (Threshold)** is assigned becomes active, and if the level is higher than the configured level, the AUX Output port becomes inactive. (Refer to Available Functions for the AUX Output Ports.)

Configuration using KPG-D2

Configuring **Lowest Receive Level Threshold** (See Edit > Optional Features > Common Page 1 > Level)

Configuring to Transmit a Voting Pilot Tone Signal (Voting Pilot Tone)

Voting Pilot Tone is the function to transmit a Voting pilot tone signal from the RA port by using the preconfigured frequency while the repeater is receiving no signal.

Refer to "Configuring to Transmit a Voting Pilot Tone Signal (Voting Pilot Tone)" in "BASE STATION (SIMPLEX/ DUPLEX)" for the details of **Voting Pilot Tone**.

Configuration using KPG-D2

Configuring **Voting Pilot Tone** to be enabled or disabled and configuring the frequency (See Edit > Optional Features > Common Page 2 > Voting Pilot Tone)

14.3 Configuring the Functions Related to Transmission and Repeat

This section explains the functions and configurations related to transmission used when the repeater is operated in the Conventional IP network system.

Configuring the Priority Order of When Multiple Causes for Transmission Occur Together (PTT Priority)

The following methods for transmission are available for the repeater:

- Mic PTT (**PTT** (microphone) switch)
- External PTT
- Repeat PTT
- Console PTT
- Network PTT

PTT Priority is the priority order for these transmission methods.

Refer to "Configuring the Priority Order of When Multiple Causes for Transmission Occur Together (PTT Priority)" in "BASE STATION (SIMPLEX/ DUPLEX)" for the details of **PTT Priority**.

Configuration using KPG-D2

Configuring **PTT Priority** (See Edit > Optional Features > Common Page 1)

Configuring the Transmission Power Level

One of "High", "Mid", and "Low" can be configured for each channel as the transmission power of the repeater.

Refer to "Configuring the Transmission Power Level" in "BASE STATION (SIMPLEX/ DUPLEX)" for details.

Configuration using KPG-D2

Configuring **Transmit Power** (See Edit > Channel Information/ Channel Edit)

Restricting the Continuous Transmission Time for the Repeater (Time-out Timer)

Time-out Timer (TOT) is the function to restrict the continuous transmission time for the repeater.

This function is used to prevent a user from occupying the repeater or frequency which is shared with other users. The repeater automatically stops transmitting and releases the channel if it continuously transmits longer than the configured time.

Refer to "Restricting the Continuous Transmission Time for the Repeater (Time-out Timer)" in "BASE STATION (SIMPLEX/ DUPLEX)" for the details of **Time-out Timer (TOT)**.

Notifying a user that the continuous transmission is about to end (TOT Pre-alert)

TOT Pre-alert is the function to notify a user that a continuous transmission is about to end by the **Time-out Timer**.

Refer to "Notifying a user that the continuous transmission is about to end (TOT Pre-alert)" in "BASE STATION (SIMPLEX/ DUPLEX)" for the details of **TOT Pre-alert**.

Configuring the length of time from when the transmission is automatically terminated by Time-out Timer until the transmission becomes possible again (TOT Rekey Time)

TOT Rekey Time is the length of time from when the transmission ends by the **Time-out Timer** until the transmission becomes possible again.

Refer to "Configuring the length of time from when the transmission is automatically terminated by Time-out Timer until the transmission becomes possible again (TOT Rekey Time)" in "BASE STATION (SIMPLEX/ DUPLEX)" for the details of **TOT Rekey Time**.

Configuring the time before starting to initialize and reset the Time-out Timer (TOT Reset Time)

TOT Reset Time is the time required to initialize and reset the elapsed time for **Time-out Timer**.

Refer to "Configuring the time before starting to initialize and reset the Time-out Timer (TOT Reset Time)" in "BASE STATION (SIMPLEX/ DUPLEX)" for the details of **TOT Reset Time**.

Configuration using KPG-D2

Configuring each function of **Time-out Timer (TOT)** when using the Repeat PTT control, External PTT control, Network PTT control or Console PTT control (See Edit > Optional Features > Common Page 1 > Repeater/ External/ Network/ Console PTT)

Toggling the Transmission by Pressing the PTT (Microphone) Switch between Enabled and Disabled (Local TX Enable/Disable)

Local TX Enable/Disable is the function to enable or disable the transmission by using the **PTT** (microphone) switch.

Refer to "Toggling the Transmission by Pressing the PTT (Microphone) Switch between Enabled and Disabled (Local TX Enable/Disable)" in "BASE STATION (SIMPLEX/ DUPLEX)" for the details of **Local TX Enable/Disable**.

Toggling the Repeat Behavior between Enabled and Disabled (Repeat Enable/Disable)

Repeat Enable/Disable is the function to enable or disable the repeat behavior.

Refer to "Toggling the Repeat Behavior between Enabled and Disabled (Repeat Enable/Disable)" in "SINGLE REPEATER SYSTEM" for the details of **Repeat Enable/Disable**.

Toggling the Transmission Behavior between Enabled and Disabled (TX Enable/Disable)

TX Enable/Disable is the function to enable or disable all transmissions.

Refer to "Toggling the Transmission Behavior between Enabled and Disabled (TX Enable/Disable)" in "BASE STATION (SIMPLEX/ DUPLEX)" for the details of **TX Enable/Disable**.

Toggling the Pre-emphasis of the TA Port between Enabled and Disabled (TA line Pre-emphasis On/Off)

TA line Pre-emphasis On/Off is the function to enable or disable the pre-emphasis of the TA port.

Refer to "Toggling the Pre-emphasis of the TA Port between Enabled and Disabled (TA line Pre-emphasis On/Off)" in "BASE STATION (SIMPLEX/ DUPLEX)" for the details of **TA line Pre-emphasis On/Off**.

Toggling the Signaling Encoding between Enabled and Disabled (Encode Signaling Enable/Disable)

Encode Signaling Enable/Disable is the function to enable or disable the RAN code encoding.

Refer to "Toggling the RAN encoding between enabled and disabled (Encode Signaling Enable/Disable)" for the details of **Encode Signaling Enable/Disable**.

Waiting to Receive Multiple Signaling (Multiple Encode/Decode Table)

Multiple Encode/Decode Table is the table in which the Encode/Decode signaling that the repeater waits to receive along with the Primary signaling (RAN code) configured for each channel is configured. If this function is used, the repeater can wait to receive a maximum of 16 combinations of signaling (a combination of Primary + 15 combinations of Encode/Decode codes).

Refer to "Waiting to receive multiple RAN codes (Multiple Encode/Decode Table)" for the details of **Multiple Encode/Decode Table**.

Configuring the Length of Time to Transmit in the Same Mode as When the Repeater Receives a Signal on a Mixed Channel and the Received Signaling Matches (Signaling Reset Timer)

Signaling Reset Timer is the length of time to transmit in the same communication method (either Analog or NXDN) as the method for the received signal regardless of the configuration in **Transmit Mode** if the repeater receives a signal on a mixed channel and the received signaling matches the signaling preconfigured for the repeater.

Refer to "Transmitting by Using the Communication Method of Reception (Signaling Reset Timer)" for details of **Signaling Reset Timer**.

Preventing the Receiving Party from Wrongly Detecting a Signal due to Chassis Radiation from the Repeater (Standby on Transmit Frequency)

Standby on Transmit Frequency is the function to wait to receive on the transmit frequency configured for each channel while the repeater is in the standby mode.

Refer to "Preventing the Receiving Party from Wrongly Detecting a Signal due to Chassis Radiation from the Repeater (Standby on Transmit Frequency)" in "BASE STATION (SIMPLEX/ DUPLEX)" for the details of **Standby on Transmit Frequency**.

Configuration using KPG-D2

Configuring **Standby on Transmit Frequency** to be enabled or disabled (See Edit > Optional Features > Common Page 1)

Preventing the Beginning of the Digital Frame from Being Undetected (Preamble Length)

Preamble Length is the function to extend the time for sending a preamble when the digital frame is sent.

Refer to "Preventing the Beginning of the Digital Frame from Being Undetected (Preamble Length)" in "BASE STATION (SIMPLEX/ DUPLEX)" for the details of **Preamble Length**.

Configuration using KPG-D2

Configuring **Preamble Length** (See Edit > NXDN > General)

Continuing Transmission for a Certain Length of Time After Reception Stops (Repeater Hold Time)

Repeater Hold Time is the length of time from when the repeater stops receiving a signal until the repeater terminates transmission using the Repeat PTT control while the repeater transmits the received signals using the Repeat PTT control.

Refer to "Continuing Transmission for a Certain Length of Time After Reception Stops (Repeater Hold Time)" in "SINGLE REPEATER SYSTEM" for the details of **Repeater Hold Time**.

Configuration using KPG-D2

Configuring **Repeater Hold Time** (See Edit > Optional Features > Common Page 1 > Repeater/ External/ Network/ Console PTT)

Restricting the IDs for Repeat Transmission (User List)

User List is the function to restrict the IDs to be transmitted by using the Repeat PTT control on the NXDN digital channels for which **User List** is enabled.

Refer to "Restricting the IDs for Repeat Transmission (User List)" in "SINGLE REPEATER SYSTEM" for the details of **User List**.

Configuration using KPG-D2

- Configuring **Group ID List** (See Edit > User List > Group ID List)
- Configuring **Unit ID List** (See Edit > User List > Unit ID List)
- Configuring **User List** to be enabled or disabled (See Edit > Channel Information/ Channel Edit)
- Configuring **Site Group** to be enabled or disabled (See Edit > Channel Information/ Channel Edit > Network Setting)
- Configuring **Site Group (Group ID List)** (See Edit > User List > Group ID List)
- Configuring **Site Group (Unit ID List)** (See Edit > User List > Unit ID List)

Avoiding Interference of Other Parties and Preventing Interference to Other Parties (Cross-busy)

The repeater can restrict transmission in order to prevent the transmission from interfering with other communications if the channel is being used by another subscriber unit when the repeater transmits using the Repeat PTT control, Network PTT control or Console PTT control, or transmits a beacon.

In order to use this function, an external transceiver that is used to monitor the transmit frequency of the repeater is required. Also, **Repeat Disable** needs to be assigned to an AUX Input port of the repeater.

If the BUSY signal is applied from an external transceiver monitoring the transmit frequency of the repeater to the AUX Input port to which **Repeat Disable** is assigned, the repeater determines whether to permit the transmission using the Repeat PTT control, Network PTT control or Console PTT control, or the transmission of a beacon.

According to the configuration in **Cross-busy**, the repeater behaves as follows:

Table 14-2 Cross-busy 1

Cross-busy Configuration	Description
Enabled	The repeater continues transmission even if **Repeat Disable** becomes enabled while the repeater is transmitting using the Repeat PTT control, Network PTT control or Console PTT control, or transmitting a beacon.
Disabled	The repeater stops transmission if **Repeat Disable** becomes enabled while the repeater is transmitting using the Repeat PTT control, Network PTT control or Console PTT control, or transmitting a beacon.

Also, the behavior varies as follows according to the transmission status of the repeater, the configuration for **Cross-busy**, and the status of **Repeat Disable/Enable**.

- **If the repeater starts the transmission using the Repeat PTT control, Network PTT control or Console PTT control, or the transmission of a beacon while not transmitting:**

Table 14-3 Cross-busy 2

Cross-busy Configuration	The Status of Repeat Disable/Enable	The Behavior of the Repeat PTT control/ Network PTT control/ Console PTT control/ Beacon
Enabled	Repeat Enable	Transmits.
	Repeat Disable	Does not transmit.
Disabled	Repeat Enable	Transmits.
	Repeat Disable	Does not transmit.

- **If the repeater starts the transmission using the Repeat PTT control, Network PTT control or Console PTT control having a higher priority while transmitting:**

Table 14-4 Cross-busy 3

Cross-busy Configuration	The Status of Repeat Disable/Enable	The Behavior of the Repeat PTT control/ Network PTT control/ Console PTT control
Enabled	Repeat Enable	Starts a new transmission.
	Repeat Disable	Starts a new transmission.
Disabled	Repeat Enable	Starts a new transmission.
	Repeat Disable	Does not transmit.

- **If the repeater is transmitting using the Repeat PTT control, Network PTT control or Console PTT control, or transmitting a beacon:**

Table 14-5 Cross-busy 4

Cross-busy Configuration	The Status of Repeat Disable/Enable	The Behavior of the Repeat PTT control/ Network PTT control/ Console PTT control/ Beacon
Enabled	Repeat Enable (no change)	Continues transmission.
	Repeat Enable → Repeat Disable	Continues transmission.
Disabled	Repeat Enable (no change)	Continues transmission.
	Repeat Enable → Repeat Disable	Stops transmission.

- **If the Repeat PTT control, Network PTT control or Console PTT control is enabled:**

Table 14-6 Cross-busy 5

Cross-busy Configuration	The Status of Repeat Disable/Enable	The Behavior of the Repeat PTT control/ Network PTT control/ Console PTT control
Enabled	Repeat Disable (no change)	Continues stopping transmission.
	Repeat Disable → Repeat Enable	Starts transmission.
Disabled	Repeat Disable (no change)	Continues stopping transmission.
	Repeat Disable → Repeat Enable	Starts transmission.

Configuration using KPG-D2

Configuring **Cross-busy** to be enabled or disabled (See Edit > Conventional IP Network > General > Cross-busy)

Avoiding Interference with Other Communications (Busy Channel Lockout (Cross-busy))

Busy Channel Lockout (Cross-busy) is the function used by the repeater to restrict the transmission automatically in order to avoid interfering with communications if the channel on which the repeater attempts to transmit using the Network PTT control or Console PTT control or to transmit a beacon is already used by other subscriber units.

According to the configuration in **Busy Channel Lockout (Cross-busy)**, the repeater behaves as follows:

Table 14-7 Busy Channel Lockout (Cross-busy)

Configuration	Description
No	**Busy Channel Lockout (Cross-busy)** is disabled. No transmission is restricted even if the NXDN digital channel on which the repeater attempts to transmit is busy.
Carrier Only	The repeater cannot transmit while the repeater is receiving a signal.
Incorrect RAN	The repeater cannot transmit if the repeater receives a signal and the received RAN code does not match the RAN code preconfigured for the repeater.
Correct RAN	The repeater cannot transmit if the repeater receives a signal and the received RAN code matches the RAN code preconfigured for the repeater.

According to the configuration in **Busy Channel Lockout (Cross-busy)** and the receiving conditions, the transmission is restricted as follows:

Table 14-8 Busy Channel Lockout (Cross-busy)

RAN Configuration	Receiving Conditions	Busy Channel Lockout Configuration		
		Carrier Only	Incorrect RAN	Correct RAN
Enabled	Receives only a signal.	Network PTT/ Console PTT: No Beacon: No	Network PTT/ Console PTT: No Beacon: No	Network PTT/ Console PTT: Yes Beacon: Yes
	Receives a signal and the RAN code does not match.	Network PTT/ Console PTT: No Beacon: No	Network PTT/ Console PTT: No Beacon: No	Network PTT/ Console PTT: Yes Beacon: Yes
	Receives a signal and the RAN code matches.	Network PTT/ Console PTT: No Beacon: No[*1]	Network PTT/ Console PTT: Yes Beacon: No[*1]	Network PTT/ Console PTT: No Beacon: No[*1]
None	Receives only a signal.	Network PTT/ Console PTT: No Beacon: No	Network PTT/ Console PTT: No Beacon: No	Network PTT/ Console PTT: Yes Beacon: Yes
	Receives a signal and the RAN code.	Network PTT/ Console PTT: No Beacon: No[*1]	Network PTT/ Console PTT: Yes Beacon: No[*1]	Network PTT/ Console PTT: No Beacon: No[*1]

[*1] No beacon is transmitted because the transmission starts using the Repeat PTT control.

Yes: Can transmit.

No: Cannot transmit.

Note

- If the priory order of Repeat PTT is configured to be higher than those of Network PTT and Console PTT in **PTT Priority**, the transmission by using the Network PTT control or Console PTT control cannot be executed.
- The repeater continues transmission even if the conditions for disabling the transmission by **Busy Channel Lockout (Cross-busy)** are satisfied while the repeater is transmitting using the Network PTT control or Console PTT control, or transmitting a beacon. However, if the transmission using the Repeat PTT control starts, the transmission using the Network PTT control or Console PTT control, or the transmission of a beacon stops.

Configuration using KPG-D2

Configuring **Busy Channel Lockout (Cross-busy)** to be enabled or disabled (See Edit > Conventional IP Network > General > Cross-busy)

Configuring the Target of an Intersite Call (Site Group Table)

Site Group Table is the table in which **Multicast IP Address** or **Unicast Site List** to be the target of an Intersite Call is configured in addition to **Multicast IP Address** or **Unicast Site List** configured for each channel.

This function is used to make an Intersite Call only to a local site or a specific site group, not to all the sites simultaneously. Configuring **Site Group Table** can avoid an Intersite Call to an unwanted site among the sites connected via an IP network.

By using KPG-D2, **Multicast IP Address** or **Unicast Site List** to be the target of an Intersite Call can be configured for each table of the maximum 64 tables.

Also, whether to use **Site Group Table** can be configured for each Group ID or Unit ID registered in **User List**. By using **Site Group Table**, the target of an Intersite Call can be changed for each Group ID or Unit ID. (Refer to Configuring the conditions to initiate an Intersite Call (Site Group).)

Note

- If multicast communications are used, network devices that support multicast communications need to be used.

Configuration using KPG-D2

Configuring **Site Group Table** (See Edit > Site Group Table)

Configuring the conditions to initiate an Intersite Call (Site Group)

Site Group is the function to determine how the repeater initiates an Intersite Call when a Group Call is initiated to the target Group ID or when an Individual Call is initiated to the target Unit ID.

By using KPG-D2, the behavior of the repeater when the repeater initiates an Intersite Call can be configured for each ID configured in **Group ID List** and **Unit ID List**.

According to the configuration in **Site Group**, the repeater behavior when initiating an Intersite Call varies as follows:

Table 14-9 Site Group

Configuration	Description
Local	No Intersite Call is initiated. The repeater transmits by only relaying the received signals.
Selected Channel	The repeater initiates the Intersite Call according to the **Site List** configured for the selected channel.
1 to 64 (Available number of Site Group Table)	The repeater initiates the Intersite Call according to the configuration in **Site Group Table** of the configured number. (Refer to Configuring the Target of an Intersite Call (Site Group Table).)

Note

- **Intersite Call** is the function that can be used in the Conventional IP network system. (Refer to CONVENTIONAL IP NETWORK SYSTEM.)

Configuration using KPG-D2

- Configuring **Group ID List** (See Edit > User List > Group ID List)
- Configuring **Unit ID List** (See Edit > User List > Unit ID List)
- Configuring **User List** to be enabled or disabled (See Edit > Channel Information/ Channel Edit)
- Configuring **Site Group** to be enabled or disabled (See Edit > Channel Information/ Channel Edit > Network Setting)
- Configuring **Site Group (Group ID List)** (See Edit > User List > Group ID List)
- Configuring **Site Group (Unit ID List)** (See Edit > User List > Unit ID List)

14.4 Configuring the IP Network Information

To operate the repeater in the Conventional IP network system, the repeater needs to be connected to the IP network and the configuration related to the IP network by using KPG-D2 is required.

Configuring for Broadcasting a Call in a Wide Area by Connecting Repeaters by Using an IP Connection (Intersite Call)

Intersite Call is the function to broadcast a call in a wide area by interconnecting multiple repeaters installed in different locations by using an IP network. By using this function, a subscriber unit can communicate with a distant subscriber unit via an IP network.

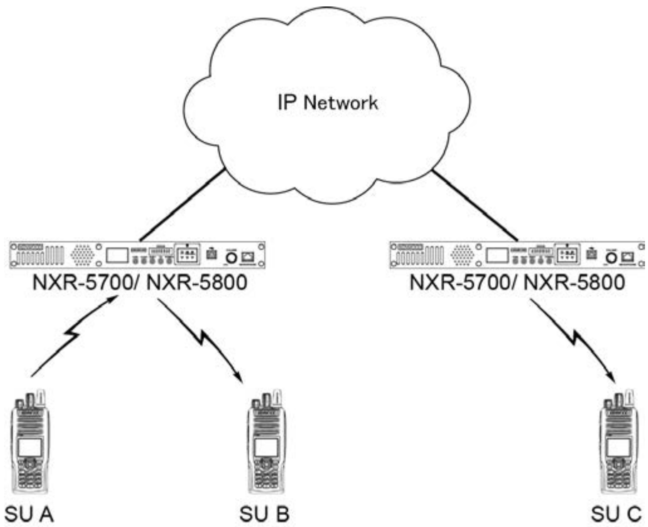


Figure 14-1 Conventional IP Network System

Connecting the repeaters with each other by using an IP network allows the subscriber unit A and subscriber unit C to communicate.

In order to use **Intersite Call**, **Intersite Call** needs to be enabled by using KPG-D2, and the target **Site Group** needs to be configured for each channel. Also, the configurations associated with an IP network, such as an IP address, need to be configured.

By configuring the target site of an Intersite Call in **Site Group Table**, the target of the Intersite Call can be changed for each Group ID or Unit ID by using **User List**. (Refer to Configuring the Target of an Intersite Call (Site Group Table).)

Behavior of the transmitting repeater (Intersite Call)

The repeater starts transmitting using the Repeat PTT control when the repeater receives an NXDN digital signal from a subscriber unit. Or, the repeater starts transmitting using the Console PTT control when the repeater receives packet data from an IP console. At the same time, the repeater transmits the received signal and packet data to another repeater that is interconnected by using an IP network.

If the transmitting repeater receives an NXDN digital signal from the subscriber unit and transmits the received signal by using the Repeat PTT control, or if the transmitting repeater receives packet data from the IP console and transmits the received packet data by using the Console PTT control, the transmitting repeater can make an Intersite Call. The transmitting repeater cannot make an Intersite call if the repeater receives an analog signal from a subscriber unit.

The transmitting repeater stops making an Intersite Call at the same time as when the transmission by using the Repeat PTT control or Console PTT control stops, and notifies the receiving repeater that an Intersite Call ends.

Note

- On the channel with “Mixed” configured in **Channel Type**, the transmitting repeater can make an Intersite Call only if the repeater sends an NXDN digital signal by using the Repeat PTT control.
- The transmitting repeater cannot make an Intersite Call if the repeater transmits using the **PTT** (microphone) switch or the External PTT control.
- Regardless of whether a subscriber unit makes a Group Call or an Individual Call, the transmitting repeater makes an Intersite Call for the target configured for each channel.

Behavior of the receiving repeater (Intersite Call)

The repeater, which receives an Intersite Call from the repeater that is interconnected by using an IP network, transmits the received signal by using the Network PTT control according to the configuration in **PTT Priority**. If the repeater receives Intersite Calls from multiple repeaters, the repeater sends the first received signal using the Network PTT control.

When the Intersite Call ends, the Network PTT control becomes disabled, and the repeater stops the transmission using the Network PTT control.

The receiving repeater can send the received signal using the Network PTT control by using the same RAN code that is used by the transmitting repeater. Or, the receiving repeater can transmit using the RAN code which is different from that the transmitting repeater used. Also, according to the configuration for User List, the repeater can determine whether the repeater sends the received signal using the Network PTT control. (Refer to Controlling the Intersite Call of the Receiving Repeater by Using a RAN Code (Network-wide RAN).)

Note

- If **Time-out Timer (TOT) (Network PTT)** is configured, transmission using the Network PTT control stops according to the configuration in **Time-out Timer (TOT) (Network PTT)**.
- If **Repeat Disable** is enabled, transmission using the Network PTT control cannot be executed. (Refer to Toggling the Repeat Behavior between Enabled and Disabled (Repeat Enable/Disable).)
- Even if **Take Over** is enabled, transmission using the Network PTT control can be executed. (Refer to Disabling Control from External Devices (Take Over).)

Configuration using KPG-D2

- Configuring **Intersite Call** to be enabled or disabled (See Edit > Conventional IP Network > General > Intersite Call)
- Configuring **Site Group** (See Edit > Channel Information/ Channel Edit > Network Setting)
- Configuring the IP network (See Edit > Conventional IP Network)

Configuring Whether to Deliver by Unicast Communications or by Multicast Communications (IP Casting)

IP Casting is the communication method used by the repeater to send and receive an Intersite Call in the Conventional IP network system.

According to the configuration in **IP Casting**, the repeater behaves as follows:

Table 14-10 IP Casting

Configuration	Description
Unicast	The repeater uses unicast communications when the repeater sends and receives an Intersite Call in the Conventional IP network system. Unicast communications is the communication method to send packet data to one site. If there are multiple target sites, the same packet data is sent multiple times. In order to use this communication method, the target site needs to be configured in **Unicast Site List** by using KPG-D2.
Multicast	The repeater uses multicast communications when the repeater sends and receives an Intersite Call in the Conventional IP network system. Multicast communications is the communication method to send packet data to multiple sites. Even if there are multiple target sites, the same packet data is delivered to each site if packet data is sent just once. In order to use this communication method, the target IP address needs to be configured in **Multicast IP Address** by using KPG-D2. The transmitting repeater sends packet data to this **Multicast IP Address** when the repeater makes an Intersite Call in multicast communications. The receiving repeater sends the received packet data by using the Network PTT control after receiving the packet data sent to the **Multicast IP Address** when the receiving repeater receives an Intersite Call.

Note

- A maximum of 16 repeaters can be interconnected if unicast communications are used. If multicast communications are used, the number of repeaters that can be interconnected varies depending on the type of network devices, such as a router.
- If multicast communications are used, network devices that support multicast communications need to be used.

Configuration using KPG-D2

- Configuring **IP Casting** (See Edit > Conventional IP Network > General > Intersite Call)
- Configuring **Unicast Site List** (See Edit > Site Group Table)
- Configuring **Multicast IP Address** (See Edit > Site Group Table)

Network Configuration for Unicast Communications

To transmit and receive an Intersite Call in unicast communications, the IP address of the target repeater for unicast communications and the IP network information of the repeater at the own station need to be configured by using KPG-D2.

Configuring the IP address of the target repeater for communications (Unicast IP Address List)

Unicast IP Address List is the list in which the IP address of each repeater interconnected by using an IP network is configured. The IP address configured in **Unicast IP Address List** becomes the target for transmission when the repeater makes unicast communications.

A maximum of 16 IP addresses can be configured in **Unicast IP Address List**, but one of the IP addresses is configured as the IP address of the repeater at the own station.

Note

- Site No.1 to Site No.16 in **Unicast IP Address List** correspond to **Site 1** to **Site 16** in **Unicast Site List**.

Configuring the IP information of the repeater at the own station (Unicast)

The following IP network information of the repeater at the own station is configured by using KPG-D2:

Table 14-11 Configuration of IP Information (Unicast)

Configuration	Description
Site Number	**Site Number** is the site number of the repeater at the own station used by the repeater to make unicast communications. The desired site number can be selected from the site numbers (1 to 16) of the IP address configured in **Unicast IP Address List**. By using the IP address configured for the selected site number, the repeater can make unicast communications.
IP Address	**IP Address** is the IP address of the repeater at the own station. If the repeater makes unicast communications, the IP address of the site configured in **Site Number** is automatically configured. Configure the IP address provided by the network administrator in **IP Address**.
Subnet Mask	**Subnet Mask** is the subnet mask number of the repeater at the own station. Configure the subnet mask number provided by the network administrator in **Subnet Mask**.
Default Gateway	**Default Gateway** is the gateway IP address that is used by the repeater at the own station. Enter the gateway IP address provided by the network administrator in **Default Gateway**.

Configuration using KPG-D2

- Configuring **Unicast IP Address List** (See Edit > Conventional IP Network > Network > Unicast IP Address List)
- Configuring the IP information of the repeater at the own station (See Edit > Conventional IP Network > Network > Own IP Address)

Network Configuration for Multicast Communications

To transmit and receive an Intersite Call in multicast communications, the IP address of the target multicast group for unicast communications and the IP network information of the repeater at the own station need to be configured by using KPG-D2.

Note

- If multicast communications are used, network devices that support multicast communications need to be used.

Configuring the IP address of the router to be used in multicast communications (Multicast IP Address)

Multicast IP Address is the IP address of the multicast group to be used for transmission and reception of an Intersite Call.

The transmitting repeater sends packet data to the IP address configured in **Multicast IP Address**.

If the receiving repeater receives the packets sent to the IP address configured in **Multicast IP Address**, the receiving repeater starts transmission by using the Network PTT control.

Configuring the IP information of the repeater at the own station (Multicast)

The following IP network information of the repeater at the own station is configured by using KPG-D2:

Table 14-12 Configuration of IP Information (Multicast)

Configuration	Description
IP Address	**IP Address** is the IP address of the repeater at the own station. If the repeater makes multicast communications, the IP address can be configured by being directly entered. Configure the IP address provided by the network administrator in **IP Address**.
Subnet Mask	**Subnet Mask** is the subnet mask number of the repeater at the own station. Configure the subnet mask number provided by the network administrator in **Subnet Mask**.
Default Gateway	**Default Gateway** is the gateway IP address that is used by the repeater at the own station. Enter the gateway IP address provided by the network administrator in **Default Gateway**.

Configuration using KPG-D2

- Configuring **Multicast IP Address** (See Edit > Site Group Table)
- Configuring the IP information of the repeater at own station (See Edit > Conventional IP Network > Network > Own IP Address)

Configuring to Reduce the Jitter of an IP Network Connection (Maximum/ Minimum Jitter Buffer Size)

Maximum Jitter Buffer Size

Maximum Jitter Buffer Size is the maximum length of time to store the received packet data in the buffer memory when the receiving repeater receives an Intersite Call.

In the case that voice communications are made by using Intersite Call, the transmitting repeater sends packet data at certain time intervals. On the other hand, there may be a variation in the intervals for packet data to reach the target site. Therefore, the receiving repeater starts sending the received packet data after the received packet data is stored in the buffer memory for once and the length of time configured in **Minimum Jitter Buffer Size** elapses.

Although the receiving repeater stores the received packet data in the buffer memory, the received packet data is discarded if the receiving repeater receives the packet data exceeding the value configured in **Maximum Jitter Buffer Size**. If the received packet data is discarded, quality of voice communications may be degraded due to audio interruption, etc.

Smaller buffer size reduces delay of the received audio, but the risk of interruption of the received audio increases. Larger buffer size reduces the risk of interruption of received audio, but delay of the received audio increases.

This function is available only for doing voice communications. The received packet data is not stored in the buffer memory if data communications are made.

Minimum Jitter Buffer Size

Minimum Jitter Buffer Size is the minimum length of time to store the received packet data in the buffer memory when the receiving repeater receives an Intersite Call.

In the case that voice communications are made by using Intersite Call, the transmitting repeater sends packet data at certain time intervals. On the other hand, there may be a variation in the intervals for packet data to reach the target site. Therefore, the receiving repeater starts sending the received packet data after the received packet data is stored in the buffer memory for once and the length of time configured in **Minimum Jitter Buffer Size** elapses.

Smaller buffer size reduces delay of the received audio, but the risk of interruption of the received audio increases. Larger buffer size reduces the risk of interruption of received audio, but delay of the received audio increases.

This function is available only for doing voice communications. The received packet data is not stored in the buffer memory if data communications are made.

Configuration using KPG-D2

Configuring **Maximum Jitter Buffer Size** (See Edit > Conventional IP Network > General > Intersite Call)

Configuring **Minimum Jitter Buffer Size** (See Edit > Conventional IP Network > General > Intersite Call)

14.5 Controlling the Intersite Call of the Receiving Repeater by Using a RAN Code (Network-wide RAN)

Network-wide RAN is the function to determine the behavior of the repeater which receives an Intersite Call when the repeater transmits using the Network PTT control.

According to the configuration in **Network-wide RAN**, the repeater which receives an Intersite Call behaves as follows:

Table 14-13 Network-wide RAN

Configuration	Description
Caller Site	The repeater which receives an Intersite Call transmits the received signal using the Network PTT control by using the RAN code that is same code as the RAN code used by the transmitting repeater. The RAN code can be changed for each call; hence the group can be distinguished by the RAN code while the same channel is shared among several groups. Also, the repeater does not confirm whether **User List** is enabled on the receiving channel even if the repeater receives an Intersite Call. Regardless of whether the configuration of **User List** has been done or not, the repeater transmits the received signal by using the Network PTT control.
Site Dependent	The repeater which receives an Intersite Call transmits using the RAN code configured for each repeater. If **Multiple Encode/Decode Table** is configured, the repeater transmits using the RAN code configured in **Multiple Encode/Decode Table**. If the received RAN code matches the RAN code preconfigured in **Multiple Encode/Decode Table**, the repeater transmits the received signal by using the Network PTT control. If **Multiple Encode/Decode Table** is not configured, the repeater transmits by using the RAN code configured for the channel. In this case, the repeater transmits the received signal by using the Network PTT control, regardless of whether the received RAN code matches the RAN code configured for the channel. If the repeaters sharing the same frequency are adjacent and the RAN code is used for distinction, and if the RAN code used for transmission is determined as license conditions for frequency, this configuration is used. Also, if the repeater receives an Intersite Call, the repeater confirms whether **User List** is enabled on the receiving channel. On the channel with **User List** enabled, the repeater transmits the received signal by using the Network PTT control only if the Unit ID or Group ID of the transmitting subscriber unit is enabled (Yes) in **User List**.

Note

- If a delivery area of Intersite Call is restricted by **User List** for each Unit ID or Group ID, combining Decode/ Encode RAN in each delivery area is recommended.

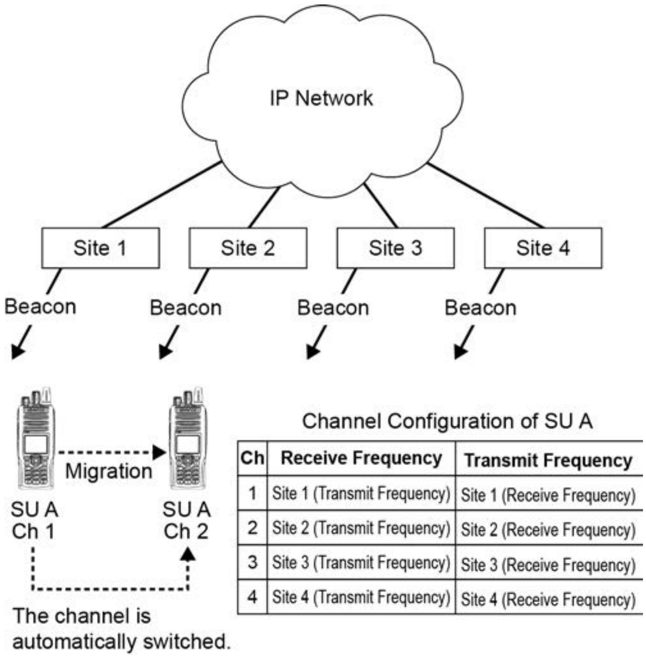
Configuration using KPG-D2

Configuring **Network-wide RAN** (See Edit > Conventional IP Network > General > Intersite Call)

14.6 Configuring Site Roaming

Site Roaming is the function to automatically migrate to the site (channel) providing better radio environment if a subscriber unit is operated in an NXDN Conventional system.

If a moving subscriber unit goes outside of the communication area, the subscriber unit can communicate via the repeater if there is an interconnected repeater by using an IP network in the location where the subscriber unit is used.



Ch	Receive Frequency	Transmit Frequency
1	Site 1 (Transmit Frequency)	Site 1 (Receive Frequency)
2	Site 2 (Transmit Frequency)	Site 2 (Receive Frequency)
3	Site 3 (Transmit Frequency)	Site 3 (Receive Frequency)
4	Site 4 (Transmit Frequency)	Site 4 (Receive Frequency)

Figure 14-2 Site Roaming

Each of the inter connected repeaters by using an IP network simultaneously transmit a beacon at certain time intervals. A subscriber unit measures the strength of the received beacon and then migrates to the site (channel) having the strongest signal automatically.

To use **Site Roaming**, **Intersite Call** and **Beacon** need to be enabled by using KPG-D2. Also, the configurations associated with an IP network, such as an IP address, need to be configured. (Refer to Configuring the IP Network Information.)

Note

- In order to use **Site Roaming**, the function associated with **Site Roaming** also needs to be configured for a subscriber unit.

Configuring Beacons (Beacon)

Each of the inter connected repeaters by using an IP network simultaneously transmit a beacon at certain time intervals. A subscriber unit measures the strength of the received beacon and then migrates to the site (channel) having the strongest signal automatically.

If **Beacon** is enabled, the repeater transmits a beacon by using the RAN code (Primary) configured for the channel at the time interval configured in **Transmit Interval Time**. (Refer to Configuring the Intervals to Transmit a Beacon (Transmit Interval Time).)

A beacon is transmitted for the length of time configured in **Duration**. (Refer to Configuring the Length of Time to Transmit a Beacon (Duration).)

If a subscriber unit receives a beacon, the subscriber unit detects the RSSI level and automatically migrates to the site of the strongest reception (Channel). However, a subscriber unit remains on the channel and does not start **Site Roaming** while the subscriber unit is receiving the signal with the RAN code matched during the communications. If the RAN code does not match or the received signal drops out, a subscriber unit starts **Site Roaming**.

Note

- The repeater can transmit a beacon only on the channel configured as follows:
  Operation Mode: Repeat or Duplex
  Channel Type: NXDN or Mixed
- The repeater cannot transmit a beacon while transmitting a signal, sending a CW ID, etc.

Configuration using KPG-D2

Configuring **Beacon** to be enabled or disabled (See Edit > Conventional IP Network > General > Site Roaming)

Configuring the Host Repeater (Host Repeater)

Host Repeater is the function to control the transmission of a beacon by each repeater interconnected by using an IP network.

By repeaters that are interconnected by using the IP network starting to transmit a beacon almost simultaneously, a subscriber unit can measure the strength of the received beacon and then automatically migrate to the site (channel) having the strongest signal.

Multiple repeaters start transmitting a beacon almost simultaneously with reference to the host repeater.

The host repeater notifies other repeaters interconnected via an IP network of the beginning of the transmission of a beacon at the same time as the host repeater transmits a beacon when the length of time configured in **Transmit Interval Time** elapses.

Repeaters other than the host repeater transmit a beacon upon lapse of the length of time configured in **Transmit Interval Time**. If the host repeater notifies the beginning of the transmission of a beacon to other repeaters, the repeaters synchronizes the timing to start transmitting a beacon.

The behavior of the repeater for notifying the arrival of timing to transmit a beacon varies depending on the configuration in **IP Casting** (Unicast or Multicast). (Refer to Configuring Whether to Deliver by Unicast Communications or by Multicast Communications (IP Casting).)

- **Unicast**

  The repeater notifies all IP addresses configured in **Unicast IP Address List** of the arrival of timing to transmit a beacon. (Refer to Configuring the IP address of the target repeater for communications (Unicast IP Address List).)

- **Multicast**

  The repeater notifies the IP address configured in **Common Multicast IP Address** of the arrival of timing to transmit a beacon.

According to the configuration in **Host Repeater**, the repeater behaves as follows:

Table 14-14 Host Repeater

Configuration	Description
Primary	In a Conventional IP network system, the repeater always behaves as the host repeater (Primary Host Repeater). If the repeater starts behaving as the host repeater, Status LED 1 of the repeater lights.
Secondary	In a Conventional IP network system, the repeater behaves as the secondary host repeater (Secondary Host Repeater). If the communications with the Primary Host Repeater are available, the Secondary Host Repeater synchronizes the timing to start transmitting a beacon with reference to the Primary Host Repeater. If the communications with the Primary Host Repeater are available, Status LED 1 of the repeater is unlit. If the communications with the Primary Host Repeater become unavailable such as due to communication failure, the Secondary Host Repeater starts behaving as the host repeater, and the Status LED 1 of the repeater lights. If the communications with the Primary Host Repeater are restored, the Secondary Host Repeater stops behaving as the host repeater, and the Status LED 1 of the repeater turns off.
Deselected (Continuous)	In a Conventional IP network system, the repeater does not behave as the host repeater. If the communications with the Primary Host Repeater are available, the repeater with **Deselected (Continuous)** configured synchronizes the timing to start transmitting a beacon with reference to the Primary Host Repeater. If the communications with the Primary Host Repeater are unavailable, the Secondary Host Repeater becomes the reference repeater. If the communications with both the Primary Host Repeater and the Secondary Host Repeater are unavailable, the repeater continues to transmit a beacon according to the configurations in **Duration** and **Transmit Interval Time**. At this time, Status LED 1 of each repeater flashes. If the communications with the Primary Host Repeater or Secondary Host Repeater are restored, the repeater synchronizes the timing to start transmitting a beacon with reference to the Primary Host Repeater or Secondary Host Repeater. At this time, Status LED 1 of each repeater turns off. When the repeater starts up, Status LED 1 flashes until the notification of the start of the transmission of a beacon is received from the host repeater. If the **Transmit Interval Time** of the repeater configured in **Deselected (Continuous)** elapses while Status LED 1 is flashing, a beacon is transmitted. Using this configuration can migrate a subscriber unit to a site requiring use of the subscriber unit even if communication failure is occurring in the site.

Configuration	Description
Deselected (Suspended)	In a Conventional IP network system, the repeater does not behave as the host repeater. If the communications with the Primary Host Repeater are available, the repeater with **Deselected (Suspended)** configured synchronizes the timing to start transmitting a beacon with reference to the Primary Host Repeater. If the communications with the Primary Host Repeater are unavailable, the Secondary Host Repeater becomes the reference repeater. If the communications with both the Primary Host Repeater and the Secondary Host Repeater become unavailable, Status LED 1 of each repeater flashes and the transmission of a beacon stops. If the communications with the Primary Host Repeater or Secondary Host Repeater are restored, the repeater synchronizes the timing to start transmitting a beacon with reference to the Primary Host Repeater or Secondary Host Repeater. At this time, Status LED 1 of each repeater turns off. When the repeater starts up, Status LED 1 flashes until the notification of the start of the transmission of a beacon is received from the host repeater. If the **Transmit Interval Time** of the repeater configured in **Deselected (Suspended)** elapses while Status LED 1 is flashing, a beacon is not transmitted. When communication failure is occurring in a site, using this configuration makes a subscriber unit receive a beacon of a different site and makes a subscriber unit difficult to stay in the site where the communication failure is occurring.

Note

- Configure one of the repeaters interconnected by using an IP network as the host repeater and the Secondary Host Repeater each.
- In principle, the repeater starts transmitting a beacon at the interval of **Transmit Interval Time** configured for the own station. Therefore, in order to synchronize the timing to start transmitting a beacon, the same value needs to be configured in **Transmit Interval Time** in each repeater. (Refer to Configuring the Intervals to Transmit a Beacon (Transmit Interval Time).)

Configuration using KPG-D2

Configuring **Host Repeater** (See Edit > Conventional IP Network > General > Site Roaming)

Configuring the Length of Time to Transmit a Beacon (Duration)

Duration is the length of time for which the repeaters interconnected by using an IP network continue to transmit a beacon.

The repeater must transmit a beacon until the subscriber unit determines the site providing good radio environment using the received beacon. If the number of repeaters interconnected by using an IP network increases, the length of time for a subscriber unit to determine the site providing a good radio environment increases; hence a long duration needs to be configured in **Duration**.

Configuration using KPG-D2

Configuring **Duration** (See Edit > Conventional IP Network > General > Site Roaming)

Configuring the Intervals to Transmit a Beacon (Transmit Interval Time)

Transmit Interval Time is the interval time at which the repeaters interconnected by using an IP network transmits a beacon.

The frequency at which the subscriber unit determines the site providing a better radio environment and then automatically migrates to the site (channel) can be controlled according to the configuration in **Transmit Interval Time**.

For instance, if the subscriber unit moves at a high speed, the subscriber unit frequently moves to accessible area of each site; hence the site providing a good radio environment frequently changes. In this case, configuring a short duration in **Transmit Interval Time** enables the subscriber unit to determine the site providing a better radio environment at short intervals.

In contrast, if the subscriber unit hardly moves from the accessible area of the same site, the subscriber unit does not need to determine the site providing a better radio environment at short intervals; hence a long duration can be configured in **Transmit Interval Time**.

Configuration using KPG-D2

Configuring **Transmit Interval Time** (See Edit > Conventional IP Network > General > Site Roaming)

14.7 Structuring a Voting System (Voting Repeater/ Voting Receiver)

Voting is the function to control a signal from a subscriber unit among the repeaters connected to a Conventional IP network system according to the level of the received signal.

Usually, the transmission power of a subscriber unit is lower than that of the repeater. Therefore, while a subscriber unit can receive the signal transmitted from the repeater to a subscriber unit, the repeater may not be able to receive a signal transmitted from a subscriber unit to the repeater. This function resolves the foregoing communication failure.

In order to use this function, the relay repeater to send the signal transmitted from a subscriber unit to an IP network and the control repeater to control the signal sent to an IP network are required. The relay repeater and the control repeater are referred to as Voting receiver and Voting repeater, respectively. In addition, the system structured with these repeaters is referred to as Voting system.

In a Voting system, multiple Voting receivers can be installed in the transmission area of the subscriber unit, and the signal from the subscriber unit can be sent to a Voting repeater via these repeaters.

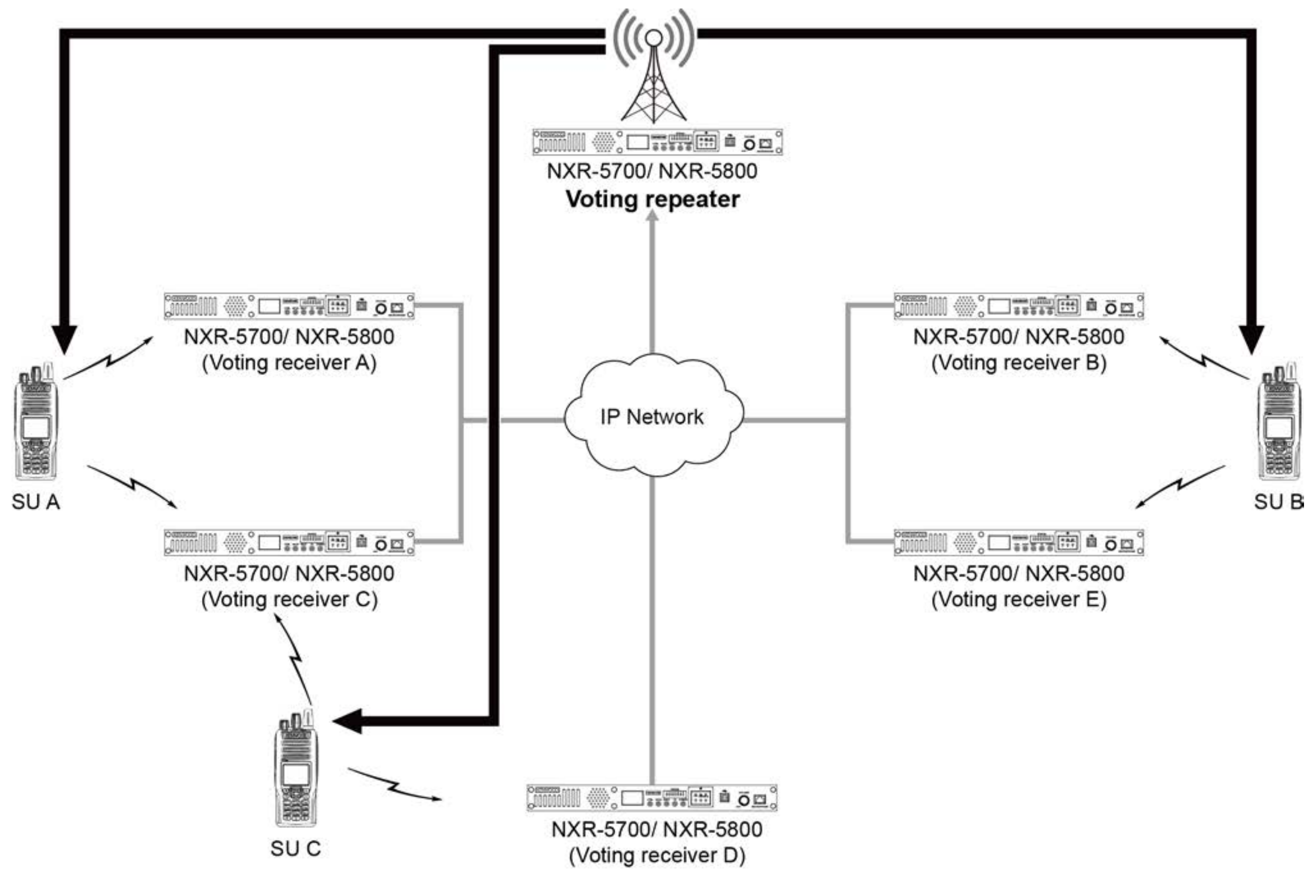


Figure 14-3 Voting System

Note

- In order to use a Voting system, the Conventional IP network system in each repeater needs to be enabled. (Refer to Configuring the IP Network Information.)

Basic Behaviors

A Voting system consists of 2 types of repeaters; Voting receivers and Voting repeaters. The following are the behaviors of each repeater.

Voting receiver behaviors

The Voting receiver is the relay repeater that sends the received signal from a subscriber unit to the Voting repeater via an IP network.

In addition to sending the signal received from a subscriber unit, the Voting receiver periodically sends the level of the received signal to the Voting repeater at 500-ms intervals via an IP network. The Voting repeater selects a Voting receiver to use according to the received level of the signal.

The IP address of the Voting receiver selected by the Voting repeater is notified to each Voting receiver by the Voting repeater. In order to prevent congestion on a network, only the Voting receiver having the specified IP address can send voice or data (the RTP packet) to an IP network.

The following figure shows the behavior example of each repeater if Voting receiver A (RSSI Level A) is selected.

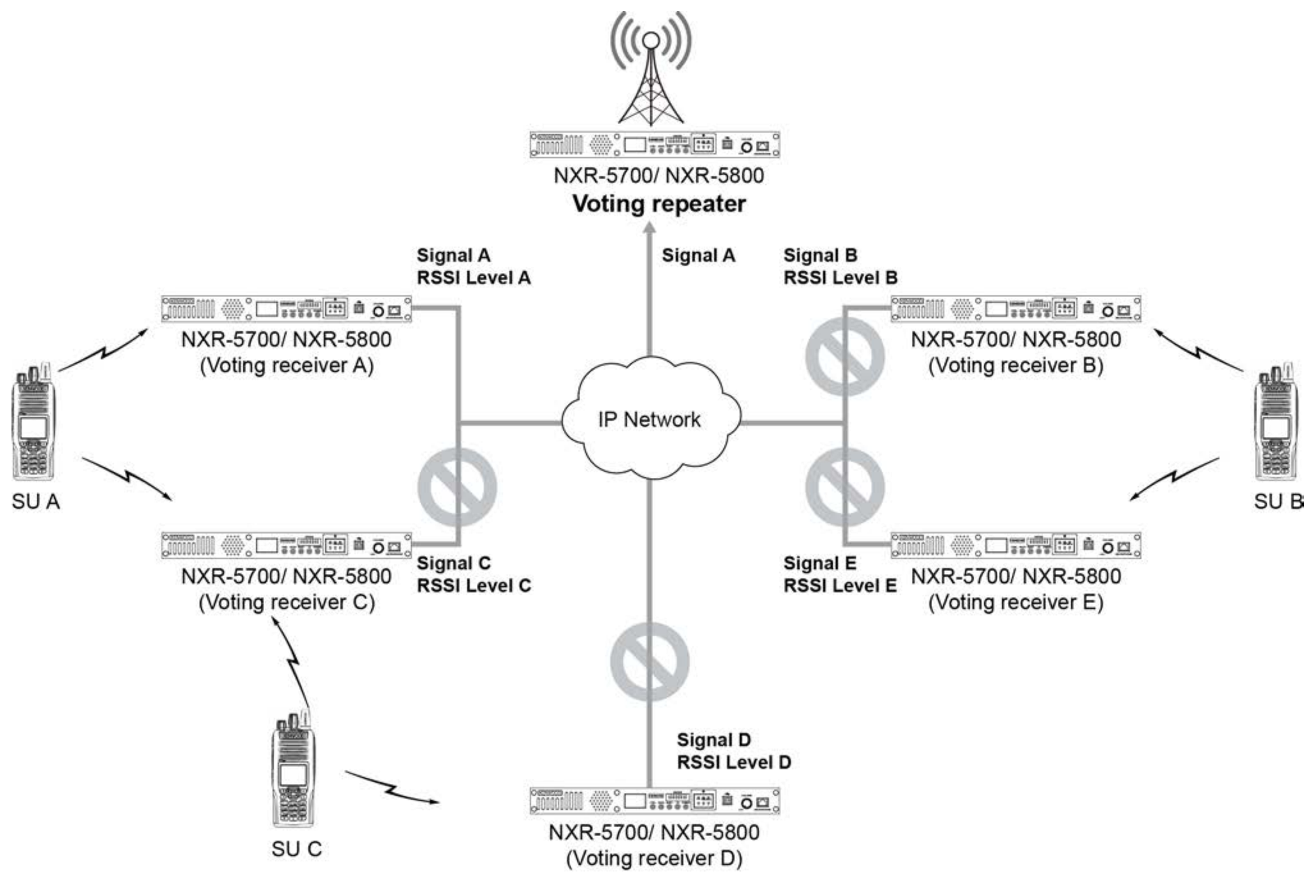


Figure 14-4 Behavior Example of Each Repeater in a Voting System

The Voting receiver selected by the Voting repeater starts transmission to an IP network, and CONT LED lights green.

The Voting receiver not selected by the Voting repeater stops transmission to an IP network, and CONT LED turns off. The received level of a signal is sent periodically to the Voting repeater even while the transmission to an IP network is stopped.

Voting repeater behaviors

The Voting repeater is the repeater to control the signals transmitted from multiple Voting receivers to an IP network.

The Voting repeater compares the level of the signal received from each Voting receiver via an IP network and sends only the signal received from the Voting receiver with the highest received level to the other subscriber units or sites.

The Voting repeater always monitors the level of the received signal transmitted from each Voting receiver via an IP network. If the Voting repeater detects the repeater satisfying the conditions for selecting the Voting receiver, the Voting repeater selects the Voting receiver. Also, the signal which the Voting repeater directly received from a subscriber unit is a candidate for selecting.

The IP address of the repeater selected by the Voting repeater is notified to each Voting receiver by the Voting repeater.

Note

- The channel with “Voting Receiver” configured in **Operation Mode** behaves as the Voting receiver. (Refer to Configuring the Operation Mode of the Repeater (Operation Mode).)
- The channel with “Voting Repeater” configured in **Operation Mode** behaves as the Voting repeater. “Voting Repeater” can be configured in **Operation Mode** only if **Voting Repeater** is enabled in **Enhanced Features** of KPG-D2. (Refer to Configuring the Operation Mode of the Repeater (Operation Mode).)
- By using KPG-D2, the IP address of the target Voting repeater can be configured. (Refer to Configuring the IP Address of a Voting Repeater.)
- Only if no transmit frequency is configured, the channel of the repeater can be configured as the Voting receiver. Therefore, the Voting receiver cannot transmit using wireless communications.
- The Voting receiver transmits the received signal or the level of the received signal to an IP network by using unicast communications regardless of the configuration in **IP Casting**.
- By using KPG-D2, the received level for the Voting repeater to determine whether to select a Voting receiver can be configured. (Refer to Configuring the Received Level for Starting to Search (RSSI Threshold), Configuring the Received Level for Determining a Voting Receiver (RSSI Hysteresis).)
- If “Unicast” is configured in **IP Casting**, up to 16 sites including Voting receivers and Voting repeaters can be configured. Also, if “Multicast” is configured in **IP Casting**, up to 15 Voting receivers can be configured for 1 Voting repeater. (Refer to Configuring Whether to Deliver by Unicast Communications or by Multicast Communications (IP Casting).)

Configuration using KPG-D2

Configuring **Voting Repeater** to be enabled or disabled (See Model > Product Information > Enhanced Features)

Configuring the IP Address of a Voting Repeater

The Voting receiver sends the signal received from a subscriber unit to the Voting repeater via an IP network. By using KPG-D2, the IP address of the target Voting repeater can be configured for each channel.

The configuration method varies as follows depending on the configuration in **IP Casting** (Unicast or Multicast):
(Refer to Configuring Whether to Deliver by Unicast Communications or by Multicast Communications (IP Casting).)

- **Unicast**

  If a site number (1 to 16) is configured in **Site Number** of the channel configured as a Voting receiver, the IP address of the corresponding Voting repeater is automatically configured.

- **Multicast**

  The IP address of the target Voting repeater is directly entered and configured in **IP Address** of the channel configured as a Voting receiver.

Configuration using KPG-D2

- Configuring **Site Number** (See Edit > Channel Information/ Channel Edit > Network Setting > Voting Repeater)
- Configuring **IP Address** (See Edit > Channel Information/ Channel Edit > Network Setting > Voting Repeater)

Configuring the Received Level for Starting to Search (RSSI Threshold)

RSSI Threshold is the received level for the Voting repeater to start searching for a Voting receiver having a signal level stronger than the signal level of the currently selected Voting receiver.

If the level of the signal received from the currently selected Voting receiver drops below the signal level configured in **RSSI Threshold**, the Voting repeater starts searching for switching to the Voting receiver having a higher signal level.

Configuration using KPG-D2

Configuring **RSSI Threshold** (See Edit > Conventional IP Network > General > Voting)

Configuring the Received Level for Determining a Voting Receiver (RSSI Hysteresis)

RSSI Hysteresis is the received level at which Voting Repeater determines whether to select the Voting Receiver.

If the level of the signal received from the currently selected Voting receiver drops below the signal level configured in **RSSI Threshold**, the Voting repeater starts searching for switching to the Voting receiver having a higher signal level. If Voting receivers having received levels higher than the value acquired by adding the values configured in **RSSI Threshold** and **RSSI Hysteresis** are found during the search for Voting receivers, the Voting repeater switches to the Voting receiver having the highest received level among these Voting receivers.

Configuration using KPG-D2

Configuring **RSSI Hysteresis** (See Edit > Conventional IP Network > General > Voting)

14.8 Transmitting the Received Signal to Only a Network (RF Link)

RF Link is the mode in which the repeater transmits the received signal only to a Conventional IP network upon receipt of a signal. If the received RAN code matches the RAN code preconfigured for the repeater, the repeater sends the received signal to the Conventional IP network. Although the signal sent to the Conventional IP network is the same as the one transmitted by the repeater relaying the received signal, this signal is not transmitted using the transmit frequency. However, if the repeater receives a signal from the Conventional IP network, the repeater transmits the received signal using the transmit frequency.

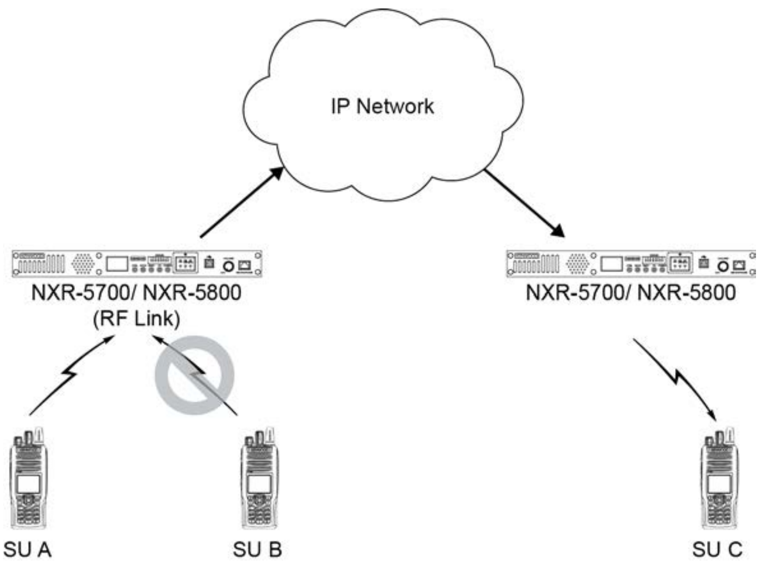


Figure 14-5 RF Link Connection

Note

- This mode can be used only on a channel with “RF Link” configured in **Operation Mode**. (Refer to Configuring the Operation Mode of the Repeater (Operation Mode).)

14.9 Configuring an IP Console

The IP console is the function that enables communication with a subscriber unit by connecting an IP console and a conventional repeater from outside the wireless area by using NXIP Console Interface.

To use this function, the Unit ID of the IP console to be permitted to connect to the Conventional repeater needs to be configured in **IP Console ID List**. Also, the priority order to use the Conventional repeater can be configured for each Unit ID of the configured IP console.

Note

- NXIP Console Interface is the interface specifications defined for connecting an IP console to a Conventional repeater. Refer to the NXIP Console Interface manual for details of the NXIP Console Interface.

Configuration using KPG-D2

Configuring **IP Console ID List** (See Edit > Conventional IP Network > IP Console)

Registration Behavior of IP Console

To make a voice or data communication to a subscriber unit by connecting an IP console and a conventional repeater by using the IP console, the use of the repeater needs to be previously declared. This occurs when the Unit ID of an IP console is registered in the repeater by a Registration request of NXIP Console Interface.

Use of the repeater is permitted if the repeater receives a Registration request from an IP console and the Unit ID of the IP console matches the Unit ID configured by using KPG-D2. By permitting use of the repeater, the transmission and reception of audio or data are enabled in the IP console.

For an IP console to receive a Group Call, the Group ID that the IP console waits to receive needs to be registered in the repeater by a Group Registration request of NXIP Console Interface.

In Group Registration of an IP console, multiple Group IDs can be registered in the repeater at the same time. Up to 20 Group IDs can be registered for each IP console at the same time.

Transmission Behavior of IP Console

If the Console PTT control is enabled by receiving a call request from an IP console and transmission is enabled, the repeater starts RF transmission of audio and data packets received from the IP console, and the repeater transmits to other sites, according to the configuration in **PTT Priority**. In this case, on a channel with **User List** enabled, whether an ID transmitted by using the Console PTT control is permitted in **User List** is checked.

The RAN codes used when the repeater transmits using the Console PTT control are as follows:

Table 14-15 RAN Codes Used When Transmitting Using the Console PTT Control

Call Request of the IP Console	RAN Code Transmitted Using the Console PTT Control
Call request for a communication not participated by the IP Console	The IP console specifies the RAN code when making a call request in NXIP Console Interface. If the specified RAN code matches the RAN Decode code configured by using KPG-D2, the repeater transmits using the Console PTT control with the corresponding RAN Encode code.
Call request for a communication participated by the IP Console	The repeater transmits using the Console PTT control with the RAN Encode code used in the most recent transmission.

Note

- Communications not participated by the IP console indicate new communications occurring while the repeater is not in use, and communications of differing combinations of RAN code and ID.
- Communications participated by the IP console indicate communications on the repeater and communications of matching combinations of RAN code and ID. This also corresponds when a call request is made by the IP console while the hold time is counting down. In this case, the repeater transmits using the Console PTT control with the RAN Encode code used for the communication immediately preceding the start of the hold time countdown.
- Audio or data transmission using the IP console can be executed only on a channel configured as below:

  Conventional IP Network: Enabled

  Operation Mode: Repeat

  Channel Type: NXDN or Mixed
- If **Repeat Disable** is enabled, transmission using the Console PTT control cannot be executed.

Reception Behavior of IP Console

For an IP console to receive audio or data from a subscriber unit, the Unit ID, RAN code to wait to receive, and Group ID of the IP console needs to be registered in the repeater by a Registration request of NXIP Console Interface.

If a digital signal is received from a subscriber unit and transmission is started using the Repeat PTT control, or if an Intersite Call is received from another repeater connected by the IP and transmission is started using the Network PTT control, the repeater starts transmission of audio or data packets for the IP console when the combination of the RAN code and ID of this communication matches the RAN code and ID preconfigured for the IP console.

Note

- The repeater transmits audio and data packets to the IP console only on a channel with the Conventional IP network enabled.
- In transmission using the Local Mic PTT control and External PTT control, audio and data packets are not transmitted to the IP console.
- In transmission using the Repeat PTT control with an analog signal, audio and data packets are not transmitted to the IP console.

Priority Order (Priority) for Using the Conventional Repeater

The priority order to use the Conventional repeater can be configured for each IP console.

If the repeater is being used for transmission from another IP console having a lower priority while an IP console having a higher priority transmits audio or data, the IP console having a higher priority is reserved as the next user of the repeater. When the transmission by an IP console having a lower priority ends, the repeater disconnects the communication and switches to the transmission from the reserved IP console without starting the hold time countdown.

If prioritizing transmission from a specific IP console, this function enables transmission from the IP console as much as possible.

If another IP console is transmitting when the IP console makes a call request, the repeater behaves as follows depending on the configuration in **Priority**:

Table 14-16 Repeater Behavior Depending on the Configuration in Priority

Priority Order of the IP Console Making a Call Request	Repeater Behaviors
Higher priority order than the transmitting IP console	The call request is received and the use of the repeater is reserved. When the transmission by the transmitting IP console ends, the repeater switches to transmission from the reserved IP console.
Priority order equal to or lower than the transmitting IP console	The call request is rejected and communication by the transmitting IP console continues.

Note

- If a call request from another IP console having a higher priority is made while an IP console reserving use of the repeater exists, the use of the repeater is reserved only by the IP console having the highest priority, and the call request of the previously reserved IP console is rejected.
- This function determines the IP console using the repeater by the priority order of the IP consoles. The behavior when an IP console makes a call request while the repeater is in use by another PTT control corresponds to the configuration in **PTT Priority**.
- If a call request from another IP console having a higher priority is reserved while an IP console is transmitting data, the repeater switches to transmission from the reserved IP console at the timing of starting the hold time countdown, even if data transmission is incomplete.
- **Priority** of each IP console functions only when a communication where the combination of the communication already occurring on the repeater and the RAN code, ID, and call type differ.
- When a communication occurs where the combination of the RAN code, ID, and call type is the same as the combination of the communication already occurring on the repeater, the call request of the IP console is rejected regardless of the priority order.

Configuration using KPG-D2

Configuring **Priority** of an IP console (See Edit > Conventional IP Network > IP Console > IP Console ID List)

15 TELEPHONE INTERCONNECT

Telephone Interconnect is the function that interconnects between a NEXEDGE system and a telephone line via an IP network to establish a communication between a subscriber unit and a telephone. Connection to a telephone line, such as PSTN and PABX, can be made via a telephone patch by connecting an optional Interconnect Adapter (KTI-4) to an IP network of a NEXEDGE system.

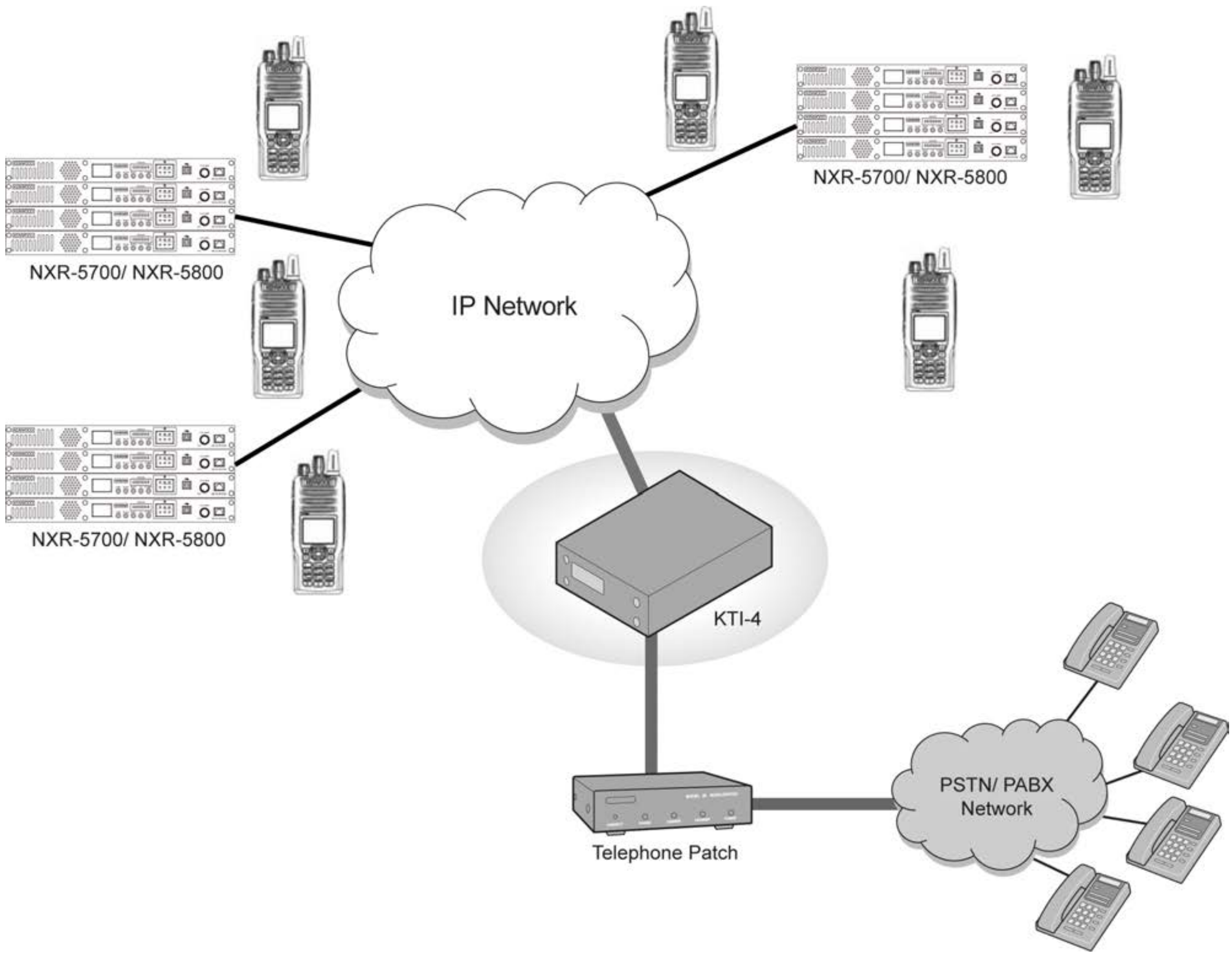


Figure 15-1 Example of the System Structure

For details of this function, refer to the manual for “Telephone Interconnect KTI-4” supplied separately.

If the repeater is operated in the NXDN digital base station mode, individual calls and group calls can be made by using an NXDN ID. Also, various calls such as status messages, short messages, and long messages can be made by using the communication ports of the repeater.

If the repeater is operated in a Conventional IP network system, voice calls such as Intersite Calls and Console Calls can be made.

16.1 Voice Calls in the NXDN Digital Base Station Mode (Selective Call)

Selective Call is the function to make a call by specifying a Unit ID or a Group ID in the NXDN digital base station mode. The call specifying a Unit ID is referred to as Individual Call, and the call specifying a Group ID is referred to as Group Call.

Individual Call and Group Call can be made after the following functions are configured in the repeater by using KPG-D2:

- Optional Signaling (NXDN)
- Selcall on PTT (NXDN)
- Unit ID List
- Group ID List

Note

- Selective Call can be made only on a channel with “Simplex” or “Duplex” is configured in **Operation Mode**. (Refer to Configuring the Operation Mode of the Repeater (Operation Mode).)

Making an Individual Call

Individual Call is the function to initiate a call to the target party individually to establish voice calls. By specifying an Unit ID, the only subscriber unit having the specified Unit ID can be called.

Initiating an Individual Call

An Individual Call can be started by one of the following methods:

- **Selcall on PTT**

  An Individual Call can be started by selecting the channel where the target Unit ID to be called by **Selcall on PTT** is configured and then pressing the **PTT** (microphone) switch. (Refer to Executing an Individual Call by Pressing the PTT (Microphone) Switch (Selcall on PTT).)

  The target Unit ID can be configured for each channel by selecting only one ID from **Unit ID List** by using KPG-D2. (Refer to Unit ID List.)

- **Talkback**

  An Individual Call can be started for the received Unit ID by pressing the **PTT** (microphone) switch after receiving a call using Individual Call until the length of time configured in **Auto Reset Timer** elapses. (Refer to Configuring Auto Reset Timer.)

- **PC command**

  An Individual Call can be started by sending a transmission command for an Individual Call from a PC to the communication port of the repeater. In order to use a PC command, “Data” or “Data + GPS Data Output” needs to be assigned to the communication port of the repeater. (Refer to Making Serial Command Communications by Using Communication Ports.)

Receiving an Individual Call

The repeater can wait to receive an Individual Call on a channel with “NXDN ID” configured in **Optional Signaling (NXDN)**. (Refer to Controlling the Speaker Mute by the Received Optional Signaling (NXDN).)

The repeater can receive an Individual Call if the received Unit ID matches the Unit ID (Own) preconfigured for the repeater. (Refer to Configuring the Unit ID or ID Name of the Repeater.)

If Selective Call Alert LED is enabled, BUSY LED flashes orange when the repeater receives an Individual Call. (Refer to Selective Call Alert LED.)

Making a Group Call

Group Call is the function that allows you to establish two-way group voice communications by initiating a call to a group. By specifying a Group ID, the all subscriber units having the same Group ID can be called.

Initiating a Group Call

A Group Call can be started by one of the following methods:

- **Selcall on PTT**

  A Group Call can be started by selecting the channel where the target Group ID to be called by **Selcall on PTT** is configured and then pressing the **PTT** (microphone) switch. (Refer to Executing an Individual Call by Pressing the PTT (Microphone) Switch (Selcall on PTT).)

  The Group ID of the target subscriber unit can be configured for each channel by selecting only one ID from **Group ID List** by using KPG-D2. (Refer to Group ID List.)

- **Talkback**

  A Group Call can be started for the received Group ID by pressing the **PTT** (microphone) switch after receiving a call using Group Call until the length of time configured in **Auto Reset Timer** elapses. (Refer to Configuring Auto Reset Timer.)

- **PC command**

  A Group Call can be started by sending a transmission command for a Group Call from a PC to the communication port of the repeater. In order to use a PC command, “Data” or “Data + GPS Data Output” needs to be assigned to the communication port of the repeater. (Refer to Making Serial Command Communications by Using Communication Ports.)

Receiving a Group Call

The repeater can wait to receive a Group Call on a channel with “NXDN ID” configured in **Optional Signaling (NXDN)**. (Refer to Controlling the Speaker Mute by the Received Optional Signaling (NXDN).)

The repeater can receive a Group Call if the received Group ID matches the Group ID preconfigured for the repeater.

If **Selective Call Alert LED** is enabled, BUSY LED flashes orange when the repeater receives a Group Call. (Refer to Selective Call Alert LED.)

Making an All Groups Call

All Groups Call is the function that allows you to establish two-way group voice communications by initiating a call to all groups. If using a Group ID with “ALL” configured in **Group ID List** when sending a Group Call, the repeater can call all groups. (Refer to Making a Group Call.)

16.2 Voice Calls in a Conventional IP Network System

In a Conventional IP network system, by interconnecting multiple repeaters by using an IP network, a subscriber unit can communicate with a distant subscriber unit by using voice calls such as Intersite Calls and Console Calls.

Making an Intersite Call

Intersite Call is the function to broadcast a call in a wide area by interconnecting multiple repeaters installed in different locations by using an IP network. By using this function, a subscriber unit can communicate with a distant subscriber unit via an IP network.

Refer to "Configuring for Broadcasting a Call in a Wide Area by Connecting Repeaters by Using an IP Connection (Intersite Call)" for the behavior and configuration of **Intersite Call**.

Making a Console Call

Console Call is the function that enables communication with a subscriber unit by connecting an IP console and a conventional repeater from outside the wireless area by using NXIP Console Interface.

Refer to "Configuring an IP Console" for the behavior and configuration of Console Call.

Note

- For a Console Call in a NEXEDGE Trunking system, the following communication functions are available:
  - Status Call
  - Remote Control
  - Short Data Call
  - Voice Call
  - Data Call
- Refer to "NEXEDGE 2nd Generation Function Reference" for the details of a Console Call in a NEXEDGE Trunking system.

16.3 Data Calls

In the NXDN digital base station mode, various data calls such as status messages, short messages, and long messages can be made by using the communication ports of the repeater.

Making a Status Call

Status Call is the simple messaging system to send and receive a status number. Since the message is replaced by a status number to be communicated, communications can take place quickly and communication traffic can be reduced.

If a command to transmit a status message is sent to the communication port of the repeater from a PC, the repeater sends a status message.

The status number 1 to 207, and 226 can be sent by the repeater. 226 is the reserved status number used as Emergency Termination.

The received status message is sent from the communication port by using **Status Message Serial Output**. (Refer to Status Message Serial Output.)

Note

- Refer to the PC Interface Protocol manual for the details of a PC command.
- In order to make a Status Call, “Data” or “Data + GPS Data Output” needs to be assigned to any communication port. (Refer to Making Serial Command Communications by Using Communication Ports.)
- A status message can be sent and received only on an NXDN digital channel or mixed channel of the repeater operated in the base station mode. However, even on a mixed channel, no status message can be sent if the transmission mode is analog.
- If a status message is received on a mixed channel, an acknowledgment is sent in the NXDN digital mode even if the transmission mode is analog.
- In order to receive a status message, the received RAN code needs to match the RAN code preconfigured for the repeater.
- During transmission, the repeater cannot receive a status message. Also during transmission, the repeater cannot send a status message even if a transmission command for a status message is sent from a PC to the communication port.

Making a Short Data Call

Short Data Call is the function for message communications to send and receive a maximum of 100-character message. Short Data Call can accurately send information that is difficult to send by voice, such as an address or a telephone number, by using characters.

If a command to transmit a short message is sent to the communication port of the repeater from a PC, the repeater sends a short message.

The received short message can be sent from the communication port by using **Short Message Serial Output**. (Refer to Status Message Serial Output.)

Note

- Refer to the PC Interface Protocol manual for the details of a PC command.
- In order to make a Short Data Call, “Data” or “Data + GPS Data Output” needs to be assigned to any communication port. (Refer to Making Serial Command Communications by Using Communication Ports.)
- A short message can be sent and received only on an NXDN digital channel or mixed channel of the repeater operated in the base station mode. However, even on a mixed channel, no short message can be sent if the transmission mode is analog.
- If a short message is received on a mixed channel, an acknowledgment is sent in the NXDN digital mode even if the transmission mode is analog.
- In order to receive a short message, the received RAN code needs to match the RAN code preconfigured for the repeater.
- During transmission, the repeater cannot receive a short message. Also during transmission, the repeater cannot send a short message even if a transmission command for a short message is sent from a PC to the communication port.

Making a Long Data Call

Long Data Call is the function for message communications to send and receive a maximum of 4,096-character message. This function is used for the intercommunication among external devices, such as MDT or a PC, via a subscriber unit.

If a command to transmit a long message is sent to the communication port of the repeater from a PC, the repeater sends a long message. The received long message is sent from the communication port.

Note

- Refer to the PC Interface Protocol manual for the details of a PC command.
- In order to make a Long Data Call, “Data” or “Data + GPS Data Output” needs to be assigned to any communication port. (Refer to Making Serial Command Communications by Using Communication Ports.)
- A long message can be sent and received only on an NXDN digital channel or mixed channel of the repeater operated in the base station mode. However, even on a mixed channel, no long message can be sent if the transmission mode is analog.
- If a long message is received on a mixed channel, an acknowledgment is sent in the NXDN digital mode even if the transmission mode is analog.
- In order to receive a long message, the received RAN code needs to match the RAN code preconfigured for the repeater.
- During transmission, the repeater cannot receive a long message. Also during transmission, the repeater cannot send a long message even if a transmission command for a long message is sent from a PC to the communication port.

A.1 LED

The repeater is equipped with various LEDs.

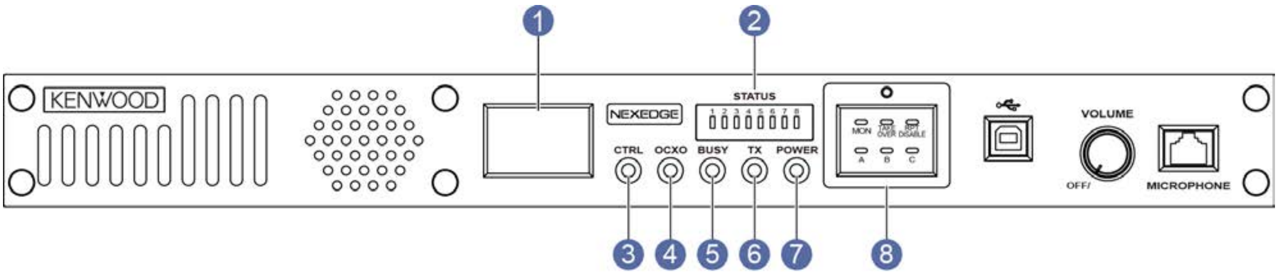


Figure A-1 Front Panel

❶ **17-segment LED display**
Displays the channel name and error status with the 2-digit 17-segment LED display. (Refer to 17-segment LED.)

❷ **STATUS LED**
Notifies the repeater status with 8 STATUS LEDs. (Refer to STATUS LED.)

❸ **CTRL LED**
Lights green when the repeater behaving as a Voting receiver starts transmission to an IP network in a Voting system of an NXDN Conventional system. (Refer to Structuring a Voting System (Voting Repeater/ Voting Receiver).)
Lights or flashes green when the repeater is operated as a control channel if the repeater is operated in a trunking system. (Refer to Control Channel LED.)

❹ **OCXO LED**
This LED is used when the repeater is operated in a trunking system. (Refer to OCXO LED.)

❺ **BUSY LED**
Lights green while the repeater is receiving a signal. (Refer to BUSY LED.)

❻ **TX LED**
Lights red while the repeater is transmitting. (Refer to TX LED.)

❼ **POWER LED**
Lights green when the repeater is turned on. (Refer to POWER LED.)

❽ **PF key**
If any **PF** key is pressed, the LED lights red and the function assigned to the key is activated or enabled. (Refer to AVAILABLE FUNCTIONS FOR THE PF KEYS.)
If the repeater is operated in a trunking system, the functions assigned to the **[MON]**, **[TAKE OVER]** and **[RPT DISABLE]** keys at the top are fixed. The **[A]**, **[B]**, and **[C]** keys at the bottom cannot be used. (Refer to PF Key with LED.)

STATUS LED

The repeater is equipped with 8 STATUS LEDs, which display the communication status of the repeater in the NXDN digital mode.

STATUS LEDs are the LEDs for checking whether the repeater is properly operated.

When a failure occurs in the repeater, the cause of the failure can be confirmed. STATUS LEDs are STATUS LED 1 to STATUS LED 8 in order from the left. STATUS LEDs notify users of the following statuses:

Table A-1 STATUS LED

STATUS LED	Description
1	LED 1 flashes when the repeater starts up. LED 1 turns off if the repeater starts up properly. If the repeater is operated in a trunking system, LED 1 lights if the repeater is the master unit of a SYNC signal.
2	LED 2 lights while the repeater is transmitting a Long Data Call.
3	LED 3 lights while the repeater is transmitting a Voice Call.
4	If the repeater is used as a control channel, LED 4 shows that a trunking control signal is being transmitted. If the trunking control signal is transmitting properly, LED 4 rapidly flashes. If the repeater is used as a traffic channel or Conventional Channel, LED 4 shows the following behaviors: • LED 4 momentarily lights upon transmission of data, such as status messages, along with a Voice Call. • While making a Voice Call in a Digital Narrow system, because the audio frames and data frames are alternately transmitted, LED 4 flashes at these transmission intervals. • LED 4 momentarily lights upon completion of a Voice Call or Long Data Call.
5	LED 5 lights while the repeater is receiving a Long Data Call.
6	LED 6 lights while the repeater is receiving a Voice Call.
7	If the repeater is used as a control channel, LED 7 shows that a trunking control signal is being received. If a subscriber unit transmits by random access and if the repeater receives the control signal, LED 7 momentarily lights. If access is congested from multiple subscriber units, LED 7 may rapidly flash. While the repeater is used as a traffic channel or Conventional Channel, LED 7 shows the following behaviors: • LED 7 momentarily lights upon receipt of data, such as status messages, along with a Voice Call. • While making a Voice Call in a Digital Narrow system, because the audio frames and data frames are alternately received, LED 7 flashes at these reception intervals. • LED 7 momentarily lights upon completion of a Voice Call or Long Data Call.
8	If an error is detected in the received data, LED 8 lights. LED 8 may also light in response to noise. Although LED 8 may also momentarily light when a call is completed, this is not a failure.

Control Channel LED

The Control Channel LED lights or flashes green while the repeater is operated as a control channel in trunking mode. The Control Channel LED displays the following statuses.

Table A-2 Control Channel LED

State of the LED	Description
Green (solid)	The repeater is operated as a control channel.
Green (flashing)	The repeater behaves as a traffic channel by **Non-dedicated Control Channel**. The LED stops flashing and remains lit when the repeater returns to a normal control channel. (Refer to Using a Control Channel as a Traffic Channel (Non-dedicated Control Channel).)
Disappears	The repeater is operated as a traffic channel. Or, the repeater is in conventional mode.

OCXO LED

The OCXO LED indicates the status of the 10 MHz reference oscillator.

To operate a system using Very Narrow channel spacing, a very accurate reference oscillator is required for the repeater. A reference oscillator needs to be externally connected to the repeater or the OCXO unit (KXK-3 M3) needs to be installed in the repeater.

Table A-3 OCXO LED

State of the LED	Description
Disappears	The reference signal from the VCTCXO installed in the repeater is used.
Green (solid)	KXK-3 M3 is correctly installed in the repeater and KXK-3 M3 supplies reference signals to other repeaters.
Orange (solid)	The repeater receives reference signals from external devices or other repeaters.
Red (solid)	Reference signals are not normally supplied even though reference signals are inputted from KXK-3 M3 or external resource.

BUSY LED

The LED lights green when the repeater receives a signal regardless of digital mode and analog mode. Also, the LED flashes green when the reception PLL is unlocked.

TX LED

The LED lights red while the repeater is transmitting. Also, the LED flashes red when the transmission PLL or reference signal PLL is unlocked.

POWER LED

The LED lights green when the repeater is turned on.

PF Key with LED

If any **PF** key is pressed, the LED lights red and the function assigned to the key is activated or enabled.
The following are the defaults of each key.

Table A-4 Defaults of PF Keys

PF key	Default
MON	Monitor On/Off
TAKE OVER	Take Over On/Off
RPT DISABLE	Repeat Enable/Disable
A	None
B	Channel Down
C	Channel Up

Note

- Refer to "AVAILABLE FUNCTIONS FOR THE PF KEYS" for available functions for the **PF** keys.
- If the repeater is operated in a trunking system, the functions assigned to the **[MON]**, **[TAKE OVER]** and **[RPT DISABLE]** keys at the top are fixed. The **[A]**, **[B]**, and **[C]** keys at the bottom cannot be used.

17-segment LED

The repeater displays alphanumeric characters and symbols by turning on or off 16-segment LEDs and a dot.

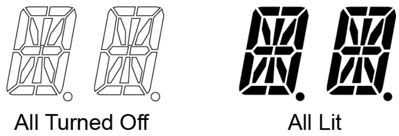


Figure A-2 17-segment LED

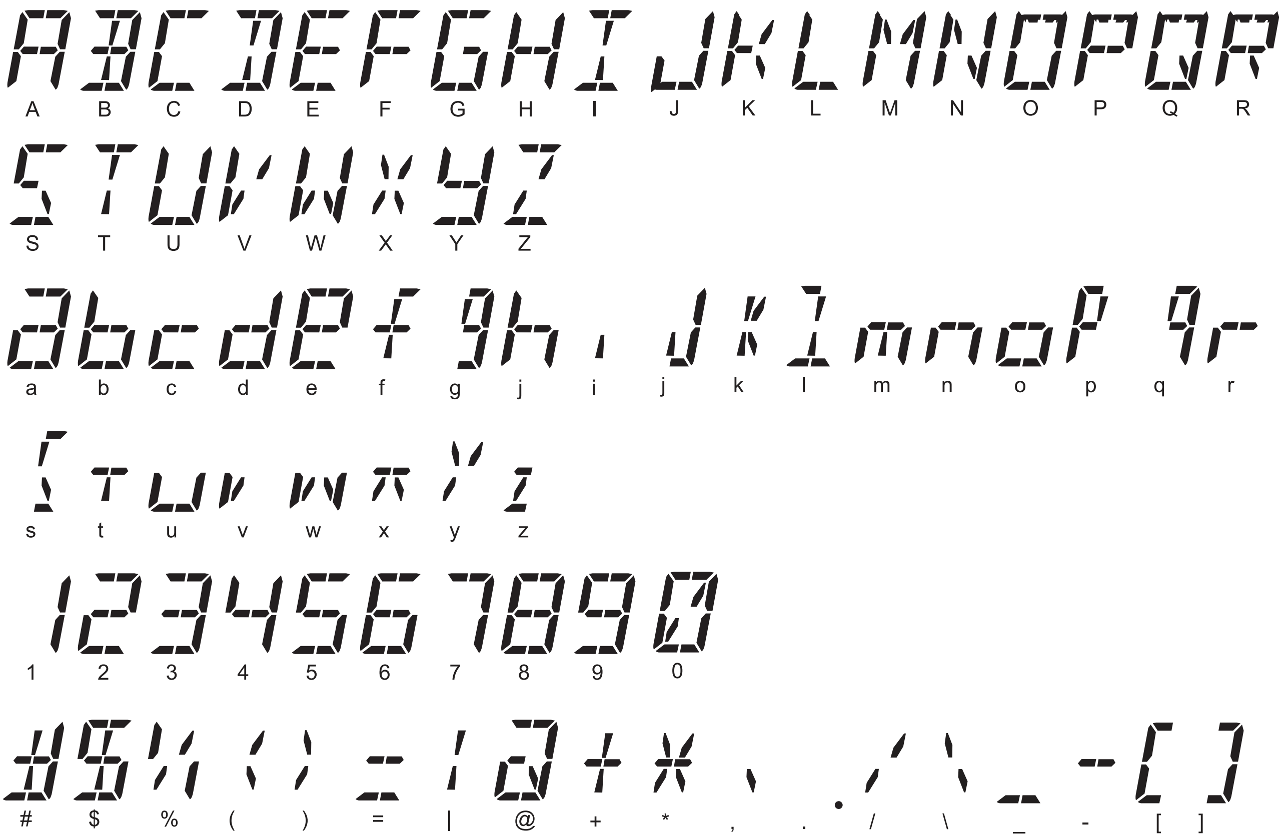


Figure A-3 Displayable Alphanumeric Characters and Symbols

Table A-5 Display of 17-segment LED

Repeater Status	LED Display	Remarks
PC Programming Mode PC Test Mode PC Tuning Mode	PC	-
Firmware Programming Mode	PG	Appears if the firmware data is transferred from KFL via a USB Type-B cable.
Un-Programmed	E1	Appears if data is not configured for any channel.
Channel data blank	E2	Appears if a channel for which no data is configured is selected.
PLL Un-Lock	E3	**TX PLL Unlock**: TX LED flashes. **RX PLL Unlock**: BUSY LED flashes.
TX frequency data blank	E4	Appears if the repeater attempts to transmit by using the **PTT** (microphone) switch or External PTT control on a channel for which no transmit frequency is configured.
IP configuration error	E5	Appears if an error is detected in the configuration of an IP address.
Frame Pulse Error	E6	Appears if no frame clock frequency is entered while the repeater is operated in a trunking system.
Temperature protection operated	E7	Appears upon activation of temperature protection by a temperature of the Final Unit board exceeding the preset temperature, such as due to an abnormality in the PA Module. If the temperature protection becomes active, transmission is disabled. If the temperature returns to a normal temperature, transmission becomes enabled.
Failure Channel Detected	E8	Appears if the Failure Channel Input port (AUX Input 3) becomes active. (Trunking system) Appears if the software option not allowed for a subscriber unit is allowed by the FPU configuration. (Conventional system)
System Firmware Version Unmatch Error	E9	Appears if NXR-5700/ NXR-5800 of firmware version 5.00.00 or later and in trunking mode is added to a trunking system including NXR-700/ NXR-800 of firmware earlier than version 5.00.00 as the lowest numbered channel.
ESN Blank	e5	Appears if no ESN is written to the repeater.
Sub MCU Internal RAM Error	e.6.	Appears if a failure of the ASIC internal RAM is detected.
DSP Internal RAM Error	e6.	Appears if a failure of the DSP internal RAM is detected.
External RAM Error	e6	Appears if a failure of the external RAM is detected.
MCU Connection Error	e7	Appears if the connection with an MCU cannot be confirmed when the repeater starts up.
Main MCU External RAM Error	e7.	Appears if a failure of the DDR RAM of the Main MCU is detected.
Feature Error	e8	Appears if the software option not allowed for a subscriber unit is allowed by the FPU configuration.
Connecting to MCU	--	Flashes while the connection with the Main MCU is being checked.

A.2 About Communication Operations with the Repeater

Communicating with the repeater by using a network connection or serial connection enables various operations.
The following operations can be enabled by either a network connection or a serial connection.

- Writing of the firmware data
  For a network connection, the web interface is used. For a serial connection, KFL is used.
  (Refer to Updating the Firmware Version of the Repeater.)
- Reading of the FPU data (using KPG-D2)
- Writing of the FPU data (using KPG-D2)
- Reading of the repeater information (using KPG-D2)
  (Refer to Confirming the Firmware Version of the Repeater.)

The following operations can be enabled only for a serial connection. KPG-D2 is used for any of the operations.

- Operation in Test Mode
- Embedded Message with Password (writing of a message)
- Embedded Message with Password (writing of a password)
- Password Reset Execution

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