# Multi-PAD Support for X.25 Connections

This feature facilitates calls that connect asynchronous network elements configured for PAD access to Cisco asynchronous terminal lines. PAD calls can then be initiated and received on the same terminal line using full X.121 addresses.

### History of the Multi-PAD Support for X.25 Connections Feature

| Release | Modification |
|---|---|
| 12.3(11)YN | This feature was introduced. |
| 12.4(4)T | This feature was integrated into Cisco IOS 12.4(4)T. |

### Finding Support Information for Platforms and Cisco IOS Software Images

Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at http://www.cisco.com/go/fn. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** when presented with the login screen and follow the instructions that appear.

## Contents




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# Prerequisites for Multi-PAD X.25 Connections

This feature relies on the support of legacy PAD and/or X.28 user emulator sessions.

# Restrictions for Multi-PAD X.25 Connections

1. Although this feature improves connection options between individual terminal lines and X.121 addresses, it does not include any timing adjustments. Nor does it modify existing X.28 user emulator mode.
2. Ensure that X.121 addresses already assigned to a line or hunt group are not also assigned to:
   - X.25 interfaces;
   - X.25 profiles;
   - X.25 host-address, translate, or route entries.
3. X.121 addresses cannot be configured on VTY lines.

# Information about Multi-PAD Support for X.25 Connections

Multi-PAD Support for X.25 Connections has the following details:



## Capabilities

With this feature it is now possible to:

- Receive and initiate PAD calls on the same terminal line using full X.121 addresses.
- Associate an X.121 address to a specific line so that:
  - an incoming call to the address will be routed to the associated line with no rollover;
  - calls originating from the line will have the X.121 address as their source address.

  **Note** This occurs so long as at least one of the following conditions is true:
  **a.** the line is not a member of any rotary group (“hunt group”);
  **b.** any rotary group associated with this line does not have an X.121 address;
  **c.** the address of a rotary group associated with this line is not configured to be a calling address.

- Associate an X.121 address to a specific rotary group so that:
  - an incoming call to the group address will be routed to a line according to the selection method configured for that group;
  - the group may include some lines that have, and some lines that do not have, X.121 addresses assigned to them;
  - calls originating from a line within the group—when the group’s address has not been made the calling address—will have the first of the following source addresses, in order:
    a. the line’s X.121 address;
    b. the hunt group’s X.121 address;
    c. the interface or router host address (the default is the current behavior).
    d. Alternatively, you may assign any originating call to have either its line address or its group address.

## Call Processing Behavior

This section describes the behavior of incoming and outgoing calls to X.121 addresses of individual lines and rotary (hunt) groups.

### Incoming PAD Call Acceptance

If an incoming call’s destination address matches:

- the X.121 address of **a particular line**, the call will be routed to that line. If the line is in use, the call will be cleared with Cause 9, Diag 0 (Out of order/No additional information).
- the X.121 address of **a hunt group**, the call will be routed to a line according to the algorithm configured for that group. If a match is found, but there are no available free lines, the call will be cleared with Cause 9, Diag 0 (Out of order/No additional information).

If no Multi-PAD address is found, the call will be passed to other X.25 clients (for example, X.25 switch, datagram encapsulation, or qllc) for further processing. (The default is the current behavior).

## Outgoing PAD Call Behavior

The outgoing call algorithm checks to see if the Multi-PAD feature is enabled on the line. If so, it applies the source address to the outgoing call as follows:

- If the call originates from a line that is a member of a hunt group configured to be used as the source address, that hunt group's X.121 address will be applied.
- If an X.121 address is specified on the line, calls originating from the line will have that address as the source address.
- If an X.121 address is not specified for the line, but the line is a member of a hunt group that has an X.121 address, calls originating from the line will have the hunt group address as the source address. (The customary procedure of using an X.25 subaddress is incorporated in this case, with the hunt group's source address now becoming the prefix.)

If the outgoing call algorithm finds no Multi-PAD feature enabled on the line, calls originating from the line will have the router (interface/host) address as the source address. (The default is the current behavior).

# How to Configure Multi-PAD X.25 Connections

This section contains the following procedures:



## Assigning an X.121 Address to a TTY Line

To assign an X.121 address to a TTY line, perform the following tasks.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **line** *line_number*
4. **x25 address** *x121-address*
5. **exit**

### DETAILED STEPS

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br><br>**Example:**<br>`Router> enable` | Enables privileged EXEC mode.<br>• Enter your password if prompted. |
| **Step 2** | **configure terminal**<br><br>**Example:**<br>`Router# configure terminal` | Enters global configuration mode. |
| **Step 3** | **line [aux \| console \| tty \| vty]** *line-number* [*ending-line-number*]<br><br>**Example:**<br>`Router(config)# line 98` | Identifies a specific line for configuration, and enters line configuration mode. |
| **Step 4** | **x25 address** *x121-address*<br><br>**Example:**<br>`Router(config-line)# x25 address 12345` | Assigns an X.121 address to the TTY line. |
| **Step 5** | **exit**<br><br>**Example:**<br>`Router(config-line)# exit` | Moves back into global configuration mode. |

## Example

```
Router> enable
Router# configure terminal
    Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# line 33
Router(config-line)# x25 address 12345
Router(config-line)# exit
Router(config)#
```

# Assigning an X.121 Address to a Rotary Group

You have the option to have the group's X.121 address be used as the source address of calls emanating from each line in this group. (And if any of those lines has a subaddress, that subaddress is appended to the group address as part of the outgoing call's source address.)

If the group has no X.121 address assigned to it, each line's own X.121 address is used as the source address.

And if neither the line nor the group has yet been assigned an X.121 address, the source address is filled according to the existing addressing rules (for example, using router host address, line subaddress, etc.).

## Prerequisites

Support for legacy PAD and/or X.28 user emulator sessions.

## Restrictions

If the rotary group has already been configured with the Queued or Queued-by-Role selection method, it cannot take on an X.121 address.

Likewise, as long as the group has an X.121 address assigned to it, it cannot be configured with the Queued or Queued-by-Role selection method.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **x25 rotary** *group-num x121-address* [**calling-address** *rotary* | *line*]

### DETAILED STEPS

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br><br>**Example:**<br>`Router> enable` | Enables privileged EXEC mode.<br>• Enter your password if prompted. |
| **Step 2** | **configure terminal**<br><br>**Example:**<br>`Router# configure terminal` | Enters global configuration mode. |
| **Step 3** | **x25 rotary** *group-num x121-address* [**calling-address** *rotary* \| *line*]<br><br>**Example:**<br>`Router(config)# x25 rotary 2 12345` | Assigns an X.121 address to the rotary group (and optionally, sets that address to be the source address of calls originating in the lines that are members of this group). |

## Examples

```
Router> enable
Router# configure terminal
    Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# x25 rotary 2 12345
```

# Configuration Examples for X.25 Multi-PAD Connections



## Assigning X.121 Addresses to TTY Lines and Their Rotary Group: Example

The following example:

- configures lines 33, 34 and 39 with X.25 addresses 12345, 23456, and 34567
- makes each of those lines a member of rotary group 1
- sets 'round-robin' as the selection method of that rotary group
- gives that rotary group an X.25 address of 45678.

```
Router# configure terminal
   Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# line 33
Router(config-line)# x25 address 12345
Router(config-line)# rotary 1 round-robin
Router(config-line)# exit

Router(config)# line 34
Router(config-line)# x25 address 23456
Router(config-line)# rotary 1 round-robin
Router(config-line)# exit

Router(config)# line 39
Router(config-line)# x25 address 34567
Router(config-line)# rotary 1 round-robin
Router(config-line)# exit

Router(config)# x25 rotary 1 45678
Router(config-line)# end
```

The following verifies the settings just configured and displays the lines' current status:

```
Router# show line x121-address
 X121-Addresses     Line   Rotary
    45678           -      1
    34567           39     -
    23456           34     -
    12345           33     -

Router# show x28 hunt-group
   ID       Type    HG-Address    TTy          Address       Uses   status
================================================================================
    1       RRA     45678         39          34567          0      NXTUSE
    1       RRA     45678         34          23456          0      NXTUSE
                                  33          12345          0        IDLE
```

## Setting the Rotary Group X.121 Address to be the Member Lines' Calling Address: Example

Configure line 39 to have an X.121 address of 2222:

```
Router# configure terminal
    Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# line 39
Router(config-line)# x25 address 2222
```

Add that line 39 to rotary group 1:

```
Router(config-line)# rotary 1
Router(config-line)# exit
Router(config)#
```

Assign the X.121 address 1111 to rotary group 1, and set that address to be the calling address of outgoing calls from the lines in this group:

```
Router(config)# x25 rotary 1 1111 calling-address rotary
```

# Additional References

The following sections provide references related to Multi-PAD Support for X.25 Connections.

## Related Documents

| Related Topic | Document Title |
|---|---|
| Configuring dial technologies | *Cisco IOS Dial Technologies Configuration Guide* |
| Line configuration mode | *Cisco IOS Dial Technologies Command Reference* |
| X.25 protocol | *Internetworking Technology Handbook* |

## Standards

| Standards | Title |
|---|---|
| ITU X.3, X.25, X.28, X.29, X.121 | *ITU-Recommendations X.3, X.25, X.28, X.29, X.121* |

## Technical Assistance

| Description | Link |
|---|---|
| The Cisco Technical Support website contains thousands of pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content. | http://www.cisco.com/techsupport |

# Command Reference

This section documents new and modified commands only.

- **show line x121-address**
- **show x28 hunt-group**
- **x25 address (line)**
- **x25 rotary**

# show line x121-address

To display all the line and rotary group addresses that are in a router, use the **show line x121-address** command in user EXEC or privileged EXEC mode.

**show line x121-address**

## Syntax Description

This command has no arguments or keywords.

## Command Modes

User EXEC
Privileged EXEC

## Command History

| Release | Modification |
|---|---|
| 12.3(11)YN | This command was introduced. |
| 12.4(4)T | This command was integrated into Cisco IOS Release 12.4(4)T. |

## Usage Guidelines

You use this command to see whether any X.121 address has been assigned, and if so, to which line or rotary group it has been assigned.

## Examples

The following example shows the lines and groups that have X.121 addresses. It also shows that address 1111 will be used as the calling address by calls originating from lines within Rotary Group 2.

```
Router# show line x121-address

   X121-Addresses     Line   Rotary
   34567              97      -
   12345              98      -
   23456              -       1
   1111               -       2 (calling-address)
```

***Table 1 show line x121-address Field Descriptions***

| Field | Description |
|---|---|
| X121-Addresses | X.121 address assigned to the TTY line or rotary group identified to the right in the same row. |
| Line | The TTY line's absolute number. |
| Rotary | The rotary group's ID number.<br>The words "calling address" also appear in this column when the group's X.121 address has been assigned to be the source address for all calls originating with members of that group. |

## Related Commands

| Command | Description |
|---|---|
| **show line** | Displays status of configured lines. |

# show x28 hunt-group

To display the members and status of each member in an X.28 hunt group, use the **show x28 hunt-group** command in user EXEC or privileged EXEC mode.

**show x28 hunt-group** [*group-num*]

## Syntax Description

| | |
|---|---|
| *group-num* | (Optional) Identification number of a particular hunt group. |

## Command Default

The members of all X.28 hunt groups in the router are displayed.

## Command Modes

User EXEC
Privileged EXEC

## Command History

| Release | Modification |
|---|---|
| 12.3(11)YN | This command was introduced. |
| 12.4(4)T | This command was integrated into Cisco IOS Release 12.4(4)T. |

## Examples

The following example displays the configuration of four hunt ("rotary") groups and the current status of their member lines:

```
Router# show x28 hunt-group

    ID  Type    HG-Address TTy      Address Uses   status
    ================================================================================
    1   RRA         23456       97      34567   2        INUSE
                            98      12345   0       NXTUSE
                            100     -       0       INUSEO
                            102     456789  0         IDLE
    2    QBR,FIF    -           99       -      0        UNAVL
    3   QUE,FIF     -           101     -       0       NXTUSE
    4   FIF         56789       103     67890   0        UNAVL
                            104     789012  0        UNAVL
```

*Table 2 show x28 hunt-group Field Descriptions*

| Field | Description |
|---|---|
| ID | The identification number of the hunt group. |
| Type | The line-selection mechanism used within the group:<br>• **FIF** (First Idle First): Lines are searched in increasing order of their line (absolute) number, and the first idle line found is given the incoming call.<br>• **RRA** (Round-Robin): The incoming call is given to the line whose line number is the next highest from the line that received the last call.<br>• **QUE** (Queued): If all lines in the group are busy when a call request arrives, that call is queued and given to the first line that frees up.(Not implementable with Multi-PAD X.25 addressing.)<br>• **QBR** (Queued By Role): Same as "Queued," except that calls belonging to priority users are placed at the head of the queue. (Not implementable with Multi-PAD X.25 addressing.) |
| HG-Address | X.28 address assigned to the hunt group. |
| TTy | Absolute number of the line. |
| Address | X.121 address assigned to that line. |
| Uses | How many calls have been placed on that line. |
| status | Current status of the line:<br>• **IDLE**: available<br>• **NXTUSE**: idle and next to be used<br>• **INUSE**: busy in a PAD call<br>• **INUSEO**: busy in a non-PAD call<br>• **UNAVL**: unavailable (either because of inactive modem control signals or because PAD transport is unavailable) |

# x25 address (line)

To assign an X.121 address to a TTY line, use the **x25 address** command in line configuration mode. To remove the assigned address, use the **no** form of this command.

**x25 address** *x121-address*

**no x25 address** *x121-address*

## Syntax Description

| | |
|---|---|
| *x121-address* | X.121 address. The address must be a numerical string no longer than 20 digits. |

## Command Default

No X.121 address is defined.

## Command Modes

Line configuration

## Command History

| Release | Modification |
|---|---|
| 12.3(11)YN | This command was introduced. |
| 12.4(4)T | This command was integrated into Cisco IOS Release 12.4(4)T. |

## Usage Guidelines

Each X.121 address can be associated with only one line.

This command cannot configure VTY lines.

## Examples

The following example assigns the X.121 address of 12345 to the TTY line:

```
x25 address 12345
```

## Related Commands

| Command | Description |
|---|---|
| **x25 address** | Sets the X.121 address of a particular network interface. |

# x25 rotary

To assign an X.121 address to a rotary group (and optionally, to specify that address to be the source address of calls originating from lines within the group), use the **x25 rotary** command in global configuration mode. To remove an X.121 address from a rotary group, use the **no** form of this command.

**x25 rotary** *group-num x121-address* [**calling-address** [**rotary** | **line**]

**no x25 rotary** *group-num x121-address* [**calling-address** [**rotary** | **line**]

## Syntax Description

| | |
|---|---|
| *group-num* | A number from 1 through 127, assigned to identify the rotary group. |
| *x121-address* | X.121 address. The address must be a numerical string no longer than 20 digits. |
| **calling-address** | (Optional) The source address of outgoing calls from members of this group. The default calling address is each line's X.121 address. |
| *rotary* | Makes the rotary's X.121 address the source address of outgoing calls. |
| *line* | Uses each line's absolute address as the source address of outgoing calls. |

## Command Default

No group X.121 address is defined.

## Command Modes

Global configuration

## Command History

| Release | Modification |
|---|---|
| 12.3(11)YN | This command was introduced. |
| 12.4(4)T | This command was integrated into Cisco IOS 12.4(4)T. |

## Usage Guidelines

Each X.121 address can be associated with only one rotary group.

A rotary group cannot be configured with an X.121 address if it has "queued" or "queued-by-role" selection type.

## Examples

The following example sets the rotary address to be used as the calling address:

```
Router(config)# x25 rotary 1 1111 calling-address rotary
```

## Related Commands

| Command | Description |
|---|---|
| **rotary** | Defines a group of lines as a rotary ("hunt") group, and optionally, configures their response to connection requests. |

# Glossary

**PAD**—Packet Assembly/Disassembly. A service specified for X.25 networks and standardized by the International Telecommunication Union (ITU). It defines a way for asynchronous character-mode terminals (DTE-Cs) to use a packet switching network.

**subaddress**—The second of two subfields in an X.121 address. Permissible subaddress values run from zero through 99, and are padded with leading zeros when necessary. Valid examples therefore include 00, 09, 10, and 99. For PAD connections, either the physical port's number or the line's absolute number is used as the subaddress.

**X.25**—The ITU Recommendation that defines the interface and packet formats for "X.25 Networks".

**X.28**—The ITU Recommendation that defines the user interface for an X.25 PAD. All user-entered commands and responses by the PAD are defined here. Users can initiate connections to X.25 destinations and set parameters.

**X.121 address**—The format used for addressing network elements within X.25 networks.

**Note** See *Internetworking Terms and Acronyms* for terms not included in this glossary.