



X.3 PAD Parameters

A PAD is a packet assembler/disassembler, which is a device that collects data from a group of terminals and periodically outputs the data in packets (data organized in a special format). A PAD also does the reverse. That is, it can take data packets from a host and return them into a character stream that can be sent to the terminals, or start-stop mode DTE, as defined by the International Telecommunication Union (ITU). A PAD is defined by ITU-T Recommendations X.3, X.28, and X.29. (The ITU-T carries out the functions of the former Consultative Committee for International Telegraph and Telephone.)

ITU-T Recommendation X.3 specifies the parameters for terminal-handling functions such as data speed, flow control, character echoing, and other functions for a connection to an X.25 host. The X.3 parameters are similar in function to the Telnet options.

ITU-T Recommendation X.29 specifies a protocol for setting the X.3 parameters via a network connection. When a connection is established, the destination host can request that the PAD or terminal change its parameters using the X.29 protocol. A PAD can refuse the request, in which case a terminal user can change the parameter later. A PAD cannot tell the destination host to change its X.3 parameters, but it can communicate that its own parameters were changed.

Along with Recommendations X.3 and X.29, the ITU-T also provides Recommendation X.28 to specify the user interface for locally controlling a PAD.

Cisco IOS software offers two ways of connecting to a PAD: using the **pad EXEC** user interface command to initiate an outgoing connection to a PAD, and using the **x28 EXEC** command to access the Cisco universal X.28 PAD user emulation mode.

In X.28 PAD user emulation mode, you can perform the same functions available from the Cisco **pad EXEC** user interface; however, X.28 PAD user emulation mode adds functionality such as the ability to exchange PAD signals across an X.25 network, and is useful for connecting to systems using software designed to interact with an X.28 PAD. X.28 PAD user emulation mode is also useful when a reverse connection requires packetization according to the X.29 parameters.

This appendix discusses the X.3 PAD parameters. The chapter [“Configuring the Cisco PAD Facility for X.25 Connections”](#) in this publication explains how to make PAD connections and how to switch between connections. Refer to the ITU-T X.3 and X.28 recommendations for additional information about the X.3 PAD parameters.

X.3 PAD Parameter Descriptions

Following are descriptions of X.3 parameters 1 through 22. Default values are noted in the descriptions. The default value for any parameter not so noted is zero for outgoing connections or not set for incoming PAD connections. For incoming PAD connections, the access server sends an X.29 SET PARAMETER packet to set the noted defaults.

Because the X.3 parameters describe the user terminal, which exists on only one side of the connection, the PAD protocols are not always symmetric.

**Note**

Some of the commands described in this section require ASCII decimal values. Refer to the “ASCII Character Set and Hex Values” appendix in the *Cisco IOS Configuration Fundamentals Command Reference*, Release 12.2, for a list of ASCII characters. Also note that the PAD EXEC user interface and X.28 PAD user emulation mode provide different support for the PAD parameters, and these differences are noted in the following descriptions.

Parameter 1: PAD Recall Using a Character

Parameter 1 determines whether the start-stop mode DTE is allowed to escape from data transfer mode to send PAD command signals.

Because the PAD EXEC mode uses a two-character escape sequence, and there is no way to set the escape character on a Telnet connection, this parameter is refused on translation sessions. The PAD EXEC user interface does not support this parameter; however, the Cisco X.28 standard user interface does support this parameter.

Minimum value: 0; maximum value: 126; X.28 PAD user emulation mode default: 1.

Parameter 2: Echo

Parameter 2 determines whether or not PAD is required to perform local echo of characters. This parameter can be negotiated end-to-end on translation sessions. On incoming PAD connections, software turns off local echo on the remote PAD to support the Cisco user interface. See [Table 9](#) for local echo mode values and their descriptions.

Table 9 PAD Local Echo Mode Values

Value	Description
0	No local echo (incoming PAD connection default).
1	Local echo on (outgoing connection default).

Minimum value: 0; maximum value: 1; PAD EXEC mode and X.28 PAD user emulation mode defaults: 1.

Parameter 3: Selection of Data Forwarding Character

Parameter 3 sets up a packet forwarding mask; that is, it selects which character causes PAD to forward a packet either before expiration of the idle timer (see parameter 4) or when in local editing mode. See [Table 10](#) for data forward character values and their descriptions.

Table 10 PAD Data Forward Character Values

Value	Description
0	None—full packet.
1	Forward packet upon receipt of an alphanumeric character.
2	Forward packet upon receipt of an ASCII CR (a Return is the outgoing connection default).
4	Forward packet upon receipt of an ASCII ESCAPE, BEL, ENQ, or ACK.
8	Forward packet upon receipt of an ASCII DEL, CAN, or DC2.
16	Forward packet upon receipt of an ASCII ETX or EOT.
32	Forward packet upon receipt of an ASCII HT, LT, VT, or FF.
64	All other characters in columns 0 and 1 of the ASCII chart not listed.
128	Forward packet upon receipt of a semicolon (;).

Because X.3 supports a wider variety of dispatch characters than Telnet does, parameter changes to or from the default cause a translation session to negotiate in or out of line mode on the Telnet connection.

A forwarding mask can also be statically set using the **terminal dispatch-character** terminal parameter-setting EXEC command. This command can set any character or characters as the forwarding mask, and overrides (when logical) any values set by parameter 3.

Minimum value: 0; maximum value: 255; PAD EXEC mode default: 2 (ASCII CR); X.28 PAD user emulation mode default: 126 (ASCII ~).

Parameter 4: Selection of Idle Timer Delay

Parameter 4 controls the amount of time the software waits for new data before sending a packet in the absence of a data forwarding character. See [Table 11](#) for PAD idle timer values and their descriptions.

Table 11 PAD Idle Timer Values

Value	Description
0	No timer.
1–255	Delay value in twentieths of a second (default for both connection types is 1).

Minimum value: 0; maximum value: 255; PAD EXEC mode default: 1; X.28 PAD user emulation mode default: 0.

Parameter 5: Ancillary Device Control

Parameter 5 selects whether PAD can send flow control X-ON/X-OFF (ASCII DC1/DC3 transmission on and off) characters during data transfer to the start-stop mode DTE to control the terminal and data flow. Flow control is not directly supported on access servers because data must make network hops to travel to its final destination. However, depending on the type of incoming connection, setting this parameter can cause similar negotiations to be sent over the connection, thereby attempting to change the state of the flow control option at the device closest to the user.

See [Table 12](#) for PAD flow control signal values and their descriptions.

Table 12 *PAD Flow Control Signal Values*

Value	Description
0	No use of X-ON/X-OFF.
1	Use of X-ON/X-OFF (data transfer).
2	Use of X-ON/X-OFF (data transfer and command).

Minimum value: 0; maximum value: 2; PAD EXEC mode default: 0; X.28 PAD user emulation mode default: 1.

Parameter 6: Control of PAD Service Signals

Parameter 6 controls PAD service signals and the prompt. By default, the Cisco X.28 standard user interface prompt is an asterisk (*), but the prompt can be changed. See [Table 13](#) for PAD BREAK signal values and their descriptions.

Table 13 *PAD BREAK Service Signal Values*

Value	Description
0	No service signals are sent to the start-stop DTE.
1	Service signals other than the prompt PAD service signal are sent.
2	Editing PAD service signals are only sent in the format specified by parameter 19.
4	The prompt PAD service signal is sent in the standard format.
8 to 15	PAD service signals are only sent in network-dependent format. Value 8 specifies the prompt as x28>. Value 9 enables French extended mode support. Value 10 specifies the prompt be the same as the Cisco EXEC prompt.

The PAD EXEC user interface does not support this parameter; however, the Cisco X.28 standard user interface does support this parameter.

Minimum value: 0; maximum value: 255; PAD EXEC mode default: 0; X.28 PAD user emulation mode default: 2.

Parameter 7: Selection of Operation of PAD on Receipt of a BREAK Signal

Parameter 7 defines the action of the PAD after receiving a BREAK signal from the from the start-stop mode DTE. See [Table 14](#) for PAD BREAK signal values and their descriptions.

Table 14 PAD BREAK Signal Values

Value	Description
0	Ignore the BREAK signal.
1	Send an interrupt packet to notify the remote host or another PAD that the BREAK signal has been generated.
2	Send a Reset packet to reset the virtual circuit.
4	Send an X.29 Indication of Break to the remote host, or to a PAD (outgoing connection default).
8	Escape from data transfer mode.
16	Discard output to the start-stop mode DTE by setting parameter 8 to a value of 1.
21	Combination of values 1, 4, and 16 (incoming connection default).

The PAD protocols allow you to send a special X.29 Indication of Break packet, send an Interrupt packet, perform a reset operation, act as if the recall character had been typed, or begin discarding output to the user. Combinations of these options are also allowed, as long as they are logical. Common options are to begin discarding output and send both an X.25 Interrupt packet and an X.29 Indication of Break packet; these options are supported. All other options are not supported and are silently ignored.

Minimum value: 0; maximum value: 31; PAD EXEC mode default: 4; X.28 PAD user emulation mode default: 2.

Parameter 8: Discard Output

Parameter 8 indicates to the PAD whether to discard received packets rather than disassemble and send them. This parameter works in conjunction with parameter 7. If value 16 is chosen for parameter 7, all output is discarded after reception of the BREAK signal. Setting parameter 8 to 0 restores normal data delivery to the terminal.

This parameter also can be set and unset manually using the PAD **resume EXEC** command.

See [Table 15](#) for PAD discard output values and their descriptions.

Table 15 PAD Discard Output Values

Value	Description
0	Normal data delivery to the terminal (outgoing connection default).
1	Discard all output to the start-stop mode DTE. Set by parameter 7; see previous description.

Minimum value: 0; maximum value: 1; PAD EXEC mode and X.28 PAD user emulation mode default: 0.

Parameter 9: Padding After Return

Parameter 9 determines whether PAD can provide padding (insert filler characters) upon receipt of an ASCII CR (Return) control code from the start-stop mode DTE.

Minimum value: 0; maximum value: 255; PAD EXEC mode and X.28 PAD user emulation mode default: 0.

Parameter 10: Line Folding (Not Supported)

Neither the PAD EXEC user interface nor the X.28 PAD user emulation mode supports this parameter.

Parameter 11: DTE Speed

Parameter 11 is a read-only value that determines the binary speed of the start-stop mode DTE sent across the interface between PAD and the access server. See [Table 16](#) for PAD speed values and their descriptions.

Table 16 PAD DTE Speed Values

Value	Description (in Bits per Second)
10	50
5	75
9	100
0	110
1	134.5
6	150
8	200
2	300
4	600
3	1200
7	1800
11	75/1200
12	2400
13	4800
14	9600
15	19200
16	48000
17	56000
18	64000

Minimum value: 0; maximum value: 18; PAD EXEC mode and X.28 PAD user emulation mode default: 14.

Parameter 12: Flow Control of the PAD by the Start-Stop Mode DTE

Parameter 12 determines whether the start-stop mode DTE can send ASCII X-ON/X-OFF characters to PAD during the data transfer mode. Flow control is not directly supported on access servers because data must make network hops to travel to its final destination. However, depending on the type of incoming connection, setting this parameter can cause similar negotiations to be sent over the connection, thereby attempting to change the state of the flow control option at the device closest to the user.

See [Table 17](#) for PAD flow control values and their descriptions.

Table 17 PAD Flow Control Values

Value	Description
0	No use of X-ON/X-OFF.
1	Use of X-ON/X-OFF.

Minimum value: 0; maximum value: 1; PAD EXEC mode default: 0; X.28 PAD user emulation mode default: 1.

Parameter 13: Line Feed Insertion

Parameter 13 determines the procedure for inserting the line feed character upon receipt of an ASCII CR character. The PAD also responds to a value that results from the addition of any of the line feed signal values described in [Table 18](#).

Table 18 PAD Line Feed Signal Values

Value	Description
0	Do not insert the line feed character (outgoing connection default).
1	Insert a line feed after sending an ASCII CR to the start-stop mode DTE.
2	Insert a line feed after echoing an ASCII CR to the start-stop mode DTE.
4	Insert a line feed after echoing an ASCII CR to the remote host.

Minimum value: 0; maximum value: 7; PAD EXEC mode and X.28 PAD user emulation mode default: 0.

Parameter 14: Line Feed Padding

Parameter 14 determines whether PAD can provide padding (insert filler characters) upon receipt of a line feed character from the start-stop mode DTE. This function is generally provided by the end-user operating system.

Minimum value: 0; maximum value: 255; PAD EXEC mode and X.28 PAD user emulation mode default: 0.

Parameter 15: Editing

Parameter 15 enables or disables a PAD editing function for the start-stop mode DTE in data transfer mode.

Enabling the editing function disables the idle timer (see parameter 4). The user at the start-stop mode DTE can make corrections and display the line buffer containing the characters to be sent when the data forwarding character (see parameter 3) is received. See [Table 19](#) for PAD local editing function values and their descriptions.

Table 19 PAD Local Editing Functions

Value	Description
0	Disables editing capabilities in data transfer mode. Any characters entered become part of the data stream and are sent (default for both connection types).
1	Enables editing capabilities in the data transfer mode, which suspends the following PAD operations: <ul style="list-style-type: none"> • Full packet data forwarding until the edit buffer is full • Forwarding of data packets upon expiration of the idle timer

Parameters 16, 17, and 18 provide the editing functions.

Minimum value: 0; maximum value: 1; PAD EXEC mode and X.28 PAD user emulation mode default: 0.

Parameter 16: Character Delete

Parameter 16 allows you to select a character that will delete a character while in PAD editing mode. This character is valid only if parameter 15 is set to 1. Select one character from the ASCII character set to represent the delete character.

Minimum value: 0; maximum value: 127; PAD EXEC mode and X.28 PAD user emulation mode default: 127 (ASCII DEL).

Parameter 17: Line Delete

Parameter 17 allows you to select a character that will delete a line while in PAD editing mode. This character is valid only if parameter 15 is set to 1. Select one character from the ASCII character set to represent the line delete character.

Minimum value: 0; maximum value: 127; PAD EXEC mode default: 21 (ASCII NAK or Ctrl-U); X.28 PAD user emulation mode default: 24 (ASCII CAN or Ctrl-X).

Parameter 18: Line Display

Parameter 18 allows you to select a character that will display a line while in PAD editing mode. This character is valid only if parameter 15 is set to 1. Select one character from the ASCII character set to represent the delete character.

Minimum value: 0; maximum value: 127; PAD EXEC mode and X.28 PAD user emulation mode default: 18 (ASCII DC2 or Ctrl-R).

Parameter 19: Editing PAD Service Signals

Parameter 19 allows you to set editing PAD service signals.

The PAD EXEC user interface does not support this parameter; however, the X.28 PAD user emulation mode does support this parameter.

See [Table 20](#) for editing PAD service signal values and their descriptions.

Table 20 *Editing PAD Service Signal Values*

Value	Description
0	No editing PAD service signals.
1	Editing PAD service signals for printing terminals.
2	Editing PAD service signals for display terminals.
8; 32–126	Editing PAD service signals using an ASCII character in the value range.

Minimum value: 0; maximum value: 126; PAD EXEC mode default: 0; X.28 PAD user emulation mode default: 2.

Parameter 20: Echo Mask

Parameter 20 allows you to set the start-stop mode DTE to echo all characters.

The PAD EXEC user interface does not support this parameter; however, the X.28 PAD user emulation mode does support this parameter.

See [Table 21](#) for PAD echo mask values and their descriptions.

Table 21 *PAD Echo Mask Values*





Value	Description
0	No echo mask (all characters echoed).
1	No echo of ASCII character CR.
2	No echo of ASCII character LF.
4	No echo of ASCII characters VT, HT, FF.
8	No echo of ASCII characters BEL or BS.
16	No echo of ASCII characters ESCAPE or ENQ.
32	No echo of ASCII characters ACK, NAK, STX, SOH, EOT, ETB, or ETX.
64	No echo of characters as designated by parameters 16, 17, or 18.
128	No echo of all other characters not listed and of ASCII DEL.

Minimum value: 0; maximum value: 255; PAD EXEC mode and X.28 PAD user emulation mode default: 0.

Parameter 21: Parity Treatment

Parameter 21 controls the parity and character format used by the start-stop mode DTE. [Table 22](#) provides a brief description for each value of parameter 21. For a description of Cisco IOS X.28 default behavior for parameter 21, see [Table 23](#); see [Table 24](#) for a description of the Cisco IOS X.28 implementation for the French Transpac public switched data network and its technical specification and utilization of networks standards (STUR).

Table 22 Parity Treatment Values

Value	Description
0	No parity checking or generation (default). When the PAD transfers a data character or interprets a received character for a specific action different from the transfer of this data character to the remote DTE, it inspects only the first seven bits and will not take account of the eighth bit.
1	Check character parity against the parity configured on the asynchronous line, and drop character if invalid parity is set.  Note The PAD treats the eighth bit of the characters received from the start-stop DTE as a parity bit and checks this bit against the type of parity used between the PAD and the start-stop mode DTE.
2	Generate parity.  Note The PAD replaces the eighth bit of the characters to be sent to the start-stop mode DTE with the bit that corresponds to the type of parity used between the PAD and the start-stop mode DTE.
3	Check and generate parity (combination of 1 and 2).  Note The PAD will both check the parity bit for characters received from the start-stop mode DTE and generate the parity bit for characters to be sent to the start-stop mode DTE, as described for values 1 and 2.
4	Pass parity transparently.  Note The PAD transparently passes the eighth bit whenever it must transfer a data character or interpret a received character.

Minimum value: 0; maximum value: 4; PAD EXEC mode and X.28 PAD user emulation mode default: 0.

Table 23 Parity Treatment (Parameter 21) Cisco IOS and X.28 Standards Behavior

Selectable Values:	0	1	2	3	4
Direction	No parity checking or generation	Parity checking	Parity generation	Parity checking and generation	No parity, transparent bit 8
Terminal -> Host data	If parity, strip parity bit and send to host. If local echo, do local echo of character received.	Check 8th bit received against type of parity configured on the line. If parity error, discard the character and do not echo the character in error, and send the ASCII BELL signal to the terminal. Strip parity bit and send to host. If local echo, do local echo of character received.	Strip parity bit and send to host. If local echo and if parity, replace the 8th bit with type of parity configured on the line. Otherwise, do local echo of character received.	Check 8th bit received against type of parity configured on the line. If parity error, discard the character and do not echo the character in error, and send the ASCII BELL signal to the terminal. Strip parity bit and send to host. If local echo and if parity, replace the 8th bit with type of parity configured on the line. Otherwise, do local echo of character received.	Transparently pass the 8th bit. If local echo, do local echo of character received.
Host -> Terminal data	Transparently pass the 8th bit.	Transparently pass the 8th bit.	Replace 8th bit to be sent with the type of parity bit configured on the line.	Replace 8th bit to be sent with the type of parity bit configured on the line.	Transparently pass the 8th bit.
PAD generated data	Transmit with the type of parity configured on the line. ¹	Transmit with the type of parity configured on the line.	Transmit with the type of parity configured on the line.	Transmit with the type of parity configured on the line.	Transmit transparently.
Terminal -> PAD	Strip parity before testing the command string. Echo the character received.	Strip parity before testing the command string. ² Echo with the type of parity configured on the line.	Strip parity before testing the command string. Echo with the type of parity configured on the line.	Strip parity before testing the command string. ² Echo with the type of parity configured on the line.	Strip parity before testing the command string. Echo the character received.
CUD, terminal -> PAD	Pass all data bits; 8th bit is 0 in case of 7 data bits.	Pass all data bits; 8th bit is 0 in case of 7 data bits.	Pass all data bits; 8th bit is 0 in case of 7 data bits.	Pass all data bits; 8th bit is 0 in case of 7 data bits.	Pass all data bits; 8th bit is 0 in case of 7 data bits. ³

1. Deviates from X.28 standards, should transmit with even parity.

2. Deviates from X.28 standards, should check parity against type of parity configured on the line.

3. Deviates from X.28 standards, should transparently pass all data bits.

Table 24 Parity Treatment (Parameter 21) Transpac/STUR Specific Behavior

Selectable Values:	0	1	2	3	4
Direction	No parity checking or generation	Parity checking	Parity generation	Parity checking and generation	No parity, transparent bit 8
Terminal -> Host data	Transparently pass the 8th bit. ¹ If local echo, do local echo of character received.	Check the 8th bit received against type of parity configured on the line. If parity error, discard character and do not echo the character in error, and send the ASCII BELL signal to the terminal. Strip parity bit and send to host. If local echo, do local echo of character received.	Strip parity bit and send to host. If local echo and if parity, replace the 8th bit with type of parity configured on the line. Otherwise, do local echo of character received.	Check the 8th bit received against type of parity configured on the line. If parity error, discard character and do not echo the character in error, and send the ASCII BELL signal to the terminal. Strip parity bit and send to host. If local echo and if parity, replace the 8th bit with type of parity configured on the line. Otherwise, do local echo of character received.	Transparently pass the 8th bit. If local echo, do local echo of character received.
Host -> Terminal data	Transparently pass the 8th bit.	Transparently pass the 8th bit.	Replace the 8th bit to be sent with the type of parity bit configured on the line.	Replace the 8th bit to be sent with the type of parity bit configured on the line.	Transparently pass the 8th bit.
PAD generated data	Transmit with even parity. ²	Transmit with the type of parity configured on the line.	Transmit with the type of parity configured on the line.	Transmit with the type of parity configured on the line.	Transmit transparently.
Terminal -> PAD	Strip parity before testing the command string. Echo the character received.	Strip parity before testing the command string. ³ Echo with the type of parity configured on the line.	Strip parity before testing the command string. Echo with the type of parity configured on the line.	Strip parity before testing the command string. ³ Echo with the type of parity configured on the line.	Strip parity before testing the command string. Echo the character received.
CUD, terminal -> PAD	Transparently pass all data bits. ¹	Pass all data bits with parity configured on the line. ¹	Pass all data bits; 8th bit is 0 in case of 7 data bits.	Pass all data bits with parity configured on the line. ¹	Transparently pass all data bits. ²

1. Conforms to the Transpac and STUR specifications but not the X.28 standard.

2. Conforms to both the Transpac and STUR specifications and the X.28 standard.

3. Deviates from X.28 standards; should check parity against the type of parity configured on the line.

Parameter 22: Page Wait (Not Supported)

Neither the PAD EXEC user interface nor the X.28 PAD user emulation mode supports this parameter.

