

Chapter 6 Protocols

CCITT V.42 BIS ERROR CONTROL PROTOCOL

V.42 bis is an industry standard for error control adopted by the Consultative Committee for International Telephone and Telegraph (CCITT). The CCITT V.42 bis protocol incorporates two error control algorithms, LAPM and MNP. LAPM is a CCITT Link Access Protocol family member related to LAPB and LAPD currently in use in other communications applications. MNP is Microcom Networking Protocol that has become an industry standard by the number of its users.

The use of V.42 bis requires both local and remote modems to be V.42 bis compatible. Error control protocol is transparent to the user and requires no special hardware or software. Data to be transmitted is put in a buffer so the modem can retransmit it if an error occurs. The modem also buffers data received from the remote modem in case an error occurs and the data is retransmitted. To avoid overfilling the buffer, flow control is used to control data between the modem and the terminal. V.42 bis protocol options can be set by AT commands.



Note

Error control protocols are only valid when using asynchronous DTE options.

RELIABLE

When a LAPM or MNP link is established the modem is in reliable mode. V.42 bis allows negotiation with a remote modem to the highest level of protocol common to both units. Both LAPM and MNP control data errors by retransmitting any block of data that was corrupted in transit. LAPM is assigned highest priority and if not supported, then an MNP connection is attempted.

AUTO-RELIABLE

In auto-reliable mode the modem negotiates to the highest protocol (LAPM or MNP) common to both modems. However, if a reliable connection cannot be established, auto-reliable allows the protocol to fallback to normal mode.

CONSTANT SPEED INTERFACE

The modem serial port adapts to the data rate of the DTE and does not change speed if the (modem) data link connects at another speed. Therefore the DTE to DCE interface speed is constant.

DATA COMPRESSION

Using MNP Class 5 data compression, the modem can achieve data throughput approaching 28800 bps. With LAPM data compression, the modem can achieve data throughput approaching 115200 bps. This increase in speed is achieved by automatically analyzing the data stream and reducing the number of bits required to represent the characters. 100% error-free transmission is assured by the application of the MNP or LAPM error control protocol on the compressed data.

Compression takes place only if the modem detects that the remote modem supports compression. If not, a reliable connection is made without compression.

Although data compression is compatible with any type of data, it is most efficient for ASCII text files. For maximum throughput when using data compression, the terminal should be set to a higher speed than the connect speed with the constant speed interface on and flow control enabled. When transmitting or receiving data files in one direction, the throughput can be increased for V.42 bis by having extra buffer and more processor time with the *%C2* and *%C3* data compression commands.

NORMAL MODE

No error control with or without constant speed DTE interface. Data is buffered.

DIRECT MODE

The DTE speed and DCE speed are forced to be the same. No error control or buffering.



Note

In direct mode and the DCE link is established at a rate other than the original DTE speed, the modem will issue the connect message for the new DTE speed at the original rate. All subsequent data will be sent to the DTE at the new DCE speed.

FLOW CONTROL

If the serial port speed exceeds that of the modem connection, characters may be sent by the DTE to the modem faster than it can send them to the remote modem. The modem holds characters in an internal buffer until they can be transmitted. When this buffer is full, the modem uses flow control to cause the DTE to stop sending characters. As the modem continues to transmit data and the buffer empties, flow control is again used to cause the DTE to resume sending data. The modem can use hardware flow control (RTS/CTS) or in-band flow control (XON/XOFF).

PROTOCOL COMMANDS

These commands enable or control the various data compression, flow control, and error correction options of the modem. Table 6-1 illustrates mode and the associated features.

Table 6-1. Operating Modes and Conditions

Operating Mode	Error Correction	Data Compression	Flow Control	Data	Constant Speed Interface
Normal	Disabled	Not applicable	Allowed	Buffered	On or off
Direct	Disabled	Not applicable	Not applicable	Not buffered	DTE=DCE (slaved)
Reliable (MNP and LAPM)	Enabled	On or off	Allowed	Buffered	On
Auto-reliable (MNP and LAPM)	Enabled	On or off	Allowed	Buffered	On

Disconnect Buffer Delay %D

Select a delay during which the modem processes data in its transmit and receive buffers before disconnecting. When a condition exists which causes a disconnect, the modem tries for n seconds to empty its buffers. When the buffers are empty or if $n=0$, the modem disconnects immediately.

Command	Operation
%D	Disconnect buffer delay disabled *
%Dn	Disconnect buffer delay value ($n = 1-255$ seconds)

* *default*

Serial Port (DTE) Constant Speed \J

The \J command allows DCE and DTE to operate at different speeds. The \J1 command forces serial port (DTE) speed to follow data link speed in any mode.

If the modem is in direct mode (\J1) and a DCE link is established at a speed other than that of the original DTE autobaud speed, the modem will issue the CONNECT message for the new DTE speed at the original rate. All subsequent data will be sent to the DTE at the new DCE speed.

Command	Operation
\J	Disable slaved DTE/DCE (constant speed DTE on)*
\J1	Enable slaved DTE/DCE (constant speed DTE off)

* *default*

V.42 Optional Detection Phase \M

This is a data sequence that speeds up the LAPM link negotiation time if V.42 LAPM is supported by the remote modem.

Command	Operation
\M	V.42 fast detect data sequence disabled
\M1	V.42 fast detect data sequence enabled *

* *default*

Operating Mode \N

Select the V.42b mode to be used in data mode. An \Nn command issued during command mode while a connection is in progress will not affect the current connection but will be acted on for subsequent connections. LAPM or MNP protocol operation is referred to as MNP-only mode, and the auto-reliable modes allow protocol fallback.

Command	Operation
\N	Normal mode — no error control; data buffered
\N1	Direct mode — no error control; data not buffered
\N2	MNP only — try MNP; disconnect if not successful
\N3	MNP or normal — try MNP; fallback to normal async
\N4	LAPM only — try LAPM; disconnect if not successful
\N5	LAPM or normal — try LAPM; fallback to normal
\N6	LAPM or MNP — try both protocols; disconnects if not successful
\N7	LAPM, MNP, or normal — try both protocols; fallback to normal if not successful *

* default

Auto-Reliable Fallback Character %An

Select the ASCII character to be recognized as the auto-reliable fallback character by the answering modem. During negotiation of protocol in auto-reliable mode, the answering modem switches from reliable to normal mode when receiving the auto-reliable fallback character from the calling modem and passes the character to the serial port.

Enter the %An command to set the auto-reliable fallback character (n=1-27 decimal representing an ASCII character).

Command	Operation
%A0	Disable auto-reliable fallback character *
%An	Sets ASCII character to be recognized as the auto-reliable fallback character

* default

 **Note**

The modem must be set for auto-reliable mode (AT\N3, \N5, \N6, \N7).

Serial Port Flow Control \Q

The \Q commands set the type of flow control used by the serial port. If the serial port speed exceeds that of the modem connection, characters may be sent by the DTE to the modem faster than it can send them to the remote modem. The modem holds characters in an internal buffer until they can be transmitted. When this buffer is full the modem uses flow control to stop data from DTE. As the modem continues to transmit data and the buffer empties, flow control is again used to cause the DTE to resume sending data.

The \Q - \Q3 commands affect both DTE and DCE flow control.

The \Q4 - \Q7 commands affect only flow control by the DCE.

The \Q command disables flow control bilaterally.

When the \Q1 command is used, the modem generates and accepts XON/XOFF characters to start and stop the data flow. These characters have the same parity as the DTE setup taken from the last AT command.

When the \Q2 command is used, the modem uses CTS off to stop the data from the DTE and CTS on to restart it.

When the \Q3 command is used, the modem uses CTS off to stop the data from the DTE and CTS on to restart it. The DTE uses RTS off to stop data from the modem and RTS on to restart it.

The \Q4 command disables flow control by the DCE.

The \Q5 command enables XON/XOFF flow control by the DCE only.

The \Q6 and \Q7 commands force the modem to use RTS off to stop data from the modem and RTS on to restart it. This does not effect DTE flow control.

Command	Operation
\Q	Disable bilateral flow control
\Q1	Enable bilateral XON/XOFF flow control *
\Q2	Enable DTE CTS flow control, disable DCE flow control
\Q3	Enable CTS/RTS bilateral flow control
\Q4	Disable DCE flow control
\Q5	Enable DCE XON/XOFF flow control *
\Q6	Enable DCE RTS flow control
\Q7	Enable DCE RTS flow control

* default

XON/XOFF Pass Through \X

This option is active when flow control of the modem by the DTE has been selected for XON/XOFF and the connect mode is MNP-only or normal. It enables or disables the sending of local flow control characters (XON/XOFF) to the remote modem as well as being acted on in the local modem. In MNP-only mode the modem treats incoming XON/XOFF characters from the remote modem as data characters. In normal mode the modem will look at the \G command and act accordingly.



Caution

With \X1 in effect local flow control characters will be sent to the remote system. These characters may turn on the data flow from the remote system before the modem is ready to receive more data, possibly resulting in data loss.

Command	Operation
\X	Process but do not pass XON/XOFF characters to remote DCE *
\X1	Process and pass XON/XOFF characters to remote DCE

* default

Data Link Flow Control \G

This flow control paces data from the remote modem to the local modem during a normal connection. When the \G1 command is sent, the modem uses XON/XOFF to start/stop data transmission from the remote modem. This command is ignored during an MNP connection.

Command	Operation
\G	Disable data link flow control *
\G1	Enable data link flow control

* default

Note

The V.3400 will transmit the XON/XOFF characters to start/stop data transmission from the remote modem. The V.3400 will not respond to the XON/XOFF characters. This is to insure that a false XON/XOFF is not detected resulting data loss.

Break Control \Kn

Use \Kn ($n = 0-5$) to indicate the action taken by the modem when a break is encountered.

Command	Operation
\K	Break option 0
\K1	Break option 1
\K2	Break option 2
\K3	Break option 3
\K4	Break option 4
\K5	Break option 5 *

* default

Conditions under which breaks may occur are explained below with descriptions of the modem's response under the different \K command break options.

A break is sent to the serial port while the modem is in *connect state* during an *reliable* or *normal connection* (no protocol, data buffered).

Command	Operation
\K, \K2, \K4	Enter command mode but do not send break to the remote modem
\K1	Empty the data buffers and send break to the remote modem
\K3	Immediately send break to the remote modem
\K5	Send break to the remote modem in sequence with any data received from the serial port

A break is sent to the serial port while the modem is in *connect state* during a *direct connection* (no protocol, data not buffered).

Command	Operation
\K, \K2, \K4	Immediately send break to the remote modem and enter command mode when break is through
\K1, \K3, \K5	Immediately send break to the remote modem

A break is received from the remote modem while the modem is in *connect state* during a *normal connection* (no protocol, data buffered).

Command	Operation
\K, \K1	Empty the data buffers and send break to the serial port
\K2, \K3	Immediately send break to the serial port
\K4, \K5	Send break to the serial port in sequence with any data received from the remote modem

A transmit break command is issued while the modem is in *command state* during a *reliable* (protocol) or *normal connection* (no protocol, data buffered).

Command	Operation
\K, \K1	Empty data buffers and send break to the remote modem
\K2, \K3	Immediately send break to the remote modem
\K4, \K5	Send break to the remote modem in sequence with any data received from the serial port

Inactivity Timer \T

The \T command specifies the number of minutes the modem will stay online without transmitting or receiving data before hanging up. When the value is set to 0, the timer is disabled.

Command	Operation
\T	Disable inactivity timer *
\Tn	Set inactivity to n (n=1-255) minutes

* default

Maximum Reliable Block Size \A

The \A command sets the maximum transmit block size for MNP connections. Use this command to force the modem to transmit smaller blocks in an MNP connection. A smaller block size maximizes throughput when marginal line conditions are causing errors. The modem sends a block up to the size specified by the \A command.

Command	Operation
\A	Maximum transmit block size = 64 characters
\A1	Maximum transmit block size = 128 characters
\A2	Maximum transmit block size = 192 characters
\A3	Maximum transmit block size = 256 characters *

* default

Transmit Break / Set Break Length \B

The \B commands tell the local modem to send a break signal to the remote modem. In all modes except direct, S79 determines the length of the break sent to the DTE by the modem receiving a break signal over the link. S79 may be set directly or via \Bn where n=1-255 in 20 ms increments. The default is 35 (700 ms).

Command	Operation
\B	Sends a break signal to the remote modem (does not modify S79) *
\Bn	Sets S79 to length of break desired; n=1-255 in 20 ms increments; default= 35 (700 ms)

* default

Set Auto-Reliable Buffer \C

This determines whether or not a modem in reliable mode will buffer data received from a modem that is not in reliable mode during the 4 seconds in which the modems try to establish a reliable link. Use these commands when the modem is in the auto-reliable mode and is expected to process a call from a modem not in a reliable mode.

Command	Operation
\C	Disable auto reliable data buffer *
\Cn	Buffer data for 4 seconds or 200 characters

* default

V.42bis Data Compression %C

The %C command determines application of data compression while running LAPM protocol.

Command	Operation
%C	Data compression disabled
%C1	Enabled on transmit and receive data *
%C2	Enabled on transmit data only (enhanced compression)
%C3	Enabled on receive data only (enhanced compression)

* default

