Teldat Router

LAN Interfaces

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Chapter 1
Configuring Token Ring Interfaces

1. Introduction

This chapter describes the Token Ring configuration commands. It includes:

- Displaying the Token Ring Configuration Prompt
- Token Ring Configuration Commands
- LLC Configuration Commands

1.1. Displaying the Token Ring Configuration Prompt

To display the Token Ring configuration *TKR config>* prompt

1. Enter **LIST DEVICES** at the *Config>* prompt to display the list of interfaces and its interface number.
2. Enter **NETWORK** followed by Token Ring interface identifier.

Example:

```
Config>LIST DEVICES

 Interface       Con    Type of interface             CSR     CSR2  int
 ethernet0/0     LAN1   Fast Ethernet interface   fa200e00            27
 serial0/0       WAN1   X25                       fa200a00 fa203c00   5e
 serial0/1       WAN2   X25                       fa200a20 fa203d00   5d
 serial0/2       WAN3   X25                       fa200a60 fa203f00   5b
 bri0/0          ISDN1  ISDN Basic Rate Int       fa200a40 fa203e00   5c
 x25-node        ---    Router->Node                     0             0
 token-ring3/0   SLOT 3 Token Ring                e0000000            24
Config>NETWORK TOKEN-RING3/0

-- Token Ring Config --
TKR config>
```

1.2. Token Ring Configuration Commands

Next table summarizes the Token Ring configuration commands which are further explained below. Enter the commands at the *TKR Config>* prompt.

You must restart the router for configuration changes to take effect.

Command	Function
? (HELP)	Displays available commands or options.
LIST	Displays the selected Token Ring interface configuration.
LLC	Displays the LLC configuration prompt (*LLC config>*).
MAC-ADDRESS	Configures the interface physical address (MAC).
NO	Configures the default values for the configuration parameters.
PACKET-SIZE	Modifies packet-size for all Token Ring networks.
RIF-TIMER	Configures the Routing Information Field (RIF) timer.
SOURCE-ROUTING	Enables or disables source-routing on the interface.
SPEED	Sets the interface speed in Mbps.
EXIT	Returns to the configuration prompt (C*onfig>*).

a) ? (HELP)

Lists the available commands or their options.

Syntax:

```
TKR config>?
```

Example:

```
TKR config>?
LIST
LLC
MAC-ADDRESS
NO
PACKET-SIZE
SET
SOURCE-ROUTING
SPEED
EXIT
TKR config>
```

b) LIST

Displays the current configuration for the Token Ring interface.

Syntax:

```
TKR config>LIST
```

Example:

```
TKR config>LIST

Packet size :   2052
Speed:          16 Mbps

RIF aging:      120
Source Routing: Enabled
MAC address:    00:00:00:00:00:00

TKR config>
```

c) LLC

Displays the LLC configuration prompt (*LLC Cfg>*). LLC configuration is required to pass packets over the SNA network. See the "LLC Configuration Commands" section for a description of these commands.

Syntax:

```
TKR config>LLC
```

Example:

```
TKR config>LLC

-- LLC user configuration --
LLC Cfg>
```

d) MAC ADDRESS

Configures the interface physical address (MAC). The interface can adopt locally administered addresses or those given by the device manufacturer (universal administration). Through this command, only locally administrated address are given. Entering **00:00:00:00:00:00** (default value) causes the router to use the address given by the manufacturer for the interface. This last MAC address is used by default.

Example:

```
TKR config>SET MAC-ADDRESS
MAC address  [00:00:00:00:00:00]?
TKR config>
```

e) NO

Sets the different parameters to their default values.

Syntax:

```
TKR config>NO ?
MAC-ADDRESS
PACKET-SIZE
RIF-TIMER
SPEED
TKR config>
```

The default values are as follows:

Command	Default Value
MAC-ADDRESS	00:00:00:00:00:00
PACKET-SIZE	2052 bytes
RIF-TIMER	120 seconds
SPEED	16 Mbps

f) PACKET-SIZE

Changes packet-size for all Token Ring networks. Changing packet-size can greatly increase buffer memory requirements.

Next table shows valid packet-size for 4 Mbps and 16 Mbps networks.

Speed	Values (# of bytes)
4 Mbps	1470, 2052, 4399*
16 Mbps	1470, 2052, 4399
	8130, 11407, 17749

Configuring a packet size greater than 4,399 bytes forces the program to adjust the packet size to 4,399.

Syntax:

```
TKR config>PACKET-SIZE <packet size>
```

Example:

```
TKR config>PACKET-SIZE
Packet Size (1470,2052,4399,8130,11407,17749)[2052]? 4399
TKR config>
```

If you enter an incorrect value the following text is displayed:

```
Wrong packet size
```

g) RIF-TIMER

Configures the Routing Information Field (RIF) timer. Amount of time in seconds the router maintains RIF information before it is refreshed. The default value is 120 seconds.

Example:

```
TKR config>RIF-TIMER
RIF aging[120]?150
TKR config>
```

h) SOURCE-ROUTING

Enables or disables end station source routing. Through this process the end stations can determine the route to other network devices over bridges implementing source routing. This allows the IP protocol to reach nodes located on the other side of the bridge in source routing mode. This option is independent of whether the interface supports source routing in packet transmission and reception for this type or not. The default is enabled.

Syntax:

```
TKR config>SOURCE-ROUTING ?
DISABLED
ENABLED
TKR config>
```

Example:

```
TKR config>SOURCE-ROUTING DISABLED
```

i) SPEED

Modifies the data transmission speed. The options are 4 or 16 Mbps. The default value is 4 Mbps. If a speed value is not specified, the device will request this.

Syntax:

```
TKR config>SPEED <speed>
```

Example:

```
TKR config>SPEED
Speed (16/4 Mbps)[4]? 16
TKR config>
```

j) EXIT

Returns to the general *Config>* prompt.

Syntax:

```
TKR config>EXIT
```

Example:

```
TKR config>EXIT
Config>
```

1.3. LLC Configuration Commands

LLC configuration is required to pass packets over an SNA network. Enter these commands at the *LLC config>* prompt, which appears on entering **LLC** at the *TKR Config>* prompt.

Next table summarizes the LLC subcommands. There is a more detailed explanation on these further on in this section.

Command	Function
? (HELP)	Displays all the LLC commands or lists subcommand options for specific commands.
LIST	Displays the selected LLC configuration.
N2-MAX-RETRY	Modifies N2.
N3-FRAMES_RCVD-BEFORE-ACK	Modifies N3.
NO	Sets the parameters to their default values.
NW-ACKS-TO-INC-WW	Configures NW.
RW-RECEIVE-WINDOW	Configures RW: size of the receive window
T1-REPLY-TIMER	Configures T1.
T2-RECEIVE-ACK-TIMER	Configures T2.
TI-INACTIVITY-TIMER	Configures TI.
TW-TRANSMIT-WINDOW	Configures TW: size of the transmit window.
EXIT	Returns to the *TKR Config>* prompt.

WARNING:

Modifying the LLC parameters default values may affect the performance of the LLC protocol.

a) ? (HELP)

Lists all the available commands or options for specific commands.

Syntax:

```
LLC Cfg>?
```

Example:

```
LLC Cfg>?
LIST
N2-MAX-RETRY
N3-FRAMES_RCVD-BEFORE-ACK
NO
NW-ACKS-TO-INC-WW
RW-RECEIVE-WINDOW
T1-REPLY-TIMER
T2-RECEIVE-ACK-TIMER
TI-INACTIVITY-TIMER
TW-TRANSMIT-WINDOW
EXIT
LLC Cfg>
```

b) LIST

Displays the current LLC configuration.

Syntax:

```
LLC Cfg>LIST
```

Example:

```
LLC Cfg>LIST
No LLC configuration record found for this interface.
Default values are used.
  Reply Timer(T1):                1 seconds
```

```
  Receive ACK Timer(T2):           1 100miliseconds
  Inactivity Timer(Ti):            30 seconds
  Max Retry value(N2):             8
  Rcvd I-frames before Ack(N3):    1
  Transmit Window(Tw):             2
  Receive Window(Rw):              2
  Acks needed to increment Ww(Nw): 1
LLC Cfg>
```

c) *N2-MAX-RETRY*

Maximum number of times the LLC transmits an RR without receiving an acknowledgment when the inactivity timer times out. The range is 1 to 255. The default is 8.

Example:

```
LLC Cfg>N2-MAX-RETRY
Max Retry value(N2)[8]?
LLC Cfg>
```

d) *N3-FRAMES_RCVD-BEFORE-ACK*

This counter works with the T2 timer to reduce acknowledgment traffic for received I-frames. Each time the router receives an I-frame, this value decreases by one. When this counter reaches 0 or when the T2 timer times out, the router sends an acknowledgement. The range is 1 to 255. The default is 1.

Example:

```
LLC Cfg>N3-FRAMES_RCVD-BEFORE-ACK
Number I-frames received before sending ACK(N3)[1]?
LLC Cfg>
```

e) *NW-ACKS-TO-INC-WW*

When the possibility of sending I-frames is not operative, LLC goes into a mode where the working window (Ww) is set back to 1, and then slowly increased back to its normal size (Tw). This is known as the dynamic window algorithm. This value is the number of I-frames that the LLC must receive before incrementing Ww by 1. The range is 1 to 127. The default is 1.

Example:

```
LLC Cfg>NW-ACKS-TO-INC-WW
Acks needed to increment Ww(Nw)[1]?
LLC Cfg>
```

f) NO

Sets the different parameters to their default values.

Syntax:

```
LLC Cfg>NO ?
N2-MAX-RETRY
N3-FRAMES_RCVD-BEFORE-ACK
NW-ACKS-TO-INC-WW
RW-RECEIVE-WINDOW
T1-REPLY-TIMER
T2-RECEIVE-ACK-TIMER
TI-INACTIVITY-TIMER
TW-TRANSMIT-WINDOW
LLC Cfg>
```

The default values are as follows:

Command	Default value
N2-MAX-RETRY	8
N3-FRAMES_RCVD-BEFORE-ACK	1

NW-ACKS-TO-INC-WW	1
RW-RECEIVE-WINDOW	2
T1-REPLY-TIMER	1 second
T2-RECEIVE-ACK-TIMER	1 (100 ms.)
TI-INACTIVITY-TIMER	30 seconds
TW-TRANSMIT-WINDOW	2

g) *RW-RECEIVE-WINDOW*

Maximum number of unacknowledged sequentially numbered I-frames that an LLC can receive from a remote LLC peer. This value must be equal to or less than 127.

Example:

```
LLC Cfg>RW-RECEIVE-WINDOW
Receive Window(Rw), 127 Max.[2]?
LLC Cfg>
```

h) *T1-REPLY-TIMER*

This timer times out when the LLC fails to respond on receiving a required acknowledgment or response from another LLC station. When this timer times out, an RR is sent with the poll bit set and T1 is re-started. If the LLC receives no response after the configured maximum number of retries has timed out (N2), the lower link is declared inoperative. The range is 1 to 256. The default is 1.

Example:

```
LLC Cfg>T1-REPLY-TIMER
Reply Timer(T1) in sec. [1]?
LLC Cfg>
```

i) *T2-RECEIVE-ACK-TIMER*

Delays acknowledging I-format frames. This timer starts when the router receives an I-frame, and it is reset when the router sends an acknowledgment. If this timer times out, LLC2 sends an acknowledgment as soon as possible. T2 must be set to a value less than T1 to insure that the remote LLC2 peer receives the delayed acknowledgment before the T1 timer expires. The range is 1 to 2.560. The default is 1 (100 ms), which disables the timer.

Example:

```
LLC Cfg>T2-RECEIVE-ACK-TIMER
Receive Ack timer(T2) in 100millisec.[1]?
LLC Cfg>
```

j) *TI-INACTIVITY-TIMER*

This timer times out when the LLC does not receive a frame during a specified time period. When this occurs, the LLC transmits an RR until the other LLC responds or the N2 retry count is exceeded. The range is 1 to 256. Default is 30 seconds.

Example:

```
LLC Cfg>TI-INACTIVITY-TIMER
Inactivity Timer(Ti) in sec.[30]?
LLC Cfg>
```

k) TW-TRANSMIT-WINDOW

Maximum number of I-frames that can be sent before receiving an RR. Assuming that the other end of the LLC session can actually receive this many consecutive I-frames, and the router has enough heap memory to keep copies of these frames until an acknowledgment is received, increasing this value may increase the performance. The range is 1 to 127. The default is 2.

Example:

```
LLC Cfg>TW-TRANSMIT-WINDOW
Transmit Window(Tw), 127 Max.[2]?
LLC Cfg>
```

l) EXIT

Returns to the *TKR Config>* prompt.

Syntax:

```
LLC Cfg>EXIT
```

Example:

```
LLC Cfg>EXIT
TKR config>
```

Chapter 2
Monitoring Token Ring Interfaces

1. Introduction

This chapter describes the commands you can use to monitor Token Ring interfaces. It includes the following sections:

- Displaying the Token Ring Monitoring prompt
- Token Ring Monitoring Commands
- LLC Monitoring Commands
- Token Ring Interfaces and the Monitoring Interface Command

1.1. Displaying the Token Ring Monitoring Prompt

To displays the Token Ring monitoring prompt *TKR>*

1. Enter **DEVICE** at the monitoring prompt (+) to display the list of interfaces configured in the router.
2. Enter **NETWORK** followed by the Token Ring interface identifier at the (+) prompt.

Example:

```
*P 3
Console Operator
+DEVICE

                                        Auto-test   Auto-test     Maintenance
Interface            CSR     Vect         valids    failures        failures
ethernet0/0     fa200e00       27              0        2687               0
serial0/0       fa200a00       5E              1           0               0
serial0/1       fa200a20       5D              0       36796               0
serial0/2       fa200a60       5B              0       36796               0
bri0/0          fa200a40       5C              1           0               0
x25-node               0        0              1           0               0
token-ring3/0   e0000000       24              1           0               0
+NETWORK TOKEN-RING3/0

-- Token Ring Console --
TKR>
```

1.2. Token Ring Monitoring Commands

Next table summarizes the Token Ring monitoring commands which are further explained in the subsequent paragraphs. Enter these commands at the *TKR>* prompt.

Command	Function
?(HELP)	Displays available commands or options.
LLC	Displays the LLC monitoring prompt.
RIF-DUMP	Displays an RIF cache dump.
EXIT	Returns to the (+) prompt.

a) ? (HELP)

Lists available commands or options.

Syntax:

```
TKR>?
```

Example:

```
TKR>?
LLC
RIF-DUMP
EXIT
TKR>
```

b) LLC

Displays the *LLC>* monitoring prompt. Enter LLC monitoring commands at this prompt. See the "LLC monitoring commands" section for a description of these commands.

Syntax:

```
TKR>LLC
```

Example:

```
TKR>LLC
LLC user Monitoring
LLC>
```

c) RIF-DUMP

When source routing is enabled (see Token Ring configuration commands) on the Token Ring interface, the **RIF-DUMP** command displays the content of the RIF cache. The **RIF-DUMP** command only applies to protocols. It does not apply to DLSw or bridging.

Syntax:

```
TKR>RIF-DUMP
```

Example:

```
TKR>RIF-DUMP

MAC Address           RIF
================   ===============
00:00:C9:1E:ED:5C   0620 0011 0020

TKR>
```

The meaning of each field is:

MAC Address	Token Ring interface MAC address in non-canonical format.
RIF	Displays a code that indicates the RIF in hexadecimal.

d) EXIT

Returns to the (+) monitoring prompt.

Syntax:

```
TKR>EXIT
```

Example:

```
TKR>EXIT
+
```

1.3. LLC Monitoring Commands

Next table summarizes the LLC monitoring commands which are further explained in the subsequent paragraphs.

Command	Function
? (AYUDA)	Displays the LLC command or options for specific commands.
CLEAR-COUNTERS	Clears all the statistics counters.
LIST	Displays interface, SAP, and session information.
SET	Allows you to dynamically configure LLC parameters that are valid for the life of the session.
EXIT	Exits the LLC monitoring process.

a) ? (HELP)

Lists the available commands or their options.

Syntax:

```
LLC>?
```

Example:

```
LLC>?
CLEAR-COUNTERS
LIST
SET
EXIT
LLC>
```

b) CLEAR-COUNTERS

Clear all the LLC statistics counters.

Syntax:

```
LLC>CLEAR-COUNTERS
```

Example:

```
LLC>CLEAR-COUNTERS
LLC>
```

c) LIST

Displays interface, service access point (SAP), and session information.

Syntax:

```
LLC>LIST ?
INTERFACE
SAP
SESSION
LLC>
```

LIST INTERFACE

Displays all SAPs opened on this interface.

Syntax:

```
LLC>LIST INTERFACE
```

Example:

```
LLC>LIST INTERFACE
SAP       Number of Sessions
0         0
4         1
8         0
c         0
f0        0
LLC>
```

LIST SAP

Displays information for the specified SAP on the interface.

Syntax:

```
LLC>LIST SAP <SAP number>
```

Example:

```
LLC>LIST SAP
SAP value in hex(0-FE)[0]? 4
Interface:                      6,TKR/0
Reply Timer(T1):                1 sec
Receive ACK Timer(T2):          1 100milisec (note: not used when N3=1)
Inactivity Timer(Ti):           30 sec
MAX Retry Value(N2):            8
MAX I-Field Size(N1):           0
Rcvd I-frames before Ack(N3):   1
Transmit Window Size(Tw):       2
Acks Needed to Inc Ww(Nw):      1

Frame Type          Xmt      Rcvd
UI-frames:            0         0
TEST-frames:          0        24
XID-frames:           0        58
I-frames:            16        17
RR-frames:          687       677
RNR-frames:           2         0
REJ-frames:           0         0
SABME-frames:         0         2
UA-frames:            2         1
DISC-frames:          1         0
DM-frames:            0         0
FRMR-frames:          0         0
I-frames Discarded by LLC:      0
I-frames Refused by LLC user:   0

Cumulative number of sessions:  13
Number of active sessions:      1
Session ID                                          Remote
(int-sap-id)  Local MAC          Remote MAC         SAP     State
00-04-000c    00:05:24:a7:a3:99  00:05:24:3e:d7:28  04      LINK_OPENED
LLC>
```

The meaning of each field is:

SAP value in hex(0-FE)	The SAP value of the session (hexadecimal value).
Interface	The interface number and type over which the session is running.
Reply Timer(T1)	Time it takes for this timer to time out when the LLC fails to receive an acknowledgment or response from the other LLC station.
Receive ACK Timer(T2)	Time delay the LLC uses before sending an *ACK* for a received I-frame.
Inactivity Timer(Ti)	Time the LLC waits during inactivity before issuing an RR.
MAX Retry Value(N2)	Maximum number of retries by the LLC protocol.
MAX I-Field Size(N1)	Data (in bytes) allowed in the I-field of an LLC2 frame.
Rcvd I-frames before Ack(N3)	Value that is used with T2 timer to reduce acknowledgment traffic for received I-frames.
Transmit Window Size(Tw)	I-frames that can be sent before receiving an RR.
Acks Needed to Inc Ww(Nw)	I-frames that the LLC must receive before incrementing Ww

	by 1.
Frame Type (Xmt, Rcvd)	Frame types transmitted (Xmt) and received (Rcvd).
I-frames Discarded by LLC	I-frames discarded by the LLC, usually because the sequence number is out of sequence.
I-frames Refused by LLC user	I-frames discarded by the software above the LLC. For example: LNM (LAN Network Manager) and DLSw (Data Link Switching).
Cumulative number of sessions	Sessions that were opened over this session SAP.
Number of active sessions	Currently active sessions running over the interface.
Session ID (int-sap-id)	Session ID for the interface.
Local MAC	Router's LLC MAC address.
Remote MAC	Remote router's LLC MAC address.
Remote SAP	Remote router's SAP address for the LLC connection.

Remote State

The defined state(s) that results from interaction between the LLC peers. There are 21 states that are described below:

LINK_CLOSED	The remote LLC peer is not known to the local LLC peer and is considered as not existing.
DISCONNECTED	The local LLC peer is known to the other peer. This LLC peer can send and receive XID, TEST, SABME, and DISC commands; and XID TEST, UA, and DM responses.
LINK_OPENING	The state of the local LLC peer after sending an SABME or UA in response to a received SABME.
DISCONNECTING	The state of the local LLC after sending a DISC command to the remote LLC peer.
FRMR_SENT	The local LLC peer has entered the frame reject exception state and has sent an FRMR response across the link.
LINK_OPENED	The local LLC peer is in the data transfer phase.
LOCAL_BUSY	The local LLC peer is unable to receive additional I-frames.
REJECTION	The local LLC peer has received one or more out-of-sequence I-frames.
CHECKPOINTING	The local LLC peer has sent a poll to the remote LLC peer and is waiting for an appropriate response.
CKPT_LB	Combination of checkpointing and local busy states.
CKPT_REJ	Combination of checkpointing and rejection states.
RESETTING	The local LLC peer has received an SABME and is reestablishing the link.
REMOTE_BUSY	State that occurs when an RNR is received from the remote LLC peer.
LB_RB	Combination of Local_Busy and Remote_Busy states.
REJ_LB	Combination of rejection and Local_Busy states.
REJ_RB	Combination of rejection and Remote_Busy states.
CKPT_REJ_LB	Combination of checkpointing, rejection, and Local_Busy states.
CKPT_CLR	Combination state resulting from the termination of a Local-Busy

condition while the LLC peer is CKPT_LB.

CKPT_REJ_CLR	Combination state resulting from the transfer of an unconfirmed Local_Busy clear while the link station is in the CKPT_REJ_LB state.
REJ_LB_RB	Combination of the rejection, Local_Busy, and Remote_Busy states.
FRMR_RECEIVED	The local LLC peer has received an FRMR response from the remote LLC peer.

LIST SESSION

Displays information on a specified LLC session that is open on the interface.

Syntax:

```
LLC>LIST SESSION <session identifier>
```

Example:

```
LLC>LIST SESSION
Session Id: [0]? 07-04-000c
Session ID:                     07-04-000c
Interface:                      07,BDG/0
Remote MAC addr:                00:05:24:3e:d7:28
Source MAC addr:                00:05:24:a7:a3:99
Remote SAP:                     04
Local SAP:                      04
RIF:                            None
Access Priority:                0
State:                          LINK_OPENED
Reply Timer(T1):                1 sec
Receive ACK Timer(T2):          1 100milisec (note: not used when N3=1)
Inactivity Timer(Ti):           30 sec
MAX I-Field Size(N1):           0
MAX Retry Value(N2):            8
Rcvd I-frames before Ack(N3):   1
Transmit Window Size(Tw):       4
Working Transmit Size(Ww):      4
Acks Needed to Inc Ww(Nw):      1
Current Send Seq (Vs):          7
Current Rcv Seq (Vr):           7
Last ACK'd sent frame(Va):      7
No. of frames in ACK pend q:    0
No. of frames in Tx pend q:     0
Local Busy:                     NO
Remote Busy:                    NO
Poll Retry count:               8
Appl output flow stopped:       NO
Send process running:           YES

Frame Type          Xmt      Rcvd
I-frames:             7         7
RR-frames:           19        15
RNR-frames:           1         0
REJ-frames:           0         0
I-frames Discarded by LLC:      0
I-frames Refused by LLC user:   0
LLC>
```

The meaning of each field is:

Session ID	Session ID number.
Interface	Interface over which this session is running.
Remote MAC addr	MAC address of the remote LLC peer.
Source MAC addr	MAC address of the local LLC.
Remote SAP	Remote router's SAP address for the LLC.
Local SAP	Router's local SAP for LLC connection.
RIF	Frame RIF.

Access Priority	Packet priority. 0-7 for upper layer control.
State	The defined state(s) that results from interaction between the LLC peers. Refer to the **LIST SAP** command previously described in this chapter for more information.
Reply Timer(T1)	Timer time out duration period when the LLC is unable to receive an acknowledgement or response from the other LLC station.
Receive ACK Timer(T2)	Time delay the LLC uses before sending an acknowledgment for a received I-frame.
Inactivity Timer(Ti)	Time delay the LLC waits during inactivity before issuing an RR.
MAX I-Field Size(N1)	Maximum size of a frame's data field (in bytes). The default is the interface size.
MAX Retry Value(N2)	Number of times the LLC transmits an RR without receiving an acknowledgment.
Rcvd I-frames before Ack (N3)	Value that is used with T2 timer to reduce acknowledgement traffic for received I-frames.
Transmit Window Size (Tw)	Number of I-frames that can be sent before receiving an RR.
Working Transmit Size (Ww)	Number of I-frames that are sent before receiving an RR. This can be less than Tw during the dynamic window algorithm.
Acks Needed to Inc Ww (Nw)	Number of I-frames that the LLC must receive before incrementing Ww by 1.
Current Send Seq (Vs)	Send state variable (Ns value for the next I-frame to be transferred).
Current Rcv Seq (Vr)	Receive state variable (next in-sequence Ns to be accepted).
Last ACK'd sent frame(Va)	Acknowledged state variable (last valid Nr received).
No. of frames in ACK pend q	Transmitted I-frames pending acknowledgment.
No. of frames in Tx pend q	Number of frames pending transmission.
Local Busy	LLC router's local connection is sending RNRs.
Remote Busy	Remote LLC is receiving RNRs.
Poll Retry count	Normal value of the counter retry in the LLC protocol.
Appl output flow stopped	LLC has ordered the application to stop sending it outgoing data frames.
Send process running	This process runs concurrently with other frame actions and takes I-frames in the transmit queue and sends them.
Frame Type (Xmt, Rcvd)	Displays the total number of frame types transmitted (Xmt) and received (Rcvd).
I-frames Discarded by LLC	I-frames discarded by the LLC, usually because the sequence number is erroneous.
I-frames Refused by LLC user	I-frames discarded by the LLC software. For example, LNM (LAN Network Manager) and DLSw (Data Link Switching).

d) SET

Dynamically configures the LLC parameters on a current LLC session. Modifications made to the parameters are effective for the session's lifetime. These parameters are the same as those in Chapter 1 of this manual "Configuring Token Ring Interfaces".

WARNING!

Modifying the default values of the LLC parameters may affect the LLC protocol performance.

Syntax:

```
LLC Cfg>SET ?
N2-MAX-RETRY
N3-FRAMES_RCVD-BEFORE-ACK
NW-ACKS-TO-INC-WW
T1-REPLY-TIMER
T2-RECEIVE-ACK-TIMER
TI-INACTIVITY-TIMER
TW-TRANSMIT-WINDOW
LLC Cfg>
```

SET N2-MAX-RETRY

The maximum number of times the LLC protocol transmits an RR without receiving an acknowledgment when the inactivity timer times out. The range is 1 to 225. Default is 8.

Syntax:

```
LLC>SET N2-MAX-RETRY <session ID, value>
```

Example:

```
LLC>SET N2-MAX-RETRY
Session Id: [0]? 07-04-000cMax Retry value(N2)[8]?LLC>
```

SET N3-FRAMES_RCVD-BEFORE-ACK

This value is used with the T2 timer to reduce acknowledgment traffic for received I-frames. Set this counter to a specified value. Each time an I-frame is received, this value is decremented. When this counter reaches 0, or the T2 timer times out, an acknowledgment is sent. The range is 1 to 255. Default is 1.

Syntax:

```
LLC>SET N3-FRAMES_RCVD-BEFORE-ACK <session ID, value>
```

Example:

```
LLC>SET N3-FRAMES_RCVD-BEFORE-ACK
Session Id: [0]? 07-04-011fNumber I-frames received before sending ACK(N3)[1]?
LLC>
```

SET NW-ACKS-TO-INC-WW

When the ability to send I-frames is not working, the LLC protocol goes into a mode where the working window (Ww) is set back to 1, and is then slowly increased back to its normal size (Tw). This is known as the dynamic window algorithm. This value is the number of I-frames that the LLC must receive before incrementing Ww by 1. The range is 1 to 127. Default is 1.

Syntax:

```
LLC>SET NW-ACKS-TO-INC-WW <session ID, value>
```

Example:

```
LLC>SET NW-ACKS-TO-INC-WW
Session Id: [0]? 07-04-00acAcks needed to increment Ww(Nw)[1]?2
LLC>
```

SET T1-REPLY-TIMER

This timer times out when the LLC fails to receive a required acknowledgment or response from the other LLC station. When this timer times out, an RR is sent with the poll bit set and T1 is started

again. If the LLC receives no response after the configured maximum number of retries has been reached (N2), the lower link is declared inoperative. The range is 1 to 256. Default is 1.

Syntax:

```
LLC>SET T1-REPLY-TIMER <session ID, value>
```

Example:

```
LLC>SET T1-REPLY-TIMER
Session Id: [0]? 07-04-000cReply Timer(T1) in sec. [1]?LLC>
```

SET T2-RECEIVE-ACK-TIMER

This timer is used to delay sending of an acknowledgment for a received I-format frame. This timer is started when an I-frame is received and reset when an acknowledgment is sent. If this timer times out, LLC2 sends an acknowledgment as soon as possible. Set this value so that it is less than that of T1. This insures that the remote LLC2 peer receives the delayed acknowledgment before the T1 timer expires. The range is 1 to 2,560. Default is 1 (100 ms).

Syntax:

```
LLC>SET T2-RECEIVE-ACK-TIMER <session ID, value>
```

Example:

```
LLC>SET T2-RECEIVE-ACK-TIMER
Session Id: [0]? 07-04-000cReceive Ack timer(T2) in 100millisec.[1]?
LLC>
```

Note: If this timer is set to 1 (the default) it will not run (e.g., N3-FRAMES_RCVD-BEFORE-ACK=1)

SET TI-INACTIVITY-TIMER

This timer expires when the LLC does not receive a frame for a specified time period. When this timer times out the LLC transmits an RR until the other LLC responds or the N2 timer expires. Default is 30 seconds. The range is 1 to 256.

Syntax:

```
LLC>SET TI-INACTIVITY-TIMER <session ID, value>
```

Example:

```
LLC>SET TI-INACTIVITY-TIMER
Session Id: [0]? 07-04-000cInactivity Timer(Ti) in sec.[30]?
LLC>
```

SET TW-TRANSMIT-WINDOW

Sets the maximum number of I-frames that can be sent before receiving an RR. Assuming that the other end of the LLC session can actually receive this many consecutive I-frames, and the router has enough heap memory to keep copies of these frames until an acknowledgment is received, increasing this value may increase the throughput. The range is 1 to 127. Default is 2.

Syntax:

```
LLC>SET TW-TRANSMIT-WINDOW <session ID, value>
```

Example:

```
LLC>SET TW-TRANSMIT-WINDOW
Session Id: [0]? 07-04-000cTransmit Window(Tw), 127 Max.[2]?
LLC>
```

e) EXIT

Use the exit command to return to the LAN monitoring prompt (Ethernet: *ETH>* or Token Ring: *TKR>).*

Syntax:

```
LLC>EXIT
```

Example:

```
LLC>EXIT
TKR>
```

1.4. Token Ring Interfaces and the Interface Monitoring Command

The router displays statistics for network interfaces when you enter **DEVICE** at the monitoring prompt (+).

a) DEVICE

On entering the **DEVICE** command at the monitoring prompt (+) together with the identifier associated with the said interface, the following statistics are displayed for the chosen Token Ring interface.

Syntax:

```
+DEVICE <TKR interface identifier>
```

Example:

```
+DEVICE TOKEN-RING3/0

                                    Auto-test   Auto-test     Maintenance
Interface            CSR    Vect      valids    failures        failures
token-ring3/0   e0000000      24           1           0               0

Physical Address: 00:05:64:02:D0:25
PROM Address:     00:05:64:02:D0:25
Speed:            16 Mbps

Max. packet size:     4399
Handler state:        Available ring
Ring status:          OK

  Number of Signal lost           0  'beacon' packets              0
  Fatal errors                    0  Lobe errors                   0
  'auto-remove' errors            0  'Removes' packets             0
  Ring recovery                   0

  Line errors                     0  'burst' errors                0
  ARI/FCI errors                  0  Input drops                   0
  Frame copy errors               0  'token' errors                0
  Lost frames                     0  Too big frames                0
MAC code version: EMAC 2.28 512K
+
```

The following section describes these statistics:

Interface	Interface name.
CSR	Control/status/data Register Address.
Vect	Interrupt vector associated to the interface, written in hexadecimal.
Auto-test Valids	Number of successful auto-tests.
Auto-test Failures	Number of unsuccessful auto-tests.
Maintenance Failures	Number of maintenance failures.
Physical Address	Token Ring interface MAC address in NON-canonical format. This is the address currently used by the interface. This can be a locally administrated address or a universal address.
PROM Address	MAC address provided by the manufacturer for the Ethernet interface. This is a universal address.
Speed	Transmit speed, in Mbps, of the Token Ring network connected to the

interface.

Max. packet size — Maximum size of the data field, in bytes, configured for this interface.

Handler state — Current state of the Token Ring interface. This is the state of the interface after executing the auto-test.

Ring status — Information indicating the current status of the ring where the interface is found. The displayed values are:

OK	ok	ARMV	Auto removal
SIGERR	Signal loss	RXRMV	Remove received
HERR	Hard error	COVF	Counter overflow
SERR	Soft error	SGST	Single station
TXBCM	Transmit beacon	RNGREC	Ring recovery
LWFAULT	Lobe wire fault		

Some of these values (errors) make the below indicated counters increase:

Number of Signal lost — The route is unable to transmit a frame due to loss of signal in the line interface.

Fatal errors — The interface transmits or receives "beacon" frames from the network.

'auto-remove' errors — The interface, due to the beacon auto-removal process, fails the lobe wrap test and removes itself from the ring.

Ring recovery — The interface detects toke request MAC frames.

'beacon' packets — Number of beacon frames transmitted by the interface.

Lobe errors — The network detects an open circuit or a short circuit in the cable linking the interface to the MAU (Multistation Access Unit).

'Removes' packets — Number of MAC frames "remove from the ring" received by the interface. On receiving these, the interface removes itself from the ring.

Line errors — Increments when a frame is repeated or copied, and the Error Detected Indicator (EDI) bit is 0 for the incoming frame and one of the following conditions also exist:

a) A Token with a code violation exists.

b) A frame has a code violation between the start and end delimiters.

c) A Frame Check Sequence (FCS) error occurs.

ARI/FCI errors — The ARI/FCI (Address Recognized Indicator/Frame Copied Indicator) Errors counter increments if the interface receives either of the following:

a) An Active Monitor Present (AMP) MAC frame with the ARI/FCI bits equal to 0 and a Standby Monitor Present (SMP) MAC frame with the ARI/FCI bits equal to 0.

b) More than one SMP MAC frame with the ARI/FCI bits equal to 0, without an intervening AMP MAC frame.

c) This condition indicates that the upstream neighbor (from whom the frames are received) is unable to activate the ARI/FCI bits.

Frame copy errors — The interface in receive/copy mode recognizes a frame addressed to its specific address but finds the Address Recognize Indicator (ARI) bits not equal to 0. This error indicates a possible line hit or duplicate address.

Lost frames — The interface is in transmit mode and fails to receive the end of a

	transmitted frame.
'burst' errors	The interface detects the absence of transitions for five half-bits times between the start delimiter (SDEL) and the end delimiter (EDEL) or between the EDEL and the SDEL.
Input drops	The interface in repeat mode recognizes a frame addressed to it but has no space available to copy the frame.
'token' errors	Increments when the active monitor detects a token protocol with any of the following errors: a) The token MONITOR_COUNT bit with nonzero priority equals one. b) The frame MONITOR_COUNT bit equals one. c) No token or frame is received within a 10ms window. d) The starting delimiter/token sequence has a code violation in an area where code violations cannot exist.
Too big frames	Number of received frames with a bigger data field than the one supported by the interface.

Chapter 3
Configuring Ethernet Interfaces

1. Introduction

This chapter describes the Ethernet configuration commands. It includes the following sections:

- Displaying the Ethernet Configuration Prompt
- Ethernet Configuration Commands

1.1. Displaying the Ethernet Configuration Prompt

In order to display the Ethernet configuration prompt *ETH config>*, execute the following steps:

1. Enter **LIST DEVICES** at the *Config>* prompt to display a list of all the interfaces.
2. Enter the **NETWORK** command followed by the Ethernet interface identifier.

Example:

```
*P 4

Config>LIST DEVICES

 Interface       Con    Type of interface             CSR     CSR2  int
 ethernet0/0     LAN1   Fast Ethernet interface   fa200e00             27
 serial0/0       WAN1   X25                       fa200a00 fa203c00    5e
 serial0/1       WAN2   X25                       fa200a20 fa203d00    5d
 serial0/2       WAN3   X25                       fa200a60 fa203f00    5b
 bri0/0          ISDN1  ISDN Basic Rate Int       fa200a40 fa203e00    5c
 x25-node        ---    Router->Node                     0              0
Config>NETWORK ETHERNET0/0

-- Config of the Ethernet Interface --
ETH config>
```

1.2. Ethernet Configuration Commands

This section summarizes and then explains the Ethernet configuration commands. Enter this commands at the *ETH config>* prompt.

Command	Function
? (HELP)	Lists available commands and their options.
AUTO-NEGOTIATION	Enables auto-negotiation.
DUPLEX	Permits you to establish the mode (half-duplex or full-duplex).
INPUT-BUFFERS	Configures the number of buffers used at reception.
IP-ENCAPSULATION	Sets the IP encapsulation as Ethernet type 8137 or Ethernet 802.3.
LIST	Displays the type of connector and IP encapsulation.
LLC	Displays the LLC configuration prompt (*LLC config>*).
MAC-ADDRESS	Sets the MAC address used by the interface.
NO	Permits you to de-configure previously configured parameters.
SPEED	Configures the interface speed (10 Mbps or 100 Mbps).
EXIT	Returns to the *Config>* prompt.

a) ? (HELP)

Lists the available commands or their options.

Syntax:

```
ETH config>?
```

Example:

```
ETH config>IP ?
Ethernet
IEEE-802.3
ETH config>
```

b) AUTO-NEGOTIATION

Configures the Ethernet interface to operate in auto negotiation mode. In this mode, the interface speed and the duplex mode are configured subject to the characteristics of the rest of the devices connected to the Ethernet. The device with the worst characteristics will limit the rest of the devices connected to the Ethernet. If, for example, there are various devices capable of operating at 100 Mbps and one that can only operate at 10 Mbps, what the auto negotiation does is to configure the interface to 10 Mbps.

Syntax:

```
ETH config>AUTO-NEGOTIATION
```

Example:

```
ETH config>AUTO-NEGOTIATION
ETH config>
```

c) DUPLEX

Configures the device duplex mode: half duplex or full duplex. If the device is configured with auto negotiation, the duplex mode configuration is ignored, the interface is configured subject to the characteristics of the devices connected to the Ethernet.

Syntax:

```
ETH config>DUPLEX <duplex mode>
```

Example:

```
ETH config>DUPLEX ?
FULL
HALF
ETH config>
```

Example:

```
ETH config>DUPLEX FULL
ETH config>
```

d) INPUT-BUFFERS

Configures the number of buffers used at reception. The default value depends on the type of driver. We recommend that this is not modified unless expressly indicated by the Teldat technical personnel.

This command is only available for Fast-Ethernet interfaces.

Syntax:

```
ETH config>INPUT-BUFFERS <input-buffers>
```

Example:

```
ETH config>INPUT-BUFFERS 50
ETH config>
```

e) IP-ENCAPSULATION

Selects the IP transport mode in the Ethernet frame data field. Possible formats are: Ethernet (Ethernet type 8137) or IEEE-802.3 (Ethernet 802.3 "raw" without 802.2). Default option is ETHERNET configuration.

Syntax:

```
ETH config>IP-ENCAPSULATION <encapsulation type>
```

```
ETH config>IP-ENCAPSULATION ?
Ethernet
IEEE-802.3
ETH config>
```

Example:

```
ETH config>IP IEEE-802.3
ETH config>
```

f) LIST

Displays the current configuration of the Ethernet interface. This includes the MAC address used by interface, the speed, the duplex mode and IP encapsulation. In cases where the interface is configured with auto negotiation, the speed and the duplex mode are not displayed as these are obtained from the characteristics of the devices connected to the Ethernet.

Syntax:

```
ETH config>LIST
```

Example:

```
ETH config>LIST

MAC address: 000000000000
Speed: Auto-negotiation
IP encapsulation:   ETHER
ETH config>
```

Example:

```
ETH config>LIST

MAC address: 000000000000
Speed: 100Mbps
Duplex mode : Half duplex
IP encapsulation:   ETHER
ETH config>
```

g) LLC

Displays the LLC configuration prompt (*LLC config>*). LLC configuration is required to pass frames over the SNA network. See "LLC Configuration Commands" section for a description of these commands.

Syntax:

```
ETH config>LLC
```

Example:

```
ETH config>LLC
LLC Cfg>
```

h) MAC-ADDRESS

The interface can adopt locally administered addresses or those given by the device manufacturer. Through this command, only locally administrated address are given. Entering **00:00:00:00:00:00**

(default value) causes the router to use the default factory station address. This last MAC address is used by default.

Syntax:

```
ETH config>MAC-ADDRESS <MAC address>
```

Example:

```
ETH config>MAC-ADDRESS
MAC address [00-00-00-00-00-00]?
ETH config>
```

i) NO

Permits you to de-configure previously configured parameters.

Syntax:

```
ETH config>NO <option>
```

Example:

```
ETH config>NO ?
AUTO-NEGOTIATION
INPUT-BUFFERS
ETH config>
```

· *NO AUTO-NEGOTIATION*

Disables the auto negotiation in the Ethernet interface. In this way the interface is forced to operate at the configured speed and duplex mode.

Example:

```
ETH config>NO AUTO-NEGOTIATION
ETH config>
```

· *NO INPUT-BUFFERS*

Uses the default value for the number of buffers for reception. The default value depends on the type of driver.

Example:

```
ETH config>NO INPUT-BUFFERS
ETH config>
```

j) SPEED

Configures the interface speed. 10 Mbps (LOW) or 100 Mbps (HIGH). If the device is configured with auto negotiation, the speed configuration is ignored, the interface is configured subject to the characteristics of the devices connected to the Ethernet.

Syntax:

```
ETH config>SPEED <speed>
```

```
ETH config>SPEED ?
HIGH (100Mbps)
LOW (10Mbps)
ETH config>
```

Example:

```
ETH config>SPEED HIGH
TH config>LIST

MAC address: 000000000000
Speed: 100Mbps
Duplex mode : Half duplex
IP encapsulation:   ETHER
ETH config>SPEED LOW
ETH config>LIST

MAC address: 000000000000
Speed: 10Mbps
Duplex mode : Half duplex
IP encapsulation:   ETHER
ETH config>
```

k) EXIT

Returns to the *Config>* prompt.

Syntax:

```
ETH config>EXIT
```

Example:

```
ETH config>EXIT
Config>
```

Chapter 4
Monitoring Ethernet Interfaces

1. Introduction

This chapter describes the commands you can use to monitor Ethernet interfaces. It includes the following sections:

- Displaying the Ethernet Monitoring Prompt
- Ethernet Monitoring Commands
- Ethernet Interfaces and the Interface Monitoring Command

1.1. Displaying the Ethernet Monitoring Prompt

To display the Ethernet monitoring prompt *ETH>*:

1. Enter **DEVICE** at the monitoring (+) prompt to display a list of all the interfaces configured on the router.
2. Enter **NETWORK** followed by the Ethernet interface identifier at the GESTCON (+) monitoring prompt.

Example:

```
*P 3

+DEVICE

                                    Auto-test   Auto-test     Maintenance
Interface            CSR    Vect      valids    failures       failures
ethernet0/0     fa200e00      27           1           0              0
serial0/0       fa200a00      5E           0        6679              0
serial0/1       fa200a20      5D           0        6679              0
serial0/2       fa200a60      5B           0        6679              0
bri0/0          fa200a40      5C           1           0              0
x25-node               0       0           1           0              0
+NETWORK ETHERNET0/0

--  Ethernet Console  --
ETH>
```

1.2. Ethernet Monitoring Commands

Next table summarizes and the following sections explain the Ethernet monitoring commands. Enter commands at the *ETH>* prompt.

Command	Function
? (HELP)	Displays available commands or options.
COLLISIONS	Displays collision statistics for a specified Ethernet interface.
LLC	Displays the LLC monitoring prompt.
STATUS	Displays the status of the Ethernet interface
EXIT	Returns to the monitoring (+) prompt.

a) ? (HELP)

List available commands or their corresponding options.

Syntax:

```
ETH>?
```

Example:

```
ETH>?
COLLISION
LLC
STATUS
EXIT
ETH>
```

b) COLLISION

Displays the counters for frames in transmission that incurred collisions before successfully being transmitted. The counters tally the number of successfully sent frames after the specified number of collisions in a range of 1 to 15 collisions. Characteristic transmission signals to a busy Ethernet are: the increase of the number of frames transmitted with collisions and the increase of the number of collisions per frame.

Use the **CLEAR statistics** command at the monitoring prompt (+) to clear these counters. This data is exported via SNMP.

Syntax:

```
ETH>COLLISION
```

Example:

```
ETH>COLLISION
Transmitted with  1 collisions:        341
Transmitted with  2 collisions:        281
Transmitted with  3 collisions:         94
Transmitted with  4 collisions:         26
Transmitted with  5 collisions:          5
Transmitted with  6 collisions:          4
Transmitted with  7 collisions:          4
Transmitted with  8 collisions:          4
Transmitted with  9 collisions:          2
Transmitted with 10 collisions:          2
Transmitted with 11 collisions:          0
Transmitted with 12 collisions:          0
Transmitted with 13 collisions:          0
Transmitted with 14 collisions:          0
Transmitted with 15 collisions:          0
ETH>
```

c) LLC

Displays the *LLC>* monitoring prompt. The LLC monitoring commands must be entered here. For a detailed description of these commands, please consult the "LLC Monitoring Commands" section.

Syntax:

```
ETH>LLC
```

Example:

```
ETH>LLC
LLC user Monitoring
LLC>
```

d) STATUS

Displays information on the Ethernet interface: phyter model used, link status, auto negotiation status and the speed and duplex mode the interface operates with.

Syntax:

```
ETH>STATUS
```

Example:

```
ETH>STATUS
Organizationally Unique Identifier (OUI) ... 80017(national)
Vendor model ............................... 2(DP83846A)
Model Revision ............................. 3

  Link ............... Established
  Autonegotiation ... Completed
  Duplex ............. Half duplex
  Speed .............. 10 Mbps

FEC
  Duplex ............. Half duplex
ETH>
```

e) EXIT

Returns to the monitoring (+) prompt.

Syntax:

```
ETH>EXIT
```

Example:

```
ETH>EXIT
+
```

1.3. Ethernet Interfaces and the Interface Monitoring Command

The router displays statistics for network interfaces when you enter **DEVICE** at the monitoring (+) prompt.

a) DEVICE

On entering the **DEVICE** command followed by the identifier of the interface associated to Ethernet, the router displays a series of statistics associated to this.

Syntax:

```
+DEVICE <ETH interface identifier>
```

Example:

```
+DEVICE ETHERNET0/0

                                    Auto-test   Auto-test     Maintenance
Interface            CSR    Vect      valids    failures       failures
ethernet0/0     fa200e00      27           1           0              0

Physical address:  00A026700000
PROM address:      00A026700000
Speed:             10 Mbps

 Input statistics:
  failed, frame too long             0  failed, FCS error                1
  failed, alignment error            0  failed, FIFO overrun             1
  internal MAC rcv error             1  packets missed                   1
```

```
 Output statistics:
  deferred transmission              0  single collision                  0
  multiple collisions                0  total collisions                  0
  failed, excess collisions          0  failed, FIFO underrun             0
  failed, carrier sense err          0  SQE test error                   0
  late collision                     0  internal MAC trans errors         0
  Ethernet MAC code release 1
+
```

The meaning of each of the distinct fields is as follows:

Interface	Interface name.
CSR	Control/status and physical interface data register address.
Vect	Interrupt vector associated to the interface, written in hexadecimal.
Auto-test valids	Number of successful auto-tests.
Auto-test failures	Number of unsuccessful auto-tests.
Maintenance failures	Number of maintenance failures.
Physical address	The MAC address used in the Ethernet interface in canonical format.
PROM address	MAC address for the Ethernet interface provided by the manufacturer.
Speed	Speed (in Mbps) at which the Ethernet interface operates. This can take values between 10 and 100.

Input statistics:

failed, frame too long	The interface received a frame that exceeds the maximum size of 1,518 bytes for an Ethernet frame. This data is exported via SNMP as the dot3StatsFrameTooLongs counter.
failed, FCS error	The interface received a packet with a CRC error. This data is exported via SNMP as the dot3StatsFCSErrors counter.
failed, alignment error	The interface received a frame whose size in bits is not a multiple of eight.
failed, FIFO overrun	The Ethernet chipset is unable to store bytes in the local packet buffer as fast as they come off the cable.
packets missed	The interface tries to receive a packet, however the local packet buffer is full. This indicates that the network has more traffic than the interface can handle.
internal MAC rcv error	Receive errors that are not due to excessive collisions or to carrier detection. This data is exported via SNMP as the dot3StatsInternalMacReceiveErrors counter.

Output statistics:

deferred transmission	The carrier detection mechanism detects activity on the line causing the interface to defer transmission. This data is exported via SNMP as the dot3StatsDeferredTransmission counter.
single collision	Increments when a frame has a collision on the first transmission attempt, and then successfully sends the frame on the second transmission attempt. This data is exported via SNMP as the dot3StatsSingleCollisionFrames counter.
multiple collisions	Increments when a frame has multiple collisions before being successfully transmitted. This data is exported via SNMP as the

	dot3StatsMultipleCollisionFrames counter.
total collisions	Total number of collisions.
failed, excess collisions	Increments when a frame transmission fails due to 16 or more successive collisions. This error indicates a high volume of network traffic or hardware problems with the network. This data is exported via SNMP as the dot3StatsExcessiveCollisions counter.
failed, FIFO underrun	Increments when packet transmission fails due to the inability of the interface to retrieve packets from the local packet buffer fast enough to transmit them onto the network.
failed, carrier sense err	Increments when a frame collides because the carrier detector is disabled. This error indicates a problem between the interface and it's Ethernet transceiver. This data is exported via SNMP as the dot3StatsCarrierSenseErrors counter.
SQE test error	Increments when the interface sends a frame but detects that the transceiver has no heartbeat. The packet is treated as successfully transmitted because some transceivers do not generate heartbeats. This data is exported via SNMP as the dot3StatsSQETTestErrors counter.
late collision	Increments when a frame collides after transmitting at least 512 bits. This error indicates that an interface on the network failed to defer, or that the network has too many stations. This data is exported via SNMP as the dot3StatsLateCollisions counter.
internal MAC trans errors	Transmit errors that are not late, excessive, or carrier sense collisions. This data is exported via SNMP as the dot3StatsInternalMacTransmitErrors counter.
Ethernet MAC code release	Microcode release running over the Ethernet communications processor.