Chapter 26

Test Facility

Introduction

This chapter describes the main features of the Test Facility on a router, and how to set up and use the Test Facility. The Test Facility is intended to be used by the manufacturer during router production and servicing, and by distributors and router owners to verify router operation.

Some interface and port types mentioned in this chapter may not be supported on your router. The interface and port types that are available vary depending on your product's model, and whether an expansion unit (PIC, NSM) is installed. For more information, see the Hardware Reference.

The Test Facility provides a simple, efficient method of validating the operation of the router hardware, including the interfaces (Synchronous, BRI, etc.) and any MAC cards. The router processing core is not tested by the Test Facility since it must be operational for the Test Facility to operate. The processing core is tested during every power up.

The Test Facility does not test Ethernet interfaces on AR026 PICs.

The Test Facility runs in the normal router operating system environment. This means that the router processing core and an access port must be operational before testing begins. The tests operate by using standard router device drivers, so this software must also be fully operational. Tests are controlled using the router command interface; either from a local terminal port or remotely using Reverse Telnet. An SNMP management system can determine whether a port is being tested, but cannot be used to initiate a test; the section of the MIB used to set a port to test mode may be written and read, but does not result in any action.

Tests on interfaces require external connections to be made to loopbacks or specialised test hardware.

When a test is initiated from a local asynchronous connection, test messages are printed for tests that are completed or halted. These messages may occur at any time during the test. If the test command has been entered from another source, such as a remote Reverse Telnet connection, these messages are not printed. In this case the test status is only printed in response to a **show test** command on page 26-14.

Tests have the potential to generate network problems if tests are enabled on active resources (for example, interfaces connected to a LAN, Frame Relay network, an active MAC or card, or another router). To limit this potential problem, tests automatically halt if an active resource is detected. The synchronous and asynchronous port tests are halted if there is a very high loopback error rate. Ethernet port tests are halted if LAN activity is detected. After a test has halted the resource is returned to its pre-test configuration.

With the exception of the asynchronous ports, tests should not be used to test the interface through which access was obtained to the router. The reason for this is that the connection to the router is broken when the Test Facility attaches to the interface. The same applies to MAC cards – a MAC card should not be placed into test mode if the test commands themselves pass through the MAC card. No mechanism is provided to prevent this from occurring. It is the responsibility of the user to check the operation of a resource before starting the test.

Interface tests use data loopbacks and (where applicable) control line loopbacks. Frames containing a known data sequence are repeatedly transmitted via the controller being tested. The contents of frames received via the controller are compared against this sequence. To allow shorts between interfaces to be detected the transmitted sequence is unique for each interface. If a packet is received with the wrong sequence it is counted as a bad frame.

The loopback error free rate is calculated as:

```
Error free = # good frames received/# frames sent
```

where a good frame is one where the received and transmitted data and lengths match. For ports that do not transport frames (for example, asynchronous ports), the term “frame” means the test string.

Tests cannot be enabled on asynchronous ports if they are already configured for use by other modules; they must first be de-configured. The Ethernet port does not have this requirement. When tests are enabled on an Ethernet port the configurations of all the attached modules are stored and their configuration is replaced by the Test Facility.

All ports can be tested simultaneously, including the asynchronous port used to enter the test command, by using the command:

```
enable test interface=all
```

on an asynchronous port. The Test Facility detects that a test is required on an asynchronous port that was the source of the test command and tests only its control signals; the testing of the data path is made visually—if the command interpretation by the router and the response displayed on the terminal are correct then the data path is judged to be functional. A special cable is used in this case to provide a normal data path while looping the control signals (Figure 26-1 on page 26-3, Figure 26-2 on page 26-4 and Figure 26-3 on page 26-4).

The Test Facility can test only one switch port at a time on the AR410 switch. This means you can install only one loopback plug at a time in a switch port.

Figure 26-1: Pin wiring diagram for a cable to connect a terminal to an asynchronous port that is to be tested by the Test Facility

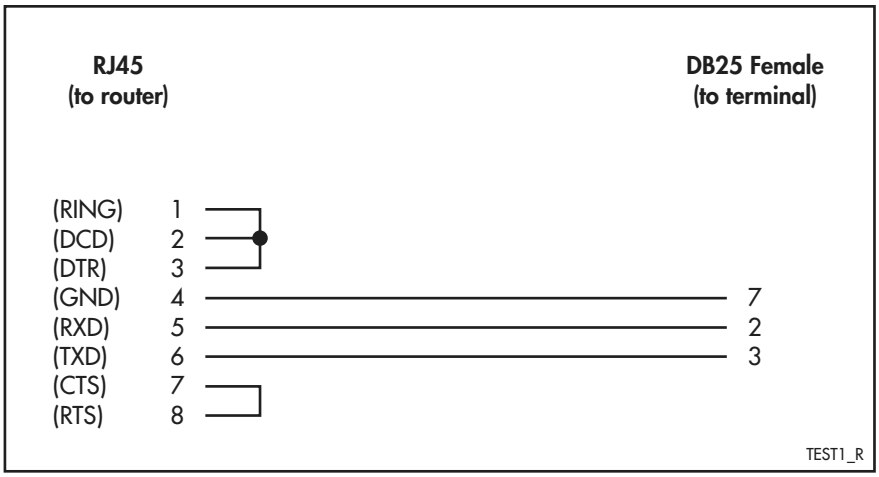


Figure 26-2: Pin wiring diagram for a cable to connect a terminal to a DB9 female asynchronous port that is to be tested by the Test Facility

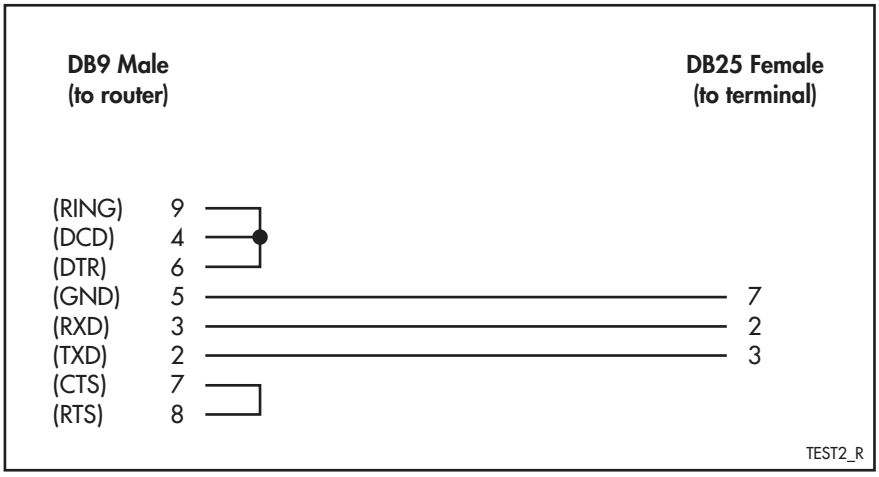
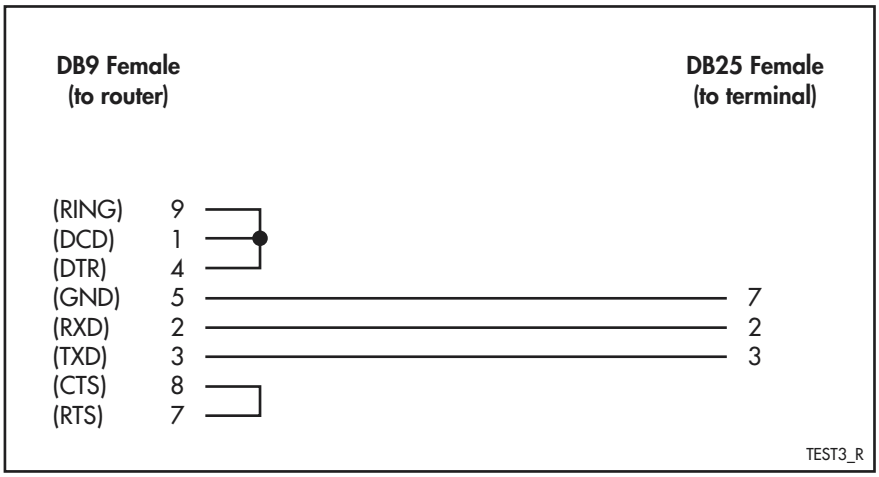


Figure 26-3: Pin wiring diagram for a cable to connect a terminal to a DB9 male asynchronous port that is to be tested by the Test Facility



Ethernet Port Tests

The Ethernet port on the router consists of an Attachment Unit Interface (AUI) connector and/or a twisted pair (TP) connector. Two internal loopbacks (ENDEC and MAC) and one or two external loopbacks are used to test the Ethernet port. The test cycles through each loopback in turn.

The Test Facility does not test Ethernet interfaces on AR026 PICs.

To quickly detect if the test is being run on an active LAN the transceiver loopback test is run first, if data is detected on the LAN then it is assumed to be active and the test is immediately aborted. The AUI external loopback can be provided using a standard thin wire transceiver with the coax port connected to an isolated segment. Alternatively a transceiver loopback plug can be used (Figure 26-4 on page 26-5). The TP external loopback can be provided using a transceiver loopback plug (Figure 26-5 on page 26-5). The possible test outcomes are listed in Table 26-1 on page 26-5.

Gigabit copper interfaces cannot be looped back. Loopback plugs can only be used with 10/100 Ethernet interfaces.

Figure 26-4: Ethernet AUI loopback plug wiring diagram

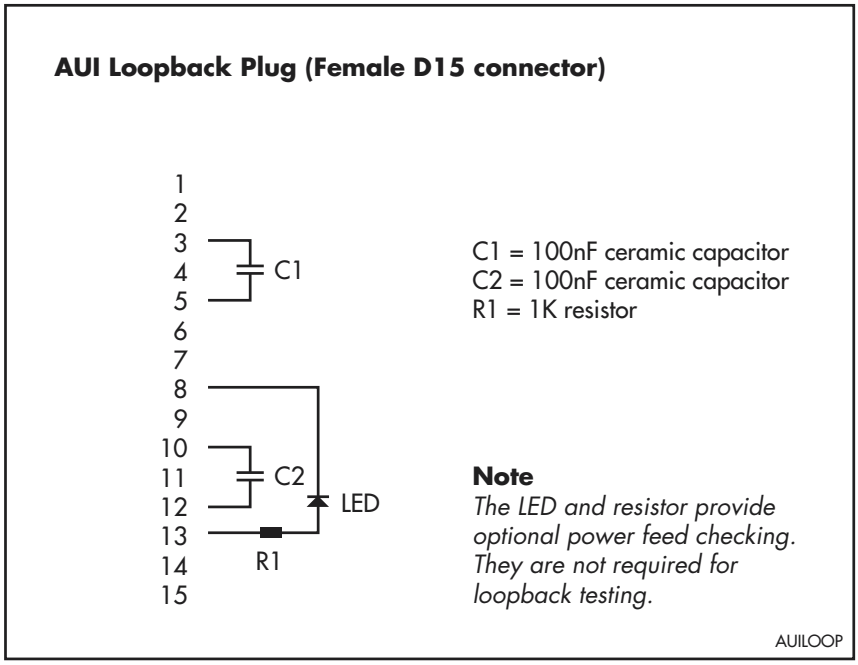


Figure 26-5: Ethernet twisted pair (TP) loopback plug wiring diagram

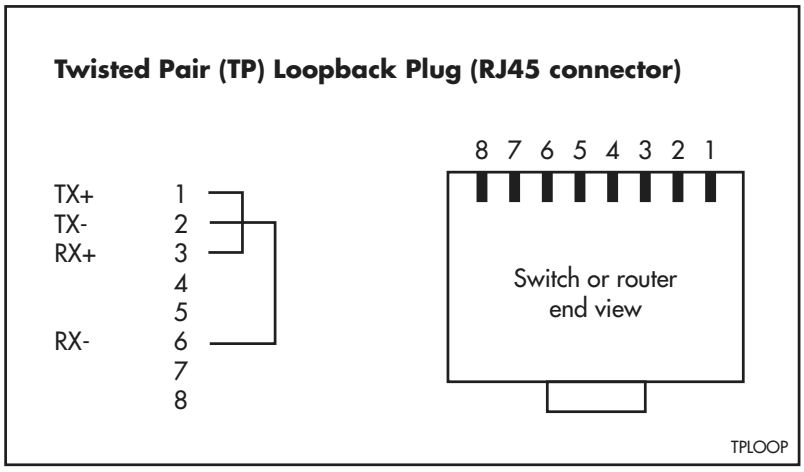


Table 26-1: Possible test outcomes for an Ethernet interface

Event	Action	Error	Result
2 non-sent frames received in any second	Halt test	Active LAN	Bad
10 consecutive bad or missing frames during transceiver loop	Complete test	No Transceiver warning	See below
< 99.9% error free frames	Complete test	-	Bad
>= 99.9% error free frames	Complete test	-	Good

Asynchronous Port Tests

The asynchronous port test requires a loopback plug in the port being tested, to loop data and control signals back to the router (Figure 26-6, Figure 26-7 on page 26-6 and Figure 26-8 on page 26-6).

Figure 26-6: RJ45 loopback plug wiring diagram

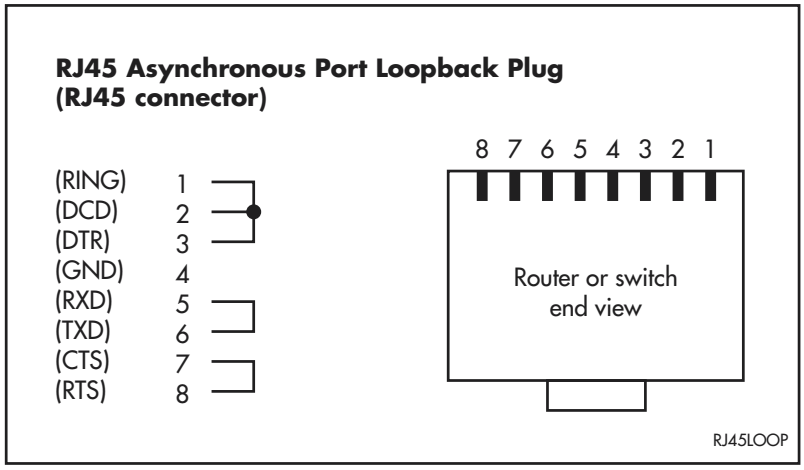


Figure 26-7: DB9 male loopback plug wiring diagram

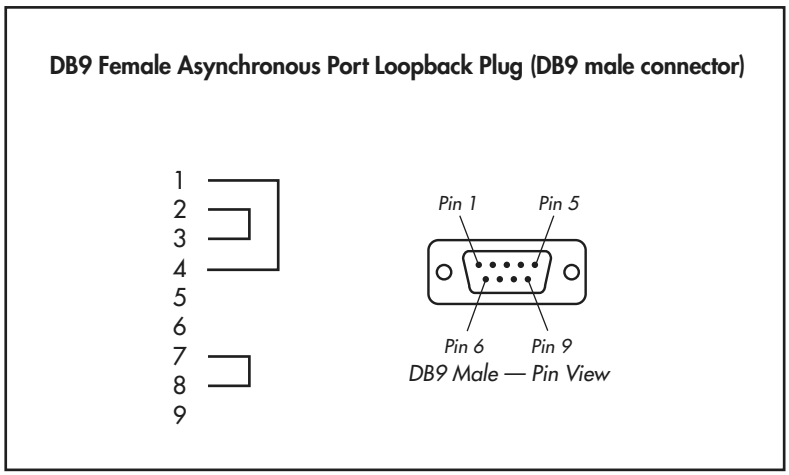
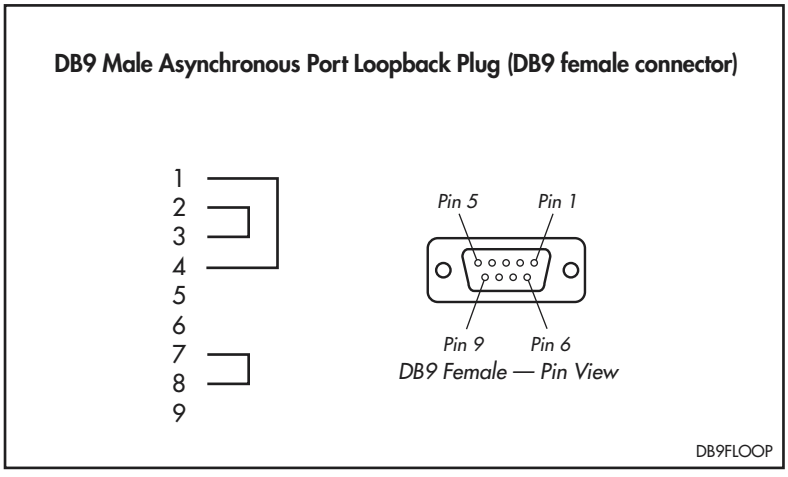


Figure 26-8: DB9 female loopback plug wiring diagram



Three error thresholds determine the test outcome (Table 26-2 on page 26-7). For the error rate calculations a test data sequence is considered to be the equivalent of a frame.

Table 26-2: Possible test outcomes for an asynchronous interface

Event	Action	Error	Result
10 consecutive bad or missing sequences	Halt test	No loopback	Bad
< 99.9% error free sequences	Complete test	-	Bad
>= 99.9% error free sequences	Complete test	-	Good

To test the port control signals the output signals are continuously toggled, and the corresponding (looped back) input state is examined. To pass the control signal test the state of an input must match the state of the corresponding output.

Tests cannot be run on an asynchronous port that is already assigned, for example, as a permanent assignment, a service, a printer port or a Telnet session.

Synchronous Port Tests

The synchronous port test verifies the operation of all the data, clock and control signals of the router's universal synchronous port. Because a universal synchronous port provides a number of electrical interface types, and can generate or receive data clocks, an external test device is required. This device, called the SynTester, provides all the switching, clocking, and interface control features required for complete testing of a universal synchronous port. The operation of the SynTester ensures that the failure of any signal does not cause a false "good" result, though in some of these cases the fault source (data or control) may be wrongly identified.

The SynTester is available from your authorised distributor or reseller.

The SynTester MkI tests interfaces that use DB37 connectors, and supports four modes of operation—RS-232 DTE, RS-232 DCE, X.21 DTE and V.35 DTE.

The SynTester MkII tests interfaces that use AMPLIMITE 50-way connectors, and supports six modes of operation—RS-232 DTE, RS-232 DCE, X.21 DTE, X.21 DCE, V.35 DTE and V.35 DCE.

To fully test a synchronous port the interface hardware is cycled through all supported modes of operation. During each mode test frames are transmitted and the received frames are checked for errors. The possible test outcomes are listed in Table 26-3 on page 26-8.

Table 26-3: Possible test outcomes for a universal synchronous interface

Event	Action	Error	Result
3 consecutive bad or missing frames in every mode	Halt test	No SynTester	Bad
< 99.9% error free frames	Complete test	-	Bad
>= 99.9% error free frames	Complete test	-	Good

In addition to data signals the port control signals are tested. To test the control signal operation each signal is continuously toggled, and the corresponding input signals are examined. To pass the control signal test the state of the input must always match the state of the corresponding output. To test the mode select control lines the state read from the port is compared to the state the port was set to. If they differ then the control test also fails.

It is normal for a small number of errors to occur during synchronous tests. These are a result of the test method and should be ignored.

Basic Rate ISDN Port Tests

If your router, or expansion option's BRI port has an MC145474 or MC145574 transceiver, a loopback plug is required before the BRI interface can be tested (Figure 26-9 on page 26-8). For all other transceiver types the test can be performed without a loopback plug. To determine which type of transceiver your product uses, enter the command:

```
show bri test
```

Figure 26-10 on page 26-9 shows an example of the output screen from the **show bri test** command, with the transceiver type listed in the first line.

Figure 26-9: Basic Rate ISDN loopback plug wiring diagram

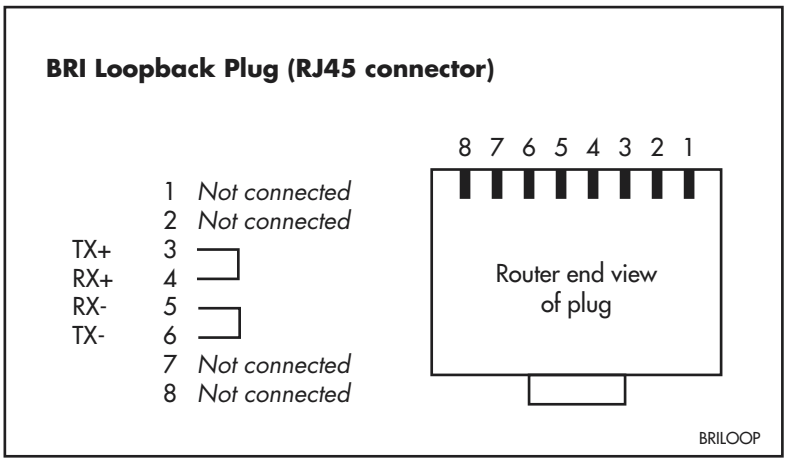


Figure 26-10: Example output from the **show bri test** command

```
Test switches for BRI instance 0 (MC145574 transceiver):
Number     Action                              Status
-------------------------------------------------
  1     Transceiver B1 GCI Transp Loop ....... no
  2     Transceiver B2 GCI Transp Loop ....... no
  3     Transceiver 2B+D GCI Transp Loop ..... no
  4     Transceiver B1 GCI Non-Transp Loop ... no
  5     Transceiver B2 GCI Non-Transp Loop ... no
  6     Transceiver B1 S/T Transp Loop ....... no
  7     Transceiver B2 S/T Transp Loop ....... no
  8     Transceiver B1 S/T Non-Transp Loop ... no
  9     Transceiver B2 S/T Non-Transp Loop ... no
 10     Transceiver External S/T Loop ........ no
 11     Transceiver 96kHz Test Tone .......... no
 12     Transceiver Force Activation ......... no
 13     Transceiver Ignore D Channel Procs ... no
 14     Transceiver Map E Channel to GCI ..... no
 15     Transceiver GCI Free Run ............. no
```

Three error thresholds determine the test outcome (Table 26-4 on page 26-9).

Table 26-4: Possible test outcomes for a Basic Rate ISDN interface

Event	Action	Error	Result
10 consecutive bad or missing sequences	Halt test	No loopback	Bad
< 99.9% error free sequences	Complete test	-	Bad
>= 99.9% error free sequences	Complete test	-	Good

Tests cannot run on a BRI port that has a call established. This should not be a problem if a loopback plug is being used because removing the ISDN connection to insert the loopback plug disconnects the call.

It is normal for up to three errors to occur at the start of the test. These errors should be ignored.

Primary Rate ISDN Port Tests

The Primary Rate ISDN port test requires a loopback plug or cable in the port being tested, to loop data back to the router. For a 75Ω interface, use a length of 75Ω coaxial cable between the Rx and Tx connectors on the interface. For a 120Ω interface use a loopback plug (Figure 26-11 on page 26-10). Three error thresholds determine the test outcome (Table 26-5 on page 26-10).

Figure 26-11: Primary Rate ISDN 120Ω loopback plug wiring diagram

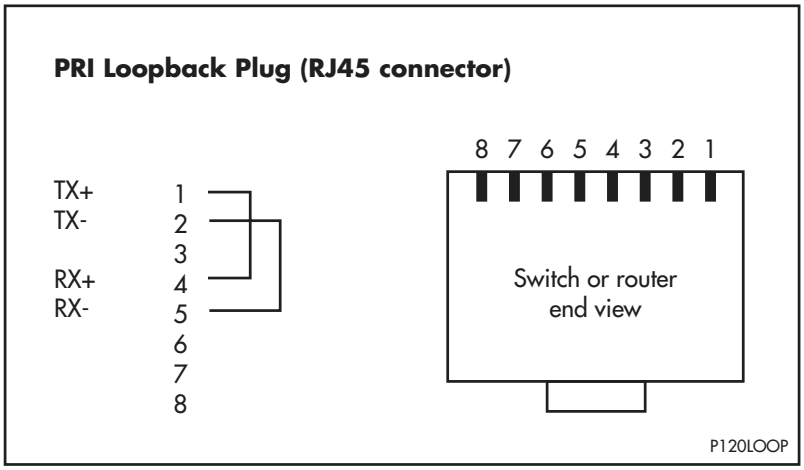


Table 26-5: Possible test outcomes for a Primary Rate ISDN interface

Event	Action	Error	Result
10 consecutive bad or missing sequences	Halt test	No loopback	Bad
< 99.9% error free sequences	Complete test	-	Bad
>= 99.9% error free sequences	Complete test	-	Good

MAC Card Tests

The MAC (*Mini Accelerator Card*) is not strictly an interface, but the MAC card tests are included with the interface tests to allow the tests to be managed in the same manner.

There are two different types of tests to check the correct functioning of the installed MAC card – encryption tests and compression tests. The tests that may be run depend on the specific MAC card installed in the router. For example, encryption tests can only be run on a card capable of performing encryption. Individual tests can be activated manually. However, the Test Facility can also detect the type of MAC card installed and running all of the tests appropriate for that type of MAC card.

When the test is enabled, the Test Facility configures the necessary encryption and/or compression channels. Test frames are processed through these channels and the resulting data compared with the original data.

Three error thresholds determine the test outcome (Table 26-6).

Table 26-6: Possible test outcomes for a MAC card

Event	Action	Error	Result
10 consecutive bad or missing sequences	Halt test	Hardware fault in MAC card.	Bad
< 99.9% error free sequences	Complete test	-	Bad
>= 99.9% error free sequences	Complete test	-	Good

In Test Facility commands, the MAC cards are referred to by the names MAC, MAC0, and MAC1.

Command Reference

This section describes the commands available on the router for testing the router's hardware.

Some interface and port types mentioned in this chapter may not be supported on your router. The interface and port types that are available vary depending on your product's model, and whether an expansion unit (PIC, NSM) is installed. For more information, see the Hardware Reference.

The shortest valid command is denoted by capital letters in the Syntax section. See "Conventions" on page xcv of Preface in the front of this manual for details of the conventions used to describe command syntax. See Appendix A, Messages for a complete list of messages and their meanings.

To alert the user of a test failure, the bell character is printed each time a negative test result is printed. In the following outputs, a bell character is printed for each * character displayed in the outputs (the * character is included in the actual output).

disable test interface

Syntax `DISable TEST INTerface=`*`interface`*

where *interface* is the interface being tested

Description This command halts interface tests that are active. The interface must be specified (Table 26-7 on page 26-12).

Examples To disable testing on asyn 3, use the command:

```
dis test int=asyn3
```

Related Commands

enable test interface
reset test interface
show test

enable test interface

Syntax `ENAble TEST INTerface=`*`interface`* `[TIme=`*`time`*`|CONT] [MORE]`

where:

- *interface* is the interface to be tested.
- *time* is the required test duration in minutes.

Description This command enables interface tests. The interface or interfaces to be tested must be specified (Table 26-7).

Table 26-7: Valid interface options for the **enable test interface** command

Interface options	Tests
ALL	All router interfaces
BASE	All interfaces on the base board
EXPANSION	All interfaces on the expansion board
ETHn	Ethernet interface n
SYNn	Synchronous interface n
ASYNn	Asynchronous port n
PORTn	Switch port n
BRIn	Basic Rate ISDN interface n
PRIn	Primary Rate ISDN interface n
MAC	All possible tests on the installed MAC card
MAC0	MAC card encryption
MAC1	MAC card compression

The TIME parameter specifies the duration of the tests in minutes. If TIME is not specified the tests are run for 4 minutes. If CONT is specified the tests are run continuously.

The MORE parameter provides continuous updates of the status of the current test and control states of asynchronous and synchronous interfaces (Figure 26-12 on page 26-13 and Figure 26-13 on page 26-13). Control signal faults are logged to the router's logging facility, which can be displayed with the command:

```
show log
```

The MORE parameter should be used on a single interface at any one time. The MORE parameter is not valid when INTERFACE specifies a group of interfaces; however, no mechanism is provided to prevent MORE being individually enabled on multiple interfaces. This command is provided for hardware servicing purposes only.

Due to the nature of the output, it may be difficult to enter commands, including the **disable test interface** command on page 26-11, while the MORE option is in effect. Tests should therefore be enabled for a short period.

Figure 26-12: Example output from the **enable test interface more** command for an asynchronous port

```
asyn1 control signals; cycle 2

output        input
------------------------
rts   OFF     cts   OFF
dtr   ON      cd    ON
              ring   -
------------------------
```

Figure 26-13: Example output from the **enable test interface more** command for a synchronous port

```
syn0 control signals; cycle 4
Test cycle 2      X.21
Interface mode 3  X.21

output        input
----------------------
rts OFF       cts OFF
rl  ON        cd  ON
ll  OFF       ti  OFF
----------------------
```

Examples To enable testing on switch port 3, use the command:

```
ena test int=port3
```

To enable testing on asynchronous port 0, use the command:

```
ena test int=asyn0
```

Related Commands
disable test interface
reset test interface
show test

reset test interface

Syntax `RESET TEST INTerface`

Description This command is used to clear all the results from interface tests, setting the state column to “no test” and clearing the other result parameters.

Examples To clear all previous test results ready to start a new test, use the command:

```
reset test int
```

Related Commands
disable test interface
enable test interface
show test

show test

Syntax

```
SHow TEST [INTerface[={ALL|BASe|EXPpansion|MAC}]]
   [COUnter]
```

Description

This command displays the unit test status and results. The results are stored until a test is rerun, the **reset test interface** command on page 26-13 is entered, or the router is powered off or reset. The interface or interfaces currently being tested may be specified (Table 26-8). If no interface is specified, the results for all tests are displayed.

Table 26-8: Valid interface options for the **show test** command

Interface	Tests
ALL	All router interfaces
BASE	All interfaces on the base board
EXPANSION	All interfaces on the expansion board
MAC	All resources on a MAC card.

The **show test interface** variant displays the results of interface tests (Figure 26-14 on page 26-14, Table 26-9 on page 26-15), for the interfaces specified. The results are stored until a test is rerun, a **reset test interface** command on page 26-13 is entered, or the router is powered off or reset.

Figure 26-14: Example output from the **show test interface** command

```
Board      ID  Bay Nick Name       Part Name       Rev   Serial number
-------------------------------------------------------------------------
Base        0      2820-2WAN       niq-2820        M2    2158849
                                                Duration      Details
Interface  State    Result              Type    (minutes)  Data( %OK ) Control
-------------------------------------------------------------------------
  eth0    complete  * BAD               trans         5   BAD (  0.0)    -
                                        TP            0    -     -       -
                                        ENDEC         5   good(100.0)    -
                                        MAC           5   good(100.0)    -

  syn0    testing   wait continuous     RS-232dte   355   good(100.0)  good
                                              dce   355   good(100.9)  good
                                        X.21  dte   354   good(100.0)  good .
                                              dce     0    -     -       -
                                        V.35  dte   354   good(100.0)  good
                                              dce     0    -     -       -

  syn1    complete  good                RS-232dte     5   good( 99.9)  good
                                              dce     5   good(100.0)  good
                                        X.21  dte     5   good(100.0)  good
                                              dce     0    -     -       -
                                        V.35  dte     5   good(100.0)  good
                                              dce     0    -     -       -
  port0   testing   wait 12789 minutes   -           1   BAD ( 75.1)  good .
  port1   complete  check this screen    -           4   N/A          good
  port2   complete  good                 -        1000   good( 99.9)  good
  port3   complete  * BAD                -          15   good(100.0)  BAD
-------------------------------------------------------------------------
```

Table 26-9: Parameters in the output of the **show test interface** command

Parameter	Meaning
Board	Board type. Possible types are: Base Expansion NSM PIC MAC Uplink
ID	Identification number for the board model.
Bay	Bay number where the expansion card is installed.
Nick Name	Short name for the board.
Part Name	Complete part name for the board.
Rev	Version number of the board.
Serial Number	Unique serial number for the board.
Interface	Name of the interface to which the test results apply.
State	State of the test module for this interface: no test testing complete halted
Result	The test result. If the test has been completed, the result can be "check this screen", "good" or "* BAD". If testing is in progress the result is either "wait continuous" or "wait <mins> minutes". If testing has been halted the result is either "* Active LAN", "* BAD or no SynTstr", or "* BAD or no loop".
Type	The particular test sub-mode. This varies depending on the router model and interface type being tested. Not all tests have multiple sub-modes. For example, there are possible test sub-modes for Ethernet: "trans", "TP" and "ENDEC".
Duration	Duration of the test.
Data	Whether results for data signals are good or bad.
%OK	Number of data frames successfully received as a percentage of the total number of data frames transmitted.
Control	Whether results for control signals are good or bad.

In Figure 26-14 on page 26-14, RS-232r and RS-232g refer to "RS-232 receive clocks" and "RS-232 generate clocks", respectively. The entry "check this screen" means that the **enable test interface** command on page 26-12 that started that interface's test was entered from that interface. This means that only the control signals are tested. The data signals are tested by visually checking the output screen. When the control signal test had failed, then "* BAD" is printed, as with the other tests. The dot (".") in the control column of the syn0 test indicates the interface mode that is currently being tested. A dot is also used in the control column of Ethernet tests to indicate which loopback mode is being tested. The dot is printed when the test state is "testing".

Due to the criteria used to halt tests, the details columns of halted tests may show “good” if the event that halted the test occurred after the test had been running correctly.

The **show test interface counter** variant displays the counters used for interface tests (Figure 26-15 on page 26-16, Table 26-10 on page 26-16). The counters are stored until a test is rerun, the **reset test interface** command on page 26-13 is entered or the router is powered off or reset.

Figure 26-15: Example output from the **show test interface counter** command

```
                              Duration                    Frame Counters
Interface  State     Type     (minutes)         Tx     RxTotal     RxGood      RxBad
-------------------------------------------------------------------------------
  eth0     complete  trans           10  000453728  000453727  000453727  000000000
                     TP               0  000000000  000000000  000000000  000000000
                     ENDEC           10  000456098  000456097  000456097  000000000

  syn0     no test    -               -          -          -          -          -

  syn1     testing   RS-232dte        5  000003098  000003097  000003096  000000001
                           dce        5  000002187  000002186  000002186  000000000
                     X.21  dte        5  000012453  000012452  000012452  000000000
                           dce        0  000000000  000000000  000000000  000000000
                     V.35  dte        5  000011398  000011397  000011397  000000000
                           dce        0  000000000  000000000  000000000  000000000

  port0    testing    -               1  000000176  000000175  000000175  000000000
  port1    complete   -           10000  001965688  001965688  001965688  000000000
  port2    complete   -              15  000003983  000003983  000003983  000000000
  port3    halted     -             600  000110986  000110986  000110976  000000010
-------------------------------------------------------------------------------
```

Table 26-10: Parameters in the output of the **show test interface counter** command

Parameter	Meaning
Interface	Name of the interface to which the test counters apply.
State	The state of the test module for this interface: no test testing complete halted
Type	The particular test sub-mode. This is test dependent and not all tests have multiple sub-modes. For example, there are possible test sub-modes for Ethernet: trans, TP, and ENDEC.
Duration	Duration of the test.
Tx	Total number of frames transmitted on the interface.
RxTotal	Total number of frames received on the interface.
RxGood	Number of good frames received on the interface.
RxBad	Number of bad frames received on the interface.

Examples To display the test results from testing a MAC, use the command:

```
sh test int=mac cou
```

Related Commands disable test interface
enable test interface
reset test interface