CHAPTER 6

Corrective Maintenance—Interface Circuits

Digital interface circuits connect the VCO/4K to external telecommunication environments. Problem isolation requires establishing whether the fault stems from external causes or with internal circuit cards and adapters. This chapter reviews general troubleshooting procedures for VCO/4K Port Interface Cards. For detailed information about specific circuit cards, refer to the *Cisco VCO/4K Card Technical Descriptions.*

Fault Isolation

The demarcation point for interface with the VCO/4K is the Storage/Control I/O Module in the rear of the VCO/4K. From this module, problems are external to the VCO/4K and must be corrected using conventional digital telephone troubleshooting techniques.

Database entries define the external telecommunication environment with which the VCO/4K interfaces. If the entries do not reflect the reality of the environment, the system cannot effectively process calls. Problems with the database can be caused by human error in administering the database and by undocumented alterations to the external wiring plan or telephone station programming.

Other hardware-related faults include faulty CO lines, defective interconnect cables and backplane adapters, and software/firmware incompatibility. VCO/4K status LEDs on the front panel provide a visual indication of operating status.

The following sections review the hierarchy of probable faults that may cause problems with VCO/4K interface circuits.

Database Administration

The entries in the system database must meet the requirements of a specific implementation and must correspond to the external telecommunications environment. In VCO/4K systems, the environment includes circuit card locations, trunk or line card configurations, port configurations, inpulse and outpulse rules, answer supervision templates, and resource group configurations.

Altering the Database

Adding or removing stations, lines, and trunks affects the contents of the database. If this environment changes, the database must be altered or incremented to keep the system in harmony with the environment. Unless the database is properly administered, VCO/4K call processing software will be unable to complete calls through the system.

■ **Fault Isolation**

Record Keeping

Cisco Systems recommends careful record keeping to monitor the system configuration as it changes. Record changes made to the database and make appropriate alterations to the system database.

Backing Up Copies of the Database

Make floppy disk backup copies of the original database, the immediate past database, and the current database. Clearly label the floppy disks and store them in a safe place so that you can quickly restore the system database if a hard disk must be replaced or new system software installed.

Note   Since the A-side and B-side of the system may differ, for example in the system configuration, host configuration, peripheral, and file system, separate backups are necessary.

Detecting Database Problems

System error messages and general error messages provide some indication of database configuration problems. Status information returned in reports to the host can also indicate configuration problems in the database. The Database Administration Menu can be used to access submenus, which you can use to correct the database configuration.

Refer to the *Cisco VCO/4K System Administrator's Guide* and *Cisco VCO/4K System Messages* for information about database problems and error messages.

Correcting Database Problems

Use the Print Screen key or Print Database Detail function to obtain hardcopy listings of the contents of the database. Compare the listing against the original or immediate past database entries to determine where a change has been made that affects system operation.

Refer to the *Cisco VCO/4K System Administrator's Guide* for details on making changes to the system database.

Station or CO Line/Trunk Problems

Poor signal quality and/or loss of line/trunk service can also adversely affect system operation. Line/trunk connections can also be broken or miswired at the Digital Cross Connector serving the system or through the digital cross cables running to the Storage/Control I/O Module cards.

Poor Signal Quality

A line/trunk with poor transmission characteristics can cause intermittent problems that may be difficult to detect without using special transmission test sets. Answer supervision and in-band call setup signaling can be lost even though voice transmission is intelligible.

If the VCO/4K is implemented behind a PBX, excessive cumulative losses in signal levels going out and returning through the PBX can greatly affect the intelligibility of voice-band transmission and reception. Similar problems may occur with losses through a CO in dial-up implementations.

Loss of Lines/Trunks

Out-of-service lines/trunks can cause a degradation in system performance as calls must wait for available lines/trunks before processing can be completed. Calls made through dial-up stations may be blocked at the CO because no dial-up trunk is available to complete routing to the VCO/4K.

Detecting Station and CO Line/Trunk Problems

The best way to assure early detection of line/trunk problems is to run frequent checks of call completing trunks. Do this at the Digital Cross Connector with a handset. Dial-up service can also be checked, but the procedure is more complicated and would require progressively busying out each dial-up trunk.

Another method of checking trunk status is to use the Card Display function under the Diagnostics Menu to monitor individual trunk cards. If a port on an interface card does not appear to be processing calls, use the Port Display to look at the specific circuit. Use the Set Up Paths Utility to verify voice path to a suspected port.

Permanent signal conditions are reported to the host. Permanent signal conditions informs the host that a line or trunk has not released within 30 seconds of a release by the VCO/4K system. Refer to the $D2 command and the Permanent Signal Condition (PSC) report in the *Cisco VCO/4K Standard Programming Reference* and the *Cisco VCO/4K Extended Programming Reference*.

Correcting Station and CO Line/Trunk Problems

If the problem is on the system side of the Digital Cross Connector, check interconnecting cables, the midplane adapter, and the current status of the interface card to which the faulty line/trunk is connected. If an entire group of lines/trunks is out-of-service, suspect a bad interface card and go to the "Digital Interface Card Problems" section on page 6-3.

If the problem is on the network or direct connect station side of the Digital Cross Connector, the responsibility for repairing the circuit depends on where the system is located and who is supporting line/trunk services. The faulty circuit number should be recorded and a repair history maintained.

Digital Interface Card Problems

Interface with digital channel banks across a T1 span line requires the use of the following Digital Trunk Interface cards:

- T1 (Domestic) or E1 (International)
- T1-E (Japan only)
- Programmable 4 Span T1 (Domestic) or Programmable 4 Span E1 (International)

VCO/4K systems also support the following optional Primary Rate Interface (PRI) cards for ISDN-PRI services:

- PRI/N (Domestic)
- E1-PRI (International)

Note   PRI cards must be used in conjunction with Cisco's ISDN PRI software package.

The NBC3 assures synchronization between VCO/4K internal clocks and incoming/outgoing T1/PRI and E1 channels.

Digital Alarm Conditions

Factors which cause Digital Interface major alarm indications include:

- Loss of carrier
- Failure of internal communications bus test (card self-test)
- Card out-of-service (manually via Master Console or due to a communication bus error)

Table 6-1 summarizes the Master Console actions that affect these cards. For more information, refer to the *Cisco VCO/4K System Administrator's Guide*.

Table 6-1   Master Console Actions Affecting Digital Interface Cards

Action Taken at Master Console	Outward Action
Change card state to Diagnostic from Active or Maintenance	Tears down any active calls and goes into local loopback; sends all 1s, all bits alarm. Stops sending, which causes Red alarm at far end.
Change card state to Maintenance	New seizures are not processed.
Change card status to Active from Diagnostic	Starts sending bits or stops sending all 1s, all bits. Yellow alarm sent from far end causes yellow LED to go on. Far end stops sending Yellow alarm when carrier is restored; yellow LED goes off. If card was previously in Maintenance state, it returns to Maintenance. Otherwise it returns to Active.

Any ports that have been deactivated from Card Maintenance Menu or by host command are seized out (busied out). |
| Change to OOS | Sends all 1s, all bits. |
| Change card status to Active from OOS or Maintenance | Card is reset. All LEDs ON changes to yellow and green LEDs ON, then red LED ON. Red and Yellow LEDs go off when carrier is restored.

Any ports that have been deactivated from Card Maintenance Menu or by host command are seized out (busied out). |

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> **Note**   Refer to the specific digital interface card's technical description for the card's LED states.

Factors which cause Digital Interface minor alarms include:

- Loss of remote carrier
- Detection of a signaling bit alarm
- Slips
- Out-of-Frame (OOF) condition
- Out-of-Frame (OOF) maintenance threshold reached

Loss of carrier can be attributed to a fault in the span line or a failure of the digital side of the terminating equipment. Loss of synchronization can be related to problems with the T1/PRI span line providing external sync with the VCO/4K, an external sync pulse source connected to the NBC3, or NBC3 Digital Interface phase lock timing.

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Verify terminating equipment operation and the span line connection before removing and replacing one of the Digital Interface or NBC3 cards. Loss of a channel(s) may be the result of problems on the originating side of the terminating equipment/digital switch.

Test Port Card

The Diagnostics Menu offers the Test Port Card screen which allows a technician to send a digit string through specified channels of a Digital Interface card and loop the results through a DTMF or MF Receiver card. The test compares the expected string against the received string and sends an error message to the file and printer, indicating the error and ports affected.

Note   The Test Port Card utility can only be used to test T1 channels or ISDN B-channels. PRI/N D-channels cannot be tested using this utility.

For DTMF receivers, the following string of digits is sent through the first and subsequent T1 channels: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, *, #. For MF receivers the following string of digits is used: KP, 0, 1, 2, 3, ST, 4, 5, 6, 7, ST3, 8, 9, ST1, KP, 0, 1, 2, STP. The test automatically cycles through the range of receiver ports entered by the administrator as each T1/PRI channel is tested.

Note   Use the Card Maintenance Menu under the Maintenance Menu to place the desired receiver card and T1/PRI card in Diagnostic (D) mode. This test does not work unless both cards have been placed in Diagnostic mode.

If all messages are printed, the screen shows the RLSP addresses of both the receiver and the Digital Interface card ports, as well as the results when each channel is tested. If a channel passes the test, a message appears on the screen and the port numbers are incremented for the receiver and Digital Interface cards. When all channels of the Digital Interface card have been tested, a message appears at the bottom of the screen.

If a channel fails a test, an error message, the two digit test strings and the address of the channel are sent to the error log and the system printer. For additional information, refer to the *Cisco VCO/4K System Administrator's Guide.*

System Log—Digital Interface Error and Status Messages

Error and status messages associated with Digital Interface cards are listed and described in *Cisco VCO/4K System Messages*.

Interface Card Configuration

Card configuration refers to setting jumpers and switches on interface cards to meet application requirements. *Cisco VCO/4K Card Technical Descriptions* details configuration requirements for VCO/4K digital interface cards.

■ Troubleshooting

If a card is improperly configured, it may fail to perform its interface function between external lines/trunks and the system. Verify configuration settings before installing a replacement interface card in the system. Always check the firmware version against the requirements specified in the configuration portion of the system software release notes. If the wrong version of firmware is installed, the system does not operate properly.

Port Configuration refers to the process of specifying appropriate data for each port in the system database. If the port is improperly configured, the system may interpret seizures as disconnects or not see them at all.

Class of Service (COS) also greatly affects operation of the card. A COS of T or 2 sees inward seizures as call originations. A COS of O interprets inward seizures as the port being busied out by the far end. If calls are not being properly processed, check the COS.

Troubleshooting

Refer to the *Cisco VCO/4K Card Technical Description*s and the *Cisco VCO/4K Troubleshooting Guide* for detailed information on troubleshooting and repair/replacement of VCO/4K Port Interface cards.

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Caution   Observe antistatic precautions when handling interface circuit cards to avoid damaging sensitive CMOS devices. Wear a ground strap connected to the VCO/4K equipment frame whenever servicing or cleaning circuit cards. The ground point is indicated by a label on the upper, right side in the front of the system (with the door removed).