SC30-3164-1
S370/4300-30

Program Product

X.25 NCP Packet Switching Interface for IBM 3705 Diagnosis Guide

Program No. 5668-981
Release 2, 3 and 3.1

IBM

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Second Edition (July 1983)

This is a major revision of and obsoletes SC30-3164-0 and Technical Newsletter SN30-3246. A change to the text or to an illustration is indicated by a vertical line to the left of the change. This edition applies to Releases 2, 3, and 3.1 of X.25 NCP Packet Switching Interface Program Product 5668-981, and to all subsequent releases and modifications unless otherwise indicated in new editions or Technical Newsletters. Changes are made periodically to the information herein; before using this publication in connection with the operation of IBM systems, consult the latest IBM System/370 and 4300 Processors Bibliography, GC20-0001, for the editions that are applicable and current.

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PREFACE

This manual is designed to help customer diagnosticians and IBM Program Support Representatives (PSRs) to isolate and define problems in the X.25 NCP Packet Switching Interface program product. The following procedures guide you through the problem determination process. They describe:

- How to ensure that your problem is with the X.25 NCP Packet Switching Interface
- How to use relevant information to describe your problem
- How to gather appropriate documentation about your problem
- How to report your problem to the IBM Support Center

Note: In this publication, generic terms are used for brevity. Network control program (or NCP) refers to ACF/NCP. Access method refers to the access method being used, when there is no need to distinguish between TCAM and VTAM. Where necessary, the text refers to VTAM -- meaning ACF/VTAM or VTAM -- and TCAM -- meaning ACF/TCAM or TCAM.

This manual can be used in conjunction with the

Short Title	Complete Title	Order Number
ACF/NCP Diagnosis Guide Release 3	Advanced Communication Function for Network Control Program and System Support Programs for the IBM 3705 Release 3 Diagnosis Guide	SC30-3156
ACF/NCP Diagnosis Guide Version 2	ACF/NCP-SSP for the IBM 3705 Version 2 Diagnosis Guide	SC30-3171
ACF/NCP Utilities Release 3	ACF/NCP-SSP for the 3705 Release 3 Utilities	SC30-3158
ACF/NCP Utilities Version 2	ACF/NCP-SSP for the 3705 Version 2 Utilities	SC30-3168

This manual shows you how to describe your problem and how to gather information from diagnostic aids. If you need help to further analyze or interpret any of these diagnostic aids, refer to:

Short Title	Complete Title	Order Number
Diagnosis Reference	X.25 NCP Packet Switching Interface for the IBM 3705 Diagnosis Reference	LY30-3054
Reference Summary	X.25 NCP Packet Switching Interface for the IBM 3705 Reference Summary	SC30-3079
ACF/NCP Logic Release 3	ACF/NCP/VS for the 3705 Release 3 Logic	LY30-3057
ACF/NCP Logic Version 2	ACF/NCP/VS for the 3705 Version 2 Logic	LY30-3061

Prerequisite Publications

Before using this manual, you should be familiar with the concepts and terminology in the:

Short Title	Complete Title	Order Number
General Information	X.25 NCP Packet Switching Interface for the IBM 3705 General Information	GC30-3080
Installation and Operation	X.25 NCP Packet Switching Interface for the IBM 3705 Installation and Operation	SC30-3163

Related Publications

When using this manual, you should have the following publications available (some of these publications are dependent upon the access method and the operating system that you are using).

For Hardware

Short Title	Complete Title	Order Number
	5973-LO2 Product Description	GA11-8643
	Guide to Using the IBM 3705 Communication Controller Control Panel	GA27-3087

For Network Control Program

Short Title	Complete Title	Order Number
ACF/NCP Messages Release 3	ACF/NCP/VS-SSP Release 3 Messages	SC30-3145
ACF/NCP Messages Version 2	ACF/NCP/VS-SSP Version 2 Messages and Codes	SC30-3169
	ACF/NCP/VS: Program Reference Summary	LY30-3058
	ACF/NCP-SSP Version 2 Installation and Resource Definition	SC30-3167
	ACF/NCP Release 3 Customization	ZC30-3146
	ACF/NCP Version 2 Customization	SC30-3170

For ACF/VTAM Release 3

Short Title	Complete Title	Order Number
	ACF/VTAM Diagnosis Reference Release 3 (for OS/VS)	LY38-3027
	ACF/VTAM Diagnosis Reference Release 3 (for VSE)	LY38-3022
	ACF/VTAM Diagnosis Guide Release 3 (for OS/VS)	SY38-3029
	ACF/VTAM Diagnosis Guide Release 3 (for VSE)	SY38-3020
	ACF/VTAM Operation Release 3	SC27-0466

For ACF/VTAM Version 2

Short Title	Complete Title	Order Number
	ACF/VTAM Diagnosis Reference Version 2 (for OS/VS)	LY38-3053
	ACF/VTAM Diagnosis Reference Version 2 (for VSE)	LY38-3058
	ACF/VTAM Diagnosis Guide Version 2 (for OS/VS)	SY27-0615
	ACF/VTAM Diagnosis Guide Version 2 (for VSE)	SY27-0630
	ACF/VTAM Operation Version 2	SC27-0612

For ACF/TCAM

Short Title	Complete Title	Order Number
	ACF/TCAM Diagnosis Reference	LY30-3052
	ACF/TCAM Diagnosis Guide	SC30-3155
	ACF/TCAM Operation	SC30-3136

For Operating Systems

Short Title	Complete Title	Order Number
	IBM Virtual Machine Facility/370 OLTSEP and Error Recording Guide	GC20-1809
	OS/VS1 Service Aids	GC28-0665
	OS/VS2 MVS System Programming Library (SPL) Service Aids	GC28-0674
	VSE/Advanced Functions Serviceability Aids and Debugging Procedures	SC33-6069
	OS/VS, VSE and VM/370 Environmental Recording, Editing and Printing (EREP) Program	GC28-0772

CONTENTS

FIGURES

SUMMARY OF AMENDMENTS

This second addition includes the new functions of Release 3.1 of the X.25 NCP Packet Switching Interface. Boundary Network Node Qualified Logical Link Control (BNN QLLC) offers a new method of communication between SNA hosts and SNA peripheral nodes. BNN QLLC is an extension of Logical Link Control level 3. The COMMIT/DECOMMIT function manages buffers.

Other minor changes, corrections, and clarifications appear throughout this edition.

A change to the text or to an illustration is indicated by a vertical line to the left of the change.

CHAPTER 1. INTRODUCTION

FINDING THE PROBLEM

The most important step in diagnosing a problem is locating the starting point of the problem. You must try to identify the failing component.

The X.25 NCP Packet Switching Interface runs under NCP, which interacts with a host processor, an X.25 network, and terminals. Errors in an access method or breakdowns in a terminal sometimes appear to be failures of the NCP or the X.25 NCP Packet Switching Interface.

To determine if your problem is with the X.25 NCP Packet Switching Interface, you must analyze the flow of data through your network. Obtain the Record Maintenance Statistics (RECMS) records and a formatted NCP dump to see if the problem is with X.25 NCP Packet Switching Interface. Depending on your problem, you may need other types of diagnostic aids such as the X.25 SNAP facility, physical circuit (MCH)[1] line trace, VTAM buffer trace, or TCAM PIU trace. Chapter 3, "Diagnostic Aids" contains information on how to obtain these other types of diagnostic aids.

Interpreting the information obtained from dumps, traces, and other diagnostic aids may be a complex task. This manual is not designed to help you analyze these materials, but rather to let you know the types of service aids available and how to obtain them. For information on how to interpret these aids, see the Diagnosis Reference and the Reference Summary. You can also call the IBM Support Center for help in analyzing your diagnostic data.

If you find by analyzing of the flow of data through your network that your problem does not seem to be originating from the X.25 NCP Packet Switching Interface, then refer to the following manuals for the component that you believe to be the cause of the problem.

- The Maintenance Information Manual for a hardware component
- The Diagnosis Guide for a program component

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[1] A physical circuit is sometimes referred to as a multichannel link (MCH) that describes the physical link over which many virtual circuits are established. This document uses the term physical circuit instead of multichannel link except in tables and charts where MCH is used.

GATHERING INFORMATION TO DESCRIBE THE PROBLEM

Before calling the first level of the IBM Support Center, be sure you have the following information available:

The X.25 NCP Packet Switching Interface Component ID Number

This number identifies the particular IBM licensed program product that is experiencing the problem.

Licensed IBM Program Product	Component ID Number
X.25 NPSI (MVS/OS/VS) *	566898101
X.25 NPSI (VSE) *	566698101

* X.25 NCP Packet Switching Interface

The X.25 NCP Packet Switching Interface Release Number

Be sure to have the release level of the program that failed and the operating system it is running under (see Figure 1-1 for OS/VS or Figure 1-2 for VSE).

You need not record the System Maintenance Program (SMP), Field Maintenance Identifier (FMID), and Release Level Keyword. If the support representative wants this information, he will ask you for it.

Component Name and Release Level	Code	System Maintenance Program	Field Maintenance Identifier	Release Level Keyword
X.25 NPSI Release 1	PP	SMP4	JXX1100	R100
X.25 NPSI Release 2	PP	SMP4	JXX1200	R200
X.25 NPSI Release 3	PP	SMP4	JXX1300	R300
X.25 NPSI Release 3.1	PP	SMP4	JXX1310	R310

Figure 1-1. Chart for Determining Release Levels in OS/VS Systems

Component Name and Release Level	Code	Release Level Keyword	Program Information Number
X.25 NPSI Release 1	PP	RE53	E53
X.25 NPSI Release 2	PP	RF17	F17
X.25 NPSI Release 3	PP	RF22	F22
X.25 NPSI Release 3.1	PP	RH30	H30

Figure 1-2. Chart for Determining Release Levels in VSE Systems

List of Fixes and Changes to Your System

Have a list of all fixes, Program Temporary Fixes (PTFs), and Authorized Program Analysis Report (APAR) fixes that have been applied to your system. Also have a list of any recent changes that have been made to your system, such as user program modifications, redefinition of macros in system generation, or change of parameters used to start the system.

List of Documents

Prepare a list of all documentation that you have used for operating your system and for trying to find or fix the problem.

System Configuration

Be ready to tell the support representative:

- The X.25 network you are using
- The types of terminals you are using
- The logical link control you are using
  - LLC0 - PCNE
  - LLC2 - PSH
  - LLC3 - QLLC (BNN and INN)
  - LLC4 - GATE
  - LLC5 - PAD

Background Information Regarding the Problem

Recall the first indication you had of the problem and any recovery attempts made before a dump or trace was taken.

Type of Problem

Describe your problem to the Level 1 support representative. The support representative will enter your description as a list of keywords into the RETAIN program to see if your problem matches an existing X.25 NCP Packet Switching Interface problem.

Chapter 2, "Determining the Type of Problem" shows how to prepare a report to describe your problem. X.25 NCP Packet Switching Interface problems can be described as one or more of the following types:

- ABEND
- MESSAGE
- LOOP
- INCORRECT OUTPUT
- PERFORMANCE
- DOCUMENTATION

Before Determining the Type of Problem

Familiarize yourself with the problem by reviewing the following set of questions:

- Has the system run successfully before?
- Have any changes (APAR fixes, PTFs, user modifications, application changes, hardware changes, table changes) been made since the last successful run?

- If fixes have been applied, have all modules involved been link edited? Were there any problems applying the fixes or PTFs?
- If fixes have been applied, will removing the fixes cause successful execution?
- Are the parameters that are used to start the system the same as when the system ran successfully?
- Can the problem be recreated?
- Does the problem always show the same symptoms?
- Is the problem related to a certain application request? For example: RECEIVE, SEND, CLSDST?
- Is the problem dependent on the host processor load, network activity, or time?
- Is the entire network affected? If not, is a certain line or line type, terminal or terminal type affected?
- Is there a Record Maintenance Statistics message (RECMS) for the failure?

If the answer to any of these questions is yes, be sure you report this to the support representative when you call.

REPORTING THE PROBLEM

After you have gathered the appropriate information and documentation to describe your problem, contact the IBM Support Center. The IBM Support Center is the first point of contact for X.25 NCP Packet Switching Interface users who require assistance with program problem identification or resolution.

There are two levels of IBM program support. You will contact the first level, the IBM Field and Technical Support Center, for most X.25 NCP Packet Switching Interface problems. When you contact the Support Center, a dispatcher will ask you for your **ACCESS CODE, ACCOUNT NAME, LICENSE NUMBER,** and other customer identification information. The dispatcher will then determine the type of assistance that you require, assign a problem number, and place your call on a queue to the appropriate Level 1 representative.

Talking with a Level 1 Representative

The Level 1 representative will ask you for a description of your problem. Supply any of the information that you have gathered about your problem beginning with the problem type. After obtaining the

necessary information, the support representative will use your information to build a keyword string. Keywords are used to search an indexed data base called RETAIN for a fix to the problem.

If the search does not yield a fix, the support representative may add some more keywords to the string by asking you for information you have gathered through service aids and documentation. If this additional search does not yield a fix, the support representative will refer your call to the Level 2 support group queue. Before the Level 1 representative assigns you to the Level 2 group, he will make sure you have the documentation necessary to provide the Level 2 representative with the more detailed information he requires.

Talking with a Level 2 Representative

A Level 2 representative will contact you as soon as possible. He will ask you for further information about your problem that will help him to further refine the keywords for additional searches of the data base.

If a fix still cannot be found through data base searches, the Level 2 representative will ask you for more details so he can complete an Authorized Program Analysis Report (APAR) in the RETAIN data base. The APAR allows the Level 2 support group to examine the problem more closely and to develop a fix for the problem. After the fix is developed and tested, it is sent to you or to the IBM Program Support Representative (PSR).

In some cases, you and the Level 2 representative may decide that the problem requires on-site assistance. If so, the appropriate programming service personnel will be sent. In any case, the data base is kept up-to-date with problem descriptions and information about fixes so that similar problems can be resolved by searching the data base with keywords.

RESOLVING PROBLEMS IN HIGH SEVERITY SITUATIONS

If neither Level 1 nor Level 2 of the IBM Support Center can locate a fix for your problem by searching RETAIN, and if the nature of your problem is so severe that it must be resolved immediately, you should work closely with a program specialist to help him develop a quick fix for you. This program specialist will most likely be a representative from the Level 2 Support Center.

Provide the specialist with detailed information about your problem. To help you perform an in-depth analysis of your problem, refer to the Diagnosis Reference and the Reference Summary. By answering questions and following procedures directed by the Level 2 program specialist, you should be able to provide him with the necessary information to quickly develop a temporary fix for your problem.

Working with a program specialist by telephone to solve a high-severity problem is a complex task. If you feel you are not qualified to do a

detailed analysis of a problem, or if you feel that the error is too severe, you may want a Program Support Representative (PSR) sent to the problem site. The Level 2 Support Center can arrange this.

Program Support Representatives are trained to do complex problem diagnosis, but should be requested only after all other attempts to solve the problem have failed. The object of this manual is to help you resolve problems quickly by performing your own problem source identification and determination.

CHAPTER 2. DETERMINING THE TYPE OF PROBLEM

This chapter will help you determine the type of programming problem that you have. If you believe that your problem is a hardware problem, then refer to the appropriate hardware maintenance manual for that device.

The six major types of program problems are:

ABEND:
The program unexpectedly stops processing.

MESSAGE:
A message (an error message or any other message) is associated with the problem or seems itself to be in error.

LOOP:
The program is repeating something endlessly.

INCORRECT OUTPUT:
Output from the program is incorrect.

PERFORMANCE:
The performance of the program has been degraded.

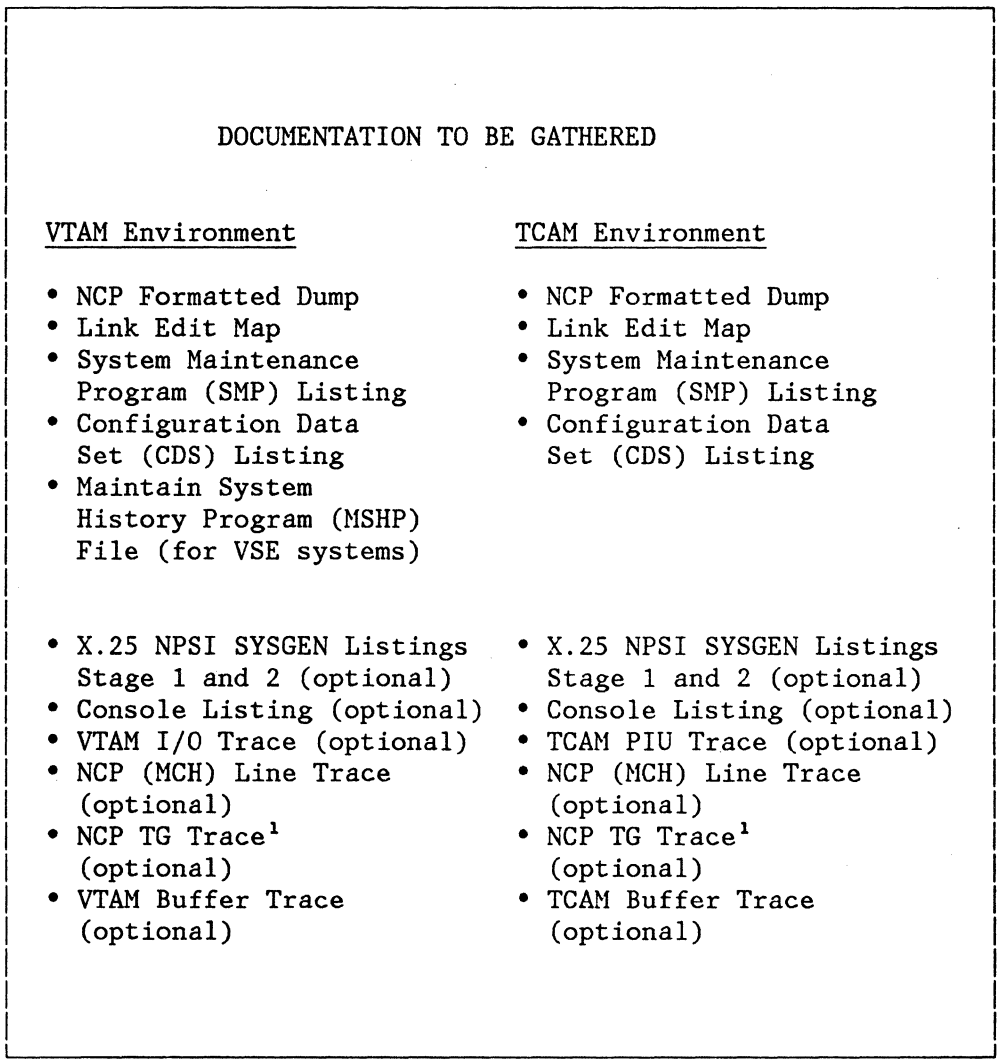
DOCUMENTATION:
Documentation about the program appears to be in error.

For each problem, this chapter provides:

- A list of the documentation to be gathered
- A description of the type of problem
- Directions for preparing your report to the Support Center

Note: Chapter 3, "Diagnostic Aids" contains information that will help you use the diagnostic aids and services.

ABEND



Description

An NCP ABEND may be caused by X.25 operations. The ABEND is usually first indicated by a message at the host console specifying an I/O error on the 3705 channel address.

```
STATUS = DE, UC
SENSE = IPL REQUIRED
```

[1] The NCP TG Trace is valid only for Releases 3 and 3.1 of the X.25 NCP Packet Switching Interface.

Preparing the Report

To determine if the ABEND is related to the X.25 NCP Packet Switching Interface, look at location X'760' in your NCP dump. If a 4-digit value from X'0A00' to X'0ADF' appears, then your ABEND is related to the X.25 NCP Packet Switching Interface. If a different value is indicated, refer to the ACF/NCP Diagnosis Guide for your Release or Version of ACF/NCP.

If location X'760' contains a value within the range from X'0A00' to X'0ADF':

1. Go to Appendix A, "Abend Codes and Program Modules" for a description of the ABEND code.

2. Give this ABEND code to the Level 1 Support Center when you call to report your problem.

MESSAGE

DOCUMENTATION TO BE GATHERED

For Loader/Dump Message Problems:

- Console Log
- Job Output Listing
- Host Region (OS/VS) or Partitioned (VSE) Dump (optional)
- Host Channel Control Word (CCW) Trace (optional)
- NCP Formatted Dump (optional)

For Assembler Message Problems:

- Input to the Assembler and Output Listing
- Console Log (optional)
- Host Region (OS/VS) or Partitioned (VSE) Dump (optional)

Description

A MESSAGE problem consists of an ACF/SSP (Advanced Communications Function/System Support Program) message that:

- Is incorrect
- Is not documented in the ACF/NCP Messages manual for your Release or Version of ACF/NCP, or does not agree with the description there
- Is issued under conditions that should not have caused it to be issued

Preparing the Report

To prepare a MESSAGE problem report:

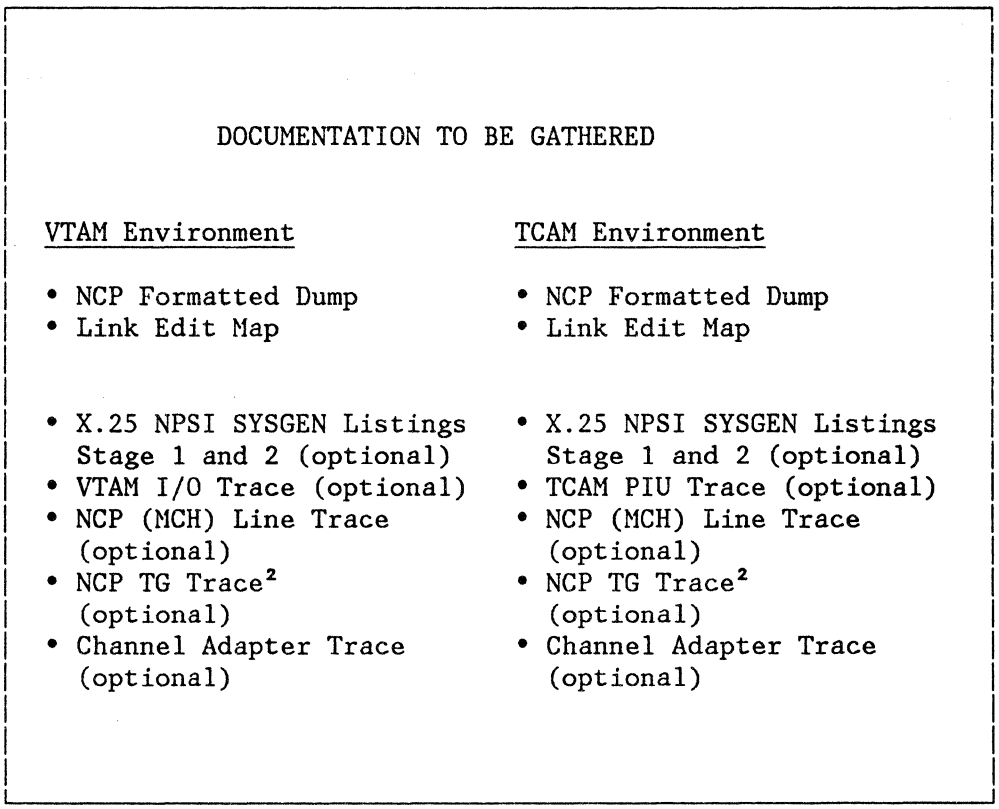
1. Record:
   - The operation you were trying to perform
   - The results you expected

- The results you received

2. Record the entire content of the message, including the message identifier.

3. Give this information to the Level 1 Support Center when you call to report your problem.

LOOP



Description

A loop problem is indicated by X.25 NCP Packet Switching Interface repeating an operation endlessly. Some signs of LOOP problems include:

- A message repeating endlessly (console output with a message identifier)
- Printed output repeating endlessly
- Console output other than a message repeating endlessly
- The system appears to be doing nothing
- The WAIT light on the 3705 panel never blinks

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[2] The NCP TG Trace is valid only for Releases 3 and 3.1 of the X.25 NCP Packet Switching Interface.

Preparing the Report

To determine if you have a loop problem and to prepare to report the problem to the Level 1 support center:

1. Make a note of the indications that make you suspect you have a loop problem.

2. Look at the program level indicators on the 3705 control panel to determine the level in which the loop is occurring. Record the program level displayed by these indicators.

3. Set the DISPLAY/FUNCTION SELECT switch on the 3705 control panel to Temporary Address Register (TAR) and Operation (OP) Register, and press the STOP button. Record the contents of Display A and B. Display A contains the storage address of the next instruction to be executed. Display B contains the first 16 bits of the last instruction executed. For more information on displaying the Temporary Address Register (TAR) and the Operation (OP) Register, see the Guide to Using the IBM 3705 Communications Controller Control Panel.

4. Press the START button on the 3705 control panel, then quickly press the STOP button again. Record the contents of Display A and B. Repeat this procedure several times, trying to get through as much of the loop as possible. Record the contents of Display A and B after each time you press the STOP button.

5. Use the link edit map and the addresses you obtained from displaying the TAR and OP registers to locate the CSECT name or names to determine where in the program the loop is occurring.

6. Obtain an NCP formatted dump to answer any questions that support representatives may ask you.

7. Give the following information to the Level 1 Support Center when you call to report your problem:

   - The initial symptoms that caused you to believe you had a loop problem

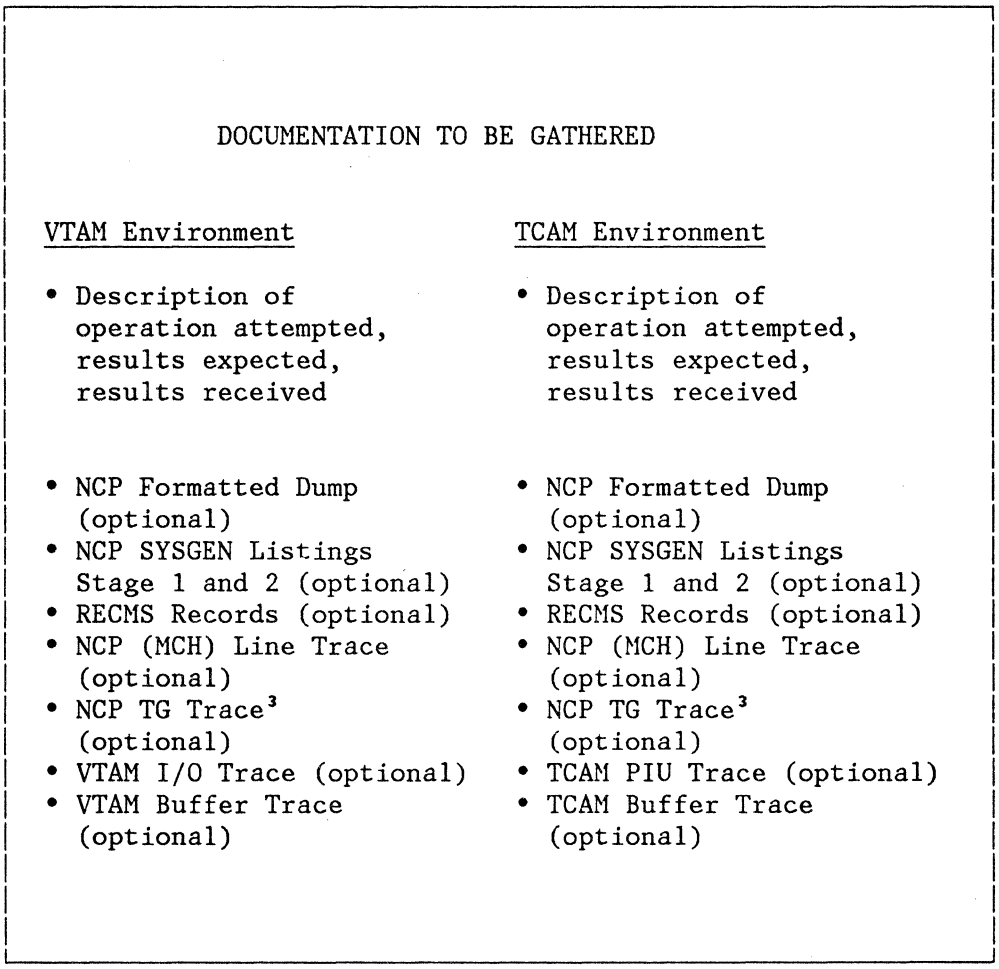
   - The program level in which the loop is occurring, as indicated on the 3705 control panel

   - The contents of the TAR and OP registers (in Display A and B) after each time you press the START and STOP buttons on the 3705 control panel

   - The CSECT name or names in which the loop is occurring, obtained from your link edit map

If you think that LOOP problem does not adequately describe your problem, then refer to INCORRECT OUTPUT problem, following.

INCORRECT OUTPUT



Description

An X.25 NCP Packet Switching Interface INCORRECT OUTPUT problem is an unexpected result during normal network operation. An example of this is missing or incorrect data at a terminal. INCORRECT OUTPUT is the broadest type of problem category and includes problems such as:

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[3] The NCP TG Trace is valid only for Releases 3 and 3.1 of the X.25 NCP Packet Switching Interface.

- ACTIVATE FAILURE

  The inability of the host to establish a session with the physical unit (PU) of a physical circuit (MCH), a non-SNA device, or an SNA device.

- DEACTIVATE FAILURE

  The inability of the host to normally end a session that has been established with the physical unit (PU) of a physical circuit, a remote SNA device or a non-SNA device connected by an X.25 network.

- LOAD FAILURE

  Any problem occurring from the time you invoke the LOAD utility to the time the NCP is initialized.

- DUMP FAILURE

  Any problem occurring when you invoke the DUMP utility to dump the storage contents of the 3705.

- LOST TERMINAL FAILURE

  The inability of a terminal or cluster controller to continue communication across a packet-switched data network.

Preparing the Report

INCORRECT OUTPUT problems are often caused by user definition errors at program generation time. Before calling the Support Center to report your problem, check that all the macro operands were specified correctly for your system during the generation process.

After you have confirmed that all user definitions are specified correctly:

1. Prepare a description of:

   - The operation you were trying to perform
   - The results you expected
   - The results you received

2. Give this information to the Level 1 Support Center when you call to report your problem.

PERFORMANCE

DOCUMENTATION TO BE GATHERED

VTAM Environment	TCAM Environment
• Description of operation attempted, results expected, results received	• Description of operation attempted, results expected, results received
• Stage 1 SYSGEN Listing	• Stage 1 SYSGEN Listing
• NCP Formatted Dump (optional)	• NCP Formatted Dump (optional)
• Console Log(optional)	• Console Log (optional)
• RECMS Records (optional)	• RECMS Records (optional)
• NCP SYSGEN Listing Stage 2 (optional)	• NCP SYSGEN Listing Stage 2 (optional)
• NCP (MCH) Line Trace (optional)	• NCP (MCH) Line Trace (optional)
• NCP TG Trace[4] (optional)	• NCP TG Trace[4] (optional)
• VTAM I/O Trace (optional)	• TCAM PIU Trace (optional)
• VTAM Buffer Trace (optional)	• TCAM Buffer Trace (optional)

Description

A performance problem is almost always characterized by slow response time. PERFORMANCE problems are hard to pinpoint and difficult to define. When you suspect that you have a performance problem, the best thing to do is gather as much information as possible about your operating environment before and during your poor performance times.

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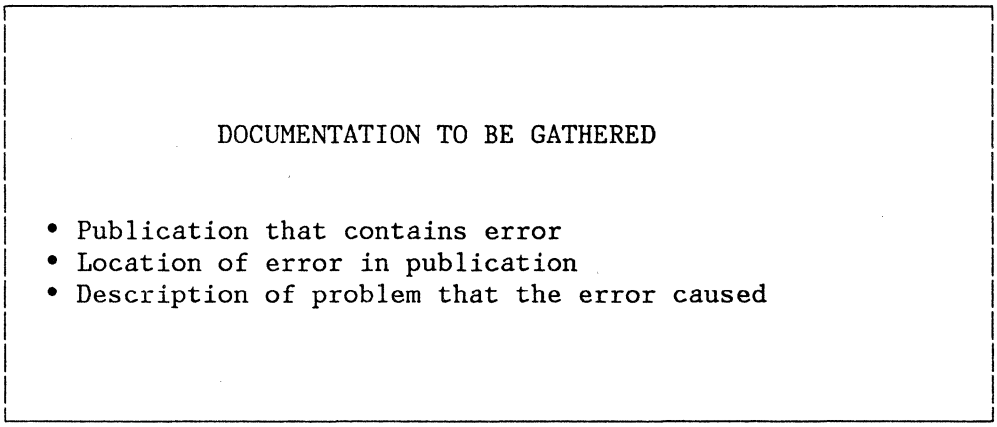
[4] The NCP TG Trace is valid only for Releases 3 and 3.1 of the X.25 NCP Packet Switching Interface.

Preparing the Report

To prepare a PERFORMANCE problem report:

1. Have a description of:
   - The operation you were trying to perform
   - The results you expected
   - The results you received
2. Record any unique characteristics about your operating environment during the time of the PERFORMANCE problem. Some examples of these characteristics are:
   - The time of day when the poor performance occurs
   - Any unique applications that are running at the time of the problem, such as a batch transfer operation.
   - The permanent virtual circuit or the switched virtual circuit involved (and when applicable, the virtual route)
   - The number of circuits involved
   - Any user modifications made to ACF/TCAM, ACF/VTAM, ACF/NCP, or X.25 NCP Packet Switching Interface.
3. Monitor and record the RECMS records
4. Check the console for slow-down messages
5. Give as much of the above information as possible to the Level 1 support center when you call to report your problem.

DOCUMENTATION



Description

An X.25 NCP Packet Switching Interface DOCUMENTATION problem is caused by incorrect, missing, or ambiguously stated information in one of the program product manuals. Report a DOCUMENTATION error only if it actually interferes with the program operation. For comments or suggestions on content, use the Reader's Comment Form in the back of the appropriate manual.

Preparing the Report

Give the following information to the Level 1 Support Center when you call to report your problem:

- The order number and revision number of the manual that contains the error

  These numbers appear on the front cover and title page of the manual in the form **xxxx-xxxx-n**, where xxxx-xxxx is the order number and n is the revision number.

  If the documentation error is found in a Technical Newsletter (TNL), the order number is at the top of each page in the manual affected by that TNL. It is in the form xxxx-xxxx.

- Give the exact location of the documentation error in the text.

- Prepare a description of the problem caused by the documentation error.

CHAPTER 3. DIAGNOSTIC AIDS

To diagnose suspected X.25 NCP Packet Switching Interface problems, you must use service and documentation aids. These aids provide information that enables you to closely examine the flow of data through your network so you can isolate and identify the source of X.25 NCP Packet Switching Interface problems.

After you have determined that the problem is with the X.25 NCP Packet Switching Interface, these aids help you gather information that IBM support representatives use to find a fix for your problem.

The diagnostic aids available with X.25 NCP Packet Switching Interface are:

- Tools to Check the Hardware
  - Online Tests
  - NIA Wrap
  - Using the PSDN's ECHO Service with an Application Program
  - X.25 Link Level 2 Test for a Permanent Virtual Circuit
  - End-to-End Communication for a Switched Virtual Circuit
- NCP Formatted Dump Facility
- Error Reports
  - Exception Responses
  - Inoperative Messages
  - Record Maintenance Statistics Messages (RECMS)
- NCP Line Trace for X.25 Physical Circuits
- X.25 SNAP Facility
- NCP Transmission Group (TG) Trace (X.25 NCP Packet Switching Interface Releases 3 and 3.1 only)
- Channel Adapter Trace
- Address Trace
- NCP Dynamic Storage Display
- Dynamic Panel Displays
- ACF/VTAM I/O Trace
- ACF/VTAM Buffer Trace
- ACF/TCAM PIU Trace
- ACF/TCAM Channel I/O Interrupt Trace
- ACF/TCAM Buffer Trace

For each type of diagnostic aid, instructions (or references to instructions) are provided to tell:

1. How to run the diagnostic aid.

2. How to format the output (if applicable).

3. How to interpret the diagnostic information.

Be sure to have an ACF/NCP Diagnosis Guide for your Release or Version of ACF/NCP available so that you can refer to it as needed.

TOOLS TO CHECK THE HARDWARE

Tests are available to check for hardware problems on particular circuits or machines in your configuration. Refer to Figure 3-1 to see where in the hardware configuration these tests apply.

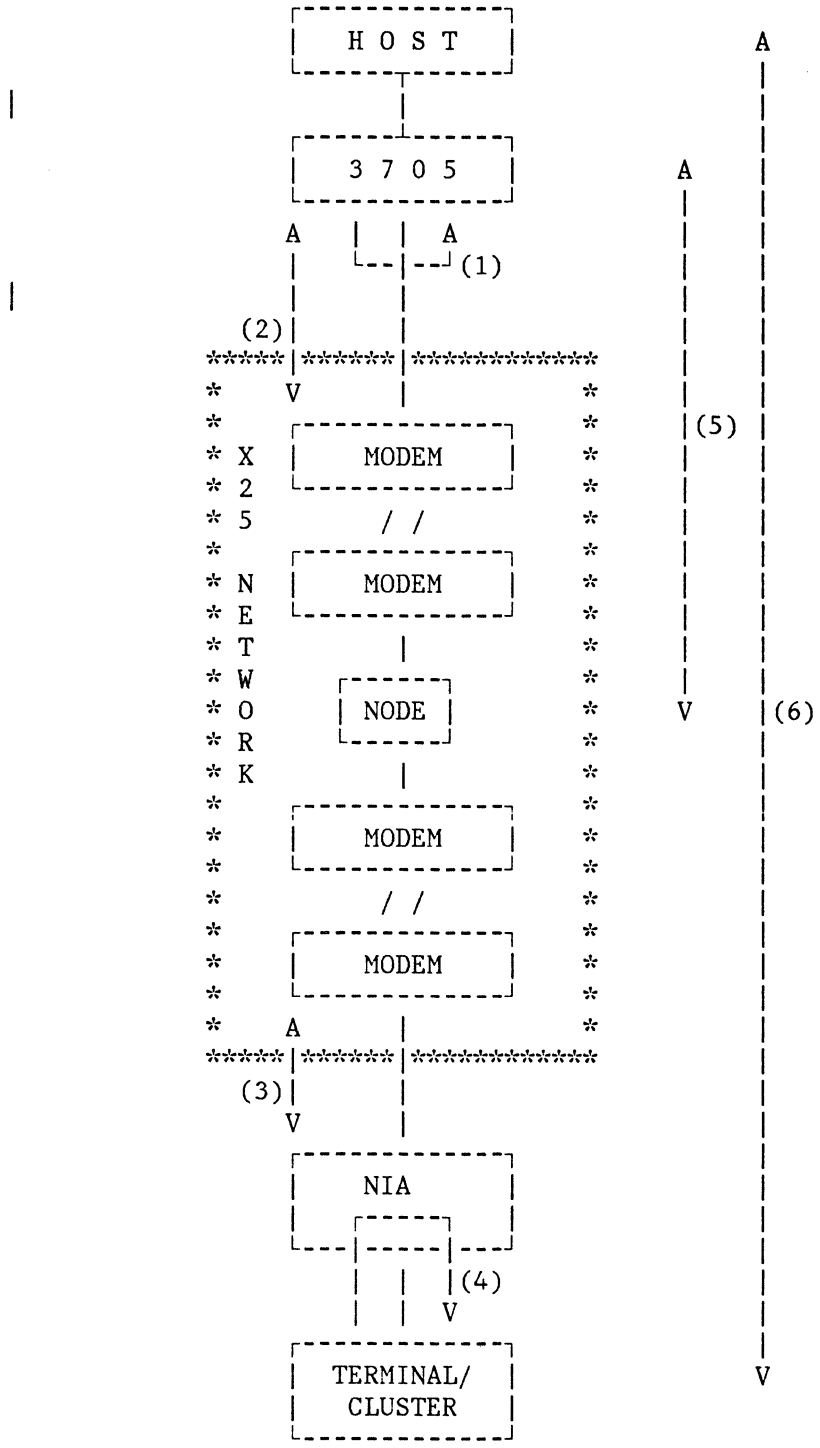


Figure 3-1. Hardware Configuration

Online Line Tests (OLT)

Online Line Tests (OLT) can be used to test physical circuits when OLT=YES is specified on the BUILD macro instruction during NCP generation. These tests cannot be performed on particular permanent or switched virtual circuits because a virtual circuit does not represent a real physical connection.

Note: A message "RESOURCE NOT AVAILABLE" is reported if the OLT is attempted for a virtual circuit.

The OLT sends PIUs of interpretive chain commands to the OLT NCP processor through VTAM's TOLTEP program or TCAM's TOTE program. Refer to the appropriate access method documentation for more information.

Two types of Online Line Tests may be performed as depicted by **arrow 1** and **arrow 2** in Figure 3-1 on page 3-3.

The test corresponding to **arrow 1** can be executed by the T3700LTA test. This test performs an internal data wrap by using the hardware diagnostic wrap facilities of the 3705 scanner. It tests the data path of the line set, up to but not including the line drivers.

The test corresponding to **arrow 2** can be executed by the T3700LTB test. This test performs a modem data wrap, provided the external modem switch is in the external position.

Tests T3700LTA and T3700LTB are described in more detail under "Online Line Tests" in the ACF/NCP Diagnosis Guide.

NIA Wrap

The 5973-L02 Network Interface Adapter (NIA) can test the physical circuit that corresponds to **arrow 3** in Figure 3-1 on page 3-3, provided the modem has a wrap capability (wrap switch).

The NIA is equipped with a wrap switch at the SDLC procedure level and can also perform the test depicted by **arrow 4** in Figure 3-1 on page 3-3. The NIA acts as a modem for the remote SNA terminal.

Refer to the 5973-L02 Network Interface Adapter Product Description Manual for more details and operation guidelines.

Using the PSDN's ECHO Service with an Application Program

An application program must communicate with the packet switched data network's (PSDN) ECHO service to use the test corresponding to **arrow 5** in Figure 3-1 on page 3-3. (ECHO service is not provided by all PSDNs.) The ECHO service appears to the X.25 NCP Packet Switching Interface as a non-SNA X.25 DTE working in LLC level 0. Communication with the ECHO services is allowed only through switched virtual circuits.

After the connection is established, the application program sends data, which is returned from the network without change.

Note: This facility can be used to debug an application program.

Link Level 2 Test for a Permanent Virtual Circuit

This test corresponds to **arrow 6** in Figure 3-1 on page 3-3. This test allows you to perform end-to-end communication without using an application program. The SNA link resource corresponding to this permanent virtual circuit must be activated before issuing the command for this test. The PU must be inactive.

This test can be performed with:

- SNA terminals connected to the X.25 network by the remote Network Interface Adapter (NIA) (VC type 2). See "For SNA Terminals Connected with Remote NIA" on page 3-6.
- SNA terminals connected with the Boundary Network Node (BNN) QLLC (VC type 3). See "For SNA Terminals Connected with X.25 BNN QLLC Links" on page 3-7.
- Other 3705 Communications Controllers connected to the network by an Intermediate Network Node (INN) link. See "For Other Communications Controllers Connected with X.25 INN Links" on page 3-9.
- Non-SNA X.25 DTEs if they have a type of ECHO facility that allows them to return X.25 network data without change. (X.25 network data is data contained within a packet. Non-SNA X.25 DTEs must follow the standard X.25 protocol when returning data to the network.) See "For Non-SNA X.25 DTEs with ECHO Facility" on page 3-10.

For SNA terminals connected by the remote NIA and non-SNA X.25 DTEs, the data length must not exceed the packet length minus two bytes. If this length is exceeded, the link level 2 test request is rejected by the X.25 NCP Packet Switching Interface. For other 3705s connected with the INN QLLC and SNA terminals connected with the BNN QLLC, there is no limit to the length of the data.

For SNA Terminals Connected with Remote NIA

For permanent virtual circuits defined on LLC level 2:

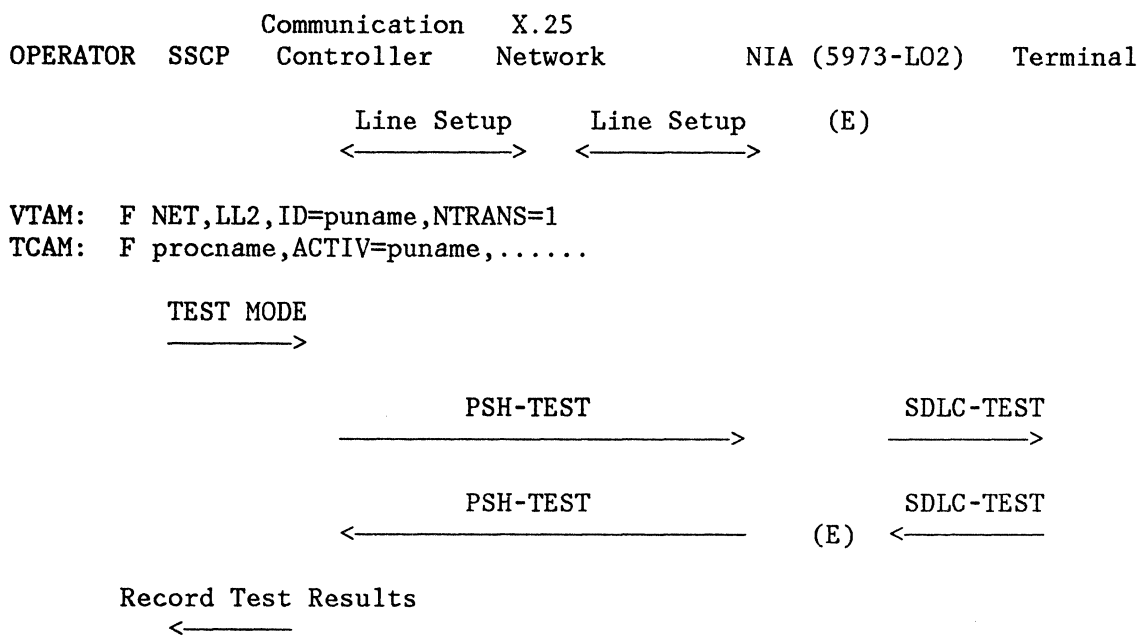


Figure 3-2. Link Level 2 Test, SNA Terminals Connected with Remote NIA

After the X.25 line setup has been performed, first between the communication controller and the X.25 network, and second between the NIA and the X.25 network, the operator can key a command to activate the Link Level 2 Test.

The TEST MODE command sent by the SSCP results in a PSH-TEST Logical Link Unit (LLU) being transmitted to the NIA. The PSH-TEST LLU is changed into an SDLC-TEST over the SDLC link. When the answer is received, the NIA sends the PSH-TEST back to the communication controller. (The NIA adds the address of the terminal between the PSH-TEST commmand and the data.)

This exchange is done as many times as requested in the TEST MODE command. The X.25 NCP Packet Switching Interface sends a report to the SSCP that indicates if the test was successful. The NIA remains in the (E) state.

This test makes it possible to follow the transmission of a message through the entire path.

For SNA Terminals Connected with X.25 BNN QLLC Links

For permanent virtual circuits defined on LLC Level 3:

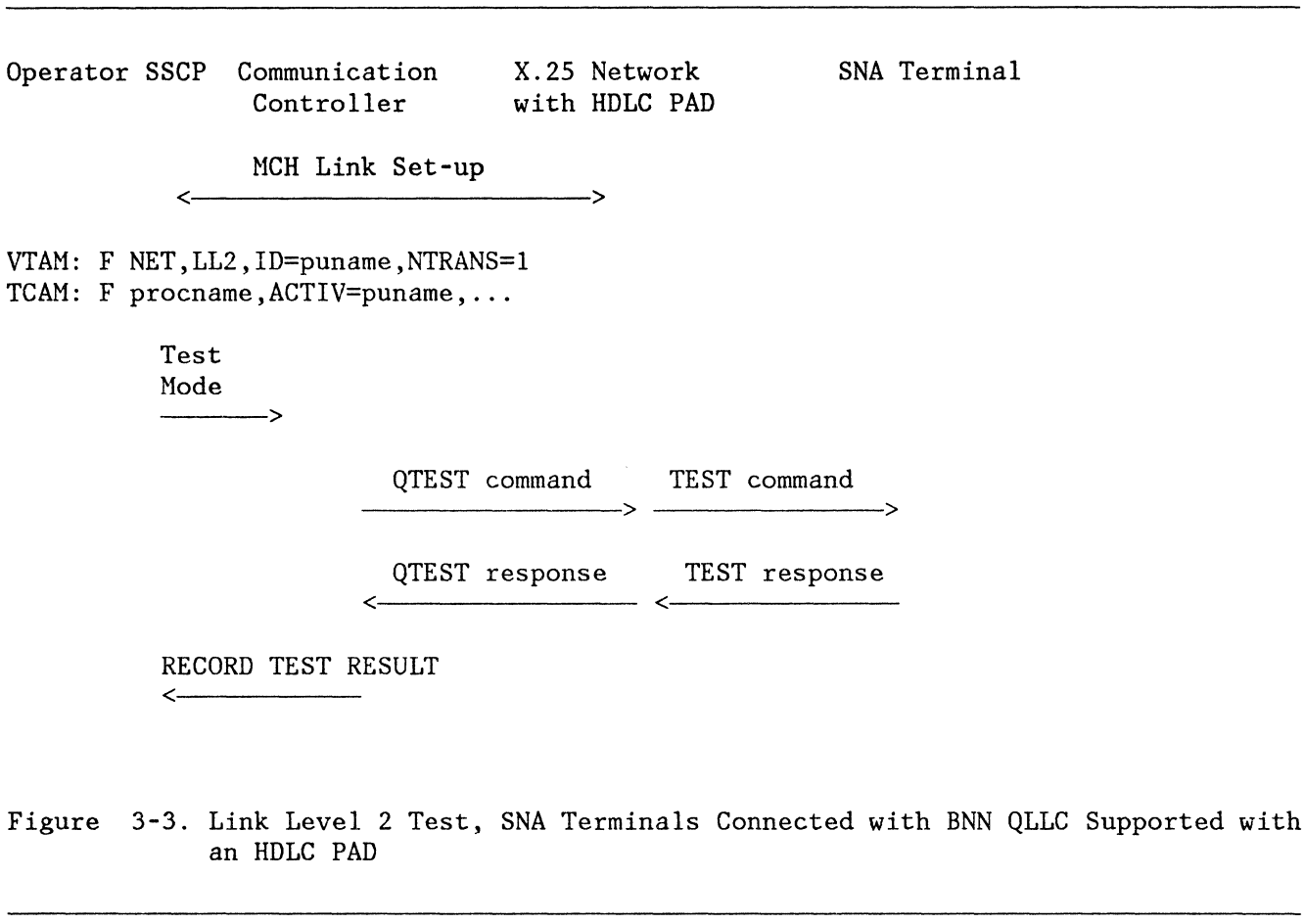


Figure 3-3. Link Level 2 Test, SNA Terminals Connected with BNN QLLC Supported with an HDLC PAD

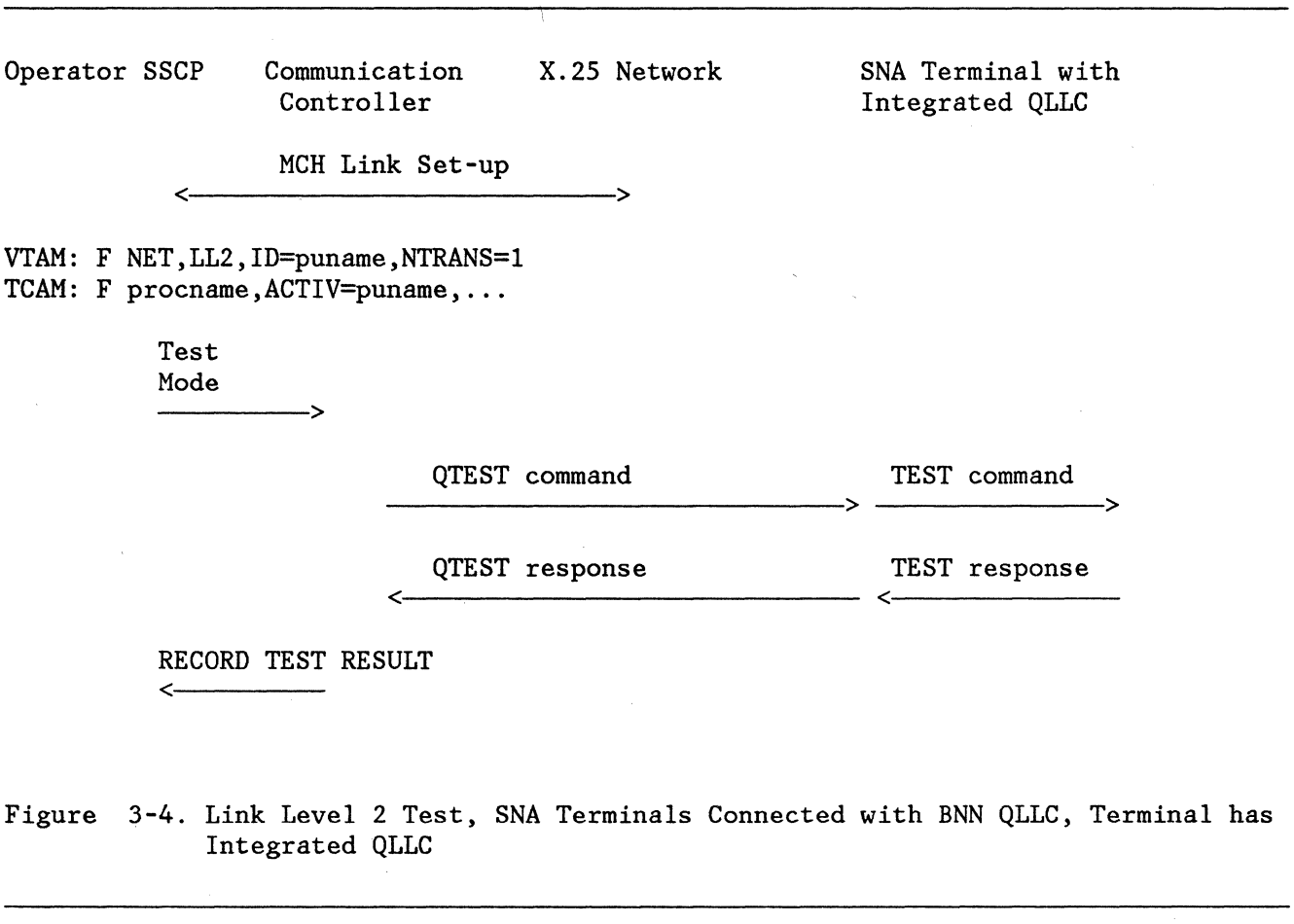


Figure 3-4. Link Level 2 Test, SNA Terminals Connected with BNN QLLC, Terminal has Integrated QLLC

The VC link must be active and the physical unit associated with the virtual circuit must be inactive. The host operator starts the Link Level 2 Test the same as for an SDLC link.

The communication controller sends a QTEST request and the terminal sends back a QTEST response. The X.25 NCP Packet Switching Interface compares the transmitted data to the received data and records the result.

At the completion of the test (when the number of transmission requests are completed or when the operator requests that the test be stopped), a RECORD TEST RESULTS PIU is sent to the host.

For Other Communications Controllers Connected with X.25 INN Links

For permanent virtual circuits defined on LLC level 3:

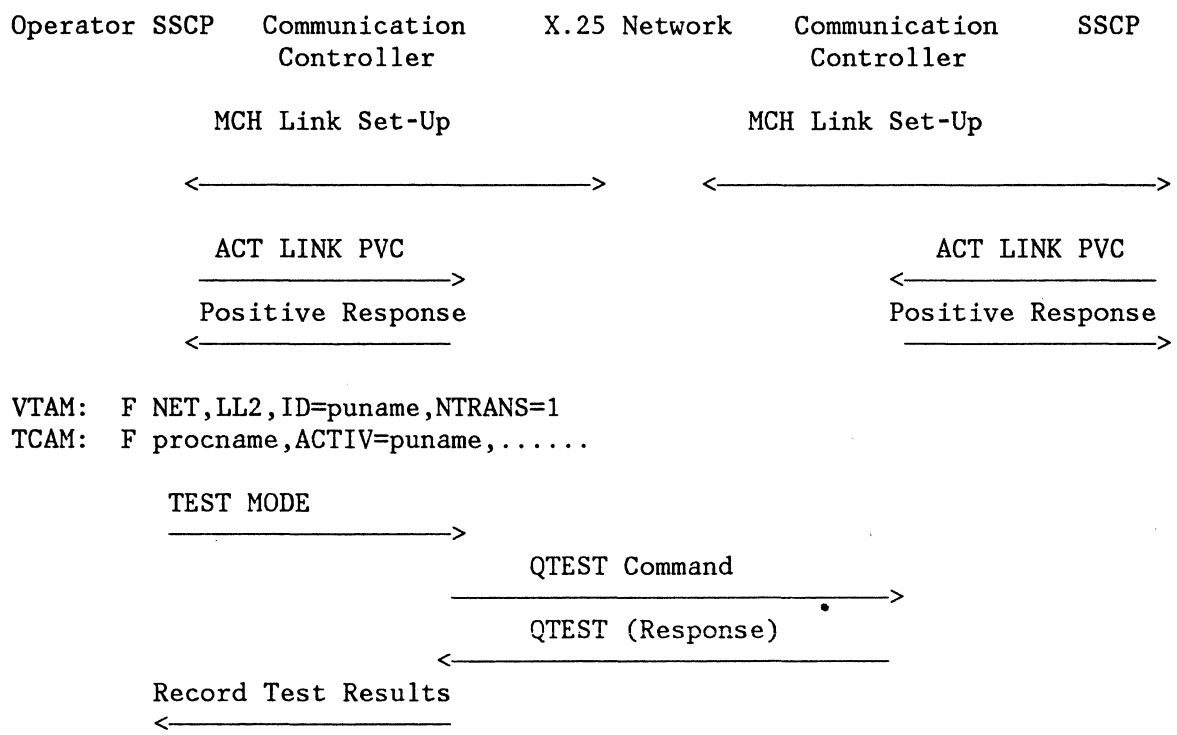


Figure 3-5. Link Level 2 Test, Communications Controllers Connected with INN QLLC

Both INN links must be active and both PUs must be inactive. The host operator starts the Link Level 2 Test the same as for an SDLC INN link.

The communication controller sends a QTEST command and the remote 3705 sends a QTEST response. The X.25 NCP Packet Switching Interface compares the transmitted data to the received data and records the result.

At the completion of the test (when the number of transmission requests are completed or when the operator requests to stop the test), a Record Test Results PIU is sent to the host.

Contention may occur when the Link Level 2 Test is initiated from both sides. If this happens, the test is terminated; the host operator should restart the test from one side only.

For Non-SNA X.25 DTEs with ECHO Facility

For a permanent virtual circuit defined in LLC level 0, 4, or 5:

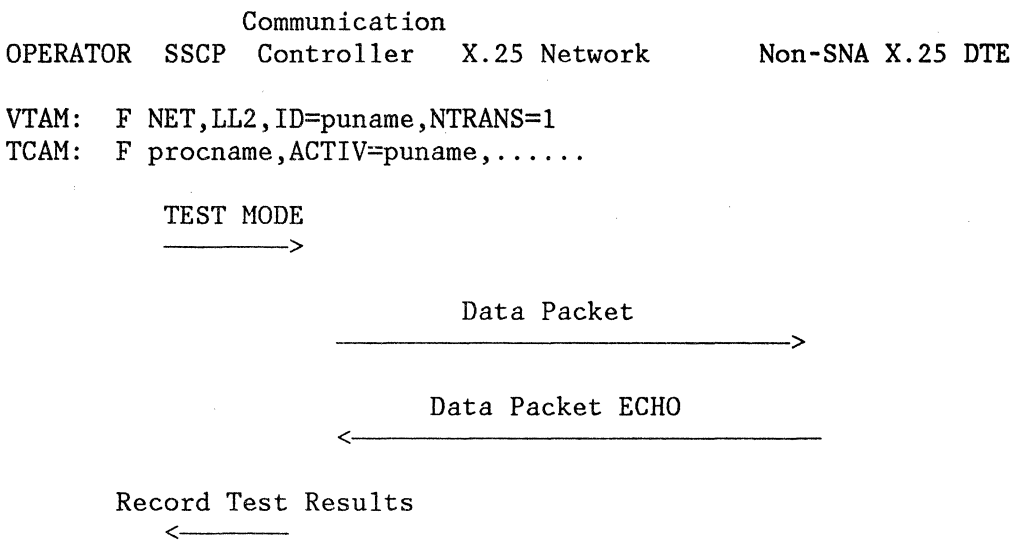


Figure 3-6. Link Level 2 Test, Non-SNA DTEs with ECHO Facility

The line corresponding to the permanent virtual circuit must be active for this test to be performed. The PU must be inactive. The non-SNA X.25 DTE must be in ECHO mode. The operator initiates a Link Level 2 Test using the appropriate access method command.

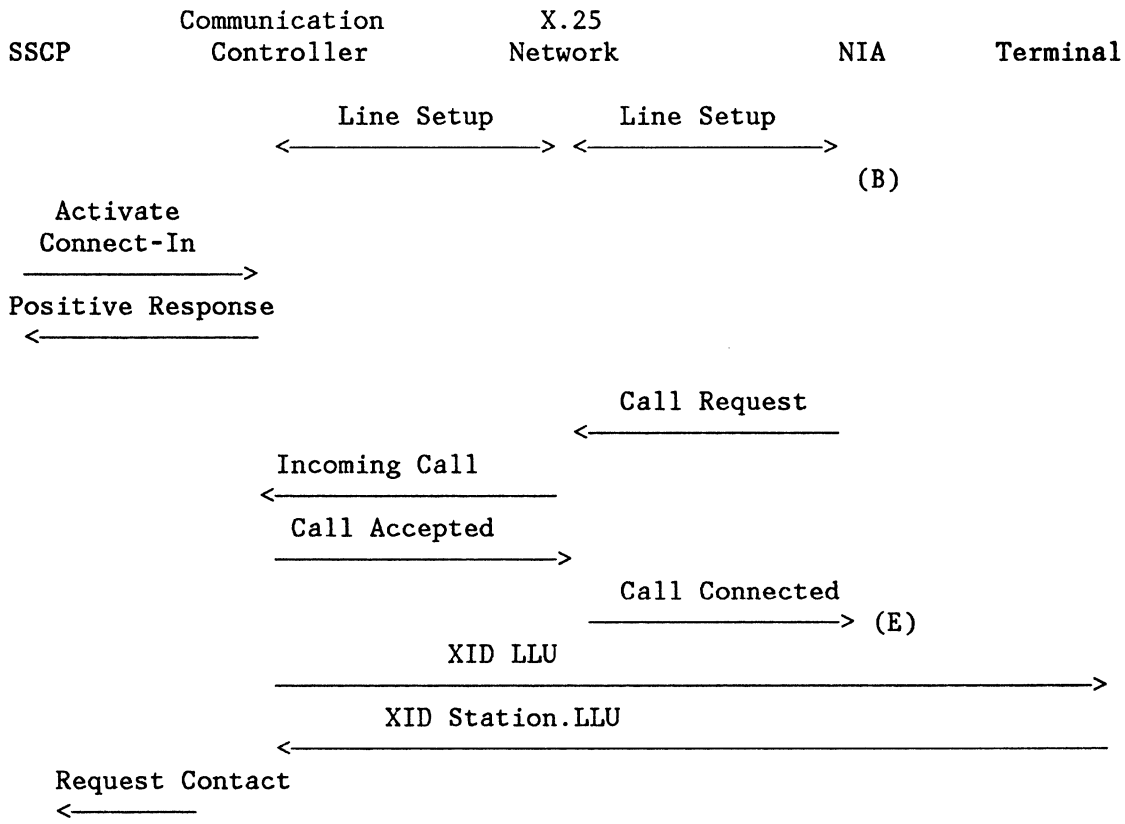
The SSCP sends a TEST MODE command that is converted into a packet. The terminal sends back this packet to the 3705, which sends the results of the test to the host.

End-to-End Communication for a Switched Virtual Circuit

This facility corresponds to **arrow 6** in Figure 3-1 on page 3-3. It allows you to perform end-to-end communication without using an application program for switched virtual circuits connected to SNA terminals.

For a Type 2 Switched Virtual Circuit under VTAM

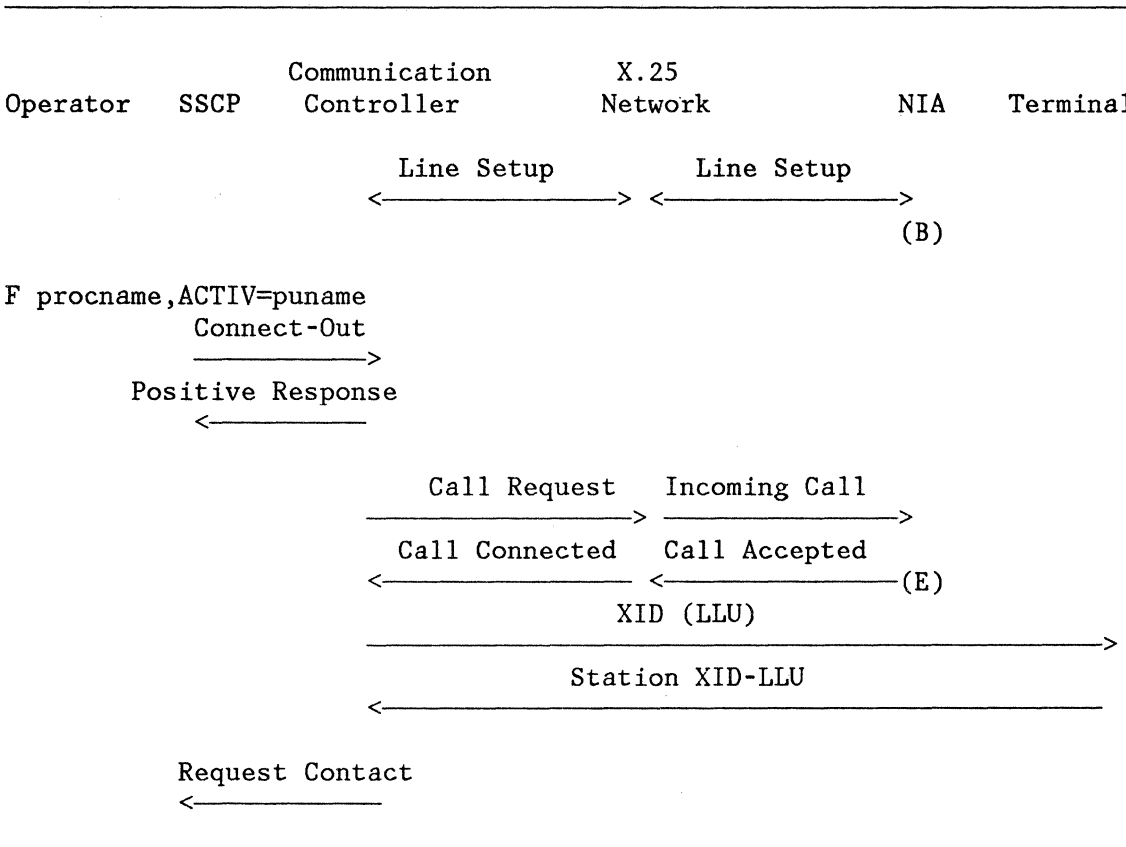
Because an operator cannot send a Connect Out command directly without an application program, you should initiate the call from the 5973-L02 Network Interface Adapter (NIA).



After the line setup and the Answer command, an NIA operator may key digits to call the communication controller over the desired line.

The NIA state goes from B to E when the Call Connected packet is received.

For a Type 2 Switched Virtual Circuit under TCAM



After the X.25 line setup has been performed, first between the communication controller and the X.25 network, and second between the NIA and the X.25 network (Status B of the NIA), the operator may enter a command to access a terminal (F procname, ACTIVE=puname). When the call is accepted, the state of the NIA changes to E.

NCP FORMATTED DUMP FACILITY

The NCP dump has been enhanced to allow you to format X.25 NCP Packet Switching Interface control blocks.

Refer to the ACF/NCP Diagnosis Guide for your Release or Version of ACF/NCP for instructions on how to invoke and print an NCP dump.

Refer to the ACF/NCP/VS Logic Manual for your Release or Version of ACF/NCP, the Diagnosis Reference, and the Reference Summary for information on interpreting the dump.

ERROR REPORTS

When an invalid request is encountered, or when an abnormal condition occurs, the NCP reports the condition to the access method by means of the following messages:

- Exception Responses
- Inoperative Messages
- Record Maintenance Statistics

The Exception Response and Inoperative Messages keep the console operator informed of what is going on. The Record Maintenance Statistics messages (RECMS) contain more detail and are recorded on:

- SYSERR for a VM System
- SYS1.LOGREC for an OS/VS System
- SYSREC for a VSE System

Exception Response

An SNA exception response is generated by the NCP when one of the following occurs:

- The NCP detects an invalid PIU request
- The PIU is valid but the NCP detects an abnormal condition

To Identify an Exception Response

Exception responses are identified in the RH when byte 0 bit 5 is on. The RU is displaced four bytes to the left to make room for sense data. The first two bytes (bytes 0 and 1) of the sense data contain the exception response code. Bytes 2 and 3, which contain user-specified sense information, are not used by the X.25 NCP Packet Switching Interface.

The exception response code information, used by the X.25 NCP Packet Switching Interface, is described in the following table.

To Interpret the Exception Response

EXCEPTION RESPONSE CODE	MEANING
X'0001'	Component not available
X'0806'	VC ID received from CTCP is invalid (GATE/PAD)
X'080C'	Activate line trace on reject VC or invalid command from CTCP (GATE/PAD)
X'0813'	Bracket rejected, or BB request received from host on an OIC or LIC request with exception response
X'0817'	XIO unsuccessful (GATE/PAD) MCH inactive
X'081B'	Receiver in transmit
X'081C'	Link level 2 test rejected on a MCH
X'081C'	ACTLU rejected on a MCH
X'081C'	Command from CTCP is temporarily not executable (GATE)
X'0821'	Invalid session operand
X'0850'	Load/dump failed
X'08F3'	Invalid SC/DFC requests
X'08F4'	PCNE error
X'08F5'	Segmenting not supported
X'08F6'	Interrupt confirmation not received
X'08F7'	Interrupt request contention
X'08F8'	DFC request not supported
X'08F9'	SHUTD request not currently allowed
X'1003'	Function not supported
X'2002'	Chaining error
X'2003'	FMD without Begin Bracket or Exception Response requested on OIC during conditional bracket initialization
X'400C'	Bracket not supported
X'8007'	Segment error

Figure 3-7. Exception Response Codes

Inoperative Message

When the NCP detects an abnormal condition not caused by a request PIU, the NCP generates an inoperative message followed by one or several RECMS.

The destination of an inoperative message is the SSCP. The destination of a RECMS is a data set that belongs to the operating system.

There are two types of inoperative messages for X.25 NCP Packet Switching Interface:

1. Inoperative Station Message (Inoperative Type = X'01'):

   reports that the SNA PU resource is no longer available. An explanation of the failure and statistics information (relating to the PU) is contained in the associated RECMS for SNA station errors.

2. Inoperative Link Message (Inoperative Type = X'02'):

   reports that the SNA link resource is no longer available. An explanation of the failure is contained in the associated RECMS for an SNA link error. Also, for each PU associated with this link, statistics information is sent to the host in a RECMS for SNA statistics.

There are three additional types of inoperative messages for Releases 3 and 3.1 only, which apply to the X.25 INN link:

1. Inoperative type X'03': Disconnect (DISC)

2. Inoperative type X'04': Request Disconnect (RD)

3. Inoperative type X'05': Disconnect Mode (DM)

More detailed information about these failures is contained in the associated RECMS for SNA station errors.

To Identify an Inoperative Message

Inoperative messages are Function Management Data (FMD) messages that belong to the "Physical Configuration Services." The format of an inoperative message is as follows:

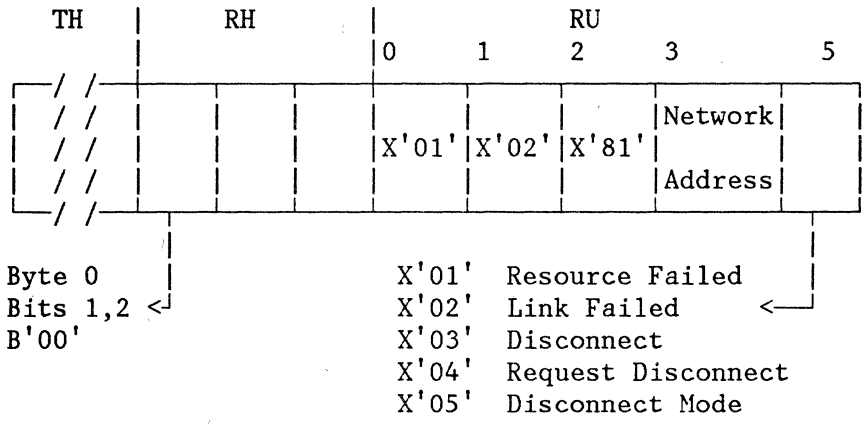


Figure 3-8. Format of an Inoperative Message

Circumstances for which an Inoperative Message is Sent

Inoperative Messages for a Physical Circuit

The X.25 NCP Packet Switching Interface generates an inoperative link message only in case of a hardware problem that cannot be resolved by the program. When this happens, the next PIU accepted by the X.25 NCP Packet Switching Interface can only be an Activate Link PIU followed by a Contact command.

The X.25 NCP Packet Switching Interface generates an inoperative station message only if the number of link level retries has been exceeded. When this happens, the LAPB does not send a Disconnect command but waits for a Contact command from the SSCP.

Note: The X.25 NCP Packet Switching Interface sends a Disconnect command frame only when operator enters a Deactivate PU command.

Inoperative Messages for a Virtual Circuit

The X.25 NCP Packet Switching Interface generates only inoperative station messages for virtual circuits. A virtual circuit can fail because of an abnormal condition detected at the:

1. Physical Circuit (MCH) level
2. Virtual Circuit Manager (VCM) level
3. Packet Level Procedure (PLP)
4. Logical Link Control (LLC) level

Note: If there is a failure during the Link Level 2 Test, then the link corresponding to the virtual circuit becomes inoperative.

Figure 3-9 indicates the action taken by the X.25 NCP Packet Switching Interface under specific circumstances.

Failure Level	Failure Category	Event	Action
MCH		Hardware failure on X.25 physical link	inoperative link
		MCH down	inoperative station
VCM	Timeout	Timeout on Call Request (Connect-out)	inoperative station
		Timeout on Clear Request	inoperative station
	Outgoing call refused by the X.25 NPSI	LLC type invalid	inoperative station
		LLC type not supported	inoperative station
		Invalid VCCPT index	inoperative station
		Invalid OUFT index	inoperative station
		Slowdown during Connect-out	inoperative station
		Command refused due to MCH failure	inoperative station
		Command refused because VC not defined for CALLOUT	inoperative station
	Incoming call refused	LLC type invalid	RECMS link
		LLC type not supported	RECMS link
		VC not in answer mode	RECMS link
		VC defined with CALL=OUT only	RECMS link
		Contention	RECMS link
		Invalid facility field	RECMS link
	Clear Indication received		inoperative station
	Reset Indication received	PU contacted	inoperative station
	Restart Indication received	VC inactive	No action
		VC active	inoperative station
	Invalid or not supported control packet received	Before XID exchange	no action
		After XID exchange	inoperative station

Figure 3-9 (Part 1 of 2). X.25 NCP Packet Switching Interface Reaction to Events that Affect Virtual Circuits

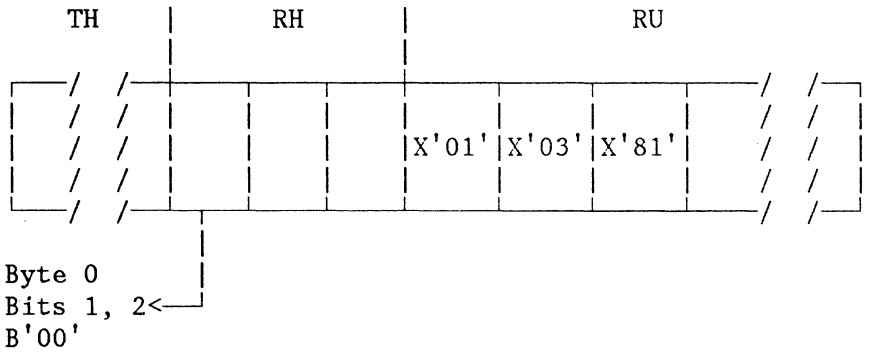
Failure Level	Category of Failure	Event	Action
PLP		Invalid P(S) received	inoperative station
LLC	LLC-OUT Dispatcher	LLU to be sent on X.25 LVL3 Status different from Information Transfer (P4)	inoperative station
	PSH	Invalid PU type in XID	inoperative station
		XID-LLU to be sent on: *a PVC *or state different from XMIT-XID	inoperative station
		Timeout and retries exhausted	inoperative station
		Invalid/Unexpected NS-LLU received	inoperative station
		CMDR received	inoperative station
		Invalid N(S) received in an I-LLU	inoperative station
		I-LLU to be sent on state different from "PSH Data Transfer"	inoperative station
		I-LLU received on state different from "PSH Data Transfer"	inoperative station
		Contact/Discontact request out of valid PSH state	inoperative station
	PCNE	Discontact processing on a PVC due to an ANS condition	inoperative station
		Error in transmission to the host detected by:	
		LUSREQ: No SSCP-SLU session	inoperative station
		LUSREQ: No PLU-SLU session	inoperative station
		LUSREQ: SLU in RCV or FME-WAIT state	inoperative station
		LUSREQ: SHUTC state entered	inoperative station
		LUSREQ: Wait for DFC response	inoperative station
		LUSREQ: No DFC request pending	inoperative station
		LUSREQ: Begin bracket pending	inoperative station

Figure 3-9 (Part 2 of 2). X.25 NCP Packet Switching Interface Reaction to Events that Affect Virtual Circuits

Record Maintenance Statistics Messages

To Identify RECMS Messages

RECMS messages are Function Management Data (FMD) messages that belong to the "Physical Maintenance Services" and are identified by:



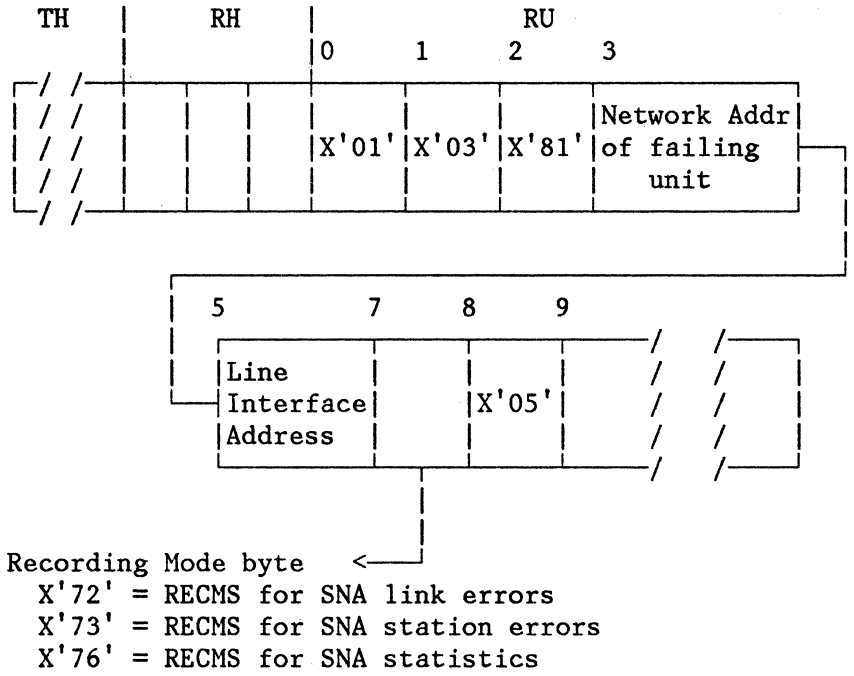
There are three types of Record Maintenance Statistics message for the X.25 NCP Packet Switching Interface:

1. The RECMS for SNA link errors: Recording mode = X'72'.
2. The RECMS for SNA station errors: Recording mode = X'73'.
3. The RECMS for SNA statistics: Recording mode = X'76'.

The recording mode bytes X'72', X'73', and X'76' are located in the seventh byte of the RU.

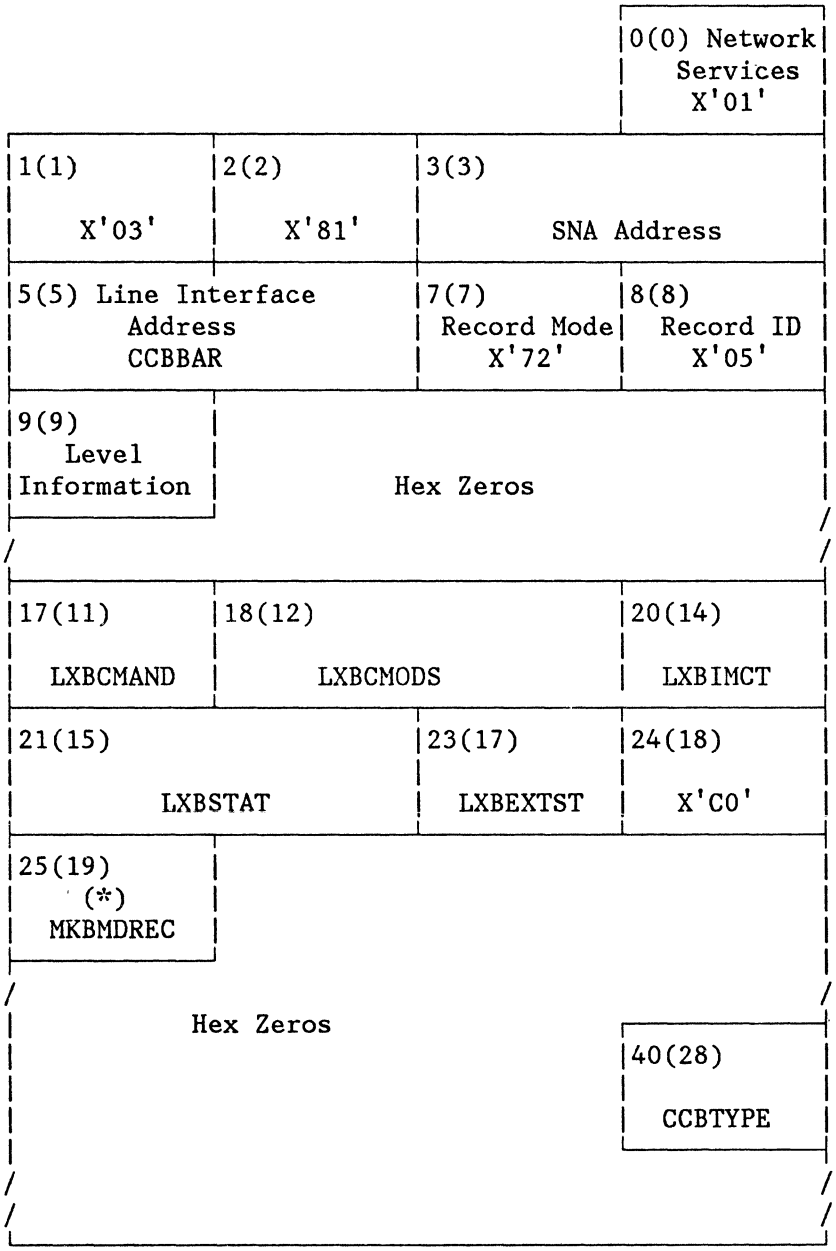
Note:
If you have not installed one of the following PTFs, then the recording mode byte X'82' is used instead of X'72' and the record looks like an SDLC record. Refer only to the hexadecimal portion of the record.

- For ACF/NCP Release 2.1
  - UR03062 (OS Systems)
  - UR03064 (DOS Systems)
- For ACF/NCP Release 3
  - UR03063 (OS Systems)
  - UR03065 (DOS Systems)
- For ACF/NCP Version 2
  - There are no PTFs



RECMS for SNA Link Errors Related to a Physical Circuit (MCH)

The purpose of the RECMS for SNA link errors is to explain in detail the cause of a failure.



* This byte is particular to X.25 NCP Packet Switching Interface.

Refer to Appendix B, "RECMS Byte Expansions" for the byte expansion for MKBMDREC.

Figure 3-10. RU Format of RECMS for SNA Link Errors Related to a Physical Circuit

RECMS for SNA Station Errors Related to a Physical Circuit (MCH)

The purpose of the RECMS for SNA station errors is to:

- Explain in detail the cause of the failure
- Send to the host processor the information concerning the activity of the corresponding station

A RECMS for SNA station errors contains the information provided in:

- A RECMS for SNA link errors
- A RECMS for SNA statistics

The NCP maintains 8 counters to give information about the traffic concerning this station. The X.25 NCP Packet Switching Interface uses the same fields located in the SCB to maintain its own statistics.

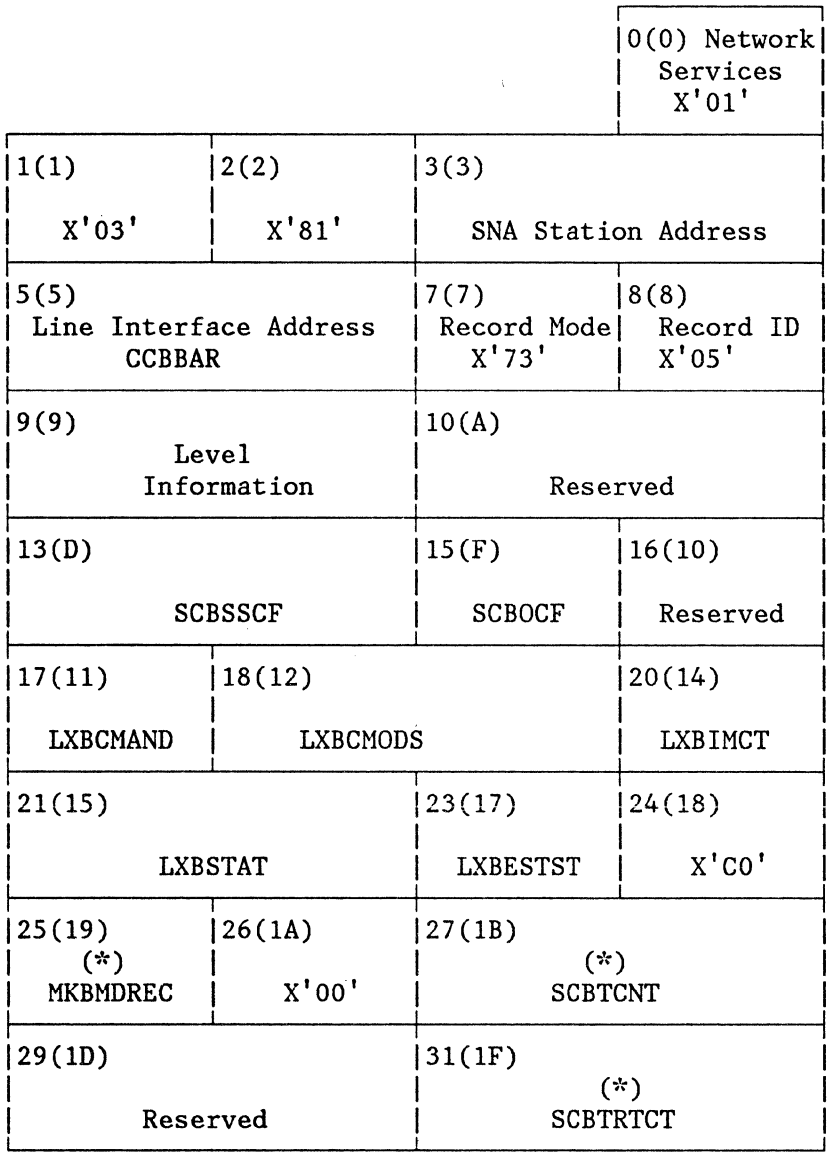
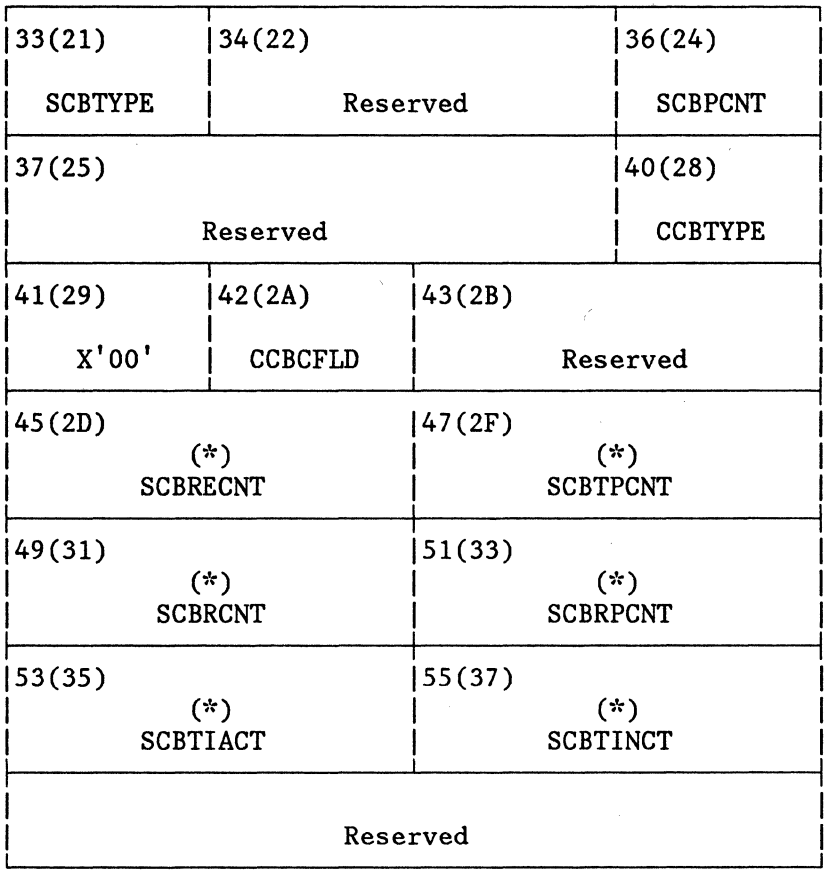


Figure 3-11 (Part 1 of 2). RU Format of RECMS for SNA Station Errors Related to a Physical Circuit



* This field is particular to X.25 NCP Packet Switching Interface.

Refer to Appendix B, "RECMS Byte Expansions" for the byte expansion for MKBMDREC.

Refer to the Figure 3-12 for the meaning of the counters.

Figure 3-11 (Part 2 of 2). RU Format of RECMS for SNA Station Errors Related to a Physical Circuit

Location	Length in Bytes	Meaning
SCBTCNT	2	Number (count) of I frames transmitted
SCBTRTCT	2	Number of I frames received
SCBRECNT	2	Number of RRs transmitted
SCBTPCNT	2	Number of RRs received
SCBRCNT	2	1st byte: Number of RNRs transmitted 2nd byte: Number of RNRs received
SCBRPCNT	2	1st byte: Number of REJs transmitted 2nd byte: Number of REJs received
SCBTIACT	2	1st byte: Number of retries on transmission 2nd byte: Number of frames received with FCS error
SCBTINCT	2	1st byte: Number of all errors on receive except FCS 2nd byte: Number of all modem errors

Figure 3-12. RECMS Counters for SNA Station Errors Related to a Physical Circuit

RECMS for SNA Statistics Related to a Physical Circuit (MCH)

The purpose of the RECMS for SNA statistics is to send the host processor information concerning the activity of the corresponding station. Note that for an inoperative link message, a RECMS for SNA statistics is generated for each station depending on the line.

The NCP maintains 8 counters to give information about the traffic concerning this station.

The X.25 NCP Packet Switching Interface uses the same fields located in the SCB to maintain its own statistics.

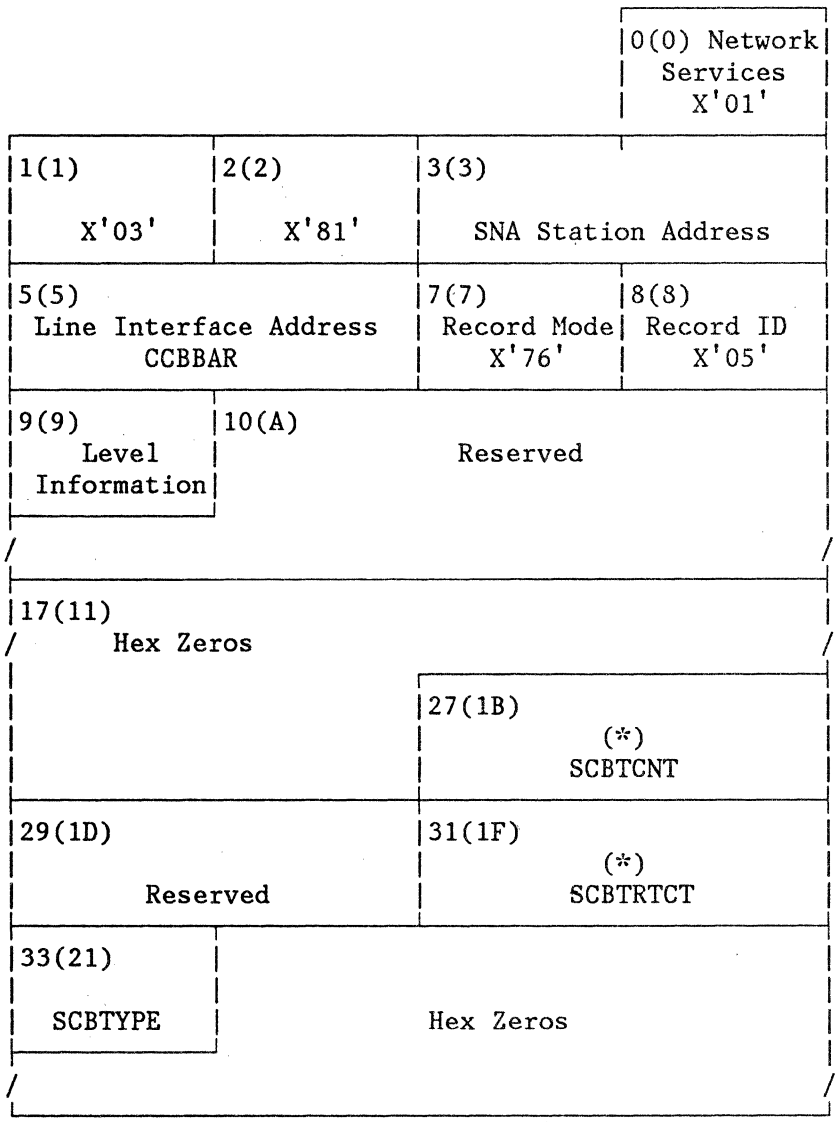


Figure 3-13 (Part 1 of 2). RU Format of RECMS for SNA Statistics Related to a Physical Circuit

45(2D) (*) SCBRECNT	47(2F) (*) SCBTPCNT
49(31) (*) SCBRCNT	51(33) (*) SCBRPCNT
53(35) (*) SCBTIACT	55(37) (*) SCBTINCT

* This field is particular to X.25 NCP Packet Switching Interface.

Refer to Figure 3-14 for the meaning of the counters.

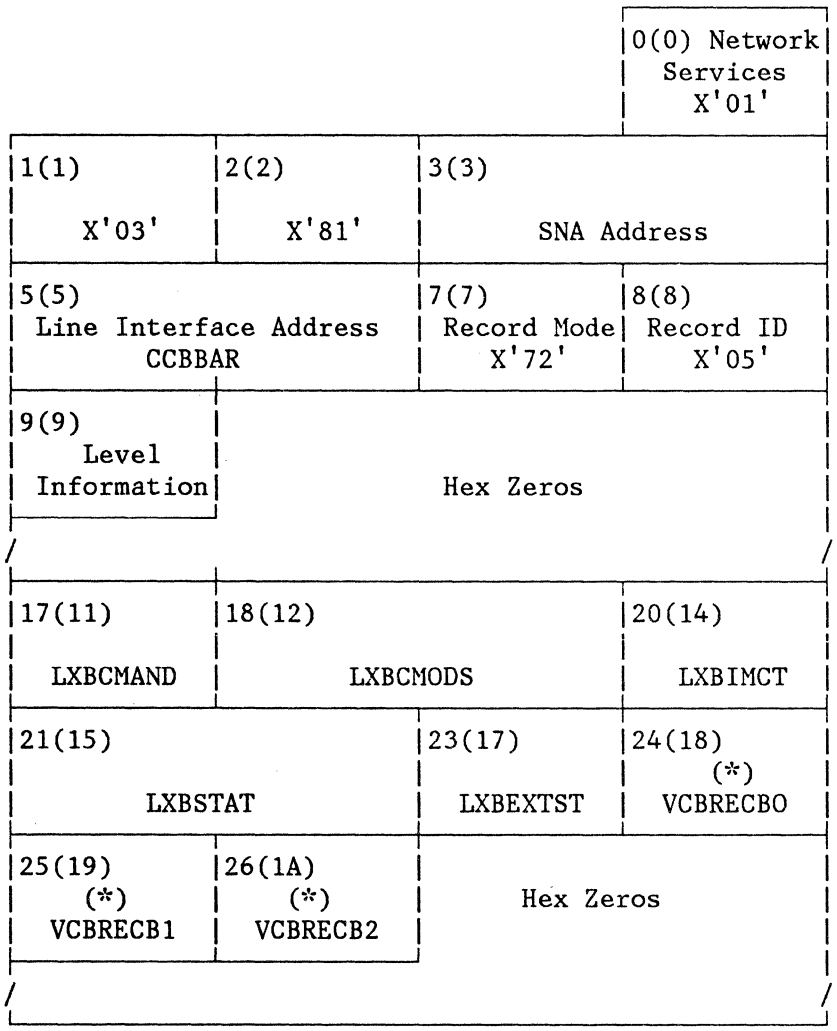
Figure 3-13 (Part 2 of 2). RU Format of RECMS for SNA Statistics Related to a Physical Circuit

Location	Length in Bytes	Meaning
SCBTCNT	2	Number (count) of I frames transmitted
SCBTRTCT	2	Number of I frames received
SCBRECNT	2	Number of RRs transmitted
SCBTPCNT	2	Number of RRs received
SCBRCNT	2	1st byte: Number of RNRs transmitted 2nd byte: Number of RNRs received
SCBRPCNT	2	1st byte: Number of REJs transmitted 2nd byte: Number of REJs received
SCBTIACT	2	1st byte: Number of retries on transmission 2nd byte: Number of frames received with FCS error
SCBTINCT	2	1st byte: Number of all errors on receive except FCS 2nd byte: Number of all modem errors

Figure 3-14. RECMS Counters for SNA Statistics Related to a Physical Circuit

RECMS for SNA Link Errors Related to a Virtual Circuit

The purpose of the RECMS for SNA link errors is to explain in detail the cause of a failure.



* This field is particular to X.25 NCP Packet Switching Interface.

Refer to Appendix B, "RECMS Byte Expansions" for the byte expansion for VCBRECB0, VCBRECB1, and VCBRECB2.

Figure 3-15. RU Format of RECMS for SNA Link Errors Related to a Virtual Circuit

RECMS for SNA Station Errors Related to a Virtual Circuit

The purpose of the RECMS for SNA station errors is to:

- Explain in detail the cause of the failure
- Send to the host processor the information concerning the activity of the corresponding station

A RECMS for SNA station errors must contain the information provided in:

- A RECMS for SNA link errors
- A RECMS for SNA statistics

The NCP maintains 8 counters to give information about the traffic concerning this station. The X.25 NCP Packet Switching Interface uses the same fields located in the SCB to maintain its own statistics.

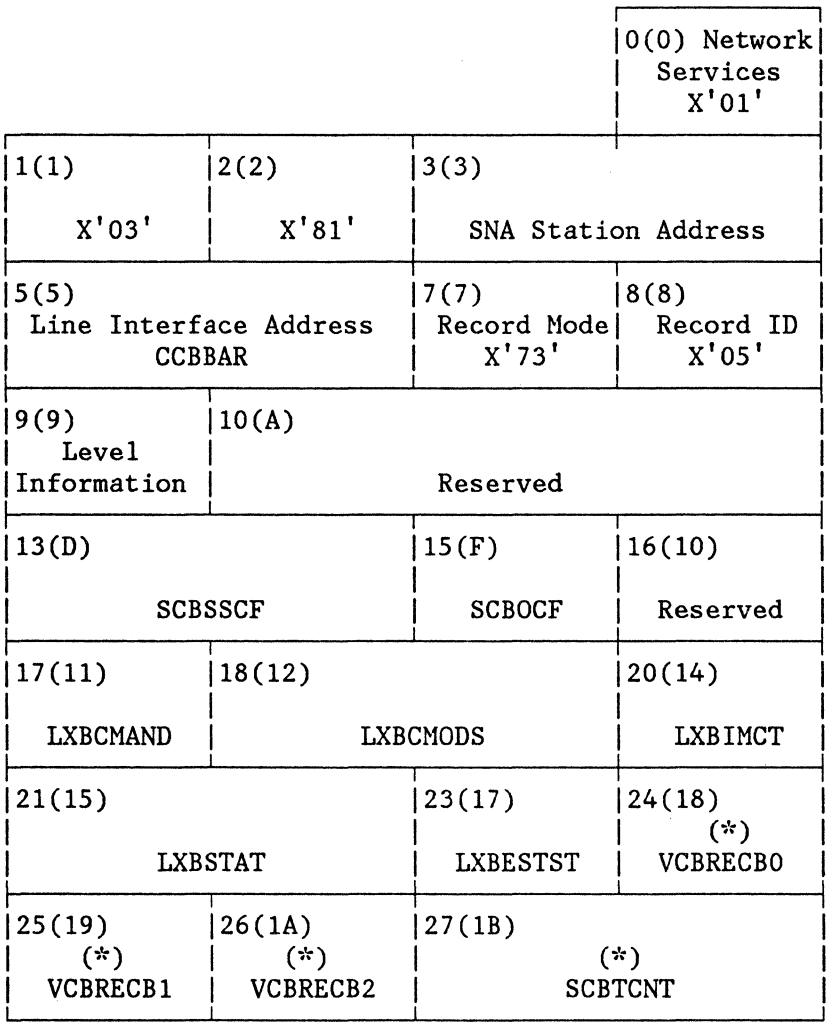
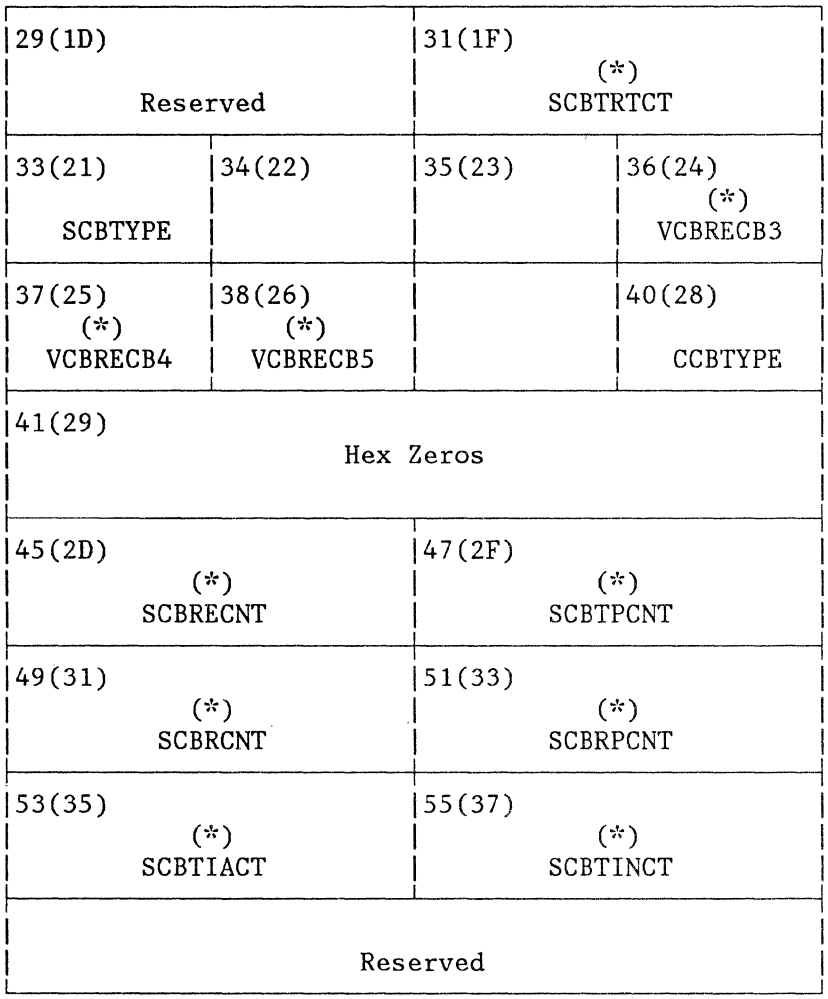


Figure 3-16 (Part 1 of 2). RU Format of RECMS for SNA Station Errors Related to a Virtual Circuit



* This field is particular to X.25 NCP Packet Switching Interface.

Refer to Appendix B, "RECMS Byte Expansions" for the byte expansion for VCBRECB0, VCBRECB1, VCBRECB2, VCBRECB3, VCBRECB4, and VCBRECB5.

Refer to Figure 3-17 for the meaning of the counters.

Figure 3-16 (Part 2 of 2). RU Format of RECMS for SNA Station Errors Related to a Virtual Circuit

Location	Length in Bytes	Meaning
SCBTCNT	2	Number of I packets transmitted
SCBTRTCT	2	Number of I packets received
SCBRECNT	2	Number of RR packets transmitted
SCBTPCNT	2	Number of RR packets received
SCBRCNT	2	1st byte: Number of RNR packets transmitted 2nd byte: Number of RNR packets received
SCBRPCNT	2	Reserved
SCBTIACT	2	Reserved
SCBTINCT	2	Reserved

Figure 3-17. RECMS Counters for SNA Station Errors Related to a Virtual Circuit

RECMS for SNA Statistics Related to a Virtual Circuit

The purpose of the RECMS for SNA statistics is to send the host processor information concerning the activity of the corresponding station. Note that for an inoperative link message, a RECMS for SNA statistics is generated for each station depending on the line.

The NCP maintains 8 counters to give information about the traffic concerning this station.

The X.25 NCP Packet Switching Interface uses the same fields located in the SCB to maintain its own statistics.

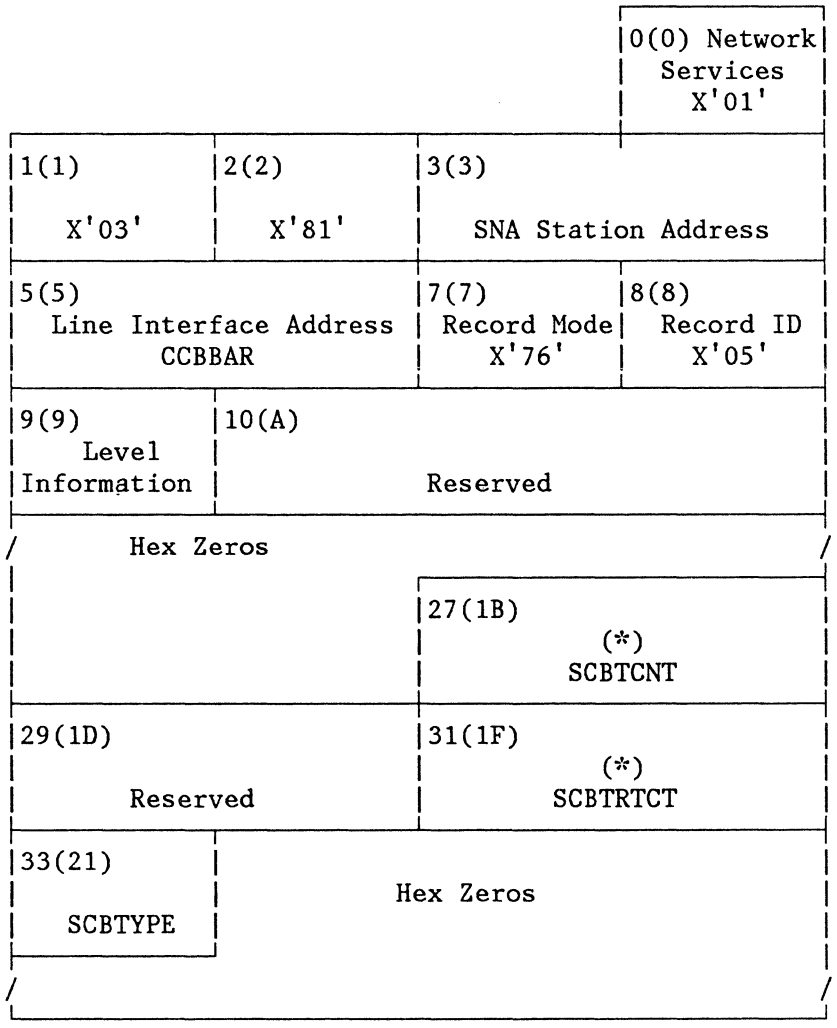


Figure 3-18 (Part 1 of 2). RU Format of RECMS for SNA Statistics Related to a Virtual Circuit

45(2D) (*) SCBRECNT	47(2F) (*) SCBTPCNT
49(31) (*) SCBRCNT	51(33) (*) SCBRPCNT
53(35) (*) SCBTIACT	55(37) (*) SCBTINCT

* This field is particular to X.25 NCP Packet Switching Interface.

Refer to Figure 3-19 for the meaning of the counters.

Figure 3-18 (Part 2 of 2). RU Format of RECMS for SNA Statistics Related to a Virtual Circuit

Location	Length in Bytes	Meaning
SCBTCNT	2	Number of I packets transmitted
SCBTRTCT	2	Number of I packets received
SCBRECNT	2	Number of RR packets transmitted
SCBTPCNT	2	Number of RR packets received
SCBRCNT	2	1st byte: Number of RNR packets transmitted 2nd byte: Number of RNR packets received
SCBRPCNT	2	Reserved
SCBTIACT	2	Reserved
SCBTINCT	2	Reserved

Figure 3-19. RECMS Counters for SNA Statistics Related to a Virtual Circuit

RECMS Retrieval Under a VM System

The RECMS messages are recorded on the SYSERR file under a VM system.

Refer to the IBM Virtual Machine Facility/370: OLTSEP and Error Recording Guide, and particularly to the section "Using the CPEREP Command."

EXAMPLE:

First enter:

```
DEF STOR 1M
I CMS
CPEREP
```

After you have keyed the CPEREP command, you may enter the following operands using the prompting technique:

```
ACC=N
CUA=(address)
DATE=(yyddd)
HIST=N
PRINT=PS
```

Where yy=the last two digits of the year
ddd=three digits representing the day

Note: The printout of the RECMS contains formatted explanations concerning the nature of the failure. Ignore the edited information because the contents of the fields do not have the same meaning any more. Only the hexadecimal printing of the record is useful.

RECMS Retrieval Under an OS/VS System

The RECMS messages are recorded on SYS1.LOGREC under an OS/VS system.

Refer to the OS/VS Environmental Recording Editing and Printing (EREP) Program Manual.

EXAMPLE:

```
//STEP1    EXEC    PGM=IFCEREP1,
//   PARM=('ACC=N,TYPE=T,CUA=(address),DATE=(yyddd),PRINT=PS')
//SERLOG   DD      DSN=SYS1.LOGREC,DISP=OLD
//TOURIST  DD      SYSOUT=A,DCB=BLKSIZE=133
//EREPPT   DD      SYSOUT=A,DCB=BLKSIZE=133
//SYSIN    DD      DUMMY,DCB=BLKSIZE=80
```

Note: The printout of the RECMS contains formatted explanations concerning the nature of the failure. Ignore the edited information because the contents of the fields are no longer meaningful. Only the hexadecimal printing of the record is useful.

RECMS Retrieval Under a VSE System

The RECMS messages are recorded on the SYSREC file under a VSE system.

```
// JOB EREP
// EXEC EREP
   OPTION CLEAR
/*
/&
```

Note: During the execution of this job, you must reply C or S to the following prompting message:

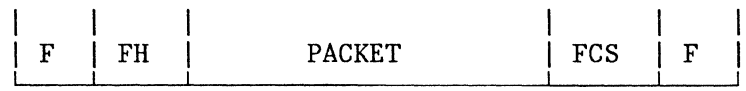
```
3E11D ENTER OPTION SOURCE, C=CARD, S=CONSOLE, N=NONE.
```

NCP LINE TRACE FOR PHYSICAL CIRCUITS

The NCP line trace for physical circuits allows you to record the activity on a specific physical circuit working with a communication scanner type 2 or 3. This trace does not apply to permanent or switched virtual circuits because no real physical connection is associated with a virtual circuit.

To Identify the Line Trace Data

The following is the format of the trace data:



Where:
F = Flag = X'7E'
FH = Frame Header (A and C fields)
PACKET - for the format refer to Diagnosis Reference
FCS = Frame Check Sequence (2 bytes)

To Start the NCP Line Trace

Refer to the ACF/NCP Diagnosis Guide for your Release or Version of ACF/NCP for instructions on how to start the trace.

Note: Before you start the line trace for ACF/VTAM in OS/VS systems, you must activate the Generalized Trace Facility (GTF) with at least the USR option. The following code is an example of how to start the Generalized Trace Facility program.

EXAMPLE

To start the Generalized Trace Facility program, code the following JCL:

```
//S1      EXEC  PGM=HHLGTF,
//              PARM='MODE=EXT,DEBUG=NO,TIME=YES'
//SYSPRINT DD   SYSOUT=A,DCB=BLKSIZE=1089
//IEFRDER  DD   DSN=SYS1.TRACE,UNIT=3400-4,DISP=OLD,
//              VOL=SER=NLTAPE
//SYSLIB   DD DSN=SYS1.PARMLIB(VTGTFTRA),DISP=SHR
/*
```

Be sure that the VTGTFTRA member in the SYS1.PARMLIB is defined with at least the following option:

```
TRACE=RNIO,USR
```

To Print the Line Trace

The Advanced Communications Function/Trace Analysis Program (ACF/TAP) does not support the line trace for X.25 physical circuits. Therefore, to process the X.25 line trace records, you must use the following process depending upon the access method.

For VTAM Operation in OS/VS Systems

To print X.25 line trace data recorded by the Generalized Trace Facility, you must use the edit option of the PRDMP system service aid with the USR=(LINE) keyword. For more information on using the Generalized Trace Facility and PRDMP, see the service aids manual for your operating system. The following code is an example of JCL used to print the trace data.

EXAMPLE

```
//PRINT     EXEC   PGM=HMDPRDMP
//SYSPRINT  DD     SYSOUT=A
//PRINTER   DD     SYSOUT=A,DCB=BLKSIZE=1089
//TAPE      DD     DSN=SYS1.TRACE,UNIT=3400-4,
//                 DISP=OLD,VOL=SER=NLTAPE
//SYSIN     DD     DSN=SYS1.PARMLIB(GTFTPIOA),DISP=SHR
```

Be sure that the GTFTPIOA member in SYS1.PARMLIB is defined by EDIT DD=TAPE,USR=(LINE).

For VTAM Operation in VSE Systems

The X.25 line trace can be printed (1) by using the modify TPRINT command or (2) as a job step under VSE. For information on how to print the line trace using both of these methods, see the ACF/VTAM Operation manual and the ACF/VTAM Diagnosis Guide for VSE.

For TCAM Operation

To print the X.25 Line trace data for ACF/TCAM, invoke the COMEDIT routine (IEDQXB). The following code is an example of JCL that prints the line trace data from the COMWRITE data set:

EXAMPLE

```
//PRINT     JOB    MSGLEVEL=1
//STEP      EXEC   PGM=IEDQXB,PARM='LINT'
//SYSPRINT  DD     SYSOUT=A
//SYSUT1    DD     DSN=COMWRITE,UNIT=2400,DISP=OLD,
//                 LABEL=(,NL),VOL=SER=DUMMY
/*
```

X.25 SNAP FACILITY

The X.25 SNAP facility should not be used in an operating environment. The X.25 SNAP facility can be very useful; however, the processing is time-consuming. The possibility of overrun is rather high and depends on the number and speed of the lines connected to the 3705.

To follow X.25 NCP Packet Switching Interface processing in a 3705, the macro instruction called X25SNAP records the following information in a wraparound storage area:

- Identifier: Label of the X25SNAP macro (4 bytes)
- Registers 1 to 7 of the level (4 bytes):
  - The level is indicated in the first byte of register 1
  - The register identification is in the first half-byte of the second byte.
  - The register itself is in the 20 right-most bits of these 4 bytes.
- 32 bytes of 3705 storage (optional).

This information can be read when a dump of 3705 storage is made.

The X.25 SNAP handler tests whether or not the SNAP area is included. If it is included, it is executed. If it is not, the processing is bypassed.

To Activate the X.25 SNAP Facility

Do one of the following:

1. Run the X.25 generation (Stage 1 and 2) by coding SNAP=YES in the X25BUILD macro
   - Run the first assembly of the NCP stage 2 generation
   - Run the final link edit of the NCP module
2. Change the member coded in the "INCL2HI" operand of the X25END macro of the MACLIB by replacing BALSTAM8 by BALSTAS8. Run the linkedit of the NCP module.

To Edit the Output from the X.25 SNAP

To edit the trace produced by the X25SNAP macro, use the formatted dump. At each physical circuit (MCH), the trace area is dumped in the formatted blocks.

The last entry filled is immediately followed by an entry flagged with FFFF as the SNAP label. Going backwards from the FFFF label, you may find what caused the problem.

Note: If the FFFF label appears twice in the SNAP area, refer only to the first FFFF label starting from the beginning.

The structure of one entry, filled with registers, in the SNAP area is as follows:

```
XXXXXXXX 0L1RRRRR 002RRRRR 003RRRRR 004RRRRR 005RRRRR 006RRRRR 007RRRRRR

XXXXXXXX   Is the SNAP identifier label of the X25SNAP macro in hexadecimal,
           in the edited part of the dump, it is the SNAP label in character
L          Is the level at which the X25SNAP has occurred (3 or 5).
1 to 7     Is the identification of the register.
RRRRR      Is the value of the register at SNAP time.
```

This entry is optionally followed by 32 bytes of storage taken at the same time.

To Interpret the X.25 SNAP Dump

The description of the significant register contents and of the optional 32 bytes follows:

IN THE BNN QLLC-IN (BALQBNNM Module):

```
BQI1  Q BNN-INN entry:
          R1=VCBQSTAT          R2=A(VCB)           R3=A(VCBQCB3)
          R4=CUBSSCF           R5=LLH0/LLH1        R7=BUFFER COUNT/PH0
BQI2  Q BNN-IN Exit:
          R1=VCBQSTAT          R2=A(VCB)           R3=A(BUFFER)
          R5=VCBQFL/action before exit
             (X'40' release buffer
              X'10' enqueue PIU to host
              X'08' stop timer)
          R7 not = 0 trigger NCP terminator.
```

IN THE BNN QLLC-OUT (BALQBNNM Module):

```
BQO1  Q BNN-OUT entry:
          R1=VCBQSTAT          R2=A(VCB)           R3=A(Buffer)
          R4=element or 0      R5=CUBSSCF          R7LO=VCBEEST
BQO2  QBNN-OUT exit:
          R1=VCBQSTAT          R2=A(VCB)           R3=A(BUFFER)
          R5=VCBQFL/action before exit
             (X'80' start timer
              X'20' trigger)
```

In the CONTROL PACKET ROUTER (BALCTLPR Module):

```
CPR0  Entry in control packet router:
          R2=VCB address                 R3=address of received buffer
          R5=address of received packet  R7=return address
          DATA=contents of received packet
CPG1  Control packet received after the connection has been established
      on a VC (where the underlying MCH has the GATE function allowed).
          R1LO=VCBEUID         R2=VCB address      R3=buffer address
          R4=MKB address       R5=packet address
CPGP  Control packet received on a VC working in LLCJ(PAD)
          R2=VCB address       R3=buffer address   R4=MKB address
          R5=packet address    DATA=contents of received packet
CPG2  Control packet received prior to connection establishment on a VC
      which has the GATE function allowed.
          R2=VCB address       R3=buffer address   R4=MKB address
          R5=packet address
CPG3  Subaddressing process:
          R2=VCB address       R3=buffer address   R4=MKB address
          R5=packet address    DATA=contents of received packet
CPD0  Control packets received on a VC which has the GATE function allowed
          R2=VCB address       R3=buffer address   R4=MKB address
          R5=packet address
CPN0  Control packets received on a VC that has neither the DATE nor the
      GATE nor the PAD functions allowed:
          R2=VCB address       R3=buffer address   R4=MKB address
          R5=packet address    DATA=contents of received packet
```

In the DATE-IN (BALDATE Module):

```
DI01  BALDATI entry:
          R1=Packet bytes 0,1    R2=VCB address      R3=Buffer address
          R4=SLUB address        R5=Packet byte 0 address
DI05  BALDATID entry:
          R1=MKBATGFG/MKBSTATC   R2=MKBQCB1 address
          R4=MKB address
DI10  DINFMSG case:
          R1=CTCP Cause and Diagnostic
```

In the DATE-OUT (BALDATE Module):

```
DO01  BALDATO entry:
          R2=MKB address         R4=Buffer address
DO03  BALDATOD exit:
          R2=MKB address
DO04  BALDATOR routine:
          R2=MKB address         R4=saved RESTART buffer address
DO10  DRSTRAN case:
          R2=MKB address         R3=Buffer address
          R5=SLUB address        R7=LSDATGFG
```

In the GATE-IN (BALGATE Module):

```
GI0A  Reset received on a PVC not bound:
          R2=VCB address        R4=Reset Packet buffer address
GI0B  Incoming call received:
          R1LO=X'FF' when refused by VCM
          R2=VCB address        R4=Incoming call buffer address
GI0C  Call Confirm packet received:
          R2=VCB address        R4=Call Confirm command buffer address
GI0D  Clear Packet received on outgoing call:
          R2=VCB address        R4=Clear command buffer address
GI0E  Checking of 'INHIBIT XMIT' for  Reset packet received (PVC):
          R1LO=Cause byte       R2=VCB address
          R4=Reset Packet buffer address
GI0F  Purge incoming accumulation Q:
          R2=VCB address
GI01  Diagnostic Packet processing:
          R2=MKBQCB1            R4=first buffer of diagnostic packet
GI02  Interrupt Packet received:
          R2=VCB address        R4=Interrupt command buffer address
GI03  Reset Packet received:
          R2=VCB address        R4=Packet buffer address
GI04  Reset Confirm Packet received:
          R2=VCB address        R4=Reset Confirm command buffer address
GI05  Clear Packet received:
          R2=VCB address        R4=Clear command buffer address
GI06  Clear Confirm packet received:
          R2=VCB address        R4=Clear confirm command buffer address
GI07  Data- or Q-Packet received and last packet sent was CLEAR or RESET:
          R2=VCB address        R4=Packet buffer address
GI08  Data- or Q-Packet received:
          R2=VCB address        R4=Data or Q command buffer address
GI09  Call or Reset (PVC) received while LU-MCH session is not active:
          R2=VCB address        R4=Clear or Reset Confirm packet buffer address
```

In the GATE-OUT (BALGATE Module):

```
G00A  CALL CONFIRM command received from the CTCP:
          R2=VCB address          R4=CALL CONFIRM command buffer address
G00B  Enque on MCH a command for the CTCP (MCH LU):
          R2=VCB address          R4=Buffer address
          R7=MKBQCB4 address
G00C  X25XIO control packet:
          R2=VCB address          R4=Packet buffer address
G00D  Buffer Release:
          R4=Buffer address
G00E  Routine to find a VCB address (VC NB on entry):
          R2=VCB address if found or 0
G00F  Routine to find a free VC (CALL OUT command):
          R2=VCB address if found or 0 (no free VC)
G001  GATE-OUT processing entry:
          R2=VCB or MKB address  R4=Buffer address
G002  Timer elapsed on outgoing call:
          R2=VCB address          R4=Buffer address (CLEAR command)
G003  Timer elapsed on control packet sent:
          R2=VCB address          R4=Buffer address (Error Information command)
G004  Invalid command received from the CTCP:
          R1=sense code           R2=VCB address (If PORT LU)
          R5=MKB address (If MCH LU)
G005  GATE-OUT processing, VC in session:
          R2=VCB address          R4=Packet buffer address
          R5LO=command code
G006  GATE-OUT control packet processing:
          R2=VCB address          R4=control packet buffer address
G007  GATE-OUT processing, VC not yet in session, CLEAR command received
      after INCOMING CALL command was sent to CTCP
          R2=VCB address (If not call)
            =MKB address (If call)
          R4=CLEAR packet buffer address
G008  CALL command received from the CTCP:
          R2=VCB address (If found) or 0,
          R4=Buffer address
G009  CALL command, no usable VC found:
          R1=sense code           R3=MCH SLUB
G010  CALL OUT command, VC found not usable
G011  End of build logon processing:
          R2=VCB address          R4=Logon buffer address
G012  Update sense in SLUB routine:
          R1=sense code           R2=VCB address
```

In the LLC-IN Dispatcher (BALLCIND Module):

```
LCID  LLC-IN exit:
          R2=VCB address
LCIE  LLC-IN after PCNE or PSH processing:
          R2=VCB address       Snap area=Buffer begin
LCIQ  LLC-IN after ENQ on BNN:
          R2=VCB address       R3=Buffer address   R5=CUB address
          Snap area=Buffer begin
LCIR  LLC-IN inop:
          R2=VCB address       R3=Buffer address   Snap area=Buffer begin
LCIO  LLC-IN entry:
          R2=VCB address       R3=Buffer address   R7=PLP-IN return address
```

In the LLC-OUT Dispatcher (BALT5OUT Module):

```
LCOA  LLC-OUT wait:
          R2=VCB address
LCOB  LLC-OUT routine, perform LLC-OUT and PLP-OUT:
          R2=VCB address       R3=PIU address or 0
LCOI  LLC-OUT Inop:
          R1LO=LLC status      R2=VCB address      R3=PIU address or 0
LCOO  LLC-OUT entry:
          R2=VCBQCB3
```

In LAC Level 3 Code (BAL3LAP1 and BAL3LAP2 Modules):

```
LPE1  Error:
          R2=Send UACB address       R3=LIQ flag
          R4=LIQ address             R5=MKB address
LPE2  Error:
          R2=Send UACB address       R3=LIQ flag
          R4=LIQ address             R5=MKB address
LPE3  Event error on states M4/M5:
          R2=Send UACB address       R3=LIQ flag
          R4=LIQ address             R5=MKB address
LPM1  PCI L3 on state M1:
          R2=Send UACB address       R3=LIQ flag
          R4=LIQ address             R5=MKB address
LPM3  PCI L3 on state M3:
          R2=Send UACB address       R3=LIQ flag
          R4=LIQ address             R5=MKB address
LPM6  PCI L3 on state M6:
          R2=Send UACB address       R3=LIQ flag
          R4=LIQ address             R5=MKB address
LPM7  PCI L3 on state M7:
          R2=Send UACB address       R3=LIQ flag
          R4=LIQ address             R5=MKB address
LPRC  Receive on states M4/M5:
          R2=Receive UACB address    R3=A C fields
          R4=LIQ address             R5=MKB address
LPTO  Timeout on states M4/M5:
          R2=Send UACB address       R3=LIQ flag
          R4=LIQ address             R5=MKB address
LPXE  Send End on states M4/M5:
          R2=Send UACB address       R3=A C fields
          R4=LIQ address             R5=MKB address
LP00  Enable entry:
          R2=Receive UACB address    R3=XIO LINE command
          R5=MKB address
LP01  Disable entry:
          R2=Receive UACB address    R3=XIO LINE command
          R5=MKB address
LP10  X25XIO entry:
          R3=Buffer address          R5=MKB address
LP30  Disable request by VCM-IN:
          R2=Receive UACB address    R5=MKB address
LP60  Contact entry:
          R2=Send UACB address       R5=MKB address
LP70  Discontact entry:
          R2=Send UACB address       R5=MKB address
```

In the LU Simulator (BALUSIMF Module):

```
LRP1  LURSP Entry:
          R3=SLUB address      Snap area=SLUB
LRP2  LURSP Exit with error:
          R1=SLUB address      R2=PIU address
LRP3  LURSP Normal Exit:
          R1=SLUB address      R2=CUB address      R3=PIU address
LRP5  LURSP Normal Exit:
          R1=SLUB address      R2=CUB address      R3=PIU address
LRQ1  LUREQ Entry:
          R2=PIU address       R3=SLUB address     Snap area=SLUB
LRQ2  LUREQ Exit with error:
          R2=PIU address       R3=SLUB address     Area=SLUB
LRQ3  LUREQ Normal Exit:
          R1=SLUB address      R2=CUB address      R3=PIU address
          Snap area=SLUB
LRQ5  LUREQ Normal Exit:
          R1=SLUB address      R2=CUB address      R3=PIU address
          Snap area=PIU
LRV1  LUSRCV Entry:
          R2=PIU address       R3=SLUB address     Snap area=SLUB
LRV2  LUSRCV Exit with error:
          R1=SLUB address      R2=PIU address      Area=SLUB
LRV3  LUSRCV Normal Exit:
          R2=PIU address       R3=SLUB address     Area=SLUB
```

In the Link Level 2 Test (BALL2TMB Module):

```
L2I1  Inbound frame checking:
        R2=VCB address     R3=Received buffer address   R5=Packet type byte
        R7=PH address
L2I2  Test frame reformatting:
        R2=VCB address     R3=Received buffer address   R4=New buffer address
L2I3  Frame received, error free:
        R2=VCB address     R5=TCB address
L2I4  No data received:
        R2=VCB address     R3=Data count                R4=Received buffer address
        R5=TCB address
L2I5  Less data received:
        R2=VCB address     R4=Received buffer address   R5=TCB address
L2I6  Data length discrepancy:
        R2=VCB address     R4=Received buffer address   R5=TCB address
L2I7  More data received:
        R2=VCB address     R4=Received buffer address   R5=TCB address
L2I8  Data character invalid:
        R2=VCB address     R4=Received character address
        R5=Sent character address
L2O1  Timer elapsed entry:
        R2=VCB address     R3=LLC-OUT ECB address
L2O2  LL2T activation:
        R2=VCB address     R4=TCB address               R5=VCBAT entry
L2O3  Data length error:
        R1=Maximum packet length                        R2=VCB address
        R3=First buffer data count
L2O4  Data length checking:
        R1=Last TCB buffer length                       R2=VCB address
        R4=Last TCB buffer address
L2O5  LL2 test end:
        R2=VCB address     R3=Frame request count       R4=TCB address
        R5=Test ending state                            R7=Sent frame count
L2O6  COPYPIU unsuccessful:
        R1=Return code     R2=VCB address               R7=Transmitted test
                                                           frame count
L2O7  Test frame building:
        R2=VCB address     R3=Test buffer address       R4=TCB address
        R7=PH address
L2O8  SARM inhibited state:
        R2=VCB address     R3=Test buffer address      R4=TCB address
R5=LLC-OUT QCB address
L2O9  Release unused buffers:
        R2=VCB address     R3=Address of buffer to be released
        R4=Previous buffer address
```

In the NAS (BALNASM4 Module):

```
NMI1  XIO IMMED to MCH:
          R1HI=LXBIMCTL       R2=UACB address     R3=LKB address
NMK1  XIO LINK to MCH (TRANSPARENT):
          R1HI=AVTSMK         R2=UACB address     R3=Buffer address
          R4=MKB address      R3=Transparent-out QCB
          Area=Buffer
NMK2  XIO LINK to MCH (from NCP Link L2 active):
          R1=CUBSTATS         R2=UACB address     R3=Buffer address
          R4=CUB address      Snap Area=Buffer
NMK3  XIO LINK to MCH (from NCP not first segment):
          R1=CUBSTATS         R2=UACB address     R3=Buffer address
          R4=CUB address      Snap Area=Buffer
NMK4  XIO LINK to MCH (from NCP first segment):
          R1=CUBSTATS         R2=UACB address     R3=Buffer address
          R4=CUB address      Snap Area=Buffer (-RESP)
NML1  XIO LINE to MCH (Exit):
          R2=UACB address
NMR1  MCH unrecoverable error:
          R2=UACB address     R3=MKBATGFG         R4=MKBAT address
NVI1  XIO IMMED to VC:
          R2=UACB address (VUA)
NCL1  XIO LINE to VC:
          R2=UACB address     R3=LXBCMAND         R4=MKBAT address
          R5=QCB address
NVL2  DISCONTACT  VC, MCH not running:
          R2=CUB address      R3=VCB address      R4=AVT address
          R7=MKBAT address
```

In the Integrated PAD-IN (BALPAD Module):

```
PAIA  Interrupt Request processing:
          R2=VCB address       R3=Interrupt Confirm packet buffer address
PAIB  Clear packet received (after invitation to clear):
          R2=VCB address       R4=Clear Confirm packet buffer address
PAI8  Data packet received for the SSCP (logon):
          R2=VCB address       R4=Packet buffer address
PAI9  Reset Confirm processing entry (PVC):
          R2=VCB address       R4=Reset Confirm packet buffer address
```

In the Integrated PAD-OUT (BALPAD Module):

```
PAI1 Integrated PAD processing entry:
        R1=RH3B0 + RU3BTO        R2=VCB address
        R4=Buffer address
PAI2  Integrated PAD Exit:
        R2=VCB address
PAI3  Data FIC or OIC received from host, set parameter Q-packet to Send:
        R2=VCB address           R3=Q-packet buffer address
        R4=PIU data from host buffer address
PAI4  Bind processing, set parameter Q-packet to send:
        R2=VCB address           R3=Q-packet buffer address
        R4=bind buffer address
PAI5  Signal processing, break packet to send:
        R2=VCB address           R3=Break packet buffer address
        R4=Signal buffer address
PAI6  SHUTD processing, invitation to send CLEAR packet (SVC):
        R2=VCB address           R3=Invitation to Clear buffer address
        R4=SHUTD buffer address
PAI7  SHUTD processing, reset packet to send (PVC):
        R2=VCB address           R3=Reset packet buffer address
        R4=SHUTD buffer address
```

In the PAD Routines (BALPAD Module):

```
PAR1  Translate Routine entry:
         R2=VCB address           R1=Data to translate begin address
         R4=Buffer address        R7=MKB address
PAR2  Send control packet routine:
         R2=VCB address           R4=Packet to send address
PAR3  Release buffer routine:
         R4=Released buffer address
PAR4  Purge incoming accumulation Q:
         R2=VCB address           R7=VCBQCB4
```

In the Transparent PAD-OUT (BALPAD Module):

```
PAX1  Transparent PAD processing entry:
          R2=VCB address           R4=Command buffer address
          R5=SLUB address
PAX2  Transparent PAD outgoing exit:
          R2=VCB address
PAX3  PIU received from the SSCP:
          R2=VCB address           R4=Buffer address
PAX4  Invalid command received from the host:
          R2=VCB address           R4=Invalid command buffer address
          R5=SLUB
PAX5  Transparent PAD incoming exit:
          R2=VCB address
```

In the PCNE (BALPCNM9 Module):

```
PA0C  X25XIO reject for interrupt packet:
          R1=Return code      R2=VCB address        R4=Buffer address
          R7=SLUB address
PA0E  FMD procedure entry:
          R2=VCB address      R4=PIU address
PA0M  DFC procedure entry:
          R2=VCB address      R4=PIU address
PA03  Contact received while SARM inhibited (GATE):
          R2=VCB address
PA04  Outgoing procedure exit:
          R1=return code      R2=VCB address        R4=PIU address
          R7=SLUB address
PA05  Poll procedure exit:
          R2=VCB address      R7=LXBSTAT value
PA06  SHUTC Request to Host:
          R2=VCB address      R4=SHUTC PIU address  R7=SLUB address
PA07  Session Control Procedure:
          R2=VCB address      R4=PIU address
PA13  Data Packet Procedure exit:
          R2=VCB address      R3=SLUB address       R4=Buffer address
PA22  TRANSPARENT-IN:
          R3=MKB address      R4=PIU address        R5=CUB address
PA32  TRANSPARENT-OUT:
          R3=MKB address      R4=PIU address        R7=SLUB address
```

In the LU MCH Support (BALPCMCH Module):

```
PC01  PCNE MCH outgoing processing exit must not be retriggered:
          R2=MKB address       R7=MCH SLUB address
PC02  SHUTC request processor:
          R2=MKB address       R4=SHUTC command buffer address
          R7=MCH SLUB address
PC03  Session control processor:
          R2=MCB address       R4=SC PIU Buffer address
          R7=MCH SLUB address
PC04  FMD processor entry:
          R2=MKB address       R4=FMD PIU address  R7=MCH SLUB
PC05  DFC processor:
          R2=MKB address       R3=MCH SLUB         R4=DFC PIU address
PC06  PCNE MCH-IN:
          R2=MKB address       R3=MCH SLUB         R4=Buffer address
PC07  PCNE MCH-IN processing exit:
          R2=MKB address       R3=MCH SLUB
```

In the Packet Dispatcher (BALPLPL3 Module):

```
PN3A  Invalid VCN Received:
          R1=first VCBAT address     R2=first VCB address
          R5=MCH address
PN4B  Pseudo-Buffer release:
          R2=VCB address             R5=PLP/IN QCB
          R7=Pseudo-Buffer address
PN4C  VCN validity check:
          R1=VCBAT entry             R2=VCB address
```

In the PLP-IN (BALPLPI Module):

```
PPIA  Unlock, receive QCBI for RR/RNR:
          R2=VCB address      R5=VCBQCB1          R7=Return code
PPIC  Logon from GATE:
          R2=VCB address      R3=Packet Header address
          R4=Buffer address
PPIE  Interrupt Packet:
          R2=VCB address      R4=Buffer address
PPIG  Invalid P(R) or P(S):
          R2=VCB address      R4=Buffer address   R3=VCBATGFG/VCBEVID
          R5=MKB address
PPII  Incoming accumulation:
          R2=VCB address      R4=Buffer address   R5=Offset data count
PPIK  Timer elapsed:
          R2=VCB address      R5=VCBAT address
PPIM  PLP-IN task (VCBQCB4):
          R2=VCB address      R4=first element    R5=VCBQDB4
          R7=last element
PPI0  Discard unexpected packet:
          R1HI=MKBATGFG       R2=VCB address      R5LO=VCBEGST
          R7=VCBVCM0/VCBEUB
PPI1  Discard Interrupt Packet:
          R1=MKBATGFG         R2=VCB address      R4= Buffer address
          R5=MKBAT address    R7=VCBEPST/VCBVCM0
PPI2  RNR received:
          R1=VCBEPST/RNR packet type              R2=VCB address
          R4=Buffer address
PPI3  LLC-OUT wait trigger:
          R2=VCB address      R5=VCBQCB3          R7LO=VCBEEST
PPI4  Inop from PLP:
          R2=VCB address      R7=VCBAT entry
PPI5  Inop from all layers:
          R2=VCB address
PPI6  Timer routine safe:
          R2=VCB address      R5=PLP-IN QCB1 address
          R7=PLP-IN ECB address
PPI7  Complete packet received:
          R2=VCB address      R3=Buffer address   R5=PLP-IN QCB4 address
PPI8  Purge element being accumulated:
          R1LO=VCBEPST        R2=VCB address      R4= purged element
          R7=VCBQCB4 address
```

In the PLP-OUT (BALPLPOU Module):

```
PPO1  XIO LINK not executed:
          R2=VCB address      R3=Packet address   Snap area=Packet
PPO2  XIO LINK not executed (RR/RNR):
          R2=VCB address      R3=Packet address   Snap area=Packet
```

In the PSH (BALPSHM7 Module):

```
PSIA  PSH abandon connection completed:
          R2=VCB address          Snap area=VCB starting from VCBVCM0
PSIC  Contact terminator completed:
          R1=Return code to LLC-IN
          R2=VCB address          R3=Received buffer address,
          R5=PSH header address
PSID  Discontact terminator completed:
          R1=Return code to LLC-IN
          R2=VCB address          R3=Received buffer address
          R5=PSH header address
PSII  PSH-IN inoperative entry:
          R1=Return code to LLC-IN
          R2=VCB address          R7 byte 1=Failure code
          Snap area=VCB starting from VCBVCM0
PSIP  Terminal data handler completed:
          R1=Return code to LLC-IN
          R3=Buffer address (chain) ready to be sent to the host (if any)
          Snap area=VCB starting from VCBVCM0
PSIX  XID terminator completed:
          R1=Return code to LLC-IN
          R2=VCB address          R3=Received buffer address
          R5=PSH header address
PSOI  PSH-OUT inop completed:
          R1=Return code to LLC-OUT
          R2=VCB address          R7 byte 1=Failure code
          Snap area=VCB VCBVCM0
PSOR  Exit without action:
          R1LO=CUBSSCP            R1HI=LLC state
          R2=VCB address          R5=QCB address
          R7 byte 1=PSH state
PSOT  PSH-OUT timeout handler completed:
          R1 byte 0=VCB state     R1 byte 1=PSH state
          R2=VCB address          R5=QCB address
PSOX  PSH-OUT exit after process:
          R1=Return code to LLC-OUT
          R2=VCB address          R3=Edited out buffer address
          R5=Active QCB address
PSOY  Delayed contact wait re-issuance:
          R1=Return code to LLC-OUT
          R2=VCB address
PSO3  Delayed contact wait issuance:
          R1=Return code to LLC-OUT
          R2=VCB address          R5=Active QCB address
PSO5  Discontact retry:
          Registers contents as for PSOX
          Snap Area=Edited out buffer
PSO6  Discontact immediate end:  Register contents same as for PSO3
PSO8  Retry XID:  Register contents, dump area, same as for PSO5
PSO9  Retry contact:  Register contents, dump area, same as for PSO5
```

In the INN-IN (BALLCINN Module):

```
QI1   INN-IN entry:
          R1=VCBQSTAT              R2=A(VCB)
          R3=Buffer address or 0 (if inoperative)
          R4=SCBCSCF               R5=LLH0/LLH1 (if present)
          R7=Packet Byte 0/U4DATCNT
QI2   INN-IN exit:
          R1=VCBQSTAT              R2=A(VCB)
          R3=Buffer address        R5=VCBQFL/Action before exit
                                      (X'40' release buffer
                                       X'01' Error during processing)
          R7=LXBSTAT
```

In the INN-OUT (BALLCONN Module):

```
QO1   INN-OUT entry:
          R1=VCBQSTAT         R2=A(VCB)          R3=SCBLOBH
          R4=Element or 0     R5=SCBSSCF         R7=SCBCSCF/VCBEEST
QO2   INN-OUT exit:
          R1=VCBQSTAT         R2=A(VCB)          R3=Buffer address
          R5=VCBQFL/Action before exit
             (X'80' start timer
              X'20' Trigger)
          R7=LXBSTAT
```

In the VCM-IN Routine (BALVCIMC Module):

```
VCFA  Check Facility Field in Call Packets:
          R1=Facility Field address     R2=VCB address
          R3=Buffer address             R4=Return address
          R5=Facility code/Facility parameter
          R7=LLC type byte address
VIMC VCM-IN routine entry:
          R1HI=MKBATGFG                 R1LO=VCBATGFG
          R2=VCB address                R3=Buffer address
          R4=MKB address                R5=PKT2/PKT3
          R7HI=PKT4                     R7LO=VCBVCM0
```

In the VCM-IN Task (BALVCIM6 Module):

```
VIM6 VCM-IN task entry:
          R1HI=MKBATGFG       R1LO=LKBSTATC       R2=MKBQCB1 address
          R3=Element address  R4=MKB address
The following SNAPS (VI61 to VI67) are issued before triggering NCP terminator
VI61  Inoperative link or station CONTACT/DISCONTACT KO:
          R1=Current SOT address                  R2=UACB address
          R3=CUBSSCF          R5=CUB address      R7LO=LXBSTATC
VI62  CONTACT/DISCONTACT/XID:
          R1=Current SOT address                  R2=UACB address
          R3=CUBSSCF          R5=CUB address      R7LO=LXBSTATC
VI63  Enable/Disable/Switched Connect Termination:
          R1=Current SOT address                  R2=UACB address
          R5=CUB address                          R7LO=LXBSTATC
VI64  LL2TEST and MCH statistics:
          R1=Current SOT address                  R2=UACB address
          R5=CUB address      R7LO=LXBSTATC
VI66  INN (Release 3 only)
          R2=VUACB address    R3=SCBSSCF          R5=SCB address
          R7LO=LXBSTATC
VI67  CONTACT/DISCONTACT/XID on INN link:
          R2=VUACB address    R3=SCBSSCF          R5=SCB address
          R7LO=LXBSTATC
```

In the VCM-OUT Task (BALVCOMA Module):

```
VOF1 VCM-OUT entry:
        R1LO=LXBCMAND       R2=VCB address      R3=Element address
        R4=MKB address      R5=VCBAT address    R7HI=VCBATGFG
        R7LO=VCBVCM0

VOF2 XIO immediate:
        R1="Switched ANS terminator" address    R2=UACB address
        R3=VCB address      R4=LKB address,RSHI=Request code
        R7=NCP terminator address in the LKB

VOF3 Inoperative routine:

        R2=VCB address      R4=VCBAT address    R5LO=VCBRECB0
        R7HI=VCBATGFG       R7LO=VCBVCM0

VOF4 Dial command:
        R1HI=MKBATGFG       R1LO=LXBCMAND       R2=VCB address
        R4=Dial digit address                   R7LO=VCBTYPE
```

TRANSMISSION GROUP (TG) TRACE (X.25 NCP PACKET SWITCHING INTERFACE RELEASES 3 AND 3.1 ONLY)

The Transmission Group (TG) trace describes the sequence of transmissions to and from one endpoint of the transmission group. You must specify TYPE=TG when starting the NCP line trace. The TG trace is associated with a single X.25 INN link in the transmission group.

Refer to the ACF/NCP Diagnosis Guide for your Release or Version of ACF/NCP for information on how to start and print this trace.

CHANNEL ADAPTER TRACE

The channel adapter trace is a maintenance debugging tool used to trace channel adapter interrupts. Use the channel adapter trace when you have a LOOP problem or when an ABEND indicates a channel adapter problem. You can also use the channel adapter trace to monitor channel STATUS/SENSE commands and to monitor PIUs if no response is returned.

Refer to the ACF/NCP Diagnosis Guide for your Release or Version of ACF/NCP for information on how to start and print this trace.

ADDRESS TRACE

The address trace allows you to record the contents of selected areas of communication controller storage, general registers, and external registers at each successive interrupt.

Use the address trace to locate programming or hardware errors that can be identified in external registers.

Refer to the ACF/NCP Diagnosis Guide for your Release or Version of ACF/NCP for information on how to start and print this trace.

NCP DYNAMIC STORAGE DISPLAY

You can obtain a dynamic dump of NCP storage by using the DISPLAY NCP STORAGE command. This command allows you to display up to 256 bytes of NCP storage data on the operator's console of the host processor while the NCP remains active.

Refer to the ACF/NCP Diagnosis Guide for your Release or Version of ACF/NCP for information on how to start and use this facility.

DYNAMIC PANEL DISPLAYS

The dynamic panel display feature of the 3705 allows information to be displayed on the control panel of the communication controller.

Use dynamic panel displays when you want to check information in the ICW fields and external registers, or when you want to alter or check storage values at a specific point in time.

Refer to the ACF/NCP Diagnosis Guide for your Release or Version of ACF/NCP for information on how to start and use this facility.

ACF/VTAM I/O TRACE

The ACF/VTAM I/O trace records the order of I/O events that take place between the communication controller and ACF/VTAM. Use this trace when you believe you have an ABEND, INCORRECT OUTPUT, LOOP, or PERFORMANCE problem.

Refer to the ACF/NCP Diagnosis Guide for your Release or Version of ACF/NCP for information on how to start and print this trace.

ACF/VTAM BUFFER TRACE

The ACF/VTAM buffer trace records the contents of message buffers as PIUs are sent and received by ACF/VTAM. Use this trace when you believe you have an ABEND, INCORRECT OUTPUT, or PERFORMANCE problem. Also use this trace to identify any changes made to data by ACF/VTAM during transmission between nodes.

Refer to the ACF/NCP Diagnosis Guide for your Release or Version of ACF/NCP for information on how to start and print this trace.

ACF/TCAM PATH INFORMATION UNIT (PIU) TRACE

The ACF/TCAM PIU trace provides a record of the information contained in PIUs in the sequence in which ACF/TCAM presents the PIUs to ACF/NCP and in which ACF/NCP presents them to ACF/TCAM. Use this trace when you suspect you have an NCP error and want to verify that the proper sequence of commands is being exchanged between ACF/TCAM and ACF/NCP.

Refer to the ACF/NCP Diagnosis Guide for your Release or Version of ACF/NCP for information on how to start and print this trace.

ACF/TCAM CHANNEL I/O INTERRUPT TRACE

The ACF/TCAM channel interrupt I/O trace sequentially records the I/O interruptions that occur on a channel. Use this trace when you want to record the I/O interrupts for the channel addresses of the communication controller.

Refer to the ACF/NCP Diagnosis Guide for your Release or Version of ACF/NCP for information on how to start and print this trace.

ACF/TCAM BUFFER TRACE

The ACF/TCAM buffer trace records the contents of ACF/TCAM buffers before and after message handler (MH) processing. Use this trace when you believe you have an ABEND, INCORRECT OUTPUT, or PERFORMANCE problem.

Refer to the ACF/NCP/VS Diagnosis Guide for your Release or Version of ACF/NCP for information on how to start and print this trace.

APPENDIX A. ABEND CODES AND PROGRAM MODULES

ABEND CODES

CODE	COMMENTS	MODULE
0A00	NO ECB ON TIMEOUT	BALVCOMA
0A01	INVALID VCM STATE ON AN ACTIVATE LINK FOR A PVC	BALVCOMA
0A02	WRONG INTERFACE AT BALMAR1 ENTRY	BALVCOMA
0A03	INVALID VCM STATE ON A TIMEOUT FOR AN SVC	BALVCOMA
0A10	DISCREPANCY BETWEEN THE NCP AND X.25 SYSGEN NUMBER OF ERRORS THAT CAN BE FOUND IN THE DUMP. THEY ARE SAVED IN THE MODULE AFTER THE LABELS: ER1= MORE THAN ONE UACB FOR ONE LKB ER2= UACB NOT IDENTIFIED AS X.25 (MU OR VU) ER3= NCP/X.25 DISCREPANCY ABOUT SWITCHED/PERMANENT ER4= PU TYPE INVALID FOR LLC0 (PU TYPE 1 ONLY) OR FOR LLC3 ON PVC (PU TYPE 4 ONLY)	BALINIMD
0A20	INVALID VALUE IN MKBSTATC	BALVCIM6
0A21	NO ELEMENT ON QCB DURING RESTART PHASE	BALVCIM6
0A22	NO ELEMENT ON QCB WHEN MCH OPERATIONAL	BALVCIM6
0A23	INVALID VALUE IN LXBSTATC	BALVCIM6
0A24	INVALID VALUE IN CUBSSCP	BALVCIM6
0A30	PHYSICAL SERVICES REQUEST INVALID	BALQBNNM
0A31	LOGICAL ERROR ON TIMEOUT	BALQBNNM
0A32	PHYSICAL SERVICES ELEMENT ON LOBQ	BALQBNNM
0A33	DATA PROCESSOR Q STATE ERROR	BALQBNNM
0A34	LL2 TEST Q STATE ERROR	BALQBNNM
0A35	XID PROCESSOR Q STATE ERROR	BALQBNNM
0A36	SNRM/UA Q STATE ERROR	BALQBNNM
0A3D	NO TCB TO BUILD Q TEST ERROR	BALQBNNM

CODE	COMMENTS	MODULE
0A40	NO MORE LIQ AVAILABLE	BAL2BM
0A41	CSB3: TRANSMIT ERROR ENTRY WITHOUT REASON	BAL2B3
0A42	CSB3: TRANSMIT, NO BUFFER WHILE BUFFER SERVICE	BAL2B3
0A43	DISCREPANCY IN WACK Q AND WACK Q COUNT	BAL3LAPS
0A55	NO BUFFER RECEIVED FROM BALPLI	BALCTLPR
0A56	PAD MODE NOT IDENTIFIED (INTEGRATED OR TRANSPARENT)	BALCTLPR
0A60	ERROR DURING SEGMENTING IN PACKETS, VCBQCB3 EMPTY	BALT5OUT
0A70	INVALID BUFFER OR PSEUDO-BUFFER ON X25XIO	BALNASM4
0A71	INVALID PACKET LENGTH: LT.3 OR GT.FRMLGTH	BALNASM4
0A72	LINE TIMER LEVEL 3 FOR A VC	BALNASM4
0A73	DEQUEUE INVALID DURING RESET SYSTEM TIMER	BALNASM4
0A74	X25XIO INTERFACE ERROR	BALNASM4
0A75	X.25 NPSI ISSUED XIO LINK INSTEAD OF X25XIO	BALNASM4
0A76	LINK TEST LEVEL 2 REQUEST ON AN INN VC WITHOUT EMPTY LOQ	BALNASM4
0A77	X25EXTRA INTERFACE ERROR	BALNASM4
0A7E	LEVEL 3 INTERRUPT FOR A VC	BALNASME
0A7F	LEVEL 2 INTERRUPT FOR A VC	BALNASME
0A80	PHYSICAL SERVICES REQUEST INVALID	BALLCONN
0A81	LOGIC ERROR DETECTED IN TIMER ROUTINE	BALLCONN
0A82	PHYSICAL SERVICES ELEMENT (TCB/XID) QUEUED ON LOBQ	BALLCONN
0A83	QSTATE ERROR DETECTED IN DATA PROCESSOR OUT	BALLCONN
0A84	QSTATE ERROR DETECTED IN LL2 TEST	BALLCONN
0A85	QSTATE ERROR DETECTED IN QXID PROCESSOR	BALLCONN
0A86	QSTATE ERROR DETECTED IN QSNRM/QUA PROCESSOR	BALLCONN
0A87	LOBQ EMPTY OF FIRST ELEMENT OR LOBQ NOT AN XID	BALLCONN
0A8A	QSTATE ERROR DETECTED IN QRD PROCESSOR	BALLCONN
0A8D	NO TCB TO BUILD THE QTEST REQUEST, LL2 TEST FRAME BUILDER OUT	BALLCONN

CODE	COMMENTS	MODULE
0A90	QSTATE ERROR DETECTED IN MAIN ROUTINE	BALLCINN
0A91	PHYSICAL SERVICES PACKET LENGTH INVALID	BALLCINN
0A93	DATA PIU LENGTH INVALID	BALLCINN
0A94	QSTATE ERROR DETECTED IN DATA PROCESSOR	BALLCINN
0A95	QTEST RESPONSE RECEIVED INSTEAD OF QTEST REQUEST	BALLCINN
0A96	QSTATE ERROR DETECTED IN LL2 TEST ECHOER	BALLCINN
0A9F	ERROR DURING XPC-OUT VERIFICATION -FID TYPE INVALID, NOT FID0/1/4, -PIU LENGTH TOO SHORT, -PIU'S TH LENGTH WRONG -SUB-AREA ADDRESS IN PIU'S TH=0	BALLCINN
0AA1	DISPATCH-OUT FUNCTION NOT RECOGNIZED	BALPCNM9
0AA2	PHYSICAL SERVICES ERROR	BALPCNM9
0AA3	UNKNOWN SESSION CONTROL COMMAND	BALPCNM9
0AA4	INVALID ENTRY IN THE TIMER ROUTINE	BALPCNM9
0AA5	DISPATCH-IN FUNCTION NOT RECOGNIZED	BALPCNM9
0AA6	NO PIU QUEUED IN TRANSPARENT MODE	BALPCNM9
0AB0	VC NUMBER DISCREPANCY IN VCB AND PKT	BALVCIMC
0AB2	OTHER THAN CONTROL PACKET RECEIVED	BALVCIMC
0AB3	INVALID PVC STATUS, PROGRAMMING ERROR	BALVCIMC
0AB4	INVALID SVC STATUS, PROGRAMMING ERROR	BALVCIMC
0AD0	LINK TEST LEVEL 2 WITHOUT TCB QUEUED	BALL2TMB

X.25 NCP PACKET SWITCHING INTERFACE MODULES

The X.25 NCP Packet Switching Interface modules are:

BALCTLPR	Control Packet Router
BALDATE	DATE
BALGATE	GATE LLC4
BALINIMD	Initialization Routine
BALLCIND	LLC-IN Dispatcher
BALLCINN	INN Incoming (Releases 3 and 3.1 only)
BALLCONN	INN Outgoing (Releases 3 and 3.1 only)
BALL2TMB	Link Level 2 Test
BALNASME	NAS Level 2/3 in Low Core
BALNASM4	NAS Level 3/4/5
BALPAD	PAD LLC5
BALPCMCH	LU MCH Support
BALPCNM9	PCNE LLC0
BALPLPI	PLP-IN Task
BALPLPL3	Packet Dispatcher
BALPLPOU	PLP-OUT Routine
BALPSHM7	PSH LLC2
BALQBNNM	BNN QLLC
BALQLLCM	QLLC Dispatcher
BALSTAM8	Block Dump Tables
BALSTAS8	Same as BALSTAM8 plus SNAP area
BALT5OUT	LLC-OUT Dispatcher
BALUSIMF	Logical Unit Simulator for Non-SNA Support
BALVCIMC	VCM-IN Routine
BALVCIM6	VCM-IN Task
BALVCOMA	VCM-OUT
BALXLT	PAD Translation Tables
BAL2BM	Common LAC Level 2 Code for CSB2 and CSB3
BAL2B2	Specific LAC Level 2 Code for CSB2
BAL2B3	Specific LAC Level 2 Code for CSB3
BAL3LAPS	Subroutines for LAC Level 3 code
BAL3LAP1	LAC Level 3 Code for CSB2 and CSB3 Part 1
BAL3LAP2	LAC Level 3 Code for CSB2 and CSB3 Part 2

APPENDIX B. RECMS BYTE EXPANSIONS

MKBMDREC

If a failure occurs on a physical circuit, the X.25 NCP Packet Switching Interface maintains one byte in the MKBMDREC to explain the failure.

The format of the byte is shown on the next two pages:

MKBMDREC

	ERROR CODES ASSOCIATED WITH AN INOP MCH LINK (RECMS LINK)
	X'01' Enable on a busy line
	X'02' SET MODE error on send side of link
	X'03' SET MODE error on receive side of link
	X'04' MONITOR DSR error on send side of link
	X'05' MONITOR DSR error on receive side of link
	X'06' RTS error on send side of link (CSB3)
	X'07' Timeout on Enable phase
	X'08' Flag transmission error during contact
	X'09' Flag monitoring error during contact
	X'0A' Timeout on flag monitoring during contact
	X'0B' DEACTIVATE PU for MCH already disabled
	X'0C' DEACTIVATE PU for MCH in enable phase
	X'0D' DEACTIVATE PU for MCH during modem check recovery
	X'0E' Transmit error during shutdown
	X'0F' Receive error during shutdown
	X'10' Timeout on transmit during shutdown
	X'11' Timeout on transmit during information transfer
	X'12' Permanent hardware failure
	X'13' Modem check

MKBMDREC (continued)

	ERROR CODES ASSOCIATED WITH AN INOP STATION (RECMS STATION)
	X'20' Limit reached in LAP outgoing queue
	X'21' DEACTIVATE PU for MCH already deactivated or for MCH in flag monitering phase
	X'22' Timeout on receive after retries during shutdown
	X'23' Timeout on receive after retries during contact
	X'24' Timeout on receive after retries during ABM phase
	X'25' DM received during contact
	X'26' DM received during reinitialization phase
	X'27' DCE does not Send DISC (LAP only)
	X'28' DCE does not Send SARM (LAP only)
	X'FF' Restart Request Timeout
	ERROR CODES USED FOR MCH LINK REINITIALIZATION (RECMS LINK)
	X'30' Reinitialize after sending FRMR on receiving Disconnect
	X'31' Reinitialize after receiving UA in information transfer
	X'32' Reinitialize after receiving FRMR for invalid N(R)
	X'33' Reinitialize after receiving FRMR for length error in I frame
	X'34' Reinitialize after receiving FRMR for short frame length error
	X'35' Reinitialize after receiving FRMR for invalid Control field
	X'36' Reinitialize after receiving DM during information transfer or during timer recovery
	X'37' Reinitialize after receiving SABM during information transfer or during timer recovery

VCBRECB0, VCBRECB1, VCBRECB2, VCBRECB3, VCBRECB4, AND VCBRECB5

If an abnormal condition occurs on a virtual circuit, the X.25 NCP Packet Switching Interface maintains six bytes in the virtual circuit block (VCB) to explain this condition.

The format of these six bytes is:

VCBRECB0

	bit 0 = 0 Indicates that the RECMS applies to a VC
VCBR0X25	bit 1 = 1 Indicates that the RECMS is generated by the X.25 NCP Packet Switching Interface
	bits 2,3:
VCBR0MCH	00 MCH failure
VCBR0VCM	01 VCM failure
VCBR0PLP	10 PLP failure
VCBR0LLC	11 LLC failure
	bits 4-7: indicate the category of the failure. Valid in case of VCM or LLC failure:
	IN THE CASE OF VCM FAILURE:
VCBR0TO	0001 Timeout
VCBR0OCR	0010 Outgoing call refused
VCBR0CLE	0011 Clear indication received
VCBR0RET	0100 Reset indication received
VCBR0RAT	0101 Restart indication received
VCBR0ICP	0110 Invalid or unexpected control packet received
VCBR0ICR	0111 Incoming call refused
	IN THE CASE OF LLC FAILURE:
VCBR0PSH	0001 PSH failure
VCBR0PC0	0010 Non-SNA LLC failure (PCNE/GATE/PAD)
VCBR0QLC	0011 INN QLLC (LLC3)
VCBR0LLD	0100 LLC-OUT dispatcher failure
VCBR0LLI	0101 LLC-IN dispatcher failure
VCBR0QBI	0111 BNN QLLC Inbound failure
VCBR0QBO	1000 BNN QLLC Outbound failure

VCBRECB1

VCBR1MC0	IN CASE OF MCH FAILURE (VCBRECB0 bits 2,3=00): = X'00'
	IN CASE OF VCM FAILURE (VCBRECB0 bits 2-3=01)
VCBR1A01	*type of failure: TIMEOUT X'01' Timeout on CALL REQUEST X'00' Other types of timeouts
	*type of failure: OUTGOING CALL REFUSED
VCBR1B01	X'01' LLC type invalid
VCBR1B02	X'02' LLC type not supported
VCBR1B03	X'03' Invalid VCCPT index
VCBR1B04	X'04' Invalid OUFT index
VCBR1B05	X'05' Slowdown during Connect-out
VCBR1B06	X'06' Command refused due to MCH failure
VCBR1B07	X'07' SVC not defined for CALL=OUT
VCBR1B08	X'08' Calling or Called DTE address length invalid
VCBR1B09	X'09' Invalid Dial Digits length
VCBR1B0B	X'0B' SVC already reserved by GATE
VCBR1B0D	X'0D' CALL-OUT not allowed in DATE
	*type of failure: CLEAR INDICATION RECEIVED The value of this byte is equal to the CAUSE byte received in the CLEAR indication packet (See note 1)
	*type of failure: RESET INDICATION RECEIVED The value of this byte is equal to the CAUSE byte received in the RESET indication packet (See note 2)
	*type of failure: RESTART INDICATION RECEIVED The value of this byte is equal to the CAUSE byte received in the RESTART indication packet (See note 3)

VCBRECB1 (continued)

	*type of failure: INVALID OR UNEXPECTED CONTROL PACKET RECEIVED The value of this byte is equal to byte 0 of the packet header received
	*type of failure: INCOMING CALL REFUSED
VCBR1C01	X'01' LLC type invalid
VCBR1C02	X'02' LLC type not supported
VCBR1C03	X'03' VC not in answer mode
VCBR1C04	X'04' VC defined with CALL=OUT only
VCBR1C05	X'05' Contention with an outgoing call
VCBR1C06	X'06' Invalid facility field
	IN CASE OF PLP FAILURE (VCBRECB0 bits 2,3=10)
VCBR1PL1	X'01' Invalid P(S) received
VCBR1PL2	X'02' Q bit received, not supported
VCBR1PL3	X'03' Invalid P(R) received (BALPLPI)
VCBR1PL4	X'04' D-Bit not supported (BALPLPI)
	IN CASE OF LLC FAILURE (VCBRECB0 bits 2,3=11)
	*for an LLC-OUT DISPATCHER failure:
VCBR1LL1	X'01' LLU to be sent on an X.25 LVL3 state different from "Information Transfer" (P4)
VCBR1LL2	
	*for an LLC-IN DISPATCHER failure:
	X'02' Invalid input from End-User
	*for a PSH failure:
VCBR1PS2	X'02' Invalid PU type in XID
VCBR1PS3	X'03' XID-LLU to send on a PVC or on a state different from XMIT-XID
VCBR1PS4	X'04' Timeout and retries exhausted
VCBR1PS5	X'05' Invalid NS-LLU received
VCBR1PS6	X'06' CMDR Received
VCBR1PS7	X'07' Invalid N(S) received in I-LLU
VCBR1PS8	X'08' I-LLU to be sent on state different from PSH Data Transfer
VCBR1PS9	X'09' I-LLU received on state different from PSH Data Transfer
VCBR1PSA	X'0A' Contact request out of valid PSH state
VCBR1PSB	X'0B' Discontact request out of valid PSH state

VCBRECB1 (continued)

	*for a NON-SNA LLC failure: The LUSREQ macro cannot send the designated SNA RU to the host because:
VCBR1PC1	X'01' No SSCP-SLU session
VCBR1PC2	X'02' No PLU-SLU session
VCBR1PC3	X'03' SLU in Receive or FME-WAIT state
VCBR1PC4	X'04' SHUTC state entered
VCBR1PC5	X'05' Wait for DFC response
VCBR1PC6	X'06' No DFC request pending
VCBR1PC7	X'07' Begin bracket pending
VCBR1PC8	X'08' Discontact processing on a PVC due to an ANS condition
VCBR1PC9	X'09' Exception Response received from the host while D-bit is used
	*for an INN QLLC failure: X'00'
	*for a BNN QLLC-IN failure: (VCBRECB0 bit 4,7=0111) The value of this byte is equal to the A field of the received Q packet
	*for a BNN QLLC-OUT failure: (VCBRECB0 bit 4,7=1000) X'01" timeout X'02' XID requested from host when PLP not ready (A0)

VCBRECB2

	IN CASE OF MCH FAILURE (VCBRECB0 bits 2,3=00)
VCBR2MC0	= X'00'
	IN CASE OF VCM FAILURE (VCBRECB0 bits 2,3=01)
	*type of failure: TIMEOUT OUTGOING CALL REFUSED INCOMING CALL REFUSED
VCBR2VC0	= X'00'
	*type of failure: CLEAR INDICATION RECEIVED the value of this byte is equal to the DIAGNOSTIC byte received in the Clear Indication packet (Note 5)
	*type of failure: RESET INDICATION RECEIVED the value of this byte is equal to the DIAGNOSTIC byte received in the Reset Indication packet (Note 5)
	*type of failure: RESTART INDICATION RECEIVED the value of this byte is equal to the DIAGNOSTIC byte received in the Restart Indication packet
	*type of failure: INVALID OR NOT SUPPORTED CONTROL PACKET RECEIVED the value of this byte is equal to byte 2 of the packet header received
	IN CASE OF PLP FAILURE (VCBRECB0 bits 2,3=10)
VCBR2PL0	= X'00'

VCBRECB2 (continued)

VCBR2LL0	IN CASE OF LLC FAILURE, (VCBRECB0 bits 2,3=11) *for a LLC-OUT DISPATCHER failure LLC-IN DISPATCHER failure PSH failure NON-SNA LLC failure =X'00' *for an INN QLLC failure, (VCBRECB0 bits 4-7=0011) =VCBQSTA1 (LLC status byte 1) X'00' Reset Status (configurable) X'80' QXID sent (configurable) X'88' QXID exchange in progress (configurable) X'C8' QSNRM in progress (primary) X'8C' QSNRM received (secondary) X'AC' QUA in progress (secondary) X'CA' Data transfer (primary) X'AE' Data transfer (secondary) *for an BNN QLLC-IN failure (VCBRECB0 bit 4,7=0111) The value of this byte is equal to the C field of the received Q packet.

VCBRECB3

	This byte contains a copy of VCM state at the time of the failure: =VCBVCM0 X'40' Inhibit transmit SARM X'08' P6 - DTE CLEAR REQUEST in progress X'04' P4 - Data transfer X'02' P2 - CALL REQUEST in progress X'01' D2 - DTE RESET REQUEST in progress

VCBRECB4

	This byte contains a copy of PLP state at the time of the failure: =VCBEPST X'80' DTE window closed X'40' RNR received X'20' Incoming packet accumulation in progress X'10' PLP-IN locked for PCNE

VCBRECB5

	This byte contains a copy of the end user state taken at the time of the failure *LLC dispatcher state = VCBEEST X'80' LLC timer running X'40' LLC-OUT waits for triggering X'20' LLC-IN timer elapsed X'10' Send RR/RNR X'08' LLC-OUT SYSXIT with trigger X'04' D-bit not allowed *PSH state = VCBPSS1 X'80' Information transfer X'40' Waiting XID X'20' Waiting PSCONT X'10' Waiting PSDISC X'08' Outgoing segmenting X'04' Incoming segmenting *PCNE state = VCBEUS1 X'40' SHUTC pending X'20' D-Bit RR pending X'08' Incoming purge mode *INN QLLC state = VCBQSTA2 (LLC status byte 2) X'08' QRD or QDISC received (primary) X'80' QDISC in progress (primary) X'88' QDISC in progress (primary) X'40' QRD in progress (secondary) X'20' QTEST request in progress (requestor) X'22' QTEST request in progress (requestor) X'10' QTEST response in progress (echoer) *BNN QLLC failure state X'B0' closed X'B2' XID Request pending X'B3' test request pending X'C0' opening X'E0' closing X'F0' opened

Notes:

1. Cause byte in a Clear Indication packet:

X'00'	DTE clearing
X'01'	Number busy (or Call Collision)
X'03'	Invalid facility request or invalid call (for Network Type 1)
X'05'	Network congestion or incidents on the network (for Network Type 1)
X'09'	Out-of-order
X'0B'	Access barred
X'0D'	Unknown number
X'11'	Remote procedure error
X'13'	Local procedure error
X'15'	RPOA out-of-order
X'19'	Remote DTE refuses reverse charging
X'21'	Incompatible destination or end of out-of-order condition (for Network Type 1)
X'29'	Fast select acceptance not subscribed

   Refer to 4.

2. CAUSE byte in a Reset Indication Packet:

X'00'	DTE resetting (for Network Type 1)
X'00'	End of out-of-order (for Network Type 2)
X'01'	Out-of-order
X'03'	Remote procedure error
X'05'	Local procedure error
X'07'	Network congestion
X'09'	Remote DTE operational
X'0F'	Network operational
X'11'	Incompatible destination

   Refer to 4.

3. Cause byte in Restart Indication Packet:

X'00'	DTE restart
X'01'	Local procedure error
X'03'	Network congestion
X'05'	End of out-of-order condition (for Network Type 1)
X'07'	Network operational

   Refer to 4.

4. Defining Network Type:

   Network Type 1 is defined by coding NETTYPE=1 in the X25NET macro.
   Network Type 2 is defined by coding NETTYPE=2 in the X25NET macro.

If the network type is not indicated in the preceding notes, then the cause byte is as specified in the CCITT Recommendation X.25 (1980).

5. Interpretation of the Diagnostic Byte in a Clear/Reset Indication Packet:

   The diagnostic byte is meaningful only for Type 1 networks. For Type 2 networks, there is no diagnostic byte in a Clear Indication packet and it is equal to X'00' in a Reset Indication packet.

   When the cause byte indicates DTE clearing or resetting, the associated diagnostic byte should be interpreted according to the type of remote DTE:

   a. If the remote DTE is a remote NIA, refer to the IBM 5973-LO2 Product Description Manual. (specify code 7043)

   b. If the remote DTE is the X.25 NCP Packet Switching Interface program product, refer to Appendix C, "Diagnostic Bytes Specified by X.25 NCP Packet Switching Interface" for the meaning of the diagnostic byte in the Clear Request and Reset Request packet.

   c. If the remote DTE is an SNA terminal supported by the QLLC, refer to the documentation of this specific terminal.

   For cause values other than DTE clearing or resetting, see the X.25 network specifications corresponding to the PSDN you are using for an interpretation of the diagnostic byte.

APPENDIX C. DIAGNOSTIC BYTES SPECIFIED BY X.25 NCP PACKET SWITCHING INTERFACE

DIAGNOSTIC BYTE IN THE CLEAR REQUEST PACKET FOR RELEASES 2 AND 3

For Type 1 Networks

For Type 1 Networks, when the X.25 NCP Packet Switching Interface sends a Clear Request packet, the clearing cause byte is set to X'00' and the diagnostic field byte is set to the following values:

HEXADECIMAL VALUE	EXPLANATION
00	Disconnection upon request for the host or an ANS situation has occurred
14	Data packet received in P1 state
15	Received something other than Clear Indication or Incoming Call in state P2
45	Incoming call received and link not owned by SSCP or SVC disabled during ANS
84	PLP or LLC error
A2	Invalid or unexpected control packet received
AB	Invalid P(S) received
AC	Invalid P(R) received
B1	LU-MCH session not active
E0	Reset indication received while in VCM inoperative status (switched virtual circuit)
E3	Incoming call received and VC not in ANSWER mode
E5	Incoming call received and LLC type invalid
E6	Incoming call received and LLC type not supported or facility field invalid
E8	Timeout on call request
E9	Incoming call received for a callout only VC
EA	Incoming call received during NCP slowdown
EB	Reset indication while in VCM data transfer status
EC	Incoming call received and Switched Connection Terminator (CXDDSCT) not present

Figure C-1. Diagnostic Field Byte for Clear Requests in Releases 2 and 3

For Type 2 Networks

For Network Type 2, there is no diagnostic field in the Clear Request packet.

DIAGNOSTIC BYTE IN THE RESET REQUEST PACKET FOR RELEASES 2 AND 3

For Type 1 Networks

For Type 1 Networks, when the X.25 NCP Packet Switching Interface sends a Reset Request packet, the resetting cause byte is set to X'00' and the diagnostic byte is set to the following values:

HEXADECIMAL VALUE	EXPLANATION
14	Data packet received on an inactive VC link
82	Invalid or unexpected control packet received
83	Disconnection upon request from the SSCP, or because an ANS situation has occurred
84	PLP or LLC error

Figure C-2. Diagnostic Field Byte for Reset Requests in Releases 2 and 3

For Type 2 Networks

For Type 2 Networks, the diagnostic byte is always equal to X'00'.

DIAGNOSTIC BYTES IN THE CLEAR/RESET REQUEST PACKETS FOR RELEASE 3.1

For Type 1 Networks

For Type 1 networks, when the X.25 NCP Packet Switching Interface sends a Clear/Reset Request packet, the clearing cause byte is set to X'00' and the diagnostic field is set to the following value:

HEXADECIMAL VALUE	EXPLANATION
00	XIO Disable and no ANS (normal)
0C	On SVC, on state P1 incoming call received with invalid or not supported LLC type
14	Invalid packet type received in state P1 - On SVC, Data packet received control packets (except incoming call and reset indication) - On PVC, Data packet received before link activation
15	Invalid packet type received in state P2. (control packets received except Call Connect, Clear Indication and Incoming Call)
17	Invalid packet type received in state P4. (Control packets received except Reset Indication and Clear Indication)
1B	On PVC, Reset Confirmation received in state P4/D1
30	GATE: DTE timer elapsed
31	Timeout on call request
50	BNN QLLC ERROR: general
52	BNN QLLC ERROR: Unexpected C-field
56	BNN QLLC ERROR: Frame reject received
57	BNN QLLC ERROR: Header invalid
58	BNN QLLC ERROR: Data received in wrong state
59	BNN QLLC ERROR: time-out condition

Figure C-3 (Part 1 of 3). Diagnostic Field Byte for Clear/Reset Requests in Release 3.1

HEXADECIMAL VALUE	EXPLANATION
	PSH ERROR
60	Invalid PU type (XID)
61	Invalid N(S) received in I-LLU
63	Invalid NS-LLU (<F0)
64	Command undefined
65	XID to send on PVC
	XID to send, wrong state
	Invalid command received
	Data to send, wrong state
	Contact to send, wrong state
	Discontact to send, wrong state
66	Data received, wrong state
69	PSH timeout
A3	Control packets except Reset
	Indication received in state P4
	PACKETS RECEIVED WITH
AB	Invalid P(S)
AC	Invalid P(R)
AD	Invalid D-bit received
AE	Invalid Q-bit received
B1	PCNE: No LU-MCH session in GATE/DATE
C0	PCNE: Negative response with D-bit
C1	PCNE: SHUT-C status
C2	XIO disable and ANS
	PCNE error: DISC due to ANS
C5	PCNE error: No SSCP-LU session
	No PLU-LU session
	SLU waiting in wrong state
	Wait for DFC response
	No DFC request pending
	Begin Bracket Pending

Figure C-3 (Part 2 of 3). Diagnostic Field Byte for Clear/Reset Requests in Release 3.1

HEXADECIMAL VALUE	EXPLANATION
D0	In state P1, incoming call received Not in answer mode Link not owned if SNP bit off CXDDSCT is not the NCP terminator In state P2, Call Connect received without dial in progress (NPSI internal error) In state P4, PIU to be exported with an invalid format (probable SYSGEN error)
D1	In state P1, incoming call received, slowdown in progress
D2	PIU to be exported is too long
EA	Reset Indication received in state P2/P4 on SVC
E3	In state P1, incoming call received Not in answer mode
E6	With Invalid facility field

Figure C-3 (Part 3 of 3). Diagnostic Field Byte for Clear/Reset Requests in Release 3.1

For Type 2 Networks

For network type 2:

- There is no diagnostic byte in the Clear Request packet
- The diagnostic byte is always equal to X'00' in the Reset Request packet

GLOSSARY

This glossary contains definitions reprinted from:

(1) The American National Dictionary for Information Processing, copyright 1977 by the Computer and Business Equipment Manufacturers Association, copies of which may be purchased from the American National Standards Institute at 1430 Broadway, New York, New York 10018. These definitions are identified by an asterisk.
(2) The ISO Vocabulary of Data Processing, developed by the International Standards Organization, Technical Committee 97, Subcommittee 1. Definitions from published sections of this vocabulary are identified by the symbol "(ISO)" preceding the definition. Definitions from draft proposals and working papers under development by the ISO/TC97 vocabulary subcommittee are identified by the symbol "(TC97)," indicating that final agreement has not yet been reached among its participating members.
(3) The CCITT Sixth Plenary Assembly Orange Book, Terms and Definitions, and working documents published by the International Telecommunication Union, Geneva, 1978. These are identified by the symbol "(CCITT/ITU)" preceding the definition.

ABM. Asynchronous balanced mode.

abort. A function invoked by a sending primary, secondary, or combined station causing the recipient to discard and ignore all bit sequences transmitted by the sender since the preceding flag sequences. See also frame abortion.

access barred. (CCITT/ITU) The state in which the calling data terminal equipment (DTE) is not permitted to make a call to the DTE identified by the selection signals.

ADM. Asynchronous disconnected mode.

administration. See telecommunication Administration.

ARM. Asynchronous response mode.

asynchronous balanced mode (ABM). An operational mode of a balanced data link in which either combined station can send commands at any time and can initiate transmission of response frames without explicit permission from the other combined station. See also asynchronous response mode, normal response mode.

asynchronous disconnected mode (ADM). A nonoperational mode of a balanced or unbalanced data link in which the secondary or combined station is logically disconnected from the data link and therefore cannot transmit or receive information. See also initialization mode, normal disconnected mode.

asynchronous response mode (ARM). An operational mode of an unbalanced data link in which a secondary station may initiate transmission without explicit permission from the primary station. See also asynchronous balanced mode, normal response mode.

balanced data link. A data link between two participating combined stations; each station can transmit both command frames and response frames and assumes responsibility for the organization of its data flow and for the data link level error recovery operations for the transmissions that it originates. Contrast with unbalanced data link.

balanced station. Synonym for combined station.

bracket. One or more of request units (RUs) and their responses, that are exchanged between two LU-LU half-sessions and that represent a transaction between them. A bracket must be completed before another bracket can be started.

call. (1) (CCITT/ITU) A transmission for the purpose of identifying the transmitting station for which the transmission is intended. (2) (CCITT/ITU) An attempt to reach a user, whether or not successful.

call accepted packet. (CCITT/ITU) A call supervision packet transmitted by a called data terminal equipment (DTE) to inform the data circuit-terminating equipment (DCE) of the acceptance of the call.

call-accepted signal. (TC97) A call control signal that is sent by the called data terminal equipment (DTE) to indicate that it accepts the incoming call.

call collision. (CCITT/ITU) The simultaneous transmission of a call request signal from the data terminal equipment (DTE) and an incoming call signal from the data circuit-terminating equipment (DCE) so that neither equipment receives the expected responses.

call connected packet. (CCITT/ITU) A call supervision packet transmitted by a data circuit-terminating equipment (DCE) to inform a calling data terminal equipment (DTE) of the complete establishment of a call.

call control character. (CCITT/ITU) A character of an alphabet, or a part of it, which is used for call control. It may be used in conjunction with defined signal conditions on other interchange circuits.

call control procedure. (TC97) The implementation of a set of protocols necessary to establish and release a call.

call control signal. (TC97) One of the set of signals necessary to establish, maintain, and release a call.

called party. On a switched line, the location to which a connection is established.

call establishment. (CCITT/ITU) The sequence of events for the establishment of a data connection.

call identifier. (CCITT/ITU) A network utility that is an identifying name assigned by the originating network for each established or partially established virtual call and, when used in conjunction with the calling data terminal equipment (DTE) address, uniquely identifies the virtual call over a period of time.

calling. (TC97) The process of transmitting selection signals in order to establish a connection between data stations.

calling party. On a switched line the location that originates a connection.

calling sequence. (1) * (ISO) An arrangement of instructions and, in some cases, of data also, that is necessary to perform a call. (2) A polling list. See also polling.

call not accepted signal. (TC97) A call control signal sent by the called data terminal equipment (DTE) to indicate that it does not accept the incoming call.

call progress signal. (CCITT/ITU) A call control signal transmitted from the data circuit-terminating equipment (DCE) to the calling data terminal equipment (DTE) to inform it about the progression of a call, the reason why the connection

could not be established, or any other network condition. Additionally, for packet services, a control signal:

- for virtual call service, to inform the calling and called DTEs about the reason why the call has been cleared
- for permanent virtual circuit service, to inform the DTEs about the reason why the permanent virtual circuit has been reset
- for datagram service, to inform the source DTE about the delivery or nondelivery of a specific datagram, or general operation of the DTE/DCE interface or service.

call request packet. (CCITT/ITU) A call supervision packet transmitted by a data terminal equipment (DTE) to ask for a call establishment through the network.

call request signal. (CCITT/ITU) A signal in the call establishment phase that alerts the data circuit-terminating equipment (DCE) that the data terminal equipment (DTE) wishes to make a call.

call supervision packet. (CCITT/ITU) A packet used for the establishment or the clearing of a call at the DTE/DCE interface.

centralized control. Control in which all the primary station functions of the data link are centralized in one data station.

centralized multipoint facility. (CCITT/ITU) A multipoint facility that enables a central data terminal equipment (DTE) to transmit data simultaneously to two or more remote DTEs, and to receive data transmitted by the remote DTEs one at a time. Data transmitted by a remote DTE is not delivered to other remote DTEs.

channel. See data communication channel.

character alignment. (CCITT/ITU) The identification of groups of contiguous bits that constitute characters.

circuit. See data circuit.

circuit switched data transmission service. (TC97) A service using circuit switching to establish and maintain a connection before data can be transferred between data terminal equipments (DTEs). See also packet switched data transmission service.

circuit switching. (TC97) A process that, on demand, connects two or more data terminal equipments (DTEs) and permits the exclusive use of a data circuit between them until the connection is released. Synonymous with line switching. See also message switching, packet switching.

class of service. See user class of service.

clear collision. The condition that occurs when a data terminal equipment (DCE) and a data circuit-terminating equipment (DCE) simultaneously transmit a clear request packet and a clear indication packet over the same logical channel.

clear indication packet. (CCITT/ITU) A call supervision packet transmitted by a data circuit-terminating equipment (DCE) to inform a data terminal equipment (DTE) of the clearing of a call.

clear request packet. (CCITT/ITU) A call supervision packet transmitted by a data terminal equipment (DTE) to ask for clearing a call.

closed user group. (TC97) In a group of users, a subgroup that is assigned a facility that enables a member of one subgroup to communicate only with other members of the subgroup. See also bilateral closed user group.

Note: A data terminal equipment (DTE) may belong to more than one closed user group.

closed user group with outgoing access. (CCITT/ITU) A closed user group that has a user assigned a facility which enables that user to communicate with other users of a public data network transmission service, where appropriate, or with users having a data terminal equipment (DTE) connected to any other public switched network to which interworking facilities are available.

collision. See call collision, clear collision, reset collision.

combined station. (1) (TC97) In high level data link control (HDLC), a data station that includes both a primary and a secondary. (2) A data station that supports the combined station control functions of a data link. The combined station generates commands and responses for transmission and interprets received commands and responses. Specific responsibilities assigned to a combined station include:

- initialization of control signal interchange
- organization of data flow
- interpretation of received commands and generation of appropriate responses
- actions regarding error control and error recovery functions at the data link level.

(3) Synonymous with balanced station. See also primary station, secondary station.

command. In data communications, an instruction represented in the control field of a frame and transmitted by a primary or combined station. It causes the addressed secondary/combined station to execute a specific data link control function. See also response.

command frame. A frame transmitted by a primary station or a frame transmitted by a combined station that contains the address of the other combined stations.

communication line. Synonym for telecommunication line.

communication common carrier. In the USA and Canada, a public data transmission service that provides the general public with transmission service facilities; for example, a telephone or telegraph company. See also telecommunication Administration, Post Telephone and Telegraph Administration, public data network, public data transmission service, Recognized Private Operating Agency.

contention mode. A mode of transmission in which a transmitter can send on its own initiative.

controlled slip. (CCITT/ITU) Slip where the number of digits lost or gained is always fixed.

CTCP. Communication and Transmission Control Program.

data channel. A device that connects a processor and main storage with I/O control units. Synonymous with input/output channel, I/O channel. Contrast with data communication channel.

data circuit. (1) (TC97) Associated transmit and receive channels that provide a means of two-way data communication. (2) See also physical circuit, virtual circuit.

Notes:

1. Between data switching exchanges (DSEs), the data circuit may or may not include data circuit-terminating equipment (DCE), depending on the type of interface used at the data switching exchange.

2. Between a data station and a data switching exchange or data concentrator, the data circuit includes the data circuit-terminating equipment at the data station end, and may also include equipment similar to a DCE at the data switching exchange or data concentrator location.

data circuit-terminating equipment (DCE). (TC97) The equipment installed at the user's premises that provides all the functions required to establish, maintain, and terminate a connection, and the signal conversion and coding between the data terminal equipment (DTE) and the line.

> **Note:** The DCE may be separate equipment or an integral part of other equipment.

data circuit transparency. (TC97) The capability of a data circuit to transmit all data without changing the data content or structure.

data communication channel. (1) (TC97) A means of one-way transmission. Contrast with data channel.

> **Note:** A channel may be provided, for example, by frequency or time division multiplexing.

data communication line. Deprecated term for telecommunication line.

data link. (1) * The physical means of connecting one location to another for the purpose of transmitting and receiving data. (2) (TC97) The assembly of parts of two data terminal equipments (DTEs) that are controlled by a link protocol, and that, together with the interconnecting data circuit, enables data to be transferred from a data source to a data sink. (3) The interconnecting data circuit between two or more equipments operating in accordance with a link protocol; it does not include the data source and the data sink. (4) In SNA, synonym for link(3). (5) Contrast with telecommunication line.

> **Note:** A telecommunication line is the physical medium, for example, a telephone wire, a microwave beam. A data link includes the physical medium of transmission, the protocol, and associated devices and programs—it is both logical and physical.

data link level. The conceptual level of control or processing logic existing in the hierarchical structure of a data station (primary, secondary, or combined station) that is responsible for maintaining control of the data link. The data link level functions provide an interface between the data station high level logic and the data link. These functions include transmit bit insertion and receive bit deletion; address/control field interpretation; command/response generation, transmission, and interpretation; and frame check sequence computation and interpretation. See also higher level, packet level, physical level.

data packet. (CCITT/ITU) A packet used for the transmission of user data on a virtual circuit at the DTE/DCE interface.

data phase. (CCITT/ITU) That phase of a data call during which data signals may be transferred between data terminal equipments (DTEs) that are interconnected via the network. See also network control phase.

data signaling rate. Synonym for data transfer rate.

data station. (TC97) The data terminal equipment (DTE), the data circuit-terminating equipment (DCE), and any intermediate equipment. Synonymous with data terminal installation.

Note: The DTE may be connected directly to a data processing system or may be part of it.

data terminal equipment (DTE). (TC97) That part of a data station that serves as a data source, data sink, or both, and provides for the data communication control function according to protocols.

data terminal installation. Synonym for data station.

data transfer. (1) (CCITT/ITU) The result of the transmission of data signals from a data source to a data sink. (2) The movement, or copying, of data from one location and the storage of the data at another location.

data transfer mode. Synonym for data transfer phase.

data transfer phase. That phase of a data call during which data signals may be transferred between data terminal equipments (DTEs) that are interconnected via the network. Synonymous with data transfer mode. See also network control phase.

data transfer rate. (1) (CCITT/ITU) The average number of bits, characters, or blocks per unit of time transferred from a data source to a data sink. The rate is usually expressed as bits, characters, or blocks per second, minute, or hour. (2) Synonymous with data signaling rate.

data transfer state. See data transfer phase.

data transmission line. Synonym for telecommunication line.

DATE. Dedicated Access to X.25 Transport Extension

DCE. Data circuit-terminating equipment.

DCE clear confirmation packet. (CCITT/ITU) A call supervision packet transmitted by a data circuit-terminating equipment (DCE) to confirm the clearing of a call.

DCE/DTE interface. See DTE/DCE interface.

deadlock. (1) Unresolved contention for the use of a resource. (2) An error condition in which processing cannot continue because each of two elements of the process is waiting for an action by or a response from the other.

dedicated channel. A channel that is not switched.

dedicated circuit. A circuit that is not switched.

dedicated connection. Deprecated term for nonswitched connection.

direct call. (CCITT/ITU) A facility which enables the establishment of a call without the need to convey address signals to the network.

discarded packet. (CCITT/ITU) A packet that is destroyed intentionally or by default while being transmitted through the network.

disconnected mode. Synonym for disconnected phase

disconnected phase. A phase entered by a data circuit-terminating equipment (DCE) when it detects error conditions, recovers from a temporary internal malfunction, or receives a DISC command from a data terminal equipment (DTE). In the disconnected phase, the DCE may initiate link setup but can transmit only DM responses to received frames. See also information transfer phase.

DTE. Data terminal equipment.

DTE busy. (CCITT/ITU) The status of a data terminal equipment (DTE) which is unavailable because it cannot accept an additional call.

DTE clear confirmation packet. (CCITT/ITU) A call supervision packet transmitted by data terminal equipment (DTE) to confirm the clearing of a call.

DTE/DCE interface. (CCITT/ITU) The physical interface elements and the link access procedures between data terminal equipment (DTE) and data circuit-terminating equipment (DCE).

echoplex mode. (CCITT/ITU) A mode of operation whereby characters transmitted by data terminal equipment (DTE) are automatically returned to that DTE from some specified network node.

end-to-end control. (CCITT/ITU) A means in which during the data phase of a call, interconnected data terminal equipment (DTE) may exchange control signals without loss of data bit sequence independence.

F sequence. Flag sequence.

fast select. (CCITT/ITU) A facility applicable to virtual calls that allows a data terminal equipment (DTE) to expand the possibility to transmit data in call setup and clearing packets beyond the basic capabilities of a virtual call.

FCS. Frame checking sequence.

first speaker. The LU-LU half-session defined at session activation as: (1) able to begin a bracket without requesting permission from the other LU-LU half-session to do so, and (2) winning contention if both half-sessions attempt to begin a bracket simultaneously.

flag (F) sequence. The unique sequence of eight bits (01111110) employed to delimit the opening and closing of a frame.

flow control. (1) (TC97) The procedure for controlling the data transfer rate. See also transmit flow control. (2) In SNA, the process of managing the rate at which data traffic passes between components of the network. The purpose of flow control is to optimize the rate of flow of message units with minimum congestion in the network; that is, to neither overflow the buffers at the receiver or at intermediate routing nodes, nor leave the receiver waiting for more message units.

frame. (1) In high level data link control (HDLC), the sequence of contiguous bits bracketed by and including opening and closing flag (01111110) sequences. (2) (CCITT/ITU) A set of consecutive digit time slots in which the position of each digit time slot can be identified by reference to a frame alignment signal.

frame checking sequence (FCS). See frame check sequence.

frame check sequence (FCS). The field immediately preceding the closing flag sequence of a frame, containing the bit sequence that provides for the detection of transmission errors by the receiver.

frame level interface. (CCITT/ITU) The level of the DTE/DCE interface in packet mode operation relating to the exchange of packets with local error control, where packets are contained in frames.

GATE. General Access to X.25 Transport Extension.

HDLC. High-level data link control.

high-level data link control (HDLC). (CCITT/ITU) Control of data links by use of a specified series of bits rather than by the control characters of the ISO Standard 7-bit character set for information processing interchange.

I format. Information format.

I frame. Information frame.

IM. Initialization mode.

inactive character. (CCITT/ITU) A character that is sent in the data transfer phase as a filler that does not represent information.

incoming call packet. (CCITT/ITU) A call supervision packet transmitted by a data circuit-terminating equipment (DCE) to inform a called data terminal equipment (DTE) of a call requested by another DTE.

information (I) format. A format used for information transfer.

information (I) frame. A frame in I format, used for numbered information transfer. See also supervisory frame, unnumbered frame.

information transfer phase. A phase in which a data circuit-terminating equipment (DCE) can accept and transmit information (I) frames and supervisory (S) frames. See also disconnected phase.

initialization mode (IM). A nonoperational mode of a balanced or unbalanced data link in which the remote secondary or combined station data link control program may be initialized or regenerated by the the local primary or combined station, or in which other parameters to be used in the operational mode may be exchanged. See also asynchronous disconnected mode, normal disconnected mode.

leased line. Synonym for nonswitched line.

line switching. Synonym for circuit switching.

link access procedures (LAP, LAPB). The link level elements used for data interchange between a data circuit-terminating equipment (DCE) and a data terminal equipment (DTE) operating in user classes of service 8 to 11, as specified in CCITT Recommendation X.1.

link level. See data link level.

link station. The combination of hardware and software that allows a node to attach to and provide control for a link.

logical channel. (CCITT/ITU) In packet mode operation, a means of two-way simultaneous transmission across a data link, comprising associated send and receive channels.

Notes:

1. A number of logical circuits may be derived from a data link by packet interleaving.

2. Several logical circuits may exist on the same data link.

lower window edge. (CCITT/ITU) The lowest sequence number in a window.

MCH. Multi-Channel link, or physical circuit. MCH is the physical link over which many virtual circuits are established.

message switching. (1) (TC97) In a data network, the process of routing messages by receiving, storing, and forwarding complete messages. (2) The technique of receiving a complete message, storing, and then forwarding it to its destination unaltered.

multiplex interface. (CCITT/ITU) A DTE/DCE interface that conveys the bit stream of a number of subscriber channels by means of time division multiplexing.

multiplex link. (CCITT/ITU) A means of enabling a data terminal equipment (DTE) to have several access channels to the data network over a single circuit. Three likely methods have been identified: packet interleaving, byte interleaving, and bit interleaving.

NDM. Normal disconnected mode.

network control mode. Synonym for network control phase.

network control phase. (CCITT/ITU) A facility that gives the user the ability to reestablish a link with the network during the data transfer phase to obtain a supplementary facility provided by the network. Synonymous with network control mode. See also data transfer phase.

network failure. (CCITT/ITU) A circumstance occurring in a network that prevents a service to be offered because the network is not functioning correctly.

nonoperational modes. See asynchronous disconnected mode, initialization mode, normal disconnected mode. Contrast with operational modes.

nonswitched connection. A connection that does not have to be established by dialing. Contrast with switched connection.

nonswitched line. A telecommunication line on which connections do not have to be established by dialing. Contrast with switched line. Synonymous with leased line.

normal disconnected mode (NDM). A nonoperational mode of an unbalanced data link in which the secondary station is logically disconnected from the data link and therefore cannot transmit or receive information. See also asynchronous disconnected mode, initialization mode.

normal response mode (NRM). An operational mode of an unbalanced data link in which the secondary station initiates transmission only as the result of receiving explicit permission from the primary station. See also asynchronous balanced mode, asynchronous response mode.

NRM. Normal response mode.

*** octet.** (ISO) A byte composed of eight binary elements.

operational modes. See asynchronous balanced mode, asynchronous response mode, normal response mode. Contrast with nonoperational modes.

packet. (TC97) A sequence of binary digits including data and call control signals that is switched as a composite whole. The data, call control signals, and possibly error control information, are arranged in a specific format. See data packet, DCE clear confirmation packet, discarded packet, call accepted packet, call connected packet, call request packet, call supervision packet, clear indication packet, clear request packet, control packet, diagnostic packet, incoming call packet, interrupt packet, permit packet, qualified data packet, reset packet, restart packet.

packet assembly/disassembly (PAD). (CCITT/ITU) A user facility that permits non-packet mode terminals to exchange data in the packet mode.

packet level. The packet format and control procedures for the exchange of packets containing control information and user data between the data terminal equipment (DTE) and the data circuit-terminating equipment (DCE). See also data link level, higher level, physical level.

packet level interface. (CCITT/ITU) The level of the DTE/DCE interface in packet mode operation relating to the exchange of data and signaling, where this information is contained in packets. See also frame level interface.

packet mode operation. (TC97) Synonym for packet switching.

packet mode terminal. (TC97) Data terminal equipment that can control, format, transmit, and receive packets.

packet sequencing. (TC97) A process of ensuring that packets are delivered to

the receiving data terminal equipment (DTE) in the same sequence as they were transmitted by the sending DTE.

packet switched data transmission service. (CCITT/ITU) A user service involving the transmission and, if necessary, the assembly and disassembly of data in the form of packets.

packet switching. (TC97) The process of routing and transferring data by means of addressed packets so that a channel is occupied only during the transmission of a packet; upon completion of the transmission, the channel is made available for the transfer of other packets. Synonymous with packet mode operation. See also circuit switching.

PAD. Packet assembly/disassembly.

PCNE. Protocol Converter for Non-SNA Equipment.

permit. (CCITT/ITU) An authorization sent on a logical channel for the transmission of one or more data packets in the reverse direction.

physical circuit. (CCITT/ITU) A circuit created with hardware rather than by multiplexing. See also data circuit. Contrast with virtual circuit.

physical level. The mechanical, electrical, functional and procedural media used to activate, maintain and deactivate the physical link between the data terminal equipment (DTE) and the data circuit-terminating equipment (DCE). See also data link level, higher level, packet level.

port. An access point for data entry or exit.

Post Telephone and Telegraph Administration (PTT). A generic term for the government-operated common carriers in countries other than the USA and Canada. Examples of the PTT are the Post Office in the United Kingdom, the Bundespost in Germany, and the Nippon Telephone and Telegraph Public Corporation in Japan.

primary station. The data station that supports the primary control functions of the data link, generates commands for transmission, and interprets received responses. Specific responsibilities assigned to the primary include initialization of control signal interchange, organization of data flow, and actions regarding error control and error recovery functions at the data link level. Contrast with secondary station. See also combined station.

public data network (PDN). See public network.

public data transmission service. (CCITT/ITU) A data transmission service established and operated by an Administration and provided by means of a public data network.

> **Note:** Circuit switched, packet switched and leased circuit data transmission services are feasible.

public network. (CCITT/ITU) A network established and operated by an Administration for the specific purpose of providing data transmission services to the public. Circuit switched, packet switched, and leased-circuit services are feasible. Contrast with user-application network.

> **Note:** Administration refers to both an Administration and an RPOA.

Recognized Private Operating Agency (RPOA). Any individual, company, or corporation, other than a government department or service, that operates a telecommunication service and that is subject to the obligations undertaken in the Convention of the International Telecommunication Union and in the

Regulations; for example, a communication common carrier. Contrast with telecommunication Administration.

reset (of a virtual circuit). (CCITT/ITU) Reinitialization of flow control on a virtual circuit, which eliminates all data that may be in transit for the virtual circuit at the time of resetting.

reset collision. A condition that occurs when a data terminal equipment (DTE) and a data circuit-terminating equipment (DCE) simultaneously transmit a reset request packet and a reset indication packet over the same logical channel.

reset packet. (CCITT/ITU) A packet used for the resetting of a virtual circuit at the DTE/DCE interface.

response. In data communications, a reply represented in the control field of a response frame. It advises the primary/combined station with respect to the action taken by the secondary/combined station to one or more commands. See also command.

response frame. A frame transmitted by a secondary station or a frame transmitted by a combined station that contains the address of the transmitting combined station.

reverse charging acceptance. A facility that enables a data terminal equipment (DTE) to receive incoming packets that request reverse charging.

RNR packet. A packet used by a data terminal equipment (DTE) or by a data circuit-terminating equipment (DCE) to indicate a temporary inability to accept additional packets for a given virtual call or permanent virtual circuit.

RPOA. Recognized Private Operating Agency.

RR packet. A packet used by a data terminal equipment (DTE) or by a data circuit-terminating equipment (DCE) to indicate that it is ready to receive data packets within the window.

secondary station. A data station that executes data link control functions as instructed by the primary station. A secondary station interprets received commands and generates responses for transmission. Contrast with primary station. See also combined station.

sequence number. A numerical value assigned to each message exchanged between two nodes.

S format. Supervisory format.

S frame. Supervisory frame.

slip. (CCITT/ITU) The displacement of a sequence of digits from its allowed digit positions such that digits are either lost or gained. See also controlled slip.

supervisory (S) format. A format used to perform data link supervisory control functions such as acknowledge I frames, request retransmission of I frames, and request a temporary suspension of transmission of I frames. See also information format, unnumbered format.

supervisory (S) frame. A frame in supervisory format, used to transfer supervisory control functions. See also information frame, unnumbered frame.

switched connection. (1) (TC97) A mode of operating a data link in which a circuit or channel is established to switching facilities, as, for example, in a public switched network. (2) A connection that is established by dialing. (3) Contrast with nonswitched connection.

switched line. A telecommunication line in which the connection is established by dialing. Contrast with nonswitched line.

switched network. Any network in which connections are established by closing switches, for example, by dialing.

telecommunication administration. (CCITT/ITU) Any governmental department or service responsible for discharging the obligations undertaken in the Convention of the International Telecommunication Union and in the Regulations. Contrast with Recognized Private Operating Agency.

telecommunication line. (1) (TC97) The portion of a data circuit external to a data-circuit terminating equipment (DCE) that connects the DCE to a data switching exchange (DSE), that connects a DCE to one or more other DCEs, or that connects a DSE to another DSE. (2) Any physical medium, such as a wire or microwave beam, that is used to transmit data. (3) Synonymous with data transmission line, transmission line. (4) Contrast with data link.

> **Note:** A telecommunication line is the physical medium; for example, a telephone wire, a microwave beam. A data link includes the physical medium of transmission, the protocol, and associated devices and programs--it is both logical and physical.

time-out. (CCITT/ITU) A parameter related to an enforced event designed to occur at the conclusion of a predetermined elapsed time.

transmission line. Synonym for telecommunication line.

transparency. See transparent.

transparent. (1) In data transmission, pertaining to information that is not recognized by the receiving program or device as transmission control characters. (2) See code transparent, code transparent data transmission, inherent transparency.

transparent data. Data that is not recognized as containing transmission control characters.

transparent data transfer phase. (CCITT/ITU) The phase of a call during which any bit sequence can be transmitted in both directions between data terminal equipments (DTEs).

transparent information. Information that is not recognized as transmission control characters by a receiving program or device.

U format. Unnumbered format.

U frame. Unnumbered frame.

unbalanced data link. A data link between a primary station and one or more participating secondary stations. The primary station assumes responsibility for the organization of data flow and for data link level error recovery operations and transmits command frames to the secondary stations. The secondary stations transmit response frames. Contrast with balanced data link.

unnumbered (U) commands. Commands that do not contain sequence numbers in the control field.

unnumbered (U) format. A format used to provide additional data link control functions and unnumbered information transfer. See also information format, supervisory format.

unnumbered (U) frame. A frame in unnumbered format, used to transfer unnumbered control functions. See also information frame, supervisory frame.

unnumbered (U) responses. Responses that do not contain sequence numbers in the control field.

user-application network. (TC97) A configuration of data processing

products, such as processors, controllers, and terminals, established and operated by users for the purpose of data processing or information exchange, which may use services offered by communication common carriers or telecommunication Administrations. Contrast with public network.

user class of service. (TC97) A category of data transmission provided in a network in which the data signaling address selection and call progress signals signalling rates and terminal operating mode are standardized.

virtual call. See virtual call facility.

virtual call facility. (CCITT/ITU) A user facility in which a call setup procedure and a call clearing procedure will determine a period of communication between two data terminal equipments (DTEs) in which user's data will be transferred in the network in the packet mode of operation. All the user's data is delivered from the network in the same order in which it is received by the network.

Notes:

1. This facility requires end-to-end transfer control of packets within the network.
2. Data may be delivered to the network before the call setup has been completed, but it is not delivered to the destination address if the call setup attempt is unsuccessful.
3. Multi-access DTEs may have several virtual calls in operation at the same time.

virtual circuit. (TC97) In packet switching, those facilities provided by a network that give the appearance to the user of an actual connection. See also data circuit. Contrast with physical circuit.

virtual link. (CCITT/ITU) A procedure that operates over physical transmission media to provide a reliable and secure communications medium for use by higher levels of procedure, but which is not associated with a particular physical circuit.

window. An ordered set of consecutive packet send sequence numbers of the data packets authorized to cross a DTE/DCE interface on a logical channel used for a virtual call or as a permanent virtual circuit.

window edge. The lowest sequence number in a window.

INDEX

A

B

C

D

E

F

G

I

L

M

N

O

P

Q

R

S

T

V

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