IBM

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Field Engineering Handbook

SNA
Systems Network Architecture
Part 1 - General Information

PREFACE

This handbook was prepared by NCC (Network Competence Center) and ETPCC (European Teleprocessing Competence Center), and is organized in two parts.

Part 1 - General Information
Part 2 - Maintenance Aids

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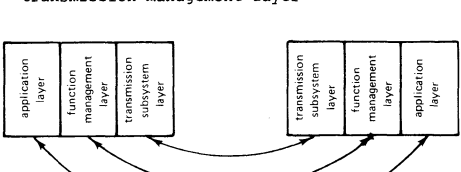
SEPARATION OF FUNCTIONS

SNA is structured in three layers

- application layer
- function management layer
- transmission management layer



Application layer - perform the user's application processing

Function management layer - is concerned with the presentation of information from one application to another application layer.

Transmission subsystem layer - is concerned with the routing and movement of data units between origins and destinations.

SNA STRUCTURE

TRANSMISSION SUBSYSTEM

Provides information exchange between NAU's.

DATA LINK CONTROL (DLC)

Manages the link between nodes

PATH CONTROL (PC)

Provides routing of data units over the path between network addresses.

TRANSMISSION CONTROL (TC)

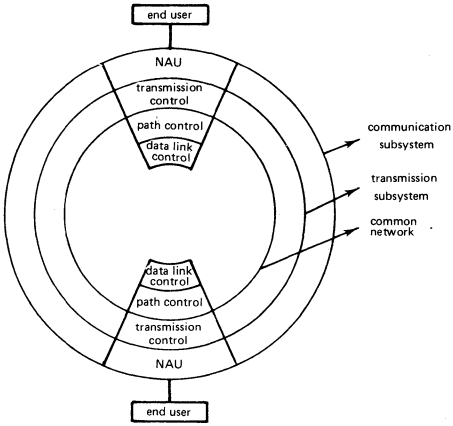
Controls sessions and manages the flow of data into and out of the common network (DLC + PC).

Transmission control consists of three components :

1) Session control (SC) - provides the NAU function for controlling the operation of its sessions.

2) Network control (NC) - provides transmission control and path control with administrative functions.

3) Connection Point Manager (CPM) - controls the transmission of requests and responses during the session, including those generated by SC and NC.

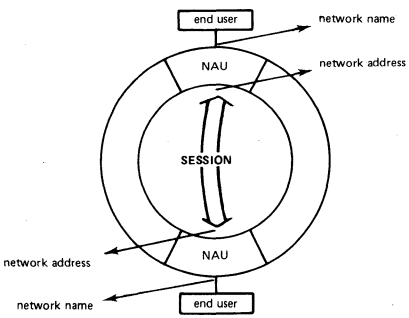


END USER

ultimate sources and destinations of information. They include programs, operators and devices media (cards, tapes,...)

NETWORK ADDRESSABLE UNIT (NAU)

It is a resource managed by the communication system. It provides a port for end-user access to the communication system. NAU's are the origin and destination of information units flowing in the communication system.



A session must be established between two NAU's before their end-user can communicate.

TYPES OF NAU'S

- System service control point (SSCP)
- Logical Unit (LU)
- Physical Unit (PU)

SSCP - Provides a set of commands processors like network services. It is responsible for the general management of the network.

LU - It is the port through which an end-user accesses the SSCP or another end-user.

PU - Each unit in the network (whose existence has been defined to the SSCP) has a PU. A session is used to control the physical configuration or resources associated with the unit, and to collect maintenance and operational statistics.

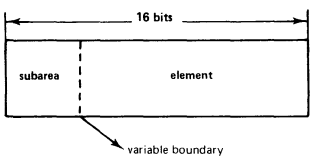
Three kinds of sessions are defined in SNA
1) LU to LU
2) SSCP to LU
3) SSCP to PU

NETWORK NAMES AND ADDRESSES

A network name is associated with each PU, link, and LU in the configuration. The SSCP maintains a directory of network names and transforms network names of PU's and LU's into network addresses. Network names are used by terminal operators, application programs, and network administrators. Network addresses are used within the transmission subsystem. They identify the origin and destination of information units flowing in the communication system.

The full network address is 16 bits long and consists of two parts:

1) Subarea
2) Element within the subarea



The boundary between subarea and element is variable and must be selected at system generation. It must remain constant for all addressable entities in the configuration.

TYPES OF NETWORK NODES

HOST NODE - Is a multi-purpose facility that houses the SSCP in addition to executing application programs, managing data bases, and so forth.
Example of host node is system 370 with VTAM and DOS/VS or OS/VS.

COMMUNICATION CONTROLLER NODE - Is dedicated to the task of controlling communication lines (and related resources such as buffers) in addition to performing the functions related to supporting one or more subareas.
Example of communication controller node is 3705 with NCP.

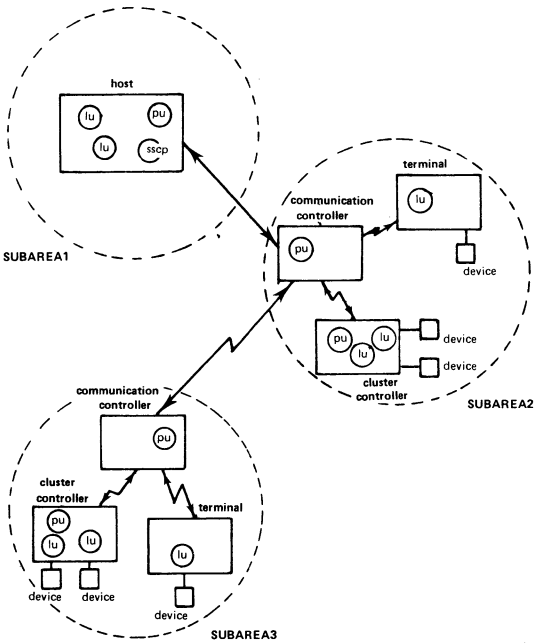
Two different communication controller nodes can be defined.

1) Intermediate network node (INN) is concerned with the transmission and routing of data from or to the host.

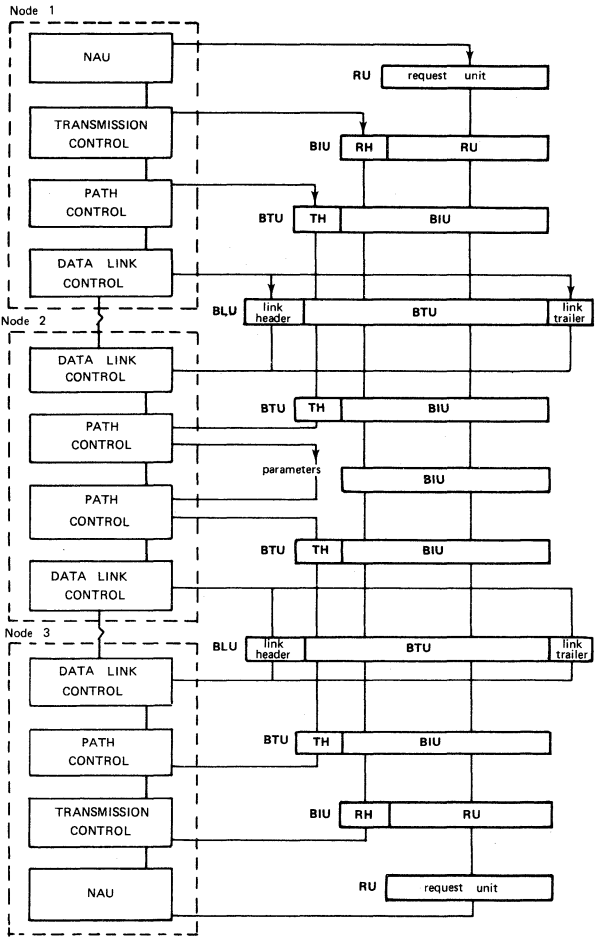
2) Boundary network node (BNN) is an intermediate node with the additional functions of cluster controller or terminal nodes.

CLUSTER CONTROLLER NODE - Supports up to 255 LU (address 0 is reserved for the PU). It allows the end-user attached through the LU in the cluster to share the function management and transmission services components required to interact with other LU/PU in the network.
Example of cluster controller node is 3601 or 3791.

TERMINAL NODE - The existing terminal nodes support only a single LU. It implies a limited subset of transmission services supported, the absence of PU services in the node and additional support required of the BNN to allow valid terminal node interaction with the remainder of the network.
Example of terminal node is the 3767.


host
lu
pu
lu
sscp
SUBAREA1
terminal
communication controller
lu
pu
device
pu
lu
lu
device
device
cluster controller
SUBAREA2
communication controller
pu
cluster controller
terminal
pu
lu
lu
lu
device
device
device
SUBAREA3

TRANSMISSION SUBSYSTEM DATA FLOW



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SNA conveys information concerning the network via three basic mechanisms:

1) Request - Response unit (RU)
2) Request - Response Header (RH)
3) Transmission Header (TH)

RU - Normally contains user data but may contain control information to assist in the routing of the particular types of messages through the network

RH - Contains control information to assist in the routing of RU's (see RH format)

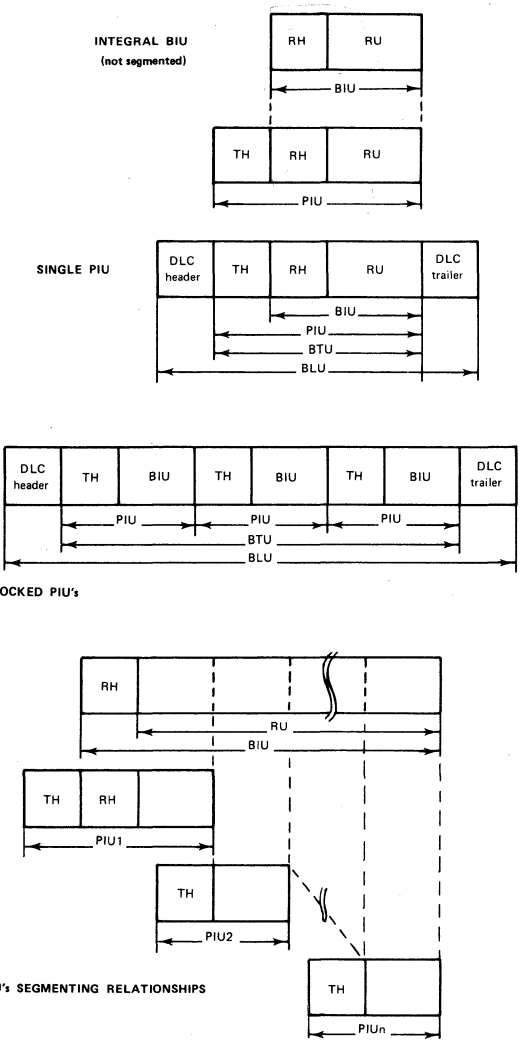
TH - Contains control information required by path control for manipulating BIU (see TH format)

BIU - It is the fundamental unit handled by path control (BIU = Basic Information Unit). A BIU consists of RH + RU.

PIU - Path control affixes a TH to each BIU or BIU segment to form a PIU (Path Information Unit).

BTU - It is the fundamental unit passed between path control and data link control (BTU = Basic Transmission Unit). A BTU consists of one or more PIU's depending on blocking or not.

BLU - The Basic unit of transmission at the data link level is the BLU (Basic Link Unit). For example, in SDLC the BLU is one frame.
BLU = frame = F, A, C, (BTU), FCS, F (see SDLC chapter).


INTEGRAL BIU
(not segmented)
RH
RU
BIU
TH
RH
RU
PIU
SINGLE PIU
DLC header
TH
RH
RU
DLC trailer
BIU
PIU
BTU
BLU
DLC header
TH
BIU
TH
BIU
TH
BIU
DLC trailer
PIU
PIU
PIU
BTU
BLU
BLOCKED PIU's
RH
RU
BIU
TH
RH
PIU1
TH
PIU2
TH
PIUn
PIU's SEGMENTING RELATIONSHIPS

A transmission header is attached to each BIU or BIU segment that is handled by the path control. The TH is composed of a byte which contains the format identification field (FID), the mapping field (MPF) and the expedited flow indicator (EFI), followed by a series of fields defining other attributes of the associated BIU or BIU segment.

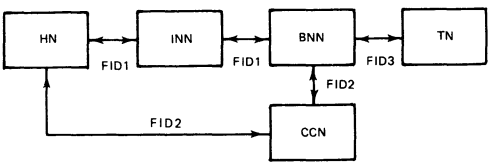
The format of the TH is depending on the type of FID.

TH FORMAT WITH FID1 - Used between a host node and communication controller node or between communication controller nodes (INN or BNN)

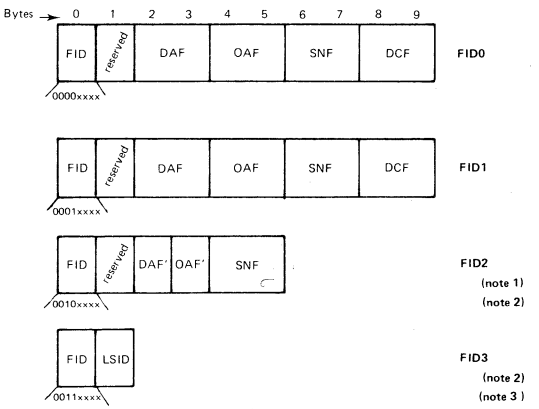
TH WITH FID2 - Used between communication controller nodes and their adjacent cluster controller nodes.

TH FORMAT WITH FID3 - Used between terminal nodes and their adjacent nodes providing the boundary functions.

TH FORMAT WITH FID0 - Used between a host node and communication controller nodes in handling Pre-SNA devices.



TH FORMAT



Note 1 - The physical unit services of a cluster control node (CCN) is always assigned to the local address value of 0.

Note 2 - Blocking of PIU's cannot be done since TH does not have a DCF.

Note 3 - Segmenting not allowed since SNF is omitted.

Note 4 - DAF and OAF are replaced by a single byte, the LSID

Bits 0-1 = 00 SSCP to PU
01 SSCP to LU
11 LU to LU
10 INVALID

Bits 2-7 = Select one of 64 possible LU's in the NAU (must be 0 for SSCP to PU)

Note 5 - The SNF has the same value in each segment of the associated BIU.

BYTE 0

XXXX	Format identification field
.... XX..	Mapping field 00 = Middle segment 01 = Last segment 10 = First segment 11 = Only segment
.... ..X.	Reserved
....X	Expedited flow 0 = Normal flow 1 = Expedited flow

BYTE 1 (FID 3 ONLY)

X...	1 = To/From application 0 = To/From SSCP
.X..	1 = To/From Logical Unit 0 = To/From Physical Unit
..XX XXXX	Local address of station

BYTES 2-3 : DAF (Destination Address Field) Address of the destination NAU

BYTES 4-5 : OAF (Origin Address Field) Address of the originating NAU

BYTES 6-7 : SNF (Sequence Number Field) Provide numerical identity for the associated BIU

BYTES 8-9 : DCF (Data Count Field) Binary count of bytes in the BIU or BIU segment associated with the header. The count does not include TH, only RH + RU

The RH is three bytes long and is attached to each RU

RH BYTES EXPANSION

BYTE 0

X...	0 = Request 1 = Response
.XX.	Type of network command in process 00 = FM Data (FMD) 01 = Network Control (NC) 10 = Data Flow Control (DFC) 11 = Session Control (SC)
...X	Reserved
.... X...	1 = FM Header present or field-formatted 0 = No FM Header or character-coded
.... .X..	1 = Sense data included (see page 4-1) 0 = No sense data
.... ..XX	Chaining control : 00 = Middle element 01 = Last element 10 = First element 11 = Only element

For FM Header format see FM Header chapter

BYTE 1

X...	Definite Response 1 (DR1)
.X.. XXX.	Reserved
..X.	Definite Response 2 (DR2)
...X	Exception Response (ERI)
....X	Pacing

For the form of response see next page

BYTE 2

X...	Begin bracket
.X..	End bracket
..X.	Change direction
...X .XXX	Reserved
.... X...	Code selection indicator

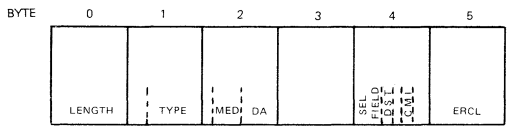
FORM OF RESPONSE REQUESTED

DR1	DR2	ERI	FORM OF RESPONSE REQUESTED
0	0	0	no response
1 0 1	0 1 1	0 0 0	definite response
1 0 1	0 1 1	1 1 1	exception response
0	0	1	reserved

FORM OF RESPONSE SENT

DR1	DR2	ERI	FORM OF RESPONSE SENT
copied from request		0	positive response
		1	negative response

When the RH format indicator = 1, the first six bytes of the RU are interpreted as an FM Header with the following format :



Byte 0

xxxx xxxx	Length = X'06'

Byte 1

xx..	Reserved
..xx xxxx	Type = 000001

Byte 2

x...	Reserved
.xxx	Medium (MED) (output class) 000 = console 001 = exchange (e.g, customer-removable diskette) 002 = card punch 003 = printer
.... xxxx	Device address (DA)

MED and DA fields identify the desired LU component.

Byte 3

xxxx xxxx	Reserved

Byte 4

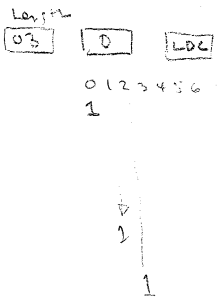
xxx.	Selection Field 000 Resume suspended LU component selection 001 END (normal) of LU component selection 010 Begin LU component selection 011 Begin then end LU component selection 100 Suspend LU component selection 101 END (abortive) LU component selection 110 Reserved 111 Reserved
...x	Data Stream Type (DST) (used in conjunction with ERCL field) 0 = Basic-exchange format not used ;ERCL field is reserved 1 = Basic exchange format follows FM Header ERCL field defines the record length (see details in IBM diskette general information GA21-9132)
.... x.xx	Reserved
.... .x..	Compression indicator (CMI) 1 = Presence of string control bytes (SCB's) 0 = Absence of string control bytes (SCB's are used to compress data)

Byte 5

xxxx xxxx	Exchange Record Length (ERCL)

Used when DST = 1 to indicate the record length used in the basic exchange format. When DST = 0, this field is reserved.

Note :For 3790 machines specific FMH's are used (FMH1 and FMH2). Refer to 3790 communication system host system programmer's guide F/N GC22-9033.



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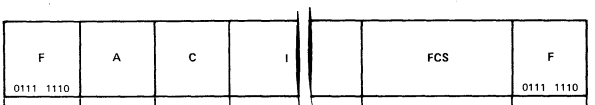
FRAME FORMAT



3

F = FLAG (1 byte = 01111110 = X'7E')

A = ADDRESS (of secondary station) (1 byte)

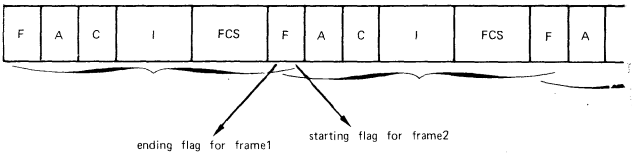
C = CONTROL FIELD (1 byte)

I = INFORMATION FIELD (variable length - present or not depending on C field)

FCS = FRAME CHECK SEQUENCE FIELD (2 bytes)
Fields A - C - I (if present) are included.
Inserted zeros are not included.

The transmitting station complements the FCS before transmission and the receiving station combines the received FCS with its own FCS. The result must be F0B8 in the CRC register.

The frames may be contiguous as follows :



FRAME TYPE

Three types of frames

- Information frame — I
- Supervisory frame — S
- Non-sequenced frame — N/S

C FIELD

	0	1	2	3	4	5	6	7
I		Nr		P/F		Ns		0
S		Nr		P/F	S	S	0	1
NS	M	M	M	P/F	M	M	1	1

I   for data transfer

S   for flow control

N/S   for link control

S   Supervisory function bits

M   Modifier function bits

P/F   Poll bit for primary station
       Final bit for secondary station

---

cmdr
byte 2: Z Y X W

- W — buffer
- X — cmd.
- Y — I field not allowed.
- Z — RX NR ≠ TX NS

byte 1: NR 0 NS

byte 0: Received control field.

Format (*)	Binary configuration 0 1 2 3 4 5 6 7	Acronym	Command	Response	I Frame prohibited	Reset Nr/Ns	Definition
NS	0 0 0 P/F 0 0 1 1	NSI	X	X			Non sequenced information
	0 1 0 P 0 0 1 1	DISC	X		X		Disconnect
	1 0 0 P 0 0 1 1	SNRM	X		X	X	Set normal response mode
	0 0 1 P/F 0 0 1 1	NSP **	X	X			Non sequence poll
	1 1 1 P/F 0 0 1 1	TEST	X	X			Test
	0 0 0 P 0 1 1 1	SIM	X		X	X	Set initialization mode
	0 0 0 F 0 1 1 1	RQI		X	X		Request initialization
	0 1 1 F 0 0 1 1	NSA		X	X		Non sequenced acknowledge
	1 0 0 F 0 1 1 1	CMDR		X			Command reject
	0 0 0 F 1 1 1 1	ROL		X	X		Request on line
	1 0 1 P/F 1 1 1 1	XID	X	X			Exchange station identification
S	-Nr- P/F 0 0 0 1	RR	X	X	X		Receive ready
	-Nr- P/F 0 1 0 1	RNR	X	X	X		Receive not ready
	-Nr- P/F 1 0 0 1	REJ	X	X	X		Reject
			X	X	X		
I	-Nr- P/F -Ns- 0	I	X	X			Information

* - NS = Non sequenced
- S = supervisory
- I = information

** also referenced as ORP (Optional Response Poll)

* NSI (Nonsequenced Information) : As a command, an NSI frame is the vehicle for nonsequenced information. An NSI frame is also a vehicle for nonsequenced information sent to the primary station. NSI is not acknowledged.

* SNRM (Set Normal Response Mode) : This command subordinates the receiving secondary station to the transmitting primary station. No unsolicited transmissions are allowed from a secondary station that is in normal response mode. NSA is the expected response. The primary and secondary station Nr and Ns counts are reset to 0. The secondary station remains in normal response mode until it receives a DISC or SIM command.

* DISC (Disconnect) : This command terminates other modes and places the receiving secondary station effectively offline. The expected response is NSA. (A switched data link station then disconnects, or goes 'on hook'). A disconnected secondary under station cannot receive or transmit information frames ; it remains disconnected until it receives an SNRM or SIM command.

* NSA (Nonsequenced Acknowledgement) : This is the affirmative response to an SNRM, DISC or SIM command. Further transmissions are at the option of the primary station.

* RQI (Request for Initialization) : An RQI frame is transmitted by a secondary station, to notify the primary station of the need for an SIM command. Any command other than SIM causes repetition of RQI by the secondary station.

* SIM (Set Initialization Mode) : This command initiates system specified procedures at the receiving secondary station, for the purpose of initializing link-level functions. NSA is the expected response. The primary and secondary station Nr and Ns counts are reset to 0.

* ROL (Request Online) : This response is transmitted by a secondary station, to indicate that it is disconnected. A secondary station in NDM transmits this response if the received command is not implemented or not valid.

* CMDR (Command Reject) : This response is transmitted by a secondary station in NRM, when it receives a non-valid command. A received command may be non-valid for several reasons :

  1. It is not implemented at the receiving station. This category includes unassigned commands.
  2. The I field is too long to fit into the receiving station buffers. This use is optional.
  3. The command received does not allow the I field that was also received.
  4. The Nr that was received from the primary station is incongruous with the Ns that was sent to it.

  The secondary station cannot release itself from the CMDR condition, nor does it act upon the command that caused the condition. It repeats CMDR whenever it responds, except to an acceptable mode-setting command : SNRM, DISC, or SIM.

The secondary station sends an I field containing status information as part of the CMDR response frame (see figure). This I field provides the secondary station status data that the primary station needs to select appropriate recovery action.

* TEST (Test) : As a command, a TEST frame may be sent to a secondary station in any mode to solicit a TEST response. If an I field is included in the command, it is returned in the response (unless the I field cannot be stored in the secondary station buffer).

* XID (Exchange Station Identification) : As a command, this C field solicits the identification of the receiving secondary station. An I field may be included in the frame to convey the system identification of the transmitting primary station. (A common secondary station address may be used in the A field of the command frame : An XID response is required from the secondary station. An I field in the response is a system option : It is the vehicle for the system identification of the responding secondary station.

  XID is not restricted to a switched data link.

* NSP (Nonsequenced Poll) : This command, with no P-bit, invites transmission from the addressed secondary station(s) ; with the P-bit, it demands transmission from the addressed secondary stations(s). An I field is not permitted. The response to an NSP command requires an F-bit only if the command had the P-bit on.

  NSP is not restricted to a loop data link.

* RR (Receive Ready) : Sent by either a primary or a secondary station, RR confirms sequenced frames through Nr-1 and indicates that the originating station is ready to receive.

* RNR (Receive Not Ready) : Sent by either a primary or a secondary station, RNR indicates a temporarily busy condition in which no frames that require buffer space can be accepted.

  As a command or response, RNR confirms sequenced frames through Nr-1 and indicates that frame Nr is expected next.

* REJ (Reject) : This command/response may be transmitted to request transmission or retransmission of sequenced information. REJ confirms frames through

  Nr-1 and requests Nr and following frames.

  An REJ command may be interspersed in the sequence of transmitted frames ; an REJ response may also be interspersed. The REJ condition clears when the Nr and succeeding frames have been correctly received.

  If a final frame (with the F-bit on) is not accepted by a primary station, or if a poll frame (with the P-bit on) is not accepted by a secondary station, the primary station times out, waiting for a response to its P-bit, and polls the secondary station again.

Checking for missing or duplicated frames.

- sending count = Ns
- Receiving count = Nr
- Counting capacity = 8 (3 bits) with wrap-around (7 is sequentially followed by 0)
- Up to 7 frames may be sent before Nr count will be transmitted

Ns	Nr		Ns	Nr	
0	0		0	0	
		I,Nr=0,Ns=0,P=0 →			
1	0		0	1	
		I,Nr=0,Ns=1,P=0 → Error			no change
2	0		0	1	
		I,Nr=0,Ns=2,P=1 →			
3	0		0	1	
		← I,Nr=1,Ns=1,F=1			
3	1		1	1	
		I,Nr=1,Ns=1,P=0 →			
2	1		1	2	
		I,Nr=1,Ns=2,P=0 →			
3	1		1	3	
		I,Nr=1,Ns=3,P=1 →			
4	1		1	4	
		← I,Nr=4,Ns=2,F=1			
4	2		2	4	
		I,Nr=2,Ns=4,P=0 →			
5	2		2	5	

ZERO INSERTION

- Any bit pattern can be sent
- Only the flag may have more than 5 contiguous ones (And Abort pattern)
- The line can never be all ones

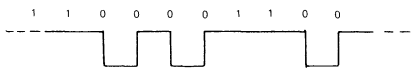

```
01111110  11111111  11000000  11111000   Bit stream station trans.

01111110  111110111110000000  111110000  Bit stream on the line.
inserted zeroes      ↑     ↑        ↑
01111110  11111111  11000000  11111000   Bit stream station receiv.
```

NRZI

(non return to zero inverted)

- Change the level of the send data for each zero
- Maintain the existing level for each one



- NRZI is used for non-synchronous type modems , no scrambler modems, pattern sensitive modems, to prevent the occurance of extended periods of transitionless data due to contiguous zero bit sequence.

- The following modems are synchronous and do not need NRZI :
  3874 - 3875 - 3978 (all models) - 5979.

- Other modems use NRZI.

- For World Trade, WT Signal Converter Handbook ZZ19-6066 provides information related to the coding to be used with mandatory modems of every country (facility notes).

ACTIVE STATE

Condition when a station is transmitting or receiving data link control or data signals.

IDLE STATE

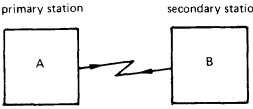
Condition when the link is operational but no transmission is in progress, and after a station is receiving a succession of 15 or more consecutive binary 1s.

HDX	- No signal
FDX/PP	- All ones
FDX/MP PRI	- All ones
FDX/MP SEC	- No signal
Loop primary	- All ones

Do not confuse with IDLE STATION, where a serie of contiguous flags may be transmitted by a primary station or by a duplex secondary station to maintain bit synchronism and to maintain data link in an ACTIVE STATE.

TRANSIENT STATE

Condition when the carrier is turned on in order to transmit. This is the delay between request-to-send on and clear-to-send on (turnaround).



3

negative response to poll

B,SNRM-P ⟶		A sets B's response mode. Nr and Ns counts are reset to 0.
	⟵ B,NSA-F	B acknowledges.
B,RR-P(0) ⟶		A polls B for transmission
	⟵ B,RR-F(0)	B has nothing to transmit. (B remains in NRM).

affirmative response to poll
secondary station sends sequenced frames

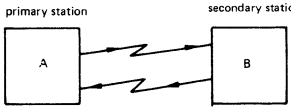
B,RR-P(0) ⟶		A polls B for transmission.
	⟵ B,I(0)F(0)	B sends final I-frame
B,RR-P(1) ⟶		A confirms frame 0 and polls B for transmission
	⟵ B,I(1)$\overline{F}$(0)	B sends sequenced I-frames.
	⟵ B,I(2)$\overline{F}$(0)	
	⟵ B,I(3)F(0)	B sends final I-frame, RR is implied
B,I(0)$\overline{F}$(4) ⟶		A confirms frames 1-3 and starts sending sequence I-frames.
B,I(1)$\overline{F}$(4) ⟶		
B,I(2)P(4)		A sends poll I-frame, B must respond.
	⟵ B,RR-F(3)	B confirms frame 0-2.

online and offline status changes

B,DISC-P ⟶		A sets B offline.
	⟵ B,NSA-F	B acknowledges (B assumes NDM).
B,RR-P(0) ⟶		A polls B
	⟵ B,ROL-F	B requests online status.
B,SNRM-P ⟶		A sets B online. Nr and Ns counts are reset to 0.
	⟵ B,NSA-F	B acknowledges. (B remains in NRM).

primary and secondary station exchange sequenced frames

B,I(0)$\overline{P}$(0)→		A sends frame 0.
B,I(1)P(0)→		A sends poll I-frame, B must respond.
	←B,I(0)F(2)	B confirms frames 0-1 and sends frame 0.
B,RR-P(1)→		A confirms frame 0 and polls B for transmission.
	←B,I(1)$\overline{F}$(2)	B sends sequenced I-frames.
(CRC error)←	B,I(2)$\overline{F}$(2)	A discards frame 2 because of a CRC error.
	←B,I(3)$\overline{F}$(2)	
	←B,I(4)F(2)	B sends final I-frame.
B,RR-P(2)→		A confirms frame 1 and requests frame 2.
	←B,I(2)$\overline{F}$(2)	B sends frames 2-4 again.
	←B,I(3)$\overline{F}$(2)	
	←B,I(4)F(2)	B sends final I-frame
B,RR-$\overline{P}$(5)→		A confirms frames 2-4 (B remains in NRM).



B,RR-P(0) →		A polls B.
	← B,RQI-F	B requests initialization
B,SIM-P →		A sets B to initialization mode.
	← B,NSA-F	B acknowledges.
		B is brought online through system procedures when initialization is complete.
B,SNRM-P →		A sets B's response mode. Nr and Ns counts are reset to 0.
	← B,NSA-F	B acknowledges.
B,RR-P(0) →		A polls B for transmission.
B,I(0)P(0) ⇄	B,I(0)F(0)	Duplex exchange of sequenced I-frames (B uses longer frames than A).
B,I(1)P(0) →		A sends frame 1.
B,I(2)P(0) ⇄	B,I(1)F(2)	A sends frame 2. B confirms frames 0-1 and sends frame 1.
B,I(3)P(1) →		A confirms frame 0 and send frame 3.
	← B,I(2)F(4)	B confirms frames 2-3 and sends frame 2.
B,RR-P(3) →		A confirms frames 1-2
	← B,RR-F(4)	B relinquishes transmission. (B remains in NRM).

secondary station comes online, primary and secondary exchange sequenced frames

B,I(4)P(3) →		A sends sequenced I-frames.
B,I(5)P(3) →		
B,I(6)P(3) →		
B,I(7)P(3) →		
B,I(0)P(3) →		A polls B for confirmation.
	← B,RNR-F(0)	B becomes busy, but confirms frames 4-7.
B,RR-P(3) →		A asks if B is still busy.

busy secondary station

←— B,RR-F(0)	B can receive again and expects frame 0.
B,I(0)P(3) —→	A sends frame 0 again.
B,I(1)P(3) —→	A continues with frame 1.
B,I(2)P(3) —→	A sends poll I-frame.
←— B,RR-F(3)	B confirms frames 0-2. (B remains in NRM).

busy primary station

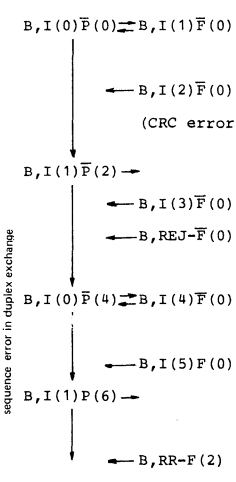
B,SNRM-P —→	A sets B's response mode to reset The Nr and Ns counts to 0.
←— B,SNA-F	B acknowledges.
B,RR-P(0) —→	A polls B.
←— B,I(0)F(0)	B sends sequenced I-frames.
←— B,I(1)F(0)	
←— B,I(2)F(0)	
B,RNR-P(3) ←— B,I(3)F(0)	A becomes busy, but confirms frames 0-2.
←— B,RR-F(0)	B stops sending.
B,RR-P(3) —→	A polls B for frame 3.
←— B,I(3)F(0)	B retransmits frame 3.
(CRC error) ←— B,I(4)F(0)	B sends frame 4.
B,RR-P(4) —→	A polls B, confirms frame 3, and requests frame 4.
←— B,I(4)F(0)	B sends frame 4 again.
B,RR-P(5) —→	A confirms frame 4. (B remains in NRM).

invalid command

B,XXX-P —→	A sends frame with an undefined C field.
←— B,CMDR-F	B rejects the command.
	Higher level at A processes the status reported by B in the CMDR response.
B,SNRM-P —→	A resets B's error condition. Nr and Ns counts are reset to 0.
←— B,NSA-F	B acknowledges. (B remains in NRM).

B,RR-P(0) —→	A polls B for transmission.
←— B,I(0)F(0)	B sends sequenced I-frames.

sequence error in duplex exchange



Duplex exchange of sequenced I-frames. (A uses longer frames than B).

B receives frame 0 with a CRC error,

A's frame 1 is out of sequence.
B expects frame 0.

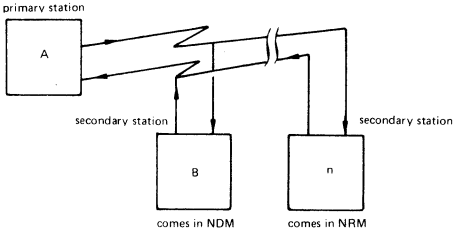
B continues sending.
A sends frame 0 again and confirms frame 0-3.

B sends final I-frame.

A retransmits frame 1, confirms frames 0-5, and polls B for confirmation.

B confirms.
(B remains in NRM).

MULTIPOINT DUPLEX EXCHANGES



secondary stations come online:

B,RR-P ⟶	A polls B for status.
⟵ B,RQI-F	B asks for initialization mode.
B,SIM-P ⟶	A sets B to initialization mode.
⟵ B,NSA-F	B acknowledges.
	B is brought online through system procedures when initialization is complete.
B,SNRM-P	A sets B online. Nr and Ns counts are reset.

primary station sends to one and receives from the other

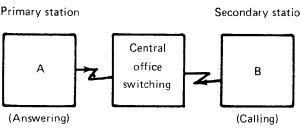
← B,NSA-F		B acknowledges.
n,RR-P(0) →		A polls n for transmission.
B,I(0)-P̄(0)→	← n,I(0)F̄(0)	n sends sequenced frames to A while A sends to B.
B,I(1)P̄(0)→	← n,I(1)F̄(0)	
	← n,I(2)F̄(0)	
	← n,I(3)F(0)	n completes its sequence.
B,RR-P(0) →		A polls B for confirmation.
← B,RR-F(2)		B confirms frames 0-1.
n,RR-P̄(4) →		A confirms frames 0-3. (B and n remain in NRM).

interleaved primary station transmission

n,I(0)P̄(4)→		A sends sequenced frames to n.
B,I(2)P̄(0)→		A sends sequenced frames to B.
n,I(1)P(4)→		A concludes sending to n and requests confirmation.
B,I(3)P̄(0)→	← n,RR-F(2)*	A continues sending to B and n confirms frames 0-1.
B,I(4)P(0)→		A concludes sending to B and requests confirmation.
← B,RR-F(5)*		B confirms (B and n remain in NRM).

* If a secondary station has information to send this confirmation may be in the I format

POINT-TO-POINT SWITCHED EXCHANGES (HALF DUPLEX)



'Handshaking' and mode-setting

Common Address, XID-P	⟶	A requests B's ID.
	⟵ B,XID-F	B identifies itself to A.
B,RR=P(0)	⟶	A alerts B for status change.
	⟵ B,ROL-F	B requests online status.
B.SNRM-P	⟶	A sets B's response mode. Nr and Ns counts are reset.
	⟵ B,NSA-F	B acknowledges (B remains in NRM).

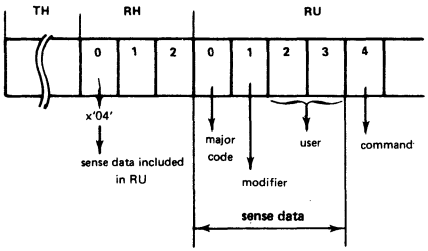
Inquiry-response exchange

B,RR-P(0)	⟶	Primary always initiates switched communication. A polls B for transmission.
	⟵ B,I(0)$\overline{F}$(0)	B sends sequenced frames
	⟵ B,I(1)$\overline{F}$(0)	
	⟵ B,I(2)$\overline{F}$(0)	
	⟵ B,I(3)F(0)	B concludes its sequence
B,RR-$\overline{P}$(4)	⟶	A confirms B's frames 0-3.
		(inactivity timeout at A)
B,RR-P(4)	⟶ (CRC error)	A polls B for response. B discards the frame because of CRC error.
		(idle receive timeout at A)
B,RR-P(4)	⟶	A polls B again
	⟵ B,RR=F(0)	B responds.
B,I(0)$\overline{P}$(4)	⟶	A sends sequenced frames
B,I(1)P(4)	⟶	A concludes its sequence
	⟵ B,RR-F(2)	B confirms frames 0-1
B,DISC-P	⟶	A commands disconnect.
	⟵ B,NSA-F	B acknowledges
		A and B disconnect.

SECTION 4: SENSE DATA

Sense data format. 4.1
Sense data codes 4.3

SNA provides for four bytes of sense data to be returned on all negative responses or exception responses. The sense data defines the specific condition preventing successful processing of the request. Sense data always comprises the first four bytes in the RU when the Sense data Included is set in the RH. The format of the sense data field is described below.



MAJOR CODE

It is the first byte of the sense data. It reflects the nature of the exception.

Byte 0	Category
X'80'	Path Error
X'40'	RH usage error
X'20'	State Error
X'10'	Request Error
X'08'	Request Reject
X'00'	User Sense Data Only

Path Error

The request could not be delivered to the intended receiver due to physical path outage, Transmission Header error or violation of the rules for session establishment protocols.

RH Error

The setting of field values in the RH violates session rules. These errors are independent of current session or data flow states.

State Error

A sequence number, RH Field value or RU was received when not allowed in the current state of the receiver.

Request Error

The request was delivered to the intended NAU, but could not be interpreted or processed due to a mismatch in FM capabilities.

Request Reject

The request was delivered to the intended NAU and was interpreted and supported, but was not executed.

MODIFIER

It is the second byte of the sense data. It defines the specific exception condition within the major category.

USER SENSE DATA

They are the third and fourth bytes of sense data and may carry user-defined sense information.

Path Error (Major Code = 80)

indicates that the request could not be delivered to the intended receiver due to path outage or Transmission Header Error. The SSCP may initiate Path recovery action after notification of a path outage by means of the NS command INOPERATIVE. Sessions may be suspended or unbound.

Modifier

01 Intermediate Node Failure : Machine or Program Check in an intermediate node ; request discarded. A response may or may not be possible.

02 Link Failure : Data link failure.

03 LU Inoperative : The LU is unable to process requests.

04 Unrecognized DAF : An intermediate or boundary node has no routing information for the DAF, or an end mode has no LU with indicated DAF (FID2 or FID3) or DAF (FID1).

05 No Session : (Note 2) No session is bound in the receiver for the indicated OAF, or no active CP manager. Exists for the OAF-DAF pair in a communication controller node providing a Boundary Function. This exception does not apply to BIND, ACTPU or ACTLU (Note 2).

06 FID : Invalid FID for the receiving node (Note 1)

07 Segmenting error : Mapping field error, such as first, last, middle, or segmenting not supported and MPF ≠ 11 (Note 3)

08 PU Not Active : The physical unit in the receiving node has not been activated and request is not ACTPU for this PU (Note 2)

09 LU Not Active : The LU indicated by the DAF has not been activated and the request is not ACTLU. (Note 2)

0A Reserved

0B Incomplete TH : Transmission received shorter than TH. (Note 1)

0C DCF : Data Count Field inconsistent with transmission length.

0D Lost Contact : Contact with the link station for which the transmission was intended has been lost, but the link has not failed. If the difference between link failure and loss of contact is not

detectable, link failure (8002) is sent.

Note 1 : It will generally not be possible to send a response for these exception conditions, since information (FIP, Addresses) required to generate a response is not available. They are logged as errors along with the error codes if this capability exists in the receiver. Depending upon the node in which the errors are detected, the SSCP may be notified via Record Maintenance Statistics.

Note 2 : These errors are listed as path errors since the request could not be delivered to the intended CP Manager. They are actually detected by the Common Session Control function interpreter in the PU. This is because Path Control delivers any request for which no session exists to the Common Session Control component on the assumption that is BIND, ACTLU or ACTPU.

Note 3 : If segmenting is not supported, a negative response will be returned for the first segment only, since this contains the RH. Subsequent segments are discarded.

RH Error (Major code = 40)

Indicate that the value of a field or combination of fields in the RH violates architectural rules or BIND options previously selected. These errors are independent of the current states of the session or data flows. They result from the failure of the sender to enforce session rules. It is not required that the receiver check for these conditions.

Modifier

01 Invalid SC or NC RH : The RH of a SC or NC request was invalid.

02 Reserved

03 BB not allowed : The BB bit was set on MOC or LOC.

04 EB not allowed : The EB bit was set on MOC or LOC, or by the Primary when only the Secondary may send EB.

05 Incomplete RH : Transmission shorter than full TH-RH.

06 Exception Not Allowed : Exception response was requested when not permitted.

07 Definite Response Not Allowed : A definite response was requested when not permitted.

08 Pacing Not Supported : The Pacing bit was set on a request, but the receiving CPM does not support pacing for this session.

09 CD Not allowed : The CD bit was set on FOC or MOC.

0A No Response Not Allowed : No response was specified on a request when not permitted.

0B Chaining Not Supported : Chaining bits indicate other than 'only in chain' but multi-request chains are not supported on the session.

0C Brackets Not Supported : A Bracket bit was set, but brackets are not used on the session.

0D CD Not Supported : Change Direction bit was set, but is not supported.

0E Sense Data Included not allowed : The sense data included bit was set on a request (EXR) when not allowed by session rules.

0F Format Indicator Not allowed : The format indicator was set when not supported on the session, or when BC was not set.

10 Alternate Code not supported : The Code Indicator was set when not supported on the session.

State Error (Major code = 20)

Indicates a sequence number error, or an RH field or RU which is not allowed in the current session control or data flow control state of the receiver.

Modifier

01 Sequence Number : Sequence number received on normal flow request was not one greater than the last.

02 Chaining Chaining field error such as first, middle, first.

03 Bracket : Error resulting from failure of sender to enforce Bracket rules for session. Does not include contention errors or race errors.

04 Direction : FM Data request received while in the HDX-ff transmit state.

05 Data Traffic Reset : An FM Data or DFC request received in a session which is bound but which is in the Data Traffic Reset State.

06 Data Traffic Quiesced : FM Data or DFC request received from an LU which has previously sent Quiesce Complete or Shutdown Complete and has not responded to Release Quiesce.

07 Data Traffic Not Reset : A Session Control request allowed only in the Data Traffic Reset state (e.g., STSN) was received while Data Traffic was not reset.

Request Error (Major Code = 10)

Indicates that the RU was delivered to the intended NAU, but could not be interpreted or processed. This condition represents a mismatch in FM capabilities.

Modifier

01 RU Data Error : User Date in the RU is not acceptable to the receiving FM, such as a character code not in the set supported, or a formatted data field which is not acceptable to Presentation Services.

02 RU Length Error : RU too long or too short .

03 Function Not Supported : The function requested is not supported. The function may have been specified by a formatted request code, a field in an RU, or a control character.

04 Reserved

05 Parameter Error : A parameter modifying, a control function is invalid or outside of the range allowed by the receiver.

06 Reserved

07 Category Not Supported : DFC, SC or NC request received by a NAU not supporting any request in the Category, or Network Services request with byte 0 ≠ 01, or byte 1 ≠ valid NS Category supported by the receiver.

08 Invalid FM Header : The FM Header is not understood or translatable by the receiver, or FM header is expected but not present.

Request Reject : (Major code = 08)

Indicates that the request was delivered to the intended NAU and understood and supported, but was not executed.

Modifier

01 Resource Not Available : The requested resource (LU, PU, link) specified in an RU is not available.

02 Intervention Required : Forms or cards are required at an output device, device is temporarily in local mode, or other conditions requiring intervention.

03 Missing Password : The required password was not supplied.

04 Invalid Password : Password was not valid

05 Session Limit Exceeded : The requested session cannot be bound as one of the NAUs is at its session limit. Applies to INITIATE, BIND and CINIT commands.

06 Resource Unknown : The resource (LU, PU or Link) name or address in an RU is not recognized by the receiver.

07 Reserved

08 Reserved

09 Mode Inconsistency : The requested function cannot be performed in the present mode of the receiver.

0A Permission Rejected : The receiver has denied an implicit or explicit request of the sender.

0B Bracket Race Error : Recoverable apparent violation of Bracket Protocols. Arises when Bracket Initiation/termination is allowed by both NAUs in a session.

0C Procedure Not Supported : A named procedure (Test, Measurement, Trace,) specified in an RU is not supported by the receiver.

0D Reserved

0E LU Not Authorized : The requesting LU does not have access to the requested resource.

0F End-User Not Authorized : The requesting End User does not have access to the requested resource.

10 Missing Requestor ID : Required Requestor ID was missing.

11 Break : Asks the receiver of Break to terminate present chain with Cancel or EOC. Sender enters purging Chain State when break is sent.

12 Insufficient Resource : Receiver cannot act on

request because of a temporary lack of resources.

13 Bracket Bid Reject - No RTR : BID (or BB) is received while INB or while BETB and the FM denies permission. RTR will not be sent.

14 Bracket Bid reject - RTR : BID (or BB) is received while INB or while BETB and the FM denies permission. RTR will be sent.

15 Function Active : A request to activate a network element or procedure was received, but the element or procedure was already active.

16 Function Inactive : A request to terminate a procedure or deactivate a network element was received but the element or procedure was not active.

17 Link Inactive : A request requires the use of a link, but the link is inactive.

18 Link Procedure in Process : Contact, Discontact, IPL or other link procedure in progress when a conflicting request is received.

19 RTR Not Required : Receiver of Ready to receive has nothing to send.

1A Request Sequence Error : Invalid sequence of requests.

1B Receiver in Transmit Mode : Sent to notify the sender that a transmission cannot be accepted because receiver is in HDX contention transmit mode.

1C Request not executable : The requested function could not be executed due to a permanent error condition in the receiver.

1D Invalid Station/SSCP Id : The station or SSCP was found to be invalid by the receiver.

1E Session Reference Error : A request contains a reference to a session which is not bound or in process. Generally applies to Network Commands.

1F Reserved

20 Control Vector Error : Data is invalid for the Control Vector specified by the target network address and key. Applies to Set and Sense Control Vector.

21 Invalid Session Parameters : Session Parameters are invalid or not supported by the NAU(s) for which the session is requested.

22 Link Procedure Failure : A link-level procedure has failed due to link hardware failure, loss of contact with a link station or an invalid response to a link command (This is not a path error since the request being rejected was delivered to its destination).

23 Unknown Control Vector : The Control Vector specified by a Network Address and key is not known

to the receiver.

24 Component Aborted : The LU component which had been selected has been aborted due to an error condition or resource depletion.

25 Component Not Available : The LU component selected in an FM Header is not available.

26 FM Function Not Supported : A function requested in an FM data RU is not supported by the receiver.

27 Intermittent Error-Retry Requested : An error at the receiver caused an RU to be lost. The error is not permanent and retry of the RU (or chain) is requested.

28 Reply Not Allowed : A request requires a reply, but the outbound data flow is Quiesced or Shutdown, and there is no queueing capability at the LU.

29 Change Direction Required : A request requires a reply, but the data flow is in HDX-ff receive state ; CD was not set on the request and there is no queuing capability at the NAU.

SECTION 5: NETWORK COMMANDS

Network commands format. 5.1
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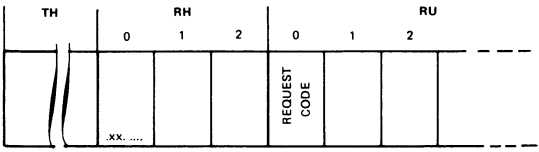
Network Commands Format



- RH Byte 0 Bits 1-2 indicate the type of network command in process:

  Bits 1-2 = 00 Function management data

  = 01 Network control

  = 10 Data flow control

  = 11 Session control

- RU Byte 0 indicates the request code except for function management data (request code in byte 2). (see Network Services Commands par.)

- See page 5-28 for response format

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REQUEST CODE	COMMAND	TYPE OF COMMAND
X'01'	NETWORK SERVICES	
X'04'	LUSTAT	DFC
X'05'	RTR	DFC
X'07'	ANSC	NC
X'0D'	ACTLU	SC
X'0E'	DACTLU	SC
X'11'	ACTPU	SC
X'12'	DACTPU	SC
X'31'	BIND	SC
X'32'	UNBIND	SC
X'80'	QEC	DFC
X'81'	QC	DFC
X'82'	RELQ	DFC
X'83'	CANCEL	DFC
X'84'	CHASE	DFC
X'A0'	SDT	SC
X'A1'	CLEAR	SC
X'A2'	STSN	SC
X'A3'	RQR	SC
X'C0'	SHUTD	DFC
X'C1'	SHUTC	DFC
X'C2'	RSHUTD	DFC
X'C8'	BID	DFC
X'C9'	SIG	DFC

NC NETWORK CONTROL
SC SESSION CONTROL
DFC DATA FLOW CONTROL

NETWORK CONTROL

REQUEST CODE	COMMAND	COMMAND NAME	SESSION	FLOW
X'07'	ANSC	AUTO NETWORK SHUTDOWN COMPLETE	PU → SSCP	E

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SESSION CONTROL

REQUEST CODE	COMMAND	COMMAND NAME	SESSION	FLOW
X'0D'	ACTLU	ACTIVATE LOGICAL UNIT	SSCP → LU	E
X'0E'	DACTLU	DEACTIVATE LOGICAL UNIT	SSCP → LU	E
X'11'	ACTPU	ACTIVATE PHYSICAL UNIT	SSCP → PU	E
X'12'	DACTPU	DEACTIVATE PHYSICAL UNIT	SSCP → PU	E
X'31'	BIND	BIND	PLU → SLU	E
X'32'	UNBIND	UNBIND	PLU → SLU	E
X'A0'	SDT	START DATA TRAFFIC	PLU → SLU	E
X'A1'	CLEAR	CLEAR	PLU → SLU	E
X'A2'	STSN	SET AND TEST SEQUENCE NUMBER	PLU → SLU	E
X'A3'	RQR	REQUEST RECOVERY	SLU → PLU	E

DATA FLOW CONTROL

REQUEST CODE	COMMAND	COMMAND NAME	SESSION	FLOW
X'04'	LUSTAT	LOGICAL UNIT STATUS	PLU→SLU SLU→PLU	N
X'05'	RTR	READY TO RECEIVE	PLU→SLU SLU→PLU	N
X'80'	QEC	QUIESCE AT END OF CHAIN	PLU→SLU SLU→PLU	E
X'81'	QC	QUIESCE COMPLETE	PLU→SLU SLU→PLU	N
X'82'	RELQ	RELEASE QUIESCE	PLU→SLU SLU→PLU	E
X'83'	CANCEL	CANCEL	PLU→SLU SLU→PLU	N
X'84'	CHASE	CHASE	PLU→SLU SLU→PLU	N
X'C0'	SHUTD	SHUTDOWN	PLU→SLU	E
X'C1'	SHUTC	SHUTDOWN COMPLETE	SLU→PLU	E
X'C2'	RSHUTD	REQUEST SHUTDOWN	SLU→PLU	E
X'C8'	BID	BID	PLU→SLU SLU→PLU	N
X'C9'	SIG	SIGNAL	PLU→SLU SLU→PLU	E

E is for expedited flow

N is for normal flow

AUTO NETWORK SHUTDOWN COMPLETE (ANSC) - PU→SSCP

RU format bytes

0 X'07' request code

1 reason code :

X'01' operator initiated

X'02' unrecoverable timeout

X'03' ACTPU (ERP) received while session active

X'04' DISC received while session active

X'05' SR/RM received while session active

X'06' unrevoverable link error

Sent by a PU to notify the SSCP that the network shutdown procedure signalled by AUTO NETWORK SHUTDOWN has been completed.

BID (BID) - LU→LU

RU format byte
0 X'C8' request code

Requests permission to begin a bracket BID is issued by the Bidder and is used only when using the Bracket protocol.

CANCEL (CANCEL) - LU→LU

RU format byte
0 X'83' request code

Sent by an FM to terminate a partially sent chain of FM data requests.

CHASE (CHASE) - LU→LU

RU format byte
0 X'84' request code

Sent by an FM to request the receiving FM to return all outstanding normal flow responses for requests previously received from the issuer of CHASE.

LOGICAL UNIT STATUS (LUSTAT) - LU→LU

RU format bytes
0 X'04' request code
1-2 status
3-4 user field

Used by one LU to send status information to its session partner.

Status - X'0000' = No op, no system-defined status present
X'0001' = component now available
X'081C' = component failure - permanent error
X'0802' = component failure - intervention required
X'400A' = 'no response mode' not allowed
X'0824' = function cancelled

User field - for X'0001', X'081C', X'0802' } contains component-ID
for X'400A' = contains sequence number of the requesting no response

QUIESCE COMPLETE (QC) - LU→LU

RU format byte
0 X'81' request code

Sent by either the Secondary or Primary FM after receiving a QEC to indicate to the other FM that it has placed itself in Quiesce state.

QUIESCE AT END OF CHAIN (QEC) - LU→LU

RU format byte
0 X'80' request code

Sent by an FM which may be either the Primary or Secondary FM to request the other FM to enter QUIESCE state at the end of the Data Chain it is currently sending.

RELEASE QUIESCE (RELQ) - LU→LU

RU format byte
0 X'82' request code

Sent by either Primary or Secondary FM to remove the other FM from Quiesce state.

REQUEST SHUTDOWN (RSHUTD) - SLU→PLU

RU format byte
0 X'C2' request code

Sent from secondary FM to Primary FM to indicate that the secondary FM is at an 'End of Job' condition and would like the session terminated.

READY TO RECEIVE (RTR) - LU→LU

RU format byte
0 X'05' request code

Indicates that the Bidder is now allowed to initiate a bracket.

SHUTDOWN COMPLETE (SHUTC) - SLU→PLU

RU format byte
0 X'C1' request code

Sent by the secondary FM to indicate that it has completed session processing and has placed itself in Quiesce state.

SHUTDOWN (SHUTD) - PLU→SLU

RU format byte
0 X'C0' request code

Sent from Primary FM to the secondary FM to request that the secondary FM enter the Quiesce state when the secondary 'End of session' processing has been completed.

SIGNAL (SIG) - LU→LU

RU format byte
0 X'C9' request code
1-4 signal code

Permits an expedited signal to be sent through the network, regardless of the status of the normal flows. It carries a four bytes signal code set by the sending FM.

(Signal code = X'00010000' = request-to-send)

ACTIVATE LOGICAL UNIT (ACTLU) - SSCP→LU

RU format bytes

0	X'0D' request code
1	type
2	Bits 0-3 FM profile
2	Bits 4-7 TS profile

Type session : X'01' = cold
X'02' = ERP

FM profile = see appendix C
TS profile = see appendix D

ACTLU (COLD) is requested when SSCP cannot recover the SSCP - LU session or has lost track of session and data flow state for the LU.

ACTLU (ERP) is requested to recover the session when the SSCP has retained enough information.

ACTIVATE PHYSICAL UNIT (ACTPU) - SSCP→PU

RU format bytes (request)

0	X'11' request code
1	type activation requested
2	Bits 0-3 FM profile
2	Bits 4-7 TS profile
3-8	SSCP ID

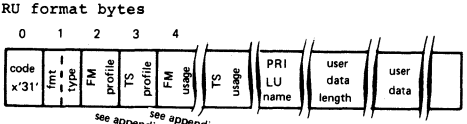
type activation X'01' = cold
X'02' = ERP
FM profile = see appendix C
TS profile = see appendix D
SSCP ID = six bytes field including the ID of the SSCP issuing the ACTPU

ACTPU (COLD) is specified on the initial session, and for reactivation where the SSCP has not retained enough information to recover the session.

ACTPU (ERP) is requested when the SSCP has enough information to recover the session.

BIND SESSION (BIND) - PLU→SLU (expedited)

RU format bytes



Is sent from the PLU to the SLU to establish a session between the LUs.

The BIND format which has been defined is Format 0

Location	Field	Values
Byte 0	BIND RU Code	X'31'
Byte 1, bits 0-3	Format	X'0'
Byte 1, Bits 4-7	Type	X'1' = Cold, Other values reserved
Byte 2	FM Profile	(See Appendix C)
Byte 3	TS Profile	(See Appendix D)

FM Usage

Primary LU Protocols for FM Data

Byte 4, bit 0	Chaining Use	1 = Multiple RU chains are allowed from the Primary LU 0 = Only single RU chains are allowed from the Primary LU
Byte 4, bit 1	Request mode Selection	0 = Immediate Request mode 1 = Delayed Request Mode
Byte 4, bit 2-3	Chain Responses Protocol used by Primary LU	Chains from Primary will ask for : '00' - no response '01' - Exception Response '10' - Definite Response '11' - Definite Response Exception Response
Byte 4, bit 4	Reserved	
Byte 4, bit 5	Reserved	
Byte 4, bit 6	Compression Indicator	1 = Compression may be used 0 = Compression will not be used on requests from primary
Byte 4, bit 7	Send EB Indicator	1 = Primary may send EB 0 = Primary will not send EB

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Secondary LU Protocols for FM Data

Byte 5, bit 0	Chaining Use	1 = Multiple RU chains are allowed from the Secondary LU 0 = Only single RU chains are allowed from the Secondary LU
Byte 5, bit 1	Request Mode Selection	0 = Immediate Request mode 1 = Delayed Request mode
Byte 5, bit 2-3	Chain Response used by the Secondary LU	(See encoding in Primary LU Protocol field)
Byte 5, bit 4	Reserved	
Byte 5, bit 5	Reserved	
Byte 5, bit 6	Compression Indicator	1 = Compression may be used 0 = compression must not be used on requests from Secondary
Byte 5, bit 7	Send EB Indicator	1 = Secondary may send EB 0 = Secondary will not send EB

Common LU Protocols

Byte 6, bit 0	Reserved	
Byte 6, bit 1	FM Header Usage	0 = FM Headers not allowed 1 = FM Headers allowed
Byte 6, bit 2	Brackets	1 = Brackets will be used during this session, 0 = Brackets will not be used
Byte 6, bit 3	Bracket Termination Rules	0 = Bracket Termination rule # 2 will be used during the session

		1 = Bracket Termination rule # 1 will be used during the session
Byte 6, bit 4	Alternate Code Set Allowed Indicator	1 = Alternate Code set may be used 0 = Alternate Code set will not be used
Byte 6, bit 5-7	Reserved	
Byte 7, bit 0-1	FM Transaction Mode	00 = Full duplex 01 = HDX Contention 10 = HDX Flip Flop 11 = Master Slave
Byte 7, bit 2	Recovery Responsibility	0 = Primary LU responsible 1 = Sender of RU Responsible
Byte 7, bit 3	Bckts First Spkr	0 = Secondary is 1st Spkr 1 = Primary is 1st Spkr
Byte 7, bit 4-5	Reserved	
Byte 7, bit 6	Reserved	
Byte 7, bit 7	Contention Resolution	0 = Secondary speaks first in Data Traffic Active State if HDX-FF Secondary wins content-ion if HDX-CON 1 = Primary speaks first in Data Traffic Active State if if HDX-FF or wins content-ion if HDX-CON

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Byte 8-9	Presentation Class	Binary value selecting the Presentation class for the session All values reserved
Bytes 10-26	Reserved	

TS USAGE (Presently this field has zero length)

Byte 27	Length of Primary LU name	
Bytes 28 thru N	Primary LU name	Network name of LU sending this RU (length limited to 8 bytes maximum)
Byte N+1	Length of User Data Field	
Bytes N+2 thru M	User Data	Transparent to Transmission Subsystem

Notes on Format 0 :

1. The 'User Data length' field must always be present. In the situation where the User Data Field is zero in length, the contents of the User Data Length field will be X'00'.

Bind Response Format :

Byte 0 X'31' response code

Exceptions : The following exceptions (in addition to General exceptions) may cause the BIND to be rejected. They are reported in the sense data field.

Session Limit Exceeded (X'0805') : The Secondary LU cannot accept another session at this time.

Function Active (X'0815') A session already exists for this pair of LUs.

RU Length Error (X'1002') : The BIND RU is shorter than the FMT field allows.

Invalid Session Parameter (X'0821') : A BIND parameter (other than Primary LU name) is unacceptable.

NAU Not Authorized (X'080E') : The Secondary LU will not allow a session with the Primary LU.

Permission Rejected (x'080A') : The Secondary LU does not want to go into session with the Primary LU.

Notes : Certain combinations of BIND parameters are invalid. These mutually exclusive settings are listed below.

1. Brackets, Primary will not send EB, Secondary will not send EB.
2. Primary uses Delayed Response Mode, Secondary uses Immediate Request Mode.
3. Secondary uses Delayed Response Mode, Primary uses Immediate Request Mode.

For some settings of certain BIND parameters, other BIND parameters are reserved. These cases are listed below.

Condition	Reserved BIND parameters
1. Primary uses Immediate Control Mode	Primary Request Mode Selection, Chaining use, and chain response protocol
2. Secondary uses Immediate Control Mode	Secondary Request Mode Selection, chaining use, and chain response protocol
3. No Brackets	Primary and Secondary send EB indicators ; Bracket termination rules ; Brackets First Speaker
4. Full duplex	Contention Resolution
5. Brackets	Contention Resolution
6. FM Headers not allowed	Primary and Secondary Compression indicators

CLEAR (CLEAR) - PLU→SLU (expedited)

RU format bytes
0 X'A1' Request Code

Is sent by the primary session control to reset the data traffic subtrees in the primary, secondary and boundary function.

DEACTIVATE LOGICAL UNIT (DACTLU) - SSCP→LU

RU format bytes
0 X'0E'

Is sent from an SSCP to a LU to end the session between the SSCP and the LU. All SSCP - LU and LU - LU state information maintained by the LU is reset.

DEACTIVATE PHYSICAL UNIT (DACTPU) - SSCP→PU

RU format bytes

0	X'12' request code
1	type :
	X'01' final use
	X'02' not final use

Final use : indicates that the physical connection may be broken

DACTPU is sent to end the session between SSCP and PU. All SSCP - PU, SSCP - LU, and LU - LU state information is reset.

REQUEST RECOVERY (RQR) - SLU→PLU (expedited)

RU format bytes

0 X'A3' Request code

Is sent by the secondary session control to request the Primary session control to initiate data traffic recovery procedures as defined by the primary.

START DATA TRAFFIC (SDT) - PLU→SLU (expedited)

RU format bytes

0 X'A0' Request Code

Is sent by Primary session control to complete a data traffic recovery or initialization sequence. The FMs and associated Session Control of both sender and receiver are removed from Data Traffic Reset state and so may begin an exchange of traffic between the NAU's.

SET AND TEST SEQUENCE NUMBERS (STSN) - PLU→SLU (expedited)

RU format bytes

0	X'A2' Request Code
1	bits 0-3 Action Code
2-5	Values depending on Action Code

Is sent by the primary CPM session control during a data traffic recovery or initialization sequence to resynchronize the sequence numbers for one or both of the normal flow.

Action code : Byte 1 Bits 0-1 : Action Code for S→P flow ; related data are in bytes 2-3

Byte 1 Bits 2-3 : Action code n for P→S flow ; related data are in bytes 4-5

Action Code :

00 = IGNORE :	Flow not affected by this STSN
01 = SET :	CPM value must be set to the value in the RU

10 = SENSE : Secondary end-user must return its sequence number for this flow in the RU

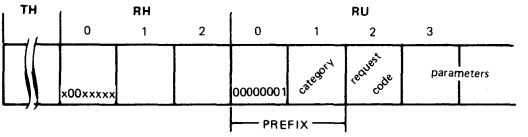
11 = SET AND TEST : CPM value must be set to the RU value and the secondary end-user must compare that value against its own value and respond accordingly

(Byte 1 Bits 4-7 are reserved)

UNBIND SESSION (UNBIND) - PLU→SLU (expedited)

RU format bytes
0 X'32' Request Code
1 Type Unbind (X'01' = normal end session)

Is sent from the Primary LU's to the secondary LU's to end a session between the two associated LU's.



Bytes 0 - 1 of RU are referenced like 'PREFIX'

byte 0 = x'01'
byte 1 = category

x'02' = configuration services
x'03' = maintenance services
x'06' = session services

MAINTENANCE SERVICES

REQUEST CODE	COMMAND	COMMAND NAME	SESSION
X'01'	EXECTEST	EXECUTE TEST	SSCP→PU SSCP→LU
X'02'	ACTTRACE	ACTIVATE TRACE	SSCP→LU
X'03'	DACTTRACE	DEACTIVE TRACE	SSCP→PU
X'81'	RECMS	RECORD MAINTENANCE STATISTICS	PU→SSCP LU→SSCP
X'82'	RECTD	RECORD TEST DATA	PU→SSCP LU→SSCP
X'83'	RECTRD	RECORD TRACE DATA	PU→SSCP

*Flow is normal for all these commands

SESSION SERVICES

REQUEST CODE	COMMAND	COMMAND NAME	SESSION
X'01'	CINIT	CONTROL INITIATE	SSCP→LU
X'02'	CTERM	CONTROL TERMINATE	SSCP→LU
X'04'	NSPE	NS PROCEDURE ERROR	SSCP→PU SSCP→LU
X'80'	INIT-OTHER	INITIATE-OTHER	LU→SSCP
X'81'	INIT-SELF	INITIATE-SELF	LU→SSCP
X'82'	TERM-OTHER	TERMINATE-OTHER	LU→SSCP
X'83'	TERM-SELF	TERMINATE-SELF	LU→SSCP
X'85'	BINDF	BIND FAILURE	LU→SSCP
X'86'	SESST	SESSION STARTED	LU→SSCP
X'87'	UNBINDF	UNBIND FAILURE	LU→SSCP
X'88'	SESSEND	SESSION ENDED	LU→SSCP

*Flow is normal for all these commands

REQUEST CODE	COMMAND	COMMAND NAME	SESSION
X'01'	CONTACT	CONTACT	SSCP → PU
X'02'	DISCONT	DISCONTACT	SSCP → PU
X'03'	IPLINIT	IPL INITIAL	SSCP → PU
X'04'	IPLTEXT	IPL TEXT	SSCP → PU
X'05'	IPLFINAL	IPL FINAL	SSCP → PU
X'06'	DUMPINIT	DUMP INITIAL	SSCP → PU
X'07'	DUMPTEXT	DUMP TEXT	SSCP → PU
X'08'	DUMPFINAL	DUMP FINAL	SSCP → PU
X'09'	RPO	REMOTE POWER OFF	SSCP → PU
X'0A'	ACTLINK	ACTIVATE LINK	SSCP → PU
X'0B'	DEACTLINK	DEACTIVATE LINK	SSCP → PU
X'0E'	CONNOUT	CONNECT OUT (DIAL)	SSCP → PU
X'0F'	ABCONN	ABANDON CONNECTION	SSCP → PU
X'11'	SETCV	SET CONTROL VECTOR	SSCP → PU
X'14'	ESLOW	ENTERING SLOWDOWN	PU → SSCP
X'15'	EXSLOW	EXITING SLOWDOWN	PU → SSCP
X'16'	ACTCONNIN	ACTIVATE CONNECT IN (ENABLE ANSWER)	SSCP → PU
X'17'	DACTCONNIN	DEACTIVATE CONNECT IN (ABANDON ANSWER)	SSCP → PU
X'18'	ABCONNOUT	ABANDON CONNECT OUT (ABANDON DIAL)	SSCP → PU
X'19'	ANA	ASSIGN NETWORK ADDRESSES	SSCP → PU
X'1A'	FNA	FREE NETWORK ADDRESSES	SSCP → PU
X'1B'	REQDISCONT	REQUEST DISCONTACT	PU → SSCP
X'80'	CONTACTED	CONTACTED	PU → SSCP
X'81'	INOP	INOPERATIVE	PU → SSCP
X'84'	REQCONT	REQUEST CONTACT (OFF HOOK)	PU → SSCP

*Flow is normal for all these commands

CONFIGURATION SERVICES

ABANDON CONNECTION (ABCONN) - SSCP→PU

RU format bytes
2 X'0F' Request Code
3-4 Link Network address

Requests the PU to terminate all connections on the indicated link.

ABANDON CONNECT OUT (ABCONNOUT) - SSCP→PU
(Old name = ABANDON DIAL)

RU format bytes
2 X'18' Request Code
3-4 Link Network address

Requests the PU to terminate an outbound connection procedure at the specified link station.

ACTIVATE CONNECT IN (ACTCONNIN) - SSCP→PU
(Old name = ENABLE ANSWER)

RU format butes
2 X'16' Request Code
3-4 Link network address
5 Type

Type : X'00' PU is primary link station
X'01' PU is secondary link station

Requests the PU to enable the indicated link station to accept an incoming connection.

ACTIVATE LINK (ACTLINK) - SSCP→PU

RU Format bytes
2 X'0A' Request Code
3-4 Network address of link
Initiates a procedure to place the addressed link in the active state.

ASSIGN NETWORK ADDRESSES (ANA) - SSCP→PU

RU format bytes
2 X'19' Request Code
3-4 Network address of PU associated with the node to which addresses are to be designed
5 Number of network addresses to be assigned
6 Type (X'80' = noncontiguous)
7-8 First network addresses

9-n Additional network addresses (if any)

Updates the Path Control routing table in the receiver such that PIUs with the indicated network addresses will be routed to the adjacent node whose PU network addresses appears in bytes 3 and 4. Several network addresses maybe assigned with one request.

CONNECT OUT (CONNOUT) - SSCP→PU
(Old name = DIAL)

RU format bytes
2 X'0E' Request Code
3-4 Link network address
5 Link station address
6 Type
7 Retry limit
8 Number of dial digits
9-n Dial digits

Type : Byte 6 Bit 0 = 0 PU is primary link data
= 1 PU is secondary link station
Bit 1 = 0 Not manual connect out
= 1 manual connect out
Retry limit : number of times the CONNECT OUT is to be retried.
Note - Bytes 7 to n are not included on manual CONNECT OUT requests.

Requests the PU to initiate a connection procedure with the indicated link stations.

CONTACT (CONTACT) - SSCP→PU

RU format bytes
2 X'01' Request Code
3-4 Network address of the PU to be contacted.

Initiates a procedure to establish link level contact with the link station associated with the PU addressed in the request.

CONTACTED (CONTACTED) - PU→SSCP

RU format bytes
2 X'80' Request Code
3-4 Network address of contacted PU
5 Status
Status - X'01' = loaded
X'02' = load required
X'03' = error on contact

Informs SSCP of completion of a procedure to contact the station associated with an adjacent PU

DEACTIVATE CONNECT IN (DACTCONNIN) - SSCP→PU
(Old name = ABANDON ANSWER)

RU format bytes
2 X'17' Request Code
3-4 Link Network address

Requests the PU to reset the CONNECT IN state for the specified link

DEACTIVATE LINK (DACTLINK) - SSCP→PU

RU format bytes
2 X'0B' Request Code
3-4 Network address of link

Initiates a procedure to deactivate an active link specified by the network address parameter of the request. It is used after all stations on the link have been discontacted.

DISCONTACT (DISCONT) - SSCP→PU

RU format bytes
2 X'02' Request Code
3-4 Network address of PU to be discontacted

Initiates a procedure to terminate link level contact with the station associated with the PU.

DUMP FINAL (DUMPFINAL) - SSCP→PU

RU format bytes
2 X'08' Request Code
3-4 Network address of PU in node to be dumped

Terminates a dump sequence at the node specified by the network address. CONTACT is required after DUMPFINAL if the station is to be contacted.

DUMP INITIAL (DUMPINIT) - SSCP→PU

RU format bytes
2 X'06' Request Code
3-4 Network address of PU in node to be dumped

Initiates a dump of the node specified by the network address. Basic dump data such as register, key and indicator values may be returned on the response to this request. If further dump data is required, DUMPINIT is followed by DUMPTEXT. The dump sequence should be terminated with DUMPFINAL.

DUMP TEXT (DUMPTEXT) - SSCP→PU

RU format bytes
2 X'07' Request Code
3-4 Network address of PU in node to be dumped
5-8 Starting location (address)
9-10 Length of text

Causes the dump data specified by the starting parameter to be returned as data on the response.

ENTERING SLOWDOWN (ESLOW) - PU→SSCP

RU format bytes
2 X'14' Request Code
3-4 PU network address

Informs the SSCP that the sender has entered a state called SLOWDOWN. This state is generally associated with buffer depletion, and may require traffic through the unit to be reduced or suspended until the state is exited.

EXITING SLOWDOWN (EXSLOW) - PU→SSCP

RU format bytes
2 X'15' Request Code
3-4 PU Network address

Informs the SSCP that the PU has exited the SLOWDOWN state.

FREE NETWORK ADDRESSES (FNA) - SSCP→PU

RU format bytes
2 X'1A' Request Code
3-4 Network address of PU
5 X'00'
6 Type (X'80' = non contiguous)
7-8 (first network address to be freed)
9-n (additional network addresses - if any -)

Updates the Path Control routing table in the receiver such as PIUs received containing a freed network address in the DAF will no longer be routed to the node containing the PU whose network address appears in bytes 3-4.

INOPERATIVE (INOP) - PU→SSCP

RU format bytes
2 X'81' Request Code
3-4 Network address of inoperative link or PU
5 Element type

Element type : X'01' = PU (loss of contact, unexpected loss of connection, connection establishment failure)
X'02' = link (link failure)

Reports a loss of contact with a link station, the failure of a link, or the failure to establish a connection on a switched link.

IPL FINAL (IPLFINAL) - SSCP→PU

RU format bytes
2 X'05' Request Code
3-4 Network address of PU in node
5-8 Entry point location within load module

This request completes the load sequence and supplies the load module entry point to the node being loaded (a CONTACT is required after IPL FINAL)

IPL INITIAL (IPLINIT) - SSCP→PU

RU format bytes
2 X'03' Request Code
3-4 Network address of PU in node to be loaded

Initiates a link level load of the node containing the PU specified by the network address parameter of the request.

IPL TEXT (IPLTEXT) - SSCP→PU

RU format bytes

2 X'04' Request Code
3-4 Network address of PU in node to be loaded
5-n Text
Text = variable length in the form required by the destination node

This request transfers load module text to the PU providing primary station link support for the node being loaded.

REQUEST CONTACT (REQCONT) - PU→SSCP
(Old name = OFF HOOK)

RU format bytes

2 X'84' Request Code
3-4 Link Network address
5-10 Station ID (see appendix B)

Notifies the SSCP that a physical connection with a station has been established on the indicated link and requests CONTACT of that station.

REQUEST DISCONTACT (REQDISCONT) - PU→SSCP

RU format bytes

2 X'1B' Request Code
3 Type = X'00' = normal
X'80' = immediate

Requests the SSCP to start a procedure to discontact the station.

REMOTE POWER OFF (RPO) - SSCP→PU

RU format bytes

2 X'09' Request Code
3-4 Network address of PU in node to be powered off

Causes a link level power off sequence to be initiated to the node specified by the network address. It is not necessary that the node being powered off have an active PU or even be contacted.

SET CONTROL VECTOR (SETCV) - SSCP→PU

RU format bytes

2 X'11' Request Code
3-4 Network address of element to which control vector applies control vector key (0-255)
6-n Control vector data

Control Vectors are named sets of parameters providing control information for network components such as NAUs, links and link stations. This request

loads the information in the Control Vector data field into the Control Vector for the specified network address. The DAU of the request indicates the PU maintaining the Control Vector ; the netwwork address in the RU indicates the element for which the Control Vector is maintained ; the key in the RU specifies the particular type of Control Vector to be set.

Control Vector formats are defined in Appendix A.

ACTIVE TRACE (ACTTRACE) - SSCP→PU

RU format bytes
2 X'02' Request mode
3-4 Network address of the resource
5 Which trace (X'01' = link trace)
6-n Data to support trace

Requests activation of a trace of the resource specified by the network address in the RU.

DEACTIVATE TRACE (DACTTRACE) - SSCP→PU

RU format bytes
2 X'03' Request Code
3-4 Network address of resource to be traced
5 Which trace
6-n Data to support deactivation

Requests deactivation of the specified resource trace.

EXECUTE TEST (EXECTEST) - SSCP→PU or LU

RU format bytes
2 X'01' Request Code
3-4 Target network address
5-8 which test (binary value)
9-n Data to support test

Instructs the PU or the LU to execute a test on the network address designated.

RECORD MAINTENANCE STATISTICS (RECMS) - PU or LU→SSCP

RU format bytes
2 X'81' Request Code
3-4 Network address
5-n Statistics

Permits the passing of maintenance statistic from a LU or PU to a centralized recording facility at the control point.

RECORD TEST DATA (RECTD) - PU or LU→SSCP

RU format bytes
2 X'82' Request code
3-4 Network address of element under test
5-8 Which test (binary value)
9-n Test status and results

Returns the status and results of a test to maintenance services.

RECORD TRACE DATA (RECTRD) - PU→SSCP

RU format bytes
2 X'83' Request Code
3-4 Network address of resource
5 Which trace
6-n Trace data

Returns data collected during a trace of the indicated resource.

BIND FAILURE (BINDF) - LU→SSCP

RU format bytes
2 X'85' Request Code
3-4 Primary LU network address
5-6 Secondary LU network address
7 Reason

Reason = see NSPE

Notifies the SSCP that a failure occured during an attempt to start a session between the two LUs indicated.

CONTROL INITIATE (CINIT) - SSCP→LU

RU format bytes
2 X'01' Request Code
3-4 Network address of secondary LU
5 CINIT format
6-m BIND image
m+1-p Secondary LU network name
p+1-q Requester ID
q+1-r Password
r+1-s User field

CINIT format - X'00'

BIND image - see BIND session format in Session Control section

Requests the Primary LU to bind a session with the indicated LU which is designated Secondary for this session.

CONTROL TERMINATE (CTERM) - SSCP→LU

RU format bytes
2 X'02' Request Code
3 Type unbind
4-5 Secondary LU network address

Requests that the Primary LU initiate a procedure to unbind the session with the indicated secondary LU. 'Type Unbind' parameter indicates if the session is to be unbound in a forced or orderly manner.

INITIATE-OTHER (INIT-OTHER) - LU→SSCP

RU format bytes
2 X'80' Request Code
3 Bits 0-3 Format
3 Bits 4-7 Reserved
4-11 Mode
12-m Network name of primary LU
m+1-p Network name of secondary LU
p+1-q Requester ID
q+1-r Password
r+1-s User field

Requests that a session be initiated between the Primary LU and the secondary LU named in the RU.

INITIATE-SELF (INIT-SELF) - LU SSCP

RU format bytes

2	X'81' Request Code
3	Bits 0-3 Format
3	Bits 4-7 Reserved
4-11	Mode
12-m	Network name of LU
m+1-p	Requester ID
p+1-q	Password
q+1-r	User field

Format : X'0' (only value defined)
Mode : Symbolic name identifying the set of rules and protocols to be used for the session.

Requests that a session be initiated between the sender of the request and the LU named in the RU.

NS PROCEDURE ERROR (NSPE) - SSCP→LU or SSCP→PU

RU format bytes

2	X'04' Request Code
3	Reason
4-m	Network name 1 (Primary LU)
m+1-n	Network name 2 (Secondary LU)

Reason bit 0 = Bind error at Primary
1 = Bind error at Secondary
2 = Bind reject at Primary
3 = Bind reject at Secondary
4 = Unbind failure

Indicates to the LU or PU issuing an NS request that some error has occured after the request was accepted but before completion of the procedure.

SESSION ENDED (SESSEND) - LU→SSCP

RU format bytes

2	X'88' Request Code
3-4	Primary LU network address
5-6	Secondary LU network address

Notifies the SSCP that a successful End of Session has been reached by unbinding both the Primary and Secondary LU's in the session.

SESSION STARTED (SESSST) - LU→SSCP

RU format bytes

2	X'86' Request Code
3-4	Primary LU network address
5-6	Secondary LU network address

Notifies the SSCP that a session between the indicated LUs has been successfully started. It allows synchronization of the session states between the Primary LU and SSCP session services.

TERMINATE-OTHER (TERM-OTHER) - LU →SSCP

RU format bytes

2	X'82' Request Code
3	Type of termination
4-m	Network name of primary LU
m+1-n	Network name of secondary LU
n+1-p	Requester ID
p+1-q	Password

Requests that the session between the primary LU and the secondary LU named in the RU be terminated

TERMINATE-SELF (TERM-SELF) - LU→ SSCP

RU format bytes

2	X'83' Request Code
3	Type of termination
4-n	Network name of LU

Requests that the session between the sender and the LU named in the RU be terminated. The request may be designated as forced or orderly.

UNBIND FAILURE (UNBINDF) - LU→ SSCP

RU format bytes

2	X'87' Request Code
3-4	Primary LU network address
5-6	Secondary LU network address
7	Reason

Reason : see NSPE

Reports a failure to successfully unbind a session.

		POSITIVE RESPONSES	NEGATIVE RESPONSES
NC		Only the Request Code is returned	4 Sense Data bytes and the Request Code are returned
DFC		Only the Request Code is returned	4 Sense Data bytes and the Request Code are returned
SC		Only the Request Code is returned, except for : ACTLU (see note) ACTPU (see note) STSN (see note)	4 Sense Data bytes and the Request Code are returned
NS	Maintenance Services	Only the 3-byte request prefix and code is returned	4 Sense Data bytes and the 3-byte request prefix and code are returned if RH Byte 0 Bit 4 = 1 . Otherwise only the 4 sense data bytes are returned
	Session Services	Only the 3-byte request prefix and code is returned	
	Configuration Services	Only the 3-byte request prefix and code is returned except for DUMPINIT and DUMPTEXT (see note)	

NOTE - The Response Units not standard are detailed below

ACTLU - 2 Bytes are returned

Response format Bytes
0 X'0D' Request Code
1 Type activation

Type activation : X'01' = cold
X'02' = ERP

ACTPU - 10 Bytes are returned

Response format Bytes
0 X'11' Request Code
1 Type activation selected
2-9 Contents ID

Type activation : X'01' = cold
X'02' = ERP

Contents ID : Eight character EBCDIC symbolic name of the load module currently operating in the node. Eight blank is the default value.

STSN - 6 Bytes are returned

Response format Bytes

0	X'A2'	Request code
1 Bits 0-1	:	Result code for action code specified for S→P flow; related data are in bytes 2-3
1 Bits 2-3	:	Result code for action code specified for P→S flow ; related data in bytes 4-5
1 Bits 4-7	:	reserved
2-3		S→P sequence number data to support S→P action code (see below)
4-5		P→S sequence number data to support P→S action code (see below)

SET/IGNORE action code

Result code : 01 = ignore (related data reserved); other values reserved. Bytes 2-3 and 4-5 are reserved

SENSE action code

Result code : 00 = secondary end user cannot return a valid user sequence number
01 = reserved
10 = invalid to request the secondary end user to return a user sequence number
11 = user sequence number included

Data related to result code : if result Code = 11 the corresponding field (bytes 2-3 and/or 4-5) contains the secondary value for the user sequence number; if result code ≠ 11, bytes 2-3 and/or 4-5 are reserved

SET AND TEST action code

Result code : 00 = secondary end user cannot perform the requested test on the user sequence number
01 = test positive (value received in the STSN request = user value);
10 = valid to request the secondary end-user to test the user sequence number
11 = test negative (value received in the STSN request ≠ user value)

Data related to result code if result code = 01 or 11, bytes 2-3 and/or 4-5 = 00 or 10, bytes 2-3 and/or 4-5 are are secondary value for flow sequence number; if result code = 00 or 10, bytes 2-3 and/or 4-5 are reserved

DUMPINIT - n bytes are returned

Response format Bytes

0-1	X'0102' Prefix
2	X'06' Request code
3-n	Dump Data

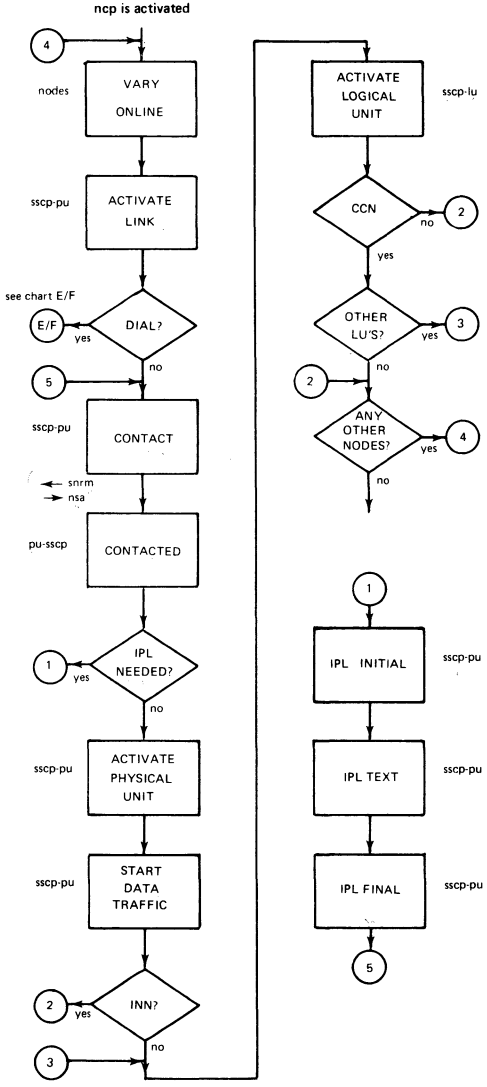
DUMPTEXT - n bytes are returned

Response format Bytes

0-1	X'0102' Prefix
2	X'07' Request Code
3-n	Dump Data

SECTION 6: PROCEDURES

Vary online (chart A). 6.1
Vary offline (chart B) 6.2
Session initiation (chart C) 6.3
Session termination (chart D). 6.4
Dialing In (chart E) 6.5
Dialing Out (chart F). 6.6
Final On-Hook sequence (chart G) 6.7


ncp is activated
4
nodes
VARY ONLINE
sscp-pu
ACTIVATE LINK
see chart E/F
E/F
DIAL?
yes
no
5
sscp-pu
CONTACT
snrm
nsa
pu-sscp
CONTACTED
1
IPL NEEDED?
yes
no
sscp-pu
ACTIVATE PHYSICAL UNIT
sscp-pu
START DATA TRAFFIC
2
INN?
yes
no
3
ACTIVATE LOGICAL UNIT
sscp-lu
CCN
no
2
yes
OTHER LU'S?
yes
3
no
2
ANY OTHER NODES?
yes
4
no
1
IPL INITIAL
sscp-pu
IPL TEXT
sscp-pu
IPL FINAL
sscp-pu
5

6

chart A

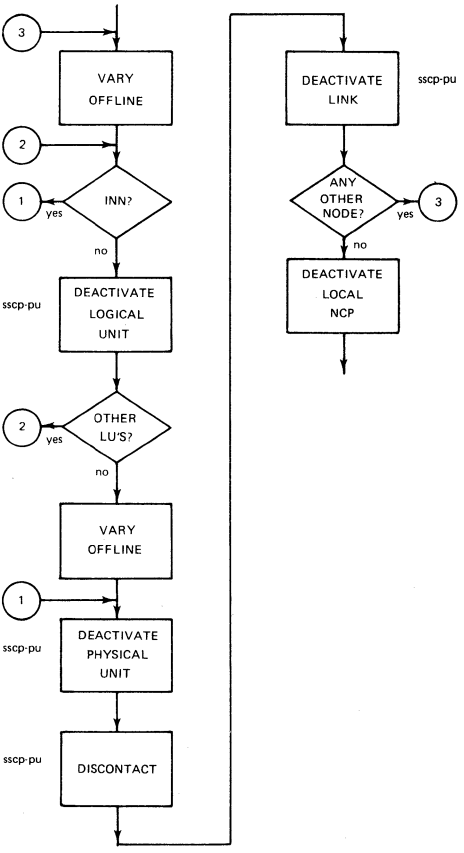

3
VARY OFFLINE
2
1
yes
INN?
no
sscp-pu
DEACTIVATE LOGICAL UNIT
2
yes
OTHER LU'S?
no
VARY OFFLINE
1
sscp-pu
DEACTIVATE PHYSICAL UNIT
sscp-pu
DISCONTACT
DEACTIVATE LINK
sscp-pu
ANY OTHER NODE?
yes
3
no
DEACTIVATE LOCAL NCP

chart B

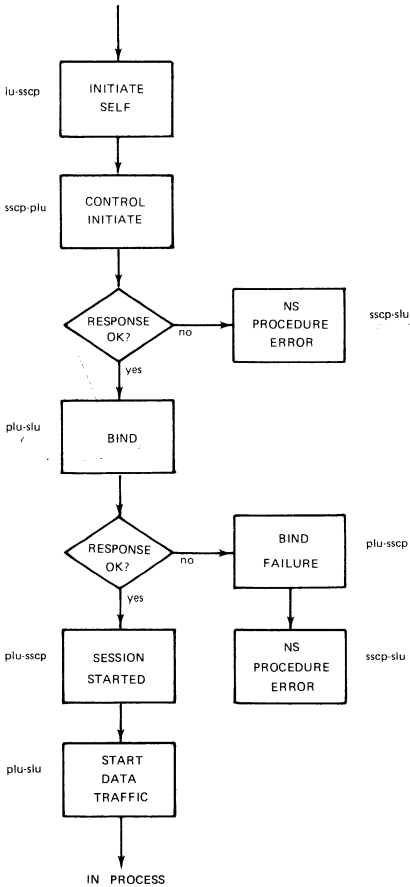

lu-sscp
INITIATE SELF
sscp-plu
CONTROL INITIATE
RESPONSE OK?
no
NS PROCEDURE ERROR
sscp-slu
yes
plu-slu
BIND
RESPONSE OK?
no
BIND FAILURE
plu-sscp
yes
plu-sscp
SESSION STARTED
NS PROCEDURE ERROR
sscp-slu
plu-slu
START DATA TRAFFIC
IN PROCESS

chart C

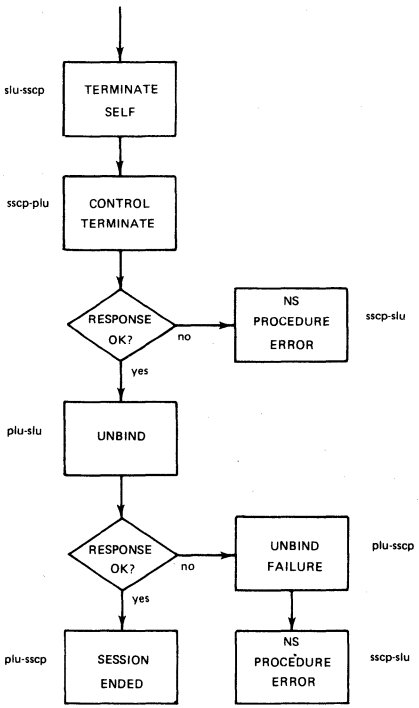

slu-sscp
TERMINATE SELF
sscp-plu
CONTROL TERMINATE
RESPONSE OK?
no
NS PROCEDURE ERROR
sscp-slu
yes
plu-slu
UNBIND
RESPONSE OK?
no
UNBIND FAILURE
plu-sscp
yes
plu-sscp
SESSION ENDED
NS PROCEDURE ERROR
sscp-slu

chart D

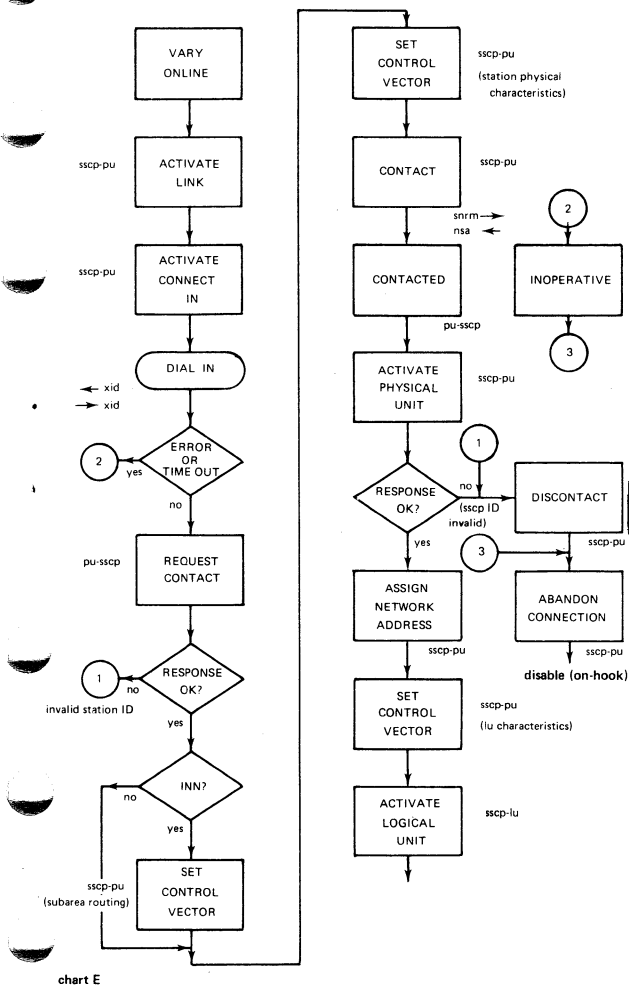

VARY ONLINE
sscp-pu
ACTIVATE LINK
sscp-pu
ACTIVATE CONNECT IN
DIAL IN
xid
xid
2
ERROR OR TIME OUT
yes
no
pu-sscp
REQUEST CONTACT
1
RESPONSE OK?
no
invalid station ID
yes
INN?
no
yes
sscp-pu
(subarea routing)
SET CONTROL VECTOR
SET CONTROL VECTOR
sscp-pu
(station physical characteristics)
CONTACT
sscp-pu
snrm
nsa
2
CONTACTED
INOPERATIVE
3
pu-sscp
ACTIVATE PHYSICAL UNIT
sscp-pu
1
RESPONSE OK?
no
(sscp ID invalid)
DISCONTACT
yes
3
sscp-pu
ASSIGN NETWORK ADDRESS
ABANDON CONNECTION
sscp-pu
sscp-pu
disable (on-hook)
SET CONTROL VECTOR
sscp-pu
(lu characteristics)
ACTIVATE LOGICAL UNIT
sscp-lu

chart E

6

DIALING OUT

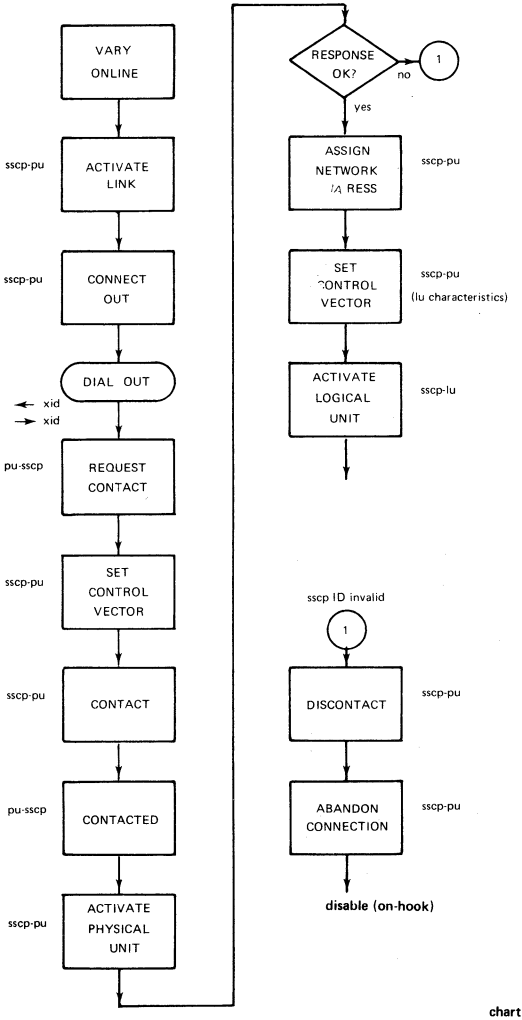


chart F

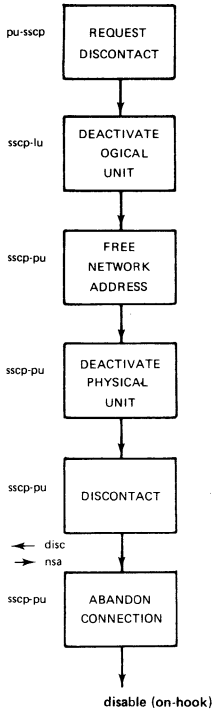

pu-sscp
REQUEST DISCONTACT
sscp-lu
DEACTIVATE OGICAL UNIT
sscp-pu
FREE NETWORK ADDRESS
sscp-pu
DEACTIVATE PHYSICAL UNIT
sscp-pu
DISCONTACT
disc
nsa
sscp-pu
ABANDON CONNECTION
disable (on-hook)

chart G

SECTION 7: APPENDIX

Control vector format (appendix A) 7.1
Station ID (appendix B). 7.3
Function management profiles (appendix C). 7.5
Transmission subsystem profiles (appendix D) . . . 7.8

APPENDIX A :CONTROL VECTOR FORMATS (for SET CONTROL VECTOR command)

When sent on SET CONTROL VECTOR, or the response to SENSE CONTROL VECTOR, the formats below are preceeded by a two-byte prefix and a one-byte request code.

1. DATE-TIME

Key = X'01'

Bytes	Description
3-4	PU network address
5	Key = X'01'
6-17	MM/DD/YY.ddd (date)
18-25	HH.MM.SS. (time)

date and time fields are EBCDIC characters.

2. SUBAREA ROUTING

Key = X'02'

Bytes	Description
3-4	Network address of the link to be used for routing to the Subarea specified in Byte 6
5	Key = X'02'
6	Subarea address (left justified)

Note :This control vector supports subarea addresses no greater than 8 bits, and links which only attach single remote subareas. When additional requirements are established, new control vectors will be defined.

3. SDLC LINK STATION

Key = X'03'

Bytes	Description
3-4	Network address of PU at station
5	Key = X'03
6	Link station address (SDLC)
7	PU type (see next figure)
8	Type modifier
9	SDLC BTU send limit
10	Maximum contiguous PIUs
11	Error retry indicator
12-13	Link error recovery control information
14-15	Max segment length (bytes)

4. NAU

Key = X'04'

Bytes	Description
3-4	NAU network address
5	Key = X'04'

6	Local address form of NAU network address
7	n pacing
8	Reserved, set to a value of 1
9	Priority

5. CHANNEL

Key = X'05'

Bytes	Description
3-4	Link network address of the channel
5	Key = X'05'
6-7	Channel delay :minimum interval between successive inbound transmissions. Binary in tenths of second.

APPENDIX B - STATION ID
(For REQUEST CONTACT command)

The station ID consists of a 48 bit field. Bits 0 to 3 of this field contain the ID format. Presently, the only format described is format '0' (bits 0 to 3 all equal to zero). All other formats are reserved.

Station ID format 0 consists of five fields :

Bits 0-3 : ID format '0000'.

Bits 4-7 : Physical Unit Type.

This field defines the Physical Unit type of the PU in the node at the station. It provides to the SSCP and to the Communication Controller Node with SNAF information regarding the characteristics of the SSCP-PU session and the FID transformation required by the calling node. The following PU types are defined today.

PU Type 1

* The transmission header format is FID 3.

* The PU services for a type 1 PU is located in the adjacent Boundary function.

PU Type 2

* The transmission header format is FID 2.

PU Type 3

Reserved

PU Type 4

* The transmission header format is either FID0 or FID1 for intermediate function and FID2 or FID3 for boundary function.

* Identifies a PU at a node which has intermediate and/or boundary function.

PU Type 5

* The transmission header format is either FID0 or FID1 for intermediate function and FID2 or FID3 for boundary function.

* Identifies a PU at a node which has intermediate and/or boundary function. The node containing a PU type 5 also contains a SSCP.

All other PU types are reserved.

Bits 8 - 15 are reserved for self-description at the link level. The intention of self-description is to minimize the number of SYSGEN options seen by the user, and ease the process of configuration changes in a network.

Bits 16 - 27

Block number. 12 bits provides for 4096 block numbers. Usually a switched line product will be assigned a single block number ; however, in some cases, more than one block may be assigned.

Bits 28 - 47

ID number. The ID number is a binary number which identifies a specific station in a unique way within a customer installed network. The ID number can be assigned by the system generation or installation process, and controlled either by FE or by the customer or the ID number could be assigned at manufacture time and never be changed.

One of the following ways may be used to enter the ID bits :

* Wiring or strapping
* Entered locally at the terminal or cluster, by operator
* Written on removable disk and carried to remote station
* Loaded from the link, using an 'All zero' ID number to provide initial load capability.

The 20 bits allow for 1 048 576 ID numbers, to be assigned within any block number. It is recognized that the best way to achieve the link integrity provided by the ID number is that a unique ID field be defined within a specific block number at manufacturing level. This would allow, in particular, a terminal to dial into multiple systems.

APPENDIX C - FUNCTION MANAGEMENT (FM) PROFILES (For ACTLU - ACTPU - BIND commands)

FM profiles 0-5 are described here. All other profile numbers are reserved.

FM PROFILE 0 (RESTRICTED TO SSCP-PU AND SSCP-LU SESSIONS)

Profile 0 requires the following rules :

- Primary and Secondary NAUs use Immediate Control Mode and Immediate Response Mode
- Primary and Secondary NAUs send only single RU chains
- No compression
- No DFC RUs are allowed
- No FM Headers
- No Brackets
- No alternate code
- The FM transaction mode is HDX-contention
- Primary NAU is responsible for recovery
- Secondary NAU wins contention

FM PROFILE 1 (RESERVED)

FM PROFILE 2 (RESTRICTED TO 3270 ONLY)

Profile 2 requires the following rules :

- Primary LU uses delayed control mode
- Secondary LU uses delayed request mode
- Secondary LU uses immediate response mode
- Only single element chains are allowed
- Secondary LU requests are 'no response requested'
- No compression
- Primary LU will send EB
- Secondary LU will not send EB
- No DFC RUs are allowed
- FM Headers are not allowed
- Bracket termination rule 2 is used if brackets are used
- Normal flow send/receive mode is FDX
- Primary LU is responsible for ERP
- Secondary LU is first speaker if brackets are used

The FM usage fields defining the options for profile 2 are :

- Primary request mode selection
- Primary chain response protocol (no response may not be used).
- Brackets
- Alternate code

FM PROFILE 3 (RESTRICTED TO LU-LU SESSIONS)

Profile 3 requires the following rules :

- Primary LU and Secondary LU use delayed control mode and immediate response mode
- Primary LU and Secondary LU support the following DFC functions :
  - CANCEL
  - SIGNAL

LUSTAT (Allowed Secondary to Primary only)
CHASE
SHUTD
SHUTC
RSHUTD
BID (allowed only if brackets are used)
RTR (allowed only if brackets are used)

The FM usage fields defining the options for Profile 3 are :

Chain Use (Primary and Secondary)
Request Mode Selection (Primary and Secondary)
Chain Response Protocol (Primary and Secondary)
Compression Indicator (Primary and Secondary)
Send EB Indicator (Primary and Secondary)
FM Header Usage
Brackets
Bracket Termination rule
Alternate Code
Normal flow send/receive mode
Recovery Responsibility
First Speaker(for bracket protocol)
Contention Resolution

FM PROFILE 4 (RESTRICTED TO LU-LU SESSIONS)

Profile 4 requires the following rules :

Primary LU and Secondary LU use Delayed Control Mode and Immediate Response Mode
Primary LU and Secondary LU support the following DFC functions :

CANCEL
SIGNAL
LUSTAT
QEC
QC
RELQ
SHUTD
RSHUTD
CHASE
BID (Allowed only if brackets are used)
RTR (Allowed only if brackets are used)

The FM Usage fields defining the options for Profile 4 are :

Chaining use (Primary and Secondary)
Request Mode Selection (Primary and Secondary)
Chain Response Protocol (Primary and Secondary)
Compression Indicator (Primary and Secondary)
Send EB Indicator (Primary and Secondary)
FM Header Usage
Brackets
Brackets Termination Rule
Alternate Code
Normal flow send/receive mode
Recovery Responsibility
First Speaker (for bracket protocol)
Contention Resolution

FM PROFILE 5 (RESTRICTED TO SSCP-PU SESSIONS)

Profile 5 requires the following rules :

Primary and Secondary NAUs send only single RU chains
Primary NAU uses Delayed Request Mode
Secondary NAU uses Delayed Request Mode and Delayed Response Mode
Primary NAU chains ask for Definite Response
Secondary NAU chains ask for No Response
No compression
No DFC RUs are allowed
No FM Headers
Brackets are not used
No Alternate Code
The FM Transaction Mode is FDX
Primary NAU is responsible for recovery

Note : If the FM usage field specifies a value for a parameter, that value is used unless it conflicts with a value specified by the FM profile. The FM profile overrides the FM usage field.

APPENDIX D : Transmission subsystem (TS) Profiles
(For ACTLU - ACTPU - BIND commands)

TS Profiles 0-5 are described here. All other profile numbers are reserved.

TS PROFILE 0 (RESERVED)

TS PROFILE 1 (RESTRICTED TO SSCP-PU AND SSCP-LU SESSIONS

TS Profile 1 specifies the following information :
No Pacing
IDs rather than sequence numbers are used on the Normal flows
SDT is not allowed
CLEAR is not allowed
RQR is not alloqed
STSN is not allowed

TS PROFILE 2 (RESTRICTED TO 3270 ONLY)

TS Profile 2 specifies the following information :

Primary to Secondary normal flow is paced
Sequence Numbers are used on the Normal Flows
SDT is not allowed
CLEAR is required
RQR is not allowed
STSN is not allowed

TS PROFILE 3 (RESTRICTED TO LU-LU SESSIONS)

TS Profile 3 specifies the following information :

Primary to Secondary normal flow is paced
Sequence Numbers are used on the Normal Flows
SDT is required
RQR is not allowed
STSN is not allowed

TS PROFILE 4 (RESTRICTED TO LU-LU SESSIONS)

TS Profile 4 specifies the following information :

Primary to Secondary normal flow is paced
Sequence numbers are used on the normal flows
SDT is required
CLEAR is required
RQR may be used
STSN may be used

TS PROFILE 5 (RESTRICTED TO SSCP-PU SESSIONS)

TS Profile 5 specifies the following information :

No Pacing
Sequence Numbers are used on Normal Flows
SDT is required
CLEAR is not allowed
RQR is not allowed
STSN is not allowed

SECTION 8: ABBREVIATIONS

Abbreviations. 8.1

BB	- BEGIN BRACKET
BETB	- BETWEEN BRACKET STATE
BIU	- BASIC INFORMATION UNIT
BLU	- BASIC LINK UNIT
BNN	- BOUNDARY NETWORK NODE
BTU	- BASIC TRANSMISSION UNIT
CCN	- CLUSTER CONTROL NODE
CD	- CHANGE DIRECTION
CPM	- CONNECTION POINT MANAGER
DAF	- DESTINATION ADDRESS FIELD
DCF	- DATA COUNT FIELD
DFC	- DATA FIELD CONTROL
DLC	- DATA LINK CONTROL
EB	- END BRACKET
EFI	- EXPEDITED FLOW INDICATOR
EU	- END-USER
FCS	- FRAME CHECK SEQUENCE
FDX/MP PRI	- FULL DUPLEX/MULTIPOINT PRIMARY
FDX/MP SEC	- FULL DUPLEX/MULTIPOINT SECONDARY
FDX/PP	- FULL DUPLEX/POINT-TO-POINT
FID	- FORMAT IDENTIFICATION FIELD
FM	- FUNCTION MANAGEMENT
HDX	- HALF-DUPLEX
HN	- HOST NODE
INB	- IN BRACKET
INN	- INTERMEDIATE NETWORK NODE
LSDI	- LOCAL SESSION IDENTIFIER
LU	- LOGICAL UNIT
MPF	- MAPPING FIELD
NAU	- NETWORK ADDRESSABLE UNIT
NC	- NETWORK CONTROL
NRZI	- NON RETURN TO ZERO INVERTED
OAF	- ORIGIN ADDRESS FIELD
PC	- PATH CONTROL
PIU	- PATH INFORMATION UNIT
PU	- PHYSICAL UNIT
RH	- REQUEST/RESPONSE HEADER
RTR	- READY TO RECEIVE
RU	- REQUEST/RESPONSE UNIT
SC	- SESSION CONTROL
SDLC	- SYNCHRONOUS DATA LINK CONTROL
SNA	- SYSTEM NETWORK ARCHITECTURE
SNF	- SEQUENCE NUMBER FIELD
SSCP	- SYSTEM SERVICES CONTROL POINT
STSN	- SET AND TEST SEQUENCE NUMBER
TC	- TRANSMISSION CONTROL
TH	- TRANSMISSION HEADER
TN	- TERMINAL NODE
TS	- TRANSMISSION SUBSYSTEMS

NOTES

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Field Engineering Handbook

SNA
Systems Network Architecture
Part 2 - Maintenance Aids

PREFACE

This handbook was prepared by NCC (Network Competence Center) and ETPCC (European Teleprocessing Competence Center), and is organized in two parts.

Part 1 - General Information
Part 2 - Maintenance Aids

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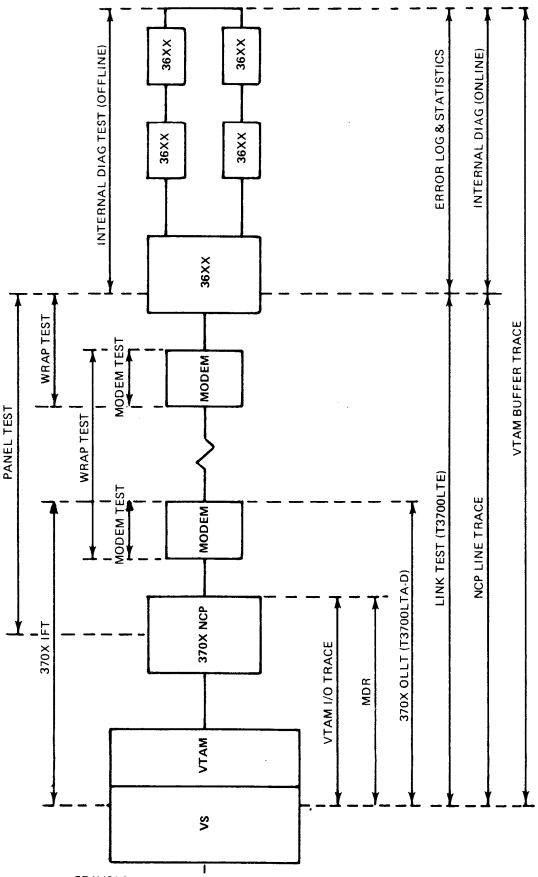
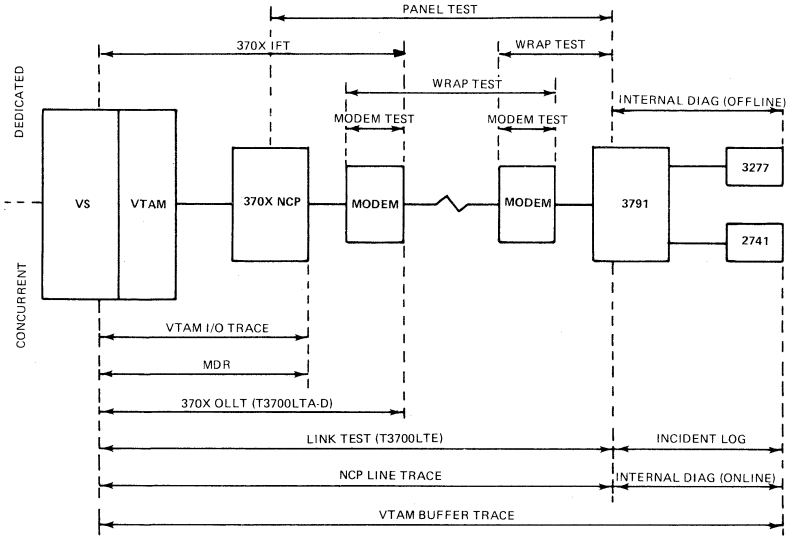
SNA NETWORK WITH 3651 AND 3601




PANEL TEST
370X IFT
WRAP TEST
WRAP TEST
INTERNAL DIAG (OFFLINE)
MODEM TEST
MODEM TEST
DEDICATED
VS
VTAM
370X NCP
MODEM
MODEM
3791
3277
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CONCURRENT
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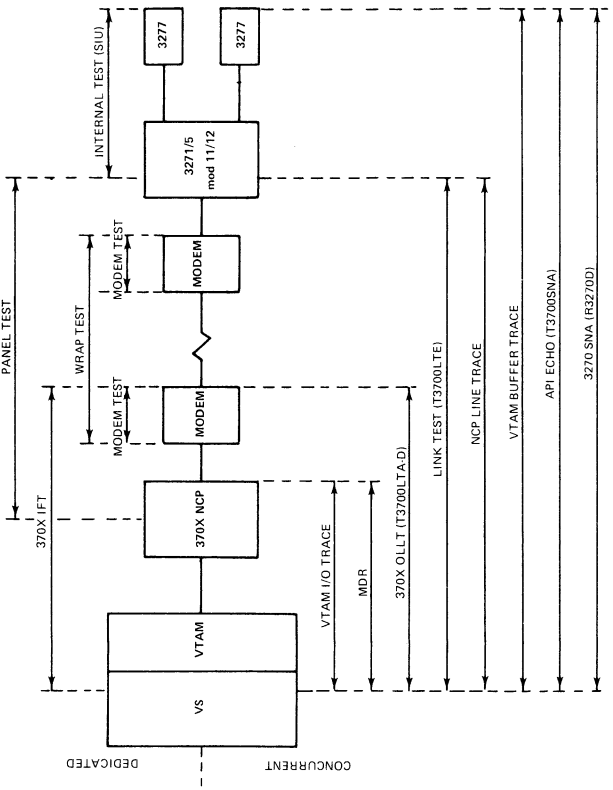
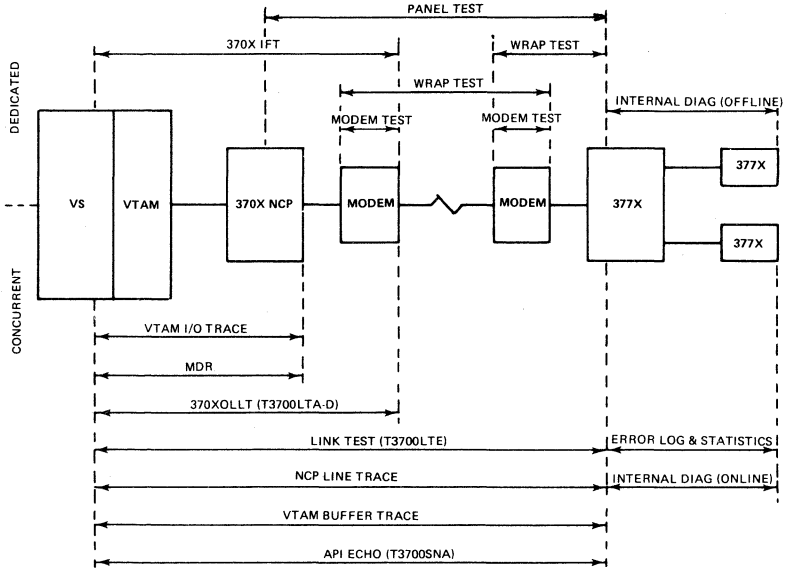
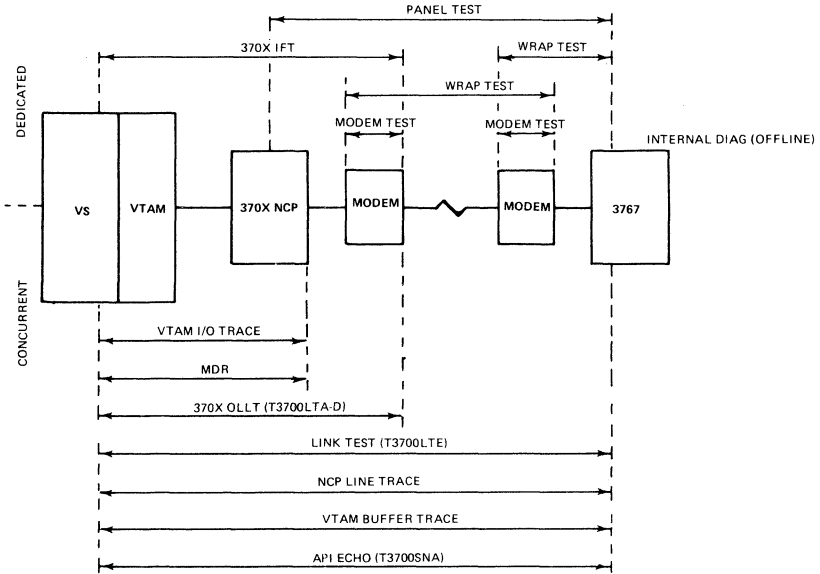
370X OLLT (T3700LTA-D)
LINK TEST (T3700LTE)
INCIDENT LOG
NCP LINE TRACE
INTERNAL DIAG (ONLINE)
VTAM BUFFER TRACE

SNA NETWORK WITH 3271/5





SNA NETWORK WITH 377X


PANEL TEST
370X IFT
WRAP TEST
WRAP TEST
MODEM TEST
MODEM TEST
INTERNAL DIAG (OFFLINE)
DEDICATED
VS
VTAM
370X NCP
MODEM
MODEM
3767
CONCURRENT
VTAM I/O TRACE
MDR
370X OLLT (T3700LTA-D)
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VTAM will supply the following traces :

1) NCP line trace
2) Buffer trace
3) I/O trace
4) Internal trace (DOS only)

These VTAM facilities are always included in VTAM and do not require to be specified during VTAM or System generation.

The OS GTF and the DOS PDAID (PDAID=VT) may be used to trace the above events.

For OS, the three VTAM traces can be traced by use of GTF. The VTAM trace facility requires the following GTF options :

- RNIO
- IO or IOP
- USR

TIME=YES should be specified in the GTF start command.

1) LINE TRACE

The line trace facility of VTAM allows a user to activate or deactivate the NCP trace of a particular line and to record the NCP trace records on the VTAM trace data set.

For further information, refer to NCP Line Trace section in this handbook.

Activating/Deactivating Line Trace (OS/VS) (see figure 3)

```
{MODIFY } PROCNAME, { TRACE   },TYPE=LINE,ID=name
{F      }           { NOTRACE }
```

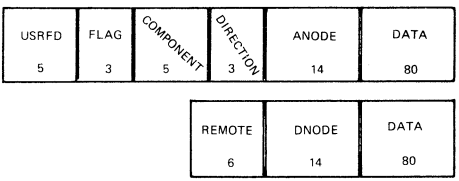
Activating/Deactivating Line Trace (DOS/VS)

```
{MODIFY } NET, { TRACE   },TYPE=LINE,ID=name
{F      }      { NOTRACE }
```

2) BUFFER TRACE

The buffer trace provides a trace of buffer contents for any of these types of addressable nodes : component, terminal (which may be a logical unit), cluster control unit, or NCP. A buffer trace is a means of identifying all changes to data caused by VTAM. As a message originating from or destined to an application program enters VTAM control, it is placed in a trace record and written to auxiliary storage. Included in the record are : node name of the application program, resource ID of the terminal, and message data.

Buffer Trace Record - OS/VS (see fig 1)



USRFD
identifies the trace record as a GTF USR trace record.

FLAG
Is X'FEF' for a TPIOS trace record, or X'FF1' for a control layer trace record.

COMPONENT
Is either TPIOS, or C/L for control layer, indicating where the data was traced.

DIRECTION
Is either IN or OUT, indicating the traced information was inbound or outbound at the indicated component.

ANODE
Is the name of the application node.

DATA
Is an FDB, FSB, TH/RH, or buffer text. If the data is hexadecimal buffer text, the EBCDIC translation appears at the end of the line. There may be more than one line of data in a single trace record.

REMOTE/LOCAL
Appears on TPIOS trace records, indicating the traced data was for a remote or local service.

DNODE
Is the name of the destination node.

Activating/Deactivating Buffer Trace (OS/VS) (see figure 3)

```
{MODIFY} PROCNAME,{ TRACE   },TYPE=BUF,ID=name
{F     }          { NOTRACE }
```

Buffer trace record DOS/VS (see figure 2)

TYPE = BUF	DEST	DATE	TIME	LOST RCDS	APPLICATION NAME	DIRECTION
9	26	11	13	16	22	13

TYPE
Specifies the type of trace record in the form TYPE=BUF.

DEST
Is the node name or device CID (communication identifier) of the destination in the form DEST.NODENAME=cccccccc or DEST.CID=hhhhhhhh. The node name is used if it can be resolved, otherwise the CID is given. The CID is described in the VTAM Macro Language Reference.

DATE
Is the date of the trace, in the form DATE=yy.ddd. where yy represents the year and ddd represents the day (using January first as day 1).

TIME
Is the time of the trace in the form TIME=hh.mm.ss, where hh represents the hours, mm represents minutes, and ss represents second.

LOST RCDS
Is the number of records lost since the previous first I/O record because of the inability of the trace facility to obtain a VTAM buffer. The count is in the form LOST RCD CNT=ccc.

APPLICATION NAME
Is the name of the application program in the form APL.NODENAME=cccccccc.

DIRECTION
Is the direction of the record : INBOUND or OUTBOUND.

The second and subsequent parts of the buffer trace record show the contents of the buffer. Each line contains 32 bytes of user data in standard dump format: that is, eight groups of eight hexadecimal digits followed by the equivalent 32 EBCDIC characters.

Buffer Trace Record

Second part

BUFFER	BUFFER DATA IN HEX	BUFFER DATA IN EBCDIC
8	82	32

BUFFER=
Is a label in the form BUFFER=.

BUFFER DATA IN HEX
Is 32 or fewer bytes of the user's data in hexadecimal form. Each subsequent line contains following 32-byte segments of the user's data. Confidential data is not recorded. When the trace facility detects confidential data (CONFTXT option of the application program's NIB macro instruction), the second record of the buffer trace contains ***CONFIDENTIAL DATA***.

BUFFER DATA IN ECBDIC
Is 32 or fewer EBCDIC characters equivalent to the 64 hexadecimal digits contained at the left of this same trace record.

Trace Print Utility

When the trace print utility is activated, all tracing is suspended until the printout is completed. While the print utility is running, all trace records are discarded : upon completion, all active traces start again.

Activating/Deactivating Buffer Trace (DOS/VS)

```
{MODIFY} NET, { TRACE   },TYPE=BUF,ID=name
{F     }      { NOTRACE }
```

3) I/O TRACE

The I/O trace collects information for a local or remote NCP or for remote devices attached to an NCP.

The data collected is variable, it depends on the type of node being traced.

I/O Trace Record (OS/VS) (see fig.1)

RNIO	TCB	JOBN	RO	DIRECTION	PIU
4	12	13	12	3	44

RNIO
Indicates the trace record was created by the GTF RNIO trace.

TCB
Is the address of the TCB of the partition running the application program.

JOBN
Is the contents of register 0, which indicates the length of the PIU.

DIRECTION
Is the direction of the trace record : IN for inbound or OUT for outbound.

PIU
Is the path information unit. It consists of a transmission header (TH) a request/response header (RH), and a request/response unit (RU).

Activating/Deactivating I/O Trace (OS/VS)

{MODIFY / F} PROCNAME, { TRACE / NOTRACE },TYPE=I/O,ID=name

I/O Trace Record (DOS/VS) (see fig.2)

First Part

TYPE = IO	DEST	DATE	TIME	LOST RCDS	LOCAL REMOTE	MPX	DIRECTION
9	28	11	13	16	9	13	13

TYPE
Specifies the type of trace in the form TYPE=I0.

DEST
DATE
TIME
LOST RCDS
Are the same as 'Buffer Trace Record - First Part'.

LOCAL or REMOTE
Indicates whether the record is from a local or remote communications controller, by the word LOCAL or REMOTE.

MPX
Indicates that the record is for either a communications controller by INT.MPX or a 3270 by NON-INT or MPX.

DIRECTION
Is the direction of the record : INBOUND or OUTBOUND.

I/O Trace Record

Second part

TH	RH	BDU/SENSE
23	9	7/4

TH=
Is the transmission header in the form TH= followed by the transmission header in the form of 20 hexadecimal characters.

RH
Is the request/response header in the form RH= followed by the request/response header in the form of six hexadecimal characters.

BDU or SENSE
Is either the 7-byte BDU (if the I/O being traced is for a BSC or start-stop device) or contains seven bytes of sense information (if the I/O being traced is for an SNA device and the sense indicator in the RH indicates that sense information is present).

Activating/Deactivating I/O Trace (DOS/VS)

```
{MODIFY} NET,{ TRACE   },TYPE=I/O,ID=name
{F     }     { NOTRACE }
```

4) VTAM INTERNAL TRACE (DOS/VS ONLY)

VTAM internal trace can trace the following internal VTAM functions :

* Application program interface (API)
* Process scheduling service (PSS)
* Executing sequence control (ESC)
* Locking and unlocking
* Storage management service (SMS)

Tracing these functions permits the reconstruction of sequences of VTAM events and can be used in debugging new applications.

Activating/Deactivating Internal Trace (DOS/VS)

```
{MODIFY}{{TRACE   }},TYPE=VTAM
{F     }{{NOTRACE }}
```

```
    TIME    44192.142741
FF2 LINE        DNODE NCP52AF                       TIME 23
                      LCD 9  PCF 9  TIME 22  SCE 45  PDF 7E       LCD 9  PCF 9  TIME 22  SCF 40  PDF C1
                      LCD 9  PCF 9  TIME 22  SCF 40  PCF 91       LCD 9  PCF 9  TIME 22  SCF 40  PDF 35
                      LCD 9  PCF 9  TIME 22  SCF 40  PDF 59       LCD 9  PCF 9  TIME 22  SCF 45  PDF 7E
                      LCD 9  PCF 9  TIME 22  SCF 45  PDF FF       LCD 9  PCF 5  TIME 22  SCF 45  PDF FF
    TIME    44192.147431
FEF  TPIOS IN  ANODE ISTOLTEP  FDB  00000000 001C03E9 00010000   RSVD 081C   LNG2 00E0
       REMOTE  DNODE A3767LU   FSB  022C0001 00000000 0201C218 00030000 00000000 00000000 00000000 00040000
                               THRH 1F000201 02180003 0004EB80 00
                               TEXT A1                                    *.                  *
    TIME    44192.228461
FEF  TPIOS OUT ANODE ISTOLTEP  FDB  00000000 001C03C8 000 0000   RSVD 0000   LNG2 00C4   RSVD  00000000 00000000
       REMOTE  DNODE A3767LU   THRH 1C00C218 02010000 00006B80 00
                               TEXT A0                                    *.                  *
    TIME    44192.234144
FEF  TPIOS IN  ANODE ISTOLTEP  FDB  00000000 001006A1 00010000   RSVD 0810   LNG2 00E0
       REMOTE  DNODE A3767LU   FSB  022C0001 00000000 0201C218 00010000 00000000 00000000 00000000 00040000
                               THRH 1F000201 C21B0001 0004EB80 00
                               TEXT A0                                    *.                  *
    TIME    44192.753558
FF1  C/L  OUT  ANODE ISTOLTEP  TEXT C1C2C3C4 C5C6C7C8 C9D1D2D3 D4D5D6D7 D8D9E2E3  *ABCDEFGHIJKLMNOPQRST*
               DNODE A3767LU        E4E5E6E7 E8E9                               *UVWXYZ             *
    TIME    44192.757421
FEF  TPIOS OUT ANODE ISTOLTEP  FDB  00000000 001C0680 00270000   RSVD 0000   LNG2 00C4   RSVD  00000000 00000000
       REMOTE  DNODE A3767LU   THRH 1C00C218 02010000 00000380 80
                               TEXT C1C2C3C4 C5C6C7C8 C9D1D2D3 D4D5D6D7 D8D9E2E3  *ABCDEFGHIJKLMNOPQRST*
                                    E4E5E6E7 E8E9                               *UVWXYZ             *
    TIME    44192.771054
FF2 LINE        DNODE NCP52AF                       TIME 2E
                      LCD 9  PCF 6  TIME 23  SCF 0D  PDF FF       LCD 9  PCF 7  TIME 33  SCF 49  PCF C1
                      LCD 9  PCF 7  TIME 23  SCF 49  PDF B8       LCD 9  pCF 7  TIME 23  SCF 49  PDF 3F
                      LCD 9  PCF 7  TIME 23  SCF 49  PDF C0       LCD 9  PCF 7  TIME 23  SCF 49  PDF EB
                      LCD 9  PCF 7  TIME 23  SCF 49  PDF 80       LCD 9  PCF 7  TIME 23  SCF 49  PDF 00
                      LCD 9  PCF 7  TIME 23  SCF 49  PDF A1       LCD 9  PCF 7  TIME 23  SCF 49  PDF BA
                      LCD 9  PCF 7  TIME 23  SCF 49  PDF 5F       LCD 9  PCF 6  TIME 24  SCE 0D  PDF 5F
                      LCD 9  PCF 9  TIME 24  SCF 45  PDF 00       LCD 9  PCF 9  TIME 24  SCF 45  PDF 7E
                      LCD 9  PCF 9  TIME 24  SCF 40  PDF C1       LCD 9  PCF 9  TIME 24  SCF 40  PDF B1
                      LCD 9  PCF 9  TIME 24  SCF 40  PDF 37       LCD 9  PCF 9  TIME 24  SCF 40  PDF 78
```

VTAM TRACE OUTPUT OS/VS (continued)

```
LCD 9  PCF 9  TIME 24  SCF 45  PDF 7E      LCD 9  PCF 9  TIME 24  SCF 45  PDF FF
LCD 9  PCF 5  TIME 25  SCF 45  PDF FF      LCD 9  PCF 6  TIME 25  SCF 0D  PDF FF
LCD 9  PCF 7  TIME 25  SCF 49  PDF C1      LCD 9  PCF 7  TIME 25  SCF 49  PDF B1
LCD 9  PCF 7  TIME 25  SCF 49  PDF 37      LCD 9  PCF 7  TIME 25  SCF 49  PDF 78
LCD 9  PCF 6  TIME 26  SCF 0D  PDF 78      LCD 9  PCF 9  TIME 26  SCF 45  PDF 00
LCD 9  PCF 9  TIME 26  SCF 45  PDF 7E      LCD 9  PCF 9  TIME 26  SCF 40  PDF C1
```

```
*** DATE   DAY 162     YEAR 1975          TIME 04 35 47 974462

RNIO   TCB 0002F220   JOBN N/A   R0  0000000D   OUT   1E00D600 02000040 00080B80 00
RNIO   TCB 0002F220   JOBN N/A   R0  0000000D   IN    1E000200 D6000040 00068B80 00
RNIO   TCB 0002F220   JOBN N/A   R0  0000000D   OUT   1E00D600 02000041 00080B80 00
RNIO   TCB 0002F220   JOBN N/A   R0  0000000D   IN    1E000200 D6000041 00068B80 00
RNIO   TCB 0002F220   JOBN N/A   R0  0000000D   OUT   1E00D600 02000042 00080B80 00
RNIO   TCB 0002F220   JOBN N/A   R0  0000000D   IN    1E000200 D6000042 00068B80 00
RNIO   TCB 0002F220   JOBN N/A   R0  0000000D   OUT   1E00D600 02000043 00080B80 00
RNIO   TCB 0002F220   JOBN N/A   R0  0000000D   IN    1E000200 D6000043 00068B80 00
RNIO   TCB 0002F220   JOBN N/A   R0  0000000D   OUT   1E00D600 02000044 00080B80 00
RNIO   TCB 0002F220   JOBN N/A   R0  0000000D   IN    1E000200 D6000044 00068B80 00
RNIO   TCB 0002F220   JOBN N/A   R0  0000000D   OUT   1E00D600 02000045 00080B80 00
RNIO   TCB 0002F220   JOBN N/A   R0  0000000D   IN    1E000200 D6000045 00068B80 00
RNIO   TCB 0002F220   JOBN N/A   R0  0000000D   OUT   1E00D600 02000046 00080B80 00
RNIO   TCB 0002F220   JOBN N/A   R0  0000000D   IN    1E000200 D6000046 00068B80 00
RNIO   TCB 0002F220   JOBN N/A   R0  0000000D   OUT   1E00D600 02000047 00080B80 00
RNIO   TCB 0002F220   JOBN N/A   R0  0000000D   IN    1E000200 D6000047 00068B80 00
RNIO   TCB 0002F220   JOBN N/A   R0  0000000D   OUT   1E00D600 02000048 00080B80 00
RNIO   TCB 0002F220   JOBN N/A   R0  0000000D   IN    1E000200 D6000048 00068B80 00
RNIO   TCB 0002F220   JOBN N/A   R0  0000000D   OUT   1E00D600 02000049 00080B80 00
RNIO   TCB 0002F220   JOBN N/A   R0  0000000D   IN    1E000200 D6000049 00068B80 00
RNIO   TCB 0002F220   JOBN N/A   R0  0000000D   OUT   1E00D600 0200004A 00080B80 00
RNIO   TCB 0002F220   JOBN N/A   R0  0000000D   IN    1E000200 D600004A 00068B80 00
RNIO   TCB 0002F220   JOBN N/A   R0  0000000D   OUT   1E00D600 0200004B 00080B80 00
```

FIGURE 1

```
TYPE=BUF   DEST.NODENAME=T27410A      DATE=74.206  TIME=14.54.53   LOST RCD CNT=000   APPL.NODENAME=APPL1      OUTBOUND
  BUFFER= 7A4040C5  D5E3C5D9  4040C4C1  E3C140E8  D6E440D3  C9D2C540  C1D5C440  C5D6E315       :  ENTER  DATA YOU LIKE AND EOT.
          25                                                                                    .

TYPE-BUF   DEST.NODENAME=T27410A      DATE=74.206  TIME=14.54.57   LOST RCD CNT=000   APPL.NODENAME=APPL1      OUTBOUND
  BUFFER= 089AD602  000803                                                                    ..0....

TYPE=BUF   DEST.NODENAME=T27410A      DATE=74.206  TIME=14.54.57   LOST RCD CNT=000   APPL.NODENAME=APPL1      OUTBOUND
  BUFFER= 7A4040C5  D5E3C5D9  4040C4C1  E3C140E8  D6E440D3  C9D2C540  C1D5C440  C5D6E315       :  ENTER  DATA YOU LIKE AND EOT.
          25                                                                                    .

TYPE= IO   DEST.NODENAME=T27410A      DATE=74.206  TIME=14.54.57   LOST RCD CNT=000   REMOTE   NON-INT.MPX     OUTBOUND
          TH=0E00D60202014100000D  RH=039000    00089A00000000

TYPE= IO   DEST.NODENAME=T27410A      DATE=74.206  TIME=14.54.57   LOST RCD CNT=000   REMOTE   NON-INT.MPX     OUTBOUND
          TH=0E00D60202011101002B  RH=039000    00020A00000000

TYPE= IO   DEST.NODENAME=T27410A      DATE=74.206  TIME=14.56.12   LOST RCD CNT=000   REMOTE   NON-INT.MPX     INBOUND
          TH=0E000201D6024101000A  RH=039000    00089A00006000

TYPE= IO   DEST.NODENAME=T27410A      DATE=74.206  TIME=14.56.12   LOST RCD CNT=000   REMOTE   NON-INT.MPX     INBOUND
          TH=0E000201D6021101000A  RH=039000    00020A00006000

TYPE= IO   DEST.NODENAME=T27410A      DATE=74.206  TIME=14.56.16   LOST RCD CNT=000   REMOTE   NON INT.MPX     OUTBOUND
          TH=0E00D60202011102000A  RH=039000    00010300000000

TYPE= IO   DEST.NODENAME=T27410A      DATE=74.206  TIME=14.56.28   LOST RCD CNT=000   REMOTE   NON=INT.MPX     INBOUND
          TH=0E000201D60211020017  RH=039000    00010310006038
```

```
TYPE=BUF    DEST.NODENAME=T27410A      DATE=74.206  TIME=14.56.32   LOST RCD CNT=000   APPL.NODENAME=APPL1      INBOUND
  BUFFER= C6C9D9E2  E340D4C5  E2E2C1C7  C5                                                 FIRST MESSAGE

TYPE=BUF    DEST.NODENAME=T27410A      DATE=74.206  TIME=14.56.32   LOST RCD CNT=000   APPL.NODENAME=APPL1      OUTBOUND
  BUFFER= 7AE2E3C1  D5C4C1D9  C440D9C5  E2D7D6D5  E2C540D4  C5E2E2C1  C7C56040  D7D3C5C1       :STANDARD RESPONSE MESSAGE- PLEA
          E2C540C5  D5E3C5D9  40D4D6D9  C540C4C1  E3C11525                                    SE ENTER MORE DATA..

TYPE=BUF    DEST.NODENAME=T27410A      DATE=74.206  TIME=14.56.34   LOST RCD CNT=000   APPL.NODENAME=APPL1      OUTBOUND
  BUFFER= 7AE2E3C1  D5C4C1D9  C440D9C5  E2D7D6D5  E2C540D4  C5E2E2C1  C7C56040  D7D3C5C1       :STANDARD RESPONSE MESSAGE-PLEA
          E2C540C5  D5E3C5D9  40D4D6D9  C540C4C1  E3C11525                                    SE ENTER MORE DATA..

TYPE= IO    DEST.NODENAME=T27410A      DATE=74.206  TIME=14.56.34   LOST RCD CNT=000   REMOTE   NON=INT.MPX      OUTBOUND
          TH=0E00D60202011103003E      RH=039000    00020200000000

TYPE= IO    DEST.NODENAME=T27410A      DATE=74.206  TIME=14.57.13   LOST RCD CNT=000   REMOTE   NON-INT.MPX      INBOUND
          TH=0E000201D6021103000A      RH=039000    00020200006000

TYPE= IO    DEST.NODENAME=T27410A      DATE=74.206  TIME=14.57.16   LOST RCD CNT=000   REMOTE   NON-INT.MPX      OUTBOUND
          TH=0E00D60202011104000A      RH=039000    00010300000000
  NO LINE RECORDS FOUND IN TRACE FILE
END OF TRACE PRINT UTILITY
```


FIGURE 2

```
 IEF005I PARTITION WAITING FOR WORK P01
S NET.P1,,,(LIST=00,CONFIG=5A)
 IEF403I NET      STARTED TIME=12.06.12 P01
S VGTF.P0
 IEF403I VGTF     STARTED TIME=12.06.58 P00
*01 HHL100A  SPECIFY TRACE OPTIONS P00
 IST197I  SAVED CONFIGURATION APPCON0A READ FROM VTAMOBJ P01
 IST093I  APPCON0A ACTIVE P01
 IST197I  SAVED CONFIGURATION NCP52AF  READ FROM VTAMOBJ P01
 IST020I  VTAM INITIALIZATION COMPLETE P01
1,TRACE=USR,RNIO
 HHL103I  TRACE OPTIONS SELECTED --USR,RNIO P00
*02 HHL125A  RESPECIFY TRACE OPTIONS OR REPLY U P00
2,U
 HHL031I GTF INITIALIZATION COMPLETE P00
 IST270I  370X NCP52AF  NOW LOADED WITH LOADMOD NCP52AF  P01
 IST093I  NCP52AF  ACTIVE P01
V NET,ACT,ID=A023
 IST097I  VARY     ACCEPTED P01
 IST067I  VARY FAILED- A023     NODE ALREADY ACTIVE P01
V NET,ACT,ID=A3767PU
 IST097I  VARY     ACCEPTED P01
 IST093I  A3767PU  ACTIVE P01
V NET,ACT,ID=A3767LU
 IST097I  VARY     ACCEPTED P01
 IST093I  A3767PU  ACTIVE P01
F NET.P1,TRACE,TYPE=LINE,ID=A023
 IST097I  MODIFY   ACCEPTED P01
 IST513I  TRACE INITIATED FOR NODE A023     P01
F NET.P1,TRACE,TYPE=BUF,ID=A3767LU
 IST097I  MODIFIED ACCEPTED P01
 IST513I  TRACE INITIATED FOR NODE A3767LU  P01
F NET.P1,TEST
 IST097I  MODIFY   ACCEPTED P01
 ITA102I ISTOLTEP REL.2.0 INITIALIZATION IN PROGRESS P01
 ITA107I OPTIONS ARE NTL,NEL,NPP, FE,NMI, EP, CP, PR,NTR,NAP P01
*03 ITA105D ENTER DEV/TEST/OPT/ P01
3,A3767LU/T3700SNA/NFE/
 ITA158I  S T3700SNA UNIT 00AF A3767LU P01
 ITA158I  T T3700SNA UNIT 00AF A3767LU P01
 ITA107I OPTIONS ARE NTL,NEL,NPP,NFE,NMI, EP, CP, PR,NTR,NAP P01
*04 ITA105D ENTER DEV/TEST/OPT/ P01
R 04,A3767LU/T3700SNA/EXT=12ABCDEFGHIJKLMNOPQRSTUVWXYZ/
 ITA548I ISTOLTEP NO LONGER REQUIRES A3767LU P01
 ITA158I  S T3700SNA UNIT 00AF A3767LU P01
 ITA158I  T T3700SNA UNIT 00AF A3767LU P01
 ITA107I OPTIONS ARE NTL,NEL,NPP,NFE,NMI, EP, CP, PR,NTR,NAP P01
 ITA327I EXT=12ABCDEFGHIJKLMNOPQRSTUVWXYZ P01
*05 ITA105D ENTER DEV/TEST/OPT/ P01
5,CANCEL
 ITA548I ISTOLTEP NO LONGER REQUIRES A3767LU P01
F NET.P1,NOTRACE,TYPE=LINE,ID=A023
 IST097I  MODIFY   ACCEPTED P01
 IST512I  TRACE TERMINATED FOR NODE= A023    P01
F NET.P1,NOTRACE,TYPE=BUF,ID=A3767LU
 IST097I  MODIFY   ACCEPTED P01
 IST512I  TRACE TERMINATED FOR NODE= A3767LU P01
P P0
 HHL006I GTF ACKNOWLEDGES STOP COMMAND P00
 IEF404I VGTF     ENDED   TIME=12.18.41 P00
 IEF049I VGTF    ON DEVICE
 IEF005I PARTITION WAITING FOR WORK P00
 IEF868I     WTR WAITING FOR WORK
S PRINTGTF.P2
 IEF403I PRINTGTF STARTED TIME=12.19.19 P02
 IEF0741 SPOOL CRITICAL. READER SUSPENDED. QUEUE HELD. P02
 IEE332I          QUEUE HELD
*IEF075A  SPOOL  75 PER CENT ALLOCATED P02
*IEF075A  SPOOL  80 PER CENT ALLOCATED P02
 IEF404I PRINTGTG ENDED   TIME=12.20.30 P02
 IEF049I PRINTGTF ON DEVICE
 IEF049I PRINTGTF ON DEVICE 00E
 IEF868I     WTR WAITING FOR WORK
 IEF005I PARTITION WAITING FOR WORK  P02
Z NET
 IST097I  HALT     ACCEPTED P01
 IST133I  VTAM TERMINATION IN PROGRESS P01
 IST617I  DEACTIVATE IN PROGRESS FOR A3767PU  P01
 IST141I  NODE A3767PU NOW DORMANT P01
 IST105I  A3767PU  NODE NOW INACTIVE P01
PRT FILE 0715  FOR VS1TPA   COPY 01 NOHOLD
 IEF077A SPOOL NO LONGER CRITICAL. RELEASE QUEUE. START RDR.
 IEF868I 00E WTR WAITING FOR WORK
```

OS/VS SYSTEM CONSOLE OUTPUT (continued)

FIGURE 3

SECTION 11: NCP LINE TRACE

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11

DESCRIPTION

The line trace facility of VTAM allows a user to activate or deactivate the NCP trace of a particular line and to record the NCP trace records on the VTAM trace data set.

LINE TRACE (TYPE 1/2 SCANNER)

The Line Trace function is an optional diagnostic and debugging aid that stores certain fields from the interface control word (ICW) each time a level 2 interrupt occurs on a designated communication line. The line trace is activated and deactivated by network commands from the host. Only one line at a time may be traced. If a duplex line is being traced, there is an LTCB and buffer or buffer chain for both the receive leg and transmit leg. The NCP always transfers both the receive and transmit buffers to the host together (the transmit buffers follow the receive buffers).

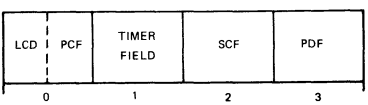
The following ICW fields are stored as a unit at each level 2 interrupt on the designated line :

* Line Control Definer (LCD)
* Primary Control Field (PCF)
* Secondary Control Field (SCF)
* Parallel Data Field (PDF)

If a type 1 communication scanner is installed, the fields are obtained from the bit control block (BCB) rather than the ICW.

Also stored with each unit is a one-byte timer field. It contains a hexadecimal value indicating in tenths of a second the time that elapsed between the activiation of the line trace and the level 2 interrupt represented by this unit. The value in this field wraps around to zero after 25,5 seconds have elapsed.

The diagnostic unit stored for each level 2 interrupt is four bytes long. It has the following format :



The units are stored in NCP buffers, allocated dynamically as the line trace progresses. These buffers are transferred to the host whenever one of two conditions is met : (1) the maximum number of buffers for the line trace (determined at NCP generation) is filled, or (2) a time interval specified

by the host expires. In both cases, the trace continues, using a new chain of buffers, until the host issues a command to terminate the trace.

Illustration of an SDLC line trace of the transfer of a Bind command from the NCP to a terminal, the NCP's poll for a response, and the terminal's response.

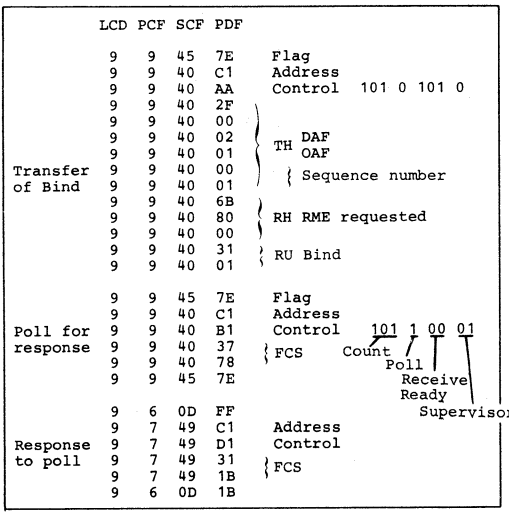


FIGURE 1

In the previous example the timer field has been deleted

SDLC Line Trace

Figure 1 illustrates an SDLC line trace of a polling sequence from the NCP to a programmable controller. Under the primary polling sequence and secondary response to polling are the trace fields. The sample has been formatted for illustration which is not the format of the normal trace entries.

LCD of 9 indicates an SDLC 8 bit byte length line. All of the illustrations show a value of 9 for the LCD. An LCD value of 8 indicates the monitor for flag which does not appear on the trace. A level 2 interrupt only occurs after a flag is received and the LCD value is now 9 indicating a flag was received.

The PCF value of 9, transmit normal, is used for sending the flag, address, polling, etc. In the polling response the PCF value is changed from 5 (Monitor flag) to 6 (Receive information - inhibit data interrupt). The data is inhibited because the flag character is not needed, only the recognition of the flag condition. From flag recognition the PCF state is set to 7 (Receive Information - allow data interrupts) until the next flag is received (PCF 6).

The SCF field is initially 45. The 4 indicates a service request interlock. If another character arrives before the interlock is cleared by character service the character overrun/underrun bit will also be set. The 5 indicates flag detection with zero insertion disabled to transmit a flag. The subsequent text transfers of the polling sequence do not have any bits set except the service request interlock (40). The end of the polling sequence requires a flag and the value is again 45.

The SCF field on the response to polling is 45 to indicate a service request interlock and flag detection. The second entry indicates the flag was received, and the 49 values during the transfer of the frame specify a receive signal detector and disable zero/insert control. The ending flag condition of the SCF is indicated by the 0D.

The PDF field value illustrates a 7E or FF on output, FF or the residual of 78 on input. The polling sequence of C1 (address), B1 (control) and 3778 (check characters) illustrate the text between frames. The response characters are C1 (address), B1 (control), 3778 (check characters) and the second 78 is residual PDF on the ending flag received (PCF 6).

LINE TRACE (TYPE 3 SCANNER)

Line trace for a type 3 scanner requires a host access method change to format the line trace data. Since the type 3 and type 2 scanner may reside together, the NCP notifies host access method via the Request/Response Unit (RU) whether character or buffer line trace data is contained in the PIU.

The NCP sets a flag in the ICW to inform the scanner that the line is a trace mode. On transmit operations for SDLC, the NCP inputs the BCC from the ICW on the interrupt following the line turnaround. In the case of SDLC receive operations, the normal procedure is for the scanner to store the BCC accumulation in the data buffer for 'I' format frames. When in trace mode the scanner treats all frames as 'I' format type so the BCC is stored in a buffer.

The status information consists of the following eight bytes of information :

```
* SCF                      ICW byte 0
* LCD/PCF                  ICW byte 2
* Extended PCF             ICW byte 16
* Status byte 1            ICW byte 14
* Status byte 2            ICW byte 15
* Timer field
* SDLC address character (BSC=0)
* SDLC control character (BSC=0)
```

Status information does not cross buffer boundaries. The data length is variable but data that crosses buffer boundaries gets a new count field in the next buffer.

STATUS	SCF	LCD	PCF	EPCF	STAT1	STAT2	TIME	ADDR	CNTL
	47	9	7	05	80	00	78	C1	91
	TEXT 3559								
STATUS	SCF	LCD	PCF	EPCF	STAT1	STAT2	TIME	ADDR	CNTL
	47	9	5	00	00	01	78	C1	51
	TEXT 0000								
STATUS	SCF	LCD	PCF	EPCF	STAT1	STAT2	TIME	ADDR	CNTL
	43	9	6	03	80	00	79	C1	91
	47	9	7	05	80	00	79	C1	91
	TEXT 3559								
STATUS	SCF	LCD	PCF	EPCF	STAT1	STAT2	TIME	ADDR	CNTL
	47	9	5	00	00	01	79	C1	51
	TEXT								

LCD (LINE CONTROL DEFINER)

The scanner uses the LCD field during transmit and receive operations to determine the position of the character within the parallel data and serial data fields. This field is also used during transmit operations to set up the proper PDF to SDF transfer and the proper SDF to PDF during receive operations.

SCANNER TYPE 2

LCD State X'8' (SDLC Monitor Flag) : This LCD state along with PCF State X'5' is set by the control program to monitor the received information for an SDLC flag sequence. For a description of what happens when a flag is detected, see PCF State X'5' in this section.

LCD State X'9' (SDLC 8 Bit Byte) : This LCD state is used for transferring SDLC 8-bit characters. This state must be set by the control program for transmitting on SDLC lines. When a character to be transmitted is sent to the PDF, the eight data bits must be placed into bits 0-7 of the PDF as shown below.

PDF bit positions 0 1 2 3 4 5 6 7

Character bits X1 X2 X3 X4 X5 X6 X7 X8

Characters received from the interface are in the same format when the scanner requests a character service interrupt. All address, control, and flag characters are 8-bit bytes.

This field is set by scanner hardware when a flag is detected in the received information while LCD state X'8' is set.

This is the only LCD state that can be set by the scanner. It is set by the scanner when a flag is received while LCD state X'8' is set.

SCANNER TYPE 3

LCD State X'9' : this state causes the Type 3 Scanner to block all characters into eight-bit bytes and to search for SDLC control characters (Flag, Abort, Idle).

PCF (PRIMARY CONTROL FIELD)

This field identifies the status of the communications line this ICW is controlling.

SCANNER TYPE 2

PCF State X'0' (No-Op) : This PCF state causes the type 2 Scanner to take no action (active or passive) upon subsequent scans. The scanner hardware can request a Type 2 Scanner L.2 interrupt and set this PCF state for an interface if it determines that new control information is required from the control program. This PCF state can be set by the control program ; however, no interrupt are generated by the interface.

PCF State X'1' (Set Mode) : This PCF state causes scanner to set and reset certain mode latches in the line interface hardware. These latches are specified the SDF field. When setting this PCF state, the control program must ensure the integrity of the entire ICW. This may be done by first setting the PCF to state X'0' (no-op) so that the ICW will not be modified by a possible interrupt. The SDF can than be set to the proper value. Finally, state X'1' (set mode) can be set into the PCF field. Execution of a set mode does not require a bit service request from the addressed interface. However, a bit service request must occur to allow the scanner to request a Type 2 Scanner L2 interrupt to end the set mode operation. The set mode operation ends when the scanner hardware sets the PCF state to X'0' (no-op).

A set mode can be executed to change the state of the data rate selector bit and the oscillator select bits without requiring a disable. However, data terminal ready must remain on.

PCF State X'2' (Monitor Data Set Ready) : This PCF state places the interface in a wait-for-incoming-call condition. For switched lines, this state should normally be set by the control program following a PCF State X'F' (disable) and PCF state X'1' (Set mode with data terminal ready bit = 1). When an interface is in this state, the Type 2 Scanner tests the 'data set ready' lead from the common carrier or IBM line adapter for an active condition when the ICW is fetched. When data set ready is on, indicating that a call is established, the Type 2 Scanner sets PCF state X'0' (No-Op) for start-stop or PCF state X'4' (monitor phase - data set ready check off) for binary synchronous transmission and requests an L2 interrupt.

Though not necessary, this state can also be used for leased lines. Data set ready should be on at the first bit service request when the interface is scanned.

PCF State X'3' (Monitor Ring Indicator or Data Set Ready) : This PCF state, when set by the control program, places the line interface in a wait-for-incoming call (ring indicator on) or wait-for-manual-call-out connection condition (data set ready on). This state must be preceded by setting PCF state X'F' (disable), or a set mode that resets data terminal ready. When the PCF state is set to X'3', the Type 2 Scanner tests the 'ring indicator' and 'data set ready' leads from the common carrier equipment for an active condition of either lead. When 'ring indicator' is active, a call is coming in and a pending connection is to be established. When either of these conditions occurs, the Type 2 Scanner sets PCF state X'0' (no-op) and places the line in a L2 interrupt pending state. This PCF state must be followed by PCF state X'1' (set mode) from the control program to set the 'data terminal ready' latch. After the Type 2 Scanner executes the set mode, it sets PCF X'0' (no-op) and places the line in a L2 interrupt pending state. The interrupt handling program must then place the line in PCF state X'2' (monitor data set ready on), after which the operation proceeds as described in PCF state X'2' - Monitor Data Set Ready.

PCF State X'4' (Monitor Flag - Block Data Set Ready Error) : This PCF state is identical to PCF state X'5' (monitor flag - allow data set ready error) except that the inactive condition of 'data set ready' does not signal a check condition.

PCF State X'5' (Monitor Flag - Allow Data Set Ready Error) : This PCF state is used in conjunction with LCD state X'8' to monitor for an SDLC flag after a half-duplex turnaround or after an inactive period on the communication channel. Each bit interval time, the SDF is shifted one bit and the counter located in ICW bits 34-36 is updated. The counter is used to detect the flag character. When a flag character is detected, the following actions are taken by the scanner :

* The contents of the SDF are zeroed out and a tag bit is inserted in the ICW
* The flag detection bit (ICW bit 5) is set on in the SCF
* The PCF state is set to X'6'
* The LCD state is set to X'9'
* A level 2 interrupt is requested.

The flag character is not transferred to the PDF and the service request bit (ICW bit 1) is not turned on.

PCF State X'6' (Receive Information - Inhibit Interrupts) : This state is entered when a flag is detected while in state X'4', X'5' or X'7'. During this state scanner monitors the receive data stream. Inserted zeros are deleted and 8-bit characters are assembled. If contiguous flags are received :

* Flag detection (ICW bit 5) is set in the SCF every character time
* Transfer from SDF to PDF is inhibited
* Service request (ICW bit 1) is not set
* No interrupt is requested.

When a non-flag character is assembled

* The PCF state is set to X'7'
* The character is transferred from SDF to PDF
* Service request (ICW bit 1) is set to initiate data transfer between the control program and the PDF.

PCF State X'7' (Receive Information - Allow Data interrupts) : This state can be entered from PCF state X'6' when a non-flag character is detected. This state is used in conjunction with LCD state X'9' to assembble consecutive bits into 8-bit SDLC characters. The scanner remains in this state until a flag sequence is detected, or until the state is changed by the control program. When a flag sequence is detected, the scanner changes to PCF state X'6' and requests a level 2 interrupt.

PCF State X'8' (Transmit Initial) : PCF state X'8' is used to initiate a transmit operation on an SDLC interface when the LCD is set to X'9'. This state disables the NRZI mode and forces to send data lead to a mark state as long as 'clear to send' is not active. When 'clear to send' becomes active, the NRZI mode and the 'send data' lead are allowed to operate normally.

If business machine clocking is used, the first characters transmitted must be X'00' (if using NRZI mode) or X'AA' (if not using NRZI mode) so that the remote clock can get in synchronization. If modem clocking is used, the two leading characters (X'00' or X'AA') are not required, and the first two characters and the tag bit should be set in the SDF and PDF.
When a flag is placed in the PDF for transmission, the disable zero insert control bit (ICW bit 7) must be turned on by the control program. When the type 2 Scanner begins transmission ('clear to send' on), the scanner hardware changes the PCF state to X'9' (transmit data).

Note : When operating on a half-duplex line, the control program should not set the PCF state to X'8' until ICW bit 4 (receive line signal detector) is turned off.

PCF State X'9' (Transmit Normal) : This PCF state is set by the Type 2 Scanner after completion of PCF state X'8'. Data is transmitted in this state until one of the transmit turnaround states (PCF X'C' or X'D') is set by the control program.
During transmission of characters over the SDLC line, the control program must maintain the proper state of the LCD. For example, when a flag character is placed into the PDF, the LCD must be set to X'9' and ICW bit 7 (disable zero

insert control) must be set to 1. This allows transmission of more than five consecutive 1 bits for control purposes. For non-flag characters the disable zero insert control bit must be off.

PCF State X'A' (Transmit Data with New Sync) : This state is identical to PCF state X'9' (transmit data) except that the 'new sync' line to the modem equipment is active. It must be used only with 4-wire duplex, multipoint leased-line modem equipment where the associated interface is designated as the master station. The control program must change PCF state X'A' to PCF state X'9' (transmit data) in the character service routine that places the last character to be transmitted into the PDF.

PCF State X'C' (Transmit Turnaround - Request to Send Off) : This PCF state is set by the control program on the interrupt following the interrupt that placed the last flag character to be transmitted into the PDF. While bits are being transmitted, this state is the same as PCF state X'9'. When the character is completely transmitted, request to send is reset along with the transmit mode talch in the interface hardware.

PCF State X'D' (Transmit Turnaround - Request to Send On) : This PCF state is set by the control program when the ending flag character for a message is placed in the PDF and the disable zero-insert control bit (7) is set on. In this state, the scanner transfers the flag character from the PDF to the SDF and sets the flag detection/disable zero insert remembrance bit (5) to the current state of the disable zero-insert control bit (7) every flag character transfer. Continuous flag characters will be serialized to the LIB without further interrupts until PCF state X'D' is ended by the control program.

The control program normally ends this state by setting PCF state X'9'. When changing from PCF state X'D' to PCF state X'9', the first character to be transmitted in the X'9' state is loaded into the PDF and the disable zero-insert control bit (7) is reset if that character is not a flag. Subsequent characters are supplied by normal data servicing requests.

Programming note : When changing from state X'D' to state X'9', the program should check that the zero insert remembrance bit (5) is 1 to ensure that at least one flag character has been sent since X'D' was set.

PCF State X'F' (Disable) : This state is set by the control program and causes the Type 2 Scanner to turn off data terminal ready. A disable resets all control information in the line that was provided by the last set mode (PCF State X'1'). The scanner hardware then causes the interface to be placed in an interrupt pending state when the 'data set ready' lead and the 'receive line signal detector' lead are deactivated. For auto-dial applications, other conditions on the automatic calling unit must be satisfied before another dial operation can be attempted. Before the interrupt is requested, PCF State X'0' (no-op) is set by the scanner. Because all control information in the line set is reset, the control program must set up the proper control information again by a set mode (PCF state X'1') in the interrupt after the disable.

SCANNER TYPE 3

The type 3 scanner has an extended PCF which is used in conjunction with the normal PCF.

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PCF State X'0' (no-Op). This PCF state causes the Type 3 Scanner to take no action (active or passive) upon subsequent scans. The scanner hardware can request a Type 3 Scanner L2 interrupt and set this PCF state for an interface if it determines that new control information is required from the control program. This PCF state can be set by the control program; however, no interrupts are generated by the interface.

PCF State X'1' (Set Mode) : This PCF state causes the scanner to set and reset certain mode latches in the line interface hardware. These latches are specified by the SDF field. When setting this PCF state, the control program must ensure the integrity of the entire ICW. This may be done by first setting the PCF to state X'0' (no-op) so that the ICW will not be modified by a possible interrupt. The SDF can then be set to the proper via Output X'46'. Finally, state X'1' (set mode) can be set into the PCF field. Execution of a set mode does not require a bit service request from the addressed interface. However, a bit service request must occur to allow the scanner to request a Type 3 Scanner L2 interrupt to end the set mode operation. The set mode operation ends when the scanner hardware sets the PCF state to X'0' (no-op).

A set mode can be executed to change the state of the data rate selector bit and the oscillator select bits without requiring a disable. However, 'data terminal ready' must remain on.

PCF State X'2' (Monitor Data Set Ready) : This PCF state places the interface in a wait-for-incoming-call condition. For switched lines, this state should normally be set by the control program following a PCF state X'F' (disable) and a PCF State X'1' (set mode with data terminal ready bit = 1). When an interface is in this state, the Type 3 Scanner tests the 'data set ready' lead from the common carrier or IBM line adapter for an active condition when the ICW is fetched. When data set ready is on, indicating that a call is established, the Type 3 Scanner sets PCF state X'4' (monitor phase data set ready check off) and requests an L2 interrupt.
Though not necessary, this state can also be used for leased lines. Data set ready should be at the first bit service request when the interface is scanned.

PCF State X'3' (Monitor Ring Indicator or Data Set Ready) : This PCF state, when set by the control program, places the line interface in a wait-for-incoming-call (ring indicator on) or wait-for-manual-call-out connection condition (data set ready on). This state must be preceded by setting PCF state X'F' (disable), or a set mode that resets data terminal ready. When the PCF state is set to X'3', the Type 3 scanner tests the 'ring indicator' and 'data set ready' leads from the common carrier equipment for an active condition of either lead. When 'ring indicator' is active, a call is coming in and a pending connection is to be established. When either of these conditions occurs, the

Type 3 Scanner sets PCF state X'0' (no-op) and places the line in a L2 interrupt pending state. This PCF state must be followed by PCF state X'1' (set mode) from the control program to set the 'data terminal ready' latch. After the Type 3 Scanner executes the set mode, it sets PCF state X'0' (no-op) and places the line in a L2 interrupt pending state. The interrupt handling program must then place the line in PCF state X'2' (monitor data set ready on), after which the operation proceeds as described in PCF state X'2' - Monitor Data Set Ready.

PCF State X'4/PECF State X'0' (Monitor Phase - Data Set Ready (check off) : This PCF state is identical to PCF state X'5' except that the inactive condition of 'data set ready' does not signal a check condition. PCF X'4' is intended to initialize the first receive operation after a switched network call connection has been established.

PCF/EPCF State X'5'/'0' (Monitor Flag - Allow Data Set Ready Check) : This state is used in conjunction with LCD state X'9' to monitor received data for an SDLC flag character. To do so, the scanner uses the three low-order bits of the ones counter (ICW bits 4.2.4.4.). Upon detecting a flag character, the scanner sets a tag bit in the SDF to block the next character into eight bits and enters PCF/EPCF state X'6'/'1'. If diagnostic bit 1 is set, the PCF/EPCF state is instead changed to X'7'/'C'.

PCF State X'6' (Receive Initiated) : The Type 3 Scanner sets this state upon receiving a flag. In this state the scanner receives the address (A) control (C), and first two data characters. The scanner examines the control character to determine whether the frame is information or supervisory. If the frame is information, the scanner stores the data. (Normally, the control program has a two-byte area set up to receive the A and C characters; when these are stored, the scanner makes a level 2 interrupt to obtain a data buffer). If the scanner does not receive four characters, the length check (ICW bit 14.7) and the OEM (ICW bit 0.5) or Abort Detect (ICW bit 0.0) bit is set and a level 2 interrupt is made.

If the frame is supervisory, on the other hand, the scanner waits for the two BCC characters and the flag that follow the control character before storing the A and C characters. If the Flag or Abort occurs before the fifth character is received in the PDF array, the scanner returns to monitoring for the flag character and does not set any error bits in the ICW. If the fifth character (not including the initial flag) is not a flag, the scanner sets the Control exception bit (ICW bit 15.0) and continues to receive data as if the frame being received were an information frame. If ICW bit 14.5 is off, the scanner adjusts the number of bytes expected to accomodate two control (C) characters.

PCF/EPCF State X'6'/'1' (Receiving flags) : In this state, the scanner has received one or more consecutive flag characters. If the character assembled in the SDF is a flag, the scanner remains in this state. The first non-flag character it receives causes the scanner to changethe state. Unless an abort condition is detected, the state becomes X'6'/'2' (Receive address) the character in the SDF is transferred to the PCF and the BCC is accumulated.

PCF/EPCF State X'6'/'2' (Received Address) : In this state, the scanner has received the address character and the control character is currently being received into the SDF. When the character is assembled in the SDF, the scanner changes to PCF/EPCF state X'6'/'3' (Receive Control), transfers the contents of the SDF to the PDF and accumulates the BCC. The scanner interrogates the control byte and if an information (I) frame is indicated, sets sequence bit 1 (ICW bit 13.1) and increments the cycle steal message counter (ICW bits 13.6-13.7), allowing cycle steal operation to be activated. If a supervisory (S) frame is indicated, the scanner waits for an ending flag character before allowing cycle steal operation to begin. If a flag character or an abort condition is detected, the scanner does not set sequence bit 1 or increment the message counter.

The scanner decrements the PDF pointer by one, erasing the A character, and sets the PCF/EPCF state to X'6'/'1' (if a flag character was received) or X'5'/'0' (if an abort condition was detected).

PCF/EPCF State X'6'/'3' (received Control) : The scanner enters this state from state X'6'/'2'. In this state the scanner has received the control character and the next character expected is either data or the first BCC character. (If ICW bit 14.5 is on, indicating that two control characters are expected, sequence bit 0 is set upon entering this state and the second control character is received before the PCF/EPCF changes to a new state). After the character is assembled in the SDF, the scanner changes to state X'6'/'4' (receive data/BCC) with sequence bit 0 on unless a flag character or an abort condition is detected. The scanner transfers the contents of the SDF to the PDF and accumulates the BCC characters.
Upon detecting a flag character, the scanner sets PCF/EPCF state X'6'/'1'. If sequence bit 1 is off (indicating a supervisory frame), the PDF array pointer is decremented to erase the 'AC' characters from the PDF array. If sequence bit 1 is on, the scanner sets end-of-message and length check indicators (ICW bits 0.5 and 14.7) into a control byte in the PDF array for a level 2 EOM interrupt request.
Upon detecting an abort condition, the scanner sets PCF/EPCF state X'7'/'3' (if sequence bit 1 is on) or X'5'/'0' (if sequence 1 is off) and adjusts the PDF array pointer to erase the 'AC' characters.

PCF/EPCF State X'6'/'4' (Received Data 1 and 2) : the scanner enters this state from state X'6'/'3'. In this state, when sequence bit 0 is on, the scanner has received the first data or BCC character and expects as the next character the second data or BCC character. Upon receiving that character, sequence bit 0 is reset, the received character is written in the PDF array, and BCC is accumulated. Following this, the next character expected is a flag (for a supervisory frame) or data (for an information frame).
Receipt of a flag character if ICW bit 13.1 is off because the PDF pointer to be decremented by two (this erases the BCC characters from the PDF array) and sets sequence bit 2 (ICW bit 13.3). This bit causes checking of the BCC accumulation at the next bit service time, writes an EOM control byte with the BCC result into the PDF array, increments the message counter, sets sequence bit 1, and changes the PCF/EPCF state to X'7'/'4'.
Receipt of a data character causes the scanner to write the character into the PDF array, accumulate BCC, and change to state X'7'/'4'.

Upon detecting an abort condition, the scanner enters PCF/EPCF state X'7'/'3' if sequence bit 1 is on. If sequence bit 1 is off, the scanner enters state X'5'/'0' and decrements the PDF pointer to erase the characters received, beginning with the 'A' character.

PCF State X'7' (Received Data) : In this state, the Type 3 Scanner is receiving information (I) frames. Data is stored under cycle steal control. If the cycle steal byte count reaches zero or the scanner detects a flag character in the received data, the scanner generates a level 2 interrupt. The scanner must receive an ending flag or detect a line idle condition to leave this PCF state.
PCF/EPCF State X'7'/'3' (Received Abort) : In this state, the scanner has received an Abort character between the starting and ending flag character or a line idle condition. If the scanner detects a flag character, the PCF/EPCF state changes to X'7'/'5' (received ending flag) ; if it detects an idle condition, the PCF/EPCF state changes to X'5'/'0' (monitor flag). In either case the scanner also sets end-of-message (ICW bit 0-5) and makes a level 2 interrupt. The abort bit (ICW bit 0.0) is also set and in the case of an idle condition -ICW bit 14.1 is set.

PCF/EPCF State X'7'/'4' (Received Data) : In this state, the scanner is receiving message data (other than flag or abort characters). The data is transferred from the SDF to the PDF array and the BCC is accumulated. The PCF/EPCF state does not change while consecutive data characters are being received. If the scanner detects a flag character, the state changes to X'7'/'5' (received ending flags0 or X'6'/'1' (received flag). If either case the scanner sets the OEM bit (ICW bit 0.5) and makes a level 2 interrupt request. If the scanner receives an abort character, the PCF/EPCF state changes to X'7'/'3' (received abort).

PCF/EPCF State X'7'/'5' (Receive ending flag) : In this state, the scanner has received an ending flag character. When the character is assembled in the SDF, the scanner changes state to X'6'/'1' (received flag) if a flag has been received or to X'7'/'7' if an abort character has been received. If the received character is neither a flag nor an abort character, the state changes to X'6'/'2' (received address) ; in this case, the contents of the SDF are transferred to the PDF and the BCC is accumulated.

PCF/EPCF State X'7'/'7' (Receive Idle) : This state is entered by the scanner either when the scanner detects an abort character following a good message or when the control program places the scanner in this state. The program uses this state to monitor received data for flag or idle characters. Upon detecting a flag, the state changes to X'6'/'1' (received flag). Upon detecting an idle character (when ICW bit 15.3 is on), the scanner changes state to X'5'/'0' (monitor flag) and requests a level 2 interrupt.

PCF/e2EPCF State X'8'/'0' (Transmit Initial) : This state is set by the control program to initiate text transmission. The program must initialize the following ICW fields :

* Transmit control (ICW byte 15)
* LCD (ICW byte 2)
* PCF/EPCF (ICW bytes 2 and 16)
* The low order cycle steal address (ICW byte 9)

* The cycle steal control (ICW byte 6) and cycle steal byte count (ICW byte 7). The cycle steal valid bit (ICW bit 6.5) must be set in order for the scanner to initiate a text transmission.

This state may also be used in transmitting a supervisory frame by writing the 'AC' characters into the PDF array with an Output X'4D' instruction ; the cycle steal address (ICW byte 9) and cycle steal control (byte 6) need to be set.

PCF State X'9' (Transmit Data) : This PCF state is used to transmit message data and control characters, the specific kinds of characters being specified by the EPCF states. The scanner enters this state from PCF state X'8'/'0' when the 'clear to send' line of modem becomes active.

PCF/EPCF State X'9'/'0' (Transmit Pad) : In this state the scanner serializes the leading Pad character from the serial data field (SDF) to the line adapter. The address and control bytes are in the PDF array awaiting transmission. Any data to be transmitted is also in the PDF array. At the time the next character is transferred the scanner takes places a clock sync or flag character in the SDF and changes the PCF/EPCF state.

PCF/EPCF State X'9'/'1' (Transmit Clock Sync) : In this state the scanner serializes the clock sync character from the SDF to the line adapter. After the sync characters are transmitted, the scanner places a flag character in the SDF and changes the PCF/EPCF state.

PCF/EPCF State X'9'/'2' (Transmit Flags) : In this state the scanner serializes the clock sync characters from the SDF to the line adapter. After the sync characters are transmitted, the scanner places a flag character in the SDF and changes the PCF/EPCF state.

PCF/EPCF State X'9'/'2' (Transmite Flags) : In this state the scanner serializes consecutive flag characters until a data character is available in the PDF for transmission. The scanner then places that character in the SDF, resets the BCC accumulation, accumulates a new BCC for that character, and changes the PCF/EPCF state. Zero bit insertion is inhibited in this state.

PCF/EPCF State X'9'/'3' (Transmit Abort) : This state is entered if the scanner is to transmit an abort sequence. After transmitting the abort sequence the scanner places a flag character in the SDF, aborts transmission of the current message, sets appropriate error flags in the ICW, changes the PCF/EPCF state to X'9'/'2' to send consecutive flags characters, and makes a level 2 interrupt request.

The scanner transmits an Abort sequence if the ICW control bits indicate that more data is to be transmitted but the PDF array is empty. This condition also sets the underrun bit (ICW bit 0.2). Zero bit insertion is inhibited in this state.

PCF/EPCF State X'9'/'4' (Transmit Data) : In this state the scanner transmits message text. The scanner transfers each character from the PDF array to the SDF, from which it is serialized to the line adapter. When the cycle steal byte count reaches zero and the data chain flag (ICW bit 6.6) is

on, the scanner makes a level 2 interrupt request to obtain the next buffer. If the data chain flag is not on (indicating that no more data blocks are to be sent), the scanner continues to transfer characters from the PDF array to the SDF until the PDF array is empty. At the next character transfer time the scanner places the first BCC character in the SDF and changes the PCF/EPCF state. Zero bit insertion is active in this state.

PCF/EPCF State X'9'/'5' (Transmit Ending Flag) : This flag is entered after the BCC characters are serialized, the ending flag has been placed in the SDF, and the need for a line turaround is indicated by ICW bit 15.7. When leaving this state, the scanner places a two-or aight-bit pad of 1 bits in the SDF, as indicated by ICW bit 15.6. Zero bit insertion is inhibited in this state.

PCF/EPCF State X'9'/'6' (Transmit BCC) : In this state the scanner serializes the two BCC characters from the SDF to the line adapter. After this is completed, an ending flag character is placed in the SDF and the PCF/EPCF state is changed. Zero bit insertion is active in this state.

PCF/EPCF State X'9'/'7' (Transmit Idle) : In this state the scanner transmits continuous line idle characters (all one bits) if line turnarounc is not specified by ICW bit 15.7 (line turnaround after transmission). If ICW bit 15.7 does specify line turnaround, the scanner transmits two or eight consecutive one bits before changing its state to X'5'/'0'. The two bits serialized from the SDF to the line set ensure that the modem has transmitted an ending flag bit before a line turaround occurs. Zero bit insertion is inhibited in this state.

PCF State X'A' (Transmit Initial with New Sync) : This state is identical to PCF state X'8' (transmit initial) except that the new sync interface lead to the modem will be controlled according to the setting of ICW bit 16.0. (The scanner sets and resets this bit). This state must be used only with four wire, duplex multipoint leased-line modems where the associated interface is the master station. All of the EPCF states described for PCF state X'8' are valid for PCF state X'A'.

PCF State X'B' (Transmit Data with New Sync) : This state is identical to PCF state X'9' (transmit data) except that the new sync interface lead to the modem is activated when the address (A) character is transmitted and deactivated when the second BCC character is transmitted. ICW bit 16.0 (set and reset by the scanner) controls the activation of the new sync lead. This state must be used only with four-wire, duplex, multipoint leased-line modems where the associated interface is the master station. All of the EPCF states described for PCF state X'9' are valid for PCF state X'B'.

PCF State X'C' (reserved)

PCF State X'D' (reserved)

PCF State X'E' (Transmit Continuous) : The control program can use this state to transmit the same character continuously. Before setting this state, the program must set the SDF via an Output X'46' instruction and the PDF via an Output X'44' instruction (bit 0.4 must be on to allow writing in the PDF). The scanner activates the 'request to

writing in the PDF). The scanner activates the 'request to send' (RTS) lead to the modem. When the modem signals 'clear to send' (CTS), the scanner sets sequence bit 0 and transfers the SDF content serially by bit to the line set. At each character transfer time, the character in the PDF is transferred to the SDF to be serialized. The PDF pointer is not incremented. The control program must change this state to end the continuous transmission.

PCF State X'F' (Disable) : The control program sets this state to cause the Type 3 scanner to turn off the 'data terminal ready' lead to the modem. A disable command resets all control information that was provided by the last Set Mode Instruction (PCF state X'1'). The scanner then causes the interface to be placed in an interrupt pending state when the 'data set ready' lead and the 'receive line signal detect' lead are deactivated. For Auto Call applications, other conditions on the automatic calling unit must be satisfied before another dial operation can be attempted following the Disable. The Scanner sets PCF state X'0' (no-op) before requesting the interrupt. Because all control information in the line set is reset, the control program must set the proper control information in the line set via a Set Mode instruction (PCF state X'1') issued after the Disable command.

STATUS BYTE 1

Bit 14.0 (Receive Line Signal Detected) : The type 3 scanner sets this bit to 1 at bit service time when the CD (carrier detect) lead from the modem is active and is reset when the CD lead becomes active.

Bit 14.1 (SDLC Idle Detect) : For SDLC receive operations the Type 3 Scanner sets this bit upon detecting an idle-line condition while receiving a frame. ICW bit 0.0 (Abort Detect) is also set in this case. Bit 14.1 is also set if the scanner is in PCF/EPCF state X'7'/'7', ICW bit 15.3 is on, and an line-idle condition is detected. A level 2 interrupt request is also generated,
This bit is unused for SDLC transmit operations.

Bit 14.3 (Data Check) : This bit is set on by the Type 3 Scanner upon detecting a bad BCC character in the received data stream. If this bit is on, ICW bit 0.1 is reset.

Bit 14.4 (Flag Off Boundary) : For SDLC, this bit is set when a flag byte detected in received data is not on a character boundary. If this bit is on, ICW bit.0 is reset.

Bit 14.5 (2 control characters) : For SDLC, the control program sets this bit to indicate to the Type 3 Scanner to expect multiple control (C) bytes. When this bit is on, the scanner expects two control bytes to follow the address (A) byte.

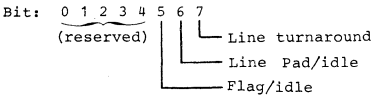
Bit 14.7 (Length Check) : For SDLC, the Type 3 Scanner sets this bit upon detecting an ending flag after the address and control (AC) characters are received but before two more characters have been received.

STATUS BYTE 2

The Type 3 Scanner uses the status indicators in byte 15 of the ICW to determine the appropriate control sequences to send during a transmit operation. During a receive operation, the scanner uses these indicators to inform the control program what control characters were received.

Transmit

The format of the status byte for SDLC transmit operation is :



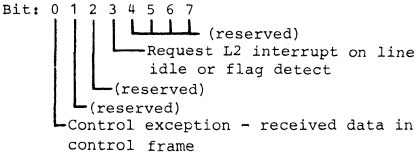
Bit 5 : When set (1), this bit causes the scanner to transmit continuous flag characters at the end of the frame if bit 7 is not set to cause the line to turn around. When reset (0), this bit causes the scanner to assume a line idle state after sending the ending flag after a frame.

Bit 6 : When set (1), this bit causes the scanner to send an all-1s character (8 consecutive 1's) before turning the line around if bit 7 is set to cause line turnaround.

Bit 7 : When set (1) this bit causes the scanner to turn the line around (that is, change from a transmit to a receive state) after it transmits the ending flag character.

Receive

The format of the status byte for SDLC receive operations is :



Bit 0 : The scanner sets this bit when a control (C) frame was indicated by the C byte but the flag character was not received three bytes afterward.

Bits 1 and 2 : (reserved)

Bit 3 : The control program sets this bit to request that the scanner make a level 2 interrupt request if the receive line assumes an idle state or a flag character is detected.

The secondary control field is used as a sense, status, and operation modifier field between the control program and the communication scanner, it is an eight bit field.

SCANNER 2 TYPE 2

SCF bit 0 - Abort : The type 2 scanner sets this bit to 1 when it detects seven consecutive 1 bits in the received data stream while the PCF state is X'6' or X'7'. If this bit is 1, the service request interlock (ICW bit 1) is forced to 0. Bit 0 must be reset by the control program using an Output X'44' instruction.
This bit has no significance during a transmit operation.

Note : A transmitted abort sequence consists of eight contiguous 1 bits. However, if the scanner detects seven contiguous 1 bits while receiving data, it will set the abort bit (ICW bit 0) to 1.

SCF bit 1 - Service Request Interlock : This bit is set when the type 2 scanner detects that data transfer or control servicing is required between the control program and the 'parallel data field'. The control program must reset this bit after the interrupt is honored and all bits or bytes of the ICW have been modified. If this bit is already set when the scanner is prepared to set it on, and the PCF state is X'7' through X'A', a character overrun/underrun flag is set (ICW bit 2).

The scanner is prevented from setting this bit if an SDLC flag or SDLC abort is detected. This bit is reset by detection of SDLC abort. If this bit is 1, the abort 1 character overrun/underrun, and modem check bits are 0.

SCF bit 2 - Character overrun/underrun : this bit is set when the type 2 scanner attempts to set the service request interlock (ICW bit 1) and finds it already set. This error is normally caused by an instantaneous peak overload situation. Errors of this type should not occur in the average installation and should not occur only infrequently in high throughput installations.
If a character overrun occurs, the next character received is placed into the PDF field overlaying the character that was to have been serviced. Thus, if an overrun occurs, a character is lost.
In the event of an overrun, the same character is transmitted until the program changes the PDF field to another character or the primary control field to another character or the primary control field is changed from the transmit state.
If this bit is 1, the service request interlock (ICW bit ±0 is 0.
If the PCF state is X'7' and the flag is detected at other than the predicted position, this bit is set to one.

SCF Bit 3 - Modem Check : During each bit interval (bit service time), the type 2 scanner checks the line interface for the proper modem conditions. This bit is set to 1 to indicate the following conditions :

1. The 'data set ready' line is inactive when the PCF field of the ICW is in states X'5', X'7', X'8', X'9', X'A', X'B' or X'D'.
2. The 'clear to send' line is inactive when the PCF field of the ICW is in states X'9', X'A', X'B', or X'D'.

SCF bit 4 - Received line signal detector : This bit is sent when the line interface indicates that the data communication equipment is receiving a carrier signal that meets its requirements for receiving data. The program has no control over this bit.

SCF Bit 5 - Flag Detection/Disable Zero Insert Remembrance : During a receive operation (LCD X'8' or X'9'), this bit is set to 1 when the scanner detects a flag character in the received data. An interrupt request may be set by a change of the PCF state due to detection of the flag. This bit must be reset to 0 by the control program when the scanner is in a receive operation.

During a transmit operation, this bit is set to 1 as a character is being transferred from the PDF to the SDF, provided ICW bit 7 is set to 1. ICW bit 5 set to 1 prevents insertion of a zero after five contiguous 1 bits are transmitted. If ICW bit 7 is 0, ICW bit 5 is set to 0 as a character is transferred from the PDF to the SDF. With ICW bit 5 set to 0, a 0 bit is inserted into the data stream after five contiguous 1 bits are transmitted.

SCF bit 6 - Program Flag : This bit provides a flag in the ICW that can be used by the program.

SCF bit 7 - Disable Zero Insert Control : For a transmit operation, this bit should be turned on by the control program at the same time a flag or an abort character is set into the PDF. When this bit is 0, the scanner inserts a 0 bit into a transmitted character after five 1 bits, and the sixth bit transmitted is not changed.
As a character is transferred from the PDF to the SDF for transmission, the state of ICW bit 7 is transferred to ICW bit 5. This bit has no significance during a receive operation.

SCANNER TYPE 3

SCF bit 0.0 - Abort Detected : The Type 3 Scanner sets this bit to 1 when it detects seven consecutive 1 bits in the received data stream while the PCF state is X'6' or X'7'. If this bit is 1, the service request interlock (ICW bit 0.1) is forced to 0. Bit 0 must be reset by the control program using an Output X'44' instruction.
This bit has no significance during a transmit operation.

Note : A transmitted sequence consists of eight consecutive 1 bits. However, if the scanner detects seven consecutive 1 bits while receiving data, it will set the abort bit (ICW bit 0.0) to 1.
SCF bit 0.1 - Normal Service Request interlock : This bit is set when the type 3 scanner detects that buffer servicing or control servicing is required between the control program and the addressed ICW. The control program must reset this bit after the interrupt is honored and all bits or bytes of the ICW have been modified. If this bit is already set when

the scanner is prepared to set it on, and the scanner is in a transmit or receive state, a character overrun/underrun flag is set (ICW bit 0.2).
If this bit is 1, ICW bits 0.0, 0.2, 0.3, 14.1, 14.4, 14.6 and 14.7 are 0. Programming notes :

1. The control program should reset the normal service request interlock before setting the PCF state to monitor modem or autocall unit control lines.
2. For level 2 interrupt routines that change the cycle steal address and count, the cycle steal valid bit should be set before the normal service request interlock is reset.
3. An Output X'44' instruction that resets the normal service request interlock and/or EOM bits should be the last Output instruction executed for the scanner in program level 2.

SCF bit 0.2 - Character Overrun/Underrun : This bit is set when the Type 3 scanner attempts to set the service request interlock (ICW bit 0.1) and finds it already set. This error is normally caused by an instantaneous peak overload situation. Errors of this type should not occur in the average installation and should occur only infrequently in high-throughput installations.

If a character overrun occurs, the next character received overlays the previously received character in the PDF array. Thus, one or more characters are lost. When this occurs, the flush bit (ICW bit 14.2) is set, the PDF array is reset, and all subsequent data received is discarded until an ending sequence is received. At that point, the EOM bit (0.5) and the character overrun/underrun bit (0.2) are set.
If an underrun occurs (possible only on an SDLC transmit line), an Abort character is transmitted and the EOM and overrun/underrun bits are set.
An underrun conddition cannot occur on a BSC line because the scanner automatically transmits SYN characters (non-transparent text) or DLE SYN sequences (transparent text) until the control program sets up another cycle steal operation.
If this bit is 1, the service request interlock (ICW bit 0.1) is 0.

SCF bit 0.3 - Modem Check : During each bit interval (bit service time), the type 3 scanner checks the line interface for the proper modem conditions. This bit is set to 1 to indicate the following conditions :

1. The 'data set ready' line is inactive when the PCF field of the ICW is in states X'5', X'6', X'7', X'8', X'9', X'A', or X'B'.
2. The 'clear to send' line is inactive when the PCF field of the ICW is in states X'9' or X'B'.
   If this bit is 1, the service request interlock (ICW bit 0.1) is 0.

SCF bit 0.4 - Not Level 2 bid : This bit is set whenever an Output X'44' instruction is executed, regardless of the contents of the register specified by R. It is reset by the type 3 scanner when a level 2 bid is accepted by the interrupt priority register of the type 2 Attachment Base. When reset, this bit prevents the type 3 scanner from making another level 2 interrupt request for the line.

SCF bit 0.5 - End-of-Message interrupt : This bit is set to 1 byt the type 3 scanner to indicate the end of a received or transmitted message. If both this bit and bit 0.1 are 1, the receive or transmit operation ended normally. The operation ended abnormally if both this bit and bit 0.0, 0.2, 0.3, 14.1 14.3, 14.4 , 14.6 or 14.7 are 1.

During an SDLC receive operation, the scanner sets this bit after storing the received data and checking the block check characters (BCC). During an SDLC transmit operation, the scanner sets this bit after sending an ending control character.

SCF Bit 0.6 - Program Flag : This bit provides a flag in the ICW that can be used by the control program for any desired purpose. It is not used by the scanner.

SCF Bit 0.7 - Line Trace Active : The control program sets this bit to indicate to the scanner that the line represented by the ICW is to be traced.

PDF (PARALLEL DATA FIELD)

This eight bit character buffers the data between the control program and the serial data field.

ACTIVATING/DEACTIVATING NCP LINE TRACES

DOS/VS

```
{MODIFY} NET, {TRACE   },TYPE=LINE, ID=Line name
{F     }      {NOTRACE}
```

OS/VS

```
{MODIFY} PROCNAME, {TRACE   } ,TYPE=LINE,ID=Line name
{F     }           {NOTRACE}
```

ADDRESS TRACE

11

Address trace is a service aid by which the contents of selected areas of communications controller storage and selected external registers can be recorded at each successive interrupt. Certain types of interrupts, or all successive interrupt. Certain types of interrupts, or all interrupts can be designated. The Network Control Program records the trace data in a trace table within control storage. When the desired data has been recorded, the contents of the trace table can be displayed on the control panel 1 of the controller. The contents of controller storage can be transferred to the host processor via the Dump program and the contents of the trace table examined in the listing of the dump.

The TRACE operand of the BUILD macro specifies whether the address trace option is to be included in the network control program, and specifies the size of the trace table.

The address trace function is performed only for lines operating in network control mode.

Address trace is activated or deactivated by the 3704/3705 control panel for the user specified storage address or external register. The instructions for operating address trace can be found in the IBM 3704 Communications Controller Control Panel (GA27-3086) or the IBM 3705 Communications Controller Control Panel (GA27-3087).

The Trace table can be displayed via the control panel, dynamic dump, or storage dump. To locate the trace table, see the Address Trace Block (ATB) in the IBM 3704 and 3705 Program Reference Handbook (GY30-3012). The sequence to locate the trace table is as follows :

a. Storage address X'7D8' is the fullword address of the Extended Halfword Direct Addressables (HWE).

b. At HWE plus 8 is a halfword address of the Address Trace Block (ATB).

c. at ATB plus X'14' is the shifted address of the last entry of the trace table.

e. At ATB plus X'12' is the shifted address of the current (last used) entry in the trace table.

The trace entries can be analyzed by starting at the current entry plus one, the oldest entry. From the oldest entry the events are consecutive with a wrap from the last table entry to the first table entry.

The address trace facility allows the user to select any combination of up to four external registers, general registers, and storage halfwords whose contents are to be recorded each time data is loaded from or sorted into a specified storage address at a specified program level.

Figure 2 illustrates the Address Trace Block (See next page)

ADDRESS TRACE BLOCK

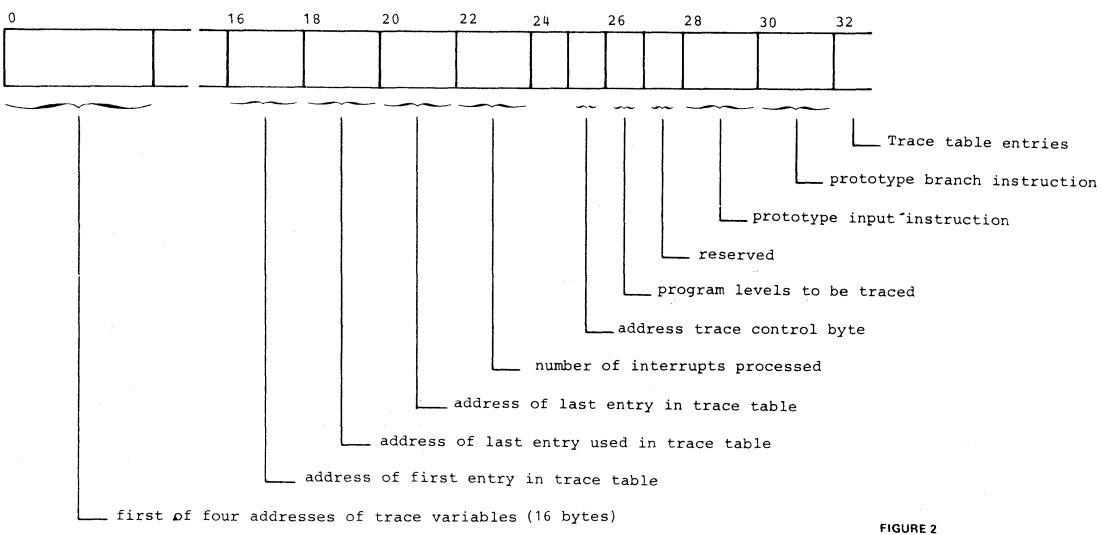


FIGURE 2

CHANNEL ADAPTER TRACE

11

The channel adapter trace is an optional diagnostic and debugging aid that stores certain fields from the Channel Control Block (CHB) of a type 2/3 channel adapter or the Channel Operation Block (COB) of a type 1 channel adapter into a trace table. The trace is included in the system by reassembling SYSCG006 of stage 2 generation specifying the TRACE operand. The TRACE operand specifies the number of trace entries desired in the Channel Adapter Trace table (maximum of 256). An entry is placed into the table for each level 1 and level 3 interrupt relating to the channel. After the last entry in the table is used, succeeding entries overlay the previous entries, beginning with the first. The trace table can be examined in a storage dump by locating CXCAIO53 (type 1 channel adapter) or CXCA1054 (type 2/3 channel adapter) in the dump listing. The trace table prefix is 24 bytes. Each entry is 32 bytes. The format of the trace is illustrated below with the detail of the each trace entry in the IBM 3704 and 3705 Program Reference Handbook (GY30-3012) under Channel Adapter Trace Table.

The trace table should not be included in the regular production system. If the trace is included, it is automatically active and cannot be turned off. This would take machine cycles required for production in a heavily loaded system. It should only be added to diagnose suspected or known channel problems.

The values in the trace table entries must be analyzed based upon the external register values for a specific channel adapter type. Information on the values recorded can be found in the IBM 3704 and 3705 Communications Controller Principles of Operation, GC-30-3004.

CHANNEL ADAPTER TRACE

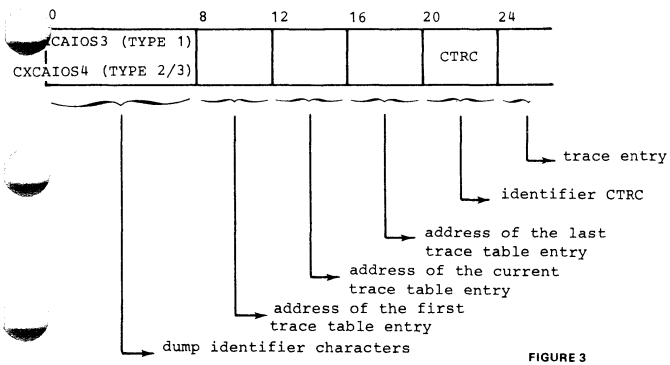


FIGURE 3

PANEL TESTS

Panel Support Routines

These routines process requests from the control panel. They are the panel display control update/refresh routine, the panel test routine, the panel display routine, and the panel monitor.

Dynamic Panel Displays

The network control program allows the user to display the following types of information on the control panel :

* Communication scanner interface control word (ICW)
* Contents of an external register
* Contents of a halfword of controller storage.

The user selects a function by setting the DISPLAY/FUNCTION SELECT and STORAGE ADDRESS/REGISTER DATA switches on the panel. When he presses the INTERRUPT push button, a level 3 interrupt to the NCP occurs.

The NCP uses a group of routines common to all the displays to process interrupts from the panel. One of these routines is the panel reader, which receives control from the level 3 router as a results of the interrupt. The panel reader reads the switch settings from the panel and ensures that it is in NCP mode. If it is, the panel reader triggers the panel service module. This routine determines which function was requested and passes control to an appropriate subroutine to set up for the display.

The remaining panel support routines get control once every 100 milliseconds as a result of a level 3 interval timer interrupt. The routines check the panel control block (PCB) the common data area for all panel routines. If the panel service module has completed its processing of a panel request, an indication is set in the PCB, notifying the panel support routines that they have work to do. First, the panel display control update/refresh routine determines whether an appendage routine is required to finish servicing the panel request. If so, it branches to the appendage routine.

One appendage routine is the communication scanner interface control word display routine. This routine moves the ICW fields into display register 2 to satisfy a dynamic ICW display request. This routine returns control to the panel monitor.

If no appendage routine is necessary, the panel display routine determines whether something is to be displayed or whether a display is to be updated. If so, it gathers the requested data and places it into display registers 1 and 2, which are gated to the panel display lights.

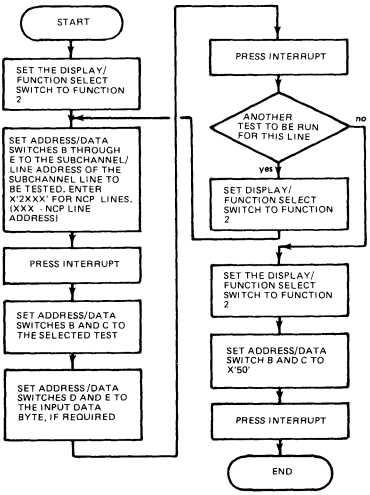
Finally, the panel monitor determines whether a panel function is currently in progress. If so, it determines whether the panel switches have been changed. If it detects a change, it triggers the panel service module to terminate the display.

Line Test

The line test feature allows the user to address, poll, dial, and transmit or receive from a terminal. The test function consists of an initialization subroutine, a series of test subroutines and an end-test subroutine. The test can be used to analyze the operation of a line by observing the ICW (displayed in DISPLAY A and DISPLAY B) during any part of the test executed in level 2 or level 3.

Note : If a line is in use by the test function, it is not available to the system. If a line is in use by the system, it is not available to the test function. Always use X'50' to end all test functions to ensure the availability of the line.

To run the NCP line trace and the NCP line test (panel test) procedures together, start the line test procedure first then start the line trace.



Test Settings for the NCP Line Test Function

The following test settings are the relevant tests for SDLC

FUNCTIONS	ADDRESS/ DATA SWITCHES B AND C	ADDRESS/DATA SWITCHES D AND E INPUT DATA BYTE	DESCRIPTIONS
Set Mode (set by NCP generation)	40	None	Retrieves set mode byte from the ACB and loads it into the line's SDF. Sets the PCF to the set mode state and returns the line to the NO-OP state.
Set Mode (variable)	41	Set Mode Character entered and used instead of the CCB set mode byte.	Loads the byte from ADDRESS/DATA switches D and E into the line's SDF. Sets the PCF to the set mode state and returns the line to the NO-OP state.
Transmit Test Character Repeat	44	Test Character	Reads the test character from ADDRESS/DATA switches D and E and places it in the line's PCF. The line must be in transmit mode already (PDF state X'9') The test character is transmitted repeatedly. If the line being tested is attached to a type 3 scanner, this function is equivalent to the Transmit Initial function (function 42), except the test character is placed in both the SDF and PDF. The line does not have to be in transmit mode initially.
Data Rate Select	49	FF=high rate 00=low rate	Selects the high or data rate for a line previously defined in the test.
Receive Mode	4A	None	Places the line in receive mode and places the first character received in the first position of the data buffer. If more than 16 characters are received, subsequent characters overlap into the last byte position of the data buffer. If the line being tested is attached to a type 3 scanner, the PCF/EPCF state is set to X'5'/X'0' (SDLC monitor flag). A receive count of 40 is set up to be compared with the receive compare characters. If a match is found, the line is turned around to the transmit state. If more than 40 characters are received only the first 40 are compared.

Change PCF turn character	4B	Turn	Changes the PCF turn character to the value set in ADDRESS/DATA switch E. DISPLAY D should be set to zero.
Display LTS	4C	Displacement into LTS	Displays two half words of the line test control block (LTS) beginning at the displacement specified in ADDRESS/DATA switches D and E.
Transmit Test and Repeat (SCF bit 7 set)	4E	Test Character	Same as transmit test character and repeat except SCF bit 7 is set. This test can be used to trasnmit a character on an SDLC (Synchronous Data Link Control) line with inhibit 0 bit insert set. If the line being tested is attached to a type 3 scanner the PCF/EPCF state (X'9'/X'C' Transmit Diagnostic Mode) is set to transmit the test character continuously. The PCF/EPCF state allows only transmission of data and thus inhibits 0 bit insertion. (Enter function 42 before performing this function).
Transmit Buffer 0 or 1	4F	0(X) digit	The line is set to trasnmit mode (PCF state X'8'). When PCF state X'8' goes to PCF state X'9' buffer 0 is transmitted if byte 1, bit 7 is zero. If bit 7 is one, buffer 1 is transmitted. If the line being tested is attached to a type 3 communication scanner, the transmit is done on count rather than with a transmit end compare character. (The transmit on count operation is applicable for all scanner types used with NCP 4.1 and later releases).
End Test	50	0(X) digit	If byte 1, bit 7 is 0, the test is ended, the line test control block (LTS) is cleared, and the line is placed in a NO-OP state (drops DTR and resets options selected by set-mode). If bit 7 is 1, the line remains enabled (DTR active).

Load Buffer 0 (see Note 1)	51	(XX) digit	The character in switches D and E is stored in a 40 character buffer.
Load Buffer 1 (See Note 1)	52	(XX) digit	Same as 'Load Buffer 0' except the character is stored in buffer 1.
Load Receive Compare Character 1 (See Note 3)	53	(XX) digit	The character in switches D and E is stored as the first receive compare character.
Load Receive Compare Character 2 (see Note 3)	54	(XX) digit	Same as Load Receive Compare Character 1 except the character is stored as the second receive compare character.
Load Receive Compare Character 3 (see Note 3)	55	(XX) digit	Same as Load Receive Compare Character 1 except the character is stored as the third receive compare character.
Load Swap Transmit Buffer 0 Compare Character (See Note 3)	56	(XX) digit	The character in switches D and E (XX) is stored as the swap transmit buffer 0 compare character.
Load Swap Transmit Buffer 1 Compare Character (See Note 3)	57	(XX) digit	Same as Load Swap Transmit Buffer 0 Compare Character except the character is stored as the swap transmit buffer 1 compare character.
Initialize Buffer 0 Offset	58	XX	Sets in the LTS the displacement (normally X'00') into the appropriate buffer at which the storing of data entered through the panel is to begin. As the data is subsequently entered, a count of the data characters will be accrued and this count will then be used by the transmit routine to determine when the line should be placed into receive mode.
Initialize Buffer 1 Offset	59	XX	Same as function 58 except the displacement is for buffer 1.

SDLC CRC Accumulation Buffer 0/1	5B (invalid for Type 3 Scanner)	00 (for buffer 0) 01 (for buffer 1)	Accumulates the BCC for SDLC data (to be transmitted) as it is entered into either buffer 0 or 1. If the line being tested is attached to a type 3 communication scanner DISPLAY A and DISPLAY B will display all zeros.
Set Receive Mode Byte	5C	setting dependent on option selected (see description	Allows the selection of certain options by setting a control byte in the LTS (line test control block). Bit 3 will indicate that the option of checking for two special characters (set by subfunctions 53 and 54) in sequence in a received data stream is to be used by the panel line test function to determine when the line being tested should be placed into transmit mode. Bit 7 will give the same indication for SDLC data. (For type 3 communication scanner only). Bit 5 (modem test in progress) is set whenever a modem test is performed. Bits 6 and 7 indicate that the line is to be turned around from receive mode to transmit mode when good block check characters are received.

Note 1: For NCP 4.1 and later releases, the transmit operation is done on a count accumulated as data is stored in the desired transmit buffer.

Note 2: Before doing a Load Dial Digits operation (function 47) or Load Buffers 0 or 1 (function 51 or 52), ensure that the LTSDCNT field in the LTS is zero by entering X'5899' then X'4F99' in the ADDRESS/DATA switches and pressing INTERRUPT.

Note 3: Each received character is compared with the five compare characters in the following order : receive compare character 1, 2, 3, swap transmit buffer 0 compare character, swap buffer 1 compare character. If the received character compares with one of the receive compare character, the line is set to transmit mode and the previously specified buffer is transmitted. If the received character compares with the swap buffer 0 character, buffer 0 is transmitted ; if it compares with the swap buffer 1 character, buffer 1 is transmitted.

For more detailed information on panel routines, refer to 'Guide to Using the IBM 3705 Communications Controller Control Panel' form number GA27-3087.

SECTION 12: T O L T E P

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TOLTEP requirements. 12.2
How to start TOLTEP. 12.2
Acquiring devices. 12.3
TOLTEP messages prefixes for DOS/VS and OS/VS. . .12.3
How to define and run tests. 12.4
Console printout example 12.5

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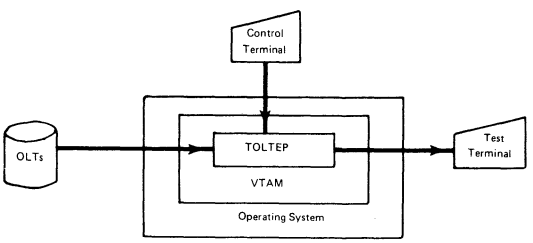
12

DESCRIPTION

The Teleprocessing Online Test Executive Program (TOLTEP) operates with the online test (OLT) programs and the Virtual Telecommunications Access Method (VTAM). TOLTEP controls the selection and execution of the OLT's used for testing the teleprocessing terminals supported by VTAM. You can use the OLT programs to :

* Perform preventive maintenance
* Perform problem determination
* Diagnose I/O errors
* Verify device repairs and engineering changes



TOLTEP RELATIONSHIP WITH ONLINE TESTS (OLTs)

TOLTEP supports online testing for :

* Local and remote 3270 Information Display Systems

* Remote terminals attached to local or remote 3704 and 3705 Communication Controllers
  1. 3270
  2. 3767
  3. 3770

* Teleprocessing line hardware.

TOLTEP does not support online testing for 3704 and 3705 Communications Controllers (e.g. IFT's).

TOLTEP REQUIREMENTS

To include and run TOLTEP in your system :

* VTAM must be specified as an access method during system generation.

* For a device (terminal, control unit, or teleprocessing line) to be tested, TOLTEP requires that the device is allocated to VTAM, and that an online test (OLT) and configuration data set (CDS) are available for the device.

* For OS/VS, the appropriate DD statements must be included in the START VTAM procedure so that TOLTEP can refer to the proper data sets. The OS/VS1 VTAM System Programmer's Guide, GC27-6996, and OS/VS2 System Programming Library : VTAM GC28-0688 include this information in the START VTAM procedure.

* OLT=YES should be specified during NCP (network control program) generation. Some OLT's require this for execution.

* Symbolic names specified in the CDSs must agree with the names assigned during NCP (network control program) generation and VTAM system definition. TOLTEP associates the terminal to be tested with the CDS.

* TOLTEP does not support duplicate symbolic names. OLT test results from terminals with duplicate names can be misleading, especially if such terminals have different characteristics.

* TOLTEP consists of two load modules that are brought into virtual storage with VTAM. TOLTEP requires 79K bytes of virtual storage for DOS/VS and 85K bytes of virtual storage for OS/VS. (For OS/VS planning purposes, TOLTEP with SNA devices requires 89K bytes of virtual storage). For each user that invokes TOLTEP, including the first user, an additional 34K bytes of virtual storage are required for the OLT and a work area.

* TOLTEP requires CDSs for all test terminals and for SNA control terminals and alternate printers.

HOW TO START TOLTEP

To start TOLTEP from the network operator's console, enter one of the following operator commands.

* MODIFY NET,TEST (for DOS/VS only)
* MODIFY procname,TEST (for OS/VS only)

Where 'procname' is the name of the VTAM start cataloged procedure and 'termname' is the name of the terminal to be logged on to TOLTEP as the control terminal.

To start TOLTEP from a terminal other than the network operator's console, use the logon procedure defined at your installation. Note that the system name for TOLTEP is ISTOLTEP. TOLTEP requires CDSs for all test terminals and for SNA control terminals and alternate printers.

e.g. LOGON APPLID (ISTOLTEP)
Logging on remote terminal from system console

VARY NET,ID=termname,LOGON=ISTOLTEP

If you cannot start TOLTEP, it may be because the network operator denied the request, the device is not supported as a TOLTEP control terminal, VTAM cannot honor the request, or there is not a CDS for an SNA device.

Acquiring Devices

You can acquire terminals for TOLTEP use only when the terminals are not connected to an application program. When the desired terminals are not connected, TOLTEP obtains use of the terminals in the same manner as other application programs.

You can disconnect terminals from an application program by :

* Using the logoff procedure defined at your installation.
* Pressing the RFT (Request for text) key on terminals that have this key (include the selection characters on a 3270 cluster).

* Issuing a VARY inactivate immediate command from the network operator's console.

TOLTEP Message prefixes for DOS/VS and OS/VS

The prefix 'ITA' is used for identification of OS/VS and 'F' for DOS/VS.

e.g. ITA105D ENTER-DEV/TEST/OPT/ (OS/VS)

F105D ENTER-DEV/TEST/OPT/ (DOS/VS)

The message serial number (identification) and message text are identical for both the DOS/VS and OS/VS systems.

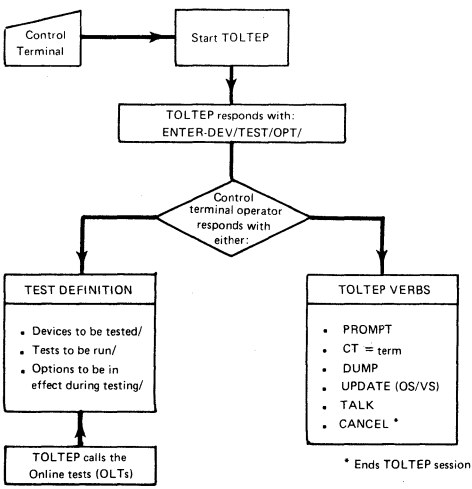
HOW TO DEFINE AND RUN TESTS

When TOLTEP is started, the control terminal operator is prompted with the message :

ENTER - DEV/TEST/OPT

The operator responds to this message as for other OLT requests (OLTEP). He also may enter any of the following TOLTEP verbs :

PROMPT	asking for help.
CT=term	switching the TOLTEP control terminal
DUMP	causing a dump
CANCEL	terminating a TOLTEP session
TALK	communicate with the OLT.



- See example of console printout (page 12-5)

CONSOLE PRINTOUT EXAMPLE

```
F net,test

 IST097I MODIFY ACCEPTED P00
 ITA102I ISTOLTEP R.2.0 INITIALIZATION IN PROGRESS P00
 ITA107I OPTIONS ARE NTL,NEL,NPP, FE,NMI, EP, CP, PR,NTR,NAP P00
*01 ITA105D ENTER DEV/TEST/OPT/ P00
r 01,t3767z/3700sna/nfe/
 IEE600I REPLY TO 01 IS 'T3767Z/3700SNA/NFE/'
 ITA158I  S T3700SNA UNIT 0033 T3767Z P00
 ITA158I  T T3700SNA UNIT 0033 T3767Z P00
 ITA107I OPTIONS ARE NTL,NEL,NPP,NFE,NMI, EP, CP, PR,NTR,NAP P00

*02 ITA105D ENTER DEV/TEST/OPT/ P00
r 2,cancel
 IEE600I REPLY TO 02 IS 'CANCEL'
 ITA548I ISTOLTEP NO LONGER REQUIRES T3767Z P00
v net,id=t3767z,logon=istoltep
 IST097I  VARY     ACCEPTED P00
 IST120I  LOGON COMPLETE FOR NODE T3767Z P00
*03 ITA920D MAY T3767Z   BE USED FOR TESTING-REPLY Y/N P00
r 3,y
 IEE600I REPLY TO 03 IS 'Y'
```

Initializing TOLTEP

Running 3700SNA (API Echo) OLLT to test 3767

Cancelling TOLTEP

Logging on a terminal from system console for terminal to have control of running test

TERMINAL PRINTOUT EXAMPLE

```
logon applid (istoltep)
ITA102I ISTOLTEP REL.2.0 INITIALIZATION IN PROGRESS
ITA107I OPTIONS ARE NTL,NEL,NPP, FE,NMI, EP, CP, PR,NTR,NAP
ITA105D ENTER DEV/TEST/OPT
```

Logging on from remote terminal to TOLTEP

SECTION 13: 370X ON-LINE TESTS

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DESCRIPTION OF TESTS

The 3704/3705 Communications Scanner On-Line Tests (OLLT's) were designed to functionally test the per-line hardware (line sets, line adapters, integrated modems, and automatic call originate features) of the 3704/3705 Communications Controller, and SDLC links attached to the 3704/3705.

The OLLT's reside in the host CPU. The individual OLLT modules build 'interpretive command chains' which are passed to the On-Line Line Test Control Program (OLLTCP). The OLLTCP, in turn puts the command chains into a Path Information Unit, or PIU. The PIU is given to the OLT executive, TOLTEP, which sends the PIU, through VTAM, to the NCP residing in the 3704/3705. The NCP decodes the individual interpretive commands and performs the indicated operation.

Some of the interpretive commands initiate certain hardware manipulations or buffering operation, e.g., set LCD/PCF, send data, etc. Other commands are used to check the results of such operations and control such things as error branching and looping.

When execution of a command chain is complete, the NCP returns certain information relating to the results of the command chain (the OLLTCB) and any received data back to the OLLT in the host. The OLLT analyzes the results and sends over the next command chain or issues an error print, as appropriate.

All of the foregoing takes place while normal VTAM and NCP operations continue on all other lines not being tested.

The OLLT's may be divided into two categories :

1) Those primarily designed for customer problem identification, and
2) Those primarily designed for use by the CE.

The tests in the first category were designed to be simple to run and to verify proper operation in the normal environment, i.e., use the same line control values as used by the NCP, etc. The tests are T3700LTA through T3700LTF.

Only one test falls into the second category, T3700 LT. This section tests all the same functions as those in the first category, provides for an external data wrap, and also allows for the optional selection of such things as the data to be wrapped, the LCD, etc.

The following sections describe the individual tests. Refer to the 3704/3705 FETMM for details on the data paths and hardware operation of the individual diagnostic wraps.

T3700LTA

T3700LTA - provides for an internal data wrap. Utilizing the hardware diagnostic wrap facilities of the 3704/3705 communications scanner, this section tests the data path of a line set, up to (but not through) the line drivers and terminators. This section has only one routine.

The following illustrations show samples of the 'DEV' field to the test request message and are used to illustrate the T3700LTA test sequence.

Since full duplex lines have only one symbolic name but are made up of two 3704/3705 addresses, the internal wrap will be run twice for each full duplex line to be tested. The 'TX' and 'RX' symbols, used below, indicate the respective transmit and receive lines of a full duplex pair.

The symbols 'Wn' and 'Tn' indicate the respective wrap and test lines, where 'n' indicates the sequence of the test. Examine the following examples and the descriptions that follow.

a)

	LONDON,	MANCHESTER, GLASGOW	
		(TX)	(RX)	
PASS 1:	W1	T1	
PASS 2:	W2		T2
PASS 3;	W3		T3
PASS 4:	T4		W4

b)

	MANCHESTER,	LONDON
	(TX)	(RX)
PASS 1:	W1	T1
PASS 2:	W2	T2
PASS 3:	T3	W3

In example a), 'LONDON' is used as the wrap line, throughout the test, since it is the first line entered in the test request message. Each line, in turn, is then selected as the test line. (Both transmit and receive sides of full duplex lines are tested). When the last line entered has been tested, it is then used as the wrap line, and the firts line (which has not yet been tested) is used as the test line.

The sequence is the same in example b). Note that the transmit line side of 'MANCHESTER' is used throughout as the wrap line, just as 'LONDON' was in example a).

Up to sixteen symbolic names may be entered in the 'DEV' field of the test request message.

This test section can be utilized to test the per-line hardware of the 3704/3705 up to the line drivers. It tests the ability of the receive (test) line to strobe in data and present it to the Communications Scanner.

If a problem is suspected on only one line of the 3704/3705, this section should be run first, with the failing line used as the receive (test) line. If the

test indicates a failure, the problem is probably in the associated line interface cards (the problem may also possibly be in the associated Line Interface Base cards).

If several lines are failing, examine their addresses. If they are all on the same Line Interface Base (LIB), then suspect a problem in that LIB. If they are not on the same LIB, suspect a problem in the Communications Scanner itself.

Remember that the actual line drivers are not tested. Therefore, if a single line is failing, but the test section runs and the trouble still seems to lie in the 3704/3705, suspect the line drivers.

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T3700LTB

T3700LTB - provides for a modem data wrap. This section was designed to test the 1200 BPS half and full duplex integrated modems and the 2400 BPS full duplex integrated modem. This section may also be used to test external 3872, and 3875 modems attached to 3704/3705 full duplex lines. The test section looks at the external clock bit in the set-mode SDF to determine the type of modem. If internally clocked, the section assumes an integrated 1200 BPS modem. If externally clocked, it assumes an integrated 2400 BPS modem or external 3872/3874/3875.

This test section has three routines. All three routines perform the same function. The only difference is in the selection of data rate select.

Routine 1 - 1200 BPS integrated modems only. (No data rate select)

Routine 2 - 2400 BPS integrated modems or 3872, 3874, 3875. This routine runs with the higher modem speed selected. (Data rate select on).

Routine 3 - 2400 BPS integrated modems or 3872, 3874, 3875. This routine runs with the lower modem speed selected. (Data rate select off).

Note : if running with an external 3872/3874/3875 modem whose mode switch is not in the 'external' position, both routines 2 and 3 will be run; however, the modem will actually be tested only at the speed selected by the mode switch.

The following illustrations show examples of the 'DEV' field of the test request message and are used to illustrate the T3700LTB test sequence.

The sequence of testing is similar to that of T3700LTA. Since T3700LTB tests modems, however, there is a difference. When a full duplex line is encountered by T3700LTB, the transmit side is always used as the wrap line and the receive side is always used as the test line. Examine the following examples and the descriptions that follow.

```
a)              BIRMINGHAM, LONDON, LIVERPOOL
   PASS 1:         W1      T1
   PASS 2:         W2              T2
   PASS 3:         T3              W3

b)              MANCHESTER, LEEDS, LIVERPOOL
                (TX)    (RX) (TX)    (RX)
   PASS 1:       W1      T1
   PASS 2:                       W2       T2
   PASS 3:       W3                              T3
```

In example a), 'BIRMINGHAM' is used as the wrap line, throughout the test, since it was the first line entered. Each line in turn is then selected as the test line.

Example b) illustrates, however, that whenever a full duplex line is encountered, its transmit side is used as the wrap line.

Up to sixteen symbolic line names may be entered in the test request message.

This section should be run only after successful completion of T3700LTA (to insure that the - set itself is operative). If T3700LTA runs successfully and this section does not, suspect a definite problem in the 1200 BPS integrated modem. Refer to the 3704/3705 FETMM for addition service aids and information.

T3700LTC

T3700LTC - provides for execution of a modem self-test. This section was designed to test the 2400 BPS half duplex integrated modem and external 3872, 3874, and 3875 modems attached to 3704/3705 half duplex lines.

This section has two routines. Both provide the same function. The only difference is the state of data rate select. Routine 1 runs with the data rate select interface lead on (the high modem speed) and routine 2 runs with it off (the lower modem speed).

Note : If running with an external 3872/3874/3875 modem whose mode switch is not 'external' position, both routines 1 and 2 will be run ; however, the modem will actually be tested only at the speed selected by the mode switch.

Since this section requires only one line at a time to

run, illustrations are unnecessary. Enter the name of each line to be tested. Each line, in the order entered, will be tested. Up to sixteen line names may be entered.

This section should be run only after successful completion of T3700LTA (to insure that the line set itself is operative). If T3700LTA runs successfully and this section does not, suspect a problem in the modem. (For externally attached modems, T3700LTA may be run first to check the 3704/3705 interface and the 'test 1' position of the modem may be used to check the modem).

Refer to the 3704/3705 FETMM for additional service aids and information.

T3700LTD

T3700LTD - provides for a test of the Autocall originate (AC0) feature of the integrated modem. It may also be used to exercise externally attached autocall units. Basically, the test is performed by dialing numbers selected by the operator.

There are two routines in this section, also. The first routine dials a valid telephone number and tests for successful connection. The second dials an invalid number, no answer or busy, and tests for no connection.

The numbers to be dialed may be entered by the operator at either of two times. The first is at the time the test is requested, by supplying the numbers in the EXT=field of the test request message. None, one, or both of the numbers may be entered at that time. The second is at the beginning of each of the routines. If the dial number for the individual routine was not entered in the EXT=field, a request will be made for the operator to enter it.

This section, also, requires only one line at a time. Enter the name of each line to be tested up to a maximum of sixteen names. Each line will be tested, in the order entered.

The telephone numbers to be dialed by this section may be entered at the same time the lines are selected. This is done by providing them in the EXT=option of the 'OPT' field of the test request message. If this is desired, enter the numbers in the EXT=option, as follows :

a) The telephone number for routine 1, routine 2, or both may be entered. If both are entered, they must be separated by a comma. If only the number for routine 2 is entered, it must be preceeded by a comma to indicate the absence of the number for routine 1. (Example : EXT=,4451). If only the number for routine 1 is entered, no comma is necessary.

b) Total length of the EXT=field may not exceed 54 characters. The total length of either telephone number may not exceed 34 characters. (If the total length of both numbers exceeds 54 characters, omit one of the numbers. When the routine requiring that number is executed, it will ask for it).

c) Only the characters 0-9, '?', '%' or '_' may be entered.

If this section detects any failures in the AC0 feature of the integrated modems, refer to the 3704/3705 FETMM for diagnostic flowcharts, service aids, and additional information.

T3700LTE (see section SDLC link 1 test)

T3700LTE - provides for execution of the SDLC link test. This test is designed to aid in isolating failures on an SDLC link.

This section automatically sends the SDLC test frame 10 times and does not allow optional data to be sent in the test frame.

Since this section requires only one line at a time to run, illustrations are unnecessary. Enter the name of each line to be tested. Each line, in the order entered, will be tested. Up to sixteen line names may be entered.

This section should be run only after successful completion of T3700LTA, and T3700LTA, and T3700LTB or T3700LTC if integrated modems or 3872/3874/3875 modems are being used. This section is used to help isolate failures on an SDLC link. Analyzation of the statistics accumulated at the primary and secondary stations is helpful.

On full duplex links, the use of wrap blocks or other methods of wrapping the transmit and receive interfaces, may be helpful. The lines should be wrapped in such fashion that all normal interface signals are present and send data of the transmit interface is tied to receive data of the receive interface. The lines may be wrapped anywhere, even down-line. Half duplex links may not be wrapped.

Note - The LU, PU and Line must be deactivated in order to run this test.

T3700LTF

T3700LTF - provides for a test of the break circuitry of the integrated 1200 bps modem with break feature.

This section has two routines. The first tests the ability of the break circuitry to detect a mark frequency and the second routine tests its ability to

detect a space frequency.

Note : It is recommended that section T3700LTB be successfully run before attempting to run this routine.

Since this section requires only one line at a time to run, illustrations are unnecessary. Enter the name of each line to be tested. Each line, in the order entered, will be tested. Up to sixteen line names may be entered.

This section should be run only after successful completion of T3700LTA and T3700LTB. If both of these sections run okay and T3700LTF fails, the problem is most likely to be in the modem's break feature circuitry.

T3700LT

T3700LT - CE utility and external data wrap. This section provides for testing any of the same functions tested by T3700LTA through T3700LTE. It also provides for an external data wrap. In any of these cases, the operator may optionally specify :

a) The data to be sent.

b) The LCD to be utilized. (If SDLC, the operator may also specify if NRZI mode is to be used).

c) The set-mode SDF to be utilized.

The device entry for this section differs from that of the other test sections. For this section, only one or two symbolic line names may be entered in the test request message. The second line name entered, if there is one, will be used as the wrap line. (Some tests under T3700LT do not require a wrap line. In addition, if either of the lines whose names are entered are full duplex lines, message ITB502 will occur. This message is a request to select the side of the line to be utilized, i.e., transmit or receive.

If no wrap line is entered (only one line name entered), and the test line is full duplex, the side not selected in response to message ITB502 will be used as the wrap line.

This section when used in conjunction with T3700LTA can help isolate a problem to the 3704/3705 line drivers. First, run T3700LTA to verify the operation of the line set. Then attach external wrap blocks on the 3704/3705 line drivers or receivers.

The above description does not fully cover the facilities available under this section. The reader should therefore refer to 3704/5 Communications Scanner On-Line Tests form D99 - 370C for a more comprehensive description.

T3700 SNA (API ECHO)

Description

The API Echo Test is designed to verify the integrity of the link between the terminal and the central site. This is done by sending to the terminal the data that was requested the number of times specified.

The above takes place while normal VTAM and NCP operations continue on all terminals not being tested, including other Terminals on a multidropped T.P. line.

T3700SNA - provides for echoing the data to the terminal. The test will repeat the requested data the number of times specified. In addition, if no data is requested, the test will send default test data to the test terminal.

Products supported :

3270 SNA
3767
3770

Test Request Message Entry

1 - Device Field

This section will test only one terminal at a time. Enter the symbolic name of the terminal to be tested.

2 - Test Field

T3700SNA is the test section name.

3 - Option Field

Data to be echoed by this section may be entered at the same time the terminal is selected. This is done by providing it in the EXT= option of the 'OPT' field of the test request message. (See note). If this is desired, enter the request in the EXT= option, as follows :

a. 2 digit number for the times to receive the data followed by the data. (Example :EXT=99ABC..Z). (This will send ABC...Z to the test terminal 99 times).

   Note :Only Alpha-numeric characters will be echoed.
   Caution :Over-printing will result on Test devices that require a carriage return character in its data stream.

b. 2 digit number for the times to receive the standard message. (Example :EXT=99). (This will send A-Z,

0-9 to the test terminal 99 times).

c. 2 digit number for the times to receive the data followed by X' then data. (Example :EXT=99X'FFFF). (This will send the Hex text (FFFF) to the terminal 99 times).

Note :If the test terminal cannot request data, the EXT=Option must be used to request YYDATA.

d. The word BIND to display the bind parameters for the symbolic unit in the Test field.

Selecting the Echo Options

T3700SNA provides for selection of three different options in addition to allowing the operator to specify the data to be echoed.

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This message 'ENTER YYDATA, PROMPT, or END' will occur, providing an opportunity to select any of the following options :

a. 'YYDATA' - YY is number of times to repeat the data. Data is the information to be echoed.

b. 'PROMPT' - This will prompt the user of the YYDATA format.

c. 'END' - Terminates the Echo Test.

NOTE :If no options are selected, the test will repeat the last requested option (YYDATA).

Selecting the Echo Data

The 'DATA' option allows specification of the data to be transmitted during the selected test. Up to 100 bytes of data may be specified.

The data can be one of two formats :

(1) Normal keyboard data :ie. ABC...Z

(2) Hex data :ie. X'F1F2

Hex data must be preceded by X' and consist of an even number of characters.

Reference documentation :

API echo D99-3700D

Examples of running tests

1 - NAME/T3700SNA//

Where :NAME is the symbolic name of the terminal to be tested.
T3700SNA is API Echo Test.

This example will select the terminal called 'NAME' and send a message to it requesting what data to echo.

2 - */T3700SNA//

This example is used when the test terminal and control terminal are the same. Only the * is required for the symbolic name.

3 - NAME/T3700SNA/EXT=YYDATA/

EXT=YYDATA is requesting the Echo Test to send 'DATA' to the terminal YY times.

4 - NAME/T3700SNA/EXT=YY/

EXT=YY is requesting the Echo Test to send Default Test Data (A-Z, 0-9) to the terminal YY times.

5 - NAME/3700SNA/OPT,EXT=YYX'DATA/

EXT=YYX'DATA is requesting the Echo Test to send the data in Hex to the terminal YY times.

R3270D (SNA)

The diagnostic programs detailed in this section are designed to test and provide functional exercisors for :

* 3271 Remote Multiplexor Control Unit with SNA Feature

* 3275 Remote Standalone Display Station with SNA Feature

with attached
* 3277 Display station
* 3284 Printer
* 3286 Printer
* 3288 Printer

TEST INITIATION

Test execution is initiated through the normal executive operator requests. The test ID shall be R3270D. The variations for inclusion in the request message are :

...SYM NAME/R3270D/OPTIONS/ will cause a default to EXT=CHK.

NAME/R3270D/(OPTIONS),EXT=xxx/'-where xxx entries are explained below and a specific set of OLTs can be selected.

EXT option

Specific portions of the OLT package can be selected by the use of an
EXT= entry in the options field of the operators request message. The permitted entries for EXT= are:

ENTRY	TESTS SELECTED
CHK	Check tests (Functional Exercisors)
MAN*	Manual tests (includes both KEY and MAG).
KEY*	Keyboard tests.
MAG*	Magnetic Card Reader.
PAT*	Patterns for Display Station or Buffered Printer.
PAT,DPRT*	Patterns for dedicated printer (Non-Buffered).
RPQ	RPQ Tests (For Future Use).

* These entries should be proceded by option MI, e.g.,...
(SYM NAME)/R3270D/NFE,MI,EXT=MAN/'

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Routine Selection

Functional Exercisors (CHK)

ROUTINE NUMBER DECIMAL	TEST DESCRIPTION (CHK)
1	Write and Read all Graphic Characters
2	Start Field Order with all valid attributes
3	Insert Cursor with all WCCs
4	Erase all unprotected command
5	Erase Unprotected to Address Order
6	Repeat to Address order
7	Program Tap Order
8	Copy command
9	Start Printer
10	APL Graphic character test

Keyboard (key)

ROUTINE NUMBER DECIMAL	TEST DESCRIPTION (KEY)
31	Manual Interrupt AID check
32	Uppercase Keyboard Check
34	APL Keyboard Check

Magnetic Card Reader (MAG)

ROUTINE NUMBER DECIMAL	TEST DESCRIPTION (MAG)
61	Test Magnetic Card Reader and Cards Reader and Cards

Patterns (PAT)

ROUTINE NUMBER DECIMAL	TEST DESCRIPTION (PAT)
91	RFT's Menu Pattern
92	Copying all characters and symbols
93	Test Patterns for 480 buffer alignment
94	Test Pattern for 1920 buffer alignment
95	Check Program Tab and Erase unprotected
96	Universal pattern display
97	New Line function test

Reference Documentation

Remote 3270 Display system D99-3270D

Example of running test

```
R 01, 3277D/R3270D,91,92/NFE,MI,EXT=PAT/
```

where :
- 3277D is the symbolic name of the terminal
- R3270D is the test
- 91,92 are the routine numbers to be run
- NFE,MI,EXT=PAT is the pattern test with options specified.

SECTION 14: SDLC LINK TEST1 (LTE)

Description. 14.1
SDLC frame test. 14.1
Operation. 14.2
T3700LTE 14.2
Link test statistics table 14.3
Example of running link test 14.5

DESCRIPTION

The SDLC Link Test, provided within the SNA architecture, is basically an echo test. The primary SDLC station sends an SDLC 'TEST' frame down the link to the secondary station. If the secondary station receives the 'TEST' frame without errors, it resends the frame to the primary station.

The SDLC Link Test is implemented in all SDLC devices. In the 3704/3705 it is implemented in two vehicles. The first is in the the Internal Functional Tests (IFT's), and is commonly referred to as Link level 0. The IFT's provide support for the 3704/3705 to act as either a primary or secondary station and require that the entire 3704/3705 be dedicated to the test. (Refer to the descriptions of routines X6F0 and 15F0 in D99-3700A for further detail).

The second is in the ON-Line Line Tests (OLLT's), and is commonly referred to as Link Level 1. This Level of the Link Test provides support for the 3704/3705 to act as a primary station only, and requires only the line to be tested be dedicated to the test. This level of the Link Test is described in the following paragraphs. The 'test' frame that is sent is the same, regardless of the level of the test. Operating procedures and requirements, and statistics accumulated may be different.

All SDLC frames are of structure as shown in figure 1. The command field, for a 'TEST' frame indicates 'TEST'. The optional data field may or may not be present. (T3700LTE does not allow the optional data field, while test 6, under T3700LT, does).

SDLC Test Frame

Pad Pad F A C dd BC BC F ee

where,

Pad = alternate data transition characters for clock correction : X'00' if NRZI mode, 'XAA' if not

F = SDLC flag characters : X'7E'

A = SDLC station address byte

C = SDLC command byte : X'F3' for 'TEST'.

dd = optional data field.

BC = block check (CRC) characters.

ee = ending transmission of idle character : X'FF'

Note : All characters between the two flags are defined as a frame. If NRZI is in use, the actual bit pattern on the line will be different due to NRZI mode. Also, SDLC zero bit insertion/deletion apply to all characters within the frame.

OPERATION

The Link Test OLLT sends a 'TEST' frame down the line. The secondary station (SDLC device or remote 3704/3705) acts as follows :

a) Buffer the received frame.
b) Check the block check characters.
c) Check for valid address and command bytes.
d) Maintain statistics
e) If no errors in receiving the frame, return the frame to the primary. (If more optional data is received that can be buffered, the basic 'test' frame is returned without the optional data).

(Note that some SDLC devices may respond differently. These differences are beyond the scope of this document. Information relating to the responses of an individual device should be obtained from the documentation for the specific device).

The Link Test OLLT checks the frames received from the secondary station in a fashion similar to the secondary station. In addition the optional data field received is compared to the optional data sent. Statistics are gathered and printed prior to test termination.

T3700LTE

Since this section requires only one line at a time to run, illustrations are unnecessary. Enter the name of each line to be tested. Each line, in the order entered, will be tested. Up to sixteen line names may be entered.

e.g. SYM NAME/T3700LTE//

- See console printout example (page 14-5)

RESULTS

Link Test Statistics Table

The following describes the Link Test statistics table. This table is immediately printed following the transmission of the requested number of SDLC 'TEST' frames. Any hardware errors occuring while transmitting the frames will be printed first. Note that this table will always be printed whether or not errors occurred ; however, if no errors occurred there will be no '*' on the TOLTEP test terminate message.

Example of table :

```
T3700LT - 00 RTN 001 - DEV/LN 00B SLBSCAD ECA 0 RETNUM 00000

        LINK TEST STATISTICS (IN HEX)

FRMS REQUEST-000A  FRMS TX       -000A  TOT RCVD FRM-0000
BCC ERRORS  -0000  HRDWARE ERR   -0000  TIME OUT ERR-000A
INV A/C  FLD-0000  DATA NT RCVD  -0000  INCORRECT DAT-0000
'CMDR' RESP -0000  'NSA' RESP    -0000  RCVD W/0 ERR-0000

ACCUMULATED SCF    -01
ACCUMULATED RCVD DATA BITS IN ERROR
      0000
```

a) FRMS REQUEST - The number of frames requested to be sent. (if T3700LTE, this will always be X'0A').

b) FRMS TX - The actual number of frames transmitted successfully. (Transmission of frames halts if any error is detected while transmitting).

c) TOT RCVD FRM - The total number of frames received. This count includes all frames received, including frames in error.

d) BCC ERRORS - The number of frames received in which block check errors occurred.

e) HRDWARE ERR - The number of receive operations that ended because of one or more bits in error in the SCF. As each level two interrupt occurs, bits 0, 2 and 3 of the SCF should be off.

f) TIME OUT ERR - The number of receive operations that ended in a timeout, i.e. nothing received within three seconds.

g) INV A/C FLD - The number of frames received whose station address was not equal to the station address sent, or whose command field did not contain X/'F3'.

h) DATA NT RCVD - The number of frames received that contained no optional data when optional data was included in the frames sent.

i) INCORRECT DAT - The number of frames received whose optional data fields did not compare with the optional data sent. This also includes the number of frames that included data when no data was sent.

j) 'CMDR' RESP - The number of frames received whose command field contained 'CMDR' (command rejects) :

k) 'NSA' RESP - The number of frames received whose command field contained 'NSA', (non-sequenced acknowledgement) : X'73'.

l) RCVD W/O ERR - The total number of frames received without error, i.e., all frames whose receipt was not included in any of the fields described in d-k above.

m) ACCUMULATED SCF - The accumulated SCF. As each frame is received the ending SCD is or'ed into this field.

n) ACCUMULATED RCVD DATA BITS IN ERROR - As each frame is received, the frame is compared with the frame sent. Each bit in error is or'ed into this field.

EXAMPLE OF RUN LINK TEST

```
 ITA107I OPTIONS ARE NTL,NEL,,NPP,NFE,NMI, EP, CP, PR,NTR,NAP P01
*32 ITA105D ENTER DEV/TEST/OPT/ P01
R 32,A023/T3700LTE/NFE/
 ITA548I ISTOLTEP NO LONGER REQUIRES A023 P01
 ITA158I  S T3700LTE UNIT 0000 A023 P01
*33 ITB531D  - ENTER THE ONE BYTE STATION ADDRESS IN HEX P01
R 33,C1
  T3700LTE-00  RTN 001   DEV/LN 0000 A023      ECA 0    REFNUM 00000 P01
   P01
         LINK TEST STATISTICS (IN HEX) P01
   P01
   FRMS REQUEST-000A   FRMS TX     -000A   TOT RCVD FRM-000A P01
   BCC ERRORS  -0000   HRDWARE ERR -0000   TIME OUT ERR-0000 P01
   INV A/C FLD -0000   DATA NT RCVD-0000   INCORRCT DAT-0000 P01
   'CMDR' RESP -0000   'NSA' RESP  -0000   RCVD W/O ERR-000A P01
   P01
   ACCUMULATED SCF    -0D P01
   ACCUMULATED RCVD DATA BITS IN ERROR P01
      00000000 P01
   P01
   P01
ITB533I  - TEST 6 ENDED ON A023      (0846/NONE). P01
ITA158I  T T3700LTE UNIT 0000 A023 P01
```

'ECTION 15: MISCELLANEOUS DATA RECORDER (MDR)

Description. 15.1
Permanent SDLC line error MDR (figure 1) 15.2
LXBCMODS 15.3
LXBIMCTL 15.3
LXBCMAND 15.4
LXBEXTST 15.4
SCBTYPE. 15.4
LXBSTAT (byte 0) 15.5
LXBSTAT (byte 1) 15.6

DESCRIPTION

The 3705 Network Control Program (NCP) and VTAM provide records as input to the Miscellaneous Data Recorder (MDR). VTAM recognizes these records by the system response (X'0A') set by the NCP in the BTU. The text portion of the MDR record consists of a field of up to 25 bytes. The third byte of the field is the recording mode byte, which is used to differentiate between the types of NCP MDR records. The fourth byte, the record ID byte, is always set to X'05' indicating to VTAM that this is a 370X MDR record.

The recording mode byte (third byte) is broken down as follows :

High-order Hex digit indicates the error category

```
0000 .... - 3705 TP Line Errors
0001 .... - 3705 Temporary Errors
```

The two Hex digits together indicate :

```
0000 0000 - Permanent SDLC Line Errors
0000 0001 - Statistical Data on Line Errors
0001 0000 - Channel Adapter Temporary Error
0001 0001 - Communications Scanner Temporary Error
0001 0010 - Program Checks Temporary Error
0001 0011 - Miscellaneous Program Level 1/Level 3
            Temporary Error
```

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The Temporary errors are further defined by the fifth (+X'04') byte of the MDR record.

If the recording mode byte (+X'02') is a X'10' (Channel Adapter Temporary Error) then :

Error Record Byte (+X'04')	Applies to
X'02'	Type 2 Channel Adapter Position 2
X'04'	Type 2 Channel Adapter Position 1
X'84'	Type 1 Channel Adapter Position 1

If the recording mode byte (+X'02') is a X'11' (Communication Scanner Temporary Error) then :

Error Record Byte (+X'04')	Applies to
X'08'	Type 2 Communications Scanner Position 4
X'10'	Type 2 Communications Scanner Position 3
X'20'	Type 2 Communications Scanner Position 2
X'40'	Type 2 Communications Scanner Position 1
X'C0'	Type 1 Communications Scanner Position 1

The OS utility IFCEREP0 and DOS EREP prints a formatted dump of these error records from the data set (SYS1.LOGREC).

Figure 1 shows an example of a Permanent SDLC Line Error MDR.

```
                              --- I/O DEVICE EDITING ---

RECORD ENTRY TYPE - VTAM MDR     SOURCE - OUTBOARD
CPU MODEL 0145    SERIAL 750109
DOS RELEASE LEVEL 32
DEVICE TYPE           3705
CHANNEL UNIT ADDRESS 0050
RESOURCE ID           201F        RESOURCE NAME LINE2A
 RECORD TYPE - PERMANENT SDLC LINE ERROR
LIB ADDR              002A
  LINK INFORMATION
   CCB TYPE CONNECTION FLAGS   00      LXB COMMAND          8D       LXB LAST ERROR STATUS            06F4
   CCB TYPE FLAGS              21      LXB MODIFIERS        0000     LXB LAST ERROR EXTENDED STATUS   00
                                       LXB IMMED CTRL CMD   00       LXB FIRST ERROR STATUS            0000
                                                                     LXB FIRST ERROR EXTENDED STATUS  00

   LAST ERROR, BIT DECODE      LAST ERROR EXT STAT
   EXTENDED ERR STAT FLG 0     OVERRUN/UNDERRUN FLAG 0
   FORMAT EXCEPTION FLAG 0     BLOCK OVERRUN         0
   CHARACTER SYNC CHECK  0     ABORT BLOCK           0
   DATA CHECK            0     MONITOR COUNT OVERFLO 0
   SDLC POLL FINAL BIT   0
  LOCAL (PRI) STATION INFORMATION
   SCB DEVICE TYPE             00
   SCB LINK SCHEDULING FLAGS   0000
   SCB OUTPUT CONTROL FLAGS    00
   LXB XMTD BLU CMD FIELD      00
   LXB RCVD BLU CMD FIELD      00
   SCB SEQUENCE   N(R)         0
   SCB SEQUENCE   N(S)         0
   SCB BLKS OUTSTANDING COUNT  000
   SCB PASS COUNT              000
   SCB I-FORMATS TRANSMIT CNT  000000
   SCB TEMP XMIT ERROR COUNT   000
```

FIGURE 1

The following pages contain a breakdown of the most important fields contained in the MDR for 'Permanent SDLC Line Errors'.

LXBCMODS

Byte 0	Command modifiers :
x...	1=Suppress ending a new command due to outstanding status 0=Immediate end to new command when status is outstanding
.x..	1=No retry 0=retry
...x	1=Immediate retry if errors while normal polling 0=if errors, retry at next normal poll cycle
....x	1=Do not release transmitted buffers after ACK
Byte 1	
x...	1=Perform command reset step first 0=Normal command execution

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LXBIMCTL

	Immediate control command flags :
X'80'	Reset immediate issued
	Set Mode Commands (for idle or busy lines)
X'04'	Read line type
X'06'	Set text error retry limit
X'10'	Set receive buffer cutoff factor
X'12'	Start line trace
X'14'	Stop line trace
X'18'	Set operation link
X'1A'	Reset operational link
	Set Mode Commands (idle lines only) :
X'05'	Set line adapter interface parameters
X'07'	Set line control procedure
	LXB line type :
X'8C'	Primary SDLC station mask
X'8E'	Secondary SDLC station mask

LXBCMAND

	LXB command
X'83'	Disable
X'8D'	Enable
X'8F'	Dial
X'30'	Run SDLC link
X'32'	Run initial (remote NCP)

LXBEXTST

	Extended error status
1...	1 = overrun if LXBSTAT Bit 4 = 0 1. Lost character, PDF overlayed 2. Flag received off boundary 1 = Underrun if LXBSTAT Bit 4 = 1 Character in PDF transmitted more than one (Limit 127 retries LSBRTYCT)
.... 1...	Block overrun occured Level 3 block processing in progress when another block available from L2
.... ..1.	Abort received Eight consecutive 1 bits received
....1	Monitor count overflow 64 temporary I format receive errors have occured 1. I format receive data check 2. I format receive format checks 3. I format receive aborts

SCBTYPE

	Station type
x...	1=Duplex station 0=Half duplex station
..1.	Switched SDLC station
.... .1..	Terminal node (Type 1 PU)
.... ..1.	Cluster controller (Type 2 PU)
....x	1=Intermediate node (INN) 0=Boundary node (BNN)

Byte 0	Status equates :
1...	Extended error status see LXBEXTST
.1..	Format exception invalid SDLC format 1. Frame contained Data (NSA, SNRM) 2. Not a complete frame 3. The following is a list of LXBSTATC values and the reason for the format exception : 0E Rec REJ, line is not duplex 1C Rec RR or in NS Phase 1E Rec XID in RR or RNR phase A2 Rec Invalid SDLC Command A8 Rec SDLC Disc AC Rec RQI B2 Rec SDLC SNRM B6 Rec SDLC ROL BC Rec NSA in RR or RNR Phase BD Sent SNRM did not rec NSA
..1.	Synch check
...1	FCS error (data check)
	Run command error/exception phase field :
.... 000.	No Command Active
.... 001.	SDLC I-format sent or SDLC RR sent
.... 010	SDLC RNR sent
.... 011.	SDLC NS command sent
.... 100.	Transmit
.... 101.	Error while sending text I-format
.... 110.	Error while sending normal polling or response S-format
.... 111.	Error while sending NS control sequence

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Byte 1	Completion code status byte :
000.	Normal Final Status : control information received in S-format
0 000.	Timeout received RR, RNR or REJ
0 110.	Partial acknowledgement sequence number change (OR) Negative acknowledgement sequence number does not change
0 111.	SDLC REJ received
1 110.	SDLC RR received positive acknowledgement (NS = NR)
1 111.	SDLC NRN received
001.	Normal Final Status : Data received in I-format
0 000.	Timeout received address and control fields
0 010.	Buffer Cutoff Exceeded buffer limit
0 110.	Partial acknowledgement sequence number change (OR) Negative acknowledgement sequence number does not change
1 010.	End of Block I-format received
011.	Normal final status : Data received in NS format
0 000.	Timeout flag received
0 001.	SDLC CMDR received (no retry) MDR has reason for CMDR
0 010.	Buffer Cutoff Exceeded buffer limit
1 010.	SDLC NSI received
100.	Special 0 Final Status : Special Status or control information received in NS-format
0 000.	Timeout Nothing received
0 010.	Buffer Pool Depleted No more buffers available
0 110.	Reset end run command
0 111.	Invalid Address Received from Secondary
1 011.	Poll stop
1 100.	SDLC Frame sent
1 110.	Disabled
1 111.	Enabled

101.	Special 1 SDLC Final Status
	control information received in NS format
0 000.	Timeout
	received flag
0 001.	Received Invalid SDLC Command (no retry)
0 010.	Received Invalid (incongruous) N(R) in I or S-format
0 011.	Link Activity Timeout (Secondary only)
0 100	Received SDLC DISC
0 110.	Received SDLC RQI or SIM (No retry)
1 000.	Record statistics
	total retry count overflowed or transmission count overflowed
1 001.	Received SDLC SNRM
1 011.	Received SDLC ROL (no retry)
1 110.	Received SDLC SNA
1 111.	Received SDLC XID
111.	Hardware final status :
... 0 100.	Adapter Check -
	1. Timer has detected no level 2 interrupt when at least one was expected.
	2. Modem self-test failed to get level 2 interrupt after placing the PCF in turnaround
	3. Enable or dial failed to get a level 2 interrupt after setting the PCF to set mode
...0 101.	Adapter Feedback Check -
	1. Timer detects an LCD of X'F' which results from a hardware-detected error within the adapter
	2. Improper SYSGEN about the adapter in use.
...1 000.	Modem error - Set when the SCF modem error bit is on.
	1. Occurs when DSR drops during a transmit or receive operation
	2. Can be set by the timer
	3. Set if CTS drops while transmitting
...1 001.	Transmit Clock or CTS failure
	1. During enable or write control operation, a Level 2 interrupt failed to follow turnaround
	2. During enable on a full duplex line, CTS failed to come up
	3. Time-out occurs with PCF of transmit initial (8)
...1 010.	DSR Turn On Check - DSR fails to come up during an enable or dial operation
...1 100.	DSR Turn Off Check - DSR fails to drop during a disable operation

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LXBSTAT (BYTE 1) continued

...1 110.	Auto call check 1. Initial dial PCF 'F' sees ACR, DLO, COS, or PND up 2. Dial PCF '4' sees ACR, COS, or PND up
1111 1111	Program failure 1. Line I/O code completed in an impossible status, (e.g. EHQ on SDLC line). 2. A negative data length was computed
....x	Poll final bit

SECTION 16: MODEM TEST

Description. 16.1

DESCRIPTION

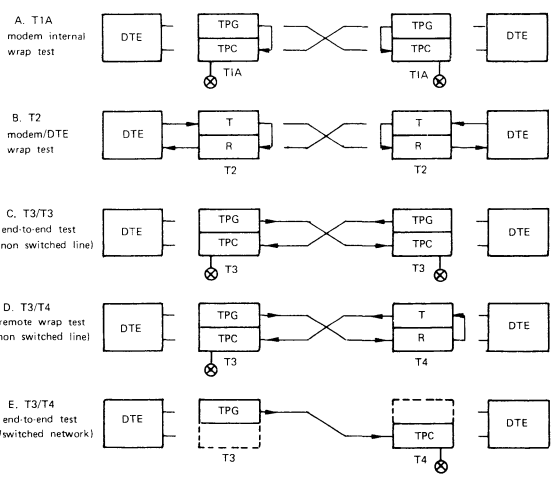
The tests referred to in this section apply to IBM modems 3872, 3874 and 3875 and integrated modems.

Tests A, B, C, and D may be carried out for a centralized multipoint configuration. In this configuration, end-to-end testing is always carried out between the control modem and one of the tributary modems.

Tests A, B, and E may be carried out for public switched network operation.

Tests C through E require the cooperation of the other-end operator (remote or tributary); for tests C and D conversation may take place over the leased line via the handset (if the 'Alternate Voice' feature is installed) or may take place over the public telephone system. When test E is being performed the conversation must take place via the data coupler or the data access arrangement.

In each of the tests, with the exception of test B, a fault is indicated by the operate lamp on the receiving modem going out.



SECTION 17: 3600 DIAGNOSTICS

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Maintenance Analysis Procedures (MAP) 17.1
3601 log. 17.1
Error statistic counter 17.4
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Terminal component error statistic counter (chart) 17.8

DESCRIPTION

The maintenance package for the 3600 consists of :

1) Problem Determination Procedures (PDP)
2) Maintenance Analysis Procedures (MAP)
3) 3601 Log
4) Errors Statistics Counters

1) PROBLEM DETERMINATION PROCEDURES (PDP)

PDP's are available to the customer and are located in the Operating Guide for the IBM 3600 Finance Communication System, GA27-2776. Use of the PDP's will enable the customer to direct the CE to the problem area.

2) MAINTENANCE ANALYSIS PROCEDURES (MAP)

MAP's are used by the CE to analyse problems with the 3601 and the connected terminals and are included in the Maintenance Information Manual.

3) 3601 LOG

The 3601 Log is a file located on the diskette. The system monitor places messages in this log that relate to maintenance and engineering data. The user's programs also have the ability to place messages in this log. The first two digits of any log messages are significant. The meaning of these digits are as follows :

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First digit = 1 : System written log message.
First digit = Not 1: User-written log message. User should not begin the message with a 1.
Second digit = 1: The log message requires immediate attention. To alert the CE to the presence of such a message, the 3601 turns on the CHECK, 1, 2 or 3 indicator light of the control operator's 3604. (The configuration process at generation time determines which light will be used for this purpose. Usually, it is the CHECK light). If the control operator's 3604 is not operating, the 3601 turns on the corresponding light of the first available 3604 that is operating.
Second digit = Not 1 : This message does not require immediate attention and does not turn on the CHECK light at a 3604.

NOTE : The 3601 log is lost through a cold start. It is not lost through a warm start.

The CE can examine a display or a printout of the 3601 log by logging on at any operating 3604, and then giving a 001, 002 or 046 command.

TYPES OF LOG MESSAGES

10 002 AA BBBBBB CCCCCCCC DDDDDDDD EE F GGGG, where

A = Control Code supplemental version ID.
B = Diskette identification (Volume D).
C = Configuration identification (GEN ID).
D = The EC level of the controller data.
E = Control Unit (controller) address (CUA).
F = Relocate count. A count of the number of the diskette records moved to the error track because of disk surface defects.
G = Session identification (ID). A session is one or more periods of time that the customer thinks of as one continuous period of time for the purpose of record keeping.

NOTE : On a cold start, message 10 002 is placed in the log and the session identification is incremented. On a warm start, message 10 002 is placed in the log but the session identification is not incremented.

10 030 DATA where :

DATA is any text, up to 176 characters, keyed in by the CE for diskette test.

11 003 NNNNNNNN SS PP AAAACCCC IIII, where :

N = Application program name.
S = Work station identification in hexadecimal.
P = Program check code in hexadecimal.
A = Program check address in hexadecimal.
C = Loop count in hexadecimal (a count to indicate whether the application program is in an endless loop).
I = First two bytes of instruction. If PP = 0B (user's instruction counter invalid), IIII is not valid data.

NOTE : The above information is connected with the customer's application program and should be supplied to the customer.

11 004 EEMM CCLL PPII WWWW WWWW TTTT ZZZZ ....

This message contains design support information. The CE may be called upon to provide this information when aid is required to correct a problem.

11 005 LOOP X ERROR,CODE = Y-Z, where :

X = Loop number.
Y = Loop Status.
0 = The 3601 loop control card and the modem (if a

remote loop) passed the wrap test.
1 = Modem failed wrap test.
2 = 3601 loop control card failed wrap test.
4 = Machine check.
6 = Combination of 2 and 4.
8 = User requested stop loop.

Z = Modem status :
0 = Transmit and receive not ready.
1 = Receive ready (carrier detect).
2 = Transmit ready (clear to send).
3 = Combination of 1 and 2.

11 006 (host link error message) has three formats :

Format 1 : 11 006 A
Format 2 : 11 006 AXXXBXXXXXXXXXXX
Format 3 : 11 006 A (followed by 28 hexadecimal characters).

Format 1 :
A ≠ 0. An error condition has caused the 3601 to run wrap tests, and they were successful, The 3601 automatically wrap-tests the SDLC card and the modem if it is an integrated modem. The 3601 may or may not automaticcally wrap-test an external modem. This is determined by the customer's configuration image and the external modem capability.

A = 2. A stop link command has been given the 3601.

Format 2
A = 1. Either the SDLC card or the modem failed the wrap test.

B = 9. The SDLC card failed the wrap test.

B = D. The modem failed the wrap test.

The remaining characters contain design support information.

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Format 3
A = 3. A message was received in error.

NOTE : The 28 characters that follow '3' are for programming information.

Log usage Notes.

1. When displaying and paging down the log by repeatedly pressing the enter (EM) key after entering the 001 command, the 3601 will cause message 90001 to be displayed if the enter key is pressed after message number one has been displayed.

2. If an attempt is made to write a log message while you are logged on and the log area is full, the 3601 will cause message 90012 40000 to be displayed.

4) ERROR STATISTIC COUNTERS

In addition to recording errors in the log, the 3601 maintains error statistic counters for each of the following components of the system :

- 3601 Diskette
- 3601 Loop control (for each loop)
- 3601 Host communication link
- 3604 keyboard
- 3604 Display
- 3604 Encoder
- 3610 Document Printer
- 3612 Document printer
- 3612 Passbook Printer
- 3614 Consumer Transaction Facility
- 3618 Administrative Line Printer

Keyboards commands are available to display or print the contents of error statistic counters.

NOTE : Error statistic counts are located in functional storage and are lost each time there is a startup (warm or cold). In contrast, the 3601 log is located on the diskette. Thus, this log is lost only on a cold start.

After logging on at a 3604, the CE can key in either of two commands to obtain error statistics.

1. 010 LSSD is keyed to display the error statistics of a specified component.

2. 012 X is keyed to print error statistic counters for all components on the assigned output printer. X is the number of loops attached to the 3601.

Refer to 'Commands given at keyboard' in 3601 Maintenance Information form number SY27-2360 for details on the 010 and 012 commands and on the format of the printed/displayed error statistic messages.

Concerning the displayed or printed error counts, note that :

1. Each three-digit count represents the decimal count in one counter. The counters are designated as counter 1, counter 2, etc. from left to right.

2. If a count reaches 256, additional errors of that type will cause the count to return to 128 and continue from there. Thus, counts of 128 or over, are not definitive.

3. Error counts represent the number of operation failures, not the number of retries per operation,

The following tables explain the error counts for the 3601 components ; that is, the diskette loop control, the host communication link and the counters that record terminal component errors.

DISKETTE ERROR STATISTIC COUNTER

9020 02 XXX XXX XXX	
Counter	Stepped by :
1	Intervention required. The diskette is not rotating or the speed is not within limits. The count can include normal operations of changing the diskette.
2	Command reject
3	Record not found
4	Incorrect cyclic redundancy check (CRC)
5	Incorrect format
6	Machine check
7	Seek failure
8	Overrun
9	A diskette surface defect encountered when attempting to write a record in the customer's temporary data file. Record is then written in the next sector.

LOOP ERROR STATISTIC COUNTER

X000 80 XXX XXX XXX XXX XXX	
Counter	Stepped by
1	Sync check. The counter is stepped if the loop goes out of sync and sync cannot be recovered within 64 tries.
2	Noise errors in loop return to 3601.
3	Machine check during wrap test of loop control card
4	Error during wrap test of loop control card
5	Error during wrap test of modem

HOST LINK ERRORS STATISTICS COUNTER

9010 01 XXX XXX XXX	
Counter	Stepped by :
1	Receipt of a valid set response mode command from host
2	Receipt of a test message from host
3	Write retry. When the controller sends a message as the results of a poll from the 370X, it waits for confirmation that the complete message was received. If this confirmation is not found, the controller resends the entire message and increments this counter. If a part of the message was received, the parts not received are resent, but the counter is not incremented (This is a Soft error).
4	Timeout. The line has been inactive for a period of time specified by the user in the CTG parameter in the COMLINK macro, then the adapter is reset, an automatic wrap is performed, and this counter is incremented. If the wrap test is not successful, a message is recorded in the controller log and the adapter is disabled. If the wrap test is successful, a message is also recorded in the controller log and the controller waits for traffic on the line : any subsequent timeouts are ignored until communication is restored. This is a Hard error.
5	Overrun
6	Underrun
7	Connection problem. In association with counter 3, if a complete message is resent more than a preset number of times (20), this counter is incremented. This is a Soft error on the line. Counter 3 steps 20 times, counter 7 steps 1 time. Note : a Soft error means there is no interruption in the session. A Hard error interrupts the session and the adapter is wrap tested.

(continued next page)

(continued)

Counter	Stepped by :
8	Invalid controller data. Indicates a failure in 3601.
9	Block check count (BCC). The CRC check failed for last message received. Indicates a probable communication line problem.
10	The 3601 detecting a not-normal termination of a message by the host. Indicate a network problem.
11	Data communication equipment (DCE) error. Indicates a probable modem problem.
12	3601 busy because of no available receive buffers. Indicates a probable 3601 configuration procedure problem.
13	A command reject condition that resulted from messages received out of sequence. Frame has good BCC.
14	Machine check
15	A command reject condition that resulted from receipt of a data field with an otherwise valid write command for which no data field is defined. Frame has good BCC.
16	A command reject condition that resulted from receipt of an invalid command in a frame which has good BCC.

TERMINAL COMPONENT ERROR STATISTIC COUNTER

Terminal Component	Counter	Stepped by :
3604 keyboard	1	Common loop error *
	2	Common loop error *
	3	Keyboard or magnetic stripe reader error.
	4	Translate error.
	5	Application program block (APB) segment overrun.
3604 display	1	Common loop error *
	2	Common loop error *
3604 encoder	1	Common loop error *
	2	Common loop error *
	3	Bad write, bad LRC, or bad buffer format
3610 and 3612	1	Common loop error *
	2	Common loop error *
	3	Intervention required
	4	Emitter check
	5	End of forms **
	6	Platen open
	7	Timeout (no response) from 3610 or 3612
3614	1	Common loop error *
	2	Common loop error *
3618	1	Common loop error *
	2	Common loop error *
	3	Hammer fire check, printer sync check, illegal order or initialization check
	4	Hammer fire check
	5	Forms motion check
	6	Timeout
	7	Printer sync check
	8	End-of-forms, left or right, or both
	9	Retry count for initializations
	10	Belt not up to speed
	11	Printer overheated
	12	Cover/throat open

* Counter 1 of each terminal component records the number of loop error checks detected (status 0200) while the 3601 was actively communicating with that terminal component. Counter 2 of each terminal component records the number of terminal address card checks detected (status 0201) while the 3601 was communicating with that terminal component.

** 3610 or 3612 models 3 and 13 only.

SECTION 18: 3650 DIAGNOSTICS

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DESCRIPTION

The maintenance package for the 3650 consists of :

1. Problem Determination Procedures (PDP)
2. Maintenance Analysis Procedures (MAP).
3. Diagnostic Tests.
4. Error Log.

Problem Determination Procedures

Problem Determination Procedures are included in the IBM 3650 Retail System Administrative Operations Guide, GA27-3088. These procedures tell the user how to determine fault responsibility between IBM and other equipment manufacturers, but the user will never perform trouble diagnosis or make repairs to IBM equipment.

In some cases, the CE may have to use these procedures during trouble analysis ; they are included in the MAP's for CE use.

Maintenance Analysis Procedures

Maintenance Analysis Procedures (MAPs) are used by the CE to analyse problems with the 3650 Retail Store System. The MAPs are arranged in frames, with each frame representing one item of information or a task to be performed. The CE should begin a service action by starting at the first frame in the MAPs (for example, frame 10-001 in the 3651 MAPs) and proceeding, frame by frame, as directed by the MAPs. Unless he is directed otherwise by the text in a frame the CE should perform each frame in sequence.

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Diagnostic Tests

Diagnostic Tests are to be used only as directed by the MAPs and/or problem determination procedure. When the MAPs or problem determination procedure require a diagnostic test, they will give the instructions for executing the test.

These are two groups of diagnostic tests : offline and online. When offline diagnostic tests are operating, the system is not available for normal store support operations. When the online diagnostic tests are operating, store support operations are normal, except for the device being tested. The MAPs or problem determination procedure dictate system requirements.

3650 ERROR LOG DISPLAY

Make sure 3651 is not running OLT or LOGSCAN already.

On 3653 press ENTER twice (2 digit operator I.D. may be required)
Key in 32/NNNN where /NNNN is optional Security Number

Press ENTER MSG = ENTER ERROR SCAN ARGUMENTS

Key in * 4 LOG SCAN, 3 DEV/TERM SCAN, 2 UNIT SCAN,
1 SYSTEM SCAN

Press DATE ENTRY

If 1 SELECTED AT * ABOVE Press ENTER then exit

Key in ** 01 3651, 02 Loop 1, 03 Loop 2,
04 Loop 3, 05 Host Link, 06 Terminal

Press RETURN CREDIT

If 2 SELECTED AT * ABOVE Press ENTER then exit

If 01 SELECTED AT ** ABOVE Key in

Key in 001 DISK 002 CONTROLLER
003 CE/OP PANEL 004 CLOCK LOG SCAN ONLY

If 02, 03, 04, 05 SELECTED AT ** ABOVE key in

Key in 001 DRIVER 002 LINK

If 06 SELECTED AT ** ABOVE

Key in XXX DECIMAL TERMINAL ADDRESS

Press MOD TICKET

If 3 or 4 SELECTED AT * Press ENTER

MESSAGE NOW PRINTED

ENTER 1 FOR RANGE SCAN

ENTER 2 FOR TOTAL SCAN

If 2 SELECTED PRINTOUT IS IMMEDIATE

If 1 SELECTED ENTER RANGE TIMES HHMM HHMM

1st HHMM	START TIME	2nd HHMM STOP TIME
Press	PAYMENT	if ENTER Pressed - Just get todays log
Key in	MM DD Y MM DD Y for start-stop date range	

If printout stops without completing press enter again, for rest of data. Press VOID to cancel.

```
          LOG SCAN

AAAA  HH.MM   MM.DD.Y   BB    CCC
HHHH  HHHH  HHHH  HHHH  HHHH  HHHH
HHHH  HHHH  HHHH  HHHH  HHHH  HHHH
```

These three lines will be repeated for each error.

In the above format example

- AAA = the sequence number of this entry in the error log (hexadecimal).
- HH.MM = time (hour and minute) when this entry was made in the error log
- MM.DD.Y = date (month, day, and year) this entry was made in the error log
- BB = device type (decimal)
- CCC = device address (decimal)
- HHHH = error data (hexadecimal)

```
      UNIT SCAN - 3651

FROM          TO        PRESENT
HH.MM         HH.MM     HH.MM
MM.DD.Y       MM.DD.Y   MM.DD.Y

                        NO OF
     DEVICE             ERRORS

DISK                    NNNN
CONTROLLER              NNNN
CE/OP PANEL             NNNN
CLOCK                   NNNN
```

In this format (example) :

HH.MM = hours and minutes
MM.DD.Y = month, day, and year
NNNN = number of errors

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```
        SYSTEM SCAN

FROM          TO          PRESENT
HH.MM         HH.MM       HH.MM
MM.DD.Y       MM.DD.Y     MM.DD.Y

                          NO OF
        UNIT              ERRORS

3651                      NNNN

STORE LOOP
    POSITION 1            NNNN
    POSITION 2            NNNN
    POSITION 3            NNNN

TERMINALS                 NNNN

HOST                      NNNN
```

In this format (example)

HH.MM = hours and minutes
MM.DD.Y = month, day, and year
NNNN = number of errors (decimal)

DRIVER = Those types of errors that can be associated with the store controller hardware for that store loop.

LINK = Those types of errors, detected by the line control, that can be associated with the store loop (noise injection, poor connector wiring in terminal plugs, opening the loop and turning on or turning off the terminal power).

```
        DEVICE SCAN-DISK

FROM          TO          PRESENT
HH.MM         HH.MM       HH.MM
MM.DD.Y       MM.DD.Y     MM.DD.Y

     ERROR                NO OF
     TYPE                 ERRORS

MC/PC
    EXTERNAL CHECK        NNNN
    I/O PARITY            NNNN
CYCLE STEAL
    EXTERNAL CHECK        NNNN
    I/O PARITY CHECK      NNNN
READ DISK                 NNNN
WRITE DISK                NNNN
SEEK
    1 to 7 TRACKS         NNNN
    8 OR MORE TRACKS      NNNN
FILE NOT READY            NNNN
BAD SECTOR                NNNN
```

```
          UNIT SCAN

    STORE LOOP POSITION ####

FROM       TO         PRESENT
HH.MM      HH.MM      HH.MM
MM.DD.Y    MM.DD.Y    MM.DD.Y

DEVICE                NO OF
ID                    ERRORS

DRIVER                NNNN
LINK                  NNNN

ERROR RATE FOR ALL
LINK ERRORS
FROM       TO           00.00
HH.MM      HH.MM        PER
MM.DD.Y    MM.DD.Y      CENT
```

Note : The average figure for remote loop is 6%

```
DEVICE SCAN - LINK
STORE LOOP POSITION ####

   FROM       TO          PRESENT
   HH.MM      HH.MM       HH.MM
   MM.DD.Y    MM.DD.Y     MM.DD.Y

   ERROR                  NO OF
   TYPE                   ERRORS

END-OF-POLL TIME-OUTS     NNNN

CRC WITH INV TERM ADR     NNNN

TERMINAL AAA

   CRC ERRORS             NNNN
   SEQUENCE ERRORS        NNNN
   RETRANSMISSIONS        NNNN

TERMINAL AAA

   CRC ERRORS             NNNN
   SEQUENCE ERRORS        NNNN
   RETRANSMISSIONS        NNNN
```

In this format (example)

can be 0001, 0002, or 0003
AAA is the terminal address
NNNN is the number of errors

Definitions :

END-OF-POLL TIMEOUTS = The store controller is sending out a Poll message on the loop requesting terminals to send their messages to the store controller and the store controller is not receiving its End-of-Poll byte back.

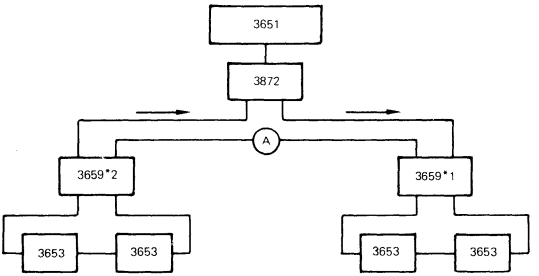
CRC WITH INV TERM ADDR = The store controller has calculated a CRC error on a message that contains a terminal address that is illegal for that store loop. (For example a CRC error with the terminal address of 095 on Store Loop 1 is illegal, since terminal 095 is a Store Loop 2 terminal address). This can happen if the address byte of the message is changed (by noise, etc.) as it goes around the store loop or if eight bits are not a legal address byte.

TERMINAL AAA = Identifies the terminal against which errors have been recognized by the store controller. (It is possible for the address byte to be changed by noise, etc. in such a way that an error is logged against the wrong terminal. However, for this to happen, the address must still be valid for that store loop. For example, address 040 may be changed to 041). This failure may be identified by a scattering of CRC errors around the entire store loop, with no significant pattern.

CRC ERRORS = The store controller has calculated a CRC error on a message that contains the terminal's address. Since the address byte is only eight bits of the entire message, the probability that it is the byte affected is small. But this is possible, and it must be considered when the total log output is analyzed.

SEQUENCE ERRORS = Information messages have send and receive counts so that the store controller and the terminal can make certain they are in step with each other when the receipt of a message is acknowledged. If the store controller receives messages with counts that do not match, a SEQUENCE ERROR is logged against that terminal.

RETRANSMISSIONS = This is looged when the store controller recognizes the need to retransmit to a given terminal. This may be a reaction to a CRC error.



The 3653's on 3659# 1 have CRC errors in the 3651, i.e. the data transmitted from the 3653 has to go through the degradation and therefore gets corrupted.

The 3653's on 3659# 2 should have only those CRC errors expected during normal operation.

The 3653's on 3659# 2 should have retransmission errors in the 3651, i.e. the data received by the 3653 from the 3651 has gone through the degradation and been corrupted.

The 3653's on 3659# 1 should have only those retransmissions expected during normal operation.

After using the previous technique, the problem should be diagnosed to a specific link.
This will include the communication line and the associated Transmit and Receive parts of the attached modems.
It should be possible to use the wrap test to test the local 3659 and then use the equalise position of 3659 to set up and monitor the quality of the line as shown in the 3650 system Maintenance Information book.

It must be remembered that with line degradation it is possible that :
1) The address could be corrupted and logged against a wrong device.
2) The address could be corrupted in such a way that the address is not valid for that loop to which is attached, The indication is then 'CRC with invalid terminal address'.

SECTION 19: 3767 DIAGNOSTICS

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Problem determination procedures. 19.1
Maintenance analysis procedures 19.1
Offline diagnostics 19.1
Online diagnostics. 19.3
Example of running API echo test from 3767 . . . .19.4

DESCRIPTION

The maintenance package for the 3767 consists of :

A. Problem Determination Procedures (PDP)
B. Maintenance Analysis Procedures (MAP)
C. Offline Diagnostics
D. Online Diagnostics

A. PROBLEM DETERMINATION PROCEDURES

PDP's are available to the customer and are located in the '3767 Communication Terminal Operators Guide', GA18-2000, Chapter 6.
Use of the PDP's will enable the customer to direct the CE to the problem area.

B. MAINTENANCE ANALYSIS PROCEDURES

MAP's are used by the CE to analyse problems with the 3767 and are located in the 3767 MLM, SY18-2000.

C. OFFLINE DIAGNOSTICS

The 3767 diagnostic tests reside in a ROS module on the planer card and consist of the following :

1. THE BASIC ASSURANCE TEST is initiated each time the terminal power switch is turned on, or by other operations as shown in Figure 1.

   BAT entries are as follows :
   * Power on
   * Test switch and numeric 0 key
     This method is used for terminating the tests.
   * Automatic entries from CE jumper Register Printout, Section V Line Buffer Printout, and Terminal Indepth Test.

2. THE TEST SECTION TESTS are intiated by pressing and holding the Test switch while the numeric key corresponding to the test section described is pressed (except Katakana keyboard, where for this function the one and six keys are inverted); the test switch is then released. If no key, or a key another than 1 through 6, is pressed while holding the test switch, the test section is bypassed and Terminal Indepth Tests are run, followed by the BAT.

3. A REGISTER PRINTOUT is initiated by CE installed jumpers. This is followed by the BAT.
   The following descriptions of offline tests apply regardless of the method in which started (Figure 1).

4. INDICATOR TEST turns on eight Indicator lights and all ANR segments. They remain on until te test switch is released or a keyboard key is pressed.

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5. REGISTER PRINTOUT prints the contents of the registers (64 lines with 16 registers per line) in hexadecimal format of two characters per register and one space between registers.

6. CONTROLLER TEST CHECKS with predetermined data, the functions and associated hardware of most of the controller circuits. Successful completion of the tests ensures, to a high degree, that the controller is operating correctly.

7. ROS SCAN TEST checks, on a byte basis, whether the ROS readout of each address is valid. A cyclic redundancy check (CRC) count is made for each module and compared with the expected results.

8. REGISTER SPACE TEST verifies that 0's and 1's can be written into and read out of each position of each register.

9. BUFFER TEST verifies that 0's and 1's can be written into and read out of each position of the communication line buffer.

10. COMMUNICATION WRAP TEST tests the transmit and receive hardware. It checks all data combinations. Some unique signal lines are time-out counted.

11. PRINTER TEST consists of one or two tests made as shown in Figure 1.

    1. THE TIMER TEST checks that the time-out counter is operating properly.

    2. THE PRINT TEST checks the printer functions. Four lines, each consisting of all 96 characters, are printed. These lines may be compared to check for complete and accurate printing.

12. KEYBOARD TEST (Test Section II selected) checks the scan code of each key pressed for correct parity, and that the key code is valid. The pressed key scan code bits are displayed in the indicator lights. Key scan codes are also displayed in the indicator lights, when a key is depressed, while holding the Test switch.

13. PRINTER INDEPTH TEST (Test Section III selected) is a print line test. A detected error will not stop the printer. A variable length line of data (up to the maximum of the print line buffer) may be entered and repeated until stopped. This test is useful to exercise printer functions to isolate a problem.

14. COMMON REGISTER DISPLAY (test Section IV selected) is used to display contents of inbound common registers (CR). This may be used to display switch settings, terminal jumpers, amd print and carriage emitters by manually moving the print head or platen and observing the indicator lights.

15. LINE BUFFER PRINTOUT (Test Section V selected) prints, in hexadecimal format, the contents of the communication line buffer. This is useful in diagnosing lines or line-related problems.

16. MODEM TRANSMIT LEVEL ADJUSTMENT (Test Section VI selected) permits the continuous sending of known data on the line. It may be used to adjust the modem transmit level.

Notes :

1. Test switch is normally used in local mode, to avoid communication interface.
2. BAT and Terminal Indepth Test are customer Test functions. These tests and all others also CE test functions.
3. Inbound lines are displayed. Outbound lines cannot be delayed.
4. The printer is not be checked during these printouts.
5. Disconnect modem plug before running Test Section VI to prevent interference to other terminals.
6. If the alarm is sounding constantly, it may be disconnected temporarily while serving the machine by removing pin 3 from the berg connector of the cable plugged into J1 or J2 of the dc distribution card. Alarm may sound at end of the power on.
7. Running the Basic Assurance Test will alter the contents of line buffer.

For more detailed description of tests refer to chapter 2 in MLM (SY18-2000).

ON LINE DIAGNOSTICS

The following tests can support the 3767 in SDLC mode:

LINK TEST (T3700LTE). The SDLC link test is basically an echo test initiated by the host. The primary station sends a SDLC 'TEST' frame down the link to secondary station. If the secondary station (3767) receives the 'TEST' frame without errors it resends the frame to the primary. (see Link Test, section 14).

API ECHO TEST (T3700SNA). The API echo test is designed to verify the integrity of the link between the terminal (3767) and the central site (370X). This is done by sending to the terminal the data that was requested the number of times specified. This test can be initiated from either host or terminal (see section 13).

EXAMPLE OF RUNNING API ECHO TEST FROM 3767

```
Logon applid (istoltep)                                  } Logging on terminal
F102I ISTOLTEP REL 2.0 INITIALIZATION IN PROGRESS        { to TOLTEP
F107I OPTIONS ARE NTL,NEL,NPP,FE,NMI,EP,CP,PR,NTR,NAP    {
F105D ENTER DEV/TEST/OPT/                                }
*/3700sna//                                              }
F158I S T3700SNA UNIT 00CF RT2LU1                        }
901 ENTER YYDATA,PROMPT,OR END                           }
4 test data                                              }
test data                                                } Running Echo test
test data                                                }
test data                                                }
test data                                                }
901 ENTER YYDATA,PROMPT,OR END                           }
end                                                      }
905 END OF ECHO TESTING                                  }
F158I T3700SNA UNIT 00CF RTS2LU1                         }
F107I OPTIONS ARE NTL,NEL,NPP,FE,NMI,EP,CP,PR,NTR,NAP    { Cancelling TOLTEP
F105D ENTER DEV/TEST/OPT/                                {
cancel                                                   }
```

SECTION 20: 3770 DIAGNOSTICS

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Maintenance analysis procedures 20.1
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CE diagnostics tests. 20.4
Cable end wrap test 20.4
Online tests (API echo test T3700SNA) 20.4
Example of running API echo test from 3770. . .20.5
Error log 20.5

DESCRIPTION

The maintenance package for the 3770 system consists of :

1. Problem Recovery Procedures (PRP)
2. Maintenance Analysis Procedures (MAP)
3. Offline tests
4. Online tests
5. Error log

Problem Recovery Procedures

The customer is supplied with an Operator Guide containing PRP's. These charts will enable the customer to isolate the problem to the IBM, OEM, or common-carrier equipment (GA27-3114).

Maintenance Analysis Procedures

MAP's are used by the CE to analyse problems with the 3770 system and are located in MLM SY27-0129.

Offline tests

a) Bring-up Diagnostic test

This test runs following any Power On Reset or System Reset. The following areas are tested: Controller, ROS, RAM, System Card or Keyboard Adapter and Operator Panel. Successful completion or an error condition will be indicated by the operator panel lights and NPR (LED's).

b) Communication Tests

This series of tests assists in determining whether the 3770, local modem, line, or remote modem is causing the problem.

Test 0 (Terminal Communication Test)

Enter communication test mode :
Hold the CODE key down and enter the number '0' from the keyboard.
Release the CODE key.
Enter the number '6' from the keyboard.

Note : The number '6' displays in the readout indicators ; this indicates that you have selected the communication test mode function. The terminal will enter communication test mode when you press the OEM key.

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Press the EOM key to enter communication test mode, and run test 0 (terminal communication test).
Test 0 (terminal communication test) runs automatically. The operator panel readout indicator (NPR) displays one of these indications of the status of the test.

NPR = 01 : the test is running ; has not completed.
NPR = 00 : the test ended without error ; no problem was detected in the terminal communication test.

NPR displays an 800-series number, and the operator panel SYSTEM CHECK indicator turns on : An error was detected during the test ; these 800-series numbers (for example 801 = a clear to send error) identify the error. These numbers are listed in the error code section of the MLM and also in the Operators Guide. If the test ended without error, you have identified that the problem is not in the terminal's controller (including the communication driver).

Test 2 (Modem Wrap Test)

After test 0 ends (without error), enter the number '2' from the keyboard to start test 2 (Modem Wrap Test). Test 2 (Modem Wrap Test) runs. The operator panel readout indicators (NPR) display indications of the status of the test.

If an error was detected during the test :
Check that the modem's cables (power cord cable from the terminal to the modem, and cable from the modem to the communication line jack) are plugged in ; run the communication tests again after re-connecting any plugs that were plugged in.

Test 3 (Modem Transmit Test)

Contact the operator at the central processor ; inform the operator that you will run test 3 (Modem Transmit Test) ; request that the processor operator run test 4 (Modem Receive Test), and record the error count while the test runs.
Start test 3 (Modem Transmit Test) by entering a numeric '3' from the keyboard. The operator panel STANDBY indicator turns on when the test starts.
If using a switched communication (dial) network, dial the central processor's modem and establish the communication link.
Contact the operator at the processor to obtain the test results ; one of these conditions could occur :
The processor did not receive the test transmission ; if this happens :
(1) When using a switched communication line, re-dial the connection and run the test again
(2) When using a leased communication line, request that the common-carrier company test the communication facilities, and correct any problems.
The processor received the test transmission, but the error count was excessive when compared to the 'Error Count During Normal Transmission' chart that follows : if this happens :
(1) If using a switched communication line, re-dial the connection and try the test again.
(2) If using a leased communication line, and the terminal's auxiliary operator panel has a TRANSMIT

EQUALIZER control knob, or the terminal's modem is an IBM 3872 modem, check the equalization as described in the 'Modem Transmit Equalization' section in the Operator's Guide : then, return to this point in the test procedure. If performing transmit equalization does not correct the problem, request that the common-carrier company test the communication facilities and correct any problems.

(3) If using a leased line and the terminal's auxiliary operator panel does not have a TRANSMIT EQUALIZER control, request the common-carrier company test the communication facilities and correct any problems.

If no problems were noted when running test 3, you have identified that the terminal can transmit to the central processor. The next step : Run test 4 (Modem Receive Test), is to identify that the terminal can receive from the central processor.

Test 4 (Modem Receive Test)

Contact the operator at the central processor ; request that the processor operator run test 3 (Modem Transmit Test) : inform thm the operator that you will run test 4 (Modem Receive Test), and check the error count for the test message received. Start test 4 by entering a numeric '4' from the keyboard.

The operator panel PROCEED indicator turns on when the test starts : this indicates that you are receiving a signal from the processor's modem.

When test 4 starts, a count of the number of errors received displays in the operator panel readout indicators. Compare this error count to the 'Error Count During Normal Transmission' Chart that follows.

Note : You can reset the error count, and start counting the errors again, by entering a numeric '4' from the keyboard (this restart test 4). Do this to re-check the number of errors received for any given period of time.

One of these problems can occur when the test starts :

A. The terminal did not receive the test transmission : if this happens :
   (1) When using a switched communication line, re-dial the connection and try the test again
   (2) When using a leased communication line, request that the common-carrier company test the communication facilities and correct any problems.

B. The terminal received the test transmission, but the error count was excessive when compared to the 'Error Count During Normal Transmission' chart that follows ; if this happens :
   (1) If using a switched communication line, re-dial the connection and try the test again
   (2) If using a leased communication line, and the terminal's auxiliary operate panel has a RECEIVE EQUALIZER control knob, or the terminal's modem is an IBM 3872 Modem, check the equalization as described in the 'Modem Receive Equalization' section in the Operator's Guide. Then, return to

this point in the test procedure. If performing receive equalization does not correct the problem request that the common-carrier company test the communication facilities and correct any problems.

(3) If using a leased line and the terminal's auxiliary operator panel does not have a RECEIVE EQUALIZER control, request that the common-carrier company test the communication facilities and correct any problems.

The above tests should be performed in order sequence and can be used by either customer or CE.

CE Diagnostics Tests

Located on the CE cassette tape supplied with the terminal, these tests are read into the terminal RAM using the cassette tape player (CE tool). If an error is detected during a selected test, an error code is displayed in the keyboard NPR's (LED) or the operator panel lights if no keyboard. This error code acts as a key entry point into the MAP's.

The following functions are checked in tests :

Line Printer
Wire Matric Printer
Keyboard
Operator Panel
ID Badge Reader
Communication Adapter/Modem
Multipoint Feature
Cycle Steal Adapters
Disc Unit
Buffers
2502 Card Reader
3501 Card Reader
3521 Card Reader/Punch

For detailed information on running the above test, refer to MLM SY27-0129.

Cable End Wrap Test

This test enables the CE to loop the communication cable, using a socket attached, back into the terminal. This will enable the CE to completely check his terminal to the cable end.

Online test (API Echo Test - T3700SNA)

This test is designed to verify the integrity of the link between the terminal (3770) and the central site (370X). This is done by sending to the terminal the data that was requested the number of times specified. This test can be

initiated from either the host or terminal (see section 12 and 13).

EXAMPLE OF RUNNING API ECHO TEST FROM 3770

```
Logon applid (istoltep)
F102I ISTOLTEP REL.2.0 INITIALIZATION IN PROGRESS
F107I OPTIONS ARE NTL,NEL,NPP,FE,NMI,EP,CP,PR,NTR,NAP
F105D ENTER DEV/TEST/OPT/
*/3700sna/
F158I S T3700SNA UNIT 00CF RT2LU1
901 ENTER YYDATA, PROMPT, OR END
4 test data
test data
test data
test data
test data
901 ENTER YYDATA, PROMPT, OR END
end
905 END OF ECHO TESTING
F158I T3700SNA UNIT 00CF RTSLU1
F107I OPTIONS ARE NTL,NEL,NPP,FE,NMI,EP,CP,PR,NTR,NAP
F105D ENTER DEV/TEST/OPT
cancel
```

Error Log

The 3770 has an Error Log which contains detailed hardware, software and machine check information. To print this Error Log, hold the 'code' key down and press the numeric 2 key. This information is destroyed with Power-On-Reset.

SECTION 21: 3791 DIAGNOSTICS

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Maintenance analysis procedures. 21.1
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Adapter/Device tests 21.2
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DESCRIPTION

The maintenance package for the 3790 system consists of :

1. Problem Recovery Procedures (PRP)
2. Maintenance Analysis Procedures (PRP)
3. Offline tests
4. Online tests

1. Problem Recovery Procedures

The customer is provided with an Operations Guide, GA27-2786 for version 1-5, GA27-2822 for version 6. These charts will enable the customer to perform Problem Recovery.

2. Maintenance Analysis Procedures

MAP's are used by the CE to analyse problems with the 3790 system and are located in the 'Maintenance Information' manuals, these are located with the machine (volume 1/2/3)

3. Offline tests

a. Bring Up

The Bring-Up tests test the functional units of the controller as listed below :

1. Unit controller
2. Control storage/Extended storage
3. Operator panel
4. Diskette drive

Failures are detected and repairs are verified by running the Bring-Up tests. To run Bring-Up test, the Diagnostic Diskette must be in Diskette Drive. To start the Bring-Up tests, turn power on. When power is turned on there is a ten second delay, during which 1500 is displayed. If the Data/Function Select switch is set to position 0, the entire test should run properly, ending with BC80 displayed. If the test stops with any display other than BC80, a failure occured.

If power is on, set Data/Function Select switch to position F. Press reset switcl.. When Digit Display indicates FF00, press Enter Function switch to continue tests. When tests are completed, BC80 will be displayed. If the test stops with any display other then BC80, a failure occured.

If a failure occured while running the Bring-Up test, go to AA01, General Failure Index. You will then be sent to the proper MAP to isolate the problem. This could be the BU, DD, OP or other MAP, depending upon the failure pattern displayed.

b. Adapter/Device tests

How to Invoke	Comments
* At the 3791 Operator Panel	LAF0 displays while tests run.
* After initialization using the Diagnostic Diskette or at the completion of an offline test or routine.	LA00 displays when a test completes successfully. BC80 displays when a test or routine is terminated with Enter Function F.
* At a BC80 or an LA00 display	LAXX (XX = 01 through 7F) display indicates a Manual Intervention stop. Refer to the appropriate MAP for the required action.
* Enter Data LASLRR (See Notes 1 and 4). Where : LA = Logical Address of adapter or device to be tested S = Test Selection Option S = 0 = Test Adapter (not Device) 1 = Test Adapter and Device 2 = Test Adapter and Device with manual intervention L = Loop Option L = 0 = No looping 1 = Loop, stop on failure 2 = Loop, no stop on failure RR = Routine Number for a specific routine; otherwise no entry is required.	LAEE or LAYY (YY = 80 through 9F) display indicates a failure has occured during a test. Use the Error Data Recovery procedure to display and record the Error Data. (Refer to section 3.4.3.) See Notes 2 and 3. BCZZ (ZZ = 81 or greater) display indicates a procedure error while invoking or running the tests. Refer to the AA MAP General Failure Index (GFI). To terminate, Enter Function F.
* Enter Function B.	

C. Maintenance Function

The Maintenance Function consists of six routines which enable the CE to service the 3790 system offline :

Routine 1. Displa/Patch Diagnostic Diskette : Routine 1 is used (only after aid is requested) to display or change a data field in a test residing on the Diagnostic Diskette.

Routine 2. Configure Diagnostic Diskette : Routine 2 is used after an EC installation to transfer configuration data from the installation Diskette to a new unpersonalized Diagnostic Diskette

Routine 3. Disk Map Generation : Routine 3 is used by the DS MAP to record sector ID status of the disk storage unit(s) on the Diagnostic Diskette.

Routine 4. Format Disk : Routine 4 is used (only after aid is requested or by EC installation instructions) to format disk sector ID or Data fields; action is dependent on run option.

Routine 5. Disk Surface Analysis : Routine 5 is used by the DS MAP to determine the condition of disk sector IDs and data fields.

Routine 6. Configuration and MAP File Save : Routine 6 is used to transfer Configuration data and disk MAPs from a personalized Diagnostic Diskette tp an unpersonalized backup Diagnostic Diskette.

d. Diskette Surface Analysis

This test identifies bad tracks on a formatted diskette capable of being used by a 3791. It may be invoked from any Diagnostic Diskette because the test is not dependent on system configuration. It may be run on any range of tracks (o to 76) with the option to loop or not to loop the test. A failure, after one or more tracks have been read successfully, indicates a diskette surface or head alignment problem. Go and perform the Head Alginment Check. If the Head Alignment is correct and the diskette has more than two bad tracks, replace the diskette.

e. Remote Adapter Tests

The RA Offline Tests are invoked using the invocation procedures that are described in Chapter 3, Offline Adapter/Device Test Invocation (SY27-2445).

Routines 1 through 15 - Adapter Test.
These routines test the RA adapter. They do not require or test the attached EIA card, integrated modem, or external modem. A failure in any of these routines is probably caused by a defective RA adapter.

Routine 16 - Integrated or External Modem Wrap Test. This test puts either the integrated or external modem into wrap mode by raising the Local Test Line and running various data patterns through the modem. A failure in this test is probably an integrated modem or external modem problem. The external modem must have wrap capability.

Routine 17 - Wrap Plug Test (adapter with clock)
This test requires a wrap plug, PN 2605944, to be installed at the end of the EIA interface cable. The test then checks for open or short circuits on the EIA interface by activating Driver Lines and Checking for proper responses through the wrap plug. This routine is selected manually.

Routine 18 - Wrap Cable Test (adapter without clock)
This routine requires a wrap cable, PN 2605949, to be installed between the end of the EIA cable and the external modem. This routine is similar in operation to Routine 17, and also must be selected manually.

Routine 19 - Wrap Cable Test (JAPAN)
This test requires a wrap cable, PN 2722052, to be installed at the end of the EIA cable. This routine is similar to Routine 17, and it also must be selected manually.

4. Online Tests

Online condition allows normal 3790 system customer data processing operations. Online service operations, run by the CE, share the 3790 system with customer operations.

Online functions provide the CE with additional system support. The CE can select these functions :

* SYSLDEV (898) List Device Status
* SYSREQ (908) System Messages
* SYSTRACE * (911) Trace System Operation
* SYSLPROG (914) List Functions
* SYSPAT* (915) Emergency Patches
* SYSIMOD (934) Installation Parameters/modification
* SYSLERR (978) List Condition/Incident Records
* SYSTCM (999) Online Tests
* SYSTCM (999) Free Task Option

The following chart shows which CE functions can be selected by 3790 terminals.

Function Name/Number	Valid Terminals			
	2741	3277	3793	Other
SYSLDEV 898	Yes	Yes	Yes	-
SYSREQ 908	No	Yes	Yes	-
SYSTRACE 911	Yes	Yes	Yes	-
SYSLPROG 914	No	Yes	Yes	-
SYSPAT** 915	No	Yes	Yes	-
SYSIMOD 934	No	Yes	Yes	-
SYSLERR 978	Yes	Yes	Yes	-
SYSTCM 999	Yes	Yes	Yes	3791* Operator Panel

a. SYSLDEV (898) List Device Status

The SYSLDEV Function

* is used by the Control Operator or a CE
* Displays device status
* Can be invoked from a 2741, 3277, or a 3793
* is used only when the 3791 is online.

b. SYSREQ (908) System Messages

Caution : This function should be used by the CE only at Site Installation time for recovering Control Operator messages. When these messages are required at other times, the 3790 Control Operator must perform message recovery.

After Site Installation, the CE does not have access to the Control Operator password. For security reasons this password is normally changed by the customer when the 3790 system is turned over to the customer.

Description

The SYSREQ function is invoked from a Control Operator's terminal (3277 or 3793). The SYSREQ Function prints or displays control messages from the 3790 Control Operator's queue. These control messages describe a 3790 system condition or status and may prompt a 3790 Control Operator or CE for additional system action.

A single control message is printed or displayed when the SYSREQ function is invoked. To obtain another message, the SYSREQ function must be re-invoked.

c. SYSTRACE (911) Trace System Operation

The SYSTRACE Function

* is used to trace selected Operating Code events while troubleshooting an Operating Code problem.
* Is used only after contact with the Product Support Center.
* Trace Data is obtained by taking a Dump of Control Storage
* May be terminated by logoff or by initializing the 3791
* Contain four options :
  Option 1 - Common code trace
  Option 2 - Terminal Code Trace
  Option 3 - Host Code Trace
  Option 4 - Host Communication Error Trace

d. SYSLPROG (914) List Functions

The SYSLPROG Function

* Used by the Control Operator or a CE

* Lists the name, number, primary device, access information, and transaction data set use of functions stored in 3790 Data Sets.

Function Range

* The Control Operator may list the information related to programs (numbers 1 through 832)

* The CE may list ONLY information related to functions (numbers 897 through 1023)

e. SYSPAT (915) Emergency Patches

CAUTION : Customer Operations must be terminated before SYSPAT is used.

The SYSPAT Function

* Allows the CE to patch any block of data in the System Data Sets.

* Can only be used on 3277 or 3793

* Is used only after contact with the Product Support Center.

f. SYSIMOD(934) Installation Parameters

The SYSIMOD Function

* Can be invoked from a 3277 or a 3793

* Is used to customize the Operational Code to a particular installation.

* Consists of five Parameter Option Groups :
  Group 1 - Host Communication table
    a. For a remote teleprocessing 3790 system (no Local Channel Feature), contains host communication link parameters.
    b. For a S/370 attached 3790 system (Local Channel feature) contains the S/370 Control Unit address of the 3791 Controller.

  Group 2 - Print Group Table, contains parameters to customize the Print Data Set.
  Group 3 - Transaction Data Set Group Table, contains parameters to customize the Transaction Data Set (TDS).
  Group 4 - System IOCB Table, contains parameters that indicate the Enable/Disable condition of terminals attached to the 3790 system.
  Group 5 - 2741 IOCB Table, contains 2741 communication link parameters.

* Information for Groups 1,2,3 and 5 is provided by the customer using the 3790 SYSIMOD Worksheets, form GX27-2980.

* Information for Group 4 is generated by the CE.

The SYSIMOD Function is used :

* At Initial Site Installation

* After an Operational Code EC installation

* After an Operational Code Full Installation

* To change 3790 parameters after an Initial Site Installation

* To enable or disable a selected terminal.

g. SYSLERR (978) Condition/Incident Log

Description

The SYSLERR Function :

* Is provided to search, display, and print the contents of the Condition/Incident Log

* Is used only when the 3791 is On Line.

* Is invoked from a 2741, 3277, or a 3793

Note : The Log may also be outputted on a Line Printer after invoking from one of the terminals listed above.

Some of the SYSLERR Options Are :

* Search by Incident Type (1, 2 or 4)

* Search by LA (Logical Address)

* Search by sequence range

* Clear Log

* Print on a Line Printer

The Log output is always in reverse chronological order. The most recent records for the range selected are outputted first.

h. SYSTCM (999) Online Tests

The SYSTCM Function

* INvoked from a 2741, 3277, 3793, or 3791 Op Panel.

* Allows the user to request an execute tests in a 3790 online condition.

These devices can invoke tests to other devices as shown in the table below :

Invoking Device	Device to Be Tested			
	3793	3277	2741	Line Printer
3793	Yes	Yes	No	Yes
3277	Yes	Yes	No	Yes
3791 PANEL	Yes	Yes	No	Yes
2741	Yes	Yes	Yes (Same 2741)	Yes

For description on running previous tests, refer to MI, SY27-2445 section 3-10.

j. Condition/Incident Log

The 3791 records selected system events in a Condition/ Incident Log. This log resides on Disk Storage LA=21. Each event is identified by an incident type and a sequence number. Sequence numbers are assigned in order of occurence, sequentially from 1 to 4095. The Log will wrap around at 4095, starting over at 1, and any previous recordings will be over-written.
Note : Somce Condition/Incident Log records may be lost after a 3791 power-off sequence if 1) the Control Operator did not perform a normal termination of system operations prior to power-off or 2) the CE did not initialize the 3791 prior to power off.

There are three types of Condition/Incident records :

1. Type 1 records are associated with Adapter or Device failures.
2. Type 2 records are associated with Machine Check failures
3. Type 4 records are associated with various system events such as System Start, System Abend, System Shutdown, etc.

Incident records are obtained by using the CE Function SYSLERR (978) and by requesting the specific RA record types. RA records can be outputted as 'hard' copy on the 3793 or 3791 Line Printer.

Record Types

Type 1 Record

```
  1              2           3     4     5
1-TYPE    I-REC  SEQ-XXXX  NA-XX PA-XX LA-XX

  6                7                 8
C-CODE-XX          B-STAT-XX         C-FR-XX
  9                10                11
X-STAT1-XX         X-STAT2-XX        S-FR-XX
12                   13
IOCB    -XXXX XXXX       RC-XX
15        16        17           18
D1-XXXX  D2-XXXX  D3-XXXX      D4-XXXX
```

Type 1 Log Record Description

Field 1	Type 1	Indicates a Type 1 record, 3791 Feature failure.
Field 2	SEQ	A 4 digit decimal sequence number ranging from 0001 to 4095. Number indicates the relative order at which the record occured.
Field 3	NA	The number of functions and programs which were active at the time of the failure.
Field 4	PA	The Physical Address of the Adapter for which the recording was made.
Field 6	C-CODE	A completion Code which identifies the amount of retries performed and if they were successful. Each MAP describes its C-Codes.
Field 7	B-STAT	A Basic Status byte presented by the adapter and used by the MAPs to identify the problem.
Field 8	C-FR	The adapter operation active at the time of the failure.
Field 9 10	X-STATX	X-STATX STatus X = 1 or 2 information presented by the adapter (used by MAPs).
Field 11	S-FR	The System Operation in process at the time of the failure.
Field 12 13 15 16 17 18		Feature dependent, MAPs identify usable fields.

Type 2 Record

```
 1                2          3     4     5
2-TYPE    I-REC  SEQ-XXXX   NA-XX PA-XX LA-XX
 19                20               8
D21-XXXX XXXX      LVL-XX           C-FR-XX
21                 22               11
D22-XXXX XXXX      MC-XX            S-FR-XX
23          24        25
D23-XXXX    D24-XXXX    D25-XXXX
```

Type 2 Log Record Description

Field 1 Type 2	Indicates a Type 2 record, 3791 Machine Check
Field 2 3 4 5 8 11	Same as for Type 1 record.
Field 19 20 21 23 24 25	Reserved
Field 22 MC	Two hex digits that indicate the type of Machine Check that occured. Bits 0 and 1 indicate an adapter failure. Bits 2 and 3 indicate a Unit Controller Logic or Control Storage failure.

Type 4 System Incident Records

The RA adapter uses the Type 4 System Incident Record (SYS-COND-20) to indicate a majority of hardware errors. The format for the Type 4 record is :

```
1              2                  26
 -TYPE I-REC SEQ-XXXX             SYS-COND-XX
  27     28     29      30        31
  D01-XX D02-XX D03-XX D04-XX  D05-XX
```

1 - This field indicates the Type 4 incident (1) Record.

2 - This field indicates the decimal sequence number of the record.

26- This field indicates that the incident was RA related (System Condition 20)

27 thru 30- These fields provide maintenance information in hexadecimal and are described as follows.

31 - Not used

Field D[illegible]ption

The following table describes the Type 4 maintenance information fields.

Note : The D03 field is in binary so that the Status Flag Bits may be identified.

X = Any Value 0 = Always zero	D01 Field Function Request Hex 27	D02 Field Completion Code Hex 28	D03 Field Status Flags BINARY 29								D04 Field Extended Status Hex 30
			0	1	2	3	4	5	6	7	
Write Complete	0 2	x 8	x	x	x	x	x	x	x	x	x x
Read Intermediate Completion	0 1	x 1	XID Rcvd	Link Test	Rd T.O.	Lost Data	Sec Busy	Rd FBI	Rd Msg Aval	Poll Rcvd	
Write Complete and Read Intermediate Completion	0 2 0 1	x 9	0	0	0	Lost data	0	0	Rd Msg Aval	0	
Read/Write Exception	0 1 0 2	x 2	Sx RM Rcvd	Disc Rcvd	Wr Retry	Idle T.O.	Over Run	Under Run	Conn Prob	Dump Msg*	
Write - Error	0 2	x C	Inv Bstat	0	DCE Error	Write T.O.	0	MC	0	0	
Write - Halted	0 2	x A	x	x	x	x	x	x	x	x	
Read (sense) Normal completion	0 1	x 8	x	x	x	x	x	x	x	x	
Open - Normal Completion	0 0	x 8	0	0	0	RI	0	0	0	0	
Open - Intermediate Completion	0 0	x 2	0	0	0	Rtry T.O.	0	0	0	0	
Open - Error	0 0	x C	Inv BStat	0	DCE Error	Write T.O.	0	MC	0	0	
Open - Halted	0 0	x A	x	x	x	x	x	x	x	x	
Close - Normal Completion	0 4	x 8	x	x	x	x	x	x	x	x	
Close - Error	0 4	x C	Inv BStat	0	DCE Error	0	0	MC	0	0	x x

Status Flag Bit Description

Status flag bits (D03 field) are described below. Standard SDLC data communication terminology apply.

Conn Prob

Some condition exists in the link that is preventing the proper establishment or reestablishment of communication with the remote station (20 Write Retries, 20 ROL8, 20 CMDR).

DCE Error
A DCE interrupt or other unexpected DCE condition has occured (e.g. DSR dropped when it should be on).

Disc Rcvd
Set Disconnect Response Mode command received and acknowledged.

Dump Msg
One or more significant errors have occured and are Command Reject conditions. All data in the buffer is bad due to this condition.

Idle T.O.
On a seitched or leased line, there has been inactivity (no flags received) for a period of 20 seconds.

Inv BStat
Adapter Basic Status was not meaningful. The probable cause was a hardware error.

Link Test
Posted at command time upon receiving and decoding Link Test command. (Note : BCC check has not been made yet). Also indicated along with Rd Msg Aval at END FLAG time if valid Link Test has been received.

Lost Data
This bit is set along with the Rd Msg Aval bit and indicates that a count exceeded condition exists in an otherwise normal read completion.

MC
A non-recoverable machine check has occured.

Overrun
An overrun condition has been detected by the hardware (RCV mode) and the adapter is attempting recovery.

Poll Rcvd
The poll bit has been detected in the command field and no Write Function Request is outstanding. (Note : Poll cannot be verified until end frame time).

Rd FBI
The storing of the last character Read has caused the count to go to zero.

Read Msg Aval
1. A complete message has been received with no detectable errors and is now available for processing.
2. A valid Link Test has been received. 3791 code has sent the correct response.

Rd T.O.
This completion is posted when the 3791 code has been receiving (in sync) for a period longer than 20 seconds without receiving a Flag character interrupt, possibly indicating :

* Intermediate Flag characters missed due to line noise.
* Continuous Flags being received
* Long message besing received
* Line hung at 'space' or valid data character
* Receive clock failure (modem).

RI
A Ring Indicate signal had been detected while the Open Function Request was active.

Rtry T.O.
An indication during an Open Function request that a time-out has occured while awaiting the data set to become ready. The condition will prevail until either the data set becomes ready or a halt request is received (on switched line only).

Sec Busy
An RNR response has been sent to the primary station due to lack of receive buffers in the 3791.

SxRM
A valid SARM or SNRM was received, acknowledged and the 3791 Host code resequenced. The SNA response will be automatically sent.

Underrun
An underrun condition has been detected by the hardware (XMIT mode) and the adapter is attempting recovery (Secondary abort).

Wr Rtry
The adapter is required to send a previously transmitted message (I Frame) or series of messages, in its entirety, due to lack of confirmation by sequence number from the primary station. (Note : 'Write Retries = 'Conn Prob' and both completions will be posted).
Write T.O.
A timeout condition has occured during a write operation (or while sending tone during Open) and indicates a potential hardware problem (e.g. Xmit clock failure).

XID Rcvd
A valid XID was received. (Note : XID is normally received with either no associated data field or with a six byte data field).

D04 Field Extended Status

This field is valid only for a Read/Write - Exception with DUMP Msg bit ON.

Bit	Name	Description
0	BCC	The CRC check failed for the last message received.
1	Primary Abort	A detected condition indicating abnormal termination of a message by the remote transmitting station.
2	Not used	
3	Not used	
4	NR Seq Error	A Command Reject condition resulted from the receipt of an illegal NR sequence count in an information or supervisory frame containing good BCC. Recovery action will be taken by the 3791 code.
5	Count exceeded	A Command Reject condition resulted from a message being received, which was longer than the READ COUNT allocated for it. Originally, the read buffer pointer was valid, and a not-busy condition existed for the operation to begin. (Frame had good BCC). The 3791 will attempt recovery.
6	Data with command	A Command Reject condition resulted from the receipt of a data field with an otherwise valid command, for which no data field is defined. Recovery action will be taken by the 3791 code. This bit will be on along with INVAL CMD. (Frame had good BCC).
7	Invalid command	A Command Reject condition resulted from the receipt of an undefined or non-implemented command field in a frame that has good BCC. Recovery action will be taken by the 3791 code.

For further information on Incident Logs refer to RA300-320 SY27-2392

Hard Copy Procedure

This procedure enables the CE to obtain all available RA incident records from the 3791 Condition/Incident Log. The RA records may be printed on the 3791 Line Printer or the 3793.

To obtain the RA records, perform the following :

1. Log on the 3793 with CE ID = 48CE3791. Refer fo Chapter 3, 3790 Basic Procedures.
2. Select the SYSLERR Function :
   type 978, press Return Key.
3. Obtain Type 4 RA records :
   ENTER FIELD3
   type 3 ; press Return Key.
   ENTER FIELD2
   type 2420 ; press Return key.
   ENTER FIELD 1
* To print on 3793
   type 11 ; Press Return Key.
* To print on 3791 Line Printer (if present)
  type 12 ; press Return Key.
  Then, at message ENTER PRINTER ID,
  type 14, press Return Key.

The most recent Type 4 record is outputted, if present.

4. Obtain Type 2 RA records :
  ENTER FIELD 3
  type 3 ; press Return Key.
  ENTER FIELD 2
  type 22 ; press Return Key
  ENTER FIELD 1
* To print on 3793 :
  type 11 ; press Return Key.
* To print on 3791 Line Printer (if present),
  type 12 ; press Return Key.
  Then, at message, ENTER PRINTER ID
  type 14 ; press Return Key.

The most recent Type 2 record is outputted, if present.
Review and identify Type 2 records with LA and/or PA=24.
These are the RA Type 2 records.

k. Link Test

The Host 3704/3705 Communications Controller provides an SDLC Link Test that may be used for Host data link problem determination and repair verification.

The SDLC link test is basically an Echo Test with the 370X sending an SDLC test frame to a 3791. The 3791 will echo the test sequence back to the 370X, if it is received without error.

The receiving of SDLC Test Frames and the echoing back to the 370X is handled by the SYSHOST function of the Operating Code. With the SYSHOST function selected, the 3791 will receive and check all test frames. Test frames that are received good and have 9 or less data bytes will be transmitted back to the 370X exactly as received. Test frames that are received good but have more than 9 data bytes will cause a CMDREJ sequence to be transmitted back to the 370X. The 3791 will not send a response to any frame received bad. The results of the Link Test are recorded in the 3791 Condition/Incident Log as Type 4 COND-20 records.

For further information concerning Link Test operation procedure refer to RA172-174, SY27-2392 (see also Link Test section 14 in this handbook).

SECTION 22: 3271/5 DIAGNOSTICS

Description. 22.1
Problem determination procedures. 22.1
Maintenance analysis procedures 22.1
Offline tests 22.1
Online tests. 22.2

DESCRIPTION

The maintenance Package for the 3271/5 system consists of :

1. Problem Determination Procedures
2. Maintenance Analysis Procedures
3. Offline Test
4. Online Test

1. Problem Determination Procedures

The customer is supplied with an Operator Guide, GA27-2750 containing PRP's. These charts will enable the customer to perform Problem Determination.

2. Maintenance Analysis Procedures

MAP's are used by the CE to analyse problems with the 3271/5 system and these are located with the machine.

3. Offline Tests

Off-line testing is provided through the use of the following :

A) Switch Indicator (SIU): Four hexadecimal LED indicators and a 16 bit block checker has been added to the SIU. The modified SIU is compatible with the existing 3270 BSC CU maintenance procedures.

B) Pre-recorded cassette tape: One common pre-recorded tape will be available for both 3270 SDLC CU machine types. Diagnostic Read and Write commands have been added to the tape routines for additional fault isolation.

C) Cassette Record Adapter Unit (CRAU): The CRAU provides the capability of operating pre-recorded tapes.

D) SDLC Test Tape Procedure : When the original version of the SIU was used with 3270 BSC CU's, many bit switch manipulations were required to exercise the control units. The SDLC Test Tape procedure does not require manual bit switch operation ; thus reducing the possibility of switch operation errors. The following is a brief description of the SDLC test tape procedures :

1. Test tape routine exercises the 3270 SDLC CU
2. The SIU block checks the transmitted 3270 SDLC CU response.
3. The Tape Routine Completion Code (TRCC) is indicated in the SIU Hexadecimal LEDS. This TRCC value is used along with the MLTG to determine the Failing Tape Routine.

4. The repeatable tape routines are used for logic probing and with the SIU indicators, help in isolating the faulty card.

4. Online Tests

A. 3270 SNA (R3270D) : The OLT programs and patterns can be invoked from the host CPU or via a test request message from a remote keyboard. The OLTs operate concurrently with the customer program. Card calling fault locating tests (FLT) have been removed from the OLTs and inserted in the off-line maintenance procedures (see section 13).

B. API Echo (T3700SNA) : Test data in the form of characters or patterns are entered via the remote keyboard. The operator (customer or CE) specifies the number of times the test data will be repeated. The host system sends the test data to the remote display or printer specified, the number of times as indicated in the Echo Test message. The Echo Test is invoked from any remote keyboard and requires the dedication of the remote control unit under test (see section 13).

C. SDLC Link Test (T3700LTE) : The SDLC Link Test is provided for installation verification and for definition and isolation of link problems. The link test is invokable from the host CPU (See section 14).

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