



Program Product

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**APL\360 - DOS
System Generation Manual**

Program Number 5736-XM1

This manual describes the procedure for generating an APL\360 system adapted to a particular machine configuration, and the procedure for updating an existing system to incorporate improvements. It includes detailed instructions for generating both the host system and APL, and an analysis of common problems encountered in the process.

The appendices include an example of system generation, a description of changes to the DOS supervisor for APL, and instructions for adding billing routines to the APL utility programs. Reference is made to APL\360-DOS Operations Manual, Form No. H20-0685.

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INTRODUCTION

This manual describes the procedure for generating an APL\360 - DOS system adapted to a particular machine configuration, and the procedure for updating an existing APL\360 - DOS system to incorporate improvements and corrections. Familiarity with the following publications is assumed:

xxx-xxxx APL\360 User's Manual
xxx-xxxx APL\360 - DOS Operations Manual
C24-5033 DOS/360 System Generation and Maintenance
C24-5022 DOS/360 Operating Guide
C24-5036 DOS/360 System Control and System Service

For a listing of other APL publications, see the Bibliography in the APL\360 User's Manual. For other DOS publications, see the IBM System/360 Bibliography (A22-6822).

APL\360 - DOS consists of two main components, the APL time-sharing system (Core Image phase APL360) and the APL Utility program (Core Image phase APLUTIL). The APL time-sharing system operates as a privileged problem program under DOS and is normally run in a foreground partition. When running in a multiprogramming environment, its priority is alternated between the highest and the lowest in the system, thus providing a specified minimum percentage of the CPU for other jobs.

The APL Utility program is normally run in the DOS background partition when APL360 is not running, and provides for backup and maintenance of APL Libraries. It is described in the APL\360 - DOS Operations Manual.

The APL\360 system is based on the notion of a workspace, as explained in Part 2 of the APL\360 Users Manual. Operation of the system requires that space for a certain number of workspaces be available in core at all times, and some calculations given in this manual are based on the recommended minimum workspace of 36000 bytes. The absolute minimum size is 20480 bytes, but this should not be used except where there is no alternative, since it leaves only 16350 bytes for the user and some applications will not run in it.

MACHINE CONSIDERATIONS

System Resources Used By APL360

At least 160K bytes of main storage.*
At least one 2311 (or 2314) Disk Storage Drive.
At least one 2701, 2702, or 2703 Transmission Control
Unit line position.

Interval Timer.

Minimum System Configuration

CPU	2040 Processing Unit 192K bytes main storage* Timer feature Universal Instruction Set Multiplexor Channel Selector Channel 1052-7 Printer Keyboard
Unit Record	Card Reader Card Punch Printer
DASD	Three 2311 Disk Storage Drives and 2841 Control Unit, or One 2314 Direct Access Storage Facility
Tape	One 2400-series 9 track (or 7 track with data-conversion feature) magnetic tape unit and control unit
T/P	One 2701, 2702 or 2703 Transmission Control Unit
Terminals	See Part 1 of the APL\360 User's Manual for a description of the types and features supported.

* Assumes a standard size workspace.

Additional Devices Supported

CPU	2044 (with Commercial Feature), 2050, 2065, 2067, 2075, 2085, or 2091 Processing Unit Additional Main Storage High-Resolution Timer
DASD	Additional 2311 drives or 2314 DASF (all DASD drives used by APL for Libraries must be the same type)
Tape	One additional tape drive
T/P	Additional 270X Transmission Control Units

Data-Sets and Modems

Dial-up terminals may be connected by Western Electric 103A2* Data-sets. Fixed connection terminals may be connected either by IBM Limited-Distance Four Wire Modems, IBM World Trade 3976 Leased Line Modems, or Western Electric 103F2* Data-sets. An interrupt facility is highly desirable for dial-up terminals, and is required for fixed connection terminals.

* Or equivalent

IBM 2701/2702/2703 Configuration Guide

The accompanying tables give information for ordering a 2701, 2702, or 2703 for use with APL. Specifications are given for configurations in which all ports are connected by 103A2 (or equivalent) dataphones. The specifications must be modified if terminals are to be connected by IBM 4-wire modems or leased telephone lines, or as required for other teleprocessing applications.

The symbol "n" appearing below represents the number of ports which are to be connected to the Transmission Control. The maximum number of ports which may be connected to a 2701 is 4; to a 2702 is 31; and to a 2703 is 176.

	<u>Feature</u>	<u>Quantity</u>	<u>Note</u>
2701	Transmission Control Unit	1	
4645	IBM Terminal Adapter Type I	n	
3855	Expansion Feature	n-1	
3815	Extended Capability	n>2	Note 1
904x	Color	1	
990x	Voltage	1	
2702	Transmission Control Unit	1	
4615	IBM Terminal control Type I	1	
8055	2741 Break	1	
7955	31-Line Expansion	n>15	Note 2
3233	Data Set Line Adapter	n	
9696	Terminal Control Base	1	
9685	Selective Speed 134.5 bps	1	
904x	Color	1	
990x	Voltage	1	

2703	Transmission Control Unit	1	
7505	Start-Stop Base Type I	$\lceil \underline{n} \div 88$	Note 3
1440	Base Expansion	$\underline{n} > 88$	Note 4
4619	IBM Terminal Control Base	1	
4696	IBM Terminal Control Type I	1	
8055	2741 Break	1	
3205	Data Line Set	$\lceil \underline{n} \div 16$	Note 5
3206	Data Line Set Expander	$\lceil (\underline{n} - 8) \div 16$	Note 6
4878	Line Speed Option 134.5 bps	1	
904x	Color	1	
908x	Cabling	1	
990x	Voltage	1	

Notes:

1. One 3815 if more than 2 lines.
2. One 7955 if more than 15 lines.
3. One 7505 for up to 88 lines, two for more than 88 lines.
4. One 1440 if more than 88 lines.
5. One 3205 for each group of sixteen lines or fraction thereof.
6. One 3206 for each group of sixteen lines or fraction thereof greater than eight.

SYSTEM GENERATION PROCEDURE

DISTRIBUTION TAPE FORMAT

APL\360 - DOS is distributed as one magnetic tape volume consisting of eight physical files (six logical files). The first logical file contains standard labels, the remaining are unlabelled.

```
HDR1 ... Standard Tape Header Label
T/M
APL\360 Distribution Library
T/M
EOF1 ... Standard Tape Trailer Label
T/M
APL\360 - DOS Update Job
T/M
Reserved File
T/M
Reserved File
T/M
DOS/360 R19 Update Job
T/M
DOS/360 R20 Update Job
T/M
T/M
```

SUMMARY OF SYSTEM GENERATION STEPS

If you are updating an existing APL system and wish to preserve APL Libraries, dump the libraries to tape (using the DUMP operation of the APL Utility) before beginning this APL system generation. This dump tape must be prepared using your current version of the APL Utility. This tape will later be restored in Step 3-E. If sufficient disk packs are available, hold the existing APL Library packs until system generation is finished as protection against hardware malfunction or human error.

The remainder of the APL generation procedure can be divided into three steps:

1. Storage Requirement Calculation
2. DOS System Generation for APL
 - 2-A. Restore DOS SYSRES from Tape
 - 2-B. Catalog Modifications to DOS
 - 2-C. DOS System Generation
3. APL Generation
 - 3-A. Catalog APL Modules
 - 3-B. Assemble the APL Configuration
 - 3-C. Catalog APL
 - 3-D. Label APL Library and Swap Disks
 - 3-E. Create APL Libraries
 - 3-F. Initialize APL360

1. STORAGE REQUIREMENT CALCULATIONS

The quantities WSSIZE, DIRS, INCORE, and IODEBUG are parameters of the APLSCONF macro of the APL Configuration which designate system parameters.

WSSIZE (Workspace Size) designates the physical size in bytes for workspaces in the system. All calculations of directory capacity assume standard size (36000 byte) workspaces. The actual space required for workspaces in core is WSSIZE rounded up to the next 2K boundary; on disk it is the number of tracks to contain the active portion of the workspace, rounded up to the next track boundary.

DIRS (Directories) designates the number of user directories in the APL Libraries. These directories contain the account number, name, billing information, and pointers to the saved workspaces of all enrolled users. Each standard size directory holds about 150 users and requires 21 tracks for 2311 and 10 tracks for 2314. Two copies of each directory are maintained to protect the integrity of the information they contain.

INCORE (Workspaces In Core) designates the number of areas of main storage reserved for workspaces when APL360 is running. INCORE must be at least 2, and in systems with more than 20 ports there is a considerable improvement in performance if INCORE is 3 or greater.

IODEBUG designates the number of entries in the input/output trace table. The default value of 200 will suffice for most cases. The workspace 314159 IODEBUG, which uses this table, assumes that the length is a multiple of 100.

Two other quantities are not APLSCONF parameters, but are derived from the APL Configuration assembly. Ports is the number of ports configured by APLDEV macro calls, plus the number of ports in a control unit position bracketed by configured ports. Libs is the number of APLDS macro calls, not including the Swap extent.

$DISK \leftarrow 10$ for 2311 $DISK \leftarrow 20$ for 2314

All APL Library extents must be on the same device type, although the Library and Swap devices may differ.

Calculate the number of tracks required to contain a full workspace.

$WSTRK \leftarrow \lceil WSSIZE \div 362.4 \times DISK$

Size of Swap Extent in cylinders

$WSTRK < DISK$: $\lceil (PORTS + 5) \div \lfloor DISK \div WSTRK$
 $WSTRK \geq DISK$: $\lceil (PORTS + 5) \times \lceil WSTRK \div DISK$

If workspace size is greater than cylinder capacity, the Swap extent is the number of cylinders per workspace times five plus the number of ports. If workspace size is not greater than the cylinder capacity, the Swap extent is five plus the number of ports divided by the number of workspaces per cylinder.

Minimum Size of Library Extent 0 in cylinders

$\lceil (DIRS \times (2 \times WSTRK) + 0 = DISK \mid WSTRK) \div DISK$

The result is two times the number of directories times the number of tracks per workspace, plus one more track per directory if a workspace occupies a number of tracks that is an integral number of cylinders.

Size of APL Partition in bytes

$APLCORE \leftarrow 2048 \times \lceil (82000 + (LIBS \times 76) + (INCORE \times (8 + 2048 \times \lceil WSSIZE \div 2048))) + (IODEBUG \times 10) + PORTS \times 312 \div 2048$

The result is the sum of: 82000; 76 times the number of library extents; the number of workspaces in core times 8 plus the workspace size rounded up to a 2K boundary; 312 times the number of ports; finally rounded up to a 2K boundary.

The value given on the ALLOC statement for the partition APL will use is $APLCORE$ divided by 1024.

Origin of APL Partition

The calculation of the origin of APL360 depends on which partition is being used. The result of this calculation is used on the PHASE APL360 statement of Step 3-C.

BG : $2048 \times \lceil \text{SUPSIZE} \div 2048 \rceil$

The end of the DOS supervisor, rounded to a 2K boundary.

F1 : $2048 \times \lceil (\text{MACHINESIZE} - \text{APLCORE}) \div 2048 \rceil$

The machine size minus the size of APL360.

F2 : $2048 \times \lceil (\text{MACHINESIZE} - \text{APLCORE} + 2048 \times \lceil \text{F1SIZE} \div 2048 \rceil) \div 2048 \rceil$

The machine size minus the total size of APL360 plus the size of the foreground l partition rounded to a 2K boundary.

2. DOS SYSTEM GENERATION FOR APL

The procedure required to generate a DOS system for use with APL is the same as described in the DOS/360 System Generation and Maintenance Manual, with the exception that modified SYSGEN macros must be cataloged before the DOS supervisor is assembled. Also the DOS supervisor must be assembled with the necessary options, as given in Table 1.

Step 2-A Restore DOS SYSRES from Tape

See the DOS/360 System Generation and Maintenance Manual for instructions.

Step 2-B Catalog APL Modifications to DOS

Mount the APL Distribution Tape on tape drive X'cuu' and enter the following statements from SYSLOG:

```
MTC REW,X'cuu' ②  
MTC FSF,X'cuu',f ②      f=6 for R19, f=7 for R20  
ASSGN SYSIN,X'cuu' ②  
②
```

This job catalogs DOS Sysgen macros with the modifications described in Appendix D. Only the macros which have been modified for APL are provided. When it is completed SYSLOG will print: 1C00A ATTN. c uu. Assign SYSIN back to its previous assignment.

Step 2-C DOS System Generation

Assemble the DOS supervisor. Table I lists the multiprogramming supervisor options which may be used with APL. Catalog the DOS supervisor and system control and the desired language processors, and reallocate SYSRES as required. See the DOS/360 System Generation and Maintenance Manual for instructions.

3. APL SYSTEM GENERATION

Step 3-A Catalog APL Modules

Mount the APL distribution tape on tape drive X'cuu' and enter the following statements from SYSLOG:

```
MTC REW,X'cuu' ②  
MTC FSF,X'cuu',3 ②  
ASSGN SYSIN,X'cuu' ②  
②
```

This job catalogs the source and relocatable modules listed in Appendix C. When it is completed SYSLOG will print:
1C00A ATTN. c uu. Assign SYSIN back to its previous assignment.

Step 3-B Assemble the APL Configuration

The APL Configuration assembly consists of a series of macro calls which tailor APL to a particular system configuration. Table 2 describes the APL Configuration Macros. Many of the parameter options were discussed in Step 1.

The program begins with an APLSCONF statement designating certain system parameters. An APLDEV statement follows for each port in the system, designating the hardware address of that port, as well as the type of connection. At least two APLDS statements follow, one to describe the Swap disk extent, and one for each APL Library extent. The APLSEND statement, followed by the assembler END statement, complete the program.

Assemble the APL Configuration and get an object deck, which will be used in the next step. The configuration should assemble without error; Appendix B describes the diagnostic messages that may be produced by the APL Configuration.

MACRO	RECOMMENDED	ALLOWED	NOT ALLOWED
SUPVR	SYSTEM=DISK MPS=YES TP=APL MICR=NO AP=NO EU=NO	MPS=BJF TP=(APL,BTAM) TP=(APL,QTAMnn) EU=YES	MPS=NO TP=NO TP=BTAM TP=QTAMnn MICR=14nn AP=YES
CONFG	MODEL=nn SP=YES DEC=YES FP=YES TIMER=YES		SP=NO DEC=NO FP=NO TIMER=NO
STDJC	All parameters are optional		
FOPT	OC=NO IT=F1 note 1 PC=YES TEB=n SKSEP=NO CE=NO PTO=YES CBF=NO CCHAIN=YES TRKHLD=NO AB=YES WAITM=NO ACCTG=YES note 2 DASDFP=(n,n,231n) SYSFIL=NO	OC=YES IT=F2 note 1 IT=BG note 1 TEB=NO SKSEP=YES SKSEP=n PTO=NO CBF=n TRKHLD=n WAITM=YES ACCTG=NO note 2 DASDFP=NO SYSFIL=(231n,n,n)	PC=NO CE=YES CE=n CCHAIN=NO AB=NO
PIOCS	SELCH=YES BMPX=NO CHANSW=NO TAPE=9	BMPX=YES note 3 CHANSW=RWTAU CHANSW=TSWTCH TAPE=7	SELCH=NO TAPE=NO
ALLOC	F1=nK note 4	F2=nK note 4	
IOTAB	All parameters are optional		
DVCGEN	notes 5 and 7		
ASSGN	notes 6 and 7		
HOLD	F1 note 8	F2 note 8	
SEND	X'2800' (10K SUPVR)	X'xxxx' (>10K SUPVR)	

Table 1 DOS Supervisor Options for APL

Notes on Table 1:

1. Before APL is initiated, the interval timer must be assigned to the partition APL will use. Normally the timer will be given to a partition at sysgen and rarely changed.
2. The ACCTG=YES parameter provides for job step CPU usage to be reported on SYSLOG.
3. BMPX=YES should be specified only for tapes attached to a 2870 selector subchannel. Burst mode devices may not be used on a multiplexor subchannel while APL is running.
4. Storage allocation may be controlled in the usual way by the machine operator (see DOS Operating Guide). Specifying allocation at system generation will, however, make APL initiation easier. The calculation of the APL partition size was done in step 1.
5. DVCGEN calls for 270X ports used by APL are not required; these ports are included in the APL Configuration (Step 3-B). They must be included only if these ports are used by other applications when APL is not running.
6. The ASSGN macro has been extended to permit assignment of logical units to a foreground partition.

Example: ASSGN SYS011,X'172',F1

The partition (F1, F2 or BG) is written following the physical unit designation.

If such foreground assignments are made, the use of the ADD and DEL commands at IPL will yield unpredictable results.

7. If APL ports are defined by DVCGEN statements, they must not be assigned to any partition while APL is running.
8. The HOLD macro causes all I/O assignments for the foreground area specified to remain in effect after IPL and from job to job. This is particularly useful when logical units within foreground partitions are initially assigned, since the assignments will be held when the partition terminates or is cancelled. The HOLD can, of course, be overridden by the Machine Operator with a RELSE command. (See DOS Operating Guide.)

Deck Setup:

```
// JOB APLSCONF      ASSEMBLE APL CONFIGURATION
// OPTION DECK,LIST
// EXEC ASSEMBLY
          APLSCONF  DIRS=d,INCORE=i, ...
          APLDEV   X'uu', ...
          .
          .
          .
SWAP     APLDS      n,'file-name'
LIB      APLDS      n,'file-name'
          .
          .
          .
          APLSEND
          END

/*
/ &
```

Step 3-C Catalog APL

Linkage edit and catalog APL in the Core Image Library, as shown in the following deck setup. The APL Configuration object deck from the previous step must be inserted as specified.

```
// JOB APLLINK      LINK EDIT & CATALOG APL
// OPTION LINK,CATAL
// EXEC MAINT
          <<< APL Configuration object deck >>>
/*
          PHASE APL360,F+nnnK  note 1
          INCLUDE APLSLINK
// EXEC LNKEDT
          INCLUDE APLUTIL
// EXEC LNKEDT
/ &
```

Note 1: nnnK is the origin of the partition that APL360 will use. This value was calculated in Step 1.

Note 2: These messages following the storage maps may be ignored:

```
* UNREFERENCED SYMBOLS
nnn UNRESOLVED ADDRESS CONSTANTS
```

Step 3-D Label APL Library and Swap Disks

During APL360 initialization, the pack on each logical unit specified in the APL Configuration APLDS statements is searched for the associated Format 1 label (DSCB). These

LABEL	MACRO	OPERAND	DESCRIPTION
none	APLSCONF		This must be the first macro call, and appear only once.
		HOST=DOS	The host system with which APL will run.
		DIRS=5 DIRS=d	The number of user directories in the APL libraries; d must be 2 or greater.
		WSSIZE=36000 WSSIZE=n	The size in bytes for workspaces. WSSIZE should be specified as standard (36000) unless major requirements dictate otherwise. $n \geq 20480$ and $n \leq 216000$ (2311) or $n \leq 432000$ (2314).
		INCORE=3 INCORE=i	The number of areas of WSSIZE bytes reserved in main storage; i must be 2 or greater.
		EXPLIM=8 EXPLIM=m	The express time limit in minutes in effect when APL is initialized. This limit may also be designated during APL operation.
		IODEBUG=200 IODEBUG=n	The number of entries in the IODEBUG trace table.
none	APLDEV		One APLDEV call is required for each multiplex device. APLDEV calls must be given in order of increasing multiplex addresses.
		X'uu'	The multiplex device address.
		TYPE=AMBIG TYPE=1050 TYPE=2741 TYPE=TS41	The type of device on this port. AMBIG denotes a dial-up connection (103-A2 or equivalent). For a fixed connection, the terminal type must be designated: 1052 denotes the 1052-7 console keyboard-printer; 2741 denotes a 2740 or 2741 with standard Selectric keyboard; TS41 denotes a 2740 or 2741 with PTTC/EBCD keyboard.
		SAD=SAD0 SAD=SAD1 SAD=SAD2 SAD=SAD3 SAD=NOP	For a 2702 port, gives the terminal control address wired to this port. For a 2701 port, SAD=NOP is required. For a 2703 port or 1052-7, any SAD is valid.
		EXPRESS=NO EXPRESS=YES	Designates whether this port is express when APL is initialized. Express ports may also be designated during APL operation.
		SWAP LIB none	APLDS
	n		DOS logical unit number assigned to the drive which contains this extent.
	'file-name'		The file name of this extent. The file name may be up to 44 characters long; trailing blanks may be omitted.
none	APLSEND	none	Follows the last APLDS call and precedes the END card.

TABLE 2 APL\360-DOS Configuration Macros

labels must be written when APL is first generated. They are written subsequently only to change file names or extent boundaries. (See APL Operations Manual). A deck setup of the following form is required for each label to be written:

```
// ASSGN SYSnnn,X'cuu'
// DLBL APLDS,'file-name',99/365
// EXTENT SYSnnn,serial,,,fff,ttt
// EXEC APLLABEL
```

SYSnnn may be any valid logical unit, but must be the same on the ASSGN and EXTENT statements.

cuu is the device address on which the pack is mounted.

file-name is the identification of this extent, and must agree with the corresponding APLDS statement in the APL Configuration.

serial is the volume serial number of the disk pack.

fff is the relative starting track of this extent, and must correspond to track zero of some cylinder.

ttt is the number of tracks in this extent, and must represent an integral number of cylinders.

Step 3-E Create APL Libraries

If APL Libraries are being preserved, mount the APL Dump tape on tape drive X'cuu', otherwise mount the APL Distribution Tape. Provide the following statements on SYSIN:

```
// JOB APL360 CREATE APL LIBRARIES
// ASSGN SYS004,X'cuu'
// ASSGN SYS005,X'cuu'
// EXEC APLUTIL
  WSLIST
  CREATE
  SELREST << Only when Libraries being preserved >>
  ACCTG 1
/*
/&
```

The tape label is logged, and several minutes are spent formatting the library disks. The tape rewinds, the label is logged again and the tape is read and the workspaces written to disk. At end of file workspace totals are logged and the tape is unloaded.

If APL Libraries are being preserved, the DOS message OP08A INTERV REQ SYS004=cuu is logged. Mount the APL Distribution Tape. This tape will also be read and the workspaces transferred to disk.

SYSLST will contain a listing of all workspaces as they are written to disk, as well as an accounting listing of all libraries and workspaces in the system.

Step 3-F Initialize APL360

Start APL360 in the manner described in the APL Operations Manual.

The operator's workspace - *OPFNS* must now be initialized from the recording terminal by these statements:

```
)LOAD OPFNS
SAVED time date
INITIALIZE
```

This defined function will give the operator a series of instructions, allowing him to initialize the workspace *OPFNS* which provides utility functions. The phone numbers requested are used to identify the ports for several of the functions (e.g. *FREE*, *PORT*, and *PHONE*) and may be 4, 7, or 10 digits as desired. Although a number of phones may be connected to a roll-up with a single access number, the actual phone numbers should be provided to facilitate servicing. For fixed connection ports any numbers may be provided for identification. After the initialization is completed, *OPFNS* should be saved, using the system command *)SAVE OPFNS:lock*.

The APL Operator should examine the contents of public library 1, to which the distribution library should have been restored. He can do this with the command:

```
)LIB 1
```

which will cause a list of the workspaces in public library 1 to be printed.

SOME COMMON PROBLEMS

The system enters a tight loop immediately after the message
APL HAS m SLOTS, nnnn BUFFERS.

- Check in the APL Configuration that all dial-up ports have been designated as TYPE=AMBIG, and all fixed-connection ports have been designated with the correct terminal type (TYPE=2741, TYPE=TS41, TYPE=1050 or TYPE=1052) (Step 3-B).
- Have the Customer Engineer verify that the proper SAD command has been designated for ports connected to a 2702 Transmission Control Unit (Step 3-B).
- Check that SAD=NOP has been designated for ports connected to a 2701 Transmission Control Unit (Step 3-B).
- Have the Customer Engineer verify that the proper condition code is being set after a SIO instruction to the 270X Transmission Control Unit.
- If the 270X Transmission Control Unit is address x'80' or higher, verify that the CPU has the additional multiplexor subchannel feature.
- Check that all ports designated by APLDEV statements in the APL Configuration (Step 3-B) are physically installed in the 270X Transmission Control Unit.

The telephones attached to the 270X Transmission Control Unit will not answer.

- Ensure that the data-sets have power and are in the auto-answer mode.
- Check that the telephones are installed, that a dial-tone can be obtained, and that the data-set rings when dialed.
- Have the Customer Engineer verify that the telephones are correctly connected to the 270X Transmission Control Unit.
- Have the Customer Engineer verify that the proper SAD command has been designated for ports connected to a 2702 Transmission Control Unit (Step 3-B).

A 2741 keyboard repeatedly unlocks immediately after the APL operator enters)314159.

- Ensure that the first character entered is) on the APL keyboard.
- Verify that the 270X Transmission Control Unit is at a recent Engineering Change level.
- Check in the APL Configuration that all dial-up ports have been designated as TYPE=AMBIG, and all fixed-connection ports have been designated with the correct terminal type (TYPE=2741, TYPE=TS41, TYPE=1050 or TYPE=1052) (Step 3-B).
- Try another 2741.

The Attention signal does not function correctly.

- Verify that the terminal used has the attention feature.
- Verify that the 270X Transmission Control Unit has the 2741 Break Feature installed.
- Have the Customer Engineer verify that the proper SAD command has been designated for ports connected to a 2702 Transmission Control Unit (Step 3-B).
- Ports connected to a 2701 Transmission Control Unit do not fully support the Attention signal.

The dial-up connection is not disconnected when a user signs-off.

- Ensure that the data-sets have the remote-disconnect feature.
- Verify that the 270X Transmission Control Unit is at a recent Engineering Change level.

APPENDIX A

EXAMPLE APL SYSTEM GENERATION

Configuration: System/360 Model 50 H

<u>Device</u>	<u>Address</u>
1052 Console Printer-Keyboard	009
2540 Card Reader	00C
2540 Card Punch	00D
1403 Printer	00E
2702 Transmission Control Unit	
IBM 4 wire modems, Sad 2	020 to 02F
103A2 Dial-up, Sad 1	030 to 03E
2314 DASD	170 to 177
2400 9 Track Tape	282 and 283

Step 1 Storage Requirement Calculations

$WSSIZE \leftarrow 36000$
 $DIRS \leftarrow 5$
 $INCORE \leftarrow 3$
 $IODEBUG \leftarrow 200$
 $PORTS \leftarrow 31$
 $LIBS \leftarrow 2$
 $DISK \leftarrow 20$
 $\square \leftarrow WSTRK \leftarrow \lceil WSSIZE \div 362.4 \times DISK \rceil$

5

Size of Swap Extent in cylinders

$\lceil (PORTS + 5) \div \lfloor DISK \div WSTRK \rfloor \rceil$

9

Minimum Size of Library Extent 0 in cylinders

$\lceil (DIRS \times (2 \times WSTRK) + 0 = DISK \mid WSTRK) \div DISK \rceil$

3

Size of APL Partition in bytes

$\square \leftarrow APLCORE \leftarrow 2048 \times \lceil (82000 + (LIBS \times 76) + (INCORE \times (8 + 2048 \times \lceil WSSIZE \div 2048 \rceil) + (IODEBUG \times 10) + PORTS \times 312) \div 2048 \rceil$

202752

$APLCORE \div 1024$

198

Origin of APL Partition

```
MACHINESIZE←256×1024
□←ORIGIN←2048×[(MACHINESIZE-APLCORE)÷2048
59392
ORIGIN÷1024
58
```

Step 2 DOS System Generation

```
// JOB APL360 ASSEMBLE DOS SUPERVISOR
// OPTION LIST,DECK,XREF
// EXEC ASSEMBLY
    SUPVR SYSTEM=DISK,MPS=YES,TP=APL
    CONFG MODEL=50,SP=YES,DEC=YES,FP=YES,TIMER=YES
    STDJC DUMP=NO
    FOPT OC=YES,IT=F1,PC=YES,TEB=10,CCHAIN=YES, *
        AB=NO,PTO=YES,ACCTG=YES,CE=NO, *
        DASDFP=(1,6,2314)
    PIOCS SELCH=YES,TAPE=9
    ALLOC F1=198K,F2=0K
    IOTAB BGPGR=25,F1PGR=10,F2PGR=5,JIB=30, *
        CHANQ=50,IODEV=50
    DVCGEN CHUN=X'009',DVCTYP=1050A
    DVCGEN CHUN=X'00C',DVCTYP=2540R
    DVCGEN CHUN=X'00D',DVCTYP=2540P
    DVCGEN CHUN=X'00E',DVCTYP=1403
    DVCGEN CHUN=X'170',DVCTYP=2314
    DVCGEN CHUN=X'171',DVCTYP=2314
    DVCGEN CHUN=X'172',DVCTYP=2314
    DVCGEN CHUN=X'173',DVCTYP=2314
    DVCGEN CHUN=X'174',DVCTYP=2314
    DVCGEN CHUN=X'175',DVCTYP=2314
    DVCGEN CHUN=X'176',DVCTYP=2314
    DVCGEN CHUN=X'177',DVCTYP=2314
    DVCGEN CHUN=X'282',DVCTYP=2400T9
    DVCGEN CHUN=X'283',DVCTYP=2400T9
    ASSGN SYSLOG,X'009'
    ASSGN SYSRDR,X'00C'
    ASSGN SYSIPT,X'00C'
    ASSGN SYSPCH,X'00D'
    ASSGN SYSLST,X'00E'
    ASSGN SYSLNK,X'171'
    ASSGN SYS001,X'171'
    ASSGN SYS002,X'171'
    ASSGN SYS003,X'171'
    ASSGN SYS006,X'172'
    ASSGN SYS007,X'173'
    ASSGN SYS006,X'172',F1
    ASSGN SYS007,X'173',F1
    HOLD F1
    SEND X'2800'
    END
```

```
/*
/ &
```

Step 3-A Catalog APL Modules

```
BG mtc rew,x'283' B
BG mtc fsf,x'283',3 B
BG assgn sysin,x'283' B
BG B
```

Step 3-B Assemble the APL Configuration

```
// JOB APLSCONF ASSEMBLE THE APL CONFIGURATION
// OPTION LIST,DECK,XREF
// EXEC ASSEMBLY
    APLSCONF ,                                DEFAULT OPTIONS
    APLDEV X'20',TYPE=TS41,SAD=SAD2
    APLDEV X'21',TYPE=TS41,SAD=SAD2
    APLDEV X'22',TYPE=TS41,SAD=SAD2
    APLDEV X'23',TYPE=TS41,SAD=SAD2
    APLDEV X'24',TYPE=2741,SAD=SAD2
    APLDEV X'25',TYPE=2741,SAD=SAD2
    APLDEV X'26',TYPE=2741,SAD=SAD2
    APLDEV X'27',TYPE=2741,SAD=SAD2
    APLDEV X'28',TYPE=2741,SAD=SAD2
    APLDEV X'29',TYPE=2741,SAD=SAD2
    APLDEV X'2A',TYPE=2741,SAD=SAD2
    APLDEV X'2B',TYPE=2741,SAD=SAD2
    APLDEV X'2C',TYPE=2741,SAD=SAD2
    APLDEV X'2D',TYPE=2741,SAD=SAD2
    APLDEV X'2E',TYPE=2741,SAD=SAD2
    APLDEV X'2F',TYPE=2741,SAD=SAD2
    APLDEV X'30'                                DEFAULT OPTIONS
    APLDEV X'31'
    APLDEV X'32'
    APLDEV X'33'
    APLDEV X'34'
    APLDEV X'35'
    APLDEV X'36'
    APLDEV X'37'
    APLDEV X'38'
    APLDEV X'39'
    APLDEV X'3A'
    APLDEV X'3B'
    APLDEV X'3C'
    APLDEV X'3D'
    APLDEV X'3E'
SWAP APLDS 6,'APL.SWAP'
LIB APLDS 7,'APL.LIB.ZERO'
    APLDS 6,'APL.LIB.ONE'
    APLSEND
    END
/*
/&
```

Step 3-C Catalog APL

```
// JOB APLLINK      LINK EDIT & CATALOG APL
// OPTION LINK,CATAL
// EXEC MAINT
//   <<< APL Configuration Object Deck >>>
/*
  PHASE   APL360,F+58K
  INCLUDE APLSLINK
// EXEC LNKEDT
  INCLUDE APLUTIL
// EXEC LNKEDT
/&
```

Step 3-D Label APL Library and Swap Disks

```
// JOB APLLABEL      LABEL APL DISKS
// ASSGN SYS006,X'172'          SWAP
// DLBL APLDS,'APL.SWAP',99/365
// EXTENT SYS006,APL001,,,20,200
// EXEC APLLABEL
// ASSGN SYS007,X'173'          LIBRARY 0
// DLBL APLDS,'APL.LIB.ZERO',99/365
// EXTENT SYS007,APL002,,,20,3960
// EXEC APLLABEL
// ASSGN SYS006,X'172'          LIBRARY 1
// DLBL APLDS,'APL.LIB.ONE',99/365
// EXTENT SYS006,APL001,,,220,3760
// EXEC APLLABEL
/&
```

Step 3-E Create APL Libraries

```
// JOB APL360      CREATE APL LIBRARIES
// ASSGN SYS004,X'283'
// ASSGN SYS005,X'283'
// EXEC APLUTIL
  WSLIST
  CREATE
  ACCTG 1
/*
/&
```

Step 3-F Initialize APL360

)314159 Sign-on Recording Terminal
OPR) 14.53.09 09/26/69 OPERATOR

A P L \ 3 6 0

)LOAD OPFNS Load OPFNS Workspace
SAVED 12.05.57 09/01/69
INITIALIZE Initialize OPFNS

A P L \ 3 6 0 OPERATOR FUNCTIONS INITIALIZATION
THIS SYSTEM HAS 31 PORTS.

ENTER PHONE NUMBERS OR OTHER NUMERIC IDENTIFICATION
TO STOP NUMBERING PREMATURELY, TYPE STOP

PORT 1 MPX 20 FIXED, ID IS:
9901
PORT 2 MPX 21 FIXED, ID IS:
9902

• • •
PORT 16 MPX 2F FIXED, ID IS:
9916

PORT 17 MPX 30 DIALUP, PHONE NUMBER IS:
3500

PORT 18 MPX 31 DIALUP, PHONE NUMBER IS:
3501

PORT 19 MPX 32 DIALUP, PHONE NUMBER IS:

• • •
PORT 30 MPX 3D DIALUP, PHONE NUMBER IS:
3513

PORT 31 MPX 3E DIALUP, PHONE NUMBER IS:
3514

OPFNS INITIALIZATION IS COMPLETE. SAVE THIS WORKSPACE
WITH THE SYSTEM COMMAND)SAVE OPFNS
SINCE THIS WORKSPACE SHOULD BE USED ONLY BY THE OPERATOR
OR BY SYSTEMS PROGRAMMERS, PROTECT IT WITH A LOCK.
(SEE APL\360 USER'S MANUAL)

)SAVE OPFNS:SECRET Save OPFNS With Lock
15.28.04 09/26/69
2 3 4+5 6 7 Try Some APL Statements
7 8 9

• • •
)OFF:PASSWORD Sign-off Changing Sign-on Lock

OPR 16.14.21 09/26/69 OPE
OPR 16.14.21 09/26/69 OPE
CONNECTED 1.21.12 TO DATE 1.21.12
CPU TIME 0.00.20 TO DATE 0.00.20

APPENDIX B

APL\360 - DOS CONFIGURATION ASSEMBLY DIAGNOSTIC MESSAGES

APLSCONF Macro:

DIRS MAY NOT BE LESS THAN 2, MACRO IGNORED

Meaning: APL requires at least 2 directories.

Effect: The assembly is unusable and must be corrected and rerun.

HOST SPECIFICATION INVALID, MACRO IGNORED

Meaning: The host system must be specified as DOS, APL, or CP67.

Effect: The assembly is unusable and must be corrected and rerun.

INCORE MAY NOT BE LESS THAN 2, MACRO IGNORED

Meaning: APL requires at least 2 slots in core.

Effect: The assembly is unusable and must be corrected and rerun.

IODEBUG MAY NOT BE LESS THAN 1, MACRO IGNORED

Meaning: APL requires at least 1 entry in the input/output debug trace table.

Effect: The assembly is unusable and must be corrected and rerun.

WARNING - NON STANDARD WORKSPACE SIZE

Meaning: Warning that the workspace size designated is not standard.

Effect: None.

WS SIZE TOO SMALL, MACRO IGNORED

Meaning: The workspace size must be at least 20480 bytes.

Effect: The assembly is unusable and must be corrected and rerun.

APLDEV Macro:

APLDEV CALLS OUT OF ORDER, MACRO IGNORED

Meaning: The APLDEV macro calls must follow the APLSCONF macro call and must be in ascending sequence by multiplexor device address.

Effect: The port designated by this statement is not included in the configuration, however the assembly is otherwise usable.

APLDS Macro:

FILE NAME INVALID, MACRO REJECTED

Meaning: The file name for the extent must be put in quotes.

Effect: This extent is not included in the assembly.

FILE NAME TOO LONG, TRUNCATED

Meaning: The file name may not be longer than 44 characters.

Effect: The file name is truncated to 44 characters.

LOGICAL UNIT INVALID, MACRO REJECTED

Meaning: The DOS logical unit number must not be less than 0 or greater than 244. The logical unit number may not be designated as 4 or 5 for a Library extent.

Effect: This extent is not included in the assembly.

APLSEND Macro: No diagnostics.

Assembler Diagnostics may occur in conjunction with some of the APL diagnostics.

APPENDIX C

APL\360 - DOS LIBRARY SPACE REQUIREMENTS

The following tables give the approximate disk space in the DOS libraries used by APL. Actual requirements may vary slightly due to the difference in record lengths used by DOS for 2311 and 2314 drives. The size of APL360 will also vary, depending on the number of ports and APL library extents. The figures shown are for a system with 60 ports and 5 library extents.

DOS Core Image Library

<u>Phase</u>	<u>Records</u>	<u>Notes</u>
\$\$BEACCT	1	
\$\$BOAPL	1	
APLLABEL	2	
APLUTIL	25	
APL360	60	

DOS Relocatable Library - APL

<u>Module</u>	<u>Records</u>	<u>Notes</u>
APLLABEL	6	
APLSAGOR	4	
APLSTAKE	7	
APLSARTH	20	
APLSASUP	145	
APLSBASE	4	
APLSBLOW	4	
APLSCATN	6	
APLSCONF	65	Varies by installation
APLSDEXP	3	
APLSDIOT	4	
APLSDKFM	5	
APLSDPY	7	
APLSDQRY	4	
APLSDRHO	5	
APLSDSER	11	
APLSDTRA	5	
APLSDYIB	7	
APLSEPSI	4	

APLSERAF	7	
APLSFFSS	4	
APLSGOUT	5	
APLSGRAD	4	
APLSMIBM	6	
APLSINDX	16	
APLSLINK	50	
APLSMSOP	14	
APLSMTRA	4	
APLSOCTL	13	
APLSOPEN	7	
APLSOPLB	5	
APLSPCSB	6	
APLSPROD	8	
APLSRAVL	2	
APLSREDU	7	
APLSREPS	4	
APLSMRIO	3	
APLSSCOP	8	
APLSSINA	11	
APLSSINI	12	
APLSSLCT	9	
APLSSUPA	140	
APLSSYNT	20	
APLSTBCD	5	
APLSTPIN	51	
APLSTRTB	11	
APLSTRTC	11	
APLSROTR	8	
APLUBILL	10	
APLUDISK	25	
APLUDUMP	13	
APLUINST	3	Varies by installation
APLUMAIN	18	
APLURSTR	17	
APLUTAPE	23	
APLUTIL	15	
APLUUREC	15	
	906	

DOS Source Statement Library - APL

<u>Book</u>	<u>Records</u>	<u>Notes</u>
APLSCONF	42	
APLDEV	40	
APLDS	7	
APLSEND	23	
APLPUB	2	Auxiliary Macro
APLSUPC	19	Auxiliary Macro
	133	

DOS Source Statement Library - DOS Release 19

<u>Book</u>	<u>Records</u>	<u>Notes</u>
ASSGN	19	
COMMN	56	
FOPT	228	
SEND	187	
HOLD	5	
SGDFCH	96	
SGSVC	253	
SGTCHS	325	
SGTCON	127	
SGUNCK	111	
SUPVR	45	
	1452	

DOS Source Statement Library - DOS Release 20

<u>Book</u>	<u>Records</u>	<u>Notes</u>
ASSGN	19	
COMMN	56	
FOPT	230	
SEND	192	
HOLD	5	
SGDFCH	98	
SGSVC	261	
SGTCHS	337	
SGTCON	128	
SGUNCK	104	
SUPVR	52	
	1482	

APPENDIX D

CHANGES TO DOS/360 SUPERVISOR FOR APL

The modifications to DOS have been confined to the DOS core resident supervisor (\$\$A\$SUP1), program number 360N-CL-453. These modifications are a true superset of the DOS supervisor, and if a supervisor is generated without APL specified, the same supervisor will be generated as with the standard macros. When APL is selected, an additional logical transient (\$\$BEACCT) is called at end of job step to reset and optionally log CPU time usage on SYSLOG, before control is transferred to \$\$BE0Jx. The following changes take effect when APL is specified:

<u>MACRO</u>	<u>DESCRIPTION OF CHANGES</u>
ASSGN	Macro extended to permit assignments to F1 and F2 partitions.
COMMN	Pointers to time accounting and scheduling tables added to the background communication region. DSECT option added for use in other assemblies.
FOPT	Optional ACCTG parameter added to select end of job step accounting on SYSLOG. DOS scheduler modified to dispatch a partition immediately after an I/O interrupt. Total CPU time usage by partition is maintained. All bound wait done in problem state with PSW address zero, to facilitate machine check recovery.
HOLD	Macro added to permit foreground assignments to be held from system generation and between job steps.
SGDFCH	Total CPU time usage by partition is maintained.
SGSVC	Program check in supervisor state causes the system to enter a hard wait.
SGTCHS	Linkage to channel appendage routine included. DOS scheduler modified to dispatch a partition immediately after an I/O interrupt.

SGTCON Tables for CPU time accounting added.

SGUNCK Unique code put into the address of the hard wait
PSW for each type of hard stop.

If a machine check occurs in the problem state, a message is logged and an attempt is made to resume the running program. If in supervisor state, a hard wait is entered.

Total CPU time usage by partition is maintained.

SUPVR The option APL has been added to the TP parameter. The TP parameter may optionally be a sublist, permitting specification of APL with or without BTAM or QTAM as desired.

Diagnostic scan-out area expanded to the 256 byte maximum size.

A branch to EXT03 is assembled at absolute location x'188' for APL entry to the DOS general exit.

APPENDIX E

ADDING INSTALLATION BILLING ROUTINES TO THE APL UTILITY

This appendix sets forth the rules for writing and adding billing routines to APL\360 - DOS. Billing routines may be added during system generation or at any later time; they need not be added at all if no billing of users is to be done.

The Utility BILLING operation reads cards containing account numbers (and, optionally, other data), locates and resets accounting information stored in an APL directory, and provides the accounting information to an installation-written formatting program. The use of card input allows selective billing (since a user's accumulated CPU and connect time will be neither reset nor output unless his account number is on an input card), and it also allows optional information on input cards to be combined with the accounting output. Because the Utility buffers up to two hundred input cards in order to minimize disk accesses, billing output will not usually appear in the same order as the input cards.

The Utility performs card reading and buffering; directory reads, searches, and writes; and card punching. The routines to be written by the installation for input and output formatting are named APLUBILN and APLUBILF, and must be cataloged in the relocatable library under the name APLUINST. Standard DOS linkage conventions are followed. General registers 2-12 must be preserved by APLUBILN and APLUBILF.

Installation-Written Routine Descriptions

APLUBILN

Purpose: To scan an input card for an account number, and return it as a fullword integer.

On entry, R1 points to a two-word parameter list. The first word is the address of an 80-character EBCDIC card image, and the second word is the address of a fullword in which to store the converted account number. A zero value returned for the account number causes the Utility to ignore the card, print an error message, and continue processing. A negative value causes the Utility to ignore the card with no error message. APLUBILN may modify the card image. The Utility calls APLUBILN once for each input card.

APLUBILF

Purpose: To prepare billing information for output, and optionally to output it.

On entry, R1 points to a two-word parameter list. The first word is the address of the same 80-character EBCDIC card image passed to APLUBILN, including any modifications made by APLUBILN. The second word is the address of a block of billing information defined by this DSECT:

BILINFO	DSECT		SECOND PARAM FROM BILLING
CONN	DS	F	CONNECTED TIME IN SEC/300
CPU	DS	F	COMPUTE TIME IN SEC/300
BILNAME	DS	CL12	SIGN ON NAME IN INTERNAL CODE
BILWSQ	DS	H	WORKSPACE QUOTA
BILWSA	DS	H	ACTUAL NUMBER OF WS
WSTRACKS	DS	H	TOTAL TRACKS FOR ALL WS
	DS	5H	RESERVED

The track count in WSTRACKS includes tracks occupied by any workspaces saved by this user in common libraries. APLUBILF is called once for each billing input card that was not rejected by APLUBILN or by the BILLING program.

APLUBILF may prepare no, one, or more than one output record. If output records are being punched, punching must be done by calling the subroutine APLUBILP with R1 pointing to a parameter list whose single entry is the address of the 80-character EBCDIC output record. APLUBILP supports punch retry and works in coordination with the card reading and buffering subroutine to maximize reading and punching rates. Output to a device other than SYSPCH must be done by APLUBILF.

Following the last billing output, APLUBILL calls APLUBILF one additional time with all fields of the second parameter set to -1. If output is to a unit other than SYSPCH, this call may serve as a signal for APLUBILF to close any output files. It also provides an opportunity to output summary totals. As usual, APLUBILF must return to its caller.

Including APLUBILN and APLUBILF in the APL Utility

1. Assemble or compile APLUBILN and APLUBILF, preferably as a single relocatable module.

2. Catalog the relocatable module by the name APLUINST.
If the programs are not in a single module, catalog them separately and catalog a calling module with the name APLUINST.
3. Link-edit the APL Utility.
4. Before performing a BILLING operation, make sure that APLUBILN and APLUBILF are debugged, by testing them using the TESTBILL operation. Because of the bufferring done by the Utility, a program check during a BILLING execution is very likely to produce billing output without resetting system accounting information.

Sample Installation Routines

The following pages show sample assembly and Cobol routines for APLUBILN and APLUBILF. With the exception of punching the date on output cards, the two programs are believed to behave identically.

```

// EXEC COBOL
IDENTIFICATION DIVISION.
PROGRAM-ID. 'APLUIINST'.
REMARKS. INSTALLATION-DEFINED ROUTINES FOR APL BILLING.
BILLING-OUTPUT-CARD AND BILLING-INPUT-CARD HAVE
INSTALLATION-DEFINED FORMATS. FORMATTING IS DONE BY
APLUBILN AND APLUBILF.
ENVIRONMENT DIVISION.
DATA DIVISION.
WORKING-STORAGE SECTION.
01 BILLING-OUTPUT-CARD.
02 FILLER PICTURE X, VALUE '0'.
02 ACCOUNT-NO PICTURE X(11).
02 FILLER PICTURE X, VALUE SPACE.
02 PROJ-NO PICTURE X(4).
02 FILLER PICTURE X(7), VALUE SPACE.
02 DEPT-NO PICTURE X(3).
02 NAME PICTURE X(15).
02 TIME PICTURE 9(8) DISPLAY.
02 FILLER PICTURE X, VALUE '*'.
02 CARDCODE PICTURE X.
02 FILLER PICTURE X(28), VALUE SPACE.
01 WORK-ACCOUNT PICTURE X(12).
01 CONCHG PICTURE S9(9) COMPUTATIONAL.
01 CPUCHG PICTURE S9(9) COMPUTATIONAL.
LINKAGE SECTION.
01 BILLING-INPUT-CARD.
02 ACCOUNT-NO PICTURE 9(12).
02 FILLER PICTURE X(68).
01 RETURN-ACCOUNT-NO PICTURE S9(9) COMPUTATIONAL.
01 BILLING-INFO-CARD.
02 FILLER PICTURE X.
02 ACCOUNT-NO PICTURE X(11).
02 FILLER PICTURE X.
02 PROJ-NO PICTURE X(4).
02 FILLER PICTURE X.
02 DEPT-NO PICTURE X(3).
02 FILLER PICTURE X.
02 NAME PICTURE X(15).
02 FILLER PICTURE X(42).
01 BILLING-INFO-CHARGE.
02 CONNECT PICTURE S9(9) COMPUTATIONAL.
02 CPU PICTURE S9(9) COMPUTATIONAL.
02 FILLER PICTURE X(12).
02 WS-QUOTA PICTURE S9(4) COMPUTATIONAL.
02 WS-ACTUAL PICTURE S9(4) COMPUTATIONAL.
02 WS-TRACKS PICTURE S9(4) COMPUTATIONAL.
02 FILLER PICTURE X(10).
PROCEDURE DIVISION.
ENTER LINKAGE.
ENTRY 'APLUBILN' USING BILLING-INPUT-CARD, RETURN-ACCOUNT-NO.
ENTER COBOL.
MOVE ACCOUNT-NO IN BILLING-INPUT-CARD TO WORK-ACCOUNT.

```

```

MOVE 0 TO RETURN-ACCOUNT-NO.
EXAMINE WORK-ACCOUNT REPLACING LEADING SPACES BY ZEROES.
IF WORK-ACCOUNT IS NUMERIC THEN
    IF WORK-ACCOUNT NOT GREATER THAN '002147483647' THEN
        MOVE ACCOUNT-NO IN BILLING-INPUT-CARD
        TO RETURN-ACCOUNT-NO.
ENTER LINKAGE.
RETURN.
ENTER COBOL.
ENTER LINKAGE.
ENTRY 'APLUBILF' USING BILLING-INFO-CARD,
    BILLING-INFO-CHARGE.
ENTER COBOL.
IF CPUCHG NEGATIVE GO TO NO-OUTPUT.
NOTE WOULD CLOSE FILE INSTEAD HERE IF GOING TO TAPE OUTPUT.
IF CONNECT ZERO GO TO NO-OUTPUT.
DIVIDE 18000 INTO CONNECT GIVING CONCHG ROUNDED.
DIVIDE 300 INTO CPU GIVING CPUCHG ROUNDED.
IF CONCHG ZERO MOVE 1 TO CONCHG.
IF CPUCHG ZERO MOVE 1 TO CPUCHG.
MOVE ACCOUNT-NO IN BILLING-INFO-CARD
    TO ACCOUNT-NO IN BILLING-OUTPUT-CARD.
MOVE PROJ-NO IN BILLING-INFO-CARD
    TO PROJ-NO IN BILLING-OUTPUT-CARD.
MOVE DEPT-NO IN BILLING-INFO-CARD
    TO DEPT-NO IN BILLING-OUTPUT-CARD.
MOVE NAME IN BILLING-INFO-CARD
    TO NAME IN BILLING-OUTPUT-CARD.
MOVE '&' TO CARDCODE IN BILLING-OUTPUT-CARD.
MOVE CONCHG TO TIME.
ENTER LINKAGE.
CALL 'APLUBILP' USING BILLING-OUTPUT-CARD.
ENTER COBOL.
MOVE '=' TO CARDCODE IN BILLING-OUTPUT-CARD.
MOVE CPUCHG TO TIME.
ENTER LINKAGE.
CALL 'APLUBILP' USING BILLING-OUTPUT-CARD.
ENTER COBOL.
NO-OUTPUT. ENTER LINKAGE.
RETURN.
ENTER COBOL.

```

/*

```

PUNCH ' CATALR APLUINST '
APLUINST CSECT
        EXTRN APLUBILP
        ENTRY APLUBILN
        ENTRY APLUBILF
        PRINT NOGEN
LKR     EQU     15
*
*       APLUBILN CHECKS THAT THE INPUT CARD IS VALID AND
*       GETS THE MAN NUMBER FROM IT. ZERO MAN NO IS USED
*       TO INDICATE AN INVALID CARD
APLUBILN SAVE (14,12)
        BALR   11,0
        USING *,11
        LR     6,1
        L      5,0(6)
        BCTR   5,0           R5 HAS ADDRESS OF INPUT CARD
        LR     1,5
        LA     2,1
        LA     3,11(1)      SCAN TO COLUMN 12
BPCH1   CLI    1(1),C' '
        BNE    BPCH2
        BXLE   1,2,BPCH1
        B      ZEROMAN
BPCH2   CLI    1(1),C'0'    MUST BE NUMERIC
        BL     ZEROMAN
        BXLE   1,2,BPCH2
        PACK   WORK1(8),1(12,5)  GET MAN NO
        CLC    WORK1(8),=X'000002147483647F'
        BH     ZEROMAN
        CVB    1,WORK1
        B      STMAN
ZEROMAN SR     1,1           ZERO MAN NO MEANS INVALID CARD
STMAN   L      5,4(6)
        ST     1,0(5)      STORE MAN NO IN 2ND PARAMETER
        RETURN (14,12)
*
*       APLUBILF USE THE INFORMATION IN BILINFO TO DO THE
*       ACCOUNTING. IN OUR CASE THIS MEANS PUNCHING TWO
*       CARDS ONE FOR CONNECT TIME IN MINUTES AND ONE FOR
*       COMPUTE TIME IN SECONDS. THE PUNCHING IS DONE BY
*       THE APL PROVIDED FUNCTION APLUBILP
APLUBILF SAVE (14,12)
        BALR   11,0
        USING *,11
        ST     13,SAVE13    PROTECT R13 DURING CALL TO PUNCH
        LR     6,1
        L      5,0(6)
        BCTR   5,0           R5 HAS ADDRESS OF INPUT CARD
*       INITIALIZE CARD WITH BLANKS AND DATE
        MVI    BILBF,C'0'
        MVI    BILBF+1,C' '
        MVC    BILBF+2(78),BILBF+1
        MVI    BILBF+50,C'**'
        COMRG
        MVC    BILBF+68(2),0(1)

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MVC      BILBF+70(2),3(1)
*        MOVE INFORMATION FROM INPUT CARD TO OUTPUT CARD
MVC      BILBF+1(11),2(5)
MVC      BILBF+13(4),14(5)
MVC      BILBF+24(3),19(5)   MOVE IN NAME, PROJ & DEPT NOS.
MVC      BILBF+27(15),23(5)
MVI      BILBF+51,C'&&'
L        5,4(6)              2ND PARAMETER IS BILINFO
*        PROCESS CONNECT TIME CARD
L        3,CONN-BILINFO(5)
LTR      3,3                NO OUTPUT IF ZERO CONNECT TIME
BZ       EXIT
BL       EXIT                NEGATIVE CONNECT TIME   EOF SIGNAL
A        3,=A(300*30)       ROUND UP TO MINUTES
SR       2,2
D        2,=A(300*60)
LTR      3,3                MINIMUM 1 MINUTE
BNZ      *+8
LA       3,1
CVD     3,WORK1
MVC     BILBF+42(8),EDPAT
EDMK    BILBF+42(8),WORK1+4
LA      13,SAVREG2
CALL    APLUBILP,(BILBF)   USE APL PUNCHING ROUTINE
MVI     BILBF+51,C'='      COMPUTE TIME CARDS HAVE = IN COL
*                               51
*        PROCESS COMPUTE TIME CARD
L        3,CPU-BILINFO(5)
A        3,=A(150)         ROUND UP TO SECONDS
SR       2,2
D        2,=A(300)
LTR      3,3                MINIMUM 1 SECOND
BNZ      *+8
LA       3,1
CVD     3,WORK1
MVC     BILBF+42(8),EDPAT
EDMK    BILBF+42(8),WORK1+4
LA      13,SAVREG2
CALL    APLUBILP,(BILBF)   USE APL PUNCHING ROUTINE
EXIT    L        13,SAVE13
        RETURN (14,12)
EDPAT   DC      X'FC21202020202020'
SAVE13  DS      F
WCRK1   DC      D'0'
SAVREG2 DS      9D
BILBF   DS      CL80
BILINFO DSECT
CONN    DS      F          SECOND PARAM FROM APLUBIL
CPU     DS      F          CONNECTED TIME IN SEC/300
BILNAME DS      CL12      COMPUTE TIME IN SEC/300
BILWSQ  DS      F          SIGN ON NAME IN INTERNAL CODE
BILWSA  DS      F          WORKSPACE QUOTA
WSTRACKS DS      F        ACTUAL NUMBER OF WS
        DS      5H        TOTAL TRACKS FOR ALL WS
        DS      5H        RESERVED
*        END OF ACCOUNTING ROUTINES
END

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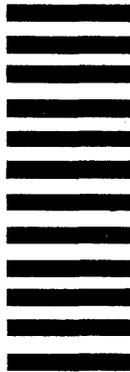
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